

# THE CONCEPT OF INDUSTRY 4.0

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# Fraunhofer Institute for Embedded Systems and Communication Technologies ESK



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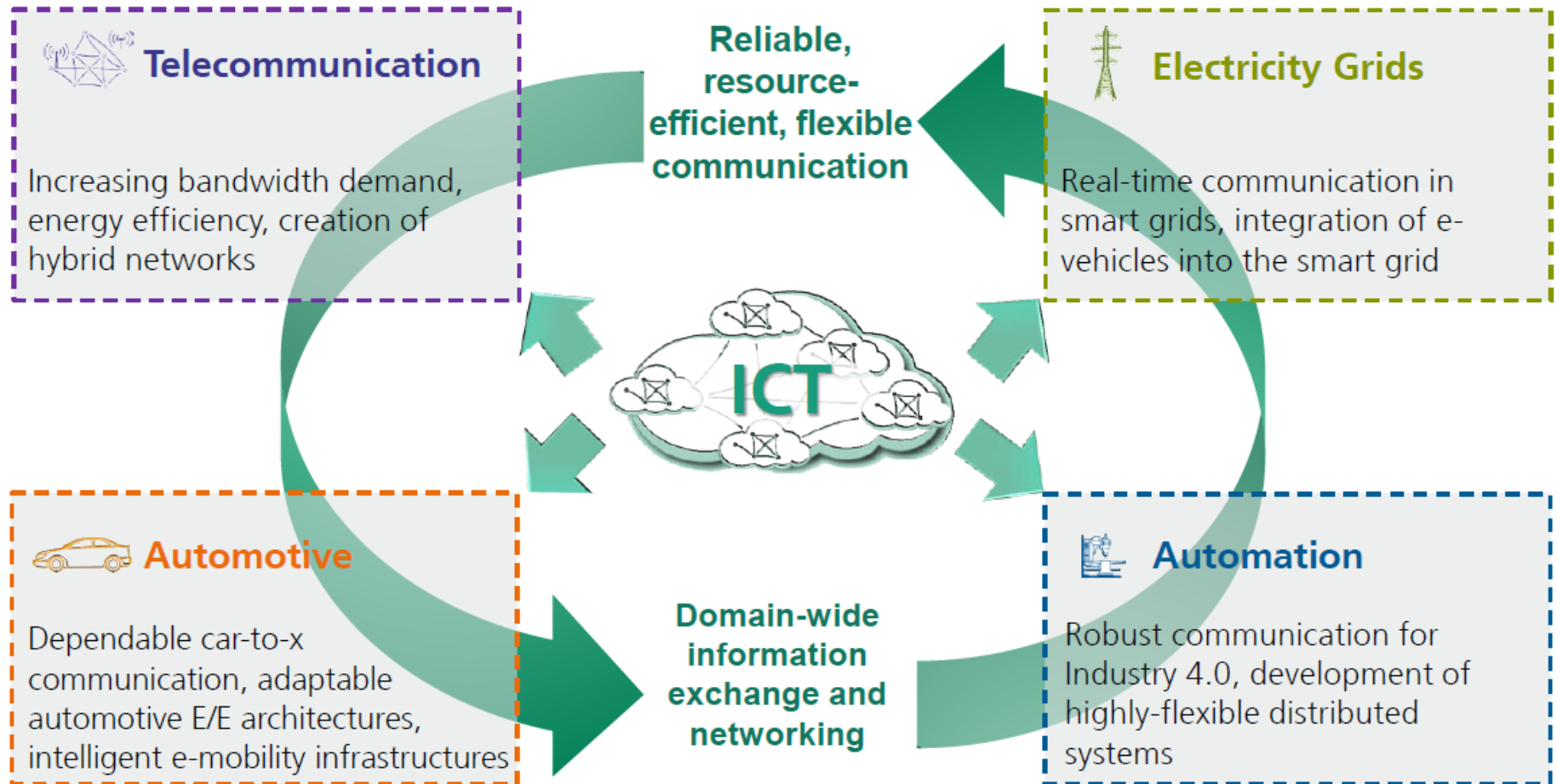


Technologies
Adaptive and Reliable Communication Systems
Software-intense, embedded Systems

