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Qualcomm

Co-opetition, Innovation and Standardisation

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Delivering on the 5G vision

$13.2 Trillion in goods & services by 2035*

*The 5G Economy, an independent study from IHS Markit, commissioned by Qualcomm

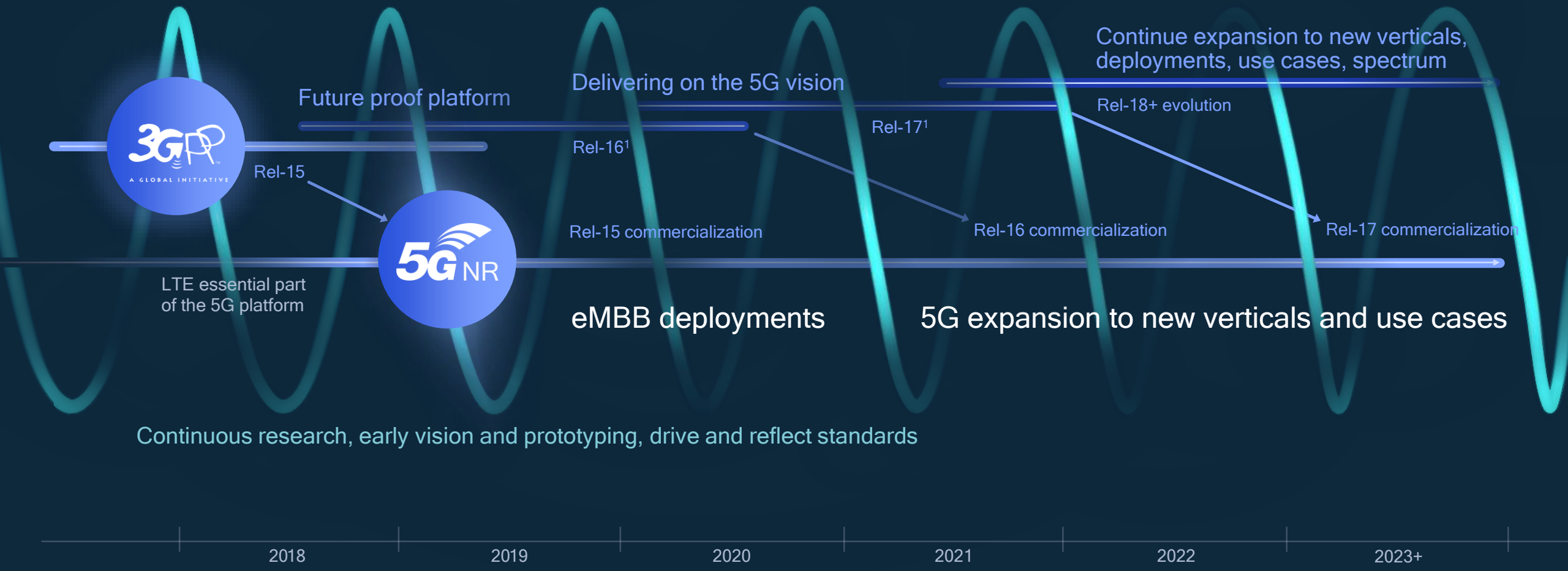

Enhanced mobile broadband
Computer vision
Head mounted display
Handheld terminal
Massive IoT
Sensors
Ultra-reliable low-latency
Automated guided vehicle (AGV)
Wireless edge analytics
Industrial robot


RSU with AI-based camera
Traffic hazard warning
AI-based camera detects hazards and alerts
Road safety
V2V/V2I: Intersection assist, non-line of sight warning
RSU with AI-based camera
Pedestrian alert
Traffic light detects crossing and alert cars via I2V
V2V
C-V2X direct communication
I2V
V2P
Burger spot
.5 miles
On-device intelligence
Key for cars to act with immediacy
Evolving 5G for smart transportation

XR for closer collaborations at the work place


Emerging dedicated private networks for targeted needs
Shipping logs
Trip times
Cargo loads
Local management for low latency and protection of sensitive data
Reliable robotic control
UHD surveillance
Reliable, autonomous AGVs
On-premise compute and storage
Updating
Real-time inventory
Lumber
Hardware
Technology
Manufacturing
Produce
Automotive
Earth/Soil
Retail
5G NR
Private network
Real-time asset tracking
At port (Days)
3
Location
Spools shipped
Camera
Capacity
Robots
106
640
84
21
On-device intelligence
Seamless interworking with public network
AR-guided execution

