5G智慧城市的展望

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20 August 2019

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5G is happening much faster than initial industry expectations.

... commercial 5G Networks and Devices launching now for eMBB services.

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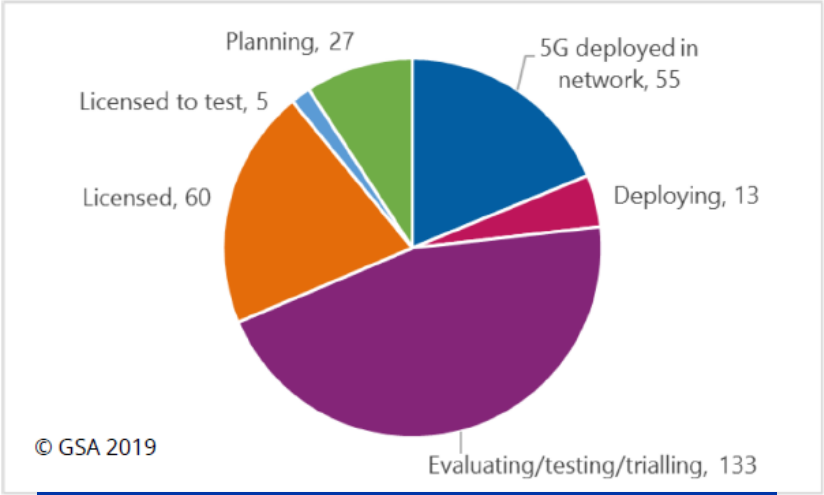
5G terminals and networks status
As of July 2019

5G terminals

13 Form factors	39 ue vendors
5 Chipset vendors	9 Smartphones

5G networks



35 operators in 20 countries offering 3GPP compliant commercial 5G services

Source: GSA

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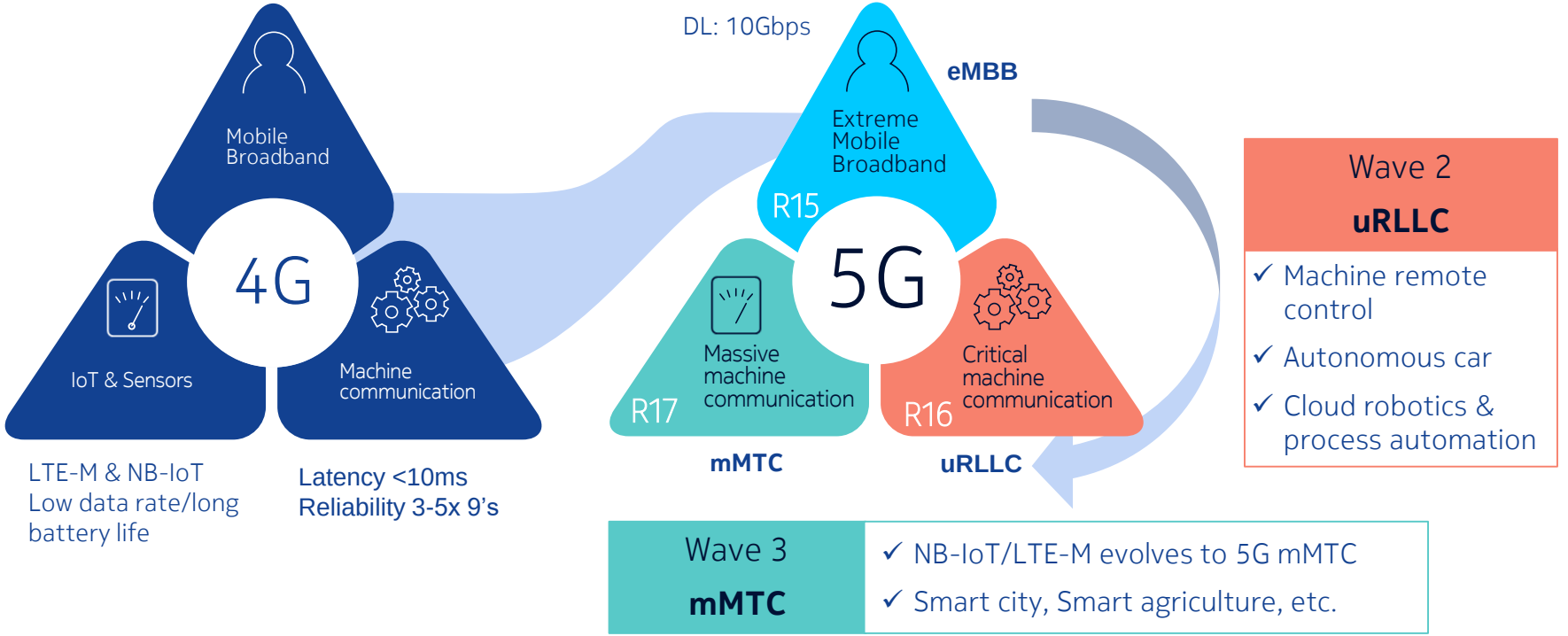
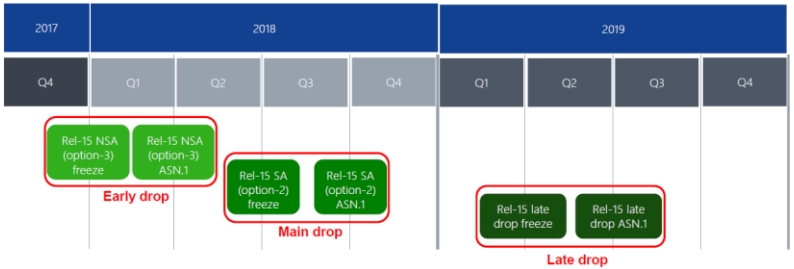
5G use case roadmap: eMBB → uRLLC → mMTC



