
Leading the 5G Advanced technology evolution on the path to 6G
Creating new values across applications
5G
5G Positioning
Advanced MIMO
Mobile mmWave
Green Networks
Industrial 5G Networks
Industrial Precise Positioning
AI-enabled Air Interface
Automotive
Enabling the Metaverse
Wide-area IoT

Our Presenter

Dr. John Smee

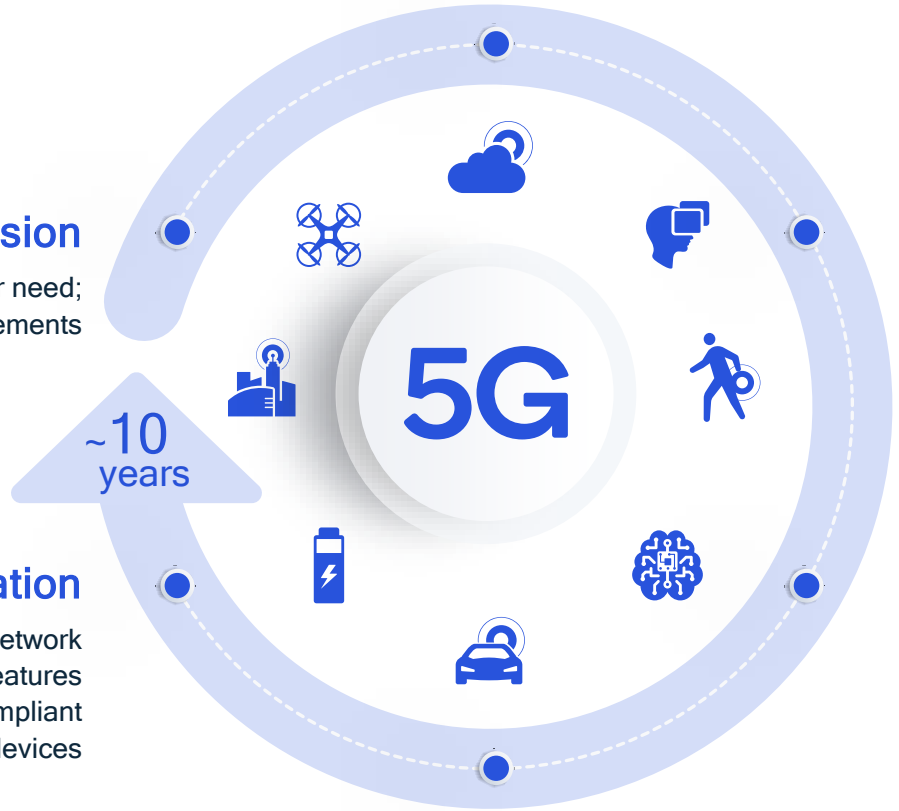
Senior Vice President, Engineering,
Qualcomm Technologies, Inc.

Today's Agenda

Leading the 5G Advanced evolution	15 min
Our MWC demonstrations	25 min
Q&A	20 min

Foundation to 5G leadership is technology leadership

Early R&D and technology inventions essential to leading ecosystem forward



Invention

Invent new technologies and e2e system architecture

Proof-of-concept

Deliver end-to-end prototypes and impactful demonstrations

Standardization

Drive e2e design with ecosystem and through standards process

Trials

Collaborate on OTA field trials that track 3GPP standardization and drive ecosystem towards rapid commercialization

