Industrial Communication as substantial element for Automation and Digitalization

Our day-to-day operations

275,000 deliveries per month

17 warehouse locations

350 employees developing **innovative solutions**

24,000 customers and **2,000 suppliers** worldwide

20 ongoing **research projects** all over the world focusing on new technologies

1,200 active trademark rights and registrations worldwide

340 tonnes of **copper** and **steel**
200 tonnes of **plastic**
75,000,000,000 screws
per month

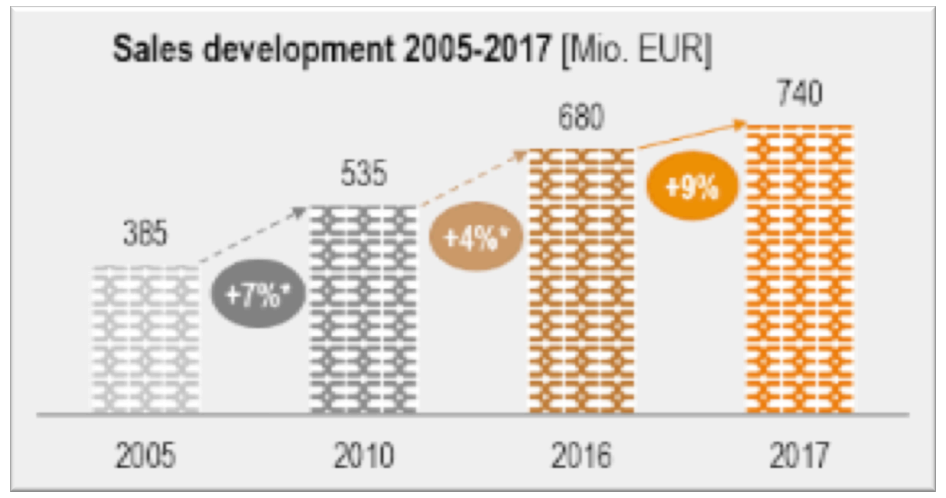
1,000 training sessions and **seminars** per year

>1,200 talented young people acquiring new expertise every year.

Weidmüller - an overview

Over
30,000
saleable **products**

Sales of EUR 820 million
in 2018



We connect **people, markets** and **sectors.**

Let's connect.

4,700 employees worldwide
6 plants,
31 sales companies and
~ **60** exclusive **agents & representatives**

Over
40 innovative products
launched on the market each year

3 divisions

Cabinet Products	Device and Field Connectivity	Automation Products and Solutions

1 global team

Family-owned since **1850.**
Re-established in **1948** in **Detmold.**

Connectivity & automation partner
for a cyber-physical industrial world

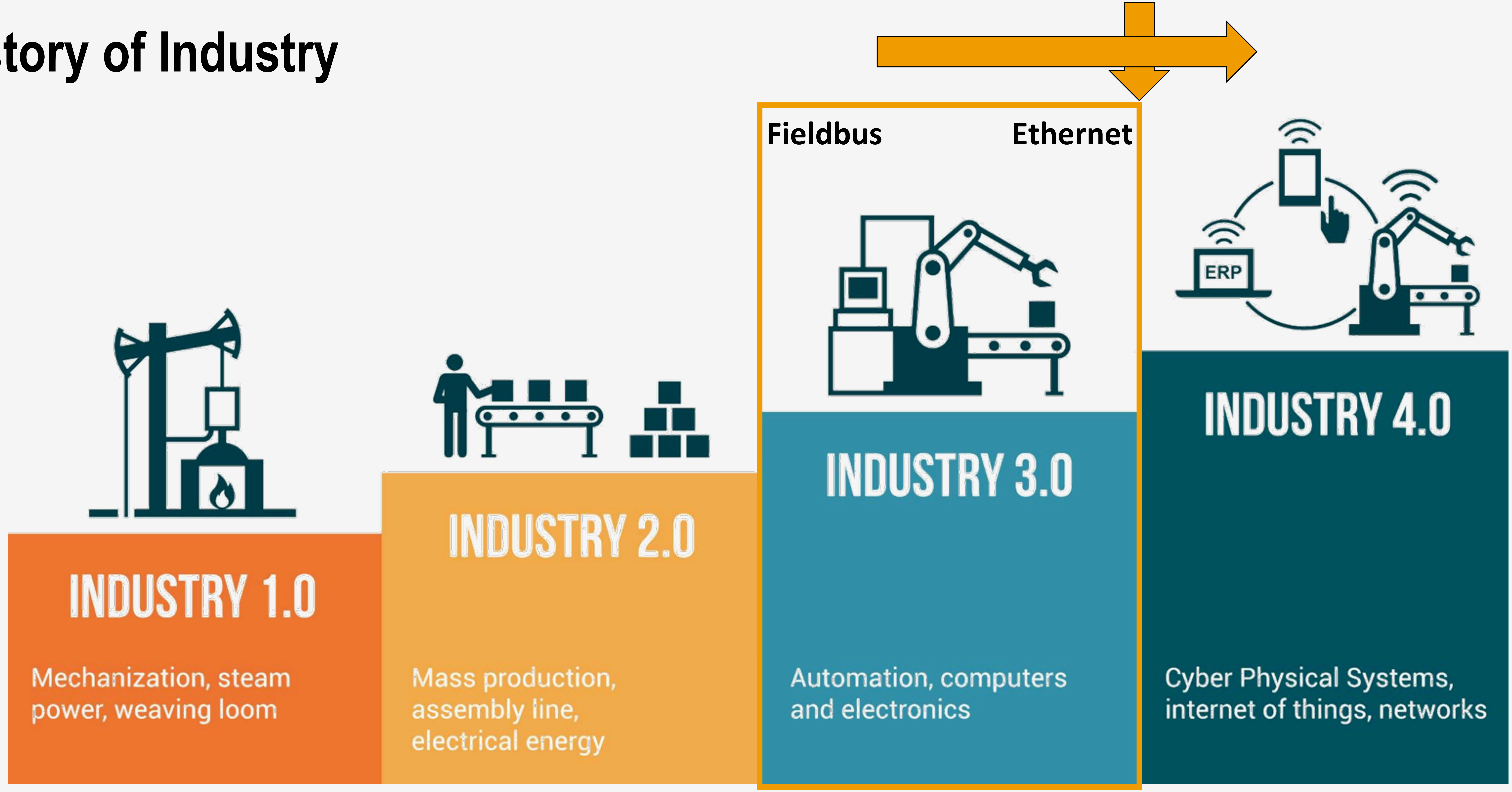
Presenter

- Sebastian Stelzer
- Product Manager Industrial Ethernet and IoT
- At Weidmüller since 2011
- M.Sc. Industrial Engineering and Management Electronics

Storyline

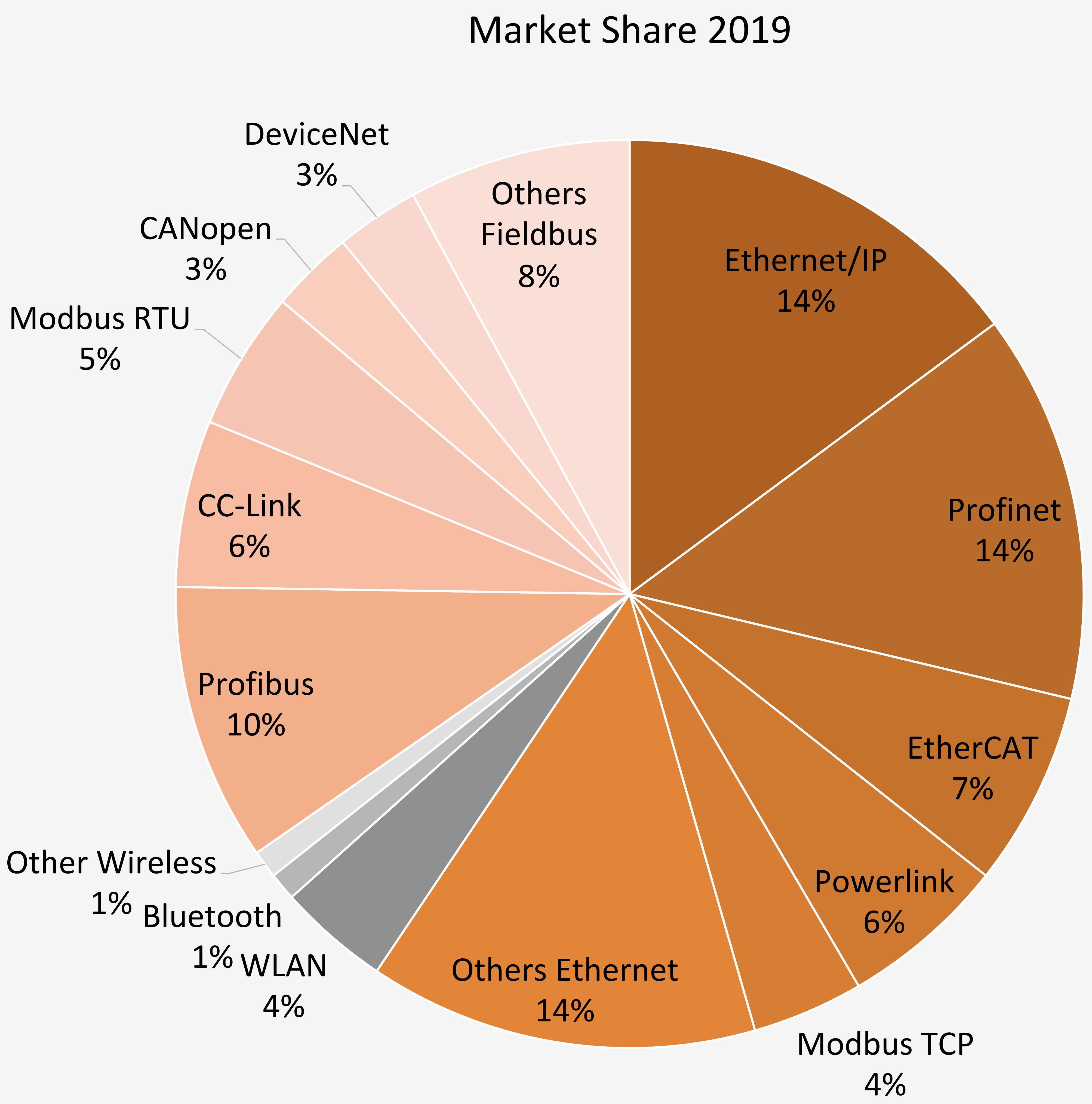
- History Networking
- Actual figures
- IoT – use-cases
- IoT-Topology
- IE as central element
- Trends
  - SPE
  - 5G
  - TSN
  - OPC UA
- Weidmüller offers

History of Industry



http://blogs.brighton.ac.uk/thedigitalrevolution/2018/04/03/uk-preparing-students-fourth-industrial-revolution/

Industrial Ethernet Market Share



Ethernet is now covering ~60 % of new installed Nodes

Already?

Only?