Markets
 Automation
 Automotive
 Electricity Grids
 Telecommunication

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

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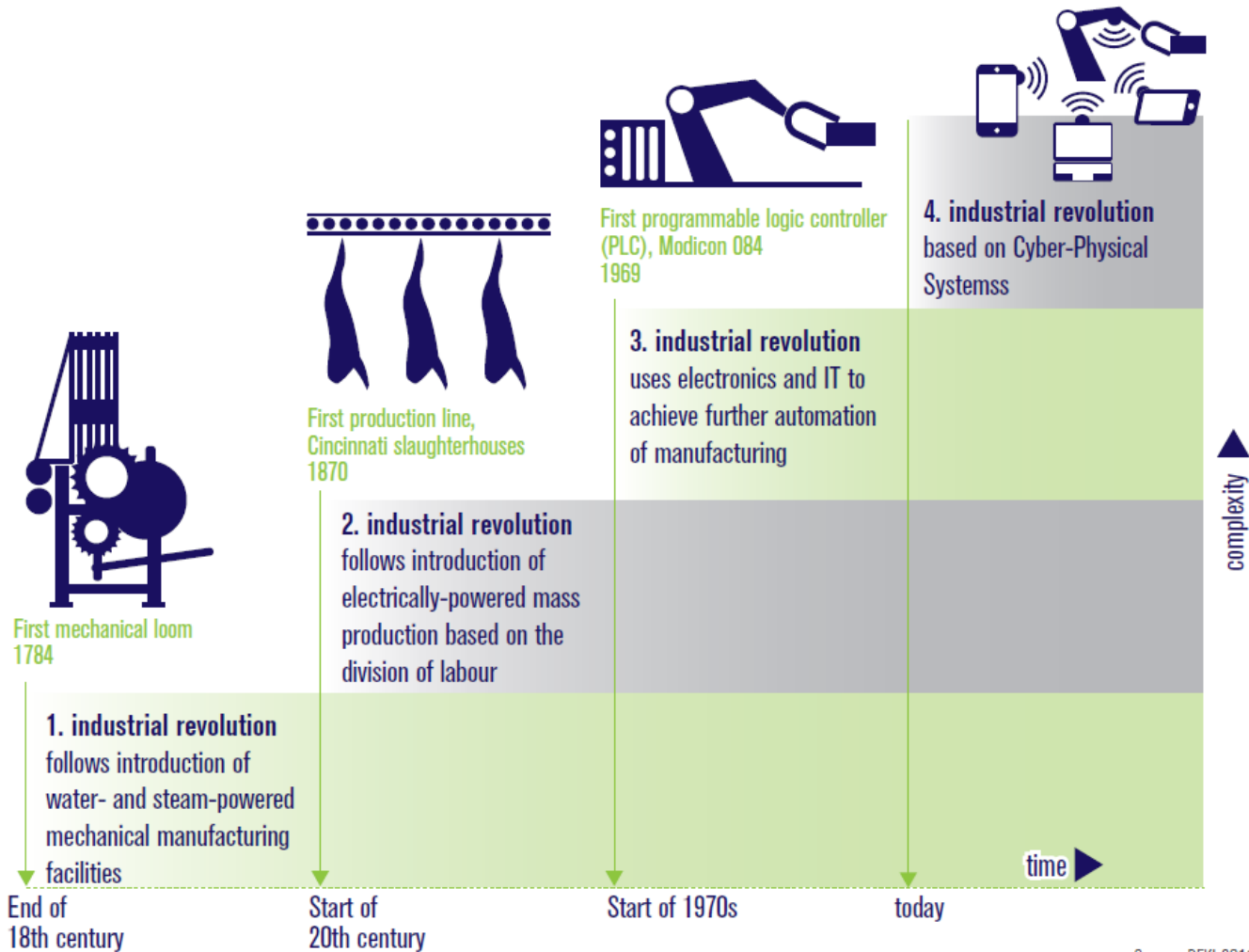
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# PRESENTATION OUTLINE

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- 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

