

THE CONCEPT OF INDUSTRY 4.0

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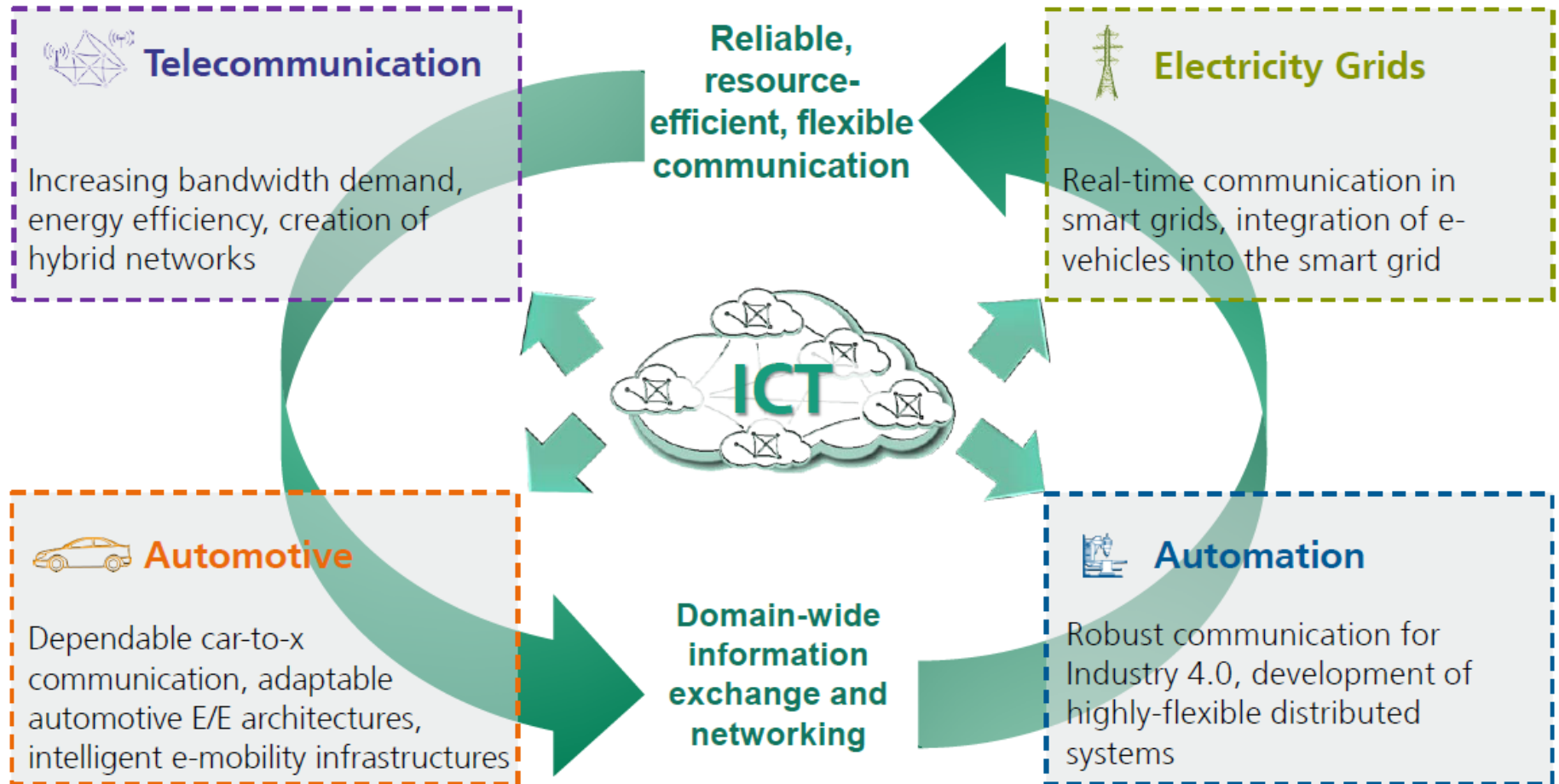


Technologies
Adaptive and Reliable Communication Systems
Software-intense, embedded Systems

