



Enterprise Linux* Selection Guide

Balancing Features, Support, and Cost

Considering moving your enterprise to the Linux operating system? Since there are so many similar versions, choosing the right one can be tough. This paper offers a clear process to help you make an informed decision and get the features, support, and cost that are right for your business and technical needs.

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Executive Summary

The Linux operating system has grown exponentially over the last decade—both in popularity and in functionality. Today, it is robust and ready for front-end Internet infrastructure applications such as Web servers, security servers, directory servers, and firewalls. Moreover, as open source software, Linux encourages a continuous stream of new applications and development tools and offers benefits such as lower risk and easier customization.

When an enterprise considers moving to Linux, it must first decide which Linux distribution will best meet its business and technical needs. This is not always easy, since the various Linux distributions are so similar.

This paper can help an enterprise make an informed Linux choice by offering a clear process for deciding which version offers the best possible combination of features, support, and cost. It also suggests key questions to ask and offers references for further research.

While the primary focus is on Linux distributions that are popular in the U.S., the techniques and issues apply equally well to other geographies.

The Linux* Landscape

The distributed, open source development model for the Linux operating system is the result of the efforts of a worldwide network of dedicated developers. This development model provides for extensive peer review of open source projects and provides key benefits such as:

- **Enabling bugs discovered after code is released** to be generally shallow and relatively easy to remedy.
- **Providing a large, distributed pool of resources** to help solve problems or add features. Even if an enterprise chooses to limit its participation in this community, the resources are still available to help it discover any unique problem that its traditional support structure is unwilling (or unable) to address.

As Linux began to gain acceptance in the enterprise, information technology (IT) industry leaders recognized the need for an organization dedicated to supporting open source development. This group could provide resources to speed development and drive enterprise acceptance of the open source model. To fill this need, a group of leaders came together and founded the Open Source Development Labs (OSDL).

Home to Linus Torvalds, the father of Linux and head of Linux kernel development, OSDL is a non-profit organization that provides state-of-the-art computing and test facilities in the U.S. and Japan and makes these resources available to developers worldwide. OSDL founding members are Computer Associates, Hewlett-Packard, IBM, Intel, and NEC. A complete list of OSDL member organizations is available on the group's Web site at <http://www.osdl.org>.

The OSDL's mission is to be the recognized center of gravity for Linux and the central body dedicated to accelerating the use of Linux for enterprise computing through:

- **Enterprise-class testing** and other technical support for the Linux development community.
- **Marshalling of Linux industry resources** to focus investment on areas of greatest need, thereby eliminating inhibitors to growth.
- **Practical guidance to members**—vendors and users alike—on working effectively with the Linux development community.

The Players

Linux is now having a significant impact on the server market segment, and many industry analysts are trying to predict what life will be like in years to come. In a ZDNet article, analysts from Gartner Group predict a continued operating system shakeout and an even faster shakeout for server microprocessors. [Weiss] the Gartner analysts believe this will lead to:

- **Only three growth server operating systems** (Windows*, Linux, and AIX*) will exist through 2008 (0.8 probability).
- **Only three growth server microprocessor architectures** (IA-32 Intel® architecture, Intel® Itanium® Processor Family [IPF], and IBM Power Architecture*) will exist through 2008 (0.8 probability).
- **A significant increase in the market segment share for Linux**, much of it from the use of scale-out architectures such as blades, compute clusters, replicated systems, and appliance-type deployments.
- **Linux possessing 70 percent of the performance and functionality** available from UNIX* by 2006 (0.8 probability).
- **80 percent of the functionality layered above the UNIX kernel** migrating to Linux by 2008 (0.8 probability).

Mature market segments tend to have two or three dominant players (e.g., Coke and Pepsi). In the U.S. Linux server distribution market segment, there are two key players:

- **Novell SUSE* Linux** (<http://www.novell.com>)
- **Red Hat Linux*** (<http://www.redhat.com>)

Other Linux distribution vendors are prominent in different geographic regions and in selected circumstances, such as embedded and desktop systems. Some of these vendors include:

- **Conectiva** (<http://www.conectiva.com.br/cpub/pt/principal/index.htm>)
- **Debian** (<http://www.debian.org>)
- **Linspire** (<http://www.linspire.com>)
- **Mandriva** (<http://www.mandriva.com>)
- **MontaVista Software** (<http://www.mvista.com>)
- **Red Flag** (<http://www.redflag-linux.comeindex.html>)
- **Turbolinux** (<http://www.turbolinux.com>)
- **UnitedLinux** (<http://www.unitedlinux.com>)
- **Xandros** (<http://www.xandros.com>)

Turbolinux, a UnitedLinux partner, has emerged as a leading supplier in the Asia Pacific region, especially in Japan and China. Its product portfolio includes 32-bit and 64-bit operating systems and a wide range of enterprise-class products. Widespread acceptance of Turbolinux in Asia could provide the momentum necessary to promote acceptance in the American and European enterprise market segments.

UnitedLinux was formed by Caldera, Conectiva, Novell, and Turbolinux to build a single, worldwide Linux standard for enterprise deployment of Linux. UnitedLinux released version 1.0 in November 2002.

The desktop space enjoys a much larger number of participants. Some of the more significant and/or interesting choices are identified in the “Desktop Linux” section. The major U.S. server distribution vendors recently introduced desktop offerings of their own, which suggests that desktop distributions may now be ready for the enterprise.

Legal Considerations

On March 6, 2003, The SCO Group, which owns the UNIX operating system, filed a civil lawsuit against IBM. SCO claims that elements of its UNIX source code have made their way into Linux, making it an “unauthorized derivative” of UNIX. SCO has gone on to sue others and to send letters to Linux customers asking for discounted license fees in advance of any court ruling. Several counter-suits have been filed by IBM and Red Hat.

In response to these suits, several organizations—including Sun Microsystems, Novell, Hewlett-Packard, and Red Hat—are offering indemnification programs protecting their customers from the potential fallout of these litigations. IBM has chosen not to indemnify its rapidly-growing base of Linux customers because it believes the SCO lawsuit is baseless. The OSDL has begun a defense fund that it hopes will bring in \$10 million for users entangled in any related legal fights.

Several outcomes of the SCO lawsuit are possible:

- **SCO loses**, yielding no impact.
- **SCO settles**, yielding an unknown impact specified by the terms of the settlement.
- **SCO wins**, and organizations using Linux will need to pay license fees.
- **SCO wins**, and the offending source code will need to be removed from Linux.

Although the SCO lawsuit does not seem to be hindering the adoption of Linux, any enterprise should exercise due diligence and perform its own risk and benefit analysis pending the outcome of this lawsuit.

Selecting a Linux Distribution

Even though most of the kernel code base is identical in different Linux distributions, there are many differences in availability of applications, value-added products, third-party relationships, and quality of service. Other factors to consider include:

- **A predictable and consistent** update schedule.
- **Easy integration** into existing IT support structure.
- **Third-party software** support.
- **Availability** of hardware vendor support.
- **Availability** of adequate service level agreements (SLAs).

While operating system stability and reliability are baseline characteristics for an enterprise-class operating system, IT managers and third-party application vendors looking to successfully manage their own businesses, need predictable and consistent update schedules at a more sedate pace than usually characterizes mainstream open source development.

Since Linux closely resembles UNIX, most current enterprise UNIX knowledge can transfer directly to the Linux environment. Further, many (if not most) IT staff members are likely familiar with Linux and using it at home. This makes training and ramp-up for the IT staff a relatively small part of the overall Linux deployment picture.

Most popular enterprise management tools can support Linux systems. As an enterprise deploys Linux, it must carefully evaluate its current IT environment to ensure minimal impact on existing tools and procedures. Developing an accurate picture of the existing environment helps to immunize the enterprise against the possibility that some important detail is overlooked in the evaluation process.

The enterprise needs to evaluate the third-party software products it currently uses—including middleware, databases, and Web development suites—to see if Linux versions are available. It also needs to evaluate any locally developed software to determine how difficult it will be to migrate it to a Linux environment.

The best scenario is to select a Linux distribution supported by the vendor(s) the enterprise turns to for its hardware. Having hardware vendor support simplifies bug fixes and updates because the hardware vendor has a vested interest

in delivering timely updates for its specific hardware drivers and value-added software packages. The vendor can also verify that the updates work with the Linux distributions it supports.

An enterprise IT department typically has a variety of SLAs, depending on how critical specific applications are to the overall health of the business. While Linux may not be the first operating system considered for mission-critical situations, Linux is, ultimately, UNIX. Therefore, down the road, mission-critical Linux deployments will likely be possible, making it wise to ensure mission-critical SLAs are available for the Linux distribution the enterprise selects.

The Decision Process

There are four key steps in the process of choosing a Linux distribution:

- **Step 1:** Evaluate the environment.
- **Step 2:** Define support needs.
- **Step 3:** Consider total cost of ownership (TCO).
- **Step 4:** Calculate support costs.

