

## Fujitsu Network Communications

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Item #	Line Item	Notes	Unit Price	Qty/Unit	Total Price	Attch.	Docs
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Supplier Total						<b>\$0.00</b>	

**Fujitsu Network Communications**

Item: JP14001 - Data Communications Products & Services

**Attachments**

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**August 2013**



# Executive Summary

## State of Utah

### Data Communications Products and Services

#### JP14001

August 30, 2013

Proprietary Information

The information contained herein is not for use or disclosure outside recipient company, their respective affiliated and subsidiary companies, and their third party subcontractors or suppliers, except under written agreement.

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## **INTRODUCTION**

Fujitsu Network Communications, Inc. (FNC) is pleased to share its Data Communications Products and Services capabilities with The State of Utah as an initial step in becoming a valued partner who works as an “extension” of The State of Utah team. This capabilities response will show how The State of Utah can leverage Fujitsu’s vast Data Communications Products and Services along with its Managed Services, Network Operations Center (NOC) Planning, Deployment, Maintenance and Professional Services capabilities to deliver a customized solution based on individual or holistic requirements.

Fujitsu is committed to creating “best-in-class” solutions. We welcome the opportunity to explain our capabilities in providing robust Data Communications Products and Services coupled with our Professional Service Solutions which will meet the goals and objectives of The State of Utah. FNCs established history and demonstrated success as an OEM Transport and a turn-key Service Provider, has resulted in very strong customer loyalty, exemplified by our unparalleled customer retention and is something we strive to maintain. Based on our analysis and understanding of The State of Utah’s RFP requirements, we have endeavored in this response to provide the requisite data that will exceed The State of Utah’s expectations and provide The State of Utah with the technical flexibility to meet network reliability and expansion requirements in a cost effective manner.

The State of Utah can rest assured that FNC has the corporate infrastructure, financial bench strength, commitment to Service development, breadth of product and service portfolios, and the industry experience to foster a strong business relationship with The State of Utah for years to come.

### **The State of Utah Goals and Objectives**

The purpose of this request for proposal is to establish master agreements with qualified manufacturers to provide Data Communications Products and Services outlined in the specifications for all participating States. The services resulting from the award of this solicitation are to be available to all state entities, cities, counties, higher education, school districts and other political subdivisions on an as needed basis under the same pricing and terms and conditions agreed to in the Master Agreement.

It is anticipated that this RFP may result in Master Agreement awards to multiple contractors.

Fujitsu would welcome the opportunity to sit down with The State of Utah and discuss the issues and challenges that they face on a daily basis. This mutual due diligence is a part of the Fujitsu discovery phase and helps us better understand the goals that The State of Utah has set to achieve their vision. Only with this in-depth knowledge, can customized solutions be designed that can mitigate those pain points.

### **FNC Overview**

#### ***A Strategic Partner***

FNC is an innovator and strategic partner with over 24 years of experience as a leading provider of wireline and wireless networking solutions that solve critical business issues and enable new services. FNC’s comprehensive consulting and customer services offer support at any network design, development, deployment and maintenance stage. With the support of Fujitsu Limited (TSE:6702, ranked #138 in Fortune’s Global 500), a \$53B company with approximately 175,000 professionals in 100 countries, FNC enables customers to build, support or seamlessly migrate to fully converged networks that improve network performance and profitability. Fujitsu maintains a well-established and highly-regarded position as a market leader by providing the best-in-breed optical networking solutions and support services that drive next-generation access, core, and wireless networks. FNC is located in Richardson, Texas backed by engineering, service and sales forces across the United States.

Manufacturing is a core competency of FNC and as such, FNC is one of the few truly vertically integrated suppliers in the industry, manufacturing components used within our FLASHWAVE systems. Our technologically advanced worldwide factories provide FNC stability in business operations particularly during times of fluctuating demand. This stability makes FNC a financially sound partner during turbulent economic times.

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Footprint and power consumption are designed to be very low to keep the cost of operation in check. Other innovative features such as tunable narrowband optics eliminate transponder costs and minimize capital investment in spare units. All FNC products are designed to be easy to install, turn-up, test, operate, and maintain.

At Fujitsu we are committed to delivering products that enable customers to reduce their environmental footprint and meet their own sustainability commitments. Our research and development arm, Fujitsu Laboratories, has already started measuring the potential carbon reduction effect of all technologies under development. We take an active lead in Green ICT initiatives around the world - with representation on all significant working groups on carbon reduction, including the Green Grid, ENERGY STAR, EPEAT, Climate Savers Computing Initiative, the European Union initiative ICT4EE, the Copenhagen Communiqué on Climate Change, the Japan Climate Leaders' Partnership (Japan-CLP), Blue Angel, Nordic Swan and the German BITKOM Green IT Alliance.

Our manufacturing plants, data centers and offices are designed for low emissions, drawing on renewable energy and using natural landscaped surroundings. In 2006 we completed global integration of our manufacturing plants based on the ISO14001 environmental management system, including our Richardson, TX facilities.

FNC was one of the first telecommunication companies to become registered to TL 9000 – a single set of worldwide telecommunications standards that combine the quality requirements of the ISO 9001, Malcolm Baldrige, and Telcordia, SEI, and ISO 12207 standards. The result is products and services that follow detailed quality standards from initial conception through delivery. This commitment to quality has resulted in FNC having the lowest failure rates in the industry (less than 1/10 of 1% [.001] for all cumulative shipments.

All of FNC products are currently manufactured in one of our three U.S based facilities thus satisfying the State of Utah's requirements of Buy America.

## **FUJITSU SERVICES OVERVIEW**

As stated earlier, a more thorough understanding of The State of Utah goals and challenges is required before a customized solution can be developed. With this in mind, please see the listed services below for a high level overview of our capabilities, and the associated attachments for more detailed information.

### **Program Management**

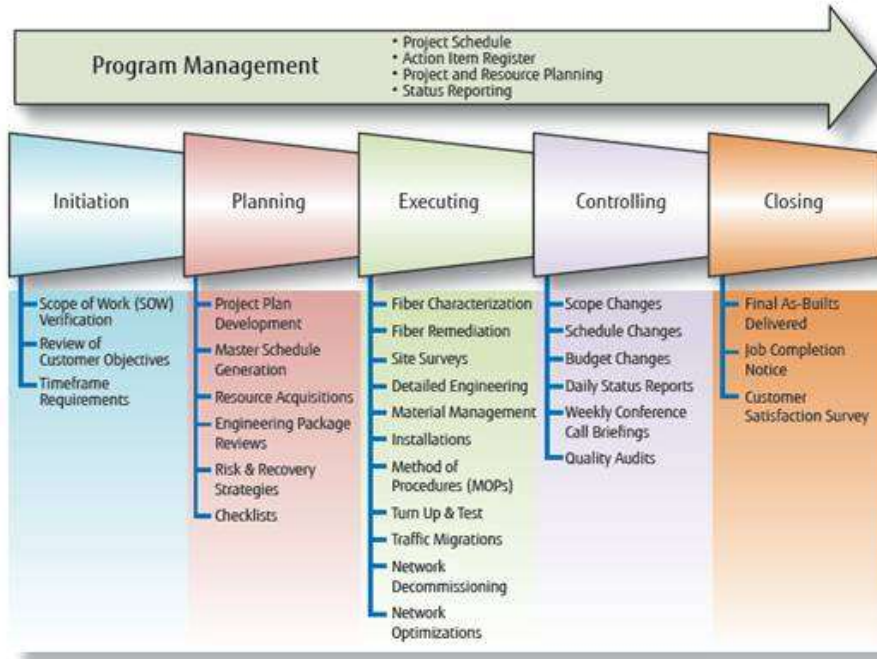
Fujitsu's Program Management Office (PMO) organizes and consolidates multiple resources and fulfillment activities into a single manageable stream. Our PMO enables us to eliminate inefficiencies within the program, create flexibility and clearly dictate objectives to the project teams. Consistent communication helps to mitigate risk and to ensure program goals are achieved.

The Fujitsu Program Management Office (PMO) serves as the central communications center for all project activities and resources. The PMO will have a clear understanding of the goals, objectives and milestones of each project, and will provide recommendations that will assist in facilitating consistent and repeatable processes across multiple projects. The primary objective of the PMO is to ensure successful performance of all network deployments by providing support services such as mentoring, in-flight risk reviews, methodology practices, tools and resource optimization techniques.

Proper planning makes for successful projects. Fujitsu's practice of due diligence includes a detailed Plan of Record (POR). This POR is a strategic document that defines not only what is to be done...but how to do it. A detailed Plan of Record includes information such as project scope, high-level release plan, program structure, contact details, escalation processes, work breakdown structure, risk assessment, critical path dependencies, change control procedures, defect management, job completion criteria and audit procedures. Having this level of detail written into a formal document allows all parties to understand

each process and how it fits together into the overall project.

Fujitsu will sit down with The State of Utah and create the customized Plan of Record as a strategic weapon to be used by executives, planners, product management, finance and operations to collaborate and align each stakeholder within the formal process. Creating and maintaining a detailed plan of record requires new thinking, more clearly defined practices and a new class of cross-functional, cross-enterprise planning.



**Deployment Services**

Fujitsu Deployment services offers a comprehensive suite of Engineering, Installation and Turn-up and Test services that are available as a packaged request, as value-added optional services, as an Original Equipment Manufacturer (OEM) solution or as a customized option to meet your specifications. Fujitsu offers multi-vendor Deployment Solutions and has capabilities to support and integrate multiple platforms. Fujitsu’s Deployment Services ensure that your network is deployed quickly and at optimal performance, to help you manage the momentum of technology while minimizing the challenges. Through our comprehensive and flexible approach we will install the network according to your exact specifications, all within the required timeframe.

Deployment Services include:

**Optical Engineering**

Some of the tasks associated with Optical Engineering are creation of network diagrams and rack/shelf/card view drawings, Intra / inter-bay fiber plans, channel plans and as-builts. Creation and maintenance of Network Engineering Development Tools as well as test and acceptance records will be maintained.

**Rack and Cabinet Integration (RCI)**

RCI provides pre-configured cabinet and rack turnkey solutions utilizing both standard and custom cabinets. Cabinets can include indoor and outside applications. Solutions can be fully NEBS and UL approved if required, and solutions include telecom, thermal, fiber, battery and cross connect solutions.

**Engineering, Furnish and Installation (EFI)**

EFI includes site surveys with detailed documentation, coordination of site shipments and staging if required, Method of Procedure (MOP) generation, installation and quality audits.

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### **Furnish Materials (FMAT)**

FMAT can include furnishing fiber ducting, cables, wiring, bays, racks, cabinets and ancillary material. The service can also help define and identify material requirements, design new materials as necessary and create Kits to aid in customer ordering.

### **Managed Services**

Fujitsu Managed Services is a set of network operations support services that offers flexible choices in multivendor, multiservice network management. We can take full responsibility for all planning, deployment, operation, and maintenance activities on your behalf, and we ensure your network operates according to agreed performance goals. The scope of Managed Services covers the full range of mobile network services, fixed (wireline) networks, utilities, transportation, and data networks. Three types of Managed Services are available:

- Network Outsourcing
- Operational Readiness
- Operations Optimization

### **Network Outsourcing**

Fujitsu can provide a fully outsourced service in which we function as a staffing company under an agreed set of service quality and performance metrics. FNC will onboard the customer's staff and manage the staffing operation going forward. This service delivers significant, sustainable Opex savings in comparison to the Present Mode of Operation (PMO). The Network Outsourcing service falls into one of four categories:

- Capacity and efficiency management
- Field services outsourcing including spares management
- Implementation and OSP planning and engineering
- Network operations outsourcing

### **Operational Readiness**

The Operational Readiness service provides support for major network operations projects such as Build-Operate-Transfer (BOT) arrangements. By using this service, customers can avoid the cost of adding their own full-time employees, instead using Fujitsu expertise for completion of the project. This service also enables teams in any location to supervise and manage projects. With our pricing and quality guarantees, on-time, in-budget project completion is assured—to the high level of performance you expect from Fujitsu. We assign a single program manager to act as a single point of contact from start to finish, giving you continuity of communication from inception to completion.

### **Operations Optimization Services**

Operations Optimization is an expert advisory service in which seasoned network operations personnel evaluate and validate suspected problems, providing a third-party, non-partisan view. There are two types of Operations Optimization service:

- Advisory Services
- Business Continuity Services

### **Advisory Services**

This service comprises a methodical study of network operations, to give a true baseline of the PMO. Our experts then compare the PMO baseline with the organization's vision of its network. The end result is a comprehensively documented set of recommendations, including a cost-benefit analysis, for bringing the network into alignment with the vision. As an additional project contract, we can also manage the recommended changes.

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### **Business Continuity Service**

This service supports organizations seeking to assure business continuity and network survivability. The service covers Network Operations Center and/or any set of network elements or service provisioning functions critical to survivability and service restoration. Available services include:

- Current plan audits
- Single point of failure identification
- Recommended prevention and correction plans
- Overall design and management of the survivability function
- Certified expertise, manpower and equipment to effect restoration

### **Maintenance (NOC) Services**

The Fujitsu NOC provides 7x24xForever network monitoring. Fujitsu has the capability to monitor equipment from multiple original equipment manufacturer (OEM) vendors and engineers monitoring the network are specifically qualified for the equipment being monitored. A fully redundant network is provided in Fujitsu's NOC so that failure of any one data-link or facility will not interrupt NOC operations.

### **Condition Notification**

Whenever any condition or alarm on the network changes, Fujitsu will notify the Customer. A notification can be initiated because of an alarm or equipment condition, but can also be due to trending over days or weeks.

### **Management DCN Monitoring**

All connections to the Customer network are monitored for both condition and quality.

### **Remote Move, Add, Change (MAC)**

All actions are remote and include adding new SONET OC-N signals, element provisioning for additions or deletions, cross connect changes, VLAN changes, and voice switch provisioning.

### **Alarm Isolation & Resolution**

Engineers will respond to all alarm or condition triggers. The engineer's actions include troubleshooting and root cause analysis as well as fault correlation. The NOC engineer will provide identification, isolation, diagnosis, resolution and restoration of network troubles.

### **Circuit Resource Management (CRM)**

Fujitsu will perform circuit bandwidth allocation and circuit provisioning as requested through the proven Change Control Request process.

### **Configuration Management**

The Fujitsu NOC will perform remote memory backups (RMBU) to allow network restoration of supporting devices in the event of an NE failure from loss of database or provisioning loss.

### **Inventory Management**

Fujitsu will maintain a database of part numbers (including issue numbers) of the parts in Customer's network on a per NE basis. This will be delivered to the Customer as required in a mutually agreeable format.

### **Third Party Management**

Fujitsu will work with Customer's vendor/subscriber as requested. Examples include: Fiber cuts: contact dark fiber vendor to initiate repair, contacting end customer to inform that remedy is underway. Fujitsu and many OEMs require a Letter of Agency (LOA) for Fujitsu to act as the Customers representative.

### **Reports**

Fujitsu will prepare and send reports to the Customer in accordance with a schedule, and in a format mutually agreeable to the parties. Reports can include performance monitoring, trouble ticket reports, and any issues raised throughout the month.

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#### **On-Site Maintenance**

With the On-Site Maintenance (OSM) support service, experienced technicians will be at your location to troubleshoot issues and perform network maintenance within a guaranteed response time. Our nationwide team can evaluate Fujitsu and OEM equipment and provide you with a cost-effective method to quickly restore your network to optimal performance levels. This service is available with a next business day or other custom response times.

#### **Routine Preventative Maintenance**

Provides two site visits per year to confirm and retrieve conditions specified in a checklist. The parties will identify and create a mutually agreeable checklist. The checklist could include alarm retrievals, confirmation of site security, voltages, cable connections, general cleaning or replacement of fan filters. Preventative maintenance trips should be scheduled at least four weeks in advance. However, if an emergency response is needed, and it is feasible, the RPM functions can be performed during emergency maintenance visit.

#### **Advanced Hardware Replacement (AHR)**

The Advance Hardware Replacement (AHR) service ensures your network is continually supported with the spares you need because you can request delivery of covered Fujitsu replacement parts or Customer supplied OEM parts.

#### **On-site technicians**

Fujitsu will provide specialized telecommunications technicians on site that have working knowledge of equipment to support emergency break/fix repair of the network. The technician will work closely with the Fujitsu NOC which will coordinate the action during the time on-site.

#### **Fujitsu Technical Assistance Center (TAC)**

The Fujitsu Technical Assistance Center (TAC) is our "Customer's Solution Center." Staffed by seasoned telecom engineers who have completed extensive technical training, the TAC experts are your central point of contact for resolving network issues related to operations, performance, reliability, and maintenance of new installations and on-line, operational systems.

Equipped with a library of equipment specifications, manuals, update bulletins, and years of hands-on experience, TAC engineers are available for telephone consultation 24 hours a day, seven days a week. They provide detailed recommendations on maintenance procedures, test practices, and equipment configurations for your specific applications. In most cases, problems can be resolved through telephone contact. If on-site support is required, a Fujitsu representative can be dispatched to the site.

#### **Maintenance Support Program (MSP)**

A Fujitsu support program gives The State of Utah the freedom to select from a menu of maintenance services to meet their business needs for FNC as well as non-FNC products. Whether it is minimal support to complement your existing resources or comprehensive coverage to outsource operations and reduce operating costs, we offer a support package that meets your specific business needs. And, no matter what level of support you choose, The State of Utah can rest assured that every Fujitsu support plan offers 24x7x365 technical assistance so expert help is available whenever you need it.

Choose any level of service support and you ensure your network runs efficiently and effectively. Our packages are made up of support services most often requested by our customers.

#### **Professional Services**

Fujitsu's Professional Service Organization can methodically assess your network infrastructure and design, quantify the performance of their network assets, design an intelligent network architecture that addresses your business needs; and implement and augment your network strategy. We follow a systematic approach that can ultimately help The State of Utah address and remedy areas of concern or risk, and enact plans for expansion, streamlining, and growth.

Professional Services include but are not limited to:

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**CO Modernization**

The Fujitsu Central Office (CO) Modernization service draws upon our extensive experience in both legacy and next-generation environments to help your customer simplify and streamline their network infrastructure. CO Modernization provides a complete, start-to-finish implementation path to increase scalability, improve network performance and reduce overall cost of ownership.

With the support of the CO Modernization service, customers can build competitive strength, flexibility and longevity into their network.

**Fiber Characterization**

Through our Fiber Characterization services, Fujitsu can provide you with comprehensive verification, determination, and analysis of your installed fiber to ensure your infrastructure is compatible with the advanced network elements used in today's high-capacity SONET and DWDM networks. By identifying problems in advance, we can trouble-shoot your network to provide a clear picture of any potential faults and issues that could interfere with current or future fiber usage, preparing you for seamless growth.

**Turn-Up and Test**

Proper Turn Up and Testing of equipment is vital to a network or equipment deployment. Every hour spent on maintenance due to a faulty installation is an hour of lost revenue. FNC Services knows this and is here to help your customers achieve their network goals from the start. With two options from which to choose: Onsite Turn Up and Test and Turn Up & Test Hotline, FNC Services provides our customers with two price points that deliver the appropriate level of service. This service includes on-site configuration and simple turn-up, or rigorous long-term testing including Network Acceptance Testing (NAT) and Network Element Acceptance Testing (NEAT).

**Network Migration**

Through our Network Migration service, Fujitsu can perform even the most difficult migrations from moving circuits to moving from one platform to another. Our extensive experience and planning allows us to pinpoint potential network problems in advance and develop a step-by-step plan for a successful migration. We will customize the Network Migration program to match your specific requirements, whether you need to completely outsource your network migration or just need a mentor to assist you with Methods of Procedure (MOP), recommendations or individual tasks.

**Resident Engineer**

Fujitsu engineer operates as the customer employee to assist with test and turn-up, Moves, Adds or Changes (MAC), network analysis or design.

**Network Discovery**

This service reconciles records that do not reflect the field implemented design. Network actuals are recorded and presented as reported by the vendor specific network element system.

**Software Upgrades**

This service is to be utilized when The State of Utah determines that Network Terminating Equipment (NTE) software upgrades are necessary to bring the NTE's to the latest Fujitsu-recommended release.

**Interoperability Testing**

Fujitsu offers Interoperability Testing with lab-based or remote lab-based access to a full array of multi-protocol equipment to test the compatibility and interoperability across customers' entire networks.

**OSS Integration**

Today, OSS providers face the daunting challenge of managing hundreds or thousands of individual elements and their respective management systems across a host of disparate vendors and protocols. The Fujitsu Professional Services group can create adapters for a customer's individual EMS, or for a family of devices under a Network Management System (NMS), that communicate consistent data directly to their OSS regardless of brand. Fujitsu Professional Services will work with your customer to identify key metrics crucial to network performance, then build and test APIs that meet those needs.

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By mediating between the OSS and the EMS and NMS systems, network architects and operators can now add support without disrupting or changing the OSS, translating to substantial savings and a faster time to market.

All development and testing takes place in the FNC traffic-bearing laboratory network to ensure the adapters meet "real world" expectations. If your customer finds themselves with unruly management systems and the poor performance they can cause,.

#### **FOCIS Partners Website**

All Fujitsu customers are highly encouraged to take advantage of the Fujitsu's On-line Customer Information Service (FOCIS) Partners website (<https://partners.fnc.fujitsu.com/>). The website is The State of Utah's portal to Fujitsu technical documentation and offers the following key benefits:

- All online documentation is always the most current version (this includes equipment manuals and software downloads). The online documentation on FOCIS is searchable using a keyword search engine. FOCIS users have access to information including Technical Information Bulletins (TIB), Product Change Notices (PCN), Method of Procedure (MOP), and Customer Information Release (CIR).
- Registered users can receive automatic e-mail notification whenever new information is posted. Individuals can customize which update notices they receive - from every new TIB and PCN to updates on only a single product.
- The FOCIS website enables you to open, review and annotate customer service requests and trouble tickets. This facility provides a convenient portal for information exchange with our Technical Assistance Center (TAC) in non-critical situations.

#### **PAST PERFORMANCE**

FNC has extensive experience with projects of this magnitude and complexity. Recently FNC has performed similar services on the CenturyLink Mobile Backhaul Turnkey build across the US, and also on a major upgrade with the Verizon NOVA project across the US and in Europe and Asia as well. Both projects required the seamless integration of design engineering, Program Management, installation, test engineers, Onsite maintenance support, spares management, and NOC integration. To ensure successful completion of project requirements, FNC task organizes program teams. Service leads are assigned from the pertinent areas with FNC and serve as the primary contact for that task. Experts from engineering, deployment services, test and integration, and the Program Management Office work as a team, under an assigned Program Manager, or Services Delivery Manager (SDM).

Fujitsu has approximately 300 active Services projects in progress. These scale from small projects to vast global initiatives. As an example of past performance, in addition to the CenturyLink project mentioned above, the following projects are provided.

#### **Horizon BAFO Project**

Horizon partnered with Fujitsu to deliver a fiber optic broadband network in Central and Southern Ohio. Utilizing a turnkey delivery approach, Fujitsu provides:

##### **Interoperability & Integration Testing**

- DWDM Optical Transport Verification
- Layer 2, Layer 3 and MPLS Packet Core Verification
- Layer 2, Layer 3 Access Verification

##### **Multi-vendor Network Maintenance**

- Single Point of Contact (SPOC)
- Technical Assistance Center (TAC)
- Multi-vendor Sparing
- On-Site Maintenance

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### **Multi-vendor Network Operations**

- 24x7 NOC Monitoring and Support
- Tier 1 Customer Triage Support
- Performance Management
- Inventory Management.

### **Multi-vendor Deployment Services**

- Engineering (network design validation, site survey and interoperability)
- Furnished Installation Material
- Testing
- Provisioning (including customer premise equipment)

### **Fujitsu Serves a Global Carrier**

In a partnership with a major Tier 1 carrier, Fujitsu signed a five year agreement with one of the top five global financial institutions in 2010. Support of this customer is a multi-vendor fiber optic network support model where Fujitsu has developed partnerships with OEM vendors to provide seamless Tier 1 through Tier 4 support. Fujitsu is delivering Management and Field Maintenance Services in 14 countries including the USA, England, Scotland, Japan, Australia, Switzerland, Germany, Spain, France, Hungary, Italy, Russia, Singapore, and Canada.

Through the partnership with the Tier 1 carrier, Fujitsu also provides Services to many other banking, mortgage and investment agencies in the United States. Starting in 2003, Fujitsu signed its first financial institution for a three year commitment for Full Management services, Onsite Maintenance and Spares Management services. Over the years, this customer has renewed their services contracts and continues to be one of the longest signed customers in Fujitsu portfolio.

### **Managing Complex Engagements**

As the master network integrator for the CenturyLink project, FNC has the responsibility to perform site surveys, fiber characterization testing, site engineering, installation and turn up and commissioning at 1500 sites in 30 States. The scope includes providing optical Ethernet services requiring 4G service through fiber to the tower. Through careful evaluation, the normal project organization for this scope was deemed inadequate for the program needs. FNC put in place a Regional Project structure to allow for better communication, coordination and implementation of the project requirements. A single Program Manager is in place and responsible for all program objectives. Reporting to him are 3 Regional Project Managers who exercise control over 4 additional Market area Managers. This project structure has allowed for better control of the execution in each area. To date FNC has surveyed, installed, tested and handed over almost 800 sites across the continental US in 2012 alone.

For a Global Tier 1 carrier project, FNC conducted sites surveys, site engineering, spares management, setting up onsite maintenance services, and integration of all NOC monitoring services into the FNC NOC. The platforms monitored in this effort include Fujitsu FLASHWAVE equipment, as well as ADVA, Ciena, NORTEL and Symmetricom/Spectracom. This project consisted of 68 sites, almost 700 NE's, spread across 8 countries on 3 different continents. As part of the service migration and integration, FNC is performing decommissioning of several nodes as service capabilities are increased where needed. To ensure proper management of this project, a task organized project team was put in place pulling from multiple departments across the Services Organization. A dedicated Services Delivery Manager (SDM) is in charge of all associated activities. The SDM reports to the Director of Deployment Services, and has immediate access to the Services VP for program related matters. Reporting to the SDM are project managers for On Site Maintenance, Spares Management, and the NOC.

To further illustrate FNC's ability to manage and deploy large complex projects, we recently completed the deployment of almost 200 core and ILA sites for AT&T in the EMEA and APAC areas. Working with the customer to create a standard configuration for a given market size, FNC converted these designs into

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workable deployment plans. A dedicated Program Manager was assigned to run those efforts. Vendor evaluation and selection was performed in Europe, Australia, Japan and Singapore. Approved vendors and subcontractors were utilized to deliver high quality installations at the most advantageous price. Additionally, FNC trained test engineers in the market areas to assist or conduct the testing and commissioning on the newly installed systems.

### **Summary**

In today's volatile economy, The State of Utah not only wants to make sure that the Products and Services chosen for this RFP are reliable, but also that the partner providing these products is stable and reliable, thereby reducing the risk associated with such an important initiative. Fujitsu is dedicated to providing The State of Utah with the best combination of quality, service and price for your unique network management requirements. We possess the track record, commitment, expertise, and technical leadership necessary to support your current and evolving needs. Not only is FNC supported by a \$53B company in Fujitsu Limited, but is also committed to the continued development of the proposed Products and Services and has a broad spectrum of other product platforms and services to keep FNC strong in the toughest of economic times. We believe that this response offers a number of key differentiating advantages in every one of the proposed Product and Service areas. FNC looks forward to building a relationship with The State of Utah by working together to help achieve our mutual strategic goals.

With each opportunity comes the challenge of finding an experienced and reliable partner to utilize in a "trusted advisor role." We believe this challenge requires teaming with a partner who already has expertise with the proposed Products and Services and experience in your market; partners like Fujitsu.

**Fujitsu Network Communications**

Item: JP14001 - Data Communications Products &amp; Services

**Attachments**

03 State of Utah - BID\_21740916\_Document\_11009258 - Final Master Response Document - 8-30-2013.docx

04 Annual Report-2012.pdf

04A FNC Product Pricing - State of Utah Solicitation JP14001 - Final.xls

05 FNC Financial Highlights as of May 2013.xls

06 Dunn and Bradstreet Report as of 6-26-2013.pdf

07 Attachment A - FNC exceptions to terms and conditions.docx

08 FLASHWAVE 4100ES\_ds.pdf

09 FLASHWAVE 7120\_ds.pdf

10 FLASHWAVE\_7420\_ds.pdf

11 FLASHWAVE\_7500\_ds.pdf

12 FLASHWAVE 9500\_ds.pdf

13 FLASHWAVE\_CDS\_ds.pdf

14 MetroE Solution Products v9.pptx

15 Roadmap Program Review -2013-06-25.pptx

16 NETSMART\_1500\_ds.pdf

17 NETSMART\_2000\_ds.pdf

18 NetOmnia.pdf

19 State of Utah - SAMPLE - Integration Services overview.docx

20 Central Office Modernization.pdf

21 Documentation Service.pdf

22 Managed Network Solutions.pdf

23 Master Network Integration-datasheet.pdf

24 NOC Audit Services.pdf

25 Quality Audit Services.pdf

26 Site Grounding and Bonding.pdf

27 Training Catalog Oct 2012 - Sep 2013.pdf

# Solicitation JP14001

## Data Communications Products & Services

**Bid designation: Public**

State of Utah



**State of Utah**

## Bid JP14001 Data Communications Products & Services

Bid Number **JP14001**  
Bid Title **Data Communications Products & Services**

Bid Start Date **Jul 1, 2013 5:07:32 PM MDT**  
Bid End Date **Aug 30, 2013 11:00:00 AM MDT**  
Question & Answer  
End Date **Jul 26, 2013 11:00:00 AM MDT**

Bid Contact **Jennifer A Porter**  
**Purchasing Agent**  
**DAS/State Purchasing**  
**jenniferporter@utah.gov**

Contract Duration **5 years**  
Contract Renewal **2 annual renewals**

Bid Comments Do not contact the WSCA-NASPO Contract Administrator or other RFP Sourcing Committee members with questions relating to this solicitation. All questions pertaining to this RFP must be submitted through BidSync. All responses will be posted through BidSync. Please read the RFP requirements thoroughly to ensure proposal response is compliant.

Clarification on terms and conditions attached to the RFP: WSCA-NASPO Terms and Conditions will apply to the Master Agreements that result from this RFP. The State of Utah - Attachment A Information Technology Terms and Conditions will apply specifically to the Participating Addendum's (PA's) Utah signs and is not specific to the WSCA-NASPO Master Agreement. Other States may have their own terms and conditions that will be addressed specifically when their PA's are executed.

### Item Response Form

Item **JP14001-01-01 - JP14001 - Data Communications Products & Services**  
Quantity **1 contract**  
Prices are not requested for this item.  
Delivery Location **State of Utah**  
No Location Specified  
**Qty 1**

#### Description

Do not contact the WSCA-NASPO Contract Administrator or other RFP Sourcing Committee members with questions relating to this solicitation. All questions pertaining to this RFP must be submitted through BidSync. All responses will be posted through BidSync. Please read the RFP requirements thoroughly to ensure proposal response is compliant. Prices & Percentages discounts must be submitted using the RFP Attachment C - Cost Sheet provided. Do not include prices or percentage discounts in the technical portion of the response.

## STATE OF UTAH

**SOLICITATION NO. JP14001**

Data Communications Products &amp; Services

RESPONSES DUE NO LATER THAN:

Aug 30, 2013 11:00:00 AM MDT

RESPONSES MAY BE SUBMITTED ELECTRONICALLY TO:[www.bidsync.com](http://www.bidsync.com)RESPONSES MAY BE MAILED OR DELIVERED TO:

State of Utah  
Division of  
Purchasing  
3150 State Office Building, Capitol Hill  
Salt Lake City, Utah 84114-1061



# State of Utah Request for Proposal

Legal Company Name (include d/b/a if applicable)	Federal Tax Identification Number	State of Utah Sales Tax ID Number <b>1314127-0143</b>	
<b>Fujitsu Network Communications</b>	<b>75-2394286</b>	<b>N/A</b>	
Ordering Address <b>2801 Telecom Pkwy</b>	City <b>Richardson</b>	State <b>Texas</b>	Zip Code <b>75082</b>
Remittance Address (if different from ordering address) <b>2801 Telecom Pkwy</b>	City <b>Richardson</b>	State <b>Texas</b>	Zip Code <b>75082</b>
Type <b>Corporation</b>	Company Contact Person <b>Bruce Greene</b>		
Telephone Number (include area code) <b>(206) 890-7154</b>	Fax Number (include area code) <b>Not available</b>		
Company's Internet Web Address <a href="http://www.fujitsu.com">www.fujitsu.com</a>	Email Address <a href="mailto:Bruce.Greene@us.fujitsu.com">Bruce.Greene@us.fujitsu.com</a>		
Discount Terms (for bid purposes, bid discounts less than 30 days will not be considered)	Days Required for Delivery After Receipt of Order (see attached for any required minimums) <b>60 Days ARO</b>		
The undersigned certifies that the goods or services offered are produced, mined, grown, manufactured, or performed in Utah. <u>if not</u> enter where produced, etc. <b>No. All of FNC products are currently manufactured in one of our three U.S based facilities thus satisfying the State of Utah's requirements of Buy America.</b>	Offers' Authorized Representatives Signature  <b>X Please refer to the required digital signature page attached. File name - 'State of Utah – Digital Signature'</b>	Date  <b>X <u>August 26, 2013</u></b>	
	Type or Print Name <b>Paul Fagan</b>	Position or Title <b>SVP Sales &amp; Marketing</b>	

**NOTICE**

When submitting a response (proposal, quote or bid) electronically through BidSync, it is the sole responsibility of the supplier to ensure that the response is received by BidSync prior to the closing date and time. Each of the following steps in BidSync MUST be completed in order to place an offer:

- A. Login to [www.bidsync.com](http://www.bidsync.com);
- B. Locate the bid (solicitation) to which you are responding;
  - a. Click the "Search" tab on the top left of the page;
  - b. Enter keyword or bid (solicitation) number and click "Search";
- C. Click on the "Bid title/description" to open the Bid (solicitation) Information Page;
- D. "View and Accept" all documents in the document section;
- E. Select "Place Offer" found at the bottom of the page;
- F. Enter your pricing, notes, other required information and upload attachments to this page;
- G. Click "Submit" at the bottom of the page;
- H. Review Offer(s); and
- I. Enter your password and click "Confirm".

Note that the final step in submitting a response involves the supplier's acknowledgement that the information and documents entered into the BidSync system are accurate and represent the supplier's actual proposal, quote or bid. This acknowledgement is registered in BidSync when the supplier clicks "Confirm". BidSync will post a notice that the offer has been received. This notice from BidSync MUST be recorded prior to the closing date and time or the response will be considered late and will not be accepted.

Be aware that entering information and uploading documents into BidSync may take considerable time. Please allow sufficient time to complete the online forms and upload documents. Suppliers should not wait until the last minute to submit a response. It is recommended that suppliers submit responses a minimum of 24 hours prior to the closing deadline. The deadline for submitting information and documents will end at the closing time indicated in the solicitation. All information and documents must be fully entered, uploaded, acknowledged (Confirm) and recorded into BidSync before the closing time or the system will stop the process and the response will be considered late and will not be accepted.

Responses submitted in BidSync are completely secure. No one (including state purchasing staff) can see responses until after the deadline. Suppliers may modify or change their response at any time prior to the closing deadline. However, all modifications or changes must be completed and acknowledged (Confirm) in the BidSync system prior to the deadline. BidSync will post a notice that the modification/change (new offer) has been received. This notice from BidSync MUST be recorded prior to the closing date and time or the response will be considered late and will not be accepted.

Utah Code 46-4-402(2) Unless otherwise agreed between a sender (supplier) and the recipient (State Purchasing), an electronic record is received when: (a) it enters an information processing system that the recipient has designated or uses for the purpose of receiving electronic records or information of the type sent and from which the recipient is able to retrieve the electronic record; and (b) it is in a form capable of being processed by that system.

**WSCA-NASPO Data Communications Services Solicitation # JP14001****REQUEST FOR PROPOSAL - INSTRUCTIONS AND GENERAL PROVISIONS**

- 1. SUBMITTING THE PROPOSAL:** (a) The Utah Division of Purchasing and General Services (DIVISION) prefers that proposals be submitted electronically. Electronic proposals may be submitted through a secure mailbox at BidSync (formerly RFP Depot, LLC) ([www.bidsync.com](http://www.bidsync.com)) until the date and time as indicated in this document. It is the sole responsibility of the supplier to ensure their proposal reaches BidSync before the closing date and time. There is no cost to the supplier to submit Utah's electronic proposals via BidSync. (b) Electronic proposals may require the uploading of electronic attachments. The submission of attachments containing embedded documents is prohibited. All documents should be attached as separate files. (c) If the supplier chooses to submit the proposal directly to the DIVISION in writing: The proposal must be signed in ink, sealed, and delivered to the Division of Purchasing, 3150 State Office Building, Capitol Hill, Salt Lake City, UT 84114-1061 by the "Due Date and Time." The "Solicitation Number" and "Due Date" must appear on the outside of the envelope. All prices and notations must be in ink or typewritten. Each item must be priced separately. Unit price shall be shown and a total price shall be entered for each item offered. Errors may be crossed out and corrections printed in ink or typewritten adjacent and must be initialed in ink by person signing offer. Unit price will govern, if there is an error in the extension. Written offers will be considered only if it is submitted on the forms provided by the DIVISION. (d) Proposals, modifications, or corrections received after the closing time on the "Due Date" will be considered late and handled in accordance with the Utah Procurement Rules, section R33-3-209. (e) Facsimile transmission of proposals to DIVISION will not be considered.
- 2. PROPOSAL PREPARATION:** (a) Delivery time of products and services is critical and must be adhered to as specified. (b) Wherever in this document an item is defined by using a trade name of a manufacturer and/or model number, it is intended that the words, "or equivalent" apply. "Or equivalent" means any other brand that is equal in use, quality, economy and performance to the brand listed as determined by the DIVISION. If the supplier lists a trade name and/or catalog number in the offer, the DIVISION will assume the item meets the specifications unless the offer clearly states it is an alternate, and describes specifically how it differs from the item specified. All offers must include complete manufacturer's descriptive literature if quoting an equivalent product. All products are to be of new, unused condition, unless otherwise requested in this solicitation. (c) Incomplete proposals may be rejected. (d) Where applicable, all proposals must include complete manufacturer's descriptive literature. (e) By submitting the proposal the offeror certifies that all of the information provided is accurate, that they are willing and able to furnish the item(s) specified, and that prices offered are correct. (f) This proposal may not be withdrawn for a period of 60 days from the due date.
- 3. FREIGHT COST:** Suppliers are to provide line item pricing FOB Destination Freight Prepaid. Unless otherwise indicated on the contract/purchase order, shipping terms will be FOB Destination Freight Prepaid.
- 4. SOLICITATION AMENDMENTS:** All changes to this solicitation will be made through written addendum only. Answers to questions submitted through BidSync shall be considered addenda to the solicitation documents. Bidders are cautioned not to consider verbal modifications.
- 5. PROTECTED INFORMATION:** Suppliers are required to mark any specific information contained in their offer which they are claiming as protected and not to be disclosed to the public or used for purposes other than the evaluation of the offer. Each request for non-disclosure must be made by completing the "Confidentiality Claim Form" located at: <http://www.purchasing.utah.gov/contract/documents/confidentialityclaimform.doc> with a specific justification explaining why the information is to be protected. Pricing and service elements of any proposal will not be considered proprietary. All material becomes the property of the DIVISION and may be returned only at the DIVISION's option.
- 6. BEST AND FINAL OFFERS:** Discussions may be conducted with offerors who submit proposals determined to be reasonably susceptible of being selected for award for the purpose of assuring full understanding of, and responsiveness to, solicitation requirements. Prior to award, these offerors may be asked to submit best and final offers. In conducting discussions, there shall be no disclosure of any information derived from proposals submitted by a competing offeror.
- 7. SAMPLES:** Samples of item(s) specified in this offer, brochures, etc., when required by the DIVISION, must be furnished free of expense to the DIVISION. Any item not destroyed by tests may, upon request made at the time the sample is furnished, be returned at the offeror's expense.

**WSCA-NASPO Data Communications Services Solicitation # JP14001**

**8. AWARD OF CONTRACT:** (a) The contract will be awarded with reasonable promptness, by written notice, to the responsible offeror whose proposal is determined to be the most advantageous to the DIVISION, taking into consideration price and evaluation factors set forth in the RFP. No other factors or criteria will be used in the evaluation. The contract file shall contain the basis on which the award is made. Refer to Utah Code Annotated\_65-56-408. (b) The DIVISION may accept any item or group of items, or overall best offer. The DIVISION can reject any or all proposals, and it can waive any informality, or technicality in any proposal received, if the DIVISION believes it would serve the best interests of the DIVISION. (c) Before, or after, the award of a contract the DIVISION has the right to inspect the offeror's premises and all business records to determine the offeror's ability to meet contract requirements. (d) The DIVISION will open proposals publicly, identifying only the names of the offerors. During the evaluation process, proposals will be seen only by authorized DIVISION staff and those selected by DIVISION to evaluate the proposals. Following the award decision, all proposals become public information except for protected information (see number 5 above). A register of proposals and contract awards are posted at <http://purchasing.utah.gov/vendor/bidtab.html>. (e) Estimated quantities are for bidding purposes only, and not to be interpreted as a guarantee to purchase any amount. (f) Utah has a reciprocal preference law which will be applied against offerors offering products or services produced in states which discriminate against Utah products. For details see Section 63G-6-404 and 63G-6-405, Utah Code Annotated. (g) Multiple contracts may be awarded if the DIVISION determines it would be in its best interest.

**9. DEBRIEFING OF UNSUCCESSFUL OFFERORS:**

State Purchasing does not conduct face to face or teleconference debriefings. All debriefings are to be conducted in writing. A debrief request must be submitted in writing to the Purchasing Agent within seven (7) calendar days of the award notification or rejection notification made through written correspondence or posted on BidSync. The debrief response will be limited to critiquing the strength/weakness of an offeror's proposal based on the evaluation criteria. The debriefing is intended as a courtesy to offerors, providing feedback to be used for future opportunities. Comparisons between proposals or evaluations of other proposals will not be allowed.

- 10. DIVISION APPROVAL:** Contracts written with the State of Utah, as a result of this proposal, will not be legally binding without the written approval of the Director of the DIVISION.
- 11. DEBARMENT:** The CONTRACTOR certifies that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction (contract) by any governmental department or agency. If the CONTRACTOR cannot certify this statement, attach a written explanation for review by the DIVISION.
- 12. ENERGY CONSERVATION AND RECYCLED PRODUCTS:** The contractor is encouraged to offer Energy Star certified products or products that meet FEMP (Federal Energy Management Program) standards for energy consumption. The State of Utah also encourages contractors to offer products that are produced with recycled materials, where appropriate, unless otherwise requested in this solicitation.
- 13. GOVERNING LAWS AND REGULATIONS:** All State purchases are subject to the Utah Procurement Code, Title 63 Chapter 56 U.C.A. 1953, as amended, and the Procurement Rules as adopted by the Utah State Procurement Policy Board. These are available on the Internet at [www.purchasing.utah.gov](http://www.purchasing.utah.gov). By submitting a bid or offer, the bidder/offeror warrants that the bidder/offeror and any and all supplies, services equipment, and construction purchased by the State shall comply fully with all applicable Federal and State laws and regulations, including applicable licensure and certification requirements.
- 14. SALES TAX ID NUMBER:** Utah Code Annotated (UCA) 59-12-106 requires anyone filing a bid with the state for the sale of tangible personal property or any other taxable transaction under UCA 59-12-103(1) to include their Utah sales tax license number with their bid. For information regarding a Utah sales tax license see the Utah State Tax Commission's website at [www.tax.utah.gov/sales](http://www.tax.utah.gov/sales). The Tax Commission is located at 210 North 1950 West, Salt Lake City, UT 84134, and can be reached by phone at (801) 297-2200.

WSCA-NASPO Data Communications Services Solicitation # JP14001

# The State of Utah Division of Purchasing and General Services

In conjunction with



Request for Proposals

**JP14001**

## **WSCA-NASPO Master Agreement for DATA COMMUNICATIONS PRODUCTS & SERVICES**

July 1, 2013

## WSCA-NASPO Data Communications Services Solicitation # JP14001

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**WSCA-NASPO Data Communications Services Solicitation # JP14001**

**REQUEST FOR PROPOSAL  
DATA COMMUNICATIONS PRODUCTS AND SERVICES CONTRACT  
Solicitation # JP14001 Revised 5/30/2013**

**Section 1: WSCA-NASPO Solicitation General Information****1.1 Purpose of Request for Proposal (RFP)**

The State of Utah, Division of Purchasing is requesting proposals in conjunction with WSCA-NASPO Cooperative Purchasing Organization, LLC (WSCA-NASPO). The purpose of this request for proposal is to establish master agreements with qualified manufacturers to provide Data Communications products and services outlined in the specifications for all participating States. The services resulting from the award of this solicitation are to be available to all state entities, cities, counties, higher education, school districts and other political subdivisions on an as needed basis under the same pricing and terms and conditions agreed to in the Master Agreement.

It is anticipated that this RFP may result in Master Agreement awards to multiple contractors.

While the primary purpose of this solicitation is to select a proposer(s) who can offer the Products or Services for all Participating States, proposers are permitted to submit a proposal on more limited geographical areas, but not less than one entire Participating State. Proposers must clearly describe the geographical limits (e.g. by State name) if proposing a geographical area less than that of all Participating States. However, if a proposer elects to submit a Proposal for a single State then the proposer must be willing to supply the entire State and will not be allowed to add additional States following award or at any time during the term of the contract or any renewals.

A Participating State may evaluate and select a proposer for award in more limited geographical areas (e.g. A single state) where judged to be in the best interests of the State or States involved.

Each participating entity shall select the authorized contractor(s) they choose to do business with during the participating addendum process. A participating entity may require the authorized contractor(s) to submit additional information regarding their firm as part of the selection process during the execution of a participating addendum. This information could include, but is not limited to; partners or resellers approved under their PA, business references, number of years in business, technical capabilities, and the experience of both their sales and installation personnel.

Each participating entity has the option to select one or more product categories or services from the resulting Master Agreement(s) during the execution of the participating addendum process.

Each participating entity has the option to negotiate an expanded product line within the product category offering and within the scope of this RFP during the Participating Addendum process. Any additional incremental discounts available to a Participating Entity, if offered, may be provided at the discretion and as the sole legal obligation of the Contract provider or their Authorized Sub-Contractor to the Participating Entity and negotiated during the Participating Addendum process. All Participating entities have the right to put dollar limits and certain line item, parts or on the total amount purchased per occasion on their individual PA's as they deem appropriate.

The resulting Master Agreement will be awarded with the understanding and agreement that it is for the sole convenience of the participating entities. The participating entities reserve the right to obtain like goods or services from other sources when necessary.

This RFP is designed to provide interested proposers with sufficient basic information to submit proposals meeting minimum requirements, but is not intended to limit a proposal's content or exclude any relevant or essential data. Suppliers are encouraged to expand upon the specifications to evidence service and capability.

**1.2 WSCA-NASPO Background Information**

WSCA-NASPO is a cooperative purchasing organization of all 50 states, the District of Columbia and the organized US territories. WSCA-NASPO is a subsidiary of the National Association of State Procurement Officials (NASPO). NASPO is a non-profit association dedicated to strengthening the procurement community through education, research, and communication. It is made up of the directors

**WSCA-NASPO Data Communications Services Solicitation # JP14001**

of the central purchasing offices in each of the 50 states, the District of Columbia and the territories of the United States. For more information consult the following websites [www.wsca-naspo.org](http://www.wsca-naspo.org) and [www.naspo.org](http://www.naspo.org)

Obligations under master agreements that result from this cooperative procurement are limited to those states and other eligible entities that execute a Participating Addendum:

**63G-6a-2105 Participation of a public entity or a procurement unit in agreements or contracts of procurement units -- Cooperative purchasing -- State cooperative contracts.**

(2) A public entity may obtain a procurement item from a state cooperative contract or a contract awarded by the chief procurement officer under Subsection (1), without signing a participating addendum if the quote, invitation for bids, or request for proposals used to obtain the contract includes a statement indicating that the resulting contract will be issued on behalf of a public entity in Utah.

Financial obligations of Participating States (Entities) are limited to the orders placed by the departments, agencies and institutions of that Participating State (Entity) having legally available funds. Participating States incur no financial obligations on behalf of its political subdivisions, other governmental entities or other eligible entities.

Unless otherwise specified in the solicitation or a Participating Addendum, the resulting master price agreement(s) will be permissive.

This RFP is designed to provide interested Offerors with sufficient basic information to submit proposals meeting minimum requirements, but is not intended to limit a proposal's content or exclude any relevant or essential data. Proposals must be succinct, concise, and as short as possible to allow for efficient evaluation. Blanket marketing material and unnecessary elaborate brochures or representations beyond what is sufficient to present a complete and effective proposal are not acceptable.

Offerors must respond to any or all of the 12 categories that follow. The following product and service categories are included in this RFP:

1. Data Center Application Services
2. Networking Software
3. Network Management and Automation
4. Network Optimization and Acceleration
5. Optical Networking
6. Routers
7. Security
8. Storage Networking
9. Switches
10. Wireless
11. Unified Communications
12. Services

**1.3 Objective**

The objective of this RFP is to obtain deeper volume price discounts than are obtainable by an individual state or local government entity. This discount is based on the collective volume of potential purchases by the numerous state and local government entities. The savings realized by the contractor in managing one comprehensive WSCA-NASPO Master Agreement rather than numerous state and local contracts should result in the most attractive service level and discounts available in the marketplace.

The Master Agreement(s) resulting from this procurement may be used by state governments (including departments, agencies, institutions), institutions of higher education, political subdivisions (i.e., colleges, school districts, counties, cities, etc.), and other eligible entities subject to approval of the individual state procurement director and local statutory provisions.

Participation by political subdivisions, other government entities and other eligible participants is with the authorization or acknowledgement of the specific state chief procurement official, and the execution of a Participating Addendum.

## WSCA-NASPO Data Communications Services Solicitation # JP14001

### 1.4 Solicitation Background

This is a rebid for the current for the WSCA-NASPO Data Communications Equipment, Supplies and Services contracts. Eight (8) Manufacturers currently have Master Contracts to provide Data Communications Equipment, Supplies and Services. They are as follows:

Alcatel-Lucent – AR1466  
 Brocade Communications – AR214  
 Cisco Systems – AR233  
 Enterasys Networks, Inc. – AR1471  
 Extreme Networks – AR1471  
 Hewlett-Packard - AR1464  
 Juniper Networks – AR229  
 Meru Networks – AR218

Although the State of Utah and WSCA-NASPO does not guarantee any usage or spend under these contracts, for bid purposes only, the total combined spend on these contracts for 2012 was \$204 million dollars.

### 1.5 Issuing Office and Solicitation Number

The State of Utah, Division of Purchasing is the issuing office for this document and all subsequent addenda relating to it. The reference number for the transaction is Solicitation # JP14001. This number must be referred to on all proposals, correspondence, and documentation relating to the RFP.

### 1.6 WSCA-NASPO Contract Administrator

The WSCA-NASPO Contract Administrator designated by WSCA-NASPO and the State of Utah, Division of Purchasing and General Services is:

Name: Jennifer Porter  
 State of Utah Division of Purchasing and General Services  
 State Office Building, Capitol Hill Room 3150  
 Salt Lake City, UT 84114-1061  
 Email: [jenniferporter@utah.gov](mailto:jenniferporter@utah.gov)  
 Phone: 801-538-3064  
 Fax: 801-538-3882

### 1.7 Proposal Submittal

Offers must be received, according to instructions, by the posted due date and time. Offers received after the deadline will be non-responsive.

**Proposals are due August 30, 2013 at 11:00 am MST**

**Questions will be accepted until July 26, 2013 at 11:00 am MST**

**Data Communication RFP Release Webinar is scheduled for July 11, 2013.** Webinar details will be posted on the WSCA-NASPO website ([www.wsca-naspo.org](http://www.wsca-naspo.org)).

The preferred method of submitting your original 'master' proposal packet is electronically in Microsoft Word and Excel through BidSync, ([www.bidsync.com](http://www.bidsync.com)), or you may mail or drop off your hard copies to the address noted in Section 1.6 of this RFP on or before the due date and time. The original 'master' proposal packet shall include a separate document or sealed envelope labeled "SOLICITATION # JP14001 Cost Schedule" that contains the pricing document. Please note that the State of Utah Division of Purchasing office is closed on Saturday and Sunday and therefore does not accept deliveries on those days.

When submitting an offer electronically through BidSync, please allow sufficient time to complete the online forms and upload documents. The solicitation will end at the closing time listed in the offer. If you are in the middle of uploading your documents at the closing time, the system will stop the process and your offer will not be received by the system. It is recommended that the submission process be completed the day prior to the due date, with the knowledge that any changes/updates will be accepted through the due date and time.

Electronic offers may require the uploading of electronic attachments. BidSync's site will accept a wide variety of document types as attachments. However, the submission of documents containing

**WSCA-NASPO Data Communications Services Solicitation # JP14001**

embedded documents (zip files), mov, wmp, and mp3 files are prohibited. **All documents should be attached as separate files.**

BidSync customer support may be contacted at (800) 990-9339 for guidance on the BidSync site. Respondents are responsible for ensuring that their BidSync registration information is current and correct.

The State of Utah accepts no responsibility for missing or incorrect information contained in the vendor registration in BidSync. Incorrect or missing vendor registration information may result in failure to receive notification from BidSync regarding this procurement.

In addition to the original 'master' proposal packet submission, Respondents are required to send one (1) hard copy and one (1) electronic version (Microsoft Word and Excel) of the complete proposal, **excluding pricing information**, to each of the evaluation team members listed below. Each proposal packet shall be marked with the solicitation number and be in accordance with the submittal requirements. The original 'master' sent to the WSCA-NASPO Master Agreement Administrator identified in Section 1.6 of this RFP will prevail in resolving any discrepancies.

Alaska – Ted Fawcett Contracting Officer  
[ted.fawset@alsaka.gov](mailto:ted.fawset@alsaka.gov)

California - Bonnie Bahnsen  
[bonnie.bahnsen@dgs.ca.gov](mailto:bonnie.bahnsen@dgs.ca.gov)

Nevada – Marti Marsh Purchasing Officer  
[mmarsh@admin.nv.gov](mailto:mmarsh@admin.nv.gov)

New Jersey – Vicente Azarcon Procurement Specialist  
[vicente.azarcon@treas.state.nj.us](mailto:vicente.azarcon@treas.state.nj.us)

Utah – Jennifer Porter Purchasing Agent State of Utah  
[jenniferporter@utah.gov](mailto:jenniferporter@utah.gov)

**1.8 Current State Participants**

The States currently participating in the existing contracts are: Alaska, Arkansas, California, Colorado, Delaware, District of Columbia, Hawaii, Idaho, Iowa, Kentucky, Louisiana, Minnesota, Missouri, Montana, Nevada, New Jersey, Oklahoma (Grand River Dam Authority), Oregon, South Dakota, Utah, Washington, Wisconsin and Wyoming.

States with "Intent to Participate" – The following states have executed an Intent to Participate thru WSCA- NASPO, which simply indicates that they want to be formally listed in the published Request for Proposal as participating in the solicitation process: California, Hawaii, Minnesota, Missouri, Montana, Nevada, New Jersey, South Carolina, South Dakota, Utah, Vermont and Washington. All 56 NASPO members are eligible to participate in all WSCA-NASPO contracts when and if they decide they want to, in accordance with their individual statutory requirements.

**1.9 Governing Laws and Regulations**

This procurement is conducted by the State of Utah, Division of Purchasing & General Services, in accordance with the Utah Procurement Code. These are available at the Internet website [www.purchasing.utah.gov](http://www.purchasing.utah.gov) for the State of Utah's Division of Purchasing & General Services.

The laws of the State of Utah will govern all Master Agreements that result from this procurement unless the Data Communications Products and Services Provider and participating entity agree in a Participating Addendum that the laws of another jurisdiction will govern purchases made by purchasing entities within the jurisdiction of the participating entity.

**1.10 Length of Contract**

The Master Agreement(s) resulting from this RFP will be for a period of five years (initial term). The Master Agreement(s) may be extended beyond the original Master Agreement period for a two (2) year period, by mutual agreement.

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### 1.11 Pricing Structure

**Pricing Structure:** Pricing for the WSCA-NASPO Master Agreements shall be based on the Percent Discount off the current global Mthe State Schedule applicable to United States customers.

### 1.12 Price Guarantee Period

**Price Guarantee Period:** The Data Communication Provider's Discount rate shall remain in effect for the term of the WSCA-NASPO Master Price Agreement.

### 1.13 Price Escalation

**Equipment, Supplies and Services:** Data Communications provider may update the pricing on their MSRP the State price list one time every year after the first year of the original contract term. The WSCA-NASPO Contract Administrator will review a documented request for a Price Schedule price list adjustment only after the Price Guarantee Period.

### 1.14 Price Reductions

In the event of a price decrease in any category of product at any time during the contract in a Provider's Price Schedule, including renewal options, the WSCA-NASPO Contract Administrator shall be notified immediately. All Price Schedule price reductions shall be effective upon the notification provided to the WSCA-NASPO Master Agreement Administrator.

### 1.15 Usage Reporting Requirement

All Data Communication Provider's will be required to provide quarterly usage reports to the WSCA-NASPO Contract Administrator or designee. The initiation and submission of the quarterly reports are the responsibility of the Data Communication Contract Provider. You are responsible to collect and report all sales data including your resellers and partners sales associated with your Master Agreement. There will be no prompting or notification provided by the WSCA-NASPO Contract Administrator.

Quarterly reports must coincide with the quarters in the fiscal year as outlined below:

Quarter #1:	July 1 through September 30, due annually by October 30.
Quarter #2:	October 1 through December 31, due annually by January 30.
Quarter #3:	January 1 through March 31, due annually by April 30.
Quarter #4:	April 1 through June 30, due annually by July 30.

Respondents must identify the person responsible for providing the mandatory usage reports. This contact information must be kept current during the Master Agreement period. The WSCA-NASPO Contract Administrator must be notified if the contact information changes. The contact information for the person responsible for the mandatory quarterly usage reporting must be specified per Section 3.1.5.

The purpose of the Master Agreement usage-reporting requirement is to aid in Master Agreement management. The specific report content, scope, and format requirements will be provided to the awarded Data Communications Products and Services Provider's during Master Agreement execution. Some WSCA- NASPO States may require additional reporting requirements. Those requirements will be addressed through the individual participating entity's Participating Addendum process. Failure to comply with this requirement may result in Master Agreement cancellation.

### **FNC Response:**

[Read, understood and comply](#)

### 1.16 Standard Contract Terms and Conditions

Any Master Agreement resulting from this RFP will include, but will not be limited to, the WSCA-NASPO Standard Master Agreement Terms and Conditions, the State of Utah Additional Terms and Conditions (Appendix A) and any additional terms and conditions specific to WSCA-NASPO participating addendums for participating entities. The WSCA-NASPO Master Agreement Terms and Conditions and State of Utah Additional Terms and Conditions will take highest precedence in any contract resulting from this solicitation. Vendors must clearly identify exceptions to the WSCA-NASPO Standard Master Agreement Terms and Conditions and the State of Utah Additional Terms and Conditions in the bid submission. Vendor exceptions must include proposed solution language. Failure to submit exceptions and/or solution language will constitute vendor acceptance of WSCA-NASPO and State of Utah

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Additional Terms and Conditions. No third party terms and conditions will be allowed in resulting contracts awarded under this solicitation. Additional vendor terms and conditions must be submitted with the solicitation bid response for legal review and contract applicability. Submission of vendor terms and conditions with a bid response does not guarantee acceptance. Vendor terms and condition will not include any reference to website URLs that house additional terms and conditions. All terms and conditions associated with resulting contracts will be identified and attached to the WSCA-NASPO Master Agreement. The State of Utah reserves the right to accept, reject, and/or negotiate vendor terms and conditions after the award(s) have been made if it is in the best interest of the State of Utah. Participating States reserve the right to negotiate vendor terms and conditions during the Participating Addendum process. **Vendor terms and conditions included with a bid response are limited to a maximum of 10 pages (8 1/2 x 11 inch paper, 10 pt Arial font, and single sided). Failure to adhere to these terms and conditions requirements may result in vendor disqualification.**

**FNC Response:**

Read and Understood; See Attachment A below for exceptions.

The following changes/exceptions to the State of Utah Agreement are being proposed

**ATTACHMENT A - REQUESTED CHANGES TO AGREEMENT**

**Term 7 Defaults & Remedies** subsection b will be revised by adding "The amount of the liquidated damages, if any, must be agreed upon by the parties to this contract in writing."

**Term 8 Delivery** is deleted and replaced with the following: "Unless otherwise indicated in the Master Agreement, the prices are the delivered price to any Participating State agency or political subdivision. All deliveries shall be F.O.B destination with all transportation and handling charges paid by the Contractor unless expedited shipping is requested by the customer in which case, the freight will be prepaid and added to the invoice. Responsibility and liability for loss or damage shall remain the Contractor until final inspection and Acceptance when responsibility shall pass to the Buyer except as to latent defects, fraud and Contractor's warranty obligations. The minimum shipment amount will be found in the special terms and conditions. Any order for less than the specified amount is to be shipped with the freight prepaid and added as a separate item on the invoice. Any portion of an order to be shipped without transportation charges that is back ordered shall be shipped without charge."

**Term 11 Indemnification** is deleted and replaced with: "The Contractor shall defend, indemnify and hold harmless WSCA- NASPO, the Lead State and Participating Entities along with their officers, agencies, and employees from and against claims, damages or causes of action including reasonable attorneys' fees and related costs for any death, injury, or damage to property arising from negligent or willful act(s), error(s), or omission(s) of the Contractor, its employees or subcontractors or volunteers, at any tier, relating to the performance under the Master Agreement. This section is not subject to any limitations of liability in this Master Agreement or in any other document executed in conjunction with this Master Agreement.

**Term 12 Indemnification – Intellectual Property** is deleted and replaced with:

"**Indemnity** Contractor will defend WSCA-NASPO, the Lead State and Participating Entities ("Indemnified Party") against any claim, action, or proceeding (Claim) brought against Indemnified Party to the extent it is based on an allegation that a Product or Service, as delivered to Indemnified Party by Contractor, infringes any US patent, trademark, copyright, or other proprietary right of a third party. Contractor will pay Indemnified Party the direct and actual damages finally awarded against Indemnified Party in any action attributable to a Claim if Indemnified Party: (a) promptly after receiving notice of the Claim notifies Contractor of the Claim and any action taken by Indemnified Party on it; (b) gives Contractor sole control of the Claim's defense and any negotiations of its settlement; and (c) cooperates with and assists Contractor as reasonably requested for the Claim's defense.

**Third Party Injunctive Action** If any third party obtains an injunction against Indemnified Party's use of any Product or Service as a result of a Claim, or if Contractor determines, in its sole discretion, that Indemnified Party's use of any Product or receiving a Service may be subject to a Claim, Contractor may, at its own expense and option (a) procure for Indemnified Party the right to continue using the Product or receiving the Service; (b) replace the Product or Service with a Product or Service of substantially equal or greater functionality; or (c) modify the Product or

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Service to avoid a Claim. If in Contractor's sole judgment none of these alternatives are reasonably available, Contractor may (i) request that Indemnified Party return the applicable Product to Contractor and upon its receipt provide Indemnified Party a credit toward future purchases equal to the purchase price of the Product paid by Indemnified Party, less a reasonable adjustment for beneficial use; or (ii) cease performance of the Service and grant Indemnified Party a credit for any amounts paid for any portion of the Service not yet performed.

Allegations Not Covered. Contractor will not be liable to Indemnified Party for actual or alleged infringement if (a) the Product in question is used in combination with items not furnished by Contractor when use of the Product by itself would not cause the infringement or Claim; (b) the Product is used in a manner for which it was not designed by Contractor; (c) modifications were made to the Product by someone other than Contractor after delivery to Indemnified Party; or (d) the infringement arises from Contractor's compliance with Indemnified Party's specifications or request. Contractor will not be liable for any Claim of trademark infringement based upon any branding or marking not applied by Contractor or that is applied at Indemnified Party's request."

Term 15 Insurance is amended as follows: " Contractor shall, during the term of this Master Agreement, maintain in full force and effect, the insurance described in this section. Contractor shall acquire such insurance from an insurance carrier or carriers licensed to conduct business in the Participating Entity's state and having a rating of A-, Class VII or better, in the most recently published edition of Best's Reports. Failure to buy and maintain the required insurance may result in this Master Agreement's termination or at a Participating Entity's option; result in termination of its Participating Addendum.

Commercial General Liability Coverage shall be written on an occurrence basis.

The minimum acceptable limits shall be as indicated below, with no deductible for each of the following categories:

- a) Commercial General Liability covering the risks of bodily injury (including death), property damage and personal injury, with an annual policy limit of not less than \$1 million per occurrence/\$2 million general aggregate;
- b) Contractor must comply with any applicable State Workers Compensation or Employers Liability Insurance requirements.

Contractor shall pay premiums on all insurance policies. Such policies shall also reference this Master Agreement and shall have a condition that they not fall to levels below those required herein without first having the insurer provide thirty (30) calendar days after notice of intended revocation thereof.

Prior to commencement of the work, Contractor shall provide to the Participating Entity a written endorsement to the Contractor's general liability insurance policy that (i) names the Participating Entity as an additional insured, (ii) provides that no material alteration, cancellation, non-renewal, or expiration of the coverage contained in such policy shall be reduced to levels of coverage below those required herein unless the named Participating Entity has been given at least thirty (30) days prior written notice, and (iii) provides that the Contractor's liability insurance policy shall be primary, with any liability insurance of the Participating Entity as secondary and noncontributory for insured claims caused by Contractor while engage in activities toward the completion of this agreement.

Contractor shall furnish to Participating Entity copies of certificates of all required insurance within thirty (30) calendar days of the Participating Addendum's effective date and prior to performing any work. Copies of renewal certificates of all required insurance shall be furnished within thirty (30) days after renewal date. These certificates of insurance must expressly indicate compliance with each and every insurance requirement specified in this section. Failure to provide evidence of coverage may, at State's sole option, result in this Master Agreement's termination"

Term 17 License of Pre-Existing Intellectual Property is deleted and replaced with: "**LICENSE OF INTELLECTUAL PROPERTY**

**LICENSED PRODUCTS**

Defining Licensed Products. Software and documentation are Licensed Products. Software means the machine-readable (object code) form of computer programs, instruction sequences, or other like data residing in or necessary to use the equipment, components, or hardware furnished by

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Contractor and includes any subsequent revisions, patches, fixes, updates, or upgrades thereto. Software includes base Software and any individually licensed NE Software features that are purchased, accessed or otherwise activated by Participating Entity. Software may be provided by Contractor and third parties. Contractor will provide or make available third party terms and conditions that may apply to the Software or third party software to be furnished by Contractor. Contractor may provide software in any electronic, magnetic, optical, or mechanical media, in loadable or downloadable form, or embedded in a Product. Contractor does not license any human-readable source code to Participating Entity. Documentation means all supporting or informative material related to the use or maintenance of Products, provided in print, electronic, or any other format.

Grant of License Contractor will license Licensed Products to Participating Entity solely for Participating Entity's internal use without any right to sublicense. Upon delivery of Licensed Product to Participating Entity and payment by Participating Entity of the applicable license fee for base Software and individually licensed Software features or other consideration as determined by Contractor, Contractor grants and Participating Entity accepts a non-exclusive, non-transferable right-to-use (RTU) license to documentation and to software that is embedded in or loaded, activated, accessed, or downloaded into any Contractor furnished Product only for the use intended by Contractor on and with that Product. These license terms also apply to any other software that Contractor furnishes to Participating Entity unless other license terms are furnished by Contractor (a) with the other software or (b) during the load-key acquisition sequence Participating Entity must perform to obtain access to the other software.

Restricted Rights Participating Entity may not modify, adapt, translate, reverse engineer, disassemble, decompile, or otherwise attempt to derive source code from or create or prepare derivative works of or from Licensed Products. Participating Entity may not distribute, sublicense, rent, lease, loan, publish, timeshare, or transfer Licensed Products or remove, alter, or in any way obscure any proprietary notices on Licensed Products. Participating Entity may not publicly display visual output or publish any test results of the software, or make unauthorized copies of any portion of the Licensed Products. Participating Entity may not use the Software in inherently high-risk applications such as, but not limited to, aircraft navigation or communications, nuclear facilities, mass transit, or medical emergency communications. Contractor licenses Licensed Products to government Participating Entity's as set forth herein or only with restricted rights. If applicable laws and regulations would grant any government Participating Entity's greater rights than granted herein, then the government Participating Entity will receive only the minimum rights required by those laws and regulations. Use, copying, or disclosure by government Participating Entity's is subject to applicable restrictions in any of the following: paragraph (c) of the Commercial Computer Software - Restricted Rights (June 1987) clause at FAR 52.227-19 and the Restricted Rights Notice of subparagraph (g)(3) of the Rights in Data - General (June 1987) clause at FAR 52.227-14.

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Additional Restriction NE Software is licensed as a single Product with individual Software license features and may not be separated for use other than as permitted above.

Third Party Terms and Conditions

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**SOFTWARE**Release Level Definitions:

- “Major Release” means a software release or version that contains what Contractor in its sole discretion defines as significant new features and capabilities. A Major Release will typically be announced as a major release or version in a New Product Announcement.
- “Minor Release” means a software release, version or service pack that contains what Contractor in its sole discretion defines as a more limited set of new features and capabilities, and will typically be announced as a minor release, version or as a service pack in the Software Release Notes.
- “Maintenance Release” means a software release, version, or patch that contains what Contractor in its sole discretion defines as a software fix that is issued to fix or work around significant software non-conformances. A Maintenance Release will typically be announced as a maintenance release, or version, or as a patch, in the Software Release Notes.

Software Support Contractor may at any time discontinue development, sale, and support of (“manufacture discontinue”) a software Release, including issuing of any Maintenance Releases for that Release of a particular software Product upon 6 months’ advance notice to Participating Entity. Despite the previous sentence, Contractor may, in its sole discretion, manufacture discontinue any Obsolete Release without advance notice. An Obsolete Release of a Product is one for which there have been 3 subsequent Major Releases of the Product. Participating Entity acknowledges and agrees that Contractor’s announcement of general availability of the most recent Major Release of the Product may provide notice of the immediate effective manufacture discontinuance of any Obsolete Releases of the Product, and no prior advance notice is required.

Recordkeeping/Network Audits: Participating Entity agrees to maintain records establishing its right to use the Software and, upon request, will provide Contractor written verification of Release and individually licensed features usage. Upon 10 days written notice, Contractor (or its authorized representative) may audit Participating Entity’s use of the Software. Participating Entity agrees to pay any applicable fees for Software usage in excess of license rights within ten (10) days of written notification. Pricing for non-reported usage will be based on pricing in effect at the time of the notification.”

Term 22 Payment: the first sentence of this section is deleted and replaced with: “Payments are due 35 days following the date the entire order is delivered or the date of a correct invoice, whichever is later.”

Term 26 – Standard of Performance and Acceptance is deleted and replaced with; “The Standard of Performance applies to all Product(s) purchased under this Master Agreement which are being installed by Contractor. The Acceptance Testing period shall be thirty (30) calendar days or other time period identified in the solicitation or the Participating Addendum, starting from the day after the Product is installed and Contractor certifies that the Product is ready for Acceptance Testing. If the Purchasing Entity fails to provide Contractor with written notice of Acceptance or rejection within ten (10) days after the Acceptance Period, the Services are deemed Accepted. If the Product does not meet the Standard of Performance during the initial period of Acceptance Testing, Participating Entity may, at its discretion, continue Acceptance Testing on a day-to-day basis until the Standard of Performance is met. Upon rejection, the Contractor will have fifteen (15) calendar

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days to cure the Standard of Performance issue(s). If after the cure period, the Product still has not met the Standard of Performance Participating Entity may, at its option: (1) declare Contractor to be in breach and terminate the Order; (2) demand replacement Product from Contractor at no additional cost to Participating Entity; or, (3) continue the cure period for an additional time period agreed upon by the Participating Entity and the Contractor. Contractor shall pay all costs related to the preparation and shipping of Product returned pursuant to the section. No Product shall be accepted and no charges shall be paid until the Standard of Performance is met.”

**Term 28 - Title of Product:** is deleted and replaced with: “Upon Acceptance by the Participating Entity, Contractor shall convey to Participating Entity title to the equipment free and clear of all liens, encumbrances, or other security interests. Software is licensed, not sold, as described under the section of this Agreement entitled License of Intellectual Property above.”

**Term 29 – Waiver of Breach** is revised by deleting each use of “Lead State or Participating Entity” and replacing it with “any party to this Agreement”.

**Term 30 – Warranty**– The warranty section is deleted in its entirety and replaced with FNC’s warranty as follows: “**Software Warranty.** FNC warrants that for a period of 90 days from date of shipment from FNC (a) the media on which the Software is furnished will be free of defects in materials and workmanship and (b) the Software will function substantially as described in its Documentation when used on the hardware and with the system or configuration for which the Software is specified. FNC does not warrant that the operation of the Software will be uninterrupted or error free, or that the Software functions will meet Customer’s requirements. Customer’s sole remedy under this limited warranty is (a) with respect to defective media, replacement of the media at no additional charge to Customer if it is returned to FNC during the warranty period with proof of the date of shipment and (b) with respect to the Software functionality, for FNC to use reasonable efforts to provide a maintenance release, patch, or workaround or otherwise correct the Software to bring it substantially into conformance with the Documentation. This warranty does not apply if the Software (a) has been altered, except by FNC, (b) has not been installed, operated, repaired, or maintained in accordance with instructions supplied by FNC, (c) has been subjected to abnormal physical or electrical stress, misuse, negligence, or accident, or (d) is used in high-risk applications.

**Equipment Warranties**

**Express Warranties.** FNC warrants that for 12 months from date of shipment from FNC (a) the applicable equipment, components, or hardware, (individually or collectively “equipment”) purchased from FNC will be free from defects in material and workmanship, and (b) the equipment will conform to FNC’s applicable hardware specifications, exclusive of separately licensed software, at the time of shipment. These warranties are provided only to the original purchaser of the Product(s) under this Agreement and are not transferable unless agreed to in writing by an authorized representative of FNC.

**Remedy** Customer’s sole and exclusive remedy under this warranty is that FNC will, at its option and without additional charge to Customer, repair or replace any equipment that does not materially conform to this warranty during its respective warranty period.

**Defective on Arrival (DOA) Returns** If Customer performs the initial installation of the equipment and Customer rejects the equipment because, within 30 days after shipment of the equipment to Customer, it fails Customer’s acceptance testing against applicable hardware specifications, exclusive of separately licensed software, provided or agreed upon in writing by FNC or its supplier before such acceptance testing, Customer should immediately notify FNC. Upon receipt of this notification by FNC within the time prescribed above, FNC will furnish replacement equipment to Customer with the understanding that Customer will within 30 days after receipt of the replacement equipment (a) return the non-conforming equipment to FNC or (b) issue a purchase order to FNC for the purchase price of the replacement equipment. FNC will test any returned rejected equipment against FNC’s applicable hardware specifications, exclusive of separately licensed software. If FNC determines there is no trouble found (NTF) with the equipment, Customer agrees to issue a purchase order to FNC for FNC’s then current fee for each returned item found to be NTF.

**Warranty Returns.** Before Customer can return any equipment furnished by FNC that Customer believes does not conform to the above warranties, Customer must first obtain a Return Material Authorization (RMA) from FNC. To obtain an RMA Customer should call 1-800-525-0303. Once the RMA is obtained and properly completed, Customer must send the RMA to FNC along with the

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equipment being returned. Customer agrees that it will issue a purchase order to FNC for applicable charges if (a) FNC determines the equipment returned is actually out of warranty; or (b) the returned equipment is found to comply with the applicable hardware specifications, exclusive of separately licensed software. The charge for out of warranty repair will be based on a quotation provided by FNC and mutually agreed to by the parties and the charge to cover returned equipment found to comply with the applicable hardware specifications will be the NTF fee as described above. If the warranty for the returned equipment is determined to be void for any of the reasons set forth in the section below, the equipment will be returned to Customer without repair. Return of equipment to the repair facility designated by FNC is at Customer's expense. Equipment that is repaired, replaced, or found to be NTF will be returned to Customer's point of shipment at no expense to Customer. Customer does not need to return defective software media. Customer should contact FNC and request a replacement CD. If, after exercising commercially reasonable efforts to repair or replace defective equipment, FNC determines that the equipment cannot be repaired or replaced, then FNC may, in its sole discretion, provide Customer a credit toward future purchases equal to the purchase price paid by Customer, less a reasonable adjustment for beneficial use. Under no circumstances will FNC or its suppliers have any obligation for any data contained in any equipment sent to FNC or its supplier for repair Services. Title to non-conforming equipment returned by Customer that is replaced by FNC or its supplier passes to FNC or its supplier when the returned equipment arrives at the facility designated by FNC. Title to equipment sent to Customer as a replacement for non-conforming equipment returned by Customer will pass to Customer upon delivery to Customer, provided the equipment Customer returned as non-conforming was fully paid for; otherwise, title to the replacement equipment will pass when Customer has paid the full purchase price

No Implied Warranties. Except as expressly provided in this agreement, there are no warranties, express or implied, including, without limitation, the implied warranties of merchantability and fitness for a particular purpose.

No Liability. The above warranties are void and FNC disclaims any obligation under this article if: (a) the warranty period has expired; (b) the Product has not been stored, configured, installed, operated, or maintained in accordance with FNC's applicable specifications, documentation, and instructions for the Product or packed for return in accordance with FNC's instructions or reasonable care (e.g. avoiding the possibility of electrostatic discharge damage when packing equipment); (c) the Product has been subjected to accident, disaster, neglect, abuse, misuse, damage (e.g. burned, cracked, etc.) repair, or modification in any respect, by anyone other than FNC or its authorized service representatives without prior consent; (d) the Product's performance is adversely affected by materials, equipment, software or services provided by an entity other than FNC; or (e) anyone other than the Customer asserts the warranty rights without Customer first advising FNC in writing."

**Definitions**

The defined term **Acceptance** is revised as follows: - "means a written notice from a purchasing entity to contractor advising Contractor that the equipment has passed its Acceptance Testing. Acceptance of a Product for which acceptance testing is not required shall occur following the completion of delivery, installation, if required, and a reasonable time, not to exceed 10 days for inspection of the Product, unless the Purchasing Entity provides a written notice of rejection to contractor."

The defined term **Intellectual Property** is revised as follows: "means any and all patents, copyrights, service marks, trademarks, trade secrets, trade names, patentable inventions, or other similar proprietary rights, in tangible or intangible form, and all rights, title, and interest therein. For clarity, Contractor's Product documentation and training materials are considered Intellectual Property."

**The following terms are added:**

**"LIMITATION OF LIABILITY** Except for a breach of the sections of this agreement entitled LICENSED PRODUCTS or CONFIDENTIAL INFORMATION, neither party may be held liable to the other for indirect, incidental, punitive, special, or consequential damages, lost profits, data, or revenues, or costs of procurement of substitute goods or services, even if the party has been advised of the possibility of such damages or losses. Contractor's liability for direct damages will not exceed the total purchase price of the purchase order under which the Products or Services

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giving rise to such damages were purchased from Contractor.

*Except for valid warranty claims under this agreement, the Participating Entity waives any claim against Contractor, including without limitation any cross-claim based upon a third party action brought against Participating Entity, arising out of an alleged Product defect to the extent that any such claim results from Participating Entity, or any third party contracted by Participating Entity (a subcontractor), engineering, configuring, installing, maintaining, or operating the Product in a manner inconsistent with the applicable Product documentation furnished by Contractor and Participating Entity will defend, indemnify, and hold Contractor harmless from and against any claim asserted by a third party against Contractor arising out of an alleged Product defect to the extent that any such claim results from such action by Participating Entity or its subcontractor.”*

**“Order Rescheduling and Cancellation** If Participating Entity (a) cancels all or part of any purchase order within 30 days before the scheduled shipment date, (b) refuses to accept delivery of any shipment, or (c) postpones shipment more than 60 days beyond the scheduled shipment date, Participating Entity may be invoiced for, and agrees to pay Contractor if so invoiced, a restocking charge of 15% of the purchase price of the affected Products.”

**Attachment A – STATE OF UTAH STANDARD INFORMATION TECHNOLOGY TERMS AND CONDITIONS**

**Term 11 Indemnity Clause** is deleted and replaced with the language in Term 12 above, entitled **Indemnification – Intellectual Property**.

**Term 13 Termination** is revised by deleting the last sentence and replacing with: “Contractor further acknowledges that in the event of such termination, all SOU Deliverables are the property of the State and shall be promptly delivered to the State.

**Term 25 – Payment.** The first sentence of this section is deleted and replaced with: “Payments are due 35 days following the date an order is delivered or the date of a correct invoice, whichever is later.”

**Term 26 Copyright** – Delete the first sentence and replace with “The contractor agrees that any and all State of Utah Deliverables prepared solely for the State of Utah at the State of Utah’s sole expense (“SOU Deliverables”), as required by this contract, to the extent to which it is eligible under copyright law in any country, shall be deemed a work made for hire, such that all rights, title and interest in the work and SOU Deliverables shall be exclusively owned by the State of Utah. All references to Deliverables in this section 26 shall be replaced with SOU Deliverables”

**Term 29 OWNERSHIP, PROTECTION, AND RETURN OF DOCUMENTS AND DATA UPON CONTRACT TERMINATION OR COMPLETION** is deleted and replaced with: “All SOU Deliverables required by this contract will be the property of the State and must be delivered to the State within 30 working days after termination or completion of the contract, regardless of the reason for contract termination, and without restriction or limitation to their future use. Any State data that may be returned under provisions of this clause must either be in the format as originally provided, or in a format that is readily usable by the State or that can be formatted in a way that it can be used. Costs for all of these described items will be considered as included in the basic contract compensation of the work described used by the State.”

**Term 31 Termination upon Default** - Add the following sentence at the end of this section: “Damages, if any, must be previously approved by the parties to this agreement in writing.”

**Term 39 Time is of the Essence** - The following is added at the end of this section: “In spite of the foregoing, any damages must be approved by the parties to this Agreement in writing.”

**Term 43 Insurance** – shall be the insurance requirements described above

### 1.17 Questions

All questions must be submitted through BidSync. Answers will be given via the BidSync website. Questions received after the Question/Answer period will not be answered. No agency employee, board member, or evaluation committee member should be contacted concerning this solicitation during the solicitation posting and selection process. Failure to comply with this requirement may result in vendor disqualification.

**WSCA-NASPO Data Communications Services Solicitation # JP14001****1.18 Discussions with Respondents (Oral Presentation)**

An oral presentation by a Respondent to clarify a proposal may be required at the sole discretion of the WSCA-NASPO Master Agreement Administrator. However, the WSCA-NASPO Contract Administrator may award a Master Agreement based on the initial proposals received without discussion with the Respondent. If oral presentations are required, they will be scheduled after the submission of proposals. Oral presentations will be made at the Respondents expense.

**1.19 Protected Information**

The Government Records Access and Management Act (GRAMA), Utah Code Ann., Subsection 63-2-304, provides in part that:

The following records are protected if properly classified by a government entity:

- (1) trade secrets as defined in Section 13-24-2 if the person submitting the trade secret has provided the governmental entity with the information specified in Section 63-2-308 (Business Confidentiality Claims);
- (2) commercial information or non-individual financial information obtained from a person if:
  - (a) disclosure of the information could reasonably be expected to result in unfair competitive injury to the person submitting the information or would impair the ability of the governmental entity to obtain necessary information in the future;
  - (b) the person submitting the information has a greater interest in prohibiting access than the public in obtaining access; and
  - (c) the person submitting the information has provided the governmental entity with the information specified in Section 63-2-308;
- (3) records the disclosure of which would impair governmental procurement proceedings or give an unfair advantage to any person proposing to enter into a contract or agreement with a governmental entity, except that this Subsection (6) does not restrict the right of a person to see bids submitted to or by a governmental entity after bidding has closed;

GRAMA provides that trade secrets, commercial information or non-individual financial information may be protected by submitting a Claim of Business Confidentiality.

**To protect information under a Claim of Business Confidentiality, the Respondent must:**

1. provide a written Claim of Business Confidentiality at the time the information (proposal) is provided to the State, and
2. Include a concise statement of reasons supporting the claim of business confidentiality (Subsection 63-2-308(1)).
3. Submit an electronic "redacted" (excluding protected information) copy of your proposal response. Copy must clearly be marked "Redacted Version." Failure to submit a redacted version may result in release of your entire proposal.

A Claim of Business Confidentiality may be appropriate for information such as client lists and non-public financial statements. **Pricing and service elements cannot be protected. An entire proposal cannot be protected under a Claim of Business Confidentiality or Proprietary. Failure to comply with this requirement may result in your proposal being ruled Non-Responsive** and no longer considered.

The claim of business confidentiality must be submitted with your proposal on the form which may be accessed at: [www.purchasing.utah.gov/contract/documents/confidentialityclaimform.doc](http://www.purchasing.utah.gov/contract/documents/confidentialityclaimform.doc)

To ensure the information is protected, the Division of Purchasing asks the Respondent to clearly identify in the Executive Summary and in the body of the proposal any specific information for which a Respondent claims business confidentiality protection as "PROTECTED".

All materials submitted become the property of the State of Utah. Materials may be evaluated by anyone designated by the State as part of the sourcing team. Materials submitted may be returned only at the State's option.

**WSCA-NASPO Data Communications Services Solicitation # JP14001****FNC Response:**

Read and understood; See Attachment A above for exceptions.

**1.20 WSCA Administrative Fee**

The Contracted Supplier must pay a WSCA-NASPO administrative fee of one quarter of one percent (.025%) in accordance with the terms and conditions of the contract. The WSCA-NASPO administrative fee shall be submitted quarterly and is based on the actual sales of all products and services in conjunction with your quarterly reports. The WSCA-NASPO administrative fee must be included when determining the pricing offered. The WSCA-NASPO administrative fee is not negotiable and shall not be added as a separate line item on an invoice.

Additionally, some WSCA-NASPO participating entities may require that an administrative fee be paid directly to the WSCA-NASPO participating entity on purchases made by purchasing entities within that State. For all such requests, the fee percentage, payment method and payment schedule for the participating entity's administrative fee will be incorporated in the Participating Addendum. Data Communications Provider will be held harmless, and may adjust (increase) the WSCA-NASPO Master Agreement pricing by the fee percentage for that participating entity accordingly for purchases made by purchasing entities within the jurisdiction of the State. All such agreements may not affect the WSCA-NASPO fee or the prices paid by the purchasing entities outside the jurisdiction of the participating entities requesting the additional fee.

**FNC Response:**

Comply

**1.21 Interest**

Any payments that a Contracted Supplier makes or causes to be made to WSCA-NASPO after the due date as indicated on the Quarterly Report schedule shall accrue interest at a rate of 18% per annum or the maximum rate permitted by law, whichever is less, until such overdue amount shall have been paid in full. The right to interest on late payments shall not preclude WSCA-NASPO from exercising any of its other rights or remedies pursuant to this agreement or otherwise with regards to Data Communication Provider's failure to make timely remittances.

**FNC Response:**

Comply

**1.22 Proposal Offer Firm**

Responses to this RFP, including proposed discounts offered will be considered firm for one hundred and sixty (160) days after the proposal due date. By signature (electronic or otherwise) and submission of a proposal, the person signing verifies that they are authorized to submit the proposal and bind the firm to provide the products/services in the proposal and potential Master Agreement.

**FNC Response:**

Comply

**1.23 Cancellation of Procurement**

This RFP may be canceled at any time and any and all proposals may be rejected in whole or in part when the State of Utah, Division of Purchasing and General Services determines such action to be in the best interest of the State of Utah.

**FNC Response:**

Read and understood; See Attachment A above for exceptions.

**1.24 Right to Waive**

The sourcing team reserves the right to waive minor irregularities at its sole discretion.

**FNC Response:**

Read and understood

**WSCA-NASPO Data Communications Services Solicitation # JP14001****1.25 Right to Accept All or Portion**

It is our intent to accept the entire line of Data Communications Equipment and Services (included in the scope) from the awarded Data Communications Providers, however we reserve the right to accept all or a portion of a Respondents proposal.

**FNC Response:**

Read and understood

**1.26 Service Line Additions and Updates**

During the term of the contract, Data Communications Providers may submit a request to update the awarded items (within the scope listed in IDENTIFY SECTION) as new technology is introduced, updated or removed from the market. The Master Agreement Administrator will evaluate requests and update the contract offering via written amendment as appropriate. The Data Communications Service Provider shall update the dedicated website, price lists, and catalogs to reflect approved changes. Pricing must utilize the same pricing structure as was used for services falling into the same service category.

**FNC Response:**

Read and understood

**1.27 Right to Publish**

Throughout the duration of this procurement process and Master Agreement term, Respondents, Data Communications Providers and their authorized contractors must secure from the WSCA-NASPO Contract Administrator prior approval for the release of any information that pertains to the potential work or activities covered by this procurement or the Master Agreement. The Data Communications Provider shall not make any representations of WSCA-NASPO's opinion or position as to the quality or effectiveness of the services that are the subject of this Master Agreement without prior written consent of the WSCA-NASPO Contract Administrator. Failure to adhere to this requirement may result in disqualification of the Respondents proposal or termination of the Master Agreement for cause

**FNC Response:**

Read and understood

**1.28 Changes in Representation**

The Contracted Supplier must notify the WSCA-NASPO Contract Administrator of changes in the Contracted Supplier's key administrative personnel, to the extent that there may be adverse impacts to the contract. The WSCA-NASPO Contract Administrator reserves the right to require a change in Contracted Supplier(s) representatives if the assigned representative(s) is not, in the opinion of the WSCA-NASPO Contract Administrator, meeting the terms and conditions of the contract.

**FNC Response:**

Read and understood

**1.29 E-Rate Requirement**

All award contractors must commit to participation in the Federal Communication Commission's E-rate discount program established under authority of the Federal Telecommunications Commission Act of 1996. Participation in, and implementation of, this program must be provided without the addition of any service or administration fee by the contractor.

**FNC Response:**

FNC is not currently participating in the E-rate discount program and cannot agree to do so without further investigation.

**1.30 Section 508 Compliant**

Respondents must meet all Federal and State regulations required to these types of products including but limited to accessible products by describing their support of the applicable provisions of the Workforce Investment Act of 1998, Section 508.

## WSCA-NASPO Data Communications Services Solicitation # JP14001

### FNC Response:

Comply

#### 1.31 Glossary

**Authorized Contractor:** The Prime Contractor as listed as Contractor under the resulting Master Agreement(s) as a result of this RFP

**Authorized Sub Contractor:** sub-contractor, Reseller, Partner, etc. Authorized by the Contractor (Prime) to sell only the products and services listed under the Master Agreement (s) established as a result of this RFP. This authorized sub-contractor must have the authority and ability to accurately reflect the ability of the Respondent to meet the requirements detailed in this RFP.

**WSCA-NASPO Contract Administrator:** A dedicated person with the authority and ability to manage compliance with the scope and terms and conditions for this contract.

**Mandatory Minimum Requirements:** Requirements that must be met in order to be considered for further evaluation. Mandatory minimum requirements are non-negotiable. An offer that does not meet the mandatory minimum requirements will be disqualified from further consideration.

**Participating Addendum:** A Participating Addendum must be executed by any State that decides to adopt a WSCA-NASPO Master Agreement.

A Participating Addendum shall be executed for each contractor by the individual State desiring to use their contract.

Additional States may be added with the consent of the contractor and the Lead State (on behalf of WSCA-NASPO) through execution of Participating Addendums.

A Participating Addendum allows for each Participating State to add terms and conditions that may be unique to their State.

The Participating State and the Contractor shall negotiate and agree upon any additional terms and conditions prior to the signing and execution of the Participating Addendum.

States are not mandated to sign a Participating Addendum with all awarded vendors.

**Participating Entity:** A State that has indicated intent to participate in the solicitation process, or after award, a State that has executed a participating addendum

**Purchasing Entity:** Any end-user in a participating State that is eligible to use the Master Agreement(s) through the participating addendum, including but not limited to State Agencies, Counties, Cities, Education, and other entities.

**Qualified Entity:** An entity that is eligible to use the Master Agreement(s)

**Usage Report Administrator:** A contractor's person responsible for the quarterly sales reporting and payments described in Section 1.15 Usage Reporting Requirement.

**Volume Discount:** A percentage discount offered by the seller to the buyer for purchasing a stated dollar amount of Data Communications services and products to be delivered at one time or for a specified period.

**Sourcing Team:** The technical and business team charged with setting requirements for the Data Communications procurement, and its subsequent evaluation

## Section 2: General Proposal Requirements and Information

### 2.1 Proposal Content and Format Requirements

Proposals must be detailed and concise. Unless otherwise stated in your proposal as an "exception", Respondents agree to comply with every section, subsection, attachment and addendum of this RFP. **Each proposal must be submitted in Microsoft Word or Excel, labeled and organized in a manner that is congruent with the section number, headings, requirements, and terminology used in this RFP. Proposal documents must be Arial font size 10.** Respondent responses that are limited to a specified number of pages are referring to single sided pages. As an example, a response that is limited to a document that is no more than two pages long may be submitted on one double sided page, but not two double sided pages.

**WSCA-NASPO Data Communications Services Solicitation # JP14001****2.2 RFP Revisions**

Revisions, if any, and all written questions and the State's answers, will be posted on the BidSync website. Solicitation documents will not be mailed to prospective Proposers. Respondents must register (free of charge) as a vendor with BidSync in order to have access to the RFP and related documents. Respondents are responsible for ensuring that their registration information is current and correct. The State of Utah accepts no responsibility for missing or incorrect information contained in the supplier's registration information on BidSync. The State of Utah accepts no responsibility for a prospective Respondent not receiving solicitation documents and/or revisions to the solicitation. It is the responsibility of the prospective Respondent to obtain the information provided through BidSync.

**FNC Response:**

[Read and Understood](#)

**2.3 Right to Waive**

The State of Utah reserves the right to waive any informality or technicality in any proposal.

**FNC Response:**

[Read and Understood](#)

**2.4 Proposals Become Property of the State of Utah**

All proposal contents become the property of the State of Utah. All proposal content is proprietary during the proposal evaluation process. Upon Master Agreement award, the successful Respondents' proposals will be open to public inspection, by request, with the exception of any proposal content that is marked as "proprietary or confidential" by the Respondent. All content designated as "proprietary or confidential" must be supported by documentation as to the rationale for the proprietary nature of the information.

**FNC Response:**

[Read and Understood](#)

**2.5 News Releases**

News releases or other public disclosure of information pertaining to this RFP or the statewide contracts may not be published without the prior written permission of the State of Utah.

**FNC Response:**

[Read and Understood](#)

**2.6 State Seal Use**

The Utah Great Seal Rule states, in section R622-2-3.Custody and Use, that "no facsimile or reproduction of the Great Seal may be manufactured, used, displayed, or otherwise employed by anyone without the written approval of the Lieutenant Governor."

Other participating States have similar rules that must be adhered to by Respondents or interested parties.

**FNC Response:**

[Read and Understood](#)

**Section 3: Data Communications Provider Mandatory Minimum Requirements****3.1 General Information**

This section contains requirements that must be addressed in order for your proposal to be considered for the evaluation phase of this RFP. All of the items described in this section are non-negotiable. Respondents are required to complete:

**Mandatory Requirements (M)**

**WSCA-NASPO Data Communications Services Solicitation # JP14001**

All Respondents must meet the **(M)** requirements listed in this section, and explain how the requirement is met. **A 'no' response on the acceptance document or omission of the required explanation will disqualify the service from further evaluation.**

**3.1.1 Equipment Offering**

**(M)** Identify Equipment offering in sections 5.2.1-5.3.0.

**FNC Response:**

Comply

**3.1.2 Service Offering**

**(M)** Identify Service Offerings for all products offered in Sections 5.2.1-5.3.0.

**FNC Response:**

Comply

**3.1.3 Insurance Requirement**

**(M)** This pertains to the State of Utah insurance requirements. Other Participating States may identify different insurance requirements during the participating addendum process.

Data Communications Provider's and their authorized contractors shall procure and maintain insurance which shall protect the authorized contractor and The State and/or purchasing entity (as an additional insured) from any claims from bodily injury, property damage, or personal injury covered by the indemnification obligations set forth herein. The Data Communications Provider's authorized contractor shall procure and maintain the insurance policies described below at their own expense and shall furnish to the procurement manager, upon award, an insurance certificate listing the participating State(s) as certificate holder and as an additional insured. The insurance certificate must document that the Commercial General Liability insurance coverage purchased by the authorized contractor to include contractual liability coverage applicable to this Master Agreement. In addition, the insurance certificate must provide the following information: the name and address of the insured; name, address, telephone number and signature of the authorized agent; name of the insurance company (authorized to operate in all States); a description of coverage in detailed standard terminology (including policy period, policy number, limits of liability, exclusions and endorsements) and an acknowledgment of notice of cancellation to the participating States.

Authorized contractor is required to maintain the following insurance coverage's during the term of the WSCA-NASPO Master Agreement:

- 1) Workers' Compensation Insurance – The Data Communications Provider's authorized contractor must comply with Participating State's requirements and provide a certificate of insurance.
- 2) Commercial General Liability Policy per occurrence - \$1,000,000. Coverage to include bodily injury and property damage combined single limit.
- 3) Business Automobile Policy to include but not limited to liability coverage on any owned, non-owned, or hired vehicle used by Data Communications Provider's authorized contractor personnel in the performance of this Master Agreement. The business automobile policy shall have the following limits of liability: Per Occurrence - \$1,000,000, Annual Aggregate - \$3,000,000, Annual Aggregate applying to products and services - \$3,000,000. Coverage must include premises and operations, bodily injury and property damage, personal and advertising injury; blanket contractual, products and services, owner named as an additional insured. The State of Utah must be listed as an additional insured.

Within 10 days of contract award, the Contracted Supplier and/or Authorized Contractor must submit proof of certificate of insurance that meets the above requirements or the Participating States requirements.

**FNC Response:**

Understood and partial comply. See alternate language provided for the agreement in Appendix A above.

**WSCA-NASPO Data Communications Services Solicitation # JP14001****3.1.4 Delivery**

(M) The prices offered shall be the delivered price to any WSCA-NASPO purchasing entity. All deliveries shall be F.O.B. destination with all transportation and handling charges paid by the contractor. Responsibility and liability for loss or damage shall remain the Contractor until final inspection and acceptance (*within 30 days after delivery for external damage and 30 days for any concealed damage*) when responsibility shall pass to the Buyer except as to latent defects, fraud and Contractor's warranty obligations. The minimum shipment amount will be found in the special terms and conditions. Any order for less than the specified amount is to be shipped with the freight prepaid and added as a separate item on the invoice. Any portion of an order to be shipped without transportation charges that is back ordered shall be shipped without charge.

**FNC Response:**

Agree for orders where FNC is installing the equipment. For orders that are for equipment delivery only, inspection should be within 10 days. Also see Warranty for out of box failure replacement.

**3.1.5 Service Offering Documentation**

(M) Upon request, user and/or technical documentation should be supplied for all procured products and services. Manuals may be available via the Contracted Supplier's website. The manual shall contain user and technical instructions appropriate to the service.

**FNC Response:**

Comply. Tech documentation to be supplied upon award of contract

**3.1.6 Data Communications Provider Contract Administrator and Usage Report Administrator**

(M) The Contracted Supplier shall provide a Contract Administrator to manage compliance with the scope and terms and conditions for this contract. The following Information, at a minimum, regarding the Contract Administrator shall be provided:

- a. Administrator's number of years' experience in the Data Communications Services business.
- b. Confirmation that the Data Communications Provider Contract Administrator has authority to enforce the scope of work and terms and conditions of the resulting contract.

The Contracted Supplier shall also provide a Usage Report Administrator responsible for the quarterly sales reporting described in Section 1.15 Usage Reporting Requirement.

**FNC Response:**

Comply

FNC will assign a Contract Administrator with 20+ years of experience in telecommunications who would have the authority to enforce compliance of the resulting agreement. FNC will provide reports as described in Section 1.15.

**3.1.7 eMarket Center Cooperation**

(M) To be eligible for contract award, the Contractor must agree to cooperate with WSCA-NASPO and SciQuest (and any authorized agent or successor entity to SciQuest) with uploading a hosted catalog or integrating a punch-out site. The contract requirements are in section 7.

**FNC Response:**

Comply

**Section 4: Data Communications Provider Qualifications****4.1 General Information:**

Provide any pertinent general information about the depth and breadth of the Offeror's product and service offerings and their overall use and acceptance in the Data Communications marketplace.

**FNC Response:**

Fujitsu is a trusted partner in transforming government operations. FNC has provided comprehensive next-generation communications network solutions and services for over three decades. Our solutions reduce capital and operational expenditures and advance critical e-Government initiatives,

### WSCA-NASPO Data Communications Services Solicitation # JP14001

including modernization and security, broadband connectivity, consolidation, and convergence. FNC collaborates with you to develop networks to support all types of government service, including health information, public safety and transportation systems. Our expertise enables you to deliver more efficient, effective and innovative services to citizens.









Whether the State of Utah needs unified, multiservice, high-bandwidth WAN connections or a pay-as-you-grow architecture, our field-proven FLASHWAVE® optical networking portfolio will optimize your investments in Ethernet, metro/regional WDM, SONET MSP or packet-based networking. Our services consultants solve critical issues, boost efficiency or develop new solutions via a suite of professional, managed and network multivendor integration services.

# Fujitsu Network Communications

## Our Solutions Portfolio



Services Aggregation and Transport			
<b>Multiservice Provisioning Platform</b>  FLASHWAVE 4500	<b>Packet Optical Networking</b>  FLASHWAVE 9500 FLASHWAVE 7120	<b>ROADM/DWDM</b>  FLASHWAVE 7500 FLASHWAVE 7420	<b>Network Design &amp; Management</b>  NETSMART 2000 NETSMART 1500 NETSMART 500 
Services Access			
<b>Multiservice Provisioning Platform</b>  FLASHWAVE 4100 FLASHWAVE 4010	<b>Packet Optical Networking</b>  FLASHWAVE 4100 ES FLASHWAVE CDS	<b>Ethernet Demarcation</b>  FLASHWAVE 9420 FLASHWAVE 9410 FLASHWAVE 5150 FSP 150 Family	

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WSCA-NASPO Data Communications Services Solicitation # JP14001


# FNC Access Product Portfolio



### Multi-Protocol Access


<p><b>Ethernet</b></p>  <p>FLASHWAVE CDS HD12</p> <p>Ethernet</p>	<p><b>EPON</b></p>  <p>FA2232 OLT / FA2132 ONU</p> <p>EPON Ethernet</p>	<p><b>WDM</b></p>  <p>FLASHWAVE 7120</p> <p>C/DWDM Ethernet</p>
<p><b>OTN</b></p>  <p>FLASHWAVE CDS HD32</p> <p>OTN Ethernet TDM</p>	<p><b>Ethernet Demarc.</b></p>  <p>FLASHWAVE 9410 FLASHWAVE 9420</p> <p>Ethernet EoTDM</p>	<p><b>SONET</b></p>  <p>FLASHWAVE 4100 ES</p> <p>TDM Ethernet</p>

### Network Design & Management



NETSMART 500  
NETSMART 1500  
NETSMART 2000

### Cabinets & Ancillary Equipment



Cabinets and Racks  
Batteries and Rectifiers  
Cables and Patch Panels

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WSCA-NASPO Data Communications Services Solicitation # JP14001

# Our Global Data Centers

More than 100 Data Centers Worldwide



As of March 2013

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# Centers of Excellence



## Hardware Development

### PEARL RIVER, NY

61,000 sq. ft. of testing, verification and research labs

Hardware development center for high-speed optical network platforms



### RICHARDSON, TX (HQ)

1 million square feet of plant and office space

132,000 sq. ft. manufacturing floor for advanced optical networking equipment



## Software Development

### SUNNYVALE, CA

41,000 sq. ft. campus in the heart of Silicon Valley

Software development and testing center



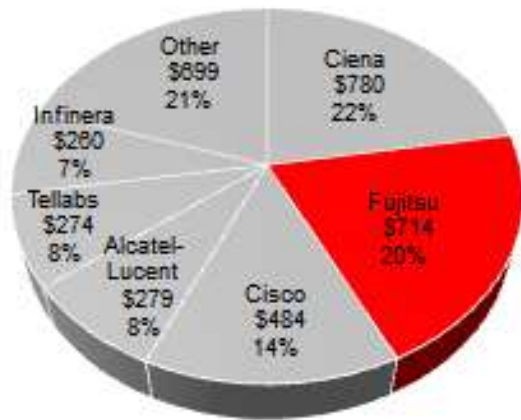
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# Fujitsu Network Communications

## North America Market Share



Fujitsu consistently captures 20%+ of total addressable market (TAM) for optical networking

ON Segment	Fujitsu	Competition
Aggregation	#1 at 32%	Cisco #2 at 18%
Metro WDM	#1 at 27%	Cisco #2 at 20%
Metro ROADM	#1 at 32%	Cisco #2 at 22%, Tellabs #3 at 13%
Converged Packet	#1 at 19%	Infinera #2 at 18%
Backbone WDM	--	Infinera #1 at 33%
Switching	--	Ciena #1 at 44%
<b>Total ON Market</b>	<b>#2 at 20%</b>	<b>Ciena #1 at 22% Cisco #3 at 14%</b>

Source: Ovum-RAK Quarterly Market Share: 1Q 2013 Report

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WSCA-NASPO Data Communications Services Solicitation # JP14001

# Fujitsu Network Communications

## Our Services Portfolio



Building Optical Networks		Maintaining Networks	Operating Networks
<b>Professional Services</b> <ul style="list-style-type: none"> <li>• Design</li> <li>• Integration</li> <li>• Migration</li> <li>• Product Training</li> </ul>	<b>Deployment Services</b> <ul style="list-style-type: none"> <li>• Engineering</li> <li>• Installation and Materials</li> </ul>	<b>Maintenance Services</b> <ul style="list-style-type: none"> <li>• Remote Technical Assistance</li> <li>• Onsite Maintenance</li> <li>• Advance Hardware Replacement</li> <li>• Repair and Return</li> </ul>	<b>Operational Services</b> <ul style="list-style-type: none"> <li>• Network Operations Center</li> <li>• Hosted Applications</li> </ul>
Building and Operating Multivendor Networks			
<b>Master Network Integration</b> <ul style="list-style-type: none"> <li>• Prime Contracting</li> <li>• UO Testing</li> <li>• Integration</li> <li>• Documentation</li> </ul>	<b>Managed Services</b> <ul style="list-style-type: none"> <li>• Network Engineering Outsourcing</li> <li>• Field Operations Outsourcing</li> </ul>	<b>Cabinet Installation</b> <ul style="list-style-type: none"> <li>• Outside Plant</li> <li>• Indoor Wall-Mount</li> <li>• Racks</li> </ul>	<b>Program Management</b> <ul style="list-style-type: none"> <li>• Project Management</li> <li>• PCNs</li> </ul>

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# Fujitsu Network Communications

*Our Customers*



**Communications Network Providers**

**Cable/MSO**

**Enterprise/Utility**

**Federal Government, Research & Education**

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## WSCA-NASPO Data Communications Services Solicitation # JP14001

## Summary – A Partner You Can Trust



- End-to-end network solutions that support efficient, effective business models
- Trusted by virtually every major communications service provider in North America (Over 500K Network Elements deployed)
- #1 North American optical communications patent-holder for six consecutive years
- Subsidiary of a financially durable \$46.6 billion company with positive cash flow
- Renowned for high quality and reliability
- 78 years of heritage in global communications network and ICT industries



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# Fujitsu in North America



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## WSCA-NASPO Data Communications Services Solicitation # JP14001

# Manufacturing Capability & Commitment

## World-Class Operations



### Texas Telecom Corridor

1 million square feet of plant and office space on 100 acres for manufacturing and developing advanced optical/electronic technology products

### World-Class Manufacturing

- Integrated supply chain management
- Best practices in production
- Continuous process improvement
- Continuous quality improvement
- Advanced SMT (surface mount) assembly automation



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## 4.2 Warranty

Specify the Offeror's standard warranty offerings for the products and services proposed in the response to this RFP.

### FNC Response:

#### Standard Warranty

#### 15. WARRANTY

15.1 Software Warranty. FNC warrants that for a period of 90 days from date of shipment from FNC (a) the media on which the Software is furnished will be free of defects in materials and workmanship and (b) the Software will function substantially as described in its Documentation when used on the hardware and with the system or configuration for which the Software is specified. FNC does not warrant that the operation of the Software will be uninterrupted or error free, or that the Software functions will meet Customer's requirements.

Customer's sole remedy under this limited warranty is (a) with respect to defective media, replacement of the media at no additional charge to Customer if it is returned to FNC during the warranty period with proof of the date of shipment and (b) with respect to the Software functionality, for FNC to use reasonable efforts to provide a maintenance release, patch, or workaround or otherwise correct the Software to bring it substantially into conformance with the Documentation.

This warranty does not apply if the Software (a) has been altered, except by FNC, (b) has not been installed, operated, repaired, or maintained in accordance with instructions supplied by FNC, (c) has been subjected to abnormal physical or electrical stress, misuse, negligence, or accident, or (d) is used in high-risk applications.

**WSCA-NASPO Data Communications Services Solicitation # JP14001****15.2 Equipment Warranties.**

15.2.1 Express Warranties. FNC warrants that for 12 months from date of shipment from FNC (a) the applicable equipment, components, or hardware, (individually or collectively "equipment") purchased from FNC will be free from defects in material and workmanship, and (b) the equipment will conform to FNC's applicable hardware specifications, exclusive of separately licensed software, at the time of shipment. These warranties are provided only to the original purchaser of the Product(s) under this Agreement and are not transferable unless agreed to in writing by an authorized representative of FNC.

15.2.2 Remedy. Customer's sole and exclusive remedy under this warranty is that FNC will, at its option and without additional charge to Customer, repair or replace any equipment that does not materially conform to this warranty during its respective warranty period.

15.2.3 Defective on Arrival (DOA) Returns. If Customer performs the initial installation of the equipment and Customer rejects the equipment because, within 30 days after shipment of the equipment to Customer, it fails Customer's acceptance testing against applicable hardware specifications, exclusive of separately licensed software, provided or agreed upon in writing by FNC or its supplier before such acceptance testing, Customer should immediately notify FNC. Upon receipt of this notification by FNC within the time prescribed above, FNC will furnish replacement equipment to Customer with the understanding that Customer will within 30 days after receipt of the replacement equipment (a) return the non-conforming equipment to FNC or (b) issue a purchase order to FNC for the purchase price of the replacement equipment. FNC will test any returned rejected equipment against FNC's applicable hardware specifications, exclusive of separately licensed software. If FNC determines there is no trouble found (NTF) with the equipment, Customer agrees to issue a purchase order to FNC for FNC's then current fee for each returned item found to be NTF.

15.2.4 Warranty Returns. Before Customer can return any equipment furnished by FNC that Customer believes does not conform to the above warranties, Customer must first obtain a Return Material Authorization (RMA) from FNC. To obtain an RMA Customer should call 1-800-525-0303. Once the RMA is obtained and properly completed, Customer must send the RMA to FNC along with the equipment being returned. Customer agrees that it will issue a purchase order to FNC for applicable charges if (a) FNC determines the equipment returned is actually out of warranty; or (b) the returned equipment is found to comply with the applicable hardware specifications, exclusive of separately licensed software. The charge for out of warranty repair will be based on a quotation provided by FNC and mutually agreed to by the parties and the charge to cover returned equipment found to comply with the applicable hardware specifications will be the NTF fee as described above. If the warranty for the returned equipment is determined to be void for any of the reasons set forth in the section below, the equipment will be returned to Customer without repair. Return of equipment to the repair facility designated by FNC is at Customer's expense. Equipment that is repaired, replaced, or found to be NTF will be returned to Customer's point of shipment at no expense to Customer. Customer does not need to return defective software media. Customer should contact FNC and request a replacement CD. If, after exercising commercially reasonable efforts to repair or replace defective equipment, FNC determines that the equipment cannot be repaired or replaced, then FNC may, in its sole discretion, provide Customer a credit toward future purchases equal to the purchase price paid by Customer, less a reasonable adjustment for beneficial use. Under no circumstances will FNC or its suppliers have any obligation for any data contained in any equipment sent to FNC or its supplier for repair Services. Title to non-conforming equipment returned by Customer that is replaced by FNC or its supplier passes to FNC or its supplier when the returned equipment arrives at the facility designated by FNC. Title to equipment sent to Customer as a replacement for non-conforming equipment returned by Customer will pass to Customer upon delivery to Customer, provided the equipment Customer returned as non-conforming was fully paid for; otherwise, title to the replacement equipment will pass when Customer has paid the full purchase price.

15.3 No Implied Warranties. Except as expressly provided in this agreement, there are no warranties, express or implied, including, without limitation, the implied warranties of merchantability and fitness for a particular purpose.

15.4 No Liability. The above warranties are void and FNC disclaims any obligation under this article if: (a) the warranty period has expired; (b) the Product has not been stored, configured, installed, operated, or maintained in accordance with FNC's applicable specifications,

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documentation, and instructions for the Product or packed for return in accordance with FNC's instructions or reasonable care (e.g. avoiding the possibility of electrostatic discharge damage when packing equipment); (c) the Product has been subjected to accident, disaster, neglect, abuse, misuse, damage (e.g. burned, cracked, etc.) repair, or modification in any respect, by anyone other than FNC or its authorized service representatives without prior consent; (d) the Product's performance is adversely affected by materials, equipment, software or services provided by an entity other than FNC; or (e) anyone other than the Customer asserts the warranty rights without Customer first advising FNC in writing.

#### Installation Warranty

FNC covenants that installation services will materially conform to FNC's specifications at the time of performance and be free from defects in workmanship for a period of 90 days after completion of the installation services at any given site. If during this period the customer notifies FNC that the installation services do not conform to the installation specification, FNC will re-perform any installation service to comply with the specifications.

#### **4.3 Website**

Award contractors are required to establish and maintain a website applicable to the WSCA/NASPO contract which will allow Participating States to see applicable contract price list, discounts on said price list, approved resellers or partners for their state and any additional information that may be required to assist the participating states in obtaining information concerning the contract award. The State of Utah representing WSCA/NASPO reserves the right to require the award contractor to add additional items to assist in this process. Specify Websites used by the Offeror to facilitate customer ordering under awarded contracts.

**This is a mandatory requirement.**

#### **FNC Response:**

FNC will work with SoU in support of a managed web site that can include applicable contract price list, discounts on said price list, approved resellers or partners for their state and any additional information that may be required to assist the participating states in obtaining information concerning the contract award.

#### Partners-FNC Extranet for Customers

All Fujitsu customers are highly encouraged to take advantage of the Fujitsu's Partners website (<https://partners.fnc.fujitsu.com/>). The website will be the State of Utah's portal to Fujitsu technical documentation and much more, offering the following key benefits:

- All online documentation is always the most current version (this includes equipment manuals and software downloads).The online documentation is completely searchable using a keyword search engine. Access to information including Technical Information Bulletins (TIB), Product Change Notices (PCN), Method of Procedure (MOP), and Customer Information Release (CIR).
- Registered users can receive automatic e-mail notification whenever new information is posted. Individuals can customize which update notices they receive - from every new TIB and PCN to updates on only a single product.
- Customer Self Service area provides trouble ticket creation, update and searches. Software updates and tools are available for download, as enabled The Partners website also has links to Training, Software Registration, Order Status and RMA requests.

#### **4.4 Customer Service**

Specify the Offeror's standard customer service policies and detail the escalation process used to handle customer-generated issues.

#### **FNC Response:**

#### **TAC ESCALATION Details**

In compliance with GR929, faults will be placed into one of the following categories:

**Critical** - Emergency system outage

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**Major** - Potential outage or degradation

**Minor** - Non Service Affecting

An example is given below of the typical escalation procedures that may be employed:

For **Critical** problems (Emergency system outage), the TAC will:

- Provide immediate and continuous coverage until the service level is restored to pre-incident operation.
- Escalate the problem to FNC's Post Design Support Group immediately to ensure restoration of service in the minimum time.

For **Major** problems (Potential outage or degradation), The TAC will:

- Provide immediate and continuous coverage until the service level is restored to pre-incident operation.
- Escalate the problem to FNC's Post Design Support Group within 1 hour if unable to restore system operation

For **Minor** problems (Non Service Affecting), the TAC will:

- Provide a status report to the customer in 4 weeks
- Provide a weekly status report to the Operations and Engineering Directors
- Schedule corrective action within an agreed period

Further detailed definitions of the classifications and escalation paths will be determined when the customer's requirements are fully defined.

#### Classifications of Errors

Calls to the TAC are normally answered within 60 seconds, and the average time to resolution is 24 minutes.

FNC follows the guidelines for "Severity Definitions for Switching and Transport Systems" as defined in "Telcordia GR-929-CORE". FNC utilizes these guidelines to determine the severity of Errors reported by Customer. An Error will be classified as a Critical, Major, or Minor as follows:

##### (i) Critical Error

A "Critical Error" includes any, all or any combination of the following: (i) Fiber cut or loss of optical path with loss of traffic, (ii) any system that has any level of traffic loss (1-DS0 to xWDM), (iii) if Customer has to reroute traffic to establish service, (iv) service or traffic affecting problems that require immediate corrective action regardless of time of day, or (v) a complete FNC-provided NMS server failure where visibility to the entire network is lost.

##### (ii) Major Error

A "Major Error" includes any, all or any combination of the following: (i) fiber cut or loss of optical path and the system performs the APS with a loss of redundancy or protection switching capabilities, but no loss of traffic, (ii) equipment failure on a redundancy path which will inhibit any protection switching capabilities and no traffic loss occurs, or (iii) a partial FNC-provided NMS server outage where a portion of the network still has visibility

##### (iii) Minor Error

A "Minor Error" includes all Errors not otherwise included in, or defined as, Critical Errors or Major Errors.

#### Error Escalation

FNC will escalate all Critical Errors and all Major Errors automatically by utilizing FNC's problem tracking system. The system will automatically notify various individuals of FNC's management and executive management, as well as any Customer specified personnel, via e-mail and text messaging to either a pager or mobile phone, whenever a Critical Error or Major Error remains unresolved for the time periods listed below:

- (i) In the event that a Critical Error or a Major Error remains unresolved for a period of four (4) hours from the time the error was first reported to FNC by the customer, the tracking system will immediately contact FNC's TAC Manager, FNC's Director of Maintenance Services and FNC's Vice

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President of Services.

- (ii) In the event that a Critical Error or a Major Error remains unresolved for a period of eight (8) hours from the time the error was first reported to FNC by the customer, the tracking system will contact all of FNC's personnel identified in paragraph (i) above and also FNC's Senior Vice President of Operations.
- (iii) In the event that a Critical Error or a Major Error remains unresolved for a period of twelve (12) hours from the time the error was first reported to FNC by the customer, the system will contact (in the manner specified above) all of FNC's personnel identified in paragraph (ii) above and, additionally, FNC's Senior Vice President of Sales, FNC's Chief Operating Officer.
- (iv) In the event a Critical Error or a Major Error remains unresolved for a period of twenty-four (24) hours from the time the error was first reported to FNC by the customer, the system will contact all of FNC's personnel identified in paragraph (iii) above and, additionally, FNC's President, FNC's Chief Executive Officer and FNC's Group President.

**4.5 Firm**

- a. Provide a brief history of your firm including the following:

**FNC Response:**Fujitsu in North America

Fujitsu Network Communications began operations in the United States in 1980 as the Transmission Division of Fujitsu America providing analog and microwave radio transmission systems for MCI. In 1984, we established manufacturing operations and customer support functions in Richardson, Texas. Fujitsu Limited, our parent company, created Fujitsu Network Switching of America in 1988, and a year later the new company launched the FETEX-150 ATM core switch. In 1989, the Transmission Division delivered the first digital loop carrier to Bell South and the first SONET multiplexer, an OC-3-based system, to US West. By 1990, the Transmission Division was the leader in developing and manufacturing SONET equipment for North America. The increasing demand for Fujitsu SONET products led to the construction of an \$80 million telecommunications center-the first to be built outside Japan by Fujitsu-for additional manufacturing, planning, research and development, and customer support. A year later, the Transmission Division diversified from Fujitsu America and became Fujitsu Network Transmission Systems Inc., a wholly-owned subsidiary. In 1996, Fujitsu Limited combined the switching and transmission companies into Fujitsu Network Communications, Inc.

FNC Today

Today, Fujitsu Network Communications is thriving and growing. We have expanded our base with major development centers in different geographic locations to draw upon the particular technical expertise and universities that exists in each area. You will find us in:

- Richardson, Texas
  - Corporate headquarters
  - Optical system planning and development
  - State-of-the-art manufacturing
  - System customization
  - Engineer, furnish, and install services
  - Customer support
  - Technical assistance center
- Pearl River, New York  
High-capacity, multiservice access system planning and development
- San Jose, California  
Network management software development

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We serve our customers through more than three dozen support and sales offices across North America to cover the United States, Canada, and Mexico.

Fujitsu Network Communications Inc. is an innovator in Connection-oriented Ethernet and optical transport technologies, and is a market-leading provider of multiservice SONET, WDM, and packet optical networking solutions.

With the support of Fujitsu Limited (TSE:6702), a \$53B company with approximately 175,000 professionals in 100 countries, Fujitsu enables its customers to migrate to fully converged packet optical networks that improve performance and profitability. Over 500,000 Fujitsu network elements have been deployed by all major carriers across North America. Fujitsu maintains a longstanding and highly-regarded position as a market leader by providing best-in-class data networking solutions optimized for Ethernet service delivery and transport.

Our technologies focus on three key areas: Access – for broadband packet service delivery over diverse media with Ethernet as the dominant interface, Packet – optimized aggregation and transport leveraging connection oriented technologies in support of carrier-class OAM, QoS, and scalability requirements, and Optical – network convergence onto WDM with unrestricted grooming, integrated packet and circuit switching, and at rates up to 40G, and 100G in the future.

For Government applications, the Fujitsu FLASHWAVE® 7500 Reconfigurable Optical Add/Drop Multiplexer (ROADM) is Technology Integration Center (TIC) recommended for I3MP. This was achieved only after successful completion of U.S. Department of Defense (DOD)-sponsored assessment and conformance testing. Additionally, several Fujitsu FLASHWAVE platforms are undergoing rigorous DoD-sanctioned testing at Joint Interoperability Test Command (JITC) facilities.

Our FLASHWAVE 9500 product was selected by Verizon in 2008 for deployment to enhance the metro transport infrastructure within Verizon markets in the United States to support and consolidate SONET, Ethernet, and wavelength services traffic in a variety of applications. Including high-definition video on demand, higher-speed Internet access, and advanced voice services.

Our network vision enables us to deliver a robust, manageable, and scalable “transport layer” that converges a packet-transport “logical sub-layer” with a high-bandwidth, dynamic optical “physical sub-layer” that extends from core networks through to end user access. This architecture enables customers to scale their “IP services layer” by separating it from a reliable “transport layer” providing packet-aggregation and optical transport services. Our portfolio of solutions leverages our customer’s installed base and can integrate into existing operations environments. With our NETSMART® network management tools and dynamic control plane technologies such as GMPLS, complexity can be abstracted and operations procedures can be more accurate and dynamic.

Focus on the Customer - In all our business activities, we place paramount importance on customer focus and maximize customer satisfaction by knowing our customers' perspectives and anticipating needs. Our customer base includes major carriers, cable companies, local utilities, local and federal government agencies, education institutions and research and healthcare organizations.

Our Research and Development Expertise: Commitment to Technological Innovation Fujitsu has a substantial U.S. R&D presence, with photonic laboratories in California, New York and Texas. Globally, our company invests more than \$2 billion in R&D every year; in fact, Fujitsu is one of the top ten global patent awardees.

The key to our future success is our ability to continue to generate innovative technological breakthroughs that will keep our products and systems capabilities at the forefront of the industry. Fujitsu researchers are shaping the future development of the industry through a constant stream of innovations that allow us to solve critical business issues and enable new services for our customers.

Our Manufacturing Edge - One of the keys to the continued success of Fujitsu is our unwavering commitment to manufacturing excellence and product quality. Fujitsu began manufacturing its telecommunications equipment at its 143-acre campus in Richardson (TX) in 1984 and we are now the only major North American optical networking vendor with our own U.S.-based manufacturing. We were among the first to achieve TL-9000 Quality

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Manufacturer status in 2000; even today only 13 telecommunications companies worldwide hold this distinction. We're charter members of the Quality Excellence for Suppliers of Telecommunications (QuEST) Forum, and have participated on its executive board since 2000. The QuEST Forum acknowledges several Fujitsu processes as industry best practices.

Quality and reliability are vital to customers who provide the communication infrastructure on which every one of us depends. Our unit return rate is 75% lower than the industry average and only a handful of vendors can claim their equipment is in service 99.999% of the time. We're one of those few.

Our Advantage - FNC understands the profound transformations taking place in today's networks and we are continuously evolving to deliver innovative transport solutions to optimize performance. We have participated in every major development in the evolution of the telecommunications landscape and our expertise is ingrained in the products we deliver and the way we do business.

### Viability as a company

Fujitsu Network Communications Inc. (FNC) creates innovative optical transport solutions by designing, manufacturing and installing an integrated set of metro and regional, next-generation multiservice SONET, Dense Wavelength Division Multiplexing (DWDM) and Packet-based solutions that help solve network needs. Supported by Fujitsu Limited, with over 175,000 professionals in more than 100 countries with revenues of \$53 billion, Fujitsu enables its customers to migrate to fully converged packet optical networks that improve performance and profitability. Over 500,000 Fujitsu network elements have been deployed by all major carriers across North America. Fujitsu maintains a longstanding and highly-regarded position as a market leader by providing best-in-class data networking solutions optimized for Ethernet service delivery and transport.

The company's comprehensive consulting and customer services offer support at any network design, development, deployment and maintenance stage. Our strengths in such areas as high-speed/capacity optical networks and complex systems integration allow us to meet rapidly changing customer needs in today's connected and convergent global marketplace. The cornerstone of Fujitsu Group's business strategy is our interlocked value chain of Technologies, Platforms, and Services. This approach creates value by building on a solid foundation of expertise at each link along the chain.

### Technologies

FNC is an innovator in Connection-oriented Ethernet and optical transport technologies, and is a market-leading provider of multiservice SONET, WDM, and packet optical networking solutions.

Our technologies focus on three key areas: Access – for broadband packet service delivery over diverse media with Ethernet as the dominant interface, Packet – optimized aggregation and transport leveraging connection oriented technologies in support of carrier-class OAM, QoS, and scalability requirements, and Optical – network convergence onto WDM with unrestricted grooming, integrated packet and circuit switching, and at rates up to 100G.

### Platforms

Our telecommunications platforms, such as IP switching and fiber-optic transmission systems and base station systems for mobile communications, support the communications backbone of today's most sophisticated networks.

### Services

As corporations focus on their core competencies and making their businesses more efficient and responsive, Fujitsu's expertise in the full array of services--from consulting and systems integration to managed services and outsourcing--enables us to offer innovative and cost-effective solutions tailored to specific customer objectives.

### Corporate Structure

Fujitsu Network Communications (FNC), Inc. a California corporation, is an industry-leading

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manufacturer of telecommunications equipment with corporate offices in Richardson, Texas.

FNC is an innovator in Connection-oriented Ethernet and optical transport technologies, and is a market-leading provider of multiservice SONET, WDM, and packet optical networking solutions that help solve network needs.

Critical communications infrastructure technology demands the support of a strong and stable manufacturer. Our parent company, Fujitsu Limited, is a powerful \$53 billion organization employing approximately 175,000 people in more than 100 countries. Our global presence and perspective are assets in an industry that exists to facilitate communication, and the company's comprehensive professional services offer support during any stage of network design, development, deployment and maintenance.

The focus of our business is on providing best-in-class optical networking equipment, while constantly improving network cost efficiencies. At Fujitsu, providing our customers with the best transport products featuring the lowest cost-to-performance ratio is our number one priority. In fact, this commitment to our customers is so prevalent; it's the focus of our corporate mission statement:

"...to lead the industry in optical transport products and services. Our solutions will drive down the cost of delivering bandwidth for Internet and carrier services."

FNC's in-house manufacturing capabilities, coupled with innovative, industry-leading research and development, provide our customers with advanced integrated network solutions, while at the same time meeting all cost, service and interoperability requirements.

FNC also offers a complete line of comprehensive engineering services, installation services, materials management services, Program / Project Management services, Network Operations Center (NOC) Services, Technical Assistance Center (TAC), Repair Services, and training.

FNC has been providing this equipment and services to customers since 1984, and the company was incorporated in California in 1991

### FNC Differentiators

#### Consulting and Customer Service

FNC's comprehensive consulting and customer services offer support at any network design, development, deployment and maintenance stage. FNC produces innovative optical transport solutions by designing, manufacturing and installing an integrated set of metro and long haul, next-generation multiservice SONET, DWDM, and packet optical networking solutions that help our customers stay competitive and profitable.

#### Risk Management

Fujitsu maintains a well-established and highly-regarded position as a market leader by providing the best-in-breed data networking solutions that drive next-generation converged network solutions. In fact, based on Ovum-RHK, Quarterly Market Share: 1Q12; FNC is the North American Market Share leader for Total Optical Transport and Switching. With over 500,000 network elements deployed, we provide network solutions with which our customers deploy faster and more dependable digital communication services. FNC is committed to the continued development of these products not only to lead the industry in developing truly converged platforms, but also to keep up with the development demand already committed to new customers.

#### Our Manufacturing and Quality Edge

One of the keys to the continued success of Fujitsu is our unwavering commitment to manufacturing excellence and product quality. Fujitsu began manufacturing its telecommunications equipment in Richardson in 1984 and is one of the few equipment vendors that continue to manufacture the majority of its products in house. Our work begins at the earliest stage of a product's design to ensure manufacturing efficiency and outstanding product quality. Our integrated supply chain model, which is based on an annual benchmark survey, is modified quarterly to reflect improvements in forecast accuracy and factory flexibility. This

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integrated approach provides us with customer responsiveness, uncompromising quality and low cost production that set us apart from our competition.

Vertical Integration - Innovation

FNC's broad packet optical networking portfolio is built upon in house key technologies and components combined with comprehensive network services. Leveraging this organizational expertise across Fujitsu companies allows us to continue to deliver state of the art technologies combined with industry leading services and support. Fujitsu Laboratories of America's photonics research team continuously delivers cutting edge optical research resulting in over 34,000 optical communications patents. With a \$2.8 billion annual research and development investment in more than 1,450 researchers and 11,000 development engineers, Fujitsu has retained the number one optical communications patent-holder position for the last consecutive seven years. FNC has the corporate infrastructure, commitment to product development, breadth of product and service portfolios, and the industry experience to foster a strong and unmatched network solution. Fujitsu Network Communications, Inc., has successfully achieved registration for TL 9000 - a single set of worldwide telecommunications requirements that combines the quality requirements of the ISO 9001, Malcolm Baldrige, and Telcordia, SEI, and ISO 12207 standards. Fujitsu was one of the first telecommunication companies to become registered to TL 9000.

FNC has achieved the following registrations

- ISO 9002 registered January 1996
- ISO 9001 registered July 1998
- ISO 14001 registered May 1999
- TL 9000 registered January 2000

## Fujitsu Network Communications

*Industry Recognition and Affiliations*

### Recent Industry Awards

- IEC InfoVision Award Winner for FLASHWAVE® 9500 Packet ONP
- TMC/4GWE Wireless Backhaul Distinction Award for FLASHWAVE 4100 ES and FLASHWAVE 9500 Packet ONPs
- Supercomm Eos Award for Technical Innovation in Optical Networking for FLASHWAVE 9500 EoX Gateway
- Light Reading Ethernet Expo Carrier Ethernet Award for "Best Packet Optical Infrastructure Solution" for FLASHWAVE 9500 EoX Gateway
- Broadband Gear Report – 4.0/5.0 Diamonds in Diamond Technology Reviews for FLASHWAVE CDS Packet ONP

**Industry Leadership — Influencing Technology & Development**



- Over 30 years' business presence in North America
- IOCs, LECs, MSOs, wireless carriers
- Federal, state and local government, financial, utilities, transportation,

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- Healthcare, Research and Education
  - Global scope — local presence
  - Large US office and manufacturing facility
  - The ONLY major optical networking manufacturer to manufacture its own equipment in North America
  - Broad portfolio, proven real-world performance
  - Packet Optical Networking Platforms
  - Professional services and software
  - FLASHWAVE® DWDM and SONET/SDH
  - 500,000+ network elements deployed in the US
1. Number of years providing Data Communications Services being offered in response to this RFP.

**FNC Response:**

FNC has been providing data communications services for over 30 years.

2. Number of separate services provided in each of the area categories described in this RFP.

**FNC Response:**

Services for each of FNCs platforms have been identified in the product details. Professional Services are further identified in greater detail below. It should be noted that many of FNCs services can overlap the area categories described in this RFI.

- b. Describe specifically what makes your firm a stable long term partner for WSCA-NASPO.

**FNC Response:**

As FNC moves toward a new era of ubiquitous networking, demand for new ways to use information technology is expanding. To provide the foundation for the products and services that will give shape to this new era, Fujitsu Laboratories is carrying out cutting-edge research and development in fields ranging from IT services to computing and telecommunications systems, as well as in supporting fields such as electronic devices and materials technologies. Fujitsu believes we are one of the few systems vendors in the world that have the depth and experience to offer true innovations that will contribute to Customer's success.

To remain competitive, carriers must continually offer new and useful services. These changes demand that the underlying transport networks evolve. Fujitsu knows that today's network must be bridged to tomorrow's solutions. The introduction of disruptive technologies to implement new services cannot repeatedly occur if it jeopardizes the revenues based on the existing networks. Fujitsu provides the products and services that enable carriers to migrate, expand and enhance their network in a timely and cost-effective manner. We work closely with our customers to understand what they require, then deliver those solutions at the proper time. This anticipation of needs is evident in the 'firsts' that Fujitsu has brought to market.

- As a pioneer in SONET, Fujitsu led the industry by introducing the first OC-3/12/48 ADMs in the late 1980s ..... and continues its leadership today, providing the highest capacity, smallest footprint SONET terminals.
- Fujitsu was the first to place into carriers' networks 4-channel tunable transmitters and 22-channel tunable transmitters.
- Fujitsu carries on its successful leadership in innovation with the FLASHWAVE DWDM products. Fujitsu introduced into the market the first commercial 320 Gb/s DWDM systems.

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- We were the first to place into service a DWDM transmission system capable of scaling from a single channel to 176 channels providing up to 1.76 Terabit capacity over two fibers and ultra-long-haul distances utilizing the same FLASHWAVE product platform.
- We introduced the FLASHWAVE 9500 Packet Optical Networking Platform (Packet ONP), which provides modular integration of Ethernet, ROADM, and SONET transport technologies built on a single addressable optical networking class element and was selected by Verizon in 2008 for deployment to enhance the metro transport infrastructure within Verizon markets in the United States.

Fujitsu Limited is a company with \$36.5B in assets, and has an annual Research & Development (R&D) budget. Over the last five years, we have spent an average of \$3.2B annually on R&D to support our pursuit of cutting edge innovations.

- c. Describe specifically what information the Data Communications Provider contract administrator would provide at annual meetings with an entity that has executed a participating addendum.

**FNC Response:**

FNC would provide an overview of new products or new features being released as well as provide reporting on purchase volumes, quality, lead times, and other specific reporting that a Participating Entity may request.

- d. Describe how you plan to implement the contract including having a single point of contact to perform and manage all aspects of this contract.

**FNC Response:**

FNC will assign a person Sales, Order Administration and Contract Management to support your account. You have the option of having the single point of contact coordinate with all groups within FNC to provide support or, if preferred, you have the option of contacting each of the people in these departments directly. We will work with you to best meet your needs and preferences.

- e. Describe in detail your firm's escalation management plan including contact information.

**FNC Response:**Error Escalation

FNC will escalate all Critical Errors and all Major Errors automatically by utilizing FNC's problem tracking system. The system will automatically notify various individuals of FNC's management and executive management, as well as any Customer specified personnel, via e-mail and text messaging to either a pager or mobile phone, whenever a Critical Error or Major Error remains unresolved for the time periods listed below:

- (i) In the event that a Critical Error or a Major Error remains unresolved for a period of four (4) hours from the time the error was first reported to FNC by the customer, the tracking system will immediately contact FNC's TAC Manager, FNC's Director of Maintenance Services and FNC's Vice President of Services.
- (ii) In the event that a Critical Error or a Major Error remains unresolved for a period of eight (8) hours from the time the error was first reported to FNC by the customer, the tracking system will contact all of FNC's personnel identified in paragraph (i) above and also FNC's Senior Vice President of Operations.
- (iii) In the event that a Critical Error or a Major Error remains unresolved for a period of twelve (12) hours from the time the error was first reported to FNC by the customer, the system will contact (in the manner specified above) all of FNC's personnel identified in paragraph (ii) above and, additionally, FNC's Senior Vice President of Sales, FNC's Chief Operating Officer.
- (iv) in the event that a Critical Error or a Major Error remains unresolved for a period

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of twenty-four (24) hours from the time the error was first reported to FNC by the customer, the system will contact all of FNC's personnel identified in paragraph (iii) above and, additionally, FNC's President, FNC's Chief Executive Officer and FNC's Group President.

**4.6 Authorized Sub Contractor Relationships**

Respondents may propose the use of Servicing Subcontractors or partners however; the Contractor shall remain solely responsible for the performance under the terms and conditions of the Contract if Servicing Subcontractors are utilized. This includes sales report information. The Contractor will be responsible to collect, and report this information from all partners or resellers representing your contract.

**FNC Response:**

Comply.

As has become the case with most equipment manufacturers, FNC has moved to a mixed employee/subcontractor support model to maintain competitive installation and support pricing levels.

During the implementation phase of projects, the percentage of FNC personnel versus subcontractors varies from 0% to 80% dependent on project scope, geographic location, resource requirements, availability and other factors. Typically, projects requiring professional services, such as testing or service migrations, will be completed by FNC personnel. For projects requiring basic installation service, FNC will engage qualified sub-contractors who can support both local and nation-wide deployments. For every project, we work closely with the customer to ensure the right set of skills and capabilities are utilized to complete the project as contracted.

When actual requirements are identified - FNC will determine the best fit for the State of Utah project. At that time FNC will be happy to provide the requested information to the State of Utah.

As has become the case with most equipment manufacturers, FNC works with a variety of sub-contractors, including the following:

- TE Connectivity (aka ADC Telecommunications) - EFI
- Ledcor Technical Services - AHR/OSM
- AFL Networks – EFI
- YPSG (MWBE) – EFI
- JAC Telecom - EFI
- ANS – EFI

This list is not exclusive and is only intended to be representative of the major sub-contractors currently certified to install FNC equipment. FNC is willing to work to certify other sub-contractors should the State of Utah prefer to use a particular company

- a. Briefly describe what your firm requires from potential contractors to become an "Authorized Data Communications Reseller". Provide an Authorized Contractor List.

**FNC Response:**

Our process is documented in our internal quality standard. This standard provides the methods for qualifying an outside vendor, methods for addition of the vendor to our Approved Vendor List (AVL), and providing a quality audit with standardized report card grading criteria. All AVL vendors meet the requirements in Telcordia GR 1275 – Core.

- b. Describe in detail how your firm currently measures an authorized contractors' performance.

**FNC Response:**

FNC grades its contractor's performance through vendor report cards. FNC also grades on field quality performance and on time delivery

- c. Describe in detail the process for revoking a designation as a sub-contractor from an authorized contractor for issues related to customer service, or other authorized contractor

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performance related issues.

**FNC Response:**

If FNC were to revoke a sub-contractor as an authorized contractor it is based on field quality performance, on time delivery, pricing issues and or behavioral issues. The sub-contractor is notified that they are disapproved and have been removed from the Approved Vendors List.

- d. Describe in detail how your firm will support and assist an authorized contractor in improving their performance and the corrective action process.

**FNC Response:**

FNC assists contractors with corrective actions via the Supplier Corrective Action Request and established action plans. The action plans are tracked to ensure that established milestones are met.

- e. Describe in detail the process that your firm uses to track and respond to issues and concerns from both your authorized contractors and from participating entities.

**FNC Response:**

Issues and concerns are logged and tracked to completion.

- f. Describe in detail how your firm will track, report and verify sales from your designated Data Communication partners and authorized contractors.

**FNC Response:**

Upon contract award FNC is willing to discuss a process to track, report and verify sales from the customer

**Section 5: Service Offering Qualifications****5.1 General Information**

This section contains mandatory minimum requirements that must be met in order for your proposal to be considered for the evaluation phase of this RFP. All of the items described in this section are non-negotiable. Respondents are required to complete:

**Mandatory Requirements (M)**

All Respondents must meet the **(M)** requirements listed in this section, and explain how the requirement is met. A 'no' response on the acceptance document or omission of the required explanation will disqualify the service from further evaluation.

**5.1.1 General Business Requirements**

Each provider must meet the following mandatory general business requirements:

**5.1.2 Terms and Conditions**

**(M)** Respondents *must* indicate their acceptance of the State of Utah Standard Terms and Conditions in addition to the WSCA-NASPO Terms and Conditions attached to this RFP as Attachment A and Attachment

**FNC Response:**

FNC agrees to comply with the terms and conditions provided by the State. Any exceptions have been identified above as required.

B. Any exceptions to these terms and conditions must be clearly identified in bid response and during the question and answer period on BidSync. Significant exceptions may constitute grounds for rejecting Respondent proposals.

**FNC Response:**

Please see exceptions as identified above

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### 5.1.3 Experience

**(M)** Respondents *must* be able to provide reference service contracts from a minimum of five government or commercial customers for their Data Communications Product and Services offerings. Government references are preferred. References must include environments and complexity that is similar in scope to those described within this RFP. Any proposals from Respondents that cannot meet these requirements will not be considered. The Respondent must provide specific contact information describing their reference service contracts, which may be verified.

#### FNC Response:

Comply

Financial Stability

**(M)** The Data Communications Product and Services vendor must provide audited financial statements to the State and should meet a minimum Dun and Bradstreet (D&B) credit rating of 4A2 or better, or a recognized equivalent rating. Please provide the Respondent's D&B Number and the composite credit rating. The State reserves the right to verify this information. If a branch or wholly owned subsidiary is bidding on this RFP, please provide the D&B Number and score for the parent company that will be financially responsible for performance of the agreement. Prime contractors working on behalf of Respondents must submit financial statements that demonstrate financial stability, and adequate working capital, but do not need to meet 4A2 credit rating requirements.

#### FNC Response:

Fujitsu Network Communications is a privately held wholly owned subsidiary of Fujitsu Limited and as such the audited financial information being requested is considered confidential. Please refer to the attached D&B report dated June 26, 2013. Also attached is Fujitsu Limited Annual Report 2012, and Financial Highlights as of May 2013.

### 5.1.4 Other General Responsibilities

**(M)** The Respondent *must* provide the personnel, equipment, tools, and expertise to meet the requirements in this RFP.

#### FNC Response:

Comply. Upon award of contract, FNC will provide the necessary personnel, equipment, tools, and expertise to meet the requirements in this RFP.

**(M)** Computer applications and Web sites *must* be accessible to people with disabilities, and *must* comply with Participating entity accessibility policies and the Americans with Disability Act.

#### FNC Response:

Comply

**(M)** Applications and content delivered through Web browsers must be accessible using current released versions of multiple browser platforms (such as Internet Explorer, Firefox, Chrome, and Safari) at minimum.

#### FNC Response:

Comply

### 5.2 Data Communications Services – Requirements

Offerors may respond to any of the sections where they have substantive product offerings that address the scope detailed in each Section from **5.2.1-5.3.0**. All Offerors must include a response to section 5.31 services that addresses products proposed in 5.2.1-5.3.0.

#### FNC Response:

Read and understood

Products may be used by the states in branch offices, main government offices and data centers, and by overall government data communications providers offering carrier class services. Responses should consider this breadth of use and users.

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## Read and understood

The scope and context of this solicitation does not include endpoints such as cell/smart phones, other mobile devices or devices designed exclusively for use by individual users. It is focused on the equipment and software infrastructure required to support provisioning of a variety of network services within a modern digital network. The user context will vary from branch offices through enterprise and statewide data communication network installations. Respondents should offer a range of solutions that are appropriate for installations of varying size and complexity.

**FNC Response:**

## Read and understood

**5.2.1 DATA CENTER APPLICATION SERVICES** Application networking solutions and technologies that enable the successful and secure delivery of applications within data centers to local, remote, and branch-office users using technology to accelerate, secure, and increase availability of both application traffic and computing resources.

**5.2.1.1 Virtualized Load Balancers** Virtual devices that act like a reverse proxy to distribute network and/or application traffic across multiple servers to improve the concurrent user capacity and overall reliability of applications. Capabilities should include:

- SSL (Secure Sockets Layer) Off-loading
- Caching capabilities
- Layer 4 Load Balancing
- Layer 7 Load Balancing
- Detailed Reporting
- Supports multiple load balancers in the same system for multiple groups
- Supports TLS1.2

**FNC Response:**

FNC does not currently have a device to support virtual load balancers

**5.2.1.2 WAN Optimization** An appliance utilizing a collection of techniques for increasing data-transfer efficiencies across wide-area networks (WAN). Capabilities should include:

- CIFS (Common Internet File System) acceleration
- Data Compression
- SSL encryption/decryption for acceleration (Optional)
- Layer 4-7 visibility
- Application Specific optimization

**FNC Response:**

FNC does not currently have a device to support WAN optimization

**5.2.2 NETWORKING SOFTWARE**

Software that runs on a server and enables the server to manage data, users, groups, security, applications, and other networking functions. The network operating system is designed to allow shared file and printer access among multiple computers in a network, typically a local area network (LAN), and a private network or to other networks. Networking software capabilities should include:

**FNC Response:**

FNC does not currently have Networking software that meets the requirements of section 5.2.2

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- Restartable Process
- High availability options
- Targeted operating systems, i.e. DC, campus, core, wan, etc.
- Operating System Efficiencies

**5.2.2.2 Network Management and Automation** Software products and solutions for data center automation, cloud computing, and IT systems management.

**FNC Response:**

FNC does not currently have software products that meet the requirements of section 5.2.2.2

**5.2.2.3 Data Center Management and Automation** Software products and solutions that capture and automate manual tasks across servers, network, applications, and virtualized infrastructure.

**FNC Response:**

FNC does not currently have software products for data center management and automation that meets the requirements of section 5.2.2.3

**5.2.2.4 Cloud Portal and Automation** Software products and solutions for cloud management with policy-based controls for provisioning virtual and physical resources.

**FNC Response:**

FNC does not currently have software products for cloud portal and automation that meets the requirements of section 5.2.2.4

**5.2.2.5 Branch Office Management and Automation** Software products and solutions for management of branch offices. Capabilities include remote troubleshooting, device management, WAN performance monitoring.

**FNC Response:**

FNC does not currently have software products for branch office management and automation that meets the requirements of section 5.2.2.5

**5.2.3 NETWORK OPTIMIZATION AND ACCELERATION** Devices and tools for increasing data-transfer efficiencies across wide-area networks.

**FNC Response:**

FNC does not currently have Network Optimization and Acceleration devices and tools that meet the requirements of section 5.2.3

**5.2.3.1 Dynamic Load Balancing** An appliance that performs a series of checks and calculations to determine which server can best service each client request in order to select the server that can successfully fulfill the client request and do so in the shortest amount of time without overloading either the server or the server farm as a whole.

**FNC Response:**

FNC does not currently have a dynamic load balancing device that meets the requirements of section 5.2.3.1

**5.2.3.2 WAN Acceleration** Appliance that optimizes bandwidth to improve the end user's experience on a wide area network (WAN). Capabilities should include:

- CIFS acceleration
- Data Compression
- SSL encryption/decryption for acceleration (Optional)
- Layer 4-7 visibility

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- Application Specific optimization

**FNC Response:**

FNC does not currently have a WAN Acceleration device that meets the requirements of section 5.2.3.2

- 5.2.3.3 High Availability and Redundancy** Limits any disruption to network uptime should an appliance face unforeseen performance issues. Transparently redistributes workloads to surviving cluster appliances without impacting communication throughout the cluster.

**FNC Response:**

FNC does not currently have a High Availability and Redundancy device that meets the requirements of section 5.2.3.3

- 5.2.4 OPTICAL NETWORKING** High capacity networks based on optical technology and components that provide routing, grooming, and restoration at the wavelength level as well as wavelength based services.

- 5.2.4.1 Core DWDM (Dense Wavelength Division Multiplexing) Switches** -Switches used in systems designed for long haul and ultra-long-haul optical networking applications

**FNC Response:**

The following FNC platforms are well suited for long haul and ultra-long-haul optical networking applications:

**FLASHWAVE 9500**

The Fujitsu FLASHWAVE 9500 Packet Optical Networking Platform (Packet ONP) is a lasting technology foundation for the evolving packet-centric network. This platform integrates Connection-Oriented Ethernet (COE) and Layer 1 transport technologies. It delivers high-bandwidth, high-quality packet, TDM, and WDM services on an open, multiprotocol platform. The FLASHWAVE 9500 platform reduces the complexity, and ultimately the cost, of metro/regional transport.

The FLASHWAVE 9500 Packet Optical Networking Platform is now MEF CE 2.0 certified for E-Line, E-Access, and E-LAN services.

With the addition of the MEF certification, the FLASHWAVE 9500 system offers a unified CE 2.0 Ethernet service delivery platform that can deliver any MEF service over any type of access network.

The integration of packet and transport technologies is a natural evolution of the metro and regional network as it changes to address bandwidth-intensive applications cost-efficiently. Specific technologies have been incorporated into the FLASHWAVE 9500 system to support this evolution, including:

- COE for Layer 2 capabilities with Layer 1 reliability
- Centralized SONET/SDH and packet/OTN switch fabric
- Ethernet over TDM/SONET to native Ethernet interworking
- ROADM-on-a-card

COE with advance traffic engineering

Next-generation mobile backhaul, high-definition video distribution and mission-critical enterprise services require a deterministic, high-performance, high-availability, connection-oriented environment. COE is the basis for high-quality, simple-to-manage integrated networks that support packet, optical, and TDM technologies.

Software Release 5.1 adds support for a 20 Gbps low-order switch fabric plug-in unit for cross connections of VT1.5, VC12, or LO VC3 circuits. This optional, non-blocking, fully meshed, VT switching solution supports unidirectional, bidirectional, drop-and-continue, and broadcast cross-connections with path selector switching (for VT UPSR and VC SNCP). The integrated VT switch fabric in the FLASHWAVE 9500 platform eliminates the need for external MSPP NEs traditionally used for VT grooming, which reduces

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expenses.

The FLASHWAVE 9500 Packet ONP integrates SONET/SDH, packet, and OTN switching into a centralized, non-blocking, fully redundant switch fabric. Each slot on the universal shelf provides unrestricted access to any of the switch fabric technologies, enabling the FLASHWAVE 9500 platform to be deployed as 100% SONET/SDH, 100% packet/OTN, or any combination.

With Software Release 5.1, the FLASHWAVE 9500 platform supports CWDM and DWDM optics for 1 Gbps, 2.5 Gbps, and 10 Gbps client services. Narrowband pluggable optics enable FLASHWAVE 9500 Packet ONP client interfaces to connect directly to C/DWDM mux/demux and OADM equipment without using a separate transponder to accomplish wavelength conversions. WDM SFP/XFPs alleviate the need for additional fiber as access network service requirements increase, reducing the total cost of ownership. The various multirate CWDM and DWDM optics packages available for the FLASHWAVE 9500 platform extend the capacity of a particular fiber pair, increasing scalability.

The FLASHWAVE 9500 platform is powering the transition from traditional TDM transport to next-generation data infrastructure. The EoX Mapper is critical to this transition, providing the interworking function between Ethernet over SONET/SDH (EoS) and native Ethernet. The EoX Mapper terminates EoS and EoPDH circuits and aggregates the native Ethernet flows. This produces a highly concentrated, fully redundant collection point for hundreds of EoS circuits, alleviating the scalability issues associated with Layer 1 port-based data service hand-offs to the IP service edge. Combined with advanced traffic management, the EoX Mapper offers a cost-effective, scalable EoS aggregation solution.

The FLASHWAVE 9500 Packet ONP can aggregate, switch and deliver COE services across any type of access network (EoX) on a single NE. This EoX Gateway configuration dramatically increases the number of addressable customers for differentiable Ethernet and IP services, benefiting wholesale and retail service providers by leveraging existing access networks. This accelerates time to revenue and significantly reduces the cost and space of hub Central Office (CO) equipment.

The EoX Gateway cards and system software transparently terminate a wide variety of access networks, perform COE switching and grooming, and present fully protected Ethernet or SONET/SDH handoffs to other transport or service delivery networks. By deploying the EoX Gateway, service providers realize significant advantages, including:

- Converging disparate network elements and management systems
- Leveraging existing TDM, Ethernet and WDM access networks
- Enabling the transition to an optimal packet-centric infrastructure

ROADM-on-a-card technology delivers economical bulk bandwidth and operational stability. The FLASHWAVE 9500 platform offers industry leading density with up to 40 Gbps of bandwidth on each of 88 channels, across eight directions. Software Release 5.1 builds on these strengths with the split-hub ROADM option, which enables location independent allocation of a ROADM degree across multiple shelves, while functioning as a cohesive unit. As a result, you can increase flexibility and reduce downtime risk.

The 8+1 muxponder enables transport of all SONET/SDH service types, including OC-3 through OC-48 and STM-1 through STM-16, as well as Ethernet over SONET/SDH. The 8+1 muxponder can be used in either of two operating modes to reduce first-port costs and increase the service density of the FLASHWAVE 9500 Packet ONP. In standalone mode, the eight multirate client ports are aggregated into one full-band tunable 10 Gbps OTU2 uplink for direct connection to the ROADM network.

Switch-fabric mode, enabled in Software Release 5.1, connects all ports to the centralized switch fabric and effectively combines the capabilities of the eight-port multirate multiservice plug-in and the OC-192/OTU2 full-band tunable narrowband optics plug-in unit into a single card. Switch-fabric mode protects embedded-base investments by providing full grooming capabilities between the 8+1 muxponder and

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other existing SONET/SDH plug-in units through the non-blocking, fully redundant, centralized switch fabric.

The FLASHWAVE 9500 Packet ONP is ideal for evolving core metro/regional transport networks. Layer 1 and 2 technology integration provides a wide variety of transport options to connect offices within a metro, and metros within a region. Centralized switching provides unrestricted SONET/SDH and COE aggregation and grooming, while ROADM-on-a-card provides high channel-count 10 Gbps and 40 Gbps wavelength services. By basing the consolidated core metro/regional infrastructure on the FLASHWAVE 9500 system, service providers can:

- Meet growing demand for core bandwidth
- Support both legacy and next-generation technologies
- Use operational automation to simplify the network
- Realize potential for large-scale deployment

Demand for higher speed wireless data services continues to surge as new applications proliferate. To tap into this revenue opportunity, wireless service providers are deploying 3G and 4G wireless technologies, increasing the number of cell sites and boosting the bandwidth capacity of the backhaul network.

While these new technologies are expanding, there are still approximately 190,000 existing cell sites in the US. Most have T1 TDM base stations and require T1 TDM backhaul. This large installed base will remain in operation for many years, resulting in a continued need to provide T1 mobile backhaul transport.

The FLASHWAVE 9500 Packet ONP is ideally positioned to address this transitional situation. The system simultaneously supports COE and native TDM services to manage latency-sensitive wireless applications regardless of access and transport technology.

By basing the mobile backhaul infrastructure on the FLASHWAVE 9500 system, service providers can:

- Integrate seamlessly with existing TDM backhaul networks
- Prepare for 3G/4G backhaul with COE interface modules
- Transition at their own pace

The FLASHWAVE 9500 Packet ONP allows carriers to consolidate enterprise and wholesale infrastructure by supporting native TDM, COE and WDM access, aggregation and transport in a single NE. Seamless integration with Fujitsu access products, combined with NETSMART 1500 end-to-end management, allows the FLASHWAVE 9500 Packet ONP to deliver a broad range of enterprise and wholesale services. By basing the enterprise and wholesale services infrastructure on the FLASHWAVE 9500 system, service providers can:

- Deliver private network service over multiple transport-layer technologies
- Provide low-cost point-to-point Ethernet and TDM metro access to long-distance packet services with guaranteed QoS

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- Deliver end-to-end enterprise/wholesale services over existing (TDM) and new (packet) network infrastructures using EoX Gateway service interworking

	HDS	SDS Rear Access	SDS Front Access
Common System Software	X	X	X
Common MPU hardware	X	X	X
Common interface modules	X	X	X
19" rack mountable		X	X
23" rack mountable	X	X	X
240 Gbps universal switch fabric		X	X
480 Gbps universal switch fabric	X	X	X
Number of interface slots	24	16	16

FLASHWAVE 9500 Packet ONP family shelf options include the following:

In addition each shelf type above can support a variety of interfaces including:

- ROADM
- SONET/SDH MSP
- Connection-Oriented Ethernet
- Packet optical networking-any mix of transport technologies

**System Capacity**

- 480 Gbps non-blocking SONET/SDH grooming
- 480 Gbps non-blocking packet grooming
- 20 Gbps non-blocking VT grooming
- Up to 8 degrees of ROADM connectivity
- 88 x 10 Gbps/40 Gbps wavelengths per ROADM degree
- Universal interface slots
  - SDS shelf – 16
  - HDS Shelf – 24

<b>Interfaces</b>	
Fast Ethernet	10Base-T, 100BaseTX, 100Base-FX, 100Base-LX
Gigabit Ethernet (SFP)	1000Base-T, 1000Base-SX, 1000Base-LX, 1000Base-ZX, CWDM
OC-3/STM-1 (SFP)	SR-1, IR-1, LR-1, LR-2
OC-12/STM-4 (SFP)	SR-1, IR-1, LR-1, LR-2
OC-48/STM-16 (SFP)	SR-1, IR-1, LR-1, LR-2, CWDM, DWDM
10 GBE (XFP)	10GBase-LR/LW, 10GBase-ER/EW, 10GBase-ZR, CWDM, DWDM
OC-192/STM-64 (XFP)	SR-1, IR-2, LR-2, CWDM, DWDM
OC-768/STM-256	VSR

<b>Number of Service Interfaces</b>			
	Ports/Card	SDS Ports/Shelf	HDS Ports/Shelf
Fast Ethernet/Gigabit Ethernet	20	240	480
OC-3/OC-12/OC-48/STM-1/STM-4/STM-16/ Gigabit Ethernet	8	96	192
10 Gbps Fiber Channel	1	16	24
OUT-2	1	16	24
OC-192/STM-64/10GbE	2	24	48

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OC-192/STM-64/10GbE/88-channel NBO	1	12	24
OC-768/STM-256	1	8	12

Fabric support

Sub-wavelength (electronic) universal switch fabric

- SDS Shelf
  - 240 Gbps SONET/SDH + 240 Gbps packet
- HDS Shelf
  - 480 Gbps SONET/SDH + 480 Gbps packet
- Wavelength (Photonic) fabric
  - SDS/HDS – WSS-based 44 or 88 channels per direction
- Optional VT switch fabric
  - SDS/HDS – 20 Gbps non-blocking VT grooming with full TSI

Synchronization

- DS1/EC1 BITS primary and secondary clock input/output
- Line timing
- Synchronization Status Messaging (SSM)
- Internal Stratum 3 timing source

Network/client protection architectures

- Optical Channel Dedicated Protection Ring (OCH-DPRING)
- ITU-T G.8031 Ethernet Protection Switching (EPS) over any topology
- IEEE802.3ad Ethernet Link Aggregation (LAG)

Equipment protection

- Universal fabric 1:1
- Management complex 1:1
- Interface card 1:1

ROADM functions

- High-density 8-degree ROADM configuration in a single shelf or distributed across multiple shelves (split-hub ROADM)
- 8-degree x 88-channel Wavelength Selectable Switch (WSS)
- Operator-selectable ITU-T wavelengths support 50 GHz ITU-T grid
- ROADM full-band tunable interface units
  - 10 Gbps universal transponder
  - 40 Gbps transponder
  - 100Gbps transponder
  - 8-port multirate muxponder
- 10 Gbps/40 Gbps/100G wavelength support
- Automatic level and gain control (No manual attenuation)
- Per-channel optical channel monitoring
- Operator-tunable dispersion compensation
- Narrowband direct connect
- SONET SDCC and OTN GCC support
- OCh-DPRING optical protection
- Operator-configurable Forward Error Correction options (FEC or EFEC)

Operations

- TL1
- SNMP
- NETSMART 500 Element Manager

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- NETSMART 1500 Management System
- NETSMART 2000 Design and Planning Tool
- TCP/IP to OSI operations gateway
- Software download and remote memory backup/restore

SONET/SDH functions

- STS/STM cross connects
- Ethernet over SONET/SDH (with GFP, VCAT, LCAS)
- GR-1093 state model

Environmental compliance

- UL-certified
- GR-1089 compliant
- NEBS Level 3 compliant
- IEC 60825-1
- IEC 60950-1
- FDA CDRH
- RoHS
- CE
- WEEE

<b>Physical characteristics</b>		
	<b>SDS</b>	<b>HDS</b>
Shelf dimensions (H x W x D)	22.75 x 17.4 x 14.8" (578 x 442 x 376 mm)	22.75 x 22.5 x 15" (578 x 571 x 380 mm)
<b>Weight (empty shelf)</b>	73 lb. (33 kg)	95 lb. (43.1 kg)

**FLASHWAVE 7500 Product Description**

The FLASHWAVE 7500 platform offers advanced DWDM, optical hubbing, ROADM, and network capabilities to deliver and manage growing metro and regional networks. The system supports both ANSI and ETSI-certified solutions, with flexible configurations to optimize metro and regional networks.

Building the Metro Backbone

Metro and regional optical networks are entering a period of dramatic expansion, driven by demand for high-speed data services, legacy TDM services, and high-bandwidth video services. Competing successfully requires a network architecture that consolidates and manages all high-bandwidth services over a single core optical transport network. The FLASHWAVE 7500 system provides a high-capacity ROADM platform for metro and regional networks, improving operational efficiency, reducing operations expenses, and lowering overall network costs.

Flexible Architecture, Deployed Worldwide

Chosen by major service providers worldwide, the FLASHWAVE 7500 platform is deployed in North America, Europe and Asia. American National Standards Institute (ANSI) and European Telecom Standards Institute (ETSI)-certified versions allow operation in any global environment. The platform aggregates TDM, SONET, Ethernet, and video services onto a single core optical transport infrastructure, improving efficiency, flexibility, and cost-effectiveness.

Field-Proven Technology

As the industry-leading metro ROADM platform, thousands of FLASHWAVE 7500 nodes are in operation with dozens of carriers worldwide, providing proven real-world performance. In addition, the systems go through rigorous internal system testing and verification prior to each software release. The FLASHWAVE 7500 platform has also been extensively tested by numerous outside facilities. These include customer test labs, NEBS, UL, Telcordia OSMINE, in addition to federal government testing and

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certification by the U.S. Defense Information Systems Agency (DISA)-sanctioned Joint Interoperability Test Command (JITC).

### Recent Product Enhancements

New FLASHWAVE 7500 features and enhancements improve network performance, enable new applications, and offer DWDM network and operational efficiencies. These new capabilities deliver significant capital and operational cost benefits.

### OTN Muxponder

Optical Transport Network (OTN) technology has been used for years in DWDM equipment, implemented as G.709 digital wrapper for wavelengths. OTN provides a common frame structure, optical layer Operations, Administration and Maintenance (OAM), General Communications Channel (GCC0), and Forward Error Correction (FEC) for improved performance.

Carriers are adopting OTN for sub-wavelength multiplexing and aggregation applications, in addition to its role as a digital wrapper for wavelengths. OTN multiplexing offers several benefits over other techniques, including universal containers with the introduction of the OTN muxponder unit on the FLASHWAVE 7500 platform, carriers can enable OTN multiplexing and services on existing ROADM networks. Supporting eight client ports of OC-3, OC-12, OC-48, GbE, and OTU1 services, the OTN muxponder maps all services into standard OTN containers and a 10G OTU2 network interface. In addition to the OTN muxponder unit, Fujitsu is adding 40G OTU3 support to the existing 40G transponder cards. OTN is transforming optical transport networks—with Fujitsu leading the way. supporting any signal type, transparent aggregation of signals, an industry-standard multiplexing scheme, and robust OAM.

### FLASHWAVE 7500 and 9500 Integration

Carriers can now have the best of both worlds, with the ability to mix and match transponders and muxponder from either the FLASHWAVE 7500 or 9500 platforms, over a common FLASHWAVE 7500 ROADM network.

### Reduce OPEX and Troubleshooting Time

With thousands of FLASHWAVE 7500 nodes deployed, existing carriers and networks can upgrade to the latest technologies and advancements, such as the Fujitsu 100G transponder and 100G muxponder, all running over their existing ROADM infrastructure. FLASHWAVE 7500 and 9500 integration enables carriers to expand and enhance their network without the need for costly overbuilds.

### 40G Improves Network Utilization

The FLASHWAVE 7500 system supports 10G, 40G, and 100G (via 9500 trib) wavelengths with a wide array of transponder and muxponder service units.

Recently, 40G units have become increasingly popular and widely deployed, providing carriers with a fourfold improvement in capacity. Fujitsu supports both coherent and non-coherent 40G units. The non-coherent 40G units are based on Adaptive Dual Phase Shift Keying (ADPSK) and provide a cost-effective method for expanding capacity in metro and regional DWDM networks. However, these 40G ADPSK units are not applicable on high Polarization Mode Dispersion (PMD) fiber spans.

PMD is an optical impairment with some older fibers that limits both transmission speeds and span distances. The 40G coherent transponders enable deployment and operation over high PMD routes, which were previously limited to 10G operation. Carriers reap substantial savings by eliminating the need to remove and replace problematic high-PMD routes.

### Sub-Wavelength Aggregation Reduces Capex

The Flexponder unit is an 8-port multirate, multiservice unit that integrates SONET STS-1 aggregation and switching along with WDM on a single card. Commonly referred

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to as a "Multiservice Provisioning Platform (MSPP)-on-a-blade," these cards perform the functions previously performed by standalone SONET MSPPs, saving equipment costs, space, and power.

The flexponder can be used as a single unit, supporting eight multirate, multiservice ports along with an integrated 20G STS-1 switch fabric for traffic grooming, or with multiple units. When using multiple flexponder, the system provides sub-wavelength aggregation and grooming across all units installed in a shelf with a 160G STS-1 distributed switching matrix.

#### Stacked Muxponders Reduce Remote Costs

The FLASHWAVE 7500 Extension Shelf provides a low-cost method of extending services to customer premises or remote locations. Instead of a full ROADM node at the remote location, the Extension Shelf can be deployed with a single transponder or muxponder, utilizing the network-side optical interface as a single-channel transport system. The limitation of this approach is that many remote sites require more low-speed aggregation ports than available on a single 10G muxponder unit. By combining multiple 10G muxponder cards with a 40G muxponder card in a stacked configuration, carriers can efficiently aggregate remote services and transport them over a single 40G channel, without the cost of a full ROADM node.

A similar application is to provide capacity expansion and fiber relief on fully filled DWDM networks. By upgrading to 40G wavelengths, carriers can expand their network capacity by a factor of four, without costly network overbuilds. Existing 10G muxponder, providing low-rate client OC-3/12/48 or GbE services, can be combined with the 40G muxponder unit in a stacked configuration to enable 40G or even 100G DWDM transport.

#### Enhanced Software Operational Features

Several operational features and enhancements have been incorporated to improve performance and reduce operation time and costs.

Capability/Feature	Value
Security Enhancements	Added protection for user passwords and network ports ensures the utmost security from network compromise for the most demanding, secure network environments
Enhanced alarm storage for WSS & amplifier modules	Additional storage of PM values aids in network troubleshooting and prevention
Client-side DWDM XFPs	Reduces costs by eliminating the need for back-to-back transponders when interconnecting WDM networks (FLASHWAVE 7210 or 9500)
Multiple IS-IS instances	Enables OSI management area to be subdivided, specifically within optical hub nodes, as networks grow and expand in size. Improved network management and scalability

**WSCA-NASPO Data Communications Services Solicitation # JP14001**Versatile Configurations

As a unified, scalable platform, the FLASHWAVE 7500 system offers flexible configurations to support a wide range of applications, including:

- FLASHWAVE 7500 WSS ROADM (1–12 degree optical hubbing)
- FLASHWAVE 7500 2-degree ROADM
- FLASHWAVE 7500 Extension Shelf for low-cost, remote nodes
- FLASHWAVE 7500 In-Line Amplifier (ILA)

The FLASHWAVE 7500 optical line cards and software are common to all configurations, reducing operational costs for engineering, training, installation and spare parts. Chassis options include a 23-inch North American version, a 19-inch version, and a 500 mm front-access ETSI version.

The FLASHWAVE 7500 system also supports managed service extensions with the FLASHWAVE CDS Micro Packet Optical Networking Platform (Packet ONP) and FLASHWAVE 7120 Access CWDM/ DWDM platform. The FLASHWAVE CDS is a compact 2RU customer premises platform that provides advanced Ethernet services and legacy SONET services. The FLASHWAVE 7120 provides a small, cost-effective WDM solution for transporting multiple wavelengths in access applications.

The FLASHWAVE 7500 platform supports both mixed 10G and 40G wavelengths on the same network, enabling carriers to efficiently and cost-effectively upgrade their WDM capacity, without the need for expensive overbuild networks

FLASHWAVE 7500 WSS ROADM

The FLASHWAVE 7500 wavelength selective switch (WSS) ROADM provides a powerful and cost-effective solution for metro and regional networks. Supporting up to 40 channels and capacity up to 1.6 Tb, the system provides an ideal solution for consolidated core optical networks; eliminating costly multiple overlay networks for each service type. Advanced features, such as automatic power balancing, optical hubbing, and A-Z wavelength provisioning, reduce operational expenses and improve service implementation times. Configurations range from simple 2-degree ROADMs to multidegree optical hub nodes supporting complex mesh network architectures.

FLASHWAVE 7500 2D ROADM

An economical choice for locations only requiring two degrees of connectivity, as opposed to multidegree hubbing, the FLASHWAVE 7500 2D ROADM can be deployed alone or in mixed applications along with FLASHWAVE 7500 WSS optical hub nodes. The 2D ROADM provides full 1–40 channel support, ring, linear, and terminal configurations, and utilizes all of the same optical line cards for client-side service interfaces. In addition, the 2D ROADM supports up to eight transponder slots on the same shelf as the ROADM switch/ muxponder and amplifier cards, enabling single-shelf deployments for low channel-count sites. Additional tributary shelves can always be added when additional slot capacity is required.

FLASHWAVE 7500 Extension Shelf

The FLASHWAVE 7500 Extension Shelf is a non-ROADM standalone configuration designed to extend individual services to customer premises. Primarily intended for single-channel extensions, the system offers very low-cost service delivery without the need for DWDM layer amplifiers, optical switches, and multiplexer/demultiplexer units.

FLASHWAVE 7500 ILA

Large optical networks require amplification every 60–100 Km, depending on the fiber type, data rates, and service mix. At those midpoints where service or wavelength drops are not required, the FLASHWAVE 7500 ILA offers a very economical solution to re-amplify the WDM signal and extend the network reach. If service or wavelength drops are ever needed at an ILA location, the FLASHWAVE 7500 ILA can be upgraded in-service to a full ROADM node.

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Core Transport Infrastructure

As a high-capacity optical transport platform, the FLASHWAVE 7500 ROADM is ideal for aggregating large, high-bandwidth services over a single optical core network. Previously, carriers typically deployed separate transport networks for each service type and network layer. The FLASHWAVE 7500 consolidates TDM, SONET, Ethernet, and video services into a single DWDM infrastructure, providing substantial savings and streamlining the network architecture, while providing additional capacity for future network growth.

Collapsed Network Functions

The FLASHWAVE 7500 system is more than just a pure optical transport platform, as it also supports sub-wavelength grooming and aggregation for legacy SONET services. In a typical network, SONET MSPPs provide STS-1 grooming and aggregation for OC-3/12/48 interfaces, with an OC-192 interconnection to the DWDM layer. Most DWDM locations also have many subtending SONET MSPPs, providing STS-1 level aggregation, grooming, and switching.

The FLASHWAVE 7500 Flexponder unit eliminates the need for subtending SONET MSPPs, by integrating SONET physical interfaces, STS-1 switching, and SONET protection switching into a single unit along with DWDM. The FLASHWAVE 7500 Flexponder supports eight multirate, multiservice ports that can be individually provisioned for OC-3/12/48 or GbE services, with a high-speed, full-band tunable OTU2 (10G DWDM) network interface. The Flexponder can be used as a single unit providing eight multirate ports along with an integrated 20G STS-1 switch fabric. It can be deployed in pairs, functioning as a SONET MSPP on a blade with SONET 1+1 and UPSR protection switching, along with the integrated STS-1 fabric. Finally, multiple units can be deployed supporting up to 160G of STS-1 switching and aggregation across all ports in the shelf.

High-PMD Routes

For optical routes with high polarization mode dispersion (PMD), the FLASHWAVE 7500 platform supports both 10G and 40G transponders superficially designed for problematic high-PMD fiber. The 40G coherent transponder and muxponder units utilize advanced DP-QSPK modulation and coherent optical receivers, which improves performance over high-PMD fiber.

Video Distribution

Perfectly suited for video applications in the cable and IPTV industry, the FLASHWAVE 7500 platform lets service providers distribute both broadcast and VoD video streams over large metro and regional networks from head end offices to video serving offices or distribution hubs.

Private Network Applications

As the backbone infrastructure for large private network applications, the FLASHWAVE 7500 system ensures that financial institutions, educational consortiums and federal government installations can accommodate traffic growth without costly network upgrades.

**FLASHWAVE 7500 Features and Specifications**

Architectures	<ul style="list-style-type: none"> <li>• Optical hubbing (up to 12 degrees)</li> <li>• Ring</li> <li>• Mesh</li> <li>• Linear add/drop</li> <li>• Point-to-point</li> <li>• In-Line Amplifier (ILA)</li> </ul>
Network Capacity	<ul style="list-style-type: none"> <li>• 1.6 Tbps (40 wavelengths at 40 Gbps each)</li> <li>• Up to 1200 Km reach without regeneration</li> <li>• WSS-based optical switch fabric (1 to 12 degrees)</li> <li>• 2D-only ROADM option</li> </ul>

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	<ul style="list-style-type: none"> <li>• Optional Raman amplifiers for extended-reach spans</li> <li>• FLASHWAVE 7500 Extension Shelf for low-cost remote services</li> </ul>
Optical Line Cards	<ul style="list-style-type: none"> <li>• Transponders/regenerators for 10G and 40G services</li> <li>• Muxponders including 4x1 10G, 4x1 2.5G, and 8x1 10G</li> <li>• OTN muxponder 8-port for OC-3/12/48/GbE and OTU1 services</li> <li>• Flexponder 8x1 SONET MSPP-on-a-blade for OC-3/12/48 and GbE services</li> <li>• Full C-band tunable narrowband optics at 10G, 40G, and 100G</li> <li>• G.709-compliant digital wrappers with RS-FEC, Ultra FEC (U-FEC) and enhanced FEC (E-FEC)</li> <li>• SFP/XFP pluggable client-side optics</li> </ul>
Optical Line Cards	<ul style="list-style-type: none"> <li>• 40G transponder</li> <li>• OC-768/STM-256</li> <li>• OTU3 40G muxponder (4 x 10G)</li> <li>• OC-192/STM-64</li> <li>• 10 GbE</li> <li>• OTU2 10G universal transponder</li> <li>• OC-192/STM-64</li> <li>• 10 GbE</li> <li>• OTU2 10G muxponder (4 x 2.5G)</li> <li>• OC-48/STM-16 OTN muxponder (8-port)</li> <li>• OC-3/12/48</li> <li>• STM1/STM4/STM16</li> <li>• GbE</li> <li>• OTU1 10G Flexponder (8-port)</li> <li>• OC-3/12/48</li> <li>• STM1/STM4/STM16</li> <li>• GbE muxponder (8-port)</li> <li>• GbE Multirate 2.5G transponder (1-port) • Multirate transponder 100 Mbps–2.7 Gbps for any service type</li> </ul>
System Features	<ul style="list-style-type: none"> <li>• Automatic per-channel power balancing</li> <li>• A-Z wavelength provisioning</li> <li>• Sub-wavelength grooming and aggregation (160G) per shelf</li> <li>• Optical hubbing for ring and mesh network interconnections</li> <li>• ILA upgrades to full ROADM node in-service</li> </ul>
Operations	<ul style="list-style-type: none"> <li>• TL1 over TCP/IP</li> <li>• TL1 over OSI</li> <li>• SNMP (alarms)</li> <li>• Remote software updates</li> <li>• Remote memory backup/restore</li> <li>• NETSMART® 500 Element Manager</li> <li>• NETSMART 1500 Management System</li> <li>• NETSMART 2000 Network Design and Planning Tool</li> </ul>
Monitoring and Alarms	<ul style="list-style-type: none"> <li>• Optical per-channel and WDM monitoring</li> <li>• Wavelength management</li> <li>• Optical layer (OTN) PM</li> <li>• SONET/SDH PM</li> <li>• Gigabit Ethernet PM</li> </ul>
Power Consumption/ Heat Dissipation	<ul style="list-style-type: none"> <li>• Optical/hub shelf &lt;360W (1228 BTU/hr)</li> <li>• Tributary shelf &lt;630W (2150 BTU/hr)</li> <li>• ILA &lt;360W (1228 BTU/hr)</li> </ul>

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Environment	<ul style="list-style-type: none"> <li>• Temperature –5 to 50 °C (23 to 122 °F)</li> <li>• Humidity 5 to 95% (non-condensing)</li> <li>• Power input –48 V DC</li> <li>• NEBS Level 3 compliant</li> <li>• FLASHWAVE 7500 ETSI system meets the following requirements for CE marking:</li> <li>• EMC Directive 2004/108/EC</li> <li>• UL/ IEC 60950</li> <li>• IEC/EN 60825-1 and IEC/EN60950-1 requirements for a Class 1 laser product</li> <li>• Restriction of Hazardous Substances Directive 2002/95/EC</li> <li>• Waste of Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC</li> </ul>	
Physical Characteristics	Dimensions (H x W x D)	23" Shelf: 22.5 x 21.5 x 11.5" (572 x 546 x 292 mm) 19" Shelf: 22.5 x 17.3 x 11.5" (572 x 439 x 292 mm) ETSI shelf: 30.2 x 19.3 x 11.5" (767 x 490 x 292 mm)
	Weight (fully loaded shelf)	<145 lb. (66 kg)

**FLASHWAVE 7420**

The FLASHWAVE 7420 system is a DWDM transmission system designed for **enterprise, access, metro core, and regional** applications. The system consists of optical terminal multiplex, add/drop multiplex systems and supports various topologies, such as point-to-point, linear add/drop, single fiber working (SFW) as well as two-fiber ring with feeders, meshed and star structures.

Up to 120 protected, 240 unprotected, or a combination of protected and unprotected optical channels can be transmitted over a two-fiber ring configuration. Either 40 or up to 80 channels are supported in dynamically reconfigurable networks using ROADM technology. Single Fiber Working (SFW) is supported as well.

The FLASHWAVE 7420 system provides a high level of flexibility through protocol transparent interfaces. It can interface easily with all types of fiber and transmission equipment such as SDH, SONET, OTH/G.709 as well as Ethernet, ESCON, Fibre Channel, and Digital Video.

The FLASHWAVE 7420 system uses a modular structure to accommodate both low initial cost and flexible upgrade of capacity and functionality. The modular design allows for a gradual in service expansion. It can be configured as a point-to-point system with one single channel. Complying with the network operator's needs, the system can evolve to a complete 80 wavelength fully protected DWDM system.

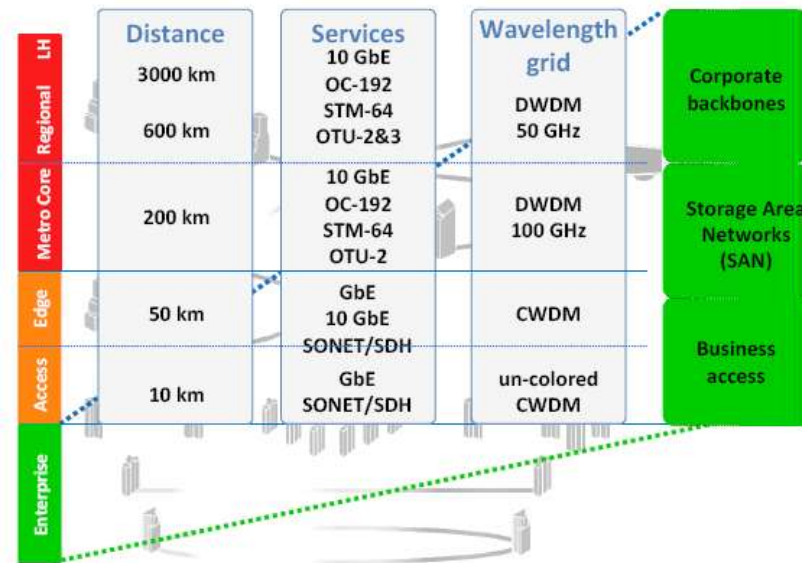
The system supports an initial configuration and in-service migration from a point-to-point unprotected system to a multi-node two-fiber ring architecture. The initial configuration does not cause any interruption or change of service, nor modification of operational concept or network management. The system is designed to support the "pay as you grow" paradigm for cost effective network deployments.

It is ideally designed to increase the exhausted capacity of large enterprise networks as well as inter-office, metropolitan, and regional rings.

The exceptional scalability is a core part of the FLASHWAVE 7420 Release 10.3 value proposition. This is best exemplified in the "one product from Core/Regional to Edge" philosophy. Figure 1 below illustrates this value proposition by market segment.

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Figure 1: FLASHWAVE 7420 Market Segment Overview



### Core - Transport

The main characteristics for core transport networks are:

- Optical transparent (no regeneration) for up to 3000 km (1865 miles)
- Homogeneous service portfolio (OC-48/192/768, STM-16/64/256, 10 GbE, OTU-1/2/3)
- Hierarchical network-to-network management layer
- Reconfiguration capability demand

To fulfill these main characteristics, core transport networks support the following important system technologies/features:

- High performance optical transmission features (FEC-G.709, EFEC-G.975, EDC)
- OTH feature set
- Dynamic network configuration and utilization - enabling components (Multi Degree ROADM, GMPLS, etc.)

### Access – Transport

The main characteristics for access transport networks are:

- Optical transparent (no regeneration) for up to 200 km (125 miles)
- Ethernet is the dominant service
- Need for massive bandwidth scalability due to broadband rollouts

To fulfill these main characteristics, access transport networks support the following important system technologies/features:

- Channel module set enabling lowest cost GbE transmission
- Mass-rollout proven network scaling concept
- Multi-service grooming capability
- Multi service ADM support
- Ethernet Layer-2 functionality
- CPE connection concept

### Enterprise – Transport

The main characteristics for enterprise transport networks are:

- Entire distance range needed starting from Business Access and Storage Area Networks (200 km) up to Corporate Backbones (2300 km)
- Huge service mix (IP/Ethernet, SONET/SDH, Open Systems, Mainframe)
- Certified interoperability with storage equipment

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## Services and Applications

The table below shows the services that are supported on the FLASHWAVE 7420.

Table 1: Supported Services

Application	Interface	Data Rate
G.709/OTN	OTU-1	2.666 Gbit/s
	OTU-2	10.709 Gbit/s
	OTU-2 LAN	11.096 Gbit/s
	OTU-3	43.018 Gbit/s
SDH	STM-1	155.52 Mbit/s
	STM-4	622.08 Mbit/s
	STM-16	2.488 Gbit/s
	STM-64	9.953 Gbit/s
	STM-256	39.813 Gbit/s
SONET	OC-3	155.52 Mbit/s
	OC-12	622.08 Mbit/s
	OC-48	2.488 Gbit/s
	OC-192	9.953 Gbit/s
	OC-768	39.813 Gbit/s
Storage	Fibre Channel 1G (e.g.100-M6-SN-S), FICON 1G	1.062 Gbit/s
	Fibre Channel 2G (e.g.200-M6-SN-S), FICON 2G	2.125 Gbit/s
	Fibre Channel 4G (e.g.400-M6-SN-S), FICON 4G	4.250 Gbit/s
	Fibre Channel 8G (e.g.800-M6-SN-S), FICON 5G	8.5 Gbit/s
	Fibre Channel 10G (e.g.1200-SM-LC-L), FICON 10G	10.51 Gbit/s
IBM	ESCON	200 Mbit/s
	Sysplex Timer (ETR, CLO)	8 Mbit/s
	Coupling Link (ISC-1; ISC-2 HyPerLink ISC-3 Compatibility Mode)	1.06 Gbit/s
	Coupling Link (ISC-3; Peer-Mode)	2.125 Gbit/s
	InfiniBand SDR	2.500 Gbit/s
	InfiniBand DDR	5 Gbit/s
	InfiniBand QDR	10 Gbit/s
LAN	Fast Ethernet	125 Mbit/s
	Gigabit Ethernet (1000-Base-Sx, -Lx) and 1000Base-T)	1.25 Gbit/s
	10 Gigabit Ethernet (LAN-PHY-10GBase-LR and WAN-PHY-10GBase-LW)	10.313 Gbit/s
	FDDI	9.953 Gbit/s
	ATM 155	125 Mbit/s
	ATM 622	155.52 Mbit/s
	ATM 2.488	622.08 Mbit/s
		2.488 Gbit/s
Video	270 Mbit/s SDI	270 Mbit/s
	HDTV-SDI	1.485 Gbit/s
Other	Any scrambled NRZ-encoded signal between 8 Mbit/s and 2.7 Gbit/s	8 Mbit/s to 2.700 Gbit/s

The highlights of the FLASHWAVE 7420 system are:

- Support for both CWDM and DWDM installations in one product, including hybrid (CWDM/DWDM) networks
- Support for both core- and access-type channel modules with focus on performance or cost optimization
- Support for different protection schemes based on optical switches or channel modules The following are features of the FLASHWAVE 7420 system:
- Transport Technology:
  - DWDM support: 32 or 40 wavelengths configurations at 100 GHz according to ITU-T G.694.1 and 80 wavelength configuration at 50 GHz with interleaver
  - Hybrid support: 4 CWDM wavelengths + 32 DWDM wavelengths
  - Single channel transport
  - TDM through muxponder units
  - Tunable optics at 10G, 40G, and 100G
  - SFP/XFP modules (pluggable optics) at 2.5G and 4G
- Configuration: point-to-point, add/drop, ring, mesh, and star

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- Available path and line protection:
  - Client layer protection
  - Channel protection
  - Channel module protection
- Link distance:
  - Point-to-point configuration: > 1300 km (~808 miles)
  - Ring circumference: > 1300 km (~808 miles)
- Transport of all common OTN, SDH/SONET, Ethernet, storage, and Packet services such as
  - E-Line services
    - Ethernet Private Line
    - Ethernet Virtual Private Line
  - E-LAN services
    - Multipoint services
    - E-Tree services
- Integrated, complete muxponder offerings:
  - 4 x OC-48/STM-16 into 10.7G (OTU-2)
  - 2 x OC-12 into 2.5G
  - 9 x 1 Gigabit Ethernet into OC-192/STM64 or 10.7G (OTU-2)
  - 8 x 1 Gigabit Ethernet into 10.7G (OTU-2)
  - 4 x 1 Gigabit Ethernet into 4G
  - 2 x 1 Gigabit Ethernet into 2.5G
  - 10 x 1G Fibre Channel into 10G
  - 5 x 2G Fibre Channel into 10G
  - 2 x 4G Fibre Channel into 10G
  - 4 x 1G Fibre Channel into 4G
  - 2 x 2G Fibre Channel into 4G
  - 2 x 1G Fibre Channel into 2.5G
  - Support of both GFP-T for full rate and GFP-F with STS-1 granularity for sub-rate 1GE and 1G FC services
  - Erbium-Doped Fiber Amplifiers (EDFAs) and RAMAN
  - Optional Optical Supervisory Channel (OSC)
- FLASHWAVE 7420 system is a Class 1M laser product with Hazard Level 1M.
- Management and control plane:
  - Development for GMPLS control plane with OSPF-based DCN routing and constraint-based traffic routing
  - Up to 20 NEs per basic structure (ring, linear add/drop)
  - Up to 100 NEs per DCN domain
  - Up to 20 shelves per NE
  - SNMP, TL1, SSH/Telnet
- Communications options:
  - Out-of-band OSC at 1630 nm and 1510 nm (OSCM, OSFM, 2OSCM-PN)
  - In-band SONET data communications channel
  - In-band OTN general communications channel
  - In-band proprietary embedded operations channel
  - Up to 5 in-band communications channels per NCU2E
- Interoperability with all major SAN solution providers

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- Compliance:
  - NEBS™ Level 3/ETSI
  - CE, FCC, UL, CUL
- Power
  - Voltage: –36 V DC to –72 V DC or 110/220 V AC
  - Maximum power consumption: 540 W per shelf
  - Temperature:
    - –5 °C to +45 °C long term
    - –5 °C to +55 °C short term
    - Relative humidity: 95% at 40 °C
- Physical:
  - Four shelf types:
    - 9U/20 slot (DC power)
    - 7U/20 slot (rear power)
    - 1U/2 slot (DC power)
    - 1U/4 slot (passive only)
  - AC and DC power options:
    - DC (1U)
    - DC (7U rear)
    - AC (7U front)
    - DC (1U)

The FLASHWAVE 7420 also supports redundant DC or AC power supplies. The power supplies operate in the same slots whether AC or DC. The system can operate with dual power supplies.

- DC Power – The voltage range is -36V DC to -72V DC.
- AC power – Both North American (120V AC) and European (220V AC) standards are supported.
- NEBS Level 3 compliant
- Underwriters Laboratory (UL) listing

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Supported Interfaces:

Application	Interface	Data Rate
G.709/OTN	OTU-1 OTU-2 (OC-n into OTU-2) OTU-2 LAN OTU-3	2666.06 Mb/s 10709.23 Mb/s 11049.1/11095.7 Mb/s 43.018 Gb/s
SDH	STM-1 STM-4 STM-16 STM-64 STM-256	155.52 Mb/s 622.08 Mb/s 2488.32 Mb/s 9953.28 Mb/s 39.81312 Gb/s
SONET	OC-3 OC-12 OC-48 OC-192 OC-768	155.52 Mb/s 622.08 Mb/s 2488.32 Mb/s 9953.28 Mb/s 39.81312 Gb/s
Storage Area Networking (SAN)	Fibre Channel 1G (for example, 100-M6-SN-S) Fibre Channel 2G (for example, 200-M6-SN-S) Fibre Channel 4G (for example, 400-M6-SN-S) Fibre Channel 8G (for example, 800-M6-SN-S) Fibre Channel 10G (for example, 1200-SM-LC-L)	1062.5 Mb/s 2125 Mb/s 4250 Mb/s 8500 Mb/s 10518.75 Mb/s
IBM (SAN)	FICON 1G FICON 2G FICON 4G Coupling Link (ISC-1; ISC-2 HyperLink; ISC-3 Compatibility Mode) Coupling Link (ISC-3; Peer-Mode)	1062.5 Mb/s 2125 Mb/s 4250 Mb/s 1062.5 Mb/s 2125 Mb/s
LAN	Fast Ethernet Gigabit Ethernet (1000Base-Sx, -Lx) Gigabit Ethernet (1000Base-T) 10 Gigabit Ethernet: <ul style="list-style-type: none"> <li>▪ LAN-Phy-10GBase-LR</li> <li>▪ WAN-Phy-10GBase-LW</li> </ul>	125 Mb/s 1250 Mb/s 1000 Mb/s  10312.5 Mb/s 9953.28 Mb/s

SFP/XFP pluggable units

FLASHWAVE 7420 uses Industry standard SFP/XFP pluggable units. The following figures illustrate Circuit pack specifications, including SFP/XFP use for all available interface modules:

The following table lists the currently supported channel cards for DWDM operation:

Part #s (FC9685xxxx)	Card Type	Client Port(s)	Network Port(s)	Embedded Comms	Services	Network Rate(s)
CE99*	<u>Tunable 10G Transponder:</u> WCC-PCTN-10G-V	1 x XFP	1 x Tunable λ	SDCC, GCC0	10GE LAN, 10GE WAN, 10G FC, OC192, OTU2	OC-192, OTU2, OTU2LAN
CC99*	<u>4:1 Tunable 10G Muxponder:</u> 4TCC-PCTN-2G7+10G-V	4 x SFP	1 x Tunable λ	GCC0	4 x OC-48, 4x OTU1	OTU2
CF99*	<u>10:1 Tunable 10G Muxponder:</u> 10TCC-PCTN-4GU+10G-V	10 x SFP	1 x Tunable λ	GCC0	9 x 1GE, 10 x 1G FC; 5 x 2G FC, 2 x 4G FC (GFP-T)	OTU2
CB00 (R9.1)	<u>as Dual 2.7G Transponder:</u> 2TWCC-PCN-2G7U	2 x SFP	2 x SFP λ	SDCC, GCC0	OC-48, OTU1	Same as Service Rate
CB00 (R9.1)	<u>as 2:1 2.7G Muxponder:</u> 2TWCC-PCN-2G7U	2 x SFP	2 x SFP λ	SDCC, GCC0	2 x 1GE (GFP-T)	OC-48, OTU1
CB1N	<u>2.7G Transponder:</u> WCC-PC1N-2G7U	1 x SFP	1 x SFP λ	SDCC, GCC0	1GE, OC-3/12/48, OTU1	Same as Service Rate
AD00	<u>4:1 4G Data Muxponder:</u> 4TCA-PCN-4GU+4G	4 x SFP	2 x SFP λ	ECC	4 x 1GE, 4 x 1G FC, 2 x 2G FC, 1 x 4G FC	4.25G
CA00	<u>4:1 2.5G Muxponder:</u> 4TCC-PCN-2G1U+2G5	4 x SFP	2 x SFP λ	SDCC	4 x 1GE, 4 x 1G FC, 1 x 2G FC (with sub-rate support)	OC-48
AA00	<u>2.5G Transponder:</u> WCA-PCN-2G5U	1 x SFP	2 x SFP λ	None	OC-3, OC-12, OC-48, 1GE, 1G & 2G FC, FE	Same as Service Rate
AB00	<u>2:1 2.5G Data Muxponder:</u> 2TCA-PCN-1G3+2G5	2 x SFP	2 x SFP λ	ECC	2 x 1GE, 2 x 1G FC	2.5G
AM00	<u>2:1 OC12 Muxponder:</u> 2TCA-PCN-622M+2G5	2 x SFP	2 x SFP λ	ECC	2 x OC-12	2.5G

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### Wavelength Technologies

The FLASHWAVE 7420 system supports Dense Wavelength Division Multiplexing (DWDM), Coarse Wavelength Division Multiplexing (CWDM) and a mixture of both, called Hybrid CWDM/DWDM.

### DWDM

There are two options available for DWDM in the C-band:

- 32 banded wavelengths—Up to 32 wavelengths per fiber pair according to ITU-T G.694.1 (100 GHz channel spacing).
- 40 unbanded wavelengths—Up to 40 wavelengths per fiber pair are supported contiguously from 1530.334 nm to 1561.419 nm, including all the guard band wavelengths (#DC).

Note: Channel 01 (1529.553 nm) that is part of the 32 banded wavelengths is not supported in the 40 unbanded channel plan

### Flexible wavelength services

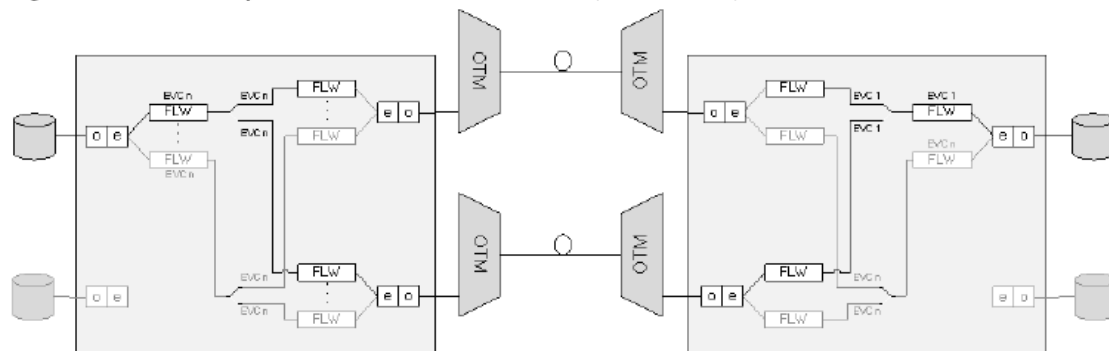
The hardware design of the FLASHWAVE 7420 platform, coupled with the benefits of WDM technology, enables the system to support point-to-point, linear add/drop and ring topologies across fixed and reconfigurable networks. The platform takes full advantage of the latest optical technologies, including ROADM, 40 Gbps, and 100G transport, to increase bandwidth, improve optical performance and support numerous protocols and applications. A full suite of optical amplifiers and signal conditioning units enable the creation of networks tailored to individual customers. Combined with existing support for an optical supervisory channel (OSC) and an embedded communications channel (ECC), the FLASHWAVE 7420 platform offers complete operation and service provisioning capabilities from any node on the network.

### FLASHWAVE 7420 Protection

#### Ethernet linear protection implemented according to ITU-T G.8031

Ethernet linear protection provides end-to-end protection for individual VLAN-based E-Line services within the network of xPCA modules. Up to 200 protected E-Line services are supported on the xPCA modules. Ethernet linear protection is supported at I-NNI ports (ports between xPCA modules), but not at UNI/NNI ports (towards 3rd party equipment). The protection span starts on the I-NNI, which means that user frames are protected once they are received on UNI and NNI ports.

Figure 39: Example of Ethernet Linear Protection (ITU-T G.8031)



Ethernet linear protection is realized by sending packets belonging to the E-Line service (EVC) through two different paths. One path is the working path and the other is the protection path. Which path is used to transport the protected E-Line service depends on the quality of the two paths and is selected by the channel module at egress.

The basis for the switch decision is switch commands (both local and remote) and detected connection fault management failures relevant to the specific flow-points.

Switching intelligence is represented by a protection group. In Ethernet linear protection the

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protection group members are flow point entities. An E-Line service is mapped to a flow point on each of the I-NNI ports. It is these two flow points that are members of the protection group. Thus two flows are used to transport the protected E-Line service. Each E-Line service can thus be protected and switched individually. Not all E-Line services of a given module need to be provisioned with protection.

The various protection schemes and channel modules offer different sets of switching criteria. For interoperability between different modules, some of the switching criteria may be disabled. The most common defects that cause autonomous protection switching are:

- Signal Failure (SF)
- Signal Degrade (SD)

#### Signal Failure (SF)

Autonomous switching is triggered by Signal Fail (SF) or its equivalent such as:

- Supporting equipment outage
- Facility disablement

Although SF triggering is module dependent, all ports are designed to switch if LOS and LOC occur.

SDH/SONET ports have the following defects enabled as SF criteria, depending on the selected protection level:

- LOF
- MS-AIS/AIS-L

OTN ports have the following defects enabled as SF criteria, depending on the selected protection level:

- LOF
- LOM
- OTU-AIS
- ODU-AIS
- ODU-OCI
- ODU-LCK

Modules with proprietary framing on ports have the following defects enabled as SF criteria, depending on the selected protection level:

- LOF
- AIS
- Autonomous Switch Triggers

#### Equipment Failure

The following events will generate equipment failure in channel card protection groups:

- Laser Tx fail for all plugs and lasers (network and client port)
- Voltage outage of vital stages that involve traffic
- Depending on module, PCB specific equipment failures
- Internal clock failure for automatic protection switching, the switching criteria is based on.

#### Signal Degrade (SD)

Autonomous switching is triggered by the Signal Degrade (SD) alarm. The FLASHWAVE 7420 provides signal degrade alarms to indicate signal quality degradation.

#### Data-Layer Signal Degrade Alarm

A data-layer signal degrades (SD) alarm indicates that the data-layer signal quality has degraded below a specified threshold, and that this situation has lasted for a specified duration. SD is implemented according to ITU-T ref. G.806/6.2.3 and GR253-CORE. It is raised based on the following layers:

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- SDH/SONET: Multiplex Section/Line (for some modules Regenerator Section/Section is used)
- OTN: OTU, ODU, TCM A, TCM B and TCM C

In addition, some modules with proprietary signal framing on the network port have SD support as well, based on error measurement. A candidate second for a SD alarm is present when the registered errored blocks per second (SDH and OTN), or registered errored bits per second (SONET), on that data layer exceeds a threshold. The threshold is configurable, and the default value for this threshold is:

- For SDH: 30% registered errored blocks per second relative to the total number registered blocks per second
- For SONET: 10-6 registered errored blocks per second
- For OTU, ODU, TCM A, TCM B and TCM C: 15% registered errored blocks per second relative to the total number registered blocks per second

For automatic protection switching, the switching criteria is based on LOS, LOF and BER switching criteria. For the protection of signals, two protection scenarios exist in the FLASHWAVE 7420 system:

- Channel card protection and
- Channel protection

The common factor in these scenarios is that to form a protection group, two network ports of the same type must exist.

The facilities must have the same parameters set for all relevant parameters. Each of the protection scenarios supports automatic protection switching and user-initiated protection switching (such as manual or forced). Channel modules must be in the same shelf for the equipment protection to function.

Network Protection Using the Protection Modules

Channel module protection requires two network ports of two channel modules in the same shelf and communicating with each other over the backplane. Channel module protection supports automatic switching and user-initiated manual switching.

For the protection to properly operate, the configuration requires two of the same channel modules and a protection module (1 PM, 2 PM). The two channel modules must be in the same shelf, even in a multi-shelf configuration.

Additionally, the two network-side facilities must be of the same type (for example, both 1 Gigabit Ethernet and both 1 Gigabit Fiber Channel), and they must be provisioned with the same parameters for all relevant parameters. The parameters are:

- Behavior
- Error Forwarding
- ALSMODE
- ALSHOLD
- SONET/SDH/OTN layer termination (PHYS/SECTION)

On the client side, the facilities must be completely identical.

Network Protection with Hot-Standby

In hot-standby (HST) protection, two network ports of a hot-standby module form the protection group. The transmission mode must be hot standby or multiplex HST. The HST mode supports automatic switching and user-initiated manual switching, but not forced switching

Two channel (network-side) facilities of the same type (for example, both 1 Gigabit Ethernet and both 1 Gigabit Fibre Channel) must be provisioned with the same parameters for all relevant parameters. These parameters must be identical:

- Behavior
- Error Forwarding
- ALSMODE

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- ALSHOLD

The SFP modules for this protection scheme do not have to be the same. They may differ in:

- Channel (C or D)
- Rate
- REACH

Note: However, both SFP modules must support the same type of facility.

**5.2.4.2 Edge Optical Switches** Provide entry points into the enterprise or service provider core networks.

**FNC Response:**

The following FNC platforms are well suited and provide excellent entry points into the enterprise or service provider core networks.

**FLASHWAVE CDS Micro Packet Optical Networking Platform Overview**

The FLASHWAVE CDS (Compact Density System) combines high capacity Ethernet transport and aggregation with support for existing SONET/SDH services at the network edge. It's designed to extend the reach of today's core and distribution networks, providing an efficient on-ramp for packet-centric applications while ensuring support for revenue-bearing legacy services.

The FLASHWAVE CDS two-slot chassis supports a range of interface units to meet a variety of business applications, traffic capacity requirements, and price points. Service providers can leverage its modular architecture to enhance their business services and optimize their access network.

The FLASHWAVE CDS Micro Packet ONP is MEF CE 2.0 certified for E-Line and E-Access services.

The FLASHWAVE CDS Micro Packet Optical Networking Platform is the ideal access and aggregation solution for mobile backhaul and commercial/enterprise Ethernet services. Its high-density Ethernet interface cards enable a scalable solution with integrated traffic management and carrier-grade service OAM capabilities to provide robust, carrier-grade data services with guaranteed Service Level Agreements (SLAs).

**Enterprise Ethernet Services**

The FLASHWAVE CDS Micro Packet Optical Networking Platform is the ideal access and aggregation solution for commercial/enterprise Ethernet services. High-density Ethernet interface cards allow large numbers of data customers to be supported on a single system. Integrated traffic management, data aggregation, and Connection-Oriented Ethernet transport technologies provide robust, carrier-grade data services with guaranteed Service Level Agreements (SLAs).

**Legacy Services Demarcation**

Legacy SONET/EoS services remain the primary revenue producers for most service providers. Today, these services are usually terminated at customer sites by deploying a full SONET platform. With the FLASHWAVE CDS system, a single service module provides both service delivery and service demarcation. The platform's small size, low power consumption and strong cost-to-value ratio all offer compelling benefits when compared to terminating these services on a traditional ADM.

**Mobile Backhaul**

Mobile data traffic is exploding due to escalating demand for wireless connectivity. At the same time, the consumer trend of "a better experience at a bigger bargain" is severely eroding average revenue per user for wireless service providers. These providers are seeking ways to improve profitability, and can realize large savings by outsourcing their backhaul networks.

This situation amounts to an excellent opportunity for transport providers to profit by providing wireless operators with essential backhaul services at compelling price points. With huge investments in optical fiber plant, transport providers already reach into the heart of metropolitan and suburban residential areas, where the majority of mobile traffic originates.

**WSCA-NASPO Data Communications Services Solicitation # JP14001****Building a Backhaul Revenue Engine**

Capitalizing on existing fiber plant by building a backhaul business is no small undertaking. Strict requirements demand close attention to network architecture and technology, right up to the last mile. Fujitsu offers full turnkey backhaul solutions and the broad span of expertise needed to take your backhaul network from project plan to profit. We take a vendor-and product-neutral approach, providing services, support and equipment solutions that are engineered to your specific situation.

**Backhaul cost comparisons**

10 Mbps or Equivalent to 500 Sites	Backhaul Cost per Month: One Site	Backhaul Cost per Month: 500 Sites	Backhaul Cost per Year: 500 Sites
7 T1s @ \$300 per month per T1	\$2,100	\$1,050,000	\$12,600,000
Ethernet @ \$75 per month per Mb	\$750	\$375,000	\$4,500,000
Ethernet @ \$40 per month per Mb	\$400	\$200,000	\$2,400,000

**Services-Based Multivendor Approach**

Fujitsu has the resources, expertise and technology needed to build and operate large-scale next-generation backhaul networks. Fujitsu uses a professional services-based approach. Fujitsu has business analysts, network architects, master network integration specialists, program managers, and a full-service network operation center to deploy or modernize state-of-the-art backhaul networks. This approach must be based on a thorough understanding of the wireless provider's critical business needs, such as SLA support and last-mile connectivity.

**Key Business Advantages**

By leveraging their existing infrastructure transport providers can capitalize on three key business advantages:

- Transport provider infrastructure is often in close proximity to key cell tower locations
- Because transport providers often use Ethernet as a transport medium, they can offer equivalent T1 service to mobile operators at a significant discount over what the LECs charge
- Bandwidth can be sold in increments of 1 Mb that can be provisioned remotely with no truck roll needed

**Master Network Integration Services**

Fujitsu Master Network Integration Services are designed to ensure that network elements are deployed and integrated for optimal performance and efficiency. We deliver the same high level of commitment, expertise and results regardless of whether the network elements are Fujitsu or those of another vendor.

**Technical Expertise to Support Stringent Requirements**

As you work through the challenges and choices of developing your backhaul business offering, technology selection is crucial. Fujitsu has the right expertise to prepare your network for the stringent service-level requirements of wireless providers. We take every aspect into account and we collaborate with you to identify and deploy the best solutions. Our expert technicians will guide you through complex issues such as:

**Wireless-specific architecture requirements and Architecture**

- Multitenant cell sites
- Coexisting legacy and new technologies
- Transparent implementation to support:
- TDM-based services (GSM and CDMA)
- ATM/IMA (UMTS)

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- Native IP/Ethernet-based technologies
- WiMAX and LTE

### Wireless carrier SLAs

- 20–100 Mbps Committed Information Rate (CIR) for bandwidth scalability
- 50–500 Mbps Excess Information Rate (EIR) for burst capability
- Less than 3–5 ms latency (one- way)
- Less than 1–3 ms jitter (one- way)
- Up to eight unique Classes of Service (CoS)
- Sub50 ms Ethernet Virtual Circuit (EVC) recovery time
- 99.99–99.999% network availability

Timing and synchronization – CDMA base stations require timing alignment to within 3 ms, and packet-based timing standards such as IEEE 1588v2 are still vulnerable to packet network impairments

Network monitoring – Strict monitoring is essential for full SLA compliance and speedy fault resolution. The Fujitsu NETSMART® 1500 Management System delivers powerful monitoring features for heterogeneous networks

### Leading Hardware Platforms

Fujitsu is an innovator in Connection-Oriented Ethernet and optical transport technologies.

The Fujitsu FLASHWAVE® product portfolio includes systems such as the FLASHWAVE 4100 ES Micro Packet Optical Networking Platform (Packet ONP), supporting TDM and native Ethernet services; the FLASHWAVE CDS Packet ONP, which is a native Ethernet solution with support for 1 Gbps up to 10 Gbps; and the FLASHWAVE 9500 Packet ONP, which is a full fiber aggregation solution.

### Mobile Backhaul Project Cycle

- Phase 1 – Planning and Consulting
- Phase 2 – System Design and Architecture
- Phase 3 – Proof of Concept/Technology Selection
- Phase 4 – Interoperability and Solution Integration
- Phase 5 – Site Development
- Phase 6 – Installation and Commissioning
- Phase 7 – Performance Verification and Optimization
- Phase 8 – Legacy Equipment Decommissioning
- Phase 9 – Operation and Maintenance

### Next-Generation Transition

The FLASHWAVE CDS system provides an advanced Ethernet service and aggregation architecture for access networks. Incorporation of SONET/SDH and Ethernet enables a smooth, seamless transition to a packet-centric architecture.

The FLASHWAVE CDS platform eases migration from TDM to Ethernet transport for next-generation WiMAX and 4G LTE base stations. These systems require high-bandwidth, highly reliable, native Ethernet transport services—the perfect application for the FLASHWAVE CDS Micro Packet Optical Networking Platform

The FLASHWAVE CDS Micro Packet ONP enables business Ethernet and legacy services over an existing network infrastructure. This modular platform combines:

- High-capacity differentiated Ethernet service access for efficient bandwidth management
- Smooth scalability from GbE to 10 GbE transport for hub/spoke, ring or mesh networking
- Service multiplexing for centralized aggregation

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- Support for time-restrictive TDM services
- Optimize fiber utilization with CWDM XFP optics
- Simplex or duplex card support for either low startup costs or high reliability
- Alternate profile plug-in units supporting existing SONET services at the network edge

These capabilities are available from a resilient, temperature-hardened 2RU platform engineered for 99.999% availability.

The FLASHWAVE CDS system consists of a common two-slot chassis and a range of interface units to meet a variety of business applications, traffic capacity requirements and price points. Service providers can leverage its modular architecture to enhance their business services and optimize their access network. This innovative platform smoothes the transition to a packet-centric network architecture by enabling next-generation Ethernet while preserving the integrity of legacy services.

### Key Technical Advantages

- 2RU chassis with two-slot modular design
- High-density Ethernet interfaces up to 10 GbE
- COE transport providing guaranteed deterministic performance
- Advanced traffic prioritization and traffic management for efficient service delivery
- Robust Ethernet link and service OAM lowers operations expense
- Ethernet delivery with hardware protection using cross-card link aggregation (LAG)
- Diverse interface options for Ethernet and SONET services
- Mix-and-match packet and legacy services

### Key Network Benefits

- Offers line, ring and mesh resilient network architectures up to 10 GbE
- Supports SONET access for OC-3, OC-12 and GbE over OC-48
- Delivers guaranteed high-bandwidth Ethernet services over networks up to 10 GbE
- Provides guaranteed QoS and SLAs using deterministic COE for optimal performance
- Reduces bandwidth costs through optional statistical multiplexing
- Reduces equipment space requirements
- Leverages and extends existing optical network
- Maintains support for existing services

### Service Scalability for 1 GbE to 10 GbE Networks

One chassis and one card type offers both GbE and 10 GbE operations, which provides efficient scaling options and minimizes spares inventory. Redundant hardware and facility protection eliminates single points of failure, which is especially critical in multi-tenant service delivery.

Other vendor solutions utilize separate, non-redundant hardware platforms for 1 GbE and 10 GbE network operation. This arrangement slows the scaling process, requires additional footprint, and results in several hours of service downtime as service providers de-install GbE platforms and then install 10 GbE platforms. A complete platform change Reduced Ring Protection Costs

The FLASHWAVE CDS Micro Packet ONP supports protected VLAN-based Ethernet virtual circuits (G.8031), which lowers operational expenses for optical network ring protection through simplified maintenance and troubleshooting. This industry standard provides the most field-cost-effective mechanism for facility protection, quickly resolving network outages due to loss of signal from adverse network fiber issues. G.8031 provides superior network protection on a per-VLAN basis by establishing end-to-end working and protection paths over network facilities. This protection provides 99.999% network availability and eliminates single points of failure.

By contrast, other technologies such as MPLS require significantly more operational test

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equipment, personnel, and time resources to properly protect the network due to its complex and complicated design as compared to COE. In addition, G.8031 provides better performance than traditional switched Ethernet because it uses COE and its sub-50 ms protection switching.

### Reduced Network Operating Costs

Inband VLAN management enables the NETSMART® 1500 management system to remotely manage, maintain and provision services on the FLASHWAVE CDS platform through a management channel over an Ethernet network facility port. The system simplifies the Operations, Administration, Maintenance, and Provisioning (OAM&P) process with an A-Z provisioning wizard, graphical view of Ethernet services, real time performance monitoring statistics, service test facilitation and graphical displays. Performance Management polling and reporting, and layered topology views help visualize both the physical and the logical network topologies. Inband VLAN management reduces the need for truck rolls during troubleshooting tasks. It also has the added risk of provisioning errors, further impacting service time-to-market.

### Efficient Bandwidth Management

Efficient traffic management, using a mix of guaranteed SLAs, statistical multiplexing, queue policing, and shaping, lowers the cost of network bandwidth provisioning by efficiently allocating client services bandwidth over the network. Prior to traffic management, service providers were only able to offer a single bandwidth premium offering to their customer. With traffic management, service providers are able to expand their offerings to markets that can't afford premium QoS bandwidth. This new offering of differentiated service levels of bandwidth capability opens new markets and potential new revenue streams for service providers.

### FLASHWAVE 4100ES

The FLASHWAVE 4100 ES Micro Packet Optical Networking Platform (Packet ONP) is ideal for delivering Ethernet and TDM service with highest reliability in extreme environments, and where space is at a premium. Its modular, 2RU chassis provides the flexibility to minimize capital outlay, with pay-as-you-grow scalability.

FLASHWAVE® 4100 ES platforms are in service across tens of thousands of locations, such as central offices, cell sites, outside-plant cabinets and cable distribution networks. The platform is also widely deployed on customer premises in rack, cabinet and wall-mount configurations.

The FLASHWAVE 4100 ES Micro Packet (Packet ONP) is the optimal solution for the network edge, offering:

- Smooth, economical migration from legacy SONET to next generation packet optical networking.
- Service delivery for high concentrations of Connection-Oriented Ethernet (COE), DS1, DS3, EC1, OC-3 and OC-12 services
- Flexible COE over Ethernet and SONET resulting in long-term investment protection

The COE and TDM capabilities of the FLASHWAVE 4100 ES system are optimized for 2G/3G/4G mobile backhaul, wholesale Ethernet access, metro Ethernet business services, and backhaul of triple play services, including broadband Internet access from DSLAM, PON or CMTS equipment.

The COE service unit combines SONET attributes such as extremely low latency, jitter and frame loss with the flexibility and scalability of Ethernet. The unit provides:

- Guaranteed bandwidth (CIR) per Ethernet Virtual Connection (EVC)
- Four classes of service
- VC service multiplexing (aggregation)
- VLAN ID mapping/translation
- COE network operation on any port with optional 1:1 LAG facility protection

The FLASHWAVE 4100 ES platform controls costs with flexible options to reuse existing resources. This strategy maintains TDM service performance while offering bandwidth efficiency and differentiated services over existing SONET equipment. As SONET bandwidth becomes

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exhausted, COE services can be scaled over new Ethernet facilities using an available port on the existing COE service unit without adding shelves or common equipment.

FLASHWAVE 4100 ES systems can easily be upgraded in-service to deliver high-performance COE services. As a result, the State can offer high-performance Ethernet services and centralized network maintenance without incurring the cost and inefficiency of building and maintaining an overlay access network.

Ethernet, fundamentally a connectionless technology, is now the method of choice for delivering high-bandwidth data services. However, next-generation mobile backhaul, high-definition video distribution and mission-critical enterprise services require deterministic, high-performance, high-availability connections. These kinds of connections are only possible in a connection-oriented environment. The frame delay, packet loss and service protection performance of connectionless networks are unacceptable for critical voice, video and storage applications. The answer is COE which is the basis for high-quality, simple-to-manage integrated networks that support packet, optical, and TDM networks.

Multiple levels of fault tolerance, including redundant power, Ethernet facility protection using IEEE 802.3ad link aggregation, card protection and network protection using SONET 50 ms path protection, ensure non-stop operation. The Fujitsu NETSMART® 1500 management system simplifies service assurance leveraging the product's integrated by 802.3ah link OAM (Operations, Administration, and Management) and connection admission control for EVC CIR bandwidth reservation.

The FLASHWAVE 4100 ES DS1 service card with integrated NIU condenses trouble ticket resolution time and expedites installation. Its extensive loopback capabilities, NPRM, 30-day PM binning, CI alarm recognition and integrated multi-pattern Bit Error-Rate Testing (BERT) provide a powerful tool set to expedite installation, mitigate service issues and reduce truck rolls. As a result, operational expenses are reduced.

The FLASHWAVE 4100 ES COE service unit offers multiple mapping options for scaling services. All COE services in a shelf have multiple mapping options for existing SONET and native Ethernet WAN facilities. Once SONET bandwidth is exhausted, COE services can scale at EVC granularity over Ethernet network facilities through simple point-and-click provisioning. This can be done using the existing COE service units, chassis and common cards. This flexible architecture provides investment protection and minimizes capital expenses when scaling COE service.

For COE service applications with native Ethernet, up to 48 10/100Base-T and 10 Fast/GbE ports can be cascaded per shelf using the integrated line unit switch fabric and transported over native GbE with 1:1 LAG facility protection.

In SONET networks, up to 48 10/100Base-T and 12 Fast/Gigabit Ethernet ports can be mapped to individual HO-VCGs or as shown below onto the same high order virtual concatenation group (HO-VCG) within the SONET facility. The single VCG sharing option minimizes service multiplexing capacity at the aggregation site, improves end-to-end transport service bandwidth efficiency offering more flexible service bandwidth options. The SONET facility provides automatic path protection switching.

The FLASHWAVE 4100 ES platform offers the option to multiplex multiple ports and EVCs over a single SONET VCG. This advanced technology significantly improves SONET bandwidth efficiency within the shelf.

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## FLASHWAVE 4100ES Features and Specifications

<u>Architecture</u>	<u>WAN Interfaces</u>	<u>Service (Client Interfaces)</u>
<ul style="list-style-type: none"> <li>• Terminal (1+1)</li> <li>• Linear ADM (1+1)</li> <li>• Universal Path Switching Ring (UPSR)</li> <li>• 0:2 Both line cards working and protect</li> <li>• Ethernet with 1: LAG facility protection</li> </ul>	<ul style="list-style-type: none"> <li>• 10/100 Base-T and FE/GE Base-X</li> <li>• OC-3, OC-12 and OC-48 line interfaces</li> <li>• Optical SFP-based with LC connectors</li> <li>• 1310 or 1550 nm wide band</li> <li>• CWDM SFP optics</li> <li>• OC-48 DWDM SFP Optics</li> </ul>	<ul style="list-style-type: none"> <li>• 10/100 Base-T with RJ-45 connectors</li> <li>• 100Base-X (SFP) with LC connectors</li> <li>• 1000Base-X (SFP) with LC connectors</li> <li>• DS1 with 64-pin AMP connectors</li> <li>• DS3/EC1 with BNC connectors</li> <li>• DS3 Transmux with BNC connectors</li> <li>• OC-3 and OC-12 (SFP) with LC connectors</li> <li>• 1310 or 1550 nm wideband</li> <li>• CWDM SFP optics</li> </ul>
<u>Operations</u>	<u>COE Service Unit Ethernet Features</u>	<u>Synchronization</u>
TL1 protocol over OSI/Ethernet or IP/Ethernet	Supports MEF Ethernet Private Line (EPL) and Ethernet Virtual Private Line (EVPL) services	DS1/EC1 BITS primary and secondary clock input and output ports
SNMP Monitoring	Ethernet tag switching implementation of Connection-Oriented Ethernet (COE)	Line timing
SSH/SFTP	Create Ethernet switched paths using standard IEEE 802.1 ad frame format	Synchronization Status Messaging (SSM)
NETSMART 500 Element Manager	Supports VLAN ID push/pop/swap with multiple tag stacking options for maximal flexibility	Internal Stratum 3 timing source
NETSMART 1500 Management System	Unlimited scalability through reuse of VLAN IDs across a COE domain	
<p>TCP/IP gateway functionality</p> <p>Software download and remote memory backup/restore</p> <p>Interoperable with all Fujitsu products</p> <p>Telcordia OSMINE supported</p>	<p>Ingress classification on port, VLAN ID or IEEE 802.1p priority code points</p> <p>Ingress bandwidth profiles per EVC or EVC per CoS</p> <p>4 Class of Service queues defined via 16 unique CoS profiles</p> <p>Connection Admission Control (CAC) to guarantee CIR bandwidth for each EVC</p>	

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NEBS Level 3 certified	Supports RFC 2698 and MEF 10.1 TCM policers	
UL listed	IEEE 802.3ah Link OAM IEEE 802.3ad Link Aggregation	
	Supports LACP or static LAG configurations	
	Up to 250 EVCs per card	

**Maximum Number of Service Interfaces**

	Port/Card	Unprotected Ports/Shelf	Protected Ports/Shelf
DS1	28	168	168
DS3	3	18	18
High-density DS3/EC1	8	48	48
DS3 Transmux	3	18	18
OC-3	2	24	12
OC-12	1	12	6
10/100Base-T	8	48	-
100/1000Base-T	2	12	-

**Protection Options**

DS1	1:1 or protected
DS3	1:1 or protected
DS3 Transmux	1:1 or protected
SONET	1+1, UPSR or 0:2 dual working
COE Ethernet	Client or Native Ethernet 1:1 LAG facility protection
VITS Output	1+1 redundant output

**SONET Switching**

	STS-1 TSI	VT1.5 TSI
OC-3 Dual Line Interface	48x48	1344x1344
OC-12 Line Interface	168x168	4704x4704
OC-48 Line Interface	240x240	6720x6720

**Advantage of FLASHWAVE® 4100ES**

The FLASHWAVE® 4100 ES is a 2 rack unit (RU) platform that implements all industrial-grade components and is temperature hardened (-40° to +149°F) for outside plant (OSP) installation. It features a dual power bus for +24/-48 volts direct current (VDC) powering.

On the line side, the 4100 ES supports independent OC-3, OC-12, or OC-48 SONET interfaces. In R8.2, support for a 1Gbps G.8031 native Ethernet interface is available. There is full support for Connection Oriented Ethernet (COE) on all interfaces, which means the FLASHWAVE® 4100ES offers a smooth migration from pure SONET to packet-SONET operation.

On the service side, the FLASHWAVE® 4100ES has a rich port offering. It features a modular structure with 12 service slots. It can support up to 168 DS-1 port (28 ports per card) with integrated Network Interface Units (NIU). The 4100 ES can support up to forty-eight 10/100 Ethernet ports (8 per card), twelve 100 Mbps optical (bX) Ethernet ports (2 per card), and twelve 1000 Mbps optical (bX) ports (2 per card). It can also support up to 48 DS-3/EC1 interfaces (8 high-density ports per card). There is also support for a standard 3-port DS-3 card (18 ports per shelf) and a 3-port DS-3 transmux (also 18 ports per shelf). Finally, 24 OC-3 ports unprotected (12 protected) using the dual port service unit and 12 OC-12 ports (6 protected, 1 port per card)

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using the dual function service unit. The dual function OC-12 service unit also provides dual OC-3 ports as an alternative to single port OC-12 operation.

The platform has many enhanced capabilities, including support for four service classes; client-side Link Aggregation Groups (LAG) per card or between two cards for hardware protection, flow based performance with 4096 addressable and 512 configurable flows, native Ethernet with G.8031 VLAN protection capabilities, and service/link OAM (Y.1731, 802.3ah). It also supports the use of Low Order (LO) and High Order (HO) Virtual Concatenation (VCAT), the Links Capacity Adjustment Scheme (LCAS) and Generic Framing Procedure (GFP) encapsulation. It features the full DS1 network interface unit (NIU) suite, a 30-day performance management (PM) capability that identifies intermittent service faults and an integrated bit error rate tester (BERT), NPRM to instantly sectionalize a DS1 fault, Inband loopback capability that enables remote testing and single-ended, single-tech testing.

**FLASHWAVE® 4100ES OC-48 Line Unit features:**

- SONET-compliant OC-48 interface
- Facility and terminal loopbacks
- Available fiber facility protection–based UPSR, 1+1, and conventional UPSR protection
- Variety of supported SFP optics:
  - 1310 nm SR
  - 1310 nm IR
  - 1310 nm LR1
  - 1550 nm LR2
  - CWDM in eight wavelengths supported through LR optics
  - Narrowband (dense wavelength division multiplexing [DWDM]) in 34 wavelengths supported through LR optics
- SONET Path, Line, and Section overhead processing and termination
- Optional automatic path switching
- Full non-blocking 240 x 240 STS-1 or 6720 x 6720 VT1.5 switch matrices
- Provides 622 Mb/s to each service slot
- Backup path mapping
- Optional line switching
- Works with partner line unit to provide GR 1244–compliant synchronization, including automatic reference switching for all transmission circuits within the NE
- Onboard stratum-3 clock
- Building integrated timing supply (BITS) input connections
- Synchronization to subtending service units
- +24 V DC or –48 V DC operation
- Backup storage for NE configuration database in slot 1

The FLASHWAVE® 4100 extension shelf synchronized from any of the following sources:

- External building integrated timing supply (BITS) timing reference
- Line timing derived from an OC-n line unit source
- Internal stratum 3 clock

In addition to the extended synchronization, the FLASHWAVE® 4100 extension shelf supports synchronization status messaging (SSM) to ensure that the network maintains proper timing if a network failure occurs. All Telcordia synchronization functions are provided (for example, BITS interfaces and local stratum 3 clock holdover). The current timing source for the OC-48 ring and the OC-12 ring is DS-1.

The FLASHWAVE® 4100 extension shelf defaults to the following reference clocks:

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- Line timing from line units (default)
- Primary BITS input
- Secondary BITS input
- Internal (INT)

After a mode change, the FLASHWAVE® 4100 extension shelf cannot remain in holdover unless the old reference is still a valid candidate in the new mode. The user is given the protection state of each reference. This state indicates whether the reference is currently active or if the previously active reference is operating in holdover.

**FLASHWAVE® 4100ES Management Options**

The FLASHWAVE® 4100ES Management unit provides RAM, ROM and processors to support the following management functions in the FLASHWAVE® 4100ES:

- Data processing and control for the extension shelf NE
- Local and remote user interface message, and NE-to-NE interface message processing and generation
- Signal overhead processing and generation
- DCC processing and generation for one DCC channel from each line unit
- Ethernet 10/100Base-T local communication network (LCN) connection through a backplane RJ-45 connector
- Local user interface device access through RS-232/DB-9 (TERM) connector on front panel
- Nonvolatile memory backup of provisioning data and program files (primary) Software download (SWDL) and remote memory backup (RMBU) and restoration support

Note: For Release 7.1 or later, a redundant copy of the MCU system software is stored in the line unit in slot 2 if the line unit is installed.

- Alarm detection and reporting (critical [CR], major [MJ], and minor [MN])
- Identifies units and maintains a unit inventory
- Configures units with provisioning data
- Monitors unit and facility status and performance
- Controls automatic protection switching
- Routes DCC information bound for other NEs

**FLASHWAVE 4100ES**

**802.3ah Link & 802.1ag/Y.1731 Service Support**

	FLASHWAVE 4100 ES		
	R8.2	R8.3	R8.4
<b>802.3ah</b>			
Link Discovery	Yes	Yes	Yes
Link Monitoring	Yes	Yes	Yes
Loopback	Yes	Yes	Yes
Critical Event/Fault Messages Identification	Yes	Yes	Yes
<b>802.1ag</b>			
CC		Yes	Yes
Link Trace		Yes	Yes
Loopback		Yes	Yes
<b>Y.1731</b>			
LCK			Under Consideration

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AIS		Yes
RDI	Yes	Yes
Frame Delay (Responder mode)	Yes	Yes
IFDV (Responder mode)	Yes	Yes
Frame Delay Range (Responder mode)	Yes	Yes
Mean FD (Responder mode)	Yes	Yes
Frame Loss Ratio (Responder mode)	Yes	Yes
Delay OAM Messages (Responder mode)		
-1DM		
-DMM	Yes	Yes
-DMR	Yes	Yes
Synthetic OAM Messages (Still in draft)		Under Consideration, Not Planned
-1SL		
-SDM		
-SMR		

**FLASHWAVE® 7120**

The proposed FLASHWAVE 7120 passive 1RU shelf provides a broad range of services and applications. The wavelength services range from 100M to 10G wavelength services. It also provides for Ethernet Services such as (EPL, EVPL, ELAN, and EVLAN) up to 10GigE. The FLASHWAVE 7120 can also be a fixed OADM WDM based platform (FOADM) which will support point to point, linear, and ring based solutions as well as a fiber relief, reach extension platform for all network applications including IOF and backhaul configurations.

Introduction & Applications

FLASHWAVE® 7120 WDM Access Solution delivers:

- Intelligent WDM Transport for growing bandwidth & service demands
- Interfaces to deliver an extensive protocol suite and meet today's applications: storage extensions, private line, virtual private line, Ethernet-based business services, IP-based multipoint applications, and transparent wavelength applications.

