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5G in Process Industry

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5G – Transforming our world through interconnectivity

Up to now…
Connecting people

The future…
Building ecosystems

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Economic impact through megatrend wireless connectivity

Manufacturing
~$1.4-1.7T

Health
~$400-700B

Autonomous cars
~$2.0-2.5T

Retail
~$400-500B

$6-8 Trillion economical impact 2025-2030

Smart cities
$~1.0-1.2T

Smart home
~$200-350B

Logistics
~$600-800B

Office
~$70-100B

Source: Qualcomm

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5G key features

eMBB
Enhanced mobile Broadband

Gigabytes in a second

3D video, UHD Screens

Work and play in cloud

Augmented reality

Industry automation
Factory of the future
Deterministic real time

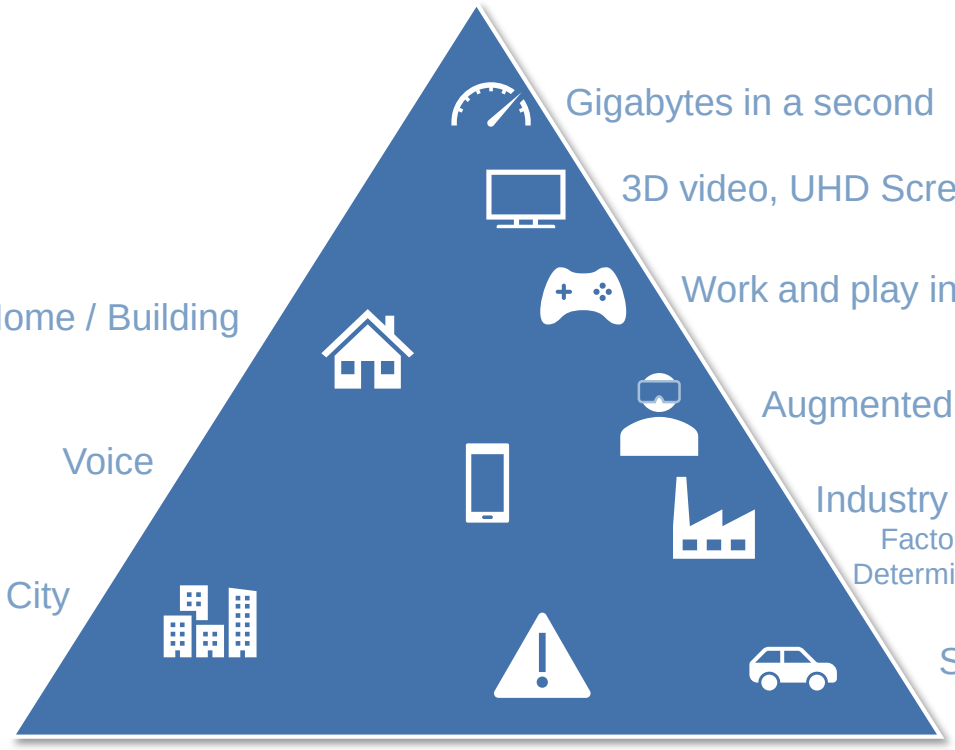
Self driving car

Mission critical applications

Smart Home / Building

Voice

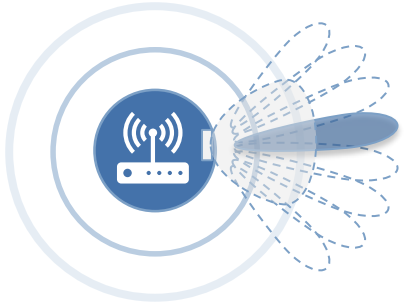
Smart City



mMTC
Massive Machine Type Communication

uRLLC
Ultra-Reliable and Low-Latency Communications

New air interface

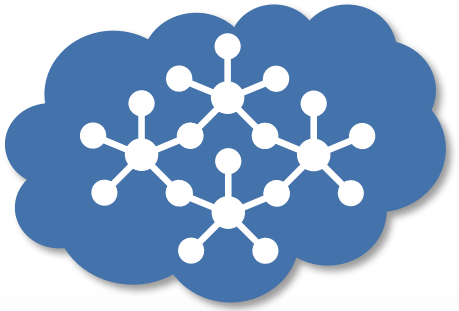


Massive MIMO Beamforming

mmWave

Flexibility and spectrum efficiency

New architecture



Service based architecture

Slicing

One physical network
Multiple Applications

 Source: Huawei

Frequencies for the industry – a basic prerequisite for the success of smart manufacturing/ “Industry 4.0”