Markets
 Automation
 Automotive
 Electricity Grids
 Telecommunication

Facts & Figures 2014	
Employees	70
Location	Munich
Budget	7.4 Mio. €

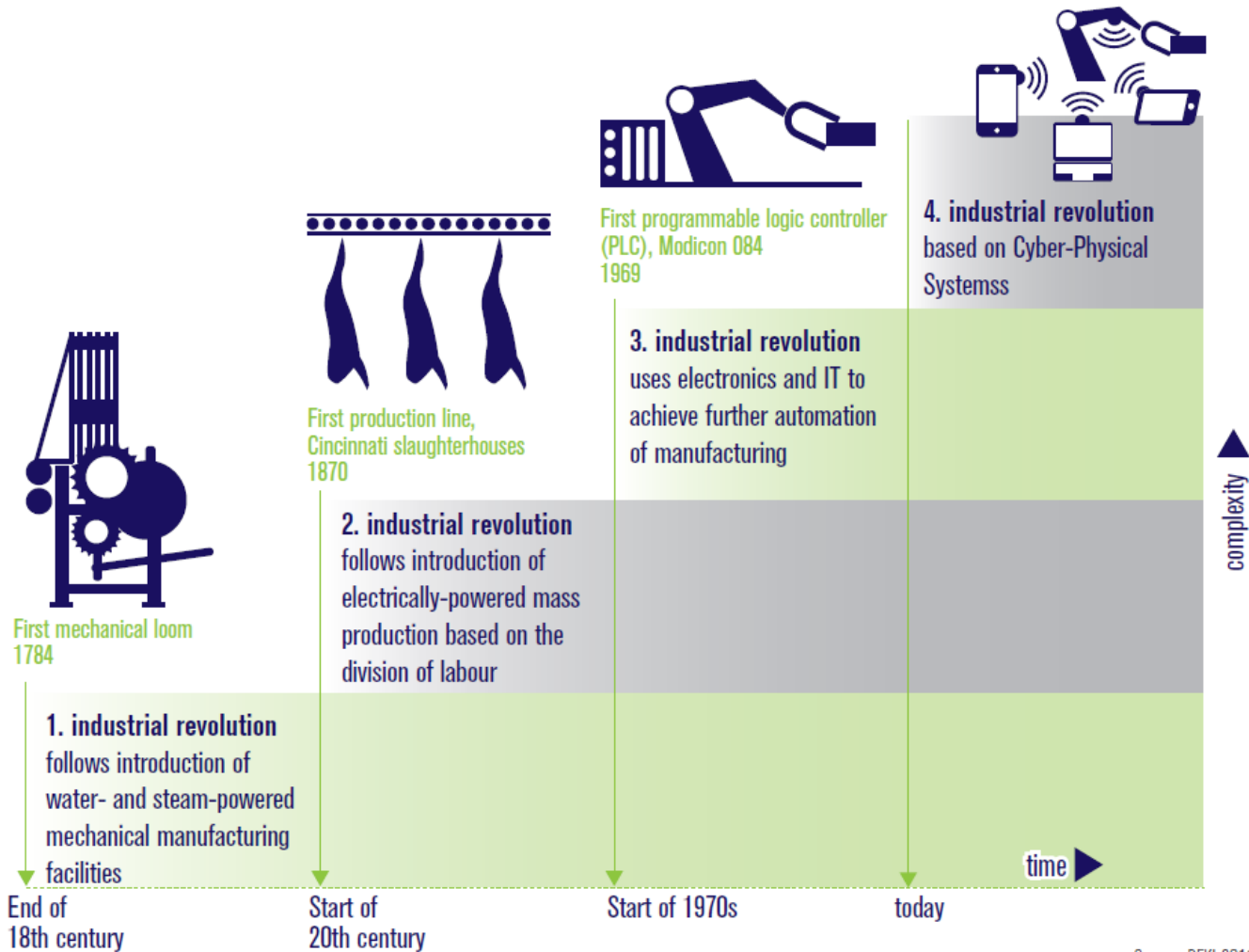
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PRESENTATION OUTLINE

- Introduction to Industry 4.0
- The key elements of Industry 4.0
- The reference model RAMI 4.0
- Implementation of Industry 4.0
- Comparison to other international initiatives
- Conclusions

