

September 2021

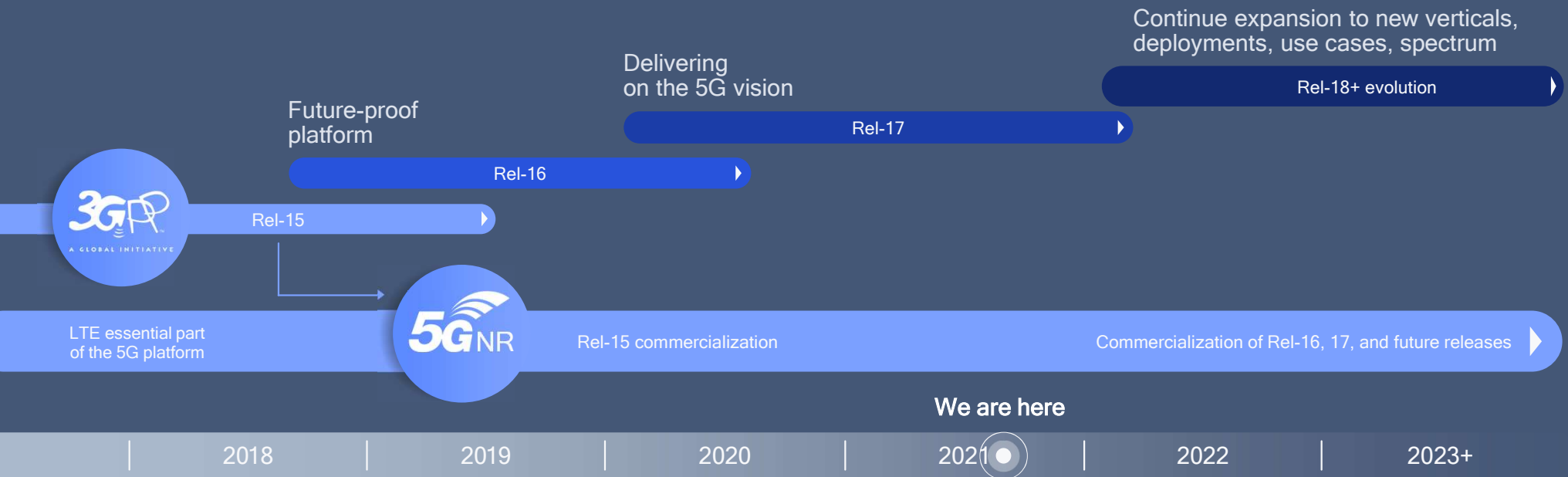
Qualcomm

Enable 5G private network for Industrial IoT

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Driving the 5G technology evolution



Rel-15 eMBB focus

- 5G NR foundation
- Smartphones, FWA, PC
- Expanding to venues, enterprises

Rel-16 industry expansion

- eURLLC and TSN for IIoT
- NR in unlicensed (NR-U)
- Positioning
- 5G V2X sidelink
- In-band eMTC/NB-IoT

Rel-17+ long-term expansion

- Reduced Capability NR devices
- Boundless extended reality (XR)
- Higher precision positioning and more...