There are use-cases where it makes no sense to change to Industrial Etherent

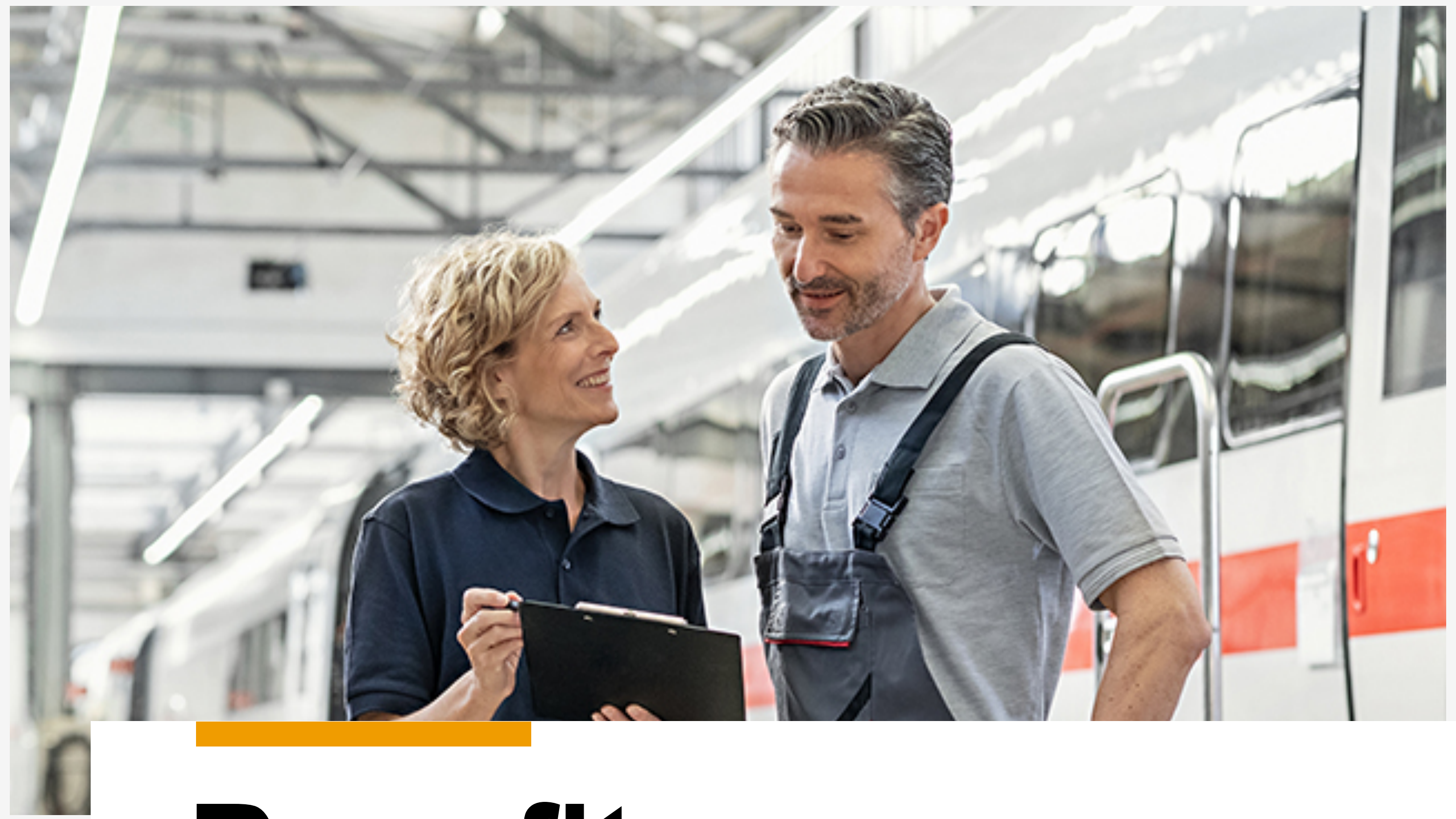
Source: HMS Industrial Networking

The real reason behind the development

„Nobody does automation only for the sake of doing automation.

The same applies to IoT“

Creating added value through Industrial IoT



Benefits

- Optimised efficiency
- Business model innovations
- OPEX reduction
- and much more

Use cases

- Predictive maintenance
- Overall equipment effectiveness
- New service models
- and much more

Use-cases for Industrial IoT

Industrial IoT

Managing machines and systems
Asset management

Monitoring machine conditions
Condition monitoring

Energy management

Connecting systems with servers or clouds
Connectivity

Remote access to machines and systems
Remote maintenance

Supporting machine commissioning
Commissioning

Visualising machine conditions
Cockpits/dashboards

Monitoring product quality
Predictive quality

Automatically detecting machine errors
Anomaly detection

Monitoring overall equipment effectiveness
Overall equipment effectiveness OEE

Performing predictive machine maintenance
Predictive maintenance

Use-cases for Industrial IoT

Connecting systems with servers or clouds
Connectivity

Data Analytics and Business Logic

Data Communication

Data Preprocessing

Data Acquisition

Digital Machine Interface

Additional Sensors

Supporting machine commissioning

Cockpits/dashboards

Overall equipment effectiveness OEE

Predictive maintenance

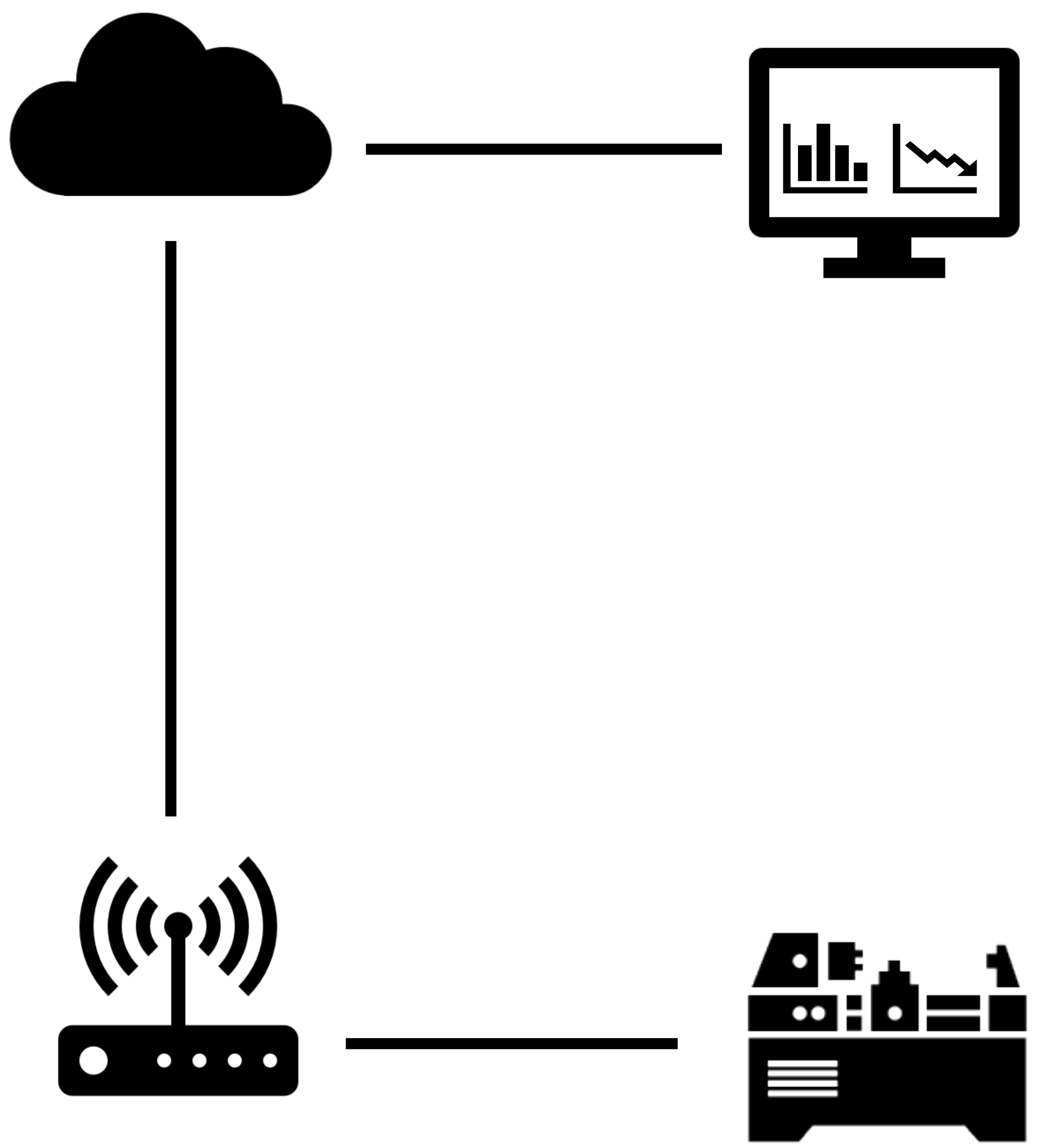
Use case – machine/system connection to the cloud

Initial situation

As a machine manufacturer or system operator, I want to:

- Connect machines to an existing IoT platform or service platform
- Be able to directly connect new machines and upgrade existing machines
- Develop a new IoT platform or service platform and offer special services