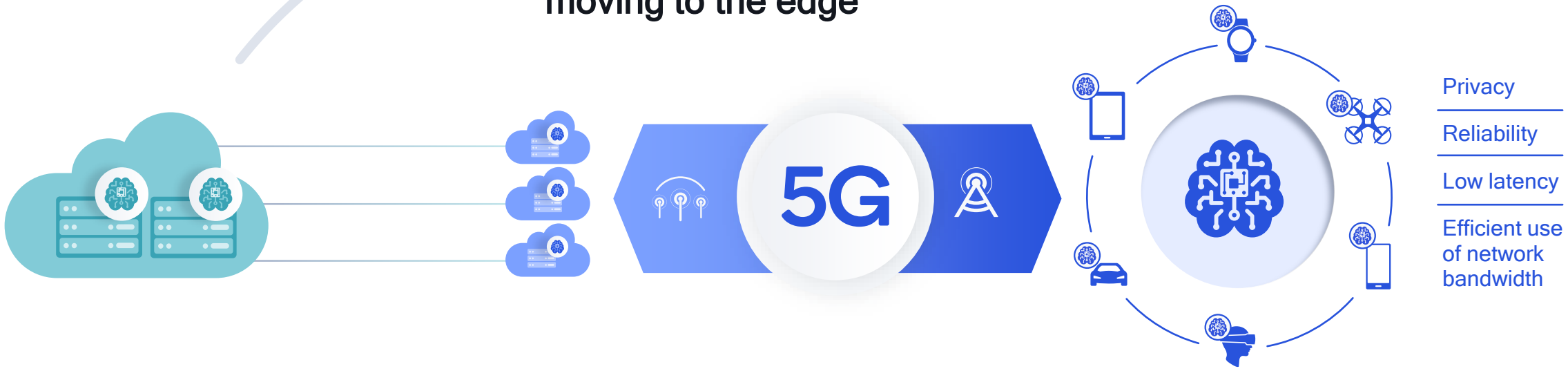
Commercialization

Engage with global network operators to deploy new features with standards-compliant infrastructure and devices

Vision

Identify a problem or need; establish requirements

To scale, the center of gravity of AI processing is moving to the edge



Central Cloud

Edge cloud

On-device

- Privacy
- Reliability
- Low latency
- Efficient use of network bandwidth

Connected Intelligent Edge

Qualcomm is leading the realization of the Connected Intelligent Edge

Convergence of:

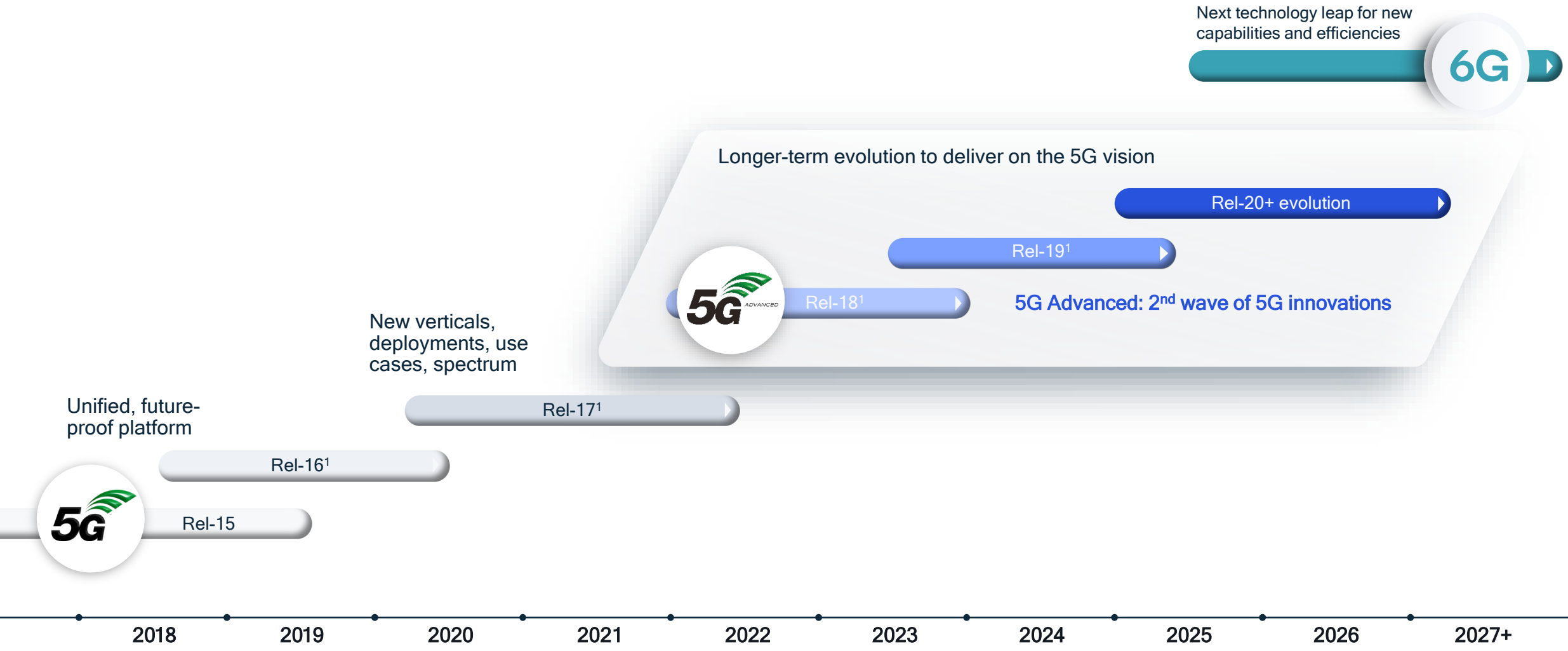
Wireless connectivity

Efficient computing

Distributed AI

Unlocking the data that will fuel our digital future

Driving the 5G Advanced technology evolution in the new decade



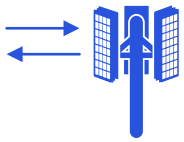
5G ADVANCED

Release 18

3GPP Release 18

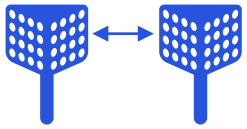
sets off the 5G Advanced Evolution

Strengthen the end-to-end 5G system foundation



Advanced DL/UL MIMO

Enhanced mobility



Mobile IAB, smart repeater

Evolved duplexing

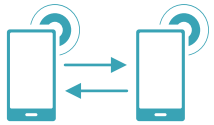
AI/ML data-driven designs

Green networks

Proliferate 5G to virtually all devices and use cases

Boundless extended reality

NR-Light (RedCap) evolution



Expanded sidelink

Expanded positioning

Drones & expanded satellites comm.

