

Digital Transformation of Processes, Products and Solutions

Example thyssenkrupp

Paderborn | 2016 June 29th | Reinhold Achatz

engineering.tomorrow.together.



thyssenkrupp

thyssenkrupp - Diversified Industrial Company

Leveraging synergies between the business areas creates huge benefits



Components
Technology



Elevator
Technology



Industrial
Solutions



Materials
Services



Steel
Americas



Steel
Europe

In the past the focus was on productivity only –
In future connecting value chains is a key success factor



thyssenkrupp's sustainable innovation strategy



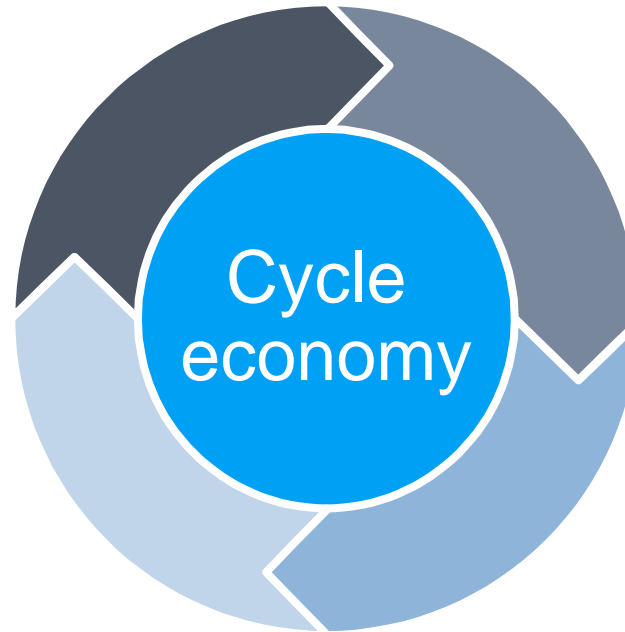
Resource Efficiency

- Raw Materials
- Energy
- CO₂



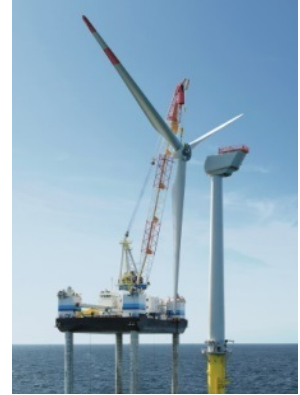
Leading edge technology

- Products
- Processes



Sustainability

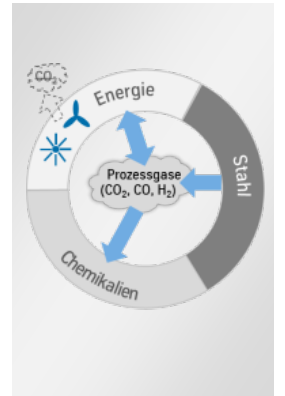
- Products and Solutions
- ThyssenKrupp's Production



System Optimum

vs.

Local Optima



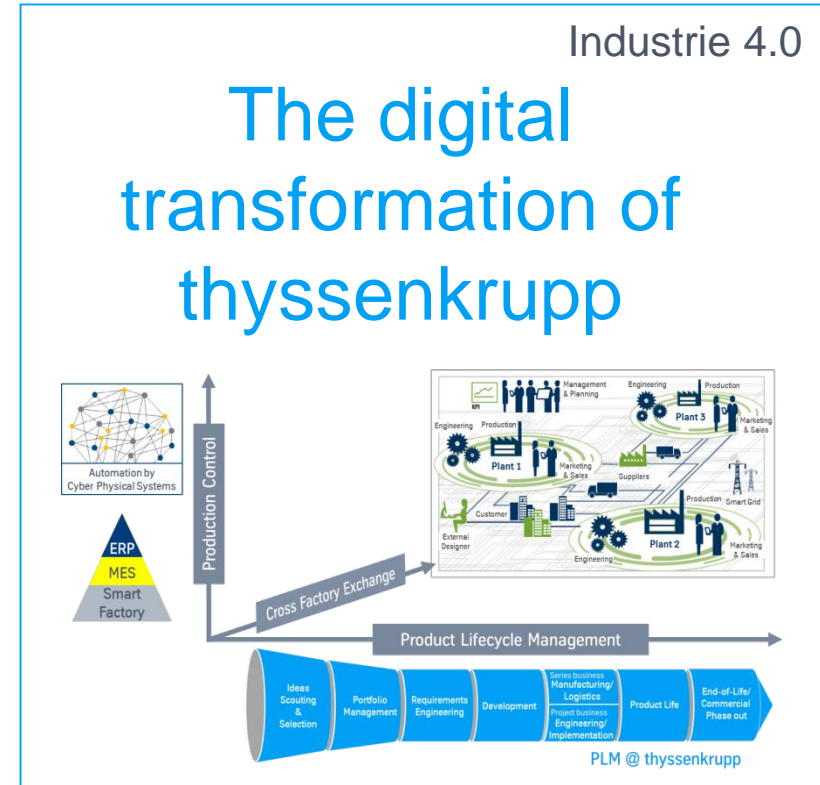
Sustainability includes economical, social and environmental aspects



thyssenkrupp will use the digital technologies available to create a competitive advantage

ING.
INGENIEURKUNST

ENGINEERING OR THE ABILITY TO
CONNECT COMPETENCES



In the past, industry was focused on productivity –
In future, the connection of value chains will be the key of success



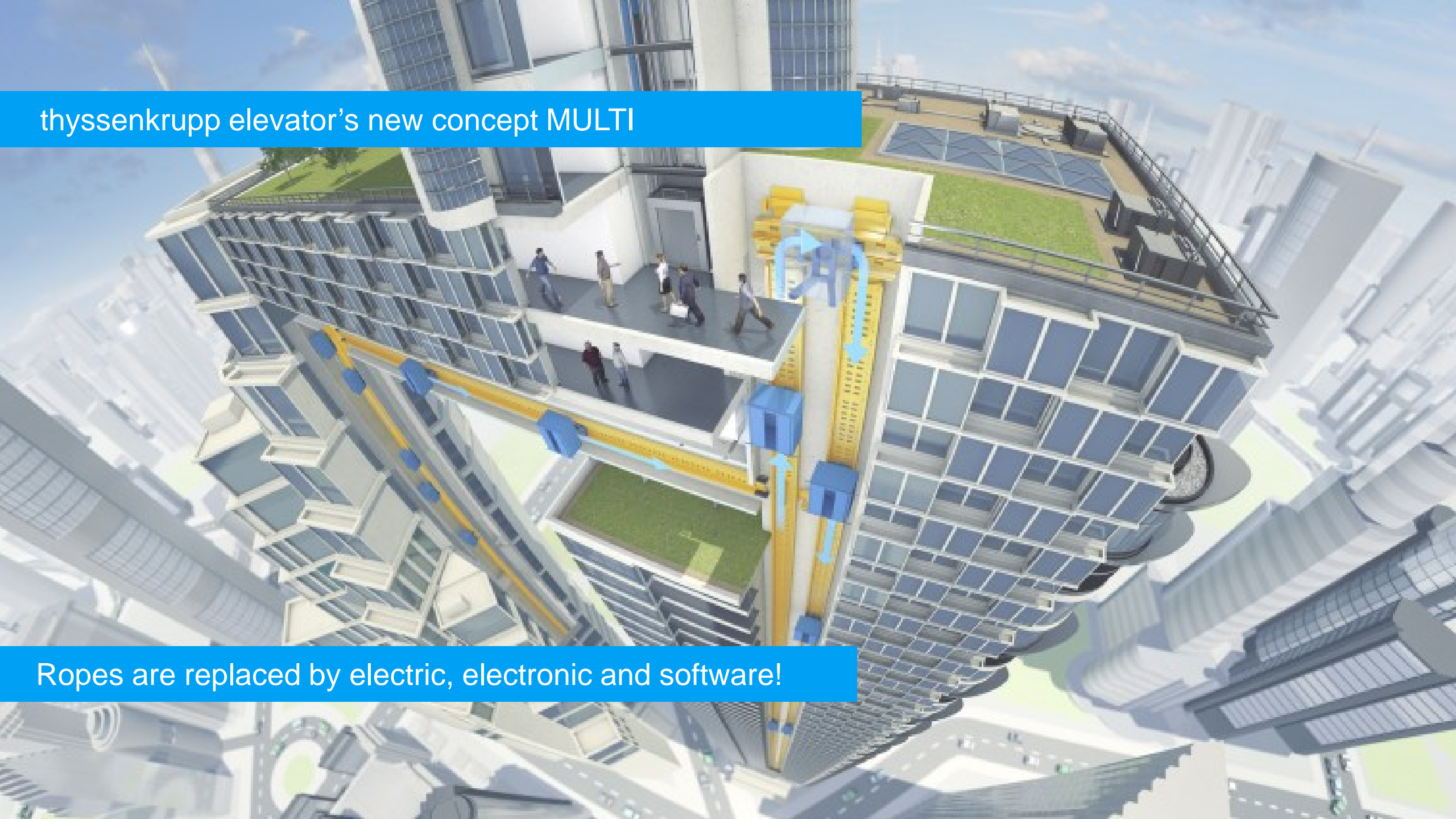
External perception: thyssenkrupp is one of the 50 “smartest companies” 2015

1 Tesla Motors	2 Xiaomi	3 Illumina	4 Alibaba	5 Counsyl	6 Sun Edison	7 Tencent	8 Juno Thera peutics	9 SolarCity	10 Netflix
11 Ova Science	12 Google	13 Amazon	14 AliveCor	15 Gilead Sciences	16 Apple	17 Voxel8	18 IDE Technolo gies	19 Amgen	20 Aquion Energy
21 Baidu	22 SpaceX	23 Sakti3	24 Freescale Semi conductor	25 Universal Robots	26 Bristol-Myers Squibb	27 Teladoc	28 Nvidia	29 Facebook	30 Alynlam
31 Rethink Robotics	32 Philips	33 Collectis	34 Bluebird Bio	35 thyssenkrupp	36 Slack	37 Line	38 Improbable	39 Enlitic	40 Coinbase
41 HaCon	42 3D Systems	43 Generali	44 Intrexon	45 DN Anexus	46 IBM	47 Snapchat	48 Microsoft	49 Imprint Energy	50 Uber

Quelle: MIT Technology Review 2015



thyssenkrupp elevator's new concept MULTI



Ropes are replaced by electric, electronic and software!

Digital Transformation

Success of the digital transformation depends on three elements

 Internet Business

 Industrie 4.0 / Industrial Internet of Things

 Big data / Predictive Analytics

Nobody needs the Digital Transformation,

if it does not create added value!