**Data**

- 100M Fast Ethernet
- Gigabit Ethernet
- 10GE WAN PHY
- 10GE LAN PHY
- 10GE LAN PHY+FEC

**Storage**

- ESCON
- 1G Fibre Channel
- 2G Fibre Channel
- 4G Fibre Channel
- 10G Fibre Channel

**SDH/SONET**

- STM1 / OC3
- STM4/ OC12
- STM16 / OC48
- STM64 / OC192
- OTU1
- OTU2

**WSCA-NASPO Data Communications Services Solicitation # JP14001****Fujitsu's WDM-based Transport portfolio**

- Give customers a way to provide a low wavelength count, WDM-based product to address the growing need for wavelength services
- Address the need to continually reduce costs, including providing customers with 10G CWDM without sacrificing performance or requiring different equipment
- Globally deployable with support for ANSI / ETSI, OTN, ITU-T, RoHS, etc.
- Provide managed solutions to the edge of the network with the following advantages:
- High bandwidth (up to 320G delivered to a site)
- Compact size (between 1U and expansion in-service up to 8U)
- Temperature hardening (-20 to +65C)
- Full suite of protocol and application support, including OTN transport

**Integrate with Fujitsu's access strategy**

- Provide active and passive WDM fiber relief solutions
- Operate as a stand-alone service access, aggregation, and transport solution or as part of an integrated solution

**FLASHWAVE® 7120 Summary****Small Footprint with expansion capabilities**

Start with a single shelf

- 1 SCP and 5 interface slots
- Support for any interface in any slot
- Add the first expansion shelf
- SCP to ESI on 2nd shelf
- Provides 11 service slot capacity
- Additional expansion shelves may be added as required
- Grow to 17 slot (3 shelves) or 23 (4 shelves) slot capacity

Advantages

- Grow as capacity demands
- Same shelf and cooling unit used for Main and Expansion shelves
- Shelves are added in-service
- Single TID across all shelves

Note: Main and Expansion shelf are defined by the system's SW and MSI/ESI; they use the same part number

**Shelf Options****FLASHWAVE® 7120 Shelves**

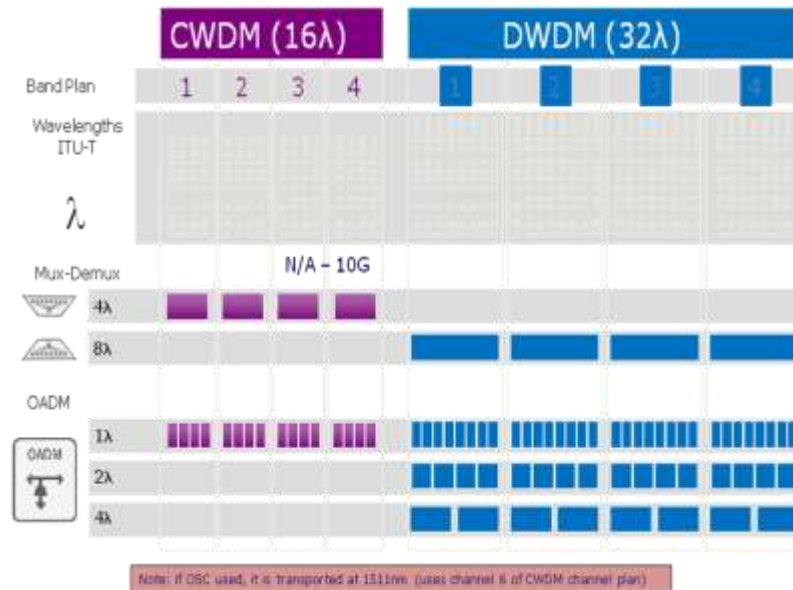
- The system's primary shelf is 2U with integrated power, a fan interface, a shelf interface (MSI), a system controller (SCP) and 6 interface slots
- Additional shelves may be linked under a single TID for system expansion
- For passive only applications, a 1U passive shelf is available
- Houses all passive WDM filters and DCM units

**Services Summary**

- SDH / SONET (OC-3 to OC-192, STM1 to STM64)
- OC3/OC12: single and dual wavelength transport or 8:1 service multiplexing
- OC48: single and dual wavelength transport of 4:1 service multiplexing
- OC192: single and dual wavelength transport per transponder
- Ethernet point to point (with MEF E-LINE)

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- 100M (100BaseT): 2:1 service multiplexing
- GigE: single and dual wavelength transport and both 2:1 and 9:1 service multiplexing
- 10GigE: single and dual wavelength transport support (LAN and WAN PHY) per transponder
- Storage
- 1G/2G FC: single and dual wavelength transport or up to 10:1 service multiplexing using
- 4G FC: single and dual wavelength transport or 2:1 service multiplexing
- 10G FC: single and dual wavelength transport
- OTN (Optical Transport Network)
- OTU1: currently network transport only
- OTU2: single and dual wavelength transport

**Key Highlights**

- ELINE and ELAN services(MEF9)
- Bandwidth profiles (MEF14)
- Ethernet ring protection via MSTP or G.8032
- End-end Network Element and Service Management (NS1500, NS712)
- Integrated OTN/WDM for reach and capacity

**Standardized Services**

- Addresses MEF “Carrier Ethernet”
- Private Line (EPL, EVPL) along with multi-point to multi-point Ethernet LAN (ELAN, EVLAN) applications
- MEF9 / 14 certified

**Reliability / protection**

- Ring based protection today with MSTP or G.8032
- Leverages OTN (G.709 DW) for detection of hard failures (LOS), single fiber failures, and soft failures (degrading ODU BER)
- Assures rapid detection and switching in sub-50 ms
- Module stacking

**WSCA-NASPO Data Communications Services Solicitation # JP14001****Quality of Service (QoS)**

- End-to-end SLAs supported with Y.1731
- Frame loss, delay, delay variation

**Quality of Service and Class of Service**

- 802.1p, DSCP and TOS traffic prioritization
- 8 queues per port, strict priority, round-robin, weighted round-robin and deficit round-robin scheduling
- Ingress and egress bandwidth profiles per UNI, EVC, COS

Bandwidth limitations are applied to a classified flow of traffic using a bandwidth profile. The bandwidth profile describes the bandwidth limitation in terms of four parameters:

- Committed Information Rate (CIR)
- Committed Burst Size (CBS)
- Excess Information Rate (EIR)
- Excess Burst Size (EBS)

**Bandwidth Profile Rate Enforcement**

Bandwidth profile rates are enforced through an algorithm that is commonly implemented through a token bucket algorithm (TBA). The MEF has defined a two-rate, three-color marker (trTCM) algorithm that can be implemented through two token buckets.

One bucket, referred to as the Committed (C) bucket, is used to determine CIR conforming, in-profile service frames, while a second bucket, referred to as the Excess (E) bucket, is used to determine EIR-conforming excess service frames.

**Ingress and egress bandwidth profiles**

Ingress and egress bandwidth profiles are provisioned using policing and packet queuing or scheduling parameters.

There are three types of ingress bandwidth profiles:

- Ingress Bandwidth Profile per Ingress UNI, which is applied to all ingress service frames for all EVCs at the UNI
- Ingress Bandwidth Profile per EVC Service Attribute, which is applied to all ingress service frames for an EVC at the UNI
- Ingress Bandwidth Profile per Class of Service Identifier Service Attribute, which is applied to all ingress service frames with a specific CoS identifier

There are three types of egress bandwidth profiles:

- Egress Bandwidth Profile per Egress UNI Service Attribute, which is applied to the sequence consisting of all egress service frames at the UNI
- Egress Bandwidth Profile per EVC Service Attribute, which is applied to the egress service frames that are mapped to the EVC
- Egress Bandwidth Profile per Class of Service Identifier Service Attribute, which is applied to the egress service frames with the CoS identifier

The rates are rounded to 64 Kb/s increments up to 1 Mb/s and they are rounded to 1 Mb/s increments above 1 Mb/s. The burst sizes are rounded up to the next increment of 4 Kbytes.

**Packet Classification**

Incoming packets can be assigned to a CoS at SERVICE UNI based on matching certain packet criteria. This is done by defining a class map that specifies the fields of the packet to be matched

The MATCH commands include:

- MATCH C-VLAN <vlan-id>

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- MATCH C-VLAN-PRIORITY <priority>
- MATCH MAC SRC <mac address>
- MATCH MAC DEST <mac address>
- MATCH ETHERTYPE <value>
- MATCH IP SRC <ip-address>
- MATCH IP DEST <ip-address>
- MATCH IP PROTOCOL <value>
- MATCH IP TCP-UDP-PORT DEST <port #>
- MATCH IP TCP-UDP-PORT SRC <port #>
- MATCH IP DSCP <value>

A class map is paired with a bandwidth profile into a policy map. The policy map can then be applied to a SERVICE UNI

**Service Management**

- Carrier class OAM&P with Y.1731
- Provisioning with a simple 3 step provisioning GUI

**Multiple detection triggers:**

- Loss of Signal (LOS)
- Loss of Frame (LOF)
- Loss of Multi-frame (LOM)
- Signal Degrade (SD) on Bit Error Rate (BER)
- Single Fiber Failure using backwards signaling

**Additional OTN Benefits:**

- In-band management solution using General Communications Channel (GCC) for network element communications
- Forward Error Correction (FEC) using RS (255/239) enables detection and correction of bit errors for improved throughput and signal reach

**Layer 2 Matrix Features for FLASHWAVE 7120**

FNC	FLASHWAVE 7120 (Packet VX)	
	R7.4	R8.2
	FGA	
Physical Information		
Units	12/2 & 24/4	
Ports and type:		
10G		
1G		
10M		
100M		
Size		
Power consumption		
AC / DC		
Volts		

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802.3ah Ethernet in the First Mile (EFM)		
Link Discovery	-	-
Link Monitoring	-	-
Remote port-level loopback	-	-
Critical Event/Fault Messages	-	-
Remote Fault Indication (RFI)	-	-
802.1ag Connectivity Fault Management (CFM)		
Continuity Check Messages (CCM)	√	√
Link Trace (LT)	√	√
Loopback (LB)	√	√
Y.1731 Service OAM		
Locked Signal Function (LCK)	-	-
Test Signal (TST)	-	-
Alarm Indication Signal (AIS)	-	-
Remote Defect Indication (RDI)	√	√
Frame Loss Ratio (FLR)	-	planned
1-way Frame Delay (DM frames)	-	-
2-way Frame Delay (DMM/DMR frames)	-	planned
1-way Frame Delay Variation or Jitter	-	-
2-way Frame Delay Variation or Jitter	-	planned
Link Aggregation		
1:1 network interface (same card)	---	planned
1:1 network interface (cross-card)	---	planned
1:1 client interface (same card)	---	planned
1:1 client interface (cross-card)	---	planned
0:n with LACP network interface (same card)	√ (n=8)	√ (n=8)
0:n with LACP network interface (cross-card)	---	planned (n=8)
0:n with LACP client interface (same card)	√ (n=8)	√ (n=8)
0:n with LACP client interface (cross-card)	---	planned (n=8)
Multi-chassis LAG (MC-LAG)	---	---
Ethernet Topology		
1 GigE ring (network)	√	√
1 GigE ring (subtending)	√	√
1 GigE pt-to-pt, mesh (network)	√	√

## WSCA-NASPO Data Communications Services Solicitation # JP14001

1 GigE pt-to-pt., mesh (client)	√	√
10 GigE ring (network)	√	√
10 GigE ring (subtending)	√	√
10 GigE pt-to-pt, mesh (network)	√	√
10 GigE pt-to-pt, mesh (client)	√	√
<b>Ethernet Services</b>		
Ethernet Private Line (EPL)	√	√
Ethernet Virtual Private Line (EVPL)	√	√
E-TREE	-	planned
E-LAN (802.1ad Provider Bridging)	√	√
# of EVCs/card (GE, 10GE)	768	768
# of EVCs/NE	4090	4090
C- & S-Tag Switching (Push, Pop, Swap)	Pu, Po, Sw*	Pu, Po, Sw*
<b>Ethernet Protection</b>		
G.8031 (linear, ring, mesh)	-	-
# of G.8031 protection tunnels/card	-	-
# of G.8031 protection tunnels/NE	-	-
G.8032 Ethernet ring protection	√	√
Rapid Spanning Tree Protocol (RSTP)	√	√
Multiple Spanning Tree Protocol (MSTP)	√	√
<b>Ethernet Traffic Management</b>		
Per-port policing	√	√
Per-flow policing	√	√
# of policers/card	1024	1024
# of queues/card	8 / port	8 / port
CIR/CBS	√	√
EIR/EBS (2-rate. 3-color)	√	√
CIR over-subscription		
EIR over-subscription		
Classes of Service (per-Ingress-Port, per-EVC, per-Ingress-VLAN)	P, E, V	P, E, V
# of CoS per EVC	8 / port	8 / port
Shaping (by Port, by EVC, by CoS)	P*	P*
Backplane access throughput per Ethernet card	-	-
<b>Ethernet Timing</b>		

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Synchronous Ethernet with SSM	-	-
IEEE 1588v2	-	-
External BITS timing	-	-
MEF Certification		
MEF 9 (Test Suite for UNI Services)	√	√
MEF 14 (Test Suite for Traffic Management)	√	√
MEF 21 (Test Suite for UNI Type 2 - Link OAM)	-	-
Operational/Physical Parameters		
Class II Temperature-hardened	√	√
AC Power	√	√
DC Power	Dual	Dual
NEBS 3	√	√
Network Management		
SNMPv2c & v3 (Trap, GET, SET)	v1, v2c (T, G, S)	v1, v2c (T, G, S)
TL1	-	-
CLI	√	√
NETSMART 500 (Provisioning)	?	?
NETSMART 712 (Provisioning)	√	√
NETSMART 1500 (Fault Monitoring, Provisioning)	FM	FM
Gateway NE capable	√	√
Inband Management VLAN support	√	√
OSMINE	-	-
TIRKS	-	-
NMA	-	-

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Metro-E Applications

## FLASHWAVE 5310

### Multiservice Ethernet Aggregation Device

-48VDC/+24VDC/AC  
Redundant PS  
Dual A/B Feeds  
Power <50W

4x FE/GigE SyncE SFP Ports;  
10/100 Mbps OoB Management;  
Serial Console Port; Alarm Port;  
Time of Day and 1PPS Outputs;  
BITS In/Out SMB Connectors

Field Replaceable Fan Unit  
3 Fans for High Reliability  
Temperature Controlled  
Monitored for Failures

Optional 1588v2 RTU License

- 1 RU; 255mm Depth
- -40 to 65C Temperature
- Support for WDM SFPs
- Dedicated traffic FPGA for Y.1731 SLA measurements
- Embedded NID functionality
- Station loopbacks
- Throughput testing
- 3.3ms CCM for G.8032v2 sub 50ms protection
- Primary/Secondary Clock
- Stratum 3 Clock

2 Module slots provides PAYGO for Ethernet and TDM Services

4x FE/GigE SyncE SFP Ports

8x T1/E1 CESoEth SAToP MEF 8

1x OC-3/STM-1 Channelized Circuit Emulation SAToP MEF 8 Active standby protection mode

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## FLASHWAVE 5310

### Multiservice Ethernet Aggregation Device Benefits

- 4 GE with 2 access modules
  - 4 port FE/GE
  - 8 ports T1/E1
  - 1 port OC-3/STM-1
- Dedicated hardware for Y.1731 -> High precision SLA measurement and advanced loopbacks; Eliminate the standalone NID
- Hardware based G.8032v2 -> Enabling a highly available network infrastructure and service protection
- SyncE, 1588v2, BITS and Stratum 3 -> Highly reliable Frequency, Phase and Time synchronization
- 1RU and Low Power -> Addressing space and power constraints at the tower; Green cell site deployments
- MEF Carrier Ethernet 2.0 support -> standards-based for EPL, ELAN and multi-vendor interop

Part Number	Description
FC9696EM21	FW 5310 Base System
FC9696FN1	FW 5310 Fan Unit
FC9696EP11	FW 5310 -48/+24 VDC Power Supply
FC9696EP21	FW 5310 120/240 VAC Power Supply
FC9696E4G1	FW 5310 4xGE Service module
FC9696E8T1	FW 5310 8xE1/T1 Service module
FC9696EC31	FW 5310 Channelized OC3 Service module

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## WSCA-NASPO Data Communications Services Solicitation # JP14001

The FLASHWAVE® 5310 is a compact, multiservice, carrier-grade platform designed to deliver both Ethernet and TDM-based connectivity services in support of enterprise business and wireless provider mobile backhaul service applications. Its small form factor, low power and temperature resilient architecture is ready to be installed at wireless towers or customer premises to solve space and power challenges, deliver high performance scalable services and reduce operational costs. In addition, integrated support for both Ethernet and TDM connectivity create an affordable, versatile and seamless path to high performance Ethernet WAN and wireless 3G/4G mobile backhaul services. The FLASHWAVE® 5310 has two bays for access modules. There are three access modules; 8xT1, 4xGE/GE and 2xOC3 are currently available. A 2x10GE is planned for 1H14.

### Value Proposition

#### Standards-Based Carrier Ethernet Delivery

Designed to support both Metro Ethernet Forum and SONET/SDH industry standards, the FLASHWAVE® 5310 platform delivers Ethernet Private Line, Ethernet Virtual Private Line and Ethernet LAN based connectivity for high capacity business and mobile backhaul 4G services as well as T1/E1 circuit emulation and SONET/SDH channelized OC-3/STM-1 connectivity for leased line replacement and mobile backhaul 2G/3G services. With dedicated hardware for 1588v2 clock recovery the FLASHWAVE® 5310 provides 1 Pulse per Second (1PPS) and Time of Day (ToD) GPS Minimum Recommended Data sentence (GPRMC) outputs for phase and clock synchronization.

#### Service Level Provisioning, Monitoring and Management

Graphical user interfaces based upon SNMP supported by in band or out of band interface options and NETSMART 1200, a full featured network management system, are available to provide users a full solutions management view from the individual node to an end-to-end network and service centric view. With dedicated hardware for traffic performance monitoring, the FLASHWAVE® 5310 delivers on today's requirement for hardware based Y.1731 latency, jitter and frame loss ratio measurements. Hardware based MAC address swapping on the FLASHWAVE® 5310 enables the device to support station loopbacks to allow centralized test sets to complete service turn-up and performance verification. Tiered Ethernet services as well as wireless backhaul service level performance may also be monitored through the web-based SLA portal.

#### Scalable, Flexible and Reliable Services Platform

Architected with service module and SFP port flexibility, the FLASHWAVE® 5310 provides Ethernet service scalability from 1Mbps to 1Gbps, and 1 to 16 T1/E1, with an integrated flexible combination of Ethernet and TDM services. High reliability is provided for Ethernet services with G.8032v2 sub-50ms ring protection, ladder rings and multiple instances. Carrier class TDM services can depend upon sub-50ms protection with SONET/SDH based APS on OC-3/STM-1 channelized ports.

### FEATURES AND BENEFITS

- a) Compact, low power and temperature resilient platform, ready for tower or CPE deployment, delivers high performance and reduces operational cost;
- b) Multiservice TDM and Ethernet support provides affordable and seamless path to high capacity business Ethernet and wireless 4G services;
- c) Synchronization source derived from any of the following: SyncE Ethernet interfaces, BITS In, any SONET/SDH interface, any T1/E1 interface and the embedded 1588v2 slave clock;
- d) System clock meets the accuracy, stability, and holdover specifications required for stratum 3 timing (ANSI T1.101);

### WSCA-NASPO Data Communications Services Solicitation # JP14001

- e) Carrier grade platform with hot swappable power (x2) and fans, low latency, and highly reliable service delivery with 50ms ring protection G.8032v2 and SONET/SDH based APS;
- f) Standards-based and interoperable with MEF Carrier Ethernet 1.0 and 2.0;
- g) Deep fault and performance management with Y.1731, loopback, link trace, delay, jitter and loss measurement with customer SLA Portal access.

#### Applications

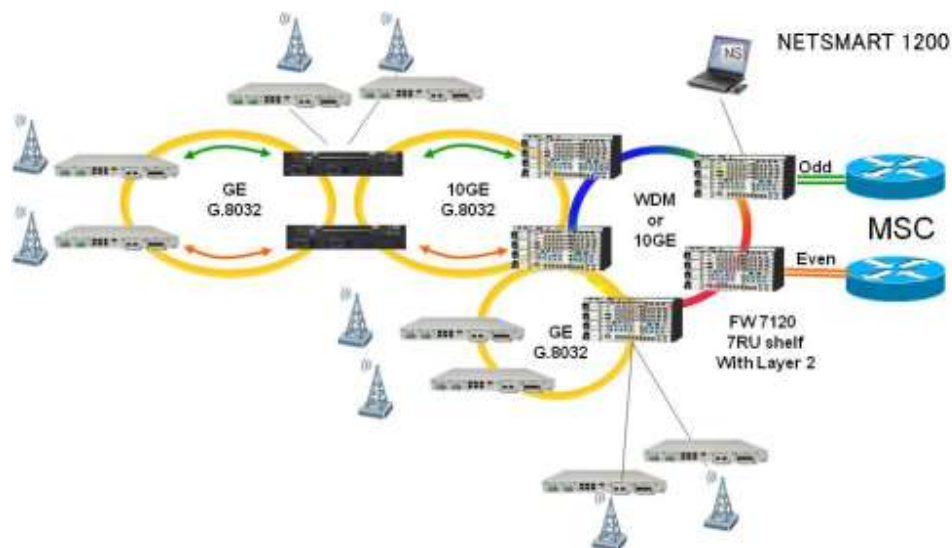
There are three primary applications that the FLASHWAVE® 5310 was specifically designed for, namely mobile backhaul, enterprise service delivery, and access infrastructure.

#### Mobile Backhaul

Mobile Backhaul is a perfect application and is optimized for the FLASHWAVE® 5310. The platform's reuse of underutilized bandwidth maximizes throughput and use of fiber assets. The enhanced traffic management makes it possible to attain consistently optimal performance in complex, high traffic networks during peak-traffic times. It also offers guaranteed minimal bandwidth support, while dynamically allocating individual EVCs to peak rates. Optional sub-50 ms network resiliency, using G.8032, offers selective service protection. The FLASHWAVE® 5405 is the high-performance cell tower access platform solution for "five nines" carrier-class backhauling of 4G LTE services.

Mobile backhaul is experiencing an explosion in traffic bandwidth demand. Wireless operators are moving from leased lines to dark fiber as part of their solution and must leverage wavelengths to secure their investment for future expansion at minimal additional cost. The solution to their backhaul needs includes the FW5310 and FW7120 as shown in the diagram below delivering redundancy at all critical points:

1. Wavelength based scalability
2. Even (green)/Odd(orange) traffic replication
3. Ring based service aggregation with redundant E-Line EVC's per cell site
4. Throughput turn-up testing
5. Y.1731 performance monitoring
6. End-to-end service protection

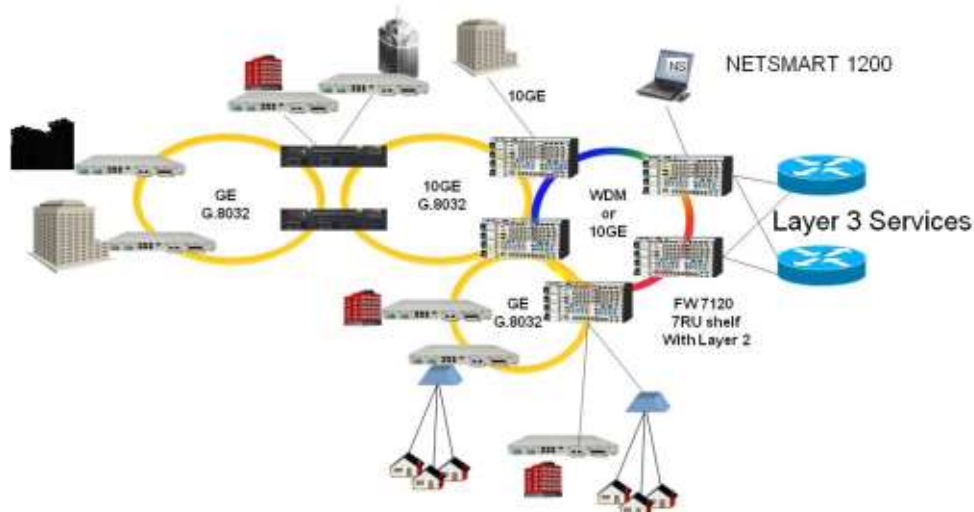


#### Enterprise Service Delivery

The FLASHWAVE® 5310 system is the ideal access and aggregation solution for delivering Ethernet business services. High-density Ethernet service interfaces allow

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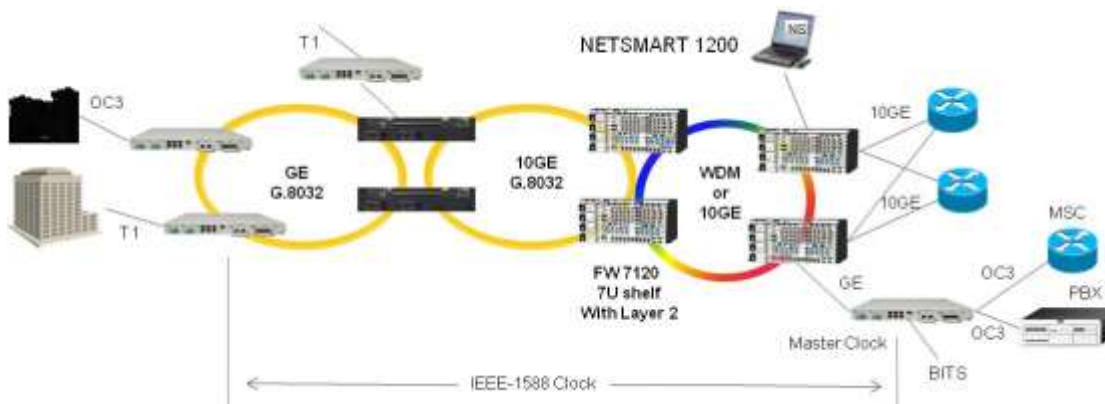
large numbers of data customers to be supported in a single system. Integrated traffic management, data aggregation, E-Line and E-LAN technologies provide robust, carrier-grade data services with guaranteed SLAs.



Some businesses require relatively small flows (10M to 100MBps) which can use a Switched Ethernet access network for economic transport. On the other hand, other businesses require the entire 1GE and need it completely intact including the framing bits (transparent). Both of these customers can make use of the FLASHWAVE 5310 for further aggregation before handing off higher end interfaces.

**T1 and OC3 Circuit Emulated Service Delivery**

The FLASHWAVE® 5310 system is capable of delivering T1 and OC3 TDM business services for applications such as PBX systems or backhaul of TDM radios over and Ethernet infrastructure. The 8xT1 module or 2xOC3 module allow a FLASHWAVE® 5310 to forward Ethernet as well as T1 or OC3 from the same device. Aggregation of T1s from multiple locations into a single OC3 is supported.



**WSCA-NASPO Data Communications Services Solicitation # JP14001****Ordering Information****Part Numbers**

The part numbers for the FLASHWAVE 5320 are as follows:

Part Number	Description
FC9696EM21	FW5310 Base System
FC9696EFN1	FW5310 Fan Unit
FC9696EP11	FW5310 -48/+24 VDC Power Supply
FC9696EP21	FW5310 120/240 VAC Power Supply
FC9696E4G1	FW5310 4xGE Service module
FC9696E8T1	FW5310 8xE1/T1 Service module
FC9696EC31	FW5310 Channeleized OC3 Service module

**Support****Network Operations**

Network Operations are a large part of the expense of a network. The design, implementation, and maintenance of a network all play a part in this operational expense. NETSMART 1200 is an excellent tool as it streamlines the process of deploying and maintaining an Ethernet network. The FLASHWAVE® 5310 is fully supported by NETSMART 1200. Of particular interest is that FLASHWAVE® 1200 provides for a Metro Ethernet Forum (MEF) approach to Operations. It uses MEF terms and concepts for provisioning and allocating resources which greatly simplifies the operational aspect. It determines flows based on the CIR/CBS/EIR/EBS and reduces the complexity and the need to know all of the complex intricacies of the systems. It makes Ethernet provisioning simple and easy. NETSMART 1200 also covers all of the network functions including WDM and Ethernet.

**Network Services**

Fujitsu offers a broad selection of professional services for every stage in a network's evolution and operation. From planning through deployment and ongoing maintenance to future enhancements, Fujitsu Network Services are available whenever needed. Fujitsu sales representatives can guide service providers in selecting options that address individual business needs.

Popular planning and deployment services for the FLASHWAVE® 5310 platform include:

- Custom Cabinet Solutions – Turnkey inside wall-mount and outside-plant solutions, including standard and custom configurations for wireline, wireless, FTTx, cable and MSO customers
- Furnish Material – Identification and ordering of the material needed to install network equipment such as electrical and fiber cable solutions, minor materials and third-party ancillary equipment
- Turn-Up and Test – From on-site configuration and simple turn-up to rigorous, long-term testing

**Maintenance and Support Program**

For a complete professional maintenance solution, the Fujitsu Maintenance and Support Program has the right combination of flexibility and comprehensive assurance. Choose the level and types of service you need to supplement your own resources. The Maintenance and Support Program helps keep your network running smoothly, provides critical care and protects the longevity of your investment.

**WSCA-NASPO Data Communications Services Solicitation # JP14001****Managed Network Solutions**

With a full range of vendor-independent network fault and performance monitoring features, the Fujitsu Managed Network Solutions offer guaranteed, round-the-clock system protection. Our reliable NOC facility is available as a primary or supplemental operations resource. This service not only helps you control costs and maintain high levels of customer satisfaction, it also provides trustworthy and reliable after-hours and emergency monitoring.

**Technical Specifications****Base System Hardware**

Hot Swappable Power Supply	
Modularity	Hot Swappable Fan Unit
	2 Service Module Slots
Size 1RU	1.7”h x 17.1”w x 10”d
	44h x 435w x 255d (mm)
Ethernet Ports	4x FE/GE SFP Ports
	ITU-T G.8262
	ITU-T G.781 Option 1 SSM QL
	SyncE In/Out
System Clock	Stratum 3 ANSI T1.101
	G.813
	BITS In/Out, SMB Connector
	1PPS share with BITS IN
	Time of Day Out via Serial Port
	1588v2 traceable to PTP SyncE, Line Timing, BITS In, ACR and
Clock Sources	1588v2 Best Master Clock

**Ethernet Switching**

Switching Fabric	32 Gbps
Packets per Second	18 Mbps
MAC Address Table	32 K Table Entries
	Enable/Disable Learning per Port
Jumbo Frames	9600 Bytes
VLAN Tagging 802.1Q	4094 C-VLANs
Provider Bridging 802.1ad	4094 S-VLANs
	CVLAN Translation
Tagging Double Tagging	
	Tagging, De-tagging, Swapping
	Virtual Untagged

**Traffic QoS**

Priority Queues	8 queues per port
Traffic Classification	802.1P, Port, VLAN, ToS, DSCP
	CIR/CBS and PIR/PBS
	2-rate 3-color (2R3C)
Bandwidth Meters	Bandwidth Profiles
	Ingress and Egress Filters
	Per Service in 1Mbps Increments

**Ethernet OAM**

	802.1ag CFM, Y.1731
Fault Management	802.3ah EFM Dying Gasp
	Loopback and Link trace
	Ethernet Fault Propagation Shutdown
Loopbacks	Station Loopback
	Loopback based on L2 and L3 Filter
	MAC address swap for RFC 2544
Topology Discovery	LLDP

**WSCA-NASPO Data Communications Services Solicitation # JP14001****Ethernet Services**

E-LINE and E-LAN
MEF 2.0 Certified
MEF Abstraction Layer

**Network Protection**

<50ms Protection Switching
Ethernet Ring 3.3ms CCMs in hardware
Protection Switching Non Revertive / Revertive
ITU-T G.8032v2
Multiple Instances / Laddered Rings
Link Aggregation 1:1 LAG with LACP (802.3ad)

**Security**

Access Control List
Port Mirroring
Storm Control

**Management**

SNMPv2C and MIB-II
Private and Public MIBs
FTP, SFTP, Telnet and SSH
In Band and Out of Band
RADIUS

**Performance Monitoring**

Bin Frequency 24hr, 15min and 5min bins for PMs
Y.1731 Frame Delay
Ethernet SLA PMs Y.1731 Delay Variation
Y.1731 Loss Ratio
Throughput Measurement
Rx, Tx and Error Statistics
Ethernet Port PMs Input and Output Rate per Port
Input and Output Utilization per Port
PMs: ES, SES and UAS
TDM Alarms: AIS, RAI, LOS and LOF
Terminal & Remote Loopback

**Circuit Emulation**

Internal System Clock
Adaptive Clock Recovery
T1/E1 & OC-3/STM-1 Up to 8 ACR clock domains
Module 2ms to 32ms PDV Buffers
SAToP and CESoPSN (T1/E1 Only)
MPLS, MPLS-Dry Martini,
MEF8 and IPv4+UDP

**Service Modules**

8 Port RJ-48C
T1/E1 Module ITU-T G.8261, G.823, G.824
E1 Balanced 120 $\Omega$ , T1 Balanced 100 $\Omega$
2x SFP Connector
OC-3/STM-1 Module Active Standby
T1/E1 Channelized - 84xDS1 / 63xE1
Ethernet Module 4x FE/GE SFP
SyncE Out

**WSCA-NASPO Data Communications Services Solicitation # JP14001**

**Operation**

Operating Temperature	-40°C to +65°C
Short Term Temperature	-45°C to +85°C
Humidity	Up to 90% non-condensing
Redundant Power Supply	
Power Supply	DC: +24 VDC (+19 to +30 VDC)
	DC: -48 VDC (-40 to -62 VDC)
	AC: 120v
Nominal/Maximum Power	30W / 50 W
Fan Unit	Hot Swappable Fan Unit
	3 Fans Alarm Monitored

**Regulatory**

CSA/UL & CE Mark
NEBS Level 1 & NEBS Level 3
ROHS 5/6

**FLASHWAVE® 5320 Metro Ethernet Aggregator**



**Service Delivery for Ethernet Business Services**

- 24x 100/1000 Mbps SFP and 2x 10GE XFP Network interfaces
- \*2x 10GE XFP Module (Plan of Intent for 2014)
- 802.1ag CFM & Y.1731 SLA measurements (Embedded NID)
- Station loopbacks and Throughput testing via traffic FPGA

**Carrier Grade Ethernet**

- 3.3ms CCM for sub 50ms protection
- G.8032v2 Laddered Rings and Multiple Instances
- Active / Standby LAG and Ethernet Fault Propagation Shutdown
- -48VDC/+24VDC/AC Power Options
- All front access; -20 to 65C; Hot Swappable Fans, Filters and Power Supplies

**End to End Management**

- SNMP for alarms/traps and provisioning via secure out-of-band or in-band
- Service management with NS1200 Service Management and SLA Portal
- A-Z E-service provisioning and SLA/PM stats collection

WSCA-NASPO Data Communications Services Solicitation # JP14001

# FLASHWAVE 5320

## Ethernet Aggregation Device Benefits



- Flexible Deployment Options -> 24x GigE + 2x 10GigE Ethernet Ports; Optional 2x 10GigE Module; AC & DC Power
- Robust hardware design-> All front access; -20 to 65C; Hot Swappable Fans, Filters and Power Supplies
- Dedicated hardware for Y.1731 -> High precision SLA measurement and advanced loopbacks; Eliminate the standalone NID
- Hardware based G.8032v2 -> Enabling a highly available network infrastructure and service protection
- Ethernet OAM for Service Management -> Y.1731 FM, 802.1ag; EFPSP; LLDP
- MEF Carrier Ethernet 2.0 support -> standards-based for EPL, ELAN and multi-vendor interoperation
- Hardware ready for IPv6, PBB or MPLS-TP and future 10GigE module -> investment protection and future-proof



Part Number	Description
FC9696JM21	FW 5320 Base System
FC9696JP12	FW 5320 DC Power Unit Dual Feed
FC9696JP11	FW 5320 AC Power Unit
FC9696JFN1	FW 5320 Fan Module
FC9696JFF1	FW 5320 Air Filter
FC9696J2A1	FW 5320 2x 10 GigE XFP Module

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The FLASHWAVE® 5320 provides intelligent service demarcation, and aggregation for Ethernet Business Services and Cloud Service, such as, hosted voice, video conferencing, backup/recover and hosted application services. The FLASHWAVE® 5320 delivers Carrier Ethernet connectivity through the access network directly to customer premises, allowing service providers to cost-effectively extend Ethernet, IP and Intelligent Cloud services to business parks, multi-tenant buildings, cell towers, and Wi-Fi hotspots. With 24 SFP ports and 2 XFP ports the FLASHWAVE® 5320 provides Ethernet service scalability from 1Mbps to 10Gbps. Based upon a fixed form factor design the FLASHWAVE® 5320 can be deployed in remote locations from wiring closet to road side cabinets enabling services to be delivery anywhere where fiber optics have been deployed.

### Value Proposition

#### Standards-Based Carrier Ethernet Delivery

Designed to support MEF CE 2.0 standards, the FLASHWAVE® 5320 delivers Ethernet Private Line, Ethernet Virtual Private Line and Ethernet LAN based connectivity for high capacity business and mobile backhaul 4G services. With hardware based 3.3ms CCMs and G.8032v2 ERPS the FLASHWAVE® 5320 delivers sub-50ms protection switching capabilities. The FLASHWAVE® 5320 leverages standardized User-Network-Interface (UNI), Network-to- Network (NNI) as well as service and traffic management features, which allow service definition on a per-port, priority, or VLAN basis. Differentiated service levels can be future defined using prioritization, policing, shaping, and flow control mechanisms.

#### Service Level Provisioning, Monitoring and Management

Graphical user interfaces based upon SNMP supported by in band or out of band interface options and NETSMART 1200, a full featured network management system, are available to provide users a full solutions management view from the individual node to an end-to-end network and service centric view. With dedicated hardware for traffic performance monitoring, the FLASHWAVE® 5320delivers on today's requirement for hardware based Y.1731 latency, jitter and frame loss ratio

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measurements. Hardware based MAC address swapping on the FLASHWAVE® 5320 enables the device to support station loopbacks to allow centralized test sets to complete service turn-up and performance verification. Tiered Ethernet services as well as wireless backhaul service level performance may also be monitored through the web-based SLA portal.

**FEATURES AND BENEFITS**

- Carrier grade platform, for deployment in CPE and aggregation environments;
- 24x SFP and 2x XFP ports with Carrier Ethernet service scalability from 1Mbps to 10Gbps;
- Additional 2xXFP access module will be available in the future for a total of 24GE+4x10GE;
- Low latency, and highly reliable service delivery with G.8032 sub 50ms ring protection;
- High precision SLAs and Service performance monitoring and reporting via Y.1731;
- Ethernet Fault Propagation Shutdown (EFPSD) monitoring and reacting to faults in the cloud;
- Integrated SLA hardware eliminating the need for a standalone NID;
- Standards-based Carrier Ethernet and aligned with MEF CE 2.0.
- Deep fault and performance management with Y.1731, loopback, link trace, delay, jitter and loss measurement with customer SLA Portal access.

**Applications**

There are three primary applications that the FLASHWAVE® 5320 was specifically designed for mobile backhaul, enterprise Ethernet service delivery, and Ethernet access infrastructure.

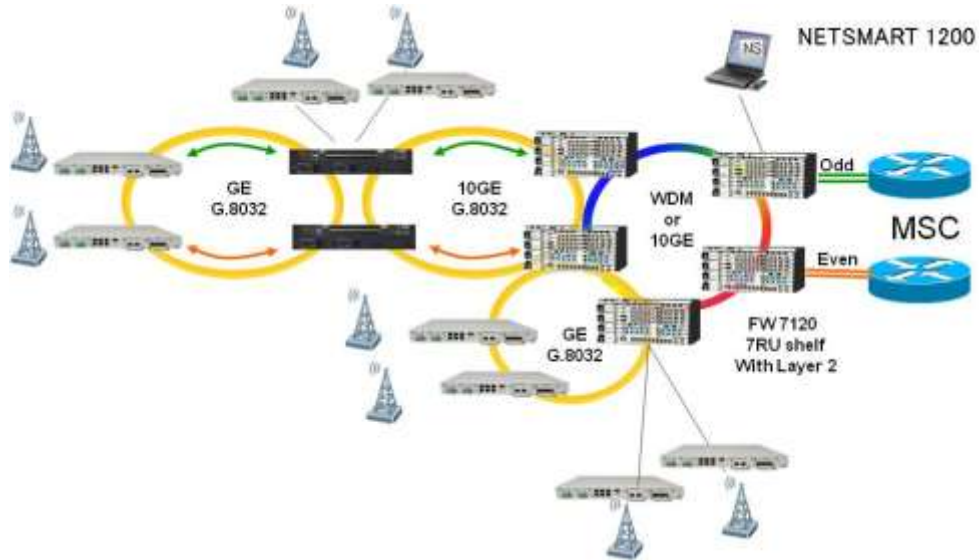
**Mobile Backhaul**

Mobile Backhaul is a perfect application and is optimized for the FLASHWAVE® 5320. The enhanced traffic management makes it possible to attain consistently optimal performance in complex, high traffic networks during peak-traffic times. It also offers guaranteed minimal bandwidth support, while dynamically allocating individual EVCs to peak rates. Optional sub-50 ms network resiliency, using G.8032, offers selective service protection. The FLASHWAVE® 5320 is the high-performance cell tower aggregation platform solution for “five nines” carrier-class backhauling of 4G LTE services.

Mobile backhaul is experiencing an explosion in traffic bandwidth demand. Wireless operators are moving from leased lines to dark fiber as part of their solution and must leverage wavelengths to secure their investment for future expansion at minimal additional cost. The solution to their backhaul needs includes the FW5320 as shown in the diagram below delivering redundancy at all critical points:

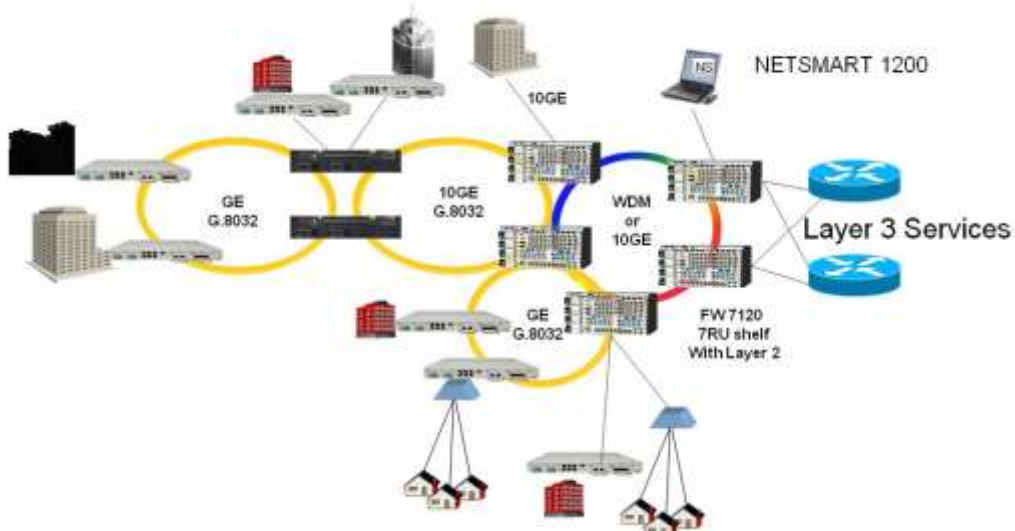
- Even (green)/Odd(orange) traffic replication
- Ring based service aggregation with redundant E-Line EVC's per cell site
- Throughput turn-up testing
- Y.1731 performance monitoring
- End-to-end service protection

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**Enterprise Service Delivery**

The FLASHWAVE® 5320 system is the ideal aggregation solution for delivering Ethernet business services. High-density Ethernet service interfaces allow large numbers of data customers to be supported in a single system. Integrated traffic management, data aggregation, E-Line and E-LAN technologies provide robust, carrier-grade data services with guaranteed SLAs.



Some businesses require relatively small flows (10M to 100MBps) which can use a Switched Ethernet access network for economic transport. On the other hand, other businesses require the entire 1GE and need it completely intact including the framing bits (transparent). Both of these customers can make use of the FLASHWAVE 5320 for further aggregation before handing off higher end interfaces.

**WSCA-NASPO Data Communications Services Solicitation # JP14001****Ordering Information****Part Numbers**

The part numbers for the FLASHWAVE 5320 are:

Part Number	Description
FC9696JM21	FW5320 Base System
FC9696JP12	FW5320 DC Power Unit Dual Feed
FC9696JP11	FW5320 AC Power Unit
FC9696JFN1	FW5320 Fan Module
FC9696JFF1	FW5320 Air Filter
FC9696J2A1	FW5320 2x 10 GigE XFP Module

**Support****Network Operations**

Network Operations are a large part of the expense of a network. The design, implementation, and maintenance of a network all play a part in this operational expense. NETSMART 1200 is an excellent tool as it streamlines the process of deploying and maintaining an Ethernet network. The FLASHWAVE® 5320 is fully supported by NETSMART 1200. Of particular interest is that FLASHWAVE® 1200 provides for a Metro Ethernet Forum (MEF) approach to Operations. It uses MEF terms and concepts for provisioning and allocating resources which greatly simplifies the operational aspect. It determines flows based on the CIR/CBS/EIR/EBS and reduces the complexity and the need to know all of the complex intricacies of the systems. It makes Ethernet provisioning simple and easy. NETSMART 1200 also covers all of the network functions including WDM and Ethernet.

**Network Services**

Fujitsu offers a broad selection of professional services for every stage in a network's evolution and operation. From planning through deployment and ongoing maintenance to future enhancements, Fujitsu Network Services are available whenever needed. Fujitsu sales representatives can guide service providers in selecting options that address individual business needs.

Popular planning and deployment services for the FLASHWAVE® 5320 platform include:

- Custom Cabinet Solutions – Turnkey inside wall-mount and outside-plant solutions, including standard and custom configurations for wireline, wireless, FTTx, cable and MSO customers
- Furnish Material – Identification and ordering of the material needed to install network equipment such as electrical and fiber cable solutions, minor materials and third-party ancillary equipment
- Turn-Up and Test – From on-site configuration and simple turn-up to rigorous, long-term testing

**Maintenance and Support Program**

For a complete professional maintenance solution, the Fujitsu Maintenance and Support Program has the right combination of flexibility and comprehensive assurance. Choose the level and types of service you need to supplement your own resources. The Maintenance and Support Program helps keep your network running smoothly, provides critical care and protects the longevity of your investment.

**Managed Network Solutions**

With a full range of vendor-independent network fault and performance monitoring features, the Fujitsu Managed Network Solutions offer guaranteed, round-the-clock

**WSCA-NASPO Data Communications Services Solicitation # JP14001**

system protection. Our reliable NOC facility is available as a primary or supplemental operations resource. This service not only helps you control costs and maintain high levels of customer satisfaction, it also provides trustworthy and reliable after-hours and emergency monitoring.

**Technical Specifications Base System Hardware**

Hot Swappable AC and DC  
 Modularity Hot Swappable Fan Unit  
 Hot Swappable Air Filter  
 Size 2RU 88h x 440w x 260d (mm)  
 Ethernet Ports 24x FE/GE SFP Ports  
 2x 10GE XFP Ports  
 Console Ports RJ-45 Serial Port  
 Local Craft Access  
 Out of Band Management 10/100Mbps Ethernet RJ-45

**Ethernet Switching**

Switching Fabric 64 Gbps  
 Packets per Second 96 Mbps  
 MAC Address Table 32 K Table Entries  
 Enable/Disable Learning per Port  
 Jumbo Frames 9600 Bytes  
 VLAN Tagging 802.1Q 4094 C-VLANs  
 Provider Bridging 802.1ad 4094 S-VLANs  
 CVLAN Translation  
 Tagging Double Tagging  
 Tagging, De-tagging, Swapping  
 Virtual Untagged

**Traffic QoS**

Priority Queues 8 queues per port  
 Traffic Classification 802.1P, Port, VLAN, ToS, DSCP  
 CIR/CBS and PIR/PBS  
 2-rate 3-color (2R3C)  
 Bandwidth Meters Bandwidth Profiles  
 Ingress and Egress Filters  
 Per Service in 1Mbps Increments up to 1Gbps

**Ethernet OAM**

Fault Management Y.1731 CCMs  
 Loopback and Link trace  
 Station Loopback  
 Loopbacks Loopback based on L2 Filter  
 MAC address swap for RFC 2544  
 Topology Discovery LLDP

**Network Protection**

<50ms Protection Switching  
 Ethernet Ring 3.3ms CCMs in hardware  
 Protection Switching Non Revertive / Revertive  
 ITU-T G.8032v2  
 Multiple Instances / Laddered Rings  
 Link Aggregation LAG with LACP (802.3ad)

**Ethernet Services**

E-LINE and E-LAN  
 MEF Abstraction Layer

**Security**

Access Control List

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Port Mirroring  
Storm Control

**Management**

SNMPv2C and MIB-II  
Private and Public MIBs  
FTP, Telnet and SSH  
In Band and Out of Band  
RADIUS  
Local Sys Log

**Performance Monitoring**

24hr, 15min and 5min bins for PMs  
Y.1731 Frame Delay  
Ethernet SLA PMs Y.1731 Delay Variation  
Y.1731 Loss Ratio  
Throughput Measurement  
Rx, Tx and Error Statistics  
Ethernet Port PMs Input and Output Rate per Port  
Input and Output Utilization per Port

**Operation**

Operating Temperature -20°C to +65°C  
Short Term Temperature -25°C to +75°C  
Humidity Up to 90% non-condensing  
Power Supply DC: -48 VDC (-36 to -72 VDC)  
AC: Redundant Power Supply  
Power Redundancy DC supporting A and B feed per  
Power Supply  
Nominal Power 75W  
Maximum Power 100W  
Fan Unit Hot Swappable Fan Unit  
3 Fans Alarm Monitored


**Regulatory**

CSA/UL  
CE Mark  
ROHS 5/6


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FLASHWAVE 7120 7U Shelf for Metro E Solutions

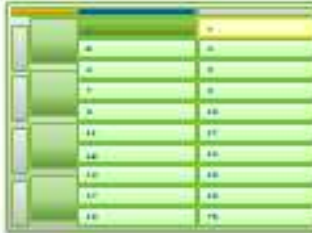
# FLASHWAVE 7120 7U Shelf



**20 service slots | 7RU**




FLASHWAVE 7120  
7U Shelf







**MSI (Main Shelf Interface)**  
Communication and alarm indicators  
Management LAN port (RJ45)  
Office alarm connector (26-pin D-Sub)  
Alarm and shelf status LEDs plus ADD/lamp test



**CCM (Common Communication Module)**  
Module communications and monitoring (7200 platform)  
Two auxiliary Ethernet ports (RJ45) – for future use  
Expansion shelf communications (SFP) port



**System Control Processor (SCP)**  
Shelf management and configuration module  
External communication via three RJ45 connectors: two IP addressable Ethernet ports and one RS-232 serial port  
Two SFP-based OSC communication ports  
Three SFP-based ports for expansion shelf communications



**Cooling Unit (CU)**  
Two independent, multispeed fans  
Supports outside plant operations

- All FLASHWAVE 7120 Modules
  - Amplifiers, CWDM Mux Options and DWDM Mux Options
  - Transponders and Muxponders
  - 12/2, 24/4 & 8x10 Layer 2 Cards

**INTERNAL USE ONLY**

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# FLASHWAVE 7120

## Layer 2 Ethernet Switch

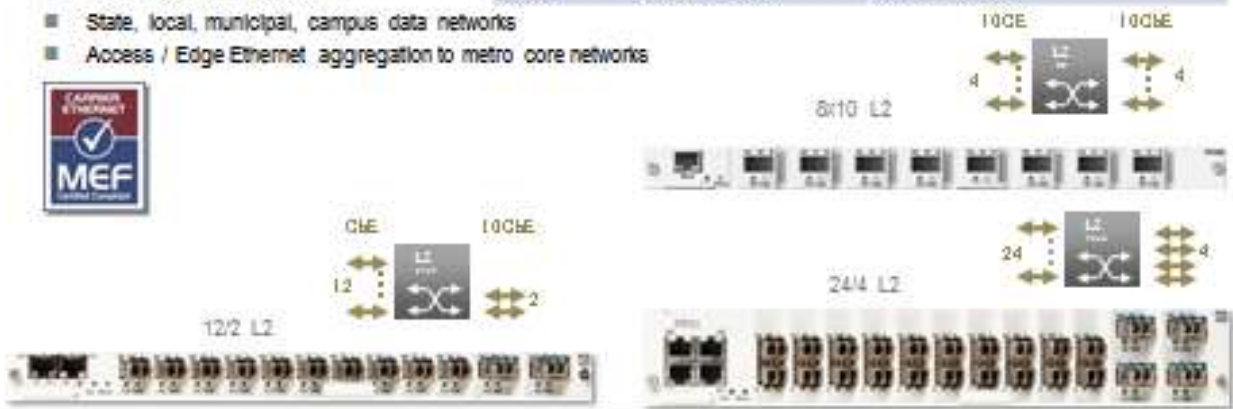


- Ideal solution for metro Ethernet aggregation and service delivery
- Supporting EPL, EVPL, EVLAN, EVPLAN services
- G.8032 and MSTP protection options for fully protected or unprotected services on a per EVC basis
- Optional CWDM / DWDM capabilities of the FLASHWAVE 7120 provide scalability for future network growth

■ Key Applications

- Enterprise Ethernet services
- Mobile backhaul for 4G LTE
- State, local, municipal, campus data networks
- Access / Edge Ethernet aggregation to metro core networks

L2 Modules	Part #	Description
12/2 L2	FC9686PSAA	(12) GE ports & (2) 10 GE ports
24/4 L2	FC9686PSCA	(24) GE ports & (4) 10 GE ports
8x10 L2	FC9686PSSA	(8) 10 GE ports



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## WSCA-NASPO Data Communications Services Solicitation # JP14001

# FLASHWAVE 7120

## Layer 2 Ethernet Switch Features



### ■ Features

- Ethernet Aggregation & Switching
- VLANs and Provider Bridging – 802.1Q & 802.1ad
- ITU-T G.8032
- Link Aggregation – 802.3ad
- Multiple Spanning Tree – 802.1s
- OTU2 with FEC and EFEC
- Access Control Lists
- Traffic classification – 802.1p
- Optical and Ethernet PMs
- CLI/SSH, SNMP, TL1 out-thru and GCC
- Ethernet Business Services
- Bandwidth Management (CIR/EIR/CBS/EBS)
- Ethernet First Mile – 802.3ah
- Connectivity Fault Management – 802.1ag
- Performance Management – Y.1731
- Local Management Interface – MEF 16 E-LMI
- Supports a maximum of 32,000 MAC addresses

### ■ MEF Carrier Ethernet Attributes

- Standardized services
  - EPL, EVPL services
  - ELAN, EVLAN multi-point to multi-point services
  - MEF9 / 14 certified
- Reliability / protection
  - Ring based protection today with MSTP or G.8032
  - Leverages OTN overhead for hard & soft failure detection & reporting
  - Sub-50 ms
- Quality of service (QoS)
  - End-to-end SLAs supported with Y.1731
  - Frame loss, delay, delay variation
- Service management
  - Carrier class OAM&P with Y.1731
  - Provisioning with a simple 3 step provisioning GUI

*Simplified Packet Services Delivery*

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# FLASHWAVE 7120

## Layer 2 Ethernet Switch Feature Comparison



NEW


	PVX 12/2	PVX 24/4	PVX 80
Dimensions	1H x 2W	2H x 2W	1H x 2W
10GE/OTU2 (XFP)	2	4	8
GE (SFP)	10	20	—
10/100/1000BT (RJ45)	2	4	—
Backplane Capacity	—	—	80G
Switching Capacity	32G	64G	160G
Chassis Support	2U, 7U Shelf	2U, 7U Shelf	2U, 7U Shelf
Provider Bridging (PB)	Yes	Yes	Yes
MSTP	Yes	Yes	Yes
G.8032 v2	Yes	Yes	Yes
Y.1731 CFM	Yes	Yes	Yes
Y.1731 PM	Yes	Yes	Yes
Stacking	Yes (via XFPs only)	Yes (via XFPs only)	Yes (via backplane only)
Management VLAN	Yes	Yes	Yes
GCC/OTU2	Yes	Yes	Yes (future)

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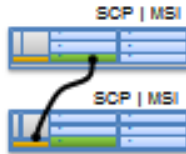
# FLASHWAVE 7120 Shelf Expansion Options



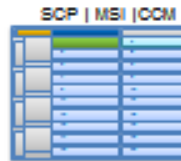
2U Shelf



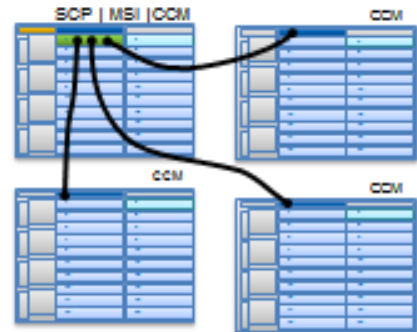
Dual 2U Shelf



7U Shelf



Quad 7U shelf



### Compact

- Up to:
- Single 24/4
  - Pair 12/2 Stacked

### Small

- Up to:
- Pair 24/4 Stacked
  - 2 Pair 12/2 Stacked

### Medium

- Up to:
- 2 Pair 24/4 Stacked
  - 4 Pair 12/2 Stacked
  - 4 pair 8x10 Stacked

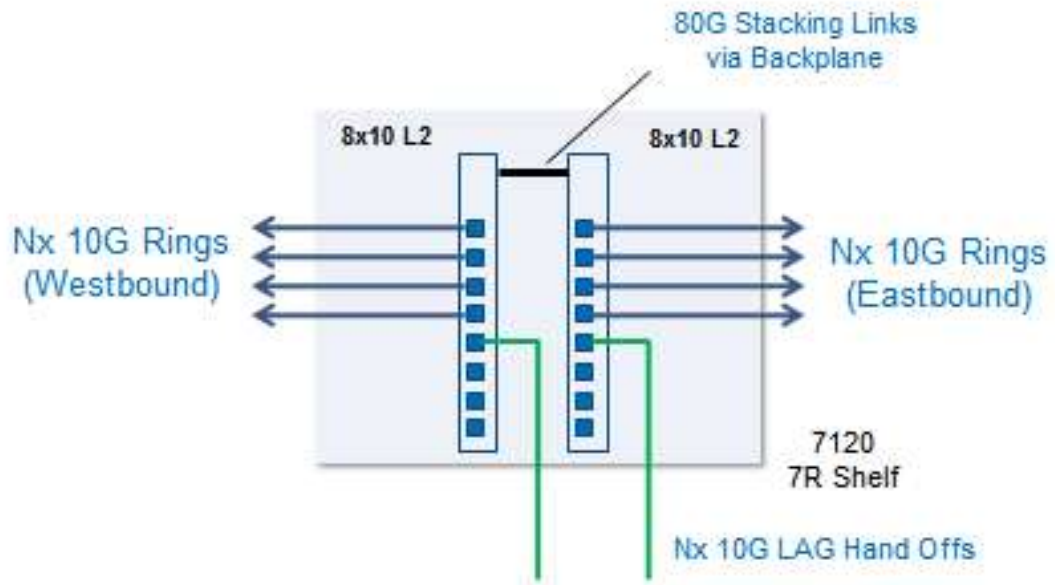
### Large

- Up to:
- 8 Pair 24/4 Stacked
  - 16 Pair 12/2 Stacked
  - 16 pair 8x10 Stacked

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# FLASHWAVE 7120

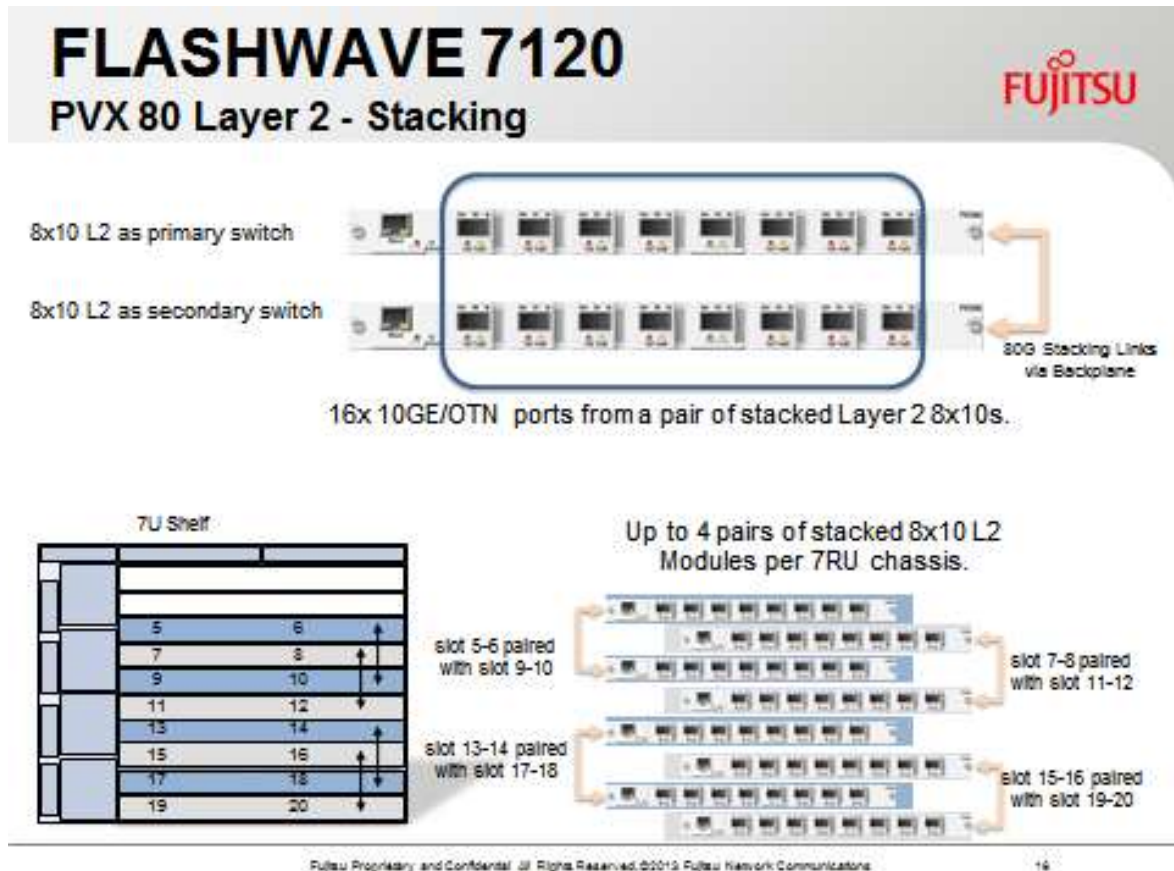
## PVX 80 Layer 2 – Basic Configuration



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## WSCA-NASPO Data Communications Services Solicitation # JP14001



**5.2.4.3 Optical Network Management** Provides capabilities to manage the optical network and allows operators to execute end-to-end circuit creation.

#### **FNC Response:**

The NETSMART 1500 Network Management System provides the required capabilities to manage the optical network and allows operators to execute end-to-end circuit creation.

#### **NETSMART 1500 EMS Overview**

##### Integrated Management Solution Simplifies Network Complexities

The NETSMART® 1500 software simplifies the management, provisioning and surveillance of Fujitsu Network Elements (NEs). The NETSMART 1500 software provides a full suite of network and element management features, enabling you to quickly turn up Ethernet, Wavelength Division Multiplexing (WDM), SDH and SONET services. As new services are added to the network, your NETSMART 1500 software is able to accommodate the largest networks and scales to support hundreds of users and thousands of NEs – securing your existing investment.

The NETSMART 1500 device seamlessly integrates into the customer's existing and future Operations Support System (OSS) network architecture to:

- Support up to 8,000 NEs per system
- Support up to 200 concurrent client sessions
- Simplify provisioning via a feature-rich Graphical User Interface (GUI)
- Discover NEs and network topology automatically
- Customize network architectures with topology maps
- Logically partition networks for user groups
- Protect network integrity by restricting user roles
- Manage upgrades of NE software remotely

**WSCA-NASPO Data Communications Services Solicitation # JP14001**

- Perform disaster recovery of NE software and databases
- Integrate with a wide array of OSSs via northbound interfaces including TL1, SNMP uplink, TMF-814 CORBA interface, and future support for MTOSI in NETSMART 1500 V6
- Maintain surveillance with a high-availability server configuration
- Support two independent UNIX based EMS servers in a high-availability configuration in geographically diversified locations for disaster recovery. Both EMS servers shall operate in an "active" mode and shall not require data replication mechanisms to synchronize NE related information within the EMS servers.

Real-Time Fault and Performance Management

The NETSMART 1500 software keeps you up-to-date on network conditions through real-time fault management. The software continually monitors your network, displaying alarms and conditions as they occur, while the remote notification package warns you of events during off hours. The Alarm to Affected Circuit report identifies which circuits are affected by a particular alarm for quick response to customers. Real-time, performance management tools easily isolate faults on data circuits. With the scheduled Performance Monitoring (PM) export function, you can collect and transfer PM data to OSSs for performance trend analysis and reporting. Performance management helps you detect – and take action to correct – network problems before any service deterioration can affect customers.

Rapid Time-to-Service

Featuring carrier-class reliability, NETSMART 1500 device delivers full control over your network through simplified point-and-click provisioning from a centralized location. Powerful configuration and cross-connect management features enable remote turn up of NEs and customer circuits, reducing costly field operations.

The NETSMART 1500 automated connection management tool minimizes the design and circuit activation time within even the most complex networks. Connection management automatically finds the route, or you can take a more active role in circuit design with powerful include/exclude routing and time slot assignment options. Connection management allows you to provision services such as Gigabit Ethernet, DVB-ASI, and 10/100Base-T Ethernet using high-and low-order Virtual Concatenation (VCAT) as easily as you might provision a DS1 or DS3.

Reduced Operational Costs

The NETSMART 1500 device can perform remote NE software upgrades without service interruption—eliminating the need to dispatch technicians and reducing other operational costs. You can also complete a Remote Memory Backup (RMBU) to capture and preserve vital NE database information. Once the databases have been collected, the NETSMART 1500 software automatically transfers the files to external systems. If an act of nature damages or destroys the NE, a Remote Memory Restoration (RMR) can build the NE provisioning database in seconds.

The Task Management feature saves time by efficiently using maintenance windows. One-time or repetitive tasks such as RMBU, NE audits, NE time synchronization, Software Download (SWDL), TL1 batch files and circuit activation/deactivation can be scheduled and executed automatically.

NE User Management can manage all the user accounts on all your NEs. Simply define the user accounts you want on your NEs and the NETSMART 1500 device can update every NE in the network or audit the network and generate a discrepancy report. Easily implement corporate security policies such as periodic password changes. You decide who has access to your NEs and to what degree they can make changes.

With Product Change Notice (PCN) management, you can quickly identify every piece of equipment that is affected by a PCN to keep your Fujitsu network operating efficiently and effectively. New Web-based services allow you to keep your PCN database current, with alerts when a PCN affects your network.

**WSCA-NASPO Data Communications Services Solicitation # JP14001**Manage the evolution to packet-based services

The NETSMART 1500 system simplifies network management and handles mature technologies such as TDM in combination with emerging technologies such as Connection-Oriented Ethernet (COE). The NETSMART 1500 Management System supports and manages the Fujitsu FLASHWAVE product family and all current and legacy Fujitsu NEs. The system also scales to support hundreds of users and thousands of NEs—securing your existing investment and supporting growth.

NETSMART 1500 software provides a single interface for the Layer 1 transport network (cross-connects, circuits and paths) and the Layer 2 data network (such as tunnels, protection domains and service flows). The ability to view multiple network technologies in a single management application enables operations personnel to view relationships among layers, improve fault isolation, and reduce training time.

Managing complex COE services is dramatically simplified with the end-to-end flow provisioning features of the NETSMART 1500 Management System. Centralized A-to-Z management and end-to-end service provisioning enable consistent application of traffic and bandwidth profiles, a unified database of service inventory, and end-to-end service views and maintenance operations. The NETSMART 1500 software manages switched VLAN services delivered on Fujitsu Packet Optical Networking Platforms (Packet ONPs), avoiding the need for custom in-house software development. The data service management interface provides the tools to provision Ethernet tunnels, protection domains and service OAM.

NETSMART 1500 capabilities include:

- Determine how managed NEs are interconnected through topology discovery
- Manage all SONET, mixed network of NEs, and selected SDH NEs
- Create, delete, and modify DWDM connections
- Generate PM reports automatically and transfer to a remote FTP server
- Notify NOC personnel during off hours with the Remote Notification feature
- Configure the SNMP-integrated uplink interface and manage security
- Provision native Ethernet flows through the DSM Provisioning wizard
- Automatically download new PCNs
- Resolve links between two NEs
- Perform conflict resolution on unresolved links
- Display rings in a circular manner
- Increase priority of resync time for NEs
- Schedule BLSR exerciser activities for BLSR-configured rings
- Upgrade firmware on one or multiple NEs and build list of plug-in-units that can be firmware upgraded

The NETSMART 1500 application operates on a dedicated server/workstation. It uses the TL1 operations support system (OSS) language over an Open Systems Interconnection (OSI) and/or Transmission Control Protocol/Internet Protocol (TCP/IP) stack to communicate with remote NEs. NE management is done over a combination of wide area networks (WANs), LANs, and data communications channels (DCCs).

**New Features in NETSMART 1500 SP 730**

- Topology Management:
  - Panel on Topology view that shows connection information upon selecting a link in the graphical view
  - Capability to insert an NE on a Layer 2 link
- Connection Management:
  - Connection details window showing maximum alarm severity on each link by color

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- Capability to launch associated DWDM connection from lambda link on SONET/SDH Connection details window
- Opening Operations dialog box from Connection details window to configure source and destination ports
- From Connection Management window, opening PM View showing all NEs in a connection
- Data Services:
  - Layer 2 link report for flows, Ethernet tunnels, and protection domains
  - LIF use report for flows, Ethernet tunnels, and protection domains
  - Discovering a protection domain and detaching a protection domain
  - Detaching a flow and an Ethernet tunnel
  - Capability in SOAM view to discover, detach, and audit/reconcile MEGs associated with flows, Ethernet tunnels, and Ethernet links
- NE Maintenance:
  - New Data Services activation task
- External Interfaces:
  - Detailed information related to PM Export task: the data exported, output file format, where exported files are stored, and how long data are retained
  - Management information base (MIB) for the NETSMART 1500 management system to act as an SNMP agent and provide customer systems, acting as SNMP managers, notification of alarms from NEs, a means to discover NEs, a way to detect and rectify a loss of notification from NEs, and a means to perform alarm synchronization of NEs
- Reports:
  - Capability to select and order report columns
- Support Levels
  - The NETSMART 1500 application provides the following levels of support for Fujitsu products and product release levels:
    - Full support— All NETSMART 1500 functions available
    - Forward-compatible support— Support of future releases of supported NEs at the highest level provided by the current NETSMART 1500 release
    - Backward-compatible support— Treats an earlier release of an NE as the most recent major release and processes autonomous messages and command responses as if they were from the more recent version of the NE; denies commands that cannot be carried out by the earlier release but continues to function
- Support Features
  - In addition to the levels of support described the NETSMART 1500 application provides support for Fujitsu products through the additional features:
    - Network partitioning
    - SCID-based DCC management
    - Resilient packet ring (RPR) enhancements
    - Optical power end-to-end monitoring
    - Security enhancements
    - Topology enhancements
    - TMF 814 Element Management Layer-Network Management Layer (EML-

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NML) interface enhancements

- PCN enhancements

**User Levels**

Three levels of NETSMART 1500 users are supported:

- System Administrator— a top-level UNIX operator responsible for loading the software onto the server and for other related tasks. For example, only UNIX System Administrators can install NETSMART 1500 software.
- User Administrator— a top-level operator who has all privileges within the application, including the ability to create other NETSMART 1500 user accounts.
- User— an operator-level user whose rights are defined by a role description, which is classified by the User Administrator. For example, an Alarms User is restricted to using only those commands related to responding to alarms and is not allowed to do cross-connects.

**MySQL Server Specifications for NETSMART 1500 Management System**

NETSMART 1500 Version 7 software will still support Solaris 10 based server environments. This includes the proposed small server configuration part number NS-07-0-0-PRODSL. All optional features are supported on the small, Standard License (MySQL® database) based configuration (PRODSL and NETUSL) except for High Availability and Network Partitioning (NS-08-0-0-NPART). The database is a Windows based solution thus allowing for a much lower cost of implementation.

The table below provides the server requirements based upon the number of network elements depicted in the network design drawing.

**Server Requirements**

NE Count	Operating System	Server Type	CPU Count	Memory	Storage (Minimum)
500 NEs	Solaris	T4-1	1 x 8 Core	16GB	2 x 146GB
2000 NEs	Solaris	T4-1	1 x 8 Core	32GB	4 x 146GB
4000 NEs	Solaris	T4-2	2 x 8 Core	64GB	6 x 146GB
8000NEs	Solaris	M5000	4 x 4 Core	64GB	12 x 146GB

**Hardware Requirements for Upgrades From Version 7 to Version 8**

The table below lists the minimum hardware requirements for customers who are upgrading from Version 7 (or earlier releases) to Version 8. It is important to note that these are minimum requirements for Version 8 and they may not be sufficient to support future features or future major versions.

NE Count	Operating System	CPU Count	Memory	Storage (Minimum)
500 NEs	Solaris	1 x 4 Core	16GB	66GB + Boot Disk
2000 NEs	Solaris	1 x 6 Core	16GB	180GB + Boot Disk
4000 NEs	Solaris	2 x 4 Core	24GB	276GB + Boot Disk
8000NEs	Solaris	4 x 4 Core	32GB	540GB + Boot Disk

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Metro E Management Products

## Metro E Management Products



### ■ MetroE Design

- Network design tool; Java-based.

### ■ NETSMART 712

- Craft Tool; manages a single node; can open multiple sessions; Supports FLASHWAVE 7120 family but not the MetroENID, EAD and aggregation products..

### ■ NETSMART 1200 MetroE NMS

- Element Management System; designed to simplify provisioning, management, and performance monitoring of end-to-end packet-optical services; Supports FLASHWAVE 7120 family and the FLASHWAVE 53xx MetroE NID, EAD and aggregation products.
- Provisioning → accelerate, simplify, and standardize service configuration
- Discovery & Visualization → simplify service understanding
- Monitoring and Troubleshooting → enhanced knowledge = rapid response

### ■ MetroE SLA Portal

- SLA Performance Monitoring via Y.1731; uses Collection Server separate from MetroE EMS.

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# NETSMART 1200 Metro E NMS

## Key Functions that Simplify Service Delivery



### ■ Standardized service definition

- Service templates streamline service definition
- Provides a standardized and consistent approach that eliminates the potential for human error while reducing the time required to provision services



Service Template definition

### ■ Automated activation

- Automated assistance simplifies endpoint and intermediate connection point selection
- Graphically displays available nodes and available ports, with mouse clicks replacing onsite configuration of network elements and alleviating the complexities of CLIs



Service Activation

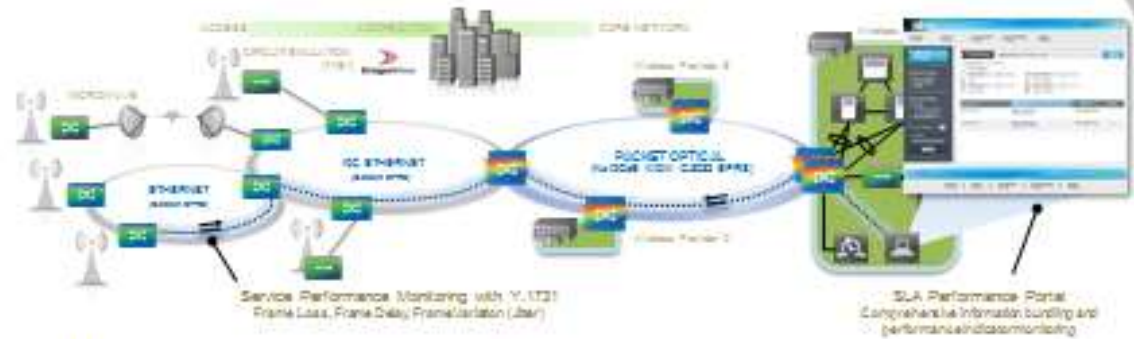
### ■ Rapid information retrieval

- Comprehensive information-bundling capabilities enable network operators to understand the services they deliver, how their customers utilize them, the status and performance of these services, and the resources used to deliver them
- Enable operators to quickly determine which customers are affected and how to respond

Service Reports

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# MetroE SLA Performance Portal Performance Monitoring



## Performance Monitoring

- Providing accurate information for true, end-to-end, holistic visibility on the wellbeing of a packet service
- Y.1731 OAM-based for end-to-end Ethernet services
- Advanced awareness through monitoring of key performance indicators, SLA metrics or user-defined benchmarks
- Graphical interface for operations-staff and customer visibility to real-time performance indicators and history

### ■ Key Service Performance Statistics

- Availability, Uptime, Downtime
- Utilization (Primary/Protect, Average, Egress, Ingress)
- Latency, Packets (Dropped, Forwarded), Frame Errors

### ■ MetroE SLA Portal Values

- Real-time & historical SLA performance and conformance
- Performance statistics displayed based on user-defined profiles
- End-to-end capabilities using standard OAM strategies

Comprehensive monitoring of circuit service levels metrics

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Applications

# Key Application #1 – Ethernet Business Services

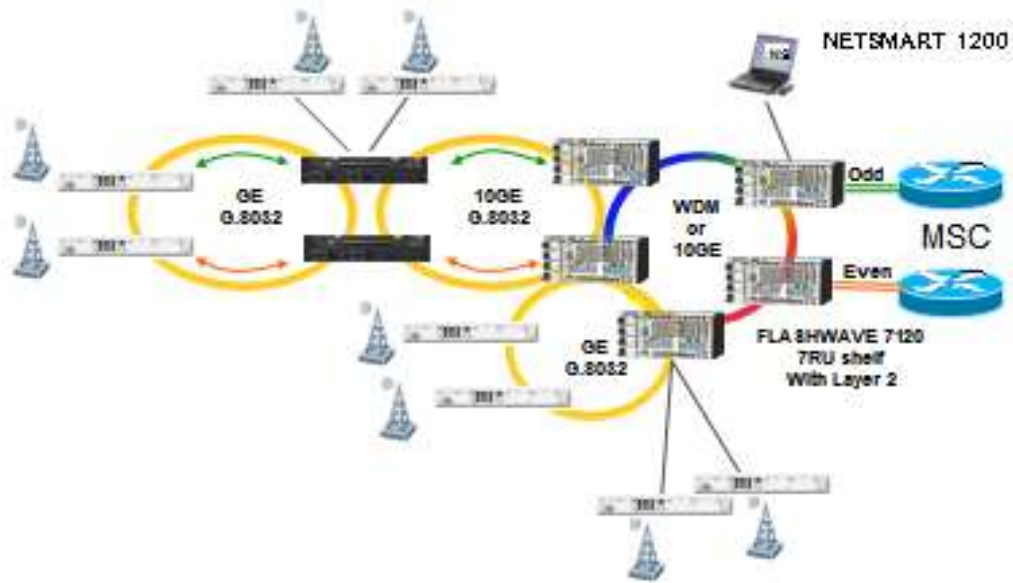
MSOs, some Tier 2, Tier 3 and 4  
E-Line and E-LAN Services

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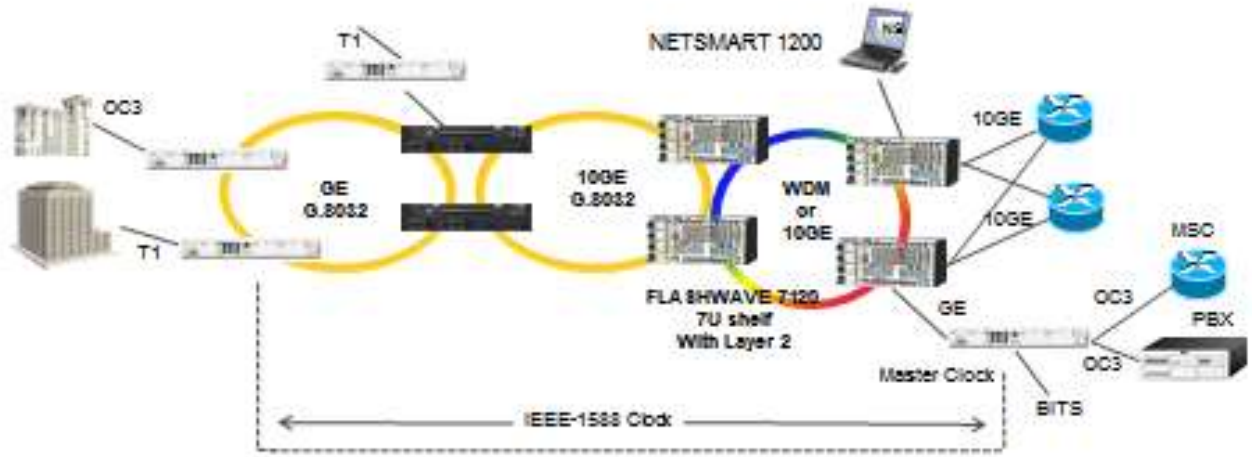
# Key Application #2 – Mobile Backhaul



MSOs, some Tier 2, Tier 3 and 4  
E-Line and E-LAN  
Dual EVC MBH architecture or ELAN architecture

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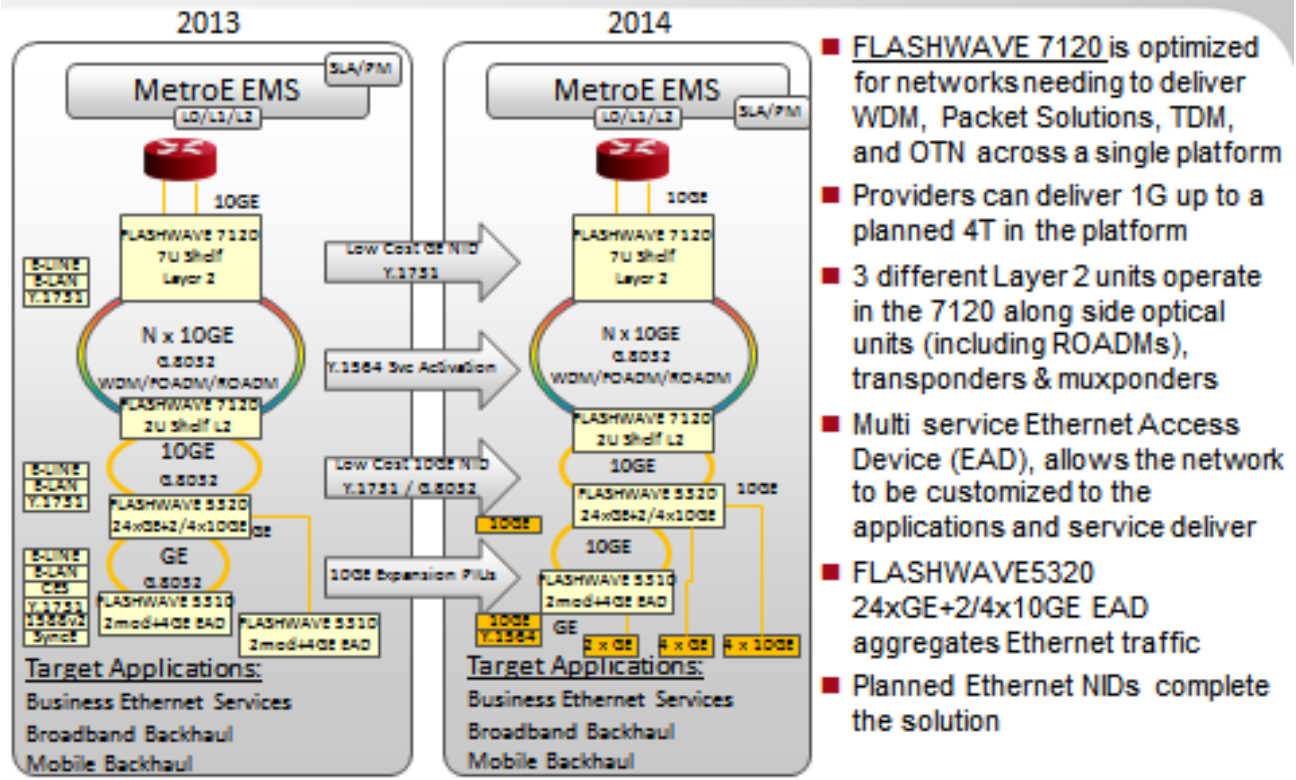
# Key Application #3 – T1 and OC3 Circuit Emulated Services



MSOs, some Tier 2, Tier 3 and 4  
E-Line and E-LAN Services

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# Metro Ethernet Solutions Overview



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## ADDITIONAL NETWORKING TOOLS AVAILABLE

### NETSMART 2000 Engineering/Design Software Tool

#### Comprehensive Network Design

Network planners and engineers require configuration tools to assist the planning and design activities vital to creating a revenue-generating Dense Wavelength Division Multiplexing (DWDM) and FLASHWAVE 9500 Packet Optical network. The java- based NETSMART® 2000 network design and planning tool supports the market-leading FLASHWAVE® 7500 Reconfigurable Optical Add/Drop Multiplexer (ROADM) and Packet Optical product lines. With the NETSMART 2000 network design and planning tool, you can optimize network usage and reliability, plan future expansion, and evaluate the effects of various traffic demands during the design process.

Use the NETSMART 2000 planning tool to configure FLASHWAVE 7500 and FLASHWAVE 9500 systems into a wide variety of comprehensive network topologies. You can save time by fine-tuning the network at early stages. Plus, the NETSMART 2000 software allows you to easily predict and validate system performance under different traffic scenarios and compare design alternatives.

With the NETSMART 2000 network design and planning tool, you get:

- Network designs with following fiber types: SMF 21, SMF 28, SMF 28E, AllWave, TrueWave Classic, TrueWave Plus, TrueWave RS and ELEAF
- Support for various site types (OADM, TERM, HUB, ILA, EXPRESS, FOADM, Bypass or AUTO) and intuitive site icons to easily select and build the designed network topology
- Direct graphical form entry or via Excel file import for entering network design data, with optional additional information such as fiber loss and chromatic dispersion

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- Physical topology views for linear, ring and mesh designs that include placement of amplifiers, Dispersion Compensation Modules (DCMs)
- Bidirectional span information, including the fiber type, fiber loss, span distance, chromatic and polarization mode dispersion details for both directions
- Brownfield design support where an existing network can be “locked” and marked as baseline. The brownfield designation to a design provides the user a controlled environment where new changes are allowed on the network with little or no effect on the baseline network
- Routing criteria that allow you to place constraints on the routing on a per demand basis
- Hardware configurations that allow you to select from a predefined set of shelf and rack configurations
- Optical line card customized part lists for controlling the network’s design equipment selections
- Version controlled price lists where you can select which specific price list (based on multiple imported price lists) to use as the system level price list for all design revisions
- Reach-ability reports displaying distance of all potential light paths with supported line rates before regeneration is required

#### Key Features of NETSMART 2000

- Audit Management\* for faster, lower-cost equipment reconciliation
- Reachability Matrix\* for easy identification of the best wavelength pathways
- Custom Profile\* for increased accuracy of field deployments
- Models and PIDs\* for exporting rack, shelf, and card data into customer-specific format
- TRIB site-additional shelves for the FLASHWAVE® 7500 and 9500 platforms, enabling assignment for larger sites
- Customer-specific support kits provide customized Bills of Material (BoMs) to suit customer needs
- Site location by vertical and horizontal coordinates for increased design flexibility and accuracy
- Single Network Design Method for reducing time and effort when creating a phased design
- Customized Excel and print options speed up importing and printing of network information
- Large network support for networks of more than 1,000 NEs
- FLASHWAVE® 9500 integration with FLASHWAVE® 7500 network topology

The NETSMART 2000 planning tool configures FLASHWAVE 7500 and FLASHWAVE 9500 systems into a wide variety of topologies including linear point-to-point, ring and mesh networks. The results can be viewed via simple graphical windows. Such views include the full channel assignment that shows all the wavelengths used for the traffic demands, the path reach-ability for the traffic demands and the detailed optical power budget and dispersion performance. Additionally, the network topology, the equipment view, the equipment Bill of Material (BOM) for the design and the cabling information are also presented. You can quickly and accurately optimize network usage and reliability, plan future expansion, and evaluate the effects of various traffic demands during the design process with the NETSMART 2000 planning tool, which features:

- Cabling information that maintains a running list of all the inter- and intra-rack cabling information, with suggestions on connection types
- Network design information and demand sheets that includes all network topology and demand information entered on the network design
- Graphical views of nodes, racks and shelves, with card and small form pluggable (SFP) details that realistically depict the platform
- Part change management where the material part list in NETSMART 2000 database is

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being updated to align with latest issues of parts available for the network element

- Excel-formatted reporting features that allow you to output selected report(s) to an Excel file on specific portion of the network design
- Ability to print the optical graphs of a network design
- Zero wavelength design so you can design a new network based on fiber, site and line rate

**Client/Server Features**

- User management tools to easily create new user accounts or change existing accounts
- User group role where multiple users can be a member of the same group and have read and write access to other members' design/design revisions

**Backed by the Optical Networking Leader**

For over 20 years, carriers across North America have trusted Fujitsu with mission-critical networking needs. The NETSMART 2000 network design and planning tool and the FLASHWAVE 7500 ROADM and FLASHWAVE 9500 are key components for a cost-effective network that satisfies current traffic demands and scales to meet future requirements.

**Minimum Hardware Requirements for Client/Server:**

**Server Platform:** Fujitsu SPARC Enterprise T2000; Solaris® 10 Hardware Release 06/06; 2 x 1 GHz or faster CPU; 2 GB minimum RAM; 2 x 72 GB disk drives; CD drive

**Windows® Platform:** Microsoft Windows XP Professional SP2 or Windows 2000 (SP4 or later); 450 MHz Pentium® III or better CPU; 512 MB minimum RAM; 400 MB free disk space; 1024 x 768 or higher resolution monitor; 32-bit or higher color video processor recommended; CD drive; LAN card

**Web Browser:** Microsoft Internet Explorer® Version 5.5 or later; Mozilla® Firefox® 1.5x or later

**Minimum Hardware Requirements for Windows Standalone:**

**Windows® Platform:** Microsoft Windows XP Professional SP2 or Windows 2000 (SP4 or later); 1.8 GHz Pentium IV or better CPU; 1 GB minimum RAM; 6 GB free disk space (40 GB free disk space recommended); 1024 x 768 or higher resolution monitor; 32-bit or higher color video processor recommended; CD/DVD drive

**Web Browser:** Microsoft Internet Explorer Version 5.5 or later; Mozilla Firefox 1.5x or later

**NetOmnia**

NetOmnia is a software tool used for Ethernet service measurement polling, storage, and reporting. NetOmnia connects to the NE's themselves or to NETSMART 1500 and pulls the Ethernet PM's. NetOmnia then stores the data, analyzes it and presents the data in order to manage a carrier's SLAs. NetOmnia also includes a web portal so the end user can see the performance of their circuits. It is multi-vendor so it not only covers the Fujitsu domain but many other vendor domains as well.

**5.2.4.4 IP over DWDM (IPoDWDM)** a device utilized to integrate IP Routers and Switches in the OTN (Optical Transport Network).

**FNC Response:**

Fujitsu believes that integrating the packet and optical layer will limit scalability of the network and overall network solution performance. The Fujitsu vision promotes a scalable WDM architecture that offers best in breed optical networking where transponders offer seamless interworking for client signals, client and network scalable ports, system level upgrades to next generation 4 x 100G Muxponders and optimized transponder/muxponder performance, monitoring and control. Guaranteeing 3rd party alien wavelength performance over a WDM network is difficult, since vendor required optical transmission performance parameters and specifications are vendor proprietary information. There are many optical parameters required to support an alien wavelength. These are the types of parameters Fujitsu qualifies on our own optical

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interfaces, coupled with extensive, lengthy transmission testing over our ROADM networks to validate the information in our DWDM modeling tool. Fujitsu also believes control plane interworking is valuable and an SDN layer is the correct direction to provide a unified IP/WDM solution. Fujitsu's optical control plane supports the OTN and WDM layers. Fujitsu's control strategy for the optical layer is a combination of centralized and distributed control. Most control functions are implemented on a logically centralized controller except for those functions that have stringent performance requirements requiring distributed control.

WDM and OTN circuit information can be provided to the packet layer over a packet-optical control interface. The specifics of this interface are under evaluation. It could be a GMPLS-UNI interface between a packet router and the Fujitsu optical network element, or an East-West SDN controller interface to be defined. It is expected that this interface would support circuit aggregate information from the optical layer to the packet layer (such as cost, SRLG, admin group, protection availability) and could accept requests for bandwidth adjustments driven by the packet layer requirements. Fujitsu does support Alien Wavelengths. As a result, Fujitsu does not provide optical reach guarantees or optical layer network designs with 3rd party Alien Wavelengths.

The FLASHWAVE 9500 is a single, modular platform capable of Packet, OTN, and SONET aggregation and can be combined with CDCG ROADM for optical layer scalability & flexibility.

This multi-haul platform supports metro, regional, & LH network applications. This provides for low startup costs based on keeping the lowest cost per port (high port density), ease of turn-up with no complicated Layer 3 expertise required and simplest solution for backhaul of Ethernet.

The centralized switch fabric on the FLASHWAVE supports TDM, Packet and OTN that scales from 2.4Tb upwards. Interworking between domains uses the EoX pluggable card which allows diversely mapped Ethernet streams like EoS to be migrated to Ethernet flows.

Fujitsu offers different classes of interface cards based on whether switch fabric access is needed or not. If so, these interface cards plug into the slot independent backplane as either Client or Network facing interfaces and connect to the appropriate fabric type OTN, Packet, or TDM. Switching between like OTN, Packet or TDM Cards is done in the switch fabric. For switching between Ethernet over SONET (EOS) and Packet flows is done through a pluggable interworking card. For those interface cards that are standalone Transponder or Muxponder, not requiring switch fabric access, will connect directly to the ROADM cards.

## 5.2.5 ROUTERS

### FNC Response:

FNC does not have a router device in its product portfolio to support the requirements of section 5.2.5

A device that forwards data packets along networks. A router is connected to at least two networks, commonly two LANs or WANs or a LAN and its ISP's network. Routers are located at gateways, the places where two or more networks connect, and are the critical device that keeps data flowing between networks and keep the networks connected to the Internet.

**5.2.5.1 Branch Routers** A multiservice router typically used in branch offices or locations with limited numbers of users and supports flexible configurations/feature. For example: security, VoIP, wan acceleration, etc.

**5.2.5.2 Network Edge Routers** A specialized router residing at the edge or boundary of a network. This router ensures the connectivity of its network with external networks, a wide area network or the Internet. An edge router uses an External Border Gateway Protocol, which is used extensively over the Internet to provide connectivity with

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remote networks.

**5.2.5.3 Core Routers** - High performance, high speed, low latency routers that enable Enterprises to deliver a suite of data, voice, and video services to enable next-generation applications such as IPTV and Video on Demand (VoD), and Software as a Service (SaaS).

**5.2.5.4 Service Aggregation Routers** Provides multiservice adaptation, aggregation and routing for Ethernet and IP/MPLS networks to enable service providers and enterprise edge networks simultaneously host resource-intensive integrated data, voice and video business and consumer services.

**5.2.5.5 Carrier Ethernet Routers** High performance routers that enable service providers to deliver a suite of data, voice, and video services to enable next-generation applications such as IPTV, Video on Demand (VoD), and Software as a Service (SaaS).

**5.2.6 SECURITY****FNC Response:**

FNC does not have a security device in its product portfolio to support the requirements of section 5.2.6

**5.2.6.1 Data Center and Virtualization Security Products and Appliances**

Products designed to protect high-value data and data center resources with threat defense and policy control.

**5.2.6.2 Intrusion Detection/Protection and Firewall Appliances**

Provide comprehensive inline network firewall security from worms, Trojans, spyware, key loggers, and other malware. This includes Next-Generation Firewalls (NGFW), which offer a wire-speed integrated network platform that performs deep inspection of traffic and blocking of attacks. Intrusion Detection/Protection and Firewall Appliances should provide:

- Non-disruptive in-line bump-in-the-wire configuration
- Standard first-generation firewall capabilities, e.g., network-address translation (NAT), stateful protocol inspection (SPI) and virtual private networking (VPN), etc.
- Application awareness, full stack visibility and granular control
- Capability to incorporate information from outside the firewall, e.g., directory-based policy, blacklists, white lists, etc.
- Upgrade path to include future information feeds and security threats
- SSL decryption to enable identifying undesirable encrypted applications (Optional)

**5.2.6.3 Logging Appliances and Analysis Tools** Solutions utilized to collect, classify, analyze, and securely store log messages.

**5.2.6.4 Secure Edge and Branch Integrated Security Products** Network security, VPN, and intrusion prevention for branches and the network edge. Products typically consist of appliances or routers.

**5.2.6.5 Secure Mobility Products** Delivers secure, scalable access to corporate applications across multiple mobile devices.

**5.2.6.6 Encryption Appliances** A network security device that applies crypto services at the network transfer layer - above the data link level, but below the application level.

**5.2.6.7 On-premise and Cloud-based services for Web and/or Email Security** Solutions that provide threat protection, data loss prevention, message level encryption, acceptable use and application control capabilities to secure web and email

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communications.

**5.2.6.8 Secure Access**

Products that provide secure access to the network for any device, including personally owned mobile devices (laptops, tablets, and smart phones). Capabilities should include:

- Management visibility for device access
- Self-service on-boarding
- Centralized policy enforcement
- Differentiated access and services
- Device Management

**5.2.7 STORAGE NETWORKING**

High-speed network of shared storage devices connecting different types of storage devices with data servers

**FNC Response:**

FNC does not currently have a Storage Networking device in its product portfolio. However, the products listed below detail the interoperability and certifications of FNCs equipment with Major SAN equipment vendors.








**Description:**

In the enterprise environment, storage is a critical application creating a demand for multiple optical services to connect dedicated storage servers, virtual tape servers, disk arrays, etc. Two of Fujitsu's platforms that can compete well in this space are the FLASHWAVE 7420 and FLASHWAVE 7120. The platforms can provide Fibre Channel, Ethernet, and now InfiniBand (FW7420 only) services over DWDM to support low latency requirements for enterprise customers. The scope of this application note is not to delve into different architectures of SAN, NAS, DAFS, and disk array applications, but rather to inform the reader on the various certifications the two platforms have.







As in the service provider space, there is a transition towards requiring carrier class Ethernet services between SAN or NAS locations. With the proliferation of iSCSI (internet small computer systems interface), customers are able to improve performance by allowing block-mode SCSI commands to be used over an IP-based Ethernet network. iSCSI enables organizations to manage storage over long distances and improves interoperability and flexibility in a SAN-style environment because it allows a dedicated Fibre Channel (FC) network to be replaced by a generalized IP-based Ethernet network. It should be noted that iSCSI is currently being weighed against with Fiber Channel over Ethernet (FCoE) on delivery protocols options, but that debate is not addressed in this application. From the transport vendor's perspective, we have to be able to provide multiple protocol options to provide what the customer request based upon their specific requirements whether it FICON, ESCON, FiCHAN, or Ethernet wave services while introducing the minimum amount of latency as possible. Many customers already have a substantial investment in their existing storage infrastructure, so fiber channel is still widely used for these types of connections. Both Fibre channel and Ethernet (iSCSI and FCoE) allow transport across distances that traditional SCSI cannot support and that is where customers require DWDM solutions based upon bandwidth requirements and fiber availability. With data recovery requirements looking for remote site storage mirroring, as well as desire to move cloud based applications closer to the client, many customers require interoperability assurance before they purchase the transport equipment solution. It also works in reverse with ILEC type offerings where there is an established vendor for DWDM offerings. The customer wants to choose the right SAN server vendor based upon what that ILEC's vendor

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currently has had interoperability testing and certification with.

Vendor	Equipment Platform	Primary Application	Interface
	BROCADE 300 BROCADE 2000 BROCADE 3000 BROCADE 4100 BROCADE 5xxx BROCADE 75xx BROCADE 12000 BROCADE 24000 BROCADE 48000 DCX Backbone Intrepid Switches Spherion Switches Mi10K Director Ultra Net Storage Director (USD) Channel ink Ultra Net Storage Edge Router FC9000	Storage Directors, Switches	ESCON, FC/FICON (1G, 2G, 4G, 8G, 10G ISLs) GbE, 10GE OC-3, OC- 12, ATM
	MDS 912058 MDS 914058 MDS 9216 MDS 9506137 MDS 9509 MDS 9513	Storage Directors and Switches	FC/FICON (1G, 2G, 4G, 10G ISLs)
	Symmetrix CLARiiON Celerra	Disk Mirror (SRDF, Mirrorview)	ESCON, FC, FICON, GbE (1G, 2G, 4G, 10G ISLs)
	Powervault	Disk (EMC, CLARiiON) Tape	FC, GbE (1G, 2G, 4G and 10G ISLs)
	Eternus GR 740	Disk Mirror (ROPC & REC)	FC (1G, 2G, 4G and 10G ISLs)
	Lightning Tagmastore USP V/VM	Disk Mirror (True Copy)	ESCON, FC, FICON, GbE (1G, 2G, 4G, 8G, 10G ISLs)
	Surestore Storage Works USP (TagmaStore) 100, 600, 1100 Nonstop ServerNet	Disk Mirror Continuous Access XP Continuous Access EVA	FC, GbE (1G, 2G, 4G, 8G, 10G ISLs)

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		Disk Mirroring/True Copy ServerNet Cluster Nomadic disk RDF	
	s/390s Mainframe System z ESS, DS (Disk) Virtual Tape (VTC, VTS) SAN Volume Controller (SVC)	Mainframe Clustering Disk Mirror (PPRC, XRC, Metro & Global Mirror) Tape Vault Virtual Tape Virtual Disk	GDPS (ETR/CLO, ISC, STP, PSIFB SDR/DDR) ESCON, FC/FICON, GbE (1G, 2G, 4G, 8G, 10G ISLs)
	Connectrix Intrepid Directors Spherion Fabric Switches i10K UltraNet Storage Director (USD) Channelink UltraNet Storage Edge Router	Storage Switches & Directors (SAN)  Channel Extension Channel Extension FC /GbE/SDH Gateway	ESCON, FC, FICON (1G, 2G, 4G, 10G ISLs) ESCON, FC, OC-3, OC-12 ATM ESCON, OC-3, OC-12 ATM FC, GbE, OC-3, OC-12
	iStorage	RDC	FC (1G, 2G, 4G, 10G ISLs)
	NetApp File Systems	SnapMirror	FC, GbE (1G, 2G, 4G and 10G ISLs)
	StorEdge - 99XX, 6920, 6320, T-3 StorEdge - L100, 3510 SunFire E-10000, E-459, 6920, 6800, 15000, V1280 SVA Disk Powderhorn Tape Library L-Series Tape Library Timberwolf Tape Library	Disk & Tape  Server interconnection Server Cluster  Disk & Tape Tape Vault Virtual SAN	ESCON, FC/FICON, GbE (1G, 2G, 4G, 10G ISLs)
	SVA Disk Powderhorn Tape Library L-Series Tape Library Timberwolf Tape Library Storage Net Switches	Disk Mirr. (PPRC, XRC) Tape Vault Tape Vault Tape Vault	ESCON, FC, FICON ESCON, FC, FICON FC, GbE






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		Virtual SAN	FC, GbE, FICON FC (1G, 2G, 4G, 10G ISLs)
	Vixel 7100 Vixel 7200	Storage Switches, SAN Storage Switches, SAN	FC FC



The ADVantage program also includes qualifications for Corporate IP Networking, Encryption solutions, and Video networking shown in Exhibit III.

Exhibit III:



The ADVantage Qualification Program (AQP) – for Corporate Networking (IP)

Vendor	Equipment Platform	Primary Application	Interface
	Catalyst 5000, 6000 series	IP Corporate Networking	GbE
	Matrix series	IP Corporate Networking	GbE
	Summit series Black Diamond	IP Corporate Network Backbone IP switching	GbE 10 Gig Ethernet
	TeraScale E-Series (E-300, E-600, E-1200)	Ethernet switches and routers	GbE (1G, 10G)
	T/M-series routers MX-series Ethernet aggregation routers	core networks metro networks	10 GbE, OTU2 10 GbE



The ADVantage Qualification Program (AQP) – for Encryption Solutions

Vendor	Equipment Platform	Primary Application	Interface
	SonetGuard EtherGuard EtherGuard10	SonetGuard Encryption of Ethernet or SONET/SDH signals	OC-192, STM-64 1G and 10G Ethernet
	10G SDH Encryptor	Inflight Encryption of 10G SONET/SDH signals	STM-64, OC-192

The ADVantage Qualification Program (AQP) - for Video Networking

Vendor	Equipment Platform	Primary Application	Interface
	iLYNX SDH/SONET based Optical Backbone	Video transmission over optical networks (DWDM)	SDI, SMPTE-259-C Analog Video PAL/NTSC, Audio BG/QAM DVB, MN/QAM ITU-B/C SPTS or MPTS
	7700 Rack universal Video/Audio	Video transmission over optical networks	SDI, SMPTE-259-C

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	transport platform	(DWDM & CWDM)	
	MD 8000	Video Transport over GbE, 10GbE and STM64/OC192	SDI / HD-SDI
	Nimbra 680 Nimbra 340HD	Video transmission over optical WDM networks	SDI HD- SDI

**Summary:**

With the availability of the FW7120 and FW7420, Fujitsu is well positioned to compete in the enterprise transport environment. The State of Utah and potential customers need to be aware that FNC has the solutions in this vertical for various transport and protocol options that are certified by the major SAN equipment vendors. With remote data recovery and cloud computing migrating to the edge, the optical demand for these applications will only increase.

**5.2.7.1 Director Class SAN (Storage Area Network) Switches and Modules**

A scalable, high-performance, and protocol-independent designed primarily to fulfill the role of core switch in a core-edge Fibre Channel (FC), FCOE or similar SAN topology. A Fibre Channel director is, by current convention, a switch with at least 128 ports. It does not differ from a switch in core FC protocol functionality. Fibre Channel directors provide the most reliable, scalable, high-performance foundation for private cloud storage and highly virtualized environments.

**FNC Response:**

FNC does not currently have a SAN Switch platform in its portfolio to support the requirements of section 5.2.7

**5.2.7.2 Fabric and Blade Server Switches**

A Fibre Channel switch is a network switch compatible with the Fibre Channel (FC) protocol. It allows the creation of a Fibre Channel fabric, which is currently the core component of most SANs. The fabric is a network of Fibre Channel devices, which allows many-to-many communication, device name lookup, security, and redundancy. FC switches implement zoning; a mechanism that disables unwanted traffic between certain fabric nodes.

**FNC Response:**

FNC does not currently have a Fabric or Blade Server Switch platform in its portfolio.

**5.2.7.3 Enterprise and Data Center SAN and VSAN (Virtual Storage Area Network) Management**

Management tools to provisions, monitors, troubleshoot, and administers SANs and VSANs.

**FNC Response:**

FNC does not currently have management tools to provision, monitor, troubleshoot and administer SANS and VSANs.

**5.2.7.4 SAN Optimization**

Tools to help optimize and secure SAN performance (i.e. Encryption of data-at-rest, data migration, capacity optimization, data reduction, etc.

**FNC Response:**

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FNC does not currently have a tool that will help to optimize and secure SAN performance.

**5.2.8 SWITCHES**

Layer 2/3 devices that are used to connect segments of a LAN (local area network) or multiple LANs and to filter and forward packets among them

**FNC Response:**

FNC currently does not have a layer 2/3 device in its product portfolio for routers and switches. FNC connects to L2/L3 via a Connection Oriented Ethernet connection. Please refer to section 5.2.4.1 for details about the FLASHWAVE 9500

**5.2.8.1 Campus LAN – Access Switches** - Provides initial connectivity for devices to the network and controls user and workgroup access to internetwork resources. The following are some of the features a campus LAN access switch should support:

- Security
  - i. SSHv2 (Secure Shell Version 2)
 

**FNC Response:**

SSHv2 supported on FLASHWAVE 9500 and FLASHWAVE 4100ES. SSH is supported on all other FNC products.
  - ii. 802.1X (Port Based Network Access Control)
 

**FNC Response:**

Not currently supported
  - iii. Port Security
 

**FNC Response:**

FLASHWAVE NEs support port security via SSH Version 2 and IP ACL, as well as use of RADIUS for 3rd party authentication.
  - iv. DHCP (Dynamic Host Configuration Protocol) Snooping
 

**FNC Response:**

DHCP supported on FLASHWAVE 4100ES, 7500, 7420
- VLANs
 

**FNC Response:**

Supported on FLASHWAVE 7120, 7420, CDS, 9500, 4100ES
- Fast Ethernet/Gigabit Ethernet
 

**FNC Response:**

Gig E Supported on FLASHWAVE 9500, 7500, CDS, 4100ES, 7120, and 7420

Fast Ethernet supported on FLASHWAVE 4100ES, 7120, 9500, and 7420
- PoE (Power over Ethernet)
 

**FNC Response:**

Not supported on Fujitsu products
- link aggregation
 

**FNC Response:**

Supported on FLASHWAVE CDS, 4100ES, 9500, 7500, 7420, 7120
- 10 Gb support

**WSCA-NASPO Data Communications Services Solicitation # JP14001****FNC Response:**

Supported on FLASHWAVE CDS, 7120, 7420, 7500, 9500

- Port mirroring

**FNC Response:**

Supported on FLASHWAVE 9500

- Span Taps

**FNC Response:**

Current FLASHWAVE products do not support span taps.

- Support of IPv6 and IPv4

**FNC Response:**

Currently all FNC products support IPv4. IPv6 is slated for a future release.

- Standards-based rapid spanning tree

**FNC Response:**

Rapid Spanning Tree is currently supported on the FLASHWAVE 7120

- Netflow Support (Optional).

**FNC Response:**

Netflow is not currently supported by FNC as this is a Cisco protocol. FNC may support open flow on a future SDN product.

**5.2.8.2 Campus LAN – Core Switches** - Campus core switches are generally used for the campus backbone and are responsible for transporting large amounts of traffic both reliably and quickly. Core switches should provide:

- High bandwidth

**FNC Response:**

Supported on the FLASHWAVE 9500, 7500

- Low latency

**FNC Response:**

Supported on the FLASHWAVE 7420

- Hot swappable power supplies and fans

**FNC Response:****Hot swappable Power Supplies**

FLASHWAVE 9500 complete system wide hot swap ability

FLASHWAVE 7420

- Security

- i. SSHv2

**FNC Response:**

SSHv2 supported on FLASHWAVE 9500. The FW7500 requires the use of an external encryption device to support SSH. Border Guard manufactured by Blue Ridge is the one FNC uses with the DOD. SSH is supported on all other FNC products.

- ii. MacSec encryption

**FNC Response:**

**WSCA-NASPO Data Communications Services Solicitation # JP14001****No Support for MacSec.**

## iii. Role-Based Access Control Lists (ACL)

**FNC Response:**

Role based ACL is not supported on the FLASHWAVE 7500 and FLASHWAVE 4100ES. The 4100ES does support ACL

FLASHWAVE NEs can support an IP ACL which is a white list to only allow connections to the NE from the source IP address listed in the ACL. Some NEs (like FLASHWAVE 4100) also support an OSI ACL that limits what NSAP addresses can connect. Also, the FLASHWAVE 9500 and CDS support a L2 ACL for data services.

- Support of IPv6 and IPv4

**FNC Response:**

Currently all FNC products support IPv4. IPv6 is slated for a future release.

- 1/10/40/100 Gbps support

**FNC Response:**FLASHWAVE 9500

– Supports 10/40/100 Gbps

FLASHWAVE 7500

– Supports 2.5/10/40 Gbps

FLASHWAVE 7420

– Supports 2.7/10/40/100 Gbps

- IGP (Interior Gateway Protocol) routing

**FNC Response:**

Not supported on FLASHWAVE 4100ES, FLASHWAVE 7500,

- EGP (Exterior Gateway Protocol) routing

**FNC Response:**

Not supported on FLASHWAVE 4100ES, FLASHWAVE 7500,

- VPLS (Virtual Private LAN Service) Support

**FNC Response:**

Supported on FLASHWAVE 9500

- VRRP (Virtual Router Redundancy Protocol) Support

**FNC Response:**

Not supported

- Netflow Support.

**FNC Response:**

Not supported on FLASHWAVE 4100ES, FLASHWAVE 7500

**5.2.8.3**

**Campus Distribution Switches** - Collect the data from all the access layer switches and forward it to the core layer switches. Traffic that is generated at Layer 2 on a switched network needs to be managed, or segmented into Virtual Local Area Networks (VLANs), Distribution layer switches provides the inter- VLAN routing functions so that one VLAN can communicate with another on the network. Distribution layer switches provides advanced security policies that can be applied to network traffic using Access Control Lists (ACLs).

**FNC Response:**

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FNC does not currently have a distribution switch in its product portfolio. Distribution is handled through a router type device.

- High bandwidth
- Low latency
- Hot swappable power supplies and fans
- Security (SSHv2 and/or 802.1X)
- Support of IPv6 and IPv4
- Jumbo Frames Support
- Dynamic Trunking Protocol (DTP)
- Per-VLAN Rapid Spanning Tree (PVRST+)
- Switch-port auto recovery
- NetFlow Support or equivalent

**5.2.8.4 Data Center** - Data center switches, or Layer 2/3 switches, switch all packets in the data center by switching or routing good ones to their final destinations, and discard unwanted traffic using Access Control Lists (ACLs), all at Gigabit and 10 Gigabit speeds. High availability and modularity differentiates a typical Layer 2/3 switch from a data center switch. Capabilities should include:

**FNC Response:**

FNC does not currently have a data center switch in its product portfolio. Distribution is handled through a router type device.

- High bandwidth
- Low latency
- Hot swappable power supplies and fans
- Ultra-low latency through wire-speed ports with nanosecond port-to-port latency and hardware-based Inter-Switch Link (ISL) trunking
- Load Balancing across Trunk group able to use packet based load balancing scheme
- Bridging of Fibre Channel SANs and Ethernet fabrics
- Jumbo Frame Support
- Plug and Play Fabric formation that allows a new switch that joins the fabric to automatically become a member
- Ability to remotely disable and enable individual ports
- Support NetFlow or equivalent

**5.2.8.5 Software Defined Networks (SDN) - Virtualized Switches and Routers** Technology utilized to support software manipulation of hardware for specific use cases.

**FNC Response:**

Currently not supported

**5.2.8.6 Software Defined Networks (SDN) - Controllers** - is an application in software-defined networking (SDN) that manages flow control to enable intelligent networking? SDN controllers are based on protocols, such as Open Flow, that allow servers to tell switches where to send packets. The SDN controller lies between network devices at one end and applications at the other end. Any communications between applications and devices have to go through the

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controller. The controller uses multiple routing protocols including Open Flow to configure network devices and choose the optimal network path for application traffic.

**FNC Response:**

SDN is scheduled for a future release.

FNC has not yet made a decision about controllers, but we are considering use of Open Daylight coupled with our own in-house development.

In a future release our SDN solution will support REST and MTOSI APIs northbound. FNC expects to develop Java APIs to allow applications to run within the SDN platform.

Our SDN solution will support optical bandwidth on demand for datacenter interconnect services; network optimization and regrooming capabilities for OTN and DWDM layers, and multi-layer control/restoration.

FNC intends to create an open SDN development environment to allow and encourage SDN applications to be created by customers, partners, or other organizations.

FNC's future SDN platform will incorporate optical design rules for reachability testing and will provide an interface to feed as-built network information to modeling and design tools.

**5.2.8.7 Carrier Aggregation Switches** - Carrier aggregation switches route traffic in addition to bridging (transmitted) Layer 2/Ethernet traffic. Carrier aggregation switches' major characteristics are:

**FNC Response:**

Please refer to SECTION 5.2.4.1 Core DWDM (Dense Wavelength Division Multiplexing) Switches section above for the aggregation capabilities of each platform listed below.

FLASHWAVE 9500, FLASHWAVE 7500, FLASHWAVE 4100ES, FLASHWAVE 7120, and the FLASHWAVE CDS.

- Designed for Metro Ethernet networks
- Designed for video and other high bandwidth applications
- Supports a variety of interface types, especially those commonly used by Service Providers

Capabilities should include:

- Redundant Processors
- Redundant Power
- IPv4 and IPv6 unicast and multicast
- High bandwidth
- Low latency
- Hot swappable power supplies and fans
- MPLS (Multiprotocol Label Switching)
- BGP (Border Gateway Protocol)
- Software router virtualization and/or multiple routing tables
- Policy based routing
- Layer 2 functionality
  - i. Per VLAN Spanning Tree
  - ii. Rapid Spanning Tree
  - iii. VLAN IDs up to 4096
  - iv. Layer 2 Class of Service (IEEE 802.1p)

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- v. Link Aggregation Control Protocol (LACP)
- vi. Q in Q (IEEE 802.1ad)

**5.2.8.8 Carrier Ethernet Access Switches** - A carrier Ethernet access switch can connect directly to the customer or be utilized as a network interface on the service side to provide layer 2 services.

**FNC Response:**

Please refer to section 5.2.4.2 (Edge Switches) above for platform capabilities of the FLASHWAVE CDS AND FLASHWAVE 4100ES

- Hot-swappable and field-replaceable integrated power supply and fan tray
- AC or DC power supply with DC input ranging from 18V to 32 VDC and 36V to 72 VDC
- Ethernet and console port for manageability
- SD flash card slot for additional external storage
- Stratum 3 network clock
- Line-rate performance with a minimum of 62-million packets per second (MPPS) forwarding rate
- Support for dying gasp on loss of power
- Support for a variety of small form factor pluggable transceiver (SFP and SFP+) with support for Device Object Model (DOM)
- Timing services for a converged access network to support mobile solutions, including Radio Access Network (RAN) applications
- Support for Synchronous Ethernet (SyncE) services
- Supports Hierarchical Quality of Service (H-QoS) to provide granular traffic-shaping policies
- Supports Resilient Ethernet Protocol REP/G.8032 for rapid layer-two convergence

**5.2.9 WIRELESS**

Provides connectivity to wireless devices within a limited geographic area System capabilities should include:

- Redundancy and automatic failover
- IPv6 compatibility
- NTP Support

**FNC Response:****BroadOne GX-4000, E-Band Millimeter Wave Radio:**

The Fujitsu BroadOne GX-4000 E-band Millimeter Wave radio is ideal for delivering multi-gigabit capacity transport in the 70/80 GHz frequency band for 3G/4G mobile networks or fixed broadband networks. It supports a 71-76 GHz and 81-86 GHz FDD spectrum, accepts shorter reach hops for small-cell mobile networks, and has virtually no interference between links allowing for flexible network engineering and supports quick process and low cost of frequency licensing. Fujitsu's patented Impulse Radio technology for millimeter-wave radio transmission makes possible ultra-high data rate of >3 Gbps for a wireless link. The GX-4000 simple architecture offers low power consumption (30W), small platform (10x10x2.6") and is light weight (10 lbs.) and in maintaining a green network. In addition, it provides a secure inter-connection between centralized Base Band Unit (BBU) and multiple Remote Radio Heads (RRH) can provide a latency-sensitive solution and can be used as a portable disaster and infrastructure restoration solution.

**WSCA-NASPO Data Communications Services Solicitation # JP14001****FRX-3E Long Haul Microwave Radio:**

The FRX-3E Long Haul Microwave Radio system supports Ethernet transport on a single platform for long haul high-capacity wireless backhaul applications. The FRX-3E is scalable up to 16 RF carriers in a single rack system, supports a variety of ITU-R Radio Frequency channel arrangements with powerful Cross-Polarization Interference Canceller (XPIC) performance, optimizes Ethernet data speeds through carrier-class Radio Link Aggregation and QoS, Ring Protection, OAM, etc. In addition, it supports frequency diversity, RF band diversity and space diversity. The FRX-3E offers a broad range of modulation schemes with LDPC Forward Error Correction, adjustable Automatic Transmit Power Control (ATPC) dynamic range for maximum transmission, low power consumption as well as simple design, easy system set-up and user-friendly web interface.

**5.2.9.1 Access Points**

A wireless Access Point (AP) is a device that allows wireless devices to connect to a wired network using Wi-Fi, or related standards. Capabilities should include:

- 802.11a/b/g/n
- 802.11n
- 802.11ac
- Capable of controller discovery method via DHCP (onsite controller or offsite through Cloud Architecture)
- UL2043 plenum rated for safe mounting in a variety of indoor environments
- Support AES-CCMP (128-bit)
- Provides real-time wireless intrusion monitoring and detection

**FNC Response:**

FNC does not currently have an Access Point device in its product portfolio.

**5.2.9.2 Outdoor Wireless Access Points**

Outdoor APs are rugged, with a metal cover and a DIN rail or other type of mount. During operations they can tolerate a wide temperature range, high humidity and exposure to water, dust, and oil. Capabilities should include:

- Flexible Deployment Options
- Provides real-time wireless intrusion monitoring and detection
- Capable of controller discovery method via DHCP (onsite controller or offsite through Cloud Architecture)

**FNC Response:**

FNC does not currently have a Wireless Access Point device in its product portfolio.

**5.2.9.3 Wireless LAN Controllers**

- An onsite or offsite solution utilized to manage light-weight access points in large quantities by the network administrator or network operations center. The WLAN controller automatically handles the configuration of wireless access-points. Capabilities should include:
- Ability to monitor and mitigate RF interference/self-heal
- Support seamless roaming from AP to AP without requiring re-authentication
- Support configurable access control lists to filter traffic and denying wireless peer to peer traffic
- System encrypts all management layer traffic and passes it through a secure tunnel

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- Policy management of users and devices provides ability to de-authorize or deny devices without denying the credentials of the user, nor disrupting other AP traffic
- Support configurable access control lists to filter traffic and denying wireless peer to peer traffic

**FNC Response:**

FNC does not currently have a Wireless LAN Controller device in its product portfolio.

**5.2.9.4 Wireless LAN Network Services and Management**

Enables network administrators to quickly plan, configure and deploy a wireless network, as well as provide additional WLAN services. Some examples include wireless security, asset tracking, and location services. Capabilities should include:

- Provide for redundancy and automatic failover

**FNC Response:**[Fujitsu Hosted Element Management System Maintenance \(Option\)](#)

The Fujitsu Hosted Element Management System (Hosted EMS) MSP gives you top-class network management and provisioning, without the overhead of maintaining your own EMS server, software licenses and staff. The Hosted EMS plan delivers all the benefits of network management using the NETSMART 1500 Management System, but hosted at the Fujitsu Network Operations Center on Fujitsu-owned servers. Hosted EMS is a fully redundant, secure, carrier-class solution, offering:

- 24/7 remote technical assistance
- NETSMART 1500 features
- Fujitsu management of server, hardware and database
- Webinars about new features and enhancements
- Monthly call reports
- Historical trend and real time performance reporting is supported

**FNC Response:**

Historical trends and real time performance reporting is supported via NETSMART 1500 for FNC products.

- Management access to wireless network components is secured
- SNMPv3 enabled

**FNC Response:**

Supported in a future release of NETSMART 1500

- RFC 1213 compliant
- Automatically discover wireless network components
- Capability to alert for outages and utilization threshold exceptions

**FNC Response:**

Supported via NETSMART 1500

- Capability to support Apple's Bonjour Protocol / mDNS

**FNC Response:**

Not supported

- QoS / Application identification capability

**FNC Response:**

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[FNC does not currently support this requirement](#)

**5.2.9.5 Cloud-based services for Access Points**

Cloud-based management of campus-wide Wi-Fi deployments and distributed multi-site networks. Capabilities include:

- Zero-touch access point provisioning
- Network-wide visibility and control
- RF optimization,
- Firmware updates

**FNC Response:**

[FNC does not currently support this requirement](#)

**5.2.9.6 Bring Your Own Device (BYOD)**

Mobile Data Management (MDM) technology utilized to allow employees to bring personally owned mobile devices (laptops, tablets, and smart phones) to their workplace, and use those devices to access privileged government information and applications in a secure manner. Capabilities should include:

- Ability to apply corporate policy to new devices accessing the network resources, whether wired or wireless
- Provide user and devices authentication to the network
- Provide secure remote access capability
- Support 802.1x
- Network optimization for performance, scalability, and user experience

**FNC Response:**

[FNC does not currently support this requirement](#)

**5.3.0 UNIFIED COMMUNICATIONS (UC)**

**FNC Response:**

[FNC has elected not to respond to the requirements of section 5.3.1](#)

A set of products that provides a consistent unified user interface and user experience across multiple devices and media types. Unified Communications that is able to provide services such as session management, voice, video, messaging, mobility, and web conferencing; It can provide the foundation for advanced unified communications capabilities of IM and presence-based services and extends telephony features and capabilities to packet telephony network devices such as IP phones, media processing devices, Voice over IP (VoIP) gateways, and multimedia applications. Additional services, such as unified messaging, multimedia conferencing, collaborative contact centers, and interactive multimedia response systems, are made possible through open telephony APIs. General UC solution capabilities should include:

- High Availability for Call Processing
- Hardware Platform High Availability
- Network Connectivity High Availability
- Call Processing Redundancy

**5.3.0.1 IP Telephony**

**FNC Response:**

[FNC has elected not to respond to the requirements of section 5.3.0.1.](#)

Solutions utilized to provide the delivery of the telephony application (for example, call setup and teardown, and telephony features) over IP, instead of using circuit-switched or other modalities. Capabilities should include:

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- Support for analog, digital, and IP endpoints
- Centralized Management
- Provide basic hunt group and call queuing capabilities
- Flexibility to configure queue depth and hold time, play unique announcements and Music on Hold (MoH), log in and log out users from a queue and basic queue statistics (from the phone)
- E911 Support

**5.3.0.2 Instant messaging/ Presence****FNC Response:**

FNC does not currently support the requirements of section 5.3.0.2.

Solutions that allow communication over the Internet that offers quick transmission of text-based messages from sender to receiver. In push mode between two or more people using personal computers or other devices, along with shared clients, instant messaging basically offers real-time direct written language-based online chat. Instant messaging may also provide video calling, file sharing, PC-to-PC voice calling and PC-to-regular-phone calling.

**5.3.0.3 Unified messaging**

Integration of different electronic messaging and communications media (e-mail, SMS, Fax, voicemail, video messaging, etc.) technologies into a single interface, accessible from a variety of different devices

**FNC Response:**

FNC does not currently support the requirements of section 5.3.0.3.

- Ability to access and manage voice messages in a variety of ways, using email inbox, Web browser, desktop client, VoIP phone, or mobile phone
- Visual Voicemail Support (Optional)

**5.3.0.4 Contact Center**

A computer-based system that provides call and contact routing for high-volume telephony transactions, with specialist answering "agent" stations and a sophisticated real-time contact management system. The definition includes all contact center systems that provide inbound contact handling capabilities and automatic contact distribution, combined with a high degree of sophistication in terms of dynamic contact traffic management.

**5.3.0.5 Communications End Points and Applications****FNC Response:**

FNC does not currently support the requirements of section 5.3.0.4.

- Attendant Consoles
- IP Phones

**5.3.0.6 UC Network Management**

Provides end-to-end service management for Unified Communications. Capabilities include testing, performance monitoring, configuration management, and business intelligence reporting.

**FNC Response:**

FNC does not currently support the requirements of section 5.3.0.6.

**5.3.0.7 Collaboration**

Voice, video, and web conferencing; messaging; mobile applications; and enterprise social software

**WSCA-NASPO Data Communications Services Solicitation # JP14001****FNC Response:**

FNC does not currently support the requirements of section 5.3.0.7.

**5.3.0.8 Collaborative Video**

A set of immersive video technologies that enable people to feel or appear as if they were present in a location that they are not physically in. Immersive video consists of a multiple codec video system, where each meeting attendee uses an immersive video room to “dial in” and can see/talk to every other member on a screen (or screens) as if they were in the same room and provides call control that enables intelligent video bandwidth management.

**FNC Response:**

FNC does not currently support the requirements of section 5.3.0.8.

**5.3.0.8.1 Content Delivery Systems (CDS)**

A large distributed system of servers deployed in multiple data centers connected by the Internet. The purpose of the content delivery system is to serve content to end-users with high availability and high performance. CDSs serve content over the Internet, including web objects (text, graphics, URLs, and scripts), downloadable objects (media files, software, and documents), applications (e-commerce, portals), live streaming media, on-demand streaming media, and social networks.

**FNC Response:**

FNC does not currently support the requirements of section 5.3.0.8.1

**5.3.0.8.2 Physical Security**

Technology utilized to restricting physical access by unauthorized people to controlled facilities. Technologies include:

**FNC Response:**

FNC does not currently support the requirements of section 5.3.0.8.2

- a. Access control systems
- b. Detection/Identification systems, such as surveillance systems, closed circuit television cameras, or IP camera networks and the associated monitoring systems.
- c. Response systems such as alert systems, desktop monitoring systems, radios, mobile phones, IP phones, and digital signage
- d. Building and energy controls

**5.3.1 SERVICES**

For each Category above (5.21-5.30), the following services should be available for procurement as well at the time of product purchase or anytime afterwards.

**FNC Response:**

Services are custom in nature and as such FNC will provide service pricing based on the release of a specific RFP or on a clearly defined project. Such pricing shall be based on a mutually upon agreed detailed Statement of Work (SOW) by both parties.

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<p>Program Management</p>	<p>The Fujitsu Program Management Office (PMO) will oversee and coordinate the entire project scope of work from start to finish. The PMO is specifically designed to be the complete epicenter for all project resources working on and communications. Dedicated Program Managers will be assigned with the lead Program Manager as the single point of contact. Roles of the Program Management team:</p> <ul style="list-style-type: none"> <li>• Plan and organize project scope, schedule and assign resources</li> <li>• Identify program constraints, risks, parameters and resource needs</li> <li>• Develop and manage budget and cost control</li> <li>• Execute plan according to your requirements</li> <li>• Manage communications</li> <li>• Ensure quality performance and adherence to quality standards</li> <li>• Manage program closeout and customer's satisfaction</li> </ul>
<p>NOC</p>	<p>The Network Operations Center (NOC) solution from Fujitsu provides a full range of network management features offered for transport network elements, data network devices, firewalls, servers and other public-access equipment. The NOC's fully integrated management systems support standards-based TL1 and SNMP management protocols. Fujitsu provides customized offerings to enhance your operational requirements, including Event Management, Fault Management and many Value Added Services. So, whether you require round-the-clock management or additional resources to supplement your staff or cover after-hours support, we can provide the experience you need to manage a successful network.</p>
<p>Professional Services</p>	<p>Fujitsu can provide consulting and network design because of its technical expertise and network design experience for multi-vendor architectures. Fujitsu would work the higher level design to ensure all of the vendors' products work together to form an interoperable, efficient network in an end-to-end, holistic view.</p>

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<p>EFI &amp; T</p>	<p>Fujitsu Deployment Services offers a comprehensive suite of Engineering, Furnish, Installation and Turn-up and Test (EFI&amp;T) services that are available as a packaged request, as value-added optional services, as an Original Equipment Manufacturer (OEM) solution or as a customized option to meet your specifications. Fujitsu's Deployment Services ensure that your network is deployed quickly and at optimal performance, to help you manage the momentum of technology while minimizing the challenges. Through our comprehensive and flexible approach we will install the network according to your exact specifications, all within the required timeframe.</p>
<p>RCI</p>	<p>Fujitsu Rack and Cabinet Integration (RCI) group provides the engineering for high quality integrated telecommunications system solutions. These engineered solutions combine Fujitsu equipment with the industry's best elements to provide indoor and outdoor systems for COs, customer premise and Outside Plant (OSP) environments. RCI integrates elements from a variety of suppliers to offer the best system solution to most cost effectively meet the customer's unique requirements.</p>
<p>Documentation</p>	<p>If you have a documentation project or requirement but are uncertain how to proceed, Fujitsu can assist you in determining where to start, what questions need to be addressed, and how to lay out a plan to get there.</p> <p>Fujitsu Documentation Consulting Services include the following:</p> <ul style="list-style-type: none"> <li>• Auditing and consultation</li> <li>• Documentation foundation and architecture</li> <li>• Documentation control processes</li> <li>• Documentation standardization development</li> <li>• Process design and implementation</li> </ul>

**5.3.1.1 Maintenance Services**

Capability to provide technical support, flexible hardware coverage, and smart proactive device diagnostics for hardware

**FNC Response:**

**Maintenance and Support Program Overview**

In a dynamic, competitive business climate, staying economical is crucial to success. High standards of network reliability and efficiency are equally essential. Fujitsu understands the challenge of balancing downward pressure on operations costs against the need for top service quality. We know this balance is achievable; your customers don't compromise their expectations and neither should you. That's why we developed the Maintenance and Support Program (MSP).

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With the Fujitsu MSP, you protect your network assets with technical assistance and software upgrades. Fujitsu also offers options such as preventative maintenance from expert Fujitsu technicians, as well as spares management and on-site maintenance.

#### Flexible plan choices

The Fujitsu MSP is a suite of maintenance plans that support your network operations, equipment and software. Whether it's supplemental support to complement existing resources, or comprehensive coverage with outsourced operations, there's a Fujitsu MSP solution that meets your business needs.

#### Program tiers and entitlements

The Fujitsu MSP offers four program tiers, from Select to Premier. All plans include 24/7 remote technical assistance and a maintenance plan for Network Element (NE) and craft software. Additional entitlements are available for Prime, Peak and Premier Tiers.

#### 24/7 remote technical assistance

The Fujitsu Technical Assistance Center (TAC) team is your point of contact for resolving network issues. The TAC is staffed by experienced telecommunications engineers with extensive technical qualifications. The TAC operates 24/7/365 to support your Fujitsu and selected third-party systems.

The Fujitsu Technical Assistance Center (TAC) is our "Customer's Solution Center". Staffed by seasoned telecom engineers who have completed extensive technical training, the TAC is your central point of contact for resolving network issues related to operations, performance, reliability, and maintenance of on-line, operational systems.

In most cases, problems can be resolved via remote management, but if on-site support is required, a technician will be dispatched to the site.

Our technical assistance lab is equipped with more than \$20 million of FNC and OEM products, as well as other telecom equipment. Experience with this state of the art equipment allows our engineers to address your network configuration issues, including centralized fault notification, problem replication, and troubleshooting and fault escalation management.

Our call tracking software documents all of your communications with the TAC staff and ensures your issues are promptly addressed and resolved. An evolving historical solutions database is developed so that TAC engineers can quickly respond to similar issues that may arise in the future.

A built-in escalation and audit module monitors all Customer Service Requests and escalates to senior management when appropriate. The call software allows total flexibility for the production of regular or on-demand management reports detailing the performance, volumes, and response times of your network.

FNC's highly trained and experienced Technical Support Engineers (TSEs) are available 24x7x365 to help answer questions and solve hardware and software problems for our entire product line.

#### TAC ESCALATION Details

In compliance with GR929, faults will be placed into one of the following categories:

- Critical** - Emergency system outage
- Major** - Potential outage or degradation
- Minor** - Non Service Affecting

An example is given below of the typical escalation procedures that may be employed:

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For **Critical** problems (Emergency system outage), the TAC will:

- Provide immediate and continuous coverage until the service level is restored to pre-incident operation.
- Escalate the problem to FNC's Post Design Support Group immediately to ensure restoration of service in the minimum time.

For **Major** problems (Potential outage or degradation), The TAC will:

- Provide immediate and continuous coverage until the service level is restored to pre-incident operation.
- Escalate the problem to FNC's Post Design Support Group within 1 hour if unable to restore system operation

For **Minor** problems (Non Service Affecting), the TAC will:

- Provide a status report to the customer in 4 weeks
- Provide a weekly status report to the Operations and Engineering Directors
- Schedule corrective action within an agreed period

Further detailed definitions of the classifications and escalation paths will be determined when the customer's requirements are fully defined.

Classifications of Errors

Calls to the TAC are normally answered within 60 seconds, and the average time to resolution is 24 minutes.

FNC follows the guidelines for "Severity Definitions for Switching and Transport Systems" as defined in "Telcordia GR-929-CORE". FNC utilizes these guidelines to determine the severity of Errors reported by Customer. An Error will be classified as a Critical, Major, or Minor as follows:

(i) Critical Error

A "Critical Error" includes any, all or any combination of the following: (i) Fiber cut or loss of optical path with loss of traffic, (ii) any system that has any level of traffic loss (1-DS0 to xWDM), (iii) if Customer has to reroute traffic to establish service, (iv) service or traffic affecting problems that require immediate corrective action regardless of time of day, or (v) a complete FNC-provided NMS server failure where visibility to the entire network is lost.

(ii) Major Error

A "Major Error" includes any, all or any combination of the following: (i) fiber cut or loss of optical path and the system performs the APS with a loss of redundancy or protection switching capabilities, but no loss of traffic, (ii) equipment failure on a redundancy path which will inhibit any protection switching capabilities and no traffic loss occurs, or (iii) a partial FNC-provided NMS server outage where a portion of the network still has visibility

(iii) Minor Error

A "Minor Error" includes all Errors not otherwise included in, or defined as, Critical Errors or Major Errors.

Error Escalation

FNC will escalate all Critical Errors and all Major Errors automatically by utilizing FNC's problem tracking system. The system will automatically notify various individuals of FNC's management and executive management, as well as any Customer specified personnel, via e-mail and text messaging to either a pager or mobile phone, whenever a Critical Error or Major Error remains unresolved for the time periods listed below:

- (i) In the event that a Critical Error or a Major Error remains unresolved for a period of

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four (4) hours from the time the error was first reported to FNC by the customer, the tracking system will immediately contact FNC's TAC Manager, FNC's Director of Maintenance Services and FNC's Vice President of Services.

- (ii) In the event that a Critical Error or a Major Error remains unresolved for a period of eight (8) hours from the time the error was first reported to FNC by the customer, the tracking system will contact all of FNC's personnel identified in paragraph (i) above and also FNC's Senior Vice President of Operations.
- (iii) In the event that a Critical Error or a Major Error remains unresolved for a period of twelve (12) hours from the time the error was first reported to FNC by the customer, the system will contact (in the manner specified above) all of FNC's personnel identified in paragraph (ii) above and, additionally, FNC's Senior Vice President of Sales, FNC's Chief Operating Officer.
- (iv) In the event a Critical Error or a Major Error remains unresolved for a period of twenty-four (24) hours from the time the error was first reported to FNC by the customer, the system will contact all of FNC's personnel identified in paragraph (iii) above and, additionally, FNC's President, FNC's Chief Executive Officer and FNC's Group President.

Maintenance and upgrade subscriptions to NE and craft software

The software on your NEs provides critical service-enabling features and capabilities; if upgrades are not made, you adversely affect your ability to roll out new services. Coverage includes new software releases including functionality\*, feature enhancements, and necessary modifications. The NETSMART<sup>®</sup> 500 Element Manager, the Fujitsu craft interface, supports graphical shelf views, equipment and facility provisioning, alarm surveillance, software download, remote memory backup/restore and cross-connect provisioning. Your MSP allows you to download and install the latest versions and upgrades to the NETSMART 500 software on all your NEs.

As a general rule, FNC will issue one (1) major software release per year that addresses significant feature or functionality enhancements. Maintenance releases are issued on an as needed basis to address fixes or modifications and the frequency may vary from year to year.

*\* Certain functionality is individually licensed and not covered under the Software Maintenance and Upgrade Subscription.*

NETSMART 1500 Maintenance and Support Plan

Your NETSMART 1500 management system simplifies network management, provisioning, and maintenance. To maintain this critical investment, we offer around-the-clock online, on-call, and on-site access to technicians and key information. Our comprehensive maintenance package safeguards your critical NETSMART 1500 system with:

- 24/7 remote technical assistance
- NETSMART 1500 software maintenance subscription
- Onsite technical support
- Webinars about new features and enhancements
- No-hassle upgrade portal
- Access to web-based tutorials
- Monthly call reports

Repair and return

With an MSP, your covered network is eligible for repair and return services for defective parts, even if your parts are beyond the standard warranty period. This entitlement offers you significant savings in comparison to out-of-warranty fees.

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Advance Hardware Replacement (AHR) (Optional)

FNC's Advance Hardware Replacement Service is available 24x7x365 days a year to ensure that your network is continually supported with the spares you need for optimal performance. And we can help you cut your costs in warehousing and the resources required to maintain an inventory in support of potentially volatile network situations

Through a single point of contact at our Technical Assistance Center (TAC), you can request delivery of FNC-owned and managed spares from our strategically located stocking sites. The TAC engineer will be able to validate the need for a spare component prior to shipment, reducing the chance of getting the wrong version or component, second trips to the repair site, and potential additional shipping costs because of exchanges.

Our nationwide stocking locations ensure the fastest response times to get your systems back in operation, and we also operate a back-up depot in Dallas, Texas which can backfill local depots as needed.

Our standard response time is Next Business Day which ensures delivery before the end of the next business day. Custom response times are also available.

FNC will ensure that all FNC components are current to A and A/C levels for Product Change Notices (PCN) so that your spares receive the most current upgrades. And during the contract term, all included equipment is covered for ongoing repair and return.

We also offer a supplemental service, On-site Support, to supply an experienced technician to implement the replacement and troubleshoot issues for those locations where you may not retain technical staff on-site.

On-site maintenance (Option)

FNC can provide specialized telecommunications technicians on site that have working knowledge of equipment to support emergency break/fix repair of the network. The technician will work closely with the FNC NOC which will coordinate his action during his time on-site. He will be equipped with appropriate test equipment and minor supplies to complete the repair in a timely fashion. Unless otherwise noted, the technician will make a commercially reasonable effort to arrive on-site within four (4) hours after dispatch.

It is understood that FNC will do due diligence to analyze alarms and other information provided by the systems to minimize on-site repairs recognizing that any remote analysis of complex telecommunication equipment alarms requires professional judgment which, in some cases, can only be confirmed by on-site presence. There are conditions that may require one or more trips to a site to confirm equipment conditions that don't require a card replacement.

Routine preventative maintenance (Option)

Routine preventative maintenance entitles you to regular site visits to keep your network in optimal working condition. Our experienced technicians will perform onsite inspection of your Fujitsu equipment in order to detect any potential trouble conditions before they disrupt service. Based upon your requirements, a custom series of non-service-affecting tasks will be developed to test, clean and back up critical network data. Extra site visits are available for additional fees.

Network Element Maintenance and Support Tiers				
Service	Select	Prime	Peak	Premier
24/7 Remote Technical Assistance	✓	✓	✓	✓
Software Maintenance and Upgrade Subscription for Network Element (NE) and Element Manager (craft)	✓	✓	✓	✓

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Training		✓	✓	✓
Repair and Return		✓		
Advance Hardware Replacement (next business day)			✓	
On-site Maintenance (next business day)			✓	
On-site Maintenance (4-hour)				✓
Routine Preventive Maintenance				✓

Standard warranty

With every equipment purchase, you receive our standard one-year warranty for hardware and 90-day software warranty. We also provide secure online access to technical documentation and information on equipment and software updates.

Optional network maintenance and design plans

Optional MSPs guarantee covered software upgrades. Releases are automatically available via electronic download. We send e-mail alerts to plan participants, announcing all generally available software releases. We also offer access to technicians, on-site visits, webinars and tutorials. MSPs are available for:

- NETSMART 2000 Design and Planning Tool
- NETSMART 1500 Management System
- Fujitsu Hosted Element Management System

These plans ensure that you have all the latest features on covered systems and that your software runs optimally. New releases add functionality, enhancements and additional modifications.

NETSMART 2000 Maintenance and Support Plan (Option)

For optimal performance in the output of your designs, it is important to have the latest features and NE release support. The NETSMART 2000 MSP gives you immediate access to software upgrades and support, so you get the most out of your NETSMART 2000 software:

- Remote technical assistance (8 am–5 pm CT Monday–Friday)
- NETSMART 2000 Design and Planning Tool software maintenance subscription
- Webinars about new features and enhancements
- Monthly call reports

Fujitsu Hosted Element Management System Maintenance and Support Plan (Option)

The Fujitsu Hosted Element Management System (Hosted EMS) MSP gives you top-class network management and provisioning, without the overhead of maintaining your own EMS server, software licenses and staff. The Hosted EMS plan delivers all the benefits of network management using the NETSMART 1500 Management System, but hosted at the Fujitsu Network Operations Center on Fujitsu-owned servers. Hosted EMS is a fully redundant, secure, carrier-class solution, offering:

- 24/7 remote technical assistance
- NETSMART 1500 features
- Fujitsu management of server, hardware and database
- Webinars about new features and enhancements
- Monthly call reports

**WSCA-NASPO Data Communications Services Solicitation # JP14001****5.3.1.2 Professional Services****FNC Response:**

Fujitsu can provide consulting and network design because of its technical expertise and network design experience for multi-vendor architectures. Fujitsu would work the higher level design to ensure all of the vendors' products work together to form an interoperable, efficient network in an end-to-end, holistic view.

- Deployment Services

**FNC Response:**

Please refer to the EF&I Services description detailed below.

- Survey/ Design Services

**FNC Response:**

Fujitsu's engineers will perform an inspection of the site to determine engineering, installation and implementation requirements.

Information gathered on-site will be used to prepare an Engineering Design Package which will be the basis from which installation material will be ordered as well as be the work instruction for the installation and test engineers. The Site Survey report will cover such items as a basic floor plan indicating the placement of existing and proposed equipment, existing relay rack inventory with available space, location and availability of power, conduit availability and other items such as local site contact information.

Some of the other activities included with performing a site survey may include:

1. Conducting joint site meetings during the survey
  2. Conducting follow up meetings with customer to discuss survey results
  3. Fine tuning the scope of project based on actual site requirements that include cost and material adjustments
  4. Obtaining concurrence from designated customer representative(s)
- Includes, but not limited to, discovery, design, architecture review/validation, and readiness assessment.

**FNC Response:****Network Design Service**

Planning and designing multivendor network solutions, fine-tuned for best performance and customized to solve complex business problems, is a vital element of any network rollout or technology upgrade. It takes just the right amount and combination of resources and expertise to develop the infrastructure needed to service growing demands and stringent SLAs.

Effective network design means making the right choices to maximize efficiency, profitability and reliability. Every level of your network's structure and configuration has a major impact on revenues, scalability, and positioning for future growth. To ensure the health of your business, your network must be purposely designed to be reliable, scalable, cost-effective, and flexible.

Fujitsu offers a unique combination of technical expertise and experience architecting networks for multivendor environments. With our dedication to best practices and proven, effective design tools and processes, the Fujitsu Network Design Services can help you engineer a network that exceeds customer requirements, keeps costs low, and generates healthy revenue.

**Maximize Efficiency and Profitability**

With the Fujitsu Network Design Services, you can achieve important business benefits:

- Immediate cost-effectiveness

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- Ongoing reliability and efficiency
- Reduced OpEx and Capex
- Improved time to revenue
- Reduced deployment risk
- Best-in-class performance and capacity
- Improved flexibility and scalability

Enduring Partnerships Based on Trust

After serving all types of customers in the communications network industry for more than 25 years, we understand service providers' immediate and long-term needs. This is why many consider us a trusted partner able to support durable, positive business relationships. As with all of our service offerings, Fujitsu Network Design Services are peerless in quality. The services are applicable to any transport, data and wireless technology, and can be delivered remotely or on-site. We also make administration and management easier for you by acting as a single point of contact for complex, end-to-end, multivendor design solutions.

Whatever your network needs, our highly qualified architects and engineers can address all scenarios including:

- Greenfield
- Expansion
- Migration
- Upgrade
- Overlay
- Replacement
- Rehome
- Optimization

Network Design Services Portfolio

Fujitsu Network Design Services are a comprehensive portfolio of architectural and engineering design services that you can customize to meet your individual network needs. We take an end-to-end, multivendor approach, and are able to add value at every phase of a network design project. From information acquisition, to architectural and topological design, to site surveys and drawings, our specialists have the expertise you need to engineer performance into your revenue-generating network.

**Network Architecture Design** – FNC delivers a high-level design that specifies the necessary equipment to meet your requirements.

- Requirements and infrastructure analysis
- Technologies recommendations
- Architecture planning
- Topology and logical network design
- Traffic and capacity demand planning
- Network modeling and simulation studies
- Channel plan
- Circuit design
- Network management design
- Equipment list
- Network-level drawings
- Network architecture packages

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**Detailed Network Engineering Design** – FNC delivers a complete, detailed engineering design specification including equipment BoMs, necessary circuit capacity and other design details.

- Site survey
- Bill of materials
- Rack & stack design
- Connectivity design
- Network management system information
- Methods of Procedure (MOPs)
- Installation, integration and test specifications
- Site-level drawings
- Engineering design packages

#### Services that Target your Needs

The Fujitsu Network Design Services can be customized or packaged with other service offerings to fit your unique situation. For example, you can combine our Network Design Services with network audits, field services, knowledge services, and project management for turnkey or tailored packages that support your individual network and business objectives.

The Fujitsu Network Design Services are ideal for your network design project. We combine the methodical and the innovative aspects of network engineering into one complete solution based on our peerless network engineering and design expertise. Consult with us to discuss your architecture or detailed network engineering project, and discover how we can help you ensure world-class reliability for your customers and get the maximum profitability and efficiency from your network.

#### **Rack & Cabinet Integration Solutions (*Cabinets, Racks and Kits*)**

The Fujitsu Network Communications (Fujitsu) Rack & Cabinet Integration (RCI) group offers high quality integrated telecommunications system solutions. RCI engineered systems combine the industry's best elements to provide indoor and outdoor broadband solutions for the Wireline, Wireless, FTTx, Cable, and MSO markets.

Fujitsu RCI integrates the following elements from various suppliers to offer the best system solution to cost-effectively meet customer requirements:

- Racks
- Cabinets (Indoor and Outdoor)
- Thermal Management Systems
- Power Systems and Distribution
- Backup Power and Batteries
- Telecommunications System Shelves
- Fiber Management
- RF Protection and Distribution
- Lightning Protection
- Cross-Connect Panels
- DS1, DS3 and DSx Panels
- Filters, Combiners

#### **Accelerate Network Deployments**

##### **Fujitsu RCI Advantages**

Fujitsu RCI group brings renowned Fujitsu quality to every cabinet, rack and kit it designs. Fujitsu builds and tests its RCI products to the same exacting standards as our legendary FLASHWAVE optical transport equipment.

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Fujitsu Product Customization Design combines extensive telecommunications knowledge and experience coupled with the best technology available in the industry, to provide high quality, cost-effective, telecom system solutions.

- Flexibility of configurations provide the best system solution
- Expandability for indoor and outdoor system growth
- Full NEBS and UL compliance when required
- Most cost-effective value to the customer
- Highly reliable systems that offer unparalleled quality

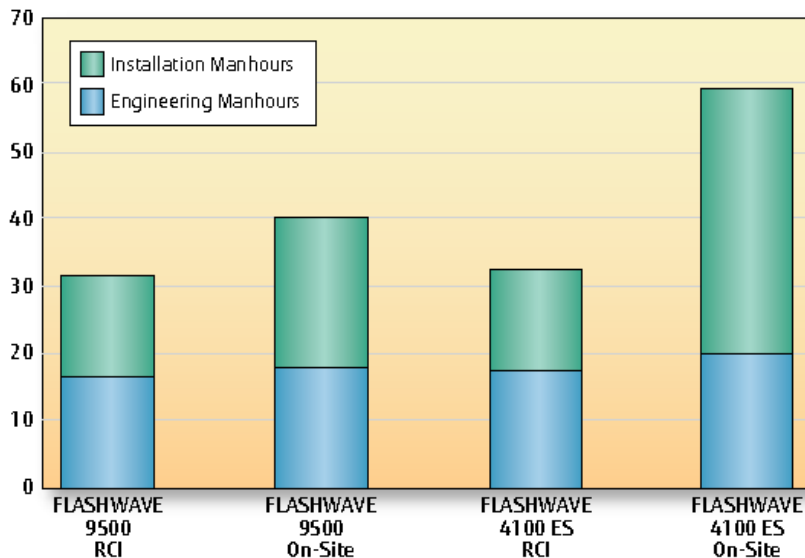
**Preconfigured or Build on-Site**

Analysis of two typical rack configurations shows that choosing to deploy preconfigured rack solutions results in significant time and operational cost savings. The first configuration modeled is a four degree FLASHWAVE® 9500 rack which includes one HDS shelf and four passive ROADM/DCM shelves. The second configuration modeled is a six-shelf FLASHWAVE 4100ES rack equipped with associated fans and heat baffles.

**Installation Time Savings**

Figure 1 shows the installation time saved by selecting the preconfigured Rack & Cabinet Integration (RCI) option for the two solutions modeled. The FLASHWAVE 9500 RCI preconfigured solution provides a 21% installation time savings over the “build on-site” model.

The FLASHWAVE 4100ES RCI preconfigured model returns a 46% installation time savings when compared to the “build on-site” model. As shown in Figure 1, both engineering and installation times are the same for preconfigured racks regardless of the configuration, as opposed to “build on-site” racks. This affords service providers the ease of project planning for installation. With the preconfigured racks, minimal installation includes mounting the racks and running the power and ground cables to be turn-up ready. This simplicity cuts time to service and speeds up revenue generation.

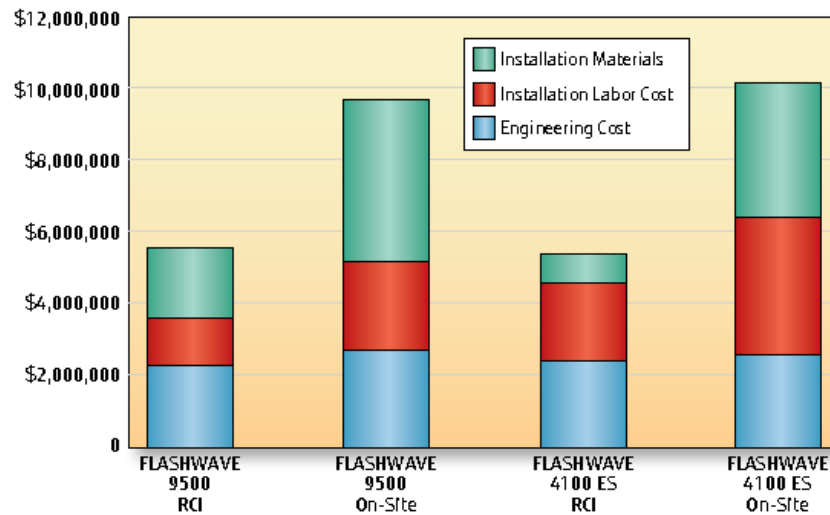


**Figure 1: Installation Time RCI Preconfigured Rack vs. On-Site Rack Build**

**Operational Cost Savings**

Figure 2 shows the operational cost savings by selecting the preconfigured (RCI) rack for the two solutions modeled. The FLASHWAVE 9500 RCI preconfigured solution provides a 44% operational cost savings over the “build on-site” model. The FLASHWAVE 4100ES preconfigured model returns a 46% operational cost savings. Operational costs remain constant with preconfigured racks regardless of solutions deployed.

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**Figure 2: Operational Cost  
RCI Preconfigured Rack vs. On-Site Rack Build**

#### Key Advantages of Preconfigured Rack Solutions

In addition to both time and operational cost savings, preconfigured rack solutions offer service providers the following advantages:

- Consistency of preconfigured rack builds
- The racks are built and tested in the factory to the same engineering and installation standards.
- A preconfigured rack deployed on the East coast will be exactly the same rack as one deployed on the West coast. There is no variance in workmanship standards from one installation vendor to another.
- Ease of ordering
- Fujitsu RCI offers a single part number for each preconfigured rack solution.
- The single part number includes all the associated telecommunication shelves, power panels, rack and inter-rack cabling.
- Ease of material management
- Only one part number is used to track and deliver to the site for deployment.
- Receiving is accelerated by delivery of one rack versus multiple shelves, empty rack and ancillary equipment for a "build on-site" rack.
- Streamlined installation
- Simply mount the preconfigured rack and run power and ground cables to be turn-up ready.

#### Consistent, Simple, Convenient

While total cost of deployments (capital and operational) can be relatively comparable, the deployment of preconfigured rack solutions speeds your time to deployment by saving both operational costs and time.

Operational costs show a savings of over 40% with the use of preconfigured solutions. The preconfigured racks provide consistent workmanship across the network. From a planning perspective, the preconfigured solutions provide simplified ordering and standard installation time, allowing service providers to easily and accurately plan their network deployments.

Accelerate your network installation by up to 46% and meet the challenges of a rapidly growing market with preconfigured solutions from Fujitsu RCI.

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TM

**NetOmnia** Comprehensive Ethernet assurance performance and SLA management  
**End-to-End, MEF-Compliant Service Assurance**



A key challenge of delivering Ethernet services is the time-consuming task of network monitoring. Many key metrics must be accurately measured to assess the performance of an entire, often multivendor, network. The lack of a single, unified management system further complicates this challenge, as operators must work with multiple management systems: an inefficient, time consuming, and costly overhead. Gathering data to support accurate and effective performance measurement across an entire Ethernet network is, therefore, often a best-effort project involving a substantial amount of manual work.

In addition, end customers and subscribers often want to know how well the service provider is executing on Service-Level Agreements (SLAs). Providing real-time and accurate reports for SLA management is difficult to produce on a continuous basis; an error here can result in lost revenue, not to mention lost customers.

To address these challenges, Fujitsu offers NetOmnia<sup>TM</sup>, a comprehensive Ethernet Assurance Performance and SLA management system providing end-to-end service assurance and service quality management solutions in a multivendor environment.

NetOmnia enables you to achieve three key business objectives:

- Monitor Ethernet-related performance data efficiently in a constantly changing network
- Provide consistent-looking, meaningful performance and SLA management information to stakeholders
- Reduce or eliminate instances and impact of customer SLA violations

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**NetOmnia's Workflow Automation empowers users to create automations and notifications based on performance criteria**

### [Next-Generation Visualization to Improve Network Performance](#)

NetOmnia Ethernet Assurance is a multivendor, MEF-compliant solution that provides end-to-end visualization and monitoring of Ethernet services to ensure and improve customer experience. With off-the-shelf, multivendor support, NetOmnia can be deployed and configured quickly to discover Ethernet services and begin monitoring and reporting on the health and status of customer services.

NetOmnia provides configurable monitoring and visualization of service quality metrics such as availability, delay, jitter, and frame loss, as well as the ability to create and monitor custom-defined metrics.

### [Deliver Better Service, Increase Revenue, Reduce Costs](#)

NetOmnia SLA Manager, an optional overlay, enables service providers to easily define, track and report on contractual SLAs. NetOmnia can seamlessly monitor the operational performance of customer services to show the impact of network degradation and service outages on per-contract corporate SLAs.

With NetOmnia, technicians can define SLAs based on service quality and service availability. It is also possible to define the conformance period and configurable levels for warning and violation notifications. SLA reports can be delivered to customers on a scheduled basis to provide differentiated service to improve customer retention.

In contrast to solutions that merely provide monthly SLA reports, NetOmnia provides real time reports on SLA compliance and predicts SLA violations based on current trends. Reports can be scheduled and automatically delivered to both users and end customers.

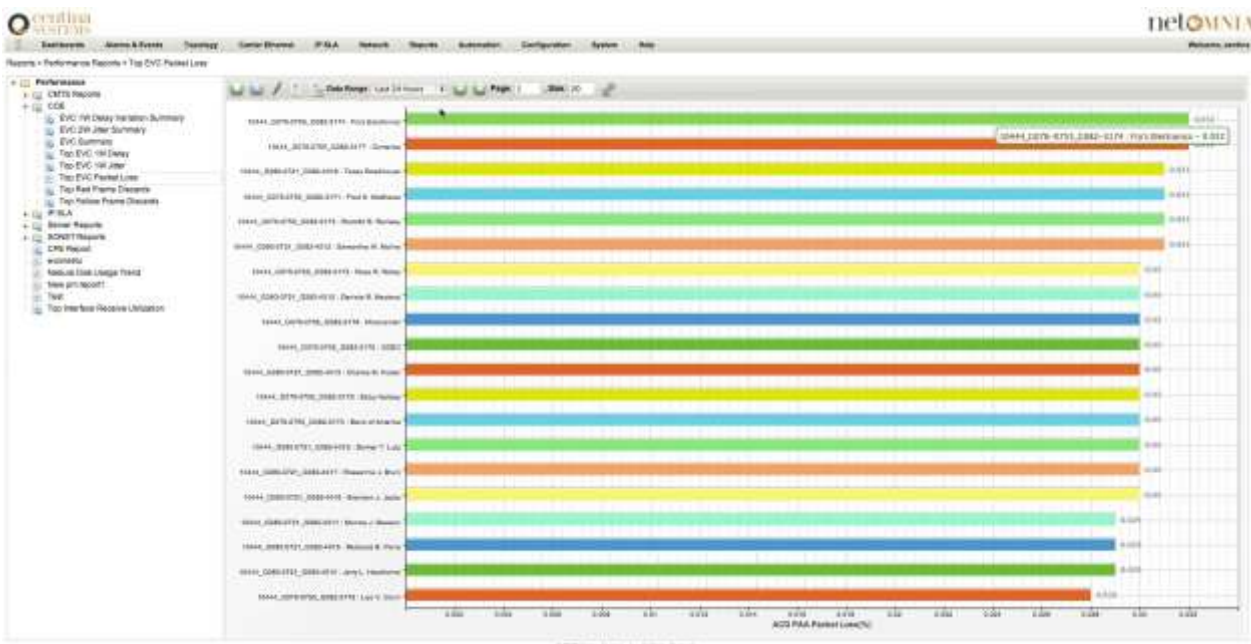
### [Innovative Performance and SLA Management](#)

NetOmnia delivers dramatic innovation that takes network performance and SLA management to the next level with true end-to-end services visibility and ease of use. This system is highly scalable and supports a distributed, high-availability cluster environment. NetOmnia takes advantage of the latest software and hardware technologies to offer you:

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- 100% Web 2.0-based architecture requiring no administration
- Easy integration with existing software systems
- Simple Web browser-based access—no Java software needed
- Full compliance with ITU-T Y.1731, IEEE 802.1ag and 802.3ah, and MEF 10.2, 15, and 17 standards
- Comprehensive discovery, mapping, and monitoring of:
  - Devices and physical ports
  - Logical interfaces, including UNIs
  - Ethernet Virtual Connections
  - Point-to-point
  - Multipoint-to-multipoint
  - Traffic profiles
    - CIR, CBS, EIR, EBS, and color
  - Testing and diagnostics
  - Customer-centric performance monitoring and SLA management
  - Customer portals available for SLA conformance reports
  - One system to monitor a multivendor hardware environment
  - Support for multiple customer networks without risk of data leakage
  - Customized reporting capabilities including key performance and key quality indicators (KPIs and KQIs)
  - Detailed metrics on key service quality parameters such as availability, delay, jitter, throughput, frame loss ratio, and packet loss
  - Deploys in days and configures in weeks, not months
  - New network devices can be added in just minutes
  - Auto-discovery of EVCs and VLANs provides out-of-box functionality
  - Multivendor support ensures seamless end-to-end service views across vendors

**NetOmnia allows users to create and run detailed summary and top-n reports**



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### Multivendor Ethernet Assurance and SLA Management

Owner	Severity	Priority	Subnetwork	Node	Cause	Description	Received time	Last received time	Source	Source Description	Additional Information
NetOmnia	High	High	ALLM	ALLM0010M1	1	Signal Loss	Tue Jan 02 15:02:53 CST 2013	Fri Jul 02 14:06:28 CST 2013	ST53-2-1	Remote Failure Indication	Signal Loss: 15.02.53 CST 2013
NetOmnia	High	High	ALLM	ALLM0010M2	1	Signal Loss	Tue Jan 02 15:02:53 CST 2013	Fri Jul 02 14:06:28 CST 2013	ST53-2-2	Remote Failure Indication	Signal Loss: 15.02.53 CST 2013
NetOmnia	High	High	ALLM	ALLM0010M3	1	Signal Loss	Tue Jan 02 15:02:53 CST 2013	Fri Jul 02 14:06:28 CST 2013	ST53-2-3	Remote Failure Indication	Signal Loss: 15.02.53 CST 2013
NetOmnia	High	High	ALLM	ALLM0010M4	1	Signal Loss	Tue Jan 02 15:02:53 CST 2013	Fri Jul 02 14:06:28 CST 2013	ST53-2-4	Remote Failure Indication	Signal Loss: 15.02.53 CST 2013
NetOmnia	High	High	ALLM	ALLM0010M5	1	Signal Loss	Tue Jan 02 15:02:53 CST 2013	Fri Jul 02 14:06:28 CST 2013	ST53-2-5	Remote Failure Indication	Signal Loss: 15.02.53 CST 2013

#### NetOmnia consolidates, filters and correlates alarms across the entire network

##### Quality Audit Services

The Fujitsu Quality Audit service is a simple and highly effective method of installation quality assurance. This service is available for installations performed by any vendor, and for both Fujitsu and non-Fujitsu equipment.

We assign certified quality engineers to visit your site and assess your completed installation, before you begin test and turn-up. These engineers comb through your site and make careful records of everything they find. Equipment, wiring, facilities and onsite installation technicians are all given a pass/fail status. In every instance where standards are not met, the Fujitsu auditors make a specific recommendation for remedial action. All findings and corrective recommendations are then delivered to you in an exhaustive audit report, including clearly labeled photographic documentation where appropriate

If your installation has been completed by another vendor, we can also issue a corrective action request to that vendor, to identify the root cause of any deficiency and eliminate it from future installations. Once all defects have been corrected, you are certified as ready to test and turn-up your new installation. As a result, you identify and remedy defects that are more costly to diagnose during testing or worse, after services have been rolled out.

A Fujitsu Quality Audit verifies that your installation is performed to Telcordia GR1275-CORE, and/or to all applicable customer-specific or equipment-specific quality standards.

The scope of the Fujitsu Quality Audit service includes:

- Bay assembly and markings
- Ironwork
- Cable racking
- Cabling
- Wiring conformity
- Fiber ducts

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- Bonding & grounding
- Power connections
- Connections
- Recordkeeping and documentation
- Staff professionalism and workmanship
- Housekeeping and cleanliness
- Environmental controls
- Others as detailed in GR-1275

No matter who installs your equipment, your business depends on it being properly installed. A day spent waiting on unexpected corrections and rework is a day spent without generating revenue. It's simple: quality is not negotiable. By choosing the Fujitsu Quality Audit service, you let us centralize all of your engineering quality function, freeing up personnel while you concentrate on running your business.

Site Grounding and Bonding Audit Service

## Assess and Minimize your Risk

The Fujitsu Site Grounding and Bonding Audit service is a flexible service that consists of a detailed inspection and assessment of the lightning exposure at sites of your choice, including cell, core and regeneration sites, as well as small central offices and switching locations. These inspections frequently reveal problems such as violations of National Electrical Code (NEC) requirements, Occupational Health and Safety Administration (OSHA) regulations, and equipment manufacturers' installation specifications. Other common problems include:

- Harmonic currents
- Load unbalance
- Loose wiring connections
- Missing surge protectors
- Improper or absent grounds
- Improperly isolated grounds

Proper installation and maintenance of power and ground at cell sites protects your revenue stream by helping to prevent equipment damage and customer service disruption from lightning and other adverse events. Careful attention to power and grounding also reduces network outages and protects the useful life of your equipment. Power problems, such as fluctuations in the voltage level, can and do adversely affect sensitive electronic systems. Revenue is lost when outages, surges, sags, objectionable currents and low voltage cause loss of data or damage to components. Proper grounding and a proper relationship between the neutral and the ground are essential, not only to meet regulatory requirements but also for optimal equipment operation and workplace safety.

## Typical Report Contents

- Power criteria and findings
- Grounding criteria and findings
- Transient criteria and findings
- Summary of findings and results
- Recommendations
- Supporting data and survey records
- Photographs

In carrying out the Fujitsu Site Grounding and Bonding Audit service, an engineer begins by studying the available documentation provided by the site equipment manufacturer, including power and grounding drawings, specifications and power quality data. The engineer then uses this information to perform a comprehensive electrical power, grounding and lightning

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protection inspection at each of the selected sites.

During the on-site inspections, the engineer gathers measurements and other data to support analysis:

- Verify proper electrical distribution wiring of the main entrance panel and subpanels
- Survey the grounding scheme for code compliance
- Check systems and equipment for compliance with accepted installation practices and manufacturer's specifications
- Measure selected impedances, voltages and currents and verify proper load balance
- View voltage wave shapes with an oscilloscope and verify significant amounts of harmonics distortion
- Survey electrical distribution and lightning protection schemes

After collecting the necessary data, the engineer performs a thorough analysis. The analysis is documented in a report detailing all findings and the root cause of those findings for each of the sites inspected. The report is issued as soon as possible after either completion of the survey or receipt of all requested data.

The report discusses any problem areas and also provides expert recommendations for correcting electrical problems and minimizing potential future damage and downtime.

Many service providers carry out this type of study after a cell-site has been damaged by lightning. Fujitsu recommends a more proactive approach, in the form of a quarterly monitoring and analysis program for a number of sites, before lightning damage disrupts service to your customers and adversely affects your business. In some cases, cell sites are subject to theft or vandalism in addition to environmental wear and tear. With regular grounding and bonding inspections by Fujitsu experts, you have the assurance that comes with thorough, regular, scheduled preventive procedures. As with all Fujitsu services, we get to know your requirements and customize the service specifically for you.

Once we have completed a Grounding and Bonding Audit, we can also help you take action. Our experts can implement the recommendations and necessary changes to protect your sites.

#### Documentation Consulting Services

Fujitsu Documentation Consulting Services support competitive, high-quality network operations with consultancy, implementation and migration services to build state-of-the-art technical documentation solutions.

Technical documentation is essential to the efficient operation of any network, and influences every aspect of ownership and operation. It is vital to recognize the crucial importance not only of your network's information repository, but also of established processes, procedures, and controls for maintaining it. However, in a competitive market and under pressure to control costs, many service providers are challenged with maintaining an appropriate standard and range of documentation. Fujitsu Documentation Consulting Services provide an answer to this challenge and support you in developing, building, and managing network planning, engineering, deployment, operation, and test documentation.

#### Experts in Technical Publishing

Fujitsu is well-known throughout the industry for commitment to best-in-class solutions in every area of our business. Our established history and high level of technical expertise has resulted in very strong customer loyalty, exemplified by our unprecedented customer retention rate. Our technical publications team is no exception; Fujitsu has the tools and experience to address the growing demand for professional and consistent documentation. As a TL-9000 certified manufacturer and service solutions provider, we have wide-ranging technical publications management expertise in-house. We can put this at your disposal to deliver precise documentation that creates a positive customer experience, improves quality, and enhances employee performance and productivity. We work in partnership with you to

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meet your unique documentation standardization needs, whether for Methods Of Procedure (MOPs), work instructions, operational maintenance guides or reference materials.

#### Documentation Consulting Services Portfolio

If you have a documentation project or requirement but are uncertain how to proceed, Fujitsu can assist you in determining where to start, what questions need to be addressed, and how to lay out a plan to get there.

Fujitsu Documentation Consulting Services include the following:

- Auditing and consultation
- Documentation foundation and architecture
- Documentation control processes
- Documentation standardization development
- Process design and implementation

#### How we solve Your Documentation Challenges

- We develop and implement cost-effective processes for creating all kinds of technical documentation.
- We can evaluate the effectiveness of your existing documentation development team and resources.
- We help you determine if and how documentation projects should be implemented.
- We evaluate and recommend authoring tools, document control systems, and data repositories.
- We determine the best approach to content development for a variety of outputs, such as end-user documentation, online help, and operational procedures.
- We determine the most effective way for the user community to access the documentation they need.

#### Documentation Foundation Service

Documentation comes in a variety of formats and the potential volume and structure of content is diverse. It is critical to provide clear and concise information in a format that is consistent. Fujitsu helps you meet this need with our Documentation Foundation Service, which provides a structured and consistent documentation solution. The Documentation Foundation Service covers all the essentials of developing, implementing, and migrating a technical publications library.

The Documentation Foundation Service incorporates the following:

- Template creation
- Documentation style guide
- Documentation work instructions
- Documentation migration service

#### Template Creation

The primary purposes of template use are to maintain a clean, consistent look throughout all documents of a given type, and to reduce the labor involved in creating and updating content. A well-constructed template set ensures that all documentation follows a particular structure, layout, and style. Templates save time and provide a general outline of information to be included. This helps to confirm that all pertinent data are present, and that all documents created from that template are accurate and functional.

The following are just a few examples of the numerous document types for which templates can be developed:

- Work instructions

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- MOPs
- Operations maintenance guides
- Product description documents
- Product deployment guide
- Lab entrance criteria checklist
- Document change request form

Templates provide ease of use when creating, revising, and/or approving documentation. Rather than developing a new document from scratch each time content needs to be updated, a template standardizes the work effort, improves efficiency, and enhances future document creation. In addition, templates reinforce the styles and format presented in the documentation style guide.

**Documentation Style Guide**

The purpose of a documentation style guide is to convey precise standards on document structure, appropriate language, and format. Style guides contain editorial guidance that is specific to an industry, company, and sometimes, a given department. To establish a corporate identity, Fujitsu offers a Documentation Style Guide service. The deliverable for this service is a comprehensive style guide that establishes the following:

- Word choice parameters to ensure all documentation is written in approved, appropriate language.
- Grammar and punctuation conventions that are to be used properly throughout all documentation and procedures.
- Format and style standardization of fonts, sizes, margins, logo, and other visual and editorial aspects, to create a universal look for all documentation.
- Consistent document naming and numbering conventions, including documentation type, name, and version.
- Proprietary information that is up to date, relevant, and universal.
- Document revision history, which details the document's status, purpose, and specific updates that have been made
- Signoff authorization to ensure all documentation updates are accurately recorded and approved

**Documentation Work Instructions**

Documentation work instructions are essential tools that provide explicit details for use in documentation authoring. To establish controlled and efficient work processes and procedures, work instructions provide guidance for generating documents for each document type. Fujitsu can provide a complete solution to procedural management and documentation by identifying specific prerequisites, step-by-step instructions, and preferred outcomes.

**Documentation Migration Service**

Documentation migration allows you to present existing content in a new format using standard templates. The migration could be a conversion of file types or source files to a standard format. Fujitsu can develop a detailed plan to convert your existing material into newly developed templates while applying style guides to deliver professional polished material.

**Documentation Control Services**

Fujitsu offers the creation of a document management solution that enforces change control best practices for all documents and forms used by internal departments. By implementing a document control solution, you ensure that only correct and valid documents and forms are in use; that revisions are a matter of record; and that document creation, revision, and review cycles follow a predetermined lifecycle. A Document Control solution could include a Content Management System (CMS) that provides information regarding document change history, approvals, and distribution lists. This information is be readily available for review and ensures full process compliance. A CMS-based solution also enhances the documentation

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user community's ability to find and access information, through improved document search capabilities

Disaster Recovery

The Fujitsu Network Operations Center deploys multiple areas of redundancies for servers, EMS applications, and customer network access with dual carriers connected through dual gateways and geographic locations between Richardson, TX and the Fujitsu office located in Sunnyvale, CA. Each location deploys the servers, the EMS applications and Frame Relay connections to the customer's networks.

In the event of a disaster (fire, flood, tornado, etc...) within the primary NOC location (Richardson, TX), recovery operations will be initiated. Personnel at the secondary location in Sunnyvale, CA will be contacted to monitor the managed networks while the specially assigned Richardson NOC engineers are contacted or dispatched to their home office locations. All specially assigned engineers are equipped with broadband circuits, NOC computers with client access via a VPN connection into the Sunnyvale, CA or Richardson, TX locations and a secondary computer for logging Customer Support Records (CSR), looking up documentation and email access. All NOC engineers' home offices are also equipped with multi-line VoIP phones. The NOC 800 phone numbers are also diverted to a backup PBX in the Fujitsu Pearl River, New York office for receiving customer phone calls.

If the Technical Assistance Center (TAC) facility is uninhabitable or if the TAC facility is inhabitable, but the FNC Richardson computer system, or phone system, is inoperable, the Technical Assistance Center Manager will assign Technical Support Engineers (TSEs) to work from their homes by dialling into the TAC ACD system remotely using Teltone devices installed specifically for this purpose.

Sample Integration Support Services

Due to the size of the sample Integration and Support Services document, FNC has provided this comprehensive service offering overview as an attachment.

- Implementation Services
  - Includes, but not limited to, basic installation and configuration or end-to-end integration and deployment.

**FNC Response:**ImplementationCritical Path

It is through the careful and deliberate analysis of project constraints, deliverables and scheduling that businesses in today's dynamic marketplace maintain a level of success. FNC's Program Management will follow each project throughout the critical path outlined below, allowing for optimum and effective use of customer time and resources.

The key benchmarks are as follows:

- Sales Order - Receipt of approved order begins authorized activities. Resources are allocated and final planning completed based on customer desired end date.
- Project Plan Released - All Departments (Team Members) are provided the Master Project Plan.
- Site Surveys Completed - Site specific information is gathered and recorded in a formal document.
- Release BOM - Order all Installation Material
- Complete Engineering Specifications - Engineering specifications of how the product/site is to be configured and installed.
- Staging – Electronics and Installation Material are packaged for shipment.
- MOP Meeting - Method of Procedure meeting. FNC provides documentation on how work will be performed, and any potential service interruptions rectified.

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- Start and Complete Installation - Defines the start and stop dates for specific milestones.
- Audits - FNC performs random Quality Audits to ensure quality installation procedures are being followed.
- Complete As-Built - Updates the drawings and records to reflect the completed installation.
- Turn Over - FNC provides formal agreed upon documentation for job completion.
- Delivery of FNC Test Plan results to the customer

Project Plan Development

The FNC Program Manager (PM) will provide the Customer and all FNC team members with a "Master Project Plan". The PM will provide all members of the Project Team with the following uniform information contained within the Master Project Plan:

Project Purpose	- What is the objective to be achieved?
Project Scope	How are we to achieve the project objective? What are the responsibilities of the various team members?
Project Resources	- Where can one find project information? - Who is on the project team?
Project's Schedule	In what order are project activities to be completed? When are each team member's deliverables due? When would a team member be receiving their needed information/materials requirements? When would a team member start their work? Is the project ready for a team member to begin their work?

Project Schedules

The purpose of the project's schedule section is to provide the Customer, and all members of the Project Team with site-specific benchmarks. Project Schedules will be developed by the Program Manager in Microsoft Project and/or Microsoft Excel. All Projects will track the following:

- Initial Project Activities
- Site Location/Ship Address
- Configuration(s)
- Engineering Activities
- Procurement and Logistics
- Staging Activities
- Site Preparations
- Installation Start/Finish
- % Complete for Installation & Testing
- Quality Audit(s)
- Testing/Turn up Activities
- Site Turnover

All Project Schedules will be updated on a real time basis, and reported back to the Customer.

**WSCA-NASPO Data Communications Services Solicitation # JP14001**Project Notebook

A Project Notebook will be compiled and maintained for each site location. The Notebook includes, but is not limited to the following documents:

- Project Plan
- Project Schedule
- Equipment Order/Sales Order
- Site Survey
- Engineering Specification
- Turnover Documents
- Notes/Miscellaneous

Project Management Meetings

FNC Program Management will facilitate regular program meetings with the State along with key FNC departmental resources. The FNC Program Manager will hold this meeting to report project status. Additionally, issues, concerns, as well as receivables and deliverables related to the Project will be tracked. An Action Item Register will be developed and maintained to track all Action Items resulting from the meeting and/or Project Deployment. The weekly meeting will usually be held with Project Team members dialing in on a Conference Bridge Number.

The Program Manager will provide a telephone number that will be used by FNC, and the Customer team members to escalate any problem in the field, as well as provide immediate response to Installation and Test personnel. The assigned telephone number will allow any Site Survey Engineer, Installer, and Tester with issues regarding; Material Shortages, Engineering, Shipping, Scheduling, or Logistics, to have direct access to the respective Prime.

Furthermore, FNC will provide the Customer with a copy of the Installation Percentage Guideline Table, which lists benchmarks for Installation percent completion. This allows all parties tracking the installation, to have an accurate view of the work completed and required.

Program Management Inter-Departmental Role and Responsibility

Program Management is responsible for planning, coordination, scheduling, and reporting the Network Deployment and post installation support services. Program Management will provide each team with a detailed schedule of receivables and deliverables pertinent to their respective department. These schedules will provide each department with specific dates and milestones for successful deployment of the network. Program Management will provide coordination of activities, and scheduled deployment for the following FNC functions:

- Product Warehouse
- Engineering
- Logistics
- Staging
- Quality
- Installation
- Testing
- Operations Support
- Business Systems

The FNC Program Manager will provide project management support for the life of the contract and will provide the Customer with a single point of contact throughout the EFI&T activities.

**WSCA-NASPO Data Communications Services Solicitation # JP14001****EF&I T&T Services**

FNC offers a comprehensive suite of engineering, furnishing and installation, test and turn-up services that are available as a packaged request, as value-added optional services, as an Original Equipment Manufacturer (OEM) solution or as a customized option to meet your specifications.

Our EF&I services ensure that your network is deployed quickly and at optimal performance, to help you manage the momentum of technology while minimizing the challenges. Through our comprehensive and flexible approach we will locate the appropriate resources and equipment and install the network according to your exact specifications, all within the required timeframe.

**Detail Engineering Services:**

Includes:

- Site Survey  
Performing an inspection of the customer site to determine engineering, installation and implementation requirements
- Installation specification  
Developing a general job summary technical reference, work items, installer notes, installer cable running list & summary of materials and drawings
- Bill of Materials  
Generating a list of specific types and quantities of direct materials required to install the project

**Installation Services:**

Includes (as applicable):

- Unpacking and racking vendor's equipment
- Integrating pre-configured racks or cabinets
- Pulling signal, power, or fiber cable from rack to termination point
- Installing specialized telecommunication materials and components.

**Logistics Services:**

Logistics provides the supply chain necessary for the complete, on-time delivery of quality materials in support of FNC's network installation projects for your company. FNC, teaming with strategic partners, has established centers to provide coverage throughout the US.

Services include:

- Central point of contact
- Strategic kit management
- Materials management
- Consignment stock management
- Reduction of administrative cost
- Transportation management

**Commissioning Plan**

FNC commissions a node or a network through a series of steps that can be tailored around Customer's requirements. The following activities all fall under Commissioning:

- Turn-up – the preliminary actions, checks and test performed on a system prior to powering it up and loading the software.
- Node Level Test – a series of actions and tests to confirm the node is operational and ready to be provisioned for traffic.

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- Span Level Test – a series of actions and tests to confirm that the node is able to communicate to the last point wired
- Network Level Test – a series of actions and tests to integrate multiple nodes into a network and confirm the network's performance.
- Customized Test and Services – this may include additional tests, circuit and network provisioning, circuit or network migrations, SAT Testing or any other services as agreed with the customer.

These services can be extended to SONET, Packet, WDM or hybrid networks as required.

Commissioning will take place when all equipment has been installed.

The tasks are broken down into the following:

#### FNC Equipment Node Turn-up

Requirements:

- All installation activities will be complete and nodes (network elements) will be ready for testing.
- Customer specific configurations will be defined.

FNC Technical support engineers will perform the following test elements at the node level:

- Check installation including primary and secondary power and ground. Check voltage levels. Check all cable connections as appropriate.
- Unpack and check common cards, clean optical interfaces and position in appropriate slots.
- Sequence up the power and initiate the software load.
- Confirm operation of common equipment and enter basic element provisioning.

#### FNC Equipment Node Test

- Slot and provision service interface cards as defined for the node. Install and clean small form factor modules as required.
- Perform loopback testing on all populated slots.
- Verify connection to and communication with the network operations center and confirm alarm reporting if facilities exist.
- Measure and set optical levels to connect the node to the network as defined in the scope of work for the project.

#### FNC Equipment Span Test

Requirements:

30 days prior to span turn-up and testing being performed:

- Fiber segment loss budgets will be within engineering and FNC guidelines.
- FNC equipment span origination and destination points will be defined.
- All span hardware will be in place.
- Customer specific configurations will be defined.
- Fiber plans will be made available.
- Site locations will be defined. If there is no street address, exact GPS coordinates will be used.

FNC Technical support engineers will perform the following test elements for each span in the lineup:

- Slot Cards
- Provision the equipment

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- Perform Voltage testing
- Perform Troubleshooting
- Work with NOC for alarm testing
- Perform x hr BER Test - y hr working path and y hr on the populated portion of the protect path (duration is customer defined)
- Perform Continuity Testing \* NOTE: Continuity test is from the last point wired and back
- Perform segment span testing

Acceptance test of the Span will be performed per FNC's applicable MOPs.

**FNC Equipment Network Testing**

Network testing extends the turn up and test of each node with the integration of nodes to form a network. This includes simple two nodes point-to-point spans or complex networks composed of multiple interconnected rings.

Requirements:

30 days prior to any turn-up and testing being performed in the field:

- Customer specific configurations are defined.
- Fiber plans are made available.
- Site locations are defined. If there is no street address, exact GPS coordinates will be used.
- FNC Technical support engineers will perform the following test elements for each span in the lineup:
- Perform all node level turn up and test described previously.
- Provision nodes to interconnect interfaces around the network. (This will follow Customer's traffic patterns if known and is not intended to include every possible combination across the network.)
- Perform x hour BER test – y hours on the populated portions of both the "working" path and the "protect" path (duration defined by customer)
- Trouble-shoot any issues until test meets the performance characteristics engineered for the network.

Test and acceptance paperwork will be provided after project completion.

- Optimization
  - Includes, but not limited to, assessing operational environment readiness, identify ways to increase efficiencies throughout the network, and optimize Customer's infrastructure, applications and service management.

**FNC Response:****Central Office (CO) Modernization**

Meeting subscribers' expectations and retaining their loyalty are key challenges in a competitive telecommunications industry. Your ability to meet these challenges may be limited by an outdated, expensive network that was not designed for today's technology and business environment.

**Revitalize Your Network**

The Fujitsu Central Office (CO) Modernization service draws upon our extensive expertise in both legacy and next- generation environments. If you find yourself with power-hungry legacy equipment and sub-optimal circuit plans, we can help you simplify and streamline your network infrastructure. CO Modernization provides a complete, start-to-finish implementation path to increase scalability and improve network performance.

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Boost Your Competitive Position

With the support of our CO Modernization service, you can build competitive strength, flexibility and longevity into your network. It's a fact that older network infrastructure generates less revenue per square foot than up-to-date technology. Costly power bills, high failure rates, unused bandwidth and wasted capital all erode the health of your business. Overstretched equipment limits your ability to respond to customer demands, reducing business opportunities and potential.

With the Fujitsu CO Modernization service, you can renovate your network to achieve important business benefits:

- Improve reliability
- Optimize performance
- Cut power consumption
- Reduce physical footprints
- Eliminate stranded bandwidth
- Economize on operations
- Control capital spending

Fujitsu CO Modernization keeps you in control. The service consists of three phases, each of which concludes with specific deliverables that require customer approval before proceeding to the next step. A dedicated Fujitsu program manager oversees the project from beginning to end. From initial inventories to final cut-over, you'll have seamless, dependable support and proactive communication.

Three Phases—Discover, Analyze, Implement

**Phase 1: Discovery** – Fujitsu personnel assess the network equipment and infrastructure, both electronically and via on-site physical audit. During this phase, technicians prepare an exhaustive report containing meticulously validated data. This identifies discrepancies and provides a basis for accurate network analysis.

**Phase 2: Analysis** – The Fujitsu technical team analyzes the current state of the network, using the data retrieved during the Discovery phase. The team works with you to develop necessary plans of action, such as a migration plan, detailed implementation schedule and Methods of Procedure (MOPs) to optimize equipment and facilities utilization, based on data from audit results.

**Phase 3: Implementation** – The final phase is to perform the implementation tasks that result from the Analysis phase. We pre-provision, migrate and test circuits that reside on legacy equipment to new platforms, as defined in the migration plan. After a stabilization period, a full quality audit is performed before we turn-up, test and roll traffic.

**Meet Current and Future Demand**

Project Phase	Deliverables
Discovery	Physical Inventory Power availability Floor space availability Equipment types and locations Optical demarcations Electrical demarcations Virtual inventory Provisioning Software revisions Databases

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	Circuit utilization Network topology End-to-end circuit connectivity Implementation plan
<b>Analysis</b>	Detailed methods of procedure Migrations Optimization of existing circuits Quantification of capacity and real estate savings Engineering package Network diagrams Circuit provisioning
<b>Implementation</b>	Ongoing status reports Weekly status Audit progress Capacity recovery Project Engineering package including: As-built diagrams Circuit maps Detailed network change report Detailed floor space and capacity recovery report

**OSS Readiness Assessment**

Evaluate and document OSS readiness by leveraging its knowledge of operational support systems architecture, design, and deployment in a converged technology environment with outstanding industry OSS knowledge and expertise in the following support areas.

- Inventory control/management systems
- Customer care technologies, including self-care
- Customer account management applications in converged environments
- Monitoring/measuring application software for eHealth
- Service assurance/service provisioning from the EML to the BML layers
- Customer and service activation capabilities, including web-based technologies
- IP, Video, Data convergence billing, including electronic delivery methodologies
- Reporting applications for monitoring, settlements, revenue reporting, network health
- NOC/VOC software identification and deployment

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### Knowledge Planning and Transfer

Support will encompass knowledge transfer of solution architecture and experiences to implementation teams. This transfer will comprise delivering technical expertise in matters of «Solution» OSSs, integrating legacy and new OSSs, supporting architecture and development, and strategies for successful deployment of the solution. These services will culminate in a fully documented OSS Plan that will contain the following:

- Description of «Solution» EMSs and their respective interfaces to The State of Utah's OSSs in the support areas previously mentioned
- Gap Analyses between current and planned OSSs to validate interface requirements versus available interface capabilities
- Recommendations for mitigation and alternative approaches to OSS integration
- Data mapping of «Solution» APIs and other interfaces to supporting OSSs
- Validation of functionality of APIs to ensure completeness and accuracy of API documentation
- Creation of data dictionary specific to OSS interface requirements

### OSS Selection

In addition to assisting with NOC/VOC software selection, Fujitsu will take a vendor-neutral approach in assisting in identifying the best OSS (BSS/OSS/EMS) solutions for the customer's networks. Fujitsu's world-wide expertise enables us to present and deliver the best solution for The State of Utah's network.

### Data Population and Migration

One of the most daunting tasks is data population and migration into new OSSs. Fujitsu can bring value-added services to The State of Utah by taking this responsibility, enabling The State of Utah to focus on its core competencies as Fujitsu applies its knowledge resources of OSSs to bring systems online efficiently and economically.

- Remote Management Services
  - Includes, but not limited to, continuous monitoring, incident management, problem management, change management, and utilization and performance reporting that may be on a subscription basis.

### FNC Response:

#### NETSMART 500

#### Powerful Turn-up and Provisioning

NETSMART® 500 application software is a powerful Windows®-based craft interface tool which supports the next-generation Fujitsu FLASHWAVE® product line and locally manages all FLASHWAVE Network Elements (NEs). It boasts a powerful Graphical User Interface (GUI) which makes provisioning, maintenance and troubleshooting a simple and efficient process. The NETSMART 500 software supports graphical shelf views, equipment and facility provisioning, alarm surveillance, Software Download (SWDL), **Remote Memory Backup (RMBU) and Remote Memory Restore (RMR) capabilities** and cross-connect provisioning. In addition, NETSMART 500 offers tools to simplify provisioning and troubleshooting for a Fujitsu DWDM system.

Key features are:

- Point-and-click GUI
- NE-based provisioning and SWDL tools

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- Intelligent provisioning checklist
- Local or remote management
- Topology discovery and auto-routed A to Z circuit provisioning for DWDM

The NETSMART 500 software allows support personnel to provision, maintain and upgrade Fujitsu powered networks without the need for TL1 knowledge. It is supported on any Windows-based laptop or desktop, connecting to the network elements via an Ethernet Local Area Network (LAN) cable or RS-232 serial cable to an NE.

**Ease-of-Use Boosts Employee Productivity**

The NETSMART 500 software is easy to learn and use. The software uses common operations dialogs, making provisioning different products and types of services easy and consistent. Services, alarms states, work and protect cards are illustrated with colors and icons. This consistency translates to lower operational costs and a minimal learning curve when introducing new technologies or NEs. By using the NETSMART 500 software at a centralized location, you can **remotely troubleshoot** issues which greatly reduce the need for costly truck rolls.

The NETSMART 500 software offers an intelligent provisioning checklist, guiding the user through many operations. A checklist is provided showing the preconditions that must be met before an operation can be performed. This function prevents the user from sending commands that will be denied by the NE.

**Simplified DWDM Management**

The NETSMART 500 software offers several unique features that simplify NE operations. The DWDM service-provisioning tool helps users turn up a service and performs the required individual steps automatically. The software automatically provisions the service facilities, protection and cross-connections to completely provide the service. Another advanced tool is the A to Z Provisioning Wizard, which utilizes control-plane technology to provision DWDM circuits from end to end.

**Simple Updates for Software and Database Management**

The NETSMART 500 interface offers an easy way to update and manage NE software using a wizard-based Q&A approach. It additionally provides extensive feedback on the progress of the SWDL process, including detailed information about operation failures, to facilitate rapid troubleshooting.

This approach enables the user to perform RMBU and RMR operations on the NE. The backups can be used for disaster recovery if the NE is destroyed or disabled. Also RNR can be used to clone new elements with configurations that are identical to the original.

**Flexible Solutions for Optimal Network Growth**

The NETSMART 500 software provides a natural progression for customers to move up through the NETSMART portfolio of products. You can start with the NETSMART 500 software at the craft level for monitoring and managing up to 16 NEs.

As you network grows, you can migrate to a NETSMART 1500 small server, which supports up to 100 NEs, then progress to larger system configurations as your network evolves. The NETSMART 1500 Element Management System (EMS) ultimately offers a large network management configuration with proven scalability up to 8000 NEs. With a common look and feel across the Fujitsu craft and EMS platforms, field technicians can communicate more effectively with centralized Network Operations Center (NOC) personnel.

- Consulting/Advisory Services
  - Includes, but not limited to, assessing the availability, reliability, security and performance of Customer's existing solutions.

**WSCA-NASPO Data Communications Services Solicitation # JP14001****FNC Response:**Documentation Consulting Services

Fujitsu Documentation Consulting Services support competitive, high-quality network operations with consultancy, implementation and migration services to build state-of-the-art technical documentation solutions.

Technical documentation is essential to the efficient operation of any network, and influences every aspect of ownership and operation. It is vital to recognize the crucial importance not only of your network's information repository, but also of established processes, procedures, and controls for maintaining it. However, in a competitive market and under pressure to control costs, many service providers are challenged with maintaining an appropriate standard and range of documentation. Fujitsu Documentation Consulting Services provide an answer to this challenge and support you in developing, building, and managing network planning, engineering, deployment, operation, and test documentation.

Upon contract award FNC would welcome the opportunity to discuss consultation and advisory services with the State of Utah to clearly understand their requirements.

- Data Communications Architectural Design Services
  - Developing architectural strategies and roadmaps for transforming Customer's existing network architecture and operations management.

**FNC Response:**

Please refer to the Network Design Service overview above.

- Statement of Work (SOW) Services
  - Customer-specific tasks to be accomplished and/or services to be delivered based on Customer's business and technical requirements.

**FNC Response:**Experts in Technical Publishing

Fujitsu is well-known throughout the industry for commitment to best-in-class solutions in every area of our business. Our established history and high level of technical expertise has resulted in very strong customer loyalty, exemplified by our unprecedented customer retention rate. Our technical publications team is no exception; Fujitsu has the tools and experience to address the growing demand for professional and consistent documentation. As a TL-9000 certified manufacturer and service solutions provider, we have wide-ranging technical publications management expertise in-house. We can put this at your disposal to deliver precise documentation that creates a positive customer experience, improves quality, and enhances employee performance and productivity. We work in partnership with you to meet your unique documentation standardization needs, whether for Methods of Procedure (MOPs), work instructions, operational maintenance guides or reference materials.

Upon contract award FNC will develop a mutually agreed upon statement of work (i.e. work instructions) clearly detailing the responsibilities of both parties.

**Additional Value Added Services Currently Available for The State of Utah's consideration****FNC Response:**Access Integration Service

Communications networks that serve utilities providers must be highly reliable, fault-tolerant, scalable and flexible. Achieving this goal makes it critical to partner with the right network solution provider. With the current industry focus on advanced metering technologies, we developed the Fujitsu Access Integration

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service to address your access technology needs. Based on our experience with utility clients, this service offers a special set of skills, fielded by expert network engineers.

Fujitsu knows how to build the kind of efficient, failsafe network that can serve the increasing diversity of communications needs facing today's utilities. We focus on your access technologies and design a standards-based, interoperable network architected specifically to support your smart grid infrastructure and future applications needs.

As your trusted business partner, we can ensure that your network is outfitted for the challenges of maintaining the world's most reliable electrical grid. With our expert support, your communications infrastructure will be prepared to support such challenges as securing generation and distribution against threats, anticipating a future with flexible demand management, and alternative source generation capabilities.

### Meeting the Challenge of the Multirate Access Network

Typically, critical data is transported using a SONET backbone, fed by an assortment of multirate, multivendor access devices. Access elements range through voice, FAX, ISDN, SCADA, Multiple Address Systems (MAS), and emerging smart grid platforms such as Distributed Management Systems (DMS). For some years to come, utilities providers will support legacy technologies (such as TDM), as they simultaneously upgrade to deliver new services, such as Carrier Ethernet and Connection-Oriented Ethernet, over fiber-optic media.

### Dependable, Thorough Implementation Services

A truly integrated network requires more than designing a network on paper and hoping it works. A high quality result demands a comprehensive, end-to-end approach coupled with centralized program management. At Fujitsu, we make a practical commitment to this integrated view by providing a dedicated Project Manager (PM) for each engagement, no matter the size. The PM coordinates all aspects of the project from the outset, including equipment sourcing and delivery as well as installation. Ongoing maintenance and project budgeting are also managed by your PM. As a result, you have the assurance of a single, dependable customer contact throughout the duration of your access network integration project.

### Support Throughout your Network's Lifecycle

For the communications networks on which your business depends, it's essential to choose a support vendor with intelligence, experience and a reputation for quality. Fujitsu has extensive expertise with ongoing maintenance. We're committed to ensuring the highest standards of reliability throughout the lifespan of your network. A Fujitsu service support package with a single point of contact can provide added peace of mind and assurance that your network will always function at peak performance.

## Fiber Characterization

### Service Description

The Fiber Characterization Service provided by Fujitsu Network Communications (FNC) is an essential service to protect customer's future network investment by determining whether or not the embedded fiber performance will adhere to the engineering specifications and support the current or desired network applications requirements in terms of throughput, bandwidth and reliability.

Fiber performance is critical for any customer considering deployment of a DWDM or high-bandwidth optical carrier rate network (OC-x or Ethernet). Fiber Characterization enables proactive identification of problems before engineering or turn-up activities are scheduled and provide a baseline for growth into the future.

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The Fiber Characterization service can also be used to support:

- Broader wavelength ranges
- High-speed network applications
- New system selection or specification
- Component Quality Checks
- Dark Fiber Deals
- Mergers & Acquisitions

FNC's Fiber Characterization service consists of fiber performance testing, analysis of the measurements to identify and isolate potential faults and/or incompatibilities with engineering specifications or network applications requirements, customer notification of findings, as well as comprehensive recommendations to the customer regarding corrective actions and next steps to be taken in order to improve fiber performance.

The service outcome will be qualification of the customer fiber network as being "DWDM ready", or else recommend corrective actions to improve fiber performance.

Deliverables

Upon receipt of Customer's order, FNC shall provide the following deliverables:

Fiber Testing

This deliverable consists of the following testing measurements:

- Bi-directional OTDR (Optical Time Domain Reflectometer) at 1550nm and 1625nm
- Bi-directional Optical Insertion Loss (OIL) readings at 1310nm, 1550nm and 1625nm
- Bi-directional Optical Return Loss (ORL) readings at 1550nm
- Chromatic Dispersion (CD) readings from 1520nm to 1620nm
- Polarization Mode Dispersion (PMD) readings at 1550nm

Advanced and/or multiple testing can be performed in order to identify, isolate and determine the root cause of fiber span problems, to support the Fiber Analysis deliverable below.

Fiber Analysis

This deliverable consists of the following activities:

- Measurements Validation  
The fiber testing results are compared against engineering specification thresholds and/or network applications requirements, to determine whether they pass or fail.
- Fault Identification  
Additional testing and engineering analysis is used to determine the type of fault that is causing a particular measurement to fail.
- Fault Isolation  
Advanced testing and engineering analysis is used to determine the location of the fault in the fiber span.
- Fault Cause Analysis  
Engineering analysis is used to determine the root cause(s) of the fault in the fiber span.
- Corrective Actions Identification

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Engineering analysis is used to determine appropriate corrective actions that would address the fiber fault and/or failed measurement.

#### Component Quality Checks

Component quality checks and corrective actions such as visual inspections, cleaning connectors, patch panel bulkhead adapters and fiber end-faces, are also included in this service and will be performed on the spot by FNC. All other corrective actions and quality checks will be properly captured as recommendations in the Results & Recommendations Report provided to the customer.

#### Customer Notification

The customer will be immediately notified (by the FNC Technical Support Engineer and Project Manager) of the following:

- Any conditions preventing the test measurements to take place (e.g. no test light passing through the span, etc.).
- Failed measurements that cannot be addressed by the simple cleaning and quality checks included in this service. This would give customer an opportunity to address maybe some of these issues immediately, or assign another fiber. FNC can re-test (one time only –“before and after” snapshot) and potentially pass these measurements while still working on the site.

#### Results and Recommendations Report

All the test procedures and measurements performed, the engineering validation criteria, the faults, their locations and causes, recommended corrective actions, as well as any relevant supporting data (e.g. screen captures, equipment calibration records, etc.), will be assembled into a comprehensive report and sent to the customer after the project completion. The outcome of the report will be qualification of the customer fiber network as being “DWDM ready”, or else recommend corrective actions to improve fiber performance.

#### Formal Report Delivery

Upon customer confirmation of receipt of the Results & Recommendations Report, the FNC Project Manager will schedule a 1 hour conference call with the customer, during which an FNC resource will explain in detail and walk the Customer through the report, its findings, recommendations, etc., while ensuring the report is properly understood, and giving an opportunity to the customer to ask questions and get answers.

#### Program Management

FNC will assign a Project Manager as a single point of contact with the Customer during the project. The Project Manager serves as the central communications center for all project activities and resources, and is engaged throughout the project lifecycle. The PM will have a clear understanding of project goals, objectives, and milestones. Throughout the process, the PM will regularly communicate status updates, as defined in the project communication plan.

#### Service Prerequisites

In order for FNC to perform this service effectively and efficiently, the following prerequisites are required prior to field deployment:

- The fiber should be dark fiber, or FNC will make arrangements with the Customer to switch all live traffic off the fiber during the tests. The Fiber Characterization service cannot be performed on live fiber.
- All glass-through sites within the span should be patched prior to the start of tests.
- Secure physical access to fiber sites.

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- The following information should be provided: contact names and phone numbers, site addresses, fiber identification, port assignments, initial meeting time and location for the first day, escalation name and phone number.
- Method of Procedure (MOP) should be provided by the customer if required, or otherwise make specific arrangements with the FNC Project Manager.
- A lead time of (minimum) 2 weeks is required for the delivery of this service

Roles and Responsibilities

The table below details the anticipated roles and responsibilities during the project. FNC and Customer will review and discuss the roles and responsibilities and will agree to the final version prior to project launch.

Role and Responsibility	Customer	FNC
Designate the spans to be tested	X	
Migration of live traffic from fibers, as applicable	X	
Ensure service pre-requisites are met before project starts	X	
Service deliverables execution		X
Visual inspections, cleaning connectors, patch panel adapters and fiber end faces		X
Other fiber troubleshooting (e.g. replace splices, install fiber jumpers, splice fiber, etc.)	X	
Provide physical access to facilities, escorts if needed, etc.	X	X
Program Management (also single point of contact)		X
Acceptance	X	X

Assumptions

**Prerequisites:** Service pre-requisites are met before project can start

**Lead Time:** A lead time of (minimum) 2 weeks is allowed prior to starting the service. Rush service is available also for an additional fee.

**Test Equipment, PC, and Tools:** FNC will provide required testing instrumentation, tools and PC

**Work Hours:** FNC resources will work business days only, according to customer's local time; no overtime is included. During longer projects, FNC resources are flown home and back to the project every other weekend, and this is included in the price provided. Tests performed in maintenance windows will be quoted separately.

**Work Flow:** FNC will execute the fiber characterization service on a span-by-span, market-by-market basis. All glass-through sites within the span are patched prior to the start of test.

**Travel and Living expenses:** Travel and living expenses are included in the price provided.

**Job Change Order:** Any changes to the scope of the project requirements could result in a Change Notice (CN) and additional charges may apply.

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**Network and Traffic Migrations\*:** Network and traffic migrations for the purpose of fiber characterization.

**Fiber Troubleshooting:** Cutting/replacing/splicing fiber, as well as any outside plant troubleshooting.

**Training\*:** Informal, on-the-job, or formal FNC training.

**Extensive Re-Testing\*:** Any re-testing required beyond the initial testing plus a one-time re-testing after corrective action has been taken by the customer while FNC engineers are still on the site requiring re-testing ("before and after" snapshots are included in the current price).

**Customer Delays:** Any customer-caused delays or out-of-scope work will be billed at higher rates.

**Unusual Access/Delivery:** Unusual delivery conditions (e.g. special permits, etc.) and working site not accessible by normal methods of over-the-road transport will require additional funding.

\* All services above are available from FNC for an extra fee. FNC recommends that overall customer project delivery can be streamlined significantly if FNC is also awarded these additional services at the same time with the Fiber Characterization service.

Logistics Services:

Logistics provides the supply chain necessary for the complete, on-time delivery of quality materials in support of FNC's network installation projects for your company. FNC, teaming with strategic partners, has established centers to provide coverage throughout the US.

Services include:

- Central point of contact
- Strategic kit management
- Materials management
- Consignment stock management
- Reduction of administrative cost
- Transportation management

Knowledge and Expertise to Meet your Exact Needs

With technical expertise and resources that span North America and quality that meets the strict requirements of the RBOCS, we are equipped with a full range of services to rapidly deploy your network for improved time-to-market and guaranteed performance and support.

Disaster Recovery for NOC and TAC

**NOC:** The Fujitsu Network Operations Center deploys multiple areas of redundancies for servers, EMS applications, and customer network access with dual carriers connected through dual gateways and geographic locations between Richardson, TX and a co-location facility in Houston, TX. Each location deploys the servers, the EMS applications and MPLS or Secure VPN connections to customers' networks.

In the event of a disaster (fire, flood, tornado, etc...) within the Richardson, TX NOC location recovery operations will be initiated. Richardson backup personnel are contacted or dispatched to their home office locations. . All specially assigned engineers are equipped with broadband circuits, NOC computers with client access via a VPN connection into the primary or secondary locations and a secondary computer for logging Customer Support Records (CSR), looking up documentation

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and email access. All NOC engineers' home offices are also equipped with multi-line VoIP phones. The NOC 800 phone numbers are also diverted to a backup PBX in the Fujitsu Pearl River, New York office for receiving customer phone calls.

**TAC:** If the Technical Assistance Center (TAC) facility is uninhabitable or if the TAC facility is inhabitable, but the FNC Richardson computer system, or phone system, is inoperable, the Technical Assistance Center Manager will assign Technical Support Engineers (TSEs) to work from their homes by dialing into the TAC ACD system in the Fujitsu Pearl River, New York office..

**Fujitsu Hosted Element Management System**

Fujitsu Hosted EMS enables you to realize the network management benefits of NETSMART 1500 EMS, at a price that fits the size of your network. Hosted EMS relieves you of the need to purchase, administer and maintain your own EMS and server. If you operate Fujitsu hardware and want to manage your own network without the cost and bother of the accompanying IT infrastructure, Hosted EMS is the right choice for you.

The Hosted EMS solution, owned and administered at Fujitsu, provides an element management client for your network that is 100% server-side redundant. We fully manage the EMS IT assets, directly enabling you to reduce operational and capital costs in several ways:

- No need for database or system administrator resources
- No need for UNIX systems or UNIX support staff
- Eliminates software license costs
- Maintain the "latest and greatest" software version

The Fujitsu Hosted EMS service also includes:

- EMS setup and configuration
- Secure access for anytime, anywhere access
- Server hardware maintenance and upgrades
- Automatic daily system database backup
- Customer scheduled supplemental remote memory backups

Your network will access the redundant, geographically diverse EMS servers with automatic fail-over, via Secure Connection Devices (SCD) which are provided on a loan basis as part of the Hosted EMS Service. SCDs are issued in pairs and the amount of SCD equipment will be mutually agreed to by the parties and depends on your Data Communication Network (DCN) configuration(s). The Hosted EMS Service includes the loan of the SCD equipment and management, repair, support, and remote turn-up of the SCD equipment for as long as you maintain the Service.

You can access FNC's servers through secure internet connections using your own hardware and software (i.e. computers). In order to interface with FNC's servers, the computers will require Solaris, Windows XP, or Vista operating systems and Internet Explorer, Firefox, or Netscape Navigator as the browser. Each user requires a client/browser combination. The number of simultaneous clients is limited based on the number of network elements covered under the Hosted EMS Service as follows:

# of Network Elements	Maximum # of Simultaneous Users*
1-10	2
11-20	5
21-50	10
Over 50	15

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\*additional simultaneous users can be added for an incremental fee

**Responsibilities:**

<b>CUSTOMER</b>	<b>FNC</b>
ISP connectivity <ul style="list-style-type: none"> <li>ISP connections to managed network elements (GNE)</li> </ul>	IP connectivity <ul style="list-style-type: none"> <li>ISP connections to element management application</li> <li>Security of management network</li> </ul>
DCN Maintenance <ul style="list-style-type: none"> <li>GNE connectivity and access</li> </ul>	Server Hardware <ul style="list-style-type: none"> <li>Maintenance</li> <li>Upgrades</li> </ul>

**Post-Deployment Maintenance and Support**

The Planning, Engineering, Installation and Commissioning of your network are the first steps in a long-term relationship. Following successful hand-over of the equipment to the State the project will migrate into a Post Acceptance phase, where FNC's sophisticated support processes and infrastructure will take effect.

With every equipment purchase, you receive our standard one-year warranty for hardware and 90-day software warranty. We also provide secure online access to technical documentation and information on equipment and software updates.

To augment the standard warranty, FNC's post deployment Maintenance and Support Program (MSP) offers a suite of maintenance plans that support your network operations, equipment and software. We can provide supplemental support to complement existing resources or comprehensive coverage with outsourced operations.

With an MSP, you protect your network assets with technical assistance and software upgrades. FNC also offers options such as preventive maintenance from expert technicians as well as repair and return, spares management, on-site maintenance and training.

**24/7 Remote Technical Assistance**

The Technical Assistance Center (TAC) is the entry point for customers in the Deployment and Post Deployment phases where requirements are defined and agreed in terms of scope and roles and responsibilities. This requirements capture process is crucial in ensuring that the subsequent solution mirrors the States requirements. With all incoming calls registered through our automatic call tracking system every enquiry or request for assistance is uniquely identified, monitored and captured in a database for future reference.

TAC engineers are available for telephone consultation 24 hours a day, seven days a week. They provide detailed recommendations on maintenance procedures, test practices, and equipment configurations for the States specific applications.

Our technical assistance lab is equipped with Fujitsu legacy and next generation products, as well as other manufacturer's telecom equipment. Experience with these state of the art products allows our engineers to address customer network configuration issues, including centralized fault notification, problem replication, and trouble-shooting and fault escalation management.

Calls are received by our call distribution system and are routed to the engineer who is most qualified to support the State specific technology, equipment type and issues. Our call tracking software documents all of the State communications with the TAC staff and ensures issues are promptly addressed and resolved and will escalate to senior management when appropriate. An evolving historical solutions database is also maintained so that TAC engineers can quickly respond to similar issues that may arise in the future.

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Regular or on-demand management reports detailing the performance, volumes and response times of the State's network are also available.

#### NE and Craft Software Support

The software on your NEs provides critical service-enabling features and capabilities; if upgrades are not made, you adversely affect your ability to roll out new services. Coverage includes new software releases including functionality\*, feature enhancements, and necessary modifications. The NETSMART® 500 Element Manager, the Fujitsu craft interface, supports graphical shelf views, equipment and facility provisioning, alarm surveillance, software download, remote memory backup/restore and cross-connect provisioning. Your MSP allows you to download and install the latest versions and upgrades to the NETSMART 500 software on all your NEs.

As a general rule, FNC will issue one (1) major software release per year that addresses significant feature or functionality enhancements. Maintenance releases are issued on an as needed basis to address fixes or modifications and the frequency may vary from year to year.

\* Certain functionality is individually licensed and not covered under the Software Maintenance and Upgrade Subscription.

#### Repair Service

With an MSP, your covered network is eligible for repair and return services for defective parts, even if your parts are beyond the standard warranty period. This entitlement offers you significant savings in comparison to out-of-warranty fees.

#### In-Warranty Service

In-warranty units are repaired or replaced at no charge to the State except in-warranty units that prove to be No Trouble Found (NTF) will be subject to NTF charges. If the unit is in the warranty period but the warranty has been voided, FNC also reserves the right to bill for services.

#### Out-Of-Warranty Service

If the unit inspection determines that the unit is not repairable, or it is not economical to repair, FNC will either return the unit or dispose of it per your instructions. Out of warranty costs may vary based on specific contractual agreements between FNC and the State.

#### On-Site Maintenance

With on-site maintenance, experienced technicians will be at your location to troubleshoot issues and perform network maintenance within a guaranteed response time. Our nationwide team can evaluate issues and quickly restore optimal performance. This service is available with a next-business-day or a 4-hour response time.

#### Routine preventative maintenance

Routine preventative maintenance entitles you to regular site visits to keep your network in optimal working condition. Our experienced technicians will perform on-site inspection of your Fujitsu equipment in order to detect any potential trouble conditions before they disrupt service. Based upon your requirements, a custom series of non-service-affecting tasks will be developed to test, clean and back up critical network data. Extra site visits are available for additional fees.

#### Optional Network Maintenance and Design Plans

Optional MSPs are available for:

- NETSMART 2000 Design and Planning Tool
- NETSMART 1500 Management System
- Fujitsu Hosted Element Management System

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Optional MSPs guarantee covered software upgrades with releases. We send e-mail alerts to plan participants, announcing all generally available software releases which are automatically available via electronic download. We also offer access to technicians, on-site visits, webinars and tutorials.

#### **NETSMART 2000 Maintenance and Support Plan**

For optimal performance in the output of your designs, it is important to have the latest features and NE release support. The NETSMART 2000 MSP gives you immediate access to software upgrades and support, so you get the most out of your NETSMART 2000 software:

- Remote technical assistance (8 am–5 pm CT Monday–Friday)
- NETSMART 2000 Design and Planning Tool software maintenance subscription
- Webinars about new features and enhancements
- Monthly call reports

#### **NETSMART 1500 Maintenance and Support Plan**

Your NETSMART 1500 management system simplifies network management, provisioning, and maintenance. To maintain this critical investment, we offer around-the-clock online, on-call, and on-site access to technicians and key information. Our comprehensive maintenance package safeguards your critical NETSMART 1500 system with:

- 24/7 remote technical assistance
- NETSMART 1500 software maintenance subscription
- Onsite technical support
- Webinars about new features and enhancements
- No-hassle upgrade portal
- Access to web-based tutorials
- Monthly call reports

#### **Network Operations Solutions - NOC**

##### **Overview of Capabilities**

Fujitsu has the expertise and resources necessary to manage large nationwide turnkey projects, providing results that are on time and within budget. Fujitsu provides a wide range of vendor-neutral, public network implementation and management services through a hierarchical approach that manages both activities and resources. Currently supporting hundreds of customers, Fujitsu provides network monitoring and management, telephone-support, advanced hardware replacement, on-site support and/or combinations of all three support elements.

The Fujitsu NOC provides full monitoring and management services including; Fault & Performance Management, Configuration and Circuit Resource Management, Inventory Management, Data Communications Network Management for NOC managed networks, and Third Party Management. Included in the NOC service offerings, the NOC staff can initiate on-site dispatching and advanced hardware replacement services as contracted.

The Fujitsu NOC deploys a completely redundant network with servers, applications and circuit connections into two geographically different datacenters. The Fujitsu NOC deploys the OEM's specific Element Management Systems (EMS) for management and operations of the network elements deployed by the NOC customers.

All monitoring and troubleshooting efforts are operational 7x24x365 by trained network operations engineers. When awarded, due to the significant size and complexity, Fujitsu will assign specific NOC personnel to be the subject matter

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experts (SME) monitoring the customer's network. The SME's will understand the requirements and design for the network operations, maintenance and engineering capabilities. All alarm and trap notifications will be captured and reported by the specific management applications. When alarms or traps are reported, the support engineers will log a Customer Service Record (CSR). The CSR will include all details and information on the trouble reported, customer contacts, troubleshooting process and resolution for trouble clearing. CSR's are viewable by Fujitsu direct customers through the Fujitsu Partners web site (<https://partners.fnc.fujitsu.com/>). Fujitsu deploys Siebel as the trouble-ticket application, and the ticket information from Siebel can be electronically bonded into other trouble-ticketing applications.

During troubleshooting efforts, if the support engineers determine that on-site assistance is required, the support engineer will dispatch technicians to be on-site within the contracted period, (i.e., 4 hour, NBD or a specific scheduled time) the support engineer will initiate the escalations per the NOC processes as outlined in the Customer Specific Work Instruction (CSWI), if replacement hardware is required, Fujitsu will dispatch the required spare unit(s) and technician to the specific site(s) for additional troubleshooting and resolution. For non-Fujitsu products, a Letter of Agency will be required, along with a support agreement between the customer and the OEM. This is to assure that the agreed support levels are being provided by Fujitsu. Once technicians arrive on-site, the NOC will control operations and troubleshooting efforts until the trouble is restored to original operations.

If escalation is required to the next level of support engineer or management, the assigned support engineer will initiate the escalations per the NOC processes as outlined in the CSWI. The Siebel ticketing system also provides notification of critical outage conditions to the internal Fujitsu management and operations teams.

**Network Operations Center:**

The Fujitsu support engineers will pro-actively monitor the customer's network, and will immediately begin troubleshooting whenever an alarm or other trouble condition is identified. If this is a situation that could potentially affect data or equipment visibility, the support engineer will contact the customer's designated representative and advise them of the status. Fujitsu engineers will continue to troubleshoot to isolate the problem. In most cases, problems can be restored via remote management, but if on-site support is required, a technician will be dispatched to the site.

The network will be managed for software and hardware upgrade notices including Move, Add and Changes (MACs). Once the NOC receives notice of any new software, hardware or MAC, a review of the notice will be conducted and determine if change is necessary or possible. If MAC is required and possible, Fujitsu will contact the customer to get approvals and schedule maintenance time to implement the MAC or upgrade. Customer notifications of upgrades will be no less than 10 business days prior to required upgrade.

The Fujitsu NOC will remain as a single point of contact (SPOC) for requests of network engineering services, overbuilds and network enhancements. All requests will be routed from the NOC to the Fujitsu program manager assigned to the customer network. Any design, engineering, installation and testing will be managed through completion from the program management organization and worked in parallel with the support engineers for MAC with the specified networks.

Fujitsu is committed to provide the highest level of service capable to support customer requirements. If specific requirements arise during the contracted term, Fujitsu and the customer will work to resolve or implement the new requirements as necessary. The Fujitsu NOC is capable of providing specific functions and processes focused around the customer.

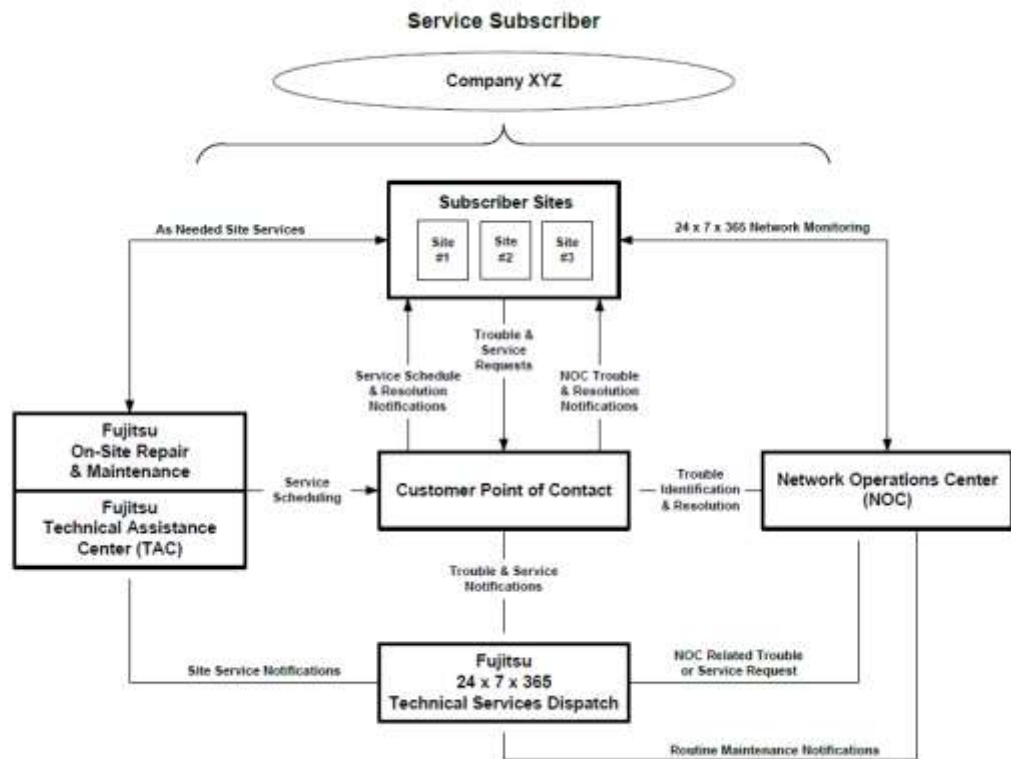
The support lab is equipped with more than \$20 million of Fujitsu legacy and next generation products, as well as other telecom equipment. Experience with this

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state of the art equipment allows the engineers to address network configuration issues, including centralized fault notification, problem replication, trouble-shooting, and fault escalation management.

The call tracking software documents all of the customer communications with the support staff and ensures that issues are promptly addressed and resolved. An evolving historical solutions database is developed so that support engineers can quickly respond to similar issues that may arise in the future.

A built-in escalation and audit module monitors all Customer Service Requests and escalates to senior management when appropriate. The call software allows total flexibility for the production of regular or on-demand management reports detailing the performance, volumes, and response times of the network.



- With a NOC Service Agreement, the customer will have access to the following:
  - Support and hardware services for multiple platforms and multiple vendor operating environments
  - Reduction of complexity across multi-vendor environments
  - Mission critical service ethic, attitude and culture
  - Proactive and predictive services that help the customer realize more value from the network investments
  - Problem management with time based escalations
  - Global Service Center with 24x7x365 support
  - ISO 9001 Certified customer support and logistics management
  - Service level monitoring, reporting, and metrics
  - Installations, adds, moves, and changes
  - Fujitsu's highly trained and experienced support engineers are available 24x7x365 to help answer questions and solve hardware and

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software problems.

- Online access to view Customer Service Reports (CSR) via the Partners web site
- Electronic bonding of ticketing systems for real-time updates (optional)

Whether the customer requires assistance with trouble-shooting, routine preventive maintenance or network configuration changes, Fujitsu's experienced staff is available 24x7x365 to support the Fujitsu and/or OEM products. In critical situations, the customer needs the peace of mind from having qualified technical assistance on-site quickly. With the onsite maintenance service from Fujitsu, qualified technicians will be at the locations based on agreed to SLAs. The advance hardware replacement service and on-site maintenance is available 24x7x365 days a year per contract to ensure that the network is continually supported with the spares required for optimal performance and highest availability.

The Fujitsu Network Operations Center (NOC) is our "Customer's Solution Center." Staffed by seasoned telecom engineers who have completed extensive technical training, the NOC is the central point of contact for resolving network issues related to operations, performance, reliability, and maintenance of on-line, operational systems.

**Phased Implementation and Operations Approach**

Fujitsu's Network Operations Center Services provide a full range of network fault and performance management features with connection services offered for transport network elements and public-access equipment. Management systems support the collection of messages from equipment that provides standards-based TL1 and SNMP data protocols.

Fujitsu recommends a phased approach for discovery, implementation and management that has been proven successful and meets the highest levels of quality in delivering turn-key managed solutions. The following services will be established to support the network and will be accomplished in three phases:

**Phase 1 – Discovery****Phase 1 Task**

- New Service Kickoff meeting held with customer contacts
- Information requirements document sent (Telemetry, Contacts, Locations, etc.)
- Analyze customer requirements based on developed Scope-of-Work (SOW)
- Design of the Telemetry Data Network to Fujitsu NOC
- Configure telemetry equipment
- Telemetry equipment sent to customer as necessary
- Data modeling, design and integration
- Develop "Best in Class" Methods, Procedures and Policies
- The following documentation, if it exists, will be available to Fujitsu:
  - Network diagrams
  - Equipment documentation including type, model and software release
  - Software and hardware configurations
  - Disaster recovery plans/details
  - Escalation contact list with names and phone numbers
  - Security policy
  - Data Communication Network (DCN) architecture including IP addresses, routing protocols, and hardware
  - Additional Services – AHR and OSM
  - Organization chart(s)
  - Site survey and as-built documentation

**Phase 2 – Implementation****Phase 2 Tasks**

- Development of an Operational Level Agreement (OLA)

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- Telemetry network installation by customer
- Telemetry network turn-up and test connectivity to NOC
- Electronic discovery of the transport network – Inventory of monitored NEs using specific EMS application
- Evaluation of the network and report on findings
- Configure Fujitsu network Inventory Management System
- Configure Fujitsu Network Management System
- Configure Fujitsu Trouble Ticketing System
- Fujitsu Client/Gateway development
- Validation of Network Element Models and functionality on Fujitsu NOC systems
- Functional System Test and Acceptance document
- Documented inventory listing of discovered Network Elements to be monitored from the Fujitsu NOC
- Network topology map of monitored network
- Assessment Report of network environment for NOC monitoring
- Development and review of the Customer Specific Work Instruction (CSWI)

**Phase 3 – Operation**

**Phase 3 Task**

- NE Alarms/Trap Parameter Setting within the NOC Operational Support System (OSS)
- Alarm/Trap Collection and Archiving
- Alarm/Trap Filtering
- Alarm/Trap Correlation
- Alarm/Trap Routing
- Alarm/Trap Processing and User Interface
- Fault Diagnosis
- Service Restoration and Fault Correction
- Facility and Customer Identification
- NE Alarm/Trap Status Upload/Reporting
- Alarm/Trap Parameter Customization
- NE database backups
- Reports

**Network Surveillance**

NOC Service Components	NOC Service Offerings		
	Event Mgmt	Fault Mgmt	Value Added
Network Management Level	Yes	Yes	Fault Mgmt Required
Condition Notification	Yes	Yes	
DCN Management	Yes	Yes	
Reporting	Yes	Yes	
Alarm Isolation and Restoration		Yes	
Third Party Management		Yes	
Remote User Access (Read Only)			Optional
Performance Management			Optional
Engineering Services			Optional
Provisioning Service*			Optional*
Electronic Bonding (eBonding)			Optional
Onsite Maintenance (OSM)			Optional
Advanced Hardware Replacement (AHR)			Optional
Routine Preventative Maintenance (RPM)			Optional
Element Software (Fujitsu Products Only)			Optional

\* "Element Software" required for remote upgrades of Fujitsu elements in "Provisioning Service"

Partner Services			
NOC Assist	Event Mgmt		Optional
Disaster Recovery	Event Mgmt		Optional
Network Hosting			Optional
Disaster Recovery with Network Hosting	Event Mgmt		Optional

**WSCA-NASPO Data Communications Services Solicitation # JP14001**General

Provide 7x24x365 network monitoring. FNC has the capability to monitor equipment from multiple original equipment manufacturer (OEM) vendors and engineers monitoring the network are specifically qualified for the equipment being monitored. A full redundancy is provided in FNC's NOC so that failure of any one data-link or facility will not interrupt NOC operations.

Assumptions

FNC will provide the NOC Services as described herein. Delivery of those Services depends on the following assumptions:

- a) FNC owned servers or FNC monitoring via clients located at FNC facilities.
- b) The FNC NOC requires DCN connectivity between FNC NOC and Customer gateway network element (GNE) and server facilities. The GNE is the network element (NE) used as interface to DCN that provides connections between GNEs and NOC facilities. FNC will provide the specifications for this connectivity. The DCN connectivity can be provided by Customer directly or may be purchased through FNC.
  - (1) Customer has rack space and AC/DC power available for AC/DC routers and/or Switch required for NOC monitoring Services.
  - (2) Cooperation in establishing circuit connections of frame-relay, Internet, or other required connectivity.
- c) To establish new GNE connectivity, the FNC NOC requires 90 business days for MPLS connectivity (less for Secure VPN) after receipt of signed agreement and purchase orders to set up NOC Services.
- d) Network Surveillance requires the following:
  - Network diagrams
  - Equipment documentation including type, model and software release
  - Software and hardware configurations
  - Disaster recovery plans/details
  - Escalation contact list with names and phone numbers
  - Security policy
  - Data Communication Network (DCN) architecture including IP addresses, routing protocols, and hardware
  - Site survey and as-built documentation

Condition Notification

Whenever any condition or alarm on the network changes, FNC will notify the Customer. A notification can be initiated because of an alarm or equipment condition, but can also be due to trending over days or weeks. Notification is typically a telephone call to the contact identified by Customer including, if requested, Customer's vendor or subscriber.

Management DCN Monitoring

All connections to the Customer network are monitored for both condition and quality.

Remote Move, Add, Change (MAC)

All actions are remote and include adding new SONET OC-N signals, element provisioning, cross connect changes, VLAN changes, and voice switch provisioning. Any on-site activities (i.e. equipment insertion) require purchase of other FNC Services On-Site Maintenance and/or Advanced Hardware

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Replacement.

Alarm Isolation & Resolution

Engineers will respond to any alarm or condition triggers. The engineer's actions include troubleshooting and root cause analysis as well as fault correlation. Provides identification, isolation, diagnosis, resolution and restoration of network troubles

Performance Management

Provide monitoring and reporting capabilities on network effectiveness and equipment performance based on Customer's Quality of Service (QoS) parameters as provided to FNC.

