LEVERAGING ANALYTICS FROM THE INDUSTRIAL INTERNET OF THINGS (IIoT) TO MAXIMIZE PRODUCTION AND MAINTAIN REGULATORY COMPLIANCE

Joe Whyte
ISPE Product Show
Track 1, Session 4
September 26, 2018

Title: Leveraging Analytics from the Industrial Internet of Things (IIoT) to maximize production and maintain Regulatory Compliance

Agenda:

- IoT – What is it & why do we care?
- IoT in Manufacturing & the Connected Supply Chain
- End-to-End Digital Supply Chains - Stakeholder Benefits
- Digital Supply Chains – What are the challenges?
- 4 Considerations for a Connected Digital Supply Chain

The Industrial Internet of Things

INTELLIGENT ASSETS

50 Billion devices are forecasted to be installed in industrial applications by 2020
Source: Gartner

48 Percent of installed industrial devices do not use an Industrial Protocol.
Source: IHS

84% Of **Executives** believe Internet of Things (IoT) will create new income streams for their operations

IoT will deliver:
87% long-term JOB growth
57% long-term REVENUE growth

46% saw improving productivity as the key benefit of IoT

61%

Executives cited **digital initiatives as a tool for growth,** compared to 31% in 2014.

Leaders understand IoT?
38% fully understand it
57% some understanding
4% little at all

ONLY 7% have developed a comprehensive strategy

SOURCE: Accenture CEO Briefing and The Economist Intelligent Unit

What is Disruptive Technology?

Something NEW which DISPLACES existing technology and substantially CHANGES an existing industry or CREATES a new one.

The term was coined by HBS Professor Clayton Christensen in his 1997 best selling book "The Innovator's Dilemma".

Historic Examples:

- The automobile revolutionized the personal transportation industry
- The digital camera changed the way photographers create, manipulate & share images
- The iPhone changed human behavior and how we communicate

Why do we Care?

If I had asked people what they wanted, they would have said “faster horses”.

- Henry Ford

Disruptive innovation can hurt if you are not the one doing the disrupting.

-Clayton Christensen

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The Industrial IoT at Work for Manufacturing

Contextualizing and analyzing data

Smart devices create more **'things'** to be analyzed

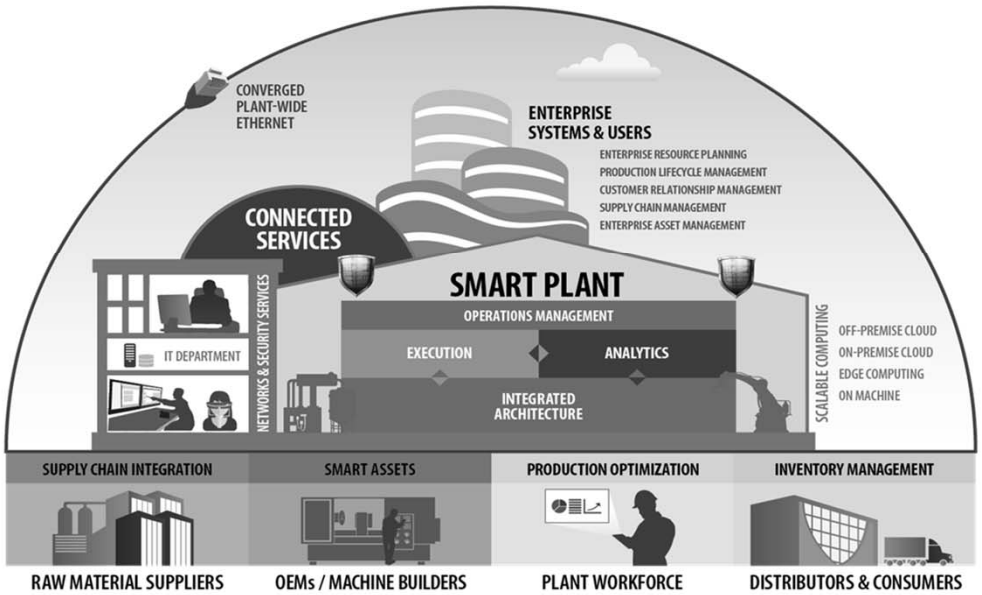
Reliability, support, and disaster recovery

Shift from CapEx to **Flexible & Scalable** OpEx

Access to actionable information

Workforce is **Mobile** during typical work day

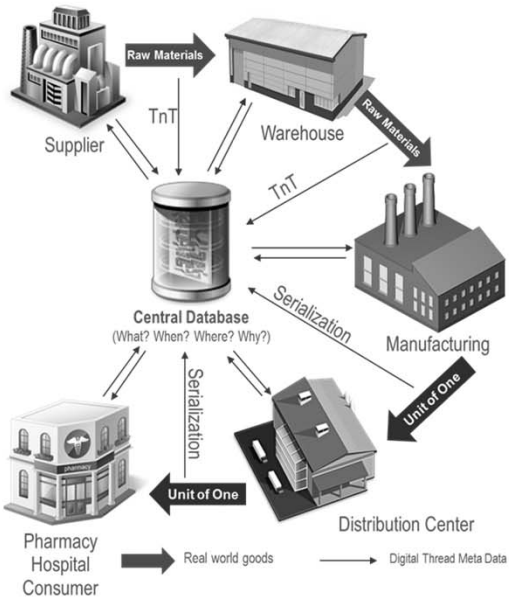
The Connected Supply Chain



Pharmaceutical Digital Supply Chain Objective - Personalized Healthcare

1. Horizontally and vertically integrated End-to-End supply chain digital threads
2. Secure Global Multi-Stakeholder Collaboration Environment
3. Integrated & Interoperable Vendor Agnostic IoT Data Fabric and Analytics