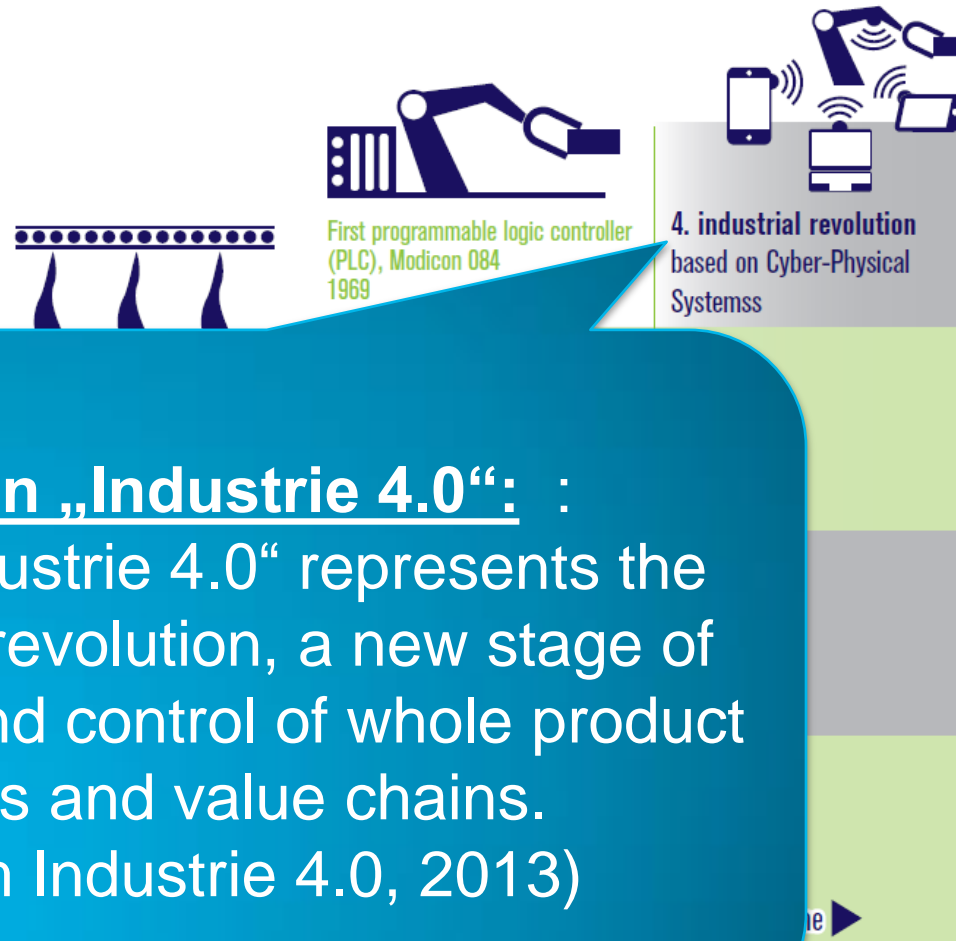
Introduction to Industry 4.0



Source: DFKI 2011

Source: acatech: "Recommendations for implementing the strategic initiative Industrie 4.0"

Introduction to Industry 4.0



Definition „Industrie 4.0“: :

The term „Industrie 4.0“ represents the 4th industrial revolution, a new stage of organization and control of whole product lifecycles and value chains.
(Plattform Industrie 4.0, 2013)

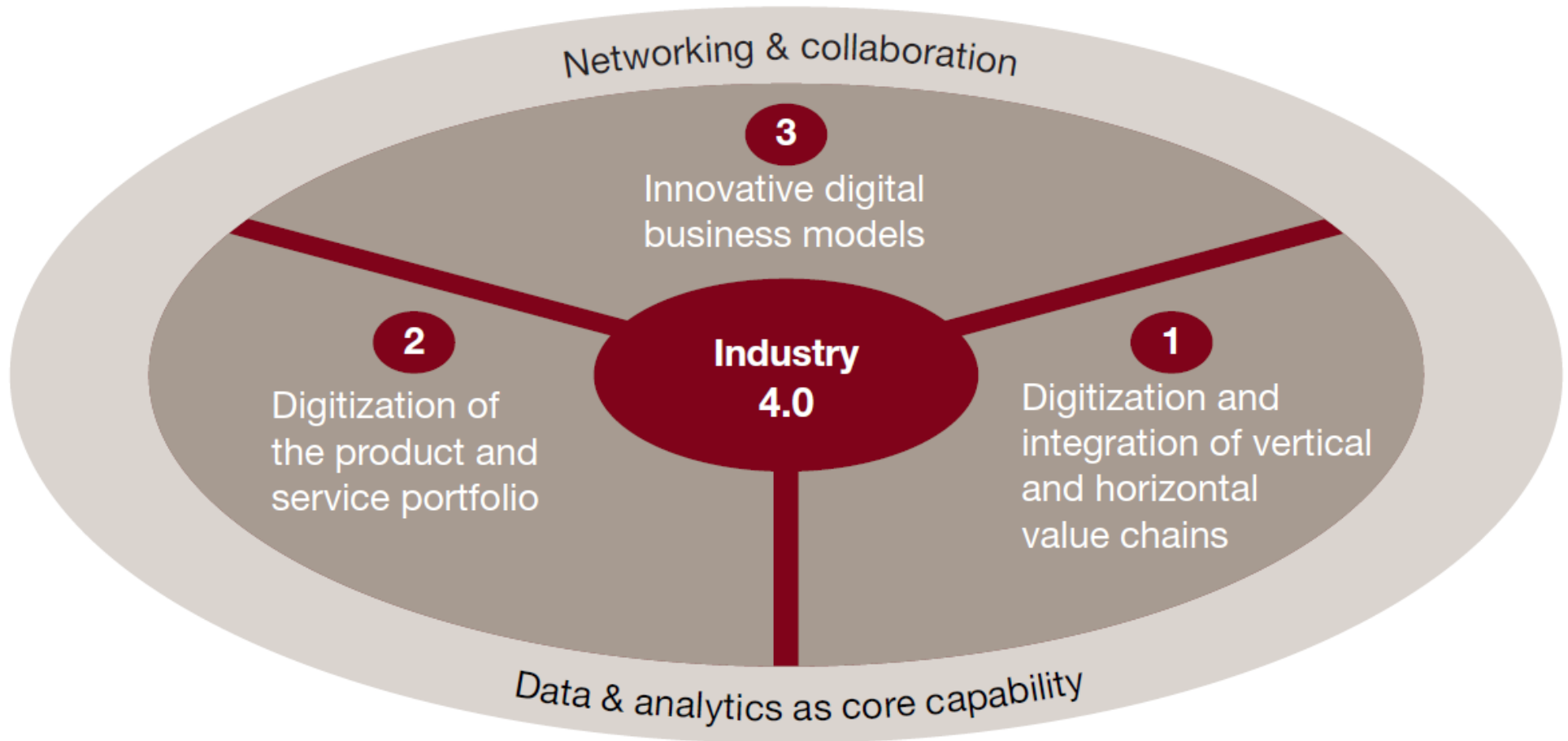
Source: DFKI 2011

Source: acatech: “Recommendations for implementing the strategic initiative Industrie 4.0”, 2013

