

Industrie 4.0 – “The Big Picture“

Prof. Dr. Dieter Wegener

Head of External Cooperation, Siemens Corporate Technology
Speaker “ZVEI Management Team Industrie 4.0”

Webinar “Industrie 4.0” @ Poland, April 29th, 2020

ZVEI – German Electrical and Electronic Manufacturers’ Association

1

Digitalization of Economy

2

„Industrie 4.0“ operates in 3 dimensions

3

German Initiative „Industrie 4.0“

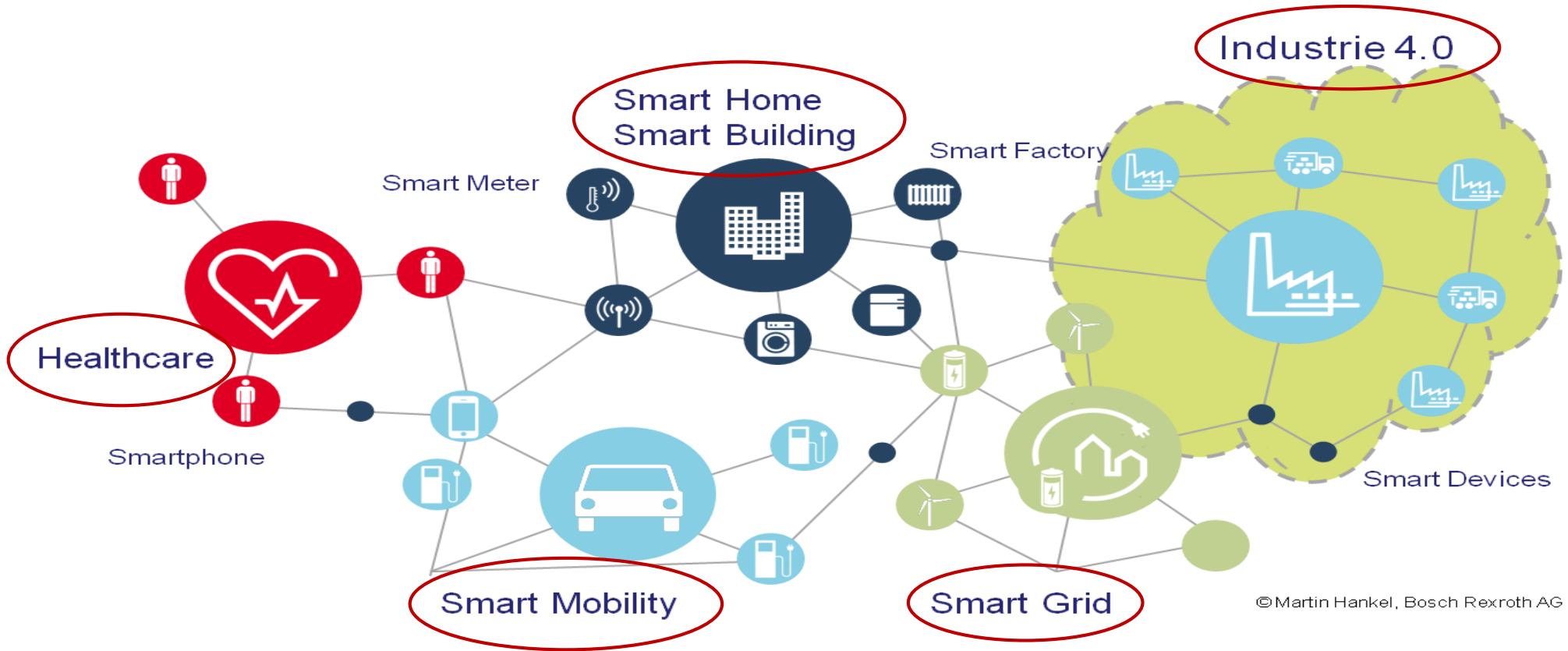
4

Standardisation 4.0

5

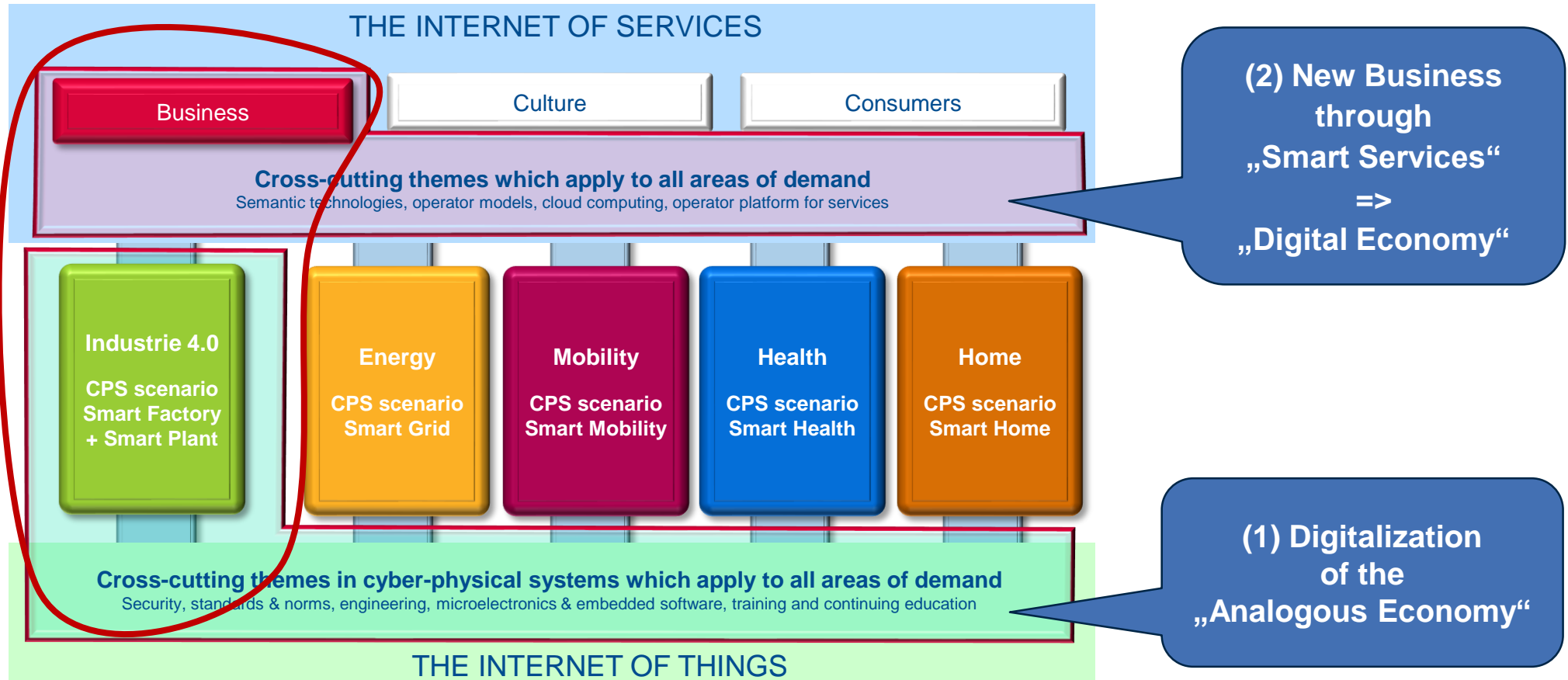
„Industrie 4.0“ and Digitalization @ Siemens

„Digitalization of Economy“ is leading to a „Connected World“



© Martin Hankel, Bosch Rexroth AG

Two aspects at „Digitalization of Economy“ - „Industrie 4.0“ is one Application Scenario



Quelle: Acatech / ZVEI

„Digital Economy“ based on „IoT-Platforms“ for B2C and B2B



„Digital Value Add“

means

„Big Data“ out of OT-Devices

will be analysed with „Apps“ (Algorithms) at SaaS-Layer to „Smart Data“

and distributed via INTERNET as „Smart Services“ to the customers

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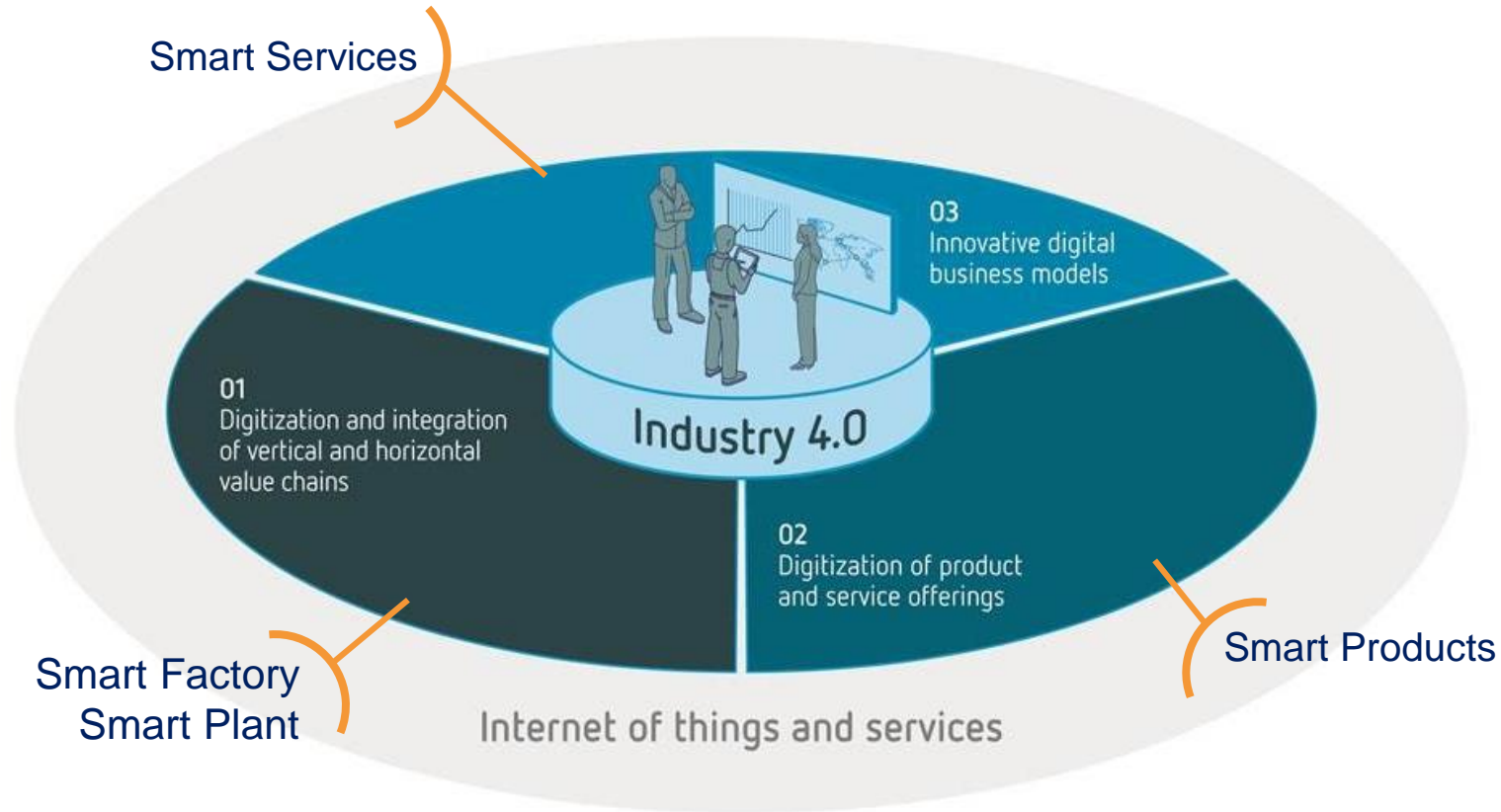
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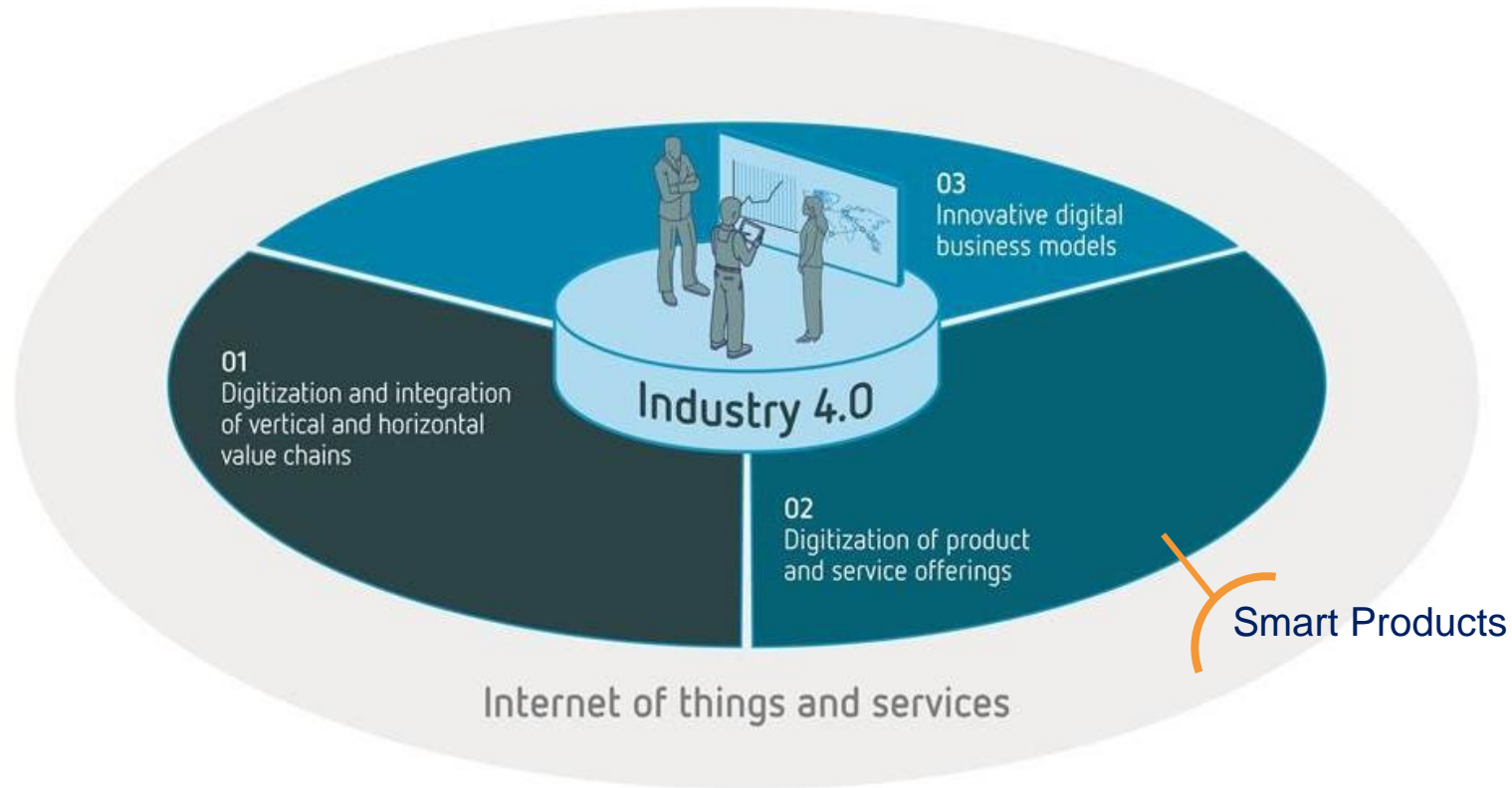
„Industrie 4.0“ and Digitalization @ Siemens

„Industrie 4.0“ impacts on every company in 3 dimensions



Quelle: ZVEI nach PwC

Siemens approach for „Smart Products“ is the „Digital Twin“

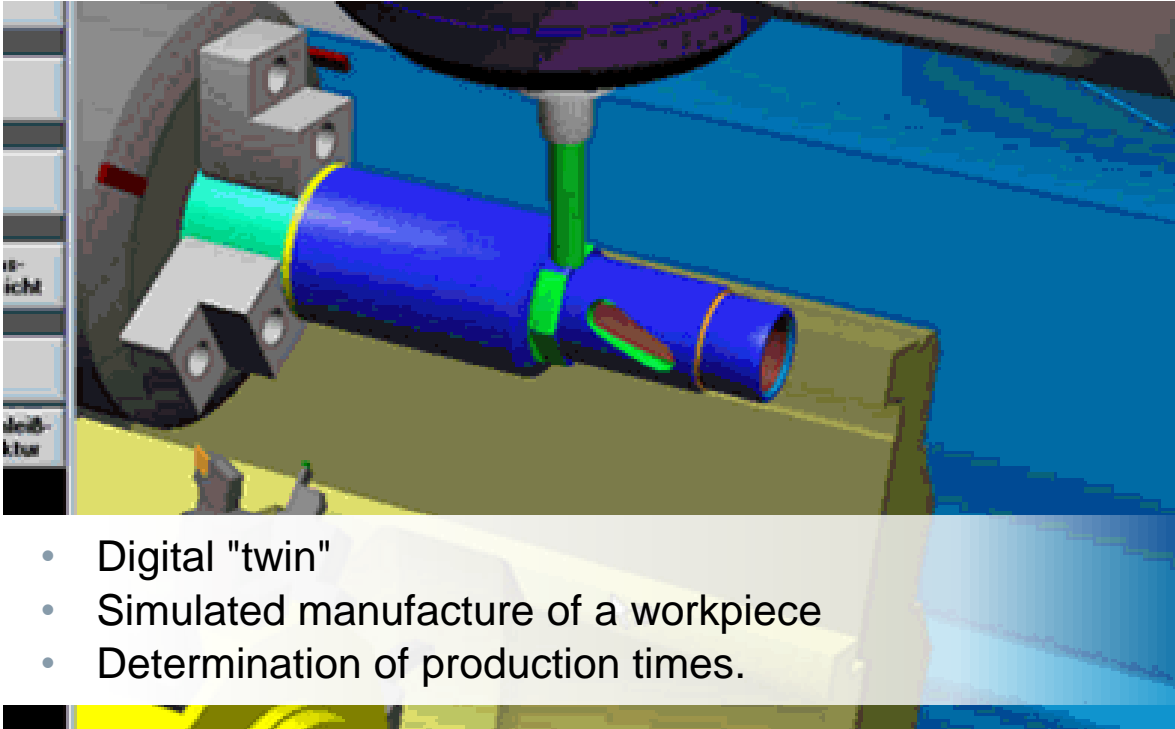


Quelle: ZVEI nach PwC

"Virtual machine" –

Increase in productivity through simulation of the production process

SIEMENS

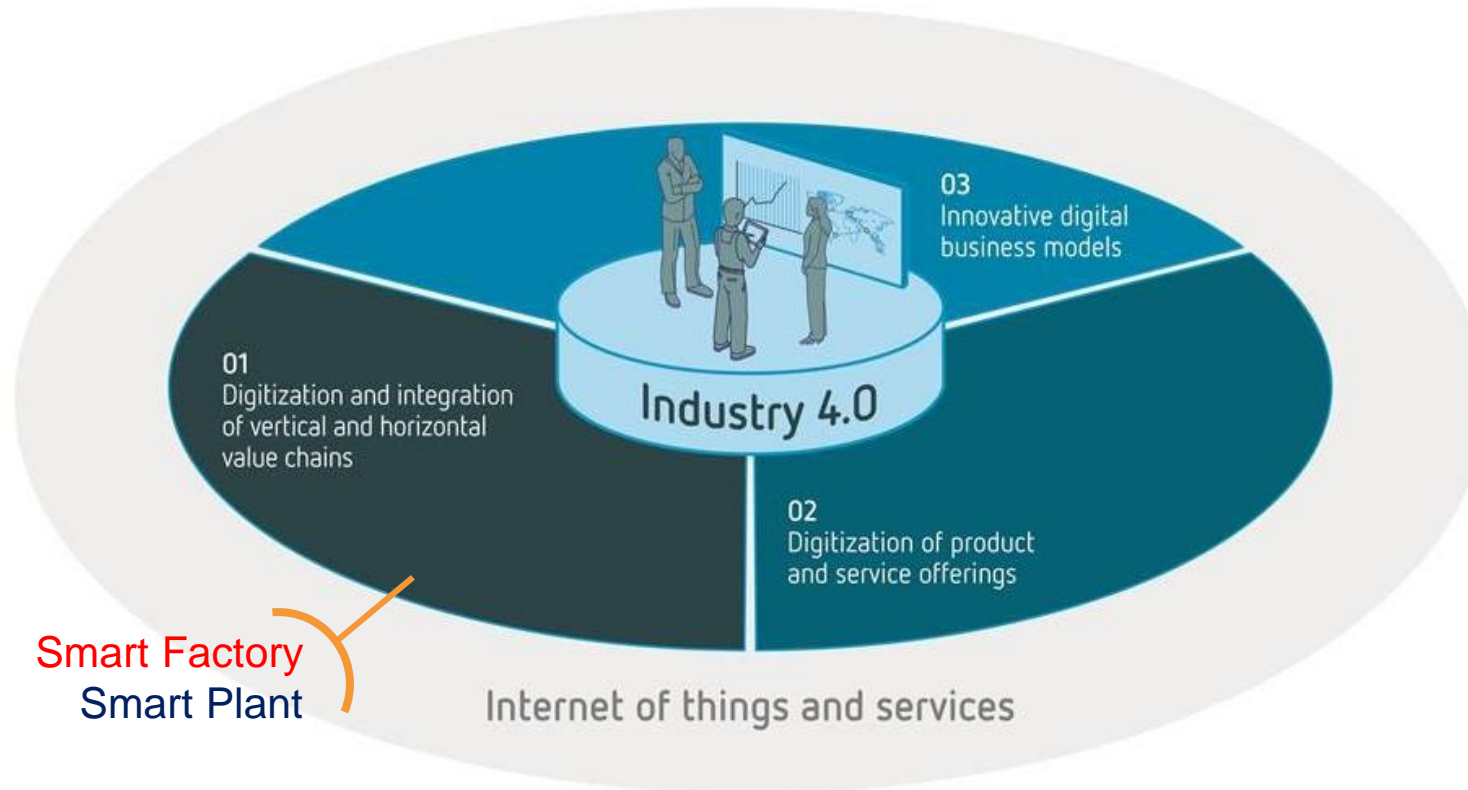


- Digital "twin"
- Simulated manufacture of a workpiece
- Determination of production times.



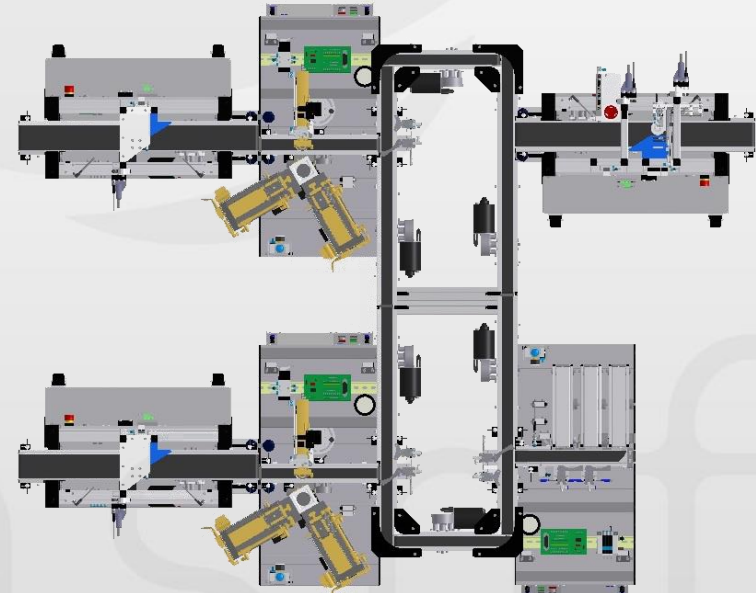
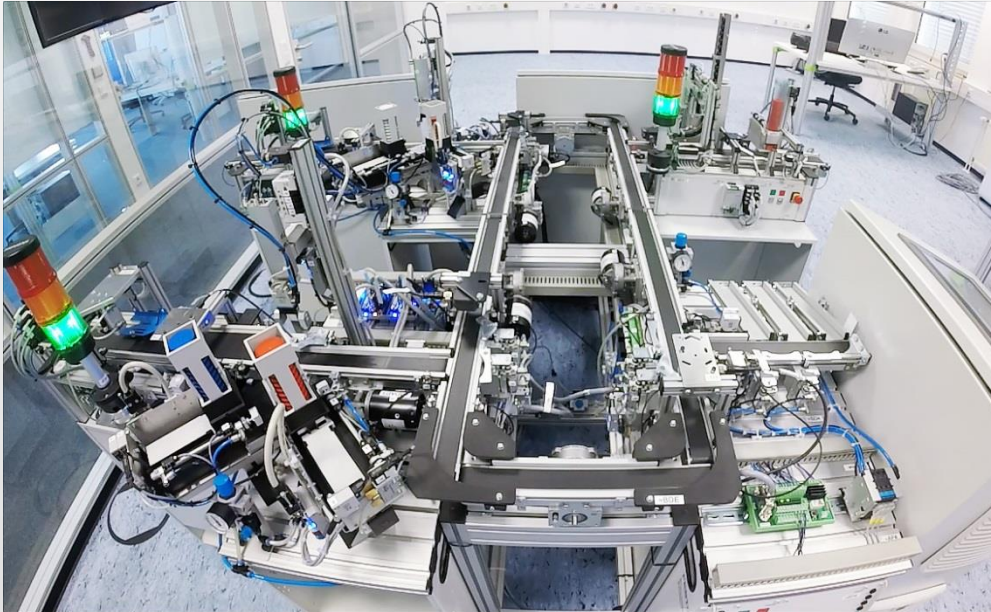
10% increase in productivity in day-to-day operations and time savings of up to 80% during setup/configuration of the real machine.