- The German Federal Network Agency (BNetzA) provides the first time spectrum for local and regional mobile networks for Industry 4.0 applications
- BASF announced in accordance with other industry associations the demand of 100MHz bandwidth for industrial 5G networks in Germany

BUT: Formal Application Process and Condition are still missing !

Bundesnetzagentur

Regionale und lokale Netze

Frequenzen für das Betreiben regionaler und lokaler drahtloser Netze zum Angebot von Telekommunikationsdiensten

Frequenzen im Bereich von 3,7 GHz bis 3,8 GHz

Für regionale und lokale Zuteilungen sollen im Bereich von 3.700 MHz bis 3.800 MHz Frequenzen, insbesondere für 5G-Anwendungen, bereitgestellt werden. Hierzu hat die Bundesnetzagentur ein Antragsverfahren entwickelt. Interessierte Kreise waren bis zum 28. September 2018 aufgerufen, das Frequenzzuteilungsverfahren und die Nutzungsbedingungen zu kommentieren.

Use Cases

Mobile Automation

Autonomous Logistic Systems

M+O Sensors

Hazard Alarm Technology

Mobile Automation

Everyone, Anytime, Anywhere - The next step for technology is universal access

Bill Gates *- October 4th, 1999*

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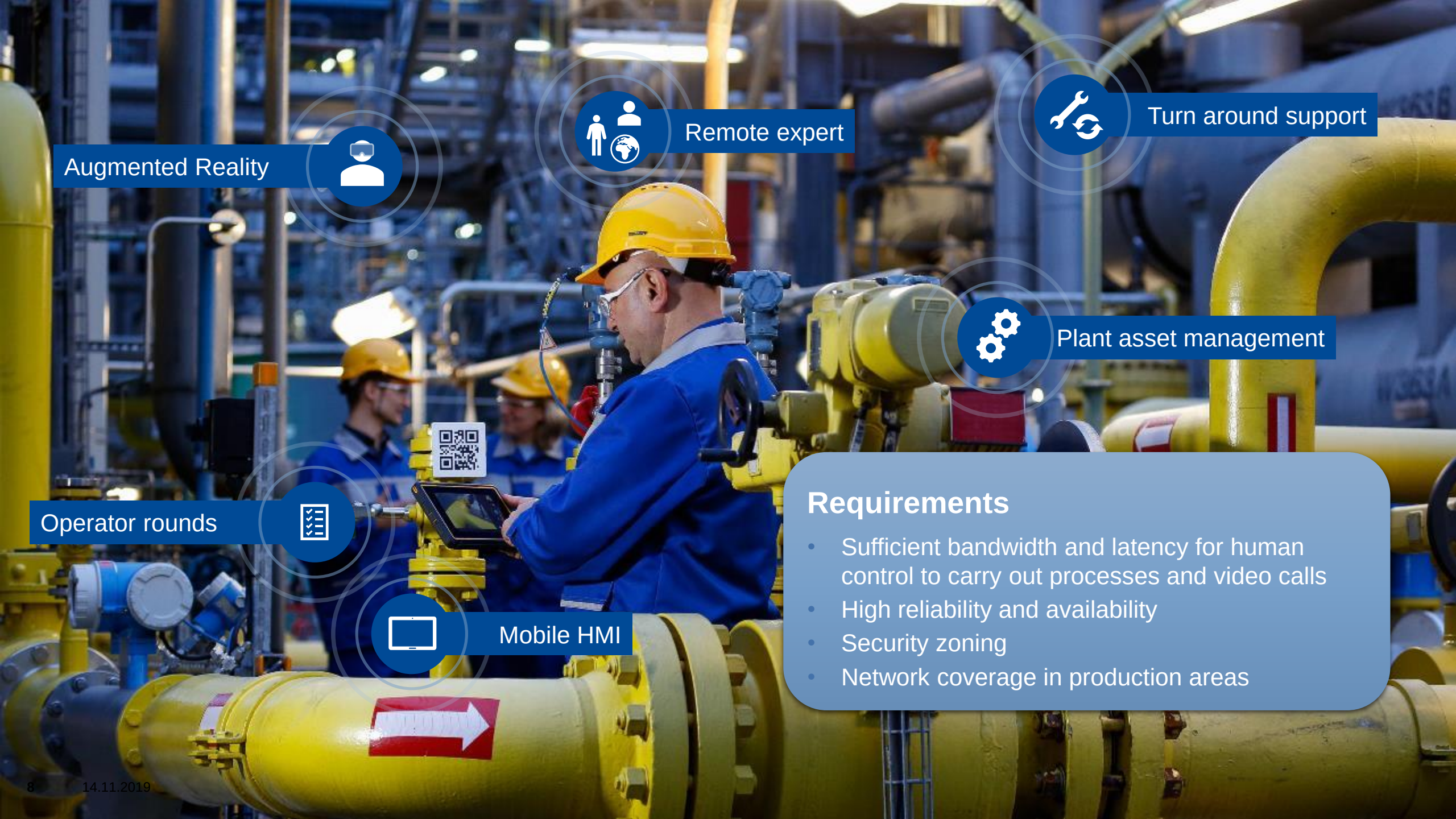