Origins and Evolvement of the Industry 4.0 Initiative

- Initiated in a research project from „Forschungsunion“
- First publication of the term „Industrie 4.0“ at HMI 2011
- Evolvement mainly driven by „Plattform Industrie 4.0“
- Plattform Industrie 4.0: Joint initiative between the German industry organizations VDE, VDMA and BITKOM
- Up to 2015: Reference architecture RAMI 4.0 and roadmap

Economic Impacts to Enterprises



Source: PWC Survey: „Opportunities and challenges of the industrial internet“ 2014

Market Perspectives

- 40 bn. € annual investment in Germany (PWC 2014)
- Digitization of approx. 80% of value chains by 2020
- Resource efficiency growth by 18%
- Germany: 30 bn. € additional revenue by digital services

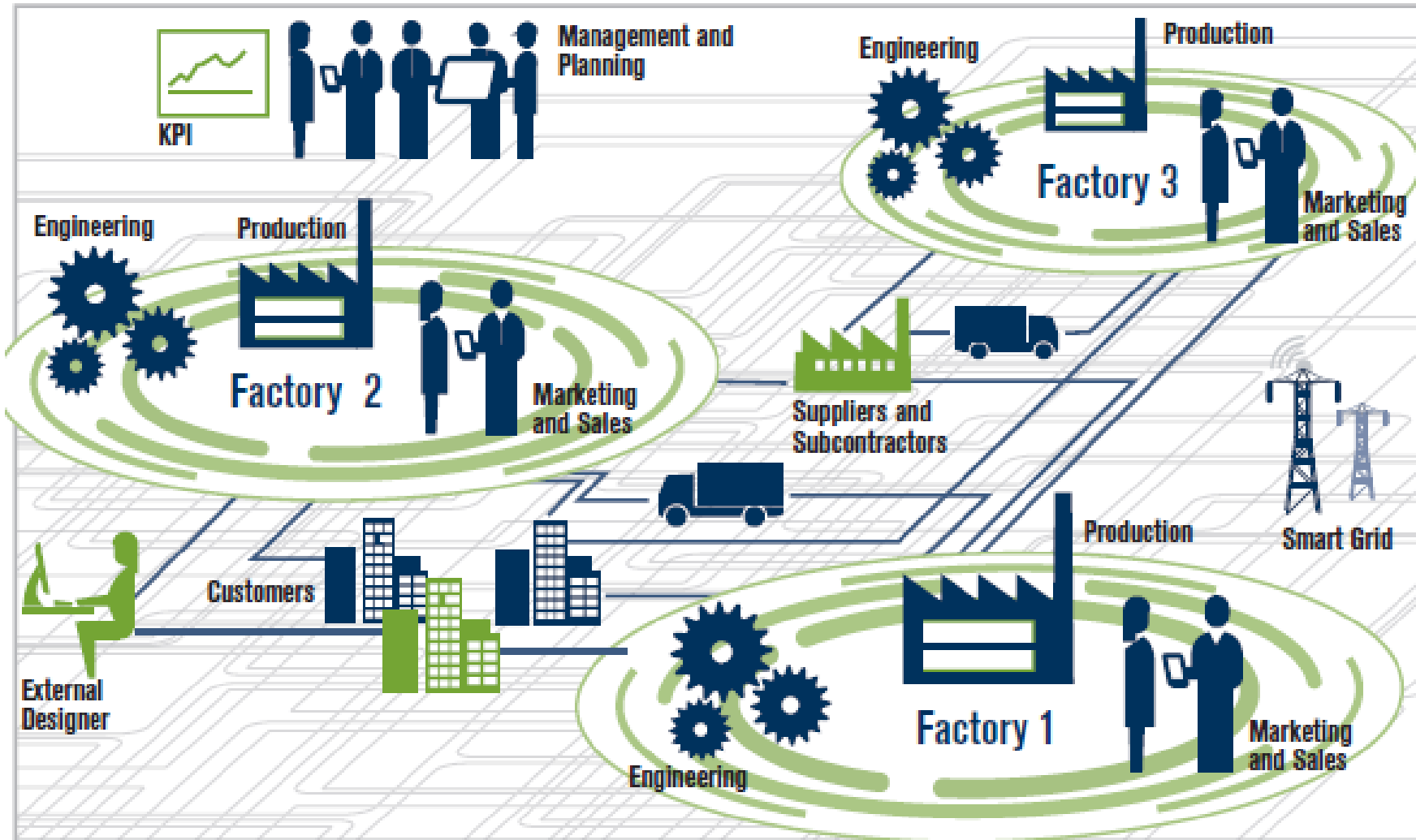


The Key Elements of Industry 4.0

- Horizontal integration through value networks
- Vertical integration and networked manufacturing systems
- End-to-end digital integration of engineering across the entire value chain
- Social infrastructures

