This webinar reviews an education session presented at GEAPS Exchange 2017
The Industrial Internet of Things
Industrial Internet of Things

“The Internet of Things is ground zero for a new phase of global transformation powered by technology innovation, generating significant economic opportunities and reshaping industries.”

Marc Benioff, Chairman and Chief Executive Officer, Salesforce.com, USA
Industrial Internet of Things

- Industrial Internet (of Things), is the latest wave of technological change that will bring unprecedented opportunities, along with new risks, to business and society.

- It will combine the global reach of the Internet with a new ability to directly control the physical world, including the machines, factories and infrastructure that define the modern landscape.
Industrial Internet of Things

By 2020, there will be 50 billion devices connected to the internet.

- **2005**: 500 million
- **2010**: 12.5 billion
- **2015**: 25 billion
- **2020**: 50 billion

People on Earth:
- **2005**: 6.3 billion
- **2010**: 6.8 billion
- **2015**: 7.2 billion
- **2020**: 7.6 billion

Source: Cisco IBSG
Industrial Internet of Things

FROM INDUSTRY 1.0 TO INDUSTRY 4.0

FIRST
Industrial Revolution
Through the introduction of mechanical production facilities with the help of water and steam power
First mechanical loom, 1784

SECOND
Industrial Revolution
Through the introduction of a division of labor and mass production with the help of electrical energy
First assembly line, Cincinnati slaughter houses, 1870

THIRD
Industrial Revolution
Through the use of electronic and IT systems that further automate production
First programmable logic controller (PLC), Modicon 084, 1969

FOURTH
Industrial Revolution
Today
Through the use of cyber-physical systems

DEGREE OF COMPLEXITY

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Industrial Internet of Things

Figure 1: The adoption and impact path of the Industrial Internet

1. Operational Efficiency
   - Asset utilization
   - Operational cost reduction
   - Worker productivity

2. New Products & Services
   - Pay-per-use
   - Software-based services
   - Data monetization

3. Outcome Economy
   - Pay-per-outcome
   - New connected ecosystems
   - Platform-enabled marketplace

4. Autonomous, Pull Economy
   - Continuous demand-sensing
   - End-to-end automation
   - Resource optimization & waste reduction
Industrial Internet of Things

• Like the Internet was in the late 1990s, the Industrial Internet is currently in its early stages.

• Many important questions remain, including how it will impact existing industries, value chains, business models and workforces.

• In addition, what actions business and government leaders need to take now to ensure long-term success.
Industrial Internet of Things

In the coming years, 40% of total data created will be from sensors.

This includes sensors in iPhones, cars, and other household objects, but it also includes large-scale and multi-million dollar industrial machines like power grids, airplanes, and oil extraction.

Source: Gartner
Opportunities & Benefits
Opportunities & Benefits

• Massive volumes of data from connected products, and the increased ability to make automated decisions and take actions in real time.

• Vastly improved operational efficiency (e.g., improved uptime, asset utilization) through predictive maintenance and remote management.

• The emergence of an outcome economy, fueled by software-driven services; innovations in hardware; and the increased visibility into products, processes, customers and partners.
Opportunities & Benefits

• New connected ecosystems, coalescing around software platforms that blur traditional industry boundaries.

• Collaboration between humans and machines, which will result in unprecedented levels of productivity and more engaging work experiences.
Opportunities & Benefits

- Optimize asset utilization
  - Extremely Important: 16%
  - Very Important: 43%
  - Important: 36%
  - Somewhat Important: 4%
  - Not Important: 1%

- Reduce operational cost
  - Extremely Important: 16%
  - Very Important: 45%
  - Important: 36%
  - Somewhat Important: 3%
  - Not Important: 0%

- Improve worker productivity
  - Extremely Important: 22%
  - Very Important: 54%
  - Important: 20%
  - Somewhat Important: 16%
  - Not Important: 0%

- Enhance worker safety
  - Extremely Important: 28%
  - Very Important: 28%
  - Important: 16%
  - Somewhat Important: 0%
  - Not Important: 1%

- Create new revenue streams through new products and services
  - Extremely Important: 25%
  - Very Important: 34%
  - Important: 26%
  - Somewhat Important: 0%
  - Not Important: 3%

- Improve sustainability
  - Extremely Important: 30%
  - Very Important: 42%
  - Important: 25%
  - Somewhat Important: 0%
  - Not Important: 3%

- Enhance customer experience
  - Extremely Important: 10%
  - Very Important: 45%
  - Important: 26%
  - Somewhat Important: 0%
  - Not Important: 0%
IIOT & How to use it?

USE CASE 1: Managing Recipe Variation

Let's bring the framework to life with some examples. Brewing beer is a touchy process that must balance the relationships between live cultures, bacteria, time, ambient and equipment temperatures, ingredients, equipment, elevation, and much more. The inherent variation can cause quality issues.

One of the largest craft brewers in the US recently implemented machine learning (ML), artificial intelligence (AI) and historical process data to solve a batching problem that was causing a major quality issue and the loss of entire batches.

The brewmasters thought the problem was the relationship between pressure and temperature; instead it was an issue with the timing of batch processes determined by natural variances in yeast. They used ML/AI to build a model to alter the recipe and optimize batches on previously unknown relationships. By establishing a new process, the brewer eliminated lost batches associated with this quality issue and recaptured two weeks of extra capacity per lost batch.