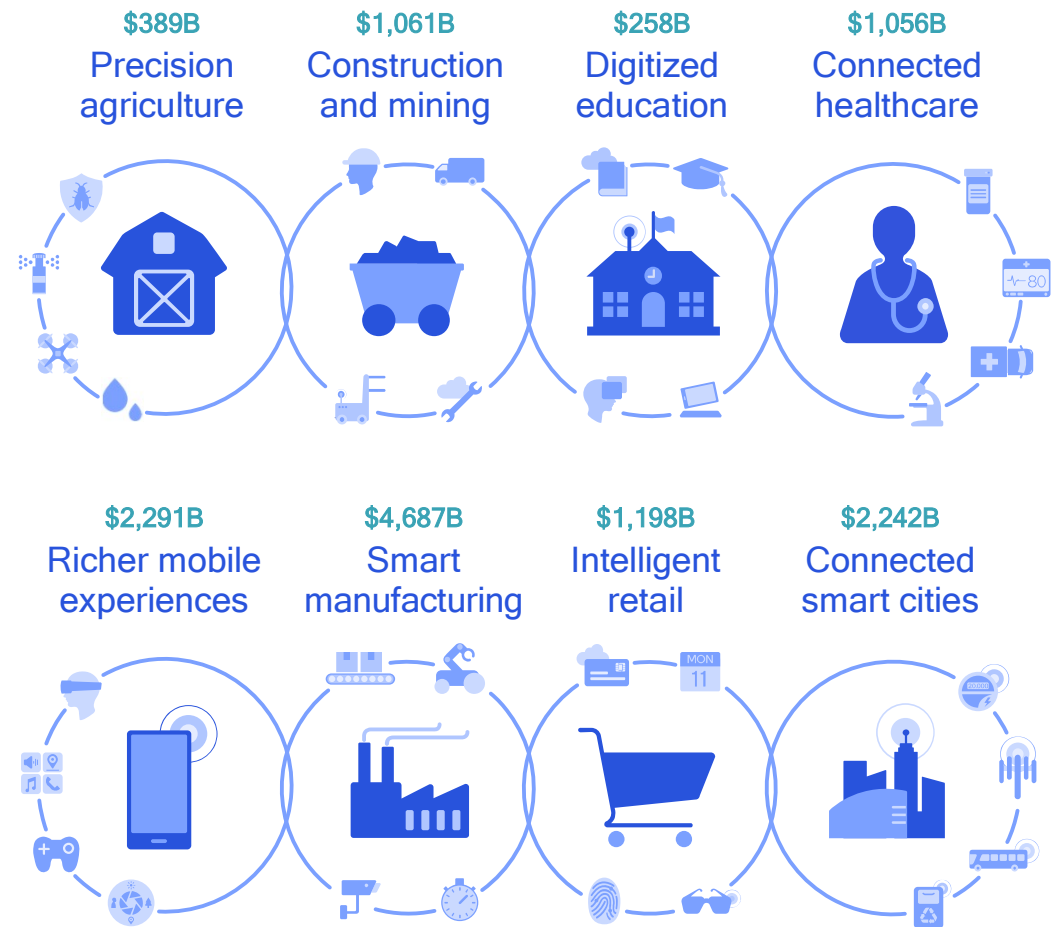
5G will expand the mobile ecosystem to new industries

Powering the digital economy

\$13.2

Trillion

In global economic value by 2035*



Enhanced mobile broadband

Computer Vision

Security camera
Latency: 50ms
Availability: 99.9%
Rate: Mbps



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



Automated guided vehicle (AGV)