Circuit Resource Management (CRM)

FNC will perform circuit bandwidth allocation and circuit provisioning.

Configuration Management

FNC NOC will perform remote memory backups (RMBU) to allow network restoration in the event of an NE failure from loss of database or provisioning loss.

Inventory Management

FNC will maintain a database of part numbers (including issue numbers) of the parts in Customer's network on a per NE basis. This will be delivered to Customer as required in a mutually agreeable format.

Third Party Management

FNC will work with Customer's vendor/subscriber as requested. Examples include: Fiber cuts: contact dark fiber vendor to initiate repair, contacting end customer to inform that remedy is underway.

Reports

FNC will prepare and send reports to Customer in accordance with a schedule and in a format mutually agreeable to the parties. Reports can include performance monitoring, trouble ticket reports, and any issues raised throughout the month.

On-Site Maintenance

The On-Site Maintenance (OSM) support service, experienced technicians will be at your location to troubleshoot issues and perform network maintenance within a guaranteed response time. Our nationwide team can evaluate Fujitsu equipment and provide you with a cost-effective method to quickly restore your network to optimal performance levels. This service is available with a next business day or other custom response time.

Routine Preventative Maintenance

**Definition:** Provides two site visits per year to confirm and retrieve conditions specified in a checklist. The parties will identify and create a mutually agreeable checklist. The checklist could include alarm retrievals, confirmation of site security, voltages, cable connections, general cleaning, and fan filters.

**Dispatch:** Preventative maintenance trips should be scheduled at least 4 weeks in advance. However, if an emergency response is needed, and it is feasible, the PM functions can be performed during emergency maintenance visit.

**Pricing:** These Services can be quoted on hourly (4-hour minimum required), per trip or annual basis. Except as otherwise set forth in this Article, all travel and living costs for FNC personnel performing on-site Preventive Maintenance will be borne by FNC.

**WSCA-NASPO Data Communications Services Solicitation # JP14001**Customer's Obligation to Make Site Available:

Customer is responsible for ensuring FNC personnel access upon their arrival to the site where the support is to be performed. If FNC is unable to obtain access to the site Customer agrees that FNC has the right to invoice Customer, and Customer agrees to pay, for travel and living expenses for the applicable trip made by FNC personnel. These charges will be added to the applicable invoice sent to Customer that includes this on-site Service.

MAC/PCN Field Implementations (Customer location)

Definition: A MAC is when Customer equipment needs a change related to re-arranging, or adding equipment to existing equipment. A PCN is required occasionally when FNC issues PCNs that allow Customers to enhance their equipment. If the enhancements are not required, or if they could have been performed remotely, FNC would charge to perform the on-site service.

Dispatch: MAC and PCN Services should be scheduled two weeks in advance. However, if an emergency response is needed, and it is feasible, these Services can be performed during emergency maintenance visit

Pricing: These Services can be quoted on hourly (4-hour minimum required), per trip or annual basis. . Except as otherwise set forth in this Article, all travel and living costs for FNC personnel performing MAC/PCN Field Implementation will be borne by FNC.

Customer's Obligation to Make Site Available: Customer is responsible for ensuring FNC personnel access upon their arrival to the site where the support is to be performed. If FNC is unable to obtain access to the site Customer agrees that FNC has the right to invoice Customer, and Customer agrees to pay, for travel and living expenses for the applicable trip made by FNC personnel. These charges will be added to the applicable invoice sent to Customer that includes this on-site Service.

NOC Redundancy and NOC Emergency Operation Plan

The Fujitsu NOC is geographically redundant with regards to systems and network infrastructure. The datacenters are geographically dispersed and redundant with redundant uninterruptable power supply (UPS) power feeds through an automatic transfer switch (ATS) power distribution unit (PDU) in each data cabinet. The primary NOC surveillance circuit is connected through the Richardson, Texas data center. For customers who choose to have redundant NOC surveillance circuits, a secondary circuit provider is used and connected through the secondary data center.

In the case of an event that inhibits the use of, or renders inoperable, the Richardson, Texas facility, the NOC Emergency Operation Plan is initiated. Our Emergency Operation Plan dictates that previously identified Support Engineers will use their assigned NOC laptops to VPN into the NOC network into one of the datacenters remotely and resume NOC operations from their residences utilizing broadband Internet connections. The NOC laptops have installed all of the applications normally available on the Support Engineers NOC workstation. Each previously identified support engineer also has a broadband connection and VoIP telephone set at their residence which would be logged into the redundant private branch exchange (PBX) and automatic call distribution (ACD) system in Pearl River, New York. Once the Richardson, Texas facility is usable and/or inhabitable, normal NOC operations would resume. If the Texas facility is uninhabitable for an extended period of time, the assigned support engineers will be transferred to secondary datacenter for NOC services.

**WSCA-NASPO Data Communications Services Solicitation # JP14001****Resume and References**

Fujitsu maintains a centralized operations support center to provide assistance to our customer base which includes customers in the following categories: RBOCs, CLECs, ILECs, IXCs, ISPs, RUSs and OEMs such as Verizon and Alltel.

The Fujitsu operations support center, staffed by seasoned professionals and containing state of the art equipment and troubleshooting tools, has provided centralized support to our customers for more than 20 years. During that timeframe, Fujitsu has provided not only standard service offerings, but has also initiated special customer handling processes to meet specific requirements. Support is provided 24 hours a day, 7 days a week and ranges from network monitoring/management to on-call support with response time goals of less than 2 minutes – currently averaging 2-3 minutes.

The average support engineer has at least 5 years related industry experience and many more have more than 10 years' experience. These individuals have highly qualified skill sets, including an excellent working knowledge of Layer 1, Layer 2 and Layer 3 networking technologies. Each support engineer is highly competent with the operation of test sets to complete work functions associated with the testing and repair of copper, fiber, transmission, LAN/WAN, ATM/ Packet and other special circuits and devices. Combined with training in customer relations, these support engineers provide an unparalleled level of service.

Many of Fujitsu's support engineers supporting the Technical Assistance Center (TAC), Network Operations Center (NOC), Field Operations and Product Support have obtained certifications that cover products and applications outside the Fujitsu product families. Some of these certifications include Cisco's CCNA, CCNP, CCDA, CCDP, CCIE and currently MEF-CECP in progress. Fujitsu is committed to be best in class working towards the core competencies of TL, GR and ISO standards.

**Focused on Primary Business Needs**

Service at Fujitsu means the ability to listen to customers and tailor responses to meet specific requirements. Fujitsu's services allow the customer to select the level of support needed with support and network operations solutions. Fujitsu provides support to compliment internal resources and help balance operational expenses. Fujitsu solutions meet the needs for today and the future.

**On-site Maintenance (OSM)**

This optional service reduces the need for placement of personnel in all areas of your network. We dispatch expert technicians to your site to be the eyes and hands of the NOC engineers. Personnel can arrive within 4 hours or a specific scheduled time.

**Supplemental NOC Services**

Supplemental NOC Services are designed to assist customers in overcoming resource limitations. This could either be by assisting you to ramp up your own NOC facility or by supplementing your existing operations center with our NOC resources.

To assist in the ramp up of your own NOC, our professional team conducts an analysis of your requirements and prepares a statement of work to integrate the network into the FNC NOC. We then manage your network from our NOC facilities, providing the Basic NOC Services Suite. When you decide to establish your own NOC facilities, our team will conduct an analysis of the requirements and prepare a statement of work for the design, construction and implementation. Our professional transition team then mentors your incoming NOC operations staff, transferring the responsibility for operating the NOC facility to your staff over a defined period of transition.

**WSCA-NASPO Data Communications Services Solicitation # JP14001****NetMIGRATION**

This service involves the movement or re-configuration of any live traffic on a node, across a network or the re-configuration of networks. This may include the insertion of nodes into a live network, the closing of rings in a network, the division of traffic between physical or virtual rings or moving or replacing nodes on a ring. This service is highly adapted around the Customer's needs and involves an analysis of the Customer's existing network, the preparation and review of MOP and the coordinated scheduling of maintenance windows to perform the work.

Through extensive experience and planning, FNC pinpoints potential network problems in advance and develops a step-by-step plan for a successful migration. Our NetMIGRATION service can be customized to fit your requirements whether you need to completely outsource your network migration or just require a mentor to assist you with Methods of Procedure (MOP), recommendations or individual tasks.

The NetMIGRATION service covers numerous migration procedures including:

- Software release upgrades
- Circuit rolls
- Addition and deletion of Network Elements (NE)
- Terminal, Linear and Ring network conversions
- Circuit grooming
- Platform and optical capacity changes
- Migration to next-generation platforms

FNC can conduct one-on-one mentoring during the migration to give your technical staff the in-depth information and hands-on experience they need to handle future migrations in-house. In addition, FNC is accessible during any migration to help your staff avoid potential pitfalls and delays.

Our NetMIGRATION service can be customized to meet the exact specifications for your network. FNC engineers and designers have been successfully migrating networks for more than 20 years and will utilize their knowledge and expertise to ensure your migration is implemented on time and at the optimal level, while minimizing service-affecting issues.

**5.3.1.3 Partner Services - Provided by Contractor's Authorized Partners/Resellers**

- Subject to Contractor's approval and the certifications held by its Partners/Resellers, many Partners/Resellers can also offer and provide some or all of the Services as listed above at competitive pricing, along with local presence and support. As the prime, Contractor is still ultimately responsible for the performance of its Partners/ Resellers. Customers can have the option to purchase the Services to be directly delivered by Contractor (OEM) or its certified Partners/Resellers.

**FNC Response:****Supplier/Subcontractor Management**

FNC Services maintains a rigorous process of supplier qualification and approval. Potential suppliers are evaluated based on their quality management system, workmanship requirements, skill level of personnel, and security program (background checks/drug screens). Once approved, completed projects are audited to customer and/or industry standards by FNC's Field Quality Auditor, a telecommunications professional with over 30 years installation and audit experience. Suppliers must maintain established quality levels based on On-time Delivery, Quality Audits and issue response in order to remain on the FNC Services AVL.

**5.3.1.4 Training - Learning offerings for IT professionals on networking technologies, including but not limited to designing, implementing, operating, configuring, and troubleshooting network systems pertaining to items provided under the master**

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agreement.

**FNC Response:**

FNC recognizes the variety of skill sets required to support a diverse network. All FNC product classes are performance based with approximately 20% lecture and 80% hands-on with the actual equipment.

FNC recommends that all Tier I resources attend at least an Engineering and Maintenance training course. This training can be conducted on-site, utilizing the actual equipment the engineering and operations staff will be supporting. FNC will work closely with <Customer> and the turn-up and test teams to schedule training after turn-up, and prior to traffic introduction. In the event that scheduling for this time frame is not possible, FNC can schedule to train <Customer> Tier I engineers at our Training Center in Richardson, Texas.

In addition to the Engineering and Maintenance courses, FNC recommends that the Network Operations Center and Tier II engineering staff be scheduled to attend a product overview course in our Training Center located in Richardson, Texas.

FNC offers training courses in the following categories:

Turn up and Test

The Turn-Up and Test courses provide core training for FNC equipment and related applications. These courses are the first step in gaining understanding of the entire spectrum of the FNC product line. Turn-Up and Test courses begin with a system overview, including descriptions of plug-in units. Students learn how to provision various configurations and hardware features. Students learn to use product specific Technical Documentation and procedures to place equipment online, and then apply test traffic. Through acceptance testing, students verify that the transport functions and protection features are fully functional. The courses also introduce students to support resources, such as the FNC Technical Assistance Center (FTAC), and Fujitsu Online Customer Information Service (FOCIS).

The Turn up and Test courses are in session from two to four days, depending on the product.

Maintenance

Maintenance courses cover operations, interpretation of alarms and condition reports, trouble clearing, performance monitoring, upgrades and migrations, as well as an introductory overview of element management software.

The Maintenance courses are in session from four to five days, depending on the product.

Engineering

FNC Engineering courses enable students to identify and deploy various hardware including shelves and plug-in units associated with FNC products. Engineering courses train students to plan and engineer networks and system applications using FNC equipment in various configurations. Case studies are used extensively to develop examples of operational networks.

The Engineering courses are in session from two to three days, depending on the product.

Network Management

Network Management courses train students in the administration, planning, monitoring, provisioning, and trouble analysis of FNC NEs in various networks using the NETSMART 1500 Network Management System. Hands-on exercises are used extensively to provide the students with practice in using NETSMART 1500 Network Management System in the administration, planning, monitoring, provisioning, and trouble analysis of FNC NEs.

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Richardson, TX based courses have a duration of one to four days, depending on the product.

Please see the FNC course catalog attached for a complete list of courses and course descriptions

**5.3.2 ADDING PRODUCTS**

The ability to add new equipment and services is for the convenience and benefit of WSCA-NASPO, the Participating States, and all the Authorized Purchasers. The intent of this process is to promote "one-stop shopping" and convenience for the customers and equally important, to make the contract flexible in keeping up with rapid technological advances. The option to add new product or service categories and/items will expedite the delivery and implementation of new technology solutions for the benefit of the Authorized Purchasers.

After the contracts are awarded, additional IT product categories and/or items may be added per the request of the Contractor, a Participating State, an Authorized Purchaser or WSCA-NASPO. Additions may be ad hoc and temporary in nature or permanent. All additions to an awarded Contractor or Manufacturer's offerings must be products, services, software, or solutions that are commercially available at the time they are added to the contract award and fall within the original scope and intent of the RFP (i.e., converged technologies, value adds to manufacturer's solution offerings, etc.).

**FNC Response:**

Comply

**5.3.2.1 New Product from Contractors** - If Contractor, a Participating State, an Authorized Purchaser or WSCA-NASPO itself requests to add new product categories permanently, then all awarded Contractors (Manufacturers) will be notified of the proposed change and will have the opportunity to work with WSCA to determine applicability, introduction, etc. Any new products or services must be reviewed and approved by the WSCA-NASPO Contract Administrator.

**FNC Response:**

Comply

**5.3.2.2 Ad Hoc Product Additions** - A request for an ad hoc, temporary addition of a product category/item must be submitted to WSCA-NASPO via the governmental entity's contracting/purchasing officer. Ad hoc, temporary requests will be handled on a case-by-case basis.

**FNC Response:**

Comply

**5.3.2.3 Pricelist Updates** - As part of each Contractor's ongoing updates to its pricelists throughout the contract term, Contractor can add new SKUs to its awarded product categories that may have been developed in-house or obtained through mergers, acquisitions or joint ventures; provided, however, that such new SKUs fall within the Contractor's awarded product categories.

**FNC Response:**

Read and Understood

**Section 6: Evaluation****6.1 General Information**

Proposals will be evaluated for completeness and compliance with the requirements of this RFP by a sourcing team. The sourcing team may engage additional qualified individuals during the process to assist with technical, financial, legal, or other matters.

Except at the invitation of the sourcing team, no activity or comments from Offerors regarding this RFP shall be discussed with any member of the sourcing team during the evaluation process. An Offeror who contacts a member of the sourcing team in reference to this RFP may have its proposal rejected.

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Each proposal must be submitted in Microsoft Word or Excel, or PDF labeled and organized in a manner that is congruent with the section number, headings, requirements, and terminology used in this RFP. Proposal documents must be use Arial font size 10. All proposals must be submitted in electronic form.

### 6.2 Administrative Requirements Compliance

The sourcing team will evaluate each proposal for compliance with administrative requirements. **Noncompliance with any of these requirements will render a proposal non-responsive. Only those proposals that pass the administrative requirements will be evaluated further.**

In order to pass the Administrative Requirements, the following must be received by due date and time associated with this RFP as listed in Bid Sync.

#### 6.2.1 References

Vendor must provide a least three current account references for which your company provides similar Data Communications services for private, state and/or large local government clients (preferably government/public entities). **Offerors are required to submit Attachment B - Reference Form, for business references. The business providing the reference must submit the Reference Form directly to the State of Utah, Division of Purchasing.** It is the offeror's responsibility to ensure that completed forms are received by the State of Utah Division of Purchasing on or before the proposal submission deadline for inclusion in the evaluation process. Business references not received, or not complete, may adversely affect the offeror's score in the evaluation process. The Purchasing Division reserves the right to contact any or all business references for validation of information submitted.

### 6.3 Minimum Scope Requirements Compliance

The sourcing team will evaluate each proposal that passed the administrative requirements for compliance with Section 5.2 Data Communications Services – Requirements. Scope requirements are evaluated in terms of the breadth and depth of the offeror proposal for each of the section 5.2.1-5.3.0 Scope categories. **Only those proposals in each section that score 70% or better will move on to cost evaluation.**

### 6.4 Evaluation Criteria

The following table details how each proposal shall be evaluated on a basis of 100 points.

An evaluation committee comprised of representatives from some WSCA-NASPO member States will be appointed by the WSCA-NASPO Contract Administrator to perform the proposal evaluation.

All Offeror's proposals will be initially reviewed for compliance with the mandatory general requirements in Section 3 and Sections 5.1.1-5.1.5 stated within the RFP. Any proposal failing to meet one or more mandatory requirement(s) will be considered non-responsive and deemed "unacceptable", and will be eliminated from further consideration.

Those proposals deemed "acceptable" or "potentially acceptable" will be evaluated against the following proposal evaluation criteria using a point-based scoring methodology. Proposal evaluation criteria are listed in relative order of importance:

#### 6.4.1 Cost – (bid sheets including discounts off list price attached) – 30%

Given that technology products generally depreciate over time and go through typical product lifecycles, it is more favorable for customers to have prime contracts be based on minimum discounts off the Offeror's' commercially published pricelists versus fixed pricing. In addition, Offerors must have the ability to update and refresh their respective price books, as long as the agreed-upon discounts are fixed. Minimum guaranteed contract discounts do not preclude an Offeror and/or its authorized resellers from providing deeper or additional, incremental discounts at their sole discretion.

**6.4.1.1 Refurbished Equipment** – Many IT manufacturers offer refurbished equipment at a substantially lower cost with attractive warranties that also address risk concerns some customers may have with refurbished gear. Offerors may add an optional provision for manufacturer-certified refurbished equipment to be available for procurement under this contract. This offering will not be evaluated as part of the cost scoring process.

**WSCA-NASPO Data Communications Services Solicitation # JP14001****FNC Response:**

FNC does not offer refurbished equipment

**6.4.2 Demonstrate ability to provide products and services within scope of the RFP (Section 5.2-5.31) – 25%****FNC Response:**

Comply. FNC has demonstrated its ability to provide products and services that meet the requirements of specific sections of this RFP

**6.4.3 Qualifications, technical ability, maintenance, training and value added services– 10%****FNC Response:**

Comply. FNC has demonstrated its ability to provide its qualifications, technical expertise, maintenance, training and other valued services within the body of this RFP

**6.4.4 Ability to supply to WSCA / NASPO member states/geographical coverage -10%****FNC Response:**

FNC currently has regional offices in the following locations:

**California****San Ramon**

5000 Executive Parkway  
Suite 290,  
San Ramon 94583  
**(925) 355-2196**

**Colorado****Highland Ranch**

300 Plaza Drive  
Suite 250  
Highland Ranch, CO 80129  
**(303) 209-3000**

**Georgia****Atlanta**

One Midtown Plaza  
1360 Peachtree Street  
Suite 1100  
Atlanta, Ga. 30309  
**(404) 853-4100**  
**(404) 881-8142**

**Hawaii****Honolulu**

1001 Bishop Street  
Suite 1188  
Pauahi Tower  
Honolulu 96813  
**(808) 585-8185**

**Illinois****Buffalo Grove**

318 Half Day Road  
Suite 233  
Buffalo Grove 60089  
**(847) 946-1932**

**WSCA-NASPO Data Communications Services Solicitation # JP14001****Itasca**

500 Park Blvd.  
Suite 1450  
Itasca 60143  
**(630) 250-8230**

**Maryland  
Baltimore**

100 East Pratt Street  
Suite 2570  
Baltimore 21202  
**410-244-5172**  
**410-244-5175**

**Massachusetts****Marlborough**

33 Boston Post Road  
Suite 320  
Marlborough 01752  
**(508) 460-9700**

**New York****New York**

733 3rd Avenue  
17th Floor  
New York 10017  
**(212) 850-6629**

**Ontario, CANADA****Mississauga, Ontario**

6975 Creditview Road  
Unit 1  
Mississauga L5N 8E9  
**(905) 286-3423**

**Pennsylvania****Wexford**

101 Bradford Road  
Suite 200 Office #8  
Wexford 15090  
**(724) 933-3131**

**Texas****Houston**

2424 Wilcrest Drive  
Suite 107  
Houston 77042  
**(832) 242-7573**

**Richardson, Texas**

2801 Telecom Parkway  
Richardson 75082  
**(972) 690-6000**

**San Antonio, Texas**

13750 San Pedro Ave.  
Suite 700  
San Antonio 78232  
**(210) 442-5200**

**WSCA-NASPO Data Communications Services Solicitation # JP14001**

**Virginia**  
**Falls Church**  
 344 Maple Ave  
 Suite 230  
 Vienna, VA 22180  
**730-282-2785**

**Washington**  
**Vancouver**  
 1412 NE 134th Street  
 Suite 220  
 Vancouver 98685  
**(360) 694-9707**

**Offer profile and references** (i.e., financial stability, presence in marketplace, adequate staff, marketing efforts etc.) – **20%**

**FNC Response:**

Please find attached FNCs 2012 Annual Report as well Financial Highlights as of May 2013. Market share information has been provided earlier in this response document.

**Fujitsu Network Communications, Inc.**  
 Headcount by Job Title & Function

<u>Employees/Temps</u>	<u>4/30/2012</u>	<u>10/30/2012</u>	<u>1/1/2013</u>
Manufacturing & Operations	272	284	277
Engineering (Including TDD)	569	550	544
Planning	111	111	113
Marketing	52	52	49
Sales	171	173	167
Services (Includes TSO)	273	256	254
Administration	193	181	182
<b>Total FNC</b>	<b>1,641</b>	<b>1,607</b>	<b>1,586</b>
Managers & Above	247	243	235
%	15%	15%	15%
Temps	145	106	94

**6.4.5 Administrative** (i.e., report generating ability, e-commerce, account reps, problem resolution, customer satisfaction, website hosting and other administrative related issues) – **5%**

**FNC Response:**

The above requirements have been provided earlier in this response.

At the option of the evaluation committee the WSCA-NASPO Contract Administrator may initiate discussion(s) with Offerors who submit responsive or potentially responsive proposals for the purpose of clarifying aspects of the proposal(s), however, proposals may be evaluated without such discussion(s). Such discussion(s) is not to be initiated by Offerors.

Based on the competitive range of the evaluation scores, the evaluation committee may choose to make a "finalist list" of offeror's; if opted for, all offeror's will be notified of their status at this juncture by the Procurement Manager.

Finalist Offeror's may be required, at the option of the evaluation committee, to present their proposals and possibly demonstrate their Internet website to the evaluation committee. The Procurement Manager will schedule the time and location for each Offeror presentation. Each Offeror presentation will be of equal duration for all offeror's and may also include an additional

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amount of time reserved for questions/answers.

The sourcing team will evaluate each proposal that has passed the administrative requirements and met or exceeded the Section 3 and Section 5.1.1-5.1.5 Mandatory Requirements.

**WSCA-NASPO Data Communications Services Solicitation # JP14001**  
**WSCA-NASPO Data Communications Equipment and Associated Products #JP14001**

Firm Name: \_\_\_\_\_

Section Number: \_\_\_\_\_

Evaluator: \_\_\_\_\_

Date: \_\_\_\_\_

Score will be assigned as follows:

0 = Failure, no response

1 = Poor, inadequate, fails to meet

requirement 2 = Fair, only partially responsive

3 = Average, meets minimum requirement

4 = Above average, exceeds minimum

requirement 5 = Superior

		Score (0-5)	Weight	Points
<b>1. Demonstrated Ability to meet scope of requirements (25 points possible)</b>		-----	-----	
Scope and Variety of products provided	8 points possible		X 1.6	
Experience and technical ability of manufacturer	7 points possible		X 1.4	
Maintenance Program	2 points possible		X .40	
Training Program	2 points possible		X .40	
Service Program	2 points possible		X .40	
Demonstrate Effective Reseller Program managed by the manufacturer in WSCA / NASPO States	4 points possible		X .80	
<b>2. Demonstrate Qualifications and Technical Ability (10 points possible)</b>		-----	-----	
Technical Staff Qualifications	2 points possible		X .40	
Maintenance Staff Qualifications	2 points possible		X .40	
Training Staff Qualifications	2 points possible		X .40	
Technical Suitability of Products	4 points possible		X .80	
<b>3. Demonstrate ability to supply WSCA / NASPO member States (10 points possible)</b>	10 points possible		X 2	
<b>4. Company profile and references (20 points)</b>		-----	-----	
Financial Statements and Records	10 points possible		X 2	
References, Reputation, Breadth and Depth of Offering	10 points possible		X 2	
<b>5. Demonstrate ability to provide administrative support (5 points possible)</b>	5 points possible		X 1	
<b>6. Cost (30 points possible)*</b>	30 points possible	-----	-----	<b>* Inserted</b>
Services (10 Points)	possible			<b>by</b>
<b>TOTAL EVALUATION POINTS</b>	(100 points		Total	

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\* Purchasing will use the following cost formula for the "Services": The points assigned to each Offeror's cost proposal will be based on the lowest proposal price. The offeror with the lowest Proposed Price will receive 100% of the price points. All other Offerors will receive a portion of the total cost points based on what percentage higher their Proposed Price is than the Lowest Proposed Price. An Offeror who's Proposed Price is more than double (200%) the Lowest Proposed Price will receive no points. The formula to compute the points is:  $\text{Cost Points} \times (2 - \text{Proposed Price} / \text{Lowest Proposed Price})$ .

Purchasing will use the following cost formula for the "Product Offering Discount Percentage": The points assigned to each Offeror's cost proposal will be based on the highest discount percentage. The Offeror with the highest discount percentage will receive 100% of the price points. All other Offerors will receive a portion of the total cost points based on what percentage lower their discount percentage is than the highest discount percentage. An Offeror whose proposed percentage discount is less than double (20%) the highest discount percentage will receive no points. The formula to compute the points is:  $\text{Cost Points} \times (2 - \text{Highest Proposed Discount} / \text{Proposed Discount})$ .

**WSCA-NASPO Data Communications Services Solicitation # JP14001****Section 7: Master Agreement Terms and Conditions/Exceptions****FNC Response:**

Agree. See Attachment A above for exceptions as identified.

**7.1 WSCA-NASPO Master Agreement Terms and Conditions**

- 7.1.1** The WSCA-NASPO Contract Administrator referred to in section 2 of the WSCA- NASPO Master Agreement Terms and Conditions is Debra Gunderson, State of Utah Division of Purchasing and General Services. This RFP represents the WSCA-NASPO Contract Administrator's written approval of the modifications, waivers, alterations, amendments, and supplements to the Master Agreement Terms and Conditions made in this RFP and this Section 7.
- 7.1.2** Except as limited in this section or elsewhere in this RFP, Participating Entities who execute a Participating Addendum may alter, modify, supplement, or amend the WSCA- NASPO Master Agreement Terms and Conditions as necessary to comply with Participating Entity law or policy with respect to their orders under the Master Agreement. A Contractor may not deliver Products or perform services under this Master Agreement until a Participating Addendum acceptable to the Participating Entity and Contractor is executed. The WSCA-NASPO Terms and Conditions are applicable to any order by a Participating Entity, except to the extent altered, modified, supplemented or amended by a Participating Addendum. By way of illustration and not limitation, this authority may apply to unique delivery and invoicing requirements, confidentiality requirements, and defaults on orders, governing law and venue relating to orders by a Participating Entity, Indemnification, and insurance requirements. Statutory or constitutional requirements relating to availability of funds may require specific language in some Participating Addenda in order to comply with applicable law. The expectation is that these alterations, modifications, supplements, or amendments will be addressed in the Participating Addendum or, with the consent of the Participating Entity and Contractor, may be included in the commitment voucher (e.g. purchase order or contract) used by the Participating Entity to place the order.
- 7.1.3** The term Purchasing Entity and Participating Entity shall both mean "Participating Entity" as that term is defined in WSCA-NASPO Master Agreement Terms and Conditions
- 7.1.4** With respect to section 11, Indemnification, the terms of any Participating Addendum may alter, modify, supplement, or amend the language in section 11 and may include a limitation of liability mutually agreeable to the Participating Entity and the Contractor.
- 7.1.5** With regard to section 20, Participants, Participating Entities who are not states may under some circumstances sign their own Participating Addendum, subject to the approval of the Chief Procurement Official of the state where the Participating Entity is located. Contractors may upon request obtain a copy of the written authorization from the WSCA-NASPO Contract Administrator.

**7.2 Offeror Exceptions to Terms and Conditions**

- 7.2.1** The Lead State discourages exceptions to contract terms and conditions in the RFP, attached Participating Entity terms and conditions (if any), and the WSCA-NASPO Master Agreement Terms and Conditions. As specified in this RFP, exceptions may cause a proposal to be rejected as nonresponsive when, in the sole judgment of the Lead State (and its evaluation team), the proposal appears to be conditioned on the exception or correction of what is deemed to be a deficiency or unacceptable exception would require a substantial proposal rewrite to correct. Moreover, Offerors are cautioned that award may be made on receipt of initial proposals without clarification or an opportunity for discussion, and the nature of exceptions would be evaluated. Further, the nature of exceptions will be considered in the competitive range determination if one is conducted. Exceptions will be evaluated to determine the extent to which the alternative language or approach poses unreasonable, additional risk to the state, is judged to inhibit achieving the objectives of the RFP, or whose ambiguity makes evaluation difficult and a fair resolution (available to all vendors) impractical given the timeframe for the RFP.
- 7.2.2** The Lead State will entertain exceptions to contract terms and conditions in this RFP, including the WSCA-NASPO Master Agreement Terms and Conditions. Offerors are strongly encouraged to be judicious in identifying exceptions.
- 7.2.3** Based on the market research conducted by the Lead State, the following provisions are intended

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to frame the contours of exceptions that may be acceptable, additional risk so long as the Offeror's exceptions are specified with sufficient particularity.

- 7.2.4** The Lead State will consider Offeror standard terms for inspection and acceptance, so long as a reasonable time for acceptance is stated. However, the Participating Entities right to exercise revocation of acceptance under its Uniform Commercial Code must be preserved. Submit the standard terms with the offer and describe generally how commerciality in their use is established, e.g., identify publicly-available catalogs where the warranty terms are used and how long they have been in use.
- 7.2.5** The Lead State will consider standard warranty and/or maintenance terms, but the alternative warranty and/or maintenance will be evaluated to determine whether they provide comparable protection to the warranty specified in section 30 of the WSCA- NASPO Master Agreement Terms and Conditions. Provide the terms of the warranty and maintenance in the offer. Also describe generally how commerciality is established for those terms, e.g., publicly-available catalogs the warranty terms are used and how long they have been in use. Provide one reference from a customer having comparable sales volume who is using the warranty and maintenance provisions, where the warranty term has expired, and who has exercised rights under the warranty.
- 7.2.6** Intellectual property. The Lead State will consider license terms and conditions that as a minimum convey to Participating Entities a nonexclusive, irrevocable, perpetual, paid-up, royalty free license to use software or other intellectual property delivered with or inherent in the commodity or service, and to transfer the license rights to third parties for government purposes. Provide the terms of the license, including any terms that cover third party intellectual property used in the Offeror's solution. Offerors should be aware that Participating Entities using federal funds may be required to negotiate additional or different terms to satisfy minimum rights requirements of their federal grants.
- 7.2.7** Any limitation of liability provision – including any exclusion of damages clause – proposed by an Offeror to be the default limitation of liability provision under the Master Agreement must preserve a reasonable amount of direct damages for breach of contract, additionally permit the Participating Entity to recoup amounts paid for supplies or services not finally accepted (as in the case of advance or progress payments, if used), and preserve the right of the Participating Entity to be held harmless from costs of litigation as well as ultimate liability within limits agreed by the parties.
- Moreover, any limitation of liability clause proposed by an Offeror should be reciprocal, cover lost profits, and exclude claims or liability arising out of intellectual property infringement, bodily injury (including death), damage to tangible property, and data breach. Include the text of any such language if proposed. Further, provide contact information for a public entity, or private entity if no public entity exists, where the limitation of liability clause (or another clause substantially similar) operated to limit liability. If no such example exists, provide contact information for a state, or if no state exists, a higher education institution, or if none exists, a city or county represented by counsel in the negotiations who has agreed to the proposed terms and conditions.
- 7.2.8** The enumerated examples in subsection 7.2 are not intended to limit the ability of Offerors to propose additional, reasonable exceptions. For any other exception, where the exception is based on claims of standard or normal commercial practice, provide contact information for a state, or if no state exists, a higher education institution, or if none exists, a city or county represented by counsel in the negotiations who has agreed to the proposed terms and conditions.

**7.3 WSCA-NASPO eMarket Center**

- 7.3.1** In July 2011, WSCA-NASPO entered into a multi-year agreement with SciQuest, Inc. whereby SciQuest will provide certain electronic catalog hosting and management services to enable eligible WSCA-NASPO entity's customers to access a central online website to view and/or shop the goods and services available from existing WSCA- NASPO Cooperative Contracts. The central online website is referred to as the WSCA- NASPO eMarket Center Contractor shall either upload a hosted catalog into the eMarket Center or integrate a punch-out site with the eMarket Center.

**FNC Response:**

FNC will work with SoU in support of a managed web site that can include applicable contract price list, discounts on said price list, approved resellers or partners for their state and any

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additional information that may be required to assist the participating states in obtaining information concerning the contract award.

**Supplier's Interface with the eMarket Center**

There is no cost charged by SciQuest to the Contractor for loading a hosted catalog or integrating a punch-out site.

At a minimum, the Contractor agrees to the following:

1. **Implementation Timeline:** WSCA-NASPO eMarket Center Site Admin shall provide a written request to the Contractor to begin enablement process. The Contractor shall have fifteen (15) days from receipt of written request to work with WSCA-NASPO and SciQuest to set up an enablement schedule, at which time SciQuest's technical documentation shall be provided to the Contractor. The schedule will include future calls and milestone dates related to test and go live dates. The contractor shall have a total of Ninety (90) days to deliver either a (1) hosted catalog or (2) punch-out catalog, from date of receipt of written request.
2. **Definition of Hosted and Punch out:** WSCA-NASPO and SciQuest will work with the Contractor, to decide which of the catalog structures (either hosted or punch-out as further described below) shall be provided by the Contractor. **Whether hosted or punch-out, the catalog must be strictly limited to the Contractor's awarded contract offering (e.g. products and/or services not authorized through the resulting cooperative contract should not be viewable by WSCA-NASPO Participating Entity users).**
  - a. **Hosted Catalog.** By providing a hosted catalog, the Contractor is providing a list of its awarded products/services and pricing in an electronic data file in a format acceptable to SciQuest, such as Tab Delimited Text files. In this scenario, the Contractor must submit updated electronic data annually to the eMarket Center for WSCA- NASPO Contract Administrator's approval to maintain the most up-to- date version of its product/service offering under the cooperative contract in the eMarket Center.
  - b. **Punch-Out Catalog.** By providing a punch-out catalog, the Contractor is providing its own online catalog, which must be capable of being integrated with the eMarket Center as a Standard punch-in via Commerce eXtensible Markup Language (cXML). In this scenario, the Contractor shall validate that its online catalog is up-to-date by providing a written update quarterly to the Contract Administrator stating they have audited the offered products/services and pricing listed on its online catalog. The site must also return detailed UNSPSC codes (as outlined in line 3) for each line item. Contractor also agrees to provide e-Quote functionality to facilitate volume discounts.
3. **Revising Pricing and Product Offerings:** Any revisions (whether an increase or decrease) to pricing or product/service offerings (new products, altered SKUs, etc.) must be pre-approved by the WSCA-NASPO Contract Administrator and shall be subject to any other applicable restrictions with respect to the frequency or amount of such revisions. However, no cooperative contract enabled in the eMarket Center may include price changes on a more frequent basis than once per quarter. The following conditions apply with respect to hosted catalogs:
  - a. Updated pricing files are required by the 1<sup>st</sup> of the month and shall go into effect in the eMarket Center on the 1<sup>st</sup> day of the following month (i.e. file received on 1/01/14 would be effective in the eMarket Center on 2/01/14). Files received after the 1<sup>st</sup> of the month may be delayed up to a month (i.e. file received on 11/06/14 would be effect in the eMarket Center on 1/01/15).
  - b. Contract Administrator-approved price changes are not effective until implemented within the eMarket Center. Errors in the Contractor's submitted pricing files will delay the implementation of the price changes in eMarket Center.
4. **Supplier Network Requirements:** Contractor shall join the SciQuest Supplier Network (SQSN) and shall use the SciQuest's Supplier Portal to import the Contractor's catalog and pricing, into the SciQuest system, and view reports on catalog spend and product/pricing freshness. The Contractor can receive orders through electronic delivery (cXML) or through low-tech options such as fax. More information about the SQSN can be found at: [www.sciquest.com](http://www.sciquest.com) or call the SciQuest

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Supplier Network Services team at 800-233-1121.

5. Minimum Requirements: Whether the Contractor is providing a hosted catalog or a punch-out catalog, the Contractor agrees to meet the following requirements:
- a. Catalog must contain the most current pricing, including all applicable administrative fees and/or discounts, as well as the most up-to-date product/service offering the Contractor is authorized to provide in accordance with the cooperative contract; and
  - b. The accuracy of the catalog must be maintained by Contractor throughout the duration of the cooperative contract between the Contractor and the Contract Administrator; and
  - c. The Catalog must include a Lead State contract identification number; and
  - d. The Catalog must include detailed product line item descriptions; and
  - e. The Catalog must include pictures when possible; and
  - f. The Catalog must include any additional WSCA-NASPO and Participating Addendum requirements.\*
6. Order Acceptance Requirements: Contractor must be able to accept Purchase Orders via fax or cXML.
- a. The Contractor shall provide positive confirmation via phone or email within 24 hours of the Contractor's receipt of the Purchase Order. If the Purchasing Order is received after 3pm EST on the day before a weekend or holiday, the Contractor must provide positive confirmation via phone or email on the next business day.
7. UNSPSC Requirements: Contractor shall support use of the United Nations Standard Product and Services Code (UNSPSC). UNSPSC versions that must be adhered to are driven by SciQuest for the suppliers and are upgraded every year. WSCA-NASPO reserves the right to migrate to future versions of the UNSPSC and the Contractor shall be required to support the migration effort. All line items, goods or services provided under the resulting statewide contract must be associated to a UNSPSC code. All line items must be identified at the most detailed UNSPSC level indicated by segment, family, class and commodity. More information about the UNSPSC is available at: <http://www.unspsc.com> and <http://www.unspsc.com/FAQs.asp#howdoesunspscwork>.
8. Applicability: Contractor agrees that WSCA-NASPO controls which contracts appear in the eMarket Center and that WSCA-NASPO may elect at any time to remove any supplier's offering from the eMarket Center. The WSCA-NASPO Contract Administrator reserves the right to approve the pricing on the eMarket Center. This catalog review right is solely for the benefit of the WSCA-NASPO Contract Administrator and Participating Entities, and the review and approval shall not waive the requirement that products and services be offered at prices (and approved fees) required by the Master Agreement.

\* Although suppliers in the SQSN normally submit one (1) catalog, it is possible to have multiple contracts applicable to different WSCA-NASPO Participating Entities. For example, a supplier may have different pricing for state government agencies and Board of Regents institutions. Suppliers have the ability and responsibility to submit separate contract pricing for the same catalog if applicable. The system will deliver the appropriate contract pricing to the user viewing the catalog.

Several WSCA-NASPO Participating Entities currently maintain separate SciQuest eMarketplaces; these Participating Entities do enable certain WSCA-NASPO Cooperative Contracts. In the event one of these entities elects to use this WSCA-NASPO Cooperative Contract (available through the eMarket Center) but publish to their own eMarketplaces, the Contractor agrees to work in good faith with the entity and WSCA-NASPO to implement the catalog. WSCA-NASPO does not anticipate that this will require substantial additional efforts by the Contractor; however, the supplier agrees to take commercially reasonable efforts to enable such separate SciQuest catalogs.

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## Attachment B – Reference Form

### Solicitation Number JP14001 WSCA-NASPO Data Communications RFP

Please complete the following:

\_\_\_\_\_  
(Full Name of Company Requesting Reference)

\_\_\_\_\_  
(Your Company Name)

This form is being submitted to your company for completion as a business reference for the company listed above. This form is to be returned to the State of Utah, Division of Purchasing, via email to [teutsler@utah.gov](mailto:teutsler@utah.gov) or by fax to the attention of Tara Eutsler at 801-538-3882, no later than, 2011, and **must not** be returned to the company requesting the reference.

For questions or concerns regarding this form, please contact the State of Utah, Division of Purchasing, at [dgundersen@utah.gov](mailto:dgundersen@utah.gov). When contacting the State, please be sure to include the solicitation number listed at the top of this page.

#### CONFIDENTIAL INFORMATION WHEN COMPLETED

Company providing reference:	
Contact Name and Title/Position:	
Contact Telephone Number:	
Contact Email Address:	

#### QUESTIONS:

**FNC Response:**

FNC has provided this form to our references as directed by the State of Utah.

- In what capacity have you worked with this firm in the past?

COMMENTS:

- How would you rate this firm's knowledge and expertise?

\_\_\_\_\_ (3=Excellent; 2=Satisfactory; 1=Unsatisfactory; 0=Unacceptable)

COMMENTS:

- How would you rate this firm's flexibility relative to changes in the project scope and timelines?

\_\_\_\_\_ (3=Excellent; 2=Satisfactory; 1=Unsatisfactory; 0=Unacceptable)

COMMENTS:

- What is your level of satisfaction with materials produced by this firm?

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\_\_\_\_\_ (3=Excellent; 2=Satisfactory; 1=Unsatisfactory; 0=Unacceptable)

COMMENTS:

- 5. How would you rate the dynamics/interaction between firm and your staff?

\_\_\_\_\_ (3=Excellent; 2=Satisfactory; 1=Unsatisfactory; 0=Unacceptable)

COMMENTS:

- 6. Who were the firm's principal representatives involved in your project and how would you rate them individually? Please comment on the skills, knowledge, behavior or other factors on which you based the rating? (3=Excellent; 2=Satisfactory; 1=Unsatisfactory; 0=Unacceptable)

Principal Representative's Name: \_\_\_\_\_ Rating:

Principal Representative's Name: \_\_\_\_\_ Rating:

Principal Representative's Name: \_\_\_\_\_ Rating:

COMMENTS:

- 7. How satisfied are you with the manner in which the firm handled confidential, personal, and sensitive information?

\_\_\_\_\_ (3=Excellent; 2=Satisfactory; 1=Unsatisfactory; 0=Unacceptable)

COMMENTS:

- 8. With what aspect(s) of this firm's services are you most satisfied?

COMMENTS:

- 9. With which aspect(s) of this firm's services are you least satisfied?

COMMENTS:

- 10. Would you recommend this firm's services to your organization again?

COMMENTS:



## WSCA-NASPO Master Agreement Terms and Conditions

### 1. AGREEMENT ORDER OF PRECEDENCE:

The Master Agreement shall consist of the following documents:

1. A Participating Entity's Participating Addendum ("PA");
2. WSCA-NASPO Master Agreement Terms and Conditions;
3. The Statement of Work;
4. The Solicitation; and
5. Contractor's response to the Solicitation.

These documents shall be read to be consistent and complementary. Any conflict among these documents shall be resolved by giving priority to these documents in the order listed above. Contractor terms and conditions that apply to this Master Agreement are only those that are expressly accepted by the Lead State and must be in writing and attached to this Master Agreement as an Exhibit or Attachment. No other terms and conditions shall apply, including terms and conditions listed in the Contractor's response to the Solicitation, or terms listed or referenced on the Contractor's website, in the Contractor quotation/sales order or in similar documents subsequently provided by the Contractor.

**2. AMENDMENTS** The terms of this Master Agreement shall not be waived, altered, modified, supplemented or amended in any manner whatsoever without prior written approval of the WSCA-NASPO Contract Administrator.

**3. ASSIGNMENT/SUBCONTRACT** Contractor shall not assign, sell, transfer, subcontract or sublet rights, or delegate responsibilities under this contract, in whole or in part, without the prior written approval of the WSCA-NASPO Contract Administrator.

**4. CANCELLATION** Unless otherwise stated in the special terms and conditions, any Master Agreement may be canceled by either party upon 60 days' notice, in writing, prior to the effective date of the cancellation. Further, any Participating State may cancel its participation upon 30 days written notice, unless otherwise limited or stated in the special terms and conditions of this solicitation. Cancellation may be in whole or in part. Any cancellation under this provision shall not affect the rights and obligations attending orders outstanding at the time of cancellation, including any right of and Purchasing Entity to indemnification by the Contractor, rights of payment for goods/services delivered and accepted, and rights attending any warranty or default in performance in association with any order. Cancellation of the Master Agreement due to Contractor default may be immediate.

### 5. CONFIDENTIALITY, NON-DISCLOSURE AND INJUNCTIVE RELIEF

**5.1 Confidentiality.** Contractor acknowledges that it and its employees or agents may, in the course of providing the Product under this Master Agreement, be exposed to or acquire information that is confidential to Participating Entity or Participating Entity's clients. Any and all information of any form that is marked as confidential or would by its nature be deemed confidential obtained by Contractor or its employees or agents in the performance of this Master Agreement, including, but not necessarily limited to (a) any Participating Entity records, (b) personnel records, and (c) information concerning individuals, is confidential information of Participating Entity ("Confidential Information"). Any reports or other

documents or items (including software) that result from the use of the Confidential Information by Contractor shall be treated in the same manner as the Confidential Information. Confidential Information does not include information that (a) is or becomes (other than by disclosure by Contractor) publicly known; (b) is furnished by Participating Entity to others without restrictions similar to those imposed by this Master Agreement; (c) is rightfully in Contractor's possession without the obligation of nondisclosure prior to the time of its disclosure under this Master Agreement; (d) is obtained from a source other than Participating Entity without the obligation of confidentiality, (e) is disclosed with the written consent of Participating Entity or; (f) is independently developed by employees, agents or subcontractors of Contractor who can be shown to have had no access to the Confidential Information.

**5.2 Non-Disclosure.** Contractor shall hold Confidential Information in confidence, using at least the industry standard of confidentiality, and not to copy, reproduce, sell, assign, license, market, transfer or otherwise dispose of, give, or disclose Confidential Information to third parties or use Confidential Information for any purposes whatsoever other than the performance of this Master Agreement to Participating Entity hereunder, and to advise each of its employees and agents of their obligations to keep Confidential Information confidential. Contractor shall use commercially reasonable efforts to assist Participating Entity in identifying and preventing any unauthorized use or disclosure of any Confidential Information. Without limiting the generality of the foregoing, Contractor shall advise Participating Entity immediately if Contractor learns or has reason to believe that any person who has had access to Confidential Information has violated or intends to violate the terms of this Master Agreement and Contractor shall at its expense cooperate with Participating Entity in seeking injunctive or other equitable relief in the name of Participating Entity or Contractor against any such person. Except as directed by Participating Entity, Contractor will not at any time during or after the term of this Master Agreement disclose, directly or indirectly, any Confidential Information to any person, except in accordance with this Master Agreement, and that upon termination of this Master Agreement or at Participating Entity's request, Contractor shall turn over to Participating Entity all documents, papers, and other matter in Contractor's possession that embody Confidential Information. Notwithstanding the foregoing, Contractor may keep one copy of such Confidential Information necessary for quality assurance, audits and evidence of the performance of this Master Agreement.

**5.3 Injunctive Relief.** Contractor acknowledges that breach of this Section, including disclosure of any Confidential Information, will cause irreparable injury to Participating Entity that is inadequately compensable in damages. Accordingly, Participating Entity may seek and obtain injunctive relief against the breach or threatened breach of the foregoing undertakings, in addition to any other legal remedies that may be available. Contractor acknowledges and agrees that the covenants contained herein are necessary for the protection of the legitimate business interests of Participating Entity and are reasonable in scope and content.

**6. DEBARMENT** The contractor certifies that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from participation in this transaction (contract) by any governmental department or agency. If the contractor cannot certify this statement, attach a written explanation for review by WSCA-NASPO.

## 7. DEFAULTS & REMEDIES

h) The occurrence of any of the following events shall be an event of default under this Master Agreement:

- i. Nonperformance of contractual requirements; or
  - ii. A material breach of any term or condition of this Master Agreement; or
  - iii. Any representation or warranty by Contractor in response to the solicitation or in this Master Agreement proves to be untrue or materially misleading; or
  - iv. Institution of proceedings under any bankruptcy, insolvency, reorganization or similar law, by or against Contractor, or the appointment of a receiver or similar officer for Contractor or any of its property, which is not vacated or fully stayed within thirty (30) calendar days after the institution or occurrence thereof; or
  - v. Any default specified in another section of this Master Agreement.
- i) Upon the occurrence of an event of default, Lead State shall issue a written notice of default,

identifying the nature of the default, and providing a period of 15 calendar days in which Contractor shall have an opportunity to cure the default. The Lead State shall not be required to provide advance written notice or a cure period and may immediately terminate this Master Agreement in whole or in part if the Lead State, in its sole discretion, determines that it is reasonably necessary to preserve public safety or prevent immediate public crisis. Time allowed for cure shall not diminish or eliminate Contractor's liability for damages, including liquidated damages to the extent provided for under this Master Agreement.

j) If Contractor is afforded an opportunity to cure and fails to cure the default within the period specified in the written notice of default, Contractor shall be in breach of its obligations under this Master Agreement and Lead State shall have the right to exercise any or all of the following remedies:

- i. Exercise any remedy provided by law; and
- ii. Terminate this Master Agreement and any related Contracts or portions thereof; and
- iii. Impose liquidated damages as provided in this Master Agreement; and
- iv. Suspend Contractor from receiving future bid solicitations; and
- v. Suspend Contractor's performance; and
- vi. Withhold payment until the default is remedied.

k) In the event of a default under a Participating Addendum, a Participating Entity shall provide a written notice of default as described in this section and have all of the rights and remedies under this paragraph regarding its participation in the Master Agreement, in addition to those set forth in its Participating Addendum.

**8. DELIVERY** Unless otherwise indicated in the Master Agreement, the prices are the delivered price to any Participating State agency or political subdivision. All deliveries shall be F.O.B. destination with all transportation and handling charges paid by the contractor. Responsibility and liability for loss or damage shall remain the Contractor until final inspection and acceptance when responsibility shall pass to the Buyer except as to latent defects, fraud and Contractor's warranty obligations. The minimum shipment amount will be found in the special terms and conditions. Any order for less than the specified amount is to be shipped with the freight prepaid and added as a separate item on the invoice. Any portion of an order to be shipped without transportation charges that is back ordered shall be shipped without charge.

**9. FORCE MAJEURE** Neither party to this Master Agreement shall be held responsible for delay or default caused by fire, riot, acts of God and/or war which is beyond that party's reasonable control. WSCA-NASPO may terminate this Master Agreement after determining such delay or default will reasonably prevent successful performance of the Master Agreement.

**10. GOVERNING LAW** This procurement and the resulting agreement shall be governed by and construed in accordance with the laws of the state sponsoring and administering the procurement. The construction and effect of any Participating Addendum or order against the Master Agreement(s) shall be governed by and construed in accordance with the laws of the Participating Entity's State. Venue for any claim, dispute or action concerning an order placed against the Master Agreement(s) or the effect of an Participating Addendum shall be in the Purchasing Entity's State.

**11. INDEMNIFICATION** The Contractor shall defend, indemnify and hold harmless WSCA- NASPO, the Lead State and Participating Entities along with their officers, agencies, and employees as well as any person or entity for which they may be liable from and against claims, damages or causes of action including reasonable attorneys' fees and related costs for any death, injury, or damage to property arising from act(s), error(s), or omission(s) of the Contractor, its employees or subcontractors or volunteers, at any tier, relating to the performance under the Master Agreement. This section is not subject to any limitations of liability in this Master Agreement or in any other document executed in conjunction with this Master Agreement

**12. INDEMNIFICATION – INTELLECTUAL PROPERTY** The Contractor shall defend, indemnify and hold harmless WSCA-NASPO, the Lead State and Participating Entities along with their officers, agencies, and employees as well as any person or entity for which they may be liable ("Indemnified Party") from and against claims, damages or causes of action including reasonable attorneys' fees

and related costs arising out of the claim that the Product or its use, infringes Intellectual Property rights ("Intellectual Property Claim"). The Contractor's obligations under this section shall not extend to any combination of the Product with any other product, system or method, unless:

- (1) the Product, system or method is:
  - (a) provided by the Contractor or the Contractor's subsidiaries or affiliates;
  - (b) specified by the Contractor to work with the Product; or
  - (c) reasonably required, in order to use the Product in its intended manner, and the infringement could not have been avoided by substituting another reasonably available product, system or method capable of performing the same function; or
- (2) It would be reasonably expected to use the Product in combination with such product, system or method.

The Indemnified Party shall notify the Contractor within a reasonable time after receiving notice of an Intellectual Property Claim. Even if the Indemnified Party fails to provide reasonable notice, the Contractor shall not be relieved from its obligations unless the Contractor can demonstrate that it was prejudiced in defending the Intellectual Property Claim resulting in increased expenses or loss to the Contractor. If the Contractor promptly and reasonably investigates and defends any Intellectual Property Claim, it shall have control over the defense and settlement of it. However, the Indemnified Party must consent in writing for any money damages or obligations for which it may be responsible. The Indemnified Party shall furnish, at the Contractor's reasonable request and expense, information and assistance necessary for such defense. If the Contractor fails to vigorously pursue the defense or settlement of the Intellectual Property Claim, the Indemnified Party may assume the defense or settlement of it and the Contractor shall be liable for all costs and expenses, including reasonable attorneys' fees and related costs, incurred by the Indemnified Party in the pursuit of the Intellectual Property Claim. This section is not subject to any limitations of liability in this Master Agreement or in any other document executed in conjunction with this Master Agreement.

**13. INDEPENDENT CONTRACTOR** The contractor shall be an independent contractor, and as such shall have no authorization, express or implied to bind WSCA-NASPO or the respective states to any agreements, settlements, liability or understanding whatsoever, and agrees not to perform any acts as agent for WSCA-NASPO or the states, except as expressly set forth herein.

**14. INDIVIDUAL CUSTOMER** Except to the extent modified by a Participating Addendum, each Participating Entity shall follow the terms and conditions of the Master Agreement and applicable Participating Addendum and will have the same rights and responsibilities for their purchases as the Lead State has in the Master Agreement, including but not limited to, any indemnity or to recover any costs allowed in the Master Agreement and applicable Participating Addendum for their purchases. Each Participating Entity will be responsible for its own charges, fees, and liabilities. The Contractor will apply the charges and invoice each Participating Entity individually.

**15. INSURANCE** Contractor shall, during the term of this Master Agreement, maintain in full force and effect, the insurance described in this section. Contractor shall acquire such insurance from an insurance carrier or carriers licensed to conduct business in the Participating Entity's state and having a rating of A-, Class VII or better, in the most recently published edition of Best's Reports. Failure to buy and maintain the required insurance may result in this Master Agreement's termination or at a Participating Entity's option; result in termination of its Participating Addendum.

Coverage shall be written on an occurrence basis. The minimum acceptable limits shall be as indicated below, with no deductible for each of the following categories:

c) Commercial General Liability covering the risks of bodily injury (including death), property damage and personal injury, including coverage for contractual liability, with a limit of not less than \$1 million per occurrence/\$2 million general aggregate;

d) Contractor must comply with any applicable State Workers Compensation or Employers Liability Insurance requirements.

Contractor shall pay premiums on all insurance policies. Such policies shall also reference this Master Agreement and shall have a condition that they not be revoked by the insurer until thirty (30) calendar

days after notice of intended revocation thereof shall have been given to Participating Entity by the Contractor.

Prior to commencement of the work, Contractor shall provide to the Participating Entity a written endorsement to the Contractor's general liability insurance policy that (i) names the Participating Entity as an additional insured, (ii) provides that no material alteration, cancellation, non-renewal, or expiration of the coverage contained in such policy shall have effect unless the named Participating Entity has been given at least thirty (30) days prior written notice, and (iii) provides that the Contractor's liability insurance policy shall be primary, with any liability insurance of the Participating Entity as secondary and noncontributory.

Contractor shall furnish to Participating Entity copies of certificates of all required insurance within thirty (30) calendar days of the Participating Addendum's effective date and prior to performing any work. Copies of renewal certificates of all required insurance shall be furnished within thirty (30) days after renewal date. These certificates of insurance must expressly indicate compliance with each and every insurance requirement specified in this section. Failure to provide evidence of coverage may, at State's sole option, result in this Master Agreement's termination.

Coverage and limits shall not limit Contractor's liability and obligations under this Master Agreement.

**16. LAWS AND REGULATIONS** Any and all supplies, services and equipment offered and furnished shall comply fully with all applicable Federal and State laws and regulations.

**17. LICENSE OF PRE-EXISTING INTELLECTUAL PROPERTY** Contractor grants to the Participating Entity a nonexclusive, perpetual, royalty-free, irrevocable, unlimited license to publish, translate, reproduce, modify, deliver, perform, display, and dispose of the Intellectual Property, and its derivatives, used or delivered under this Master Agreement, but not created under it ("Pre-existing Intellectual Property"). The license shall be subject to any third party rights in the Pre-existing Intellectual Property. Contractor shall obtain, at its own expense, on behalf of the Participating Entity, written consent of the owner for the licensed Pre-existing Intellectual Property.

**18. NO WAIVER OF SOVEREIGN IMMUNITY** In no event shall this Master Agreement, any Participating Addendum or any contract or any purchase order issued thereunder, or any act of a Lead State or a Participating Entity, be a waiver by the Participating Entity of any form of defense or immunity, whether sovereign immunity, governmental immunity, immunity based on the Eleventh Amendment to the Constitution of the United States or otherwise, from any claim or from the jurisdiction of any court.

If a claim must be brought in a federal forum, then it must be brought and adjudicated solely and exclusively within the United States District Court for the Participating State. This section applies to a claim brought against the Participating State only to the extent Congress has appropriately abrogated the Participating State's sovereign immunity and is not consent by the Participating State to be sued in federal court. This section is also not a waiver by the Participating State of any form of immunity, including but not limited to sovereign immunity and immunity based on the Eleventh Amendment to the Constitution of the United States.

**19. ORDER NUMBERS** Master Agreement order and purchase order numbers shall be clearly shown on all acknowledgments, shipping labels, packing slips, invoices, and on all correspondence.

**20. PARTICIPANTS** WSCA-NASPO is the cooperative purchasing arm of the National Association of State Procurement Officials. It is a cooperative group contracting consortium for state government departments, institutions, agencies and political subdivisions (e.g., colleges, school districts, counties, cities, etc.) for all 50 states, the District of Columbia and the organized US territories. Obligations under this Master Agreement are limited to those Participating States who have signed a Participating Addendum where contemplated by the solicitation. Financial obligations of Participating States are limited to the orders placed by the departments or other state agencies and institutions having available funds. Participating States incur no financial obligations on behalf of political subdivisions. Unless otherwise specified in the solicitation, the resulting award(s) will be permissive.

**21. ENTITY PARTICIPATION** Use of specific WSCA-NASPO cooperative Master Agreements by state agencies, political subdivisions and other entities (including cooperatives) authorized by individual state's statutes to use state contracts are subject to the approval of the respective State Chief Procurement Official. Issues of interpretation and eligibility for participation are solely within the authority of the respective State Chief Procurement Official.

22. **PAYMENT - Payment** for completion of a contract order is normally made within 30 days following the date the entire order is delivered or the date a correct invoice is received, whichever is later. After 45 days the Contractor may assess overdue account charges up to a maximum rate of one percent per month on the outstanding balance. Payments will be remitted by mail. Payments may be made via a State or political subdivision "Purchasing Card" with no additional charge.

23. **PUBLIC INFORMATION** This Master Agreement and all related documents are subject to disclosure pursuant to the Participating Entity's public information laws.

24. **RECORDS ADMINISTRATION AND AUDIT** The contractor will maintain, or supervise the maintenance of all records necessary to properly account for the payments made to the contractor for costs authorized by this Master Agreement. These records will be retained by the contractor for at least four years after the Master Agreement terminates, or until all audits initiated within the four years have been completed, whichever is later. The contractor agrees to allow WSCA-NASPO, State and Federal auditors, and state agency staff access to all the records of this Master Agreement and any order placed under this Master Agreement, for audit and inspection, and monitoring of services. Such access will be during normal business hours, or by appointment.

25. **REPORTS and ADMINISTRATIVE FEES** The contractor shall submit quarterly reports to the WSCA-NASPO Contract Administrator showing the quantities and dollar volume of purchases by each participating entity.

The contractor must pay a WSCA-NASPO administrative fee of one quarter of one percent (.25%) in accordance with the terms and conditions of the Master Agreement. The WSCA-NASPO administrative fee shall be submitted quarterly and is based on sales of products and services. The WSCA-NASPO administrative fee is not negotiable. This fee is to be included as part of the pricing submitted with proposal.

Additionally, some States may require that an additional fee be paid directly to the State on purchases made by procuring entities within that State. For all such requests, the fee level, payment method and schedule for such reports and payments will be incorporated in a Participating Addendum that is made a part of the Master Agreement. The contractor may adjust the Master Agreement pricing accordingly for purchases made by procuring agencies within the jurisdiction of the State. All such agreements may not affect the WSCA-NASPO administrative fee or the prices paid by the procuring agencies outside the jurisdiction of the State requesting the additional fee.

26. **STANDARD OF PERFORMANCE AND ACCEPTANCE** The Standard of Performance applies to all Product(s) purchased under this Master Agreement, including any additional, replacement, or substitute Product(s) and any Product(s) which are modified by or with the written approval of Contractor after Acceptance by the Participating Entity. The Acceptance Testing period shall be thirty (30) calendar days or other time period identified in the solicitation or the Participating Addendum, starting from the day after the Product is installed and Contractor certifies that the Product is ready for Acceptance Testing. If the Product does not meet the Standard of Performance during the initial period of Acceptance Testing, Participating Entity may, at its discretion, continue Acceptance Testing on a day-to-day basis until the Standard of Performance is met. Upon rejection, the Contractor will have fifteen

(15) calendar days to cure the Standard of Performance issue(s). If after the cure period, the Product still has not met the Standard of Performance Participating Entity may, at its option:

(1) declare Contractor to be in breach and terminate the Order; (2) demand replacement Product from Contractor at no additional cost to Participating Entity; or, (3) continue the cure period for an additional time period agreed upon by the Participating Entity and the Contractor. Contractor shall pay all costs related to the preparation and shipping of Product returned pursuant to the section. No Product shall be accepted and no charges shall be paid until the Standard of Performance is met. The warranty period will begin upon Acceptance.

27. **SYSTEM FAILURE OR DAMAGE** In the event of system failure or damage caused by the Contractor or its Product, the Contractor agrees to use its best efforts to restore or assist in restoring the system to operational capacity.

28. **TITLE OF PRODUCT** Upon Acceptance by the Participating Entity, Contractor shall convey to Participating Entity title to the Product free and clear of all liens, encumbrances, or other security interests. Transfer of title to the Product shall include an irrevocable and perpetual license to use the

Embedded Software in the Product. If Participating Entity subsequently transfers title of the Product to another entity, Participating Entity shall have the right to transfer the license to use the Embedded Software with the transfer of Product title. A subsequent transfer of this software license shall be at no additional cost or charge to either Participating Entity or Participating Entity's transferee.

29. **WAIVER OF BREACH** Failure of Lead State or Participating Entity to declare a default or enforce any rights and remedies shall not operate as a waiver under this Master Agreement or Participating Addendum. Any waiver by the Lead State or Participating Entity must be in writing. Waiver by the Lead State or Participating Entity of any default, right or remedy under this Master Agreement or Participating Addendum, or breach of any terms or requirements shall not be construed or operate as a waiver of any subsequent default or breach of such term or requirement, or of any other term or requirement under this Master Agreement or Participating Addendum.

30. **WARRANTY** The Contractor warrants for a period of one year from the date of Acceptance that: (a) the Product performs according to all specific claims that the Contractor made in its response to the solicitation, (b) the Product is suitable for the ordinary purposes for which such Product is used, (c) the Product is suitable for any special purposes identified in the solicitation or for which the Participating Entity has relied on the Contractor's skill or judgment, (d) the Product is designed and manufactured in a commercially reasonable manner, and (e) the Product is free of defects. Upon breach of the warranty, the Contractor will repair or replace (at no charge to the Participating Entity) the Product whose nonconformance is discovered and made known to the Contractor. If the repaired and/or replaced Product proves to be inadequate, or fails of its essential purpose, the Contractor will refund the full amount of any payments that have been made. The rights and remedies of the parties under this warranty are in addition to any other rights and remedies of the parties provided by law or equity, including, without limitation, actual damages, and, as applicable and awarded under the law, to a prevailing party, reasonable attorneys' fees and costs.

31. **ASSIGNMENT OF ANTITRUST RIGHTS** Contractor irrevocably assigns to a Participating Entity any claim for relief or cause of action which the Contractor now has or which may accrue to the Contractor in the future by reason of any violation of state or federal antitrust laws (15 U.S.C. § 1-15 or a Participating Entity's state antitrust provisions), as now in effect and as may be amended from time to time, in connection with any goods or services provided to the Contractor for the purpose of carrying out the Contractor's obligations under this Master Agreement or Participating Addendum, including, at a Participating Entity's option, the right to control any such litigation on such claim for relief or cause of action.

Contractor shall require any subcontractors hired to perform any of Contractor's obligations, under this Master Agreement or Participating Addendum, to irrevocably assign to a Participating Entity, as third party beneficiary, any right, title or interest that has accrued or which may accrue in the future by reason of any violation of state or federal antitrust laws (15 U.S.C. § 1-15 or a Participating Entity's state antitrust provisions), as now in effect and as may be amended from time to time, in connection with any goods or services provided to the subcontractor for the purpose of carrying out the subcontractor's obligations to the Contractor in pursuance of this Master Agreement or Participating Addendum, including, at a Participating Entity's option, the right to control any such litigation on such claim for relief or cause of action.

32. **WSCA-NASPO eMarket CENTER Awarded** responders are required to participate in the WSCA-NASPO eMarket Center and, working through WSCA-NASPO's contractor (SciQuest), connect with the eMarket Center. The ideal situation would be to use either a hosted (by SciQuest) or Punch out Level 2 catalog configurations, but actual requirements will be determined by the Lead State Contract Administrator, WSCA-NASPO, WSCA-NASPO's contractor (SciQuest) and the awarded contractor, after award. Participation does not require an awarded responder to have any special level of technology or technological understanding.

### **Definitions**

**Acceptance** - means a written notice from a purchasing entity to contractor advising Contractor that the Product has passed its Acceptance Testing. Acceptance of a product for which acceptance testing is not required shall occur following the completion of delivery, installation, if required, and a reasonable time for inspection of the product, unless the Purchasing Entity provides a written notice of rejection to contractor.

**Acceptance Testing** - means the process for ascertaining that the Product meets the standards set forth in the section titled Standard of Performance and Acceptance, prior to Acceptance by the Purchasing Entity.

**Contractor** - means the person or entity delivering Products or performing services under the terms and conditions set forth in this Master Agreement.

**Intellectual Property** – means any and all patents, copyrights, service marks, trademarks, trade secrets, trade names, patentable inventions, or other similar proprietary rights, in tangible or intangible form, and all rights, title, and interest therein.

**Lead State** - means the State conducting this cooperative solicitation and centrally administering any resulting Master Agreement with the permission of the Signatory States.

**Master Agreement** – means the underlying agreement executed by and between the Lead State, as WSCA-NASPO contract administrator, acting on behalf of WSCA-NASPO, and the Contractor, as now or hereafter amended.

**Order** - means any purchase order, sales order, or other document used by a Participating Entity to order the Products.

**Participating Addendum** - means a bilateral agreement executed by a Contractor and a Participating Entity incorporating this Master Agreement and any other additional Participating Entity specific language or other requirements, e.g. ordering procedures specific to the Participating Entity, other terms and conditions.

**Participating Entity** - means a state, or other legal entity, properly authorized by a state to enter into the Master Agreement or Participating Addendum or who is authorized to order under the Master Agreement or Participating Addendum.

**Product** - Any equipment, software (including embedded software), documentation, or deliverable supplied or created by the Contractor pursuant to this Master Agreement.

**WSCA-NASPO** -is a cooperative group contracting consortium for state procurement officials, representing departments, institutions, agencies, and political subdivisions (i.e., colleges, school districts, counties, cities, etc.) for all states and the District of Columbia. WSCA- NASPO is a cooperative purchasing arm of the National Association of State Procurement Officials (NASPO).

#### **Additional Definitions and Alternative Terms for Consideration**

Below are additional definitions and alternative terms for consideration by the sourcing teams depending upon the nature of the solicitation and negotiations between the Contractor and Vendor.

**Embedded Software** - means one or more software applications which permanently reside on a computing device.

**Machine Code** – means microcode, basic input/output system code, utility programs, device drivers, diagnostics, and another code delivered with a computing device for the purpose of enabling the function of the computing device, as stated in its published specifications.

## ATTACHMENT A

**STATE OF UTAH STANDARD INFORMATION TECHNOLOGY TERMS AND CONDITIONS  
(FOR WSCA CONTRACTS and DTS RELATED CONTRACTS)**

**FNC Response:**

See Attachment A above for exceptions as identified.

1. **AUTHORITY:** Provisions of this contract are pursuant to the authority set forth in 63G-6, Utah Code Annotated, 1953, as amended, Utah State Procurement Rules (Utah Administrative Code Section R33), and related statutes which permit the State to purchase certain specified services, and other approved purchases for the State.
2. **CONTRACT JURISDICTION, CHOICE OF LAW, and VENUE:** The provisions of this contract shall be governed by the laws of the State of Utah. The parties will submit to the jurisdiction of the courts of the State of Utah for any dispute arising out of this Contract or the breach thereof. Venue shall be in Salt Lake City, in the Third Judicial District Court for Salt Lake County.
3. **LAWS AND REGULATIONS:** The Contractor and any and all supplies, services, equipment, and construction furnished under this contract will comply fully with all applicable Federal and State laws and regulations, including applicable licensure and certification requirements.
4. **RECORDS ADMINISTRATION:** The Contractor shall maintain, or supervise the maintenance of all records necessary to properly account for the payments made to the Contractor for costs authorized by this contract. These records shall be retained by the Contractor for at least four years after the contract terminates, or until all audits initiated within the four years, have been completed, whichever is later. The Contractor agrees to allow State and Federal auditors, and State Agency Staff, access to all the records to this contract, for audit and inspection, and monitoring of services. Such access will be during normal business hours, or by appointment.
5. **CERTIFY REGISTRATION AND USE OF EMPLOYMENT "STATUS VERIFICATION SYSTEM":** The Status Verification System, also referred to as "E-verify", only applies to contracts issued through a Request for Proposal process, and to sole sources that are included within a Request for Proposal. It does not apply to Invitation for Bids or to the Multi-Step Process.

**1. Status Verification System**

- (1) Each offeror and each person signing on behalf of any offeror certifies as to its own entity, under penalty of perjury, that the named Contractor has registered and is participating in the Status Verification System to verify the work eligibility status of the contractor's new employees that are employed in the State of Utah in accordance with applicable immigration laws including UCA Section 63G-12-302.
- (2) The Contractor shall require that the following provision be placed in each subcontract at every tier: "The subcontractor shall certify to the main (prime or general) contractor by affidavit that the subcontractor has verified through the Status Verification System the employment status of each new employee of the respective subcontractor, all in accordance with applicable immigration laws including UCA Section 63G-12-302 and to comply with all applicable employee status verification laws. Such affidavit must be provided prior to the notice to proceed for the subcontractor to perform the work."
- (3) The State will not consider a proposal for award, nor will it make any award where there has not been compliance with this Section.
- (4) Manually or electronically signing the Proposal is deemed the Contractor's certification of compliance with all provisions of this employment status verification certification required by all applicable status verification laws including UCA Section 63G-12-302.

**2. Indemnity Clause for Status Verification System**

- (1) Contractor (includes, but is not limited to any Contractor, Design Professional, Designer or Consultant) shall protect, indemnify and hold
- (2) harmless, the State and its officers, employees, agents, representatives and anyone that the State may be liable for, against any claim, damages or liability arising out of or resulting from violations of the above Status Verification System Section whether violated by employees, agents, or contractors of

the following: (a) Contractor; (b) Subcontractor at any tier; and/or (c) any entity or person for whom the Contractor or Subcontractor may be liable.

- (3) Notwithstanding Section 1. above, Design Professionals or Designers under direct contract with the State shall only be required to indemnify the State for a liability claim that arises out of the design professional's services, unless the liability claim arises from the Design Professional's negligent act, wrongful act, error or omission, or other liability imposed by law except that the design professional shall be required to indemnify the State in regard to subcontractors or subconsultants at any tier that are under the direct or indirect control or responsibility of the Design Professional, and includes all independent contractors, agents, employees or anyone else for whom the Design Professional may be liable at any tier.
4. **CONFLICT OF INTEREST:** Contractor represents that none of its officers or employees are officers or employees of the State of Utah, unless disclosure has been made in accordance with 67-16-8, Utah Code Annotated, 1953, as amended.
5. **CONFLICT OF INTEREST WITH STATE EMPLOYEES:** In addition to the provisions of State of Utah Terms and Conditions # 6, Conflict of Interest, the Contractor certifies that no person in the State's employment, directly or through subcontract, will receive any private financial interest, direct or indirect, in the contract. The Contractor will not hire or subcontract with any person having such conflicting interest.
6. **CONTRACTOR ACCESS TO SECURE STATE FACILITIES / CRIMINAL CONVICTION INFORMATION / FORMER FELONS:**

The Contractor shall provide (at its own expense) the State with sufficient personal information about its agents or employees, and the agents and employees of its subcontractors (if any) who will enter upon secure premises controlled, held, leased, or occupied by the State during the course of performing this contract so as to facilitate a criminal record check, at State expense. "Sufficient personal information" about its agents or employees, and the agents and employees of its subcontractors (if any) means for the Contractor to provide to the State Project Manager, in advance of any on-site work, a list of the full names of the designated employees, including their social security number, driver license number and the state of issuance, and their birth date. Thereafter, on their first site visit, each contractor employee expected to work on-site shall be fingerprinted by the State, and the State is authorized to conduct a federal criminal background check based upon those fingerprints and personal information provided. Contractor, in executing any duty or exercising any right under this contract, shall not cause or permit any of its agents or employees, and the agents and employees of its subcontractors (if any) who have been convicted of a felony and misdemeanors other than minor misdemeanors to enter upon any premises controlled, held, leased, or occupied by the State. A felony and misdemeanor are defined by the jurisdiction of the State of Utah, regardless of where the conviction occurred.

7. **DRUG-FREE WORKPLACE:** The Contractor agrees to abide by the Department of Technology Services (DTS) drug-free workplace policies while on State of Utah premises. DTS will provide the Contractor with a copy of these written "drug-free workplace policies" upon request.
8. **CODE OF CONDUCT:** When Contractor employees are working on-site, the Contractor agrees to follow and enforce DTS Policy 2000-001 Code of Conduct. If Contractor is working at facilities controlled by other State agencies, Contractor agrees to follow and enforce the Code of Conduct Policy of these other State agencies when Contractor is providing services at these facilities under provisions of this contract. The Contractor will assure that each employee or volunteer under Contractor's supervision receives a copy of such Code of Conduct, and a signed statement to this effect must be in each Contractor or Subcontractor employee's/volunteer's file and is subject to inspection and review by the State's monitors. Upon request, DTS agrees to provide Contractor with a copy of any applicable codes of conduct. If a Contractor or Subcontractor is working at any State agency which has a Code of Conduct applicable to this Contract, the DTS Project Manager will provide the Contractor with a copy in advance of the Contractor's on-site contract services performance.
9. **INDEMNITY CLAUSE:** The Contractor agrees to indemnify, save harmless, and release the State of Utah, and all its officers, agents, volunteers, and employees from and against any and all loss, damages, injury, liability, suits, and proceedings arising out of the performance of this contract which are caused in whole or in part by the acts or negligence of the Contractor's officers, agents, volunteers, or employees, but not for claims arising from the State's sole negligence. The parties

agree that if there are any Limitations of the Contractor's Liability, including a limitation of liability for anyone for whom the Contractor is responsible, such Limitations of Liability will not apply to injuries to persons, including death, or to damages to property.

10. **EMPLOYMENT PRACTICES CLAUSE:** The Contractor agrees to abide by the provisions of Title VI and VII of the Civil Rights Act of 1964 (42USC 2000e) which prohibits discrimination against any employee or applicant for employment or any applicant or recipient of services, on the basis of race, religion, color, or national origin; and further agrees to abide by Executive Order No. 11246, as amended, which prohibits discrimination on the basis of sex; 45 CFR 90 which prohibits discrimination on the basis of age; and Section 504 of the Rehabilitation Act of 1973, or the Americans with Disabilities Act of 1990 which prohibits discrimination on the basis of disabilities. Also, the Contractor agrees to abide by Utah's Executive Order, dated March 17, 1993, which prohibits sexual harassment in the work place.
11. **TERMINATION:** Unless otherwise stated in the Special Terms and Conditions, this contract may be terminated, with cause by either party, in advance of the specified termination date, upon written notice being given by the other party. The party in violation will be given ten (10) working days after notification to correct and cease the violations, after which the contract may be terminated for cause. This contract may be terminated without cause, in advance of the specified expiration date, by either party, upon sixty (60) days prior written notice being given the other party. On termination of this contract, all accounts and payments will be processed according to the financial arrangements set forth herein for approved services rendered to date of termination.

In the event of such termination, and professional services apply to the contract; the Contractor shall be compensated for services properly performed under this Contract up to the effective date of the notice of termination. The Contractor agrees that in the event of such termination for cause or without cause, Contractor's sole remedy and monetary recovery from the State is limited to full payment for all work properly performed as authorized under this Contract up to the date of termination as well as any reasonable monies owed as a result of the Contractor having to terminate contracts necessarily and appropriately entered into by the Contractor pursuant to this Contract. Contractor further acknowledges that in the event of such termination, all work product, which includes but is not limited to all manuals, forms, contracts, schedules, reports, and any and all documents produced by Contractor under this Contract up to the date of termination are the property of the State and shall be promptly delivered to the State.

12. **SUSPENSION OF WORK:** Should circumstances arise which would cause the State to suspend the work, but not terminate the contract, this will be done by formal notice. The work may be reinstated upon advance formal notice from the State.
13. **NONAPPROPRIATION OF FUNDS:** The Contractor acknowledges that the State cannot contract for the payment of funds not yet appropriated by the Utah State Legislature. If funding to the State is reduced due to an order by the Legislature or the Governor, or is required by State law, or if federal funding (when applicable) is not provided, the State may terminate this contract or proportionately reduce the services and purchase obligations and the amount due from the State upon 30 days written notice. In the case that funds are not appropriated or are reduced, the State will reimburse Contractor for products delivered or services performed through the date of cancellation or reduction, and the State will not be liable for any future commitments, penalties, or liquidated damages.
14. **SALES TAX EXEMPTION:** The State of Utah's sales and use tax exemption number is 11736850-010-STC, located at <http://purchasing.utah.gov/contract/documents/salestaxexemptionformsinged.pdf>. The tangible personal property or services being purchased are being paid from State funds and used in the exercise of that entity's essential functions. If the items being purchased are construction materials, they will be converted into real property by employees of this government entity, unless otherwise stated in the contract.

15. **SECURE PROTECTION AND HANDLING OF DATA:**

- a. **Network Security:** Contractor agrees at all times to maintain network security that - at a minimum - includes: network firewall provisioning, intrusion detection, and regular third party penetration testing. Likewise Contractor agrees to maintain network security that conforms to one of the following:
- i. Those standards the State of Utah applies to its own network, found at <http://www.dts.utah.gov>;

- ii. Current standards set forth and maintained by the National Institute of Standards and Technology, includes those at: <http://web.nvd.nist.gov/view/ncp/repository/>; or
  - iii. Any generally recognized comparable standard that Contractor then applies to its own network and approved by DTS in writing.
- b. **Data security:** Contractor agrees to protect and maintain the security of the State of Utah data with protection that is at least as good as or better than that maintained by the State of Utah. These security measures included but are not limited to maintaining secure environments that are patched and up to date with all appropriate security updates as designated, (ex. Microsoft Notification).
  - c. **Data Transmission:** Contractor agrees that any and all transmission or exchange of system application data with the State of Utah and/or any other parties expressly designated by the State of Utah, shall take place via secure means, (ex. HTTPS or FTPS).
  - d. **Data Storage:** Contractor agrees that any and all State of Utah data will be stored, processed, and maintained solely on designated target servers approved of by DTS and that no State of Utah data at any time will be processed on or transferred to any portable or laptop computing device or any portable storage medium, unless such medium is part of the Contractor's designated backup and recovery process.
  - e. **Data Encryption:** Contractor agrees to store all State of Utah backup data as part of its designated backup and recovery process in encrypted form, using no less than 128 bit key.
  - f. **Password Protection.** Contractor agrees that any portable or laptop computer that has access to a State of Utah network, or stores any non-public State of Utah data is equipped with strong and secure password protection.
  - g. **Data Re-Use:** Contractor agrees that any and all data exchanged shall be used expressly and solely for the purpose enumerated in this Contract. Contractor further agrees that no State of Utah data of any kind shall be transmitted, exchanged or otherwise passed to other Contractors or interested parties except on a case-by-case basis as specifically agreed to in writing by DTS.
  - h. **Data Destruction:** The Contractor agrees that upon termination of this Agreement it shall erase, destroy, and render unreadable all State of Utah data from all non-state computer systems and backups, and certify in writing that these actions have been completed within 30 days of the termination of this Agreement or within 7 days of the request of DTS, whichever shall come first.
16. **NOTIFICATION AND DATA BREACHES:** Contractor agrees to comply with all applicable laws that require the notification of individuals in the event of unauthorized release of personally-identifiable information or other events requiring notification in accordance with *DTS Policy 5000-1250-PR1 Computer Incident Reporting Procedure* (copy available upon request). In the event of a data breach of any Contractor's security obligations or other event requiring notification under applicable law (Utah Code Annotated § 13-44-101 thru 301 et al), Contractor agrees at its own expense to assume responsibility for informing all such individuals in accordance with applicable laws and to indemnify, hold harmless and defend the State of Utah against any claims, damages, or other harm related to such Notification Event.
17. **CHANGE MANAGEMENT:** Contractor agrees to comply with DTS Change Management Policy 4000-0004. This DTS policy requires that any work performed by the Contractor that has the potential to cause any form of outage, or modify the State's infrastructure architecture must first be reviewed by the DTS Change Management Committee, and coordinated accordingly. The DTS Project Manager will inform the Contractor if this change control requirement is applicable. Following this notification, any failure by the Contractor that causes outages or data security breaches caused by the Contractor as a direct result of failure to comply, will result in the Contractor's liability for the damages. For reference purposes, the latest version of DTS Change Management Policy 4000-0004 is detailed at <http://dts.utah.gov/policies/documents/4000-0004changemanagementpolicy.pdf>.
18. **PUBLIC INFORMATION:** Contractor agrees that the contract, related Sales Orders, and Invoices will be public documents, and may be available for distribution. Contractor gives the State express permission to make copies of the contract, related Sales Orders, and Invoices in accordance with the

State of Utah Government Records Access and Management Act (GRAMA). Except for sections identified in writing and expressly approved by the State Division of Purchasing, Contractor also agrees that the Contractor's response to the solicitation will be a public document, and copies may be given to the public under GRAMA laws. The permission to make copies as noted will take precedence over any statements of confidentiality, proprietary information, copyright information, or similar notation.

19. **CREDITING STATE IN ADVERTISING / PUBLICITY:** Any publicity given to the project or services provided herein shall identify the State of Utah's managing agency as the sponsoring agency and shall not be released without prior written approval by that State agency's Project Manager.
20. **STATE AGENCY WEB SITE BRANDING:** The Contractor agrees to use the DTS logo, or a newer version if replaced in the future, on websites produced under terms of this contract. Contractor further agrees to allow a State agency to also utilize their own web site branding and logo, if requested by that State agency.
21. **ORDERING AND INVOICING:** All orders will be shipped promptly in accordance with the delivery schedule. The Contractor will promptly submit invoices (within 30 days of shipment or delivery of services) to the State. The State contract number and/or the agency purchase order number shall be listed on all invoices, freight tickets, and correspondence relating to the contract order. The prices paid by the State will be those prices listed in the contract. The State has the right to adjust or return any invoice reflecting incorrect pricing.
22. **PROMPT PAYMENT DISCOUNT:** Offeror may quote a prompt payment discount based upon early payment; however, discounts offered for less than 30 days will not be considered in making the award. Contractor shall list Payment Discount Terms on invoices. The prompt payment discount will apply to payments made with purchasing cards and checks. The date from which discount time is calculated will be the date a correct invoice is received or receipt of shipment, whichever is later; except that if testing is performed, the date will be the date of acceptance of the merchandise.
23. **PAYMENT:**
  - a. Payments are normally made within 30 days following the date the order is delivered or the date a correct invoice is received, whichever is later. After 60 days from the date a correct invoice is received by the appropriate State official, the Contractor may assess interest on overdue, undisputed account charges up to a maximum of the interest rate paid by the IRS on taxpayer refund claims, plus two percent, computed similarly as the requirements of Utah Code Annotated Section 15-6-3. The IRS interest rate is adjusted quarterly, and is applied on a per annum basis, on the invoice amount that is overdue.
  - b. The contract total may be changed only by written amendment executed by authorized personnel of the parties. Unless otherwise stated in the Contract, all payments to the Contractor will be remitted by mail, electronic funds transfer, or the State of Utah's purchasing card (major credit card). The State of Utah will not allow the Contractor to charge end users electronic payment fees of any kind.
  - c. The acceptance by the Contractor of final payment without a written protest filed with the State within ten (10) working days of receipt of final payment shall release the State from all claims and all liability to the Contractor for fees and costs of the performance of the services pursuant to this Contract.
  - d. **Overpayment:** The Contractor agrees that if during or subsequent to the contract performance, a CPA audit, or a State agency audit determines that payments were incorrectly reported or paid the State may adjust the payments. The Contractor shall, upon written request, immediately refund to DTS any such overpayments. The Contractor further agrees that the State shall have the right to withhold any or all- subsequent payments under this or other contracts that the Contractor may have with the State until recoupment of overpayment is made.
  - e. **Payment withholding:** the Contractor agrees that the adequate reporting, record keeping, and compliance requirements specified in this contract are a material element of performance and that if the Contractor's record keeping practices, compliance, and/or reporting to DTS are not conducted in a timely and satisfactory manner, DTS may withhold part or all payments under this or any other contract until such deficiencies have been remedied. This includes, but is not limited to, Contractors failure to provide timely invoicing, and/or other requirements described elsewhere within this contract. In the event of the payment(s) being withheld, DTS agrees to provide ten (10)

day advance Notice to the Contractor of the deficiencies that must be corrected in order to bring about the release of withheld payment. Contractor shall have ten (10) days thereafter to correct the cited reporting or record keeping practice deficiencies or the contract may be terminated.

24. **COPYRIGHT:** The contractor agrees that any and all Deliverables prepared for the State of Utah as required by this contract, to the extent to which it is eligible under copyright law in any country, shall be deemed a work made for hire, such that all rights, title and interest in the work and Deliverables shall be exclusively owned by the State of Utah. State of Utah reserves a royalty-free, nonexclusive, and irrevocable license to reproduce, publish, or otherwise use and to authorize others to use for Federal or State Government purposes, such software, modifications and documentation. To the extent any Deliverable is deemed not to be, for any reason whatsoever, work made for hire, Contractor agrees to assign and hereby assigns all right title and interest, including but not limited to copyright patent, trademark and trade secret, to such Deliverables, and all extensions and renewals thereof, to the State of Utah. Contractor further agrees to provide all assistance reasonably requested by the State of Utah in the establishment, preservation, and enforcement of its rights in such Deliverables, without any additional compensation to Contractor. Contractor agrees to and hereby, to the extent permissible, waives all legal and equitable rights relating to the Deliverables, including without limitation any and all rights of identification of authorship and any and all rights of approval, restriction or limitation on use or subsequent modifications.
25. **OWNERSHIP, PROTECTION AND USE OF RECORDS:** Except for confidential medical records held by direct care providers, the State shall own exclusive title to all information gathered, reports developed, and conclusions reached in performance of this Contract. The Contractor may not use, except in meeting its obligations under this contract, information gathered, reports developed, or conclusions reached in performance of this Contract without the express written consent of the State. The improper use or disclosure of any information concerning a State of Utah client, or a State of Utah employee for any purpose not directly connected with the administration of the State, or the Contractor's responsibilities with respect to services purchased under this agreement, is prohibited except on written consent of the state agency employee, state agency client, their attorney, or their responsible parent or guardian. The Contractor will be required to sign a Confidential Information Certification form in situations where they will be given access to confidential computerized records. The Contractor agrees to maintain the confidentiality of records it holds as agent for the State as required by Government Records Access and Management Act ("GRAMA"), or other applicable federal or state law. The State of Utah shall own and retain unlimited rights to use, disclose, or duplicate all information and data (copyrighted or otherwise) developed, derived, documented, stored, or furnished by the Contractor under the Contract. The Contractor, and any subcontractors under its control, expressly agrees not to use confidential client, or confidential federal, state, or local government data, without prior written permission from the State of Utah Project Manager and appropriate officials of the State Agency.
26. **OWNERSHIP, PROTECTION, AND USE OF CONFIDENTIAL FEDERAL, STATE, OR LOCAL GOVERNMENT INTERNAL BUSINESS PROCESSES AND PROCEDURES:** The improper use or disclosure by any party of protected internal Federal or State business processes polices, procedures, or practices are prohibited. Confidential federal or state business processes, policies, procedures, or practices shall not be divulged by the Contractor, Contractor's employees, or their Subcontractors, unless prior written consent has been obtained in advance from the State of Utah Project Manager.
27. **OWNERSHIP, PROTECTION, AND RETURN OF DOCUMENTS AND DATA UPON CONTRACT TERMINATION OR COMPLETION:** All documents and data pertaining to work required by this contract will be the property of the State and must be delivered to the State within 30 working days after termination or completion of the contract, regardless of the reason for contract termination, and without restriction or limitation to their future use. Any State data that may be returned under provisions of this clause must either be in the format as originally provided, or in a format that is readily usable by the State or that can be formatted in a way that it can be used. Costs for all of these described items will be considered as included in the basic contract compensation of the work described used by the State
28. **CONFIDENTIALITY:** Contractor, and anyone for whom the Contractor may be liable, must maintain the confidentiality of any non-public personal information. Personal information includes, but is not limited to, names, social security numbers, birth dates, address, credit card numbers and financial account numbers. The State reserves the right to identify additional reasonable types or categories of information that must be kept confidential by the Contractor and anyone for whom the Contractor may be liable. This

duty of confidentiality shall be ongoing and survive the term of this contract.

29. **TERMINATION UPON DEFAULT:** In the event this contract is terminated as a result of a default by the Contractor, the State may procure or otherwise obtain, upon such terms and conditions as the State deems appropriate, services similar to those terminated, and Contractor shall be liable to the State for any and all damages arising there from, including, but not limited to, attorneys' fees and excess costs incurred by the State in obtaining similar services.
30. **PROCUREMENT ETHICS:** The Contractor understands that a person who is interested in any way in the sale of any supplies, services, construction, or insurance to the State of Utah is violating the law if the person gives or offers to give any compensation, gratuity, contribution, loan or reward, or any promise thereof to any person acting as a procurement officer on behalf of the State, or who in any official capacity participates in the procurement of such supplies, services, construction, or insurance, whether it is given for their own use or for the use or benefit of any other person or organization (63G-6-1002, Utah Code Annotated, 1953, as amended).
31. **WORKERS' COMPENSATION:** The Contractor shall furnish proof to the State, upon request and maintain during the life of this contract, workers' compensation insurance for all its employees as well as any subcontractor employees related to this contract.
32. **LIABILITY INSURANCE:** The Contractor agrees to provide and to maintain during the performance of the contract, at its sole expense, a policy of liability insurance. The limits of the policy shall be no less than \$1,000,000.00 for each occurrence and \$3,000,000.00 aggregate.
- It shall be the responsibility of the Contractor to require any of their Subcontractor(s) to secure the same insurance coverage as prescribed herein for the Contractor.
33. **ENTIRE AGREEMENT:** This Agreement, including all Attachments, and documents incorporated hereunder, and the related State Solicitation constitutes the entire agreement between the parties with respect to the subject matter, and supersedes any and all other prior and contemporaneous agreements and understandings between the parties, whether oral or written. The terms of this Agreement shall supersede any additional or conflicting terms or provisions that may be set forth or printed on the Contractor's work plans, cost estimate forms, receiving tickets, invoices, or any other related standard forms or documents of the Contractor that may subsequently be used to implement, record, or invoice services hereunder from time to time, even if such standard forms or documents have been signed or initialed by a representative of the State. The parties agree that the terms of this Agreement shall prevail in any dispute between the terms of this Agreement and the terms printed on any such standard forms or documents, and such standard forms or documents shall not be considered written amendments of this Agreement.
34. **SURVIVORSHIP:** This paragraph defines the specific contractual provisions that will remain in effect after the completion of or termination of this contract, for whatever reason:
- (a) State of Utah Standard IT Terms and Conditions # 2, Contract Jurisdiction, Choice of Law, and Venue;
  - (b) State of Utah Standard IT Terms and Conditions # 17, Secure Protection and Handling of Data; (c) State of Utah Standard IT Terms and Conditions # 18, Notification and Data Breaches; (d) State of Utah Standard IT Terms and Conditions # 26, Copyright; (e) State of Utah Standard IT Terms and Conditions #27, Ownership, Protection, and Use of Records, including Residuals of such records; and (f) State of Utah Standard IT Terms and Conditions # 28, Ownership, Protection, and Use of Confidential Federal, State, or Local Government Internal Business Processes, including Residuals of such confidential business processes; (g) State of Utah Standard IT Terms and Conditions # 29, Ownership, Protection, and Return of Documents and Data Upon Contract Termination or Completion; and (h) State of Utah Standard IT Terms and Conditions # 30, Confidentiality.
35. **WAIVER:** The waiver by either party of any provision, term, covenant or condition of this Contract shall not be deemed to be a waiver of any other provision, term, covenant or condition of this Contract nor any subsequent breach of the same or any other provision, term, covenant or condition of this Contract.

**If professional services are applicable to this solicitation/contract, the following terms and conditions apply:**

36. **TIME:** The Contractor shall complete the scope of services work in a manner to achieve any milestones identified in the procurement documents related to this Contract and the attachments to this Contract. The full scope of services work shall be completed by any applicable deadline stated in the

solicitation.

37. **TIME IS OF THE ESSENCE:** For all work and services under this Contract, time is of the essence and Contractor shall be liable for all damages to the State of Utah and anyone for whom the State of Utah may be liable, as a result of the failure to timely complete the scope of work required under this Contract.
38. **CHANGES IN SCOPE:** Any changes in the scope of the services to be performed under this Contract shall be in the form of a written amendment to this Contract, mutually agreed to and signed by duly authorized representatives of both parties, specifying any such changes, fee adjustments, any adjustment in time of performance, or any other significant factors arising from the changes in the scope of services.
39. **PERFORMANCE EVALUATION:** The State of Utah may conduct a performance evaluation of the Contractor's services, including specific personnel of the Contractor. References in the Contract to Contractor shall include Contractor, Contractor's subcontractors, or subconsultants at any tier, if any. Results of any evaluation will be made available to the Contractor.
40. **WAIVERS:** No waiver by the State or Contractor of any default shall constitute a waiver of the same default at a later time or of a different default.
41. **INSURANCE:**
- a. To protect against liability, loss and/or expense in connection with the performance of services described under this Contract, the Contractor shall obtain and maintain in force during the entire period of this Contract without interruption, at its own expense, insurance as listed below from insurance companies authorized to do business in the State of Utah and with an A.M. Best rating as approved by the State of Utah Division of Risk Management.
- b. The following are minimum coverages that may be supplemented by additional requirements contained in the solicitation for this Contract or provided in an Attachment to this Contract; if no insurance limits are identified in the solicitation, insurance minimums will default to Section 44.

Liability Insurance Requirements:

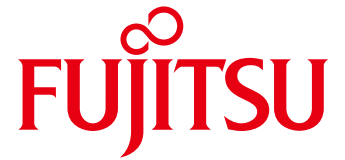
- (1) Worker's Compensation Insurance and Employers' Liability Insurance. Worker's compensation insurance shall cover full liability under the worker's compensation laws of the jurisdiction in which the service is performed at the statutory limits required by said jurisdiction.
  - (2) Professional liability insurance in the amount as described in the solicitation for this Contract, if applicable.
  - (3) Any other insurance described in the solicitation for this Contract, if applicable.
  - (4) Any type of insurance or any increase of limits of liability not described in this Contract which the Contractor requires for its own protection or on account of any statute, rule, or regulation shall be its own responsibility, and shall be provided at Contractor's own expense.
  - (5) The carrying of insurance required by this Contract shall not be interpreted as relieving the Contractor of any other responsibility or liability under this Contract or any applicable law, statute, rule, regulation, or order.
42. **STANDARD OF CARE:** The services of Contractor and its subcontractors and subconsultants at any tier, if any, shall be performed in accordance with the standard of care exercised by licensed members of their respective professions having substantial experience providing similar services which similarities include the type, magnitude and complexity of the services that are the subject of this Contract. The Contractor shall be liable to the State of Utah for claims, liabilities, additional burdens, penalties, damages or third party claims (i.e. another Contractor's claim against the State of Utah), to the extent caused by wrongful acts, errors or omissions that do not meet this standard of care.
43. **STATE REVIEWS, LIMITATIONS:** The right of the State to perform plan checks, plan reviews, other reviews and/or comment upon the services of the Contractor, as well as any approval by the State, shall not be construed as relieving the Contractor from its professional and legal responsibility for services required under this Contract. No review by the State or any entity/user, approval or acceptance, or payment for any of the services required under this Contract shall be construed to operate as a waiver by the State of any right under this Contract or of any cause of action arising out of the performance or nonperformance of this Contract, and the Contractor shall be and remain liable to the State in accordance with applicable law for all damages to the State caused by the wrongful acts, errors and/or omissions of the Contractor or its subcontractors or subconsultants at any tier, if any.

## Question and Answers for Bid #JP14001 - Data Communications Products & Services

### OVERALL BID QUESTIONS

There are no questions associated with this bid. If you would like to submit a question, please click on the "Create New Question" button below.

Question Deadline: Jul 26, 2013 11:00:00 AM MDT



Fujitsu Limited  
Annual Report  
2012

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Moving Ahead,  
Realizing Our Vision



# ICT Solutions are giving shape to a brighter tomorrow

Through cloud computing and other cutting-edge information and communication technology (ICT) utilization, Fujitsu is taking advantage of previously underutilized value emerging from human knowledge and behavior, as well as changes in the social environment, to deliver solutions to society across a broad spectrum of fields. In this way, Fujitsu is helping to make a more prosperous and convenient society possible.



## Promoting smart cities as a model for regional revitalization in Japan

The world faces a host of problems today, including rapid urbanization and energy woes resulting from populations being concentrated in cities, as well as the need to cope with environmental concerns and the global economic recession. The same can be said for Japan; as it continues to grapple with longstanding issues, pressure has mounted around building secure, safe, and sustainable communities since the Great East Japan Earthquake of March 11, 2011.

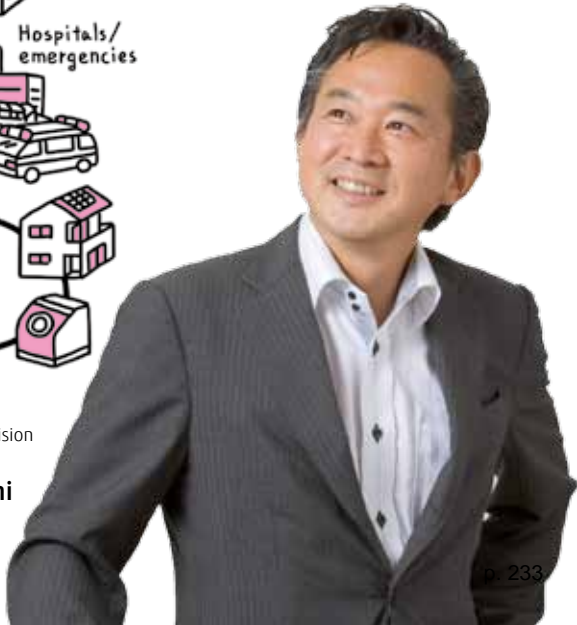
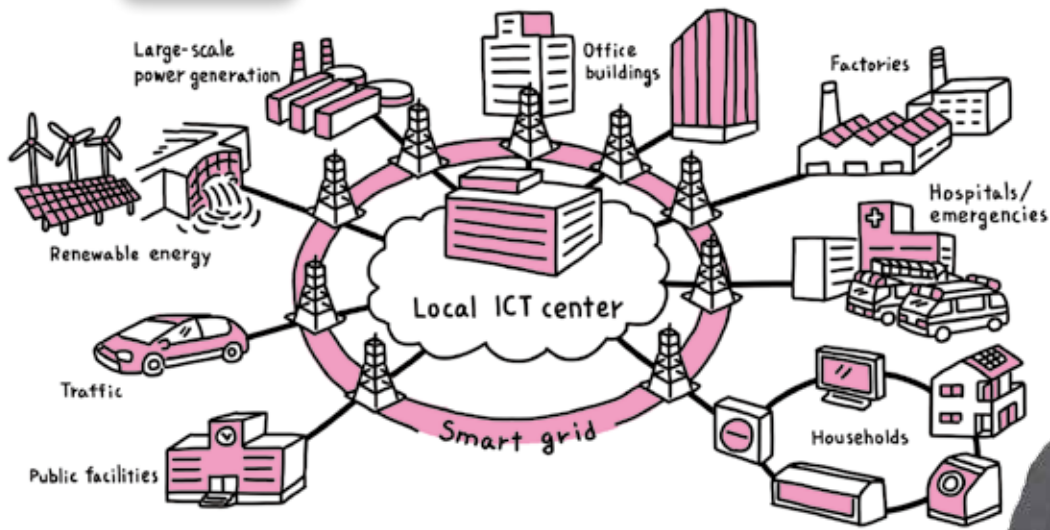
Putting renewable energy to use is an issue in every region. Utilizing ICT, Fujitsu will support the smart conversion of social infrastructure, especially in the field of energy. In tandem, Fujitsu will leverage

its own Field Innovation approach to think through and solve local issues, and tackle the question of revitalization together with local communities. In doing so, we aim to create a model whereby value is circulated throughout society for these communities to bring about sustainable "smart cities."

Furthermore, by applying its rich experience of providing business solutions—a Fujitsu forte—to address the needs of local communities, Fujitsu will create a standard "regional revitalization model" for the development of Fujitsu-original smart cities across Japan. Our ultimate goal is to roll out smart cities worldwide, contributing to the creation of societies where people can live in peace of mind.



URBAN PLANNING



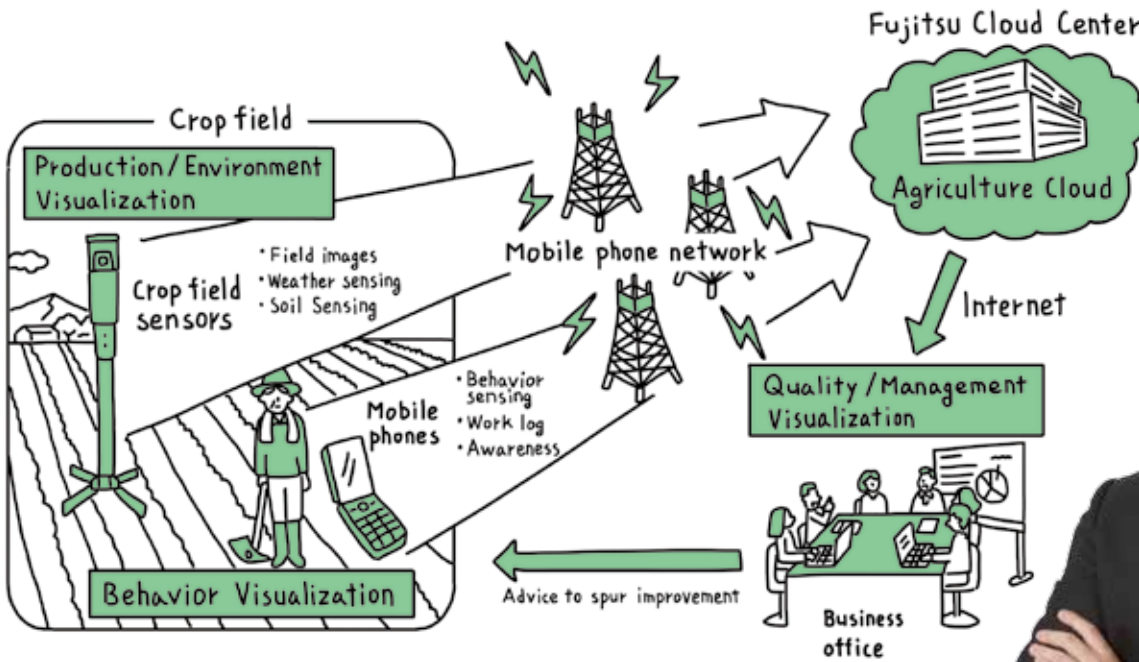
Smart City Promotion Division  
General Manager  
**Kenichi Yamagishi**

### Contributing to a future of abundant food with ICT

Fujitsu is beginning to roll out initiatives for the management of corporate farming. Data generated from sensors and cameras that record the conditions of farmland, and work logs of agricultural laborers gathered from GPS-equipped mobile phones are compiled at Fujitsu datacenters, enabling the data to be used for agricultural operations. For example, when spraying pesticides, we have shown that in some cases it is more effective in terms of total cost, including for personnel, to spray an expensive but highly effective pesticide once than a cheap but less effective one several times. Proving this, however, requires fairly in-depth data, such as when spraying occurs, the volume of pesticide used, who uses it and where, and the degree

of effectiveness. The use of ICT makes it dramatically easier to collect and analyze these types of data.

Today, the area of idle agricultural land in Japan is rising. Meanwhile, the proper transfer of agricultural techniques and knowledge as farmers grow elderly has become a serious issue. One possible solution is ICT, which enables conditions at several farmland locations to be centrally managed, and related work logs to be converted into a variety of formats. In the future, we hope to utilize ICT at food production sites as the starting point for contributing to more abundant food resources through a value chain that links together distribution channels, communities, and consumers.



Social Cloud Business Development Unit  
Business Planning Division  
**Kazumasa Tsunoda**





HEALTH CARE

### Using big data analysis to predict risk of diabetes with a high degree of accuracy

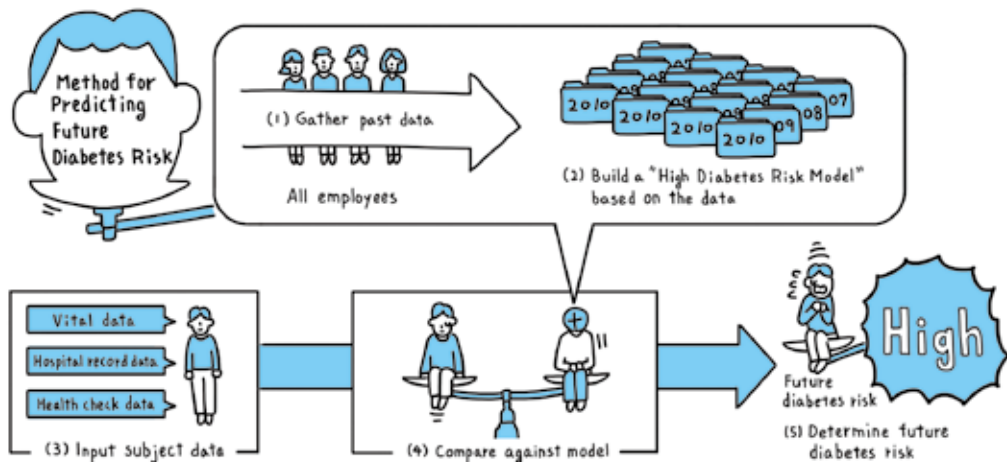
Fujitsu employees are taking part in an experimental program that aims to predict the risk of diabetes by analyzing all manner of health-related data—for example, data from regular health checks, records of hospital visits and other health insurance claim data, and vital data, including tracking the number of steps walked and day-to-day weight fluctuations. Even without medical knowledge, it is now possible to accurately assess the risk of diabetes by using a mathematical approach to analyzing such data. The early detection of precursors for diabetes and other lifestyle-related diseases has improved the health of Fujitsu employees. In the future, we would

also like to see this service find widespread use outside of Fujitsu (for example, in various companies' health insurance organizations), leading to improved health for a greater number of people and a reduction in national healthcare costs.

Broader smartphone uptake and increasingly sophisticated sensor technologies have made it possible to amass huge volumes of data. It is now possible to add value to this data via analysis using ICT in tandem with the knowledge and expertise humans have thus far cultivated. I find this to be one of the most rewarding and enjoyable aspects of our work.

Intelligent Services Business Unit  
Intelligent Computing Division  
Senior Director

Seishi Okamoto





COSMETIC SUPPORT



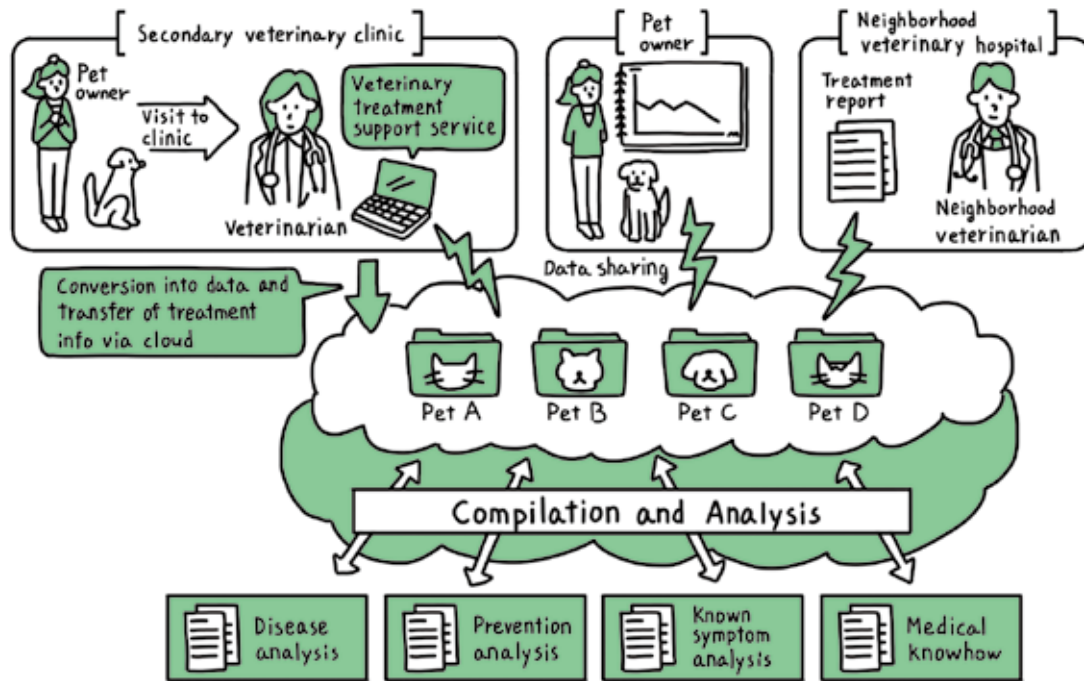
### Skin analysis service developed from Fujitsu's strength in image processing technology

Fujitsu, in cooperation with a cosmetics maker, has developed a service that enables people to confirm their skin condition by taking a picture of their face with a smartphone. When a picture of a face is taken together with a color reference chart made based on skin colors of approximately 4,000 people, Fujitsu's image processing technology enables the condition of spots, skin tone, and pores to be measured accurately with a smartphone app, regardless of where the picture is taken or lighting conditions. The results are stored in a cloud database, allowing users to confirm the benefits of daily care through continuous measurement. Along with skin information, if we can convert the range of other personal data collected, such as sleeping hours and the content of meals eaten, into databases, we can store a huge amount of data about our daily lives. The data and the results of its multifaceted analysis could then be provided to makers of cosmetics, beauty items and appliances. We would like to see this lead to new health and beauty-related services. Similarly, this information might be utilized in a wide range of other services, based on new insights that emerge from convergence with data from different industries. In utilizing this data collected from people, our goal is to offer more human-centric solutions around the world.



Intelligent Services Business Unit  
Strategic Planning Division  
Senior Manager  
**Hayuru Ito**

## Using cloud computing to create a comfortable society for people and animals



Fujitsu is taking the first steps toward a better society for both people and companion animals by utilizing cloud services to store a broad range of data concerning pets, including health and lifestyle information such as pet type, treatment information, number of steps walked, and ambient temperature, which can then be accessed by various providers of pet services.

For example, we have begun testing a system in which neighborhood veterinary clinics and secondary clinics capable of providing advanced treatment share treatment data over a cloud, allowing for the smooth provision of high-quality veterinary services. We have also built a system for cloud-based management of information on animals who are no longer able to stay with their owners as a result of the Great East Japan Earthquake, including owner information, and basic health data such as vaccination history. This system will not only facilitate health management for entire groups of animals, which is particularly important for animals staying in group settings, but will also allow for considerable improvements in work efficiency by standardizing operational processes, which has been difficult in disaster areas.

Animals are an essential part of human society. We hope that furthering initiatives such as these using cloud computing will make a substantial contribution to creating a society in which pet owners and local communities can live together comfortably.



Social Cloud Business Development Unit Business Planning Division Director

**Akira Imabayashi**



## Supporting the reconstruction effort in disaster-stricken areas, while pioneering solutions for Japan's social issues

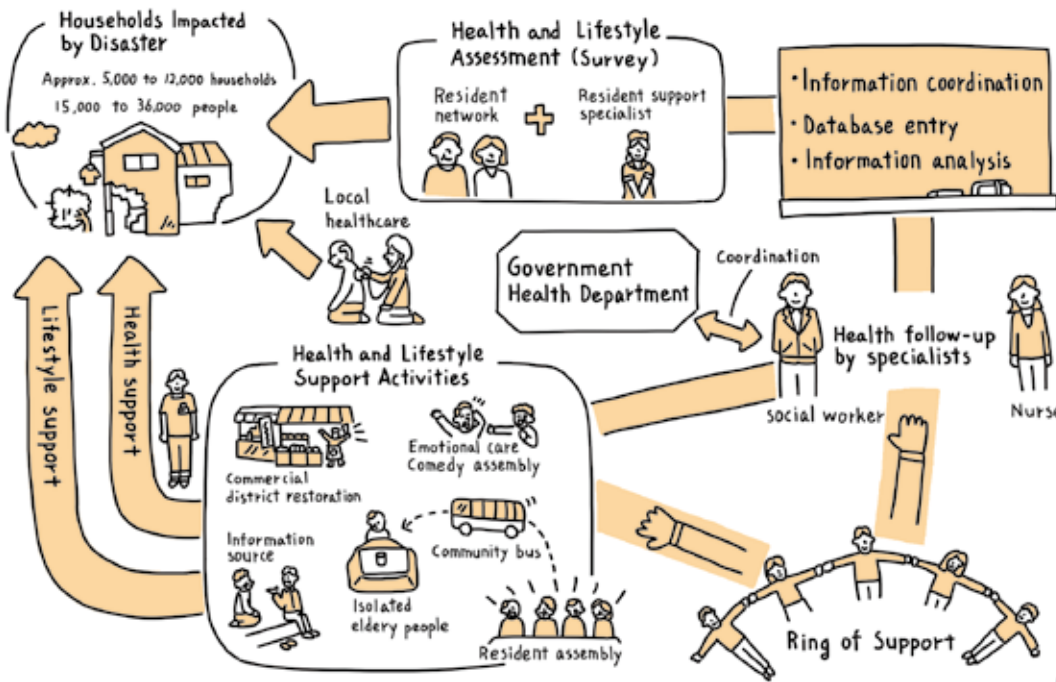
Following the Great East Japan Earthquake on March 11, 2011, local governments and communities were thrown into turmoil in trying to cope with a situation on the ground that was changing by the minute. A lack of accurate information in many cases meant that the appropriate support was not delivered. Within three days of the earthquake, Fujitsu had pulled together a special disaster support team reporting directly to an executive officer. The team was then dispatched to the frontline to provide support for affected communities by drawing on Fujitsu's strengths in system development and solutions, and its expertise in cloud computing.

In the immediate aftermath of the earthquake Fujitsu participated in Tsuna-pro, an organization of volunteers and NPOs. Fujitsu created a cloud-based database of circumstances on the ground at approximately 500 evacuation centers in Miyagi Prefecture, enabling Tsuna-pro to identify specific needs and promptly arrange for delivery of the appropriate supplies and support.

Three months after the disaster, Fujitsu aided in the establishment by Tetsuyu Institute Medical Corporation of You Home Clinic Ishinomaki, offering home-based medical care to residents of a region where the healthcare system had been completely destroyed.

Six months after the earthquake, Fujitsu assisted an organization providing support for households impacted by the disaster. We conducted a poll of all households across the region, using ICT to share the information gathered with the authorities and support organizations. This step enabled them to offer comprehensive support from both a health and lifestyle perspective.

The problems evident in disaster-affected areas—for example, isolation of the elderly and a lack of medical resources—in many respects epitomize the future Japan faces with its dwindling birthrate and aging population. I find profound meaning in the thought that our initiatives will not only hasten the recovery of disaster-affected areas, but also pioneer solutions to some of Japan's social issues.



Social Cloud Business Development Office  
Business Development Division  
Senior Manager

Shinji Narukawa



DISASTER  
RESPONSE



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The 2012 Annual Report features a glossary of industry and product-related terminology to enhance readers' understanding of the report.

## Forward-Looking Statements

This annual report may contain forward-looking statements that are based on management's current views and assumptions and involve known and unknown risks and uncertainties that could cause actual results, performance or events to differ materially from those expressed or implied in such statements. Actual results may differ materially from those projected or implied in the forward-looking statements due to, without limitation, the following factors: general economic and market conditions in key markets (particularly in Japan, Europe, North America and Asia, including China); rapid changes in the high-technology market (particularly semiconductors, PCs, etc.); fluctuations in exchange rates or interest rates; fluctuations in capital markets; intensifying price competition; changes in market positioning due to competition in R&D; changes in the environment for the procurement of parts and components; changes in competitive relationships relating to collaborations, alliances and technical provisions; potential emergence of unprofitable projects; and, changes in accounting policies.

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An overview of the Fujitsu Group's current status and future direction

## Focus

Fujitsu's management policies for realizing its vision

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An overview of business performance by segment and by region, and a progress check on research and development

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Reporting on Fujitsu's CSR activities, corporate governance and more

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Management

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# Performance Highlights

Fujitsu Limited and Consolidated Subsidiaries

Years ended March 31	2003	2004	2005	2006
<b>Financial Data</b>				
<b>POINT 1</b> Net sales	¥4,617,580	¥4,766,888	¥4,762,759	¥4,791,416
Sales outside Japan	1,336,915	1,388,623	1,422,095	1,591,574
Ratio of sales outside Japan (%)	29.0	29.1	29.9	33.2
Operating income	100,427	150,342	160,191	181,488
Operating income margin (%)	2.2	3.2	3.4	3.8
Net income (loss)	(122,066)	49,704	31,907	68,545
Cash flows from operating activities	¥ 117,797	¥ 304,045	¥ 277,232	¥ 405,579
Cash flows from investing activities	(64,415)	67,389	(15,129)	(234,684)
<b>POINT 2</b> Free cash flow	53,382	371,434	262,103	170,895
Cash flows from financing activities	(67,237)	(239,902)	(212,034)	(207,840)
Inventories	¥ 595,984	¥ 521,126	¥ 478,510	¥ 408,710
Monthly inventory turnover rate (times)	0.59	0.64	0.71	0.88
Total assets	4,225,361	3,865,589	3,640,198	3,807,131
Owners' equity (total net assets – subscription rights to shares – minority interests in consolidated subsidiaries)	702,390	827,177	856,990	917,045
Return on equity (%)	(17.4)	6.0	3.7	7.7
Owners' equity ratio (%)	16.6	21.4	23.5	24.1
Return on assets (%)	(2.9)	1.3	0.9	1.8
<b>POINT 3</b> Interest-bearing loans	1,763,769	1,277,121	1,082,788	928,613
D/E ratio (times)	2.51	1.54	1.26	1.01
Net D/E ratio (times)	2.14	1.04	0.73	0.55
R&D expenses	285,735	250,910	240,222	241,566
Capital expenditure	147,620	159,795	181,402	249,999
Depreciation	264,678	200,031	169,918	169,843
<b>Amounts per share of common stock (Yen and U.S. Dollars):</b>				
Net income (loss)	¥ (61.29)	¥ 24.55	¥ 15.42	¥ 32.83
<b>POINT 4</b> Cash dividends	–	3.00	6.00	6.00
Owners' equity	350.84	413.22	414.18	443.20

## Non-financial Data (ESG Indicators)

<b>Environmental</b>				
Trends in total greenhouse gas emissions (whole group and global) (10,000 tons)	210.2	175.5	175.5	159.8
<b>Social</b>				
Number of employees	157,044	156,169	150,970	158,491
Trends in women managers (Non-consolidated) (%)	1.4	1.6	1.7	1.8
<b>Governance</b>				
Percentage of outside directors (Non-consolidated) (%)	29	10	20	20

Note: The U.S. dollar amounts stated above and elsewhere in this report have been translated from yen, for readers' convenience only, at the rate of ¥82 = US\$1, which was the approximate rate on the Tokyo Foreign Exchange Market on March 31, 2012.

### POINT 1

In fiscal 2011, consolidated net sales declined ¥60.8 billion year on year, to ¥4,467.5 billion. Excluding the impact of exchange rate fluctuations, net sales were on par with the previous fiscal year. Negative factors, including effects from lower sales caused by flooding in Thailand and a drop in Device Solutions sales due to weak demand, were largely offset by increased sales of mobile phones and network products driven by growing smartphone usage.

### POINT 2

Free cash flow (the sum of operating and investment cash flows) was a positive ¥49.1 billion, or ¥64.2 billion less than the previous fiscal year. Excluding proceeds from the sale of investment securities and other special items reported in fiscal 2010, free cash flow was actually a positive ¥43.5 billion, or a year-on-year decline of ¥29.8 billion.

					Yen (millions)	Year-on-Year Change (%)	U.S. Dollars (thousands)
2007	2008	2009	2010	2011	2012	2012/2011	2012
¥5,100,163	¥5,330,865	¥4,692,991	¥4,679,519	¥4,528,405	<b>¥4,467,574</b>	<b>-1.3</b>	<b>\$54,482,610</b>
1,825,255	1,923,621	1,499,886	1,748,304	1,587,363	<b>1,506,096</b>	<b>-5.1</b>	<b>18,367,024</b>
35.8	36.1	32.0	37.4	35.1	<b>33.7</b>		
182,088	204,989	68,772	94,373	132,594	<b>105,304</b>	<b>-20.6</b>	<b>1,284,195</b>
3.6	3.8	1.5	2.0	2.9	<b>2.4</b>		
102,415	48,107	(112,388)	93,085	55,092	<b>42,707</b>	<b>-22.5</b>	<b>520,817</b>
¥ 408,765	¥ 322,072	¥ 248,098	¥ 295,389	¥ 255,534	<b>¥ 240,010</b>	<b>-6.1</b>	<b>\$ 2,926,951</b>
(151,083)	(283,926)	(224,611)	1,020	(142,108)	<b>(190,830)</b>	<b>-</b>	<b>(2,327,195)</b>
257,682	38,146	23,487	296,409	113,426	<b>49,180</b>	<b>-56.6</b>	<b>599,756</b>
(234,953)	62,325	(47,894)	(405,310)	(166,933)	<b>(138,966)</b>	<b>-</b>	<b>(1,694,707)</b>
¥ 412,387	¥ 383,106	¥ 306,456	¥ 322,301	¥ 341,438	<b>¥ 334,116</b>	<b>-2.1</b>	<b>\$ 4,074,585</b>
0.93	1.03	0.98	1.04	1.02	<b>1.01</b>	<b>-1.0</b>	
3,943,724	3,821,963	3,221,982	3,228,051	3,024,097	<b>2,945,507</b>	<b>-2.6</b>	<b>35,920,817</b>
969,522	948,204	748,941	798,662	821,244	<b>841,039</b>	<b>2.4</b>	<b>10,256,573</b>
10.9	5.0	(13.2)	12.0	6.8	<b>5.1</b>		
24.6	24.8	23.2	24.7	27.2	<b>28.6</b>		
2.6	1.2	(3.2)	2.9	1.8	<b>1.4</b>		
745,817	887,336	883,480	577,443	470,823	<b>381,148</b>	<b>-19.0</b>	<b>4,648,146</b>
0.77	0.94	1.18	0.72	0.57	<b>0.45</b>		
0.31	0.36	0.47	0.20	0.14	<b>0.14</b>		
254,095	258,717	249,902	224,951	236,210	<b>238,360</b>	<b>0.9</b>	<b>2,906,829</b>
305,285	249,063	167,690	126,481	130,218	<b>140,626</b>	<b>8.0</b>	<b>1,714,951</b>
202,825	200,509	223,975	164,844	141,698	<b>131,577</b>	<b>-7.1</b>	<b>1,604,598</b>
¥ 49.54	¥ 23.34	¥ (54.35)	¥ 45.21	¥ 26.62	<b>¥ 20.64</b>	<b>-22.5</b>	<b>\$ 0.252</b>
6.00	8.00	8.00	8.00	10.00	<b>10.00</b>	<b>0.0</b>	<b>0.122</b>
469.02	458.31	362.30	386.79	396.81	<b>406.42</b>	<b>2.4</b>	<b>4.956</b>
153.0	189.4	166.8	131.3	118.5	<b>109.8</b>	<b>-7.3</b>	
160,977	167,374	165,612	172,438	172,336	<b>173,155</b>		
2.2	2.4	2.9	3.1	3.5	<b>3.7</b>		
20	20	20	30	30	<b>36</b>		

**POINT 3**

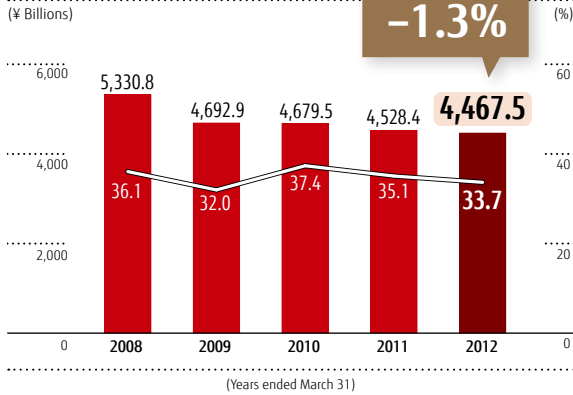
The balance of interest-bearing loans was at its lowest level in a decade. Consequently, the D/E ratio improved 0.12 points year on year, to 0.45 times, its lowest point ever. The net D/E ratio was 0.14 times, the same level as a year earlier, despite a decline in cash and cash equivalents at the end of fiscal 2011.

**POINT 4**

Both the interim and year-end dividends were ¥5 per share, for an annual dividend of ¥10 per share as initially forecast; Fujitsu paid the same dividend in fiscal 2010.

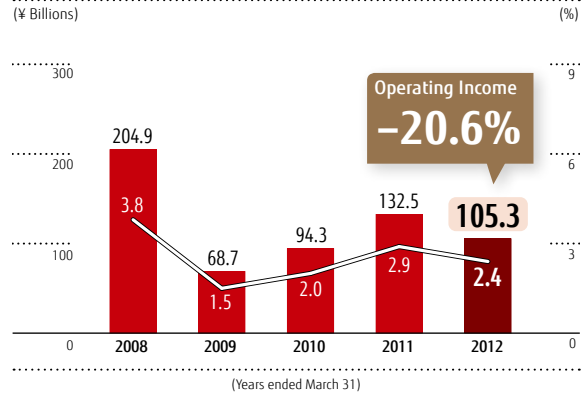
## Financial Data

### Net Sales and Ratio of Sales Outside Japan



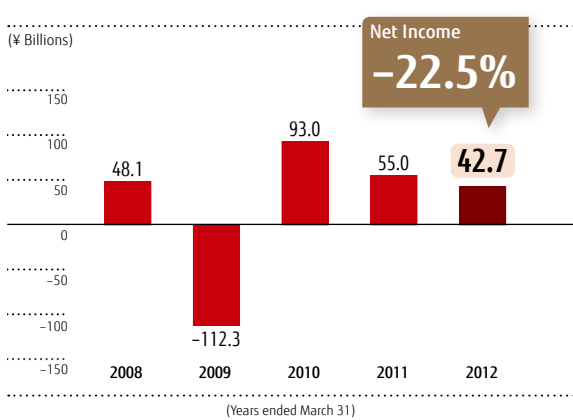
■ Net sales (left scale)  
 ○ Ratio of sales outside Japan (right scale)

### Operating Income and Operating Income Margin

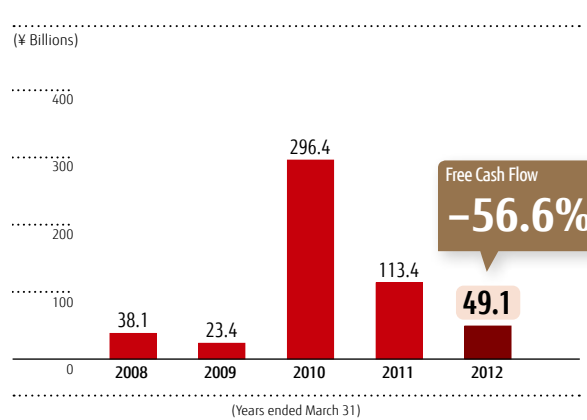


■ Operating income (left scale)  
 ○ Operating income margin (right scale)

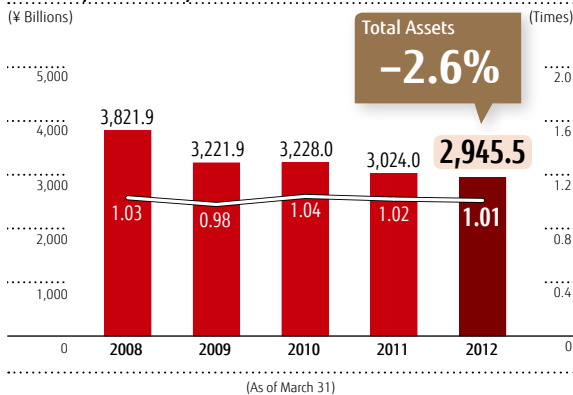
### Net Income (Loss)



### Free Cash Flow

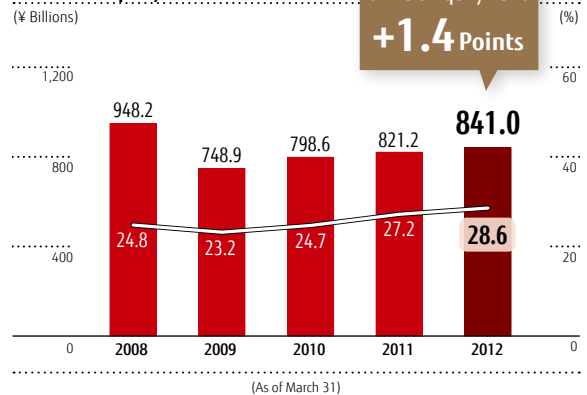


### Total Assets and Monthly Inventory Turnover Rate



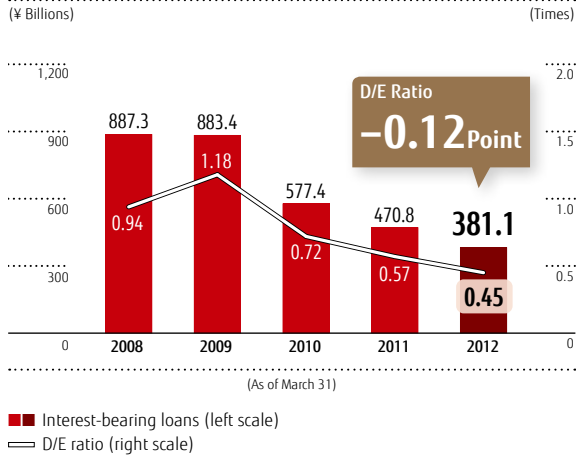
■ Total assets (left scale)  
 ○ Monthly inventory turnover rate (right scale)

### Owners' Equity/ Owners' Equity Ratio

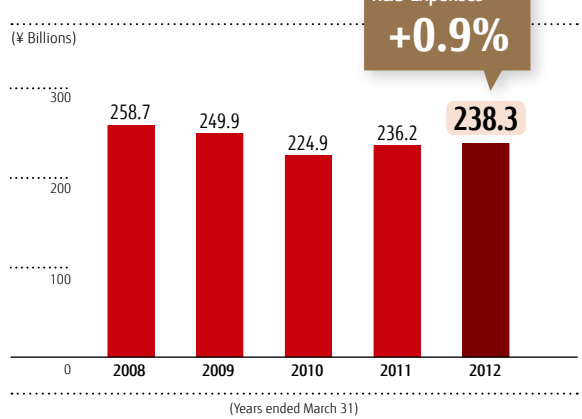


■ Owners' equity (left scale)  
 ○ Owners' equity ratio (right scale)

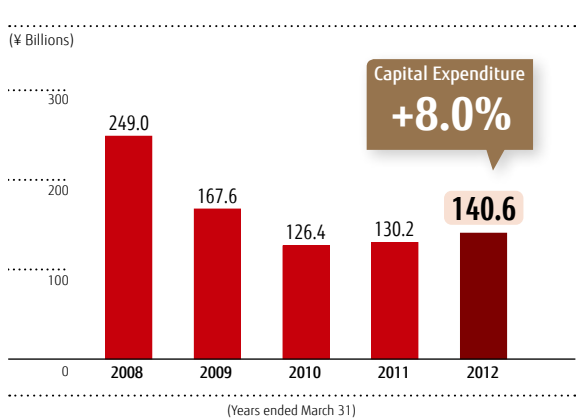
### Interest-Bearing Loans and D/E Ratio



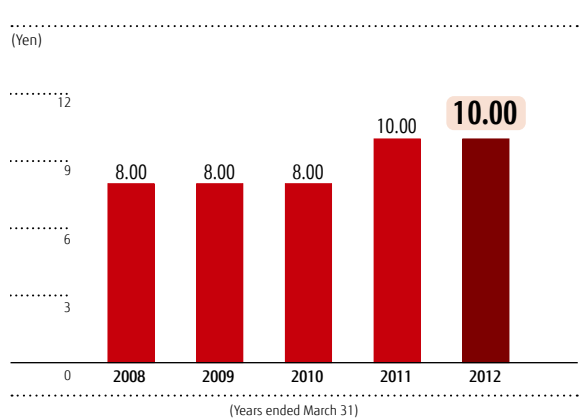
### R&D Expenses



### Capital Expenditure

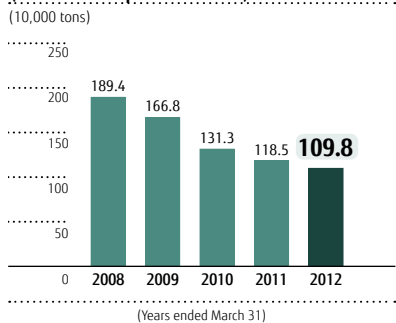


### Cash Dividends

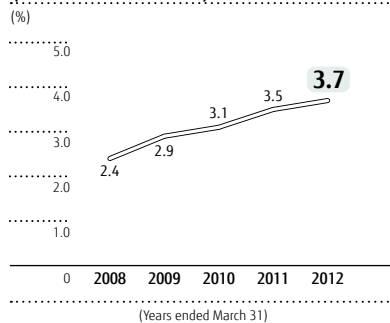


## Non-financial Data (ESG Indicators)

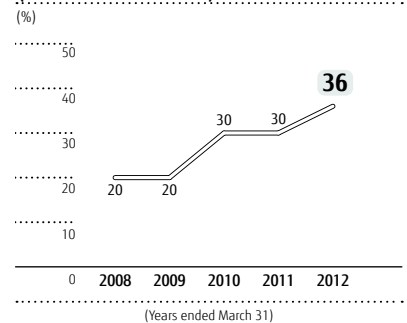
### Trends in Total Greenhouse Gas Emissions (Whole Group and Global)



### Trends in Women Managers (Non-Consolidated)



### Percentage of Outside Directors (Non-Consolidated)



## A Message from Management

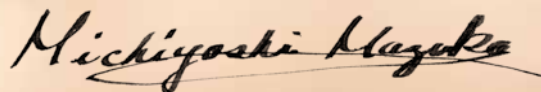
The broadening range of sophisticated ICT applications has sparked unprecedented changes in many aspects of lifestyles and business. The proliferation of smartphones, sensors, cloud services, and other technologies has prompted the development of new services, and the accumulation and analysis of the data these services generate is suggesting novel approaches to once intractable problems. This potential has raised expectations for resolving issues across a wide range of fields, including in disaster readiness, energy, agriculture, the environment, and healthcare.

This wave of change presents tremendous business opportunities for Fujitsu customers around the globe. The Fujitsu Group has set a goal of becoming a technology-based, globally integrated service company. By utilizing the Group's



vertically integrated strengths on a global scale, from services such as cloud and managed services to supercomputers, smartphones, and other products, as well as semiconductors and other technologies, we believe that we can, as a partner, meet the needs of our customers in coping with the multifaceted transformation that they face in business today, and together with them build a prosperous society.

The Fujitsu Group will utilize the capabilities it possesses to the greatest extent possible to seek continuous growth together with customers. We will also realize healthy earnings and sustainable increases in corporate value in order to meet the expectations of shareholders and investors. We very much appreciate your unwavering support.



*Michiyoshi Mazuka*

**Chairman**  
Michiyoshi Mazuka



*Masami Yamamoto*

**President**  
Masami Yamamoto

## A Conversation with the President

# A Clear Vision

The business environment was challenging during fiscal 2011 due to the effects of the European debt crisis and large-scale natural disasters. However, Fujitsu gradually began to see the benefits of its shift to a leaner management structure, reflecting a determined push to go on the offensive with structural reforms. Consequently, our fourth-quarter operating income margin was comparable to that of 2008, prior to the global financial crisis.

We designated fiscal 2012 as a "year to rekindle growth," and are decisively bolstering our capabilities in the areas of sales interaction, system engineering (SE), and technology. In addition to rebuilding a solid business foundation, we aim to achieve an operating income margin of 3%.

Along with these actions, Fujitsu is committed to the sustainable progress of humanity through ICT to realize a prosperous society in the future.

**President**  
Masami Yamamoto

*Masami Yamamoto*



### A review of fiscal 2011

Operating income fell short of initial projections, amounting to ¥105.3 billion in an extremely challenging business climate. During the fourth quarter, however, operating income and the operating income margin were both comparable to levels seen prior to the 2008 global financial crisis.

» To page 016 Q.1

### Future challenges and measures

Fujitsu has designated fiscal 2012 as a “year to rekindle growth,” and is bolstering capabilities in the three areas of sales interactions, system engineering (SE), and technology. In addition to rebuilding a solid business foundation, we aim to achieve an operating income margin of 3%.

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» To page 018 Q.3

» To page 019 Q.4

### Improving corporate value

Together with applying ICT to the challenge of resolving social issues, the Fujitsu Group is striving for improvement in corporate value through sustainable growth and development driven by a shared commitment to putting the Fujitsu Way into practice.

» To page 020 Q.5

### Return of profits and dividend policy

Our policy is to provide a stable dividend while ensuring sufficient internal reserves to support the active expansion of our business. In fiscal 2011, we paid an annual dividend of ¥10 per share as originally planned.

» To page 021 Q.6

### Message to shareholders and investors

Fujitsu believes in the power of ICT to transform society, and will leverage its strengths as a global ICT company originating in Japan to help resolve the world's problems.

» To page 021 Q.7

## A review of fiscal 2011

**Q.1** Looking back, what was the year ended March 31, 2012 like for Fujitsu? How would you rate Fujitsu's business performance?

**A.1** Operating income fell short of initial projections, amounting to ¥105.3 billion in an extremely challenging business climate. During the fourth quarter, however, operating income and the operating income margin were both comparable to levels seen prior to the 2008 global financial crisis.

In fiscal 2011, we emphasized our shift from defense to going on the offense. The global economic situation as a whole, however, continued to face substantial uncertainty. Europe's economic prospects receded as its sovereign debt problem worsened, which in turn triggered an economic slowdown in emerging markets. The US economy, meanwhile, has yet to mount a full-fledged recovery. In Japan, while the supply chain rebounded from the impact of the Great East Japan Earthquake more quickly than anticipated, the economy nonetheless stalled as the strong yen undermined exports and businesses reeled from the catastrophic flooding in Thailand. Regrettably, under the circumstances, we were only able to achieve operating income of ¥105.3 billion, falling short of our initial target of ¥135.0 billion.

Looking at performance by quarter, we posted a net loss in the first quarter as a result of the Great East Japan Earthquake. Although the economic impact from the earthquake had largely subsided by the second quarter, revenue declined as a result of the strong yen, centered on the Device Solutions segment. In the third quarter, the economic slump triggered by the flooding in Thailand and the European debt crisis led to postponement or other disruptions in certain transactions. This included delays in completing contracts, even for services. But by the fourth quarter, signs of a turnaround in the business climate began to appear, as the impact from the earthquake more or less dissipated, and the market for devices began to recover in certain sectors. In addition, we gradually started to see results from our shift to a leaner management structure by going on offense with structural reforms. We achieved fourth-quarter operating income of ¥95 billion, with an operating income margin of 7.3%, on a par with levels prior to the 2008 global financial crisis.

Structural reforms in fiscal 2011 allowed us to further solidify Fujitsu's foundations as an ICT<sup>2</sup> vendor. Our confidence was particularly bolstered by the strength of recovery in the Technology Solutions segment. To solidify it further, we will tackle a range of issues on the way to capturing new growth, and are determined to tie these steps to even greater improvement in future business performance.

» \* See pp. 022-023 for a more detailed account of fiscal 2011 performance.

### Financial Highlights

	(Billions of yen)		
(Years ended March 31)	2010	2011	2012
Net sales	4,679.5	4,528.4	4,467.5
Operating income	94.3	132.5	105.3
Net income	93.0	55.0	42.7
Interest-bearing loans	577.4	470.8	381.1
Net D/E ratio (times)	0.20	0.14	0.14

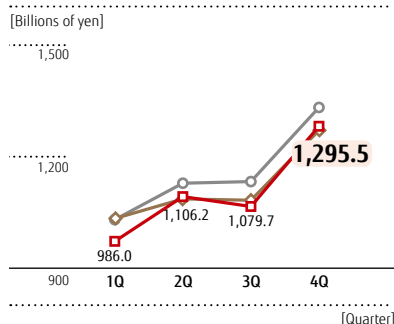
### ? Glossary

#### ICT

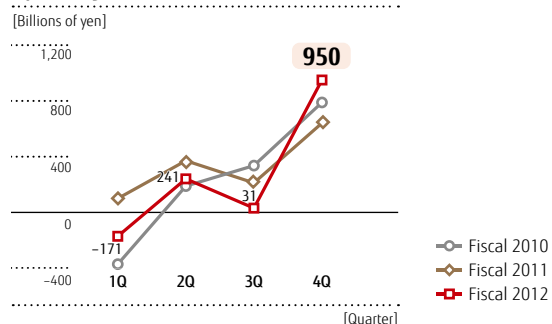
Information and communication technology, a term derived from IT (information technology) and communication, which includes the sharing of knowledge and information via communication networks. Used as a general term for information processing and communications processing technology and applied technology.

### Quarterly Data by Segment (incl. intersegment transactions)

#### Net Sales



#### Operating Income (Loss)



## Future challenges and measures

**Q.2** After reviewing the results for fiscal 2011, what are some of the objectives and urgent measures for the current term, fiscal 2012?

**A.2** Fujitsu has designated fiscal 2012 as a “year to rekindle growth,” and is bolstering capabilities in the three areas of sales interactions, system engineering (SE) and technology. While rebuilding a solid business foundation, we aim to achieve an operating income margin of 3%.

Our fiscal 2012 targets are net sales of ¥4,550.0 billion, with operating income of ¥135.0 billion and an operating income margin of 3%, representing both higher revenue and earnings. During fiscal 2011 we stated repeatedly that we are shifting from a defensive to an offensive posture. Fiscal 2012 we have designated as a “year to rekindle growth.” While maintaining our growth strategies of going on the offensive with structural reforms, accelerating globalization, and creating new services businesses, we will seek to strengthen our corporate structure. Our target operating income margin of 3% will serve as a milestone on the path to growth.

The business environment for ICT today is caught up in sweeping structural changes stemming from the current wave of cloud services<sup>2</sup> and big data<sup>2</sup>. The extent to which we can continue to provide value to our customers and lay out a path for business development will determine the true value of Fujitsu. As we reach this important juncture, we recognize that we need to move away from our previous business model centered on system integration (SI), and build a solid business foundation that can respond to this new era.

On April 1 we adopted a matrix-type organization structured along customer segments and business lines. This was an offense-style structural reform intended to bolster capabilities in the three areas of sales interactions, SE and technology. We also took further steps toward a “fab-lite” business model to strengthen the business structure for Device Solutions, including selling the Iwate Plant to Denso Corporation.

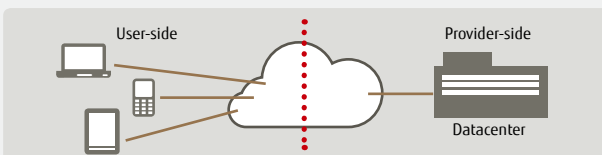


Our medium-term goals are unchanged, and we will continue to work steadily toward achieving our targets of ¥5,000 billion in net sales, with ¥250 billion in operating income and an operating income margin of 5%. Looking ahead 5 to 10 years, we will reawaken the “frontier spirit” that runs through our corporate DNA to pioneer new markets, and exceed our current growth trajectory to be a global company that stands alongside the world’s leading firms.

### ? Glossary

#### Cloud Computing

At Fujitsu, cloud computing refers to a platform enabling on-demand access via a network to IT resources (i.e., resources required to create an adequate computer operating environment such as servers, storage, networks, operating systems, and software) across the network.



#### Big Data

Yet to be definitively defined, big data does not simply refer to sheer volume. Rather, it denotes huge volumes of a wide variety of data that when processed in real time can be used to identify what users were looking for at that time and place. “Unstructured data” that is difficult to analyze such as image, voice, video, and sensor data accounts for a considerable proportion of big data.

## Future challenges and measures

**Q.3** Please tell us some of the specifics of this new matrix structure.

**A.3** This is an organizational change to strengthen our hand in sales interactions, SE, and technology. It creates a framework that allows Fujitsu to compete on a global level.

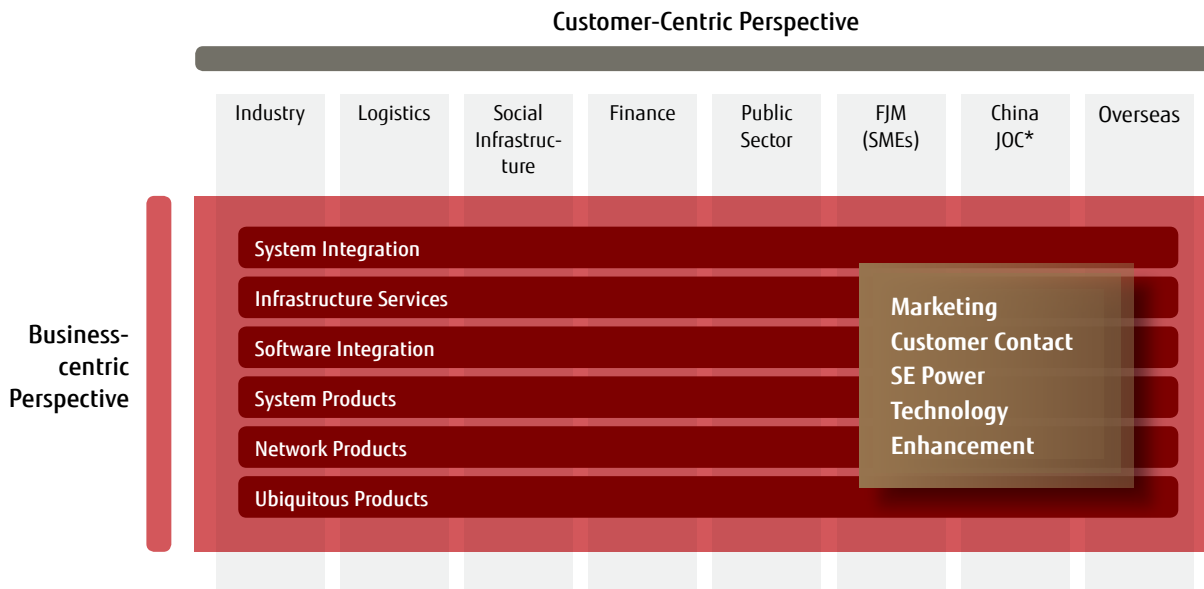
With the rise of cloud services and the rapid spread of smartphones and other mobile devices, coupled with the globalization of our customers' businesses and other acute changes in the ICT market\*, it is important for us to bolster capabilities on the sales front, which is the contact point for customers, and in SE in order to adapt to new markets. To achieve this, we separated the sales and SE divisions, which had been combined under the previous Solution Business Restructuring (SBR) framework, in order to clarify roles and functions.

» \* See pp. 050-057 for trends in the ICT market, including IT market projection graphs by geographical region.

The "customer-centric" axis is an across-the-board strengthening of our sales interactions, with the aim of positioning Fujitsu where it should be, that is, as a provider of consistent, one-stop solutions worldwide. While strengthening our Japanese sales divisions, we will integrate these with overseas business divisions to provide high-quality, uniform best practices. In the medium-size business market in Japan, we will clarify the position of the Fujitsu Marketing (FJM) Group, which plays a central role in this market, within the larger Fujitsu Group, and establish a structure to allow us to compete in an unimpeded fashion. Furthermore, by strengthening both our business solutions originating in Japan and support functions for Japanese companies expanding overseas, we will put in place a sales structure with seamless global coverage.

The "business-centric" axis is the full-scale development of a services business based on cloud services, which we intend to make a pillar for Fujitsu going forward. To accomplish this we combined our software business with the planning and development, verification and sales promotion divisions for cloud-related services, to create the new Software Integration Business. This reorganization is intended to allow us to quickly grasp market needs, as well as to shift to a business structure centered on software. It is also meant to expand business by strengthening ties with the Infrastructure Services Business.

We also integrated and combined marketing functions, which previously had been spread across the various business divisions, into a new corporate-level marketing division that will serve as a cornerstone for the entire Fujitsu Group.



\* Business supporting overseas expansion and development by Japanese companies; short for Japan Originated Company.

## Future challenges and measures

### Q.4 What initiatives do you have planned for growth fields?

#### A.4 We will continue to concentrate investment in cloud services, big data, and global business operations.

One of Fujitsu's strengths is an integrated vertical model that begins with services, such as system integration and cloud services, and extends to products such as supercomputers, servers, and smartphones, as well as to technology, specifically semiconductors. We meet customer needs by developing this model on a global scale.

Areas where we can further capitalize on the strengths of this integrated vertical model are identified as Fujitsu's next growth fields. These are the areas where we will continue to invest. For example, as the paradigm for corporate ICT systems shifts from an ownership to a user model, customers are gaining a better understanding of concepts like public<sup>2</sup> and private<sup>2</sup> clouds, and utilizing them more. Fujitsu is investing in cloud computing worldwide, and has put a structure in place to meet customer needs. Consequently, cloud-related revenue on a non-consolidated basis was 275% higher than our initial projections for the fiscal year ended March 31, 2012.

With the explosive rise in digital data, coupled with improved cost performance for ICT, some customers have taken steps to put big data to work in ways beneficial to their own corporate management processes.

In the field of big data, Fujitsu has combined the collection, collation and integration of large volumes of sensing data with new knowledge to create predictive models through real-time and batch processing. We now offer this as Platform as a Service (PaaS), the world's first cloud service.

In parallel, we are converting this technology and operational knowhow into systems, which we offer as easy-to-use software products. For Fujitsu corporate customers looking to utilize big data, we are consolidating our system development expertise and technologies to offer on-premise system solutions.

This kind of new and highly sophisticated ICT utilization may prove useful for discovering new approaches to previously intractable social issues, while bringing greater abundance to people's lives. I hope to see ICT become even more useful in these ways. In agriculture, for instance, along with traditional supply chain management for agricultural goods, farm operators are beginning to use sensing data to grow even more delicious produce. Another example is in the field of healthcare, where pulse simulations that take advantage of the advanced simulation capacity of supercomputers are being used to pioneer tailor-made treatments optimized for individual patients. Fujitsu will hone its own integrated vertical strengths in these areas to unlock this kind of new ICT potential in the years ahead.

Our globalization is a key theme for Fujitsu's growth vision going forward, and our target is to have overseas sales account for 40% of net sales. As the global competitive environment heats up, so too do calls for a common framework for sales interaction supporting customers in the same region, along with the provision of competitive products built on extensive cost efficiency. By putting a globally integrated organization and systems in place, for example, we intend to support the global expansion aspirations of any and all companies looking to advance beyond their own shores. To this end, we have set about optimizing the product portfolios of every base, where lineups often varied, to standardize and enhance our offerings on a global scale. We will also invest in integrating global communications and other business infrastructure to bolster communication between offshore bases scattered across the globe and business divisions in Japan. Ultimately, we hope to translate our determination to tie global integration efforts to Fujitsu's integrated vertical strengths into a source of competitiveness in the years ahead.



### ? Glossary

#### Public Cloud

This is a platform providing unspecified users, from individuals to groups like companies, with access to shared use of servers, storage, operating systems, and other IT resources via a network. There is no need to build an in-house system or to own or manage IT assets onsite.

#### Private Cloud

Whereas public clouds offer shared use by unspecified users, private clouds are platforms created for specific users. The idea behind private clouds is to reduce IT costs by having user groups like group companies and departments share IT resources instead of providing them for each individual entity.

## Improving corporate value

**Q.5** Many people are looking to ICT to help resolve social issues. Tell us about the type of company Fujitsu aims to become, and your approach to social contributions.

**A.5** Together with applying ICT to the challenge of resolving global issues, the Fujitsu Group is striving for improvement in corporate value through sustainable growth and development driven by a shared commitment to putting the Fujitsu Way\* into practice.

» \* See pp. 064-065 for more on the Fujitsu Way

The worldwide population topped seven billion in October 2011. The global economy continues to be driven by emerging markets, but at the same time concerns such as population growth, climate change and depletion of natural resources such as food, water and energy present serious issues for humankind. The Fujitsu Group is moving forward with the smart cities program and other initiatives that help drive positive change in society. We have a vision in which ICT utilization resolves a host of social issues, leading to the realization of a Human Centric Intelligent Society<sup>2</sup>. We also believe that the essence of CSR is embodied in our will to contribute to society through our business operations, and we intend to conduct such activities to the fullest.

ICT has the ability to transform society in three ways. Simulations and cutting-edge ICT solutions can serve as "ICT that supports modern lifestyles," generating new value in a broad range of fields, including agriculture, medicine, transportation, and education. While helping to resolve problems, it paves the way to a sustainable and prosperous future. As "ICT that anyone can use," ICT can provide opportunities to people everywhere. Fujitsu assists with the framework for the introduction of ICT in developing countries, and through the development of devices that are intuitive by design, aims to bring about a society in which all people enjoy the benefits of ICT, regardless of location, age, or physical condition. Finally, as "ICT that supports society," Fujitsu recognizes that one of its major responsibilities is to ensure the stable operation of ICT infrastructure, and to provide security solutions.

The realization of a sustainable and prosperous society requires that individuals think and act on a global level. It is our duty as managers to create an environment that enhances the ability of all Fujitsu employees to both envision the problems facing society, and elicit the creativity to resolve them. Going forward, through a shared commitment to and implementation of the Fujitsu Way, which embodies the Group's corporate philosophy and our principles for conduct, we will seek sustainable growth for the Fujitsu Group, and through that growth, improvement in our corporate value.

**Making Smart Communities a Reality**

Resolving Social Issues through ICT Innovation

- Energy management
- Local economic revitalization
- Knowledge transference
- Innovation acceleration
- Build meaningful bonds

Partnering with Customers for a Prosperous Society

**? Glossary**

**Human Centric Intelligent Society**  
 A society where everyone can benefit from value generated by ICT without worrying about complicated technologies or operations. Fujitsu's vision is to bring about a society where people live more fully, enjoying a life of greater safety, peace of mind, comfort, and convenience by pursuing greater realization of human values against a backdrop of ICT evolution.

## Return of profits and dividend policy

**Q.6** What is your stance on returns to shareholders and dividends?

**A.6** Our policy is to provide a stable dividend while ensuring sufficient internal reserves to support the active expansion of our business. In fiscal 2011, we paid an annual dividend of ¥10 per share, as originally planned.

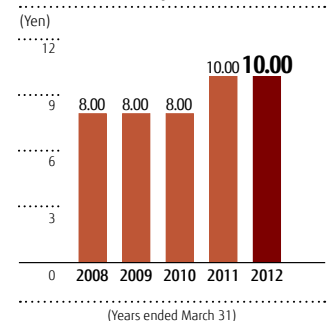
Under Fujitsu's policy on the distribution of earnings, a portion of retained earnings is paid to shareholders to provide a stable return on a continuous basis, and a portion is retained by the Company to strengthen its financial base and support new business development opportunities that will result in improved medium- and long-term performance. In addition, taking into consideration the level of profits, Fujitsu aims to increase the distribution of profits to its shareholders even more robustly when the financial base is sufficiently strong, including through share buybacks.

For fiscal 2011, operating income and net income declined year on year as a result of the sluggish recovery in ICT investment both in Japan and abroad, as well as the negative effects of the historically high yen and flooding in Thailand. These challenges aside, we managed to maintain a certain level of performance, with the profitability of the services business outside Japan improving, and net income exceeding the revised forecast announced in January 2012. Our financial position is also steadily improving, with the balance of interest-bearing loans falling to its lowest level in a decade. As a result, we were able to pay the planned year-end dividend of ¥5 per share, which together with the interim dividend (¥5 per share) amounted to an annual dividend of ¥10 per share, the same level as in the previous fiscal year.

In terms of the distribution of retained earnings, we plan to maintain a biannual payout comprising an interim and year-end dividend. For the fiscal 2012 annual dividend we plan to pay ¥10 per share, including an interim dividend of ¥5 per share, the same as in fiscal 2011.

We at Fujitsu are grateful for the continued understanding and support of our shareholders. We will make a concerted effort as a management team for sustained improvement in corporate value, in order to meet the expectations of all stakeholders.

Cash Dividends per Share



## Message to shareholders and investors

**Q.7** What message do you have for shareholders and investors?

**A.7** Fujitsu believes in the power of ICT to transform society, and as a Japanese global ICT company exemplifying the best of what Japan has to offer, will help to resolve the world's pressing problems.

We believe Fujitsu's customers to be the whole of society. To achieve sustained growth as a company, it is important for us at Fujitsu to integrate the social and environmental aspects of our business activities, and to enhance our corporate value. As for the host of issues facing the world, we hope to achieve a shared understanding with governments, international institutions, and NGOs, and to contribute to the resolution of various social issues through our main business operations.

As Japan's leading company in the ICT field, we remain prepared to compete alongside the top players around the world. We intend to take full advantage of Fujitsu's strengths as an ICT company originating in Japan to strive for ongoing improvement in corporate value by meeting the expectations of all of our stakeholders.

# A Message from the CFO

## Performance in Fiscal 2011

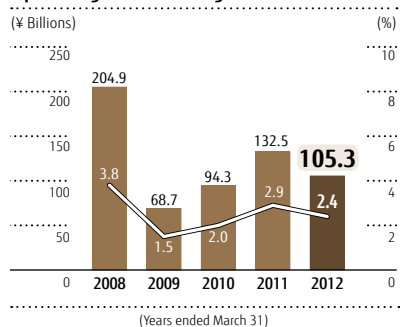
The global economy during fiscal 2011 saw Europe's worsening sovereign debt crisis and a fallback to negative growth take a toll on the real economy. In the United States, a full-fledged economic recovery remained elusive, despite promising signs in the country's employment environment and consumer spending. In emerging markets, while growth rates remained high, the pace was somewhat subdued, reflecting the effects of monetary tightening, as well as a decline in exports tracking the economic slowdown in Europe.

In Japan, the economy had at one point emerged from stagnation triggered by the Great East Japan Earthquake, thanks to faster-than-anticipated recovery in the supply chain. However, the slowdown in overseas economies, coupled with a strong yen and the impact of catastrophic flooding in Thailand, caused the economy to stall once again. Entering the fourth quarter, the economy showed signs of a turnaround on the recovery of operations damaged by the flooding in Thailand.

With respect to IT investment in Japan, though there were signs of a rebound in demand in certain sectors, a full-scale recovery remained out of reach as an overall cautious approach to investment continued to prevail.

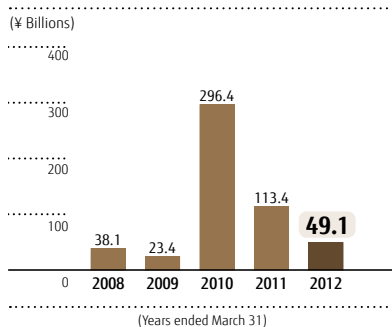
In this climate, consolidated net sales for fiscal 2011 amounted to ¥4,467.5 billion, a decline of 1.3% from fiscal 2010. Excluding the impact of foreign exchange fluctuations, however, sales were on par with the previous fiscal year. Sales in Japan were essentially unchanged from fiscal 2010. However, the impact of lower sales due to customer production cutbacks triggered by the flooding in Thailand was especially evident in car audio and navigation systems, and LSI devices. Along with the impact of weak demand for LSI devices and electronic components, server-related revenues fell on a decline in business deals for large-scale systems. These negative factors were largely balanced out, though, by increased sales of mobile phones atop broader uptake of smartphones, as well as mobile phone base stations and other network products. Sales outside Japan decreased 5.1%. Excluding the

**Operating Income and Operating Income Margin**

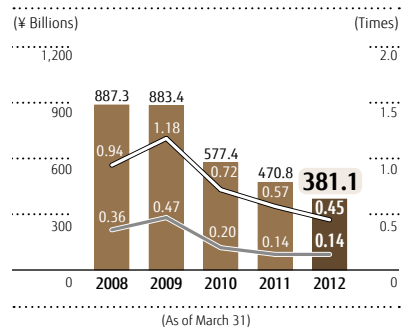


■ Operating income (left scale)  
 — Operating income margin (right scale)

**Free Cash Flow**

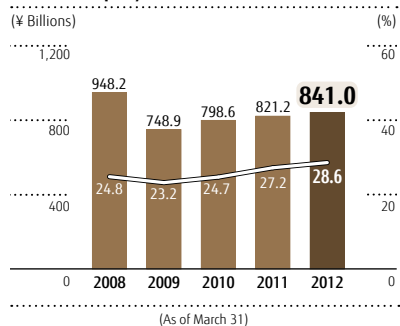


**Interest-Bearing Loans, D/E Ratio and Net D/E Ratio**



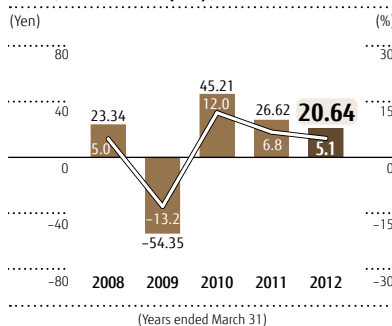
■ Interest-bearing loans (left scale)  
 — D/E ratio (right scale)  
 — Net D/E ratio (right scale)

**Owners' Equity and Owners' Equity Ratio**



■ Owners' equity (left scale)  
 — Owners' equity ratio (right scale)

**EPS (Net Income (Loss) per Share), ROE (Return on Equity)**



■ EPS (left scale)  
 — ROE (right scale)

**Approach to Financing Activities and Credit Rating Status**

To ensure efficient fund procurement when the need for funds arises, Fujitsu views the maintenance of an appropriate level of liquidity as an important policy with respect to its financing activities. "Liquidity" refers to cash and cash equivalents and the total unused balance of financing frameworks based on commitment lines established with multiple financial institutions. As of March 31, 2012, the Group had liquidity of ¥464.2 billion (\$5,661.0 million), of which ¥266.6 billion (\$3,252.0 million) was cash and cash equivalents and ¥197.5 billion (\$2,408.5 million) was the yen value of unused commitment lines.

To raise funds from global capital markets, Fujitsu has acquired bond ratings from Moody's Investors Service (Moody's), Standard & Poor's (S&P), and Rating and Investment Information, Inc. (R&I). As of March 31, 2012, Fujitsu had bond ratings (long-term/short-term) of A3 (long-term) from Moody's, A- (long-term) from S&P, and A+ (long-term) and a-1 (short-term) from R&I.

impact of exchange rate fluctuations, however, sales were essentially unchanged from the previous fiscal year. Similarly, while sales were lower for electronic components and UNIX servers, PC sales grew in Turkey, the Middle East, Russia, and other emerging markets.

While the yen's appreciation cooled modestly from the start of the fourth quarter, the average rates for the US dollar, the euro and the British pound moved to ¥79 (¥7 stronger year on year), ¥109 (¥4 stronger), and ¥126 (¥7 stronger) for the year, respectively. As a result of exchange-rate impact, net sales declined by roughly ¥80.0 billion. The ratio of sales outside Japan was 33.7%, down 1.4 percentage points year on year.

Gross profit was ¥1,235.4 billion, down ¥22.0 billion compared to the previous year. This outcome was mainly the result of lower sales of LSI devices and electronic components. The gross profit margin was 27.7%, virtually unchanged from the previous fiscal year. With the continuation of upfront investments in networks, cloud services, and other areas, selling, general and administrative expenses rose ¥5.2 billion from fiscal 2010 to ¥1,130.1 billion.

As a result, operating income amounted to ¥105.3 billion, a decrease of ¥27.3 billion compared to fiscal 2010. The operating income margin declined 0.5 of a percentage point to 2.4%.

Other income (expenses), net, amounted to a ¥38.5 billion loss, a deterioration of ¥8.2 billion from the previous fiscal year. Positive factors included a smaller net loss on foreign exchange and an improved financial balance owing mainly to a decline in interest-bearing loans. On the other hand, Fujitsu recorded ¥15.1 billion in restructuring charges in connection to the LSI devices and car audio and navigation systems, and the services businesses outside Japan.

As a result, net income for fiscal 2011 was ¥42.7 billion, representing a year-on-year decline of ¥12.4 billion.

#### Yen Exchange Rates (Average)

	Fiscal 2010	Fiscal 2011	Fiscal 2012
U.S. Dollar	93	86	<b>79</b>
Euro	131	113	<b>109</b>
British Pound	148	133	<b>126</b>

(For reference) Impact on operating income (actual) of a one yen (¥1) fluctuation in the currency exchange rate for fiscal 2012 (approximate)  
US dollar: ¥0.6 billion; Euro: ¥0.3 billion; British pound: ¥0.0 billion

#### Financial Initiatives in Fiscal 2011

The Fujitsu Group continued to improve its financial position in fiscal 2011. The owners' equity ratio rose by 1.4 percentage points compared to the previous fiscal year to 28.6%, primarily from a reduction in interest-bearing loans, and net income posted for the year. Free cash flow was a positive ¥49.1 billion. Although this figure was ¥64.2 billion less than in fiscal 2010, when excluding proceeds from the sale of investment securities and other special items reported in that year, free cash flow was actually a positive ¥43.5 billion, representing a decline of ¥29.8 billion. This outcome largely stemmed from deterioration in income before income taxes and minority interests, as well as the increased allocation of cash to datacenter-related capital investment. The balance of interest-bearing loans amounted to ¥381.1 billion, a decline of ¥89.6 billion year on year, owing to progress in loan repayment and redemptions of ¥100.0 billion in convertible bonds that reached maturity. In redeeming the convertible bonds, we supplemented the use of cash on hand for this purpose by issuing a total of ¥50.0 billion in straight bonds with maturities of three and five years, respectively. This put the D/E ratio at 0.45 times, an improvement of 0.12 points from the previous fiscal year-end.

Consequently, the net D/E ratio was 0.14 times, essentially identical to the previous fiscal year-end. Both the D/E ratio and net D/E ratio were at their lowest levels ever.



*K. Kato*  
Corporate Executive Vice President and  
Director, Chief Financial Officer  
Kazuhiko Kato

# Feature: Returning to the Starting Point for Growth



Smart cities

Health promotion



# Strategies to Realize Our Vision

## Market Environment

In the wake of the 2008 global economic crisis, the global IT market has been led by emerging markets, which continue to expand and drive growth. By contrast, Japan's IT services market, the Fujitsu Group's main market, has contracted for the past three years. In 2012, ending March 2013, the domestic market is predicted to post positive growth for the first time in four years. Motivated by this impending market recovery, the Fujitsu Group has boldly positioned fiscal 2012, as a "year for rekindling growth," and will take assertive action to address key management issues.

## Vision for Fujitsu

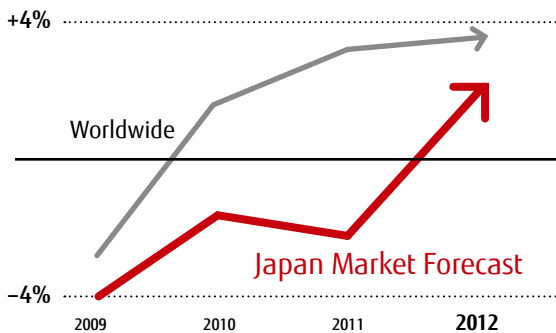
The Fujitsu Group aims to be a technology-based, globally integrated service company. To this end, the Group, anchored by Technology Solutions as its core business, will globally integrate its full spectrum of management resources, and make the creation of a powerful management structure the thrust of its medium-term strategy.

The vertical axis on the chart represents "technology integration," with the entire Group pursuing integrated vertical strengths to create a powerful service model.

The horizontal axis represents "global integration." As "One Fujitsu," we will coordinate the resources of the entire Fujitsu Group to deliver uniform, high-quality services to customers worldwide. Through these innovations, the Fujitsu Group will remain an assertive company and committed to growth.

As a concrete growth strategy, the Fujitsu Group in fiscal 2012 will continue its drive to achieve three growth priorities—implementing structural reform for an assertive posture, accelerating globalization, and creating new services businesses.

IT Services Market Growth Rate



(Source: IDC, Worldwide Black Book Query Tool, Version 1, 2012, May 2012, #234725)

Work style innovation



Next-generation marketing

Safe social infrastructure

Maintenance innovation

High-efficiency distribution

### Creation of New Services Businesses

To create new services businesses, starting with the priority fields shown, we are accelerating efforts to develop new service markets, and to propose new services across a broad array of areas to our customers.

This is particularly the case with big data utilization, a field where Fujitsu is using the collection and analysis of voluminous data to create new value. In this field, we have launched new services to support customer initiatives globally.



Business-driven farming



Solutions to environmental problems

### Structural Reform for an Assertive Posture and New Matrix Framework

As an initial step toward structural reforms for achieving an assertive posture ahead of Group integration, the Fujitsu Group has outlined a new matrix-style framework built on customer- and business-centric axes.

The customer-centric axis integrates global industry sectors and regions from the customer's perspective. On the business-centric axis, we integrate technologies, products and resources from across the entire Fujitsu Group to create a new integrated services model.

Through this global matrix, the Fujitsu Group seeks to strengthen its hand in three areas: global customer interactions, system engineering (SE), where the Group enjoys clear advantages, and technology, the essence of Fujitsu's DNA.

## Vertical Strengths

Creation of New Services

Alliances

Services

Roll out

Japan

Overseas

Products

Emerging Markets

Ubiquitous/Device

## Global Integration

Shift to Standard Models

Function Integration

### Accelerating Globalization

Bolstering the Group's service infrastructure on a global scale is one step in accelerating our globalization.

In April 2012, the Fujitsu Group opened a datacenter in Guangdong, China. This milestone facility is the Group's first solely owned datacenter in the country.

We now have a network of roughly 100 such centers worldwide.

With this powerful service infrastructure as a key strength, the Fujitsu Group will support its customers' business efforts around the globe.

\*Refer to pages 028-029 for more details concerning the Fujitsu Group's global strategy.



Focus

### Fiscal 2012–Business Structure

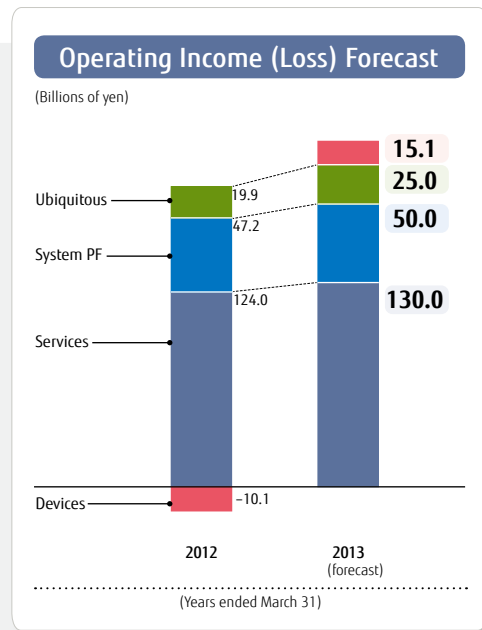
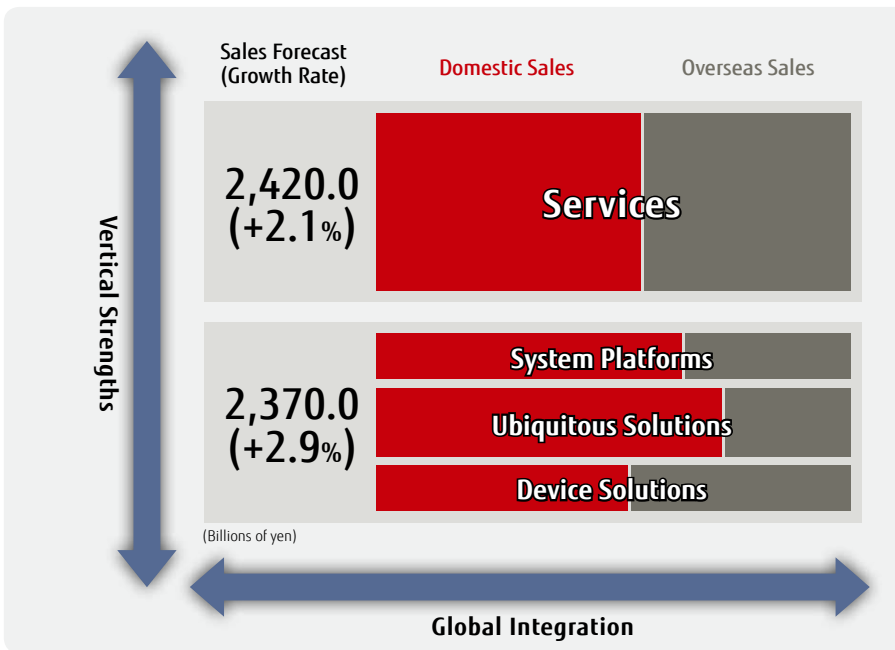
Sales in fiscal 2012, ending March 31, 2013, are expected to be structured as shown.

Services businesses are expected to account for sales of ¥2,420.0 billion, or about half of consolidated net sales. This figure represents year-on-year growth of 2.1%. Sales are projected to surpass the previous-year figure atop rebounding investment in Japan from the second half of the year, coupled with large-scale outsourcing deals ordered in the previous fiscal year outside Japan.

For product and device businesses, we are projecting total sales of ¥2,370.0 billion, for year-on-year growth of 2.9%. In

System Platforms, we anticipate strong expansion in network sales, as well as a recovery in Ubiquitous Solutions in car audio and navigation equipment, where performance had suffered due to flooding in Thailand and the effects of the Great East Japan Earthquake in fiscal 2011. Devices should also see the market rebound from the second half of fiscal 2012.

For the Group as a whole, while domestic sales are projected to grow by just under 1%, outside Japan we are targeting sales growth of 4%.



#### Services Business

For the services business, we are targeting higher earnings, with operating income of ¥130.0 billion.

As we move to create a powerful SE team that truly operates based on the customer’s perspective, we intend to innovate our SE capabilities and develop skilled global talent to relentlessly pursue quality, cost efficiency and productivity.

Elsewhere, we are reorganizing our regional SE framework and pressing ahead with organizational integration, with our sights set on establishing overwhelming dominance in the domestic market.

At the same time, we are moving to upgrade and extend our service menu with proprietary offerings that emphasize cloud services.

In business outside Japan, along with ongoing global standardization of our level of service, emerging markets and other growth markets will assume priority in Fujitsu Group strategies.

#### Product and Device Businesses

In product and device businesses, we are eyeing year-on-year earnings growth across all segments.

In System Platforms, we aim to grow earnings by using cost reductions to absorb investments in the development of our next generation of products, in addition to achieving higher network sales.

In Ubiquitous Solutions, we are projecting higher earnings as sharply higher HDD prices triggered by the flooding in Thailand ease, coupled with benefits from structural reforms in the car audio and navigation system business.

In product businesses, we intend to further solidify Fujitsu’s already dominant position in areas such as servers, software and mobile phones in Japan. At the same time, we will move quickly to establish operational frameworks and expand business scale on the global market as a precursor to capturing a larger global share.

As for device businesses, in tandem with a definite turn to profitability in fiscal 2012, we will continue forging ahead with ongoing reforms designed to enhance business structure.

### Steady Progress in Boosting Profit Margins

Our priority for fiscal 2012 is to improve operating income.

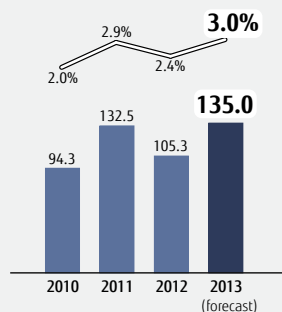
First, we are targeting a recovery in the operating income margin to 3% on a consolidated basis, roughly the same level as in fiscal 2010. In the Group's core business, Technology Solutions, we are making steady progress in boosting profit margins, with a target for fiscal 2012 of 6%.

### Targeting Top- and Bottom-Line Growth

Our consolidated business forecasts for fiscal 2012 are as follows: we are projecting net sales of ¥4,550.0 billion, up ¥82.4 billion year on year; operating income of ¥135.0 billion, up ¥29.6 billion; and net income of ¥60.0 billion, a year-on-year improvement of ¥17.2 billion. As these sales and income figures suggest, our goal is top- and bottom-line growth for the year.

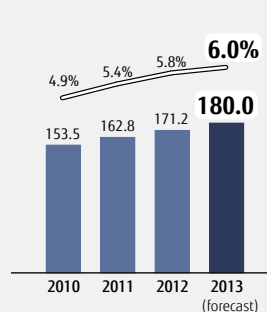
#### Fiscal 2012—Consolidated Operating Income

**Consolidated**  
(Billions of yen)



■ Operating Income  
— Operating Income Margin  
(Years ended March 31)

**Technology Solutions**  
(Billions of yen)



■ Operating Income  
— Operating Income Margin  
(Years ended March 31)

#### Business Forecasts for Fiscal 2012

	FY 2011 Results	FY 2012 Forecast	YoY
Net Sales	4,467.5 Billions of yen	4,550.0 Billions of yen	+82.4 Billions of yen
Operating Income (Margin)	105.3 Billions of yen (2.4%)	135.0 Billions of yen (3.0%)	+29.6 Billions of yen  (+0.6 Point)
Net Income	42.7 Billions of yen	60.0 Billions of yen	+17.2 Billions of yen

FOCUS

### Fiscal 2012 Is the Starting Point for Getting Back on Track for Growth

In conclusion, as our management stance, the top- and bottom-line growth objective stated for fiscal 2012 is the starting point for putting the Fujitsu Group back on track for growth. Our first target for the year is to reclaim an operating income margin of 3%. Our medium-term sights are then set on raising this margin to 5%. To hit this target, the Group will need to work as one to get growth back on track in fiscal 2012.

"Reshaping ICT-Reshaping Business" has been raised as the key business theme for fiscal 2012. Our pledge at Fujitsu is to leverage the ever-evolving potential of ICT to bring greater innovation to society at large and to the businesses of our customers.

As a trusted and valued partner to our customers, the Fujitsu Group will work together with stakeholders to seek new growth horizons in fiscal 2012.

## Accelerating Our Globalization

# Transforming Into a Truly Global Company

The Fujitsu Group will have to bolster business in growing markets outside Japan, and generate stable profits in order to realize longer-term growth. The Group will implement a constant stream of measures to this end, including those to expand business scope and develop a presence in emerging markets, while building a global portfolio and enhancing management efficiency.

### Shaping tomorrow as "One Fujitsu"

In fiscal 2011, we increased sales on a local-currency basis in almost all overseas regions where Fujitsu does business, despite a harsh business environment affected by major flooding in Thailand and a financial crisis in Europe. The rollout of Fujitsu's own cloud platform also progressed in several regions, and we were able to win large deals in the US and Australia. The benefits of assurance to eliminate unprofitable projects also emerged, and I believe we are becoming a profitable company.

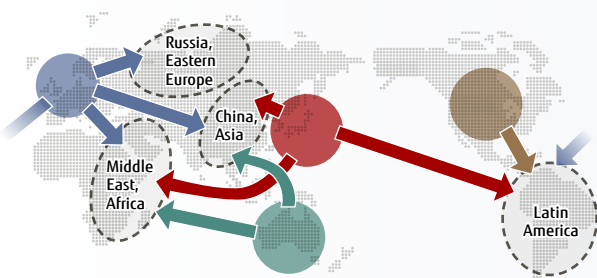
The strengths of Fujitsu's overseas business are the relationships and trust built up with many local customers, and flexibility and speed in responding to customer needs resulting from each location conducting business independently to date. While leveraging these strengths, we will standardize the best elements of service solutions in Japan and other regions to create a global portfolio, which we will then roll out overseas.

By executing "Think Local, Leverage Global (providing globally standardized services in the optimal form to local customers)" as "One Fujitsu," including in Japan, we aim to become the engine that will drive the Fujitsu Group's growth.



Corporate Senior Vice President  
Rod Vawdrey

### Advancement into Emerging Markets



### Business scope expansion and development in emerging markets

Expanding overseas sales is management's highest priority in accelerating Fujitsu's globalization. In addition to maintaining and growing business with customers in various regions, Fujitsu will strengthen its capacity to handle business deals that straddle regions, broadening business scope by supporting customers' own accelerating global business advancement. Specifically, we will powerfully back up business expansion in Asia and other growing markets by customers with whom Fujitsu has good relationships in Japan, Europe and the US by leveraging datacenter services and SAP support knowhow.

Fujitsu will also further develop its presence in emerging markets with strong growth potential, such as India, Latin America, China, Russia, Eastern Europe, and the Middle East. India already serves as an offshore base for Fujitsu. Along with

bolstering this existing role, we will expand both the product and service businesses to establish a presence in the local market, and also utilize India as a hub for surrounding Asian and Middle Eastern countries. In Latin America, Fujitsu has had product and support businesses in Brazil for many years. We will support the business expansion of Spanish and Portuguese companies into the region, and ramp up the pace of business rollout in areas other than Brazil, an initiative in play since the previous fiscal year. In China, Fujitsu will consolidate wide-ranging business fields and develop deep-rooted local business.

### Building a global portfolio

Fujitsu is building an end-to-end global portfolio (cloud computing, services, products, and solutions) that draws on the strengths of its global bases. Through this portfolio, Fujitsu will provide standardized, high-quality and uniform services all over the world.

In cloud computing, Fujitsu has built public cloud platforms at six bases worldwide, including Japan, and is already providing services. We will roll out services that leverage our track record and expertise globally in areas where growth is expected, such as the “as a service” (XaaS) field, and Virtual Client Service and other end-user services.

In the PC server business, Fujitsu situated the headquarters responsible for marketing and product development in Germany, and has been promoting sales globally. Going forward, we will strengthen this model further and raise our profile in technology, the essence of Fujitsu’s DNA.

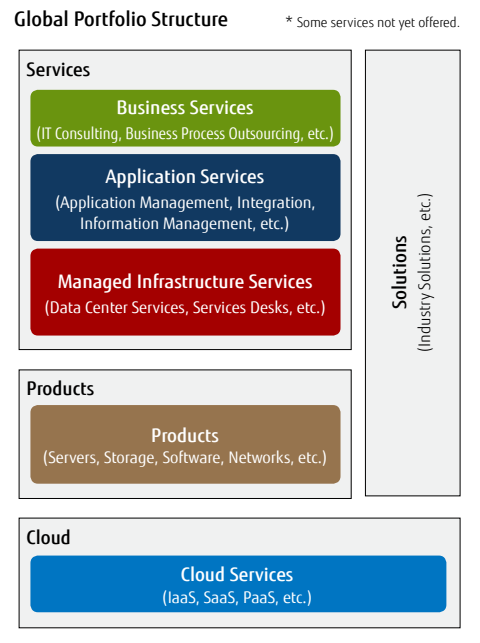
Furthermore, Fujitsu will build a portfolio of network services, one of its strengths, based on successful service examples, and roll it out globally to differentiate itself from IT service rivals. We will also bolster solutions by industry, such as electronic medical record solutions, where Fujitsu boasts top domestic market share, and point-of-sale (POS) solutions.

### Management efficiency enhancement

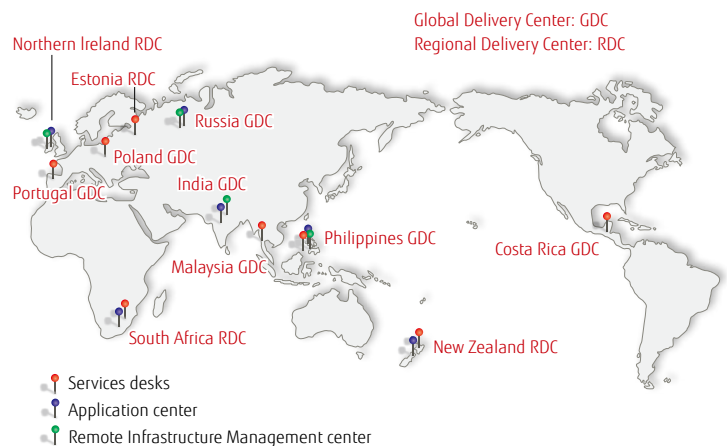
Since 2009, Fujitsu has been building up structures and pursuing fundamental structural reforms, including workforce reductions, mainly in Europe and North America. Our staunch commitment to forward-looking structural reforms will continue, as we reinforce management bases worldwide through management division consolidation and business process improvements under a “One Asia” approach, with an eye to capturing remarkable growth in Asian markets. We will also introduce shared services for finance, human resources, marketing, procurement, and other areas at overseas business locations to reduce back-office costs and streamline business.

Along with development of a global portfolio, Fujitsu will establish a service delivery model with price competitiveness that leverages its Global Delivery Centers (GDC) and Regional Delivery Centers (RDC), which are offshore/near-shore service bases located in 11 countries around the world.

As for human resource development, Fujitsu will build HR management systems and bolster educational systems to enable optimal human resource utilization across regions.



### Global and Regional Delivery Centers



FOCUS

# Business Overview

For the fiscal year ended March 31, 2012

Fujitsu delivers total solutions in the field of information and communication technology. Along with multifaceted services provision, our comprehensive business encompasses the development, manufacture, sales and maintenance of the cutting-edge, high-quality products and electronic devices that make these services possible.

## Technology Solutions

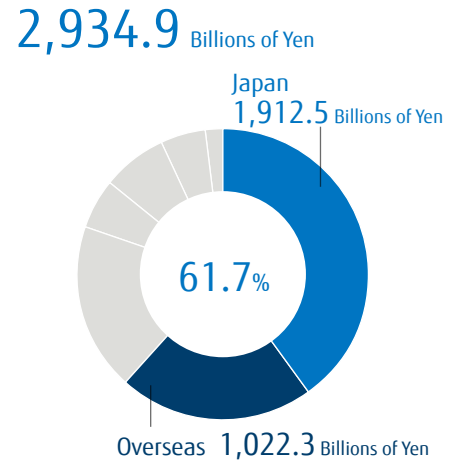


Fujitsu Technology Solutions headquarters in Munich



PRIMERGY RX350 S7 2-way 4U rack server

### Net Sales/Breakdown of Net Sales\*



## Ubiquitous Solutions



ESPRIMO EH30/GT desktop PC has a lightweight body and space-saving design

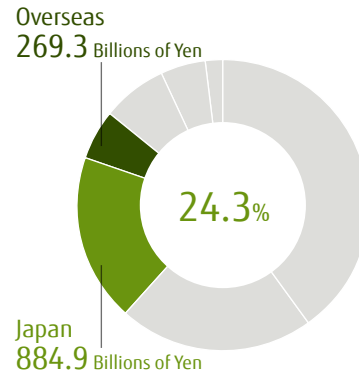


ARROWS Z ISW11F high-spec, WiMAX-enabled, water-resistant smartphone

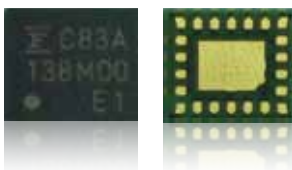


AVN-F01i car navigation systems

### 1,154.2



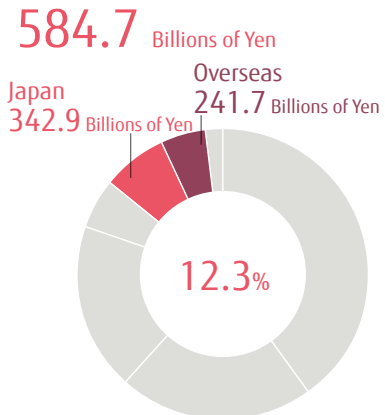
## Device Solutions



MB86C83 multiband power amp for wireless mobile devices



MB86M01 and MB86M02 memory-embedded transcoders compatible with H.264 transrating



\* Sales include intersegment sales.

## Business Description

### Services

Fujitsu provides solutions/system integration services focused on information system consulting and integration, and infrastructure services centered on outsourcing services (complete information system operation and management).

### System Platforms

Fujitsu offers system products such as servers and storage systems which form the backbone of information systems, along with network products such as mobile phone base stations, optical transmission systems, and other communications infrastructures.

In PCs, Fujitsu is enhancing functionality through smartphone compatibility, energy efficiency, and a fast boot-up feature, and driving the development of tablet PCs. We also have a product lineup in the Japanese market that capitalizes on high domestic standards of quality.

In mobile phones, along with conventional features phones, Fujitsu is developing smartphones and tablet devices under the new ARROWS brand.

In mobilewear, Fujitsu is answering diverse needs through "Connectivity Products," among them intuitively operated car navigation systems that connect with smartphones for a more enjoyable driving experience.

LSI devices and electronic components comprise Fujitsu's Device Solutions. Fujitsu Semiconductor\*, the Fujitsu Group's operating company in semiconductors, provides LSI devices found in products such as digital home appliances, automobiles, mobile phones, and servers. Meanwhile, publicly listed consolidated subsidiaries such as Shinko Electric Industries, Fujitsu Component, and FDK provide semiconductor packages and other electronic components, as well as structural components such as batteries, relays, and connectors.

## Main Products & Services

### Services

#### Solutions/SI

System integration (system construction, business applications), consulting, front-end technologies (ATMs, POS systems, etc.)

#### Infrastructure Services

Outsourcing services (datacenters, ICT operation/management, SaaS, application operation/management, business process outsourcing, etc.), network services (business networks, distribution of Internet/mobile content), system support services (maintenance and surveillance services for information systems and networks), security solutions (installation of information systems and networks)

### System Platforms

#### System Products

Full range of servers (mainframe, UNIX, mission-critical x86 and other x86 servers), storage systems, various types of software (operating system, middleware)

#### Network Products

Network management systems, optical transmission systems, mobile phone base stations

### PCs/Mobile Phones

PCs, mobile phones

### Mobilewear

Car audio and navigation systems, mobile communication equipment, automotive electronics

### LSI Devices

LSI Devices

### Electronic Components

Semiconductor packages, batteries, structural components (relays, connectors, etc.), optical transceiver modules, printed circuit boards

## Main Companies

- Fujitsu Frontech Limited
- Fujitsu Telecom Networks Limited
- Fujitsu IT Products Ltd.
- Fujitsu Broad Solution & Consulting Inc.
- Fujitsu Marketing Limited
- Fujitsu System Solutions Limited\*
- Fujitsu FIP Corporation
- NIFTY Corporation
- Fujitsu FSAS Inc.
- PFU Limited
- Fujitsu Network Communications, Inc.
- Fujitsu Services Holdings PLC
- Fujitsu America, Inc.
- Fujitsu Australia Limited
- Fujitsu Technology Solutions (Holding) B.V., others

\* On April 1, 2012, Fujitsu System Solutions Limited absorbed three consolidated subsidiaries of Fujitsu in eastern Japan and changed its name to Fujitsu Systems East Limited.

- Shimane Fujitsu Limited
- Fujitsu Isotec Limited
- Fujitsu Mobile-phone Products Limited
- Fujitsu Toshiba Mobile Communications Limited\*
- Fujitsu Peripherals Limited.
- Fujitsu TEN Limited
- Fujitsu Personal System Limited
- Fujitsu Technology Solutions (Holding) B.V., others

\* On April 1, 2012, Fujitsu Toshiba Mobile Communications Limited became a wholly owned consolidated subsidiary of Fujitsu and changed its name to Fujitsu Mobile Communications Limited.

- Fujitsu Semiconductor Limited
- Shinko Electric Industries Co., Ltd.
- FDK Corporation
- Fujitsu Component Limited
- Fujitsu Electronics Inc., others

## Operational Review and Outlook

# Technology Solutions/Services

Fujitsu provides solutions/system integration services that integrate ICT system consulting, design, application development and hardware installation, as well as infrastructure services centered on outsourcing services (complete ICT system operation and management including ICT system management via datacenters) and maintenance services.



### Fiscal 2011 Performance (Year-on-year Comparison)

(Billions of Yen)

#### Net Sales

**2,371.2**  
(-2.0%)

#### Operating Income

**124.0**  
(+6.6)

#### Capital Expenditure\*

**73.4**  
(+6.2)

\* For entire Technology Solutions segment



Fujitsu Trusted Cloud Square



PalmSecure-LT palm vein biometric authentication device (mouse sensor-type) exclusively for PC login



Integrated Control Room of Tatebayashi System Center

## Our Strength

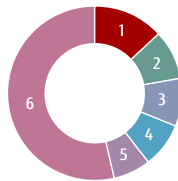
Fujitsu's services business holds the leading market share in Japan and the third-largest share worldwide. We provide services across a wide range of countries and regions, including Europe, the Americas, Asia, and Oceania.

Outsourcing services are a key field for us, where through our network of approximately 100 datacenters in 16 countries worldwide, mainly in Japan and Europe, we meet a wide variety of customer needs. Among other benefits, our services make operation of customers' information and communication technology (ICT) systems easier, and help to make their operations greener.

Fujitsu's strengths lie in its global services structure, a wealth of experience in building large-scale, advanced systems, and the technological capabilities to support these operations. We use these capabilities to help diverse customers across countries, regions and languages in utilizing ICT systems, including for government organizations and customers with a presence worldwide.

**IT Services Market Share in Japan 2011 (Revenue Basis)**

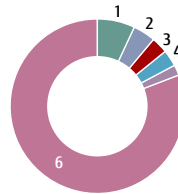
1	<b>Fujitsu</b>	<b>13.1%</b>
2	Company A	9.3%
3	Company B	8.7%
4	Company C	8.5%
5	Company D	7.0%
6	Others	53.6%



(Source: Gartner, "Market Share: IT Services 2011" 9 April 2012)

**Global IT Services Market Share in 2011 (Revenue Basis)**

1	Company A	7.1%
2	Company B	4.2%
3	<b>Fujitsu</b>	<b>3.0%</b>
4	Company C	3.0%
5	Company D	1.9%
6	Others	80.7%



(Source: Gartner, "Market Share: IT Services 2011" 9 April 2012)

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### ? Glossary

#### Cloud Computing

Cloud computing refers to a platform enabling on-demand access via a network to IT resources (i.e., resources required to create an adequate computer operating environment such as servers, storage, networks, operating systems, and software) across the network.

#### SaaS (Software as a Service)

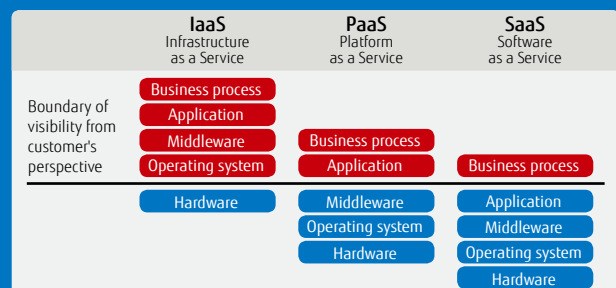
This platform provides access via a network to service providers' software (application) offerings.

#### PaaS (Product as a Service)

This platform provides access via a network to hardware, operating systems, and other infrastructure required for application development and deployment.

#### IaaS (Infrastructure as a Service)

This platform provides access via network to network lines, servers, and other infrastructure required for computer system building and operation.



## Market Trends

### 2011 Global Market Trends

The value of Japan's IT services market in 2011 declined 2.2% year on year to US\$60.6 billion. >> **GRAPH 3** The domestic economy slowed due to the effects of the Great East Japan Earthquake and Thai flooding damage, as well as the yen's further appreciation caused by sovereign debt problems in Europe. As a result, corporate IT investment was constrained and the public sector placed priority on rebuilding from the earthquake, which led to a reduction in domestic IT investment, as was the case in 2010.

By service field, demand for system-building slumped significantly. The outsourcing field, which had continued to grow to date, also saw a decrease in market scope year on year due to strongly curtailed current investments, despite rising needs for disaster-response measures and datacenter usage with an eye on business continuity planning in the wake of the Great East Japan Earthquake.

The global market for IT services expanded 3.4% year on year to US\$627.6 billion. >> **GRAPH 2** In Europe, IT investment was led by Germany, where export industries performed strongly due to the euro's depreciation. IT investment reductions continued in other areas, however,

as a result of economic deterioration, and the overall market was limited to a slight increase. In the North American market, however, IT investment tended toward recovery with the spread of cloud computing<sup>2</sup>.

### Outlook for 2012

The Japanese IT services market in 2012 is projected to grow 1.9% year on year to US\$61.8 billion. >> **GRAPH 3**

Domestic economic conditions that had continued to be severe due to stagnation caused by the Great East Japan Earthquake and flooding damage in Thailand, as well as the yen's appreciation, are turning around, and we expect a gradual recovery to continue. The recovery in domestic IT investment is expected to be modest in the first half of fiscal 2012, but is projected to broaden in the second half as corporate earnings rebound and progress is made in rebuilding from the disaster.

The global IT services market is projected to grow 3.7% year on year to US\$650.8 billion. >> **GRAPH 2** The IT market will expand globally, but severe conditions are forecast to continue in Europe in 2012 due to deterioration in the real economy caused by government debt problems. Although there are uncertainties such as the US presidential

election and the impact on Australian resource industries of a slowing Chinese economy, IT investment in the Asia-Pacific markets will generally be active, driving market expansion.

## Operational Review and Initiatives

### Fiscal 2011 Business Results

Sales from the Services sub-segment (Solutions/System Integration, Infrastructure Services) decreased 2.0% year on year to ¥2,371.2 billion. Excluding the impact of currency exchange rates, sales were virtually unchanged from the previous fiscal year.

**Solutions/System Integration:** Sales decreased 0.6% to ¥824.8 billion.

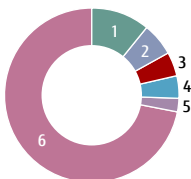
>> **GRAPH 4** Excluding currency exchange rate effects, sales were virtually unchanged from the previous fiscal year.

Investment recovered in domestic manufacturing and distribution industries, as well as in public sectors such as local governments and healthcare. On the other hand, there was a reduction in large projects compared to the previous year in the finance field, and in social infrastructure fields such as electric power and telecommunications, sales fell off from the previous year as priority was placed on infrastructure investment

GRAPH 1

Global IT Outsourcing Market Share in 2011 (Revenue Basis)

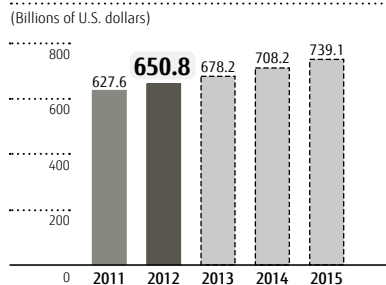
1	Company A	10.9%
2	Company B	6.1%
3	Fujitsu	4.5%
4	Company C	4.2%
5	Company D	2.6%
6	Others	71.6%



(Source: Gartner, "Market Share: IT Services 2011" 9 April 2012)

GRAPH 2

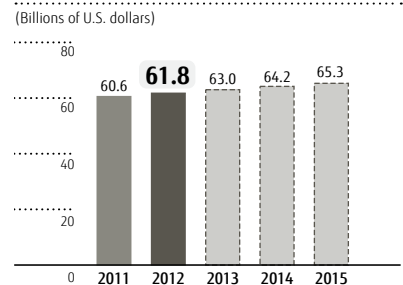
Global IT Services Market Forecast



(Source: IDC The Worldwide Black Book Q1 2012)

GRAPH 3

IT Services Market Forecast in Japan



(Source: IDC The Worldwide Black Book Q1 2012)

related to rebuilding after the earthquake. Investment by telecom carriers also shifted to hardware in response to increased communications traffic.

**Infrastructure Services:** Sales decreased 2.7% to ¥1,546.4 billion. Excluding currency exchange rate effects, sales were virtually unchanged from the previous fiscal year.

In Japan, demand for outsourcing services remained strong, although revenue declined partly due to a shift from packaged products (including access fees) to standalone products in the internet service provider (ISP) business in Network Services. Outside Japan, the impact of austerity measures by the UK government continued, coupled with an economic slump in continental Europe, the impact of flooding in Thailand, and stagnation in the US market. Australia and the Nordic region grew, however, causing revenue to increase by 1% (excluding currency exchange rate effects).

Operating income increased ¥6.7 billion year on year to ¥124.0 billion.

» **GRAPH 5** In Japan, operating income fell due to the impact of a revenue decline caused by a decrease in large system projects and continued upfront investments in cloud services.

Outside Japan, operating income rose as profitability in the European services business turned upward.

**Initiatives Going Forward**

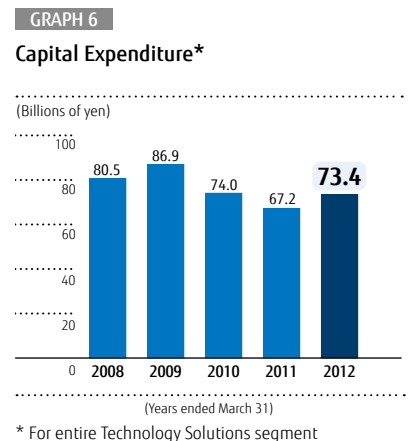
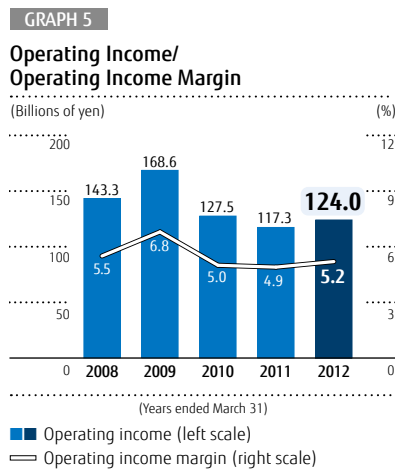
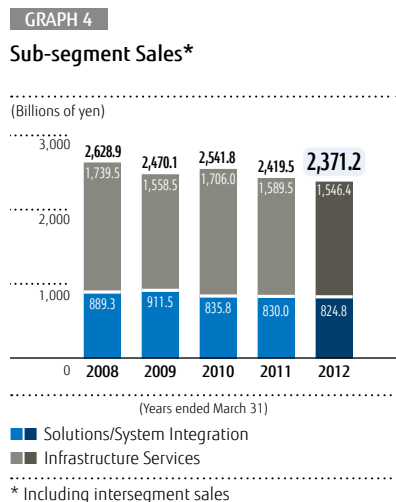
**Solutions/System Integration:** In a reorganization that took place in April 2012, we set up a system integration division that reunites Group SE divisions. We did this to further globalization and to enhance productivity and competitiveness beyond the bounds of various sectors, bolster SE capabilities, and provide new value to customers. We also reorganized regional SE companies into a new structure that as a group is intended to fully exhibit their strengths and characteristics, effectively utilize resources and streamline development investment to bolster competitiveness. We will create a powerful SE team with overwhelming competitiveness by expanding business based on our strength in existing assets, and by bolstering global responsiveness.

**Infrastructure Services:** Cloud computing will be the foundation upon which we will accelerate bringing to market new services, such as those associated with big data.

Cloud computing in Japan is spreading rapidly, and is available in a wide range of solutions and services, such as SaaS-model cloud services which leverage packaged software, PaaS and IaaS as infrastructure platforms and private clouds. We are also rolling out new

offerings such as convergence services that utilize big data, which is now attracting attention. In addition, customer interest in system backup and business continuity has greatly risen since the Great East Japan Earthquake, and outsourcing primarily using datacenters and BCP-related services is gaining momentum. In recognition that cloud computing's future expansion is all but certain, we will bolster new service proposals that apply ICT in innovative ways.

Outside Japan, we will reinforce a structure that can provide common products and services as "One Fujitsu" regardless of location or region, based on the spirit of global integration. We will also provide both private and public cloud platforms by utilizing our Fujitsu Global Cloud Platform, deployed in 2011 to six locations around the world, and other platforms. In this way, Fujitsu will provide consistent, high-quality ICT services globally to support all customers in their endeavors, no matter where they do business.



# Technology Solutions/System Platforms

System products and network products are the foundation of ICT infrastructure. System products comprise the servers (such as mainframes, UNIX, mission-critical x86 servers), storage systems and middleware on which information systems are built. Network products include the mobile phone base stations, optical transmission systems and other equipment used to build communications infrastructure.



## Fiscal 2011 Performance (Year-on-year Comparison)

(Billions of Yen)

### Net Sales

563.6

(-5.2%)

### Operating Income

47.2

(+1.7)

### Capital Expenditure\*

73.4

(+6.2)

\* For entire Technology Solutions segment



PRIMERGY RX200 S7 2-way 1U rack server



PRIMERGY CX250 S1 server node  
(installed in PRIMERGY CX400 S1)



ETERNUS VX710 storage for virtual  
environments

## Our Strength

In system products, Fujitsu has a broad lineup of offerings to meet the needs of customers around the world. These include sophisticated and highly reliable mainframe and UNIX servers that support the backbone systems of corporations and that are equipped with proprietary CPUs—Fujitsu being one of the few global ICT companies with the technology to make its own processor chips. We also provide x86 servers for cloud computing and other promising business areas, as well as storage systems able to hold increasingly vast amounts of data.

In network products, Fujitsu holds a large market share for the optical transmission systems and mobile phone base stations used by mobile communications carriers in Japan, backed by its advanced technology and support capabilities. We also have the leading market share in the highly competitive North American market for optical transmission systems, building on our highly rated technical capabilities and track record.

**Server Share in Japan 2011 (Revenue Basis)**

1	Fujitsu	27.7%
2	Company A	19.9%
3	Company B	16.0%
4	Company C	15.4%
5	Company D	9.2%
6	Others	11.8%



(Source: IDC Japan, Japan Server Quarterly Model Analysis, 2012 Q1)

**Optical Transmission Market Share in North America 2011 (Revenue Basis)**

1	Fujitsu	22.2%
2	Company A	19.8%
3	Company B	13.3%
4	Company C	12.7%
5	Company D	8.7%
6	Company E	6.0%
7	Others	17.3%



(Source: Ovum, Market Share: 1Q12 ON Global, June 2012)

### ? Glossary

**Supercomputer**

Computers with phenomenal computing power, which are used in cases such as when a large volume of highly sophisticated mathematical operations must be performed under hypothetical conditions.

**3G**

General term for the third-generation mobile phone communications standard.

**LTE**

Abbreviation for Long Term Evolution, a mobile phone communication standard.

**Router**

A device that relays the data flow from one network to another.

**Mobile Backhaul**

A network covering multiple mobile base stations in different locations responsible for transferring data traffic from mobile devices to the mobile core network.

**Backbone**

The basic trunk line at the core of a network.

## Market Trends

### 2011 Global Market Trends

**System Products:** The Japanese server market expanded by 3.9% in 2011 to US\$6.2 billion. Year-on-year expansion came atop growth in shipments of super-computers<sup>2</sup> and x86 servers for the IT services and telecommunications sectors.

The global server market grew by 2.3%, to US\$56.6 billion. >> **GRAPH 2**

While the European debt crisis and other concerns curtailed investment, most notably in Europe, market growth prevailed in China and other Asian economies.

**Network Products:** In the Japan market for network devices, although the current investment cycle in Next-Generation Network (NGN) equipment has passed its peak, Japan's optical transmission market grew year on year. Along with incorporating existing networks into NGN, growth came atop greater investment to enhance backbone infrastructure in order to cope with the rollout of LTE and increased data traffic. The router market experienced similar growth, reflecting investments in response to increased traffic. The mobile infrastructure market also reported overall growth year on year on the back of increased Long Term Evolution (LTE<sup>2</sup>) investment, despite 3G<sup>2</sup> investment by NTT DOCOMO having now run its course.

In North America, overall spending in the optical transmission market was higher than the previous year, reflecting steady investment in mobile backhaul<sup>2</sup> networks and other backbone<sup>2</sup> infrastructure to cope with increased data traffic.

### Outlook for 2012

**System Products:** In 2012, the Japanese server market is expected to contract by a substantial 10.4% to US\$5.6 billion. This decline will reflect the absence of the strong impact from supercomputers during the previous fiscal year.

Outside of Japan, the server market is projected to edge 0.8% lower year on year, to \$56.2 billion. >> **GRAPH 2** Market expansion is anticipated in China and other Asian countries, although the sluggish European market and other factors are expected to cause a backlash and economic instability in Japan.

**Network Products:** The 2012 Japanese communication devices market is likely to experience year-on-year growth, reflecting the full-scale rollout of LTE services, along with anticipated growth in investment to cope with increased traffic and to upgrade networks.

In North America's optical transmission market, flat performance appears likely for the year. Although investments to enhance mobile backhaul and other backbone infrastructure are set

to continue during 2012, lower fiscal expenditures due to economic deterioration and waning consumer spending remain causes for concern. >> **GRAPH 3**

## Operational Review and Initiatives

### Fiscal 2011 Business Results

The System Platforms sub-segment, comprising System Products and Network Products, reported sales of ¥563.6 billion, a decrease of 5.2% from the previous fiscal year. >> **GRAPH 4**

**System Products:** Sales for the fiscal year ended March 31, 2012 decreased 13.4% year on year to ¥282.7 billion.

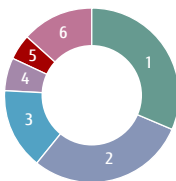
In Japan, server-related sales dropped off sharply due to a decline in business deals for large-scale systems for the finance and public sectors, as well as the impact of the mass production of supercomputer server systems in the previous year. Nevertheless, Fujitsu remained the top server company for a fifth consecutive year in terms of market share in Japan.

Outside Japan, sales of x86 servers were strong in every major geographic region. Overall, however, system product sales declined due to slumping UNIX server shipments, the halting of some business deals due to HDD supply shortages caused by flooding in Thailand, and

GRAPH 1

Global Server Share in 2011 (Revenue Basis)

1	Company A	31.5%
2	Company B	29.3%
3	Company C	15.0%
4	Company D	6.2%
5	Fujitsu	4.8%
6	Others	13.2%

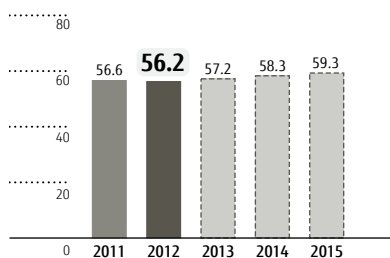


(Source: IDC Worldwide Quarterly Server Tracker 2012 Q1)

GRAPH 2

Global Server Market Forecast

(Billions of U.S. dollars)

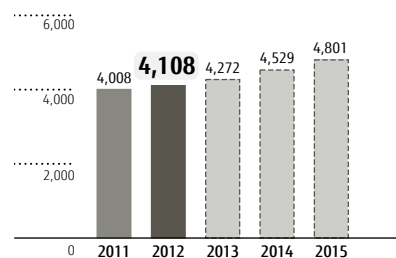


(Source: IDC The Worldwide Black Book Q1 2012)

GRAPH 3

North American Optical Transmission Market Forecast

(Millions of U.S. dollars)



(Source: Ovum, ON Market Forecast: 2012-17, June 2012)

the impact of foreign exchange rates, among other factors.

**Network Products:** Sales increased 4.7% year on year to ¥280.8 billion.

Sales of optical transmission systems decreased for the year as previously robust performance in North America suffered in line with a slowdown in capital investments in the second half of 2011. Another factor was NGN investment in Japan, which has now come full circle.

Sales of mobile systems and network solutions rose sharply due to higher sales of 3G equipment and routers to cope with higher data traffic stemming from the increasing popularity of smartphones. Sales also increased on the back of full-scale LTE investment.

Operating income for the System Platforms sub-segment totaled ¥47.2 billion, an increase of ¥1.7 billion from the previous year. Income from System Products fell on account of a precipitous drop in UNIX and other server-related sales, despite the effect of cost cutting, particularly for x86 servers. >> GRAPH 5

Profit from Network Products also increased, benefiting from higher revenues stimulated by greater investments aimed at coping with increased data traffic stemming from the widespread popularization of smartphones, and in LTE.

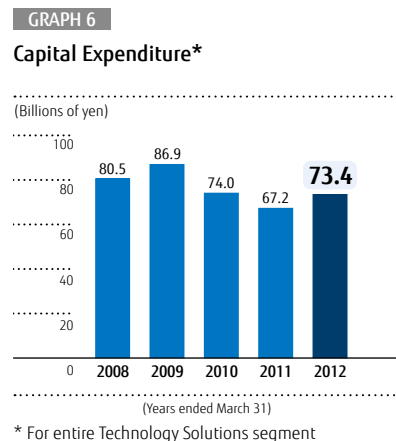
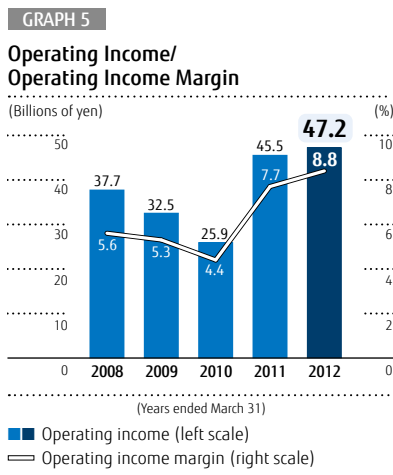
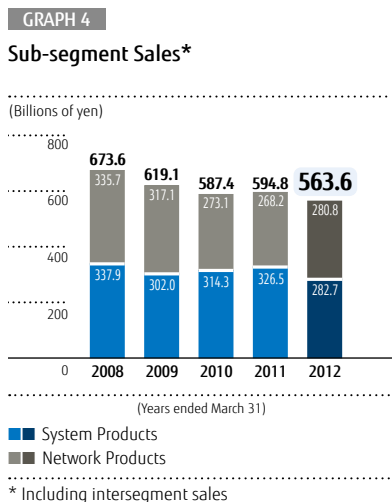
**Initiatives Going Forward**

**System Products:** ICT plays an increasingly vital role in ensuring social prosperity and security. This trend is raising the importance of servers, storage, software and other infrastructure products that support society's development. Along those lines, Fujitsu will move forward with developing platforms optimized for supporting cloud computing, which will enable flexible ICT utilization. >> GRAPH 6

In the x86 and storage divisions, we are raising development efficiency by integrating Fujitsu Technology Solutions of Germany into Group operations and creating a single set of global standards for our products. We have achieved strong market positions with high sales volumes in Japan and Europe and are endeavoring to further increase our market share in these regions. At the same time, we are striving to expand our global business by developing partner channels in newly emerging economies, where server markets continue to grow, as well as in North America, the largest server market in the world. In the software business, we are launching platform as a service (PaaS) products and focusing investment in cloud computing offerings. In the UNIX server business, we are bolstering our product capabilities through our alliance with Oracle, with an eye to expanding our business.

**Network Products:** Network products are playing an increasingly important role in the cloud era as data and networks merge. In recent years, we have returned the business to profitability by reforming the development process to achieve significant cost savings and expanded sales in key markets like Japan and North America. In the next stage of growth for the business, we are aiming to improve profitability by promoting cost reductions, together with developing new business fields using networks, such as home networks and domains specializing in related services. In the optical transmission system business, we will further solidify our market position in Japan and North America with the launch of advanced products.

In mobile systems, together with the definitive rollout of an LTE business for NTT DOCOMO in Japan, we will leverage our advantages in LTE base stations and alliances with other companies to offer total solutions and develop peripheral services, with an eye to achieving business expansion.



# Ubiquitous Solutions

In PCs, Fujitsu is enhancing functionality through smartphone compatibility, energy efficiency, and a fast boot-up feature, and driving the development of tablet PCs. We also have a product lineup in the Japanese market that capitalizes on high domestic standards of quality. In mobile phones, along with conventional features phones, Fujitsu is developing smartphones and tablet devices under the new ARROWS brand. In mobilewear, Fujitsu is answering diverse needs through "Connectivity Products," among them intuitively operated car navigation systems that connect with smartphones for a more enjoyable driving experience.



## Fiscal 2011 Performance (Year-on-year Comparison)

(Billions of Yen)

Net Sales

**1,154.2**  
(+2.5%)

Operating Income

**19.9**  
(-2.7)

Capital Expenditure

**15.6**  
(0.1)



ARROWS Tab Wi-Fi high-spec, water-resistant tablet with fingerprint sensor



Portable Navigation Device EP001



Palm-sized F-07C Windows® 7 Mobile Phone is the world's smallest PC

## Our Strength

Fujitsu offers PCs with high added value and a firm commitment to quality. Our notebook PCs are manufactured entirely by Shimane Fujitsu Limited, with operations that consolidate everything from design to manufacturing, assembly and customization in one location. Our desktop PCs use components sourced from outside Japan, and are assembled and customized for Japan by Fujitsu Isotec Limited, and for other markets, mainly Europe, by Fujitsu Technology Solutions in Germany. In mobile phones and tablet PCs, we offer a diverse lineup of high-quality models with advanced functions, including smartphones<sup>2</sup> with cutting-edge, high-speed CPUs, and the Raku-Raku Phone series with easy-to-read displays, clear-sounding speakers, and intuitive functionality. In mobilewear<sup>2</sup>, we draw on our long-nurtured expertise with in-vehicle technologies to provide car navigation systems and other types of automotive electronics that make the driving experience safer and more comfortable.

**PC Market Share in Japan 2011 (Unit Basis)**

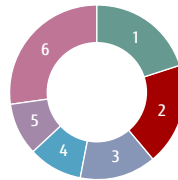
1	Company A	24.2%
2	<b>Fujitsu</b>	<b>17.3%</b>
3	Company B	12.2%
4	Company C	8.7%
5	Company D	8.5%
6	Company E	6.6%
7	Others	22.6%



(Source: Gartner, "Quarterly Statistics: Personal Computers, Worldwide by Region, 1Q12 Update" 9 May 2012)

**Mobile Phone Shipments in Japan in 2011 (Unit Basis)**

1	Company A	20.1%
2	<b>Fujitsu</b>	<b>18.8%</b>
3	Company B	14.2%
4	Company C	10.0%
5	Company D	9.7%
6	Others	27.2%



(Source: IDC Japan, Japan Quarterly Mobile Phone Tracker, 2012Q1)

### ? Glossary

**HDD**

Hard disc drive. This refers to a memory system into which information is written commonly found in PCs and other computing equipment.

**Mobilewear**

A term coined by Fujitsu that mainly refers to car audio and navigation equipment, most notably car navigation systems, but also to mobile communication and automotive electronic equipment.

**Ultrabook™**

A term originated by Intel of the United States to describe an ultra-thin, lightweight mobile notebook PC. This class of notebook PCs is notable for having shorter waiting times from power up to operation.

**Universal Design**

Refers to specifications prefaced on enabling use by the elderly, the disabled, or non-native populations by overcoming barriers due to physical limitations, as well as intellectual or linguistic barriers.

**Smartphones**

Mobile phones offering voice calling and email that also enable users to customize functionality by individually adding new software.

**Feature Phones**

General term for non-smartphone (i.e., "conventional") mobile phones.

## Market Trends

### 2011 Global Market Trends

Total PC shipments in Japan fell 2.8% year on year in 2011 to 15.65 million units. Factors affecting shipments included the suspension of factory operations following the Great East Japan Earthquake, and a shortage of HDDs<sup>2</sup> due to the flooding in Thailand. In the consumer market, sales increased as lower retail prices for high-end models stimulated demand by making them seem a comparative bargain. In the corporate market, PC shipments, which are generally concentrated in March, declined due to the earthquake. Globally, the PC market expanded 0.5% year on year to 352.56 million units. The anemic rise in sales stemmed from the European debt crisis, the HDD shortage due to the flooding in Thailand, and competition from smartphones and tablet PCs.

In Japan, mobile phone shipments in 2011 increased 5.1% year on year to 37.95 million units. >> **GRAPH 1** This was due mainly to the rapid spread of smartphones, which offset a decline in sales of feature phones<sup>2</sup>.

Worldwide shipments of car navigation systems climbed 5.1% year on year to 9.84 million units. >> **GRAPH 3** Shipments declined in Japan due to the falloff in production and sales following the

earthquake, but increased in emerging markets with the rapid rise in car ownership, and also grew steadily in Europe and North America.

### Outlook for 2012

For PCs, the Japanese consumer market is expected to decline slightly year on year as a certain segment of consumers shift to tablet PCs, offsetting the demand stimulated by the release of Ultrabook™<sup>2</sup> models and PCs with Windows® 8. The Japanese corporate market, however, is expected to grow as companies replace their PCs running on Windows® XP operating systems. As a result, the Japanese market overall is projected to grow slightly. Outside Japan, the consumer market is projected to increase on higher sales stimulated by Windows® 8 and Ultrabook™ models, while demand in the corporate market is expected to remain strong. Accordingly, the worldwide PC market is forecast to expand 4.4% year on year to 368.23 million units.

In mobile phones, domestic shipments in 2012 are expected to increase 3.6% year on year to 39.33 million units. Overall market scale is forecast to expand in line with the soaring popularity of smartphones, offsetting a contraction in the feature phone market.

Worldwide shipments of car navigation systems are expected to increase

11.5% year on year to 10.97 million units. This is due to rising automobile sales in emerging markets, leading to the accumulation and maintenance of data across a wider geographic area, as well as to an anticipated higher level of product lineups and standard options that result from rising incomes.

## Operational Review and Initiatives

### Fiscal 2011 Business Results

Net sales in the Ubiquitous Solutions segment totaled ¥1,154.2 billion in fiscal 2011 (up 2.5% year on year). >> **GRAPH 4**

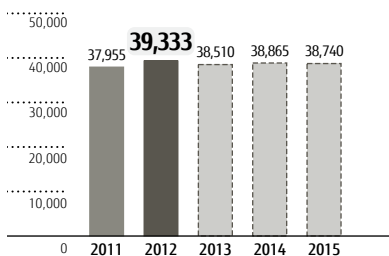
Worldwide shipments of Fujitsu PCs increased 11.1% year on year to 6.02 million units. In Japan, there were several large-volume deals for corporate clients, though the consumer market was affected by a fall in unit prices and a shortage of HDDs due to the flooding in Thailand. Outside Japan, Europe recorded higher sales of notebook PCs to corporate clients.

Mobile phone shipments in Japan rose 19.4% year on year to 8.00 million units. This was due mainly to the boost from the mobile phone business merger with Toshiba Corporation, and a wide lineup of new models centered on smartphones.

GRAPH 1

### Mobile Phone Shipment Forecast for Japan

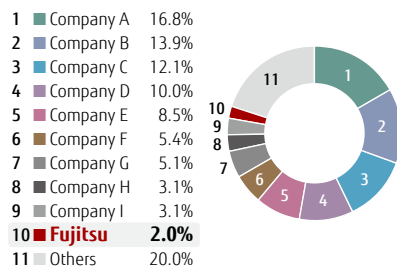
(Thousands of units)



(Source: IDC Japan, Japan Quarterly Mobile Phone Tracker, 2012Q1)  
\* The above figures are as of the end of each fiscal year (March 31)

GRAPH 2

### Global PC Market Share in 2011 (Unit Basis)

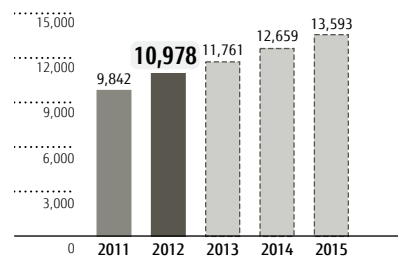


(Source: Gartner, "Quarterly Statistics: Personal Computers, Worldwide by Region, 1Q12 Update" 9 May 2012)

GRAPH 3

### Projected Trends in Global Car Navigation System Demand

(Thousands of units)



(Source: Japan Electronics and Information Technology Industries Association, "Trends in Worldwide Demand for Major Electronics," published February 2012)

In mobilewear, sales of audio and navigation devices declined year on year, due mainly to the drop in factory utilization rates in the wake of the earthquake, and production slowdowns among auto-makers due to the flooding in Thailand.

Operating income declined ¥2.7 billion from the previous fiscal year to ¥19.9 billion. >> GRAPH 5 In the PC business, earnings in Japan rose for both the consumer and corporate markets as the decline in retail prices and rising cost of HDDs was offset by reductions in material and component procurement expenses due to the strong yen. Outside Japan, despite higher unit sales, primarily in Europe, earnings declined on lower revenue as a result of a falloff in unit prices. In the mobile phone business, unit sales and prices both rose considerably, but earnings were flat as a result of stepped-up investment in smartphone development, and costs associated with the earthquake and Thailand flooding. In mobilewear, earnings fell significantly on the sharp decline in revenue.

An additional factor regarding audio and navigation device sales was Fujitsu's restructuring of its domestic production framework and its efforts to strengthen overseas production with the aim of enhancing cost competitiveness and our ability to respond to the global expansion of clients.

### Initiatives Going Forward

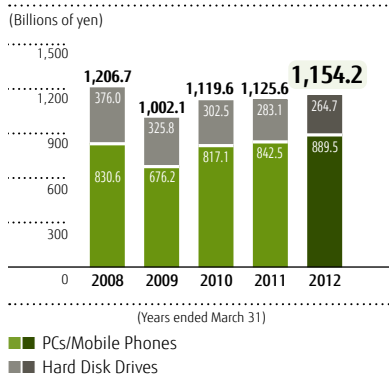
For the PC market, Fujitsu will conduct a global campaign for its high-quality and exceptionally reliable PCs made in Japan, the "Izumo Models" produced by Shimane Fujitsu Limited and the "Date Models" manufactured by Fujitsu Isotec Limited. We will also offer the Japan-developed LIFEBOOK UH SERIES, the world's thinnest Ultrabook™, as well as the ESPRIMO FH Series of desktop PCs with enhanced television features and design. We will further promote the new "My Cloud" PC concept as a way for users to easily organize data that can be collected throughout their homes, and to vastly broaden their enjoyment of that data by utilizing it over a cloud service. Outside Japan, Fujitsu will step up PC sales for the corporate market in Germany, while in North America the focus will be on bolstering sales of slate PCs in the medical and educational fields, and in Asia-Pacific and China, on developing consumer demand.

In mobile phones, Fujitsu is developing such products as the high-spec, water-resistant ARROWS F-10D smartphone utilizing a quad-core CPU, the high-quality, compact and water-resistant ARROWS Me F-11D easy-to-use smartphone that allows for easy transfer of data, and the Raku-Raku Smartphone, a large-screen smartphone that is the latest model in the long-selling

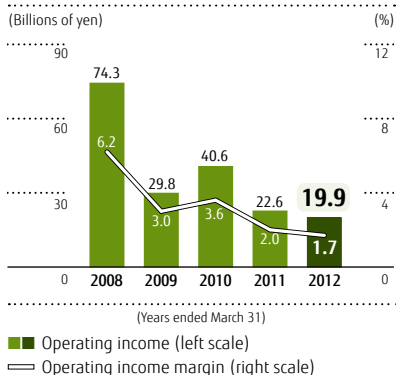
Raku-Raku Phone Series for seniors. We will distinguish our products from the competition by further enhancing our strengths in such areas as universal design<sup>2</sup> technologies, water-proofing and dust-resistance. We will retain our leading share in the Japan market, while accelerating efforts to bolster and increase efficiency in our product development structure in preparation for global business growth.

In mobilewear, Fujitsu will expand sales of high-value-added products that use ICT to connect people and society via automobiles, such as the ECLIPSE Series AVN-ZX02i car navigation system. Featuring a nine-inch screen that is among the largest in the industry, this system can also be linked to smartphones and portable game devices. In July 2012, Fujitsu Group subsidiary Fujitsu TEN Limited established a joint venture with NK MINDA Group, a major automobile component manufacturer in India. With this new company, we intend to put in place a unified structure for the development, design and manufacture of car navigation systems and other devices, as well as to increase our business in the rapidly expanding Indian market.

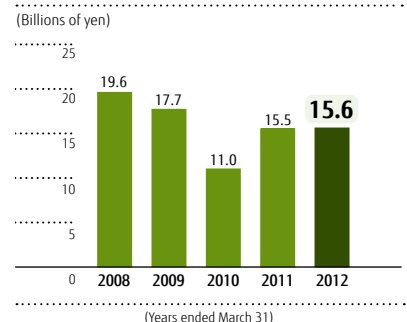
GRAPH 4 Sub-segment Sales\*



GRAPH 5 Operating Income/ Operating Income Margin



GRAPH 6 Capital Expenditure



# Device Solutions

LSI devices and electronic components comprise Fujitsu's Device Solutions. Fujitsu Semiconductor, the Fujitsu Group's operating company in semiconductors, provides LSI devices found in products such as digital home appliances, automobiles, mobile phones, and servers. Meanwhile, publicly listed consolidated subsidiaries Shinko Electric Industries and Fujitsu Component, together with companies like FDK, provide semiconductor packages and other electronic components, as well as structural components such as batteries, relays, and connectors.



