

5G

FOR PROCESS INDUSTRY

 **BASF**

We create chemistry

5G in Process Industry

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20. November 2019

5G – Transforming our world through interconnectivity




Up to now...
Connecting people




The future...
Building ecosystems

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

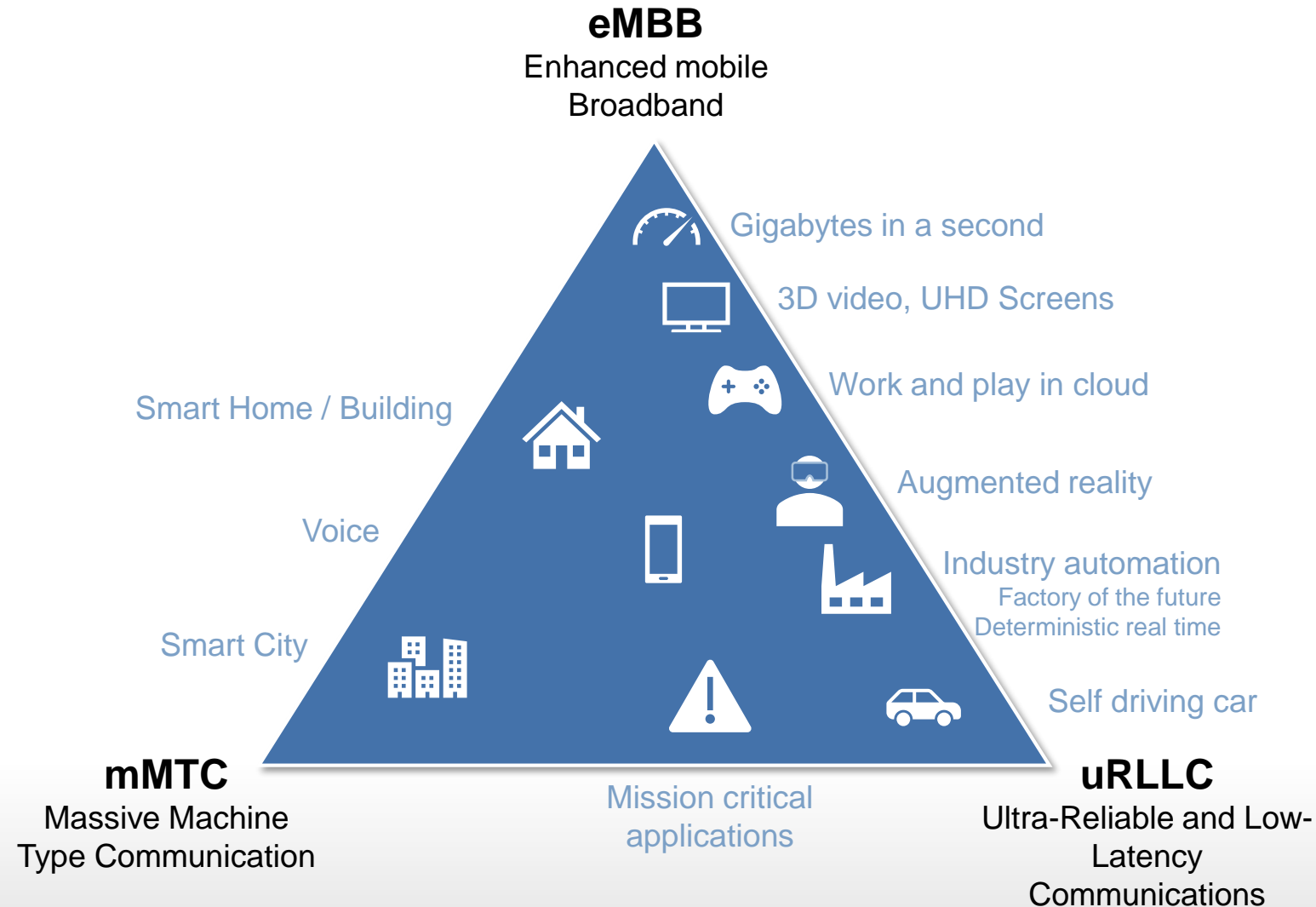
 **Logistics**
~\$600-800B

 **Office**
~\$70-100B

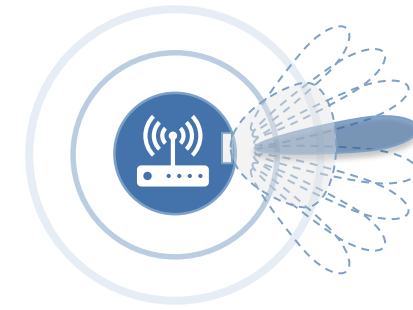
Source: Qualcomm



5G key features



New air interface

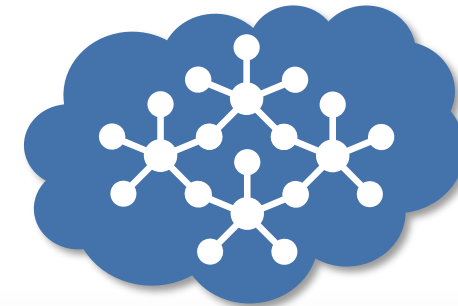


Massive MIMO
Beamforming

mmWave

Flexibility and spectrum
efficiency

New architecture



Service based
architecture

Slicing

One physical network
Multiple Applications

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

Bundesnetzagentur
für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen



Frequenzzuteilung

Zuteilungs-Nr. 06333903

Auf der Grundlage § 55 Telekommunikationsgesetz (TKG) werden der

BASF SE
Carl-Bosch-Straße 38
67056 Ludwigshafen

die auf Seite 2 aufgeführten Frequenzen für eine Nutzung im Versorgungsgebiet

BASF Ludwigshafen Werksgelände

bis 21.11.2029

für folgenden Nutzungszweck zugeteilt:

Lokale Frequenznutzungen des drahtlosen Netzzugangs für betriebsinterne Telekommunikation

Die Nutzung dieser Frequenzen durch Dritte, die nicht Inhaber dieser Frequenzzuteilung sind oder deren Verhalten dem Zuteilungsinhaber nicht zugerechnet werden kann, ist untersagt.

Diese Einzelzuteilung steht im Einklang mit § 55 Abs. 3 TKG, da sie zur Gewährleistung einer störungsfreien und effizienten Frequenznutzung erforderlich ist. Die hiermit zugeteilte(n) Frequenz(en) kann(können) in geografischer Nähe auch von anderen Nutzern genutzt werden. Nach dem derzeitigen Stand der Technik wird daher die Durchführung von Untersuchungen zur Funkverträglichkeit erforderlich sein. In den Grenzgebieten der Bundesrepublik Deutschland stehen Frequenzen aufgrund der Notwendigkeit der Frequenzkoordinierung mit den Nachbarländern nur eingeschränkt zur Verfügung. Daher kann keine bundesweit einheitliche Frequenzzuteilung ergehen.

- The German Federal Network Agency (BNetzA) provides the first time spectrum for local and regional mobile networks for Industry 4.0 applications
- Nov. 2019: BNetzA approved local Campus Network for BASF in Ludwigshafen: 100 MHz; 3.7-3,8 GHz