Co-operative driving
Latency: 20ms
Availability: 99.9999%
Rate: Mbps



5G

Ultra reliable low latency

Massive IoT



Sensors

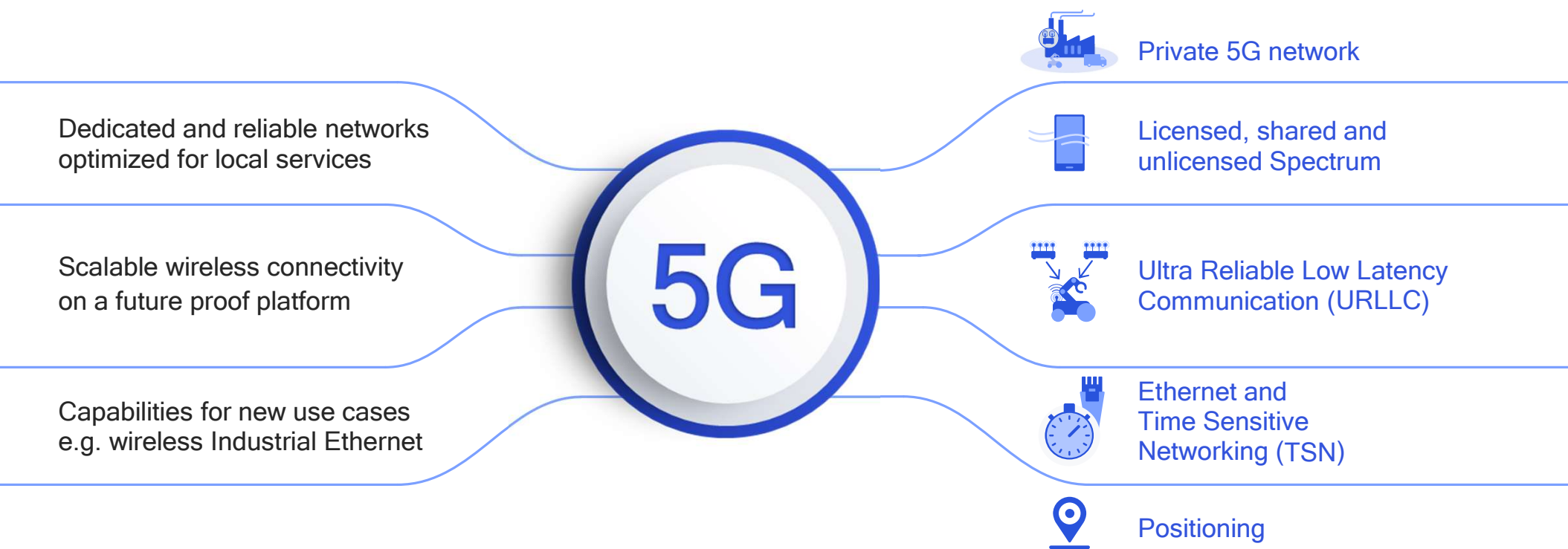
Process Monitoring
Latency: 100 ms
Availability: 99.99%
Rate: kbps

Wireless edge analytics



Industrial robot

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



Designing 5G to meet industrial IoT requirements



A central blue circle with '5G' in white is connected by wavy lines to five categories: Private 5G network, Spectrum, URLLC, Ethernet and TSN, and Positioning. Each category has an icon, a title, and a list of features or supported capabilities.

5G



Private 5G network

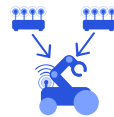
- Unique network ID
- Integrated and independent architectures
- Seamless fallback to public networks



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



Ethernet and TSN

- Ethernet over 5G with PDU session support
- Deterministic networking
- Device time synch.