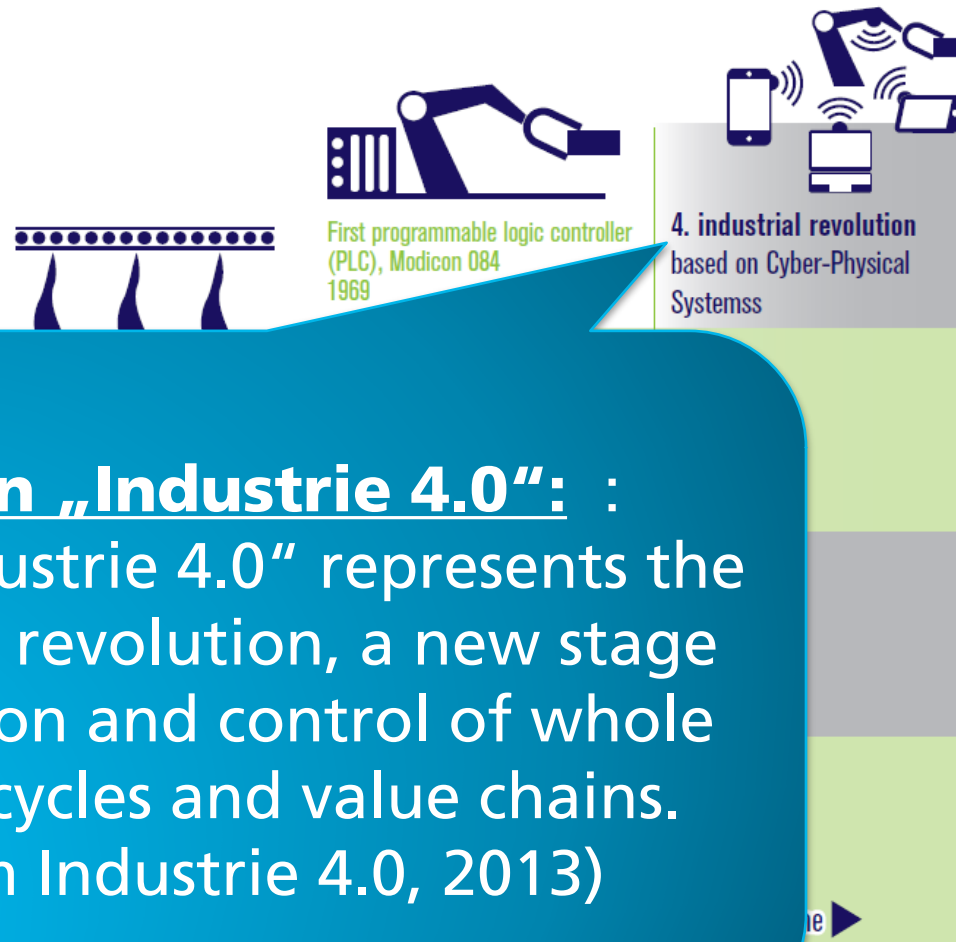
# Introduction to Industry 4.0



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

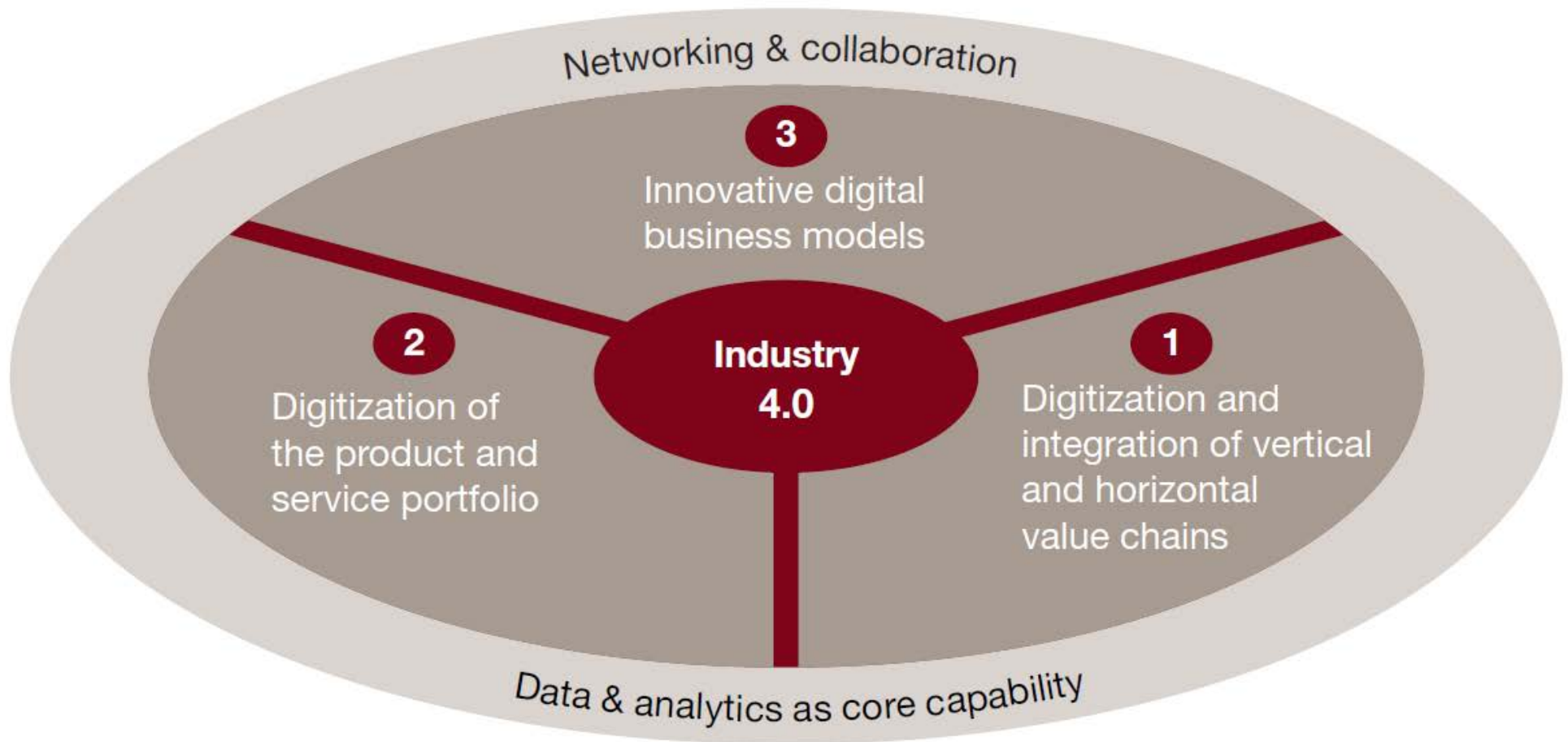
Source: acatech: "Recommendations for implementing the strategic initiative Industrie 4.0", 2013

# Origins and Evolvment of the Industry 4.0 Initiative

- Initiated in a research project from „Forschungsunion“
- First publication of the term „Industrie 4.0“ at HMI 2011
- Evolvment 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

