

On the roads to 5G: theory and practice



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Kiev, 14 May 2018

MWC Huawei 5G

5G Portfolios

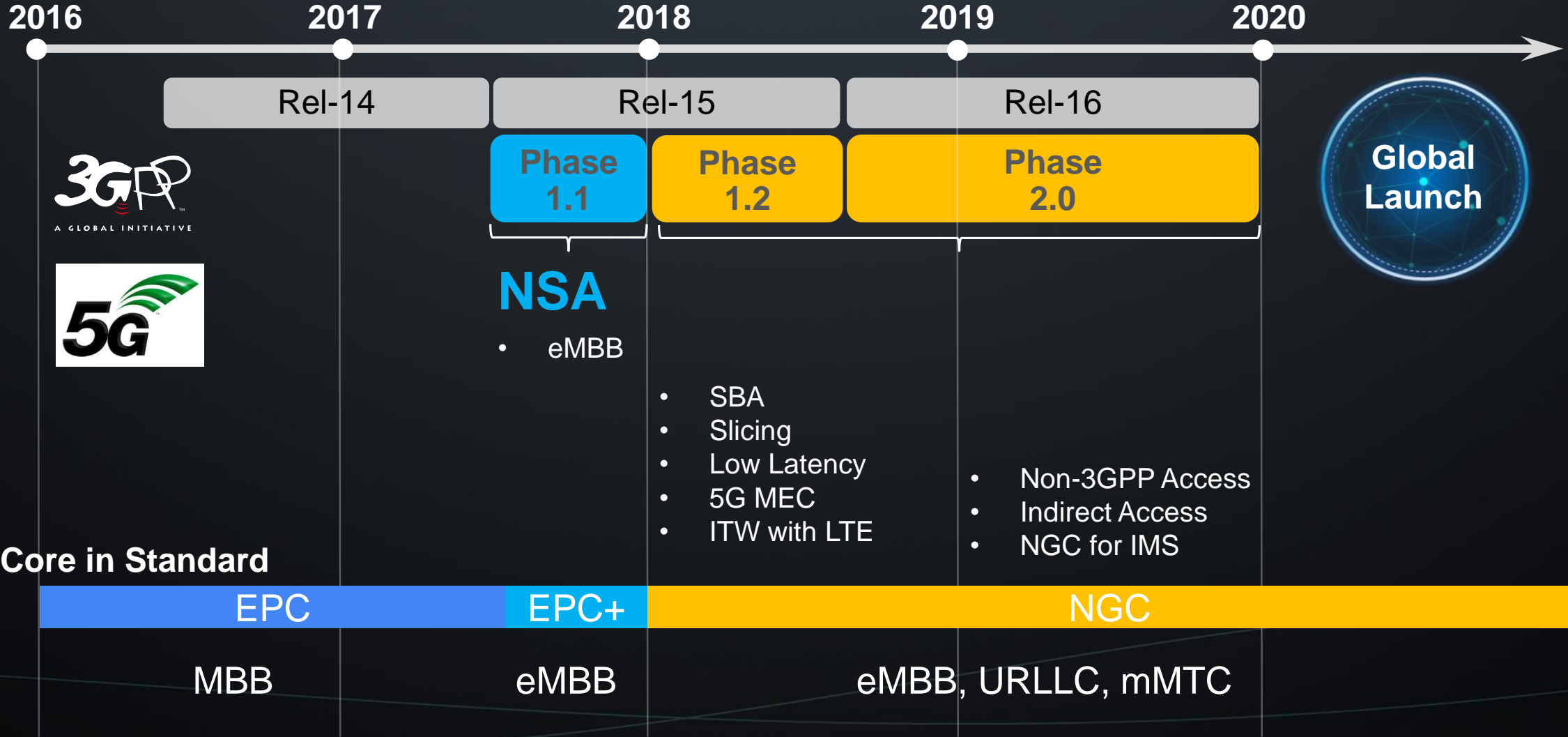
5G is Now



1st 5G CPE

5G Live Network in Korea

3GPP accelerates to match commercial progress



Network Evolution is needed to fulfill **5G requirement**

uRLLC

Ultra-reliable and Low-latency Communications



eMBB

Enhanced Mobile Broadband






mMTC

Massive Machine Type Communications



5G

Low Latency	Throughput	Access Agnostic	High Density	Agile Slice
1 ms Latency	10 Gbps Peak	3GPP RAN, WiFi, Fix ...	1,000K Connections Per km2	Modular Programmable
				

