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 INTERNET OF THINGS
Impacting Consumers, Manufacturers & Supply Chains

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: INI
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

**BIG DATA & ANALYTICS**
Contextualizing and analyzing data
Smart devices create more ‘things’ to be analyzed

**CLOUD & VIRTUALIZATION**
Reliability, support, and disaster recovery
Shift from CapEx to Flexible & Scalable OpEx

**WIRELESS & MOBILITY**
Access to actionable information
Workforce is Mobile during typical work day

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The Connected Supply Chain

**CONVERGED PLANT-WIDE ETHERNET**
**ENTERPRISE SYSTEMS & USERS**
**ENTERPRISE RESOURCE PLANNING**
**PRODUCTION LIFECYCLE MANAGEMENT**
**CUSTOMER RELATIONSHIP MANAGEMENT**
**SUPPLY CHAIN MANAGEMENT**
**ENTERPRISE ASSET MANAGEMENT**

**SMART PLANT**
**OPERATIONS MANAGEMENT**
**EXECUTION**
**ANALYTICS**
**INTEGRATED ARCHITECTURE**

**CONNECTED SERVICES**
**IT DEPARTMENT**
**NETWORK & SECURITY SERVICES**

**SUPPLY CHAIN INTEGRATION**
**SMART ASSETS**
**PRODUCTION OPTIMIZATION**
**INVENTORY MANAGEMENT**

**RAW MATERIAL SUPPLIERS**
**OEMs / MACHINE BUILDERS**
**PLANT WORKFORCE**
**DISTRIBUTORS & CONSUMERS**
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

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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

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**Supply Chain Dependencies**

**Raw Material Site**
- MES
- ERP
- WMS
- QMS

**Material Processing Site**
- MES
- ERP
- WMS
- QMS

**Final Assembly Site**
- MES
- ERP
- WMS
- QMS

**Approximate Quality Fallout**
- Rolled Throughput Yield (RTY) = 73 %
- 27 % End-to-End Supply Chain Losses
- 19% Interdependent Vendor Related Losses
Event: Reactor: Max Vacuum Pressure reached during Product Run Lot 694676

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Digital Operations
Enabling The Connected Enterprise

Customer Outcomes
- Faster Time to Market
- Lower Total Cost of Ownership
- Improved Asset Utilization
- Enterprise Risk Management

User Applications
- Production Management
- Material Management (Track & Trace)
- Quality Management
- Performance Management (OEE)
- Health & Diagnostic Analytics
- Predictive Maintenance
- Operational Analytics
- Remote Monitoring
- Real-time Prescriptive Analytics
- Asset Performance (APM) for OEMs
- Serialization Solution

Core Capabilities
- Orchestration
- Execution & Workflow Management
- Networking & Security
- Converged PlantWide Ethernet (CPwE) & Consulting
- Common User Experience
- Across All Applications and Devices
- Collaboration
- Team Enablement

Connectivity
- OPC
- FactoryTalk
- Enterprise Systems
- Cloud

Data Management
- Time Series Data
- Event Data
- Contextualization
- Big Data

Analytics
- Focused Engines
- User Specific
- Machine Learning

Presentation
- HMI
- Dashboards
- Reports
- Mobility & Alerts

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Transaction data: orders, supply network, product design …

IT

CONVERGENCE

OT

Real-time data: control, safety, security …

OT Priorities *
1. Availability
2. Integrity
3. Confidentiality

IT Priorities *
1. Confidentiality
2. Integrity
3. Availability

* Ref: NIST Pub 800-82
IoT Maturity Model
Where Are You?

Level 1
Unconnected

Level 2
Get Connected

Level 3
Get Informed

Level 4
Get Ahead

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

Connect to Assets
- Reactive Support
- Troubleshooting
- Fix
- Maintain

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

- Comprehensive Asset Inventorying
- Passive Network Monitoring
- Vendor and Protocol Agnostic
- Fine grained DPI Model

Benefits

- 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

- 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, wannacy, etc)
- Recover from Security Incidents with Highly-Trained Professionals
- Reduce Risk of Downtime with 24x7 Response
Scalable Data Collection & Data Analytics Strategy

Data Driven vs. Expert Driven Analytics
Deep Learning for IIoT

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

**Key focus:** Feature extraction via parallel processing

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