DER WEG ZUR DIGITALEN FABRIK IN REALTIME
5G CAMPUS BEI OSRAM

Industrie 4.0 Praxis Frühstück

Alpbach, am 27.08.2020
Roland Wiesmüller, T-Systems & Stefan Fritz, OSRAM

T · ·Systems· Let's power
higher performance

OSRAM

We support your digital transformation with these four core competencies.

Connectivity

Digital

T··· Powered Systems

Cloud & Infrastructure

Security

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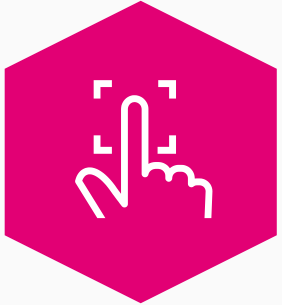
The changing industry demand defines the characteristics of 5G campus networks

Flexibilization of production – Automated Guided Vehicles (AGVs) as main driver within manufacturing industry

WIFI is not interference-free/ sufficient e.g. due to unlicensed spectrum

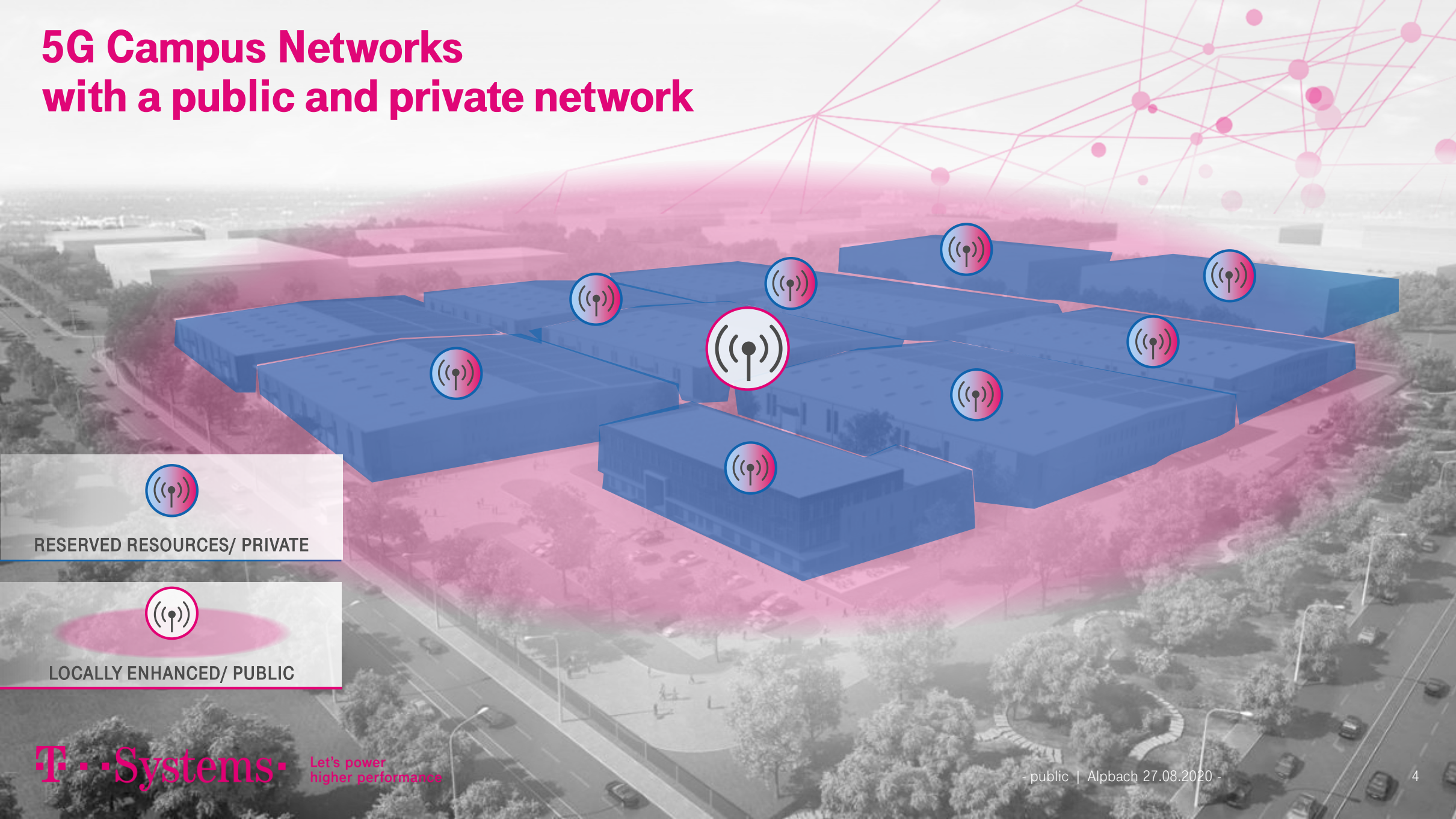Data/ traffic should not leave the campus (privacy)

Full network autonomy and control requested - ensured network resources for critical processes

Public coverage is required anyhow, e.g. to connect suppliers and use smartphone applications

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5G Campus Networks
with a public and private network