Architecture



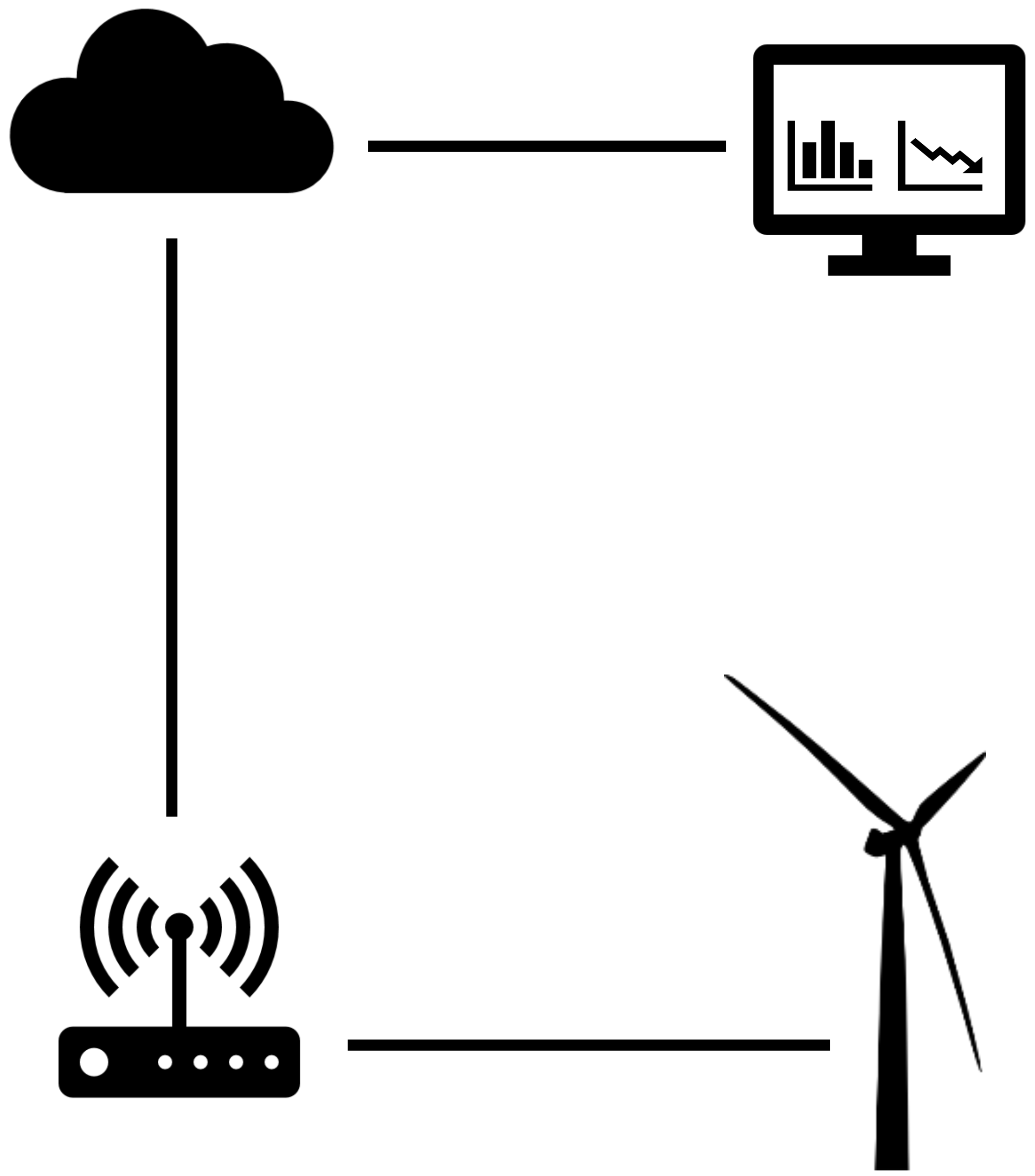
Use case – blade control as service

Initial situation

As a manufacturer or operator of wind power installations (WPI), I want to:

- Be able to see information or the condition of the rotor blade quickly and remotely
- Continually monitor the condition of every single rotor blade
- Improve the profitability of the whole WPI
- Reduce the downtime of the WPI

Architecture



Use case – predictive maintenance

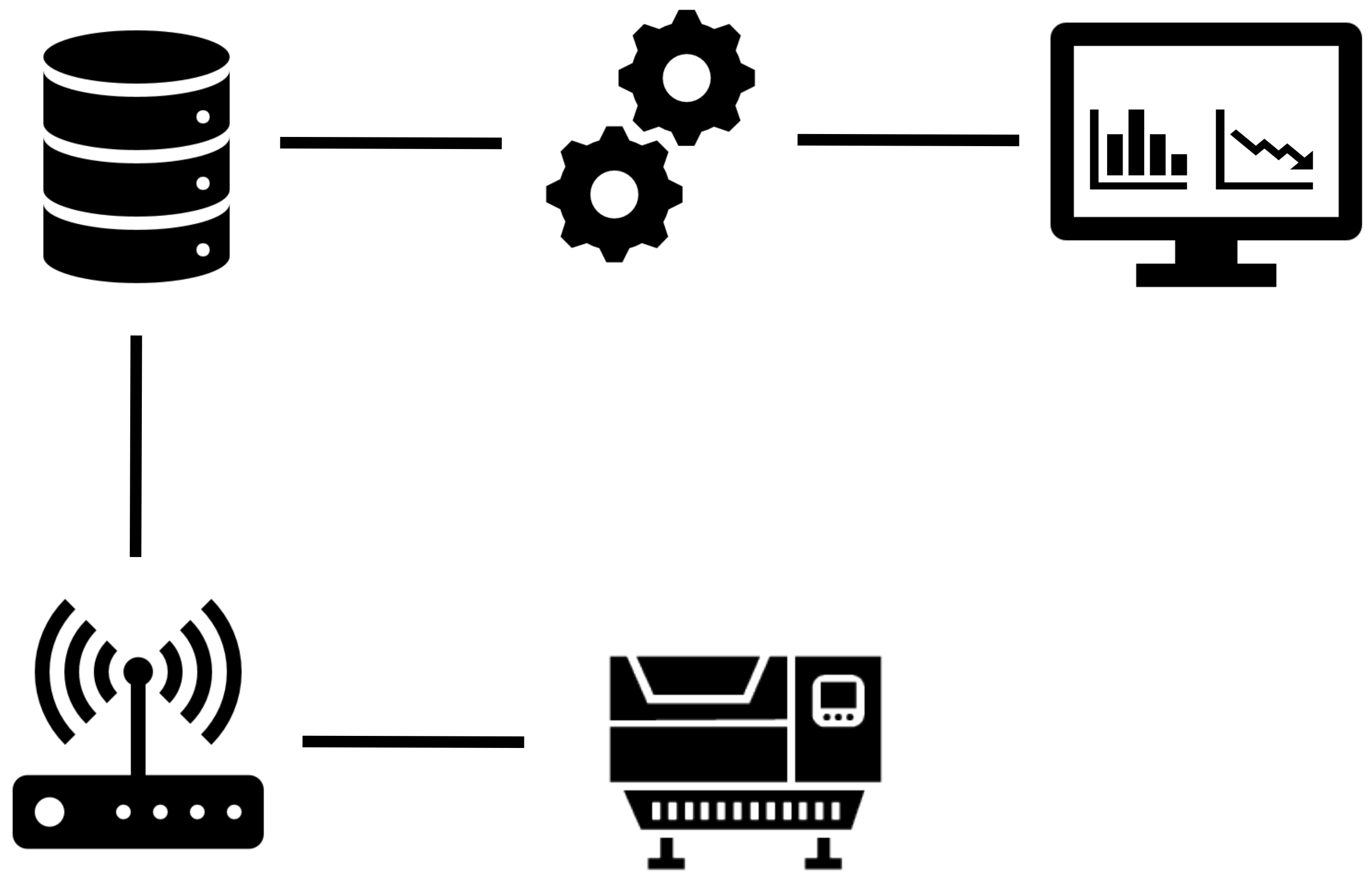
Initial situation

As a machine manufacturer,

I want to:

- Plan maintenance work based on specific requirements (not based on intervals)
- Provide my production-based customers with information on any impending machine failures

Architecture



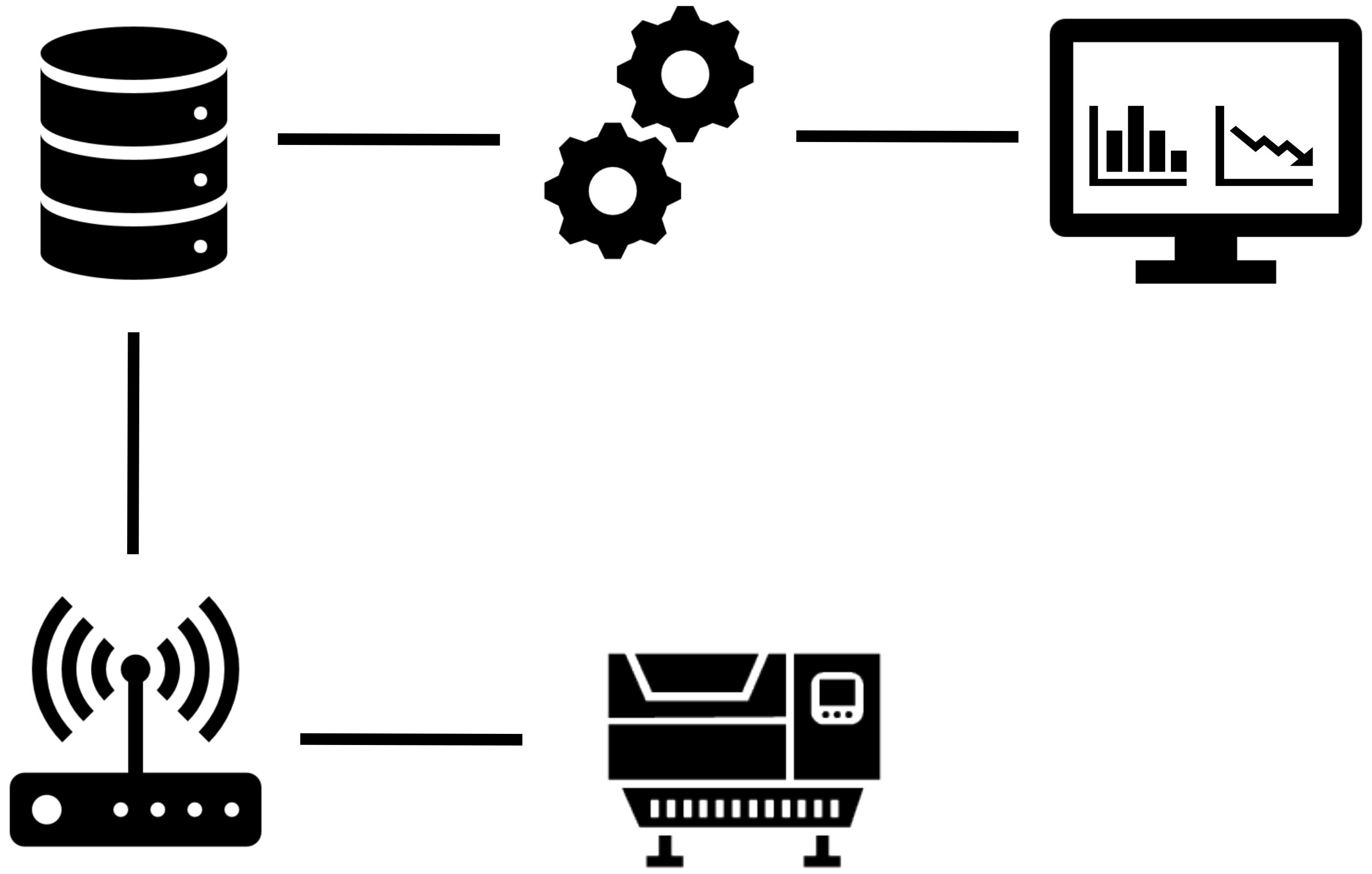
Use case – in-process quality monitoring

Initial situation

As a machine manufacturer, I want to:

- Make statements regarding the quality of the process
- Be able to make statements regarding process deviations
- Be able to make predictions regarding future quality deviations