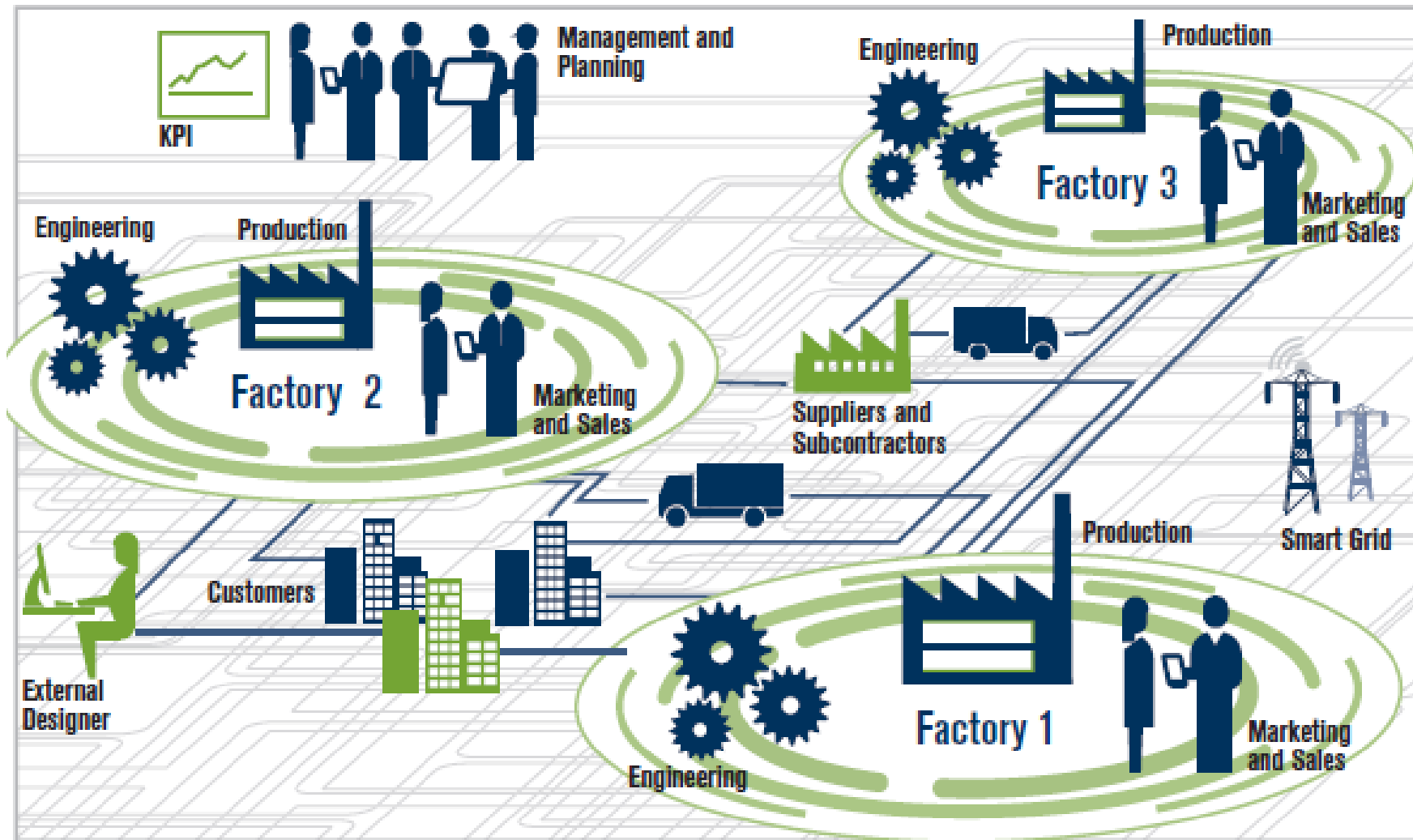


# The Key Elements of Industry 4.0

- 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

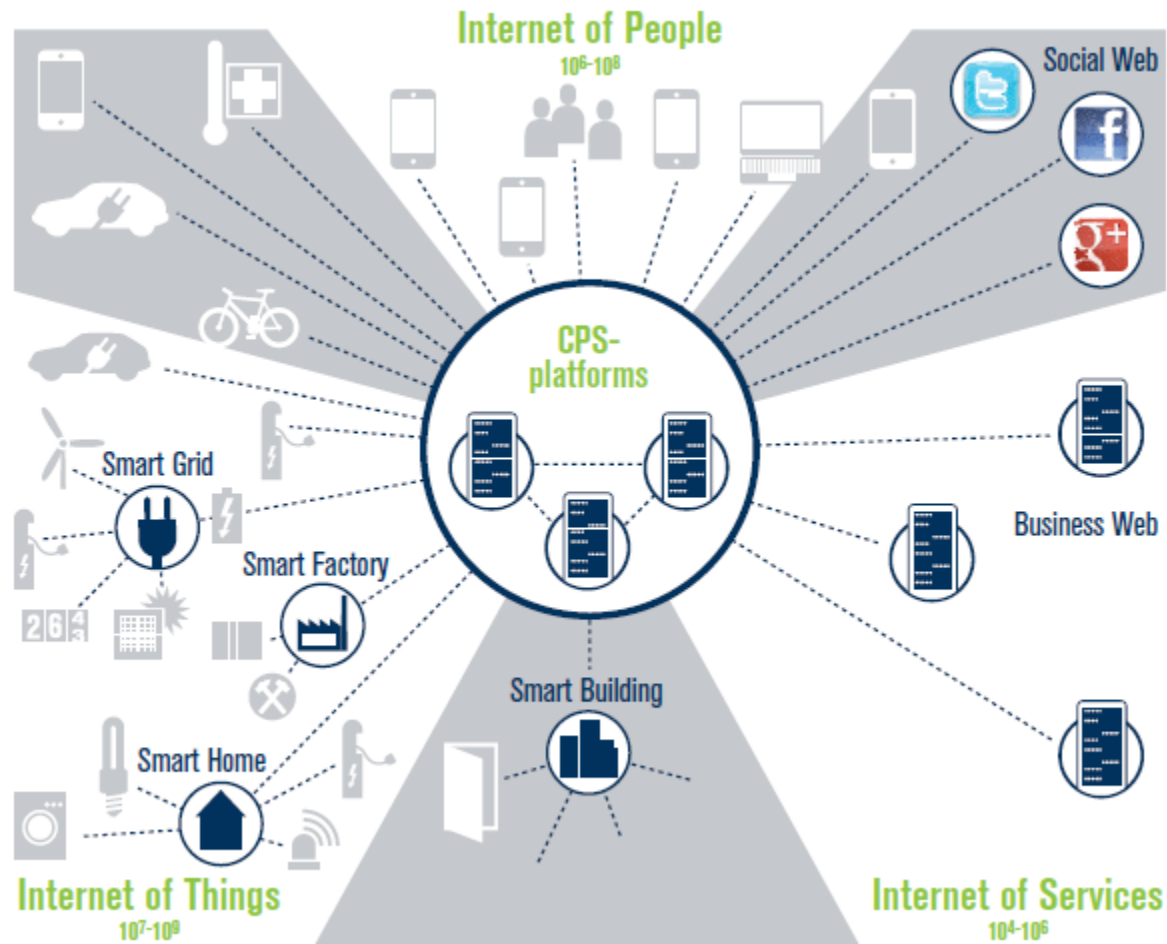