"ACHIEVING THE TRANSFORMATIVE POTENTIAL FROM DIGITAL MANUFACTURING REQUIRES INFORMATION SYSTEMS THAT ARE OPEN, INTEROPERABLE AND USER-FRIENDLY."
Source: "Digitizing the value chain" McKinsey Quarterly, March 2015



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Benefits of Horizontally & Vertically Integrated Supply Chain Digital Threads

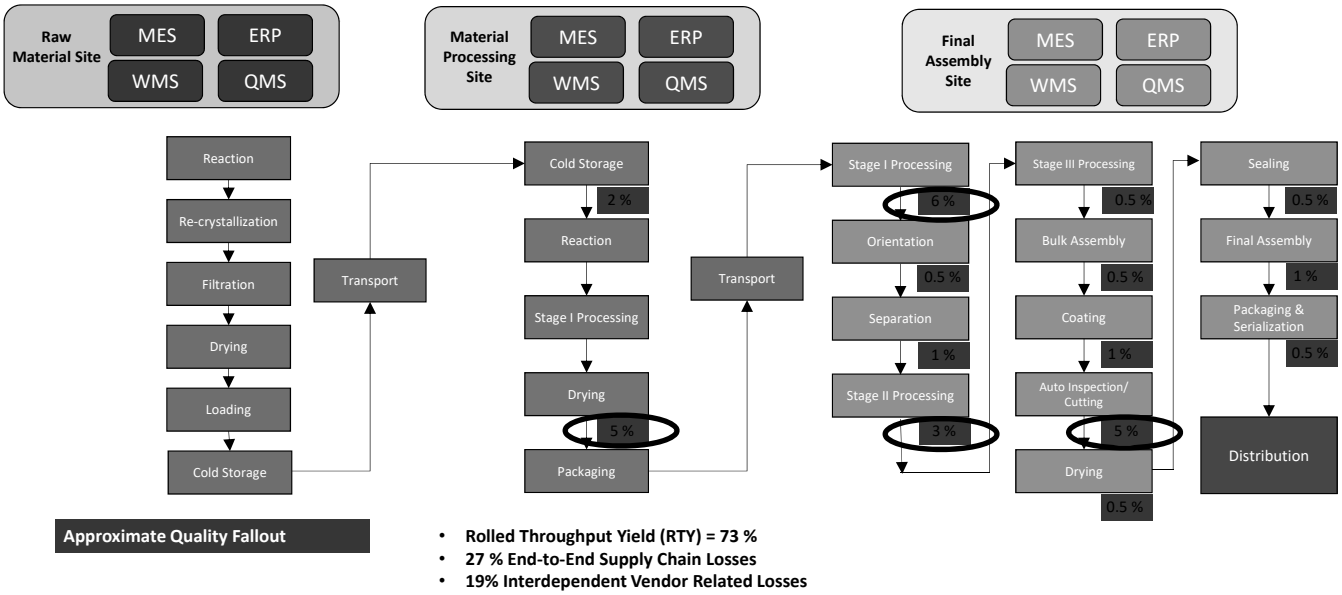
Vertical Digital Threads In Manufacturing Sites (L0 – L4)

- Genealogy Track & Trace of Product Movement & Product Specific Production Data
- Data Driven Asset Utilization, Line Optimization, Productivity & Quality
- Real time visibility to key Manufacturing Data
- OT Data Analysis, Machine Learning, AI & Prediction
- Real time data analysis for root cause production & quality issue identification

Horizontal End-to-End Supply Chain Digital Threads Between Key Stakeholders

- Visibility to key external supply chain production data
- Serialization & Product Traceability
- Integration of Industrial IoT Data for all supply chain Stakeholders
- Real time analysis to enable root cause supply chain issue identification
- Data Driven Supply Chain Optimization
  - Data Security, Data Integrity, Data Ownership