Example for a „Smart Factory“: How to transform a conventional „Factory“ to a „Smart Factory“

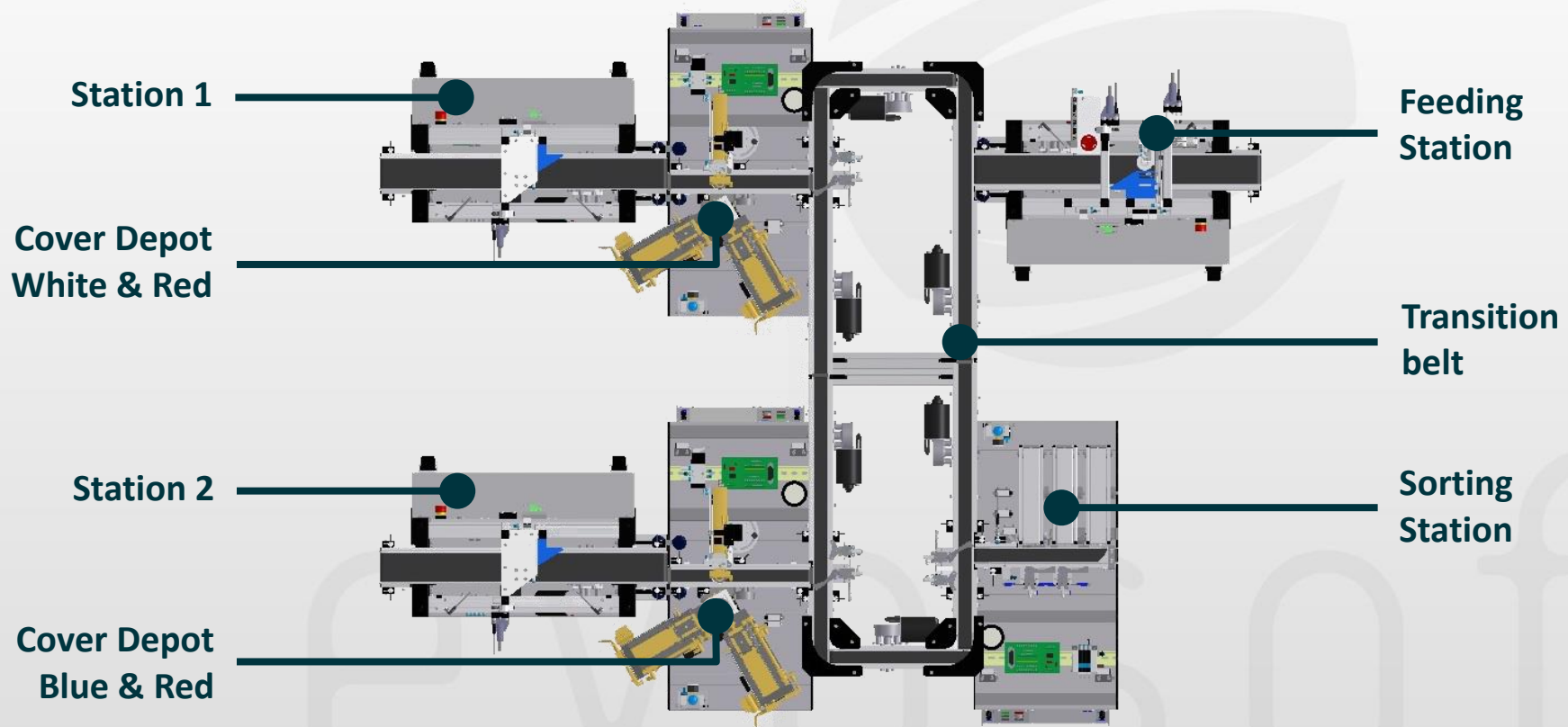


Quelle: ZVEI nach PwC

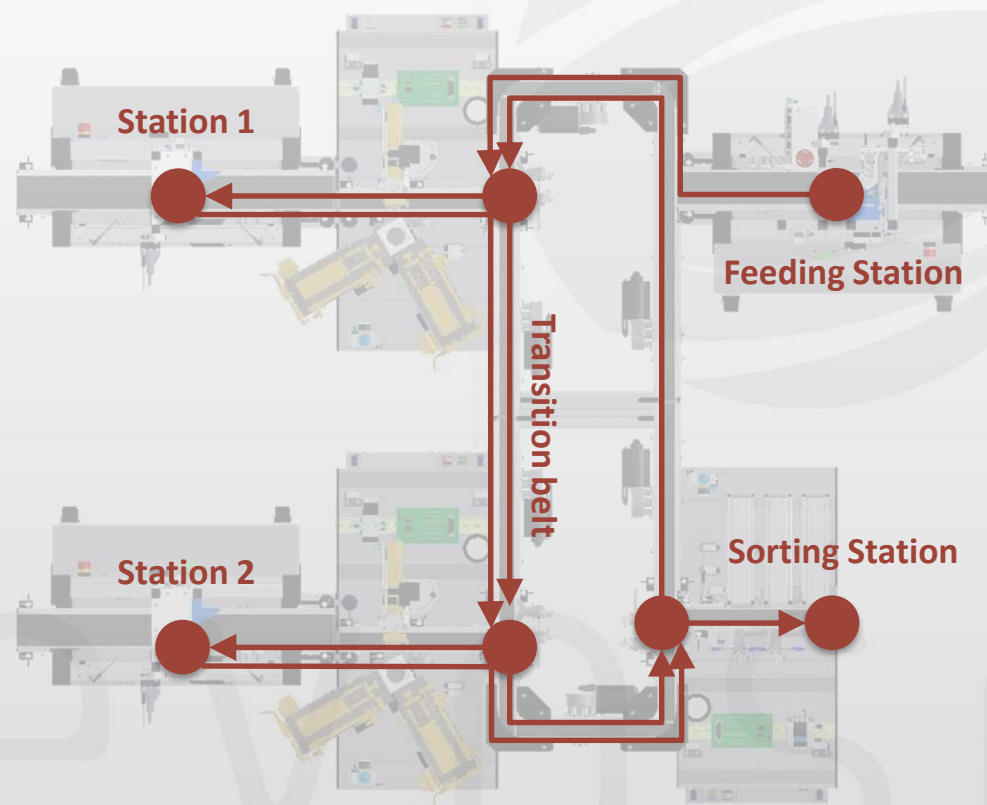
Structure of a conventional „Factory“ -> View and Layout



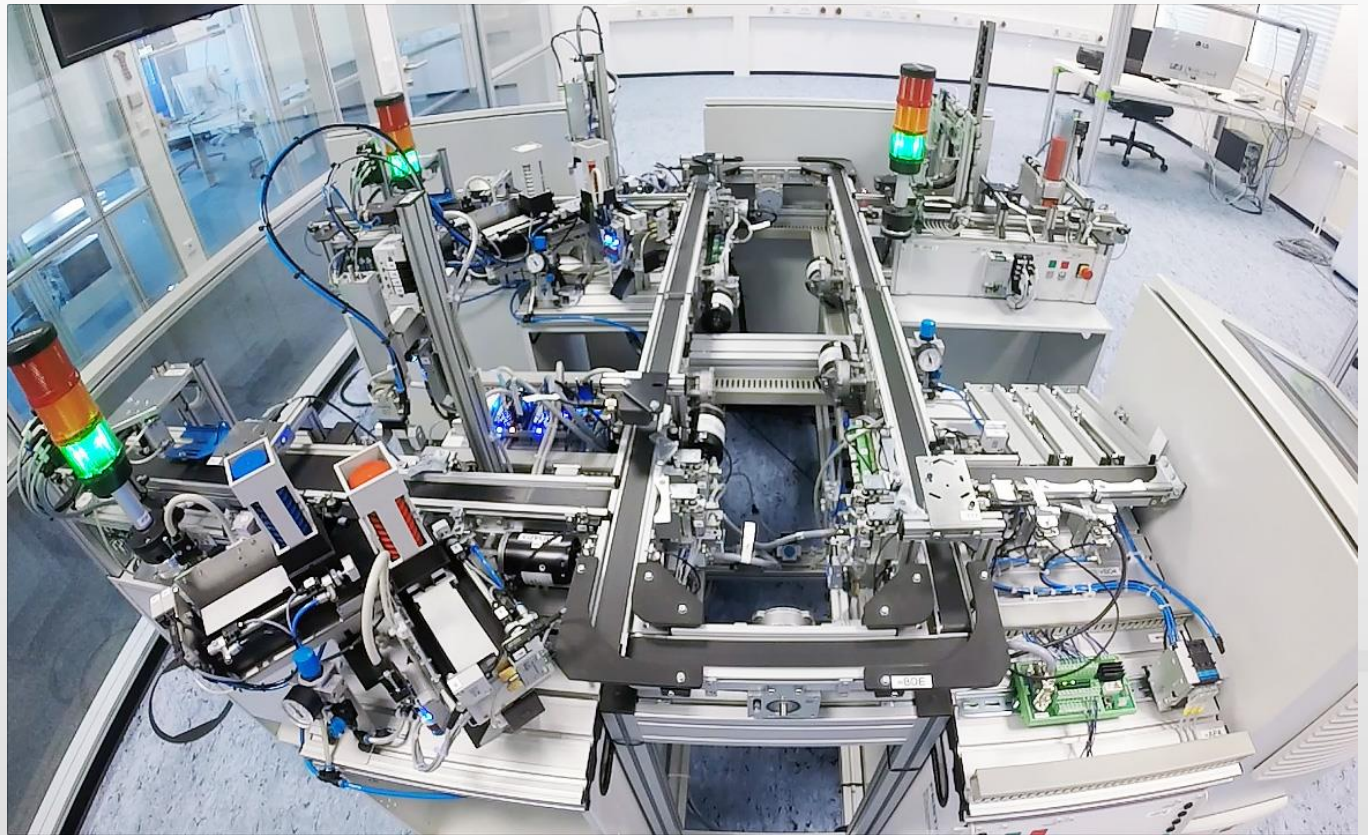
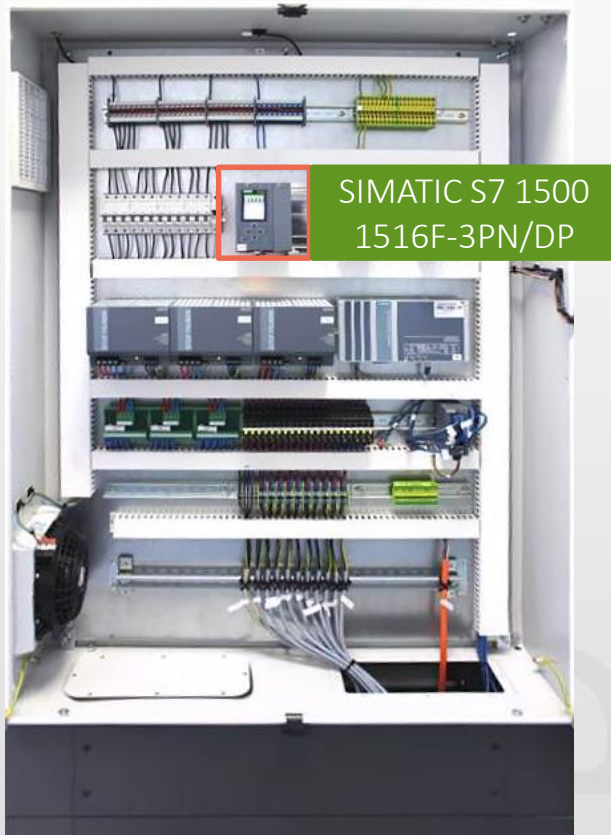
Structure of a conventional „Factory“ -> Layout in detail



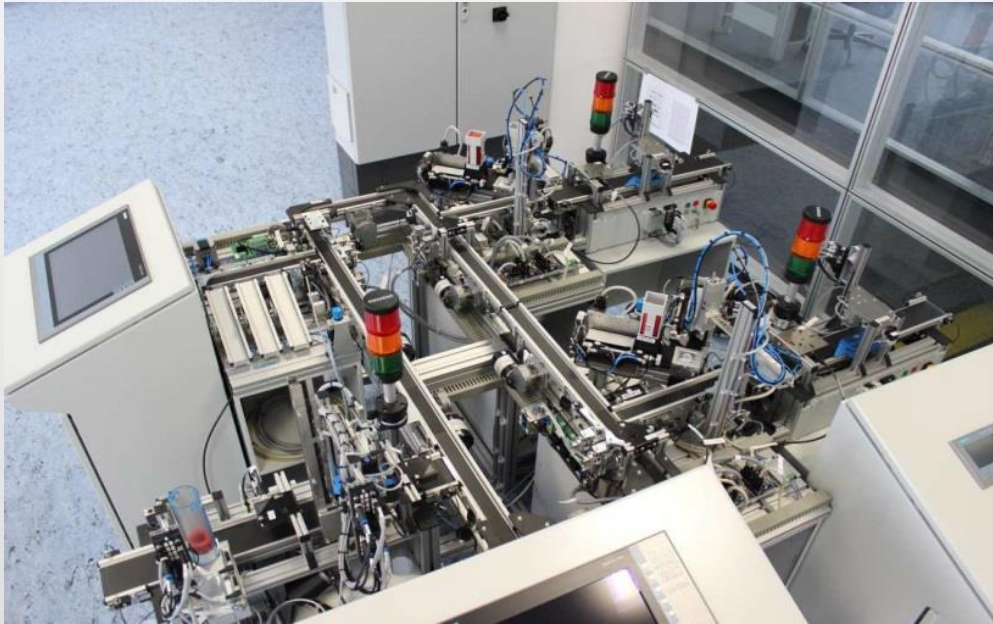
Structure of a conventional „Factory“ -> Sensor equipment



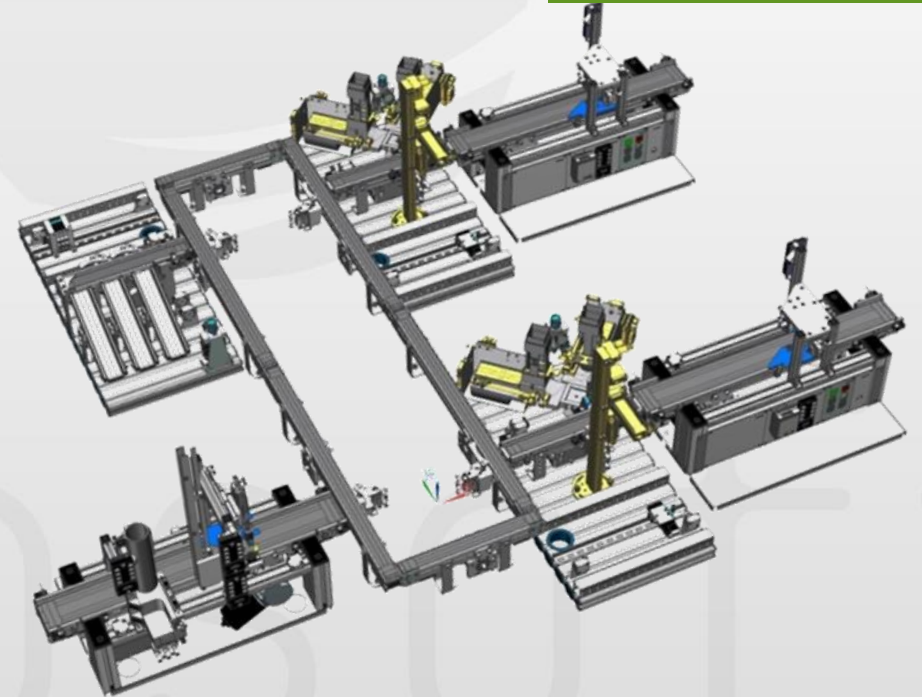
Structure of a conventional „Factory“ -> Automation equipment



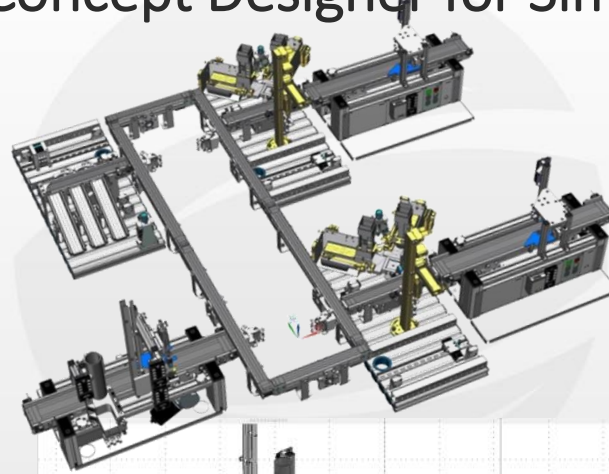
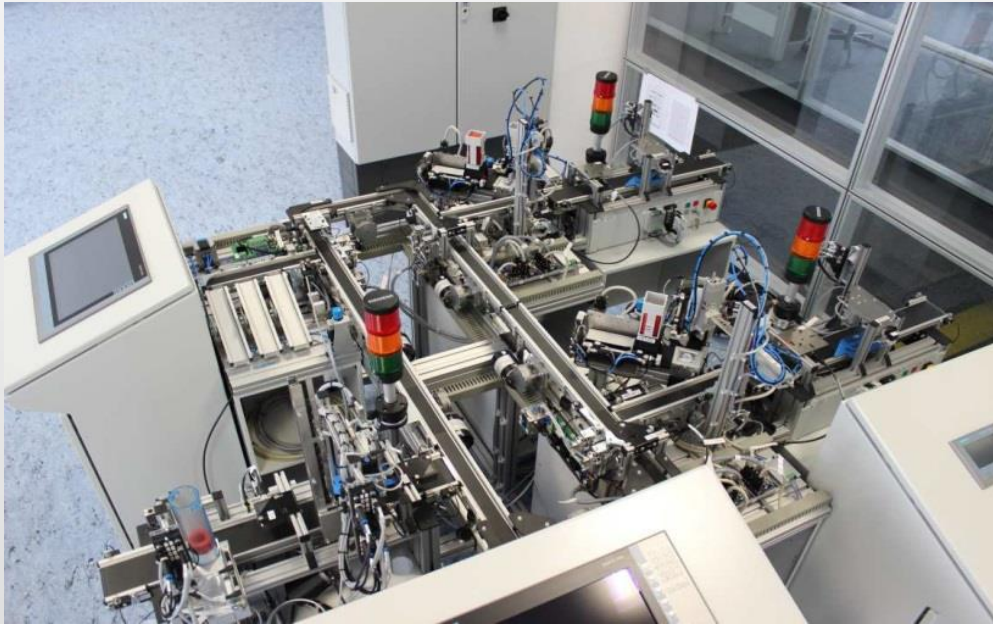
„Smart Factory“ -> Part 1: CAD-software for Design



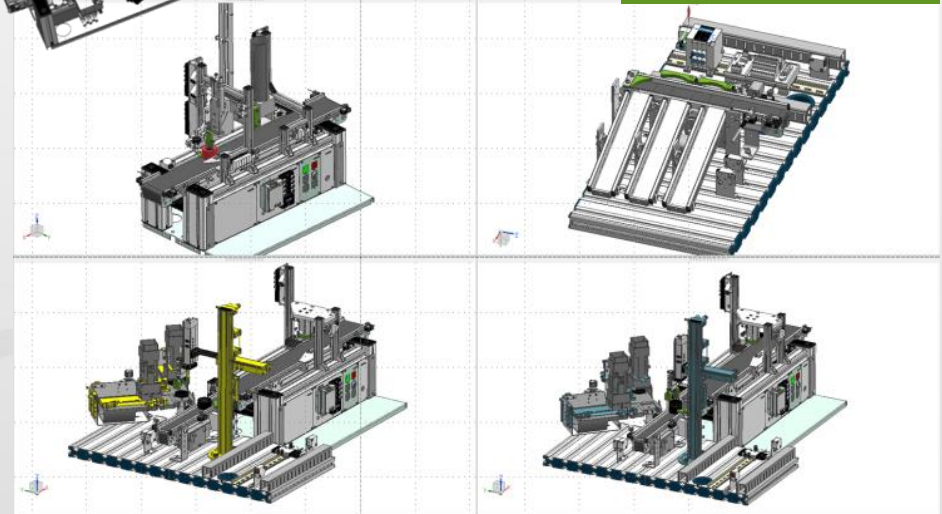
NX11 for Design



„Smart Factory“ -> Part 2: Mechatronic Concept Designer for Simulation



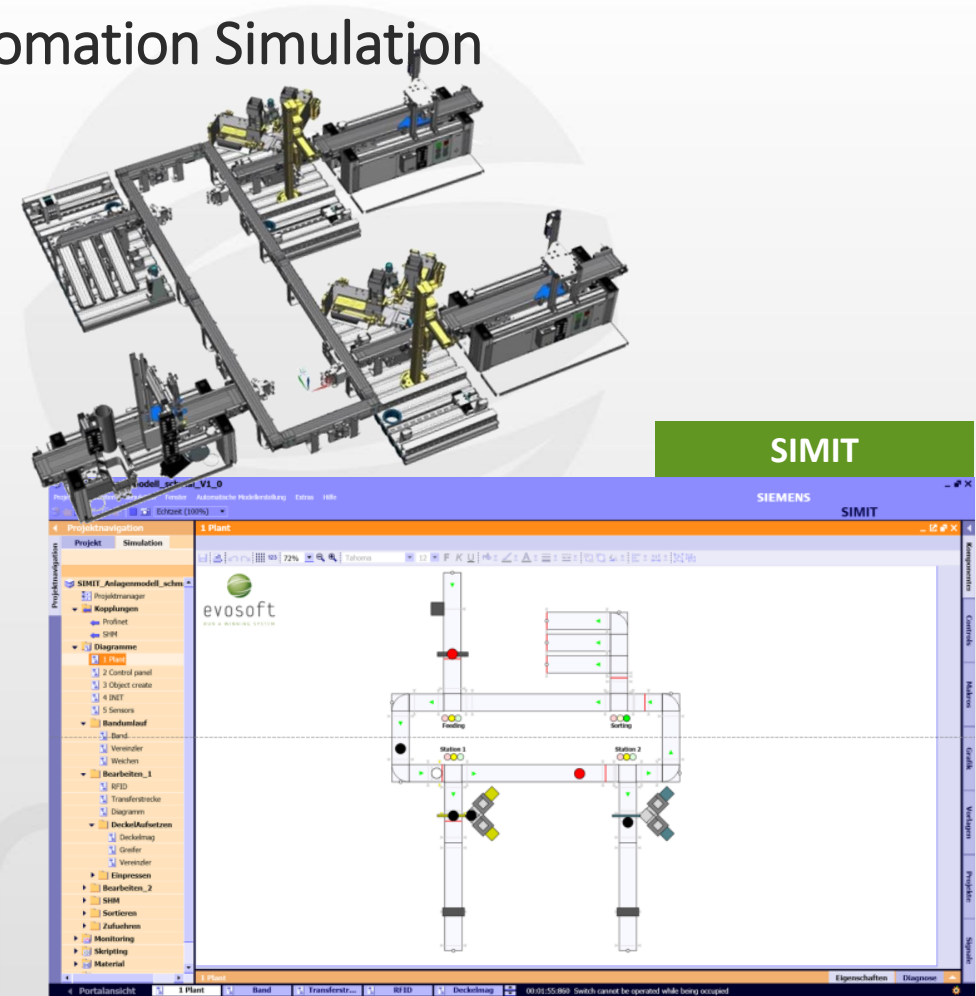
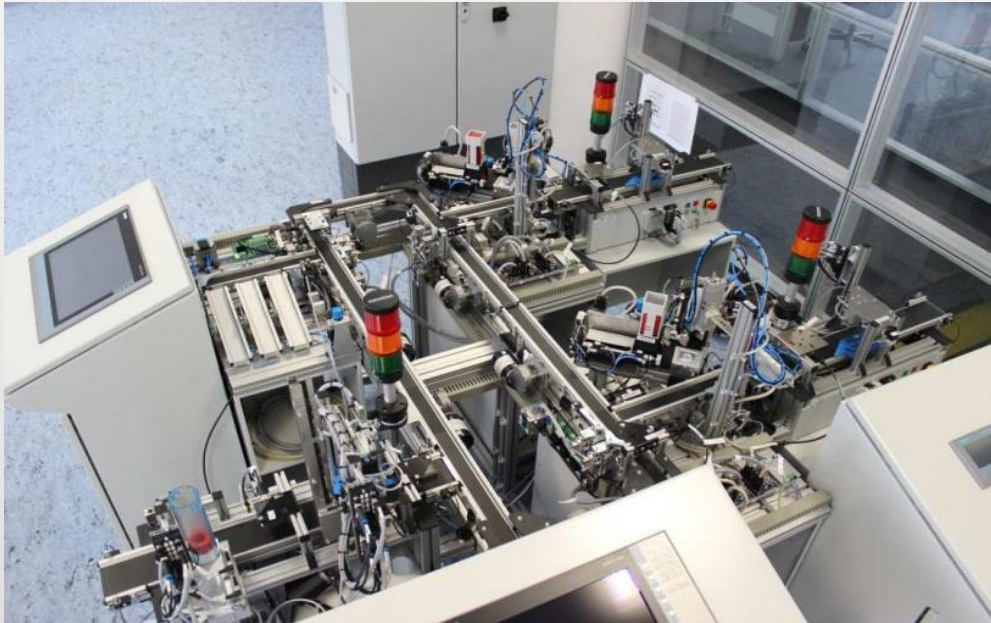
NX11 MCD



NX MCD (Mechatronics Concept Designer):

Digitaler Zwilling für Mechatronisches Engineering und Virtuelle Inbetriebnahme im Maschinenbau