Requirements

- Sufficient bandwidth and latency for human control to carry out processes and video calls
- High reliability and availability
- Security zoning
- Network coverage in production areas

Autonomous Logistic Systems

The regular operation of automated and connected driving has a direct link to the digital performance of our infrastructure

BMVI *– Federal Ministry for traffic and digital infrastructure*

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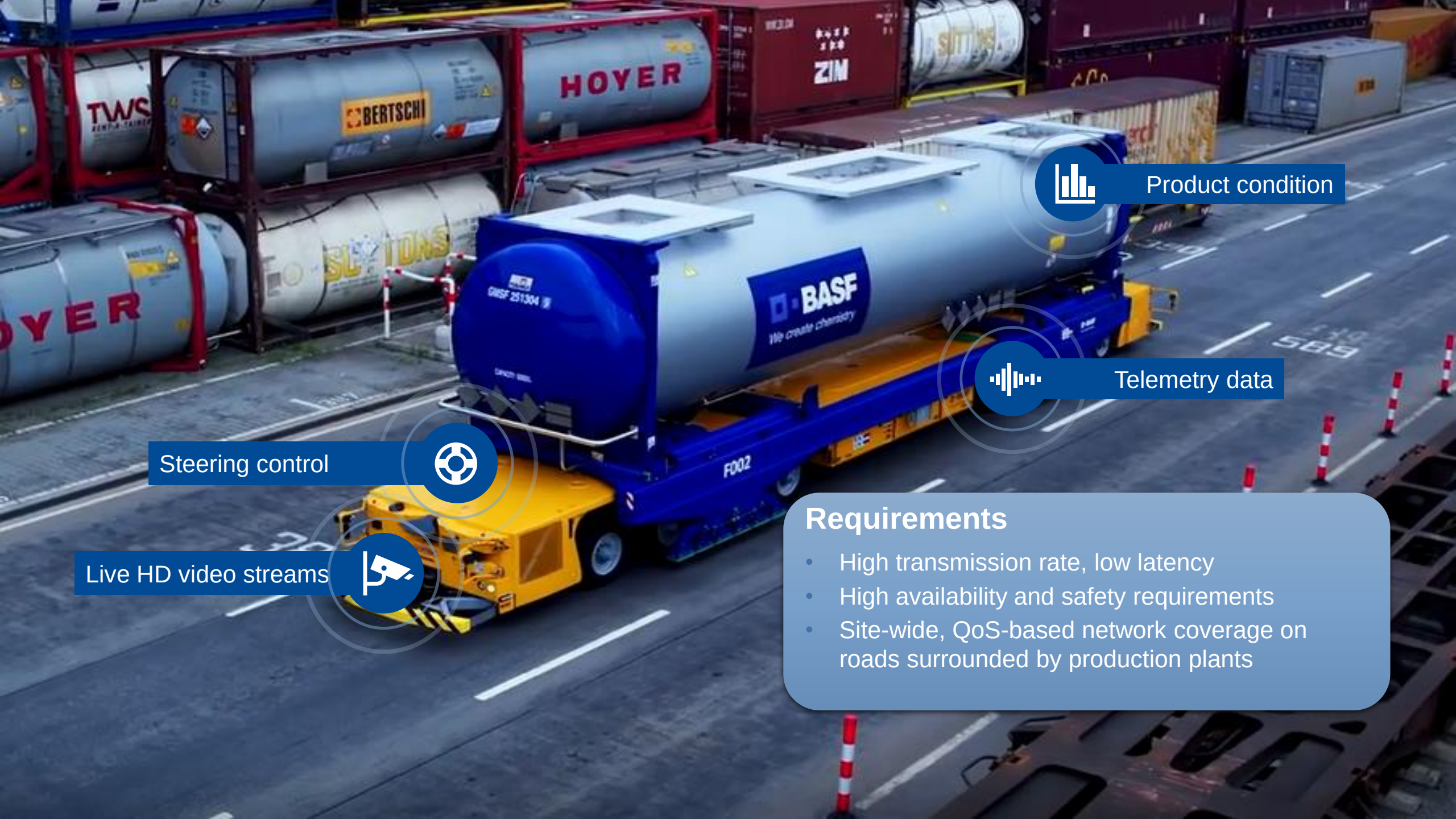
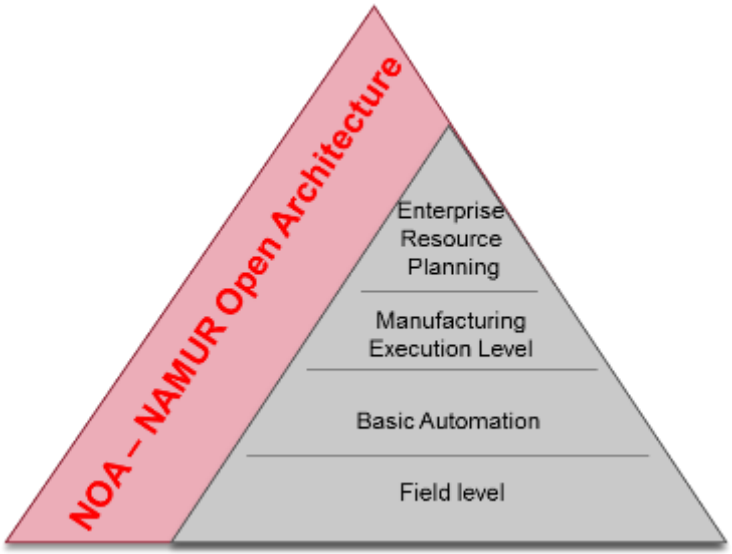


Requirements

- High transmission rate, low latency
- High availability and safety requirements
- Site-wide, QoS-based network coverage on roads surrounded by production plants

M+O Sensors

Wireless communication is a central enabler for innovative solutions for automation technology