RESERVED RESOURCES/ PRIVATE

LOCALLY ENHANCED/ PUBLIC

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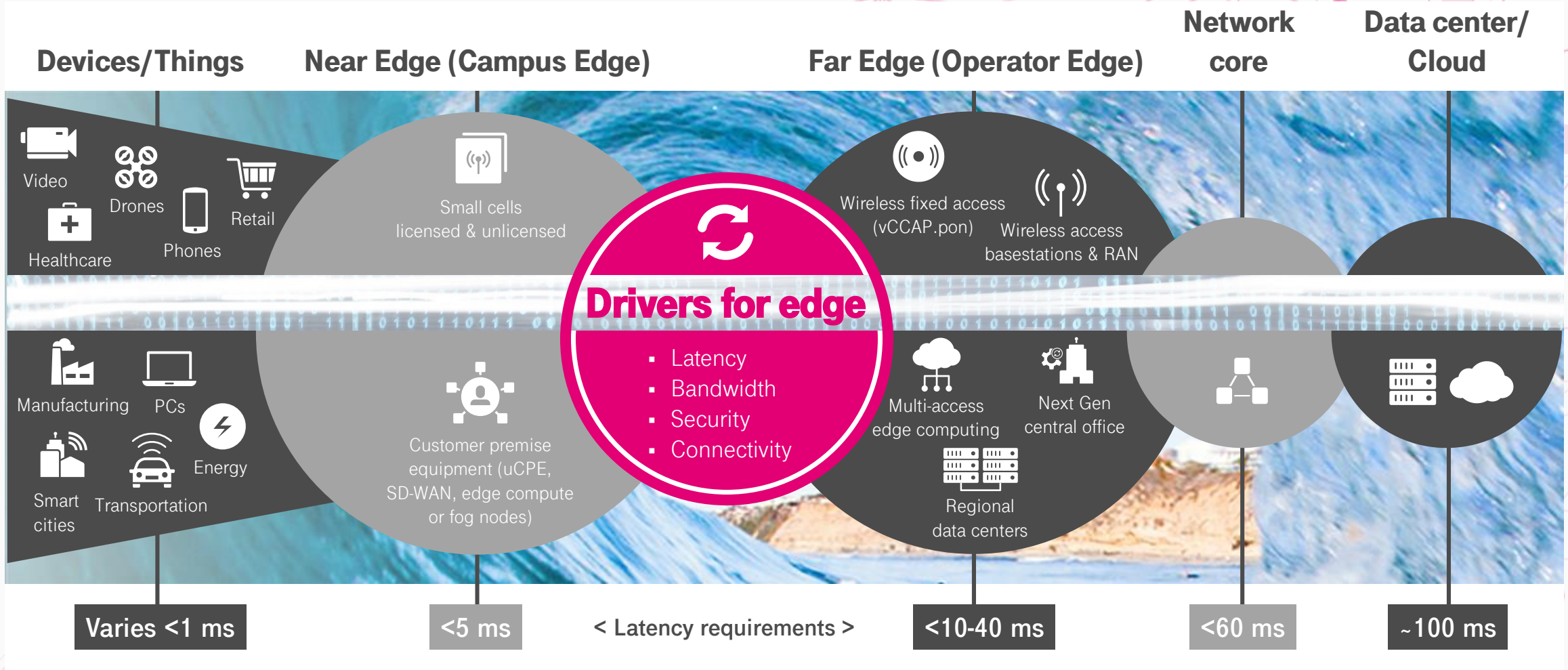
5G compared with WIFI LAN latency
High resolution video stream from a mobile robot

What are the latency requirements of the use cases?

Devices/Things

Near Edge (Campus Edge)

Far Edge (Operator Edge)

Network core

Data center/ Cloud

Video

Drones

Phones

Retail

Healthcare

Small cells licensed & unlicensed

Wireless fixed access (vCCAP.pon)

Wireless access basestations & RAN

Drivers for edge

- Latency
- Bandwidth
- Security
- Connectivity

Manufacturing

PCs

Energy

Smart cities

Transportation

Customer premise equipment (uCPE, SD-WAN, edge compute or fog nodes)

Multi-access edge computing

Next Gen central office

Regional data centers

| Varies <1 ms | <5 ms | < Latency requirements > | <10-40 ms | <60 ms | ~100 ms |

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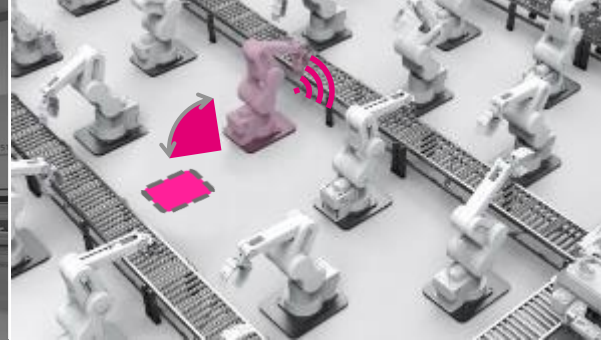# Industrial Use Cases Cluster & 5G Campus Networks

REAL TIME IOT PREDICTIVE MAINTENANCE

TRACK & TRACE

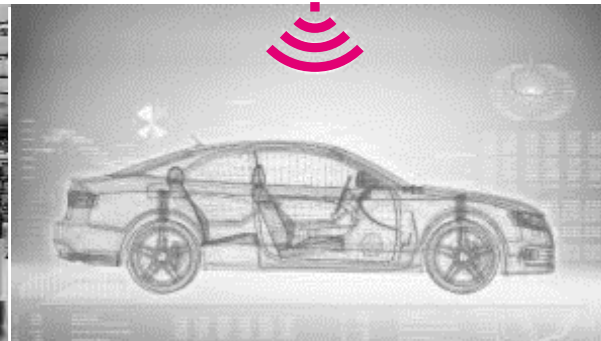**FLEXIBLE CONTROL OF PRODUCTION LINES**

DIGITAL TWIN

CAMERA ANALYTICS & SURVEILLANCE

AUTOMATED GUIDED VEHICLES INDOOR & OUTDOOR

CONTENT DOWNLOAD + UPLOAD

AUGMENTED REALITY FOR REPAIR, MAINTENANCE & OPERATIONS

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Smart Factory Program- Role of 5G Campus

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OSRAM Automotive (AM)

Revenue FY18	€ 3.8 bn	Adj. EBITDA/ margin FY18	€622 m	16.4%
Patents & patent applications	17,800	Global presence	120 countries	
R&D spend	10.2% of revenue	Employees worldwide	~26,200	

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Opto Semiconductors (OS) Automotive (AM) Digital (DI)

OSRAM Automotive

Industry position	Global No. **1**
Revenue FY18 Pro forma	€ **1.9** bn

Market size in € bn[1)]   **8** 2018   **13** 2023

OEM ~80% of revenue

Standardized light sources	LED components	LED systems
HAL Xenon AUX XLS		OSRAM CONTINENTAL Laser, Matrix, LED modules