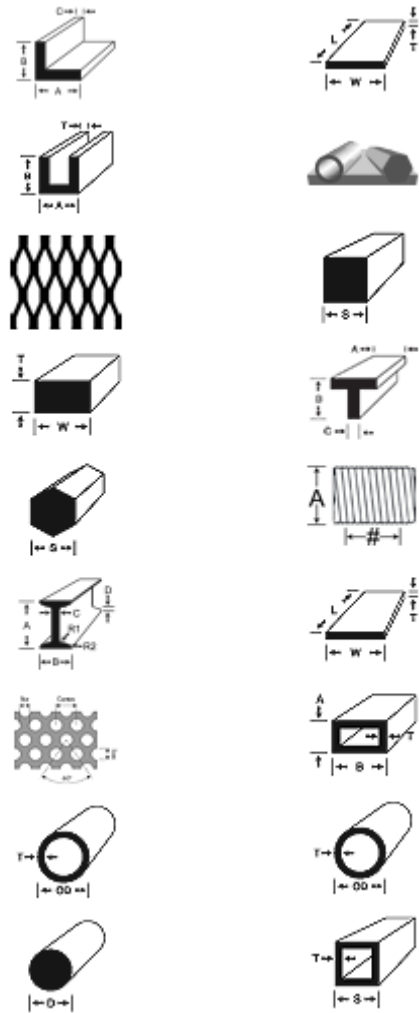
There is one important rule in internet business:

**Nobody shall be between
our customers and thyssenkrupp!**





Internet business - thyssenkrupp in e-Business

Example

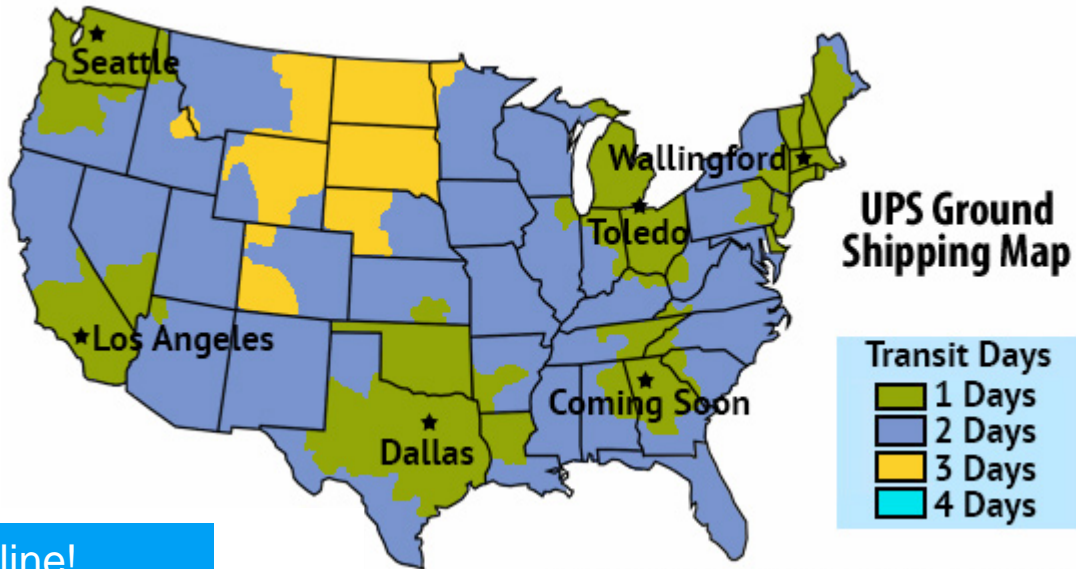


Metal & Plastic Materials
Shop Online. No Minimums.
Cut-To-Size Without the Wait.

 **Get Deals**
Sign-up for email news and coupon savings.

 **Price Match**
Never pay more. Get the best deal without shopping around >

OnlineMetals.com
CUSTOM METAL & PLASTICS SUPPLY




thyssenkrupp trades materials in the U.S. since many years online!



Internet Business

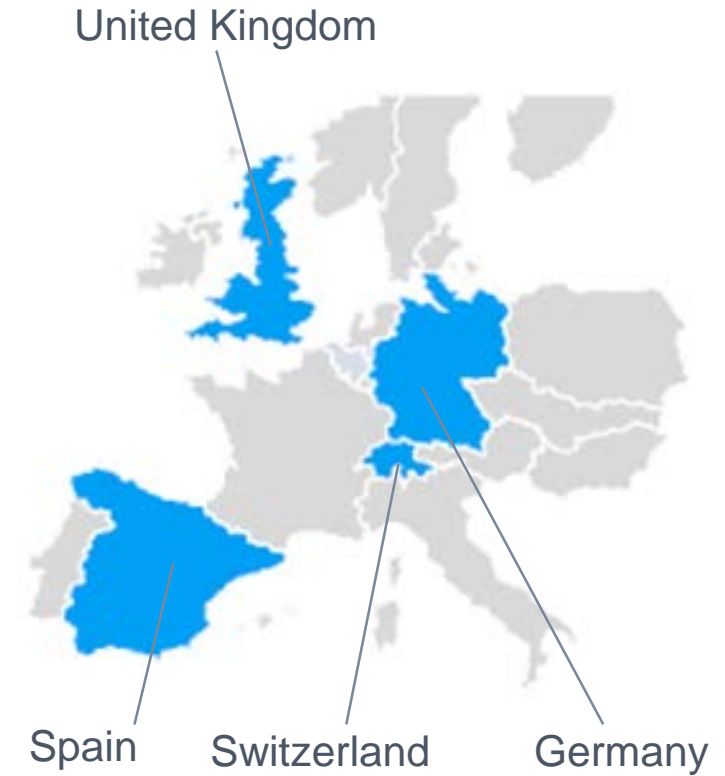
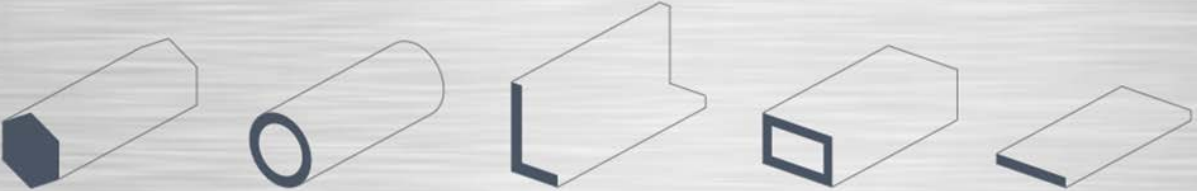
„materials4me“ is an additional sales channel for thyssenkrupp Material Services



MATERIALS 4 ME
Metals. Plastics. Online.

What we offer

Quality metals & plastics despatched same day.

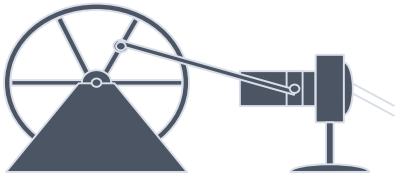


Conventional and new customers 24/7/365 can buy materials online. Delivery by the existing logistic chain.

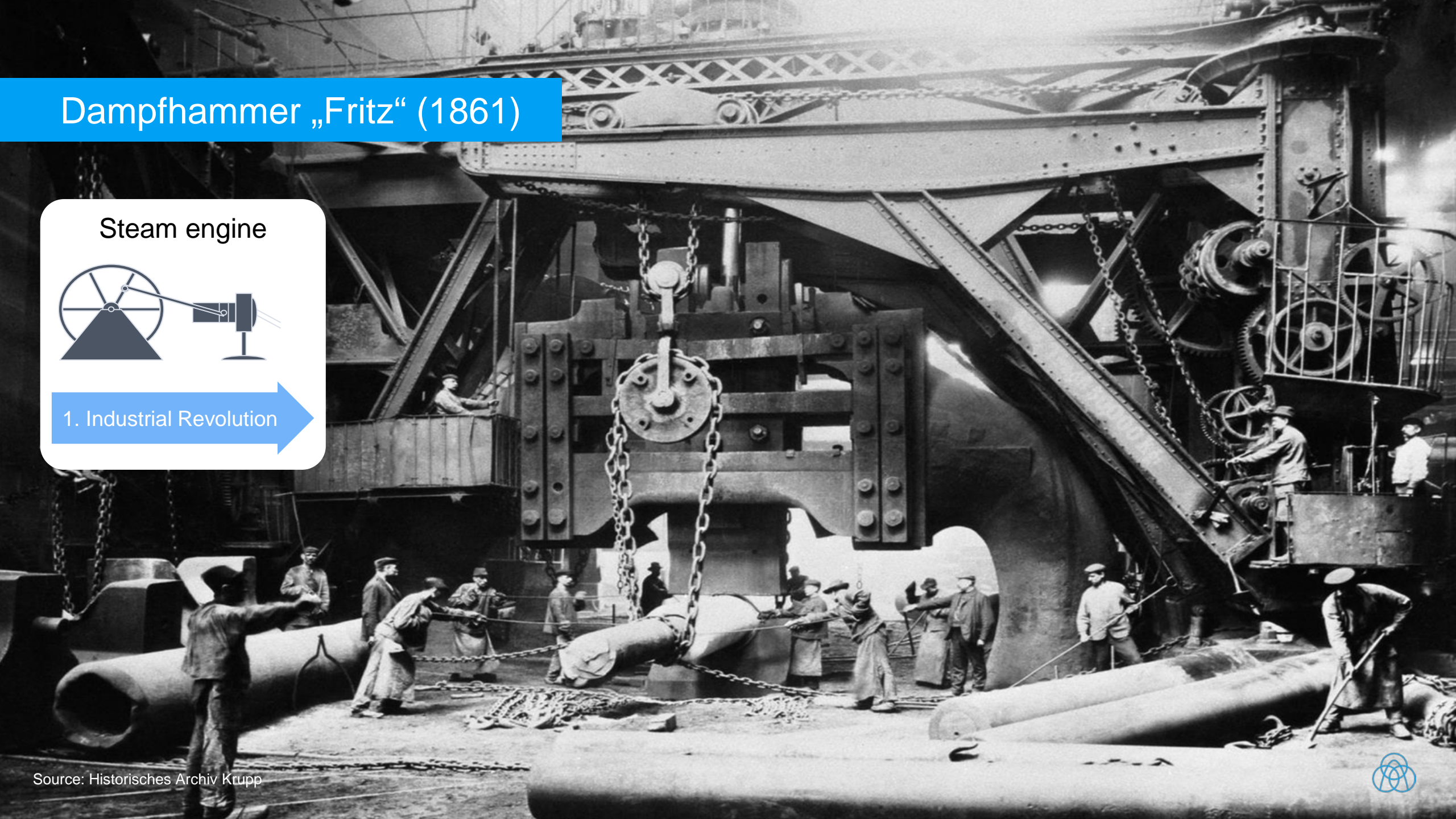


Dampfhammer „Fritz“ (1861)

Steam engine



1. Industrial Revolution



Lawn mower production (1930s)

