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# 5G FUTURES SUMMIT

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# 5G FUTURES SUMMIT

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## Welcome & Introduction



**Sylwia Kechiche**  
Principal Analyst, Enterprise  
Ookla

MWC™  
GSMA

SESSION 2:  
**To Infinity and  
Beyond with  
5G-Advanced**

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# SESSION 2 AGENDA

## Session 2 Speakers

- **Alex Sinclair**, CTO, GSMA
- **Bernard Despres**, Vice-President Core Network, Automation, Security, E2E services, Orange
- **Dr Xiaodong Xu**, Principal Researcher at China Mobile, and currently Vice Chair of 3GPP TSG RAN 1, China Mobile (*video*)
- **Alan Loh**, Executive General Manager, Zain KSA
- **John Gao**, 5.5G General Manager, Huawei
- **Tingfang Ji**, VP R&D Group at Qualcomm

## Session 2 Panel

- **Sibel Tombaz**, Head of 5G RAN, Business Area Networks, Ericsson
- **Dr. Mahmoud R. Sherif**, Head of Technology & IT Strategy, DU
- **Sheldon Yau**, Head of Wireless & Core Network Engineering, Hongkong Telecom
- **Ronnie Vasishta**, SVP Telecom from NVIDIA

## Photograph

Join GSMA for a 5G-Advanced community photograph at the end of the session

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**Introduction**  
5G-Advanced



**Alex Sinclair**  
CTO  
GSMA

**MWC™**  
GSMA

# WELCOME



## To Infinity and Beyond with 5G-Advanced

Alex Sinclair – CTO, GSMA



## 5G-Advanced Promises Step Change for Extended Reality

Cross-layer collaboration tech could enable fivefold increase in simultaneous XR users

Tests of 5G-Advanced cross-layer collaboration technology have demonstrated that forthcoming cellular networks will be able to deliver highly immersive extended reality (XR) experiences. Conducted in Hangzhou, Zhejiang province, China, the tests explored how 5G-Advanced networks could support very high-resolution virtual environments generated by computer technologies and wearable devices.



## 5G Advanced Could Turbocharge Video Uploads

Field test of UCBC tech achieves uplink of more than 1 Gbps for a single user

Huawei and China Mobile have conducted field tests that demonstrate that 5G Advanced can provide the uplink capacity and throughput to support the fast and efficient transmission of high-resolution videos from anywhere with network coverage.



## 5G Advanced to Support Self-Powered Sensors

Passive IoT tech promises to improve coverage tenfold compared with RFID.

Huawei and China Mobile have conducted field tests of a passive Internet of Things (IoT) solution, which enables large numbers of sensors to transmit data without the need for batteries. Conducted in Chengdu, Sichuan province, China, the tests used a prototype 5G-Advanced network.

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## 5G-Advanced Experience



**Bernard Després**

VP Core Network, Automation, Security  
Orange

MWC™  
GSMA



# 5G advanced experience

MWC 2023 5G Futures Summit

Session 2 – from infinity and beyond with 5G advanced

March 1<sup>st</sup> 2023

Bernard Després VP Core network, automation, security

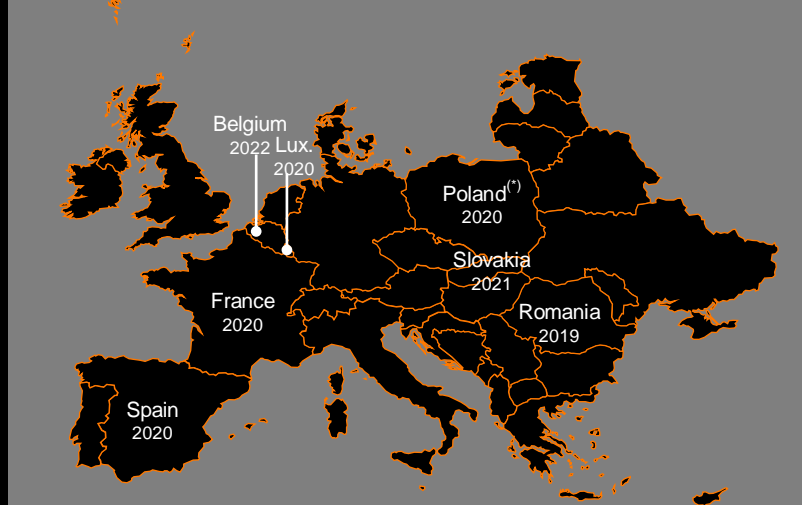


# 5G in Orange commercially available since 2019

## 5G NSA

5G Radio access  
4G core network

\* Except Poland: commercialised on 4G spectrum in DSS (Dynamic Spectrum Sharing)



+



## 5G SA

5G Radio access  
5G core network

February 13, 2022

Orange first operator to launch 5G SA (5G+) on the Spanish market

Available in  
Barcelona  
Madrid  
Sevilla  
Valencia

# 5G labs to coinnovate with partners



France, Europe (Belgium, Poland, Romania)  
3 in Middle-East and Africa (Ivory Coast, Jordan, Senegal)



> 2000 companies or public entities accompanied

176 co-innovation projects

17  
Orange 5G Lab worldwide

4  
Will to be opened in H1 2023



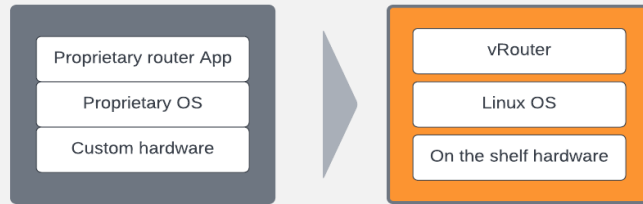
## Main business sectors:

- Entertainment
- Smart City
- Industry 4.0
- E-Health

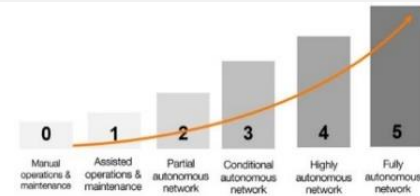
# 5G advanced will enable network hyper automation

## Disaggregation

from proprietary and closed solution, towards totally decoupled and open components which are re-combined to form a complete solution, with orchestrators



**Continuous automated delivery** (leveraging on Ci/Cd, DevSecOps and Telco cloud, Gitops)

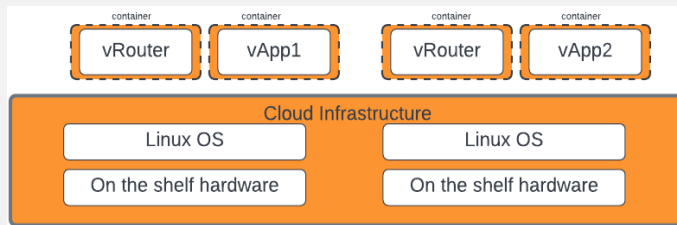


**Autonomous networks involve closed loops automation** assisted by machine learning & AI

## Automation

## Virtualization

**Virtualization** and cloudification allow pooling of hardware resources (compute, storage, I/O) and economies of scale



Network services become 'As a Service' in a real **On demand** mode. **APIs** are key enablers for this transformation