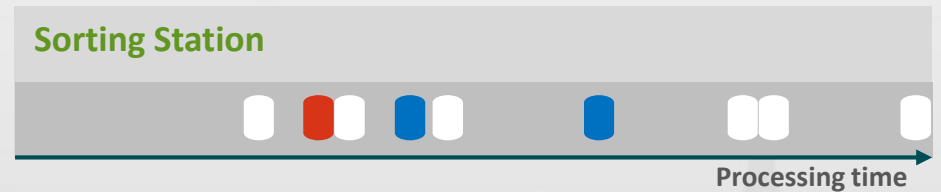
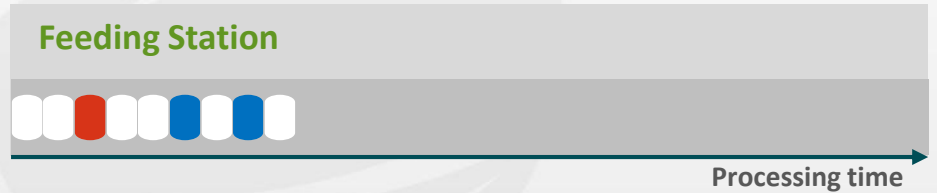
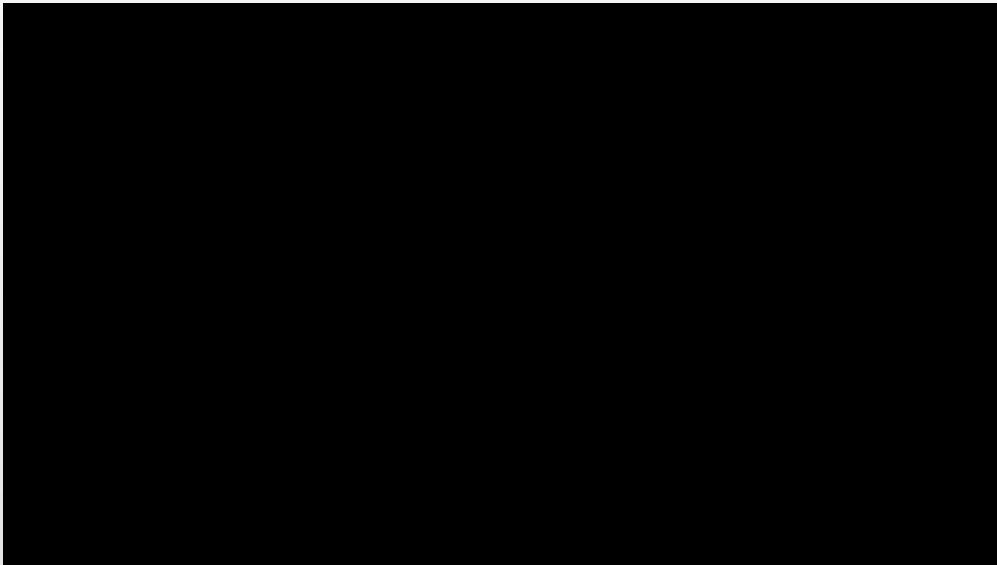
„Smart Factory“ -> Part 3: SIMIT for Automation Simulation



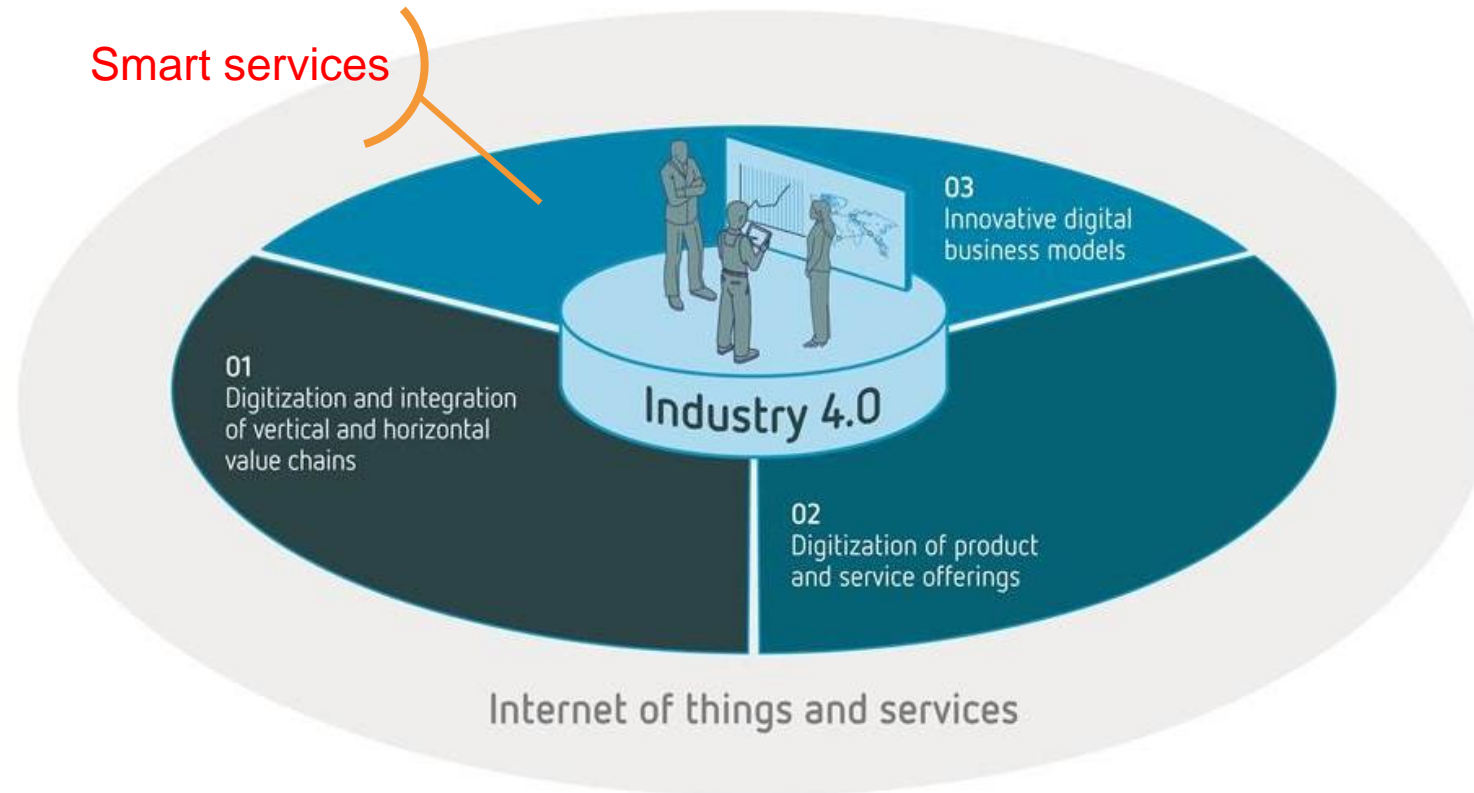
Simulation SIMIT:

Simulationssoftware von SIEMENS Automatisierungssystemen

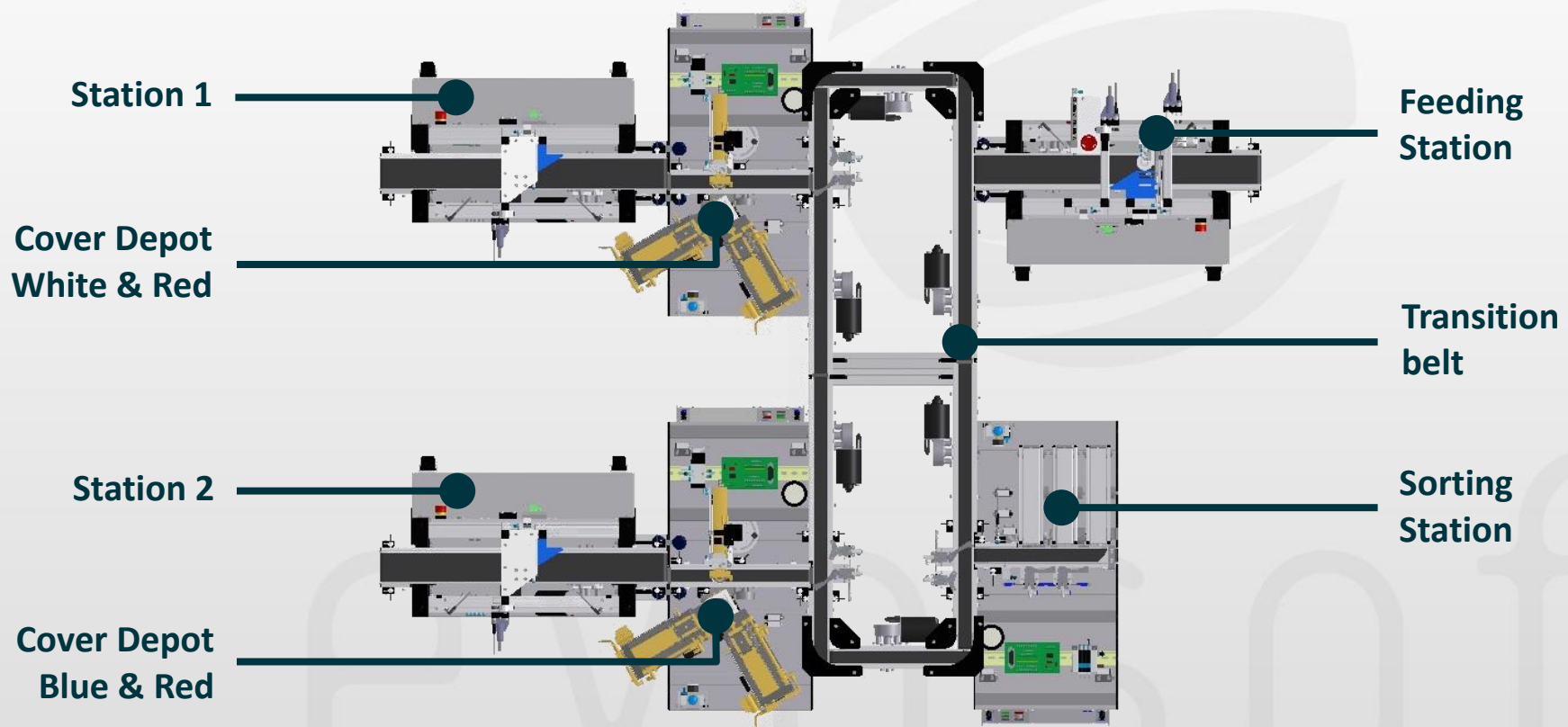
Behaviour of conventional „Factory“



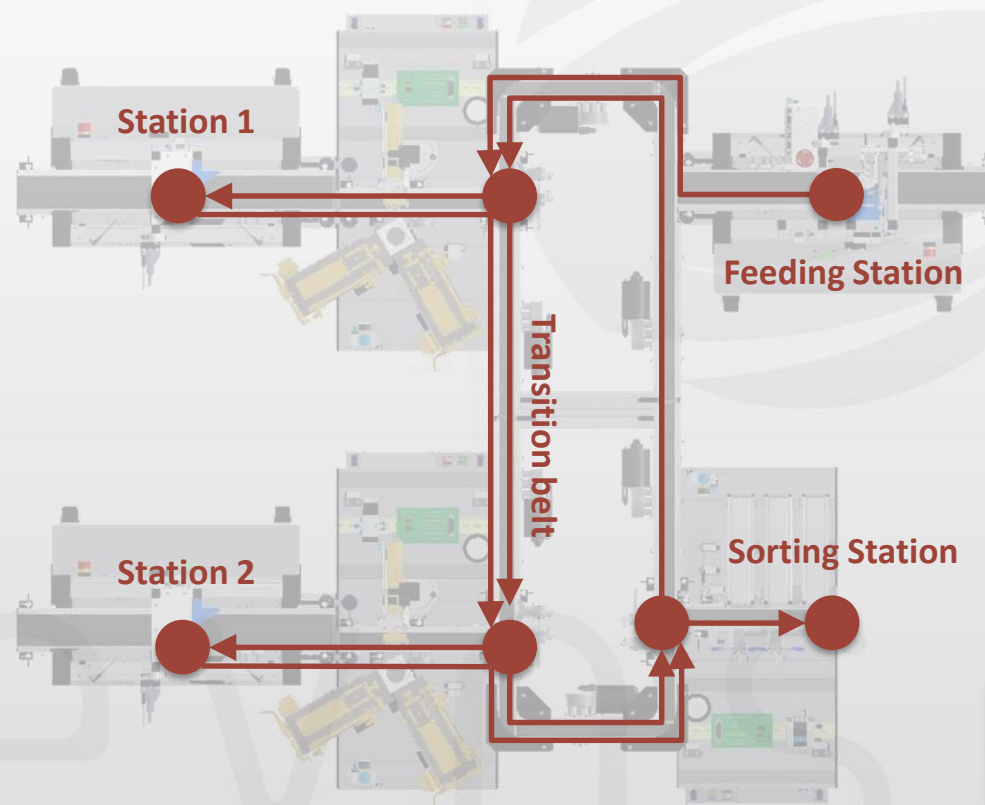
Example for „Smart Services“ in a conventional „Factory“: How to improve a conventional „Factory“ with „Smart Services“



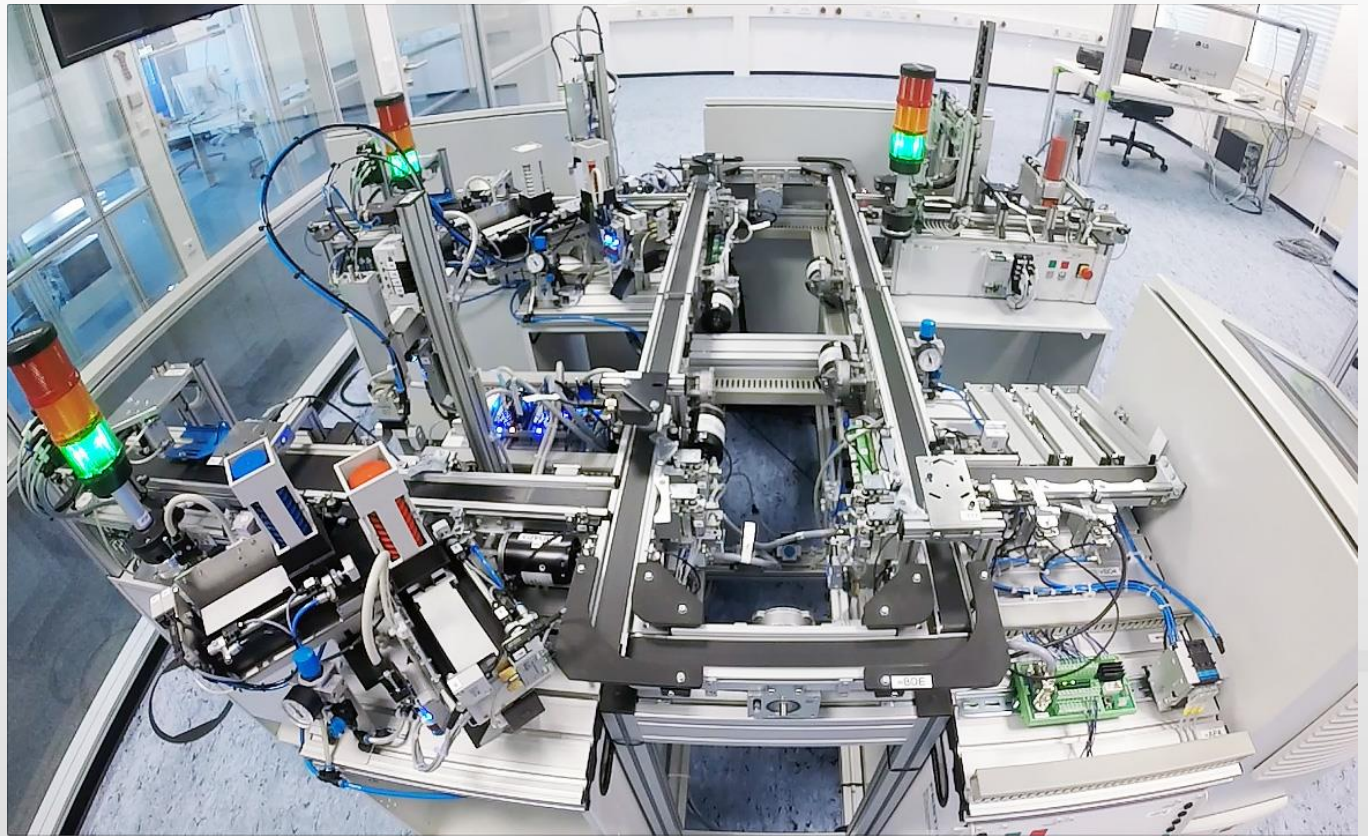
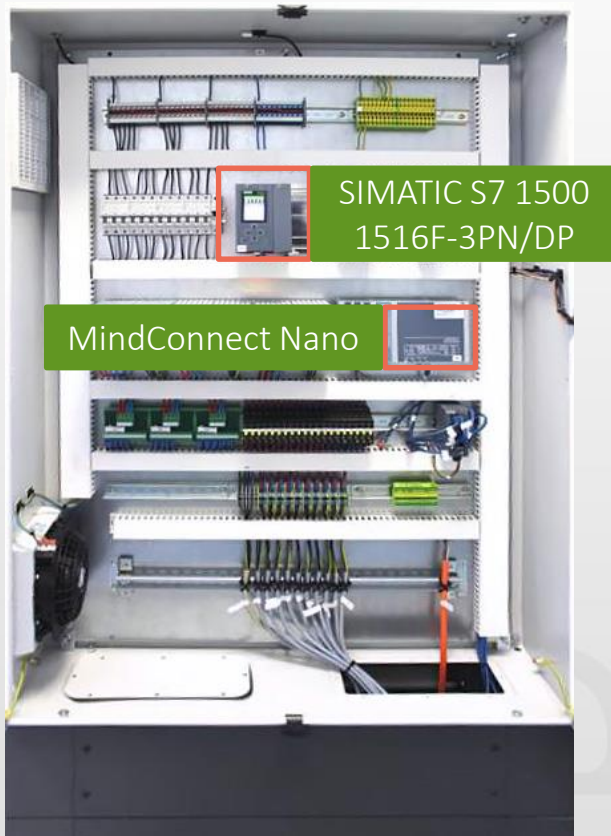
Structure of a conventional „Factory“ -> Layout in detail



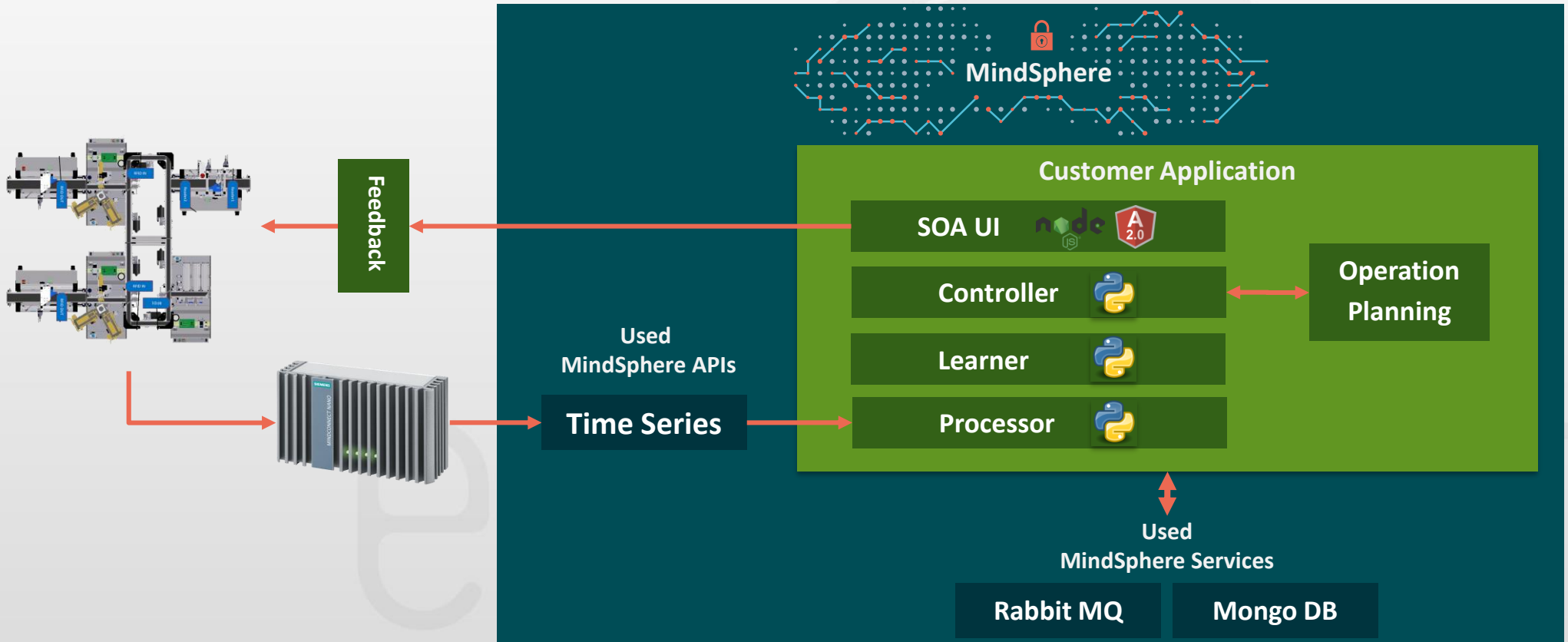
Structure of a conventional „Factory“ -> Sensor equipment



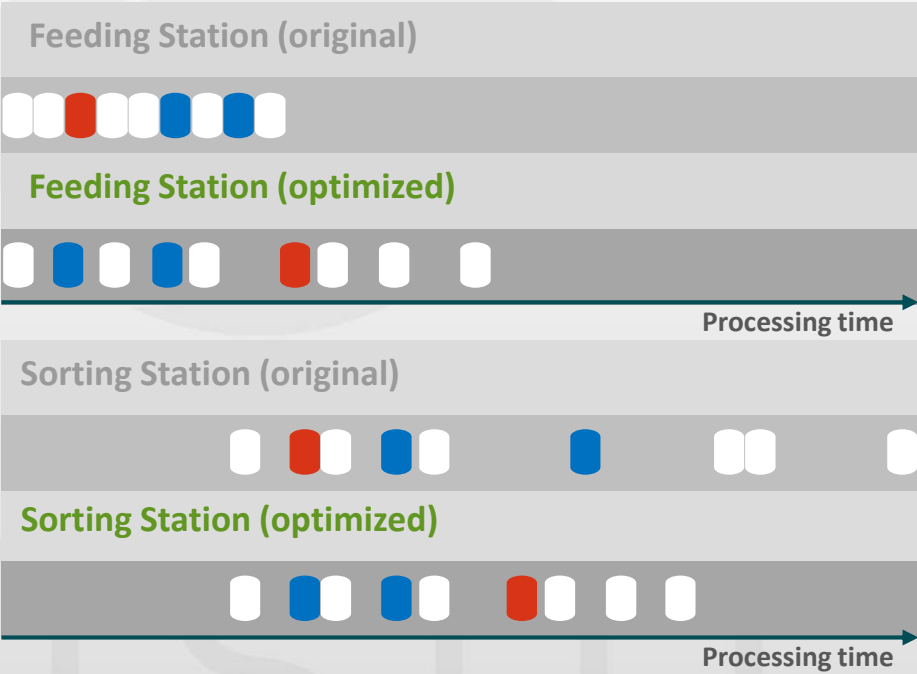
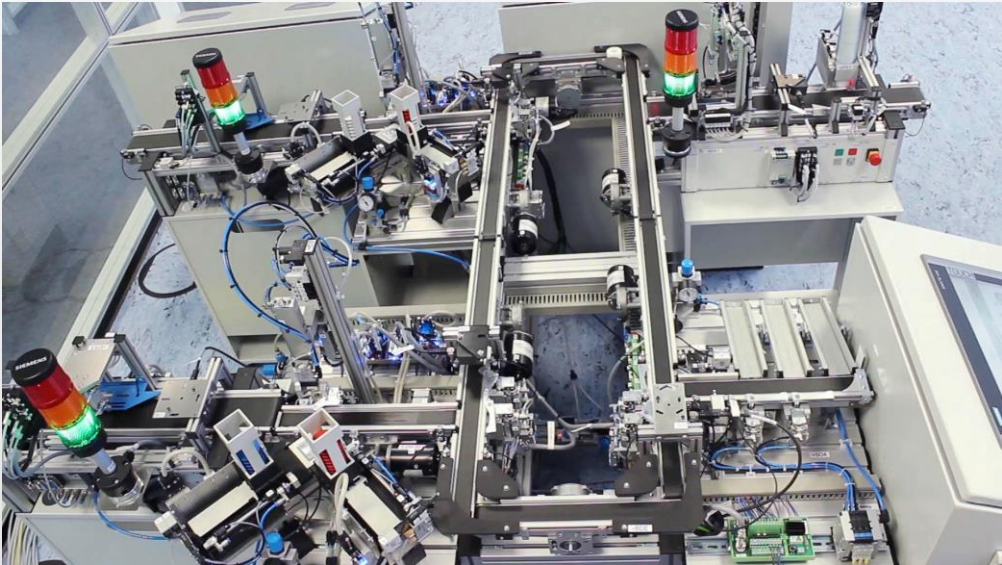
Expansion of a conventional „Factory“ with „Smart Services“



