

The Path from 5G to 6G: Vision and Technology

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Enhancing
mobile
broadband



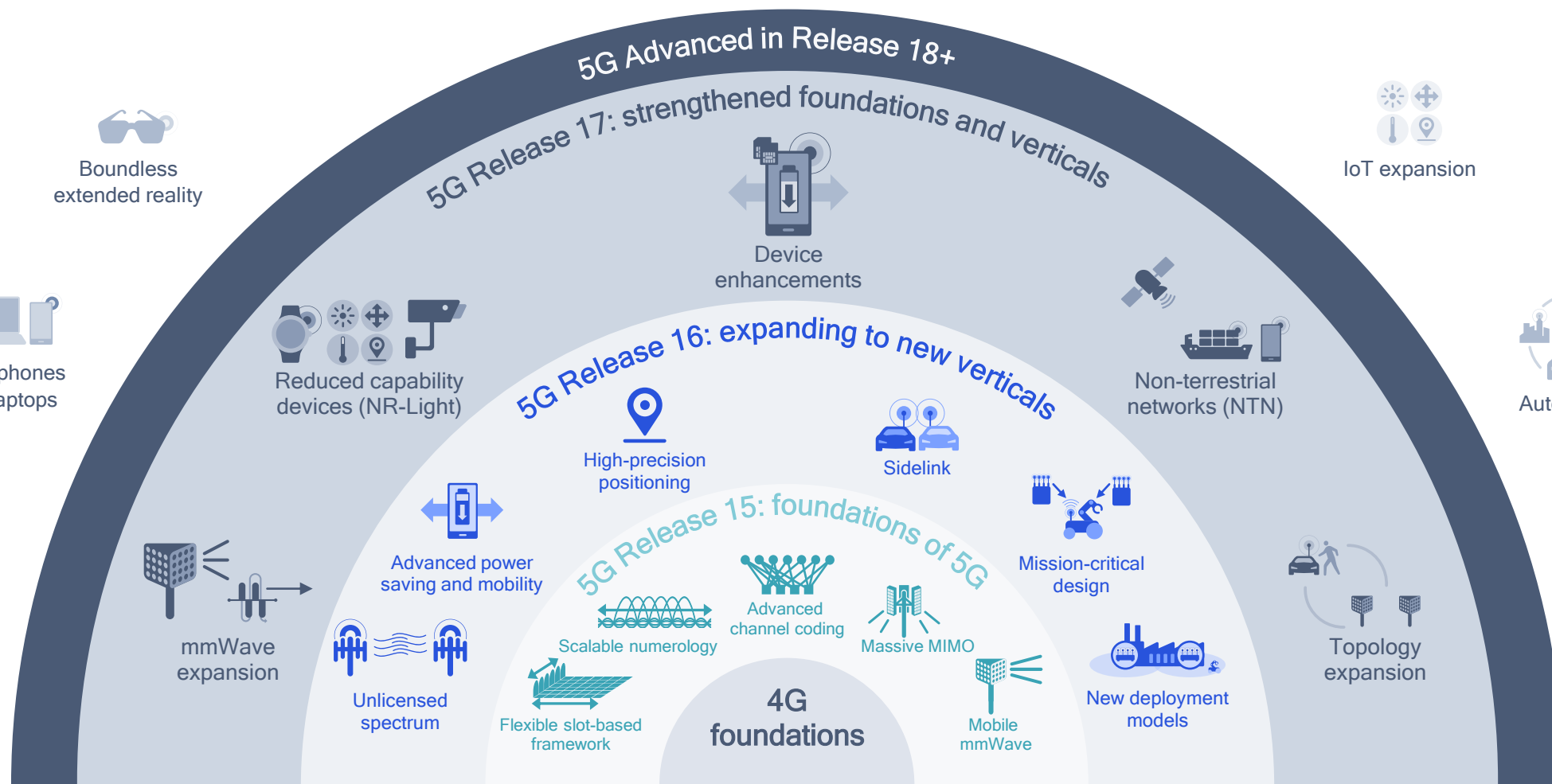
Boundless
extended reality



Smartphones
and laptops



Fixed Wireless
and enterprise



IoT expansion

Enabling
new
verticals



Automotive



Industrial IoT

Our innovations expand the foundation of 5G

Foundational Qualcomm innovations lead 3GPP Releases 15,16 and 17

Purpose-built system enhancements for XR over 5G



Release 18 focuses on capacity considerations as well as power savings for XR use cases

