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IIC Global Event Series, Beijing, November 16, 2018
Part I

IIRA, now & future
Industrial Internet - a simple idea, widely applicable

Closed-loop Optimization

Industrial Internet = Analytics → Application → Values

- Broad
  - Manufacturing
  - Power/Utilities
  - Oil & Gas
  - Transportation & Logistics
  - Buildings & Infrastructure

- Deep
  - Agriculture

- Values

an enabling technology for the digitalization process...
an data-driven optimization from assets to processes, through the value chains, across enterprises & industries, end-to-end
Industrial Internet – Key Common Technical Challenges

IIoT Systems:
- complex,
- large-scale,
- heterogeneous,
- distributed

industrial systems

How to solve these shared challenges?

Need a systematic, architectural approach
Industrial Reference Reference Architecture (IIRA)
Shared Approach to Common Challenges

- Common architecture requirements & patterns
- Common architecture concepts & vocabulary

- Raise awareness on important concerns
- Provide high-level guidance on how to address these concerns

Identify interoperability requirements & developing standards
Spurs innovation in an open ecosystem

To share know-hows, encourage interoperable common building blocks & reusable technologies across industries for building safe, secure & reliable IIoT systems at lower costs, risks and time to value
Industrial Internet Reference Architecture (IIRA)

A standards-based architectural template & methodology:
• addresses concerns about IIoT, emphasizing its broad applicability and interoperability across industries
• enables system design across the industries - based on a common framework & concepts

First edition published May 2015
First revision published February 2017; available in IIC Resource Hub October 2018

https://www.iiconsortium.org/IIRA.htm
IIRA – Business-Value-Driven Methodology

Identify & classify important system architecture concerns into related categories – viewpoints - for their analysis and resolution.

Business vision & value driven, concern-resolution centric, iterative design methodology.
IIRA – Rich Architectural Templates and Models
An architecture viewpoint that frames the vision, values & objectives of the business stakeholders in establishing an industrial internet of things (IIoT) system in its business & regulatory context.
IIRA – Usage/User-Role-Based Design Paradigm

An architecture viewpoint that frames the concerns related to industrial internet of things (IIoT) system usage
IIRA – Comprehensive Functional Design & Architecture Considerations

Identify major common functional domains & their relation and interaction.

Identify major cross-cutting functions

Identify major system characteristics as emerging system properties

An architecture viewpoint that frames the concerns related to the functional capabilities & structure of industrial internet of things (IIoT) system & its components
Growing numbers of practical architecture patterns for system architects to jump start their design conception

An architecture viewpoint that frames the concerns related to implementing the capabilities & structure of an industrial internet of things (IIoT) system
IIRA – Innovative IIoT system architecting

- concern/viewpoint oriented architecting;
- business-value-driven system conceptualization & design;
- usage/user-role-based design paradigm;
- data-analytic-centric core & cross-cutting functional design
- clear separation between functional and system characteristics as emerging properties
- implementation patterns
IIRA – Broad Influence Across the Globe

Guiding template for IIC testbed conceptualization & design

Basic framework for other IIC technical reports (IISF, IICF, IACF, ...)

Aiding system architects in concrete IIoT system designs; educating practitioners & consultant...

Direct influence in many subsequent IIoT related architectures & standards – a base reference for reference architectures

Enabling exchange of ideas & encouraging architecture alignment (harmonizing architectures across industrial domains & geographical regions)
Major Industrial Internet Related Reference Architectures

Industrial Internet Consortium (IIC), “Industrial Internet Reference Architecture – IIRA”, 2015.6/2017.2

Platform Industrial 4.0, “Reference Architecture Model – Industrie 4.0-RAMI4.0”, 2015.7


Alliance for Industrial Internet (AII), “Industrial Internet System Architecture”, 2016.8


ISO/IEC JTC 1/SC 41 CD 30141, “IoT Reference Architecture (IoT RA)”, under development

IEEE P2413, IoT Architecture Framework Standard, under development

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Driving the digitalization of industries:

advances the adoption of the industrial internet on a global scale that transcends industry boundaries

coordinates the Industrie 4.0-driven digital transformation of the German industry

