

Geospatial IT Perspective upon Industry 4.0

ENERGIC OD Workshop

INSPIRE Conference – Kehl

04.09.2017

Dr.-Ing. Thomas Usländer

Fraunhofer IOSB

Head of Department

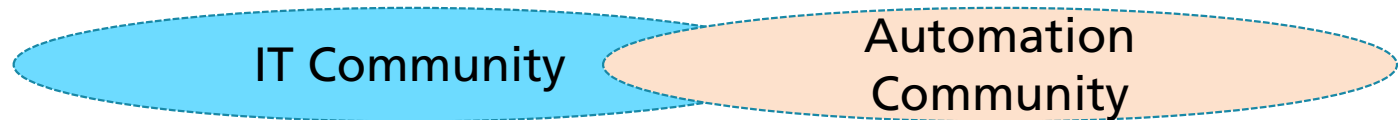
Information Management and Production Control

Spokesperson Business Unit Automation



Josef von Fraunhofer
Scientist and Entrepreneur
1787-1826

Motivation: bringing together communities



Characterization

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

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

Standardization



Geospatial aspects



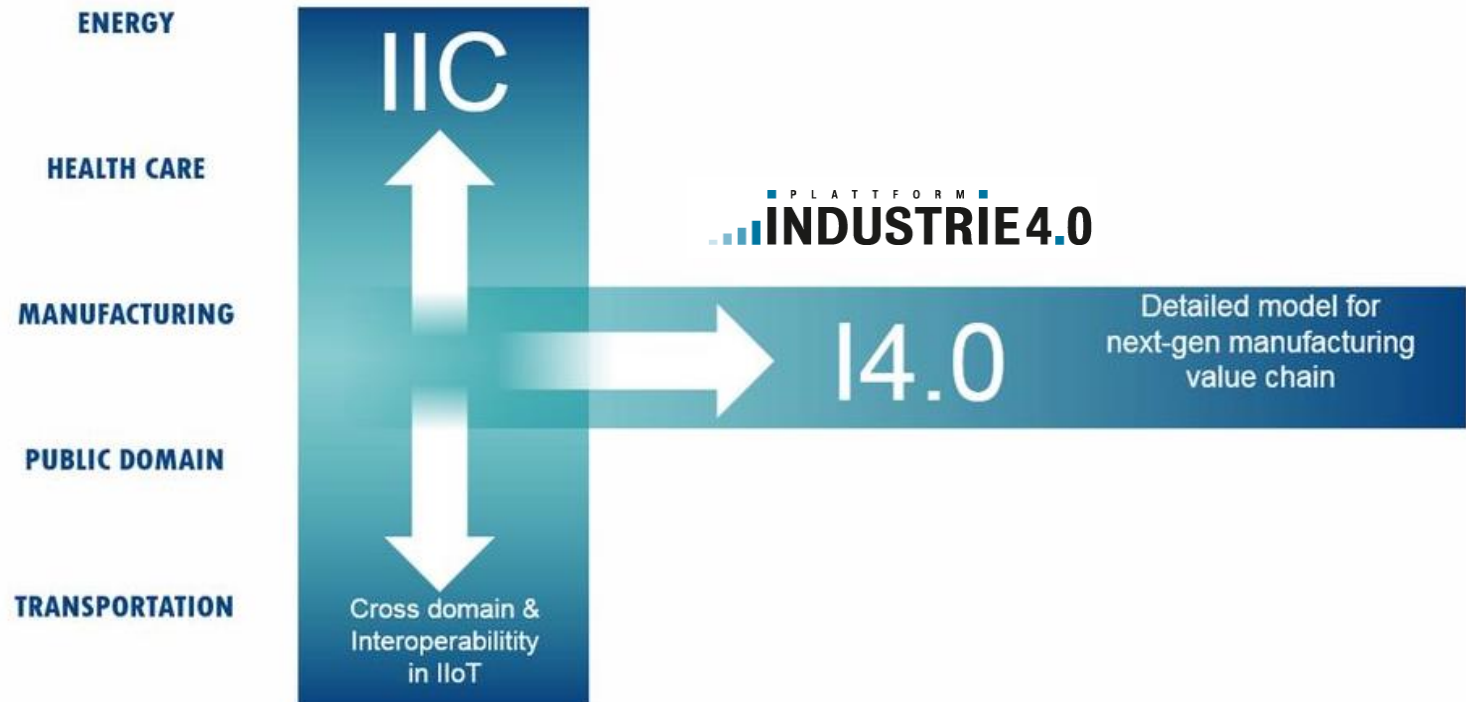
Technology Push

(Industrial) Internet of Things

Initiatives



Industrie 4.0 and IIC (Quelle: Plattform Industrie 4.0)

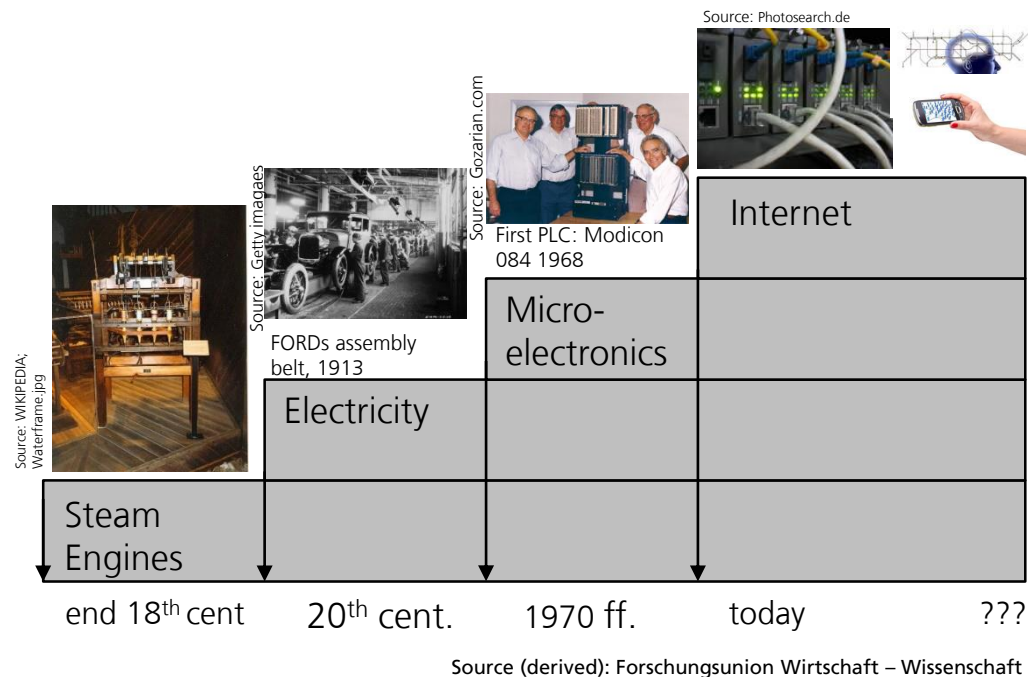


© Robert Bosch GmbH



Industry 4.0 – Advent of the 4th Industrial Revolution (1)