Gap

10x

10X

Full access

100x

Service defined

4G

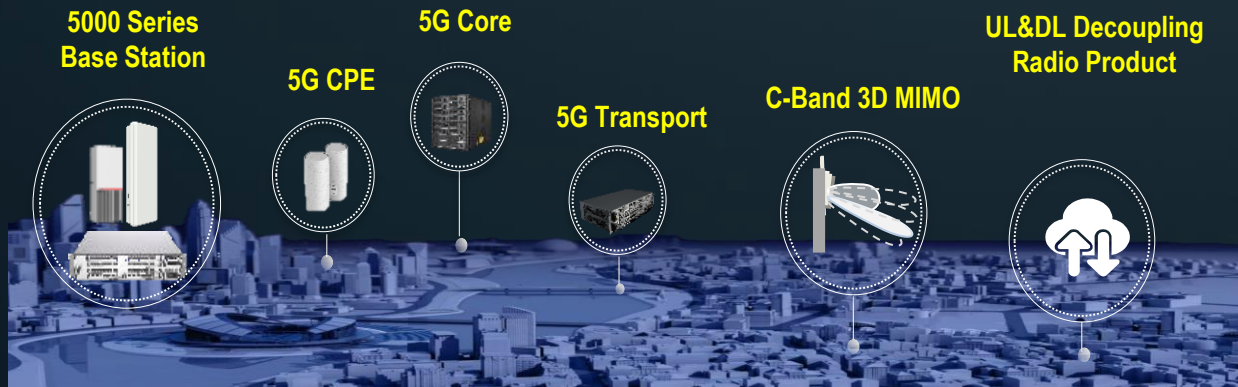
10ms	1Gbps	S1	10K	Silo
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Huawei E2E 5G Solution is Ready Now

R15: A Milestone for Enhanced MBB Experience



Huawei Provides Industry First E2E 5G Solution



Huawei 5G Network Trial in Seoul, Korea

Gbps

Outdoor
Everywhere

100Mbps

Indoor
Ubiquitous

How to Transit to 5G



Primary Band for 5G

C-band With Continuous 100MHz

M-MIMO Deployment

64T/32T for Scenario-oriented Selection

Coverage Improvement

UL/DL Decoupling Enable Co-site & Co-coverage

3D-MIMO Boosts Indoor Coverage

C-band as Primary Band, mmWave as Supplement Band

Global Auction Status and Plan



C-BAND as Primary Band

- Global Harmonization
- 100MHz / Operator
- First priority 3.5Ghz

mmWave as Supplement

- Wide bandwidth available
- 800MHz/Operator
- Large path loss
- FWA (Outdoor CPE) / Hotspot