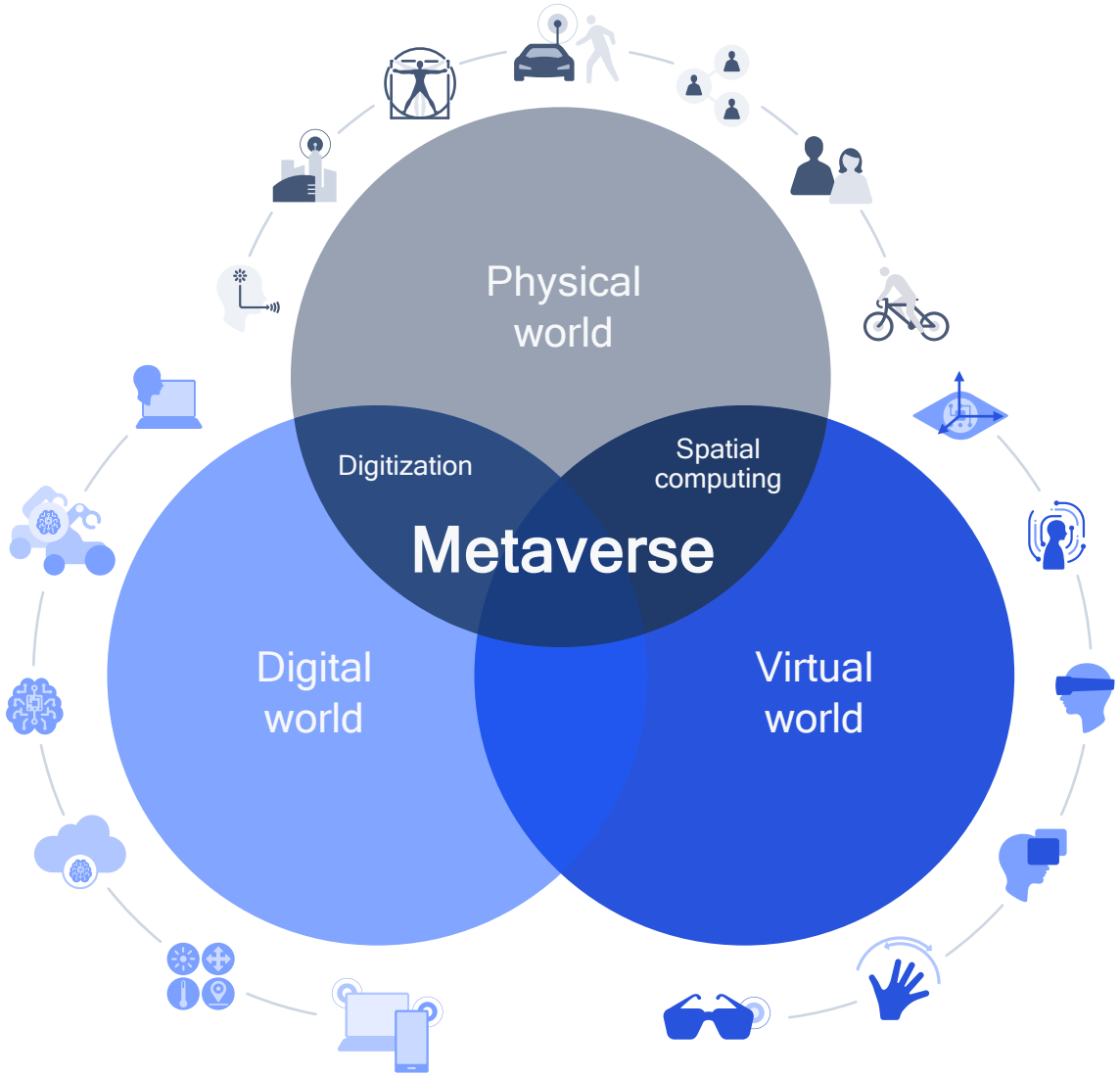
Multicast & other enhancements

New interface opportunities through

Merging worlds

The

New human interface



Ubiquitous, low-power sensing and monitoring with near real-time actions

Immersive interactions take human augmentation to the next level

Key research vectors enabling the path towards 6G

AI/ML powered E2E communications

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

Spectrum expansion & sharing

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

New radio designs

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

Scalable network architecture

Disaggregation and virtualization at the Connected Intelligent Edge, use of advanced topologies to address growing demand

Communications resiliency

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

6G

Design goals & performance vectors

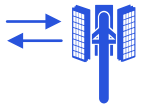
Capacity | Latency | Spectral efficiency | User experience | Ease of onboarding

Data rate | Reliability | Mobility | Security | Scalability | Intelligence | Cost efficiency

Coverage | Energy efficiency | Connection density | Positioning capability | And others...

Leading the 5G Advanced technology evolution on the path to 6G

Foundational Air Interface Innovations



Advanced MIMO Evolution

Mobile mmWave Evolution

AI-enabled Air Interface

Green Networks

5G Positioning Evolution

Expansion to New Applications

Enabling the Metaverse

Wide-area IoT Expansion

Enhancing Automotive Safety

Industrial 5G Networks

Industrial Precise Positioning

New advanced wireless technology demonstrations for MWC'22

Early R&D investments

Cutting-edge prototypes

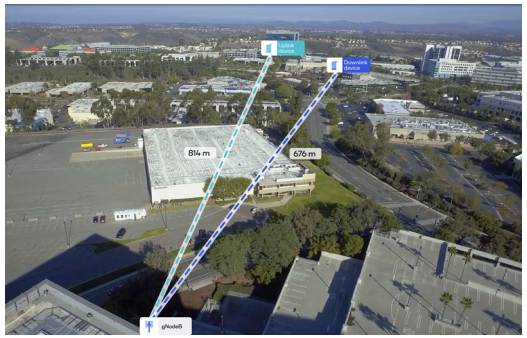
Fundamental contributions to 3GPP

Advancing towards next-generation MIMO design

Technology demonstrations in this session

Subband Full Duplex Communications

Real-time OTA prototype



Improves capacity, latency, efficiency, taking us another step closer to single frequency full duplex on the path to 6G

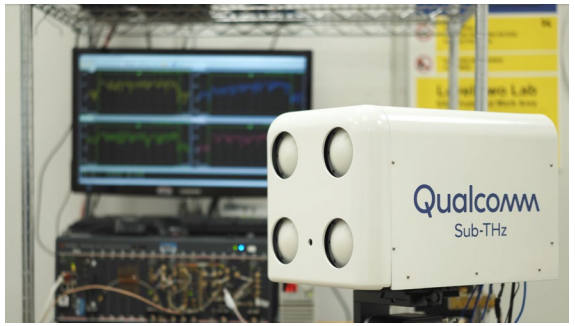
Upper Mid-band Expansion (13 GHz) with Giga-MIMO

System simulation

Unlocks even more wide-area bandwidth in the upper mid-band (i.e., 7–24 GHz) that further expands system capacity

Sub-Terahertz (145 GHz) with lensed MIMO

Real-time OTA prototype



Provides 100s Gbps throughputs utilizing wide bandwidths in 100+ GHz spectrum, towards the terabit-per-second era

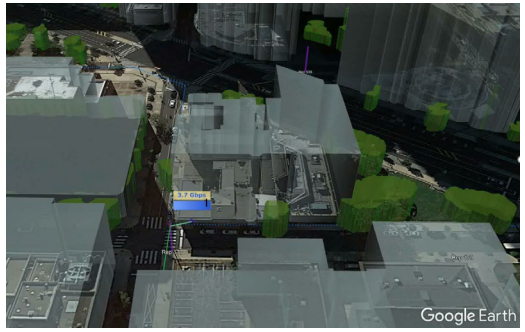
Unlocking new flexibilities, spectrum bands for better user experience and expanded network capacity