Step 1: Evaluate the Environment

The first (and likely most time-consuming) step in the process of choosing a Linux distribution is to collect data about the IT environment where Linux will be deployed. This evaluation should focus on three subject areas:

- Hardware
- Software
- Support

Once the enterprise has a clear, detailed picture of the environment, it can consider how well each Linux distribution under consideration will fit.

During this evaluation process, the enterprise can initiate a plan for introducing Linux. This plan should include:

- **Where** Linux will be initially deployed.
- **How** the migration process will unfold.
- **What** the hardware, software, and support requirements are.

Step 2: Define Support Needs

The second step in the selection process is to define the support model that will be deployed for Linux. The open source development process opens up new ways for the enterprise to support its computing platforms. The enterprise must consider these new possibilities and decide what the support model for Linux will look like.

Currently, there are four general support models to consider. These include the traditional models where support is purchased from a proprietary hardware vendor or a third-party enterprise services vendor, and two new models where support is purchased from the operating system distribution vendor or support is supplied entirely by the enterprise IT department. An enterprise can supplement any of these with support from the open source development community. Certainly, a mix of these in varying degrees may also be deployed. The Gartner analysts suggest the following possibilities:

- **Self support**, where a company provides its own support with a free, generic distribution.
- **Per-incident support**, where a company provides its own support but seeks incidence support from third parties.
- **Basic contract support**, where a company seeks a basic support contract with a distribution vendor.
- **Advanced contract support**, where a company seeks advanced operating system support—from either a Linux distribution vendor or a third party—covering both the applications and the database.
- **Comprehensive enterprise support**, where a company gets advanced, all-level support from system vendors—such as the platform supplier—with co-support arrangements back to the operating system distributor. [Weiss]

The good news with Linux is that traditional enterprise vendors are now providing support on par with other enterprise-class operating system product offerings. Selecting a platform vendor for operating system support can simplify update, patch, and driver management issues for drivers and tools the platform vendor provides.

Step 3: Consider Total Cost of Ownership (TCO)

The third step in choosing a distribution is to determine how introducing Linux will affect TCO for the enterprise. It is important to consider costs generally, and also to look for specific areas with savings potential.

Instead of exploring this issue exhaustively, we will simply point out the importance of taking a careful and unbiased look at costs to accurately estimate the impact introducing Linux will have on TCO in the enterprise.

Much has been written about the cost of deploying and supporting Linux. Often, this information is contradictory, failing to capture all the costs to deploy and support Linux. For example, some proprietary software vendors require client access licenses for their products. Linux does not require client access licenses, which removes that cost from the equation. However, the cost of client access licenses is seldom mentioned when studies are published comparing a proprietary product to Linux.

Linux and the open source development model introduce new factors. It is important to consider these factors to develop an accurate picture of how introducing Linux will impact the enterprise.

METAGroup Vice President Corey Ferengul is one Linux industry analyst who sees more companies trying to improve the TCO of their systems through alternative IT products:

“We historically have taken the position that Linux has the same TCO as Windows. However, the potential for a lower Linux TCO exists, depending on what choices an organization makes, how much work it wants to take on itself, and how much risk it desires.” [Preimesberger]

Some factors that affect TCO are inherent to a platform (e.g., platform stability, number of patches), and thus, are out of the user’s control. However, Ferengul believes that organizations can make five key choices that can help reduce the TCO of Linux between 10 and 40 percent:

- **Distribution:** This is the decision about whether to use a commercial (versus free) Linux distribution. Most IT managers agree that a commercial distribution is more likely to stabilize the Linux implementation as well as applications, resulting in fewer changes and support issues. By not using a commercial distribution, enterprises can save the cost of customized (and enhanced) distributions.
- **Support:** If an organization is using a commercial distribution, does it purchase support? If so, from whom? Support is expensive, and there are many choices. Going without support saves money, but can potentially expose an organization to risk.
- **Management tools:** It is important to decide how to manage Linux. A healthy set of open source management tools is available, and commercial management tools continue to mature. Most management vendors (e.g., Computer Associates, BMC Software, IBM, Hewlett-Packard) now support at least Red Hat and Novell SUSE Linux distributions with mainstream monitoring and management tools. Also, Red Hat and Novell each have solid tools for supporting patches and other functions for managing Linux.
- **Software stack:** What software stack will the organization use for Linux? Will it choose MySQL or run Oracle? There are obvious cost implications to selecting open source infrastructure framework services such as databases, Web servers, and Web application servers.
- **Use case:** How will Linux be used? If an organization chooses to use Linux as a consolidation platform, it incurs the cost of virtualization software and the additional support that goes with it. However, using Linux as an edge device for Web servers requires much less administration and can lower ownership costs.

“Overall, Ferengul believes that most large enterprises will make choices that result in the lifetime cost of Linux equaling the cost of other platforms. He also believes that even though organizations can choose to lower the TCO of Linux, they will inherit other risks in the process.”
[Preimesberger]

Step 4: Calculate Support Costs

Planners tend to overestimate the number of IT professionals it will take to manage Linux boxes by using the Windows management model. Since Linux is more similar to UNIX than to Windows, the UNIX management model is more appropriate.

One Linux consultant, Brian Schenkenfelder, president of Kentucky-based Linux consultancy n + 1, argues that a typical Linux administrator can handle more than the typical Windows administrator:

“What I’ve found is that a Linux administrator who knows what he’s doing should be able to administer two to three times the amount of boxes a Windows administrator should be able to administer.” [Gross]

A 2004 study conducted by Chad Robinson, senior research analyst at the Robert Frances Group (RFG) research company, supports Schenkenfelder’s claims. Robinson acknowledges that experienced administrators for Linux or Solaris* can be more expensive in some parts of the U.S., but noted that many of them have been working with UNIX for dozens of years. Robinson says:

“One of the things that Microsoft is starting to lose out on now, and I’m not sure they realize this yet, is that they still claim Windows administrators are cheaper. But the flip side of the same coin is that if one of my administrators on a Windows environment can manage only 10 to 15 systems at a time, but my Solaris admin or my NetBSD* or my Linux admin can manage 1,000 servers at a time, I need fewer admins. Sure, the salary’s more expensive, but I get more life out of them.” [Francis]

The RFG study, commissioned by Linux supporter IBM, compares the TCO of Linux to both Solaris and Windows. Robinson compared the cost of “processing units”—the number of servers that would be required to process 100,000 hits per day—over three years.

The RFG study also looked at system support costs. Among the companies surveyed, the study found few that paid for Linux support. Instead, they used free support online. Obviously, commercial support options would add to the Linux TCO equation.

According to the study, the three-year cost of a 100,000-hit processing unit was significantly different among the three types of systems:

- **Solaris:** \$561,520
- **Windows:** \$190,662
- **Linux:** \$74,475

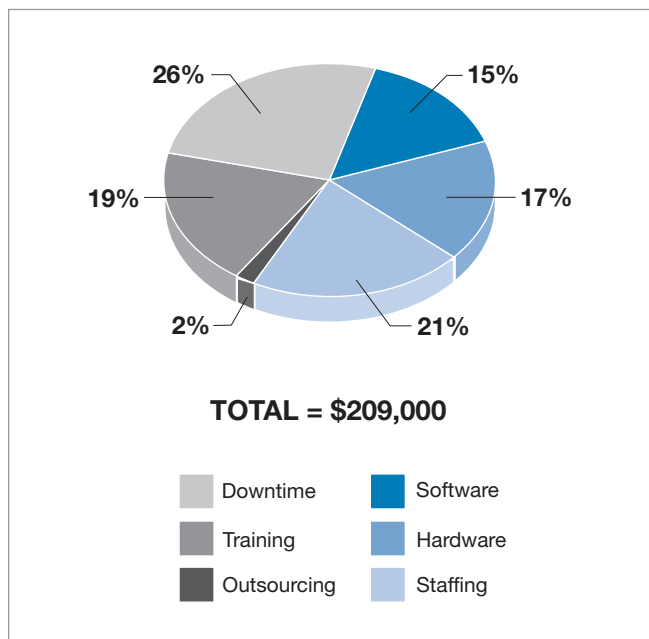
Robinson concludes:

“The Microsoft case has always been ‘Linux isn’t free,’ and they’re losing sight of something these days. Nobody’s saying Linux is free anymore. Our number here is \$74,000 for a three-year deployment. The news is that, despite its not being free, it’s still considerably cheaper and is more flexible with licensing.” [Francis]

Another View on Savings

Another example of how Linux may save money for an enterprise is presented in Figure 1. The information is extracted from a 2002 IDC study partially funded by Intel. [Perry] The study purports to accurately compare the total cost over three years of the Oracle8i* running on both UNIX and Linux. This example also highlights some of the areas where costs for Linux should be evaluated.