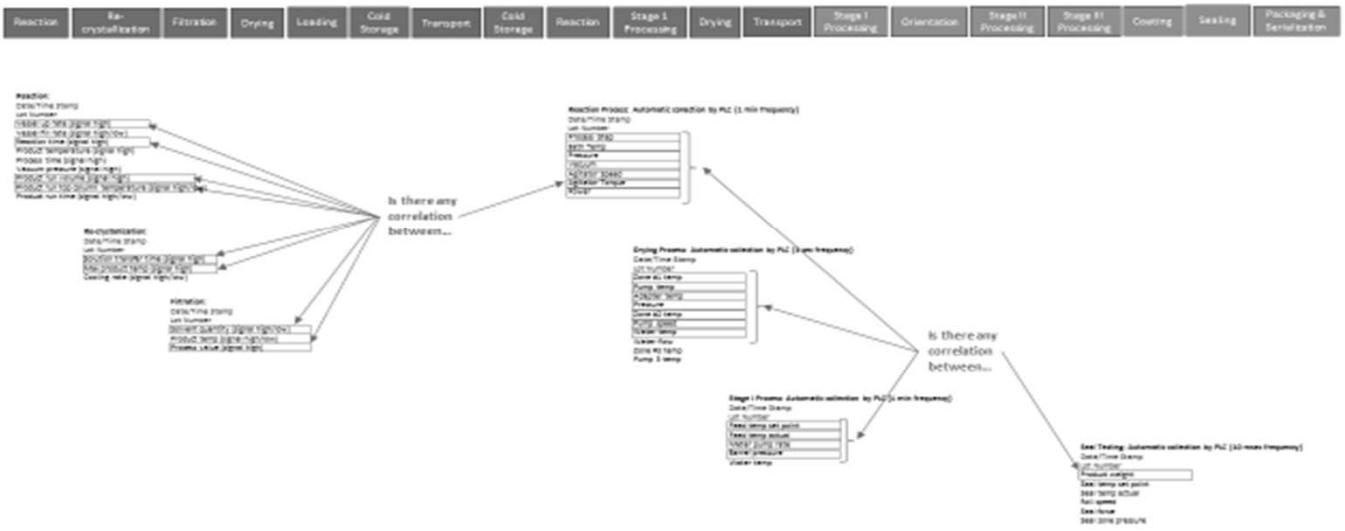
Supply Chain Dependencies

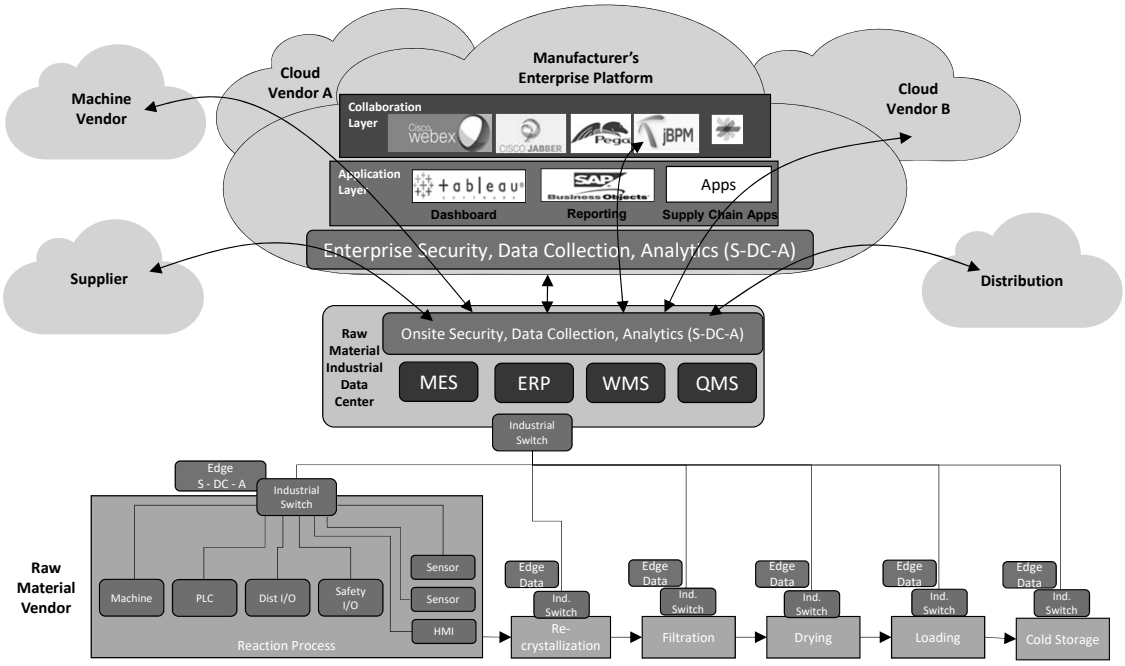


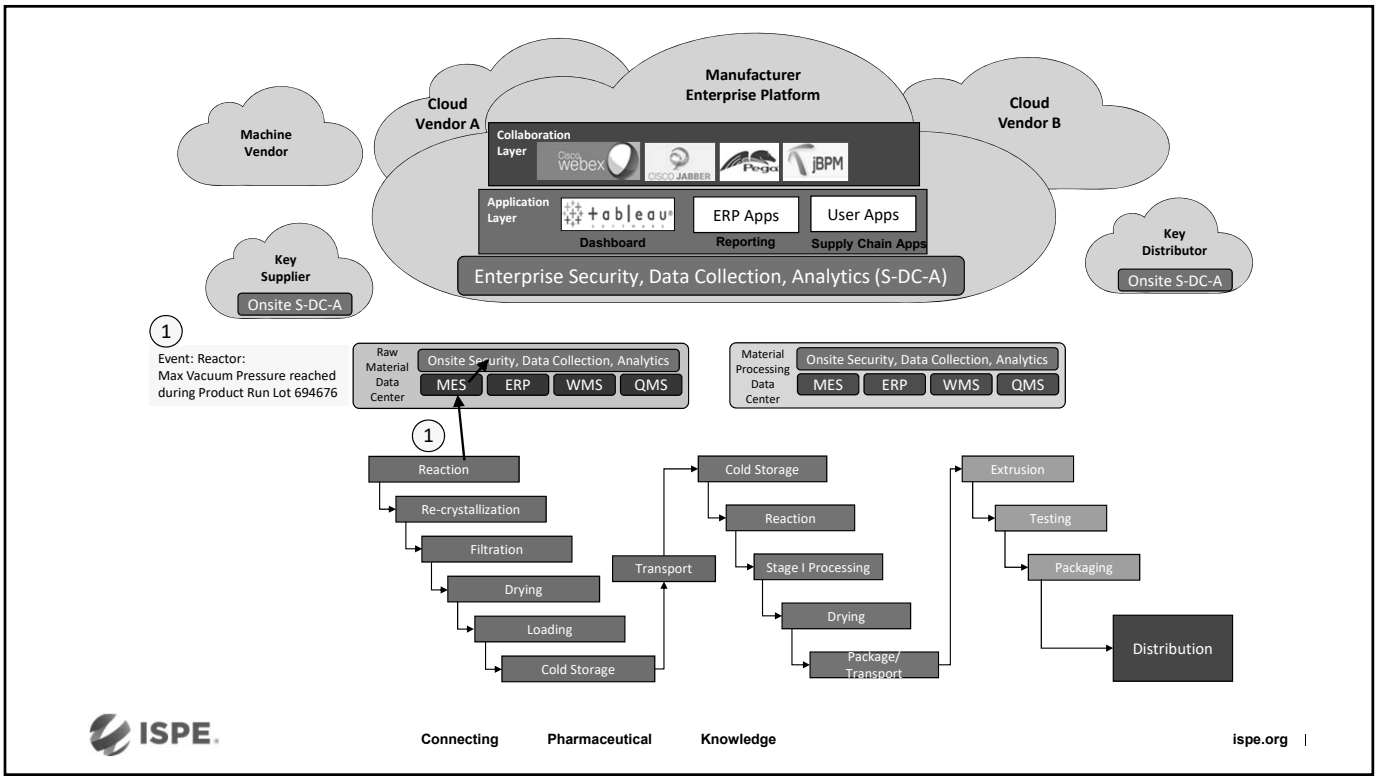
Approximate Quality Fallout