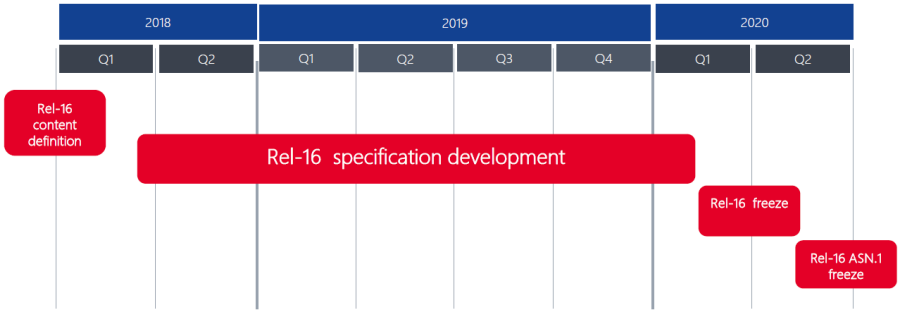
5G 3GPP standardization evolving from eMBB (R15) to Industrial 5G (R16)

Release 15 stability and completion



- Rel-15 NSA is driving commercial launches across the globe (based on March/2019 version of specs
- Rel-15 SA coming soon, first in China, driven by vertical IoT business
- Rel-15 late drop finalized specs for migration architectures

Release 16 timeline



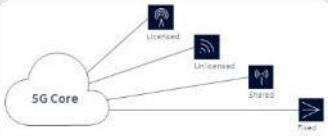
- Rel-16 focus equally on functions for Verticals and overall System Improvements

Realizing the full promise of 5G with 3GPP and own Innovation

Nokia (+ Bell Labs) evolves 5G from a strong Rel-15 base

Release 15

- Flexible 5G New Radio
- 5G Cloud Native Core
- End-to-end Network Slicing
- mmW frequency territory



Release 16

- Industrial IoT foundation
- Wireless Wireline Convergence
- Non Public Networks (aka Private)
- 5G NR for Unlicensed Bands

Release 17

- NR-Lite foundation
- 3D-Expansion in Mobility & Altitude
- AI/ML powered 5G networks
- 5G NR for >52.6 GHz

5G

Mobile Network Operators ► Converged Communication Service Provider ► Digital Service Provider