Aftermarket ~20% of revenue

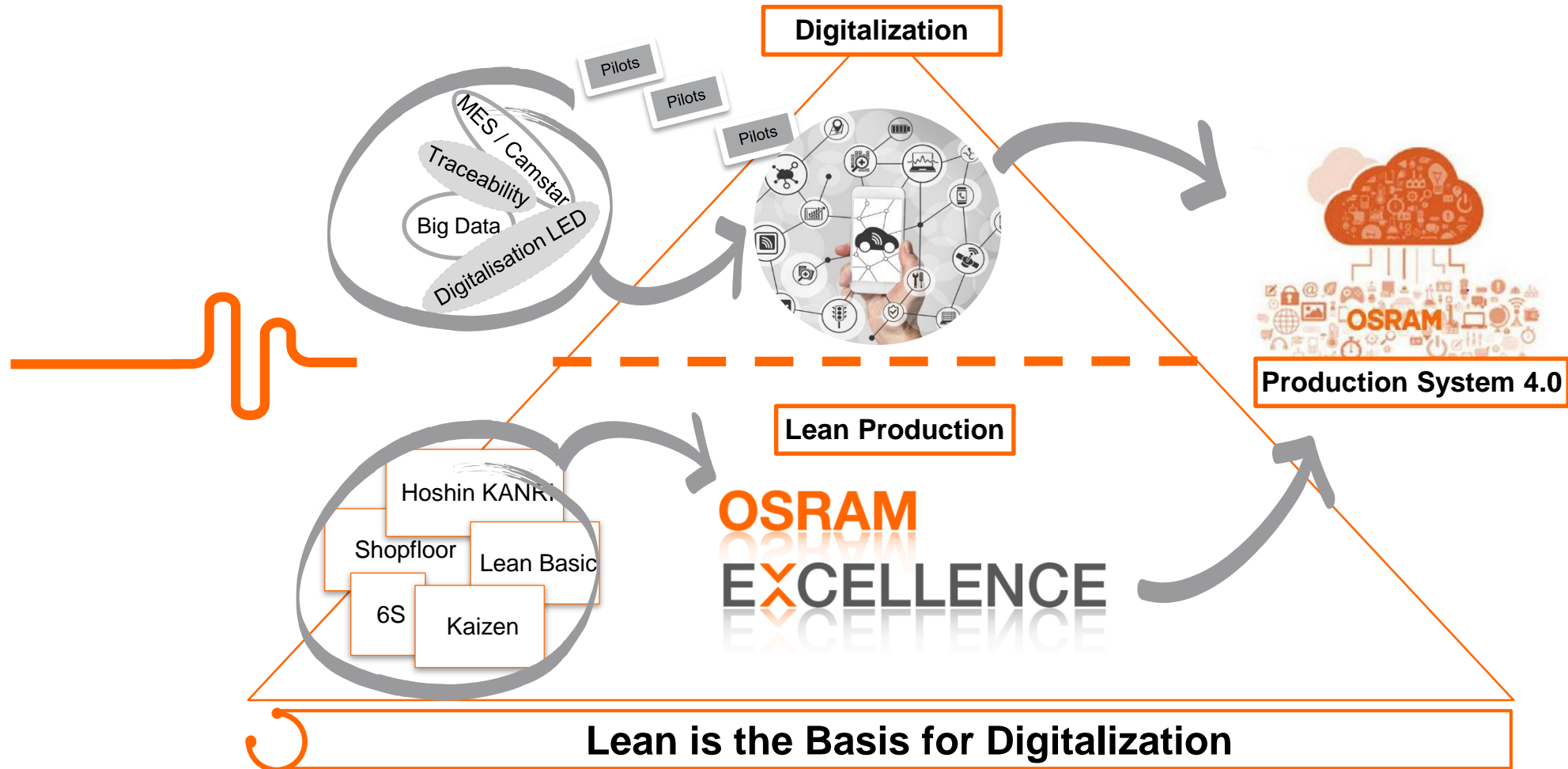| Products |
|---|
| Perfor-mance lamps LED retrofits Tuning fixtures |

1) Source: OSRAM market model

Figures for continued operations FY18 (per 09/30/2018), employee figure as FTE per 09/30/2018

OSRAM

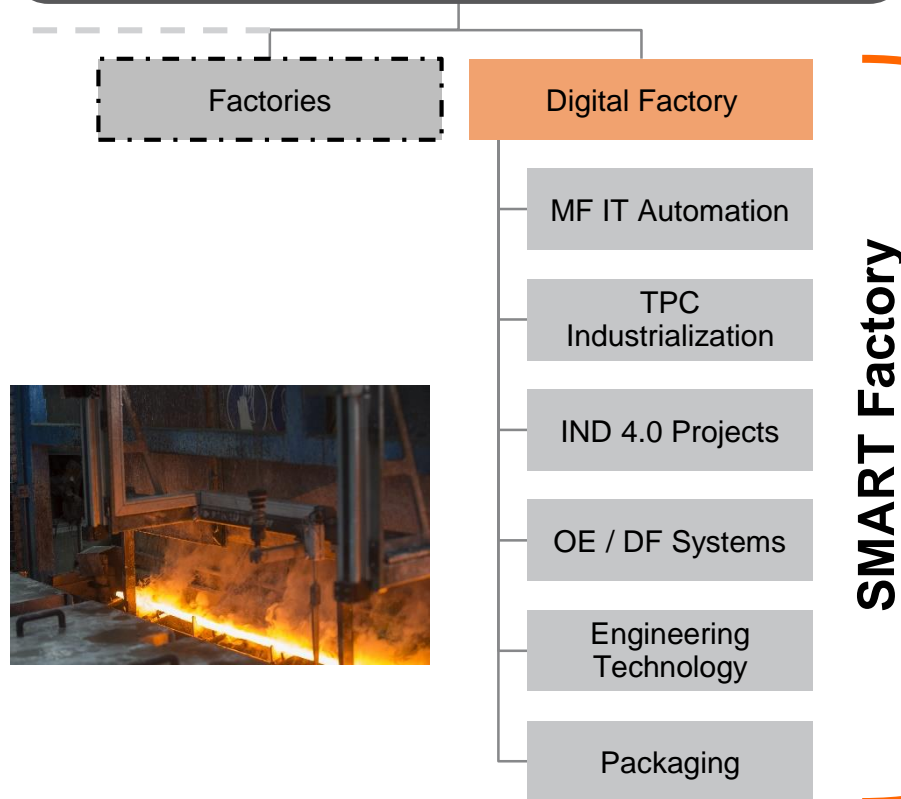# We have a global footprint of R&D and production sites – excluding JV

Herbrechtingen

Schwabmünchen

Berlin

Warren

Bruntal

Nove Zamky

Hillsboro

Foshan

Treviso

● Production Site

● R&D Site

We are able to **act globally** and
fulfill **regional demands**

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OSRAM Production System 4.0
Lean & Digitalization

