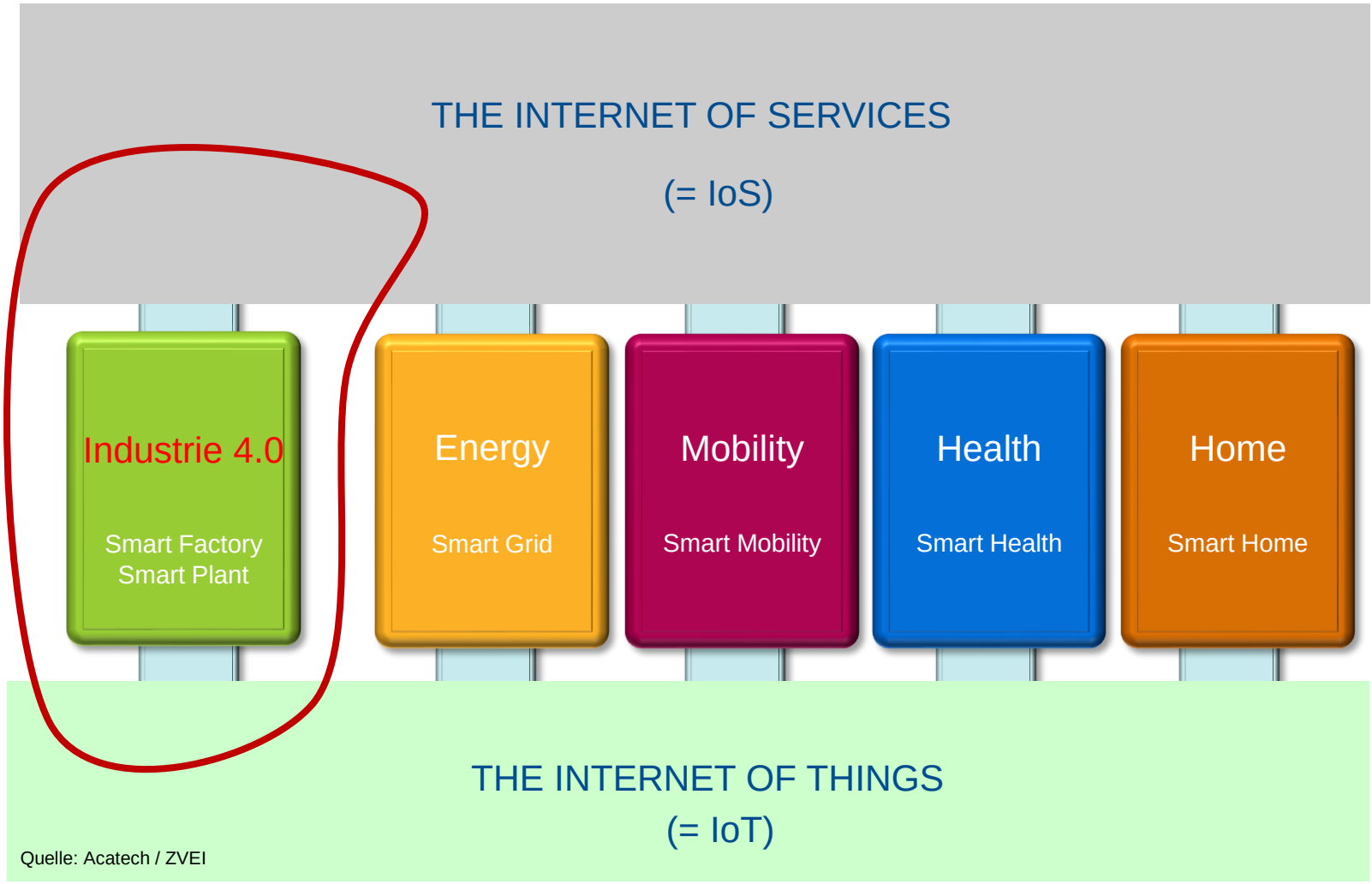
INDUSTRIE 4.0 ARCHITECTURE (RAMI 4.0) AND ITS LINKS WITH IEC STANDARDS FOR A CONNECTED WORLD

Prof. Dr.-Ing Dieter Wegener, ZVEI
Jean-Charles Guilhem, PCIC Europe

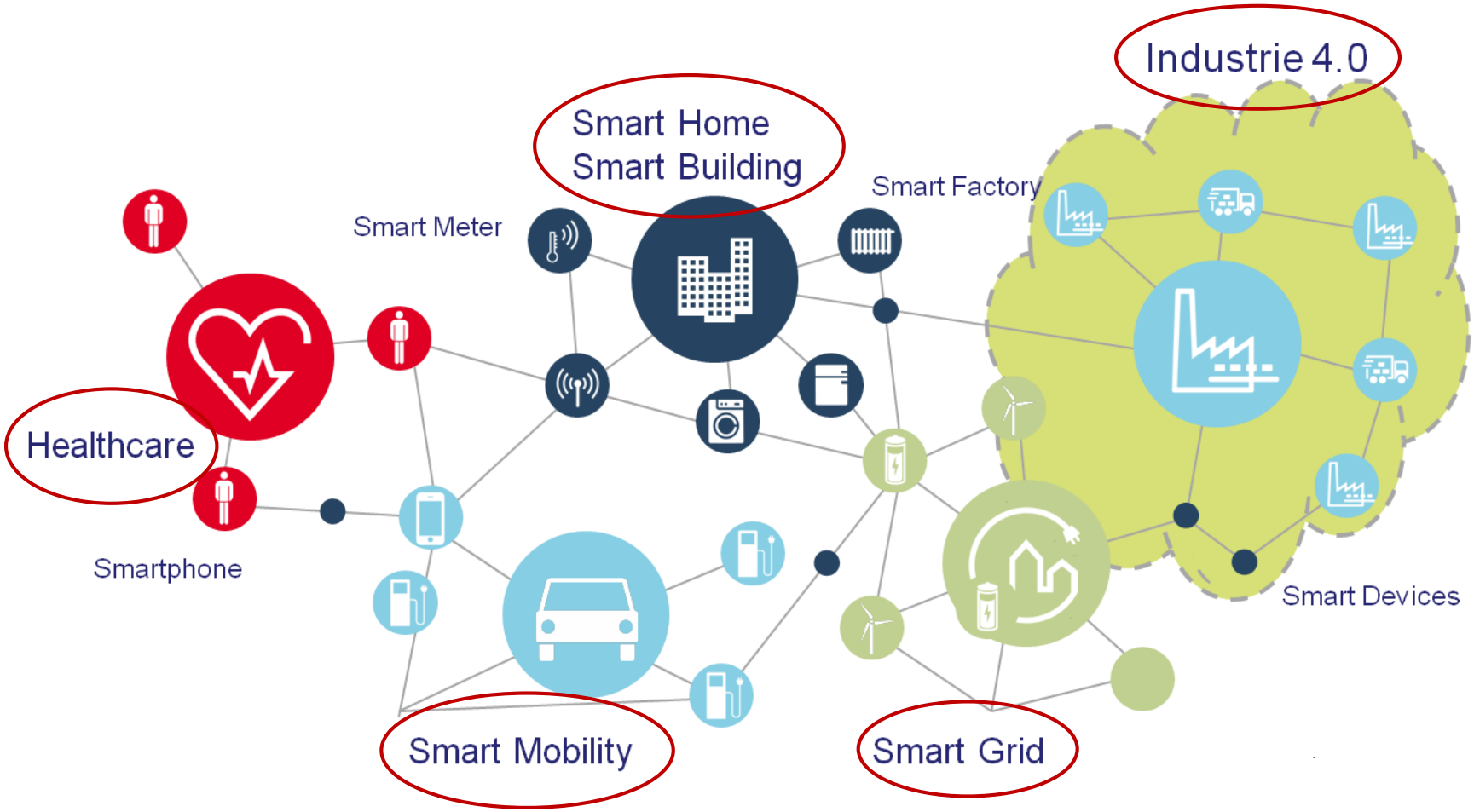
Economy Digitalization: Physical world and Cyber world fuse



Quelle: Acatech / ZVEI

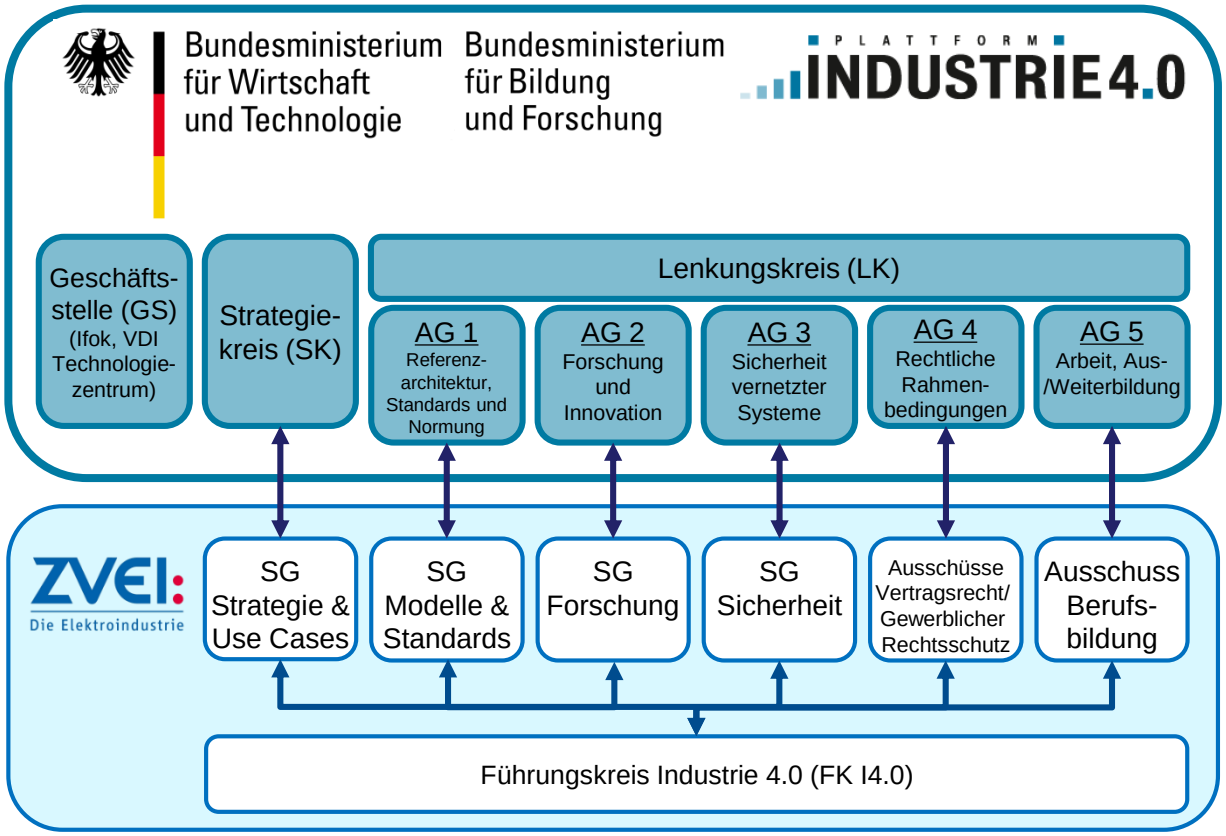
Compatibility

„Industrie 4.0“ has to be compatible with all other application scenarios in „Internet of Things and Services“