Expansion of a conventional „Factory“ with „Smart Services“



Optimized Behaviour with „Smart Services“

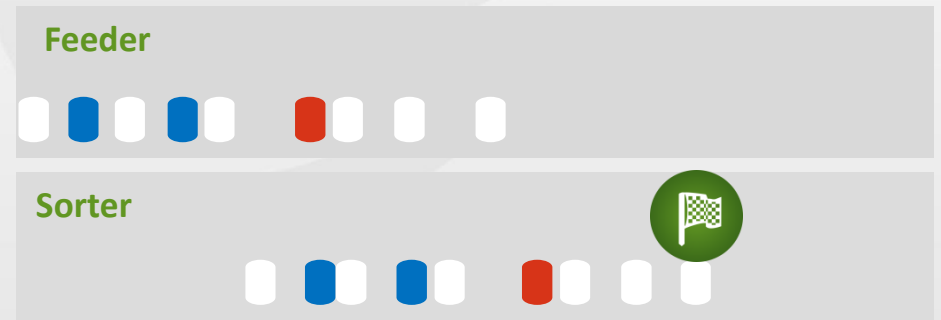


Impressive optimization of conventional „Factory“ with „Smart Services“

Original



Optimized



Efficiency Increase
31,4%

Summary Investments

Original



Optimized



Hardware

- Mindconnect Nano

Software

- Cloud Integration
- Simulation License
- App Development

break-even within first year

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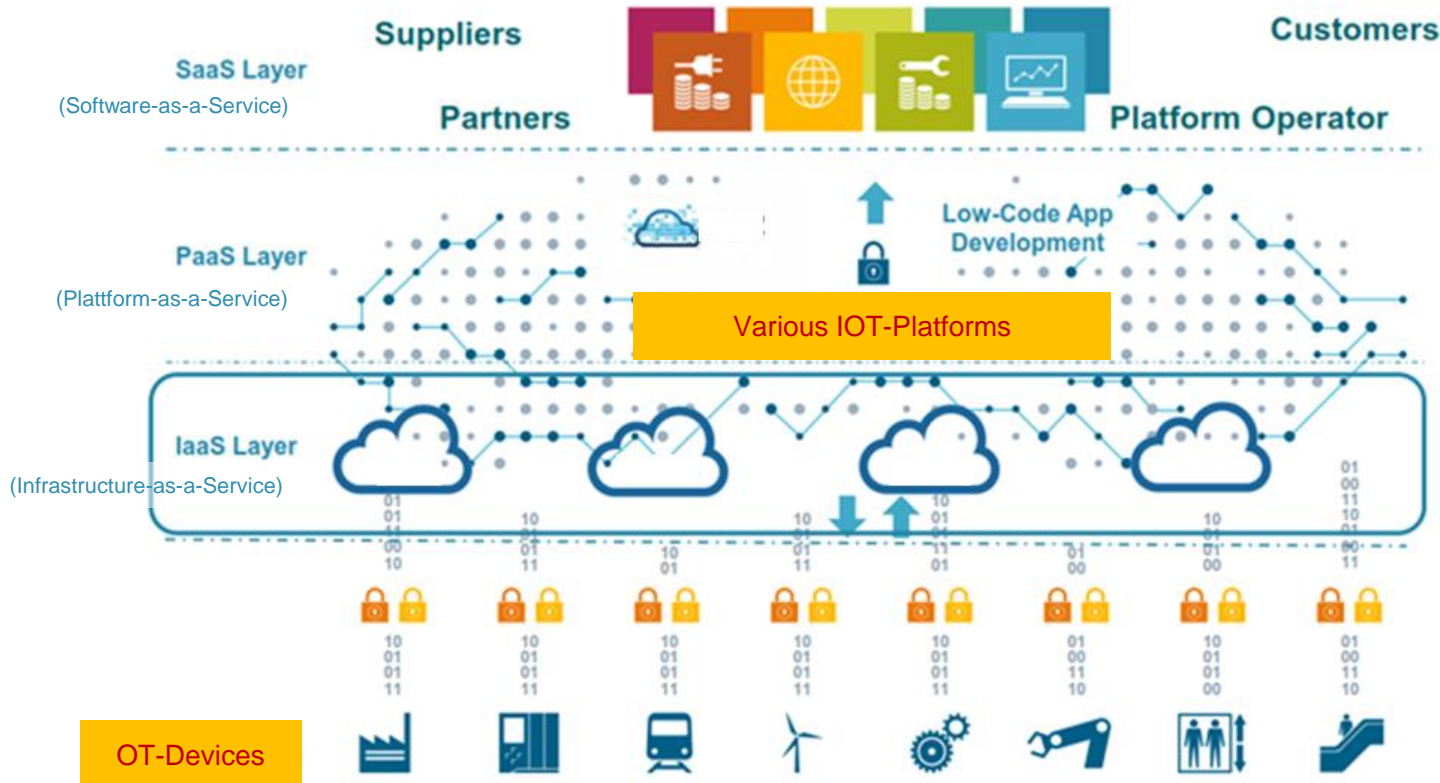
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Standardisation 4.0

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„Industrie 4.0“ and Digitalization @ Siemens

„Digital Economy“ based on „IoT-Platforms“ for B2C and B2B



„Digital Value Add“

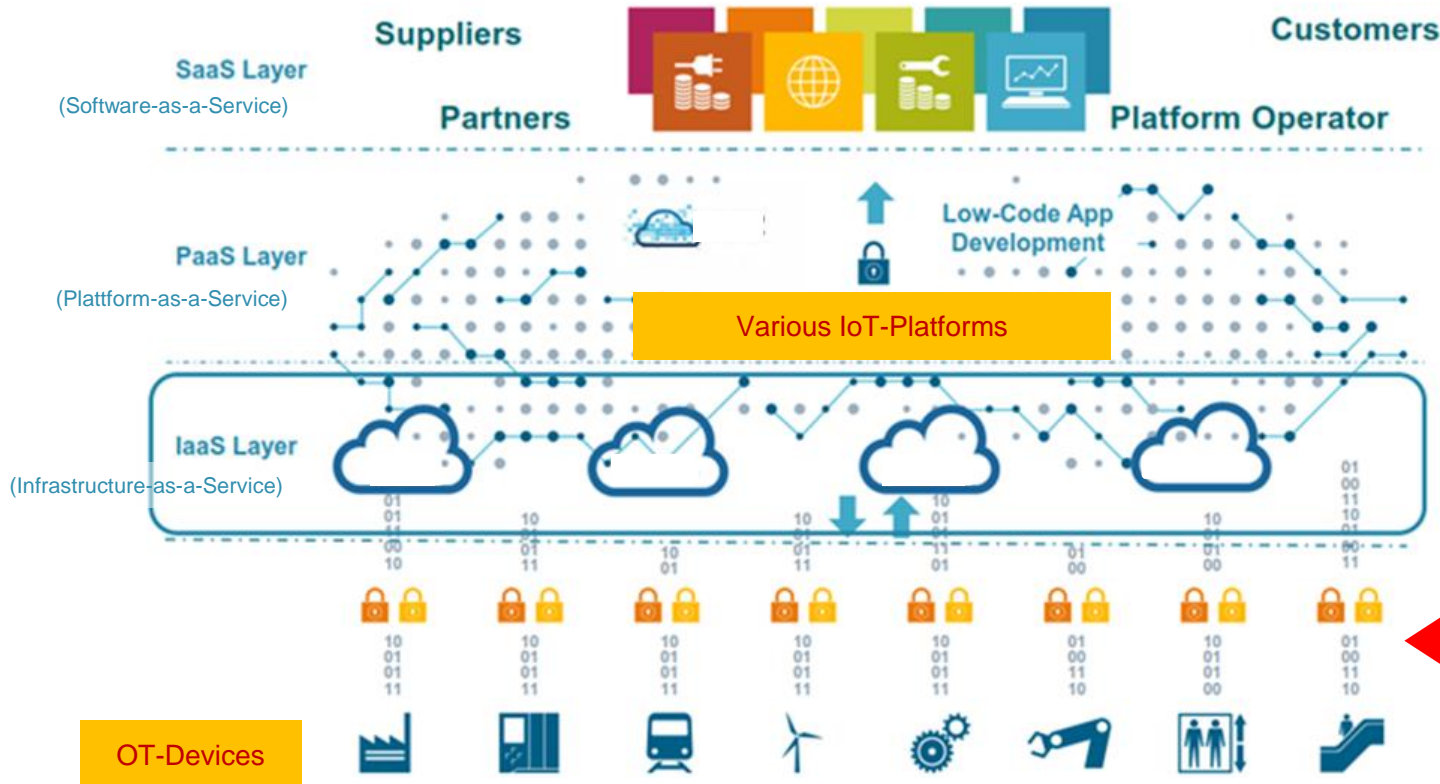
means

„Big Data“ out of OT-Devices

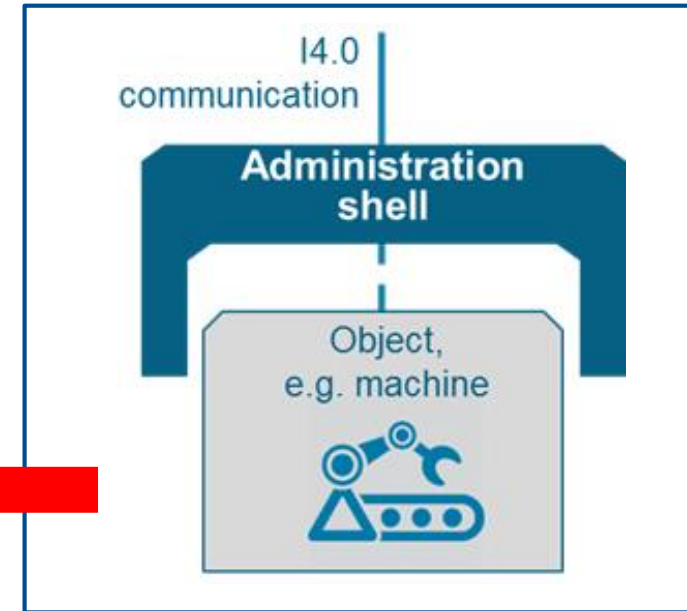
will be analysed with „Apps“ (Algorithms) at SaaS-Layer to „Smart Data“

and distributed via INTERNET as „Smart Services“ to the customers

Strategic Approach „Industrie 4.0“: Cross-company Interoperability for OT-Devices enabled by Concept of „I4.0-Component with AAS“



I4.0-Component with AAS (Asset Administration Shell)



Source:
Grafik-Vorlage Siemens AG

ZVEI-Industrie 4.0 Management Team is the key stakeholder for Industrie 4.0 in Germany

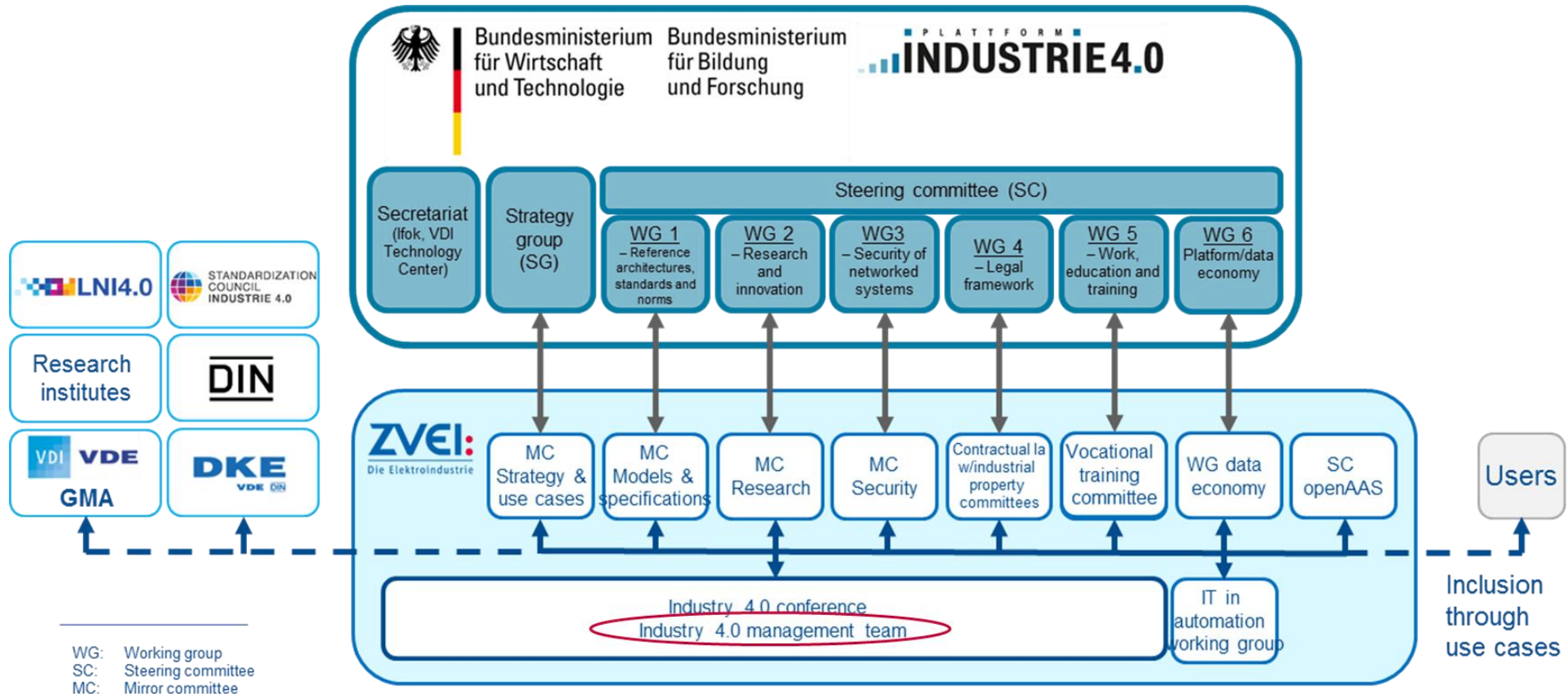


145
Mitglieder
aus
90
Unternehmen
& Institute

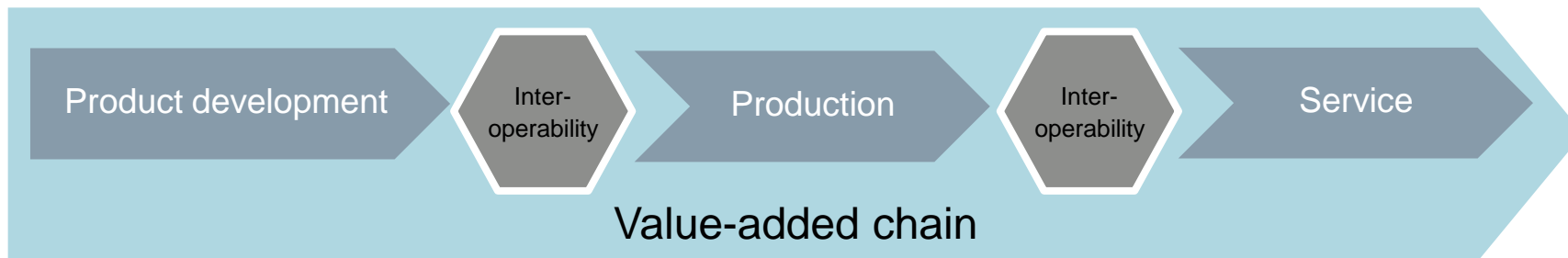
Dieter Wegener | Führungskreis Industrie 4.0

ZVEI-management-team "Industrie 4.0"

Exchange with the political "Industrie 4.0 platform"



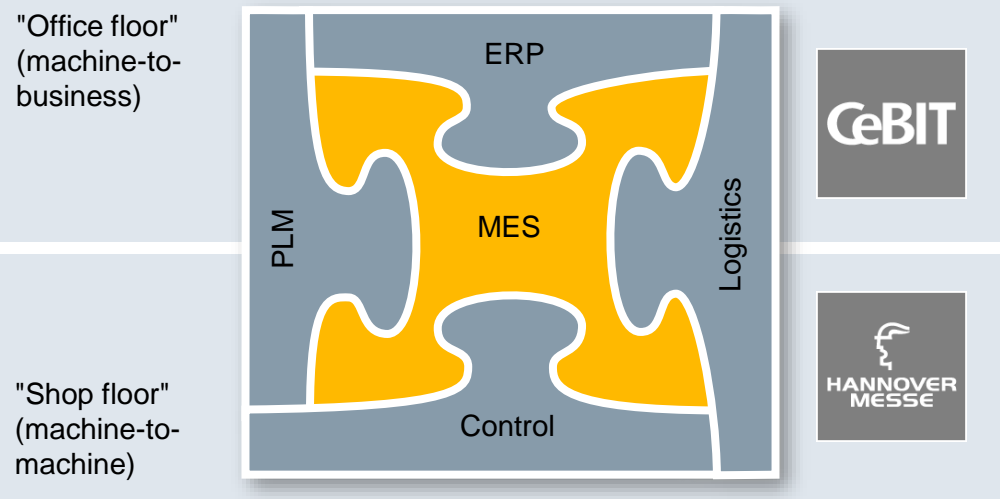
ZVEI-management-team defines areas of activity for “Industrie 4.0”, viewed from the technical perspective



bitkom

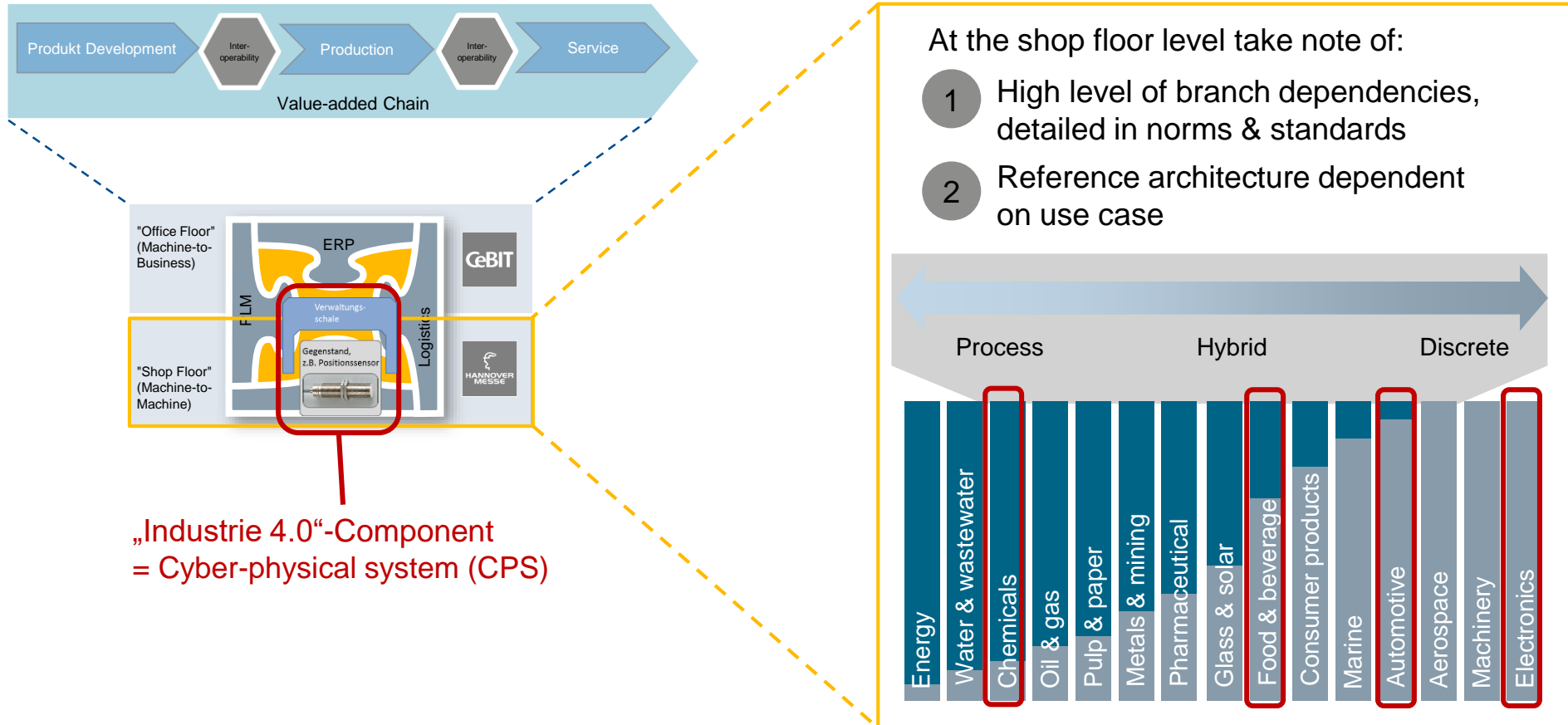
VDMA

ZVEI:
Die Elektroindustrie



Source: Siemens AG

ZVEI-management-team defines „Industrie 4.0“-Component for different branches



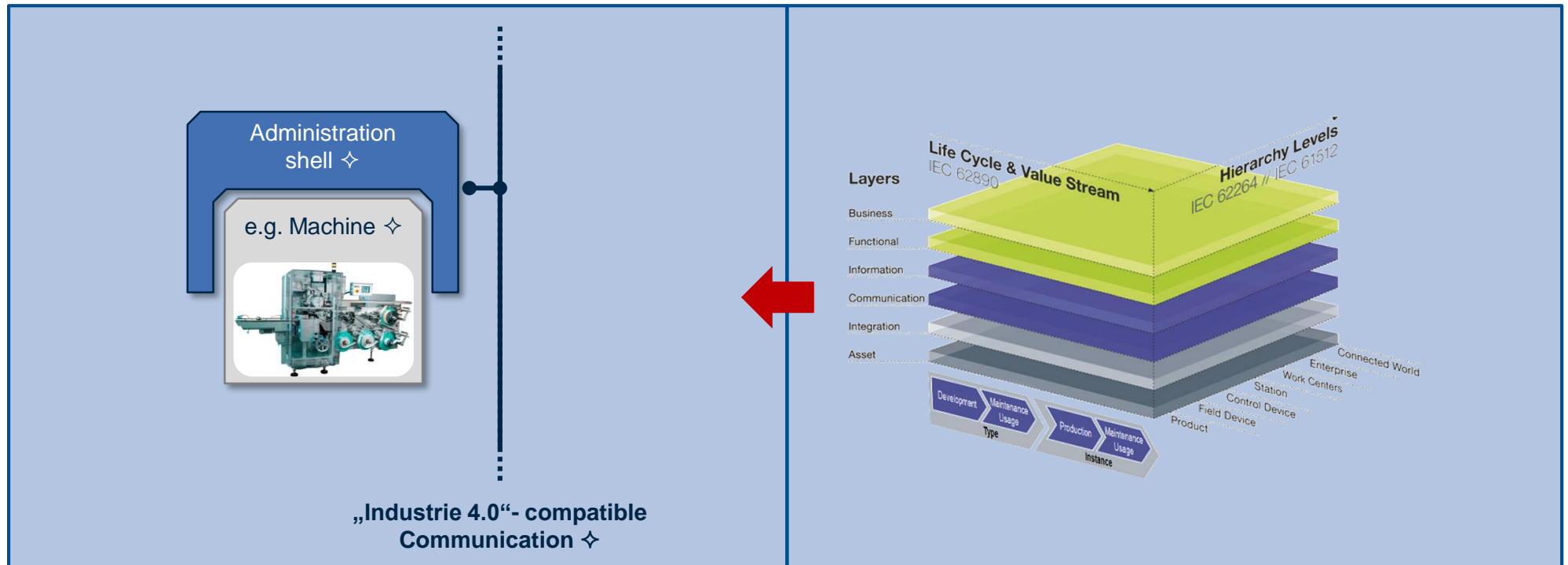
Different Use Cases

Source: Siemens AG

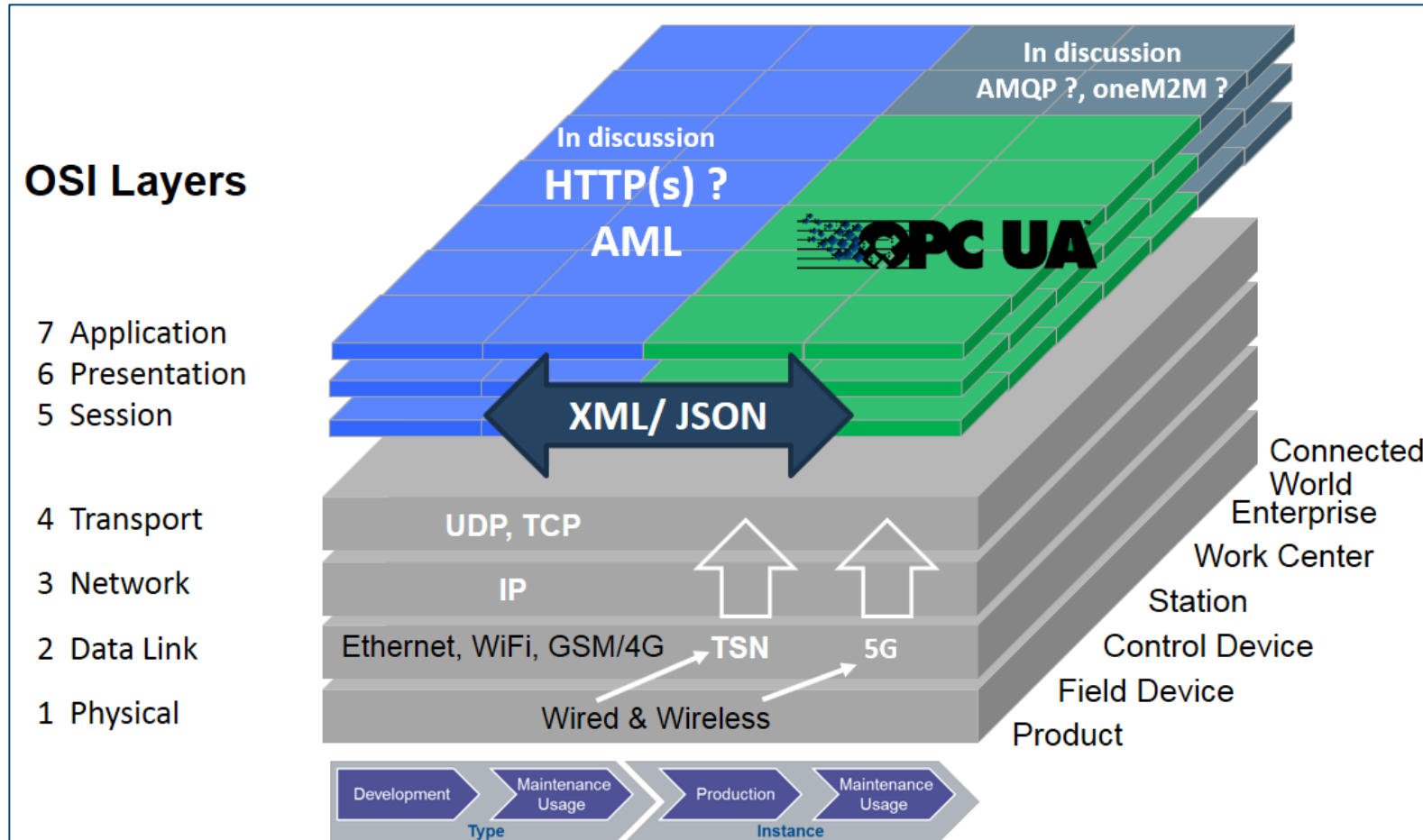
Every „Industrie 4.0“-Component will be developed based on the Reference-Architecture-Model “RAMI 4.0“