Driving the 5G roadmap and ecosystem expansion



1. 3GPP start date indicates approval of study package (study item->work item->specifications), previous release continues beyond start of next release with functional freezes and ASN.1

Continued evolution to deliver on the 5G vision

Initial focus: eMBB – enhanced mobile broadband services

5G core network

5G NR IIoT with eURLLC

5G NR Cellular V2X

5G NR in unlicensed spectrum

Enhancements to 5G NR IIoT

Expand sidelink e.g., V2X reliability, P2V, IoT relay

Unlicensed spectrum across all uses cases

Advanced channel coding

Sub-6 GHz with massive MIMO

LTE integration

5G broadcast[1]

5G massive IoT[2]

Positioning across use cases

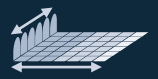
New spectrum above 52.6 GHz

NR-Light e.g., wearables, industrial sensors

Centimeter accuracy e.g., IIoT with mmWave

Mobile mmWave

Scalable OFDM-based air interface



Flexible framework

eMBB evolution[3]

IAB – integrated access/backhaul

Continuation of Rel-15 projects, others[4]

Continued eMBB enhancements[5]

More capable, flexible IAB

Rel-15 deployment learning, XR, drones, others[6]

Rel-15

Established 5G NR technology foundation

Rel-16

Expanding to new use cases and industries

Rel-17: Likely candidates

Continued expansion and enhancements

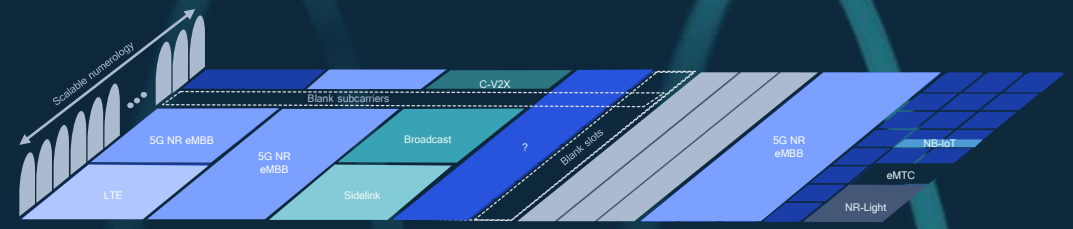
1. Enhancing Rel-14 LTE enTV to meet 5G requirements; 2. eMTC/NB-IOT in-band 5G NR and connected to 5G core; 3. MIMO, power consumption, mobility, MR DC/CA, interference management and more; 4. Non-terrestrial networks, non-public networks (private networks), NR SON/MDT and more; 5. further improvements to capacity, coverage, mobility, power consumption, spectral efficiency; 6. mixed-mode multicast, small data transmission, multi-SIM, satellite, multimedia

Expanding 5G with the flexible framework

Early vision

A unified future-proof platform

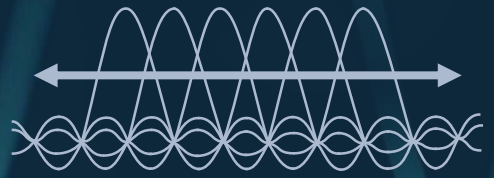
Delivering on the 5G vision and expansion