Source: RP-213587 (Enhancements for XR)

1 Quality of Service; 2 Key Performance Indicators; 3 Radio Access Network;
4 Connected Discontinued Reception; 5 Semi-Persistent Scheduling



KPIs¹ and QoS²

Enhancing RAN³ support for enhanced granularity for QoS and XR-specific parameters



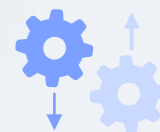
Application awareness

Optimizing DL/UL XR traffic in the network to improve user experience and network efficiency



Power optimization

Specifying XR-specific power saving techniques such as enhanced C-DRX⁴ and control channel monitoring



Capacity enhancement

Supporting resource allocation and scheduling specifically for XR traffic profile, such as enhanced SPS⁵ and dynamic grants

Car of the Future



Auto industry rapidly evolving to meet new consumer needs and wants



of a more connected, safer, autonomous, and electrified future



5G technology



C-V2X



Digital cockpit



Advanced Driver
Assistance and
Autonomous Driving



Connected services

C-V2X is a critical component to safety

Giving vehicles the ability to communicate with each other and beyond

Vehicle-to-infrastructure (V2I)

e.g., traffic signal timing / priority



Vehicle-to-vehicle (V2V)

e.g., collision avoidance safety systems



Vehicle-to-network (V2N)

e.g., real-time traffic / routing, cloud services



Vehicle-to-pedestrian (V2P)

e.g., safety alerts to pedestrians, bicyclists



Enhanced range and reliability
for direct communication
without network assistance



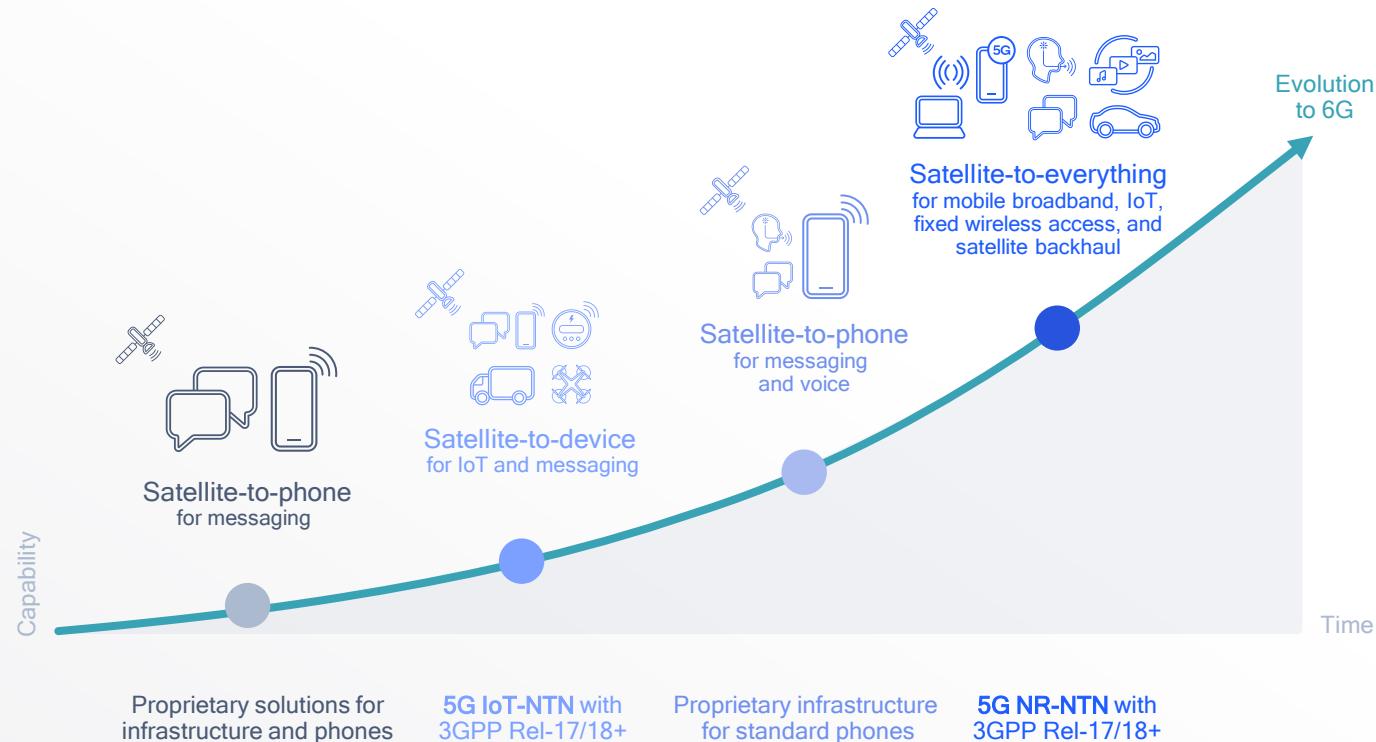
Qualcomm® 9150 C-V2X
chipset commercialized
starting 2018