Führungskreis Industrie 4.0

Exchange with the „political“ Plattform Industrie 4.0



AG: Arbeitsgruppe – Working Group
SG: Spiegelgremium – Mirror Group

Agenda

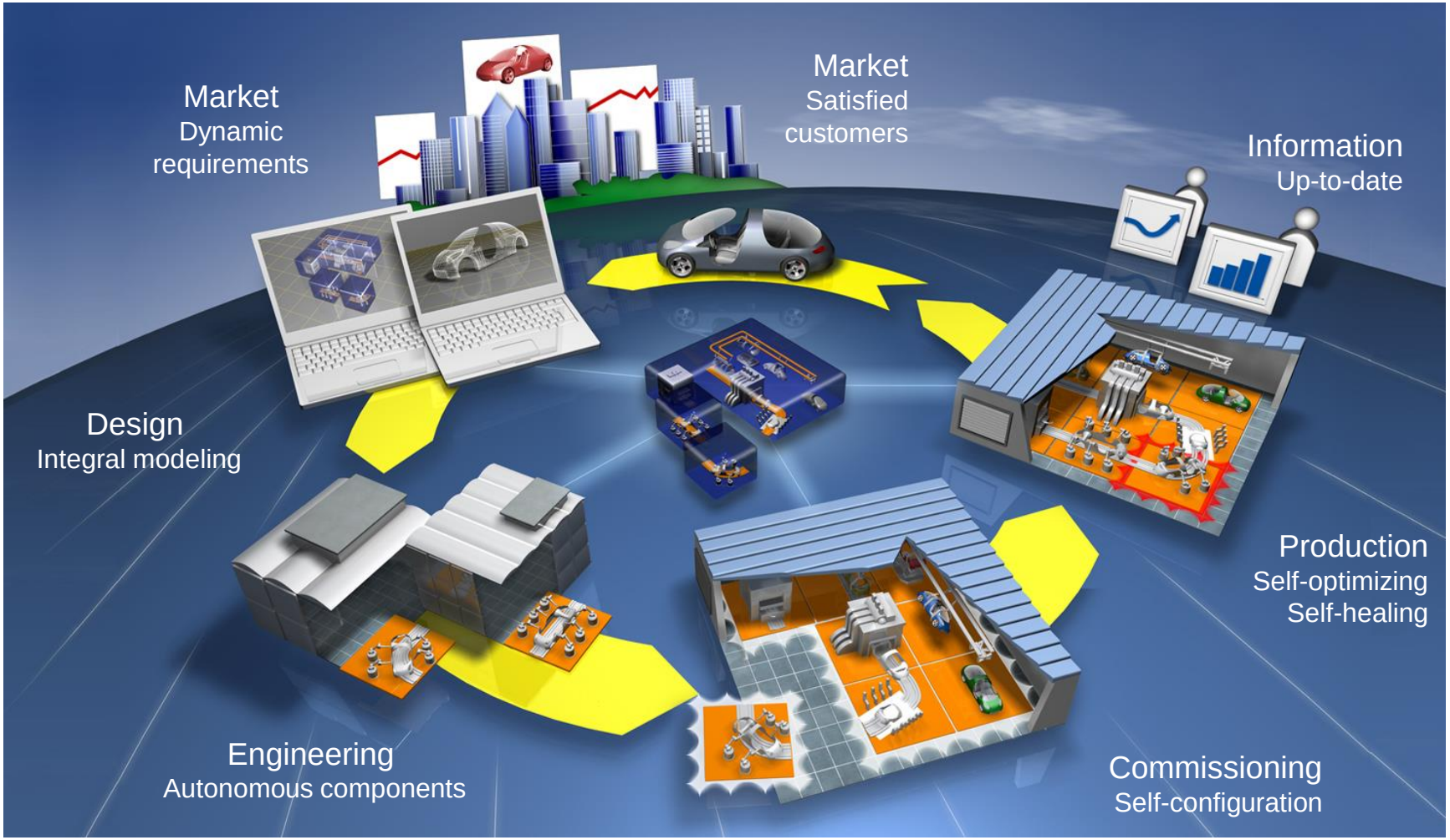
Vision „Industrie 4.0“

“Industrie 4.0”-Component

Reference Architecture Model “Industrie 4.0”

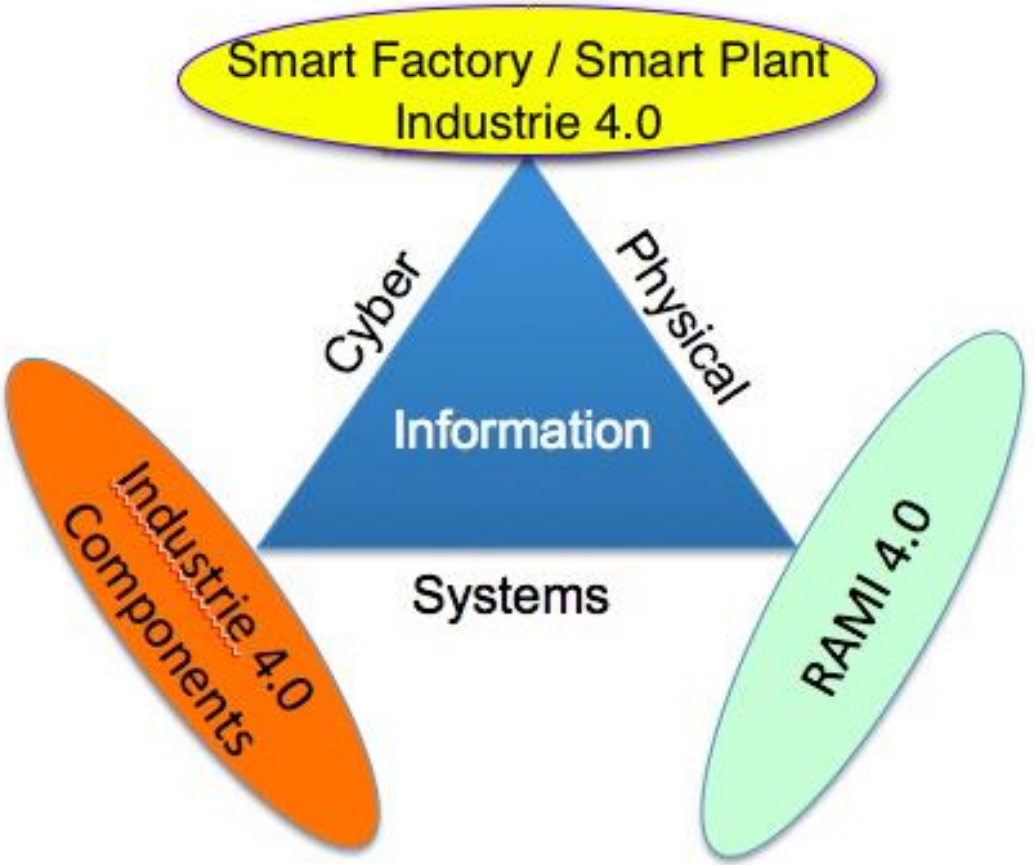
”Industrie 4.0” impacts in three dimensions

Vision “Industrie 4.0”: Smart Factory for Discrete Industries



Cyber-Physical-System (CPS)

... at the core of Industrie 4.0 concepts



Agenda

Vision „Industrie 4.0“

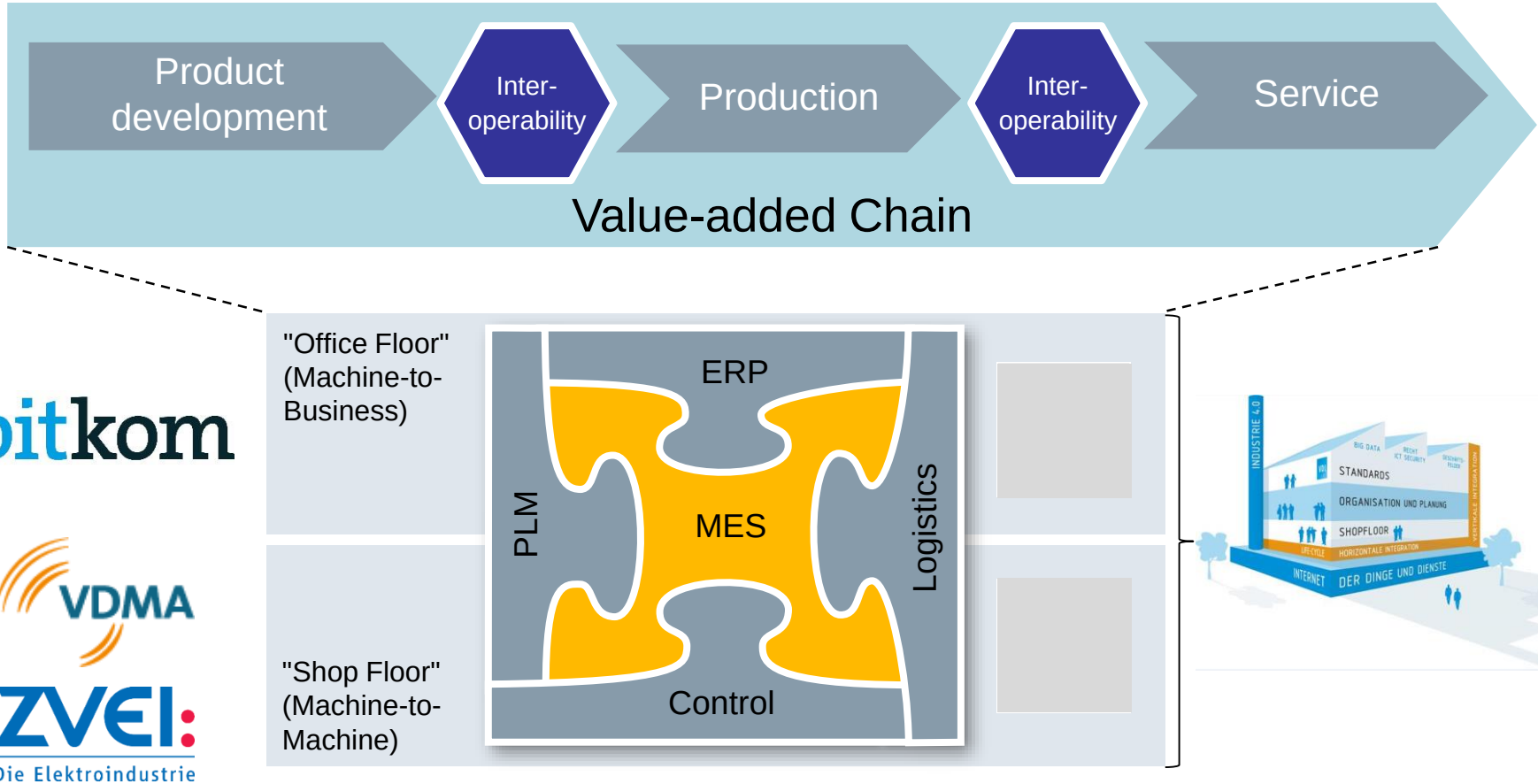
“Industrie 4.0”-Component

Reference Architecture Model “Industrie 4.0”

”Industrie 4.0” impacts in three dimensions

ZVEI-Führungskreis defines Industrie 4.0 activity areas…

…out of the technical perspective



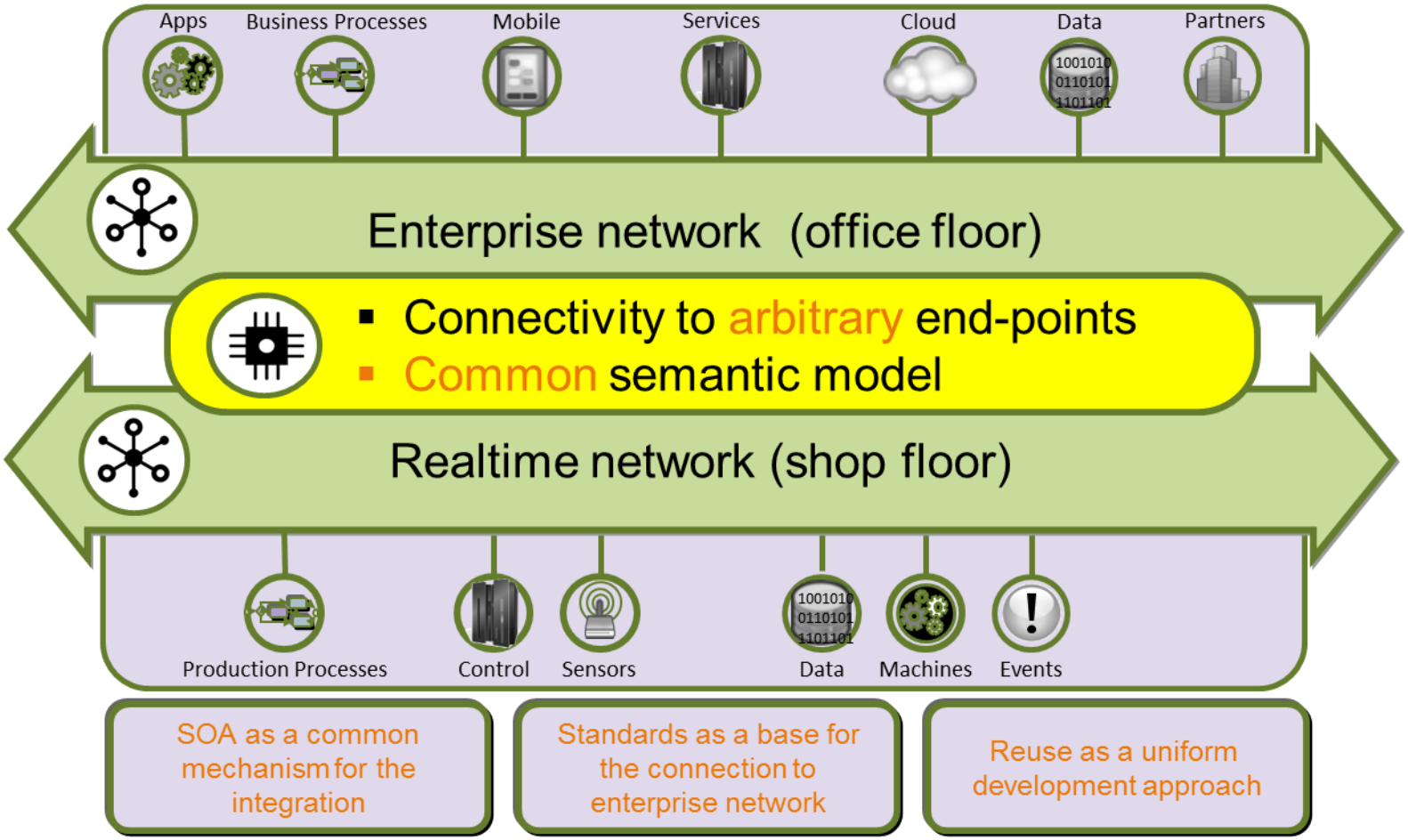
bitkom

VDMA

ZVEI: Die Elektroindustrie

Service Oriented Architecture (SOA)