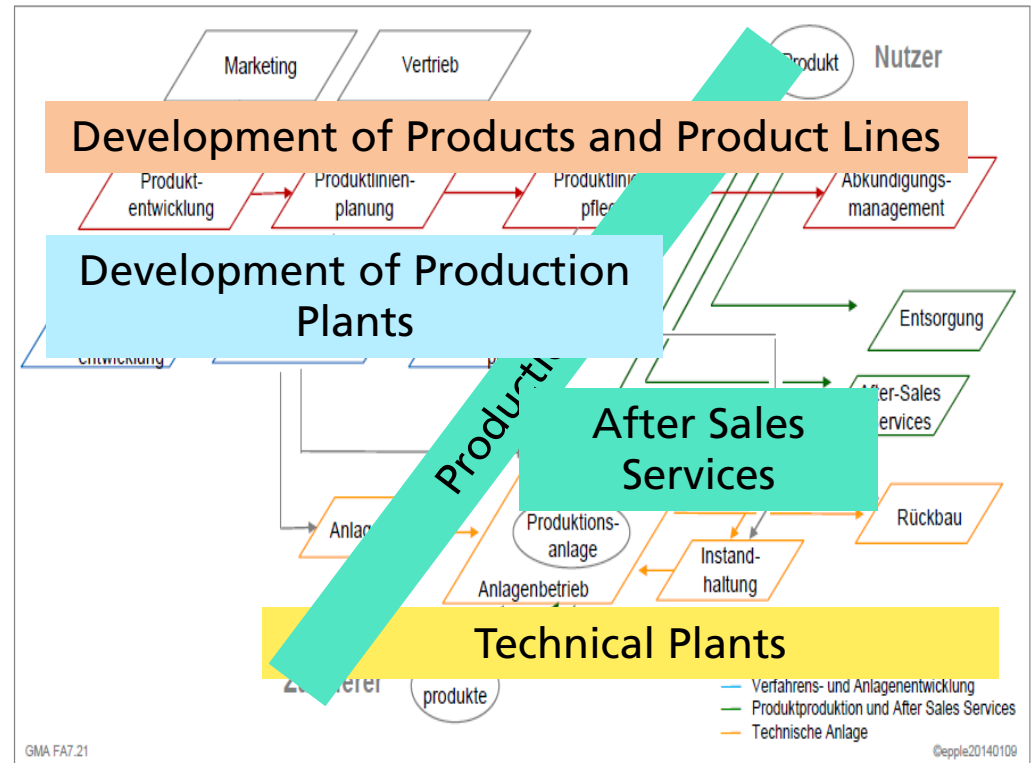
New stage of **organization and control of the whole value chain** across the entire product life cycle.



Industrie 4.0 – Advent of the 4th Industrial Revolution

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

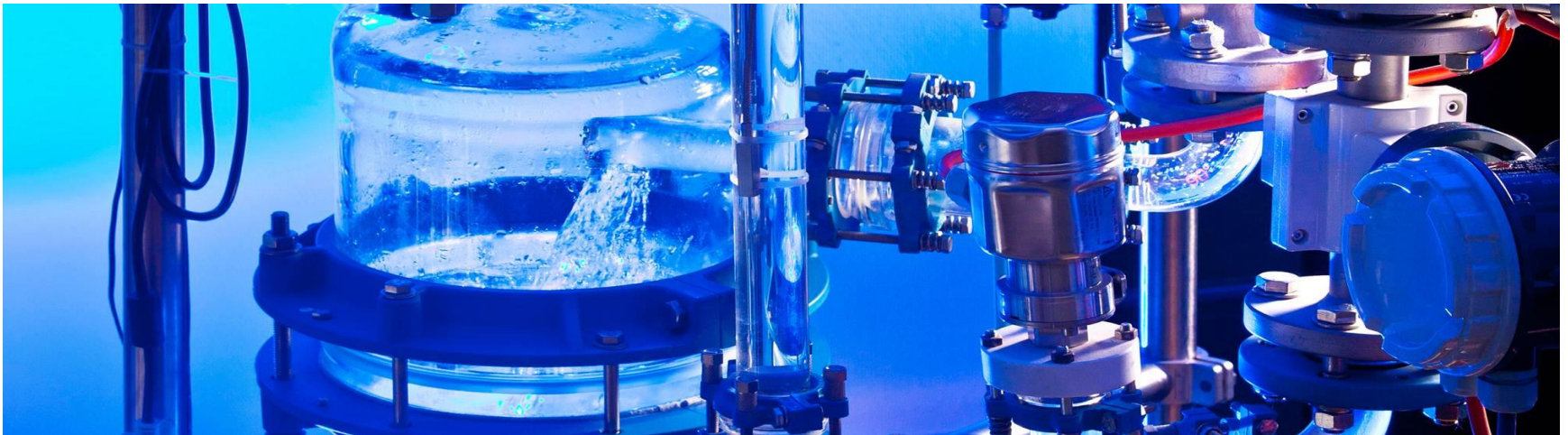
- idea
- order
- development and manufacturing
- product delivery
- recycling
- **including all related services**



New dimension of Industrie 4.0

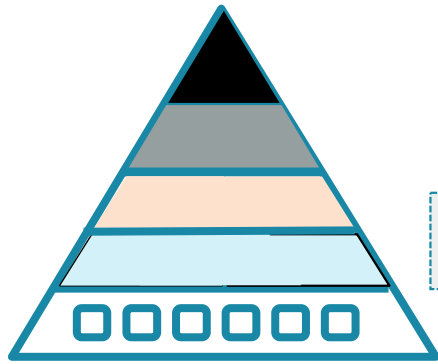
Up to now, optimization in industrial production has mainly targeted **matter**, **energy** and **cost**.