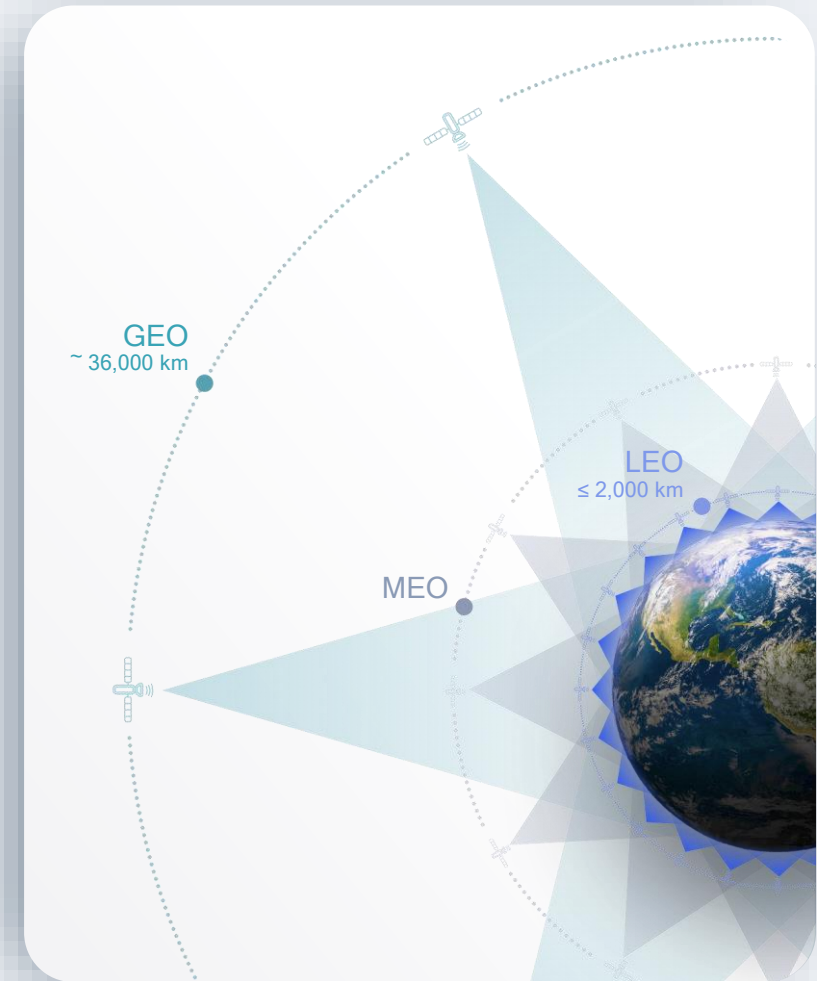
Integration of C-V2X into the Snapdragon® Automotive 4G (SA415M)
and 5G (SA515M) Platforms commercialized starting 2019

