

# How 5G can unlock the Potential of Industrial IoT

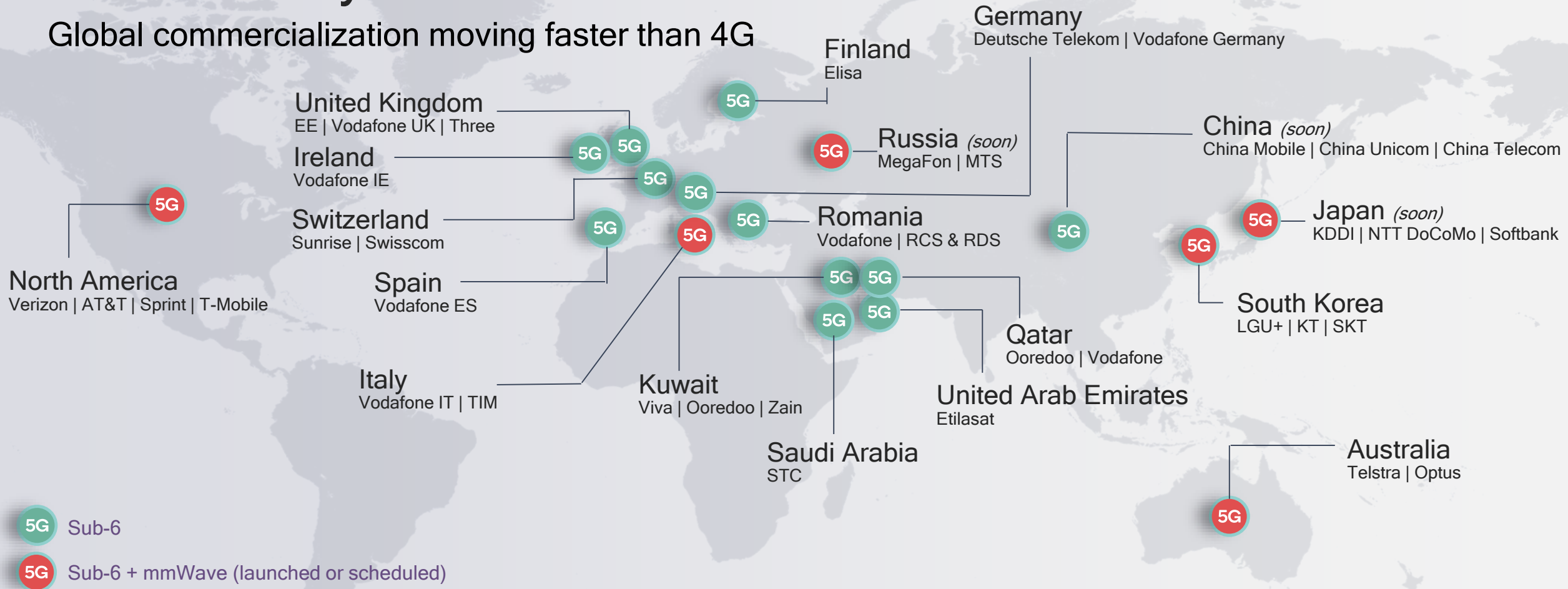
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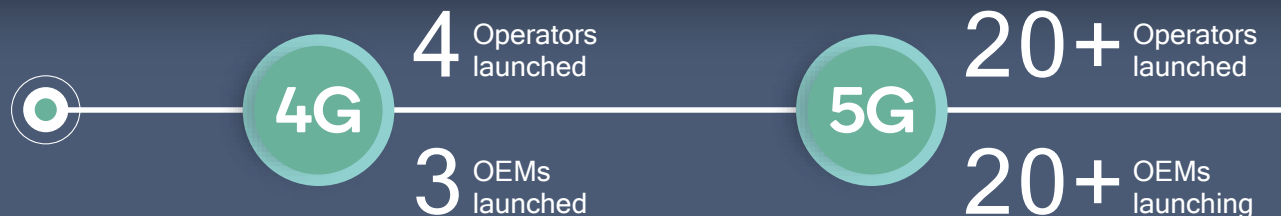


# 2019 is the year of 5G

Global commercialization moving faster than 4G



## Comparison of Year 1 announcements





# 5G in Europe

Faster-than-anticipated  
Launch of 5G devices,  
Networks and services.