„Industrie 4.0“-Component

RAMI 4.0 Reference-Architecture-Model „Industrie 4.0“



Status Quo of the Reference-Architecture-Model “RAMI 4.0“



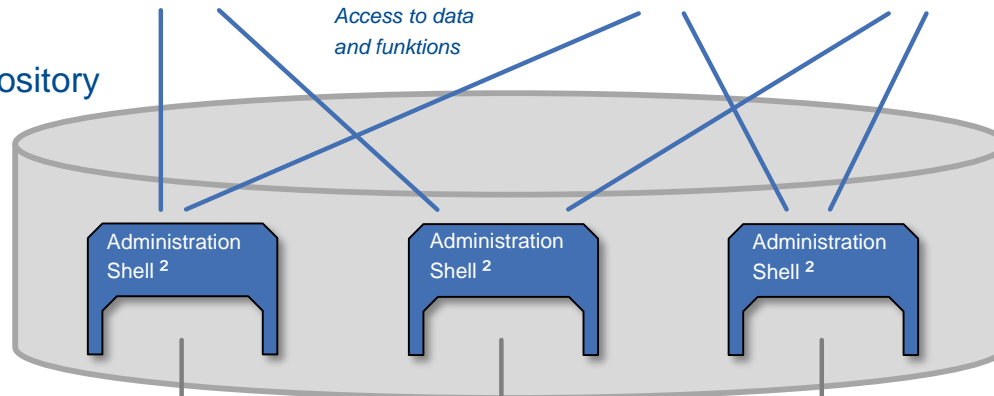
Distribution along the life cycle: Administration Shells (data + functions) can be hosted centralized

Life cycle of the factory



Tool support during life cycle

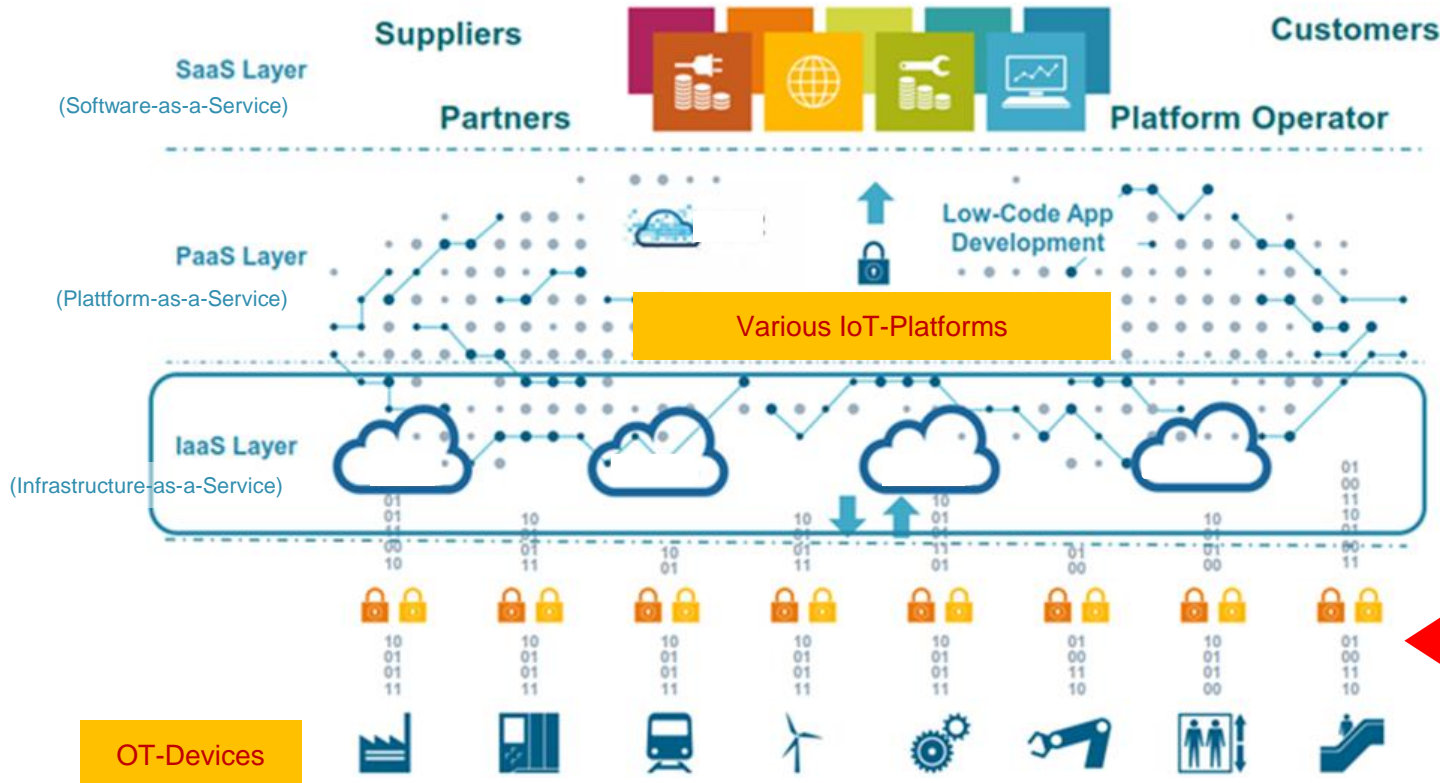
Repository



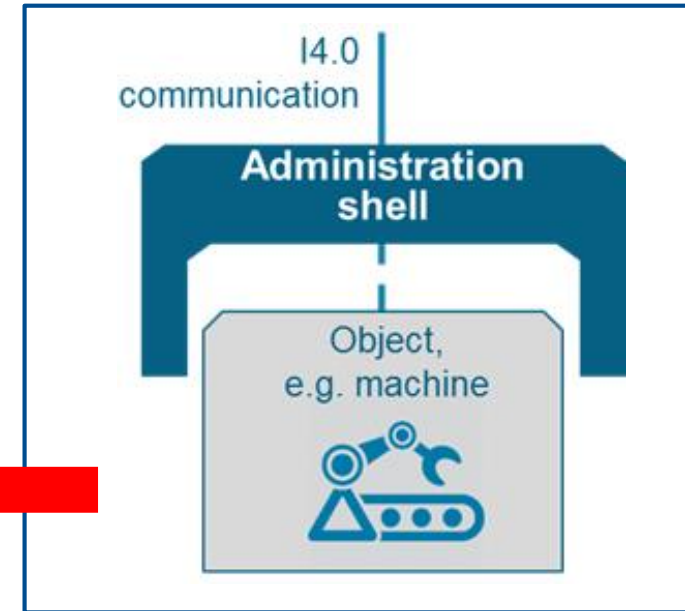
IT-server landscape

Components from various sources

Strategic Approach „Industrie 4.0“: Cross-company Interoperability for OT-Devices enabled by Concept of „I4.0-Component with AAS“



I4.0-Component with AAS (Asset Administration Shell)



Source:
Grafik-Vorlage Siemens AG

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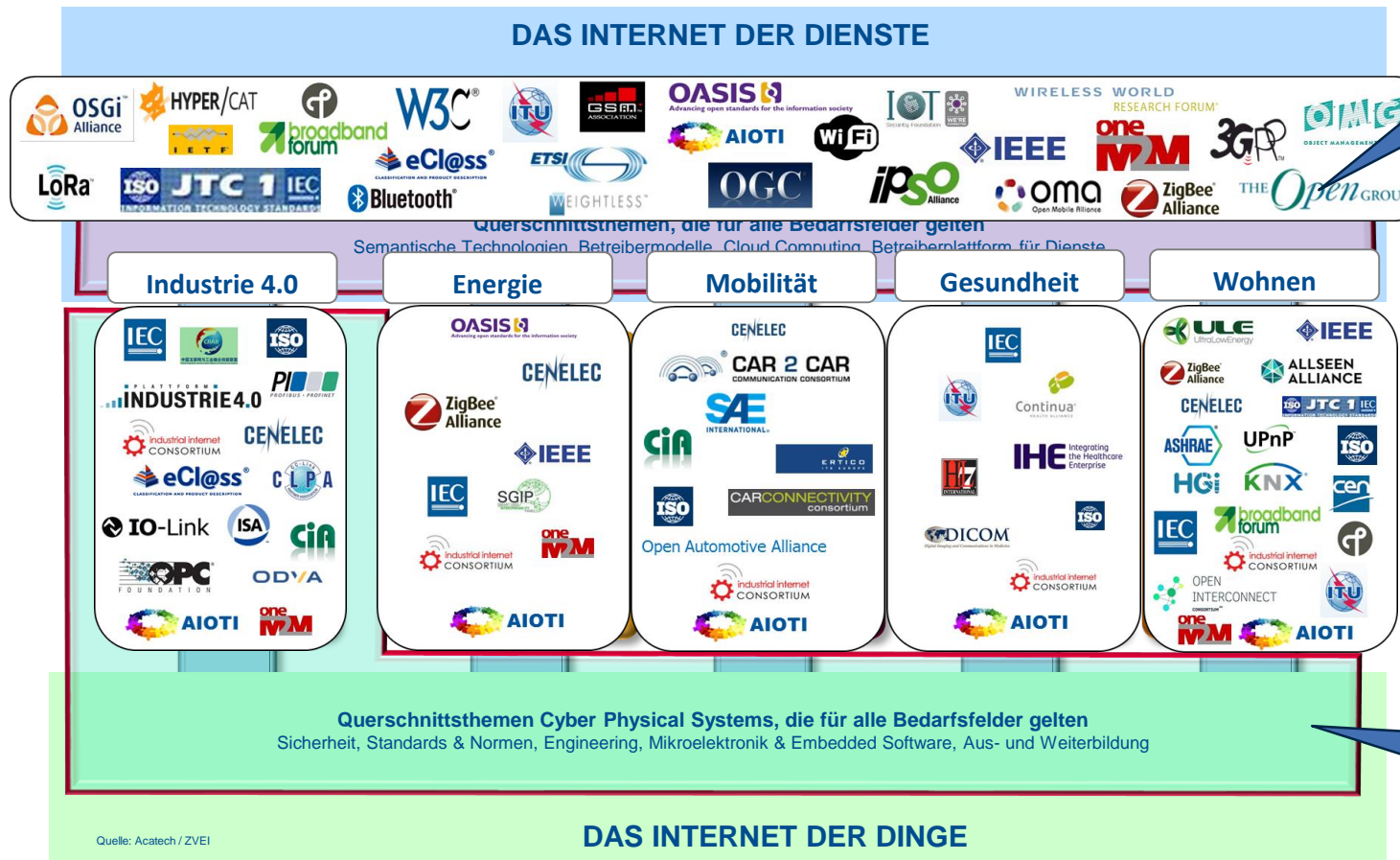
„Industrie 4.0“ and Digitalization @ Siemens

In the „Analogous Economy“ the fully consensed-based Standardisation is well established



Quelle: DIN und eigene Grafik

In the „Digital Economy“ the „Konsortial Standardisation“ is most relevant -> the „Standardisation Zoo“



IoS: Internet of Services

IoT: Internet of Things

Quelle: Acatech / ZVEI

Plattform I4.0 is extended by „SCI4.0“ and „LNI4.0“

■ P L A T T F O R M ■
INDUSTRIE4.0

Digital Transformation



STANDARDIZATION
COUNCIL
INDUSTRIE 4.0

LNI4.0 LABS
NETWORK
INDUSTRIE 4.0

Overcoming boundaries – Shaping the Future.

A digital collaboration platform



**STANDARDIZATION
COUNCIL
INDUSTRIE 4.0**

A joint project of:

bitkom

ZVEI:
Die Elektroindustrie

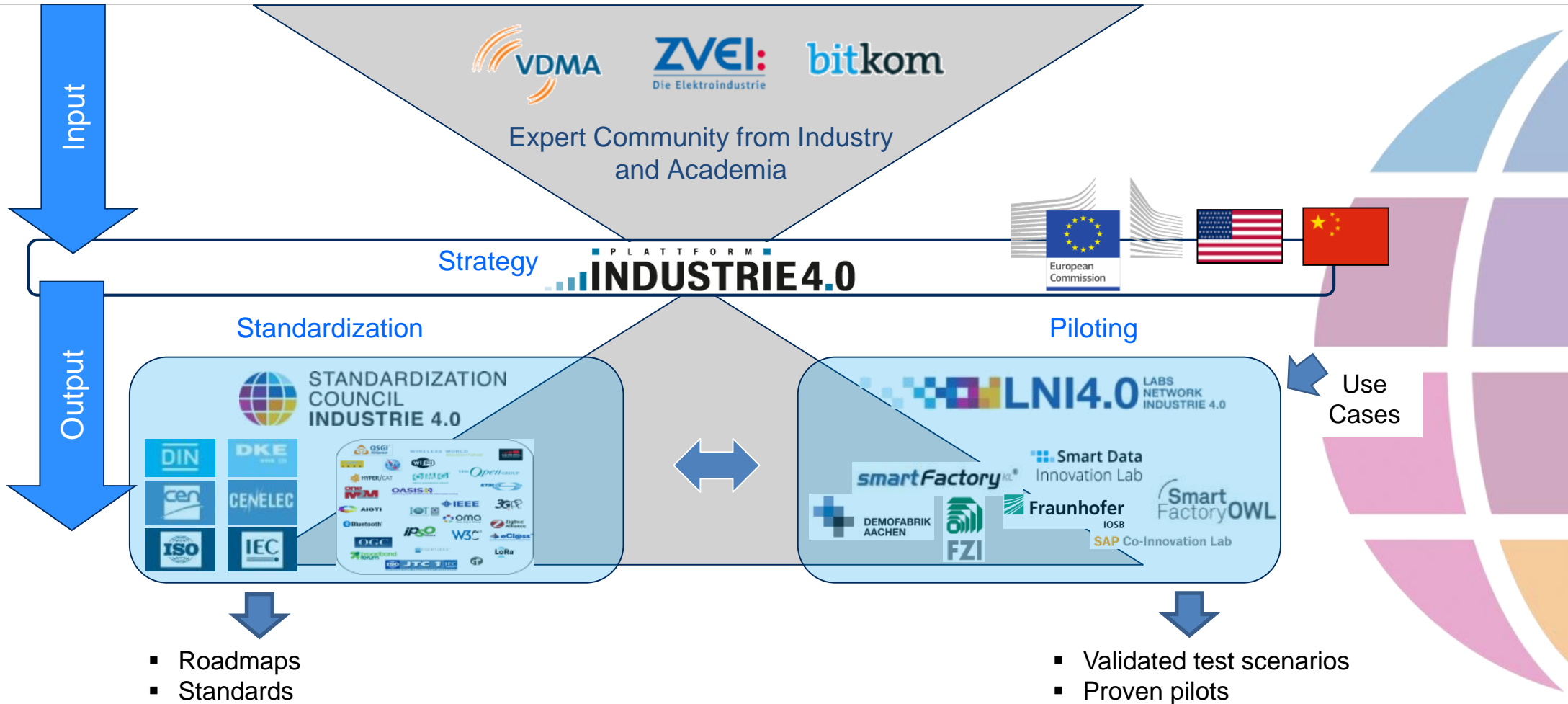
VDMA

DKE
VDE DIN

DIN

INDUSTRIE4.0

Worldwide Marketing and Implementation of „Industrie 4.0“



Overview

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„Industrie 4.0“ and Digitalization @ Siemens

Vision 2020+

New company organization has been going live on April 1, 2019



Operating Companies

Gas and Power



Smart Infrastructure



Digital Industries



Strategic Companies

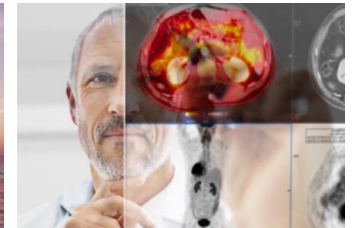
Mobility



SIEMENS Gamesa
RENEWABLE ENERGY



SIEMENS
Healthineers



Service Companies

Financial Services







Global Business Services

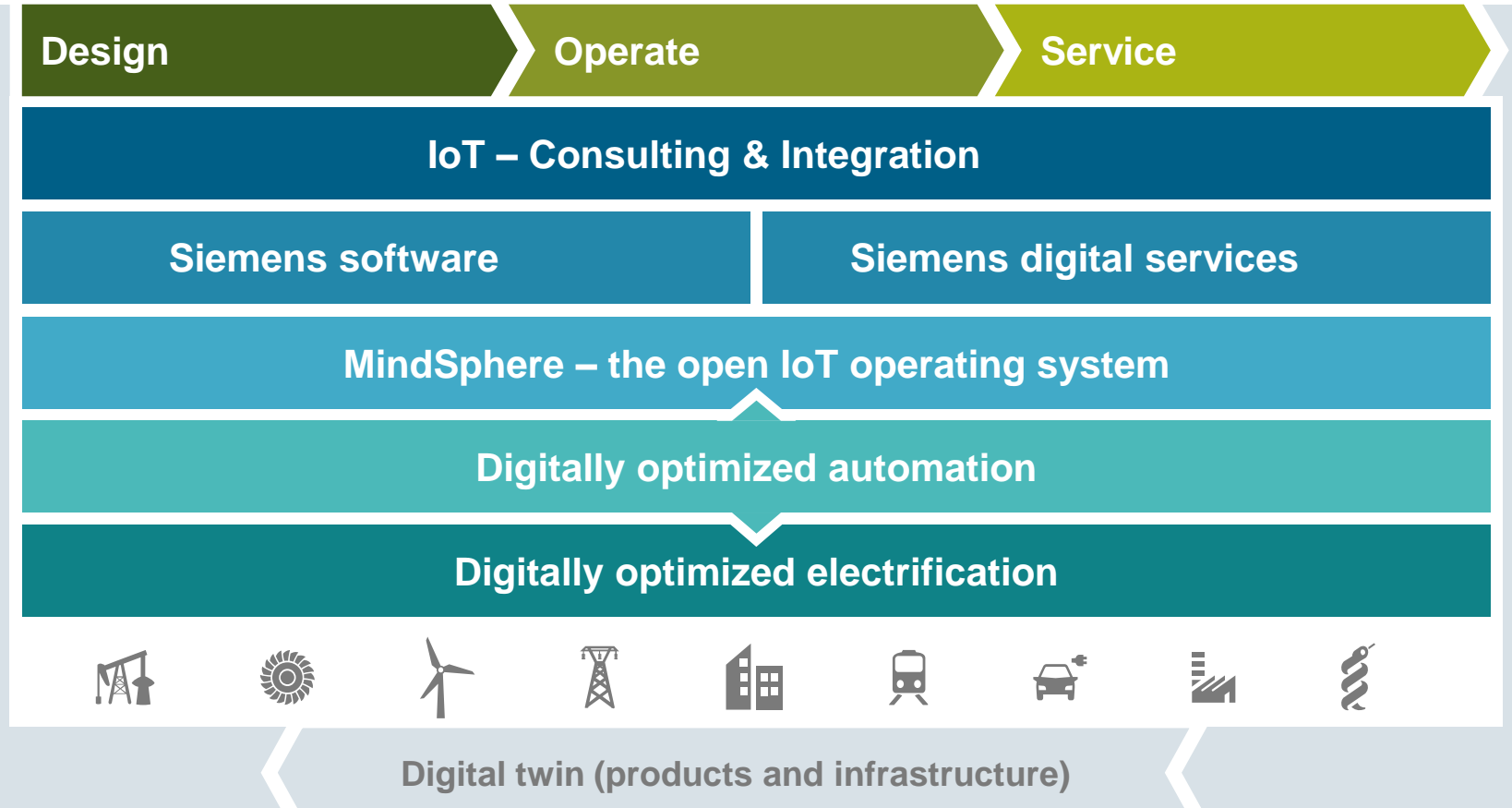
Real Estate Services

Corporate Development

(Corporate Technology, IoT Integration Services, Next47, Portfolio Companies)

Our digital portfolio

-  Data analysis
-  Artificial intelligence
-  Simulation tools
-  Cloud and platforms
-  Secure networking
-  Cyber security



Growing volumes of data in the digital transformation are opening up new productivity potential and greater flexibility



Data volume (in zettabytes¹)



Industrie 1.0

Steam engine

Industrie 2.0

Conveyor belt

Industrie 3.0

Automation
Secure processes

Industrie 4.0

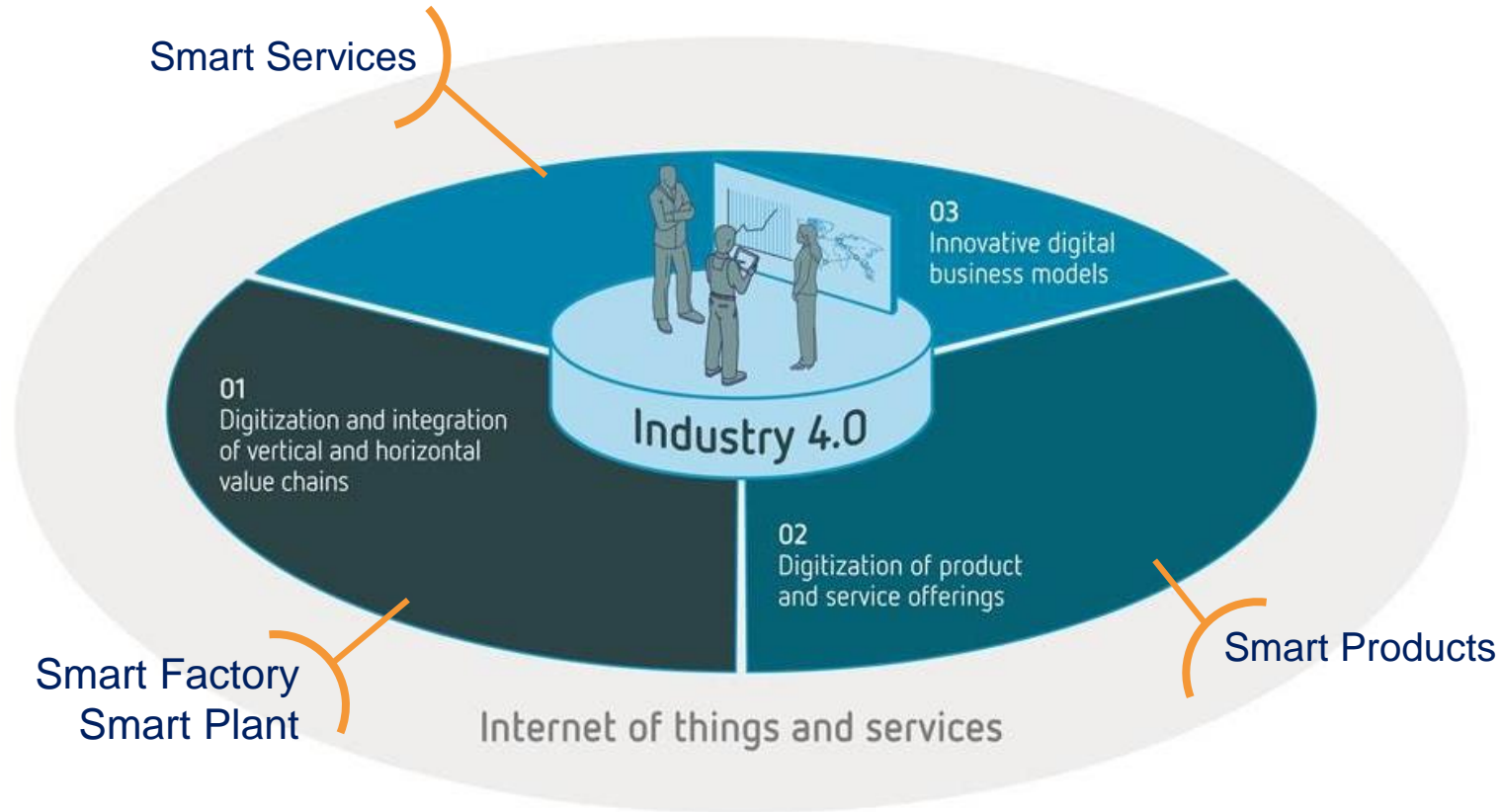
Digital Enterprise
End-to-end solutions

Thinking industry further!

¹ 1 zettabyte = 10²¹ bytes

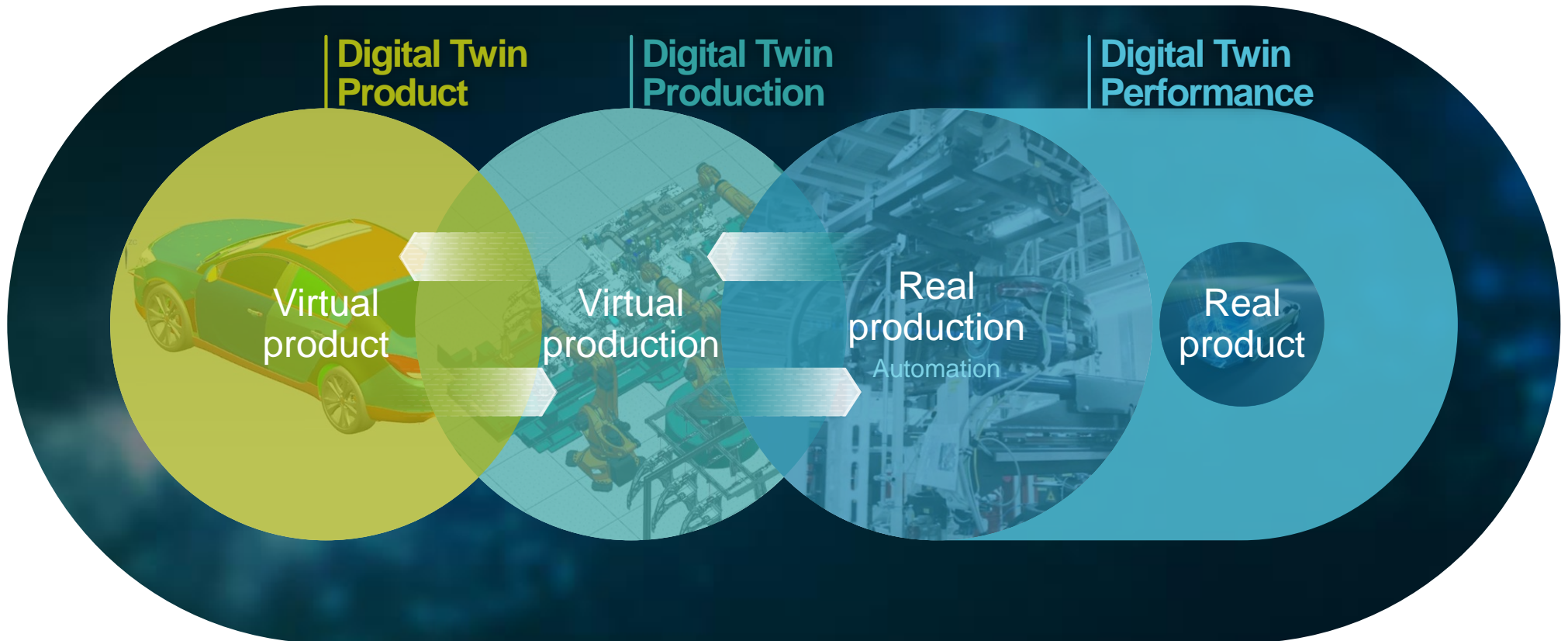
² Picture Source: Licensed under the Creative Commons Attribution-Share Alike 3.0 Unported, 2.5 Generic, 2.0 Generic and 1.0 Generic license.