Digitalization

Pilots

Pilots

Pilots

MES / Camstar

Traceability

Big Data

Digitalisation LED

Production System 4.0

Lean Production

Hoshin KANRI

Shopfloor

Lean Basic

6S

Kaizen

OSRAM EXCELLENCE

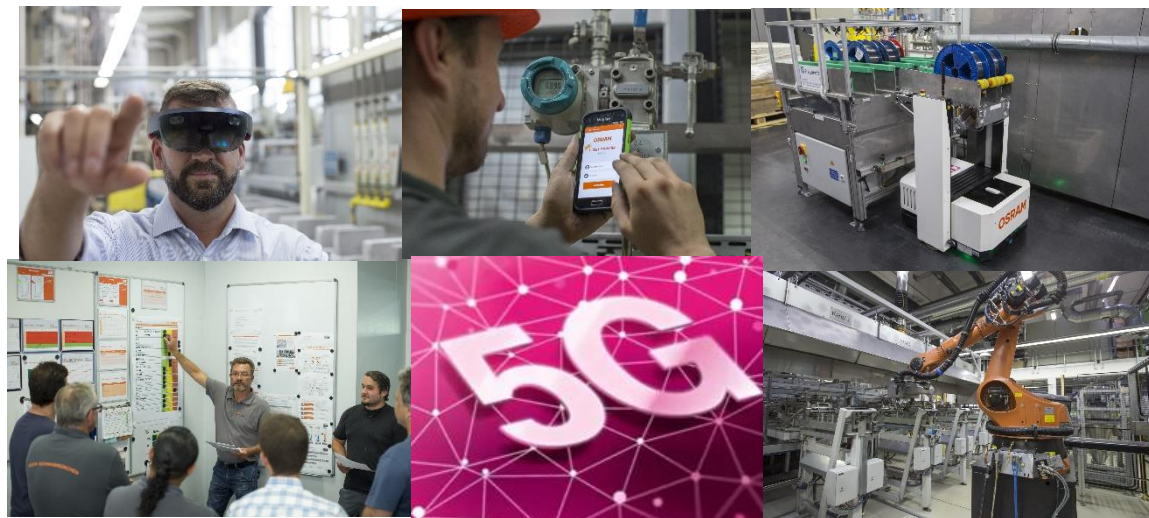**Lean is the Basis for Digitalization**

Organizational Setup follows Digital Strategy

**Operations &
Digital Factory**

Smart Factory as a core element of
Industry 4.0 / Production System 4.0

Factories

Digital Factory

MF IT Automation

TPC
Industrialization

IND 4.0 Projects

OE / DF Systems

Engineering
Technology

Packaging

SMART Factory

**Full connectivity between all production resources
including their planning and control systems is key***

*frei übersetzt nach Quelle: vgl.: Deutschlands Zukunft als Produktionsstandort sichern ; Abschlussbericht des Arbeitskreises Industrie 4.0 Vorabversion Berlin 2. Oktober 2012

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Digital Factory
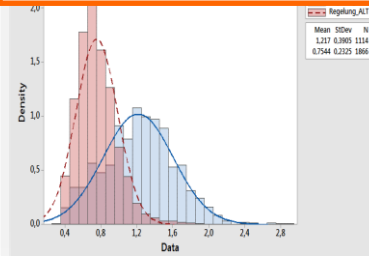# AM Operational Approach to SMART FACTORY

5 Operation Performance Programs
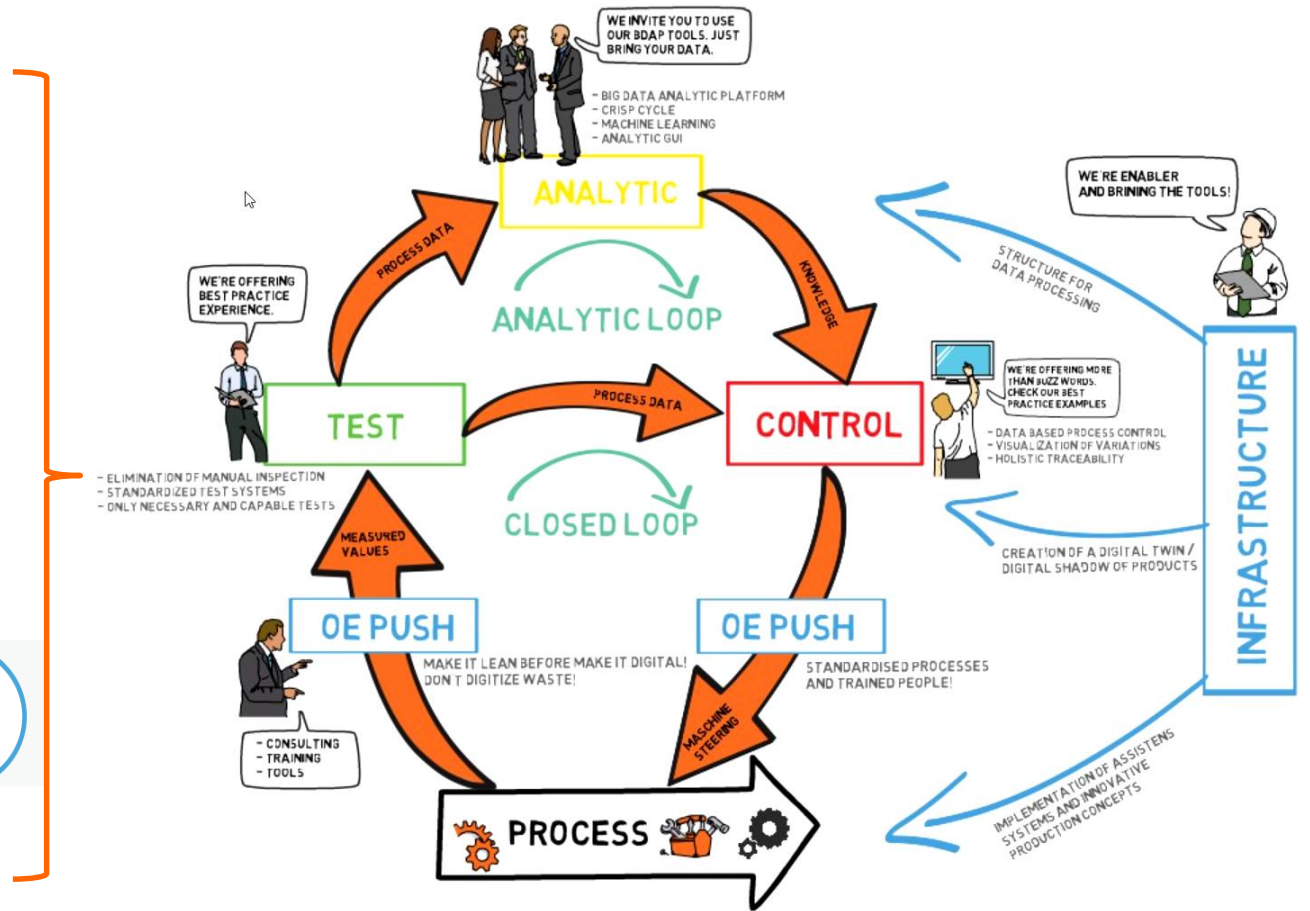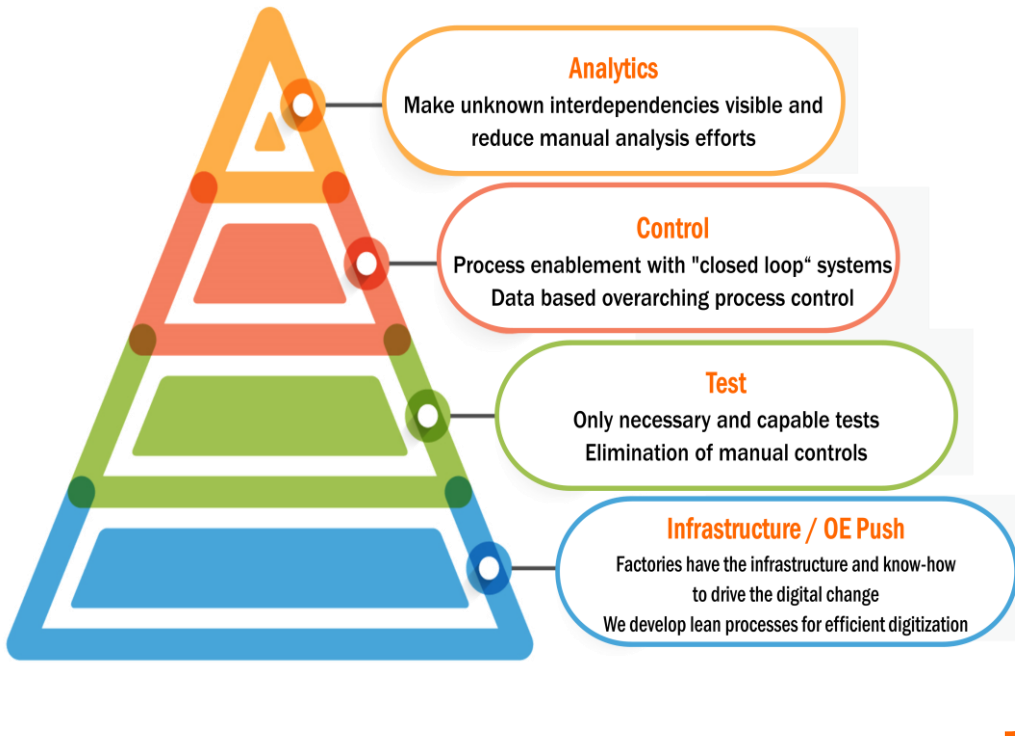
Role of 5G Campus Network ➔ Communication is Key