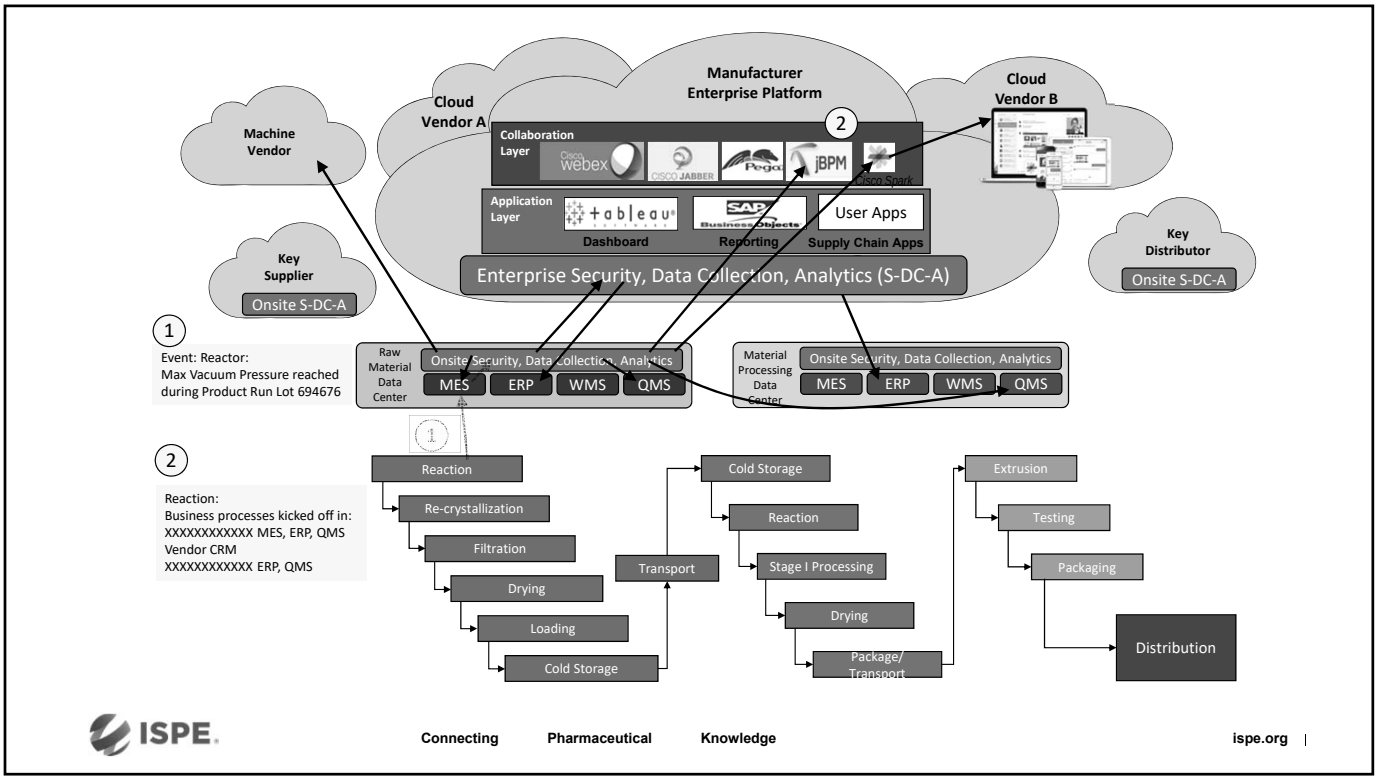
- **Rolled Throughput Yield (RTY) = 73 %**
- **27 % End-to-End Supply Chain Losses**
- **19% Interdependent Vendor Related Losses**

