Welcome and Overview
IIC Testbeds & OMG Standards

Dr. Richard Mark Soley
Executive Director
December 2017
The Industrial Internet is leading the next economic revolution
The Measurable Outcome will be in the Trillions of Dollars

GE:  **$32.3 trillion opportunity** representing 46% share of GDP today.

Cisco: Internet of Things (IoT) will **increase private sector profits 21%** and add **$19 trillion** to the global economy by 2020.

Gartner:  IoT product and service suppliers will generate **incremental revenue exceeding $300 billion** in 2020.

McKinsey Global Institute: **$36 trillion operating costs** of key affected industries could be impacted by IoT.

The convergence of *Internet of Things, Industrie 4.0, Cyber-Physical Systems* presents an enormous opportunity.

Sources: GE, Cisco, Gartner, McKinsey
The IIC: Things are coming together

Connectivity
Conducent
Big Data
Industrial Internet Consortium
Things are coming together
Vision: The Industrial Internet Consortium is the world’s leading organization transforming business and society by accelerating the Industrial Internet of Things (IIoT).

Mission: To deliver a trustworthy IIoT in which the world’s systems and devices are securely connected and controlled to deliver transformational outcomes.

Launched in March 2014 by five companies:

at&t  CISCO  GE  IBM  intel

The IIC is an open, neutral “sandbox” where industry, academia and government meet to collaborate, innovate and enable.

Over 260 Member Organizations Spanning 30 Countries
Why now?

Driving the OT – IT Convergence:
Low cost, powerful technology
• Cheap sensors & devices
• Low-cost processing power, data storage

Connected everything
• By 2020, the number of things connected to the internet will be approximately 7x the number of people on earth today.¹

Big Data
• Collecting, storing and analyzing data is now more cost effective

Smarter Machines
• Equipment is increasingly embedded with sensors & software

¹Source: Cisco Systems

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What about Standards? And Open Source?

- Already plenty of standards at the communications level (e.g., OMG DDS)

- Semantic standards are going to be critical in all verticals

- IIC is a source for standards requirements & priorities through the I3C process
The IIC has a formal Liaison team that evaluates potential formal agreements with other organizations.

We are an open membership organization and we work collaboratively on an informal basis with many other organizations, including Industrie 4.0.

The Technology Working Group is currently:
- Evaluating existing standards
- Identifying requirements for the Industrial Internet

The IIC is not a standards organization. We evaluate and organize existing standards to:
- advocate for open standard technologies, and
- influence the global standards development
IIC Core Focus Areas

Activities fall into three main areas that ultimately drive new opportunities for IIC members:

The IIC Ecosystem
Companies joining together to advance innovation, ideas, best practices, thought leadership and insights

Technology & Security
Architectural frameworks, standards requirements, interoperability, use cases, privacy & security of Big Data

Testbeds
Innovation to drive new products, processes, services

Innovative products!

BSSL: Business Strategy & Solutions Lifecycle
Current Publicly Announced Testbeds

- Asset Efficiency Testbed
- Condition Monitoring Testbed
- Connected Care Testbed
- Connected Vehicle UTM Testbed
- Deep Learning Facility Testbed
- Edge Intelligence Testbed
- FA PaaS Testbed
- FOVI Testbed
- High-Speed Network Testbed
- Industrial Digital Thread Testbed
- INFINITE Testbed
- Intelligent Urban Water Supply
- Microgrid Testbed
- Precision Crop Management Testbed
- Security Claims Evaluation Testbed
- Retail Video Analytics Testbed
- Smart Airline Baggage Management
- Smart Asset Outage Management
- Smart Energy Management Testbed
- Smart Factory Machine Learning for Predictive Maintenance
- Smart Factory Web Testbed
- Smart Manufacturing Connectivity
- Smart Water Management Testbed
- Time-Sensitive Networks Testbed
- Track and Trace Testbed

12/7/2017
Communication & Control for Microgrid Applications Testbed

The Problem
The history and nature of the traditional power grid is large-scale, bulk power generation concentrated at large power plants. The addition of distributed renewable resources (solar and wind) creates difficult control, subsystem management and safety challenges.

Our Solution
The Microgrid Testbed deployment instance at NI’s Industrial IoT Lab provides a simulated smart grid microcosm demonstrating many technologies and protocols: Data Distribution Service (DDS), Open Field Message Bus (OpenFMB), TSN and how they can be combined and deployed in the field.

