Industrial Internet Reference Architecture

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Industrial Internet Reference Architecture (IIRA)

- IIoT: broad applicability & impact with complexity & diversity
- IIoT: common technical challenges
- IIRA: a common architecture template & methodology for meeting these challenges
- IIRA: a foundation for common building blocks, sharing know-how, & reusable technologies within & across industries
- IIRA & IISF: for building safe, secure & reliable IIoT systems with reduced effort & risks, lower costs, & shorter time to value
IIoT - A Simple Idea & Common Objectives

Processes

Information

Assets

People

IIoT

Advanced Analytics

Intelligent Industrial Operations

Transformational Business Outcomes & Social Values

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IIoT - Broad Applicability with Complexity & Diversity

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IIoT – Common Technical Challenges

How to solve these shared challenges?
IIoT - Common Solutions to Shared Challenges?

Industrial Systems: large-scale, heterogeneous, distributed systems with multi-vendor building-blocks...

• Are there shared system requirements & characteristics, architectural concerns & patterns?
• Can these be abstracted & generalized into a common architectural description?

Use cases across industries + Technology outlooks

Reference Architecture: Architecture template & methodology

Applications within & across industries
IIoT - Reference Architecture - the Foundation

• Common architecture requirements, characteristics, patterns within & across industries
• Common architecture concepts & vocabulary for consistent communication & design
• Foundation for identifying interoperability requirements & developing standards
• Enable & spur innovation in an open ecosystem

For vendors to build interoperable, reusable market-fitting system building blocks

For implementers: a sound starting point for design & availability of off-the-shelf building blocks

Common building blocks, sharing know-how & reusable technologies within & across industries for building safe, secure & reliable IIoT systems at reduced effort & risks, lower costs & shorter time to value
The IIRA is a standards-based architectural template & methodology enabling Industrial Internet of Things system architects to design their own systems based on a common framework & concepts.

- Build consensus on key architecture concepts
- Raise awareness on important concerns
- Provide high-level guidance on how to address these concerns
- Present important ideas correctly & clearly
- Accessible & useful to technical generalists
• Reflect new technologies, concepts & applications
• Represent the latest thinking of IIC/IoT community
• Clarify existing concepts & models
• Provide practical & implementable deliverables to the community
IIoT system & component architects who design IIoT systems & system components, technologies & solutions within the vendors & implementers communities.

Business decision-makers, plant managers, IT/OT managers & others who want to better understand how to drive IIoT system development from business perspectives; how the convergence of Operational Technology (OT) & Information Technology (IT) is an important part of achieving the promised benefits of IIoT
Industrial Internet Reference Architecture

Industrial Internet Architecture Framework*

Frame
- Stakeholders
- Concerns
- Viewpoints
- Model Kinds

Representations
- Views
- Models

Apply to IIoT systems
- Extend, enrich & develop
- Feedback & improvement

* Based on ISO/IEC/IEEE 42010:2011 - Architecture Description
Identify & classify important system architecture concerns into related categories – viewpoints – for analysis & resolution.

Business vision & value driven, iterative design methodology
From viewpoint to view: system concern identification, analysis & resolution
Identify major common functional domains & their relation & interaction

Identify major cross-cutting functions

Identify major system characteristics as emerging system properties

Introduce the concept of Trustworthiness
Widely applicable to virtually all industrial verticals

Provide a common & open architectural foundation for each use case & vertical to specialize & extend where it is necessary
IIRA - Key System Characteristics & Assurance

System Engineering

Trustworthiness

Resilience & Reliability

Security & Privacy

Safety

Assurance

System

Engineering

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Enrich architecture patterns in each of the viewpoints by providing concrete examples of the application of IIRA and a standard template for representing patterns for each of the viewpoints.

Derive sector specific reference architecture based on IIRA, collect sector specific architecture patterns as feedback to IIRA.

Expand architectural considerations in the Control Domain in IIRA to reflect IIoT system implementation on brownfield systems and path to future environment.

Expand guidance on how to create views from each of the viewpoints with concrete examples from testbeds.
IIRA – v1.8 New Changes

- Improved & enhanced description of the architecture concepts & constructs with clearer alignment to ISO/IEC/IEEE 42010 Architecture Description standard & their application in the IIRA.
- A new section detailing IIRA viewpoints' scope of applicability & relationship to the system lifecycle process.
- A new section describing the relationship among functional domain, crosscutting functions & key system characteristics.
- A new section on functional domain & compute deployment.
- Clarity that the architecture patterns are representative & not all intended to be all inclusive or normative.
- A new section on Layered Databus Architecture Pattern derived from the IIC Smart Grid Testbed Program.
- A new appendix on Design Space Considerations providing a broad view of possible design parameters & their constraints in identifying, describing & resolving IIoT system concerns.
- Movement of IIRA 1.7 Part 2 to a separate volume (to be published shortly) as those sections are being replaced by the IISF, IICF, & other soon to be released stand-alone frameworks.
A standards-based common architecture template & methodology for designing interoperable IIoT systems within & across industries

Business value driven, comprehensive, highlighting important IIoT system characteristics – safety, security, privacy, resilience, reliability, etc.

A foundation of identifying interoperability requirements & solutions

A foundation for enabling & spurring innovation in an open ecosystem

For vendors to build marketing fitting reusable products & services

For implementers to build IIoT systems at reduced effort & costs, lower risks & shorter time-to-market