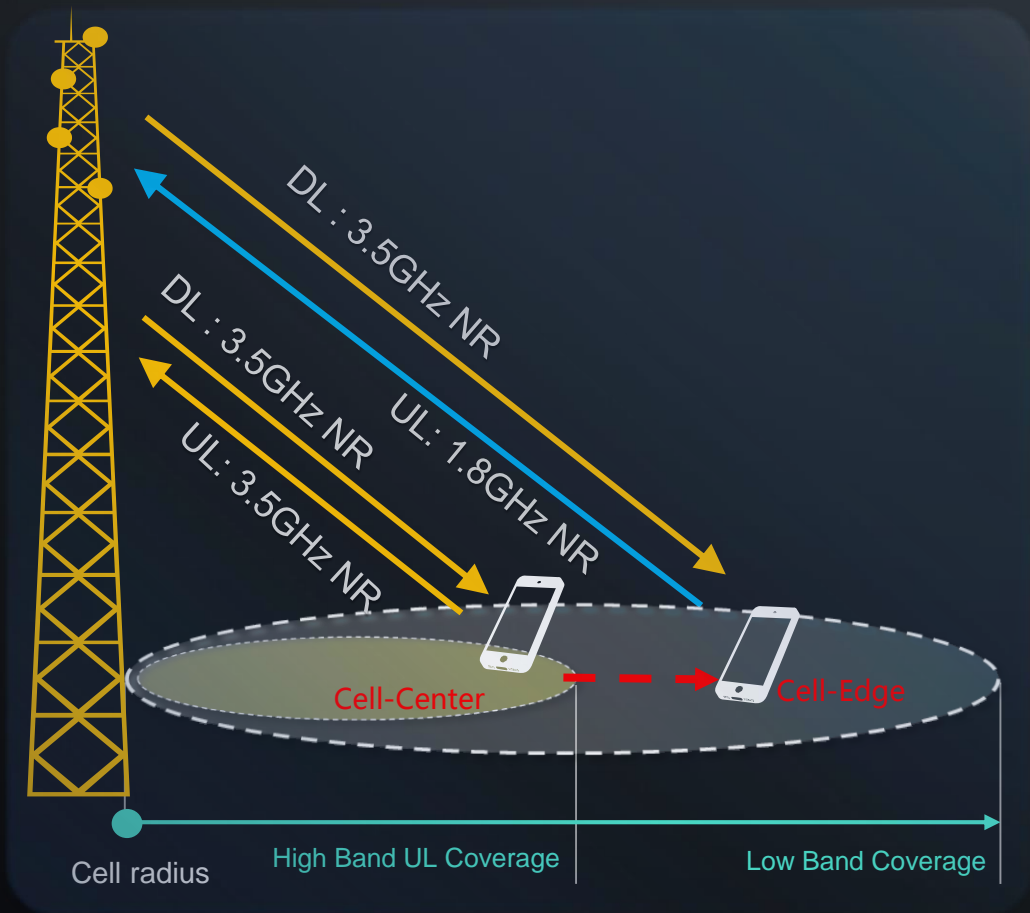
2600MHz as Candidate

- Better coverage than C-band
- Narrow bandwidth (<40Mhz 80% operator)

600/700MHz for wide coverage

- Deep and wide coverage
- Narrow bandwidth (<20Mhz 80% operators)
- URLLC / mMTC

