Connectivity Framework and Industrial Analytics

This quarter saw the publication of the Industrial Internet Connectivity Framework. There has, of course, been progress on multiple other fronts, but let's begin with Connectivity.

CONNECTIVITY FRAMEWORK

Connectivity refers to the infrastructure to enable communication between participants. Communication refers to the exchange of information between them. Without connectivity, there is no communication. Communication is the basis for interoperable systems, and to be meaningful, requires some context. The more context the connectivity infrastructure can maintain, the more meaningful the communication. The Industrial Internet Connectivity Framework (IICF) defines the role of a connectivity framework as providing syntactic interoperability for communicating between disparate Industrial Internet of Things (IIoT) systems and components developed by different parties at different times.

The IICF is a comprehensive resource for understanding connectivity considerations in IIoT. It builds on the foundation established by the Industrial Internet Reference Architecture and Industrial Internet Security Framework by explaining how connectivity fits within the business of industrial operations, and its foundational role in providing system and component interoperability when building IIoT systems. It maps the rich landscape of IIoT connectivity by:

- clarifying the layers of the connectivity stack,
- defining the minimum expectations required to build next generation capabilities,
- defining an interoperable communications reference architecture for integrating systems and components across multiple industries,
- providing an assessment template worksheet for evaluating any connectivity technology and
- offering an initial catalog of relevant connectivity frameworks and transports.

The IICF thus establishes a starting point for IIoT architects and system designers looking to make sense of the connectivity options available for IIoT projects. It takes designers from the highest-level architectural considerations all the way down to specific implementation choices.

The overarching goal is to help IIoT architects unlock data in isolated systems and enable data sharing and interoperability between previously closed components and subsystems (e.g. brownfield systems and applications) and to accelerate the development of new applications (e.g. greenfield systems and applications) within and across industries.

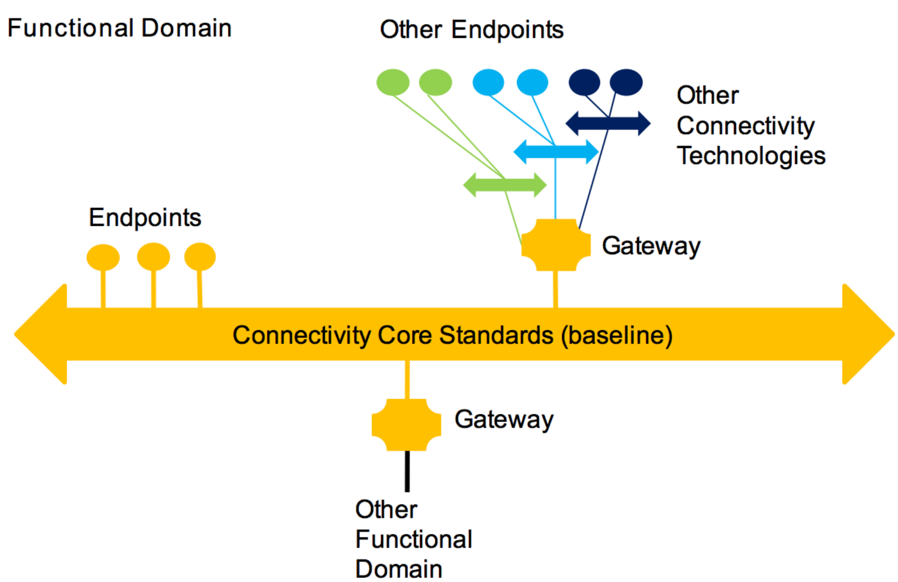
The audience of the IICF is system architects, solution architects, technology evaluators, technology decision makers, business strategists and business investment decision makers.

You can learn more from this video. Meanwhile, the IICF addresses the following questions:

- What is the role of connectivity in an IIoT architecture?
- What connectivity layers does an IIoT system need, and what are each layer's core functions, considerations and trade-offs?
- How can communication extend from a generic IIoT design to participants using a domain-specific connectivity technology?
- What must core connectivity standards provide?
- How to categorize and evaluate a given connectivity technology?
- How to assess suitability of a connectivity technology against system requirements?
- How to choose the right core connectivity standard for a problem domain?

The IIoT landscape today is a confusing mix of proprietary connectivity technologies and standards. Some are general purpose; some are mostly appropriate for enterprise applications; others are optimized for a narrow set of domain-specific use cases in vertically integrated systems. This hinders the ability to share data that IIoT systems need.

The IICF defines a reference architecture for opening up data locked in a plethora of domain-specific connectivity technologies so as to unlock the potential of a global IIoT marketplace. This architecture provides cross-industry-wide connectivity without requiring an unlimited number of core gateways, by establishing the minimum criteria for an IIoT core connectivity standard. Each core connectivity standard need only connect to other core connectivity standards through standardized core gateways, rather than building many bridges between many domain-specific standards. Data from domain-specific technologies can then be shared using gateways to one of a few core connectivity standards.