However, the potential of **data**, **information** and **knowledge** in industrial production is still **widely unexploited**.



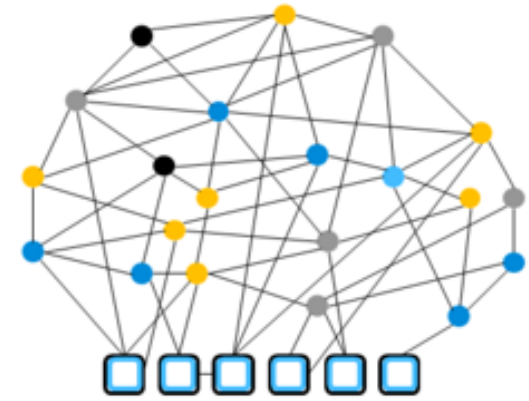
Challenges to be solved: dependable and secure service network

Revolution on Business Level



Automation
Pyramid

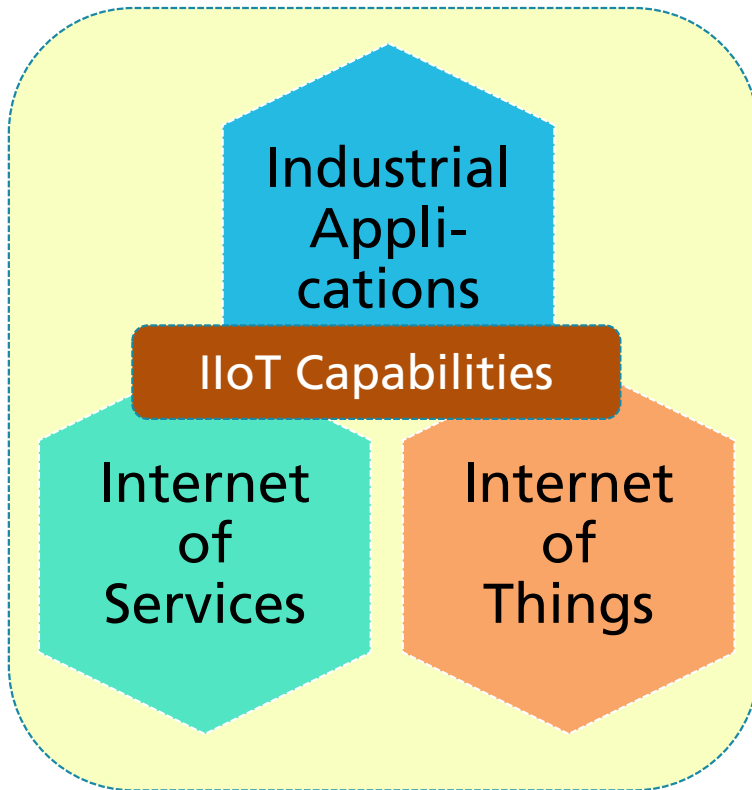
Interoperability/Standards
IT-Security/Industrial Data Space®
Dependability and Latency
Machine Learning/Data Analytics
Human-Machine Collaboration



Service Network

Evolution on Technological Level

IIoT/Industry 4.0 Challenges



Reference Architecture Model Industrie 4.0 (RAMI4.0) ... in a nutshell (YouTube)

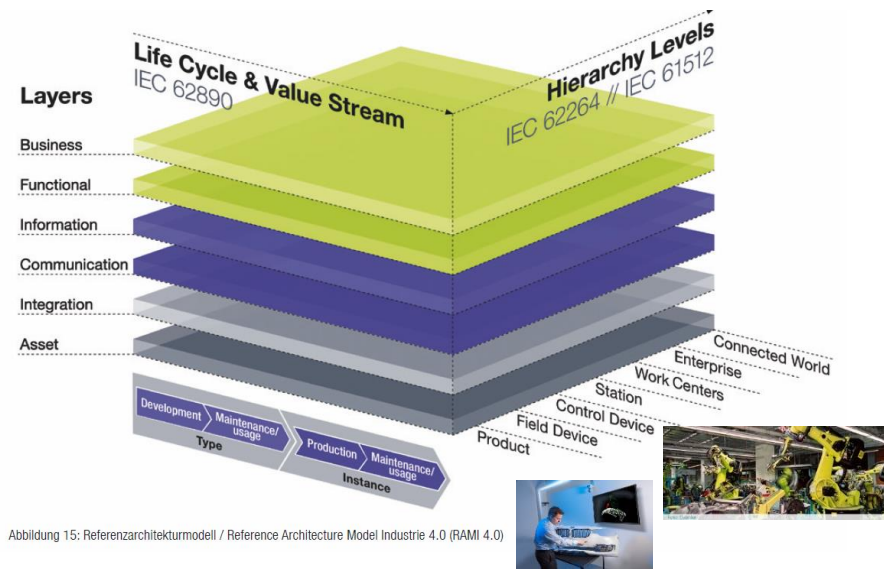
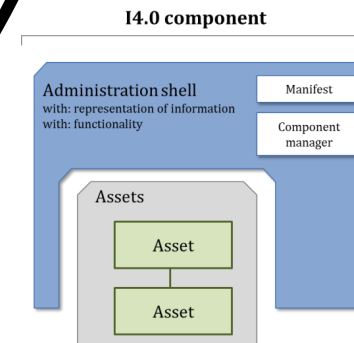


Abbildung 15: Referenzarchitekturmodell / Reference Architecture Model Industrie 4.0 (RAMI 4.0)

Asset type hierarchy:

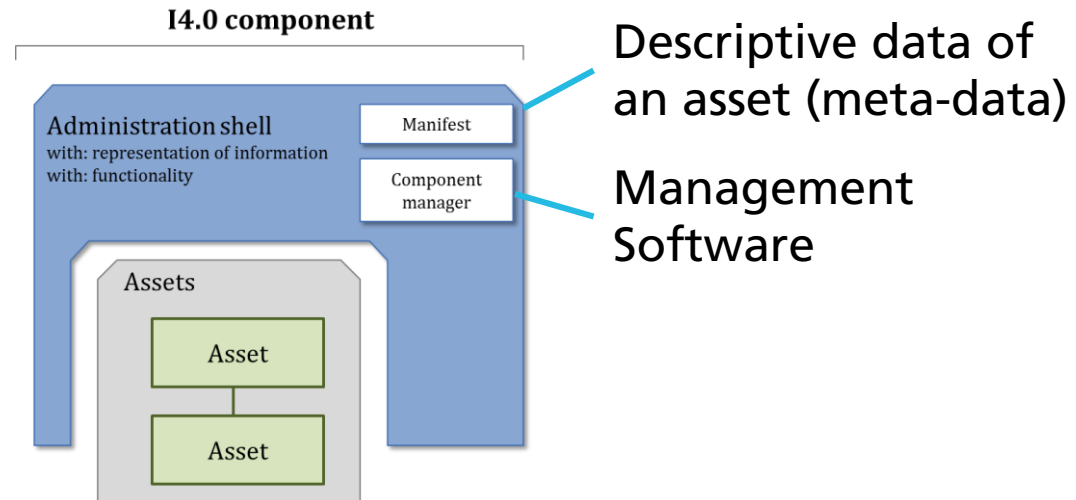
- Connected World
- Enterprise
- Work center
- Station
- Control device
- Field device (sensor/actuator)
- Product