Driving continued mobile mmWave technology evolution

Technology demonstrations in this session

Intelligent 5G mmWave Deployment

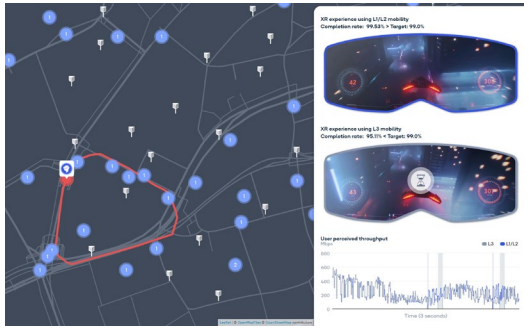
System simulation



Leverages machine learning and optimization techniques for efficient network topologies employing different mmWave infrastructure options

5G mmWave Mobility Enhancement

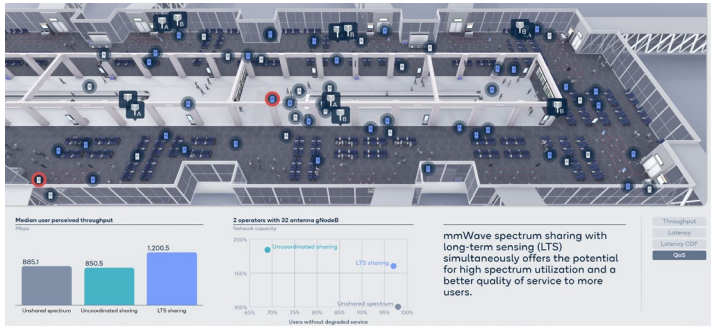
System simulation



Implements L1/L2-based mobility to further enhance system performance for demanding use cases such as mobile VR

Advanced mmWave Spectrum Sharing

System simulation



Combines the benefits of licensed and shared spectrum for higher network capacity and a better user experience

More cost-efficient network deployments

Improved user experience

More efficient sharing of spectrum

Enabling AI/ML for air interface evolution in 5G and beyond

Technology demonstrations in this session

Cross-node Machine Learning for Channel State Feedback (CSF)

Real-time OTA prototype

Reduces communication overhead that leads to improved throughput, by exploiting a new data-driven design approach for the air interface

Cross-node Machine Learning for Beam Management

Real-time OTA prototype

Brings more efficient beam management for end-to-end mmWave system; thereby, increasing the usable capacity and extending device battery life

Lower overhead leads to more capacity

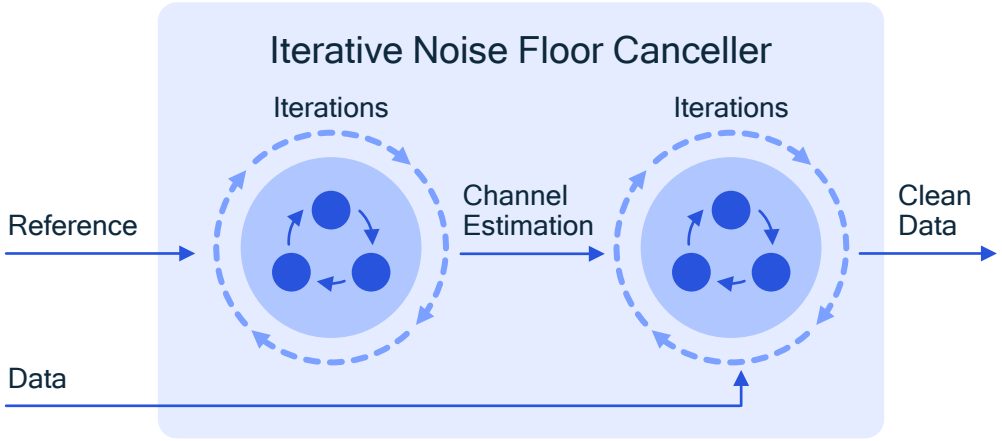
Enhanced user experience and battery life