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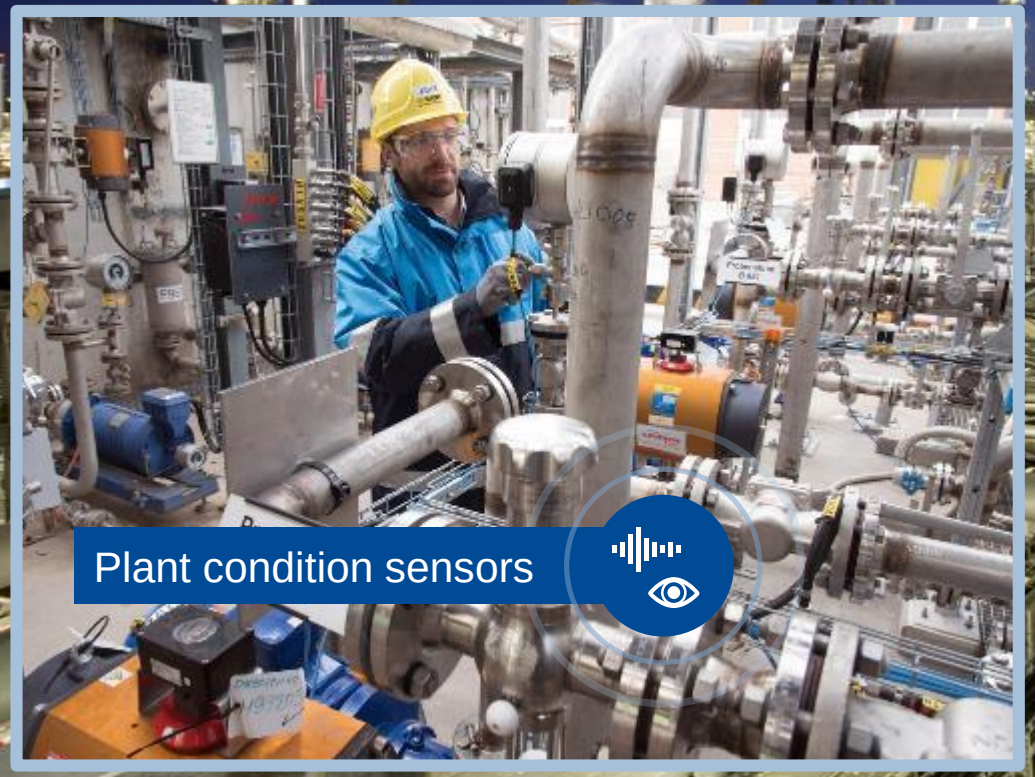
Drones

Predictive Maintenance



Plant condition sensors

Equipment tracking

Requirements

- Low in terms of response time and availability

  Comparex to core automation