Architecture



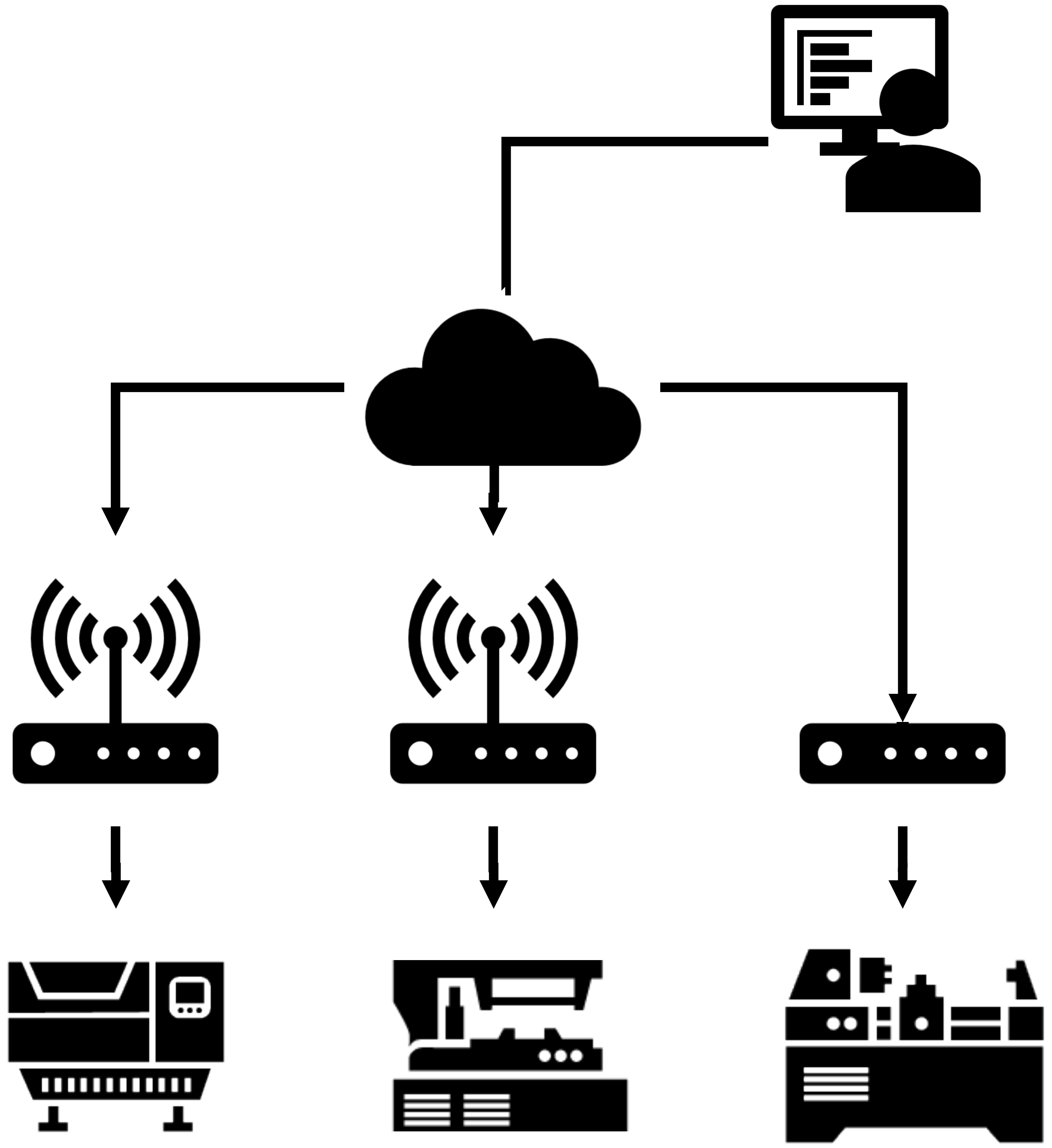
Use case – remote maintenance on machinery/systems

Initial situation

A machine manufacturer or system operator wants to be able to do the following in the event of a (predicted) error:

- Remotely access the machine or system in order to make modifications
- Support the operating company's on-site service team

Architecture



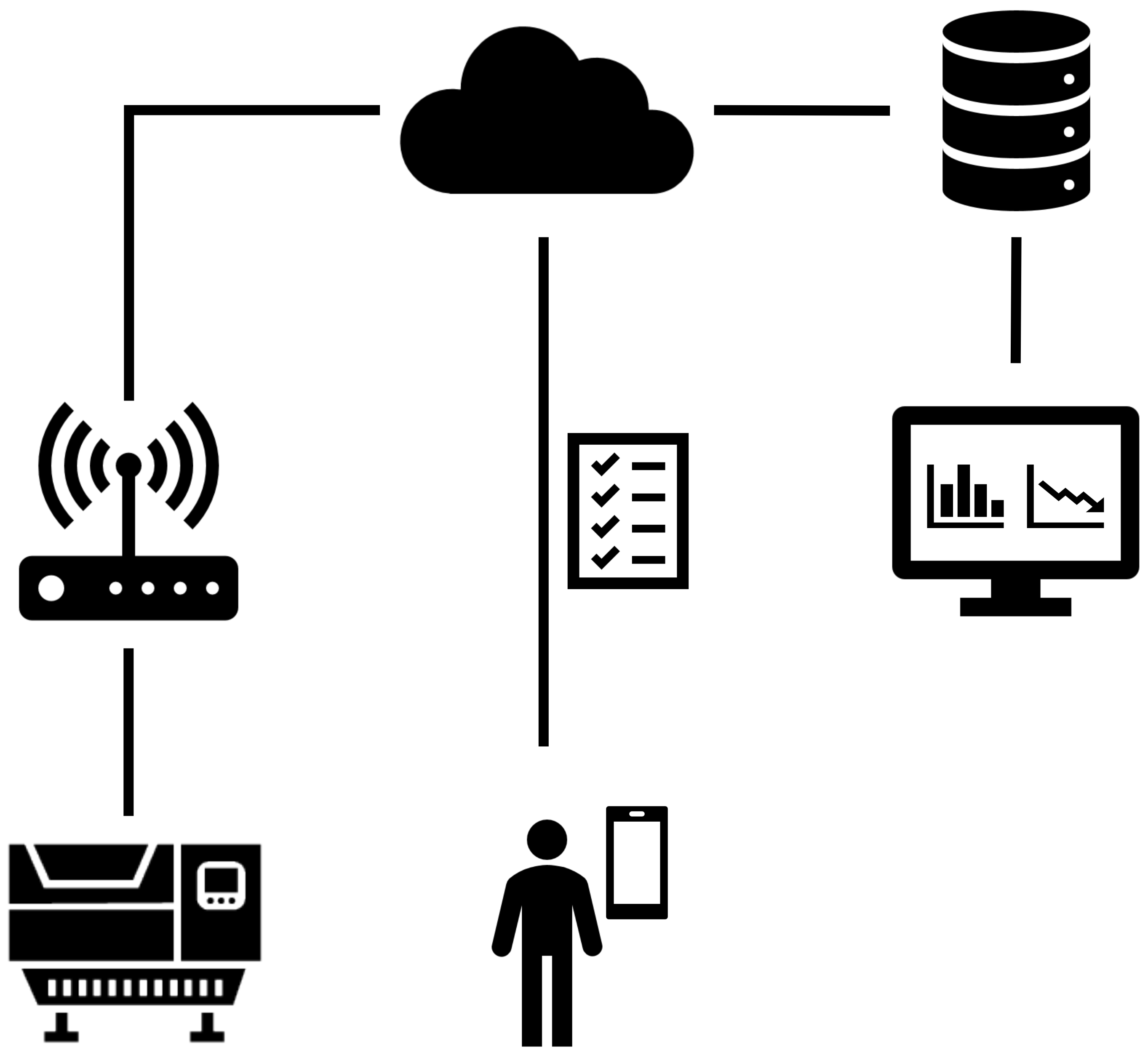
Use Case – IoT Serviceplattform

Initial situation

As a machine manufacturer, I want to:

- Offer my customers a service that meets their needs.
- Implement more efficient service planning and processing.
- Offer new service models.
- Improve customer retention.

Architecture



Many roads lead to Rome….

» **Acquire sensor and actuator data**
Development of parallel data structures

» **Capture control data**
Direct access to the running PLC

» **Using Cloud infrastructures**
Transmit data to a cloud platform

» **Using own infrastructure**
Perform IoT on Edge or on a local server

Core functions of data-driven services

Despite the differences between the various use cases, the technical implementation of Industrial IoT solutions is essentially based on a few core functionalities

- Data acquisition
- Data pre-processing
- Data communication
- Data analysis & business logic

Data pre-processing

Dedicated components for data pre-processing and data communication

PLC‘s

- Simple programming of control and IoT applications through web browser
- Use of u-remote sensor / actuator modules
- Node-RED with graphic programming
- Range of predefined functions through open community
- IEC 61131-3

IoT Gateways

- Universal Edge Gateway with mobile communication connection LTE
- Node-RED
- Access to controls and sensors with diverse interfaces.
- Web-based

Edge PCs

- High performance through the latest processors and SSD technology
- PCI/PCIe interfaces for fieldbus cards
- Simple integration of additional resource management and visualisation solutions

Data communication

Comprehensive range of industrial data communication solutions

Gateways

- Conversion between Ethernet and serial modbus

Switches

- Data communication of ethernet-enabled devices
- Unmanaged and managed for flexible use
- Fast Ethernet and Gigabit

Routers

- Separation of different networks
- Powerful & secure with integrated firewall
- Stable connection with 4G / LTE
- Remote access via VPN

Industrial WLAN

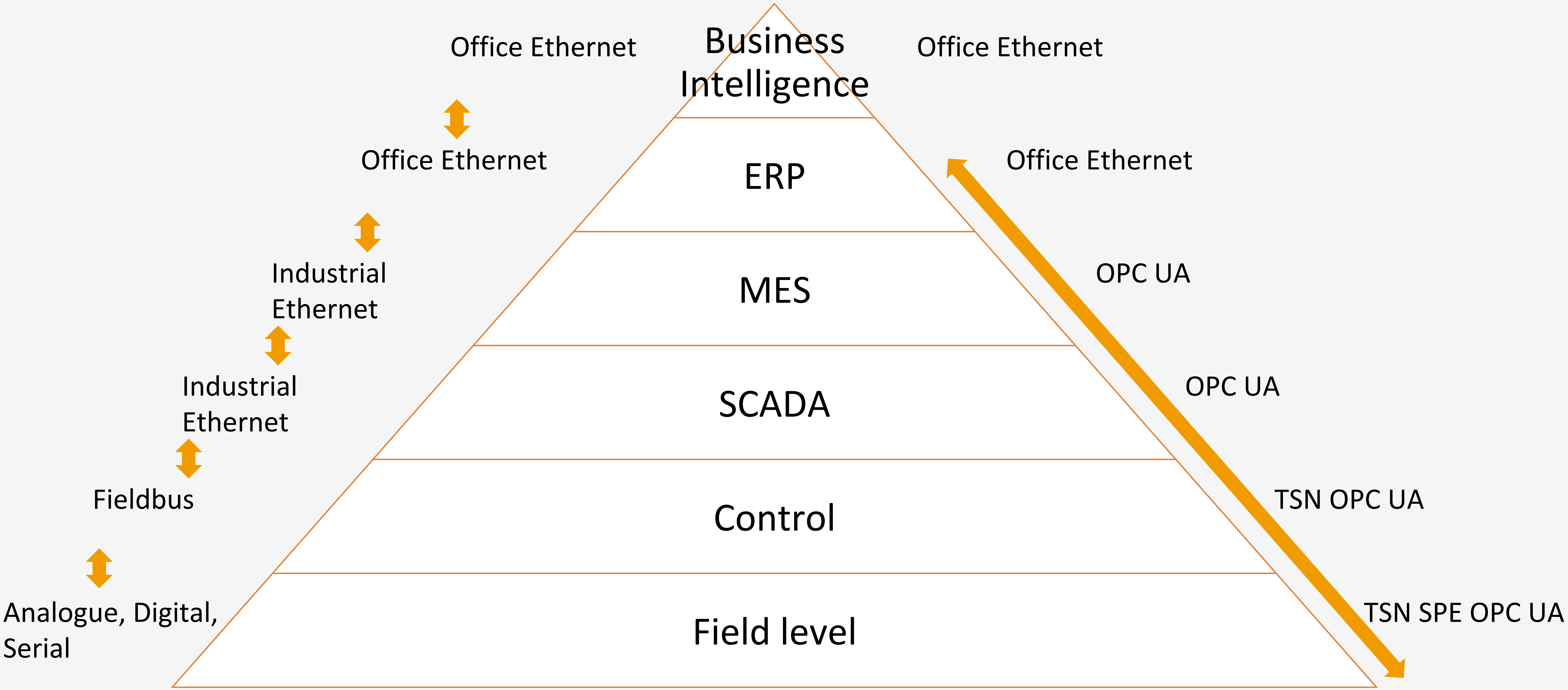
- Wireless integration of devices into a network
- Service access for mobile devices
  (e.g.. smartphones/ laptops / etc.)