Mindset	Narrow Process Scattering	Traceability	Advanced Data Collection	Big Data / Data Analytic

▪ Lean management

▪ Shopfloor-management

▪ Extended process control

➔ Increase process capability

▪ Transparent production

▪ Collect further process- & quality-data

▪ Process improvement through data analysis

5G / Edge Cloud Service

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5G Campus Network
Architecture and Components

Public Network Coverage

100 m

Locally Cellular Coverage

Indoor Cellular Coverage

OSRAM Factory Schwabmünchen
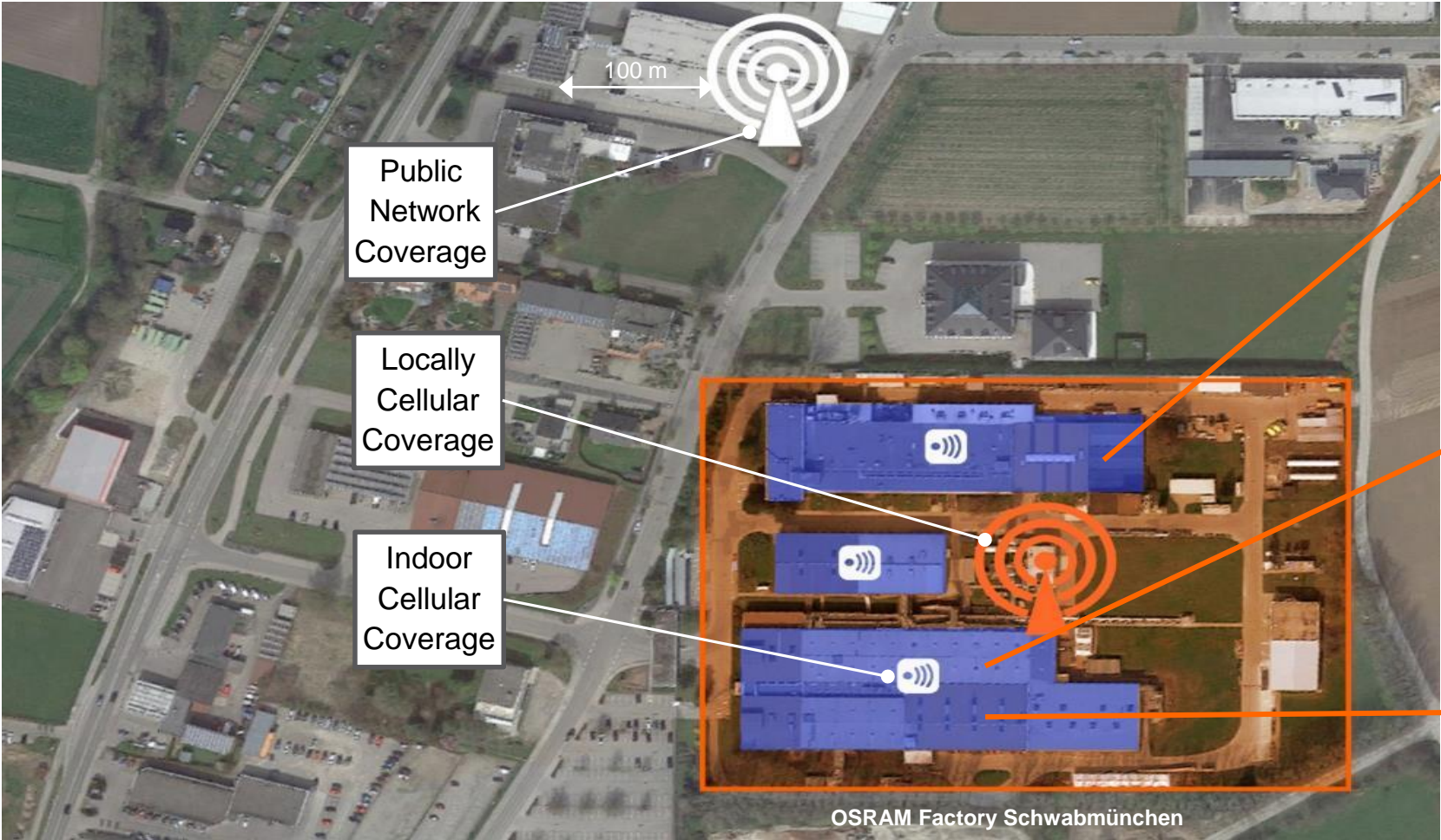
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1. 5G Use case
Indoor Autonomous Guided Vehicle (AGV)

Local Campus Edge

Data Transfer
- Low latency
- High data rates
- Very good network coverage
- reliability