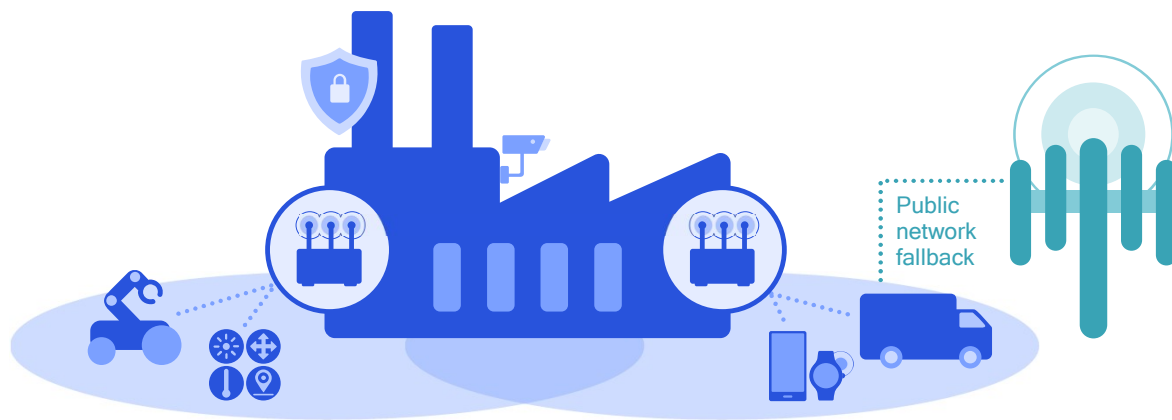


Positioning

- Network & device based
- Industrial IoT requirements

5G NR supports many industrial IoT use cases today

5G private networks bring benefits to industry and enterprise



Private network

Dedicated

Local network, dedicated resources, independently managed

Secure

Cellular grade security, sensitive data stays on-premise

Optimized

Tailored performance for local applications, e.g., low latency, QoS



Coverage, capacity and mobility

Outdoor/indoor, high data speeds, seamless handovers, public network fallback

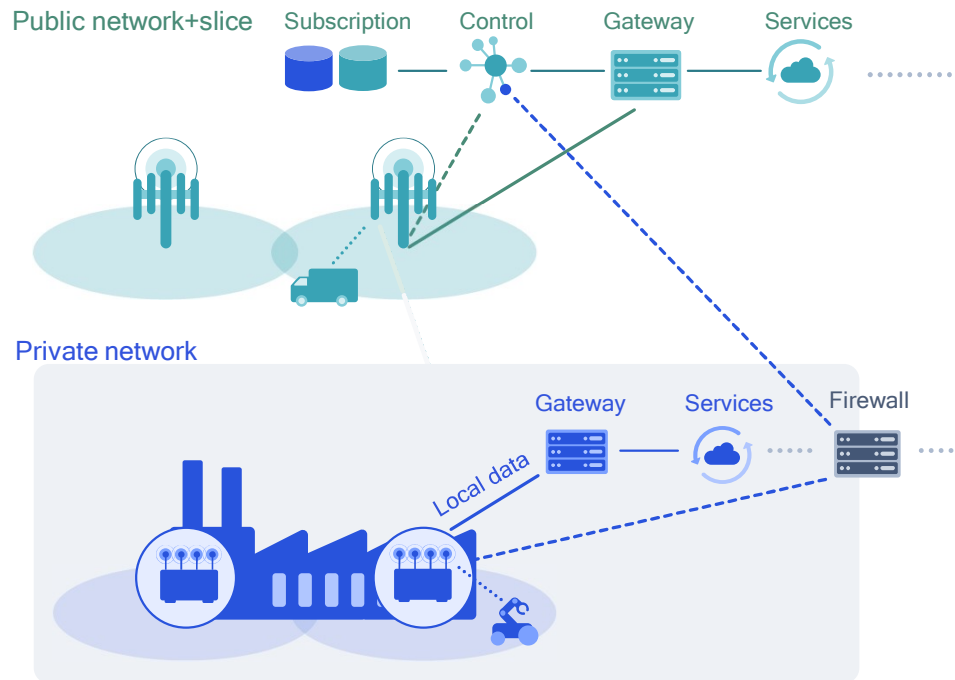
Reliability and precise timing

Industrial grade reliability, latency and synchronization (eURLLC and TSN)