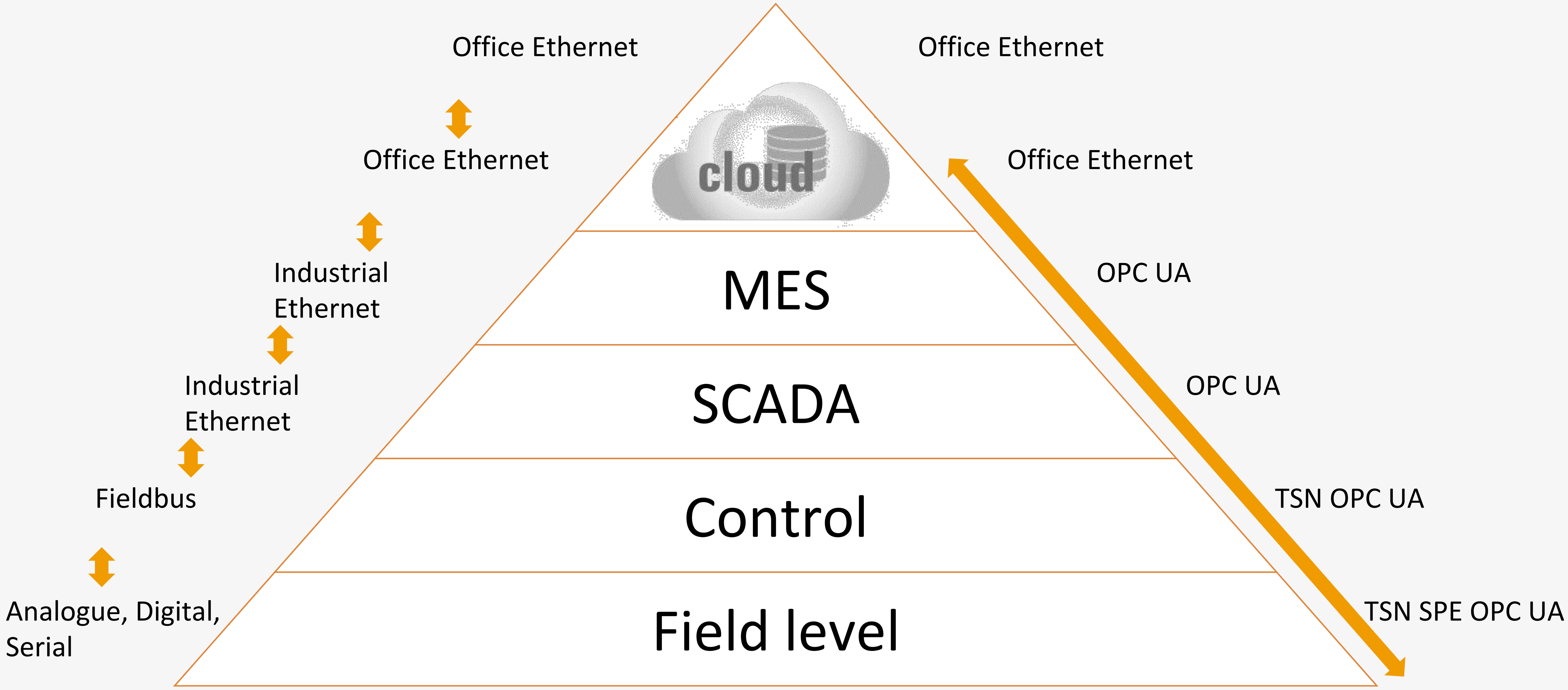
Remote access

- Remote access and maintenance
- Rapid and secure access to machines and systems
- Simple and comprehensive administration
- Rights and firmware management

The real reason behind the development

„The enabling factor for Industrial IoT is easyness. This requires consistency of technology“


Office Ethernet
Business Intelligence
Office Ethernet
Office Ethernet
ERP
Office Ethernet
Industrial Ethernet
MES
OPC UA
Industrial Ethernet
SCADA
OPC UA
Fieldbus
Control
TSN OPC UA
Analogue, Digital, Serial
Field level
TSN SPE OPC UA


Office Ethernet
Office Ethernet
Industrial Ethernet
Industrial Ethernet
Fieldbus
Analogue, Digital, Serial
cloud
MES
SCADA
Control
Field level
Office Ethernet
Office Ethernet
OPC UA
OPC UA
TSN OPC UA
TSN SPE OPC UA

a

Ethernet
Modbus

Ethernet
Remote I/O
Modbus

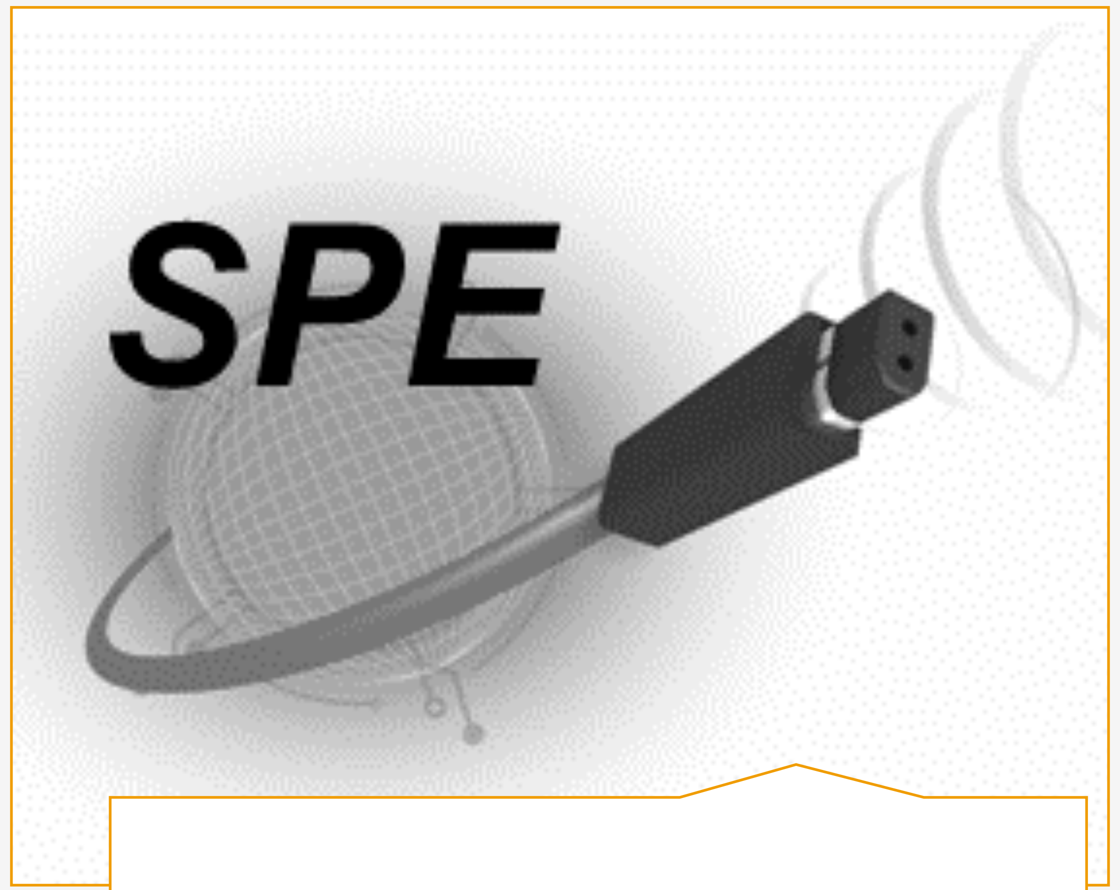
Ethernet
Foundation FB
ControlNet
DeviceNet
Profibus
Sercos I & II
AS-Interface
Interbus
FIP
CC-Link
CANopen
Remote I/O
Modbus

Safety Networks
Sensor Netoworks
WLAN
Bluetooth
OPC
BACnet IP
Sercos III
Profinet IO/RT/IRT
EtherCAT
Powerlink
CC-Link
FF HSE
Ethernet/IP
FL-net
Modbus TCP
BACnet MSP
Foundation FB
ControlNer
DeviceNet
Profibus
Sercos I & II
AS-Interface
Interbus
CC-Link
CANopen
Modbus

WLAN
Bluetooth
OPC UA
TSN

Trends in industrial communication

Time Sensitive Networking



Single Pair Ethernet

OPC Unified Automation

5G Cellular communication

https://www.it-production.com/allgemein/erster-tsn-ethernet-switch-von-moxa/

https://www.lanline.de/neue-standards-fuer-single-pair-ethernet/

http://mdenetwork.com.ar/2017/05/12/la-importancia-de-opc-en-la-construccion-de-una-industria-4-0/