AI-enabled air interface part of 3GPP Rel-18

Increasing efficiency for green and sustainable networks

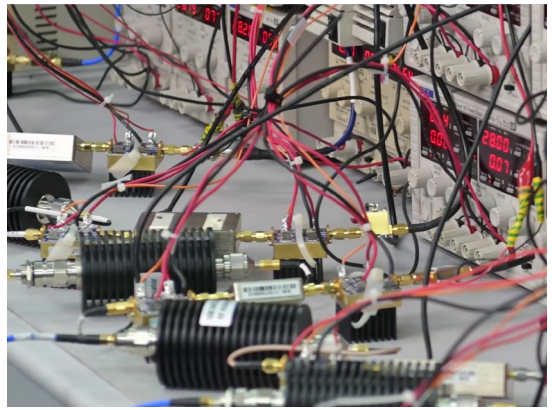
Technology demonstrations in this session

Super-QAM



Works with existing RF components

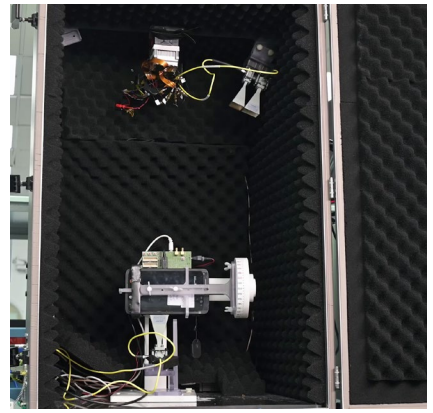
Sub-7GHz



16K-QAM

in cabled lab demo

mmWave



real-time OTA

demo with 1K-QAM

Can provide 66%-75% gain in throughput

Reduced energy utilization for greener networks

Green networks part of 3GPP Rel-18

Evolving 5G positioning for expanded spectrum

Technology demonstrations in this session

5G mmWave Precise Positioning

OTA and system simulation

Delivers high-precision positioning leveraging the wide bandwidth (e.g., 400 MHz) available from mmWave spectrum for a wide range of devices

Narrowband Positioning for 5G NR-Light (RedCap)

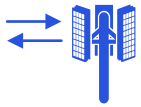
System simulation

Supports enhanced coverage, low-power positioning scalable to a massive number of low-complexity (e.g., 5 MHz bandwidth) devices

Driving positioning as a core 5G service across all bands and bandwidths

Leading the 5G Advanced technology evolution on the path to 6G

Foundational Air Interface Innovations



Advanced MIMO Evolution

Mobile mmWave Evolution

AI-enabled Air Interface

Green Networks

5G Positioning Evolution

Expansion to New Applications

Enabling the Metaverse

Wide-area IoT Expansion

Enhancing Automotive Safety

Industrial 5G Networks

Industrial Precise Positioning

New advanced wireless technology demonstrations for MWC'22

Early R&D investments

Cutting-edge prototypes

Fundamental contributions to 3GPP

Enabling the metaverse for the merging of the worlds

Technology demonstrations in this session

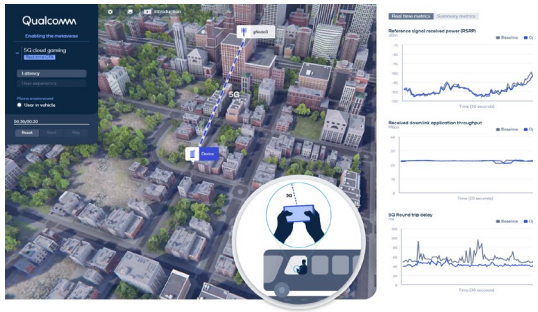
Boundless Augmented Reality

Lab prototype

Optimizes 5G and Wi-Fi roundtrip latency for various radio conditions, enabling enhanced boundless AR experiences

5G Cloud Gaming

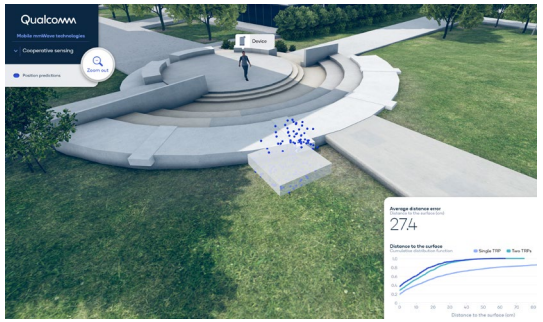
Real-time OTA prototype



Optimizes 5G latency and supports a new API to adapt to radio conditions, enabling responsive, immersive, and smooth gaming experiences

mmWave Cooperative Sensing

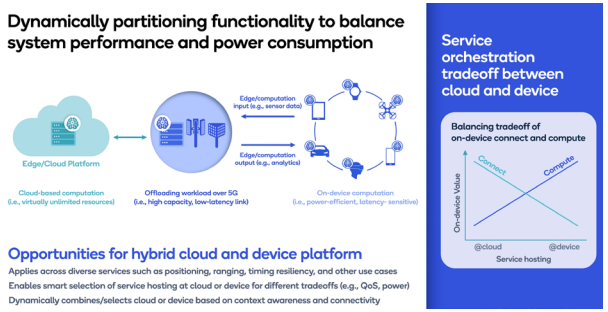
System simulation



Supports positioning and sensing to better understand the physical world for improving the metaverse experience