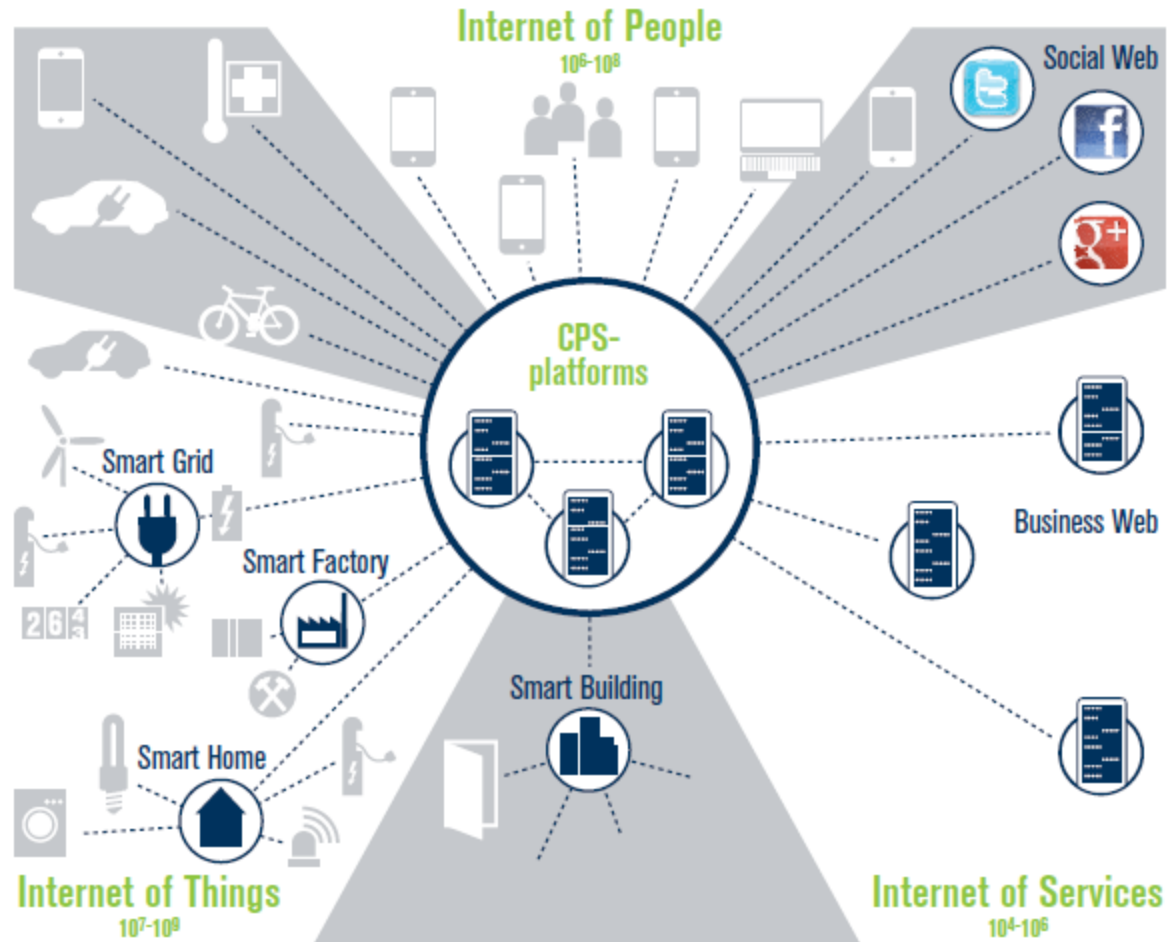


Industry 4.0 – Horizontal Integration



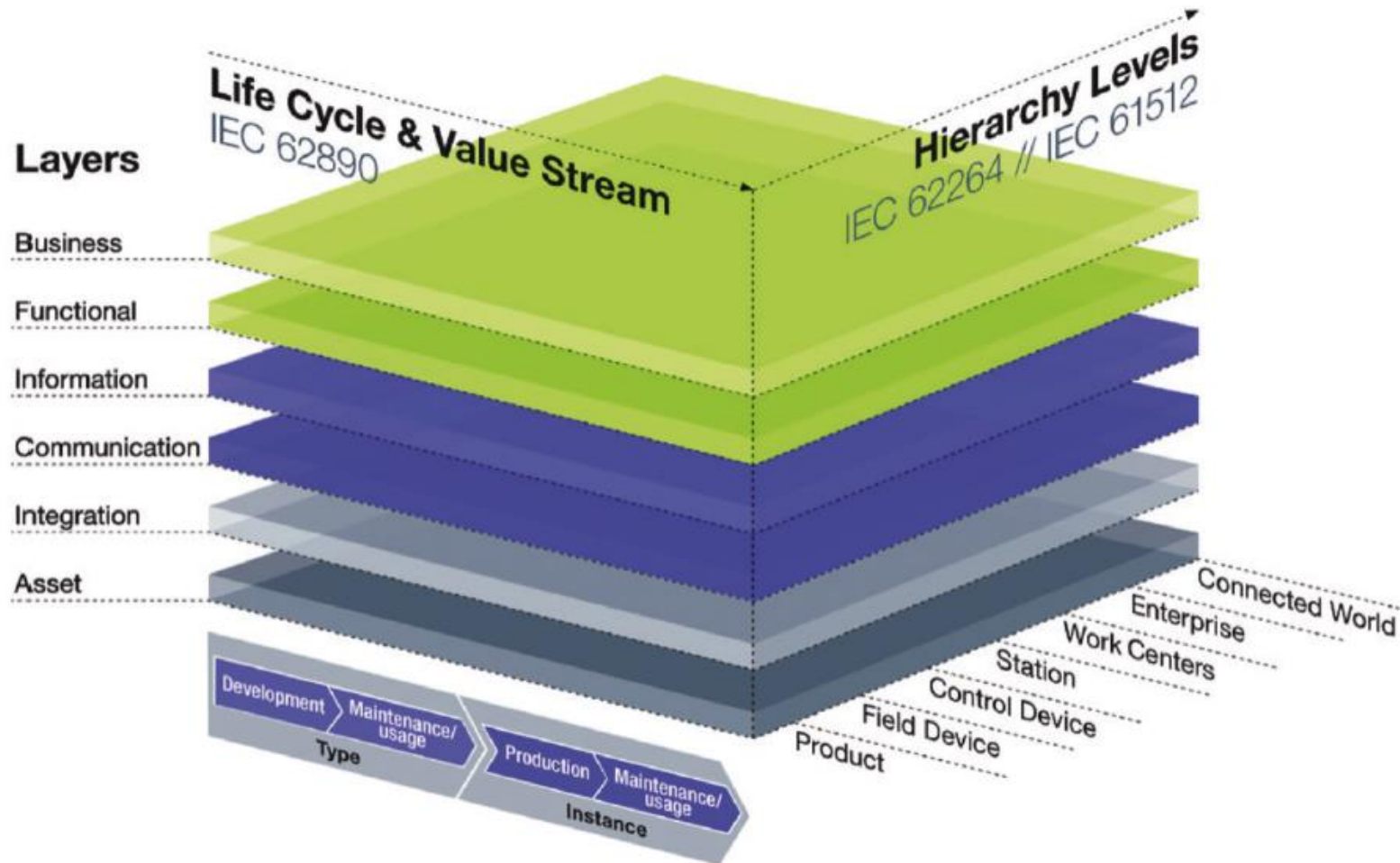
Source: acatech: "Recommendations for implementing the strategic initiative Industrie 4.0", 2013

Industry 4.0 – Vertical Integration



Source: acatech: "Recommendations for implementing the strategic initiative Industrie 4.0", 2013

The Reference Model RAMI 4.0



Source: ZVEI: Das Referenzarchitekturmodell Industrie 4.0 (RAMI 4.0), 2015

The Reference Model RAMI 4.0

- Enhancement Industrie 4.0

Connected World

- IEC 62264-1:2013 Enterprise-control system integration Part 1: Models and terminology