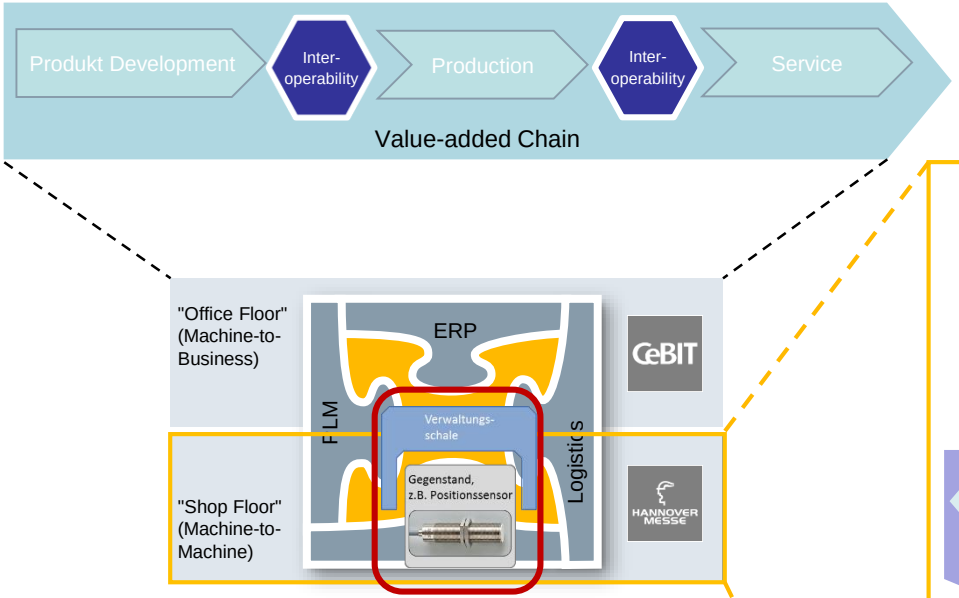
SOA implementation by way of semantic linkage of office and shop floors



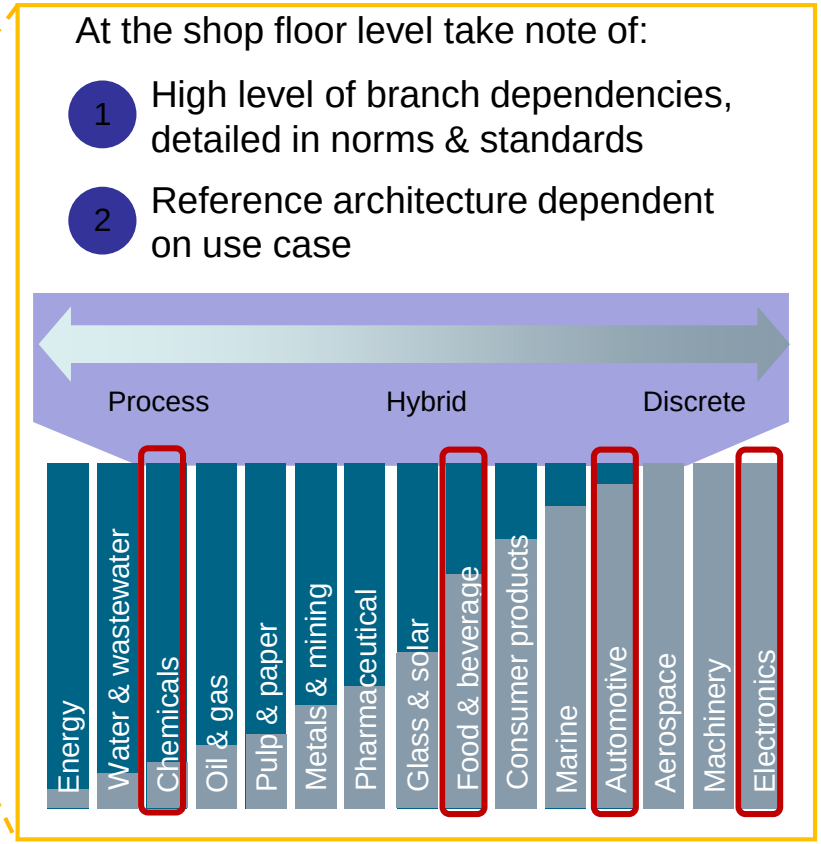
Source: ZVEI Führungskreis Industrie 4.0; 14.01.2014

Industrie 4.0 Component

ZVEI-Führungskreis defines Industrie 4.0-Component for different branches



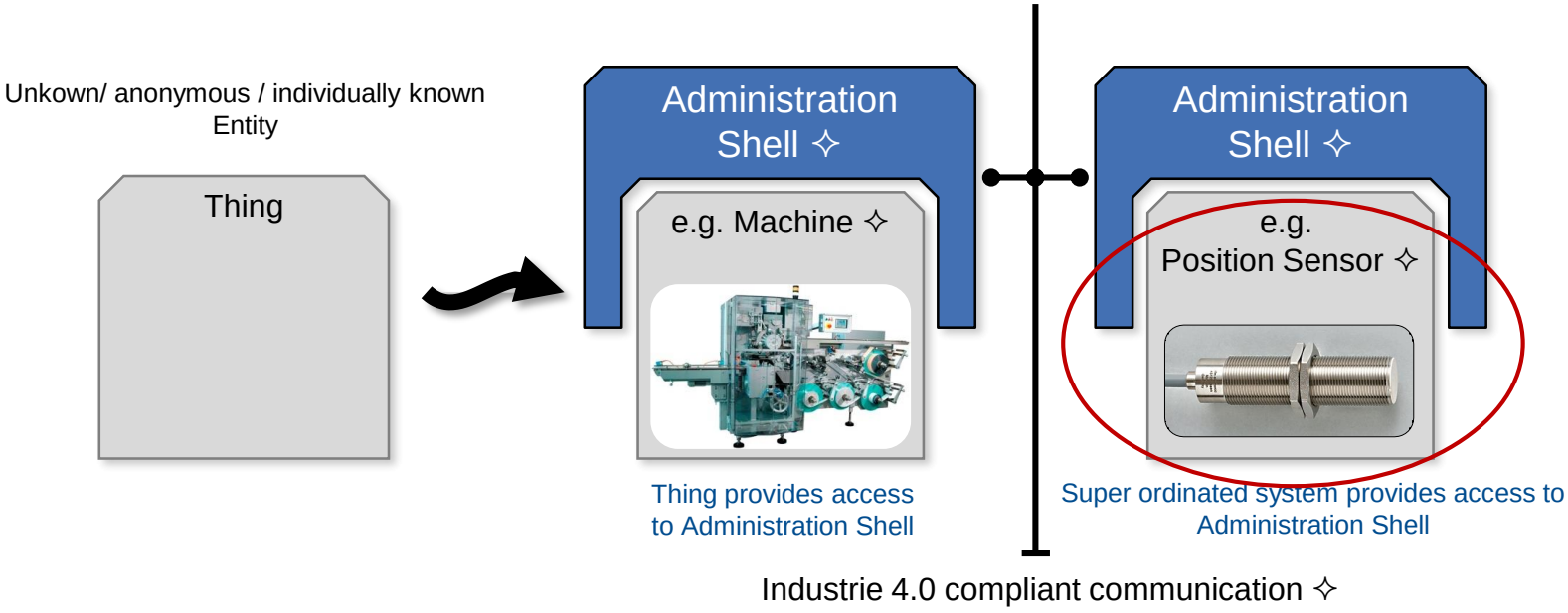
Industrie 4.0-Component



Different Use Cases

Industrie 4.0 Component in real use cases, ex: Sensors

Important machine parts become Industrie 4.0 Components



✧ = Interfaces/ data formats I4.0-compliant designed

Agenda

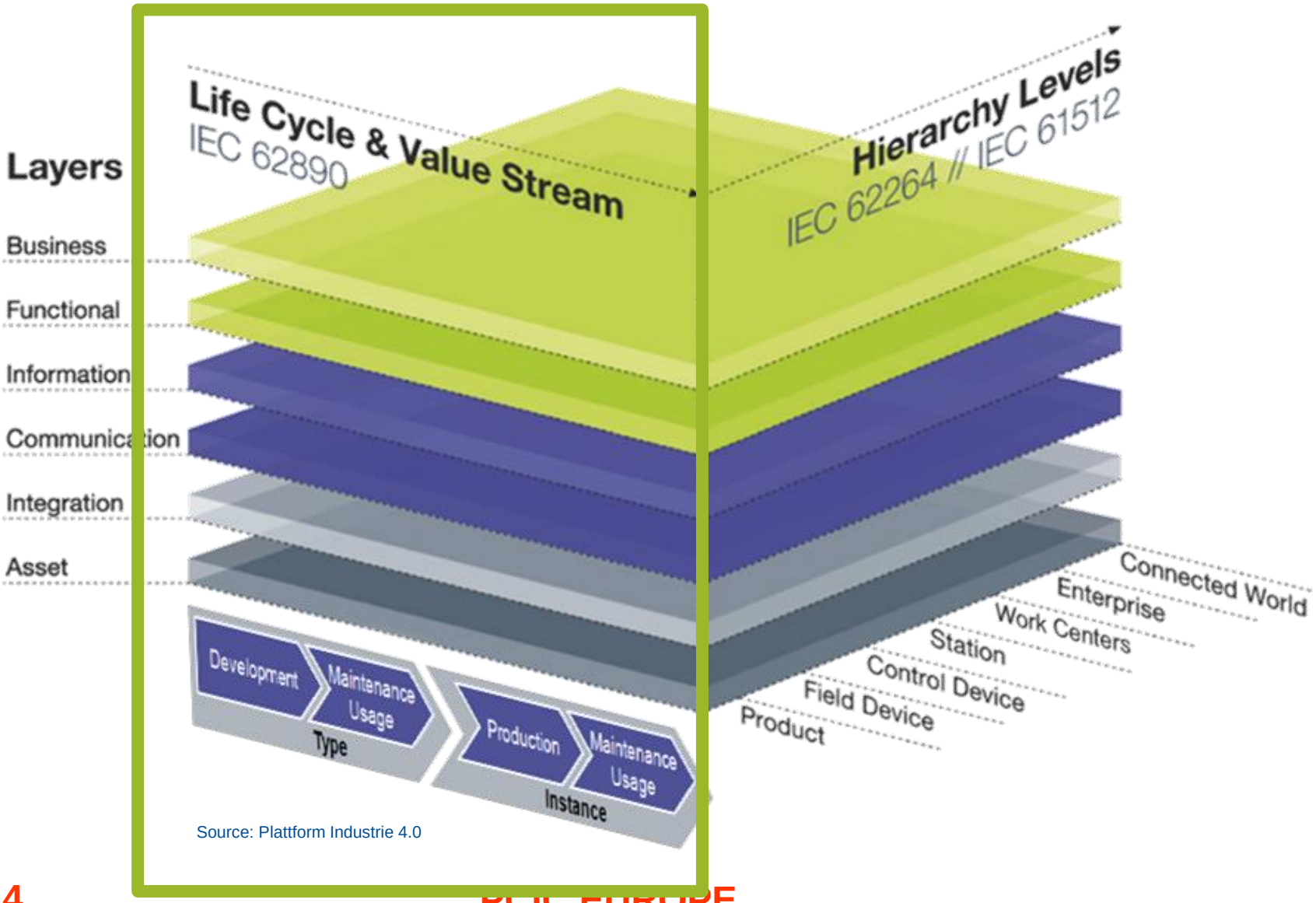
Vision „Industrie 4.0“

“Industrie 4.0”-Component

Reference Architecture Model “Industrie 4.0”

”Industrie 4.0” impacts in three dimensions

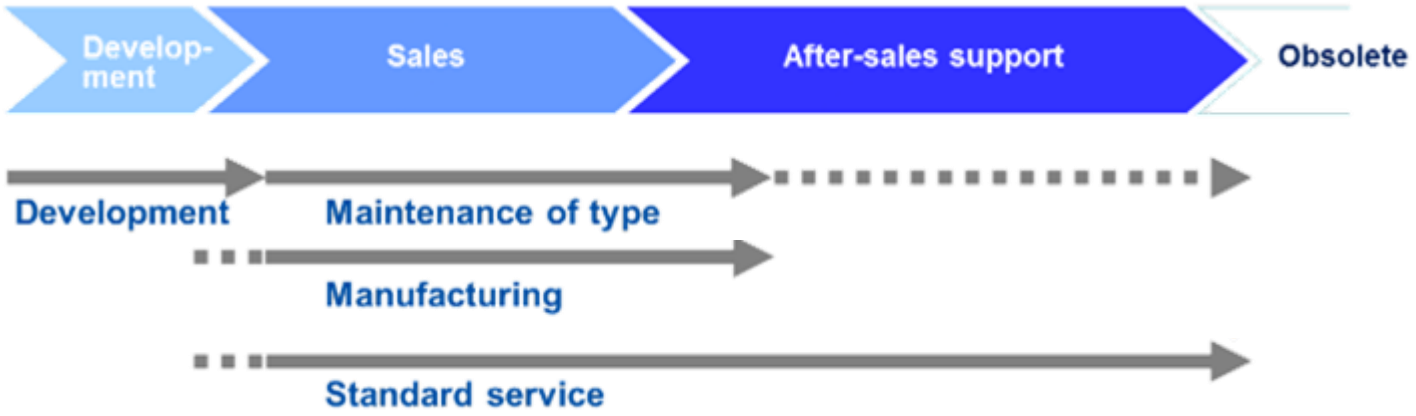
Reference Architecture Model Industrie 4.0 (RAMI 4.0)