Connected Mobility ► Connected vehicles ► Connected & flying objects

Operational Technologies Other Industries

Railway, broadcast, satellite

On the road to 5G use cases

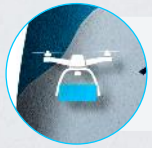
1 Video surveillance & analytics

2 Immersive experience

3 Smart Stadium

4 Fixed Wireless Access

5 Assisted & autonomous vehicles



6 Machine remote control

7 Cloud robotics & process automation

8 eHealth

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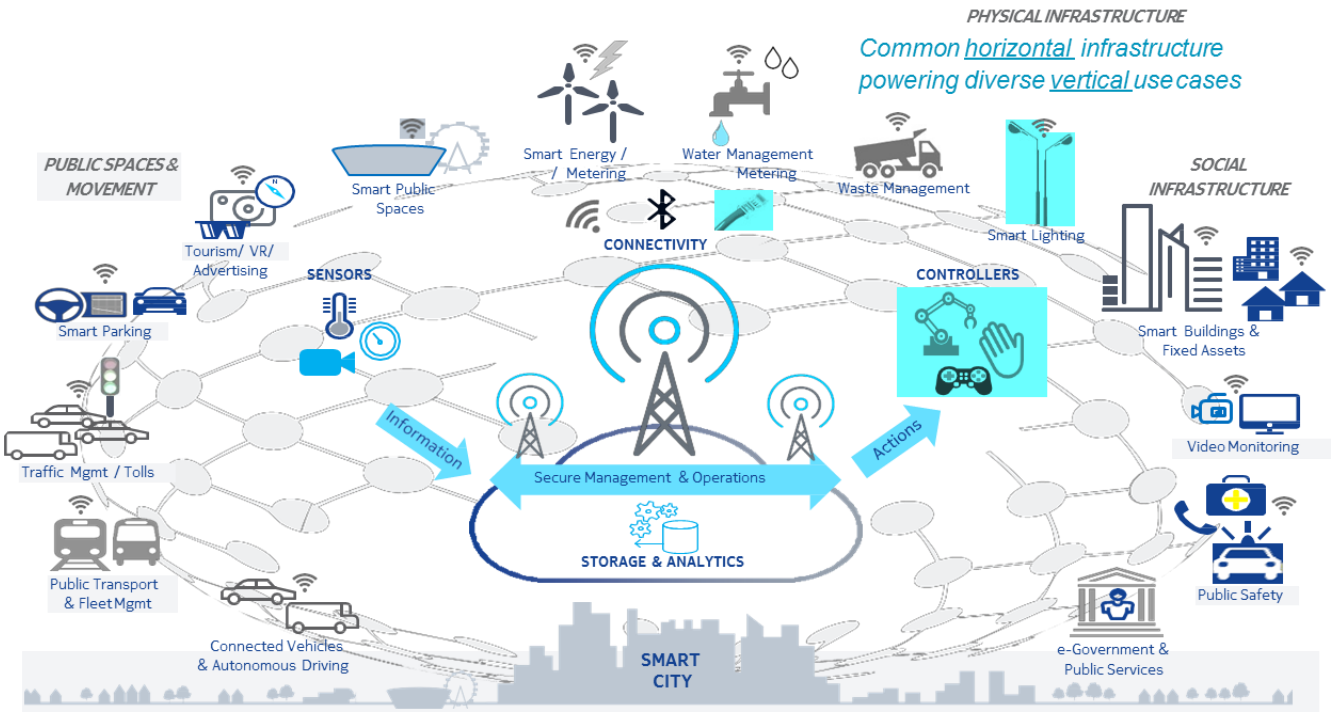
Smart Cities in action