„Industrie 4.0“ impacts on every company in 3 dimensions

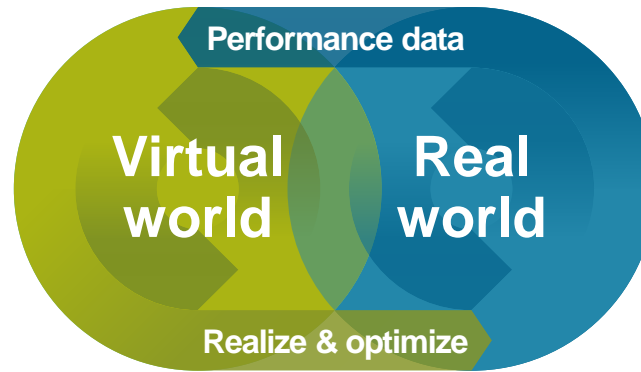


Quelle: ZVEI nach PwC

The Digital Twin of the performance enables continuous analysis of both product and production



Digital Enterprise software platforms – comprehensive, constantly expanding software portfolio



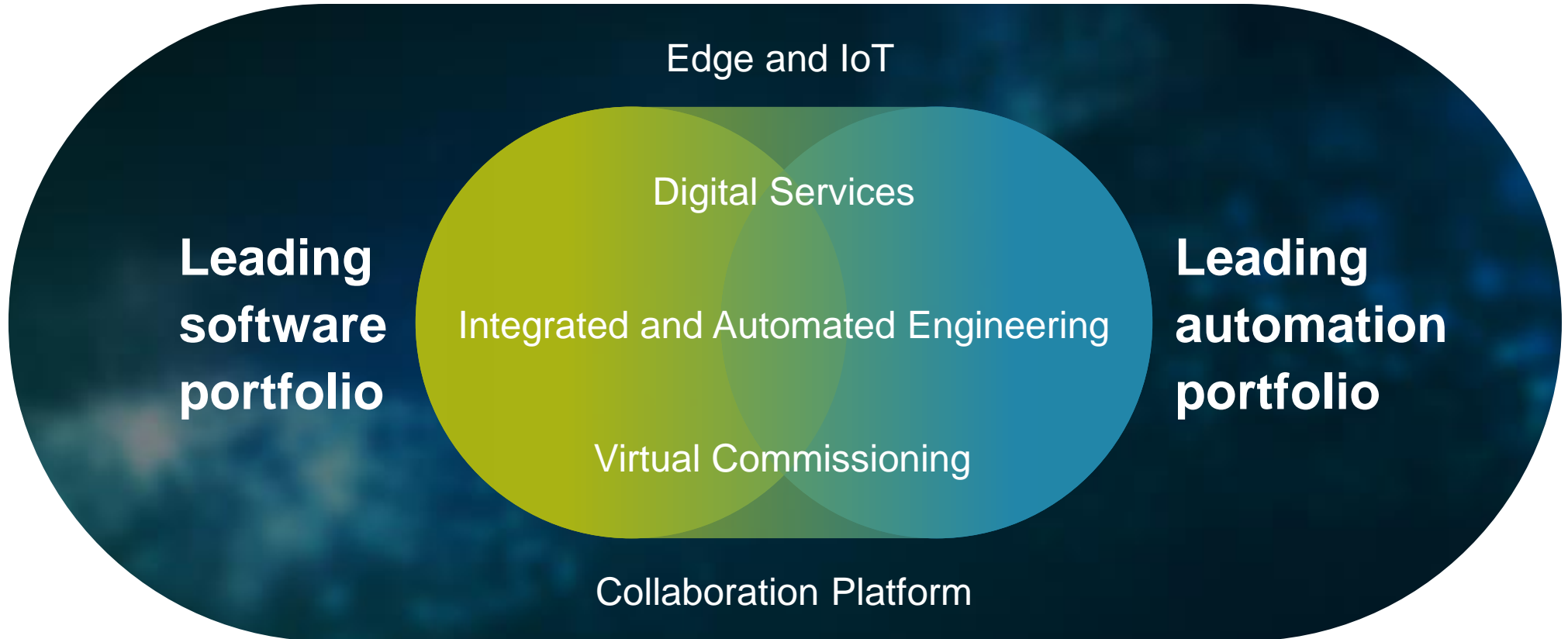
MindSphere

NX CAD	Teamcenter Manufacturing	NX Line Designer/MCD/ Automation Designer	Simatic IT	MindSphere Apps
Polarion			Camstar	Digital Lifecycle Service
Simcenter	NX CAM / Additive	Simit	WinCC/SCADA	Asset Performance Suite
Mentor Xpedition	Tecnomatix	TIA Portal	CNC Shop floor Mgt SW	
Mentor Capital	Mentor Valor	Simatic PCS7	Edge Apps	

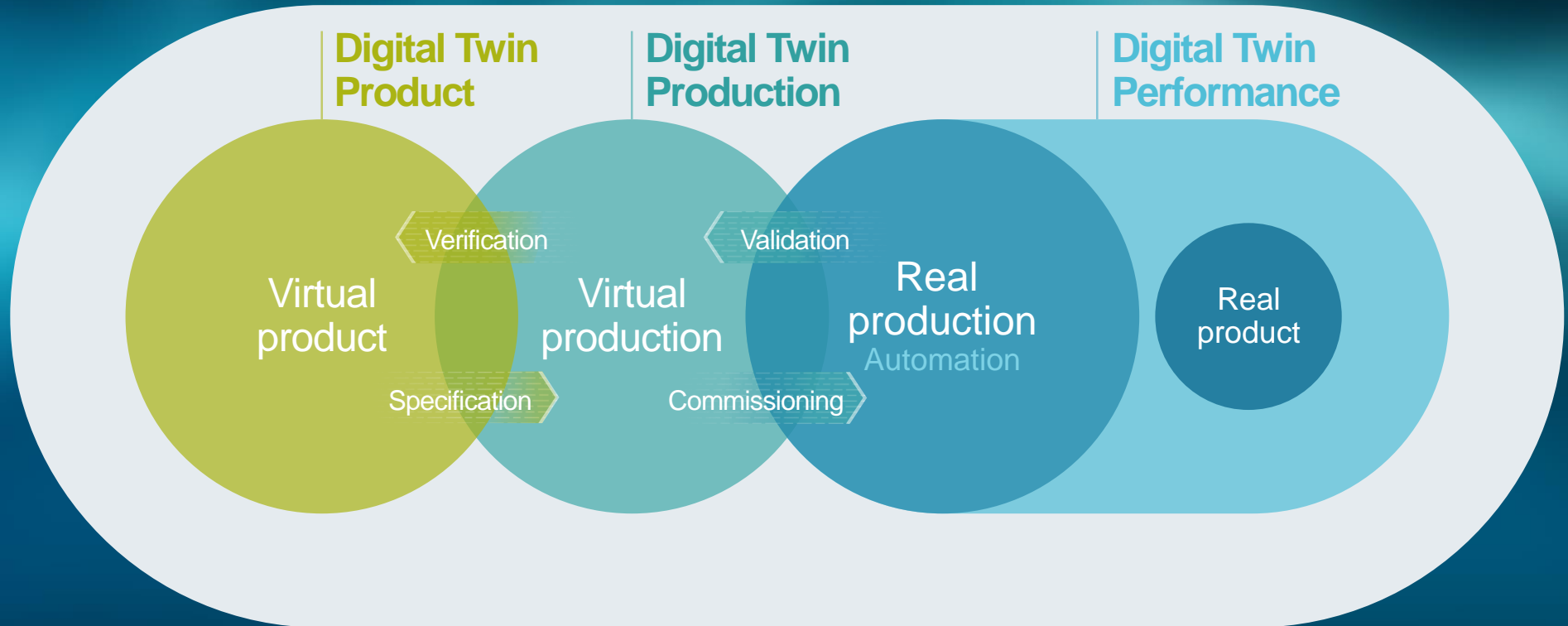
Teamcenter, Comos, PlantSight

Innovations through integration of software and automation,
based on deep domain know-how

SIEMENS
Ingenuity for life

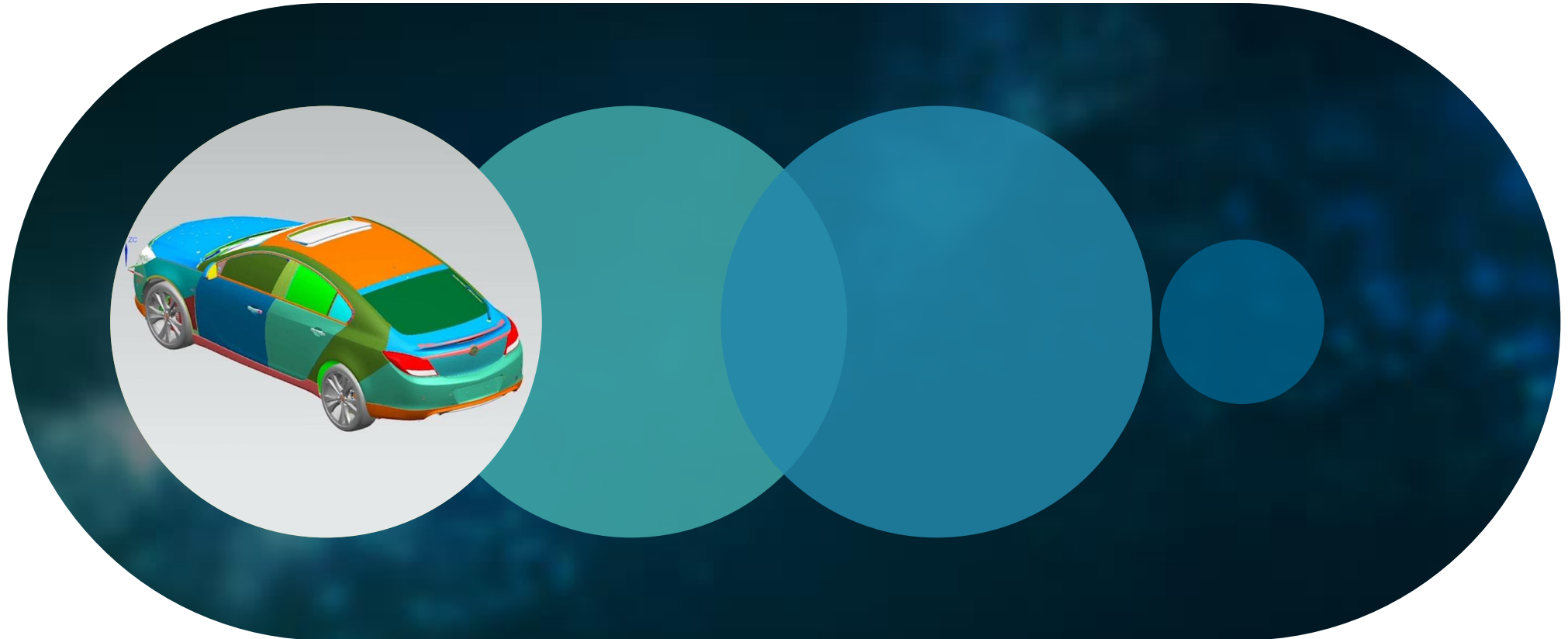


The most holistic Digital Twin

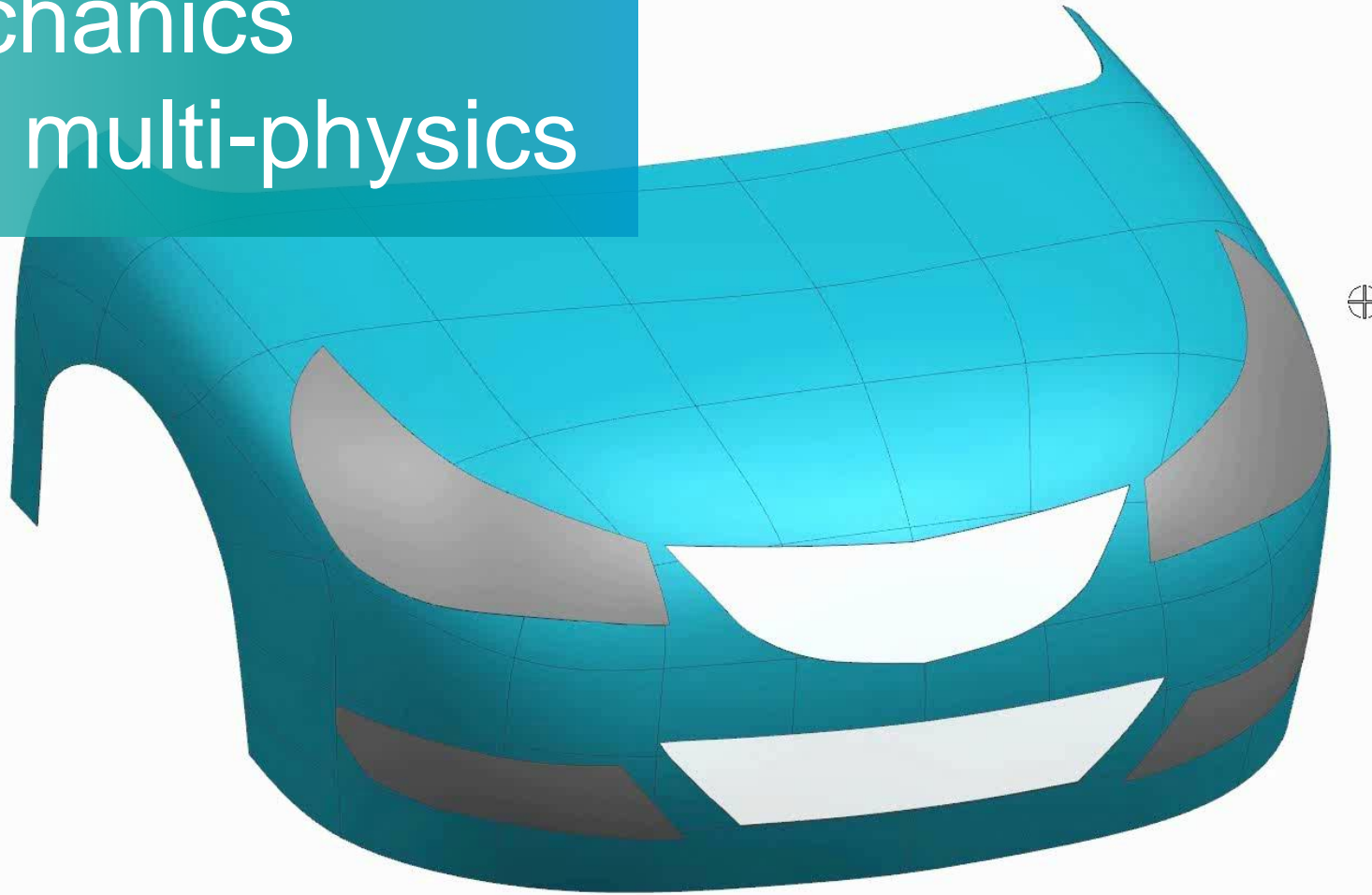


The Digital Twin of the product reduces time to market

SIEMENS
Ingenuity for life



Mechanics and multi-physics



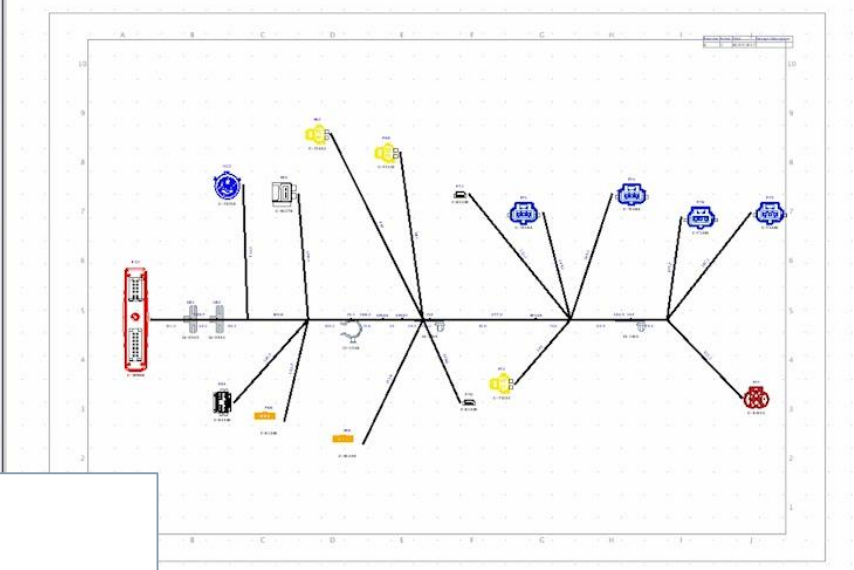
Electrical systems

Automotive Interactive

- Automotive Interactive
 - Build Lists
 - Harness Study - DOOR-LFT
 - Harness Study - DOOR-RFT
 - 1) System Designs
 - 2) Wiring Designs
 - 3) Harness Designs
 - AUDIO-SYSTEM
 - CABIN
 - DOOR-FL
 - DOOR-FL:123:A
 - Diagram1
 - Nailboard
 - DOOR-LFT
 - DOOR-RFT
 - DOOR-LF_BRG
 - ROOF
 - SEAT

Harness Design Symbols Parts

- DOOR-FL
 - Bundles
 - Nodes
 - Connectors
 - ILC1
 - ILC2
 - P64
 - P65
 - P66
 - P67
 - P68
 - P69
 - P70
 - P71
 - P72
 - P73
 - P74
 - P75
 - P76
 - P77
 - Clips
 - CL1
 - CL2
 - CL3
 - Assemblies
 - Grommets
 - Splices
 - Devices
 - SP404
 - SP407
 - SP449
 - Wires
 - 2N-SP
 - 2N-SP
 - 4N-FU
 - 4N-IN
 - 4N-IN
 - 4N-PO
 - 4N-TR
 - 5N-CT
 - 5N-CT
 - 5N-CT
 - 5N-GN
 - 5N-GN
 - 5N-GN
 - 5N-GN
 - 5N-GND-CTSY-IP-2606
 - 5N-GND-CTSY-IP-2675
 - 5N-GND-CTSY-IP-2676
 - 5N-POWER-1-2278
 - 6N-DRV-DOOR-LOCK-2282



NX NX 11 - Routing Electrical [000_00_Insignia_Jt.prt (Modified)]

File Home Route List Assemblies Curve Analysis View Render Tools Application

Auto Route by Component Manual Route by Component Unroute

Create Edit Assign Stock Delete Unassign

List Connections Connection Status Stock Report

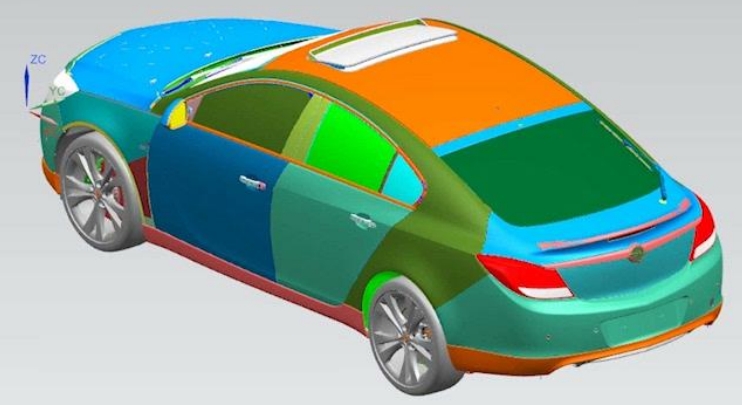
List Components Component Status Port Report

Connect Import/Export

Assembly Navigator

Descriptive Part Name

- Session Component Groups
- Component Groups in Part
 - 000_00_Insignia_Jt (Order: Chron...
 - OPD73693_001_VPPS_10_POWE...
 - OPD73697_001_VPPS_15_POWE...
 - OPD73709_001_VPPS_20_CHAS...
 - OPD73722_001_VPPS_30_HVAC...
 - OPD73728_001_VPPS_40_INTERL...
 - OPD73738_001_VPPS_50_BODY...
 - OPD73702_001_VPPS_55_BODY...
 - OPD73706_001_VPPS_60_EXTER...
 - OPD73718_001_VPPS_70_INFOR...
 - OPD73749_001_VPPS_80_ELECT...
 - 00_000_01_DOOR-FRONT-LEFT
 - 00_OPG13391_001_0005_IA_...
 - 00_OPG13384_001_0007_IA_S...
 - 00_OPG13366_001_0009_IA_...
 - 00_OPG13378_001_0008_IA_...
 - 00_OPG13386_001_0012_IA_...
 - 00_OPG13367_001_0013_IA_L...
 - 00_OPG13380_001_0006_IA_...
 - 00_OPI16245_001_0005_IA_M...
 - DOOR-FL_Harness



Kevin Smith (kevin) - Organization/Core Design & Release Engineer - Latest Working

Owner: Me Select Type

Embedded software

002052/A;1-DISPLAY UNIT DI007v1 Requirements

002052/A;1-DISPLAY UNIT DI007v1 Requirements >

Display Information ...
 REQ-000001
 Revision: A

Overview | Viewer | Architecture | Attachments | History | Relations

Properties

ID: 002052
 Revision: A
 Revision Name: DISPLAY UNIT DI007v1 Requirements
 Description:
 Occurrence Name:
 Type: Requirement Specification Revision
 Sequence:

Release Status:
 Date Released:
 Effectivity:

Owner: Kevin Smith (kevin)
 Group ID: Organization

Last Modifying User: Kevin Smith (kevin)
 Parent:
 Number Of Children: 1

Ratings

Your Rating: ☆☆☆☆☆
 Average Ratings: 0.0 ☆☆☆☆☆

Classification Properties

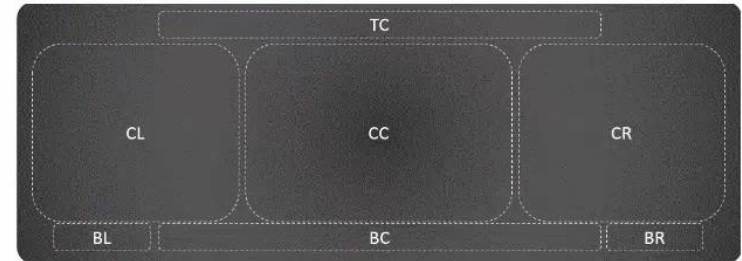
Preview

DISPLAY UNIT DI007v1 Requirements

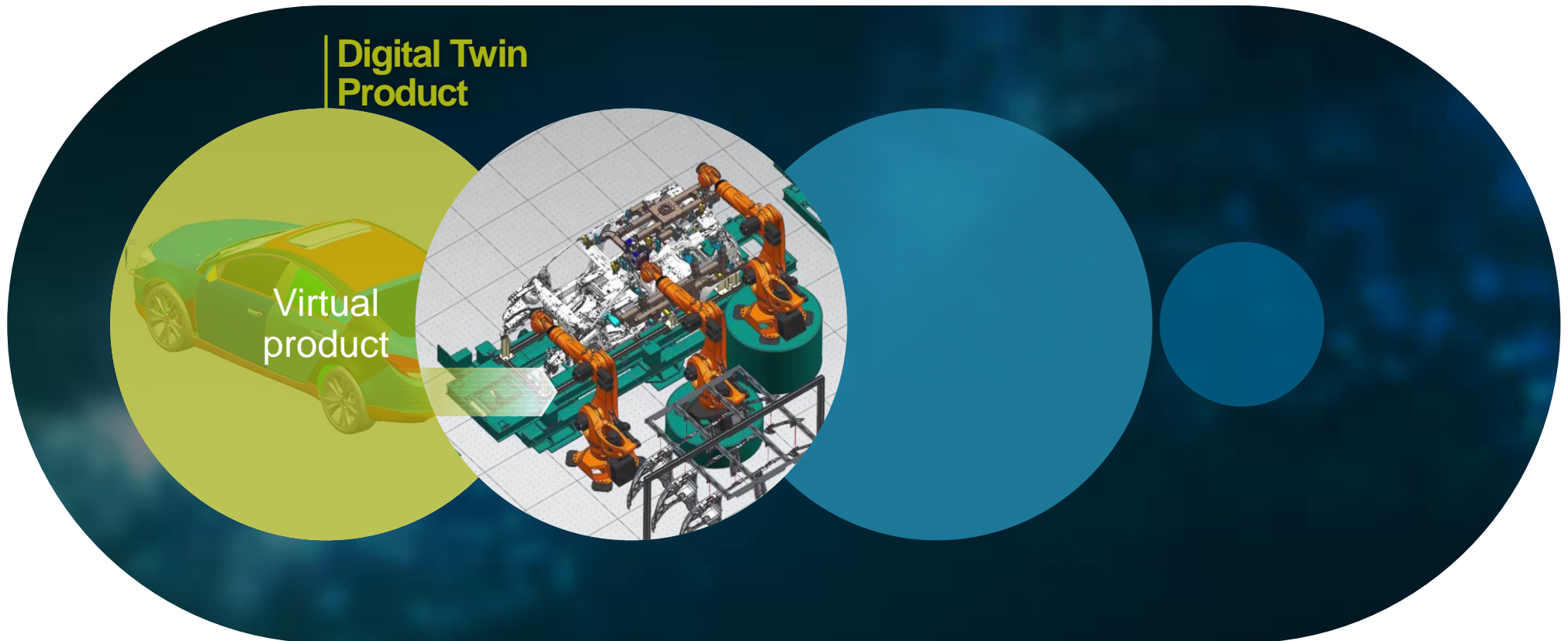
Display Information - DI007V1

Display unit shall show all the information needed for safe driving conditions to the customer. This shall include but not limited to the following information to the customer:

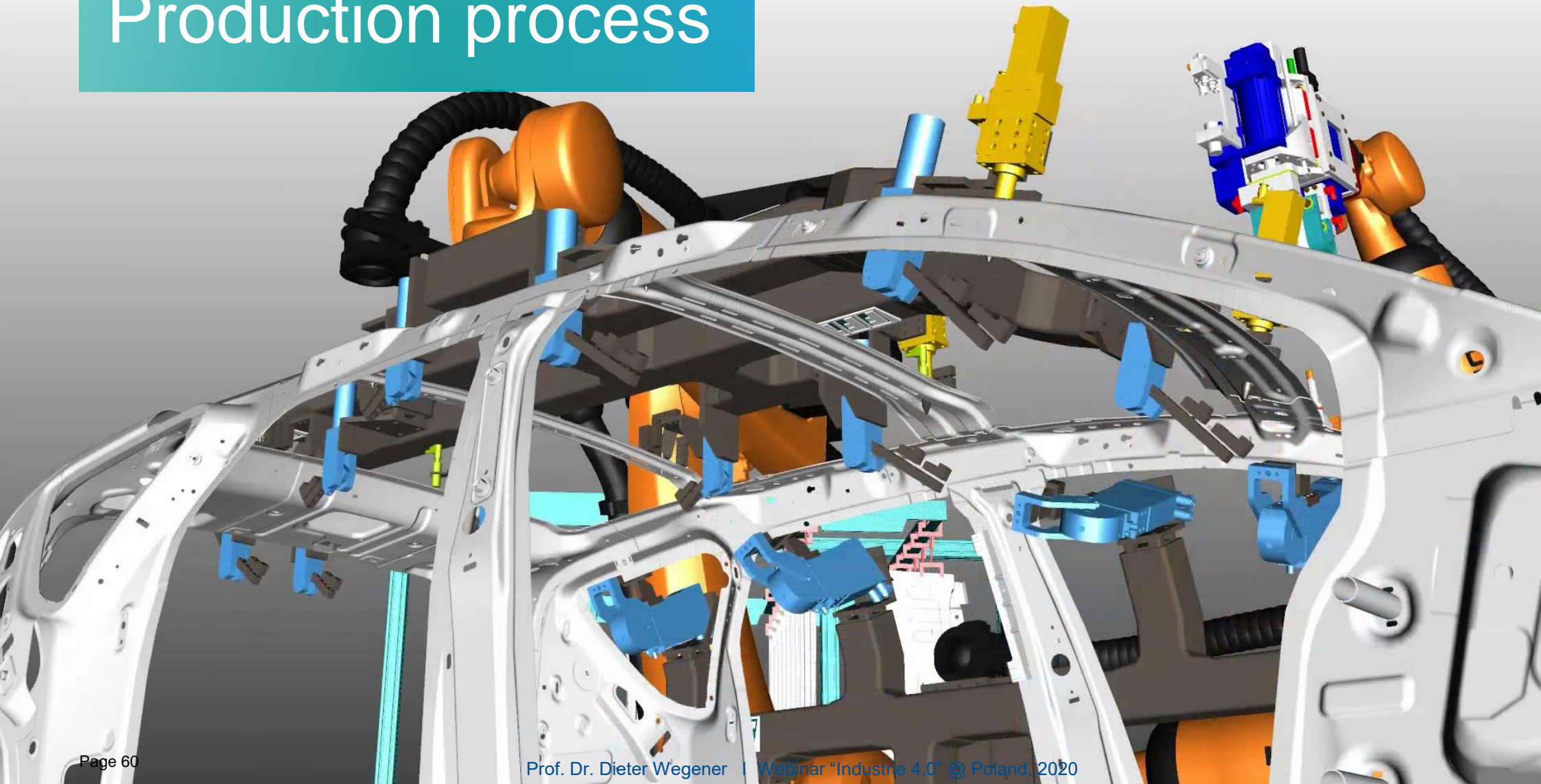
- > Trip Data - Miles lapse, Time lapse
- > Fuel gauge:
- > Speedometer: MPH or KPH
- > Tacometer:
- > Odometer:
- > Warnings: Engine, Oil, Seatbelt minder, Tire pressure, Lane Keeping
- > Infotainment current information



The Digital Twin of the production accelerates planning, setup, and optimization

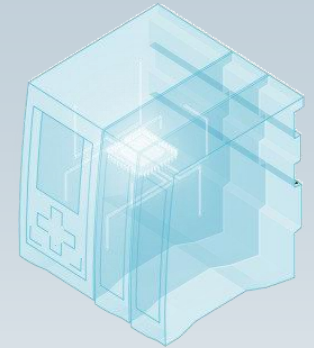
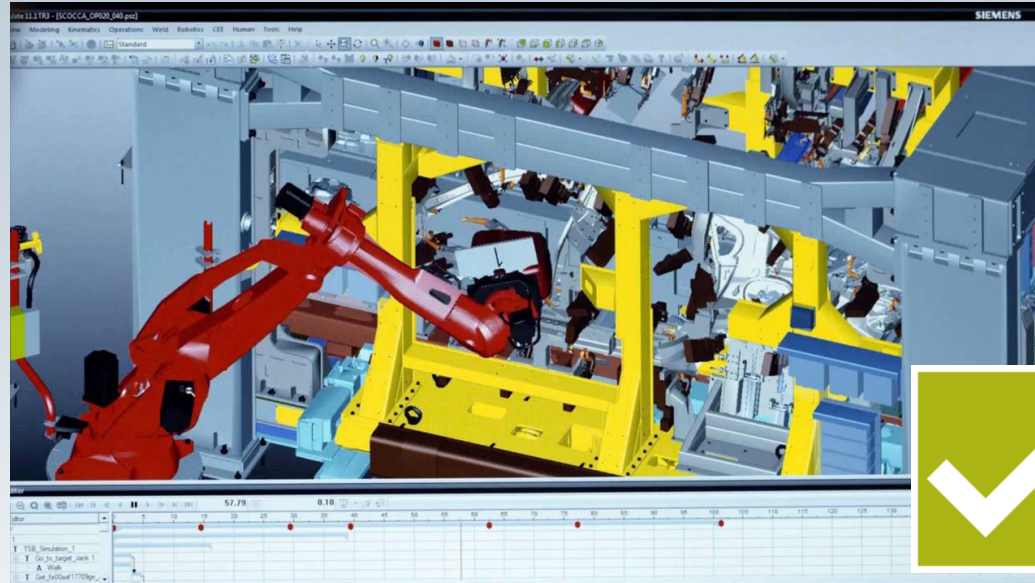


Production process



Entire factory

An aerial, high-angle view of a large industrial factory floor. The scene is filled with numerous orange robotic arms (likely KUKA) positioned at various workstations. Yellow overhead cranes are visible, spanning across the facility. The floor is a light grey, and there are various pieces of machinery, conveyor belts, and safety railings. The overall layout is organized and systematic, typical of a modern manufacturing plant.



Digital Twin
of SIMATIC
S7-1500

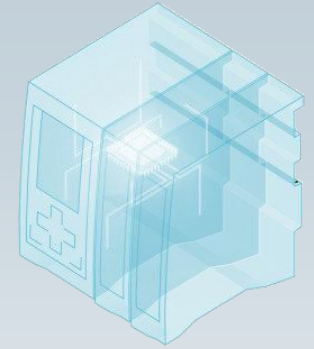
Virtual Commissioning

Unrestricted © Siemens AG 2020

Real Commissioning

Unrestricted © Siemens AG 2020

Page 64

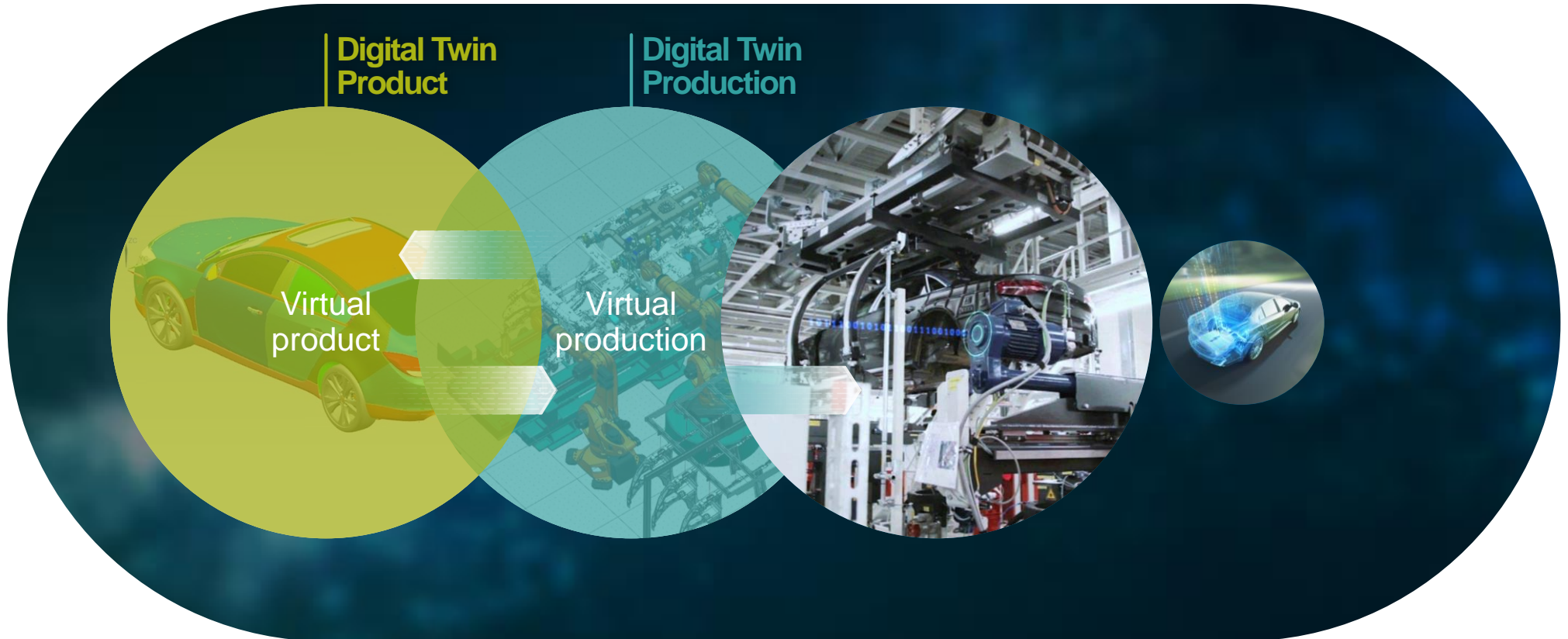


**SIMATIC
S7-1500**

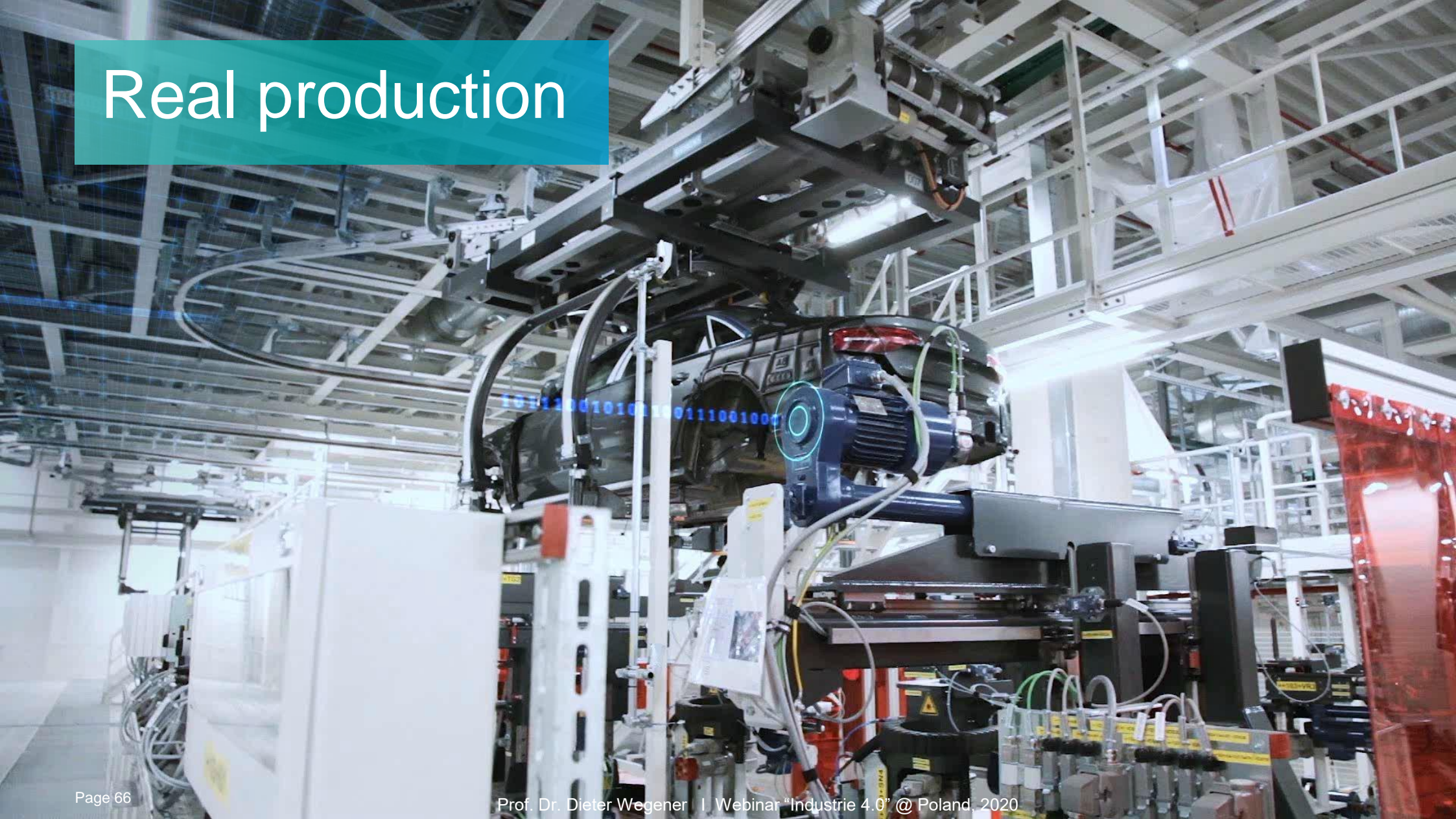


Holistic automation portfolio increases productivity on the shop floor

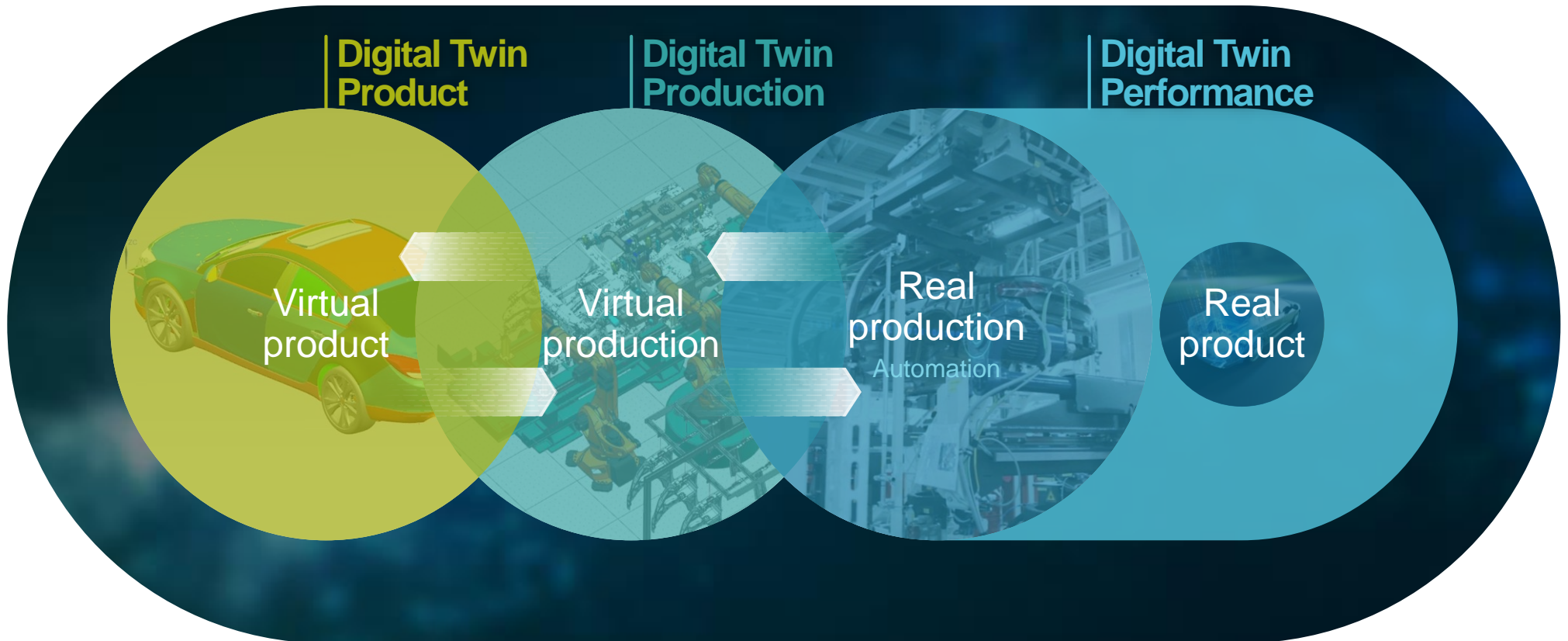
SIEMENS
Ingenuity for life



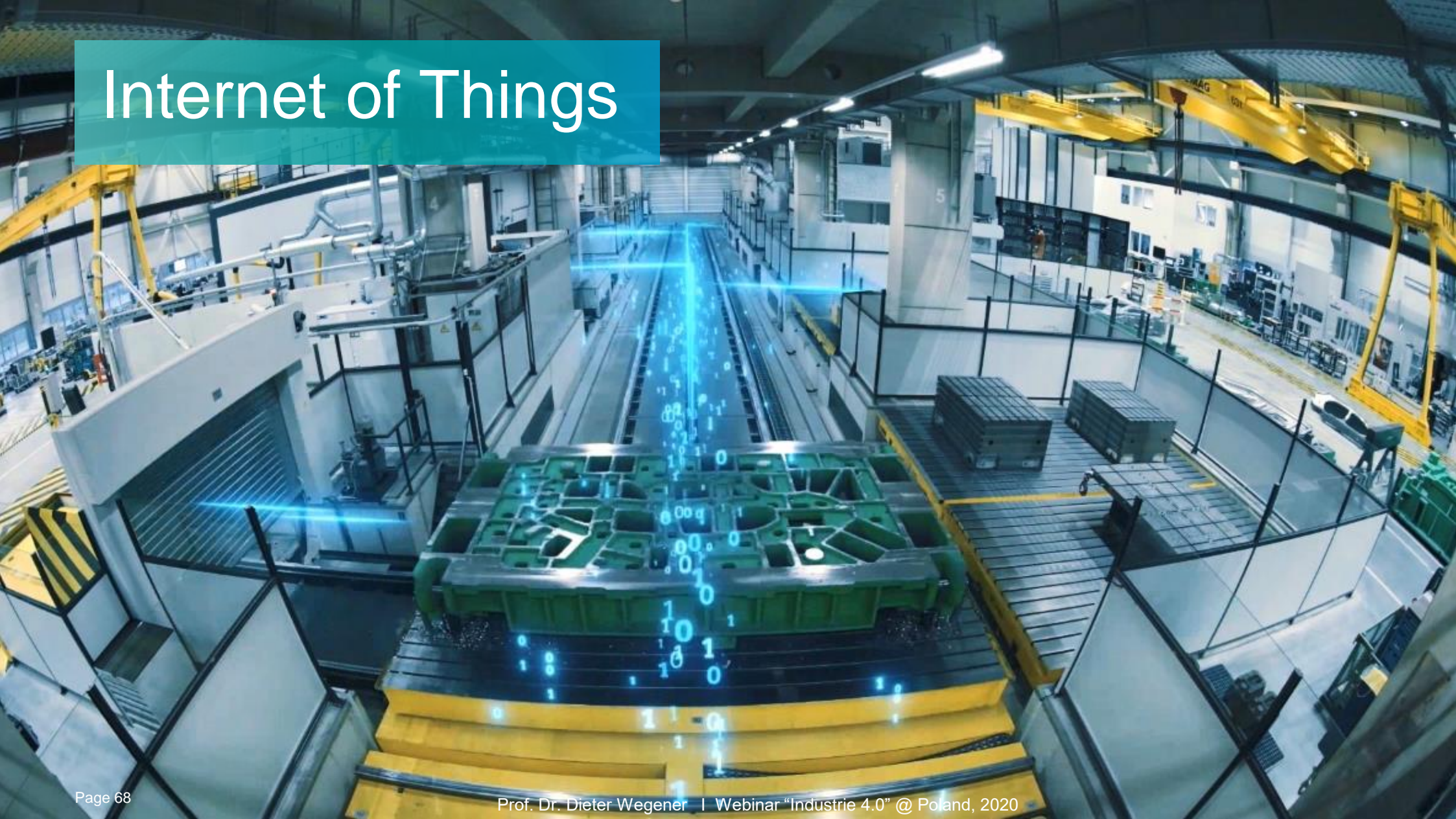
Real production



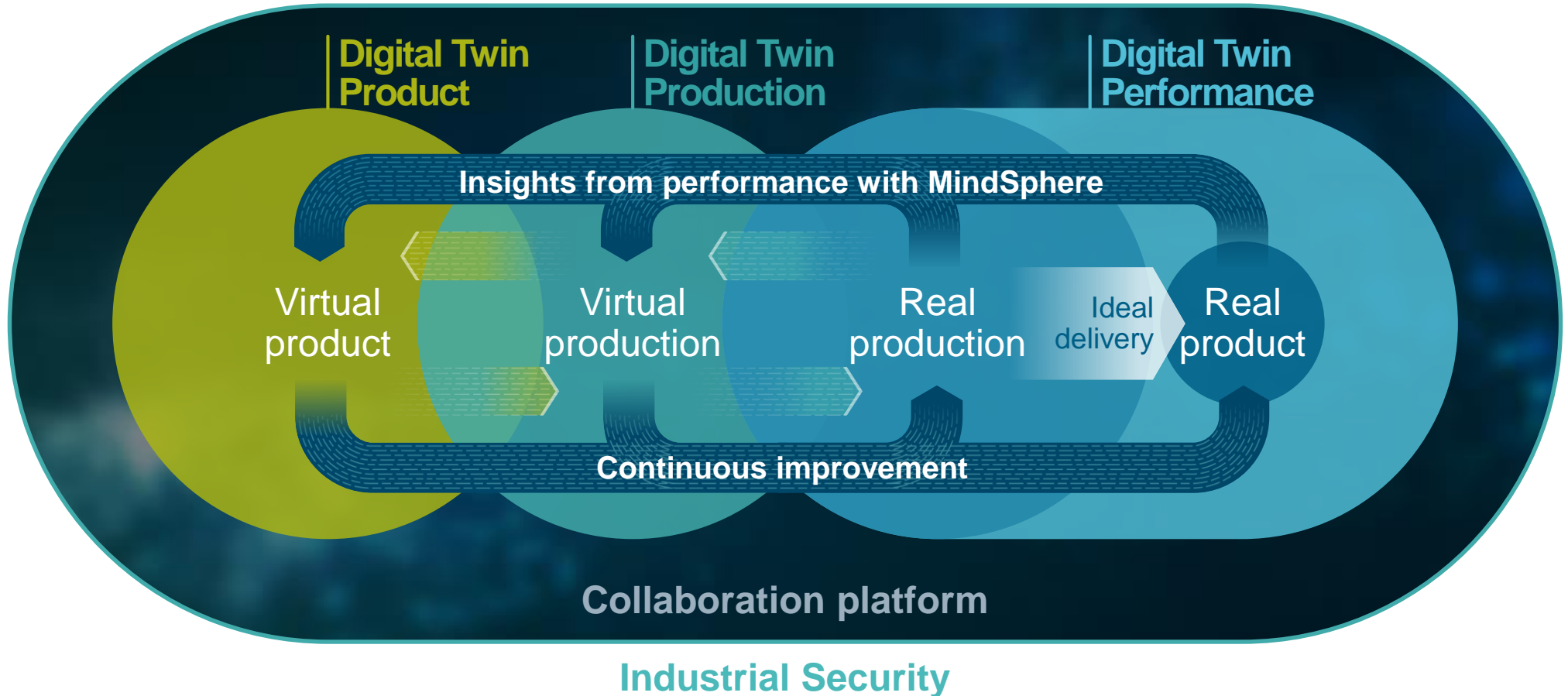
The Digital Twin of the performance enables continuous analysis of both product and production