5G NR

Flexible slot-based framework

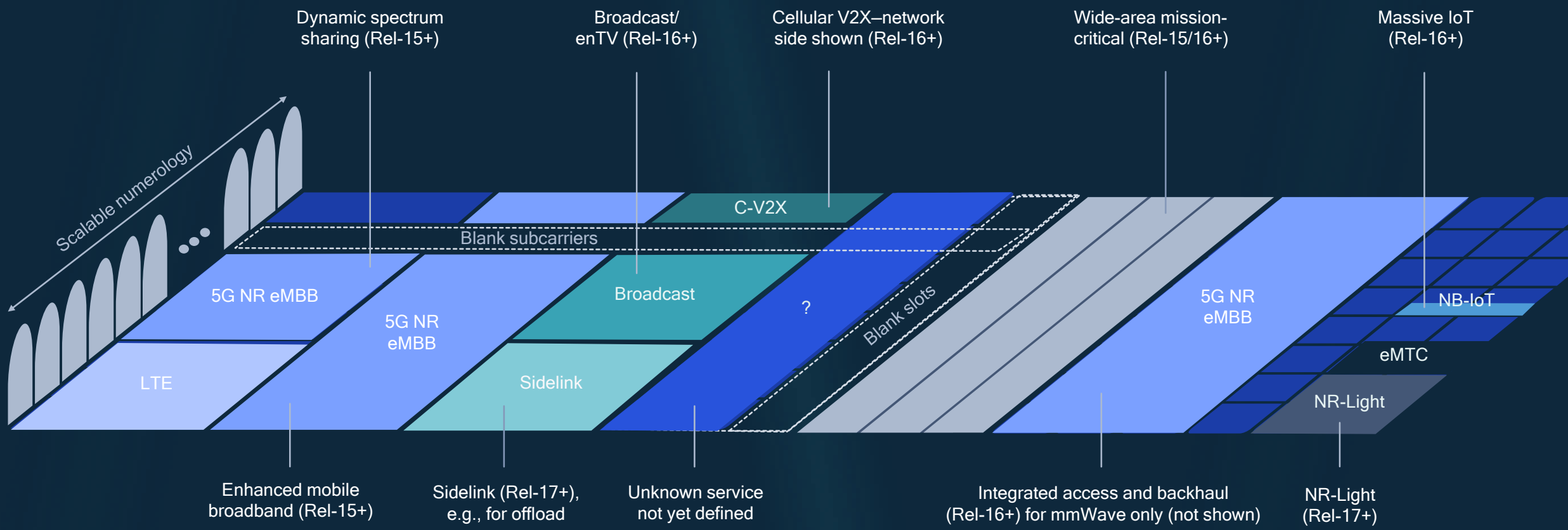
Scalable OFDM-based air interface



A flexible framework with forward compatibility

Efficiently multiplex today's and unforeseen services on same frequency

Expanding 5G with the flexible slot-based framework



Accelerated 5G to 2019 with non-standalone mode

Expand coverage with lower bands

Expand 5G coverage

- Dynamic Spectrum Sharing (DSS)