# Industry 4.0 – Horizontal Integration



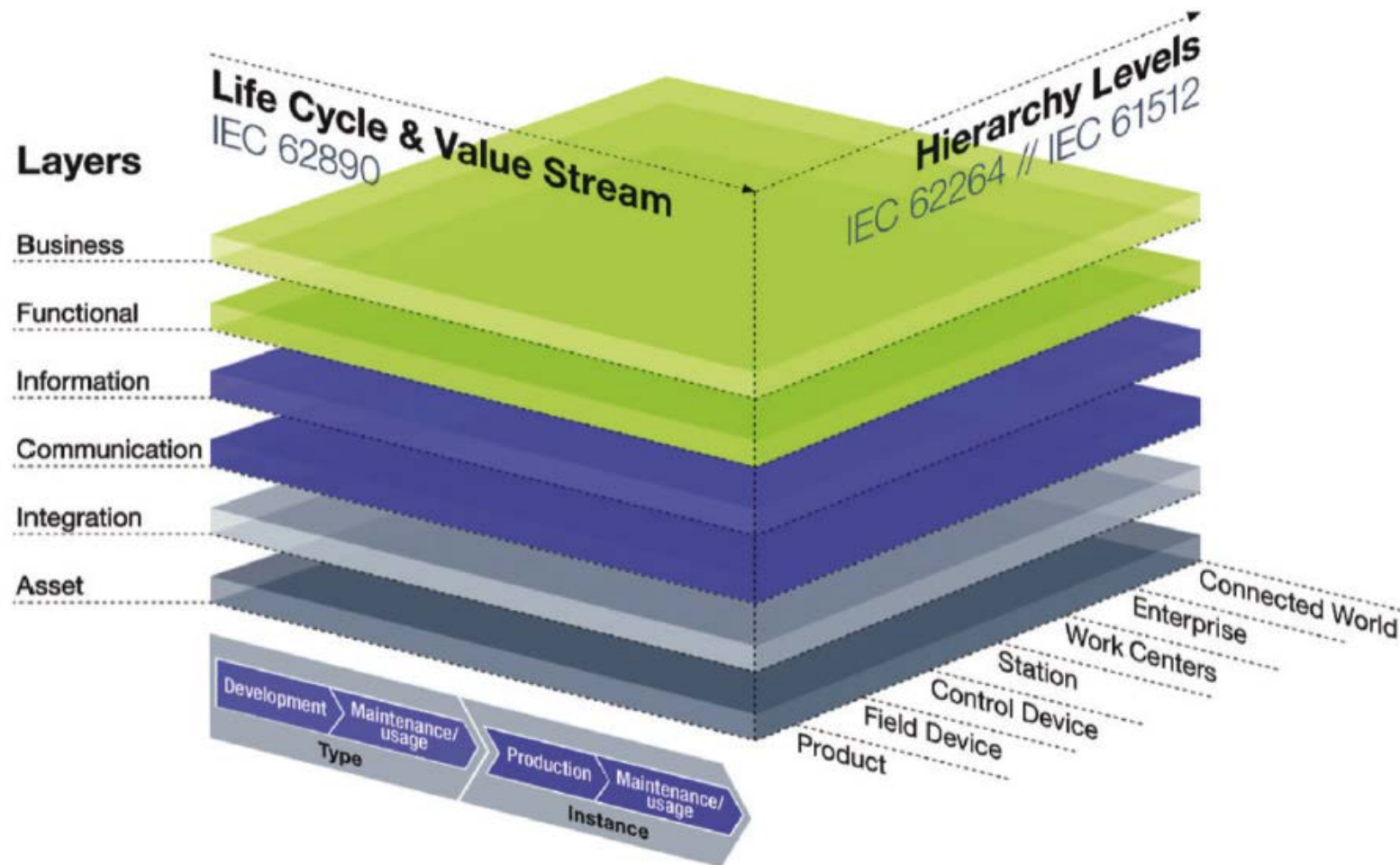
Source: acatech: "Recommendations for implementing the strategic initiative Industrie 4.0", 2013