Multiple operators and major OEMs already rolling out 5G this year



LG

OnePlus

OPPO

Xiaomi

ZTE

Samsung



European Commission to harmonize radio  
spectrum in the 26 GHz band for 5G services<sup>1</sup>

<sup>1</sup> <https://ec.europa.eu/digital-single-market/en/news/european-commission-harmonise-last-pioneer-frequency-band-needed-5g-deployment>



Container ports



Oil refineries



Manufacturing



Construction



Mines



Warehouses



Wind farms



Oil rigs

# >\$5 Trillion<sup>1</sup>

Global economic output in 2035 enabled by 5G in the following five categories



Manufacturing  
\$3,364B



Transport  
\$659B



Construction  
\$742B



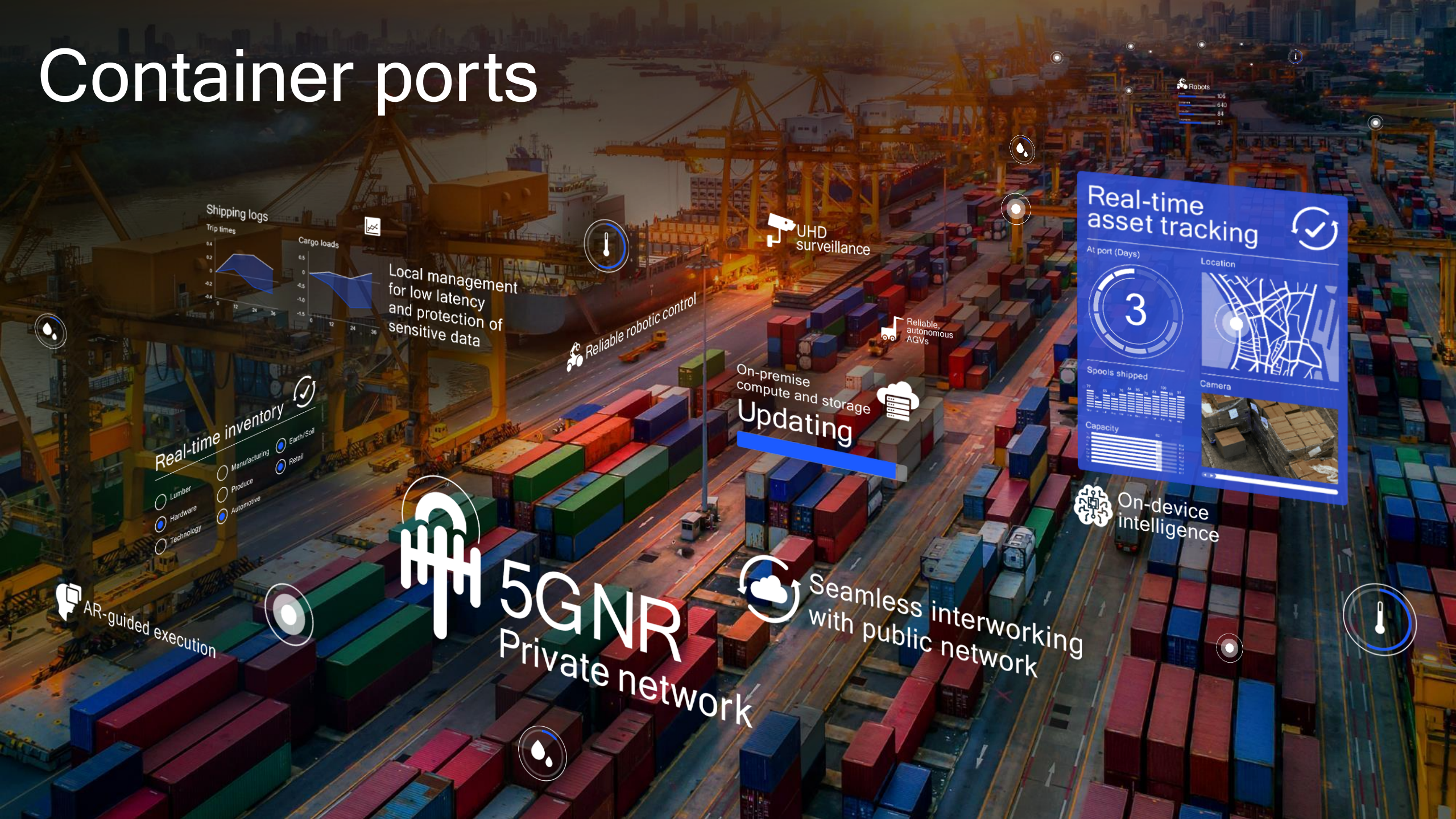
Utilities  
\$273B



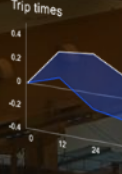
Mining  
\$249B

1. "The 5G economy: How 5G technology will contribute to the global economy" by IHS Economics / IHS Technology

# Container ports



Shipping logs



Local management for low latency and protection of sensitive data

Real-time inventory

- Lumber
- Manufacturing
- Produce
- Hardware
- Automotive
- Technology
- Earth/Soil
- Retail

UHD surveillance

Reliable robotic control

Reliable, autonomous AGVs

On-premise compute and storage  
Updating

### Real-time asset tracking

At port (Days)