Enterprise

- IEC 61512-1:1997 Batch Control Part 1: Models and terminology

Site

- ISA Draft 88/95 Technical Report Using ISA-88 and ISA-95 Together

Area

Work centers

Process cell

Production unit

Production line

Storage zone

Work units

Unit

Unit

Work cell

Storage unit

Equipment Module

Equipment Module

Station

Equipment used for storage or movement

Control Module

Control Module

Control Device

Equipment used in batch production

Equipment used in continuous production

Equipment used in repetitive or discrete production

Equipment

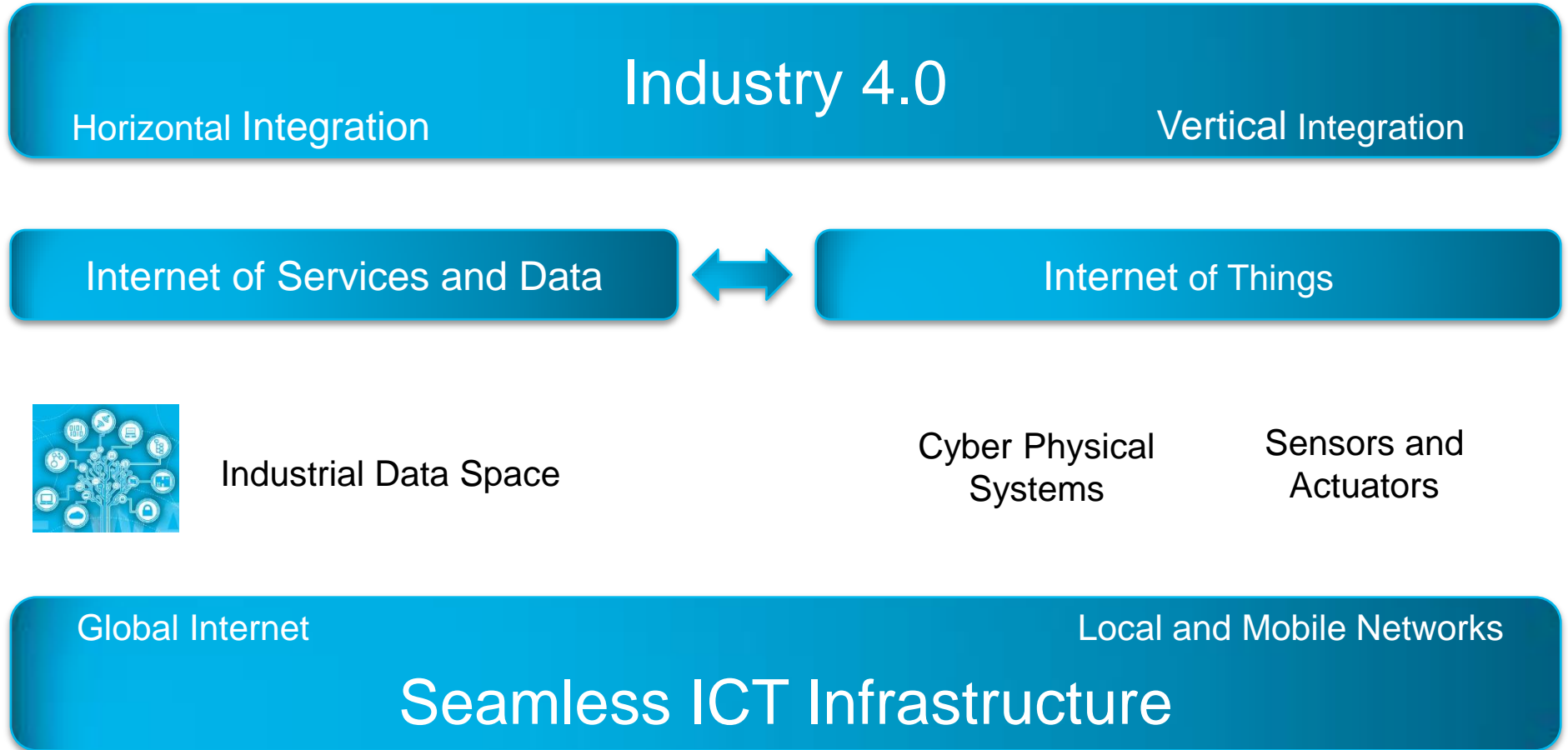
- Enhancement Industrie 4.0

Field Device

Product

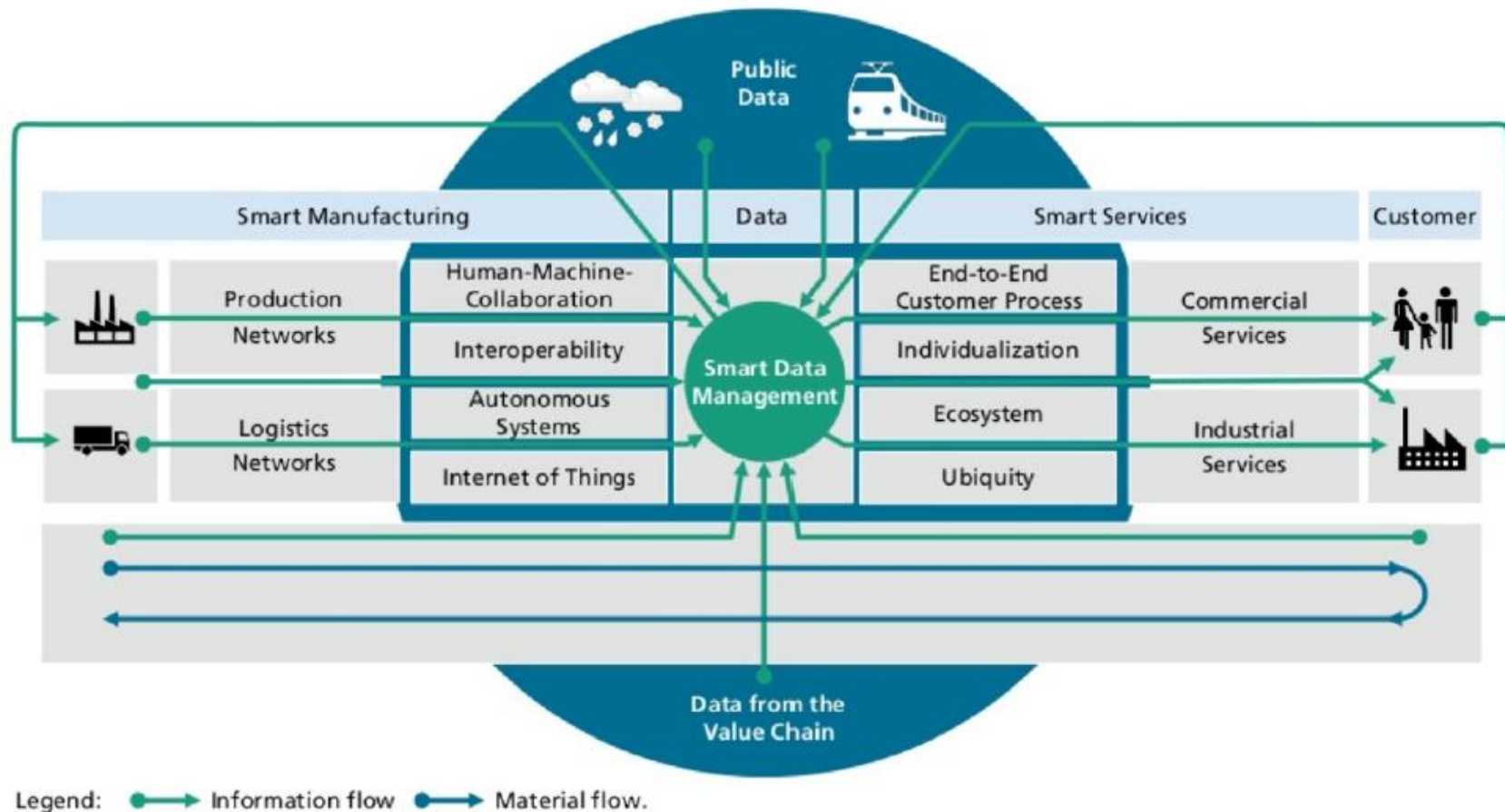
Source: ZVEI: Das Referenzarchitekturmodell Industrie 4.0 (RAMI 4.0), 2015