Taylorism

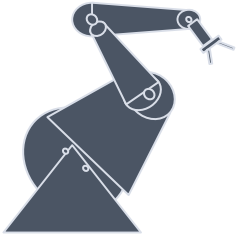


2. Industrial Revolution

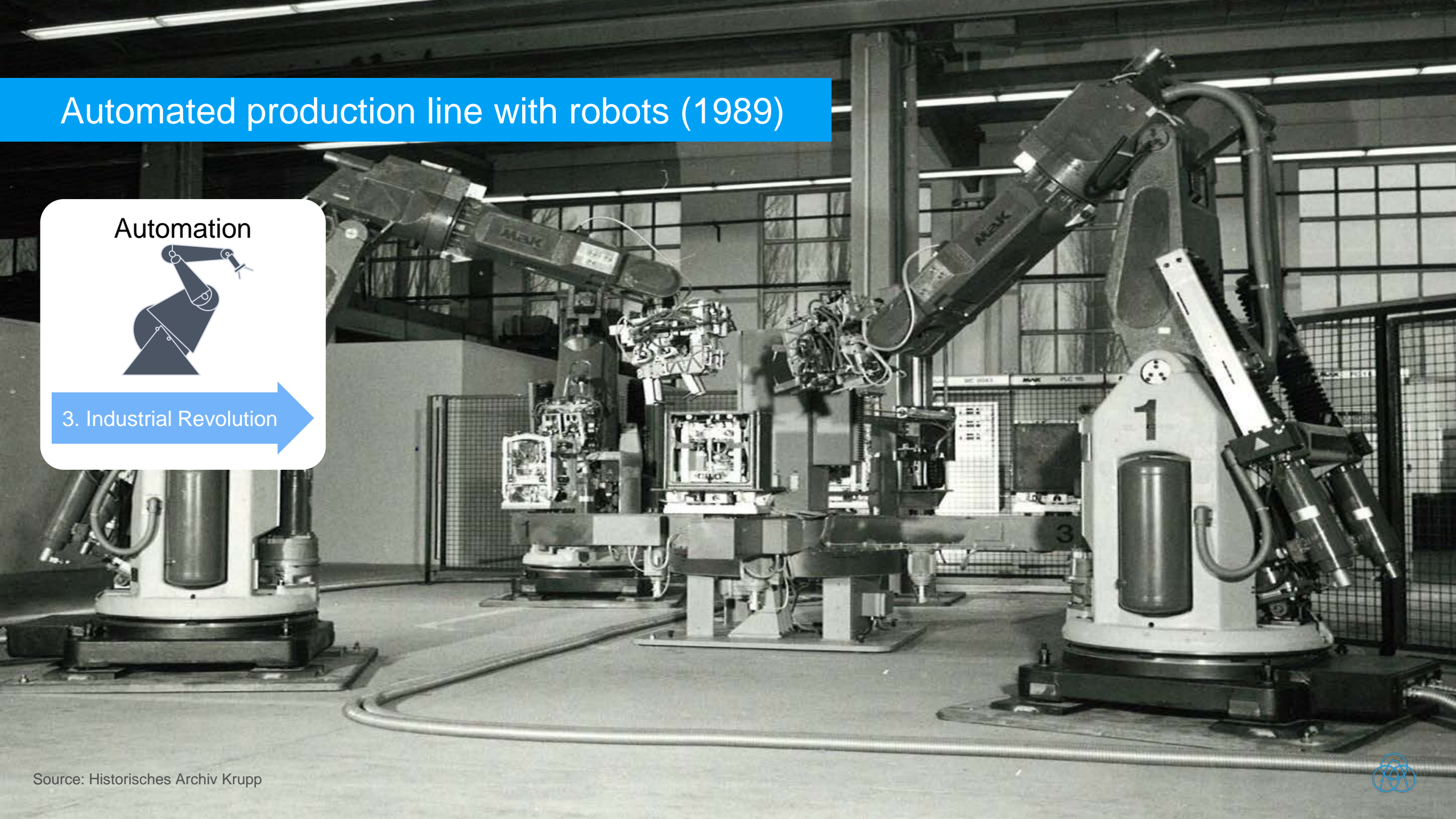


Automated production line with robots (1989)

Automation



3. Industrial Revolution



Industrie 4.0: Project „Installation-Monitoring“

Collaboration

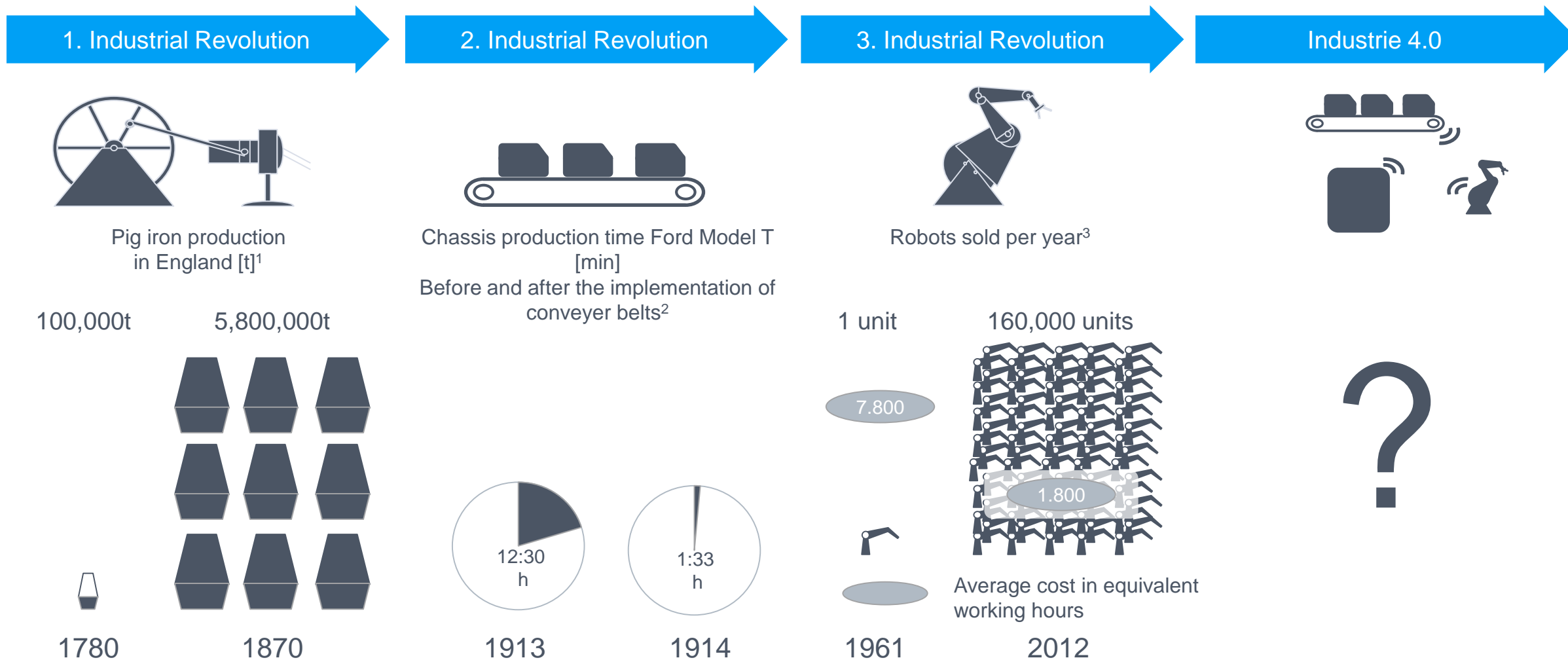


Industrie 4.0



Transformation of Industry was driven by value creation

What value is created by the fourth industrial revolution?



Sources: 1. Pfister, Uni Münster, 2008, 2. H. Ford: Mein Leben und Werk, Leipzig 1923 3. Int'. Federation of Robotics, History of Industrial Robots, 2012



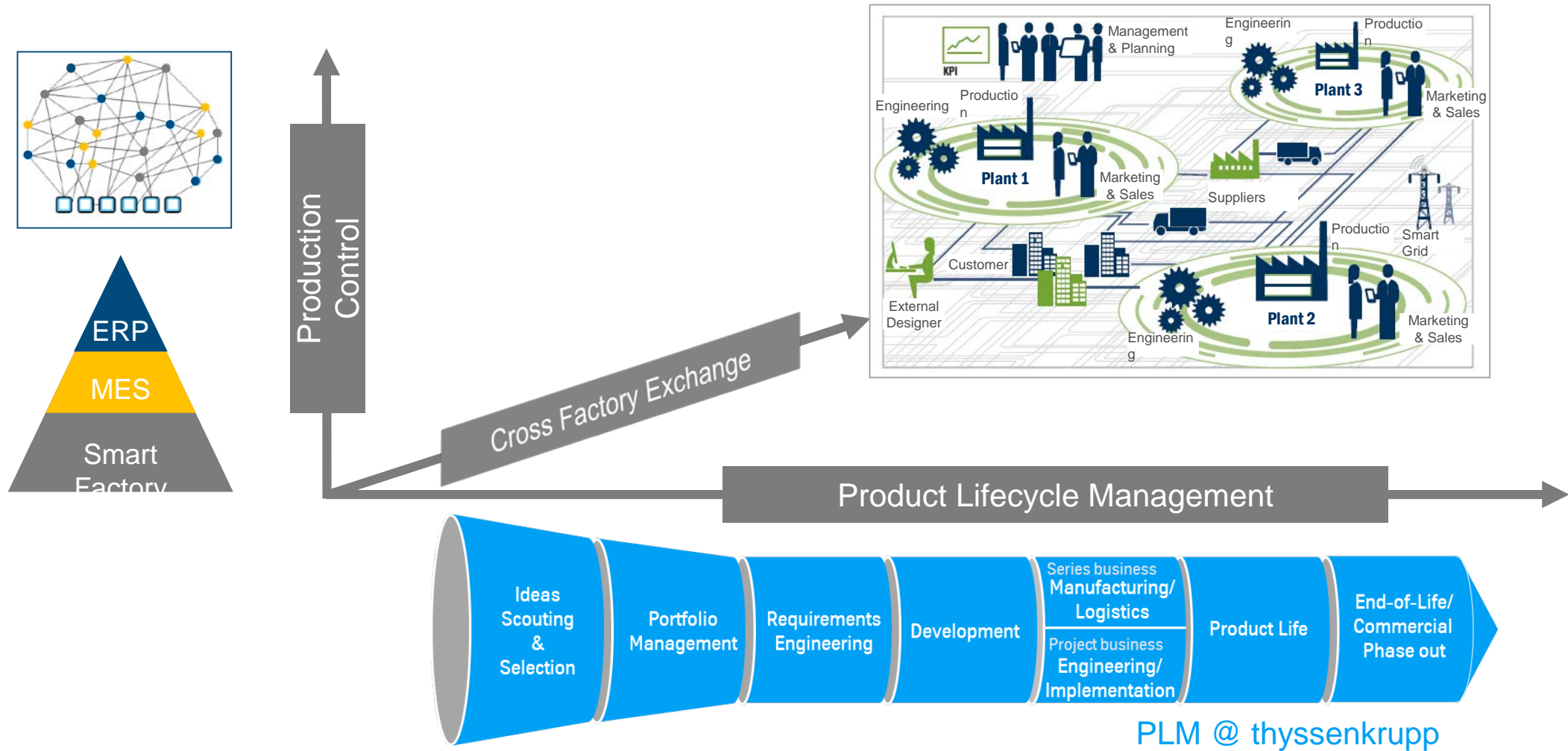
Industrie 4.0 - ThyssenKrupp's Objectives

Seamless communication and integration of processes allows to ...