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

Augmented Reality



Remote expert



Turn around support



Plant asset management



Operator rounds



Mobile HMI



Requirements

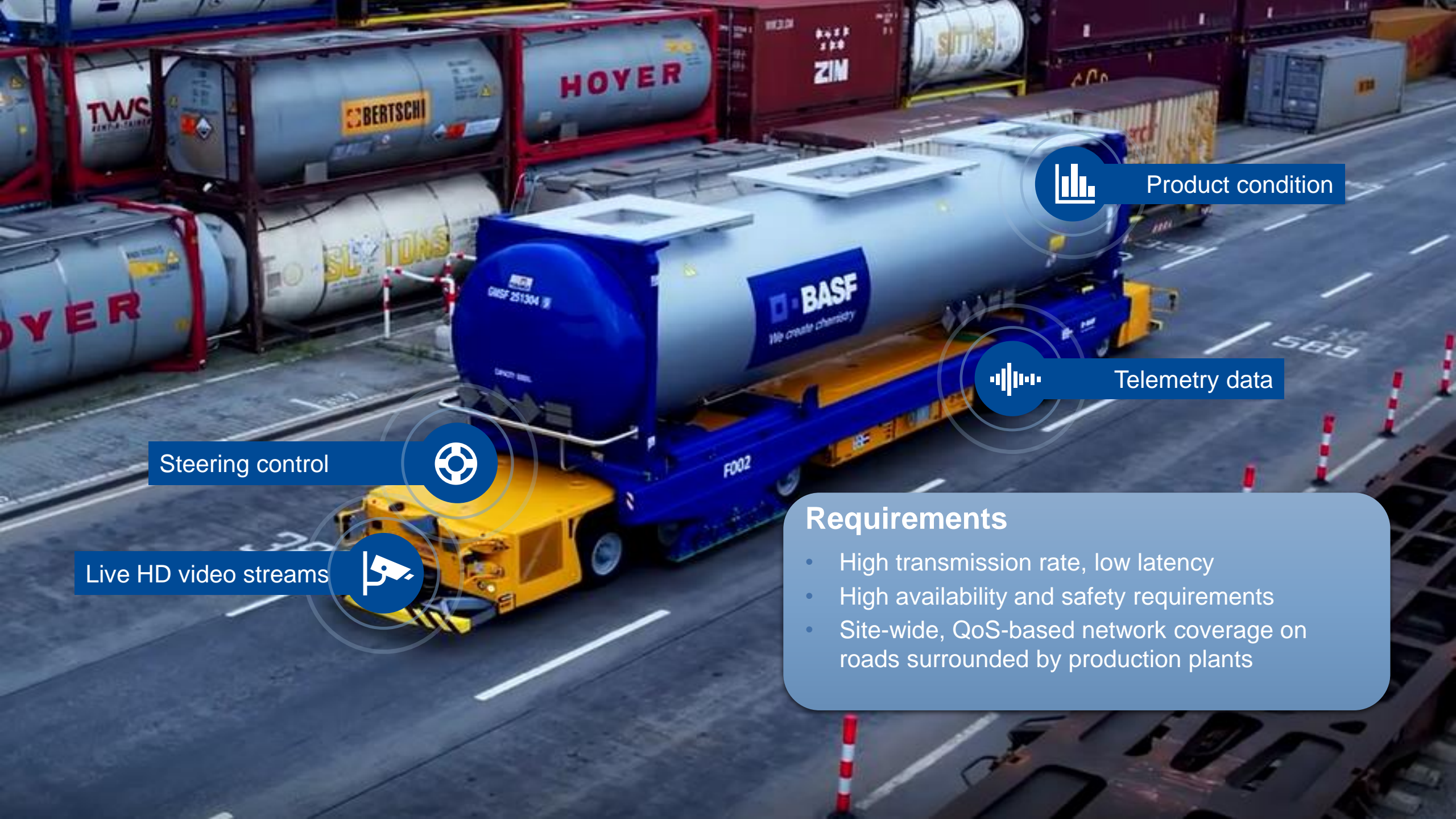
- Sufficient bandwidth and latency for human control to carry out processes and video calls
- High reliability and availability
- Security zoning
- Network coverage in production areas