5G NTN satellite services brings new efficiencies for a broad range of use cases

Complementing terrestrial networks with coverage from space



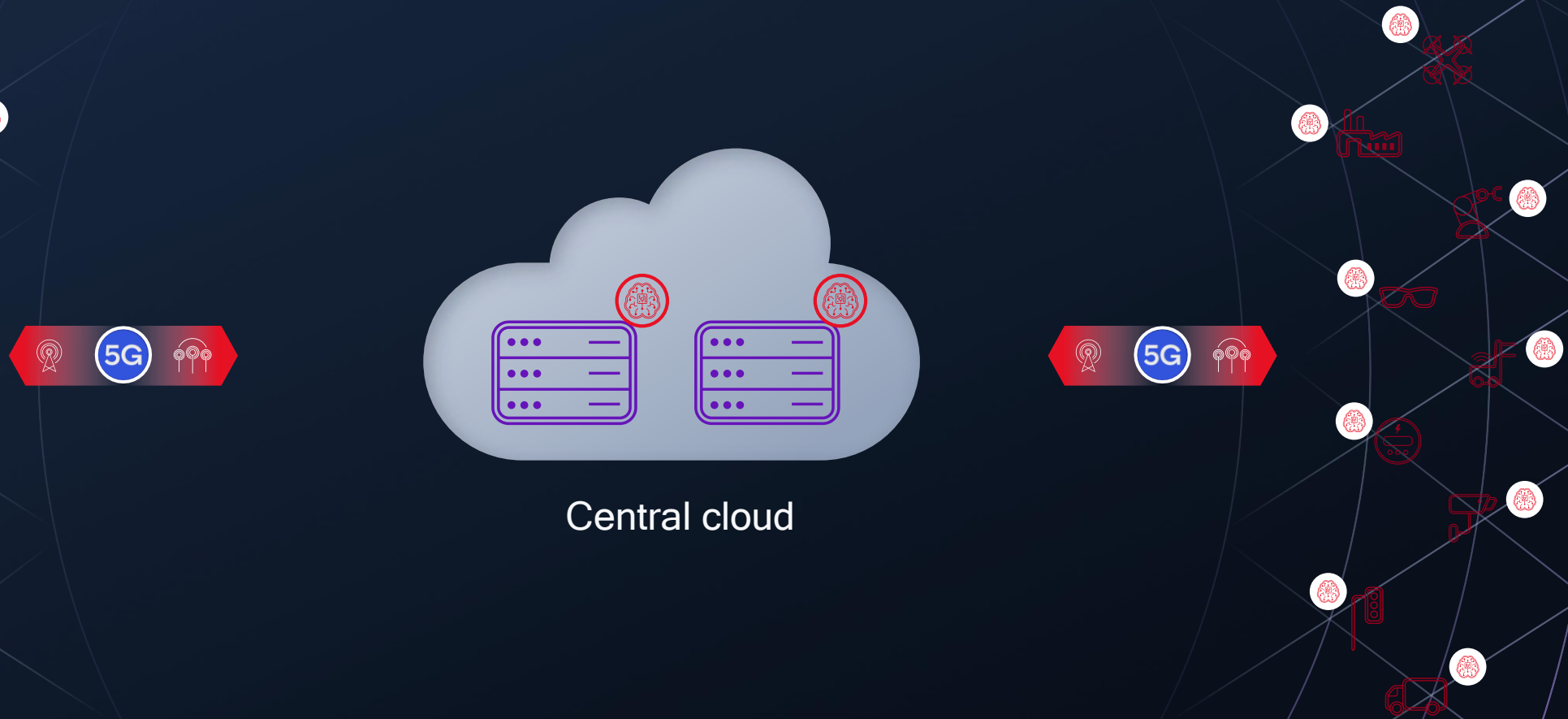
Provide ubiquitous connectivity for more services