- ▶ React more flexible on customer requests
- ▶ Reduce cost
- ▶ Increase quality
- ▶ Increase throughput
- ▶ Reduce environmental foot print



The three core elements of the implementation strategy of Industrie 4.0 at thyssenkrupp – **daproh** and **unITE** are preconditions

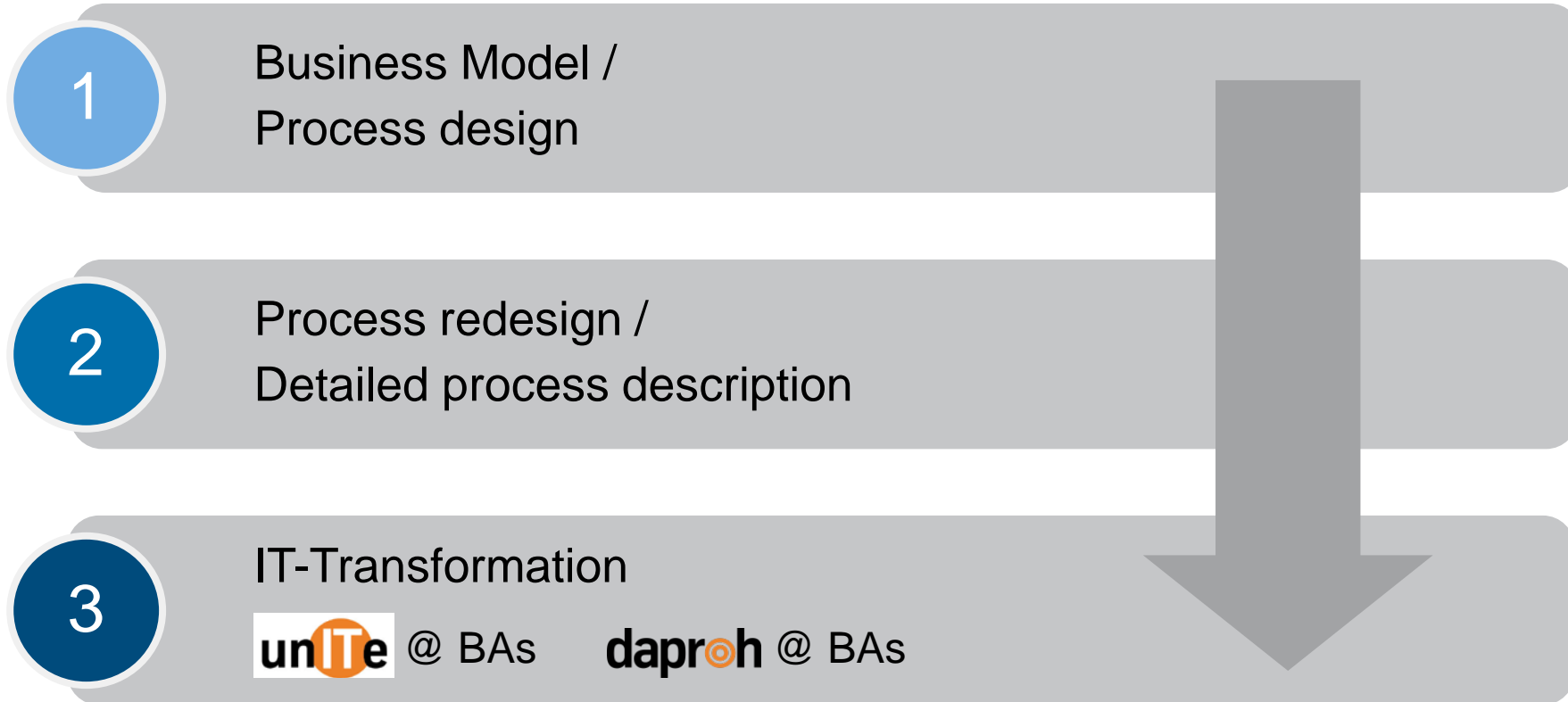


ERP = Enterprise Resource Planning MES = Manufacturing Execution System PLM = Product Lifecycle Management