Implementation of Industry 4.0



Implementation of Industry 4.0 – Horizontal Integration

The Industrial Data Space



Source: B. Otto: "Industrial Data Space Brief Overview", Dortmund, 2015

Implementation of Industry 4.0 – Vertical Integration

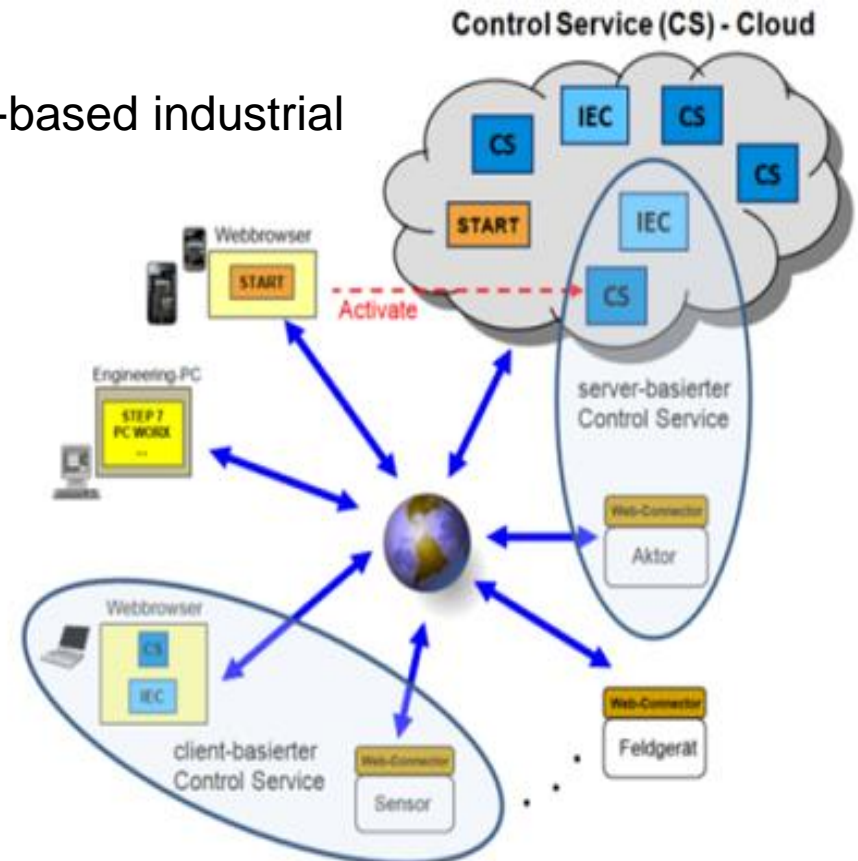
CICS – Cloud based Industrial Control System

Objective: Architecture and interfaces for cloud-based industrial control systems

Achievements:

- Reference architecture and interfaces
 - Flexible distribution of control functions
 - Deployment using web services
- Demonstration case
 - Example implementation

More information: <http://woas.ccad.eu>



Comparison to Other International Initiatives

■ USA: Industrial Internet Consortium

- Founded 2014 by AT&T, Cisco, GE, IBM, Intel
- Open membership organization hosted by OMG
- Not a standardization body
- Ecosystem for industrial internet applications



■ France: L'usine du futur



■ EC: ETP Factories of the future (FoF)



■ China: China Integration and Innovation Alliance of Internet and Industry (CIIAI) founded in 2014



Conclusions

- Industry 4.0:
New stage of organization and control of whole product lifecycles
- Origins in Germany 2011
- Mainly driven by “Plattform Industrie 4.0”
- RAMI 4.0 reference architecture
- Horizontal and vertical integration

THANK YOU VERY MUCH!

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