Do we have a better slide

Expanding on-device intelligence at the edge

Enabling new hybrid AI architectures to scale intelligence

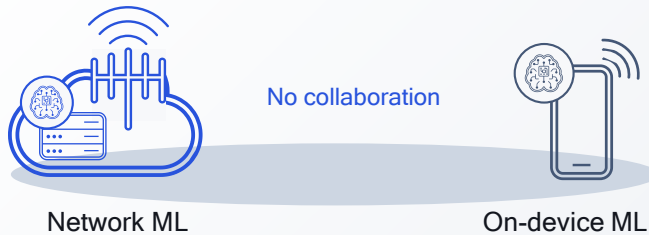


Evolving towards an AI-native wireless system

Multiple wireless AI/ML training and inference scenarios

Overlay AI/ML

INDEPENDENTLY AT THE DEVICE OR NETWORK



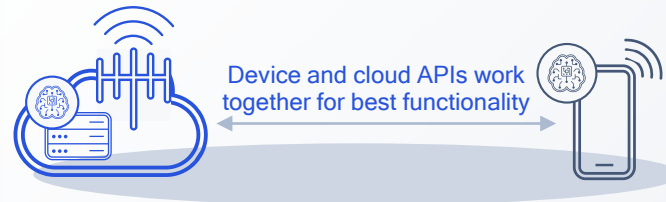
ML operates independently at the device and network as an optimization of existing functions

Proprietary ML procedures including model development and management

Proprietary and standardized data collection used as input to training

Cross-node AI/ML

COORDINATED BETWEEN DEVICE AND NETWORK



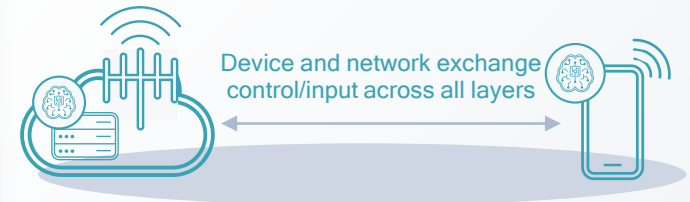
ML operates in a coordinated manner between the device and network

Proprietary and standardized ML procedures including model development and management

Further data collection used as input to training as well as monitoring

Native AI/ML

AT ALL DEVICE AND NETWORK LAYERS



ML operates autonomously between the device and network across all protocols and layers

Integrated ML procedures across to train performance and adapt to different environments

Data fusion for integrated dynamic ML lifecycle management



Leading the 5G Advanced evolution towards 6G

6G Foundational Technology Explorations

6G pre-commercial interoperability testing and trials

Foundational
research

Vision
forming

Service
requirements

Specifications

Interoperability
testing

Trials

6G

Rel-22+

Rel-21 (6G Work)

3GPP 6G
Workshop
(Mar'25)

Rel-20 (6G Study)