Secure Services Beyond Data

Messaging



Designs an enhanced and flexible platform that supports a wide range of non-data use case (e.g., positioning, timing)

End-to-end optimizations | Cutting-edge prototypes | Enabling new use cases

Expanding IoT support for the wide-area network

Technology demonstrations in this session

5G NR-Light (RedCap) Capacity

System simulation

Scales 5G NR down to narrower bandwidths (e.g., 20 MHz in sub-7 GHz) to more efficiently support lower-complexity IoT devices

5G Device Mesh Network for IoT

Real-time OTA prototype

Extends coverage for low-power IoT devices and enables cost-efficient connectivity for many devices through a single wide-area connection

Evolving 5G NR-Light to support enhanced lower-complexity IoT devices and services

Enhancing automotive safety

Technology demonstrations in this session

Cloud-connected Cooperative Radar Sensing

Demonstrates how a cloud connection can provide a safer driving experience by coordinating radars of vehicles in the same vicinity

C-V2X Sidelink Positioning with a Single RSU[1]

C-V2X positioning from a single RSU can enhance location estimates in all situations: especially when GNSS signal quality is compromised

Enhancing Safety with Smart RSUs

Adding AI capabilities to RSUs enable new safety use cases and the network effect realizing safer user experiences in challenging driving scenarios

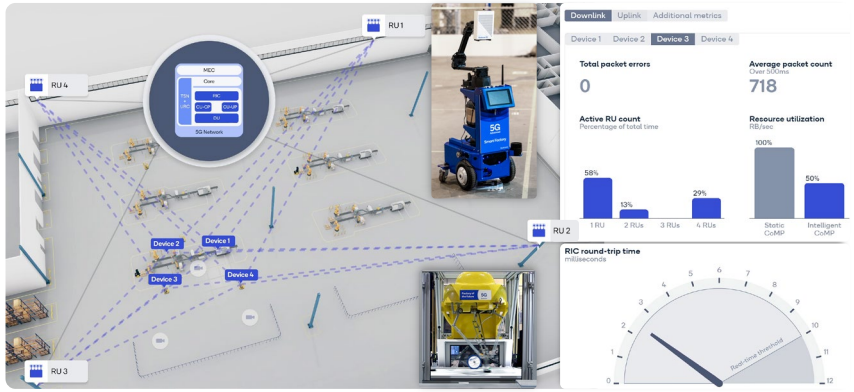
1 Roadside Unit

5G, C-V2X, and AI working together enable safer driving experiences

Breaking new ground with 5G networking for industrial IoT

Technology demonstrations in this session

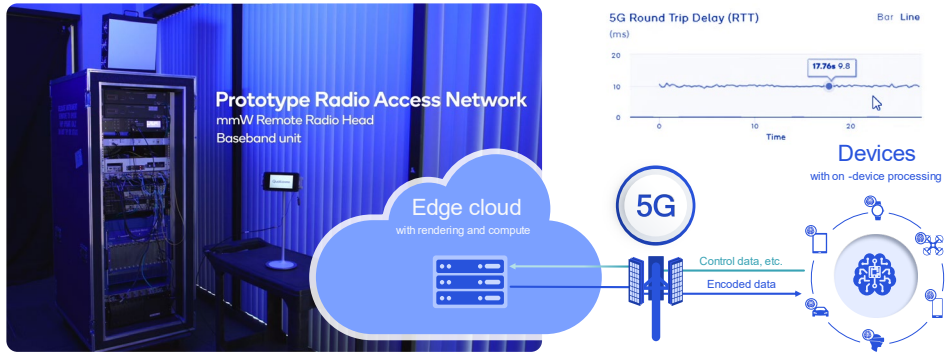
5G Advanced for the smart factory



Demonstrates efficient and robust industry 4.0 connectivity with intelligent CoMP using the O-RAN ALLIANCE framework for disaggregated network components and RAN Intelligent Controller (RIC), and 5G sidelink