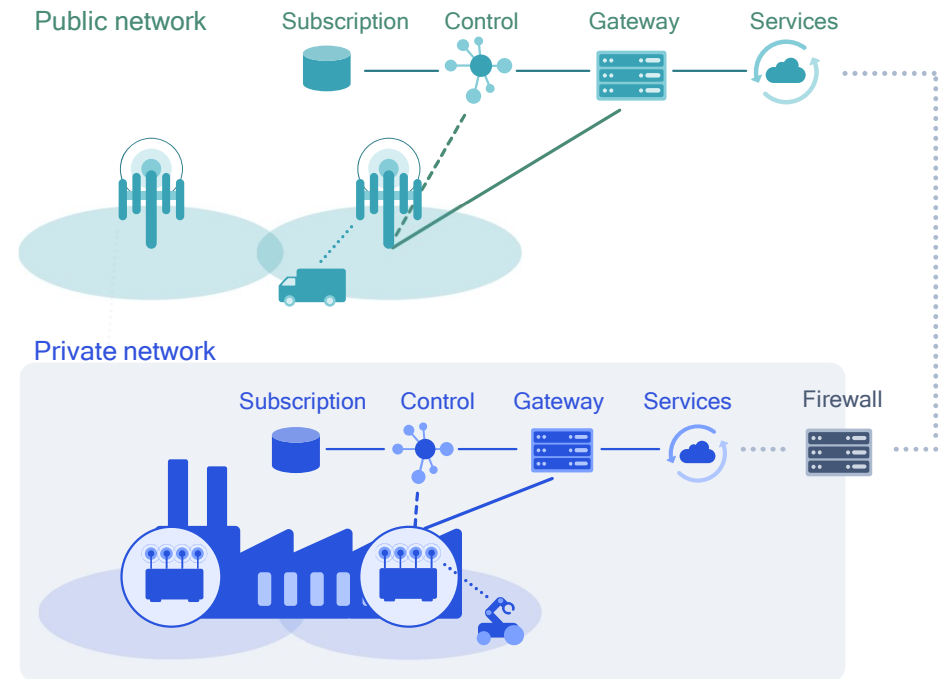
Interoperability

Global standard, vast ecosystem, future proof with rich 5G roadmap

Integrated private network



Independent private network¹



1) Mobility between private and public networks can still be supported via dual subscriptions

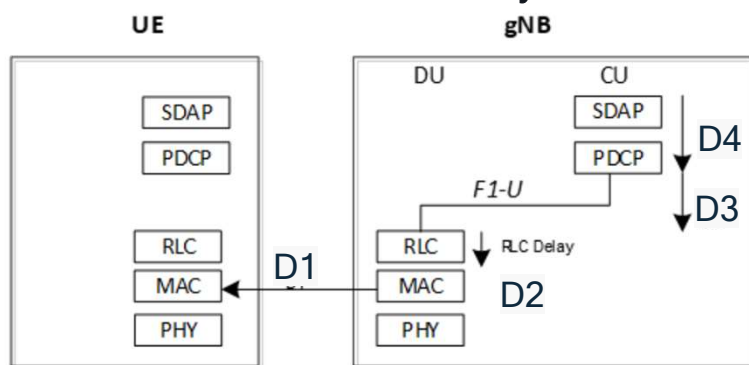
Multiple private network architectures for flexible deployments

5G performance measurement for Industrial IoT

Performance measurement is critical to evaluate whether network customer SLA is satisfied.

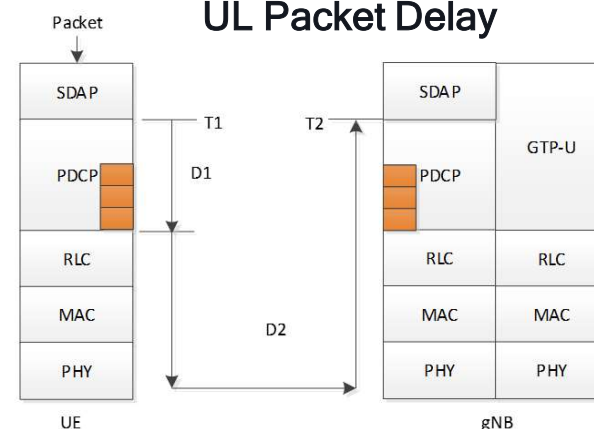
Traditional KPIs and network performance measurement is for coverage optimization and QoS verification, thus cannot provide real time end-to-end network performance measurement for Industrial IoT, e.g. the network can only obtain average DL and UL packet delay.

DL Packet Delay



D1 (the DL delay in over-the-air interface), D2 (the DL delay in gNB-DU), D3 (the DL delay on F1-U) and D4 (the DL delay in CU-UP)

UL Packet Delay



D1(UL PDCP packet average delay), D2.1(average over-the-air interface packet delay), D2.2(average RLC packet delay), D2.3(average delay UL on F1-U) and D2.4(average PDCP re-ordering delay)

Need new KPIs/network performance measurement and exposure to show real time end-to-end network performance, providing customized and more accurate, transparent way to Industrial IoT.



Thank you

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