Next technology leap for new
capabilities and efficiencies

Rel-20

Rel-19

Rel-18

5G Advanced
2nd wave of 5G
innovations

Continued 5G evolution in the 6G era

WRC-23

2023

2024

2025

2026

2027

WRC-27

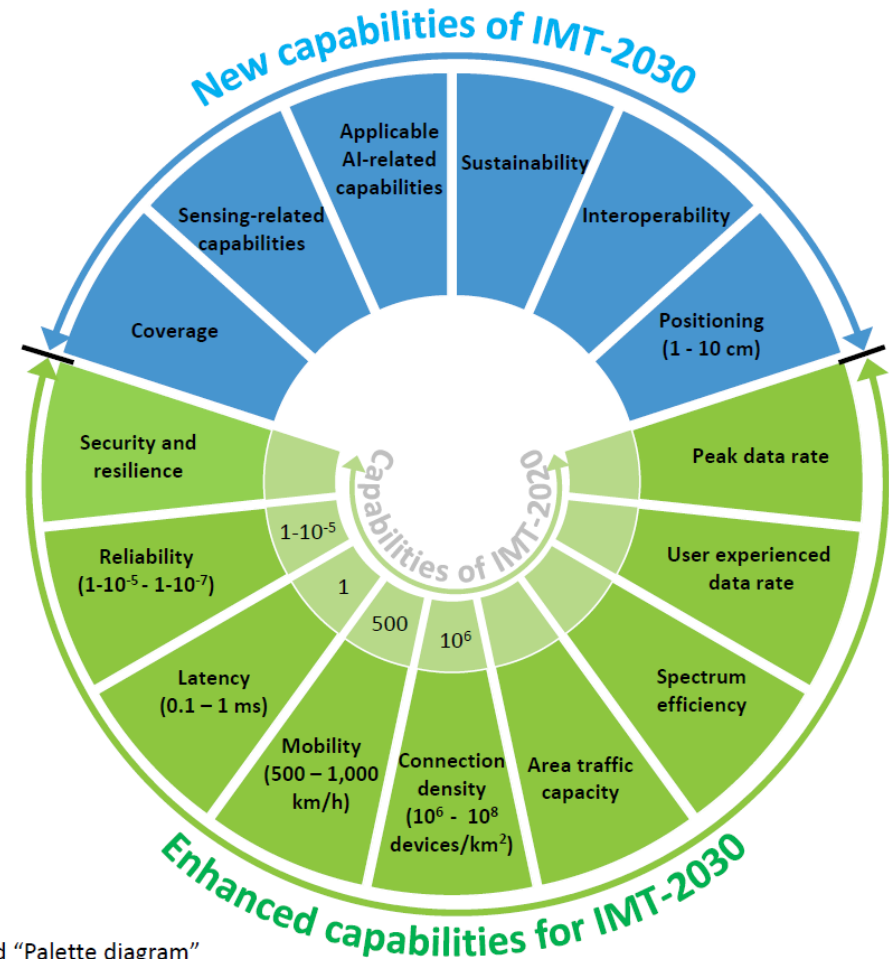
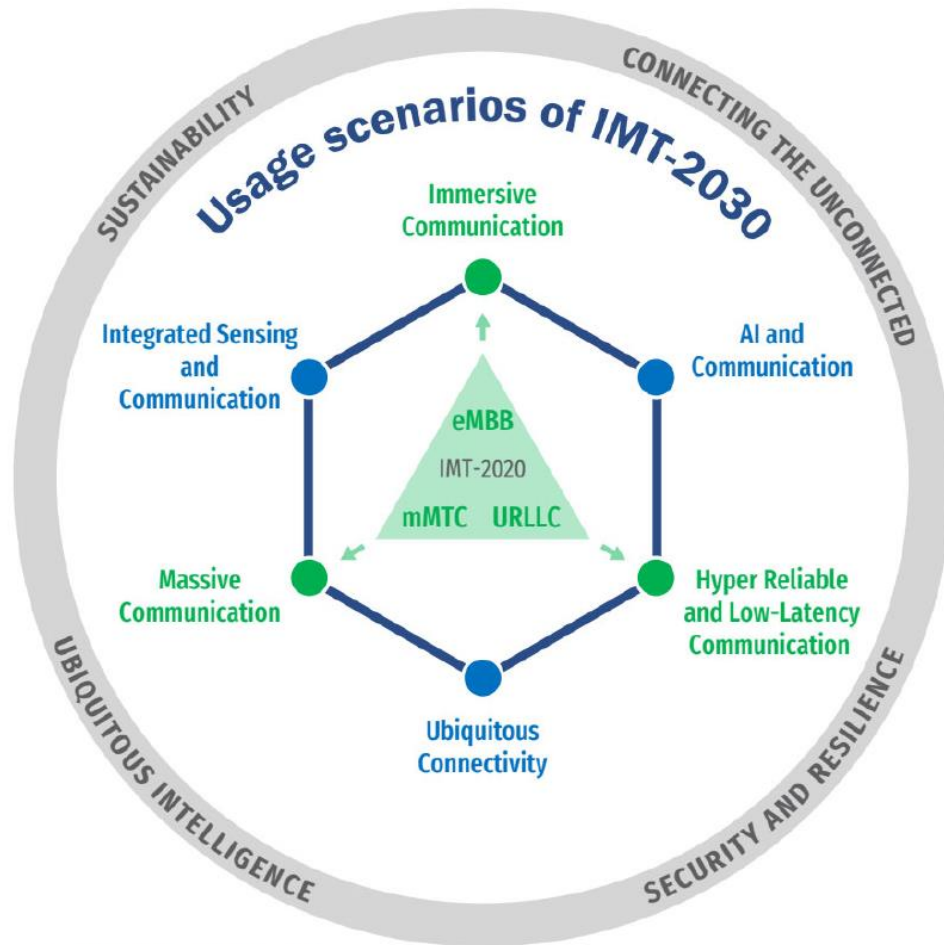
2028