UL/DL Decoupling to Extend the C-band Uplink Coverage



3.5GHz Hotspots coverage without decoupling



○ LTE low band coverage

3.5GHz continuous coverage with decoupling

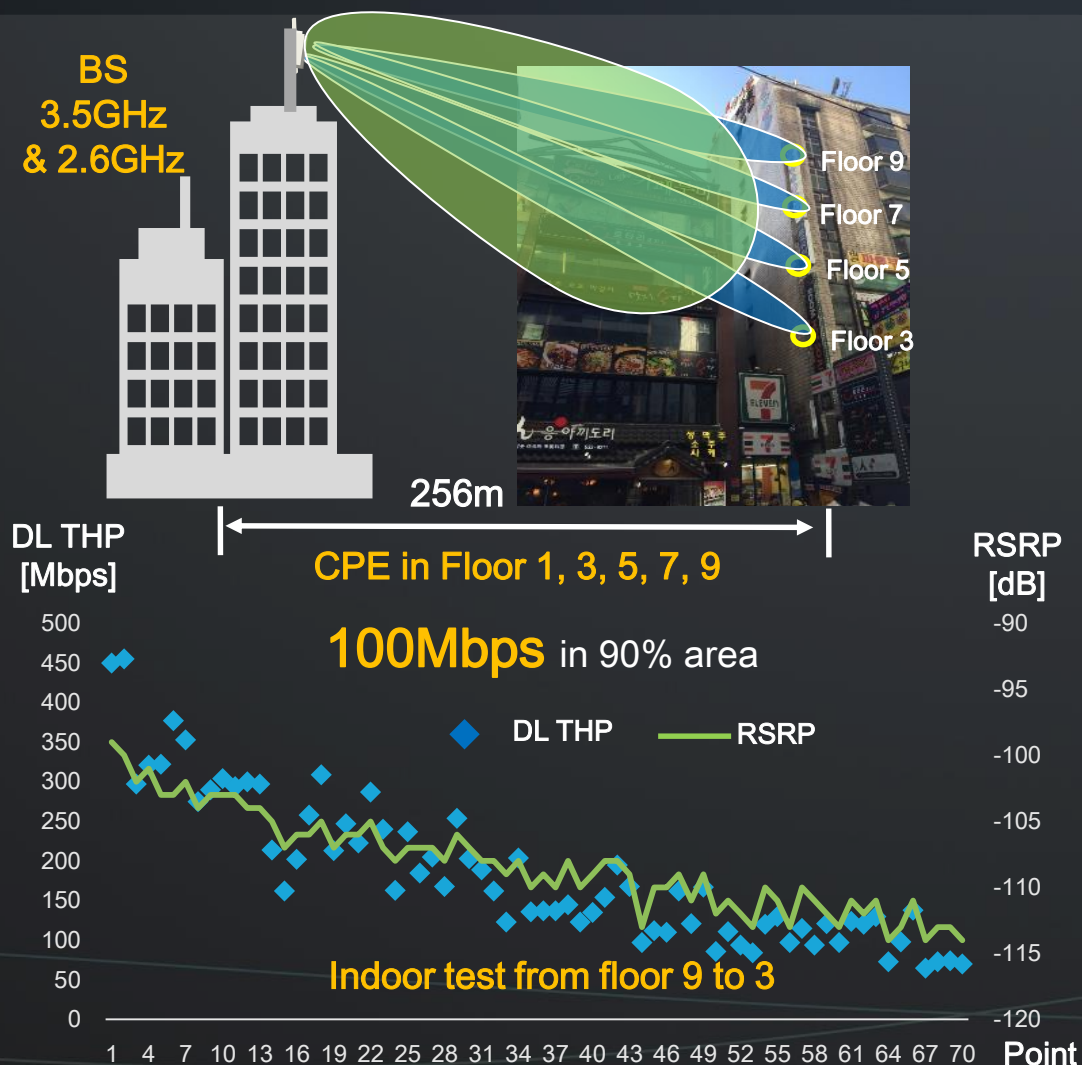


○ 3.5GHz 5G NR coverage

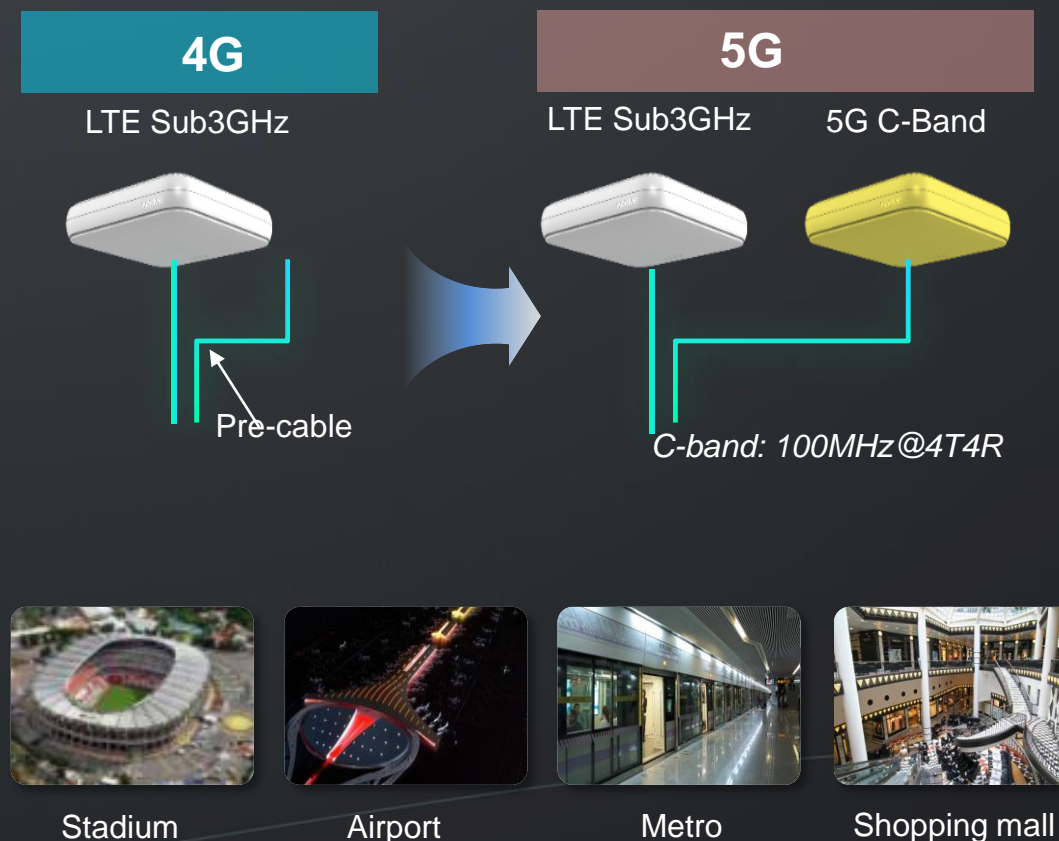
- UL/DL decoupling ensure 5G C-band to co-located and **same coverage with LTE low band**
- Candidate band for decoupling: 700/800/900/1800/2100MHz

