The IVI Approach to IoT and Current Manufacturing Projects

~New Business Model of Platforms for Connected Manufacturing~

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What is IVI?

✓ Established in June 2015 mainly by 53 Japanese manufacturers, initiated by METI and JSME-MSD. Currently, IVI has 180 member organisations:
  ✓ 70 large manufacturers
  ✓ 43 small and midsize manufacturers
  ✓ 55 supporting member organizations
  ✓ 12 sponsor member organizations
  ✓ 17 academic members

✓ Supports building collaboration scenarios and use cases of connected manufacturing among different enterprises based on a loosely defined standard

✓ Provides and manages a repository of loosely defined standard models that can be continuously changed in accordance with unexpected future requirements.
IoT/MFG Initiatives in Japan

IoT for all Industries and Society

IoT Acceleration Consortium

IoT Acceleration Lab

Robot revolution society

Robot Revolution Initiative

Robot Innovation

Robot Usage Promotion

Smart Manufacturing

Industrial Value Chain Initiative

WG1

IoT-driven Transformation in Manufacturing

Interrelated

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Some IVI Members
IVI Key Concepts

Connected Manufacturing
Manufacturers focus and invest in their core competitive production processes while dynamically connecting to other enterprises in a supply chain both in cyber and physical worlds.

Loosely Defined Standard (LDS)
LDS means that the standardization process is loosened to adjust to the industrial diversity of the actual world. (LDS does not mean that a specification is loosely defined)

Humans remain key
Cyber world and physical world come closer, but are not 1:1 related. Artificial systems require designers and engineers as well as operators. The human being remains key also in the production of the future.
Three Areas of IVI Contribution

- **Human-centric shop operations with IoT**
  - Employees will grow together with IoT, so that new job creation and skill training can be achieved.
  - IVI has a method for this approach.

- **Actual use cases of connected SMEs**
  - SMEs’ network to increase their sales amount, by some actual use cases.
  - IVI has a use case for SME collaboration.

- **CPPS platform controlled by manufacturers**
  - Platforms must allow manufacturers to select any legacy and preferred applications.
  - IVI starts development of a platform reference model.
Loosely Defined Standard (LDS)

- Interface is adjusted
- Specification is adjusted

Reference model
- Loosely defined standard

Connected operations in site A

Connected operations in site B
Profile for System Integration

Each independent application defines interfaces to the selected schema.

Common profiles shall be defined by differences from the reference model.

Implementation profile

Different company

Common model

X Specific model

Y Specific model

Z Specific model

C-LDS

S-LDS

Common profile

Independent data models

Site A

Site B

Site C

Site D
IVI’s first 20 Projects

IVI has run 20 projects between September ´15 and March ´16, covering use cases in four areas:

1. Reaction on changes in globally and locally connected factories
2. Emerging IoT technologies for production line management
3. Platform for connected world in design and manufacturing
4. New era of human centric manufacturing powered by IoT

Each project was run involving several companies, sometimes competitors, in a novel collaboration.
By this, we have studied how to connect real enterprises.
Examples of Use Cases (Area #1)

- Cloud enabled monitoring platform for globally distributed factories.
- Global B2B After-sales service for remote location with call center.
- One-stop portal and collaborative quotation management by connected SMEs.
- Cyber physical production and logistics systems with common interface.
- Risk management by connected production information in global SCM.
In its first cycle, IVI has produced an online repository of Loosely Defined Standards. This repository facilitates connecting different existing systems with reasonable efforts.
Development Process Cycles

FY2015

- Scenario definition
- S-LDS: specific reference models
- IoT tools
- Pilot systems
- Industrial implementation and evaluation

FY2016

- Scenario definition
- S-LDS: specific reference models
- Model definition
- Platform RM
- Pilot systems
- Industrial implementation and evaluation

FY2017

- Scenario definition
- S-LDS: specific reference models
- Model definition
- C-LDS: Common reference models
- Platform RM
- Pilot systems
- Industrial implementation and evaluation