3

Location

Spools shipped

Capacity

Camera

On-device intelligence

5G NR  
Private network

Seamless interworking with public network

AR-guided execution



Turbine sensor



Blade sensors



Drone inspection



Environmental sensors



Handheld computing



Vehicle tracking

# Wind farms

## Enhanced mobile broadband

### Head mounted display

#### Augmented Reality

Latency: 10 ms  
Availability: 99.9%  
Rate: Gbps-Mbps

### Handheld terminal

#### Safety functions

Latency: 10 ms  
Availability: 99.9999%  
Rate: Mbps-kbps

### Security camera

Latency: 50ms  
Availability: 99.9%  
Rate: Mbps

### Industrial robot

#### Motion control

Latency: 1 ms  
Availability: 99.9999%  
Rate: Mbps-kbps

## Massive IoT

### Sensors

#### Process Monitoring

Latency: 100 ms  
Availability: 99.99%  
Rate: kbps

### Automated guided vehicle (AGV)

Latency: 20ms  
Availability: 99.9999%  
Rate: Mbps

### Edge computing and analytics

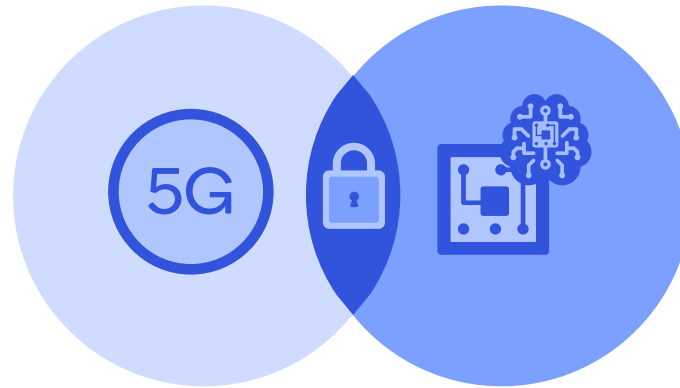
## Ultra reliable low latency

# 5G takes Industry 4.0 to the next level

Single futureproof 5G network

Scalable capacity and reliability

Flexibility with wireless Ethernet

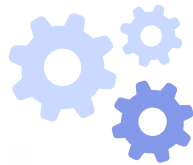


On-device processing and sensing

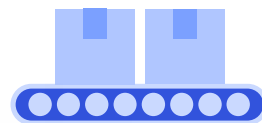
CV and AI for autonomous machines

Edge services and data privacy

Connectivity | Security | Compute



Industry 1.0  
Mechanization



Industry 2.0  
Electrification