Plattform Industrie 4.0/Hrsg. BITKOM, VDMA, ZVEI:
Umsetzungsstrategie Industrie 4.0 – Ergebnisbericht, Berlin, April 2015

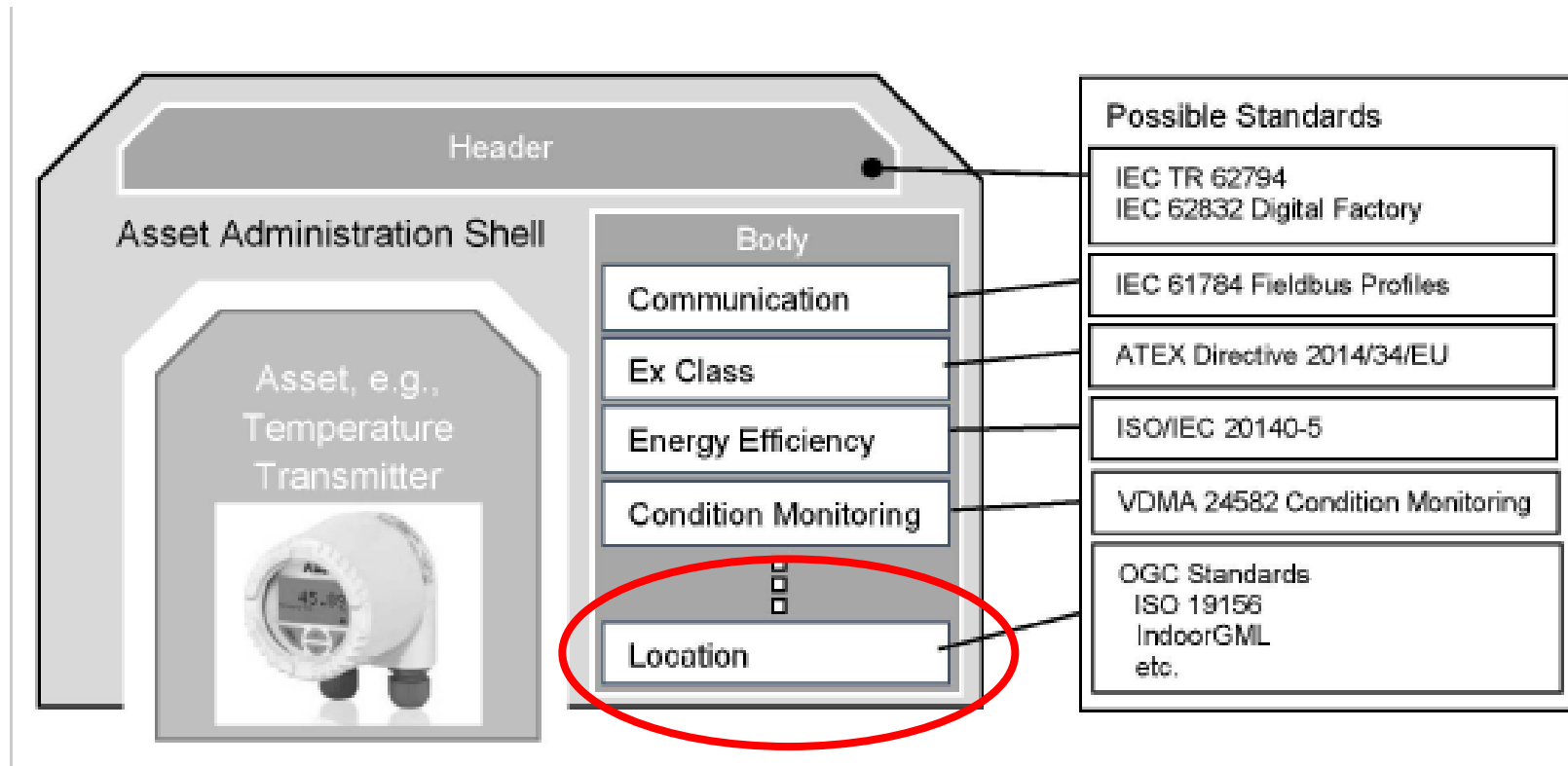
DIN SPEC 91345: I4.0 Component

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



Assets (probably composed)