Source: Plattform Industrie 4.0

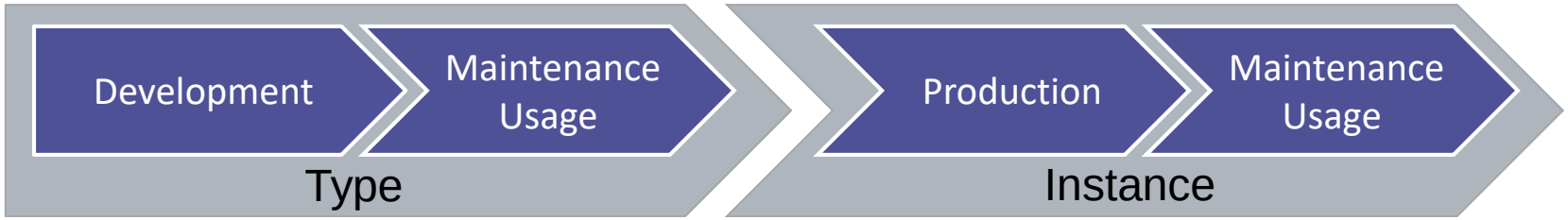
Life cycle according to IEC CD 62890

Such as developed by ZVEI-WG Systems Aspects



Source: IEC CD 62890

Mapping in RAMI 4.0*

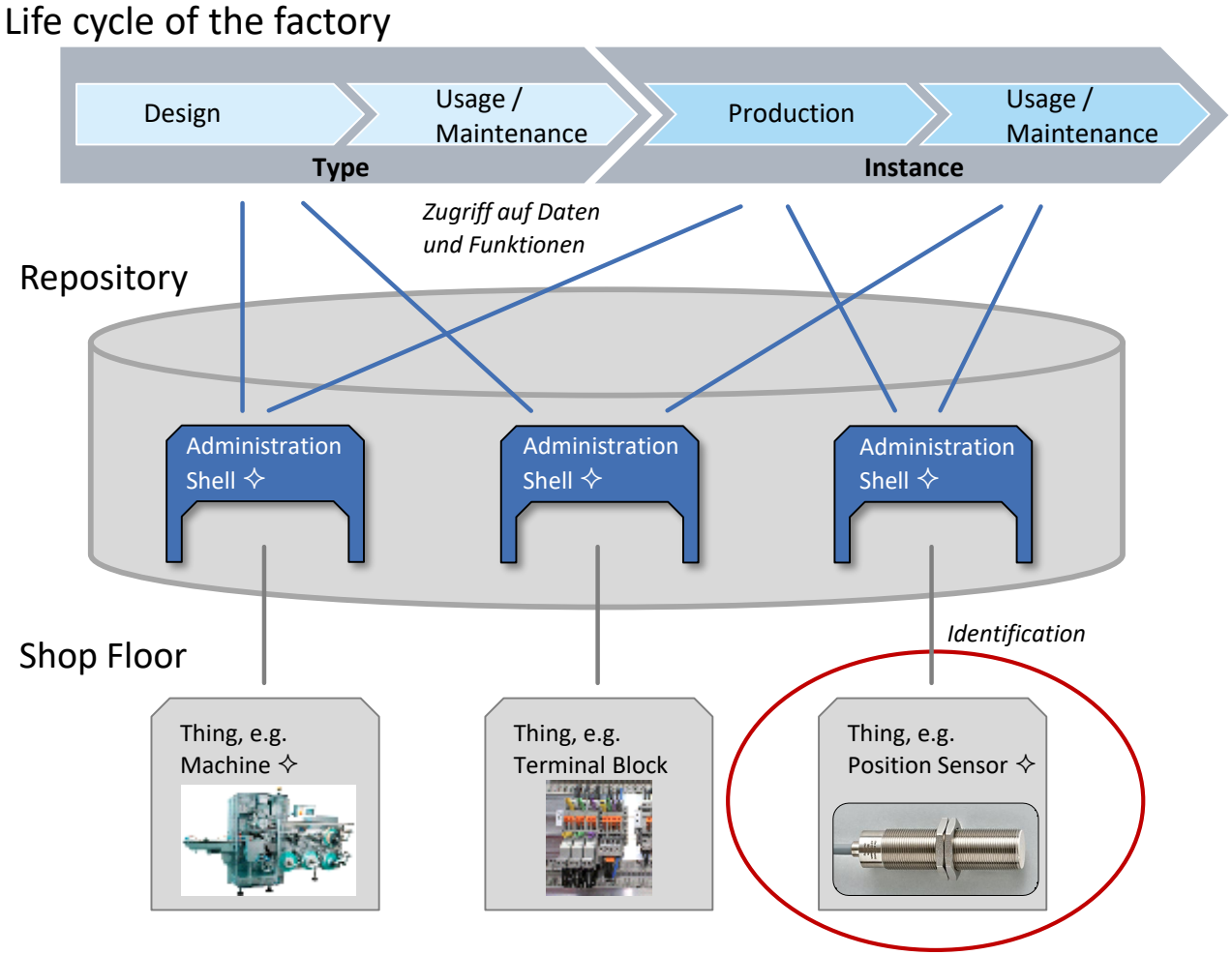


* RAMI 4.0 = Reference Architecture Model Industrie 4.0

Source: Plattform Industrie 4.0

Distribution along the life cycle

Administration Shells (data + functions) can be hosted centralized

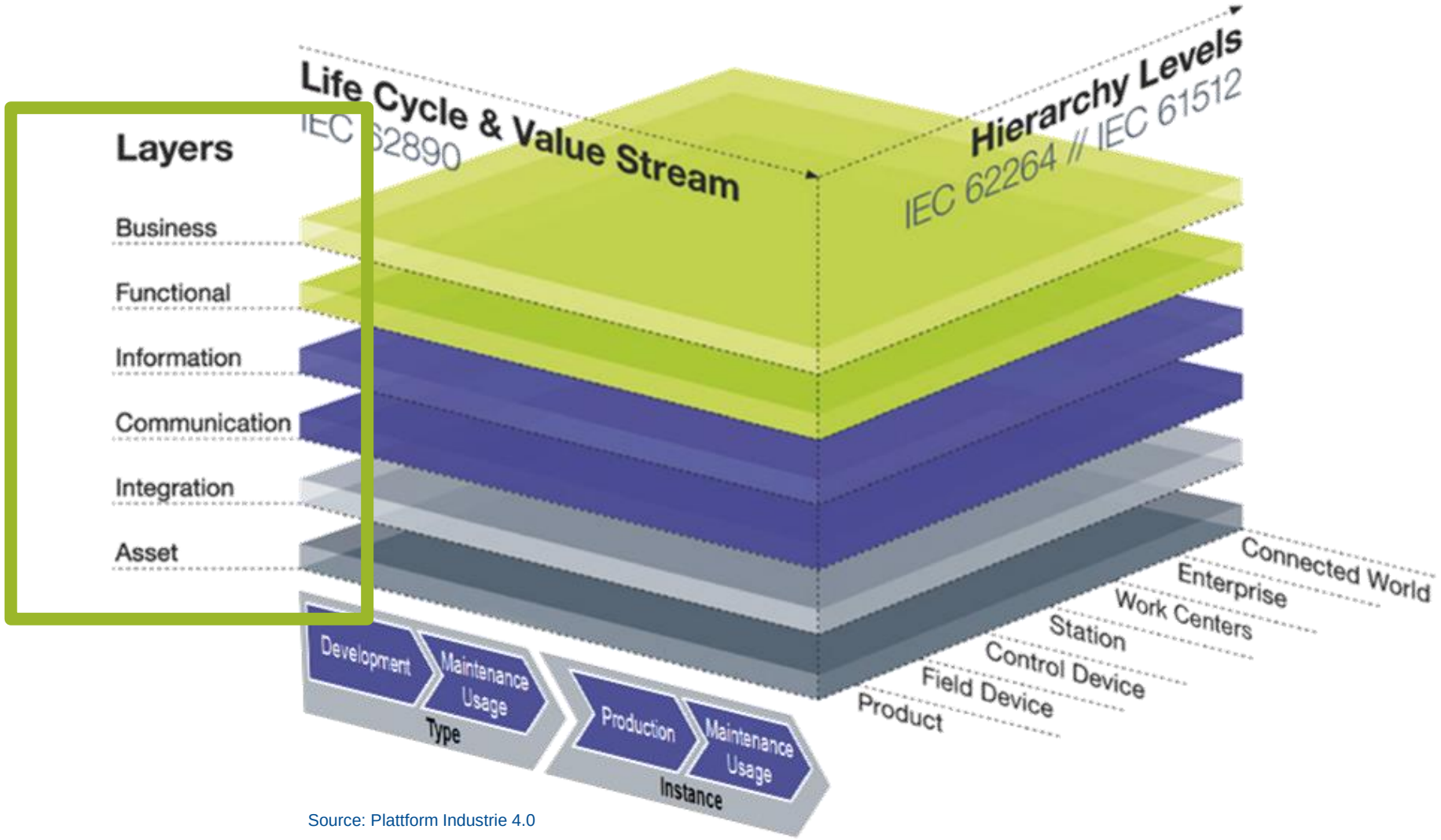


Tool support during life cycle

IT-server landscape

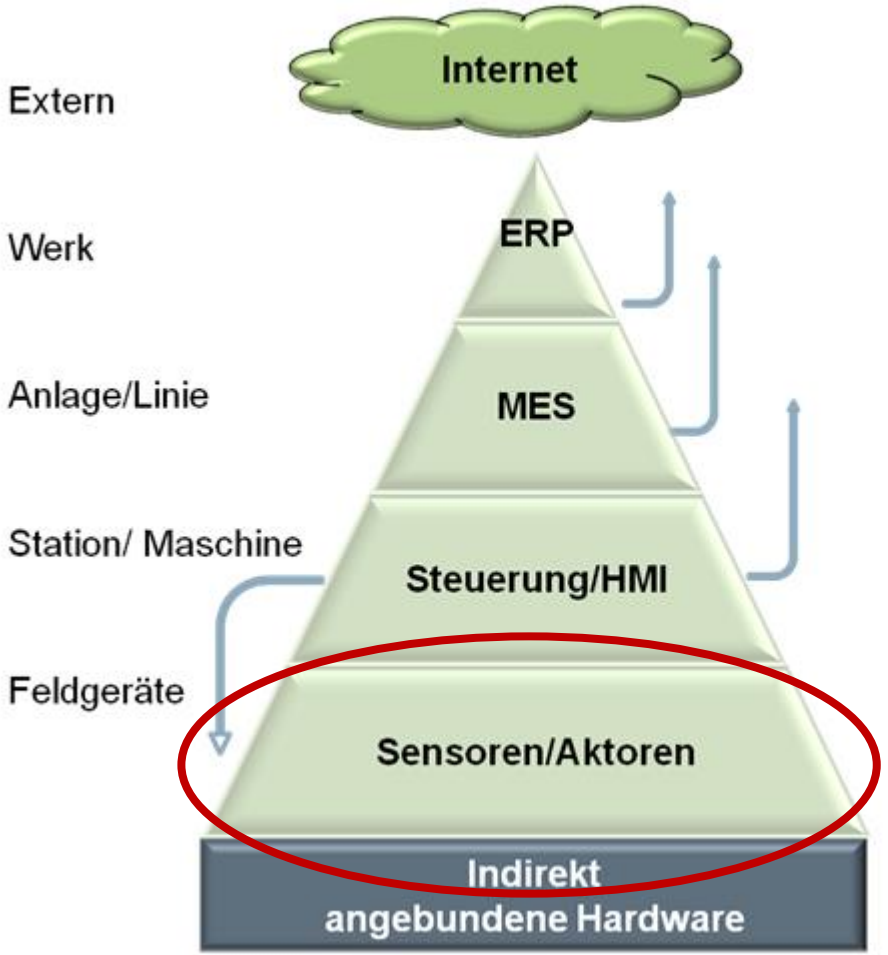
Components from various sources

Reference Architecture Model Industrie 4.0 (RAMI 4.0)