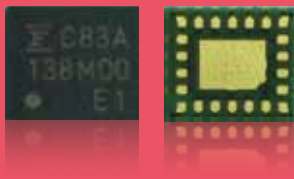
## Fiscal 2011 Performance (Year-on-year Comparison)

(Billions of Yen)

Net Sales  
**584.7**  
(-7.3%)

Operating Loss  
**-10.1**  
(-31.1)

Capital Expenditure  
**47.2**  
(+7.7)



MB86C83 multiband power amp for wireless mobile devices



MB86M01 and MB86M02 memory-embedded transcoders compatible with H.264 transcoding

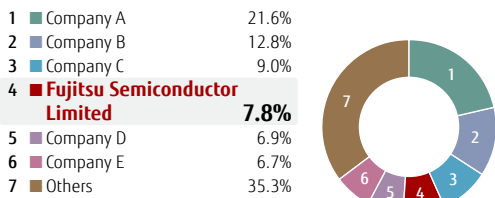


MB91580 series microcontroller with drive motor control functions for electric and hybrid vehicles

## Our Strength

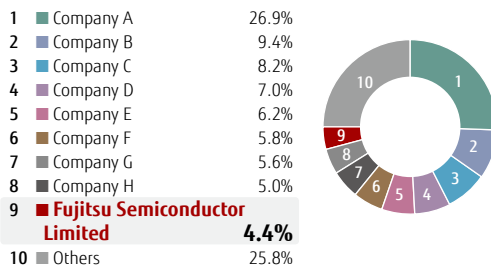
Fujitsu Semiconductor is focusing its business around the four pillars of “Mobile,” “Automotive,” “Advanced Imaging,” and “High-performance (Industrial Equipment).” In these four areas, we offer highly reliable, optimized solutions that meet the diverse needs of our customers. Our products are used in a wide range of applications, from imaging to wireless communications and security, and are increasingly energy efficient as a result of the emphasis we place on the environment. Fujitsu Semiconductor is expanding its business globally through development and sales sites in Japan, the Americas, Europe, and Asia.

2011 Global ASIC Market Share (based on sales)



(Source: IHS iSuppli May 2012)

2011 Microcontroller Market Share (based on sales)



(Source: IHS iSuppli May 2012)

### ? Glossary

**Fab-lite**

A combination of the words “fab” (i.e., a semiconductor manufacturing plant) and “lite,” this term refers to maintaining minimal in-house manufacturing capacity, with additional production outsourced. This approach contrasts with a fabless model, in which development and design alone are conducted in-house, with all manufacturing outsourced.

**Microcontroller (Microcomputers)**

Microcontrollers (also, microcomputers) contain a CPU, memory, and I/O (input/output) interface circuits all on a single chip.

**ASIC**

An IC custom-manufactured for a particular customer

**ASSP**

A standard product that implements a specific function, such as image or network processing

**SoC**

System on Chip. Also known as system LSI, refers to the condensing onto a single chip of functionality derived by combining functions previously spread across multiple individual ICs; the result is devices that are more compact but offer higher performance.

**IP**

For LSIs, refers to conventional intellectual property as well as circuit diagrams, software and other design assets

## Market Trends

### 2011 Global Market Trends

In 2011, the global semiconductor market grew 0.4%\* year on year to a new record high of US\$299.5 billion. The rate of growth, however, was markedly slower than the 31.8% increase achieved in 2010. >> **GRAPH 2**

In stark contrast with the previous year, the industry struggled as demand faltered under a global economic slowdown triggered by Europe's debt crisis, coupled with the impact of the Great East Japan Earthquake, flooding in Thailand, and other natural disasters.

Geographically, the Japanese market shrank 7.9%\* year on year (16.3%\* on a yen basis) due to factors such as the Great East Japan Earthquake of March 2011, worldwide economic weakness, the yen's appreciation, and the Thai floods, which drove down production of digital cameras and other AV equipment, as well as PC- and automobile-related production. This contraction in the Japanese market was severe compared to other markets. Similarly, the Asian market grew just 2.5% year on year, as a lackluster global economy and the effects of flooding in Thailand significantly undercut market expansion. These negative factors

offset robust demand for smartphones and other communications equipment. In other regions, weak demand and negative growth caused by the European debt crisis resulted in negative market growth in Europe. In the Americas, market growth was up slightly, as a drop in demand for PCs largely undermined firm demand for communications equipment and automotive applications.

### Outlook for 2012

In 2012, the global semiconductor market is expected to grow a mere 0.4%\* year on year to US\$300.8 billion, suggesting that challenging market conditions will remain unchanged. >> **GRAPH 2** The US market is forecast to grow 3.2%\* and Europe is set to contract by 3.5%\*. The Japanese market is expected to grow 1.7%\*, while the Asia-Pacific market is expected to increase 0.1%\*. Essentially, a return to positive growth is forecast for the Japanese market, in a rebound from the contraction seen in 2011. There is the potential for retrenchment in the European market to be greater than currently forecast, with the still-smoldering debt crisis prolonging economic uncertainty.

In terms of products, although the memory market, which includes DRAM and Flash memory, and the market for

MOS microcontrollers are both expected to decline slightly year on year, by 3.1%\* and 1.7%, respectively, the market for logic products should sustain modest growth of 2.0%.

The market is projected to continue growing gradually from 2013, with an anticipated increase of 7.2%\* to US\$322.4 billion in 2013. The market is also expected to grow by 4.4%\* in 2014, to US\$336.5 billion, for an average annual growth rate of 4.0%\* between 2012 and 2014.

\* Semiconductor market estimates according to World Semiconductor Trade Statistics (WSTS), spring 2012 forecast.

## Operational Review and Initiatives

### Fiscal 2011 Business Results

Net sales in this segment totaled ¥584.7 billion, a decrease of 7.3% from the previous fiscal year. >> **GRAPH 3** Sales in Japan fell 5.1%. Sales of LSI devices decreased due to the completion in the first quarter of shipments of CPUs for supercomputers, which were mass produced in fiscal 2010, as well as to the impact from the earthquake in the first quarter. Another factor was the decline in sales of LSIs for digital AV devices in the second half of the year as a result of the

GRAPH 1

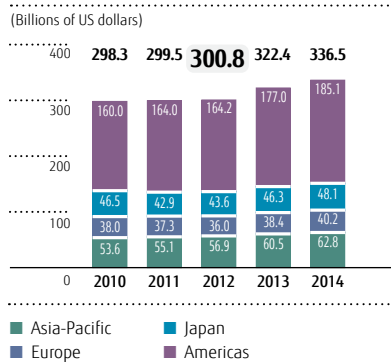
Sales of Logic LSI Products by Application for the Year Ended March 31, 2012

- 1 AV/Consumer electronics
- 2 Mobile phones
- 3 PCs and peripherals
- 4 Automobiles
- 5 Industrial machinery
- 6 Communications devices
- 7 Others



GRAPH 2

Global Semiconductor Market Forecasts



(Source: World Semiconductor Trade Statistics (WSTS))

flooding in Thailand. Electronic component sales also fell due to decreased demand for semiconductor packages. Sales outside Japan were also lower, even excluding the impact of foreign exchange rates. In LSIs, sales were brisk for image processing LSIs used in smartphones. In electronic components, however, sales of semiconductor packages and LCD modules declined, primarily in Asia.

The segment posted an operating loss of ¥10.1 billion, a deterioration of ¥31.1 billion from operating income in fiscal 2010. >> GRAPH 4 In Japan, LSI earnings were affected by lower revenue, while earnings for electronic components were hampered by lower sales and rising prices for materials, as well as the impact of foreign exchange rates.

**Initiatives Going Forward**

In April 2012, the Fujitsu Group finalized an agreement to transfer ownership of the Iwate Plant to DENSO CORPORATION. Since 2009, Fujitsu has been pursuing a unique "fab-lite" business model, outsourcing advanced process technologies for 40 nm and beyond to Taiwan Semiconductor Manufacturing Company (TSMC). The transfer of ownership of the Iwate Plant is in line with this plan, and will help Fujitsu to optimize manufacturing

resources while continuing to ensure a stable supply of products to customers, thereby enhancing the business foundation and improving corporate management in the Fujitsu Group's LSI business.

As Fujitsu establishes its unique fab-lite business model going forward, ASICs and microcontrollers will be at the center of business, with imaging, wireless and other ASSPs positioned as priority fields in pursuing growth.

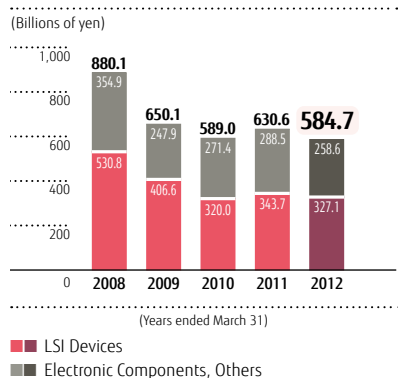
In ASICs, Fujitsu will lead in offering ASIC solutions based on advanced 28 nm processing technology offered to customers in an optimal package. At the same time, Fujitsu is poised to meet a wide range of needs by assembling a wealth of IP to support customers' state-of-the-art SoC development.

As for microcontrollers, in addition to its own original cores, Fujitsu from 2010 began offering globally viable microcontrollers that incorporate ARM's Cortex™-M3 cores. Looking ahead, Fujitsu will further enhance its microcontroller lineup, adding high-performance automotive microcontrollers with graphics functions to the available options, in order to deliver optimal products for a host of applications.

In ASSPs\*, Fujitsu's market strategy is to draw together cutting-edge LSI technologies to develop products that deliver high performance and outstanding functionality for mobile phones, PCs, communications networks and a range of other systems.

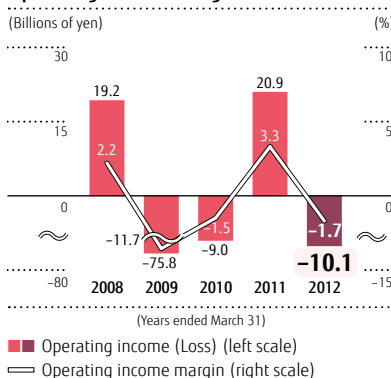
\*Transfer scheduled for October 1, 2012

GRAPH 3 Sub-segment Sales\*



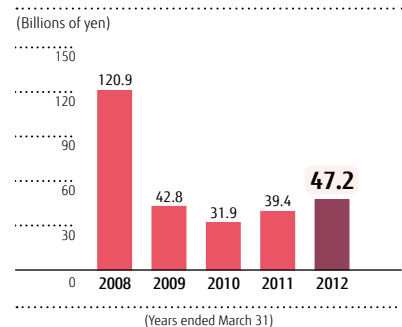
\* Including intersegment sales

GRAPH 4 Operating Income (Loss)/ Operating Income Margin



■ Operating income (Loss) (left scale)  
 — Operating income margin (right scale)

GRAPH 5 Capital Expenditure



# Major Announcements and IR Activities in Fiscal 2011

2011 4 5 6 7 8 9 10

## Technology Solutions

**April 12, 2011**

Fujitsu and Oracle Deliver Enhanced SPARC Enterprise M3000 Server



**April 26, 2011**

Fujitsu Launches New PRIMEQUEST 1000 Series Model

**May 10, 2011**

Fujitsu Launches New Energy-Saving Model of Primergy Server

**May 10, 2011**

Fujitsu Releases SaaS-Based Regional Medical Network Solution

**May 25, 2011**

Fujitsu Delivers Flexible Data Management with New ETERNUS DX Disk Storage



**May 27, 2011**

NBN Co Selects Fujitsu Australia as New Developments Deployment Partner

**June 7, 2011**

Fujitsu Launches Global Cloud Platform Service Powered by Microsoft Windows Azure™

**June 8, 2011**

Fujitsu Deploys Six-Country Global Cloud Platform

**June 14, 2011**

Fujitsu Launches New Location Data Service SPATIOWL

**June 20, 2011**

"K computer" Takes First Place among World Supercomputers

**June 21, 2011**

Fujitsu Launches TX140 S1, TX120 S3, and RX100 S7 PRIMERGY 1-way Servers



**July 7, 2011**

Fujitsu Begins Field Testing of ICT-Enabled Mandarin Orange Cultivation

**July 29, 2011**

Fujitsu Launches New Line of Windows Azure™-Compatible Middleware Products Worldwide

## Ubiquitous Solutions

**April 15, 2011**

Fujitsu Releases Raku-Raku Basic 3 Mobile Phone

**April 21, 2011**

Fujitsu Renews LIFEBOOK and ESPRIMO PC Lineup and CELSIUS Lineup of PC Workstations

**May 13, 2011**

Fujitsu Announces Summer 2011 Line of FMV Series Personal Computers



**May 25, 2011**

Vivid View Processor 3, the World's First LSI with Color Correction in Direct Sunlight for Vehicle-Mounted Displays, Launched

**May 31, 2011**

Fujitsu Launches FMV Raku-Raku PC 4

**June 1, 2011**

ECLIPSE Car Navigation System 2011 Summer Model AVN3 Launched



**June 15, 2011**

Fujitsu Introduces docomo PRIME series™ F-09C



**July 21, 2011**

Fujitsu Introduces Windows® 7 F-07C Mobile Phone



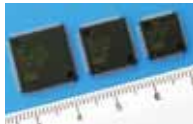
**August 3, 2011**

Fujitsu Introduces docomo F-12C Smartphone

## Device Solutions

**April 21, 2011**

Fujitsu Semiconductor releases 52 Products as Second Offering of New FM3 Family of 32-bit Microcontrollers



**April 27, 2011**

Fujitsu Semiconductor Launches 32-bit Microcontrollers for Use in EVs and HVs

**May 30, 2011**

Fujitsu Semiconductor Releases New System Controller LSI with High-Performance Graphics for Automotive Applications

**September 6, 2011**

Fujitsu Expands FM3 Family of 32-bit Microcontrollers with 64 New Products

## Others

**May 18, 2011**

Fujitsu Develops Inter-Cell Interference Coordination Technology for LTE Base Stations

**May 19, 2011**

The Fujitsu Group Announces Its "Eco First Summer 2011 Power-Saving Pledge"

**June 1, 2011**

Fujitsu Develops World's First Personal Authentication Technology to Integrate palm Vein and Fingerprint Authentication



**July 15, 2011**

Fujitsu Launches Agriculture Support System Using Sensors at a Vineyard in Yamanashi Prefecture

**September 12, 2011**

Fujitsu Develops Terahertz-Band Imaging Method for Speeding Up Material Inspections 25-fold

## IR

**April 28, 2011**

FY2010 Full-year Financial Results Announcement

**June 17, 2011**

Management Direction Briefing

**June 23, 2011**

111th Annual Shareholders' Meeting

**July 28, 2011**

FY2011 First-quarter Financial Results Announcement

**September 16, 2011**

Shimane Fujitsu PC Plant Tour

**October 13, 2011**

Fujitsu Laboratories' R&D Strategy Briefing

11 12 **2012** 1 2 3 4 5

**August 16, 2011**  
Fujitsu launches 4-way rack server PRIMERGY RX600 S6



**August 30, 2011**  
Fujitsu Develops World's First Cloud Platform to Leverage Big Data

**September 2, 2011**  
Fujitsu Wins ICT Infrastructure Support Contract from McDonald's UK

**September 30, 2011**  
Fujitsu Marketing Enhances Business Activities for the Private Sector Market

**November 1, 2011**  
Fujitsu Solves Cost-of-Growth Storage Challenge with New High-end Systems

**November 7, 2011**  
Fujitsu Launches PRIMEHPC FX10 Supercomputer



**December 12, 2011**  
Fujitsu America Concludes ICT Infrastructure Services Contract with Blue Cross and Blue Shield of North Carolina

**December 14, 2011**  
Fujitsu Releases Packet Optical Networking Platform (ONP) for Building 100 Gbps Ultrafast, High-Capacity Networks

**January 6, 2012**  
Fujitsu Releases BroadOne LTE Femtocell for Easy Indoor Wireless Communications



**January 6, 2012**  
Fujitsu Launches Cloud Services as a Platform for Big Data

**January 30, 2012**  
Fujitsu Network Communications Selected by AT&T as Domain Network Equipment Supplier

**March 7, 2012**  
Fujitsu Launches Four New 2-way PRIMERGY x86 Servers

**March 9, 2012**  
Fujitsu Launches PRIMERGY CX400 Multi-Node Server Featuring 84 Nodes in a Single Rack

**August 18, 2011**  
Fujitsu Launches Mint Green Version of Raku-Raku Phone 7



**November 16, 2011**  
Fujitsu Introduces docomo with series™ REGZA Phone T-01D



**January 12, 2012**  
Fujitsu Announces Spring 2012 Line of FMV Series Personal Computers



**October 4, 2011**  
Fujitsu Announces Winter 2011 Line of FMV Series Personal Computers

**December 14, 2011**  
Fujitsu Introduces docomo NEXT series™ ARROWS X LTE F-05D

**January 12, 2012**  
Fujitsu Introduces ARROWS Tab Wi-Fi Tablet PC for Consumers

**October 12, 2011**  
Fujitsu Introduces docomo ARROWS Tab LTE F-01D Tablet PC

**January 5, 2012**  
Fujitsu Introduces Its ARROWS ES IS12F Smartphone for au

**February 3, 2012**  
Fujitsu Releases Android Tablet PC for Corporate Customers



**January 6, 2012**  
Fujitsu Introduces docomo STYLE series™ F-04D

**December 1, 2011**  
Fujitsu Releases Transcoders with Built-in Memory and H.264 Transrating Function



**January 31, 2012**  
Fujitsu Enhances FM3 Family of 32-bit Microcontrollers with the Release of 210 New Products

**October 13, 2011**  
Fujitsu Laboratories Develops World's First Datacenter Simulator for Predicting Total Energy Consumption and Evaluating Energy Efficiency



**October 13, 2011**  
Fujitsu Develops Technology Enabling Speech-Based Information Retrieval from Smartphones

**January 4, 2012**  
Fujitsu Group's First Geothermal Heat Extraction System Deployed at Nagano Plant

**December 14, 2011**  
Fujitsu Develops Industry's First Peak Power Demand Reduction Technology for Deployment in Smart Cities

**February 7, 2012**  
Fujitsu's ICT Helps to Solve Environmental Issues in Thailand

**October 27, 2010**  
FY2011 First-half Financial Results Announcement

**January 31, 2012**  
FY2011 Third-quarter Financial Results Announcement

**April 5, 2012**  
Fujitsu Laboratories' R&D Strategy Briefing

**December 7, 2011**  
Presentation for Bond Investors

**March 30, 2012**  
Mobile Phone Plant Tour

**April 27, 2012**  
FY2011 Full-year Financial Results Announcement

# Initiatives by Region

## JAPAN

### Market Trends

The Japanese IT market is expected to grow by 1.1% year on year in 2012. >> GRAPH 2

The domestic economy slumped in 2011 due to the effects of the Great East Japan Earthquake and Thai flood damage, but a recovery is expected to emerge in 2012, including a bounce-back from the previous year. Recovery will likely be gradual in the first half of the fiscal year due to European economic trends, foreign exchange trends and other uncertainties, as well as efforts to cope with anticipated electricity shortages during summer. Full-scale economic recovery is set to occur from the second half of the fiscal year, mainly in the manufacturing and distribution sectors, as the rebound in corporate earnings and progress in rebuilding from the earthquake become clear. In the public sector, measures to bolster disaster resistance have started since the earthquake, especially at government ministries and agencies. At local governments, deals to rebuild mission-critical systems have peaked, and in the healthcare field, regional medical collaboration is spreading.

Amid these trends, the server market in Japan is expected to contract more than 10% compared with the previous year. This is in large part due to a decline in the portion of supercomputer-related shipments recorded in the previous year. Anticipated contraction in the market, including lower prices, also reflects the growing use of datacenters with a view to risk avoidance, and projected acceleration in the trend toward server integration and consolidation.

Meanwhile, the Japanese telecommunications market is expected to grow 4.8% year on year. Construction of mobile phone base stations based on next-generation Long Term Evolution (LTE)

technology is expected to continue at a high level from 2011. Ongoing measures to deal with increased telecommunications traffic due to the spread of smartphones are also anticipated.

The Japanese IT services market is projected to grow 5.1% year on year as IT budgets recover gradually along with improved corporate earnings. Since the earthquake, demand has risen for use of datacenters with an eye toward business continuity planning (BCP). Similarly, reviews of IT system operation, as well as the introduction of new IT services through cloud computing, are expected to progress further. In addition, new IT usage that utilizes big data is attracting attention, with the IT services market poised to expand in the future.

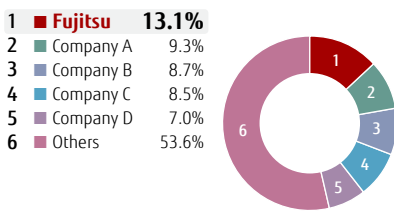
### Initiatives Going Forward

In the Japanese market, we will take on the challenge of three Group initiatives aimed at new growth—bolstering interaction with customers, enhancing system engineering (SE) capabilities, and further strengthening our technology. Our corporate structure has been reconfigured into a matrix organization along customer and business lines, further clarifying the account sales structure and bolstering sales capabilities in both quantitative and qualitative terms as we pursue higher sales.

In the system products business, mainly servers, Fujitsu is working to launch products into growth markets and to expand sales in new and undeveloped markets. To this end, we are successively launching energy-efficient rack servers for datacenters and bundle servers with virtualization functions for small and medium-sized businesses (SMBs), targeting mid-range high performance computers (HPCs), the embedded market, the datacenter market, and new channels. By introducing a model

GRAPH 1

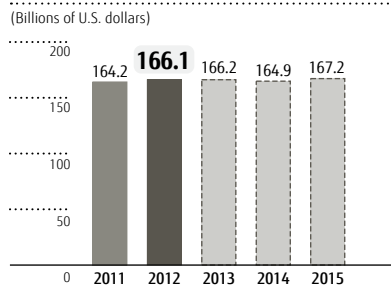
Share of 2011 IT Services Market Sales in Japan (Revenue Basis)



(Source: Gartner, "Market Share: IT Services 2011" 9 April 2012)

GRAPH 2

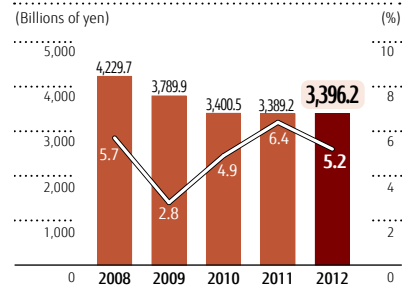
IT Market Forecasts (Japan)



(Source: IDC The Worldwide Black Book Q1 2012)

GRAPH 3

Net Sales\* and Operating Income Margin



(Years ended March 31)

■ Net sales (left scale)  
 — Operating income margin (right scale)

\* Including intersegment sales

equipped with Intel's latest CPU announced in early March 2012 ahead of rivals (only one other Japanese company has announced similar plans), we aim to increase sales by providing products sooner, especially to customers seeking high performance.

In the network products business, we will further expand our base station business as LTE rollout ramps up, and steadily advance business dealing with increased network traffic accompanying the rapid spread of smartphones. We will also aim to advance into new business fields, such as home-area networking utilizing LTE and optical access.

In the ICT services business, we will roll out new services centered on cloud computing. We will provide Data Utilization Platform Services that leverage big data, which is now attracting attention, to gather, compile, and integrate massive quantities of sensing data, apply knowledge, process it using real-time processing or batch processing, and use it to generate future

projections and other purposes. We will also roll out the public cloud service Fujitsu Global Cloud Platform in six countries around the world, responding to the global expansion of customers and their various other needs.

In addition, we will bolster our structure by unifying SE organizations and realigning regional SE companies, enhancing the flow of knowhow and resources and aiming to become a group of SE professionals with overwhelming competitiveness.

As a result of the spread of cloud computing, customers are now searching for the ideal new IT system. By leveraging our outstanding ability to provide a vertically integrated structure—from highly dependable, high-performance platforms such as networks, servers, and datacenters to top-line applications—we will lead the domestic ICT market by proposing new ICT possibilities to customers and do our utmost to respond to customer expectations.

## Customer Solution Profile

### National Hospital Organization Nagasaki Medical Center

#### Protection of clinical data and improved medical reliability realized through a cloud-based backup system

The National Hospital Organization's Nagasaki Medical Center is the largest top-tier, comprehensive medical facility in Japan's Nagasaki Prefecture, with approximately 12,800 inpatients annually and some 800 outpatient visits per day. To fulfill its role as a key regional hospital, the center is actively using ICT to upgrade and streamline treatment and to improve medical care for the region as a whole. Among other innovations, the center uses electronic medical records and participates in the Ajisai Network of regional medical facilities to collaborate with clinics and other medical facilities in the area.

As part of these efforts, Fujitsu's HumanBridge BCP Solution was utilized to build a disaster recovery backup system for the Nagasaki Medical Center at a Fujitsu datacenter. This system enables the center to avoid the risk of a disaster destroying hospital systems and all medical data being lost, but is also a pathway for continuing treatment by referencing past medical data from other medical facilities and evacuation centers.

If the Nagasaki Medical Center's electronic medical record system becomes unusable, doctors and nurses at evacuation centers and other medical facilities can refer to medical data stored at the datacenter through the Internet, based on patient approval, and can store on-site clinical records through the memo function. Since past clinical data and basic information can be referenced, medical staff coming from other regions can also provide treatment based on reliable data.

After the ICT platform at the center is rebuilt, backup data from the datacenter will be returned to the server to restore the electronic medical record system. Clinical records inputted using the memo function during a catastrophe can be referenced from the electronic medical record system as a disaster clinical record.

Fujitsu is committed to supporting the Nagasaki Medical Center's regional medical collaboration, provision of better medical care, and promotion of greater sophistication for overall medical care in the region from an ICT standpoint, by continuing to provide consulting, system building, and operational support.



National Hospital Organization Nagasaki Medical Center

# EMEA Europe, Middle East, Africa

## Market Trends

A continued recovery is forecast in the 2012 EMEA IT market, with 2.5% year-on-year growth. >> **GRAPH 2** By region, government spending cuts and constrained IT investment will remain issues in the UK, with severe conditions likely to linger going forward. Similarly, in Germany and the Nordic region where the economy had up until now been trending toward recovery against a backdrop of robust exports, growth rates are set to slow due to uncertainty surrounding countries in the euro zone. By contrast, IT markets in Eastern Europe and Africa are projected to expand as economies in these regions continue to grow.

The size of the IT services market is expected to recover modestly, with year-on-year growth of 1.1%. Although year-on-year declines are projected in system development and other traditional IT services, growth in outsourcing and other services conducted as cost-reduction efforts is expected to remain firm.

The overall EMEA server market is forecast to decline by 2.5% from the previous year. Market expansion is forecast mainly for Eastern Europe and Africa. However, mature Western European markets are likely to contract slightly against a backdrop of increasingly severe price competition. The high-end server market is expected to continue its precipitous decline as customers shift to low-end servers. Due to this shift, the market for low-end x86 servers, a mainstay product area for Fujitsu, is expected to grow, particularly in Eastern Europe, Africa and other emerging economies. The storage market is projected to recover strongly, with year-on-year growth of 4.8%, after ending lower

last year due to supply shortfalls caused by HDD component shortages in the wake of flooding in Thailand. The PC market, meanwhile, is anticipated to grow 7.0% over the previous year on the back of sharp growth projected in Eastern Europe, the Middle East, Africa and other emerging markets, along with economic recovery in Western Europe.

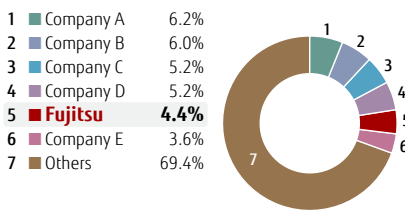
## Initiatives Going Forward

In the UK and Ireland, we will diversify risk through customer segment optimization. This will involve bolstering resources to private-sector business, pursuing further expansion in this business with an emphasis on global enterprises, and lessening our reliance on government and public-sector projects. As we continue striving to expand our infrastructure services, which comprise about 70% of our business in the region, we are shifting the business portfolio toward PaaS, SaaS and other high-value-added services to realize a highly profitable business structure. Moreover, we will move to expand our range of offerings and enhance relations with customers by pursuing expanded sales of Fujitsu-brand servers and storage, as well as reinforcement of applications, network solutions, and other businesses.

In continental Europe, we are eyeing business expansion through greater geographic coverage of emerging markets, most notably those with high market growth such as India, Russia and the Middle East. Steps will be taken to boost competitiveness in the services business by promoting delivery standardization and offshore utilization, coupled with an enhanced lineup of cloud

GRAPH 1

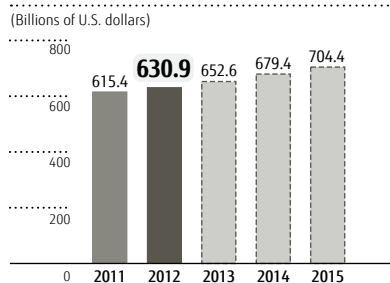
Share of 2011 IT Services Market in the UK (Revenue Basis)



(Source: Gartner, "Market Share: IT Services 2011" 9 April 2012)

GRAPH 2

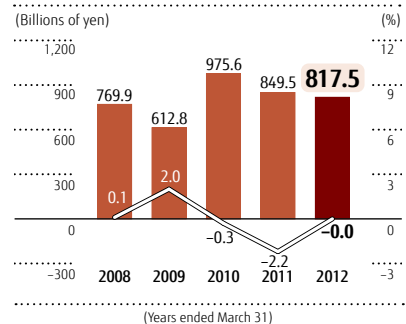
IT Market Forecasts (EMEA)



(Source: IDC The Worldwide Black Book Q1 2012)

GRAPH 3

Net Sales\* and Operating Income Margin



\* Including intersegment sales

offerings. Meanwhile, sales channel reinforcement via the introduction of telesales, online sales and other tools will strengthen our x86 server and PC-centered product business. By advancing cross-selling in tandem with services, we will aim for stable growth and profit expansion.

In the Nordic region, we will use our track record in the services business with locally based global enterprises as a springboard for strengthening our approach to supporting customers developing their operations globally, with sights on business expansion. To improve profitability in the services business, we are moving forward on standardizing and sharing delivery and business processes, coupled with boosting assurance functions. Our push to improve efficiency and profitability will also include moving forward with the integration of back-office operations and service desks in the region.

## Customer Solution Profile

### Mitchells & Butlers

## UK's biggest pub & restaurant operator goes cloud with Fujitsu

With 1,600 sites in the UK, Mitchells & Butlers is a leading restaurant and pub operator whose portfolio includes many well-known brands such as All Bar One. The company devised a plan for a renewed ICT system to drive efficiencies in its business and create a platform to develop new guest-focused services, while reducing costs.

In May 2011, Mitchells & Butlers engaged in a two-phase project with Fujitsu that was designed to deliver these business outcomes. The first phase was the delivery of a superfast broadband network to the company's 1,600 businesses, including Wide Area Network (WAN) services supporting individual outlet needs, access to central applications and services to the point of sale (POS) terminals to take payments, and Ethernet for offices. The consumer-based services also include a wired and wireless Local Area Network (LAN). The second phase was the migration of old and inefficient applications to a new cloud environment hosted by Fujitsu. As anticipated, business continuity was maintained during the transition project.

Through this innovative renewal of ICT infrastructure, applications are running on average 10% faster, and those reliant on databases up to 30% faster. The company can now launch new services quickly and easily thanks to a highly efficient on-demand system, and critically, the company now has guaranteed service availability, ensuring that its business runs smoothly across all of its locations.

According to Tony Bentham, Chief Information Officer at Mitchells & Butlers: "As a result of a genuinely innovative partnership with Fujitsu that delivered equivalent innovation in technology and business processes, Mitchells & Butlers now has a robust and reliable platform on which to build our future."



# THE AMERICAS

## Market Trends

The IT market in the Americas in 2012 is expected to grow at a comparatively high rate of 7.4% year on year. This represents a trend of continued growth, despite falling short of the considerable 7.0% growth rate in 2011. In the United States, the economy is rebounding firmly overall, with concerns of a double-dip recession having mostly dissipated. Although causes for concern persist, among them high unemployment and escalating gasoline and crude oil prices, business performance and profitability are on the rise among large companies. >> GRAPH 2

In 2012, the IT services business in the Americas is expected to grow 4.8% year on year, a modest but positive improvement following the 4.5% growth of the previous year. Substantial growth is anticipated in fields such as cloud computing, social networking and big data analysis. In addition, the growing use of smartphones, tablet PCs and other mobile devices is expected to drive the market.

The hardware market is expected to remain on an overall growth trajectory during 2012, though there are signs of unevenness in individual products. The server market is projected to expand 0.1% overall, virtually flat from the 0.3% year-on-year growth in 2011. The market for high-end servers is expected to decline 21.0% year on year, a sharp contraction compared to the relatively modest decline of 1.6% in 2011. The mid-range server market is projected to expand considerably, by 10.4%, continuing growth albeit at a slower pace compared to the 13.0% growth of the previous year. The market for low-end servers is expected to

rise 5.9% year on year, substantially reversing the year-on-year decline of 0.9% in 2011. The storage market is projected to expand steadily with 7.0% growth, largely the same level as the 7.5% growth seen in 2011. The PC market is expected to see significant growth of 12.6%, further exceeding the 10.9% growth in 2011 and reflecting greater consumer and corporate demand for tablet computers. The communication devices market is projected to continue expanding steadily at a high rate of growth, although the 11.0% growth expected for 2012 is sharply lower than the 20.3% seen in 2011.

## Initiatives Going Forward

In April 2009, Fujitsu merged three of its North American subsidiaries to establish Fujitsu America as the core of business operations in the Americas. An innovation program designed to promote expansion in business scale and boost market name recognition in the Americas is currently being implemented.

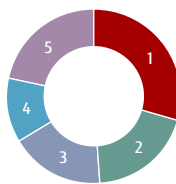
As a result, we were able in 2011 to win large-scale business deals for infrastructure services in the United States that will provide momentum for operations. We will continue the push to win more deals of this type in 2012. Furthermore, we are raising the added value of infrastructure services, including cloud business deals, and promoting a greater rate of return by focusing on the application businesses of partner companies such as SAP, Oracle, Salesforce.com, and Microsoft.

In the platform products business, we will continue to promote x86 server sales through channel upgrades and other sales

GRAPH 1

Next-Generation Metro WDM Market Share in North America (Revenue Basis)

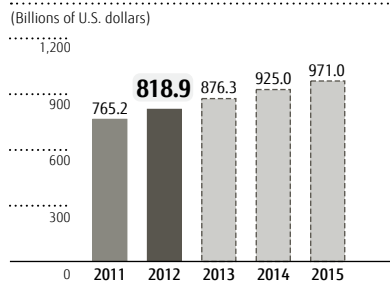
1	Fujitsu	29.6%
2	Company A	19.3%
3	Company B	17.6%
4	Company C	12.0%
5	Others	21.5%



(Source: Ovum, Market Share: 1Q12 ON Global, June 2012)

GRAPH 2

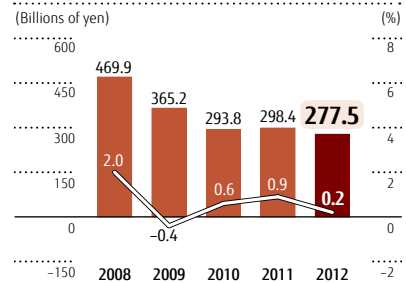
IT Market Forecasts (Americas)



(Source: IDC The Worldwide Black Book Q1 2012) (Americas: North and South America)

GRAPH 3

Net Sales\* and Operating Income Margin



(Years ended March 31)

■ Net sales (left scale)  
 — Operating income margin (right scale)

\* Including intersegment sales

structure enhancements. Plans call for applying this same model to storage and PCs to spur revitalization in the platform products business as a whole.

In Canada, along with maintaining our traditional strengths in consulting and the solutions business, we are looking to diversify our offerings by strengthening our hand in the new field of managed services. We will also use Saskatchewan-based business and IT consulting solution and services provider TMC, acquired by Fujitsu in 2012, to reinforce business development in Central and Western Canada.

With respect to business development in emerging markets, in product-centered Brazil, we will promote business expansion,

including in the services business. We will also position Brazil as a hub market from which we will push for business development in other regions in South America. Specifically, we will support the business development of customers from Europe in South America and target winning business deals for global accounts.

In North America's optical transmission systems market, investments to enhance mobile backhaul and other backbone infrastructure to cope with LTE (Long Term Evolution) and the increase in data traffic are set to continue during 2012. Along with working to win business deals that these trends present, Fujitsu will advance initiatives for developing the Canadian market and achieving expansion in the services business.

**Customer Solution Profile**

**Blue Cross and Blue Shield of North Carolina**

**Fujitsu America enters into major ICT infrastructure services outsource agreement with Blue Cross and Blue Shield of North Carolina**

Blue Cross and Blue Shield of North Carolina (BCBSNC) is a well-known leader in delivering innovative health care products, services and information to over 3.6 million members, including approximately 900,000 served on behalf of other Blue Plans. For over 78 years, the state's largest health insurer has served its customers by offering health insurance at a competitive price and has served the people of North Carolina through support of community organizations, programs and events that promote good health.

In December, Fujitsu America, Inc. (FAI) signed a major agreement with BCBSNC, under which FAI purchased the BCBSNC data center (located in Research Triangle Park, NC) and is providing a variety of ICT infrastructure services to BCBSNC. As part of this infrastructure, Fujitsu also welcomed approximately 185 talented employees from BCBSNC to FAI.

The agreement is valued at \$250 million over five years and includes ownership, management and support of various technology systems and functions—such as computer mainframes, servers, desktop PCs, telephone systems, networks and technology security. Fujitsu is taking over a 32,000-square-foot facility that includes about 18,000 square feet of space devoted to ICT functions. About half of that ICT space is currently being used.

"We entered into this agreement to find ways to reduce costs and increase flexibility while maintaining high levels of quality and service," said BCBSNC CIO Jo Abernathy. "We're pleased with Fujitsu America's strong, comprehensive and continued commitment to our people, business needs and technology."



Performance

# APAC, CHINA

## Market Trends

China's IT market is expected to continue its strong growth, despite the impact from a decline in exports to Europe, and a slight slowdown in the economic growth rate. Over the longer term, the country's economic structure will shift from dependence on exports to being driven by private-sector domestic consumption, and IT investment will increase with greater urbanization as foreign corporations gain more of a presence. IT investment in 2012 is projected to rise around 12.7% year on year, with strong growth expected to continue at an average annual rate of around 8.3% for the period from 2011 to 2015. >> **GRAPH 1** This continued investment is expected as China's 12th Five-Year Plan for state policy specifies information networking as an area for strategic development and cultivation, and because companies expanding into China are making plans to bolster production and sales to meet domestic demand.

In Asia-Pacific (APAC), excluding China, growth in the IT market is expected to be around 9.6% in 2012. In the short term, curbs on investment will continue in response to the slowdown in economic growth triggered by the European debt crisis and other factors. Over the longer term, however, countries will push ahead with infrastructure upgrades in line with economic development, and growing companies will continue their IT investment. For the period from 2011 to 2015, IT spending in the region is projected to remain strong with growth of around 8.9% annually.

In ASEAN countries, economic growth is slowing as a result of the flooding in Thailand. In other countries, however, public and private-sector IT investment continues to increase amid growth in

consumer spending and capital expenditure. In the East Asia region, the European debt crisis is slowing economies in the near term, constraining IT investment. Over the longer term, however, the IT market is projected to expand as a result of continued economic growth. In India, internal demand, centered on public-works projects and consumer spending, along with external demand in areas such as software services as an export industry, are expected to bring about high economic growth. Against this backdrop the willingness to invest in IT is increasing, with a projected rise of around 18.7% in 2012, and a strong average annual growth rate of 17.9% between 2011 and 2015. >> **GRAPH 2**

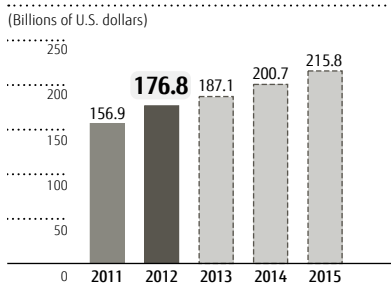
In the Oceania region, exports to China are substantial, making the region easily swayed by the Chinese economy. However, economic growth remains steady, supported by demand for natural resources, and increased IT investment during 2012 is expected to continue.

## Initiatives Going Forward

In China, Fujitsu will grow its services business for both Japanese and foreign-capitalized companies, and will develop local businesses in an effort to increase its solutions business overall. We will utilize the South China Datacenter in Foshan, Guangdong Province opened in April to the greatest extent possible, and pursue business deals for private cloud services as one of Fujitsu's core middleware products. For the platform business, we will raise sales to existing customers by focusing on value-added businesses that offer x86 servers and storage as a set.

GRAPH 1

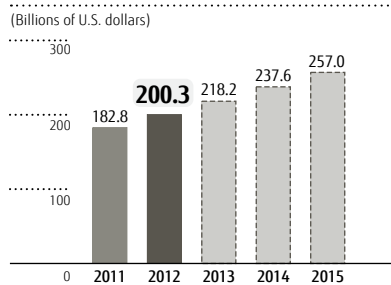
IT Market Forecasts (China)



(Source: IDC The Worldwide Black Book Q1 2012) (China: Including Hong Kong)

GRAPH 2

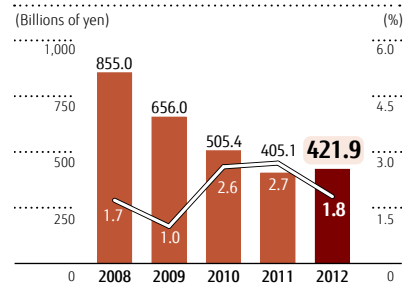
IT Market Forecasts (APAC)



(Source: IDC The Worldwide Black Book Q1 2012) (APAC: Excludes Japan, China, and Hong Kong)

GRAPH 3

Net Sales\* and Operating Income Margin



(Years ended March 31)

■ Net sales (left scale)  
 — Operating income margin (right scale)

\* Including intersegment sales

In the ASEAN region, Fujitsu will expand in three areas: business services to Japanese corporations, the datacenter business, and the application development business. We are also utilizing the Fujitsu Global Cloud Platform to achieve growth in the cloud services business.

In the East Asia region, Fujitsu will increase sales of x86 servers and storage through tie-ups with local partners, and expand its cloud services business. We are also strengthening ties with major Japanese retailers and distributors and other successful companies with aggressive overseas expansion programs, and developing businesses that generate steady revenue streams.

In India, we intend to continue efforts to increase business from Europe and the United States by boosting our offshore resources. Fujitsu Technology Solutions will lead our strategy and

planning of the ICT infrastructure business in India, which will improve business in terms of both scale and management quality. We will also aggressively expand our sales of system products such as x86 servers.

In the Oceania region, Fujitsu will make its cloud services available across the entire market, build a business model to grow Fujitsu Group business outside of Japan, and pursue a larger market share and develop its business laterally across the region. By industry type, Fujitsu currently holds a strong position in public sector business, but also plans to bolster its client portfolio and broaden business scope. We will do this through full-fledged implementation of network and broadband contracts acquired in 2011, and by offering infrastructure services to the finance industry.

## Customer Solution Profile

### Australia Post

#### Long-term partnership helps Australia Post align delivery capabilities with market demands

Australia Post is the oldest continually operating organisation in Australia. Each year Australia Post delivers more than 5 billion items to 10.9 million addresses across Australia. With more than 4,400 outlets across the nation, Australia Post has the largest retail network in Australia with over 2,500 of these outlets in rural and remote areas. Australia Post is a self-funding business and receives no taxpayer funding.

Fujitsu has enjoyed a long-term relationship with Australia Post spanning over 20 years and has played an important role in supporting the company's systems. Fujitsu is engaged with the organisation on a number of initiatives including ensuring that Australia Post can leverage its long-term investment in legacy applications while staying focused on responding to current and future market demands. Fujitsu is also assisting Australia Post in initiatives in new technology areas such as digital media in new-look, retail superstores and initiatives to integrate e-commerce with delivery models under the Australia Post Future Ready program.

Australia Post Chief Information Officer Andrew Walduck said: "Fujitsu is a key technology partner for Australia Post. As well as helping us to ensure that a number of our key systems continue to support our business objectives, Fujitsu leverages its national and international base of skills to work with us to ensure we have the right technology in place to meet our future business needs."

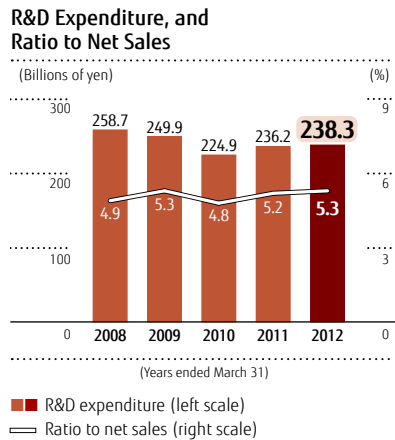


# Research & Development

## Our Mission in R&D

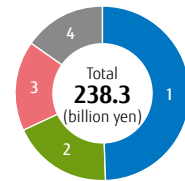
As our fundamental R&D policy, we pursue initiatives to create new value for our customers and to achieve our Corporate Vision of contributing to the creation of a networked society that is fulfilling and secure, bringing about a prosperous and dream-inspiring future. In order to achieve these initiatives, our R&D of advanced technologies includes technologies for next-generation services, computer servers and networks, as well as various electronic devices and advanced materials which serve as building blocks for our products.

- Create and accumulate advanced technologies
- Extend our value chain globally
- Foster the creation of new businesses
- Fulfill our social responsibilities



### Fiscal 2011 R&D Expenditure by Segment

1 Technology Solutions	49.5%
2 Ubiquitous Solutions	18.7%
3 Device Solutions	16.5%
4 Other Operations/ Elimination and Corporate	15.2%



## Major Advanced R&D Achievements for Fiscal 2011 (April 2011–March 2012)

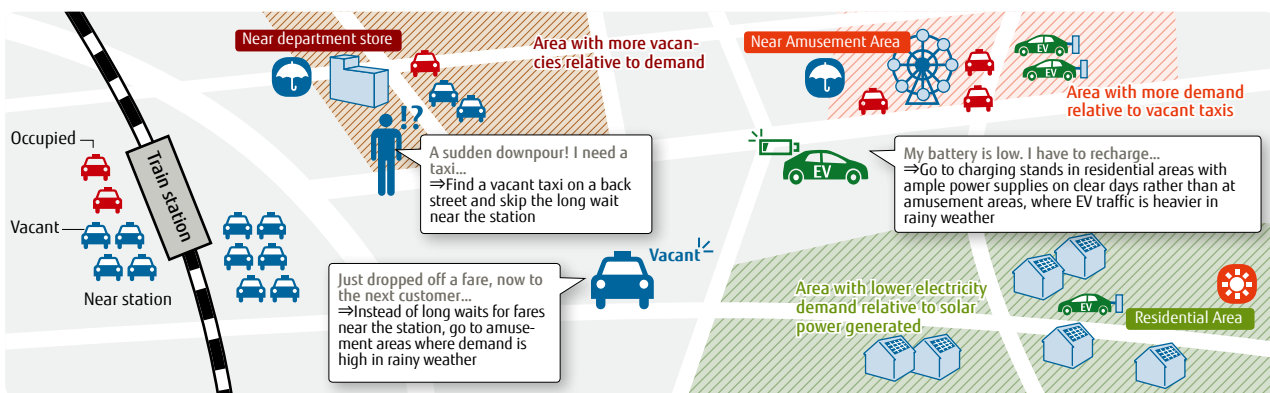
### (1) Technology for Spatiotemporal Data Processing to Quickly and Precisely Search Areas of Interest

By gathering various real-time data from social infrastructure and quickly and precisely searching areas of interest, it is possible to swiftly recognize positional patterns of people and society, and devise appropriate solutions.

GPS and other sensors generate a vast amount of positional data concerning people and their vehicles, and Fujitsu has developed a technology that identifies within this data those areas where the searched-for activity—for example, high demand for taxis or for electricity—is most likely to occur. This technology enables outstanding flexibility when searching for areas of

complex shapes and different sizes, so that areas of interest can be searched with greater precision. Narrowing the search to areas where events of interest are most likely to occur produces a boost to speed of roughly 60 times compared to previous techniques.

Potential uses include the dispatch of taxis and delivery vehicles, or to efficiently control electricity distribution based on supply and demand differences between areas. Another potential use is to support marketing based on real-time and accurate commercial area analysis. The spatiotemporal data-processing technology will also be rolled into SPATIOWL, Fujitsu's cloud service for using and managing location data, launched in July 2011.



Overview of potential areas of interest that can be searched for using spatiotemporal data processing technology

## (2) Development of Distributed Parallel Complex Event Processing Technology that Rapidly Adjusts Big Data Load Fluctuations

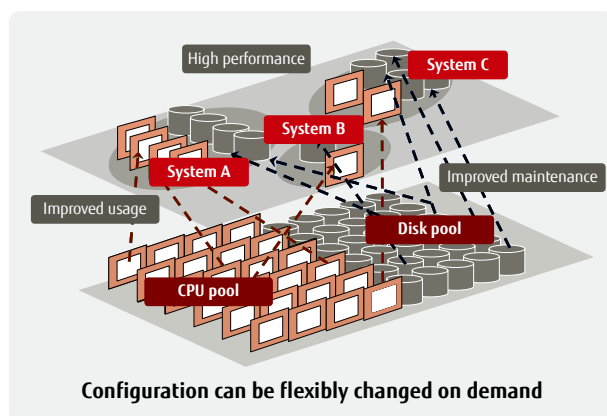
Effective use of big data demands an ever-increasing amount of time-series data be analyzed continuously in real time. Fujitsu developed the world's first distributed parallel complex event processing technology designed for use with cloud technology that rapidly adjusts big data load fluctuations. This research was supported in part by Japan's Ministry of Economy, Trade and Industry's Project for the Program to Develop and Demonstrate Basic Technology for Next-Generation High-Reliability, Energy-Saving IT Equipment for Fiscal 2010 and Fiscal 2011.

The newly developed technology enables greater segmentation during processing; when the volume of data increases, the load can be spread across more servers, while a decrease in data volume conversely sees processing concentrated among fewer servers. The ability to scale event processing across servers has resulted in a throughput function of 5 million events per second, enabling real-time analysis of big data.

## (3) Prototype of World's First Next-Generation Server Simultaneously Delivering High Performance and Flexibility

The increasing diversity of cloud services—including those involving big data—has created a need for flexible systems better tailored for each service, compared to datacenters for traditional Web services.

To answer this need, Fujitsu has developed a resource pool architecture in which the hardware components, such as CPUs and HDDs, are linked together with high-speed interconnects. This has enabled development of a next-generation server prototype that simultaneously delivers high performance and flexibility. The new architecture makes it possible at all times to flexibly configure systems to suit not just Web services and big-data processing, but also newly emerging cloud services. Furthermore, more efficient use of hardware components minimizes system costs and contributes to power conservation.



Resource pool architecture

## (4) Development of Anti-Distortion Technology to Cut Power Used by Compensation Circuits in Ultrafast Optical Fiber Transmission Systems

As the amount of data transmitted over the Internet swells—due in part to growth in big data—harnessing optical fiber technology to build ultrafast networks at low cost and with low energy consumption will become increasingly important.

In response, Fujitsu has developed a digital signal processing algorithm to compensate for waveform distortion in long-haul transmission systems over several hundreds of kilometers. This has enabled a roughly 20-fold improvement in compensation ability per circuit size compared to conventional technology, thereby extending the long-haul operating range of optical signals. The technology eliminates the need for signal regenerators in telecom carriers' trunk-line networks and in networks linking datacenters that provide cloud services and other services, paving the way for ultrafast, long-haul transmission systems that are low-cost and energy-efficient.

## (5) Supercomputer "K computer" Takes Consecutive No. 1 in World Ranking; Launch of PRIMEHPC FX10 Supercomputer

The next-generation supercomputer, the "K computer," jointly developed by RIKEN (Japan's flagship research institute devoted to basic and applied research) and Fujitsu, took the No. 1 position on the TOP500 List\*<sup>1</sup> announced in November 2011 for the second consecutive time, having previously been identified as the world's highest performing supercomputer in June 2011. The K computer system is equipped with 88,128 SPARC64 VIIIx CPUs developed by Fujitsu to deliver high performance, exceptional reliability, and low power consumption. The system achieved the world's best LINPACK\*<sup>2</sup> benchmark performance of 10.51 petaflops\*<sup>3</sup>, signifying a speed of ten quadrillion (one "kei" in Japanese; equals ten thousand times one trillion) floating-point operations per second. It achieved this performance with a computing efficiency ratio\*<sup>4</sup> of 93.2%, surpassing the previous figure. In November 2011 Fujitsu commenced global sales of the PRIMEHPC FX10 supercomputer, which further improves on the supercomputer technology employed in the K computer in being capable of scaling to a top theoretical processing performance of 23.2 petaflops.

\*<sup>1</sup> TOP500 List: A project ranking the world's supercomputers based on comparative performance, with rankings announced twice yearly.

\*<sup>2</sup> LINPACK: A program for measuring computer performance.

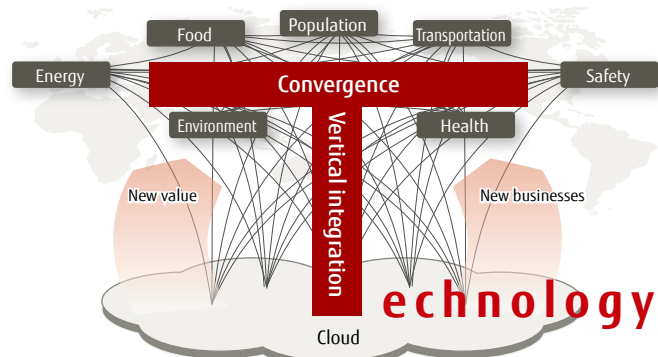
\*<sup>3</sup> Petaflops: Peta stands for one thousand trillion, or one quadrillion. FLOPS stands for floating point operations per second, or the number of calculations the machine is capable of in one second.

\*<sup>4</sup> Computing efficiency ratio: The ratio of actual performance reached versus theoretically possible peak performance.

## Topics

### Realizing a Human Centric Intelligent Society

To make the Human Centric Intelligent Society—creating new value in the real world through Human Centric IT—a reality, Fujitsu is researching and developing advanced technologies along two axes—“convergence,” linking customers from different sectors together through big data spanning myriad industries, and “vertical integration” for overall optimization.



## Awards and Prizes

**2 Commendations for Science and Technology (Development Category) from the Minister of Education, Culture, Sports, Science and Technology of Japan**

5 members of the Fujitsu Group were honored by Japan's Minister of Education, Culture, Sports, Science and Technology in fiscal 2011 with Commendations for Science and Technology: Development Category for the “development of speech quality improvement technology for mobile phones,” with 1 other member honored for “development of supercomputer core technologies and relevant human resources.”

**Awarded the Keidanren (Japan Business Federation) Chairman Award at the Fiscal 2011 Persons of Merit Awards in Business–Academia–Government Collaboration**

At the 10th Conference for the Promotion of Collaboration among Business–Academia–Government (hosted annually by the Cabinet Office and other government ministries of Japan), Professor Emeritus Hiroshi Ishiwara of the Tokyo Institute of Technology and 2 individuals from the Fujitsu Group received the Keidanren (Japan Business Federation) Chairman Award in the Fiscal 2011 Persons of Merit Awards in Business–Academia–Government Collaboration for the research and development of nonvolatile memory FRAM and its commercialization.

**“K computer” Awarded the ACM Gordon Bell Prize, Ranked No. 1 in Four Benchmarks at the HPC Challenge Awards**

A research group comprised of RIKEN, the University of Tsukuba, the University of Tokyo, and Fujitsu announced research results obtained using the K computer—jointly developed by RIKEN and Fujitsu—at SC11 (the International Conference for High Performance Computing, Networking, Storage and Analysis), receiving the ACM Gordon Bell Prize, Peak-Performance. In addition, the research group received top-ranking in all 4(\*)HPC Challenge benchmarks used for evaluating the overall performance of supercomputers.

(\*) HPC Challenge benchmarks:

- 1) Global HPL (operating speed in solving large-scale simultaneous linear equations);
- 2) Global Random Access (random memory access performance in parallel processing);
- 3) EP STREAM (Triad) per system (memory access speed under multiple loads);
- 4) Global FFT (total performance of Fast Fourier Transform)

## Advanced R&D Strategic Direction in Fiscal 2012 (April 2012 – March 2013)

Fujitsu has classified its framework for advanced research into the three categories below, with a view to achieving group-wide optimization from a global standpoint. Through this framework Fujitsu will carry out strategic R&D for the future of the Fujitsu Group, align business segment strategies with research strategies, and enhance resource shifts in response to changes in Fujitsu's business portfolio. Fujitsu will employ a top-down approach to setting research themes, and will conduct strategic research investment.

- 1. Core Strategic Themes: Technologies essential to the medium- to long-term future of the Fujitsu Group**
- 2. Business Strategic Themes: Short- to medium-term technologies that business segments have committed to commercializing**
- 3. Seeds-oriented Themes: Budding technologies not specific to current businesses, and medium- to long-term technologies targeting unknown domains**

In particular, Fujitsu is promoting the following five Core Strategic Themes.

### (1) Human Centric Computing

Fujitsu will correlate, combine and analyze data from real-world applications with data from specific industry applications, to realize convergence services that generate value.

### (2) Intelligent Society

Fujitsu will help create social infrastructure that solves increasingly complex social problems and transcends individual corporate and industry barriers, to contribute new value and knowledge to societies and corporations.

### (3) Cloud Fusion

Through effortless connections between clouds, and with existing systems, Fujitsu will link and share information to expand the fields for applying ICT, thereby creating new markets.

### (4) Green Datacenters

By optimizing power supply and cooling technologies, and employing optical networks, Fujitsu will build power-saving datacenters that realize high cost-performance as well.

### (5) Manufacturing Innovation

Fujitsu will provide advanced technologies that can contribute toward innovative manufacturing, to support Fujitsu's business and to function as a core for aligning the Fujitsu Group's product manufacturing.

## A Smartphone Seniors Can Master from Day One

### The story behind development of the F-12D Raku-Raku Smartphone

The Raku-Raku Phone handset series developed jointly with NTT DOCOMO, INC has been a huge hit with seniors. More than 20 million units have been sold since the series launched in 2001, bringing the enjoyment and convenience of mobile phones to an even wider audience. In the summer of 2012, an entirely new entry to this popular series, a smartphone designed for seniors, joined the lineup. The following is a behind-the-scenes look at the story behind this product, designed and developed from square one with convenience for seniors in mind.



#### “I want a smartphone with a bigger display”

Smartphones have become a runaway hit over the past two years, captivating users of all ages by putting the convenience and enjoyment of access to any information imaginable right in the palm of their hands. The same attraction holds for seniors. According to a Fujitsu study\*1, 42.6% of all seniors in Japan are eager to purchase a smartphone.

In expressing their expectations for smartphones, many people mentioned how exciting it would be to do any number of things on a larger display with an intuitive touch-panel interface. But when seniors actually used smartphones during hands-on conferences and focus groups Fujitsu sponsored, the touch-panel interface was a major source of mistaken user input.

Seniors clearly want to use smartphones, but there is no product on the market that fully meets their needs. After repeated research, Fujitsu opted to develop a smartphone from square one that offers what seniors want and that they can confidently master.

#### The goal: a stress-free, easily mastered device exclusively for seniors

In usability studies, it became clear that testers were unable to use the small buttons on touch panel displays accurately. There were also unintentional navigation errors due to inadvertent display touches. Fujitsu's solution was the development of a unique “Raku-Raku Touch Panel” to eliminate the anxiety associated with conventional touch panels. The goal was to do away with a “touch only” interface through a groundbreaking mechanism that delivers the tactile feel and precision of hard buttons, with fingertip vibrations used to signal that the desired input is complete. Among other included functions is accidental touch support to prevent mistaken input. The end result is a precise touch interface pleasing to seniors.

Another key issue was the difficulty and complexity of the smartphone user interface (UI)\*2. Developing a UI with a “home” application displayed large for seniors failed to fundamentally resolve this issue. This prompted Fujitsu to develop both

hardware and the UI for applications explicitly for the Raku-Raku Smartphone. While development required far more time and effort than ordinarily spent on new handset models, the outcome is a device that is easy to use in every way.

#### Human Centric fun and excitement Fujitsu strives to deliver

Smartphones make everyday life more convenient. This is why Fujitsu sought not only to make the Raku-Raku Smartphone intuitive to use, but to fill it with a host of functions, applications and services to make seniors' lives more enjoyable. The roughly 8.1 megapixel camera, for example, offers the same excellent functionality as high-end handsets, and has convenient function buttons that enables users to easily take captivating photos that they can immediately email. The device also comes with a variety of preinstalled applications available for use right away. These include popular pedometer and health management-related applications, to convenient destination maps, radio stations that users can listen to, games and more. Another offering is “Raku-Raku Community,” a site where users can fully enjoy connecting to other people. This space is one in which users can casually interact with people they normally would never meet around hobbies and travel, food, health and other themes. Raku-Raku Community is monitored 24 hours a day by Fujitsu staff, for a service that seniors can enjoy with peace of mind.

Fujitsu is optimally leveraging its ability to offer one-stop solutions encompassing hardware and software to services and content to provide senior-friendly, human-centric ICT.

Ubiquitous Business Strategy Headquarters  
Product Department I, Mobile Products  
Division  
Senior Manager  
**Kenetsu Furuki**



\*1 Smartphone Desire to Purchase Study: Research conducted by Fujitsu in December 2011 (573 mobile phone users aged 55 and older)

\*2 User Interface: Refers to a home screen and interface environment that allow users to directly navigate to and engage desired information.

# Intellectual Property

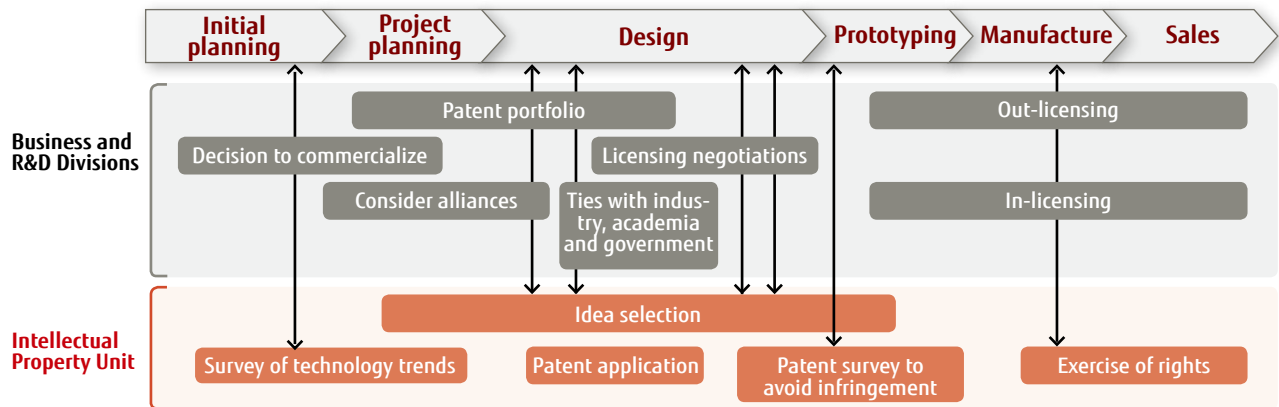
## The Importance of Intellectual Property

Protecting and respecting intellectual property is part of the Code of Conduct in the Fujitsu Way, which articulates the philosophy of the Fujitsu Group and the core values and principles guiding the actions of each of its employees. Accordingly, every employee recognizes intellectual property as a key corporate asset supporting business activities. Moreover, Fujitsu employees are acutely aware of the role that technologies backed by intellectual property play in enabling customers to rely with confidence on the products and services we deliver.

## Intellectual Property Strategy

We are promoting an intellectual property strategy closely integrated with our business and R&D strategies. Each business unit and R&D division is individually responsible for analyzing the intellectual property assets owned by Fujitsu and other companies in their respective fields. Based on this analysis, they formulate and implement intellectual property strategies.

Linking Business and R&D Divisions



## Group-Wide Initiatives

We are developing a framework to strengthen Group-wide intellectual property activities to enable the entire Group to leverage our intellectual property assets. Some issues, such as the creation of international standards, require coordinated action among the global bases in the Group. Here, we use regular meetings among Group companies to share information as well as promote specific measures. In this way, we foster a unified approach to intellectual property activities.

### 1. Patent Rights

Patent rights support technological strength. Recognizing these rights as an important corporate asset, we are assembling a global patent portfolio centered on patents in Japan.

We ensure that the acquisition, maintenance, and utilization of patents are carried out in keeping with the Fujitsu Group's global business development strategy. We therefore acquire, maintain, and utilize the patents we need in the countries (regions) where they are needed, to support the operation of our R&D, production, and sales bases. Representatives are sent to the US and China so that local research or inventions at development bases can be securely protected. For obtaining patents in the US, Fujitsu has a framework not only for yielding inventions, but for handling the entire adjudication process to achieve more efficient registration of high-quality patents.

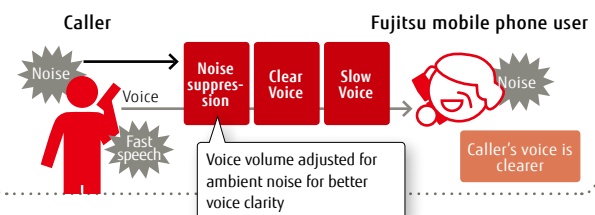
### Mobile phone voice technology

Mobile phones need to produce clear voice communications, regardless of the speaker's vocal characteristics or the surrounding environment, as they are used in a wide range of locations by people who speak in many different ways.

Fujitsu has taken the lead in developing new technologies such as "noise suppression" that reduces the inherent noise in the speaker's voice, "clear voice" that makes the speaker's voice easier to hear by adjusting for ambient noise, and "slow voice" technology to slow the speaker's voice without changing its pitch.

Intellectual property and development divisions worked collaboratively to bring these technologies to fruition, streamlining their efforts to develop the technology behind roughly 50 comprehensive patent applications and patents made both in and outside of Japan. These initiatives are also part of Fujitsu's efforts to realize a Human Centric Intelligent Society.

Fujitsu's voice technologies were awarded the Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology (Prizes for Science and Technology in Development Category) in 2012. Our noise suppression method for clearer mobile phone communications (Japanese Patent No. 4520732) received the Kanto Local Commendation for Invention and the Japan Patent Attorneys Association President's Encouragement Award sponsored by the Japan Institute of Invention and Innovation in 2011.



## 2. Exploitation of IP

Fujitsu preserves the competitive advantage of its businesses by providing differentiated products and services which are protected by prominent technologies and IP. IP also helps to preserve greater latitude in business by enabling Fujitsu to establish more advantageous terms when partnering with other companies. Furthermore, exploitation of IP rights helps to preserve business earnings through licensing and other activities. One example of such utilization is cross-licensing, which is an essential tool for securing greater latitude in business. Fujitsu enters cross-licensing agreements with a host of companies. A sample of major cross-licensees would include Intel, International Business Machines (IBM), Alcatel-Lucent USA, Texas Instruments, and Microsoft.

## 3. Global Standards Initiatives

The technology and market landscape is shifting from an era of using rules to one of creating them. Amid this changing competitive environment, Fujitsu recognizes the need for each division to align its business strategies with standardization initiatives. Fujitsu is helping to develop global standards through participation in the International Organization for Standardization/International Electrotechnical Commission (ISO/IEC), Institute of Electrical and Electronics Engineers (IEEE), European Telecommunications Standards Institute (ETSI), Internet Engineering Task Force (IETF), 3rd Generation Partnership Project (3GPP), and other major global standard-setting organizations.

## 4. Respecting Third Parties' Rights

Infringing upon the rights of third parties could have a major financial impact on our company, including having to pay significant compensation and the loss of business opportunities. In addition, it could prevent us from providing products and services, thereby severely inconveniencing our customers. We are fostering a culture at Fujitsu that respects the patent rights of other companies, as well as creating an environment that allows all our engineers to utilize the ATMS/IR.net system\* to efficiently and effectively research patents held by other companies.

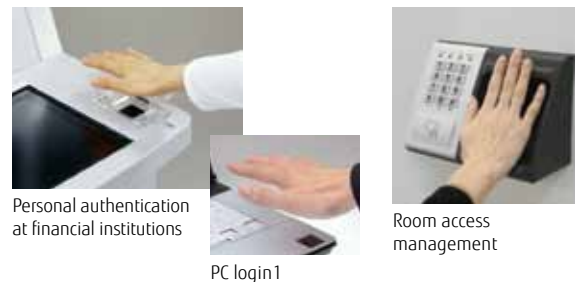
\* An ASP-based service which searches laid-open patent applications and prosecution history data provided by the Japan Patent Office.

### International standardization of biometric authentication technology

The Fujitsu Group's palm vein pattern recognition technology has earned high marks for usability and security. The technology enjoys widespread use in Japan and abroad, including at financial institutions for personal authentication and at companies for PC login and room access management. For instance, the technology is used by some seven million people at the ATMs of Brazilian bank Banco Bradesco S.A.—one of our clients.

Fujitsu is promoting standardization activities to make our palm vein pattern recognition technology as international standards for biometric authentication in order for many people to use this technology at ease. In fact, researchers at Fujitsu Laboratories played a key role in ushering in the vascular image data format standard ISO/IEC 19794-9:2011 (issued October 1, 2011).

Fujitsu is also actively working on international standardization in areas related to biometric authentication, such as information security and IC card technology.



### Patents Issued in Japan in 2011

1	Panasonic Corporation	6,812
2	TOYOTA MOTOR CORPORATION	5,011
3	Sony Corporation	4,300
4	Canon Inc.	4,206
5	TOSHIBA CORPORATION	3,825
6	Mitsubishi Electric Corporation	3,655
7	Ricoh Company, Ltd.	3,330
8	Honda Motor Co., Ltd.	3,163
9	Seiko Epson Corporation	2,964
10	Sharp Corporation	2,959
11	DENSO CORPORATION	2,949
12	<b>FUJITSU LIMITED</b>	<b>2,902</b>
13	Fuji Xerox Co., Ltd.	2,689
14	Hitachi, Ltd.	2,510
15	FUJIFILM Corporation	2,156
16	Panasonic Electric Works Co., Ltd.	2,074
17	KYOCERA Corporation	1,884
18	NEC Corporation	1,877
19	Dai Nippon Printing Co., Ltd.	1,832
20	Brother Industries, Ltd.	1,725

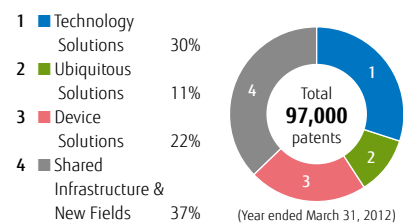
Fujitsu survey based on Japan Patent Office data (Number of issued patents)  
The number of patents granted to Fujitsu Group companies other than Fujitsu Limited is 1,337 (24 companies).  
Total Fujitsu Group patents: 4,239

### Patents Issued in US in 2011

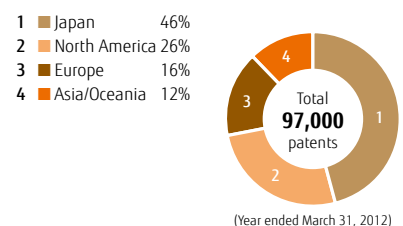
1	IBM Corporation	6,180
2	Samsung Electronics Co., Ltd.	4,894
3	Canon Inc.	2,821
4	Panasonic Corporation	2,559
5	TOSHIBA CORPORATION	2,483
6	Microsoft Corporation	2,311
7	Sony Corporation	2,286
8	Seiko Epson Corporation	1,533
9	Hon Hai Precision Industry Co., Ltd.	1,514
10	Hitachi, Ltd.	1,465
11	General Electric Company	1,448
12	LG Electronics, Inc.	1,411
13	<b>FUJITSU LIMITED</b>	<b>1,391</b>
14	Hewlett-Packard Development Company, L.P.	1,308
15	Ricoh Company, Ltd.	1,248
16	Intel Corporation	1,244
17	BROADCOM	1,164
18	GM Global Technology	1,095
19	Renesas Electronics Corporation	1,005
20	Honda Motor Co., Ltd.	997

Source: IFI CLAIMS Patent Services (Number of issued patents)  
The number of patents granted to Fujitsu Group companies other than Fujitsu Limited is 616 (13 companies).  
Total Fujitsu Group patents: 2,007

### Fujitsu Filings and Registered Patents by Business Segment



### Fujitsu Filings and Registered Patents by Geographic Region



## Our Corporate Philosophy

# FUJITSU Way

On April 1, 2008, Fujitsu announced a fully revised Fujitsu Way. The Fujitsu Way embodies the philosophy of the Fujitsu Group, articulates the Group’s overarching values, and defines concrete principles and a code of conduct that Group employees follow in their daily business activities. The new Fujitsu Way will facilitate management innovation and promote a unified direction for the Group as we expand our global business activities.

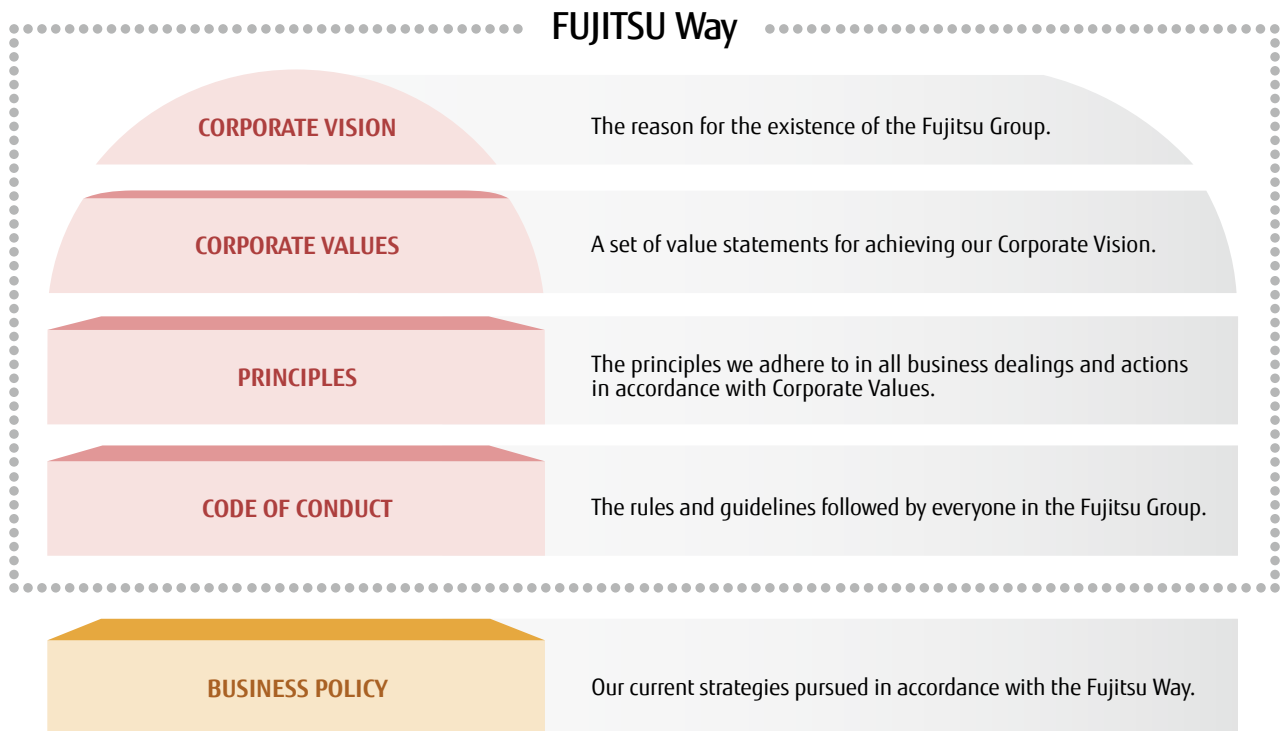
As outlined below, the Fujitsu Way consists of four core elements—the Corporate Vision, Corporate Values, Principles, and Code of Conduct. The Corporate Vision embodies the reason for the Group’s existence, as well as the social role that it should fulfill. Corporate Values encompasses a set of values important for realizing the Corporate Vision. Finally, the Principles and Code of Conduct articulate rules of behavior to which every Fujitsu Group employee should actively adhere in accordance with the Corporate Values.

The Group has also formulated a Business Policy that outlines the medium-term direction of Fujitsu’s businesses as defined by the Fujitsu Way. This policy serves as the basis for all Group business activities.

All Fujitsu Group employees have a shared commitment to the Fujitsu Way, which promotes a common direction for Group employees as they conduct their daily business activities. Employees aim to contribute to enhanced corporate value for the Fujitsu Group and to the well-being of the global and local societies in which we operate.

### The Elements of FUJITSU Way

FUJITSU Way comprises four core elements:



**CORPORATE VISION**

Through our constant pursuit of innovation, the Fujitsu Group aims to contribute to the creation of a networked society that is rewarding and secure, bringing about a prosperous future that fulfills the dreams of people throughout the world.

**CORPORATE VALUES**

**What we strive for:**

Society and Environment	In all our actions, we protect the environment and contribute to society.
Profit and Growth	We strive to meet the expectations of customers, employees and shareholders.
Shareholders and Investors	We seek to continuously increase our corporate value.
Global Perspective	We think and act from a global perspective.

**What we value:**

Employees	We respect diversity and support individual growth.
Customers	We seek to be their valued and trusted partner.
Business Partners	We build mutually beneficial relationships.
Technology	We seek to create new value through innovation.
Quality	We enhance the reputation of our customers and the reliability of social infrastructure.

**PRINCIPLES**

Global Citizenship	We act as good global citizens, attuned to the needs of society and the environment.
Customer-Centric Perspective	We think from the customer's perspective and act with sincerity.
Firsthand Understanding	We act based on a firsthand understanding of the actual situation.
Spirit of Challenge	We strive to achieve our highest goals.
Speed and Agility	We act flexibly and promptly to achieve our objectives.
Teamwork	We share common objectives across organizations, work as a team and act as responsible members of the team.

**CODE OF CONDUCT**

- We respect human rights.
- We protect and respect intellectual property.
- We comply with all laws and regulations.
- We maintain confidentiality.
- We act with fairness in our business dealings.
- We do not use our position in our organization for personal gain.

**BUSINESS POLICY**

- We use Field Innovation to find new approaches and the inspiration to improve ourselves, while delivering added value to our customers.
- We provide global environmental solutions in all our business areas.
- Fujitsu Group companies work together to accelerate our global business expansion.

**SHAREHOLDERS AND INVESTORS**

**We seek to continuously increase our corporate value.**

We aim to continuously increase corporate value and meet the expectations of shareholders and investors by achieving long-term sustainable growth and profit, and by pursuing strategic business expansion and focused management, while maintaining a sound financial standing.

We enhance our management transparency by appropriate and timely disclosure of our business activities and financial information. This ensures that investors and shareholders understand how we are performing in enhancing our corporate value.

**The Fujitsu Group's DNA**

"We need to provide returns to our shareholders commensurate with their investment.

In return for their investment, we have a responsibility and duty to respond to their expectations regarding profits and Fujitsu's corporate value."

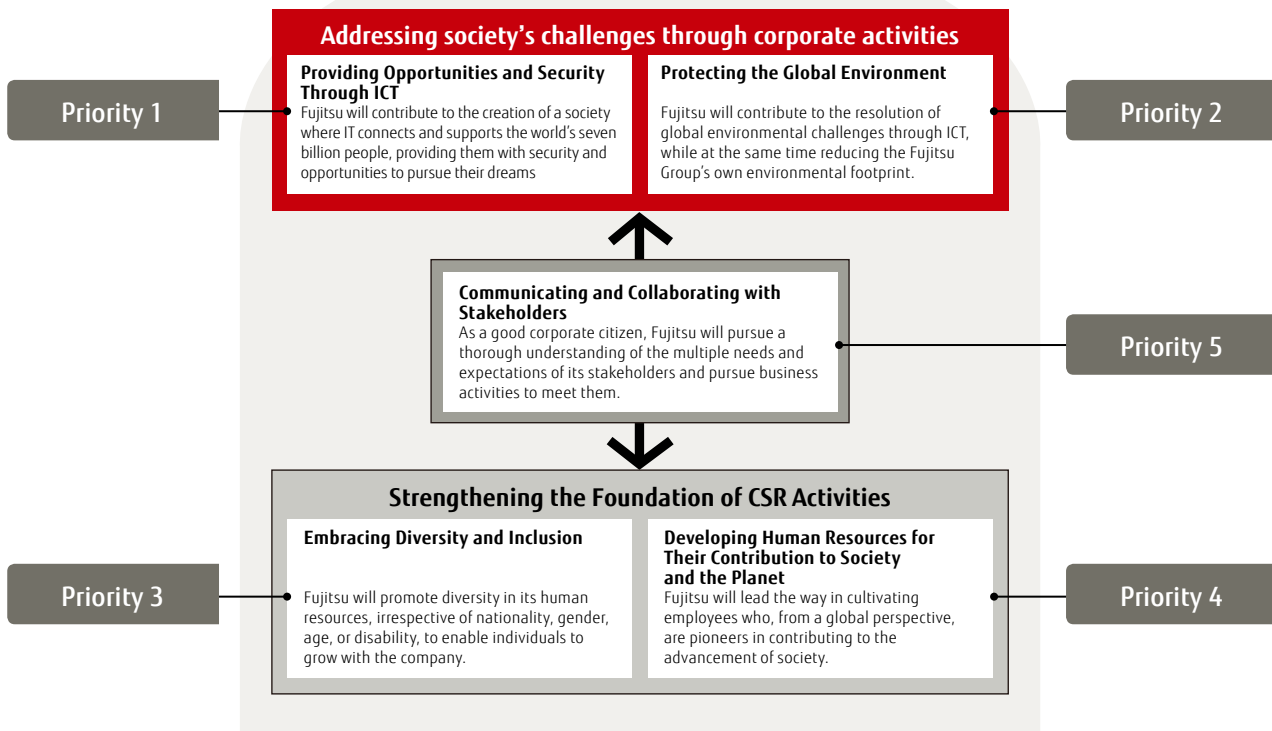
(Hiroaki Kurokawa, 12th president, message to employees on "The Interests of Shareholders," 2007)

# Fujitsu Group CSR

## Fujitsu Group CSR Policy

CSR at Fujitsu is practiced by implementing the Fujitsu Way. In all its business activities, by implementing the Fujitsu Way in light of the expectations and needs of multiple stakeholders, the Fujitsu Group contributes to the sustainable development of society and the planet. Fujitsu will focus on the following five priority issues in implementing its CSR practices. By pursuing these issues, Fujitsu will promote responsible management as a global ICT company.

### Contributing to the sustainable development of society and the planet



## CSR Activity Targets and Achievements

Fujitsu has defined medium-term targets for fiscal 2020. It also sets goals for individual fiscal years along the way, and publicizes its level of achievement. Refer to Fujitsu's "Sustainability Report 2012" on pages 43-44 for more details.

## CSR Activities Utilizing ISO 26000

Since fiscal 2011, Fujitsu has utilized the ISO 26000 social responsibility standard (issued November 2010) as a means of deepening its own CSR activities. A team drawn from across the Fujitsu Group compiled a checklist based on the seven core themes of the ISO 26000 standard, and set about confirming the status of implementation. The team's results found that Fujitsu Limited demonstrated a high level of practice overall. At the same time, the assessment revealed that a better understanding of CSR practices was needed at Fujitsu affiliates, including those overseas. Plans going forward call for conducting a survey of actual CSR practices at those affiliates.

Priority 1

Providing Opportunities and Security through ICT

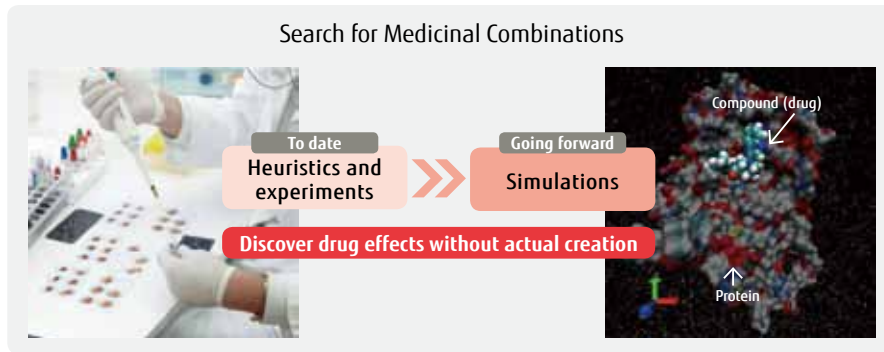
Key Examples from Fiscal 2011

Collaborative Research with Stockholm University

Using Supercomputers to Accelerate International IT-enabled Drug Discovery

Cancer is well on the way to becoming the leading cause of death globally, due in part to aging societies and modern life-styles. With cancer incidence expected to increase by 75% by 2030, the need is urgent to develop effective treatments. However, experimental drugs only have a 0.01% chance of making it to market. Raising development success rates is a pressing issue. In collaboration with the University of Tokyo's Research Center for Advanced Science and Technology and Sweden's Stockholm University, Fujitsu is working to leverage IT-enabled drug

discovery simulation technologies to reduce the conventional level of repetition for animal tests and clinical trials, helping to markedly shorten new drug development timelines and cut costs. Fujitsu will keep striving to contribute to the development and improvement of effective pharmaceuticals for an array of intractable diseases like cancer by performing high-precision simulations utilizing the lightning-fast computational speed of a supercomputer.



New drug development support via highly accurate simulation to predict binding activity

Fujitsu Group IT Platform to Handle Sharp Rise in Communications Traffic from Sophisticated Mobile Phone Services in Morocco

The Kingdom of Morocco is a constitutional monarchy located in northwest Africa, with a population of roughly 32 million people. With the country's mobile phone market continuing to grow



Moroccans using mobile phone services

rapidly, Méditel, the second-largest domestic mobile telecommunications provider, needed to quickly manage increasing communications traffic from the provision of increasingly sophisticated services to ever more users.

Fujitsu joined forces with partner company PTI (Portugal Telecom Inovação, SA) to offer an IT platform with high processing capacity, enabling Méditel to roll out new services for its 10 million users and handle feature expansion.

The Fujitsu Group's IT platforms will support globalization in Morocco and other emerging economies around the world.

Provision of a New Cloud Service to Support Water and Sewer Operations

Amid rising food demand and more severe water shortages due to climate change, roughly 13% of the world's population does not have access to safe drinking water, and nearly half of households lack running water.

Meanwhile, Japan's water and sewerage infrastructure is aging, with nationwide upgrades called for in 2015. This is problematic for many local governments that manage water and sewer operations due, in part, to a lack of financial resources and experienced engineers.

To address these issues, top-tier water treatment player Metawater Co., Ltd. teamed up with Fujitsu to build a water business cloud (WBC). This IT infrastructure enables remote monitoring of facilities spanning a wide geographic area.

The WBC makes it possible for local governments and other water and sewer business operators to use shared IT infrastructure. This framework is projected to reduce lifecycle costs, including system installation and running costs, by at least 30% compared with conventional water and sewerage wide-area surveillance.

Fujitsu will utilize cloud computing technologies to support sustainable water and sewerage operations into the future.



WBC remote support services

Priority 2

Protecting the Global Environment

The Fujitsu Group is cognizant of its mission as a global ICT corporation. We are dedicated to sustainable growth and progress with our customers and society as we seek more ways to reduce our impact on the environment.

Leveraging the Power of ICT to Contribute to Sustainable Growth

The world today faces a number of increasingly serious environmental problems, among them global warming and a loss of biodiversity. The depletion of natural resources, meanwhile, is another growing concern. The utilization of ICT, with its power to transform our society, will be essential to ensuring sustainable human development and realizing a prosperous society.

Together with an extensive drive to minimize its own environmental footprint, the Fujitsu Group is ramping up the provision of environmental products and solutions that will contribute substantially to reducing the environmental impact of its customers and society at large. By leveraging our technology and creativity, we will harness the power of ICT to help resolve global environmental issues, with the goal of achieving sustainable growth and progress for our customers and the world.

Reinforcing Environmental Management by Utilizing ICT: Environmental Management Dashboard Development and Utilization

As demands for protecting the environment continue to rise, companies are faced with the increasingly significant task of creating environmental management systems that can support both the growth of business activities and reduce the environmental impact of such activities.

The Fujitsu Group has developed an Environmental Management Dashboard to function as a support base for environmental management. Its centralized portal screen allows for collection and analysis of energy usage, CO<sub>2</sub> emissions, and other environmental data in real time. Individuals at all levels of the company, from senior executives to department managers, can use the dashboard to access the information they individually require in making decisions. This system was utilized as part of energy conservation measures in the wake of the disaster in Japan in fiscal 2011, where it delivered reductions in energy usage that surpassed those requested by the government. Accordingly, the Fujitsu Group will pursue further ICT utilization in an effort to reinforce environmental management going forward.



Environmental Management Dashboard

Curbing Greenhouse Substance Emissions

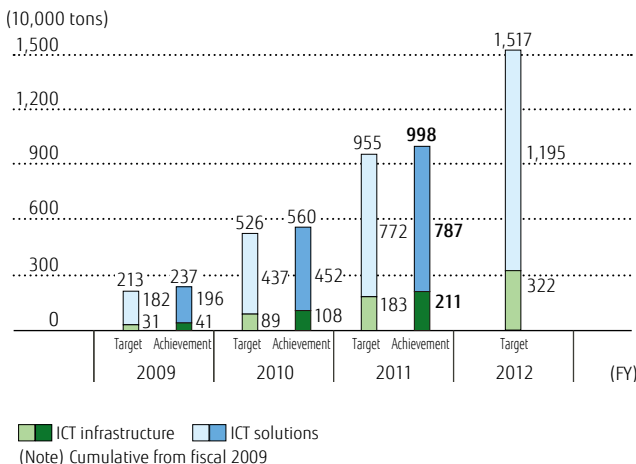
Green Policy Innovation—Achievements in Reducing CO<sub>2</sub> Emissions

The Fujitsu Group is promoting an environmental burden reduction project through Green IT known as Green Policy Innovation. Under the project, the Group has set a global target of cutting CO<sub>2</sub> emissions by more than 15 million tons over a four-year period from fiscal 2009 to 2012.

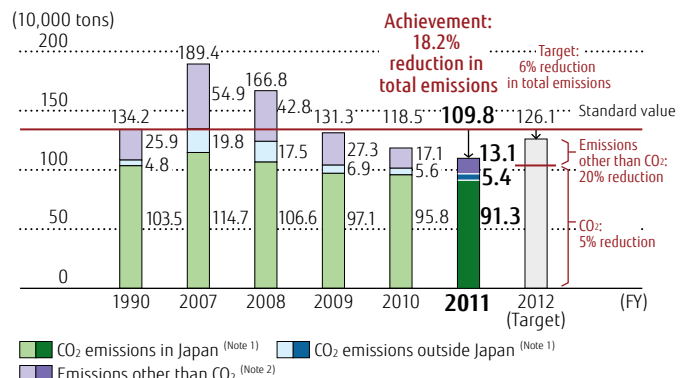
Reducing Greenhouse Gas Emissions

The Fujitsu Group is working to reduce emissions of greenhouse gases associated with Group business activities. Accordingly, we have set “reducing our total greenhouse gas emissions by 6% by the end of fiscal 2012 compared with fiscal 1990” as a goal of the Fujitsu Group Environmental Protection Program (Stage VI).

CO<sub>2</sub> Reduction Targets and Achievements under Green Policy Innovation



Change in Total Greenhouse Gas Emissions



(Note 1) CO<sub>2</sub> emissions in/outside Japan: Purchased electric power based on performance reports under the Fujitsu Group's Environmental Protection Program. CO<sub>2</sub> conversion coefficient calculations performed with a fixed value of 0.407 ton of CO<sub>2</sub> per MWh since fiscal 2002.  
 (Note 2) Greenhouse gases other than CO<sub>2</sub>: Converted to equivalent amounts of CO<sub>2</sub> using the global warming potential (GWP) of each gas. Our fiscal 1995 performance is taken to be the emissions in fiscal 1990.

## Principal Environmental Activities in Fiscal 2011

### Contribution to Advanced Environmental Monitoring at Industrial Estate in Thailand

Air pollution is responsible for 2 million deaths worldwide each year. This figure has raised concerns that air pollution will become the leading environmental factor in triggering early death in the future.

As a NEDO (see note) collaborative research project promoted at the request of the Government of Thailand, Fujitsu has launched initiatives that will culminate in the development of an environmental monitoring system; as well as support for research into predictive modeling of volatile organic compound (VOC) emission dispersion, and the training of necessary technical staff. The site of these efforts will be the Map Ta Phut industrial estate, home to Thailand's largest petrochemical complex.

Developed expressly to collect, monitor and analyze data on environmental pollutants, this system aims to prevent air pollution, as well as new or additional adverse health effects from it, even if the trend of industrial urbanization gains further momentum. Fujitsu is also supporting the creation of a basic research platform for predictive modeling of VOC emission dispersion by Thailand's Chulalongkorn University. Once complete, the models developed will form the basis of an early warning system for local residents should a serious air pollution incident occur.

Fujitsu will keep working with the government of Thailand, leveraging this project as a model case for a comprehensive environmental monitoring system that will assist Thailand in becoming a greener society.

(Note) NEDO: New Energy and Industrial Technology Development Organization (NEDO) of Japan



Map Ta Phut industrial estate in Thailand

### Promoting Conservation of Biodiversity through IT Utilization

Today, 25% of the world's mammals and 13% of all birds face extinction caused by overhunting, erosion of natural habitats, and ecosystem changes. Preserving biodiversity has thus become a major global issue.

The Fujitsu Group, in partnership with a broad range of internal and outside stakeholders, is involved in efforts to conserve biodiversity through ICT utilization. In Hokkaido, Japan, for example, the Group took part in a project in the village of Tsurui to protect Japanese cranes, in cooperation with the Wild Bird Society of Japan. Fujitsu's role was to conduct remote monitoring studies to examine the effectiveness of natural feeding grounds. Because of deep snow in the area, researchers could previously be sent to the feeding grounds only twice a month. With the installation of multi-sensing units by Fujitsu, it is now possible to capture images from the site every 10 minutes, with the data then transferred to a nature center. This innovation has enhanced survey accuracy, and also revealed that feeding sites are actually used by multiple flocks of cranes, rather than exclusively by one flock as had previously been thought.



Multi-sensing unit installed at natural feeding ground for Japanese cranes



Image taken by a multi-sensing unit

#### VOICE: Feedback from Conservation Partner



Wild Bird Society of Japan  
Sanctuary Office  
Tsurui-Ito Tancho  
Sanctuary  
Chief Ranger  
**Shigeo Arita**

Japanese cranes rely on food that humans supply during the winter. The Wild Bird Society of Japan is working to create a natural winter feeding ground so that these birds can feed themselves in winter. Now that the prepared feeding ground is continuously monitored, we can measure effectiveness and improve upon future efforts. By broadening these initiatives, we hope to make headway in preserving an environment that helps cranes to better survive the winter.

## Priority 3

## Embracing Diversity and Inclusion

Fujitsu is promoting diversity in its human resources so that its employees and organizations can grow together. By having employees mutually respect what each has to offer and capitalize on their own value, the goal is to generate new knowledge and technology through free and open debate from diverse viewpoints.

## Supporting More Active Participation by Female Employees

Beyond quantitative targets alone, Fujitsu enacts various measures to support female employees in assuming a more active role in corporate life.

## Female Leadership Development Program

To facilitate the long-term careers of its female employees, Fujitsu offers this program so that participants can experience a growth model that allows them to overcome personal limitations in a focused and conscious manner. This initiative is an effort to groom leaders and future managers among its female workforce.

Designed to boost awareness of career options and develop managerial skills, this program, which takes place over approximately one year, concludes with each of the teams utilizing its own perspective and what was learned through the program to offer suggestions to management.

## Numerical Targets for 2020

(Make the percentage of newly appointed female managers identical to that of female employees)

•Percentage of female employees --- 20%

•Percentage of newly appointed female managers ----- 20%



The Female Leadership Development Program

## VOICE: Feedback from Employees

Enterprise Server Business Division  
Product Planning Department

**Rumi Nagashima**

## Active participation by employees with lower-limb disabilities

During my job interview, I was never asked about disability. The questions I was asked instead were, "What sort of work do you want to do for Fujitsu?" and "What kind of support would you need to make that happen?" Those questions made a huge impression on me. More importantly, this stance as a company hasn't changed at all since I joined. As long as I can explain myself logically to my supervisors and senior colleagues, they have been willing to entrust more and more jobs to me. I go on business trips, and when I do overtime it's often unsupervised.

The department handles products that support social infrastructure. I have a strong sense of responsibility as a member of that team, and hope to always stay mindful in my job of my own growth and that of my team colleagues.

## VOICE: Feedback from Employees

Global HR Department, UK&I Sub-department Senior Director  
(Rewards)

**Allison Dalley**

## Employees who telecommute

I live on the south coast of the United Kingdom. I joined the company nearly 6 years ago.

My role is Global VP of Reward.

My working day consists of many calls and dialogues with my global HR Director (based in Japan), executives, colleagues and team members around the world, ranging across an 18-hour spread of time zones from Australia to the West Coast of the United States.

My conference calls and meetings start as early as 6.00 a.m. and finish late into the evening.

Given where I live, I have a 2.5-hour commute, the company has therefore allowed me to work remotely from the company offices by setting me up with a Fujitsu 'office at home'. I have a company landline phone and headset, broadband, laptop and ergonomically tested chair from which I work 2 to 3 days a week when I am not commuting to the main company offices for face-to-face meetings, Ciscos or travelling abroad on business.

This flexibility is common practice in many companies and reduces both office costs (I have no designated company office space allocated to me) and the travelling/commuting costs for the company. From a personal perspective, I am able to adjust my working day and week to accommodate the global (and therefore somewhat antisocial) nature of my role so that I manage all the relevant activities while still having quality time with my family and some work-life balance.

## Priority 4

## Developing Human Resources that Contribute to Society and the Environment

Fujitsu will contribute to social development through business activities by fostering global business leaders capable of executing business strategy and creating social value.

## Global Organization Leadership Development Program (GOLD)

Global Organization Leadership Development (GOLD) is a program that seeks to foster the next generation of leaders who will spearhead business at Fujitsu Group companies overseas. In addition to imparting strategic thinking and leadership skills, GOLD helps participants gain a better understanding of Fujitsu's history and business.

The select group of middle-level managers worldwide chosen for the program visit Fujitsu bases in Europe, Asia, North America and Japan to deepen their understanding of business and cultural characteristics unique to each region. These visits reinforce human networks that transcend regional boundaries and go beyond the limited framework of a training program. As such, GOLD has evolved into an opportunity to create new value.



Group photo of GOLD program participants

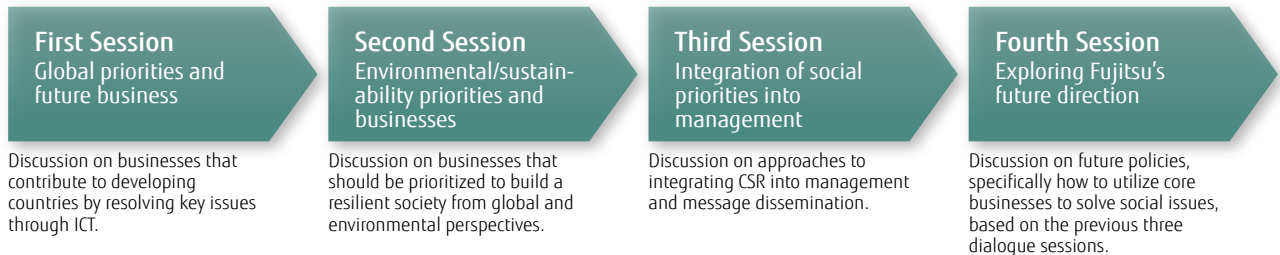
**Priority 5**

**Communicating and Collaborating with Stakeholders**

When considering the needs of customers, the Fujitsu Group always takes into consideration the broader implications in terms of the sustainability of society and the global environment. The Fujitsu Group is committed to listening closely to feedback from various stakeholders, including customers, shareholders and other investors, business partners, and local communities, and to answering their expectations. Through this process, we seek to continuously improve our corporate value.

**Dialogue Sessions with Guest Experts**

We have defined priority fields for realizing a prosperous society of the future in 2020, by gathering input from a range of experts invited to dialogue sessions.



**Three Powers of ICT (Priority Fields for a Prosperous Society of the Future in 2020)**

In the run-up to 2020, the Fujitsu Group will embrace the challenge of transforming society through the three powers of IT.

- 1. The Power to Shape the Future**  
Solve difficult global challenges and social issues through computing

  - Demonstrate world-class technology leadership to step as far as possible into the future
  - Expand the provision of solutions designed to address priorities (food, healthcare, education, etc.)
  - Achieve our environmental vision—a low-carbon, prosperous society
- 2. The Power to Provide Equal Opportunity to All People**  
Develop user-friendly terminals and interfaces, along with frameworks for promoting ICT implementation in developing countries

  - Develop terminals and devices targeting 4 billion Internet users
  - Execute businesses that provide opportunities on a global basis
  - Conduct field surveys in developing countries, and develop partnerships
- 3. The Power to Support Safe and Secure Living**  
Ensure stable operation of social ICT infrastructure and cyber security

  - Help to build a value-creation platform, eyeing an era when virtually everything is connected to the Internet
  - Achieve stable operation of world-class IT systems
  - Develop and strengthen cyber security solutions

**Socially Responsible Investment (SRI)**

Fujitsu has been incorporated into the SRI stock indexes and SRI funds listed below.

Name of Index	Rating Company
Dow Jones Sustainability Indexes (Asia Pacific)	Dow Jones Indexes (U.S.), SAM Group (Switzerland)
FTSE4Good Index Series	FTSE International, Ltd. (UK)
oekom research	oekom research AG (Germany)
Morningstar Socially Responsible Investment Index	Morningstar Japan K.K.

Name of Fund	Operating Company
Sumishin SRI Japan Open (Good Company Fund)	Sumishin Asset Management Co., Ltd. (As of April 2012)
Sompo Japan Green Open (Buna no Mori)	Sompo Japan Nipponkoa Asset Management Co., Ltd. (As of April 2012)
Mitsubishi UFJ SRI Fund (Family Friendly Fund)	Mitsubishi UFJ Asset Management Co., Ltd. (As of February 2012)
Nikko Eco Fund	Nikko Asset Management Co., Ltd. (As of May 2012)
Nihon Kabushiki SRI Fund	Sumitomo Mitsui Trust Asset Management Co., Ltd. (As of April 2012)

Responsibility

# Management

(As of June 30, 2012)



**Michiyoshi Mazuka**

*Chairman*

Birth: October 17, 1943  
 Apr. 1968 Joined Fujitsu FACOM CO., Ltd.  
 Apr. 1971 Joined Fujitsu Limited  
 Jun. 2001 Member of the Board  
 Jun. 2002 Corporate Vice President  
 Apr. 2003 Corporate Senior Vice President  
 Jun. 2005 Member of the Board  
 Corporate Executive Vice President  
 Jun. 2006 Corporate Senior Executive Vice President and Representative Director  
 Jun. 2008 Chairman and Representative Director  
 Sep. 2009 Chairman, President and Representative Director  
 Apr. 2010 Chairman and Representative Director  
 Jun. 2012 Chairman and Director\*



**Masami Yamamoto**

*President*

Birth: January 11, 1954  
 Apr. 1976 Joined Fujitsu Limited  
 Jun. 2004 Executive Vice President, Personal Systems Business Group  
 Jun. 2005 Corporate Vice President  
 Jun. 2007 Corporate Senior Vice President  
 Jan. 2010 Corporate Senior Executive Vice President  
 Apr. 2010 President  
 Jun. 2010 President and Representative Director\*



**Masami Fujita**

*Corporate Senior Executive Vice President*

Birth: September 22, 1956  
 Apr. 1980 Joined Fujitsu Limited  
 Dec. 2001 General Manager, Secretary's Office  
 Jun. 2006 Corporate Vice President  
 Jun. 2009 Corporate Senior Vice President  
 Apr. 2010 Corporate Senior Executive Vice President  
 Jun. 2010 Corporate Senior Executive Vice President and Director  
 Jun. 2012 Corporate Senior Executive Vice President and Representative Director\*



**Hideyuki Saso**

*Corporate Senior Executive Vice President*

Birth: December 18, 1952  
 Apr. 1976 Joined Fujitsu Limited  
 Apr. 2006 Senior Vice President, Mobile Phones Unit  
 Jun. 2007 Corporate Vice President  
 Jun. 2009 Corporate Senior Vice President  
 Apr. 2010 Corporate Senior Executive Vice President  
 Jun. 2012 Corporate Senior Executive Vice President and Representative Director\*



**Hiroshi Oura**

*Director*  
 Honorary Advisor, Advantest Corporation

Birth: February 14, 1934  
 Apr. 1956 Joined Fujitsu Limited  
 Jul. 1978 General Manager, Corporate Planning Division  
 Jun. 1985 Member of the Board  
 Jun. 1988 Corporate Senior Vice President (until Jun.1989)  
 Jun. 2003 Director\*  
 Jun. 1989 Representative Director, President, Advantest Corporation  
 Jun. 2001 Representative Director, Chairman of the Board  
 Jun. 2005 Director and Senior Executive Advisor  
 Jun. 2007 Senior Executive Advisor  
 Jun. 2010 Honorary Advisor\*



**Haruo Ito**

*Director*  
 Senior Advisor, Fuji Electric Co., Ltd.

Birth: November 9, 1943  
 Apr. 1968 Joined Fuji Electric Co., Ltd.\*<sup>1</sup>  
 Jun. 1998 Director, Fuji Electric Co., Ltd.\*<sup>1</sup>  
 Oct. 2003 President and Representative Director, Fuji Electric Systems Co., Ltd.\*<sup>1</sup>  
 Jun. 2006 President and Representative Director, Fuji Electric Holdings Co., Ltd.\*<sup>1</sup>  
 Apr. 2010 Director and Senior Advisor  
 Jun. 2010 Senior Advisor\*  
 Jun. 2007 Director, Fujitsu Limited\*



**Yoko Ishikura**

*Director*  
 Professor, Keio University

Birth: March 19, 1949  
 Jul. 1985 Manager of Tokyo office, McKinsey & Company, Inc.  
 Apr. 1992 Professor, School of International Politics, Economics and Business, Aoyama Gakuin University  
 Apr. 2000 Professor, Graduate School of International Corporate Strategy, Hitotsubashi University  
 Apr. 2004 Outside Director, Japan Post  
 Oct. 2005 Vice President, Science Council of Japan  
 Jun. 2010 Director, Fujitsu Limited\*  
 Apr. 2011 Professor, Graduate School of Media Design, Keio University\*

\* to present

\*<sup>1</sup> currently Fuji Electric Co., Ltd.



### Kenji Ikegai

Corporate Senior Executive  
Vice President

Birth: January 1, 1952  
Apr. 1976 Joined Fujitsu Limited  
Jun. 2004 President, Local Government Solutions Unit  
Jun. 2006 Corporate Vice President  
Apr. 2010 Corporate Senior Executive Vice President  
Jun. 2012 Corporate Senior Executive Vice President and Representative Director\*



### Kazuhiko Kato

Corporate Executive Vice President

Birth: November 13, 1951  
Apr. 1976 Joined Fujitsu Limited  
Jun. 1996 General Manager, Controller and Accounting Division  
Jun. 2001 Member of the Board  
Jun. 2002 Corporate Vice President  
Jun. 2006 Corporate Senior Vice President  
Jun. 2008 Corporate First Senior Vice President, CFO\*. \*2  
Apr. 2010 Corporate Executive Vice President  
Jun. 2010 Corporate Executive Vice President and Director\*



### Masahiro Koezuka

Corporate Executive Vice President

Birth: December 14, 1951  
Apr. 1974 Joined the Ministry of International Trade and Industry (currently the Ministry of Economy, Trade and Industry)  
Jul. 2003 Cabinet Councillor  
Sep. 2005 Director-General, Industrial Science and Technology Policy and Environment Bureau  
Jul. 2006 Director-General, Commerce and Information Policy Bureau  
Jul. 2007 Commissioner, Japan Patent Office  
Aug. 2009 Advisor, Fujitsu Limited  
Apr. 2010 Corporate Executive Vice President, CSO\*. \*3  
Jun. 2010 Corporate Executive Vice President and Director\*



### Takashi Okimoto

Director  
President, Chuo Real Estate Co., Ltd.

Birth: November 14, 1950  
Apr. 1973 Joined the Dai-Ichi Kangyo Bank, Ltd.\*4  
Jun. 2001 Corporate Officer, the Dai-Ichi Kangyo Bank, Ltd.\*4  
Apr. 2002 Corporate Officer, Mizuho Corporate Bank, Ltd.  
Oct. 2002 Managing Corporate Officer, Mizuho Corporate Bank, Ltd.  
Apr. 2005 Deputy President, (Representative Director) Mizuho Corporate Bank, Ltd.  
Jun. 2007 Representative Director, Chairman and Corporate Officer, Orient Corporation  
Jun. 2011 Director, Fujitsu Limited\*  
Jun. 2011 Chairman, Seiwa Sogo Tatemono Co., Ltd.  
Jun. 2012 President and Representative Director, Chuo Real Estate Co., Ltd.



### Shotaro Yachi

Director  
Professor, Institute of Japan-US Studies, Organization for Japan-US Studies, Waseda University

Birth: January 6, 1944  
Apr. 1969 Joined Ministry of Foreign Affairs  
Jul. 1996 Consul General in Los Angeles  
Aug. 1999 Director-General, Treaties Bureau  
Jan. 2001 Director-General, Foreign Policy Bureau  
Oct. 2002 Assistant Chief Cabinet Secretary  
Jan. 2005 Vice-Minister for Foreign Affairs  
Jan. 2008 Retirement from Ministry of Foreign Affairs  
Apr. 2008 Professor, Institute of Japan-US Studies, Organization for Japan-US Studies, Waseda University\*  
Jun. 2012 Director, Fujitsu Limited\*

\*2 CFO: Chief Financial Officer

\*3 CSO: Chief Strategy Officer

\*4 currently Mizuho Corporate Bank, Ltd. and Mizuho Bank, Ltd.

## AUDITORS

Statutory Auditors  
**Masamichi Ogura**  
**Akihiko Murakami**  
**Yoshikazu Amano**

### Auditors

**Megumi Yamamuro**  
Professor, Nihon University Law School  
**Hiroshi Mitani**  
Special Counsel, TMI Associates

## CORPORATE EXECUTIVE OFFICERS

### President

**Masami Yamamoto**

Corporate Senior Executive  
Vice Presidents

**Masami Fujita**  
**Hideyuki Saso**  
**Kenji Ikegai**

Corporate Executive  
Vice Presidents

**Kazuhiko Kato**  
**Masahiro Koezuka**

Corporate Senior  
Vice Presidents

**Hirokazu Uejima**  
**Tsuneo Kawatsuma**  
**Masaaki Hamaba**  
**Akira Yamanaka**  
**Bunmei Shimojima**  
**Takashi Mori**  
**Norihiko Taniguchi**  
**Chikafumi Urakawa**  
**Noriyuki Toyoki**  
**Nobuo Otani**  
**Rod Vawdrey**  
**Yoshikazu Kudoh**  
**Kazuhiro Igarashi**  
**Yoshihiko Hanada**

Corporate Vice Presidents

**Takashi Yagi**  
**Takanori Katayama**  
**Hirofumi Gouda**  
**Yutaka Abe**  
**Tamotsu Inoue**  
**Shinichi Koizumi**  
**Mitsutoshi Hirono**  
**Akira Kabemoto**  
**Kuniaki Saito**  
**Mitsuya Yasui**  
**Hiroyasu Takeda**  
**Hidehiro Tsukano**  
**Sanya Uehara**  
**Hiroyuki Ono**  
**Takashi Yamada**  
**Takato Noda**  
**Hiromu Kawakami**  
**Kiyoshi Handa**  
**Kazuhiko Ogawa**  
**Yoshiki Kondou**  
**Motoyuki Ozawa**  
**Tango Matsumoto**  
**Tatsuya Tanaka**  
**Atsuo Yatagai**  
**Kazuo Imada**  
**Toshiharu Kitaoka**  
**Hiroaki Kondo**  
**Shingo Kagawa**  
**Hidenori Furuta**  
**Katsumi Takada**

## Statutory Auditor Interview

Fujitsu recognizes that stronger corporate governance is vital to achieving greater growth and enhancing its corporate value as a global ICT company. In this interview, we spoke with statutory auditor Masamichi Ogura about the current state of Fujitsu's corporate governance structure and the specific role of auditors within that framework.

When auditing, I strive to maintain a fair and unbiased approach to my work at all times, so that I can better respond to the roles and expectations of all stakeholders.

**Masamichi Ogura**  
Statutory Auditor

### PROFILE

(Birth: June 30, 1946)  
Apr. 1969 Joined Fujitsu  
Apr. 2000 Executive Vice President, Electronic Devices Business Unit  
June 2000 Director  
June 2002 Managing Corporate Officer  
Apr. 2003 Corporate Executive Vice President  
June 2003 Member of the Board  
Corporate Executive Vice President/CFO  
June 2006 Corporate Senior Executive Vice President and Representative Director/CFO  
June 2008 Statutory Auditor

### Q1: What do you consider an auditor's role and mission to be?

Auditors are independent entities charged with safeguarding shareholder interests. In this capacity, they audit the actions of directors, corporate executive officers, managing directors, and other senior management to promote sound, sustainable growth. In short, auditors have the responsibility of ensuring corporate governance that merits society's trust. The audits that we auditors perform are of two types—accounting audits and business execution audits. Accounting audits are audits of financial and supplementary documentation.

Fujitsu is a company that employs accounting auditors, so they are responsible for the initial accounting audit, with the Fujitsu auditors judging the validity of the auditing methods used and the results. As for business execution audits, here we audit whether the directors are fulfilling their duties in compliance with legal regulations and Fujitsu's own articles of incorporation. The auditors also check that there are no violations of duty of care by the directors as good managers.

Simply put, these actions mean that the auditors' role is to

stand in place of shareholders to check whether management is doing its job properly. Our job is not to stand on the outside and point fingers, but to view the Company from a different standpoint than management. If problems do arise, one of our most important duties is to advise management on ways to take the Company in a more positive direction.

Auditors also have another vital role, which is to check on the status of development and operation of Fujitsu's internal control system. The internal control system is a basic structure that, among other things, enables a company to autonomously comply with legal regulations and to conduct risk management. The board directors are responsible for the development and operation of this system. In the case of Fujitsu, the auditors receive regular reports on the system's operational status from the Fujitsu Way Unit, the department overseeing Fujitsu's internal control system. We also coordinate with the Internal Auditing Division and the accounting auditors to check whether the internal control system is functioning properly through the use of PDCA cycles.

## Q2: What approach do you personally strive to bring to your work as an auditor?

Auditors have a weighty responsibility. For this reason, we have to always approach our work with a healthy sense of skepticism, and be resigned to the fact that we will occasionally have to face off against management. There are three things in particular that I personally strive for. First, I pay close attention to the character of those involved in management, and not only managers at the parent company. On any given day, I am in close contact with managers at domestic and overseas Group companies, as well as various department managers working at our business sites. Through repeated conversations with them, I eventually get a multifaceted understanding of them as a person, including their personal stance and capacity.

The second thing I strive for is to stay abreast of changes. The environment both in and outside of a company is in a constant state of flux. Since critical management issues are rarely resolved overnight, I do my best to gauge a company's ability to respond to such issues by examining its past, present and probable future approach, its speed in addressing such issues, and the real and predicted outcomes.

Third, I act from a group management perspective. The Fujitsu Group is home to roughly 540 consolidated subsidiaries. I visit worksites to get direct input from those on the ground about where Group resources overlap and where room for mutual flexibility exists. From there, I try to envisage the potential for making operations more efficient.

When I became an auditor after having been directly involved in management as a vice president, I found that I had to examine the basic starting points that underlie management from square one. Furthermore, the connections and networks cultivated over my decades at Fujitsu have become useful aids in fulfilling my current role as an auditor.

## Q3: What is your personal assessment of Fujitsu's governance structure?

For a global ICT company like Fujitsu, the pressure is on to strengthen management transparency, management oversight, and other aspects of corporate governance. From an early stage, Fujitsu sought to answer these calls by recruiting highly independent outside officers.

The outside directors and outside auditors have an objective perspective grounded in their own specialist knowledge, which they bring to the task of monitoring the board's decision-making process. Consequently, when it comes to how the Board of Directors is managed, the atmosphere is one in which the directors, on the business execution side, are responsible for explaining their actions to the outside officers and the auditors. Last fiscal year, Mr. Yoshikazu Amano, a former statutory auditor for Toyota Motor Corporation, joined our ranks as a statutory auditor for Fujitsu. My sense is that

Fujitsu will continue to benefit from an awareness of new management issues thanks to the observations he offers from his own experience in managing and auditing a global corporation.

By combining the efforts of outside officers and auditors in this way, we are working hard to make corporate governance even stronger.

## Q4: To wrap up, what issues lie ahead for Fujitsu, and what are your expectations for the Company?

Based on what I see as an auditor, there are two key issues. The first is new risks that will materialize from changes in the business environment. More to the point, as global development of the cloud business and ICT services quickens, this will likely spark changes not only in the surrounding business environment but in Fujitsu's own business. As an auditor, I need to monitor the situation closely to be sure that Fujitsu is coping well with the associated risks.

The other issue is responding to corporate misconduct. This is an area where the original role of the auditor comes into play. Fujitsu has no problems in this respect at the moment. But several well-known companies have been rocked by major scandals in recent years. This situation has deeply impressed upon me that auditors bear a great deal of responsibility for upholding good corporate governance. No matter the circumstances, auditors need to be fair and unbiased, and to stand firm in performing their duties.

As for my expectations going forward, let me say that if Fujitsu is determined to develop as a global ICT company, then it has to be capable of offering services well into the future and earn its customers' trust. For these reasons, in addition to a sound financial base, Fujitsu must be brimming with a desire to achieve this vision; and this desire must be shared by employees and management alike. It is also crucial that Fujitsu be a transparent company where corporate governance functions as it should. My sincere hope is that Fujitsu continues to clear these benchmarks and finds further growth as a company of excellence.



# Corporate Governance

The following Fujitsu-prepared translation of the revised Fujitsu Limited Corporate Governance Report is provided for reference only. The original Japanese-language report was filed with the Tokyo Stock Exchange on June 25, 2012 under TSE securities code 6702.

## I. Basic Stance on Corporate Governance and Other Basic Information

### 1. Basic Stance

The Fujitsu Group's corporate philosophy is articulated as the "Fujitsu Way," comprised of our Corporate Vision, Corporate Values, Principles, and Code of Conduct. By sharing and practicing the Fujitsu Way, we aim to continuously enhance the value of the enterprise through the continuous growth and development of the Fujitsu Group.

In order to continuously raise the Fujitsu Group's corporate value, along with pursuing management efficiency it is also necessary to control the risks that arise from business activities. Recognizing that strengthening corporate governance is essential to achieving this, the Board of Directors has articulated the Basic Stance on Internal Control Framework, and these measures are continuously implemented.

Furthermore, by separating management oversight and operational execution functions, we aim to accelerate the decision-making process and clarify management responsibilities. Along with creating constructive tension between oversight and execution functions, we are further enhancing the transparency and effectiveness of management by proactively appointing outside directors.

With respect to group companies, we are pursuing total optimization for the Fujitsu Group by clarifying each group company's role and position in the process of generating value for the group as a whole and managing the group to continuously enhance its corporate value.

### 2. Policy on Measures for Protecting Minority Shareholders When Carrying out Transactions with Controlling-Interest Shareholders

### 3. Other Particular Factors that May Have an Important Impact on Corporate Governance

Among our consolidated subsidiaries and equity method affiliates, the following companies are publicly listed on Japanese stock exchanges:

<Consolidated Subsidiaries>

Fujitsu Frontech Limited, Fujitsu Broad Solution & Consulting Inc., NIFTY Corporation, Shinko Electric Industries Co., Ltd., FDK Corporation, Fujitsu Component Limited.

<Equity Method Affiliates>

Fujitsu General Limited

While we respect the autonomy of our publicly listed subsidiaries, we require them to receive our prior authorization when they use "Fujitsu" as a trade name or trademark. In addition, while they are responsible for decisions regarding nominations and compensation for members of the board, we are notified in advance regarding member of the board candidates and levels of compensation. Regarding the setting of budget plans and revisions as well as financial performance, because their results impact our consolidated earnings, to the extent that it is reasonable, we are kept informed.

## II. Status of Management Control Organization for Management Decision-Making, Operational Execution and Oversight, and Other Corporate Governance Structural Features

### 1. Matters Regarding Institutional Structure and Organizational Operation

Type of Organization	Corporation with Auditors
<b>[Board of Directors]</b>	
Number of Directors Under the Articles of Incorporation	15
Term of Directors Under the Articles of Incorporation	1 year
Board Chair	Chairman (except when concurrently acting as President)
Number of Directors	12
Appointment of Outside Directors	Yes
Number of Outside Directors	4
Number of Outside Directors Designated as Independent Directors	4

**Relationship with Company (1)**

Name	Type of Affiliation	Relationship with Company *1								
		a	b	c	d	e	f	g	h	i
Haruo Ito	From other company			○	○				○	○
Yoko Ishikura	Scholar				○				○	
Takashi Okimoto	From other company				○				○	
Shotaro Yachi	Other				○				○	

\*1 Categories Describing Relationship with Company

a: From parent company

b: From other affiliated company

c: Principal shareholder of subject company

d: Concurrently serves as outside director or outside auditor of other company

e: Director or executive officer of other company

f: Close relative by blood or marriage to director or executive officer of the subject company or other designated interested party

g: Receives compensation or other material benefit as senior executive of parent company or subsidiary of the subject company

h: Has limited liability contract with subject company

i: Other

**Relationship with Company (2)**

Name	Independent Officer	Supplemental Explanation of Relationship	Reason Appointed as Outside Director (Including reason for designation as independent officer where applicable)
Haruo Ito		Fujitsu holds 9.96% of the shares of Fuji Electric Co., Ltd., and a former representative director of Fujitsu serves as a Director of Fuji Electric. Both the former representative director and Mr. Ito were expressly recruited for their respective appointments based on the management credentials each possesses, and there is no risk that Mr. Ito's independence would be compromised in any way. Similarly, Fujitsu and the Fuji Electric Group have business dealings. However, taking into account the scale of Fujitsu's sales, this is not considered material. Consequently, there is no risk that this business relationship would compromise Mr. Ito's independence.	Mr. Ito is a former Representative Director of Fuji Electric Co., Ltd., a major shareholder of Fujitsu. The Fuji Electric Group, including its retirement benefit trusts, as a whole holds an 11.20% equity stake in Fujitsu. Because, however, Mr. Ito has resigned his positions as Representative Director and Director of Fuji Electric Co., Ltd., Fujitsu has determined that there is no risk of a conflict of interest, and has reported to securities exchanges on which Fujitsu is listed in Japan notifying them that he is an independent director.
Yoko Ishikura	○	Professor, Graduate School of Media Design, Keio University	Ms. Ishikura has expertise for innovation and business strategies in global competition. Moreover, Ms. Ishikura has never been an executive of a major shareholder or major business partner of Fujitsu, or held another position that would compromise her independence. Fujitsu therefore has identified her as an independent director in reports to stock exchanges in Japan.
Takashi Okimoto	○	Mr. Okimoto is a former Representative Director of Mizuho Corporate Bank, Ltd., which is a major (fourth-largest) lender to the Fujitsu Group. Because, however, the current balance of funds Fujitsu has borrowed from Mizuho Corporate Bank is insignificant, there is no risk that Mr. Okimoto's independence would be compromised. Mr. Okimoto is also a former Representative Director of Orient Corporation, a company with which Fujitsu has business dealings. However, taking into account the scale of Fujitsu's sales, this is not considered material. Consequently, there is no risk that this business relationship would compromise Mr. Okimoto's independence.	Mr. Okimoto has many years of experience in corporate management. In addition to the information detailed in the "Supplemental Explanation of Relationship," more than four years have passed between the time Mr. Okimoto resigned as Representative Director of the bank and assumption of his position as Director of Fujitsu. Fujitsu has thus determined that there is no risk of a conflict of interest in representing the interests of regular shareholders, and has reported to securities exchanges on which the Company is listed in Japan notifying them that he is an independent director.

Shotaro Yachi	○	-	The Company proposes that Mr. Yachi be appointed as an Outside Director in light of his deep political and economic insights from a global perspective based on his many years of involvement in foreign policy at the Ministry of Foreign Affairs of Japan. Furthermore, Mr. Yachi is not a major shareholder nor has he held an executive management position with a major trading partner of the Company, and therefore the Company believes he is independent. Fujitsu therefore has identified him as an independent director in reports to stock exchanges on which the Company is listed in Japan.
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### [Board of Auditors]

Existence of Board of Auditors	Yes
Number of Auditors Under the Articles of Incorporation	5
Number of Auditors	5

### Coordination between Auditors, Accounting Auditors, and Internal Auditing Division

The accounting auditor, Ernst & Young ShinNihon LLC, reports to the Board of Auditors concerning the audit plan and results. The accounting auditor also conducts exchange of opinions when needed and carries out coordinated audits of business operations.

The Corporate Internal Audit Unit (with 64 members) serves as an internal audit group. This unit audits the internal affairs of the entire Fujitsu Group in cooperation with the internal audit groups of each Group company. The Corporate Internal Audit Unit reports once a month as a rule to the statutory auditors on the audit plans and results of internal audits, including matters relating to group companies, and makes regular reports (once every quarter as a rule) to the Board of Auditors and the accounting auditors.

Appointment of Outside Auditors to the Board of Auditors	Yes
Number of Outside Auditors	3
Number of Outside Auditors Designated as Independent Officers	3

### Relationship with Company (1)

Name	Type of Affiliation	Relationship with Company *1								
		a	b	c	d	e	f	g	h	i
Megumi Yamamuro	Attorney				○					○
Hiroshi Mitani	Attorney				○					○
Yoshikazu Amano	From other company									○

\*1 Categories Describing Relationship with Company

a: From parent company

b: From other affiliated company

c: Principal shareholder of subject company

d: Concurrently serves as outside director or outside auditor of other company

e: Director or executive officer of other company

f: Close relative by blood or marriage to director or executive officer of the subject company or other designated interested party

g: Receives compensation or other material benefit as senior executive of parent company or subsidiary of the subject company

h: Has limited liability contract with subject company

i: Other

### Relationship with Company (2)

Name	Independent Officer	Supplemental Explanation of Relationship	Reason Appointed as Outside Auditor (Including reason for designation as an independent officer where applicable)
Megumi Yamamuro	○	Professor, Nihon University Law School	Mr. Yamamuro has extensive experience in the legal field and extensive knowledge of legal matters, including Japan's Company Law. Mr. Yamamuro has never been an executive of a major shareholder or major business partner of Fujitsu, or held another such position that would compromise his independence. Since he is independent, the company has identified Mr. Yamamuro as an independent auditor in reports to stock exchanges in Japan.

Hiroshi Mitani	○	Special Counsel, TMI Associates	Mr. Mitani has a deep understanding of not only legal affairs, but also of economic, social, and other factors that affect the management of a company due to his service as a public prosecutor and as a member of the Fair Trade Commission. Mr. Mitani has never been an executive of a major shareholder or major business partner of Fujitsu, or held another such position that would compromise his independence. Since he is independent, the company has identified Mr. Mitani as an independent auditor in reports to stock exchanges in Japan.
Yoshikazu Amano	○	Mr. Amano is a former Senior Managing Officer of Toyota Motor Corporation, a company with which Fujitsu has business dealings. However, taking into account the scale of Fujitsu's sales, this is not considered material. Consequently, there is no risk that this business relationship would compromise Mr. Amano's independence.	Mr. Amano has experience in corporate management at a global corporation. In addition to the information detailed in the "Supplemental Explanation of Relationship," Mr. Amano has never been an executive of a major shareholder or major business partner of Fujitsu, or held another position that would compromise his independence. Fujitsu therefore has identified him as an independent director in reports to stock exchanges on which the Company is listed in Japan.

### [Independent Officers]

Number of Independent Officers	7
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### Other Issues Relating to Independent Officers

All outside officers qualified to serve as independent officers are identified as such.

### [Incentives]

Implementation Status of Incentive Policies for Directors	Introduced bonus system linked to the performance of the company
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### Supplemental Explanation

To achieve clear management accountability, with respect to compensation paid to directors, we utilize basic compensation, specifically a fixed monthly salary in accordance with position and responsibilities; stock-based compensation, which is a long-term incentive that emphasizes a connection to shareholder value; and bonuses, which are compensation linked to short-term business performance. At the 107th Annual Shareholders' Meeting held on June 22, 2007, a resolution terminating the retirement allowance system for directors was passed.

Stock Option Eligibility	-
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### [Compensation of Directors]

Disclosure of Individual Director's Compensation	Partial disclosure only
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### Supplemental Explanation

Total consolidated compensation is disclosed for individual directors and auditors only if they were paid 100 million yen or more.

Total compensation and total compensation by type for directors and auditors who were paid 100 million yen or more during fiscal 2011 is as follows.

- Michiyoshi Mazuka, Representative Director and Chairman
 

From Fujitsu:	113 million yen (Basic compensation of 84 million yen, stock-based compensation of 8 million yen and bonuses of 20 million yen)
From consolidated companies:	-
Total:	113 million yen (Basic compensation of 84 million yen, stock-based compensation of 8 million yen and bonuses of 20 million yen)
- Masami Yamamoto, President
 

From Fujitsu:	113 million yen (Basic compensation of 84 million yen, stock-based compensation of 8 million yen and bonuses of 20 million yen)
From consolidated companies:	-
Total:	113 million yen (Basic compensation of 84 million yen, stock-based compensation of 8 million yen and bonuses of 20 million yen)

\* The above bonus amount was a directors' bonus paid by resolution of the 112th Annual Shareholders' Meeting held on June 25, 2012.

Note: Michiyoshi Mazuka (Representative Director and Chairman) became Chairman of the Board of Directors at the close of the 112th Annual Shareholders' Meeting held on June 25, 2012.

For fiscal 2011, total compensation to directors and auditors was as follows:

- Directors 11 people, 522 million yen (Basic compensation of 409 million yen, stock-based compensation of 34 million yen and bonuses of 78 million yen)  
Of which, compensation paid to outside directors: 4 people, 43 million yen (Basic compensation of 43 million yen)
- Auditors 6 people, 131 million yen (Basic compensation of 131 million yen)  
Of which, compensation paid to outside auditors: 4 people, 55 million yen (Basic compensation of 55 million yen)

\*1 The above includes directors and auditors who resigned or retired in fiscal 2011.

\*2 The limit on remuneration to directors (including outside directors) was resolved to be 600 million yen per year at the 106th Annual Shareholders' Meeting held June 23, 2006. The limit on remuneration to auditors (including outside auditors) was resolved to be 150 million yen per year at the 111th Annual Shareholders' Meeting held June 23, 2011. The Company is paying the compensation shown in the above table.

\*3 The above bonus amounts were decided at the 112th Annual Shareholders' Meeting held on June 25, 2012.

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Policy on Calculation and Determination of Compensation Amounts Yes

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### Disclosed Policy on Calculation and Determination of Compensation Amounts

#### Executive Compensation Policy

To secure exceptional human resources required to manage the Fujitsu Group as a global ICT company, and to further strengthen the link between its financial performance and shareholder value, while at the same time improving its transparency, Fujitsu establishes its Executive Compensation Policy as follows.

Executive compensation is comprised of the following: "Basic Compensation," specifically a fixed monthly salary in accordance with position and responsibilities; "Stock-based Compensation," which is a long-term incentive that emphasizes a connection to shareholder value; and "Bonuses" that are compensation linked to short-term business performance.

#### Basic Compensation

- Basic compensation is paid to all directors and auditors, in accordance with position and responsibilities, as compensation for work responsibilities with regard to management oversight and the carrying out of executive responsibilities.

#### Stock-based Compensation

- Stock-based compensation, intended for directors responsible for carrying out executive duties, is a long-term performance incentive, with the amount to be paid determined based on a qualitative evaluation of medium- to long-term initiatives.
- Stock-based compensation is to be paid for the purchase of the company's own shares. These purchases are to be made through the Director Stock Ownership Plan. Shares purchased for this purpose are to be held by each director for the term of his or her service.

#### Bonuses

- Bonuses are short-term performance incentives to be paid to directors who carry out executive responsibilities. The amount of a bonus is to reflect business performance in the respective fiscal year.
- As a specific method to calculate a bonus, Fujitsu will adopt a "Profit Sharing model" which uses consolidated operating income and consolidated net income as an index. However, bonuses will not be paid in the event of negative net income recorded under non-consolidated accounting.

In accordance with a resolution of the Annual Shareholders' Meeting, the total amount of basic compensation, stock-based compensation and bonuses shall not exceed 600 million yen per year for directors and 150 million yen per year for auditors.

### [Support Structure for Outside Directors and Outside Auditors]

Certain staff members of the Secretary Office are responsible for providing support to outside directors and outside auditors. In addition, the Legal Unit (Secretariat of Board of Directors) and the Auditor's Office (Secretariat of Board of Auditors) are also responsible for providing support to outside directors and outside auditors. This responsibility involves complying with requests from outside directors or outside auditors to provide and explain information about Fujitsu or the entire Fujitsu Group that is required for management oversight or audits. Depending on the information, relevant business unit managers are made available to provide additional explanations. We also provide a dedicated webpage for all board members (directors and auditors) to use to access and discuss material relevant to Board of Directors' meetings, such as agenda items, before meetings are held in order to allow board members to gain a proper understanding of the material.

The above measures are intended to provide indirect support to help outside directors and outside auditors provide effective management oversight and auditing of the execution of duties throughout the entire Fujitsu Group by facilitating mutual communication during internal audits, statutory audits, and accounting audits.

## 2. Issues Relating to Functions for Business Execution, Auditing, Oversight, Nominating, and Compensation Decisions Overview of Current Structure (Overview of Current Corporate Governance Structure)

The Company has a Board of Directors to serve as a body for overseeing management. The Board of Directors is responsible for management oversight, supervising the business execution functions of the President and Representative Director and the Management Council, an executive organ under its authority. Moreover, outside members of the board are actively recruited for positions in the Board of Directors in order to strengthen its oversight function. The Management Council deliberates upon fundamental policies and strategy regarding business

management, as well as makes decisions on important matters regarding business execution. Issues discussed by the Management Council and a summary of its discussions are reported to the Board of Directors, which makes decisions on items of particular importance. In principle, the Management Council meets three times a month, but meetings may be convened whenever necessary.

The company has a Board of Auditors that performs the auditing function. The auditing function is carried out by auditors, who review the Board of Directors as well as business execution functions and attend important meetings, including meetings of the Board of Directors as well as the Management Council. The Auditing Support Division provides support for the audits by the auditors, and in order to promote the independence and effectiveness of the auditing, the company holds discussions with auditors prior to selecting candidates for positions in the division. Personnel with the appropriate qualifications are selected as division staff candidates, and as a general rule, as full-time staff.

The Board of Directors has 12 members, comprising eight internal directors and four outside directors, and the Board of Auditors has five members, comprising two internal auditors and three outside auditors. In order to better define the management responsibility of the directors, their terms were reduced from two years to one year in accordance with a resolution at the June 23, 2006 Annual Shareholders' Meeting.

In addition, the Corporate Internal Audit Unit (with 64 members) serves as an internal audit group. This unit audits the internal affairs of the entire Fujitsu Group in cooperation with the internal audit groups of each Group company. The Corporate Internal Audit Unit reports once a month as a rule to the statutory auditors on the audit plans and results of internal audits, including matters relating to group companies, and makes regular reports (once every quarter as a rule) to the Board of Auditors and the accounting auditors. The Corporate Internal Audit Unit includes a significant number of employees with specialist internal auditing knowledge, including Certified Internal Auditors (CIA), Certified Information Systems Auditors (CISA), and Certified Fraud Examiners (CFE).

The accounting auditor, Ernst & Young ShinNihon LLC, reports to the Board of Auditors concerning the audit plan and results. The accounting auditor also conducts exchange of opinions when needed and carries out coordinated audits of business operations. The four certified public accountants associated with Ernst & Young ShinNihon LLC who performed the accounting audit were Yasunobu Furukawa, Yuichi Mochinaga, Takao Kamitani, and Tsuyoshi Saita. In addition, they were assisted by a further 34 certified public accountants, 31 accounting assistants, and another 33 persons, all associated with Ernst & Young ShinNihon LLC.

The Fujitsu Way Promotion Council promotes internal control relating to the Fujitsu Way and financial reporting in the Fujitsu Group and forms the core of operations to upgrade and evaluate internal control for the Group. During internal control audits by the accounting auditor and statutory auditors, the Fujitsu Way Promotion Council holds regular meetings to provide and explain information as required. The council also provides and explains information to assist the Corporate Internal Audit Unit in performing internal audits.

The company established an Executive Nomination Committee and Compensation Committee in order to ensure the transparency and objectivity of the process for choosing candidates for the Board of Directors, determining their compensation and ensuring that the compensation system and levels are appropriate. The Executive Nomination Committee takes into consideration the current business climate and anticipated trends, and makes recommendations on candidates (draft) for the Board of Directors, choosing candidates having objectivity in making management decisions, foresight and perceptiveness, and a superior character. The Compensation Committee is tasked with making recommendations on executive salaries and methods for calculating bonuses linked to financial performance, taking into consideration compensation levels at other companies with similar business activities, business scale, and other factors. The aim of this activity is to retain superior management talent, and provide effective incentives for improving the company's financial performance.

### 3. Reasons for Selecting the Current Corporate Governance Structure

The current structure clarifies the management responsibility of members of the board, who, after their election at the annual meeting of shareholders, become involved in making decisions about important matters concerning the management of the company. Furthermore, the current structure maintains the robustness and efficiency of governance by having the dual features of (1) the mutual monitoring by the members of the board, and (2) the audits by the auditors. At the time of the introduction in Japan of the corporation-with-committees governance system, Fujitsu was using the corporation-with-auditors system, and since the auditors were performing the auditing function effectively, we have continued to use the system.

The company maintains the robustness of its governance system by having an effective auditing function in which auditors who are independent of the management perform objective audits, by actively appointing outside directors, and by having established the Executive Nomination Committee, Compensation Committee and an internal audit organization. Finally, to further improve efficiency, we have established a Management Council, which has accelerated decision-making and management execution.

## III. Implementation of Policies Regarding Shareholders and Other Stakeholders

### 1. Initiatives to Enliven Annual Shareholders' Meetings and Facilitate Voting

Supplemental Information

Distribute invitation notices to Annual Shareholders' Meeting early	To give shareholders sufficient time to exercise voting rights, we make efforts to send invitation notices three weeks prior to the Annual Shareholders' Meeting.
Schedule Annual Shareholders' Meeting to avoid busiest days of overlap with other corporations' annual meetings	To facilitate the attendance of as many shareholders as possible, since the Annual Shareholders' Meeting held in June 2001 we have scheduled our Annual Shareholders' Meeting to avoid the busiest days of overlap with other corporations' annual meetings.

Utilize electronic methods for exercise of voting rights	To improve convenience and facilitate the exercise of voting rights for shareholders who are unable to attend the Annual Shareholders' Meeting, since the Annual Shareholders' Meeting held in June 2002 we have accepted the exercise of voting rights through electronic methods, and since the Annual Shareholders' Meeting held in June 2006 we have been using a platform to allow institutional investors to electronically exercise voting rights.
Participation in Electronic Proxy Voting Platform and Other Measures to Enhance the Proxy Voting Environment for Institutional Investors	Fujitsu participates in the electronic proxy voting platform operated by Investor Communications Japan (ICJ) as part of its efforts to enhance the proxy voting environment for institutional investors.
Availability of English-language Notice of Convocation of Annual Shareholders' Meeting (summary of Japanese)	Fujitsu creates an English-language Notice of Convocation of the Annual Shareholders' Meeting (contents correspond to the Japanese invitation and business report) and sends the notice to foreign investors in order to promote a wider understanding of the proposals presented at the shareholders' meeting. The notice is disclosed on the Company website the same day it is sent to shareholders as part of our policy to disclose information in a prompt, accurate, and fair manner.
Other	To clarify the results of voting at the Annual Shareholders' Meetings, in addition to public notification of the results of the Shareholders' Meetings, beginning with the Annual Shareholders' Meeting held in June 2010, Fujitsu began posting the numbers of votes for and against each resolution on its website.

## 2. Investor Relations Activities

	Supplemental Information	Explanation by Company Representatives
Creation and Publication of Disclosure Policy	<p>Fujitsu has established the following disclosure policy and made the policy available on its website.</p> <p><b>Disclosure Policy</b></p> <p>The Fujitsu Group's corporate philosophy is articulated as the "Fujitsu Way," comprised of our Corporate Vision, Corporate Values, Principles, and Code of Conduct. By sharing and practicing the Fujitsu Way, we aim to continuously enhance the value of the enterprise through the continuous growth and development of the Fujitsu Group. Our basic policy on disclosure is to enhance our management transparency by appropriate and timely disclosure of our business activities and financial information. This ensures that investors, shareholders, and all other stakeholders can understand how we are performing in enhancing our corporate value.</p> <p><b>Basic Policy on Information Disclosure</b></p> <p>Fujitsu emphasizes fairness and continuity in disclosure of information, in accordance with the Financial Instruments and Exchange Act and other laws and regulations, as well as the rules of the exchanges on which its shares are listed. Moreover, our policy is to be proactive in disclosing any information that we judge to be effective for helping shareholders, investors and other stakeholders to deepen their understanding of Fujitsu, even if such disclosure is not required by laws, regulations, or other rules.</p> <p><b>Methods of Information Disclosure</b></p> <p>Fujitsu uses prescribed information disclosure methods (TDnet, EDINET, etc.) to disclose information which it is required to disclose by law or regulation. Following disclosure, materials containing the disclosed information may be made available on the Company's website if deemed necessary. The Company may also disclose information which it is not required to disclose by law or regulation. In these cases, the Company will disclose the information as necessary, using an appropriate method of disclosure (press release, website disclosure, seminar presentation, etc.) based on the contents.</p> <p><b>Forward-looking Statements</b></p> <p>Forward-looking statements included in disclosed information are based on management's views and assumptions at the time the information was disclosed. A variety of changes in the internal and external business environment may cause actual results to differ materially from those expressed or implied in such statements. The Company strives to enhance the accuracy of forward-looking statements, and in cases where its outlook changes, the Company discloses the change as necessary using an appropriate disclosure method.</p> <p><b>Silent Period</b></p> <p>The Company institutes a silent period beginning the day after its quarterly financial settlement date until the day of the financial results announcement as a way to prevent financial information from being disclosed prior to the formal announcement. During the silent period, the Company does not respond to inquiries regarding its financial results. If the possibility arises that the Company's financial results will differ significantly from previous forecasts, however, the Company will disclose the change appropriately during the silent period.</p>	

Supplemental Information		Explanation by Company Representatives
Regular Presentations to Individual Investors	Although currently we do not hold presentations for individual investors, we have a dedicated IR website for individual investors (in Japanese). In addition, through the inquiry form on our IR website and other measures, we are working to improve relations with individual investors.	No
Regular Presentations to Analysts and Institutional Investors	We hold regular presentations, including presentations by the president on our management direction, presentations by the president and CFO on our earnings results, and presentations by various senior executives on business strategy for the operations they oversee. In addition, media are always invited to the briefings by the president, CFO, and heads of businesses, with the understanding that individual investors can thereby obtain information through reports that appear in the media.	Yes
Regular Presentations to Foreign Investors	The CFO meets with foreign institutional investors regularly. We also have IR managers stationed in Europe and the US who meet and communicate regularly with investors, not just at the time of earnings announcements. We also take materials from IR presentations held in Japan, translate them into English, and post them to our English IR website, including English translations of Q&A sessions.	Yes
Posting of IR Materials to Website	We post the Yukashoken Hokokusho (Financial Report) in Japanese and Jigyo Hokoku (Business Report) in Japanese and English, the Annual Report in Japanese and English, Tanshin (Financial Earnings) reports in Japanese and English, and various other IR presentation materials in Japanese and English. Also posted in English and Japanese is the Fujitsu Group Sustainability Report. Additionally, all materials accompanying the invitation notice to the Annual Shareholders' Meeting are posted on our website.	
Unit Dedicated to IR Activities	The officer in charge of IR activities is the CFO; the division in charge of IR activities is the Public and Investor Relations Division.	
Other	In addition to the above, along with posting materials from presentations made to institutional investors and securities analysts on our website, we broadcast streaming audio of these presentations.	

### 3. Initiatives in Consideration of the Position of Stakeholders

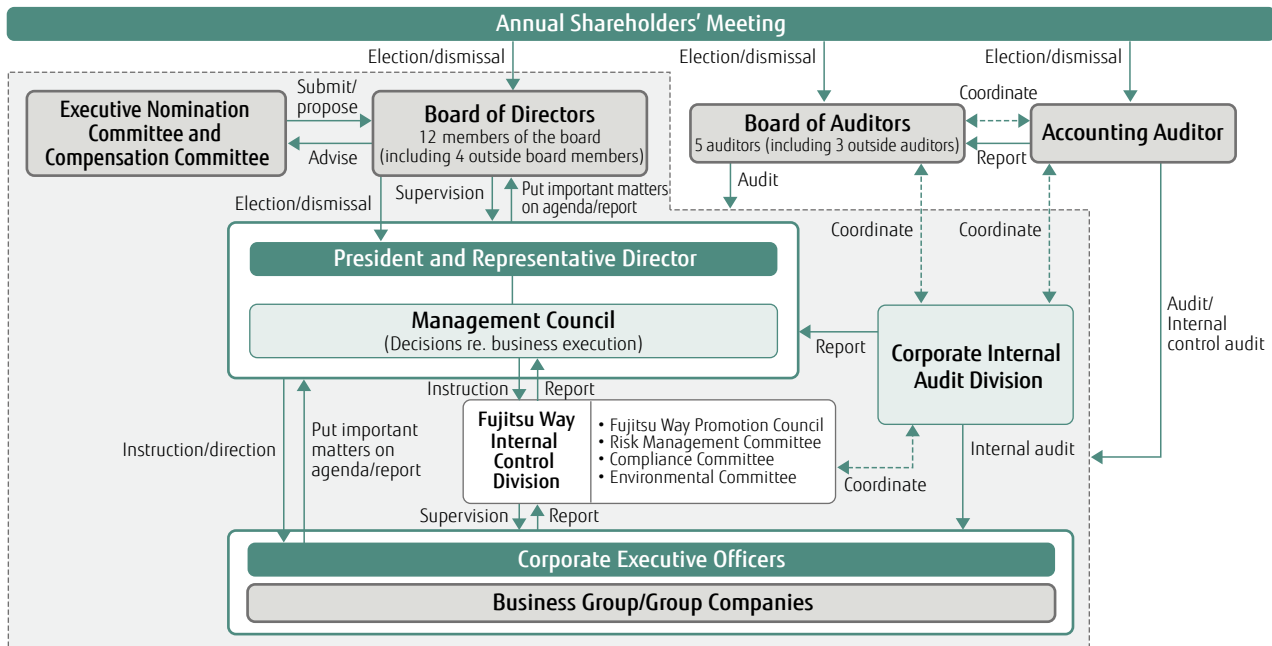
Supplemental Explanation	
Internal Company Rules Reflecting Consideration for the Position of Stakeholders	The philosophy and principle of the Fujitsu Way, the guide for the actions of the Group and its employees, is to bring about a prosperous future that fulfills the dreams of people throughout the world. As part of our Values, we strive to meet the expectations of all stakeholders, including customers, shareholders, investors, business partners, and employees.
Activities Promoting Environmental Protection and Corporate Social Responsibility	With respect to environmental activities, in the Values section of the Fujitsu Way, we clearly state that "in all our actions, we protect the environment and contribute to society," and we are continuing to actively pursue activities in this area. We are currently implementing programs based on Stage VI of the Fujitsu Group Environmental Protection Program (fiscal 2010, 2012). In March 2006, we extended our environmental management system to our overseas consolidated subsidiaries, receiving integrated global ISO 14001 certification. With respect to CSR activities, based on the Fujitsu Way, each business unit is promoting thorough adherence to our Code of Conduct and our customer-centric management perspective in order to earn the trust and meet the expectations of our stakeholders. Further details are listed in the Fujitsu Group Sustainability Report that we publish every year. Fujitsu also became a signatory to the UN Global Compact in December 2009, and has declared its intention to strengthen CSR activities from a global perspective. 2010 saw the publication of ISO 26000, an international standard for social responsibility, and revisions to the Nippon Keidanren's Charter of Corporate Behavior. These and other events show the increasing importance of approaching CSR from a long-term perspective. Under these conditions, the Fujitsu Group set out a Corporate Social Responsibility (CSR) policy in December 2010 that identifies five priority issues to be tackled.* Fujitsu will contribute to the sustainable development of the earth and society by promoting CSR activities that are integrated with management. * <a href="http://jp.fujitsu.com/about/csr/philosophy/policies/">http://jp.fujitsu.com/about/csr/philosophy/policies/</a>
Policies to Promote the Provision of Information to Stakeholders	With respect to our disclosure policies, we recognize that prompt and appropriate disclosure of company information to shareholders and investors as well as securities analysts is essential to the proper functioning of the securities markets, and we disclose information in compliance with the Securities and Exchange Law and regulations of the stock exchanges on which we are listed. Even if we are not legally required to do so under the regulations, and even if the content of the information is unfavorable to Fujitsu, if we deem the information to be material to investment decisions, our basic policy is to disclose the information in a manner that is prompt, accurate, and fair. Moreover, in consideration of the position of customers, communities, and other stakeholders, for information we deem necessary to disclose, including information that may be unfavorable to Fujitsu, our basic policy is to disclose the information in a manner that is prompt, accurate, and fair.

Supplemental Explanation

Other

We are promoting a customer-centric management perspective in order to be a trusted and valued partner to our customers. In order that all employees adopt a customer-centric mindset and apply it to their daily work, we are deepening our commitment in each business unit to previously initiated management quality improvement activities and we are attempting to create an organizational framework to facilitate continuous improvement from a customer-centric perspective. As one specific initiative, among those ideas and suggestions received by Fujitsu customer care centers and contact lines, those concerning real issues about systems and organizations, not individual matters, are viewed as something that should be shared throughout the Fujitsu Group. Therefore, the specific details of these problems and examples of how they have been resolved are shared at regular meetings where Fujitsu Group executives are assembled. As a result, we have a heightened awareness of what our customers are saying and we can take positive action to make improvements.

IV. Basic Stance on Internal Control Framework and Status of Implementation



1. Basic Stance on Internal Control System and Status

[Basic Stance on Internal Control Framework]

The Company, through a resolution by the Board of Directors, has adopted the following basic stance on the framework for internal control (resolved on May 25, 2006, and revised on April 28, 2008).

1. Objective

The Fujitsu Way, which embodies the philosophy, values, principles, and code of conduct for the Fujitsu Group, describes the vision of the Fujitsu Group as follows: "Through our constant pursuit of innovation, the Fujitsu Group aims to contribute to the creation of a networked society that is rewarding and secure, bringing about a prosperous future that fulfills the dreams of people throughout the world."

We believe that by conducting our activities in accordance with the Fujitsu Way, we maximize the value of the Fujitsu Group and enhance our contribution to the communities in which we operate and to society as a whole.

In addition, in order to continuously enhance the corporate value of the Fujitsu Group, it is necessary to pursue management efficiency and control risk arising from our business activities. Recognizing that it is essential to strengthen our corporate governance in order to accomplish this, we will continuously strive to implement the policies described below.

2. Systems to ensure the appropriateness of Fujitsu and Fujitsu Group business

(1) System to ensure efficient business execution by directors

- a. At Fujitsu, there is a separation of the oversight and operational execution functions of management. The Board of Directors oversees the execution functions of the Management Council and other management bodies, and makes decisions on important matters. Among executive organs, the Management Council discusses and decides upon basic management policies and strategies and also decides upon

- important matters regarding management execution. Matters taken up by the Management Council, including discussion items, are reported to the Board of Directors, and any important issues are decided upon by the Board of Directors.
- b. To strengthen the management oversight function, we proactively employ outside directors and auditors.
  - c. The Board of Directors clarifies the scope of authority for board directors, corporate vice presidents, and managing directors (hereafter collectively referred to as "senior management") as well as other business execution organs, and ensures that business is conducted in accordance with the division of business duties.
  - d. In performing their duties, senior management follows appropriate decision-making procedures, such as the Board of Directors Rules, Management Council Regulations, and Regulations on Corporate Decision-Making.
  - e. In addition to making employees thoroughly aware of management policies, senior management sets and achieves concrete goals in order to accomplish overall management goals.
  - f. To pursue operational efficiency, senior management promotes continuous improvement of internal control systems and reform of business processes.
  - g. By having senior management and other business execution organs provide monthly financial reports and business operation reports, the Board of Directors observes and oversees the status of achievement of management goals.
- (2) System to ensure that business execution of directors and employees complies with laws and articles of incorporation
- a. Senior management adheres to the Fujitsu Way as a basic vision for compliance issues, including compliance to laws and the articles of incorporation, and proactively promotes the Group's overall compliance on an ethical basis.
  - b. By continuously administering training, senior management instills adherence to the Fujitsu Way in employees and promotes the overall Group's compliance.
  - c. Senior management clarifies the legal and other regulations that relate to the Fujitsu Group's business activities and implements internal rules, training and oversight systems necessary to adhere to them, thereby promoting the compliance of the Group as a whole.
  - d. If senior management or employees become aware of the possibility of a major compliance violation in connection with the execution of business activities, they immediately inform the Board of Directors and the Board of Auditors via normal reporting channels.
  - e. In order to use independent information sources outside of normal reporting channels to discover and deal appropriately with compliance problems on a prompt basis, senior management establishes and operates an internal reporting system that protects whistle-blowers.
  - f. The Board of Directors receives periodic reports on the status of business execution from executive officers and verifies that there are no compliance violations in relation to the execution of work.
- (3) Regulations and other systems relating to loss mitigation
- a. Senior management strives to maintain the Fujitsu Group's business continuity, increase its corporate value and sustainably expand its business activities. In order to deal with risks that pose a threat to achieving these goals, they assign certain departments to be responsible for each type of risk and put in place appropriate risk management systems.
  - b. Senior management is constantly assessing and verifying risks that might cause losses to the Fujitsu Group, and they report significant cases to the Board of Directors.
  - c. In regard to risks discovered through assessment described in b., as well as potential risks arising from the execution of business, senior management carries out risk mitigation initiatives and strives to minimize losses from risks. In order to minimize losses from risks that arise, senior management creates a risk management committee and carries out necessary countermeasures. In addition, it periodically analyzes risks that arise and reports them to the Board of Directors. In these ways, the committee engages in activities intended to prevent the recurrence of risks.
  - d. In order to collect risk information that cannot be gathered by the methods mentioned above, an internal reporting system has been set up and is operated to ensure the protection of whistle-blowers.
- (4) Information storage and management system regarding business execution by directors
- a. In accordance with company rules, senior management shall establish an appropriate system, including appointing documentation managers, to store and manage documents relating to the execution of their business duties (including electronic documents, as with the items listed below) and other important information.
    - Minutes of shareholders' meetings and related documents
    - Minutes of Board of Directors meetings and related documents
    - Minutes and related documents for other important decision-making meetings
    - Approval documents from senior management
    - Other important documents relating to the execution of business duties by senior management
  - b. In order for directors and auditors to verify the status of execution of business duties, there is a system enabling them to view the documents described in the above item at any time. The system also provides that, in response to requests they make to those in charge of managing documents, board members and statutory auditors can see the documents whenever they wish.

## (5) System to ensure the appropriateness of Fujitsu Group business

- a. Using the Fujitsu Way as a foundation, in order to continuously increase the value of the Fujitsu Group, Fujitsu will provide direction and support to senior management of each Group company for setting up efficient, law-abiding and appropriate business execution systems as detailed in sections (1) through (4) above.
- b. In order to implement the above item a., the company has established common rules for the management of the group, such as the "Fujitsu Group Management Policy" that set out the roles, responsibilities, authority, and decision-making processes for each of the companies in the group.
- c. Senior management of Fujitsu and all Group companies periodically confirms issues related to Group management strategies and achievement of management goals through management update conferences and other means. In addition, Fujitsu Group statutory auditors deal with Fujitsu Group issues from the auditing viewpoint through Group auditor update conferences.
- d. In regard to measures needed to resolve challenges related to achieving management goals that are identified as a result of the activities described in item c., senior management of Fujitsu and Group companies implements such measures following full discussion and, when necessary, completion of reporting to Fujitsu and approval processes specified separately.
- e. Fujitsu's internal audit organization is linked to the internal audit organization of each Group company. It carries out audits of the entire Fujitsu Group and reports periodically to the Board of Directors and Board of Auditors of Fujitsu. Important matters regarding the audits of Group companies are reported to the Board of Directors and Board of Auditors of Fujitsu.

## (6) System to ensure the appropriateness of audits by statutory auditors

## &lt;Ensuring independence of auditors&gt;

- a. Fujitsu has set up an Auditing Support Division with employees assigned to assist the statutory auditors in carrying out their duties. Appropriate employees with the ability and expertise required by the statutory auditors are assigned to the division.
- b. In order to ensure the independence of the staff in the Auditing Support Division, matters relating to their appointment, transfer and compensation are decided on the basis of prior consultation with the auditors.
- c. In principle, senior management does not assign division staff to other divisions or duties. In instances, however, where a need arises to give dual assignments to staff with specialized knowledge in response to requests from statutory auditors, care is given to ensuring their independence in accordance with item b.

## &lt;Reporting system&gt;

- a. Senior management of Fujitsu and Group companies provides the statutory auditors with the opportunity to attend important meetings.
- b. In cases where risks arise that could affect management or financial results, or where there is an awareness of major compliance violations in connection with the execution of business activities, senior management as well as employees of Fujitsu and Group companies immediately report on them to the statutory auditors.
- c. Senior management as well as employees of Fujitsu and Group companies periodically report to the statutory auditors on the status of business execution.

## &lt;Ensuring effectiveness of statutory auditors&gt;

- a. Senior management of Fujitsu and Group companies periodically exchange information with the statutory auditors.
- b. The internal audit organization periodically reports to the statutory auditors on audit results.
- c. The auditors have the independent accounting auditor explain and report on accounting audits as required and periodically exchange information with the independent accounting auditors.

## [Status of Internal Control System]

Fujitsu has established a department with executive responsibility for internal controls. The company is continuing its steps to implement an even more robust operational execution structure by reviewing and revising its regulations and business operations.

In addition, Fujitsu has established the Fujitsu Way, consisting of a Corporate Vision, Corporate Values, Principles, and Code of Conduct, which guides the Group and its employees in their daily activities.

To accelerate the penetration and implementation of the Fujitsu Way and ensure the appropriateness of business operations, Fujitsu is promoting the implementation and evaluation of its internal control structure. This effort is led by the Fujitsu Way Promotion Council, which reports directly to the Management Council. In addition to the Fujitsu Way Promotion Council, three other groups were established directly under the Management Council and tasked with pursuing more robust and efficient business execution: the Risk Management Committee, the Compliance Committee and the Environmental Committee. The functions of each are described below:

## • Fujitsu Way Promotion Council

The Fujitsu Way Promotion Council promotes the inculcation and implementation of the Fujitsu Way. In addition, it has also been promoting Project EAGLE, which is a company-wide activity for building an internal compliance system for effective and reliable financial reporting in compliance with the Financial Instruments and Exchange Act, and by which the company has been able to promote the implementation and evaluation of internal control. By establishing a promotion organization dedicated to this endeavor, the Council has been working to extend it across the Group. Along with improving deficiencies, the goals of the project also include achieving greater efficiency through the pursuit of business process reforms across the Group.

• Risk Management Committee

This committee sets out risk management rules and risk management guidelines for risks inherent in Fujitsu's business activities. The committee also places risk management promotion officers in Fujitsu and its Group companies. These officers coordinate with one another to address prevention and mitigation of potential risk events, and response to emergent risks. In this way they construct risk management systems and processes for the entire Fujitsu Group. The committee is also responsible for implementation and ongoing upgrading of these systems and processes. The committee reports important matters to the Management Council and the Board of Directors, deliberates on appropriate responses, researches underlying risk factors, and proposes and implements measures to prevent recurrence. Moreover, the committee promotes business continuity management (BCM), so that when unforeseen events such as natural disasters occur, the Company can continue its key businesses, fulfill its responsibilities to society, and provide customers with a stable supply of the high performance, high-quality products and services that they need.

• Compliance Committee

This committee promotes adherence to social norms and corporate rules as well as the creation of corporate systems and initiatives for fostering a corporate culture of respect for norms. In conjunction with efforts to maximize compliance, a help line system was set up as a confidential liaison point to receive reports from employees and provide guidance to them on matters of conduct.

• Environmental Committee

This committee is responsible for promoting the environmental protection activities of the Fujitsu Group, which are based on the Fujitsu Group Environmental Policy and the Fujitsu Group Environmental Protection Program.

As a result of our Project EAGLE initiative to build an internal control system for effective and reliable financial reporting, in fiscal 2011 the accounting auditors, Ernst & Young ShinNihon LLC, issued their opinion that the Fujitsu Group has effective internal controls for its financial reporting.

**2. Basic Stance and Preparedness for Rejection of Antisocial Elements**

[Basic Stance on Rejection of Antisocial Elements]

In the Fujitsu Way, the Fujitsu Group's Code of Conduct calls for respect for and compliance with laws and socially accepted rules. Accordingly, our basic stance is to take a resolute attitude toward antisocial elements and have absolutely no dealings with them.

[Preparedness Regarding Rejection of Antisocial Elements]

We maintain a system that can quickly respond when necessary by designating a centralized response department, creating a common Group manual, maintaining liaisons and exchanging information with outside legal counsel, police, and specialist organizations, as well as by carrying out training and keeping employees fully informed about the workplace.

**V. Other**

**1. Adoption of Takeover Defense Measures**

Adoption of Takeover Defense Measures	No
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**Supplemental Explanation**

Because raising corporate value is ultimately the best defense against potential takeovers, we are focusing our efforts on raising corporate value. At the present time, we have not put in place any takeover defense measures.

Going forward, while placing first priority on corporate value and shareholder profits, we will pay careful attention to social trends and changes in the environment and continuously consider the possible need for protective measures.

**2. Other Provisions Relating to Corporate Governance**

The following is the status of the Company's internal structure for timely information disclosure.

**1. Internal Structure for Timely Disclosure of Corporate Information**

The Company endeavors to quickly and accurately grasp information (decisions, events, and financial results) related to the business, operation, and financial performance of each of its Business Groups, the organizations responsible for business operations. This information is used to improve management, and the Company uses the following deliberation and decision-making structure to ensure timely disclosure of the information

in cases where the information is important and necessary for investors.

(1) Important management matters are deliberated and decided by the Management Council.

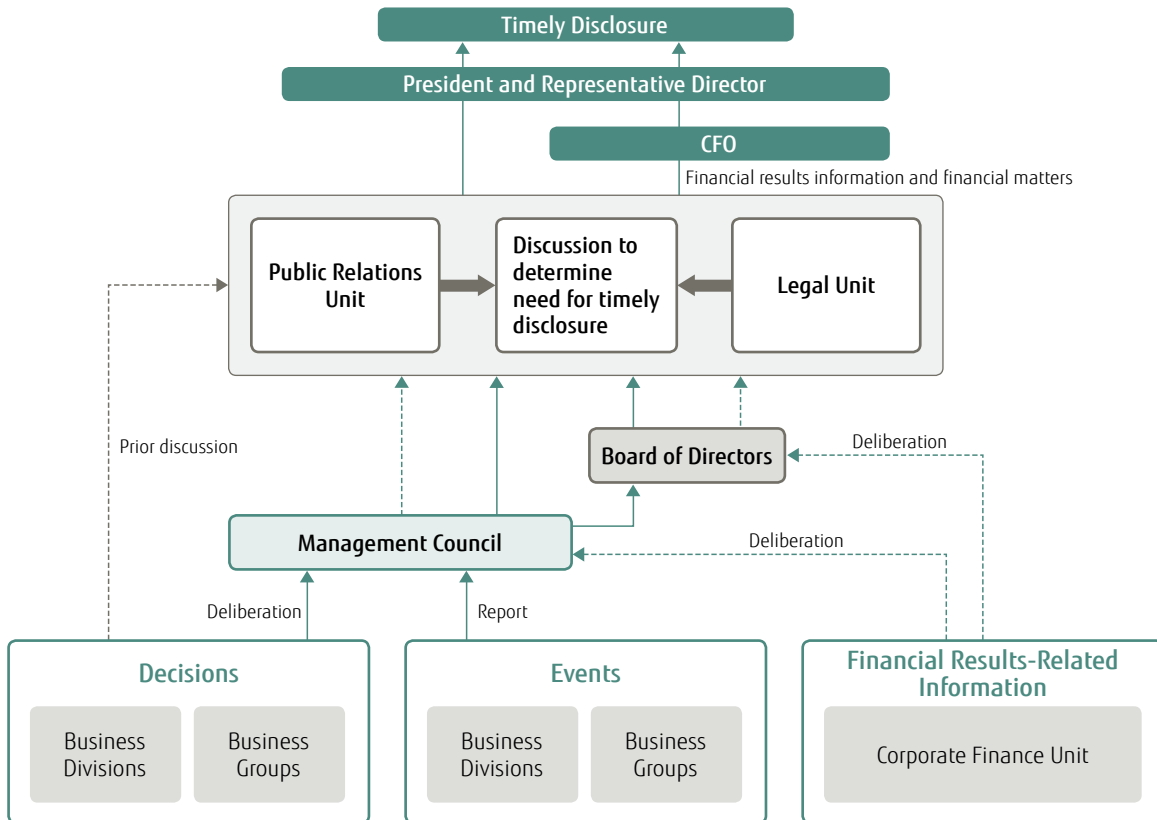
Among the matters deliberated by the Management Council, items of significant importance are decided by the Board of Directors.

Each Business Group conducts business under the control of the Management Council and the Board of Directors, which are the decision-making bodies.

- (2) Each Business Group reports matters of importance to the Company's business, operation, or financial performance to the Management Council or the Board of Directors on a regular and as-needed basis.  
Each Business Group endeavors to establish a structure to conduct risk management within its own organization. Under this structure, each Business Group controls the gathering of information within its organization and is constantly enhancing its structure to quickly and accurately grasp events and other risk information.
- (3) The Finance and Accounting Department reports financial results, revisions to financial results and forecasts, dividends and other information to the Board of Directors, based on financial information gathered from each Business Group.  
Based on information disclosure regulations, the Legal Department and Public Relations Department jointly review decisions, events, and financial results gathered as explained above to confirm the timeliness and accuracy of the information in relation to disclosing it to investors. The Company's representative director and president conducts a final review of the information before the information is disclosed to investors in a timely and accurate manner. With regard to financial results and financial items included in decisions or events, the chief financial officer (CFO) approves the information prior to the final review by the representative director and president.

**2. Internal System Confirmation Function for Timely Information Disclosure**

- (1) The Company has established the Way Promotion Council, Risk Management Committee, and Compliance Committee to enhance the internal structure for timely information disclosure by providing organizational support for the gathering and reporting of risk information. These organizations support and promote the risk management activities carried out by each Business Group.  
The Compliance Committee oversees a help-line system to promptly gather information on inappropriate activities within the Company, as part of the measures to prevent impropriety, including activities related to information disclosure.
- (2) The Company has established a Corporate Internal Audit Unit to audit the status of the internal control function and internal events (including risk information).  
The Corporate Internal Audit Unit continuously audits the risk management structure of each Business Group and contributes to the maintenance and improvement of the accuracy and appropriateness of information regarding the business, operation, and financial performance of the entire Group, including subsidiaries.



# Business and Other Risks

Listed below are the principal business and other risks affecting the Fujitsu Group (Fujitsu Limited and its consolidated subsidiaries) that we believe may influence investors' decisions. With a view to proactively disclosing information to investors, we have also included items that may not necessarily have significant bearing on such decisions. We are aware of and have evaluated these risks and are making efforts to prevent, mitigate, transfer, and retain potential risks, and immediately confront risks should they occur. Please note that the following is not an exhaustive list of all the risks that may affect the Group. Among the risks listed below are some items related to future developments, but the list only includes items that the Group deems necessary to publicly disclose as of the date of submission of these materials (April 27, 2012).

## 1. Economic and Financial Market Trends

Economic and financial market trends have an impact on the Group's business results, financial base, and other aspects of its operations. Examples of such risks are listed below.

### 1) Economic Trends in Key Markets

The Fujitsu Group provides ICT services, server and storage products, network products, as well as semiconductors and other components, to clients in corporate and public institutions, as well as consumers in Japan and every region of the globe. Hence, sales and income generated from these operations are greatly affected by economic conditions in each respective market. The economic trends in our key markets, namely Japan, North America, Europe, and Asia (including China), can significantly impact Fujitsu Group operations.

### 2) High-Tech Market Volatility

The ICT sector is periodically subject to dramatic changes in the balance of supply and demand that exceed the scope of normal cyclical market variations. This tendency is particularly evident with regard to semiconductors, PCs, and other general-purpose products. The Fujitsu Group gives ample consideration to market cycles and volatility when deciding to develop new global technology solutions and other businesses, launch new products, initiate volume production, or scale back production, among other actions. Nonetheless, we may fail to accurately forecast market changes, or changes in market conditions could exceed our forecasts. Accordingly, there is a risk that we may be unable to recoup investment costs, as well as the risk of opportunity losses. Further, the Group continuously implements structural reforms in a bid to respond to market changes. However, drastic market changes could force us to enact structural reforms on a far greater scale than initially expected, resulting in a temporary increase in related expenses.

### 3) Exchange Rates

The Fujitsu Group is expanding its business outside Japan. As a result, sudden fluctuations in US dollar, euro, and British pound exchange rates and other factors could have a significant impact on sales and income, resulting in such factors as the lowering of competitive pricing for the services and products that we deliver

outside Japan. Sudden fluctuations in exchange rates can also affect the cost of components and materials that we import from outside Japan, as well as the various products that we export. In addition, with respect to assets held by the Group outside Japan, as well as liabilities, there is the possibility that exchange rate fluctuations could lead to depreciation of assets and/or appreciation of liabilities.

### 4) Interest Rates

The Fujitsu Group has interest-bearing loans which include debt directly impacted by interest rate fluctuations. Consequently, rising interest rates could increase borrowing costs.

### 5) Capital Markets

Stock market trends in and outside of Japan have a substantial effect on the value of Group stockholdings in other companies and the management of pension assets. Weak stock market performance could thus force us to incur losses on the devaluation of marketable securities held or a reduction in pension assets, exposing the Group to the risk of higher valuation losses or additional pension obligations.

## 2. Customers

Fujitsu Group operations are highly influenced by the business trends of customers. Examples of potential risks are described below.

### 1) Changes in Customers' ICT Investment Trends

A growing proportion of our technology solutions and other businesses is with the public institutions such as the Japanese, local and foreign governments; telecommunications carriers; financial services institutions; and large manufacturers. The business environment within these industries, including shifting market trends and structural reforms, could lead to changes in customers' IT investment trends, having a significant impact on Group sales and profitability. In addition, the trends in sales of our customers' products and services have a large impact on the demand for and prices of the Group's products and services. Accordingly, soft demand and falling prices for customers' products and services, a decline in the size of customers' businesses, or customers' reduced market share, as well as restrains on customer ICT investments could negatively impact Group sales and earnings.

In our business outside Japan, for example, government-related projects in the UK are an especially important part of our business. Accordingly, changes and restrains placed on the ICT investment plans of the UK government could impact sales and profitability.

### 2) Ability to Maintain Long-Term Relationships with Customers

The Fujitsu Group is creating long-lasting ties with its customers, striving to be a valued and trusted business partner and provide solutions across the full IT system lifecycle. Accordingly, business stability hinges on maintaining relations with customers. An inability to maintain trusted relationships with such customers, or the failure to renew contracts with them, could therefore affect sales and profitability.

### 3. Competitors/Industry

The ICT sector is characterized by intense competition and fast-paced technological innovation. Events within the industry or actions by competitors could therefore have a substantial impact on our business results. Examples of such potential risks are listed below.

#### 1) Price Competition

Changes in market environments, intensifying competition, technological innovation, and other factors may cause prices for products and services to decline. Anticipating such technology- and competition-driven price reduction of ICT services, including cloud computing, and the escalation of PC prices, we are pursuing a variety of measures to reduce costs, including the introduction of Toyota Production System reforms, the industrialization of services and standardization, and software modularization, as well as efforts to expand sales of new products and services. Despite these steps, the Group still faces the risk of larger-than-expected declines in prices, as well as being unable to achieve cost reductions or sales growth due to fluctuations in procurement costs. Any of these risks could negatively impact Group sales and profitability.

#### 2) Competition from New Market Entrants and Others

In addition to challenges posed by existing industry peers, competition from new market entrants continues to intensify in the ICT sector. Today, new entrants continue to emerge in market areas where the Fujitsu Group has a competitive advantage, thus entailing the risk that we may lose our competitive edge, or fail to secure a clear competitive advantage in future business operations.

#### 3) Competition in Technology Development

Technological advancement in the ICT sector occurs at an extremely fast pace, leading to rapid turnover in new products and technologies. In this context, remaining competitive requires the continuous development of state-of-the-art technology. While the Fujitsu Group does its utmost to maintain highly competitive technologies by expanding into markets such as cloud computing and smartphones, a loss in competitiveness versus other companies in the race to develop innovative technologies could lead to a decline in the Group's market share and profitability, which would negatively impact sales and earnings. Further, sales and profitability could be affected by the development of groundbreaking technologies and services by competitors that would severely compromise the value of the Group's services and products.

### 4. Suppliers, Alliances, etc.

In the course of its operations, the Fujitsu Group conducts business with a wide range of suppliers and alliance partners. Accordingly, any significant changes in relationships with these and other business partners could affect the Group's business.

#### 1) Procurement

The Fujitsu Group utilizes sophisticated technologies to provide a range of products and services. There is therefore a risk that we may encounter difficulties in procuring a stable supply of certain

key components or raw materials, or in cases where regular supply channels are unavailable, that we may be unable to secure alternative procurement sources. There is also the risk that the Group may be unable to sufficiently procure certain parts or raw materials in the large volumes required. Moreover, natural disasters, accidents and other events, as well as any deterioration in business conditions at suppliers, could hinder the ability of business partners to provide the Group with a stable supply of required components or raw materials. The Fujitsu Group has taken a variety of measures to strengthen the resiliency of its supply chain, including moving to multiple sources for procurement, working on, or strengthening support for, business continuity management (BCM) initiatives of suppliers, and holding a sufficient supply of inventories. Despite these efforts, inadequate supplies of parts and raw materials could cause delays in the provision of products and services, resulting in postponement of deliveries to customers and opportunity losses. In respect to procurement of components and other materials, foreign exchange rate fluctuations, tight supply and demand conditions, and other pressures could drive procurement costs higher than initial estimates, leading to diminished returns on products and services, as well as lower sales due to the higher prices. Additionally, while we make every effort to ensure the quality of procured components, we cannot guarantee that all components purchased will be free of defects. The discovery of such issues could result in processing delays, as well as defective products, opportunity losses, repair costs, and disposal costs for defective goods, plus the potential obligation to pay damages to customers.

#### 2) Collaborations, Alliances, and Technology Licensing

To enhance competitiveness within a global ICT business environment, the Fujitsu Group works with a large number of companies through business alliances, technology collaborations, joint ventures, and other means, a practice that we intend to actively continue in the future. If, however, as a result of managerial, financial, or other causes, it becomes difficult to establish or maintain such collaborative ties or to gain sufficient results from them, the Group's business could be adversely affected. Moreover, many of our products and services employ other companies' patents, technologies, software, and trademarks with the consent of their owners. However, there is no guarantee that other companies will continue to grant or license the right to use their property under terms acceptable to the Fujitsu Group.

### 5. Public Regulations, Public Policy, and Tax Matters

The business operations of the Fujitsu Group are global in scope, and are therefore impacted by a variety of public regulations, public policies, tax laws, and other such factors in all countries where the Group does business. Specifically, wherever it operates, the Group must comply with a variety of government policies, regulations, such as authorizations for business or investment, import/export regulations and restrictions, as well as laws pertaining to antimonopoly policies, intellectual property rights, consumers, the environment and recycling, labor conditions,

subcontracting, and taxation. The Fujitsu Group's earnings might be affected by increased compliance costs associated with measures to make stricter or otherwise revise such policies, laws, and regulations, or by liabilities stemming from fines in cases where the company is found to have committed a violation. We also provide solutions in certain fields and business domains such as healthcare, communications, and construction that are subject to other public regulations, meaning that regulatory trends in these sectors may potentially impact the Group's business.

## 6. Others

The Fujitsu Group makes every effort to eliminate known risks but can offer no guarantee of its ability to always achieve every desired outcome in the course of executing business operations. Some of the specific risks faced in this respect are detailed below.

### 1) Deficiencies or Flaws in Products and Services

The Fujitsu Group builds and supports the infrastructure behind the modern network society, which has become increasingly global and sophisticated. In accordance with our corporate philosophy the Fujitsu Way, quality is one of our most important values, and it underpins the trust that customers and society place in us.

We are committed to improving quality at the design and development stages as well as in manufacturing by setting rules on quality control throughout the company. We are also promoting strict quality control when purchasing components from external suppliers. These efforts notwithstanding, it is impossible to totally eliminate the possibility of deficiencies or flaws occurring in products, including software. While the Group is also setting rules on quality control throughout the company, promoting software modularization, standardization of development work, and enhanced security measures in order to improve the quality of system development and other services in the technology solutions business, the possibility of defects arising cannot be excluded. With respect to systems that play a critical role in supporting social infrastructure, we have been checking for any potential problems in these systems, including the operating environment, software and hardware, in cooperation with our customers. In addition, we have continuously made improvements to the quality, contracts, and related rules in order to ensure the stable operation of social infrastructure systems. We cannot, however, entirely eliminate the possibility of deficiencies or flaws. In the event that such deficiencies or flaws occur in the products or services, the Group may have to initiate product recalls or repairs, engage in system recovery work, pay damages to customers or suffer opportunity losses, all of which would negatively impact Group sales and profitability.

### 2) Project Management

Due to such factors as the increasing scale and sophistication of systems and more rigorous demands from customers, as well as the advance of open system environments, system development work is becoming increasingly complex. At the same time, greater competition is leading to increasingly intense pricing

pressures. To deal with this situation and prevent incidences of delayed delivery and loss-generating projects, we have been revising our approach to making contracts with customers, advancing the standardization of sales and system engineering business processes, and working to manage risk from the business negotiation stage through actual project implementation. The Group continues to maintain reserves for losses as necessary. In addition, we are striving to industrialize the system development process in order to strengthen our cost competitiveness. Nevertheless, in spite of these measures, there is a possibility that we may be unable to completely prevent incidences of delayed delivery the occurrence of loss-generating projects.

### 3) Investment Decisions and Business Restructuring

In the ICT industry, large investments in R&D, capital expenditure, business acquisitions, and business restructuring are necessary to maintain competitiveness. Accordingly, the success or failure of these initiatives has a profound effect on the business results of the Fujitsu Group. When making such investment and restructuring decisions, we give ample consideration to a range of factors such as market trends, customer needs, the superiority of the Group's own technologies, the financial performance of acquisition candidates and our business portfolio. There is, however, the risk that markets and technologies, as well as acquisition candidates, deemed attractive by the Group, may fail to grow as anticipated, or that supply and demand imbalances or price erosion may be more severe than expected. The Group takes a number of steps to mitigate this risk, including the consideration of investment efficiency and responding to inherent fluctuations by dividing investment into multiple phases and forging agreements with customers prior to investment. Nonetheless, there is no guarantee that the Group can generate sufficient returns on such investments.

### 4) Intellectual Property Rights

The Fujitsu Group has accumulated technologies and expertise that help distinguish its products from those of other companies. Legal restrictions in certain regions, however, may impair our ability to fully protect some of the Group's proprietary technologies, with the result that we could be unable to effectively prevent the manufacture and sale of similar products developed by third parties using the Group's own intellectual property. Moreover, the creation of comparable or superior technologies by other companies could erode the value of the Group's intellectual property. The Group has instituted internal policies, including stringent clearance procedures prior to launching new products and services, to ensure that no infringement of other companies' intellectual property occurs. However, there is the possibility that the Group's products, services, or technologies may be found to infringe on other companies' intellectual property, and that earnings may be impacted by such consequences as the need to pay for usage rights or cover costs associated with modifying designs. In addition, the Group has previously instituted a program to compensate employees for innovations that they make in the course of their work, and will continue to implement this

program in the future in accordance with related laws and regulations. Nevertheless, the Group faces potential risk from lawsuits initiated by employees in regard to compensation for innovation created in the workplace.

### 5) Human Resources

The growth and profitability of the Fujitsu Group depends heavily on human resources. As such, a major issue for the Group is the ability to recruit, foster, and prevent the attrition of talented technical experts, system engineers, managers, and other key personnel. The inability to do so could negatively impact the Group's growth and profitability.

### 6) Environment

Making contributions to society and protecting the environment are part of the corporate values of the Fujitsu Group, as set forth in the Fujitsu Way. While committed to minimizing environmental burden and preventing environmental pollution in accordance with the Fujitsu Group Environmental Policy, the Group cannot guarantee that environmental pollution will not occur as a result of its operations. Moreover, although we monitor soil and wastewater as well as engage in clean-up activities at former factory sites, this does not mean that pollution will not be found at such sites in the future. In the event that environmental pollution were to occur or be identified, social trust in the Group may weaken, and clean up and other costs could be incurred, which would adversely affect the Group's earnings.

### 7) Information Management

In order to safeguard the personal and confidential information of customers, business partners, and the Fujitsu Group itself, the Group has taken such measures as establishing strict regulations, instituting training programs for employees, upgrading its information infrastructure and providing consultation to business subcontractors. Nevertheless, the Group cannot guarantee that information will not be leaked. In the unlikely event that this should occur, trust in the Fujitsu Group could decline and the Group may be obligated to pay damages to customers.

The Fujitsu Group has a well-developed system in place to ensure the integrity and stable operation of critical in-house networks, which are a key element of our business infrastructure. However, the Group cannot guarantee the ability to prevent computer viruses, cyber attacks or other disruptions from impeding network operations and leaking information.

### 8) Credit Ratings and Other Factors that Affect the Group's Credit

In addition to having a major influence on financing, credit ratings by outside institutions serve as reliable sources of information for our customers when they conduct transactions with us. Lower credit ratings caused by failure to meet earnings targets, deteriorating financial conditions, and other reasons could influence our ability to secure financing and place the Group at a disadvantage in bidding for projects and in other business dealings.

### 9) Litigation

The Fujitsu Group may become the subject of litigation in the course of executing its operations, resulting in an obligation to pay unforeseen damages. Depending upon the amount of damages the profit and loss of the Fujitsu Group may be materially impacted.

## 7. Natural Disasters and Unforeseen Incidents

Natural disasters and other unforeseen situations could have a major impact on the business results and financial standing of the Fujitsu Group. Examples of the potential risks posed are found below.

### 1) Damage from Earthquakes, Other Natural Disasters, and Accidents

The Fujitsu Group has instituted a Business Continuity Plan (BCP), which is continually reviewed and improved, to ensure that, even in the event of natural disasters like earthquakes, major floods, or volcanic eruptions, as well as accidents or the outbreak of infectious diseases like new forms of influenza, we can continue our critical business operations to fulfill our corporate social responsibility, while at the same time continuing to provide a stable flow of high-quality, highly reliable products and services, which our customers rely on for their business. Last fiscal year there were several large-scale disasters, including the Great East Japan Earthquake, the nuclear power plant accidents and the ensuing electrical power shortages, and the floods in Thailand. Going forward, there is also a possibility that unforeseen events may occur, such as major earthquakes in the Tokyo metropolitan area, the Tohoku region or along the Nankai Trough, or a prolongation of power shortages in Japan. Based on the fact that such events could disrupt operations, the company is making every effort to ensure the continuity of key businesses. Having dealt with the Great East Japan Earthquake, we have taken steps to make our sites resistant to earthquakes and we conduct regular site inspections, along with disaster-readiness drills. Nevertheless, there is a possibility that the Group may be forced to suspend the delivery of products and services to customers or its support for customer information systems in the event an unforeseen natural disaster or accident forces sites to suspend operations, inflicts damage to facilities and equipment, interrupts the supply of electricity or water, disrupts public transportation or communications infrastructure, or causes damage to our supply chains.

### 2) Geopolitical Issues

Armed conflicts, terrorism, political instability, currency crises, and other events in nations or regions where the Fujitsu Group operates could have a significant impact on its businesses.

## 8. Risks Associated with Financial Statements

For details, please refer to "Critical Accounting Policies and Estimates" on page 102.

## Facts &amp; Figures

# FINANCIAL SECTION

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## Five-Year Summary

Fujitsu Limited and Consolidated Subsidiaries

Years ended March 31	Yen (millions)					U.S. Dollars (thousands)
	2008	2009	2010	2011	2012	2012
Net sales	¥5,330,865	¥4,692,991	¥4,679,519	¥4,528,405	<b>¥4,467,574</b>	<b>\$54,482,610</b>
Operating income	204,989	68,772	94,373	132,594	<b>105,304</b>	<b>1,284,195</b>
Operating income margin	3.8%	1.5%	2.0%	2.9%	<b>2.4%</b>	
Income (loss) before income taxes and minority interests	109,444	(113,314)	112,706	102,236	<b>66,717</b>	<b>813,622</b>
Net income (loss)	48,107	(112,388)	93,085	55,092	<b>42,707</b>	<b>520,817</b>
Return on equity	5.0%	(13.2%)	12.0%	6.8%	<b>5.1%</b>	
Ratio of net sales outside Japan	36.1%	32.0%	37.4%	35.1%	<b>33.7%</b>	
EMEA	¥ 839,719	¥ 657,073	¥ 981,622	¥ 845,485	<b>¥ 809,277</b>	<b>\$ 9,869,232</b>
The Americas	521,989	391,443	321,603	322,272	<b>286,595</b>	<b>3,495,061</b>
APAC & China	561,913	451,370	445,079	419,606	<b>410,224</b>	<b>5,002,732</b>
Total of net sales outside Japan by customers' geographic location	¥1,923,621	¥1,499,886	¥1,748,304	¥1,587,363	<b>¥1,506,096</b>	<b>\$18,367,024</b>
Amounts per share of common stock (Yen and U.S. Dollars):						
Earnings (loss)						
Basic	¥ 23.34	¥ (54.35)	¥ 45.21	¥ 26.62	<b>¥ 20.64</b>	<b>\$ 0.252</b>
Diluted	19.54	(54.35)	42.17	25.75	<b>20.55</b>	<b>0.251</b>
Owners' equity	458.31	362.30	386.79	396.81	<b>406.42</b>	<b>4.956</b>
Total assets	¥3,821,963	¥3,221,982	¥3,228,051	¥3,024,097	<b>¥2,945,507</b>	<b>\$35,920,817</b>
Net assets	1,130,176	925,602	948,373	953,779	<b>966,598</b>	<b>11,787,780</b>
Owners' equity ratio	24.8%	23.2%	24.7%	27.2%	<b>28.6%</b>	
Cash and cash equivalents	¥ 547,844	¥ 528,174	¥ 420,166	¥ 358,593	<b>¥ 266,698</b>	<b>\$ 3,252,415</b>
Interest-bearing loans	887,336	883,480	577,443	470,823	<b>381,148</b>	<b>4,648,146</b>
D/E ratio (times)	0.94	1.18	0.72	0.57	<b>0.45</b>	
Net D/E ratio (times)	0.36	0.47	0.20	0.14	<b>0.14</b>	
Free cash flow	38,146	23,487	296,409	113,426	<b>49,180</b>	<b>599,756</b>
Cash dividends per share for the year (Yen and U.S. Dollars)	¥ 8.00	¥ 8.00	¥ 8.00	¥ 10.00	<b>¥ 10.00</b>	<b>\$ 0.122</b>
Total amount of dividends	16,552	16,538	16,522	20,696	<b>20,694</b>	<b>252,366</b>
Dividend payout ratio on a consolidated basis	34.3%	—	17.7%	37.6%	<b>48.4%</b>	
R&D expenses	¥ 258,717	¥ 249,902	¥ 224,951	¥ 236,210	<b>¥ 238,360</b>	<b>\$ 2,906,829</b>
Capital expenditure on property, plant and equipment	249,063	167,690	126,481	130,218	<b>140,626</b>	<b>1,714,951</b>
Depreciation	200,509	223,975	164,844	141,698	<b>131,577</b>	<b>1,604,598</b>
Number of employees	167,374	165,612	172,438	172,336	<b>173,155</b>	
Average exchange rate (yen)						
U.S. Dollar	¥ 114	¥ 101	¥ 93	¥ 86	<b>¥ 79</b>	
Euro	162	144	131	113	<b>109</b>	
Pound Sterling	229	174	148	133	<b>126</b>	

Notes: 1. The U.S. dollar amounts stated above and in the following Management's Discussion and Analysis of Operations have been translated from yen, for readers' convenience only, at the rate of ¥82 = US\$1, which was the approximate rate on the Tokyo Foreign Exchange Market at March 31, 2012.

2. Owners' equity: Net assets less minority interests in consolidated subsidiaries and subscription rights to shares

# Management's Discussion and Analysis of Operations

The following section, Management's Discussion and Analysis of Operations, provides an overview of the consolidated financial statements of Fujitsu Limited (the "Company") and its consolidated subsidiaries (together, the "Group") for the year ended March 31, 2012 (fiscal 2011). Forward-looking statements in this section are based on management's understanding and best judgment as of March 31, 2012. The impact of exchange rate fluctuations is calculated by taking the average exchange rates in fiscal 2010 for the U.S. Dollar, Euro and British pound and applying them to foreign currency-denominated transactions in fiscal 2011.

## 1. Analysis of Results

### Business Environment

In the global economy during fiscal 2011, the increasingly serious government debt problems in Europe had an adverse impact on the real economy, including a negative growth rate. In the United States, despite signs of improvement in employment and consumer spending, the economy has yet to reach full-fledged recovery. In emerging markets, previously high growth rates fell slightly as exports declined in the face of fiscal austerity measures and the economic slowdown in Europe.

In Japan, the supply chain was restored quicker than expected from the stalled condition that followed the Great East Japan Earthquake, but the economy became sluggish again by the slowdown in the global economy, the decline in exports due to the strong yen, and the damage caused by the flooding in Thailand. Signs of improvement were seen in the fourth quarter, however, as exchange rates moved toward a weakening of the yen, and companies recovered from the Thailand flood damage.

With regard to investment in information and communication technology (ICT), despite signs of recovery in certain sectors, on the whole companies maintained a cautious stance toward investment, deterring a full-fledged recovery.

### Net Sales

Consolidated net sales for fiscal 2011 amounted to ¥4,467.5 billion (\$54,483 million), a decline of 1.3% from fiscal 2010. On a constant currency basis, however, sales were on a par with the prior fiscal year.

### Condensed Consolidated Income Statements

Years ended March 31	2011	2012	YoY Change	Change (%)
Net sales	4,528.4	<b>4,467.5</b>	(60.8)	(1.3)
Cost of sales	3,270.9	<b>3,232.1</b>	(38.7)	(1.2)
Gross profit	1,257.4	<b>1,235.4</b>	(22.0)	(1.8)
Selling, general and administrative expenses	1,124.8	<b>1,130.1</b>	5.2	0.5
Operating income	132.5	<b>105.3</b>	(27.2)	(20.6)
Other income (expenses)	(30.3)	<b>(38.5)</b>	(8.2)	—
Income before income taxes and minority interests	102.2	<b>66.7</b>	(35.5)	(34.7)
Income taxes	48.1	<b>29.9</b>	(18.1)	(37.7)
Minority interests in income (loss) of consolidated subsidiaries	(1.0)	<b>(5.9)</b>	(4.9)	—
Net income (loss)	55.0	<b>42.7</b>	(12.3)	(22.5)

### Reference: Financial Indicators

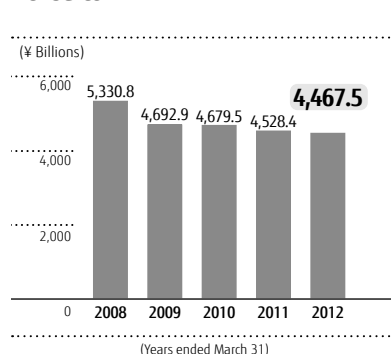
Years ended March 31	2011	2012	YoY Change
Net sales	4,528.4	<b>4,467.5</b>	(60.8)
Sales outside Japan	[1,587.3]	<b>[1,506.0]</b>	[(81.2)]
Ratio of sales outside Japan	[35.1%]	<b>[33.7%]</b>	[(1.4)%]
Gross profit margin	27.8%	<b>27.7%</b>	(0.1%)
Operating income margin	2.9%	<b>2.4%</b>	(0.5%)
Return on equity	6.8%	<b>5.1%</b>	(1.7%)

Notes: Owners' equity: Net assets – Subscription rights to shares – Minority interests  
Return on equity (ROE): Net income ÷ {(Owners' equity at beginning of period + Owners' equity at end of period) ÷ 2}

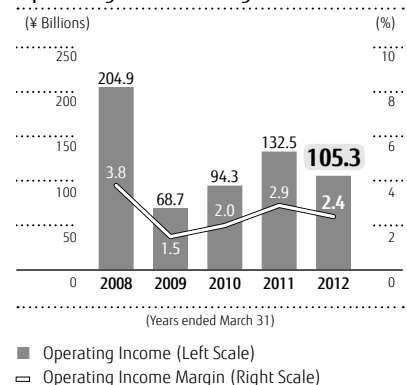
### Reference: Quarterly Breakdown of Net Sales and Operating Income

Year ended March 31, 2012	1Q	2Q	3Q	4Q	Full Year
Net sales	986.0	1,106.2	1,079.7	1,295.5	4,467.5
YoY change	(61.1)	6.0	(16.7)	11.0	(60.8)
Operating income	(17.1)	24.1	3.1	95.0	105.3
YoY change	(27.1)	(12.9)	(18.1)	30.9	(27.2)

### Net Sales



### Operating Income and Operating Income Margin



Sales in Japan were essentially unchanged from fiscal 2010. The decline in sales due to customers' production adjustments precipitated by the flooding in Thailand mainly impacted products such as car audio and navigation systems, and LSI devices. In addition to the slowdown in demand for LSI devices and electronic components, server-related revenues also declined due to reductions in project proposals for large-scale systems. However, sales increased for mobile phones and for network products such as mobile phone base stations with the widespread adoption of smartphones. Sales outside Japan decreased 5.1% year on year, but on a constant currency basis were essentially unchanged from the previous fiscal year. Revenue declined for electronic components and UNIX servers, but PC sales rose in emerging economies such as Turkey, Middle Eastern countries and Russia.

The ratio of sales outside Japan was 33.7%, a decrease of 1.4 percentage points compared to the previous fiscal year. This was due to the impact from currency exchange rates, as well as a decline in sales of UNIX servers in the Americas region.

In fiscal 2011, the average yen exchange rates against the U.S. Dollar, the Euro, and the British pound were ¥79, ¥109, and ¥126, respectively, representing a year-on-year appreciation of ¥7 against the U.S. Dollar, ¥4 against the Euro, and ¥7 against the British pound. Exchange rate fluctuations versus the U.S. Dollar, Euro, and British pound caused a reduction in net sales of approximately ¥40.0 billion, ¥20.0 billion, and ¥20.0 billion respectively. As a result, currency exchange rate fluctuations had a negative impact of approximately ¥80.0 billion on net sales for fiscal 2011.

### **Cost of Sales, Selling, General & Administrative Expenses, and Operating Income**

The cost of sales totaled ¥3,232.1 billion (\$39,416 million), with gross profit of ¥1,235.4 billion (\$15,066 million), for a gross profit margin of 27.7%. Gross profit decreased ¥22.0 billion compared to the previous fiscal year, due mainly to revenue declines in LSI devices and electronic components. The gross profit margin was on a par with that of the previous year.

Selling, general and administrative, (SG&A) expenses were ¥1,130.1 billion (\$13,782 million), an increase of ¥5.2 billion from the previous year. Among SG&A expenses, research and development spending amounted to ¥238.3 billion (\$2,907 million), an increase of ¥2.1 billion. The Group continued to make upfront investments in such areas as networks and cloud services. The ratio of R&D expenses to sales was essentially unchanged from the previous fiscal year at 5.3%.

As a result, operating income amounted to ¥105.3 billion (\$1,284 million), a decrease of ¥27.2 billion compared to fiscal 2010. The operating income margin was 2.4%, a decline of 0.5 percentage points. Along with impacts from natural disasters and sluggish economic conditions, this performance reflected the continuing effect of upfront investment.

The Group is striving to quickly achieve a consolidated operating income margin of over 5% as a measure of performance. For fiscal

2012, which will serve as an intermediate step in this direction, we are targeting net sales of ¥4,550.0 billion (\$55,488 million), operating income of ¥135.0 billion (\$1,646 million), and an operating income margin of 3.0%. As structural reforms to realize an assertive posture for new growth, we are bolstering customer contact capabilities, bolstering system engineering (SE) capabilities, and bolstering technical capabilities. To build the base to carry these reforms forward, on April 1, 2012 our companywide formation was reconfigured into a matrix organization composed of customer and business axes. In addition to further clarifying the account sales structure, thereby heightening sales specialization, we intend to enhance customer contact capabilities in terms of both quality and volume through tying up field innovators and sector consultants—visualization professionals who make on-site operations more transparent. In SE, efforts since fiscal 2004 to integrate sales divisions and curb unprofitable projects have yielded some success. Nevertheless, to transform ourselves into an organization offering globally competitive technology, quality, and cost, we opted to move from a sector-vertical sales and SE framework and once again spin off SE to establish a new System Integration unit. In parallel, a new Software Integration unit was established to spur a shift to a software-centric business structure offering products along an integrated vertical model from a services/solutions perspective. Through these changes, the Group is offering up high-value-added solutions that bring together software, infrastructure services and systems integration, while taking advantage of its strengths in the value chain with products to put a structure in place for offering one-stop solutions on a global basis.

Operating income fluctuated considerably by quarter during fiscal 2011 amid the lag in a full-fledged recovery in ICT investment, and the impact from natural disasters. During the first quarter, the Group posted an operating loss of ¥17.1 billion (\$209 million) due to the extensive impact from the Great East Japan Earthquake, centered mainly on car audio and navigation systems, mobile phones, and LSI devices. In the second quarter, the effects of the earthquake disaster had for the most part abated, and the Group recorded operating income of ¥24.1 billion (\$295 million). However, compared to the same period of the previous fiscal year this represented a decline of ¥12.9 billion, due mainly to deteriorating market conditions for LSI devices and electronic components. In the third quarter, the market downturn for LSI devices and electronic components and the flooding in Thailand adversely impacted, and the Group managed operating income of just ¥3.1 billion (\$39 million), a decrease of ¥18.1 billion compared to the same period of the previous fiscal year. In the fourth quarter, however, the Company posted operating income of ¥95.0 billion (\$1,159 million), up ¥30.9 billion from the same period of the previous fiscal year, due mainly to successful efforts to enhance profitability management in services businesses outside Japan, greater sales of network products and mobile phones, and a return to profitability for LSI devices and electronic components.

The Group strives to minimize the impact of currency exchange rate fluctuations on earnings. During fiscal 2011, performance was negatively impacted by the appreciation of the yen against the U.S.

Dollar and the Euro, but because of the weakening of the U.S. Dollar against the Euro, the Group's European subsidiaries were able to lower dollar-denominated purchasing costs for parts and materials. As a result, the impact on operating income from currency fluctuations during fiscal 2011 was minimal overall. For fiscal 2011, a one yen (¥1) fluctuation in the currency exchange rate translated into an impact on operating income of approximately ¥0.6 billion for the U.S. Dollar, ¥0.3 billion for the Euro, and ¥0.0 billion for the British pound.

### Other Income (Expenses), Net Income and Comprehensive Income

Other income (expenses) amounted to a net loss of ¥38.5 billion (\$470 million), an increase of ¥8.2 billion from the previous fiscal year. Although foreign exchange losses improved and the financial balance (interest income plus dividend income minus interest charges) improved from fiscal 2010 due to a decline in interest-bearing debt, the Group recorded ¥15.1 billion (\$185 million) in business restructuring costs as other expenses. The business restructuring costs were for the LSI devices, car audio and navigation systems, and services businesses outside Japan. In LSI devices, as part of the restructuring program to optimize manufacturing capabilities, the Company decided to transfer the Iwate Plant, one of its front-end manufacturing centers, to Denso Corporation, recording ¥5.9 billion (\$73 million) in impairment losses on plant disposal and one-time costs for the relocation of employees. In car audio and navigation systems, the Group spent ¥5.2 billion (\$64 million) for reassigning employees at plants in Japan as part of a reorganization of production operations to enhance cost competitiveness, while in services outside Japan, the Group recorded ¥3.9 billion (\$48 million) in expenses related to personnel rationalization, mainly in Europe and North America. In addition, the Group recorded ¥7.5 billion (\$92 million) for fixed costs as other expenses associated with the suspension of operations at factories affected by customer-related factors and factories damaged by aftershocks from the Great East Japan Earthquake.

Consolidated net income amounted to ¥42.7 billion (\$521 million), a decrease of ¥12.3 billion from the previous fiscal year. Income before income taxes and minority interests fell ¥35.5 billion to ¥66.7 billion (\$814 million), mainly as a result of the decline in operating income, along with the recording of business restructuring costs and other expenses. Income taxes decreased ¥18.1 billion year-on-year to ¥29.9 billion (\$366 million). The ratio of income taxes to income before income taxes and minority interests was 45%, compared with 47% in fiscal 2010. Although income tax expenses increased due to adjustments in deferred tax assets stemming from revisions to Japan's tax code, this was offset by lower tax expenses arising from decision of the liquidation of the Company's European subsidiary Fujitsu International Finance (Netherlands) B.V. during the second quarter, and a stock transfer executed in line with group reorganization. Minority interests totaled a loss of ¥5.9 billion (\$73 million), an increase of ¥4.9 billion resulting from deteriorating financial performance at the Company's car audio and navigation

equipment joint venture, and a listed components subsidiary.

The Group views profitability and efficiency of invested capital in businesses as important management indicators. For fiscal 2011, the return on equity, calculated by dividing net income by average owners' equity, was 5.1%, a decline of 1.7 percentage points from the previous fiscal year.

Other comprehensive income totaled a loss of ¥2.4 billion (\$29 million), primarily as a result of a foreign currency translation adjustment loss stemming from the ongoing appreciation of the yen. Because the Group's global business development primarily revolves around service businesses, foreign currency fluctuations in the value of the net assets of subsidiaries outside Japan are recorded in other comprehensive income. The impact of stock price fluctuations on the unrealized gain and loss on securities, net of taxes, is limited.

Comprehensive income, representing the total of other comprehensive income and income before minority interests, was ¥34.3 billion (\$418 million).

## 2. Segment Information

### Information by Operating Segment

#### Sales and Operating Income by Segment

The reportable segments were consolidated into the three segments of "Technology Solutions," "Ubiquitous Solutions," and "Device Solutions," based on organizational structure, the characteristics of the products and services, and the similarities in sales markets. The "Other Operations" segment includes operations not included in the reportable segments, such as Japan's Next-Generation Supercomputer project, facility services and the development of information systems for Group companies, and welfare benefits for Group employees.

Sales (including intersegment sales) and operating income by segment for fiscal 2011 are shown on the following pages.

		(Unit: billion yen)			
Years ended March 31		2011	2012	YoY Change	Change (%)
Technology Solutions	Net sales . . . . .	3,014.3	<b>2,934.9</b>	(79.4)	(2.6)
	Operating income . . . . .	162.8	<b>171.2</b>	8.4	5.2
	[Operating income margin] . . . . .	[5.4%]	<b>[5.8%]</b>	[0.4%]	
Ubiquitous Solutions	Net sales . . . . .	1,125.6	<b>1,154.2</b>	28.6	2.5
	Operating income . . . . .	22.6	<b>19.9</b>	(2.7)	(12.1)
	[Operating income margin] . . . . .	[2.0%]	<b>[1.7%]</b>	[(0.3%)]	
Device Solutions	Net sales . . . . .	630.6	<b>584.7</b>	(45.9)	(7.3)
	Operating income . . . . .	20.9	<b>(10.1)</b>	(31.1)	—
	[Operating income margin] . . . . .	[3.3%]	<b>[(1.7%)]</b>	[(5.0%)]	
Other Operations/ Elimination & Corporate	Net sales . . . . .	(242.2)	<b>(206.3)</b>	35.9	—
	Operating income . . . . .	(73.9)	<b>(75.7)</b>	(1.8)	—
Consolidated	Net sales . . . . .	4,528.4	<b>4,467.5</b>	(60.8)	(1.3)
	Operating income . . . . .	132.5	<b>105.3</b>	(27.2)	(20.6)
	[Operating income margin] . . . . .	[2.9%]	<b>[2.4%]</b>	[(0.5%)]	

## Technology Solutions

The Technology Solutions segment delivers products, software, and services to customers in an optimal, integrated package of comprehensive services. These consist of Solutions/Systems Integration, which are services for the construction of information and communication systems, Infrastructure Services, which are primarily outsourcing and maintenance services, System Products, which covers mainly the servers and storage systems that comprise ICT platforms, and Network Products, which are used to build communications infrastructure, such as mobile phone base stations and optical transmission systems.

Consolidated segment net sales totaled ¥2,934.9 billion (\$35,792 million), a year-on-year decline of 2.6%. Sales in Japan decreased 1.5%. Server-related sales declined mainly due to the impact from high-volume production in fiscal 2010 of dedicated servers for Japan's Next-Generation Supercomputer system. Revenue from infrastructure services also fell as a result of the shift in the network services' ISP\*<sup>1</sup> business from packaged services that include connection fees to stand-alone services. ICT investment is recovering in the manufacturing, retail and health care sectors, but a decline in business proposals for large-scale projects in the financial and public sectors had an impact on performance. Although we anticipate a full-scale recovery in domestic ICT investment from the second half of the next fiscal year, Japanese mobile carriers are stepping up investment to handle the greater network traffic stemming from the widespread adoption of smartphones, and sales rose for network products such as mobile phone base stations. Sales outside Japan declined 4.6%, but on a constant currency basis were roughly on a par with the prior fiscal year. Sales declined for UNIX servers to the US and Europe, and growth was sluggish for optical transmission systems and other network products as a result of curbs on investment by North American carriers. However, revenue from infrastructure services increased in such regions as Australia and Scandinavia.

Segment operating income amounted to ¥171.2 billion (\$2,089 million), an increase of ¥8.4 billion compared to fiscal 2010. In Japan, despite a boost from greater sales of mobile phone base stations and cost reductions for PC servers, earnings declined mainly as a result of a decrease in project proposals for large-scale systems in the solutions/SI and server-related fields, and ongoing upfront investments in cloud services. Outside Japan, despite a fall in sales of UNIX servers, a revenue drop for optical transmission systems, and an increase in upfront development spending, earnings rose on gradually improving profitability in the services business in Europe.

\*<sup>1</sup> Internet Service Provider business. This refers to the provision of value-added services in the domain of services supporting safe, secure and trouble-free internet usage, and includes the provision of Internet connectivity services, security, and troubleshooting support via phone or onsite visits.

## Ubiquitous Solutions

The Ubiquitous Solutions segment contains ubiquitous terminals or sensors-including personal computers and mobile phones, as well as car audio and navigation systems, mobile communication equipment, and automotive electronic equipment that collect and utilize

various information and knowledge generated from the behavioral patterns of people and organizations needed to achieve the Group's vision of a "Human Centric Intelligent Society" (a society that enjoys the benefits of the value generated by ICT without requiring anyone to be conscious of the technological complexities involved).

Net sales in this segment totaled ¥1,154.2 billion (\$14,077 million), an increase of 2.5% from the previous fiscal year. Sales in Japan increased 3.9%. PC sales, despite business deals with corporations for bulk purchases, were on the whole unchanged from the prior year due to falling retail prices in the consumer market, and difficulties procuring HDDs as a result of the flooding in Thailand. Mobile phone sales rose on the boost from the merger with Toshiba Corporation's mobile phone business, and expansion of the smartphone market. Sales of mobilewear sub-segment's car audio and navigation systems decreased, mainly as a result of the suspension of automobile manufacturing due to the Great East Japan Earthquake and the flooding in Thailand. Sales outside Japan declined 1.7%, but rose 3.0% on a constant currency basis. Mobilewear device sales declined as a result of the suspension of automobile production overseas, while PC unit sales increased, centered on Europe.

Segment operating income amounted to ¥19.9 billion (\$243 million), a decrease of ¥2.7 billion compared to fiscal 2010. In Japan, in response to falling retail prices for PCs and rising procurement costs for HDDs, the Company took steps to utilize the strong yen to lower procurement costs. In mobile phones, while the rise in sales boosted earnings, the Company stepped up investment in smartphone development. The decline in mobilewear sales had an impact on performance, and overall earnings were roughly on a par with the previous fiscal year. Outside Japan, earnings were affected by rising procurement costs for PC HDDs, and the revenue decline in mobilewear.

The earthquake disaster in Japan and flooding in Thailand had a considerable impact on the car audio and navigation business. The Company, in order to enhance cost competitiveness that will allow the business to adapt to the global business expansion of its clients, strengthened overseas production capacity and reorganized the Japanese production structure to which it is linked.

## Device Solutions

The Device Solutions segment provides cutting-edge technology products, such as LSI devices used in digital home appliances, automobiles, mobile phones and servers, as well as electronic components consisting chiefly of semiconductor packages.

Net sales in this segment totaled ¥584.7 billion (\$7,130 million), a decrease of 7.3% from the previous fiscal year. Sales in Japan fell 5.1%. Sales of LSI devices decreased due to the completion in the first quarter of shipments of CPUs for Japan's Next-Generation Supercomputer system, which were produced in high volume in fiscal 2010, as well as to the impact from the earthquake disaster in the first quarter. Another factor was the decline for digital AV systems as a result of the flooding in Thailand. Electronic components sales also fell on slack demand for semiconductor packages. Sales outside Japan decreased 10.2%, or 4% on a constant currency basis. In LSIs,

sales rose for image processing LSIs used in smartphones. In electronic components, sales of semiconductor packages and LCD modules declined, centered in Asia, but signs of a partial recovery in demand began to appear in the fourth quarter.

The segment posted an operating loss for the period of ¥10.1 billion (\$124 million), representing a deterioration of ¥31.1 billion from fiscal 2010. In Japan, LSI earnings were affected by the revenue decline, and the decrease in capacity utilization of manufacturing lines in response to the decline in demand. Electronic components earnings were affected by lower sales and rising prices for certain materials. Outside Japan, earnings from electronic components were impacted by falling sales and exchange rates.

In April 2012, with the aim of streamlining production capacity in the LSI business, the Group concluded an agreement with Denso Corporation for the transfer of the Iwate Plant (transfer scheduled for October 1, 2012). In accordance with this transfer, the Company recorded ¥5.9 billion (\$73 million) in business restructuring costs for impairment losses on disposal of property, plant and equipment, and expenses for the relocation of employees.

#### Other Operations/Elimination and Corporate

This category includes operations not included in the reportable segments, such as Japan's Next-Generation Supercomputer project, facility services and the development of information systems for Group companies, and welfare benefits for Group employees.

This category also includes expenses which are not classified into an operating segment. The expenses consist of strategic expenses such as basic research and development expenses, as well as group management shared expenses incurred by the Company.

The category posted an operating loss of ¥75.7 billion (\$924 million), representing a deterioration of ¥1.8 billion over fiscal 2010. This was due mainly to upfront investments for new business development.

The K computer, which is being jointly developed by Japan's Institute of Physical and Chemical Research (RIKEN) and the Company, incorporates CPUs developed by the Group and other technologies of the Group. The system has reached 93% of the target calculation speed of 10 petaflops per second, and for the second consecutive term achieved the No. 1 ranking on the TOP500 list of most powerful supercomputers, announced in November 2011. The manufacturing of more than 800 computing racks has been completed, and development has entered the final stage. The system is expected to be made available for use by researchers and other scientists in November 2012.

#### Geographic Information

One of the Group's management priorities is to increase sales and raise profitability of its business in growing markets outside Japan. Geographic financial information is important to the Group's business management and is useful for shareholders and investors in understanding the Group's financial overview.

		(Unit: billion yen)			
Years ended March 31		2011	2012	YoY Change	Change (%)
Japan	Net sales . . . . .	3,389.2	<b>3,396.2</b>	6.9	0.2
	Operating income . . . . .	215.7	<b>177.8</b>	(37.9)	(17.6)
	[Operating income margin] . . . . .	[6.4%]	<b>[5.2%]</b>	[(1.2%)]	
Europe, Middle East, Africa (EMEA)	Net sales . . . . .	849.5	<b>817.5</b>	(32.0)	(3.8)
	Operating income . . . . .	(18.4)	<b>(0.0)</b>	18.4	—
	[Operating income margin] . . . . .	[(2.2%)]	<b>[(0.0%)]</b>	[2.2%]	
The Americas	Net sales . . . . .	298.4	<b>277.5</b>	(20.8)	(7.0)
	Operating income . . . . .	2.6	<b>0.4</b>	(2.1)	(81.7)
	[Operating income margin] . . . . .	[0.9%]	<b>[0.2%]</b>	[(0.7%)]	
Asia-Pacific (APAC) & China	Net sales . . . . .	405.1	<b>421.9</b>	16.7	4.1
	Operating income . . . . .	11.0	<b>7.6</b>	(3.4)	(31.0)
	[Operating income margin] . . . . .	[2.7%]	<b>[1.8%]</b>	[(0.9%)]	
Elimination & Corporate	Net sales . . . . .	(414.0)	<b>(445.7)</b>	(31.7)	—
	Operating income . . . . .	(78.3)	<b>(80.6)</b>	(2.2)	—
Consolidated	Net sales . . . . .	4,528.4	<b>4,467.5</b>	(60.8)	(1.3)
	Operating income . . . . .	132.5	<b>105.3</b>	(27.2)	(20.6)
	[Operating income margin] . . . . .	[2.9%]	<b>[2.4%]</b>	[(0.5%)]	

#### Japan

Net sales amounted to ¥3,396.2 billion (\$4,148 million), roughly on a par with fiscal 2010. Production adjustments among customers due to the flooding in Thailand had a negative impact on sales, leading to revenue declines for car audio and navigation systems and LSI devices, as well as server products and electronic components. However, sales rose for mobile phones, as well as network products, centered on mobile phone base stations. Operating income in Japan totaled ¥177.8 billion (\$2,169 million), a year-on-year decrease of ¥37.9 billion. Earnings were boosted by greater revenue from network products, but declined overall as a result of the drop in sales for LSI devices and electronic components, as well as upfront R&D investment in network and cloud services.

#### EMEA

Net sales amounted to ¥817.5 billion (\$9,971 million), a decline of 3.8% from fiscal 2010, but roughly on a par with the previous fiscal year on a constant currency basis. PC sales expanded in emerging economies such as Turkey, Middle Eastern countries and Russia, and revenue rose in the services businesses in Scandinavia and UK private sector, though sales were down in UK public sector and in continental Europe. Operating income in EMEA was essentially at break-even point, improving by ¥18.4 billion from the loss in the previous fiscal year. The operating loss in fiscal 2010 was due mainly to the one-time recognition of initial costs and other expenses associated with the cancellation of certain long-term services contracts.

### The Americas

Net sales amounted to ¥277.5 billion (\$3,385 million), a decrease of 7.0% from fiscal 2010. Revenue declined for car audio and navigation systems and LSI devices, with sales also sluggish in the services business, centered on the United States. Sales of optical transmission systems were positive during the first half of the fiscal year, but slowed briefly during the second half, ending flat for the full fiscal year. Operating income for the region totaled ¥0.4 billion (\$6 million), a decline of ¥2.1 billion from fiscal 2010. This was due mainly to upfront investments in development for optical transmissions systems.

### APAC & China

Net sales amounted to ¥421.9 billion (\$5,146 million), a year-on-year increase of 4.1%. Sales decreased for car audio and navigation systems, while sales rose for LSI device. Operating income for the region totaled ¥7.6 billion (\$93 million), a decrease of ¥3.4 billion over fiscal 2010. This was due mainly to the decline in sales of car audio and navigation systems.

## 3. Analysis of Capital Resources and Liquidity

### Assets, Liabilities and Net Assets

#### Condensed Consolidated Balance Sheets

(Unit: billion yen)

As of March 31	2011	2012	YoY Change
<b>Assets</b>			
Current assets . . . . .	1,760.6	<b>1,701.7</b>	(58.8)
Investments and long-term loans . .	372.8	<b>372.4</b>	(0.3)
Property, plant and equipment . .	638.6	<b>640.9</b>	2.3
Intangible assets. . . . .	251.9	<b>230.2</b>	(21.6)
Total assets . . . . .	3,024.0	<b>2,945.5</b>	(78.5)
<b>Liabilities</b>			
Current liabilities. . . . .	1,507.8	<b>1,417.4</b>	(90.3)
Long-term liabilities . . . . .	562.5	<b>561.4</b>	(1.0)
Total liabilities. . . . .	2,070.3	<b>1,978.9</b>	(91.4)
<b>Net assets</b>			
Shareholders' equity . . . . .	903.9	<b>926.0</b>	22.1
Accumulated other comprehensive income. . . . .	(82.6)	<b>(85.0)</b>	(2.3)
Minority interests in consolidated subsidiaries . . . . .	132.4	<b>125.4</b>	(6.9)
Total net assets . . . . .	953.7	<b>966.5</b>	12.8
Total liabilities and net assets . . .	3,024.0	<b>2,945.5</b>	(78.5)
<b>Cash and cash equivalents at</b>			
end of year . . . . .	358.5	<b>266.6</b>	(91.8)
Interest-bearing loans. . . . .	470.8	<b>381.1</b>	(89.6)
Net interest-bearing loans . . . . .	112.2	<b>114.4</b>	2.2
Owners' equity. . . . .	821.2	<b>841.0</b>	19.7

Notes: Year-end balance of interest-bearing loans: Short-term borrowings and current portion of bonds payable (Current liabilities) + Long-term borrowings and bonds payable (Non-current liabilities)  
 Net debt: (Interest-bearing loans – cash and cash equivalents)  
 Owners' equity: Net assets – Subscription rights to shares – Minority interests in consolidated subsidiaries

### Reference: Financial Indicators

(Unit: billion yen)

Years ended March 31	2011	2012	YoY Change
Inventories. . . . .	341.4	<b>334.1</b>	(7.3)
[Inventory turnover ratio] . .	[13.65]	<b>[13.23]</b>	[(0.42)]
[Monthly inventory turnover rate] . . . . .	[1.02]	<b>[1.01]</b>	[(0.01)]
Shareholders' equity ratio . .	29.9%	<b>31.4%</b>	1.5%
Owners' equity ratio . . . . .	27.2%	<b>28.6%</b>	1.4%
D/E ratio (times) . . . . .	0.57	<b>0.45</b>	(0.12)
Net D/E ratio (times) . . . . .	0.14	<b>0.14</b>	–

Notes: Inventory turnover ratio: Net sales ÷ ((Beginning balance of inventories + year-end balance of inventories) ÷ 2)  
 Monthly inventory turnover: Net sales ÷ Average inventories during period\* ÷ 12  
 Shareholders' equity ratio: Shareholders' equity ÷ Total assets  
 Owners' equity ratio: (Net assets – Subscription rights to shares – Minority interests in consolidated subsidiaries) ÷ Total assets  
 D/E ratio: Interest-bearing loans ÷ Owners' equity  
 Net D/E ratio: Net debt (Interest-bearing loans – cash and cash equivalents) ÷ Owners' equity

\* Average inventories during period are calculated as the average of the ending balance of inventories for each of the four quarters of the fiscal year.

Consolidated total assets at the end of fiscal 2011 amounted to ¥2,945.5 billion (\$35,921 million), a decrease of ¥78.5 billion compared to the end of fiscal 2010. Current assets totaled ¥1,701.7 billion (\$20,753 million), a decrease of ¥58.8 billion. Cash and cash equivalents decreased ¥91.8 billion, used mainly to redeem convertible bonds at maturity and for repayment of debt. Trade receivables increased ¥24.2 billion, due mainly to a rise in fourth quarter sales (Jan-Mar 2012) compared to the same period of the previous fiscal year. Inventories totaled ¥334.1 billion (\$4,075 million), a decrease of ¥7.3 billion from a year earlier. Following the Great East Japan Earthquake and flooding in Thailand, the Group had increased its inventory holdings of parts and materials to prepare for unforeseen circumstances, although steady progress was achieved in the delivery of the Japan's Next-Generation Supercomputer system. The monthly inventory turnover ratio, an indicator of asset utilization efficiency, was 1.01 times, essentially unchanged from the previous fiscal year. Fixed assets totaled ¥1,243.7 billion (\$15,167 million), a decline of ¥19.7 billion. Intangible assets decreased ¥21.6 billion, due mainly to the amortization of goodwill.

Total liabilities amounted to ¥1,978.9 billion (\$24,133 million), a decrease of ¥91.4 billion from the end of fiscal 2010. The balance of interest-bearing loans was ¥381.1 billion (\$4,648 million), a decrease of ¥89.6 billion. This was due mainly to efforts to repay debt, along with the redemption of ¥100.0 billion of convertible bonds at maturity. For the redemption of the convertible bonds, together with an allocation of cash on hand, the Company issued ¥50.0 billion in straight bonds with maturity periods of three and five years. As a result, the D/E ratio was 0.45 times, an improvement of 0.12 percentage points compared to the end of fiscal 2010, with the net D/E ratio at 0.14 times, the same level as the end of the previous fiscal year. The figures for both the D/E ratio and the net D/E ratio are record lows for the Group.

Net assets amounted to ¥966.5 billion (\$1,788 million), an increase of ¥12.8 billion from the end of fiscal 2010. This was due mainly to shareholders' equity of ¥926.0 billion (\$1,293 million), an increase of ¥22.1 billion, because of the net income recorded in fiscal 2011. Accumulated other comprehensive income, centered on foreign currency translation adjustments and unrealized gain and loss on securities, net of taxes, amounted to negative ¥85.0 billion (\$1,037 million), roughly on a par with the previous fiscal year. Exchange rates and share prices fluctuated considerably during fiscal 2011, but were roughly equivalent in an end-of-year comparison. The owners' equity ratio was 28.6%, an increase of 1.4 percentage points over the end of fiscal 2010.

The unrecognized obligation for retirement benefits\*2 was ¥400.9 billion (\$ 48,893 million). The level in Japan decreased by ¥23.2 billion year on year, to ¥292.0 billion (\$3,561 million) at the end of fiscal 2011. Outside Japan, the level increased by ¥34.5 billion to ¥108.9 billion (\$1,328 million), due mainly to an increase in retirement benefit obligations stemming from a drop in the discount rate\*3 used by a UK subsidiary. The future minimum lease payment required under non-cancelable operating leases at the end of fiscal 2011 amounted to ¥79.6 billion (\$972 million). In addition, commitments outstanding at March 31, 2012 for purchases of property, plant and equipment and intangible assets were ¥6.7 billion (\$82 million), and contingent liabilities for guarantee contracts amounted to ¥2.2 billion (\$27 million).

\*2 Unrecognized obligations consist primarily of unrecognized actuarial losses. "Actuarial losses" refer to disparities that occur chiefly as the result of differences between expected and actual returns from pension plan assets differences between the estimates used for the actuarial calculation of retirement benefit obligations and actual obligations, and changes in estimates. Of these differences, those that have not yet been expensed are referred to as "unrecognized actuarial losses." The Group expenses actuarial losses that arise over the average remaining service period of its employees. Up to June 25, 2012, the filing date of the Annual Securities Report, accounting standards for retirement benefits were revised. Net assets are expected to decrease when the Group adopts the revised accounting standards. The details are noted in "Notes to Consolidated Financial Statements, 1. Significant Accounting Policies, (u) Accounting standards issued but not yet effective."

\*3 Refers to the rate used to discount to present value the amount of expected retirement benefits deemed to be incurred for each projected retirement period incurred by the fiscal year-end. The rate is decided with reference to interest on high-quality corporate bonds as of the balance-sheet date.

**Cash Flows**

**Condensed Consolidated Statements of Cash Flows**

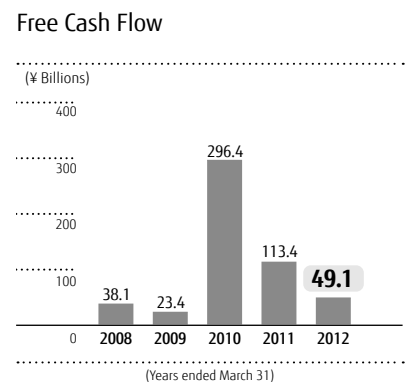
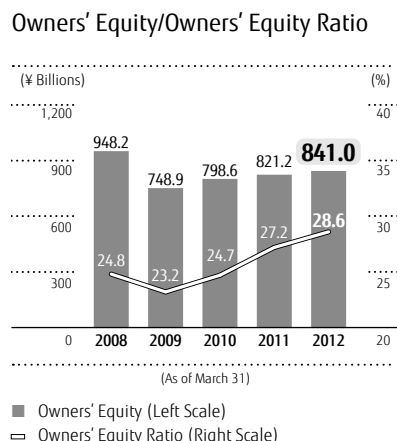
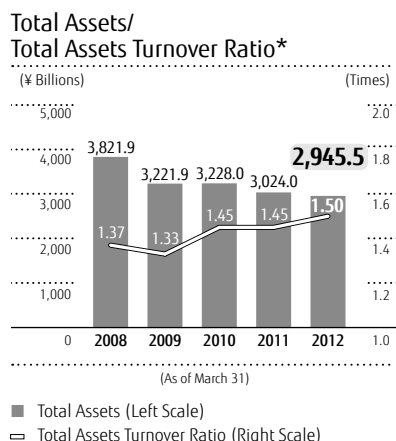
(Unit: billion yen)

Years ended March 31	2011	2012	YoY Change
I Cash flows from operating activities . . .	255.5	<b>240.0</b>	(15.5)
II Cash flows from investing activities . . .	(142.1)	<b>(190.8)</b>	(48.7)
I+II Free cash flow . . . . .	113.4	<b>49.1</b>	(64.2)
[Excluding one-time items] . . . . .	[73.3]	<b>[43.5]</b>	[(29.8)]
III Cash flows from financing activities . .	(166.9)	<b>(138.9)</b>	27.9
IV Cash and cash equivalents at end of year . . . . .	358.5	<b>266.6</b>	(91.8)

Note: "Free cash flow excluding one-time items" refers to free cash flow excluding proceeds from sales of investment securities, as well as proceeds from acquisition of subsidiaries' stock resulting in change in scope of consolidation and transfer of businesses.

Net cash provided by operating activities during fiscal 2011 amounted to ¥240.0 billion (\$2,927 million), a decrease of ¥15.5 billion from the previous fiscal year. This was due mainly to deterioration in income before income taxes and minority interests, stemming from such factors as the flooding in Thailand, slack demand for LSI devices and electronic components, and a decrease in project proposals for large-scale systems.

Net cash used in investing activities amounted to ¥190.8 billion (\$2,327 million), an increase of ¥48.7 billion from the previous fiscal year. Purchases of property, plant and equipment totaled ¥137.7 billion (\$1,680 million), mainly for capital expenditures centered on data centers, while purchases of intangible assets totaled ¥57.5 billion (\$702 million), mainly for software. During fiscal 2010, there was an inflow of ¥35.1 billion in proceeds from sales of investment securities.



\* Net Sales divided by Average Total Assets

Free cash flow (the sum of cash flows from operating and investing activities) was positive ¥49.1 billion (\$600 million), representing a decrease of ¥64.2 billion year on year. Excluding one-time items, such as proceeds from sales of investment securities, free cash flow was a positive ¥43.5 billion (\$531 million), representing a decrease of ¥29.8 billion year on year.

Net cash used in financing activities amounted to ¥138.9 billion (\$1,695 million), a decrease of ¥27.9 billion from the previous fiscal year. Along with repayment of debt, the Company redeemed ¥100.0 billion in convertible bonds at maturity. For the redemption of the convertible bonds, together with an allocation of cash on hand, the Company issued ¥50.0 billion in straight bonds with maturity periods of three and five years. During fiscal 2010, there was an expenditure for the acquisition of shares from minority shareholders in conjunction with the conversion of PFU Limited into a wholly owned subsidiary.

As a result of the above factors, cash and cash equivalents at the end of fiscal 2011 totaled ¥266.6 billion (\$3,252 million), down ¥91.8 billion from a year earlier.

To ensure efficient funding when the need for funds arises, the Company views the maintenance of an appropriate level of liquidity as an important policy with respect to its financing activities. "Liquidity" refers to cash and cash equivalents and the total unused balance of financing frameworks based on commitment lines established with multiple financial institutions. As of March 31, 2012, the Group had liquidity of ¥464.2 billion (\$5,662 million), of which ¥266.6 billion (\$3,252 million) was cash and cash equivalents and ¥197.5 billion (\$2,409 million) was the yen value of unused commitment lines.

To raise funds from global capital markets, the Group has acquired bond ratings from Moody's Investors Service (Moody's), Standard & Poor's (S&P), and Rating and Investment Information, Inc. (R&I). As of March 31, 2012, the Company had bond ratings (long-term/short-term) of A3 (long-term) from Moody's, A- (long-term) from S&P, and A+ (long-term) and a-1 (short-term) from R&I.

#### 4. Capital Expenditure

In fiscal 2011, capital expenditure totaled ¥140.6 billion (\$1,715 million), an increase of 8.0% from ¥130.2 billion spent in the previous fiscal year. In the Technology Solutions segment, capital expenditures totaled ¥73.4 billion (\$895 million) for expansion of datacenters in Japan, along with datacenters in Australia, Europe and other regions. In the Ubiquitous Solutions segment, the Group spent ¥15.6 billion (\$191 million), mainly for new models of PCs and mobile phones, along with manufacturing facilities for car audio and navigation systems. In the Device Solutions segment, expenditures totaled ¥47.2 billion (\$576 million), mainly for LSI device manufacturing facilities and facilities to increase production of electronic components.