Figure 1. Total cost of Oracle8i* database deployment over three years



Source: IDC, 2002, “Maximizing the Business Value of Enterprise Database Applications on a Linux Platform”

The study concluded that Oracle8i database implementations on Red Hat Linux were, on average, 49 percent less costly over a three-year time span than similar implementations on UNIX. Linux had cost advantages over UNIX in six areas:

- **Hardware:** Linux was 65 percent less expensive than UNIX, not just because the hardware purchase was less expensive (63 percent), but also because upgrades, training, and annual maintenance were less expensive.
- **Software:** Software was 60 percent less expensive overall. As with hardware, it was less expensive in terms of purchase, deployment, and ongoing support.
- **Staffing:** Linux was 79 percent less expensive than UNIX because fewer people were required for each server.
- **Outsourcing:** Linux was 50 percent more expensive than UNIX due to the greater use of outside support for server setup and configuration and operating system support and tuning.
- **Training:** Linux was slightly less expensive for user training (16 percent) and 87 percent less expensive for IT staff training. The IT staff training cost differential was related to the larger support staffs.
- **Downtime:** Even though the Linux users experienced only .5 hours per month of downtime compared with 1.9 hours for UNIX users, the Linux sites tended to have a higher percentage of total users affected by each downtime incident (59 percent to 42 percent). Therefore, their downtime costs were slightly higher.

For more on support models and costs for specific vendors, see the “Enterprise Support Services” section.

Distinguishing Enterprise Features

Distribution vendors hope to convince the marketplace that the products and services they offer are the best available. Each has its own view of what an enterprise will value. This section helps to differentiate one vendor from another.

Red Hat Linux

In a recent interview, Red Hat CEO Matthew Szulik was asked, "What are the differences [between Novell and Red Hat], and why is Red Hat better?" He responded:

"Red Hat is profitable and Red Hat is a pure-play, whereas Novell is not. Red Hat grew up as an open source company, whereas Novell started as a proprietary software company and spent \$400 million to buy some open source capability. However, just because Novell buys it, doesn't mean it is an OSS company. The development mindset, the business processes, the QA, all the things that Red Hat has built over 11 years, are very different as an OSS company than working in the traditional software development model. Being a proprietary company and then trying to integrate that with a community-based model presents some difficult challenges. Look at Red Hat's gross margins, and look at the economics of the last six quarters. You can start to see Red Hat's model kick in and gain momentum." [Hollands]

In fairness to Novell, it is useful to note that SUSE is really Novell's second open source acquisition. Novell previously acquired Ximian, which supplies one of the predominant Linux desktop distributions. Novell has plans to improve the integration of Ximian with SUSE Linux to provide Novell with a competitive edge in the Linux desktop market segment. Like IBM, Novell appears to have decided the open source market segment will be a lucrative one.

Red Hat has collaborated closely with many industry-leading companies on platform engineering, key application certification, and hardware systems, including:

- BEA
- BMC software
- Dell
- Fujitsu
- Fujitsu Siemens
- Hewlett-Packard
- Hyperion
- IBM
- Oracle
- VERITAS

Red Hat provides a number of value-add products that differentiate and complement their base operating system offering. These include:

- **Red Hat Cluster Suite***: Cluster manager and IP load balancing.
- **Red Hat Developer Suite***: Full featured IDE based on Eclipse.
- **Red Hat Portal Server***: Aggregate local and remote content.
- **Red Hat Content Management System***: Web content management.
- **Red Hat Network***: Management of software updates.

The kernel version released in Red Hat Enterprise Linux 3 is based on the highly stable 2.4.21 kernel with a number of the performance and scalability features of the 2.6 kernel included.

Note that the new 4 GB-4 GB memory split feature, provided for x86* systems in Red Hat Enterprise Linux 3, has not yet been incorporated in the Linux 2.6 kernel, so Red Hat Enterprise Linux 3 supports more physical memory and larger applications than Linux 2.6. (This feature is under consideration for future incorporation in the Linux kernel.)

Table 1. Linux 2.6 and Red Hat Enterprise Linux 3 feature comparison

Feature	Linux 2.6 Kernel	Red Hat Enterprise Linux 3	Provides
Native Posix Thread Library (NPTL)	Yes	Yes	High-performance POSIX compliant multi-threading
Kernel IPsec	Yes	Yes	IPsec layer available for use by kernel modules
Asynchronous I/O (AIO)	Yes	Yes	Improved application performance
O(1) Scheduler	Yes	Yes	Highly scalable SMP scheduler
OProfile	Yes	Yes	CPU hardware-based performance monitoring
Kksymoops	Yes	Yes	Improved kernel bug reporting
Reverse Map Virtual Memory (rmap VM)	Yes	Yes	Performance improvement in memory constrained systems
HugeTLBFS	Yes	Yes	Performance improvement for large virtual memory applications (e.g., databases)
Remap_file_pages	Yes	Yes	Kernel memory optimization for shared memory applications
2.6 Network stack features (IGMPv3, Ipv6, etc.)	Yes	Yes	Improved network performance and messaging
IPvs	Yes	Yes	Network load balancing
Access Control Lists (ACLs)	Yes	Yes	Improved file system security management
4 GB-4 GB memory split	No	Yes	Greatly increased x86 physical memory support and larger application address space
Scheduler support for Hyper-Threaded CPUs	No	Yes	Improved Hyper-Threaded CPU performance (2.6 implementation not yet comparable)
Block I/O (BIO) block layer	Yes	No	Major rewrite of the I/O subsystem (stabilization and driver support in progress)
Support for > 2 TB file system	Yes	No	Support for very large volumes (Red Hat Enterprise Linux 3 supports up to 1 TB)
New I/O elevators	Yes	No	Fine tuning for I/O subsystem performance (stabilization in progress)
Interactive scheduler response tuning	Yes	No	Scheduler improvements for interactive tasks (stabilization in progress)

Novell SUSE Linux Enterprise Server

Through its 2004 acquisition of SUSE, Novell added a wealth of enterprise offerings to the basic SUSE Linux distribution package, including:

- **Novell exteNd***: Comprehensive suite for the rapid development and deployment of service-oriented Web applications.
- **Novell Nsure***: Secure identity management solutions.
- **Identity Manager* 2**: Automates changes to user access rights, passwords, and profiles, streamlining administration and reducing costs.
- **Novell Nterprise***: Products for managing the interaction of people and business systems.
- **Novell Ngage***: A combination of consulting, training, and customer support services.

- **Ximian*** Linux desktop management solutions and open source projects.

- **Novell Certified Linux Engineer*** (CLE) program.

Novell mentions its involvement in extensive global programs through Novell, Ximian, and SUSE relationships with IBM, Dell, Hewlett-Packard, and others.

There are two versions of the Novell SUSE Linux enterprise product:

- Standard Server* 8
- Enterprise Server* 8.

Recently, Novell shipped an updated release, version 9, of Novell Linux Enterprise Server.

Table 2 compares version 8 of the Standard and Enterprise versions of Novell SUSE Linux.

Table 2. Comparison of Novell SUSE Linux Standard Server 8 and SUSE Linux Enterprise Server 8

Features	Novell SUSE Linux Standard Server 8	Novell SUSE Linux Enterprise Server 8
Short description	For small organizations and departments. Handles tasks expected from a server for smaller IT environments including file, print, infrastructure, e-mail, Internet gateway, and application server. Open source technology protects mission-critical data, since Standard Server 8 does not send any data to any software vendors without the user's consent.	For medium-sized and large enterprises. In server clusters, it enables high availability for mission-critical applications (groupware, ERP, databases, e-Business, etc.) and network services (file, print, etc.). Complex server applications are provided with more performance. Available for seven different hardware platforms. Open source technology provides the assurance that no data is sent to any software vendors without the user's consent.
UnitedLinux* technology	Based on UnitedLinux version 1.0 technology	Based on UnitedLinux version 1.0 technology
Maximum number of 32-bit processors per server	2	32
Maximum number of 64-bit processors per server	Not supported	64
Maximum supported RAM (32-bit version)	4 GB	64 GB
Maximum supported RAM (64-bit version)	Not supported	512 TB
LDAP directory service	Yes (optional)	Yes (optional)
Windows/Samba* domain controller	Yes	Yes
Deployment as Windows and UNIX file and print server	Yes	Yes
Integrated e-mail server	Yes	Yes
Deployment as DNS server	Yes	Yes
Deployment as DHCP server	Yes	Yes
Deployment as Internet gateway server	Yes	Yes
Deployment as high availability server	No	Yes
Clustering	No	Yes
Recommended CPU speed	700 MHz	800 MHz
Recommended minimum RAM	256 MB	256 MB
Multiprocessor support	Up to 2	32 (on x86 systems)
Hard disk space required for installation	About 1.0 GB	About 1.2 GB
AMD/Intel® x86 support	Yes	Yes
AMD 64 support	No	Yes
Intel® Itanium® 2 processor support	No	Yes
IBM iSeries* support	No	Yes
IBM pSeries* support	No	Yes
IBM S/390* support	No	Yes
IBM zSeries* support	No	Yes
Installation support		
Fixes	During the entire term of the Novell SUSE Linux Maintenance Program	During the entire term of the Novell SUSE Linux Maintenance Program
Upgrades/updates		
24x7 support	Yes (optional)	Yes (optional)
Individual SLAs	Yes (optional)	Yes (optional)
Training/courses	Yes (optional)	Yes (optional)
Consulting and implementation services	Yes (optional)	Yes (optional)

Enterprise Support Services

For an enterprise to remain successful in today's business environment, a smoothly running, trouble-free computing environment is a necessity. Keeping the computing environment in good health requires a comprehensive support structure staffed with capable personnel. This section takes a look at the support services available for Linux from an enterprise perspective.