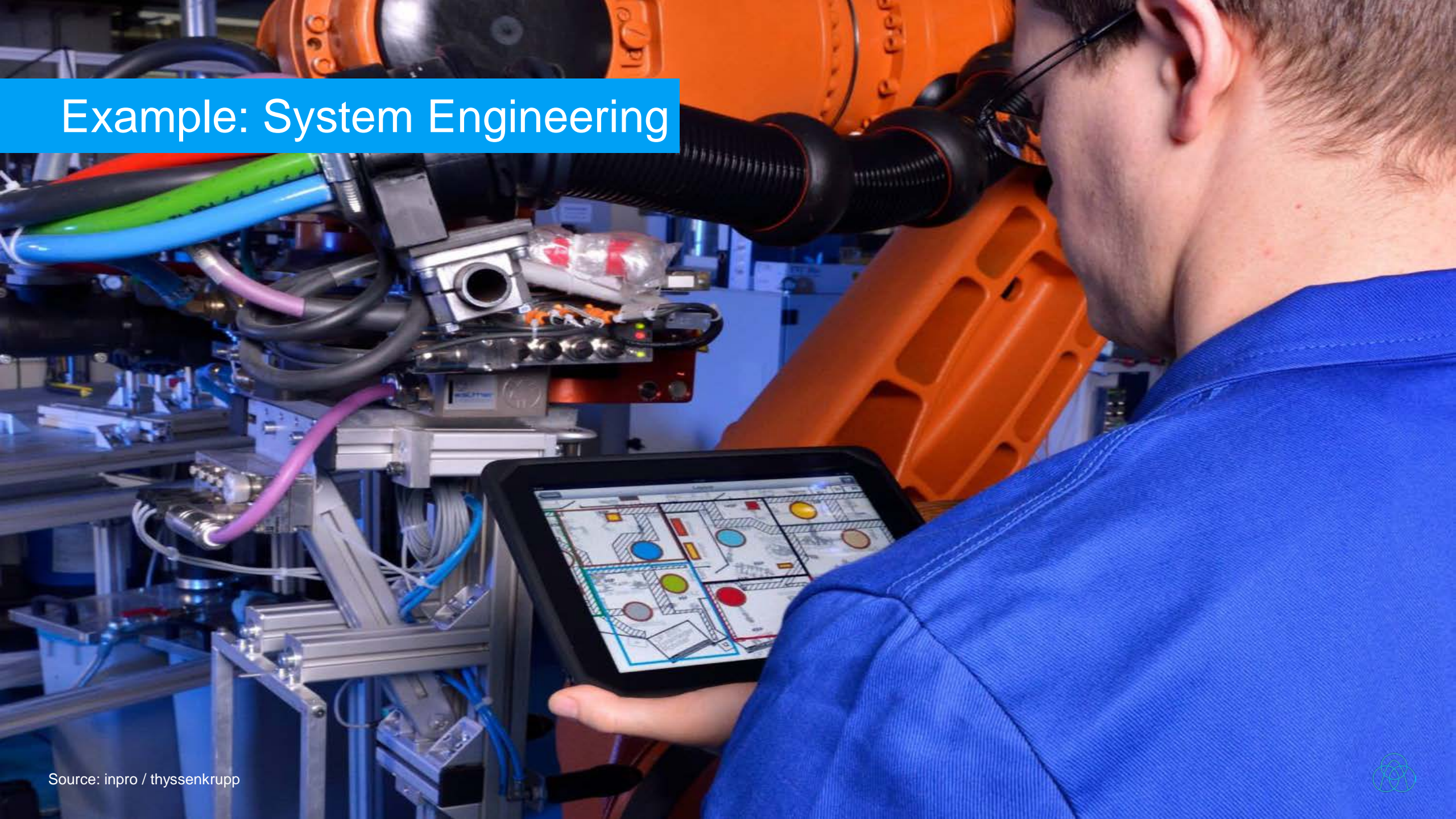


Implementation at thyssenkrupp

Digitalization starts with Description of Business Model and Process Design



Example: System Engineering

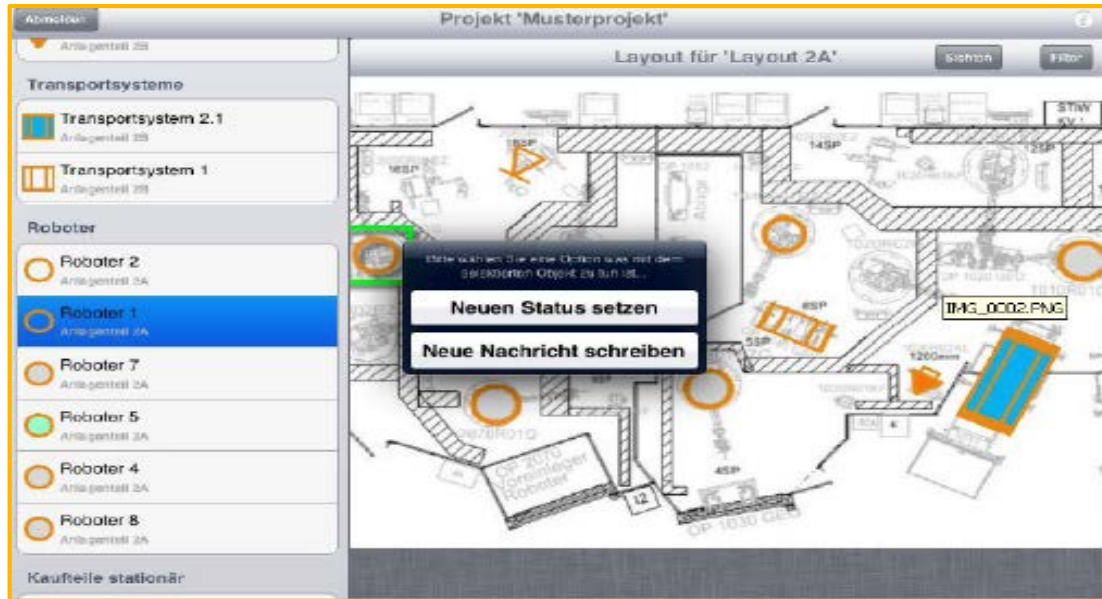


Seamless Engineering on Site

On Site Monitoring System

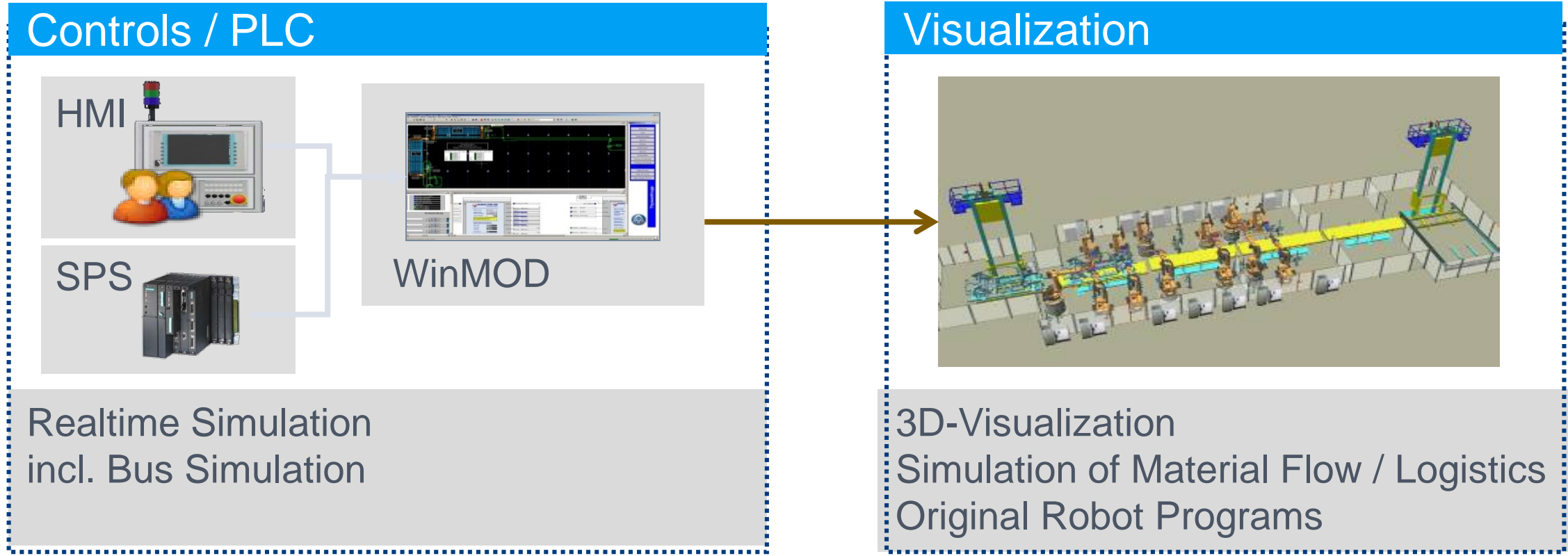
Service Order handling:

- Spare part handling
- Retooling
- Relocation



Virtual Commissioning

Integrated Engineering



Virtual Commissioning



HMI and PLC

System Behavior

Virtual 3D-Modell

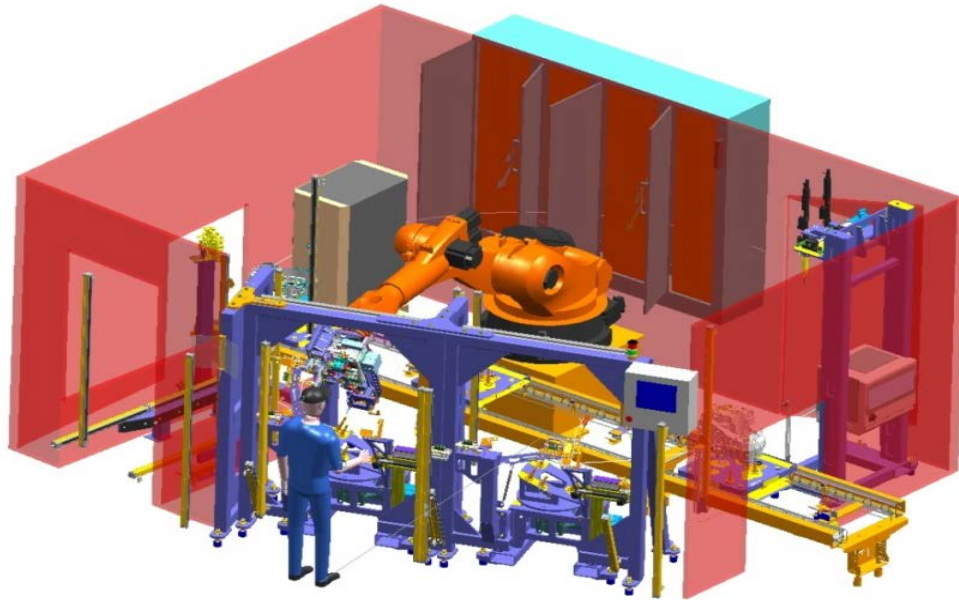
3D Model of the customer line

optional
OFFLINE-Programming



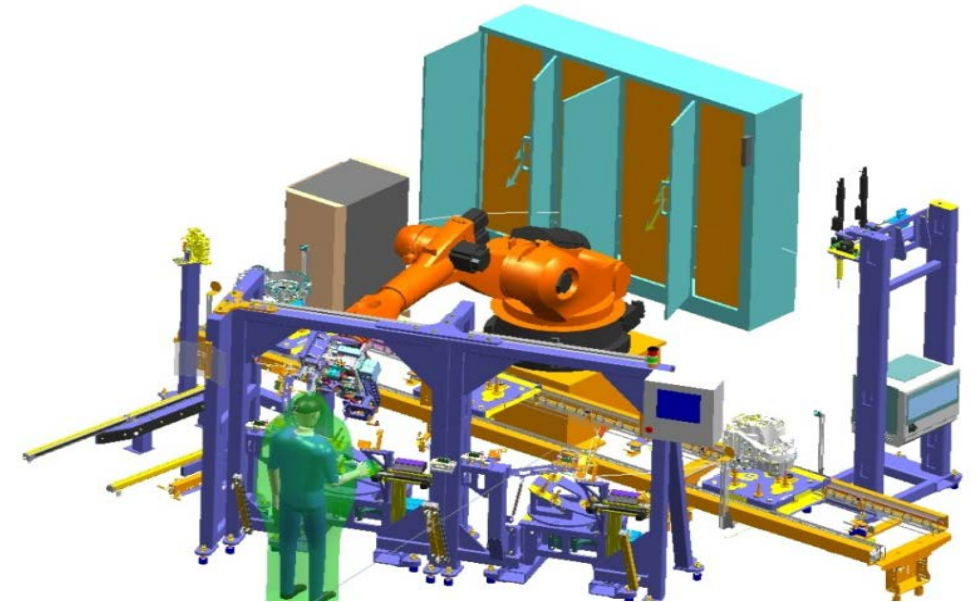
Save Human Robot Collaboration to Increase Flexibility and Productivity

Robot Cell



Clear separation of human and robot /
robot does not recognize the human worker.

