

5G-Mobilfunktechnologie für die Digitalisierung von Gesellschaft und Industrien



Vortrag Regina e.V.
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Ericsson GmbH

Ericsson at a glance: A world leader in ICT and 5G

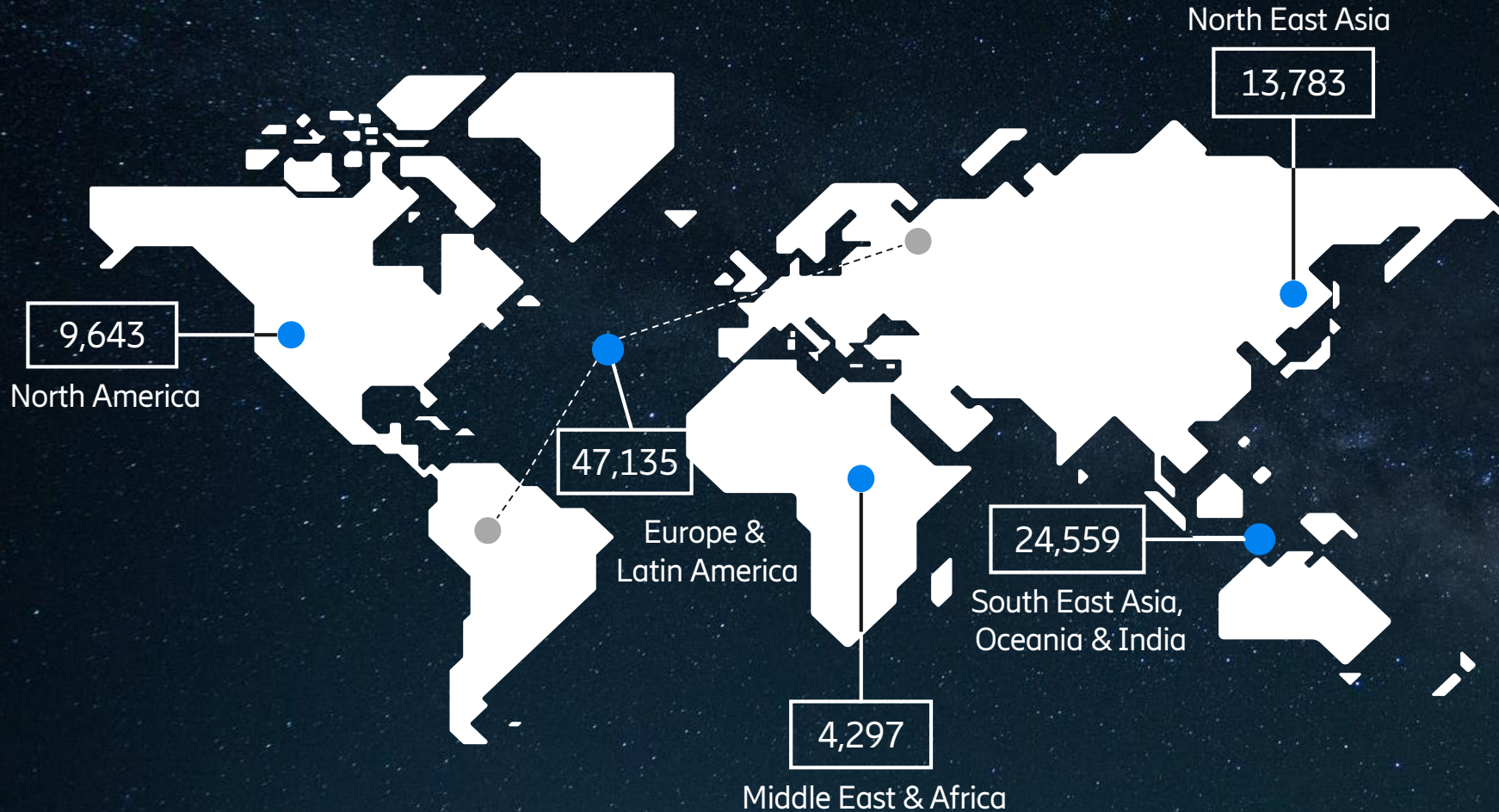
Business areas

- Networks
- Digital Services
- Managed Services
- Technologies and new businesses

By the numbers

- 180+ countries
- 227.2 b. SEK in Sales
- 99,417 employees
- 54,000 patents

Working with customers in more than 180 countries



99,417

Highly skilled people worldwide

25,096

Dedicated to R&D

50,696

Within Services supporting our product deployment and customers operations

Ericsson in Germany



Presence in
Germany

For over
60
Years



Employees

3,000



Research &
development

Development Centre
Eurolab (Aachen)
--
Kathrein
(Rosenheim)



Locations

13



Germany
Headquarter

Düsseldorf



Core business segments in Germany:



Mobile
broadband



Managed
services



Core & Cloud
solutions



System
integration



OSS and
BSS



TV and media



Industry 4.0

THE ERICSSON EUROLAB

ALMOST 30 YEARS OF RESEARCH AND DEVELOPMENT IN GERMANY



Foundation

1991



Employees

500



Patents per Year

80-100



Nationalities

45+

Eurolab
Engagements

4G/5G
NETWORKS

PRIVATE
NETWORKS

Industry
4.0

ITS

Energy

Innovation, Product and Solution Development @ Ericsson Eurolab



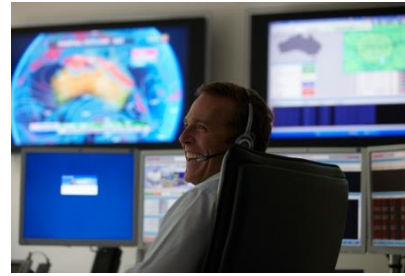
**Research and
Standardization**



SW Development



e2e System Integration



**Deployments to global
customer and product
support**

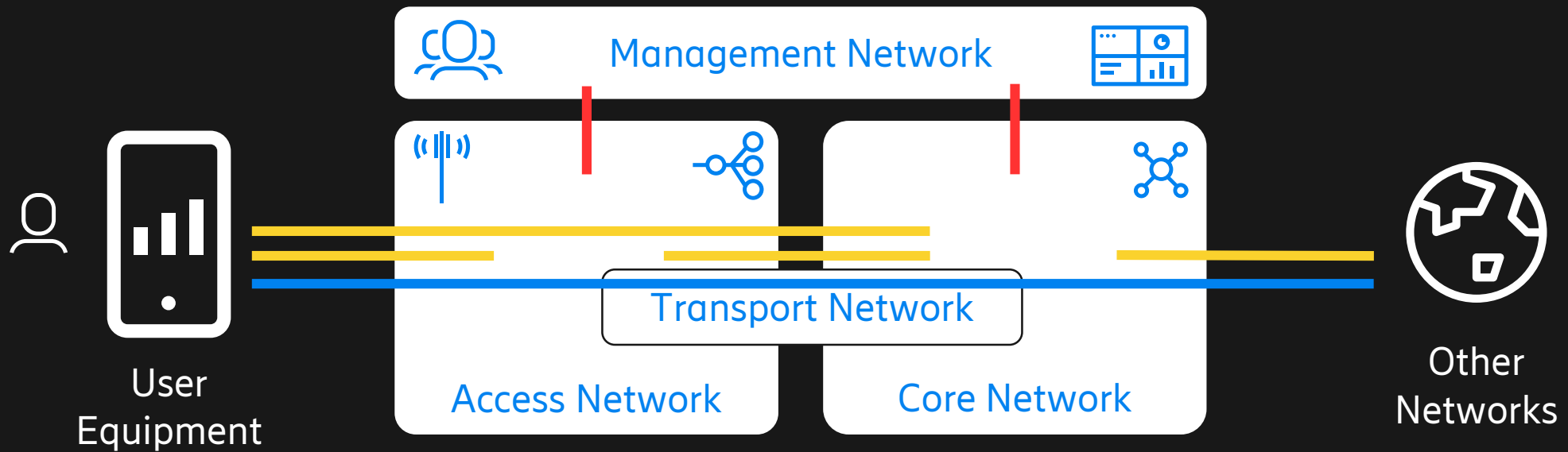


IPR



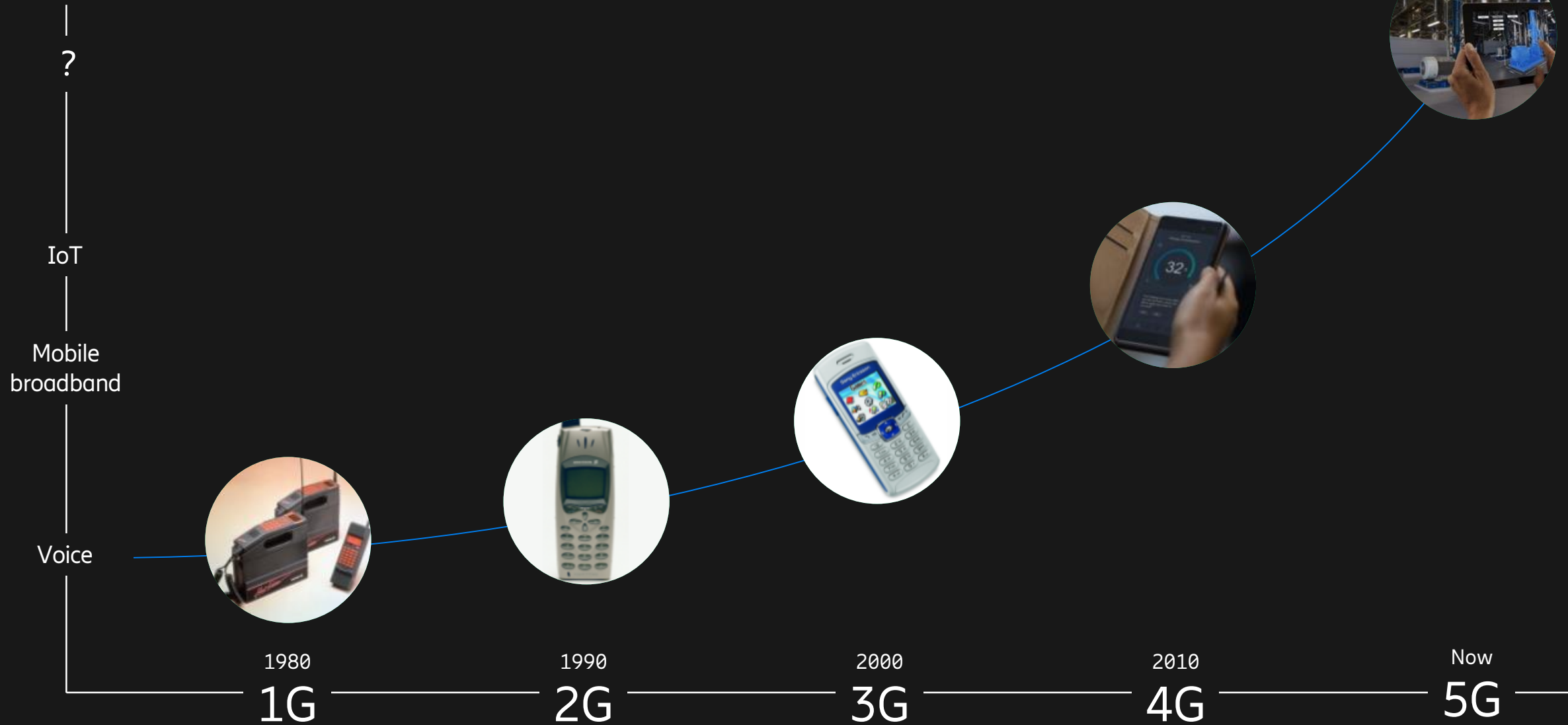
**Test and Integration
Lab operations**

Mobile network domains



Management Traffic
Control Signaling
User Payload

An industry driving change



Technologies that drive industry changes



Radio evolution

- mm Wave and massive antenna technologies
- Multi-purpose, multi-characteristic radio
- Flexible spectrum assignment and utilization

Programmable networks

- Software defined networking
- Network abstraction
- Network slicing

Machine intelligence

- Cognitive technologies and deep learning
- Responsible machine intelligence
- Capsule networks

Automation

- Model driven
- Automated life cycle management
- Autonomous systems



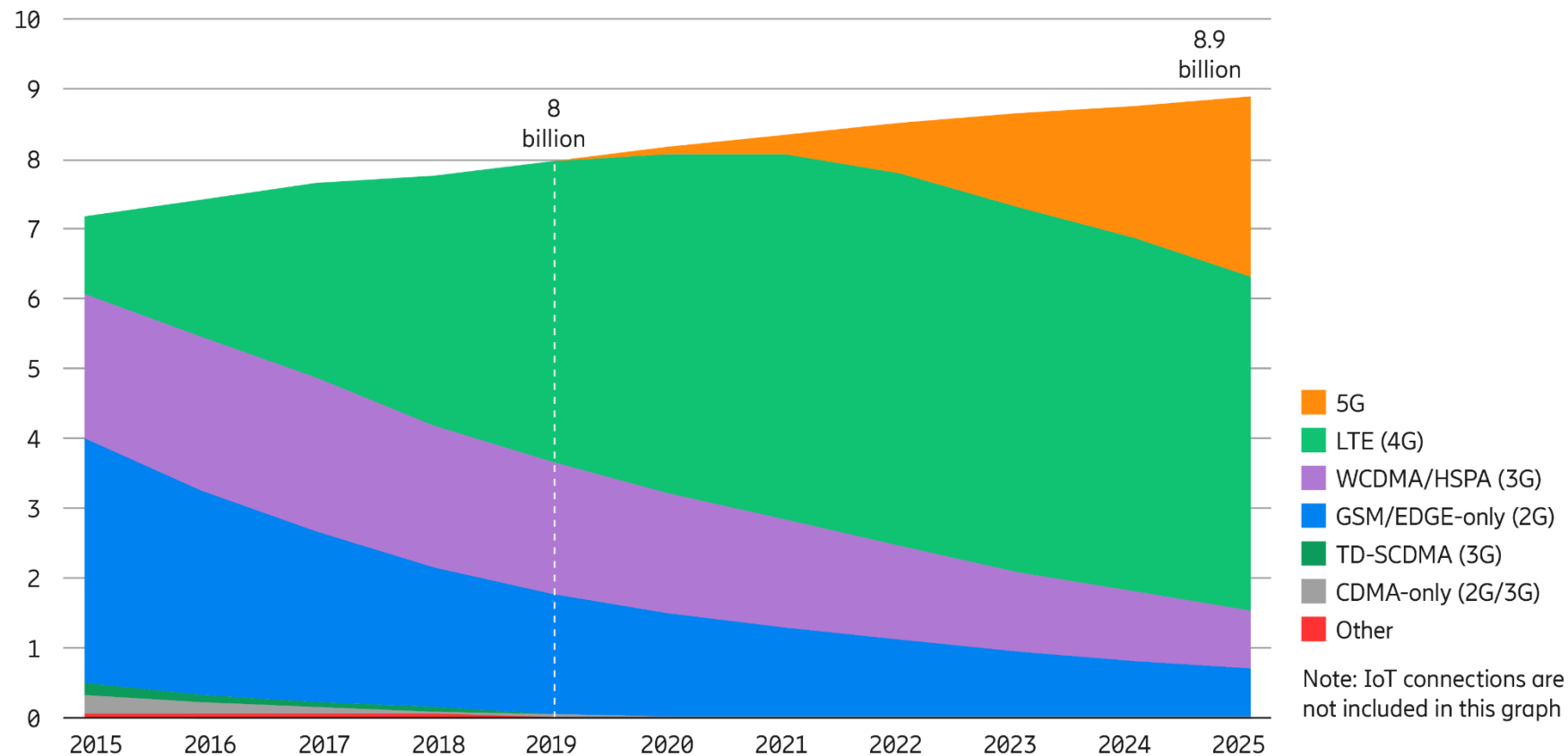
Cloud technologies

- Distributed cloud and edge computing
- Micro services and DevOps
- Virtualization, containers

In 2025 there will be 2.6 billion 5G subscriptions



Mobile subscriptions by technology (billion)