TAKEAWAY:
The brewmasters applied Quality 4.0 analytics to traditional data and processes to drive quality improvement and new competencies.
IIOT & Analytics

**Analytics Framework**

- **Descriptive**: What happened
- **Diagnostic**: Why it happened
- **Predictive**: What will happen
- **Prescriptive**: What action to take

37% of companies say POOR METRICS is a top roadblock to accomplishing quality objectives.
IIOT & Big Data

Within this mountain of data, some of it is useful, the rest is noise.

Software that creates useful insight from this overwhelming amount of information is extremely valuable.
IIOT & Big Data
Risks & Challenges
Risks & Challenges

• Security and data privacy, which are already rising in importance given the increased vulnerabilities to attacks, espionage and data breaches driven by increased connectivity and data sharing.

• Another crucial barrier is the lack of interoperability among existing systems, which will significantly increase complexity and cost in Industrial Internet deployments. Today’s operational technology systems work largely in silos.
Risks & Challenges

• Uncertain return on investments on new technologies, immature or untested technologies.

• Lack of data governance rules across geographic boundaries and a shortage of digital talent.

• Overcoming these challenges will require leadership, investment and collaborative actions among key stakeholders.
Risks & Challenges

Q: What are the greatest barriers inhibiting business from adopting the industrial Internet?

- Lack of interoperability or standards: Overall 65%, North America (n=43) 60%, Europe (n=30) 67%
- Security concerns: Overall 64%, North America (n=43) 64%, Europe (n=30) 72%
- Uncertain ROI (e.g., insufficient business cases): Overall 53%, North America (n=43) 53%, Europe (n=30) 50%
- Legacy equipment (e.g., no connectivity or embedded sensors): Overall 38%, North America (n=43) 47%, Europe (n=30) 33%
- Technology immaturity (e.g., large-scale analytics): Overall 24%, North America (n=43) 27%, Europe (n=30) 21%
- Privacy concerns: Overall 19%, North America (n=43) 20%, Europe (n=30) 14%
- Lack of skilled workers (e.g., data scientists): Overall 15%, North America (n=43) 20%, Europe (n=30) 12%
- Societal concerns (e.g., economic dislocation): Overall 3%, North America (n=43) 5%, Europe (n=30) 3%

Source: World Economic Forum Industrial Internet Survey, 2014
Risks & Challenges

Q: How likely are the following risks or negative consequences associated with the Industrial Internet?

- Security vulnerabilities due to connectivity to the global network: 41% Extremely Likely, 25% Somewhat Likely, 23% Likely, 15% Very Likely, 10% Not Likely
- Disruptions in business model or disintermediation: 35% Extremely Likely, 36% Somewhat Likely, 27% Likely, 9% Very Likely, 2% Not Likely
- Privacy breaches due to increasing availability of personal data: 36% Extremely Likely, 32% Somewhat Likely, 20% Likely, 7% Very Likely, 1% Not Likely
- Job losses and social dislocation due to increasing automation: 22% Extremely Likely, 39% Somewhat Likely, 30% Likely, 13% Very Likely, 2% Not Likely
- System breakdowns due to complexity while human life is at stake: 22% Extremely Likely, 39% Somewhat Likely, 25% Likely, 11% Very Likely, 2% Not Likely
Three Important Actions

Q: What are the three most important actions the IT industry (e.g., hardware, software and service providers) can take to help accelerate the adoption of the Industrial Internet?

- Develop a common approach to address security concerns
  - Overall: 75%
  - North America (n=43): 77%
  - Europe (n=30): 77%
- Converge on standards to support better interoperability
  - Overall: 73%
  - North America (n=43): 70%
  - Europe (n=30): 77%
- Collaborate on creating technology testbeds (i.e., experimentation platforms for testing how technologies may work together)
  - Overall: 57%
  - North America (n=43): 58%
  - Europe (n=30): 63%
- Advocate/influence public policies
  - Overall: 25%
  - North America (n=43): 23%
  - Europe (n=30): 20%
- Build "killer apps"
  - Overall: 22%
  - North America (n=43): 13%
  - Europe (n=30): 28%
- Bring to market better big data platforms
  - Overall: 15%
  - North America (n=43): 12%
  - Europe (n=30): 20%
- Develop better sensors and actuators
  - Overall: 7%
  - North America (n=43): 7%
  - Europe (n=30): 7%

Source: World Economic Forum Industrial Internet Survey, 2014
IIOT Project Framework

Impact on Business, Economy and Future of Work
- What new business models, industry ecosystems and overall economic growth will the industrial Internet create?
- How will the increasing automation transform the future job market and skillsets required to succeed in the new economy?
- How can businesses and governments best deal with the near- and intermediate-term transitions?

Key Opportunities & Disruptions

Key Enablers
- Cloud
- Ubiquitous Connectivity
- Embedded Sensors
- Real-time Analytics
- Maturing Software Industry
- Investments by big IT firms

Key Inhibitors
- Security
- Legacy OT & Infrastructure
- Interoperability
- Privacy
- New Investment
- Perceived Risks

Industrial Internet

Recommended Areas for Action
What are appropriate public policies to accelerate the development and adoption of the Industrial Internet across multiple industries, e.g., energy, manufacturing, healthcare, transportation and public sectors?
Manufacturers looking to improve quality should assess where they stand on each of the 11 axes of Quality 4.0, and prioritize investments. Given the state of the market, it is likely that many companies will need to make investments first in traditional quality, before they can fully leverage Quality 4.0. There are clearly interrelationships among the axes, and adding new capabilities to certain axes enables new applications on other axes.
Examples of where IIOT can be applied
Examples of where IIOT can be applied
Questions?
Thank you for your time and attention

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