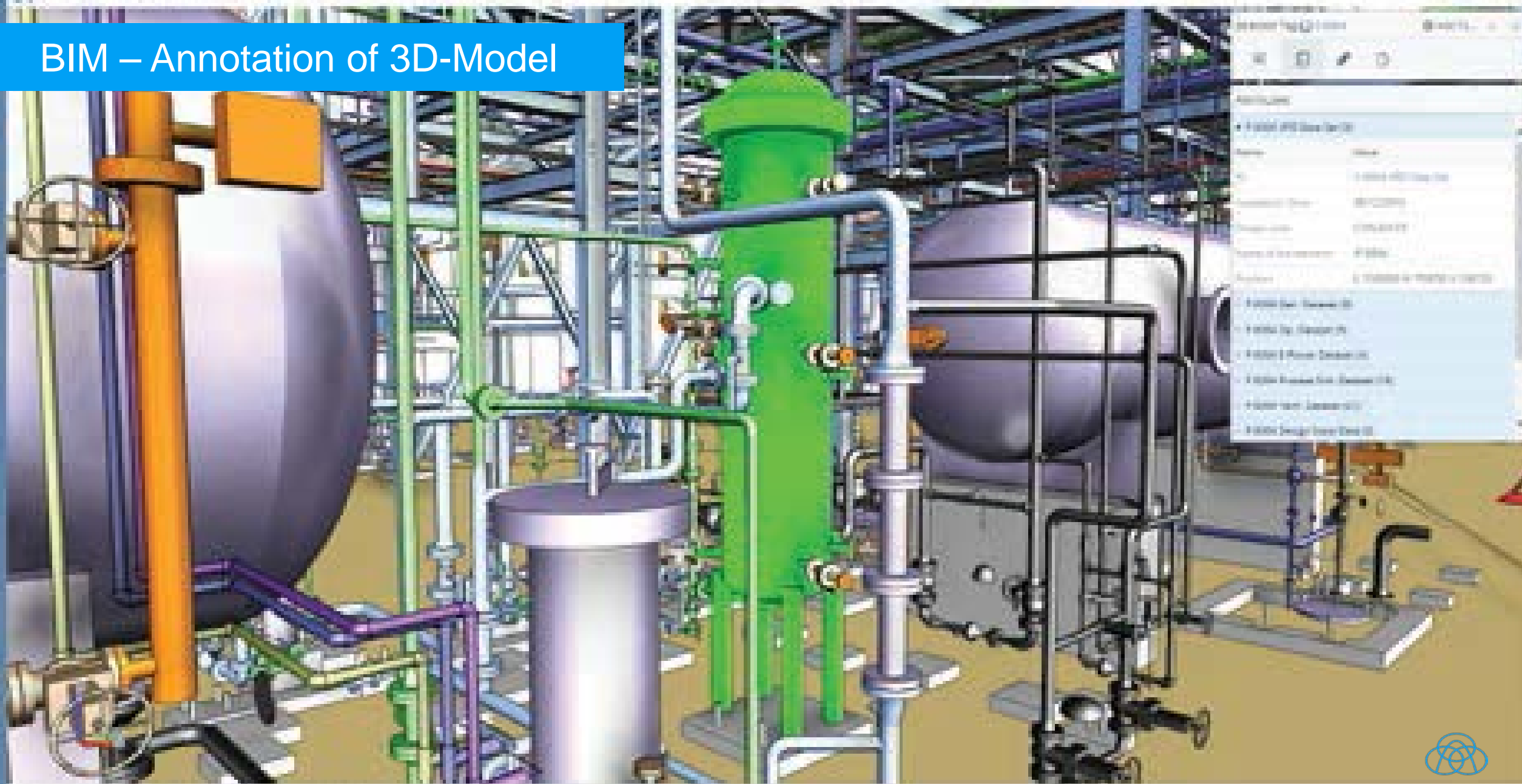
Human-Robot-Collaboration



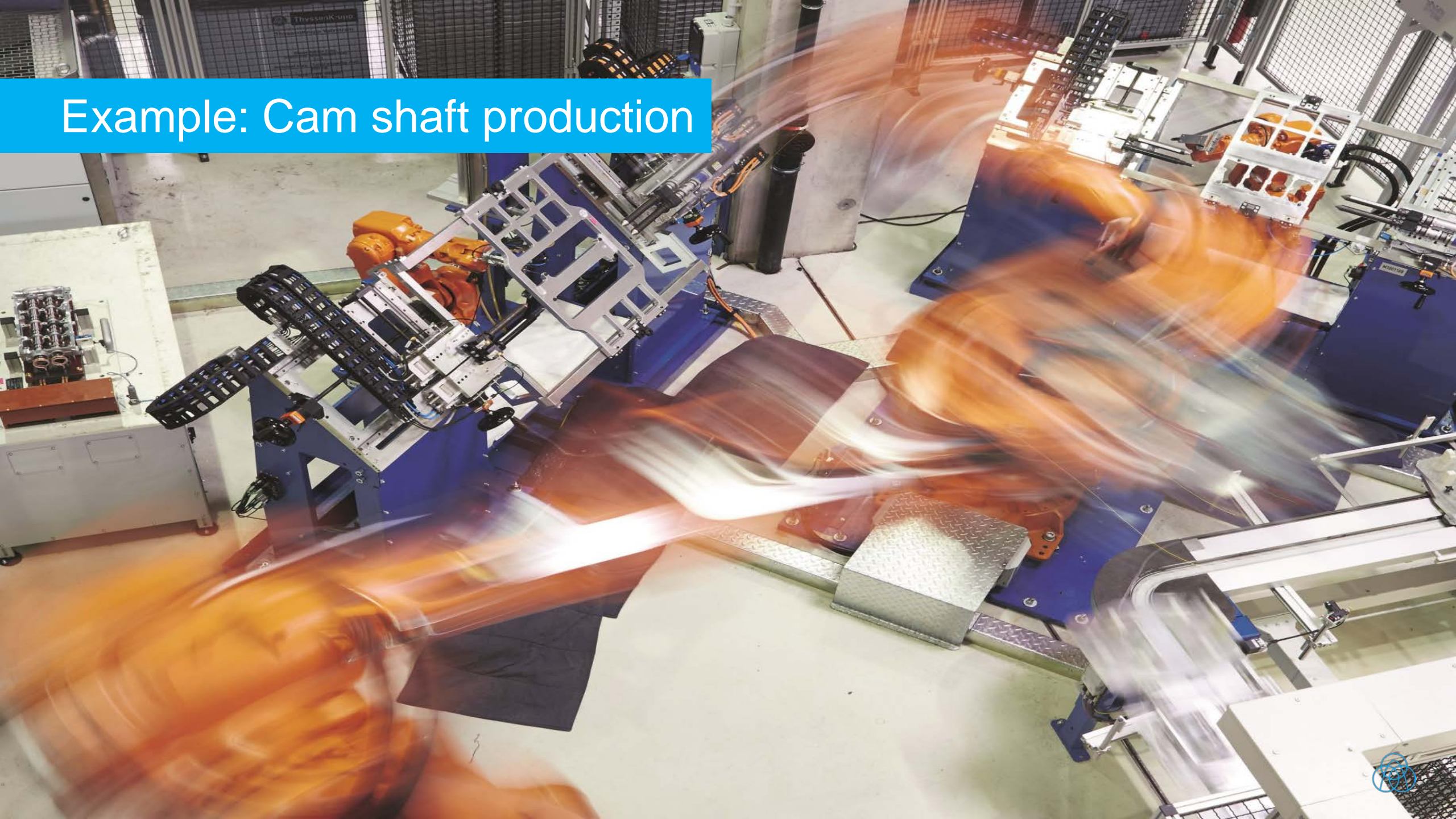
Collaboration between human and robot /
The robot recognizes the human person



BIM – Annotation of 3D-Model



Example: Cam shaft production

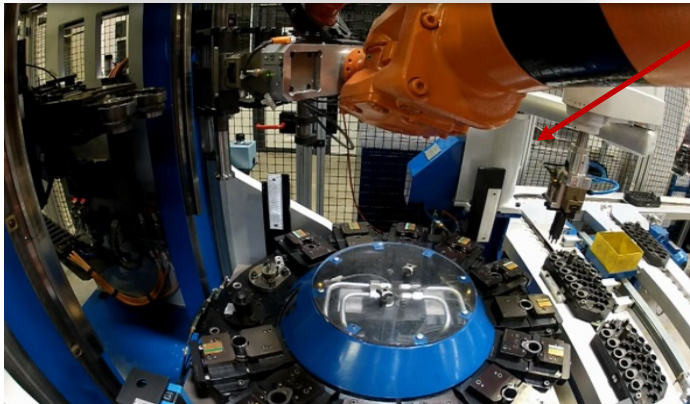


Smart Factory

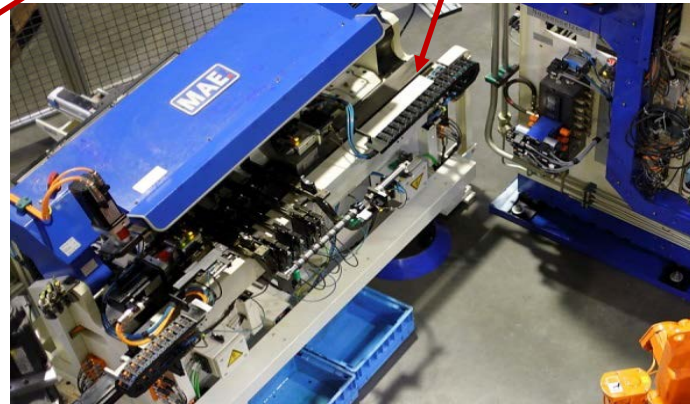
Example: Real time controlled assembly and machining of camshafts to avoid errors and reduce cycle time



Status of previous machine and update of process parameters



Assembly



Trueing



Grinding



Example: Steel Europe



Horizontal Integration - Cross Factory Exchange

Medium-wide-strip steel production at Hoesch Hohenlimburg



Main customers



Cold rolling industry



Automotive industry



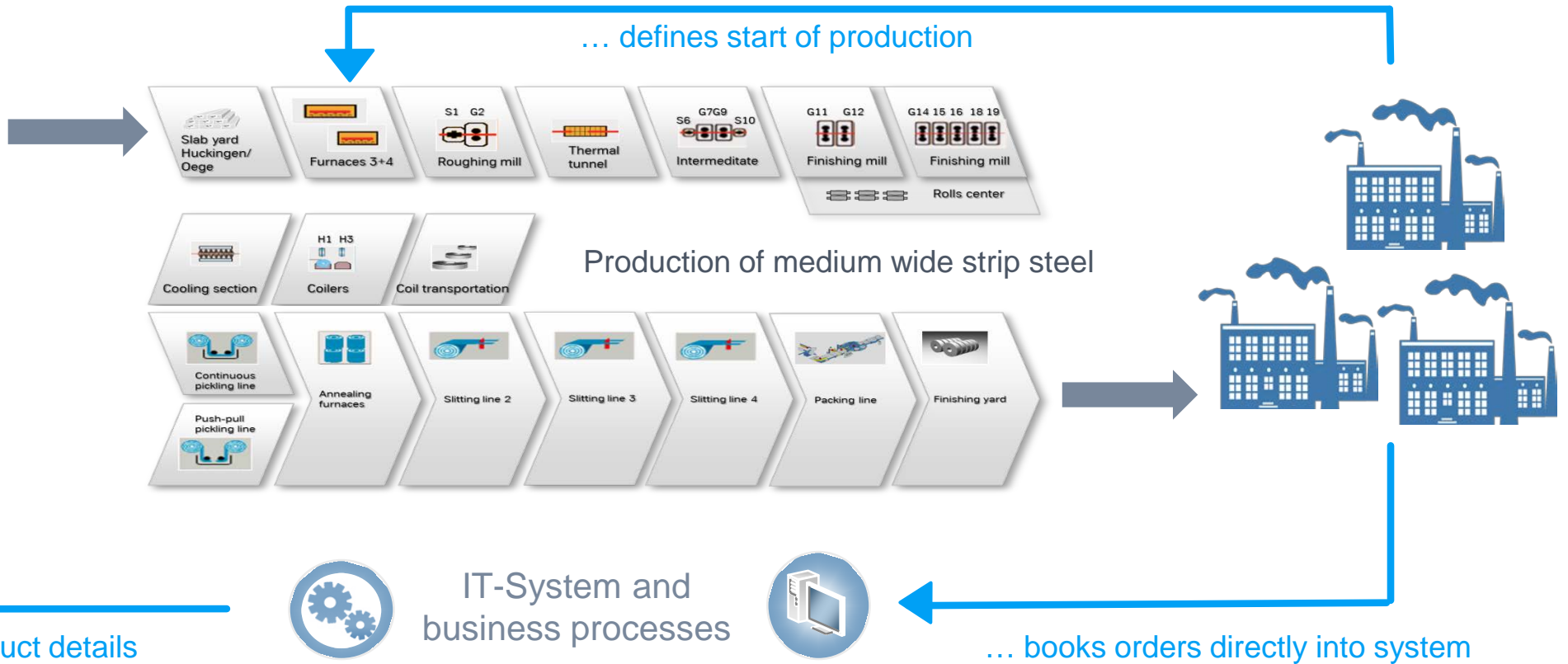
Horizontal integration - Cross factory / cross company exchange

Customers control their orders - thyssenkrupp reduces assets and increases throughput

Slab production at HKM (vendor)