#### 5. Consolidated Subsidiaries

At the end of fiscal 2011, the number of consolidated subsidiaries in Japan totaled 199, and the number outside Japan totaled 339, for a total of 538 subsidiaries. This represents a net gain of three subsidiaries from 535 at the end of fiscal 2010, comprising 23 subsidiaries added through acquisition or establishment, and 20 subsidiaries removed through liquidation or sale. Fujitsu International Finance (Netherlands) B.V., which had been a consolidated subsidiary until fiscal 2010, was liquidated because it concluded its financing role for the Fujitsu Group in Europe.

The number of affiliated companies accounted for by the equity method as of the fiscal year-end totaled 18, three more than a year earlier.

#### 6. Critical Accounting Policies and Estimates

The accompanying consolidated financial statements of the Group have been prepared in accordance with accounting principles and practices generally accepted in Japan and the regulations under the Financial Instruments and Exchange Law of Japan. The preparation of the consolidated financial statements requires management to make assumptions and estimates that affect the amount of the assets, liabilities, contingent assets and contingent liabilities reported at the end of the fiscal year, as well as the amount of revenue and expenses recognized during that term. Actual results may differ from these estimates. The following assumptions and estimates based on the application of accounting principles are those that the management believes may have a material impact on the consolidated financial statements.

##### Revenue Recognition

Revenue from sales of ICT systems and products, excluding customized software under development contracts, is recognized upon acceptance by the customers, whereas revenue from sales of personal computers, other peripheral equipment and electronic devices is recognized when the products are delivered to the customers. Revenue from customized software under development contracts is recognized on a percentage-of-completion basis.

The Group stringently assesses the potential revenue recoverable on projects for which estimated costs have exceeded estimated revenue, and recognizes the amounts assessed as non-recoverable as losses. If the estimated costs relating to such contracts increase further in the future, additional losses may be recognized.

##### Inventories

Inventories are carried at the acquisition cost. However, should the net realizable value ("NRV") at the fiscal year-end fall below that of the acquisition cost, inventories are subsequently measured based on the NRV, with the difference in value between the acquisition cost and the NRV, in principle, booked as cost of sales. Inventories outside the normal operating cycle are calculated at an NRV that reflects future demand and market trends. The Group may experience substantial losses in cases where the NRV drops dramatically as a result of deterioration in the market environment compared to forecasts.

### Property, Plant and Equipment

Depreciation for property, plant and equipment is computed principally by the straight-line method at rates based on the estimated useful lives of the respective assets, reflecting the likely period over which the value of the assets can be realized under normal business conditions. In the future, some equipment and facilities may become obsolete or may be repurposed as a result of technical innovation or other factors. In such cases, their actual useful lives may be reduced to shorter than their originally estimated useful lives. As such, there is a risk that depreciation expenses may increase.

In addition, impairment losses may be recognized in cases in which there is a decline in expected future cash flows from assets due to production facilities becoming idle and a decrease in the capacity utilization rate, associated with rapid changes in the operating environment or other factors, and business realignment.

### Software

Computer software for sale is amortized by a method based on projected sales volume over the estimated life. Computer software for internal use is amortized by the straight-line method over the useful life. Should actual sales volumes fail to meet initial projected volumes, or should actual useful life in the future be less than the original estimate, there is a risk that amortization expenses may increase.

### Goodwill

Goodwill arising from the acquisition of a business, including those purchased by consolidated subsidiaries, is amortized by the straight-line method over the period corresponding to the premium of the acquired business. Losses may be recognized if the profitability of the acquired business decreases, or if the Group withdraws from or sells the business during the period the Group expected the return.

### Investment Securities

Held-to-maturity investments are stated at amortized cost, while available-for-sale securities with market value are carried at fair market value as of the balance sheet date. Available-for-sale securities without market value are carried at cost based on the moving-average method. Fluctuations in the value of available-for-sale securities with market value cause fluctuations in the carrying value of investment securities, resulting in increases or decreases in net assets. Impairment loss is recognized on available-for-sale securities when the market value or the net worth falls significantly and is considered to be unrecoverable. If a significant decline in market value or net worth occurs and is expected to be unrecoverable in the future, additional impairment losses may need to be recognized.

### Deferred Tax Assets

The Group records an appropriate balance of deferred tax assets against losses carried forward and temporary differences. Future increases or decreases in the balance of deferred tax assets may

occur if projected taxable income decreases or increases as a result of trends in future business results. In addition, changes in the effective tax rate due to future revisions to taxation systems could result in increases or decreases of deferred tax assets.

### Provision for Product Warranties

Some of the Group's products are covered by contracts that require the Group to repair or exchange them free of charge during a set period of time. Based on past records, the Group recognizes a provision for estimated repair and exchange expenses at the time of sale. The Group is taking steps to strengthen quality management during the product development, manufacturing and procurement stages. However, should product defects or other problems occur at a level in excess of that covered by the estimated expenses, additional expenses may be incurred.

### Provision for Construction Contract Losses

The Group records provisions for projected losses on customized software under development contracts and construction contracts that show an acute deterioration in profitability as of the fiscal year-end. The Group is taking steps to curtail the emergence of new, unprofitable projects by moving ahead with the standardization of its business processes, establishing a check system as a dedicated organizational component, and conducting risk management throughout the entire progression of a project (beginning with business negotiations). Notwithstanding these efforts, the Group may incur additional losses in the event of an increase in estimated project costs in the future.

### Retirement Benefits

Retirement benefit costs and obligations are determined based on certain actuarial assumptions. These assumptions include the discount rate, rates of retirement, mortality rates, and the expected rate of return on the plan assets. In the event an actuarial loss arises, it is amortized using a straight-line method over employees' average remaining service period. When actual results differ from the assumptions or when the assumptions are changed, retirement benefit costs and obligations can be affected. In cases in which revised accounting standards pertaining to retirement benefits are applied, net assets and retirement benefit expenses are most likely to be impacted.

### Provision for Loss on Repurchase of Computers

Certain computers manufactured by the Group are sold to Japan Electronic Computer Co., Ltd. (JECC) and other leasing companies. Contracts with these companies require the buyback of the computers once lease contracts are terminated. An estimated amount for the loss arising from such buybacks is provided at the time of sale and is recorded as a provision. Any future changes in the usage trends of end-users may result in changes to the provision.

# Consolidated Balance Sheets

Fujitsu Limited and Consolidated Subsidiaries

At March 31	Notes	2011	Yen (millions) 2012	U.S. Dollars (thousands) (Note 2) 2012
<b>Assets</b>				
<b>Current assets:</b>				
Cash and cash equivalents	11, 12	¥ 358,593	¥ 266,698	\$ 3,252,415
Short-term investments	11, 12	6,101	7,227	88,134
Receivables, trade	11	877,069	901,316	10,991,659
Allowance for doubtful accounts	11	(14,781)	(12,802)	(156,122)
Inventories	3	341,438	334,116	4,074,585
Others	11, 13, 16	192,207	205,227	2,502,768
Total current assets		1,760,627	1,701,782	20,753,439
<b>Investments and long-term loans:</b>				
Affiliates	11	37,532	39,632	483,317
Others	11, 12, 13, 14, 16	335,338	332,863	4,059,305
Total investments and long-term loans		372,870	372,495	4,542,622
<b>Property, plant and equipment:</b>				
Land	4, 6	117,481	115,614	1,409,927
Buildings	4, 6, 10	817,816	830,322	10,125,878
Machinery and equipment	4, 10, 21	1,492,627	1,452,694	17,715,780
Construction in progress	4, 21	16,413	25,097	306,061
		2,444,337	2,423,727	29,557,646
Less accumulated depreciation		(1,805,695)	(1,782,784)	(21,741,268)
Property, plant and equipment, net		638,642	640,943	7,816,378
<b>Intangible assets:</b>				
Software	10, 21	135,118	132,274	1,613,098
Goodwill	5	80,083	67,526	823,488
Others	21	36,757	30,487	371,793
Total intangible assets		251,958	230,287	2,808,378
<b>Total assets</b>	18	¥ 3,024,097	¥ 2,945,507	\$ 35,920,817

The accompanying Notes to Consolidated Financial Statements are an integral part of these statements.

At March 31	Notes	2011	Yen (millions) 2012	U.S. Dollars (thousands) (Note 2) 2012
<b>Liabilities and net assets</b>				
<b>Liabilities</b>				
<b>Current liabilities:</b>				
Short-term borrowings and current portion of long-term debt	6, 11	¥ 225,554	¥ 128,922	\$ 1,572,220
Lease obligation	10, 11	24,470	15,794	192,610
Payables, trade	11	604,264	617,755	7,533,598
Accrued expenses	11	323,144	342,541	4,177,329
Accrued income taxes		23,617	18,627	227,159
Provision for product warranties		25,254	28,398	346,317
Provision for construction contract losses		21,392	13,918	169,732
Provision for bonuses to board members		125	78	951
Others	11, 13, 16	259,988	251,405	3,065,915
Total current liabilities		1,507,808	1,417,438	17,285,829
<b>Long-term liabilities:</b>				
Long-term debt	6, 11	245,269	252,226	3,075,927
Lease obligation	10, 11	26,775	27,735	338,232
Accrued retirement benefits	14	181,572	180,491	2,201,110
Provision for loss on repurchase of computers		16,320	14,356	175,073
Provision for recycling expenses		6,363	6,690	81,585
Provision for product warranties		2,207	2,006	24,463
Others	11, 13, 16	84,004	77,967	950,817
Total long-term liabilities		562,510	561,471	6,847,207
<b>Total liabilities</b>		2,070,318	1,978,909	24,133,037
<b>Net assets</b>				
<b>Shareholders' equity:</b>				
Common stock		324,625	324,625	3,958,841
Capital surplus		236,437	236,432	2,883,317
Retained earnings		343,072	365,300	4,454,878
Treasury stock, at cost		(214)	(318)	(3,878)
Total shareholders' equity		903,920	926,039	11,293,159
<b>Accumulated other comprehensive income:</b>				
Unrealized gain and loss on securities, net of taxes	12	13,564	13,660	166,585
Deferred gains or losses on hedges and others, net of taxes		2,817	3,491	42,573
Foreign currency translation adjustments		(99,057)	(102,151)	(1,245,744)
Total accumulated other comprehensive income		(82,676)	(85,000)	(1,036,585)
<b>Subscription rights to shares</b>		76	78	951
<b>Minority interests in consolidated subsidiaries</b>		132,459	125,481	1,530,256
<b>Total net assets</b>		953,779	966,598	11,787,780
<b>Total liabilities and net assets</b>		¥3,024,097	¥2,945,507	\$35,920,817

## Consolidated Income Statements

Fujitsu Limited and Consolidated Subsidiaries

Years ended March 31	Notes	Yen (millions)		U.S. Dollars (thousands) (Note 2)
		2011	2012	2012
<b>Net sales</b>	18	¥4,528,405	<b>¥4,467,574</b>	<b>\$54,482,610</b>
<b>Operating costs and expenses:</b>				
Cost of sales	7, 14, 15	3,270,923	<b>3,232,146</b>	<b>39,416,415</b>
Selling, general and administrative expenses	7, 14, 15	1,124,888	<b>1,130,124</b>	<b>13,782,000</b>
		4,395,811	<b>4,362,270</b>	<b>53,198,415</b>
<b>Operating income</b>	18	132,594	<b>105,304</b>	<b>1,284,195</b>
<b>Other income (expenses):</b>				
Interest income		2,723	<b>2,995</b>	<b>36,524</b>
Dividend income		3,398	<b>3,208</b>	<b>39,122</b>
Interest charges		(11,728)	<b>(9,283)</b>	<b>(113,207)</b>
Equity in earnings of affiliates, net		3,804	<b>3,060</b>	<b>37,317</b>
Other, net	7, 14	(28,555)	<b>(38,567)</b>	<b>(470,329)</b>
		(30,358)	<b>(38,587)</b>	<b>(470,573)</b>
<b>Income before income taxes and minority interests</b>		102,236	<b>66,717</b>	<b>813,622</b>
<b>Income taxes:</b>				
Current	16	35,057	<b>23,499</b>	<b>286,573</b>
Deferred	16	13,122	<b>6,500</b>	<b>79,268</b>
		48,179	<b>29,999</b>	<b>365,841</b>
<b>Income before minority interests</b>		54,057	<b>36,718</b>	<b>447,780</b>
<b>Minority interests in income (loss) of consolidated subsidiaries</b>		(1,035)	<b>(5,989)</b>	<b>(73,037)</b>
<b>Net income</b>		¥ 55,092	<b>¥ 42,707</b>	<b>\$ 520,817</b>
<b>Amounts per share of common stock:</b>				
Basic earnings	20	¥26.62	<b>¥20.64</b>	<b>\$0.252</b>
Diluted earnings	20	25.75	<b>20.55</b>	<b>0.251</b>
Cash dividends		10.00	<b>10.00</b>	<b>0.122</b>

## Consolidated Statements of Comprehensive Income

Fujitsu Limited and Consolidated Subsidiaries

Years ended March 31	Notes	Yen (millions)		U.S. Dollars (thousands) (Note 2)
		2011	2012	2012
<b>Income before minority interests</b>		¥ 54,057	<b>¥36,718</b>	<b>\$447,780</b>
<b>Other comprehensive income:</b>	8			
Unrealized gain and loss on securities, net of taxes		(2,495)	<b>44</b>	<b>537</b>
Deferred gains or losses on hedges and others, net of taxes		63	<b>112</b>	<b>1,366</b>
Foreign currency translation adjustments		(11,989)	<b>(3,092)</b>	<b>(37,707)</b>
Share of other comprehensive income of associates accounted for using the equity method		(846)	<b>528</b>	<b>6,439</b>
Total other comprehensive income		(15,267)	<b>(2,408)</b>	<b>(29,366)</b>
<b>Comprehensive income</b>		¥ 38,790	<b>¥34,310</b>	<b>\$418,415</b>
Attributable to:				
Owners of the parent		¥ 40,954	<b>¥40,343</b>	<b>\$491,988</b>
Minority interests		(2,164)	<b>(6,033)</b>	<b>(73,573)</b>

The accompanying Notes to Consolidated Financial Statements are an integral part of these statements.

# Consolidated Statements of Changes in Net Assets

Fujitsu Limited and Consolidated Subsidiaries

	Shareholders' equity					Accumulated other comprehensive income					Yen (millions)
	Common stock	Capital surplus	Retained earnings	Treasury stock, at cost	Total shareholders' equity	Unrealized gain and loss on securities, net of taxes	Deferred gains or losses on hedges and others, net of taxes	Foreign currency translation adjustments	Subscription rights to shares	Minority interests in consolidated subsidiaries	Total net assets
Balance at April 1, 2010	¥ 324,625	¥ 235,985	¥ 307,964	¥(2,723)	¥ 865,851	¥ 16,006	¥ 2,300	¥ (85,495)	¥ 53	¥ 149,658	¥ 948,373
Increase (decrease) during the term:											
Cash dividends from retained earnings			(20,672)		(20,672)						(20,672)
Net income			55,092		55,092						55,092
Purchase of treasury stock				(145)	(145)						(145)
Disposal of treasury stock		452		2,654	3,106						3,106
Change in scope of equity method			720		720						720
Reversal of revaluation reserve for land			(32)		(32)						(32)
Net increase (decrease) during the term, except for items under shareholders' equity						(2,442)	517	(13,562)	23	(17,199)	(32,663)
Net increase (decrease) during the term	–	452	35,108	2,509	38,069	(2,442)	517	(13,562)	23	(17,199)	5,406
Balance at April 1, 2011	¥ 324,625	¥ 236,437	¥ 343,072	¥ (214)	¥ 903,920	¥ 13,564	¥ 2,817	¥ (99,057)	¥ 76	¥ 132,459	¥ 953,779
Increase (decrease) during the term:											
Cash dividends from retained earnings			(20,696)		(20,696)						(20,696)
Net income			42,707		42,707						42,707
Purchase of treasury stock				(126)	(126)						(126)
Disposal of treasury stock		(4)		22	18						18
Change in scope of consolidation			215		215						215
Reversal of revaluation reserve for land			2		2						2
Net increase (decrease) during the term, except for items under shareholders' equity						96	674	(3,094)	2	(6,978)	(9,300)
Net increase (decrease) during the term	–	(4)	22,228	(104)	22,120	96	674	(3,094)	2	(6,978)	12,820
Balance at March 31, 2012	¥ 324,625	¥ 236,432	¥ 365,300	¥ (318)	¥ 926,039	¥ 13,660	¥ 3,491	¥ (102,151)	¥ 78	¥ 125,481	¥ 966,598

	U.S. Dollars (thousands) (Note 2)										
Balance at April 1, 2011 (in U.S. Dollars)	\$3,958,841	\$2,883,378	\$4,183,805	\$(2,610)	\$11,023,415	\$165,415	\$34,354	\$(1,208,012)	\$927	\$1,615,354	\$11,631,451
Increase (decrease) during the term:											
Cash dividends from retained earnings			(252,390)		(252,390)						(252,390)
Net income			520,817		520,817						520,817
Purchase of treasury stock				(1,537)	(1,537)						(1,537)
Disposal of treasury stock		(49)		268	220						220
Change in scope of consolidation			2,622		2,622						2,622
Reversal of revaluation reserve for land			24		24						24
Net increase (decrease) during the term, except for items under shareholders' equity						1,171	8,220	(37,732)	24	(85,098)	(113,415)
Net increase (decrease) during the term	–	(49)	271,073	(1,268)	269,756	1,171	8,220	(37,732)	24	(85,098)	156,341
Balance at March 31, 2012 (in U.S. Dollars)	\$3,958,841	\$2,883,317	\$4,454,878	\$(3,878)	\$11,293,159	\$166,585	\$42,573	\$(1,245,744)	\$951	\$1,530,256	\$11,787,780

The accompanying Notes to Consolidated Financial Statements are an integral part of these statements.

# Consolidated Statements of Cash Flows

Fujitsu Limited and Consolidated Subsidiaries

Years ended March 31	Yen (millions)		U.S. Dollars (thousands) (Note 2)
	2011	2012	2012
<b>Cash flows from operating activities (A):</b>			
Income before income taxes and minority interests	¥ 102,236	¥ 66,717	\$ 813,622
Adjustments to reconcile income before income taxes and minority interests to net cash provided by operating activities:			
Depreciation and amortization	207,767	194,449	2,371,329
Impairment loss	1,579	3,241	39,524
Amortization of goodwill	15,610	15,099	184,134
Increase (decrease) in provisions	(45,500)	(11,666)	(142,268)
Interest and dividend income	(6,121)	(6,203)	(75,646)
Interest charges	11,728	9,283	113,207
Equity in earnings of affiliates, net	(3,804)	(3,060)	(37,317)
Loss on disposal of non-current assets	7,309	5,274	64,317
Gain on sales of investment securities, net	(9,366)	—	—
(Increase) decrease in receivables, trade	25,687	(33,914)	(413,585)
(Increase) decrease in inventories	(22,706)	4,647	56,671
Increase (decrease) in payables, trade	(1,718)	20,826	253,976
Other, net	13,361	15,798	192,659
Cash generated from operations	296,062	280,491	3,420,622
Interest and dividends received	6,893	6,770	82,561
Interest paid	(11,179)	(12,588)	(153,512)
Income taxes paid	(36,242)	(34,663)	(422,720)
Net cash provided by operating activities	255,534	240,010	2,926,951
<b>Cash flows from investing activities (B):</b>			
Purchases of property, plant and equipment	(122,267)	(137,786)	(1,680,317)
Proceeds from sales of property, plant and equipment	6,861	6,135	74,817
Purchases of intangible assets	(59,693)	(57,542)	(701,732)
Purchases of investment securities	(16,029)	(6,358)	(77,537)
Proceeds from sales of investment securities	35,120	5,618	68,512
Proceeds from acquisition of subsidiaries' stock resulting in change in scope of consolidation	715	45	549
Proceeds from transfer of business	4,214	—	—
Other, net	8,971	(942)	(11,488)
Net cash used in investing activities	(142,108)	(190,830)	(2,327,195)
<b>A+B*</b>	113,426	49,180	599,756
<b>Cash flows from financing activities:</b>			
Increase (decrease) in short-term borrowings	7,373	(3,522)	(42,951)
Proceeds from long-term debt	63,739	96,118	1,172,171
Repayment of long-term debt	(174,142)	(181,435)	(2,212,622)
Proceeds from sales of treasury stock	24	18	220
Purchase of treasury stock	(145)	(126)	(1,537)
Dividends paid	(23,187)	(22,666)	(276,415)
Other, net	(40,595)	(27,353)	(333,573)
Net cash used in financing activities	(166,933)	(138,966)	(1,694,707)
<b>Effect of exchange rate changes on cash and cash equivalents</b>	(8,091)	(6,209)	(75,720)
<b>Net decrease in cash and cash equivalents</b>	(61,598)	(95,995)	(1,170,671)
<b>Cash and cash equivalents at beginning of year</b>	420,166	358,593	4,373,085
<b>Cash and cash equivalents of newly consolidated subsidiaries</b>	25	4,100	50,000
<b>Cash and cash equivalents at end of year</b>	¥ 358,593	¥ 266,698	\$ 3,252,415
<b>Non-cash investing and financing activities:</b>			
Acquisition of assets under finance leases	¥ 13,171	¥ 17,674	\$ 215,537

The accompanying Notes to Consolidated Financial Statements are an integral part of these statements.

\* This is referred to as "free cash flow" in Management's Discussion and Analysis of Operations.

# Notes to Consolidated Financial Statements

Fujitsu Limited and Consolidated subsidiaries

## 1. Significant Accounting Policies

### (a) Basis of presenting consolidated financial statements and the principles of consolidation

The accompanying consolidated financial statements of Fujitsu Limited (the "Company") and its consolidated subsidiaries (together, the "Group") have been prepared in accordance with the regulations under the Financial Instruments and Exchange Law of Japan and accounting principles and practices generally accepted in Japan. In presenting the accompanying consolidated financial statements, certain items have been reclassified for the convenience of readers outside Japan.

The consolidated financial statements include the accounts of the Company and, with minor exceptions, those of its majority-owned subsidiaries.

The Company's consolidated subsidiaries outside Japan prepare their financial statements in accordance with IFRS (International Financial Reporting Standards).

However, certain items, such as amortization of goodwill, are adjusted in the process of consolidation based on "Practical Solution on Unification of Accounting Policies Applied to Foreign Subsidiaries for Consolidated Financial Statements" (Accounting Standards Board of Japan, Practical Issues Task Force, No. 18 dated February 19, 2010).

The acquisition of companies is accounted for by the purchase method. Goodwill represents the excess of the acquisition cost over the fair value of the net assets of the acquired companies.

Investments in affiliates, with minor exceptions, are accounted for by the equity method.

### (b) Translation of foreign currency accounts

Receivables and payables denominated in foreign currencies are translated into Japanese yen at the foreign currency exchange rates in effect at the respective balance sheet dates.

The assets and liabilities accounts of the consolidated subsidiaries outside Japan are translated into Japanese yen at the exchange rates in effect at the respective balance sheet dates. Income and expense accounts are translated at the average exchange rate during the year. The resulting translation adjustments are recorded in a separate component of accumulated other comprehensive income as "foreign currency translation adjustments."

### (c) Revenue recognition

Revenue from sales of ICT systems and products excluding customized software under development contracts (the "customized software") is recognized upon acceptance by the customers, whereas, revenue from sales of PCs, other equipment and electronic devices is recognized when the products are delivered to the customers. Revenue from sales of the customized software is recognized by reference to the percentage-of-completion method.

### (d) Cash equivalents

Cash equivalents are considered to be short-term highly liquid investments with a maturity of three months or less from the date of acquisition and an insignificant risk of fluctuation in value.

### (e) Investment securities

Investment securities included in "cash and cash equivalents" and "investments and long-term loans" are classified as "Affiliates" such as investments in affiliates; held-to-maturity investments, which are the debt securities that the Group has the positive intent and ability to hold to maturity; or available-for-sale securities, which are investment securities not classified as "Affiliates" or "held-to-maturity."

Investments in affiliates are accounted for by the equity method. Held-to-maturity investments are stated at amortized cost, adjusted for the amortization of premiums or accretion of discounts to maturity. Available-for-sale securities are basically carried at fair value. However, unlisted securities are carried at the acquisition cost, and classified as "financial instruments for which it is extremely difficult to determine the fair value," as no market price is available and it is not possible to estimate the future cash flow. The cost of available-for-sale securities sold is calculated by the moving average method.

Available-for-sale securities are carried at fair market value, with the unrealized gains or losses, net of taxes, included in accumulated other comprehensive income.

**(f) Derivative financial instruments**

The Group uses derivative financial instruments mainly for the purpose of hedging against the risk of fluctuations in foreign exchange rates and interest rates on receivables and payables denominated in foreign currencies.

The hedging instruments consist of forward exchange, option and swap contracts and related complex contracts.

Derivative financial instruments are stated at fair value, and gains or losses on changes in fair values of the hedging instruments are recognized as "Other income (expenses)."

However, gains or losses on changes in fair values of derivative financial instruments, which qualify for deferral hedge accounting, are deferred on the balance sheet until gain or loss on the hedged items are recognized.

**(g) Allowance for doubtful accounts**

The allowance for doubtful accounts is provided at an amount deemed sufficient to cover estimated future losses.

**(h) Inventories**

Finished goods are mainly stated at cost determined by the moving average method.

Work in process is mainly stated at cost determined by the specific identification method or the average cost method.

Raw materials and supplies are mainly stated at cost determined by the moving average method.

Inventories with lower profitability are written down.

**(i) Property, plant and equipment (excluding lease assets)**

Property, plant and equipment, including renewals and additions, are carried at cost. Maintenance and repairs, including minor renewals and improvements, are charged to income as incurred.

Depreciation is computed by the straight-line method over the estimated useful lives, reflected by the likely period over which the value of the asset can be realized under actual business conditions.

Certain property, plant and equipment are impaired based on consideration of their future usefulness. Accumulated impairment loss is subtracted directly from each asset.

**(j) Intangible assets**

Goodwill, including the goodwill acquired by consolidated subsidiaries, representing the premium paid to acquire a business is amortized using the straight-line method over periods not exceeding 20 years as these are periods over which the Group expects to benefit from the acquired business.

Computer software for sale is amortized based on the current year sales units to the projected total products' sales units. Computer software for internal use is amortized by the straight-line method over the estimated useful lives.

Other intangible assets are amortized by the straight-line method over the estimated useful lives of the respective assets.

**(k) Leases**

Assets acquired by lessees in finance lease transactions are recorded in the corresponding asset accounts. As for lease transactions in which the title is not transferred to the lessees, the leased assets are depreciated over the lease term by the straight-line method.

Operating lease payments are recognized as an expense over the lease term.

**(l) Provision for product warranties**

Provision for product warranties is recognized at the time of sales of the products at an amount which represents the estimated cost, based on past experience, to repair or exchange certain products within the warranty period.

**(m) Provision for construction contract losses**

Provision for construction contract losses is the estimated amount of future losses on customized software or construction contracts whose costs are probable to exceed total contract revenues.

**(n) Provision for bonuses to board members**

Provision for the bonuses to board members is recorded based on an estimated amount.

**(o) Retirement benefits**

The Company and the majority of the consolidated subsidiaries have retirement benefit plans.

Under the significant defined benefit plans, the actuarial valuation used to determine the pension costs is the projected unit credit method.

**(p) Provision for loss on repurchase of computers**

Certain computers manufactured by the Group are sold to Japan Electronic Computer Co., Ltd. ("JEC") and other leasing companies for leasing to ultimate users under contracts which require the Group to repurchase the computers if they are returned by the users after a certain period. Based on past experience, an estimated amount for the loss arising from such repurchases is provided at the point of sales and is charged to income.

**(q) Provision for recycling expenses**

A provision for anticipated recycling expenses has been made based on the regime for PC recycling enforced in Japan to prepare for recycling expenses incurred upon collection of consumer PCs sold.

**(r) Income taxes**

The Group has mainly adopted the asset and liability method of tax effect accounting in order to recognize income tax effect of all temporary differences in the recognition of assets and liabilities for tax and financial reporting purposes.

**(s) Earnings per share**

Basic earnings per share is computed based on the weighted average number of shares of common stock outstanding during the respective years.

Diluted earnings per share is computed based on the weighted average number of shares after consideration of the dilutive effect of the shares of common stocks issuable upon the exercise of subscription rights to shares and the conversion of convertible bonds.

**(t) Changes in disclosures**

Effective the year ended March 31, 2012, the Group has implemented "Accounting Standard for Accounting Changes and Error Corrections" (Accounting Standards Board of Japan Statement No. 24, issued December 4, 2009) and the "Guidance on Accounting Standard for Accounting Changes and Error Corrections" (Accounting Standards Board of Japan Guidance No. 24, issued December 4, 2009).

**(u) Accounting standards issued but not yet effective**

The following accounting standards were issued but not yet effective up to June 25, 2012, the filing date of the Annual Securities Report, regulated by the Financial Instruments and Exchange Law of Japan. The Group has not yet adopted these standards as of March 31, 2012.

**“Accounting Standard for Retirement Benefits” (Accounting Standards Board of Japan Statement No. 26, issued May 17, 2012) and “Guidance on Accounting Standard for Retirement Benefits” (Accounting Standards Board of Japan Guidance No. 25, issued May 17, 2012)**

(1) Overview

Actuarial gains and losses and prior service costs are required to be recognized in net assets at net of tax effects. Funded status is fully recognized as a liability or asset on the balance sheet. With respect to the amortization method of the expected benefit, the benefit formula basis is newly allowed as an option, in addition to the straight-line basis. In addition, the method for determining the discount rate is amended.

(2) Date of adoption

The Company and its consolidated subsidiaries in Japan will adopt the accounting standards effective the fiscal year ending March 31, 2014. The standard and guidance will not be applied retrospectively to financial statements in the prior years.

(3) Impact of the adoption of the accounting standards

The Company and its consolidated subsidiaries in Japan are fully compliant with the Generally Accepted Accounting Principles in Japan. The adoption of these standards is expected to have a significant impact on the consolidated financial statements of the Group. In the consolidated balance sheet, the net assets are expected to decrease due mainly to the immediate recognition of the actuarial gains and losses. Currently, it is difficult to estimate the financial impact.

**“Employee Benefits” (IAS 19, issued June 16, 2011)**

(1) Overview

Regarding remeasurements of the net defined benefit liability (asset), including actuarial gains and losses, the option to defer partial recognition is eliminated, and immediate recognition through net assets, net of tax effects, is required. The funded status is recognized as a liability or asset. The option to recycle actuarial gains and losses from other comprehensive income to profit and loss is also eliminated. In addition, the net interest on the net defined benefit liability (asset) replaces the recognition of the interest cost and the expected return on plan assets previously required.

(2) Date of adoption

The Company's consolidated subsidiaries outside of Japan will adopt this accounting standard from the beginning of the fiscal year ending March 31, 2014, as it will be effective from the fiscal year beginning January 1, 2013. The standard requires retrospective application. The Group will therefore restate the corresponding financial statement for the year ending March 31, 2013 incorporating adjustments for the impact of the adoption of this standard.

(3) Impact of the adoption of the accounting standard

The Company's consolidated subsidiaries outside Japan prepare their financial statements in accordance with IFRS (International Financial Reporting Standards). Certain items, such as amortization of goodwill, are adjusted in the process of consolidation based on “Practical Solution on Unification of Accounting Policies Applied to Foreign Subsidiaries for Consolidated Financial Statements” (Accounting Standards Board of Japan, Practical Issues Task Force, No. 18 issued February 19, 2010). Regarding the amortization of actuarial gains and losses, no adjustment is allowed under the Practical Solution. Therefore, the Group has to date consolidated the amortization of actuarial gains and losses in respect of defined benefit pension plans in subsidiaries outside Japan with no adjustment.

The amendment to IAS 19 is considered to have a significant impact on the Group's consolidated financial statements. In the consolidated balance sheet, net assets are expected to decrease due mainly to the immediate full recognition of the actuarial gains and losses. In the consolidated income statement, operating income is considered to be adversely impacted due to the increase in amortization of actuarial gains and losses in the consolidated subsidiaries outside Japan\*, and an increase in net periodic benefit cost caused by the application of the net interest on the net defined benefit liability (asset). Currently, it is difficult to estimate the financial impact from the changes in IAS 19 on the Group consolidated financial statements.

\* The Company's consolidated subsidiaries outside of Japan have to date applied the corridor approach for recognizing a portion of actuarial gains and losses as an expense. Under the corridor approach, when the net cumulative unrecognized actuarial gains and losses at the end of the previous fiscal year exceed the greater of 10% of the present value of the defined benefit obligation or 10% of the fair value of plan assets, the excess amount is recognized as an expense over the expected average remaining service lives of employees.

The amendment to IAS 19 does not allow recycling of actuarial gains and losses held by the Company's consolidated subsidiaries outside of Japan to the income statement. However, in the process of the Group's consolidation, these are periodically recognized as an expense over the expected average remaining service lives of employees, in line with the "Practical Solution on Unification of Accounting Policies Applied to Foreign Subsidiaries for Consolidated Financial Statements." The accounting standard requires retrospective application. The Group will therefore restate the corresponding financial statement for the year ending March 31, 2013 incorporating adjustments for the impact of the adoption of this standard.

## 2. U.S. Dollar Amounts

The Company and its consolidated subsidiaries in Japan maintain their books of account in yen. The U.S. dollar amounts included in the accompanying consolidated financial statements and the notes thereto represent the arithmetic results of translating yen into U.S. dollars at ¥82 = US\$1, the approximate exchange rate at March 31, 2012.

The U.S. dollar amounts are presented solely for the convenience of readers and the translation is not intended to imply that the assets and liabilities which originated in yen have been or could readily be converted, realized or settled in U.S. dollars at the above or any other rate.

## 3. Inventories

Inventories at March 31, 2011 and 2012 consist of the following:

At March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Finished goods	¥150,685	<b>¥139,162</b>	<b>\$1,697,098</b>
Work in process	112,995	<b>106,268</b>	<b>1,295,951</b>
Raw materials and supplies	77,758	<b>88,686</b>	<b>1,081,537</b>
Total inventories	¥341,438	<b>¥334,116</b>	<b>\$4,074,585</b>

Amounts above are net of write-downs.

The amounts of write-downs recognized as cost of sales for the years ended March 31, 2011 and 2012 were ¥22,545 million and ¥17,730 million (\$216,220 thousand) respectively.

## 4. Property, Plant and Equipment

Changes in property, plant and equipment, net of accumulated depreciation (including lease assets) are as follows:

Years ended March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Land			
Balance at beginning of year	¥119,530	<b>¥117,481</b>	<b>\$1,432,695</b>
Additions	1,505	<b>601</b>	<b>7,329</b>
Impairment loss	1,255	<b>1,477</b>	<b>18,012</b>
Translation differences	(525)	<b>(269)</b>	<b>(3,280)</b>
Other, net	(1,774)	<b>(722)</b>	<b>(8,805)</b>
Balance at end of year	¥117,481	<b>¥115,614</b>	<b>\$1,409,927</b>

Years ended March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
<b>Buildings</b>			
Balance at beginning of year	¥273,133	¥277,844	\$3,388,341
Additions	29,101	26,371	321,598
Depreciation	23,095	23,573	287,476
Impairment loss	25	469	5,720
Translation differences	(2,375)	(489)	(5,963)
Other, net	1,105	4,947	60,329
Balance at end of year	¥277,844	¥284,631	\$3,471,110
<b>Machinery and equipment</b>			
Balance at beginning of year	¥248,148	¥226,904	\$2,767,122
Additions	105,626	100,627	1,227,159
Depreciation	118,603	108,004	1,317,122
Impairment loss	299	1,257	15,329
Translation differences	(3,706)	(2,495)	(30,427)
Other, net	(4,262)	(174)	(2,122)
Balance at end of year	¥226,904	¥215,601	\$2,629,280
<b>Construction in progress</b>			
Balance at beginning of year	¥ 21,924	¥ 16,413	\$ 200,159
Additions*1	(1,624)	13,027	158,866
Translation differences	(571)	(111)	(1,354)
Other, net	(3,316)	(4,232)	(51,610)
Balance at end of year	¥16,413	¥ 25,097	\$ 306,061
Total of balance at end of year	¥638,642	¥640,943	\$7,816,378

\*1 Additions to construction in progress are offset by the amounts transferred to the buildings and machinery and equipment.

## 5. Goodwill

An analysis of goodwill is presented below:

Years ended March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Balance at beginning of year	¥93,945	¥80,083	\$976,622
Additions	1,883	3,315	40,427
Amortization	15,610	15,099	184,134
Translation differences and others	(135)	(773)	(9,427)
Balance at end of year	¥80,083	¥67,526	\$823,488

## 6. Short-term Borrowings and Long-term Debt

Short-term borrowings and long-term debt at March 31, 2011 and 2012 consist of the following:

### Short-term borrowings

At March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Short-term borrowings, principally from banks, with a weighted average interest rate of 1.24% at March 31, 2011 and 1.52% at March 31, 2012:			
Secured	¥ —	¥ —	\$ —
Unsecured	54,148	50,581	616,841
<b>Total short-term borrowings (A)</b>	¥54,148	¥50,581	\$616,841

**Long-term debt (including current portion)**

At March 31	2011	Yen (millions) 2012	U.S. Dollars (thousands) 2012
<b>a) Long-term borrowings</b>			
Long-term borrowings, principally from banks and insurance companies, due from 2011 to 2020 with a weighted average interest rate of 1.30% at March 31, 2011: due from 2012 to 2016 with a weighted average interest rate of 1.04% at March 31, 2012:			
Secured	¥ —	¥ —	\$ —
Unsecured	136,375	99,281	1,210,744
<b>Total long-term borrowings</b>	<b>¥136,375</b>	<b>¥99,281</b>	<b>\$1,210,744</b>
<b>b) Bonds and notes</b>			
Bonds and notes issued by the Company:			
Secured	¥ —	¥ —	\$ —
Unsecured			
unsecured convertible bonds due 2011*1	100,000	—	—
3.0% unsecured bonds due 2018	30,000	30,000	365,854
1.49% unsecured bonds due 2012	60,000	60,000	731,707
1.73% unsecured bonds due 2014	40,000	40,000	487,805
0.307% unsecured bonds due 2013	20,000	20,000	243,902
0.42% unsecured bonds due 2015	30,000	30,000	365,854
0.398% unsecured bonds due 2014	—	20,000	243,902
0.623% unsecured bonds due 2016	—	30,000	365,854
Bonds and notes issued by consolidated subsidiaries,			
Secured	—	—	—
Unsecured			
[Japan]			
zero coupon unsecured convertible bonds due 2013	200	200	2,439
zero coupon unsecured convertible bonds due 2015	100	100	1,220
[Outside Japan]			
Medium Term Note unsecured due 2012 with rate of 0.67%	—	986	12,024
<b>Total bonds and notes</b>	<b>¥280,300</b>	<b>¥231,286</b>	<b>\$2,820,561</b>
<b>Total long-term debt (including current portion) (a+b)</b>	<b>¥416,675</b>	<b>¥330,567</b>	<b>\$4,031,305</b>
Current portion (B)	171,406	78,341	955,378
Non-current portion (C)	245,269	252,226	3,075,927
<b>Total short-term borrowings and long-term debt (including current portion)</b>	<b>¥470,823</b>	<b>¥381,148</b>	<b>\$4,648,146</b>
Short-term borrowings and current portion of long-term debt (A+B)	225,554	128,922	1,572,220
Long-term debt (excluding current portion) (C)	245,269	252,226	3,075,927

Convertible bonds are treated solely as liabilities and the conversion option is not recognized as equity in accordance with accounting principles and practices generally accepted in Japan.

\*1 The unsecured convertible bonds due 2011 were issued on August 31, 2007 and redeemed at the maturity date on May 31, 2011. The applicable interest rate was 1.60% up to May 27, 2009. 1.75% was applied on and after May 28, 2009, as the weighted average share price on 10 consecutive days to May 18, 2011 was below ¥900, and the bonds were redeemed at maturity date.

The aggregate annual maturities of long-term debt subsequent to March 31, 2012 are summarized as follows:

Years ending March 31	Yen (millions)	U.S. Dollars (thousands)
2013	¥ 78,341	\$ 955,378
2014	79,235	966,280
2015	63,795	777,988
2016	42,681	520,500
2017 and thereafter	66,515	811,159
<b>Total</b>	<b>¥330,567</b>	<b>\$4,031,305</b>

At March 31, 2012, the Group had committed facility contracts with banks aggregating ¥197,566 million (\$2,409,341 thousand) and all of it was unused.

Assets pledged as collateral for short-term borrowings and long-term debt at March 31, 2011 and 2012 are principally presented below:

At March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Property, plant and equipment, net	¥2,563	<b>¥2,530</b>	<b>\$30,854</b>

As is customary in Japan, substantially all loans from banks (including short-term loans) are made under bank transaction agreements which stipulate that, at the request of the banks, the borrower is required to provide collateral or guarantors (or additional collateral or guarantors, as appropriate) with respect to such loans, and that all assets pledged as collateral under such agreements will be applicable to all present and future indebtedness to the banks concerned. These bank transaction agreements further stipulate that the banks have the right to offset deposits at the banks against indebtedness which matures or becomes due prematurely by default owed to the banks.

## 7. Supplementary Information to the Consolidated Income Statements

The amounts of write-down of inventories recognized within "cost of sales" for the years ended March 31, 2011 and 2012 were ¥22,545 million and ¥17,730 million (\$216,220 thousand), respectively. The provision for construction contract losses charged to "cost of sales" for the same periods were ¥9,549 million and ¥8,452 million (\$103,073 thousand), respectively.

Major items that comprise "Selling, general and administrative expenses" are salaries and research and development expenses. The salaries for the years ended March 31, 2011 and 2012 were ¥308,021 million and ¥313,049 million (\$3,817,671 thousand), respectively. The research and development expenses for the same periods were ¥236,210 million and ¥238,360 million (\$2,906,829 thousand), respectively.

"Other, net" of "Other income (expenses)" for the years ended March 31, 2011 and 2012 consists of the following:

Years ended March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Gain on sales of investment securities	¥ 9,366	¥ -	\$ -
Gain on change in interest	2,368	-	-
Foreign exchange gains (losses), net	(11,063)	<b>(1,805)</b>	<b>(22,012)</b>
Gain on negative goodwill	1,220	-	-
Restructuring charges	-	<b>(15,199)</b>	<b>(185,354)</b>
Loss on disaster	(11,645)	<b>(7,529)</b>	<b>(91,817)</b>
Loss on disposal of property, plant and equipment and intangible assets	(5,477)	<b>(3,082)</b>	<b>(37,585)</b>
Loss on changes in retirement benefit plan	(1,266)	<b>(895)</b>	<b>(10,915)</b>
Impairment loss	(1,579)	<b>(776)</b>	<b>(9,463)</b>
Loss on adjustment for adoption of accounting standard for asset retirement obligations	(4,113)	-	-
Other, net	(6,366)	<b>(9,281)</b>	<b>(113,183)</b>
	¥(28,555)	<b>¥(38,567)</b>	<b>\$(470,329)</b>

For the year ended March 31, 2012

### **Restructuring charges**

Restructuring charges are in relation to the LSI device business, the car audio and navigation systems business and the services business outside of Japan. In the LSI device business, as part of structural reorganization to optimize the manufacturing capabilities, the Group reached an agreement to transfer ownership of its Iwate plant, one of the front-end manufacturing plants, to DENSO Corporation. As a result of this agreement, the Group recorded a loss of ¥5,992 million (\$73,073 thousand), including impairment losses on fixed assets agreed to be transferred and expenses associated with transferring employees to DENSO Corporation. In the car audio and navigation systems business, the Group is restructuring its manufacturing operations in order to strengthen cost competitiveness. As a result, ¥5,236 million (\$63,854 thousand) was recorded, which includes provisions and charges for reassigning employees in Japan. In the services business outside of Japan, ¥3,971 million (\$48,427 thousand) was recorded on rationalization in Europe and North America.

The restructuring charges under the LSI device and the car audio and navigation systems businesses include impairment losses of ¥2,465 million (\$30,061 thousand).

### **Loss on disaster**

Referred mainly to fixed costs associated with temporary plant shutdowns due to aftershocks following the Great East Japan Earthquake and customer-related factors.

### **Loss on changes in retirement benefit plan**

Referred mainly to the costs related to changes from qualified retirement pension plans to lump-sum retirement plans within consolidated subsidiaries in Japan.

### **Impairment loss**

Referred mainly to losses on the following asset groups;

Purpose: Production facilities for the LSI device business

Category: Land

Location: Iwate Prefecture, Japan

Purpose: Production facilities for car audio and navigation systems business

Category: Machinery and other assets

Location: Tianjin, China, and other areas

In principle, the Group's business-use assets are grouped according to managed business units, and idle assets are grouped on an individual asset basis.

In the LSI device business, in order to optimize the manufacturing capabilities, the transfer of the Iwate plant, one of the front-end manufacturing plants, to DENSO Corporation was agreed in the fiscal year ended March 31, 2012. The asset group of the Iwate plant, scheduled to be transferred during the next fiscal year, was impaired by ¥1,300 million (\$15,854 thousand) and the impairment loss is included in "Restructuring charges" classified within "Other income (expenses)" on the income statement.

In the car audio and navigation systems business, the Group has shifted to outsourced production of car audio products due to a decline in customer demand. As a result, the assets were impaired by ¥1,165 million (\$14,207 thousand). The impairment loss is included in "Restructuring charges" classified within "Other income (expenses)".

In other businesses, the impairment losses of ¥776 million (\$9,463 thousand) include losses on employee facilities already committed to be sold at the end of the fiscal year.

Total impairment losses consist of ¥1,477 million (\$18,012 thousand) for land, ¥936 million (\$11,415 thousand) for machinery and equipment and ¥828 million (\$10,098 thousand) for other assets.

The recoverable amounts are measured at fair value less costs to sell or value in use. The fair value less costs to sell is measured based on the amount obtainable from the sale of assets less any costs of disposal.

For the year ended March 31, 2011

**Gain on sales of investment securities**

Referred mainly to the sales of affiliates' shares held by a subsidiary in the U.K.

**Gain on change in interest**

Referred to changes in interest due to the issuance of new shares by an affiliate (Nantong Fujitsu Microelectronics Co., Ltd.) listed in Shenzhen, China.

**Gain on negative goodwill**

Referred mainly to the conversion of PFU Limited into a wholly owned subsidiary.

**Loss on disaster**

Referred mainly to the restoration costs for fixed assets damaged by the Great East Japan Earthquake, the fixed costs for factories that suspended operations due to the earthquake and the disposal losses on inventories. In addition, ¥4,876 million for a provision for loss on disaster is also included in this account.

**Loss on adjustment for adoption of accounting standard for asset retirement obligations**

Effective the year ended March 31, 2011, the Group adopted the "Accounting Standard for Asset Retirement Obligations" (Accounting Standards Board of Japan Statement No. 18) and the "Guidance on Accounting Standard for Asset Retirement Obligations" (Accounting Standards Board of Japan Guidance No. 21).

The loss referred mainly to the obligation of restoration for rental buildings in conjunction with the adoption of the Accounting Standard for Asset Retirement Obligations. The loss arose from the difference between the amount of the asset retirement obligations newly recognized as a liability at the beginning of the fiscal year in which the standard was adopted and the amount of asset retirement expenses recognized as an asset. The difference consists largely of the accumulated depreciation amounts of the assets in the years before the adoption of the standard.

**Impairment loss**

Referred mainly to an investment property determined to be sold.

**Loss on changes in retirement benefit plan**

Referred to the costs related to the changes to a defined contribution pension plan by consolidated subsidiaries in Japan.

## 8. Supplementary Information to the Consolidated Statements of Comprehensive Income

Year ended March 31, 2012

	Yen (millions)	U.S. Dollars (thousands)
Unrealized gain and loss on securities		
Gains (losses) during the term	¥(2,637)	\$(32,159)
Reclassification adjustments	393	4,793
Amount before related income tax effects	(2,244)	(27,366)
Income tax effect	2,288	27,902
Unrealized gain and loss on securities, net of taxes	44	537
Deferred gains or losses on hedges and others		
Gains (losses) during the term	75	915
Reclassification adjustments	(5)	(61)
Amount before related income tax effects	70	854
Income tax effect	42	512
Deferred gains or losses on hedges and others, net of taxes	112	1,366
Foreign currency translation adjustments		
Gains (losses) during the term	(3,773)	(46,012)
Reclassification adjustments	681	8,305
Amount before related income tax effects	(3,092)	(37,707)
Income tax effect	—	—
Foreign currency translation adjustments	(3,092)	(37,707)
Share of other comprehensive income of associates accounted for using the equity method		
Gains (losses) during the term	(31)	(378)
Reclassification adjustments* <sup>1</sup>	559	6,817
Share of other comprehensive income of associates accounted for using the equity method	528	6,439
<b>Total other comprehensive income</b>	<b>¥(2,408)</b>	<b>\$(29,366)</b>

\*1 The reclassification adjustments of the share of other comprehensive income of associates accounted for using the equity method include the adjustment for purchase price of assets.

The amounts of "Reclassification adjustments" and "Income tax effects" for the year ended March 31, 2011 are not presented above in accordance with "Accounting Standard for Presentation of Comprehensive Income" (Accounting Standards Board of Japan, Statement No. 25, dated June 30, 2010).

## 9. Supplementary Information to the Consolidated Statements of Cash Flows

No significant transactions.

## 10. Leases

The following is a summary of assets and liabilities related to finance lease transactions at March 31, 2011 and 2012, which includes acquisition cost, accumulated depreciation and book value of leased assets, future minimum lease payments required under finance leases, and the present value of lease obligations.

At March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Acquisition cost	¥108,165	<b>¥74,189</b>	<b>\$904,744</b>
Accumulated depreciation	68,637	<b>39,452</b>	<b>481,122</b>
Book value	39,528	<b>34,737</b>	<b>423,622</b>
Future minimum lease payments			
Within one year	25,611	<b>16,744</b>	<b>204,195</b>
Over one year but within five years	24,353	<b>25,372</b>	<b>309,415</b>
Over five years	7,630	<b>7,114</b>	<b>86,756</b>
Total future minimum lease payments	¥ 57,594	<b>¥49,230</b>	<b>\$600,366</b>
Less: Interest	(6,349)	<b>(5,701)</b>	<b>(69,524)</b>
Present value of lease obligations	¥ 51,245	<b>¥43,529</b>	<b>\$530,841</b>
Lease obligations (current)	24,470	<b>15,794</b>	<b>192,610</b>
Lease obligations (long-term)	26,775	<b>27,735</b>	<b>338,232</b>

The following is a summary of future minimum lease payments required under non-cancelable operating leases in the aggregate and for each of the following periods.

At March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Within one year	¥19,368	<b>¥18,611</b>	<b>\$226,963</b>
Over one year but within five years	42,692	<b>39,642</b>	<b>483,439</b>
Over five years	23,637	<b>21,423</b>	<b>261,256</b>
Total	¥85,697	<b>¥79,676</b>	<b>\$971,659</b>

## 11. Financial Instruments

### 1. Status of Financial Instruments

#### (1) Policies for Financial Instruments

The Group carries out its financial activities in accordance with the "Fujitsu Group Treasury Policy," and primarily obtains funds through bank borrowing and the issuance of corporate bonds based on funding requirements of its business activities. After the adequate liquidity for its business activities has been ensured, the Group invests temporary excess funds in financial assets with low risk. The Group utilizes derivative transactions only for hedging purposes and not for speculative or dealing purposes.

#### (2) Description and Risks of Financial Instruments

Trade receivables are exposed to customer credit risk. Additionally, some trade receivables are denominated in foreign currencies in conjunction with the export of products and exposed to exchange rate fluctuation risk. Investment securities are comprised primarily of certificates of deposit and available for sale securities issued by the customers. The certificates of deposit are held for fund management and the shares are held for maintaining and strengthening business relationship with the customers. Shares are exposed to market price fluctuation risk and financial risk of the company invested. The Group also loans to customers.

Trade liabilities such as payables, trade and accrued expenses are generally payable within one year. Some trade liabilities are denominated in foreign currencies in conjunction with the import of components and exposed to exchange rate fluctuation risk. Borrowings, corporate bonds, and lease obligation related to finance lease transactions are mainly for the purpose of obtaining working capital and preparing for capital expenditures. Because some of the foregoing have a floating interest rate, they are exposed to interest rate fluctuation risk.

Derivative transactions consist primarily of the use of exchange forward contracts for the purpose of hedging exchange rate fluctuation risk related to trade receivables and trade liabilities, currency swap contracts for the purpose of hedging exchange rate fluctuation risk related to foreign currency denominated cash flow, and interest swap contracts for the purpose of hedging interest rate fluctuation risk related to borrowings and corporate bonds.

### (3) Risk Management of Financial Instruments

#### (i) Management of Credit Risk

The Group strives to mitigate collection risk in accordance with credit management standards and procedures in selling goods and services. A unit independent from the sales units assesses the credit standing of customers and manages collection dates and the balance outstanding for each customer to ensure smooth and dependable collection of trade receivables. Regarding the loan receivable, the Group periodically assesses debtor's financial condition, and reviews the terms of the loan if needed. The counterparties to derivative transactions are selected upon assessment of their credit risk. The amounts of the largest credit risks as of the reporting date are indicated in the balance sheet values of the financial assets that are exposed to credit risk.

#### (ii) Management of Market Risk

The Group utilizes mainly exchange forward contracts in respect to trade receivables and trade liabilities denominated in foreign currencies to mitigate exchange rate fluctuation risk monitored by each currency respectively, currency swap contracts to mitigate the foreign currency exchange rate fluctuation risk of cash flow denominated in foreign currency, and interest swap contracts in respect to borrowings and corporate bonds to mitigate interest rate fluctuation risk. The Group regularly monitors the market price and the financial condition of the issuer in respect to its securities and continuously reconsiders investment in each company, taking into account its relationship with the counterparty.

The Group enters into derivative transactions based on regulations established by the Company. Based on policies approved by the Chief Financial Officer (CFO), the finance division undertakes particular transactions and records them and also confirms the balance of transactions with counterparties. In addition, the finance division reports on the content of transactions undertaken and changes in transaction balances to the CFO and the chief of the accounting department.

#### (iii) Management of Liquidity Risk in Financing Activities

The Group prepares a cash flow projection and monitors its funding requirements. The Group also strives to diversify its sources of financing in order to reduce liquidity risk.

### (4) Supplementary Explanation of Fair Value of Financial Instruments

The fair value of Financial Instruments is based on the market price, but in case a market price is not available, the fair value is reasonably estimated. As variable factors are incorporated in the estimation of values, values may vary depending on the assumptions used. The contract amount related to derivative transactions under "13. Derivative Financial Instruments" does not express the market risk related to the derivative transactions.

## 2. Fair Value of Financial Instruments

Amounts recorded on the consolidated balance sheet as of March 31, 2011 and 2012, fair values, and the variances between the two are as shown below. Unlisted securities, categorized within "Affiliates" and "Others" of "Investment and long-term loans," are not included in the table below, as it is extremely difficult to determine the fair value. Financial instruments categorized within "Others" of both "Current assets" and "Investments and long-term loans" are not included, except for available-for-sale securities and held-to-maturity investments stated at fair value.

At March 31, 2012	Yen (millions)			U.S. Dollars (thousands)		
	Carrying value in consolidated balance sheet	Fair value	Variance	Carrying value in consolidated balance sheet	Fair value	Variance
<b>Current assets</b>						
(1)Cash and cash equivalents	¥ 266,698	¥ 266,698	¥ -	\$ 3,252,415	\$ 3,252,415	\$ -
(2)Short-term investments	7,227	7,227	-	88,134	88,134	-
(3)Receivables, trade	901,316			10,991,659		
Allowance for doubtful accounts*1	(12,802)			(156,122)		
	<b>888,514</b>	<b>888,514</b>	<b>-</b>	<b>10,835,537</b>	<b>10,835,537</b>	<b>-</b>
<b>Investments and long-term loans*2</b>						
(4)Affiliates	21,381	40,603	19,222	260,744	495,159	234,415
(5)Others	81,118	81,118	-	989,244	989,244	-
Total assets	<b>1,264,938</b>	<b>1,284,160</b>	<b>19,222</b>	<b>15,426,073</b>	<b>15,660,488</b>	<b>234,415</b>
<b>Current liabilities</b>						
(1)Short-term borrowings and current portion of long-term debt	128,922	128,922	-	1,572,220	1,572,220	-
(2)Lease obligation	15,794	15,794	-	192,610	192,610	-
(3)Payables, trade	617,755	617,755	-	7,533,598	7,533,598	-
(4)Accrued expenses	342,541	342,541	-	4,177,329	4,177,329	-
<b>Long-term liabilities</b>						
(5)Long-term debt	252,226	258,811	6,585	3,075,927	3,156,232	80,305
(6)Lease obligation	27,735	27,911	176	338,232	340,378	2,146
Total liabilities	<b>1,384,973</b>	<b>1,391,734</b>	<b>6,761</b>	<b>16,889,915</b>	<b>16,972,366</b>	<b>82,451</b>
<b>Derivative transactions*3</b>						
(i) Transactions which do not qualify for hedge accounting	[3,236]	[3,236]	-	[39,463]	[39,463]	-
(ii) Transactions which qualify for hedge accounting	626	626	-	7,634	7,634	-
Total derivative transactions	<b>[2,610]</b>	<b>[2,610]</b>	<b>-</b>	<b>[31,829]</b>	<b>[31,829]</b>	<b>-</b>

At March 31, 2011	Yen (millions)		
	Carrying value in consolidated balance sheet	Fair value	Variance
<b>Current assets</b>			
(1)Cash and cash equivalents	¥ 358,593	¥ 358,593	¥ -
(2)Short-term investments	6,101	6,101	-
(3)Receivables, trade	877,069		
Allowance for doubtful accounts*1	(14,781)		
	<b>862,288</b>	<b>862,288</b>	<b>-</b>
<b>Investments and long-term loans*2</b>			
(4)Affiliates	18,733	43,165	24,432
(5)Others	86,224	86,224	-
Total assets	<b>1,331,939</b>	<b>1,356,371</b>	<b>24,432</b>

At March 31, 2011	Yen (millions)		
	Carrying value in consolidated balance sheet	Fair value	Variance
<b>Current liabilities</b>			
(1) Short-term borrowings and current portion of long-term debt	225,554	225,554	—
(2) Lease obligation	24,470	24,470	—
(3) Payables, trade	604,264	604,264	—
(4) Accrued expenses	323,144	323,144	—
<b>Long-term liabilities</b>			
(5) Long-term debt	245,269	252,083	6,814
(6) Lease obligation	26,775	26,983	208
<b>Total liabilities</b>	<b>1,449,476</b>	<b>1,456,498</b>	<b>7,022</b>
<b>Derivative transactions*3</b>			
(i) Transactions which do not qualify for hedge accounting	[3,646]	[3,646]	—
(ii) Transactions which qualify for hedge accounting	9	9	—
<b>Total derivative transactions</b>	<b>[3,637]</b>	<b>[3,637]</b>	<b>—</b>

\*1 It comprises the allowance for doubtful accounts in respect to Receivables, trade, short-term loan receivable and others.

\*2 Unlisted securities classified in shares in affiliates or available-for-sale securities are defined as "Financial Instruments for which it is extremely difficult to determine the fair value," because no market price is available and it is not possible to estimate the future cash flow in accordance with "Accounting Standard for Financial Instruments" (Accounting Standards Board of Japan, Statement No. 10, dated March 10, 2008) and "Implementation Guidance on Disclosures about Fair Value of Financial Instruments" (Accounting Standards Board of Japan Guidance No. 19, dated March 25, 2011). Accordingly unlisted securities are not included in the "Investments and long-term loans" stated above. The carrying values of the stocks in the consolidated balance sheet as of March 31, 2011 and 2012 are ¥47,404 million and ¥46,598 million (\$568,268 thousand), consisting of Affiliate: ¥18,799 million and ¥18,087 million (\$220,573 thousand) and Others: ¥28,605 million and ¥28,511 million (\$347,695 thousand) respectively.

\*3 The net amount of the assets and liabilities is shown. If the net amount is a liability, it is written in parentheses [ ].

Calculation method relating to fair value of Financial Instruments

Current assets

(1) Cash and cash equivalents, (2) Short-term investments and (3) Receivables, trade

The fair value of these items approximates the carrying value due to the short maturity of these instruments.

Investments and long-term loans

(4) Affiliates and (5) Others

The fair value of securities is based on the market price on the stock exchanges, and fair value of bonds is based on quotes obtained from the financial institutions or on the market price on the stock exchanges.

Current liabilities:

(1) Short-term borrowings and current portion of long-term debt, (2) Lease obligation, (3) Payables, trade and (4) Accrued expenses

The fair value of these items approximates the carrying value due to the short maturity of these instruments.

Long-term liabilities:

(5) Long-term debt and (6) Lease obligation

The fair value of bonds which have a market price is based on the market price. The fair value of bonds for which there is no market price is calculated by discounting the sum of future principal and interest payments to the present value at a rate taking into account the remaining term and the credit risk of bonds.

The fair value of long-term debt and lease obligation is calculated by discounting the sum of future principal and interest payments to the present value at the rate expected in another loan or lease transaction with the same conditions.

Impairment losses on investment securities

For the years ended March 31, 2011 and 2012

No significant losses were recorded.

Available-for-sale securities with fair value that has declined by 50% or more against their acquisition costs are generally booked as an impairment loss. Those that have declined in a range of 30% or more but less than 50% are impaired if the decline is deemed to be irrecoverable. Available-for-sale securities with no available fair value are generally impaired when issuers' net assets in the balance sheet decrease to more than 50% below the acquisition cost due to a deterioration of issuers' financial conditions.

## 12. Available-for-sale Securities

At March 31, 2011 and 2012, available-for-sale securities included in "Cash and cash equivalents," "Short-term investments" and "Others" of "Investments and long-term loans" are stated as follows. Unlisted securities for which it is extremely difficult to determine the fair value are not included in the table.

At March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Available-for-sale securities			
Acquisition costs	¥74,355	¥121,278	\$1,479,000
Carrying value (Market value)	97,025	141,544	1,726,146
Net unrealized gain	¥22,670	¥ 20,266	\$ 247,146

## 13. Derivative Financial Instruments

### 1. Derivative transactions which do not qualify for hedge accounting

<Currency-related transactions>

At March 31, 2012	Yen (millions)				U.S. Dollars (thousands)			
	Contract Amount	Contract Amount Over 1 Year	Fair Value	Gain/Loss	Contract Amount	Contract Amount Over 1 Year	Fair Value	Gain/Loss
Foreign Exchange								
Forward Contracts								
To buy foreign currencies								
U.S. Dollars	¥26,236	¥ -	¥(1,654)	¥(1,654)	\$319,951	\$ -	\$(20,171)	\$(20,171)
Euro	27,870	891	(157)	(157)	339,878	10,866	(1,915)	(1,915)
Other currencies	5,458	124	(31)	(31)	66,561	1,512	(378)	(378)
To sell foreign currencies								
U.S. Dollars	17,191	-	(498)	(498)	209,646	-	(6,073)	(6,073)
Euro	8,299	141	(88)	(88)	101,207	1,720	(1,073)	(1,073)
Other currencies	2,156	626	(3)	(3)	26,293	7,634	(37)	(37)
Foreign Exchange								
Option Contracts								
To buy options								
U.S. Dollar puts	26,488	-			323,024	-		
	<285>	<->	170	(115)	<3,476>	<->	2,073	(1,402)
Euro puts	7,593	-			92,598	-		
	<->	<->	-	-	<->	<->	-	-
To sell options								
U.S. Dollar calls	26,488	-			323,024	-		
	<(285)>	<->	(997)	(712)	<(3,476)>	<->	(12,159)	(8,683)
Euro calls	14,507	-			176,915	-		
	<->	<->	(14)	(14)	<->	<->	(171)	(171)
Foreign Exchange								
Swap Contracts								
Receive Pound Sterling	19,389	25	178	178	236,451	305	2,171	2,171
Pay Pound Sterling	22,755	-	(113)	(113)	277,500	-	(1,378)	(1,378)
Others	10,298	766	(29)	(29)	125,585	9,341	(354)	(354)
Total			¥(3,236)	¥(3,236)			\$(39,463)	\$(39,463)

At March 31, 2011				Yen
	Contract Amount	Contract Amount Over 1 Year	Fair Value	(millions)
Foreign Exchange				
Forward Contracts				
To buy foreign currencies				
U.S. Dollars	¥48,517	¥5,462	¥(3,667)	¥(3,667)
Euro	22,270	1,550	599	599
Other currencies	1,088	137	(6)	(6)
To sell foreign currencies				
U.S. Dollars	12,709	—	(178)	(178)
Euro	10,781	—	(132)	(132)
Other currencies	2,775	—	(50)	(50)
Foreign Exchange Swap Contracts				
Receive Pound Sterling	15,223	—	(282)	(282)
Pay Pound Sterling	18,994	—	108	108
Others	11,458	—	(38)	(38)
<b>Total</b>			<b>¥(3,646)</b>	<b>¥(3,646)</b>

- 1) The method for estimating the fair value is principally based on obtaining quotes provided by financial institutions.
- 2) Collateral conditions are attached to some foreign exchange forward contracts, and there is the possibility of change in contract amount and duration due to the fluctuation of the currency exchange rate.
- 3) In the column "Contract Amount," option premiums are disclosed in brackets < >, and corresponding fair value and valuation gains and losses are disclosed on the same line.
- 4) Option contracts represent zero-cost options. In this contract, no premiums are received or paid due to the offsetting payables and receivables. The amounts of "Fair Value" and the "Gain/Loss" for "Euro puts" and "Euro calls" are presented net of buying and selling positions.

## 2. Derivative transactions which qualify for hedge accounting

### (i) Currency-related transactions

At March 31, 2012		Yen (millions)			U.S. Dollars (thousands)			
Type of hedge accounting	Type of derivative transaction	Principal Item Hedged	Contract Amount	Contract Amounts Over 1 Year	Fair Value	Contract Amount	Contract Amounts Over 1 Year	Fair Value
Fair value hedge	Foreign exchange forward transactions							
	To buy foreign currencies							
	Singapore Dollars, etc	<b>Borrowings</b>	<b>¥1,141</b>	<b>¥—</b>	<b>¥(8)</b>	<b>\$13,915</b>	<b>\$—</b>	<b>\$(98)</b>
Deferral hedge	Foreign exchange forward transactions							
	To sell foreign currencies							
	U.S. Dollars	<b>Receivables, trade</b>	<b>¥1,651</b>	<b>¥—</b>	<b>¥10</b>	<b>\$20,134</b>	<b>\$—</b>	<b>\$122</b>

\*1 The fair value is based mainly on quotes obtained from the financial institutions.

\*2 Foreign exchange forward transactions accounted for by the fair value hedge accounting attribute to a transaction by a subsidiary outside Japan which adopts International Financial Reporting Standard (IFRS).

At March 31, 2011

Not applicable for the year.

## (ii) Interest-related transactions

At March 31, 2012						Yen (millions)	U.S. Dollars (thousands)		
Type of hedge accounting	Type of derivative transaction	Principal Item Hedged	Contract Amount	Contract Amounts Over 1 Year	Fair Value	Contract Amount	Contract Amounts Over 1 Year	Fair Value	
Deferral hedge	Interest rate swap transaction Pay fixed/Receive variable	<b>Borrowings</b>	<b>¥1,923</b>	<b>¥1,068</b>	<b>¥(23)</b>	<b>\$23,451</b>	<b>\$13,024</b>	<b>\$(280)</b>	

At March 31, 2011						Yen (millions)
Type of hedge accounting	Type of derivative transaction	Principal Item Hedged	Contract Amount	Contract Amounts Over 1 Year	Fair Value	
Deferral hedge	Interest rate swap transaction Pay fixed/Receive variable	Borrowings	¥2,798	¥1,937	¥9	

The fair value is based on quotes obtained from the financial institutions.

## (iii) Stock-related transactions

At March 31, 2012						Yen (millions)	U.S. Dollars (thousands)		
Type of hedge accounting	Type of derivative transaction	Principal Item Hedged	Contract Amount	Contract Amounts Over 1 Year	Fair Value	Contract Amount	Contract Amounts Over 1 Year	Fair Value	
Deferral hedge	Option transaction to sell a stock	<b>Investment Securities</b>	<b>¥555</b>	<b>¥555</b>	<b>¥647</b>	<b>\$6,768</b>	<b>\$6,768</b>	<b>\$7,890</b>	

The fair value is based on an option pricing model.

At March 31, 2011

Not applicable for the year.

## 14. Retirement Benefits

The Company and the majority of the consolidated subsidiaries in Japan have unfunded lump-sum retirement plans which, in general, cover all employees who retire before a retirement age prescribed in their internal labor codes. The employees are entitled to the benefits primarily based on their length of service and base salary as of the retirement date.

In addition, the Company and the majority of the consolidated subsidiaries in Japan participate in contributory defined benefit plans which cover substantially all employees. The major contributory defined benefit plan (the "Plan"), which is referred to as the Fujitsu Corporate Pension Fund, entitles employees upon retirement at the normal retirement age to either a lump-sum payment or pension annuity payments for life commencing at age 60, or a combination of both based on their length of service, base salary and the number of years of participation in the Plan. The contributions of the Company and the subsidiaries covered by the Plan and their employees are made to the Fujitsu Corporate Pension Fund which is an external organization.

The Fujitsu Welfare Pension Fund, in which the Company and certain consolidated subsidiaries in Japan participated, received approval of an elimination of the future benefit obligations of the substitutional portion on March 23, 2004, and then received approval of transfer of past benefit obligation of the substitutional portion on September 1, 2005, from the Minister of Health, Labour and Welfare. Accordingly, Fujitsu Welfare Pension Fund changed to the Defined Benefit Corporate Plan based on the Japanese Defined Benefit Corporate Pension Law from the Japanese Welfare Pension Plan based on the Japanese Welfare Pension Insurance Law, and concurrently a part of the pension system was revised.

The majority of the consolidated subsidiaries outside Japan have defined benefit plans and/or defined contribution plans covering substantially all their employees. The major defined benefit pension plans provided outside Japan are the plans that Fujitsu Services Holdings PLC (including its consolidated subsidiaries, "FS") and Fujitsu Technology Solutions B.V. (including its consolidated subsidiaries) provide. The plan provided by FS entitles employees payments based on their length of service and salary. The defined benefit section of the plan was closed to new entrants for the year ended March 31, 2001. New employees are, however, eligible for membership of the defined contribution section of the plan. For the year ended March 31, 2011, FS started to switch future accrual of benefits relevant to the employees participating in the defined benefit section of the plan to the defined contribution section of the plan, and completed in the year ended March 31, 2012.

The balances of the "Projected benefit obligation and plan assets" and the "Components of net periodic benefit cost" in the plans in both Japan and outside Japan are summarized as follows:

### <In Japan>

#### Projected benefit obligation and plan assets

At March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Projected benefit obligation	¥(1,280,145)	¥(1,299,513)	\$(15,847,720)
Plan assets	905,592	943,936	11,511,415
Projected benefit obligation in excess of plan assets	(374,553)	(355,577)	(4,336,305)
Unrecognized actuarial loss	398,681	357,527	4,360,085
Unrecognized prior service cost (reduced obligation)	(83,413)	(65,518)	(799,000)
Prepaid pension cost	(55,194)	(52,308)	(637,902)
Accrued retirement benefits	¥ (114,479)	¥ (115,876)	\$ (1,413,122)

As a result of pension revisions, unrecognized prior service cost (reduced obligation) occurred for the year ended March 31, 2006 in Fujitsu Corporate Pension Fund in which the Company and certain consolidated subsidiaries in Japan participate.

#### Components of net periodic benefit cost

Years ended March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Service cost	¥ 38,931	¥ 40,110	\$ 489,146
Interest cost	31,550	31,795	387,744
Expected return on plan assets	(26,651)	(26,557)	(323,866)
Amortization of unrecognized obligation for retirement benefits:			
Amortization of actuarial loss	37,355	41,999	512,183
Amortization of prior service cost	(18,633)	(18,630)	(227,195)
Others*1	353	501	6,110
Net periodic benefit cost	62,905	69,218	844,122
Loss (gain) on termination of retirement benefit plan	1,266	895	10,915
Total	¥ 64,171	¥ 70,113	\$ 855,037

\*1 Contribution for defined contribution plans.

In addition to the net periodic benefit cost stated above, extra retirement benefits of ¥1,279 million and ¥6,961 million (\$84,890 thousand) were paid for the years ended March 31, 2011 and 2012, respectively.

### Assumptions used in accounting for the plans

At March 31	2011	2012
Discount rate	2.5%	<b>2.5%</b>
Expected rate of return on plan assets	2.9%	<b>2.9%</b>
Method of allocating actuarial loss	Straight-line method over the employees' average remaining service period	<b>Straight-line method over the employees' average remaining service period</b>
Method of allocating prior service cost	Straight-line method over 10 years	<b>Straight-line method over 10 years</b>

### <Outside Japan>

FS adopted International Financial Reporting Standards ("IFRS") for the year ended March 31, 2006, and accounts for retirement benefits in accordance with IAS 19 "Employee Benefits" issued on February, 1998. For this change in accounting principles and practices, FS adopted IFRS 1 "First-time Adoption of International Financial Reporting Standards," and recognized the projected benefit obligation in excess of plan assets as of the beginning of the year ended March 31, 2005. For the year ended March 31, 2009, other subsidiaries outside Japan applied IAS 19 in accordance with adoption of IFRS. They recognized actuarial gain or loss over future periods after the adoption of IFRS 1 and applied the "corridor approach" to amortization of actuarial gain and loss.

The amended IAS 19, issued on June 16, 2011, is not yet effective and has not yet been adopted by the consolidated subsidiaries outside Japan.

### Projected benefit obligation and plan assets

At March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Projected benefit obligation	¥(534,999)	<b>¥(571,823)</b>	<b>\$ (6,973,451)</b>
Plan assets	395,927	<b>408,126</b>	<b>4,977,146</b>
Projected benefit obligation in excess of plan assets	(139,072)	<b>(163,697)</b>	<b>(1,996,305)</b>
Unrecognized actuarial loss	74,321	<b>108,912</b>	<b>1,328,195</b>
Prepaid pension cost	(2,342)	<b>(9,830)</b>	<b>(119,878)</b>
Accrued retirement benefits	¥ (67,093)	<b>¥ (64,615)</b>	<b>\$ (787,988)</b>

### Components of net periodic benefit cost

Years ended March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Service cost	¥ 8,044	<b>¥ 3,707</b>	<b>\$ 45,207</b>
Interest cost	29,781	<b>27,154</b>	<b>331,146</b>
Expected return on plan assets	(26,003)	<b>(24,145)</b>	<b>(294,451)</b>
Amortization of the unrecognized obligation for retirement benefit:			
Amortization of actuarial gain and loss	5,838	<b>3,498</b>	<b>42,659</b>
Amortization of prior service cost* <sup>1</sup>	(13,322)	<b>(118)</b>	<b>(1,439)</b>
Others* <sup>2</sup>	9,774	<b>13,488</b>	<b>164,488</b>
Net periodic benefit cost	14,112	<b>23,584</b>	<b>287,610</b>
Loss (gain) on termination of retirement benefit plan	112	<b>114</b>	<b>1,390</b>
Total	¥ 14,224	<b>¥ 23,698</b>	<b>\$ 289,000</b>

\*<sup>1</sup> For the year ended March 31, 2011, the negative prior service cost was immediately recognized as a result of pension revisions mainly in FS. The majority of this credit arose from offering an option whereby future variable increases in line with the fluctuation in prices may be exchanged for a one-off uplift in payments.

\*<sup>2</sup> Contribution for defined contribution plans.

**Assumptions used in accounting for the plans**

At March 31	2011	2012
Discount rate	Mainly 5.6%	<b>Mainly 5.0%</b>
Expected rate of return on plan assets	Mainly 7.2%	<b>Mainly 6.7%</b>
Method of allocating actuarial loss	Straight-line method over the employees' average remaining service period	<b>Straight-line method over the employees' average remaining service period</b>

**15. Share-based Payment Plans**

No significant transactions.

**16. Income Taxes**

In line with "Act for Partial Revision of the Income Tax Act etc. for the Purpose of Creating Taxation System Responding to Changes in Economic and Social Structures" (Act No. 114 of 2011) and "Act on Special Measures for Securing Financial Resources Necessary to Implement Measures for Reconstruction following the Great East Japan Earthquake" (Act No. 117 of 2011) published on December 2, 2011, the statutory income tax rate used for calculating the deferred tax assets and liabilities was changed from 40.6% to 37.9% for assets and liabilities that are expected to be recovered or settled between April 1, 2012 and March 31, 2015. The rate was also changed to 35.6% for assets and liabilities expected to be recovered or settled on and after April 1, 2015.

As a result of this change, net deferred tax assets decreased by ¥3,523 million (\$42,963 thousand), while deferred income tax and accumulated other comprehensive income, mainly as unrealized gain and loss on securities, increased by ¥4,666 million (\$56,902 thousand) and ¥1,143 million (\$13,939 thousand), respectively.

The components of income taxes are as follows:

Years ended March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Current	¥35,057	<b>¥23,499</b>	<b>\$286,573</b>
Deferred	13,122	<b>6,500</b>	<b>79,268</b>
Income taxes	¥48,179	<b>¥29,999</b>	<b>\$365,841</b>

The reconciliations between the statutory income tax rate and the effective income tax rates for the years ended March 31, 2011 and 2012 are as follows:

Years ended March 31	2011	2012
Statutory income tax rate	40.6%	<b>40.6%</b>
Increase (Decrease) in tax rates:		
Valuation allowance for deferred tax assets	7.6%	<b>(15.1%)</b>
Goodwill amortization	6.2%	<b>9.2%</b>
Decrease in deferred tax assets in accordance with changes in tax rate	—	<b>7.0%</b>
Non-deductible expenses for tax purposes	3.5%	<b>6.2%</b>
Non-taxable income	(1.8%)	<b>(2.3%)</b>
Tax effect on equity in earnings of affiliates, net	(1.5%)	<b>(1.9%)</b>
Tax credit	(4.1%)	<b>(0.2%)</b>
Other	(3.4%)	<b>1.5%</b>
Effective income tax rates	47.1%	<b>45.0%</b>

The significant components of deferred tax assets and liabilities at March 31, 2011 and 2012 are as follows:

At March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Deferred tax assets:			
Tax loss carryforwards	¥ 145,132	¥ 153,008	\$ 1,865,951
Accrued retirement benefits	150,851	137,131	1,672,329
Excess of depreciation and amortization and impairment loss, etc.	54,591	50,013	609,915
Accrued bonus	43,489	40,906	498,854
Inventories	23,081	22,043	268,817
Provision for product warranties	6,250	8,255	100,671
Loss on revaluation of investment securities	9,615	6,153	75,037
Intercompany profit on inventories and property, plant and equipment	5,688	5,673	69,183
Provision for loss on repurchase of computers	6,056	5,024	61,268
Other	57,224	48,907	596,427
Gross deferred tax assets	501,977	477,113	5,818,451
Less: Valuation allowance	(256,153)	(253,902)	(3,096,366)
Total deferred tax assets	245,824	223,211	2,722,085
Deferred tax liabilities:			
Gains from establishment of stock holding trust for retirement benefit plan	¥(110,617)	¥ (96,860)	\$(1,181,220)
Unrealized gains on securities	(9,639)	(7,498)	(91,439)
Tax allowable reserves	(2,245)	(1,364)	(16,634)
Other	(8,944)	(8,159)	(99,500)
Total deferred tax liabilities	(131,445)	(113,881)	(1,388,793)
Net deferred tax assets	¥ 114,379	¥ 109,330	\$ 1,333,293

Net deferred tax assets are included in the consolidated balance sheets as follows:

At March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Current assets—others	¥ 76,666	¥ 72,519	\$ 884,378
Investments and long-term loans—others	72,093	65,268	795,951
Current liabilities—others	(50)	(15)	(183)
Long-term liabilities—others	(34,330)	(28,442)	(346,854)
Net deferred tax assets	¥114,379	¥109,330	\$1,333,293

The Company and its wholly owned subsidiaries in Japan have adopted the consolidated tax return system of Japan.

In Japan, tax losses generated before March 31, 2008 and on and after April 1, 2008 can be carried forward up to 7 and 9 years, respectively. Tax losses can be carried forward up to 20 years in the United States, and indefinitely in the United Kingdom.

Realization depends on the abilities of the companies to generate sufficient taxable income prior to the expiration of the tax loss carryforwards. With respect to deferred tax assets, we recorded a valuation allowance to cover the amount in excess of what we are likely to recover in the future.

## 17. Business Combinations

No significant transactions.

## 18. Segment Information

### 1. Reportable Segments Overview

The Company's reportable segments consist of components of the Group for which discrete financial information is available and whose operating results are regularly reviewed by the Group's executive decision-making body to make decisions about resource allocation to the segments and assess their performance.

In the field of information and communication technology (ICT), while delivering wide varieties of services, the Group offers comprehensive solutions, from the development, manufacturing, and sales, to the maintenance and operations of cutting-edge, high-performance and high-quality products, and electronic devices that support services. The Group's business is organized into three reportable segments—Technology Solutions, Ubiquitous Solutions, and Device Solutions—based on the Group's managerial structure, characteristics of the products and services, and the similarities of the sales market within each operating segment. Managerial structure and product and service classification in each reportable segment are as follows.

#### (1) Technology Solutions

To optimally deliver to customers comprehensive services that integrate products, software, and services, the segment is organized in a matrix management structure comprised of business groups that are organized by product and service type in order to manage costs and devise global business strategies, and business groups that are organized along industry and geographic lines, integrating sales groups with systems engineers covering customers.

This reportable segment consists of Solutions/Systems Integration, which are services for the construction of information and communication systems, Infrastructure Services, which are primarily outsourcing and maintenance services, System Products, which covers mainly the servers and storage systems that comprise ICT platforms, and Network Products, which are used to build communications infrastructure, such as mobile phone base stations and optical transmission systems.

#### (2) Ubiquitous Solutions

The segment is organized into independent business management units along product lines and includes the sales departments.

This reportable segment contains ubiquitous terminals—including personal computers and mobile phones, as well as car audio and navigation systems, mobile communication equipment, and automotive electronic equipment—that collect various information and knowledge generated from the behavioral patterns of people and organizations needed to achieve the Group's vision of a "Human Centric Intelligent Society" (a society that enjoys the benefits of the value generated by ICT without requiring anyone to be conscious of the technological complexities involved).

#### (3) Device Solutions

The segment is organized by product in independent business management units which include the respective sales departments and contains the cutting-edge technologies, including LSI devices used in digital home appliances, automobiles, mobile phones and servers, as well as electronic components, such as semiconductor packages and batteries.

### 2. Method Used to Calculate Net Sales, Profit or Loss, Assets and Other Items by Reportable Segments

Accounting methods applied to Reportable Segments are almost the same as that presented in "1. Significant Accounting Policies."

Income figures for operating segments are based on operating income. The Group's financing (including financial expense and income) as well as other items such as corporate tax are managed by the whole Group and have not been allocated within the operating segments.

Inter-segment transactions are based on an arm's-length basis.

### 3. Amounts of Net Sales, Profit or Loss, Assets and Other Items by Reportable Segments

Year ended March 31	Reportable segments				Other Operations	Elimination & Corporate	Consolidated
	Technology Solutions	Ubiquitous Solutions	Device Solutions	Total			
	Yen (millions)						
<b>2012</b>							
Net sales							
External customers	¥2,864,658	¥1,039,809	¥515,834	¥4,420,301	¥35,371	¥ 11,902	¥4,467,574
Inter-segment	70,247	114,473	68,866	253,586	48,208	(301,794)	–
Total sales	2,934,905	1,154,282	584,700	4,673,887	83,579	(289,892)	4,467,574
Operating income (loss)	171,297	19,938	(10,182)	181,053	(2,056)	(73,693)	105,304
Total assets	1,446,368	361,732	434,902	2,243,002	31,188	671,317	2,945,507
Other items							
Capital expenditure (including intangible assets)	119,712	19,698	51,876	191,286	1,575	5,307	198,168
Depreciation	106,771	21,210	56,483	184,464	1,806	8,179	194,449
Amortization of goodwill for the year	14,495	48	556	15,099	–	–	15,099
Balance of goodwill at end of the fiscal year	68,024	148	(646)	67,526	–	–	67,526
<b>2011</b>							
Net sales							
External customers	¥2,927,651	¥1,013,056	¥545,729	¥4,486,436	¥32,738	¥ 9,231	¥4,528,405
Inter-segment	86,735	112,586	84,871	284,192	49,766	(333,958)	–
Total sales	3,014,386	1,125,642	630,600	4,770,628	82,504	(324,727)	4,528,405
Operating income (loss)	162,881	22,679	20,976	206,536	(7,222)	(66,720)	132,594
Total assets	1,481,119	332,121	434,718	2,247,958	37,707	738,432	3,024,097
Other items							
Capital expenditure (including intangible assets)	116,218	20,578	44,837	181,633	1,376	6,902	189,911
Depreciation	116,690	20,675	60,941	198,306	2,014	7,447	207,767
Amortization of goodwill for the year	14,991	46	573	15,610	–	–	15,610
Balance of goodwill at end of the fiscal year	79,974	184	(75)	80,083	–	–	80,083

Year ended March 31	Reportable segments				Other Operations	Elimination & Corporate	Consolidated
	Technology Solutions	Ubiquitous Solutions	Device Solutions	Total			
	U.S. Dollars (thousands)						
<b>2012 (in U.S. Dollars)</b>							
Net sales							
External customers	\$34,934,854	\$12,680,598	\$6,290,659	\$53,906,110	\$ 431,354	\$ 145,146	\$54,482,610
Inter-segment	856,671	1,396,012	839,829	3,092,512	587,902	(3,680,415)	–
Total sales	35,791,524	14,076,610	7,130,488	56,998,622	1,019,256	(3,535,268)	54,482,610
Operating income (loss)	2,088,988	243,146	(124,171)	2,207,963	(25,073)	(898,695)	1,284,195
Total assets	17,638,634	4,411,366	5,303,683	27,353,683	380,341	8,186,793	35,920,817
Other items							
Capital expenditure (including intangible assets)	1,459,902	240,220	632,634	2,332,756	19,207	64,720	2,416,683
Depreciation	1,302,085	258,659	688,817	2,249,561	22,024	99,744	2,371,329
Amortization of goodwill for the year	176,768	585	6,780	184,134	–	–	184,134
Balance of goodwill at end of the fiscal year	829,561	1,805	(7,878)	823,488	–	–	823,488

- Notes 1. "Other Operations" segment consists of operations not included in the reportable segments, such as Japan's Next-Generation Supercomputer project, facility services and the development of information systems for the Group companies and welfare benefits for the Group employees.
2. Operating income (loss) of "Elimination & Corporate" consists of corporate expenses and elimination.  
 Amounts incurred for the years ended March 31, 2011 and 2012 were, corporate expenses: ¥68,341 million and ¥75,929 million (\$925,963 thousand), elimination: ¥1,621 million and ¥2,236 million (\$27,268 thousand), respectively.  
 Corporate expenses mainly consist of strategic expenses such as basic research and development expenses which are not attributable to the reportable segments and group management shared expenses incurred by the Company.
3. Total assets of "Elimination & Corporate" consist of corporate assets and elimination. Balances at March 31, 2011 and 2012 were, corporate assets: ¥840,672 million and ¥767,959 million (\$9,365,354 thousand), elimination: ¥102,240 million and ¥96,642 million (\$1,178,561 thousand), respectively.  
 Corporate assets mainly consist of temporary excess funds, certificate of deposit, shares of customers held for maintaining and strengthening business ties and deferred tax assets.
4. The Group has adopted "Accounting Standard for Business Combinations" (Accounting Standards Board of Japan Statement No. 21) and "Revised Guidance on Accounting Standard for Business Combinations and Accounting Standard for Business Divestitures" (Accounting Standards Board of Japan Guidance No. 10) effective the year ended March 31, 2011. The negative goodwill generated by the business combination before the adoption of the standards is included in "Amortization of goodwill for the year" and "Balance of goodwill at end of the fiscal year."

#### 4. Related Information

##### (1) Information by products and services

###### Sales to external customers

Years ended March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Technology Solutions			
Services	¥2,385,345	<b>¥2,339,574</b>	<b>\$28,531,390</b>
System Platforms	542,306	<b>525,084</b>	<b>6,403,463</b>
Ubiquitous Solutions			
Personal Computers and Mobile Phones	733,035	<b>779,226</b>	<b>9,502,756</b>
Mobilewear	280,021	<b>260,583</b>	<b>3,177,841</b>
Device Solutions			
LSI	280,868	<b>281,325</b>	<b>3,430,793</b>
Electronic Components	264,861	<b>234,509</b>	<b>2,859,866</b>
Other Operations	32,738	<b>35,371</b>	<b>431,354</b>
Elimination & Corporate	9,231	<b>11,902</b>	<b>145,146</b>
<b>Total</b>	<b>¥4,528,405</b>	<b>¥4,467,574</b>	<b>\$54,482,610</b>

Note: The details of products and services are noted in "Business Overview" (page 30).

##### (2) Geographic information

###### a. Net sales

Years ended March 31	Yen (millions)		U.S. Dollars (thousands)		
	2011	2012	2011	2012	
Japan	¥2,941,042	64.9%	<b>¥2,961,478</b>	<b>66.3%</b>	<b>\$36,115,585</b>
Outside Japan					
EMEA	845,485	18.7%	<b>809,277</b>	<b>18.1%</b>	<b>9,869,232</b>
The Americas	322,272	7.1%	<b>286,595</b>	<b>6.4%</b>	<b>3,495,061</b>
APAC & China	419,606	9.3%	<b>410,224</b>	<b>9.2%</b>	<b>5,002,732</b>
Sub Total	1,587,363	35.1%	<b>1,506,096</b>	<b>33.7%</b>	<b>18,367,024</b>
<b>Total</b>	<b>¥4,528,405</b>	<b>100.0%</b>	<b>¥4,467,574</b>	<b>100.0%</b>	<b>\$54,482,610</b>

## b. Property, plant and equipment

	2011	Yen (millions) <b>2012</b>	U.S. Dollars (thousands) <b>2012</b>
At March 31			
Japan	¥531,438	<b>¥534,359</b>	<b>\$6,516,573</b>
Outside Japan			
EMEA	54,064	<b>47,344</b>	<b>577,366</b>
The Americas	16,586	<b>17,009</b>	<b>207,427</b>
APAC & China	36,554	<b>42,231</b>	<b>515,012</b>
Sub Total	107,204	<b>106,584</b>	<b>1,299,805</b>
Total	¥638,642	<b>¥640,943</b>	<b>\$7,816,378</b>

Notes 1. The principal countries and regions included in the Outside Japan segment are as follows:

- (1) EMEA (Europe, Middle East and Africa) ..... U.K., Germany, Spain, Finland, Sweden  
(2) The Americas ..... U.S.A., Canada  
(3) APAC & China (APAC = Asia-Pacific) ..... Australia, Singapore, Korea, Taiwan, China

2. There is no country which is required to be disclosed individually.  
3. Net sales are classified by countries or regions based on locations of customers.  
4. The property, plant and equipment are classified by countries or regions based on locations of the Group.

## (3) Information about major customer

## Net Sales

	2011	Yen (millions) <b>2012</b>	U.S. Dollars (thousands) <b>2012</b>
Years ended March 31			
NTT Group	¥528,327	<b>¥503,332</b>	<b>\$6,138,195</b>

Related segment: Technology Solutions, Ubiquitous Solutions and other segment

Note: NIPPON TELEGRAPH AND TELEPHONE CORPORATION, NIPPON TELEGRAPH AND TELEPHONE EAST CORPORATION, NIPPON TELEGRAPH AND TELEPHONE WEST CORPORATION, NTT COMMUNICATIONS CORPORATION, NTT DOCOMO, Inc. and NTT DATA CORPORATION are included in NTT Group.

## 19. Related-party Transactions

(Related-party transactions)

No significant transactions.

(Note to significant affiliate)

Not applicable for the year.

## 20. Earnings per Share

Years ended March 31	Yen		U.S. Dollars
	2011	2012	2012
Basic earnings per share	¥26.62	<b>¥20.64</b>	<b>\$0.252</b>
Diluted earnings per share	25.75	<b>20.55</b>	<b>0.251</b>

Years ended March 31	Yen (millions)		U.S. Dollars (thousands)
	2011	2012	2012
Net income	¥55,092	<b>¥42,707</b>	<b>\$520,817</b>
Net income not attributable to common stock holders	—	—	—
Net income attributable to common stock holders	55,092	<b>42,707</b>	<b>520,817</b>
Effect of dilutive securities	1,499	<b>155</b>	<b>1,890</b>
[Adjustment related to dilutive securities issued by subsidiaries and affiliates]	[(70)]	<b>[(18)]</b>	<b>[(220)]</b>
[Corporate bond costs (after tax adjustment)]	[1,569]	<b>[173]</b>	<b>[2,110]</b>
Diluted net income	¥56,191	<b>¥42,862</b>	<b>\$522,707</b>

	thousands	
	2011	2012
Basic weighted average number of shares	2,069,731	<b>2,069,526</b>
Effect of dilutive securities	127,549	<b>16,393</b>
[Subscription rights to share issued by subsidiaries and affiliates]	[127,549]	<b>[16,393]</b>
Diluted weighted average number of shares	2,197,280	<b>2,085,919</b>

1. There were no outstanding subscription rights to shares and stock options issued by the Company at March 31, 2012.
2. Subscription rights to shares on the unsecured convertible bonds due 2011, issued in accordance with a resolution of board of directors held on August 6, 2007, expired on May 24, 2011. The bonds were redeemed at maturity on May 31, 2011.
3. Stock options issued based on a resolution at the shareholders' meeting on June 26, 2001 expired on June 26, 2011.

## 21. Commitments and Contingent Liabilities

Commitments outstanding at March 31, 2012 for purchases of property, plant and equipment and intangible assets were approximately ¥6,750 million (\$82,317 thousand).

Contingent liabilities for guarantee contracts amounted to ¥2,271 million (\$27,695 thousand) at March 31, 2012 and referred mainly to ¥2,263 million (\$27,598 thousand) of guarantees given for employees' housing loans.

## 22. Events after the Reporting Period

No significant events.

# Independent Auditor's Report



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## Independent Auditor's Report

The Board of Directors  
FUJITSU LIMITED

### Report on the Consolidated Financial Statements

We have audited the accompanying consolidated financial statements of Fujitsu Limited and its consolidated subsidiaries (the "Group"), which comprise the consolidated balance sheet as at March 31, 2012, and the consolidated income statement, consolidated statement of comprehensive income, consolidated statement of changes in net assets, and consolidated statement of cash flows for the year then ended and a summary of significant accounting policies and other explanatory information, all expressed in Japanese yen.

#### *Management's Responsibility for the Consolidated Financial Statements*

The Group's management is responsible for the preparation and fair presentation of these consolidated financial statements in accordance with accounting principles generally accepted in Japan, and for designing and operating such internal control as management determines is necessary to enable the preparation and fair presentation of the consolidated financial statements that are free from material misstatement, whether due to fraud or error.

#### *Auditor's Responsibility*

Our responsibility is to express an opinion on these consolidated financial statements based on our audit. We conducted our audit in accordance with auditing standards generally accepted in Japan. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the consolidated financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the consolidated financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the consolidated financial statements, whether due to fraud or error. The purpose of an audit of the consolidated financial statements is not to express an opinion on the effectiveness of the entity's internal control, but in making these risk assessments the auditor considers internal controls relevant to the entity's preparation and fair presentation of the consolidated financial statements in order to design audit procedures that are appropriate in the circumstances. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

#### *Opinion*

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the consolidated financial position of the Group as at March 31, 2012, and its consolidated financial performance and its cash flows for the year then ended in conformity with accounting principles generally accepted in Japan.

#### *Convenience Translation*

We have reviewed the translation of these consolidated financial statements into U.S. dollars, presented for the convenience of readers, and, in our opinion, the accompanying consolidated financial statements have been properly translated on the basis described in Note 2.

A member firm of Ernst & Young Global Limited



### **Report on the Management's Report**

We have also audited the accompanying Management's Report on Internal Control over Financial Reporting for the consolidated financial statements as at March 31, 2012 of the Group (the "Management's Report").

#### *Management's Responsibility for the Management's Report*

The Group's management is responsible for designing and operating internal control over financial reporting, and the preparation and fair presentation of the Management's Report. Internal control over financial reporting may not prevent or detect misstatements.

#### *Auditor's Responsibility*

Our responsibility is to express an opinion on the Management's Report based on our audit. We conducted our internal control audit in accordance with auditing standards for internal control over financial reporting generally accepted in Japan. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the Management's Report is free from material misstatement.

An internal control audit involves performing procedures to obtain audit evidence about management's assessment on internal control over financial reporting in the Management's Report. The procedures selected depend on the auditor's judgment, including materiality of effect on the reliability of financial reporting. An internal control audit includes examining the overall presentation of the Management's Report, including disclosures on scope, procedures and conclusions of management's assessment of internal control over financial reporting.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our internal control audit opinion.

#### *Opinion*

In our opinion, the Management's Report referred to above, which represents that internal control over financial reporting of the consolidated financial statements as at March 31, 2012 is effective, presents fairly, in all material respects, management's assessment on internal control over financial reporting for the consolidated financial statements in conformity with standards for assessment of internal control over financial reporting generally accepted in Japan.

*Ernst & Young Shin Nihon LLC*

June 22, 2012

Tokyo, Japan

## DIRECTOR'S RESPONSIBILITY STATEMENT PURSUANT TO THE U.K. DTR4

I, Masami Yamamoto, being Representative Director of Fujitsu Limited confirm, to the best of my knowledge, that:

(i) the financial statements, prepared in accordance with Japanese GAAP, give a true and fair view of the assets, liabilities, financial position and profit or loss of Fujitsu Limited and the undertakings included in the consolidation taken as a whole; and

(ii) the management report includes a fair review of the development and performance of the business and the position of Fujitsu Limited and the undertakings included in the consolidation taken as a whole, together with a description of the principal risks and uncertainties that they face.

Masami Yamamoto

# MANAGEMENT'S REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING

## 1. Basic Framework of Internal Control over Financial Reporting

Masami Yamamoto, President and Representative Director of Fujitsu Limited (the "Company"), and Kazuhiko Kato, Corporate Executive Vice President and Director and Chief Financial Officer of the Company, are responsible for the design and operation of internal control over financial reporting for the Fujitsu Group's consolidated financial statements. The Fujitsu Group designs and operates its internal control over financial reporting in accordance with guidelines set forth in "On the Setting of the Standards and Practice Standards for Management Assessment and Audit concerning Internal Control Over Financial Reporting (Council Opinions)" from the Business Accounting Council of the Financial Service Agency of Japan.

Internal control aims at achieving the objectives to a reasonable extent with the organized and integrated function of basic individual components of internal control as a whole. There are inherent limitations to the extent that internal control can be achieved. Such limitations include misjudgments and carelessness by individuals carrying out internal control activities, or fraud caused by the collusion of two or more individuals. Accordingly, internal control may not completely prevent or detect misstatements in financial reporting.

## 2. Scope of Assessment, Assessment Date and Assessment Procedure

The Fujitsu Group performed an assessment of internal control over financial reporting for its consolidated financial statements as of the end of the fiscal year, March 31, 2012, in accordance with generally accepted assessment standards in Japan for internal control over financial reporting.

In making an assessment of the entire Fujitsu Group, including the parent company, Fujitsu Limited, and its consolidated subsidiaries and equity method affiliates, the necessary scope of the assessment was determined from the perspective of material impact on the reliability of financial reporting. Within the scope of assessment, the Company identified the risks of misstatement which would have a material impact on the reliability of financial reporting and the controls which mitigate such risks to a reasonably accepted level, and then assessed the effectiveness of the design and operation of those controls.

The Company determined that 125 consolidated companies and 1 equity method affiliate should be subject to the assessment of company-level controls, and financial closing and reporting process controls, taking into account the degree of quantitative and qualitative impact on the consolidated financial statements.

With respect to process-level controls, considering the results of the assessment of company-level controls, the Company designated 25 business locations that accounted for approximately two-thirds of the aggregated sales for this fiscal year (before elimination of inter-company transactions) of the consolidated companies as "significant business locations/units" which should be subject to the assessment.

In regard to those "significant business locations/units," the Company determined that sales, accounts receivables and inventories were the accounts closely associated with the Company's business objectives and, in principle, all business processes relating to those accounts should be subject to assessment. Some of those business processes, which do not have a material quantitative impact or are not closely associated with business objectives, were excluded from the scope of the assessment. Other business processes relating to significant accounts involving estimates and management's judgment were included in the scope of assessment, taking into account the impact on financial reporting individually.

Regarding IT general control for "significant business locations/units," the Company performed an assessment of the systems used to automate business process controls. These systems were assessed according to the type of infrastructure.

### **3. Assessment Result**

As a result of performing the assessment in accordance with the above policy, the Company concluded that the design and operation of internal control over financial reporting for the Fujitsu Group were effective as of March 31, 2012.

### **4. Supplementary Information**

The following events took place subsequent to the fiscal year ended March 31, 2012:

- On April 1, 2012, Fujitsu System Solutions Limited, the surviving company, together with Fujitsu Hokkaido Systems Limited, Fujitsu Tohoku Systems Limited and Fujitsu Nagano Systems Engineering Limited, were consolidated under one unified corporate structure. The name of the integrated company was changed to Fujitsu Systems East Limited on the same day.
- On April 1, 2012, Fujitsu Kansai Systems Limited, the surviving company, together with Fujitsu Chubu Systems Limited, Fujitsu Chugoku Systems Limited, Fujitsu Okayama Systems Engineering Limited, Fujitsu Shikoku Systems Limited and Fujitsu Nishi-Nihon Applications, Ltd. were consolidated under one unified corporate structure. The name of the integrated company was changed to Fujitsu Systems West Limited on the same day.

These events may have a significant impact on the assessment of the effectiveness of internal control over Fujitsu Group's financial reporting in fiscal year 2012 and thereafter.

# Principal Subsidiaries and Affiliates

(As of March 31, 2012)

## Consolidated Subsidiaries (538 companies)

### Japan

#### Listed

Shinko Electric Industries Co., LTD.  
NIFTY Corporation  
Fujitsu Component Limited  
Fujitsu Broad Solution & Consulting Inc.  
Fujitsu Frontech Limited  
FDK Corporation

#### Unlisted

Shimane Fujitsu Limited  
PFU Limited  
Fujitsu Isotec Limited  
Fujitsu IT Products Limited  
Fujitsu FIP Corporation  
Fujitsu FSAS Inc.  
Fujitsu Electronics Inc.  
Fujitsu Laboratories LTD.  
Fujitsu System Solutions Limited\*<sup>1</sup>  
Fujitsu Peripherals Limited  
Fujitsu Semiconductor Limited  
Fujitsu Telecom Networks Limited  
Fujitsu TEN Limited  
Fujitsu Toshiba Mobile Communications Limited\*<sup>2</sup>  
Fujitsu Personal System Limited  
Fujitsu Marketing Limited  
Fujitsu Mobile-phone Products Limited

### EMEA

#### Unlisted

Fujitsu Services Holdings PLC  
Fujitsu Technology Solutions (Holding) B.V.

### The Americas

#### Unlisted

Fujitsu America, Inc.  
Fujitsu Network Communications, Inc.  
Fujitsu Management Services of America, Inc.

### APAC/China

#### Unlisted

Fujitsu Australia Limited

\*<sup>1</sup> On April 1, 2012, Fujitsu System Solutions Limited absorbed three consolidated subsidiaries of Fujitsu in eastern Japan and changed its name to Fujitsu Systems East Limited.

\*<sup>2</sup> On April 1, 2012, Fujitsu Toshiba Mobile Communications Limited became a wholly owned consolidated subsidiary of Fujitsu and changed its name to Fujitsu Mobile Communications Limited.

## Equity-method Affiliates (18 companies)

### Japan

#### Listed

Fujitsu General Limited

#### Unlisted

Fujitsu Leasing Co., LTD.

## Shareholders' Data

(As of March 31, 2012)

Capital:	¥324,625 million
Common Stock: Authorized:	5,000,000,000 shares
Issued:	2,070,018,213 shares
Number of Shareholders:	188,185

### Equity Shareholdings by Type of Shareholder

Japanese Financial Institutions and Securities Firms	Other Japanese Corporations	Foreign Institutions and Individuals	Japanese Individuals and Others
27.26%	13.49%	35.93%	23.32%

\* The 118,892 thousand shares of Fujitsu Limited stock held by Fuji Electric Co., Ltd. and its consolidated subsidiaries as retirement benefit trust assets are categorized under the shareholdings of "Other Japanese Corporations."

Principal Shareholders	Number of shares held (thousands)	Percentage of shares held (%)
Fuji Electric Co., Ltd.	214,816	10.38
State Street Bank and Trust Company (Standing Proxy, The Hongkong and Shanghai Banking Corporation Limited Tokyo Branch)	105,256	5.08
The Master Trust Bank of Japan, Ltd. (for trust)	94,998	4.59
Japan Trustee Services Bank, Ltd. (for trust)	89,706	4.33
Fujitsu Employee Shareholding Association	46,320	2.24
SSBT ODO5 OMNIBUS ACCOUNT - TREATY CLIENTS (Standing Proxy, The Hongkong and Shanghai Banking Corporation Limited Tokyo Branch)	45,688	2.21
Japan Trustee Services Bank, Ltd. (for trust 9)	41,441	2.00
Asahi Mutual Life Insurance Company	41,389	2.00
Mizuho Corporate Bank, Ltd.	32,654	1.58
State Street Bank and Trust Company 505225 (Standing Proxy, Mizuho Corporate Bank, Ltd. Settlement & Clearing Services Division)	26,250	1.27
Total	738,521	35.68

- Notes: 1. The shares held by The Master Trust Bank of Japan, Ltd. (for trust), Japan Trustee Services Bank, Ltd. (for trust), and Japan Trustee Services Bank, Ltd. (for trust 9), are related to the institutions' trust businesses.
2. At the end of the fiscal year ended March 31, 2011 Fuji Electric Co., Ltd. (formerly called Fuji Electric Holdings Co., Ltd.) was not a major shareholder in the Company, but as of March 31, 2012, it had become a major shareholder of the Company following a merger with Fujitsu Electric Systems Co., Ltd. Of the shares held by Fuji Electric Co., Ltd., 105,718 thousand shares are trust assets entrusted to Mizuho Trust & Banking Co., Ltd., and re-trusted to Trust & Custody Services Bank, Ltd. as retirement benefit trust assets. The voting rights attached to these shares are exercised upon instructions of Fuji Electric Co., Ltd. The Fujitsu shares held by Fuji Electric Co., Ltd. and its consolidated subsidiaries total 231,873 thousand shares (which accounts for 11.20% of outstanding shares), and included 118,892 thousand shares held in the form of retirement benefit trust assets.
3. Of the shares held by the Mizuho Corporate Bank, Ltd., 212 thousand shares are trust assets entrusted to Mizuho Trust & Banking Co., Ltd., and re-trusted to Trust & Custody Services Bank, Ltd. as retirement benefit trust assets. The voting rights attached to these shares are exercised upon instructions of Mizuho Corporate Bank, Ltd.
4. Dodge & Cox submitted a change in large shareholding report dated July 4, 2011 to the Director General of the Kanto Local Finance Bureau containing information that the company was obligated to report as of June 30, 2011. Because Fujitsu was unable to verify the effective shareholdings listed in the change in large shareholding report regarding its shares, as of the fiscal year-end, the company has not been included in the above list of principal shareholders. The details of the change in shareholding report are as follows:

Shareholder	Number of shares held (thousands)	Percentage of total shares outstanding (%)
Dodge & Cox	103,918	5.02

### Corporate Headquarters:

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1-5-2 Higashi-Shimbashi  
Minato-ku, Tokyo 105-7123, Japan  
Telephone: +81-3-6252-2220

### Transfer Agent:

Mitsubishi UFJ Trust and Banking Corporation  
4-5, Marunouchi 1-chome  
Chiyoda-ku, Tokyo 100-8212, Japan

### Stock Exchange Listings:

Japan: Tokyo, Osaka, Nagoya  
Overseas: London

### Independent Auditors:

Ernst & Young ShinNihon LLC

### Shareholder Information:

For further information, please contact:  
Fujitsu Limited  
Public & Investor Relations  
Telephone: +81-3-6252-2173  
Facsimile: +81-3-6252-2783

<http://www.fujitsu.com/global/about/ir/>

# FUJITSU LIMITED

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### Legibility Considerations

We have reviewed this report using our ColorSelector tool to choose a highly accessible color combination so that the text and figures will be as legible as possible to the widest range of readers.

### Consideration for the Environment

- This report has been printed using waterless printing, which reduces the amount of harmful materials used and emitted.
- It is printed on FSC® Certified Paper as designated by the Forest Stewardship Council® in order to help preserve forestry resources.
- It uses vegetable oil inks that do not include volatile organic compounds.



## Fujitsu's brand promise: shaping tomorrow with you

A company's brand promise expresses the value the company delivers to its customers.

The Fujitsu Group's brand promise articulates the importance we place on working with our customers to shape a prosperous society, by harnessing the power of information and communication technology (ICT).

Employing over 170,000 people to support customers in more than 100 countries, Fujitsu is the Japanese global ICT company. We are delivering on our brand promise.

**State of Utah**

*PROJECT: State of Utah Division of Purchasing and General Services - WSCA-NASPO  
Solicitation JP14001*

**PREPARED BY:**

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1-(972) 479-2354

Prepared On: July 10, 2013

Last Revised On: August 16, 2013

Quote #: 2013-020175-5332

Quote Expiration Date: October 8, 2013

**SEND PURCHASE ORDERS TO:**

FUJITSU NETWORK COMMUNICATIONS

Attn: OrderAdmin9938@fnc.fujitsu.com

2801 Telecom Parkway

Richardson, Texas 75082

Ph: (972) 479-2417 Fax: (972) 479-6984

**Terms and Conditions:**

If a current written agreement already exists between the recipient of this quote and Fujitsu Network Communications, Inc.

(FNC) regarding the purchase of FNC furnished products or services of the type described in the accompanying quote, that agreement will be applicable to the purchase of products or services on the current quote. However, if a current agreement with FNC as described above does not exist, or product or services were previously purchased on a per-order basis, this quote is subject to the signing and return of FNC's General Terms and Conditions of Sale, found at <http://responder.fnc.fujitsu.com/gents>, prior to FNC shipping the quoted products or performing the quoted services.

If this quote includes DWDM equipment, the design is dependent on having accurate fiber characterization data. Any differences between fiber data used in the design and actual field conditions will result in changes to hardware and will likely impact project schedules and costs.

If a Purchase Order is received after the expiration date of this quote, a revision to the quote may be required.

Fujitsu, the Fujitsu logo, and "shaping tomorrow with you" are trademarks or registered trademarks of Fujitsu Limited in the United States and other countries. FLASHWAVE and NETSMART are registered trademarks of Fujitsu Network Communications, Inc. All rights reserved. Any other trademarks or logos used herein are the property of their respective owners and no affiliation or endorsement is claimed or intended by their use.

All purchase orders should include the corresponding quote number (2013-020175-5332) to be clearly indicated on your PO.

Unless otherwise stated, this quote does not include shipping or taxes.

## Financial Highlights (Billions of Yen)

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY2008	FY2009	FY 2010
Net sales	4,766.8	4,762.7	4,791.4	5,100.1	5,330.8	4,692.9	4,679.5	4,528.4
Japan	3,378.2	3,340.6	3,199.8	3,274.9	3,407.2	3,193.1	2,931.2	2,941.0
Overseas	1,388.6	1,422.0	1,591.5	1,825.2	1,923.6	1,499.8	1,748.3	1,587.3
Cost of sales	3,460.9	3,512.5	3,523.4	3,781.6	3,959.5	3,491.5	3,436.4	3,270.9
Cost of sales ratio	72.6%	73.8%	73.5%	74.1%	74.3%	74.4%	73.4%	72.2%
SG&A expenses	1,155.6	1,090.0	1,086.5	1,136.4	1,166.3	1,132.7	1,148.7	1,124.8
Operating income (loss)	150.3	160.1	181.4	182.0	204.9	68.7	94.3	132.5
Operating income margin	3.2%	3.4%	3.8%	3.6%	3.8%	1.5%	2.0%	2.9%
Income (loss) before income taxes and minority interests	157.0	223.5	118.0	214.4	109.4	(113.3)	112.7	102.2
Net income (loss)	49.7	31.9	68.5	102.4	48.1	(112.3)	93.0	55.0
Ending balance of:								
Total assets	3,865.5	3,640.1	3,807.1	3,943.7	3,821.9	3,221.9	3,228.0	3,024.0
Interest-bearing loans	1,277.1	1,082.7	928.6	745.8	887.3	883.4	577.4	470.8
Total liabilities	2,847.9	2,619.0	2,717.0	2,783.0	2,691.7	2,296.3	2,279.6	2,070.3
Capital	324.6	324.6	324.6	324.6	324.6	324.6	324.6	324.6
Shareholders' equity	827.1	856.9	917.0	969.5	948.2	748.9	798.6	821.2
Cash flows from operating activities	304.0	277.2	405.5	408.7	322.0	248.0	295.3	255.5
Cash flows from investing activities	67.3	(15.1)	(234.6)	(151.0)	(283.9)	(224.6)	1.0	(142.1)
Free cash flow	371.4	262.1	170.8	257.6	38.1	23.4	296.4	113.4

## ■ Sales & Operating Income by Business Segment

	Full Year FY2010				Full Year FY2011			
	Sales			Operating Income	Sales			Operating Income
	Total	Japan	Overseas		Total	Japan	Overseas	
Technology Solutions	3,014.3	1,942.1	1,072.1	162.8	2,934.9	1,912.5	1,022.3	171.2
Services	2,419.5	1,515.9	903.6	117.3	2,371.2	1,494.7	876.5	124.0
Solutions / SI Infrastructure Services	830.0 1,589.5				824.8 1,546.4			
System Platforms	594.8	426.2	168.5	45.5	563.6	417.8	145.7	47.2
System Products Network Products	326.5 268.2				282.7 280.8			
Ubiquitous Solutions	1,125.6	851.6	273.9	22.6	1,154.2	884.9	269.3	19.9
PCs / Mobile Phones Mobilewear	842.5 283.1				889.5 264.7			
Device Solutions	630.6	361.3	269.2	20.9	584.7	342.9	241.7	-10.1
L S I Devices Electronic Components	343.7 288.5				327.1 258.6			
Other/Elimination and Corporate	-242.2	-214.1	-28.0	-73.9	-206.3	-178.9	-27.3	-75.7
Other Elimination and Corporate	82.5 -324.7			-7.2 -66.7	83.5 -289.8			
Total	4,528.4	2,941.0	1,587.3	132.5	4,467.5	2,961.4	1,506.0	105.3

(Billion Yen)

Full Year FY2012			
Total	Sales		Operating Income
	Japan	Overseas	
2,942.3	1,936.4	1,005.9	180.9
2,387.2	1,516.4	870.7	131.6
837.1			
1,550.0			
555.1	419.9	135.1	49.3
262.9			
292.2			
1,090.2	823.0	267.1	9.6
822.8			
267.4			
540.3	295.9	244.4	-14.2
289.6			
252.5			
191.2	-171.9	-19.3	-81.0
64.7			-6.9
-255.9			-74.1
4,381.7	2,883.5	1,498.2	95.2

	1Q FY2012				2Q FY2012				1st Half	
	Sales			Operating Income	Sales			Operating Income	Sales	
		Japan	Overseas		Total	Japan	Overseas		Total	Japan
Technology Solutions	627.1	402.2	224.8	0.8	713.3	478.2	235.1	46.2	1,340.4	880.4
Services	513.6	315.7	197.8	4.9	575.6	376.0	199.5	32.4	1,089.2	691.8
Solutions / SI	170.5				210.2				380.7	
Infrastructure Services	343.1				365.3				708.5	
System Platforms	113.4	86.4	26.9	-4.0	137.6	102.1	35.5	13.7	251.1	188.5
System Products	49.1				61.7				110.8	
Network Products	64.3				75.9				140.2	
Ubiquitous Solutions	234.6	175.8	58.7	-2.0	314.7	250.2	64.5	12.4	549.3	426.0
PCs / Mobile Phones	170.6				249.3				420.0	
Mobilewear	63.9				65.4				129.3	
Device Solutions	130.3	72.0	58.3	-3.6	138.3	78.1	60.1	-3.3	268.6	150.1
LSI Devices	67.8				76.2				144.1	
Electronic Components	62.7				62.3				125.0	
Other/Elimination and Corporate	-34.7	-31.1	-3.5	-20.2	-51.9	-46.9	-4.9	-22.5	-86.7	-78.1
Other	19.6			-1.4	16.0			-1.6	35.7	
Elimination and Corporate	-54.4			-18.7	-67.9			-20.8	-122.4	
<b>Total</b>	<b>957.3</b>	<b>618.9</b>	<b>338.3</b>	<b>-25.0</b>	<b>1,114.4</b>	<b>759.5</b>	<b>354.8</b>	<b>32.7</b>	<b>2,071.8</b>	<b>1,378.5</b>

FY2012		3Q FY2012				4Q FY2012				Full Year FY2012		
Overseas	Operating Income	Sales			Operating Income	Sales			Operating Income	Sales		
		Total	Japan	Overseas		Total	Japan	Overseas		Total	Japan	Overseas
459.9	47.0	700.6	451.2	249.3	23.5	901.3	604.6	296.6	110.2	2,942.3	1,936.4	1,005.9
397.3	37.3	576.5	357.4	219.0	21.7	721.4	467.1	254.3	72.4	2,387.2	1,516.4	870.7
		194.8				261.5				837.1		
		381.7				459.8				1,550.0		
62.5	9.6	124.1	93.8	30.2	1.8	179.8	137.5	42.3	37.8	555.1	419.9	135.1
		58.6				93.4				262.9		
		65.4				86.4				292.2		
123.3	10.4	266.5	200.3	66.1	-2.0	274.3	196.6	77.7	1.2	1,090.2	823.0	267.1
		206.9				195.8				822.8		
		59.5				78.5				267.4		
118.5	-7.0	129.5	73.0	56.4	-9.3	142.1	72.7	69.4	2.1	540.3	295.9	244.4
		70.6				74.8				289.6		
		59.3				68.1				252.5		
-8.5	-42.7	-48.3	-43.3	-5.0	-16.3	-56.1	-50.3	-5.8	-21.9	-191.2	-171.9	-19.3
	-3.1	14.3			-1.9	14.6			-1.8	64.7		
	-39.6	-62.7			-14.3	-70.8			-20.1	-255.9		
693.2	7.6	1,048.2	681.3	366.9	-4.1	1,261.6	823.6	438.0	91.7	4,381.7	2,883.5	1,498.2

(Billion Yen)

<b>Operating Income</b>
180.9
131.6
49.3
9.6
-14.2
-81.0
-6.9
-74.1
95.2

## ■ Sales & Operating Income by Geographic Segment

	(Billion Yen)									
	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012
<b>Japan</b>										
Sales	4,071.4	4,024.5	3,944.4	4,077.1	4,229.7	3,789.9	3,400.5	3,389.2	3,396.2	3,306.4
Operating Income	185.7	173.5	171.1	191.8	240.9	106.4	166.3	215.7	177.8	178.4
<b>EMEA</b>										
Sales	563.3	596.9	632.5	736.3	769.9	612.8	975.6	849.5	817.5	785.2
Operating Income	6.6	11.7	22.9	24.1	0.7	12.0	-2.6	-18.4	-0.0	-12.4
<b>The Americas</b>										
Sales	274.6	298.9	363.4	442.3	469.9	365.2	293.8	298.4	277.5	273.7
Operating Income	-13.1	4.3	13.5	8.4	9.2	-1.3	1.8	2.6	0.4	-2.2
<b>APAC &amp; China</b>										
Sales	579.1	602.8	718.8	807.1	855.0	656.0	505.4	405.1	421.9	468.7
Operating Income	13.5	12.1	14.9	11.6	14.8	6.4	12.9	11.0	7.6	10.4
<b>Elimination</b>										
Sales	-721.8	-760.4	-867.8	-962.8	-993.8	-731.1	-496.0	-414.0	-445.7	-452.4
Operating Income	-42.4	-41.5	-41.1	-54.0	-60.7	-54.9	-84.1	-78.3	-80.6	-79.0
<b>Total</b>										
Sales	4,766.8	4,762.7	4,791.4	5,100.1	5,330.8	4,692.9	4,679.5	4,528.4	4,467.5	4,381.7
Operating Income	150.3	160.1	181.4	182.0	204.9	68.7	94.3	132.5	105.3	95.2

## Capital Expenditures &amp; Depreciation Expenses (Billions of Yen)

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
Capital Expenditures	159.7	181.4	249.9	305.2	249.0	167.6	126.4	130.2
Depreciation	200.0	169.9	169.8	202.8	200.5	223.9	164.8	141.6

## R &amp; D Expenditures (Billions of Yen, %)

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY2009	FY 2010
R & D Expenditures	250.9	240.2	241.5	254.0	258.7	249.9	224.9	236.2
As percentage of sales (%)	5.3	5.0	5.0	5.0	4.9	5.3	4.8	5.2

## Employees, Subsidiaries

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY2008	FY2009	FY 2010	FY 2011	FY 2012
The number of: Employees	156,169	150,970	158,491	160,977	167,374	165,612	172,438	172,336	173,155	168,733
Consolidated subsidiaries	455	403	392	393	430	480	540	535	538	514

## Per Share Data

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Amounts per share of common stock (yen):										
Basic earnings (loss)	24.55	15.42	32.83	49.54	23.34	(54.35)	45.21	26.62	20.64	(35.24)
Shareholders' equity	413.22	414.18	443.20	469.02	458.31	362.30	386.79	396.81	406.42	377.62
Cash dividends	3.00	6.00	6.00	6.00	8.00	8.00	8.00	10.00	10.00	5.00

Printed By: Beverly Elledge

Date Printed: June 26, 2013

## Live Report : FUJITSU NETWORK COMMUNICATIONS, INC.

D-U-N-S® Number: 78-694-5451

Trade Names: (FOREIGN PARENT IS FUJITSU LIMITED, JAPAN.)

Endorsement/Billing Reference: beverly.elledge@us.fujitsu.com


D&B Address	
<b>Address</b>	2801 Telecom Parkway Richardson, TX - 75082
<b>Phone</b>	972 479-6000
<b>Fax</b>	972-479-6900
<b>Location Type</b>	Headquarters (Subsidiary)
<b>Web</b>	

Added to Portfolio: 09/24/2008




Last View Date: 09/12/2012

Endorsement : beverly.elledge@us.fujitsu.com

## Company Summary

Currency: Shown in USD unless otherwise indicated 

### Score Bar

PAYDEX®	 75
Commercial Credit Score Class	 2
Financial Stress Score Class	 3
Credit Limit - D&B Conservative	1,000,000.00
D&B Rating	1R3

### D&B 3-month PAYDEX®

## 3-month D&B PAYDEX®: 74

Lowest Risk: 100; Highest Risk : 1

When weighted by amount, Payments to suppliers average 9 Days Beyond Terms

### D&B Company Overview

This is a headquarters (subsidiary) location

Branch(es) or Division(s) exist Y

<b>Chief Executive</b>	SATOSHI IKEUCHI, PRES- CEO
<b>Year Started</b>	1980
<b>Management Control</b>	2007
<b>Employees</b>	1400 (1000 Here)
<b>Financing</b>	SECURED
<b>SIC</b>	3661 , 3663
<b>Line of business</b>	Mfg telephone/ telegraph apparatus, mfg

### D&B PAYDEX®

## D&B PAYDEX® 75

Lowest Risk: 100; Highest Risk : 1

When weighted by amount, Payments to suppliers average 8 days beyond terms

### Public Filings

The following data includes both open and closed filings found in D&amp;B's database on this company.

Record Type	Number of Records	Most Recent Filing Date
Bankruptcies	0	-
Judgments	0	-
Liens	1	09/24/08
Suits	0	-
UCCs	51	05/22/13

The public record items contained herein may have been paid, terminated, vacated or released prior to today's date.

### Financial Stress Score Class

## Financial Stress Score Class: 3

Lowest Risk: 1; Highest Risk : 5

### Corporate Linkage

This is a **Headquarters (Subsidiary)** locationFUJITSU NETWORK COMMUNICATIONS, INC.  
Richardson , TX

radio/ tv  
communication  
equipment

D-U-N-S® Number 78-694-5451

**The Parent Company is**

FUJITSU LIMITED

TOKYO

D-U-N-S® Number 69-053-5281

<b>NAICS</b>	334210
<b>History Status</b>	CLEAR

**Commercial Credit Score Class****Commercial Credit Score Class: 2** 

Lowest Risk:1;Highest Risk :5

**Detailed Trade Risk Insight™**

Days Beyond Terms Past 3 Months

**3**

Days

Dollar-weighted average of **44** payment  
experiences reported from **33** Companies

## Recent Derogatory Events

	Mar-13	Apr-13	May-13
<b>Placed for Collection</b>	-	-	-
<b>Bad Debt Written Off</b>	-	-	-

**Corporate Linkage****Parent**

Company	City , Country	D-U-N-S® NUMBER
FUJITSU LIMITED	MINATO-KU , JAPAN	69-053-5281

**Branches (Domestic)**

Company	City , State	D-U-N-S® NUMBER
FUJITSU NETWORK COMMUNICATIONS, INC.	GIBSONIA , Pennsylvania	01-085-7808
FUJITSU NETWORK COMMUNICATIONS, INC.	EXTON , Pennsylvania	01-327-9257
FUJITSU NETWORK COMMUNICATIONS, INC.	EAST LANSING , Michigan	01-392-2229
FUJITSU NETWORK COMMUNICATIONS, INC.	CHERRY HILL , New Jersey	01-717-9305
FUJITSU NETWORK COMMUNICATIONS, INC.	PORTLAND , Oregon	01-793-6316
FUJITSU NETWORK COMMUNICATIONS, INC.	SAN JOSE , California	02-381-5173
FUJITSU NETWORK COMMUNICATIONS, INC.	FORT LAUDERDALE , Florida	03-125-8499
FUJITSU NETWORK COMMUNICATIONS, INC.	VANCOUVER , Washington	05-323-2638
FUJITSU NETWORK COMMUNICATIONS, INC.	LITTLE ROCK , Arkansas	06-992-1091
FUJITSU NETWORK COMMUNICATIONS, INC.	WAUKEE , Iowa	10-602-5344
FUJITSU NETWORK COMMUNICATIONS, INC.	ATLANTA , Georgia	61-861-2170
FUJITSU NETWORK COMMUNICATIONS, INC.	ITASCA , Illinois	61-861-2519
FUJITSU NETWORK COMMUNICATIONS, INC.	HANOVER , Maryland	62-521-9233

FUJITSU NETWORK COMMUNICATIONS, INC.	INDIANAPOLIS , Indiana	82-844-5692
FUJITSU NETWORK COMMUNICATIONS, INC.	OSSEO , Minnesota	86-857-7412
FUJITSU NETWORK COMMUNICATIONS, INC.	PEARL RIVER , New York	95-800-7528
FUJITSU NETWORK COMMUNICATIONS, INC.	TAMPA , Florida	95-756-5369
FUJITSU NETWORK COMMUNICATIONS, INC.	JACKSONVILLE , Florida	96-952-2820
FUJITSU NETWORK COMMUNICATIONS, INC.	SAN RAMON , California	94-071-7648
FUJITSU NETWORK COMMUNICATIONS, INC.	CHELMSFORD , Massachusetts	94-968-8634
FUJITSU NETWORK COMMUNICATIONS, INC.	KANSAS CITY , Missouri	96-437-2288
FUJITSU NETWORK COMMUNICATIONS, INC.	RALEIGH , North Carolina	96-643-5919
FUJITSU NETWORK COMMUNICATIONS, INC.	HONOLULU , Hawaii	00-134-4634
FUJITSU NETWORK COMMUNICATIONS, INC.	FALLS CHURCH , Virginia	16-835-6512
FUJITSU NETWORK COMMUNICATIONS, INC.	SWEDESBORO , New Jersey	02-254-3024

This list is limited to the first 25 branches.

For the complete list, Please logon to DNBI and view the Dynamic Family Tree Information.

### Affiliates (Domestic)

Company	City , State	D-U-N-S® NUMBER
FUJITSU MANAGEMENT SERVICES OF AMERICA, INC.	SUNNYVALE , California	08-292-1644
GLOVIA INTERNATIONAL, INC.	EL SEGUNDO , California	17-948-9927
FUJITSU NORTH AMERICA HOLDINGS, INC.	SUNNYVALE , California	83-170-0229


### Affiliates (International)

Company	City , Country	D-U-N-S® NUMBER
FUJITSU SERVICES HOLDINGS PLC	London , UNITED KINGDOM	21-199-0304
RUNMYPROCESS	PARIS , FRANCE	29-497-2737
Fujitsu Enabling Software Technology GmbH	München , GERMANY	33-124-3530
FUJITSU EMEA PLC	London , UNITED KINGDOM	39-817-0928
Fujitsu Technology Solutions (Holding) B.V.	Maarsse , NETHERLANDS	40-395-8643
FUJITSU SERVICES (PTY) LTD	Johannesburg , SOUTH AFRICA	53-933-8819
FUJITSU COMPUTER PRODUCTS OF VIETNAM, INC.	BIEN HOA , VIETNAM	55-526-2047
FUJITSU VIETNAM LTD	HA NOI , VIETNAM	55-527-5068
Fujitsu Services Egypt	CAIRO , EGYPT	55-809-1101
Fujitsu Mexico Systems, S.A. de C.V.	TIJUANA , MEXICO	58-914-7235
FUJITSU ASIA PTE LTD	SINGAPORE , SINGAPORE	59-587-8992
Fujitsu Optel Limited	Mandideep , INDIA	65-017-9567
FUJITSU TELECOMMUNICATIONS ASIA SDN BHD	Cyberjaya , MALAYSIA	65-226-0787
Fujitsu (China) Co., Ltd.	BEIJING , CHINA	65-470-0905
FUJITSU TAIWAN LTD.	Taipei City , TAIWAN	65-702-9724
Fujitsu PC Asia Pacific Limited	SHA TIN , HONG KONG	66-290-8250
AFFILIATE HOLDING COMPANY LIMITED	BANG RAK , THAILAND	67-166-1994
Fujitsu Hong Kong Limited	QUARRY BAY , HONG KONG	68-644-8317
Fujitsu Korea Ltd.	SEOUL , REPUBLIC OF KOREA	68-775-0877
FUJITSU TELECOM NETWORKS LIMITED	KAWASAKI , JAPAN	69-085-2330
FUJITSU LABORATORIES LTD.	KAWASAKI , JAPAN	69-087-7303
PFU LIMITED	KAHOKU , JAPAN	69-087-7626

This list is limited to the first 25 affiliates.

For the complete list, Please logon to DNBI and view the Dynamic Family Tree Information.

## Predictive Scores

Currency: Shown in USD unless otherwise indicated 

### Credit Capacity Summary

This credit rating was assigned because of D&B's assessment of the company's creditworthiness. For more information, see the [D&B Rating Key](#)

**D&B Rating : 1R3**

**Number of employees: 1R indicates 10 or more employees**  
**Composite credit appraisal: 3 is fair**

The Rating was changed on April 12, 2013 because of a change in payment information appearing in D & B's file.

The 1R and 2R ratings categories reflect company size based on the total number of employees for the business. They are assigned to business files that do not contain a current financial statement. In 1R and 2R Ratings, the 2, 3, or 4 creditworthiness indicator is based on analysis by D&B of public filings, trade payments, business age and other important factors. 2 is the highest Composite Credit Appraisal a company not supplying D&B with current financial information can receive.

**Below is an overview of the companys rating history since 01-24-2007**

**Number of Employees Total:** 1,400 (1000 here)

D&B Rating	Date Applied
1R3	04-12-2013
1R4	04-27-2012
1R3	01-04-2012
1R4	04-28-2008
1R3	01-24-2007

Payment Activity:	(based on 172 experiences)
<b>Average High Credit:</b>	56,455
<b>Highest Credit:</b>	1,000,000
<b>Total Highest Credit:</b>	7,858,550

### D&B Credit Limit Recommendation

<b>Conservative credit Limit</b>	1,000,000
<b>Aggressive credit Limit:</b>	1,000,000

**Risk category for this business : LOW**

The Credit Limit Recommendation (CLR) is intended to serve as a directional benchmark for all businesses within the same line of business or industry, and is not calculated based on any individual business. Thus, the CLR is intended to help guide the credit limit decision, and must be balanced in combination with other elements which reflect the individual company's size, financial strength, payment history, and credit worthiness, all of which can be derived from D&B reports.

Risk is assessed using D&B's scoring methodology and is one factor used to create the recommended limits. See Help for details.

### Financial Stress Class Summary

The Financial Stress Score predicts the likelihood of a firm ceasing business without paying all creditors in full, or reorganization or obtaining relief from creditors under state/federal law over the next 12 months. Scores were calculated using a statistically valid model derived from D&B's extensive data files.

The Financial Stress Class of 3 for this company shows that firms with this class had a failure rate of 0.24% (24 per 10,000), which is lower than the average of businesses in D & B's database

**Financial Stress Class : 3** 

(Lowest Risk:1; Highest Risk:5)

Moderate risk of severe financial stress, such as a bankruptcy, over the next 12 months.

**Probability of Failure:**

- Among Businesses with this Class: **0.24 %** (24 per 10,000)
- Financial Stress National Percentile : **44** (Highest Risk: 1; Lowest Risk: 100)
- Financial Stress Score :&nbsp; **1470** (Highest Risk: 1,001; Lowest Risk: 1,875)
- Average of Businesses in D&Bs database: **0.48 %** ( 48 per 10,000)

**The Financial Stress Class of this business is based on the following factors:**

- Low proportion of satisfactory payment experiences to total payment experiences.
- UCC Filings reported.
- High proportion of past due balances to total amount owing.
- High number of inquiries to D & B over last 12 months.
- Limited time under present management control

**Notes:**

- The Financial Stress Class indicates that this firm shares some of the same business and financial characteristics of other companies with this classification. It does not mean the firm will necessarily experience financial stress.
- The Probability of Failure shows the percentage of firms in a given Class that discontinued operations over the past year with loss to creditors. The Probability of Failure - National Average represents the national failure rate and is provided for comparative purposes.
- The Financial Stress National Percentile reflects the relative ranking of a company among all scorable companies in D&Bs file.
- The Financial Stress Score offers a more precise measure of the level of risk than the Class and Percentile. It is especially helpful to customers using a scorecard approach to determining overall business performance.

Norms	National %
This Business	44
Region: WEST SOUTH CENTRAL	44
Industry: MANUFACTURING	52
Employee range: 500+	61
Years in Business: 6-10	43

This Business has a Financial Stress Percentile that shows:

Similar risk compared to other companies in the same region.

Higher risk than other companies in the same industry.

Higher risk than other companies in the same employee size range.

Lower risk than other companies with a comparable number of years in business.

**Credit Score Summary**

The Commercial Credit Score (CCS) predicts the likelihood of a business paying its bills in a severely delinquent manner (91 days or more past terms), obtaining legal relief from its creditors or ceasing operations without paying all creditors in full over the next 12 months. The Credit Score class of 2 for this company shows that 2.5% of firms with this class paid one or more bills severely delinquent, which is lower than the average of businesses in D & B's database.

**Credit Score Class : 2** 

Lowest Risk:1;Highest Risk :5

**Incidence of Delinquent Payment**

- Among Companies with this Classification: **2.50 %**
- Average compared to businesses in D&Bs database: **10.20 %**
- Credit Score Percentile : **86** (Highest Risk: 1; Lowest Risk: 100)
- Credit Score : **567** (Highest Risk: 101; Lowest Risk:670)

**The Credit Score Class of this business is based on the following factors:**

- Limited time in business
- Evidence of open liens

- Proportion of slow payments in recent months

**Notes:**

- The Commercial Credit Score Risk Class indicates that this firm shares some of the same business and financial characteristics of other companies with this classification. It does not mean the firm will necessarily experience severe delinquency.
- The Incidence of Delinquent Payment is the percentage of companies with this classification that were reported 91 days past due or more by creditors. The calculation of this value is based on D&B's trade payment database.
- The Commercial Credit Score percentile reflects the relative ranking of a firm among all scorable companies in D&B's file.
- The Commercial Credit Score offers a more precise measure of the level of risk than the Risk Class and Percentile. It is especially helpful to customers using a scorecard approach to determining overall business performance.

Norms	National %
This Business	86
Region: WEST SOUTH CENTRAL	52
Industry: MANUFACTURING	62
Employee range: 500-38527	84
Years in Business: 6-10	43

This business has a Credit Score Percentile that shows:

- Lower risk than other companies in the same region.
- Lower risk than other companies in the same industry.
- Lower risk than other companies in the same employee size range.
- Lower risk than other companies with a comparable number of years in business.


## Trade Payments

**Currency:** Shown in USD unless otherwise indicated 

### D&B PAYDEX®

The D&B PAYDEX is a unique, weighted indicator of payment performance based on payment experiences as reported to D&B by trader references. Learn more about the D&B PAYDEX

Timeliness of historical payments for this company.

<b>Current PAYDEX is</b>	<b>75</b>	Equal to 8 days beyond terms ( Pays more promptly than the average for its industry of 9 days beyond terms )
<b>Industry Median is</b>	<b>74</b>	Equal to 9 days beyond terms
<b>Payment Trend currently is</b>		Unchanged, compared to payments three months ago

Indications of slowness can be the result of dispute over merchandise, skipped invoices etc. Accounts are sometimes placed for collection even though the existence or amount of the debt is disputed.

<b>Total payment Experiences in D&amp;Bs File (HQ)</b>	172
<b>Payments Within Terms (not weighted)</b>	82 %
<b>Trade Experiences with Slow or Negative Payments(%)</b>	23.84%
<b>Total Placed For Collection</b>	0
<b>High Credit Average</b>	56,455
<b>Largest High Credit</b>	1,000,000
<b>Highest Now Owing</b>	700,000
<b>Highest Past Due</b>	95,000

### D&B PAYDEX® : **75**

(Lowest Risk:100; Highest Risk:1)  
When weighted by amount, payments to suppliers average 8 days beyond terms

### 3-Month D&B PAYDEX® : 74

(Lowest Risk:100; Highest Risk:1)  
Based on payments collected over last 3 months.

When weighted by amount, payments to suppliers average 9 days beyond terms

#### D&B PAYDEX® Comparison

##### Current Year

PAYDEX® of this Business compared to the Primary Industry from each of the last four quarters. The Primary Industry is Mfg telephone/telegraph apparatus, mfg radio/tv communication equipment , based on SIC code 3661 .

Shows the trend in D&B PAYDEX scoring over the past 12 months.

	7/12	8/12	9/12	10/12	11/12	12/12	1/13	2/13	3/13	4/13	5/13	6/13
<b>This Business</b>	75	75	75	75	75	75	74	75	75	75	75	75
<b>Industry Quartiles</b>												
Upper	.	.	78	.	.	78	.	.	78	.	.	.
Median	.	.	74	.	.	74	.	.	74	.	.	.
Lower	.	.	69	.	.	69	.	.	69	.	.	.

- Current PAYDEX for this Business is 75 , or equal to 8 days beyond terms
- The 12-month high is 75 , or equal to 8 DAYS BEYOND terms
- The 12-month low is 74 , or equal to 9 DAYS BEYOND terms

##### Previous Year

Shows PAYDEX of this Business compared to the Primary Industry from each of the last four quarters. The Primary Industry is Mfg telephone/telegraph apparatus, mfg radio/tv communication equipment , based on SIC code 3661 .

Previous Year	06/11 Q2'11	09/11 Q3'11	12/11 Q4'11	03/12 Q1'12
<b>This Business</b>	UN	75	74	73
<b>Industry Quartiles</b>				
Upper	78	78	78	78
Median	74	74	74	74
Lower	69	69	69	69

Based on payments collected over the last 4 quarters.

- Current PAYDEX for this Business is 75 , or equal to 8 days beyond terms
- The present industry median Score is 74 , or equal to 9 days beyond terms
- Industry upper quartile represents the performance of the payers in the 75th percentile
- Industry lower quartile represents the performance of the payers in the 25th percentile

#### Payment Habits

For all payment experiences within a given amount of credit extended, shows the percent that this Business paid within terms. Provides number of experiences to calculate the percentage, and the total credit value of the credit extended.

\$ Credit Extended	# Payment Experiences	Total Amount	% of Payments Within Terms
Over 100,000	18	6,850,000	82%
50,000-100,000	6	375,000	100%
15,000-49,999	14	380,000	67%
5,000-14,999	23	182,500	83%
1,000-4,999	30	46,500	77%
Under 1,000	48	13,350	76%

Based on payments collected over last 24 months.

All Payment experiences reflect how bills are paid in relation to the terms granted. In some instances, payment beyond terms can be the result of disputes over merchandise, skipped invoices etc.

## Payment Summary

There are 172 payment experience(s) in D&Bs file for the most recent 24 months, with 96 experience(s) reported during the last three month period.

The highest **Now Owes** on file is 700,000 . The highest **Past Due** on file is 95,000

Below is an overview of the companys currency-weighted payments, segmented by its suppliers primary industries:

	Total Revd (#)	Total Amts	Largest High Credit	Within Terms (%)	Days Slow <31 31-60 61-90 90> (%) (%) (%) (%)			
<b>Top Industries</b>								
Whol electronic parts	19	2,391,350	500,000	98	1	1	0	0
Public finance	10	1,577,250	750,000	100	0	0	0	0
Nonclassified	9	30,500	10,000	66	34	0	0	0
Telephone communictns	9	23,700	7,500	89	0	0	0	11
Whol electrical equip	7	12,800	10,000	100	0	0	0	0
Whol computers/softwr	6	406,350	250,000	57	12	31	0	0
Misc equipment rental	5	10,600	0	50	50	0	0	0
Mfg computers	4	705,000	600,000	100	0	0	0	0
Mfg photograph equip	4	126,000	100,000	92	8	0	0	0
Mfg electric test prd	4	81,300	80,000	100	0	0	0	0
Radiotelephone commun	4	50,300	50,000	100	0	0	0	0
Mfg motors/generators	3	195,000	100,000	100	0	0	0	0
Holding company	3	105,000	50,000	93	0	0	7	0
Misc business credit	3	40,050	30,000	88	0	12	0	0
Short-trm busn credit	3	32,500	15,000	100	0	0	0	0
Mfg refrig/heat equip	3	10,150	10,000	100	0	0	0	0
Whol hardware	2	7,500	5,000	67	0	33	0	0
Whol service paper	2	2,750	2,500	95	5	0	0	0
Mfg telephone equip	2	1,500	1,000	67	33	0	0	0
Passenger car rental	2	1,250	1,000	60	40	0	0	0
Mfg misc office eqpt	2	750	500	0	33	67	0	0
Mfg extracts/syrup	2	100	50	0	0	0	100	0
Mfg elect. connectors	1	1,000,000	1,000,000	50	50	0	0	0
Mfg comp peripherals	1	400,000	400,000	0	100	0	0	0
Computer system desgn	1	200,000	200,000	50	0	50	0	0
Mfg fluid power pumps	1	200,000	200,000	50	50	0	0	0
Mfg semiconductors	1	100,000	100,000	100	0	0	0	0
Custom programming	1	45,000	45,000	0	100	0	0	0
Misc communictns svcs	1	30,000	30,000	0	100	0	0	0
Mfg public bldg furn	1	20,000	20,000	100	0	0	0	0
Whol auto parts	1	10,000	10,000	100	0	0	0	0
Mfg process controls	1	5,000	5,000	50	50	0	0	0
Whol furniture	1	5,000	5,000	100	0	0	0	0
Prepackaged software	1	2,500	2,500	50	50	0	0	0
Arrange cargo transpt	1	2,500	2,500	100	0	0	0	0
Mfg elect. capacitors	1	2,500	2,500	100	0	0	0	0
Whol printing paper	1	2,500	2,500	100	0	0	0	0

			State of Utah						
Whol industrial suppl	1	1,000	1,000	100	0	0	0	0	0
Misc publishing	1	1,000	1,000	100	0	0	0	0	0
Mfg power transformer	1	1,000	1,000	100	0	0	0	0	0
Whol office supplies	1	1,000	1,000	100	0	0	0	0	0
Whol office equipment	1	1,000	1,000	50	0	0	0	0	50
Refuse system	1	1,000	1,000	50	0	0	0	0	50
Hvy const eqpt rental	1	1,000	1,000	100	0	0	0	0	0
Trucking non-local	1	750	750	50	0	50	0	0	0
Local truck w/storage	1	750	750	50	0	50	0	0	0
Misc business service	1	500	500	50	50	0	0	0	0
Mortgage banker	1	250	250	0	0	100	0	0	0
Photocopying service	1	250	250	100	0	0	0	0	0
Whol heating/ac equip	1	250	250	50	50	0	0	0	0
Mfg soap/detergents	1	250	250	100	0	0	0	0	0
Investment advice	1	250	250	0	100	0	0	0	0
Whol durable goods	1	100	100	100	0	0	0	0	0
Whol chemicals	1	100	100	100	0	0	0	0	0
Coating/engrave svcs	1	50	50	100	0	0	0	0	0
Data processing svcs	1	50	50	100	0	0	0	0	0
Lithographic printing	1	50	50	100	0	0	0	0	0
Whol industrial equip	1	50	50	100	0	0	0	0	0
Electric services	1	0	0	0	0	0	0	0	0

**Other payment categories**

Cash experiences	27	11,200	7,500						
Payment record unknown	0	0	0						
Unfavorable comments	0	0	0						
Placed for collections	0	N/A	0						
<b>Total in D&amp;B's file</b>	<b>172</b>	<b>7,858,550</b>	<b>1,000,000</b>						

Accounts are sometimes placed for collection even though the existence or amount of the debt is disputed.

Indications of slowness can be result of dispute over merchandise, skipped invoices etc.

**Detailed payment history for this company**

Date Reported (mm/yy)	Paying Record	High Credit	Now Owes	Past Due	Selling Terms	Last Sale Within (month)
06/13	Ppt	7,500	2,500	0		1 mo
	Ppt	750	0	0		2-3 mos
05/13	Disc	2,500	0	0		1 mo
	Ppt	600,000	300,000	0		1 mo
	Ppt	500,000	500,000	0		1 mo
	Ppt	500,000	500,000	0		1 mo
	Ppt	100,000	55,000			2-3 mos
	Ppt	100,000	0	0		1 mo
	Ppt	80,000	0	0		2-3 mos
	Ppt	75,000	0	0		2-3 mos
	Ppt	65,000	60,000	0		1 mo
	Ppt	30,000	0	0		6-12 mos

		State of Utah			
Ppt	20,000	0	0		1 mo
Ppt	15,000	10,000	0		1 mo
Ppt	15,000	5,000			2-3 mos
Ppt	15,000	5,000	0		1 mo
Ppt	10,000	0	0 N30		2-3 mos
Ppt	10,000	7,500	0 N30		1 mo
Ppt	7,500	0	0		2-3 mos
Ppt	7,500	0	0		6-12 mos
Ppt	5,000	2,500	0		1 mo
Ppt	5,000	2,500	0 N30		1 mo
Ppt	2,500	100	0		1 mo
Ppt	2,500	2,500	0		1 mo
Ppt	2,500	0	0 1 10 N30		1 mo
Ppt	2,500	0	0		1 mo
Ppt	1,000	1,000	0 N30		1 mo
Ppt	1,000	0	0		2-3 mos
Ppt	1,000	0	0		4-5 mos
Ppt	1,000	1,000	0		1 mo
Ppt	1,000	0	0		1 mo
Ppt	1,000	0			6-12 mos
Ppt	500	0	0 N30		1 mo
Ppt	500	0	0		4-5 mos
Ppt	500	0	0 2 15 N30		4-5 mos
Ppt	500	0	0		6-12 mos
Ppt	250	0	0		1 mo
Ppt	250	100	0		1 mo
Ppt	250	50	0		1 mo
Ppt	250	0	0		6-12 mos
Ppt	250	100	0		1 mo
Ppt	100	50	0		1 mo
Ppt	100	0	0 N30		6-12 mos
Ppt	100	0	0		6-12 mos
Ppt	50	0	0 N30		6-12 mos
Ppt	50	0	0 N30		1 mo
Ppt	0	0	0 N30		4-5 mos
Ppt	0	0	0 N30		4-5 mos
Ppt	0	0	0 N30		1 mo
Ppt-Slow 15	250	100	100		1 mo
Ppt-Slow 30	200,000	100,000	65,000		1 mo
Ppt-Slow 30	40,000	40,000	5,000		1 mo
Ppt-Slow 30	5,000	5,000	0 N30		1 mo
Ppt-Slow 30	2,500	2,500	0		1 mo
Ppt-Slow 30	1,000	0	0		2-3 mos
Ppt-Slow 30	1,000	50	0		1 mo
Ppt-Slow 30	500	500	500		1 mo
Ppt-Slow 30	250	0	0		1 mo
Ppt-Slow 60	250,000	40,000	2,500 N30		1 mo
Ppt-Slow 90+	1,000	0	0		6-12 mos
Slow 5	500	0	0		1 mo
Slow 30	10,000	0			6-12 mos
Slow 30	250	0	0		4-5 mos
Slow 60	2,500	0	0		2-3 mos

04/13	Ppt	7,500	2,500	0		1 mo
	Ppt	1,000			N30	6-12 mos
	Ppt	500	0	0		1 mo
	<b>Slow 120</b>	<b>2,500</b>	<b>2,500</b>	<b>2,500</b>		<b>2-3 mos</b>
03/13	Ppt	50	50	0		1 mo
	<b>Slow 30</b>	<b>30,000</b>	<b>0</b>	<b>0</b>		<b>6-12 mos</b>
02/13	Ppt	100	0	0		6-12 mos
	Ppt	50	0	0		6-12 mos
	(073) Cash own option .	50			Cash account	6-12 mos
01/13	(074) Cash own option .	50			Cash account	6-12 mos
12/12	Ppt	1,000				1 mo
11/12	Ppt	750	0	0		6-12 mos
	Ppt	250	0	0	N30	6-12 mos
	(078)				Sales COD	1 mo
09/11	<b>Slow 80</b>	<b>50</b>	<b>0</b>	<b>0</b>	<b>N30</b>	<b>6-12 mos</b>
05/11	Ppt-Slow 60	10,000	0	0		6-12 mos

**Payments Detail Key:** ■ 30 or more days beyond terms

Payment experiences reflect how bills are paid in relation to the terms granted. In some instances payment beyond terms can be the result of disputes over merchandise, skipped invoices, etc. Each experience shown is from a separate supplier. Updated trade experiences replace those previously reported.

## Public Filings

**Currency:** Shown in USD unless otherwise indicated 

### Summary

The following data includes both open and closed filings found in D&B's database on this company.

Record Type	# of Records	Most Recent Filing Date
Bankruptcy Proceedings	0	-
Judgments	0	-
Liens	1	09/24/08
Suits	0	-
UCCs	51	05/22/13

The following Public Filing data is for information purposes only and is not the official record. Certified copies can only be obtained from the official source.

### Liens

A lien holder can file the same lien in more than one filing location. The appearance of multiple liens filed by the same lien holder against a debtor may be indicative of such an occurrence.

<b>Status</b>	<b>Open</b>
<b>FILING NO.</b>	087173123183
<b>Type</b>	State Tax
<b>Filed By</b>	EMPLOYMENT DEVELOPMENT DEPARTMENT
<b>Against</b>	FUJITSU NETWORK COMMUNICATIONS, INC.
<b>Where Filed</b>	SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA
<b>Date Status Attained</b>	09/24/08
<b>Date Filed</b>	09/24/08

**UCC Filings**

**Collateral** Accounts receivable and proceeds - General intangibles(s) and proceeds - Leased Equipment and proceeds  
**Type** Original  
**Sec. Party** CANON FINANCIAL SERVICES, MT LAUREL, NJ  
**Debtor** FUJITSU NETWORK COMMUNICATIONS INC  
**Filing No.** 090035123447  
**Filed With** SECRETARY OF STATE/UCC DIVISION, AUSTIN, TX

**Date Filed** 2009-12-22  
**Latest Info Received** 01/04/10

**Collateral** Accounts receivable and proceeds - General intangibles(s) and proceeds - Leased Equipment and proceeds  
**Type** Original  
**Sec. Party** CANON FINANCIAL SERVICES, MT LAUREL, NJ  
**Debtor** FUJITSU NETWORK COMMUNICATIONS INC, SAN JOSE, CA  
**Filing No.** 097187681027  
**Filed With** SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA

**Date Filed** 2009-02-13  
**Latest Info Received** 02/20/09

**Collateral** Inventory and products  
**Type** Original  
**Sec. Party** ARROW ELECTRONICS, INC., MELVILLE, NY  
**Debtor** FUJITSU NETWORK COMMUNICATIONS, INC.  
**Filing No.** 087159664985  
**Filed With** SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA

**Date Filed** 2008-05-29  
**Latest Info Received** 06/12/08

**Type** Continuation  
**Sec. Party** ARROW ELECTRONICS, INC., MELVILLE, NY  
**Debtor** FUJITSU NETWORK COMMUNICATIONS, INC.  
**Filing No.** 1373618823  
**Filed With** SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA

**Date Filed** 2013-05-22  
**Latest Info Received** 05/23/13  
**Original UCC Filed Date** 2008-05-29  
**Original Filing No.** 087159664985

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**Collateral** All Account(s) and proceeds  
**Type** Original  
**Sec. Party** TRIBECA ASSET FUNDING COMPANY LLC, NEW YORK, NY  
**Debtor** FUJITSU NETWORK COMMUNICATIONS, INC.  
**Filing No.** 077108166460  
**Filed With** SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA

**Date Filed** 2007-03-29  
**Latest Info Received** 04/11/07

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**Type** Continuation  
**Sec. Party** TRIBECA ASSET FUNDING COMPANY LLC, NEW YORK, NY  
**Debtor** FUJITSU NETWORK COMMUNICATIONS, INC.  
**Filing No.** 1272990050  
**Filed With** SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA

**Date Filed** 2012-01-30  
**Latest Info Received** 01/31/12  
**Original UCC Filed Date** 2007-03-29  
**Original Filing No.** 077108166460

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**Collateral** Leased Computer equipment and proceeds  
**Type** Original  
**Sec. Party** GENERAL ELECTRIC CAPITAL CORPORATION, TAMPA, FL  
**Debtor** FUJITSU NETWORK COMMUNICATIONS, INC.  
**Filing No.** 067085318361  
**Filed With** SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA

**Date Filed** 2006-09-18  
**Latest Info Received** 10/06/06

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**Type** Continuation  
**Sec. Party** GENERAL ELECTRIC CAPITAL CORPORATION, TAMPA, FL  
**Debtor** FUJITSU NETWORK COMMUNICATIONS, INC.  
**Filing No.** 1172795456  
**Filed With** SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA

**Date Filed** 2011-08-03  
**Latest Info Received** 08/04/11  
**Original UCC Filed Date** 2006-09-18  
**Original Filing No.** 067085318361

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**Collateral** Leased Equipment and proceeds  
**Type** Original

**Sec. Party** AGILENT FINANCIAL SERVICES, INC., LIVINGSTON, NJ  
**Debtor** FUJITSU NETWORK COMMUNICATIONS, INC.  
**Filing No.** 0417160674  
**Filed With** SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA  
  
**Date Filed** 2004-06-11  
**Latest Info Received** 07/06/04

**Collateral** Leased Equipment and proceeds  
**Type** Original  
**Sec. Party** AGILENT FINANCIAL SERVICES, INC., ATLANTA, GA  
**Debtor** FUJITSU NETWORK COMMUNICATIONS, INC.  
**Filing No.** 0128560403  
**Filed With** SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA  
  
**Date Filed** 2001-10-11  
**Latest Info Received** 11/02/01

**Type** Amendment  
**Sec. Party** AGILENT FINANCIAL SERVICES, INC., ATLANTA, GA  
**Debtor** FUJITSU NETWORK COMMUNICATIONS, INC.  
**Filing No.** 0128560403  
**Filed With** SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA  
  
**Date Filed** 2002-02-06  
**Latest Info Received** 02/15/02  
**Original UCC Filed Date** 2001-10-11  
**Original Filing No.** 0128560403

**Collateral** Leased Equipment and proceeds  
**Type** Original  
**Sec. Party** AGILENT FINANCIAL SERVICES, INC., ATLANTA, GA  
**Debtor** FUJITSU NETWORK COMMUNICATIONS, INC.  
**Filing No.** 0123360723  
**Filed With** SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA  
  
**Date Filed** 2001-08-16  
**Latest Info Received** 09/19/01

**Type** Amendment  
**Sec. Party** AGILENT FINANCIAL SERVICES, INC., ATLANTA, GA  
**Debtor** FUJITSU NETWORK COMMUNICATIONS, INC.  
**Filing No.** 0123360723  
**Filed With** SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA  
  
**Date Filed** 2001-12-18

**Latest Info Received** 12/26/01  
**Original UCC Filed Date** 2001-08-16  
**Original Filing No.** 0123360723

**Type** Amendment  
**Sec. Party** AGILENT FINANCIAL SERVICES, INC., ATLANTA, GA  
**Debtor** FUJITSU NETWORK COMMUNICATIONS, INC.  
**Filing No.** 0123360723  
**Filed With** SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA

**Date Filed** 2002-02-01  
**Latest Info Received** 02/15/02  
**Original UCC Filed Date** 2001-08-16  
**Original Filing No.** 0123360723

**Collateral** Leased Equipment  
**Type** Original  
**Sec. Party** SAFECO CREDIT CO. INC., SEATTLE, WA  
**Debtor** FUJITSU NETWORK COMMUNICATIONS, INC.  
**Filing No.** 0302160381  
**Filed With** SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA

**Date Filed** 2003-01-17  
**Latest Info Received** 02/05/03

**Collateral** Leased Equipment  
**Type** Original  
**Sec. Party** SAFECO CREDIT COMPANY, INC., SEATTLE, WA  
**Debtor** FUJITSU NETWORK COMMUNICATIONS, INC., CHERRY HILL, NJ  
**Filing No.** 0216361083  
**Filed With** SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA

**Date Filed** 2002-06-12  
**Latest Info Received** 06/24/02

There are additional UCCs in D&Bs file on this company available by contacting 1-800-234-3867.

### Government Activity

#### Activity summary


Borrower (Dir/Guar)	NO
Administrative Debt	NO
Contractor	NO
Grantee	NO
Party excluded from federal program(s)	NO

#### Possible candidate for socio-economic program consideration

Labour Surplus Area	YES (2013)
Small Business	N/A
8(A) firm	N/A

The details provided in the Government Activity section are as reported to Dun & Bradstreet by the federal government and other sources.

## History & Operations

Currency: Shown in USD unless otherwise indicated 

### Company Overview

<b>Company Name:</b>	FUJITSU NETWORK COMMUNICATIONS, INC.
<b>Doing Business As :</b>	(FOREIGN PARENT IS FUJITSU LIMITED, JAPAN.)
<b>Street Address:</b>	2801 Telecom Parkway Richardson , TX 75082
<b>Phone:</b>	972 479-6000
<b>Fax:</b>	972-479-6900
<b>History</b>	Is clear
<b>Present management control</b>	6 years

### History

The following information was reported: **04/12/2013**

<b>Officer(s):</b>	SATOSHI IKEUCHI, PRES-CEO HIROFUMI SHIMMURA, SENIOR VICE PRESIDENT-CFO GEORGE CHASE, GROUP PRESIDENT-COO YOZABURO TAJIMA, SR V PRES+ RODNEY BOEHM, SENIOR VICE PRESIDENT
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**DIRECTOR(S) :** THE OFFICER(S)

The California Secretary of State's business registrations file showed that Fujitsu Network Communications, Inc., was registered as a Corporation on September 17, 1991.

Business started 1980 by the parent company as a division. The subsidiary later became a separate corporation. Present control succeeded 2007. 100% of capital stock is owned by parent company.

#### MISC HISTORY :

In Nov 1996 Fujitsu Network Switching of America Inc, Raleigh, NC became wholly owned subsidiary of Fujitsu Network Transmission Systems Inc and subsequently its operations were merged in Fujitsu Network Transmission Systems Inc. The combined operations will be headquartered at the current Fujitsu Network Transmission Systems Inc location in Richardson, TX. The new company will operate as Fujitsu Network Communications Inc. The staffs at the two businesses will be retained. The combination of the two businesses was done to combine the units to streamline the buying process for its customers and allow all equipment to be purchased from a single source.

In Jun 1997 Fujitsu Network Communications Inc (Richardson, TX) and Ascom Nexion, Inc (Acton, MA) completed the arrangements for FNC's acquisition of the business of Nexion, which it will operate as a subsidiary. The transaction was completed on June 9, 1997. FNC acquired Nexion for approximately \$124 million from its Swiss-based parent company, Ascom Holding AG.

**SATOSHI IKEUCHI.** Brings 31 years of telecommunications industry experience to his current position as CEO and President of Fujitsu Network Communications. His career in telecommunications began in 1975 where he was hired as an Engineer in Coaxial and Optical transmission product development at Fujitsu. From 1987 through 1995, took management positions with increasing responsibility in the Transmission Group at Fujitsu, and from 1995 to 2001, served as Senior Director, Vice President and eventually Senior Vice President of Engineering for FNC.

**HIROFUMI SHIMMURA.** Has over 30 years of finance experience. After graduating from KOBE University with a Bachelor of Business, he joined Fujitsu as a member of the accounting staff in the network product division in 1979. In 1995, he was promoted to vice president in accounting/finance in the Fujitsu (Thailand) Co. Prior to accepting the CFO position at FNC, was general manager in the products business development and management unit responsible for accounting and financial control of all business units in the Product Business Group.

**GEORGE CHASE.** Began his communications career with sixteen years at AT & T Network Systems (later known as Lucent Technologies). He then joined Rockwell Network Systems (prior to its acquisition by Alcatel) where he held a number of positions in Product Management, Product Development and Sales, culminating in the position of vice president of Sales. After Rockwell, joined Fujitsu Network Communications where he rose to the level of executive vice president of Sales and Marketing. He subsequently left Fujitsu and joined Dallas-based venture capital firm, Hook Partners, Inc, where he led many investments in optical communication start-up companies.

**YOZABURO TAJIMA.** 1998-present active here.

**RODNEY BOEHM.** Was Chairman of the T1X1 Technical Sub-Committee (the organization responsible for SONET standardization) from 1990 through 1994. He has been active in SONET's National and International Standardization since 1985. Rodney began his career with Fujitsu Network Communications in 1989 as the Director of Strategic Planning. He has also held the positions of Director of Transport Product Planning, Vice President of Business Management, Senior Vice President of Sales Management and Senior Vice President of Manufacturing before being transferred to Senior Vice President of Business worked for Bell Laboratories, Bellcore (now Telcordia), and Rockwell International. He earned both his bachelors and masters degrees in electrical engineering at Texas A & M University.

**RELATED CONCERNS :**

The following are related through common parent ownership. Management noted there are no intercompany relations or shared services.

1) Fujitsu Business Communication Systems, Inc, Anaheim, CA, started 1985. D-U-N-S Number 08-914-2368. 100% owned. Manufactures and wholesales PBX systems.

2) Fujitsu Canada, Ontario, Canada, started 1986. 100% owned. Operates as a sales entity.

3) Fujitsu Computer Products of America, Inc, San Jose, CA. Started Oct 1991. D-U-N-S Number 78-773-1298. Manufactures computer peripherals and disk drives.

**Operations****04/12/2013**

Subsidiary of FUJITSU LIMITED, .

Foreign Parent is FUJITSU LIMITED, Japan. DUNS # 69-053-5281 and reference is made to that report for background information on the parent company and its management.

**Description:** Operates as a manufacturer of telephone or telegraph apparatus, specializing in fiber optics communications equipment and manufacturer of radio or TV communications equipment, specializing in cellular radio telephone.

Has 60 account(s). Terms are Net 30 days. Sells to commercial concerns.

Nonseasonal.

**Employees:** 1,400 which includes officer(s) and 30 part-time. 1,000 employed here. There are an additional 150 temporary employees utilized as needed.

**Facilities:** Owns 87,000 sq. ft. in a three story building This business also operates a one story steel manufacturing building with 287,000 sq ft; a one steel building with 50,000 sq ft and an additional building with 250,000 sq ft all at the same location.

**Location:** Industrial section on side street.

**Branches:** This business has multiple branches; detailed branch.

**8-Digit SIC:** Based on information in our file, D&B has assigned this company an extended 8-digit SIC. D&B's use of 8-digit SICs enables us to be more specific about a company's operations than if we use the standard 4-digit code.

36619908

**SIC & NAICS**

**SIC:** Based on information in our file, D&B has assigned this company an extended 8-digit SIC. D&B's use of 8-digit SICs enables us to be more specific about a company's operations than if we use the standard 4-digit code.

The 4-digit SIC numbers link to the description on the Occupational Safety & Health Administration (OSHA) Web site. Links open in a new browser window.

3661 9908 Fiber optics communications equipment

3663 0104 Cellular radio telephone

**NAICS:**

334210 Telephone Apparatus Manufacturing

334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing

**Banking**

11/11 Account(s) averages moderate 4 figures. Account open over 10 years.

**Financials**

**Currency:** Shown in USD unless otherwise indicated 

**Company Financials: D&B****Additional Financial Data**

Accountant: KPMG LLP, Dallas, TX.

As of April 12, 2013, attempts to contact the management of this business have been unsuccessful. Inside and outside sources confirmed operation and location.

## Request Financial Statements

Requested financials are provided by FUJITSU NETWORK COMMUNICATIONS, INC. and are not DUNSRight certified.

## Key Business Ratios

D & B has been unable to obtain sufficient financial information from this company to calculate business ratios. Our check of additional outside sources also found no information available on its financial performance.

To help you in this instance, ratios for other firms in the same industry are provided below to support your analysis of this business.

Based on this Number of Establishments

17

### Industry Norms Based On 17 Establishments

	This Business	Industry Median	Industry Quartile
<b>Profitability</b>			
Return on Sales %	UN	0.7	UN
Return on Net Worth %	UN	2.4	UN
<b>Short-Term Solvency</b>			
Current Ratio	UN	3.0	UN
Quick Ratio	UN	1.4	UN
<b>Efficiency</b>			
Assets to Sales %	UN	107.9	UN
Sales / Net Working Capital	UN	2.0	UN
<b>Utilization</b>			
Total Liabilities / Net Worth (%)	UN	37.1	UN

UN = Unavailable

## Associations

### All Credit Files Created from this D&B Live Report

Company Name	Type	Status	Date Created
FUJITSU NETWORK COMMUNICATIONS	Snapshot D-U-N-S Number 78-694-5451	Saved	10/14/2011 12:06 PM CDT

### All Credit Files with Same D-U-N-S® Number as this D&B Live Report

Company Name	Type	Status	Date Created
FUJITSU NETWORK COMMUNICATIONS	Account - #10388	No Action Recommended	10/14/2008 02:21 PM CDT
FUJITSU NETWORK COMMUNICATIONS	Snapshot D-U-N-S Number 78-694-5451	Saved	10/14/2011 12:06 PM CDT

## Detailed Trade Risk Insight™

Detailed Trade Risk Insight provides detailed updates on over 1.5 billion commercial trade experiences collected from more than 260 million unique supplier/purchaser relationships.

### Days Beyond Terms - Past 3 & 12 Months

**3 months** from Apr 13 to Jun 13

**3**  
Days

Dollar-weighted average of **44** payment experiences reported from **33** companies

**12 months** from Jul 12 to Jun 13

**4**  
Days

Dollar-weighted average of **69** payment experiences reported from **46** companies

### Derogatory Events Last 12 Months from Jun 12 to May 13

No Derogatory trade Event has been reported on this company for the past 13 Months

### Total Amount Current and Past Due - 12 month trend from Jun 12 to May 13

Status	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13
<b>Total</b>	1,903,091	1,761,555	1,629,545	1,494,255	1,481,209	1,313,828	1,270,189	1,536,733	1,443,770	1,424,988	1,689,294	1,589,243
<b>Current</b>	1,895,076	1,749,913	1,495,347	1,493,172	1,422,600	1,266,061	1,254,999	1,507,457	1,398,702	1,351,574	1,625,451	1,518,818
<b>1-30 Days Past Due</b>	653	10,259	130,780	1,083	57,321	48,229	22,415	35,382	41,142	68,463	59,666	62,027
<b>31-60 Days Past Due</b>	7,362	392	3,418	-	1,288	-462	-7,225	1,920	2,415	5,393	2,021	8,398
<b>61-90 Days Past Due</b>	-	991	-	-	-	-	-	-7,584	1,479	-	2,156	-
<b>90+ Days Past Due</b>	-	-	-	-	-	-	-	-442	32	-442	-	-

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**ATTACHMENT A - REQUESTED CHANGES TO AGREEMENT**

**Term 7 Defaults & Remedies** subsection b will be revised by adding “The amount of the liquidated damages, if any, must be agreed upon by the parties to this contract in writing.”

**Term 8 Delivery** is deleted and replaced with the following: “Unless otherwise indicated in the Master Agreement, the prices are the delivered price to any Participating State agency or political subdivision. All deliveries shall be F.O.B destination with all transportation and handling charges paid by the Contractor unless expedited shipping is requested by the customer in which case, the freight will be prepaid and added to the invoice. Responsibility and liability for loss or damage shall remain the Contractor until final inspection and Acceptance when responsibility shall pass to the Buyer except as to latent defects, fraud and Contractor’s warranty obligations. The minimum shipment amount will be found in the special terms and conditions. Any order for less than the specified amount is to be shipped with the freight prepaid and added as a separate item on the invoice. Any portion of an order to be shipped without transportation charges that is back ordered shall be shipped without charge.”

**Term 11 Indemnification** is deleted and replaced with: “The Contractor shall defend, indemnify and hold harmless WSCA- NASPO, the Lead State and Participating Entities along with their officers, agencies, and employees from and against claims, damages or causes of action including reasonable attorneys’ fees and related costs for any death, injury, or damage to property arising from negligent or willful act(s), error(s), or omission(s) of the Contractor, its employees or subcontractors or volunteers, at any tier, relating to the performance under the Master Agreement. This section is not subject to any limitations of liability in this Master Agreement or in any other document executed in conjunction with this Master Agreement.

**Term 12 Indemnification – Intellectual Property** is deleted and replaced with:

**Indemnity.** Contractor will defend WSCA-NASPO, the Lead State and Participating Entities (“Indemnified Party”) against any claim, action, or proceeding (Claim) brought against Indemnified Party to the extent it is based on an allegation that a Product or Service, as delivered to Indemnified Party by Contractor, infringes any US patent, trademark, copyright, or other proprietary right of a third party. Contractor will pay Indemnified Party the direct and actual damages finally awarded against Indemnified Party in any action attributable to a Claim if Indemnified Party: (a) promptly after receiving notice of the Claim notifies Contractor of the Claim and any action taken by Indemnified Party on it; (b) gives Contractor sole control of the Claim’s defense and any negotiations of its settlement; and (c) cooperates with and assists Contractor as reasonably requested for the Claim’s defense.

**Third Party Injunctive Action.** If any third party obtains an injunction against Indemnified Party’s use of any Product or Service as a result of a Claim, or if Contractor determines, in its sole discretion, that Indemnified Party’s use of any Product or receiving a Service may be subject to a Claim, Contractor may, at its own expense and option (a) procure for Indemnified Party the right to continue using the Product or receiving the Service; (b) replace the Product or Service with a Product or Service of substantially equal or greater functionality; or (c) modify the Product or Service to avoid a Claim. If in Contractor’s sole judgment none of these alternatives are reasonably available, Contractor may (i) request that Indemnified Party return the applicable Product to Contractor and upon its receipt provide Indemnified Party a credit toward future purchases equal to the purchase price of the Product paid by Indemnified Party, less a reasonable adjustment for beneficial use; or (ii) cease performance of the Service and grant Indemnified Party a credit for any amounts paid for any portion of the Service not yet performed.

**Allegations Not Covered.** Contractor will not be liable to Indemnified Party for actual or alleged infringement if (a) the Product in question is used in combination with items not furnished by Contractor when use of the Product by itself would not cause the infringement or Claim; (b) the Product is used in a manner for which it was not designed by Contractor; (c) modifications were made to the Product by someone other than Contractor after delivery to Indemnified Party; or (d) the infringement arises from Contractor’s compliance with Indemnified Party’s specifications or request. Contractor will not be liable for any Claim of trademark infringement based upon any branding or marking not applied by Contractor or that is applied at Indemnified Party’s request.”

**Term 15 Insurance** is amended as follows: “ Contractor shall, during the term of this Master Agreement, maintain in full force and effect, the insurance described in this section. Contractor shall acquire such insurance from an insurance carrier or carriers licensed to conduct business in the Participating Entity’s state and having a rating of A-, Class VII or better, in the most recently published edition of Best’s Reports. Failure to buy and maintain the required insurance may result in this Master Agreement’s termination or at a Participating Entity’s option, result in termination of its Participating Addendum.

**Commercial General Liability Coverage** shall be written on an occurrence basis.

The minimum acceptable limits shall be as indicated below, with no deductible for each of the following categories:

- a) Commercial General Liability covering the risks of bodily injury (including death), property damage and personal injury, with an annual policy limit of not less than \$1 million per occurrence/\$2 million general aggregate;
- b) Contractor must comply with any applicable State Workers Compensation or Employers Liability Insurance requirements.

Contractor shall pay premiums on all insurance policies. Such policies shall also reference this Master Agreement and shall have a condition that they not fall to levels below those required herein without first having the insurer provide thirty (30) calendar days after notice of intended revocation thereof.

Prior to commencement of the work, Contractor shall provide to the Participating Entity a written endorsement to the Contractor's general liability insurance policy that (i) names the Participating Entity as an additional insured, (ii) provides that no material alteration, cancellation, non-renewal, or expiration of the coverage contained in such policy shall be reduced to levels of coverage below those required herein unless the named Participating Entity has been given at least thirty (30) days prior written notice, and (iii) provides that the Contractor's liability insurance policy shall be primary, with any liability insurance of the Participating Entity as secondary and noncontributory for insured claims caused by Contractor while engaged in activities toward the completion of this agreement.

Contractor shall furnish to Participating Entity copies of certificates of all required insurance within thirty (30) calendar days of the Participating Addendum's effective date and prior to performing any work. Copies of renewal certificates of all required insurance shall be furnished within thirty (30) days after renewal date. These certificates of insurance must expressly indicate compliance with each and every insurance requirement specified in this section. Failure to provide evidence of coverage may, at State's sole option, result in this Master Agreement's termination"

**Term 17 License of Pre-Existing Intellectual Property** is deleted and replaced with: "**LICENSE OF INTELLECTUAL PROPERTY**

#### **LICENSED PRODUCTS.**

**Defining Licensed Products.** Software and documentation are Licensed Products. Software means the machine-readable (object code) form of computer programs, instruction sequences, or other like data residing in or necessary to use the equipment, components, or hardware furnished by Contractor and includes any subsequent revisions, patches, fixes, updates, or upgrades thereto. Software includes base Software and any individually licensed NE Software features that are purchased, accessed or otherwise activated by Participating Entity. Software may be provided by Contractor and third parties. Contractor will provide or make available third party terms and conditions that may apply to the Software or third party software to be furnished by Contractor. Contractor may provide software in any electronic, magnetic, optical, or mechanical media, in loadable or downloadable form, or embedded in a Product. Contractor does not license any human-readable source code to Participating Entity. Documentation means all supporting or informative material related to the use or maintenance of Products, provided in print, electronic, or any other format.

**Grant of License.** Contractor will license Licensed Products to Participating Entity solely for Participating Entity's internal use without any right to sublicense. Upon delivery of Licensed Product to Participating Entity and payment by Participating Entity of the applicable license fee for base Software and individually licensed Software features or other consideration as determined by Contractor, Contractor grants and Participating Entity accepts a non-exclusive, non-transferable right-to-use (RTU) license to documentation and to software that is embedded in or loaded, activated, accessed, or downloaded into any Contractor furnished Product only for the use intended by Contractor on and with that Product. These license terms also apply to any other software that Contractor furnishes to Participating Entity unless other license terms are furnished by Contractor (a) with the other software or (b) during the load-key acquisition sequence Participating Entity must perform to obtain access to the other software.

**Restricted Rights.** Participating Entity may not modify, adapt, translate, reverse engineer, disassemble, decompile, or otherwise attempt to derive source code from or create or prepare derivative works of or from Licensed Products. Participating Entity may not distribute, sublicense, rent, lease, loan, publish, timeshare, or transfer Licensed Products or remove, alter, or in any way obscure any proprietary notices on Licensed Products. Participating Entity may not publicly display visual output or publish any test results of the software, or make unauthorized copies of any portion of the Licensed Products. Participating Entity may not use the Software in inherently high-risk applications such as, but not limited to, aircraft navigation or communications, nuclear facilities, mass transit, or medical emergency communications. Contractor licenses Licensed Products to government Participating Entities as set forth herein or only with restricted rights. If applicable laws and regulations would grant any government Participating Entity greater

rights than granted herein, then the government Participating Entity will receive only the minimum rights required by those laws and regulations. Use, copying, or disclosure by government Participating Entity is subject to applicable restrictions in any of the following: paragraph (c) of the Commercial Computer Software - Restricted Rights (June 1987) clause at FAR 52.227-19 and the Restricted Rights Notice of subparagraph (g)(3) of the Rights in Data - General (June 1987) clause at FAR 52.227-14.

**NE SOFTWARE.** The following terms and conditions are only applicable to NE Software:

Additional Restriction. NE Software is licensed as a single Product with individual Software license features and may not be separated for use other than as permitted above.

Third Party Terms and Conditions.

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## **SOFTWARE.**

Release Level Definitions:

- "Major Release" means a software release or version that contains what Contractor in its sole discretion defines as significant new features and capabilities. A Major Release will typically be announced as a major release or version in a New Product Announcement.
- "Minor Release" means a software release, version or service pack that contains what Contractor in its sole discretion defines as a more limited set of new features and capabilities, and will typically be announced as a minor release, version or as a service pack in the Software Release Notes.
- "Maintenance Release" means a software release, version, or patch that contains what Contractor in its sole discretion defines as a software fix that is issued to fix or work around significant software non-conformances. A Maintenance Release will typically be announced as a maintenance release, or version, or as a patch, in the Software Release Notes.

Software Support. Contractor may at any time discontinue development, sale, and support of ("manufacture discontinue") a software Release, including issuing of any Maintenance Releases for that Release of a particular software Product upon 6 months' advance notice to Participating Entity. Despite the previous sentence, Contractor may, in its sole discretion, manufacture discontinue any Obsolete Release without advance notice. An Obsolete Release of a Product is one for which there have been 3 subsequent Major Releases of the Product. Participating Entity acknowledges and agrees that Contractor's announcement of general availability of the most recent Major Release of the Product may provide notice of the immediate effective manufacture discontinuance of any Obsolete Releases of the Product, and no prior advance notice is required.

Recordkeeping/Network Audits. Participating Entity agrees to maintain records establishing its right to use the Software and, upon request, will provide Contractor written verification of Release and individually licensed features

usage. Upon 10 days written notice, Contractor (or its authorized representative) may audit Participating Entity's use of the Software. Participating Entity agrees to pay any applicable fees for Software usage in excess of license rights within ten (10) days of written notification. Pricing for non-reported usage will be based on pricing in effect at the time of the notification."

**Term 22 Payment.** The first sentence of this section is deleted and replaced with: "Payments are due 35 days following the date the entire order is delivered or the date of a correct invoice, whichever is later."

**Term 26 – Standard of Performance and Acceptance** is deleted and replaced with: "The Standard of Performance applies to all Product(s) purchased under this Master Agreement which are being installed by Contractor. The Acceptance Testing period shall be thirty (30) calendar days or other time period identified in the solicitation or the Participating Addendum, starting from the day after the Product is installed and Contractor certifies that the Product is ready for Acceptance Testing. If the Purchasing Entity fails to provide Contractor with written notice of Acceptance or rejection within ten (10) days after the Acceptance Period, the Services are deemed Accepted. If the Product does not meet the Standard of Performance during the initial period of Acceptance Testing, Participating Entity may, at its discretion, continue Acceptance Testing on a day-to-day basis until the Standard of Performance is met. Upon rejection, the Contractor will have fifteen (15) calendar days to cure the Standard of Performance issue(s). If after the cure period, the Product still has not met the Standard of Performance Participating Entity may, at its option: (1) declare Contractor to be in breach and terminate the Order; (2) demand replacement Product from Contractor at no additional cost to Participating Entity; or, (3) continue the cure period for an additional time period agreed upon by the Participating Entity and the Contractor. Contractor shall pay all costs related to the preparation and shipping of Product returned pursuant to the section. No Product shall be accepted and no charges shall be paid until the Standard of Performance is met."

**Term 28 - Title of Product** is deleted and replaced with: "Upon Acceptance by the Participating Entity, Contractor shall convey to Participating Entity title to the equipment free and clear of all liens, encumbrances, or other security interests. Software is licensed, not sold, as described under the section of this Agreement entitled License of Intellectual Property above."

**Term 29 – Waiver of Breach** is revised by deleting each use of "Lead State or Participating Entity" and replacing it with "any party to this Agreement".

**Term 30 – Warranty**– The warranty section is deleted in its entirety and replaced with FNC's warranty as follows: "Software Warranty. FNC warrants that for a period of 90 days from date of shipment from FNC (a) the media on which the Software is furnished will be free of defects in materials and workmanship and (b) the Software will function substantially as described in its Documentation when used on the hardware and with the system or configuration for which the Software is specified. FNC does not warrant that the operation of the Software will be uninterrupted or error free, or that the Software functions will meet Customer's requirements. Customer's sole remedy under this limited warranty is (a) with respect to defective media, replacement of the media at no additional charge to Customer if it is returned to FNC during the warranty period with proof of the date of shipment and (b) with respect to the Software functionality, for FNC to use reasonable efforts to provide a maintenance release, patch, or workaround or otherwise correct the Software to bring it substantially into conformance with the Documentation. This warranty does not apply if the Software (a) has been altered, except by FNC, (b) has not been installed, operated, repaired, or maintained in accordance with instructions supplied by FNC, (c) has been subjected to abnormal physical or electrical stress, misuse, negligence, or accident, or (d) is used in high-risk applications.

#### Equipment Warranties.

Express Warranties. FNC warrants that for 12 months from date of shipment from FNC (a) the applicable equipment, components, or hardware, (individually or collectively "equipment") purchased from FNC will be free from defects in material and workmanship, and (b) the equipment will conform to FNC's applicable hardware specifications, exclusive of separately licensed software, at the time of shipment. These warranties are provided only to the original purchaser of the Product(s) under this Agreement and are not transferable unless agreed to in writing by an authorized representative of FNC.

Remedy. Customer's sole and exclusive remedy under this warranty is that FNC will, at its option and without additional charge to Customer, repair or replace any equipment that does not materially conform to this warranty during its respective warranty period.

Defective on Arrival (DOA) Returns. If Customer performs the initial installation of the equipment and Customer rejects the equipment because, within 30 days after shipment of the equipment to Customer, it fails Customer's acceptance testing against applicable hardware specifications, exclusive of separately licensed software, provided or

agreed upon in writing by FNC or its supplier before such acceptance testing, Customer should immediately notify FNC. Upon receipt of this notification by FNC within the time prescribed above, FNC will furnish replacement equipment to Customer with the understanding that Customer will within 30 days after receipt of the replacement equipment (a) return the non-conforming equipment to FNC or (b) issue a purchase order to FNC for the purchase price of the replacement equipment. FNC will test any returned rejected equipment against FNC's applicable hardware specifications, exclusive of separately licensed software. If FNC determines there is no trouble found (NTF) with the equipment, Customer agrees to issue a purchase order to FNC for FNC's then current fee for each returned item found to be NTF.

Warranty Returns. Before Customer can return any equipment furnished by FNC that Customer believes does not conform to the above warranties, Customer must first obtain a Return Material Authorization (RMA) from FNC. To obtain an RMA Customer should call 1-800-525-0303. Once the RMA is obtained and properly completed, Customer must send the RMA to FNC along with the equipment being returned. Customer agrees that it will issue a purchase order to FNC for applicable charges if (a) FNC determines the equipment returned is actually out of warranty; or (b) the returned equipment is found to comply with the applicable hardware specifications, exclusive of separately licensed software. The charge for out of warranty repair will be based on a quotation provided by FNC and mutually agreed to by the parties and the charge to cover returned equipment found to comply with the applicable hardware specifications will be the NTF fee as described above. If the warranty for the returned equipment is determined to be void for any of the reasons set forth in the section below, the equipment will be returned to Customer without repair. Return of equipment to the repair facility designated by FNC is at Customer's expense. Equipment that is repaired, replaced, or found to be NTF will be returned to Customer's point of shipment at no expense to Customer. Customer does not need to return defective software media. Customer should contact FNC and request a replacement CD. If, after exercising commercially reasonable efforts to repair or replace defective equipment, FNC determines that the equipment cannot be repaired or replaced, then FNC may, in its sole discretion, provide Customer a credit toward future purchases equal to the purchase price paid by Customer, less a reasonable adjustment for beneficial use. Under no circumstances will FNC or its suppliers have any obligation for any data contained in any equipment sent to FNC or its supplier for repair Services. Title to non-conforming equipment returned by Customer that is replaced by FNC or its supplier passes to FNC or its supplier when the returned equipment arrives at the facility designated by FNC. Title to equipment sent to Customer as a replacement for non-conforming equipment returned by Customer will pass to Customer upon delivery to Customer, provided the equipment Customer returned as non-conforming was fully paid for; otherwise, title to the replacement equipment will pass when Customer has paid the full purchase price

No Implied Warranties. Except as expressly provided in this agreement, there are no warranties, express or implied, including, without limitation, the implied warranties of merchantability and fitness for a particular purpose.

No Liability. The above warranties are void and FNC disclaims any obligation under this article if: (a) the warranty period has expired; (b) the Product has not been stored, configured, installed, operated, or maintained in accordance with FNC's applicable specifications, documentation, and instructions for the Product or packed for return in accordance with FNC's instructions or reasonable care (e.g. avoiding the possibility of electrostatic discharge damage when packing equipment); (c) the Product has been subjected to accident, disaster, neglect, abuse, misuse, damage (e.g. burned, cracked, etc.) repair, or modification in any respect, by anyone other than FNC or its authorized service representatives without prior consent; (d) the Product's performance is adversely affected by materials, equipment, software or services provided by an entity other than FNC; or (e) anyone other than the Customer asserts the warranty rights without Customer first advising FNC in writing."

### Definitions

The defined term **Acceptance** is revised as follows: - "means a written notice from a purchasing entity to contractor advising Contractor that the equipment has passed its Acceptance Testing. Acceptance of a Product for which acceptance testing is not required shall occur following the completion of delivery, installation, if required, and a reasonable time, not to exceed 10 days for inspection of the Product, unless the Purchasing Entity provides a written notice of rejection to contractor."

The defined term **Intellectual Property** is revised as follows: "means any and all patents, copyrights, service marks, trademarks, trade secrets, trade names, patentable inventions, or other similar proprietary rights, in tangible or intangible form, and all rights, title, and interest therein. For clarity, Contractor's Product documentation and training materials are considered Intellectual Property."

### **The following terms are added:**

**"LIMITATION OF LIABILITY.** Except for a breach of the sections of this agreement entitled LICENSED PRODUCTS

or CONFIDENTIAL INFORMATION, neither party may be held liable to the other for indirect, incidental, punitive, special, or consequential damages, lost profits, data, or revenues, or costs of procurement of substitute goods or services, even if the party has been advised of the possibility of such damages or losses. Contractor's liability for direct damages will not exceed the total purchase price of the purchase order under which the Products or Services giving rise to such damages were purchased from Contractor.

*Except for valid warranty claims under this agreement, the Participating Entity waives any claim against Contractor, including without limitation any cross-claim based upon a third party action brought against Participating Entity, arising out of an alleged Product defect to the extent that any such claim results from Participating Entity, or any third party contracted by Participating Entity (a subcontractor), engineering, configuring, installing, maintaining, or operating the Product in a manner inconsistent with the applicable Product documentation furnished by Contractor and Participating Entity will defend, indemnify, and hold Contractor harmless from and against any claim asserted by a third party against Contractor arising out of an alleged Product defect to the extent that any such claim results from such action by Participating Entity or its subcontractor."*

**“Order Rescheduling and Cancellation**. If Participating Entity (a) cancels all or part of any purchase order within 30 days before the scheduled shipment date, (b) refuses to accept delivery of any shipment, or (c) postpones shipment more than 60 days beyond the scheduled shipment date, Participating Entity may be invoiced for, and agrees to pay Contractor if so invoiced, a restocking charge of 15% of the purchase price of the affected Products.”

#### **Attachment A – STATE OF UTAH STANDARD INFORMATION TECHNOLOGY TERMS AND CONDITIONS**

**Term 11 Indemnity Clause** is deleted and replaced with the language in Term 12 above, entitled Indemnification – Intellectual Property.

**Term 13 Termination** is revised by deleting the last sentence and replacing with: “ Contractor further acknowledges that in the event of such termination, all SOU Deliverables are the property of the State and shall be promptly delivered to the State.

**Term 25 – Payment**. The first sentence of this section is deleted and replaced with: “Payments are due 35 days following the date an order is delivered or the date of a correct invoice, whichever is later.”

**Term 26 Copyright** – Delete the first sentence and replace with “The contractor agrees that any and all State of Utah Deliverables prepared solely for the State of Utah at the State of Utah’s sole expense (“SOU Deliverables”), as required by this contract, to the extent to which it is eligible under copyright law in any country, shall be deemed a work made for hire, such that all rights, title and interest in the work and SOU Deliverables shall be exclusively owned by the State of Utah. All references to Deliverables in this section 26 shall be replaced with SOU Deliverables”

**Term 29 OWNERSHIP, PROTECTION, AND RETURN OF DOCUMENTS AND DATA UPON CONTRACT TERMINATION OR COMPLETION** is deleted and replaced with: “All SOU Deliverables required by this contract will be the property of the State and must be delivered to the State within 30 working days after termination or completion of the contract, regardless of the reason for contract termination, and without restriction or limitation to their future use. Any State data that may be returned under provisions of this clause must either be in the format as originally provided, or in a format that is readily usable by the State or that can be formatted in a way that it can be used. Costs for all of these described items will be considered as included in the basic contract compensation of the work described used by the State.”

**Term 31 Termination upon Default** - Add the following sentence at the end of this section: “Damages, if any, must be previously approved by the parties to this agreement in writing.”

**Term 39 Time is of the Essence** - The following is added at the end of this section: “In spite of the foregoing, any damages must be approved by the parties to this Agreement in writing.”

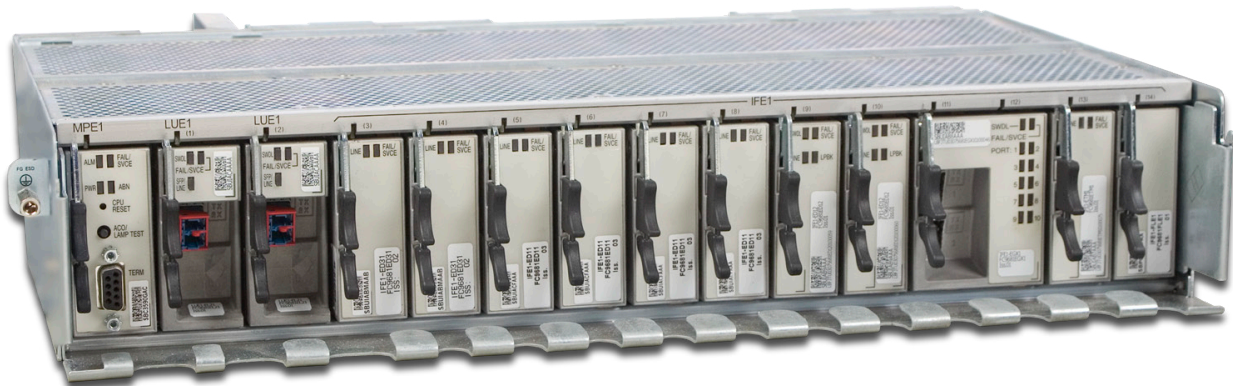
**Term 43 Insurance** – shall be the insurance requirements described above



shaping tomorrow with you

# FLASHWAVE® 4100 ES

## Micro Packet Optical Networking Platform



*The FLASHWAVE 4100 ES Micro Packet Optical Networking Platform (Packet ONP) is ideal for Ethernet and TDM access service delivery and aggregation over networks up to 10G. Offering high reliability in extreme environments, its modular, 2RU chassis provides pay-as-you-grow flexibility, minimizing capital outlay.*

# FLASHWAVE® 4100 ES

## Micro Packet Optical Networking Platform

### Optimal for the Network Edge or Customer Premises

FLASHWAVE® 4100 platforms are in service across tens of thousands of locations, such as central offices, cell sites, outside-plant cabinets and cable distribution networks. The platform is also widely deployed on customer premises in rack, cabinet and wall-mount configurations.

Configured in conjunction with a FLASHWAVE 4000 series Multiservice Provisioning Platform (MSPP) or FLASHWAVE 7000 series Wavelength Division Multiplexing (WDM) system, the FLASHWAVE 4100 ES platform improves slot cost-to-value ratio. Used with the FLASHWAVE 9500 Packet ONP EoX Gateway configuration, the platform provides a complete backhaul, aggregation and service delivery solution over Ethernet or SONET network facilities.

#### Key Platform Features

The FLASHWAVE 4100 ES Micro Packet Optical Networking Platform (Packet ONP) is the optimal solution for the network edge or customer premises, offering:

- 10G access network using OC-192 line facility
- Smooth, economical migration from legacy SONET to next-generation packet optical networking
- Service delivery for high concentrations of Connection-Oriented Ethernet (COE), DS1, DS3, EC1, OC-3, OC-12 and OC-48 services
- Flexible COE over Ethernet and SONET resulting in long-term investment protection
- Complete solution for high-performance 2G/3G/4G 10G cell site access and aggregation deployments, mobile/business backhaul and utility telecom applications
- Environmentally hardened 2RU all industrial-grade platform with modular flexibility that cost-effectively addresses a broad range of demanding applications

- Metro Ethernet Forum (MEF)-compliant Ethernet Private Line (EPL) and Ethernet Virtual Private Line (EVPL) services

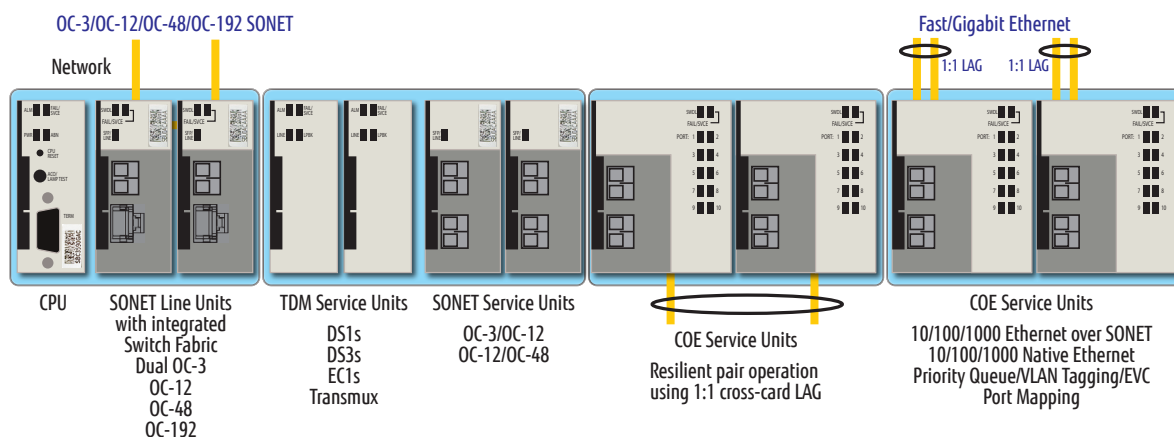
#### One Platform Combines COE, TDM Access, Self-Healing Resilient Hardware, and Aggregation

The COE and TDM capabilities of the FLASHWAVE 4100 ES system are optimized for 2G/3G/4G mobile backhaul, wholesale Ethernet access, metro Ethernet business services, and backhaul of triple play services, including broadband Internet access from DSLAM, PON or CMTS equipment, ensuring the highest standards of reliability and service transport.

#### COE Service Unit

The COE service unit combines SONET attributes such as extremely low-latency, jitter and frame loss with the flexibility, scalability and dynamic bandwidth allocation of Ethernet. The unit provides:

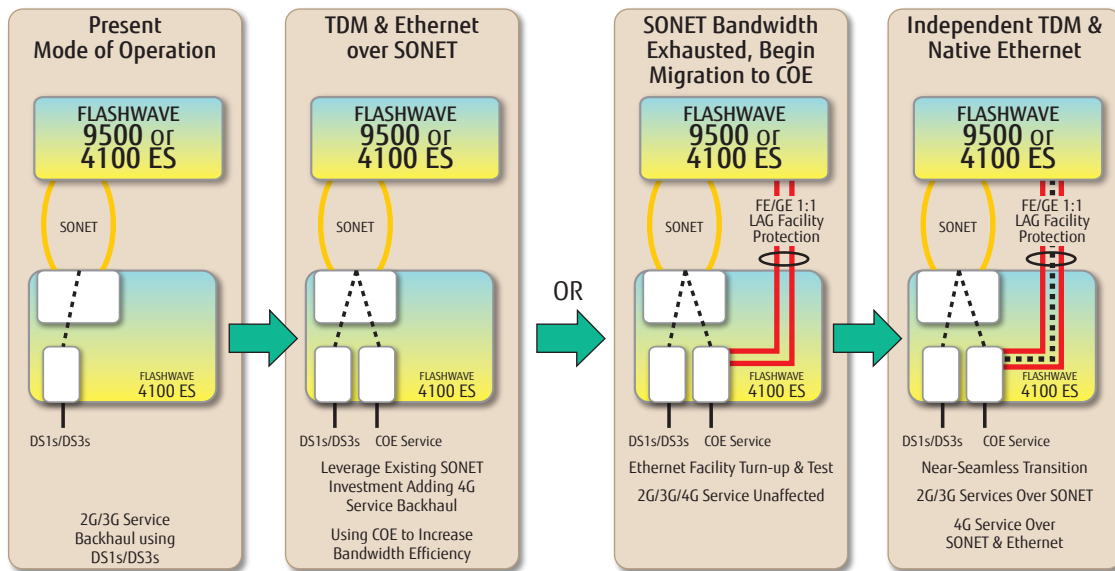
- Guaranteed bandwidth (CIR) per Ethernet Virtual Connection (EVC)
- Four classes of service with dynamic bandwidth allocation between services
- Integrated Y.1731 fault management and performance measurement responder eliminates external NIDs at remote locations
- Ethernet service multiplexing (aggregation) with resilient hardware
- VLAN ID mapping/translation
- COE network operation on any port with optional 1:1 LAG facility protection
- Metro Ethernet Forum (MEF)-certified Ethernet Private Line (EPL) and Ethernet Virtual Private Line (EVPL) services



FLASHWAVE 4100 ES Micro Packet ONP with multiple service options

# FLASHWAVE® 4100 ES Micro Packet Optical Networking Platform

## Optimized for Efficiency



### A smooth migration path to next-generation services

#### Cost-Effective, Smooth Migration to Packet Optical Networking

The FLASHWAVE 4100 ES platform controls costs with flexible options to reuse existing resources. This strategy maintains TDM service performance, while offering dynamic bandwidth allocation resulting in optimal efficiency for differentiated services over existing SONET equipment. As SONET bandwidth becomes exhausted, COE services can be scaled over new Ethernet network facilities using an available port on the existing COE service unit, without adding shelves or common equipment.

#### COE: Ethernet with Advanced Traffic Engineering

Ethernet, fundamentally a connectionless technology, is now the method of choice for delivering high-bandwidth data services. However, next-generation mobile backhaul, high-definition video distribution and mission-critical enterprise services require deterministic, high-performance, high-availability connections. These kinds of connections are only possible in a connection-oriented environment. The frame delay, packet loss and service protection performance of connectionless networks are unacceptable for critical voice, video and storage applications. The answer: COE, the basis for carrier-class high-reliability, simple-to-manage integrated networks that support packet, optical, and TDM networks.

#### Multiple Levels of Fault Tolerance and Management

The FLASHWAVE 4100 ES platform provides multiple levels of fault tolerance and management, including resilient hardware and redundant power, Ethernet facility protection using IEEE 802.3ad link aggregation, card and network protection using SONET 50 ms path protection. Integrated Y.1731 fault management and performance measurement offers early warning of service impairments to ensure non-stop operation. The Fujitsu NETSMART® 1500 Management System simplifies service assurance, leveraging the product's integrated 802.3ah link OAM and connection admission control for EVC CIR bandwidth reservation.

# FLASHWAVE® 4100 ES Micro Packet Optical Networking Platform

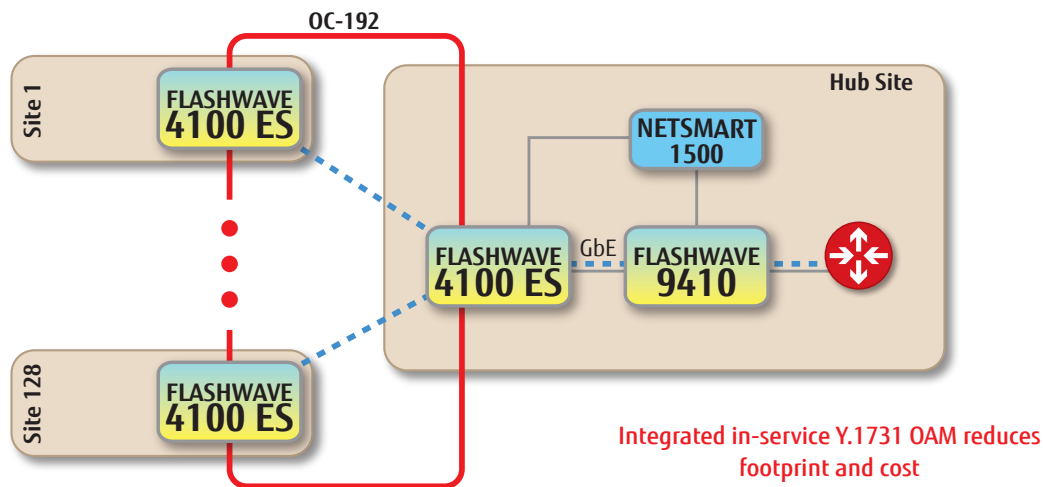
## Convergence and Resiliency

### Integrated DS1 Network Interface Unit (NIU) Functionality

The FLASHWAVE 4100 ES DS1 service card with integrated NIU condenses trouble ticket resolution time and expedites installation. Its extensive loopback capabilities, NPRM, 30-day PM binning, CI alarm recognition and integrated multi-pattern Bit Error-Rate Testing (BERT) provide a powerful tool set to expedite installation, mitigate service issues and reduce truck rolls. As a result, operational expenses are reduced.

### Integrated In-Service Y.1731 OAM

The FLASHWAVE 4100 ES system eliminates the need for an external Ethernet NID, shrinking both footprint and cost when using the FLASHWAVE 4100 ES integrated Y.1731 responder along with a test head such as the FLASHWAVE 9410 system or equivalent. Network operators provision in-service performance measurements including delay, delay variation and frame loss, without affecting production data.

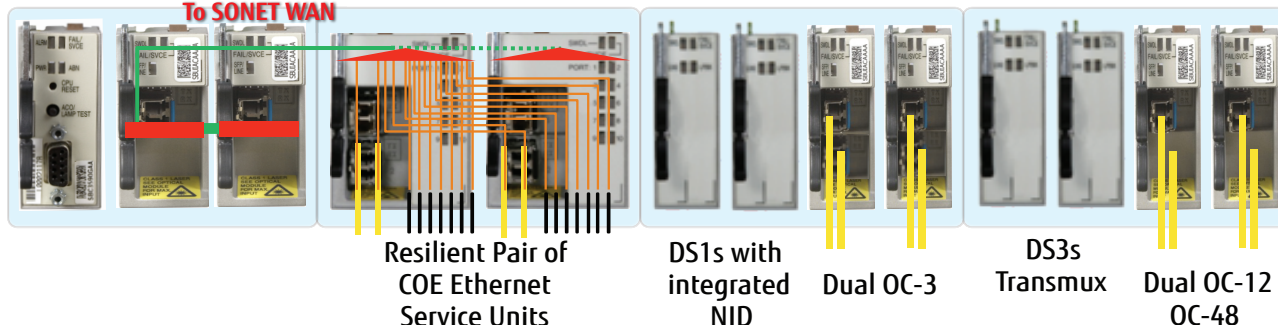


### High Availability Resilient Card Pair

Carrier-class networks require high availability with no single point of failure. The COE Ethernet service unit offers multiple provisioning options for self-healing resilient hardware operation. Client interfacing options include IEEE 802.3ad link aggregation (LAG), optical Y-cable and dual Ethernet. The LAG option splits working and protect Ethernet segments across the resilient card pair, offering both facility and hardware resiliency. The optical Y-cable option provides high-availability hardware resiliency by interfacing optical ports to early model devices not supporting IEEE 802.3ad LAG. Dual Ethernet mode operates with client ports active on both cards where EVCs automatically fail over to one card in the event of hardware impact.

### OC-3/OC-12/OC-48/OC-192

#### To SONET WAN



A wide range of flexible interface options



# FLASHWAVE® 4100 ES Micro Packet Optical Networking Platform

## A Wide Array of Applications

### COE Over SONET with Network Element VCG Sharing

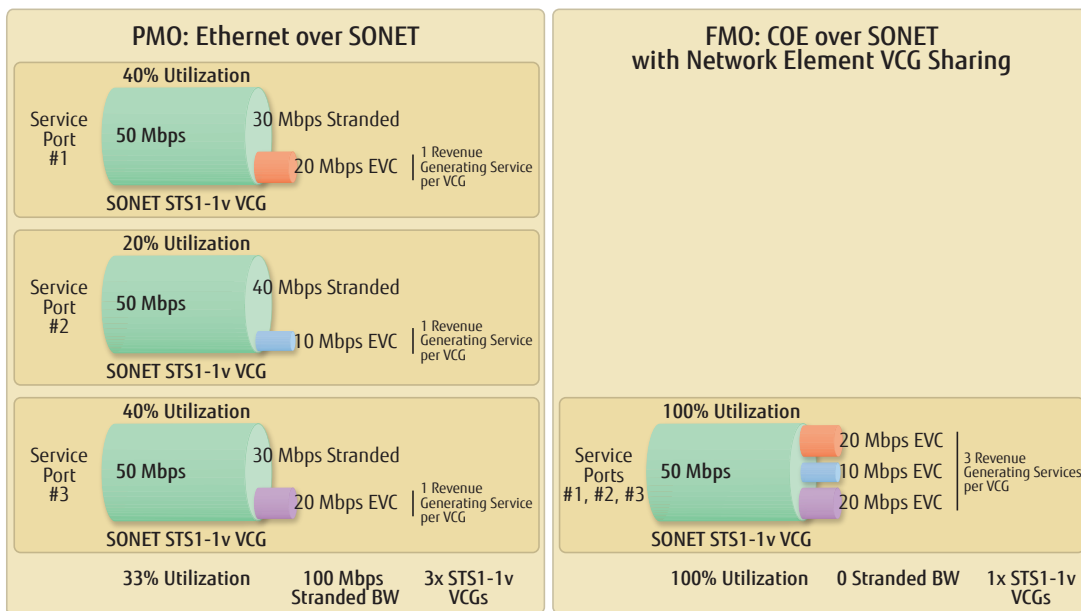
In contrast to traditional EoS implementations where each port is transported over a single SONET VCG, the FLASHWAVE 4100 ES platform offers the option to multiplex multiple ports and EVCs over a single SONET VCG. This advanced technology significantly improves SONET bandwidth efficiency within the shelf.

Network element VCG sharing enables more flexible Ethernet bandwidth options when two or more ports are transported to the same destination, which overcomes the limitations of fixed 50 Mbps bandwidth increments per-port. For example, if a customer wants to lease three Ethernet service ports each at 20 Mbps, 10 Mbps and 20 Mbps respectively, the service provider would have to allocate three STS1-1v VCGs each by stranding 30 Mbps, 40 Mbps and 30 Mbps respectively. Instead, all three ports can share a single STS1-1v VCG.

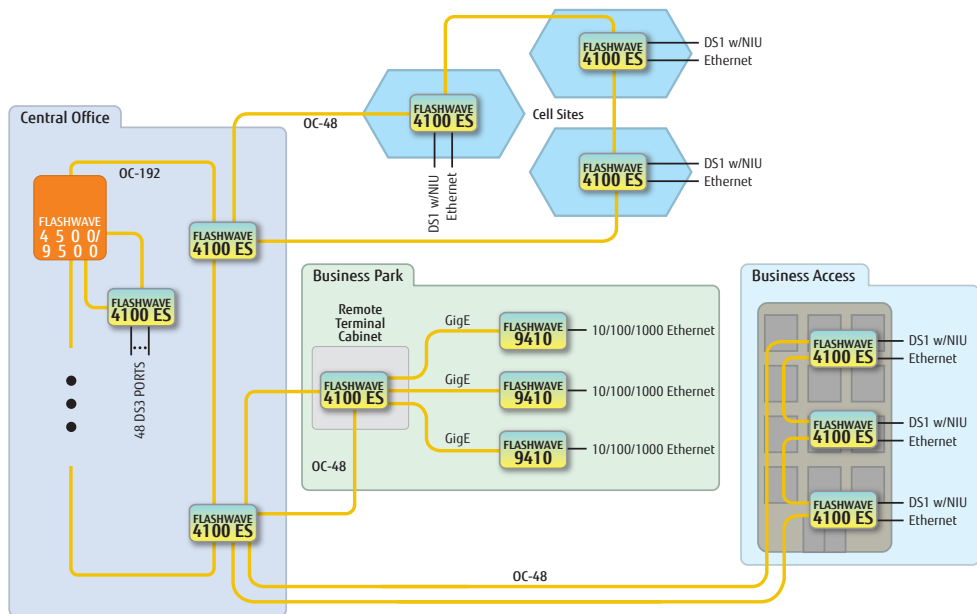
FLASHWAVE 4100 ES COE over SONET with network-element VCG sharing. This increases bandwidth utilization up to 100%, in comparison to the traditional method at 33% using three STS1-1v VCGs. The maximum shared VCG capacity is STS1-24v.

### Optical Hubbing

For aggregation sites, the FLASHWAVE 4100 ES Micro Packet ONP supports optical hubbing of multiple OC-48 rings. This enables traffic aggregation and grooming across multiple networks in a DCS-type application. Integrated transmux units allow M13 multiplexing, providing DS1 to DS3 traffic grooming.



Improve bandwidth utilization with COE



Optical hubbing with the FLASHWAVE 4100 ES

# FLASHWAVE® 4100 ES Micro Packet Optical Networking Platform

## Ideal for Mobile Backhaul

Demand for higher speed wireless data services continues to surge as new applications proliferate. To tap into this revenue opportunity, wireless service providers are deploying 3G and 4G wireless technologies, increasing the number of cell sites and boosting the bandwidth capacity of the backhaul network.

While these new technologies are expanding, there are still approximately 190,000 existing cell sites in the US that require T1 TDM backhaul. This large installed base will remain in operation for many years, resulting in a continued need to provide T1 mobile backhaul transport.

### Complete Backhaul Support

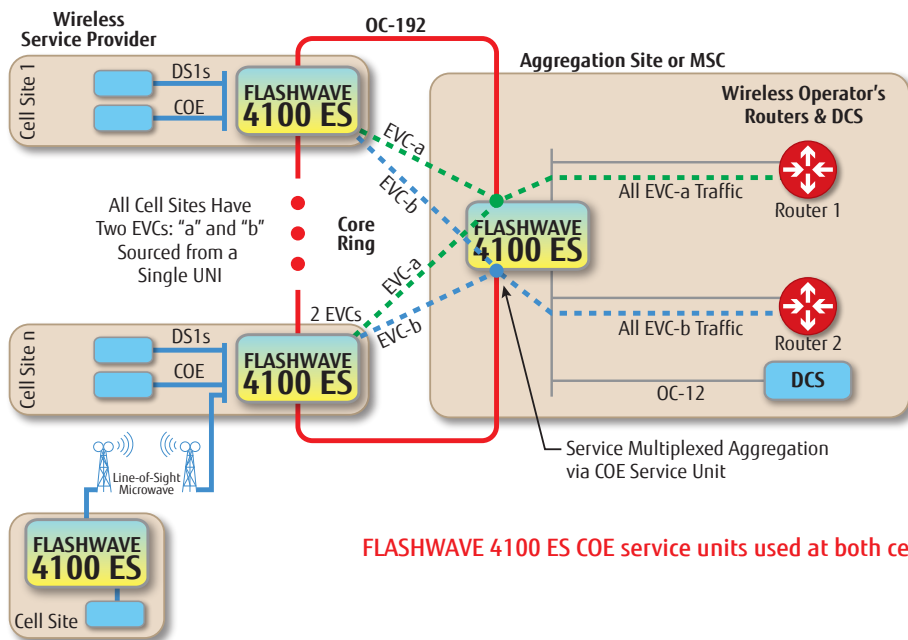
The compact 2RU FLASHWAVE 4100 ES Micro Packet ONP is ideal for mobile backhaul applications due to its integral support for T1 and Ethernet service delivery. Existing FLASHWAVE 4100 ES cell site deployments currently providing T1 backhaul for legacy 2G/3G services can be upgraded to deliver the high-performance COE capabilities required for Ethernet-based 3G and 4G wireless services. The platform is environmentally hardened to operate within the harsh environment of a cell site outside plant (OSP) cabinet, and can operate over standard -48 V DC or +24 V DC through its auto-sensing on-board power system.

The FLASHWAVE 4100 ES Micro Packet ONP provides a complete end-to-end solution at the cell tower, aggregation site, or MSC where backhaul providers can:

- Provision core rings up to OC-192
- Integrate seamlessly with existing 2G/3G TDM backhaul networks
- Provision 3G/4G backhaul with COE service units
- Increase SONET backhaul bandwidth efficiency by leveraging COE over SONET with network element VCG sharing
- Transition from Ethernet over SONET to native Ethernet at their own pace while maintaining their original capital equipment investment
- Integrate line-of-sight microwave cell sites at DS3, EC1, 100Base-T/X Ethernet, OC-3, OC-12 and OC-48
- Aggregate 2G/3G TDM traffic onto OC-3/OC-12 facilities for DCS interconnection
- Service multiplex (aggregate) and map 3G/4G services from odd and even EVCs onto separate GbE facilities for redundant router interconnection

Each COE service unit supports up to 10x SONET HO-VCGs for service multiplexing aggregation. Up to six non-redundant and three redundant pair COE service units are supported per chassis. Once HO-VCGs are translated, Ethernet VLANs are mapped to any COE Ethernet service unit port or card with optional resiliency. This feature

set is ideal for small-scale aggregation sites. For larger scale aggregation sites, the FLASHWAVE 4500 MSPP or FLASHWAVE 9500 Packet ONP offer an ideal network solution for backhaul of mobile traffic.



FLASHWAVE 4100 ES COE service units used at both cell and MSC sites

# FLASHWAVE® 4100 ES

## Micro Packet Optical Networking Platform

### Features and Specifications

#### Architectures

- Terminal (1+1)
- Linear ADM (1+1)
- Unidirectional Path Switched Ring (UPSR)
- 0:2 Both line cards working and unprotected
- Ethernet with 1:1 LAG facility protection

#### WAN Interfaces

- 10/100 Base-T and FE/GE Base-X
- OC-3, OC-12 OC-48 and OC-192 line interfaces
- Optical SFP- and XFP-based with LC connectors
- 1310 or 1550 nm wideband
- OC-3, OC-12, OC-48, OC-192 and GigE CWDM SFP and XFP optics
- OC-48 and OC-192 DWDM SFP and XFP optics

#### Service (Client) Interfaces

- 10/100Base-T with RJ-45 connectors
- 100Base-X (SFP) with LC connectors
- 1000Base-X (SFP) with LC connectors
- DS1 with 64-pin Amphenol® connectors
- DS3/EC1 with BNC connectors
- DS3 Transmux with BNC connectors
- OC-3, OC-12 and OC-48 (SFP) with LC connectors
- 1310 or 1550 nm wideband
- OC-3, OC-12, OC-48 and GigE CWDM SFP optics

#### Maximum Number of Service Interfaces

	Ports/Card	Unprotected Ports/Shelf	Protected Ports/Shelf
DS1	28	168	168
DS3	3	18	18
High-density DS3/EC1	8	48	48
DS3 Transmux	3	18	18
OC-3	2	24	12
OC-12	2	24	12
OC-48	1	12	6
10/100Base-T	8	48	-
100Base-X	2	12	-
1000Base-X	2	12	-
COE 10/100Base-T	7	42	21
COE 100Base-X	2	12	6
COE 1000Base-X	2	12	6

#### Protection Options

DS1	1:1 or unprotected
DS3/EC1	1:1 or unprotected
DS3 Transmux	1:1 or unprotected
SONET	1+1, UPSR or 0:2 dual working
COE Ethernet	1+1 EoS protection with 802.3ad (inter-card) LAG, optical Y-cable or dual Ethernet provisioning options
BITS Output	1+1 redundant output

#### SONET Switching

	STS-1 TSI	VT1.5 TSI
OC-3 Dual Line Interface	48 x 48	1344 x 1344
OC-12 Line Interface	168 x 168	4704 x 4704
OC-48 Line Interface	240 x 240	6720 x 6720
OC-192 Line Interface	960 x 960	6720 x 6720

#### COE Service Unit Ethernet Features

- MEF Certified Ethernet Private Line (EPL) and Ethernet Virtual Private Line (EVPL) services
- Ethernet tag switching implementation of Connection-Oriented Ethernet (COE)
- Y.1731 responder for in-service fault management and performance measurement
- Supports VLAN ID push/pop/swap with multiple tag stacking options for maximal flexibility
- Unlimited scalability through reuse of VLAN IDs across a COE domain
- Ingress classification on port, VLAN ID or IEEE 802.1p priority code points
- Ingress bandwidth profiles per EVC or EVC per CoS
- 4 Class of Service queues defined via 16 unique CoS profiles
- Connection Admission Control (CAC) to guarantee CIR bandwidth for each EVC
- Supports RFC 2698 and MEF 10.1 TCM policers
- IEEE 802.3ah Link OAM
- IEEE 802.3ad Link Aggregation
- Supports LACP or static LAG configurations
- Up to 250 EVCs per card
- Synchronization
- DS1 Building Integrated Timing Supply (BITS) primary and secondary clock input and output ports
- Line timing
- Synchronization Status Messaging (SSM)
- Internal Stratum 3 timing source

#### Synchronization

- DS1/E1 Building Integrated Timing Supply (BITS) primary and secondary clock input and output ports
- Line timing
- Synchronization Status Messaging (SSM)
- Internal Stratum 3 timing source

# FLASHWAVE® 4100 ES

## Micro Packet Optical Networking Platform

### Features and Specifications

#### Operations

- TL1 protocol over OSI/Ethernet or IP/Ethernet
- SNMP Monitoring
- SSH/SFTP
- NETSMART® 500 Element Manager
- NETSMART 1500 Management System
- TCP/IP gateway functionality
- Software download and remote memory backup/restore
- Interoperable with all Fujitsu transmission products
- Telcordia™ OSMINE supported
- NEBS Level 3 certified
- UL listed

#### Operating Environment

Temperature	-40 to +65 °C (-40 to +149 °F)
Humidity	5 to 95% (non-condensing)

#### Power Consumption

Maximum Power Consumption	331 W
Heat Dissipation	1130 BTU/hr
Power Input	+24 V DC or -48 V DC

#### Physical Characteristics

Shelf Dimensions (H x W x D)	3.5 x 17.5 x 13.5" (8.9 x 44.5 x 34.3 cm)
Weight (fully-loaded)	22.4 lb (10.2 kg)



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 All Rights Reserved. All other trademarks are the property of their respective owners.  
 Configuration requirements for certain uses are described in the product documentation.  
 Features and specifications subject to change without notice.

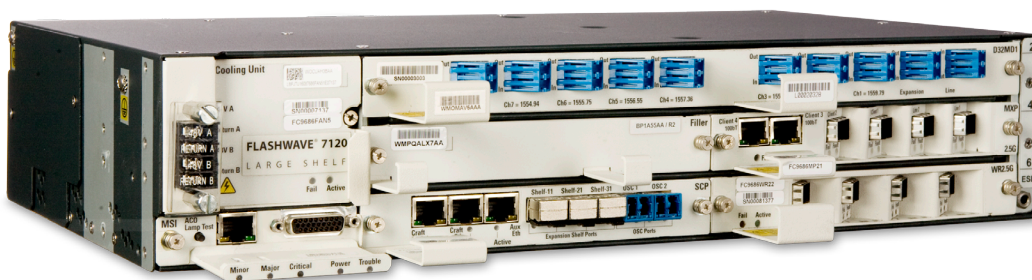
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shaping tomorrow with you

# FLASHWAVE<sup>®</sup> 7120

## Micro Packet Optical Networking Platform



*The FLASHWAVE 7120 system is a combination access WDM and intelligent edge service delivery platform. Engineered for low-latency applications, this system's high density, compact size, and low power consumption make it ideal for solving bandwidth and fiber constraints.*

# FLASHWAVE® 7120

## Micro Packet Optical Networking Platform

### Adapt to Emerging Demand

Today's business customers are widely dispersed and they demand an unpredictable mix of voice, data and video at competitive prices. Consequently, carriers must extend services while aggressively managing expenses, using infrastructure that adapts to emerging bandwidth and access backhaul demands.

#### Reduced Complexity, Extended Capabilities

The FLASHWAVE® 7120 Micro Packet Optical Networking Platform simplifies the process of providing bandwidth and intelligent services to the edge of the network. This compact solution is ideal for enterprise applications such as research and education, emerging healthcare, and utility companies. The platform is also an excellent fit for tier 1 customers seeking an integrated core-to-access Wavelength-Division Multiplexing (WDM)-based solution. The system addresses multiple network applications, including:

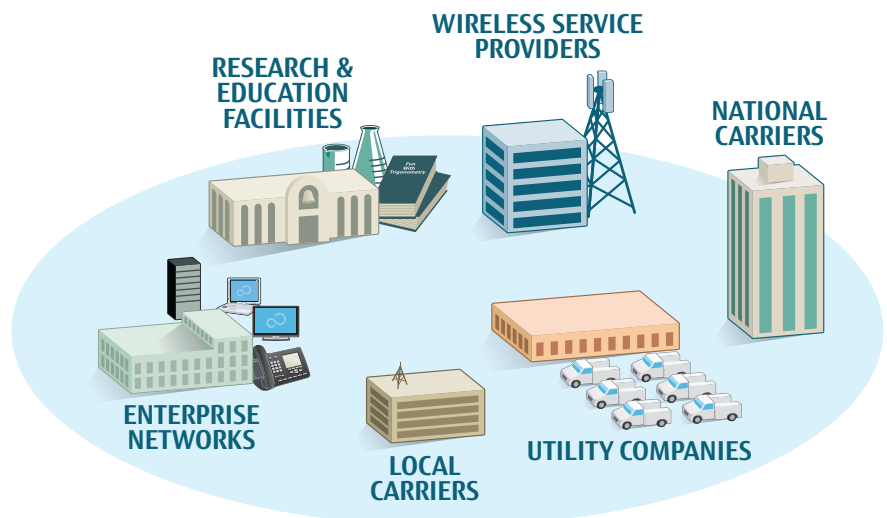
- Optical metro access and edge WDM networking
- Managed wavelength service delivery
- WDM, Optical Transport Network (OTN), Ethernet and SONET/SDH consolidation
- Metro Ethernet Forum (MEF)-certified services
- Optical reach extension and fiber relief

The FLASHWAVE 7120 platform offers a unique photonic layer solution that combines flexibility and cost-efficiency with the reliability and management of traditional optical transport systems. Its comprehensive suite of passive and active modules permits flexible customization. Cost reduction is consequently possible by mixing and matching components. As a result, you reach more customers more economically.

#### Options for Diverse Networks

The FLASHWAVE 7120 platform's compact, 2RU shelf supports:

- Cost-effective access CWD and DWDM applications
- Tier 2/3 metro networks
- Fixed-filter and 2D ROADM options
- Integrated wavelength services from FLASHWAVE 7500 and 9500 systems
- Full suite of service interfaces including:
  - Dual transponders for 2.5, 4 & 10 Gbps private line services
  - Multirate, multiprotocol muxponders for service aggregation
  - MEF E-LAN solutions with bridged L2 Ethernet interfaces
- Wide choice of amplifier options
- OTN support across all interfaces
- Capacity expansion of up to 24 service slots in one node
- Extended temperature operation





# FLASHWAVE® 7120 Micro Packet Optical Networking Platform

## Reach More Customers

The FLASHWAVE 7120 platform provides cost-effective service delivery and WDM transport for access applications and tier 2/3 metro WDM networks. Whether providing high-capacity 2.5G and 10G private line wavelength services to end customers, backhaul for mobile cell sites, or general-purpose service aggregation and WDM transport, the FLASHWAVE 7120 enables small, scalable, economical C/DWDM solutions for carrier applications. Supporting a wide array of client services, integration with FLASHWAVE 7500/9500 core metro systems, full NETSMART 1500 management system support, the FLASHWAVE 7120 is an ideal platform for access WDM applications.

### Manageable Flexibility

The FLASHWAVE 7120 architecture scales so that service slots from multiple shelves can be managed from a single CPU and TID. The NETSMART 1500 Management System allows the FLASHWAVE 7120 platform to be managed under the same Operations Support System (OSS) as other Fujitsu optical transport products. Transaction Language 1 (TL1) and Simple Network Management Protocol (SNMP) support integration into existing operating procedures and third-party management systems.

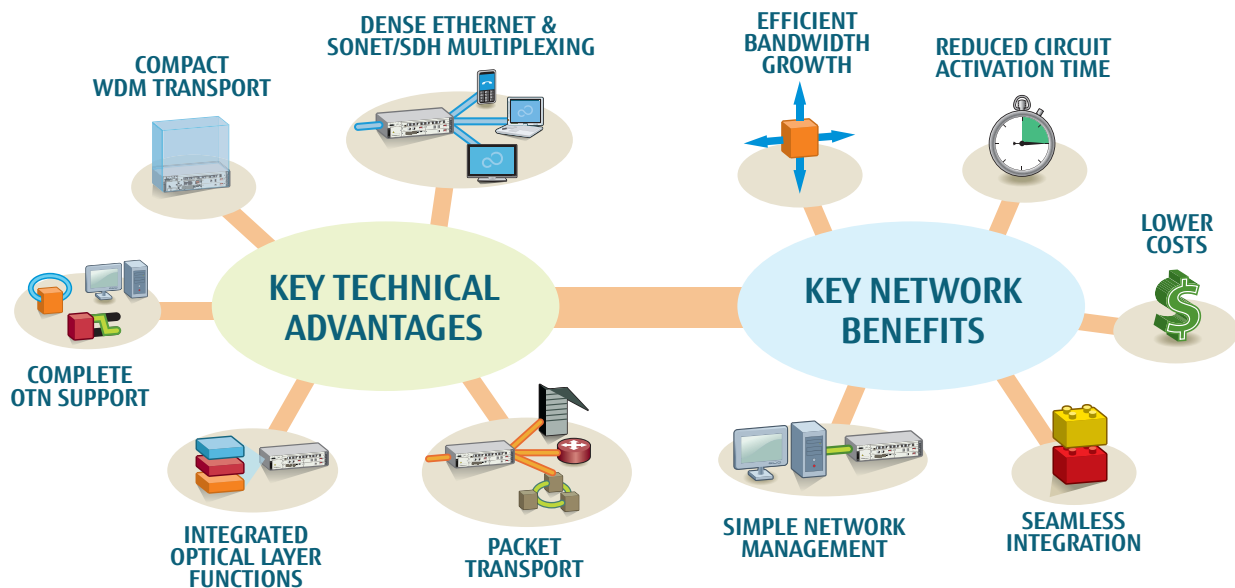
### Reduce Demand and Rationalize Your Infrastructure

The FLASHWAVE 7120 system operates as a standalone WDM-based solution, or as part of an integrated Fujitsu solution. Core-to-edge deployments are possible in concert with other Fujitsu platforms, which can eliminate back-to-back transponders and separate management systems. These integrated solutions are possible via deployment with:

- Packet ONPs such as the FLASHWAVE 9500 platform
- ROADMs such as the FLASHWAVE 7500 system for core and transport
- MSPPs such as the FLASHWAVE 4500 and FLASHWAVE 4100 platforms for certified optical networking
- Micro Packet ONPs such as the FLASHWAVE 4100 ES and FLASHWAVE CDS systems for integrated access and backhaul

### Key Technical Advantages

The platform combines optical transport building blocks (multiplexing, amplification, signal conditioning and optical add/drop) with a complete service delivery and packet transport suite. As a result, the FLASHWAVE 7120 system delivers several technical advantages and network benefits.





The FLASHWAVE 7120 Micro Packet Optical Networking Platform’s flexible, broad-ranging optical services enable several key network applications.