Red Hat Support

Red Hat Enterprise Linux has a release cycle specifically designed to provide a stable enterprise platform, with releases on a cycle of approximately 12 to 18 months. This allows application vendors to focus on a common, stable platform and customers to effectively plan their migration and upgrade cycles.

Another enterprise feature is maintaining stable binary (ABI) and programming (API) interfaces over the life of a major release. This ensures that applications do not need to be modified or recertified during the life of the release.

Red Hat Enterprise Linux products are sold with an annual support subscription with varying service levels. Two support upgrades are available for more in-depth technical service:

- Developer support
- Technical account management

Red Hat maintains an SLA page that provides details of its service offerings too numerous to summarize here (<http://www.redhat.com/support/service>).

Novell Support

Novell claims to be the first vendor to support the entire Linux environment from the data center to the desktop. Novell also points out that it is the only \$1 billion software company with a both Linux distribution and the worldwide ecosystem to support it.

Novell recently completed the acquisition of SUSE. While this suggests Novell's focus will shift to a primarily SUSE-centric view of Linux, Novell currently offers enterprise-level support for both Novell SUSE and Red Hat Linux distributions, and the company intends to continue this practice.

Novell's support offering provides 24x7x365 access to Linux experts (<http://support.novell.com>). Additional features include:

- Remote monitoring services
- Managed services
- Proactive health checks
- Preventative maintenance service
- Business continuity services

Further, Novell will support both SUSE and Red Hat Linux as follows:

- **Full support for all Novell services** running on these distributions
- **Support for SUSE Linux and Red Hat Linux**, including such things as training, certification, Novell technical support, and developer support

Both IBM and Hewlett-Packard have been expanding their relationships with Novell since the company acquired SUSE. This is evidenced by both companies now shipping computers with SUSE Linux pre-installed—from the desktop to the data center.

Hewlett-Packard Support

Hewlett-Packard supports a fairly diverse set of Linux distribution vendors. In addition to testing, qualifying, and supporting these open source distributions on industry-leading hardware, Hewlett-Packard also offers a broad range of support services for customers looking for a one-stop Linux company. Support includes:

- Red Hat
- Novell SUSE Linux
- UnitedLinux
- Debian GNU/Linux
- Turbolinux and Mandriva

Hewlett-Packard has developed a set of tools and methodologies that help customers deploy and operate a full suite of Linux-based applications from the workgroup to the data center. These solutions are designed for enterprises and service providers that want the flexibility, control, and value offered by an open source solution.

Business application companies with which Hewlett-Packard has established relationships include:

- BEA
- CollabNet
- Covalent
- Ensim
- JBoss
- Linux International
- Linuxcare
- Lotus
- MSC
- MySQL
- Oracle
- O'Reilly & Associates
- OSDL
- PolyServe
- PTC
- SAP
- Sendmail
- SteelEye
- VERITAS
- VMware

Hewlett-Packard provides “certified and supported” matrices to supply a summary of Linux support on various Hewlett-Packard hardware platforms.

Another product of interest to the enterprise customer is the Hewlett-Packard Serviceguard cluster offering for Linux (<http://h71028.www7.hp.com/enterprise/cache/4183-0-0-0-121.aspx>). Hewlett-Packard Serviceguard for Linux:

- **Can help maximize service uptime**, ensure data integrity, and minimize planned downtime.
- **Includes** heterogeneous cluster management.
- **Is designed**, developed, delivered, and supported by Hewlett-Packard.

Hewlett-Packard Serviceguard for Linux is a high availability solution that brings HP-UX* technologies to the Linux environment, as well as ProLiant* servers and Hewlett-Packard storage, to provide access to applications, information, and services.

Serviceguard on HP-UX customers can use their existing expertise for Linux clusters because both products have the same tools and concepts. The Serviceguard Manager* GUI can monitor and manage both HP-UX and Linux clusters. Both Serviceguard high availability clustering products support the same Hewlett-Packard StorageWorks* disk arrays, enabling seamless multi-OS SAN integration. Serviceguard for Linux software release A.11.15 is supported on Novell SUSE Linux Enterprise Server 8, powered by UnitedLinux 1.0 and Red Hat Enterprise Linux 3.

IBM Support

The IBM Web site (<http://www.ibm.com/linux>) references four distributors:

1. Red Hat Linux
2. Novell SUSE Linux
3. Turbolinux
4. UnitedLinux

Statements made on other IBM Web pages suggest that IBM is willing to support a number of different distributions depending on customer requirements.

A press release about the recent IBM/Red Hat co-operative stated the following:

“Today’s announcement represents an expansion of the existing multiyear agreement that commenced last year. The agreement calls for the two companies to work together to provide broad Linux support, including servers, software, and implementation services, to customers worldwide.” [Red Hat]

UnitedLinux is a consortium that includes IBM, Novell, Turbolinux, and Conectiva, whose goal is a single worldwide Linux distribution marketed under the logo of each member company.

It is clear from its Web site that IBM considers the primary Linux distributors to be Red Hat and Novell. IBM does not provide much detail about support services the company offers. It appears that IBM prefers a prospective customer speak with a sales representative to get information about IBM support services and costs.

Comparisons

This section compares the primary enterprise Linux distributions supplied by Red Hat and Novell with respect to hardware environment, software applications, and strengths and challenges.

Hardware Environment

Since all Linux distributions are derived from a common open source base, hardware support will be somewhat similar for a given kernel revision. Exceptions will usually occur with distributions supplied by hardware vendors that are pushing the envelope. An example would be SGI, whose Altix* 3000 servers support up to 256 Intel® Itanium® 2 processors.

Another area where exceptions may occur is hardware driver support for vendor-specific options. For example, NVIDIA supplies proprietary drivers for Linux that support its video hardware. Major hardware vendors often include drivers and support software tailored to the hardware they sell that is not part of a general distribution, although most hardware vendors contribute their driver code to the open source tree.

It is well known that a 32-bit processor can directly address a maximum of 4 GB of physical memory. Memory paging techniques such as Intel's physical address extensions (PAE) do provide 32-bit systems with the ability to address greater amounts of physical memory, but at a cost in processor and memory operational overhead lost to management of the extensions.

It is recommended that in deployments where the applications will benefit from access to physical memory in excess of 4 GB, the enterprise choose a 64-bit version of Linux that runs on 32-bit platforms employing processors with 64-bit extensions or on 64-bit platforms employing true 64-bit processors.

Table 3 shows Red Hat AS3 Linux hardware features with Novell SUSE Linux support added where it could be determined. If the enterprise has special requirements that fall outside the range of support indicated, additional research is advised because it is possible those requirements may be met by a vendor such as SGI.

When evaluating desktop distributions, it is advisable to carefully research the list of supported hardware provided by the distribution vendor. A number of desktop distributions are focused on a fairly small subset of the available

Table 3. Red Hat AS3 and SUSE Enterprise 8 feature comparison

Distribution	Red Hat AS3 Linux (Minimum/Maximum)	Novell SUSE Enterprise 8 Linux (Minimum/Maximum)
Memory	256 MB / 64 GB	256 MB / 64 GB
CPUs	1 / 16	1 / 32
Network interface cards (NICs)	0 / 30	NA
IDE disks	0 / 20	NA
SCSI disks	0 / 256	NA
SATA disks	0 / 2	NA
RAID/MD dev	0 / 27	NA
Block dev size	0 / 1 TB	NA
File system size	800 MB / 1 TB	NA
NFS mounts	0 / 800	NA
Graphics heads	0 / 2	NA
Cluster nodes	2 / 8	NA
Processes	1 / 32000	NA
File Systems	Ext3	Ext3, XFS

hardware. An example would be Linspire¹, whose primary focus is supporting the hardware made by Microtel that is sold through Wal-Mart and other mass marketing outlets.

Software Applications

This section provides an overview of the third-party software applications available for Red Hat and Novell SUSE Linux. It looks in detail at three vendors—Veritas, Oracle, and BEA Systems—that are very likely to appear in the enterprise.

For more information, see the list of Red Hat certified vendors on the Red Hat Web site (http://www.redhat.com/apps/isv_catalog/browse_by_vendor.html).

Oracle

Oracle's Linux commitment began in 1999 with the first commercial database on Linux. Today, Oracle is the only major software vendor to collaborate with and provide first-line support for Red Hat Linux and Novell SUSE Linux, and all Oracle products are available on Linux. The following distributions are certified and supported by Oracle:

- Red Hat Enterprise Linux AS and ES
- Novell SUSE Linux SLES8 and future versions

¹ As the result of a legal settlement, the formerly known company, Lindows, is now known as Linspire (www.linspire.com).