Computing

Navigation

Control

Sensors

Hardware

New Services
- Holistic mapping
- Centralized data processing
- …

Expandable to other AGVs
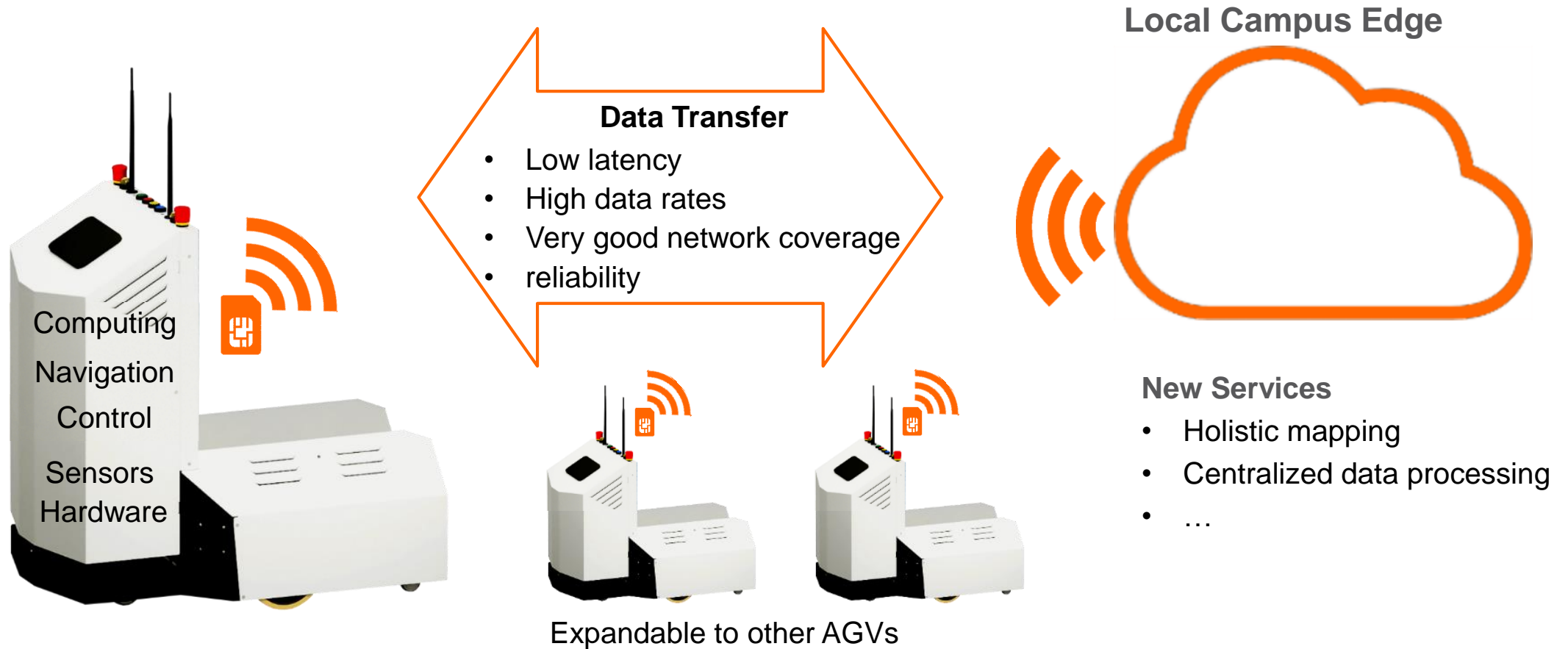
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5G Use case
OSRAM Ticket manager in the Campus Network

OSRAM
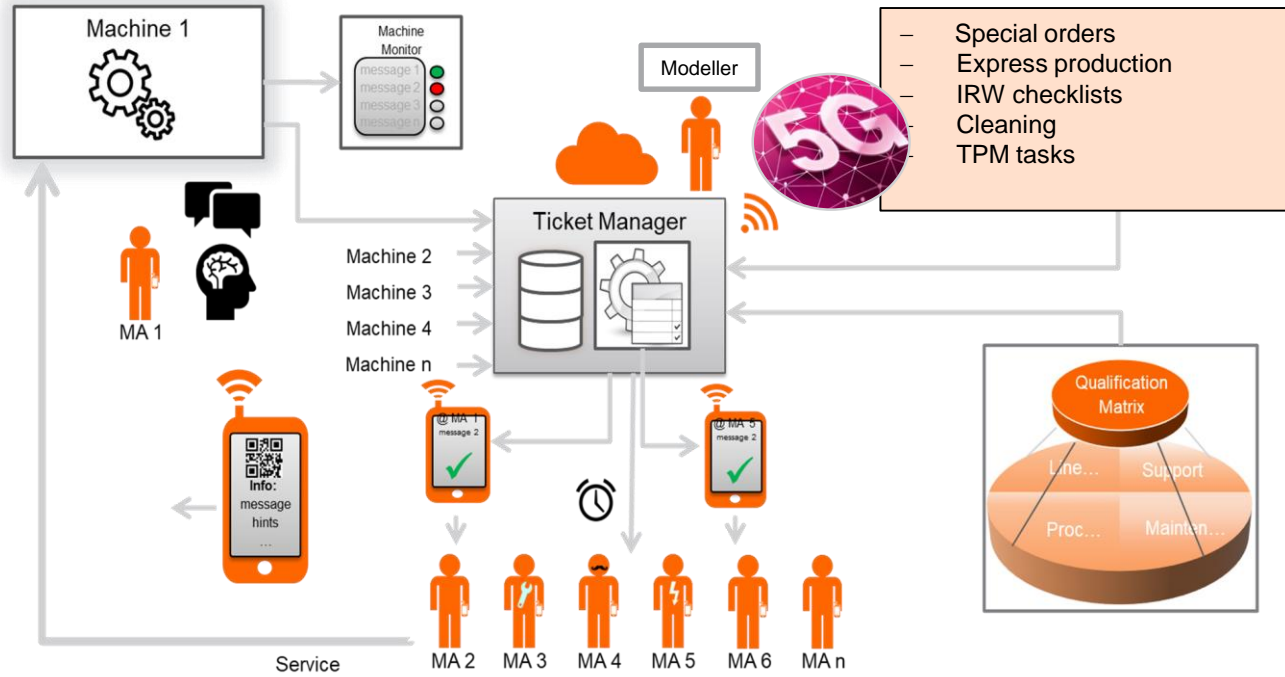
5G Use case
Ticket manager for operation & machine set-up

Cost center 160001 & 160002

- Mo-Halle
- Sintern
- Walzen
- Hämmern
- Handhämmern

waiting times

busy
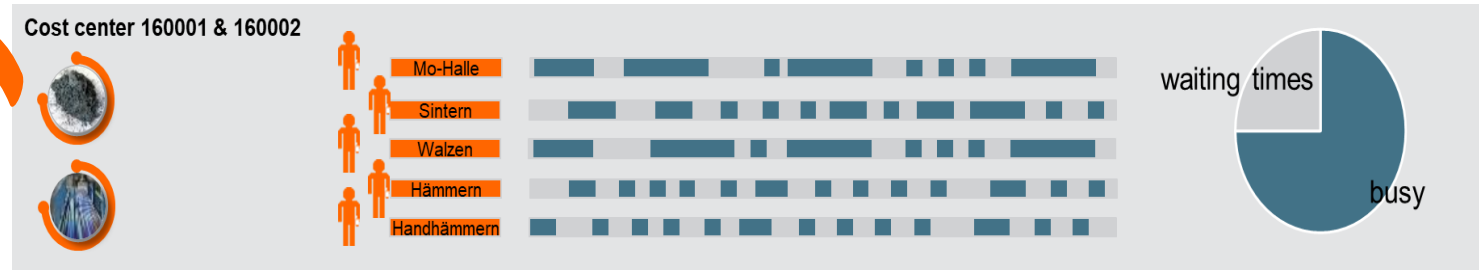
Network coverage given by 5G to 100%
Through Edge Computing & AI further potential