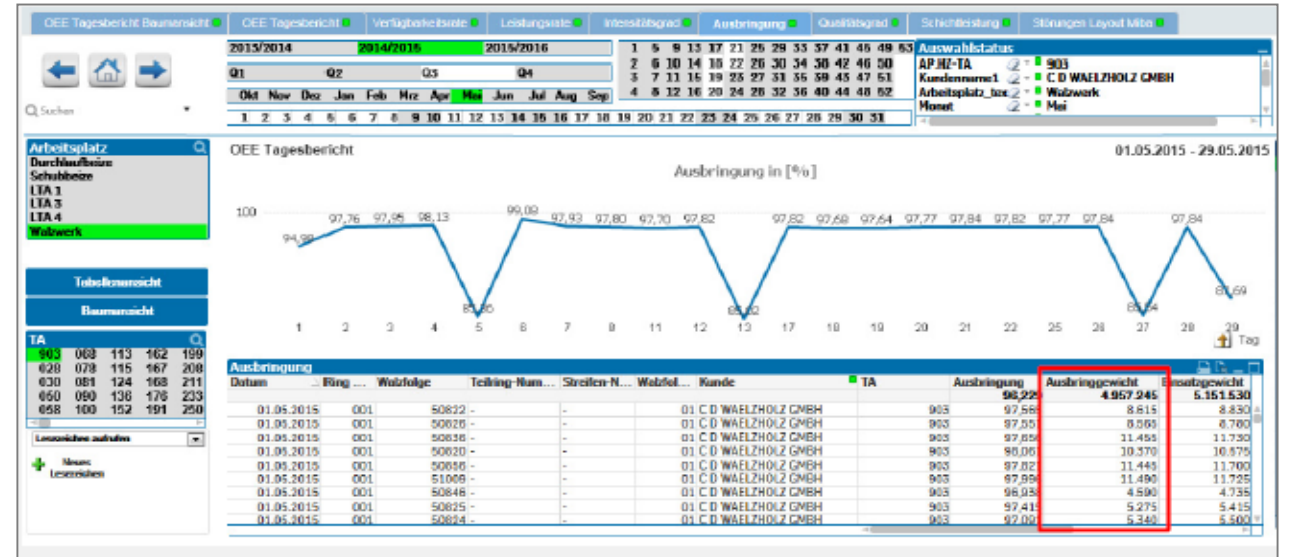
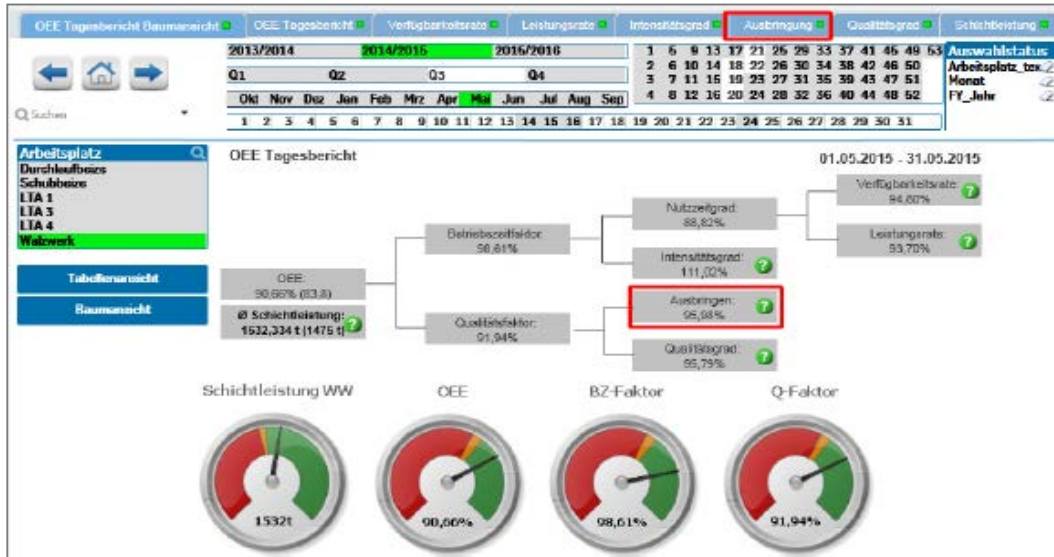
thyssenkrupp Hoesch Hohenlimburg

Customer



Big Data: Transparency

Example: Data are available in real time



All employees have access to data from a single source



Big Data and Predictive Analytics

→ The analysis of **structured** and **unstructured data** allows to get more information.

→ Today we are analyzing what happened in the past, with **predictive analytics** we can use historical data to predict the future.

→ Examples for projects in progress:

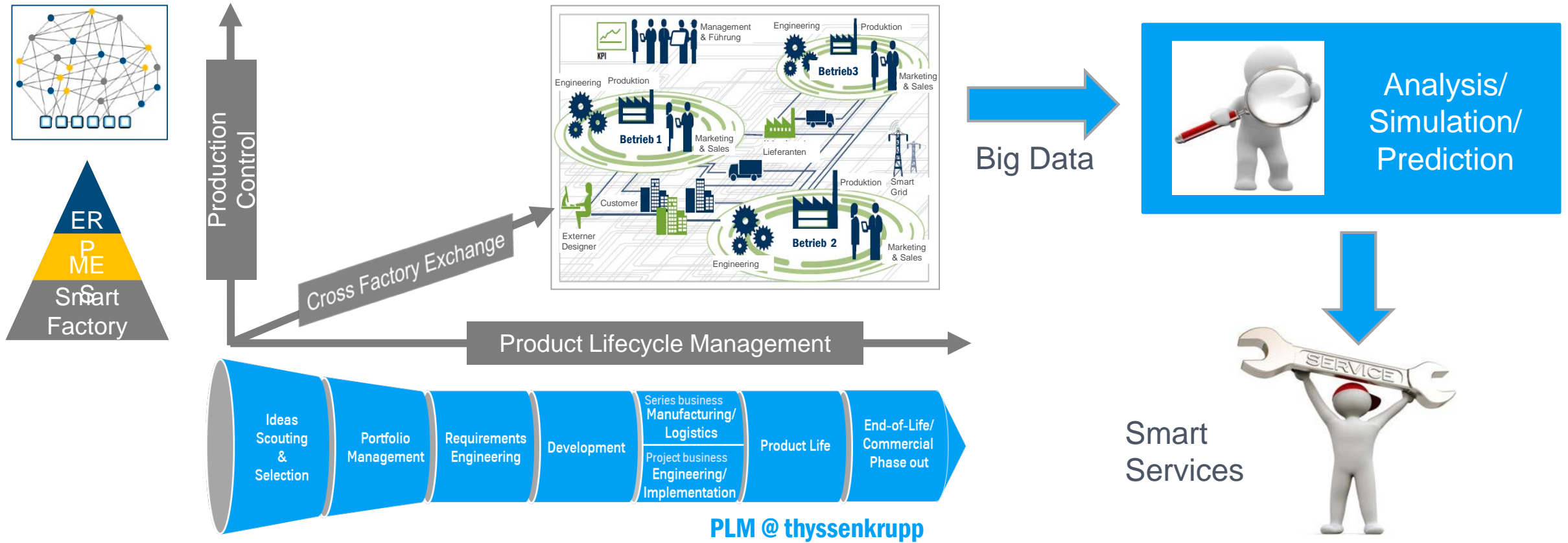
- Price prediction
- Optimize material on stock
- Predict quality of end product by analyzing production data of the parts
- Predictive maintenance
- Analyzing social media



Today we are only using a fraction of the available information.



Big Data and Predictive Analytics – better uses of already available information

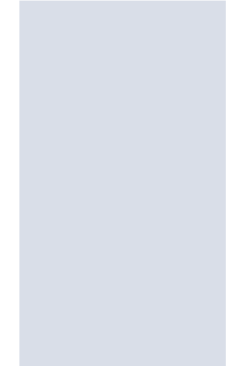
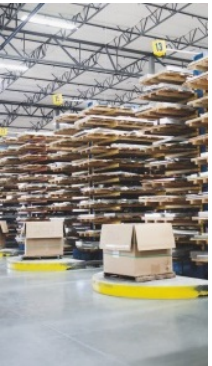


Great opportunities by utilization of the already available information/Big Data!



Example: Material Services





Optimization of stock turn





Just-in-time-delivery.

Inventory and stock management.

Supply-Chain-Management.



Optimization the use of loading and unloading slots for trucks



Example: Elevator maintenance



Example Elevator Maintenance: Big Data / Analytics

thyssenkrupp Elevator and Microsoft cooperate in data analysis



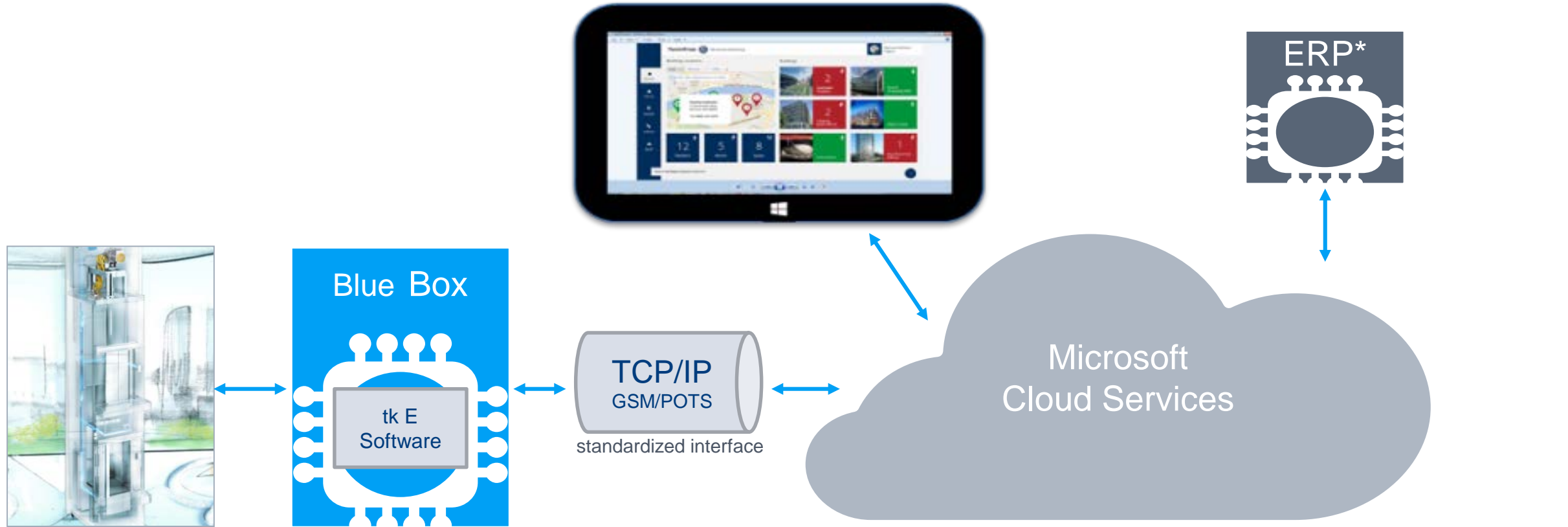
Technicians at thyssenkrupp's call center in Seoul, South Korea

Goal: Increasing the efficiency of maintenance and services for thyssenkrupp's elevators



Big Data and Predictive Analytics

Optimization of services at thyssenkrupp Elevator (MAX)