Internet of Things



Feeding back insights enables continuous optimization of product and production



Our IoT operating system MindSphere – enhanced by Edge and Mendix low code app development



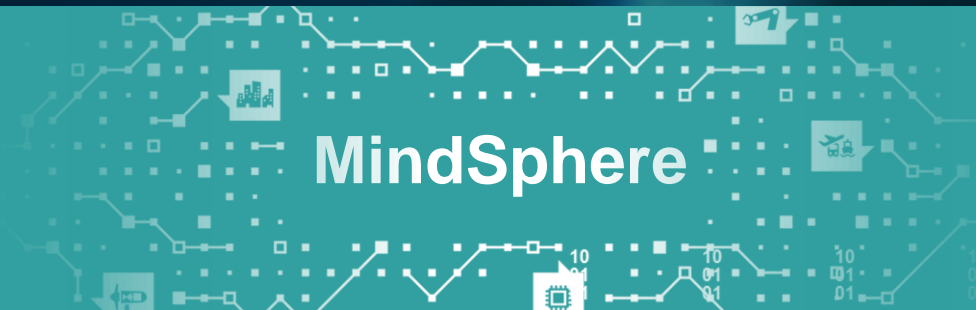
Applications

Powerful industry solutions with advanced analytics



Open PaaS

Develop robust industrial IoT solutions faster with global scalability

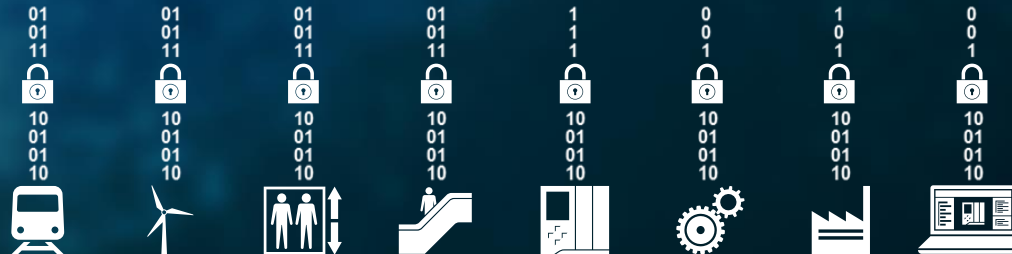


Edge Management

Edge Device Management, Edge App Management, and Edge App Store

Connectivity

Connect products, plants, systems, machines and enterprise applications



Edge Apps

Applications for intelligent data use

Edge Devices

Secure, future-proof basis for running edge applications

UseCase 1: “Industrial AI” @ Siemens EWA

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X-RAY ON

X-ray-based PCB quality assurance

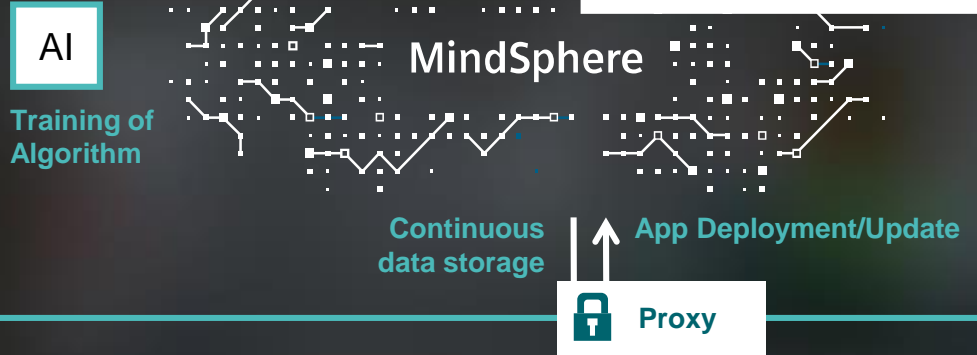
Siemens EWA
(Electronics Factory Amberg, Germany)

Challenge

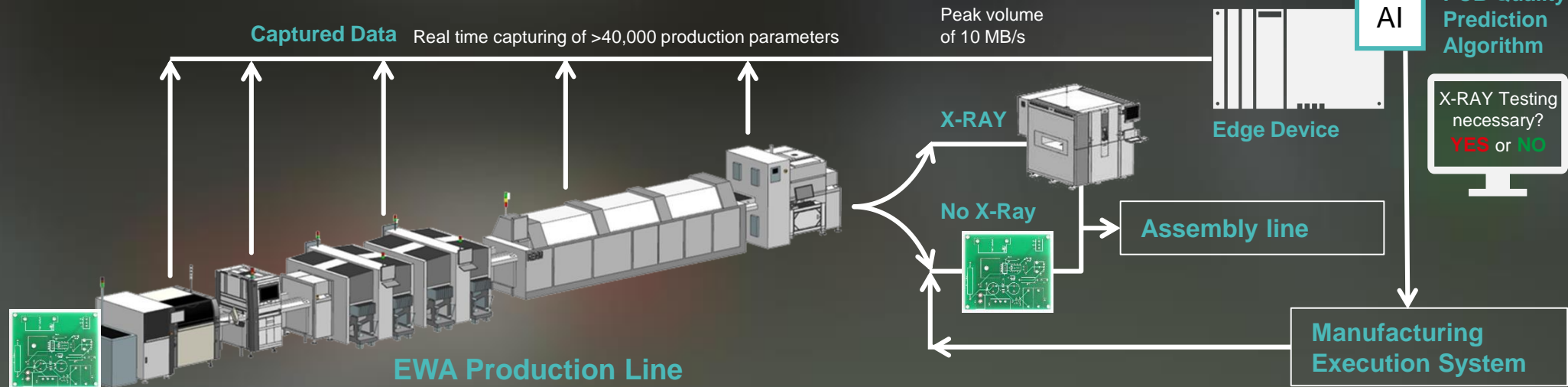
Production output of SMT line limited by time consuming X-ray Quality tests

Every further X-ray machine requires additional invest of €500,000

Non Production Critical Level



Production Critical Level



Minimization of
necessary X-ray tests
by up to

30%

Quality rate of

100%

Reduced capital
invest for further
X-ray machines of

€500,000

UseCase 2: “Industrial AI” @ Heller GmbH

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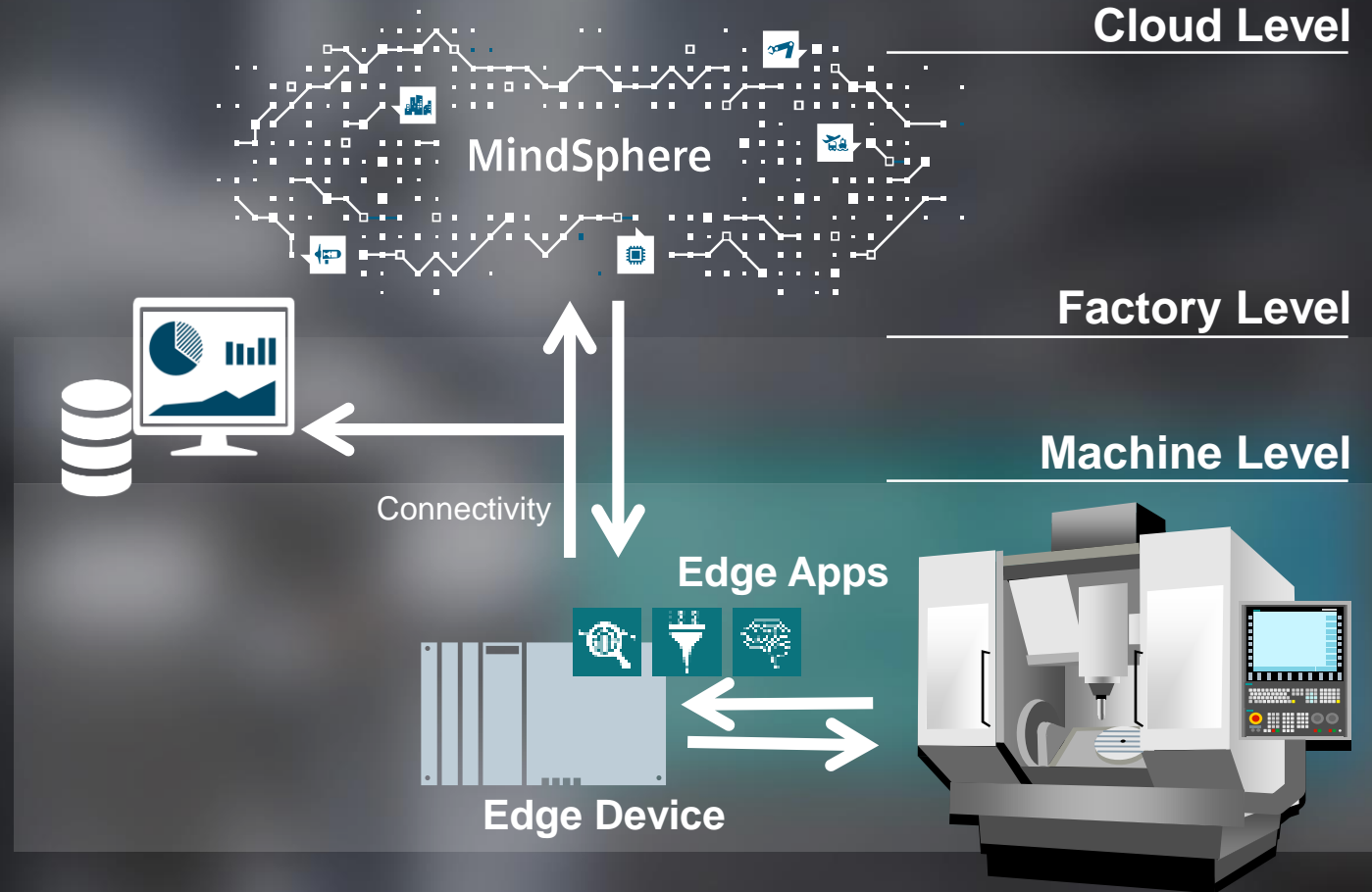
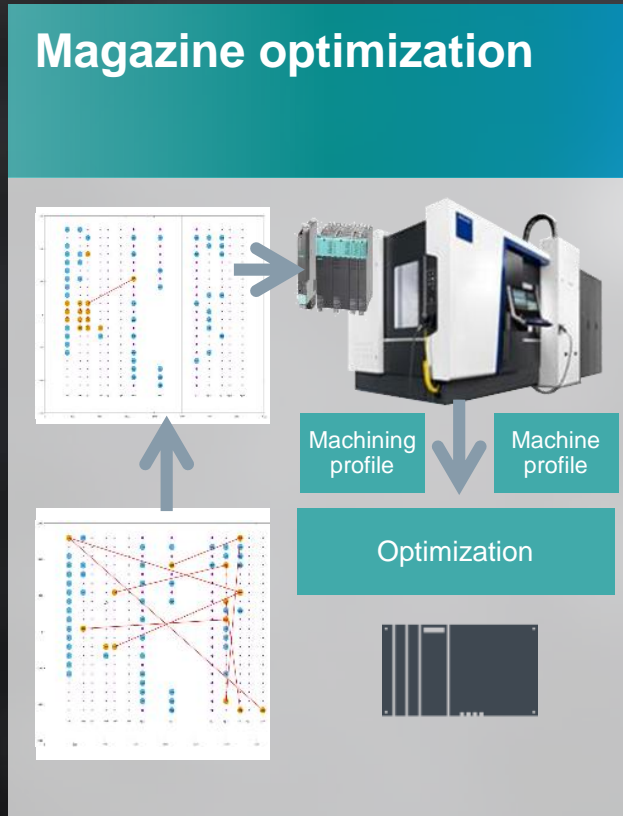
[siemens.com](https://www.siemens.com)



Magazine optimization

HELLER GmbH

Cycle-time reduction enabled by program focused optimization of tool magazine right at the machine





Magazine
optimization

HELLER GmbH

UseCase 3: “Additive Manufacturing” @ HP

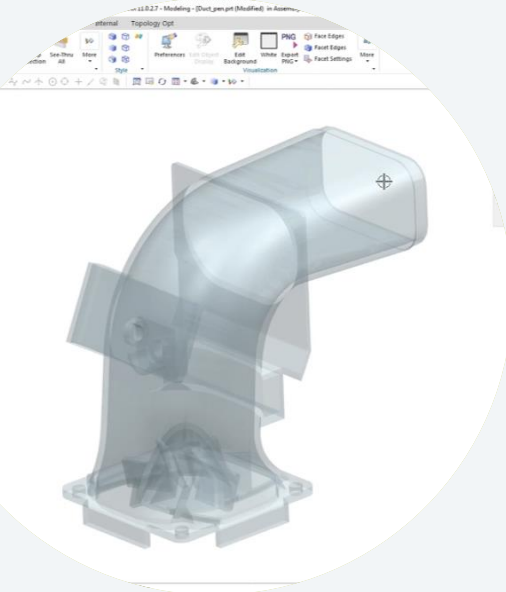
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Digital Twin Product

Digital Twin Product



Simulation-based redesign of the air duct to significantly improve coolant airflow and increase printing speed

Digital Twin Production

Digital Twin Product

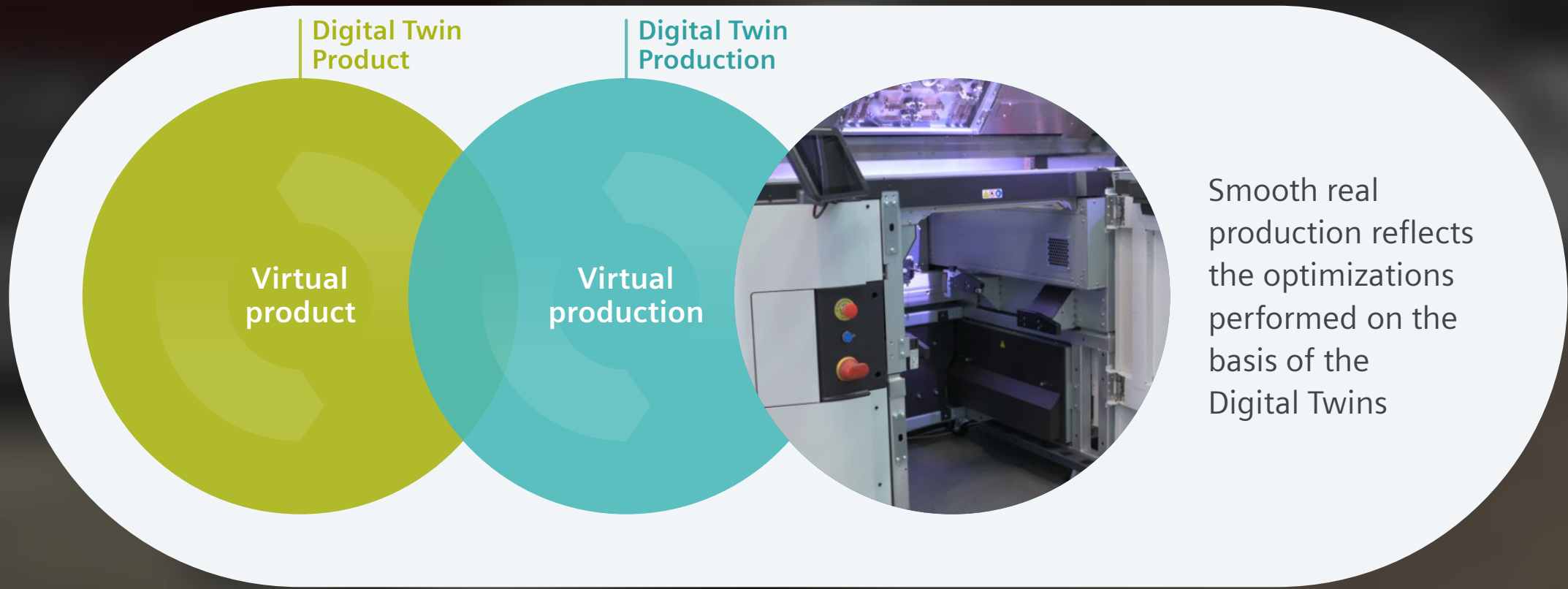
Virtual product

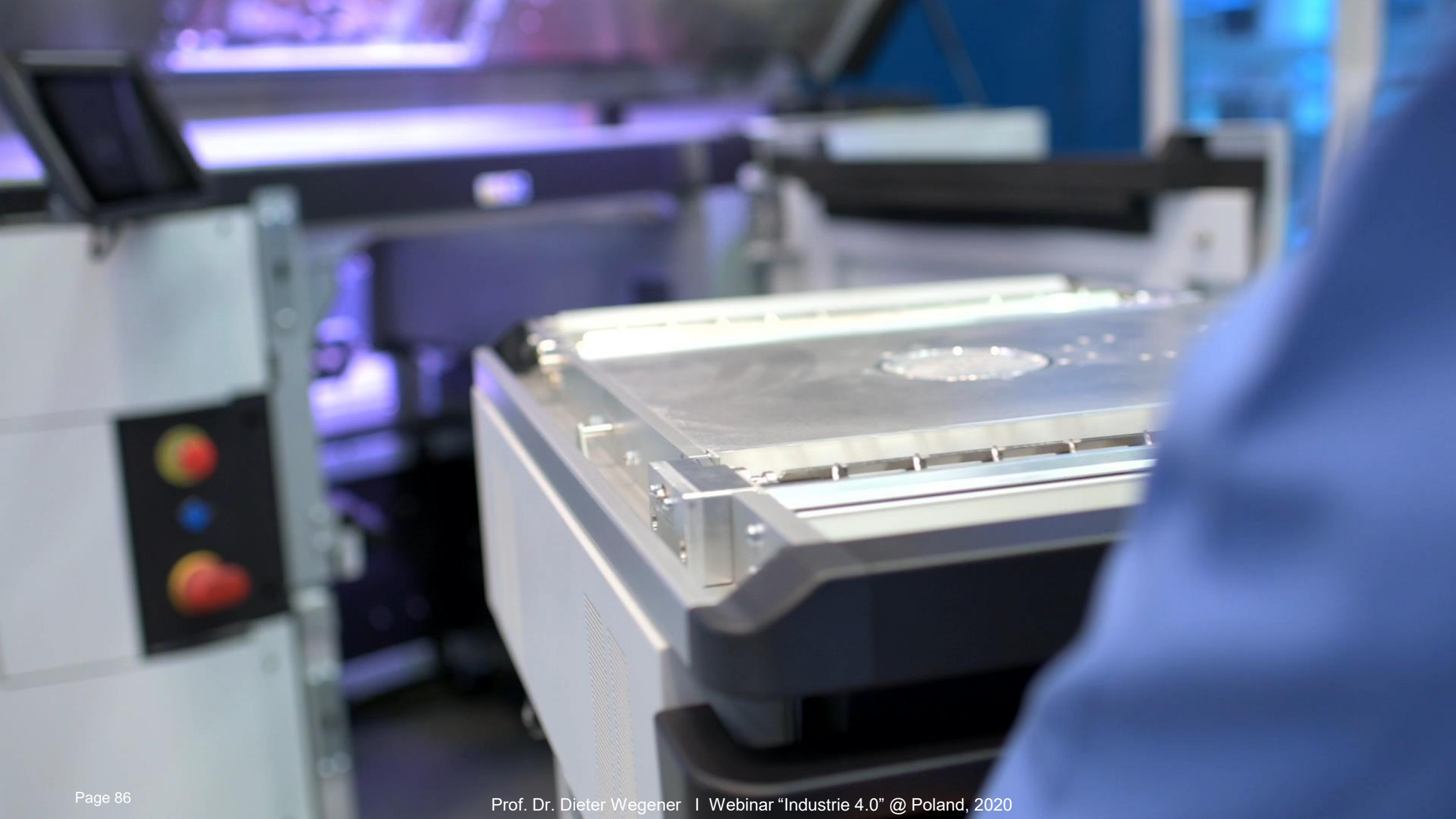
Digital Twin Production



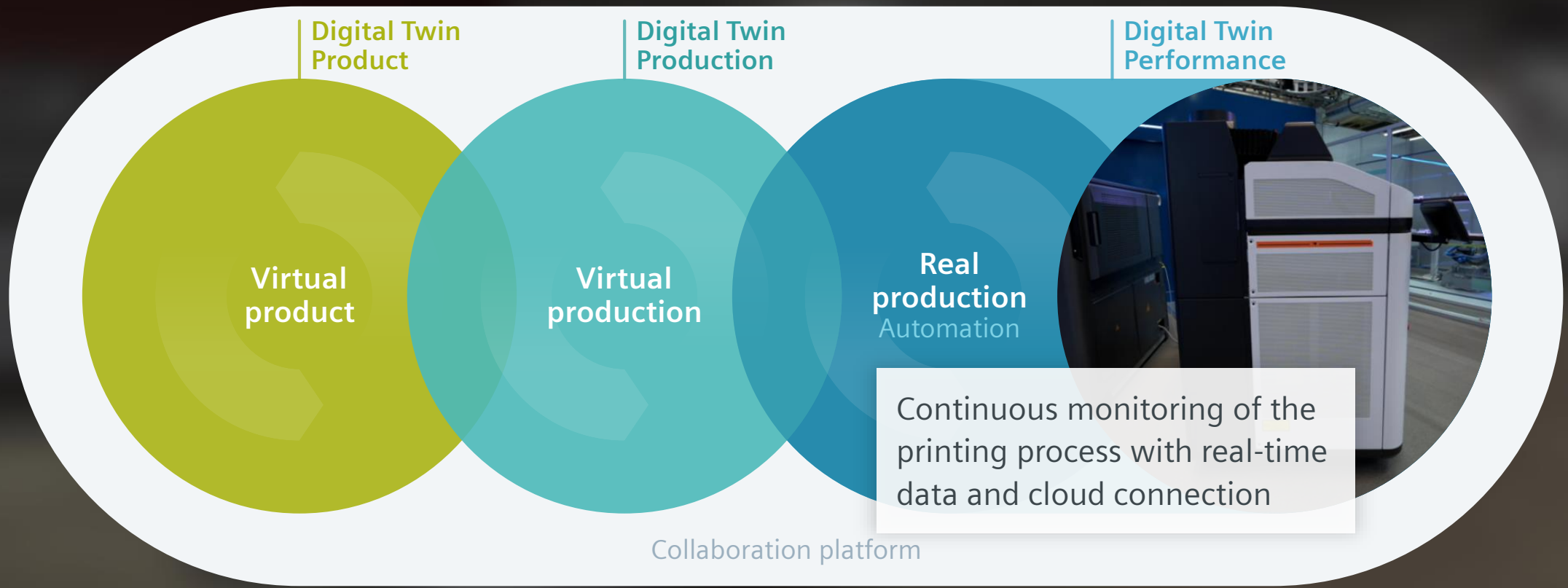
Simulation-based design improvements optimize resource-usage and scalability

Real Production



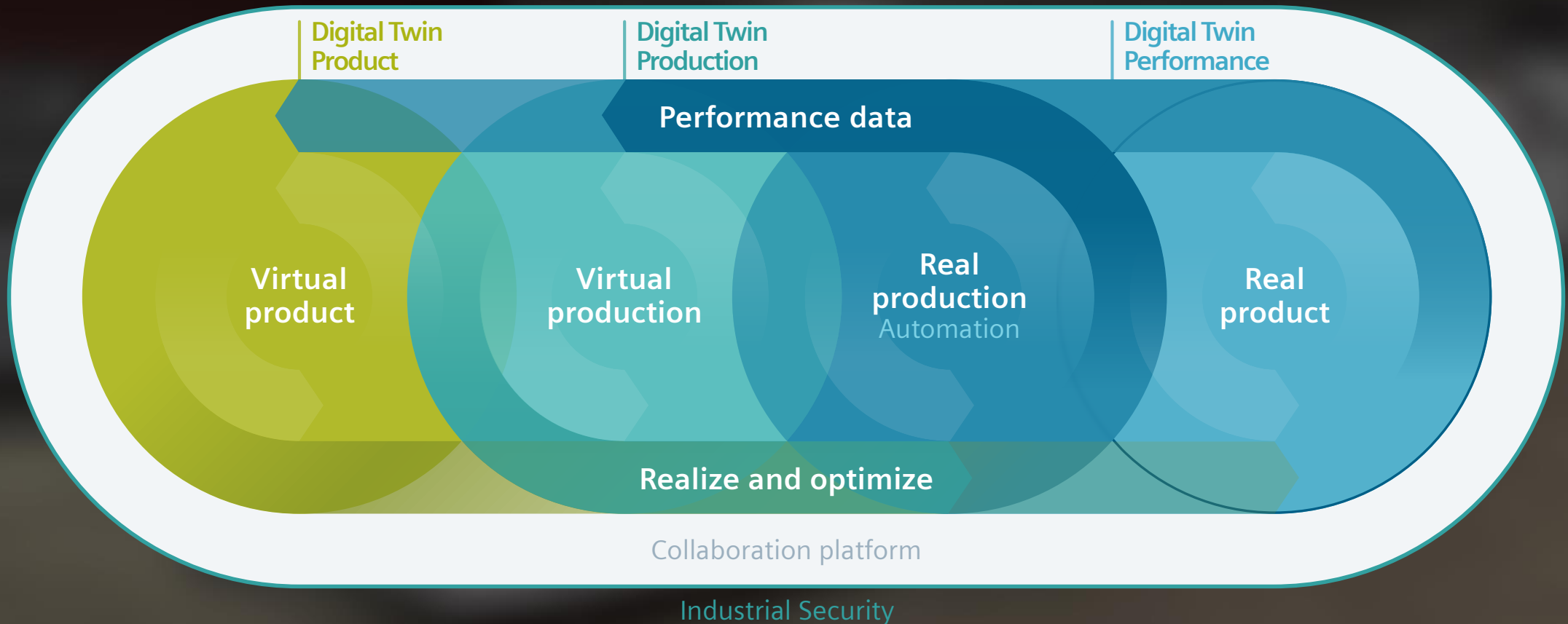


Digital Twin Performance





Continuous optimization with the most holistic Digital Twin



Impressive results

22%

flow control
improvement

75%

faster
development

34%

part cost
reduction

15%

faster
printing speed

Your questions

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Siemens Corporate Technology – Contact and further information

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