TSN

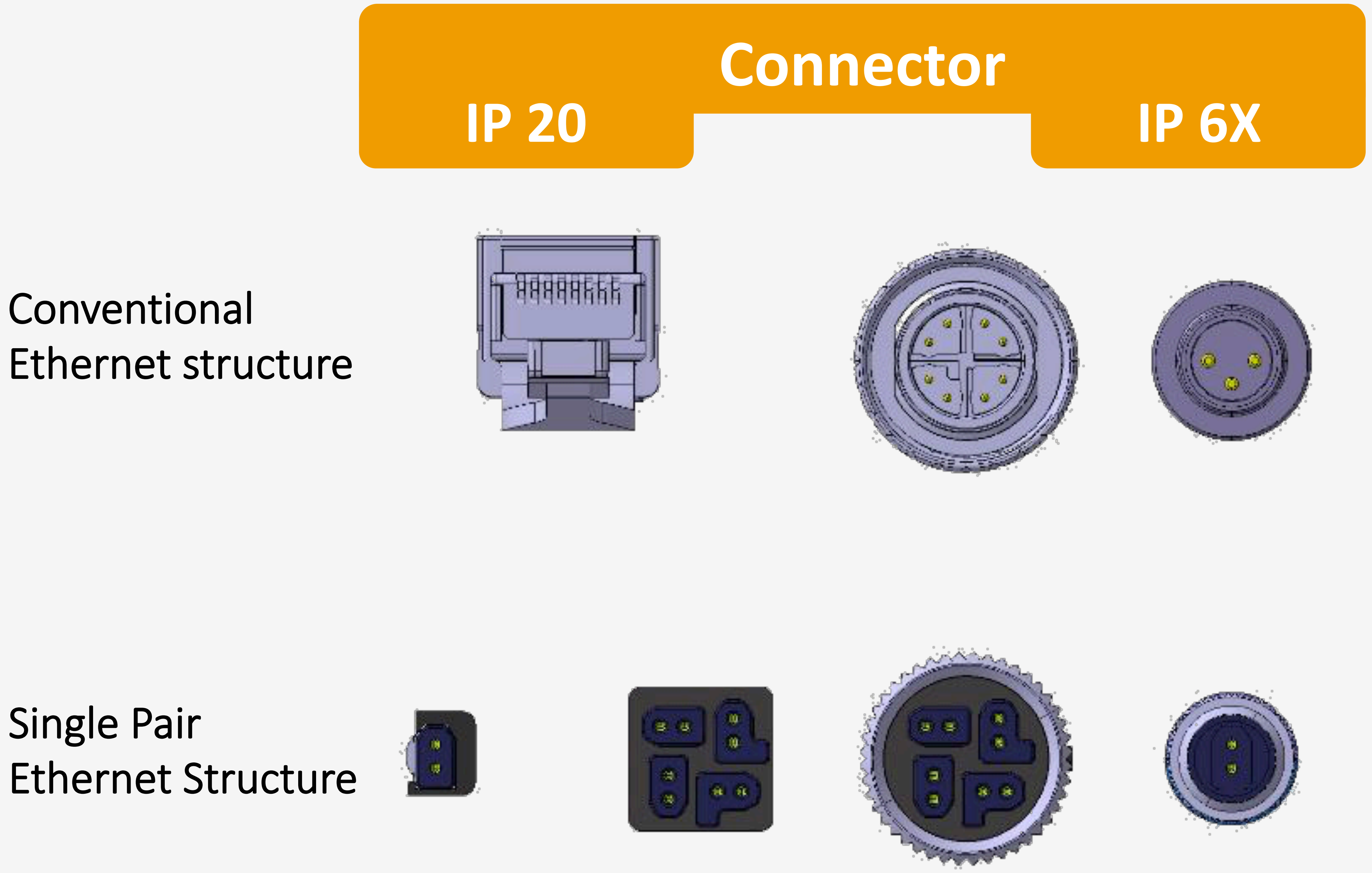
SPE

» **Miniaturization for small field devices**
Less that ¼ of an RJ45 connector

» **High transmission distance**
Up to 1 km necessary in Process Industry

» **Variable Bandwidth**
From 10 Mbit to 10 Gbit – ready for all use cases

» **Cost savings**
Less wiring and assembly of connectors



OPC UA

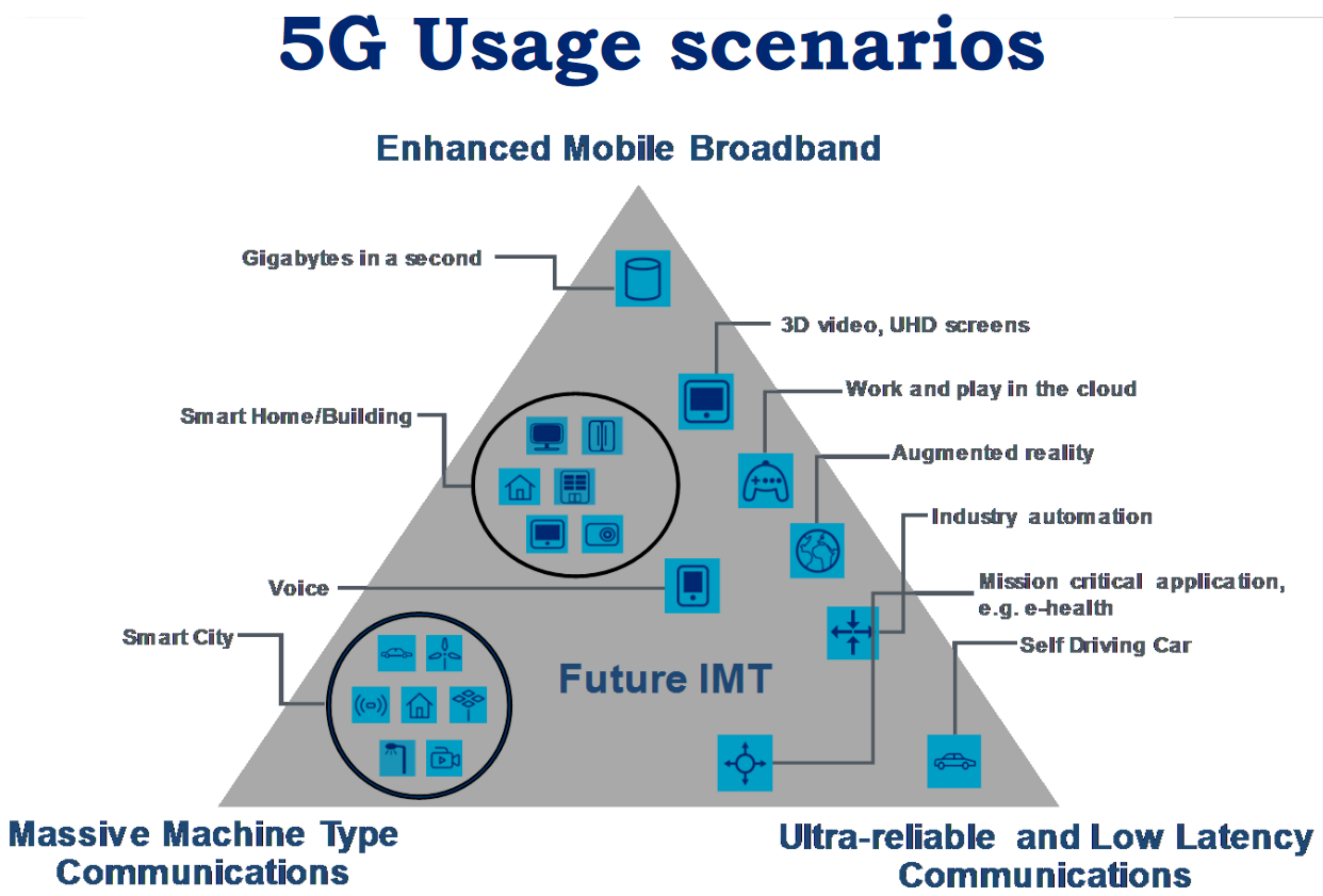
Data communication via 5G

We are already working on the technologies of tomorrow today.

5G

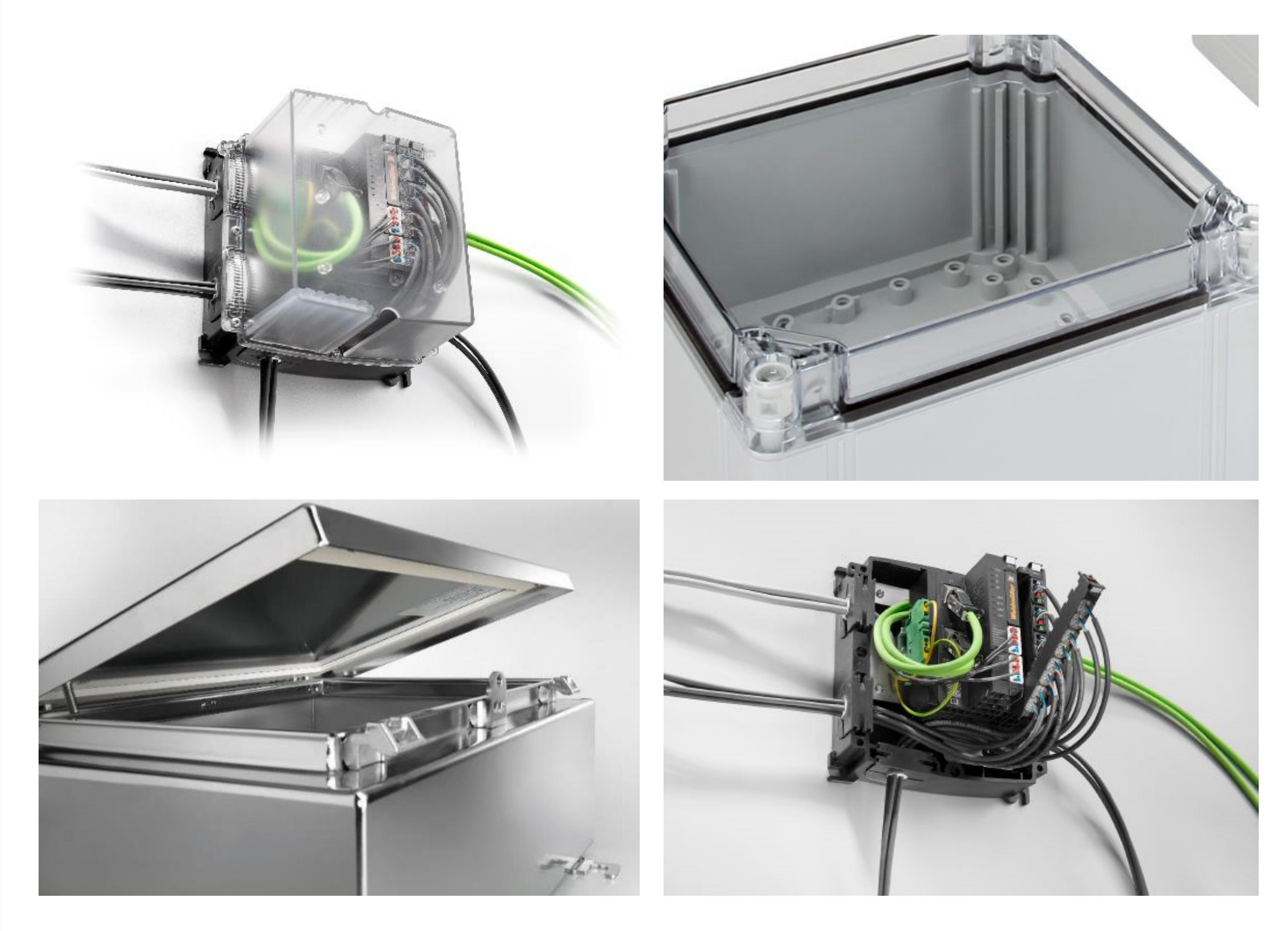
Committed to the development of 5G solutions

Data communication via 5G



We gain experience from our own in-house production

Engineering solutions: comprehensive range of housings with high level of flexibility



With a range of different housing concepts, we can provide you with the right basis for your individual Industrial IoT (retrofit) box

Service package

Your service partner

We will accompany you on your path to the Industrial IoT

The product range is accompanied by customer-oriented services

- **Application engineering**
  Support in the creation of applications
- **Electrical design**
  Electrical design of your individual solution
- **Connectivity consulting**
  Concept development for the optimisation of processes, applications and control cabinets

Weidmüller

Visit us at A11
Let's connect!