Manufacturing Data Elements






Manufacturer Enterprise Platform
Cloud Vendor A
Cloud Vendor B
Machine Vendor
Collaboration Layer
webex
CISCO JABBER
Pega
jBPM
Application Layer
tableau
ERP Apps
User Apps
Dashboard
Reporting
Supply Chain Apps
Enterprise Security, Data Collection, Analytics (S-DC-A)
Key Supplier
Onsite S-DC-A
Key Distributor
Onsite S-DC-A
1
Event: Reactor:
Max Vacuum Pressure reached during Product Run Lot 694676
Raw Material Data Center
Onsite Security, Data Collection, Analytics
MES
ERP
WMS
QMS
Material Processing Data Center
Onsite Security, Data Collection, Analytics
MES
ERP
WMS
QMS
1
Reaction
Re-crystallization
Filtration
Drying
Loading
Cold Storage
Transport
Cold Storage
Reaction
Stage I Processing
Drying
Package/ Transport
Extrusion
Testing
Packaging
Distribution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Material Processing Data Center
Onsite Security, Data Collection, Analytics
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ERP
WMS
QMS
2
Reaction:
Business processes kicked off in:
XXXXXXXXXXX MES, ERP, QMS
Vendor CRM
XXXXXXXXXXX ERP, QMS
Reaction
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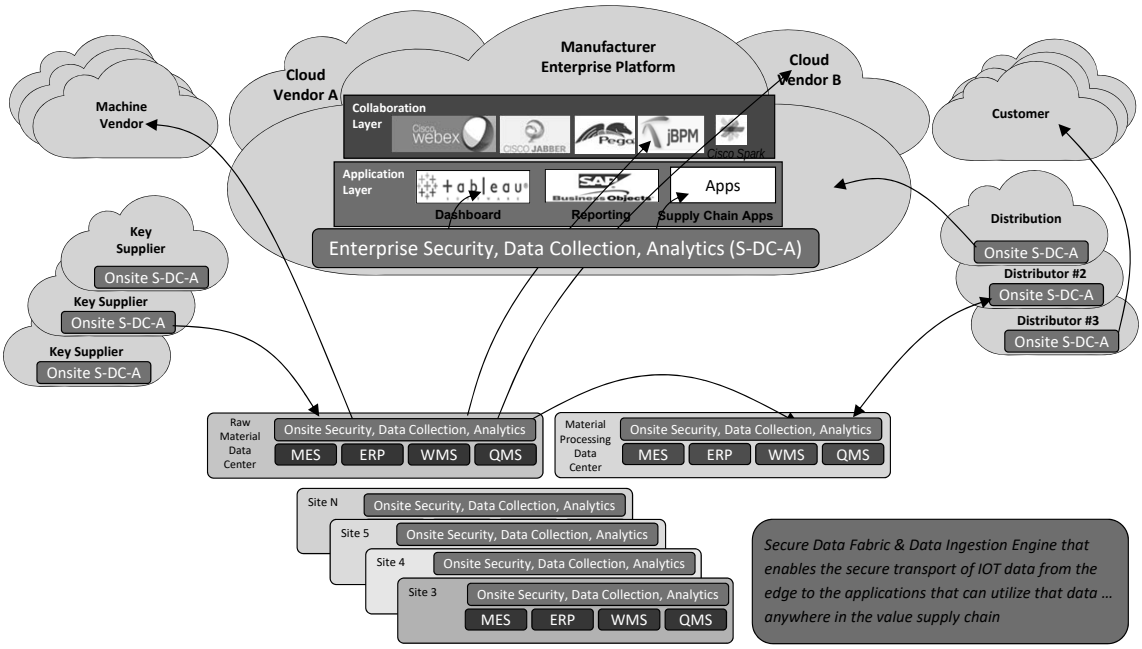