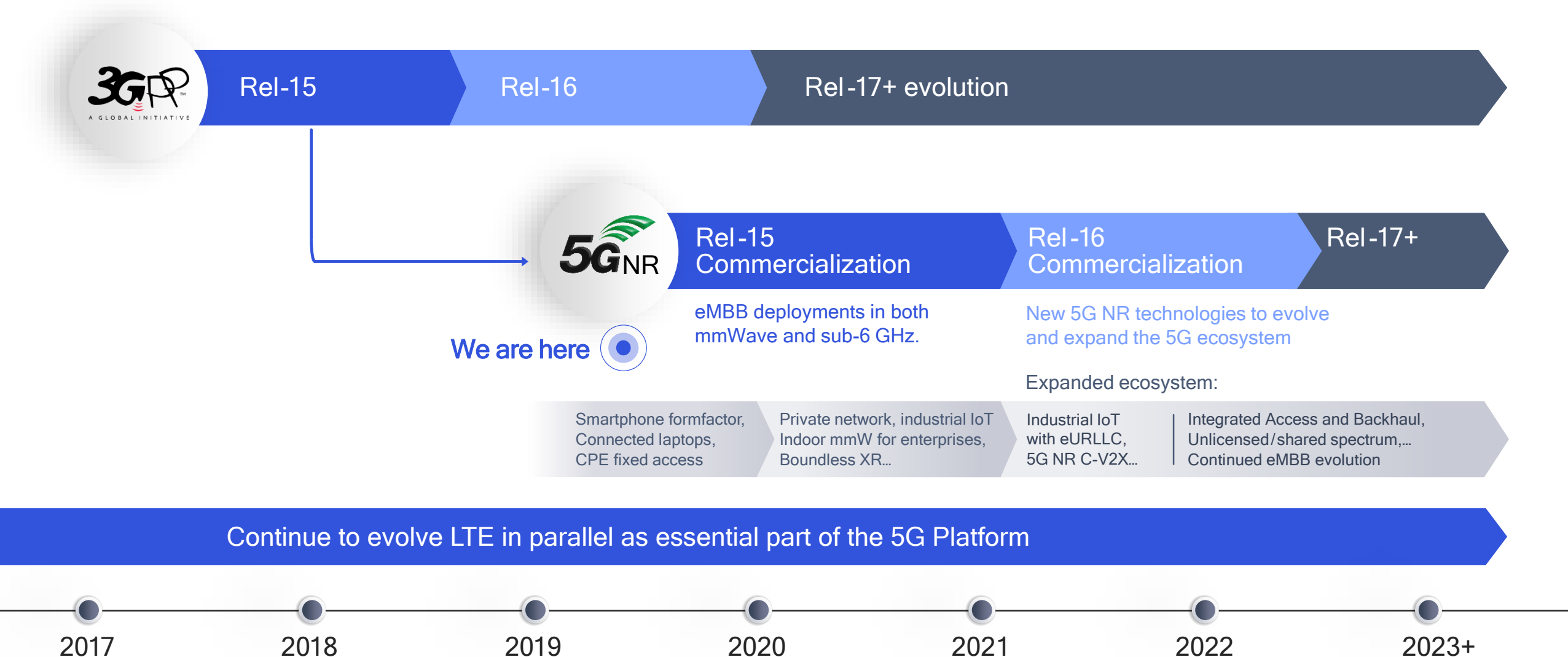


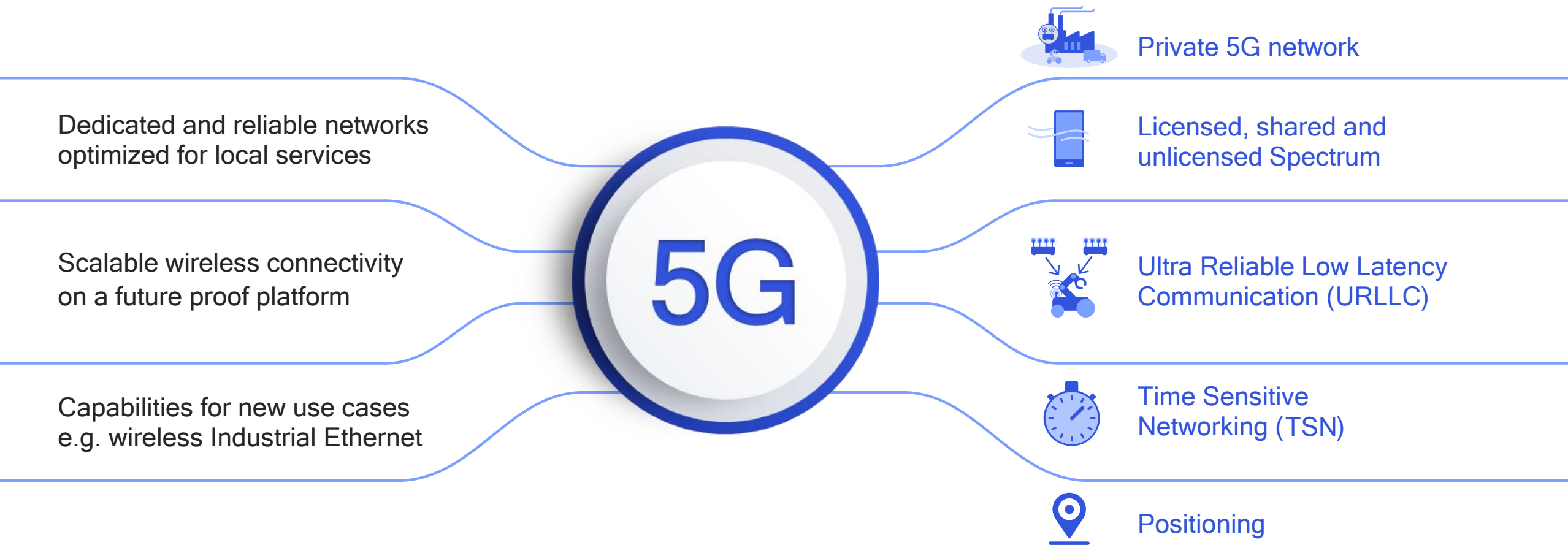
Industry 3.0  
Digitalization



Industry 4.0  
5G Connectivity

# Driving the 5G roadmap and ecosystem expansion





# Designing 5G to meet industrial IoT requirements

# 5G



## Private 5G network

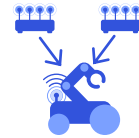
- Unique network ID
- Integrated and independent architectures
- Seamless fallback to public networks



## Spectrum

With NR-U, 5G NR will support:

- Licensed spectrum
- Shared spectrum
- Unlicensed spectrum



## URLLC

- Low latency
- Ultra-reliability
- CoMP multi-TRP
- Service multiplexing
- Enhanced mobility



## TSN

- Ethernet over 5G
- Deterministic networking
- Device time synch.