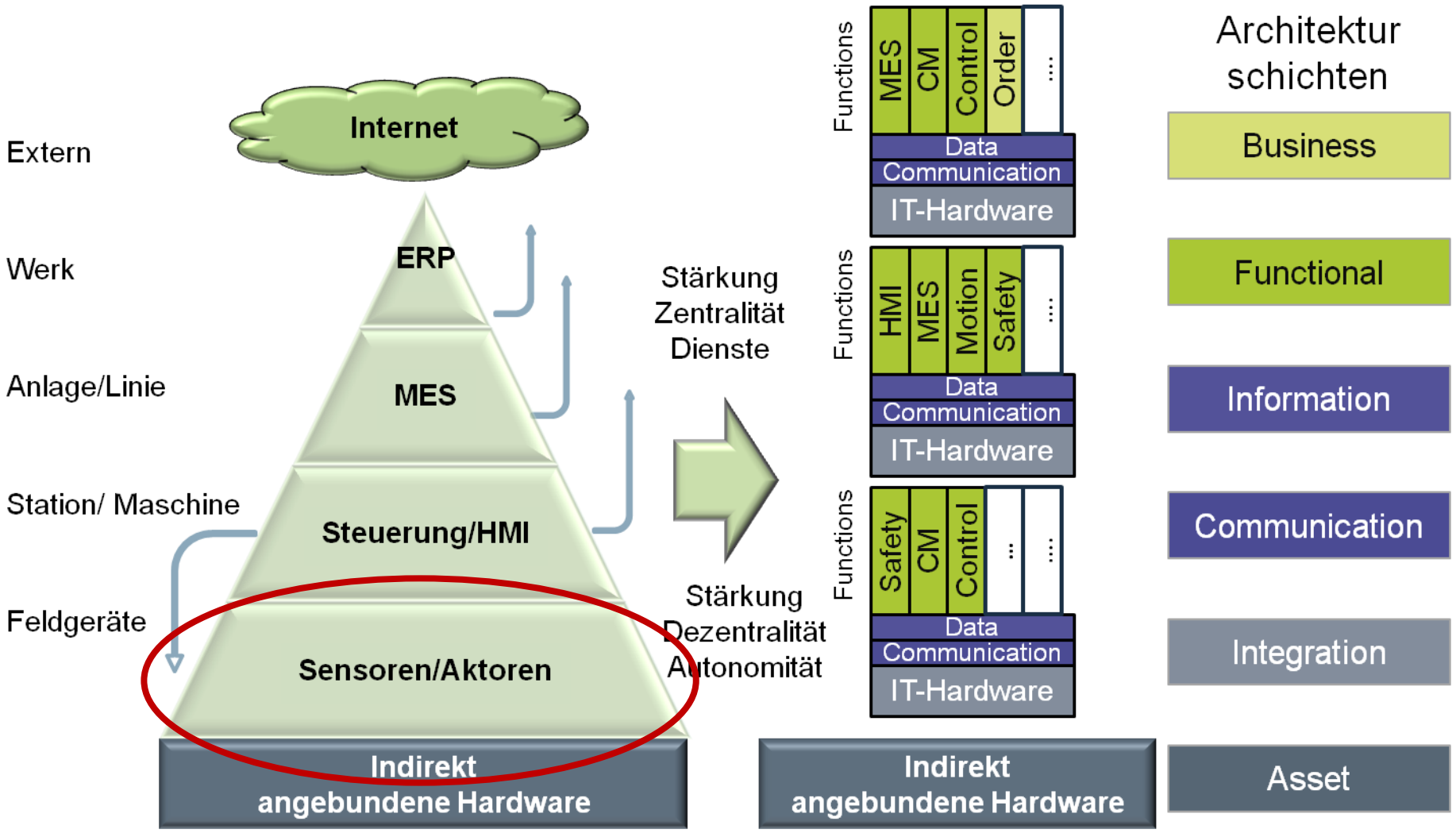


Source: Plattform Industrie 4.0

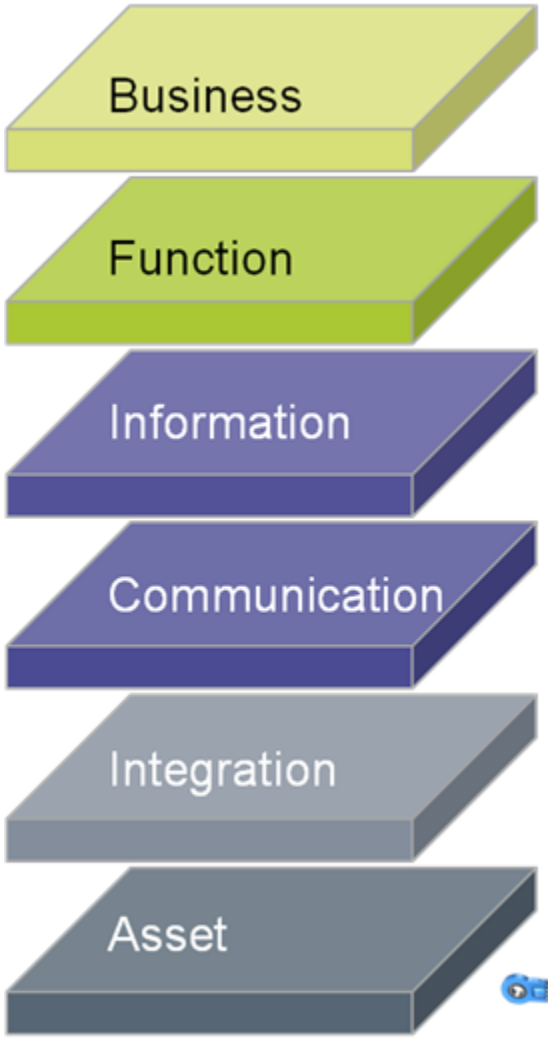
Sensors as essential elements of automation technology

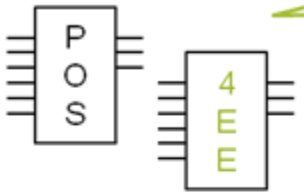


Transformation of automation technology digitalization

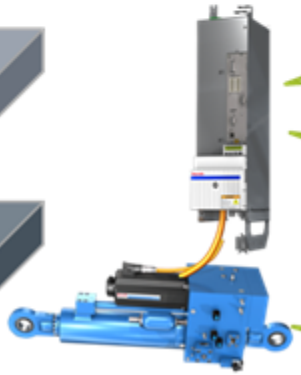


Example in RAMI 4.0 – Energy management in different layers





Daten:
Position, Energie



Energiemanagement als Business Prozess

Lageregelung verknüpft mit Kopfsteuerung auf Functional Layer

Lageregelung mit Positionsvergabe,
Sammeln und Auswerten aller Energiedaten

4EE
ENERGY EFFICIENCY

Ethernet mit OPC-UA,
Open Core Interface (OCI)

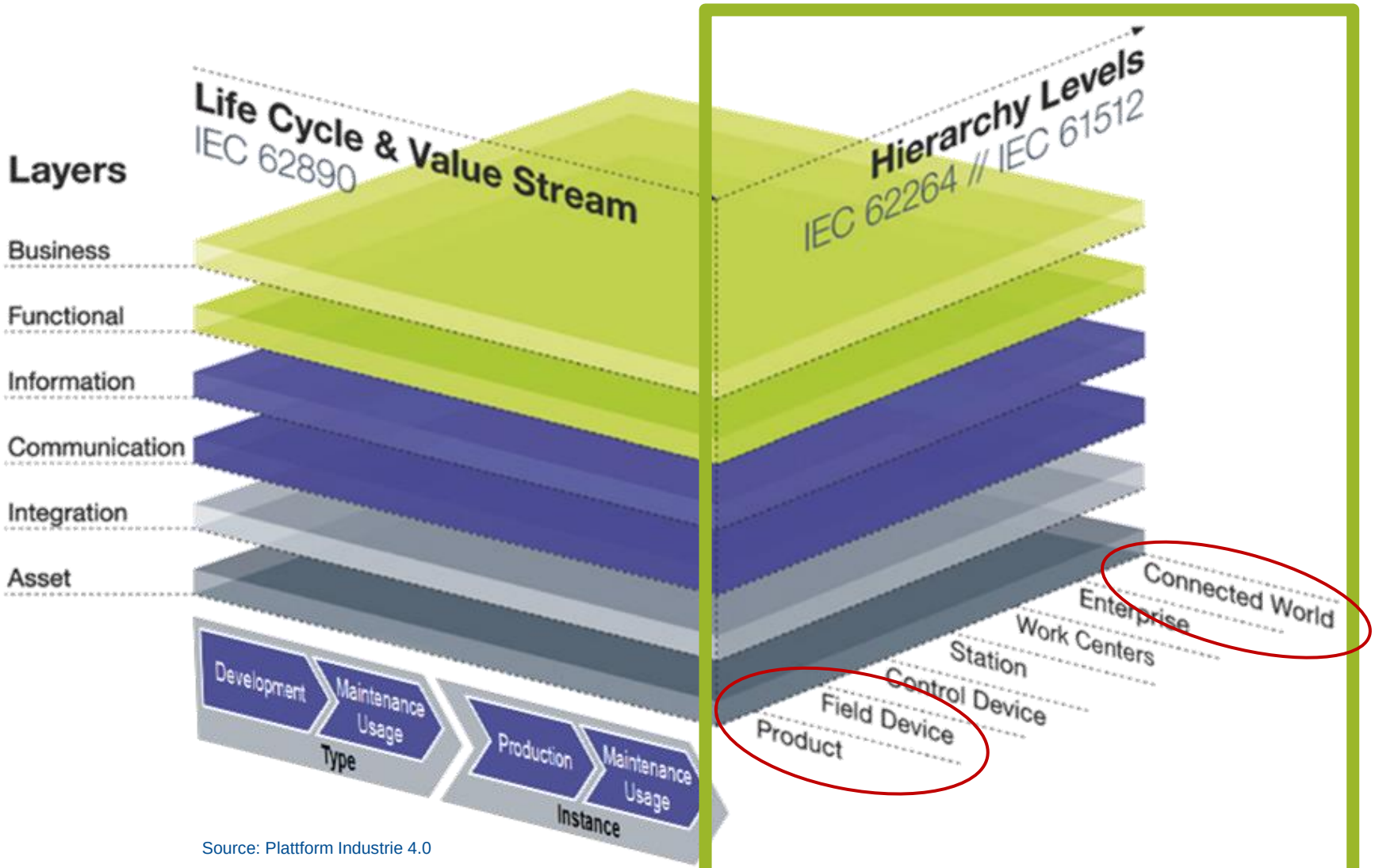
Regelungen:
Moment, Geschwindigkeit, …
Zusätzlich ladbare Funktionen:
Safety, Condition Monitoring, Steuerungstechnik,
Anti-Schwapp, Energie save mode, …

SAFETY ON BOARD

Antriebsverstärker:
WebServer, Umwandlung aller Sensorinformationen

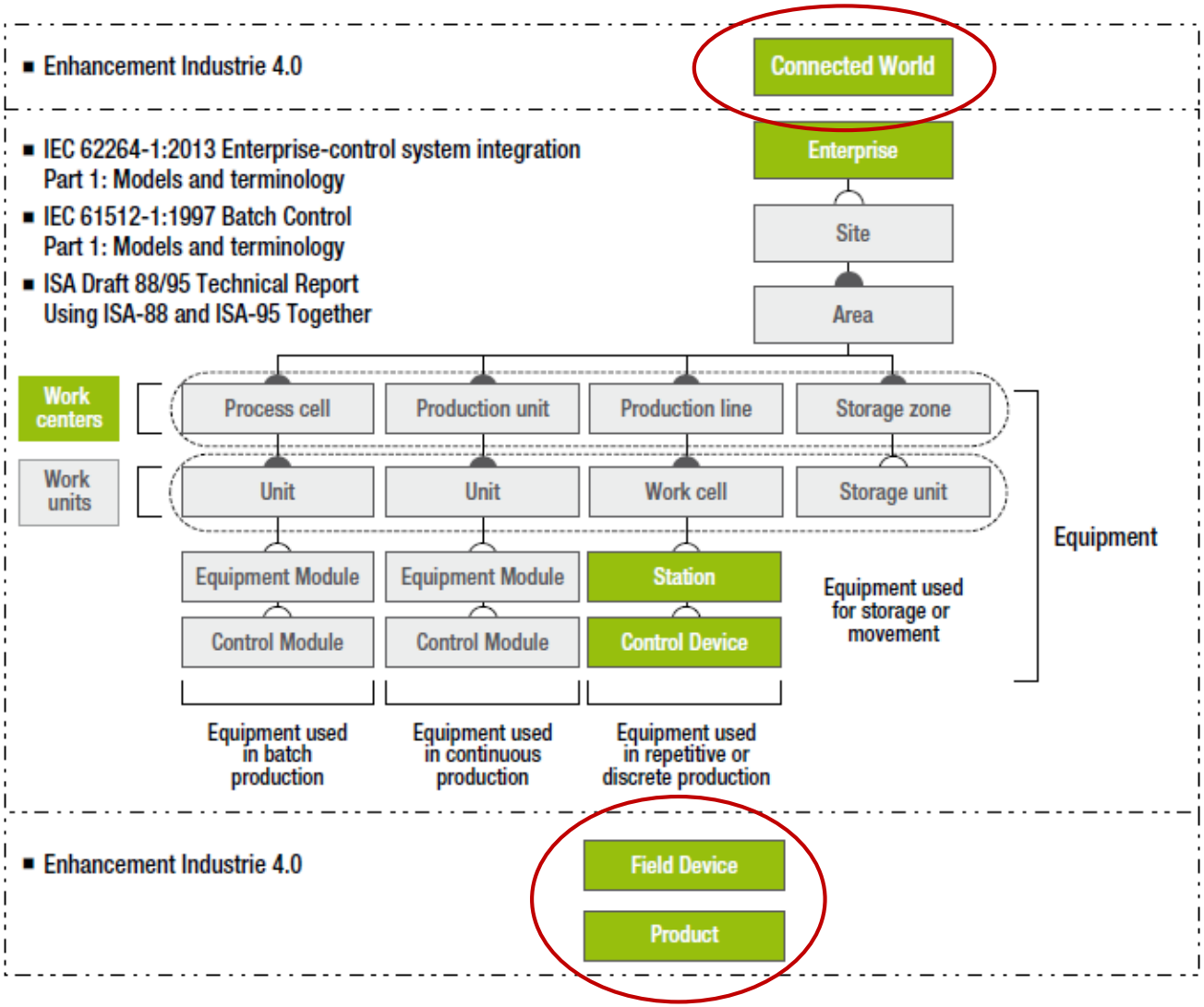
System:
Zylinder, Block mit Pumpe,
Servomotor, Ventile, Sensoren