Oracle has indicated it will continue to provide customer support for UnitedLinux 1.0 throughout its life cycle, on all the existing Oracle products that are already supported on UnitedLinux. The products supported by Oracle as part of UnitedLinux, include:

- **Conectiva Linux Enterprise Edition*** powered by UnitedLinux
- **Novell SUSE Linux Enterprise Server 8 (SLES 8)** powered by UnitedLinux
- **TurboLinux Enterprise Server* 8** powered by UnitedLinux
- **Red Flag DC Server*** (China only)
- **Miracle Linux Standard Edition*** (Japan only)

Up-to-date information on platforms Oracle supports is available from <http://www.oracle.com/technology/support/metalink/index.html>.

Oracle applications compatible with Red Hat Linux include:

- **Oracle Database 10g***: This is the first database designed for enterprise grid computing and a flexible and cost-effective way to manage enterprise data. In addition to quality and performance enhancements, Oracle Database 10g can reduce the cost of managing the IT environment with a simplified install, reduced configuration and management requirements, and automatic performance diagnosis and SQL tuning. For more information, visit http://www.redhat.com/apps/isv_catalog/AppProfile.htm?application_data_id=1412.
- **Oracle9i* Database with Real Application Clusters:** This features full XML database functionality with Oracle XML Database enhancements to Oracle Real Application Clusters, and self-tuning and self-management capabilities to help improve DBA productivity and efficiency. In addition, the built-in OLAP functionality has been expanded and significant enhancements and optimizations have been made for the Linux operating system. For more information, visit http://www.redhat.com/apps/isv_catalog/AppProfile.html?application_data_id=744.

BEA Systems

BEA Systems applications compatible with Red Hat Linux include:

- **BEA Tuxedo* 8.1:** This is a platform for simplifying distributed transaction processing and message-based application development while delivering scalability and standards-based interoperability. For more information, visit http://www.redhat.com/apps/isv_catalog/AppProfile.html?application_data_id=1576.
- **BEA WebLogic* Integration* 8.1:** This applies a standards-based approach to connecting existing IT solutions to produce a set of shared business services. By delivering these services independently of the underlying infrastructure, IT organizations can facilitate information access via real-world applications to employees, customers, third-party companies, and constituents. For more information, visit http://www.redhat.com/apps/isv_catalog/AppProfile.html?application_data_id=1577.
- **BEA WebLogic Platform* 8.1:** This enables IT to evolve application infrastructure on a project basis, creating overall faster time-to-value. For more information, visit http://www.redhat.com/apps/isv_catalog/AppProfile.html?application_data_id=1559.
- **BEA WebLogic Portal* 8.1:** This simplifies the production and management of custom-fit portals. For more information, visit http://www.redhat.com/apps/isv_catalog/AppProfile.html?application_data_id=1560.
- **BEA WebLogic Server* 8.1:** This provides an application infrastructure for developing, integrating, securing, and managing distributed, service-oriented applications. For more information, visit http://www.redhat.com/apps/isv_catalog/AppProfile.html?application_data_id=1561.

BEA Systems applications compatible with Novell SUSE Linux include:

- **WebLogic Enterprise Security***: This is an application security infrastructure solution that simplifies the process of securing applications across the enterprise. By replacing redundant silos of application security with a consistent, service-oriented approach, WebLogic Enterprise Security enables security services such as authentication, identity

assertion, credential mapping, dynamic role mapping, authorization, and auditing to be leveraged by applications across a heterogeneous enterprise. For more information, visit <http://dev2dev.bea.com/products/wlsecurity/index.jsp>.

- **WebLogic Integration:** With a service-oriented methodology, WebLogic Integration applies a standards-based approach to connecting existing IT solutions to produce a set of shared business services. By delivering these services independently of the underlying infrastructure, IT organizations can facilitate information access via real-world applications to employees, customers, partners, and constituents. For more information, visit <http://www.bea.com/framework.jsp?CNT=index.htm&FP=/content/products/integrate>.
- **WebLogic JRockit*:** BEA JRockit is a high-performance Java* Virtual Machine (JVM) optimized to run on Intel® platforms. For more information, visit <http://www.bea.com/framework.jsp?CNT=index.htm&FP=/content/products/jrockit>.

- **WebLogic Platform:** Accelerates the service-driven enterprise by enabling IT to simplify and unify its development and integration assets. This platform can accelerate the ability of enterprises to evolve into a shared services environment and deliver faster time-to-value for competitive advantage. For more information, visit <http://www.bea.com/framework.jsp?CNT=index.htm&FP=/content/products/platform>
- **WebLogic Server:** This standards-based application server offers comprehensive features, compliance with open standards, a multi-tiered architecture, and support for component-based development, providing the underlying core functionality necessary for developing and deploying business-driven applications. For more information, visit <http://dev2dev.bea.com/products/wlserver81/index.jsp>.

Table 4 gives a quick view into of some of the applications available to satisfy certain functions on Red Hat and Novell SUSE Linux. This is not a complete list.

Table 4. Applications available for Red Hat and Novell SUE Linux

Applications	Red Hat Linux	Novell SUSE Enterprise 8.0	Description
Database			
Oracle	X	X	Database
DB2*	X	X	Database server available from IBM
Informix	X	X	Database
Sybase	X	X	Database server available from Sybase
MySQL*	X	X	Database
PostgreSQL*	X	X	Database
Application Servers			
BEA WebLogic*	X	X	Java application server available from BEA
IBM WebSphere*	X	X	Java application server available from IBM IBM WebSphere application server
Web Server			
Apache Web Server*	X	X	Web server
Tux Server*	X		Web server
WebSphere	X	X	Web and application available from IBM
Zeus	X	X	Web server available from Zeus
Apache SSL*	X	X	Secure Web server
Mail Server			
Sendmail	X	X	Standard e-mail server
Lotus Domino*	X	X	E-mail server available from IBM
QMail	X		E-mail server
Filesystems and Directory Services			
NFS	X	X	Linux/UNIX distributed file sharing
VERITAS Journaled F/S	X	X	Journaling filesystem available from VERITAS
Samba	X	X	Windows/Linux file sharing

Table 4. (continued)

Applications	Red Hat Linux	Novell SUSE Enterprise 8.0	Description
OpenLDAP	X	X	Directory server
VERITAS Volume Manager	X	X	Logical volume manager from VERITAS
ext3	X	X	Journaling filesystem
JFS	X	X	Journaling filesystem from IBM
XFS	X	X	Journaling filesystem from SGI
ReiserFS	X	X	Journaling filesystem
Networking			
DNS	X	X	Name server
TCP/IP	X	X	Network protocol
Management and Monitoring			
BMC PATROL*	X	X	Monitoring tools
Tivoli Suite	X	X	Tool suite
SNMP	X	X	Management comm. protocol
RPM	X		Software package dist tool
Storage and Storage Management			
VERITAS Dual MultiPath	X	X	Storage interconnect
EMC Symmetrix	X	X	Storage subsystem
High Availability Software			
VERITAS Cluster Server	X	X	Cluster server available from VERITAS
Legato Cluster	X	X	Cluster server
Backup			
ADSM	X	X	Backup tool
Legato Networker	X	X	Backup tool
VERITAS NetBackup	X	X	NetBackup software by VERITAS for low-impact backup and recovery of files
BRU Pro	X	X	Backup tool
QuickStart	X	X	Backup tool
Arkeia	X	X	Backup tool
NovaNET	X	X	Tape backup software for Linux networks
Amanda	X	X	Backup tool
PerfectBACKUP	X		Backup tool
CA UniCenter	X	X	Backup tool
Job Schedulers			
LSF	X	X	Scheduling tool
Security			
SSH	X	X	Secure comm. protocol
Sudo	X	X	Secure comm. protocol
Kerberos	X	X	Secure auth. protocol
OpenSSL	X	X	Secure comm. protocol
Development Environment			
gcc	X	X	Compiler
gdb	X	X	IDE tool
make	X	X	IDE tool
glibc	X	X	Library
CVS	X	X	Source mgmt tool
Perl	X	X	Script language
Tomcat	X	X	IDE
Intel® C Compilers	X	X	Compiler

Strengths and Challenges

The Gartner analysts' article about the ever increasing number of deployments of Linux in the enterprise provides some insights into strengths and challenges for the primary enterprise Linux distribution suppliers. [Weiss]

Red Hat Linux

Strengths

- IS organization and vendor acceptance
- OSS community standing
- Investment backing and cash
- Large U.S. market segment share
- Multiple architecture support

Challenges

- Pricing
- Organizational scaling and response
- European acceptance and channels
- Countering Novell's software strengths

Novell SUSE Linux

Strengths

- Novell value proposition
- Multiple architecture support
- Technical skills
- Contract negotiations
- Channel members

Challenges

- Improve U.S. penetration
- ISV support
- Channel training
- Positioning (e.g., vs. Microsoft)
- OSS relationship

Desktop Linux

Linux has consistently accounted for between two and three percent of the desktop market segment in recent years, about the same as the Macintosh OS. Lately, industry watchers have begun predicting that a surge in Linux use on the desktop is just around the corner.