https://www.itu.int/en/ITU-T/ssc/Pages/default.aspx

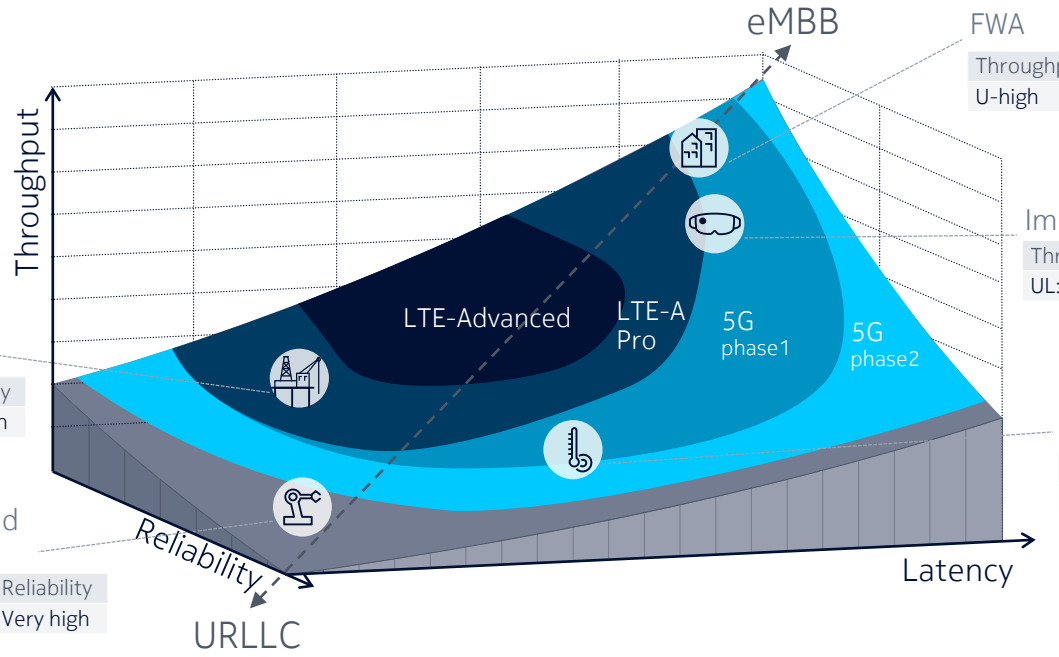
Use cases

- Smart Buildings
- Smart Lighting
- Smart Parking
- Fleet Management
- Smart Waste Bins
- Public Consultancy
- Efficient Energy Mgmt.
- Noise Monitoring
- Pollution Monitoring
- Time-of-day Tolling
- Connected Bus Shelter
- Smart Homes
- Car, Bike Sharing
- Water Monitoring
- Emergency Alerting

and many, many more …

IoT connectivity technologies

Reliability, latency, and throughput requirements



FWA

Throughput	Latency B.	Reliability
U-high	15-200 ms	Medium

Immersive 360

Throughput	Latency B.	Reliability
UL: U-high / DL: high	50-100 ms	Medium/high

Mobile Tele-Operation (Vehicle and drone)

Throughput	Latency B.	Reliability
Varies	1-10 ms	Very high

eMTC with massive number of devices

Throughput	Latency B.	Reliability
Low	10-100 ms	High

Industry robotics and automation

Throughput	Latency B.	Reliability
Varies	1-10 ms	Very high

5G NR: the only radio technology to simultaneously provide high reliability & low latency

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Connectivity on top of technologies needed to digitally transform industrial operations

TOTAL

Connectivity	**63%**
Enterprise IIoT applications/Industrial applications	**58%**
Cloud computing	56%

Aviation/Aerospace

Connectivity	64%
Enterprise IIoT applications/Industrial applications	**62%**
Automation	54%

Manufacturing

Connectivity	70%
Cloud computing	66%
Automation	62%

Power/Energy

Enterprise IIoT applications/Industrial applications	64%
Connectivity	58%
Automation	56%
Big data analytics	56%

Transportation

Connectivity	66%
Cloud computing	56%
Automation	54%

Utilities

Connectivity	58%
Enterprise IIoT applications/Industrial applications	**58%**
Cloud computing	54%
Big data analytics	54%

Q6 Which of the following technologies are required for a company to digitally transform industrial operations? Select all that apply.
(Total n=250; Manufacturing n=50; Aviation/Aerospace n=50; Transportation n=50; Utilities n=50; Power/Energy n=50)