# Industry 4.0 – Vertical Integration



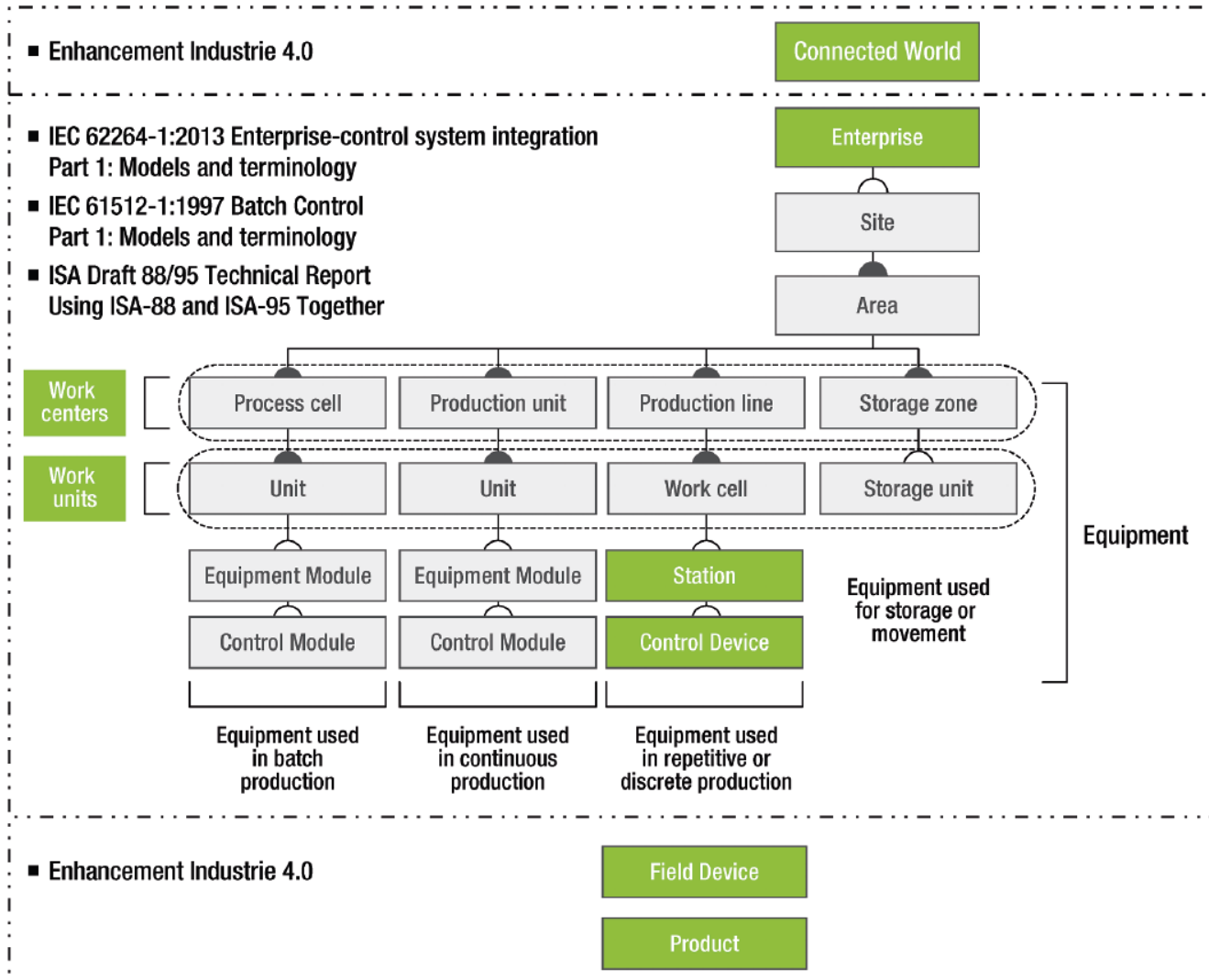
Source: acatech: "Recommendations for implementing the strategic initiative Industrie 4.0", 2013