The basis of our Industrial IoT offer

Data acquisition

Wide range of hardware for data acquisition and signals in the field:

u-remote

- Acquires sensor signals and controls actuators
- Communication modules e.g. for RS232, RS485, IO-link
- Perfect interaction with u-control and IoT Gateway

Energy meter

- Measures the energy consumption in detail
- Determines energy quality
- Analyses the currents of all connectors

Signal converters

- Converts, measures and separates signals securely and precisely
- Measurement of DC and AC currents
- Condition monitoring & diagnosis

IoT terminal

- Acquires analogue and digital signals
- Transmits the acquired data via Narrowband IoT into the cloud

- Under development -

Power Mgmt.

- Powers machines and systems with 24 V / 48 V
- High overload capacity for short-term current demands
- Electronic fuses
- Enables smart grid systems to be established
- Able to communicate

Data analysis | software

u-create
data hub

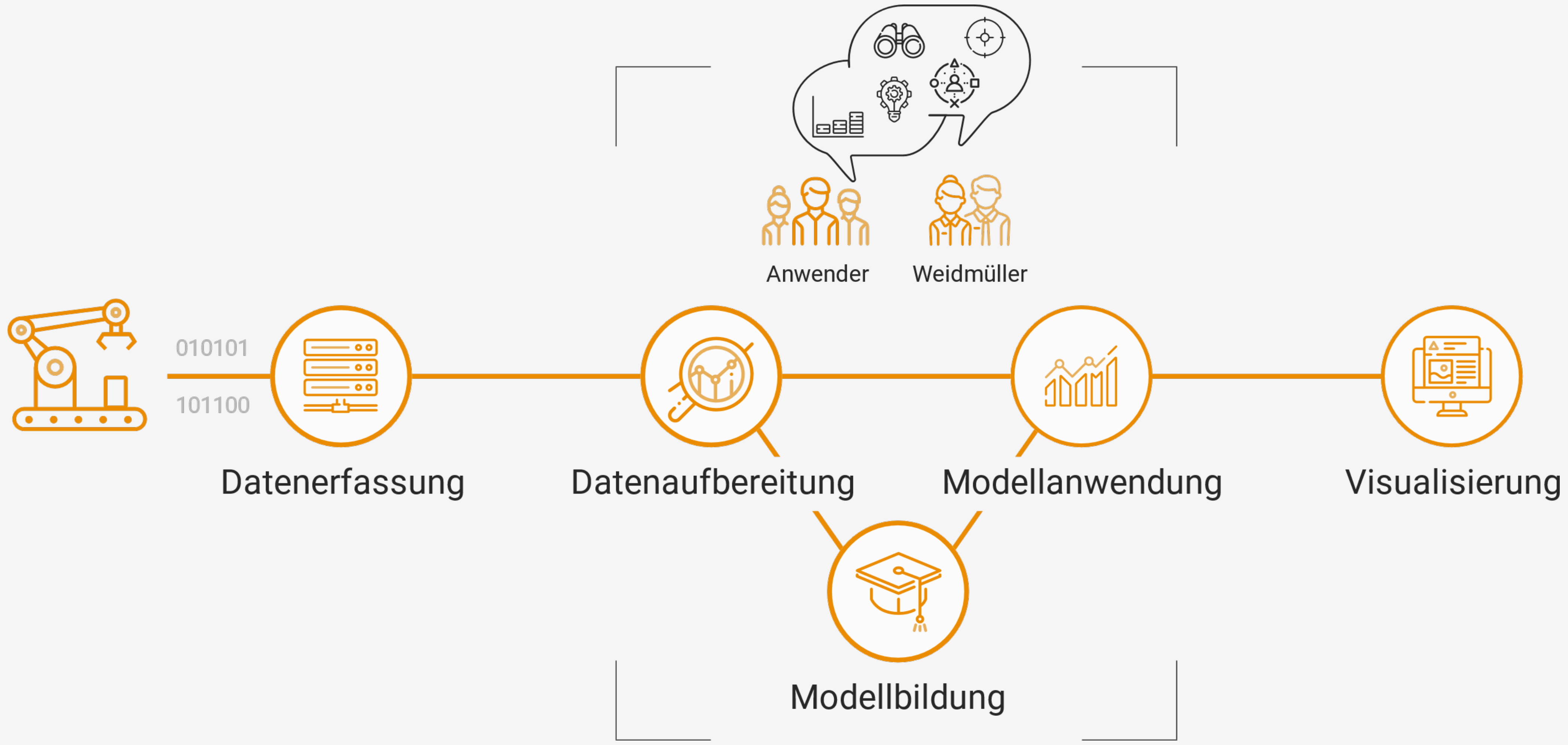
u-create
ResMa

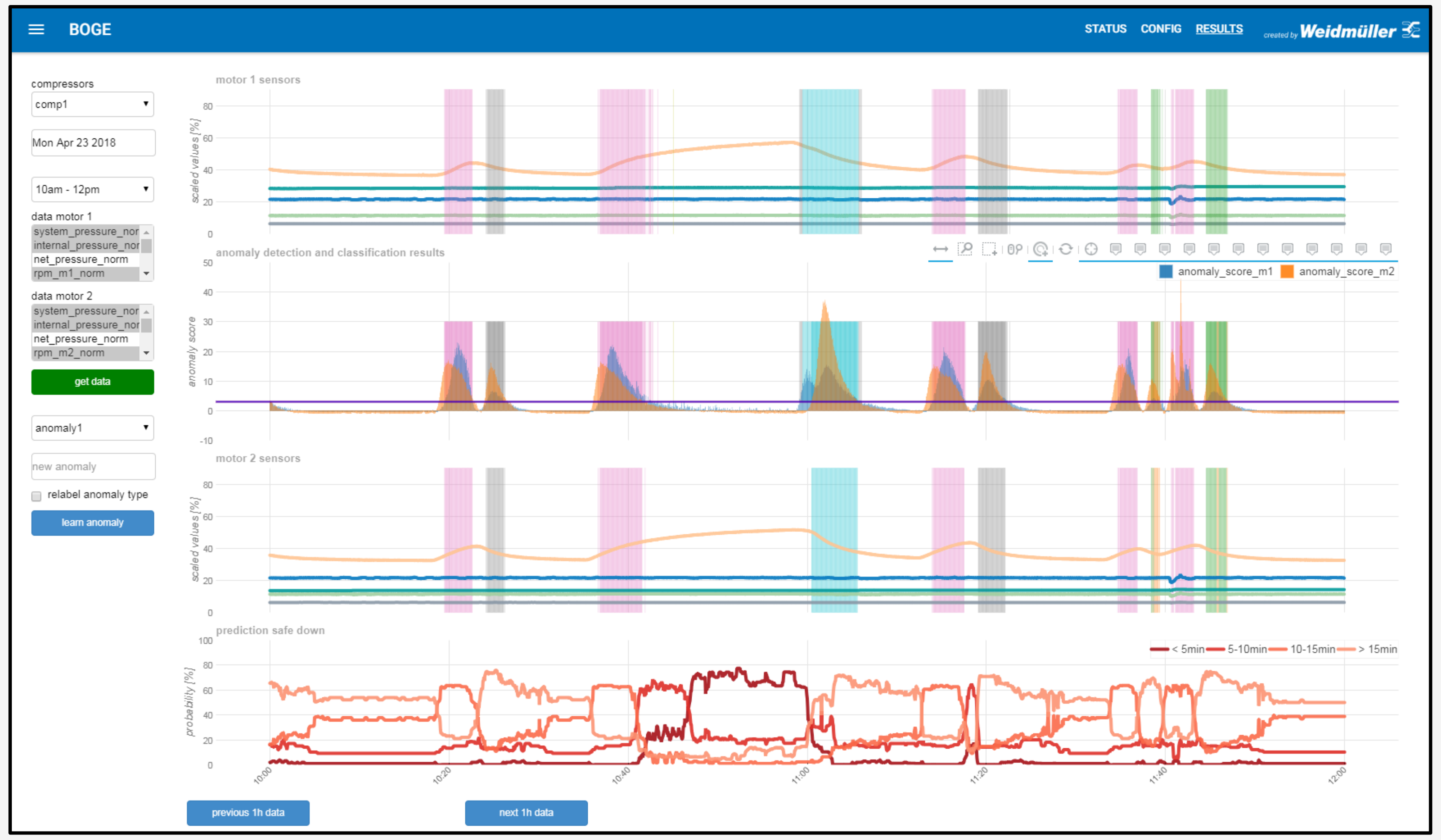
u-create
visu

Data analysis | Industrial Analytics

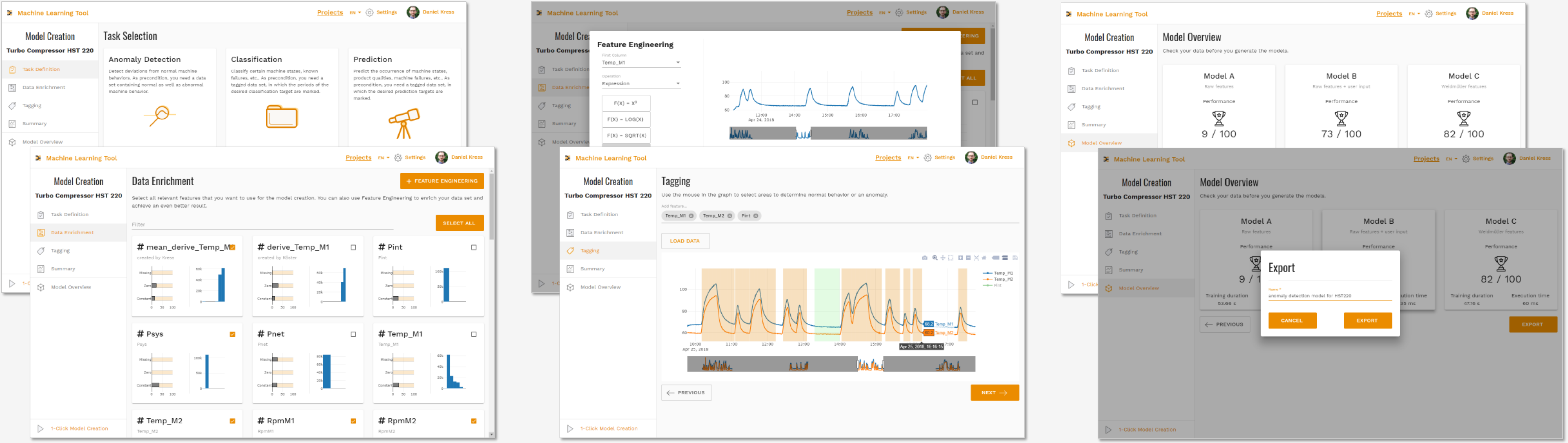
We develop your Industrial Analytics solution together with you

- **Anomaly detection:** detect anomalies in your machine to prevent failures
- **Classification:** identify causes of anomalies that have occurred
- **Predictive maintenance:** recognise when a machine failure threatens to occur
- **Predictive quality:** quality forecast of the parts manufactured in the machine