- Network coverage in production areas
- Use of standard communication technology

Hazard alarm technology

Reliable communication when it matters

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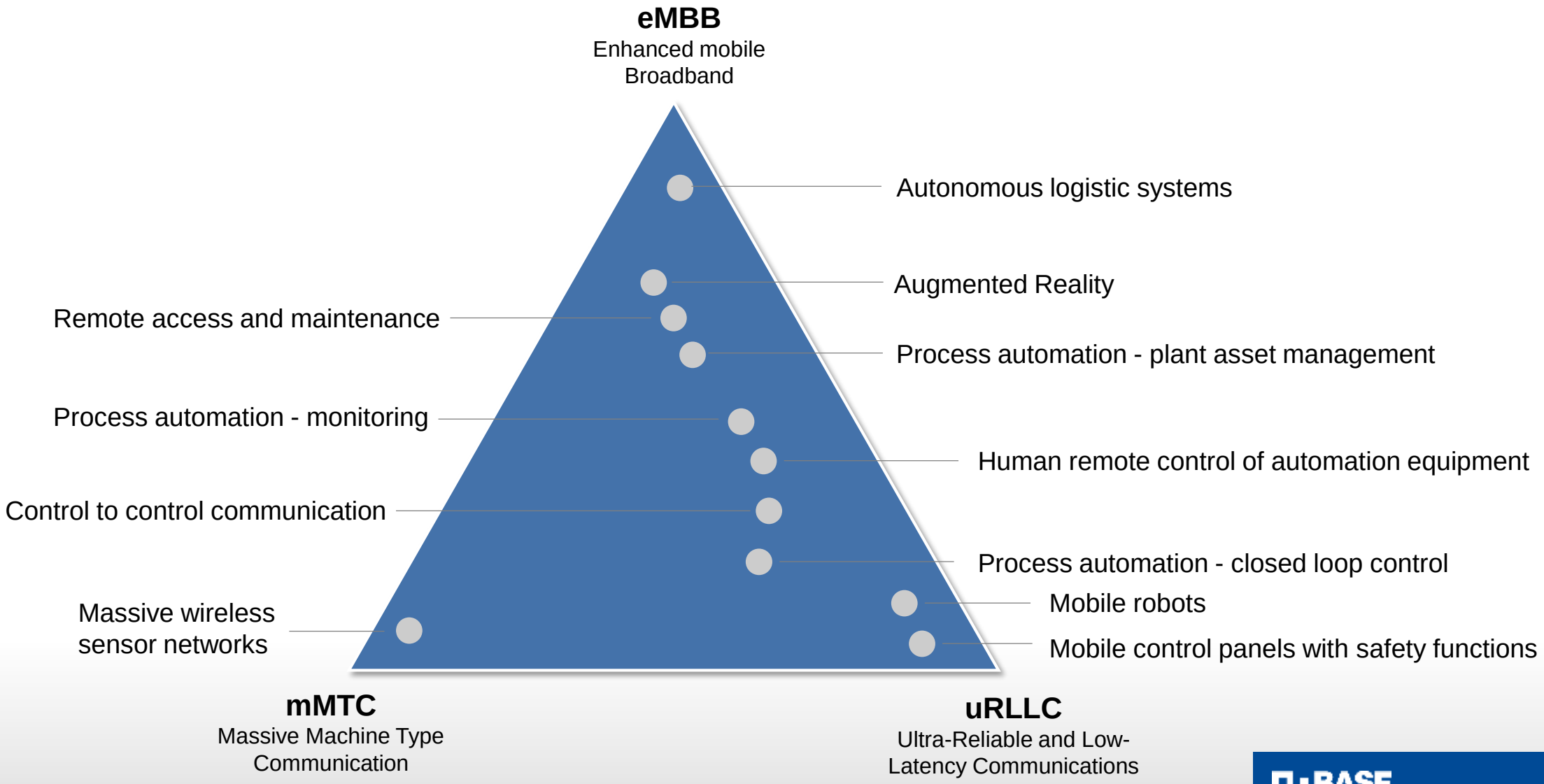
Requirements