*Top 3 listed unless there is a tie

IIoT: Industrial Internet of Things

GE Digital Industrial Evolution index 10.2017

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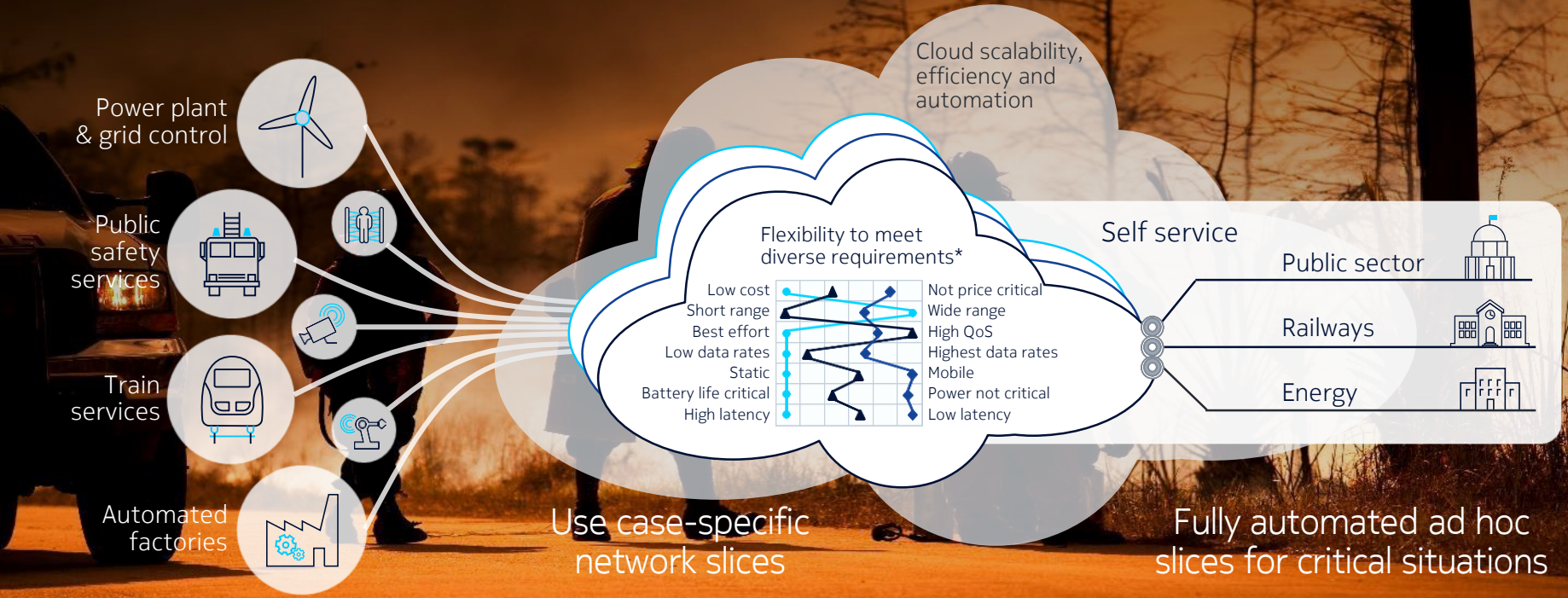
Network slicing enables guaranteed service performance



*) Conceptual – to be defined by use case

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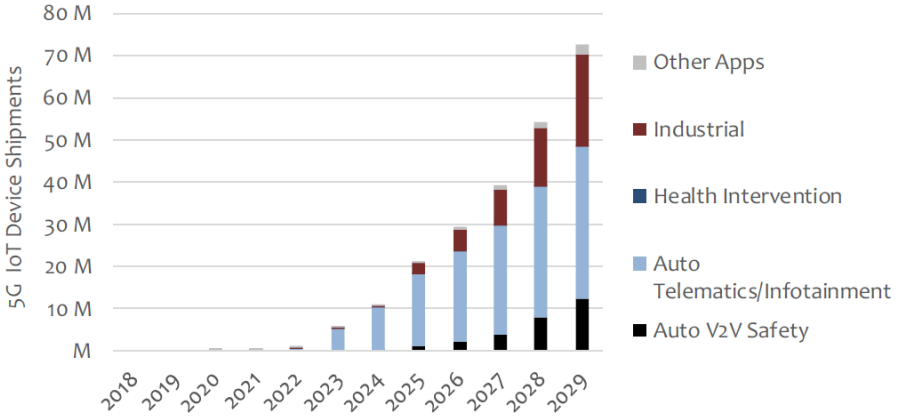
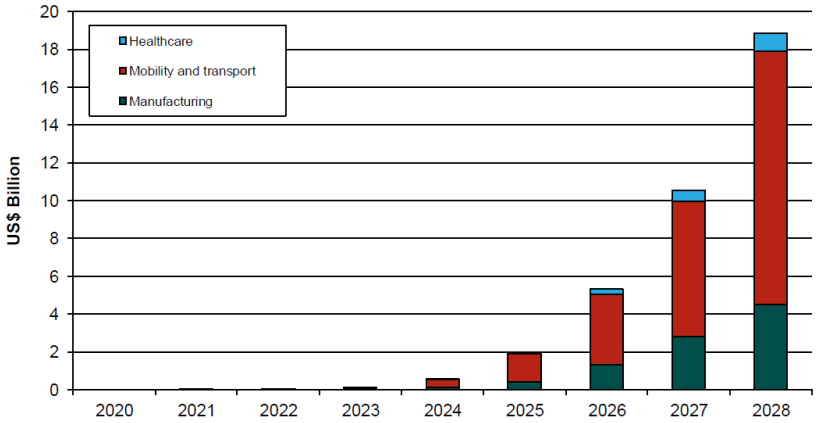
URLLC and 5G IoT Use Cases market forecast (Worldwide)