- 5G FDD in low bands

Multiple spectrum options

For private 5G networks

Licensed spectrum by mobile operators

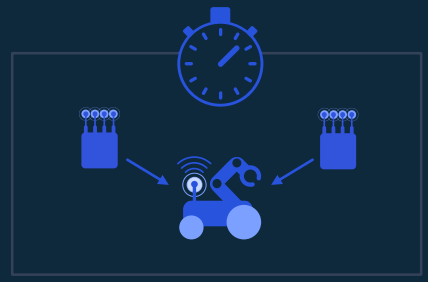
Operators can allocate spectrum in a specific area

Unlicensed spectrum with async sharing

NR-U with asynchronous sharing work for many applications

Dedicated regional spectrum

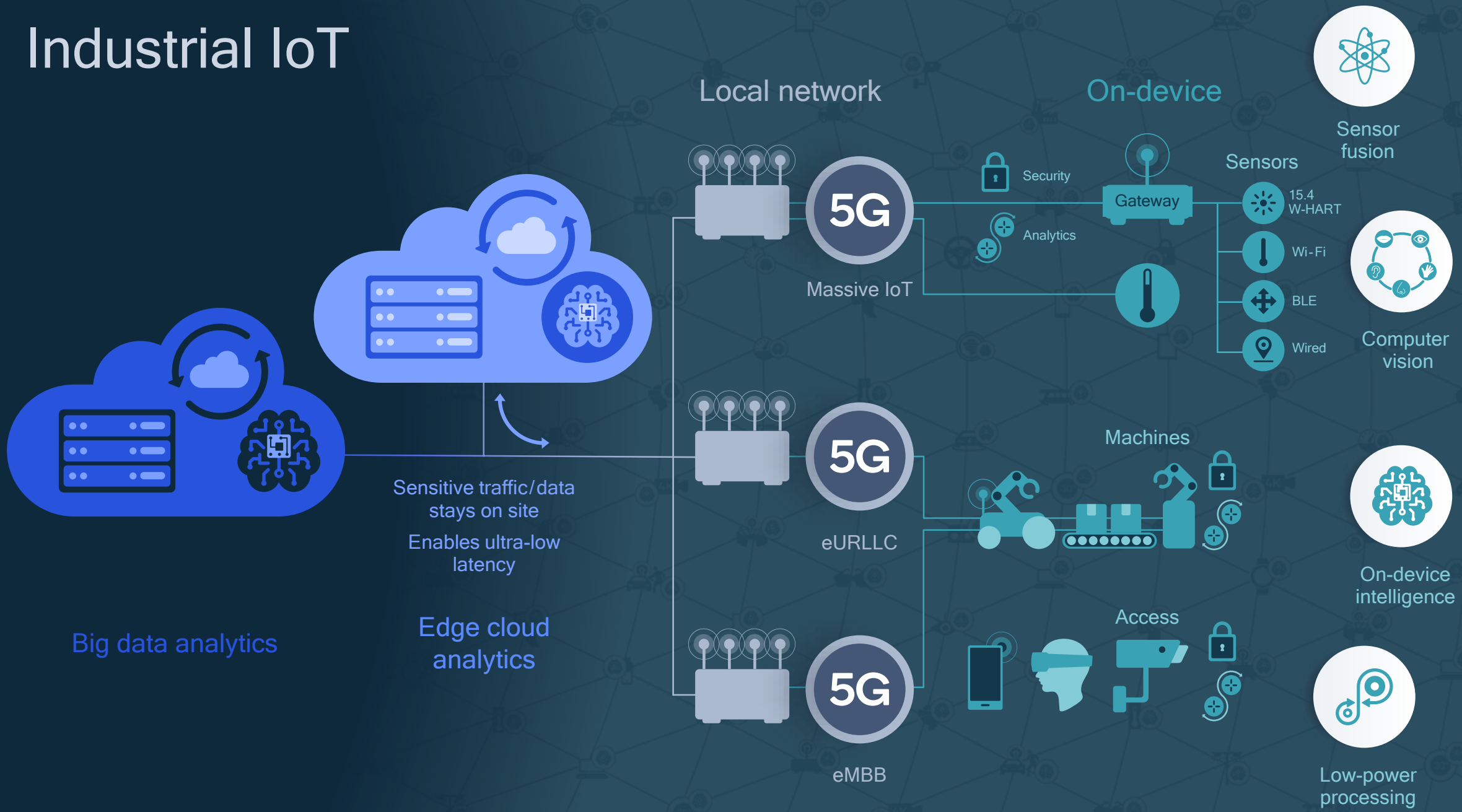
Regional spectrum such as 3.7GHz in Germany for IIoT