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



Product condition



Telemetry data



Steering control



Live HD video streams

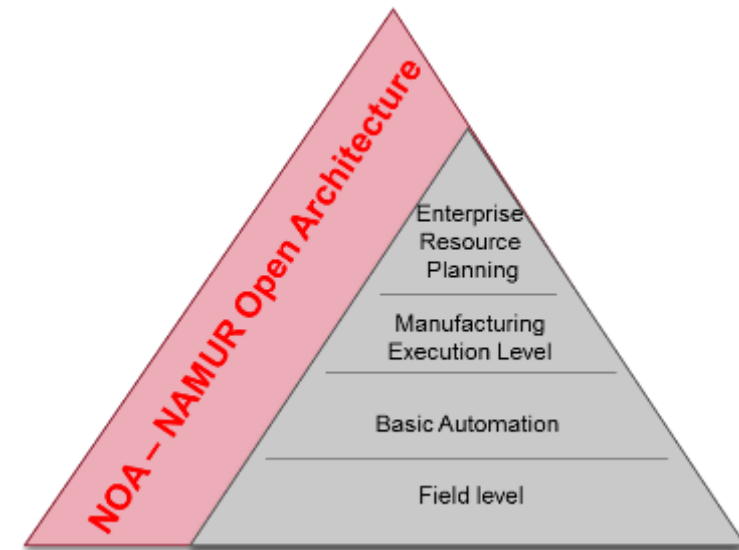
Requirements

- 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



Drones



Predictive Maintenance



Equipment tracking

Plant condition sensors



Requirements

- Low in terms of response time and availability compared to core automation
- Network coverage in production areas
- Use of standard communication technology