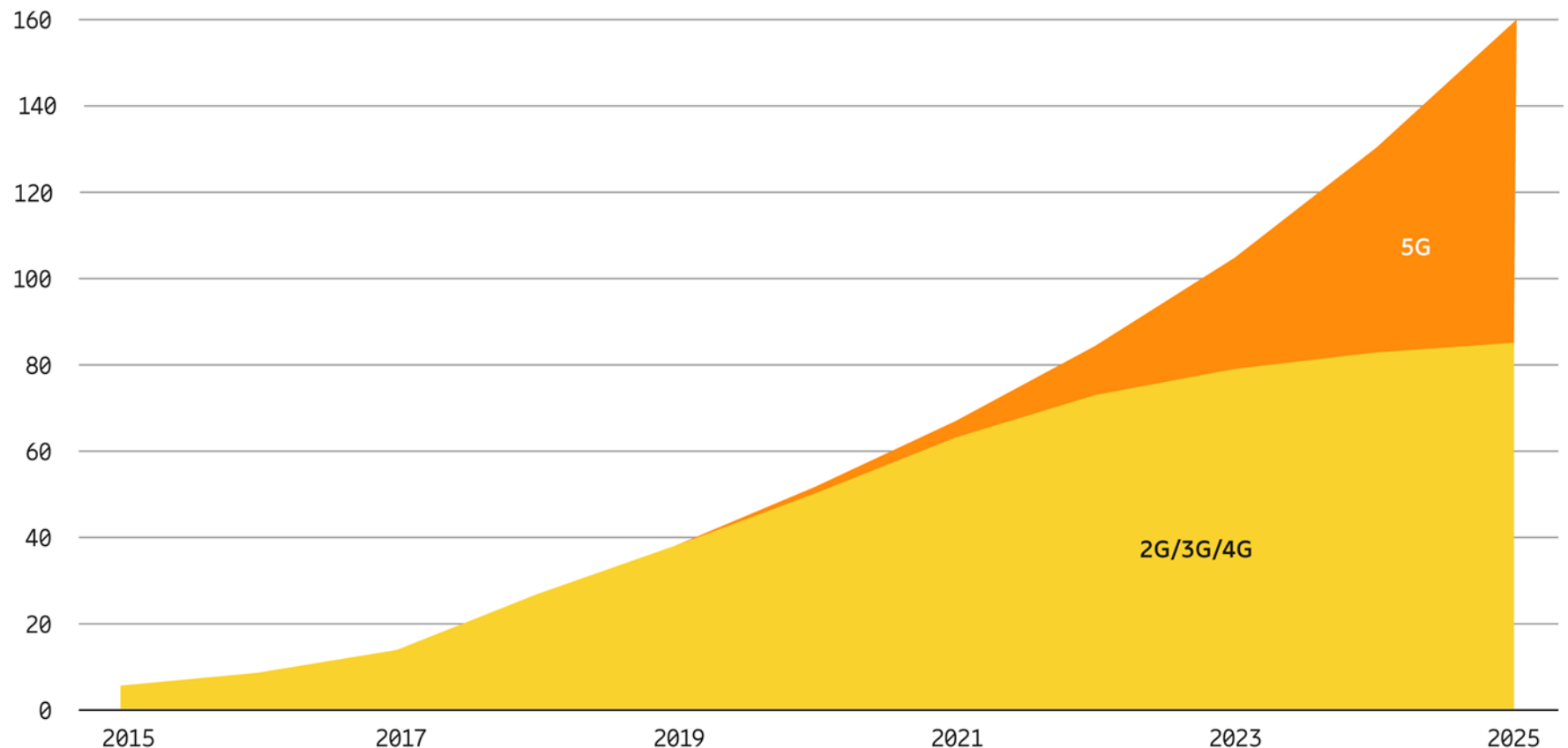


5G networks forecast to carry nearly half of the world's mobile data traffic in 2025

160EB

Total traffic predicted to reach 160 exabytes per month in 2025

Global mobile data traffic (EB per month)

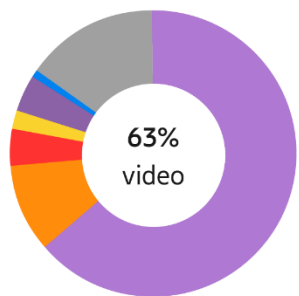


Video projected to make up 76 percent of mobile traffic in 2025

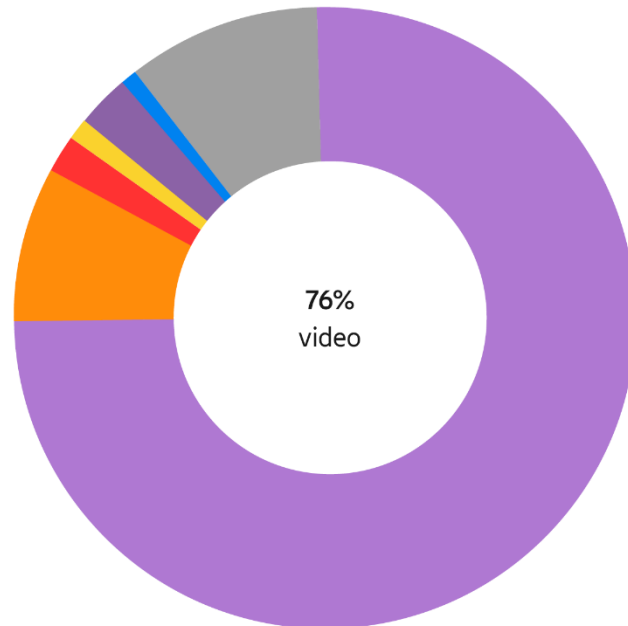


Mobile traffic by application category per month (percent)

Video Social networking Web browsing Audio Software download and update
P2P file sharing Other segments



2019
38EB
per month

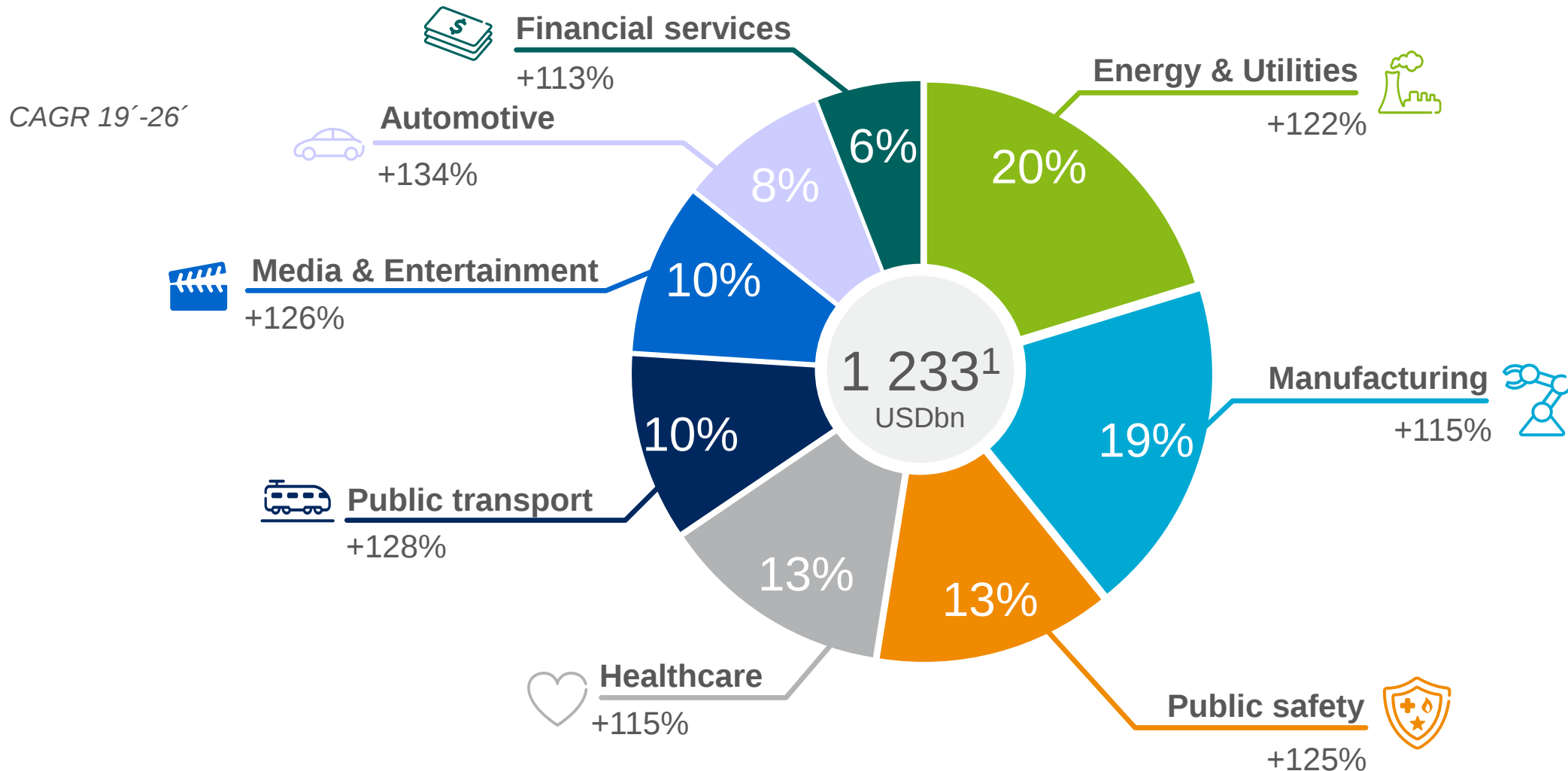


2025
160EB
per month

Main drivers:

- Video in most online content
- Video sharing services
- Video streaming services
- Changing user behavior
- Increased segment penetration
- Evolving devices
- Increased network performance
- Emerging immersive formats and applications

5G enabled digitalization revenues for ICT player



Source: Ericsson, Arthur D. Little

Note; 1) Year 2026

The 5G Business Potential, complete excl Appendix | © Ericsson AB 2017 | Page 13

Ericsson 5G-for-Europe Program (5GFE)

Strengthening European competitiveness in 5G together with academic, research and industry partners

Delivering industry pilots powered by local 5G trial networks to experiment, learn, and industrialize new use cases across industries

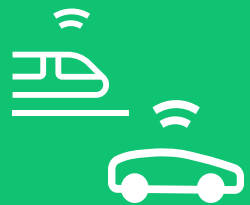


Manufacturing
5G pilots

- **KOI:** Coordinated Communication
- **5GANG:** 5G Applied in Industries
- **5G-BLISK:** 5GNR Adaptive Production
- **5GSMART:** Smart Manufacturing
- **5G-COS:** Collaborative Services & Augmented reality
- **5G-PLC:** Profinet via 5G/NR
- **5Grid:** Smart grid control

Example of partners in the different pilots

SICK	Stromnetz	Deutsche
Bosch	Berlin	Telekom
KUKA	TU-Dresden	Swisscom
Siemens	RWTH Aachen	Qualcomm
Fraunhofer	Schildknecht	PSI Logistics
ITelligence	BMBF	

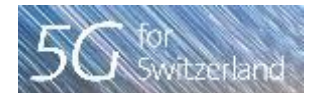
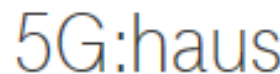


Automotive
and Rail
5G pilots

- **5G-ConnectedMobility:** Test field at the A9 focusing on V2X and Railway
- **5GNetMobil:** Tactile connected driving and platooning
- **5GCAR:** Automotive V2X lane merge, see through testing
- **5GCROCO:** Cross-border Automotive Use Cases

VW	PSA	Telefónica
Scania	5GLab	TU-Dresden
Audi	Germany	BNetzA
BMW	Deutsche	BMVI
Deutsche Bahn	Telekom	Qualcomm
bast	Vodafone	

Association partnerships



Cooperation Partner @ RWTH Aachen Campus Melaten ≡

(RWTH Aachen = University of Technology, Aachen, Germany)

Industrie 4.0 Reference
Factory / CCI

e.Go Lab

Werkzeug Maschinen
Laboratorium (WZL)

Fraunhofer IPT

e.on research institute

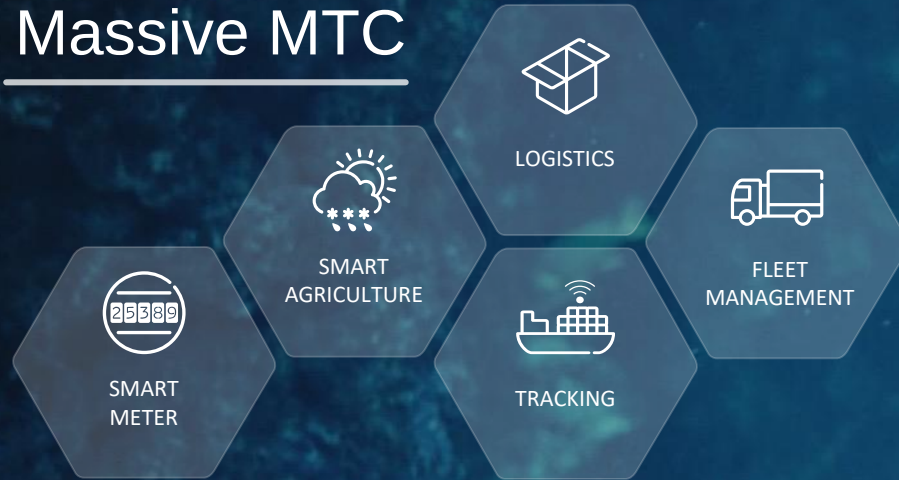


Cluster
“Production Technologies”

5G use cases



Massive MTC



LOW COST, LOW ENERGY
SMALL DATA VOLUMES
MASSIVE NUMBERS

Critical MTC

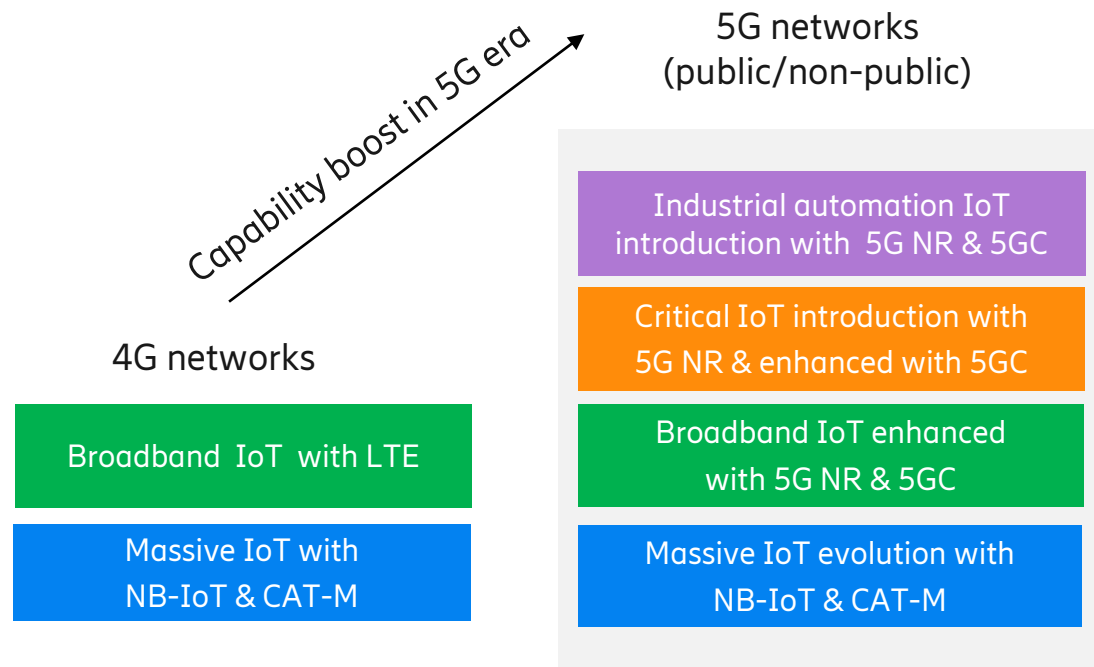
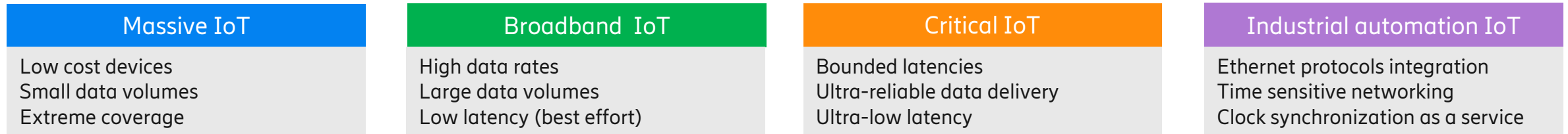