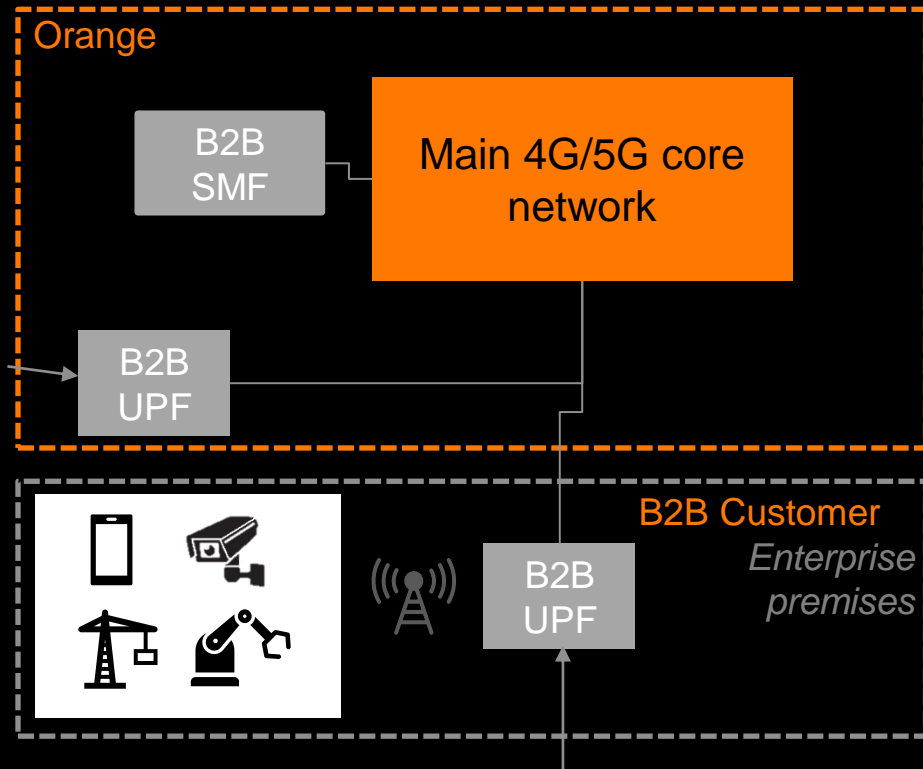
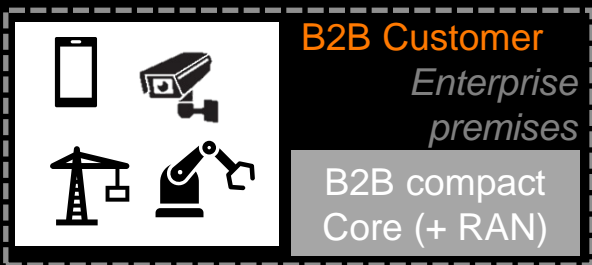
## On demand

# 5G Mobile Private Networks



# 3

MPN-Virtual  
when large  
scale slicing  
ready



# 1

Full private solution  
With/without RAN depending  
on B2B spectrum conditions

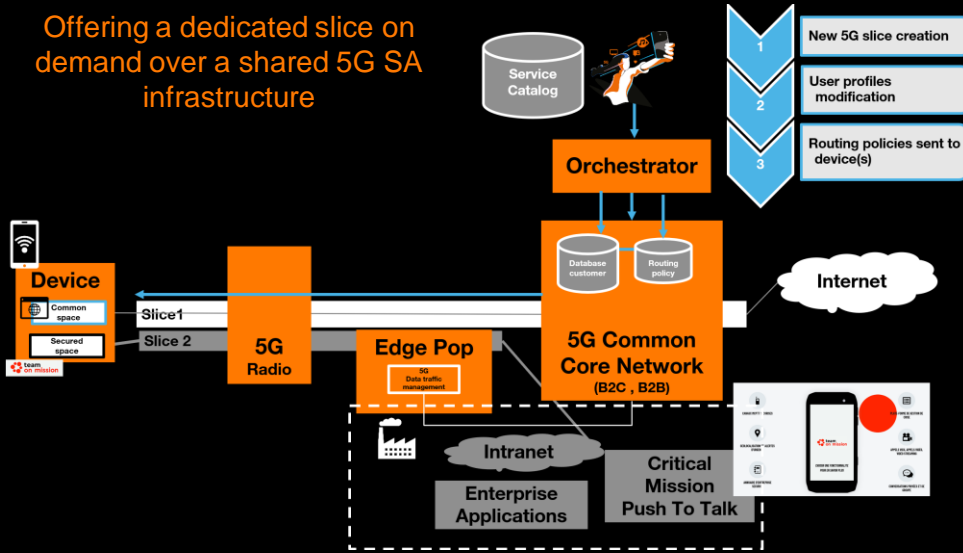
UPF = manages user traffic  
SMF = manages signalling

# 2

Hybrid-LBO (Local  
Break Out)

# Pikeo is Orange Cloud Native, full software, automated and AI-driven 5G SA experimental network

Offering a dedicated slice on demand over a shared 5G SA infrastructure



Showcased at MWC

## 5G SA

Slice : Internet service

Slice : Corporate service

Slice : Emergency service

Slice : Connected car

Slice : Industry 4.0

A network supporting several logical subnets for different use cases

# We are only at the beginning of the 5G+ journey

6 GHz  
licensed

R17 R18

Reduced  
Capability  
5G IoT

R17 R18

Extended  
reality  
XR

R18

Network  
Power  
Saving

R18

UpLink  
perf

R18

Ambient  
Power IoT

R18 R19

Satellites  
Drones

R17 R18

AI  
Artificial intelligence  
ML  
Machine learning

R18

# Thank you





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## Accelerating 5G-Advanced Adoption



**Dr Xiaodong Xu**  
Chief Specialist  
China Mobile

# MWC 2023 5G Futures Summit

BARCELONA 27 FEBRUARY-2 MARCH



## *Accelerate 5G-Advanced Adoption*

**Dr. Xiaodong Xu**  
Chief Specialist of China Mobile



**Dr. Xiaodong Xu**

Chief Specialist of China Mobile

Accelerate 5G-Advanced Adoption

Good morning, everyone

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## 5G-Advanced Empowering AI Innovation



**Alan Loh**  
Executive General Manager  
Zain KSA

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# 5G-Advanced Empowering AI Innovation