**Access WDM**

- Scalable access solutions
- CWDM up to 16 wavelengths and DWDM up to 32 wavelengths
- 2D ROADM option supporting up to 40 wavelengths
- Multiservice solutions to the edge over WDM
- Point-to-point, hub-and-spoke, linear and ring access topologies
- Backhaul of Ethernet and Time-Division Multiplexing (TDM) services over WDM for Digital Subscriber Line (DSL) and wireless
- Wavelength service delivery
- 100 Mbps to 11 Gbps wavelength services
- Transparent wavelength applications with full OAM&P
- SONET/SDH, Ethernet, Fibre Channel, and video wavelength services

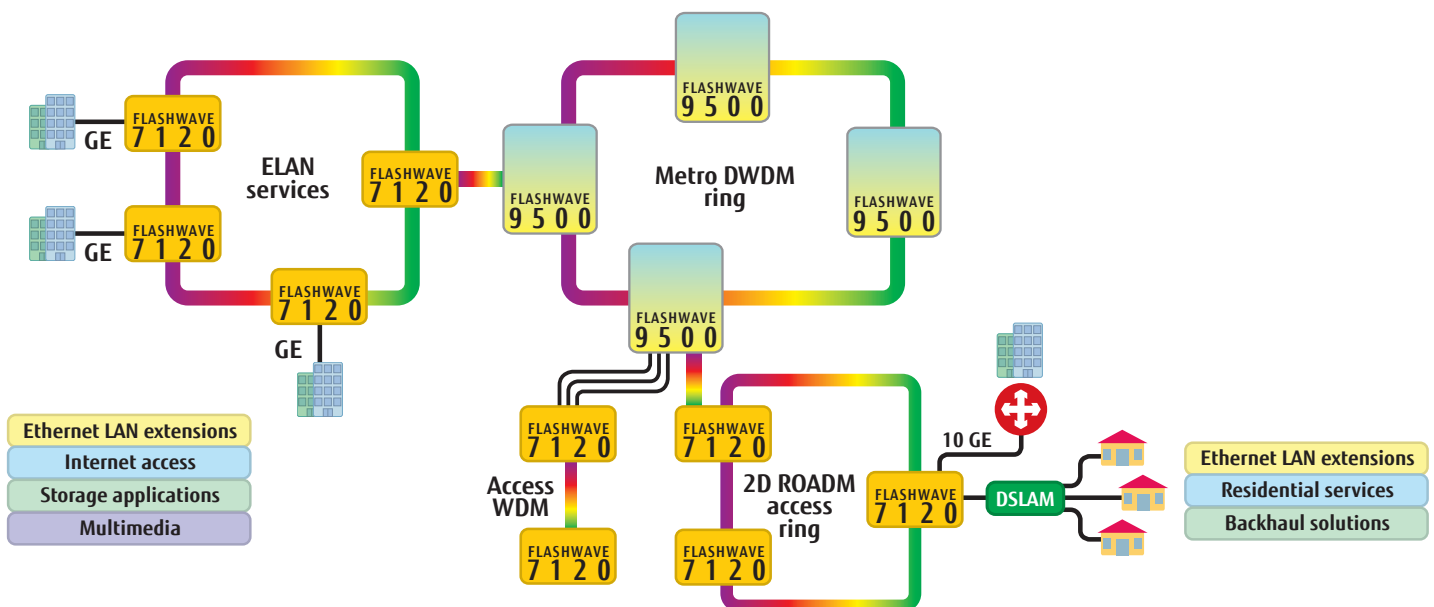
**Business and Enterprise Services**

- Native 1G/10G Ethernet transport and aggregation with ring-based protection options including OTN and IEEE G.8032
- MEF-certified solutions for Ethernet Private Line and Virtual Private Line (EPL/EVPL) and multipoint (E-LAN, EVLAN) applications
- Managed EPL and EVPL applications
- IP multicast applications supporting broadcast and on-demand video services through bridged, connectionless Ethernet
- Ethernet business services with policing, bandwidth management, and end-to-end Service-Level Agreements (SLAs)
- Native Storage-Area Network (SAN) extension applications including 10G Fibre Channel

**Optical Extension and Fiber Relief**

- Wavelength service extension using CWDM or DWDM
- Cost-effective service extension from metro networks to end customer sites
- Passive and active WDM fiber relief applications

**Flexible broad-ranging optical services**



# FLASHWAVE® 7120 Micro Packet Optical Networking Platform

## Network Services

Fujitsu offers a broad selection of professional services to assist at every stage in a network's evolution and operation. From planning through deployment and ongoing maintenance to future enhancements, Fujitsu Network Services are available whenever needed. Our comprehensive range of services includes network and system design, training, customized deployment, craft interface software, migration planning and more. Your Fujitsu sales representative can guide you in selecting the right service options for your business.

Popular planning and deployment services for the FLASHWAVE 7120 Micro Packet Optical Networking Platform include:

- **Fiber Characterization and Test** – Comprehensive verification and analysis of your installed fiber to improve current network performance, prepare you for new growth and identify potential faults and issues.
- **Design Services for DWDM Networks** – Our professional design staff works with you to prepare a complete, custom roadmap for success.
- **Turn-Up and Test** – We provide a range of options from on-site configuration and simple turn-up to rigorous, long-term testing.

### Fujitsu Maintenance and Support Program

For a complete professional maintenance solution, the Fujitsu Maintenance and Support Program has the right combination of flexibility and comprehensive assurance. Choose the level and types of service you need to supplement your own resources. The Maintenance and Support Program helps keep your network running smoothly, provides critical care and protects the longevity of your investment.

### Network Operations Center

With a full range of vendor-independent network fault and performance monitoring features, the Fujitsu Network Operations Center (NOC) offers guaranteed, round-the-clock system protection. Our reliable NOC facility is available as a primary or supplemental operations resource. This service not only helps you control costs and maintain high levels of customer satisfaction, it also provides trustworthy, reliable after-hours and emergency coverage.



# FLASHWAVE® 7120

## Micro Packet Optical Networking Platform

### Features and Specifications

<b>Platforms</b>	<p>FLASHWAVE 7120 shelf</p> <ul style="list-style-type: none"> <li>• 2U managed system with 6 interface slots</li> <li>• Expandable up to 4 shelves (24 interface slots) under a single TID</li> </ul> <p>FLASHWAVE 7120 passive shelf</p> <ul style="list-style-type: none"> <li>• 1U passive-only system with 2 interface slots</li> <li>• 19", 23" and 500 mm ETSI rack mounts available</li> </ul>	<b>Native Bridged Ethernet Packet Interfaces</b>	<ul style="list-style-type: none"> <li>• 14-port Ethernet Layer 2 packet interface</li> <li>• 12 x 1G Ethernet (10 x SFP, 2 x RJ45)</li> <li>• 2 x 10G Ethernet (2 x XFP)</li> <li>• 28-port Ethernet Layer 2 packet interface</li> <li>• 24 x 1G Ethernet (20 x SFP, 4 x RJ45)</li> <li>• 4 x 10G Ethernet (4 x XFP)</li> </ul>
<b>Architectures</b>	<ul style="list-style-type: none"> <li>• CWDM/DWDM</li> <li>• Point-to-point</li> <li>• Linear</li> <li>• 2D ROADM</li> </ul>	<b>Protocols</b>	<ul style="list-style-type: none"> <li>• 100FX, 10/100/1000BaseTX</li> <li>• 1G Ethernet</li> <li>• 10G Ethernet LAN</li> <li>• OTU2 10G Ethernet LAN</li> </ul>
<b>Applications</b>	<ul style="list-style-type: none"> <li>• Access WDM (CWDM or DWDM)</li> <li>• Wavelength service delivery</li> <li>• Ethernet services <ul style="list-style-type: none"> <li>• Private line</li> <li>• Virtual private line</li> <li>• Multipoint (ELAN, EVLAN)</li> </ul> </li> <li>• Fiber relief and reach extension</li> <li>• Multiservice backhaul</li> </ul>	<b>Applications</b>	<ul style="list-style-type: none"> <li>• MEF EPL, EVPL, ELAN, EVLAN</li> <li>• IP services</li> <li>• Multipoint Ethernet services</li> </ul>
<b>Transponder Interfaces</b>	<ul style="list-style-type: none"> <li>• Dual 2.5G multiprotocol transponder <ul style="list-style-type: none"> <li>• Rates: 125 Mbps to 2.7 Gbps</li> <li>• Protocols: 100FX, OC-3/STM-1, OC-12/STM-4, OC-48/STM-16, ESCON, DVB-ASI, 1G &amp; 2G FC/FICON, 1G Ethernet</li> </ul> </li> <li>• Dual 4G multiprotocol transponder <ul style="list-style-type: none"> <li>• Rates: 1.0 to 4.0 Gbps</li> <li>• Protocols: 1G, 2G, 4G FC/FICON, 1G Ethernet</li> </ul> </li> <li>• Single and dual 10G multiprotocol OTN transponders <ul style="list-style-type: none"> <li>• Rates: 9.9 to 11.1 Gbps</li> <li>• Protocols: OC-192/STM-64, 10 GigE WAN PHY, 10 GigE LAN PHY, OTU2, OTU2 10 GigE LAN, 10G FC/FICON</li> </ul> </li> </ul>	<b>Standards</b>	<ul style="list-style-type: none"> <li>• G.709 Digital Wrappers (OTN)</li> <li>• IEEE 802.1Q VLAN tagging</li> <li>• IEEE 802.1ad provider bridges</li> <li>• IEEE 802.3ad link aggregation</li> <li>• Ring protection MSTP and G.8032</li> <li>• Y.1731</li> </ul>
<b>Muxponder Interfaces</b>	<ul style="list-style-type: none"> <li>• 2-port, 2.5G GigE muxponders <ul style="list-style-type: none"> <li>• Clients: 100BaseTX, 1G Ethernet</li> <li>• Network: 2 x OC-48/STM-16</li> <li>• Protection: UPSR/SNCP</li> </ul> </li> <li>• 8-port, combo single 2.5G/dual 5G OTN muxponders <ul style="list-style-type: none"> <li>• Clients: OC-3, OC-12, 1G Ethernet, 1G, 2G FC/FICON</li> </ul> </li> <li>• Network: 2 x OC-48, OTU1</li> <li>• 10-port, 10G OTN muxponders <ul style="list-style-type: none"> <li>• Clients: 1G Ethernet, 1G, 2G, 4G FC/FICON, OC-48/STM-16</li> <li>• Network: 2 x OC-192/STM-64, OTU2</li> <li>• Protection: UPSR/SNCP, OTN facility</li> </ul> </li> </ul>	<b>Features</b>	<ul style="list-style-type: none"> <li>• Simplified Layer 2 Ethernet through connectionless bridging</li> <li>• 3-step service provisioning through embedded GUI</li> <li>• Aggregation and switching</li> <li>• Policing</li> <li>• Rate limiting per port</li> <li>• Bandwidth management per flow including CIR/EIR/CBS/EBS</li> <li>• Ethernet OAM&amp;P including Y.1731 and RMON 2819 performance monitoring</li> <li>• Sub-50 ms guaranteed protection switching with G.8032 and OTN</li> </ul>
		<b>Optical Components</b>	<ul style="list-style-type: none"> <li>• Single-channel/Sub-Band Pre- and Booster Amplifiers (SBA, SPA)</li> <li>• DWDM Pre- and Booster Amplifiers (OBA, OPA)</li> <li>• Line amplifier with mid-stage access (OLAM)</li> <li>• Dispersion compensation units: 30, 40, 60, 80 km compensating fiber</li> </ul>

# FLASHWAVE® 7120 Micro Packet Optical Networking Platform

## Features and Specifications

<b>Operations and Management</b>	<ul style="list-style-type: none"> <li>• TL1 over TCP/IP (except native Ethernet interfaces)</li> <li>• SNMP over UDP/IP (all interfaces)</li> <li>• NETSMART 712 Craft GUI</li> <li>• NETSMART 1500 Management System</li> <li>• Telcordia OSMINE TIRKS and NMA</li> <li>• Communications via out-of-band OSC or in-band OTN GCC</li> </ul>		
<b>Standards Compliance</b>	<ul style="list-style-type: none"> <li>• NEBS Level 3 compliant</li> <li>• RoHS compliant</li> <li>• ANSI and ETSI compliant</li> <li>• GR-63 and GR-1089</li> <li>• MEF 9/14 compliant</li> </ul>		
<b>Operating Environment</b>	Temperature	-20 to +65 °C (-4 to +149 °F)	
	Humidity	5 to 90% (non-condensing)	
	Maximum power consumption	275 W per shelf	
	Maximum heat dissipation	938 BTU/hr	
	Power Input	-48 VDC, redundant feeds	
<b>Physical Characteristics</b>	<b>FLASHWAVE 7120 shelf (2RU)</b>	Weight (fully loaded)	16.5 lbs (7.5 kg)
		Dimensions (H x W x D)	3.5 x 17.3 x 11.0" (90 x 440 x 279 mm)
	<b>FLASHWAVE 7120 passive shelf (1RU)</b>	Weight (fully loaded)	9.1 lbs (4.1 kg)
		Dimensions (H x W x D)	1.73 x 17.3 x 11.0" (44 x 440 x 279 mm)



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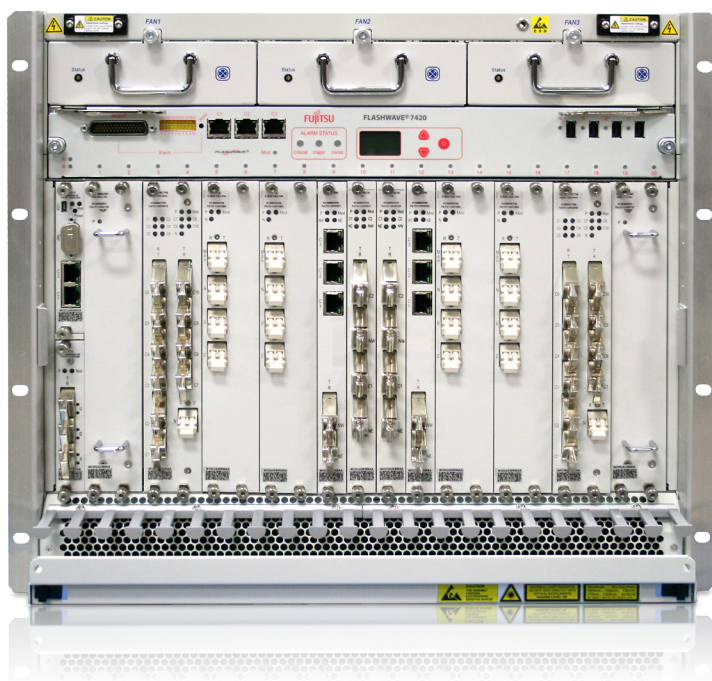
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Configuration requirements for certain uses are described in the product documentation.  
Features and specifications subject to change without notice.



shaping tomorrow with you

# FLASHWAVE<sup>®</sup> 7420

## Metro/Enterprise WDM Platform



*The FLASHWAVE 7420 system combines optical, Ethernet, and certified storage solutions in a scalable DWDM-based transport solution. Engineered for low-latency networks, the platform supports demanding applications such as high-performance computing and Storage Area Networks (SANs).*

# FLASHWAVE® 7420

## Metro/Enterprise WDM Platform

### Scalable Optical Transport

Metro optical transport networks are increasingly defined by the unpredictable convergence of voice, data and video technologies. They are shaped by accelerating service demands and shifting business models that aim to reduce overall OPEX. To succeed, metro service providers and enterprises need extremely flexible and scalable infrastructure equipment that adapts to emerging bandwidth demands.

#### Optimized for Local and Competitive Carriers and Large Enterprises

The Fujitsu FLASHWAVE® 7420 WDM platform is optimized for competitive and independent exchange carriers, as well as large enterprises and research and education network providers. The platform allows seamless capacity growth in existing networks for high-speed voice, video, data and storage services and applications. It offers a broad mix of wavelength services, as well as a cost-effective and scalable WDM entry point. Overall, the FLASHWAVE 7420 platform reduces risk and maximizes revenue across every network dimension.

#### Flexible Mix of Wavelength Services

The hardware design of the FLASHWAVE 7420 platform, coupled with the benefits of WDM technology, enables the system to support point-to-point, linear add/drop and ring topologies across fixed and reconfigurable networks. The platform takes full advantage of the latest optical technologies, including ROADM and 40G transport, to increase bandwidth, improve optical performance and support

numerous protocols and applications. A full suite of optical amplifiers and signal conditioning units enable the creation of networks tailored to individual customers. Combined with existing support for an optical supervisory channel (OSC) and an embedded communications channel (ECC), the FLASHWAVE 7420 platform offers complete operation and service provisioning capabilities from any node on the network.

Carriers select the FLASHWAVE 7420 system to meet their metro and enterprise services and transport needs, including managed and unmanaged wavelength services, as well as entire dedicated enterprise networks. It enables service providers to deliver a highly adaptable mix of legacy, data, storage and OTN wavelength services. The platform is:

- **Flexible** enough to deploy a broad and profitable mix of wavelength services over an optimized transport network
- **Scalable** for low start-up costs, with seamless ability to add new services incrementally
- **Configurable** with FOADM, large FOADM and 2D ROADM deployment options



# FLASHWAVE® 7420 Metro/Enterprise WDM Platform

## Optimized for Metro Networks

### Support for Broadcast Applications

The FLASHWAVE 7420 platform is ideal for cost-effective triple play services, including simultaneous delivery of high-bandwidth Internet connectivity to support applications like VOD and peer-to-peer gaming. The platform's unique port ADM capability allows sub-wavelength access. This reduces capital outlay, while supporting drop-and-continue routing for broadcast applications. With port ADM and TDM functioning on the same interface, the FLASHWAVE 7420 system supports multiple Gigabit Ethernet (GbE) circuits on a single wavelength. Some circuits can support video broadcast applications while others support standard point-to-point connectivity, either with or without protection. This allows the platform to be deployed from the metro core to the access edge while meeting the diverse demands of corporate, enterprise, government and residential applications.

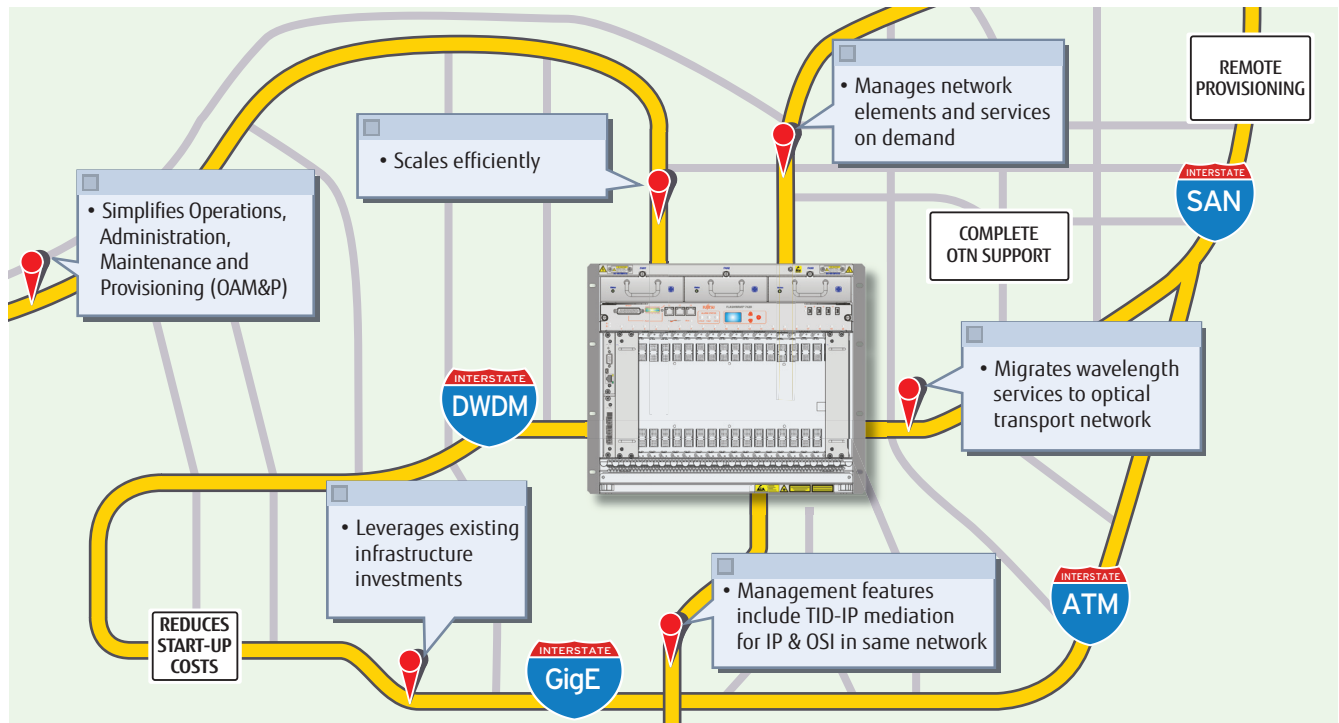
### Manageable Flexibility, Many Protocols

The modular architecture of the FLASHWAVE 7420 system comprises a rack-mountable shelf and hot-swappable modules. The result is high density and efficiency across numerous protocols including Ethernet, SONET/SDH, G.709 OTN, ATM, video and all common SAN protocols. Protocols up to 43 Gbps (OTU3) are supported.

### Key Technical Advantages and Network Benefits

The feature-rich FLASHWAVE 7420 platform lets carriers profitably deploy broadband optical services over a shared, survivable infrastructure. Features include:

- **Advanced optical technologies** with full-band tunable optics, small form-factor pluggable optics, chromatic dispersion compensation, cost-optimized amplification and optical switching
- **Efficient multiplexing** for SONET/SDH, Ethernet, storage and OTN protocols
- **Integrated** signal conditioning and amplification optimized through network design
- **Compact** WDM transport with multiple fiber and reconfigurability options
- **High density** with GbE add/drop multiplexing for per-node subwavelength access



# FLASHWAVE® 7420 Metro/Enterprise WDM Platform

## Critical Network Applications

### Metro Networks

The FLASHWAVE 7420 system is ideal for cost-effective Ethernet over SONET, drop-and-continue routing and pay-as-you-grow bandwidth scalability for local and competitive carriers' core networks.

### Gigabit Ethernet

The platform offers several efficient options for aggregating GbE traffic onto wavelengths depending on the overall bandwidth needs. This makes it ideal for providing GbE connectivity from edge routers or DSLAMs to core routers.

### Enterprise Networks

The FLASHWAVE 7420 platform provides new revenue-generating opportunities with combined GbE and certified, low-latency Storage Area Network (SAN) services on a single platform.

### Dedicated Customer Carrier Solutions

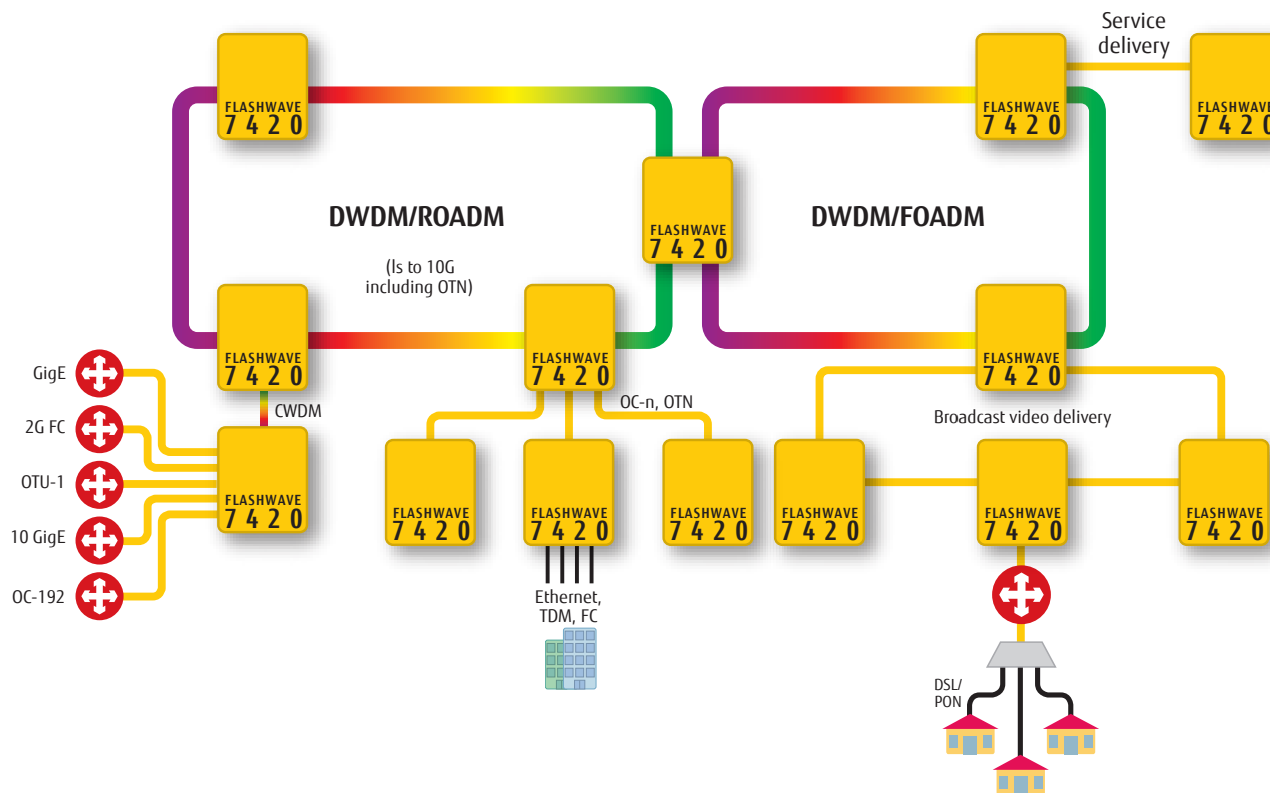
The platform enables flexible delivery of high-density wavelength services, Ethernet transport and SAN services.

### Enterprise Wavelength Services

Transparent provisioning of multiple GbE services per wavelength helps drive down the cost of access WDM solutions.

### High Capacity Optical Transport

The FLASHWAVE 7420 system scalable bandwidth deployment for high-speed voice, video, data and storage services via SONET or Ethernet over DWDM (and CWDM).



### Multiservice metro/access WDM solutions

# FLASHWAVE® 7420 Metro/Enterprise WDM Platform

## Network Services

Fujitsu offers a broad selection of professional services to assist at every stage in a network's evolution and operation. From planning through deployment and ongoing maintenance to future enhancements, Fujitsu Network Services are available whenever needed. Our comprehensive range of services includes network and system design, training, customized deployment, craft interface software, migration planning and more. Your Fujitsu sales representative can guide you in selecting the right service options for your business.

Popular planning and deployment services for the FLASHWAVE 7420 Managed Wavelength Platform include:

- **Fiber characterization** – Comprehensive verification and analysis of your installed fiber maximizes current and future network performance.
- **Design services for WDM networks** – Powerful network planning tools and our professional design staff prepares your roadmap for success.
- **Turn-up and test** – Ensures that your new equipment is turned up, comprehensively tested and operating per product specifications after physical installation is complete.

### Fujitsu Maintenance and Support Program

For a complete professional maintenance solution, the Fujitsu Maintenance and Support Program has the right combination of flexibility and comprehensive assurance. Choose the level and types of service you need to supplement your own resources. The Maintenance and Support Program helps keep your network running smoothly, provides critical care and protects the longevity of your investment.

### Network Operations Center

With a full range of vendor-independent network fault and performance monitoring features, the Fujitsu Network Operations Center (NOC) offers guaranteed, round-the-clock system protection. Our reliable NOC facility is available as a primary or supplemental operations resource. This service not only helps you control costs and maintain high levels of customer satisfaction, it also provides trustworthy and reliable after-hours and emergency coverage.



# FLASHWAVE® 7420

## Metro/Enterprise WDM Platform

### Features and Specifications

<b>Architectures</b>	<ul style="list-style-type: none"> <li>Point-to-point</li> <li>Linear add/drop</li> <li>Ring</li> </ul>	<b>Optical span length</b>	<table border="1"> <tbody> <tr> <td>Point-to-point</td> <td>Up to 200 km maximum (45 dB)</td> </tr> <tr> <td>Ring circumference</td> <td>Up to 1000 km maximum</td> </tr> </tbody> </table>	Point-to-point	Up to 200 km maximum (45 dB)	Ring circumference	Up to 1000 km maximum		
Point-to-point	Up to 200 km maximum (45 dB)								
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<b>WDM options</b>	<ul style="list-style-type: none"> <li>CWDM FOADM</li> <li>DWDM 4-channel increments to 32 total channels FOADM</li> <li>DWDM 40-channel FOADM</li> <li>DWDM 40/80-channel 2D ROADM</li> <li>DWDM 40/80-channel 8D ROADM</li> </ul>	<b>Optics</b>	<ul style="list-style-type: none"> <li>Pluggable interfaces on both client and network ports for 850 nm, 1310 nm, 1550 nm, CWDM and DWDM</li> <li>C-band support (32/40 fixed, 40 reconfigurable)</li> <li>DWDM channel spacing (50/100 GHz) per ITU-T G.694.1</li> <li>CWDM according to G.694.2</li> <li>Laser classes 1 &amp; 1M supported for many applications</li> <li>Full-band tunable optics for long-reach 10/40/100G DWDM transport</li> </ul>						
<b>Services</b>	<ul style="list-style-type: none"> <li>Ethernet</li> <li>10, 100 and 1000 Mbps</li> <li>10/100 GbE WAN PHY, 10/100 GbE LAN PHY</li> <li>SAN</li> <li>ESCON</li> <li>Fibre Channel (1, 2, 4, 8 and 10 Gbps)</li> <li>FICON (1 and 2 Gbps)</li> </ul>	<b>Operations</b>	<ul style="list-style-type: none"> <li>TL1 and SNMP</li> <li>10Base-T and RS-232</li> <li>Software download and remote memory backup/restore</li> <li>Embedded Web-based GUI craft interface, smart launch from NETSMART® 500 Element Manager and native NETSMART 1500 Management System support</li> </ul>						
<b>SONET/SDH</b>	<ul style="list-style-type: none"> <li>OC-3, OC-12, OC-48, OC-192, OC-768</li> <li>STM-1, STM-4, STM-16, STM-64, STM-256</li> <li>G.709</li> <li>OTU-1, OTU-2, OTU-3</li> <li>ATM (155, 622 and 2488 Mbps)</li> <li>FDDI Video</li> <li>Independent (8 Mbps to 2.7 Gbps)</li> </ul>	<b>Power consumption/ heat dissipation</b>	1250 W (4265 BTU/hr)						
<b>Amplifiers</b>	<ul style="list-style-type: none"> <li>RAMAN for extended spans (up to 1800 km)</li> <li>Single/double-stage EDFA, C-band, with variable gain and booster-optimized options</li> <li>Group-level EDFA (4 channels), C-band</li> </ul>	<b>Operating environment</b>	<table border="1"> <tbody> <tr> <td>Temperature</td> <td>5 to 45° C (41 to 113° F)</td> </tr> <tr> <td>Humidity</td> <td>5 to 95% (non-condensing)</td> </tr> </tbody> </table> NEBS Level 3 compliant	Temperature	5 to 45° C (41 to 113° F)	Humidity	5 to 95% (non-condensing)		
Temperature	5 to 45° C (41 to 113° F)								
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<b>Channel cards</b>	<ul style="list-style-type: none"> <li>High-Performance CORE <ul style="list-style-type: none"> <li>Core dual 2.7G and single 10/40/100 Gbps transponders</li> <li>Core 4:1 SONET/SDH and 10:1 multiprotocol muxponders</li> <li>Full SONET/STS, Ethernet/GFP, OTN/G.709 support</li> <li>Full C-band tunable lasers on 10/40/100G optics</li> <li>Core dual 10G transponder</li> </ul> </li> <li>Metro Access <ul style="list-style-type: none"> <li>Access dual 2.5G/10G transponders</li> <li>Access 2:1 SONET/SDH, 2:1 data, 4:1 data muxponders</li> </ul> </li> <li>Enterprise 5-port universal data center trans/muxponder for low latency storage applications (SAN)</li> <li>Layer 2 Ethernet Packet transport modules (G.8031 support)</li> </ul>	<b>Physical characteristics (9U shelf) Requires NCU-II</b>	<table border="1"> <tbody> <tr> <td>Dimensions (H x W x D)</td> <td>15.71 x 19 x 10.86" (399 x 483 x 276 mm)</td> </tr> <tr> <td>Weight</td> <td>&lt;36 lb (&lt;17 kg)</td> </tr> <tr> <td>Power Input</td> <td>-36 to -72 V DC</td> </tr> </tbody> </table>	Dimensions (H x W x D)	15.71 x 19 x 10.86" (399 x 483 x 276 mm)	Weight	<36 lb (<17 kg)	Power Input	-36 to -72 V DC
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		<b>Physical characteristics (1U shelf)</b>	<table border="1"> <tbody> <tr> <td>Dimensions (H x W x D)</td> <td>1.72 x 17.56 x 8.82" 44 x 446 x 224 mm</td> </tr> <tr> <td>Weight</td> <td>&lt;6.2 lb (&lt;3 kg)</td> </tr> <tr> <td>Power Input</td> <td>-36 to -72 V DC or 100/220 V AC</td> </tr> </tbody> </table>	Dimensions (H x W x D)	1.72 x 17.56 x 8.82" 44 x 446 x 224 mm	Weight	<6.2 lb (<3 kg)	Power Input	-36 to -72 V DC or 100/220 V AC
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Weight	<6.2 lb (<3 kg)								
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# FLASHWAVE® 7420 Metro/Enterprise WDM Platform



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# FLASHWAVE® 7500

## Multifunction ROADM/DWDM Platform



*The FLASHWAVE 7500 platform offers advanced DWDM, optical hubbing, ROADM, and network capabilities to deliver and manage growing metro and regional networks. The system supports both ANSI and ETSI-certified solutions, with flexible configurations to optimize metro and regional networks.*



Metro and regional optical networks are entering a period of dramatic expansion, driven by demand for high-speed data services, legacy TDM services, and high-bandwidth video services. Competing successfully requires a network architecture that consolidates and manages all high-bandwidth services over a single core optical transport network. The FLASHWAVE 7500 system provides a high-capacity ROADM platform for metro and regional networks, improving operational efficiency, reducing operations expenses, and lowering overall network costs.

**Flexible Architecture, Deployed Worldwide**

Chosen by major service providers worldwide, the FLASHWAVE 7500 platform is deployed in North America, Europe and Asia. American National Standards Institute (ANSI) and European Telecom Standards Institute (ETSI)-certified versions allow operation in any global environment. The platform aggregates TDM, SONET, Ethernet, and video services onto a single core optical transport infrastructure, improving efficiency, flexibility, and cost-effectiveness.

**Field-Proven Technology**

As the industry-leading metro ROADM platform, thousands of FLASHWAVE 7500 nodes are in operation with dozens of carriers worldwide, providing proven real-world performance. In addition, the systems go through rigorous internal system testing and verification prior to each software release. The FLASHWAVE 7500 platform has also been extensively tested by numerous outside facilities. These include customer test labs, NEBS, UL, Telcordia OSMINE, in addition to federal government testing and certification by the U.S. Defense Information Systems Agency (DISA)-sanctioned Joint Interoperability Test Command (JITC).

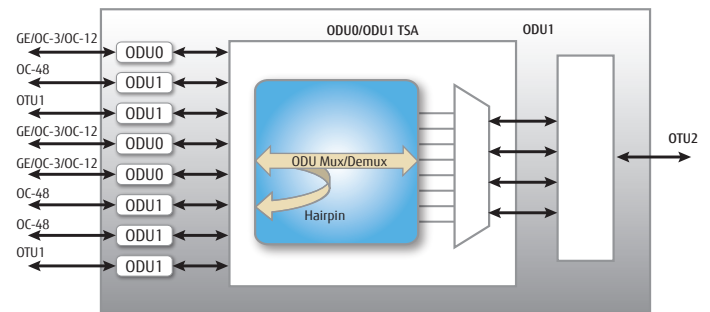
**Recent Product Enhancements**

New FLASHWAVE 7500 features and enhancements improve network performance, enable new applications, and offer DWDM network and operational efficiencies. These new capabilities deliver significant capital and operational cost benefits.

**OTN Muxponder**

Optical Transport Network (OTN) technology has been used for years in DWDM equipment, implemented as G.709 digital wrapper for wavelengths. OTN provides a common frame structure, optical layer Operations, Administration and Maintenance (OAM), General Communications Channel (GCC0), and Forward Error Correction (FEC) for improved performance.

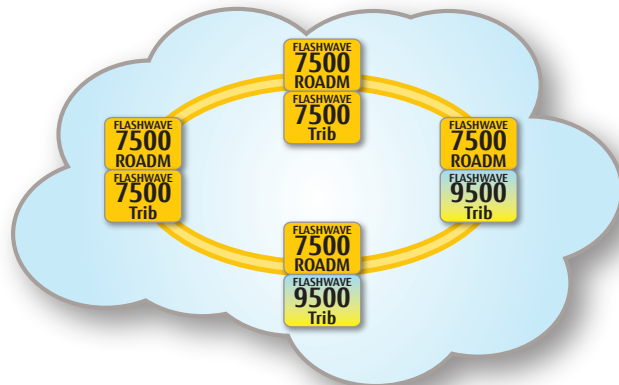
Carriers are adopting OTN for sub-wavelength multiplexing and aggregation applications, in addition to its role as a digital wrapper for wavelengths. OTN multiplexing offers several benefits over other techniques, including universal containers supporting any signal type, transparent aggregation of signals, an industry-standard multiplexing scheme, and robust OAM.



With the introduction of the OTN muxponder unit on the FLASHWAVE 7500 platform, carriers can enable OTN multiplexing and services on existing ROADM networks. Supporting eight client ports of OC-3, OC-12, OC-48, GbE, and OTU1 services, the OTN muxponder maps all services into standard OTN containers and a 10G OTU2 network interface. In addition to the OTN muxponder unit, Fujitsu is adding 40G OTU3 support to the existing 40G transponder cards. OTN is transforming optical transport networks—with Fujitsu leading the way.

**FLASHWAVE 7500 and 9500 Integration**

Carriers can now have the best of both worlds, with the ability to mix and match transponders and muxponders from either the FLASHWAVE 7500 or 9500 platforms, over a common FLASHWAVE 7500 ROADM network.





# FLASHWAVE® 7500 Multifunction ROADM/DWDM Platform

## Reduce OPEX and Troubleshooting Time

With thousands of FLASHWAVE 7500 nodes deployed, existing carriers and networks can upgrade to the latest technologies and advancements, such as the Fujitsu 100G transponder and 100G muxponders, all running over their existing ROADM infrastructure. FLASHWAVE 7500 and 9500 integration enables carriers to expand and enhance their network without the need for costly overbuilds.

### 40G Improves Network Utilization

The FLASHWAVE 7500 system supports 10G, 40G, and 100G (via 9500 trib) wavelengths with a wide array of transponder and muxponder service units.

Recently, 40G units have become increasingly popular and widely deployed, providing carriers with a fourfold improvement in capacity. Fujitsu supports both coherent and non-coherent 40G units. The non-coherent 40G units are based on Adaptive Dual Phase Shift Keying (ADPSK) and provide a cost-effective method for expanding capacity in metro and regional DWDM networks. However, these 40G ADPSK units are not applicable on high Polarization Mode Dispersion (PMD) fiber spans.

PMD is an optical impairment with some older fibers that limits both transmission speeds and span distances. The 40G coherent transponders enable deployment and operation over high PMD routes, which were previously limited to 10G operation. Carriers reap substantial savings by eliminating the need to remove and replace problematic high-PMD routes.

### Sub-Wavelength Aggregation Reduces Capex

The Flexponder unit is an 8-port multirate, multiservice unit that integrates SONET STS-1 aggregation and switching along with WDM on a single card. Commonly referred to as a "Multiservice Provisioning Platform (MSPP)-on-a-blade," these cards perform the functions previously performed by standalone SONET MSPPs, saving equipment costs, space, and power.

The flexponder can be used as a single unit, supporting eight multirate, multiservice ports along with an integrated 20G STS-1 switch fabric for traffic grooming, or with multiple units. When using multiple flexponders, the system provides sub-wavelength aggregation and grooming across all units installed in a shelf with a 160G STS-1 distributed switching matrix.

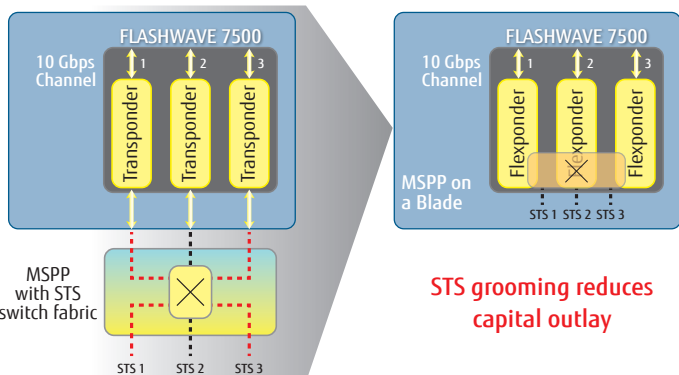
### Stacked Muxponders Reduce Remote Costs

The FLASHWAVE 7500 Extension Shelf provides a low-cost method of extending services to customer premises or remote locations. Instead of a full ROADM node at the remote location, the Extension Shelf can be deployed with a single transponder or muxponder, utilizing the network-side optical interface as a single-channel transport system. The limitation of this approach is that many remote sites require more low-speed aggregation ports than available on a single 10G muxponder unit. By combining multiple 10G muxponder cards with a 40G muxponder card in a stacked configuration, carriers can efficiently aggregate remote services and transport them over a single 40G channel, without the cost of a full ROADM node.

A similar application is to provide capacity expansion and fiber relief on fully filled DWDM networks. By upgrading to 40G wavelengths, carriers can expand their network capacity by a factor of four, without costly network overbuilds. Existing 10G muxponders, providing low-rate client OC-3/12/48 or GbE services, can be combined with the 40G muxponder unit in a stacked configuration to enable 40G or even 100G DWDM transport.

### Enhanced Software Operational Features

Several operational features and enhancements have been incorporated to improve performance and reduce operation time and costs.



Capability/Feature	Value
Security Enhancements	Added protection for user passwords and network ports ensures the utmost security from network compromise for the most demanding, secure network environments
Enhanced alarm storage for WSS & amplifier modules	Additional storage of PM values aids in network troubleshooting and prevention
Client-side DWDM XFPs	Reduces costs by eliminating the need for back-to-back transponders when interconnecting WDM networks (FLASHWAVE 7210 or 9500)
Multiple IS-IS instances	Enables OSI management area to be subdivided, specifically within optical hub nodes, as networks grow and expand in size. Improved network management and scalability

# FLASHWAVE® 7500

## Multifunction ROADM/DWDM Platform

### Versatile Configurations

As a unified, scalable platform, the FLASHWAVE 7500 system offers flexible configurations to support a wide range of applications, including:

- FLASHWAVE 7500 WSS ROADM (1–12 degree optical hubbing)
- FLASHWAVE 7500 2-degree ROADM
- FLASHWAVE 7500 Extension Shelf for low-cost, remote nodes
- FLASHWAVE 7500 In-Line Amplifier (ILA)

The FLASHWAVE 7500 optical line cards and software are common to all configurations, reducing operational costs for engineering, training, installation and spare parts. Chassis options include a 23-inch North American version, a 19-inch version, and a 500 mm front-access ETSI version.

The FLASHWAVE 7500 system also supports managed service extensions with the FLASHWAVE CDS Micro Packet Optical Networking Platform (Packet ONP) and FLASHWAVE 7120 Access CWDM/DWDM platform. The FLASHWAVE CDS is a compact 2RU customer premises platform that provides advanced Ethernet services and legacy SONET services. The FLASHWAVE 7120 provides a small, cost-effective WDM solution for transporting multiple wavelengths in access applications.

The FLASHWAVE 7500 platform supports both mixed 10G and 40G wavelengths on the same network, enabling carriers to efficiently and cost-effectively upgrade their WDM capacity, without the need for expensive overbuild networks.

#### FLASHWAVE 7500 WSS ROADM

The FLASHWAVE 7500 wavelength selective switch (WSS) ROADM provides a powerful and cost-effective solution for metro and regional networks. Supporting up to 40 channels and capacity up to 1.6 Tb, the system provides an ideal solution for consolidated core optical networks, eliminating costly multiple overlay networks for each service type. Advanced features, such as automatic power balancing, optical hubbing, and A-Z wavelength provisioning, reduce operational expenses and improve service implementation times. Configurations range from simple 2-degree ROADMs to multidegree optical hub nodes supporting complex mesh network architectures.

#### FLASHWAVE 7500 2D ROADM

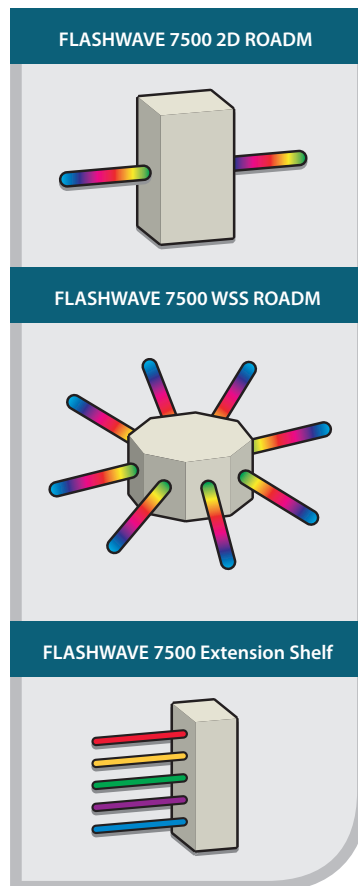
An economical choice for locations only requiring two degrees of connectivity, as opposed to multidegree hubbing, the FLASHWAVE 7500 2D ROADM can be deployed alone or in mixed applications along with FLASHWAVE 7500 WSS optical hub nodes. The 2D ROADM provides full 1–40 channel support, ring, linear, and terminal configurations, and utilizes all of the same optical line cards for client-side service interfaces. In addition, the 2D ROADM supports up to eight transponder slots on the same shelf as the ROADM switch/muxponder and amplifier cards, enabling single-shelf deployments for low channel-count sites. Additional tributary shelves can always be added when additional slot capacity is required.

#### FLASHWAVE 7500 Extension Shelf

The FLASHWAVE 7500 Extension Shelf is a non-ROADM standalone configuration designed to extend individual services to customer premises. Primarily intended for single-channel extensions, the system offers very low-cost service delivery without the need for DWDM layer amplifiers, optical switches, and multiplexer/demultiplexer units.

#### FLASHWAVE 7500 ILA

Large optical networks require amplification every 60–100 Km, depending on the fiber type, data rates, and service mix. At those midpoints where service or wavelength drops are not required, the FLASHWAVE 7500 ILA offers a very economical solution to re-amplify the WDM signal and extend the network reach. If service or wavelength drops are ever needed at an ILA location, the FLASHWAVE 7500 ILA can be upgraded in-service to a full ROADM node.





# FLASHWAVE® 7500 Multifunction ROADM/DWDM Platform

## A Wide Range of Applications

### Core Transport Infrastructure

As a high-capacity optical transport platform, the FLASHWAVE 7500 ROADM is ideal for aggregating large, high-bandwidth services over a single optical core network. Previously, carriers typically deployed separate transport networks for each service type and network layer. The FLASHWAVE 7500 consolidates TDM, SONET, Ethernet, and video services into a single DWDM infrastructure, providing substantial savings and streamlining the network architecture, while providing additional capacity for future network growth.

### Collapsed Network Functions

The FLASHWAVE 7500 system is more than just a pure optical transport platform, as it also supports sub-wavelength grooming and aggregation for legacy SONET services. In a typical network, SONET MSPPs provide STS-1 grooming and aggregation for OC-3/12/48 interfaces, with an OC-192 interconnection to the DWDM layer. Most DWDM locations also have many subtending SONET MSPPs, providing STS-1 level aggregation, grooming, and switching.

The FLASHWAVE 7500 Flexponder unit eliminates the need for subtending SONET MSPPs, by integrating SONET physical interfaces, STS-1 switching, and SONET protection switching into a single unit along with DWDM. The FLASHWAVE 7500 Flexponder supports eight multirate, multiservice ports that can be individually provisioned for OC-3/12/48 or GbE services, with a high-speed, full-band tunable OTU2 (10G DWDM) network interface. The Flexponder can be used as a

single unit providing eight multirate ports along with an integrated 20G STS-1 switch fabric. It can be deployed in pairs, functioning as a SONET MSPP on a blade with SONET 1+1 and UPSR protection switching, along with the integrated STS-1 fabric. Finally, multiple units can be deployed supporting up to 160G of STS-1 switching and aggregation across all ports in the shelf.

### High-PMD Routes

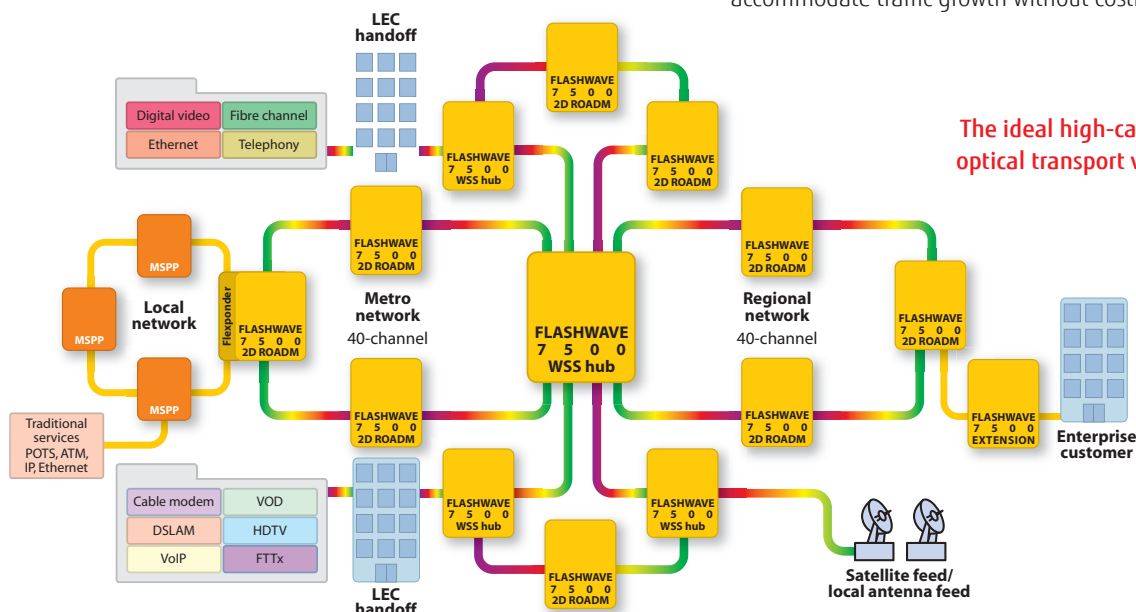
For optical routes with high polarization mode dispersion (PMD), the FLASHWAVE 7500 platform supports both 10G and 40G transponders superficially designed for problematic high-PMD fiber. The 40G coherent transponder and muxponder units utilize advanced DP-QSPK modulation and coherent optical receivers, which improves performance over high-PMD fiber.

### Video Distribution

Perfectly suited for video applications in the cable and IPTV industry, the FLASHWAVE 7500 platform lets service providers distribute both broadcast and VoD video streams over large metro and regional networks from headend offices to video serving offices or distribution hubs.

### Private Network Applications

As the backbone infrastructure for large private network applications, the FLASHWAVE 7500 system ensures that financial institutions, educational consortiums and federal government installations can accommodate traffic growth without costly network upgrades.



# FLASHWAVE® 7500

## Multifunction ROADM/DWDM Platform

### Network Life Cycle Services

Fujitsu offers a broad selection of professional services to assist at every stage in a network's evolution and operation. From planning through deployment and ongoing maintenance to future enhancements, Fujitsu Network Life Cycle Services are available whenever needed. Our comprehensive range of services includes network and system design, training, customized deployment, craft interface software, migration planning and more. Your Fujitsu sales representative can guide you in selecting the right service options for your business.

Popular planning and deployment services for the FLASHWAVE 7500 multifunction ROADM/DWDM platform include:

**Fiber characterization** – Fujitsu offers comprehensive analysis of installed fiber to improve current network performance, prepare for new growth and identify potential issues.

**Onsite mentoring** – Our experts provide full training and knowledge transfers.

**Design services for DWDM networks** – Our professional design staff works with you to prepare a complete, custom roadmap for success.

#### Fujitsu Maintenance and Support Program

For a complete professional maintenance solution, the Fujitsu Maintenance and Support Program has the right combination of flexibility and comprehensive assurance. Choose the level and types of service you need to supplement your own resources. The Maintenance and Support Program helps keep your network running smoothly, provides critical care and protects the longevity of your investment.

#### Network Operations Center

With a full range of vendor-independent network fault and performance monitoring features, the Fujitsu Network Operations Center (NOC) offers guaranteed, round-the-clock system protection. Our reliable NOC facility is available as a primary or supplemental operations resource. This service not only helps you control costs and maintain high levels of customer satisfaction, it also provides trustworthy and reliable after-hours and emergency coverage.





# FLASHWAVE® 7500 Multifunction ROADM/DWDM Platform

## Features and Specifications

<b>Architectures</b>	<ul style="list-style-type: none"> <li>• Optical hubbing (up to 12 degrees)</li> <li>• Ring</li> <li>• Mesh</li> <li>• Linear add/drop</li> <li>• Point-to-point</li> <li>• In-Line Amplifier (ILA)</li> </ul>
<b>Network Capacity</b>	<ul style="list-style-type: none"> <li>• 1.6 Tbps (40 wavelengths at 40 Gbps each)</li> <li>• Up to 1200 Km reach without regeneration</li> <li>• WSS-based optical switch fabric (1 to 12 degrees)</li> <li>• 2D-only ROADM option</li> <li>• Optional Raman amplifiers for extended-reach spans</li> <li>• FLASHWAVE 7500 Extension Shelf for low-cost remote services</li> </ul>
<b>Optical Line Cards</b>	<ul style="list-style-type: none"> <li>• Transponders/regenerators for 10G and 40G services</li> <li>• Muxponders including 4x1 10G, 4x1 2.5G, and 8x1 10G</li> <li>• OTN muxponder 8-port for OC-3/12/48/GbE and OTU1 services</li> <li>• Flexponder 8x1 SONET MSPP-on-a-blade for OC-3/12/48 and GbE services</li> <li>• Full C-band tunable narrowband optics at 10G, 40G, and 100G</li> <li>• G.709-compliant digital wrappers with RS-FEC, Ultra FEC (U-FEC and enhanced FEC (E-FEC)</li> <li>• SFP/XFP pluggable client-side optics</li> </ul>

Optical Line Cards	
40G transponder	<ul style="list-style-type: none"> <li>• OC-768/STM-256</li> <li>• OTU3</li> </ul>
40G muxponder (4 x 10G)	<ul style="list-style-type: none"> <li>• OC-192/STM-64</li> <li>• 10 GbE</li> <li>• OTU2</li> </ul>
10G universal transponder	<ul style="list-style-type: none"> <li>• OC-192/STM-64</li> <li>• 10 GbE</li> <li>• OTU2</li> </ul>
10G muxponder (4 x 2.5G)	<ul style="list-style-type: none"> <li>• OC-48/STM-16</li> </ul>
OTN muxponder (8-port)	<ul style="list-style-type: none"> <li>• OC-3/12/48</li> <li>• STM1/STM4/STM16</li> <li>• GbE</li> <li>• OTU1</li> </ul>
10G Flexponder (8-port)	<ul style="list-style-type: none"> <li>• OC-3/12/48</li> <li>• STM1/STM4/STM16</li> <li>• GbE</li> </ul>
Gbe muxponder (8-port)	<ul style="list-style-type: none"> <li>• GbE</li> </ul>
Multirate 2.5G transponder (1-port)	<ul style="list-style-type: none"> <li>• Multirate transponder 100 Mbps–2.7 Gbps for any service type</li> </ul>

<b>System Features</b>	<ul style="list-style-type: none"> <li>• Automatic per-channel power balancing</li> <li>• A-Z wavelength provisioning</li> <li>• Sub-wavelength grooming and aggregation (160G) per shelf</li> <li>• Optical hubbing for ring and mesh network interconnections</li> <li>• ILA upgrades to full ROADM node in-service</li> </ul>								
<b>Operations</b>	<ul style="list-style-type: none"> <li>• TL1 over TCP/IP</li> <li>• TL1 over OSI</li> <li>• SNMP (alarms)</li> <li>• Remote software updates</li> <li>• Remote memory backup/restore</li> <li>• NETSMART® 500 Element Manager</li> <li>• NETSMART 1500 Management System</li> <li>• NETSMART 2000 Network Design and Planning Tool</li> </ul>								
<b>Monitoring and Alarms</b>	<ul style="list-style-type: none"> <li>• Optical per-channel and WDM monitoring</li> <li>• Wavelength management</li> <li>• Optical layer (OTN) PM</li> <li>• SONET/SDH PM</li> <li>• Gigabit Ethernet PM</li> </ul>								
<b>Power Consumption/Heat Dissipation</b>	<table border="0"> <tr> <td>• Optical/hub shelf</td> <td>&lt;360W (1228 BTU/hr)</td> </tr> <tr> <td>• Tributary shelf</td> <td>&lt;630W (2150 BTU/hr)</td> </tr> <tr> <td>• ILA</td> <td>&lt;360W (1228 BTU/hr)</td> </tr> </table>	• Optical/hub shelf	<360W (1228 BTU/hr)	• Tributary shelf	<630W (2150 BTU/hr)	• ILA	<360W (1228 BTU/hr)		
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• Tributary shelf	<630W (2150 BTU/hr)								
• ILA	<360W (1228 BTU/hr)								
<b>Operating Environment</b>	<ul style="list-style-type: none"> <li>• Temperature –5 to 50 °C (23 to 122 °F)</li> <li>• Humidity 5 to 95% (non-condensing)</li> <li>• Power input –48 V DC</li> <li>• NEBS Level 3 compliant</li> <li>• FLASHWAVE 7500 ETSI system meets the following requirements for CE marking:                             <ul style="list-style-type: none"> <li>• EMC Directive 2004/108/EC</li> <li>• UL/ IEC 60950</li> <li>• IEC/EN 60825-1 and IEC/EN60950-1 requirements for a Class 1 laser product</li> <li>• Restriction of Hazardous Substances Directive 2002/95/EC</li> <li>• Waste of Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC</li> </ul> </li> </ul>								
<b>Physical Characteristics</b>	<table border="0"> <tr> <td>Dimensions (H x W x D)</td> <td>23" Shelf: 22.5 x 21.5 x 11.5" (572 x 546 x 292 mm)</td> </tr> <tr> <td></td> <td>19" Shelf: 22.5 x 17.3 x 11.5" (572 x 439 x 292 mm)</td> </tr> <tr> <td></td> <td>ETSI shelf: 30.2 x 19.3 x 11.5" (767 x 490 x 292 mm)</td> </tr> <tr> <td>Weight (fully loaded shelf)</td> <td>&lt;145 lb (66 kg)</td> </tr> </table>	Dimensions (H x W x D)	23" Shelf: 22.5 x 21.5 x 11.5" (572 x 546 x 292 mm)		19" Shelf: 22.5 x 17.3 x 11.5" (572 x 439 x 292 mm)		ETSI shelf: 30.2 x 19.3 x 11.5" (767 x 490 x 292 mm)	Weight (fully loaded shelf)	<145 lb (66 kg)
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# FLASHWAVE® 7500 Multifunction ROADM/DWDM Platform

## Available in ANSI and ETSI Shelf Configurations



FLASHWAVE 7500 ANSI Shelf



FLASHWAVE 7500 ETSI Shelf



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All Rights Reserved. All other trademarks are the property of their respective owners.  
Configuration requirements for certain uses are described in the product documentation.  
Features and specifications subject to change without notice.

12.0/R8.1/03.12

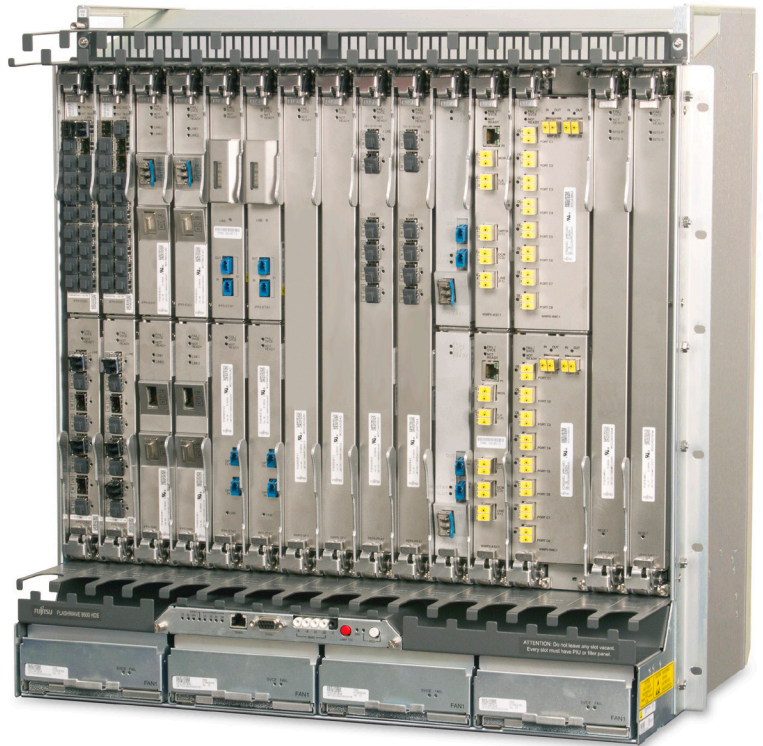


shaping tomorrow with you

# FLASHWAVE® 9500

## Packet Optical Networking Platform

*The FLASHWAVE 9500 Packet Optical Networking Platform integrates industry-leading 100G coherent optics with traffic grooming at Layers 1 and 2, in a comprehensive Packet ONP. This platform provides a truly seamless integration of technologies, serving high-bandwidth packet, WDM and TDM transport applications.*



# FLASHWAVE® 9500 Packet Optical Networking Platform

## Shaping the Future Network

As the communications world transforms, demand for bandwidth and high-quality services is escalating. Residential and business customers have rising expectations and are more selective.

This shift in expectations challenges service providers to migrate to a packet optical infrastructure, enabling diverse, bandwidth-intensive services. Operators must also maintain existing revenue-bearing services efficiently, as the transition to packet optical networking takes shape. The underlying network architecture must therefore be highly reliable, manageable, and scalable to keep the lifetime cost below the revenue curve.

### Innovative Features of the FLASHWAVE 9500 Packet ONP

- Establish technology leadership with best-in-class 100G Coherent Optics capabilities
- Add profitable COE packet services with the lowest delay, delay variation and packet loss
- Reduce the cost of Ethernet service delivery over diverse access networks with the EoX Gateway
- Increase ROADM channel count to 88 wavelengths and wavelength bandwidth capacity to 40 Gbps without adding equipment
- Increase reliability and enable flexible growth by allowing ROADM degrees to span multiple shelves on the same Network Element (NE)
- Optimize CAPEX via integrated multirate, multiservice capabilities and tunable optics

### 100G Transponder (Coherent Optics)

Strategic focus for 100G is our own technology ecosystem. This ecosystem provides Fujitsu with unique insight for creating the best possible 100G solutions for each customer. Our insight enables us to fine-tune specifications, implement trade-offs, optimize design, manage supply chain and apply the quality controls necessary to maintain its technical superiority in the market.

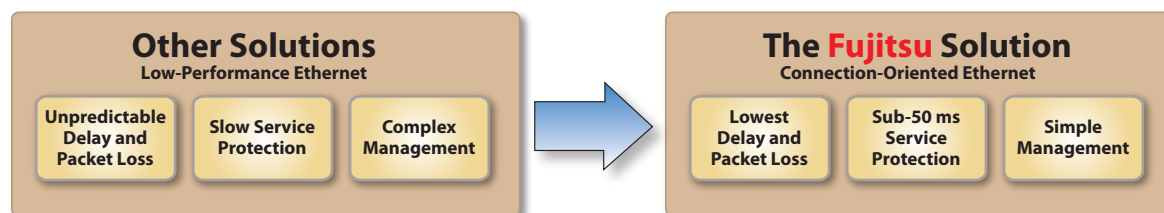
Fujitsu uses the latest 40 nm Application-Specific Integrated Circuit (ASIC) technology in its Digital Signal Processor (DSP), a key capability required to deliver on the promise of coherent optics. Together with Soft-FEC algorithm implemented in the DSP chip, the combination provides unparalleled optical transport power and performance.

The 100 Gbps transponder is central to customer fiber plant maintenance. Direct interconnect of core routers using 100 Gbps technology conserves both customer CapEx and OpEx while maintaining a flexible DWDM-based core growth strategy. In addition it serves to maximize router value by focusing it on router vs. transport functions.

### Multirate, Multiservice Interface Flexibility

Release 6.1 introduces the new CXF4 2+12 multirate, multiservice interface unit to the FLASHWAVE 9500 system. This unit multiplexes 12 client SFP interfaces, with combinations of OC-48, STS3, STS1, AU4, FC100/200/400 and 10/100/1000 GbE, into two high-speed full-band tunable 10 Gbps XFP interfaces. This unit operates in one of three modes:

- Stand-alone SONET/SDS
- Stand-alone OTN multiplexer
- Switch fabric system



COE provides simple-to-manage integrated support for packet, optical and TDM networks.



# FLASHWAVE® 9500 Packet Optical Networking Platform

## Flexible, Scalable, Efficient

SAS mode accommodates all existing Sonet/SDH/Ethernet SFP interfaces and adds support for Fiber Channel 100/200/400. These inputs are mapped into either OC192 or OTU2 XFP interfaces. All cross-connection is performed on the PIU. SAOMX mode maps eight OC48 signals into two XFP based OTU2 interfaces

Client interfaces use XFP based pluggable optics to lower first port costs and enable pay-as-you-grow bandwidth expansion. The 100G muxponder provides an efficient solution to 10G interface DWDM transport with direct 100G DWDM output for use in packet, OTN, DWDM or existing SONET networks. Onboard multiplexing technology obviates the need for a switch fabric in the shelf.

### Why FLASHWAVE COE?

- Performance, reliability and security of Layer 1-based Ethernet over SONET/SDH (EoS)
  - Determinism and security of Layer 1 private-line services
- Flexibility and efficiency of native Ethernet
- Service-aware traffic management capabilities
  - Guaranteed SLAs
  - Scalable, reliable architecture

### Built for the Multiprotocol Environment

The Fujitsu FLASHWAVE 9500 Packet Optical Networking Platform (Packet ONP) is a lasting technology foundation for the evolving packet-centric network. This platform integrates Connection-Oriented Ethernet (COE) and Layer 1 transport technologies. It delivers high-bandwidth, high-quality packet, TDM, and WDM services on a standards-compliant, multiprotocol platform. The FLASHWAVE 9500 platform reduces the complexity, and ultimately the cost, of metro/ regional transport.

### Packet ONP Integration and Innovation

The integration of packet and transport technologies is a natural evolution of the metro and regional network as it changes to address bandwidth-intensive applications cost-efficiently. Specific technologies have been incorporated into the FLASHWAVE 9500 system to support this evolution, including:

- COE for Layer 2 capabilities with Layer 1 reliability
- Centralized SONET/SDH and packet/OTN switch fabric
- Ethernet over TDM/SONET to native Ethernet interworking
- ROADM

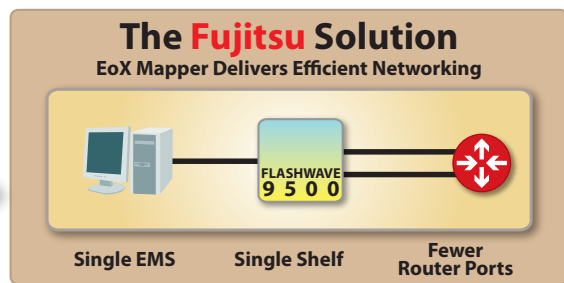
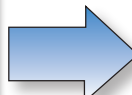
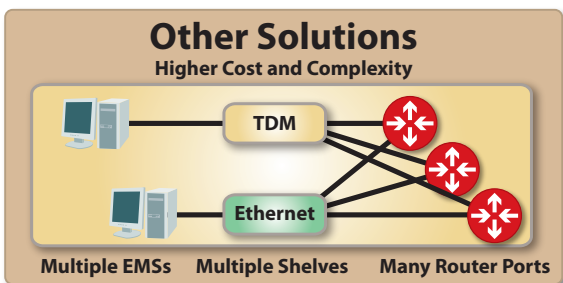
### COE with Advanced Traffic Engineering

Next-generation mobile backhaul, high-definition video distribution and mission-critical enterprise services require a deterministic, high-performance, high-availability, connection-oriented environment. The answer is COE, the basis for high-quality, simple-to-manage integrated networks that support packet, optical, and TDM technologies.

In SWSF mode the MRMS PIU operates with a combination of up to two high-speed ports and 12 low speed ports and has access to 20 or 40G of SWF card cross connect bandwidth.

### 100G Muxponder

The 100G muxponder enables DWDM transport of 10 GbE, OC-192/ STM-64 and OTU-2 client interfaces by aggregating them into one full band tunable coherent optical network interface. The network interface utilizes DP-QPSK coding techniques and connects to the ROADM using 50 Ghz channel spacing. Client ports support standard RS-FEC while the Network ports use soft-decision (SD) FEC for enhanced performance.



Software-based service aggregation consolidates multiple shelves.

# FLASHWAVE® 9500

## Packet Optical Networking Platform

### Advanced Packet ONP Solutions

#### Centralized Switch fabric – TDM, Packet, OTN

The FLASHWAVE 9500 Packet ONP integrates SONET/SDH, packet, and OTN switching into a centralized, non-blocking, fully redundant switch fabric. Each slot on the universal shelf provides unrestricted access to any of the switch fabric technologies, enabling the FLASHWAVE 9500 platform to be deployed as 100% SONET/SDH, 100% packet/OTN, or any combination.

The FLASHWAVE 9500 platform adds support for a 20 Gbps low-order switch fabric plug-in unit for cross connections of VT1.5, VC12, or LO VC3 circuits. This optional, non-blocking, fully meshed, VT switching solution supports unidirectional, bidirectional, drop-and-continue, and broadcast cross-connections with path selector switching (for VT UPSR and VC SNCP). The integrated VT switch fabric in the FLASHWAVE 9500 platform eliminates the need for external MSPP NEs traditionally used for VT grooming, which reduces expenses.

#### DWDM and CWDM Pluggable Optics

The FLASHWAVE 9500 platform supports CWDM and DWDM optics for 1 Gbps, 2.5 Gbps, and 10 Gbps client services. Narrowband pluggable optics enable FLASHWAVE 9500 Packet ONP client interfaces to connect directly to C/DWDM mux/demux and OADM equipment without using a separate transponder to accomplish wavelength conversions. WDM SFP/XFPs alleviate the need for additional fiber as access network service requirements increase, reducing the total cost of ownership. The various multirate CWDM and DWDM optics packages available for the FLASHWAVE 9500 platform extend the capacity of a particular fiber pair, increasing scalability.

#### Ethernet over SONET/SDH (EoS) to Native Ethernet

The FLASHWAVE 9500 platform is powering the transition from traditional TDM transport to next-generation data infrastructure. The EoX Mapper is critical to this transition, providing the interworking function between Ethernet over SONET/SDH (EoS) and native Ethernet. The EoX Mapper terminates EoS and EoPDH circuits and aggregates the native Ethernet flows. This produces a highly concentrated, fully redundant collection point for hundreds of EoS circuits, alleviating the scalability issues associated with Layer 1 port-based data service hand-offs to the IP service edge. Combined with advanced traffic management, the EoX Mapper offers a cost-effective, scalable EoS aggregation solution.

#### EoX Gateway – the Foundation for Advanced Ethernet/IP Aggregation

The FLASHWAVE 9500 Packet ONP can aggregate, switch and deliver COE services across any type of access network (EoX) on a single NE. This EoX Gateway configuration dramatically increases the number of addressable customers for differentiable Ethernet and IP services, benefiting wholesale and retail service providers by leveraging existing access networks. This accelerates time to revenue and significantly reduces the cost and space of hub Central Office (CO) equipment.

The EoX Gateway cards and system software terminate a wide variety of access networks, perform COE switching and grooming, and present fully protected Ethernet or SONET/SDH handoffs to other transport or service delivery networks. By deploying the EoX Gateway, service providers realize significant advantages, including:

- Converging disparate network elements and management systems
- Leveraging existing TDM, Ethernet and WDM access networks
- Enabling the transition to an optimal packet-centric infrastructure

#### Compact ROADM

Compact ROADM technology delivers economical bulk bandwidth and operational stability. The FLASHWAVE 9500 platform offers industry-leading density with up to 100 Gbps of bandwidth on each of 88 channels, across eight directions. Software Release 6.1 builds on these strengths with the split-hub ROADM option, which enables location-independent allocation of a ROADM degree across multiple shelves, while functioning as a cohesive unit. As a result, you can increase flexibility and reduce downtime risk.



# FLASHWAVE® 9500 Packet Optical Networking Platform

## Key Applications

### Consolidated Core Metro/Regional Networking

The FLASHWAVE 9500 Packet ONP is ideal for evolving core metro/ regional transport networks. Layer 1 and 2 technology integration provides a wide variety of transport options to connect offices within a metro, and metros within a region. Centralized switching provides unrestricted SONET/SDH and COE aggregation and grooming. The introduction of 100G coherent optics technology to the platform's DWDM capability establishes it as the new benchmark in optical transport applications. By basing the consolidated core metro/regional infrastructure on the FLASHWAVE 9500 system, service providers can:

- Meet growing demand for core bandwidth
- Support both legacy and next-generation technologies
- Use operational automation to simplify the network
- Realize potential for large-scale deployment
- Minimize network fiber consumption

### Mobile Backhaul

Demand for higher speed wireless data services continues to surge as new applications proliferate. To tap into this revenue opportunity, wireless service providers are deploying 3G and 4G wireless technologies, increasing the number of cell sites and boosting the bandwidth capacity of the backhaul network.

While these new technologies are expanding, there are still approximately 190,000 existing cell sites in the US. Most have T1 TDM base stations and require T1 TDM backhaul. This large installed base will remain in operation for many years, resulting in a continued need to provide T1 mobile backhaul transport.

The FLASHWAVE 9500 Packet ONP is ideally positioned to address this transitional situation. The system simultaneously supports COE and native TDM services to manage latency-sensitive wireless applications regardless of access and transport technology.

By basing the mobile backhaul infrastructure on the FLASHWAVE 9500 system, service providers can:

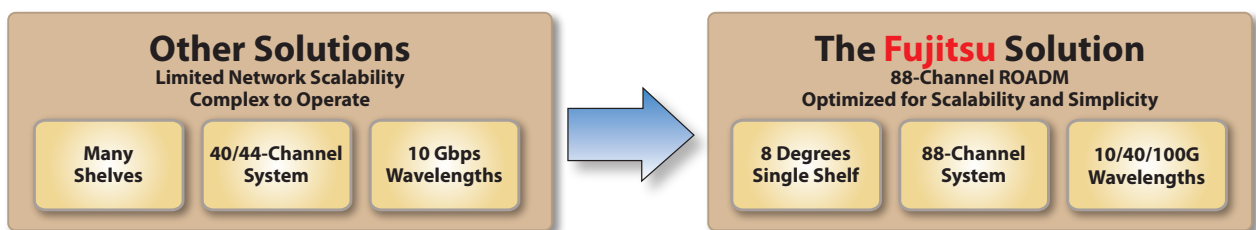
- Integrate seamlessly with existing TDM backhaul networks
- Prepare for 3G/4G backhaul with COE interface modules
- Transition at their own pace

### Enterprise and Wholesale Services

Delivering profitable enterprise and wholesale services requires economical, highly reliable solutions that accommodate varied demands: simple TDM services; advanced wavelength services; high-quality COE services.

The FLASHWAVE 9500 Packet ONP allows carriers to consolidate enterprise and wholesale infrastructure by supporting native TDM, COE and WDM access, aggregation and transport in a single NE. Seamless integration with Fujitsu access products, combined with NETSMART 1500 end-to-end management, allows the FLASHWAVE 9500 Packet ONP to deliver a broad range of enterprise and wholesale services. By basing the enterprise and wholesale services infrastructure on the FLASHWAVE 9500 system, service providers can:

- Deliver private network service over multiple transport-layer technologies
- Offer all types of private-line services over a common packet optical transport and network management layer
- Provide low-cost point-to-point Ethernet and TDM metro access to long-distance packet services with guaranteed QoS
- Deliver end-to-end enterprise/wholesale services over existing (TDM) and new (packet) network infrastructures using EoX Gateway service interworking



**ROADM software results in the simplest operations in the industry.**



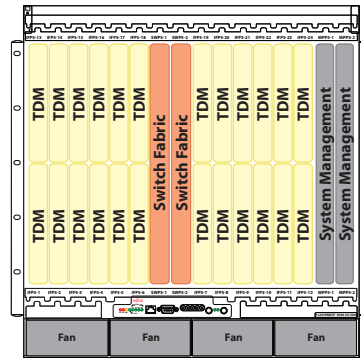
# FLASHWAVE® 9500

## Packet Optical Networking Platform

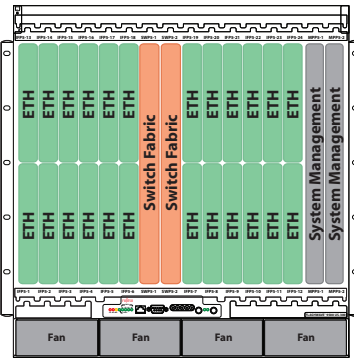
### Flexible Configuration Options

Each shelf type can support a variety of interfaces including:

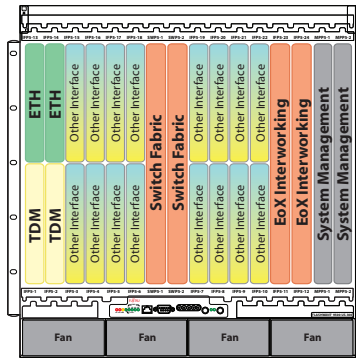
- ROADM
- SONET/SDH MSPP
- Connection-Oriented Ethernet
- Packet optical networking—any mix of transport technologies



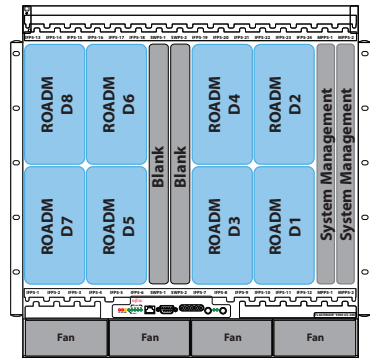
**High-Density TDM Configuration**  
 480 Gbps TDM + packet switch fabric  
 8 x multirate OC-3/STM1, OC-12/STM4, OC-48/STM16/GbE  
 2 x OC-192/STM64  
 1 x OC-192/STM64 NBO



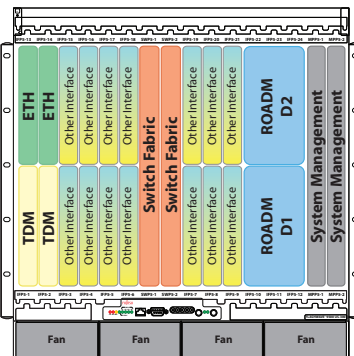
**High-Density Packet Configuration**  
 480 Gbps TDM + packet switch fabric  
 20 x GbE  
 2 x 10 GbE  
 1 x 10 GbE NBO



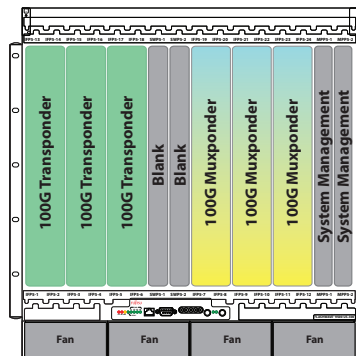
**EoX Gateway Configuration**  
 480 Gbps TDM + packet switch fabric  
 Packet interfaces  
 TDM interfaces  
 EoTDM to Ethernet service interworking



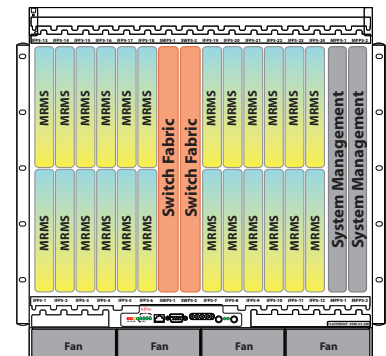
**ROADM Configuration**  
 8-degree, 88-channel ROADM  
 Multishelf support for service interfaces  
 10 Gbps/40 Gbps wavelength support  
 100 Gbps hardware ready



**Full Packet ONP Configuration**  
 480 Gbps TDM + packet switch fabric  
 Packet interfaces  
 TDM interfaces  
 2-degree, 88-channel ROADM



**6 x 100G Coherent Optics**  
 Up to six 100G Transponders  
 Up to six 100G Muxponders



**Multirate Flexible Configuration**  
 480 Gbps TDM + packet switch fabric  
 OC-3/12/48 or SDH STM-1/4/16,  
 EPoT, Fast Ethernet, Gigabit Ethernet  
 Fiber Channel 100/200/400

# FLASHWAVE® 9500 Packet Optical Networking Platform

## Network Services

Fujitsu offers a broad selection of professional services to assist at every stage in a network's evolution and operation. From planning through deployment and ongoing maintenance to future enhancements, Fujitsu Network Life Cycle Services are available whenever needed. Our comprehensive range of services includes network and system design, training, customized deployment, craft interface software, migration planning and more. Fujitsu sales representatives can guide service providers in selecting service options that address individual business needs.

Popular planning and deployment services for the FLASHWAVE 9500 platform include:

- **Fiber pre-qualification** – Fujitsu offers comprehensive analysis of installed fiber to improve current network performance, prepare for new growth and identify potential issues.
- **Onsite mentoring** – Our experts guide you individually through the critical process of determining how to address changing demand.
- **Network design services** – Our professional design staff works with you to prepare a complete, custom roadmap for success.

### Fujitsu Maintenance and Support Program

For a complete professional maintenance solution, the Fujitsu Maintenance and Support Program has the right combination of flexibility and comprehensive assurance. Choose the level and types of service you need to supplement your own resources. The Maintenance and Support Program helps keep your network running smoothly, provides critical care and protects the longevity of your investment.

### Network Operations Center

With a full range of vendor-independent network fault and performance monitoring features, the Fujitsu Network Operations Center (NOC) offers guaranteed, round-the-clock system protection. Our reliable NOC facility is available as a primary or supplemental operations resource. This service not only helps you control costs and maintain high levels of customer satisfaction, it also provides trustworthy and reliable after-hours and emergency coverage.





# FLASHWAVE® 9500 Packet Optical Networking Platform

## NETSMART® 1500 Integration

As new and legacy services coexist to support a widening variety of customers, network support presents more technical challenges. This complex, competitive environment needs a feature-rich software system that simplifies network management.

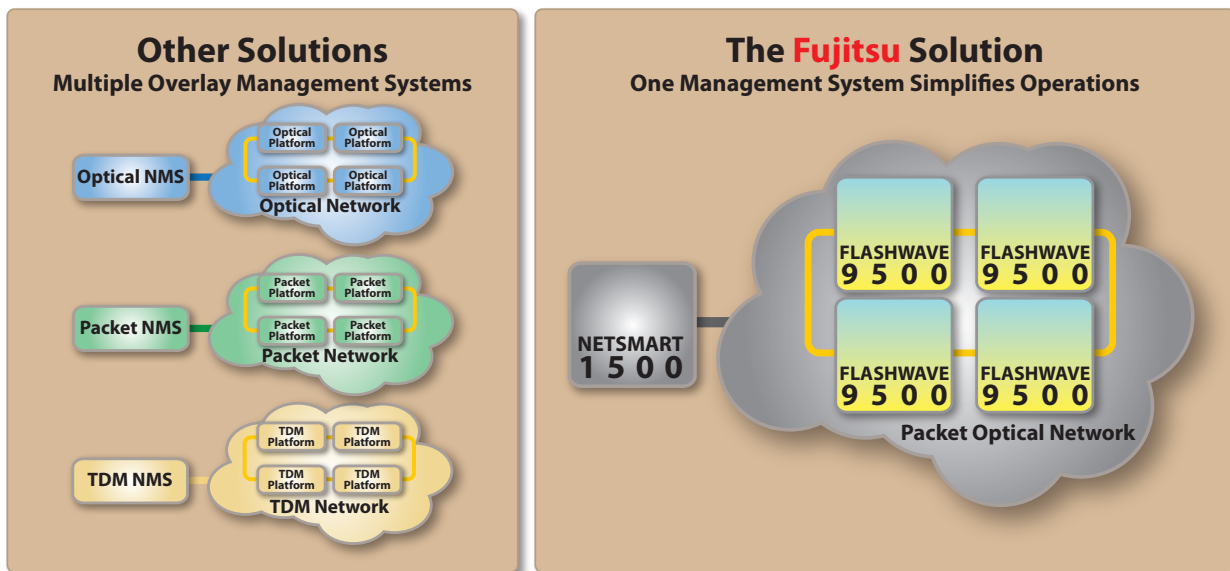
The NETSMART 1500 Management System is a powerful software system that supports and manages the Fujitsu FLASHWAVE product family and all current and legacy Fujitsu NEs. Its intuitive graphical user interface (GUI) makes provisioning, maintenance and troubleshooting a simple, efficient process. The system accommodates networks of all sizes, scaling to support hundreds of users and thousands of NEs—securing your existing investment and supporting future growth.

The NETSMART 1500 software integrates with your existing and future Operations Support System (OSS) architecture, supporting up to 8,000 NEs and 200 concurrent client sessions per system. The software protects network integrity by restricting user roles, manages upgrades of NE software remotely and performs disaster recovery of NE software and databases.

NETSMART 1500 management software provides a single interface for the Layer 1 transport network (cross-connects, circuits/paths) and the Layer 2 data network (such as tunnels, protection domains and service flows). The ability to view multiple network technologies in a single management application allows operations personnel to focus on rapid service deployment instead of learning additional software applications.

Managing complex COE services is dramatically simplified with the end-to-end flow provisioning features of the NETSMART 1500 management system. Centralized A-to-Z management eliminates the need for costly truck rolls traveling site-to-site to provision the network.

The NETSMART 1500 software manages tunnel and VLAN services (single- and dual-tagged) delivered on the FLASHWAVE 9500 platform, avoiding the need for custom in-house software development. The data service management interface provides the tools to provision Ethernet tunnels, protection domains and service OAM.



**One management system reduces OPEX, simplifies feature provisioning, and avoids the need for custom in-house development.**

# FLASHWAVE® 9500 Packet Optical Networking Platform

## Features and Specifications

### System Capacity

- 480 Gbps non-blocking SONET/SDH grooming
- 480 Gbps non-blocking packet grooming
- 20 Gbps non-blocking VT grooming
- Up to 8 degrees of ROADM connectivity
- 88 x 10 Gbps/40 Gbps/100 Gbps wavelengths per ROADM degree
- Universal interface slots
  - SDS shelf 16
  - HDS shelf 24

### Interfaces

Fast Ethernet (SFP)	10Base-T, 100BaseTX, 100Base-FX, 100Base-LX
Gigabit Ethernet (SFP)	1000Base-T, 1000Base-SX, 1000Base-LX, 1000Base-ZX, CWDM
OC-3/STM-1 (SFP)	SR-1, IR-1, LR-1, LR-2
OC-12/STM-4 (SFP)	SR-1, IR-1, LR-1, LR-2
OC-48/STM-16 (SFP)	SR-1, IR-1, LR-1, LR-2, CWDM, DWDM
10 GbE (XFP)	10GBase-LR/LW, 10GBase-ER/EW, 10GBase-ZR, CWDM, DWDM
OC-192/STM-64 (XFP)	SR-1, IR-2, LR-2, CWDM, DWDM
OC-768/STM-256	VSR
100G (CFP)	LR4, SR10, 10x10
10G (XFP)	10G (neg chirp) full band tunable

### Number of Service Interfaces

Interface	Ports/ Card	SDS Ports/Shelf	HDS Ports/Shelf
Fast Ethernet; Gigabit Ethernet	20	240	480
OC-3/OC-12/OC-48; STM-1/STM-4/STM-16 Gigabit Ethernet	8	96	192
10 Gbps Fiber Channel	1	16	24
OTU-2	1	16	24
OC-192/STM64/10 GbE	2	24	48
OC-192 /STM64/10 GbE 88-channel NBO	1	12	24
OC-768/STM256	1	8	12
100GE/OTU4	1	3	6

### FLASHWAVE 9500 Packet ONP Family Shelf Options

	HDS	SDS Rear Access	SDS Front Access
Common system software	X	X	X
Common MPU hardware	X	X	X
Common interface modules	X	X	X
19" rack mountable		X	X
23" rack mountable	X	X	X
240 Gbps universal switch fabric		X	X
480 Gbps universal switch fabric	X	X	X
Number of interface slots	24	16	16

### Fabric Support

- Sub-wavelength (electronic) universal switch fabric:
  - SDS shelf 240 Gbps SONET/SDH + 240 Gbps packet
  - HDS shelf 480 Gbps SONET/SDH + 480 Gbps packet
- Wavelength (photonic) fabric:
  - SDS/HDS WSS-based 44 or 88 channels per direction
- Optional VT switch fabric
  - SDS/HDS 20 Gbps non-blocking VT grooming with full TSI

### Synchronization

- DS1/E1 Building Integrated Timing Supply (BITS) primary and secondary clock input/output
- Line timing
- Synchronization Status Messaging (SSM)
- Internal Stratum 3 timing source

### Network/Client Protection Architectures

- Optical Channel Dedicated Protection Ring (OCh-DPRING)
- SONET/SDH protection architectures (1+1, UPSR, SNCP, BLSR, MSPRING)
- ITU-T G.8031 Ethernet Protection Switching (EPS) over any topology
- IEEE 802.3ad Ethernet Link Aggregation (LAG)

### Equipment Protection

- Universal fabric 1:1
- Management complex 1:1
- Interface card 1:1

### ROADM Functions

- High-density 8-degree ROADM configuration in a single shelf or distributed across multiple shelves (split-hub ROADM)
- 8-degree x 88-channel Wavelength Selectable Switch (WSS)
- Operator-selectable ITU-T wavelengths support 50 GHz ITU-T grid
- ROADM full-band tunable interface units
  - 10 Gbps universal transponder
  - 40 Gbps transponder
  - 8-port multirate muxponder
  - 100G Transponder/Muxponder
- 10 Gbps/40 Gbps wavelength support – 100 Gbps ready
- Per-channel optical channel monitoring
- Operator-tunable dispersion compensation
- Narrowband direct connect
- SONET SDCC and OTN GCC support
- OCh-DPRING optical protection

### Operations

- TL-1
- SNMP
- NETSMART 500 Element Manager
- NETSMART 1500 Management System
- NETSMART 2000 Design and Planning Tool
- TCP/IP to OSI operations gateway
- Software download and remote memory backup/restore

# FLASHWAVE® 9500

## Packet Optical Networking Platform

### Features and Specifications

#### Ethernet Functions

- Connection-based forwarding
  - IEEE 802.3 Ethernet
  - Static forwarding based on IEEE 802.1q and 802.1ad VLAN tags
  - Single and dual VLAN tag push, pop and translation
  - In-band management VLAN
  - Per-VLAN MTU with jumbo frame support
- Flow-based traffic management
  - Provisioned service delimiters: port, C-VLAN, S-VLAN, Q-in-Q, stacked S-VLAN
  - Bandwidth reservation with Connection Admission Control (CAC)
  - QoS/CoS classification: 802.1p, DSCP, priority code point, DE
  - Ingress policing: 2-rate 3-color MEF 10.1
  - Hierarchical egress shaping: class, logical port, port
  - Per-flow queuing with WRED
- Ethernet service protection
  - ITU-T G.8031 1:1
    - Per service or group of services
    - 3.3 ms and 10 ms CCM support
    - Operates over ring, mesh, and point-to-point topologies
  - IEEE 802.3ad Link Aggregation
    - Cross-card support
    - 1:1 and 0:N with configurable hashing options
  - IEEE 802.3ah link OAM
    - Link discovery, monitoring and identification
    - Link critical event and fault messages
    - Ethernet loopback
  - IEEE 802.1ag/Y.1731 service OAM
    - Ethernet continuity check
    - Ethernet link trace
    - Ethernet loopback
- Ethernet over TDM to Ethernet service interworking
  - Encapsulation of native Ethernet frames into GFP-F and X.86
  - GFP-F over SONET/SDH Low-Order and High-Order Virtual Concatenation (LO/HO-VCAT) groups with LCAS
  - GFP-F over bonded DS1/E1s with LCAS
  - GFP-F over single DS3/E3
  - X.86 option for DS3 encapsulation

#### SONET/SDH Functions

- STS/STM cross connects
- Ethernet over SONET/SDH (with GFP, VCAT, LCAS)
- GR-1093 state model

#### Environmental compliance

- UL-certified
- GR-1089 compliant
- NEBS Level 3 compliant
- IEC 60825-1
- IEC 60950-1
- FDA CDRH
- RoHS
- CE
- WEEE



#### Operating Environment

- Operating temperature –5 to +50 °C (23 to 122 °F)
- Storage temperature –40 to +70 °C (–40 to +158 °F)
- Humidity 5 to 95% (non-condensing)

#### Maximum Power Consumption (heat dissipation)

	SDS	HDS
Nominal system power*	800 W (2,731 BTU/hr)	800 W (2,731 BTU/hr)
Maximum power per system	3,034 W (10,356 BTU/hr)	4,266 W (14,561 BTU/hr)
Expected input	–40 to –57 VDC	–40 to –57 VDC

\* Actual power varies with configuration.

#### Physical Characteristics

	SDS	HDS
Shelf dimensions (H x W x D)**	22.75 x 17.4 x 14.8" (578 x 442 x 376 mm)	22.75 x 22.5 x 15" (578 x 571 x 380 mm)
Weight (empty shelf)	73 lb (33 kg)	95 lb (43.1 kg)

\*\* Shelf depth measurement includes all covers and cabling.



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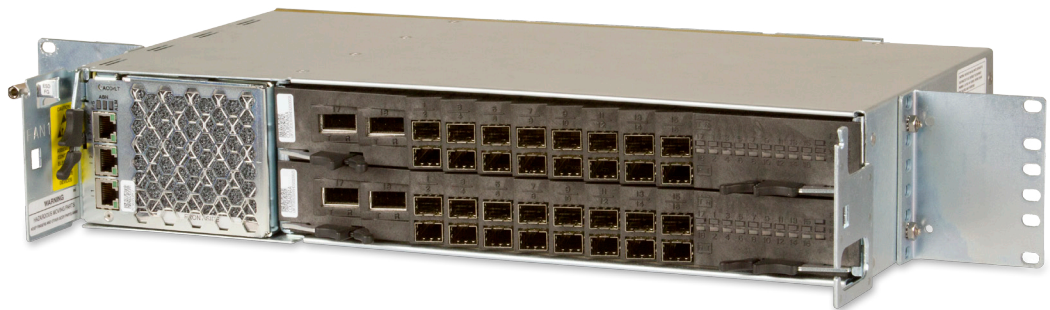
[us.fujitsu.com/telecom](http://us.fujitsu.com/telecom)



shaping tomorrow with you

# FLASHWAVE<sup>®</sup> CDS

## Micro Packet Optical Networking Platform



*The carrier-class FLASHWAVE CDS Micro Packet Optical Networking Platform (Packet ONP) can operate either standalone or as an extension of the FLASHWAVE 9500 Packet ONP. This is a cost-effective, reliable access system that provides Connection-Oriented Ethernet and OTN switching/multiplexing with no single point of failure. The platform is hardened for outside-plant applications.*



# FLASHWAVE® CDS

## Micro Packet Optical Networking Platform

### Agility for Changing Networks

In a changing communications industry, networks are being enhanced to support new packet-based and OTN services. As Ethernet becomes more prevalent, the networks must evolve to deliver it efficiently, cost-effectively, and with 99.999% service availability. Fujitsu has developed the next generation of Packet Optical Networking Platforms (Packet ONPs) specifically to meet these emerging challenges and smooth the transition to an OTN and/or Connection-Oriented Ethernet (COE) network.

#### A Whole New Class of Optical Edge System

The FLASHWAVE CDS system consists of a two-slot chassis and a range of interface units to meet a variety of business applications, traffic capacity requirements, and price points. Service providers can exploit its modular architecture to enhance their business services and optimize their access network.

#### Packet-Based Services

The FLASHWAVE CDS platform incorporates advanced rate shaping, traffic management, and aggregation supporting revenue-bearing services with guaranteed COE service delivery. The platform provides a number of innovative features including:

- Optimized throughput and fiber assets with reuse of underutilized bandwidth
- Guaranteed bandwidth with dynamic buffer allocation enabled by advanced traffic management
- Sub-50 ms network resiliency using G.8031 VLAN-based Ethernet Virtual Connection protection
- Low first-cost Nx GbE network ports provide investment protection and flexible scaling to 10 GbE transport
- Line rate throughput (10 Gbps) with 64 byte frame size

#### OTN-Based Services

A transition is occurring from using OTN purely as a digital wrapper for enhanced DWDM performance to a switching mechanism for the next generation of service grooming and aggregation. OTN provides a fully transparent, global transport capability for various service protocols such as Ethernet, SONET, and Storage Area Networks, to name a few. The OTN switching and multiplexing capabilities of the FLASHWAVE CDS system provide a transparent transport interface between these highly critical services and the OTN network.

The FLASHWAVE CDS system incorporates a non-blocking OTN switch with multirate I/O, offering very high-density OTN switching and multiplexing. The system interoperates seamlessly with the Fujitsu FLASHWAVE 9500 and 7500 platforms.

The FLASHWAVE CDS system's fully standards-compliant OTN capability also provides additional features that greatly broaden its range of addressable applications:

- 80 Gbps OTN switching capability within 2RU footprint
- Enhanced loopback capabilities
- Enhanced and provisionable signal replacement functionality

#### Simplified Network Operations

Network operations are a large part of the expense of a network. The design, implementation, and maintenance of a network all play a part in this operational expense. The Fujitsu NETSMART® 1500 Management System streamlines the process of deploying and maintaining the network. The FLASHWAVE CDS platform is fully supported by the NETSMART 1500 system, which provides for a Metro Ethernet Forum (MEF) approach to operations. The NETSMART 1500 system also uses MEF terms and concepts for provisioning and allocating resources, greatly simplifying the operational aspect. It determines flows based on the CIR/CBS/EIR/EBS and reduces the complexity and the need to know all of the intricacies of the systems. The NETSMART 1500 Management System makes COE simple and provides seamless support for all FLASHWAVE technologies combining WDM, OTN, COE and SONET.

**Provisioning  
is as simple  
as M.E.F.**



# FLASHWAVE® CDS Micro Packet Optical Networking Platform

## Carrier-Class Mobile Backhaul

The FLASHWAVE CDS Micro Packet ONP is designed for three primary applications:

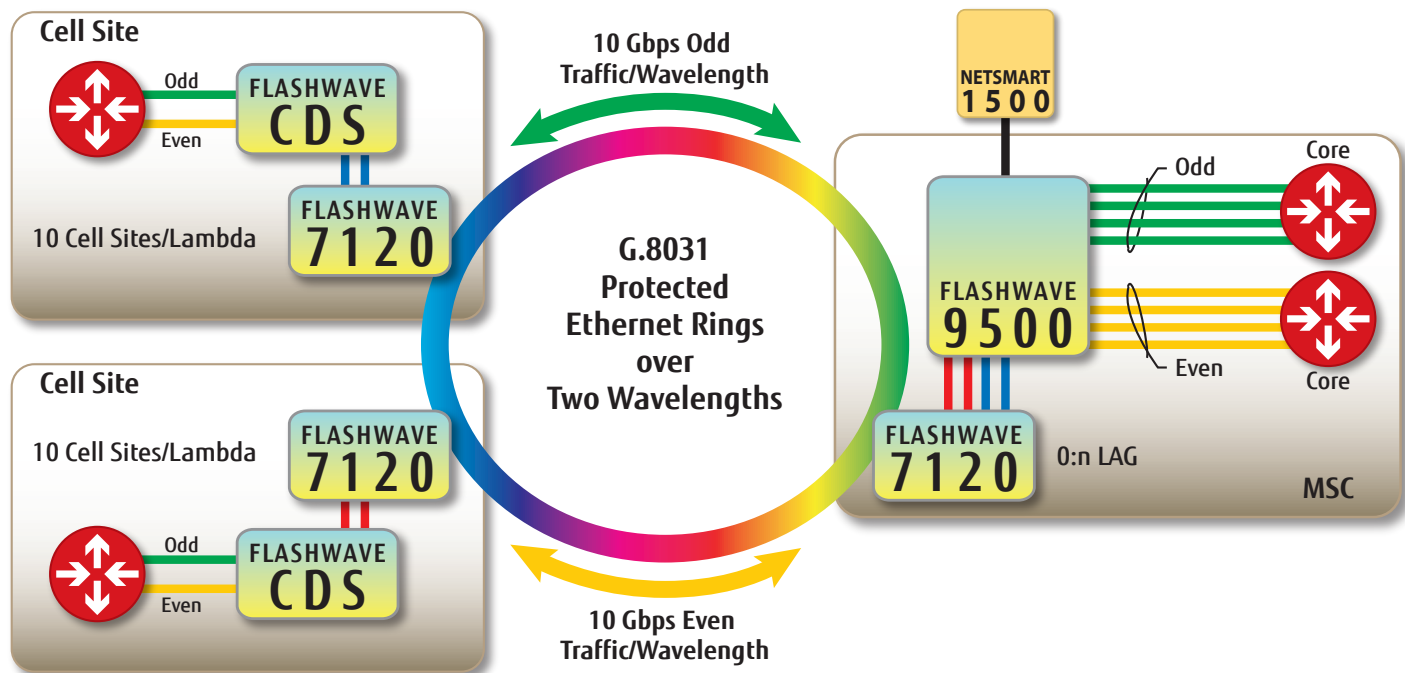
- Mobile backhaul
- Enterprise service delivery
- Access infrastructure

### Mobile Backhaul

The FLASHWAVE CDS Micro Packet ONP is optimized for mobile backhaul applications. The platform makes optimal use of underutilized bandwidth which, in turn, maximizes throughput and use of fiber assets. Enhanced traffic management makes it possible to attain consistently superior performance in complex, high-traffic networks during peak traffic times. Carriers can define individual bandwidth profiles, on a per-VLAN basis, for guaranteed minimum and peak maximum traffic rates. Optional sub-50 ms network resiliency offers selective path protection. The FLASHWAVE CDS platform is the premier high-performance cell tower access solution, providing “five nines” carrier-class reliability for mobile backhaul services.

Mobile backhaul is experiencing an explosion in traffic demand. Wireless operators are moving from leased lines to dark fiber as part of their solution and must use wavelengths as efficiently as possible to secure their investment for future expansion at minimal additional cost. The ideal solution to their backhaul needs includes the FLASHWAVE CDS and FLASHWAVE 9500 platforms as shown in the diagram below, delivering redundancy at all critical points:

- Wavelength-based scalability
- Even/odd traffic replication (green/orange)
- Ring-based service aggregation with redundant E-Line EVCs per cell site
- RFC2544 turn-up and testing
- Y.1731 performance monitoring
- End-to-end service protection

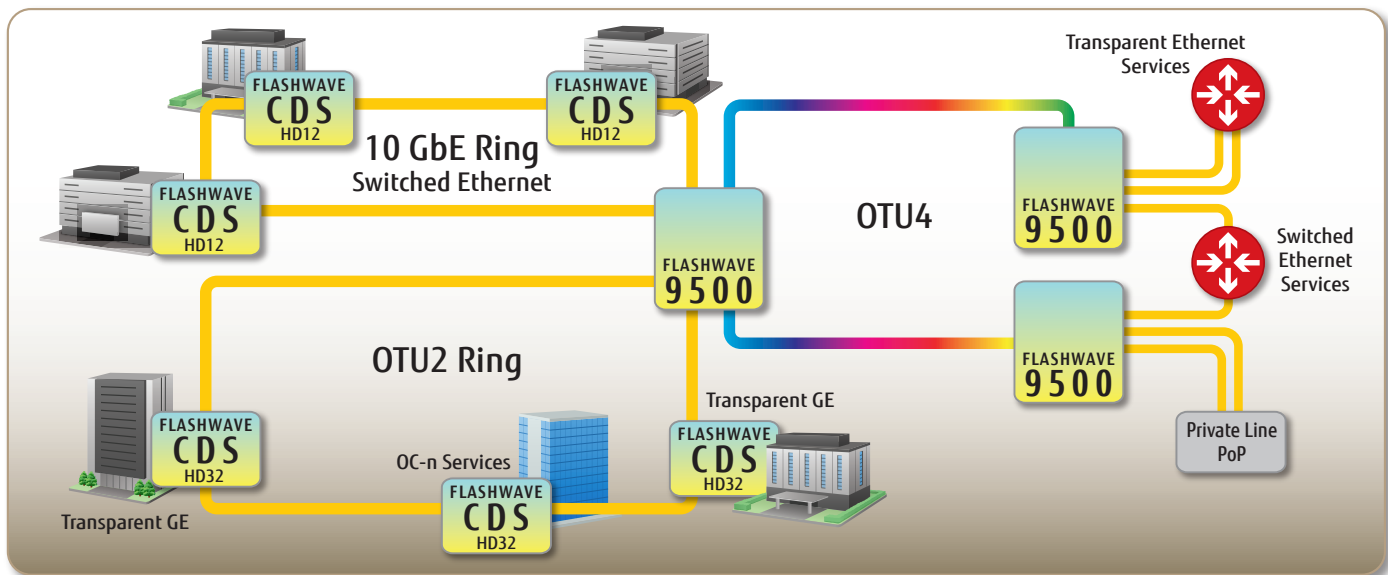


Consistently superior performance in mobile backhaul networks

# FLASHWAVE® CDS

## Micro Packet Optical Networking Platform

### Service Delivery for Enterprise Applications



#### High-density enterprise service delivery

##### Enterprise Service Delivery

The FLASHWAVE CDS system is the ideal access and aggregation solution for delivering Ethernet business services. High-density Ethernet service interface cards allow large numbers of data customers to be supported in a single system. Integrated traffic management, data aggregation, and COE transport technologies provide carrier-class data services with guaranteed SLAs.

Some businesses require relatively small Ethernet services (10 to 100 Mbps), which are optimally supported with a switched Ethernet access architecture for economical transport. Larger enterprises often require full-rate 1 GbE services and need fully transparent transport. This type of application is best served with an OTN-based network with GbE services mapped into an ODU0 format. Both of these options, Ethernet and OTN, are supported by the FLASHWAVE CDS platform, while the FLASHWAVE 9500 Packet ONP provides an additional layer of aggregation across all service types (Ethernet, OTN and SONET).

##### Transport of:

- Transparent GbE Services
- Legacy SONET Services
- Switched Carrier Ethernet Services



# FLASHWAVE® CDS Micro Packet Optical Networking Platform

## Traffic Consolidation and Aggregation

The FLASHWAVE CDS Micro Packet ONP is an excellent solution for:

- Wholesale services
- Small wire centers
- Outside-Plant (OSP) cabinets and Controlled Environmental Vaults (CEVs)

### Access Infrastructure

The FLASHWAVE CDS can act as an intermediate aggregator for networks that require multiple stages of traffic consolidation in their infrastructure. Instead of putting a very expensive piece of equipment in small wire centers that may not justify such a device, the FLASHWAVE CDS system can provide this infrastructure with significantly lower cost and simpler operations for the network operator.

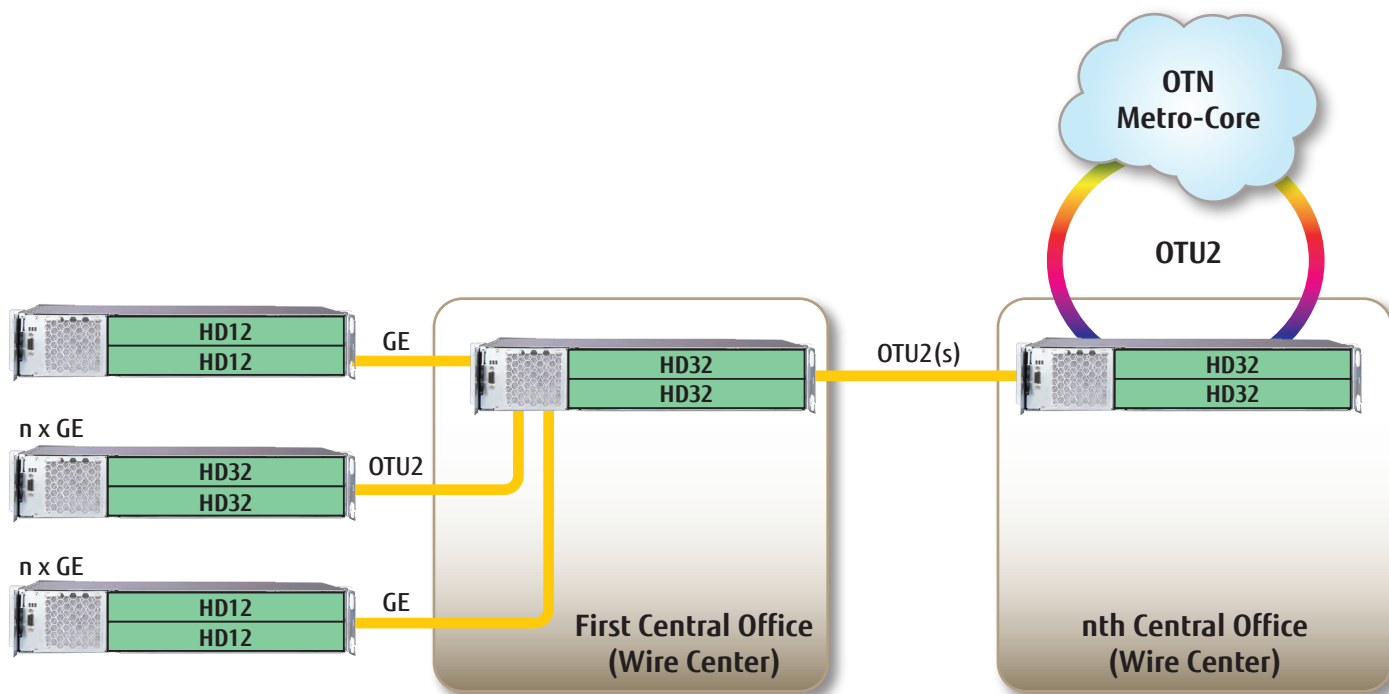
Since either Ethernet or OTN fabrics can be used on the CDS, this intermediate aggregation can consist of either or both technologies within the same small wire center. This can result in significant operational and capital savings.

### Point-of-Presence Handoff

With its slim 2RU footprint and the remote management capabilities, the FLASHWAVE CDS platform can also serve as a cost-effective Point-of-Presence (PoP) handoff to a third-party carrier. This configuration can be implemented simply and quickly, and offers an easy solution for situations that require something small and with low power consumption, such as a CLEC cage. The FLASHWAVE CDS has all the necessary loopbacks and OAM capabilities to act in this capacity, providing full visibility into the network, all the way to the PoP handoff client ports.

### Outside-Plant Installation

The FLASHWAVE CDS Micro Packet ONP is environmentally hardened, allowing the device to be put into OSP cabinets. The platform has its own thermal management capabilities with a self-contained fan tray, so it can be installed in very tight spaces, without requiring additional external fans or baffles. Its small size is also ideal for CEVs or Huts or just about any place where space is minimal, but carrier-class functionality and resiliency are still needed.



Simplified, cost-effective aggregation

# FLASHWAVE® CDS

## Micro Packet Optical Networking Platform

### Technologies that Enable Diverse New Services

The FLASHWAVE CDS platform is an ideal solution during and beyond this shift to packet optical networking, addressing the three technology groups that are making the transition possible: optical, OTN and packet.

#### Optical Capabilities

Explosive bandwidth demand is easily accommodated with the integrated 50 Ghz spaced 88-channel DWDM functionality. The FLASHWAVE CDS platform offers 10 Gbps of bandwidth on any of the 88 channels, utilizing the full-band tunable optics. It also supports fixed DWDM XFP, CWDM XFP/SFP, traditional wideband, and single-strand bidirectional optics for both network and client interfaces. Providers taking advantage of these features enjoy several key benefits: fiber plant conservation, operations practice consistency, and increased margins resulting from cost and performance optimization. Optical power and performance statistics are provided for all interface rates.

#### Packet-Based Capabilities

E-Line and E-Access services, as defined by the Metro Ethernet Forum (MEF), are all supported by the FLASHWAVE CDS platform. Standards-based interfaces at the UNI, VUNI (Virtual UNI) and INNI/ENNI enable the platform to deliver either retail or wholesale services.

The E-LAN technology of the FLASHWAVE 9500 Packet ONP can interoperate with the FLASHWAVE CDS to allow the operator to extend E-LAN services over existing access infrastructure.

Retail E-Line or wholesale E-Access services may be offered with guarantees or best effort quality as required. For example; mobile backhaul, a linear path which does not need switching but which will, with the advent of LTE, require QoS guarantees. Fujitsu COE technology may be used to support this type of E-Line service.

The FLASHWAVE CDS platform supports IEEE 802.1ag CFM and ITU-T Y.1731 capabilities. These include the use of MEPs and MIPs, continuity check, loopback, traceroute, RDI, AIS, CSF, APS, Frame Delay and Frame Loss measurements. These capabilities make the behavior of the Ethernet paths fully visible. This applies to all of the MEF-defined services offered. At the customer interface, full traffic management, including access control/classification, policing and prioritization of traffic, is available. LAG and G.8031 protection is supported at both the customer interface and the network boundaries.

#### OTN Based Capabilities

The FLASHWAVE CDS platform supports OTN multiplexing and switching functionality. These capabilities serve applications where total transparency of traffic is a necessity, or when transport of legacy-based OC-3/OC-12/OC-48 services is required.

The OTN functionality enables transport of transparent GbE and Private Line services. The HD32 card provides a built-in full non-blocking OTN switch, which allows any to any port connectivity, including client-to-client hairpinning within a single card or across two cards.

The FLASHWAVE CDS system also offers comprehensive protection capabilities so that with the use of two cards, the system can support both equipment protection and facility protection, in conjunction with the Y-cable module.

The OTN switch has all the basics built-in, such as OAM, loopbacks, and timing recovery. The HD32 card is fully standards based but also has functionality that goes beyond the standard to enhance its applicability.

The HD32 supports path protection, which means any network topology can be used, such as ring, mesh, or point-to-point. The HD32 also supports a full-band tunable XFP, which can interface directly with a ROADM, bypassing the transponder and thus saving costs.



# FLASHWAVE® CDS Packet Optical Networking Platform

## Network Services

Fujitsu offers a broad selection of network services for every stage in a network's evolution and operation. From planning through deployment and ongoing maintenance to future enhancements, Fujitsu Network Services are available whenever needed. Fujitsu sales representatives can guide service providers in selecting options that address individual business needs.

Popular planning and deployment services for the FLASHWAVE® CDS platform include:

- **Custom Cabinet Solutions** – Turnkey inside wall-mount and outside-plant solutions, including standard and custom configurations for wireline, wireless, FTTx, cable and MSO customers
- **Furnish Material** – Identification and ordering of the material needed to install network equipment such as electrical and fiber cable solutions, minor materials and third-party ancillary equipment
- **Turn-Up and Test** – From on-site configuration and simple turn-up to rigorous, long-term testing

### Maintenance and Support Program

For a complete professional maintenance solution, the Fujitsu Maintenance and Support Program has the right combination of flexibility and comprehensive assurance. Choose the level and types of service you need to supplement your own resources. The Maintenance and Support Program helps keep your network running smoothly, provides critical care and protects the longevity of your investment.

### Managed Network Solutions

With a full range of vendor-independent network fault and performance monitoring features, the Fujitsu Managed Network Solutions offer guaranteed, round-the-clock system protection. Our reliable NOC facility is available as a primary or supplemental operations resource. This service not only helps you control costs and maintain high levels of customer satisfaction, it also provides trustworthy and reliable after-hours and emergency monitoring.



# FLASHWAVE® CDS

## Micro Packet Optical Networking Platform

### Features and Specifications

- System overview**
- Carrier-class
  - No single point of failure
  - 2-slot, 2RU, modular chassis
  - Client and network rings
  - Point-to-point topologies
  - Cross card protection
    - 50 ms switch time
  - SFP and XFP
    - Multiple options based on network needs
  - CWDM XFP and SFP Optics supported

#### Available interfaces

LDP1 standard GbE data unit	<ul style="list-style-type: none"> <li>• 12 x Gigabit Ethernet (SFP) or mixed with</li> <li>• 12 x 10/100/1000Base-T (RJ45)</li> </ul>
LDP3 SONET unit	<ul style="list-style-type: none"> <li>• 2 x OC-48 WAN</li> <li>• 2 x Gigabit Ethernet/OC-3/OC-12</li> </ul>
HDP1 standard 10 GbE data unit	<ul style="list-style-type: none"> <li>• 2 x 10 Gigabit Ethernet (XFP)</li> <li>• 12 x Gigabit Ethernet (SFP)</li> <li>• 12 x 10/100/100Base-T (RJ45)</li> </ul>
HD12 Ethernet data unit with enhanced traffic management and ring support	<ul style="list-style-type: none"> <li>• 2 x 10 Gigabit Ethernet (XFP)</li> <li>• 12 x Gigabit Ethernet (SFP)</li> <li>• 12 x 10/100/100Base-T (RJ45)</li> <li>• Software-configured for 1 GbE or 10 GbE network ports</li> </ul>
HD32 OTN switch/multiplexer unit	<ul style="list-style-type: none"> <li>• 2 x 10G (OTU2) (XFP)</li> <li>• 16 x substrate port           <ul style="list-style-type: none"> <li>• OC-3/OC-12/OC-48 (SFP)</li> <li>• Gigabit Ethernet (SFP)</li> </ul> </li> </ul>

- Ethernet functions**
- Ethernet Private Line and Ethernet Virtual Private Line services
  - Hub and spoke topologies
  - Ring and mesh topologies
  - VLAN push, pop, translation
  - Connection admission control
  - IEEE 802.3ad Ethernet link aggregation (1:1 or 0:n)
  - Jumbo frame support
  - Advanced traffic classification
    - Port
    - VLAN
    - Ethernet priority bit (802.1p)
    - IP DSCP
  - Strict priority & per-EVC queuing
  - Hierarchical shaping with logical ports
  - IEEE 802.3ah link EFM OAM
  - In-band VLAN management
  - Large buffering for high burst tolerance
  - G.8031 support
  - Enhanced traffic management

- Ethernet functions**
- 2,000 flows
  - Sync E
  - Hardware-based 512 x 3.3 ms, 10 ms, 100 ms, or 1 s CCMS
  - Line rate throughput at all frame sizes (10 Gbps @ 64-byte frame)
  - SOAM – 802.1AG CFM, Y.1731
  - ACL support
  - MAC translation
  - MAC swap loopback
  - Port mirroring
  - Enhanced security

- SONET/SDH functions**
- STS/STM cross connects
  - TDM multiplexing
  - Ethernet over SONET
    - GFP-F encapsulation
    - HO VCAT
  - SDCC support for remote access

- OTN Functions**
- Full-band tunable optics
  - 80G non-blocking OTN switch fabric per two card system, 40G per single card system
  - Cross-card switching capabilities
  - Protection utilizing SNC-N/S
  - Y-cable protection on client

<b>Operating environment</b>	Operating temperature range	-40 to +65 °C (-40 to +149 °F)
	Humidity range	5 to 95%

<b>Maximum power consumption (heat dissipation)</b>	Maximum power per system	415 W (1416 BTU/hr)
	Power input	-48 VDC 110 VAC (via 1RU rectifier)

<b>Physical characteristics</b>	Dimensions (H x W x D)	3 x 17.4 x 8.9" (76 x 442 x 226 mm) 2RU high, 19/23" rack-mountable
	Weight	10.2 lb/4.6 kg

Note: No external fans or baffles required

- Operations**
- TL1 protocol over OSI/Ethernet
  - NETSMART 500 Element Manager
  - NETSMART 1500 Management System
  - Software download and remote memory backup/restore
  - Interoperable with FLASHWAVE 7500 ROADM and FLASHWAVE 9500 Packet ONPs
  - Telcordia™ OSMINE compliant
  - RADIUS support

- Regulatory & standards compliance**
- UL-certified
  - NEBS Level 3 compliant
  - Certified compliant to MEF 9 and MEF 14



#### Fujitsu Network Communications Inc.

2801 Telecom Parkway, Richardson, TX 75082  
Tel: 800.777.FAST (3278) Fax: 972.479.6900

[us.fujitsu.com/telecom](http://us.fujitsu.com/telecom)



shaping tomorrow with you

# Metro Ethernet Solutions

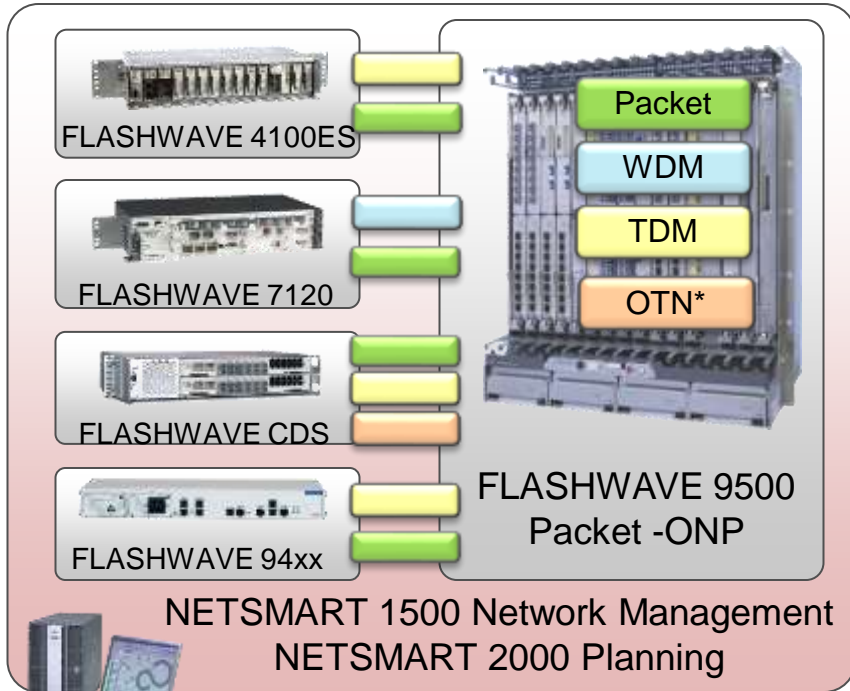
July 12<sup>th</sup>, 2013

Access Product Marketing

# Fujitsu Network Solutions

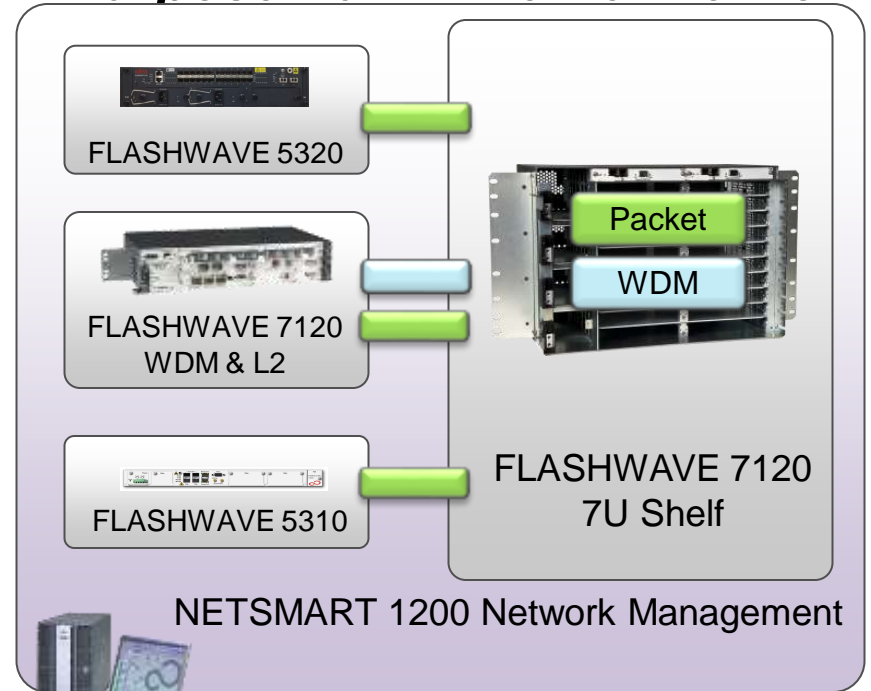


## Multi-Service Infrastructure



- Multiprotocol Access
  - WDM
  - OTN
  - TDM
  - E-Line, E-LAN
  - 100G Coherent Optics
- Universal Switching
  - 100% TDM, 100% Packet
  - Any mix of traffic

## Metro E Purpose Built Ethernet Network

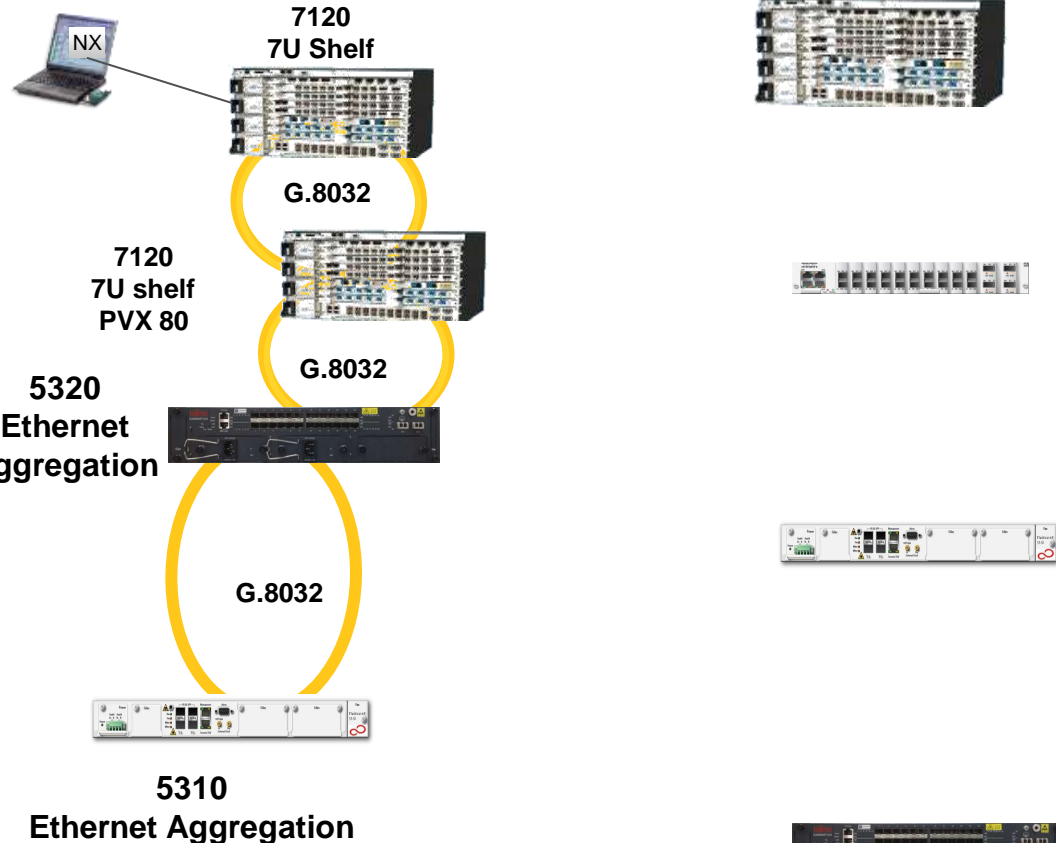


- Services
  - E-Line, E-LAN, E-Tree
  - WDM
  - T1/OC-3 CES
- Key Features
  - G.8032v2
  - Y.1731 PMs

# Metro E Solution – 2013



NS1200 NMS



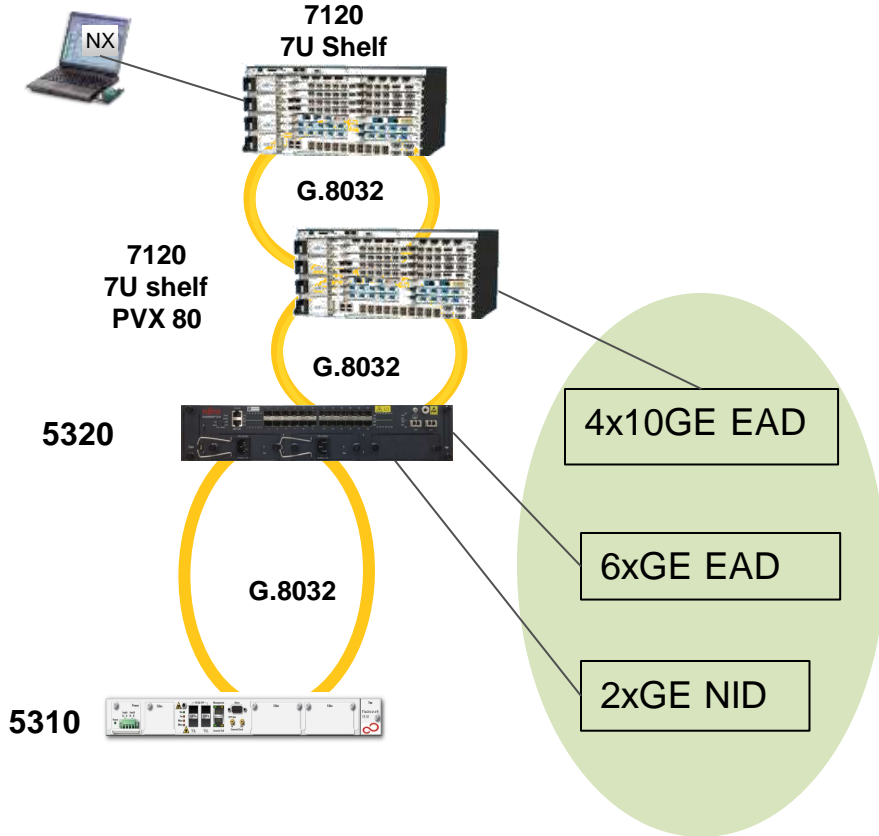
MSO, Tier 2, Tier 3 and 4  
E-Line and E-LAN

- FLASWAVE 7120 7U Shelf
  - 20 slots
  - All FLASWAVE 7120 modules
- FLASHWAVE 7120 PVX 80
  - 8x10GE 80 GBPS
  - EPL/EVPL/ELAN services
  - QoS features, G.8032v2, Y.1731 PMs
- FLASHWAVE 5310
  - 2 client modules & 4 network GE
    - 8xT1, 1xOC3, 4xGE
  - EPL/EVPL/ELAN services
  - QoS features, G.8032v2, Y.1731 PMs
- FLASHWAVE 5320
  - 24 client GE & 2 network 10GE
  - EPL/EVPL/ELAN services
  - QoS features, G.8032v2, Y.1731 PMs
  - 1 expansion slot

# Metro E Solution – 1H 2014



NS1200 NMS



2xGE NID

- 2xGE NID
  - Y.1731
  - AC / DC options

6xGE EAD

- 6xGE EAD
  - 4 client GE & 2 network GE
  - EPL/EVPL/ELAN services
  - QoS features, G.8032v2, Y.1731 PMs

4x10GE EAD

- 4x10GE EAD
  - 2 client 10GE & 2 network 10GE
  - EPL/EVPL/ELAN services
  - QoS features, G.8032v2, Y.1731 PMs



- FLASHWAVE 5310
  - 2x10GE client module



- FLASHWAVE 5320
  - 2x10GE client module

MSO, Tier 2, Tier 3 and 4  
E-Line and E-LAN

Available 1H 2014

# Small Carrier Metro Ethernet Solution



## ■ End-to-End Network Management




A-Z Provisioning	<b>NETSMART 1200 MetroE NMS</b>
Performance Management	
Fault Management	

## ■ Packet - E-LINE, E-LAN, CES (G.8032, Y.1731, 1588v2)



Low Cost GE NID Gap



**5320 Eth Agg**  
24xGE+2/4x10GE

7U Shelf

**7120 7RU Shelf**

2 Access Modules

**5310 EAD**  
2mod+4GE

4 x GE PIU  
8 x T-1 PIU  
1 x OC-3 PIU

24xGE+2x10GE Pizza Box



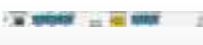
12 x GE, 2 x 10GE – G.709  
24 x GE, 4 x 10GE – G.709

7120 12/2 L2  
7120 24/4 L2

8 x 10GE – G.709

**7120 8x10 L2**

## ■ Optical – WDM, FOADM, ROADM

		
Passive WDM	FOADM	ROADM
7120 1U	7120 2U	7120 2D ROADM

New Product

Existing FLASHWAVE 7120 Product

# Metro Ethernet Products - 2014

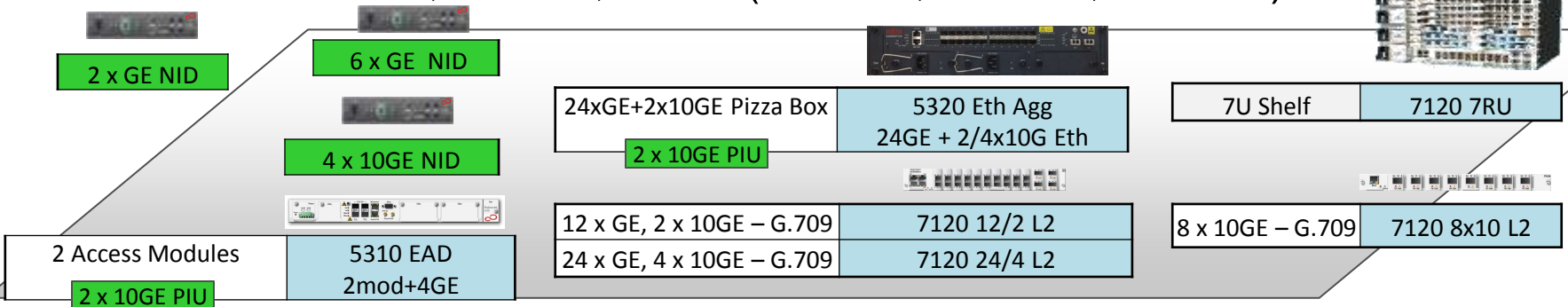


## ■ End-to-End Network Management

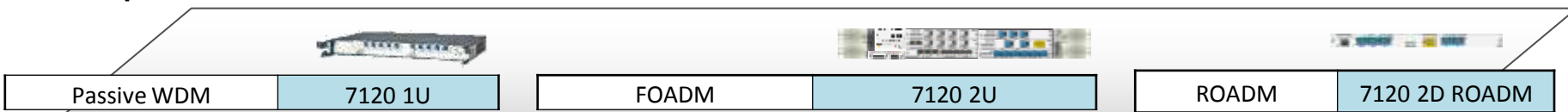


A-Z Provisioning	NETSMART 1200 MetroE NMS
Performance Management	
Fault Management	

## ■ Packet - E-LINE, E-LAN, CES (G.8032, Y.1731, 1588v2)



## ■ Optical – WDM, FOADM, ROADM



**New Product**

**Existing FLASHWAVE Products**

# FLASHWAVE 5310

State of Utah

Bid JP14001



## Multiservice Ethernet Aggregation Device

-48VDC/+24VDC/AC  
Redundant PS  
Dual A/B Feeds  
Power <50W

4x FE/GigE SyncE SFP Ports;  
10/100 Mbps OoB Management;  
Serial Console Port; Alarm Port;  
Time of Day and 1PPS Outputs;  
BITS In/Out SMB Connectors

Field Replaceable Fan Unit  
3 Fans for High Reliability  
Temperature Controlled  
Monitored for Failures



Optional 1588v2 RTU License

2 Module slots provides PAYGO  
for Ethernet and TDM Services

- 1 RU; 255mm Depth
- -40 to 65C Temperature
- Support for WDM SFPs
- Dedicated traffic FPGA for Y.1731 SLA measurements
- Embedded NID functionality
- Station loopbacks
- Throughput testing
- 3.3ms CCM for G.8032v2 sub 50ms protection
- Primary/Secondary Clock
- Stratum 3 Clock

4x FE/GigE SyncE SFP Ports

8x T1/E1 CESoEth SAToP MEF 8

1x OC-3/STM-1 Channelized  
Circuit Emulation SAToP MEF 8  
Active standby protection mode



# FLASHWAVE 5310

State of Utah

Bid JP14001



## Multiservice Ethernet Aggregation Device Benefits

- 4 GE with 2 access modules
  - 4 port FE/GE
  - 8 ports T1/E1
  - 1 port OC-3/STM-1
- Dedicated hardware for Y.1731 -> High precision SLA measurement and advanced loopbacks; Eliminate the standalone NID
- Hardware based G.8032v2 -> Enabling a highly available network infrastructure and service protection
- SyncE, 1588v2, BITS and Stratum 3 -> Highly reliable Frequency, Phase and Time synchronization
- 1RU and Low Power -> Addressing space and power constraints at the tower; Green cell site deployments
- MEF Carrier Ethernet 2.0 support -> standards-based for EPL, ELAN and multi-vendor interop



Part Number	Description
FC9696EM21	FW 5310 Base System
FC9696EFN1	FW 5310 Fan Unit
FC9696EP11	FW 5310 -48/+24 VDC Power Supply
FC9696EP21	FW 5310 120/240 VAC Power Supply
FC9696E4G1	FW 5310 4xGE Service module
FC9696E8T1	FW 5310 8xE1/T1 Service module
FC9696EC31	FW 5310 Channleized OC3 Service module

# FLASHWAVE 5320

## Ethernet Aggregation Device

State of Utah

Bid JP14001



### Service Delivery for Ethernet Business Services

- 24x 100/1000 Mbps SFP and 2x 10GE XFP Network interfaces
- \*2x 10GE XFP Module (Plan of Intent for 2014)
- 802.1ag CFM & Y.1731 SLA measurements (Embedded NID)
- Station loopbacks and Throughput testing via traffic FPGA

### Carrier Grade Ethernet

- 3.3ms CCM for sub 50ms protection
- G.8032v2 Laddered Rings and Multiple Instances
- Active / Standby LAG and Ethernet Fault Propagation Shutdown
- -48VDC/+24VDC/AC Power Options
- All front access; -20 to 65C; Hot Swappable Fans, Filters and Power Supplies

### End to End Management

- SNMP for alarms/traps and provisioning via secure out-of-band or in-band
- Service management with NS1200 Service Management and SLA Portal
- A-Z E-service provisioning and SLA/PM stats collection

# FLASHWAVE 5320

State of Utah

Bid JP14001



## Ethernet Aggregation Device Benefits

- Flexible Deployment Options -> 24x GigE + 2x 10GigE Ethernet Ports; Optional 2x 10GigE Module; AC & DC Power
- Robust hardware design-> All front access; -20 to 65C; Hot Swappable Fans, Filters and Power Supplies
- Dedicated hardware for Y.1731 -> High precision SLA measurement and advanced loopbacks; Eliminate the standalone NID
- Hardware based G.8032v2 -> Enabling a highly available network infrastructure and service protection
- Ethernet OAM for Service Management -> Y.1731 FM, 802.1ag; EFPD; LLDP
- MEF Carrier Ethernet 2.0 support -> standards-based for EPL, ELAN and multi-vendor interoperation
- Hardware ready for IPv6, PBB or MPLS-TP and future 10GigE module -> investment protection and future-proof



Part Number	Description
FC9696JM21	FW 5320 Base System
FC9696JP12	FW 5320 DC Power Unit Dual Feed
FC9696JP11	FW 5320 AC Power Unit
FC9696JFN1	FW 5320 Fan Module
FC9696JFF1	FW 5320 Air Filter
FC9696J2A1	FW 5320 2x 10 GigE XFP Module

# FLASHWAVE 7120 7U Shelf



## MSI (Main Shelf Interface)

Communication and alarm indicators  
 Management LAN port (RJ45)  
 Office alarm connector (26-pin D-Sub)  
 Alarm and shelf status LEDs plus ACO/lamp test



## CCM (Common Communication Module)

Module communications and monitoring (7200 platform)  
 Two auxiliary Ethernet ports (RJ45) – for future use  
 Expansion shelf communications (SFP) port



## System Control Processor (SCP)

Shelf management and configuration module  
 External communication via three RJ-45 connectors: two IP addressable Ethernet ports and one RS-232 serial port  
 Two SFP-based OSC communication ports  
 Three SFP-based ports for expansion shelf communications



## Cooling Unit (CU)

Two independent, multispeed fans  
 Supports outside plant operations



**20 service slots | 7RU**



FLASHWAVE 7120  
7U Shelf

	1	2
	3	4
	5	6
	7	8
	9	10
	11	12
	13	14
	15	16
	17	18
	19	20

## ■ All FLASHWAVE 7120 Modules

- Amplifiers, CWDM Mux Options and DWDM Mux Options
- Transponders and Muxponders
- 12/2, 24/4 & 8x10 Layer 2 Cards

# FLASHWAVE 7120

## Layer 2 Ethernet Switch

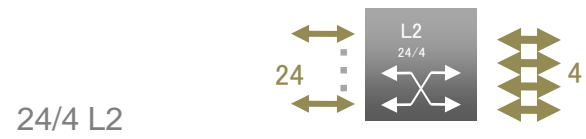
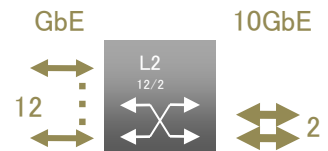
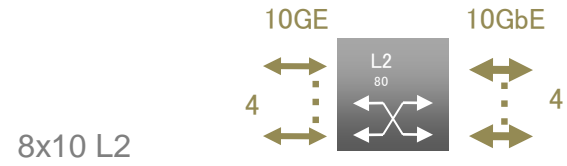


- Ideal solution for metro Ethernet aggregation and service delivery
- Supporting EPL, EVPL, EVLAN, EVPLAN services
- G.8032 and MSTP protection options for fully protected or unprotected services on a per EVC basis
- Optional CWDM / DWDM capabilities of the FLASHWAVE 7120 provide scalability for future network growth

### Key Applications

- Enterprise Ethernet services
- Mobile backhaul for 4G LTE
- State, local, municipal, campus data networks
- Access / Edge Ethernet aggregation to metro core networks

L2 Modules	Part #	Description
12/2 L2	FC9686PSAA	(12) GE ports & (2) 10 GE ports
24/4 L2	FC9686PSCA	(24) GE ports & (4) 10 GE ports
8x10 L2	FC9686PS8A	(8) 10 GE ports



## Layer 2 Ethernet Switch Features

### ■ Features

- Ethernet Aggregation & Switching
- VLANs and Provider Bridging – 802.1Q & 802.1ad
- ITU-T G.8032
- Link Aggregation – 802.3ad
- Multiple Spanning Tree – 802.1s
- OTU2 with FEC and EFEC
- Access Control Lists
- Traffic classification – 802.1p
- Optical and Ethernet PMs
- CLI/SSH, SNMP, TL1 cut-thru and GCC
- Ethernet Business Services
- Bandwidth Management (CIR/EIR/CBS/EBS)
- Ethernet First Mile - 802.3ah
- Connectivity Fault Management - 802.1ag
- Performance Management – Y.1731
- Local Management Interface - MEF 16 E-LMI
- Supports a maximum of 32,000 MAC addresses

### ■ MEF Carrier Ethernet Attributes

- Standardized services
  - EPL, EVPL services
  - ELAN, EVLAN multi-point to multi-point services
  - MEF9 / 14 certified
- Reliability / protection
  - Ring based protection today with MSTP or G.8032
  - Leverages OTN overhead for hard & soft failure detection & reporting
  - Sub-50 ms
- Quality of service (QoS)
  - End-to-end SLAs supported with Y.1731
  - Frame loss, delay, delay variation
- Service management
  - Carrier class OAM&P with Y.1731
  - Provisioning with a simple 3 step provisioning GUI

*Simplified Packet Services Delivery*

# FLASHWAVE 7120

State of Utah

Bid JP14001



## Layer 2 Ethernet Switch Feature Comparison

**NEW**



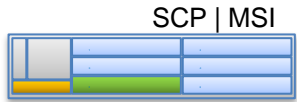
	PVX 12/2	PVX 24/4	PVX 80
Dimensions	1H x 2W	2H x 2W	1H x 2W
10GE/OTU2 (XFP)	2	4	8
GE (SFP)	10	20	---
10/100/1000BT (RJ45)	2	4	---
Backplane Capacity	---	---	80G
Switching Capacity	32G	64G	160G
Chassis Support	2U, 7U Shelf	2U, 7U Shelf	2U, 7U Shelf
Provider Bridging (PB)	Yes	Yes	Yes
MSTP	Yes	Yes	Yes
G.8032 v2	Yes	Yes	Yes
Y.1731 CFM	Yes	Yes	Yes
Y.1731 PM	Yes	Yes	Yes
Stacking	Yes (via XFPs only)	Yes (via XFPs only)	Yes (via backplane only)
Management VLAN	Yes	Yes	Yes
GCC/OTU2	Yes	Yes	Yes (future)

# FLASHWAVE 7120

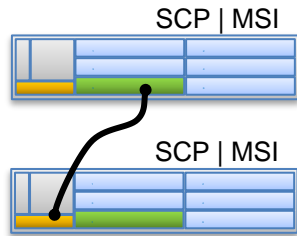
## Shelf Expansion Options



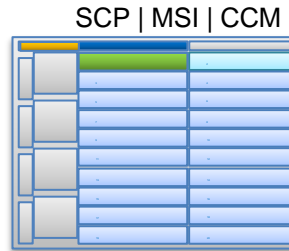
2U Shelf



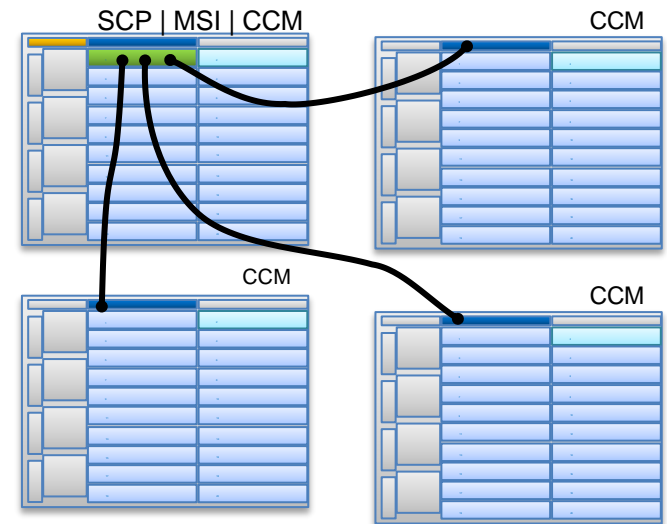
Dual 2U Shelf



7U Shelf



Quad 7U shelf



### Compact

Up to:

- Single 24/4
- Pair 12/2 Stacked

### Small

Up to:

- Pair 24/4 Stacked
- 2 Pair 12/2 Stacked

### Medium

Up to:

- 2 Pair 24/4 Stacked
- 4 Pair 12/2 Stacked
- 4 pair 8x10 Stacked

### Large

Up to:

- 8 Pair 24/4 Stacked
- 16 Pair 12/2 Stacked
- 16 pair 8x10 Stacked

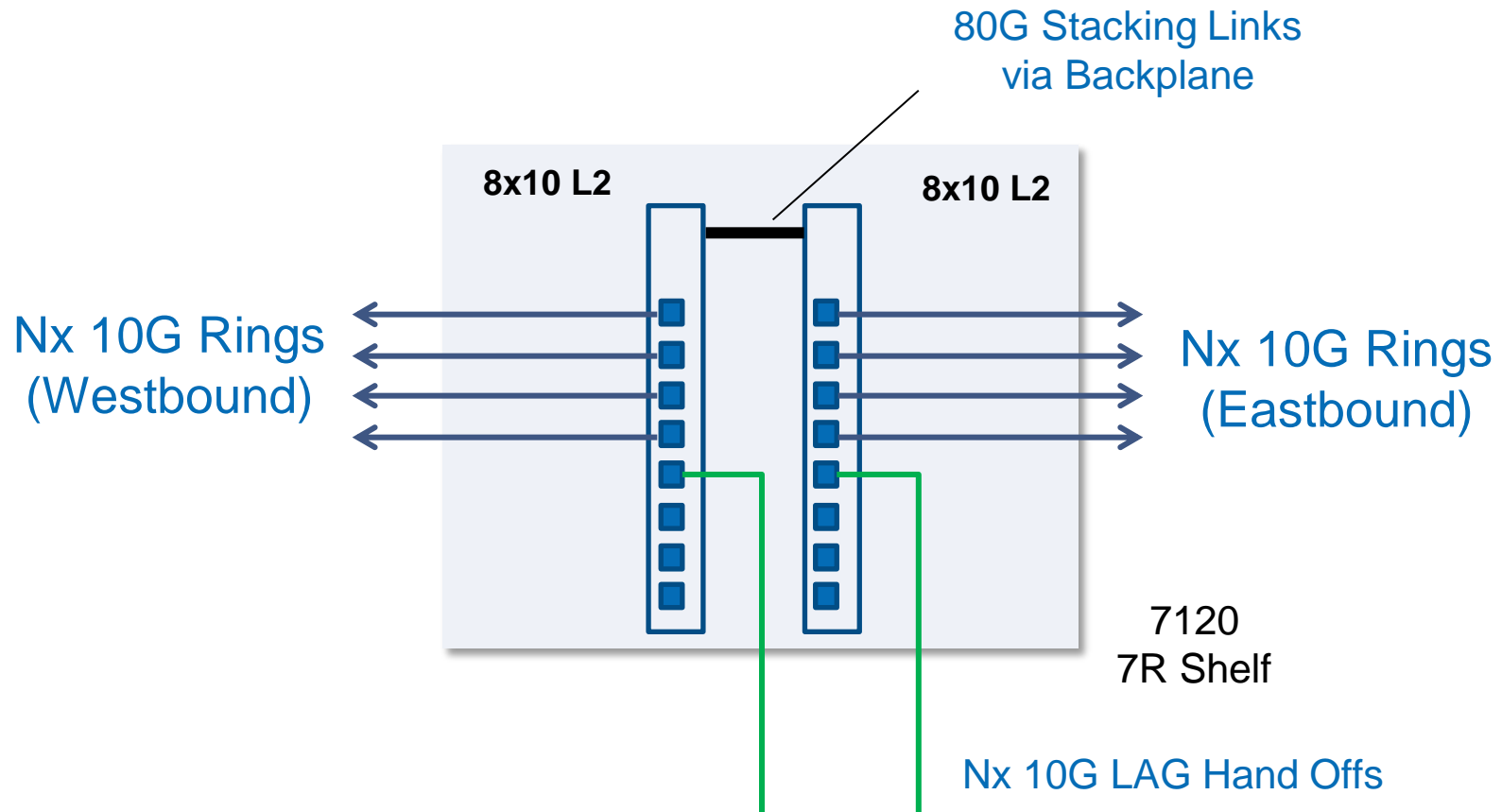
# FLASHWAVE 7120

State of Utah

Bid JP14001



## PVX 80 Layer 2 – Basic Configuration



# FLASHWAVE 7120

## PVX 80 Layer 2 - Stacking



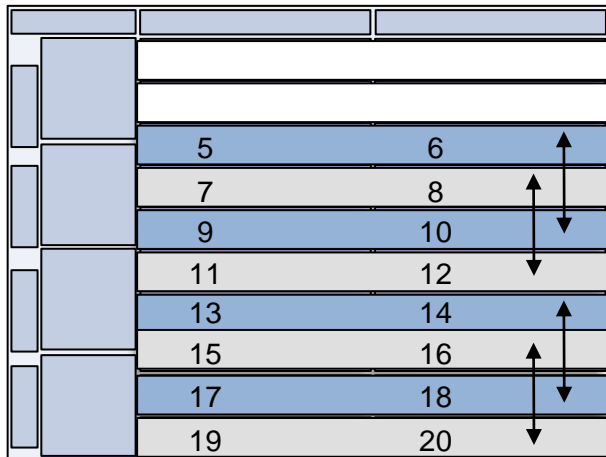
8x10 L2 as primary switch

8x10 L2 as secondary switch



16x 10GE/OTN ports from a pair of stacked Layer 2 8x10s.

7U Shelf



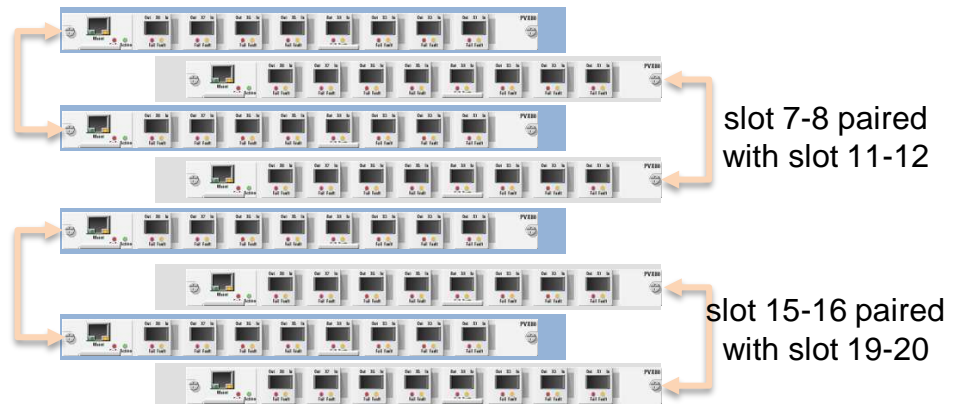
Up to 4 pairs of stacked 8x10 L2 Modules per 7RU chassis.

slot 5-6 paired with slot 9-10

slot 13-14 paired with slot 17-18

slot 7-8 paired with slot 11-12

slot 15-16 paired with slot 19-20



# Metro E Management Products



## ■ MetroE Design

- Network design tool; Java-based.

## ■ NETSMART 712

- Craft Tool; manages a single node; can open multiple sessions; Supports FLASHWAVE 7120 family but not the MetroE NID, EAD and aggregation products..

## ■ NETSMART 1200 MetroE NMS

- Element Management System; designed to simplify provisioning, management, and performance monitoring of end-to-end packet-optical services; Supports FLASHWAVE 7120 family and the FLASHWAVE 53xx MetroE NID, EAD and aggregation products.
- **Provisioning** → accelerate, simplify, and standardize service configuration
- **Discovery & Visualization** → simplify service understanding
- **Monitoring and Troubleshooting** → enhanced knowledge = rapid response

## ■ MetroE SLA Portal

- SLA Performance Monitoring via Y.1731; uses Collection Server separate from MetroE EMS.

# NETSMART 1200 Metro E NMS

## Key Functions that Simplify Service Delivery



### ■ Standardized service definition

- Service templates streamline service definition
- Provides a standardized and consistent approach that eliminates the potential for human error while reducing the time required to provision services



Service Template definition

### ■ Automated activation

- Automated assistance simplifies endpoint and intermediate connection point selection
- Graphically displays available nodes and available ports, with mouse clicks replacing onsite configuration of network elements and alleviating the complexities of CLIs



Service Activation

### ■ Rapid information retrieval

- Comprehensive information-bundling capabilities enable network operators to understand the services they deliver, how their customers utilize them, the status and performance of these services, and the resources used to deliver them
- Enable operators to quickly determine which customers are affected and how to respond

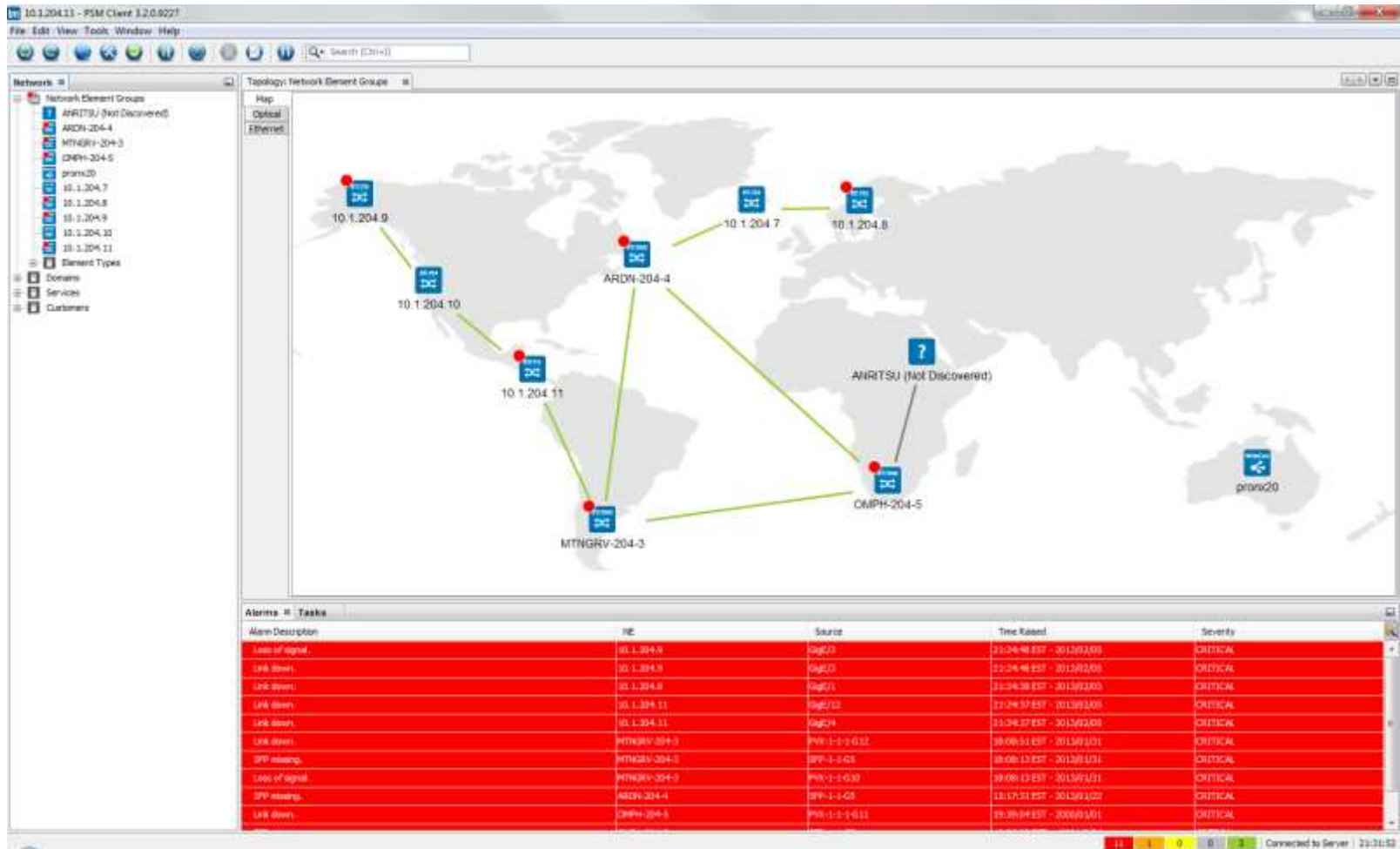
Service	Status	Type	Created	IP Address	Owner Name	IP Type	IP Address	Management	Report Status	Service Name
...	...	...	...	...	...	...	...	...	...	...

Service Reports

# NS 1200 MetroE NMS Topology via LLDP Link Layer Discovery Protocol



Layer 2 uses the information learned from LLDP to enable Ethernet Topology from NS1200 MetroE NMS.

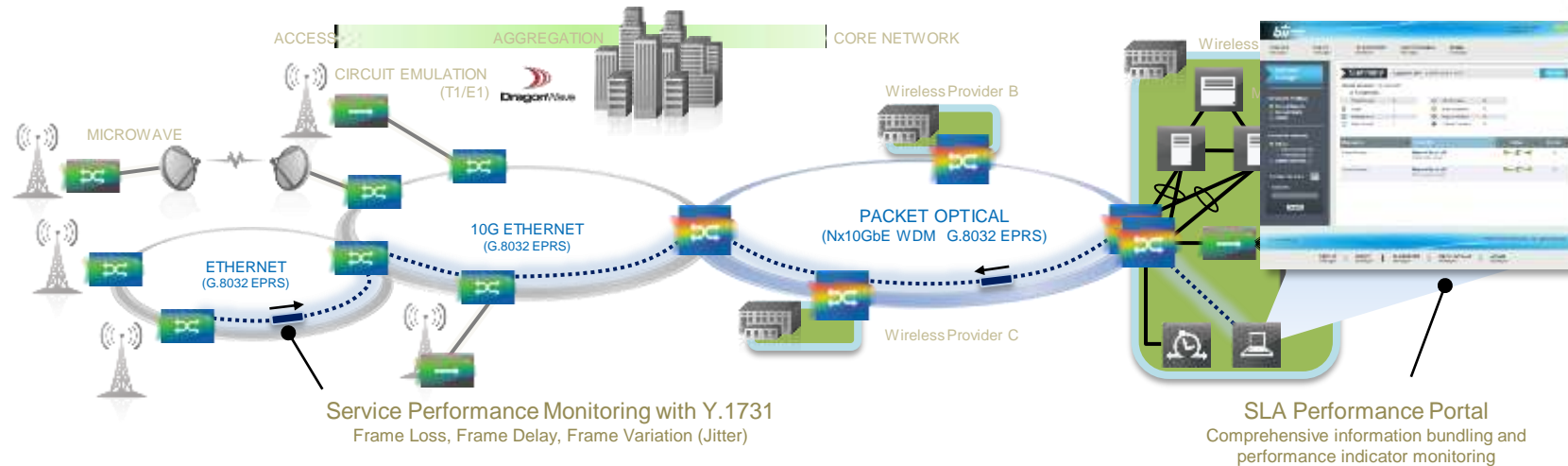


# MetroE SLA Performance Portal

## Performance Monitoring

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Bid JP14001



## Performance Monitoring

- Providing accurate information for true, end-to-end, holistic visibility on the wellbeing of a packet service
- Y.1731 OAM-based for end-to-end Ethernet services
- Advanced awareness through monitoring of key performance indicators, SLA metrics or user-defined benchmarks
- Graphical interface for operations-staff and customer visibility to real-time performance indicators and history

### ■ Key Service Performance Statistics

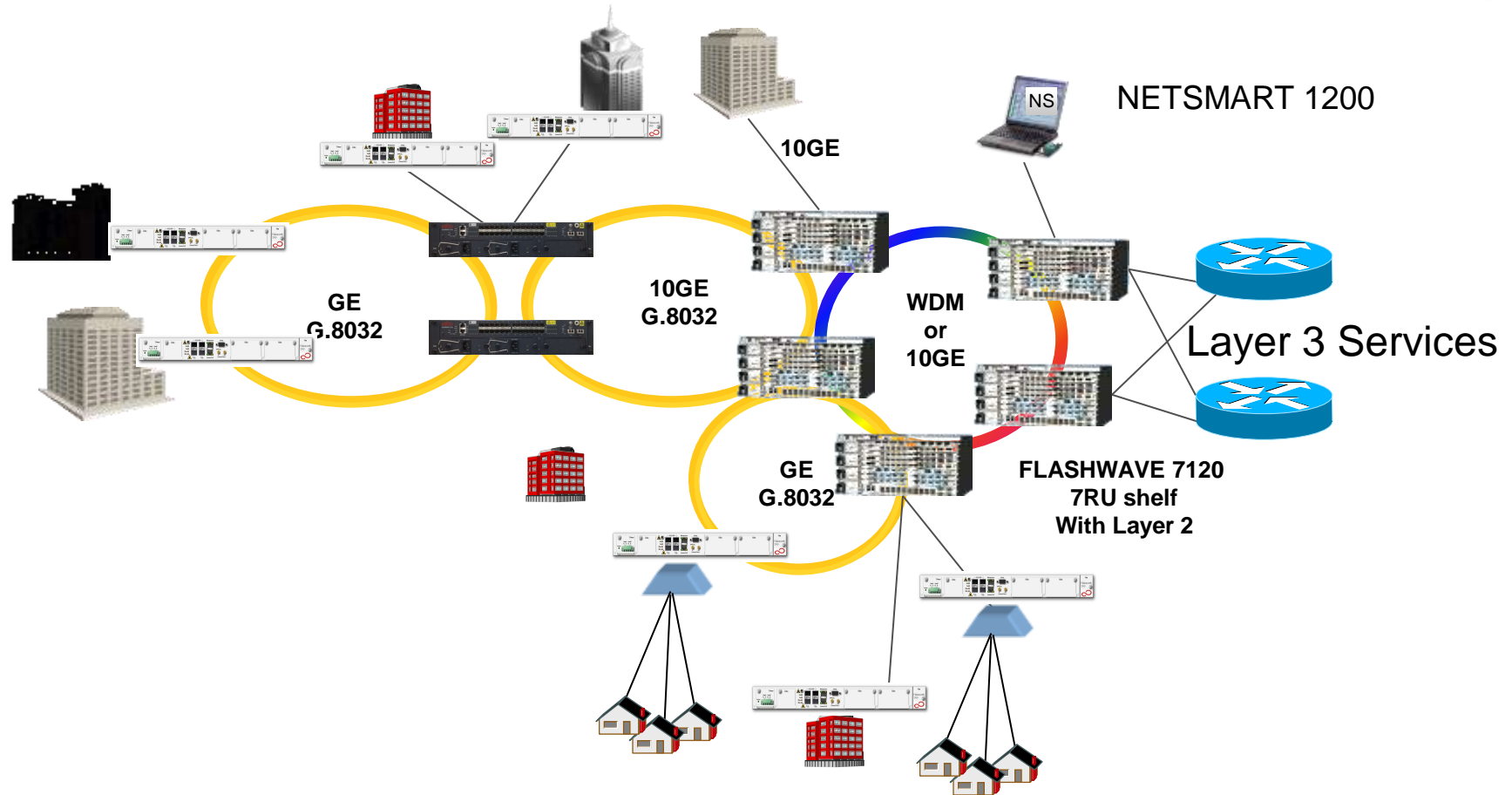
- Availability, Uptime, Downtime,
- Utilization (Primary/Protect, Average, Egress, Ingress)
- Latency, Packets (Dropped, Forwarded), Frame Errors

### ■ MetroE SLA Portal Values

- Real-time & historical SLA performance and conformance
- Performance statistics displayed based on user-defined profiles
- End-to-end capabilities using standard OAM strategies

Comprehensive monitoring of circuit service levels metrics

# Key Application #1 – Ethernet Business Services

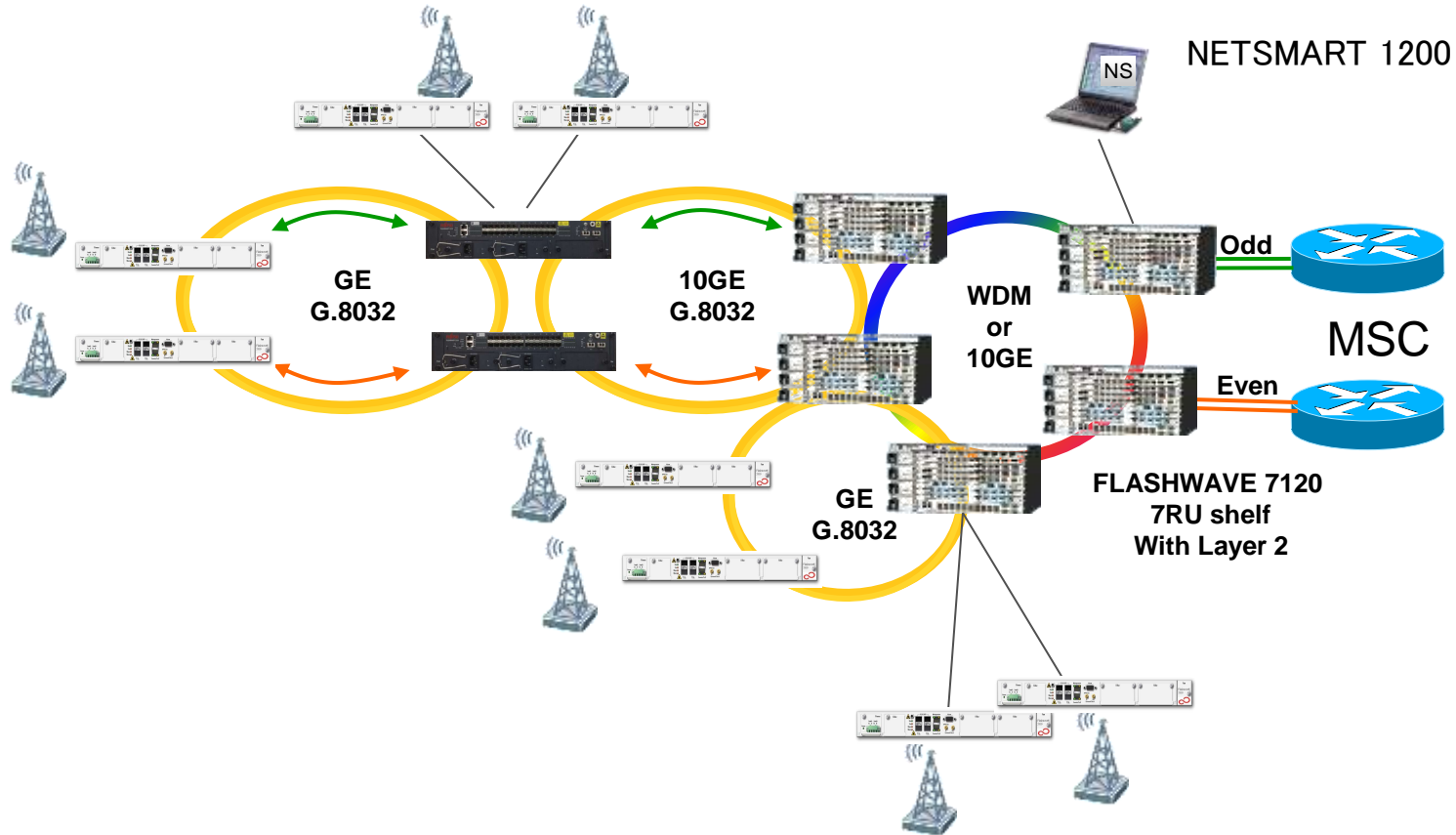


MSOs, some Tier 2, Tier 3 and 4  
E-Line and E-LAN Services

# Key Application #2 – Mobile Backhaul

State of Utah

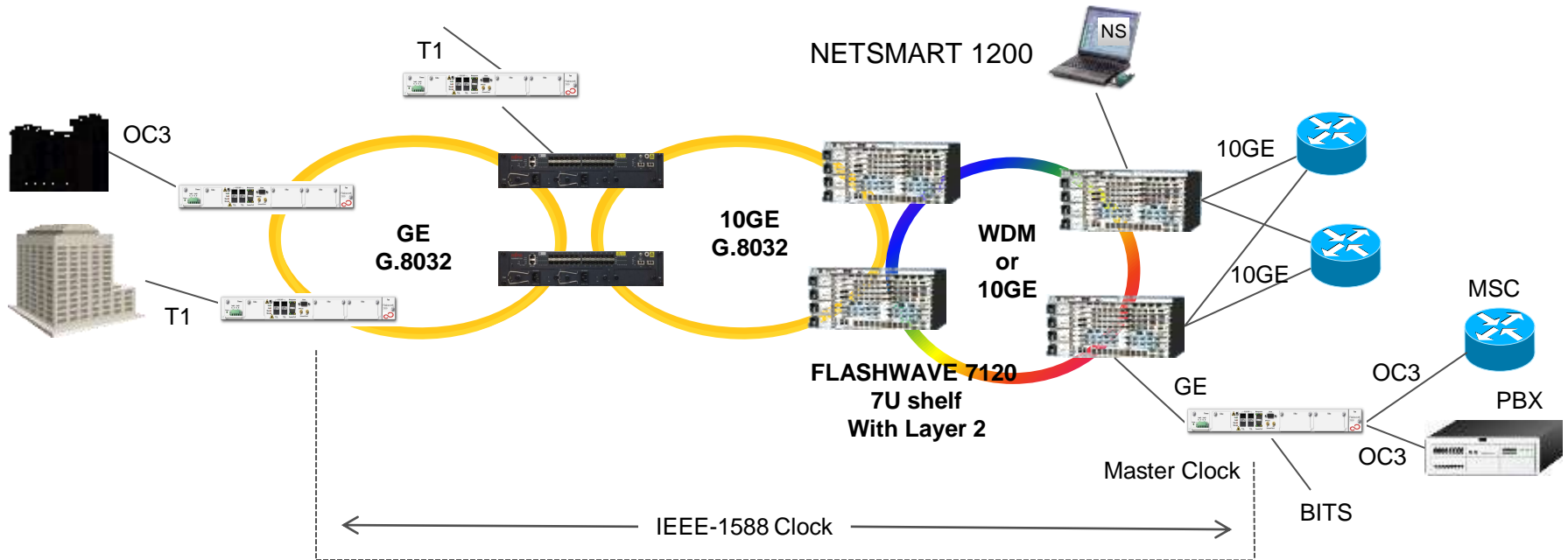
Bid JP14001



MSOs, some Tier 2, Tier 3 and 4  
E-Line and E-LAN

Dual EVC MBH architecture or ELAN architecture

# Key Application #3 – T1 and OC3 Circuit Emulated Services

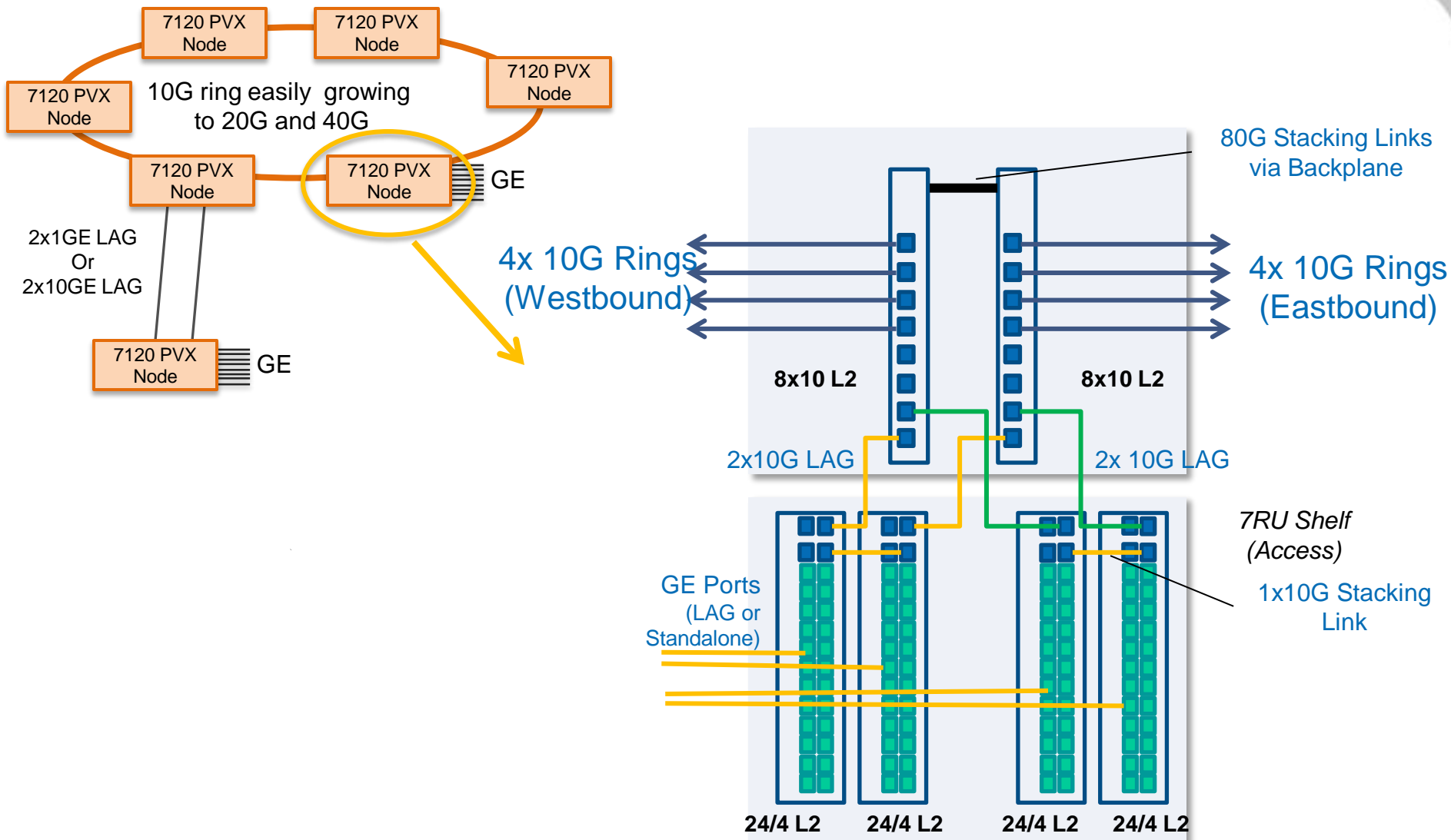


MSOs, some Tier 2, Tier 3 and 4  
E-Line and E-LAN Services

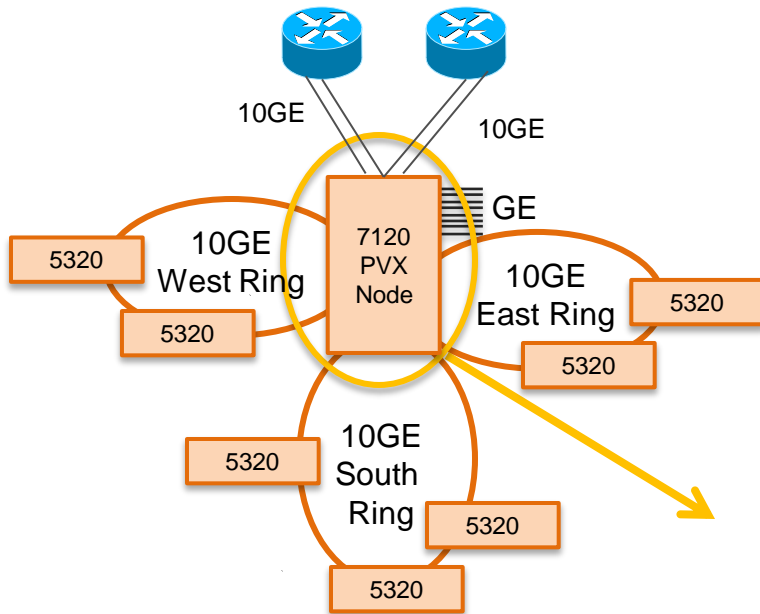
# Key Configuration #1 – High Capacity Core Nodes

State of Utah

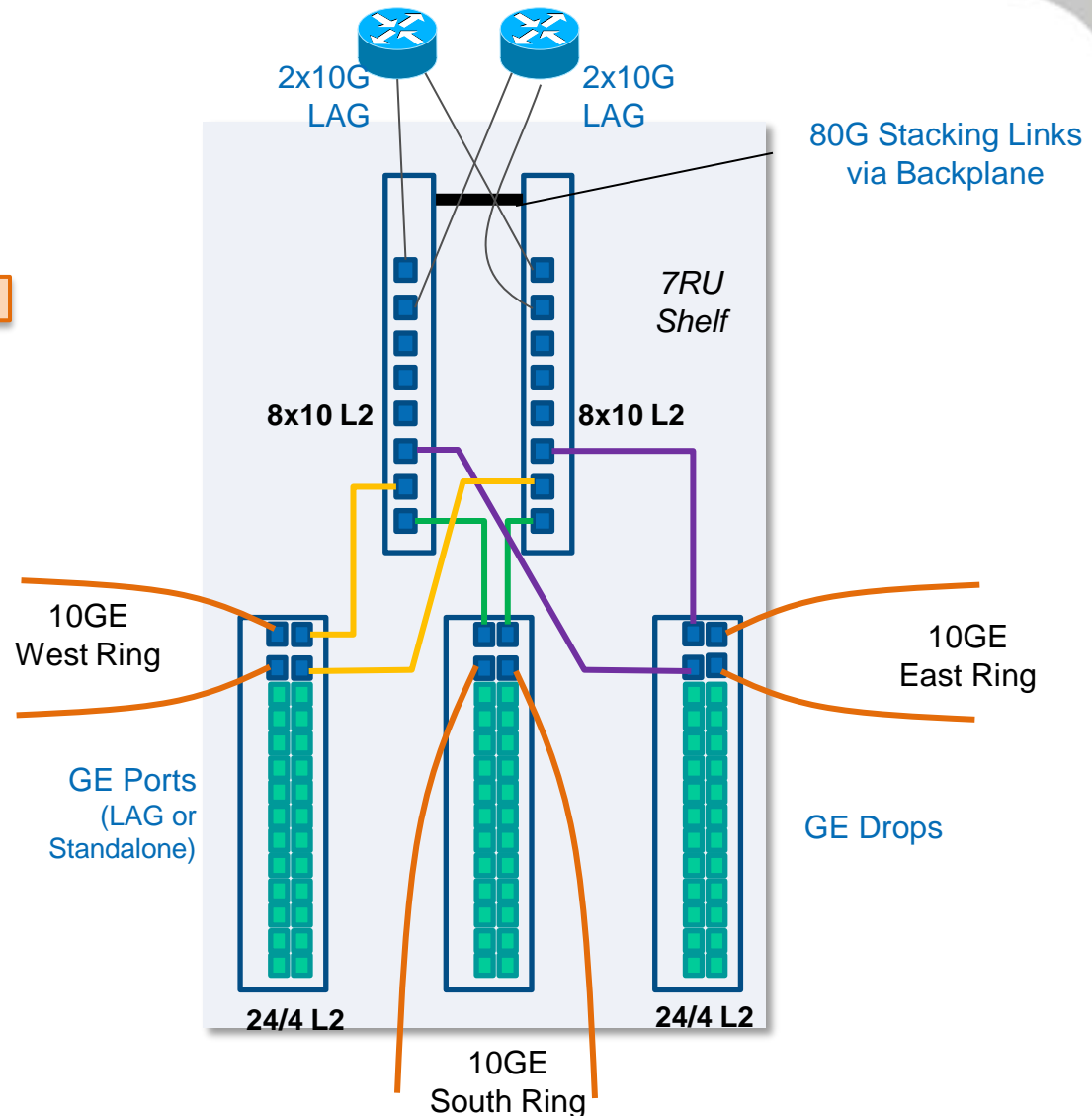
Bid JP14001



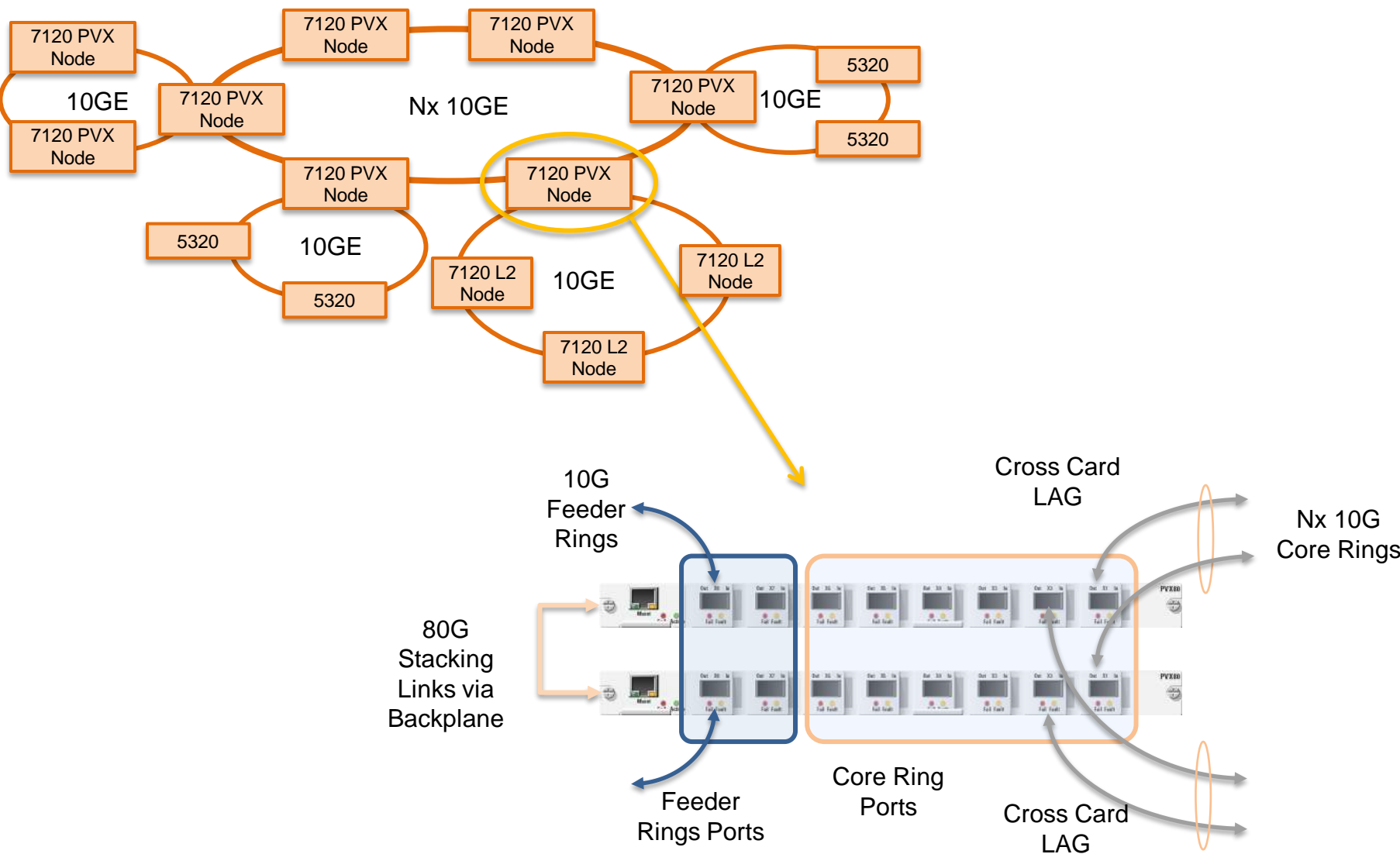
# Key Configuration #2 – 10GE Ring Aggregation



10G access ring easily growing to 20G and 30G access rings

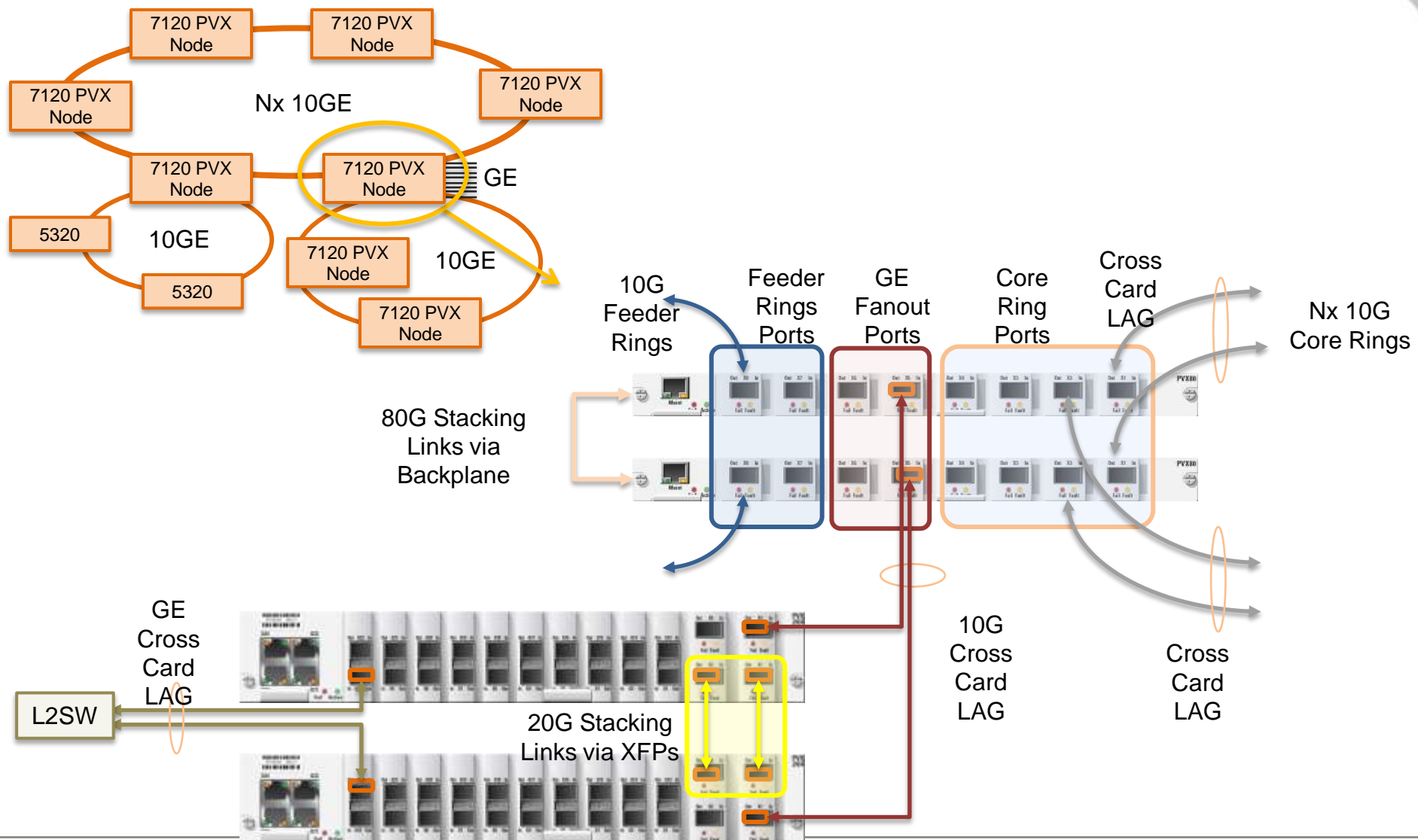


# Key Configuration #3 – Nx10G Core Rings with multiple 10G feeder rings

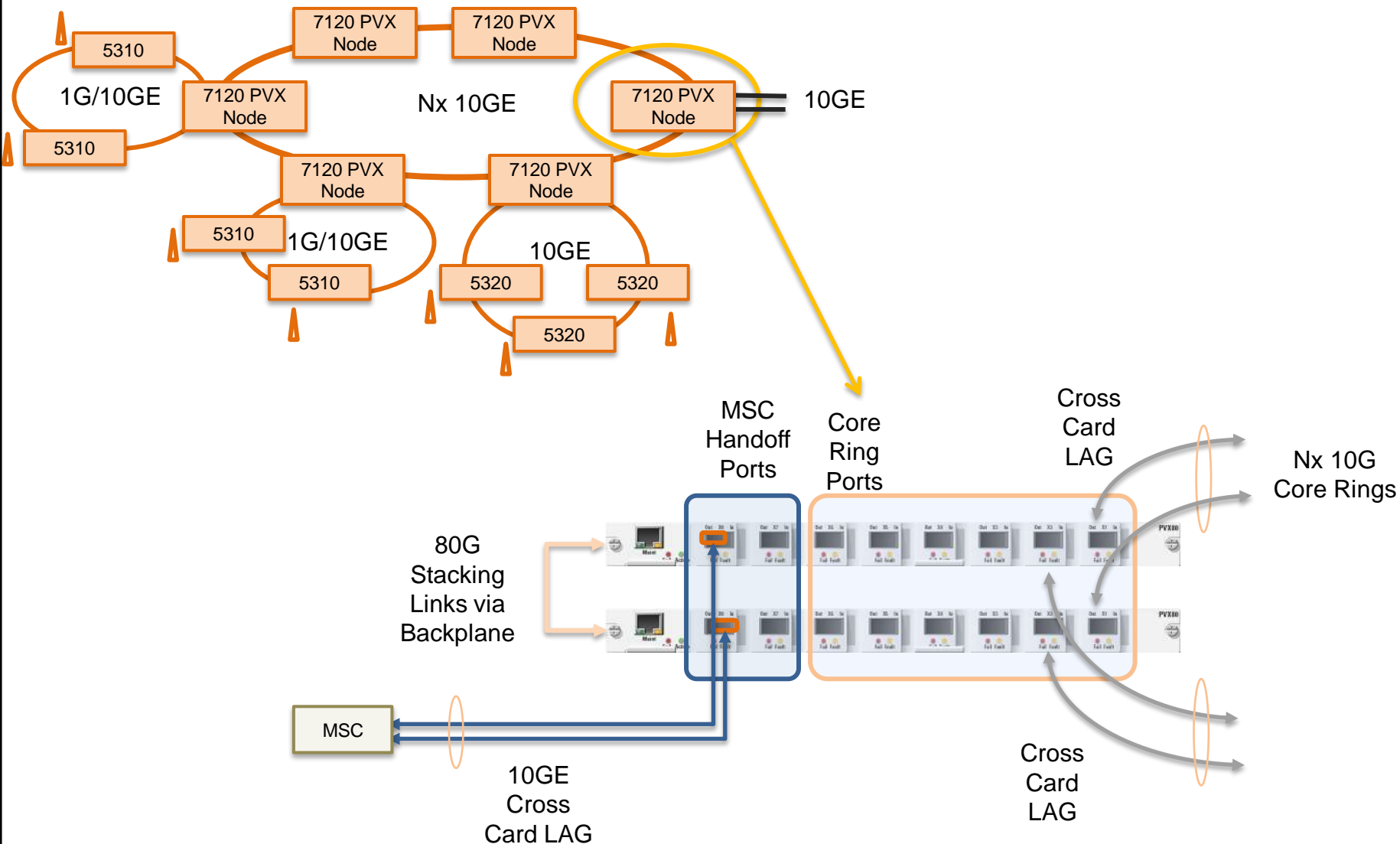


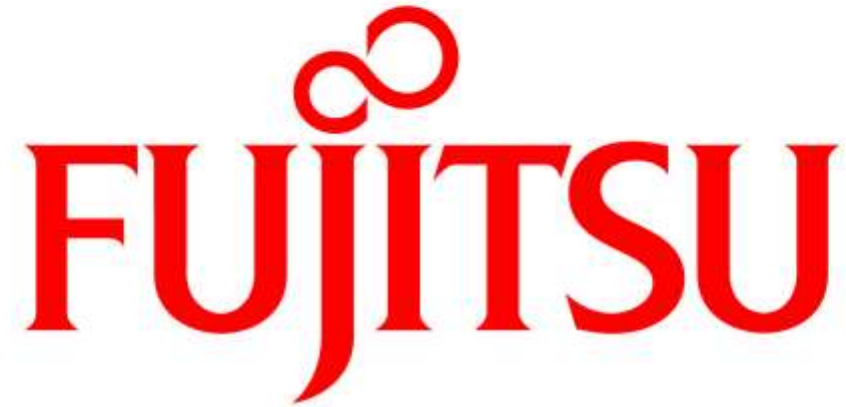


# Key Configuration #4 - Nx10G Core Rings with 10G feeder rings and local GE drops



# Key Configuration #5 – MBH MTSO Sites 10G Hand-Off





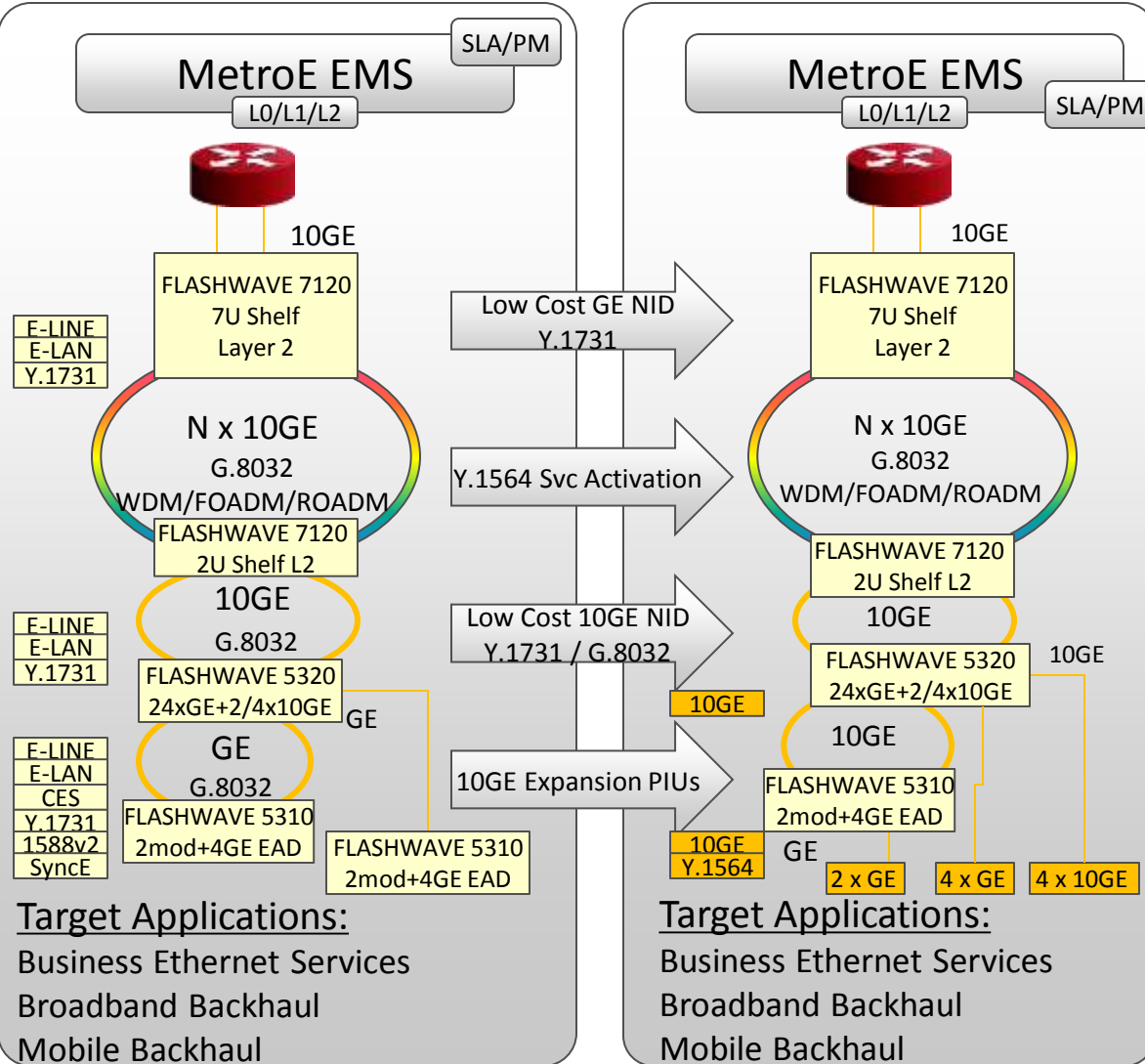
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# Metro Ethernet Solutions Overview

2013

2014



- **FLASHWAVE 7120** is optimized for networks needing to deliver WDM, Packet Solutions, TDM, and OTN across a single platform
- Providers can deliver 1G up to a planned 4T in the platform
- 3 different Layer 2 units operate in the 7120 along side optical units (including ROADMs), transponders & muxponders
- Multi service Ethernet Access Device (EAD), allows the network to be customized to the applications and service deliver
- **FLASHWAVE5320** 24xGE+2/4x10GE EAD aggregates Ethernet traffic
- Planned Ethernet NIDs complete the solution



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# Roadmap Program Review

06/25/2013

# Core Planning Roadmap Changes - Summary



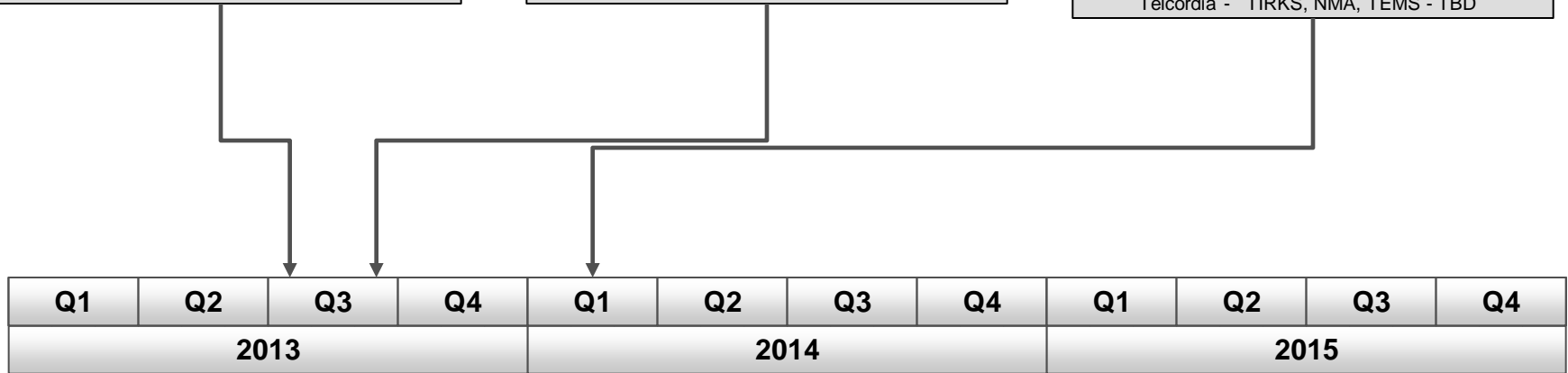
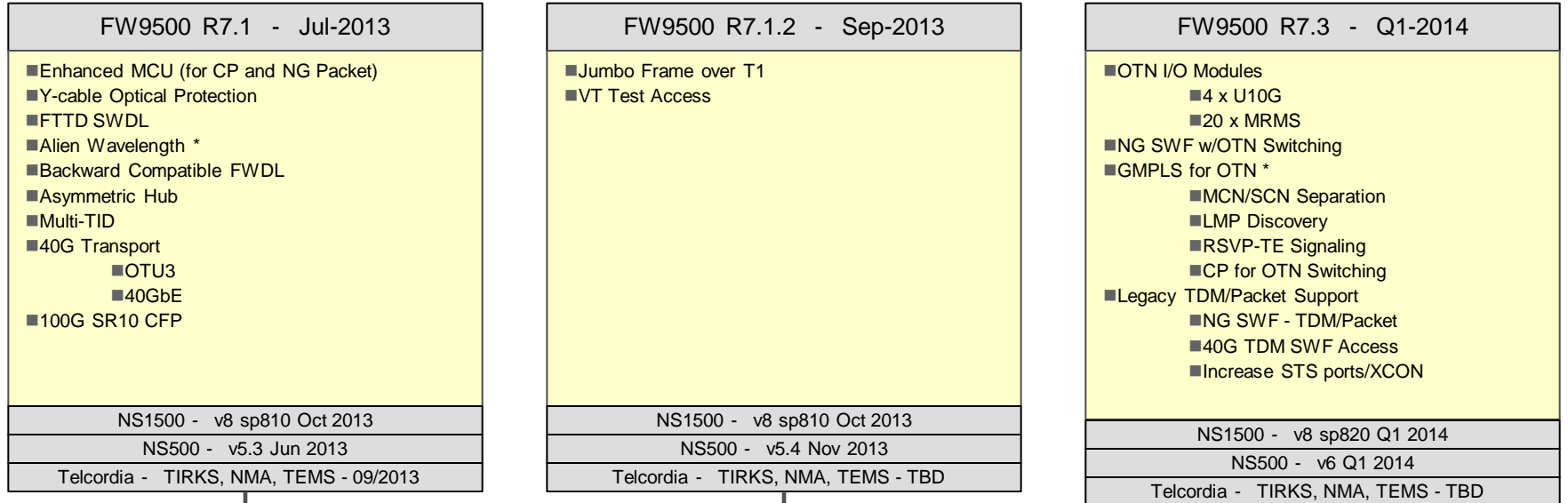
## ■ FW9500

- R7.1 - No change
- R7.1.2 - Release is now POR
  - Jumbo Frame over T1 support officially added to release
- R7.3 - No change
- R7.4 – Release is now POR but several items being discussed
  - G.8032 and Y.1731 approved in release but details are still being discussed with CTL
  - Addition of coherent CFP to 2xOTU4 card
  - In conjunction with coherent CFP, a new drop side amp may be required
- Roadmap Disclosures
  - Roadmap updated with CTL on 06/11
  - Working on plan with Sales for next set of disclosures with VZ to align remainder of 2013.
  - Telus and Bell Canada aligned with reality roadmap.

## ■ FW7420

- R11.2.3
  - AES Encryption card has been qualified by similarity and will be included in this release.