Hazard alarm technology

Reliable communication when it matters



Fire and gas alarms



Traffic displays



Video surveillance



Lone worker



Warning systems



Emergency systems

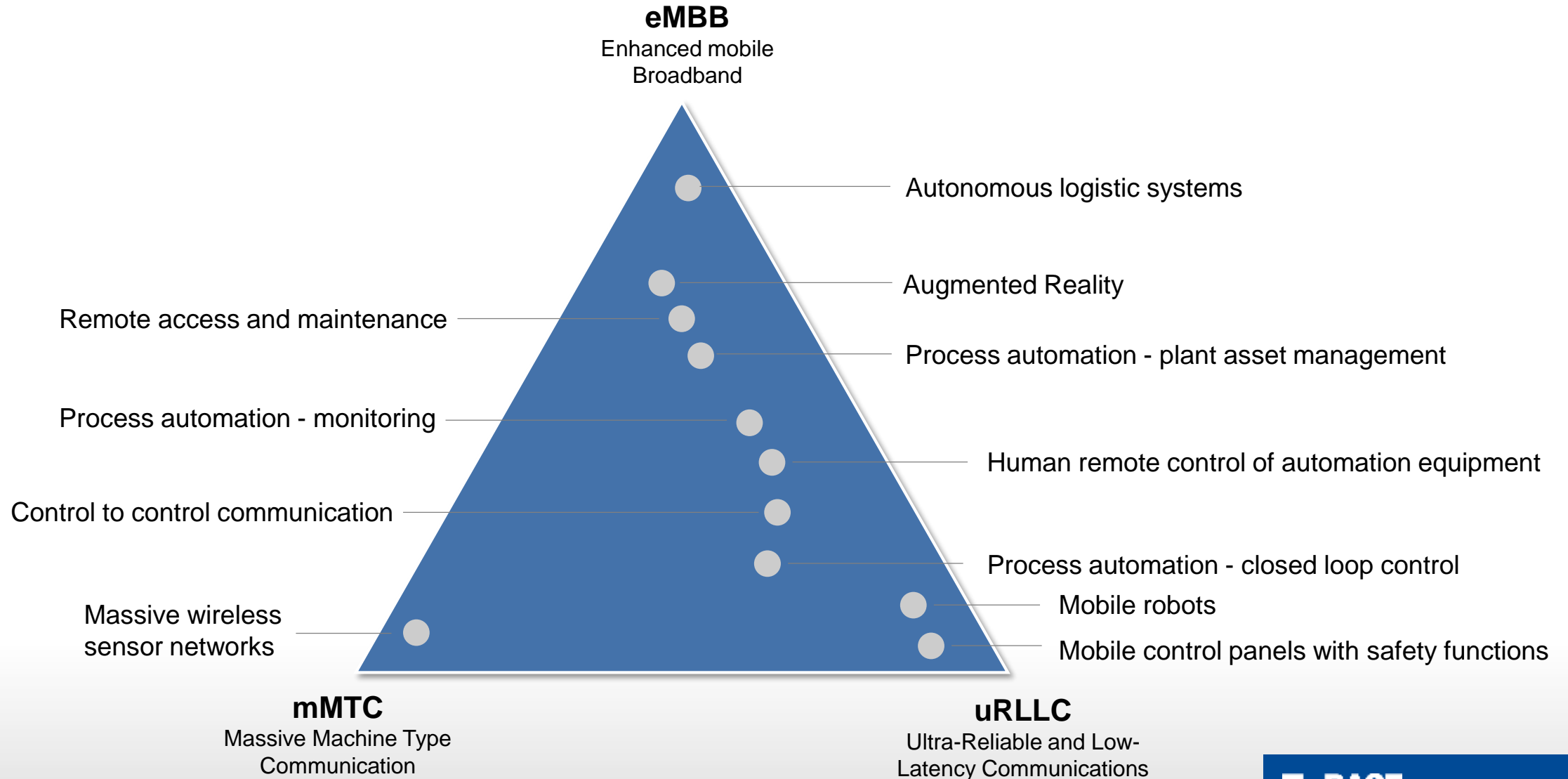
PA Systems



Requirements

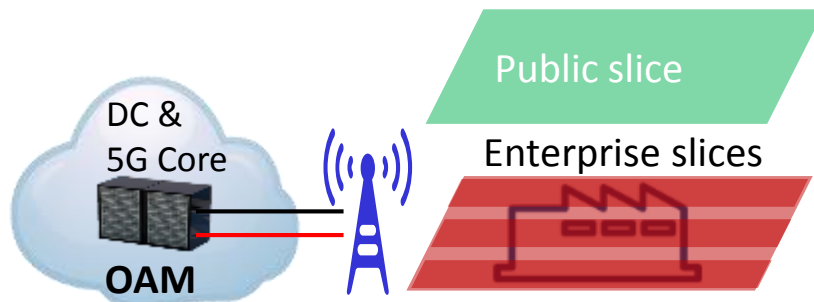
- High availability, dedicated fallback and redundancy concepts
- Prioritisation of communication
- QoS-based network coverage
- Security zoning

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



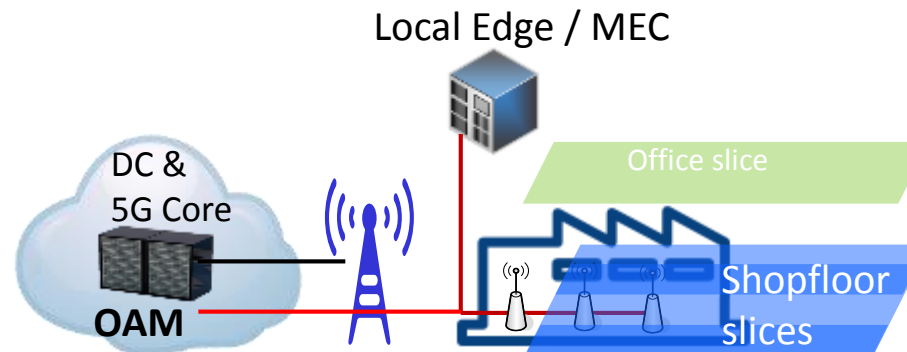
5G Industrial Network Architecture

Public NW slicing

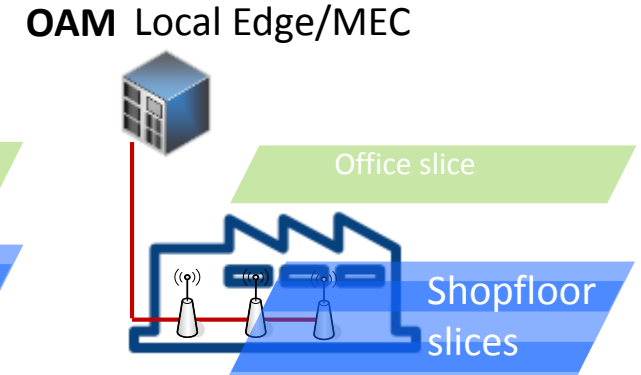


Non-public Network

Option1: Private network provided by MNO



Option2: Private –local network



- 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

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 production 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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