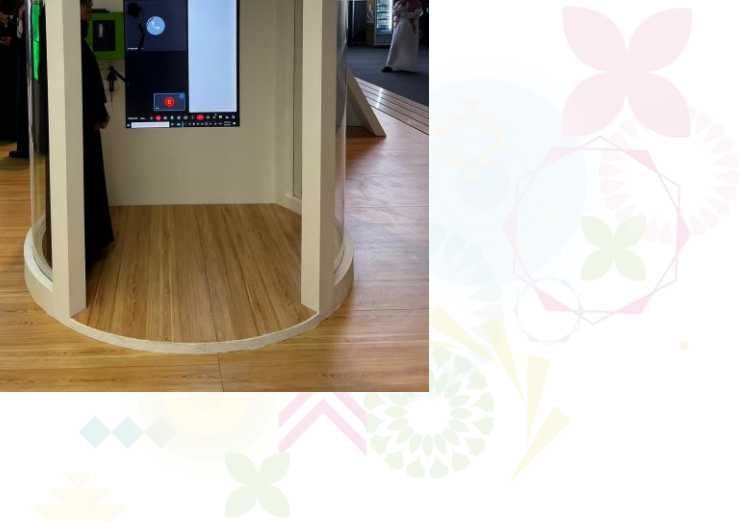
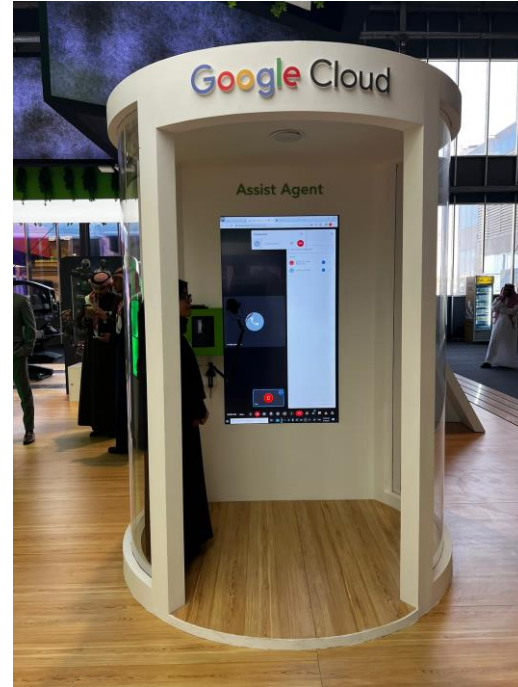
Alan Loh

Innovation and Solutions Executive General Manager

# 5G-Advanced and AI



# Zain KSA Contact Center AI (Now)



# Autonomous Optimization (Coming)

	Human Brain	AI Brain (Deep Learning)
<b>Data required to learn</b>	Few data points	Huge amount of data
<b>Quantitative optimization (picking the best parameters combination out of a million)</b>	Hard	Easy
<b>Customizing for each situation (showing each customer a different QoS to maximize CX)</b>	Hard	Easy
<b>Abstract concepts, analytical reasoning, common sense and insight</b>	Easy	Hard
<b>Creativity</b>	Easy	Hard

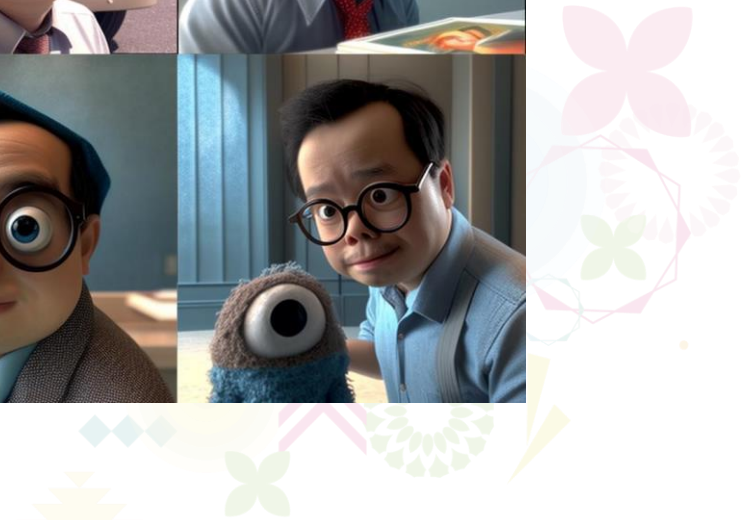


# AI Brings Dead Back to Life (Future)





# AI Generated Pictures



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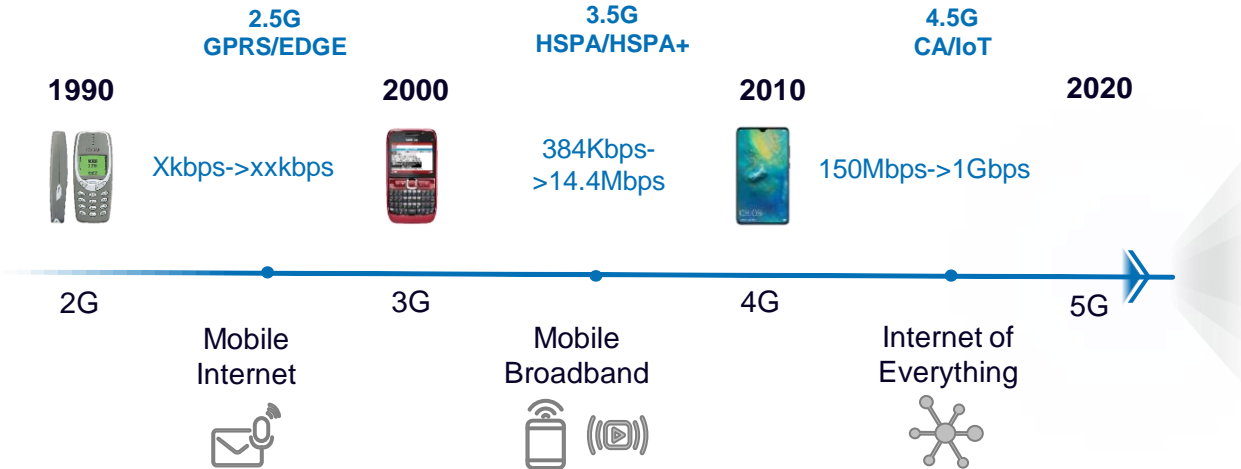
**Accelerate 5G-Advanced  
Industry, Build A Better  
Intelligent World**



**John Gao**  
President of 5.5G Domain  
Huawei

**MWC™**  
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# As 5G Reaches Maturity, New Trends Emerge



## New Service Trends

- ToC/toH: From Content Centric To Experience Centric, From Best Effort To Deterministic Experience;
- IoT: From Partial Scenario To Full Scenario;
- ToB: From Auxiliary Process To Mandatory Process;
- ToV: From Internet Service To Assisted Smart Driving.