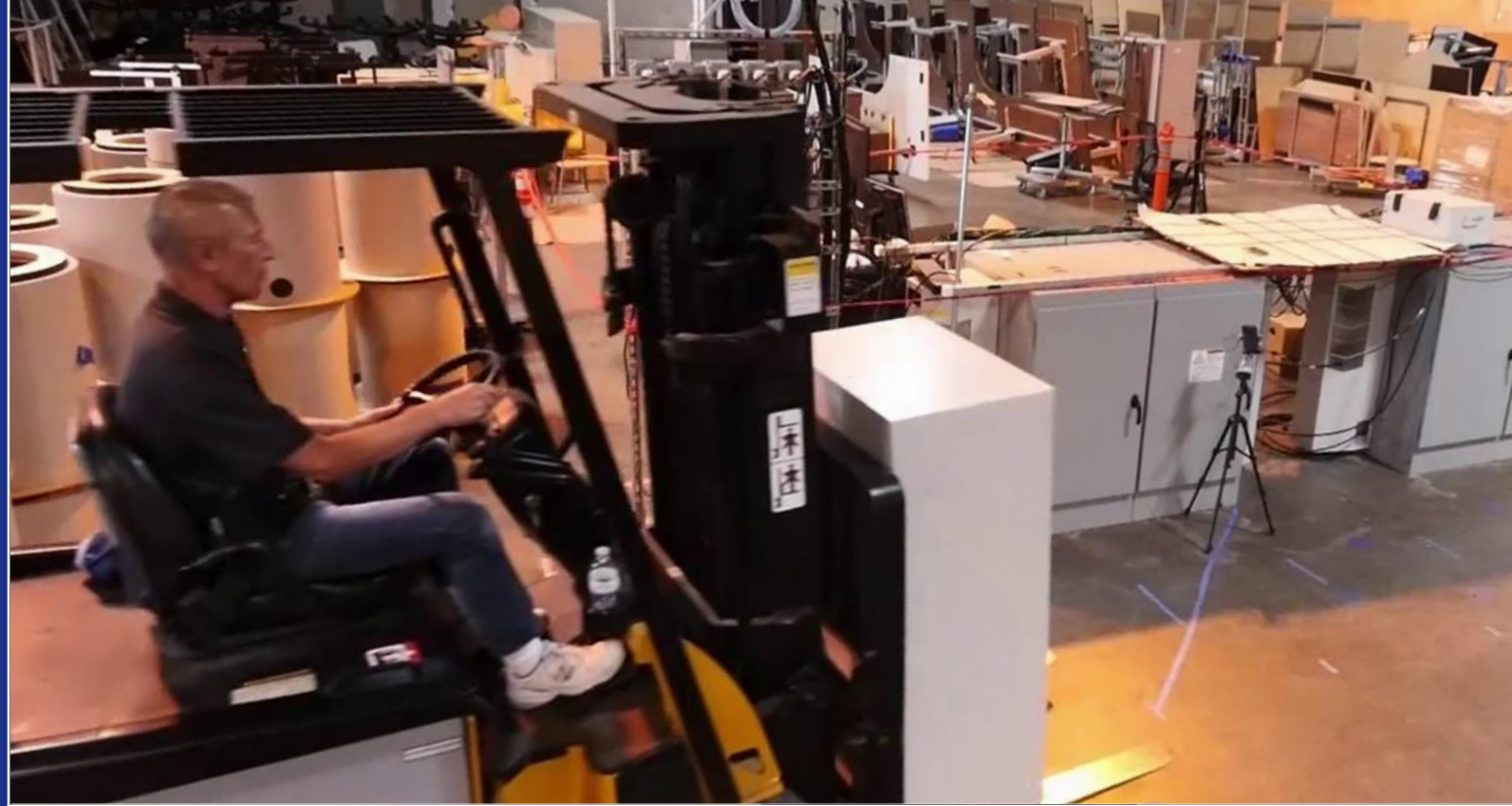
## Positioning

- Network & device based
- Industrial IoT requirements

5G NR supports many industrial IoT use cases today;  
3GPP Rel-16 brings additional capabilities

# 5G Industrial IoT testbed to drive and track progress in standards

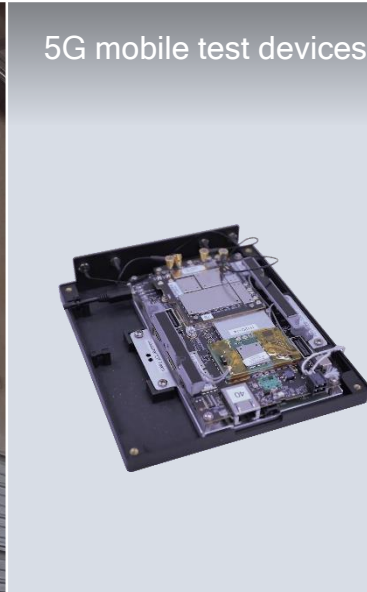
Over-the-air testbed to demonstrate new IIoT functionality such as CoMP, eURLLC, and TSN