- High availablity, dedicated fallback and redundancy concepts
- Prioritisation of communication
- QoS-based network coverage
- Security zoning

Overview of selected industrial use cases according to their basic service requirements

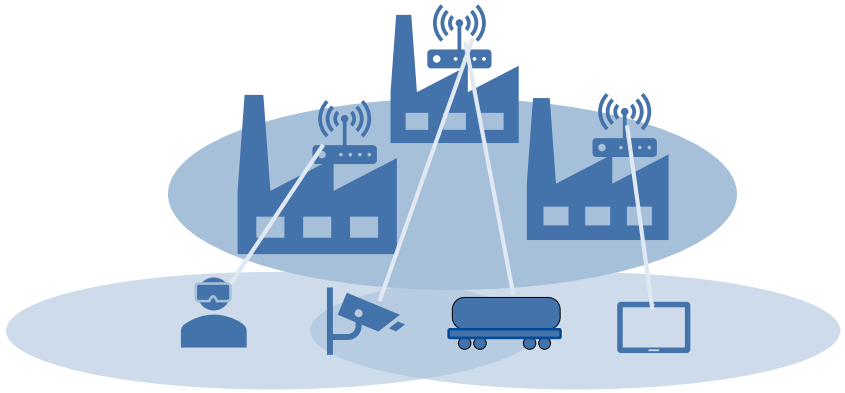


Source: ZVEI

Private mobile networks for local and customized services

Private mobile networks for production sites

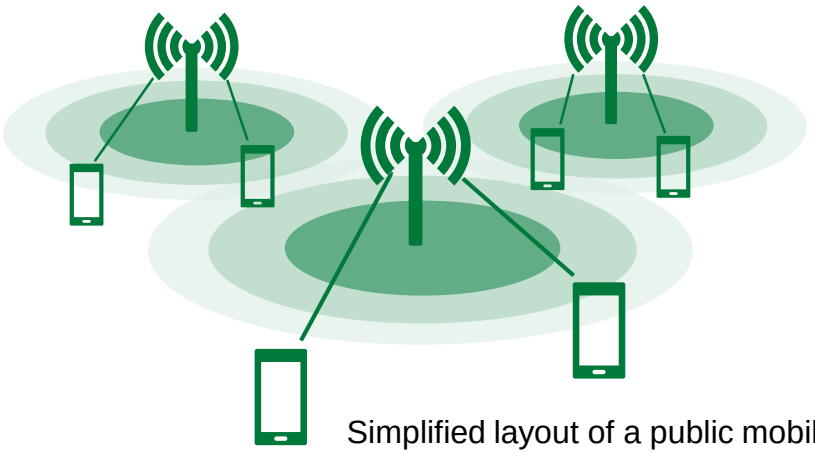
- Dedicated equipment and local coverage
- Independent of implementation of quality parameters
- Optimized for industry use cases
- Managed individually



Simplified layout of a private mobile network

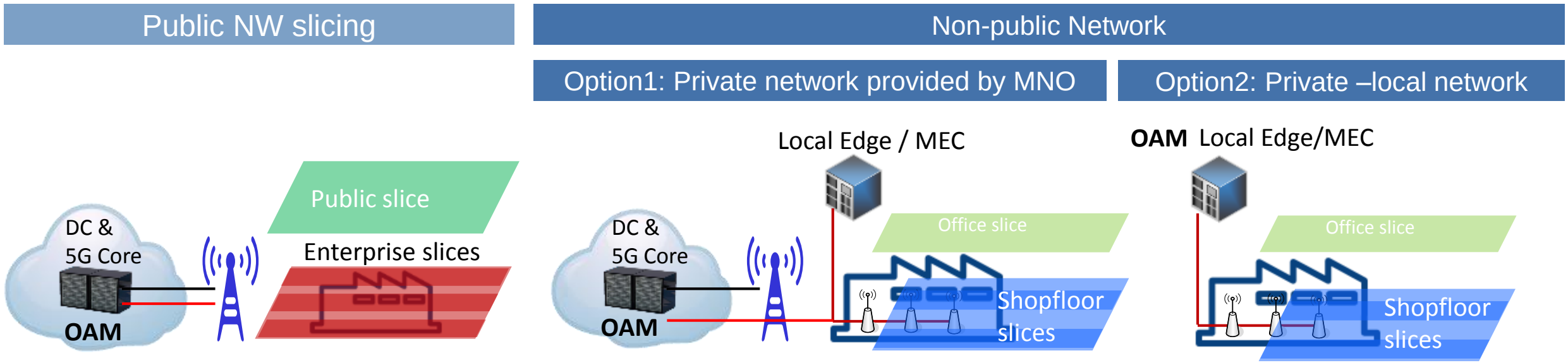
Public mobile networks

- Managed by national mobile operator
- Equipment shared with other user traffic
- Wide area coverage as business model
- Use cases for generic voice and data services



Simplified layout of a public mobile network

5G Industrial Network Architecture



- 5G enables flexible service based architecture
- Service prioritization can be distributed across the network
- Multiple options of deployment possible
- Operation models can vary from pure MNO support to pure private responsibility, tbd. best mode of operation for BASF

MNO: Mobile Network Operator
OAM: Operation and Maintenance
DC: Data Center
MEC: Multi access Edge Computing

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5G Lighthouse at BASF
Site Ludwigshafen: a city in the city …

Characteristics of production sites of the chemical industry:

- no closed indoor production halls
- campus / area locations, comparable with medium-sized small towns or city districts in large cities:
- Areas lie within defined plant boundaries
- 100% owned by the responsible operator

Our Requirements:

- Compliance with maximum latency times
- Provide minimum upload speed
- Compliance with the many legal and normative requirements
- Agility and sustainability

Example Site Ludwigshafen:

- area 10 km²;106 km road, 230 km rails
- ca. 39000 employees
- ca. 2000 buildings,
- ca. 200 productions plants

➔ comparable with small cities *Alzey (RLP), Delft (Netherlands), Cannes (France)*

Example Site Schwarzheide:

- area ca. 2,9 km²; 12 km roads; 20 km rails
- ca. 2000 employees;
- 17 production plants;

➔ compare with Hamburg Harbour City

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