# Multi-Dimension and Deterministic Experience Becomes More Significant

## To Consumer:

### From Content Centric To Experience Centric

Online Video/Gaming



3D  
 Cloudification

XR/Cloud Gaming



AI Push Information



AI Upgrade

AI Content Generation



\* XR Requirement

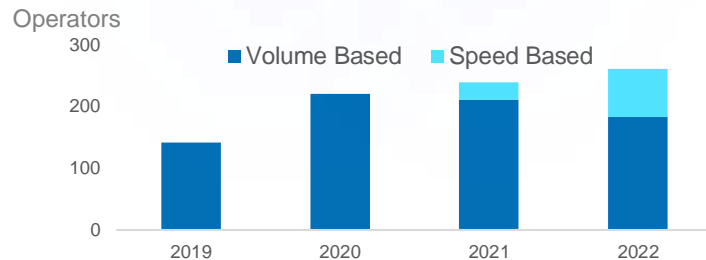
Resolution	8K	16K	32K-64K
DL THP	400Mbps	1Gbps	5-10Gbps
UL THP	20Mbps	~100Mbps	1Gbps
Latency	20ms	10ms	5ms

## To Home:

### From Best Effort To Guaranteed Experience

#### More Operators Start To Offer Speed Based Package

Volume Based Up to Speed Guaranteed Speed



#### Fiber Like Experience



Connect your home at up to 1 Gigabit/s and surf at very high speed, without limits and with all the stability of the Fastweb network.

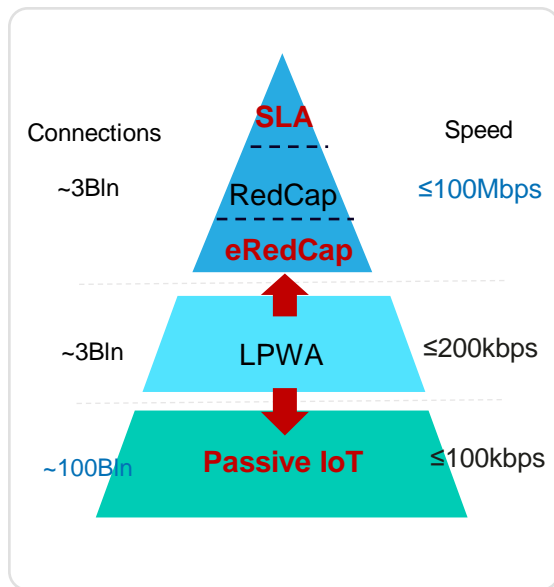
#### Guaranteed Speed



# Higher Requirements Appear In IoT/Campus/Vehicle Connections

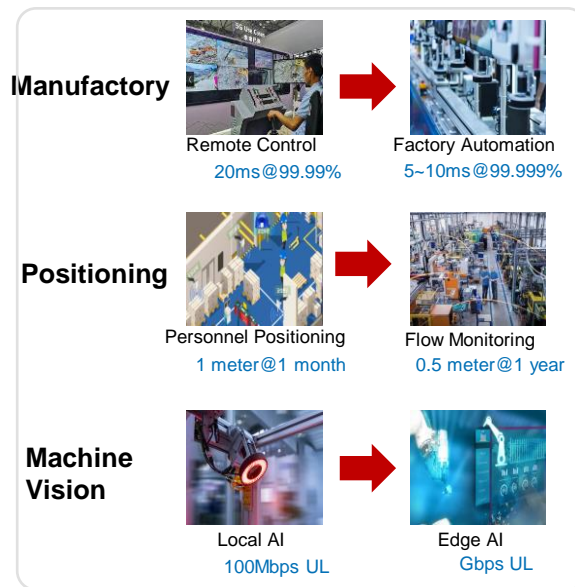
## IoT :

From Partial Scenario to All Scenario



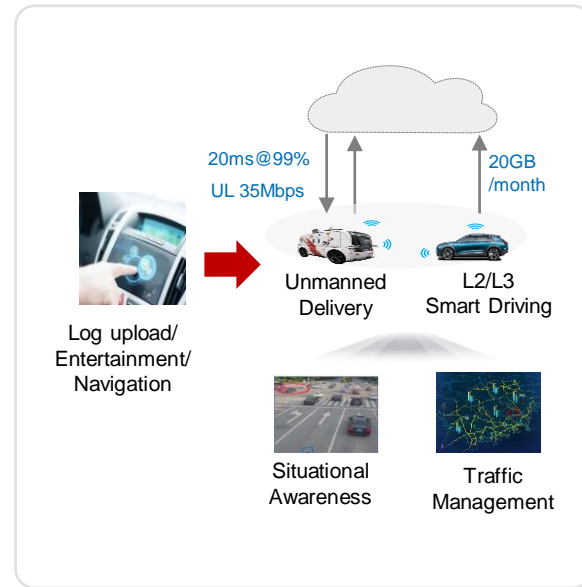
## Campus:

From Auxiliary to Mandatory

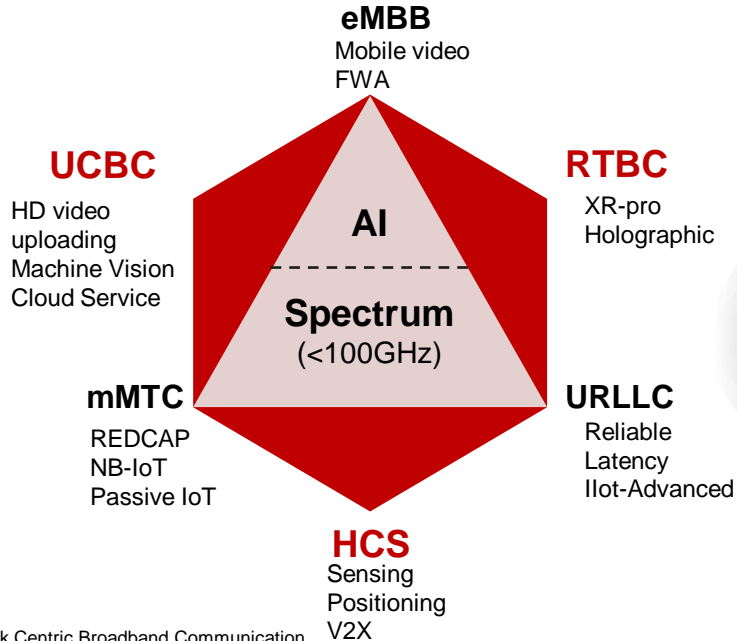


## Vehicle:

From Internet Service to Assisted Smart Driving



# 5.5G Enhances 10x Capability and Opens New Opportunity

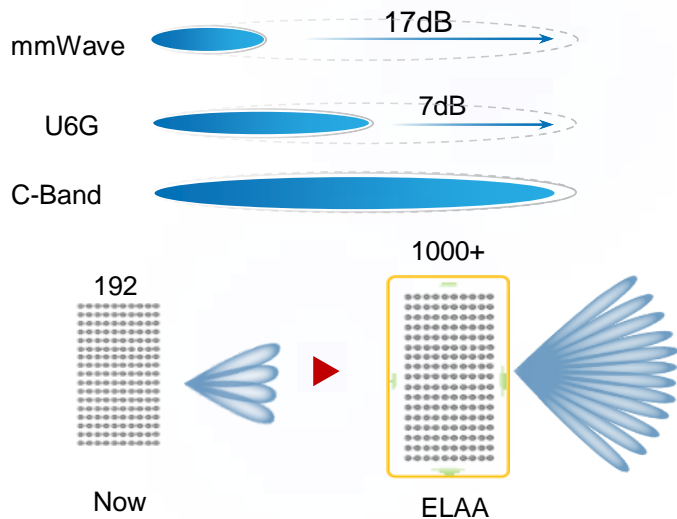


UCBC: Uplink Centric Broadband Communication  
 RTBC: Real-Time Broadband Communication  
 HCS: Harmonized Communication and Sensing