Desktop Linux in the Mainstream?

Desktop Linux is finally reaching mainstream visibility. *eWeek* Linux and Open-Source Center Editor Steven J. Vaughan-Nichols agrees, noting:

“I realize I was wrong when I said recently that 2004 wouldn't be the year of the Linux desktop. With prices, Windows virus problems and the rapid advance of the Linux desktop, this will be Linux's year.” [Vaughan-Nichols]

One pillar of support for this view is the fact that a number of large corporations have begun investigating alternatives to a Microsoft desktop solution in response to the recent outbreak of virus and worm attacks—such as MyDoom, Blaster, and SoBig—that disabled many corporate servers and desktops worldwide. CIOs recognize the significant cost of downtime in their computing infrastructure and are demanding an alternative solution they can potentially deploy to mitigate the risk of further outages.

Another factor is the recent introduction of business Linux desktop offerings by the dominant enterprise Linux distribution vendors, notably Red Hat, Novell, and Sun. Combined with steady improvements in usability, features, and hardware support, the Linux market segment share could reach 10 percent of all desktop PCs by the end of the decade. Red Hat's CEO Matthew Szulik said in a recent interview:

“What we're focused on for the next 12 to 18 months is doing a great job in the enterprise, the government and academic marketplaces [with our desktop offering].” [Sharma]

While each of the market segment verticals Red Hat is targeting for desktop Linux has its own reasons for looking seriously at Linux, reduced cost and reduced vulnerability to virus and worm attacks are common to all.

The major U.S. players currently eyeing the desktop Linux market segment are proceeding cautiously. IBM, Sun, and Red Hat believe desktop Linux is most appropriate in an environment where the computer user is performing a

defined set of tasks, such as a call center desktop, a point of sale device, or an engineering workstation.

A recent article in *eWeek* announced that IBM, Intel, and Cadence Design Systems have embarked on a project to introduce a workstation-class Linux laptop based on IBM's new T42 Thinkpad*. Rob Enderle, principal analyst for the Enderle Group, writes:

“With the workstation class of laptops carrying strong margins, the companies hope their Linux-based IBM T42 Series laptop on steroids will appeal to the engineering community”. [Enderle]

Hewlett-Packard, Sun, Dell, and others also lust after this workstation market segment, so this initiative is likely to result in the introduction of additional Linux-based desktop product offerings.

Considerations

There are a number of concepts to consider while trying to determine if, when, and how to introduce desktop Linux in the enterprise. Presented here are a couple of interesting ideas to stimulate discussion.

Enterprise Desktops

Enterprise desktops can be categorized in two classes:

- **General-purpose desktops:** Support typical office workers in their day-to-day activities.
- **Mission-specific desktops:** Support users with more bounded, specialized functional requirements such as engineering workstations or call center desktops.

Mission-specific desktops are usually found where the computer user is performing a bounded, defined set of tasks, such as:

- A call center desktop
- A point of sale device
- An engineering workstation

Many IT professionals believe this is the area where Linux should be introduced into the enterprise, primarily because having a controlled set of applications that have to be migrated and verified helps simplify the challenge and mitigate risk.

Regulations—including the Sarbanes-Oxley Act, the Health Insurance Portability and Accountability Act, Basel II, the EU Data Protection Directive, and many others—make it more important than ever for enterprises to track, manage, and secure their data. In many enterprises, much vital corporate data is stored on

remote desktops and laptops that may not be managed under a comprehensive backup policy. One strategy enterprises are evaluating for solving this problem is the use of thin clients, where vital corporate data is stored on central servers.

Another strategy where thin clients appear to be desirable is the mission-specific desktop space, where enterprises with large numbers of desktops to manage believe the thin client model will simplify the process of deploying patches and updates and other management chores. Another benefit is tighter control over individual desktop configurations, promoting greater uniformity across the desktop population.

There are some drawbacks to the thin client model. One is the need to provide network bandwidth and central server capacity sized to permit the boot process to complete within an acceptable timeframe given a number of thin clients booting simultaneously. Another drawback is the requirement for enterprise storage space to store boot images and miscellaneous, non-critical overhead such as user-specific data and desktop-specific configuration settings.

A solution to address these drawbacks is Linux Live CDs. Live CDs are a complete, functional, bootable Linux environment, with applications, burned on a CD. One of the original motivations for this concept was to provide demo CDs that could run on just about any PC that supports booting from a CD. During initialization, the boot process configures Linux based on the hardware discovered on the PC. If the application requires local disk storage, it is a simple matter to create a local RAM disk to accommodate the need.

The development and use of Live CD distributions is a rapidly expanding subculture within the Linux community. Some of the uses for a Live CD include:

- **Booting a clean environment** for troubleshooting a problem PC.
- **Using a Live CD with specialized security tools** to perform forensics on a target machine.
- **Providing a portable computing environment** tailored to specific requirements.
- **Booting a working Linux environment** on a PC with no local hard drive or access to NAS.

The flexibility of a Live CD, coupled with a USB keychain storage device, provides an elegant solution to the primary drawbacks of the thin client model. A Live CD provides a single, tightly controlled, mission-specific application environment that will boot on a numerous hardware

platforms. There is no need to maintain a separate image for each hardware platform and combination of accessories.

This built-in support for a broad spectrum of hardware provides the enterprise with greatly increased flexibility for defining supported desktop hardware configurations. Another benefit of Live CDs is that the content is inherently more secure. The CDs are not writeable, so there is no possibility of unauthorized modification of the images. The ability to boot locally at the desktop eliminates the need for network bandwidth to support boot time overhead and space on enterprise storage for boot images. The Live CD model does add a certain amount of latency for deploying updates and patches over the traditional thin client model for burning and distributing the CDs, but it is much improved over the updates per desktop model.

Issuing a USB keychain storage device to each employee—and using that USB storage device for user-specific variable data—eliminates the need to store and manage the data on centralized enterprise storage. It also provides the same flexibility for the employee as the centralized model. With the USB storage device, the employee's personalized environment is portable. Employees can use any of the desktop workstations by simply inserting their USB storage device and logging in.

Live CD Distributions

- **Knoppix** (<http://www.knoppix.org>)
- **Knoppix STD** (<http://www.knoppix-std.org>)
- **PHLAK** (<http://www.phlak.org>)
- **Linux Bootable Business Card** (<http://www.lnx-bbc.org>)
- **Morphix** (<http://www.morphix.org>)

The applications that employees use to perform their daily chores are what really make the general-purpose business desktop useful in the enterprise. Of all applications running on an enterprise desktop, the office productivity package is by far the most ubiquitous. For the enterprise considering deploying a Linux desktop in a general-purpose role, compatibility of data formats for the office productivity applications across the enterprise is a primary requirement.

If the enterprise wishes to support a mix of Linux and Windows desktops, the ability to read and write Microsoft Office* data formats is a necessity. One way to achieve this is to use Crossover Office* from CodeWeavers (<http://www.codeweavers.com>), a commercial package built on the open source WINE project, which emulates the Windows execution environment under Linux. With Crossover Office, a

Microsoft Office XP* distribution CD can be installed on a Linux desktop. The result is a desktop running Linux that can also run the Microsoft Office applications.

One drawback to this scenario is that support for the latest Microsoft Office package lags behind its release. For example, Microsoft is currently shipping Office 2003. The latest version supported by Crossover Office is Office 2000. Another drawback is that this solution does not eliminate the cost of a license for the Office software.

Another approach to providing data interchange capability involves deploying native Linux tools that provide nearly equivalent functionality to Microsoft Office with the ability to read and write Microsoft Office file formats. Perhaps the leading project that provides this sort of functionality is OpenOffice.org, a free office productivity suite compatible with all major office productivity suites and available for any Linux distribution.

At the Novell-sponsored Brainshare 2004 developer conference, Chris Stone, Vice Chairman, Office of the CEO of Novell, announced that Novell has begun the process of migrating all its desktop systems to OpenOffice.org with a full move to Linux targeted for 2005. [LinuxForYou] This suggests a migration strategy useful for any organization interested in moving to open source on the desktop, since OpenOffice.org will run under Windows and Linux, providing a manageable transition path. Novell's efforts follow those of Oracle, which has switched its 9,000-person, in-house programming staff to Linux.

Ed Benincasa, Director of MIS at FN Manufacturing, said recently, "We're actively working on an OpenOffice.org rollout, and that's something that a few years back wasn't even an option." [Coffee] The rollout was initiated based on the results of a comparison, highlighted in the next section, between Office 2003 and OpenOffice.org as competing upgrade paths from FN Manufacturing's existing Office 97 and Office 2000 installed base.

In April 2004, *eWeek* published the results of a user-based comparison study performed under real-world conditions at precision machining manufacturer FN Manufacturing Inc. in Columbia, SC. The study also included the participation of employees of Duke Energy Corporation based in Charlotte, NC. The purpose of the evaluation was to determine what training issues and costs organizations would likely experience during the transition from Microsoft's older Office suite to either Office 2003 or OpenOffice.org. Microsoft has discontinued distribution of new licenses for Office 2000 and Office 97, which FN Manufacturing currently uses, prompting the company's interest in the study.