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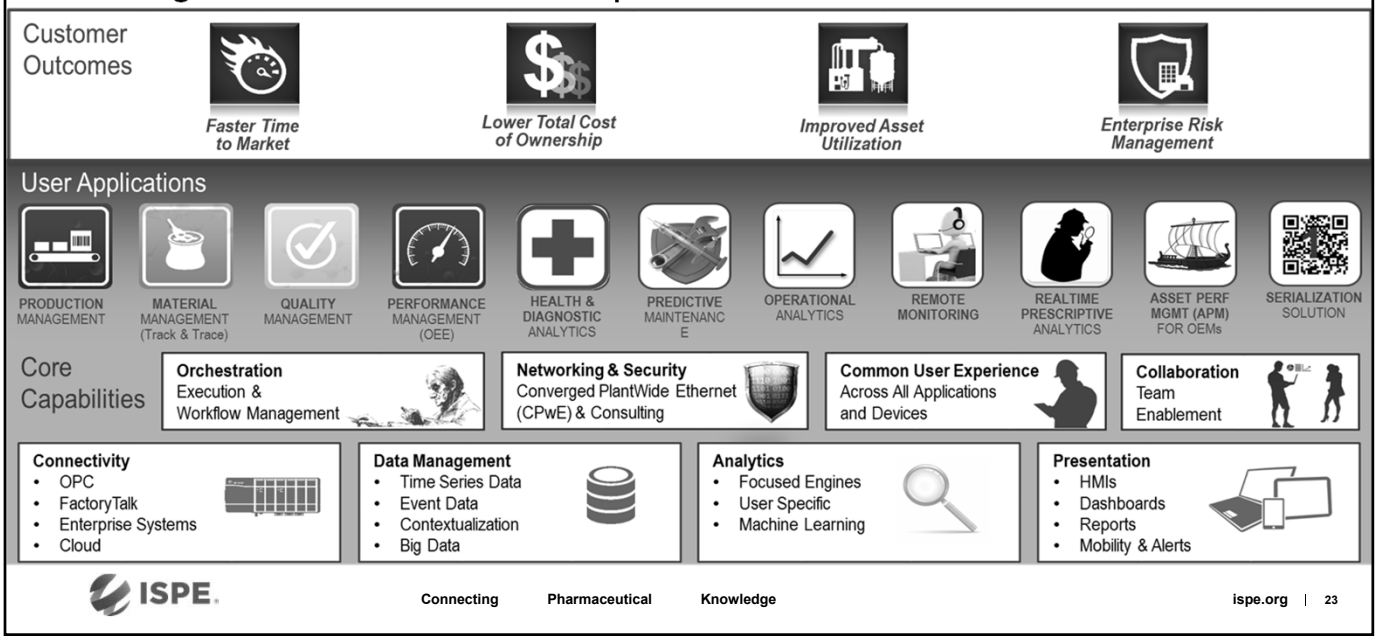
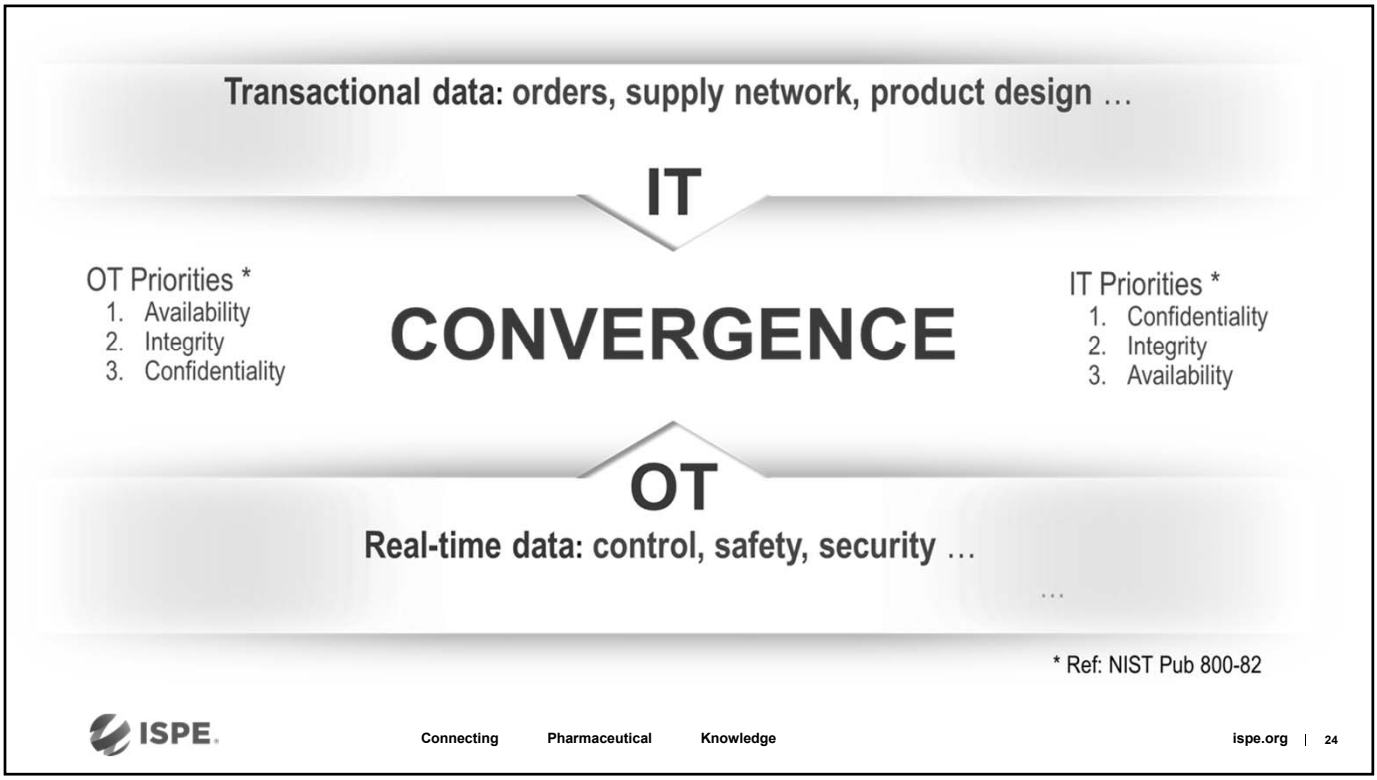
Digital Operations
Enabling The Connected Enterprise





IoT Maturity Model

Where Are You?