	5G	▶	5.5G
DL	Gbps		~10Gbps
UL	~Mbps		~Gbps
RTBC	~x00Mbps		~x00Mbps 5-20ms@99.9%
mMTC	NB-IoT, RedCap		Passive IoT
URLLC	20 ms level		4 ms level
Positioning Accuracy	Meter level		cm level
Sensing	NA		Distance Speed ...

# ELAA-MM Technique Enables DL 10Gbps Capability In Live Test

## ELAA Improves Coverage For Higher Frequency Bands



\* ELAA: Extremely Large Aperture Array

## 10Gbps Capability Are Approved by U6GHz and mmWave

### U6GHz Provides 10Gbps Peak Data Rate



- Spectrum:
  - U6GHz 400Mhz
- RAN:
  - ELAA-MM 1000+
- Terminal:
  - 4T8R

### mmWave + Sub6GHz Provides 10Gbps Peak Data Rate

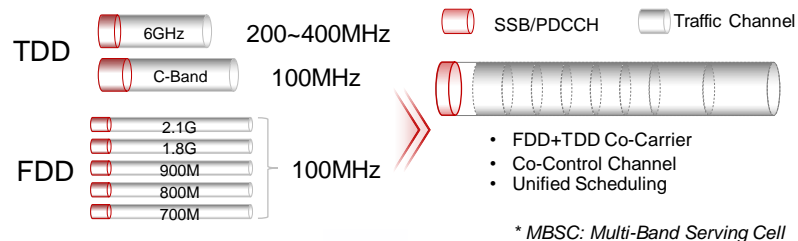


- Spectrum:
  - mmWave 800Mhz,
  - Sub-6GHz 200Mhz
- RAN:
  - mmWave ELAA-MM 4T4R
  - Sub-6GHz 64T64R
- Terminal:
  - mmWave 2T2R,
  - Sub-6GHz 4T4R

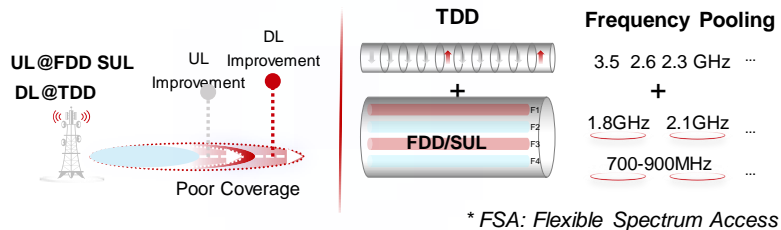
# Spectrum Decoupling and Smart Slicing Provide Deterministic Experience

## Spectrum Decoupling Improves Utilization Efficiency

- **MBSC** to Improve Spectrum Efficiency



- **FSA** For Uplink Experience Improvement

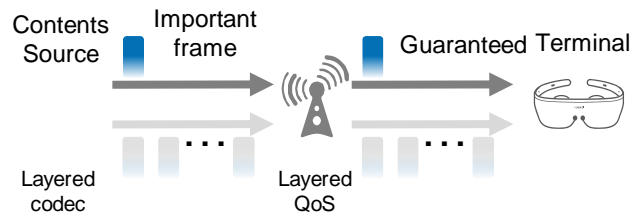


## Smart Slicing and Layered QoS Provide Elastic Performance

- **Smart Slicing** for Elastic Resource Allocation



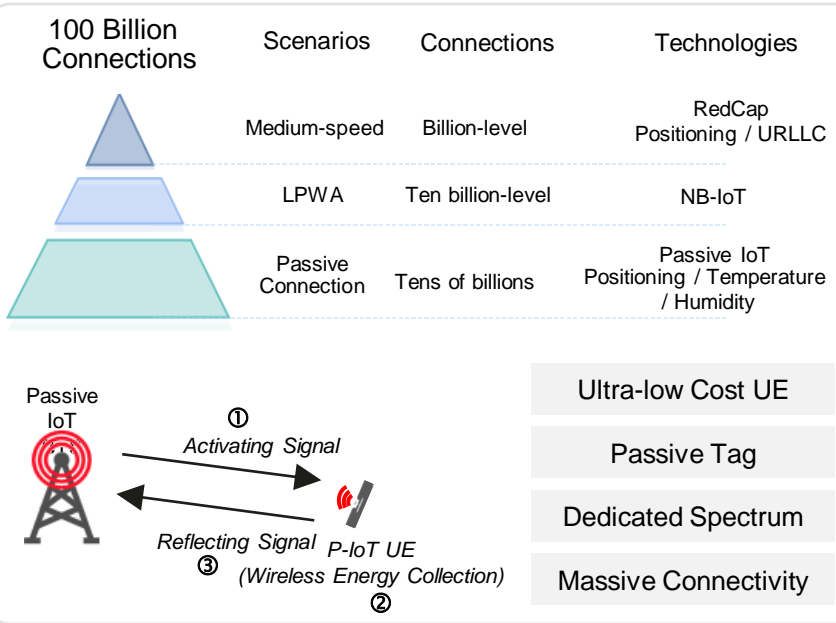
- **Layered QoS** for Guaranteed Experience





# 5.5G As A Milestone To Support All Scenario IoT

## 5.5G Extends Clot Into Passive Scenario



## Passive IoT Brings Extra Value To Industry

10x + Coverage Enables Indoor To Outdoor

Asset Inventory

Tracking Logistics

Temperature and Humidity Monitoring

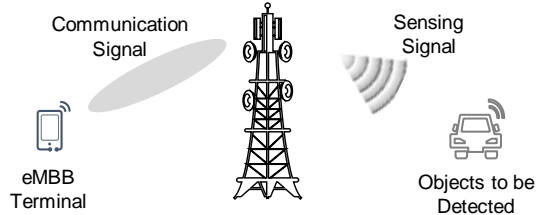
More Efficient, Accurate And Cost Effective