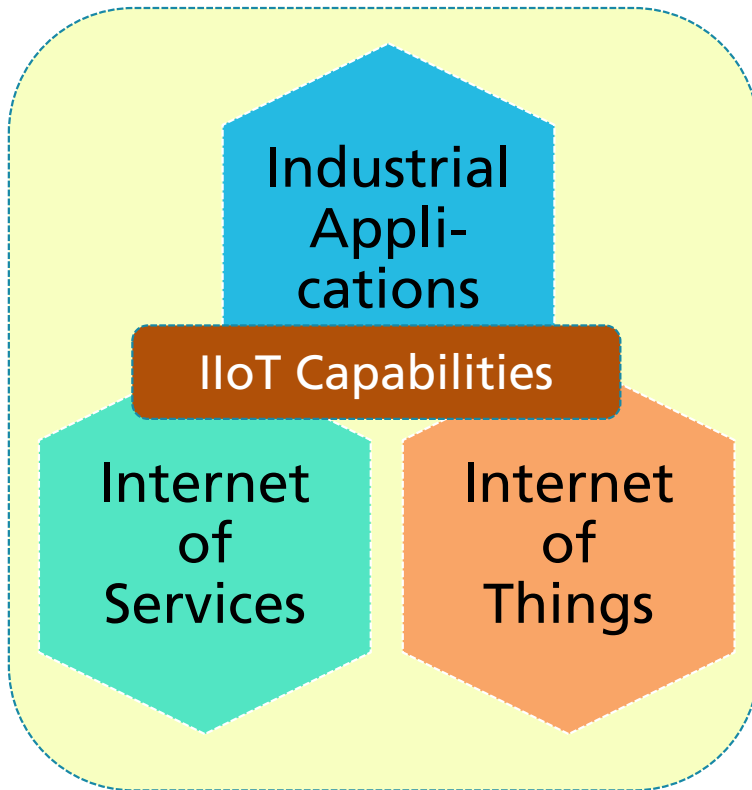
Partial Models of the Manifest



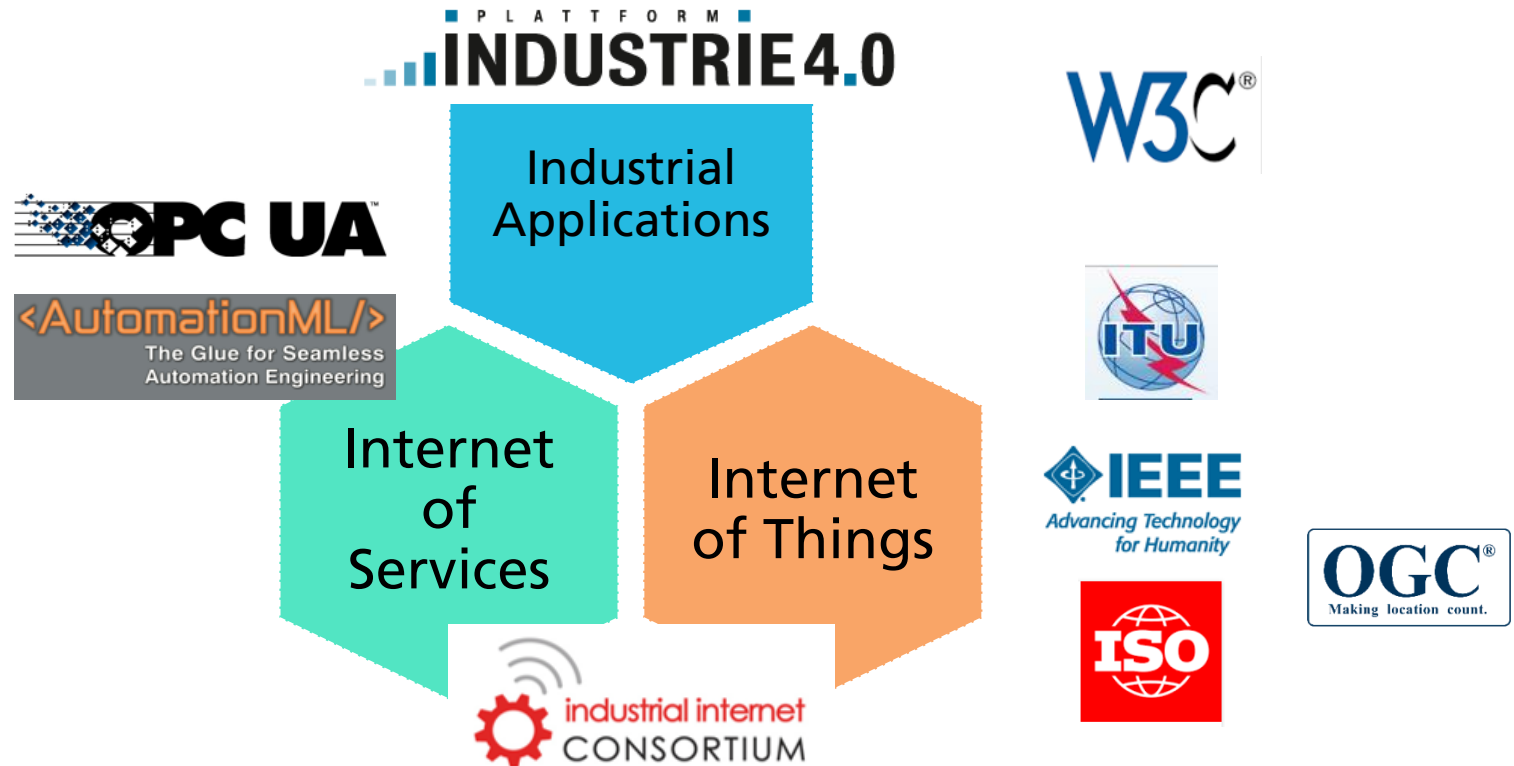
Achievements of Industrie 4.0

- 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://Ini40.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



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)



Companion
Specification
DIN SPEC 16592



IEC 62541: OPC UA

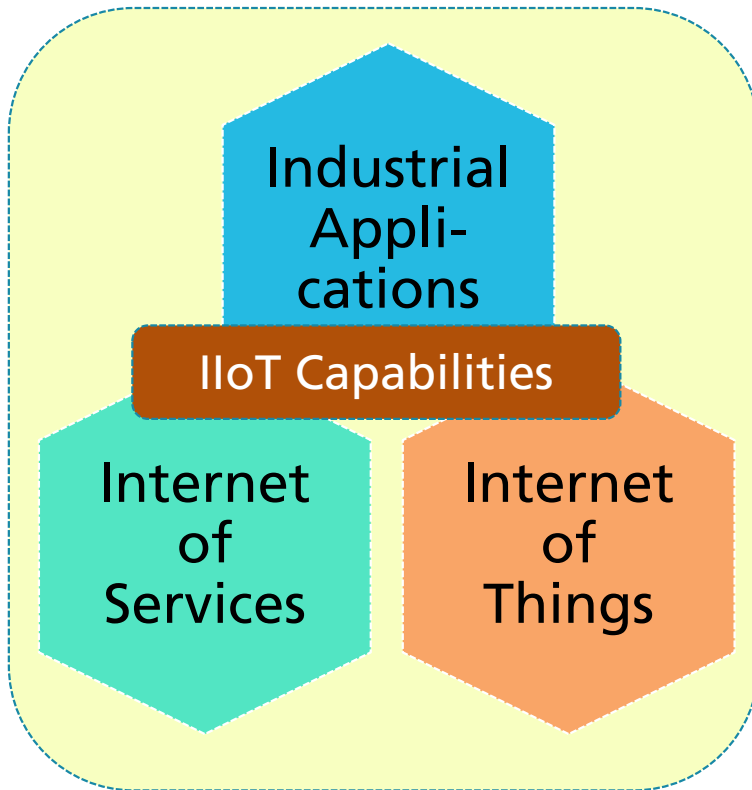
Communication services for the transmission of configuration and run-time data (HOW)

The diagram illustrates the organizational structure and process of the Standardization Council Industrie 4.0. It is organized into three main vertical sections: **Strategie** (Strategy), **Organisation + Publikation** (Organization + Publication), and **Umsetzung** (Implementation).