Key Benefits
• Demonstrates credibility & visibility
• Offers access to new technologies and protocols
• Creates dynamic, open marketplace
• Helps break the standards blockage holding back the industry

Team
• RTI
• National Instruments
• Cisco
• Various energy providers

“Talking about interoperable, framework for smart grid applications is one thing, but having a plug-and-play test environment is invaluable. There are so many layers of technologies involved that even experts are continuing to learn and evolve. The testbed dramatically reduces risk.”

BRETT BURGER, PRINCIPAL MARKETING MANAGER, MONITORING SOLUTIONS, NATIONAL INSTRUMENTS
Embracing the goals of the IIC, this testbed is accelerating the adoption of key IIoT technologies thru early standard interoperability testing, collaboration with key technology suppliers and standard organizations.

Time Sensitive Networks for Flexible Manufacturing

The Problem

Manufacturing operations have historically been deployed using non-standard network infrastructure or air-gapped (unconnected) networks leaving devices and data much harder to access.

Our Solution

Enhanced Ethernet technology to support real-time control and synchronization of high performance machines over a single, standard Ethernet network, supporting multi-vendor interoperability and integration.

Key Benefits

- Secure and reliable delivery of data
- Guaranteed latency for data delivery
- Converged networks save operating costs
- Simple system configuration and operation
- Open ecosystem

Team

- Over 20 organizations including chip vendors, testing tools, network infrastructure, SW tools and end-device makers
- Collaboration with IEEE, AVNU, OPC, ODVA and others
Track & Trace

Collaborators:
• Bosch, Cisco, SAP SE, Tech Mahindra

Market Segment
• Industrial Manufacturing
• Use Case 1: Power Tool Fleet Management
• Use Case 2: Forklift Tracking

Goal
Ensure proper usage and minimize failures of handheld power tools and forklifts improving the overall manufacturing process by accurately tracking and tracing these assets, collecting usage and status data in industrial factory, maintenance, and logistics environments

Features & Commercial Benefits
• Asset Management, Work Management
• Integration with Factory Manufacturing Systems
• Improved Safety and Operational Performance
• Monitor/Control Quality
Collaborators:
• Fraunhofer IOSB, Korea Electronics Technology Institute (KETI)

Market Segment:
• Manufacturing: industrial automation

Goals:
• Form a network of smart factories with flexible adaptation of production capabilities and sharing of resources and assets to improve order fulfillment.
• Factory-to-factory interoperability and Plug & Work of machines with the industrial standards OPC UA and AutomationML

Commercial Benefits:
• Create and validate new business models with flexible assignment of production resources across factory locations.
• Create new opportunities for SMEs, allowing them to respond flexibly to manufacturing orders.
• Faster engineering and ramp-up time of modules, machines and IT systems
**Smart Manufacturing Connectivity for Brownfield Sensors Testbed**

**Collaborators:**
- Members: TE Connectivity, SAP SE
- With: ifm, OPC Foundation

**Goals:**
- Make available all cyclic (process and status) data and acyclic data (e.g. events and device data) delivered by smart IO-Link sensors at the platform tier
- Provide a retrofit-able factory floor hardware to facilitate the easy physical integration in brown-field installations with low effort and low cost (re-use of existing cabling, no PLC re-programming)
- Define a consistent conversion from the IO-Link device description (IODD) to OPC UA and thus, providing a common semantics to allow for the quick integration with IT systems

**Commercial Benefits:**
- Retrofit-able hardware solution reduces the costs of the physical installation
- Definition and implementation of common device model enables the easy integration with IT systems
- Input to the development of an IO-Link/OPC UA Companion Standard drives the adoption of IO-Link gateways equipped with OT/IT communication capabilities
- Easy access to a high volume of sensor data enables the improvement of current analytics and the development of innovative applications.

**Market Segment:**
- Discrete Manufacturing

12/7/2017
The Future

How will we reduce jet engine failure & maintenance costs?

How will we reduce waste of natural resources?

How will we save lives through better patient care?

How will we reduce passenger fatalities?

How will we minimize unplanned factory downtime?

Things are coming together.
Summary: The Industrial Internet Consortium Today

• Approx **260 organizations** from more than 30 countries and growing
• **26 running testbeds** all over the world
  • More than 20 in the process, expanding into **new verticals**
• **Reference Architecture** second version published in January 2017
• **Security Framework** a year+ old, now integrated into Testbeds
• **Business Strategy & Solutions Lifecycle** a year+ old
• **Connectivity Framework** published in February 2017
• **Industrial Internet Vocab Technical Report** published in July 2017
• First **Testbed Results Report** Published in September 2017
• **Industrial IoT Analytics Framework** Published in October
• Strategy for influencing standardization on track – joint workshops coming in 2018

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