5G/6G innovation platform for new verticals

Lannion, France



Creating an innovation platform for end-to-end research on new verticals starting with XR and expanding to private networks, Industrial IoT, drones, and mission critical applications

Flexible and scalable network architectures

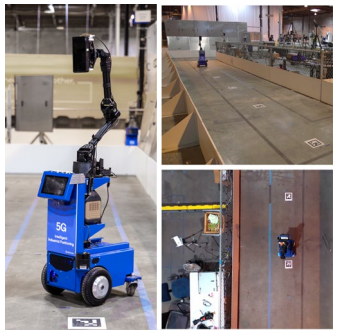
Machine learning for efficient ultra-reliable 5G connectivity

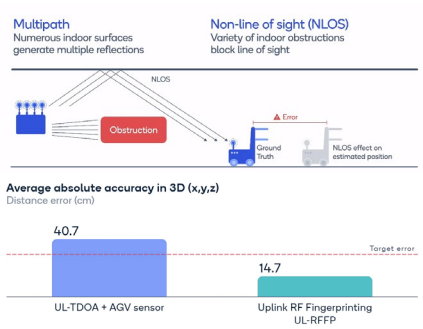
Advancing innovation to bring value to new verticals

Advancing 5G precise positioning for industry

Technology demonstrations in this session

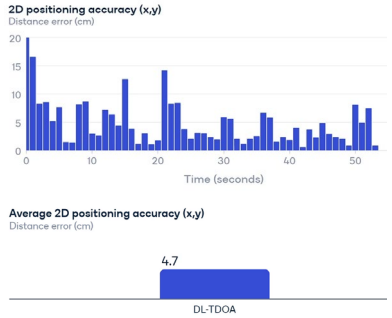
Intelligent Industrial Positioning





Delivers high-precision positioning with sub-7 GHz networks by leveraging machine learning-assisted RF-fingerprinting for non-line of sight industrial indoor environments

Precise Positioning with mmWave 5G



Demonstrates the feasibility of robust precise positioning for a mobile platform in industrial indoor environments with the 60 GHz mmWave unlicensed frequency band

5G offers a common connectivity and precise positioning solution from a single global standard that can leverage licensed, shared, and unlicensed spectrum

Innovating to pave the path to 6G

A unified connectivity fabric for this decade

Next technology leap for new capabilities and efficiencies

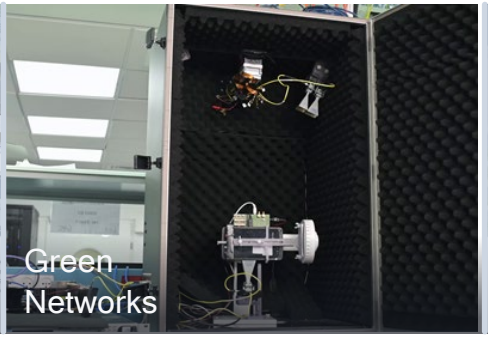
Historically 10 years between generations

Strong 5G momentum sets stage for global expansion

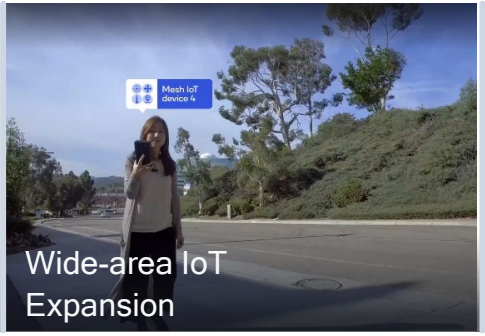
Q&A

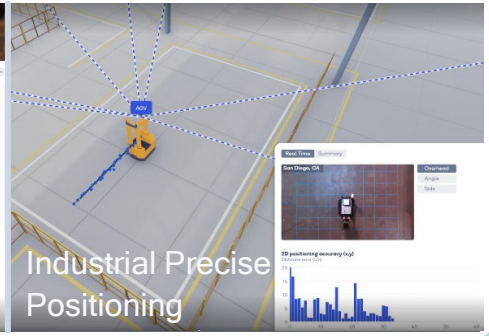
Leading the 5G Advanced technology evolution on the path to 6G

Foundational Air Interface Innovations



Expansion to New Applications





New advanced wireless technology demonstrations for MWC'22

- Early R&D investments
- Cutting-edge prototypes
- Fundamental contributions to 3GPP

Qualcomm

Thank you

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