Major Industrial Internet Related Reference

Chicago, June 2016

Heidelberg, Sept 2016

Zurich, Nov 2015

Detailed model for next-gen Manufacturing value chain

Cross-domain & Interoperability in IIoT
addresses concerns about IIoT, emphasizing its broad applicability and interoperability across industries. It takes an in-depth focus on manufacturing and related value-chain lifecycles.
Architecture Alignment & Interoperability

• Highly complementary
  o IIRA: broad applicability and interoperability across industries
  o RAMI 4.0: in-depth focus on manufacturing & value-chain lifecycles

• The concepts, methods and models map to each other well

• Different emphasis in scope & depth from different perspectives
  o together strengthen the digitalization of manufacturing and beyond
  o IIRA: analytics capability; RAMI 4.0: I4.0 Components

• Important to enable interoperability among IIoT systems that are based on IIRA & RAMI 4.0

• Common ground to enable connectivity/communication/semantic interoperability

http://www.iiconsortium.org/iic-i40-joint-work.htm
IIRA – Looking Forward

• Publish a revision (v1.9) by Q1/19 & in
  o to addressing some known issues
  o corporate some new contents

• Continue the collaboration between IIC & Plattform Industrie 4.0 on Digital Twin & Industrie 4.0 Components

• Continue the global cross-domain architecture alignment & harmonization:
  o Complete the on-going IIRA & oneM2M architecture alignment whitepaper
  o Continue IIRA & IVI-RA alignment analysis
  o Explore opportunity for IIRA & All “Industrial Internet System Architecture” alignment

• Extending IIRA to specific industrial domains
• Evolution by taking inputs from IoT architecture work from other liaison organization and lessons from real-world implementation

☞ http://www.iiconsortium.org/iic-i40-joint-work.htm
Part II

Applying II RA in Smart Manufacturing

IIoT for Smart Manufacturing (ARC - Industrial IoT/Industrie 4.0 Viewpoints)

Industrial Internet in Smart Manufacturing

Digitalization of industrial technologies & know-hows through analytic models & software

Business Processes

Analytics

Application

Better Business Decision Making

Optimized Production Processes

Material • Equipment • Processes • Product • People

Top IIoT Use Cases

- Remote monitoring: 28%
- Energy efficiency: 27%
- Asset reliability: 25%
- Business mode transformation, e.g., selling capacity instead of products: 24%
- Production visibility: 22%
- Quality improvement: 22%
- Asset and material tracking: 17%
- Internet enabled products: 15%
- Traceability and serialization: 13%
- Customer access to information: 8%
- Improving safety: 6%
- Supplier visibility: 6%
- Improving environmental performance: 4%

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Data-Driven Optimization for Manufacturing
- Challenges & Requiems

Need a new breed of data-driven industrial OS for unified & lightweight data, analytics & application agile DevOp

Application Islands
Data Silos

Multi-domain, multi-processes, vertically closed applications, forming multiple information islands
Hard to integrate, difficult to orchestrate an overall across-domain full-process

- heterogeneous sources & data formats, lack of open standards
- high collection frequency, large data volume, long shelf life
Thingswise Industrial Internet Platform

Simple, Lightweight & Easy to Use, Flexible to Deploy

Industrial Apps

Digital Twin Framework
- Equipment, System definition (OT)

Model Framework

Data Framework
- Data Collection/Processing (OT)

Industrial Internet Platform

Connectivity

Big Data

Artificial Intelligence

Microservices

Cloud Computing

Data & System Security

Data-Driven Operating Platform

Service/App Software Development (IT)

Simple, Lightweight & Easy to Use, Flexible to Deploy

Model & App • DevOps

Equipment, System definition (OT)

Analytics Model-Building (OT)

Data Collection/Processing (OT)

www.thingswise.com

www.yo-i.com.cn
Thingswise Industrial Internet Platform
as Data-Driven Industrial OS

Easy to use:
✓ Full function Industrial Internet platform purposely-built with requisite technologies
✓ GUI-based codeless development & configuration
✓ Logical division of expertise, loosely coupled independent delivery

Flexible to deploy:
✓ Support low-latency edge computing and large-scale cloud computing
✓ Safeguarding system and data security and control

Simple & Lightweight
Scalable & Reliable
Extendable & Portable

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Thank You!

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