# The Reference Model RAMI 4.0

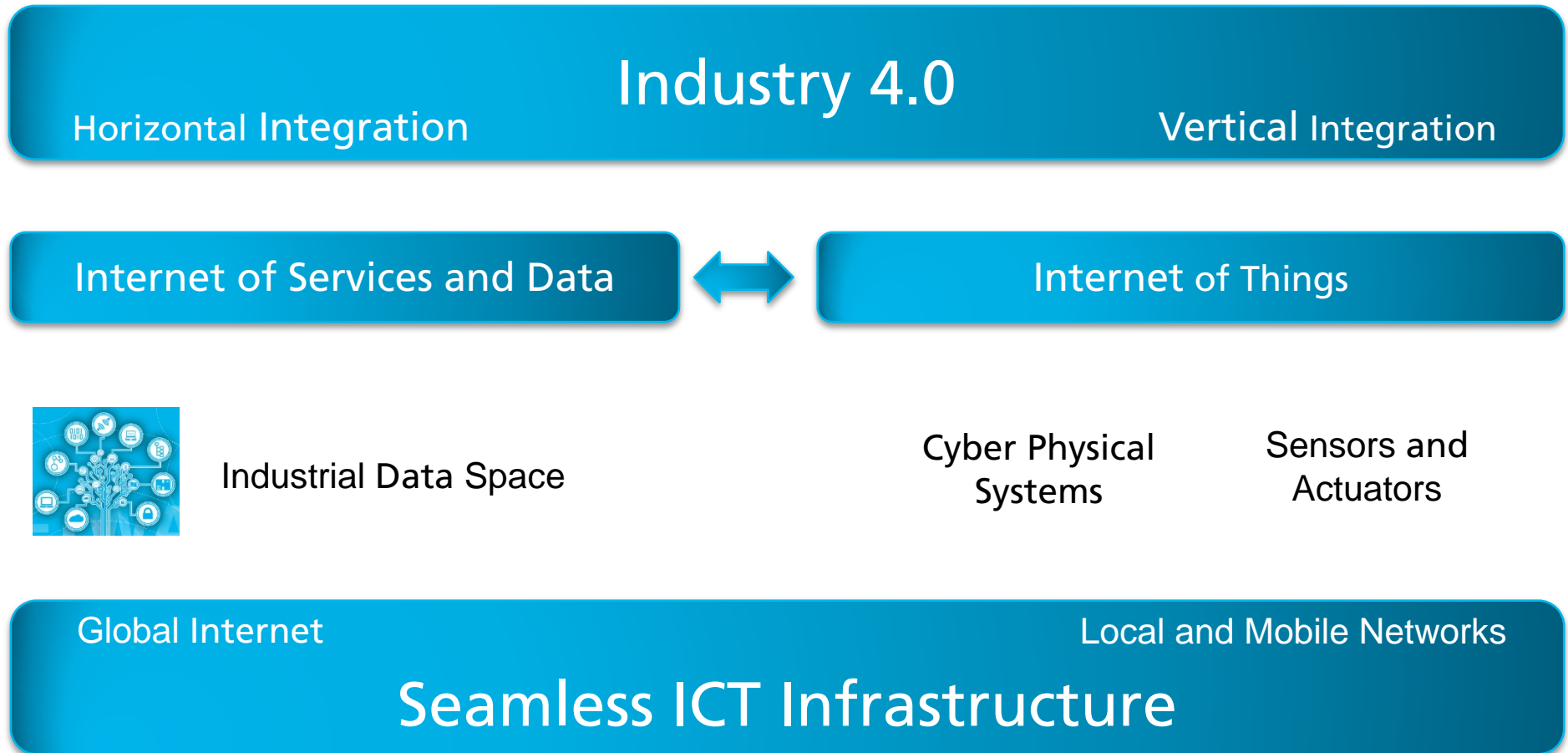


Source: ZVEI: Das Referenzarchitekturmodell Industrie 4.0 (RAMI 4.0), 2015

# The Reference Model RAMI 4.0



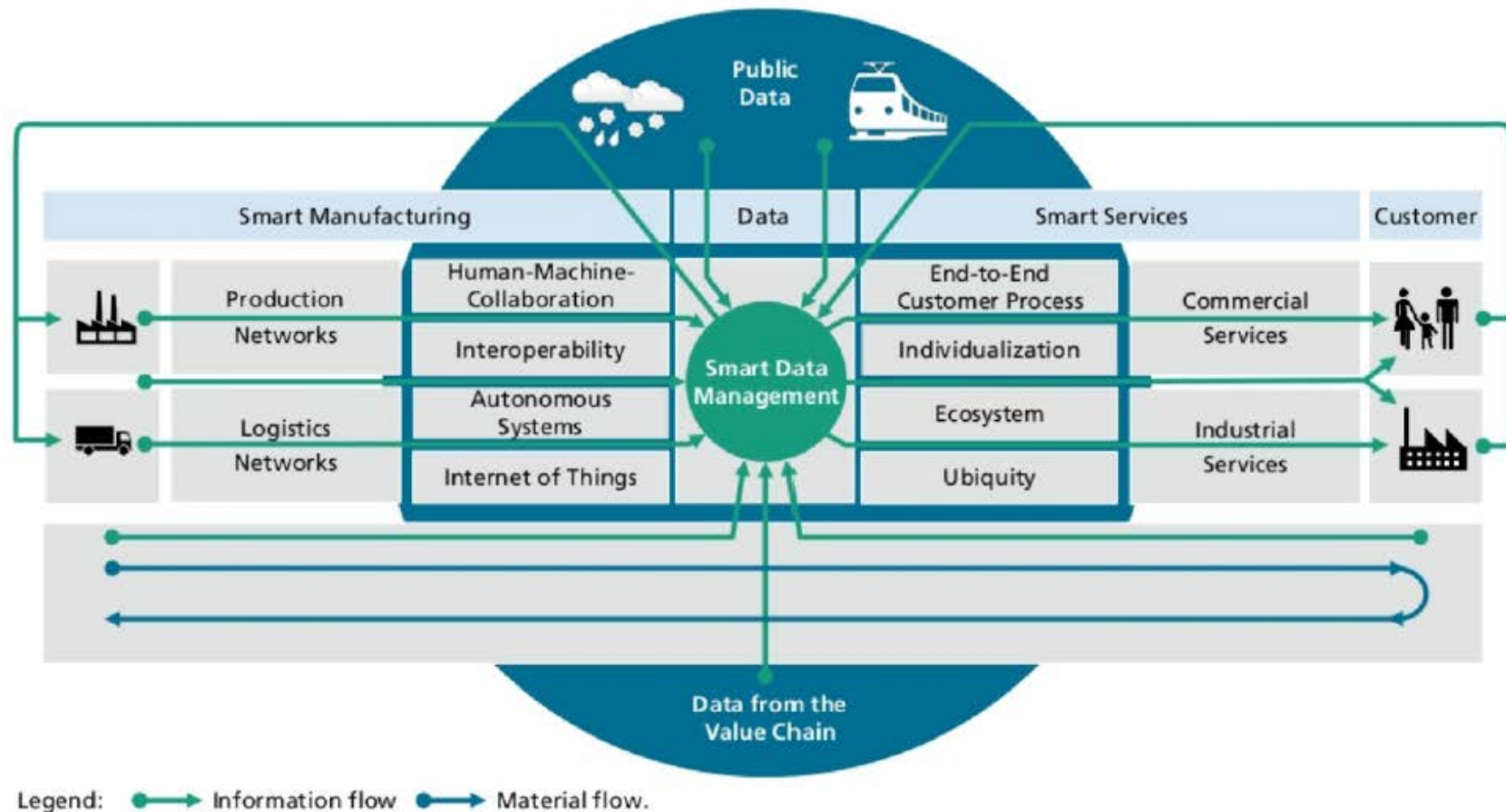
# Implementation of Industry 4.0





# Implementation of Industry 4.0 – Horizontal Integration

## The Industrial Data