OpenOffice.Org 1.1.1

Strengths

- No licensing costs: As a free software project, OpenOffice.org has no licensing.
- Good integration among suite applications: eValuation testers appreciated being able to create new spreadsheet documents from within the word processor application.
- Variety of export options: OpenOffice.org ships with PDF export capabilities, as well as support for saving presentations in Flash format.

Challenges

- File-format compatibility issues: Although OpenOffice.org does a good job of handling Microsoft Office file formats, small formatting inconsistencies require reworking of complex documents.
- Lack of traditional support: Office suites typically do not require much vendor support, but the fact that OpenOffice.org is an open source project means that software support must come from the community, generally spread out across various websites and newsgroups.
- Interface differences: OpenOffice.org is similar to Microsoft Office in its design, but not identical. Users will need some time to grow accustomed to differences between the two.

Office 2003

Strengths

- Familiarity: Most knowledge workers use some version of Microsoft Office already, and an upgrade to a new version of Office presents the flattest learning curve.
- File-format compatibility: Microsoft Office file formats are de facto standards, and no rival suite handles these proprietary formats as well as Office does.
- Advanced features: Office 2003 has more features and capabilities than competing suites. Although many users do not require or use much of this functionality, advanced users, particularly of spreadsheets, often find it vital.

Challenges

- High licensing costs: Microsoft Office licenses cost a few hundred dollars each. This cost can be difficult to justify when your users require only basic productivity suite functionality.
- Advanced features require latest versions: Some of the most compelling features added to the last two versions of Office—such as extensible smart tags, document protection, and Smart Document creation—are not backward-compatible with earlier versions of the suite.

A Look at Desktop Distributions

This section provides an introduction to some of today's high-visibility desktop distributions. The market segment focus and support model for each varies across a wide spectrum; however, any one of these distributions could be a viable choice for enterprise desktop deployment.

Novell SUSE Linux Desktop

Novell Linux Desktop (NLD), originally announced in March 2004 with the current version 9 leased in November 2004, is based on Novell's SUSE Linux Enterprise Server. Nat Friedman, Novell's vice president of Linux desktop engineering, stated in an interview with *eWeek*:

“So, we are essentially taking the best of all three companies: strength from SUSE in terms of multiplatform support and enterprise-hardened Linux distributions; our expertise and usability and innovation and interoperability on the desktop from Ximian; and Novell's strength as a billion-dollar-revenue company with an enormous channel and very powerful reach and great product quality and support.” [Francis]

Novell SUSE Linux Desktop Features

- Operating system for PCs and notebooks
- Data exchange with Palm
- No client access license costs for mail access to SUSE Linux Openexchange Server, or SUSE Linux Enterprise Server
- Optimized for cooperation and communication with mainframes and application servers
- OpenOffice.org and Sun StarOffice*
- CodeWeavers Crossover Office to run Windows applications, like Microsoft Office XP* and Adobe Photoshop* 7 under Linux
- SAP client, Windows 2000 terminal client, x3270 and x5250 terminal emulators, etc.
- KDE desktop security system (Kiosk)
- Automated installation and remote administration via YaST Online Update (YOU)

Red Hat Desktop

Designed for secure, managed clients, Red Hat Desktop is the newest member of the Red Hat Enterprise Linux family. Announced in May 2004, it provides a high-quality, full-featured client system that is suitable for use in a wide range of desktop deployments. Hewlett-Packard spokeswoman Elizabeth Phillips says:

“A key component of Hewlett-Packard’s Linux strategy is to provide its customers choice, and Red Hat’s initiative to support Linux on the desktop aligns with that vision.” [Coffee]

While primarily focused on enterprise and commercial market segments, Red Hat Desktop has features and stability that also make it attractive for use in small and medium business environments. Available configurations include Red Hat Network Proxy or Satellite Server, ensuring the complete deployment delivers the highest levels of manageability and security. Red Hat Desktop supports single-CPU systems with up to 4 GB of main memory.

Red Hat Desktop Features

- **Mail:** Evolution* is a sophisticated mail client that supports IMAP and POP3 mail servers and provides a look and feel that is familiar to Microsoft Outlook* users.
- **Document processing:** OpenOffice.org* 1.1 is a comprehensive Office Suite, providing a fully integrated set of applications for preparing documents, spreadsheets, and presentations. It provides exceptional compatibility with Microsoft Office file formats, allowing easy sharing of files.
- **Browsing: Mozilla*** is a feature-rich, high-performance Web browser.
- **Instant messaging:** GAIM
- **Professional-quality fonts:** Agfa Monotype
- **Integrated third-party applications,** including Adobe Acrobat Reader* and plug-in, Macromedia Flash* plug-in, Java (IBM and BEA) and plugin (IBM), Citrix ICA Client*, and Real Player*.

Sun Java Desktop System

If an organization uses Sun’s other enterprise products, especially if the company runs a lot of Java programs, then it might consider this version of Linux. It is somewhat expensive and, as the newcomer to this group, still has limited hardware support and some bugs to work out.

Sun Java Desktop System Features

- Not built on Java, but has an emphasis on Java Tools
- Enterprise focus
- Available in seven different languages
- Includes StarOffice, GNOME*, Evolution, and Mozilla
- Built on Novell SUSE Linux
- To be sold pre-installed on Wal-Mart PCs made by Microtel

Mandriva*

Mandriva* is a popular choice among the more technical desktop user community. Programmers and software engineers like the multitude of configuration options. In March 2004, Hewlett-Packard announced two desktop models, the dx2000* and cd5000, with Mandriva Linux installed.

Mandriva Features

- Extensive installation routine for advanced computer users, drive partitioning, etc.
- Available in several languages
- Mandriva Linux requires little maintenance as its software management system automatically handles dependency issues and avoids conflicts between applications
- Mandriva Linux PowerPack* contains more than 2,300 high-quality applications, including a complete Office suite of programs
- Mandriva provides an on-line certified hardware compatibility database.

Mandriva has several differences with other Linux operating systems including:

- **A graphical installation process** recognized by many as the best available enables Mandriva Linux to offer the most advanced and efficient hardware detection.
- **A graphical approach to system administration,** in addition to the command line, makes Mandriva Linux the operating system that takes integration and management of a user interface the furthest to dispel the image of a Linux system managed only via command line or text mode.

- **Friendly, integrated environments:** Perfect integration of user-friendly graphical environments such as KDE and GNOME provide comfort and ease-of-use.
- **Several pre-configured security levels:** A user can choose a desired degree of security specifically for their computer.
- **Centralized configuration system:** With the Mandriva Control Center*, a user can resort to a single panel to administer the entire system.

Lindows Linspire*

Lindows, Inc., the makers of Linspire*, focuses exclusively on Linux for desktop and laptop use. The company's exclusive attention to the desktop really shows in the polish and stability of this operating system. Linspire is the best choice for companies looking for a desktop Linux that is extremely easy to install and use, yet packed with features just for desktop/laptop users. An employee familiar with Microsoft Windows will feel right at home using Linspire.

Lindows Linspire Features

- No Linux knowledge or experience needed to install or use
- Pioneered Linux-based PCs at Wal-Mart
- Familiar look that will feel comfortable for Microsoft Windows users on the surface supported by full-powered Debian Linux "under the hood"
- Exclusive CNR (click-n-run) Technology makes installing, updating, and managing Linux software one-click easy
- Lsongs* supports a variety of MP3 players, including Dell DJ*
- Digital photo import, viewing, management, and sharing with Lphoto*
- Ximian Connector: The Evolution Connector adds support for Microsoft Exchange 2000 and 2003 to the Evolution groupware suite
- Offers built-in virus protection and Web filtering
- Comes with a complete Microsoft Office file-compatible office suite
- Specialized laptop edition available for advanced power management and wireless fidelity (Wi-Fi)
- Developer edition for Linux experts who are looking for a polished desktop Linux

In an inspired application of Live CD technology, Linspire has introduced a new product it calls the Lindows WebStation*. The selling price for this hardware package lowers the bar for entry for cost-conscious consumers. The \$169 product is available from <http://www.idotpc.com>.

Turbolinux 10 Desktop* (10D)

Turbolinux Desktop* includes many enhancements and tools designed to make the migration from Windows to Linux easy and comfortable, such as built-in functionality to co-exist in Windows networks.