- Automatic
- 99.99% Accuracy
- ~5x Less Expensive Compare With Tradition

# Harmonized Communication And Sensing Brings New Opportunities

## Large BW mmWave Enables High Precision Sensing Capability

### Integrated Sensing And Communication



Full Vision  
No Blind Zone

Full Time  
7\*24h

Full Convergence  
Sensing & Communication

## HCS Enables Smart Transportation



1000 m+  
Coverage

0.5 m/s  
Speed Accuracy

Sub-meter level  
Distance Accuracy



To Driver  
Increased Safe  
More Comfortable

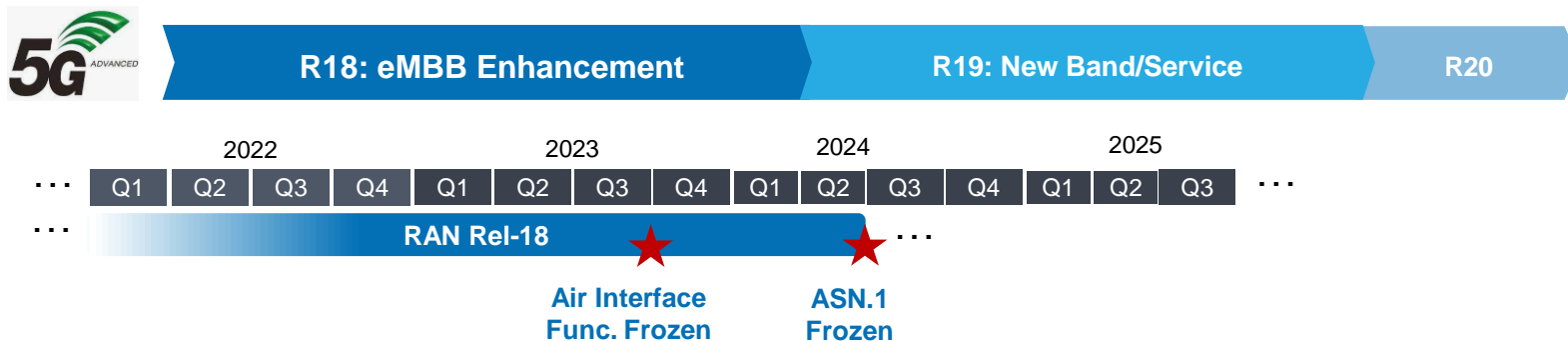


To Authority  
Improve Management Efficiency  
Reduce Traffic Accident



To Car Company  
Improve Autonomous  
Driving Level

# Further Cooperation Is Needed For Industry Acceleration



### Spectrum

- Accelerate The New Spectrum Allocation (mmWave/U6GHz/2<sup>nd</sup> Carrier)
- Accelerate Legacy Spectrum Refarming.

### Technique

- End To End Trial and Commercialization With 5.5G Techniques :
  - ELAA;
  - MBSC, FSA, QoS Layer;
  - P-IoT, Redcap.

### Terminal

- Accelerate The lot Test With R18 Chipset;
- Accelerate The mmWave/U6G Terminal Readiness;

### Application

- Further Exploring The Value Of 5.5G In Industry:
  - XR; FWA;
  - Campus Network;
  - IoT;
  - Vehicle.

*“If You Want To Go Fast, Walk Alone;  
If You Want To Go Far, Walk Together.”*

Thank You

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Reaching for New Heights  
with 5G-Advanced



**Tingfang Ji**

Vice President, Engineering  
Qualcomm Technologies, Inc.

**MWC™**  
GSMA

Reaching for New Heights with

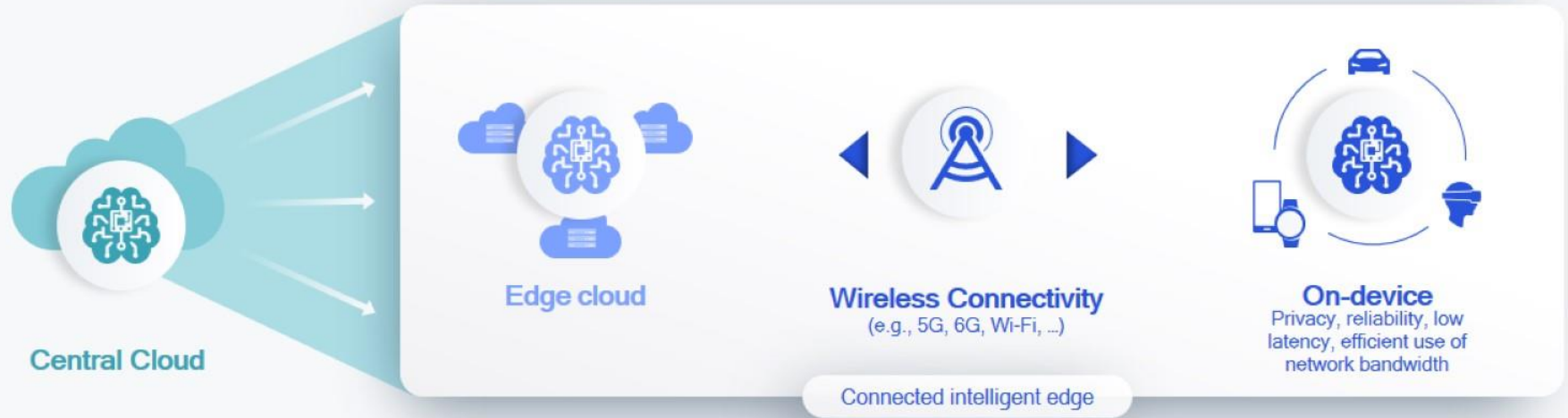
# 5G Advanced

**Dr. Tingfang Ji**

Vice President, Engineering  
Qualcomm Technologies, Inc.



# To scale efficiently, AI processing is expanding towards the edge



Qualcomm is leading the realization of the connected intelligent edge

Convergence of:

Wireless connectivity  
Efficient computing  
Distributed AI

Unleashing massive amount of data to fuel our digital future

Transportation



Manufacturing



Industrial



Retail



Energy



# Driving digital transformation across industries

5G will enable \$13.1 Trillion in global sales activities in 2035

Agriculture



Public safety



Smart cities



Healthcare



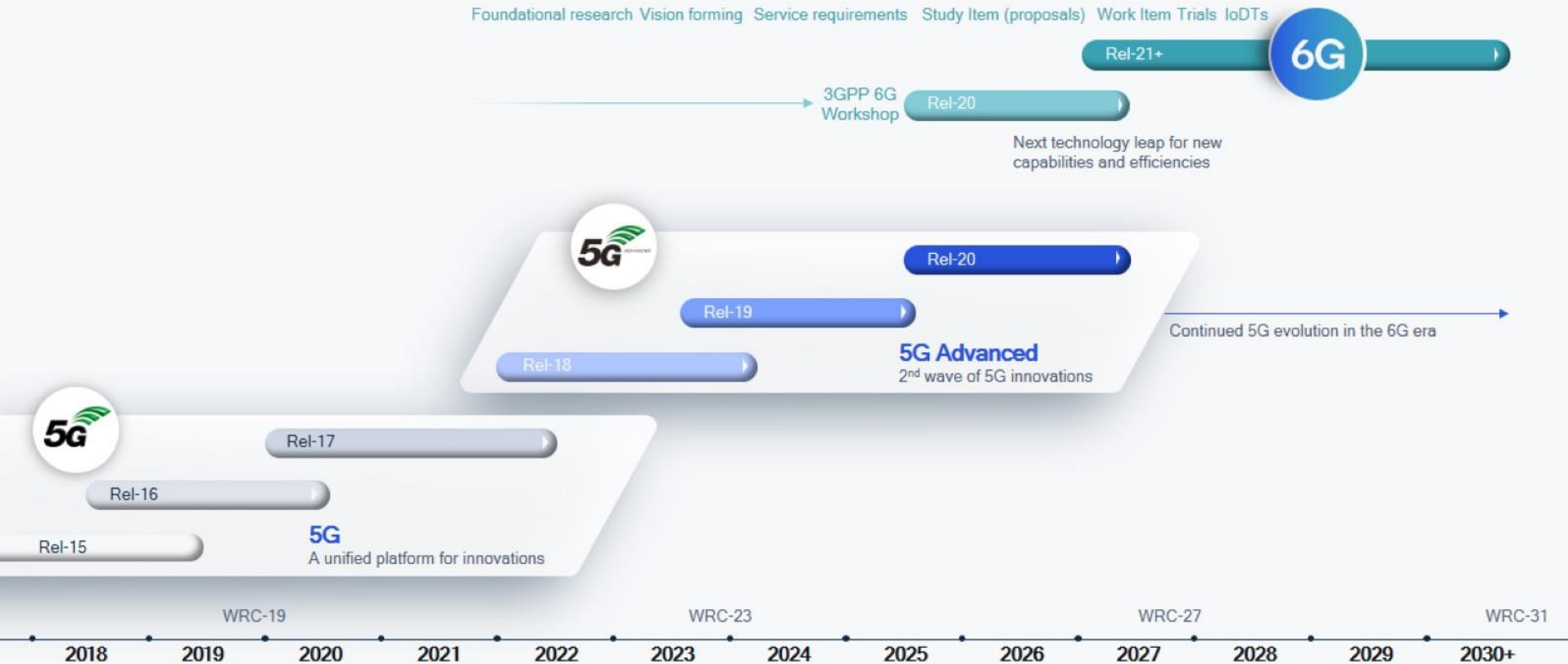
Entertainment



Source: The 5G Economy, an independent study from IHS Markit, commissioned by Qualcomm Technologies, Inc., November 2020

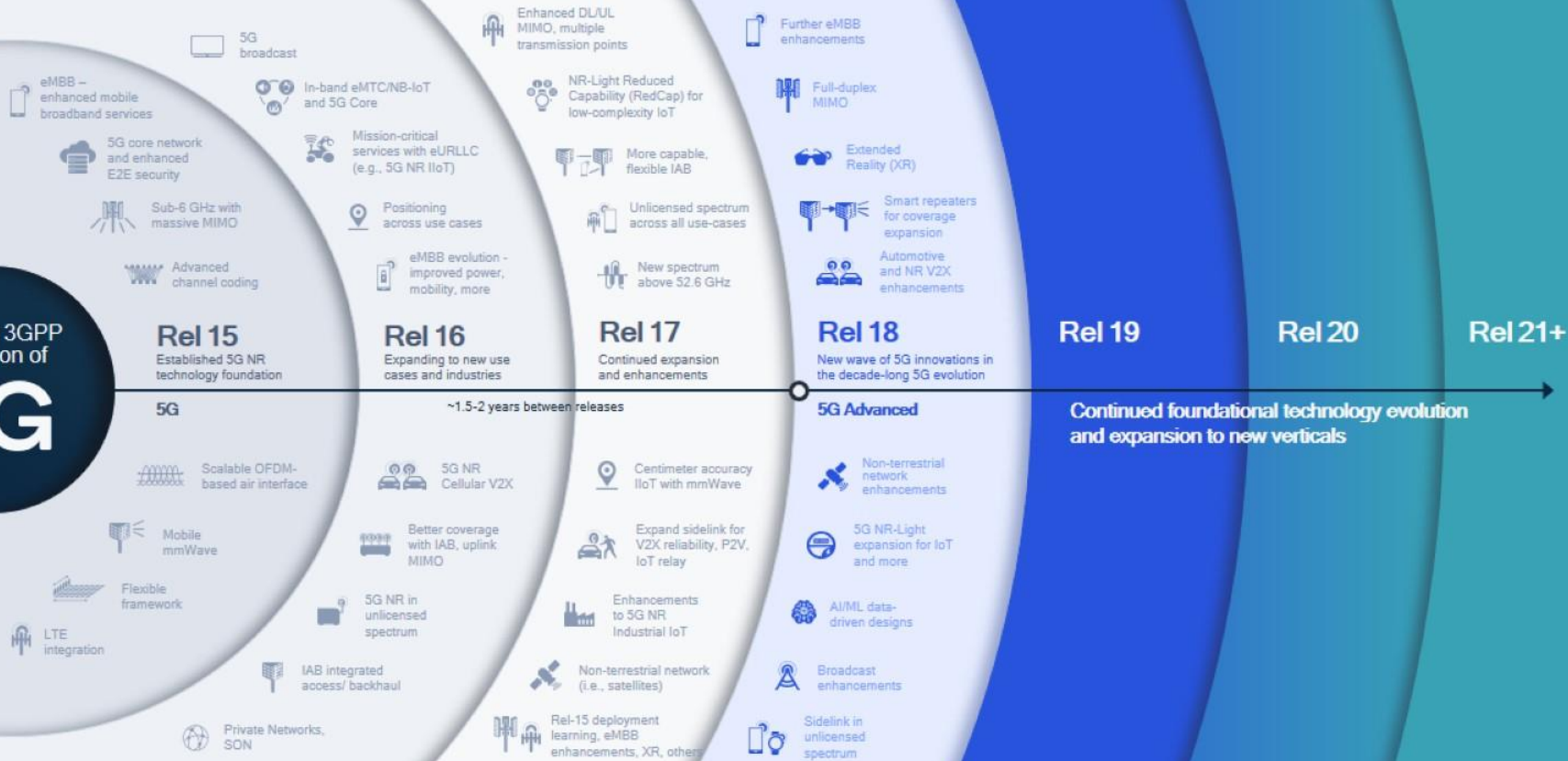


# 5G Advanced on the path to 6G



Leading 3GPP evolution of

# 5G

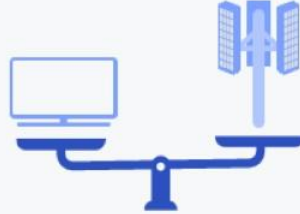


# Driving a balanced 5G Advanced evolution across key technology areas



## Mobile broadband evolution and further vertical expansion

Deliver enhanced mobile broadband experiences and extend 5G's reach into new use cases