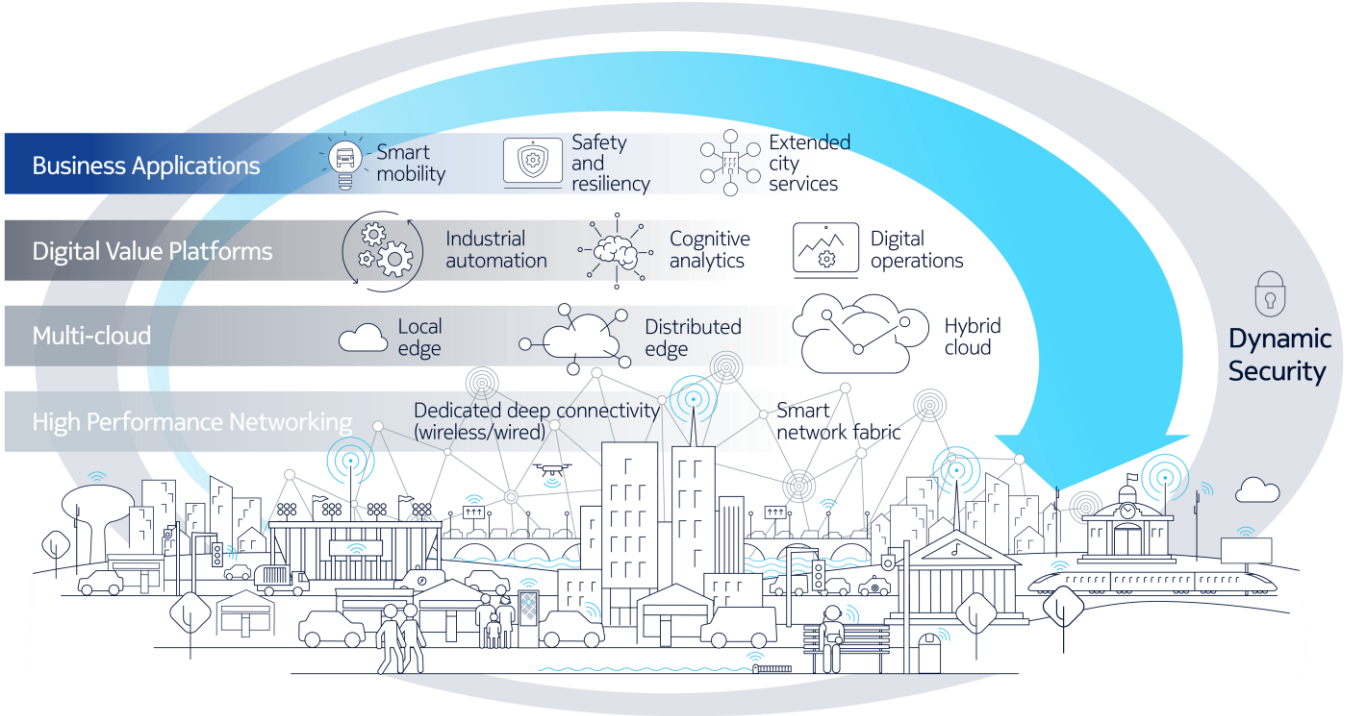




- URLLC/MIoT devices take up from 2023 aligning with 3GPP schedule and design cycles of industrial application.
- Transport and Industrial use cases being main market driver.

Source: ABI research, Mobile Experts

Nokia Bell Labs Future X architecture for smart cities



Public spaces and venues, transport, businesses, city assets and infrastructures (roads, poles, town hall, ...)