Space



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

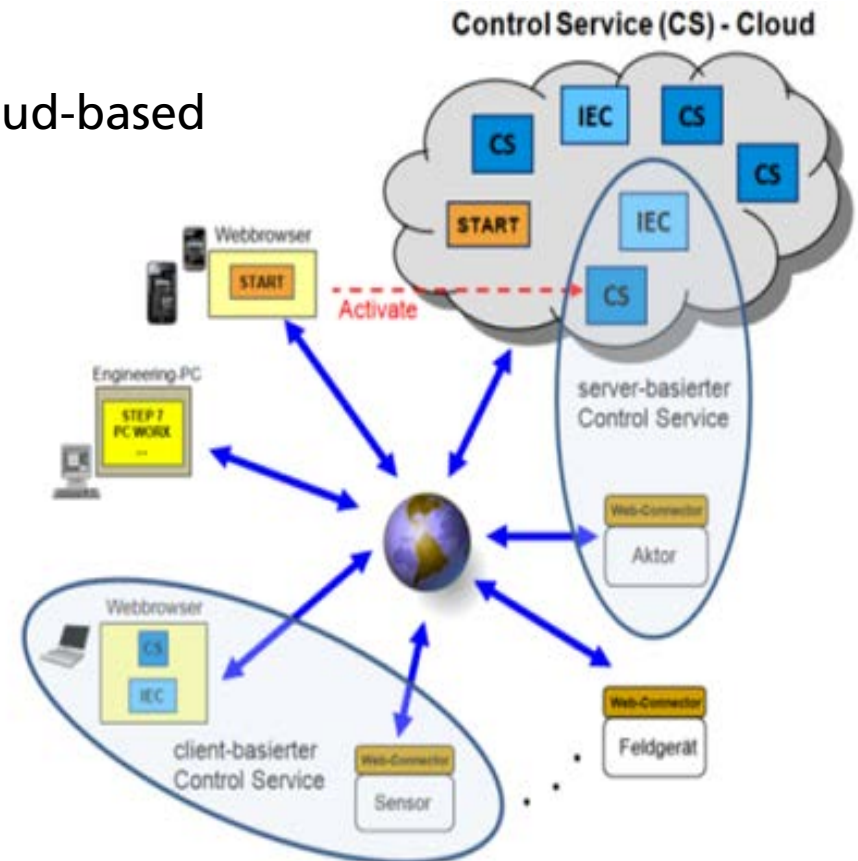
# Implementation of Industry 4.0 – Vertical Integration

## 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

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# THANK YOU VERY MUCH!

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