- Strategie:** At the top, **Plattform Industrie 4.0** (with the **INDUSTRIE 4.0** logo) leads to **Initiierte Steuerung** (Initiated Management).
- Organisation + Publikation:** This section contains the **Standardization Council Industrie 4.0**.
 - It receives input from **Initiierte Steuerung**.
 - It includes a sub-section for **Entscheidungs/Initiative** (Decision/Initiative) and **Geschäftsstelle (DKE)** (Business Office (DKE)).
 - It provides a **Normungsbefehl** (Standardization Order) to the **Roadmap Industrie 4.0**.
- Umsetzung:** This section focuses on the implementation of standards.
 - It includes a box for **Use Cases**, **Standardisierung** (Standardization), and **Validierung** (Validation).
 - It features a large box for **Standards**, which lists various standards organizations: **DIN (NAM...), DKE**; **GEN, CENELEC, ETSI**; and **ISO, IEC, JTC1, ITU**. A central area displays logos of numerous specific standards organizations.
 - It includes a **Lab Network Industrie 4.0 (LNI e.V.)** circle.

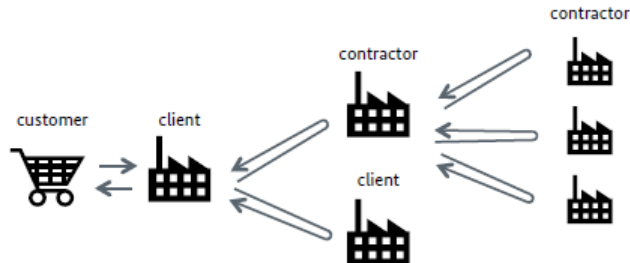
A large blue arrow points from the **OGC®** logo (with the tagline **Making location count.**) to the **Standards** box, indicating its role in the standardization process.

IIoT– Next Challenges

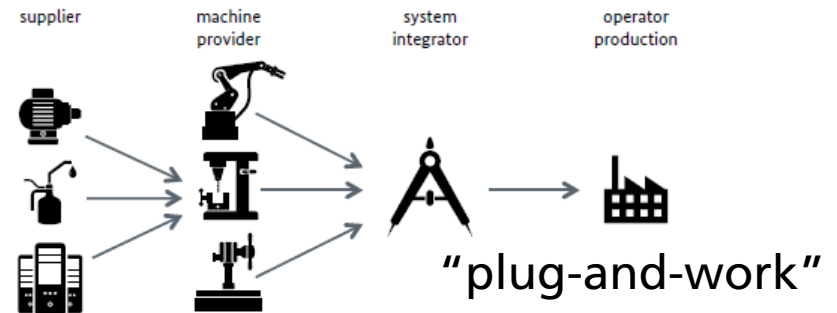


Industrie 4.0 Application Scenarios (Source: Platform Industrie 4.0)

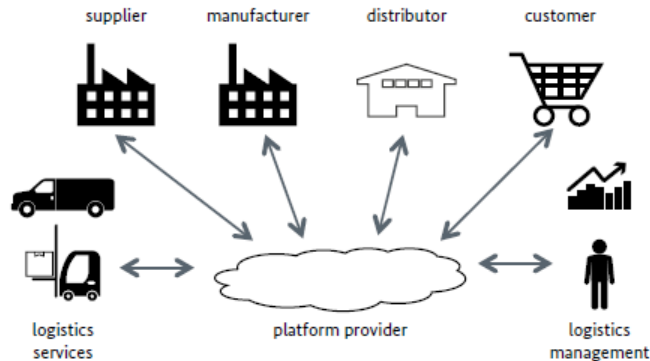
OCP – Order-Controlled Production



AF – Adaptable Factory

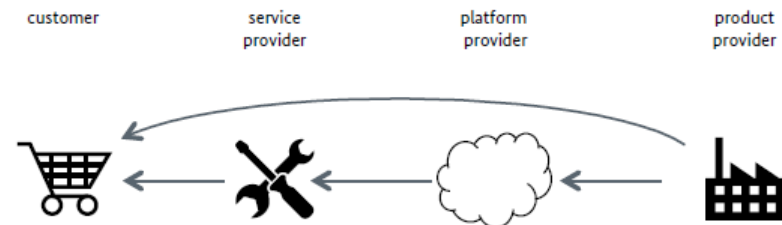


SAL – Self-organising Adaptive Logistics

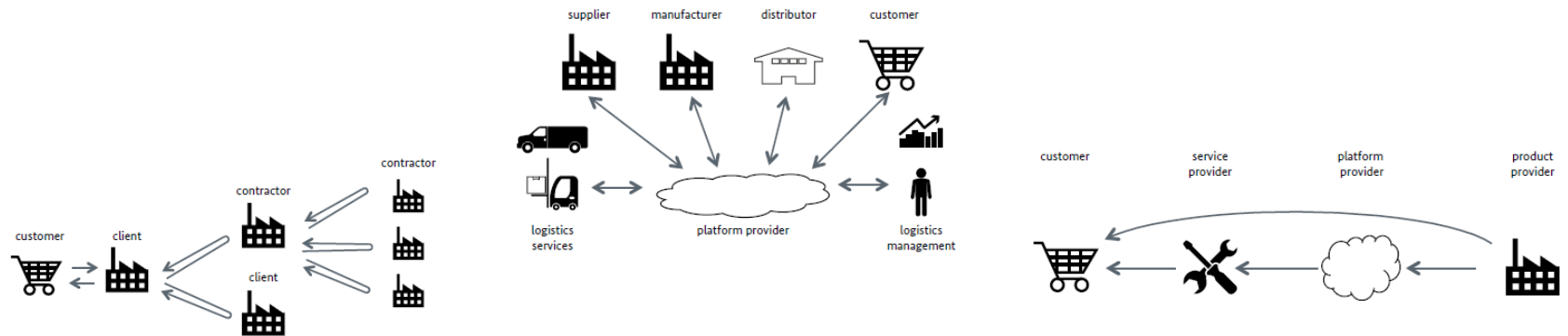


VBS – Value-Based Services

e.g. smart maintenance



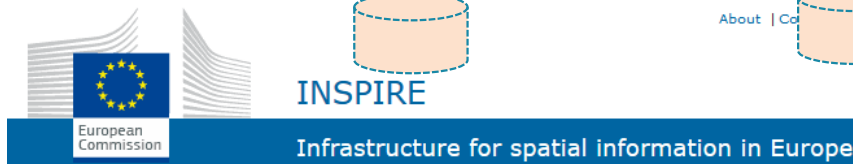
Joint Use Case (1): Industry 4.0 as customer



