Intelligence for the Industrial Internet of Things

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INTELLIGENCE FOR THE INDUSTRIAL INTERNET OF THINGS
IoT & Connected Factory

SAS Global Forum
The introduction of IoT into the manufacturing environment is ushering in a fourth Industrial Revolution.

**Industry 4.0 Characteristics**

- Dynamic business and engineering processes enabling last-minute changes to production
- Personalized, local production and mass customization
- Creating value opportunities through services
Industry 4.0 Imperatives
Intel’s View on Where it’s Going and Why

Market Disruptors
- Rise in global Middle Class
- 3D Printing at end of supply chain
- Demands and requirements of Mass customization
- Rising costs of labor in developing countries
- Increasing environmental regulation
- Digital and physical convergence

Business Challenge
- Industry 4.0 Build new Smart Factories or outsource (Fabless goes mainstream: Capital expense vs operating expense)
- New IoT driven business models
- Access to skilled workers
- Supply chain compliance and integrity

Factory as a Service Platforms
Connected Product as a Service Platforms
The Challenges

- Preserve Infrastructure
- Retrofit

- Customized Solution
- Tailored

- Many Devices to Connect
- Flexibility

- Increasing Complexity
- Information & Operation Convergence
Intel’s Industry 4.0 journey started decades ago

80’s Factory
- No robotic material transport
- Run cards on wafer boxes
- Basic equipment standards
- Initial equipment control
- Initial manufacturing execution solution

90’s Factory
- Beginning robotic material transport
- Automated statistical process control
- Improved equipment control
- Improved inventory control and tracking
- Improved equipment automation standards
- Initial manufacturing execution solutions
- Initial planning and supply chain integration
- Improved decision making systems

Today’s Factory
- Pervasive robotic material transport
- Pervasive equipment standardization
- Advanced manufacturing execution solutions
- Real-time excursion control
- Advanced process control & adjustment
- Predictive and Adaptive maintenance
- Advanced inventory control and tracking
- Advanced rapid decision making
- World class supply chain capabilities
- Big data repositories
- Quark integration with industrial equipment
Intel’s Industry 4.0 reference architecture is an open platform that enables IT cost structure and capabilities reuse across the enterprise.
Intel Manufacturing Experience

Use Case #1 – Automated Tester
- 50% Reduction in Maintenance Time
- 20% Reduction in Spare Costs
- 25% Reduction in Non-Genuine Yield Loss

Use Case #2 – Assembly
- 50% Reduction in Yield Loss

Use Case #3 – Vision System
- 10X Faster Results
- 10% Headcount Efficiency
Industrial Performance Monitoring and Control

Rise of an Information Centric Architecture
Monitoring complexities we deal with

- Annulus Pressures
- Production Chemicals
- Corrosion Monitoring
- Critical Equipment Health Monitoring
- Gas Monitoring
- OEM Equipment Monitoring
- Emissions
- Energy
- Quality
- Safety
- Inferred Measurements

**Inputs**
- Bottom Flow
- Drum Temperature
- Steam Flow
- Bottom Temperature
- Differential Pressure
- Feed Flow
- Feed Temperature
- Column Temperature 2
- Column Temperature 3
- Column Temperature 4
- Column Temperature 5
- Overhead Temperature
- Pressure
- Top Temperature
- Reflux Flow

**Output Quality Parameters**
- Composition Parameter 1 - Heavies
- Composition Parameter 2 - Tepa
Process Industry Datasets

- Data sets are large and complex – traditional data processing applications are inadequate.
- Challenges include capture, curation, quality, search, analysis, sharing, storage, transfer, visualization, and information privacy.
- Often used for predictive analytics or other certain advanced methods to extract value from data, and seldom to a particular size of data set.
Performance Monitoring (IIoT) vs. Control Architecture

Performance Monitoring (IIoT) vs. Control Architecture
The Effect On Plant Architecture

Process Safety

Process Control

Process Automation Network

Site Safety

Reliability

Energy Efficiency

Plant Operations Network

- Safety System
- DCS System

“Run Plant Safely”

3rd Party Applications

Wireless • Wired • WiFi • Remote I/O • Mobile

“Achieve Operational Excellence”
Performance Monitoring Challenges

- Data
  - What data do we collect?
  - What do we do with this data?
  - How do we get the best data in the right hands?
  - How do we then act on that data?
  - How do we prevent shutdowns with predictive data?
  - How do we improve output/production without a complete technology overhaul?
  - How do we do this quick and seamless with as little investment as possible?
  - How do we capture expertise?

- Platforms and Tools
  - What infrastructure should I use?
  - What tools do I use?
  - Should I store on-premise or in the cloud?
  - Should I use open source?
  - How do I scale?
Can analytics provide an answer?

- Are my cuts on target?
- Is my equipment performing correctly?
- Can I increase throughput?
- How do I find sources of oscillations?
- Will I detect future events before they happen?
- Am I looking at the correct leading indicators?
- Will my equipment make it to the next turnaround?

Where do we start?
Observations

- Analytics for Process Industries is distinctive in that it sets specific requirements for Data Infrastructure, Time-Series framework, training algorithms including data analytics, and presenting the results.
- Performance monitoring and analytics needs to deal with the two separate but related domains.
- The infrastructure needs to be extendable from on-site to cloud.
- Visual analytics is a key component.
Panel Questions