Turbolinux 10 Desktop Features

- Windows familiarity and compatibility
- A user-friendly, unified look and feel that resembles Windows and includes My Computer, My Documents, Windows Network (My Network), and simple menus
- Click on "My Computer" to easily access files on the local hard drive, CD-ROM, floppy disk, attached devices, or other networked machines
- Access USB flashes memory or IEEE 1394 (FireWire*) removable media via Dynaplug*, functionality developed exclusively by Turbolinux
- Embedded bitmap fonts are more visible, especially for users with LCD displays (laptop users)
- Easily access and use files on Windows and Turbolinux systems
- Share Windows files similar to the way "My Network" functions within Windows
- Support for file names containing spaces (i.e., "My File")
- Modify and save files created in Windows
- Drag-and-drop support
- Ability to auto-mount Windows 95, 98, 2000, and XP in a single PC
- Read Windows files within 10D's "My Computer" window
- Easy data migration of Windows mail and IE's favorites to Turbolinux 10 Desktop

Turbolinux recently announced an updated version of 10 Desktop, known as 10 F..., that extends functionality to support a variety of streaming video, audio, and multimedia content delivered over broadband. This is the first Linux distribution company to work with CyberLink to offer PowerDVD* for Linux. Support for playing Windows Media* content is also provided through Turbo Media Player*, an open-source-based media player. Support is provided for Windows Media Video 9* and all other versions of Windows Media Audio except for Windows Media Audio Pro*. Turbolinux is the first distribution to license the official Microsoft WMF* codecs.

Xandros

Xandros Desktop OS* version 3 is a beautiful distribution with its own look that many like better than Microsoft XP. Xandros' file manager is thought to be one of the very best Linux file managers. The deluxe edition of Xandros, a consumer product, includes Codeweavers' Crossover Office and Crossover Plugin, two programs well worth having.

Xandros Business Desktop OS* 2.5 is an alternative to Windows desktops. Built on a solid Debian/GNU Linux foundation, the Xandros Business Desktop OS is engineered from the ground up to integrate seamlessly with existing enterprise environments, where security, compatibility, and ease of use are essential requirements.

Xandros Desktop OS Features

- Windows 2000 Active Directory server and Windows NT PDC authentication
- Sun StarOffice 7 with commercial support from Sun
- Drag-and-drop CD burning in Xandros File Manager*
- Run Microsoft Office and other key Windows programs
- Seamlessly share files on Windows networks
- Thin clients and terminal emulation
- Athlon* 64 (32-bit mode), SMP, and Hyper-Threading support

To reduce the management cost of deploying and updating large numbers of desktops, Xandros has recently introduced version 1 of the Xandros Desktop Management Server* The product enables administrators to easily set up their software repositories and deploy customized Xandros Desktop configurations to various organizational units using a graphical interface that eliminates command line complexities. xDMS is bundled with the Business Edition of Xandros Desktop OS.

ELX

Everyone's Linux (<http://www.elxlinux.com>) is an India-based company that supplies commercial Linux desktop distributions. ELX has two desktop offerings, Power Desktop* and Biz Desktop*.

ELX Biz Desktop is thought to be more tightly integrated than any other Linux desktop distribution. ELX organizes applications in what it calls "launch pads." These launch pads group applications by function. Biz Desktop, geared towards business, has only two launch pads. One launch pad is a "favorite's launch pad," where the users simply put their favorite applications and the second is a control panel.

ELX Power Desktop is Linux for power users. Power Desktop integrates a comprehensive list of applications including server components, while preserving the ease of a desktop operating system.

ELX has implemented the Microsoft Windows Mind Map* on its Linux desktop. If the user wants to change the screen resolution, they right click on the desktop just as they would with Microsoft Windows. If the user wants to zip and e-mail a file, the user right clicks on that folder and the menu provides an option to zip and e-mail. For someone who is used to using Microsoft Windows, using ELX Linux will be very easy.

Another major strength for ELX Linux is that it tightly integrates Webmin onto the desktop. This allows an administrator to access every desktop from anywhere on the network. ELX Linux is strongly based on Red Hat, so it is easy to migrate just about any application or driver onto ELX.

MEPIS* Linux

MEPIS* Linux is a Debian-based desktop Linux distribution created by Warren Woodford in response to his frustration with the quality of existing Linux desktop offerings, circa 2003. Woodford stated:

“I decided to take matters into my own hands and create the kind of desktop Linux that I needed as a successor to the promise of NeXT and as a foundation for my larger vision of a computing environment that is incredibly easy to use and that facilitates collaboration, publishing, communication, and community by and for all people.” [Vaughan-Nichols]

Lycoris

Lycoris is actually a type of flower. The company name was originally Redmond Linux, but was changed to something with more potent marketing potential. Picked by Time magazine as “one to watch,” Lycoris has enjoyed much success on a modest budget. Lycoris is sold as a shrink-wrap package at CompUSA and is available pre-installed on low-cost PCs at Wal-Mart.

For business desktops, Lycoris offers Interconnect*, which combines the ease of use of Desktop/LX with its ProductivityPak* office suite and Ericom Software's PowerTerm* terminal emulator for legacy connectivity. Lycoris marketing guru Jason Spisiak said in a recent interview:

“File formats are a big thing that we try to offer compatibility for depending on the task at hand. For intense office compatibility, our ProductivityPak lets you read and write .doc, .xls, and .ppt. But it doesn't save to those formats by default since we try to emphasize open standards. We also allow Desktop/LX users to their share files with Windows workstations, so it works both ways. Desktop/LX also plays nice with Windows installations already on the same PC. Users can read and write to Windows95/98/ME and read from 2000/XP partitions and they automatically show up in 'My Linux System' for point and click access. Printing on a network works both ways as well. Desktop/LX prints to shared Windows printers and you can share your printer with Windows machines from Desktop/LX. We also include an RDP client that will display Windows Terminal Server sessions on Desktop/LX. It's a Windows world, so part of our success has been how Desktop/LX gets along with that world.” [Ederle]

Moving Your Enterprise to Linux

Today, making the move to Linux can be well worth the cost as long as your enterprise follows a clear process to decide which version offers the best possible combination of features, support, and cost.

To learn more about how to migrate your enterprise to Linux, contact Intel® Solution Services, Intel Corporation's worldwide professional services organization. Intel Solution Services helps enterprise companies capitalize on the full value of Intel® architecture through consulting focused on architecture transitions.

Backed by the largest silicon manufacturing company and one of the largest e-Business corporations in the world, Intel Solution Services uses its foremost expertise in Intel architecture and next-generation technologies, as well as its relationships with key industry alliances, to design cost-effective, leading-edge solutions that help deliver superior business results.

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For More Information

- DesktopLinux.com (<http://www.desktoplinux.com>): The latest news and announcements about Linux on the desktop.
- DistroWatch.com (<http://www.distrowatch.com>): Compares features and versions of Linux.
- Intel Solution Services (<http://www.intel.com/cd/services/intelsolutionservices/asm-na/eng/index.htm>): Intel Corporation's worldwide professional services organization, helping companies capitalize on the full value of Intel® architecture through consulting focused on architecture transitions.
- Linux Compatible (<http://www.linuxcompatible.org>): Linux news, discussion forums, and download links.
- LWN.net (lwn.net): A subscriber-supported publication covering the Linux and free software communities.
- Novell Partner Product Guide (http://www.suse.com/us/business/certifications/certified_software/applications/index.html): Allows you to search for products specifically designed to work with Novell SUSE Linux.
- Novell SUSE Enterprise Server 8 Datasheet (http://www.novell.com/products/linuxenterpriseserver8/sles_datasheet.pdf): Technical information on Novell SUSE Enterprise Server 8.
- Red Hat Linux Enterprise (<http://www.redhat.com/software/rhel/>): A broad range of information about the platform.
- Red Hat Certified Vendors (http://www.redhat.com/apps/isv_catalog/browse_by_vendor.html): Sources for third-party software compatible with Red Hat Linux Enterprise.

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As senior technical architect for Intel® Solution Services, Harold Read helps to accelerate clients' deployment of solutions based on leading Intel architectures and technologies by providing professional services. Harold works with other Intel Solution Services team members, fellow travelers, and clients to define, plan, design, and deploy solutions based on Intel architecture. He represents Intel with clients and contributes to content development for the division's practice kits. Harold's responsibilities focus primarily on UNIX/Linux projects, with a secondary focus on Microsoft projects. As a member of the Application Platform and Migration Practice, he participates in engagements with the Distributed Solutions and Advanced Data Center practices.

With more than 20 years of industry experience, Harold joined Intel from Digital Equipment Corporation/Compaq where he was a principal engineer. As an operating system software developer, Harold specialized in device drivers and clustering, networking, and disk mirroring software. As a system architect, he worked with Fortune 500 enterprise customers to design, deploy, and support business-critical computing solutions. Earlier, Harold was a product manager for Sudbury Systems, where he completed the design, development, QA, beta testing, and production roll-out of a centralized digital dictation system integrated with a paperless medical office system.

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Nishi has more than nine years of experience in software design, programming, and database applications. She joined Intel from DaimlerChrysler where she was a senior specialist, serving as technical lead for creating a device transmittal database that enables engineers from both DaimlerChrysler and its suppliers to work together to create and maintain a vehicle electrical engineering system design. She has demonstrated skills in database development using Oracle and Microsoft Access*. Previously, Nishi worked for EDS as part of the Unigraphics software development team, writing software in C/C++ that helped mechanical design engineers create the outer body panels of car bodies.

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