More than 25 Scenarios 2016 are discussed now

20 scenarios

2016 scenarios are discussed now
Definitions of “Platform”

**Definition 1**: Common specification in certain product design such as railway station and automotive.

**Definition 2**: Operation system or middleware in computer independent from devise and application.

**Definition 3**: Integration framework in cloud computing in order to deal with interoperability of applications.

**Definition 4**: A system to connect various data between decentralized systems and operations.

**Definition 5**: One stop service system that integrate relative applications by sharing common data.

**Definition 6**: Association of organizations and individuals to make collaborative works against competition.
Conventional Business Model
New Business Model

Platform is a system to mutually exploit data among different business spheres or systems (so-called system of systems).
Loosely Defined Standard

Flexible infrastructure
Enable to change the scale and structure depending on the growth of the system

Sturdy implementation
Cooperate with open technology and protect intellectual properties

Keep difference and improve the common specification
Features of IVI Platforms

An IVI Platform is a system of systems for connected manufacturing, creating values for the end-users by maintaining interoperability among platform components consisting of “Applications”, “Devices”, “Infrastructure”, and “Tools”.

✓ The aim of IVI Platforms is primarily to enhance its value for manufacturers.
✓ An IVI Platform is an open basis to make an ecosystem by providing profile specifications of each component.
✓ Data of the enterprise will be owned by itself at all times, so it is possible to create bottom-up systems by themselves.
Platform Requirement Specifications

For each of 8 categories, IVI Platform WGs define them.

Chapter 1  Scope
Chapter 2  Terminology
Chapter 3  Function models
Chapter 4  Things, info models
Chapter 5  Object models
Chapter 6  Network models
Chapter 7  Security
Appendix  Test scenarios
IVI Platform Specification

**Platform Common Architecture (PCA)**
Common abstract model of platform components and its structure an IVI platform should have to implement the capability of its functions.

**Platform Reference Model (PRM)**
Reference models that show specification items and possible candidates for each category of platform, depending on industrial needs of manufacturing.

**Platform Profile Specification (PPS)**
Profile specifications of existing platforms that consist of components to clarify the difference from the corresponding platform reference models.
## Platform Components

<table>
<thead>
<tr>
<th>Secure/hardware layer</th>
<th>Application layer</th>
<th>Integration layer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infrastructures</strong></td>
<td><strong>Applications</strong></td>
<td><strong>Device</strong></td>
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<tr>
<td></td>
<td></td>
<td><strong>Tools</strong></td>
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**Software that has capability of executing an application of real world operations that need independent data or data generated by other applications or devices in the platform.**

**Digital tools that deal with the functions of data connection in the platform, such as data conversion, bridging protocols, integration of components, administration support for platform users, and so on.**

**Fundamental asset of digital network composed by hardwares and softwares to keep/move data in the platform in order for communication, data storage, data channel control, etc.**

**Digital equipment such as sensors, terminal devises, controllers, manipulator, all of which can perform in the physical world with some hardware getting/putting data to/from the real world.**
Platform Projects in Current Cycle

Single process  ⇄ Multiple process

Production Engineering
- 01: Production Engineering

Quality Management
- 02: Quality Management

Production Management
- 03: Planning and Control
- 04: Supply Chain Management
- 05: SME Information

Maintenance Management
- 06: Preventive Maintenance
- 07: Asset and Equipment
- 08: Maintenance Service

Precision level

within enterprise  ⇄ between enterprises
After a domestic Japanese start in 2015, IVI started first contacts in the International Arena in 2016.

Enhanced global interaction is targeted for 2017.
World’s IIoT Initiatives and IVI

Factory creates value

Human Knowledge creates value

Mass customization (Lot size 1)

Factory Automation Suppliers and IT vendors

Big data
Artificial Intelligence (AI)

IT service providers and Platformers

Manufacturers and Fabrication SMEs

Loosely Defined Standard, Open and Closed strategy

Data creates value
Design of an ecosystem platform for manufacturing operations using loosely defined standards

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Web presence in English: www.iv-i.org/en/
Thank you!

https://www.iv-i.org/en/