Cost center 160012

- flex MA
- flex MA
- flex MA
- flex MA

waiting times

busy

Ticket manager for operations

Result: Merger of two production cost centers with savings

Smart Factory Program- Outlook

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Use Case- Hololense

Schwabmünchen (Germany)

Exeter (USA)
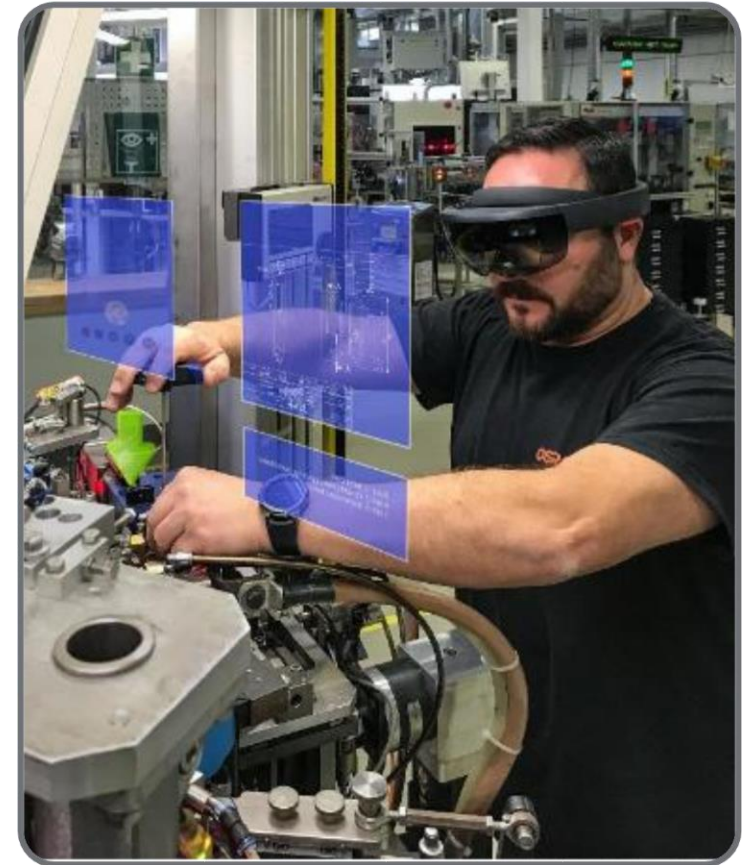
Easy Contact & Access over Big Distances (fast and computer aided)

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Teamwork of Big Data, Data Analytics und KI

Recording of all **process- and product data** at **single product level** for **all production steps**

Process Step

Phosphor mixing
(→ cartridge)

Phosphor dispensing

Photometrical measurement (wet)

Photometrical measurement (dry)

Traced Data

Prematerial amount
Mixing Time stamp

Dispening weight
Dispensing time stamp

Cx und Cy
(wet)

Cx und Cy
Shifted to tight corridor

Control Process

Closed Loop with dynamic parameters

Data Analytics and KI methods

Data Analytics and KI methods

Parameters

time
Mixing → Dispensing

Sedimentation within cartridge **and all volume tolerances**

time
Dispensing → measurement

Colour shiftt
Wet → Dry

Holistic Traceability @ AM
First plant overlaying Analytics

Scenario

Process correlation

W-SM			W-BR			W-H		
powder	rods	heavy wire	fine wire	cleaning	inspection	coil	frame	burner	socket

Analytics result

(by Martina Flörchinger)

Insights

Possible effects to coil breakage caused by annealing machine.

Machine modification helps to reduce coil breakage.

Identification of deviations between material batches
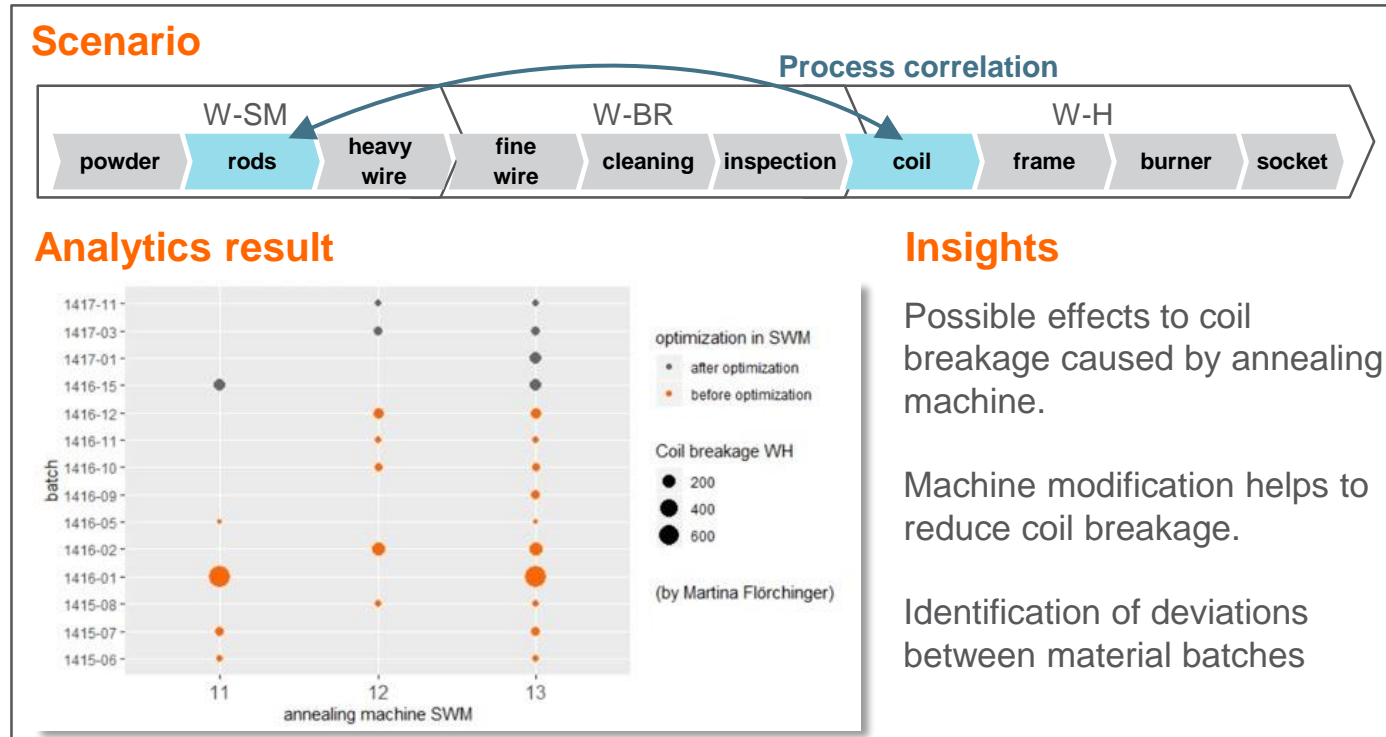
First plant overlaying data analytics draft. **Coil breakage** at WFKFlex in W-H correlates to SWM annealing process.