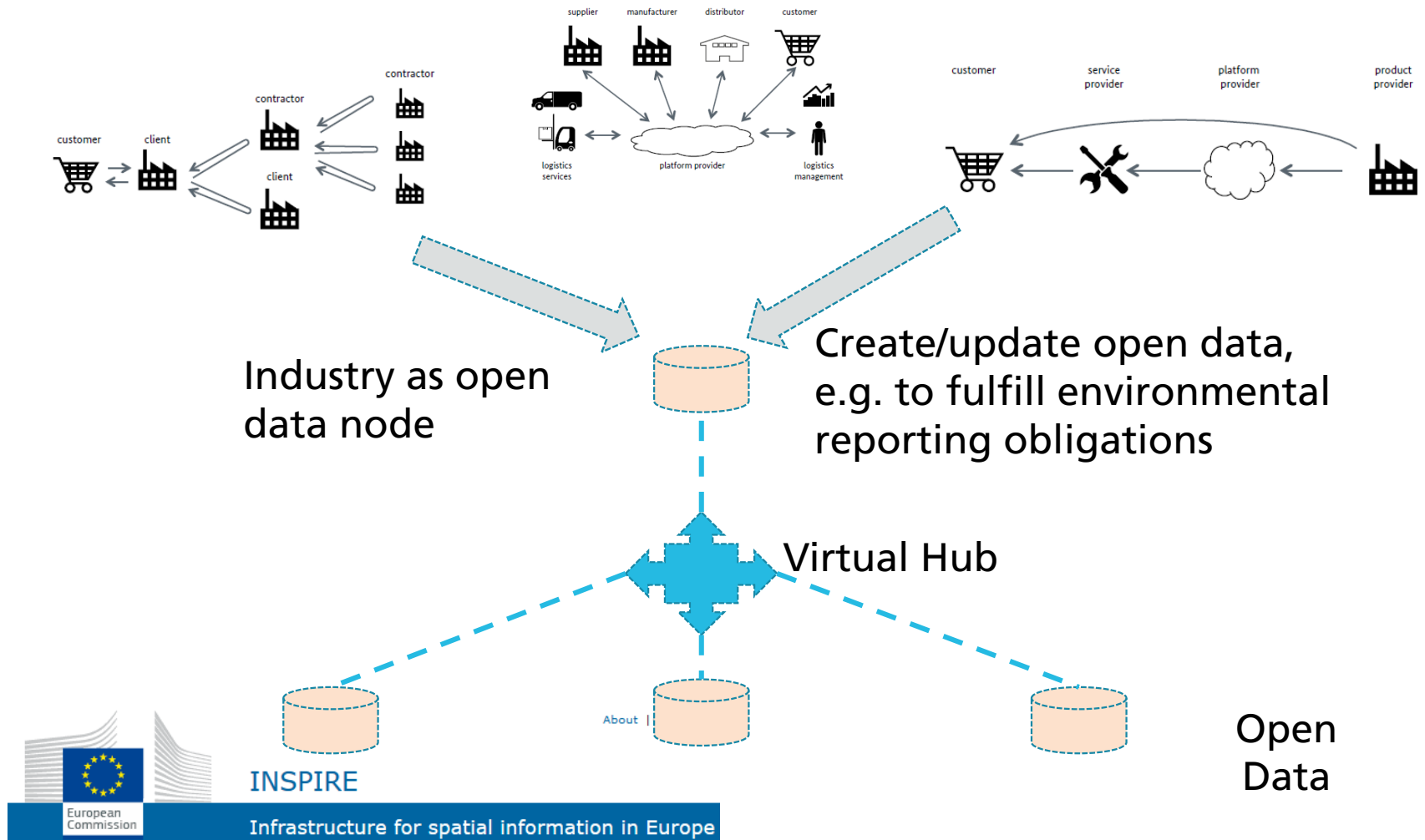
Access to open data required, e.g. to optimize logistics of goods