Level 1
Unconnected

Level 2
Get Connected

Connect to Assets

- Reactive Support
- Troubleshooting
- Fix
- Maintain

Level 3
Get Informed

Collect Information

- Contextualize Data
- Make Smarter Decisions
- Become Proactive
- Decrease Cost
- Increase Productivity

Level 4
Get Ahead

Optimize

- Centralize Information
- Layer Data Sources
- Supply Chain Integration
- Reduce Risk
- Transform your Business

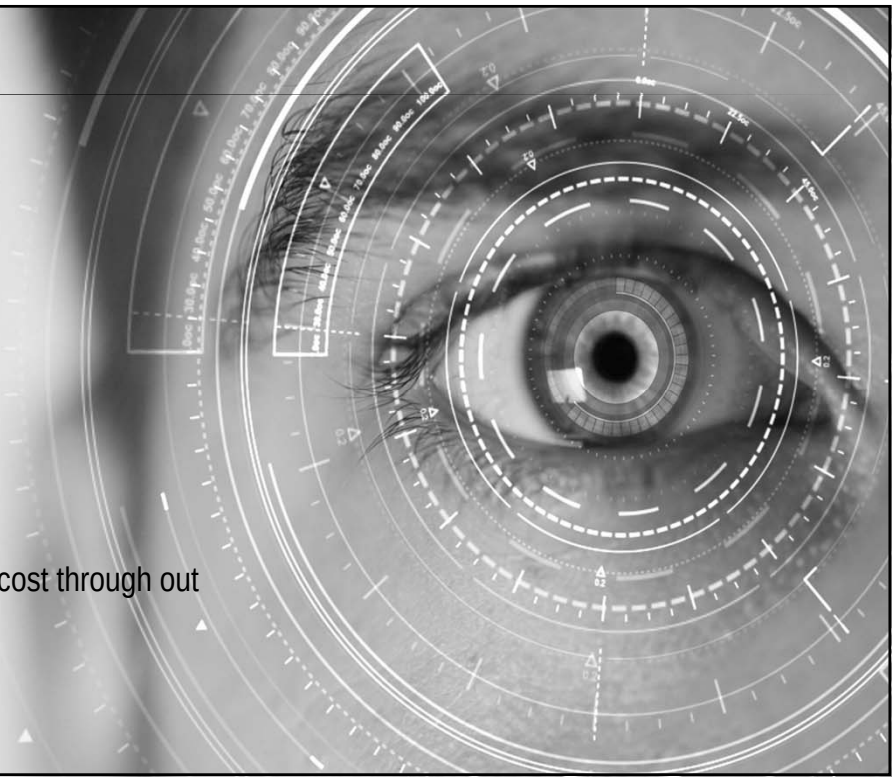
CYBER SECURITY

54%

SUFFERED A LOSS OF IP

IN THE PAST YEAR

SOURCE: Kaspersky (2017)



Near a Billion dollars in fiscal impact

- Wanna Cry May 2017
- NotPetya June 2017

Merck Annual Report

- $260M loss in sales
- Nearly $300M in expenses / cost through out the enterprise

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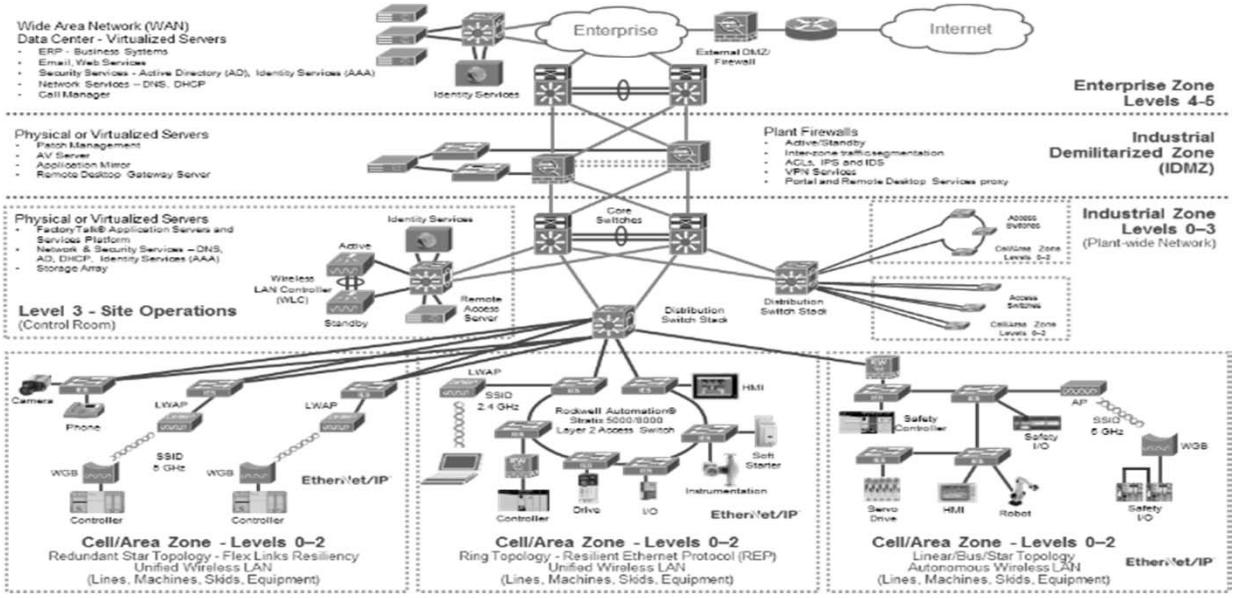
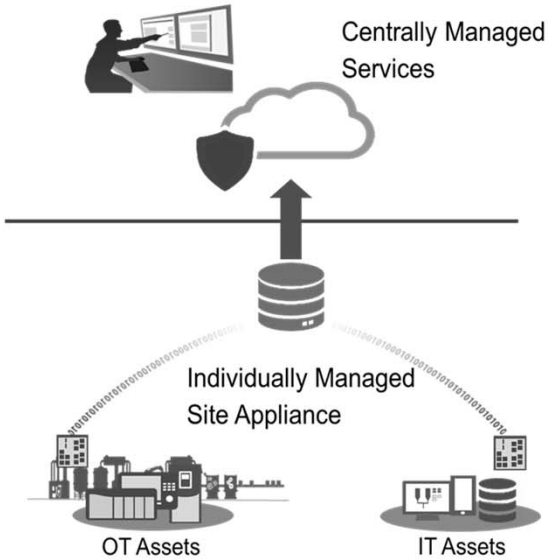
Converged Plantwide Ethernet Infrastructure Strategy