2029

WRC-31

2030+

6G vision from ITU-R – Capabilities and usage scenarios of IMT-2030



called "Palette diagram"

Key longer-term research vectors

enabling the path towards 6G



AI-native E2E communications

Data-driven communication and network design, with joint training, model sharing and distributed inference across networks and devices



Scalable network architecture

Disaggregation and virtualization at the connected intelligent edge, use of advanced topologies to address growing demand



Expanding into new spectrum bands

Expanding to THz, wide-area expansion to higher bands, new spectrum sharing paradigm, dynamic coordination with environmental awareness



Air interface innovations

Evolution of duplexing schemes, Giga-MIMO, mmWave evolution, reconfigurable intelligent surfaces, non-terrestrial communications, waveform/coding for MHz to THz, system energy efficiency



Merging of worlds

Physical, digital, virtual, immersive interactions taking human augmentation to next level via ubiquitous, low-power joint communication and sensing



Communications resiliency

Multifaceted trust and configurable security, post quantum security, robust networks tolerant to failures and attacks



ITU World Radiocommunication Conference 2023 (WRC-23)

Dubai, United Arab Emirates
20 November to 15 December 2023

Continue a spectrum pipeline ensuring the continued 5G growth across regions and enabling future 5G Advanced and 6G use cases

Key Agenda Items

1.1 – IMT in the 4.8-4.99 GHz band

Considers conditions for which the band 4800-4990 MHz could be used by terrestrial component of IMT. It addresses technical and regulatory conditions, such as power flux density (pfd) limits, which could protect aeronautical and maritime mobile services.

1.2 – IMT in the 3.5 GHz, 6 GHz, and 10-10.5 GHz bands

Considers identification of bands 3300-3400 MHz (Region 2 and amend footnote in Region 1), 3600 - 3800 MHz (Region 2), 6425-7025 MHz (Region 1), 7025-7125 MHz (globally), and 10.0-10.5 GHz (Region 2) for IMT including possible allocations to the mobile service on a primary basis.

1.3 – Mobile use of the 3.6-3.8 GHz band in Region 1

Considers possible primary allocation in Region 1 to the mobile service (except aeronautical) in the band 3600-3800 MHz.

1.5 – Consideration of sub-1 GHz spectrum in Region 1

Reviews the spectrum use and needs of existing services in the band 470-960 MHz in Region 1 and considers possible regulatory actions in the band 470-694 MHz in Region 1.

10 – Plan, support harmonization, and secure availability for new 6G coverage band

Proposing an agenda item for WRC-27 to study key upper mid-bands for 6G across all 3 regions, i.e., 7.125-15.35 GHz.

Mobile has made a leap every ~10 years

Mobile voice communication



1980s
Analog voice
AMPS, NMT,
TACS

Efficient voice to reach billions



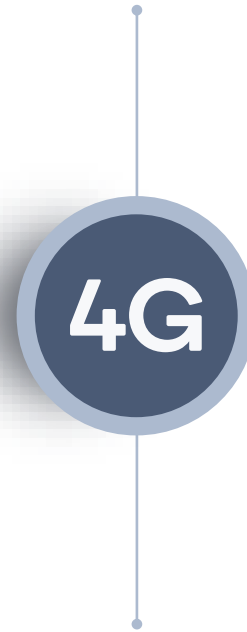
1990s
Digital voice
D-AMPS, GSM,
IS-95 (CDMA)

Focus shifts to mobile data



2000s
Wireless Internet
CDMA2000/EV-DO
WCDMA/HSPA+,

Mobile broadband and emerging expansion



2010s
Mobile broadband
LTE, LTE Advanced,
Gigabit LTE

A unified connectivity platform



2020s
Connected intelligent edge
5G New Radio

The next innovation platform



2030s
Next-gen wireless
AI-native, new spectrum, RF
sensing, and many more...

Thank you



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