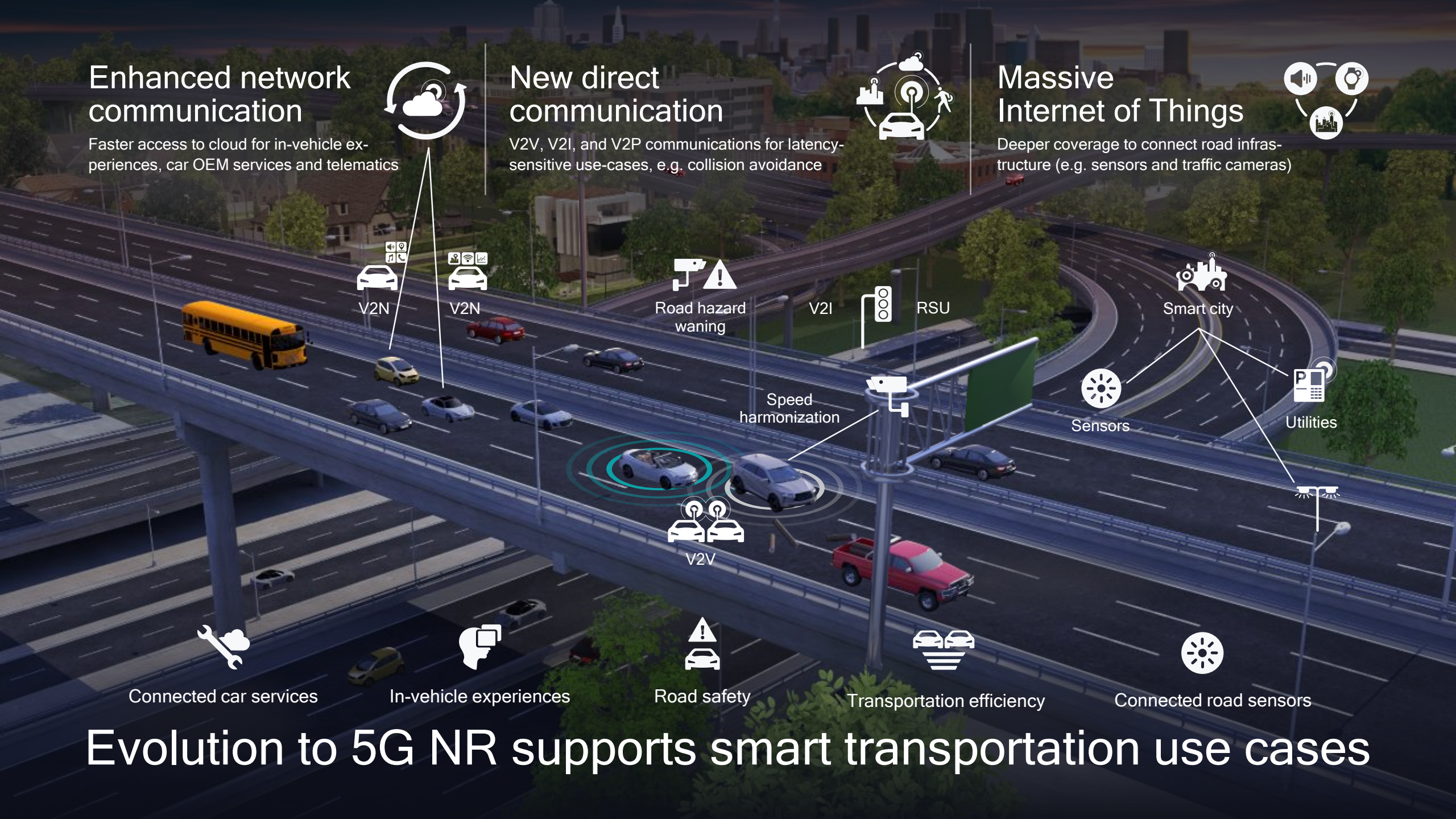


Unlicensed spectrum with synch sharing

Synchronized sharing can provide reliability and eURLLC for IIoT

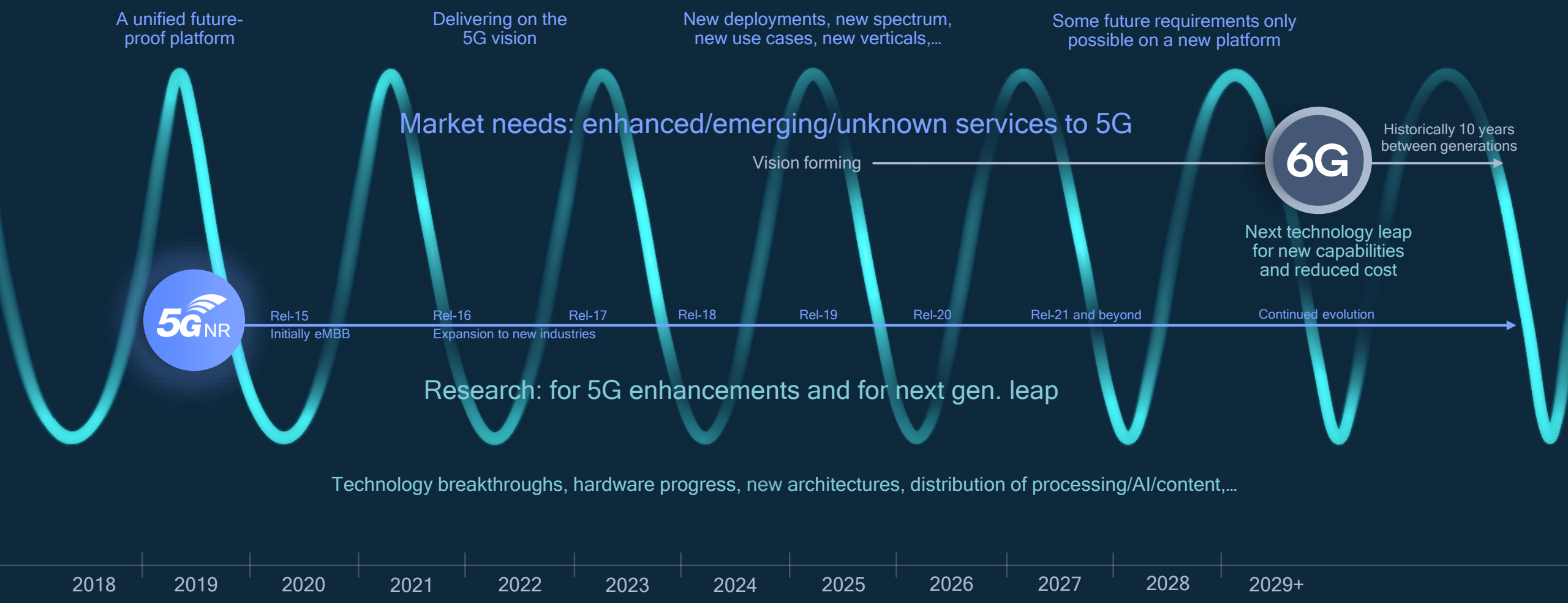
Industrial IoT





Evolution to 5G NR supports smart transportation use cases

Policies that preserve investment in standards are key



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Thank you

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