# FW9500 [1]



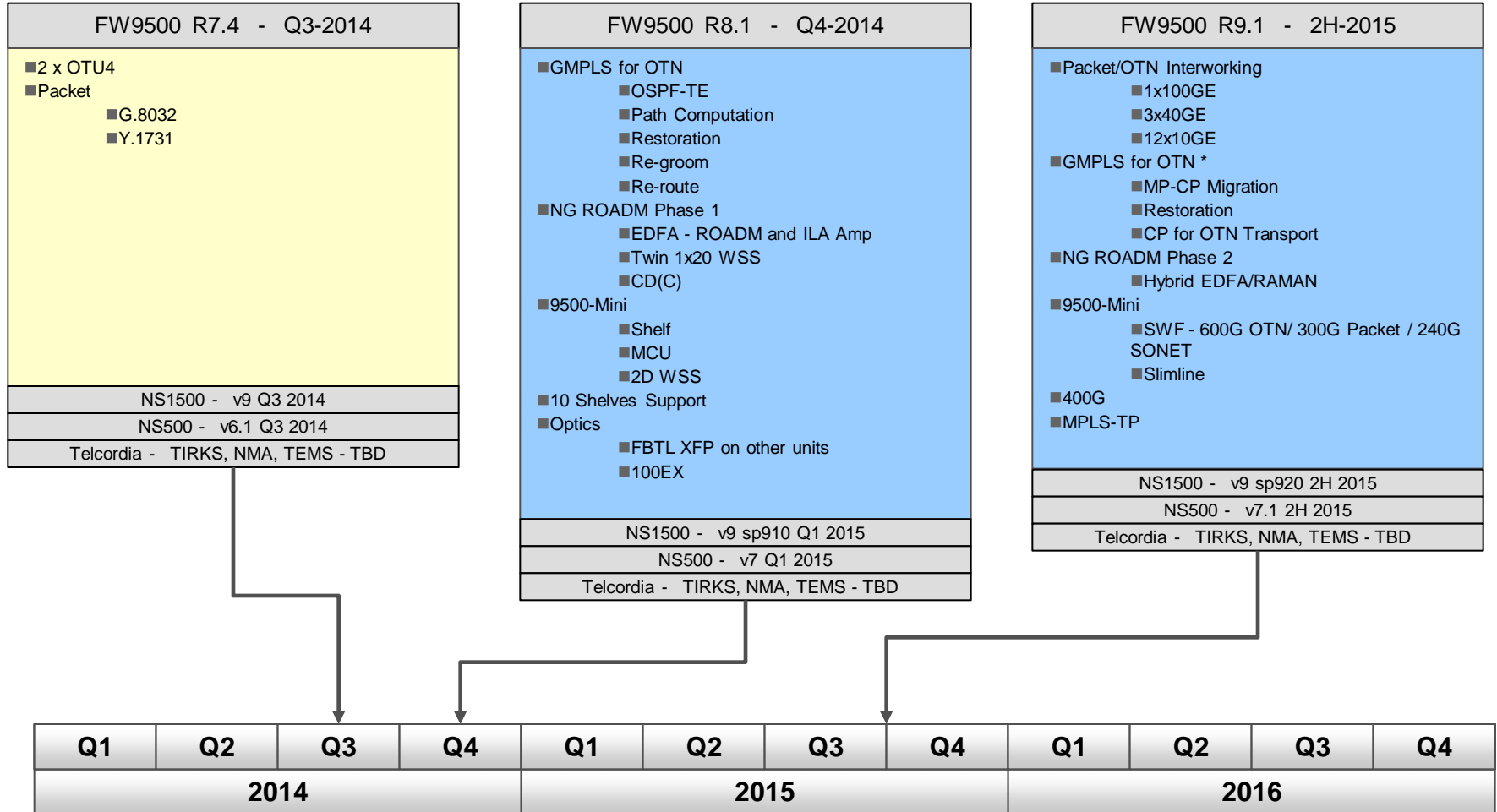
**FGA**
 **Plan of Record (POR):**  
 Planning Date  
 Engineering Estimate
  **Plan of Intent (POI):**  
 Schedule & Content  
 Under Study
  **Plan of Vision (POV):**  
 Business & Financial  
 Analysis Stage

\* - ILF Feature

Product Release Dates Shown are Target FGA Dates

Years are specified as Calendar Year

# FW9500 [2]



FGA

Plan of Record (POR):  
Planning Date  
Engineering Estimate

Plan of Intent (POI):  
Schedule & Content  
Under Study

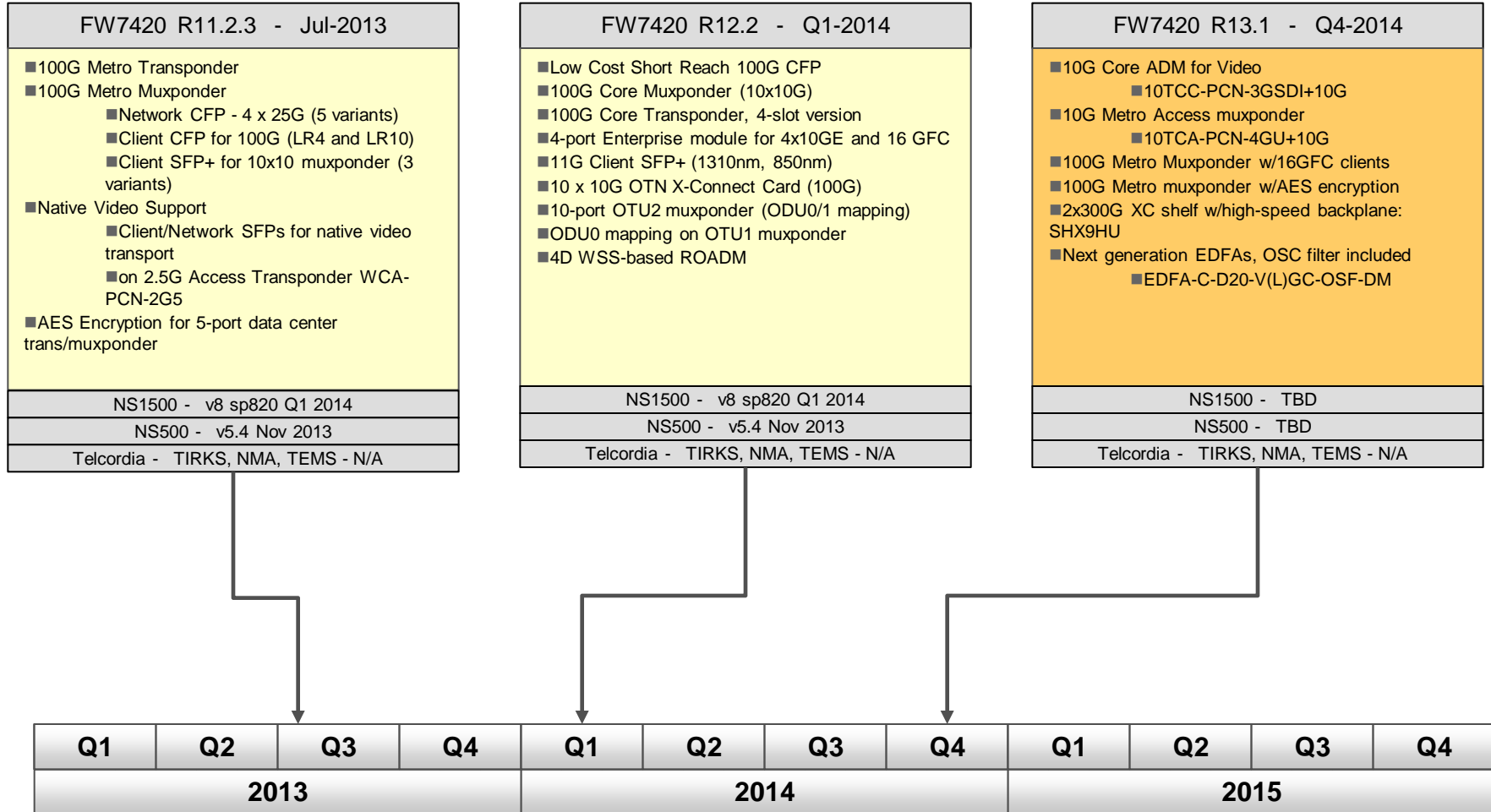
Plan of Vision (POV):  
Business & Financial  
Analysis Stage

\* - ILF Feature

Product Release Dates Shown are Target FGA Dates

Years are specified as Calendar Year

# FW7420 [1]



**FGA**
 **Plan of Record (POR):**  
 Planning Date  
 Engineering Estimate

**Plan of Intent (POI):**  
 Schedule & Content  
 Under Study

**Plan of Vision (POV):**  
 Business & Financial  
 Analysis Stage

\* - ILF Feature

Product Release Dates Shown are Target FGA Dates

Years are specified as Calendar Year



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# Access Roadmap

June 2013

# Access Planning Roadmap Changes - Summary



## ■ FLASHWAVE CDS

- R6.3 - No change
- R6.4 - FGA is now December 13
- R6.5 - No change
  - OSMINE budget unavailable in FY13
  - AT&T is now requesting OTU-2 demarcation module in same release as OTU-1
  - AT&T requesting both PIU's with OSMINE in July 2014
- R7.1 – No change
  - PR0 target week of 6/24

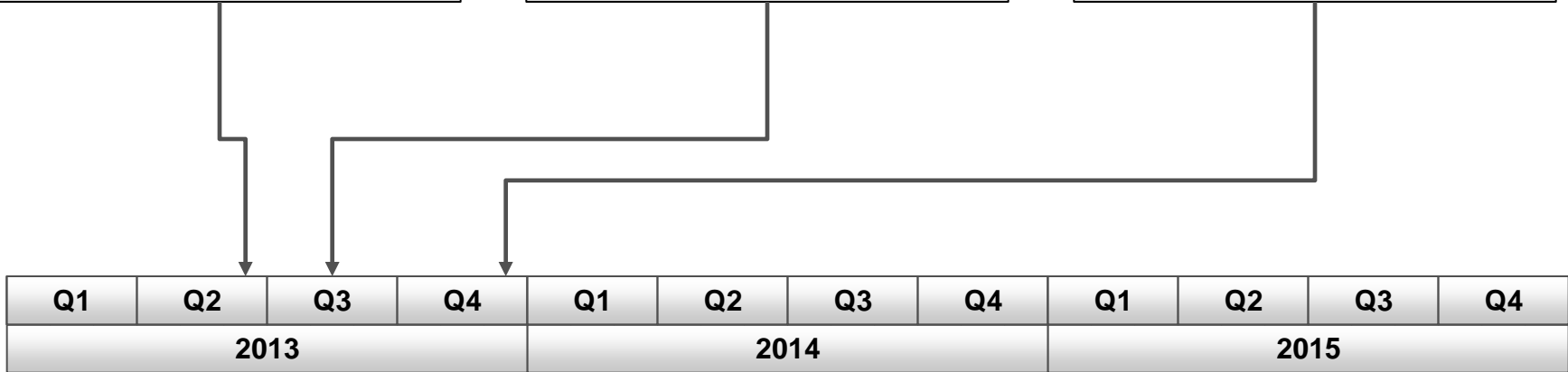
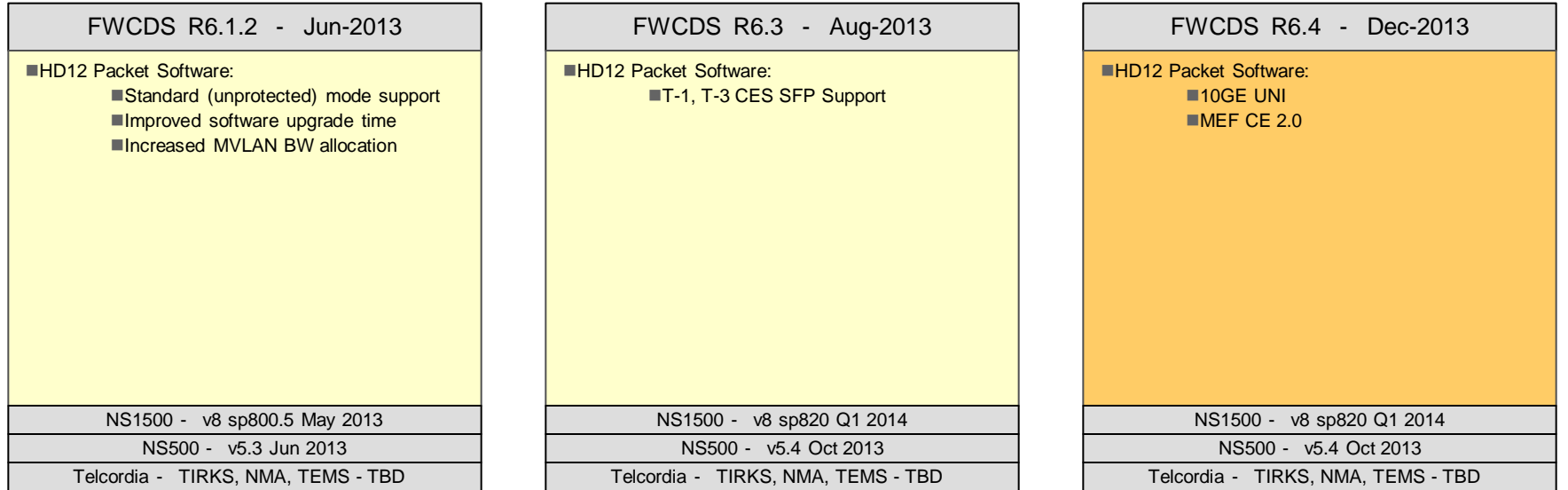
## ■ FLASHWAVE 4100ES

- New 9.x release being considered
  - ENX1 CBS increase for AT&T mobility backhaul applications
  - ENX1 slient failure fix
- R10.1
  - Removed RADIUS requirement for double density EoS SU
  - Business case complete – pending EMC review and approval

## ■ FLASHWAVE 7120

- R11.1 – No change
- Added POV R12.1
  - 4D ROADM on a blade

# FWCDS [1]



**FGA**
 **Plan of Record (POR):**  
 Planning Date  
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**Plan of Intent (POI):**  
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 Under Study

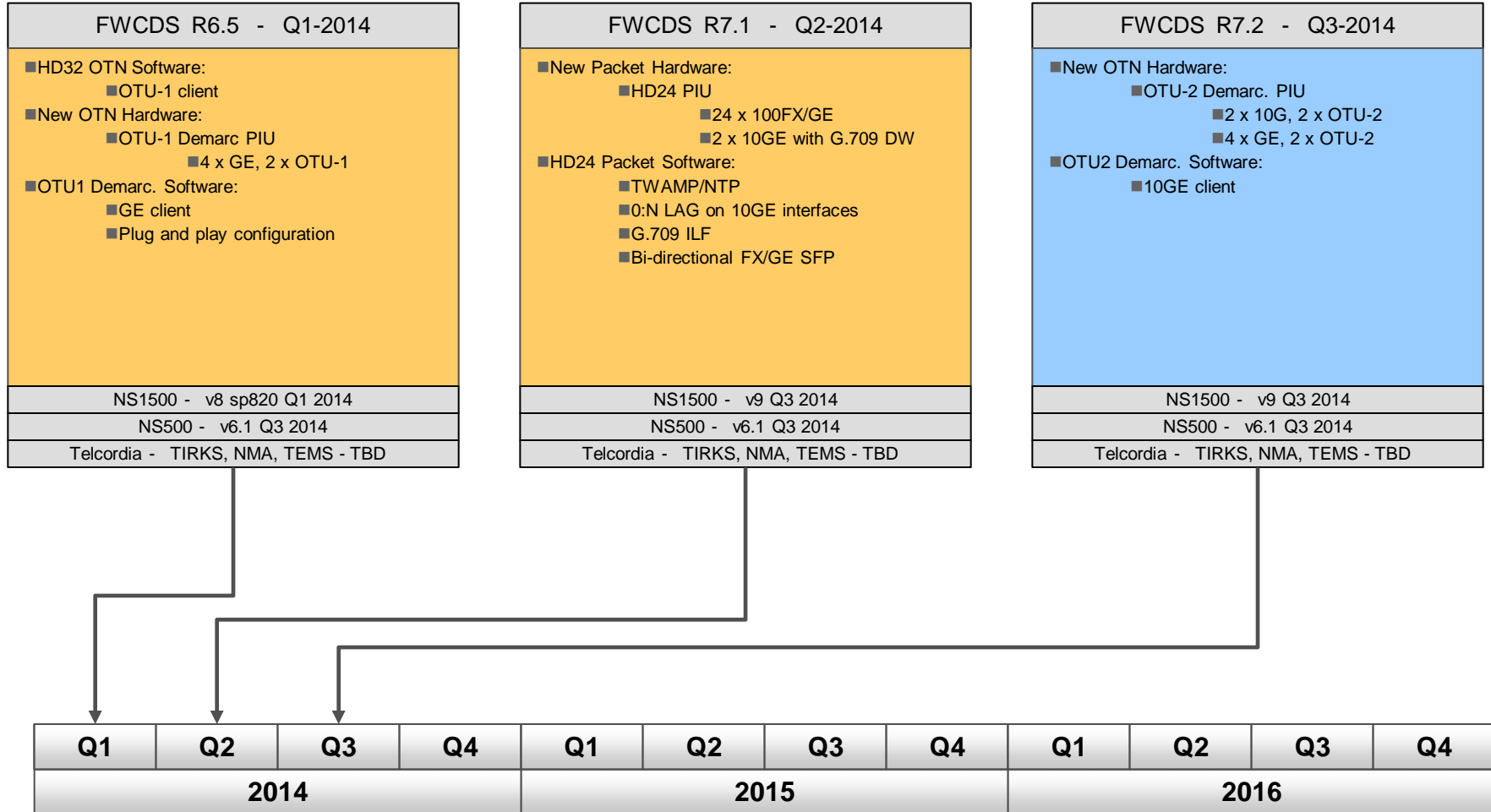
**Plan of Vision (POV):**  
 Business & Financial  
 Analysis Stage

\* - ILF Feature

Product Release Dates Shown are Target FGA Dates

Years are specified as Calendar Year

# FWCDS [2]



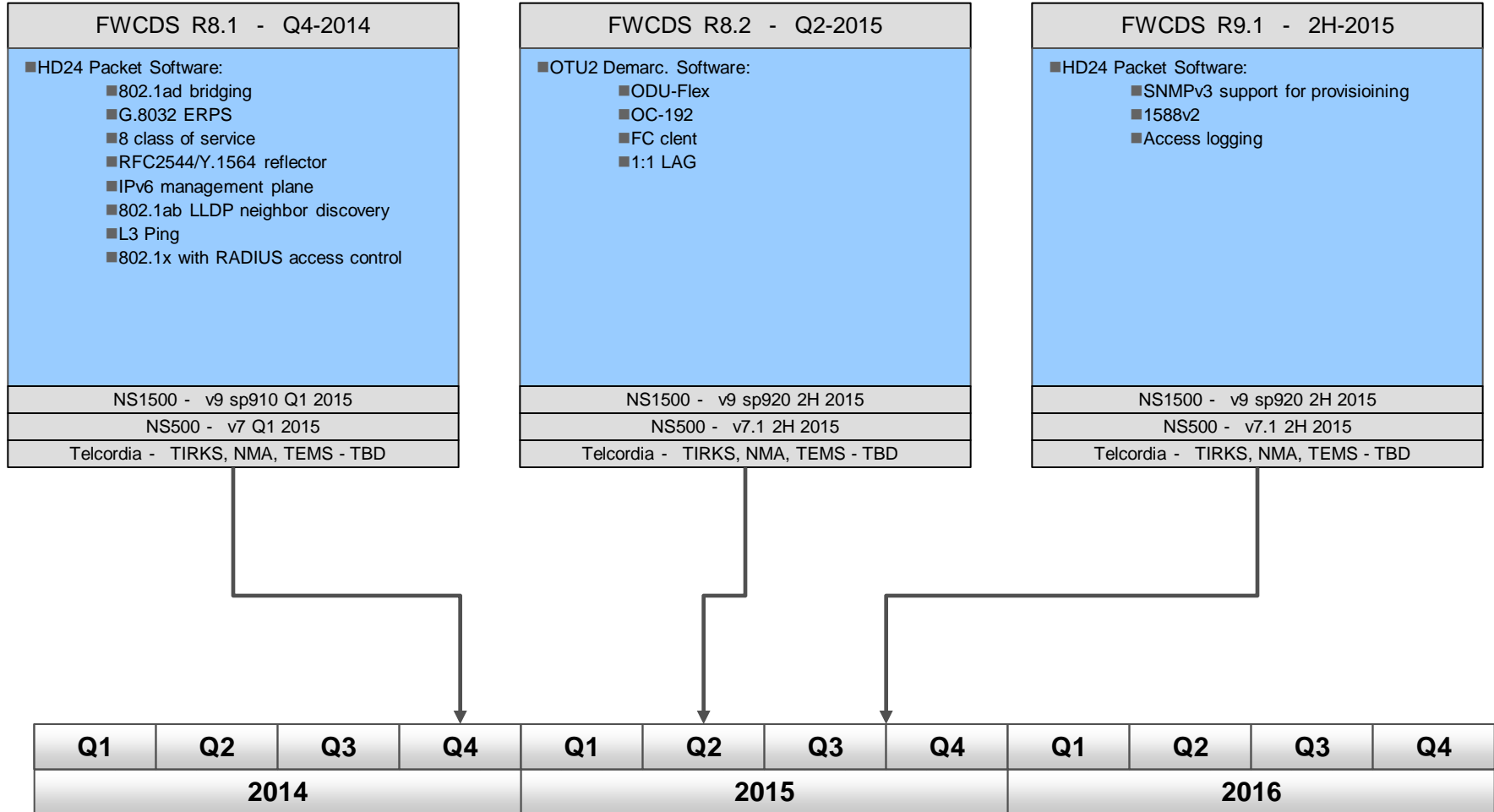
**FGA**
 **Plan of Record (POR):**  
 Planning Date  
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  **Plan of Intent (POI):**  
 Schedule & Content  
 Under Study
  **Plan of Vision (POV):**  
 Business & Financial  
 Analysis Stage

\* - ILF Feature

Product Release Dates Shown are Target FGA Dates

Years are specified as Calendar Year

# FWCDS [3]



**FGA**
 **Plan of Record (POR):**  
 Planning Date  
 Engineering Estimate

**Plan of Intent (POI):**  
 Schedule & Content  
 Under Study

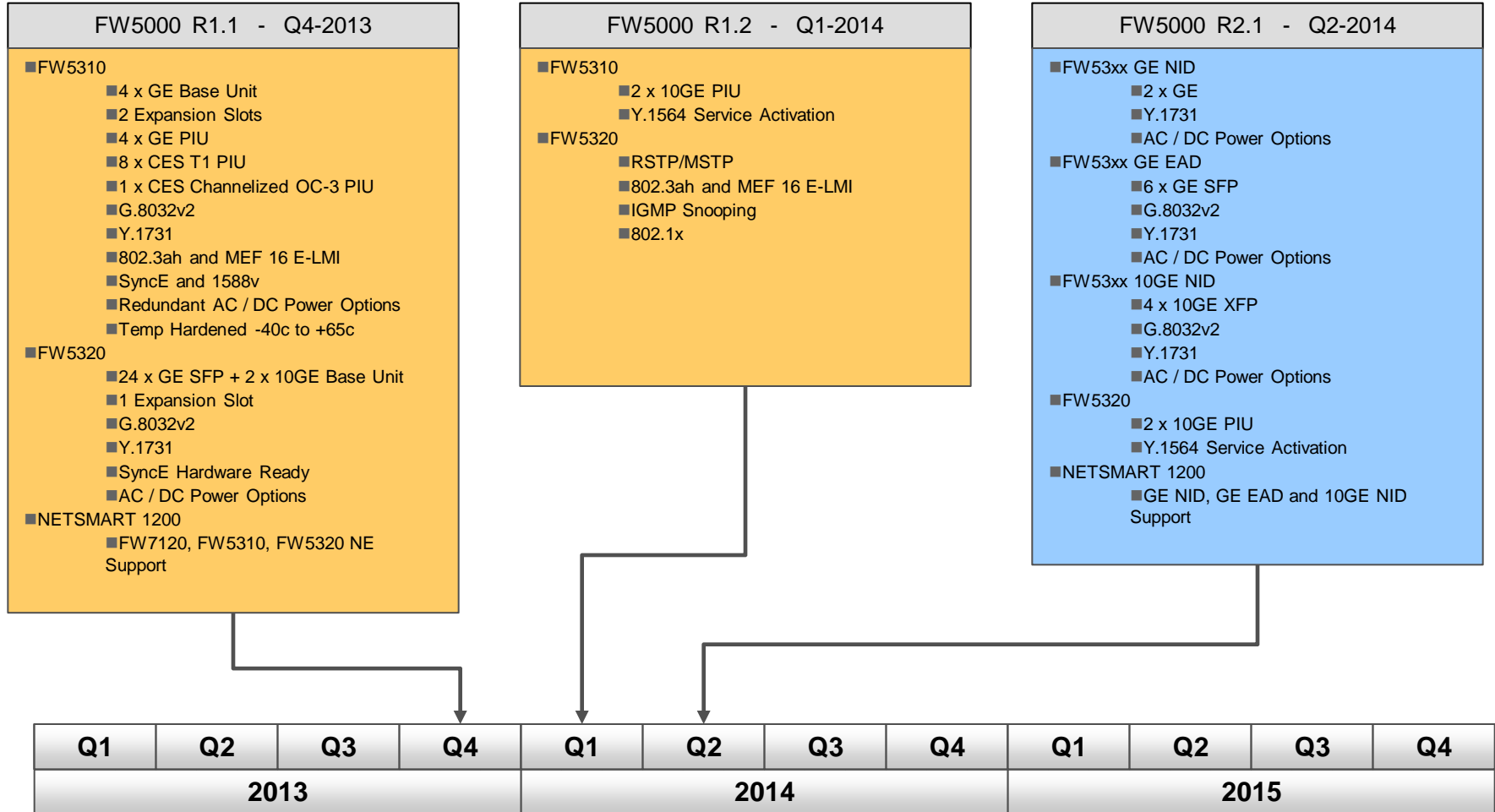
**Plan of Vision (POV):**  
 Business & Financial  
 Analysis Stage

\* - ILF Feature

Product Release Dates Shown are Target FGA Dates

Years are specified as Calendar Year

# FW5000 [1]



FGA

Plan of Record (POR):  
Planning Date  
Engineering Estimate

Plan of Intent (POI):  
Schedule & Content  
Under Study

Plan of Vision (POV):  
Business & Financial  
Analysis Stage

\* - ILF Feature

Product Release Dates Shown are Target FGA Dates

Years are specified as Calendar Year

# FW4100ES [1]



**FW4100ES R9.1.2 - Q3-2013**

- OC48 LR3 (100-120km)

NS1500 - v8 sp810 Oct 2013  
 NS500 - v5.3 Jun 2013  
 Telcordia - TIRKS, NMA, TEMS - TBD

**FW4100ES R10.1 - 1H-2014**

- 2 x GE/100FX EoS single wide service unit
- SFP/XFP
  - 100BX bi-di SFP
  - GbE bi-di SFP
  - OC192 FBT XFP

NS1500 - v8 sp820 Q1 2014  
 NS500 - v6 Q1 2014  
 Telcordia - TIRKS, NMA, TEMS - TBD

Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
2013				2014				2015			

FGA

Plan of Record (POR):  
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 Analysis Stage

\* - ILF Feature

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Years are specified as Calendar Year

# FW7120 [1]



FW7120 R9.3 - Aug-2012
<ul style="list-style-type: none"> <li>■ 2D ROADM on a blade</li> <li>■ In-line Amplifier (ILA)</li> <li>■ Y-Cable Client Protection for 10G wavelength services w/M410</li> <li>■ 10GE OTU2e mapping – interop M410 to FW7500 U5C2</li> <li>■ Common client SFP / XFP support</li> </ul>
NS1500 - v8 sp810 Oct 2013
NS500 - NS712 - Aug 12 Oct 2013
Telcordia - TIRKS, NMA, TEMS - N/A

FW7120 R10.3 - Jun-2013
<ul style="list-style-type: none"> <li>■ 7RU Shelf</li> <li>■ PVX80                             <ul style="list-style-type: none"> <li>■ 8 x 10G PVX unit</li> <li>■ Same features as existing PVX</li> <li>■ Interconnect multiple 10G PVX rings</li> </ul> </li> <li>■ PVX G.8032v2 enhancements                             <ul style="list-style-type: none"> <li>■ Multiple instances (multiple ring protection links within a PVX network)</li> <li>■ Laddered rings (rings connected by 2 or more interconnection nodes)</li> </ul> </li> </ul>
NS1500 - v8 sp810 Oct 2013
NS500 - NS712 - Apr 13 Oct 2013
Telcordia - TIRKS, NMA - 09/2013

FW7120 R11.1 - Sep-2013
<ul style="list-style-type: none"> <li>■ Enhanced dual 10G transponder with G.709v3 compliance (M431)</li> <li>■ OSI enhancements (adds),                             <ul style="list-style-type: none"> <li>■ GNE support for OSI</li> <li>■ OSI over out-of-band OSC</li> <li>■ SSH mediation</li> </ul> </li> <li>■ IPv6 (phase 1) support on management plane</li> </ul>
NS1500 - v8 sp820 Q1 2014
NS500 - NS712 - Sep 13 Q1 2014
Telcordia - TIRKS, NMA - 09/2013

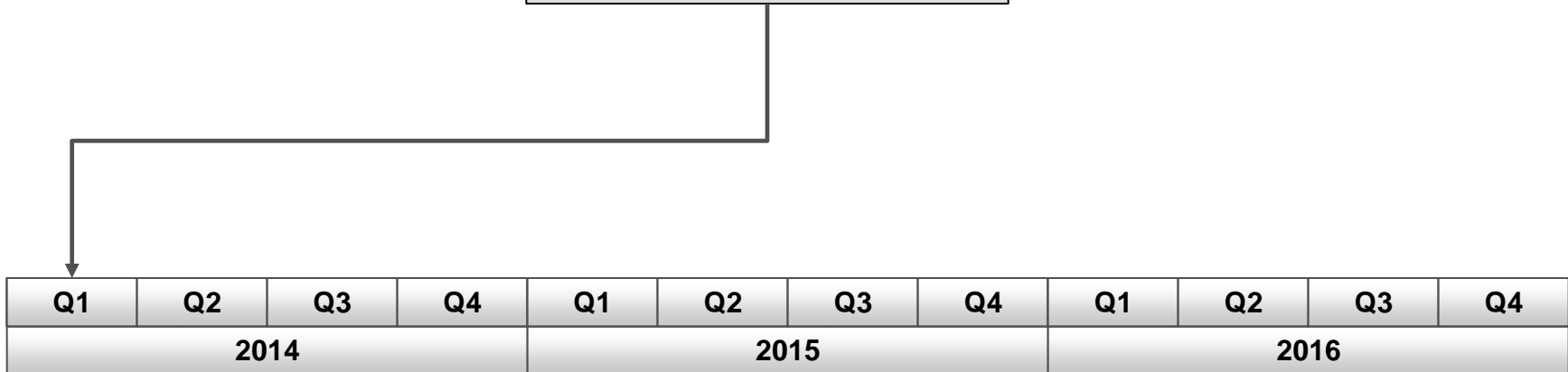
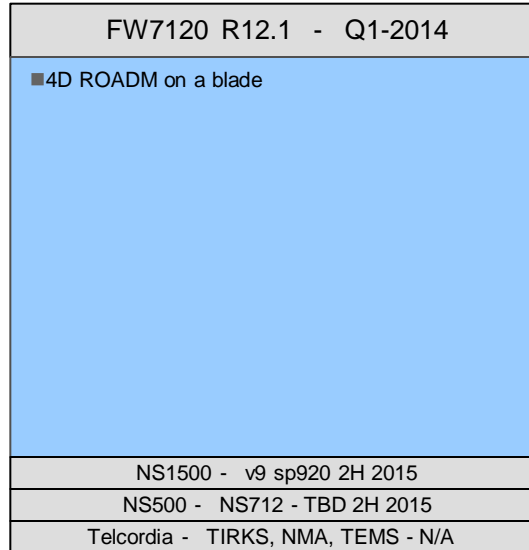


\* - ILF Feature

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Years are specified as Calendar Year

# FW7120 [2]



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\* - ILF Feature

Product Release Dates Shown are Target FGA Dates

Years are specified as Calendar Year



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# NETSMART Roadmap

June 2013

# Software Planning Roadmap Changes - Summary

## ■ NETSMART 500

- v5.4 – Release date moved to Nov 2013

## ■ NETSMART 1500

- v8 sp820 – Content reflects latest candidate features

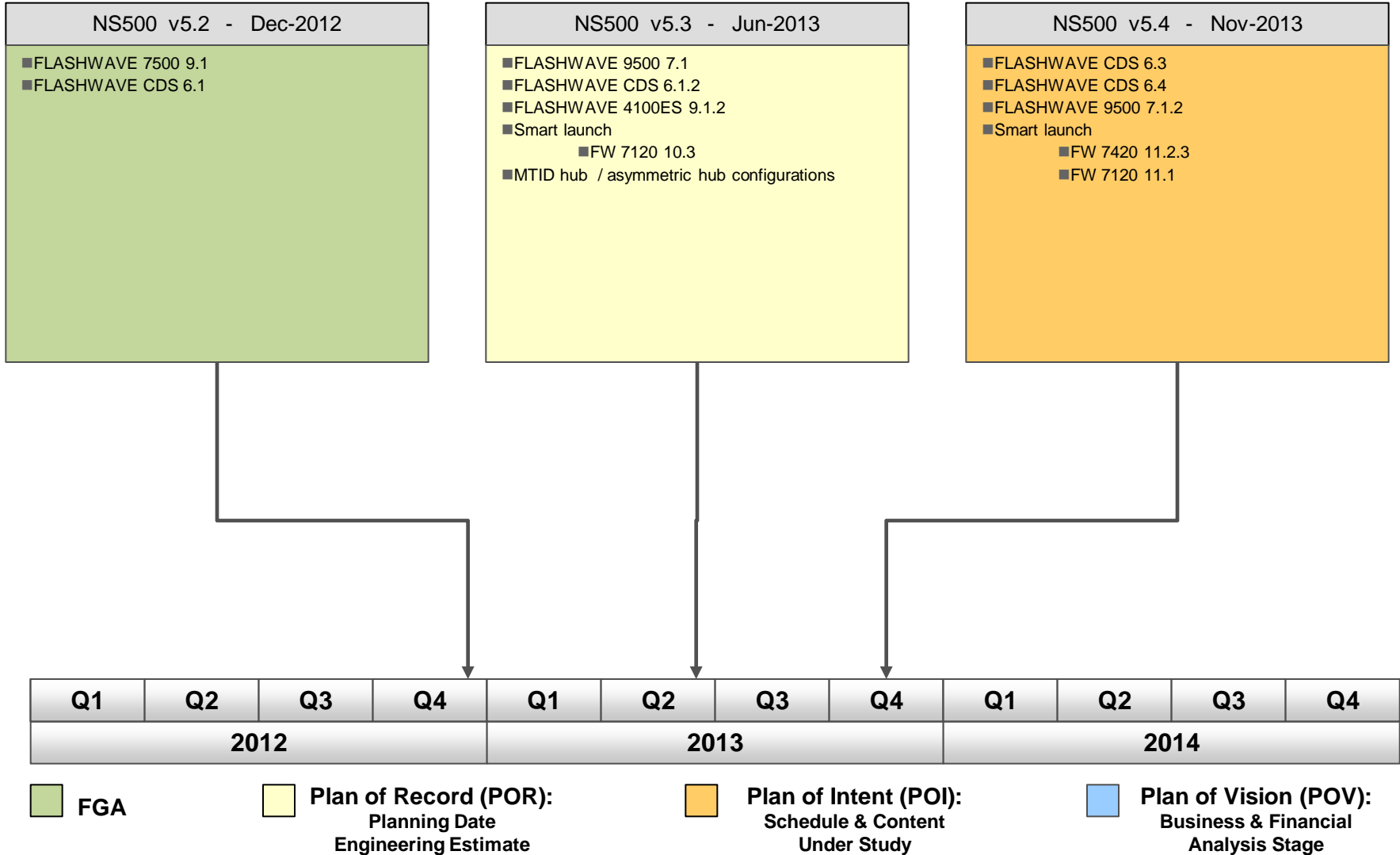
## ■ NETSMART 2000

- v6.1 – Release is now POR
- v7 – Added support for FW CDS 6.5

## ■ Potential changes

- NS 1500 release plan for CY2014 may shift as we begin sp820 discussions with Development
- Priority and scope of NS 1500 MTOSI NBI enhancements may change based on AT&T/Ericsson and CenturyLink commitments
- Still TBD – support for Ethernet bridging

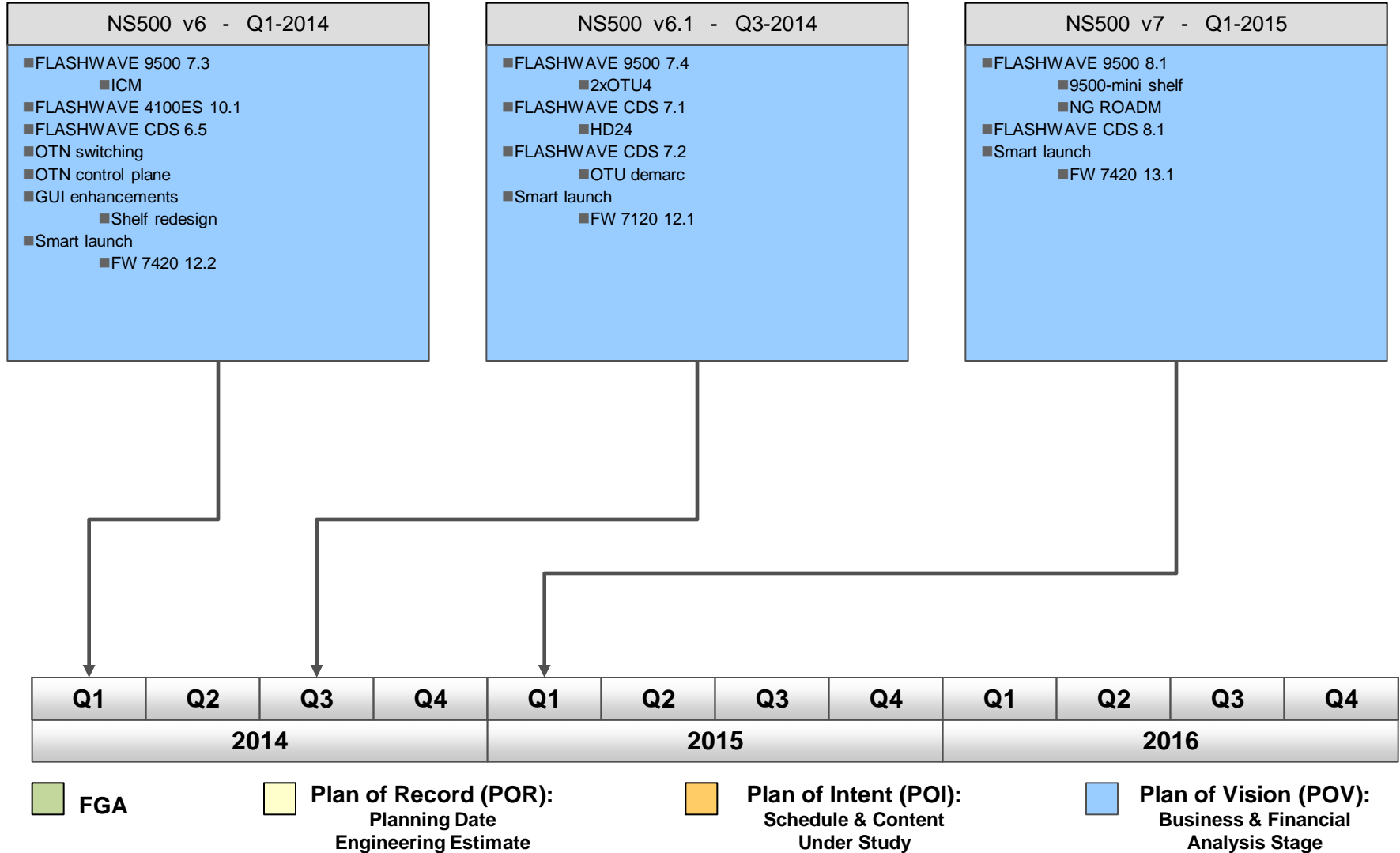
# NS500 [1]



\* - ILF Feature

Years are specified as Calendar Year

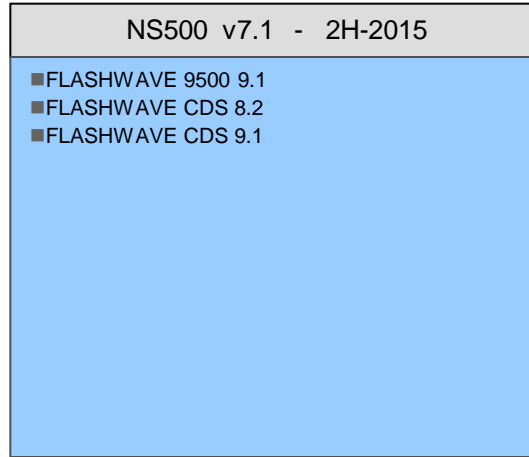
# NS500 [2]



\* - ILF Feature

Years are specified as Calendar Year

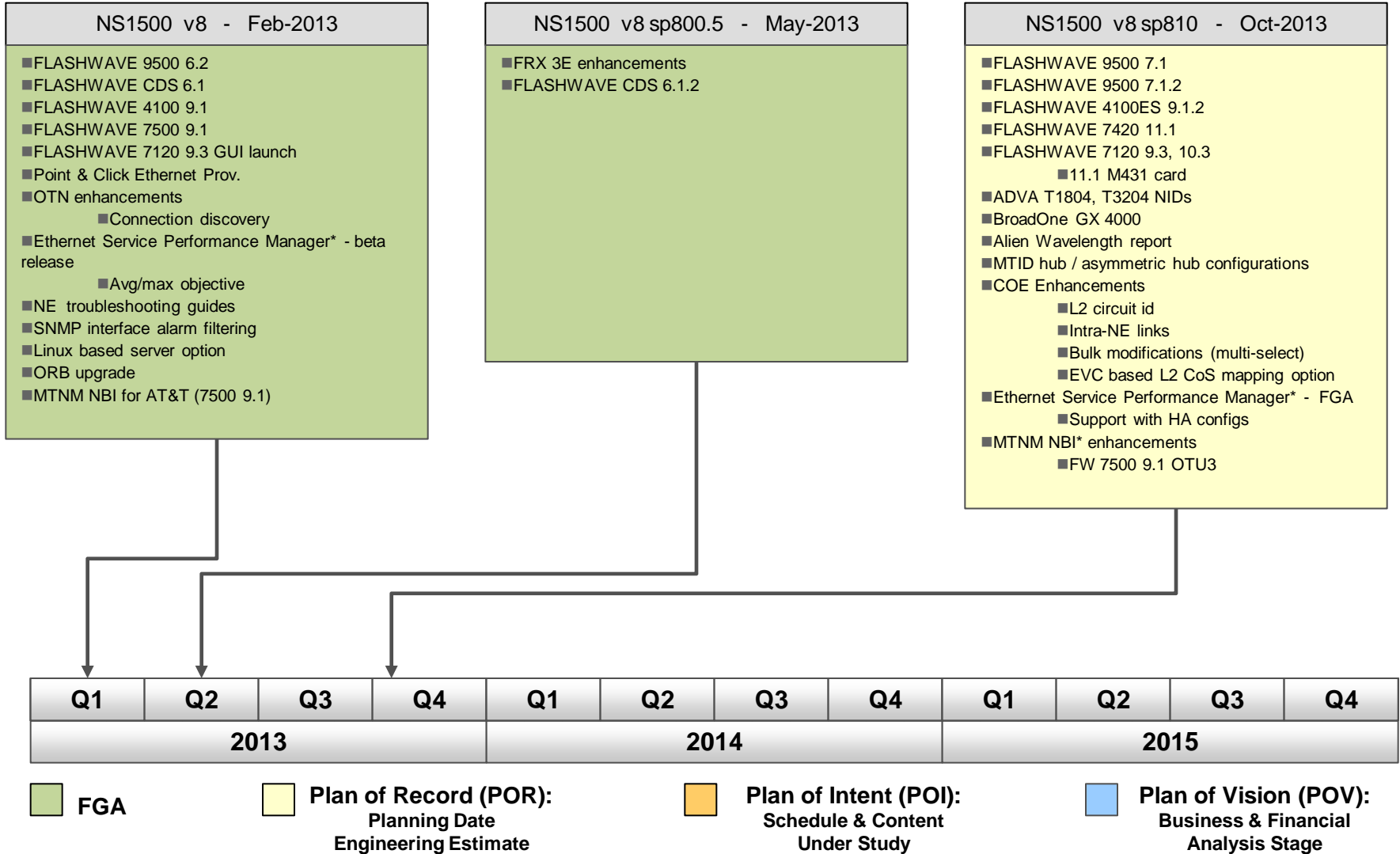
# NS500 [3]



\* - ILF Feature

Years are specified as Calendar Year

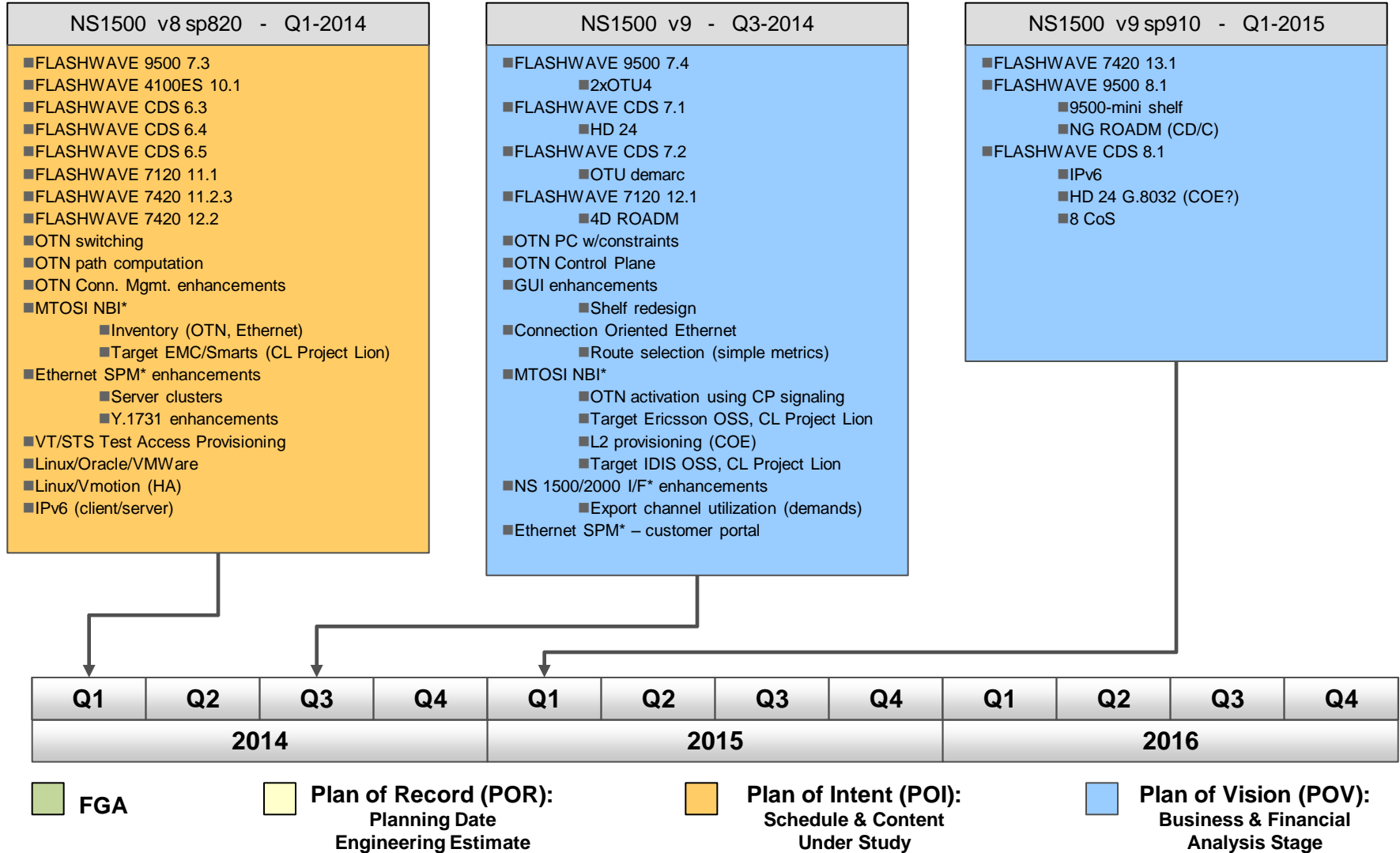
# NS1500 [1]



\* - ILF Feature

Years are specified as Calendar Year

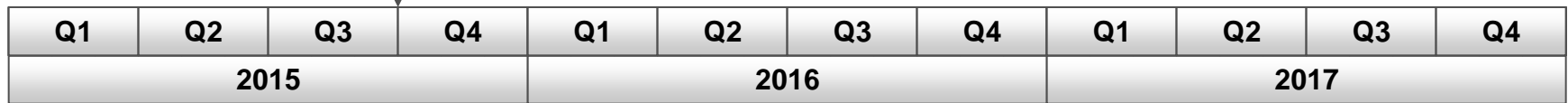
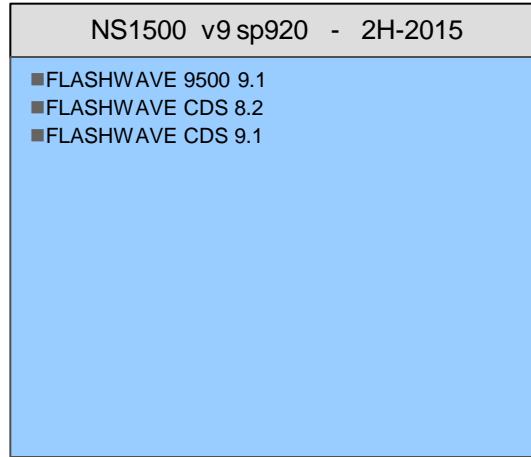
# NS1500 [2]



\* - ILF Feature

Years are specified as Calendar Year

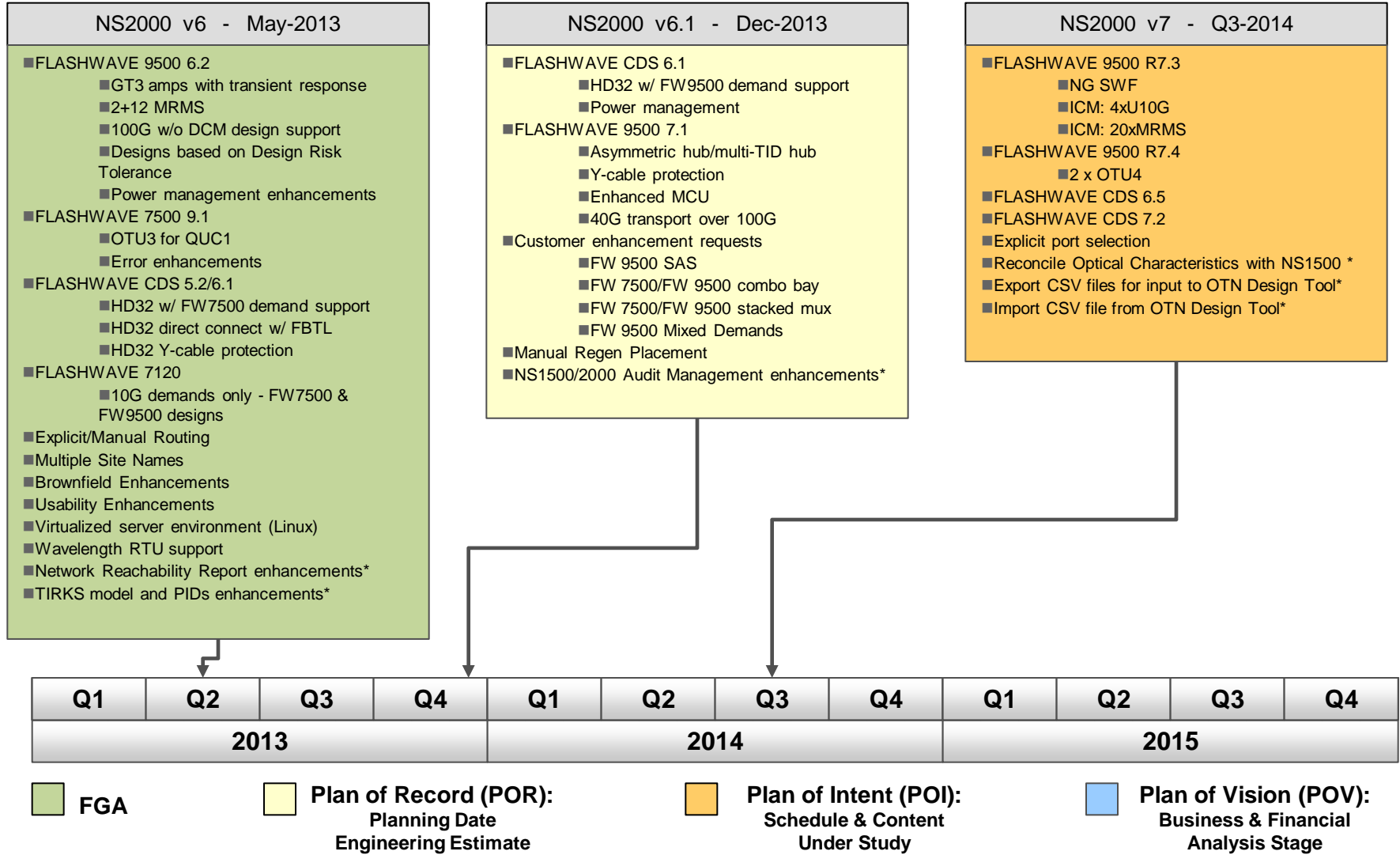
# NS1500 [3]



\* - ILF Feature

Years are specified as Calendar Year

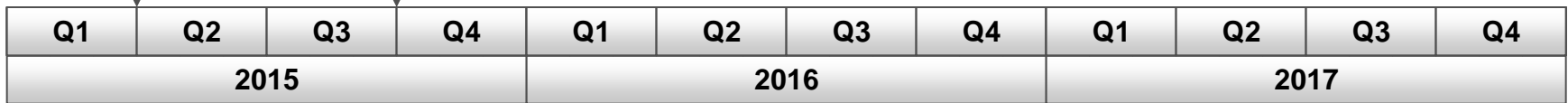
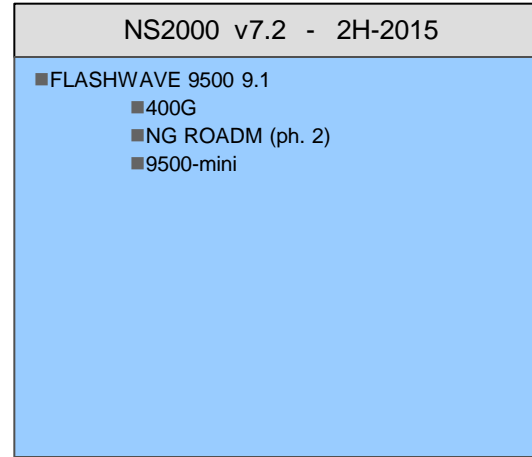
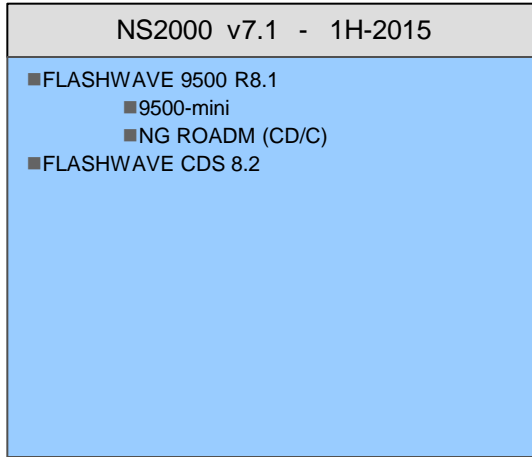
# NS2000 [1]



\* - ILF Feature

Years are specified as Calendar Year

# NS2000 [2]



FGA

Plan of Record (POR):  
Planning Date  
Engineering Estimate

Plan of Intent (POI):  
Schedule & Content  
Under Study

Plan of Vision (POV):  
Business & Financial  
Analysis Stage

\* - ILF Feature

Years are specified as Calendar Year

# NetOmnia [1]



**NetOmnia R5.4 - Mar-2013**

- Ethernet Assurance
  - 802.1ag & 802.1ah
  - Y.1731
- EVC Discovery
- Service Specific views
  - EVC, FP, LIF
- L2 adjacency discovery
  - LLDP/EDP/CDP
- Cable assurance enhancements
- SLA Management
- Performance Assurance
  - Dynamic/relative thresholds

**NetOmnia R5.5 - Q4-2013**

- Security enhancements
- Logical Topology displays
- Ethernet Assurance enhancements
  - TBD



■ FGA

■ Plan of Record (POR):  
Planning Date  
Engineering Estimate

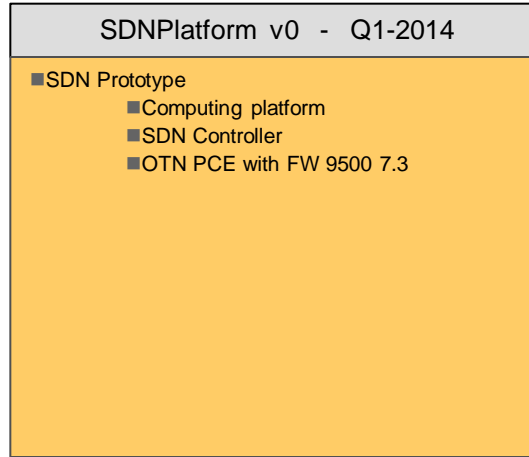
■ Plan of Intent (POI):  
Schedule & Content  
Under Study

■ Plan of Vision (POV):  
Business & Financial  
Analysis Stage

\* - ILF Feature

Years are specified as Calendar Year

# SDNPlatform [1]



Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
2014				2015				2016			



\* - ILF Feature

Years are specified as Calendar Year



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# NETSMART<sup>®</sup> Network Management Solutions



*NETSMART management solutions simplify maintenance, provisioning and surveillance.*



**NETSMART®**  
Network Management Solutions

## Unify Your Network

As new and legacy services coexist to support a widening variety of customers, network support presents more technical challenges. This complex, competitive environment needs a feature-rich software system that simplifies network management.

For managing your Fujitsu network, NETSMART® software is the answer. These powerful software systems deliver a targeted solution to get the best possible performance, keep costs under control and use resources efficiently. NETSMART management solutions simplify maintenance, provisioning and surveillance of the Fujitsu FLASHWAVE® family of networking solutions, as well as legacy Fujitsu Network Elements (NEs).

**Customizable Network Management Software**

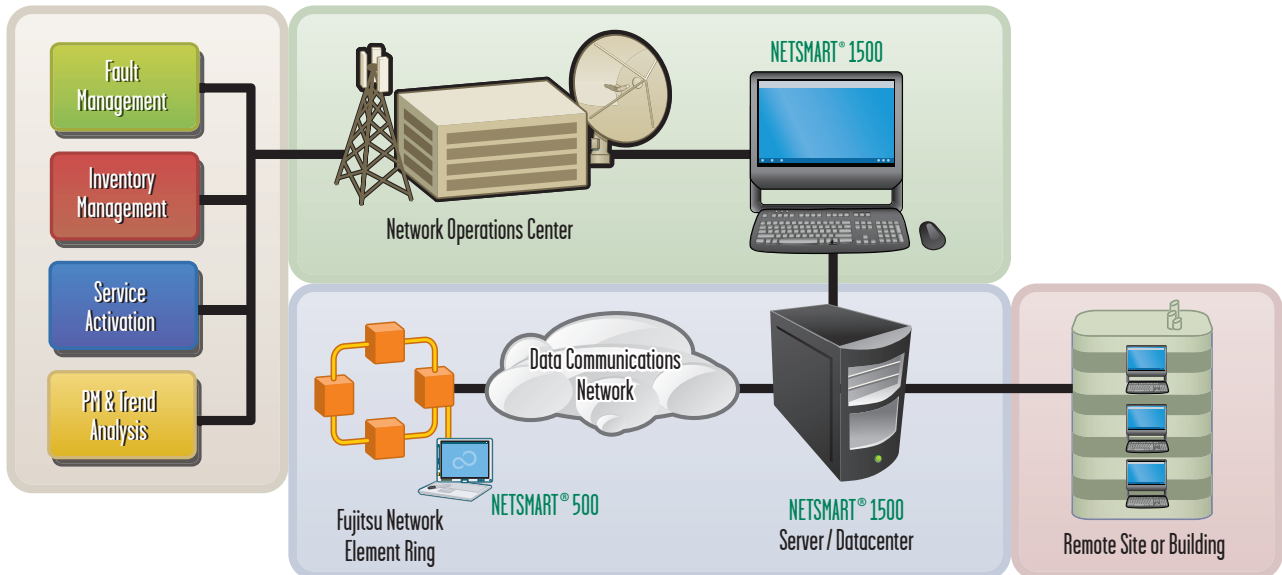
Network maintenance needs vary depending on the type and size of your network. Fujitsu offers two complementary software systems that enable customized solutions to suit individual business needs.

**NETSMART 1500 Management System**

This carrier-class management solution delivers simplified point-and-click control to enable network-wide provisioning, maintenance and surveillance from a centralized location.

**NETSMART 500 Element Manager**

This robust craft interface supports the Fujitsu FLASHWAVE product line and locally or remotely manages NEs.





## Managing the Evolution to Packet-Based Services

The NETSMART 1500 system simplifies network management and handles mature technologies such as TDM in combination with emerging packet-based technologies such as Connection-Oriented Ethernet (COE). The NETSMART 1500 Management System supports and manages the Fujitsu FLASHWAVE product family and all current and legacy Fujitsu NEs. The system also accommodates networks of any size.

### Single Interface for Layer 1 and Layer 2 Networks

NETSMART 1500 software provides a single interface for the Layer 1 transport network (cross-connects, circuits and paths) and the Layer 2 data network (such as Ethernet Virtual Circuits, tunnels and protection domains). The ability to view multiple network technologies in a single management application enables operations personnel to view relationships among layers, improve fault isolation, and reduce training time.

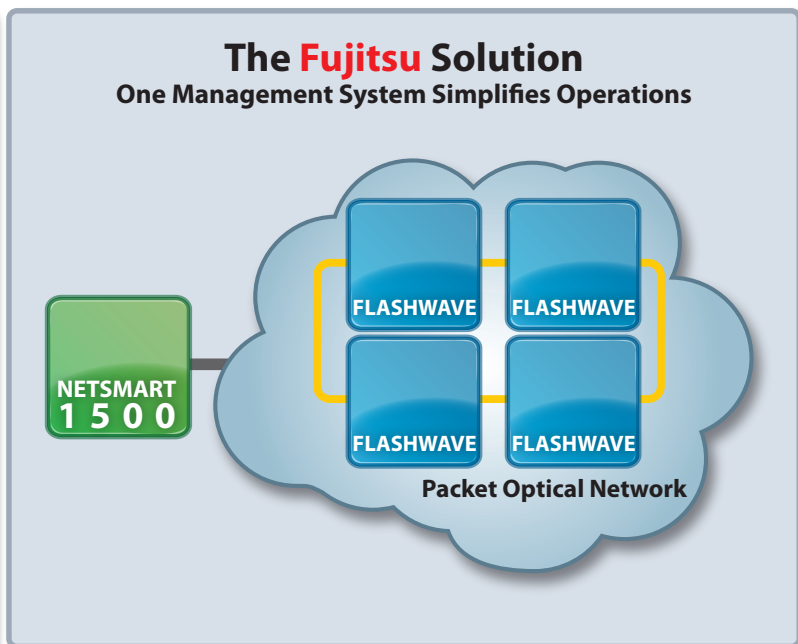
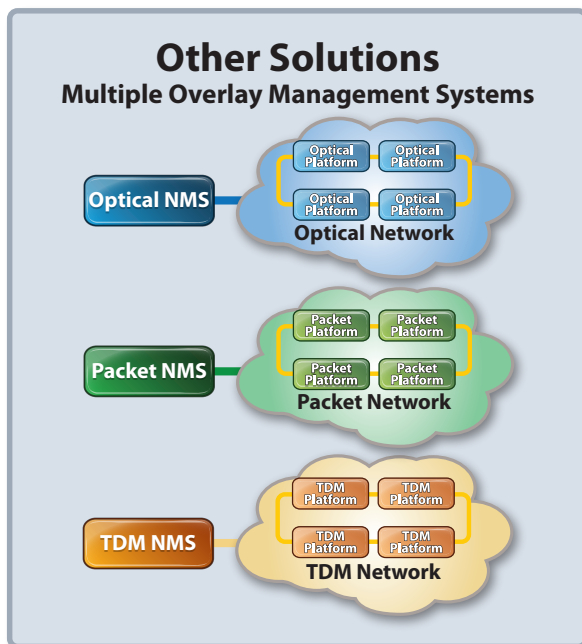
### Simplified Management for Complex Services

Managing complex COE services is dramatically simplified with the end-to-end flow provisioning features of the NETSMART 1500 Management System. Centralized A-to-Z management and end-to-end service provisioning enable consistent application of traffic and bandwidth profiles, a unified database of service inventory, and end-to-end service views and maintenance operations. The NETSMART

1500 software manages switched VLAN services delivered on Fujitsu Packet Optical Networking Platforms (Packet ONPs), avoiding the need for custom in-house software development. The data service management interface provides the tools to provision Ethernet circuits, tunnels, protection domains, and service OAM.

### Point-and-Click Provisioning for MEF Ethernet Services

With NETSMART 1500 software, provisioning new Ethernet services requires no in-depth knowledge of Carrier Ethernet parameters. NETSMART 1500 software uses Metro Ethernet Forum (MEF) terminology and default settings for commonly used MEF Ethernet service attributes, enabling users to configure their customers' unique Ethernet service attributes, such as bandwidth and Class of Service (CoS) identification. Now, when users need to define bandwidth and Quality-of-Service (QoS) terms, NETSMART 1500 software implements the associated profiles across all FLASHWAVE<sup>®</sup> Packet ONPs, automatically accounting for the different functionality and release levels of these NEs. This eliminates operator errors that normally arise when configuring different platforms. NETSMART 1500 software can fully provision an MEF-compliant E-Line or E-Access service in less than one minute. The data service management interface provides the tools to provision Ethernet tunnels, protection domains, and service OAM (SOAM) Y.1731 monitoring.



# NETSMART® Network Management Solutions

## NETSMART 1500 Management System

### Operations Made Simple

The NETSMART 1500 Management System is a powerful software system that supports and manages the Fujitsu FLASHWAVE product family and all current and legacy Fujitsu NEs. Its intuitive Graphical User Interface (GUI) makes provisioning, maintenance and troubleshooting a simple, efficient process. The system can scale to support hundreds of users and thousands of NEs—securing your existing investment and supporting future growth.

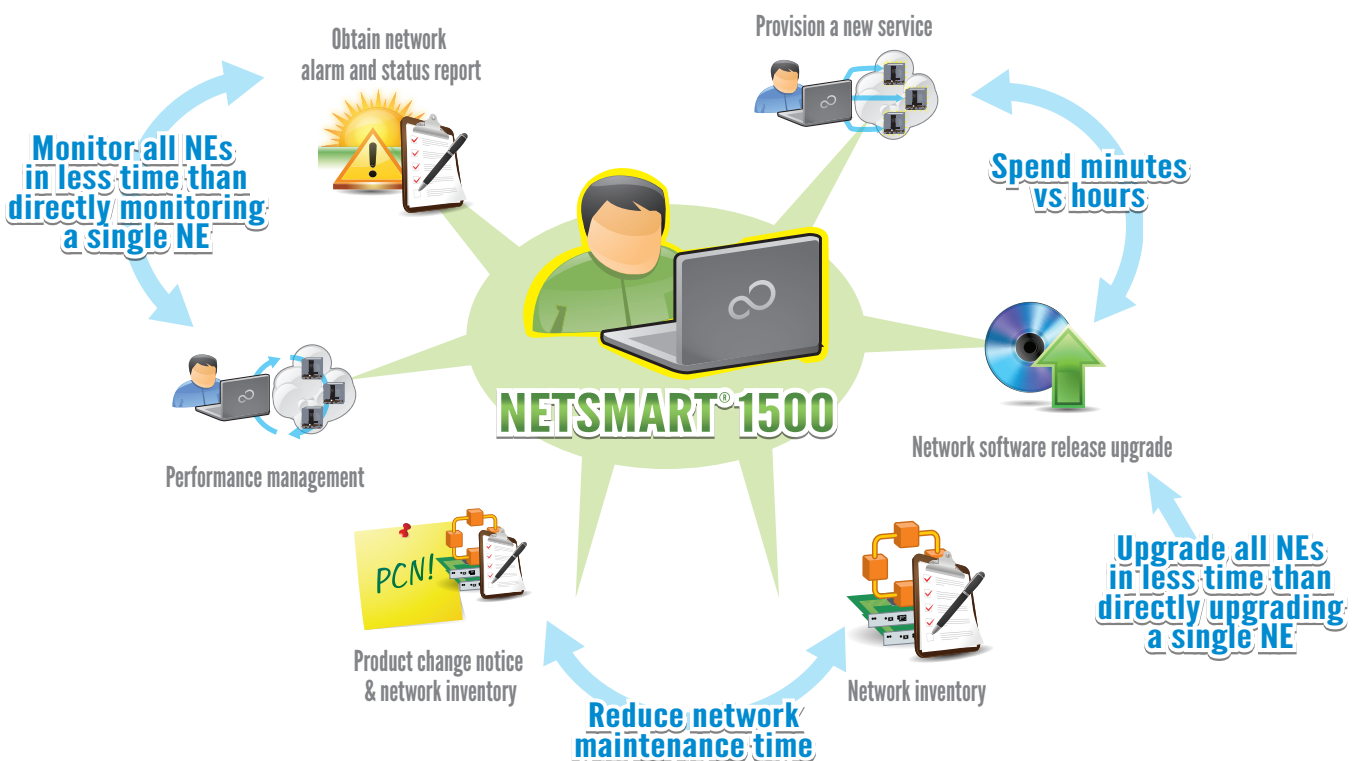
The NETSMART 1500 software integrates with your existing and future Operations Support System (OSS) architecture, supporting up to 8,000 NEs and 200 concurrent client sessions per system. The software protects network integrity by restricting user roles, manages upgrades of NE software remotely and performs disaster recovery of NE software and databases.

### Enhanced Security through Two-Factor Authentication

The NETSMART 1500 system can authenticate users to a level of security approved by the Department of Defense's Joint Interoperability Test Command (JITC). This authentication system is Public-Key Infrastructure (PKI), using a combination of a physical authentication key and a password.

### Key Features of the NETSMART 1500 Management System

- *Provision MEF-compliant services in minutes*
- *Centralized network management for:*
  - Provisioning
  - Maintenance
  - Alarm monitoring
  - Survivability
  - Troubleshooting
- *End-to-end Layer 1 and 2 service provisioning*
- *Dynamic network-wide topology view*
- *Intelligent auto-discovery of network elements and their physical links*
- *Per-link or per-network capacity and growth monitoring*
- *Real time network updates via software download*
- *Remote disaster recovery and restore capabilities*
- *Fast service turn-up with end-to-end circuit provisioning*
- *Multiple interface options for linking to higher level OSS*
- *Redundant, geographically diverse server configuration with automatic failover*





# NETSMART® Network Management Solutions

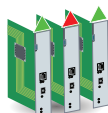
## Keep Your Network Up-To-Date

### Real Time Network Monitoring

The NETSMART 1500 software keeps you up-to-date on network conditions through real time fault management. The software monitors your network, displaying alarms and conditions as they occur, while remote notification alerts you to events during off hours.



Around the clock monitoring / analysis



Quickly correlate faults to affected circuits

The software also supports the capability to login and monitor alarms on other vendors' TL1-based equipment. Faults are tracked and logged in fault reports and forwarded through supported Northbound Interface (NBI) uplinks.



Improve fault resolution time by **50%\***

### Dedicated Custom Access

Network partitioning subdivides a system into smaller sections with the ability to grant access to designated user groups. This capability provides custom views for individual user groups or end customers, enabling targeted access to specific parts of the network. This feature can also eliminate the cost of having a separate server administrator at each site.

### Control Operational Costs

Managing equipment inventory is quick and easy with a dynamic network-wide inventory reporting tool. The inventory reporting capabilities eliminate the need for manual and spreadsheet-based management by providing the most up-to-date information on your Fujitsu equipment. You get the information you need when you need it, so you can identify the hardware release and installed equipment information. You can create, customize, and filter inventory reports according to specific criteria you define.



Save person-hours and truck rolls



Improve network update speed by **85%\***

Capacity management features of the NETSMART 1500 software enable you to track and optimize bandwidth utilization. Use these features to maximize network resources by tracking port utilization and locating unused cards and ports.

### Reduce Capital Costs

Product Change Notice (PCN) management proactively prevents problems before they occur by identifying hardware affected by PCNs. Alerts are posted when a PCN affects your network.



Eliminate manual record keeping



Need-based decision making

The NETSMART 1500 system also reduces costs by performing remote NE software upgrades to multiple NEs in parallel, without service interruption. This ability eliminates the need to dispatch technicians to perform upgrades locally at individual NEs.



Improve record keeping time by **75%\***

### Rapid Service Activation

Automated connection management minimizes design and circuit activation time within even the most complex networks. This feature finds routes automatically, or you can actively design circuits with powerful include/exclude routing and time slot assignment options. You can also provision services such as Gigabit Ethernet and 10/100Base-T Ethernet, using High- and Low-Order Virtual Concatenation (VCAT) as easily as a T1 or T3.



Create revenue-generating services in minutes



Increase service deployment speed by **75%\***



**NETSMART®**  
Network Management Solutions

**Versatile Systems Integration**

**Systems Integration Increase Efficiency**

The NETSMART 1500 management system has the versatility needed to integrate precisely with your OSS via a variety of standards-based Northbound Interface (NBI) modules:

- SNMP
- CORBA
- XML
- CSV FTP
- TL1
- MTOSI

Fujitsu Professional Services can assist with northbound integration and customization to meet individual needs. By optimizing data exchange between your management software and your OSS, you realize important business and operational benefits:

- *Improve overall efficiency* and flow-through
- *Rapid service activation* with flow-through provisioning
- *Reduce fault resolution time* by sharing alarm data with helpdesk systems
- *Maximize network utilization* with accurate inventory data
- *Analyze performance* data to predict trouble spots

**Server Requirements for NETSMART 1500 Management System**

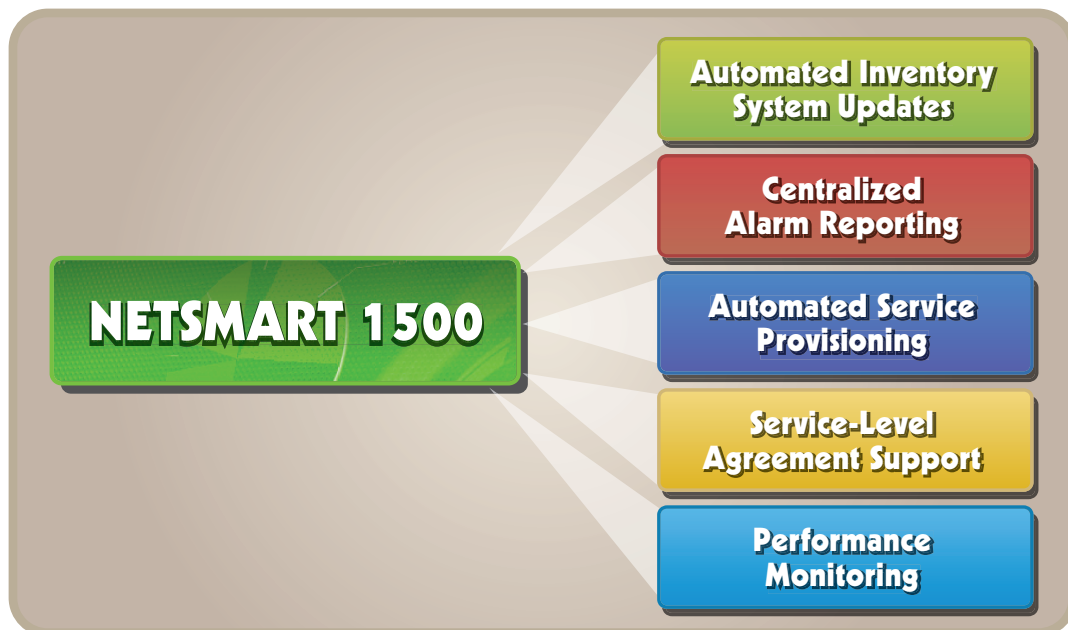
Fujitsu offers several tested server platforms for small, medium and large networks. Contact your sales representative for specific hardware offerings.

**Built with Industry-Standard Infrastructure**

- Server application supported on:
  - Oracle Solaris (using Solaris 10 OS)
  - Linux 64-bit hardware (using Red Hat OS)
- Clients are supported on Solaris, Linux, Windows XP, Windows Vista and Windows 7

**Software Licensing Options**

Some features of the NETSMART 1500 system are licensed separately. To discuss the right network management and software maintenance options for your network, including support packages and custom integration, contact your Fujitsu sales representative.





**NETSMART®**  
Network Management Solutions

## NETSMART 500 Element Manager

The NETSMART 500 Element Manager is a separate, complementary system from the NETSMART 1500 Management System. The application is used for equipment turn up, installation, and field troubleshooting. The NETSMART 500 software supports graphical shelf views, equipment and facility provisioning, alarm surveillance, software download, remote memory backup/restore capabilities and cross-connect provisioning.

### No TL-1 Knowledge Needed

With the NETSMART 500 Element Manager, support personnel can provision, maintain and upgrade Fujitsu networks without the need for TL1 knowledge. The software is supported on a Windows PC, connecting to NEs through a data communications network (DCN), or directly to individual NEs via an Ethernet interface, RJ45, or RS-232 serial cable.

### Ease-of-Use Boosts Productivity

The NETSMART 500 Element Manager is easy to learn and use. The software uses common operation dialogs, making provisioning tasks easy and consistent among different products and types of services. This translates to lower operational costs and a minimal learning curve when introducing new technologies or NEs. By using this software at a centralized location, you can troubleshoot remotely and greatly reduce truck rolls.

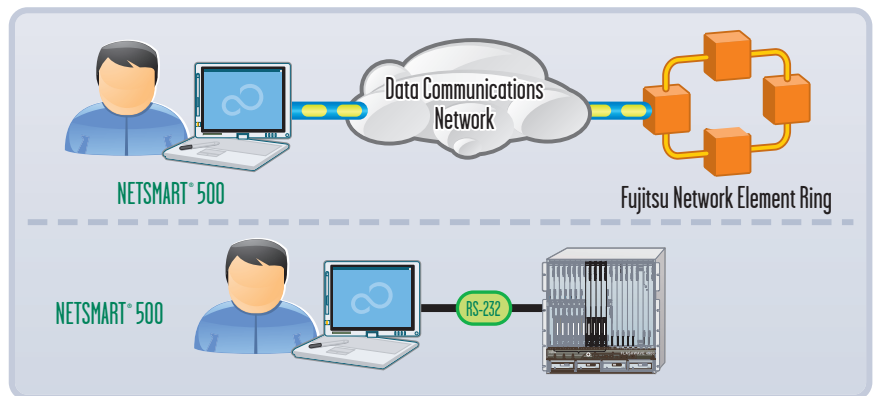
The NETSMART 500 system provides rich, context-sensitive documentation, such as the Unit Description and Alarm Troubleshooting Guides.

### Multiuser Version

A server-resident multiuser version of NETSMART 500 is also available. Running on a Windows 2008 server, this separately licensed application supports up to 10 users logged in concurrently. This application is centrally managed, which saves time and effort during software upgrades.

### NETSMART 500 System Requirements

Single User	Multiuser
<ul style="list-style-type: none"> <li>Windows XP Professional (SP 2), and Windows 7 Professional.</li> <li>2.4 GHz CPU</li> <li>500 MB available hard disk space</li> <li>CD-ROM drive</li> <li>LAN card and/or serial craft interface port and connection cable</li> <li>1024 x 768 resolution</li> <li>Internet Explorer 8.0 or above, or Mozilla Firefox 3.0 or above.</li> </ul>	<ul style="list-style-type: none"> <li>Windows Server 2008</li> <li>2.4 GHz CPU recommended</li> <li>4 GB RAM recommended</li> <li>4 GB available hard disk space</li> <li>CD-ROM drive</li> <li>10/100 LAN card</li> </ul>



**Fujitsu Network Communications Inc.**

2801 Telecom Parkway, Richardson, TX 75082  
Tel: 800.777.FAST (3278) Fax: 972.479.6900

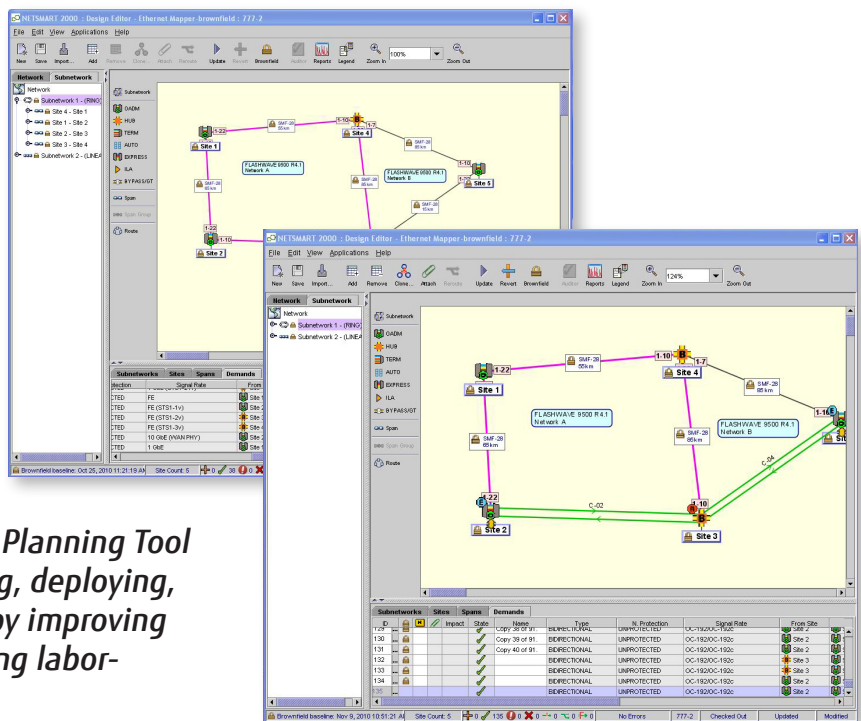
[us.fujitsu.com/telecom](http://us.fujitsu.com/telecom)

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shaping tomorrow with you

# NETSMART® 2000 Design and Planning Tool

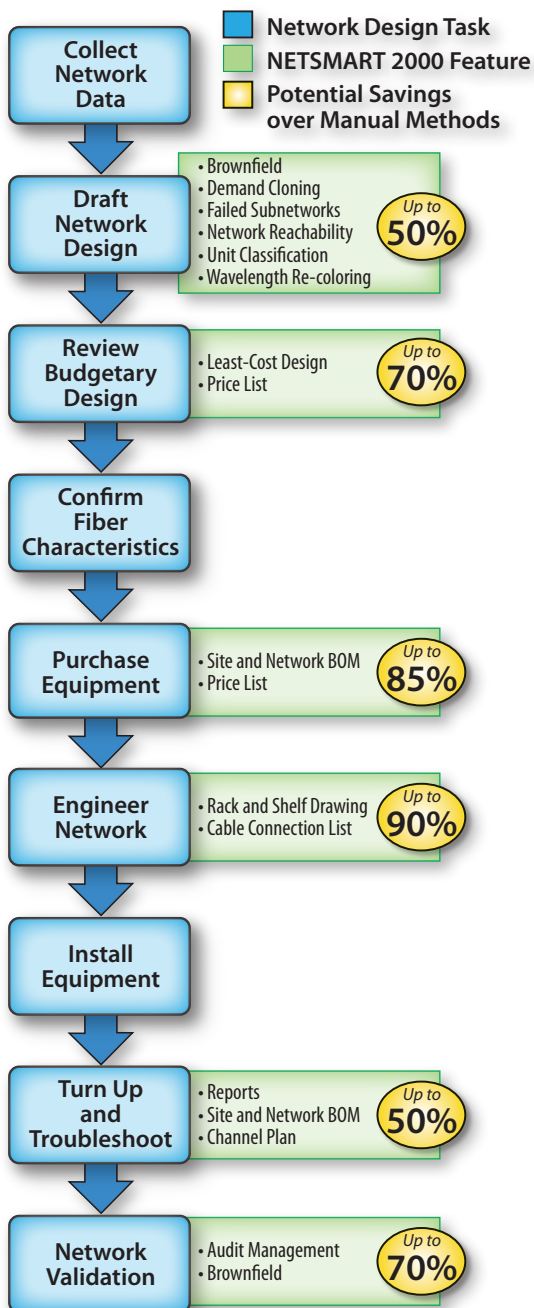


*The NETSMART® 2000 Design and Planning Tool saves time and money in planning, deploying, and operating DWDM networks, by improving business processes and automating labor-intensive tasks.*

# NETSMART 2000

## Design and Planning Tool

### Save Time—Cut Costs



The NETSMART® 2000 Design and Planning Tool saves money by improving design, planning, review, and inventory management processes for Fujitsu DWDM networks. By automating labor-intensive procedures, the NETSMART 2000 tool also drastically reduces the number of person-hours needed to complete essential tasks. Overall, the NETSMART 2000 system puts control in your hands and greatly reduces the cost of planning, deploying and operating a DWDM network.

#### Plan and Design for Efficient Service Rollout

The NETSMART 2000 system's superior planning and design features ultimately lead to rapid, cost-effective service rollout. The system collects and compiles key data that makes it simpler for you to review and plan your network. Designs created using the NETSMART 2000 system facilitate economical equipment selection, demand aggregation, and wavelength allocation.

This easy-to-use tool enables operations, business planning, engineering, strategic planning, and installation personnel to cost-effectively create, operate, and grow a DWDM network consisting of the FLASHWAVE® 7500 Multifunction ROADM/DWDM Platform or FLASHWAVE 9500 Packet Optical Networking Platform.

#### Key Features of NETSMART 2000

- **Audit Management\*** for faster, lower-cost equipment reconciliation
- **Reachability Matrix\*** for easy identification of the best wavelength pathways
- **Custom Profile\*** for increased accuracy of field deployments
- **Models and PIDs\*** for exporting rack, shelf, and card data into customer-specific format
- **TRIB site-additional shelves** for the FLASHWAVE 7500 and 9500 platforms, enabling assignment for larger sites
- **Customer-specific support kits** provide customized Bills of Material (BoMs) to suit customer needs
- **Site location by vertical and horizontal coordinates** for increased design flexibility and accuracy
- **Single Network Design Method** for reducing time and effort when creating a phased design
- **Customized Excel and print options** speed up importing and printing of network information
- **Large network support** for networks of more than 1,000 NEs
- **FLASHWAVE 9500 integration** with FLASHWAVE 7500 network topology

\* This feature is optional and must be purchased separately



# NETSMART 2000 Design and Planning Tool

## Achieve the Least-Cost Solution

### How NETSMART 2000 Controls CAPEX and OPEX

- Reduces manual labor by automating tasks
- Reduces the risk associated with designing a network
- Decreases overall deployment costs
- Reduces the time taken to install equipment
- Increases design accuracy
- Optimizes network performance

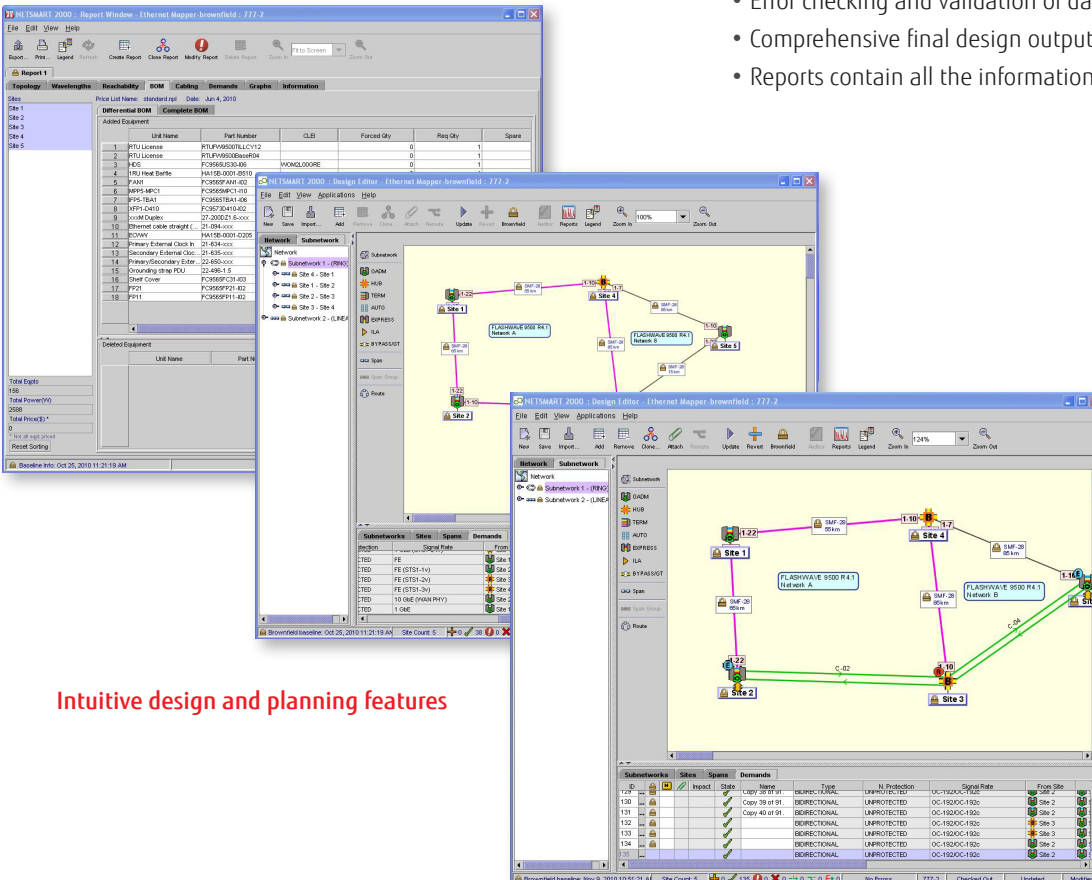
### Optimize Network Optical Performance and Traffic Demand

The NETSMART 2000 Design and Planning Tool configures the FLASHWAVE 7500 or the FLASHWAVE 9500 platform into a wide variety of topologies. Network designs are quickly and accurately optimized based upon optical performance parameters and traffic demand for initial deployment and future expansion. At the same time, the application supports fine tuning of network capacity for the best possible performance and revenue-generating services, while achieving the lowest-cost design.

### Easy-to-Use GUI Features

The NETSMART 2000 system provides a comprehensive design and planning tool that boosts productivity and accuracy with purpose-built features:

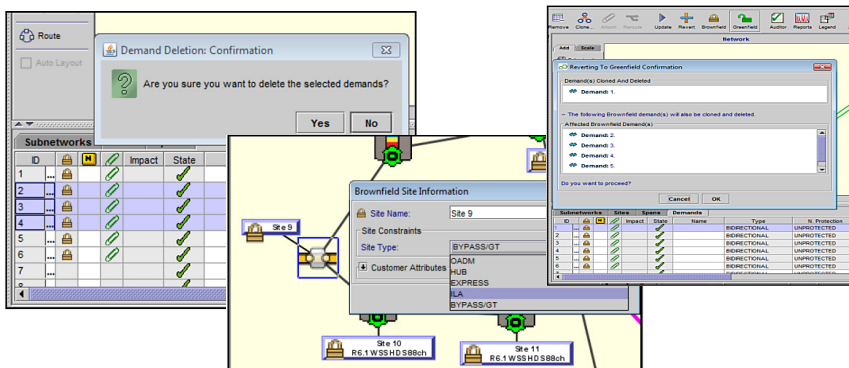
- Graphical view of Network Elements (NEs), spans, and site data
- Flexible auto-complete data entry options
- Design file management offers shared network designs, user roles and user logging
- Revision history and version control
- Audit feature compares as-designed with as-deployed networks for future planning
- Wide range of topology designs and site types supported:
  - Linear
  - Point-to-point
  - Ring
- Error checking and validation of data entries
- Comprehensive final design output
- Reports contain all the information needed for network build-out



Intuitive design and planning features

# NETSMART 2000 Design and Planning Tool

## Increase Design Flexibility, Efficiency and Accuracy



### Brownfield Designs

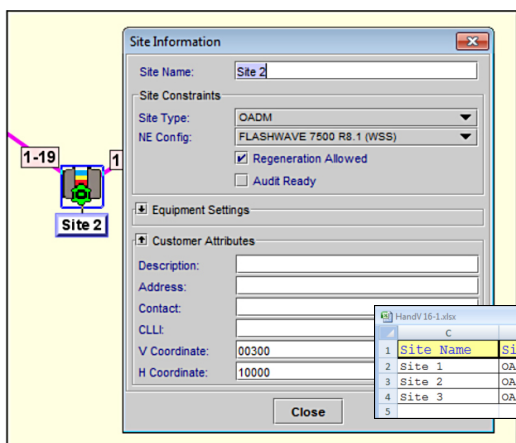
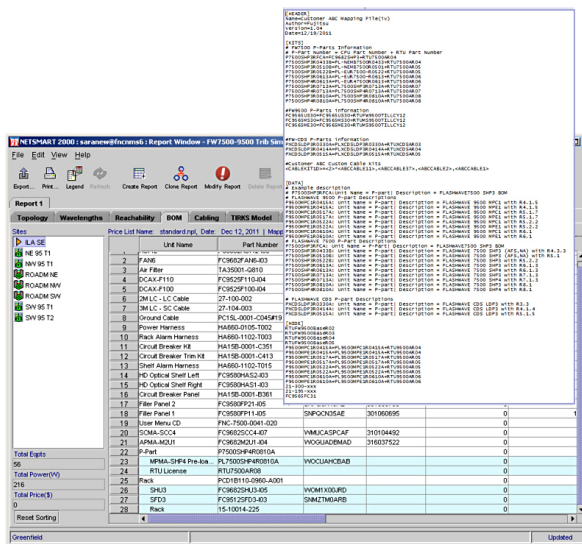
Brownfield support in the NETSMART 2000 system increases the usability and convenience of working with brownfield design features:

- Revert a demand to greenfield
- Delete a subset of staged/grouped demands
- Change a bypass site to ILA or ROADM
- Insert a greenfield site into a brownfield design

### Customer-Specific Support Kits

Customer-specific support kits increase the efficiency and accuracy of BoM updates:

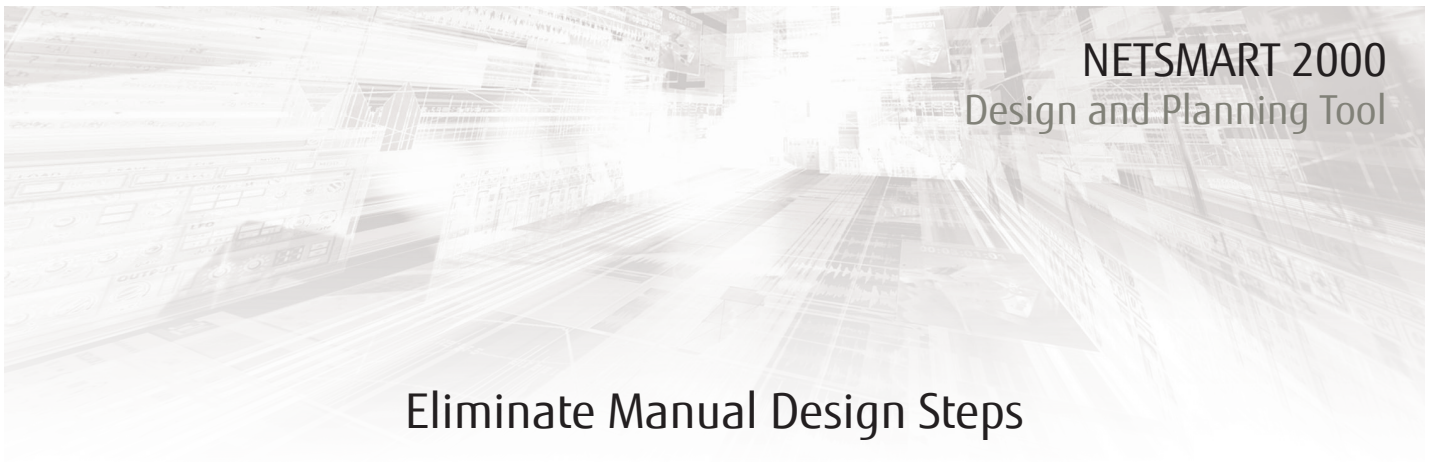
- Modify both site-level and complete BoMs via a modified text file
- Hide parts in a bill of material and remove unnecessary parts such as racks, filler panels, and covers
- Replace parts in a BoM or swap a part for a similar part
- Organize parts into custom kits, and group parts under a preferred part number.
  - Parts can be replacement parts or preferred cables, or line cards with preferred optics



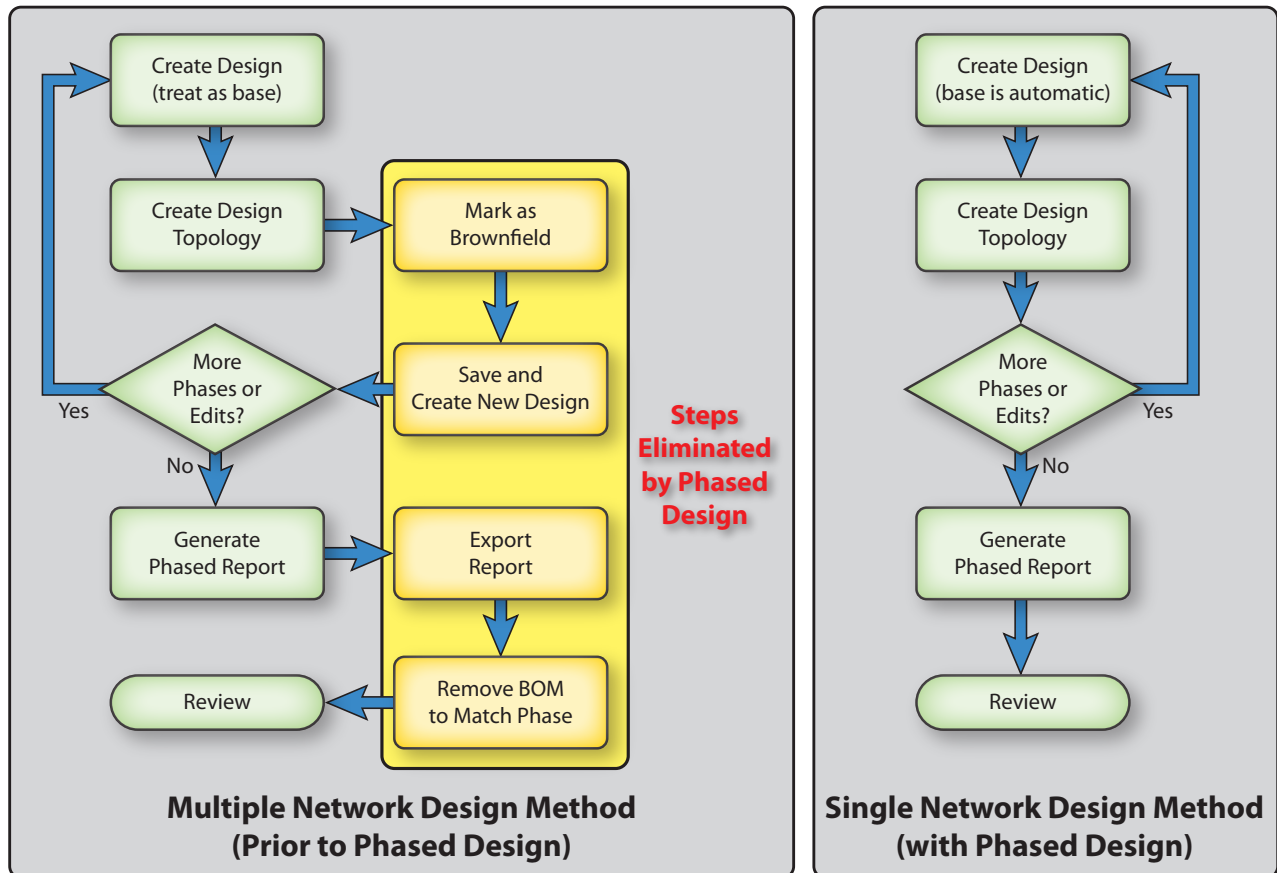
### Site Location by Vertical and Horizontal Coordinates

The ability to view site location by vertical and horizontal coordinates offers increased design flexibility and accuracy by maintaining topologies for imported designs as well as previously supported exported designs. This feature also enables you to import designs from Excel and maintain site locations in the topology view.

	C	D	E	AP	AQ	AR	AS
1	Site Name	Site Type	Requested S	V Coordinate	H Coordinate	X Coordinate	Y Coordinate
2	Site 1	OADM	OADM	10	110	36.0	314.0
3	Site 2	OADM	OADM	105	115	305.0	319.0
4	Site 3	OADM	OADM	225	5	422.0	119.0
5							



## Eliminate Manual Design Steps



### Phased Design

The single network design method provides efficient, reliable, and accurate designs, BOMs, and reports for tracking equipment changes and network reachability associated with phased designs. This approach eliminates redundant manual steps when designing a network and incorporating changes over time.

Single network design is possible with the phased design feature. The phased design feature tracks network design revisions, additions or deletions per phase. Each phase is represented by name and date. Summaries are tracked automatically, ensuring efficient, reliable, and accurate network designs. The information associated with a phase is incorporated into generated reports and detailed in exported reports including bill of material, sites, spans and subnetworks.



# NETSMART 2000 Design and Planning Tool

## Cut Network Auditing Time

### Audit Management for Fast, Accurate Design Verification

In comparison to manual methods, the NETSMART 2000 Audit Management feature\* cuts network auditing time by 50%. The audit management feature provides an actual equipment review against the planned network design, centralizes the data storage, and speeds up the process of verifying equipment selection and network placement. Used in conjunction with the NETSMART 1500 Management System, operations and planning personnel can review the state of the network remotely. The audit management feature accurately compares inventory with proposed network equipment changes and enables discrepancies to be identified without the need for site visits. The audit management tool also increases equipment lifespan by confirming that deployed and planned fiber characteristics are within a comparable range of designated values.

### Key Audit Management Capabilities

For a site or subnetwork, an audit is conducted by importing data generated from a NETSMART 1500 report and correlating site names to the TIDs in the inventory report, either manually or using a global mapping file. Once the sites are mapped, an audit of the network is executed by selecting the Audit icon from the toolbar. A report is generated detailing discrepancies for the following items:

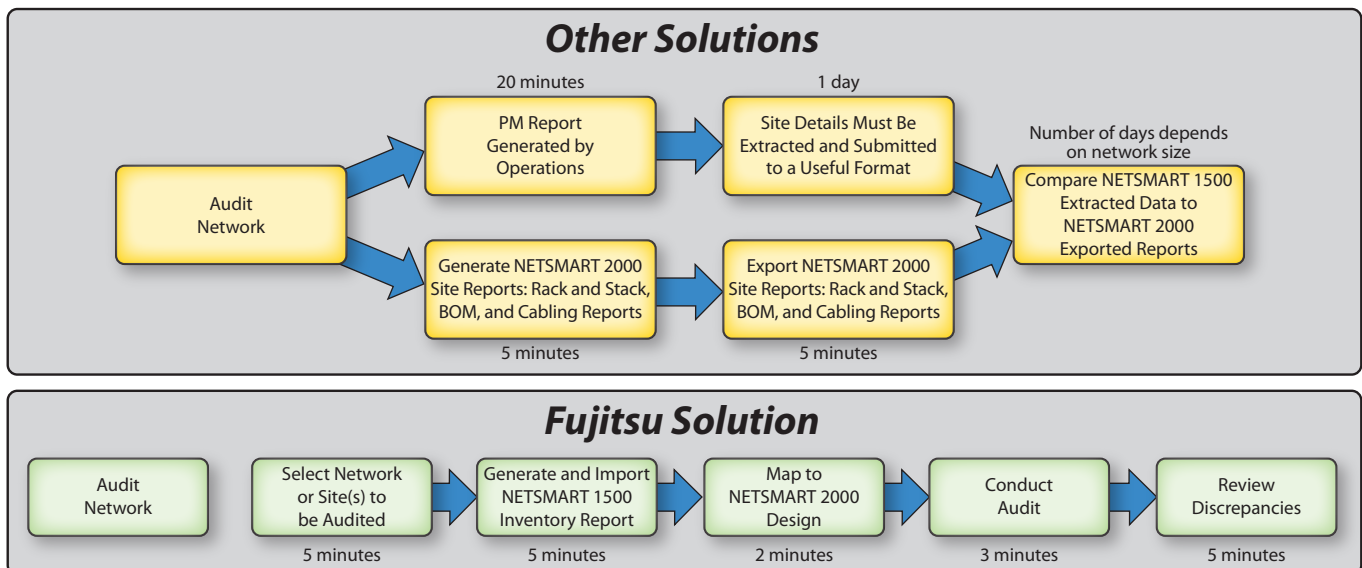
- Site
- Shelf
- Amplifier
- Common
- DCM
- Line card
- SFPs
- Fiber connection
- Fiber characteristics

The audit management feature provides objective validation of network deployment. With other vendors' auditing systems or services, subjective reports are gathered manually, a time-consuming and error-prone process. The NETSMART 2000 Design and Planning Tool offers an economical, accurate, time-sensitive method.

The automatic polling interface for the audit management feature uses federation creation provided to aid in communication to the NETSMART 1500 server. There is an online mode for automated edits and an offline mode for setup and manual edits. The interface reduces setup time to execute an audit by automatically scheduling audits, eliminating manual intervention.

\* The Audit Management feature is optional and must be purchased separately from the latest NETSMART 2000 software release. It is only available on a server-based deployment of the NETSMART 2000 system.

### Audit management cuts network auditing time





# NETSMART 2000 Design and Planning Tool

## Speed Up Equipment Installation

### Efficient Reporting and On-Demand Rack Face Drawings

The NETSMART 2000 system provides the most comprehensive reporting available on the market for a service provider-controlled network design tool. These reports allow personnel to quickly evaluate network designs:

- Performance and cabling reports deliver accurate information for quick troubleshooting of network errors with optical performance characteristics.
- Rack face drawings reduce the time needed to engineer and install a site, and consequently speed up time to market for new service offerings.

These printable reports and drawings are generated in just a few seconds, with critical network information presented in an easy-to-review graphical format. The NETSMART 2000 system replaces numerous tedious, time-consuming tasks with a single reporting menu.

### Installation, Troubleshooting and Turn-Up in Less Time

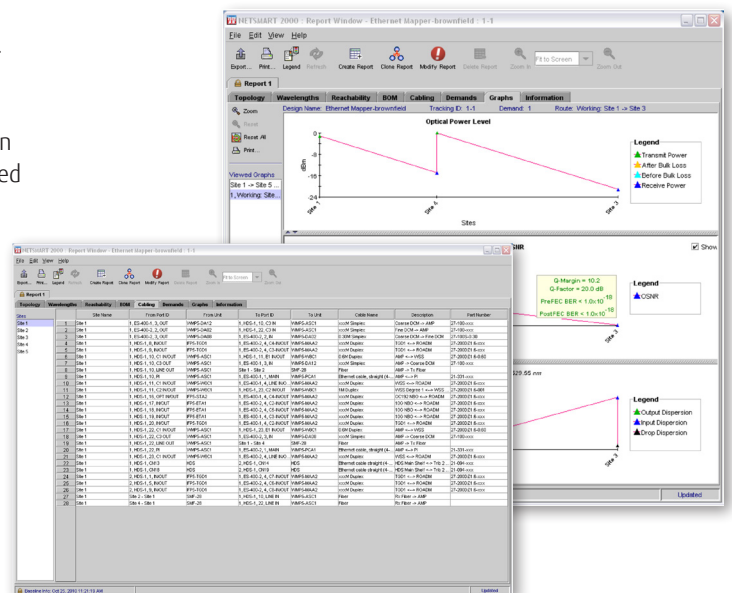
NETSMART 2000 reports are particularly useful for operations and planning personnel who need to improve troubleshooting accuracy by improving access to information about the network. The NETSMART 2000 performance reporting features are also particularly useful for installers and turn-up technicians when activating a site.

Manually creating a rack face drawing is very labor-intensive process and requires in-depth knowledge of equipment. The drawing may need to be separately acquired from a specific department or group. With NETSMART 2000, users can create customizable rack configuration designs which match their network standards, significantly decreasing the time required to configure the expansion racks. Users can also align OADM equipment and fibers with deployed networks to document “as built” states. NETSMART 2000 reporting features also speed up the process of creating demand reports detailing equipment for sites and demands. This includes information about slot placement, and characteristics such as protection schemes, latency values, demand endpoints and intermediate sites. Optical performance reports provide accurate information about metrics such as Optical Signal-to-Noise Ratio (OSNR) and power levels. This speeds up testing and troubleshooting times. Cabling reports list each individual cable together with information about the end units and port connections.

### NETSMART 2000 Performance Reports

- **Cabling** – Reduces the time needed to produce an installation plan by providing complete information about network needs
- **Channel plan** – A graphical representation of the channels in use on each segment of a subnetwork
- **Demands** – Comprehensive information including add/drop endpoints, signal rate, protection for client and network, equipment selection and wavelength, attached sub-rates for staged demands, equipment shelf and slot location, and working path latency
- **Network reachability** – A graphical representation of viable paths from node to node in a subnetwork, with details about supported line rates and failed lightpaths
- **Optical graphs** – Graphical representations of power levels for a subnetwork, showing both transmit and receive power (dBm) for each site of a subnetwork, in addition to optical power levels (dBm), OSNR level (dB), and chromatic dispersion (ps/nm)
- **Rack and shelf illustrations** – Graphical shelf illustrations showing unit placement
- **Models and PIDs** – Enables site-level BOMs to be formatted to match specified models and exported to Excel. The report details equipment for a site at the rack, shelf, and card level. This report requires the purchase of the Models and PIDs optional feature.

### Detailed performance reports





**Network Reachability Reporting Determines Optimal Network Pathways**

Network reachability and Network Reachability Matrix\* reduce the cost of network deployment by identifying and selecting the lowest cost paths for 10, 40 and 100 Gbps wavelengths at designated FEC rates. The feature enables service providers to evaluate optimized routes in ring, linear, and mesh networks. Reachability matrix reviews the viability of every possible route and documents the viable paths. Reachability provides data that can be displayed on demand for any selected path, segment or subnetwork, and reachability matrix is able to review the entire network.

**Unique Demand-Planning Capabilities**

Network reachability has high value for managing large networks in determining the most effective route for a particular demand. Reachability matrix is the only demand planning feature on the market that automates the process of reviewing network traffic from subnetwork to subnetwork. Without the NETSMART 2000 system, this critical demand planning process is manual, extremely time-consuming, and carries a high error margin. In comparison, network reachability decreases the effort required to review traffic for demand planning activities by up to 50%.

**Least-Cost Design and Price-List Management Features**

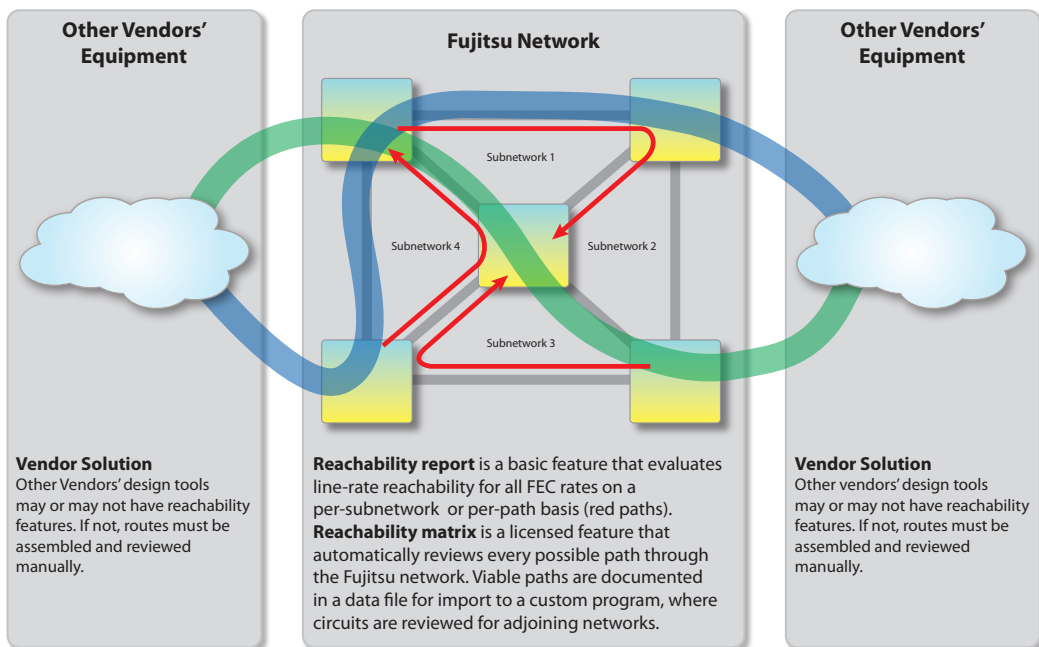
The least-cost design and price-list management features decrease the total cost of ownership of a new network design and increase the accuracy and cost-effectiveness of the budgeting process by:

- Simplifying the network design selection process by verifying that the desired network design represents the lowest possible total cost of ownership
- Increasing the accuracy of budgetary processes with the ability to remove obsolete price lists

The network reachability scheduler feature increases scheduling flexibility. Reporting activities can be scheduled at any time during the day, even after normal business hours or holidays.

\* The Network Reachability Matrix feature, which provides data for all subnetworks and paths, is an optional feature and must be purchased separately from the latest NETSMART 2000 software release. It is only available on a server-based deployment of the NETSMART 2000 system. Standard network reachability reporting only applies to a selected path or subnetwork.

**Network Reachability report and Network Reachability Matrix reduce deployment costs**



# NETSMART 2000 Design and Planning Tool

## Deploy Networks in Alignment with Design

### Custom Profile Improves Organization and Recordkeeping

The Custom Profile feature\* allows service providers to organize and constrain possible line card and interface module selections for use in network designs. Custom profiles can save service providers thousands of dollars each year by reducing the variety of hardware needed for the network and consequently streamlining the range of needed spare parts. The feature reduces the variety of card types and reduces manpower needed to properly manage inventory. Line cards are selectable using parameters such as OSMINE compliance, card type, pricing and SFP types. Custom profile also allows users to designate card placement in a shelf. Designers can align card deployment with company standards. The feature also aids in realigning network designs with deployed networks, resulting in an increase in the accuracy of equipment management.

In addition to line card filtering and line card placement, it is possible to adjust cable length in the BoM generated in the NETSMART 2000 reports. The result is accurate cable selection for a site by providing parts that align with established customer standards.

Core card override, a custom profile v5 enhancement, enhances user configuration usability and increases accuracy of field deployments. This function allows user to align field deployment with planned designed (even after the fact). Core cards include lambda access modules, switch fabrics, PE mappers, dispersion compensation modules, sync cards, and single channel amplifiers

*\* The Custom Profile feature is optional and must be purchased separately from the latest NETSMART 2000 software release. It is only available on a server-based deployment of the NETSMART 2000 system.*

### Wavelength Recoloring Speeds Up Demand Routing

The process of identifying new wavelength paths has historically been performed manually by network engineers. This is particularly labor-intensive when routing wavelengths through several subnetworks, increasing the likelihood of error. The menu-driven wavelength recoloring feature automatically reviews wavelength paths, saving time and increasing the accuracy with which subnetwork capacity can be reviewed. The feature eliminates the need to manually track available wavelengths from subnetwork to subnetwork when evaluating network capacity and adding demands.

### Brownfield Support Reduces Error Potential

Brownfield support improves accuracy and reduces the potential for error when designing new subnetwork deployments or adding demands to an existing deployment. The brownfield feature assists in the process of preplanning and predesigning networks prior to deployment. A revision of the network design can be locked down, limiting impact to existing traffic. Brownfield support ensures that networks are deployed to the intended design and configuration. The feature also:

- Prevents equipment re-selection in revised designs by locking unit selections and placement of the original network design
- Minimizes impact to the original design for the life of the network through extensive review of incremental changes
- Provides clear and detailed information about the equipment needed to support new demands and subnetworks
- Provides flexibility by allowing sites, spans, and subnetworks to revert to greenfield state for either site upgrades, site additions, or fiber modification
- Provides flexibility by permitting wavelength number change for brownfield demands
- Aligns degree to fiber and amplifier feature to synchronize network design with deployed equipment
- Increases design convenience and usability by the ability to revert a demand to greenfield and change a bypass site to an ILA or ROADM site

Brownfield support enables new subnetworks and demands to be tracked in an incremental BoM. The incremental BoM tracks additions and deletions that result from revised design. Brownfield support also enables phased design approaches. Overall, brownfield support reduces the risk and manual labor associated with new network implementations and changes.

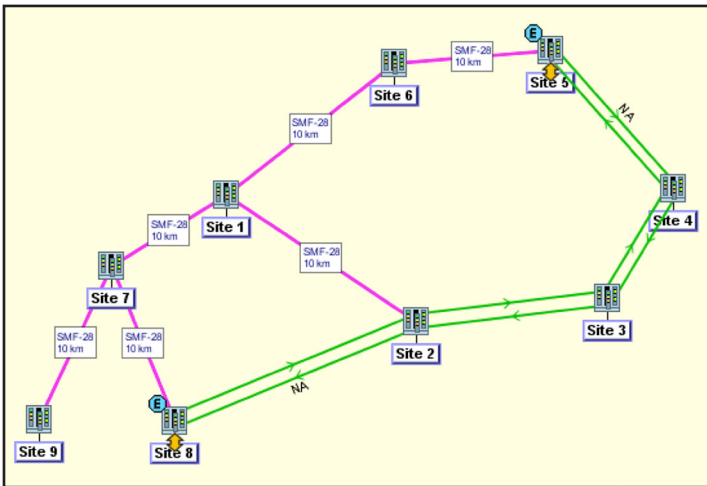


# NETSMART 2000 Design and Planning Tool

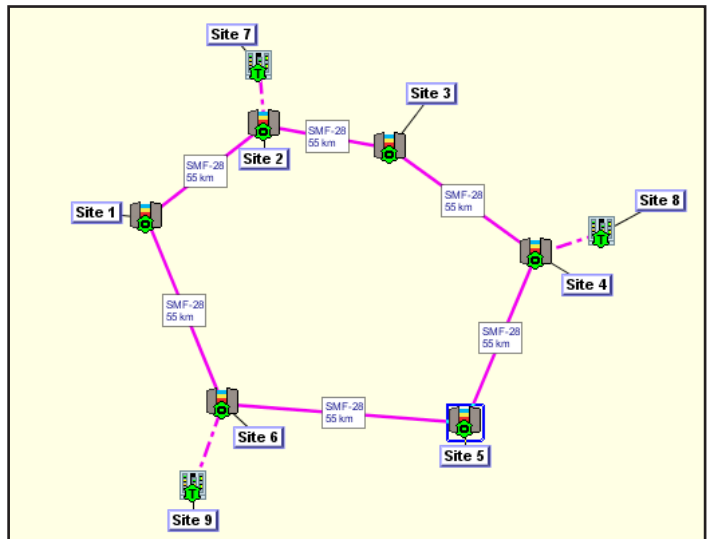
## FLASHWAVE 7500 and FLASHWAVE 9500 Platform Support

### FLASHWAVE 7500 Extension Shelf Support

NETSMART 2000 supports the FLASHWAVE 7500 Extension Shelf for standalone non-ROADM service applications. The software supports topologies created solely with 7500 Extension shelves for transport of services from remote locations to the core, or to other remote locations. The feature delivers high-capacity services to the customer premises where OADM infrastructure is not needed. The software reduces operational expenses by consolidating the complete DWDM infrastructure, from the customer to the network core, onto a unified platform. SAS topologies are limited to the 23" shelf over SMF fiber.



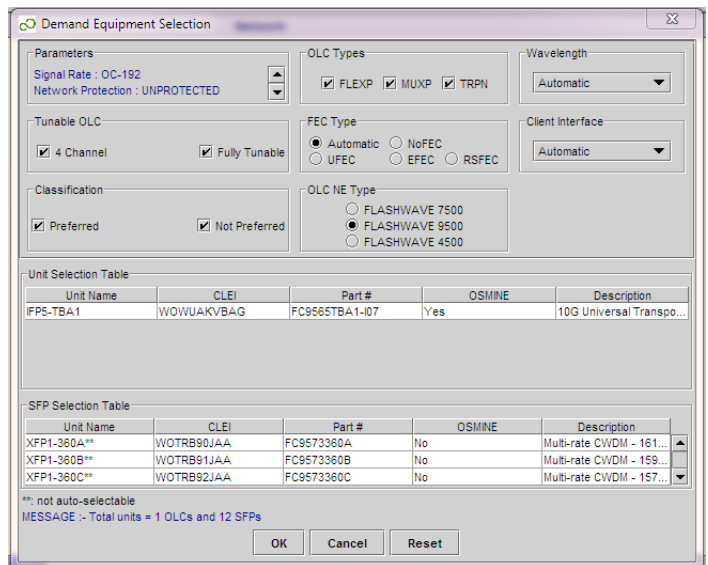
Remote SAS topology



FLASHWAVE 9500 trib site for integration to FLASHWAVE 7500 network

### Platform Integration of FLASHWAVE 9500 and FLASHWAVE 7500 Systems

The NETSMART 2000 system now includes support for FLASHWAVE 9500 optical line cards with FLASHWAVE 7500-designed networks. This capability facilitates easier transition to the FLASHWAVE 9500 platform, while maintaining deployed FLASHWAVE 7500 systems. The feature is available when a demand is created. It is possible to choose FLASHWAVE 9500 optical line cards in the Equipment Selection menu when creating new demands. FLASHWAVE 9500 optical line cards are reflected in the BoM.



FLASHWAVE 9500 platform integration

# NETSMART 2000

## Design and Planning Tool

### Summary of Supported Systems and Requirements

Microsoft Windows standalone	<ul style="list-style-type: none"> <li>• Pentium Processor 2 GHz or greater</li> <li>• 400 MB free disk space minimum</li> <li>• 16-bit sound card</li> <li>• 32 bit, 32 MB video RAM recommended</li> <li>• Monitor with 1024 x 768 resolution or better</li> <li>• 10/100 Ethernet card</li> <li>• Microsoft Windows XP Professional SP3 or Windows 7</li> <li>• DVD-ROM drive</li> </ul>
Microsoft Windows client	<ul style="list-style-type: none"> <li>• Intel Pentium IV 2.0 GHz or faster processor</li> <li>• RAM requirements: <ul style="list-style-type: none"> <li>• Windows 7: 3 GB RAM minimum</li> </ul> </li> <li>• 400 MB free disk space minimum</li> <li>• 32-bit, 32 MB video RAM recommended</li> <li>• DVD-ROM drive</li> <li>• Monitor with 1024 x 768 resolution or better</li> <li>• 10/100 Ethernet card</li> <li>• Microsoft Windows 7</li> </ul>
Linux OS server	<ul style="list-style-type: none"> <li>• IBM X3550 M3 server</li> <li>• Six-core X3 GHz CPU</li> <li>• 36 GB RAM</li> <li>• DVD-ROM drive</li> <li>• 292 GB total storage</li> <li>• (2) 100Base-T ports</li> <li>• Red Hat Enterprise Linux release 6.1</li> </ul>
Virtual Server Environment	<ul style="list-style-type: none"> <li>• KVM Linux VSE software</li> <li>• VMWare™-certified software</li> </ul>



#### Fujitsu Network Communications Inc.

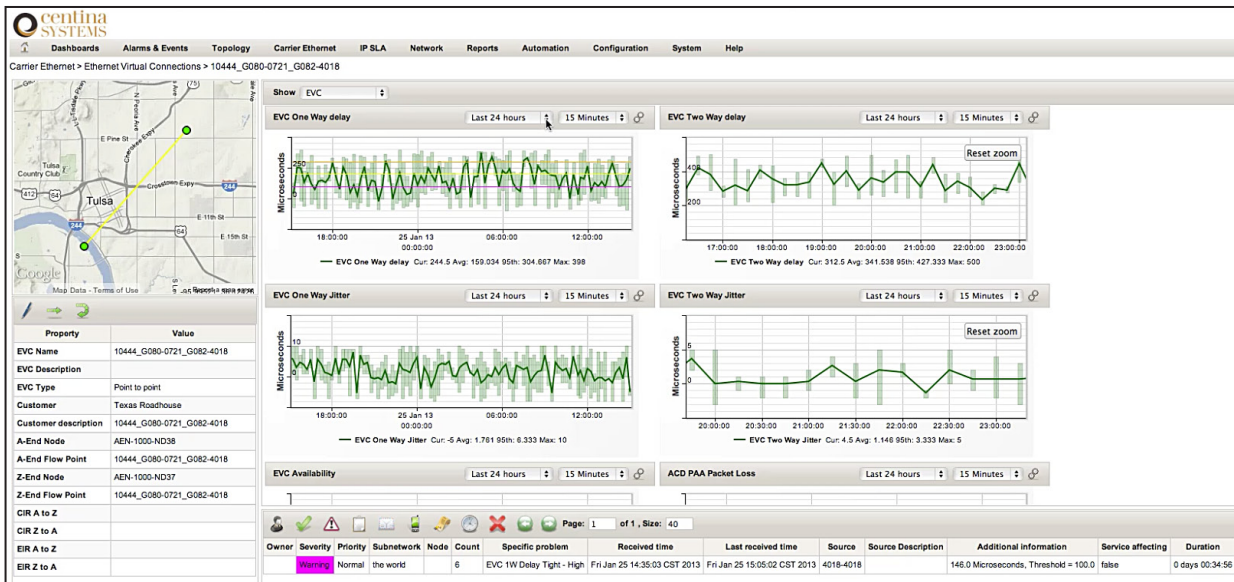
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shaping tomorrow with you

# NetOmnia™



*Comprehensive Ethernet assurance performance and SLA management*



## End-to-End, MEF-Compliant Service Assurance

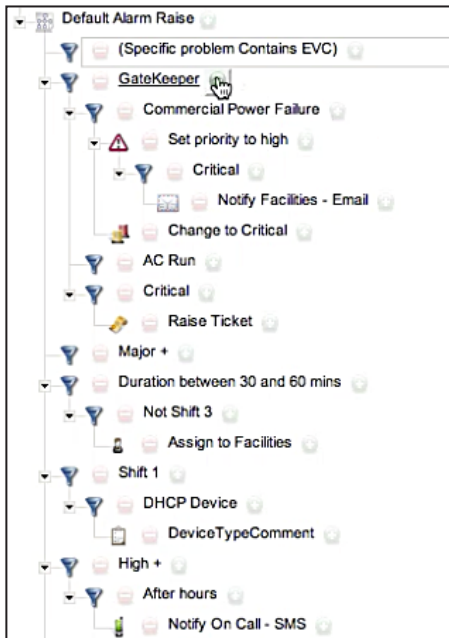
A key challenge of delivering Ethernet services is the time-consuming task of network monitoring. Many key metrics must be accurately measured to assess the performance of an entire, often multivendor, network. The lack of a single, unified management system further complicates this challenge, as operators must work with multiple management systems: an inefficient, time consuming, and costly overhead. Gathering data to support accurate and effective performance measurement across an entire Ethernet network is, therefore, often a best-effort project involving a substantial amount of manual work.

In addition, end customers and subscribers often want to know how well the service provider is executing on Service-Level Agreements (SLAs). Providing real-time and accurate reports for SLA management is difficult to produce on a continuous basis; an error here can result in lost revenue, not to mention lost customers.

To address these challenges, Fujitsu is offering NetOmnia™, a comprehensive Ethernet Assurance Performance and SLA management system providing end-to-end service assurance and service quality management solutions in a multivendor environment.

NetOmnia enables you to achieve three key business objectives:

- Monitor Ethernet-related performance data efficiently in a constantly changing network
- Provide consistent-looking, meaningful performance and SLA management information to stakeholders
- Reduce or eliminate instances and impact of customer SLA violations



**NetOmnia's Workflow Automation empowers users to create automations and notifications based on performance criteria**

### Next-Generation Visualization to Improve Network Performance

NetOmnia Ethernet Assurance is a multivendor, MEF-compliant solution that provides end-to-end visualization and monitoring of Ethernet services to ensure and improve customer experience. With off-the-shelf, multivendor support, NetOmnia can be deployed and configured quickly to discover Ethernet services and begin monitoring and reporting on the health and status of customer services.

NetOmnia provides configurable monitoring and visualization of service quality metrics such as availability, delay, jitter, and frame loss, as well as the ability to create and monitor custom-defined metrics.

**NetOmnia helps you offer profitable carrier-class Ethernet services**

### Deliver Better Service, Increase Revenue, Reduce Costs

NetOmnia SLA Manager, an optional overlay, enables service providers to easily define, track and report on contractual SLAs. NetOmnia can seamlessly monitor the operational performance of customer services to show the impact of network degradation and service outages on per-contract corporate SLAs.

With NetOmnia, technicians can define SLAs based on service quality and service availability. It is also possible to define the conformance period and configurable levels for warning and violation notifications. SLA reports can be delivered to customers on a scheduled basis to provide differentiated service to improve customer retention.

In contrast to solutions that merely provide monthly SLA reports, NetOmnia provides real time reports on SLA compliance and predicts SLA violations based on current trends. Reports can be scheduled and automatically delivered to both users and end customers.



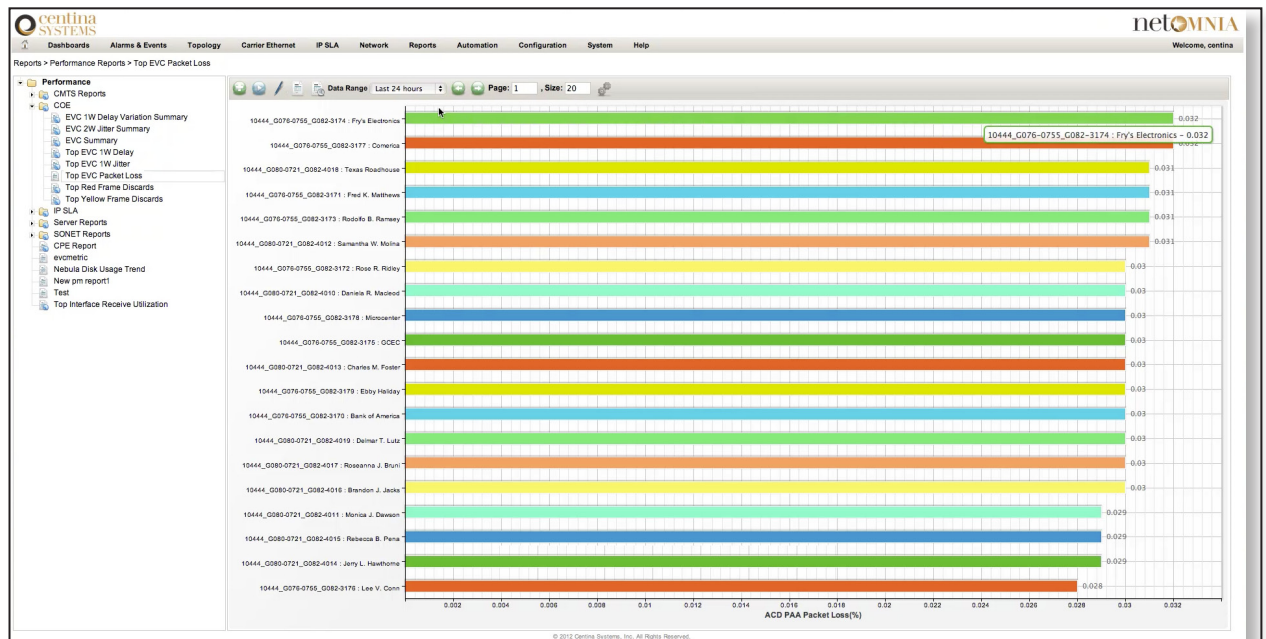
# NetOmnia Helps you Focus on Your Core Business

## Innovative Performance and SLA Management

NetOmnia delivers dramatic innovation that takes network performance and SLA management to the next level with true end-to-end services visibility and ease of use. This system is highly scalable and supports a distributed, high-availability cluster environment. NetOmnia takes advantage of the latest software and hardware technologies to offer you:

- 100% Web 2.0-based architecture requiring no administration
  - Easy integration with existing software systems
  - Simple Web browser-based access—no Java software needed
  - Full compliance with ITU-T Y.1731, IEEE 802.1ag and 802.3ah, and MEF 10.2, 15, and 17 standards
  - Comprehensive discovery, mapping, and monitoring of:
    - Devices and physical ports
    - Logical interfaces, including UNIs
    - Ethernet Virtual Connections
      - Point-to-point
      - Multipoint-to-multipoint
  - Traffic profiles
    - CIR, CBS, EIR, EBS, and color mode
  - Testing and diagnostics
- Customer-centric performance monitoring and SLA management
  - Customer portals available for SLA conformance reports
  - One system to monitor a multivendor hardware environment
  - Support for multiple customer networks without risk of data leakage
  - Customized reporting capabilities including key performance and key quality indicators (KPIs and KQIs)
  - Detailed metrics on key service quality parameters such as availability, delay, jitter, throughput, frame loss ratio, and packet loss
  - Deploys in days and configures in weeks, not months
  - New network devices can be added in just minutes
  - Auto-discovery of EVCs and VLANs provides out-of-box functionality
  - Multivendor support ensures seamless end-to-end service views across vendors

NetOmnia allows users to create and run detailed summary and top-n reports



NetOmnia™

# Multivendor Ethernet Assurance and SLA Management

Building and maintaining a monitoring system typically consumes a large quantity of resources and time; in turn, this impairs a service provider's ability to deliver and maintain revenue-generating services. NetOmnia reduces this burden by freeing network operations staff to focus on core business goals, not on reporting.

## Backed by a Market-Leading Solutions Provider

With NetOmnia, service providers also get the support of Fujitsu, a leading innovator in Connection-Oriented Ethernet and a market leader in packet optical networking solutions. Fujitsu offers a broad portfolio of multivendor network services and wide experience sourcing and selecting the best network technologies available. NetOmnia enables us to offer you a truly vendor agnostic Ethernet service assurance and SLA management solution.

Owner	Severity	Priority	Subnetwork	Node	Count	Specific problem	Received time	Last received time	Source	Source Description	Additional info
Major	Normal	Plano	hercules.rich1.centina.local	1	System Error	Tue Jan 02 15:02:53 CST 2013	Tue Jan 02 15:02:53 CST 2013	ETH-2-1	ETH-2-1	Email sending failed, check SMTP settings	Index = 5, AdminStatus = up(1), OperStatus = down(2), Descr = eqb3, Fty
Critical	High	Plano	spiga.rich1.centina.local	1	LINKDOWN	Tue Jan 02 15:02:53 CST 2013	Tue Jan 02 15:02:53 CST 2013	ETH-2-1	ETH-2-1	Spiga.rich1.centina.local	Spiga.rich1.centina.local (172.30.1.246)
Major	High	ALIN	ALINTX01DM2	1	FRSC ping Application Failure	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ETH-2-1	ETH-2-1	Remote Failure Indication	
Major	High	FRSC	FRSCIX01DM2	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ETH-2-1	ETH-2-1	Remote Failure Indication	
Major	High	MNXY	MNXYTX01DM4	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ETH-2-1	ETH-2-1	Remote Failure Indication	
Major	High	MNXY	MNXYTX01DM3	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ETH-2-1	ETH-2-1	Remote Failure Indication	
Minor	Normal	ALIN	ALINTX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-1	ST33-2-1	Alarm Indication Signal Path	
Minor	Normal	ALIN	ALINTX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-2	ST33-2-2	Alarm Indication Signal Path	
Minor	Normal	ALIN	ALINTX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-3	ST33-2-3	Alarm Indication Signal Path	
Minor	Normal	ALIN	ALINTX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-4	ST33-2-4	Alarm Indication Signal Path	
Major	High	MNXY	MNXYTX01DM1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ETH-2-1	ETH-2-1	Remote Failure Indication	
Major	High	FRSC	FRSCIX01DM1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ETH-2-1	ETH-2-1	Remote Failure Indication	
Major	High	MNXY	MNXYTX01DM2	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ETH-2-1	ETH-2-1	Remote Failure Indication	
Critical	High	PLNO	PLNOTX01DM1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	OC4x-2	OC4x-2	Loss Of Signal	
Minor	Normal	PLNO	PLNOTX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-13	ST33-2-13	Alarm Indication Signal Path	
Minor	Normal	PLNO	PLNOTX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-14	ST33-2-14	Alarm Indication Signal Path	
Minor	Normal	PLNO	PLNOTX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-15	ST33-2-15	Alarm Indication Signal Path	
Minor	Normal	PLNO	PLNOTX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-16	ST33-2-16	Alarm Indication Signal Path	
Major	High	FRSC	FRSCIX01DM3	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ETH-2-1	ETH-2-1	Remote Failure Indication	
Minor	Normal	MNXY	MNXYTX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-5	ST33-2-5	PDP TEST	Alarm Indication Signal Path
Minor	Normal	MNXY	MNXYTX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-6	ST33-2-6	Alarm Indication Signal Path	
Minor	Normal	MNXY	MNXYTX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-7	ST33-2-7	Alarm Indication Signal Path	
Minor	Normal	MNXY	MNXYTX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-8	ST33-2-8	Alarm Indication Signal Path	
Major	High	FRSC	FRSCIX01DM4	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ETH-2-1	ETH-2-1	Remote Failure Indication	
Major	High	ALIN	ALINTX01DM3	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ETH-2-1	ETH-2-1	Remote Failure Indication	
Major	High	ALIN	ALINTX01DM4	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ETH-2-1	ETH-2-1	Remote Failure Indication	
Critical	High	FRSC	FRSCIX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	OC4x-5	OC4x-5	Loss Of Signal	
Minor	Normal	FRSC	FRSCIX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-9	ST33-2-9	Alarm Indication Signal Path	
Minor	Normal	FRSC	FRSCIX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-10	ST33-2-10	Alarm Indication Signal Path	
Minor	Normal	FRSC	FRSCIX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-11	ST33-2-11	Alarm Indication Signal Path	
Minor	Normal	FRSC	FRSCIX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-2-12	ST33-2-12	Alarm Indication Signal Path	
Minor	Normal	RCDN	RCDNIX01OA1	1	false	Wed Jan 02 15:02:54 CST 2013	Wed Jan 02 15:02:54 CST 2013	ST33-3-1	ST33-3-1	Alarm Indication Signal Path	
Minor	Normal	RCDN	RCDNIX01OA1	1	false	Wed Jan 02 15:02:54 CST 2013	Wed Jan 02 15:02:54 CST 2013	ST33-3-2	ST33-3-2	Alarm Indication Signal Path	
Minor	Normal	RCDN	RCDNIX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-3-3	ST33-3-3	Alarm Indication Signal Path	
Minor	Normal	RCDN	RCDNIX01OA1	1	false	Wed Jan 02 15:02:53 CST 2013	Wed Jan 02 15:02:53 CST 2013	ST33-3-4	ST33-3-4	Alarm Indication Signal Path	
Minor	Normal	RCDN	RCDNIX01OA1	1	false	Wed Jan 02 15:02:54 CST 2013	Wed Jan 02 15:02:54 CST 2013	ST33-3-5	ST33-3-5	Alarm Indication Signal Path	
Minor	Normal	RCDN	RCDNIX01OA1	1	false	Wed Jan 02 15:02:54 CST 2013	Wed Jan 02 15:02:54 CST 2013	ST33-3-6	ST33-3-6	Alarm Indication Signal Path	
Minor	Normal	RCDN	RCDNIX01OA1	1	false	Wed Jan 02 15:02:54 CST 2013	Wed Jan 02 15:02:54 CST 2013	ST33-3-7	ST33-3-7	Alarm Indication Signal Path	

NetOmnia consolidates, filters and correlates alarms across the entire network



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1.0/04.13



# **Sample Innovative Solutions Integration Services (ISIS) Description**

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# ISIS Services Description

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# ISIS Services Description

## 1 INTRODUCTION

### 1.1 Fujitsu Innovative Solutions Integration Services

The Fujitsu Innovative Solutions Integration Services (ISIS) organization provides customers with a suite of services to address business challenges related to defining, implementing and deploying OSS solutions. The ISIS team provides expertise in OSS to EMS adapter development, custom application development, lab verification services, as well as business consulting. The following diagram provides a high level view of our areas of expertise (green boxes).

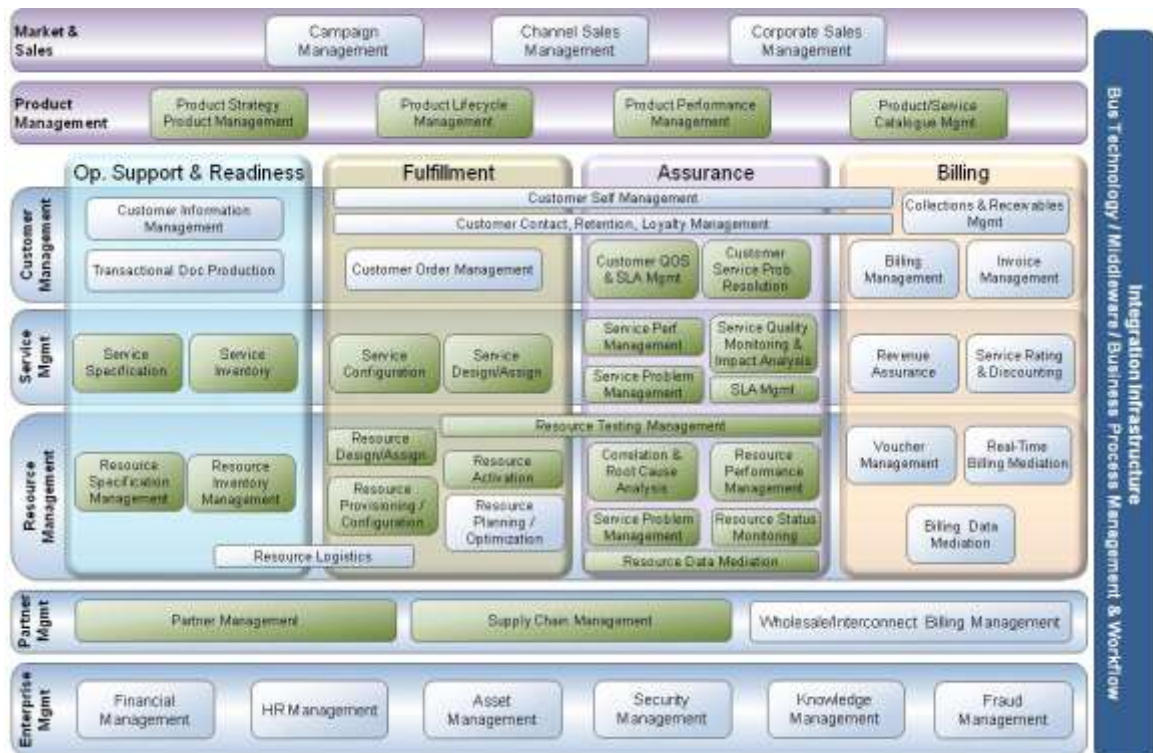


Figure 1: Areas of expertise

### 1.2 Project Scope

#### 1.2.1 Mission Statement

This ISIS Services Description document serves to detail The State of Utah and Fujitsu roles, tasks, dependencies, and activities required for Fujitsu to complete the OSS Integration and Lab Services project. This document is a template that will be filled in with details as requirements with The State of Utah of Utah are defined.

Fujitsu’s global experience with the design, business processes, and integration services will be leveraged for delivery of the services contained in this project. Fujitsu’s resources who will be

## ISIS Services Description

delivering the services will leverage their expertise to provide The State of Utah with a best-of-class service offering.

This document, along with the information contained in the appendices, is only subject to change based on mutual agreement between The State of Utah and Fujitsu through the Change Control Procedure contained in Section 12.

The Parties agree that commercial terms for this project, including pricing and invoicing milestones for Fujitsu's expanded role as the OSS Integration and Lab Services Provider, are not finalized.

This document will serve to define the detailed requirements of the project and to help develop a detailed SOW.

### 1.2.2 References to End-to-End Integration

The scope of Fujitsu's role as a systems integrator is defined within the shaded area of Figure 2: Project Scope and covers «Subsystem Location\_A», «Subsystem Location\_B», and «Subsystem Location\_C». «Out\_of\_Scope\_Project\_List» is considered as separate project related to, but outside the scope of, this ISIS Services Description; these items are instead the responsibility of The State of Utah of Utah of Utah Program Integration Office and will be managed through The State of Utah of Utah of Utah's Master Project Plan.

The terms Edge-to-Edge and End-to-End are used throughout this ISIS Services Description. For clarification the definitions of each term are as noted below and illustrated in Figure 2: Project Scope.

**Edge-to-Edge:** The network equipment/components and associated EMSs (such as DSLAMs, Routers, and Aggregators).

**End-to-End:** A term used to describe the entire «Solution» system from [*Note: define to two elements that are located at both end of the system*].

## To Be Defined

Figure 2: Project Scope

### 1.3 High-Level Release Plan

This section summarized the high-level release plan for the products and services being provided by this project. This includes:

- Software development (including OSS adapters, customer development, maintenance releases, etc.)
- Lab verification services

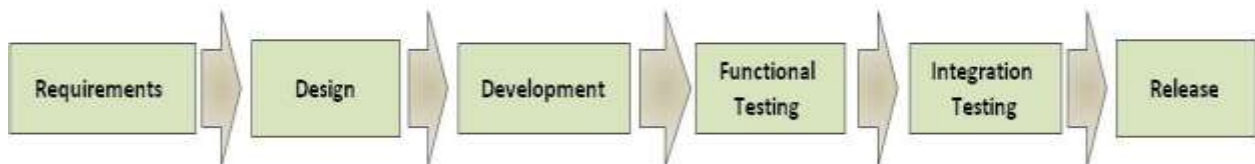


Figure 3: High-Level Release Plan

## ISIS Services Description

---

### 1.3.1 Software Development

Software development will be broken into the following phases as outlines in Figure 3: High-Level Release Plan:

#### Requirements Development

Fujitsu development team will work with The State of Utah personel to come to an agreed upon list of requirements for the adapter functionality. Once requirements are agreed to, a document will be written capturing the requirements for sign off by the customer.

#### API Design & Development

Once requirements are approved, development of the OSS adapter is performed by the Fujitsu development team following Fujitsu development practices.

#### Functional Testing

The development team will complete all functional testing prior to final integration testing. The functional testing will cover all agreed to requirements identified at the beginning of the project.

#### Integration Testing

Once the development team has completed the adapter development and functional testing, the adapter(s) are then put through an integration testing cycle. This is the final test prior to delivery to the customer.

#### Release

Once development and test is completed, the adapters are formally released to customers for deployment.

### 1.3.2 Lab Verification Services

#### Requirements Development

Fujitsu development team will work with The State of Utah personel to come to an agreed upon list of requirements for the lab verification services. Once requirements are agreed to, a document will be written capturing the requirements for sign off by the customer.

#### Test Case Development

Once requirements are approved, test cases will be developed to fully test all capabilities defined in the requirements. The test cases will be reviewed with the customer.

#### Lab Setup

Once the full scope of the verification testing has been established, any modifications to the lab will be implemented to meet the testing requirements.

#### Verification Testing

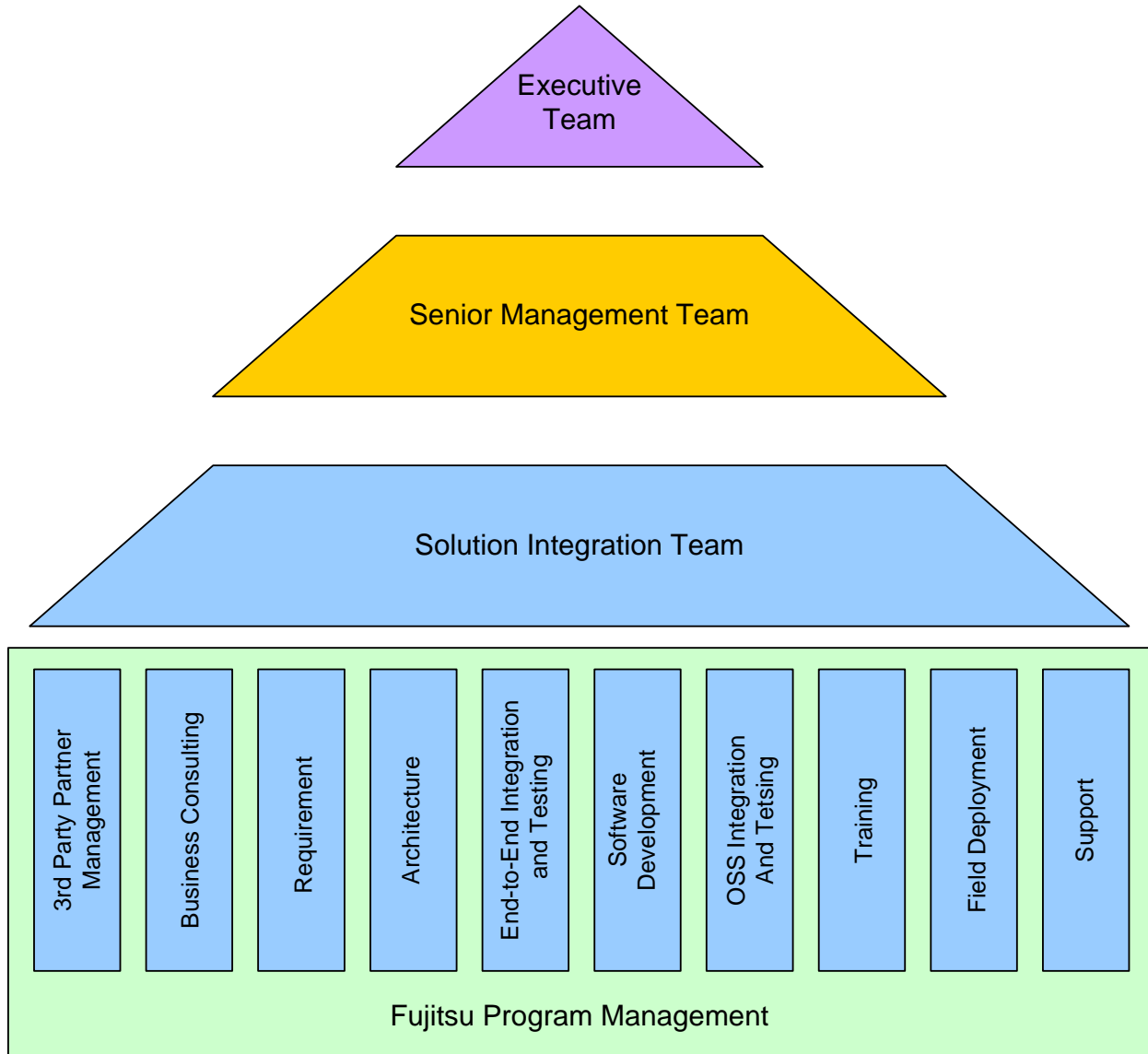
Once the lab has been configured to the agreed upon specifications, the verification team will execute the test suite, capturing results for each test.

# ISIS Services Description

## Release

When the verification test has been completed, a full report on the test case execution and results will be presented to the customer.

## 1.4 Levels of Program Execution



## ISIS Services Description

---

### Executive Team

Purpose: Communication status and assistance communicating strategic direction, and resolving critical issues with internal/external teams. Supports the project as the key stakeholders.

Meeting Frequency: Monthly or as needed

The State of Utah Chair: [Name]

Fujitsu Chair: [Name]

### Senior Management Team

Purpose: Provide oversight and ensure resolution and execution of key operational issues in a timely manner. Provides functional team member assignments to support the success of the project.

Meeting Frequency: Bi-weekly

The State of Utah Chair: [Name]

Fujitsu Chair: [Name]

### Solution Integration Team

Purpose: The Solution Integration Team is the overall management team responsible for cross-functional status, change control, timeline management, and risk management.

- Ensure overall program readiness
- Identify and manage program deliverables to ensure on-time implementation of integrated solutions
- Provide timeline, status, issue, and jeopardy communication to Senior Management team and Executive team; it is the expectation that Fujitsu Program Management lead weekly discussions with the The State of Utah Program Management lead; the Program Management Leads will schedule a weekly meeting with all Fujitsu and The State of Utah core team leads to review project plans, defects, risk mitigation plans, etc. that are discovered during the project execution.
- Fujitsu will host an internal engagement call with the core team to educate the Fujitsu team on the deliverables and scope of the OSS Integration and Lab Services project
- Joint engagement kick-off meeting with the The State of Utah and Fujitsu team; objective of this call is:
  - Introduction of team members
  - Further define roles and responsibilities of each team
  - Review project schedule
  - Review upcoming key deliverables for each team

Meeting Frequency: Weekly

The State of Utah Chair: [Name]

Fujitsu Chair: [Name]

# ISIS Services Description

SUB TEAMS	The State of Utah LEADS	FUJITSU LEADS
Program Management		
Third-Party Management		
Requirements		
Architecture and Design		
Software Development		
OSS System Integration, Implementation, and Test		
Post-Deployment Support		

## 1.5 Fujitsu/The State of Utah Program Structure

The State of Utah and Fujitsu team list and structure contained in this section are dynamic and will continue to change throughout the program. The list included in this section is a snapshot.

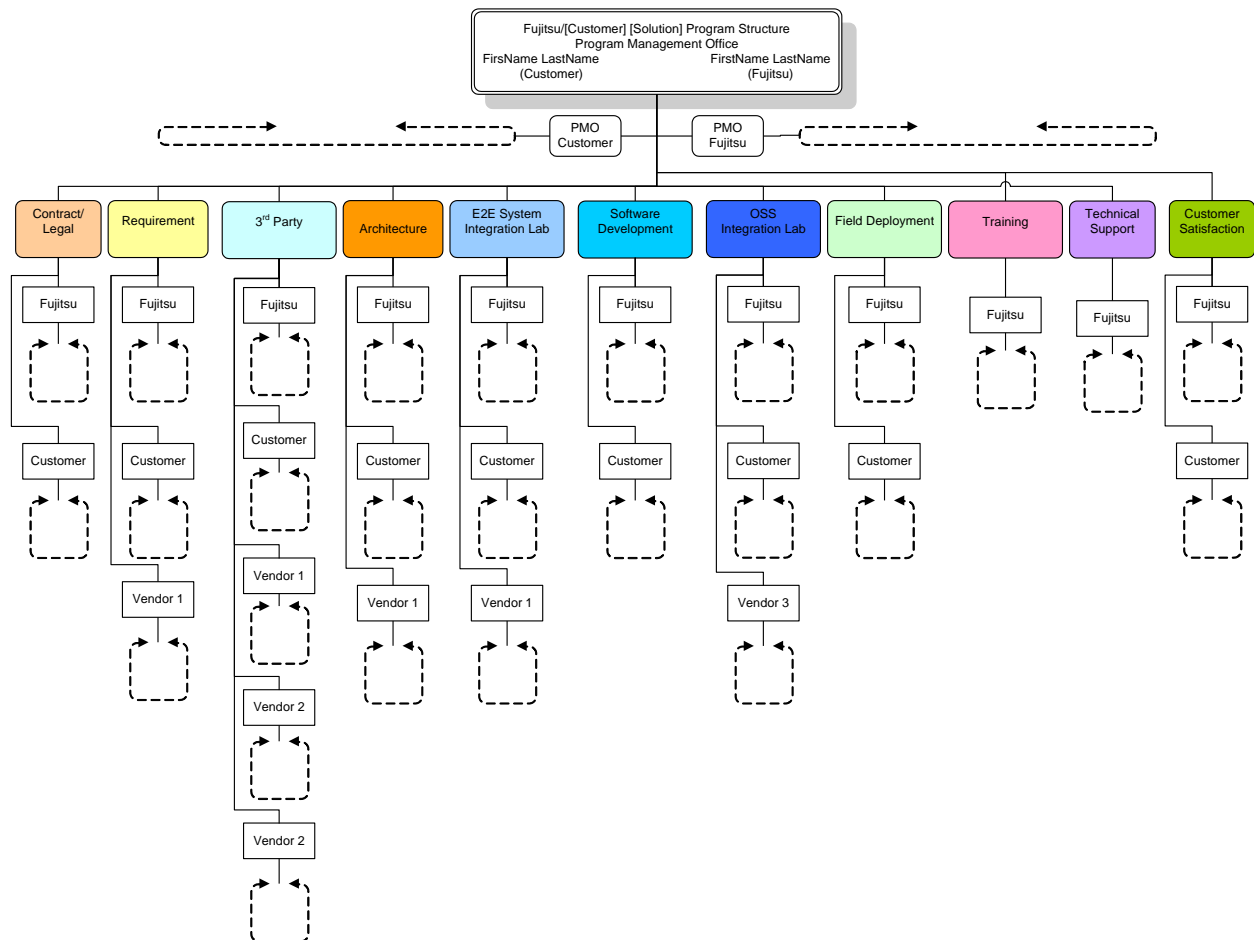


Figure 4: Program Structure

## ISIS Services Description

### 1.6 Fujitsu/The State of Utah OSS Integration and Lab Services Project Contacts

The State of Utah and Fujitsu team lists and structures contained in this section are dynamic and may continue to change throughout the program. The lists included in this section are a snapshot based on the structure in place at the effective date of the project.

#### 1.6.1 The State of Utah Project Team Contact Details

NAME	ROLE	PHONE	E-MAIL
LastName, FirstName		xxx-xxx-xxx	FirstName.LastName@customer.com
LastName, FirstName		xxx-xxx-xxx	FirstName.LastName@customer.com
LastName, FirstName		xxx-xxx-xxx	FirstName.LastName@customer.com

#### 1.6.2 Fujitsu Project Team Contact Details

NAME	ROLE	PHONE	E-MAIL
LastName, FirstName		xxx-xxx-xxx	FirstName.LastName@Fujitsu.com
LastName, FirstName		xxx-xxx-xxx	FirstName.LastName@Fujitsu.com
LastName, FirstName		xxx-xxx-xxx	FirstName.LastName@Fujitsu.com

### 1.7 Escalation Process

As detailed in Section 1.6, Fujitsu and The State of Utah have formed several joint teams that, among other activities, are forums for both Parties to facilitate coordination and resolution of activities and/or issues. It is through these joint teams that The State of Utah and Fujitsu formally first learn of potential issues surrounding the program.

Issues that cannot be resolved within each team should be escalated to the team lead for prompt resolution. Any issues that cannot be resolved through the Team Meeting should be presented to the Program Management Leads for resolution, and further escalation shall follow the Program structure contained in Section 1.4.

### 1.8 Work Breakdown Structure

The Work Breakdown Structure (WBS) will summarize the high-level overview of the roles, tasks, and activities required to enable Fujitsu to complete the OSS Integration and Lab Services project. The Work Breakdown Structure is developed by Fujitsu and shared with The State of Utah based on a working session held on TBD.

The State of Utah and Fujitsu are responsible for completing deliverables in the WBS. The Parties recognize the overall scope of Fujitsu's role includes project management, software development of OSS adapters, and lab verification of solution.

## ISIS Services Description

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The following list details the services that can be provided by Fujitsu as part of the WBS and the SOW. The approver and team responsible for each service category will be defined in the WBS. The Master Plan ID Number (MP#) for each key deliverable contained in this section and throughout the document is mapped to the same MP# in the Fujitsu OSS Integration and Lab Services Project Timeline.

Service Category 1: Program Management

Service Category 2: Third-Party Management

Service Category 3: Requirements

Service Category 4: End-to-End Solution Integration, Implementation, and Test

Service Category 5: Software Development

Service Category 6: OSS System Integration, Implementation, and Test

Service Category 7: Post-Deployment Support

## ISIS Services Description

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### 2 Service Category 1: Program Management

Fujitsu provides experienced program management capabilities to manage all of the components, including Third Party, involved within Fujitsu's defined scope to ensure the key project objectives are met in due time, within budget, and in line with the quality previously agreed to by The State of Utah and the Third Party. Fujitsu utilizes a multi-level project management discipline to ensure deployment success. Fujitsu's Program Management Office is responsible for taking The State of Utah project from its current state of service description through to general deployment.

#### ***Responsibilities of Fujitsu Program Management***

- Definition of and consensus on detailed project scope
- Project change management
- Definition, communication, and management of testing project plan(s)
- Project coordination and synchronization of testing activities
- Project reporting and communications
- Project risk management and risk mitigation
- Definition of Project plan/timeline
  - The project plan is the primary tool for managing the overall status of the project; the plan is authored in MS Project and tracks all milestone, tasks, and dependencies for the project
- «Product\_1», «Product\_2», «Product\_3», and systems documentation
- «Software\_A» software releases and Q.A.
- Synchronization of «SW\_Vendor\_A» custom API development with «Software\_A» core product testing
- Server lab delivery, configuration, and acceptance testing
- Synchronization of «Product\_1», «Product\_2», and «Product\_3» testing across all labs and components

#### ***Key Deliverables***

- Project Statement of Work including:
  - Development, writing, and execution of the project plan, which is the primary tool for managing the overall status of the project; the plan is authored in MS Project and tracks all milestones, tasks, and dependencies for the entire project; typically there will be a master project plan with multiple sub-project plans
  - Communications Strategy
  - Document Control
  - Change Management

## ISIS Services Description

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- Key Learnings meetings and document key areas of potential improvement at the end of a particular project milestone
- Report on the project key indicators, budget, planning, quality, staffing, and deliverables
- Project action registers
- Project issue registers
- Project risk registers
- Manage governance process contained in this SOW

## ISIS Services Description

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### 3 Service Category 2: Third-Party Management

#### 3.1 Service Description

Third-Party management is an integral part of the activities performed as Systems Integrator by the Program Management Team.

##### **Services and Activities**

- Communication with Third-Party Partner vendors identified below to ensure that each vendor:
  - Knows and understands the overall solution
  - Knows and understands their required deliverables
  - Delivers the required functionality based on the timelines
- Project deliverables management, ensuring that:
  - Vendor functionality and the technical design meet customer requirements
  - All vendors' project plans are synchronized into overall program plan
  - Deliverables from all vendors are on time, including design documents and delivery of solution components (hardware and software)
- Risk management, working together with all vendor project managers to anticipate and document risks and evaluate, escalate, and formulate risk mitigation plans for any issues as they affect the project
- Third-Party Partners:
  - «Vendor\_1»
  - «Vendor\_2»
  - «Vendor\_3»

##### **Key Deliverables**

- Project plans for vendor-specific deliverables
- Risk registers that include all vendors in the solution
- Development of backup plans to minimize schedule impact as issues arise
- Program schedule with milestones and deliverables for the vendors

##### **Key Assumptions**

- For partner management, Fujitsu assumes that all vendors involved in the solution will provide feedback in a timely manner and will cooperate with Fujitsu in all required communications.
- For Third-Party relationships owned by The State of Utah, The State of Utah will document Fujitsu's role as a system integrator and require such Third Party to cooperate with Fujitsu in its system integrator role as identified in this ISIS Services Description.

## ISIS Services Description

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### 3.2 Third-Party management

As the End-to-End systems integrator, Fujitsu is responsible for Project Management to ensure Third Parties managed by The State of Utah adhere to roadmaps, functionality and performance agreed to by The State of Utah and such Third Party. However, Fujitsu is not liable in its role as a system integrator for such Third Parties' failure to deliver on time, deliver said functionality, or deliver a quality product per agreed-upon test and acceptance plans.

In the event that The State of Utah purchases Third-Party equipment through Fujitsu, Fujitsu will be liable for such Third-Party deliverables per agreement between The State of Utah and Fujitsu (see Third Party Contact Table below).

To interface effectively within the program, each third party has identified a single point of contact that is responsible for the following functions and escalation paths:

- Program Management Office (PMO), including master schedule management
- Architecture / Requirements / Release Scope
- Network Test, including test plans, defect management, and metrics
- Deployment and technical support

Fujitsu is responsible for the following program tasks:

- Coordinate with Third-Party vendors to ensure they meet component functional and technical requirements, and that they meet delivery deadlines.
- Document agreement between Fujitsu, The State of Utah and other project suppliers on scope and schedule of deliverables
- Synchronize agreement with overall project marketing goals and master schedule
- Track progress and quality of deliverables according to agreement's
- Work corrective actions with The State of Utah OSS Integration and Lab Services suppliers to maintain scope, schedule, and consistency with overall program and original plan
- Report status and flag issues to The State of Utah OSS Integration and Lab Services Program Management
- Fujitsu will implement a teaming agreement with each Third Party vendor to document roles, responsibilities, schedules, metrics and dependencies. The teaming agreement will also include:
  - Third Party Version Control
  - Equipment Upgrades
  - Release Documentation of Bugs/Defects
  - Documentation of all Product Roadmaps
  - Feature Scorecards
  - Software Upgrade Migration Plans

## ISIS Services Description

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The following is a summary of the process and communication structure that is put in place to achieve the above mentioned tasks:

- Network Integration daily status meeting
  - **Lead:** Fujitsu/The State of Utah
  - **Frequency:** Daily
  - **Purpose:** Tracking schedule, working action points, preparing and maintaining metrics and dashboards
  - When warranted, each project supplier will engage with the Fujitsu project manager in advance of the NI status meeting to provide supplier updates
- Network Architecture Team Lead status meeting
  - **Lead:** Fujitsu/The State of Utah
  - **Frequency:** Bi-weekly
  - **Purpose:** Status reports from the various architecture sub-teams
  - When warranted, each project supplier will engage with the Fujitsu project manager in advance of the NI status meeting to provide supplier updates
- Oversight Team for OSS Integration and Lab Services supplier PMOs
  - **Lead:** Fujitsu
  - **Frequency:** Daily/weekly
  - **Purpose:** Set plan of record for deliverables (scope according to MPM/TRSD and schedule). Manage changes to agreed plan of record. Review Metrics and Dashboard and give direction. Decide on escalation to overall OSS Integrations and Lab Services team.
- Escalation procedures for different project management teams
  - Fujitsu will report status and escalate issues to daily Network Integration Team meeting
  - Fujitsu will report status and escalate issues to Solution Integration Team, Senior Management Team, Executive Team.

The Third Party vendor leads are summarized in the following Table:

**Table 1 - Third Party Contacts**

Company	Name	Job Title	Phone	E-Mail
«Vendor_1»				
«Vendor_2»				
«Vendor_3»				
«SW_Vendor_A»				

## ISIS Services Description

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### 3.3 Fujitsu’s Third Party Management Process

Fujitsu is hosting daily/weekly meetings with all Third Parties to ensure compliance with Fujitsu’s role as the Systems Integrator. These meetings include:

- Daily/Weekly updates on status, defects
- Visibility to the Third Parties internal development processes
- Visibility and monitoring of the Third Parties internal defects during the development process
  - Deliverables
  - Schedules
  - Internal Defects
  - Internal quality metrics (i.e test cases, defects, TL9000 equivalent)
- Third Party teaming agreements

Ensure escalation process compliance by all third parties

- 3rd parties escalate to Fujitsu
- Fujitsu escalates to The State of Utah when appropriate

Fujitsu ownership of deliverables with third parties:

- Owns the technical specifications beyond the MSD
- Manages features / schedules / change control
- Manages planning and implementation of Field Deployment
- Reports on all 3rd parties issues / provides assessment and corrective actions for The State of Utah
- The State of Utah Internal communication to ensure compliance within The State of Utah
- Equipment Allocations for pre-FOA deployment

**Table 2 - Matrix for Managing 3rd Party Internal Development**

#	Vendor	Internal Development							
		Test Cases					Defects		
		Total	Executed	Failed	Blocked	Ramping UP	Open Critical/Major Defects	Closed Critical/Major Defects	Ramping Down
1	«Vendor_1»					G/Y/R			G/Y/R
2	«Vendor_2»					G/Y/R			G/Y/R
3	«Vendor_3»					G/Y/R			G/Y/R
4	«SW_Vendor_A»					G/Y/R			G/Y/R
5									
6									

## ISIS Services Description

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### 3.3.1 Third-Party Risk Mitigation

Fujitsu will provide the following backup procedures for Third-Party products:

1. Assign full-time Third-Party Manager from Fujitsu to manage all quality measurements, schedule maintenance, product requests, documentation requests, and staffing requests.
2. Require all Third-Party suppliers to assign a full-time counterpart for the Fujitsu Third Party Manager for Project.
3. Obtain eighteen-month rolling roadmaps from each vendor.
4. Maintain Risk Matrix to track projected Third-Party jeopardy and schedule impacts in a proactive approach.
5. Have a backup plan for each Third-Party vendor to mitigate any interim project changes that may be necessary. This item will need to be submitted to the Change Control Procedure and would probably be schedule-affecting.
6. Ensure that all legal confidentiality covenants are adhered to by Third Parties.

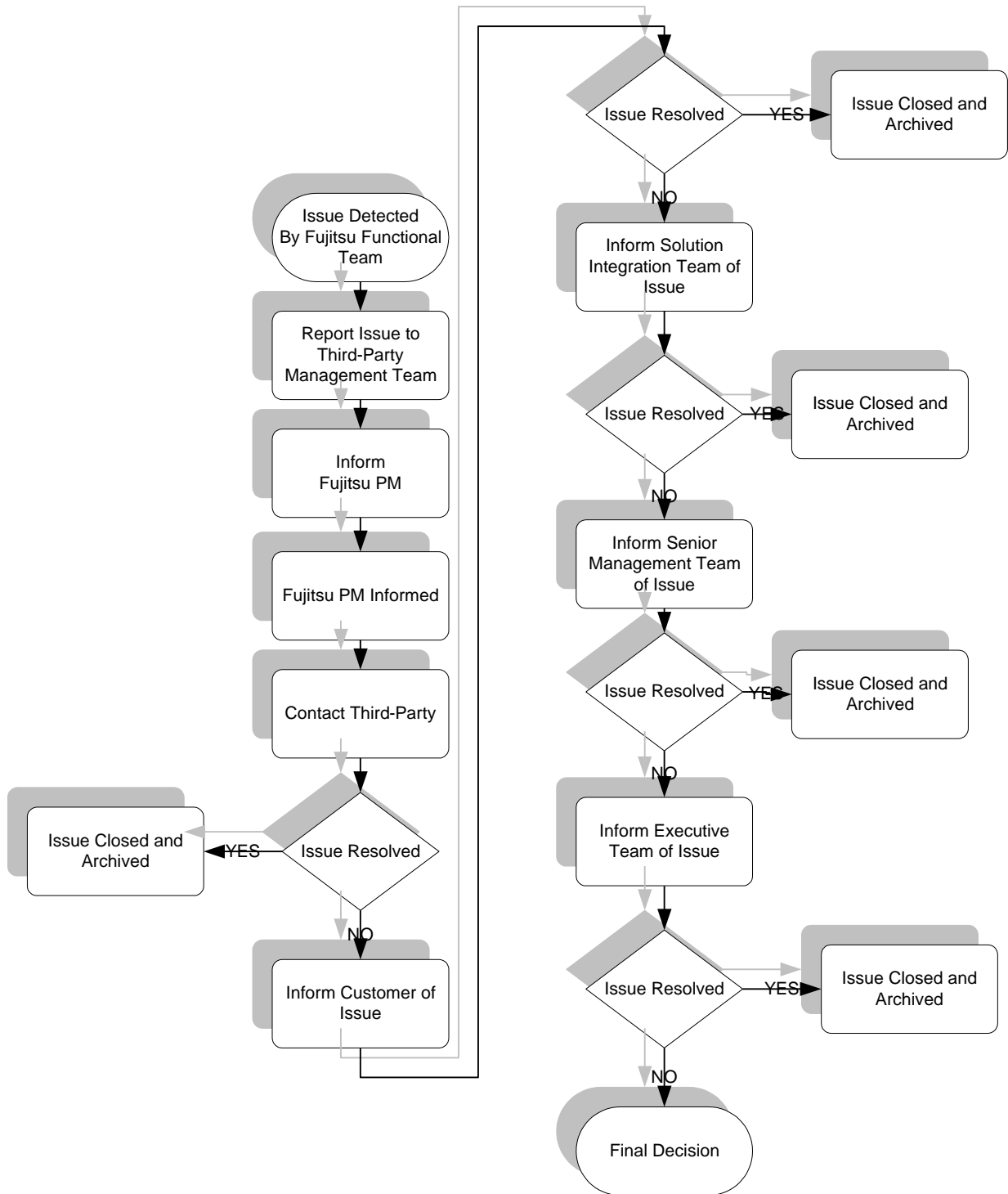
### 3.3.2 Third Party Escalation Process

Each functional organization of the OSS Integration and Lab Services project will work directly with third party technical resources.

At the point of any issue(s) or perceived delay(s) that has not been responded to in a timely manner from a third party, the appropriate Fujitsu functional organization will immediately provide all background information to the Third Party Management Organization ("TPMO"). The TPMO will establish an escalation and mitigation strategy for the unresolved issue.

Thereafter, the standard Fujitsu escalation procedure shall be implemented as follows:

# ISIS Services Description



**Figure 5: Third Party Escalation Process**

## ISIS Services Description

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1. In the event the Fujitsu Functional Team is unable to resolve an issue impacting the program, the applicable team shall escalate issues to the TPMO;
2. The TPMO shall log and map the issue to any outstanding or previously logged issues to the Fujitsu project Executive;
3. The Fujitsu project Executive shall be notified of the issue, impact and corrective action.;
4. Fujitsu TPMO will escalate with the applicable third party to achieve prompt resolution of the issues;
5. The third party shall resolve the issue and the issue shall be archived by the TPMO;
6. If the third party is unable to resolve the issue, the TPMO shall prepare the issue for escalation to The State of Utah;
7. The TPMO shall then escalate the issue to The State of Utah;
8. Fujitsu shall lead resolution of the issue with the assistance of The State of Utah
9. If the Fujitsu and The State of Utah Network Integration Team is unable to resolve the issue with the third party, the issue will be escalated to the Solution Integration Team;
10. If the Solution Integration Team cannot resolve the issue, the issue shall be escalated to the Senior Management Team;
11. If the Senior Management Team is unable to resolve the issue, the issue shall be escalated to the Executive Team for final determination.

By centralizing the Third Party Escalation Process, the Fujitsu PMO is responsible for identifying third parties that are deficient across multiple organizations. The Third Party Escalation Process shall provide measurement on third party deliveries, quality and responsiveness, which shall enable Fujitsu to see negative trends before they impact Integration schedules and deliverables to The State of Utah of Utah.

### 3.4 «Product\_1»

#### 3.4.1 Scope of Fujitsu/«Vendor\_1» Working Relationship

Fujitsu is responsible for integrating the End-to-End solution. The State of Utah owns the overall relationship with «Vendor\_1»; as such, Fujitsu shall not be liable for missing any milestones or deadlines contained in this ISIS Services Description based on «Vendor\_1»'s (or any other Third Parties' managed by The State of Utah) delivery date or quality of software.

This Section outlines the Fujitsu and «Vendor\_1» working relationship specific to supporting the End-to-End Integration Services related to The State of Utah OSS Integration and Lab Services project. In order to provide The State of Utah with successful deployment and integration which meets or exceeds the phased approach, the following key milestones, deliverables, and timelines have been identified by Fujitsu and «Vendor\_1».

«Vendor\_1», not Fujitsu, is responsible for all core product development for their «Product\_1». This does not include any services from Fujitsu associated with helping «Vendor\_1» complete their own core product development and do so in the timelines required by The State of Utah.

#### «Vendor\_1» Key Deliverables

## ISIS Services Description

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Fujitsu is responsible for Project Management, ensuring «Vendor\_1»'s adherence to roadmaps and functionality/performance agreed to by The State of Utah and «Vendor\_1». However, Fujitsu is not liable in its role as a system integrator for «Vendor\_1»'s failure to deliver on time, deliver said functionality, or deliver a quality product as per agreed-upon test and acceptance plans.

«Vendor\_1» will provide the fully tested «Product\_1» to Fujitsu's ATSC Lab meeting Entrance Criteria. Fujitsu will use the «Product\_1» release specified in the Solution Set Matrix for each phase of the program.

«Product\_1» features:

- [List features of «Product\_1»]

«Vendor\_1» will also provide:

- «Vendor\_1» is responsible for setting up a test environment in their lab to simulate and ensure «Product\_1» will meet the requirements. «Vendor\_1» is to validate «Product\_1» in the «Vendor\_1»'s Lab and certify «Product\_1» is of General Availability quality, contains all feature content and meets ATSC Lab Entrance Criteria.
- «Vendor\_1» will provide internal test cases used to qualify «Product\_1» in the «Vendor\_1»'s Validation lab
- «Vendor\_1» will identify any test case dependencies required to complete internal validation testing.
- On-site support for «Product\_1» installation in Fujitsu's Interoperability Lab.
- Training the appropriate Fujitsu personnel on «Product\_1».
- Other mutually agreed upon support services

### «Vendor\_1» Schedule

Refer to Appendix 3 for the detailed project plan containing all «Vendor\_1» deliverables.

- «Product\_1» Release x.x
- «Product\_1» Release y.y

### 3.4.2 «Product\_1»: Roadmap

This section describes the roadmap and plan for tracking «Product\_1».

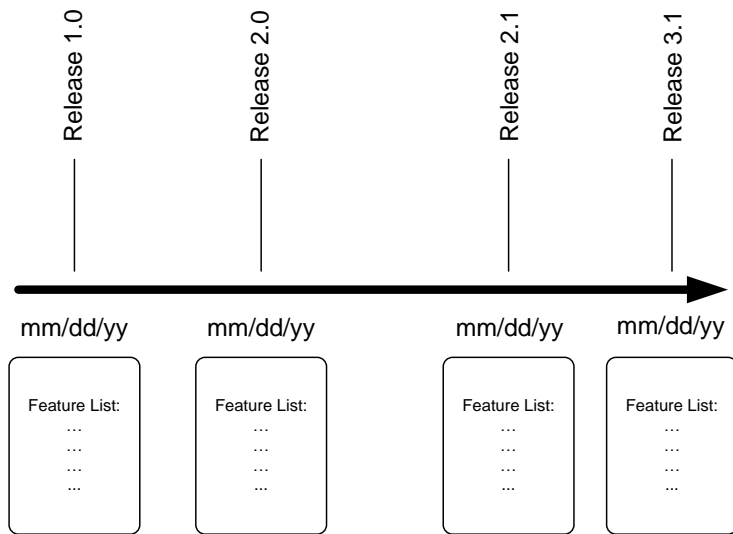
«Vendor\_1» will deliver all the features in «Product\_1» in addition to the features listed below in the roadmap. This Roadmap is only for «Product\_1» and any changes to this feature set must go through the change control process.

On a weekly basis, Fujitsu will obtain the status of each «Product\_1» feature from «Vendor\_1». The status will be the format shown below. Fujitsu will summarize this information and provide updates to The State of Utah of Utah on a monthly basis, or as requested by The State of Utah.

The following diagram defines the different release features and associated release dates for «Product\_1» provided by «Vendor\_1» for the period starting on [mm/dd/yy] and ending on [mm/dd/yy].

# ISIS Services Description

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**Figure 6: <<Product>> Roadmap**

## ISIS Services Description

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### 4 Service Category 3: Requirements

#### *Technical Requirements Document*

The Requirements team will manage the translation of The State of Utah's marketing vision and «Product\_1» specifications into specific technical product and solution requirements for the «Solution» solution scope of this ISIS Services Description. The Technical Requirements Document will:

- Provide an overview of the system architecture including network elements (NE) and element management system (EMS)
- Define EMS hardware platform recommendations for the vendor management solutions.
- Details EMS platform hardware scaling, capacity management, and EMS interactions with other application systems.
- Support The State of Utah integration efforts from the EMS to the NMS layers as it relates to EMS interface specifications.
- OSS Requirements with impact on the IT systems
- Document the technical requirements for «Solution» system and its subsystems
- Document the expected services and capabilities of the «Solution» application
- Document the mapping of each service feature into the «Product\_1» release that will deliver that feature
- If The State of Utah has a business or technical requirement that is not supported by «Product\_1» release, Fujitsu will document there is a necessity by The State of Utah for such business or technical requirement; the intent is for this document to become the single repository for all of The State of Utah business and technical requirements
- Document the technical requirements for the operational management systems
- Provide numbered and traceable requirements to facilitate integration testing and to ensure total solution coverage
- The requirement document will be updated for each deployment phase [*Note: if applicable*]

#### *Services and Activities*

Fujitsu will be responsible for the following activities:

- Facilitate necessary workshops between all involved Parties (The State of Utah, Fujitsu, and applicable Third-Party component providers) to finalize the requirements document
- Document results of workshops, including all agreements and commitments from all Parties involved

#### *Key Fujitsu Deliverables*

## ISIS Services Description

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- Develop the Technical Requirements Document (TRD) for the «Project». The final TRD will be used as the governing requirements document. Any additional requirements identified by The State of Utah or Fujitsu will be handled through the Change Control Procedure. This becomes the document by which the test plans are created. The document will include the following sections: NE, EMS, and BSS/OSS.

### ***Key Assumptions/Dependencies***

- The State of Utah takes active role and collaborates during the workshop sessions.
- The State of Utah will provide the Service Description and Product Requirement Document.
- Fujitsu will have access to all required Third-Party data (i.e., Technical Specification and API documentation)

## ISIS Services Description

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### 5 Service Category 4: End-to-End Solution Integration, Implementation, and Test

#### 5.1 Service Description

The objective of this service is to minimize the commercial and technical risks involved, which are not previously validated building blocks of the solution. Since the end-user services depend on the implementation of the solution on the existing The State of Utah network infrastructure, the Fujitsu approach is to pre-stage and validate the solution with the defined network elements prior to deployment. All network elements to be used in end-user service delivery and not presented in this document, are subject for assessment and, if required, a detailed validation in the Advance Technology and Solutions Center (ATSC) Lab.

The focus of these services is on the successful field implementation of the «Solution» solution. Fujitsu, as the End-to-End system integrator, will coordinate and manage the activities necessary to prepare the entire solution for deployment in each stage of the project.

#### **Services and Activities**

Fujitsu will be responsible for completing the following tasks:

- Lead workshops between The State of Utah and Fujitsu engineers, as well as any other third-party engineers, on technical and operational aspects of the equipment involved, in cases where validation services are required
- Coordinate with third-party vendors to ensure they meet component functional and technical requirements, and that they meet delivery deadlines
- Assign resources and follow the completion of equipment validation activities, which will include the unit testing of equipment on-site, followed by the End-to-End testing of all components in the solution and in the timeframe defined in the project plan
- Test network scalability in simulated environment [*Note: need automation tool to perform this service*]

The State of Utah of Utah will be responsible for the following tasks:

- Prepare all sites according to the Site Survey Results and Site Requirements, by the deadlines identified in the project plan
- Provide access to sites for the installation teams during the timeframe defined in the project plan, or as recommended by the Fujitsu program management team
- Provide on-site support from The State of Utah technicians to facilitate installation efforts

#### **Key Fujitsu Deliverables**

- Develop test plan for the end-to-end solution that Fujitsu will integrate for The State of Utah, including customer premises, Edge-to-Edge network, «Service» delivery network, EMSs, and Northbound interfaces
- Perform End-to-End «Service» and Network Integration testing in accordance with test plan

## ISIS Services Description

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- Documentation with configuration parameters of the validated elements of the solution
- Documented test plans (unit tests and End-to-End tests) with validation results
- Acceptance certificates signed by The State of Utah of Utah upon successful completion of test plans

### **Key Assumptions**

- Network elements jointly approved by The State of Utah and Fujitsu as part of the overall solution will be allowed entry into the ATSC lab.
- Approved vendors must provide their equipment to the ATSC lab to be validated and pre-qualified, at least three months prior to acceptance date.
- Fujitsu and The State of Utah will work in close collaboration during preparation activities for these services.
- All network elements to be used in end-user service delivery are subject for assessment and, if required, for a detailed validation in the ATSC lab.
- The State of Utah and Fujitsu to work closely through each phase of testing.

### **On-site Integration**

The objective of these services is the integration of the proposed solution components with The State of Utah networks. This service includes the solution-based, End-to-End acceptance procedure, agreed upon by the parties.

### **Joint Deliverables**

- Agreed solution acceptance plan and involved procedures
- Acceptance report on an end-to-end services basis
- Service acceptance and sign-off by The State of Utah

### **Key Assumptions**

- Network provisioning: The State of Utah to provision and configure all network elements not to be delivered under this proposal and to be used in the end-user solution environment. The configuration will be done according to the network architecture document. Fujitsu will provide assistance where necessary.
- Acceptance of the solution will be carried out on a pre-defined geographical area [Note: define the area/location and quantities, e.g. 2 central offices], with limited number of «Product\_1» deployed per access concentration point involved (the actual number will be agreed upon between The State of Utah and Fujitsu in the FOA for each Phase).
- Deployment of the solution into a large geographical area implies that many network elements need to be configured in the transport and access network. Such configuration is considered operational services and is not covered by this particular service.

## ISIS Services Description

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- Service provisioning: Acceptance will be carried out for a pre-defined, limited number of customers.
- Content provisioning: Acceptance will be carried out for the following services: [Note: define the services that will be integrated]. Provisioning of more services is considered as operational.

### 5.2 End-to-end solution integration and test strategy

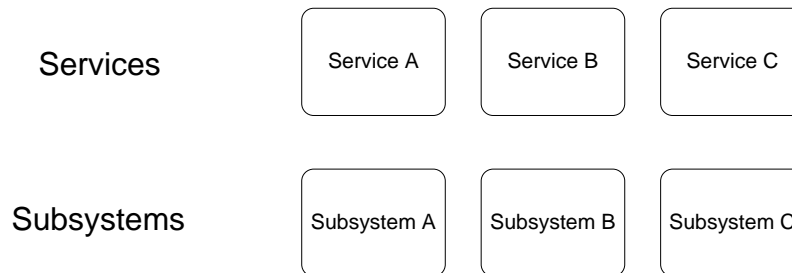
#### 5.2.1 Scope

This section describes the high-level overview and test strategy of the ISIS methodology for Fujitsu network elements and Third -Party solution providers for «Project». This section is an overview of lab entrance criteria for Fujitsu and Third-Party solution providers.

The overview covers test case creation and execution of interoperability, EMS (southbound), fault insertion stress, soak, in accordance with functional requirements to validate and support customer and operational readiness for «Service» and delivery.

#### 5.2.2 The State of Utah of Utah-Fujitsu Network Integration Test Strategy

Fujitsu is responsible for End-to-End solution and management of the implementation from “Integration” state to the “Service Ready” State. Figure 7, identifies the overall subsystems that have been identified as part of the solution architecture



**Figure 7: The State of Utah of Utah-Fujitsu Test Sub-Systems**

## ISIS Services Description

### 5.2.3 Overall End-to-End Network Integration Roles and Responsibilities

The following section identifies Fujitsu ATSC roles and responsibilities as it relates to the subsystems identified.

Subsystem/Area	Interop	EMS (Southbound)	FIT	Stress	Soak	Simulation
«SubsystemLocation_A»	FNC	FNC	FNC	FNC	FNC	
«SubsystemLocation_B»	FNC	FNC	FNC	FNC	FNC	
«SubsystemLocation_C»	FNC	FNC	FNC	FNC	FNC	
«SubsystemLocation_D»	FNC	FNC	FNC	FNC	FNC	
«Service»	FNC	FNC	FNC	FNC	FNC	
«Out_of_Scope_Project_List»	The State of Utah	The State of Utah	The State of Utah	The State of Utah	The State of Utah	FNC

FNC: Fujitsu responsibility

The State of Utah of Utah: The State of Utah responsibility

**Table 3 - Fujitsu ATSC roles and responsibilities**

#### 5.2.3.1 ATSC Lab Profile and Function

The ATSC Lab will serve several functions in support of The State of Utah deployment in support of «Service» and other services over the proposed network.

Overriding Lab Principle:

- A logical, reproducible progression to ensure that the End-to-End solution meets the design requirements
- ATSC will host and test equipment to be deployed in the network as agreed upon by The State of Utah and Fujitsu to support features and functionality as defined by the Architecture and Requirement documents

This is achieved by following a three-step process:

- Lab Entrance Criteria ( HW, SW and Document Delivery, Software Loading/Upgrade Validation)
- Sub-System Testing
- End-to-End Testing

## ISIS Services Description

### 5.2.4 ATSC Lab Layout and Structure

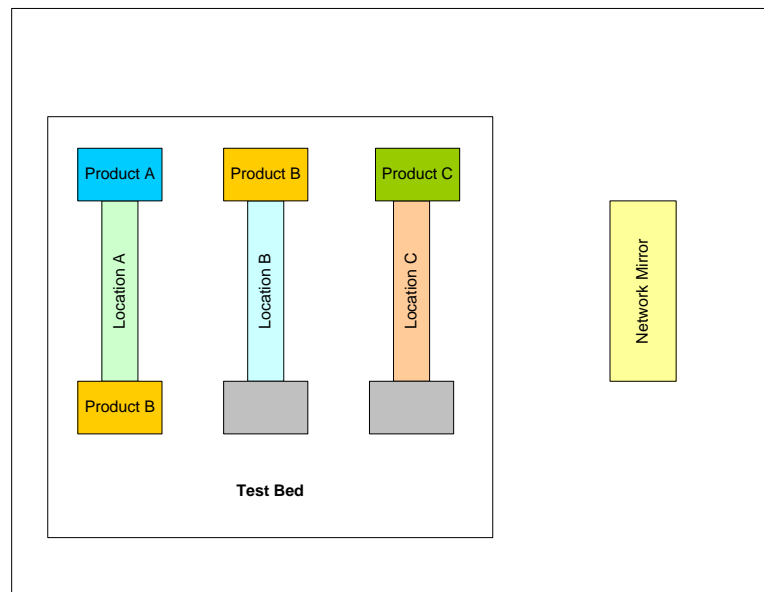
ATSC lab will provide multiple line-ups to support «Project»

- Fujitsu Business units to support with install of equipment in The State of Utah o Labs
- Lab layout to support The State of Utah for true End-to-End testing environment

**Test and Verification line** for introduction of new component releases for integration, component upgrade, and testing and system upgrade and testing. This line-up will be utilized to test and integrate bug fixes, enhancements, and changes to the Network Mirror line-up. Upon acceptance by The State of Utah and shipment of new releases, this software release will be transferred to the Network Mirror line-up. Figure 8 shows the schematic of the ATSC lab layout.

- The test and verification stage will have equipment to support the following test areas:
  - Functional Interoperability
  - EMS Southbound
  - Fault Insertion Testing
  - Stress Testing
  - Soak Testing

**Network Mirror for Support:** The Network Lineup will include elements and applications that Fujitsu has shipped to The State of Utah of Utah with the most recent release version delivered to The State of Utah network. High-Level Fujitsu Lab Process Overview



**Figure 8: Layout of the ATSC lab**

## ISIS Services Description

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### 5.2.5 Test Methodology

#### 5.2.5.1 Requirements-Based Testing

Fujitsu's test suite will be based on requirements identified by the architectural and requirements functional teams and will be based on the following:

- Market services documents are mapped to technical requirement specification documents by the Technical Requirements group.
- Requirements group must also define customer network configuration requirement to ensure they are in accordance with lab test configuration.
- The detailed specification of the TRSD are traced and mapped into formal test plans by ATSC [add reference to section in TRSD where specification are shown].
- All test plans are jointly developed between Fujitsu and The State of Utah with Fujitsu playing the lead role.
- The State of Utah will review, approve, and sign off on all High Level Test plans.
- Any requirements or architectures changes/additions must go through the Change Control Procedure.

#### 5.2.5.2 Phased Test Plan Development Process

ATSC tests will include functional inter-operability, EMS (southbound), fault Insertion, Stress and Soak capabilities.

The phased test plan development process includes the following steps:

- Step 1: Review Requirements documentation
  - Output: Allocate/map requirements to test plans
- Step 2: Test cases are created with title, purpose, pass criteria, and requirement traceability.
  - Output – High Level Test Plan
- Step 3: Detailed procedural information will be added.
  - Output – Detailed Test Plan
- Step 4: Procedural verification against Fujitsu network elements and Third-Party solution providers.
  - Output – Subsystem/E2E Test Results

### 5.2.6 Test Plan Development Process Overview

- Documentation review, approval, and signoff on High Level Plan documents jointly between Fujitsu and The State of Utah
- Version control of test documents and reported results

## ISIS Services Description

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### 5.2.6.1 ATSC Test States

- **Initial Functional State – (Lab Entry Criteria):** Review of Documentation, release notes and SW/HW install procedures and guidelines. Successful SW installation or upgrade on Target Network Element.
- **Verification State – (ETE Testing):** Test consisting of Interoperability, EMS (Sounthbound), Fault Insertion and stress testing. Testing is performed at a subsystem level as well as ETE. Emergency fixes for critical defects identified will be accepted via Change Control only.
- **Network Migration State –** Validation of Network Migration guidelines will be completed prior to Soak testing to ensure proper migration guidelines in the field
- **Final State – (Soak Testing):** No software patches or hardware configuration changes will be allowed at this point. If changes must occur, it will be done via Change Control. All regression testing and soak testing must have completed and met exit criteria in order for The State of Utah of Utah approval and acceptance.
- **The State of Utah of Utah APPROVAL:** The State of Utah will review all test reports, reports on open defects, and agree upon accepting software (Solution Release Notes).

### 5.2.7 Error States Definition per GR929 and TL9000 Specifications

- **Critical Problems** severely affect service, traffic, billing, maintenance capabilities, the desired customer experience, and require immediate corrective action, regardless of time of day or day of the week. Examples of Critical problems, but not limited to, are those that:
  - Affects service delivery and/or system operation:
  - A total system failure that results in loss of all transaction processing capability.
  - Reduction in capacity or traffic handling capability such that the system cannot handle expected loads.
  - Any loss of safety or emergency capability (e.g. 911/E911 calls).
  - Loss of the system's ability to perform automatic system reconfiguration.
  - Inability to restart a processor or the system.
  - Total System Outage to 100 or more customers.
  - Partial Loss of Capability.
  - Loss of protection switching capability.
  - Affect billing, maintenance, and databases.
  - Loss of billing capability.
  - Corruption of billing or system databases that requires service affecting corrective actions.
  - Loss of access for maintenance or recovery operations.

## ISIS Services Description

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- Loss of the system's ability to provide any required Critical or Major Trouble notification.
- Other problems that severely affect service, capacity/traffic, billing, and maintenance capabilities or are viewed as critical by a service provider upon discussion with the supplier.
- **Major Problems** cause conditions that seriously affect system operation, maintenance, and administration, etc., and require immediate attention. The urgency is less than in critical situations because of a lesser immediate or impending effect on system performance, customers, and telephone company operation and revenue. Example of Major problems, but not limited, are those that
  - Affect service and/or routine system operation.
  - Reduction in any capacity/traffic measurement function.
  - Any loss of functional visibility and/or diagnostic capability.
  - Short system or subsystem outages, whose durations accumulate to greater than 2 minutes in any 24-hour period, or that continue to repeat during longer periods.
  - Cutoff rates that exceed 1.25 per 10,000 sessions/transaction.
  - Ineffective service attempt rates that exceed 5 per 10,000.
  - Failure of any portion of a duplex operation for periods in excess of 30 seconds.
  - Repeated degradation of 10 Mbps or higher connections.
  - Affect maintenance, administration, billing, etc.
  - Prevention of access for routine administrative activity.
  - Degradation of access for maintenance or recovery operations.
  - Degradation of the system's ability to provide any required Critical or Major Trouble notification.
  - Any significant increase in system related customer trouble reports.
  - Billing errors greater than 1 in 1 million for over-billing, or 1 in 10,000 for under-billing.
  - Corruption of system or billing databases that does not result in service-affecting corrective actions.
  - Other problems that disrupt or prevent routine system activities, or are viewed as major by a service provider upon discussion with the supplier.
- **Minor Problems** do not significantly impair the functioning of the system and do not significantly affect service to customers. Does not have a serious effect on service to customers or for troubles in circuits that are not essential to NE operation.

## ISIS Services Description

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- “**Documentation**” classification will be used for tracking problems associated with all documentation. For clarity, problems with Documentation will not be classified as “Minor.”
  - A documentation issue may receive up to a Priority 1 status if it affects completion of other schedule affecting tasks (i.e. M&P, defect resolution, etc).

## ISIS Services Description

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### 5.2.8 ATSC Lab Entrance Criteria

#### 5.2.8.1 Overall Release Definition

- Major Release: Includes Functionality change.
- Point/Maintenance/Emergency Release: Includes Fixes(patch)es for defects only.

#### 5.2.8.2 Fujitsu Network Element Lab Entrance Criteria for Major Releases

- Official review at GA of each NE.
- All hardware and software test results must be available to ATSC for an official review and approval by both The State of Utah and Fujitsu.
- Field-deployable hardware is required; no prototypes in ATSC Lab.
- Test Plan includes 100% of customer requirement coverage.
- 100% test completion of NE test requirements, including stress and soak test.
- Zero critical reported problems.
- Less than 10 Major reported problems with workaround.
- Less than 50 Minor reported problems.
- List of all known or open bugs with expected release dates for fixes.
- Final Documentation for upgrade or initial install procedures.
- Final Documentation for user manuals.
- Final Documentation of release notes of new hardware and software, including but not limited to the effects of new feature to existing network elements (backward compatibility), existing network element performance, new network performance, new feature test with respect to lab and The State of Utah network configuration, and requirement changes for automation testing.
- Signoff by ATSC Test Manager to each BU for each NE that Lab Entrance Criteria is approved

#### 5.2.8.3 Fujitsu Network Element Lab Entrance Criteria for Point/Maintenance/Minor Releases

- List of all known or open bugs with expected release dates for fixes.
- Zero critical reported problems.
- Less than 5 Major reported problems with workaround.
- Less than 25 Minor reported problems.
- Final Documentation for upgrade or initial install procedures.
- Final Documentation for user manuals (if applicable).
- Final Documentation of release notes of new hardware and software, including but not limited to the effects of new feature to existing network elements (backward

## ISIS Services Description

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compatibility), existing network element performance, new network performance, new feature test with respect to lab and The State of Utah of Utah network configuration, and requirement changes for automation testing.

### 5.2.8.4 Lab Entrance Failure Scenario

- Any equipment that fails Lab entrance criteria will require immediate escalation to prevent timeline slip to determine if a waiver should be signed by The State of Utah and Fujitsu. See appendix for a copy of the Waiver form.
- Fujitsu, and Third-Party equipment provider must provide reports of impacts on Technology, Timeline, and Capabilities and provide mitigation plans for each.

### 5.2.9 Lab Entry – (Initial Functional State)

- Review required user Documentation.
- Review required Release notes.
- Review install guidelines and procedures.
- Validate install guidelines and procedures.
- Review upgrade guidelines and procedures (if applicable: Minor releases).
- Validate install guidelines and procedures (if applicable: Minor releases).

### 5.2.10 ATSC Functional Interoperability Testing (Verification State)

Interoperability testing will prove that the Fujitsu network elements and Third-Party solutions work consistently together within the entire scope of their functionality. ATSC Interoperability Test Plan includes, but is not limited, to the scenarios shown below:

- Interoperability of ... and ...
- [Note: Provide the list of elements and scenario that will be tested with respect to interoperability].
- Complete testing of EMS to supported NEs is performed by the business units; ATSC will perform basic verification testing as part of lab entrance criteria.
- Report all known defects promptly to ensure fixes are incorporated in a timely fashion.

### 5.2.11 EMS Southbound Testing (Verification State)

Element Management System Testing (Southbound) includes:

- Network Discovery
- Fault Management
- Service Administration
- NE Backups
- NE Restoral
- NE Upgrades

## ISIS Services Description

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### 5.2.12 Fault Insertion Testing (Verification State)

- Document effects and recovery time of link failure between Network Elements
- Document effects and recovery time of Node Failure (crash power outage)
- Document re-route switchover time for Network Elements that provide alternate routing and effects of alternate routing (congestion)
- Document alarms to EMS/OSS for each type of failure
- EMS/OSS link failures, ensure EMS/OSS redundancy
- EMS/OSS link failure, ensure sanity of network status during or after failover

### 5.2.13 Stress Testing: ETE Testing (Verification State)

Stress and performance testing will be performed to document the maximum utilization of individual network elements and to ensure they meet publicized criteria. The stress and performance testing will also provide insight to possible bottlenecks within each network element. Finally, the stress and performance testing will be a performance benchmark of traffic loads and response times for future releases of software and hardware.

Overall Objective of Stress Testing is to:

- Define stress criteria, test tools, methods, and network configurations.
- Lock down software release, hardware configuration, network configuration, and database configuration.
- Document protection mechanisms and alarms are activated when thresholds are reached, exceeded, and removed.
- Document times of the stability/instability when capacities are reached, exceeded, and removed.
- Document network interface utilization along with CPU, I/O, and memory.
- Document response times during stress test.
- Monitor EMS/OSS to ensure that high traffic rates do not inhibit network monitoring.

### 5.2.14 Soak Testing – (Final State)

Soak testing will consist of several days of a significant traffic load generation on each network element. Each network node will contain a field representative database. The soak test will consist of a mixture of [Note: define services tested during soak] offerings to the end user. This test will provide proven quality results of the integration of Fujitsu and Third-Party triple-play solution.

- 99.99% pass rate on all tests for the entire length of test time
- All traffic most likely to be simulated
- Capture real field database from The State of Utah network to perform additional soak test when possible
- Monitor EMS/OSS for statistics and fault reporting

## ISIS Services Description

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### 5.2.15 Exit Criteria

#### Exit Criteria Per Element

- ATSC test results have zero Critical problems.
- ATSC test results post less than or equal to 10 Major problems
- ATSC test results post no more than two Majors without workarounds
- ATSC test results post not more than 50 Minor problems
- Review and signoff by The State of Utah and Fujitsu that all of the above is complete

#### Exit Criteria – Full End-to-End Solution: All Network Elements

- ATSC test results have zero Critical problems
- ATSC test results post less than or equal to 22 Major problems
- ATSC test results post no more than four Majors without workarounds
- ATSC test results posts less than or equal to 110 Minor problems
- Completed Solution Release Notes for the end to end solution
- Audit and Update Solution Set Matrix
- Validate and Update the Network Migration Document
- Review and signoff by The State of Utah and Fujitsu that all of the above is complete

#### Formula for Calculating Defects for ETE Solution

- 10% for each additional element
- N = Number of Network elements
  - Critical 0
  - Major  $10 + 1 (N - 1)$
  - Minor  $50 + 5 (N - 1)$

### 5.2.16 Network Migration Testing

A Network Migration document will be created by the architecture team to address the overall Network Solution Software upgrade/migration plan. The document will address hardware and software configuration changes, outage times and the overall upgrade process of the End-to-End solution.

The procedures contained in this document will be verified in ATSC lab in a three step process:

1. As part of lab entry – if possible
2. Update document in parallel with Subsystem and End-to-End testing
3. Final verification test post End-to-End completion (prior to final SOAK).

## ISIS Services Description

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### 6 Service Category 5: Software Development

#### 6.1 Adaptors

New systems and new technologies must communicate with each other, and Fujitsu brings the expertise to design and develop the needed hooks or adapters to deliver a cohesive, seamless IT integration. The adapter development will be coded and tested in the ISIS lab.

#### List of the adaptors that will be develop by Fujitsu:

The State of Utah of Utah has expressed interest in the following adapter development:

- Netsmart 1500 to IBM Tivoli ITNM

Other potential adapters Fujitsu could develop include:

Netsmart 1500 to:

- IBM Tivoli OMNIBUS
- IBM Tivoli TNPM
- IBM Tivoli ITCAM
- IBM Tivoli Intelliden
- CA eHealth
- Subex RocWare

Fujitsu Deliverables:

Fujitsu will provide to The State of Utah the following deliverables:

- Technical requirement documentation
- Functional specification
- Test plan
- API specification
- Software application
- Installation and Configuration Guide
  - Hardware installation [*note: if applicable*]
  - Software installation
  - Acceptance instructions
- Operation Guide
  - Operation procedure
  - Recovery procedure
- User Guide
- Warranty Procedure

## ISIS Services Description

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- Ordering Information
- Training Instruction

### 6.2 Extended Applications

This service will provide to The State of Utah an enhanced version of «Software\_A» by adding new features to the existing applications.

#### Features of the extended «Software\_A» applications:

*[Note: list the feature of the extended applications]*

#### Fujitsu Deliverables:

Fujitsu will provide to The State of Utah the following deliverables:

*[Note: list the deliverables]*

- Technical requirement
- Functional specification
- Detailed design
- Test plan
- API specification
- Software application
- Source Code *[note: if applicable]*
- Installation and Configuration Guide
  - Hardware installation *[note: if applicable]*
  - Software installation
  - Acceptance instructions
- Operation Guide
  - Operation procedure
  - Recovery procedure
- User Guide
- Warranty Procedure
- Ordering Information
- Training Instruction

### 6.3 Software Tools

Fujitsu will create a new software tool for The State of Utah, which will enable / enhance the functionality of the «Solution» network.

#### Features of the Software Tools:

## ISIS Services Description

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[Note: list the feature of the Tools]

### Fujitsu Deliverables and Activities

Fujitsu will provide to The State of Utah the following deliverables:

[Note: list the deliverables]

- Technical requirement
- Functional specification
- Architecture design
- Detailed design
- Test plan
- API specification
- Software application
- Source Code [note: if applicable]
- Installation and Configuration Guide
  - Hardware installation [note: if applicable]
  - Software installation
  - Acceptance instructions
- Operation Guide
  - Operation procedure
  - Recovery procedure
- User Guide
- Warranty Procedure
- Ordering Information
- Training Instruction

# ISIS Services Description

## 7 Service Category 6: OSS System Integration, Implementation, and Test

### 7.1 TMN Layers

The Telecommunications Management Forum (TMF), an international standards body for the Telecommunications industry, established the Telecommunications Management Network (TMN) model to provide a standard reference for logical management layers of a network. The layers from bottom to top are the Element Layer (EL), Element Management Layer (EML), Network Management Layer (NML), Service Manager Layer (SML), and Business Management Layer (BML). Throughout this document, references are made to the various “layers” discussing “northbound” and “southbound” interfaces, which in actuality are addressing the linkage between the various network layers of the TMN model to the components of «Solution» system. Depending on the EML being referenced, a “northbound” interface refers to linking a lower hierarchical EML with a higher level within the TMN model, such as EML to NML. Conversely, “southbound” interface refers to linking a higher hierarchical EML with a lower level within the TMN model, such as BML to SML. Figure 9: Business Process Framework illustrates the TM Forum Business Process Framework in the context of this document. It is intended for illustrative purposes and not as a comprehensive depiction of «Project» architecture.

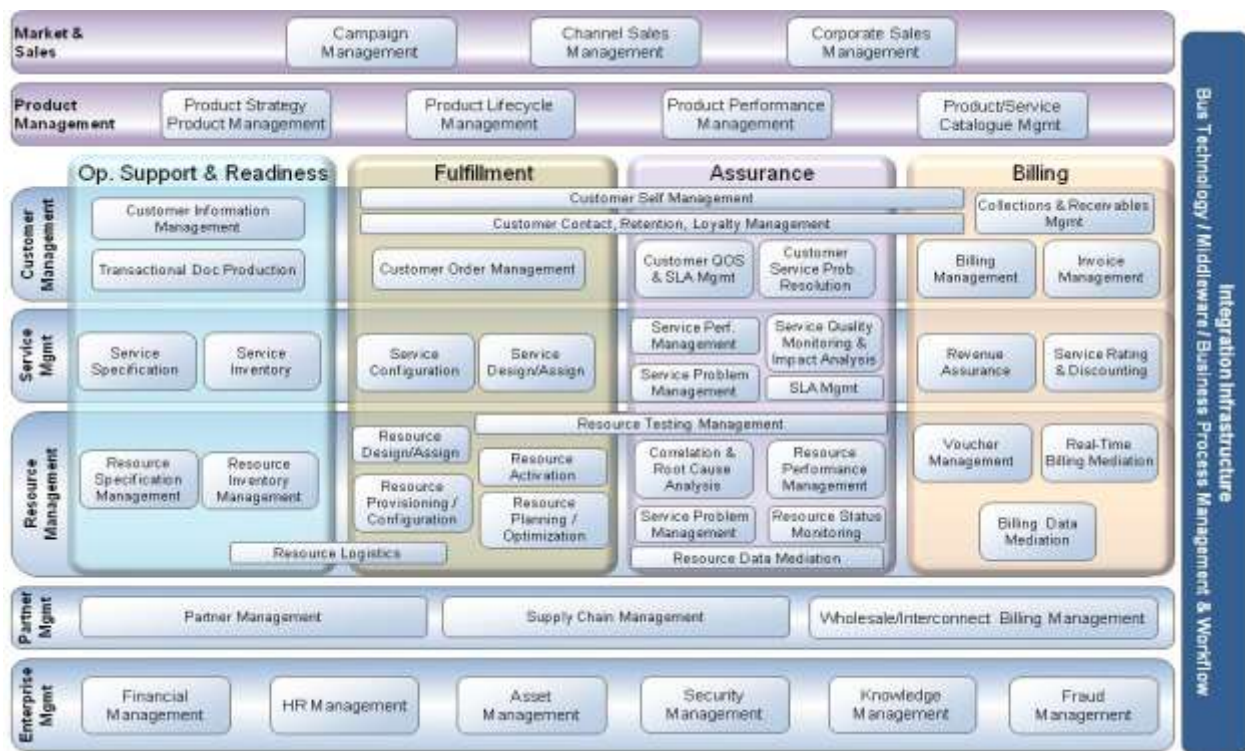


Figure 9: Business Process Framework

## ISIS Services Description

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### 7.2 OSS Readiness Assessment

Fujitsu proposes to evaluate and document OSS readiness by leveraging its knowledge of operational support systems architecture, design, and deployment in a converged technology environment with outstanding industry OSS knowledge and expertise in the following support areas.

- Inventory control/management systems
- Customer care technologies, including self-care
- Customer account management applications in converged environments
- Monitoring/measuring application software for eHealth
- Service assurance/service provisioning from the EML to the BML layers
- Customer and service activation capabilities, including web-based technologies
- IP, Video, Data convergence billing, including electronic delivery methodologies
- Reporting applications for monitoring, settlements, revenue reporting, network health
- NOC/VOC software identification and deployment

#### ***Knowledge Planning and Transfer***

Support will encompass knowledge transfer of solution architecture and experiences to implementation teams. This transfer will comprise delivering technical expertise in matters of «Solution» OSSs, integrating legacy and new OSSs, supporting architecture and development, and strategies for successful deployment of the solution. These services will culminate in a fully documented OSS Plan that will contain the following:

- Description of «Solution» EMSs and their respective interfaces to The State of Utah's OSSs in the support areas previously mentioned
- Gap Analyses between current and planned OSSs to validate interface requirements versus available interface capabilities
- Recommendations for mitigation and alternative approaches to OSS integration
- Data mapping of «Solution» APIs and other interfaces to supporting OSSs
- Validation of functionality of APIs to ensure completeness and accuracy of API documentation
- Creation of data dictionary specific to OSS interface requirements

#### ***OSS Selection***

In addition to assisting with NOC/VOC software selection, Fujitsu will take a vendor-neutral approach in assisting in identifying the best OSS (BSS/OSS/EMS) solutions for the customer's networks. Fujitsu's world-wide expertise enables us to present and deliver the best solution for The State of Utah's network.

#### ***Data Population and Migration***

## ISIS Services Description

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One of the most daunting tasks is data population and migration into new OSSs. Fujitsu can bring value-added services to The State of Utah by taking this responsibility, enabling The State of Utah to focus on its core competencies as Fujitsu applies its knowledge resources of OSSs to bring systems online efficiently and economically.

### 7.3 EMS Readiness Assessment

Fujitsu will create an EMS layer that will provide consistent network information as required by The State of Utah application products (Fujitsu and third-party as necessary).

#### *Fujitsu Deliverables and Activities*

- Support The State of Utah Level 1, Level 2, and Level 3 process designs and implementations as they relate to the EMSs.
- EMS applications and their related hardware platforms will be delivered fully integrated to The State of Utah per the EMS scaling information included in the requirement document.

#### *Key Assumptions*

The State of Utah of Utah and Fujitsu will work collaboratively to enable the following:

- Platform information; typical hardware vendor, server configuration in two configurations (small-large), server operating system, client profile, and database requirements
- Currently released software version with roadmap for next release
- Interface specifications for connectivity to northbound OSS applications
- Features, supported functions for OAM&P of the subtending network

#### *Staffing*

Fujitsu will have systems engineers and architects in the ATSC lab sufficient to support The State of Utah EMS efforts and ensure success. The OSS team will manage all aspects of third-party products from approved suppliers and platform vendors in the End-to-End solution. The EMS engineering staff will work in conjunction with the ATSC lab staff to enable EMS and End-to-End Testing.

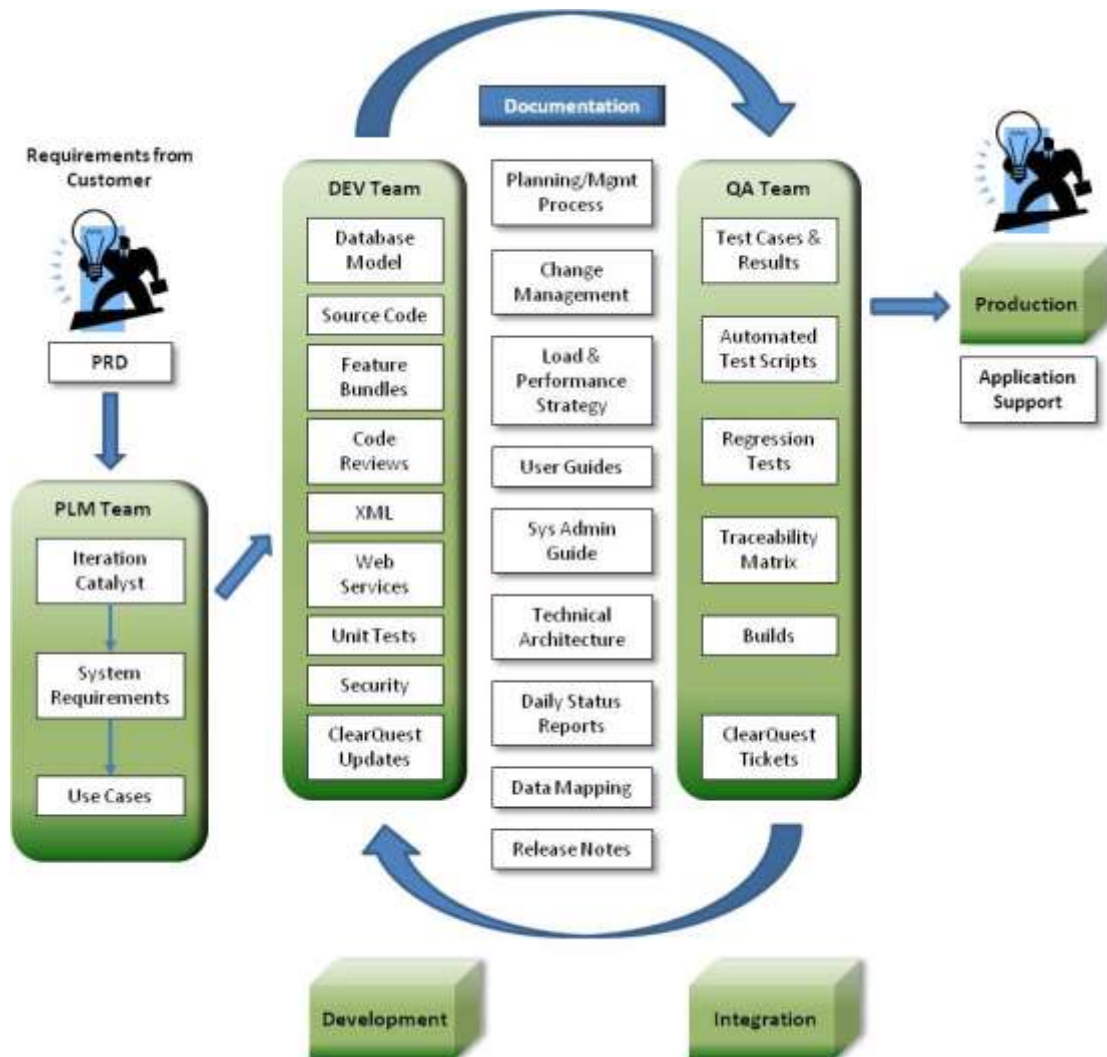
#### *Key-The State of Utah Deliverables*

The State of Utah is responsible for the overall ownership and delivery of all aspects associated with the BSS/OSS systems. The State of Utah will have the responsibility of the System Integration role pertaining to the BSS/OSS applications. This includes all aspects of the Software Delivery Life Cycle (SDLC) including the management of major milestones of business requirements (owned by the business partners), system requirements, design, development, testing and production support.

### 7.4 OSS System Integration Testing

The objective of this service is to allow a successful implementation of The State of Utah software into the network. The process followed by the OSS team will allow The State of Utah to install in their network software applications that satisfy their need both in terms of functionality and performance (refer to Figure 10 for a representation of the process following by Fujitsu).

## ISIS Services Description



**Figure 10: Software Development Cycle**

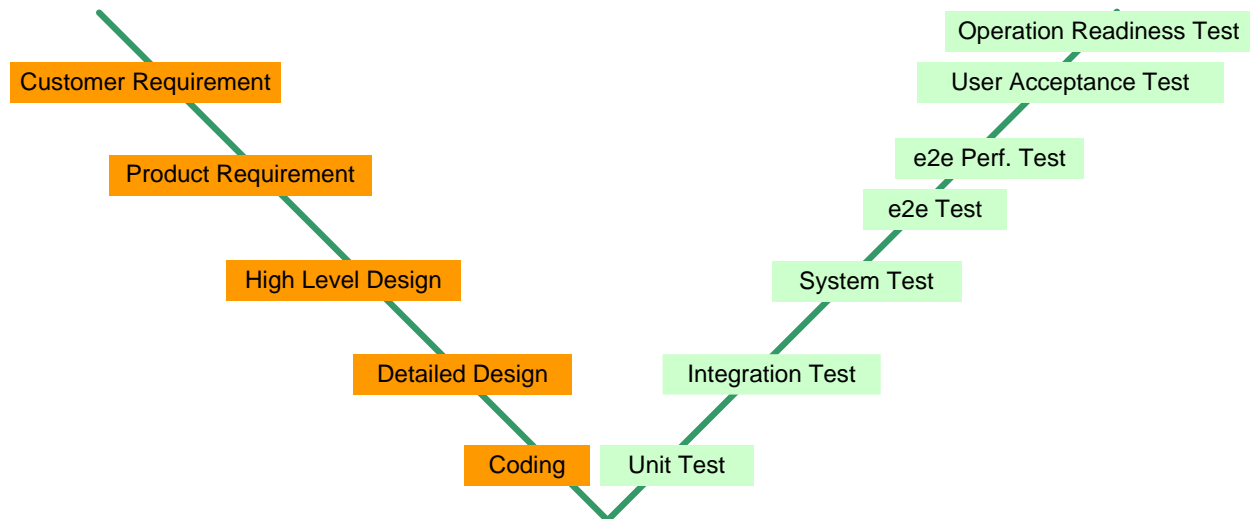
Validation of a design or a solution entails verifying that the requirements have been met. This means ensuring that the solution meets not only the technical requirements, but delivers the customer requirements as well. Hence validation activities extend from technical acceptance testing of a single element in unit testing to verification that the customer's needs are being met in business process testing and user acceptance testing.

Methods and processes are used to perform rigorous testing activities to ensure problem free network deployment.

Validation of a design or a solution entails verifying that the requirements have been met. This means ensuring that the solution meets not only the technical requirements, but delivers the customer requirements as well. Hence validation activities extend from technical acceptance testing of a single element in unit testing to verification that the customer's needs are being met in business process testing and user acceptance testing. The diagram below illustrates the link

## ISIS Services Description

between different phases of testing and requirements. All areas of testing are needed to deliver a solution that meets the customer requirements.



**Figure 11: Relationship between System Requirements and System Testing**

Within the integration and testing management model (ITM), methods and processes exist to perform rigorous testing activities to ensure problem free network deployment.

This necessarily entails a holistic approach to testing—the whole network needs to be tested, not just the single solution being developed or modified.

The basic principles for this approach can be expressed as:

- All changes to the live network must be tested before they are implemented.
- Testing should be done in an environment that adequately replicates the live network.
- These principles, together with a holistic approach to testing, have a practical application in the testing procedures used, the use of lab environments, and the different test phases that determine whether requirements have been met.

### Testing Phases

- Technical acceptance testing in laboratory environments (e.g., Network and IS Technical Testing, Integration Testing, End-to-End Service Testing)
- Testing around deployment in the live network (e.g. Commissioning Tests, System Testing)
- Testing the operational readiness of the solution (this includes processes and collateral for deployment)

### Testing Activities

The main activities are:

- Define the Test Strategy

## ISIS Services Description

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- Produce the Test Plan together with the Test Cases and Test Scripts
- Execute the tests

The test strategy describes how acceptance will be achieved for all of the solution components. The test strategy defines the activities and control processes that will meet the customer requirements and deliver a solution to the production network.

Test Plans are produced on the basis that planning the testing beforehand leads to a better standard of testing, a better understanding of the time and resources required, and better control of test activities and timelines.

Test Execution is performed in a controlled environment, in a laboratory that replicates the production network with an appropriate set of trade-offs or in the live network itself. At the completion of testing, the results are presented in a Test Report, which is used to assess whether to progress to the next stage of testing or deployment. Defects found in testing are recorded and resolution is managed.

Test Processes are implemented to ensure the:

- Quality of testing
- Management of risks to the test program
- Control of testing activities
- Testing processes are underpinned by a logical sequence of activities and associated dependencies

### **Services and Activities**

Fujitsu will be responsible for completing the following tasks:

- OSS/NMS/EMS/Network Interoperability Testing
- Adaptor/Application Development
- Adaptor/Application Testing
- Adaptor/Application Interoperability Validation
- Network Interoperability Testing and Validation
- Service Integration («Service»)
- Carrier-to-Carrier Service and System

### **Key Fujitsu Deliverables**

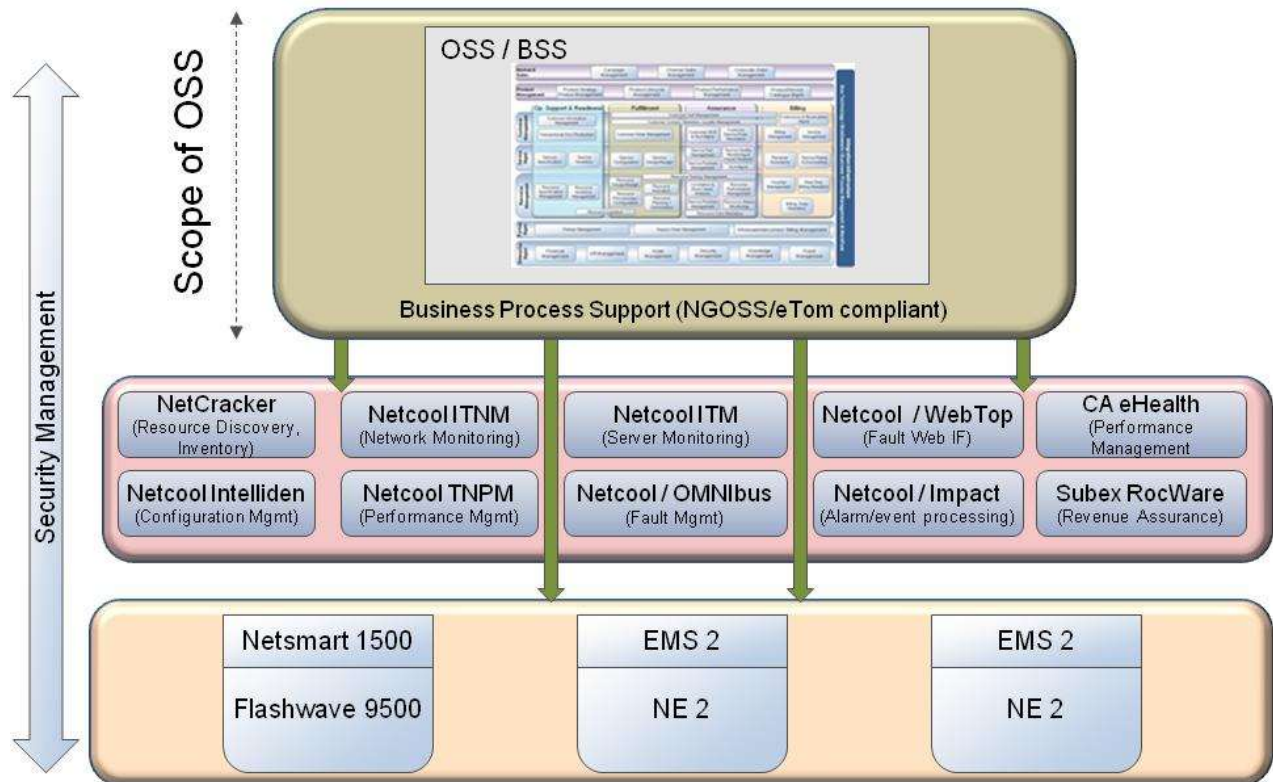
Fujitsu will be responsible for providing the following deliverables:

- Test Plan
- Test Cases
- Test Runs
- List of Defect
- Release Notes

## ISIS Services Description

### 7.5 OSS System Description

The following section presents an overview of the OSS platform that will be implemented in the The State of Utah of Utah network.



**Figure 12: OSS architecture for «Project»**

The proposed OSS will offer fully automated processes for:

- Operation support and readiness
- Fulfillment
- Assurance
- Billing

As described by the Business Process Framework, the following horizontal function will be covered:

- Customer relationship management
- Service Management and Operations
- Resource Management and Operations
- Supplier/Partner Relationship Management

## ISIS Services Description

### 8 Service Category 7: Post-Deployment Support

Fujitsu will provide solution support services to ensure appropriate response and resolution of technical issues in the deployed solution.

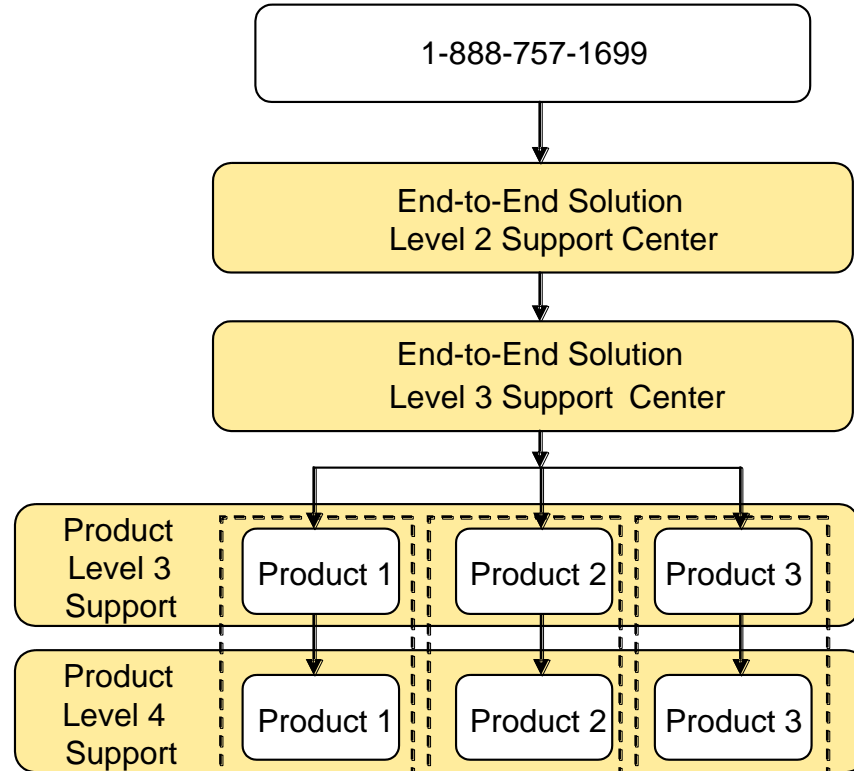


Figure 13: Fujitsu Support Center

#### 8.1 Startup Assistance

Fujitsu will provide a technical resource to provide support on-site after the launch of the system, for an agreed upon period after each phase of the project.

This technical resource will provide The State of Utah with any assistance needed in initial troubleshooting, as well as questions regarding the management and operation of the system.

#### 8.2 Fujitsu Technical Services Center

The Fujitsu Technical Assistance Center (FTAC) will be used to report any issues related to the solution provided by Fujitsu.

Telephone: 1-888-757-1699

Email: [fnccis@us.fujitsu.com](mailto:fnccis@us.fujitsu.com)

Fujitsu requests the customer to have the following data to expedite their Customer Service Request (CSR):

- Company Name
- Contact Name

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- Site Address
- Equipment Type Number
- Software Release
- Call-Back Telephone Number(s)
- Brief Problem Description

Once the CSR is opened, the FTAC will supply the customer contact with a unique log number used for identification with FTAC for any subsequent follow-up communications concerning their request.

### 8.3 Technical Support Services

Fujitsu will supply, as part of a Services Agreement, experienced technical support resources, providing the following services:

- Tier 2 and 3 issue management and analysis
- Interface point to third-party vendors Tier 3 support for issues found to lie with such vendors
- Work to provide workarounds or permanent solutions to issues as appropriate, via configuration changes, application of software fixes, etc.
- Provide guidance to The State of Utah operational forces in debugging and analysis of issues as needed
- Maintenance release information

## ISIS Services Description

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### 9 Out of Scope

Fujitsu has not been selected to perform services as part of this ISIS Services Description for the items noted in this section. Fujitsu would like to perform these services for The State of Utah, and as such may provide a proposal for the comprehensive service offering including commercial terms. Such services include: «Out\_of\_Scope\_Service\_List»

## ISIS Services Description

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### 10 Executive Critical Deliverable Dashboard

The Fujitsu Program Management Office is responsible for gathering and reporting data in a dashboard. This information will be distributed weekly to the core team and monthly to the executive team. Below is the Executive Dashboard containing “critical deliverables” and dependencies that are detailed in the Project Plan/Timeline (Appendix 3).

Index	Category	MPID#	Description	Time to Market Phase		Time to Volume Phase		Scale Launch	
				Due Date	Current Best View	Due Date	Current Best View	Due Date	Current Best View
1	POR		POR V1.0	mm/dd/yy		N/A		N/A	
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									

# ISIS Services Description

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## 11 Gating Items, Risks, Assumptions, and Dependencies

### 11.1 Risks, Assumptions, and Dependencies

This section outlines the Gating Items, Risks, Assumptions, and Dependencies contained in this ISIS Services Description for the scope of Fujitsu’s system integration. These risks, assumptions, and dependencies, identified at the time of SOW execution, will be tracked by the Program Management Team.

#### 11.1.1 Testing and Integration

RISKS	MITIGATION

**Table 4 - Testing and Integration Risks and Mitigation**

#### 11.1.2 Requirements

RISKS	MITIGATION

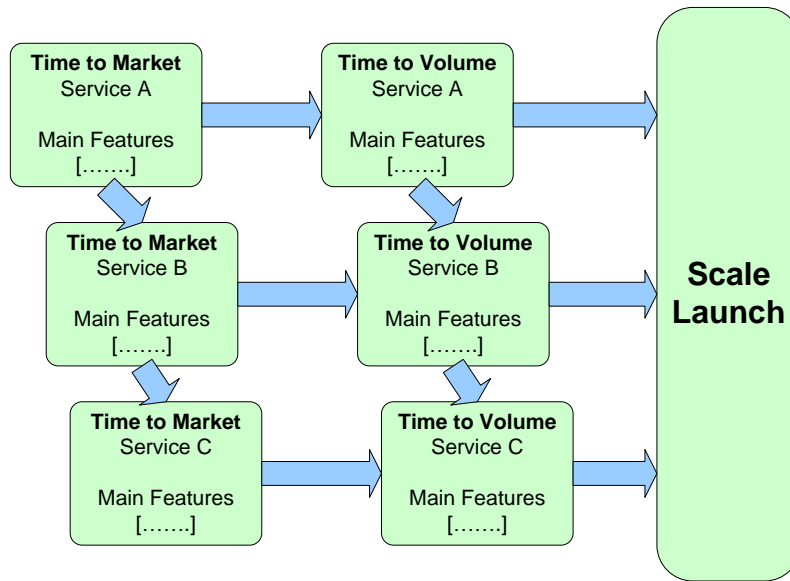
**Table 5 - Requirements Risks and Mitigation**

### 11.2 Critical Paths/Dependencies

The following figures are graphical representations of the major milestones and associated dependencies contained in Appendix 3.

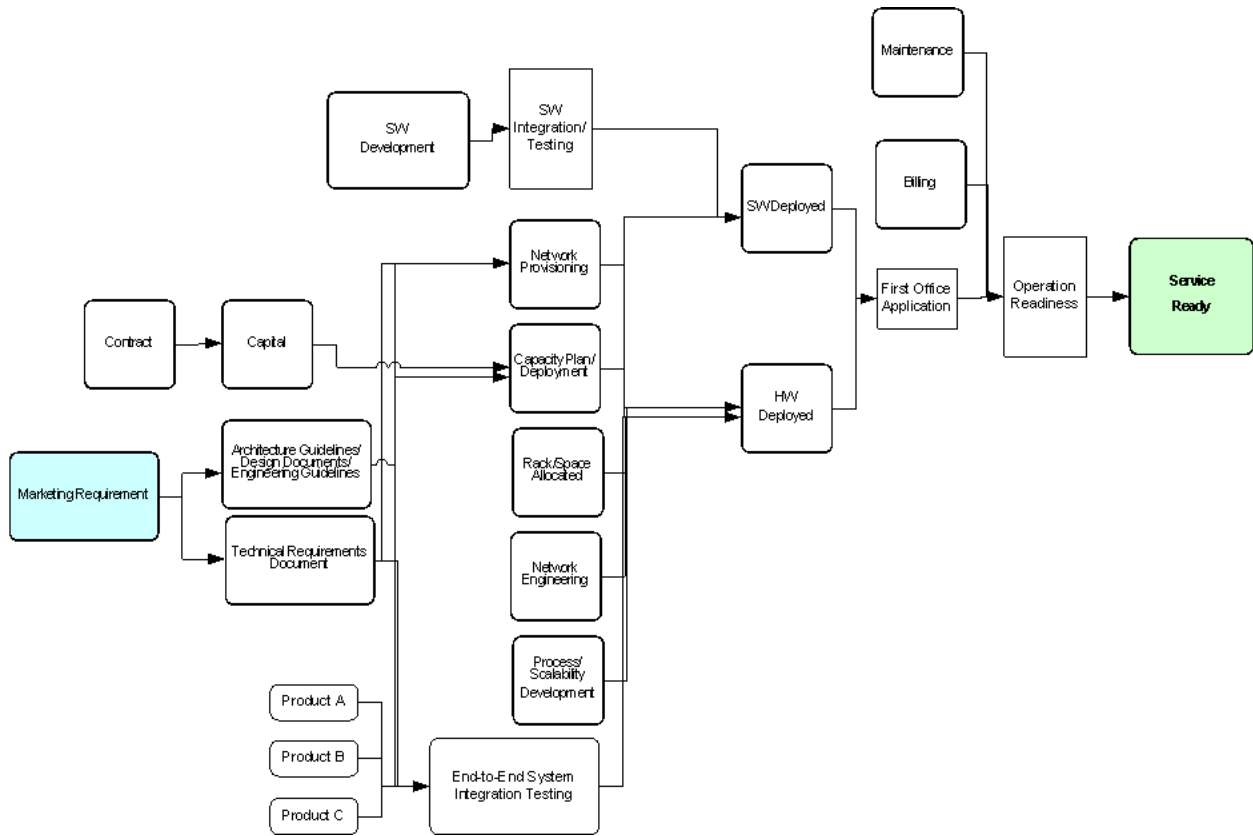
The milestones and dependencies are broken out per phase and provide a view of the critical work items, their relationships, and the sequence in which they must occur for the given phase in order to achieve service readiness/general availability.

# ISIS Services Description



**Figure 14: Overall Critical Path—Dependencies**

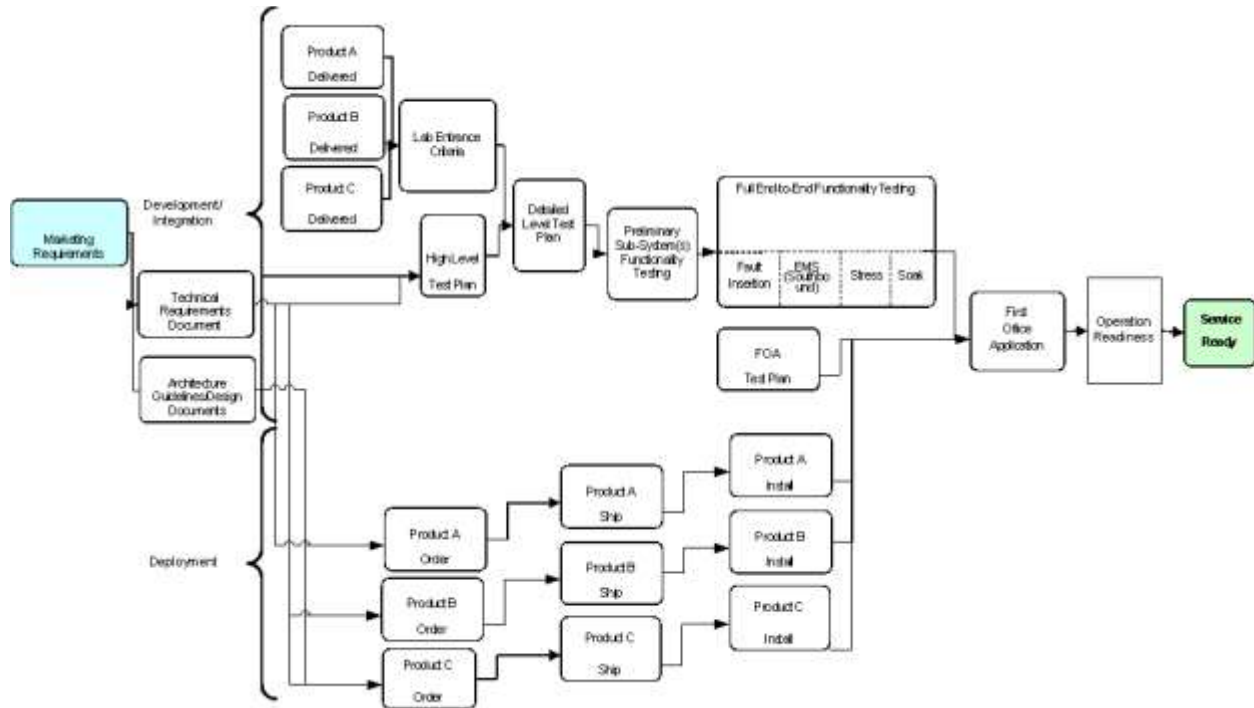
*[Note: This is a flow example - Enter custom specific critical path for each phase of the project]*



**Figure 15: High-Level Critical Path for each Phase- Dependencies**

# ISIS Services Description

[Note: This is a flow example - Enter custom specific critical path for each phase of the project]



**Figure 16: Detail Critical Path for each Phase—Dependencies**

[Note: This is a flow example - Enter custom specific critical path for each phase of the project]

## ISIS Services Description

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### 12 Change Control Procedure

In the event either Party determines the need for a change to any element of this ISIS Services Description, such changes must be routed through The State of Utah /Fujitsu Change Control Procedure. The routing procedure of all change requests is contained below. If applicable, The State of Utah and Fujitsu will use Telcordia Standards to determine severity levels. For the purpose of change control the following criteria will be used:

- Critical Change Request
  - Criteria: Major/Critical functionality, impact to Launch or dependencies leading up to Launch
  - Timeline for closure/resolution: 1 week
- Major Change Request
  - Criteria: Major functionality with a potential workaround
  - Timeline for closure/resolution: 3 weeks
- Minor Change Request
  - Criteria: Minor function/feature, workaround available, no impact to timeline
  - Timeline for closure/resolution: 6 weeks
- Documentation
  - Criteria: Changes to Documentation
  - Timeline for closure/resolution: 6-8 weeks

The State of Utah and Fujitsu PMOs are responsible for the management of any changes to the SOW and changes to deliverables of this SOW. When either party requires a Change, a Change Request (CR) form (attached in Appendix 5) will be issued by the PMO.

Change Review Board will be formed within each company to work with and achieve a decision on each CR.

Assuming the decision of the teams is to not recommend the approval of the change request, the owners will identify the reason and the Fujitsu CPO will record it as such in the Change Control Log.

Under all circumstances, the PMOs will communicate the status of change requests to the originator, stakeholders, and management of The State of Utah and Fujitsu. If issues associated with a change request cannot be resolved, the PMO will follow escalation procedures contained in this ISIS Services Description.

If it is determined that the change request is outside the scope of the current commercial terms, the updated commercial terms will be documented in the CR and be incorporated, as required, into the applicable agreement(s).

If a commercial obligation will be incurred as a result of the approval of a change request, the responsible stakeholder organization will ensure funds are approved to meet the obligation.

If The State of Utah is the Originator, Vendor will provide an initial response to The State of Utah to:

## ISIS Services Description

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- acknowledge receipt of the CR,
- inform The State of Utah if there will be any charges for Vendor Services to conduct an Impact Study,
- identify any Schedule changes or delays which will be caused by conducting the Impact Study,
- if appropriate, provide The State of Utah with a fixed price (including expenses) for conducting the Impact Study,
- provide a planned date for submitting a formal response or Impact Study, and
- if needed, arrange a meeting to confirm vendor understanding of the requested change

Based on the initial response, The State of Utah will decide whether Vendor should conduct the Impact Study.

When completed, the formal response will be incorporated into or appended to the CR, and will document the impact of the requested change, which may include any or all of the following: Scope, Schedule, and Price.

If Vendor is the Originator, the CRF will include the same elements of information as those originated by The State of Utah. The State of Utah will inform Vendor if there will be any charges for The State of Utah's services in conducting the Impact Study and Vendor will decide whether The State of Utah should conduct the Impact Study.

If the Parties agree to authorize a funded Impact Study, it shall be performed as an Order for Services under the terms of the Master Agreement.

If the Parties agree the CRF response is to be unfunded, the impacted party will proceed to develop the response.

Upon the completion of the Impact Study, the Parties shall have the right to approve, disapprove, or modify and approve the Change Request, which originated the Impact Study.

Change Requests that are agreed to by the Parties shall be codified as written amendments to this Order, which shall become effective when, signed by both Parties.

### Change Control Log

The Change Request Log details the CR Name, description, Originator, commercial implications, expected and actual completion dates. The Change Request Submission and Acceptance Forms detail the proposed change, reason for the change, the expected completion date, as well as acceptance or rejection of the CR.

The PMO will administer the CR log, and will be responsible for updating the CRs' status, as well as posting the descriptions of the approved specifications, including revisions to the specifications or committed feature deliverables that may result from approved change requests.

The following approval process will be used:

# ISIS Services Description

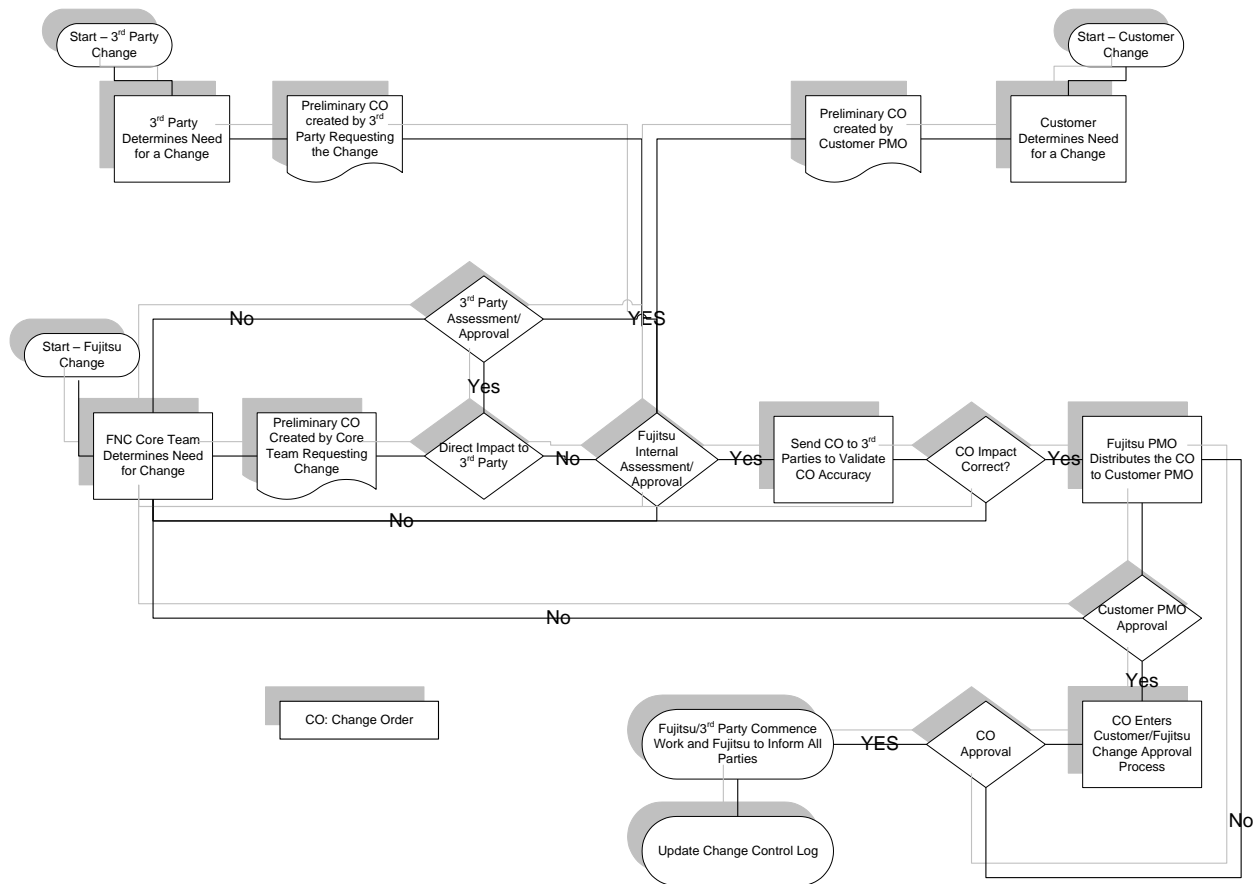


Figure 17: Approval Process

## ISIS Services Description

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### 13 Defect Management

It is Fujitsu's responsibility to set up a common Problem Reporting tool to be accessed by all Third-Party vendors and The State of Utah

#### Key functions of Defect Management

- Tracking issues in a single repository database
- Classifying Severity relative to service affecting
- Assessing customer impacts
- Communicating defects to vendors
- Developing Metrics, progress charts
- Performing correlation among defects found in different sources
- Reporting status of defects including severity, description, etc.
- Monitoring defect from the time of recording until satisfactory resolution has been determined

Defects may be written against but not limited to the following:

- Hardware Components
- Software Components
- Documentation
- Process Flows
- Architecture
- Requirements
- Methods and Procedures

Defects may be opened at any stage of testing.

Program Management is responsible management of the following defect issues

- Escalation Issues
- Time of Resolutions

#### Severity Defects Definitions

- Critical
  - Critical errors are used to classify a severe, service-affecting condition has occurred and that immediate corrective action is imperative, regardless of the time of day or day of the week.
- Major
  - Major errors are used to classify hardware or software conditions that indicate a serious disruption of service or the malfunctioning or failure of important

## ISIS Services Description

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circuits. These troubles require the immediate attention and response of a craftsperson to restore or maintain system capability. The urgency is less than in critical situations because of a lesser immediate or impending effect on service or system performance.

- Minor
  - Minor errors are used to classify troubles that do not have a serious effect on service to customers or for troubles in circuits that are not essential to NE operation.
- Documentation:
  - “Documentation” classification will be used for tracking problems associated with all documentation. For clarity, problems with Documentation will not be classified as “Minor”.

### Defect Database

**Clearquest:** A common reporting tool which is accessed by all 3rd party vendors and The State of Utah of Utah. All <<name>> related defects types are submitted through Clearquest. Automatic notifications are instantly sent via e-mail to the appropriate vendor to inform them of the problem so they can take immediate actions. Below are some of the features and capability of Clearquest:

- Off the shelf product Clearquest by Rational
- Fully Customized to suit needs.
- Intended for defect tracking and resolution.
- Tracks and manages product defects throughout a product's life cycle.
- Provides a range of meaningful metrics to measure product and process quality.
- Web-based interface for easy submission of, and access to defects through a web browser from virtually any platform.
- Extensive search and query capabilities based on any criteria.
- Reporting and analysis tools to track trends for overall product quality and stability.
- Fully distributed information management.

# ISIS Services Description

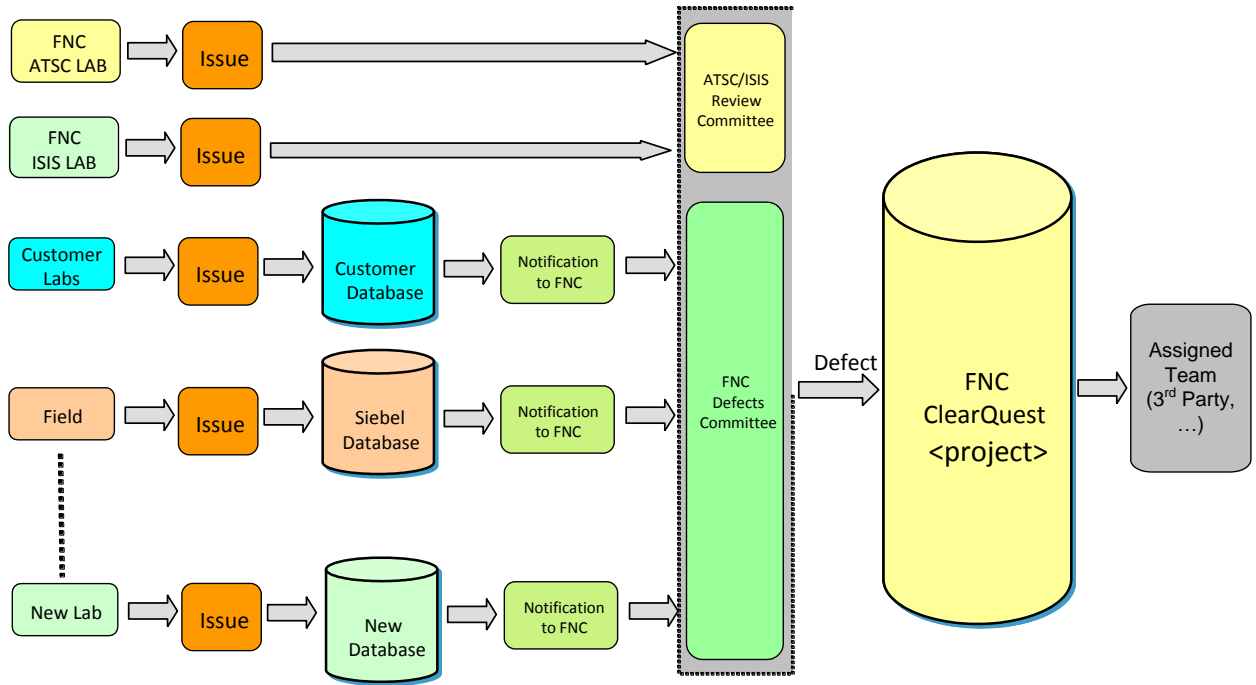


Figure 18: Defect Management Process

## ISIS Services Description

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### 14 Approvals

The following The State of Utah Senior Managers has reviewed and recommends approval of this Statement of Work.

The undersigned have reviewed and recommend approval of The State of Utah /Fujitsu «Project» Plan of Record, as described herein.

NAME	TITLE	COMPANY	SIGNATURE	DATE
		The State of Utah of Utah		

The undersigned have reviewed and approved the jointly developed The State of Utah /Fujitsu «Project» Plan of Record, which consists of the Parties' timelines, commitments, and plans associated with «Project».

NAME	TITLE	COMPANY	SIGNATURE	DATE
		The State of Utah of Utah		



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# Central Office Modernization

Meeting your subscribers' expectations and retaining their loyalty are key challenges in a competitive telecommunications industry. Your ability to meet these challenges may be limited by an outdated, expensive network that was not designed for today's technology and business environment.

## Revitalize your network

The Fujitsu Central Office (CO) Modernization service draws upon our extensive expertise in both legacy and next-generation environments. If you find yourself with power-hungry legacy equipment and sub-optimal circuit plans, we can help you simplify and streamline your network infrastructure. CO Modernization provides a complete, start-to-finish implementation path to increase scalability and improve network performance.

## Boost your competitive position

With the support of our CO Modernization service, you can build competitive strength, flexibility and longevity into your network. It's a fact that older network infrastructure generates less revenue per square foot than up-to-date technology. Costly power bills, high failure rates, unused bandwidth and wasted capital all erode the health of your business. Overstretched equipment limits your ability to respond to customer demands, reducing business opportunities and potential.

With the Fujitsu CO Modernization service, you can renovate your network to achieve important business benefits:

- Improve reliability
- Optimize performance
- Cut power consumption
- Reduce physical footprints
- Eliminate stranded bandwidth
- Economize on operations
- Control capital spending

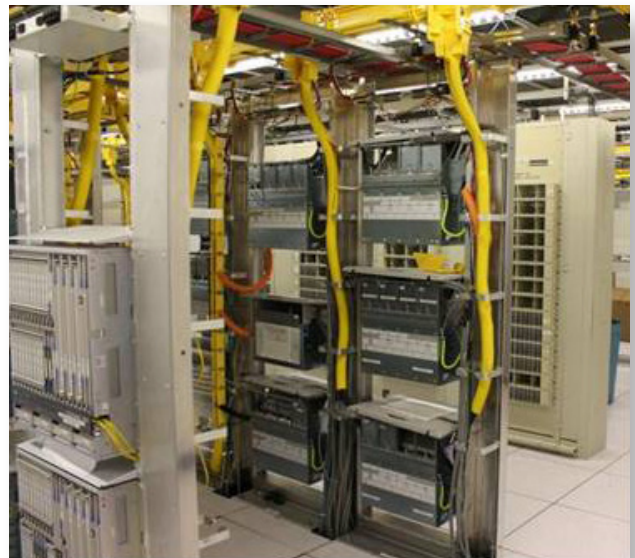
Fujitsu CO Modernization keeps you in control. The service consists of three phases, each of which concludes with specific deliverables that require customer approval before proceeding to the next step. A dedicated Fujitsu program manager oversees the project from beginning to end. From initial inventories to final cut-over, you'll have seamless, dependable support and proactive communication.

## Three phases—discover, analyze, implement

**Phase 1: Discovery** – Fujitsu personnel assess the network equipment and infrastructure, both electronically and via on-site physical audit. During this phase, technicians prepare an exhaustive report containing meticulously validated data. This identifies discrepancies and provides a basis for accurate network analysis.

**Phase 2: Analysis** – The Fujitsu technical team analyzes the current state of the network, using the data retrieved during the Discovery phase. The team works with you to develop necessary plans of action, such as a migration plan, detailed implementation schedule and Methods of Procedure (MOPs) to optimize equipment and facilities utilization, based on data from audit results.

**Phase 3: Implementation** – The final phase is to perform the implementation tasks that result from the Analysis phase. We pre-provision, migrate and test circuits that reside on legacy equipment to new platforms, as defined in the migration plan. After a stabilization period, a full quality audit is performed before we turn-up, test and roll traffic.



# Meet current & future demand

Project phase	Deliverables
Discovery	<ul style="list-style-type: none"> <li>• Physical inventory               <ul style="list-style-type: none"> <li>• Power availability</li> <li>• Floor space availability</li> <li>• Equipment types and locations</li> <li>• Optical demarcations</li> <li>• Electrical demarcations</li> </ul> </li> <li>• Virtual inventory               <ul style="list-style-type: none"> <li>• Provisioning</li> <li>• Software revisions</li> <li>• Databases</li> <li>• Circuit utilization</li> <li>• Network topology</li> <li>• End-to-end circuit connectivity</li> </ul> </li> <li>• Implementation plan</li> </ul>
Analysis	<ul style="list-style-type: none"> <li>• Detailed methods of procedure               <ul style="list-style-type: none"> <li>• Migrations</li> <li>• Optimization of existing circuits</li> </ul> </li> <li>• Quantification of capacity and real estate savings</li> <li>• Engineering package               <ul style="list-style-type: none"> <li>• Network diagrams</li> <li>• Circuit provisioning</li> </ul> </li> </ul>
Implementation	<ul style="list-style-type: none"> <li>• Ongoing status reports               <ul style="list-style-type: none"> <li>• Weekly status</li> <li>• Audit progress</li> <li>• Capacity recovery</li> </ul> </li> <li>• Project engineering package including:               <ul style="list-style-type: none"> <li>• As-built diagrams</li> <li>• Circuit maps</li> <li>• Detailed network change report</li> <li>• Detailed floor space and capacity recovery report</li> </ul> </li> </ul>

## Get started today

The Fujitsu services organization works with each and every customer according to unique individual needs. Contact us to discuss your modernization project, and discover how the Fujitsu Central Office Modernization service can bring out the full potential of your network.