ULTRA RELIABLE
VERY LOW LATENCY
VERY HIGH AVAILABILITY

Enhanced mobile broadband



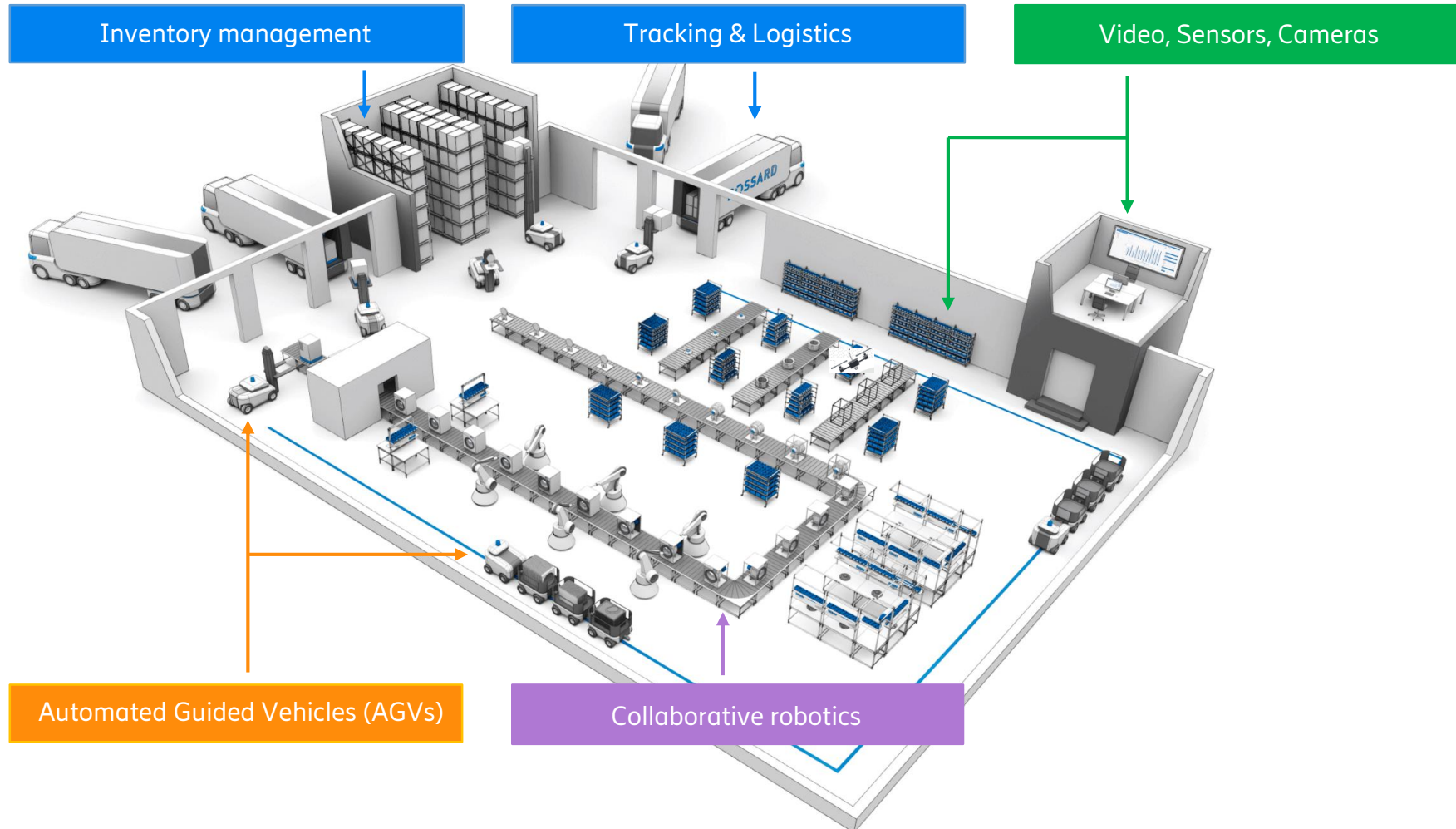
One 5G Network with Four Multi-purpose IoT Segments



Industry Digitalization with Cellular IoT

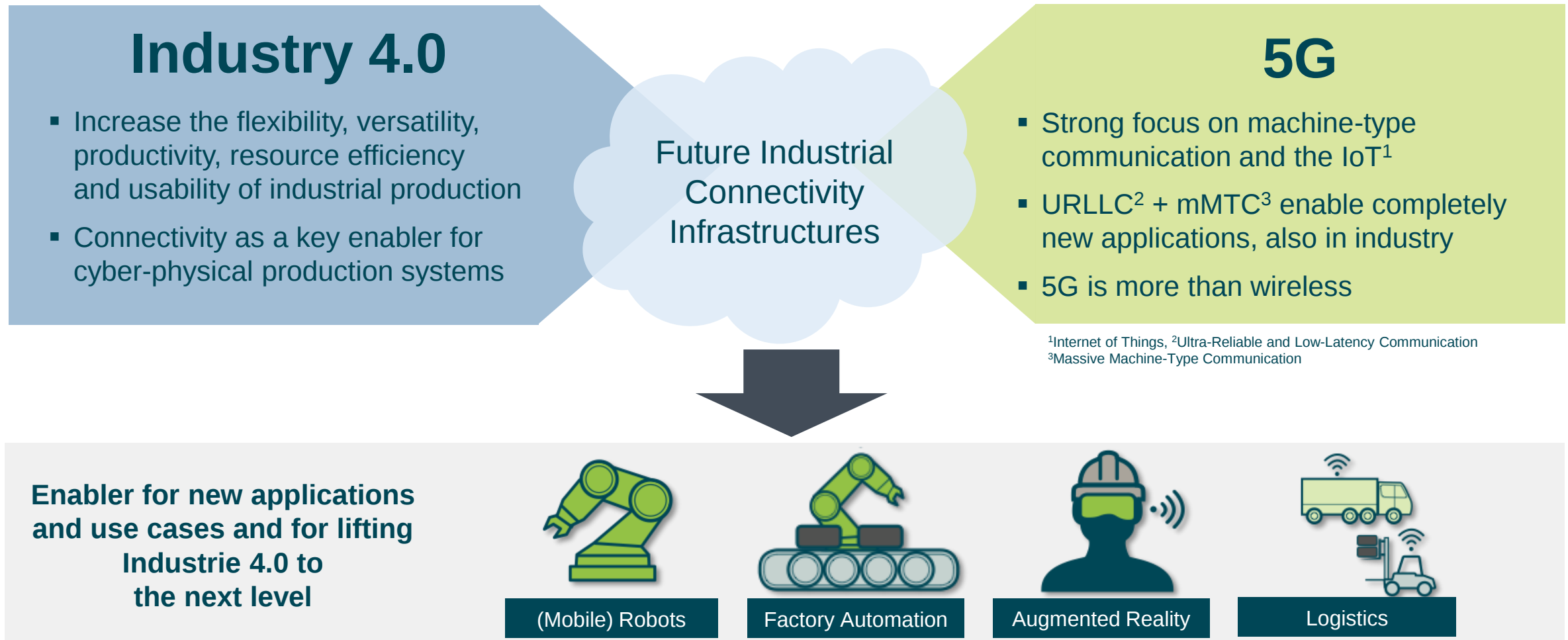
Entertainment	● ● ●	Transportation	● ● ●
Automotive	● ● ●	Smart city	● ● ●
Railways	● ● ●	Ports	● ● ● ●
Manufacturing	● ● ● ●	Education	● ● ●
Mining	● ● ● ●	Healthcare	● ● ●
Utilities	● ● ● ●	Construction	● ● ●
Forestry	● ● ●	Oil & gas	● ● ● ●
Agriculture	● ● ●	Warehousing	● ● ●
Public safety	● ● ●	Media production	● ● ●