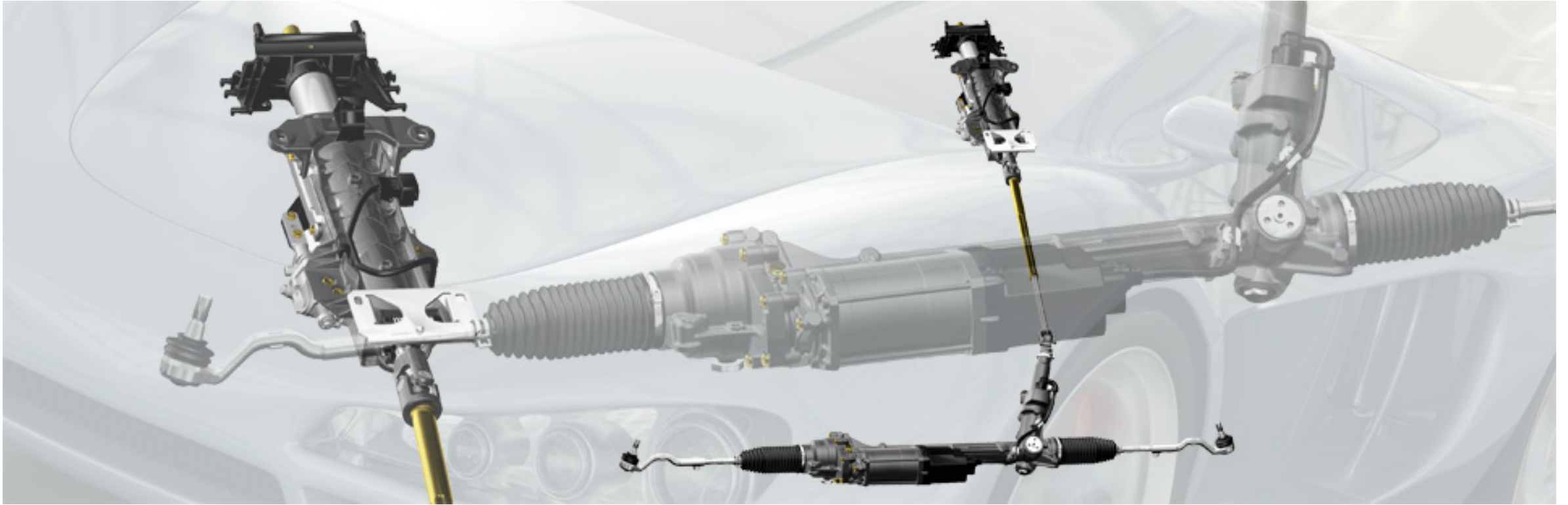
* *) ERP: Enterprise Resource Planning

Blue Box has a standardized interface to the cloud



Electrical Steering

Hardware is replaced by electric and electronic components and by software



Electrical steering is a precondition for autonomous driving



Big Data and Predictive Analytics

Example: Production of electrical steering systems



Partner:  **LYTIQ**
Microsoft understanding data

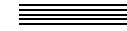
Objective: Prediction of the quality of an assembled system by analyzing the production data of the parts



Trust and Security are Preconditions

- ➔ With **Industrie 4.0** all data of a company are digitally available.
Therefore **cyber security** is a precondition.
- ➔ The extended exchange of data and information between factories or even companies requires a high level of **trust**.





INDUSTRIAL DATA SPACE ASSOCIATION

SELBSTVERSTÄNDNIS



Der IDS steht für einen sicheren Datenaustausch zwischen Unternehmen, bei dem der Erzeuger von Daten Eigentümer der Daten bleibt und die Souveränität über die Datennutzung behält. Der IDS e. V. definiert hierfür Rahmenbedingungen und Governance für eine Referenz-Architektur und Schnittstellen mit dem Ziel eines internationalen Standards.

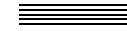
Dieser Standard wird auf Basis von Use-Cases agil entwickelt und fortgeschrieben. Er bildet die Basis für eine Vielzahl von zertifizierbaren Softwarelösungen und Geschäftsmodellen, deren Entstehung der Verein fördert.



INDUSTRIAL DATA SPACE

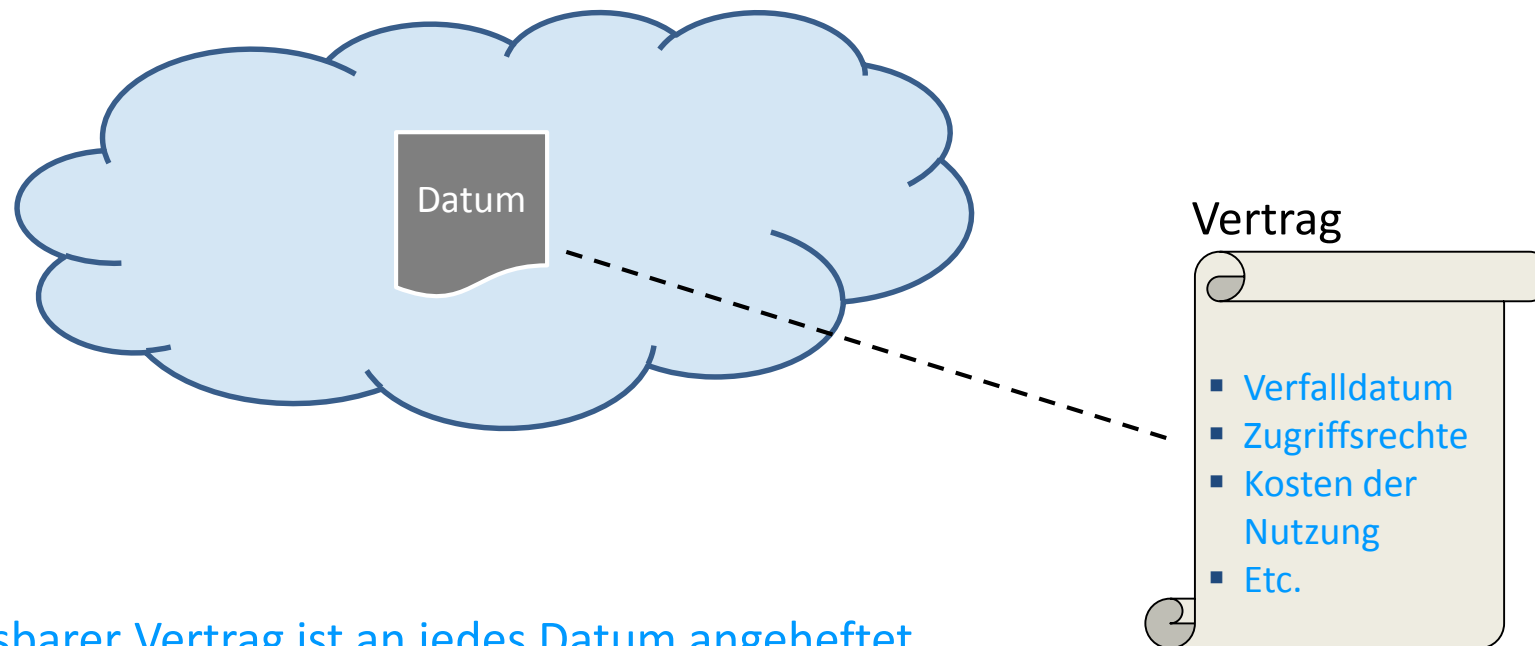
NETWORK OF TRUSTED DATA





DAS PRINZIP

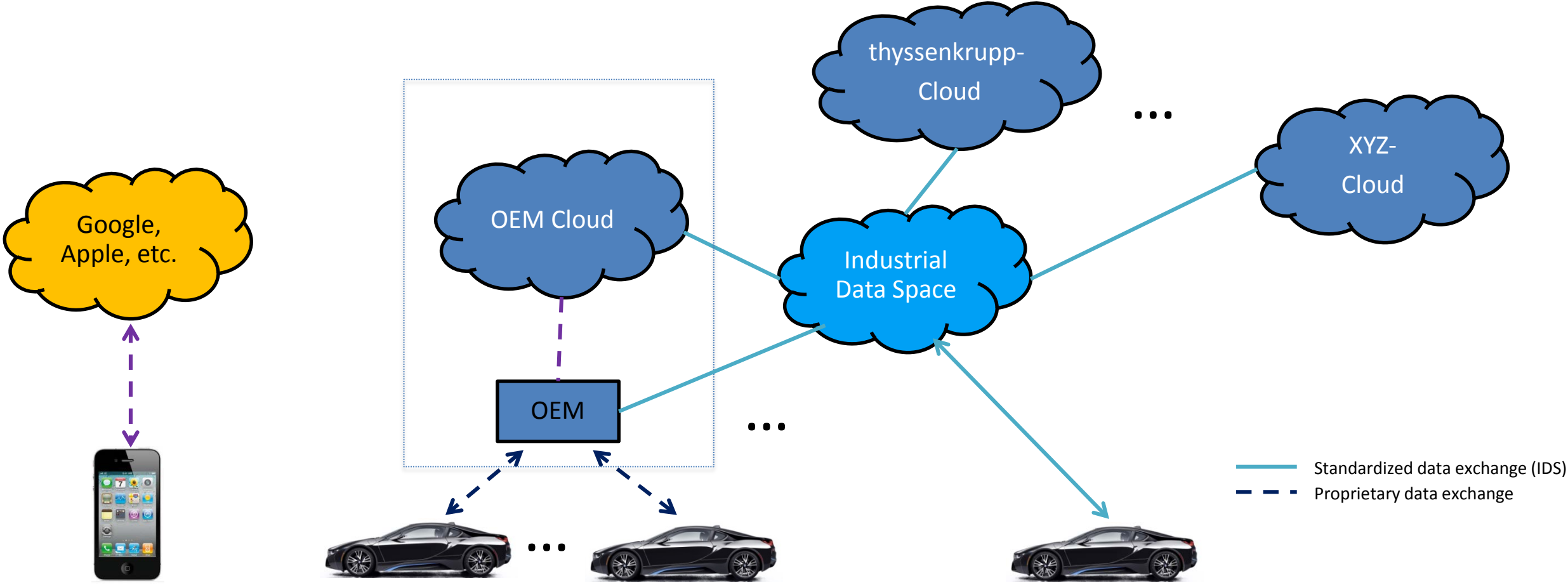
STANDARDISIERTE VERTRÄGE BESCHREIBEN ZUGRIFF UND ZULÄSSIGE NUTZUNG DER DATEN



Ein software-lesbarer Vertrag ist an jedes Datum angeheftet.



BEISPIEL EINES USE CASE: DER INDUSTRIAL DATA SPACE VERBINDET DIE CLOUDS VON INDUSTRIEPARTNERN



Digital Transformation/Industrie 4.0 creates significant challenges for enterprises and employees

Opportunities and challenges of tomorrows work place

Self-organizing
Ambiguity
Gen Y
Robot as a colleague
Complexity
Customer orientation
Work-life-balance
Resource efficiency
Ergonomic
Volatility
Quality
Security
dynamic
Efficiency
linked
Uncertainty

Industrie 4.0@HR

Qualification of the employees



Modern Leadership and company culture



Recruiting of „adequate“ employees and „skills“



New flexibility of companies and employees



Empowering and Exciting People at thyssenkrupp

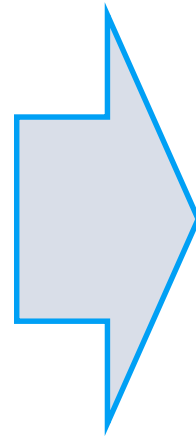


New Business Models

Today's business model



Cars are sold to the end customer



Future business model



Customer buys a mobility solution from A to B

New competitors with direct access to customer using new business models

Quellen: <http://www.pkw.de/ratgeber/auto-verkaufen/auto-verkaufen-tips/main.jpg> (links), deinewege.info (rechts)

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German Research Summit 2016 “Digitalization”

#FoGip16

Reinhold Achatz
Chief Technology Officer ThyssenKrupp AG
Keynote-Speaker beim Forschungsgipfel 2016

2016
**FORSCHUNGS
GIPFEL** Perspektiven für Wirtschaft,
Wissenschaft und Innovation

Foto: ThyssenKrupp

“Digital technologies and new business models will change all industries. The classical business have a fair chance to be the winner of the digital transformation, if they use the new opportunities proactively.”





Thank you for your attention!

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thyssenkrupp