Reference Architecture Model Industrie 4.0 (RAMI 4.0)



Source: Plattform Industrie 4.0

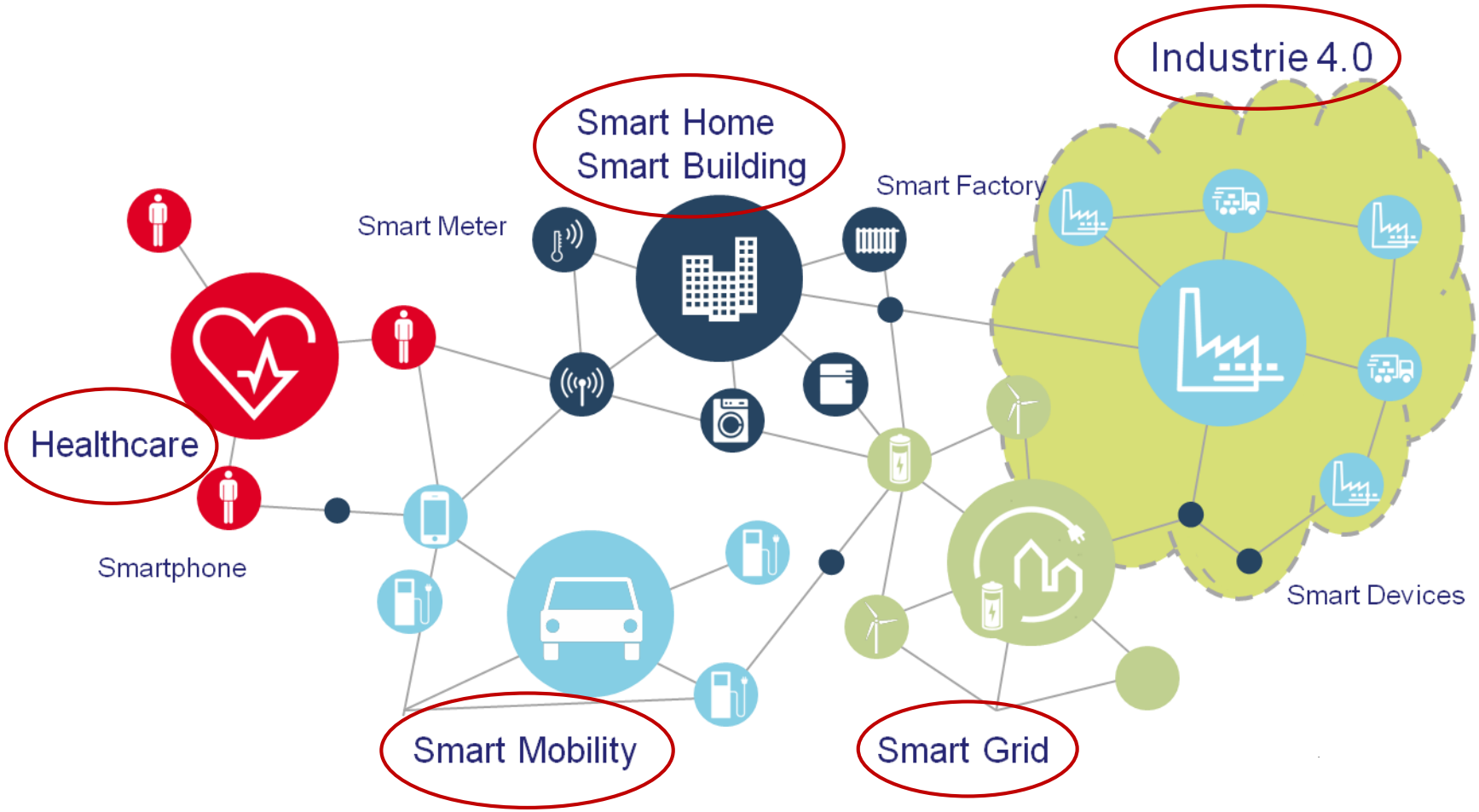
Architecture model RAMI 4.0



Based on
- IEC 62264-1
- IEC 61512-1
Expanded by
„Connected World, Field Device and Product“

Compatibility

„Industrie 4.0“ has to be compatible with all other application scenarios in „Internet of Things and Services“



Agenda

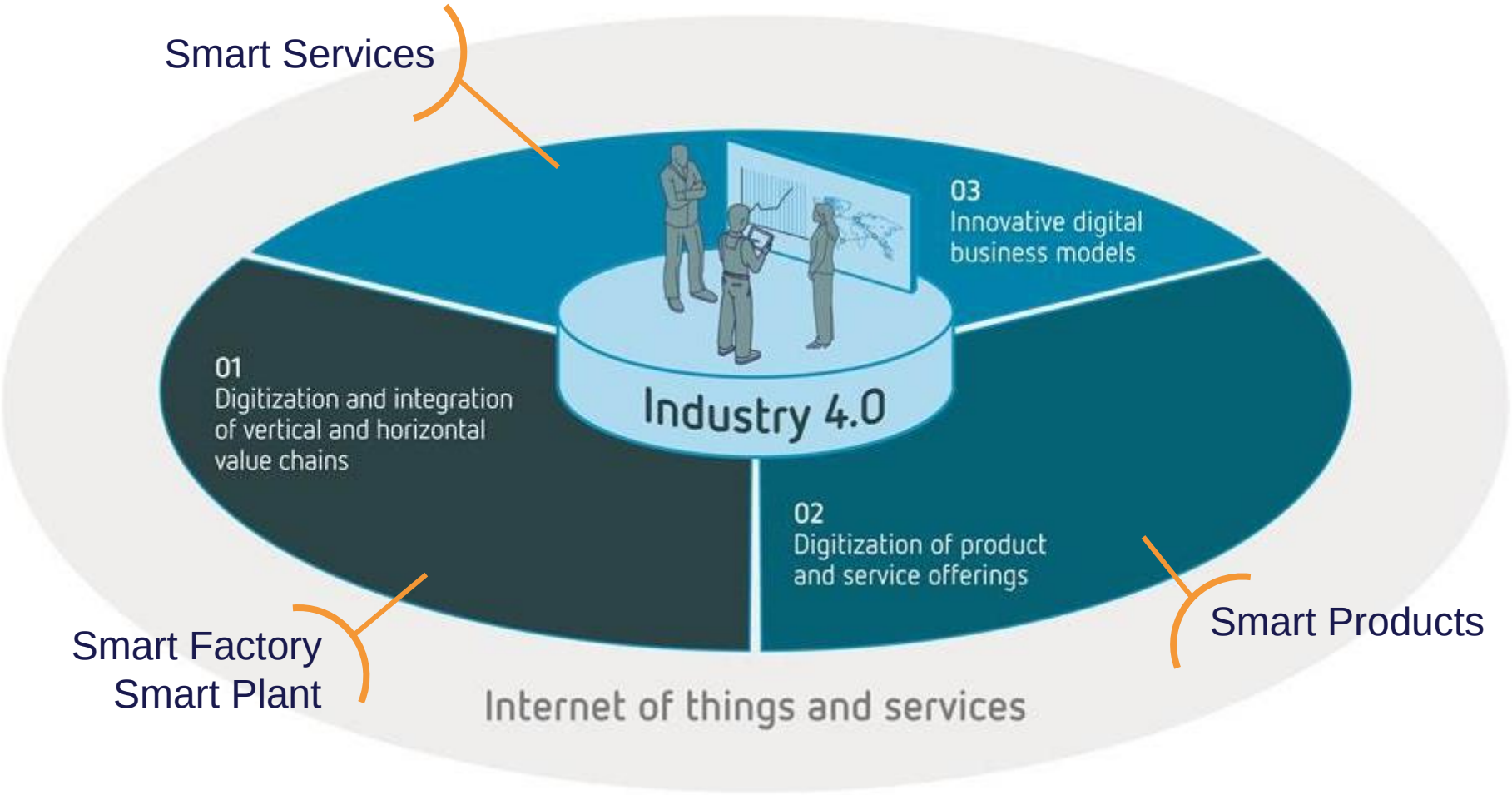
Vision „Industrie 4.0“

“Industrie 4.0”-Component

Reference Architecture Model “Industrie 4.0”

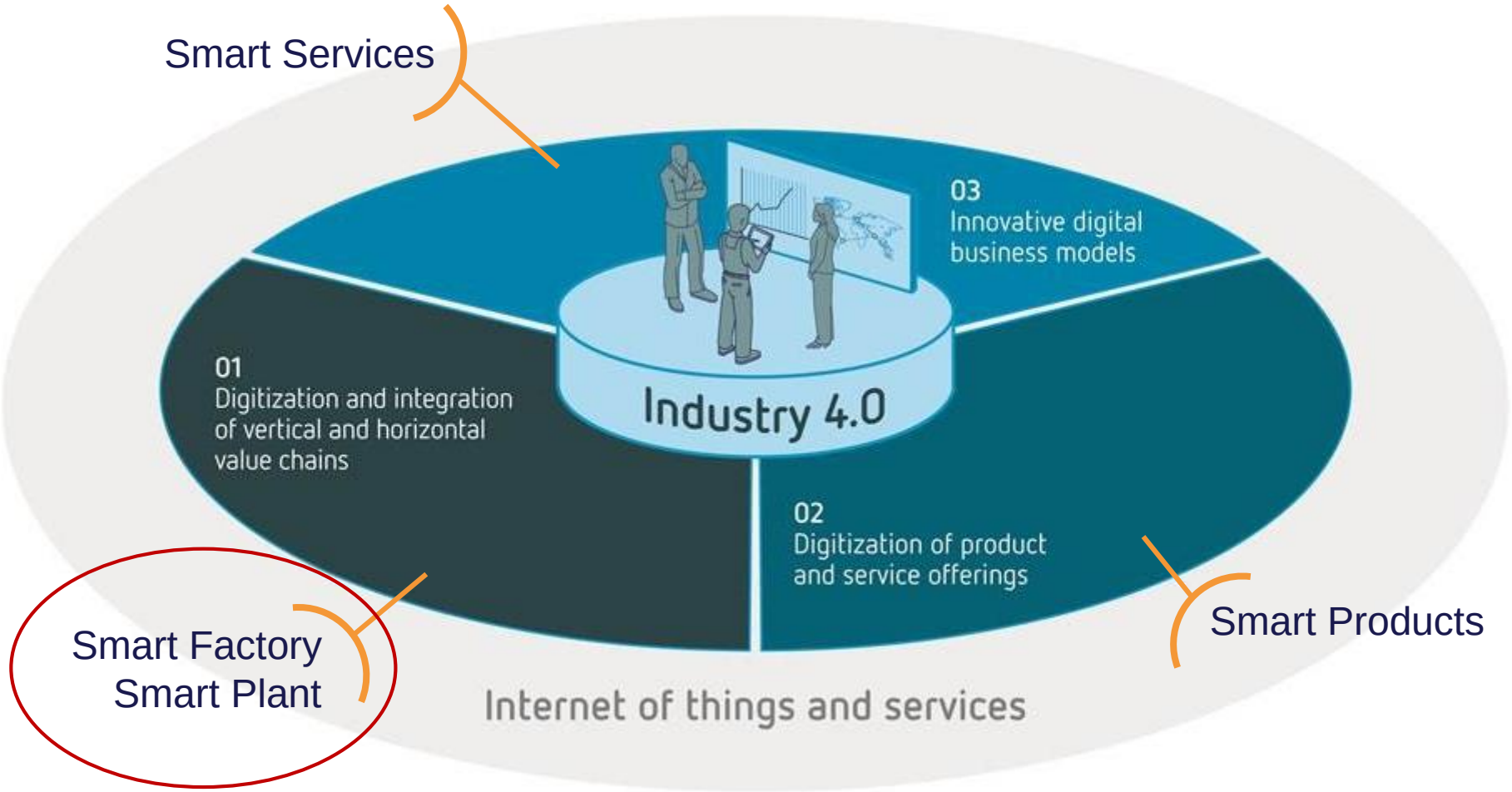
”Industrie 4.0” impacts in three dimensions