Example: Smart Factory

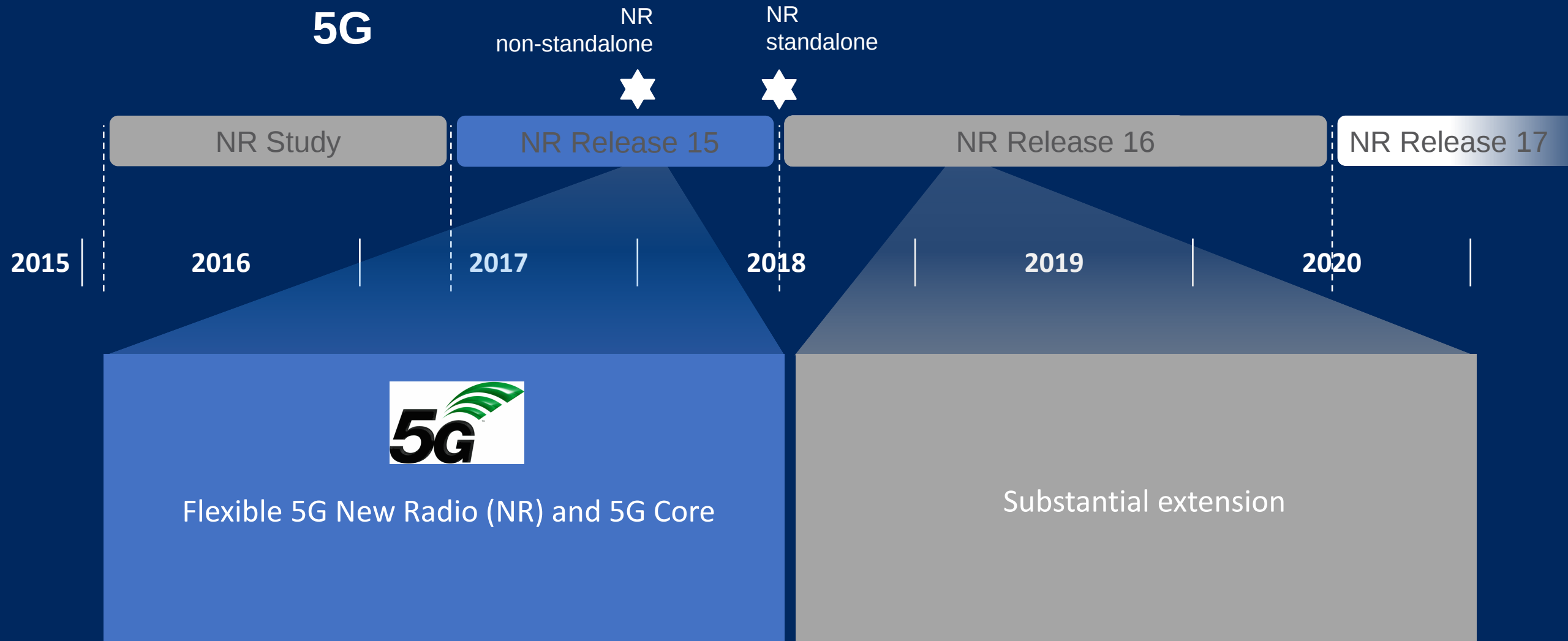


5G Alliance for Connected Industries and Automation

Motivation



5G standardization in 3GPP

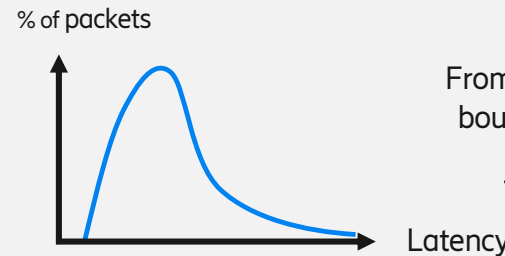


Critical IoT for Time-Critical Communications



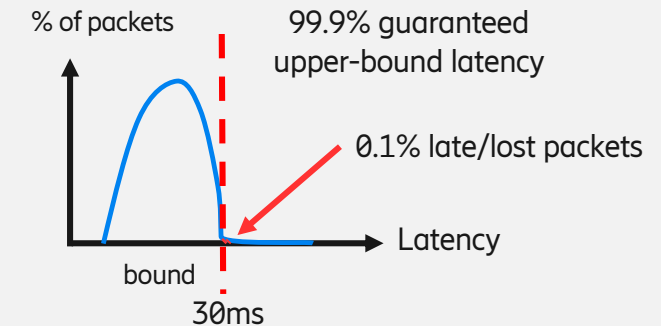
Critical IoT enables data delivery within desired latency bounds with required guarantee levels

Mobile Broadband



From best effort to bounded latency

Critical IoT (example)



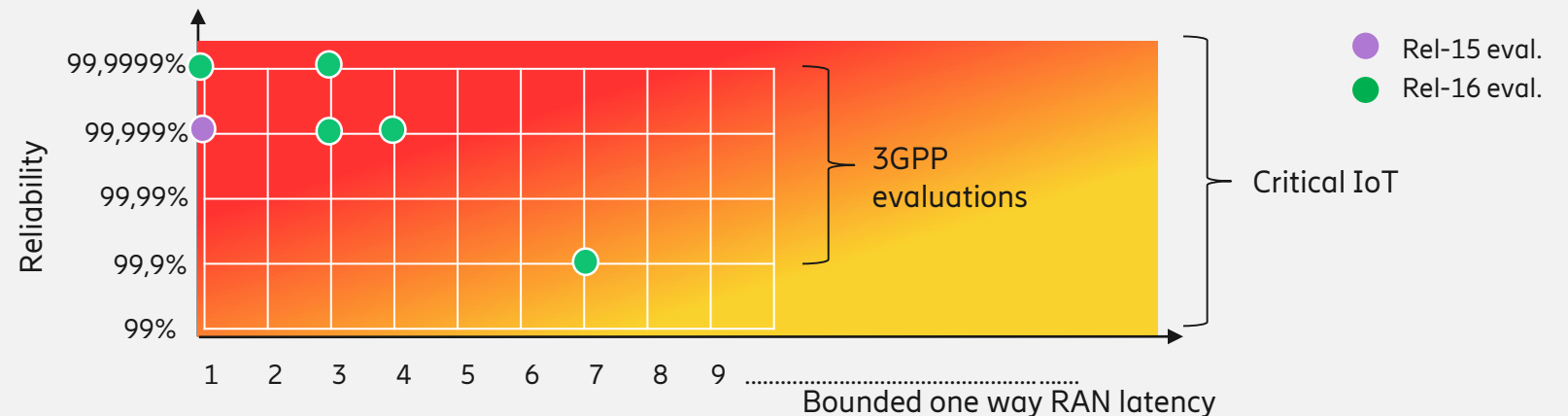
A GLOBAL INITIATIVE

Rel-15

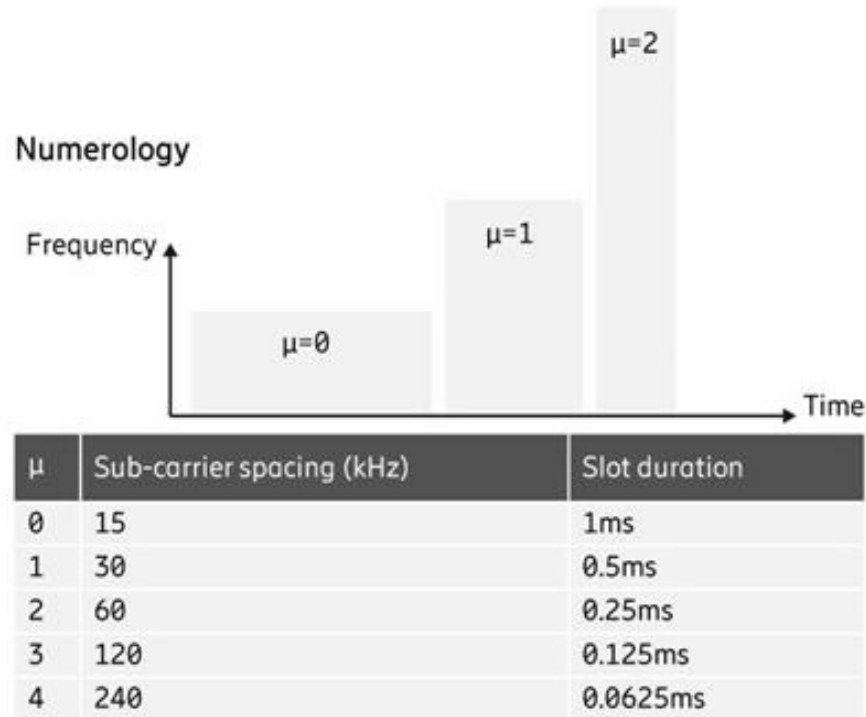
Rel-16

Rel-17

5G NR URLLC



Low latency features



Short transmissions

NR slot = 14 OFDM symbols (os)

