Geospatial IT Perspective upon Industry 4.0

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Dr.-Ing. Thomas Usländer
Fraunhofer IOSB
Head of Department
Information Management and Production Control
Spokesperson Business Unit Automation
Motivation: bringing together communities

Characterization

New Economy (Internet-driven)
CES, CeBIT,…

Old Economy (automotive, production, chemistry, steel,…)
CIRP, Hanover Trade Fair,…

Standardization

OASIS, W3C, ITU, ISO, IEC

Geospatial aspects

OGC

Technology Push

(Industrial) Internet of Things

Initiatives

industrial internet
CONSORTIUM

INDUSTRIE 4.0
Industrie 4.0 and IIC (Quelle: Plattform Industrie 4.0)
Industry 4.0 – Advent of the 4th Industrial Revolution (1)

New stage of organization and control of the whole value chain across the entire product life cycle.
Industrie 4.0 – Advent of the 4th Industrial Revolution

Life cycle of assets is oriented at the increasingly individualized customer demands and encompasses:

- idea
- order
- development and manufacturing
- product delivery
- recycling
- including all related services

Diagram showing the development of products and product lines, production plants, after-sales services, and technical plants.
New dimension of Industrie 4.0

Up to now, optimization in industrial production has mainly targeted **matter, energy and cost**.

However, the potential of **data, information and knowledge** in industrial production is still **widely unexploited**.
Challenges to be solved: dependable and secure service network

Revolution on Business Level

Interoperability/Standards
IT-Security/Industrial Data Space®
Dependability and Latency
Machine Learning/Data Analytics
Human-Machine Collaboration

Evolution on Technological Level

Automation Pyramid

Service Network
IIoT/Industry 4.0 Challenges

- Internet of Things
- Internet of Services
- Industrial Applications
- IloT Capabilities

Architecture
- Standards
- Use cases
Reference Architecture Model Industrie 4.0 (RAMI4.0) in a nutshell (YouTube)

Asset type hierarchy:
- Connected World
- Enterprise
- Work center
- Station
- Control device
- Field device (sensor/actuator)
- Product

Plattform Industrie 4.0/Hrsg. BITKOM, VDMA, ZVEI: Umsetzungsstrategie Industrie 4.0 – Ergebnisbericht, Berlin, April 2015
DIN SPEC 91345: I4.0 Component

Software Component with a well-defined I4.0 standard I/F for communication

Assets (probably composed)

Descriptive data of an asset (meta-data)
Management Software
Partial Models of the Manifest
Achievements of Industrie 4.0

• Vision broadly discussed in Germany, Europe and world-wide
• Reference Architecture Model Industrie 4.0 (RAMI4.0) as DIN SPEC 91345 published
  – new work item procedure in the relevant Technical Committee of the IEC Strategic Group 8, I 4.0, Smart Manufacturing.
  – RAMI4.0 proposed as Public Available Specification - PAS within IEC
• many I4.0 testbeds registered in Labs Network Industrie 4.0 (see http://lni40.de/en/)
• open source implementations started on github
  – OPC UA → opc62541
  – Asset Administration Shell: openAAS
• DIN SPEC 16593 published: Reference Model for an I4.0 Service Architecture – Basic Concepts of an Interaction-based Architecture
IIoT– Next Challenges

- Industrial Applications
- IIoT Capabilities
- Internet of Services
- Internet of Things

Architecture Standards Use Cases

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Standardization Activities
Two I4.0 Candidate Standards in combination (already IEC standards)

**IEC 62714: AutomationML**
Description of the contents, stored and transferred as OPC-UA data model (WHAT)

**IEC 62541: OPC UA**
Communication services for the transmission of configuration and run-time data (HOW)

Companion Specification DIN SPEC 16592
German Standardization Council Industrie 4.0 (SCI4.0)
IIoT – Next Challenges

**Industrial Applications**

**Internet of Services**

**IIoT Capabilities**

**Internet of Things**

**Architecture Standards**

**Use Cases**

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Industrie 4.0 Application Scenarios (Source: Platform Industrie 4.0)

- **OCP – Order-Controlled Production**
- **SAL – Self-organising Adaptive Logistics**
- **AF – Adaptable Factory**
- **VBS – Value-Based Services**

"plug-and-work" e.g. smart maintenance

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Joint Use Case (1): Industry 4.0 as customer

Access to open data required, e.g. to optimize logistics of goods

Virtual Hub

Open Data
Joint Use Case (2): Industry 4.0 as (open) data provider

Create/update open data, e.g. to fulfill environmental reporting obligations

Industry as open data node

Virtual Hub

Open Data

Inspire

Infrastructure for spatial information in Europe
Joint Use Case (3): Virtual Hub as Smart Factory Web

Re-use of concepts and infrastructure

Adaption to factory data models

Virtual Hub

Factory Data

Joint Use Case (3): Virtual Hub as Smart Factory Web

Re-use of concepts and infrastructure

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Virtual Hub

Factory Data
Towards a Marketplace for Manufacturing

search for capabilities and assets

matchmaking and mediation

registration of capabilities and assets

Adaptable production → secure plug & work of assets

new business models

manufacturing as a service

immediate visibility on a global market

Source: Fraunhofer IOSB and KETI
IIC Testbed run by Fraunhofer IOSB and KETI

Connect the smart factories of the world based upon international standards

How ? → OPC UA
What ? → AutomationML
THANK YOU FOR YOUR ATTENDANCE

Dr.-Ing. Thomas Usländer

Fraunhofer IOSB
Head of Department “Information Management and Production Control”
Spokesperson Business Unit Automation

Fraunhoferstr. 1
76131 Karlsruhe, Germany
thomas.uslaender@iosb.fraunhofer.de
http://www.iosb.fraunhofer.de

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