5G small-cells



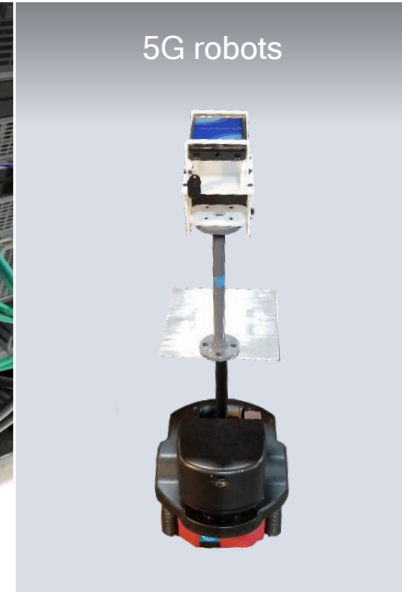
5G mobile test devices



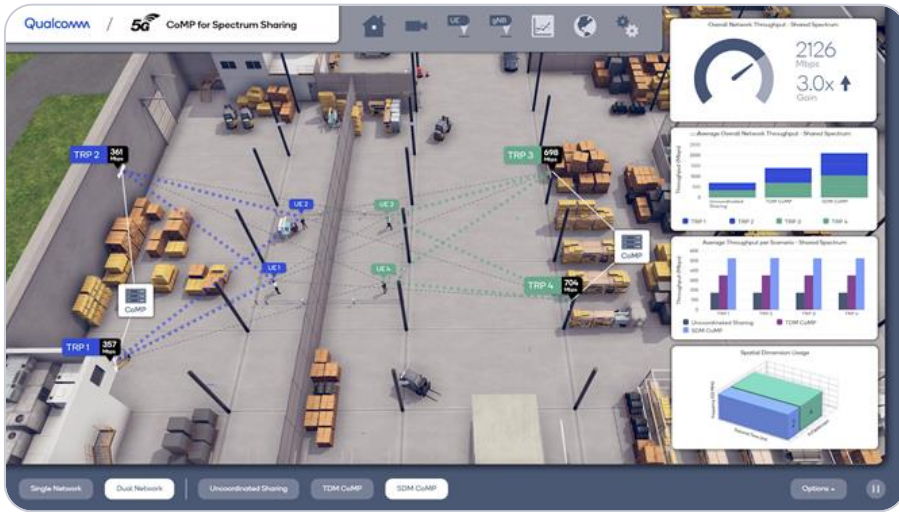
5G CoMP server



5G robots



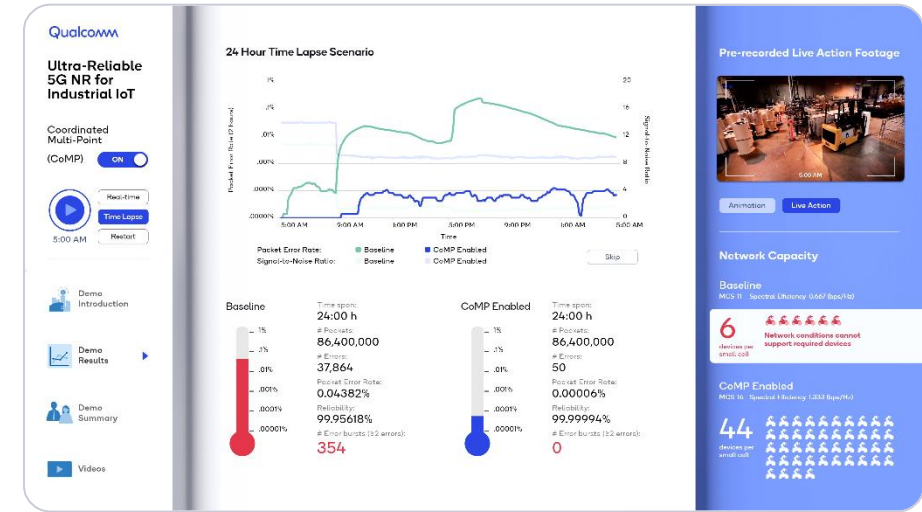
# Demonstrations of 5G CoMP at MWC Barcelona 2019



## 5G CoMP for capacity

Synchronized sharing with 5G CoMP in shared/unlicensed spectrum provides higher network capacity and perceived data speeds.

With synchronized sharing, adjacent deployments to simultaneous use of the same spectrum.