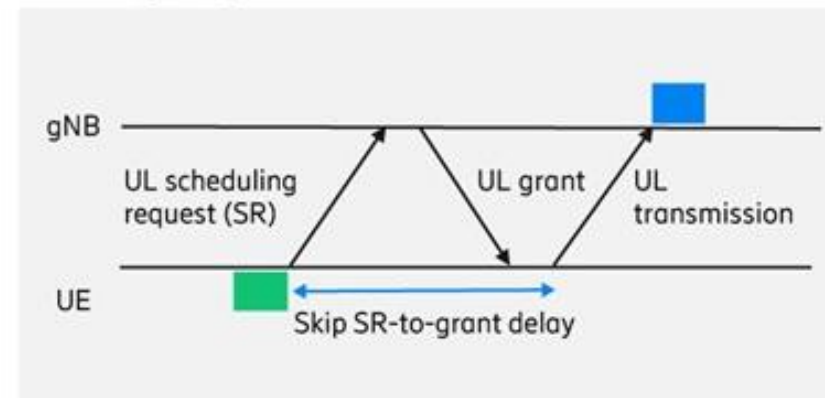


Time allocation:
— Type A (slot)
— Type B (2, 4 or 7 os)

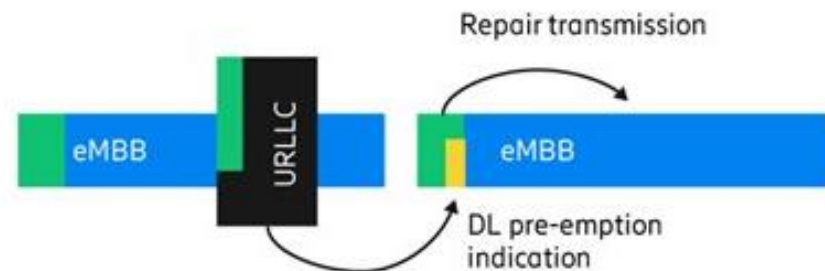
Mini-slot

Grant-free

- DL semi-persistent scheduling (SPS)
- UL configured grant (CG)

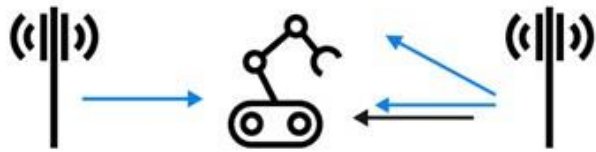


Pre-emption

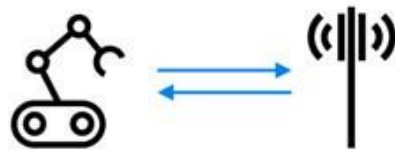


High reliability features

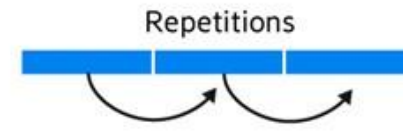
PDCCP duplication



Antenna techniques

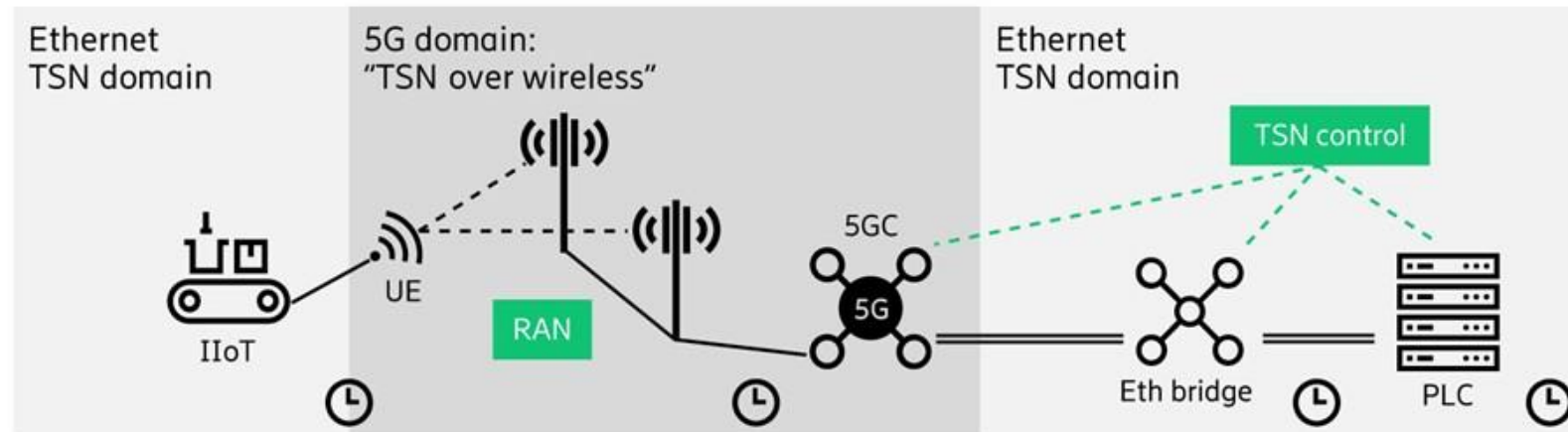


Automatic repetitions

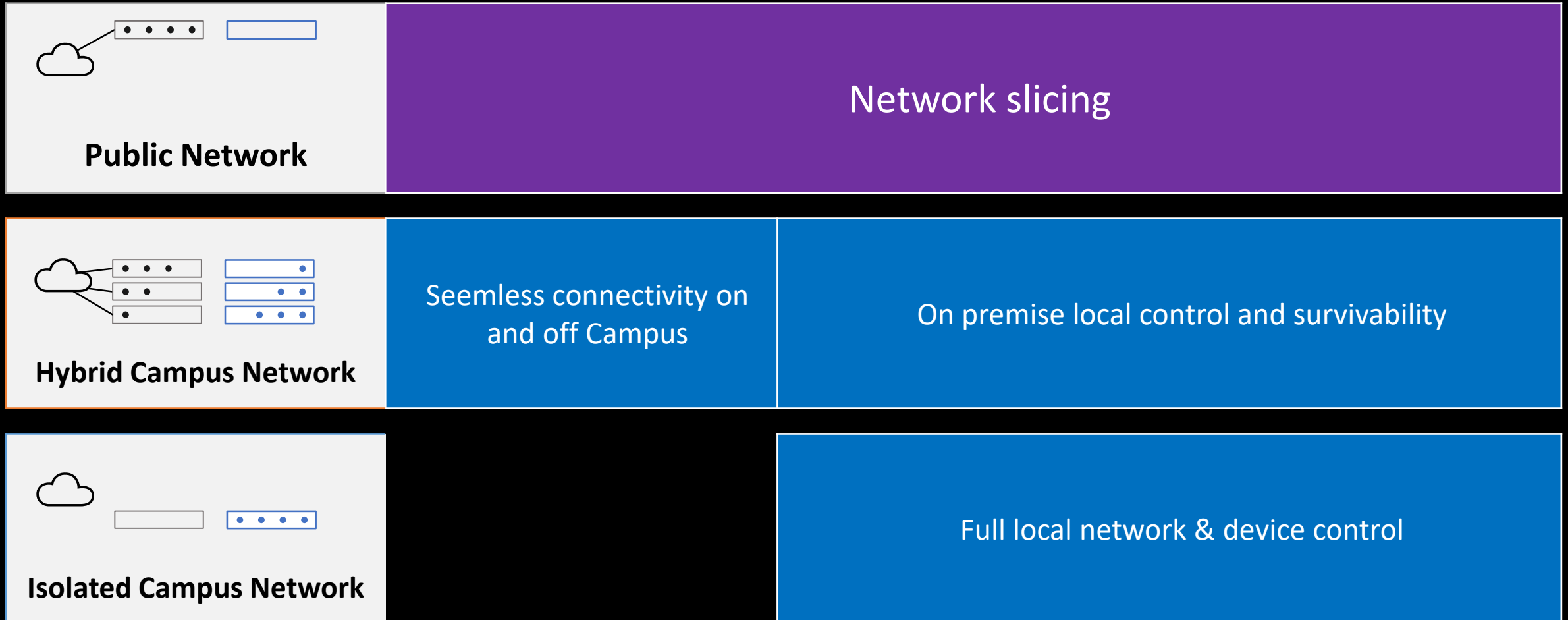


Time-sensitive networking

- Reliable deterministic flow
- Accurate time delivery (or synchronization)