3D-MIMO & Lampsite Boost Indoor Coverage and Experience

3D-MIMO Achieve 100Mbps in initial stage



Lampsite for XGbps in big building scenario



5G C-band & mmWave Large Scale Field Trial in Dense Urban Korea

5G Field Trial in Gangnam, Seoul



3.5GHz Site



28GHz Site

C-band & mmWave Performance Trial Scenarios



C-band
Outdoor
Experience

> 1Gbps



C-band
Indoor
Experience

> 100Mbps

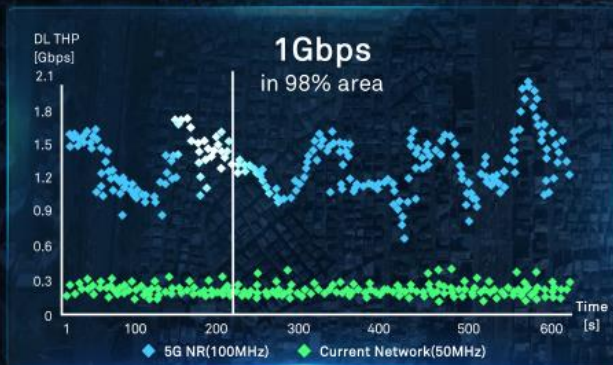


mmWave
Hotspot

> 20Gbps

xGbps Everywhere in 5G Network

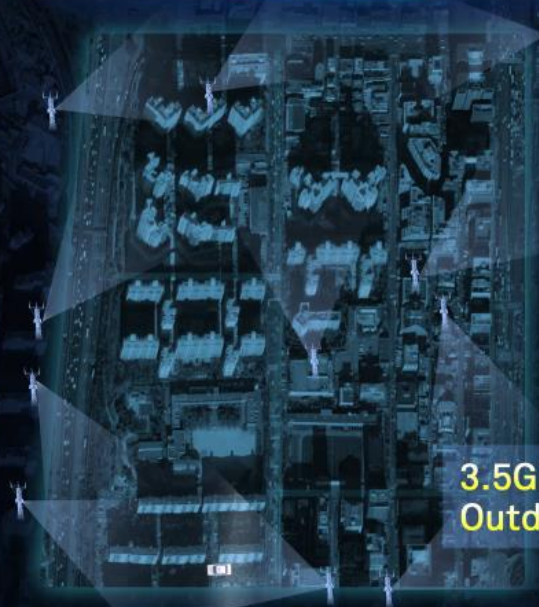
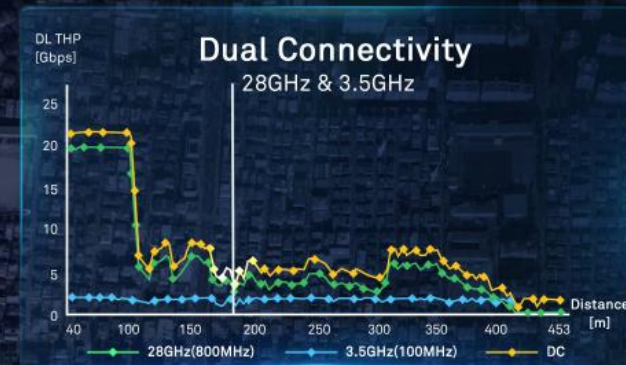
2Gbps Outdoor Experience