Virtual Hub

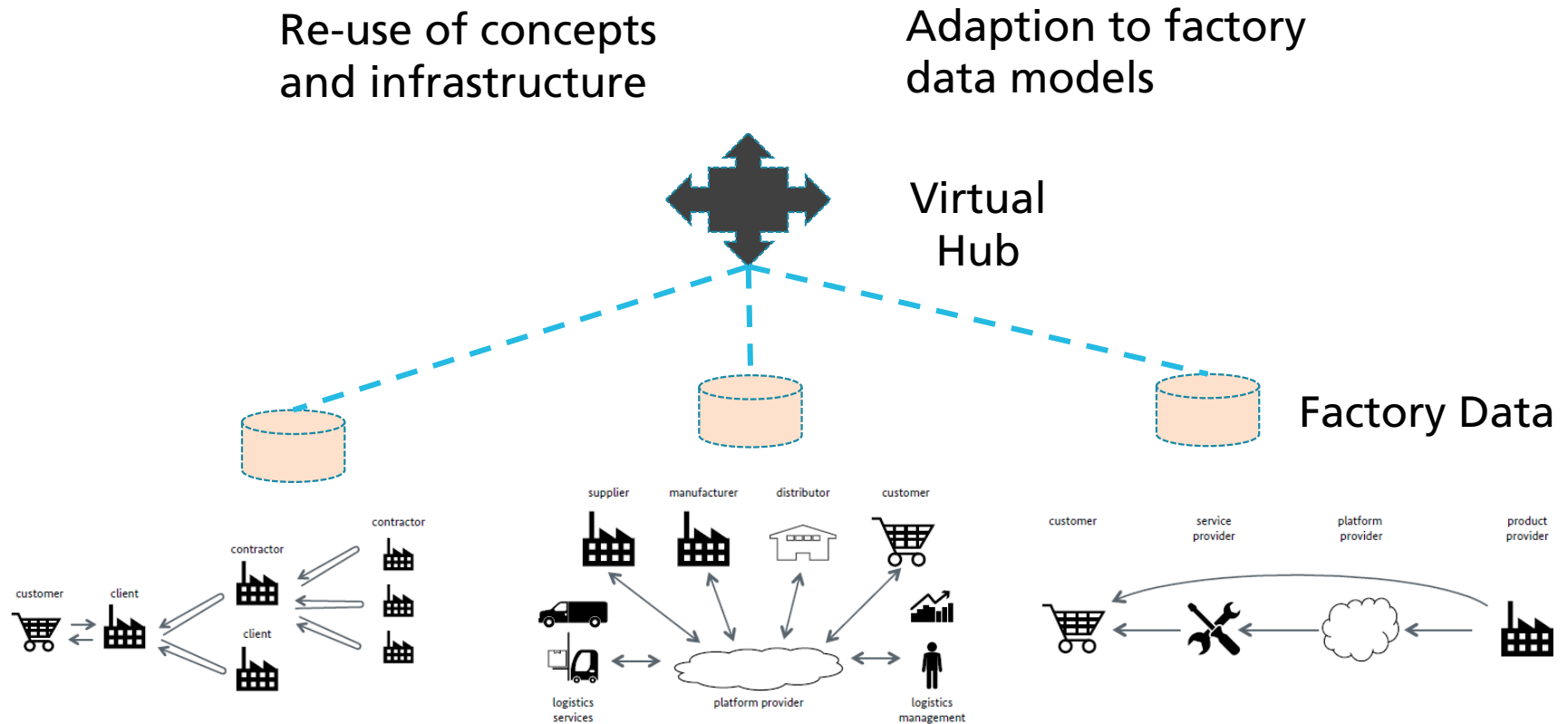
Open Data



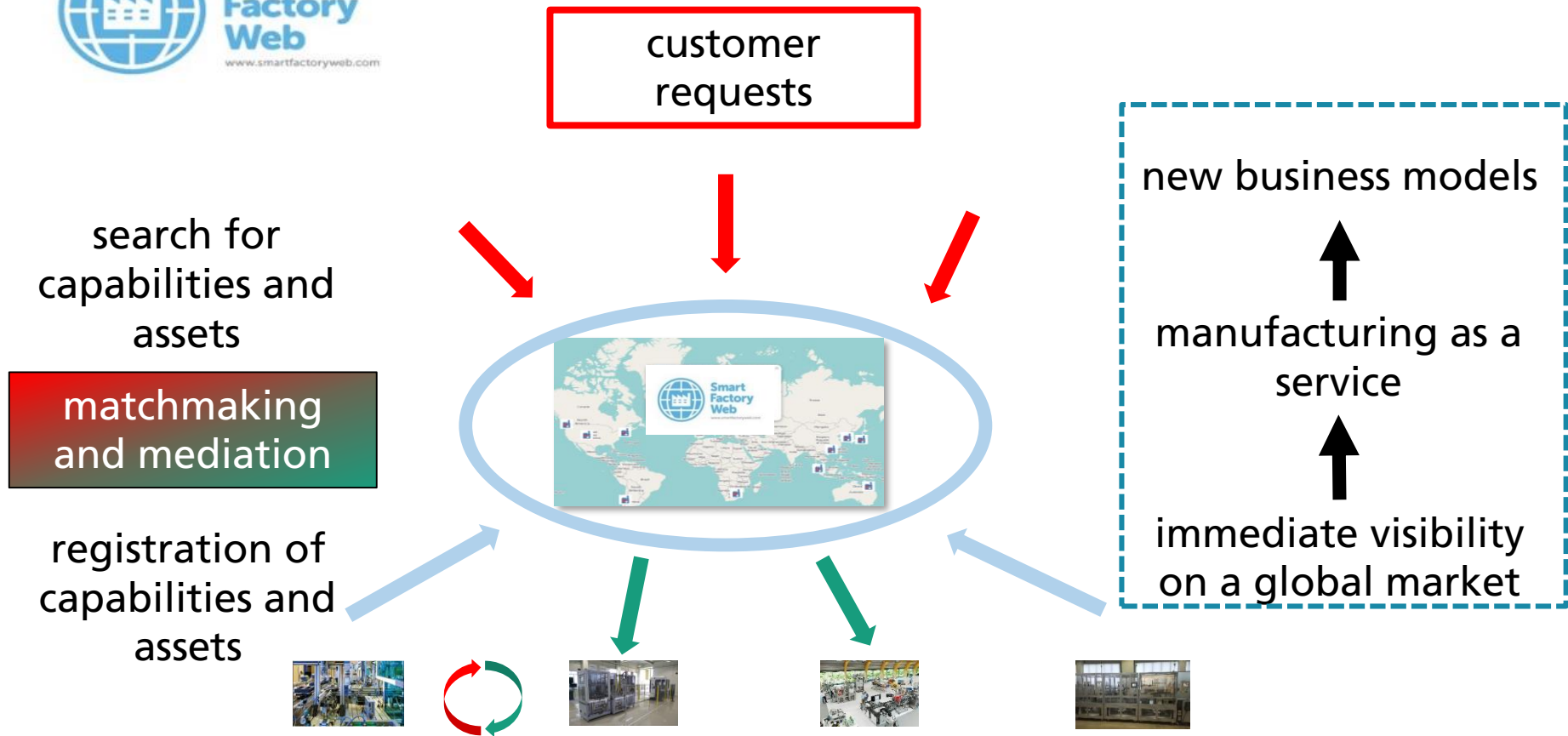
Joint Use Case (2): Industry 4.0 as (open) data provider



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



Towards a Marketplace for Manufacturing



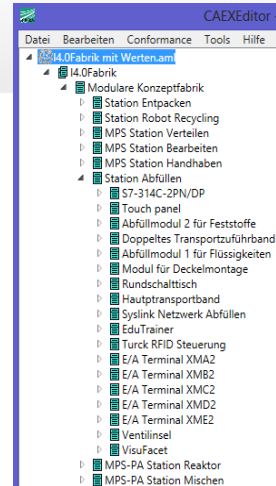
Source: Fraunhofer IOSB and KETI

adaptable production → secure plug & work of assets

IIC Testbed run by Fraunhofer IOSB and KETI



**COLLABORATIVE
FACTORY NETWORK**



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>*



*Your research partner
for industrial applications,
Industrial Internet of
Things and Industrie 4.0*