Industrie 4.0 has impact on every company in 3 dimensions



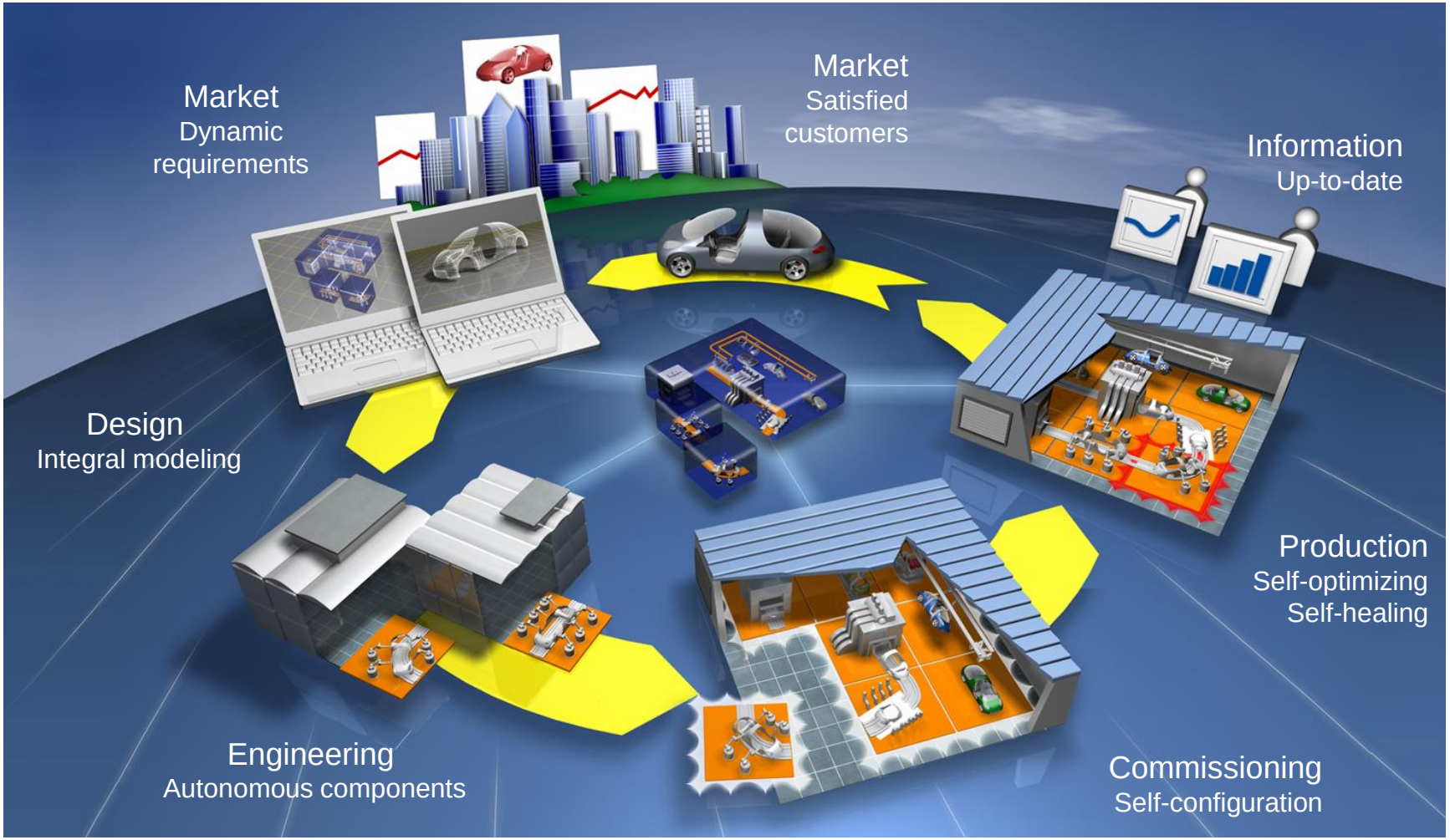
Source: ZVEI following PwC

Industrie 4.0 has impact on every company in 3 dimensions

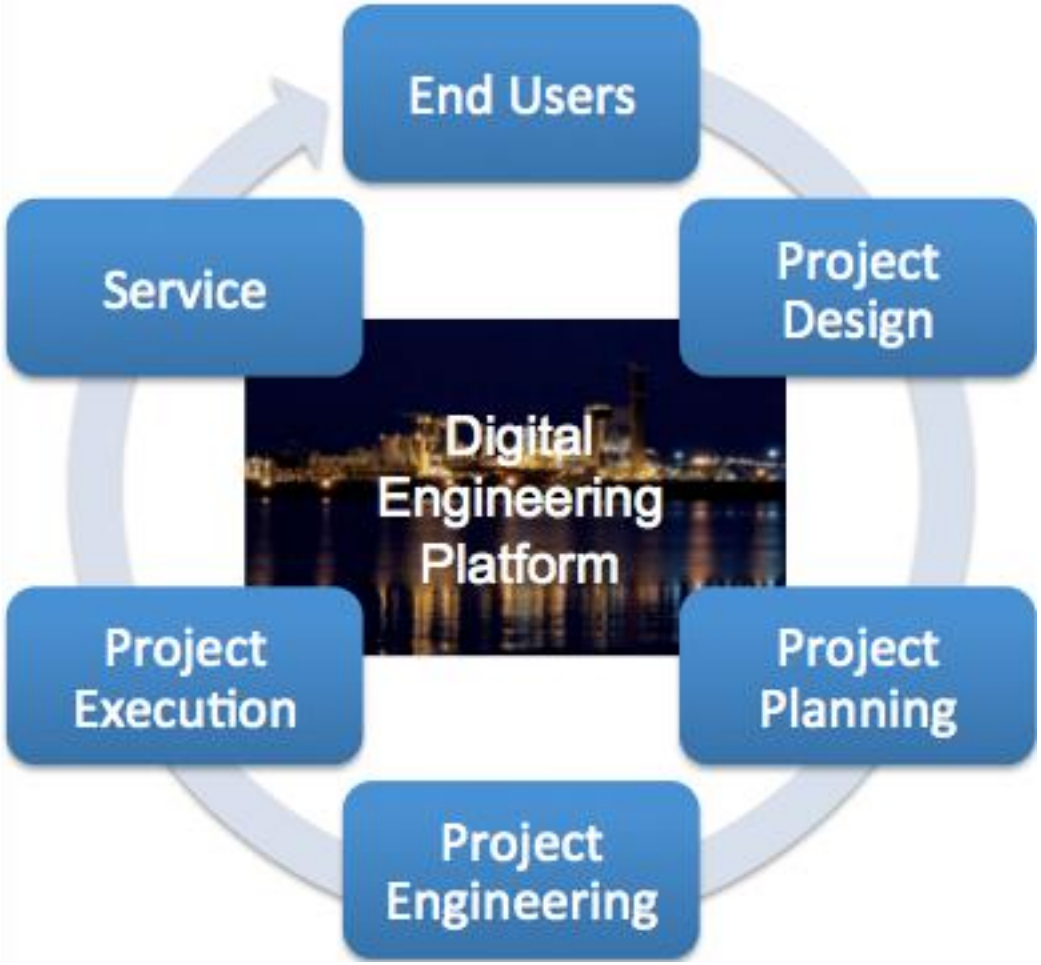


Source: ZVEI following PwC

Vision “Industrie 4.0”: Smart Factory for Discrete Industries

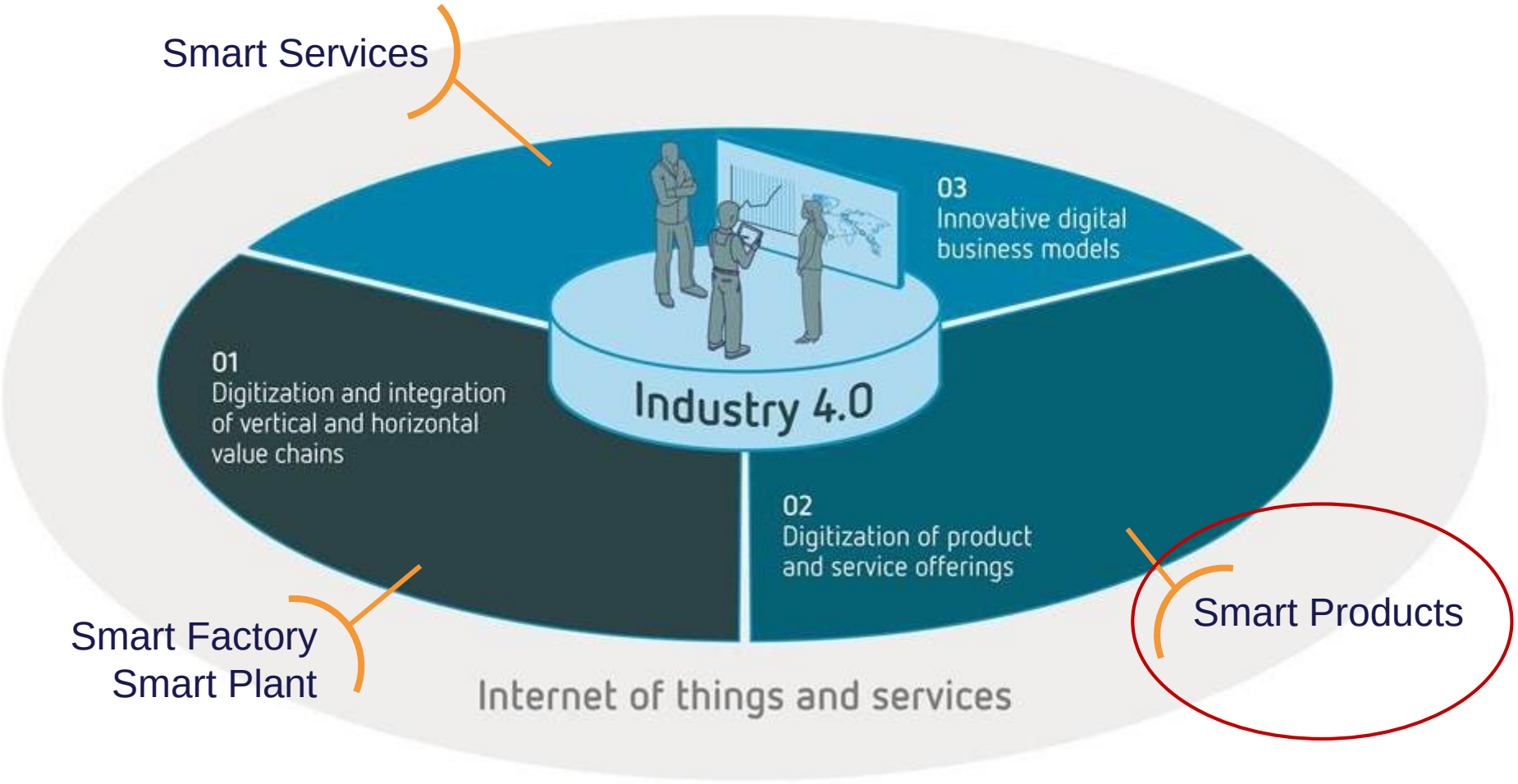


Vision “Industrie 4.0”: Smart Factory for Process Industries



- Data Management
- RAMS Traceability
- Well Integrity
- Modular Design
- One design – Many build
- Market Acceptance – Local Content
- Reduced Capital Intensity
- Shorten Time to Market (Design – Execution – Testing – Commissioning – Start-up)

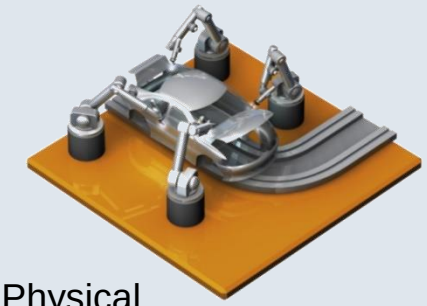
Industrie 4.0 has impact on every company in 3 dimensions



Source: ZVEI following PwC

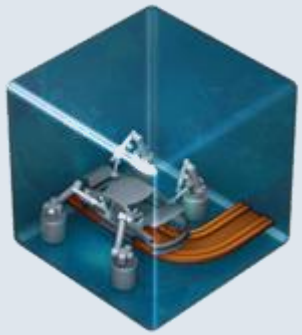
Cyber-Physical-System (CPS)

Cyber Physical System (CPS)