Done in close collaboration between plants process experts.

Data scientist from available for analytics service.

Time offset between W-SM wire production and W-H coil production up to 3 month is a huge challenge. Effects of process improvements can be tracked only with a delay.

BU wide Data Analytics

W-SM ↔ W-BR ↔ W-H

First steps for building overlaying data analytics are done. Ongoing tasks for the implementation initiated.

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THE WAY TOWARDS A DIGITAL FACTORY IN REALTIME

Why Digitization, 5G, 5GEdge, Campus Edge?
The entrepreneurial perspective does not go into technology

EFFICIENT PROCESSES - €

HIGHER AUTOMATION

BEST WORKING ENVIRONMENT

REDUCE ERRORS - €

IMPROVE SERVICES
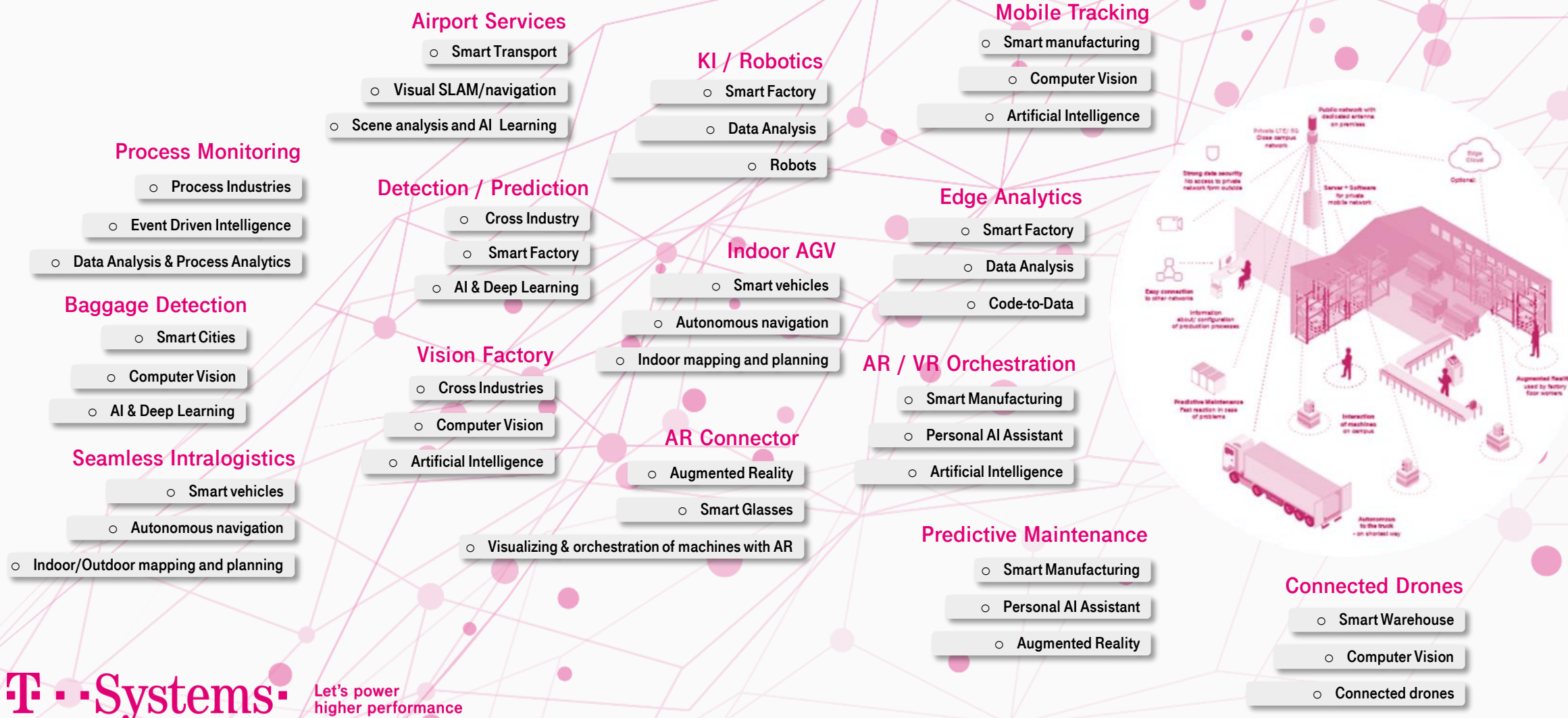
FASTER COMMUNICATION

AVOID MANIPULATION

OPTIMIZE QUALITY

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What are the Use Cases in a 5G Campus? Orchestration to customer needs based on a "toolbox"

Airport Services
- Smart Transport
- Visual SLAM/navigation
- Scene analysis and AI Learning

KI / Robotics
- Smart Factory
- Data Analysis
- Robots

Mobile Tracking
- Smart manufacturing
- Computer Vision
- Artificial Intelligence

Process Monitoring
- Process Industries
- Event Driven Intelligence
- Data Analysis & Process Analytics

Detection / Prediction
- Cross Industry
- Smart Factory
- AI & Deep Learning

Edge Analytics
- Smart Factory
- Data Analysis
- Code-to-Data

Baggage Detection
- Smart Cities
- Computer Vision
- AI & Deep Learning

Indoor AGV
- Smart vehicles
- Autonomous navigation
- Indoor mapping and planning

Vision Factory
- Cross Industries
- Computer Vision
- Artificial Intelligence

AR / VR Orchestration
- Smart Manufacturing
- Personal AI Assistant
- Artificial Intelligence

AR Connector
- Augmented Reality
- Smart Glasses
- Visualizing & orchestration of machines with AR

Seamless Intralogistics
- Smart vehicles
- Autonomous navigation
- Indoor/Outdoor mapping and planning

Predictive Maintenance
- Smart Manufacturing
- Personal AI Assistant
- Augmented Reality

Connected Drones
- Smart Warehouse
- Computer Vision
- Connected drones

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5G Campus Use Cases – Understand, Solve & Deliver

T-Systems focus:

- Cyber Security in IT & OT
- Big Data Architecture
- Product Data Management along Value Chain (PLM-ERP-MES)
- 5G Private Campus Use Cases based on Edge Computing & AI

smartfactory@tugraz

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5G CAMPUS NETWORKS & EDGE COMPUTING IS THE ENABLER TOWARDS DIGITAL FACTORY IN REALTIME

LET´S TALK ABOUT IT!

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