Connectivity Gateway Concept. Gateways integrate other connectivity technologies used within a functional domain and interface with connectivity core standards in other functional domains.

The IICF guidance can be used in a number of ways:

- The assessment template is a worksheet used to place a technology correctly on the IIoT connectivity stack, establish an IIoT system's connectivity requirements, identify gaps and identify the core connectivity standards most aligned with the system's needs.
- The IICF offers a starter set of completed assessment template worksheets for relevant IIoT connectivity frameworks and transport standards.
- The IICF identifies potential core connectivity standards, and highlights the non-overlapping system aspects targeted by them.
- Standard development organizations (SDOs) developing connectivity standards can use the architectural qualities, core functions and architectural considerations as inputs and requirements to their standard specifications. They can also use it to identify gaps.
- Platform providers can use the architectural qualities, core functions and architectural considerations to determine gaps that might exist in their technology offerings.

The IICF is organized into 9 chapters and 10 annexes.

- Chapter 1 provides and introductory overview.
- Chapters 2 to 6 cover the reference model, including the role of connectivity, the connectivity stack layers, the connectivity reference architecture, core standards criteria and the assessment template worksheet.
- Annexes A to F provide detailed assessments for three connectivity framework standards and three connectivity transport standards relevant to IIoT.
- Chapter 7 categorizes the relevant IIoT connectivity standards assessed in annexes A to F by applying the reference model established in chapters 1-2. Chapter 8 evaluates the connectivity standards from the point of view of the core standards criteria.
- Chapter 9 concludes by providing suggestions for applying the IICF guidance to specific functional domains.
- Annexes G to J provide the revision history, acronyms, glossary and references.

The IICF is a publication of the Connectivity Task Group of the Technology Working Group. It is led by Rajive Joshi (RTI), to the left and Paul Didier (Cisco) below.

In Other News

This quarter saw the publication of "*Industrial Analytics: The Engine Driving the IIoT Revolution*".

The introductory paragraph positions it well:

> "The Industrial Internet of Things seeks to connect industrial assets and machines—the things—to enterprise information systems, business processes and people who operate and use them. Advanced analytics is at the core of this next-generation level of integration and, when applied to machine and process data, provides new insights and intelligence to optimize decision making significantly and enable intelligent operations leading to transformational business outcomes and social value. If data is the new fuel, data analytics is the new engine that propels the IIoT transformation. As a fledgling new discipline combining advances in mathematics, computer science and engineering in the context of Information Technologies (IT) and Operational Technologies (OT) convergence, industrial analytics plays a crucial rule in the success of any IIoT system. Operating in industrial settings, analytics has unique requirements, characteristics and challenges compared to business analytics and so requires special considerations in its implementation. Much needs to be explored since industrial analytics is in its early stage of development. This paper is intended to spur discussions and research, and speed up the development and maturity of this indispensable technology."

This eighteen-page technical white paper covers:

- The value of Industrial Analytics
- Analytics in Industry
- Design Considerations
- Creating Business value
- Analytics Architecture
- Getting Started with Industrial Analytics
- Analytics Capacity Considerations, and
- Analytics Functionality.

This work is a product of the Industrial Analytics Task Group of the Technology WG, authored by, left-to-right, Wael Diab (Huawei), K Eric Harper (ABB), Shi-Wan Lin (Thingswise) and Will Sobel (System Insights).

AWARDS

The Steering Committee instituted an award program to recognize some of the great work you can see is being carried out in the IIC.

The IIC awards program category for the first quarter was Individual Contribution. The award was given to one Dr Rajive Joshi (Real-Time Innovations). Congratulations, Rajive!

Nominations are now open for the first quarter, Technical Innovation Award. The group leads vote in mid-May. The award is presented at the next quarterly meeting in Berlin, Germany.

Other Publications

- The 3rd edition of the Journal of Innovation was published on January 26, 2017. The June 2017 4th Edition theme is Smart Cities.
- Version 1.8 of the IIRA was published on January 31, 2017.
- The Smart Factory Applications in Discrete Manufacturing white paper, a deliverable of the Smart Factory Task Group, was published on February 22.

NEW MEMBERS

We are pleased to announce the following new members.

TONGFANG Cloud Computing Technology Co. (China)	Star Lab Corporation (USA)
System View Inc (USA)	ZingBox (USA)
PFP Cybersecurity (USA)	Chirp (United Kingdom)
Jana Software (USA)	OptimalPlus (Israel)
SkyLab Holdings (Singapore)	Nexmatrix
SICK AG (Germany),	Fluke Corporation (USA)
SmartConnect Technologies Inc. (USA)	Keysight Technologies, Inc. (USA)
Savigent Software (USA)	Ascent Intellimation Pvt LTD. (India)
Sensogram Technologies (USA)	

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