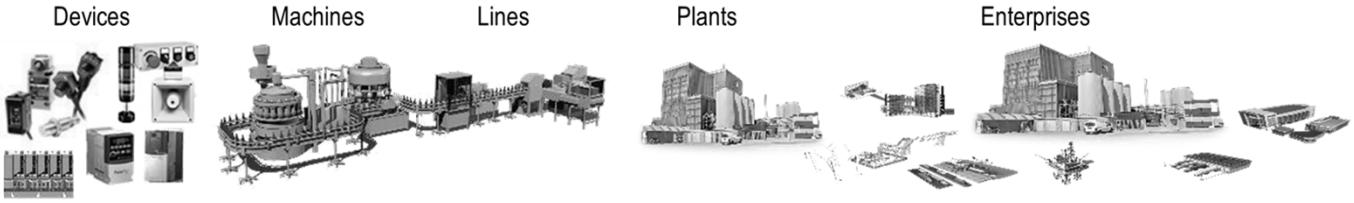
OT Cybersecurity Defense in Depth Strategy

with Threat Monitoring, Anomaly Detection, Response & Remediation



	Service	Benefits
Asset Monitoring	• Comprehensive Asset Inventorying • Passive Network Monitoring • Vendor and Protocol Agnostic • Fine grained DPI Model	• Continuous Monitoring without Interrupting Production • Single Solution for ICS Vendors • Collect Information on How Assets are configured, communicate and change • Discover issues with full visibility of ICS Networks
Security and Operational Monitoring	• Behavioral Anomaly Detection • Real-Time Change Detection • Alert on Operational and Security Events • Incident Response Services	• Validate Operational Tasks to reduce risk, and maintain process integrity • Near Real Time Detection of Cyber Threats (conficker, wannacry, etc) • Recover from Security Incidents with Highly-Trained Professionals • Reduce Risk of Downtime with 24x7 Response

Scalable Data Collection & Data Analytics Strategy



Machine Intelligence

Act
Analyze
Digitize
Detect

Data

Prescriptive
Predictive
Diagnostics
Descriptive

Decision
Action

Human Input

Source: Gartner

Data Driven vs. Expert Driven Analytics

Data

Expert Driven

IT Approach
Data Scientist Driven

Tools for Expert

Expert

Analytics Outcome

OT Approach
Data Driven

Data
+ Annotation

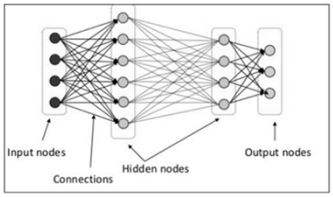
Automated Real-time
Analytics Engine(s)

Analytics Outcome

Deep Learning for IIoT

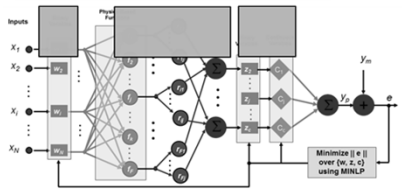
- The data of interest to Google, Amazon, Facebook, Microsoft is predominantly **stochastic** in nature. Manufacturing data **is not**.

Non-OT Deep Learning



Key focus: Feature extraction via parallel processing

OT Deep Learning



Key focus: Physics-based self-learning via MINLP

IT vs OT Managed Services Strategy

Service	OT Requirements
Level 3 – Level 0 Experience	Extensive
Service Level Agreements (SLA) Response Times	10 minutes
Global Ticket Management with Specific Knowledgebase	Yes
Replacement Part Availability	6 hours
Dispatch of Field Engineers	6 – 12 hours
Secure Remote Monitoring & Diagnostics	Yes
Plant Operations Network Design & Implementation	Yes
Infrastructure as a Service (Opex vs Capex)	Yes
Secure Remote Access with Authentication, Audit Trail, Archive & Disaster Recovery	Yes
Network, Cybersecurity & Safety Validation of OEM Systems	Yes
Lifecycle Management coordinated with Operations schedule	Yes
Patch & AV Management coordinated with Operations schedule	Yes

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