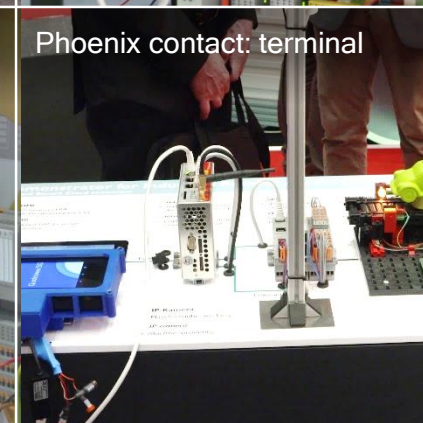
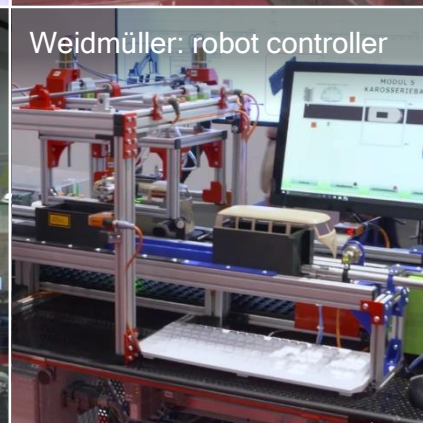
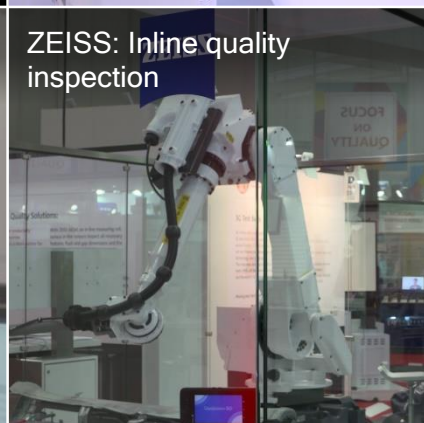
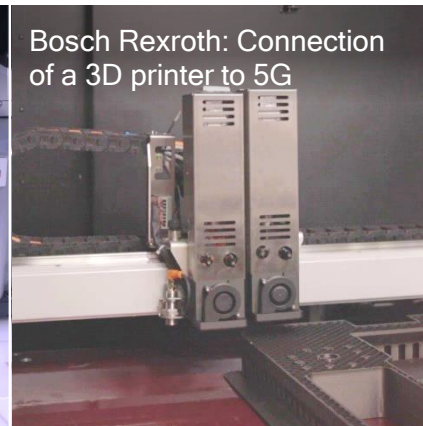
## 5G CoMP for ultra-reliability

Industry-first demo of 99.9999%<sup>1</sup> ultra-reliability in a 5G NR over-the-air testbed using CoMP

5G CoMP provides spatial diversity that can overcome blocking in challenging radio environments

1) One of the performance requirements in 3GPP TS 22.104

# Strong industry collaboration around 5G Industrial IoT



Kickstarted 5G for Industrial IoT with 10+ live ecosystem demonstrations at Hannover Messe 2019 based on Rel-15

Research collaboration with Bosch announced Feb. 2019

5G Alliance for Connected Industries and Automation (5G-ACIA)—advancing 5G for the industrial domain



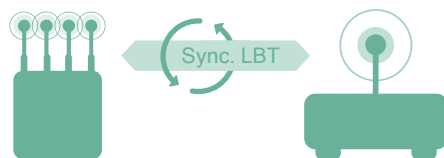
## Summary

Qualcomm



## Extending 5G to industrial IoT

5G can serve many industrial IoT applications today and 3GPP Rel-16 bringing additional functionality such as eURLLC for wireless industrial Ethernet



## Synchronized sharing

Synchronized sharing support industrial IoT in unlicensed spectrum (e.g. 5GHz & 6GHz) and sharing dedicated spectrum (e.g. 3.7GHz Germany)



## Multiple spectrum options

There are multiple deployment and spectrum options for private 5G industrial IoT networks with NR-U being part of 3GPP Rel-16.



## 5G testbeds to drive standard

Utilizing over-the-air testbeds with our 5G NR mobile test devices to research new functionality, e.g. 5G CoMP, and to drive and track progress in standard



# SPS Nuremberg

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We will be speaking & attending, please get in touch if you wish to find out more!



# Thank you

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