450Mbps Indoor Experience



20Gbps Hotspot Experience



3.5GHz Outdoor Test



3.5GHz Indoor Test



28GHz Outdoor Test



How to Transit to 5G



Cloud

**Simplify Architecture
Improve Service Agility**

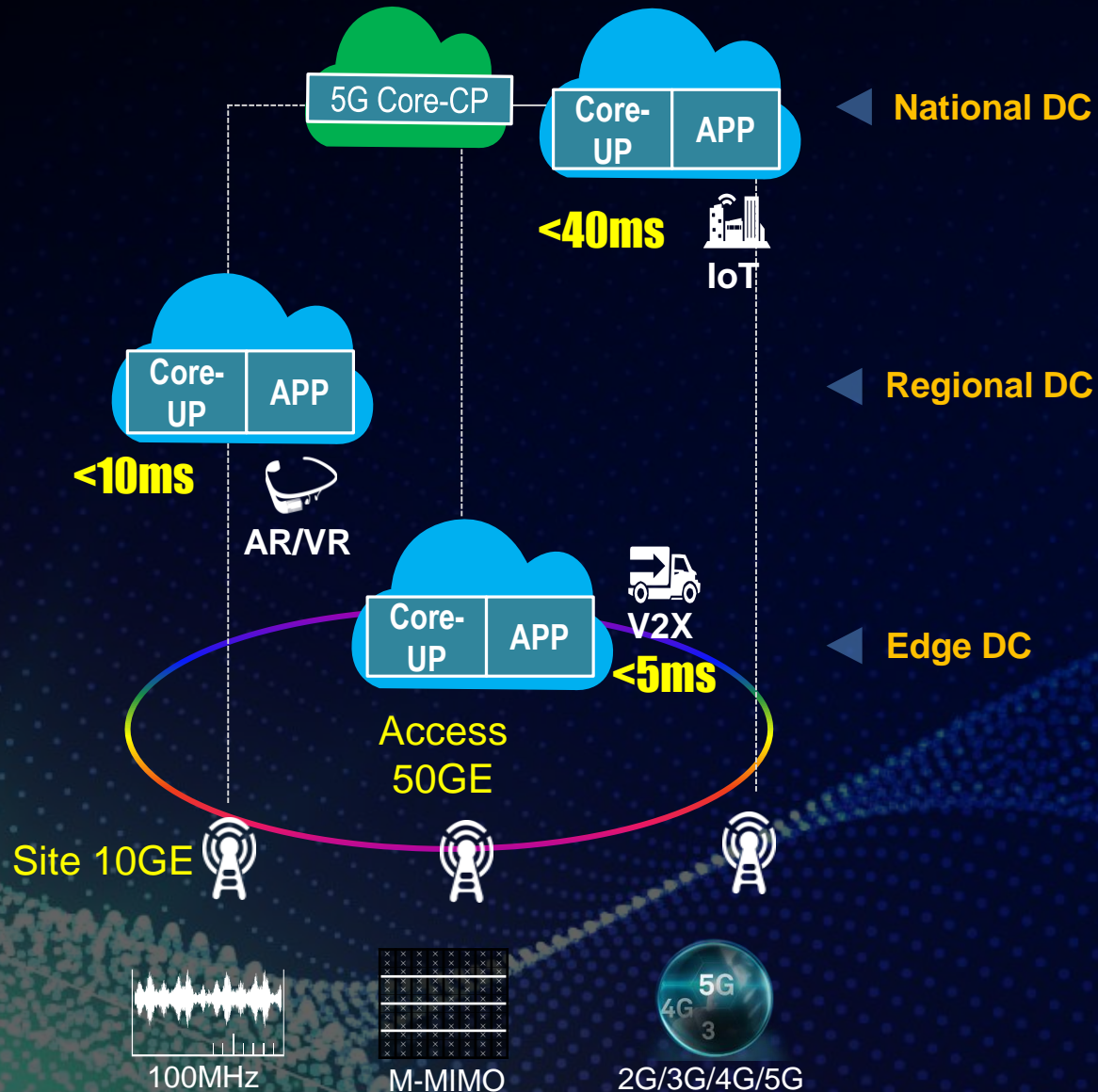
Cloud Core & Transport & RAN

AI

**Improve O&M Efficiency
Significant OPEX Saving**

MIMO Pattern Self-Optimization

To Build Service-oriented 5G Network Architecture



CORE

- ❖ **Cloudification**
Micro-service
- ❖ **Distributed Core**
CUPS

TRANSPORT

- ❖ **10GE to Site, 50GE Access Ring**
- ❖ **L3 to Edge, OTN to Aggregation**

RAN

- ❖ **New Radio add-on**
C Band 100MHz,
UL & DL Decoupling
- ❖ **SingleRAN Pro**
All-in-One Base Station