4G/5G Cellular Dedicated Networks



Strengthening the 5G research and development in Germany and Europe



5G-CM Objectives

- › Strengthening the 5G Research and Development (R&D) in Germany and Europe
- › Integration of technology requirements from various industries into upcoming international 5G-standardization activities

5G-CM Project Description

- › A cross-industry consortium driving 5G R&D in Germany and in Europe
- › Creating a network infrastructure and application environment for 5G analysis and testing in real-time for
 - Vehicle-to-vehicle
 - Vehicle-to-infrastructure
 - Railway-to-infrastructure
- › Test track of approx. 30 km along the A9 motorway and a high speed railway track between Nuremberg-Feucht and Greding
- › 5G-CM is part of the „Digital test field motorway“-Initiative of the German Federal Ministry for Transportation and Digital Infrastructure



Members of the consortium are:



Supported by:

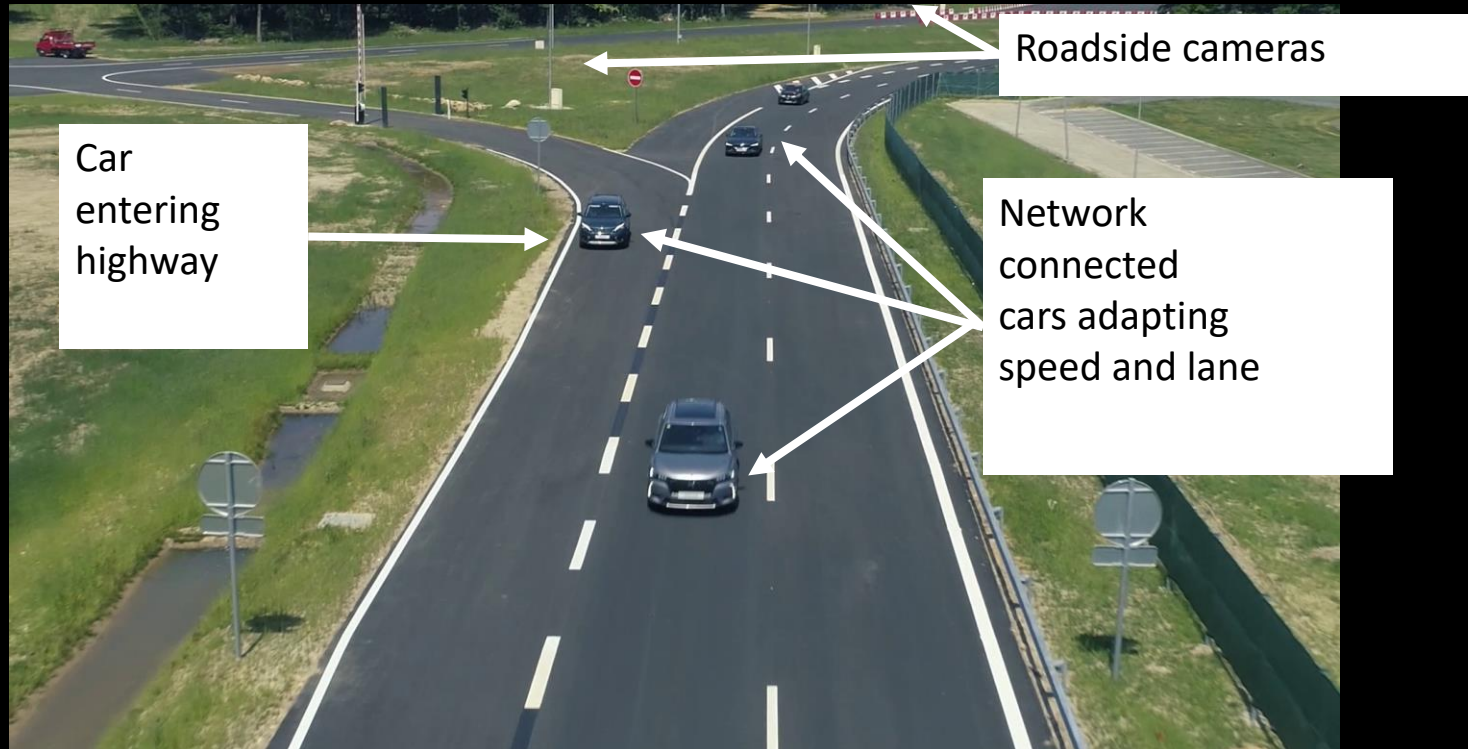


Bundesministerium
für Verkehr und
digitale Infrastruktur

Autobahndirektor
Nordbayern



5GCAR: Automated lane merge coordination



Central planning function

- Vehicle status info from cars & roadside cameras via V2N
- Data Fusion
- Maneuver Planning

Demonstrated at 5GCAR final event on June 27th 2019 south of Paris



5G monitored manufacturing of bladed disks

The challenge

Innovation in the aircraft engine design is limited by the growing complexity of the components. Ensuring maximum quality for these safety critical components and avoiding costly and energy heavy rework enable a boost in productivity and innovation.



Solution

Real-time monitoring and control of the production process of bladed disks for jet engine turbines enabled through 5G New Radio as a world's first is the pre-requisite to produce more efficient aircraft engines and secure the extremely high-quality demand.

Results

- Annual savings of 27 Million Euro per factory
- Worldwide 16 Million metric tons savings* of CO2

Partners

- MTU Aero Engines
- Fraunhofer IPT

* assuming 2% more efficient jet engines resulting from higher-quality BLISks

5G tool wear and breakage detection

Case: 5GTool

The challenge

Production tools have a significant influence on the quality of the process result and the achieved tolerance.

Today tools are replaced after a pre-defined utilization time.



Solution

Real-time monitoring of the tool wear by acoustic emission data acquisition directly from the production work piece.

Results

- 15%-20% better tool utilization can be achieved
- Prevention of tool breakage

Partners

- Artis Marposs
- Fraunhofer IPT

5G for Vehicle Production

Customer: Audi

The Challenge

Current WiFi solutions do not fulfil requirements regarding reliability, device handling and handover. Ethernet cables are inflexible and need regular maintenance to avoid service interruption.



Solution

Private 5G deployment and integration into factory mission critical ICT infrastructure and Manufacturing Execution System (MES).

Expected results

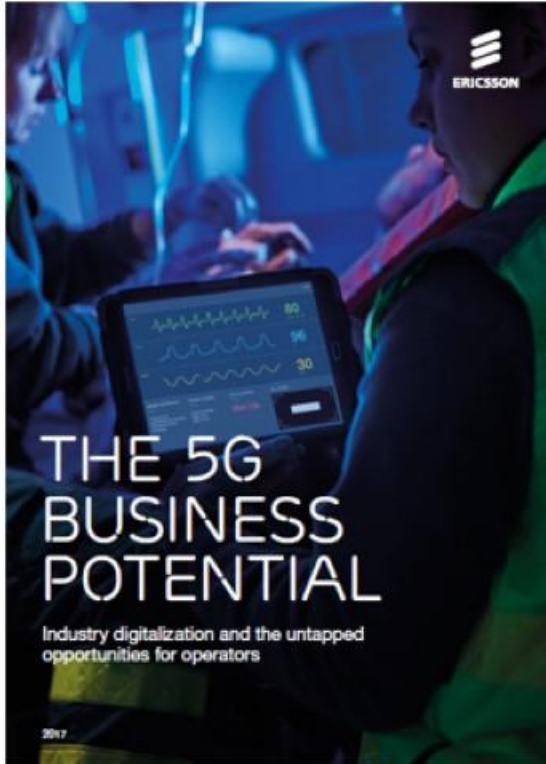
5G non-public network for industries implemented at a shop floor will enable controlling of robots, steering of AGVs, firmware download to vehicles and connecting a large amount of devices with pervasive connectivity and low latency

Partner

- Audi

Relevant reports

– Massive and Mission Critical IoT



<https://www.ericsson.com/en/networks/trending/insights-and-reports/the-5g-business-potential>



<https://www.ericsson.com/en/networks/trending/insights-and-reports/5g-challenges-the-guide-to-capturing-5g-iiot-business-potential>



https://www.ericsson.com/assets/local/reports/5g-for-industries-report_blink_27062018.pdf



<https://www.ericsson.com/en/trends-and-insights/consumerlab/consumer-insights/reports/a-case-study-on-automation-in-mining>

Summary



5G technology developed to address societal and industry needs

Ericsson Eurolab deeply involved in driving 5G technology

Europe's most advanced industrial 5G network is set-up on Campus Melaten