Industrial Analytics | Assisted creation of models using AI



- Use **anomaly recognition, classification** and **prediction** with artificial intelligence simply for your own machine
- A **Data Science Assistant** leads through the model creation process
- The models can be operated immediately with the **execution environment**
- **Independent development** of the models over the life cycle

Cloud service platforms

Basis for your individual data-driven services

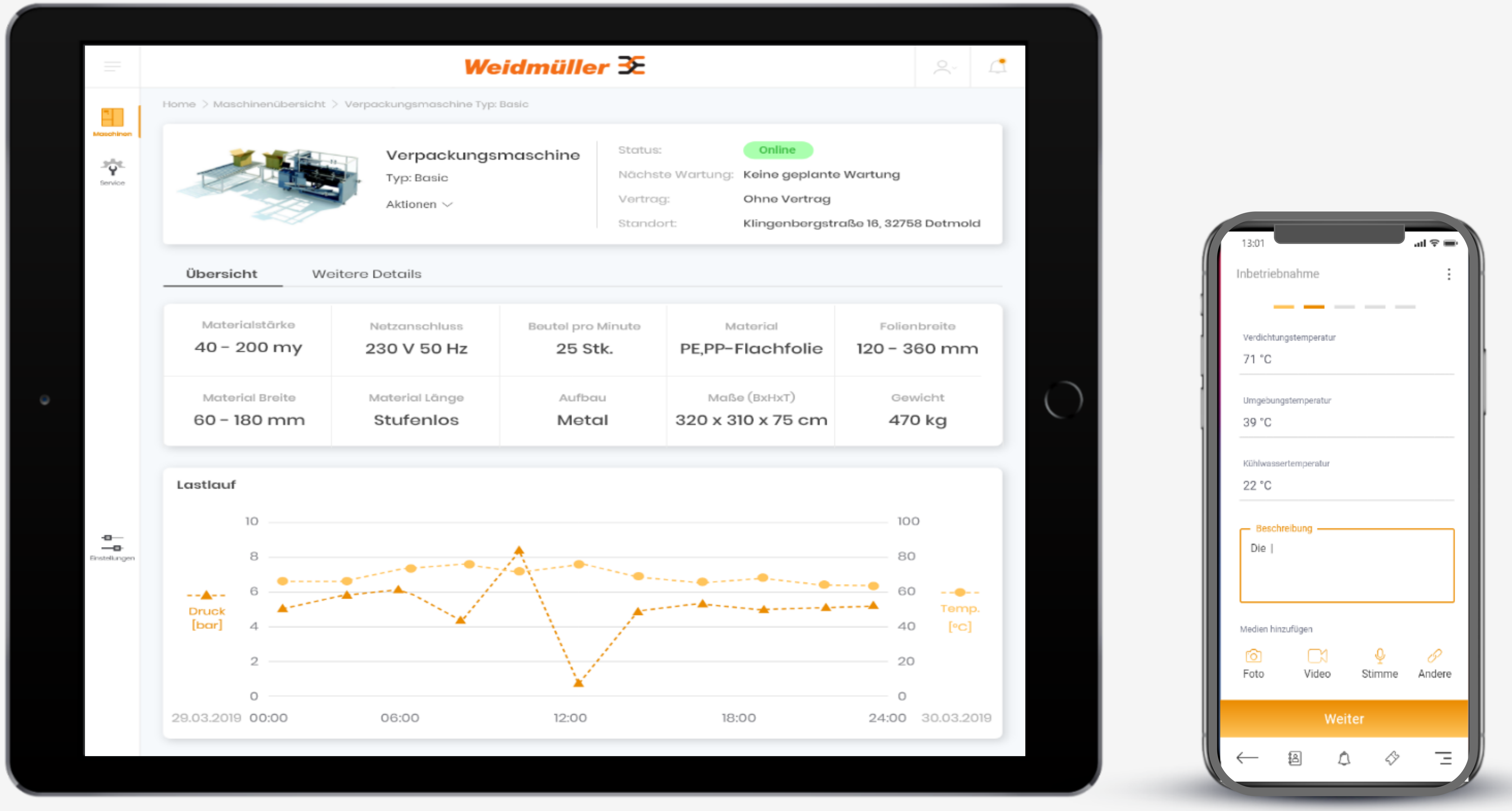
Your platform for new business models

Cloud service platforms

Front-end design
Service portal, dashboards, customised applications, …

Platform design
Back-end services, data services, …

Agile system development
User journey, epics, sprints, …



Data-driven services use your data to create added value

Condition monitoring

Continuous observation of signal values.

Overall Equipment Effectiveness (OEE)

Continuous improvement of system utilisation

Predictive maintenance

Detect errors before they occur

Energy management

System solution for the reduction of energy costs

We work with you to develop concrete application scenarios

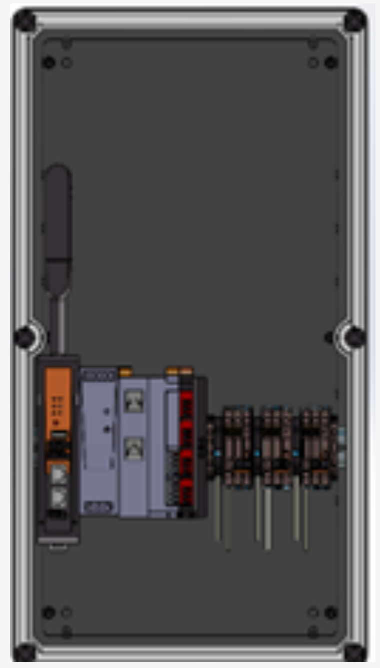
Driven by our customers' requests

Weidmüller has a number of renowned customers, and we work together with these customers to develop individual Industrial IoT solutions.
Here are just some examples…

Energy data
Continental

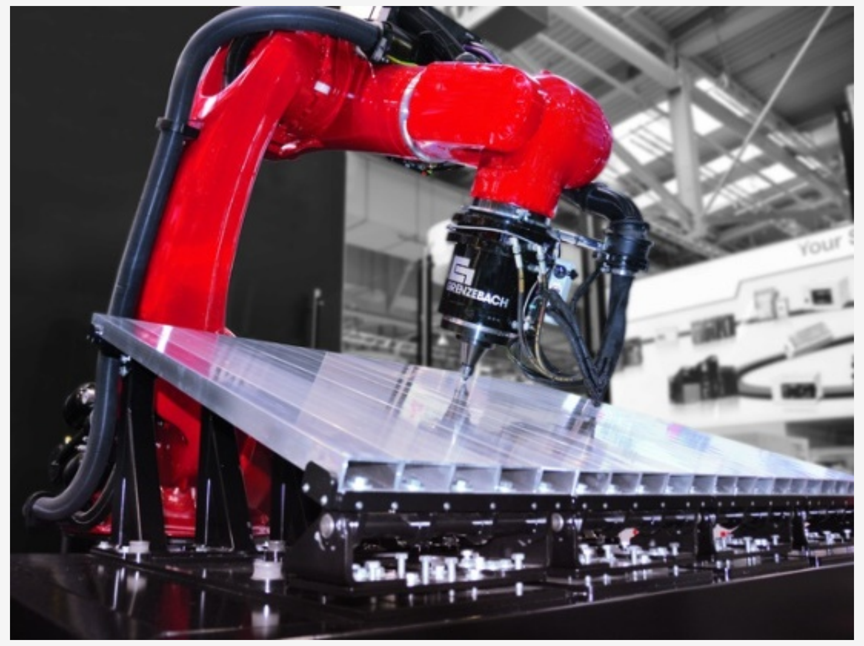
The energy and compressed air consumption of existing systems is recorded using the EMS box, and the data transmitted to a central database

Energy data
ESP NZ



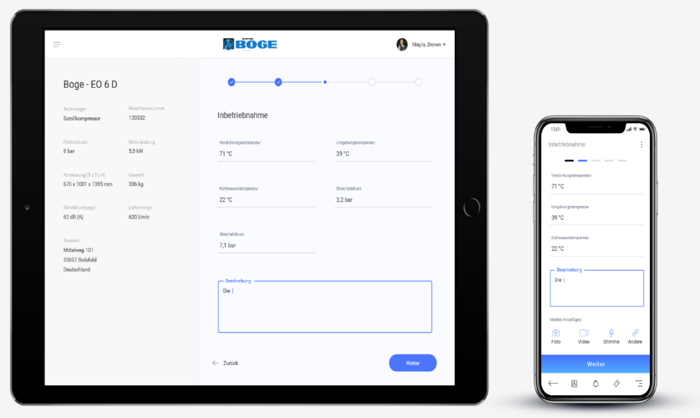
The retrofitted Energy IoT box records energy data and forwards it to a cloud for analysis and report preparation

Analytics
Grenzebach



Online quality monitoring and increased machine availability through monitoring quality of the welding seam and prediction of tool wear.

Cloud platform
Boge



Make machine data centrally accessible. Each machine can be monitored individually. Required functions such as service | analytics | and many more can be added

Driven by our customers' requests

Analytics
Automotive construction

Reduction of post-treatment by avoiding weld spatters through prediction of electrode wear.

Analytics
Ferag

Greater machine availability and lower maintenance costs through prediction of chain elongation and localisation of the error source.

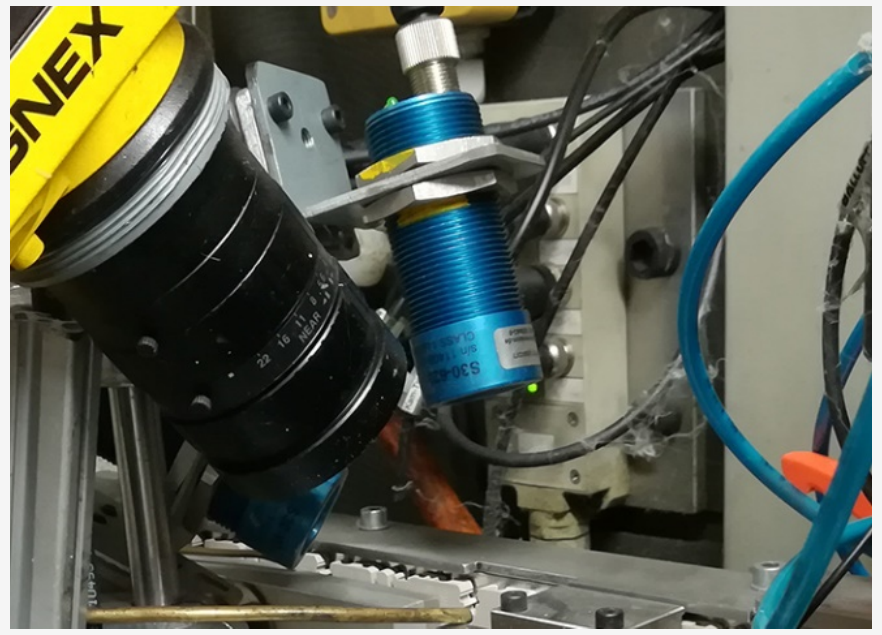
Analytics
Injection moulding

Better understanding of injection moulding process and lower lockout through prediction of machine errors.

Analytics
Boge

Tailored compressed air services to expand service business and reduce TCO for the operator.

Analytics
Image data analysis



Reduced lockout and lower quality costs through analysis of image data during production and assembly process.