On-demand CUPS Deployment for Different 5G Services

Better Experience



0.2 vMOS

10~15ms RTT
Reduced

New Business



IoT / V2X

Dedicated GW for
new business

5G Evolution



A GLOBAL INITIATIVE

CUPS Deployment for 5G NSA

5G Ready CUPS Architecture



WiFi



Mobile

Access

Edge DC
(MEC/RGW)



Auto-Pilot
1~10ms RTT

Backhaul

Local DC
(RGW)



Video/VR/AR
<20ms RTT

Backbone

Regional DC
(RGW)



Smart Metering
<100ms RTT

EPC-CP/UP
(GW-C)

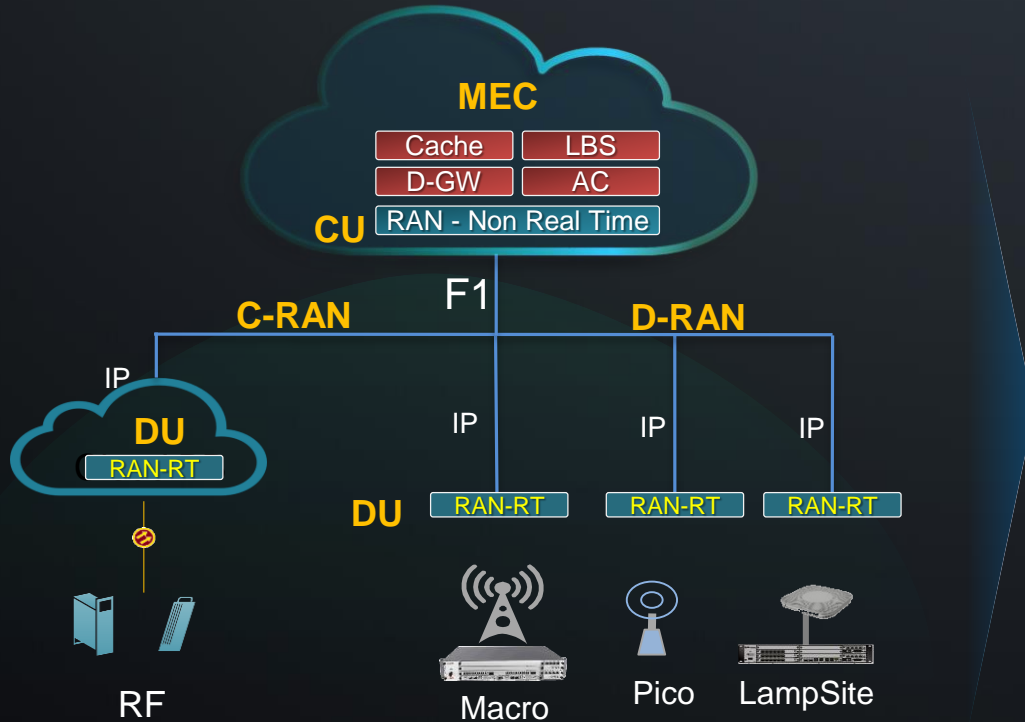
36% RTT
Signaling

Test result in China Mobile

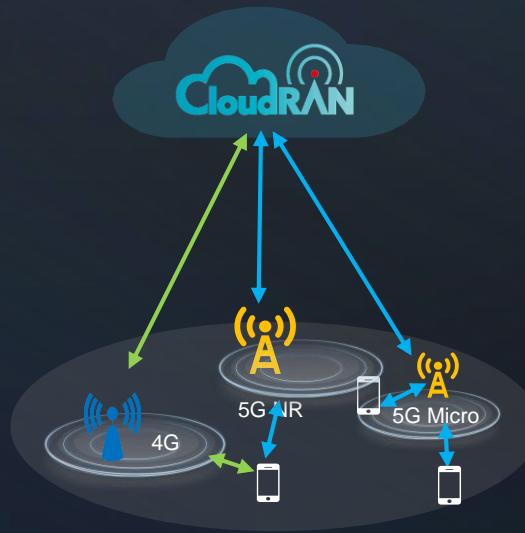
* CUPS: Control and User Plane Split

* RTT: Round Trip Time

5G-oriented Unified RAN Architecture: CloudRAN



CloudRAN enable Multi-Layer/
Multi-RAT Convergence



💰 Capex Saving

↓ (10%~15%)

Transmission investment

🕒 Experience Upgrading

↓ (5~10ms)