## Immediate commercial needs and longer-term 5G vision

Drive new value in commercialization efforts and fully realize 5G's potential with future deployments



## New/enhanced devices and network evolution

Focus on the end-to-end technology evolution of the 5G system to bring new levels of performance

Release 18 starts the 5G Advanced evolution and it prepares for new and enhanced features coming in subsequent releases



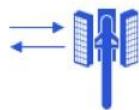
Release 18

# 3GPP Release 18

sets off the 5G  
Advanced Evolution

[Learn more about 3GPP Release 18](#)

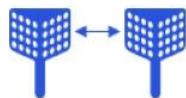
## Strengthen the end-to-end 5G system foundation



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



Working together  
across the connected  
intelligent edge



## 5G NR Release 18 Scope

### AI/ML-enabled air interface design



#### Use cases

Enhanced CSI<sup>2</sup> feedback, beam management, and positioning accuracy



#### AI/ML models

Collaboration models, life cycle management, and algorithms



#### Evaluation methodology

Existing 3GPP framework and field data to assess performance and identify KPIs



#### Impact assessment

Spec changes needed to support identified use cases, covering multiple aspects

### AI/ML framework for next-gen RAN



#### Network optimization

Data collection and signaling support for energy saving, load balancing, mobility optimization



#### Future study

New use cases (e.g., AI/ML for slicing, QoE<sup>1</sup>), network functionality and interface procedures

## 5G Advanced evolution will expand wireless ML to the end-to-end system across RAN, device, and air interface



#### Network architecture enhancements

ML to run over different HW/SW and future RAN function split to improve flexibility and efficiency



#### AI/ML procedure enhancements

Model management, training (e.g., federated and reinforced learning), and inference



#### Data management enhancements

ML data storage/access, data registration/discovery, and data request/subscription



#### New and expanded use cases

Traffic/mobility prediction, optimized coverage/capacity, massive MIMO, SON, CSI, beam management, ...



## Supporting diverse IoT devices and services



Consumer IoT



Industrial IoT



## 5G NR: A unified, scalable air interface allowing coexistence of a wide range of 5G device classes

<sup>1</sup> Ultra-reliable low-latency communication; <sup>2</sup> Time sensitive networking; <sup>3</sup> Data rate of 150 Mbps DL / 50 Mbps UL, latency of 10-30 ms, 10-3 to 10-5 reliability, coverage MCL of 143 dB; <sup>4</sup> Wakeup signal; <sup>5</sup> Wakeup receiver; <sup>6</sup> Also including satellite access; <sup>7</sup> Data rate of 1Mbps, MCL of 155.7 dB (eMTC) and 164 dB (NB-IoT)



# Pushing forward with the 5G positioning technologies



Indoor navigation

Vehicular nav.



Public safety

Geofencing



Drone tracking

User insights



AGV tracking

Asset tracking



Fleet management

XR optimization



## Release 16

Establishing foundation



Achieving accuracy of 3m/10m (indoor/outdoor) for 80% of time

Supporting RTT<sup>1</sup>, AoA/AoD<sup>2</sup>, TDOA<sup>3</sup>, single-cell positioning

Including new evaluation scenarios, i.e., industrial IoT



## Release 17

Enhancing performance



### 5G Positioning Evolution

Meeting centimeter-level absolute accuracy requirement of down to 0.3m

Reducing positioning latency to as low as 10 ms

Scaling to higher capacity for millions of simultaneous devices (e.g., IoT, automotive)



## 5G Advanced in Release 18+

Improving performance, expanding to new devices and deployments



### Sidelink positioning and ranging

Defining reference signals, measurements, procedures for out-of-range, absolute and relative (e.g., ranging) sidelink positioning



### Improved positioning performance

Specifying higher layer solutions for RAT<sup>4</sup> dependent positioning techniques, accuracy improvement based on PRS/SRS<sup>5</sup> bandwidth aggregation, carrier phase measurements, and positioning accuracy in heavy NLOS<sup>6</sup> with AI/ML



### NR-Light<sup>7</sup> positioning

Setting performance requirements, evaluating performance for R17 positioning procedures, and identifying potential enhancements



Source: RP-211660 Expanded and improved Positioning. 1. Roundtrip Time; 2. Angle of Arrival, Angle of Departure; 3. Time Difference of Arrival; 4. Radio Access Technology; 5. Positioning Reference Signal, Sounding Reference Signal; 6. Non-line of sight; 7. aka. RedCap



Snapdragon® Platforms and Reference Designs

Snapdragon XR1 Mobile Platform



Snapdragon 5G XR2 Mobile Platform



\$100M Snapdragon Metaverse Fund



Snapdragon is a product of Qualcomm Technologies, Inc. and/or its subsidiaries.

## Staggering UE packet arrivals at gNodeB

Improves scheduling more users

## QoS and delay-aware schedulers

Use Packet Delay Budget (PDB) information to improve UE and flow multiplexing

# Release 18 capacity enhancement proposals

## HARQ enhancements

Improved ACK feedback to optimize retransmissions.

## SPS/CG enhancements

Improvements to DCI signaling efficiencies  
UL skipping with gNB notification

## Network coding

Outer coding between PDCP and RLC layers to improve reliability and reduced latency

# Further improving XR experience with 5G Advanced

Refer to [3GPP contribution1](#), [3GPP contribution2](#), and [TR 38.838](#) for details



# Continued technology evolution on the path to 6G



























Building a stronger, more capable wireless system foundation



Taking 5G to new, more diverse verticals and use cases



AI-enabled end-to-end communication	Expanding into new spectrum bands	Cellular air interface innovations	Precise positioning and RF sensing	Powering the metaverse	Private network innovations	Wide-area IoT evolution	Advanced automotive connectivity
 Introduction	 Introduction	 Introduction	 Introduction	 Introduction	 Introduction	 Introduction	 Introduction
 Demo 1: Advanced ML-based mmWave beam management	 Demo 1: Giga-MIMO for wide-area coverage in 7 to 16 GHz	 Demo 1: Path to full duplex	 Demo 1: Precise positioning everywhere	 Demo 1: Boundless AR with dynamic distributed compute	 Demo 1: Adaptive RAN operation for 5G PN	 Demo 1: 5G IoT coverage extension with device mesh	 Demo 1: Cloud-based VRU safety
 Demo 2: Multi-vendor cross-node ML-based CSF	 Demo 2: Sub-terahertz communication in 100+ GHz	 Demo 2: Green networks with super-QAM	 Demo 2: High-resolution sensing	 Demo 2: 5G API for immersive applications	 Demo 2: Intelligent scheduling for virtualized 5G PN	 Demo 2: Narrowband positioning for 5G IoT	 Demo 2: 5G-based automotive radar sensing

Building a stronger, more capable wireless system foundation

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 Demo 3: Perception-assisted 5G for enhanced XR

 Demo 3: Multi-AP joint transmission for Wi-Fi

# Thank you

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