## Fujitsu Network Communications Inc.

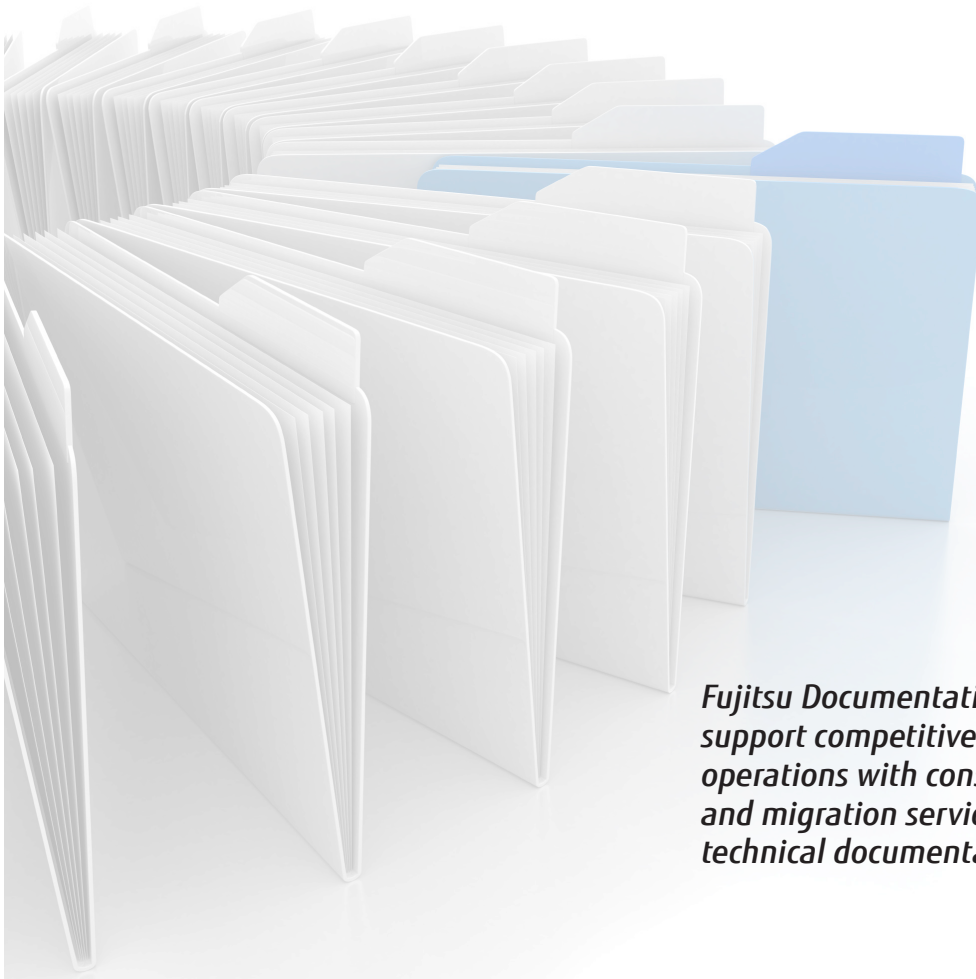
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# Documentation Consulting Services



*Fujitsu Documentation Consulting Services support competitive, high-quality network operations with consultancy, implementation and migration services to build state-of-the-art technical documentation solutions.*

# Documentation Consulting Services

## Documentation Solutions for Top-Quality Network Operations

Technical documentation is essential to the efficient operation of any network, and influences every aspect of ownership and operation. It is vital to recognize the crucial importance not only of your network's information repository, but also of established processes, procedures, and controls for maintaining it. However, in a competitive market and under pressure to control costs, many service providers are challenged with maintaining an appropriate standard and range of documentation. Fujitsu Documentation Consulting Services provide an answer to this challenge and support you in developing, building, and managing network planning, engineering, deployment, operation, and test documentation.

### Experts in Technical Publishing

Fujitsu is well-known throughout the industry for commitment to best-in-class solutions in every area of our business. Our established history and high level of technical expertise has resulted in very strong customer loyalty, exemplified by our unprecedented customer retention rate. Our technical publications team is no exception; Fujitsu has the tools and experience to address the growing demand for professional and consistent documentation. As a TL-9000 certified manufacturer and service solutions provider, we have wide-ranging technical publications management expertise in-house. We can put this at your disposal to deliver precise documentation that creates a positive customer experience, improves quality, and enhances employee performance and productivity. We work in partnership with you to meet your unique documentation standardization needs, whether for Methods Of Procedure (MOPs), work instructions, operational maintenance guides or reference materials.

### Documentation Consulting Services Portfolio

If you have a documentation project or requirement but are uncertain how to proceed, Fujitsu can assist you in determining where to start, what questions need to be addressed, and how to lay out a plan to get there.

Fujitsu Documentation Consulting Services include the following:

- Auditing and consultation
- Documentation foundation and architecture
- Documentation control processes
- Documentation standardization development
- Process design and implementation

### How we Solve Your Documentation Challenges

- We develop and implement cost-effective processes for creating all kinds of technical documentation.
- We can evaluate the effectiveness of your existing documentation development team and resources.
- We help you determine if and how documentation projects should be implemented.
- We evaluate and recommend authoring tools, document control systems, and data repositories.
- We determine the best approach to content development for a variety of outputs, such as end-user documentation, online help, and operational procedures.
- We determine the most effective way for the user community to access the documentation they need.

### Documentation Foundation Service

Documentation comes in a variety of formats and the potential volume and structure of content is diverse. It is critical to provide clear and concise information in a format that is consistent. Fujitsu helps you meet this need with our Documentation Foundation Service, which provides a structured and consistent documentation solution. The Documentation Foundation Service covers all the essentials of developing, implementing, and migrating a technical publications library.

The Documentation Foundation Service incorporates the following:

- Template creation
- Documentation style guide
- Documentation work instructions
- Documentation migration service

### Template Creation

The primary purposes of template use are to maintain a clean, consistent look throughout all documents of a given type, and to reduce the labor involved in creating and updating content. A well-constructed template set ensures that all documentation follows a particular structure, layout, and style. Templates save time and provide a general outline of information to be included. This helps to confirm that all pertinent data are present, and that all documents created from that template are accurate and functional.

# Documentation Consulting Services

## Documentation Management that Meets Your Needs

The following are just a few examples of the numerous document types for which templates can be developed:

- Work instructions
- MOPs
- Operations maintenance guides
- Product description documents
- Product deployment guide
- Lab entrance criteria checklist
- Document change request form

Templates provide ease of use when creating, revising, and/or approving documentation. Rather than developing a new document from scratch each time content needs to be updated, a template standardizes the work effort, improves efficiency, and enhances future document creation. In addition, templates reinforce the styles and format presented in the documentation style guide.

### Documentation Style Guide

The purpose of a documentation style guide is to convey precise standards on document structure, appropriate language, and format. Style guides contain editorial guidance that is specific to an industry, company, and sometimes, a given department. To establish a corporate identity, Fujitsu offers a Documentation Style Guide service. The deliverable for this service is a comprehensive style guide that establishes the following:

- Word choice parameters to ensure all documentation is written in approved, appropriate language.
- Grammar and punctuation conventions that are to be used properly throughout all documentation and procedures.
- Format and style standardization of fonts, sizes, margins, logo, and other visual and editorial aspects, to create a universal look for all documentation.
- Consistent document naming and numbering conventions, including documentation type, name, and version.
- Proprietary information that is up to date, relevant, and universal.
- Document revision history, which details the document's status, purpose, and specific updates that have been made
- Signoff authorization to ensure all documentation updates are accurately recorded and approved.

### Documentation Work Instructions

Documentation work instructions are essential tools that provide explicit details for use in documentation authoring. To establish controlled and efficient work processes and procedures, work instructions provide guidance for generating documents for each document type. Fujitsu can provide a complete solution to procedural management and documentation by identifying specific prerequisites, step-by-step instructions, and preferred outcomes.

### Documentation Migration Service

Documentation migration allows you to present existing content in a new format using standard templates. The migration could be a conversion of file types or source files to a standard format. Fujitsu can develop a detailed plan to convert your existing material into newly developed templates while applying style guides to deliver professional polished material.

### Documentation Control Services

Fujitsu offers the creation of a document management solution that enforces change control best practices for all documents and forms used by internal departments. By implementing a document control solution, you ensure that only correct and valid documents and forms are in use; that revisions are a matter of record; and that document creation, revision, and review cycles follow a predetermined lifecycle. A Document Control solution could include a Content Management System (CMS) that provides information regarding document change history, approvals, and distribution lists. This information is readily available for review and ensures full process compliance. A CMS-based solution also enhances the documentation user community's ability to find and access information, through improved document search capabilities.

# Documentation Consulting Services



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# Managed network solutions

Meeting customer expectations is essential to business health, but optimal network performance and responsiveness can create costly overhead in the form of in-house network operations and management. Fujitsu Managed Network Solutions can meet your network operations requirements and deliver rapid, provable return on investment by reducing operational expenses. Outsourcing all or part of your network management to Fujitsu compares favorably with the cost of operating your own facility. A high standard of network management is essential—with Fujitsu Managed Network Solutions, it can also be economical.

### Guaranteed system protection—around the clock

Fujitsu Managed Network Solutions offer a full range of network fault and performance monitoring features with connection services for communication and data networks. Fujitsu technicians will work independently to resolve any issues that arise, and collaborate if necessary with your in-house staff or third-party vendors. We can guarantee system protection around the clock, 365 days a year. With this level of assurance, you can achieve quicker time to revenue, simplified operations management, increased availability and operational cost efficiencies.

### World-class facility

We operate Managed Network Solutions from our fully redundant, state-of-the-art Network Operations Center (NOC), located in Sunnyvale, CA and Richardson, TX. This access-controlled NOC maintains the highest level of security and protection for your network data, including geographically dispersed backup operations and four-layer security.

The Fujitsu NOC supports many types of networks and multivendor equipment in addition to Fujitsu platforms. With 20-plus years in the business, we have the know-how to prevent outages, protect your service levels, safeguard revenues, and enhance customer satisfaction.

Managed Network Solutions Packages		
Service	Basic Package	Premium Package
Expert 24 x 7 x 365 surveillance	✓	✓
DCN management monitoring	✓	✓
Condition notification	✓	✓
Alarm isolation & resolution		✓
Performance management		✓
Configuration management		✓
Circuit resource management		✓
Move/add/change (MAC)	Per PO	Unlimited
Inventory management		✓
Third party management		✓
Customized automated reports		✓
Advance hardware replacement	Optional	Optional
Onsite maintenance	Optional	Optional



# Meet current & future demand

## Services Offered

- **Network Surveillance**

Our network surveillance service can be customized for primary or supplemental monitoring, up to the 24x7x365 level. Engineers who monitor the network are specifically qualified on the types of equipment being monitored. We immediately notify your point of contact when any condition change occurs.

- **Fault Management**

Fujitsu engineers are qualified to respond appropriately to any alarm or condition. Actions taken include troubleshooting, root cause analysis, fault correlation, isolation and diagnosis, in addition to resolution and restoration of full functionality.

- **Performance Management**

We monitor and report on your network's effectiveness and equipment performance, based on QoS parameters.

- **Configuration Management**

NOC technicians perform regular, remote memory backups on a per-NE basis. Our technicians also manage software updates and Product Change Notifications (PCNs).

- **Inventory Management**

Fujitsu technicians maintain a database of part numbers on a per-NE basis, for the equipment in your network.

- **Circuit Resource Management**

Our staff performs circuit bandwidth allocation and provisioning.

- **Remote Move/Add/Change**

We perform remote provisioning actions such as configuration of new network elements, data circuits, and optical cross-connect provisioning.

- **Preventive Maintenance**

Our regular, scheduled checkups are a great way to assess the health of your network, using a checklist of items developed to suit your individual network.

- **Advance Hardware Replacement (AHR)**

This optional extra eliminates spare-parts worries and ensures availability of needed hardware. The AHR service guarantees availability of covered replacement parts and delivery nationwide within a specified time period.

- **On-Site Maintenance (OSM)**

This optional extra reduces the need for placement of personnel in all areas of your network by utilizing the onsite maintenance services. We dispatch expert technicians to your site to be the eyes and hands of the NOC engineers. Personnel can arrive within four hours or a specific scheduled time.

- **Process Improvement**

We analyze your processes and procedures, and work with you to develop improvements. We can also help you formulate disaster recovery plans and build a resilient infrastructure.

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# Master Network Integration (MNI)



*Speed deployment, drive down costs, and meet changing business requirements with the proven turnkey approach for delivering high-quality, end-to-end multivendor networks.*

# Master Network Integration

## Bringing it all Together

Organizations deploying large, multivendor networks face daunting challenges. Not only is identifying and testing the right products and services critical to success, but IT organizations must also address interoperability, quality, costs, delivery dates, scalability, and ongoing support issues. Fujitsu, an industry leader in communications networks and IT solutions, is helping organizations speed deployment times and reduce the cost of implementing high-quality foundational networks. We bring together the right combination of best-of-breed products and services to support organizations' business needs today and into the future.

Fujitsu Master Network Integration (MNI) provides turnkey, end-to-end deployment solutions, customized to your organization's specific needs. Our program management professionals are your single point of contact as they help you plan, deploy and maintain a scalable multivendor network that supports your business-driven IP applications—delivered on-time and on-budget.

### Experts in Foundational Networks

Fujitsu delivers comprehensive, fully integrated Layer 1–4 solutions to support a wide range of customer business-driven IP applications. The MNI solution helps you deploy the right network to support your needs, whether it is cloud, video, VoIP, or other technologies.

Our turnkey delivery approach starts with a custom design to address your specific requirements. We then seek and test the best combination of products, services and equipment to ensure maximum performance and interoperability. Our responsive team of Fujitsu experts works in close partnership with you to design, engineer, test and support the multivendor network so that it achieves your business goals. Once the network is fully deployed, Fujitsu provides a range of multivendor maintenance and Network Operations Center (NOC) services to support and maintain successful network operations.

### Multivendor Build Services:

- Network Design and Engineering
- Engineering, Furnishing and Installation services (EF&I)
- On-site configuration and simple turn-up or rigorous long-term testing
- Furnish Material (FMAT)
- Program Management

### Multivendor Maintenance & NOC Services:

- Software Maintenance & Upgrade Subscription (SMUS)
- Full complement of training courses & classrooms
- Routine Preventative Maintenance (RPM)
- Remote technical assistance from Fujitsu engineers
- Repair & Return
- Advance Hardware Replacement (AHR)
- On-site Maintenance and Support

### Master Network Integration

- Accelerates network deployments
- Reduces costs, time, resources
- Ensures successful implementation
- Addresses unique business requirements
- Simplifies communication
- Streamlines procurement, accountability
- Supports business agility

### Dedicated Project Team with Single Point of Contact

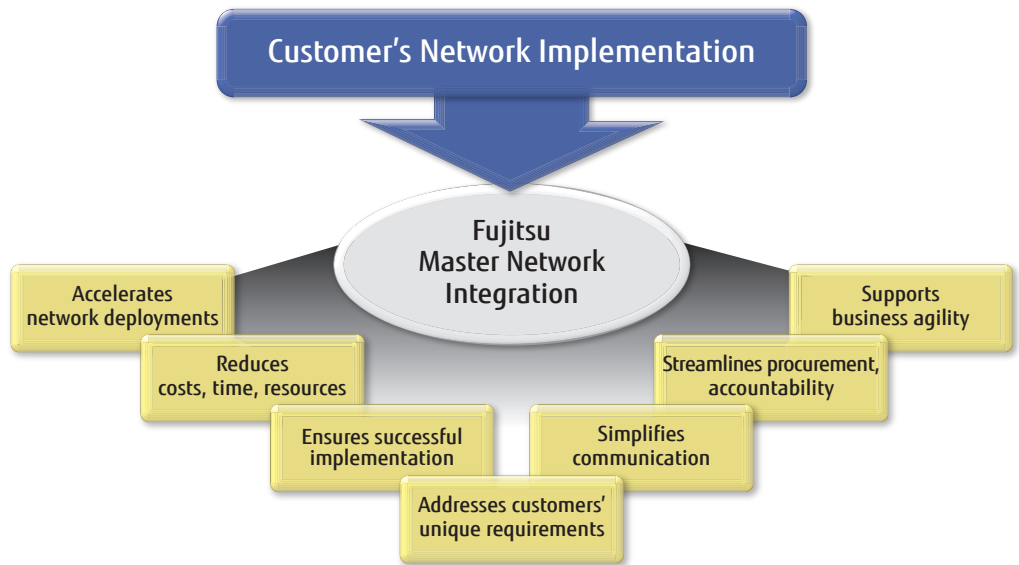
Fujitsu MNI gives each customer a single point of contact to streamline communication. Our program management team employs world-class TL 9000 certified processes that ensure the highest quality planning, co-ordination and management of all aspects of network deployment. Using these processes, we oversee everything from engineering, testing, installation, and turn-up to remote management. As the network integrator, the Fujitsu team provides unbiased mentoring, engineering and ongoing recommendations. Our proven approach ensures successful implementations of your initiatives, producing the highest quality results on-time and within your budget.



## The Effective Solution for Complex Multivendor Networks

### Strong Partner Portfolio

Fujitsu is vendor-neutral and will identify the best products and services to create the right solution for each customer. At the heart of our solution is the Fujitsu Core Transport Network Competency featuring connection-based packet optical transport, DWDM, and SONET. We partner with key industry leaders for Layer 3 switching and routing, and network peering as well as with data communications providers for access and aggregation. Depending upon your requirements, Fujitsu designs a custom solution of best-of-breed providers—bringing them all together for a successful network deployment.



**Master Network Integration (MNI) provides end-to-end products and services to ensure fully integrated, multivendor deployments for diverse customer-driven IP applications.**

### Constant Focus on Quality

Fujitsu maintains focus on providing quality processes, standards and governance in every network deployment. We strictly adhere to ISO 9000 standards for the preparation of all contract deliverables, including documentation of hardware, firmware and software. To ensure compliance with the standards, the Fujitsu Quality Team monitors progress with periodic audits during and after project completion.

### Proven Solution Ensures Success

Fujitsu is recognized as an industry leader in managing complex, collaborative deployments. MNI addresses complex business application requirements for now and the future. With a successful track record in network integration, Fujitsu MNI is an effective solution for creating flexible network architectures capable of providing premier service for the long term.



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# Audit Service for Network Operations Centers



*This service, part of our Managed Services suite, provides comprehensive study and analysis of Network Operations Centers (NOCs), to identify gaps between current operational methods and industry standards, and make recommendations for closing these gaps and optimizing performance.*

# Audit Service for Network Operations Centers

## Optimize Your Network Operations Center

The Network Operations Center (NOC) is the nerve center of your network. A NOC functioning at its peak translates to stronger ROI, increased network visibility, and accelerated problem resolution. Most importantly, improved network uptime and a high-performing NOC translates to increased customer satisfaction and stable operation. Therefore, the health of your NOC is essential to the health of your bottom line.

Fujitsu can work with you to analyze the current state of your NOC, identify gaps between the current state of a NOC and the desired state. Areas of analysis include tools, systems, processes, procedures, methods, staffing resources and organizational structure. This process of analysis helps transform your NOC to an optimized state. We use the most innovative delivery methods available in the industry, saving you time and money. Our approach is founded on a trusted strategic partner role, based on expertise, proven quality and on-time delivery performance.

### Comprehensive Analysis Builds a Path to Transformation

Our exhaustive study produces not just a list of recommended change actions; where indicated, we can overhaul entire processes based on cost-benefit analysis to enable you to achieve a desired operational state. In addition, we can analyze and budget the available outsourcing and/or workforce augmentation alternatives. In sum, you benefit from a customized solution that fits your requirements and resources. Specialty areas include consulting and outsourcing of multivendor technology design and engineering, field operations, NOC design and operations, business continuity, disaster recovery, reliability plan audits and ongoing management services.

### Proven, Repeatable Project and Process Methodology

Each NOC Audit project is coordinated by a certified program manager. This program manager serves as the focus of communication for all project activities and resources, and is engaged throughout the duration of the project. The program manager has a clear understanding of the goals, objectives, and milestones, and keeps you fully informed with regular status information throughout the project.

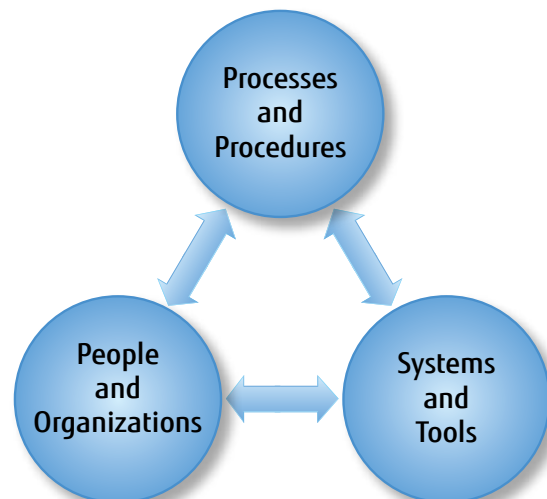
We work closely with your technical staff in a three-phase project methodology that gets the best results as expediently and smoothly as possible. The three phases are:

**Step 1: Feasibility Study** – We collaborate with you to fully understand your challenges, vision, and direction. Our objective is to understand the baseline in several areas: tools and systems; processes; procedures and methods; and people and organization.

**Step 2: Due Diligence** – We perform onsite interviews with NOC stakeholders to create a baseline of the current state and condition of the NOC. Topics for consideration include:

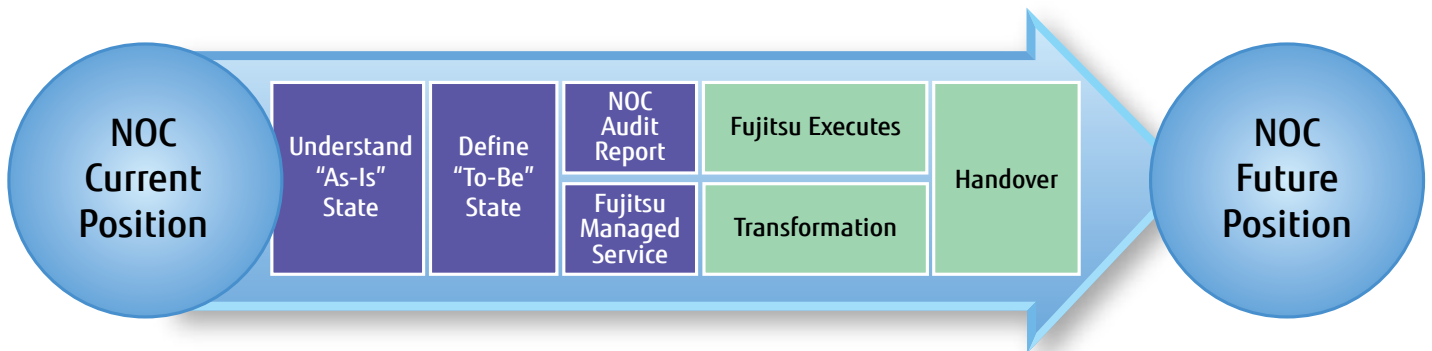
- Methods, Processes and Procedures
  - Operational processes
  - Performance metrics & KPIs
  - Work Rules
  - Disaster recovery & reliability
  - Business continuity
- Systems & Tools
  - NOC tools & systems, including OSS system design
- People & Organization
  - Personnel capabilities
  - Competence requirements
  - Training requirements
  - Organizational structure recommendations

**Step 3: Gap Analysis and Recommendations** – Using Step 2 as a basis, gaps between current operational methods and industry standards and best practices are identified. Recommendations for improvement are then proposed.



# Audit Service for Network Operations Centers

## Taking Your NOC Forward



The final deliverable of the NOC Audit process is an exhaustive audit report. This report contains the detailed findings of Step 2 and Step 3, along with recommendations for improvement, in a single document. The Audit Report compares and contrasts the present method of operation in the NOC to current industry standards like eTOM, ITIL and ISO 9000, and provides recommendations to improve areas analyzed in the earlier sections of the report. We round out the whole package with an executive summary and formal presentation. Upon receipt of the report, you can implement the recommendations using your existing resources, or contract with the Fujitsu Managed Services group to implement them.

### Experience and Expertise that Counts

Fujitsu has extensive experience maximizing the efficiency and utilization of communications networks operated by diverse customers. We have provided managed services to tier 1, 2 and 3 carriers, MSOs, utilities, transportation authorities, enterprises, and

government agencies. We run our own world-class NOC facility, providing operational support to a wide range of customers who depend on our NOC to provide the highest standards of service at all times. We leverage this extensive expertise in each new NOC Audit project, bringing you the insight you need to get the best possible performance and results. The research, analysis, study and recommendations are all performed by highly experienced network operations engineers and program managers with Total Quality Management (TQM) and ISO 9000 expertise. Our experts know how network operations really work, and how to make your NOC work most effectively for your business.

The Fujitsu NOC Audit service can be performed at regular, scheduled intervals to maintain the highest levels of performance, best practices, and standards compliance. Contact us today to find out more about how we can support you in achieving the highest standards of network performance.



### Fujitsu Network Communications Inc.

2801 Telecom Parkway, Richardson, TX 75082  
 Tel: 800.777.FAST (3278) Fax: 972.479.6900

[us.fujitsu.com/telecom](http://us.fujitsu.com/telecom)

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# Quality Audit Service

Investing in new or upgraded network equipment is a business decision that depends on high standards for its success. Your ability to generate timely revenue by attracting customers to use new services depends on installation quality.

## Quality without compromise

As a hardware manufacturer and supplier of both network equipment and professional services, Fujitsu takes pride in the highest quality standards. Our best practices are renowned throughout the industry. We understand how strong quality control measures support successful service delivery and drastically reduce rollout delays and consequent revenue loss. When you have SLAs to uphold, quality and the bottom line go hand-in-hand.

Based on our own stringent internal quality processes and procedures, the Fujitsu Quality Audit service provides you with assurance that your network installation has been performed to documented quality standards. With this guarantee in place, you can proceed to test and turn-up with confidence.

## Simple, thorough, effective

The Fujitsu Quality Audit service is a simple and highly effective method of installation quality assurance. This service is available for installations performed by any vendor, and for both Fujitsu and non-Fujitsu equipment.

We assign certified quality engineers to visit your site and assess your completed installation, before you begin test and turn-up. These engineers comb through your site and make careful records of everything they find. Equipment, wiring, facilities and onsite installation technicians are all given a pass/fail status. In every instance where standards are not met, the Fujitsu auditors make a specific recommendation for remedial action. All findings and corrective recommendations are then delivered to you in an exhaustive audit report, including clearly labeled photographic documentation where appropriate.

If your installation has been completed by another vendor, we can also issue a corrective action request to that vendor, to identify the root cause of any deficiency and eliminate it from future installations. Once all defects have been corrected, you are certified as ready to test and turn-up your new installation. As a result, you identify and remedy defects that are more costly to diagnose during testing or worse, after services have been rolled out.



# Critical checks & balances

A Fujitsu Quality Audit verifies that your installation is performed to Telcordia GR1275-CORE, and/or to all applicable customer-specific or equipment-specific quality standards.

The scope of the Fujitsu Quality Audit service includes:

- Bay assembly and markings
- Ironwork
- Cable racking
- Cabling
- Wiring conformity
- Fiber ducts
- Bonding & grounding
- Power connections
- Connections
- Recordkeeping and documentation
- Staff professionalism and workmanship
- Housekeeping and cleanliness
- Environmental controls
- Others as detailed in GR-1275

No matter who installs your equipment, your business depends on it being properly installed. A day spent waiting on unexpected corrections and rework is a day spent without generating revenue. It's simple: quality is not negotiable. By choosing the Fujitsu Quality Audit service, you let us centralize all of your engineering quality function, freeing up personnel while you concentrate on running your business.



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## Fujitsu Network Communications Inc.

2801 Telecom Parkway, Richardson, TX 75082

Tel: 800.777.FAST (3278) Fax: 972.479.6900

[us.fujitsu.com/telecom](http://us.fujitsu.com/telecom)

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## Site Grounding and Bonding Audit Service

With an average peak current of about 30,000 amps, temperature around 15,000 °C and electrical potential of up to 200 million volts, lightning is one of nature's most destructive forces. Lightning strike damage to all types of communications sites and their associated equipment, such as radio and microwave towers and other antenna structures, results in losses of over \$225 million annually in North America, according to industry estimates. Not only is equipment harmed by lightning, but also personnel.

Over the continental 48 US states, 20 million cloud-to-ground flashes have been detected, on average, every year since 1989. Although lightning strikes cannot be avoided, damage prevention is essential, especially in lightning-prone areas such as Florida and other southern states. The Fujitsu Cell Site Grounding and Bonding Audit Service should be a cornerstone of your lightning protection plan.

### Assess and Minimize your Risk

The Fujitsu Site Grounding and Bonding Audit service is a flexible service that consists of a detailed inspection and assessment of the lightning exposure at sites of your choice, including cell, core and regeneration sites, as well as small central offices and switching locations. These inspections frequently reveal problems such as violations of National Electrical Code (NEC) requirements, Occupational Health and Safety Administration (OSHA) regulations, and equipment manufacturers' installation specifications. Other common problems include:

- Harmonic currents
- Load unbalance
- Loose wiring connections
- Missing surge protectors
- Improper or absent grounds
- Improperly isolated grounds

Proper installation and maintenance of power and ground at cell sites protects your revenue stream by helping to prevent equipment damage and customer service disruption from lightning and other adverse events. Careful attention to power and grounding also reduces network outages and protects the useful life of your equipment. Power problems, such as fluctuations in the voltage level, can and do adversely affect sensitive electronic systems. Revenue is lost when outages, surges, sags, objectionable currents and low voltage cause loss of data or damage to components. Proper grounding and a proper relationship between the neutral and the ground are essential, not only to meet regulatory requirements but also for optimal equipment operation and workplace safety.

### Typical Report Contents

- Power criteria and findings
- Grounding criteria and findings
- Transient criteria and findings
- Summary of findings and results
- Recommendations
- Supporting data and survey records
- Photographs



# Essential Damage Protection

## Thorough, Methodical Study and Analysis

In carrying out the Fujitsu Site Grounding and Bonding Audit service, an engineer begins by studying the available documentation provided by the site equipment manufacturer, including power and grounding drawings, specifications and power quality data. The engineer then uses this information to perform a comprehensive electrical power, grounding and lightning protection inspection at each of the selected sites.

During the on-site inspections, the engineer gathers measurements and other data to support analysis:

- Verify proper electrical distribution wiring of the main entrance panel and subpanels
- Survey the grounding scheme for code compliance
- Check systems and equipment for compliance with accepted installation practices and manufacturer's specifications
- Measure selected impedances, voltages and currents and verify proper load balance
- View voltage wave shapes with an oscilloscope and verify significant amounts of harmonics distortion
- Survey electrical distribution and lightning protection schemes

After collecting the necessary data, the engineer performs a thorough analysis. The analysis is documented in a report detailing all findings and the root cause of those findings for each of the sites inspected. The report is issued as soon as possible after either completion of the survey or receipt of all requested data.

The report discusses any problem areas and also provides expert recommendations for correcting electrical problems and minimizing potential future damage and downtime.

## Take Action before Lightning Strikes

Many service providers carry out this type of study after a cell-site has been damaged by lightning. Fujitsu recommends a more proactive approach, in the form of a quarterly monitoring and analysis program for a number of sites, before lightning damage disrupts service to your customers and adversely affects your business. In some cases, cell sites are subject to theft or vandalism in addition to environmental wear and tear. With regular grounding and bonding inspections by Fujitsu experts, you have the assurance that comes with thorough, regular, scheduled preventive procedures. As with all Fujitsu services, we get to know your requirements and customize the service specifically for you.

Once we have completed a Grounding and Bonding Audit, we can also help you take action. Our experts can implement the recommendations and necessary changes to protect your sites.

---

## Fujitsu Network Communications Inc.

2801 Telecom Parkway, Richardson, TX 75082  
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# Training Catalog



**September 2012 - October 2013**



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## Introduction

Fujitsu delivers next-generation optical transport and data networking solutions optimized for metropolitan, regional, long-haul, and high-capacity applications.

Fujitsu Educational Services offers comprehensive training programs covering general technology, system planning and engineering, turn-up and test, network management systems, and operations, maintenance, and trouble clearing for all Fujitsu products.

Fujitsu training may be held at the Richardson, Texas, campus, or instructors may be scheduled to come directly to your site to deliver standard courses or custom training solutions at your facility. All classes are limited to a minimum and maximum student count, depending on the course to be taught and quantity of equipment available.

The types of classes referenced in this catalog are:

- **In-House Class** – Classes delivered at Fujitsu's Richardson, Texas Training Center. In-House classes include hands-on practice exercises using the latest versions of Fujitsu hardware and software. In-House Class seats are included in most Fujitsu service contracts.
- **Specially Scheduled In-House Class** – Classes delivered at Fujitsu's Richardson Texas Training Center for students from one company. Seats for Special In-House Classes are not included in Fujitsu Service Contracts.
- **Custom Class** – Customized delivery of our standard courses is available to meet your unique needs by combining two courses into one class, or by changing the course duration.
- **Suitcase Class** – Classes based on standard courses that are delivered on-site at the customer's facility.

## Richardson, Texas Training Center Classes

### Regularly Scheduled In-House Classes

Fujitsu offers regularly scheduled classes based on our standard courses at our Richardson, Texas Training Center. You can view the current class schedules with available seats, and register for classes, online at the following URL:

<https://partners.fnc.fujitsu.com/training/resources/jsp/frameset/>

### Specially Scheduled Classes

We can provide a price quotation to schedule a class exclusively for your employees at Fujitsu's Richardson, Texas Training Center. Fujitsu Educational Services offers classes based on standard courses on a pre-scheduled basis. However, if your organization needs a class at a time other than when one is scheduled, we will work with you to schedule a class that will accommodate your needs. Specially scheduled classes require a minimum tuition charge for eight students. A maximum student count applies and varies depending on the course. Contact the Fujitsu Training Coordinator at [ed.svcs@fnc.fujitsu.com](mailto:ed.svcs@fnc.fujitsu.com) to discuss your requirement and to request a price quotation.

### Custom Classes

A maximum of two courses may be combined into one custom class. We can provide a price quotation for a custom class. Custom classes are based on our standard courseware, but the delivery will be modified to meet your specific needs. If the total duration is reduced as compared to standard courses, some material may necessarily be omitted from the class. Which material is omitted and which will be included will be decided by mutual agreement. Contact the Fujitsu Training Coordinator at [ed.svcs@fnc.fujitsu.com](mailto:ed.svcs@fnc.fujitsu.com) to discuss your requirement and to request a price quotation.

Enroll now at <http://partners.fnc.fujitsu.com/training>



## Suitcase Classes (On-site)



### Standard Classes

Our standard catalog courses can be presented on-site at the customer location. Fujitsu provides all required documentation for courses on CD-ROM or DVD. Other student materials are distributed at the beginning of the class. To schedule a suitcase class, please submit a completed suitcase training request e-form through the Partners website at least 30 days prior to your requested start date. The Fujitsu Training Coordinator will contact you.

<https://partners.fnc.fujitsu.com/training/resources/jsp/frameset/>

### Custom Suitcase Classes

Custom suitcase classes are based on our standard courseware, but the delivery can be modified to meet your specific needs. For example, two courses may be combined into one custom class, or the delivery of a standard course can be changed to cover only the sections that apply to your network application of Fujitsu products. If the total duration is reduced as compared to standard courses, some material will necessarily be omitted from the class. Contact the Fujitsu Training Coordinator at [ed.svcs@fnc.fujitsu.com](mailto:ed.svcs@fnc.fujitsu.com) to request a price quotation.

### Suitcase Class Information

To discuss your requirement, email your Fujitsu sales representative or our training coordinator at: [ed.svcs@fnc.fujitsu.com](mailto:ed.svcs@fnc.fujitsu.com).

### Payment

Payment must be received at least 15 business days prior to the class start date.

## Suitcase Class Requirements

### Equipment and Facility Requirements for Suitcase Classes

Fujitsu equipment, facility, and educational tools required for suitcase classes include:

- Classroom or conference room of adequate size to accommodate students and equipment



- Noise-free environment with sufficient lighting and comfortable air conditioning
- Work space (tables and chairs) appropriate to class size
- Flip chart or dry marker/chalk board with appropriate markers or chalk and erasers
- Data projector with stand or table and screen
- Sufficient AC power for the equipment and PCs

To avoid distractions, no other work should be in progress near the classroom area.

## Equipment for Lab Exercises

The following is required for Turn-Up and Test, and Maintenance and Trouble Clearing courses:

- Dedicated non-traffic-bearing equipment installed with power and all required plug-in units
- One node per two students (optimum)
- Optical power light meter with adapter(s)
- Test set capable of testing DS1, DS3, OC-3 to OC-192 and GbE, depending on the course.
- Multimeters and optical test sets
- DSX1 with patch cords for all equipment with T1 connections
- Attenuators, fiber jumpers, and cleaners sufficient for network connections
- ESD protection (for example, wrist straps and heel straps)

Contact the Fujitsu training coordinator to discuss specific equipment requirements.

## Student Computer Requirements for Training at the Customer's Location

The customer or student is responsible for providing a minimum of one PC or laptop per node with the following minimum capabilities:

- Operating system:
  - Windows 7 32/64 bit Professional
  - Windows XP Professional (Service Pack 1 or 2)
  - Windows Vista Business (Service Pack 1)
- 1.2 GHz CPU recommended
- 512 MB RAM recommended
- 400 MB available hard disk space
- CD-ROM drive
- LAN card or serial craft interface port and connection cable

*Note: NETSMART 500 software connects to NEs using a serial port connection or TCP/IP. The TCP/IP settings on your computer must be properly configured. See your system administrator for assistance with your TCP/IP settings. TCP/IP is the preferred method for connecting to an NE with NETSMART 500 software.*

- 16-bit color
- 1024 x 768 resolution
- Web browser:
  - Microsoft Internet Explorer® Version 8.0 or later
  - Mozilla® Firefox® Version 3.0 or later

Enroll now at <http://partners.fnc.fujitsu.com/training>



# Fujitsu Training Policies and General Information

## Start and Stop Time

Classes are normally scheduled from 8AM to 5PM. The instructor may adjust the class time according to class conditions and student load. Students must be in attendance for the entire duration of the class to receive a certificate of completion. There are morning and afternoon breaks, as well as a one-hour lunch break. For lunch, a cafeteria is located in the Richardson facility. During breaks, students may use the soft drink, coffee, and vending machines near the classrooms.

## Cancellation of Enrollment or Substitution

To cancel enrollment in a Richardson class, notify Fujitsu Educational Services in writing by fax or e-mail. If the cancellation occurs ten or more business days before the scheduled class, no cancellation fee is charged. Cancellations received within nine business days prior to the class start date, as well as "no shows," are subject to the full tuition. If you need to substitute a student within nine business days of the class start date, please email Fujitsu Training at [ed.svcs@fnc.fujitsu.com](mailto:ed.svcs@fnc.fujitsu.com).

## Class Cancellation Policy

Fujitsu Educational Services makes every effort to avoid cancellation of scheduled classes. If a Fujitsu cancellation is necessary, the student will be notified at least ten business days prior to the scheduled start date. If cancellation of a requested class is necessary by the customer, Fujitsu's Training Coordinator must be contacted by the requestor at least 10 business days prior to the class start date in order to receive proper credit.

## Availability and Wait List

All course delivery (in-house and suitcase) is limited to a first-come, first-served basis. Your request for classes already filled will be placed on a wait list. If an opening becomes available, the next student registered to the wait list is notified that a seat is available. Seats are filled on a first-come, first-served basis. Confirmations are emailed within 24 hours of registration. The confirmation email serves as authorization to attend the class. If you don't receive a confirmation email from Fujitsu at least 7 days prior to the class start date, then email the Fujitsu training department at [ed.svcs@fnc.fujitsu.com](mailto:ed.svcs@fnc.fujitsu.com) to verify your enrollment. If you are a customer training coordinator and register students from your company, you may request that e-mails be sent to you instead of to the individual students.

## Dress Code for Classes at the Richardson, Texas Training Center

Casual business attire is appropriate for class attendance. For safety reasons, shorts and open-toe shoes are not permitted in the classrooms or labs. ESD damage prevention precautions are observed in the classroom.

## Prerequisite Tutorials

Students must complete the prerequisites as stated in the course descriptions to receive a certificate of completion. Fujitsu offers four tutorials:

- SONET
- Ethernet
- DWDM
- TCP/IP

These basic technology tutorials are designed for all audiences in the telecommunications field. If you are a beginning student, the tutorials raise your level of understanding quickly. Even if you are already familiar with the protocols, the tutorials will enhance and reinforce your existing knowledge base. These self-study tutorials are available for download at:

<http://us.fujitsu.com/telecom/training>

*Note: SONET knowledge is a prerequisite for all Fujitsu courses.*

Enroll now at <http://partners.fnc.fujitsu.com/training>



## Contracts, Prices and Payment

An agreement with Fujitsu must be in place prior to accepting a purchase order or payment for training. Please contact either your FNC sales representative or email Fujitsu Training at [Ed.svcs@fnc.fujitsu.com](mailto:Ed.svcs@fnc.fujitsu.com) for additional information.

### Payment Methods

There are four methods of payment:

- Course registration number for prepaid seats (The course registration number is a multi-digit number provided to you by your Fujitsu sales representative.)
- Company check
- Credit card (We accept Visa, MasterCard, or American Express.)
- Purchase order
- FNC Employee internal cost center

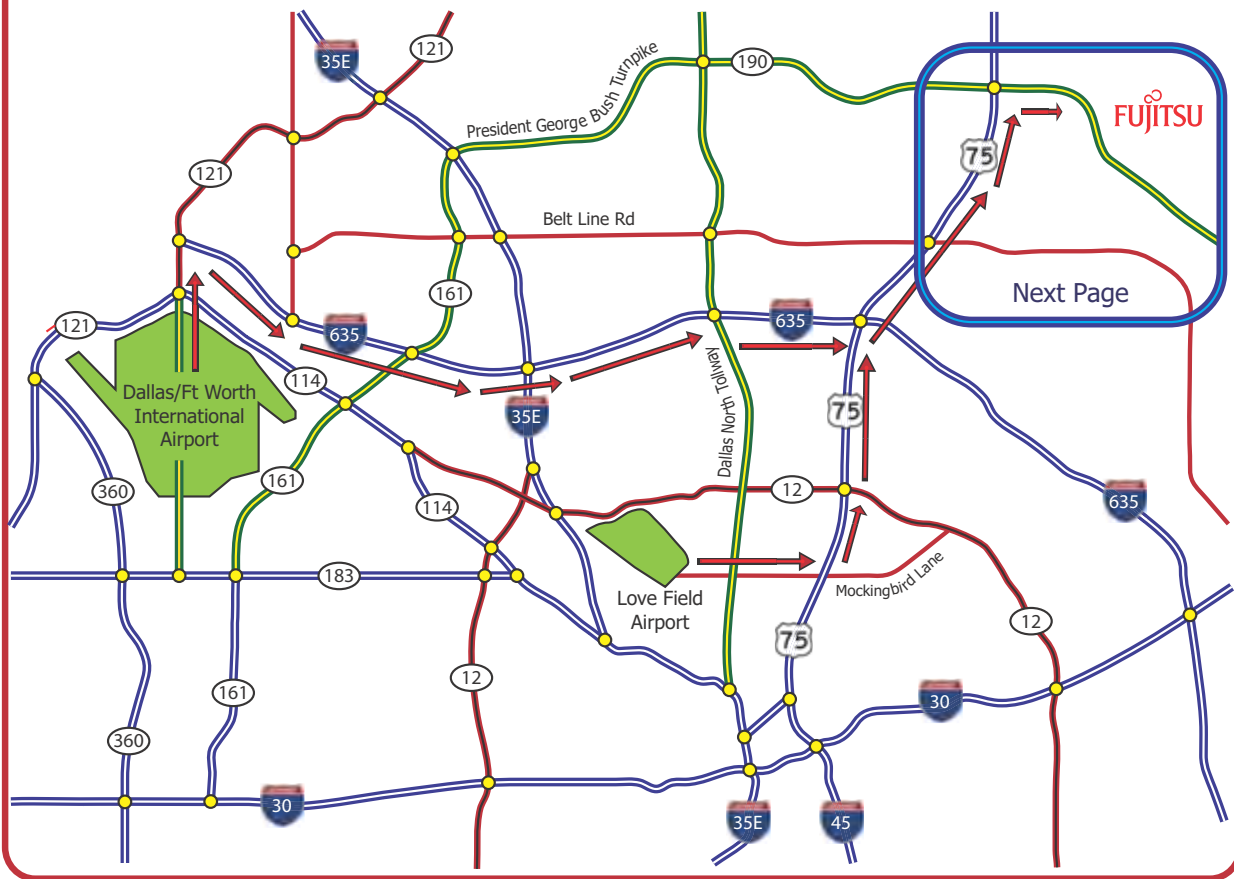
### Price Changes

Note: Prices listed on the Fujitsu Educational Services Website and in this catalog are subject to change without prior notice. Standard prices for regular Richardson classes are quoted on a per-student basis. Prices for suitcase, custom, and specially scheduled (in-house) classes at the Richardson Training Center are quoted on a per-class basis.



# Map to Fujitsu Network Communications

## Driving Directions to Fujitsu Network Communications



### Directions From DFW

Take the NORTH EXIT from DFW onto **SH121** for approximately a half mile.

Merge RIGHT and take **I-635 EAST** approximately 15 miles to Exit 19A **US-75 North** (McKinney).

Go NORTH on **US-75** for approximately 6 miles, and take Exit 27A **RENNER RD.**

Go EAST (right) on **RENNER RD** approximately 2.5 miles to **SHILOH RD.**

Go SOUTH (right) on **SHILOH RD** .5 mile and turn LEFT on **RESEARCH DR.**

Turn LEFT on **TELECOM PKWY.** Go 1 block, turn LEFT into **Fujitsu Network Communications.**

### Directions From Love Field

Exit LOVE FIELD and turn EAST (left) onto **MOCKINGBIRD LANE.**

Go EAST approximately 3.5 miles to **US-75** (Central Expressway).

Go NORTH on **US-75** for approximately 12 miles, and take Exit 27A **RENNER RD.**

Go EAST (right) on **RENNER RD** approximately 2.5 miles to **SHILOH RD.**

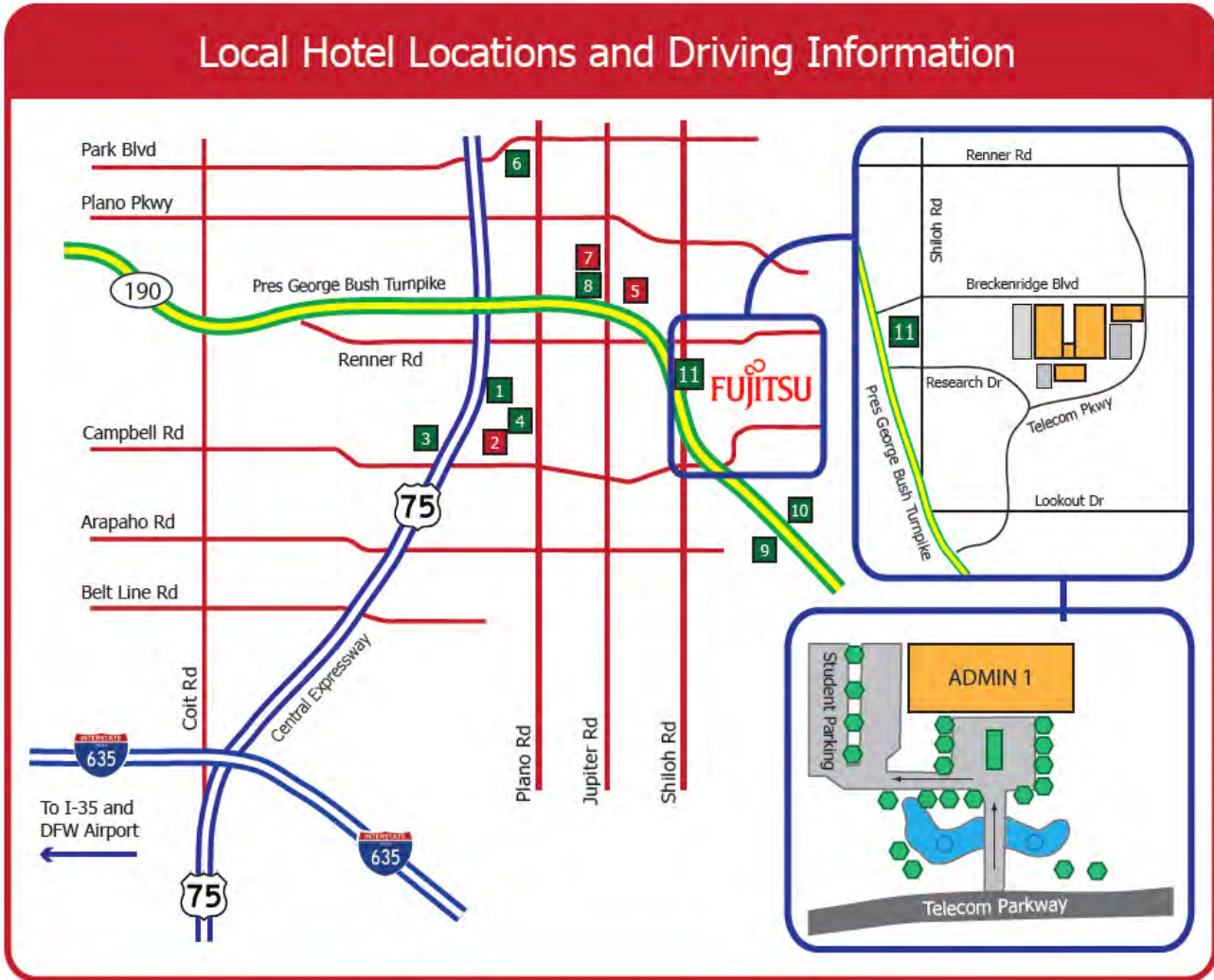
Go SOUTH (right) on **SHILOH RD** .5 mile and turn LEFT on **RESEARCH DR.**

Turn LEFT on **TELECOM PKWY.** Go 1 block, turn LEFT into **Fujitsu Network Communications.**

October 2012 - September 2013



# Map to Hotel Accommodations and Fujitsu Campus



### Hotel Contact Information

- 1 Renaissance Hotel – Dallas/Richardson (972) 367-2000
- 2 Courtyard Dallas/Richardson at Campbell (972) 994-9933
- 3 Hyatt Summerfield Suites – Dallas/Richardson (972) 671-8080
- 4 Residence Inn – Dallas/Richardson (972) 669-5888
- 5 Homewood Suites by Hilton – Richardson/Plano (972) 881-3339
- 6 Best Western Park Suites – Plano (972) 578-2243
- 7 Comfort Suites – Plano (469) 429-0700
- 8 Candlewood Suites Extended Stay – Plano (214) 474-2770
- 9 Hyatt Place Dallas – Garland (972) 414-3600
- 10 Holiday Inn – Garland (972) 495-1144
- 11 Springhill Suites by Marriott – Richardson (972) 479-0300
- Offers Student Discounts

### FNC Information

Fujitsu Main Number:  
 (972) 479-6000  
 (800) 777-FAST

Address:  
 2801 Telecom Pkwy  
 Richardson, TX 75082  
 Mapco: 9K

Website:  
[us.fujitsu.com/telecom/training](http://us.fujitsu.com/telecom/training)

October 2012 - September 2013



## Hotel Address Information

### Hotel Information:


The hotels listed below correspond to the map on the preceding page.

1	<b>Renaissance Dallas Richardson Hotel</b> 900 E. Lookout Drive, Richardson, Texas 75082 Phone: 1-972-367-2000 * <b>Fujitsu Discount</b>
2	<b>Courtyard Dallas Richardson at Campbell</b> 2191 N. Greenville Avenue, Richardson, Texas 75082 Phone: 1-972-994-9933
3	<b>Hyatt Summerfield Suites - Dallas/Richardson</b> 2301 North Central Expressway, Richardson, Texas 75080 Phone: 1-972-671-8080 * <b>Fujitsu Discount</b>
4	<b>Homewood Suites by Hilton Richardson - Plano</b> 2601 East George Bush Turnpike, Plano, Texas 75074 Phone: 1-972-881-3339 * <b>Fujitsu Discount</b>
5	<b>Residence Inn Dallas - Richardson</b> 1040 Waterwood Drive, Richardson, TX 75082 Phone: 1-972-669-5888
6	<b>Best Western Park Suites</b> 640 East George Bush Turnpike, Plano, Texas 75074 Phone: 972-578-2243 * <b>Fujitsu Discount</b>
7	<b>Comfort Suites - Plano</b> 2301 East George Bush Turnpike, Plano, Texas 75074 Phone: 469-429-0700
8	<b>Hyatt Place Dallas - Garland</b> 5101 North George Bush Turnpike, Garland, Texas 75040 Phone: 1-972-414-3600 * <b>Fujitsu Discount</b>
9	<b>Candlewood Suites - Plano</b> 2401 East George Bush Turnpike, Plano, TX 75074 Phone: 214-474-2770 * <b>Fujitsu Discount</b>
10	<b>Holiday Inn - Garland</b> 5110 N President George Bush Fwy, Garland, TX 75040 Phone: 972-495-1144 * <b>Fujitsu Discount</b>
11	<b>Springhill Suites - Richardson</b> 3251 E President George Bush Turnpike, Richardson, TX 75082 Phone: 972-479-0300

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# FLASHWAVE® 4000 Series System Engineering

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 4000-E  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-4000E  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-4000E*  <b>MSP Suitcase:</b> TRSE-4000E*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>FLASHWAVE 4100 Large and Small Shelf Overview</b></p> <ul style="list-style-type: none"> <li>• Ethernet Services</li> <li>• Network Configurations</li> <li>• Ethernet over SONET</li> <li>• Small Shelf Layout and Backplane</li> <li>• Network Management Interfaces</li> <li>• OAM&amp;P</li> </ul> <p><b>FLASHWAVE 4100 Large and Small Shelf Units</b></p> <ul style="list-style-type: none"> <li>• OC-x Line Units</li> <li>• OC-x Service Units</li> <li>• DSx Units</li> <li>• 4-Port 10/100Base-T EOS</li> <li>• 4-Port 10/100Base-T Layer 2 Ethernet</li> <li>• 2-Port Gigabit Layer 2 Ethernet Unit</li> <li>• Ethernet Bandwidth Extension Unit</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• SONET Tutorial</li> <li>• Ethernet Tutorial</li> <li>• ATM Tutorial</li> </ul>	<p><b>FLASHWAVE 4100 Packet ONP Shelf</b></p> <ul style="list-style-type: none"> <li>• Management and Control Unit</li> <li>• I/O Processing</li> <li>• Application and Boot Flash Memory</li> <li>• Local Craft Interface</li> <li>• 2-Port OC-3 Line Unit</li> <li>• OC- x Line Units</li> <li>• OC-x Service Units</li> <li>• 3-Port DS3 Service Unit</li> <li>• 8-Port DS3 Service Unit</li> <li>• 28-Port DS1 Service Unit</li> <li>• 28-Port DS1 NIU Service Unit</li> <li>• Transmux Unit</li> <li>• Ethernet Service Unit</li> </ul>	<p><b>FLASHWAVE 4500 Overview</b></p> <ul style="list-style-type: none"> <li>• Shelf Layout and Slots</li> <li>• Expansion Shelf</li> <li>• Backplane</li> <li>• Extension Panel</li> <li>• User Access Panel</li> <li>• High Density Optical Access Shelf</li> <li>• Ethernet over SONET Application</li> <li>• Network Management</li> <li>• Link Capacity Adjustment</li> <li>• FT-TD/T-TD Server Functions</li> </ul>
<p><b>Course Contents</b></p> <p><b>FLASHWAVE 4100 Shelf Overview</b>  <b>FLASHWAVE 4100 Shelf Units</b>  <b>FLASHWAVE 4100 Packet ONP</b>  <b>FLASHWAVE 4300 Overview</b>  <b>FLASHWAVE 4300 Units</b>  <b>FLASHWAVE 4500 Overview</b>  <b>FLASHWAVE 4500 Units</b>  <b>System Configurations and Design Components</b></p>	<p><b>FLASHWAVE 4300 Overview</b></p> <ul style="list-style-type: none"> <li>• FLASHWAVE 4300 ATM Support</li> <li>• ATM Provisioning Hierarchy</li> <li>• SDCC Pass-Through</li> <li>• Hitless Manual Protection Switching</li> <li>• Additional Release 3.6 Features</li> <li>• System Software Majority Rule</li> <li>• NETSMART 500 Element Manager</li> <li>• In-Service Upgrades</li> <li>• Shelf Layout</li> <li>• Craft Interface and Network Management</li> <li>• Shelf Backplane Connector Layout</li> <li>• DS3 Extension Panel Cable Connections</li> </ul>	<p><b>FLASHWAVE 4500 Units</b></p> <ul style="list-style-type: none"> <li>• Common and Microprocessor Units</li> <li>• xxx Gb/s STS Switch Fabric Units</li> <li>• Signal Flow</li> <li>• OC-x Units, Multiport Configuration</li> <li>• OC-x Short and Long Reach Units</li> <li>• Enhanced Fast Ethernet</li> <li>• 100Base-xx Ethernet Units</li> <li>• Gigabit Ethernet Units</li> <li>• Enhanced Gigabit Ethernet Units</li> <li>• 2-Port Gigabit Ethernet with LCAS</li> <li>• HO/LO TPORT Ethernet Units</li> <li>• VT Switch Fabric Units</li> <li>• 10/20 Gb/s VT Switch Fabric Unit</li> <li>• VF31 VT Switch Fabric Extension <ul style="list-style-type: none"> <li>- Features</li> <li>- Compatibility</li> </ul> </li> </ul>
<p><b>Scheduled Dates</b></p> <p>1/8/13  3/5/13  5/7/13  6/25/13  8/20/13</p>		
<p><b>Course Description</b></p> <p>The FLASHWAVE 4000 System Engineering course enables students to plan and engineer networks and system applications using Fujitsu's FLASHWAVE 4100, 4300, 4500, 4010, and 4020 series equipment in various configurations. Case studies are used extensively to develop examples of operational networks.</p> <p><b>Who Should Attend</b></p> <p>All personnel responsible for planning and engineering networks using Fujitsu FLASHWAVE 4000 series equipment will benefit from attending this course, including network planners and engineers, supervisors, and managers with budget responsibility.</p>	<p><b>FLASHWAVE 4300 Units</b></p> <ul style="list-style-type: none"> <li>• Microprocessor Units</li> <li>• DCC Unit</li> <li>• STS Switch Fabric Units</li> <li>• OC-x Units and Configurations</li> <li>• DS/EC-x Units and Configurations</li> <li>• M13 Transmux Unit</li> <li>• 10/100Base-T Ethernet Unit</li> <li>• Gigabit Ethernet Units</li> <li>• ATM Units <ul style="list-style-type: none"> <li>- Processing and Control</li> <li>- Switch Fabric</li> </ul> </li> </ul>	<p><b>System Configurations and Design Components</b></p> <ul style="list-style-type: none"> <li>• Ethernet and ATM Services</li> <li>• Terminal Configurations</li> <li>• UPSR Configurations</li> <li>• Ethernet over SONET</li> <li>• BLSR Configurations</li> <li>• LCAS Configurations</li> <li>• Resilient Packet Ring</li> <li>• Shared vs. Unshared RPR</li> <li>• Optical Design Elements</li> </ul>

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# FLASHWAVE® 4000 Series System Installation

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 4000-INST  <b>Duration:</b> 2 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-4000INST  <b>In-House Tuition: \$1400</b>  <b>Suitcase:</b> TRSC-4000INST*  <b>MSP Suitcase:</b> TRSE-4000INST*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• Purpose <ul style="list-style-type: none"> <li>- Objectives</li> <li>- Reference Documents</li> </ul> </li> <li>• FLASHWAVE 4010 <ul style="list-style-type: none"> <li>- Configurations</li> </ul> </li> <li>• FLASHWAVE 4100 Shelf Overview</li> <li>• FLASHWAVE 4300 Shelf Overview</li> <li>• FLASHWAVE 4500 Shelf Overview</li> <li>• Overall FLASHWAVE 4000 System Configurations</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• Previous mechanical, electrical and fiber-optic cable installation training and experience.</li> </ul>	<p><b>Circuit Breaker Panels</b></p> <ul style="list-style-type: none"> <li>• Purpose <ul style="list-style-type: none"> <li>- Objectives</li> <li>- Reference Documents</li> </ul> </li> <li>• FLASHWAVE 4100 System Fuse Panel</li> <li>• Office Power and Ground Cabling</li> <li>• Small Shelf DC Power Terminals</li> <li>• FLASHWAVE 4300 System Circuit Breaker Panel</li> </ul>	
<p><b>Course Contents</b></p> <p><b>Overview</b></p> <p><b>Circuit Breaker Panels</b></p> <p><b>FLASHWAVE 4100 System Cabling</b></p> <p><b>FLASHWAVE 4300 System Cabling</b></p> <p><b>FLASHWAVE 4500 System Cabling</b></p> <p><b>Fiber and LAN Cables</b></p>	<p><b>FLASHWAVE 4100 System Cabling</b></p> <ul style="list-style-type: none"> <li>• Purpose <ul style="list-style-type: none"> <li>- Objectives</li> <li>- Reference Documents</li> </ul> </li> <li>• FLASHWAVE 4100 Shelf Installation <ul style="list-style-type: none"> <li>- Engineering Specifications</li> </ul> </li> <li>• FLASHWAVE 4100 Large Shelf Layout</li> <li>• Large Shelf Cabling <ul style="list-style-type: none"> <li>- DS1 Cables</li> <li>- DS3 Cables</li> <li>- External Clock Cable</li> <li>- Office Alarm Cable</li> </ul> </li> <li>• FLASHWAVE 4100 Small Shelf Layout</li> <li>• Small Shelf Cabling <ul style="list-style-type: none"> <li>- DS1 and DS3 Cables</li> <li>- External Clock Cable</li> <li>- Housekeeping Cable</li> <li>- Office Alarm Cable</li> </ul> </li> <li>• Inventory Records</li> </ul>	<p><b>FLASHWAVE 4500 System Cabling</b></p> <ul style="list-style-type: none"> <li>• Purpose <ul style="list-style-type: none"> <li>- Objectives</li> <li>- Reference Documents</li> </ul> </li> <li>• FLASHWAVE 4500 Shelf Overview</li> <li>• FLASHWAVE 4500 Shelf Layout <ul style="list-style-type: none"> <li>- FLASHWAVE 4500 Backplanes</li> </ul> </li> <li>• DS3 Extension Panel</li> <li>• Cable Routing <ul style="list-style-type: none"> <li>- DS1 Cables</li> <li>- DS3/EC-1 Cables</li> <li>- External Clock Cables</li> <li>- Housekeeping Cables</li> <li>- Office Alarm Cables</li> </ul> </li> <li>• Inventory Records</li> </ul>
<p><b>Scheduled Dates</b></p> <p><b>Special Order Only</b>  Call for details:  1-800-777-3278 Ext. 4961</p>		
<p><b>Course Description</b></p> <p>Installation courses train students to plan and install Fujitsu networking equipment and system applications using Fujitsu equipment in various configurations. Case studies are used extensively to develop examples of installed networks.</p> <p><b>Who Should Attend</b></p> <p>This course is recommended for installers, supervisors, and managers with equipment installation responsible</p>	<p><b>FLASHWAVE 4300 System Cabling</b></p> <ul style="list-style-type: none"> <li>• Purpose <ul style="list-style-type: none"> <li>- Objectives</li> <li>- Reference Documents</li> </ul> </li> <li>• FLASHWAVE 4300 System Cabling <ul style="list-style-type: none"> <li>- Engineering Specifications</li> </ul> </li> <li>• FLASHWAVE 4300 Shelf Layout <ul style="list-style-type: none"> <li>- FLASHWAVE 4300 Backplane</li> </ul> </li> <li>• Cable Routing <ul style="list-style-type: none"> <li>- DS1 Cables</li> <li>- DS3/EC-1/Transmux Cables</li> <li>- External Clock Cables</li> <li>- Housekeeping Alarm Cables</li> <li>- Office Alarm Cables</li> </ul> </li> <li>• DS3 Extension Panel Cables</li> </ul>	<p><b>Fiber and LAN Cables</b></p> <ul style="list-style-type: none"> <li>• Purpose <ul style="list-style-type: none"> <li>- Objectives</li> <li>- Reference Documents</li> </ul> </li> <li>• NE Access</li> <li>• Optical and LAN Cables <ul style="list-style-type: none"> <li>- OSS1 X.25 Cable</li> <li>- Modem Cable</li> </ul> </li> <li>• Running Fiber</li> <li>• Craft Interface and Managent</li> <li>• FLASHWAVE 4100 System Fiber Ducts</li> <li>• FLASHWAVE 4300 System Fiber Ducts</li> <li>• FLASHWAVE 4300 System LAN Cables <ul style="list-style-type: none"> <li>- OSS2 LAN Cable</li> <li>- OSS1 X.25 Cable</li> <li>- Modem Cable</li> </ul> </li> <li>• FLASHWAVE 4500 System LAN Cables <ul style="list-style-type: none"> <li>- OSS2 LAN Cable</li> <li>- OSS1 X.25 Cable</li> </ul> </li> <li>• FLASHWAVE 4500 System Fiber Ducts</li> <li>• Access to FLASHWAVE 4500 <ul style="list-style-type: none"> <li>- Internet Protocol Address Options</li> </ul> </li> </ul>




# FLASHWAVE® 4100 ES System Maintenance, Operations & Trouble Clearing

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 4100-ESM  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-4100ESM  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-4100ESM*  <b>MSP Suitcase:</b> TRSE-4100ESM*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4100 ES Packet ONP System Overview</li> <li>Features</li> <li>Applications</li> <li>Backplane</li> <li>Network Management Interfaces</li> </ul> <p><b>Plug-In Units</b></p> <ul style="list-style-type: none"> <li>Management and Control Units</li> <li>Small Form-Factor Pluggable Units</li> <li>Line Units</li> <li>OC-3</li> <li>OC-12</li> <li>OC-48</li> </ul> <p><b>Service Units</b></p> <ul style="list-style-type: none"> <li>OC-3</li> <li>OC-12</li> <li>DS3 &amp; DS3/EC1</li> <li>DS1 &amp; DS1 NIU</li> <li>Transmux Unit</li> <li>Ethernet Unit</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>SONET Tutorial</li> <li>Ethernet Tutorial</li> </ul>	<p><b>Connection-oriented Ethernet Overview</b></p> <ul style="list-style-type: none"> <li>Layer 2 Ethernet</li> <li>C-Tags and S-Tags</li> <li>Ethernet Services</li> <li>Color and Drop Eligibility</li> <li>Flows and Flow Points</li> <li>Logical Interfaces</li> <li>Bandwidth Profiles</li> <li>Policing and Shaping</li> <li>Class &amp; Quality of Service</li> <li>Service OAM</li> <li>Ethernet on the FLASHWAVE 4100 ES</li> <li>FOSPORT Protection</li> <li>Y-Cable</li> </ul> <p><b>Configurations</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4100 ES System Configurations</li> <li>Terminal (Point-to-Point)</li> <li>UPSR</li> <li>Private Rings</li> <li>EOS Interoperability</li> <li>Point-to-Point VT-Mapped EOS</li> <li>Ethernet Enhancements</li> <li>Link Capacity Adjustment Scheme</li> </ul> <p><b>Management Systems</b></p> <ul style="list-style-type: none"> <li>NETSMART 500 Element Manager</li> <li>TL1</li> <li>NETSMART 1500 Management System</li> </ul> <p><b>Upgrades and Migrations</b></p> <ul style="list-style-type: none"> <li>Software Downloads</li> <li>Remote Memory Backup</li> <li>Software Upgrades</li> <li>Migrations</li> <li>FLASHWAVE 4100 ES Packet ONP System Release Compatibility</li> </ul>	<p><b>System Performance</b></p> <ul style="list-style-type: none"> <li>Performance Monitoring</li> <li>Equipment Configurations</li> </ul> <p><b>Synchronization</b></p> <ul style="list-style-type: none"> <li>External, Line, Internal, Mixed Timing</li> <li>Timing Paths</li> <li>Synchronous Status Messaging</li> <li>Sync Lists</li> <li>Derived DS1 Clock Features</li> <li>Stratum Levels</li> <li>Timing Distribution</li> <li>Timing Problems</li> </ul> <p><b>Network Interfaces</b></p> <ul style="list-style-type: none"> <li>Access to the FLASHWAVE 4100 ES Packet ONP System</li> <li>OSS Interface Operations</li> <li>Computer Equipment and Cabling</li> </ul> <p><b>Alarms and Conditions</b></p> <ul style="list-style-type: none"> <li>Alarms</li> <li>Alarm and Condition Reports</li> <li>Common Alarms</li> <li>Error Codes</li> <li>Equipment Problems</li> <li>Network Problems</li> </ul>
<p><b>Course Contents</b></p> <p><b>Overview</b>  <b>Plug-In Units</b>  <b>Service Units</b>  <b>Configurations</b>  <b>Management Systems</b>  <b>Upgrades and Migrations</b>  <b>System Performance</b>  <b>Synchronization</b>  <b>Network Interfaces</b>  <b>Alarms and Conditions</b></p> <p><b>Scheduled Dates</b></p> <p>11/6/12  12/4/12  1/29/13  2/26/13  3/26/13  4/23/13  5/21/13  6/18/13  7/16/13  8/13/13  9/10/13</p>	<p><b>Course Description</b></p> <p>The Fujitsu FLASHWAVE 4100 ES System Maintenance course covers operations, performance monitoring, interpretation of alarms and condition reports, fault isolation and trouble clearing, upgrades and migrations, and an introductory overview of element management software.</p> <p><b>Who Should Attend</b></p> <p>This course is recommended for Central Office, Field Repair, Network Operations Center (NOC), and Technical Assistance Center (TAC) personnel, and engineers, supervisors and managers.</p>	

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## FLASHWAVE® 4100 ES System Turn-Up & Test

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 4100-EST  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-4100EST  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-4100EST*  <b>MSP Suitcase:</b> TRSE-4100EST*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• Network Configurations</li> <li>• Ethernet over SONET Services</li> <li>• FLASHWAVE 4100 ES System Overview</li> <li>• ES Backplane</li> <li>• Input/Output Panels</li> <li>• FLASHWAVE 4100 ES System Shelf Layout</li> <li>• Network Management Interfaces               <ul style="list-style-type: none"> <li>- Craft Interface</li> <li>- Telnet</li> <li>- OSS Interface</li> <li>- SDCC</li> <li>- Protocols</li> </ul> </li> <li>• Inventory Records</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• SONET Tutorial</li> <li>• Ethernet Tutorial</li> </ul>	<p><b>Plug-In Units</b></p> <ul style="list-style-type: none"> <li>• Management and Control Unit</li> <li>• Dual OC-3 Line Unit</li> <li>• OC-12 Line Unit</li> <li>• OC-12 Line Unit with BITS-out</li> <li>• OC-48 Line Unit</li> <li>• OC-48 Line Unit with BITS-out</li> <li>• OC-12/Dual OC-3 Service Unit</li> <li>• Dual OC-3 Service Unit</li> <li>• DS3 3-port Service Unit</li> <li>• DS3/EC1 8-port Service Unit</li> <li>• DS1 Service Unit</li> <li>• DS1 NIU Service Unit</li> <li>• Ethernet over SONET Service Unit</li> <li>• Native Ethernet Service Unit</li> <li>• M13 Transmux Service Unit</li> <li>• Small Form-factor Pluggable (SFP) Units</li> </ul>	<ul style="list-style-type: none"> <li>• EOS Interoperability</li> <li>• Point-to-Point for VT-Mapped EOS</li> <li>• Ethernet Enhancement</li> <li>• Generic Frame Procedure</li> <li>• Jumbo Frames</li> <li>• Ethernet Alarm Propagation and Escalation               <ul style="list-style-type: none"> <li>- Link Capacity Adjustment Scheme</li> </ul> </li> </ul>
<p><b>Scheduled Dates</b></p> <p>10/30/12            1/22/13            2/19/13            3/19/13            4/16/13            5/14/13            6/11/13            7/9/13            8/6/13</p>	<p><b>Connection-oriented Ethernet Overview</b></p> <ul style="list-style-type: none"> <li>• Layer 2 Ethernet</li> <li>• C-Tags and S-Tags</li> <li>• Ethernet Services</li> <li>• Color and Drop Eligibility</li> <li>• Flows and Flow Points</li> <li>• Logical Interfaces</li> <li>• Bandwidth Profiles</li> <li>• Policing and Shaping</li> <li>• Class &amp; Quality of Service</li> <li>• Service OAM</li> <li>• Ethernet on the FLASHWAVE 4100 ES</li> <li>• FOSPORT Protection</li> <li>• Y-Cable</li> </ul>	<p><b>Management Systems</b></p> <ul style="list-style-type: none"> <li>• NETSMART 500               <ul style="list-style-type: none"> <li>- Wizards</li> </ul> </li> <li>• TL1 Commands               <ul style="list-style-type: none"> <li>- Acknowledgement</li> <li>- Response Messages</li> <li>- Autonomous Messages</li> </ul> </li> </ul>
<p><b>Course Description</b></p> <p>This course begins with a system overview, including descriptions of plug-in units. Students learn how to provision various configurations and hardware features through extensive hands-on lab exercises. Students learn to use product-specific technical documentation and procedures to place equipment online and then apply test traffic. Through acceptance testing, students verify that the transport functions and protection features are fully functional. The course introduces students to support resources, such as the Technical Assistance Center (TAC) and Partners Website.</p> <p><b>Who Should Attend</b></p> <p>These courses are recommended for CO, field repair, NOC, TAC technicians, engineers, supervisors, and managers.</p> <p><b>NOTE: This course does not include the instruction on the large and small shelf FLASHWAVE 4100 MSPP systems.</b></p>	<p><b>Provisioning</b></p> <ul style="list-style-type: none"> <li>• SONET Provisioning</li> <li>• Ethernet Provisioning</li> <li>• 100Base-T Ports</li> <li>• Gigabit EOS</li> </ul> <p><b>Acceptance</b></p> <ul style="list-style-type: none"> <li>• Alarms</li> <li>• Service States</li> <li>• OSS Interface Operations               <ul style="list-style-type: none"> <li>- OSI</li> <li>- SDCC Maintenance</li> </ul> </li> <li>• Timing Modes</li> <li>• Timing Paths - Three Ring Node</li> <li>• Synchronization Status Messaging               <ul style="list-style-type: none"> <li>- Quality-Level Reporting</li> <li>- Default Provisioning</li> <li>- Derived DS1 Clock Functions</li> </ul> </li> <li>• Stratum Levels</li> </ul>	

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# FLASHWAVE® 4100 System Maintenance, Operations & Trouble Clearing (Large & Small Shelf Only)

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 4100-M  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-4100M  <b>In-House Tuition:</b> \$2800  <b>Suitcase:</b> TRSC-4100M*  <b>MSP Suitcase:</b> TRSE-4100M*            * For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4100 System Overview</li> <li>Features</li> <li>Applications</li> <li>Backplanes</li> <li>Network Management Interfaces</li> </ul> <p><b>Plug-In Units</b></p> <ul style="list-style-type: none"> <li>Management and Control Unit</li> <li>Line Units               <ul style="list-style-type: none"> <li>OC-3</li> <li>OC-12</li> <li>OC-48</li> </ul> </li> <li>Small Form-Factor Pluggable Modules</li> <li>Service Units               <ul style="list-style-type: none"> <li>OC-3</li> <li>OC-12</li> <li>DS3/EC-1</li> <li>DS1 VT-Mapped</li> </ul> </li> <li>M13 Transmux Unit</li> <li>Ethernet Units               <ul style="list-style-type: none"> <li>10/100Base-T</li> <li>Gigabit</li> <li>Layer 2</li> </ul> </li> <li>Ethernet Bandwidth Extension Unit</li> <li>Access Identifiers</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>SONET Tutorial</li> <li>Ethernet Tutorial</li> </ul>		
<p><b>Course Contents</b></p>		
<p><b>Overview</b>  <b>Plug-In Units</b>  <b>Configurations</b>  <b>Network Interfaces</b>  <b>Management Systems</b>  <b>Upgrades and Migrations</b>  <b>Alarms and Conditions</b>  <b>Synchronization</b>  <b>System Performance</b>  <b>Packet ONP Shelf</b>  <b>Hands-On Exercises</b></p>	<p><b>Configurations</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4100 Configurations               <ul style="list-style-type: none"> <li>Terminal (Point-to-Point)</li> <li>UPSR</li> <li>Private Rings</li> <li>EOS Interoperability</li> </ul> </li> <li>EPORT</li> <li>Resilient Packet Ring</li> <li>Aggregation Port</li> <li>Provisioning               <ul style="list-style-type: none"> <li>SONET</li> <li>EOS</li> </ul> </li> <li>Ethernet Enhancements</li> </ul>	<p><b>Alarms and Conditions</b></p> <ul style="list-style-type: none"> <li>Alarms</li> <li>Alarm and Condition Reports</li> <li>Housekeeping Alarms</li> <li>Error Codes</li> <li>Equipment and Network Problems</li> </ul> <p><b>Synchronization</b></p> <ul style="list-style-type: none"> <li>Stratum Levels</li> <li>Synchronous Status Messaging</li> <li>Sync Lists</li> <li>Stratum Levels</li> <li>Timing Distribution and Problems</li> </ul>
<p><b>Scheduled Dates</b></p>		
<p>10/23/12            4/9/13            9/24/13</p>		
<p><b>Course Description</b>            The Fujitsu FLASHWAVE 4100 System Maintenance course covers operations, performance monitoring, interpretation of alarms and condition reports, fault isolation and trouble clearing, upgrades and migrations, and an introductory overview of element management software.</p> <p><b>Who Should Attend</b>            This course is recommended for CO, Field Repair, Network Operations Center (NOC), and Technical Assistance Center (TAC) technicians, as well as engineers, supervisors, and managers.</p> <p><b>NOTE: Does not include the FLASHWAVE 4100-ES Packet ONP system.</b></p>	<p><b>Network Interfaces</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4100 System Access</li> <li>OSS Interface Operation</li> <li>Computer Equipment and Cabling</li> </ul> <p><b>Management systems</b></p> <ul style="list-style-type: none"> <li>NETSMART 500 Element Manager</li> <li>TL1</li> <li>NETSMART 1500 Management System</li> </ul> <p><b>Upgrades and Migrations</b></p> <ul style="list-style-type: none"> <li>Software Downloads</li> <li>Remote Memory Backup/Restore</li> <li>Software Upgrades</li> <li>Migrations</li> <li>FLASHWAVE 4100 System Release Compatibility</li> </ul>	<p><b>System Performance</b></p> <ul style="list-style-type: none"> <li>Performance Monitoring</li> <li>Equipment Configurations</li> <li>Terminal APS</li> <li>UPSR</li> <li>EOS</li> </ul> <p><b>Packet ONP Shelf</b></p> <ul style="list-style-type: none"> <li>Network Configurations</li> <li>Features</li> <li>Packet ONP Shelf               <ul style="list-style-type: none"> <li>Slots</li> <li>Backplane</li> <li>I/O Panels</li> </ul> </li> <li>Network Management Interfaces</li> <li>Packet ONP Shelf Units               <ul style="list-style-type: none"> <li>Management and Control Unit</li> <li>OC-3/OC-12/OC-48 Line Units</li> <li>DS3 Service Unit</li> <li>DS1 Service Units</li> <li>M13 Transmux Service Unit</li> <li>EPORT Service Unit</li> </ul> </li> </ul>



## FLASHWAVE® 4100 System Turn-Up and Test (Large & Small Shelf Only)

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 4100-T  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-4100T  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-4100T*  <b>MSP Suitcase:</b> TRSE-4100T*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4100 System Overview</li> <li>Features</li> <li>Applications</li> <li>Backplanes</li> <li>Network Management Interfaces</li> </ul> <p><b>Plug-In Units</b></p> <ul style="list-style-type: none"> <li>Management and Control Unit</li> <li>Line Units <ul style="list-style-type: none"> <li>OC-3</li> <li>OC-12</li> <li>OC-48</li> </ul> </li> <li>Small Form-Factor Pluggable Modules</li> <li>Service Units <ul style="list-style-type: none"> <li>OC-3</li> <li>OC-12</li> <li>DS3/EC-1</li> <li>DS1 VT-mapped</li> </ul> </li> <li>M13 Transmux Unit</li> <li>Ethernet Units <ul style="list-style-type: none"> <li>10/100Base-T Ethernet</li> <li>Gigabit Ethernet</li> <li>Layer 2 (RPR and APORT)</li> </ul> </li> <li>Ethernet Bandwidth Extension Unit</li> <li>Access Identifiers</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>SONET Tutorial</li> <li>Ethernet Tutorial</li> </ul>	<p><b>Configurations</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4100 System Configurations <ul style="list-style-type: none"> <li>Terminal (Point-to-Point)</li> <li>UPSR</li> <li>Private Rings</li> <li>Ethernet over SONET (EOS) Interoperability</li> </ul> </li> <li>EPORT</li> <li>Resilient Packet Ring</li> <li>Aggregation Port</li> <li>Provisioning <ul style="list-style-type: none"> <li>SONET</li> <li>EOS</li> </ul> </li> <li>Ethernet Enhancements</li> </ul> <p><b>Management Systems</b></p> <ul style="list-style-type: none"> <li>NETSMART 500 Element Manager</li> <li>NETSMART 1500 Management System</li> <li>TL1</li> </ul> <p><b>Provisioning</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4100 System Turn-Up</li> <li>SONET Provisioning Hierarchy</li> <li>Provisioning Ethernet Service</li> <li>STS Cross-Connect Provisioning</li> <li>RPR Provisioning</li> <li>APORT Provisioning</li> <li>Storage Area Network Provisioning</li> </ul>	<p><b>Acceptance</b></p> <ul style="list-style-type: none"> <li>Alarms</li> <li>Service States</li> <li>FLASHWAVE 4100 System Access</li> <li>OSS Interface Operations</li> <li>Synchronization</li> <li>Timing Modes</li> <li>Synchronous Status Messaging</li> <li>Sync List</li> <li>Derived DS1 Clock</li> <li>Stratum Levels</li> <li>Timing Distribution</li> <li>Performance Monitoring</li> <li>Loopback Testing</li> <li>Test Access</li> </ul>
<p><b>Course Contents</b></p> <p><b>Overview</b>  <b>Plug-In Units</b>  <b>Configurations</b>  <b>Management Systems</b>  <b>Provisioning</b>  <b>Acceptance</b>  <b>Packet ONP Shelf</b>  <b>Hands-On Exercises</b></p> <p><b>Scheduled Dates</b></p> <p>6/4/13  9/24/13</p>	<p><b>Course Description</b></p> <p>This course begins with a system overview, including descriptions of plug-in units. Students learn how to provision various configurations and hardware features through extensive hands-on lab exercises. Students learn to use product-specific technical documentation and procedures to place equipment online and then apply test traffic. Through acceptance testing, students verify that the transport functions and protection features are fully functional. The course introduces students to support resources, such as the Technical Assistance Center (TAC) and Partners Website.</p> <p><b>Who Should Attend</b></p> <p>These courses are recommended for CO, field repair, NOC, and TAC technicians, as well as engineers, supervisors, and managers.</p> <p><b>NOTE: Does not include the FLASHWAVE 4100-ES Packet ONP system.</b></p>	<p><b>Packet ONP Shelf</b></p> <ul style="list-style-type: none"> <li>Network Configurations</li> <li>Features</li> <li>Packet ONP Shelf</li> <li>Slots <ul style="list-style-type: none"> <li>Backplane</li> <li>I/O Panels</li> </ul> </li> <li>Network Management Interfaces</li> <li>Packet ONP Shelf Units <ul style="list-style-type: none"> <li>Management Control Unit</li> <li>OC-3/OC-12/OC-48 Line Units</li> <li>DSS Service Unit</li> <li>DS1</li> <li>M13 Transmux</li> <li>EPORT</li> </ul> </li> </ul>

October 2012 - September 2013



# FLASHWAVE® 4300 SYSTEM MAINTENANCE, OPERATIONS & TROUBLE CLEARING

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 4300-M  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-4300M  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-4300M*  <b>MSP Suitcase:</b> TRSE-4300M*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4300 System Overview</li> <li>Features</li> <li>In-Service Upgrades</li> <li>Shelf Layout</li> <li>Craft Interface and Network Mgmt</li> <li>Inventory Records</li> <li>Shelf Backplane Connector Layout</li> </ul> <p><b>Plug-In Units</b></p> <ul style="list-style-type: none"> <li>Common Plug-In Units <ul style="list-style-type: none"> <li>Microprocessor</li> <li>DCC</li> <li>High-Speed Switch</li> <li>Timing Control</li> <li>STS Switch Fabric</li> <li>VT Switch Fabric</li> </ul> </li> <li>Interface Plug-In Units <ul style="list-style-type: none"> <li>OC-3</li> <li>OC-12</li> <li>OC-48</li> <li>2-Port OC-3</li> <li>DS3/EC-1</li> <li>M13 Transmux</li> <li>DS1</li> <li>10/100Base-T Ethernet</li> <li>Gigabit Ethernet</li> </ul> </li> <li>ATM Plug-In Units <ul style="list-style-type: none"> <li>ATM Processing and Control</li> <li>ATM Switch Fabric</li> </ul> </li> <li>Fan Units</li> <li>Filler Panels</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>SONET Tutorial</li> <li>Ethernet Tutorial</li> <li>ATM Tutorial</li> </ul>		<p><b>Network Interfaces</b></p> <ul style="list-style-type: none"> <li>Access to FLASHWAVE 4300 System</li> <li>OSS Interface Operations</li> <li>Computer Equipment and Cabling</li> </ul> <p><b>Upgrades and Migrations</b></p> <ul style="list-style-type: none"> <li>SWDL</li> <li>RMBU</li> <li>System Software Upgrades</li> <li>Migrations</li> <li>FLASHWAVE 4300 System Release Compatibility</li> </ul> <p><b>Alarms and Conditions</b></p> <ul style="list-style-type: none"> <li>Alarm and Condition Reports</li> <li>Equipment Problems</li> <li>Terminating Equipment</li> <li>Remote Alarm Indication</li> <li>Bit Error Rate Alarms</li> <li>Unequipped Codes</li> <li>Data Communications Channel Failure</li> <li>Payload Label Mismatch</li> <li>Housekeeping Alarms</li> <li>Error Codes</li> </ul> <p><b>Synchronization</b></p> <ul style="list-style-type: none"> <li>Synchronization</li> <li>Stratum Levels</li> <li>SSM</li> <li>Sync List</li> <li>Derived DS1 Clock</li> <li>Timing Distribution</li> <li>Timing Problems</li> </ul> <p><b>System Performance</b></p> <ul style="list-style-type: none"> <li>System Overview</li> <li>PM</li> <li>Equipment Configuration</li> <li>EoS</li> <li>ATM Virtual Path UPSR</li> </ul>
<p><b>Course Contents</b></p>		
<p><b>Overview</b>  <b>Plug-In Units</b>  <b>Configurations</b>  <b>Management Systems</b>  <b>ATM Turn-Up</b>  <b>Network Interfaces</b>  <b>Upgrades and Migrations</b>  <b>Alarms and Conditions</b>  <b>Synchronization</b>  <b>System Performance</b>  <b>Hands-On Exercises</b></p>		
<p><b>Scheduled Dates</b></p>	<p><b>Configurations</b></p> <ul style="list-style-type: none"> <li>Switch Fabric Routing</li> <li>Configuration Types <ul style="list-style-type: none"> <li>Linear Terminal</li> <li>Dual-Node Access UPSR</li> <li>UPSR Hub</li> <li>OC-48 BLSR</li> </ul> </li> <li>Autoprovisioning</li> <li>SONET Provisioning Hierarchy</li> <li>Ethernet Provisioning Hierarchy</li> </ul> <p><b>Management Systems</b></p> <ul style="list-style-type: none"> <li>FLEXR GT Craft Interface</li> <li>NETSMART 500 Element Manager</li> <li>NETSMART 1500 Management System</li> <li>TL1</li> </ul> <p><b>ATM Turn-Up</b></p> <ul style="list-style-type: none"> <li>Application Setup</li> <li>Provision Equipment</li> <li>Provision DS3 UNI</li> <li>Provision STS Cross-Connects</li> <li>Provision ATM Interface</li> <li>Set ATM Interface Parameters</li> <li>ATM Applications</li> <li>Virtual Links and Connections</li> <li>Virtual Cross-Connects</li> </ul>	
<p><b>Special Order Only</b>  Call for details:  1-800-777-3278 Ext. 4961</p>		
<p><b>Course Description</b>  The FLASHWAVE 4300 System Maintenance course covers operations, performance monitoring, interpretation of alarms and condition reports, fault isolation and trouble clearing, upgrades and migrations, and an introductory overview of element management software.</p> <p><b>Who Should Attend</b>  The FLASHWAVE 4300 System Maintenance course will benefit all personnel responsible for monitoring, maintaining, and troubleshooting networks, and for upgrading Fujitsu network elements. This course is recommended for Central Office (CO), Network Operations Center (NOC), field repair technicians as well as engineers, supervisors and managers.</p>		

October 2012 - September 2013




## FLASHWAVE® 4300 SYSTEM TURN-UP AND TEST

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 4300-T  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-4300T  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-4300T*  <b>MSP Suitcase:</b> TRSE-4300T*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4300 System Overview</li> <li>Features</li> <li>In-Service Upgrades</li> <li>Shelf Layout</li> <li>Craft Interface</li> <li>Inventory Records</li> <li>Shelf Backplane Connector Layout</li> </ul> <p><b>Plug-In Units</b></p> <ul style="list-style-type: none"> <li>Common Plug-In Units <ul style="list-style-type: none"> <li>Microprocessor</li> <li>Data Communication Channel</li> <li>High-Speed Switch</li> <li>Timing Control</li> <li>STS Switch Fabric</li> <li>VT Switch Fabric</li> </ul> </li> <li>Interface Plug-In Units <ul style="list-style-type: none"> <li>OC-3</li> <li>OC-12</li> <li>OC-48</li> <li>2-Port OC-3</li> <li>DS3/EC-1</li> <li>M13 Transmux</li> <li>DS1</li> <li>10/100Base-T Ethernet</li> <li>Gigabit Ethernet</li> </ul> </li> <li>ATM Plug-In Units <ul style="list-style-type: none"> <li>ATM Processing and Control</li> <li>ATM Switch Fabric</li> </ul> </li> <li>Fan Units</li> <li>Filler Panels</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>SONET Tutorial</li> <li>Ethernet Tutorial</li> <li>ATM Tutorial</li> </ul>		<p><b>ATM Turn-Up</b></p> <ul style="list-style-type: none"> <li>Application Setup</li> <li>Provision Equipment</li> <li>Provision DS3 UNI</li> <li>Provision STS Cross-Connects</li> <li>Provision ATM Interface</li> <li>Set ATM Interface Parameters</li> <li>ATM Applications</li> <li>Virtual Links</li> <li>Virtual Cross-Connects</li> <li>Virtual Connections</li> </ul> <p><b>Acceptance</b></p> <ul style="list-style-type: none"> <li>Alarms</li> <li>Equipment Service States</li> <li>Facility Service States</li> <li>Synchronization <ul style="list-style-type: none"> <li>Timing Modes <ul style="list-style-type: none"> <li>Externally Timed NE</li> <li>Line-Timed NE</li> </ul> </li> <li>Timing Paths in a 3-Node Ring <ul style="list-style-type: none"> <li>Synchronization Lists</li> <li>Revertive Switching</li> <li>Nonrevertive Switching</li> </ul> </li> </ul> </li> <li>Derived DS1 Clock Functions <ul style="list-style-type: none"> <li>Default Provisioning</li> <li>Control of Timing Reference</li> </ul> </li> <li>Synchronization Status Messaging</li> <li>Network Monitoring Interfaces</li> <li>Performance Monitoring</li> <li>Loopback Testing</li> <li>Test Access</li> </ul>
<p><b>Course Contents</b></p> <p><b>Overview</b>  <b>Plug-In Units</b>  <b>Configurations</b>  <b>Management Systems</b>  <b>Provisioning</b>  <b>ATM Turn-Up</b>  <b>Acceptance</b>  <b>Hands-On Exercises</b></p>		
<p><b>Scheduled Dates</b></p> <p><b>Special Order Only</b>  Call for details:  1-800-777-3278 Ext. 4961</p>		
<p><b>Course Description</b></p> <p>This course begins with a system overview, including descriptions of plug-in units. Students learn how to provision various configurations and hardware features through extensive hands-on lab exercises. Students learn to use product-specific technical documentation and procedures to place equipment online and then apply test traffic. Through acceptance testing, students verify that the transport functions and protection features are fully functional. The course introduces students to support resources, such as the Technical Assistance Center (TAC) and Partners Website.</p> <p><b>Who Should Attend</b></p> <p>These courses are recommended for CO, field repair, NOC and TAC technicians, engineers, supervisors, and managers.</p>	<p><b>Configurations</b></p> <ul style="list-style-type: none"> <li>Switch Fabric Routing</li> <li>Configuration Types <ul style="list-style-type: none"> <li>Linear Terminal</li> <li>Dual-Node Access UPSR</li> <li>UPSR Hub</li> <li>OC-48 BLSR</li> </ul> </li> <li>Autoprovisioning</li> <li>SONET Provisioning Hierarchy</li> <li>Ethernet Provisioning Hierarchy</li> </ul> <p><b>Management Systems</b></p> <ul style="list-style-type: none"> <li>FLEXR GT Craft Interface</li> <li>NETSMART 500 Element Manager</li> <li>TL1</li> <li>NETSMART 1500 Management System</li> </ul> <p><b>Provisioning</b></p> <ul style="list-style-type: none"> <li>Autoprovisioning</li> <li>SONET Provisioning Hierarchy</li> <li>System Turn-Up</li> <li>Ethernet Provisioning Hierarchy</li> <li>Point-to-Point Ethernet Provisioning</li> <li>Bridging</li> </ul>	



# FLASHWAVE® 4500 SYSTEM MAINTENANCE, OPERATIONS & TROUBLE CLEARING

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 4500-M  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-4500M  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-4500M*  <b>MSP Suitcase:</b> TRSE-4500M*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4500 System Overview</li> <li>FLASHWAVE 4500 Shelf Layout</li> <li>FLASHWAVE 4500 System Units</li> <li>Multishelf Interconnection</li> <li>Multishelf Port Densities</li> <li>Management Architecture</li> <li>Pass-Through SDCC</li> <li>Control Plane Phase 1</li> <li>Link Capacity Adjustment Scheme</li> </ul> <p><b>Plug-In Units</b></p> <ul style="list-style-type: none"> <li>Common Units <ul style="list-style-type: none"> <li>Microprocessor</li> <li>Alarm and Status</li> <li>Data Communications</li> <li>40/70/140</li> <li>300G STS Switch Fabric</li> <li>Expansion Shelf STS Switch Fabric</li> <li>140 Gb/s Switch Fabric</li> <li>Optical Amplifier</li> <li>Timing Control and Access</li> <li>Extension Shelf</li> </ul> </li> <li>Interface Units <ul style="list-style-type: none"> <li>DS1</li> <li>DS3/EC-1</li> <li>M13 LC Unit</li> <li>2/4/8-Port OC-3</li> <li>2/4/8-Port OC-12</li> <li>1/2-Port OC-48</li> <li>OC-48 FBTL</li> <li>12-Port Multirate SFP Base</li> <li>OC-192 Wideband</li> <li>OC-192 Narrowband</li> <li>Tunable 10.7 Gb/s OC-192</li> <li>Fast Ethernet</li> <li>10/100 Ethernet w/LCAS</li> <li>Gigabit Ethernet</li> <li>VT Switch Fabric</li> <li>10/20 Gb/s VT Switch Fabric</li> </ul> </li> <li>Filler Panels</li> <li>Fan Units</li> <li>Dispersion Compensation Module</li> <li>Access Identifiers</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>SONET Tutorial</li> <li>Ethernet Tutorial</li> </ul>		
<p><b>Course Contents</b></p> <ul style="list-style-type: none"> <li>Overview</li> <li>Plug-In Units</li> <li>Configurations</li> <li>Management Systems</li> <li>Auxilliary Equipment</li> <li>Network Interfaces</li> <li>Upgrades and Migrations</li> <li>Alarms and Conditions</li> <li>Synchronization</li> <li>System Performance</li> </ul>		<p><b>Auxiliary Equipment</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4010 System</li> <li>FLASHWAVE 4020 System</li> <li>FLASHWAVE 7120 System</li> </ul> <p><b>Network Interfaces</b></p> <ul style="list-style-type: none"> <li>Access to FLASHWAVE 4500 System</li> <li>OSS Interface Operations</li> <li>Computer Equipment and Cabling</li> </ul> <p><b>Upgrades and Migrations</b></p> <ul style="list-style-type: none"> <li>SWDL</li> <li>RMBU</li> <li>Upgrades</li> <li>Migrations</li> <li>FLASHWAVE 4500 Release Compatibility</li> </ul> <p><b>Alarms and Conditions</b></p> <ul style="list-style-type: none"> <li>Alarms</li> <li>Alarm and Condition Reports</li> <li>Housekeeping Alarms</li> <li>Error Codes</li> </ul> <p><b>Synchronization</b></p> <ul style="list-style-type: none"> <li>Synchronization</li> <li>Stratum Levels</li> <li>Multishelf Synchronization</li> <li>Timing Paths in a 3-Node Ring</li> <li>Synchronous Status Messaging</li> <li>Sync Lists</li> <li>Derived DS1 Clock</li> <li>Timing Distribution</li> <li>Timing Problems</li> </ul> <p><b>System Performance</b></p> <ul style="list-style-type: none"> <li>Performance Monitoring</li> <li>Equipment Configurations</li> <li>Switched Rings</li> <li>EoS</li> </ul>
<p><b>Scheduled Dates</b></p> <p>10/9/12  11/6/12  12/4/12  12/18/12  1/15/13  1/29/13  2/26/13  3/26/13  4/23/13  5/21/13  6/18/13  7/16/13  8/13/13  9/10/13</p>		
<p><b>Course Description</b></p> <p>The FLASHWAVE 4500 System Maintenance course covers operations, performance monitoring, interpretation of alarms and condition reports, fault isolation, trouble clearing, upgrades and migrations, and an introductory overview of element management software.</p> <p><b>Who Should Attend</b></p> <p>The course benefits all personnel responsible for monitoring, maintaining/troubleshooting networks and upgrading Fujitsu network elements.</p>	<p><b>Configurations</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4500 System Configuration</li> <li>STS Switch Fabric Routing</li> <li>300G Switching Architecture</li> <li>Terminal Configuration</li> <li>Linear ADM Configuration</li> <li>Hub Configurations</li> <li>BLSR Configurations</li> <li>Resilient Packet Ring</li> <li>Auto concatenation</li> </ul> <p><b>Management Systems</b></p> <ul style="list-style-type: none"> <li>NETSMART 500 Element Manager</li> <li>TL1</li> <li>NETSMART 1500 Management Systems</li> </ul>	




## FLASHWAVE® 4500 SYSTEM TURN-UP AND TEST

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 4500-T  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-4500T  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-4500T*  <b>MSP Suitcase:</b> TRSE-4500T*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4500 System Overview</li> <li>FLASHWAVE 4500 Shelf Layout</li> <li>FLASHWAVE 4500 System Units</li> <li>Multishelf Interconnection</li> <li>DS3 Extension Panel</li> <li>Management Interfaces</li> <li>Pass-Through SDCC</li> <li>Control Plane Phase 1</li> <li>Link Capacity Adjustment Scheme</li> </ul> <p><b>Plug-In Units</b></p> <ul style="list-style-type: none"> <li>Common Units               <ul style="list-style-type: none"> <li>Microprocessor</li> <li>Alarm and Status</li> <li>Data Communications</li> <li>40/70/140</li> <li>300G STS Switch Fabric</li> <li>Expansion Shelf STS Switch Fabric</li> <li>140 Gb/s Switch Fabric</li> <li>Optical Amplifier</li> <li>Timing Control and Access</li> <li>Extension Shelf TCA</li> </ul> </li> <li>Interface Units               <ul style="list-style-type: none"> <li>DS1</li> <li>DS3/EC-1</li> <li>M13 Transmux Unit</li> <li>2/4/8-Port OC-3 and OC-12</li> <li>1/2-Port OC-48</li> <li>OC-48 FBTL</li> <li>12-Port Multirate SFP Base</li> <li>OC-192 Wideband and Narrowband</li> <li>Tunable 10.7 Gb/s OC-192</li> <li>Fast Ethernet</li> <li>10/100 Ethernet w/LCAS</li> <li>Gigabit Ethernet</li> <li>VT Switch Fabric</li> <li>10/20 Gb/s VT Switch Fabric</li> </ul> </li> <li>Filler Panels</li> <li>Fan Units</li> <li>Dispersion Compensation Module</li> <li>Access Identifiers</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>SONET Tutorial</li> <li>Ethernet Tutorial</li> </ul>		
<p><b>Course Contents</b></p> <p><b>Overview</b>  <b>Plug-In Units</b>  <b>Configurations</b>  <b>Management Systems</b>  <b>Provisioning</b>  <b>Acceptance</b>  <b>Hands-On Exercises</b></p>		
<p><b>Scheduled Dates</b></p> <p>10/30/12  1/22/13  2/19/13  3/19/13  4/16/13  5/14/13  6/11/13  7/9/13  8/6/13</p>		<p><b>Provisioning</b></p> <ul style="list-style-type: none"> <li>Autoprovisioning</li> <li>FLASHWAVE 4500 Turn-Up</li> <li>SONET Provisioning Hierarchy</li> <li>Adding DS1 Service</li> <li>Adding DS3 Service</li> <li>Adding a New Optical Interface</li> <li>Provisioning Transmux Service</li> <li>Provisioning Ethernet Service</li> <li>Resilient Packet Ring</li> <li>Trunking Port Provisioning</li> <li>LCAS Provisioning</li> <li>Control Plane Provisioning</li> </ul> <p><b>Acceptance</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4500 System Test</li> <li>Alarms</li> <li>Equipment Service States</li> <li>Service State Changes               <ul style="list-style-type: none"> <li>Facility Service States</li> </ul> </li> <li>Single Shelf Synchronization</li> <li>Timing Modes</li> <li>Timing Paths in a 3-Node Ring               <ul style="list-style-type: none"> <li>Synchronization Lists</li> <li>Revertive Switching</li> <li>Nonrevertive Switching</li> </ul> </li> <li>Derived DS1 Clock Functions               <ul style="list-style-type: none"> <li>Control of Timing Reference Switch</li> </ul> </li> <li>Synchronization Status Messaging</li> <li>Stratum Levels</li> <li>Network Monitoring Interfaces</li> <li>Performance Monitoring</li> <li>Loopback Testing</li> <li>Test Access</li> </ul>
<p><b>Course Description</b></p> <p>The course begins with system overview, including descriptions of plug-in units. Students learn to provision various configurations and hardware features through extensive hands-on lab exercises. Students learn to use product-specific technical documentation and procedures to place equipment online and apply test traffic. Through acceptance testing, they verify transport functions and protection features are fully functional. The course introduces students to support resources, such as the Technical Assistance Center (TAC) and Partners Website.</p> <p><b>Who Should Attend</b></p> <p>These courses are recommended for CO, field repair, NOC and TAC technicians as well as engineers, supervisors, and managers.</p>		
	<p><b>Configurations</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 4500 System Configuration</li> <li>STS Switch Fabric Routing</li> <li>300G Switching Architecture</li> <li>Terminal Configuration</li> <li>Linear ADM Configuration</li> <li>Hub Configurations</li> <li>BLSR Configurations</li> <li>Resilient Packet Ring</li> <li>Auto Provisioning</li> <li>REM Overview</li> </ul> <p><b>Management Systems</b></p> <ul style="list-style-type: none"> <li>NETSMART 500 Element Manager</li> <li>TL1</li> <li>NETSMART 1500 Management Systems</li> <li>Alarms</li> </ul>	

October 2012 - September 2013




# FLASHWAVE® 7120 System Planning and Engineering

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 7120-E  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-7120E  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-7120E*  <b>MSP Suitcase:</b> TRSE-7120E*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Rep. or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>FLASHWAVE 7120 Shelves <ul style="list-style-type: none"> <li>- Large</li> <li>- Expansion</li> <li>- Passive</li> <li>- Shelf Slots</li> </ul> </li> </ul> <p><b>FLASHWAVE 7120 Units</b></p> <ul style="list-style-type: none"> <li>Main Shelf Interface</li> <li>Cooling Units</li> <li>Processor Units</li> <li>Optical Units</li> <li>Pre-amplifier and Amplifier Units</li> <li>CWDM Units</li> <li>DWDM Units</li> <li>Conversion Units</li> <li>Power Monitor Units</li> <li>DCM</li> <li>Small Form-Factor Pluggable Modules</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>SONET Tutorial</li> <li>DWDM Tutorial</li> <li>Recent experience with DWDM equipment</li> </ul>		
<p><b>Course Contents</b></p> <p><b>Overview</b></p> <p><b>Units</b></p> <p><b>Connection Oriented Ethernet</b></p> <p><b>Configurations</b></p> <p><b>Management Systems</b></p> <p><b>Optical Network Fundamentals</b></p> <p><b>proNX Overview</b></p> <p><b>Hands-On Exercises</b></p>	<p><b>Connection Oriented Ethernet</b></p> <ul style="list-style-type: none"> <li>Bridging</li> <li>Layer 2 Ethernet</li> <li>VLANs</li> <li>Ethernet Services</li> <li>Scheduling &amp; Shaping</li> <li>CoS</li> <li>QoS</li> <li>Aggregation</li> <li>SOAM</li> <li>Protection</li> <li>Specifications</li> </ul> <p><b>Configurations</b></p> <ul style="list-style-type: none"> <li>Reach Extension</li> <li>Capacity Extension</li> <li>Wavelength Conversion</li> <li>Wavelength Regeneration</li> <li>Supported Configurations</li> </ul> <p><b>Management Systems</b></p> <ul style="list-style-type: none"> <li>NETSMART 500 Craft Tool</li> <li>NETSMART 712 Element Manager</li> <li>System and Unit Provisioning</li> <li>TL1</li> <li>NETSMART 1500 Management System</li> </ul>	<p><b>Optical Network Fundamentals</b></p> <ul style="list-style-type: none"> <li>Multiplexing</li> <li>Fiber-Optic Transmission</li> <li>Signal Format</li> <li>DWDM Transmission Impairments</li> <li>FEC</li> <li>Optical Transmitters &amp; Receivers</li> <li>Amplifiers, Transponders &amp; Regenerators</li> <li>Fiber Optic Cables &amp; Issues</li> <li>Metro ROADM</li> </ul>
<p><b>Scheduled Dates</b></p> <p>4/30/13 8/20/13</p>		<p><b>proNX® Overview</b></p> <ul style="list-style-type: none"> <li>Designing Network Using proNX 9010</li> <li>Defining Services &amp; Traffic</li> <li>Layout Strategy</li> <li>BOM</li> <li>Network Schematic</li> </ul>
<p><b>Course Description</b></p> <p>The FLASHWAVE 7120 System Planning and Engineering course enables students to plan and engineer networks and system applications using the FLASHWAVE 7120 Packet ONP equipment in various configurations. Case studies are used to develop examples of operational networks.</p> <p><b>Who Should Attend</b></p> <p>All personnel responsible for planning and engineering networks using FLASHWAVE 7120 equipment will benefit from attending this course, including network planners and engineers, supervisors and managers with budgetary responsibility.</p> <p><b>NOTE: This course does not include DWDM basics of network engineering.</b></p>		

October 2012 - September 2013



# FLASHWAVE® 7120 Turn-Up, Test & Maintenance

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 7120-TM  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-7120TM  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-7120TM*  <b>MSP Suitcase:</b> TRSE7120TM*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• Shelves and Capabilities <ul style="list-style-type: none"> <li>- Large Shelf</li> <li>- Expansion Shelf</li> <li>- Passive Shelf</li> </ul> </li> <li>• Filter and Channel Plan</li> <li>• Management Communication Channel</li> </ul> <p><b>Units</b></p> <ul style="list-style-type: none"> <li>• Main Shelf Units</li> <li>• Expansion Shelf Units</li> <li>• OSC Units</li> <li>• Transponder Units</li> <li>• Muxponder Units</li> <li>• Processor Unit</li> <li>• Amplifier Units</li> <li>• CWDM Units</li> <li>• DWDM Units</li> <li>• Power Monitor</li> <li>• Noise Filter Unit</li> <li>• DCM</li> <li>• Form-Factor Pluggable Units</li> </ul>	
<p><b>Prerequisites</b></p>		
<ul style="list-style-type: none"> <li>• SONET Tutorial</li> <li>• DWDM Tutorial</li> <li>• Recent DWDM experience</li> </ul>		
<p><b>Course Contents</b></p>		<p><b>Acceptance Testing</b></p> <ul style="list-style-type: none"> <li>• Features</li> <li>• Alarms</li> <li>• Network Performance Monitoring</li> <li>• Loopbacks</li> </ul>
<p><b>Overview</b></p> <p><b>Units</b></p> <p><b>Configurations</b></p> <p><b>Connection Oriented Ethernet</b></p> <p><b>Management Systems</b></p> <p><b>Provisioning</b></p> <p><b>Acceptance Testing</b></p> <p><b>Maintenance</b></p> <p><b>Hands-On Exercises</b></p>	<p><b>Carrier Ethernet</b></p> <ul style="list-style-type: none"> <li>• Layer 2 Ethernet</li> <li>• VLAN Support</li> <li>• Bridging</li> <li>• UNI, INNI and ENNI</li> <li>• Services</li> <li>• CoS</li> <li>• QoS</li> <li>• SOAM</li> <li>• Protection</li> <li>• ERPS</li> <li>• Specifications</li> </ul> <p><b>Configurations</b></p> <ul style="list-style-type: none"> <li>• Reach Extension</li> <li>• Capacity Expansion</li> <li>• Wavelength Conversion</li> <li>• Wavelength Regeneration</li> <li>• Supported Configurations</li> </ul> <p><b>Management Systems</b></p> <ul style="list-style-type: none"> <li>• Access using Ethernet</li> <li>• NETSMART 712 Element Manager</li> <li>• TL1</li> <li>• NETSMART 1500 Management System</li> </ul>	<p><b>Maintenance</b></p> <ul style="list-style-type: none"> <li>• OAM&amp;P</li> <li>• Backup &amp; Restore</li> <li>• Alarm Thresholds</li> <li>• Alarm Severity Codes</li> <li>• Clearing Alarms</li> <li>• Events</li> <li>• Conditions</li> </ul>
<p><b>Scheduled Dates</b></p>		
<p>10/16/12, 11/27/12, 12/11/12, 2/5/13, 4/2/13, 6/4/13, 7/23/13, 9/17/13</p>		
<p><b>Course Description</b></p> <p>The FLASHWAVE 7120 Turn-Up, Test &amp; Maintenance course teaches how to turn-up, test, provision, maintain, operate, isolate faults and clear trouble for various configurations and hardware features through extensive hands-on exercises. The course also introduces support resources, such as the Fujitsu Technical Assistance Center (TAC) &amp; Partners Technical Documentation.</p> <p><b>Who Should Attend</b></p> <p>This course is recommended for central office and field personnel who perform turn-up, test local provisioning and who perform maintenance, fault isolation and trouble-clearing. Engineers, NOC personnel and supervisors also benefit from this course.</p>		




## FLASHWAVE® 7420 SYSTEM PLANNING AND ENGINEERING

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 7420-E  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-7420E  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-7420E*  <b>MSP Suitcase:</b> TRSE-7420E*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• FLASHWAVE 7420 System Description</li> <li>• FLASHWAVE 7420 Shelves <ul style="list-style-type: none"> <li>- 7HU Shelf</li> <li>- 9HU Shelf</li> <li>- 1HU High-Power Shelf</li> <li>- 1HU Passive Shelf</li> </ul> </li> <li>• Management Software</li> <li>• Transport Networks <ul style="list-style-type: none"> <li>- Metro Core</li> <li>- Metro Access</li> <li>- Enterprise</li> </ul> </li> <li>• User Traffic Types <ul style="list-style-type: none"> <li>- SONET</li> <li>- Fast Ethernet</li> <li>- Gigabit Ethernet</li> <li>- 10 Gigabit Ethernet</li> <li>- Fiber Connectivity</li> <li>- Fibre Channel</li> </ul> </li> <li>• Wavelength Plan <ul style="list-style-type: none"> <li>- DWDM</li> <li>- CWDM</li> <li>- DWDM/CWDM Hybrid</li> </ul> </li> <li>• 32-Channel Banded Architecture</li> <li>• 40-Channel Unbanded Architecture</li> <li>• 80-Channel Unbanded Architecture</li> <li>• Performance Monitoring</li> </ul> <p><b>Modules</b></p> <ul style="list-style-type: none"> <li>• Power Supply Modules</li> <li>• Fan Assembly Unit for 7HU Shelf</li> <li>• Management and Switch Modules <ul style="list-style-type: none"> <li>- Network Control Units</li> <li>- Shelf Control Unit</li> <li>- Optical Supervisory Channel Modules</li> <li>- Utility Module</li> <li>- 4-Port Optical Power Control Module</li> <li>- Common Equipment Module for 9HU Shelf</li> <li>- FAN/9HU Unit for 9HU Shelf</li> </ul> </li> <li>• ROADM Application Units <ul style="list-style-type: none"> <li>- 2-Degree and 8-Degree ROADM Optical Power Modules</li> <li>- 40-Channel Splitter Modules</li> <li>- 50 GHz/100 GHz Optical Interleaver/De-Interleaver Module</li> <li>- Passive Shelf Control Unit</li> </ul> </li> <li>• Passive Optical Modules</li> <li>• Dispersion Compensation Modules</li> <li>• 2-Port Protection Modules</li> <li>• Optical Amplifiers</li> <li>• Channel Modules <ul style="list-style-type: none"> <li>- Core Channel Modules</li> <li>- Access Channel Modules</li> <li>- Enterprise Channel Modules</li> </ul> </li> <li>• Small Form-Factor Pluggable Modules</li> <li>• Filler Panels</li> </ul>	<div> </div> <p><b>System Applications</b></p> <ul style="list-style-type: none"> <li>• Point-to-Point</li> <li>• Linear Add/Drop</li> <li>• Ring</li> <li>• ROADM</li> </ul>
<p><b>Prerequisites</b></p>		
<ul style="list-style-type: none"> <li>• SONET Tutorial</li> <li>• DWDM Tutorial</li> <li>• Students should have extensive training and experience on the fundamentals of DWDM network design prior to attending this course.</li> </ul>		
<p><b>Course Contents</b></p>		
<p><b>Overview</b>  <b>Modules</b>  <b>System Applications</b>  <b>Case Studies</b></p>		
<p><b>Scheduled Dates</b></p>		
<p>4/2/13  9/17/13</p>		
<p><b>Course Description</b></p> <p>The FLASHWAVE 7420 System Planning and Engineering course enables students to plan and engineer networks and system applications. Extensive case studies of operational networks in various configurations are used for examples.</p> <p><b>Who Should Attend</b></p> <p>All personnel responsible for planning and engineering networks using FLASHWAVE 7420 systems benefit from attending this course, including network planners and engineers, supervisors, and managers with budget responsibility.</p> <p><b>NOTE: This course does not include the basics of DWDM network engineering.</b></p>		

October 2012 - September 2013




# FLASHWAVE® 7500 SYSTEM PLANNING AND ENGINEERING

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 7500-E  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-7500E  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-7500E*  <b>MSP Suitcase:</b> TRSE-7500E*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• General Features</li> <li>• Core and Small System Configurations</li> <li>• Core and Small System Applications</li> <li>• Extension System Configuration</li> <li>• Management Options</li> <li>• Security Features</li> </ul> <p><b>Interoperability</b></p> <ul style="list-style-type: none"> <li>• FLASHWAVE 7500 System interoperability with: <ul style="list-style-type: none"> <li>- FLASHWAVE 9500 System</li> <li>- FLASHWAVE CDS System</li> <li>- FLASHWAVE 7120 System</li> </ul> </li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Core and Small System Applications <ul style="list-style-type: none"> <li>- Linear and Ring</li> <li>- In-Line Amplifier and Express Node</li> <li>- HUB</li> <li>- Broadcast</li> <li>- Stacked Muxponder</li> <li>- Regenerator</li> </ul> </li> <li>• Extension Configuration Applications</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• SONET Tutorial</li> <li>• DWDM Tutorial</li> <li>• Recent experience with DWDM equipment (recommended)</li> </ul>	<p><b>System Components</b></p> <ul style="list-style-type: none"> <li>• Core Configuration Optical and Tributary Shelves and Backplane</li> <li>• Small Configuration Optical and Tributary Shelves and Backplane</li> <li>• Extension Shelf and Backplane</li> <li>• Plug-In Unit Descriptions <ul style="list-style-type: none"> <li>- Shelf Processor Units</li> <li>- OSC Units</li> <li>- Amplifier Units</li> <li>- Multiplexer/Demultiplexer Units</li> <li>- Switch Units</li> <li>- HUB Units</li> <li>- Flexponder™ Synchronization Unit</li> <li>- Transponder Units</li> <li>- Muxponder Units</li> <li>- Flexponder Units</li> <li>- FLASHWAVE LIGHTGUARD Unit</li> <li>- Regeneration Units</li> <li>- SFP and XFP Modules</li> </ul> </li> <li>• Lambda Access Shelves and Modules</li> <li>• DCM Shelves and Modules</li> <li>• High-Density Optical Access Shelf</li> <li>• Circuit Breaker Panel</li> </ul>	<p><b>Optical Network Fundamentals</b></p> <ul style="list-style-type: none"> <li>• Optical Networks</li> <li>• Fiber-Optic Transmission</li> <li>• Signal Format</li> <li>• Impairments to DWDM Transmission</li> <li>• Forward Error Correction</li> <li>• Optical Transmitters and Receivers</li> <li>• Amplifiers and Regenerators</li> <li>• Fiber-Optic Cable</li> <li>• Fiber Issues</li> </ul>
<p><b>Course Contents</b></p> <p><b>Overview</b>  <b>Interoperability</b>  <b>Applications</b>  <b>System Components</b>  <b>Functional Description</b>  <b>Optical Network Fundamentals</b>  <b>NETSMART 2000 Design and Planning Tool</b>  <b>Engineering Case Studies</b></p>	<p><b>Functional Description</b></p> <ul style="list-style-type: none"> <li>• 40-Channel Applications <ul style="list-style-type: none"> <li>- 2D-ROADM</li> <li>- WSS-ROADM and WSS-ROADM HUB</li> <li>- ILA Node and Express Node</li> </ul> </li> <li>• 32-Channel ROADM/FOADM Applications</li> <li>• Client Interfaces <ul style="list-style-type: none"> <li>- 10G and 40G Transponders</li> <li>- Muxponders and Flexponders</li> <li>- Direct Connect</li> <li>- 10G and 40G Regenerators</li> <li>- FLASHWAVE LIGHTGUARD</li> </ul> </li> </ul>	<p><b>NETSMART 2000 Design/Planning Tool</b></p> <ul style="list-style-type: none"> <li>• New Features and Enhancements</li> <li>• Architecture</li> <li>• Design Browser &amp; Editor</li> <li>• Design Preferences</li> <li>• Wavelength Recoloring</li> <li>• Design Templates</li> <li>• Using Design Icons to Create Designs</li> <li>• Adding Demands</li> <li>• Adding Subnetworks</li> <li>• Moving a Span to Another Subnetwork</li> <li>• Reachability Matrix</li> <li>• Manual Selection of Amplifiers/DCMs</li> <li>• Rack and Shelf View</li> <li>• Design Reports</li> <li>• BOM Parts Mapping Manager</li> <li>• Custom Profile Features</li> <li>• Asymmetric HUB</li> <li>• Multi-TID HUB</li> <li>• FLASHWAVE CDS Sites</li> <li>• Small Configuration 32-Channel</li> <li>• Adding FLASHWAVE 9500 TRIB Shelf</li> <li>• Flexponder Cross-Shelf Grooming</li> <li>• Brownfield Design</li> <li>• Security Management</li> <li>• Audits &amp; Activity Log</li> <li>• Save or Open Design</li> <li>• Import and Export Design</li> <li>• Price List Support</li> </ul> <p><b>Engineering Case Studies</b></p>
<p><b>Scheduled Dates</b></p> <p>10/2/12  2/12/13  4/30/13  7/30/13  9/31/13</p> <p><b>Course Description</b></p> <p>The FLASHWAVE 7500 System Planning and Engineering course enables students to plan and engineer networks and system applications using the FLASHWAVE 7500 product family. Extensive case studies of operational networks in various configurations are developed using the NETSMART 2000 design and planning tool.</p> <p><b>Who Should Attend</b></p> <p>All personnel responsible for planning and engineering networks using FLASHWAVE 7500 equipment will benefit from attending this course, including network planners and engineers, supervisors, and managers with budget responsibility.</p>		

October 2012 - September 2013




# FLASHWAVE® 7500 SYSTEM MAINTENANCE, OPERATIONS & TROUBLE CLEARING

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 7500-M  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-7500M  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-7500M*  <b>MSP Suitcase:</b> TRSE-7500M*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• General Features</li> <li>• Core and Small System Configurations</li> <li>• Core and Small System Applications</li> <li>• Extension System Configuration</li> <li>• Management Options</li> <li>• Security Features</li> </ul> <p><b>Interoperability</b></p> <ul style="list-style-type: none"> <li>• FLASHWAVE 7500 System interoperability with: <ul style="list-style-type: none"> <li>- FLASHWAVE 9500 System</li> <li>- FLASHWAVE CDS System</li> <li>- FLASHWAVE 7120 System</li> </ul> </li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Core and Small System Applications <ul style="list-style-type: none"> <li>- Linear and Ring</li> <li>- In-Line Amplifier and Express Node</li> <li>- HUB</li> <li>- Broadcast</li> <li>- Stacked Muxponder</li> <li>- Regenerator</li> </ul> </li> <li>• Extension Configuration Applications</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• SONET Tutorial</li> <li>• DWDM Tutorial</li> <li>• Recent experience with DWDM equipment (recommended)</li> </ul>	<p><b>System Components</b></p> <ul style="list-style-type: none"> <li>• Core Configuration Optical and Tributary Shelves and Backplane</li> <li>• Small Configuration Optical and Tributary Shelves and Backplane</li> <li>• Extension Shelf and Backplane</li> <li>• Plug-In Unit Descriptions <ul style="list-style-type: none"> <li>- Shelf Processor Units</li> <li>- OSC Units</li> <li>- Amplifier Units</li> <li>- Multiplexer/Demultiplexer Units</li> <li>- Switch Units</li> <li>- HUB Units</li> <li>- Flexponder™ Synchronization Unit</li> <li>- Transponder Units</li> <li>- Muxponder Units</li> <li>- Flexponder Units</li> <li>- FLASHWAVE LIGHTGUARD Unit</li> <li>- Regeneration Units</li> <li>- SFP and XFP Modules</li> </ul> </li> <li>• Lambda Access Shelves and Modules</li> <li>• DCM Shelves and Modules</li> <li>• High-Density Optical Access Shelf</li> <li>• Circuit Breaker Panel</li> </ul>	<p><b>Cross-Connects and Connections</b></p> <ul style="list-style-type: none"> <li>• Cross-Connect Mapping and Rules</li> <li>• Core Configuration Applications <ul style="list-style-type: none"> <li>- Transponder or Muxponder Conn</li> <li>- Flexponder Connections</li> <li>- FW LIGHTGUARD-Protected OLC</li> <li>- MPO Cable Connections</li> <li>- Intrashelf Connections</li> </ul> </li> <li>• Small Configuration Applications <ul style="list-style-type: none"> <li>- 40-Channel Connections</li> <li>- 32-Channel Connections (ROADM)</li> <li>- 32-Channel Connections (FOADM)</li> </ul> </li> <li>• DCM Connections</li> <li>• Shelf Hierarchy</li> </ul> <p><b>NE Management</b></p> <ul style="list-style-type: none"> <li>• Connecting to the FLASHWAVE 7500 NE <ul style="list-style-type: none"> <li>- Serial Interface</li> <li>- Local Management Port Interface</li> <li>- LCN &amp; Modern Interface</li> </ul> </li> <li>• NE Management Using TL1</li> <li>• NETSMART 500 NE GUI <ul style="list-style-type: none"> <li>- NETSMART 500 Dashboard Window</li> <li>- NETSMART 500 Graphical Shelf View</li> <li>- NETSMART 500 Service Associations</li> <li>- NETSMART 500 Wizards</li> </ul> </li> <li>• NETSMART 1500 Management System</li> </ul>
<p><b>Course Contents</b></p> <p><b>Overview</b>  <b>Interoperability</b>  <b>Applications</b>  <b>System Components</b>  <b>Functional Description</b>  <b>Cross-Connects and Connections</b>  <b>NE Management</b>  <b>Alarms and Conditions</b>  <b>Upgrades and Migrations</b>  <b>Hands-On Exercises</b></p> <p><b>Scheduled Dates</b></p> <p>12/11/12  2/5/13  4/2/13  7/23/13  9/17/13</p>	<p><b>Course Description</b></p> <p>The FLASHWAVE 7500 System Maintenance course covers operations, performance monitoring, interpretation of alarms and condition reports, fault isolation and trouble clearing, upgrades and migrations, as well as an introductory overview of element management software.</p> <p><b>Who Should Attend</b></p> <p>The FLASHWAVE 7500 System Maintenance course will benefit all personnel responsible for monitoring, maintaining, and troubleshooting networks and for upgrading Fujitsu network elements. This course is recommended for CO, Network Operations Center (NOC), field repair, and Technical Assistance Center (TAC) technicians, as well as engineers, supervisors and managers.</p> <p><b>Functional Description</b></p> <ul style="list-style-type: none"> <li>• 40-Channel Applications <ul style="list-style-type: none"> <li>- 2D-ROADM</li> <li>- WSS-ROADM and WSS-ROADM HUB</li> <li>- ILA Node and Express Node</li> </ul> </li> <li>• 32-Channel ROADM/FOADM Aps</li> <li>• Client Interfaces <ul style="list-style-type: none"> <li>- 10G and 40G Transponders</li> <li>- Muxponders and Flexponders</li> <li>- Direct Connect</li> <li>- 10G and 40G Regenerators</li> <li>- FLASHWAVE LIGHTGUARD</li> </ul> </li> </ul>	<p><b>Alarms and Conditions</b></p> <ul style="list-style-type: none"> <li>• Optical Traffic Detection Points</li> <li>• Alarm and Status Message Reporting</li> <li>• Error Codes</li> <li>• Alarm and Condition Reports</li> <li>• Equipment and Facility Service States</li> <li>• Handling and Cleaning Connectors</li> <li>• Performance Monitoring</li> </ul> <p><b>Upgrades and Migrations</b></p> <ul style="list-style-type: none"> <li>• Backup and Restore</li> <li>• Software Upgrades</li> <li>• Changes to an In-Service Network</li> <li>• Changes to In-Service NEs</li> <li>• Firmware and Software Compatibility</li> </ul>

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# FLASHWAVE® 7500 SYSTEM TURN-UP AND TEST

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 7500-T  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-7500T  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-7500T*  <b>MSP Suitcase:</b> TRSE-7500T*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• General Features</li> <li>• Core and Small System Configurations</li> <li>• Core and Small System Applications</li> <li>• Extension System Configuration</li> <li>• Management Options</li> <li>• Security Features</li> </ul> <p><b>Interoperability</b></p> <ul style="list-style-type: none"> <li>• FLASHWAVE 7500 System interoperability with: <ul style="list-style-type: none"> <li>- FLASHWAVE 9500 System</li> <li>- FLASHWAVE CDS System</li> <li>- FLASHWAVE 7120 System</li> </ul> </li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• SONET Tutorial</li> <li>• DWDM Tutorial</li> <li>• Recent experience with DWDM equipment (recommended)</li> </ul>	<p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Core and Small System Applications <ul style="list-style-type: none"> <li>- Linear and Ring</li> <li>- In-Line Amplifier and Express Node</li> <li>- HUB</li> <li>- Broadcast</li> <li>- Stacked Muxponder</li> <li>- Regenerator</li> </ul> </li> <li>• Extension Configuration Applications</li> </ul>	
<p><b>Course Contents</b></p> <p><b>Overview</b>  <b>Interoperability</b>  <b>Applications</b>  <b>System Components</b>  <b>Functional Description</b>  <b>Cross-Connects and Connections</b>  <b>Provisioning</b>  <b>NE Management</b>  <b>Testing</b>  <b>Hands-On Exercises</b></p> <p><b>Scheduled Dates</b></p> <p>1/15/13  3/12/13  5/7/13  6/25/13  8/27/13  9/24/13</p>	<p><b>System Components</b></p> <ul style="list-style-type: none"> <li>• Core Configuration Optical and Tributary Shelves and Backplane</li> <li>• Small Configuration Optical and Tributary Shelves and Backplane</li> <li>• Extension Shelf and Backplane</li> <li>• Plug-In Unit Descriptions <ul style="list-style-type: none"> <li>- Shelf Processor Units</li> <li>- OSC Units</li> <li>- Amplifier Units</li> <li>- Multiplexer/Demultiplexer Units</li> <li>- Switch Units</li> <li>- HUB Units</li> <li>- Flexponder™ Synchronization Unit</li> <li>- Transponder Units</li> <li>- Muxponder Units</li> <li>- Flexponder Units</li> <li>- FLASHWAVE LIGHTGUARD Unit</li> <li>- Regeneration Units</li> <li>- SFP and XFP Modules</li> </ul> </li> <li>• Lambda Access Shelves and Modules</li> <li>• DCM Shelves and Modules</li> <li>• High-Density Optical Access Shelf</li> <li>• Circuit Breaker Panel</li> </ul> <p><b>Functional Description</b></p> <ul style="list-style-type: none"> <li>• 40-Channel Applications <ul style="list-style-type: none"> <li>- 2D-ROADM</li> <li>- WSS-ROADM and WSS-ROADM HUB</li> <li>- ILA Node and Express Node</li> </ul> </li> <li>• 32-Channel ROADM/FOADM Applications</li> <li>• Client Interfaces <ul style="list-style-type: none"> <li>- 10G and 40G Transponders</li> <li>- Muxponders and Flexponders</li> <li>- Direct Connect</li> <li>- 10G and 40G Regenerators</li> <li>- FLASHWAVE LIGHTGUARD</li> </ul> </li> </ul>	<p><b>Cross-Connects and Connections</b></p> <ul style="list-style-type: none"> <li>• Cross-Connect Mapping and Rules</li> <li>• Core Configuration Applications <ul style="list-style-type: none"> <li>- Transponder/Muxponder Connection</li> <li>- Flexponder Connections</li> <li>- FLASHWAVE LIGHTGUARD-Protected OLC Connections</li> <li>- MPO Cable Connections</li> <li>- Intrashelf Connections</li> </ul> </li> <li>• Small Configuration Applications <ul style="list-style-type: none"> <li>- 40-Channel Connections</li> <li>- 32-Channel Connections (ROADM)</li> </ul> </li> <li>• DCM Connections</li> <li>• Shelf Hierarchy</li> </ul> <p><b>Provisioning</b></p> <ul style="list-style-type: none"> <li>• Core and Small Configuration <ul style="list-style-type: none"> <li>- Node Turn-Up Flowcharts</li> <li>- Provisioning Hierarchy Diagrams</li> <li>- Service Provisioning Flowcharts</li> <li>- Service Provisioning Wizards</li> </ul> </li> <li>• Extension Configuration <ul style="list-style-type: none"> <li>- Node Turn-Up Flowchart</li> <li>- Provisioning Hierarchy Diagram</li> <li>- Service Provisioning Flowchart</li> </ul> </li> </ul> <p><b>NE Management</b></p> <ul style="list-style-type: none"> <li>• Serial Interface</li> <li>• LMP and LCN Interfaces</li> <li>• Modem Interface</li> <li>• Methods of Management</li> <li>• NE Management Using TL1</li> <li>• NETSMART 500 NE GUI <ul style="list-style-type: none"> <li>- NETSMART 500 Dashboard Window</li> <li>- NETSMART 500 Graphical Shelf View</li> <li>- NETSMART 500 Service Associations</li> <li>- NETSMART 500 Wizards</li> </ul> </li> <li>• NETSMART 1500 Management System</li> </ul> <p><b>Testing</b></p> <ul style="list-style-type: none"> <li>• Plug-In Unit Front Panel Indicators</li> <li>• Alarm, Status &amp; Condition Reports</li> <li>• Equipment and Facility Service States</li> <li>• Acceptance Testing</li> <li>• Measuring Optical Power</li> </ul>
<p><b>Course Description</b></p> <p>The FLASHWAVE 7500 Turn-Up and Test course provides the necessary training for technicians to turn up, test, and perform basic maintenance on the FLASHWAVE 7500 system. Hands-on portions of the course permit the student to turn up, provision, and perform basic trouble clearing with a three-node configuration.</p> <p><b>Who Should Attend</b></p> <p>This course is recommended for CO, field installation and NOC technicians, and engineers, supervisors and managers.</p>		

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# FLASHWAVE® 7500 ETSI SYSTEM ENGINEERING

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 7500-EE  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-7500EE  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-7500EE*  <b>MSP Suitcase:</b> TRSE-7500EE*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• General Features</li> <li>• ETSI Configuration</li> <li>• Functional Layout</li> <li>• Channel Assignments</li> <li>• Applications</li> <li>• Management Options</li> <li>• Security Features</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Linear</li> <li>• Ring</li> <li>• In-Line Amplifier Node</li> <li>• Express Node</li> <li>• HUB</li> <li>• Broadcast</li> <li>• Stacked Muxponder</li> <li>• Regenerator</li> <li>• Multi-Instance ISIS Routing</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• DWDM Tutorial</li> <li>• Recent experience with DWDM equipment (recommended)</li> </ul>	<p><b>System Components</b></p> <ul style="list-style-type: none"> <li>• Optical Shelf</li> <li>• Tributary Shelf</li> <li>• Station Interface Area (SIA) Connectors</li> <li>• Plug-In Unit Descriptions <ul style="list-style-type: none"> <li>- Shelf Processor Units</li> <li>- OSC Units</li> <li>- Amplifier Units</li> <li>- Multiplexer/Demultiplexer Units</li> <li>- Switch Units</li> <li>- HUB Units</li> <li>- Flexponder™ Synchronization Unit</li> <li>- Transponder Units</li> <li>- Muxponder Units</li> <li>- Flexponder Units</li> <li>- Regeneration Units</li> <li>- SFP and XFP Modules</li> </ul> </li> <li>• ILA Shelf and SIA Connectors</li> <li>• LAN/DCM Shelf <ul style="list-style-type: none"> <li>- Lambda Access Module</li> <li>- Dispersion Compensation Modules</li> </ul> </li> <li>• ETSI DCM Shelf</li> <li>• High-Density Optical Access Shelf</li> <li>• ETSI Power Distribution</li> </ul>	<p><b>Optical Network Fundamentals</b></p> <ul style="list-style-type: none"> <li>• Optical Networks</li> <li>• Fiber-Optic Transmission</li> <li>• Signal Format</li> <li>• Impairments to DWDM Transmission</li> <li>• Forward Error Correction</li> <li>• Optical Transmitters and Receivers</li> <li>• Amplifiers and Regenerators</li> <li>• Fiber-Optic Cable</li> <li>• Fiber Issues</li> <li>• Network Design</li> </ul>
<p><b>Course Contents</b></p> <p><b>Overview</b>  <b>Applications</b>  <b>System Components</b>  <b>Functional Description</b>  <b>Optical Network Fundamentals</b>  <b>NETSMART 2000 Design and Planning Tool</b>  <b>Engineering Case Studies</b></p> <p><b>Scheduled Dates</b></p> <p><b>Special Order Only</b>  Call for details:  1-800-777-3278 Ext. 4961</p>	<p><b>Functional Description</b></p> <ul style="list-style-type: none"> <li>• Network Applications <ul style="list-style-type: none"> <li>- 2D-ROADM Node</li> <li>- WSS ROADM Node</li> <li>- WSS ROADM HUB Node</li> </ul> </li> <li>• ILA Node</li> <li>• Express Node</li> <li>• Client Interfaces <ul style="list-style-type: none"> <li>- 10G and 40G Transponders</li> <li>- Muxponders</li> <li>- Flexponders (Cross-Shelf Grooming and Native OC-192)</li> <li>- Direct Connect</li> <li>- 10G and 40G Regenerators</li> <li>- G-709-Compliant Client Connection</li> </ul> </li> </ul>	<p><b>NETSMART 2000 Design/Planning Tool</b></p> <ul style="list-style-type: none"> <li>• New Features and Enhancements</li> <li>• Architecture</li> <li>• Design Browser</li> <li>• Design Editor</li> <li>• Design Preferences</li> <li>• Wavelength Recoloring</li> <li>• Design Templates</li> <li>• Using Design Icons to Create Designs</li> <li>• Adding Demands</li> <li>• Adding Subnetworks</li> <li>• Moving a Span to Another Subnetwork</li> <li>• Reachability Matrix</li> <li>• Manual Selection of Amplifiers/DCMs</li> <li>• Rack and Shelf View</li> <li>• Design Reports</li> <li>• BOM Parts Mapping Manager</li> <li>• Custom Profile Features</li> <li>• Adding FLASHWAVE 9500 TRIB Shelf</li> <li>• Flexponder Cross-Shelf Grooming</li> <li>• Brownfield Design</li> <li>• Security Management</li> <li>• Activity Log</li> <li>• Save or Open Design</li> <li>• Import Design</li> <li>• Export Design</li> <li>• Price List Support</li> <li>• Audits</li> </ul> <p><b>Engineering Case Studies</b></p>

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# FLASHWAVE® 7500 ETSI SYSTEM MAINTENANCE, OPERATIONS & TROUBLE CLEARING

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 7500-EM  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-7500EM  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-7500EM*  <b>MSP Suitcase:</b> TRSE-7500EM*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• General Features</li> <li>• ETSI Configuration</li> <li>• Functional Layout</li> <li>• Channel Assignments</li> <li>• Applications</li> <li>• Management Options</li> <li>• Security Features</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Linear</li> <li>• Ring</li> <li>• In-Line Amplifier Node</li> <li>• Express Node</li> <li>• HUB</li> <li>• Broadcast</li> <li>• Stacked Muxponder</li> <li>• Regenerator</li> <li>• Multi-Instance ISIS Routing</li> </ul> <p><b>System Components</b></p> <ul style="list-style-type: none"> <li>• Optical and Tributary Shelves</li> <li>• Station Interface Area (SIA) Connectors</li> <li>• Plug-In Unit Descriptions</li> <li>• ILA Shelf and SIA Connectors</li> <li>• LAN/DCM Shelf <ul style="list-style-type: none"> <li>- Lambda Access Module</li> <li>- Dispersion Compensation Modules</li> </ul> </li> <li>• ETSI DCM Shelf</li> <li>• High-Density Optical Access Shelf</li> <li>• ETSI Power Distribution</li> </ul> <p><b>Functional Description</b></p> <ul style="list-style-type: none"> <li>• Network Applications <ul style="list-style-type: none"> <li>- 2D-ROADM Node</li> <li>- WSS ROADM Node</li> <li>- WSS ROADM HUB Node</li> </ul> </li> <li>• ILA Node</li> <li>• Express Node</li> <li>• Client Interfaces <ul style="list-style-type: none"> <li>- 10G and 40G Transponders</li> <li>- Muxponders</li> <li>- Flexponders™ (Cross-Shelf Grooming and Native OC-192)</li> <li>- Direct Connect</li> <li>- 10G and 40G Regenerators</li> <li>- G-709-Compliant Client Connection</li> </ul> </li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• DWDM Tutorial</li> <li>• Recent experience with DWDM equipment (recommended)</li> </ul>		<p><b>NE Management</b></p> <ul style="list-style-type: none"> <li>• Connecting to the FLASHWAVE 7500 NE <ul style="list-style-type: none"> <li>- Serial Interface</li> <li>- Local Management Port</li> <li>- Local Communication Network Interface</li> <li>- Modem Interface</li> </ul> </li> <li>• Methods of Management</li> <li>• NE Management Using TL1</li> <li>• NETSMART 500 NE GUI <ul style="list-style-type: none"> <li>- NETSMART 500 Dashboard Window</li> <li>- NETSMART 500 Graphical Shelf View</li> <li>- NETSMART 500 Cross-Connect View</li> <li>- NETSMART 500 Service Associations</li> <li>- NETSMART 500 Wizards</li> <li>- Online Help</li> </ul> </li> <li>• NETSMART 1500 Management System</li> </ul>
<p><b>Course Contents</b></p> <p><b>Overview</b></p> <p><b>Applications</b></p> <p><b>System Components</b></p> <p><b>Functional Description</b></p> <p><b>Cross-Connects and Connections</b></p> <p><b>NE Management</b></p> <p><b>Alarms and Conditions</b></p> <p><b>Upgrades and Migrations</b></p> <p><b>Hands-On Exercises</b></p> <p><b>Scheduled Dates</b></p> <p><b>Special Order Only</b>  Call for details:  1-800-777-3278 Ext. 4961</p>	<p><b>Cross-Connects and Connections</b></p> <ul style="list-style-type: none"> <li>• Cross-Connect Mapping and Rules</li> <li>• Add/Drop and Pass-Through Traffic</li> <li>• OLC Connections</li> <li>• OLC Connections at HUB Node</li> <li>• MPO Cable Connections to LAM Units</li> <li>• Intrashelf Cable Connections without Raman Amplifiers</li> <li>• Raman Amplifiers Unit Interconnections</li> <li>• Dispersion Compensations</li> <li>• Shelf Hierarchy <ul style="list-style-type: none"> <li>- HUB Node</li> <li>- ETSI Add/Drop Node Equipment</li> <li>- ETSI HUB Node Equipment with Raman Amplifiers</li> </ul> </li> </ul>	<p><b>Alarms and Conditions</b></p> <ul style="list-style-type: none"> <li>• Plug-In Unit Front Panel Indicators</li> <li>• Optical Traffic Detection Points</li> <li>• Alarm and Status Message Reporting</li> <li>• Standing Condition Codes</li> <li>• Error codes</li> <li>• Alarm and Condition Reports</li> <li>• Equipment and Facility Service States</li> <li>• Handling and Cleaning Connectors</li> <li>• Test Equipment</li> <li>• Measuring Optical Power</li> <li>• Performance Monitoring</li> </ul> <p><b>Upgrades and Migrations</b></p> <ul style="list-style-type: none"> <li>• Backup and Restore</li> <li>• Software Upgrades</li> <li>• Firmware Download</li> <li>• Changes to an In-Service Network</li> <li>• Changes to In-Service NEs <ul style="list-style-type: none"> <li>- Adding/Deleting Tributary Shelves</li> <li>- Changing Service</li> </ul> </li> <li>• Firmware and Software Compatibility</li> </ul>
<p><b>Course Description</b></p> <p>The FLASHWAVE 7500 ETSI System Maintenance course covers operations, performance monitoring, interpretation of alarms and condition reports, fault isolation and trouble clearing, upgrades and migrations, as well as an introductory overview of element management software.</p> <p><b>Who Should Attend</b></p> <p>The FLASHWAVE 7500 ETSI System Maintenance course will benefit all personnel responsible for monitoring, maintaining, and troubleshooting networks and for upgrading Fujitsu network elements. This course is recommended for CO, Network Operations Center (NOC), field repair, and Technical Assistance Center (TAC) technicians, as well as engineers, supervisors and managers.</p>		

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# FLASHWAVE® 7500 ETSI SYSTEM TURN-UP AND TEST

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 7500-ET  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-7500ET  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-7500ET*  <b>MSP Suitcase:</b> TRSE-7500ET*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• General Features</li> <li>• ETSI Configuration</li> <li>• Functional Layout</li> <li>• Channel Assignments</li> <li>• Applications</li> <li>• Management Options</li> <li>• Security Features</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Linear</li> <li>• Ring</li> <li>• In-Line Amplifier Node</li> <li>• Express Node</li> <li>• HUB</li> <li>• Broadcast</li> <li>• Stacked Muxponder</li> <li>• Regenerator</li> <li>• Multi-Instance ISIS Routing</li> </ul> <p><b>System Components</b></p> <ul style="list-style-type: none"> <li>• Optical and Tributary Shelves</li> <li>• Station Interface Area (SIA) Connectors</li> <li>• Plug-In Unit Descriptions</li> <li>• ILA Shelf and SIA Connectors</li> <li>• LAN/DCM Shelf <ul style="list-style-type: none"> <li>- Lambda Access Module</li> <li>- Dispersion Compensation Modules</li> </ul> </li> <li>• ETSI DCM Shelf</li> <li>• High-Density Optical Access Shelf</li> <li>• ETSI Power Distribution</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• DWDM Tutorial</li> <li>• Recent experience with DWDM equipment (recommended)</li> </ul>	<p><b>Functional Description</b></p> <ul style="list-style-type: none"> <li>• Network Applications <ul style="list-style-type: none"> <li>- 2D-ROADM Node</li> <li>- WSS ROADM Node</li> <li>- WSS ROADM HUB Node</li> </ul> </li> <li>• ILA Node</li> <li>• Express Node</li> <li>• Client Interfaces <ul style="list-style-type: none"> <li>- 10G and 40G Transponders</li> <li>- Muxponders</li> <li>- Flexponders™ (Cross-Shelf Grooming and Native OC-192)</li> <li>- Direct Connect</li> <li>- 10G and 40G Regenerators</li> <li>- G-709-Compliant Client Connection</li> </ul> </li> </ul> <p><b>Cross-Connects and Connections</b></p> <ul style="list-style-type: none"> <li>• Cross-Connect Mapping and Rules</li> <li>• Add/Drop and Pass-Through Traffic</li> <li>• OLC Connections</li> <li>• OLC Connections at HUB Node</li> <li>• MPO Cable Connections to LAM Units</li> <li>• Intrashelf Cable Connections without Raman Amplifiers</li> <li>• Raman Amplifiers Unit Interconnections</li> <li>• Dispersion Compensations</li> <li>• Shelf Hierarchy <ul style="list-style-type: none"> <li>- HUB Node</li> <li>- ETSI Add/Drop Node Equipment</li> <li>- ETSI HUB Node Equipment with Raman Amplifiers</li> </ul> </li> </ul>	<p><b>Provisioning</b></p> <ul style="list-style-type: none"> <li>• System Turn-Up <ul style="list-style-type: none"> <li>- Prerequisites</li> <li>- Node Turn-Up Flowchart</li> <li>- Provisioning Hierarchy</li> <li>- Service Provisioning Hierarchy</li> <li>- Service Addition Flowchart</li> <li>- Auto vs Manual OLC Provisioning</li> <li>- Service Provisioning Wizards</li> </ul> </li> </ul> <p><b>NE Management</b></p> <ul style="list-style-type: none"> <li>• Connecting to the FLASHWAVE 7500 NE <ul style="list-style-type: none"> <li>- Serial Interface</li> <li>- Local Management Port</li> <li>- Local Communication Network Interface</li> <li>- Modem Interface</li> </ul> </li> <li>• Methods of Management</li> <li>• NE Management Using TL1</li> <li>• NETSMART 500 NE GUI <ul style="list-style-type: none"> <li>- Dashboard Window</li> <li>- Graphical Shelf View</li> <li>- Cross-Connect View</li> <li>- Service Associations</li> <li>- Wizards</li> <li>- Online Help</li> </ul> </li> <li>• NETSMART 1500 Management System</li> </ul> <p><b>Testing</b></p> <ul style="list-style-type: none"> <li>• Plug-In Unit Front Panel Indicators</li> <li>• Alarm and Status Message Reporting</li> <li>• Alarm and Condition Reports</li> <li>• Equipment and Facility Service States</li> <li>• Acceptance Testing</li> <li>• Measuring Optical Power</li> </ul>
<p><b>Course Contents</b></p> <p><b>Overview</b></p> <p><b>Applications</b></p> <p><b>System Components</b></p> <p><b>Functional Description</b></p> <p><b>Cross-Connects and Connections</b></p> <p><b>Provisioning</b></p> <p><b>NE Management</b></p> <p><b>Testing</b></p> <p><b>Hands-On Exercises</b></p> <p><b>Scheduled Dates</b></p> <p><b>Special Order Only</b>  Call for details:  1-800-777-3278 Ext. 4961</p>		
<p><b>Course Description</b></p> <p>This course begins with a system overview, including descriptions of plug-in units. Students learn how to provision various configurations and hardware features through extensive hands-on lab exercises. The course introduces students to support resources such as the Technical Assistance Center (TAC) and Partners Technical Documentation Website.</p> <p><b>Who Should Attend</b></p> <p>The FLASHWAVE 7500 ETSI System Turn-Up and Test course provides the necessary training for technicians to turn up, test, and perform basic maintenance on the FLASHWAVE 7500 ETSI system. Hands-on portions of the course permit the student to turn up, provision, and perform basic trouble clearing.</p>		



# FLASHWAVE® 9500 System Installation

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 9500INST  <b>Duration:</b> 2 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-9500INST  <b>In-House Tuition: \$1400</b>  <b>Suitcase:</b> TRSC-9500INST*  <b>MSP Suitcase:</b> TRSE-9500INST*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• FLASHWAVE 9500 System Features</li> <li>• FLASHWAVE 9500 System Components</li> <li>• HDS/SDS Shelf Functional Diagram</li> <li>• HDS/SDS Shelf and PS Functional Diagram</li> <li>• ROADM Functionality</li> <li>• Channel Assignments</li> <li>• Applications</li> <li>• NE Management</li> <li>• NE Logon</li> <li>• Security Features</li> </ul> <p><b>Equipment Installation</b></p> <ul style="list-style-type: none"> <li>• Equipment Installation Prerequisites</li> <li>• Storing, Unpacking and Inspecting</li> <li>• Installing Circuit Breaker Panel</li> <li>• HDS/SDS Shelves</li> <li>• Rack Configurations</li> <li>• HDS/SDS Shelf Lifting Surfaces</li> <li>• Fan Units and Filters</li> <li>• Installing Photonic Shelf</li> <li>• Installing DCMs in Photonic Shelf</li> <li>• Installing Heat Baffle</li> <li>• HDS/SDS Front Cover</li> </ul> <p><b>Cable Installation</b></p> <ul style="list-style-type: none"> <li>• Shelf Cable Connectors <ul style="list-style-type: none"> <li>- Cable Installation Prerequisites</li> <li>- Cable Routing Preconditions and Restrictions</li> </ul> </li> <li>• Connecting Clock Cables <ul style="list-style-type: none"> <li>- Clock Cables</li> <li>- Housekeeping Alarm Control Cables</li> <li>- Shelf Alarm Cables</li> <li>- Craft Interface Cable</li> <li>- TERM 2 Cable</li> <li>- OSS Cable</li> </ul> </li> </ul> <p><b>HDS Shelf Power Installation</b></p> <ul style="list-style-type: none"> <li>• Power Installation Prerequisites</li> <li>• Connecting HDS Shelf Frame Ground</li> <li>• Connecting Shelf Power to HDS Shelf CBP</li> <li>• Connecting Power to HDS Shelf</li> <li>• Checking HDS Shelf Power</li> <li>• Checking HDS Shelf Grounding</li> </ul> <p><b>SDS Shelf Power Installation</b></p> <ul style="list-style-type: none"> <li>• Power Installation Prerequisites</li> <li>• Connecting SDS Shelf Frame Ground</li> <li>• Connecting Power/Ground to SDS Shelf</li> <li>• Checking SDS Shelf Power</li> <li>• Checking SDS Shelf Grounding</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• SONET Tutorial</li> <li>• Ethernet Tutorial</li> <li>• DWDM Tutorial</li> </ul>		
<p><b>Course Contents</b></p> <p><b>Overview</b></p> <p><b>Equipment Installation</b></p> <p><b>Cable Installation</b></p> <p><b>HDS Shelf Power Installation</b></p> <p><b>SDS Shelf Power Installation</b></p> <p><b>Final Installation</b></p>		
<p><b>Scheduled Dates</b></p> <p><b>Special Order Only</b>  Call for details:  1-800-777-3278 ext. 4961</p>		
<p><b>Course Description</b></p> <p>The FLASHWAVE 9500 System Installation course covers physical installation requirements. Actual equipment is used to familiarize the student with the equipment. Hands-on exercises are not included in this course.</p> <p><b>Who Should Attend</b></p> <p>This course is recommended for installers, engineers, supervisors, and managers with installation responsibility.</p>		<p><b>Final Installation</b></p> <ul style="list-style-type: none"> <li>• Final Installation Prerequisites</li> <li>• Overall Visual Inspection</li> <li>• Defective Equipment</li> <li>• Installing/Removing HDS/SDS Plug-In Units</li> <li>• Installing/Removing SFP/XFP/CFP Modules</li> <li>• Installing/Removing HDS/SDS Filler Panels</li> <li>• Installing/Removing Photonic Shelf Plug-In Units</li> <li>• Installing/Removing Photonic Shelf Filler Panels</li> </ul>

October 2012 - September 2013




# FLASHWAVE® 9500 System Planning and Engineering

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 9500-E  <b>Duration:</b> 2 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-9500E  <b>In-House Tuition: \$1400</b>  <b>Suitcase:</b> TRSC-9500E*  <b>MSP Suitcase:</b> TRSE-9500E*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• System Features</li> <li>• System Components</li> <li>• Functional Description</li> <li>• Channel Assignments</li> <li>• Applications</li> <li>• NE Management</li> <li>• NE Security</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Applications <ul style="list-style-type: none"> <li>- Terminal/Linear</li> <li>- UPSR/SNCP</li> <li>- 2F-BLSR/MS-SPRING</li> <li>- Ethernet over SONET (EOS)/SDH</li> <li>- Ethernet</li> <li>- ROADM</li> <li>- ILA Node</li> <li>- HUB</li> <li>- Broadcast and Channel Regeneration</li> </ul> </li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• SONET Tutorial</li> <li>• DWDM Tutorial</li> <li>• Ethernet Tutorial</li> </ul>	<p><b>System Components</b></p> <ul style="list-style-type: none"> <li>• High-Density Shelves/Backplane</li> <li>• Standard-Density Shelves/Connectors <ul style="list-style-type: none"> <li>- Management Units</li> <li>- 8D-ROADM Switch Units</li> <li>- Amplifier Units</li> <li>- Switch Fabric Units</li> <li>- Multirate/Multiservice (MRMS) Units</li> <li>- 1-Port OC-192NB Unit</li> <li>- 2-Port OC-192 Unit</li> <li>- 10 Gigabit Universal Transponder Unit</li> <li>- 40 Gigabit Transponder Unit</li> <li>- 100 Gigabit Transponder Unit</li> <li>- 8+1 Muxponder Units</li> <li>- 100 Gigabit Muxponder Unit</li> <li>- 20-Port Gigabit Ethernet Packet Unit</li> <li>- 2-Port 10 Gigabit Ethernet Packet Unit</li> <li>- 10 Gigabit Ethernet NBO Packet Unit</li> <li>- EoX Mapper Units</li> <li>- VT/TU Switch Fabric Unit</li> <li>- OCh-DPRING Service Protection Unit</li> <li>- Pluggable SFP/XFP/CFP Modules</li> <li>- Filler Panels</li> <li>- Fan Units</li> <li>- Communication Panel</li> </ul> </li> <li>• Photonic Shelves <ul style="list-style-type: none"> <li>- Physical Inventory Unit</li> <li>- 44-Channel Mux/Demux Units</li> <li>- Dispersion Compensation Modules</li> </ul> </li> <li>• FLASHWAVE 9500 Circuit Breaker Panel</li> </ul>	<p><b>Optical Network Fundamentals</b></p> <ul style="list-style-type: none"> <li>• Optical Networks</li> <li>• Fiber-Optic Transmission</li> <li>• Signal Format</li> <li>• Impairments to DWDM Transmission</li> <li>• Forward Error Correction</li> <li>• Optical Transmitters and Receivers</li> <li>• Amplifiers and Regenerators</li> <li>• Fiber-Optic Cable and Fiber Issues</li> <li>• Network Design</li> </ul>
<p><b>Course Contents</b></p> <p><b>Overview</b></p> <p><b>Applications</b></p> <p><b>System Components</b></p> <p><b>Optical Network Fundamentals</b></p> <p><b>Engineering Guidelines</b></p> <p><b>NETSMART 2000 Design and Planning Tool</b></p> <p><b>Case Studies</b></p> <p><b>Scheduled Date</b></p> <p>1/8/13  3/19/13  5/14/13  7/23/13  8/27/13</p>	<p><b>Course Description</b></p> <p>The FLASHWAVE 9500 System Planning and Engineering course enables students to plan and engineer networks and system applications using the FLASHWAVE 9500 product family. Extensive case studies of operational networks in various configurations are developed using the NETSMART 2000 design and planning tool.</p> <p><b>Who Should Attend</b></p> <p>All personnel responsible for planning and engineering networks using FLASHWAVE 9500 systems benefit from attending this course, including network planners and engineers, supervisors, and managers with budget responsibility.</p>	<p><b>Engineering Guidelines</b></p> <ul style="list-style-type: none"> <li>• HDS/SDS Shelf Equipped with Only SONET/SDH Units</li> <li>• HDS/SDS Shelf Equipped with Wideband Ethernet Units</li> <li>• HDS/SDS ROADM Equipage</li> <li>• HDS/SDS Split HUB Equipage</li> <li>• Photonic Shelf Equipage</li> <li>• HDS/SDS Main Shelf Equipped with Only ROADM Units</li> <li>• HDS/SDS Main Shelf Equipped with ROADM/Non-ROADM Units</li> </ul> <p><b>NETSMART 2000 Design/Planning Tool</b></p> <ul style="list-style-type: none"> <li>• New Features and Enhancements</li> <li>• Architecture</li> <li>• Design Browser &amp; Editor</li> <li>• Design Preferences</li> <li>• Design Templates</li> <li>• Degree Mapping and Reservation</li> <li>• Using Design Icons to Create Designs <ul style="list-style-type: none"> <li>- Adding Demands and Subnetworks</li> <li>- Broadcast Demands/Mixed Demands</li> <li>- Moving a Span to Another Network</li> </ul> </li> <li>• Rack and Shelf View</li> <li>• Design Reports</li> <li>• Brownfield Designs</li> <li>• Custom Profile Feature</li> <li>• Security Management and Activity Log</li> <li>• Save or Open Design</li> <li>• Import/Export Design</li> <li>• Audits</li> </ul>

October 2012 - September 2013




# FLASHWAVE® 9500 System Maintenance, Operations & Trouble Clearing

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 9500-M  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-9500M  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-9500M*  <b>MSP Suitcase:</b> TRSE-9500M*            * For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• System Features</li> <li>• System Components</li> <li>• Functional Description</li> <li>• Channel Assignments</li> <li>• Applications</li> <li>• NE Management</li> <li>• NE Security</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Applications               <ul style="list-style-type: none"> <li>- Terminal/Linear</li> <li>- UPSR/SNCP</li> <li>- 2F-BLSR/MS-SPRING</li> <li>- Ethernet over SONET (EOS)/SDH</li> <li>- Ethernet</li> <li>- ROADM</li> <li>- ILA Node</li> <li>- HUB</li> <li>- Broadcast and Channel Regeneration</li> </ul> </li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• SONET Tutorial</li> <li>• Ethernet Tutorial</li> <li>• DWDM Tutorial</li> </ul>	<p><b>System Components</b></p> <ul style="list-style-type: none"> <li>• High-Density Shelves/Backplane</li> <li>• Standard-Density Shelves/Connectors               <ul style="list-style-type: none"> <li>- Management Units</li> <li>- 8D-ROADM Switch Units</li> <li>- Amplifier Units</li> <li>- Switch Fabric Units</li> <li>- Multirate/Multiservice (MRMS) Units</li> <li>- 1-Port OC-192NB Unit</li> <li>- 2-Port OC-192 Unit</li> <li>- 10 Gigabit Universal Transponder Unit</li> <li>- 40 Gigabit Transponder Unit</li> <li>- 100 Gigabit Transponder Unit</li> <li>- 8+1 Muxponder Units</li> <li>- 100 Gigabit Muxponder Unit</li> <li>- 20-Port Gigabit Ethernet Packet Unit</li> <li>- 2-Port 10 Gigabit Ethernet Packet Unit</li> <li>- 10 Gigabit Ethernet NBO Packet Unit</li> <li>- EoX Mapper Units</li> <li>- VT/TU Switch Fabric Unit</li> <li>- OCh-DPRING Service Protection Unit</li> <li>- Pluggable SFP/XFP/CFP Modules</li> <li>- Filler Panels</li> <li>- Fan Units</li> <li>- Communication Panel</li> </ul> </li> <li>• Photonic Shelves               <ul style="list-style-type: none"> <li>- Physical Inventory Unit</li> <li>- 44-Channel Mux/Demux Units</li> <li>- Dispersion Compensation Modules</li> </ul> </li> <li>• FLASHWAVE 9500 Circuit Breaker Panel</li> </ul>	<p><b>NE Management</b></p> <ul style="list-style-type: none"> <li>• Connecting to the HDS/SDS Shelf</li> <li>• NE Management Using TL1</li> <li>• NETSMART 500 Element Manager Functions               <ul style="list-style-type: none"> <li>- Dashboard Window</li> <li>- Graphical Shelf View</li> <li>- Cross-Connect View</li> <li>- Wizards</li> </ul> </li> <li>• NETSMART 1500 Management System</li> </ul> <p><b>Synchronization</b></p> <ul style="list-style-type: none"> <li>• Stratum Levels</li> <li>• Timing Modes and Distribution</li> <li>• Synchronous Status Messaging</li> <li>• Synchronization Lists</li> </ul> <p><b>Alarms and Conditions</b></p> <ul style="list-style-type: none"> <li>• Plug-In Unit Front Panel Indicators</li> <li>• Optical Traffic Detection Points</li> <li>• Alarm and Status Message Reporting</li> <li>• Condition Codes and Error Codes</li> <li>• Alarm and Condition Reports</li> </ul> <p><b>Maintenance and Testing</b></p> <ul style="list-style-type: none"> <li>• Fan Units</li> <li>• Frame Units</li> <li>• Plug-In Unit Installation/Removal</li> <li>• SFP/XFP/CFP Module Installation/Removal</li> <li>• Optical Power Measurements</li> <li>• Handling Fiber Connectors</li> <li>• Measuring Optical Power</li> <li>• Loopback Testing</li> <li>• PRBS Test Signal Injection Test</li> <li>• Equipment and Facility Service States</li> <li>• Performance Monitoring</li> <li>• Backup and Restore</li> </ul> <p><b>Upgrades and Migrations</b></p> <ul style="list-style-type: none"> <li>• Software Upgrades</li> <li>• Firmware Download</li> <li>• Adding/Deleting Nodes</li> <li>• Changes to an In-Service NE</li> <li>• Software and Plug-In Unit Compatibility</li> </ul>
<p><b>Course Contents</b></p> <p><b>Overview</b></p> <p><b>Applications</b></p> <p><b>System Components</b></p> <p><b>NE Management</b></p> <p><b>Synchronization</b></p> <p><b>Alarms and Conditions</b></p> <p><b>Maintenance and Testing</b></p> <p><b>Upgrades and Migrations</b></p> <p><b>Hands-On Exercises</b></p> <p><b>Scheduled Dates</b></p> <p>11/27/12            12/18/12            1/15/13            2/13/13            3/12/13            4/9/13            5/7/13            6/4/13            7/30/13            8/27/13            10/1/13</p> <p><b>Course Description</b></p> <p>The FLASHWAVE 9500 System Maintenance course covers operations, performance monitoring, interpretation of alarms and condition reports, fault isolation and trouble clearing, database backup and restore, and an introductory overview of element management software.</p> <p><b>Who Should Attend</b></p> <p>These courses are recommended for Central Office (CO), Field Repair, Network Operations Center (NOC), and Technical Assistance Center (TAC) technicians, as well as engineers, supervisors, and managers.</p>		

October 2012 - September 2013



# FLASHWAVE® 9500 System Turn-Up and Test

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 9500-T  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-9500T  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-9500T*  <b>MSP Suitcase:</b> TRSE-9500T*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• System Features</li> <li>• System Components</li> <li>• Functional Description</li> <li>• Channel Assignments</li> <li>• Applications</li> <li>• NE Management</li> <li>• NE Security</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Applications <ul style="list-style-type: none"> <li>- Terminal/Linear</li> <li>- UPSR/SNCP</li> <li>- 2F-BLSR/MS-SPRING</li> <li>- Ethernet over SONET (EOS)/SDH</li> <li>- Ethernet</li> <li>- ROADM</li> <li>- ILA Node</li> <li>- HUB</li> <li>- Broadcast and Channel Regeneration</li> </ul> </li> </ul>	<p><b>Provisioning</b></p> <ul style="list-style-type: none"> <li>• System Turn-Up <ul style="list-style-type: none"> <li>- Prerequisites</li> <li>- System Turn-Up Flowchart</li> <li>- Wideband SONET Equipment/Facilities Flowchart</li> <li>- ILA Node Turn-Up Flowchart</li> <li>- Core ROADM Node Turn-Up Flowchart</li> <li>- Provisioning Hierarchy</li> </ul> </li> </ul>
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• SONET Tutorial</li> <li>• Ethernet Tutorial</li> <li>• DWDM Tutorial</li> </ul>	<p><b>System Components</b></p> <ul style="list-style-type: none"> <li>• High-Density Shelves/Backplane</li> <li>• Standard-Density Shelves/Connectors <ul style="list-style-type: none"> <li>- Management Units</li> <li>- 8D-ROADM Switch Units</li> <li>- Amplifier Units</li> <li>- Switch Fabric Units</li> <li>- Multirate/Multiservice (MRMS) Units</li> <li>- 1-Port OC-192NB Unit</li> <li>- 2-Port OC-192 Unit</li> <li>- 10 Gigabit Universal Transponder Unit</li> <li>- 40 Gigabit Transponder Unit</li> <li>- 100 Gigabit Transponder Unit</li> <li>- 8+1 Muxponder Units</li> <li>- 20-Port Gigabit Ethernet Packet Unit</li> <li>- 2-Port 10 Gigabit Ethernet Packet Unit</li> <li>- 10 Gigabit Ethernet NBO Packet Unit</li> <li>- EoX Mapper Units</li> <li>- VT/TU Switch Fabric Unit</li> <li>- OCh-DPRING Service Protection Unit</li> <li>- Pluggable SFP/XFP/CFP Modules</li> <li>- Filler Panels</li> <li>- Fan Units</li> <li>- Communication Panel</li> </ul> </li> <li>• Photonic Shelves <ul style="list-style-type: none"> <li>- Physical Inventory Unit</li> <li>- 44-Channel Mux/Demux Units</li> <li>- Dispersion Compensation Modules</li> </ul> </li> <li>• FLASHWAVE 9500 Circuit Breaker Panel</li> </ul>	<p><b>NE Management</b></p> <ul style="list-style-type: none"> <li>• Connecting to the HDS/SDS Shelf <ul style="list-style-type: none"> <li>- Craft Interface</li> <li>- Local Management Port</li> <li>- Local Communication Network Interface</li> </ul> </li> <li>• Methods of Management</li> <li>• NE Management Using TL1</li> <li>• NETSMART 500 Element Manager Functions <ul style="list-style-type: none"> <li>- Dashboard Window</li> <li>- Logging on an NE</li> <li>- Graphical Shelf View</li> <li>- Cross-Connect View</li> <li>- FLASHWAVE 9500 ROADM DWDM Cabling</li> <li>- Wizards</li> <li>- Online Help</li> </ul> </li> <li>• NETSMART 1500 Management System</li> </ul>
<p><b>Course Contents</b></p>		
<p><b>Overview</b>  <b>Applications</b>  <b>System Components</b>  <b>Provisioning</b>  <b>NE Management</b>  <b>Synchronization and Testing</b>  <b>Hands-On Exercises</b></p>		
<p><b>Scheduled Dates</b></p> <p>11/13/12  12/11/12  1/8/13  2/5/13  3/5/13  4/2/13  4/30/13  6/25/13  7/23/13  8/20/13  9/17/13  9/24/13</p>		
<p><b>Course Description</b></p> <p>The course begins with system overview and descriptions of plug-in units. Students learn to provision various configurations and hardware features through hands-on lab exercises. Students learn to use product-specific technical documentation and procedures to place equipment online and then apply test traffic.</p> <p><b>Who Should Attend</b></p> <p>This course is recommended for CO, field repair, NOC, and TAC technicians, as well as engineers, supervisors and managers.</p>		<p><b>Synchronization and Testing</b></p> <ul style="list-style-type: none"> <li>• Synchronization</li> <li>• Synchronization Status Messaging</li> <li>• Synchronization Lists</li> <li>• Plug-In Unit Front-Panel Indicators</li> <li>• Alarm and Status Message Reporting</li> <li>• Alarm and Condition Reports</li> <li>• Equipment and Facility Service States</li> <li>• Loopback Testing</li> <li>• PRBS Test Signal Injection Test</li> <li>• Acceptance Testing</li> <li>• Measuring Optical Power</li> </ul>

October 2012 - September 2013



# FLASHWAVE® 9500 System COE Turn-Up and Test

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> 9500-COET  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-9500COET  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-9500COET*  <b>MSP Suitcase:</b> TRSE-9500COET*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• System Features</li> <li>• System Components</li> <li>• Functional Description</li> <li>• Channel Assignments</li> <li>• Applications</li> <li>• NE Management</li> <li>• NE Security</li> </ul>	<p><b>Provisioning</b></p> <ul style="list-style-type: none"> <li>• System Turn-Up <ul style="list-style-type: none"> <li>- Prerequisites</li> <li>- System Turn-Up Flowchart</li> <li>- Ethernet Provisioning</li> <li>- ILA Node Turn-Up Flowchart</li> <li>- Core ROADM Node Turn-Up Flowchart</li> <li>- Provisioning Hierarchy</li> </ul> </li> </ul>
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• SONET Tutorial</li> <li>• Ethernet Tutorial</li> <li>• DWDM Tutorial</li> </ul>	<p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Applications <ul style="list-style-type: none"> <li>- Ethernet over SONET (EOS)/SDH</li> <li>- Ethernet</li> <li>- EoX Mapper</li> <li>- ROADM</li> </ul> </li> </ul>	<p><b>NE Management</b></p> <ul style="list-style-type: none"> <li>• Connecting to the HDS/SDS Shelf <ul style="list-style-type: none"> <li>- Craft Interface</li> <li>- Local Management Port</li> <li>- Local Communication Network Interface</li> </ul> </li> <li>• Methods of Management</li> <li>• NE Management Using TL1</li> <li>• NETSMART 500 Element Manager Functions <ul style="list-style-type: none"> <li>- Dashboard Window</li> <li>- Logging on an NE</li> <li>- Shelf Graphical View</li> <li>- Cross-Connect View</li> <li>- FLASHWAVE 9500 ROADM DWDM Cabling</li> <li>- Wizards</li> <li>- Online Help</li> </ul> </li> <li>• NETSMART 1500 Management System</li> </ul>
<p><b>Course Contents</b></p> <p><b>Overview</b>  <b>Applications</b>  <b>System Components</b>  <b>Ethernet</b>  <b>Provisioning</b>  <b>NE Management</b>  <b>Synchronization and Testing</b>  <b>Hands-On Exercises</b>  <b>MSP Suitcase:</b></p> <p><b>Scheduled Dates</b></p> <p>11/6/12  1/29/13  2/26/13  3/26/13  4/23/13  5/21/13  6/18/13  7/16/13  8/13/13  9/10/13</p>	<p><b>System Components</b></p> <ul style="list-style-type: none"> <li>• High-Density Shelves/Backplane</li> <li>• Standard-Density Shelves/Connectors <ul style="list-style-type: none"> <li>- Management Units</li> <li>- Switch Fabric Units</li> <li>- Multirate/Multiservice (MRMS) Units</li> <li>- 1-Port OC-192NB Unit</li> <li>- 2-Port OC-192 Unit</li> <li>- 8+1 Muxponder Units</li> <li>- 100 Gigabit Muxponder Unit</li> <li>- 20-Port Gigabit Ethernet Packet Unit</li> <li>- 2-Port 10 Gigabit Ethernet Packet Unit</li> <li>- 10 Gigabit Ethernet NBO Packet Unit</li> <li>- EoX Mapper Units</li> <li>- VT/TU Switch Fabric Unit</li> <li>- Pluggable SFP/XFP Modules</li> <li>- Filler Panels</li> <li>- Fan Units</li> <li>- Communication Panel</li> </ul> </li> <li>• FLASHWAVE 9500 Circuit Breaker Panel</li> </ul>	<p><b>Synchronization and Testing</b></p> <ul style="list-style-type: none"> <li>• Synchronization</li> <li>• Synchronization Status Messaging</li> <li>• Synchronization Lists</li> <li>• Plug-In Unit Front-Panel Indicators</li> <li>• Alarm and Status Message Reporting</li> <li>• Alarm and Condition Reports</li> <li>• Equipment and Facility Service States</li> <li>• Loopback Testing</li> <li>• PRBS Test Signal Injection Test</li> <li>• Acceptance Testing</li> <li>• Measuring Optical Power</li> </ul>
<p><b>Course Description</b></p> <p>The Connection-Oriented Ethernet (COE) Turn-Up and Test course begins with system overview and descriptions of plug-in units. Students learn to provision various configurations and hardware features through hands-on lab exercises. Students learn to use product-specific technical documentation and procedures to place equipment online and then apply Ethernet test traffic.</p> <p><b>Who Should Attend</b></p> <p>These courses are recommended for CO, field repair, NOC, and TAC technicians, as well as engineers, supervisors and managers.</p>	<p><b>Ethernet</b></p> <ul style="list-style-type: none"> <li>• Ethernet Service</li> <li>• Data Services Architecture</li> <li>• Ethernet Provisioning Architecture</li> <li>• Ethernet Provisioning <ul style="list-style-type: none"> <li>- Ethernet Facilities/Logical Interface</li> <li>- Transport Service Groups/Flow Points</li> <li>- Link Aggregation Groups</li> <li>- Quality of Service Bandwidth Profiles</li> <li>- Class of Service Profiles</li> </ul> </li> <li>• EoX Mapper Unit <ul style="list-style-type: none"> <li>- Flow Mode and Class Mode</li> </ul> </li> <li>• Service OAM</li> <li>• Ethernet Service Protection</li> </ul>	<p>October 2012 - September 2013</p>



# FLASHWAVE® 9500 System COE Planning and Engineering

Ordering Information	What You Will Learn
<p><b>Course Code:</b> 9500-COEE  <b>Duration:</b> 3 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-9500COEE  <b>In-House Tuition: \$2100</b>  <b>Suitcase:</b> TRSC-9500COEE*  <b>MSP Suitcase:</b> TRSE-9500COEE*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• System Features</li> <li>• System Components</li> <li>• Functional Description</li> <li>• Channel Assignments</li> <li>• Applications</li> <li>• NE Management</li> <li>• NE Security</li> </ul>
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• FLASHWAVE 9500 Engineering</li> <li>• SONET Tutorial</li> <li>• Ethernet Tutorial</li> <li>• DWDM Tutorial</li> </ul>	<p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Applications <ul style="list-style-type: none"> <li>- Ethernet over SONET (EOS)/SDH</li> <li>- Ethernet</li> <li>- EoX Mapper</li> <li>- ROADM</li> </ul> </li> </ul>
<p><b>Course Contents</b></p> <p><b>Overview</b>  <b>Applications</b>  <b>System Components</b>  <b>COE Overview</b>  <b>COE Policing And Shaping</b>  <b>Ethernet OAM</b>  <b>Engineering Guidelines</b>  <b>Case Studies</b></p>	<p><b>System Components</b></p> <ul style="list-style-type: none"> <li>• High-Density Shelves/Backplane</li> <li>• Standard-Density Shelves/Connectors <ul style="list-style-type: none"> <li>- Management Units</li> <li>- Switch Fabric Units</li> <li>- Multirate/Multiservice (MRMS) Units</li> <li>- 1-Port OC-192NB Unit</li> <li>- 2-Port OC-192 Unit</li> <li>- 8+1 Muxponder Units</li> <li>- 100 Gigabit Muxponder Unit</li> <li>- 20-Port Gigabit Ethernet Packet Unit</li> <li>- 2-Port 10 Gigabit Ethernet Packet Unit</li> <li>- 10 Gigabit Ethernet NBO Packet Unit</li> <li>- EoX Mapper Units</li> <li>- VT/TU Switch Fabric Unit</li> <li>- Pluggable SFP/XFP Modules</li> <li>- Filler Panels</li> <li>- Fan Units</li> <li>- Communication Panel</li> </ul> </li> <li>• FLASHWAVE 9500 Circuit Breaker Panel</li> </ul>
<p><b>Scheduled Dates</b></p> <p>11/13/12  11/8/13  3/5/13  4/30/13  6/25/13  8/20/13</p>	<p><b>COE Ethernet Overview</b></p> <ul style="list-style-type: none"> <li>• FLASHWAVE Packet ONP Product Family</li> <li>• FLASHWAVE 9500 Interface Units</li> <li>• MEF Service Terminology</li> <li>• FLASHWAVE 9500 COE <ul style="list-style-type: none"> <li>- FLASHWAVE 9500 COE Building Blocks</li> <li>- COE Hardware</li> <li>- Connection-Based Traffic Management Features <ul style="list-style-type: none"> <li>- Ingress Traffic Management</li> <li>- Egress Traffic Management</li> <li>- Egress Packet Processing</li> <li>- Single VLAN Tag Operations</li> <li>- Dual VLAN Tag Operations</li> </ul> </li> </ul> </li> </ul>
<p><b>Course Description</b></p> <p>The Connection-Oriented Ethernet (COE) Planning and Engineering course enables students to plan and engineer connection-oriented Ethernet applications using the FLASHWAVE 9500 Packet Optical Networking Platform. Case studies are provided for various COE applications.</p> <p><b>Who Should Attend</b></p> <p>All personnel responsible for planning and engineering networks using FLASHWAVE 9500 systems benefit from attending this course, including network planners and engineers, supervisors, and managers with budget responsibility.</p>	



- Fujitsu Data Provisioning Building Blocks
  - Ethernet Interface
  - Logical Interface (LIF)
  - Transport Service Groups (TSGs)
  - Flow Points (FPs)
  - Flow point Members (FP-MBRs)
- Ethernet Supported Service Types
- Packet/TDM Interworking Unit (EoX Mapper)

### COE Policing And Shaping

- Mapping and Classification
- Detailed Packet Traffic Flow
- Data Service Model
- Ingress Traffic Management (Policing and No Policing)
- Ingress Bandwidth Profile
- Egress Shaping
- Egress Traffic Management
- HDTD and WRED Queue Management
- Egress Class of Service
- Connection Admission Control

### Ethernet OAM

- Ethernet Tunnels
- Link and Service OAM
- Ethernet Protection Domain
- Automatic Protection Switching (APS)
  - Ethernet Flows and Protection
  - APS Using SMEPs with Representative Flow
- Link Aggregation (LAG)
  - LAG Commands
  - LAG Data Service Model
- Network Design



## FLASHWAVE® 9410/9420 Turn-Up and Maintenance

Ordering Information	What You Will Learn
<p><b>Course Code:</b> 94x0-TM  <b>Duration:</b> 2 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-94x0TM  <b>In-House Tuition: \$1400</b>  <b>Suitcase:</b> TRSC-94x0TM*  <b>MSP Suitcase:</b> TRSE-94x0TM*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>FLASHWAVE 9410 System</b></p> <ul style="list-style-type: none"> <li>• System Overview</li> <li>• Features</li> <li>• Shelf LEDs</li> <li>• Power Supply Units</li> <li>• Placement/Mounting</li> <li>• Applications               <ul style="list-style-type: none"> <li>- Point-to-Point Deployment</li> <li>- Single-Ended Deployment</li> </ul> </li> <li>• Service Applications               <ul style="list-style-type: none"> <li>- Network Ethernet Virtual Connections</li> <li>- EPL and EVPL Using E-LINE Service Type</li> <li>- QoS and Traffic Management</li> <li>- Bandwidth Profile Attributes</li> </ul> </li> <li>• Network Management               <ul style="list-style-type: none"> <li>- FLASHWAVE 9410 Web GUI</li> <li>- SNMP-Based Management</li> <li>- Command Line Interface</li> </ul> </li> <li>• Customer-to-Carrier Demarcation</li> <li>• Service Assurance</li> <li>• Ethernet Connectivity Fault Management               <ul style="list-style-type: none"> <li>- Maintenance Points</li> <li>- Continuity Check Messages</li> <li>- Link Trace Messages</li> <li>- Loopback Messages</li> </ul> </li> <li>• Loopback</li> </ul>
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• SONET Tutorial</li> <li>• Ethernet Tutorial</li> </ul>	<p><b>FLASHWAVE 9420 System</b></p> <ul style="list-style-type: none"> <li>• System Overview</li> <li>• Features</li> <li>• Shelf LEDs</li> <li>• Placement/Mounting</li> <li>• Applications               <ul style="list-style-type: none"> <li>- Back-to-Back Deployment</li> <li>- Single-Ended Deployment</li> </ul> </li> <li>• Service Applications               <ul style="list-style-type: none"> <li>- Network Ethernet Virtual Circuits</li> </ul> </li> <li>• Etherjack Technology               <ul style="list-style-type: none"> <li>- Etherjack QoS and Traffic Management</li> <li>- Etherjack Cable Integrity</li> <li>- Port-Level Loopback</li> <li>- VLAN-Level Loopback</li> </ul> </li> <li>• Network Management               <ul style="list-style-type: none"> <li>- FLASHWAVE 9420 Web GUI</li> <li>- SNMP-Based Management</li> <li>- Command Line Interface</li> </ul> </li> </ul>
<p><b>Course Contents</b></p> <p><b>FLASHWAVE 9410 System</b>  <b>FLASHWAVE 9420 System</b>  <b>Hands-on Exercises</b></p>	
<p><b>Scheduled Dates</b></p> <p><b>Special Order Only</b>  Call for details:  1-800-777-3278 Ext. 4961</p>	
<p><b>Course Description</b>  This course covers both the FLASHWAVE 9410 and the FLASHWAVE 9420 systems. Students learn provisioning, testing, and maintenance through hands-on lab exercises. Students learn to use product-specific technical documentation and procedures to place equipment online and then apply test traffic.</p> <p><b>Who Should Attend</b>  This course is recommended for CO, field repair, NOC and TAC technicians, as well as engineers, supervisors, and managers.</p>	






# FLASHWAVE® CDS-TM Turn-Up and Maintenance

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> CDS-TM  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-CDSTM  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-CDSTM*  <b>MSP Suitcase:</b> TRSE-CDSTM*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Overview</b></p> <ul style="list-style-type: none"> <li>• System Features</li> <li>• System Components</li> <li>• NE Management</li> <li>• NE Logon</li> <li>• Security Features</li> </ul> <p><b>System Components</b></p> <ul style="list-style-type: none"> <li>• FLASHWAVE CDS Shelf <ul style="list-style-type: none"> <li>- Rear Panel</li> <li>- Low-Density Transponder Unit and Functions</li> <li>- Low-Density Ethernet Aggregation Unit and Functions</li> <li>- High-Density Ethernet Aggregation Unit and Functions</li> <li>- High-Density 10G Ethernet Aggregation Unit and Functions</li> <li>- Pluggable SFP/XFP Modules</li> <li>- Filler Panels</li> <li>- User Panel/Fan Unit and Functions</li> </ul> </li> <li>• Optional Power Converters <ul style="list-style-type: none"> <li>- FLASHWAVE CDS +24 V DC Power Converter</li> <li>- FLASHWAVE CDS AC Power Shelf</li> </ul> </li> </ul> <p><b>Connection-oriented Ethernet Overview</b></p> <ul style="list-style-type: none"> <li>• Layer 2 Ethernet</li> <li>• C-Tags and S-Tags</li> <li>• Color and Drop Eligibility</li> <li>• Flows and Flow Points</li> <li>• Logical Interfaces</li> <li>• Bandwidth Profiles</li> <li>• Policing and Shaping</li> <li>• Class of Service</li> <li>• Quality of Service</li> <li>• Service OAM</li> <li>• G.8031 Protection</li> <li>• Ethernet on the FLASHWAVE CDS</li> </ul> <p><b>Provisioning</b></p> <ul style="list-style-type: none"> <li>• System Turn-Up <ul style="list-style-type: none"> <li>- Prerequisites</li> <li>- System Turn-Up Flowcharts</li> <li>- Provisioning Hierarchy Diagrams</li> </ul> </li> </ul> <p><b>NE Management</b></p> <ul style="list-style-type: none"> <li>• Connecting to the FLASHWAVE CDS NE <ul style="list-style-type: none"> <li>- Craft Interface</li> <li>- Local Communication Network Interface</li> </ul> </li> <li>• Methods of Management</li> <li>• NE Management Using TL1</li> </ul>	<div> </div> <ul style="list-style-type: none"> <li>• NETSMART 500 Element Manager Functions <ul style="list-style-type: none"> <li>- Dashboard Window</li> <li>- Logging on an NE</li> <li>- Graphical Shelf View</li> <li>- Cross-Connect View</li> <li>- Wizards</li> <li>- Online Help</li> </ul> </li> <li>• NETSMART 1500 Management System</li> </ul> <p><b>Alarms and Conditions</b></p> <ul style="list-style-type: none"> <li>• Plug-In Unit Front Panel Indicators</li> <li>• Alarm and Status Message Reporting</li> <li>• Condition Codes</li> <li>• Error Codes</li> <li>• Alarm and Condition Reports</li> </ul> <p><b>Maintenance and Testing</b></p> <ul style="list-style-type: none"> <li>• Front Cover Installation and Removal</li> <li>• Clean/Replace Fan Filter</li> <li>• Plug-In Unit Installation and Removal</li> <li>• SFP/XFP Module Installation and Removal</li> <li>• Optical Power Measurements</li> <li>• Handling Fiber Connectors</li> <li>• Test Equipment</li> <li>• Loopback Testing</li> <li>• Equipment and Facility Service States</li> <li>• Synchronization</li> <li>• Performance Monitoring</li> </ul>
<p><b>Prerequisites</b></p>		
<ul style="list-style-type: none"> <li>• SONET Tutorial</li> <li>• Ethernet Tutorial</li> </ul>		
<p><b>Course Contents</b></p>		
<p><b>Overview</b>  <b>System Components</b>  <b>Native Ethernet Provisioning</b>  <b>NE Management</b>  <b>Alarms and Conditions</b>  <b>Maintenance and Testing</b>  <b>Hands-on Exercises</b></p>		
<p><b>Scheduled Dates</b></p>		
<p>1/15/13  2/19/13  4/9/13  6/11/13  8/6/13  10/1/13</p>		
<p><b>Course Description</b></p> <p>The course begins with a system overview, which includes a description of the plug-in units and their functions. Students learn provisioning, testing, and maintenance through hands-on lab exercises. Students learn to use product-specific technical documentation and procedures to place equipment online and then apply test traffic.</p> <p><b>Who Should Attend</b></p> <p>This course is recommended for CO, field repair, NOC and TAC technicians, as well as engineers, supervisors, and managers.</p>		

October 2012 - September 2013



# FLM 150/600/2400 ADM System Maintenance

Ordering Information	What You Will Learn	
<p><b>Course Code:</b> FLM-MNT  <b>Duration:</b> 5 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-FLMMNT  <b>In-House Tuition: \$3500</b>  <b>Suitcase:</b> TRSC-FLMMNT*  <b>MSP Suitcase:</b> TRSE-FLMMNT*</p> <p>* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at ed.svcs@fnc.fujitsu.com.</p>	<p><b>Protocols Overview</b></p> <ul style="list-style-type: none"> <li>• SONET Layers</li> <li>• STS-1 Signal Format</li> <li>• SONET Overhead</li> <li>• Concatenation</li> </ul> <p><b>FLM 150 Shelf and Units</b></p> <ul style="list-style-type: none"> <li>• FLM 150 ADM Shelf</li> <li>• Shelf Backplane</li> <li>• Plug-In Units</li> </ul> <p><b>FLM 600 Shelf and Units</b></p> <ul style="list-style-type: none"> <li>• FLM 600 ADM Shelf</li> <li>• Shelf Backplane</li> <li>• Plug-In Units</li> </ul> <p><b>FLM 2400 Shelf and Units</b></p> <ul style="list-style-type: none"> <li>• High-Speed Shelf and Plug-In Units</li> <li>• Fan Shelf</li> <li>• High-Density Tributary Shelf and Plug-In Units</li> <li>• FLM 600 Tributary Shelf and Plug-In Units</li> <li>• Intershelf Cabling</li> <li>• RDI Terminal Connector</li> </ul> <p><b>Network Interfaces</b></p> <ul style="list-style-type: none"> <li>• Craft Interface</li> <li>• OSS Interface</li> <li>• SDCC</li> <li>• Computer Equipment and Cabling</li> </ul> <p><b>Management Systems</b></p> <ul style="list-style-type: none"> <li>• FLEXR Introduction</li> <li>• Installing FLEXR</li> <li>• Connecting to an NE</li> <li>• Log On an NE Using FLEXR</li> <li>• FLEXR Windows</li> <li>• TL1 <ul style="list-style-type: none"> <li>- Commands</li> <li>- Acknowledgement</li> <li>- Response Messages</li> <li>- Autonomous Messages</li> </ul> </li> <li>• NETSMART 1500 <ul style="list-style-type: none"> <li>- Features</li> <li>- Supported NEs</li> <li>- Hardware Requirements</li> </ul> </li> </ul> <p><b>Maintenance Techniques</b></p> <ul style="list-style-type: none"> <li>• Handling Fiber</li> <li>• Cleaning Fibers</li> <li>• Removing FLM Plug-In Units</li> <li>• Installing FLM Plug-In Units</li> <li>• Fan Unit</li> <li>• Orderwire</li> <li>• Inventory Reports</li> </ul> <p><b>Alarms and Conditions</b></p> <ul style="list-style-type: none"> <li>• Alarms</li> <li>• Terminating Equipment</li> <li>• Error Codes</li> </ul>	
<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• SONET Tutorial</li> </ul>		
<p><b>Course Contents</b></p>		
<p><b>Protocols Overview</b>  <b>FLM 150 Shelf and Units</b>  <b>FLM 600 Shelf and Units</b>  <b>FLM 2400 Shelf and Units</b>  <b>Network Interfaces</b>  <b>Management Systems</b>  <b>Maintenance Techniques</b>  <b>Alarms and Conditions</b>  <b>Fault Isolation and Resolution</b>  <b>System Performance</b>  <b>Synchronization</b>  <b>Upgrades and Migrations</b>  <b>Dual-Node Access Ring</b>  <b>Hands-On Exercises</b></p>		
<p><b>Scheduled Dates</b></p>		
<p><b>Special Order Only</b>  Call for details:  1-800-777-3278 Ext. 4961</p>		
<p><b>Course Description</b>  The FLM 150 ADM, FLM 600 ADM, and FLM 2400 ADM System Maintenance course covers operation, performance monitoring, interpretation of alarms and condition reports, fault isolation and trouble clearing, and upgrades and migrations as well as an introductory overview of element management software.</p> <p><b>Who Should Attend</b>  This course will benefit all personnel responsible for monitoring, maintaining, and troubleshooting networks and for upgrading FLM network elements. This course is recommended for Central Office (CO), Network Operations Center (NOC), field repair, and Technical Assistance Center (NOC) technicians, as well as engineers, supervisors, and managers.</p>	<p><b>Fault Isolation and Resolution</b></p> <ul style="list-style-type: none"> <li>• Overview</li> <li>• Alarm and Condition Reports</li> <li>• Equipment Problems</li> <li>• Network Problems</li> </ul> <p><b>System Performance</b></p> <ul style="list-style-type: none"> <li>• FLM Overview <ul style="list-style-type: none"> <li>- FLM 150 ADM</li> <li>- FLM 600 ADM</li> <li>- FLM 2400 ADM</li> </ul> </li> <li>• Equipment Configurations <ul style="list-style-type: none"> <li>- Terminal</li> <li>- Linear</li> <li>- UPSR</li> <li>- BLSR (FLM 2400 ADM only)</li> </ul> </li> <li>• Performance Monitoring</li> </ul> <p><b>Synchronization</b></p> <ul style="list-style-type: none"> <li>• FLM Synchronization <ul style="list-style-type: none"> <li>- Timing Sources</li> <li>- Clock Source Protection</li> </ul> </li> <li>• Stratum Levels</li> <li>• Sync List</li> <li>• Synchronous Status Messaging</li> <li>• Timing Distribution</li> <li>• Timing Problems</li> </ul> <p><b>Upgrades and Migrations</b></p> <ul style="list-style-type: none"> <li>• Software Download</li> <li>• Remote NE Memory Backup and Restore</li> <li>• Network Growth</li> <li>• Upgrades and Migrations</li> <li>• Firmware and Software Compatibility</li> </ul> <p><b>Dual-Node Access Ring</b></p> <ul style="list-style-type: none"> <li>• Features</li> <li>• STS-1 path Through Dual-Node Access Ring</li> <li>• SDCC in a Dual-Node Access Ring</li> <li>• Cross-Connections</li> </ul>	<p><b>Fault Isolation and Resolution</b></p> <ul style="list-style-type: none"> <li>• Overview</li> <li>• Alarm and Condition Reports</li> <li>• Equipment Problems</li> <li>• Network Problems</li> </ul> <p><b>System Performance</b></p> <ul style="list-style-type: none"> <li>• FLM Overview <ul style="list-style-type: none"> <li>- FLM 150 ADM</li> <li>- FLM 600 ADM</li> <li>- FLM 2400 ADM</li> </ul> </li> <li>• Equipment Configurations <ul style="list-style-type: none"> <li>- Terminal</li> <li>- Linear</li> <li>- UPSR</li> <li>- BLSR (FLM 2400 ADM only)</li> </ul> </li> <li>• Performance Monitoring</li> </ul> <p><b>Synchronization</b></p> <ul style="list-style-type: none"> <li>• FLM Synchronization <ul style="list-style-type: none"> <li>- Timing Sources</li> <li>- Clock Source Protection</li> </ul> </li> <li>• Stratum Levels</li> <li>• Sync List</li> <li>• Synchronous Status Messaging</li> <li>• Timing Distribution</li> <li>• Timing Problems</li> </ul> <p><b>Upgrades and Migrations</b></p> <ul style="list-style-type: none"> <li>• Software Download</li> <li>• Remote NE Memory Backup and Restore</li> <li>• Network Growth</li> <li>• Upgrades and Migrations</li> <li>• Firmware and Software Compatibility</li> </ul> <p><b>Dual-Node Access Ring</b></p> <ul style="list-style-type: none"> <li>• Features</li> <li>• STS-1 path Through Dual-Node Access Ring</li> <li>• SDCC in a Dual-Node Access Ring</li> <li>• Cross-Connections</li> </ul>

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# NETSMART® 1500 Management System Administration



Ordering Information	What You Will Learn
<p><b>Course Code:</b> NS1500-USER  <b>Duration:</b> 4 Days  <b>Ordering Numbers:</b>  <b>In-house:</b> TRIH-NS1500USER  <b>In-House Tuition: \$2800</b>  <b>Suitcase:</b> TRSC-NS1500USER*  <b>MSP Suitcase:</b> TRSE-NS1500USER*  <b>Suitcase:</b> * For suitcase pricing, contact your Fujitsu Sales Rep. or email our Training Coordinator ed.svcs@fnc.fujitsu.com.</p>	<p><b>NETSMART 1500 Introduction</b></p> <ul style="list-style-type: none"> <li>• Logging On and Off</li> <li>• Dashboard Window</li> <li>• User Preference</li> <li>• NETSMART 1500 Home Page</li> <li>• High Availability</li> </ul> <p><b>Topology Management</b></p> <ul style="list-style-type: none"> <li>• Graphical and Tabular Views</li> <li>• Common Legend</li> <li>• Logging the NETSMART Server On and Off an NE</li> </ul>
<p><b>Prerequisites</b></p> <p>We strongly recommend students first attend Fujitsu products training they intend to monitor w NETSMART 1500 Mgmt System (FLASHWAVE 4xxx, FLASHWAVE 7xxx, &amp; FLASHWAVE 9500 systems). All students need basic understanding of concepts &amp; terminology used with SONET, DWDM, Ethernet, OSI, &amp; TCP/IP technologies. Fujitsu provides tutorials for SONET, Ethernet, &amp; DWDM in downloadable PDF format for students to prior to attending NETSMART 1500 Mgmt. System Classes.</p>	<ul style="list-style-type: none"> <li>• TL1 Console</li> <li>• Find NE, Group, or Subnetwork</li> <li>• Customer Attributes</li> <li>• NE Details</li> <li>• NE System Configuration Information Report</li> <li>• Sort and Filter Reports</li> <li>• Display Link Information</li> <li>• Capacity Management Reports</li> <li>• Bandwidth Management Reports</li> <li>• GNE Report</li> <li>• G-0144 Compliance Report</li> <li>• Create and Manage Groups</li> <li>• Topology Discovery <ul style="list-style-type: none"> <li>- Add Discovered NEs</li> <li>- Add a Ring</li> <li>- Resolve Conflict Links</li> </ul> </li> <li>• Add and Remove an NE</li> <li>• Add and Remove an NE Copy</li> <li>• Add or Delete a Link</li> <li>• Add Layer 2 Links</li> <li>• Add or Change the Background Map for a Group</li> <li>• Product Change Notices <ul style="list-style-type: none"> <li>- PCN Downloads</li> <li>- PCN Reports</li> <li>- Fujitsu Partner Products</li> </ul> </li> </ul>
<p><b>Course Contents</b></p> <p><b>NETSMART 1500 Introduction</b>  <b>Topology Management</b>  <b>NE DataComm and Security Management</b>  <b>TL1 Editor</b>  <b>NE List and Task Management</b>  <b>NE User Management</b>  <b>NE Software Management</b>  <b>Log Management</b>  <b>Remote Notification Management</b>  <b>Hands-On Exercises</b></p>	<p><b>NE DataComm &amp; Security Mgmt.</b></p> <ul style="list-style-type: none"> <li>• Administration Management <ul style="list-style-type: none"> <li>- System Administration</li> <li>- NEU Management</li> </ul> </li> <li>• DataComm Management <ul style="list-style-type: none"> <li>- Address View</li> <li>- Update IP Address</li> <li>- GNE List View</li> <li>- NE Communication Switch-Over</li> </ul> </li> <li>• NETSMART Security Management <ul style="list-style-type: none"> <li>- Add User</li> <li>- Select User Roles</li> <li>- Activate or Deactivate a User</li> <li>- Clone, Modify, or Delete a User</li> <li>- User Sessions</li> <li>- NETSMART 1500 EMS Roles</li> </ul> </li> <li>• Domain Management <ul style="list-style-type: none"> <li>- Domain Management Functions</li> <li>- Domain Management Reports</li> </ul> </li> </ul>
<p><b>Scheduled Dates</b></p> <p>10/9/12, 1/29/13, 2/26/13, 3/26/13, 4/23/13, 5/21/13, 6/18/13, 7/16/13, 8/13/13, 9/10/13</p> <p><b>Course Description</b></p> <p>Network Management Administration courses train students to perform basic administration-level functions within the NETSMART 1500 application. Hands-on exercises provide opportunities for creating and managing Topology databases, Domain Management, Remote Notification Management, Security Management, and Task Management for scheduled remote memory backup and software download.</p> <p><b>Who Should Attend</b></p> <p>Network &amp; system administrators, managers &amp; those with NOC, NCC, or TAC responsibility.</p>	<p><b>TL1 Editor</b></p> <ul style="list-style-type: none"> <li>• Command Mode Operations <ul style="list-style-type: none"> <li>- Command Builder</li> </ul> </li> <li>• ACL Management <ul style="list-style-type: none"> <li>- ACL Management Operations</li> </ul> </li> </ul> <p><b>NE List and Task Management</b></p> <ul style="list-style-type: none"> <li>• NE List Management <ul style="list-style-type: none"> <li>- Add NE List</li> </ul> </li> <li>• Task Management <ul style="list-style-type: none"> <li>- Create a New Task</li> <li>- Set and Select Schedule Preferences</li> <li>- Modify or Clone a Task</li> </ul> </li> <li>• Task Log Management</li> </ul> <p><b>NE User Management</b></p> <ul style="list-style-type: none"> <li>• Retrieve Accounts</li> <li>• Create Security Area</li> <li>• Create Account Group</li> <li>• Add Account</li> </ul> <p>NE User Management Log</p> <p><b>NE Software Management</b></p> <ul style="list-style-type: none"> <li>• Software Repository Management <ul style="list-style-type: none"> <li>- Install or Delete a Software Generic</li> </ul> </li> <li>• Service Database <ul style="list-style-type: none"> <li>- Install or Delete a Service Database</li> </ul> </li> <li>• NE Software Management <ul style="list-style-type: none"> <li>- Initiate Software Generic Download</li> </ul> </li> <li>• Remote Memory Backup <ul style="list-style-type: none"> <li>- Initiate Backup and Restore</li> </ul> </li> <li>• Firmware Upgrade Operations</li> </ul> <p><b>Log Management</b></p> <ul style="list-style-type: none"> <li>• Activity Log</li> <li>• System Log</li> <li>• Fault History Log</li> <li>• Transient Event Log</li> <li>• TL1 Log</li> </ul> <p><b>Remote Notification Management</b></p> <ul style="list-style-type: none"> <li>• Add Remote Notification User</li> <li>• Create Associations</li> <li>• Add Schedule</li> <li>• Audit Log Tab</li> </ul>

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# NETSMART® 1500 Management System User Operations



## Connection Management

- Features and Reports
- Connection Wizard
  - Automatic Creation
  - Multiple Automatic Creation
  - Advanced Automatic Creation
  - Discovery

## Fault Management

- System Fault Report
- Acknowledge Alarms
- Threshold Crossing Alert
- Affected Connections Report
- Resync Alarms
- Link Fault Report
- Fault History Log
- Transient Event Log

## Data Services Management

- LIF Management
- Profile Management
- Flow Management
- Ethernet Tunnel Browser
- Protection Domain Browser
- Service OAM

## NE Performance Management

- Get and Set Various PM Reports
- Polling Report
- Initialize Performance Registers
- Retrieve PM Data and History
- Real Time Monitoring
- PM Activity Report

## NE Software Management

- Software Repository Management
- Initiate Software Generic Download
- Remote Memory Backup Unit (RMBU)
- Firmware Upgrade Options

## NE List and Task Management

- NE List Management
  - Add NE List
- Task Management
  - Create a New Task
  - Set and Select Schedule Preferences
  - Modify or Clone a Task
- Task Log Management

\* For suitcase pricing, contact your Fujitsu Sales Representative or email our Training Coordinator at [ed.svcs@fnc.fujitsu.com](mailto:ed.svcs@fnc.fujitsu.com).

## Ordering Information

**Course Code:** NS1500-USER

**Duration:** 4 Days

**Ordering Numbers:**

**In-house:** TRIH-NS1500USER

**In-House Tuition: \$2800**

**Suitcase:** TRSC-NS1500USER\*

**SSP Suitcase:** TRSE-NS1500USER\*

## Prerequisites

We strongly recommend that students first attend training on the Fujitsu products that the students intend to monitor using the NETSMART Management System (for example, FLASHWAVE® 4xxx, FLASHWAVE 7xxx, and FLASHWAVE 9500 systems.

All students need a basic understanding of the concepts of and terminology used with SONET, DWDM, Ethernet, OSI, and TCP/IP technologies. Fujitsu provides tutorials for SONET, Ethernet, and DWDM on -line in downloadable PDF format for students to study prior to attending a NETSMART 1500 Management System class

## Course Contents

**NETSMART 1500 Introduction**

**Topology Management**

**TL1 Editor**

**Configuration Management**

**Wavelength Management**

**Cross-Connect Management**

**Connection Management**

**Fault Management**

**Data Services Management**

**NE Performance Management**

**NE Software Management**

**NE List and Task Management**

**Hands-On Exercises**

## Scheduled Start Dates

10/30/12, 12/18/12, 12/2/13, 2/19/13,  
3/19/13, 4/16/13, 5/14/13, 6/11/13, 7/9/13,  
8/6/13

## Course Description

Network Management User Operations course trains students to provision, monitor, and perform trouble analysis of Fujitsu NEs in network configurations using the NETSMART 1500 software. Hands-on exercises provide students real-life strategies using NETSMART 1500 software to focus on their area of network management job responsibility.

## Who Should Attend

Network operators, managers, and those with NOC, NCC, NDC, NPC or TAC responsibility.

## What You Will Learn

### NETSMART 1500 Introduction

- Logging On and Off
- Dashboard Window
- User Preference
- NETSMART 1500 Home Page

### Topology Management

- Graphical and Tabular Reports
- Common Legend
- TL1 Console
- Find NE, Group or Subnetwork
- Customer Attributes
- NE Details
- NE System Configuration Report
- Sort and Filter Reports
- Display Link Information
- Capacity Management Reports
- Bandwidth Management Reports
- Product Change Notices
- Fujitsu Partner Products

### TL1 Editor

- Command Mode Operations
- Command Builder
- Batch Mode Operations
- View TL1 Commands

### Configuration Management

- Graphical and Tabular View
- Capacity Management Reports
- System Equipment Report
- Common Legend
- Fault Management
- Properties View
- Select Dialog Box
- System Information View
- Operations Dialog Box
  - Changing Component States
  - Modifying an NE Profile
  - Enter Equip/Facility/EPG/FFP/DCC
  - Operate/Release Protection Switch
  - Changing Facility/Port State
  - Operating/Release Sync Switch
  - Environmental Alarms & Controls
- Equipment Connectivity Report
- Lambda Service Inventory Report
- PM View
- BLSR Management

### Wavelength Management

- Graphical and Tabular Views
- Optical Pwr End-to-End Monitoring

### Cross Connect Management

- Common Legend
- Add/Delete SONET Cross-Connect
  - Redline a Cross-Connect
- OUPSR and DWDM Cross-Connects
- Display the Current Path Selected
- Cross-Connect Report



# Fujitsu Maintenance and Support Program

With a Fujitsu maintenance and support solution, you keep your network operating at peak performance, control your operations costs and protect your valuable equipment and software assets. We offer flexible, comprehensive maintenance and support and network operations solutions to fit your specific needs.

## Protect Your Valuable Investment

Our Maintenance and Support Program enables you to streamline operations and increase network reliability. Choose the amount of support you need to supplement your in-house resources, so that you maintain optimum performance while controlling costs.

We offer 7 x 24 x 365 technical assistance, providing reliable support whenever you need it. Plus, you can get additional peace of mind by choosing Fujitsu management of spares for on-site technical support and advance hardware replacement (with either next business day or four-hour response times). With Fujitsu as your service and support partner, you dramatically increase operational efficiency and focus your resources on your core competencies and revenue-generating business activities.

Network Element Maintenance and Support Tiers				
Services	Select	Prime	Peak	Premier
24/7 remote technical assistance	x	x	x	x
Software maintenance and upgrade subscription for Network Element (NE) and Element Manager (craft)	x	x	x	x
Training		x	x	x
Repair and return		x		
Advance hardware replacement (Next business day)			x	
On-Site Maintenance (OSM) (Next business day)			x	
On-site maintenance (w/spare) (4-hour)				x
Routine preventative maintenance				x

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## Optional Network Maintenance and Design Plans

Several optional plans are available to cover your network maintenance and design needs. Ask your Fujitsu sales representative for details about these plans:

- NETSMART® 1500 Maintenance and Support Plan – Benefit from the most current NETSMART 1500 Management System features and management capabilities with assurance that our extensive online documentation and technical support engineers are available 24x7.
- Fujitsu Hosted EMS – All the network management benefits of NETSMART 1500 Management System, without the need to purchase, administer and maintain your own EMS and server.
- NETSMART 2000 Maintenance and Support Plan – Software upgrades, technical support and exclusive content such as webinars and tutorials

**Contact your Fujitsu sales representative for more information on how to order the support package that is right for you: 1-800-777-FAST (3278).**



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## Managed Network Solutions

Meeting customer expectations is essential to business health, but optimal network performance and responsiveness can create costly overhead in the form of in-house network operations and management. Fujitsu Managed Network Solutions can meet your network operations requirements and deliver rapid, provable return on investment by reducing operational expenses. Outsourcing all or part of your network management to Fujitsu compares favorably with the cost of operating your own facility. A high standard of network management is essential – with Fujitsu Managed Network Solutions, it can also be economical.

### Guaranteed System Protection – Around the Clock

Fujitsu Managed Network Solutions offer a full range of network fault and performance monitoring features with connection services for communication and data networks. Fujitsu technicians will work directly with your in-house staff or third party vendors, as needed. We can guarantee system protection around the clock, 365 days a year. With this level of assurance, you can achieve quicker time to revenue, simplified operations management, increased availability and operational cost efficiencies.

### World-Class Facility

We operate Managed Network Solutions from our fully redundant, state-of-the-art Network Operations Center (NOC), located in Richardson, TX and Sunnyvale, CA. This access-controlled NOC maintains the highest level of security and protection for your network data, including federated domains, hot-swap redundancy, geographically dispersed backup operations and four-layer security.

The Fujitsu NOC supports many types of networks and multi-vendor equipment in addition to Fujitsu platforms. With 20-plus years in the business, we have the knowhow to prevent outages, protect your service levels, safeguard revenues, and enhance customer satisfaction.

### Managed Network Solutions Packages

	Collaborative (Monitor & Notify)	Essential (Fault Management)	Essential Plus
Monitor & Log Events 24x7x365	X	X	X
Notify Customer	X	X	X
Root Cause Analysis		X	X
Prompt Traffic Restoration		X	X
Problem Resolution		X	X
Carrier Coordination		X	X
Multi-vendor Coordination		X	X
Customized Reports		X	X
Remote Adds/Moves/Changes			X
Configuration Management			X
Circuit Resource Management			X
Inventory Management			X

### Benefits

- Increase availability and uptime
- Reduce time to revenue for new services
- Maintain SLA compliance and reporting
- Reduce capital outlay
- Reduce operating expenses
- Simplify operations management
- Correct problems before they affect customers
- Ensure business continuity



## Core Managed Services

- **Collaborative (Monitor & Notify)** – Our network surveillance service enables you to focus on strategic initiative related to your core business while our management systems and technical experts monitor your network and promptly notify you of problems requiring your attention. With Network Surveillance, our monitoring systems constantly watch your network for alarms and alerts, correlate network events to identify the likely root cause, and notify you when action is required to resolve the problem.
- **Essential (Fault Management)** – Our Fault Management builds on Network Surveillance by assuming responsibility for resolution of issues causing network outages and service degradations. With Fault Management, our expert network engineers investigate network alerts, review device logs, and verify software configurations to identify solutions and return your network to operation with minimal impact to your users.
- **Essential Plus (Fault Management plus Supplemental Services)** – In addition to 24x7x365 network surveillance, event notification, traffic restoration and problem resolution, Essential Plus adds the following supporting services:
  - **Remote Move/Add/Change** – We perform remote provisioning actions such as configuration of new network elements, data circuits, and optical cross-connect provisioning.
  - **Configuration Management** – NOC technicians perform regular, remote memory backups on a per-NE basis. Our technicians also manage software updates and Product Change Notifications (PCN).
  - **Inventory Management** – NOC technicians maintain a database for part numbers on a per-NE basis, for the equipment in your network.
  - **Circuit Resource Management** – Our staff performs circuit bandwidth allocation and provisioning.

## Supplemental Managed Services

Supporting Service	Business Hours	Non-Business Hours	Business Strategy
NOC Assistant	Monitor and Notify	Fault Management	Customer with limited NOC resources (tools or personnel)
NOC @ Night	Disaster Recovery	Fault Management	Customer with no NOC staff during non-business hours
NOC on Call	Disaster Recovery	Monitor & Notify	Customer with NOC staff on-call during non-business hours
NOC Redundancy	Disaster Recovery	Disaster Recovery	Business Continuity for Customer's NOC

## Premium Maintenance Services

- **Preventive Maintenance** – Our scheduled, onsite checkups are a great way to proactively assess the health of your network using a checklist of items developed to suit your individual network.
- **Advance Hardware Replacement** – This optional extra provides management of spare parts and ensures availability of needed hardware. The AHR service guarantees availability of covered replacement parts and delivery nationwide within a specified time period.
- **Onsite Maintenance** – This optional extra eliminates the need for placement of personnel at all geographic points-of-presence of your network. We dispatch expert technicians to your site to work with remote NOC engineers to resolve network problems. Personnel can arrive within four hours or a specific scheduled time.

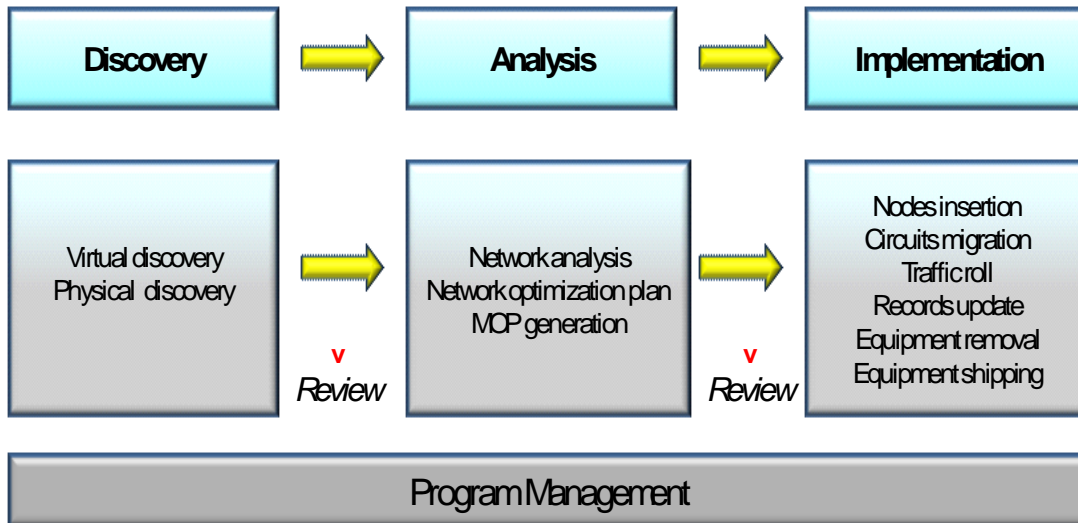
**Please contact your Fujitsu Sales Representative for more information.**



## Central Office Modernization

Many service providers (SP) are currently upgrading the optical transport equipment in their Central Offices with next generation products from multiple vendors. This new equipment allows higher traffic density and more efficient use of matrix capacity. It can reduce electricity consumption as well as postpone or eliminate expansions to HVAC capacity. Fujitsu helps the SP migrate circuits and roll traffic from the old equipment to the new equipment using a proven CO Modernization process.

This service follows a 3-phase process:



**Phase 1:** Network Discovery – Audit network both electronically and via on-site physical audit

**Phase 2:** Network Analysis – Analyze existing state of the network and develop migration plan and Methods of Procedure (MOP) to optimize equipment and facilities usage based on audit results.

**Phase 3:** Network Implementation – Migrate circuits that reside on legacy equipment to the new platforms, as defined by the migration plan.

### Benefits:

- Vendor independent solution. We can migrate circuits for products made by Fujitsu as well as others, such as Alcatel Lucent, Cisco and Tellabs
- Reclaim valuable CO floor space thereby postponing real-estate expansions or buildouts
- Reduce HVAC requirements
- Reduce power consumption
- Maximize circuit-per-rack density
- Free up old equipment to be re-deployed in other locations as needed



## Rack and Cabinet Integration

Fujitsu Network Communication's Rack and Cabinet Integration (RCI) group offers high-quality rack and cabinet (indoor/outdoor) turnkey solutions for the wireline, wireless, FTTx, Cable, Utility and MSO markets. From a variety of standard racks and cabinets to a custom design specifically for your application, the RCI group responds to each customer requirement, combining an industry leading engineering approach for a complete indoor or outdoor solution.

### Fujitsu RCI Advantages:

- Full NEBs, GR and UL compliance available
- High Value, cost effective solutions for each customer
- Flexibility to create the best overall solution
- Scalable applications for indoor and outdoor growth
- Highly reliable solutions that offer consistent quality
- Vendor Agnostic Solutions



Indoor Wall-Mount Cabinet

Integrating elements from various suppliers allows our RCI group to offer the best solution to cost effectively meet customer requirements.

### Integration Elements:

- Racks and Cabinets (Indoor and Outdoor)
- Power Systems and Distribution
- RF Protection and Distribution
- Cross-Connect Panels
- Thermal Management Systems
- Backup Power and Batteries
- Fiber Management
- Lightning Protection
- DS1, DS3, and DSx Panels
- Demarcation Panels

Fujitsu RCI brings renowned Fujitsu quality to every cabinet, rack, and kit it designs. Our experienced professionals build and test our RCI products to the same exacting standards as our legendary Fujitsu optical transport equipment.

When you select Fujitsu RCI solutions, you benefit from our extensive telecommunications knowledge and experience, coupled with the industry's best technology, for a high-quality, cost-effective, solution.



Outside Plant (OSP) Cabinet Solution



Preconfigured Rack Solution



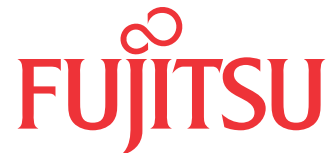
## Contact Information

**Fujitsu Network Communications, Inc.**  
**Educational Services**  
**Email: ED.SVCS@fnc.fujitsu.com**  
**Phone: 972-479-4961**  
**1-800-777-3278 x4961**  
**FAX: 972-479-7117**

**Web Page: <http://www.fujitsu.com/us/services/telecom/training>**

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**NOTES:**



**Fujitsu Network Communications Inc.**

2801 Telecom Parkway, Richardson, TX 75082

Tel: 800.777.FAST (3278) Fax: 972.479.6900

**[us.fujitsu.com/telecom](http://us.fujitsu.com/telecom)**

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FUJITSU (and design)® are trademarks of Fujitsu Limited. All Rights Reserved.  
All other trademarks are the property of their respective owners.  
Configuration requirements for certain uses are described in the product documentation.  
Features and specifications subject to change without notice.

**Supplier: Fujitsu Network Communications**

**STATE OF UTAH**



**SOLICITATION NO. JP14001**

WSCA-NASPO Data Communications Products & Services

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RESPONSES DUE NO LATER THAN:

**Aug 30, 2013 11:00:00 AM MDT**

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RESPONSES MAY BE SUBMITTED ELECTRONICALLY TO:

[www.bidsync.com](http://www.bidsync.com)

RESPONSES MAY BE MAILED OR DELIVERED TO:

State of Utah  
Division of Purchasing  
3150 State Office Building, Capitol Hill  
Salt Lake City, Utah 84114-1061

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**Supplier: Fujitsu Network Communications**



# State of Utah Request for Proposal

Legal Company Name (include d/b/a if applicable)	Federal Tax Identification Number	State of Utah Sales Tax ID Number	
Ordering Address	City	State	Zip Code
Remittance Address (if different from ordering address)	City	State	Zip Code
Type Corporation <input type="checkbox"/> Partnership <input type="checkbox"/> Proprietorship <input type="checkbox"/> Government <input type="checkbox"/>	Company Contact Person		
Telephone Number (include area code)	Fax Number (include area code)		
Company=s Internet Web Address	Email Address		
Discount Terms (for bid purposes, bid discounts less than 30 days will not be considered)	Days Required for Delivery After Receipt of Order (see attached for any required minimums)		
The undersigned certifies that the goods or services offered are produced, mined, grown, manufactured, or performed in Utah. Yes No <input type="checkbox"/> . If no, enter where produced, etc.			
Offeror=s Authorized Representative=s Signature	Date		
Type or Print Name	Position or Title		

## NOTICE

When submitting a response (proposal, quote or bid) electronically through BidSync, it is the sole responsibility of the supplier to ensure that the response is received by BidSync prior to the closing date and time. Each of the following steps in BidSync MUST be completed in order to place an offer:

- A. Login to [www.bidsync.com](http://www.bidsync.com);
- B. Locate the bid (solicitation) to which you are responding;
  - a. Click the "Search" tab on the top left of the page;
  - b. Enter keyword or bid (solicitation) number and click "Search";
- C. Click on the "Bid title/description" to open the Bid (solicitation) Information Page;
- D. "View and Accept" all documents in the document section;
- E. Select "Place Offer" found at the bottom of the page;
- F. Enter your pricing, notes, other required information and upload attachments to this page;
- G. Click "Submit" at the bottom of the page;
- H. Review Offer(s); and
- I. Enter your password and click "Confirm".

Note that the final step in submitting a response involves the supplier's acknowledgement that the information and documents entered into the BidSync system are accurate and represent the supplier's actual proposal, quote or bid. This acknowledgement is registered in BidSync when the supplier clicks "Confirm". BidSync will post a notice that the offer has been received. This notice from BidSync MUST be recorded prior to the closing date and time or the response will be considered late and will not be accepted.

Be aware that entering information and uploading documents into BidSync may take considerable time. Please allow sufficient time to complete the online forms and upload documents. Suppliers should not wait until the last minute to submit a response. It is recommended that suppliers submit responses a minimum of 24 hours prior to the closing deadline. The deadline for submitting information and documents will end at the closing time indicated in the solicitation. All information and documents must be fully entered, uploaded, acknowledged (Confirm) and recorded into BidSync before the closing time or the system will stop the process and the response will be considered late and will not be accepted.

Responses submitted in BidSync are completely secure. No one (including state purchasing staff) can see responses until after the deadline. Suppliers may modify or change their response at any time prior to the closing deadline. However, all modifications or changes must be completed and acknowledged (Confirm) in the BidSync system prior to the deadline. BidSync will post a notice that the modification/change (new offer) has been received. This notice from BidSync MUST be recorded prior to the closing date and time or the response will be considered late and will not be accepted.

Utah Code 46-4-402(2) Unless otherwise agreed between a sender (supplier) and the recipient (State Purchasing), an electronic record is received when: (a) it enters an information processing system that the recipient has designated or uses for the purpose of receiving electronic records or information of the type sent and from which the recipient is able to retrieve the electronic record; and (b) it is in a form capable of being processed by that system.

## REQUEST FOR PROPOSAL - INSTRUCTIONS AND GENERAL PROVISIONS

- 1. SUBMITTING THE PROPOSAL:** (a) The Utah Division of Purchasing and General Services (DIVISION) prefers that proposals be submitted electronically. Electronic proposals may be submitted through a secure mailbox at BidSync (formerly RFP Depot, LLC) ([www.bidsync.com](http://www.bidsync.com)) until the date and time as indicated in this document. It is the sole responsibility of the supplier to ensure their proposal reaches BidSync before the closing date and time. There is no cost to the supplier to submit Utah's electronic proposals via BidSync. (b) Electronic proposals may require the uploading of electronic attachments. The submission of attachments containing embedded documents is prohibited. All documents should be attached as separate files. (c) If the supplier chooses to submit the proposal directly to the DIVISION in writing: The proposal must be signed in ink, sealed, and delivered to the Division of Purchasing, 3150 State Office Building, Capitol Hill, Salt Lake City, UT 84114-1061 by the "Due Date and Time." The "Solicitation Number" and "Due Date" must appear on the outside of the envelope. All prices and notations must be in ink or typewritten. Each item must be priced separately. Unit price shall be shown and a total price shall be entered for each item offered. Errors may be crossed out and corrections printed in ink or typewritten adjacent and must be initialed in ink by person signing offer. Unit price will govern, if there is an error in the extension. Written offers will be considered only if it is submitted on the forms provided by the DIVISION. (d) Proposals, modifications, or corrections received after the closing time on the "Due Date" will be considered late and handled in accordance with the Utah Procurement Rules, section R33-3-209. (e) Facsimile transmission of proposals to DIVISION will not be considered.
- 2. PROPOSAL PREPARATION:** (a) Delivery time of products and services is critical and must be adhered to as specified. (b) Wherever in this document an item is defined by using a trade name of a manufacturer and/or model number, it is intended that the words, "or equivalent" apply. "Or equivalent" means any other brand that is equal in use, quality, economy and performance to the brand listed as determined by the DIVISION. If the supplier lists a trade name and/or catalog number in the offer, the DIVISION will assume the item meets the specifications unless the offer clearly states it is an alternate, and describes specifically how it differs from the item specified. All offers must include complete manufacturer's descriptive literature if quoting an equivalent product. All products are to be of new, unused condition, unless otherwise requested in this solicitation. (c) Incomplete proposals may be rejected. (d) Where applicable, all proposals must include complete manufacturer's descriptive literature. (e) By submitting the proposal the offeror certifies that all of the information provided is accurate, that they are willing and able to furnish the item(s) specified, and that prices offered are correct. (f) This proposal may not be withdrawn for a period of 60 days from the due date.
- 3. FREIGHT COST:** Suppliers are to provide line item pricing FOB Destination Freight Prepaid. Unless otherwise indicated on the contract/purchase order, shipping terms will be FOB Destination Freight Prepaid.
- 4. SOLICITATION AMENDMENTS:** All changes to this solicitation will be made through written addendum only. Answers to questions submitted through BidSync shall be considered addenda to the solicitation documents. Bidders are cautioned not to consider verbal modifications.
- 5. PROTECTED INFORMATION:** Suppliers are required to mark any specific information contained in their offer which they are claiming as protected and not to be disclosed to the public or used for purposes other than the evaluation of the offer. Each request for non-disclosure must be made by completing the "Confidentiality Claim Form" located at: <http://www.purchasing.utah.gov/contract/documents/confidentialityclaimform.doc> with a specific justification explaining why the information is to be protected. Pricing and service elements of any proposal will not be considered proprietary. All material becomes the property of the DIVISION and may be returned only at the DIVISION's option.
- 6. BEST AND FINAL OFFERS:** Discussions may be conducted with offerors who submit proposals determined to be reasonably susceptible of being selected for award for the purpose of assuring full understanding of, and responsiveness to, solicitation requirements. Prior to award, these offerors may be asked to submit best and final offers. In conducting discussions, there shall be no disclosure of any information derived from proposals submitted by a competing offeror.
- 7. SAMPLES:** Samples of item(s) specified in this offer, brochures, etc., when required by the DIVISION, must be furnished free of expense to the DIVISION. Any item not destroyed by tests may, upon request made at the time the sample is furnished, be returned at the offeror's expense.
- 8. AWARD OF CONTRACT:** (a) The contract will be awarded with reasonable promptness, by written notice, to the responsible offeror whose proposal is determined to be the most advantageous to the DIVISION, taking into consideration price and evaluation factors set forth in the RFP. No other factors or criteria will be used in the evaluation. The contract file shall contain the basis on which the award is made. Refer to Utah Code Annotated 65-

56-408. (b) The DIVISION may accept any item or group of items, or overall best offer. The DIVISION can reject any or all proposals, and it can waive any informality, or technicality in any proposal received, if the DIVISION believes it would serve the best interests of the DIVISION. (c) Before, or after, the award of a contract the DIVISION has the right to inspect the offeror's premises and all business records to determine the offeror's ability to meet contract requirements. (d) The DIVISION will open proposals publicly, identifying only the names of the offerors. During the evaluation process, proposals will be seen only by authorized DIVISION staff and those selected by DIVISION to evaluate the proposals. Following the award decision, all proposals become public information except for protected information (see number 5 above). A register of proposals and contract awards are posted at <http://purchasing.utah.gov/vendor/bidtab.html>. (e) Estimated quantities are for bidding purposes only, and not to be interpreted as a guarantee to purchase any amount. (f) Utah has a reciprocal preference law which will be applied against offerors offering products or services produced in states which discriminate against Utah products. For details see Section 63G-6-404 and 63G-6-405, Utah Code Annotated. (g) Multiple contracts may be awarded if the DIVISION determines it would be in its best interest.

**9. DEBRIEFING OF UNSUCCESSFUL OFFERORS:**

State Purchasing does not conduct face to face or teleconference debriefings. All debriefings are to be conducted in writing. A debrief request must be submitted in writing to the Purchasing Agent within seven (7) calendar days of the award notification or rejection notification made through written correspondence or posted on BidSync. The debrief response will be limited to critiquing the strength/weakness of an offeror's proposal based on the evaluation criteria. The debriefing is intended as a courtesy to offerors, providing feedback to be used for future opportunities. Comparisons between proposals or evaluations of other proposals will not be allowed.

**10. DIVISION APPROVAL:** Contracts written with the State of Utah, as a result of this proposal, will not be legally binding without the written approval of the Director of the DIVISION.

**11. DEBARMENT:** The CONTRACTOR certifies that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction (contract) by any governmental department or agency. If the CONTRACTOR cannot certify this statement, attach a written explanation for review by the DIVISION.

**12. ENERGY CONSERVATION AND RECYCLED PRODUCTS:** The contractor is encouraged to offer Energy Star certified products or products that meet FEMP (Federal Energy Management Program) standards for energy consumption. The State of Utah also encourages contractors to offer products that are produced with recycled materials, where appropriate, unless otherwise requested in this solicitation.

**13. GOVERNING LAWS AND REGULATIONS:** All State purchases are subject to the Utah Procurement Code, Title 63 Chapter 56 U.C.A. 1953, as amended, and the Procurement Rules as adopted by the Utah State Procurement Policy Board. These are available on the Internet at [www.purchasing.utah.gov](http://www.purchasing.utah.gov). By submitting a bid or offer, the bidder/offeror warrants that the bidder/offeror and any and all supplies, services equipment, and construction purchased by the State shall comply fully with all applicable Federal and State laws and regulations, including applicable licensure and certification requirements.

**14. SALES TAX ID NUMBER:** Utah Code Annotated (UCA) 59-12-106 requires anyone filing a bid with the state for the sale of tangible personal property or any other taxable transaction under UCA 59-12-103(1) to include their Utah sales tax license number with their bid. For information regarding a Utah sales tax license see the Utah State Tax Commission's website at [www.tax.utah.gov/sales](http://www.tax.utah.gov/sales). The Tax Commission is located at 210 North 1950 West, Salt Lake City, UT 84134, and can be reached by phone at (801) 297-2200.

(Revision Date: 05 Nov 2012 - RFP Instructions)