Physical manufacturing equipment

+

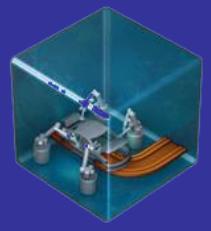


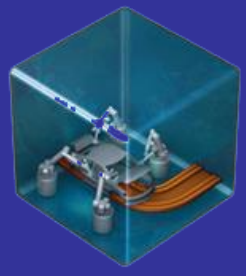
Digital model

Contains all the information relating to…

- Software, informatics
- Mechanics
- Electrical, electronics
- Automation, HMI
- Safety, security
- Maintenance
- Site location, identity
- Status
- SW version
- Interfaces
- …

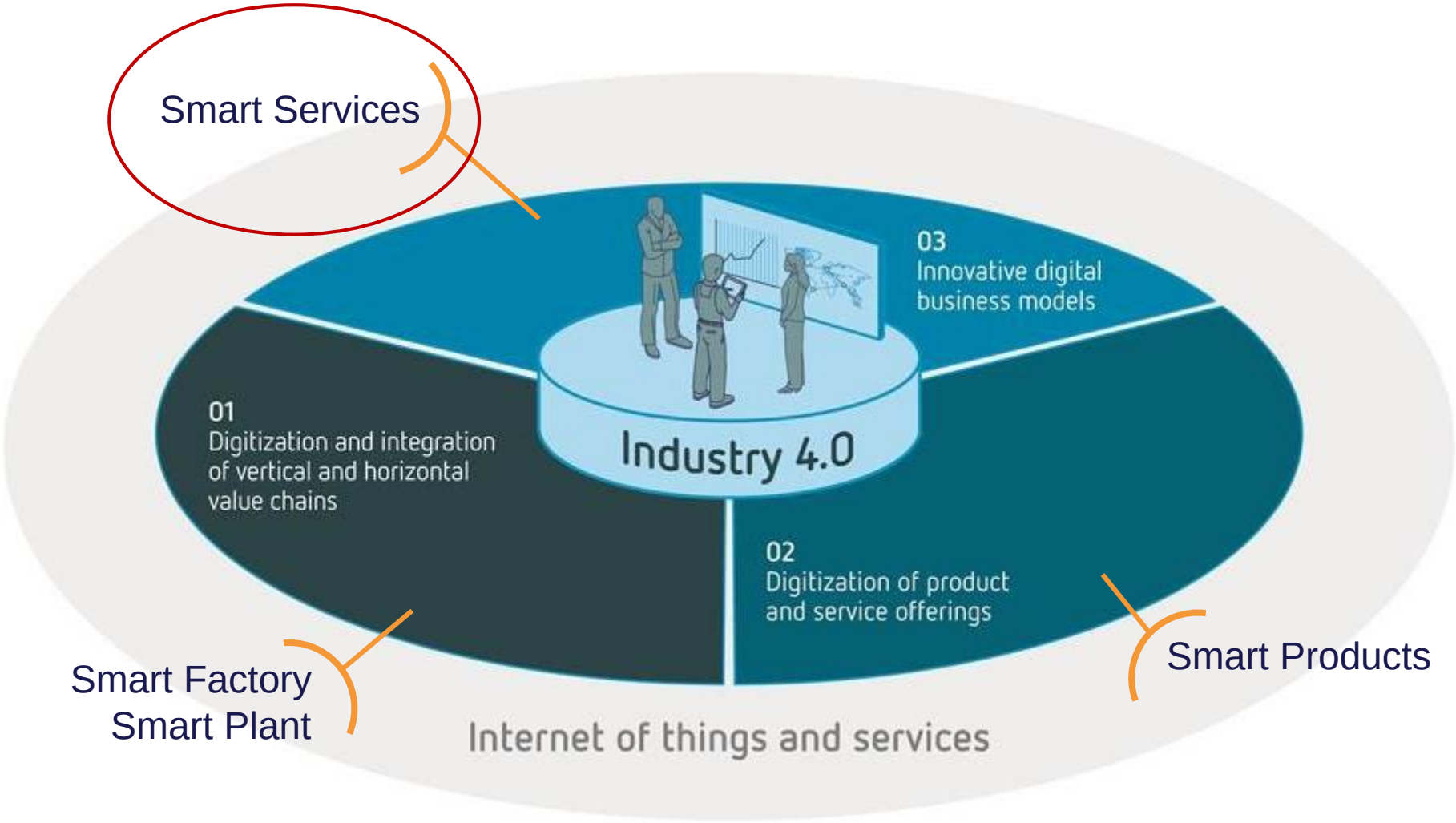
The digital model is always up-to-date and is extended throughout the entire life cycle





Product design → **Production planning** → **Production engineering** → **Production execution** → **Services**

Industrie 4.0 has impact on every company in 3 dimensions

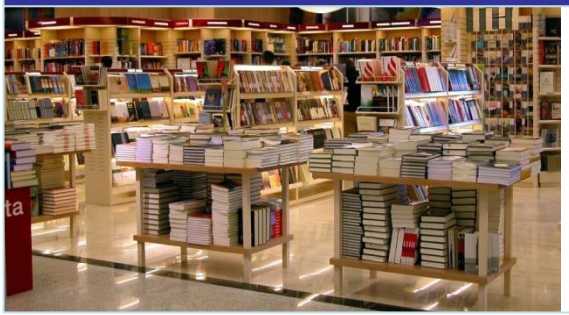


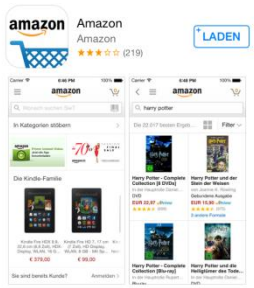
Source: ZVEI following PwC

The world is going digital

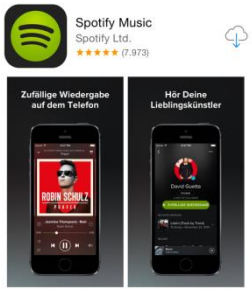
New innovative business models to change user behaviour

From Bookstores to eBooks

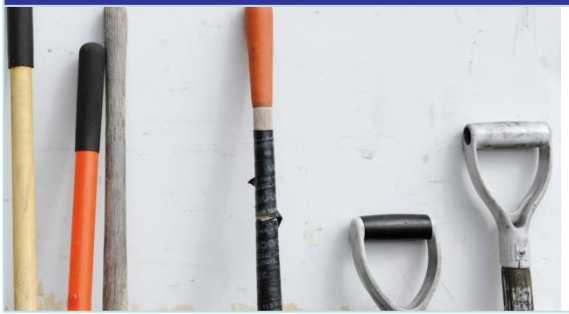


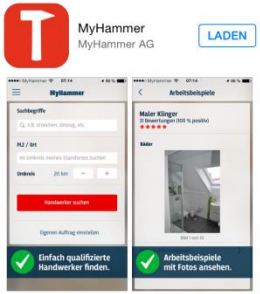


From Record Store to Streaming



From Yellow Pages to Marketplaces



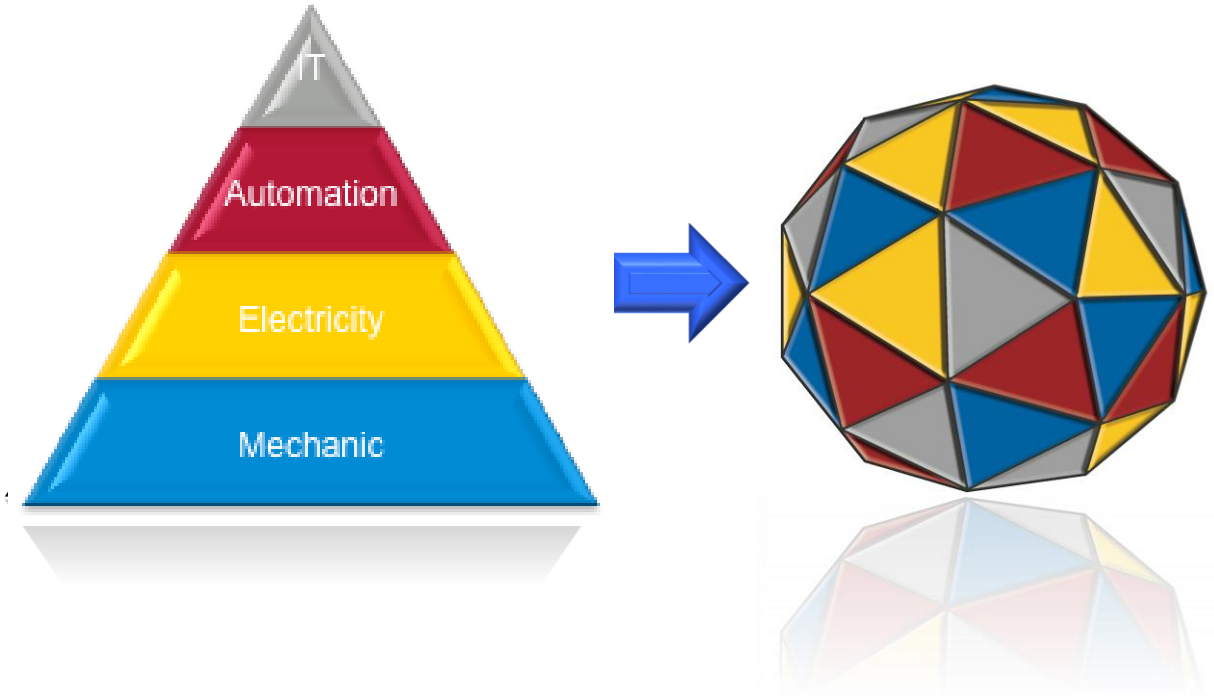


From Taxi to Ride Sharing

Source: Siemens

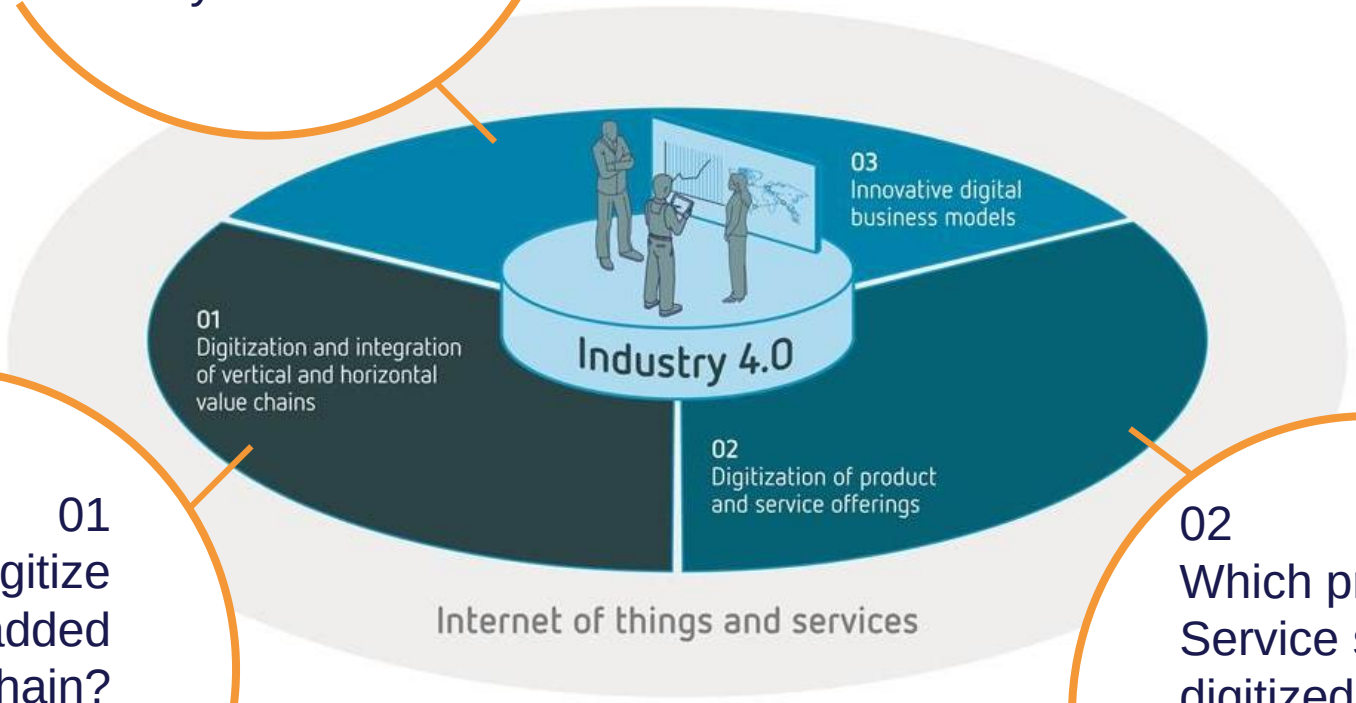
Paradigm shift in value creation

…results in termination of industry boundaries



Industrie 4.0 affects all companies: 3 relevant questions!

03
Which are the new business models that I can offer to my customers?



01
How can I digitize my value-added chain?

02
Which product or Service should be digitized?

Source: ZVEI following PwC

Thank you very much for your attention!

Any questions?