UP latency



① Network convergence
enabling better user experience



② On-demand deployment
adapting to diverse services & scenarios



③ Openness & Efficiency
promoting agile service delivery



④ Intelligence
assisting agile operation

Wireless AI Enables Massive MIMO Pattern Self-Optimization

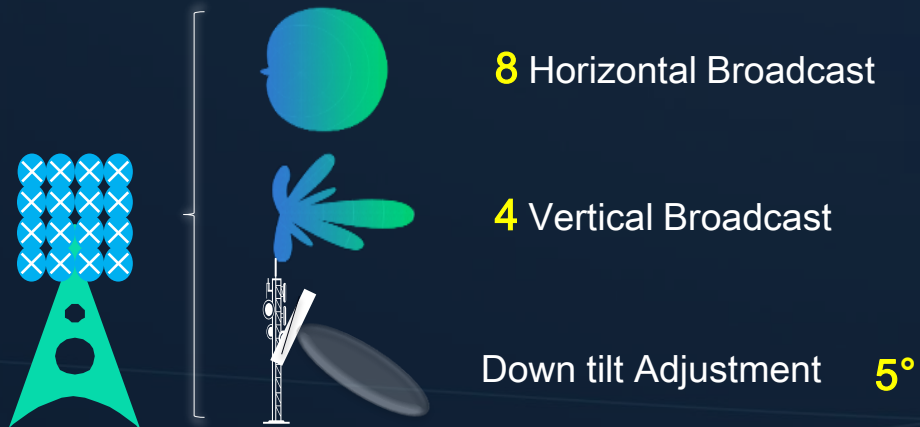
MM Solution Bring thousands times of complexity to O&M Team

Traditional **2/3/4G Site**: Down tilt adjustment only, total **13** sets

Vs

5G MM Site: **10000+** beam pattern sets

Total **17** patterns, for each pattern:



Wireless AI to Boost Fast Optimization



Reinforcement Learning for Dynamic Pattern

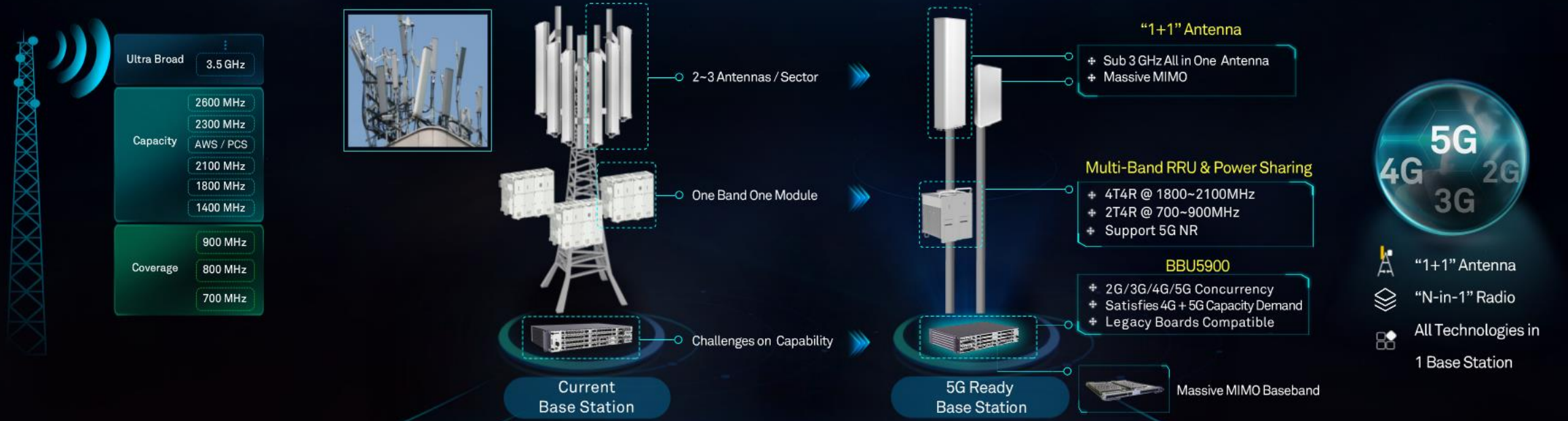


Network Performance Improvement



Reduce Network Optimization Period

SingleRAN Pro: 5G Era Fundamental Network

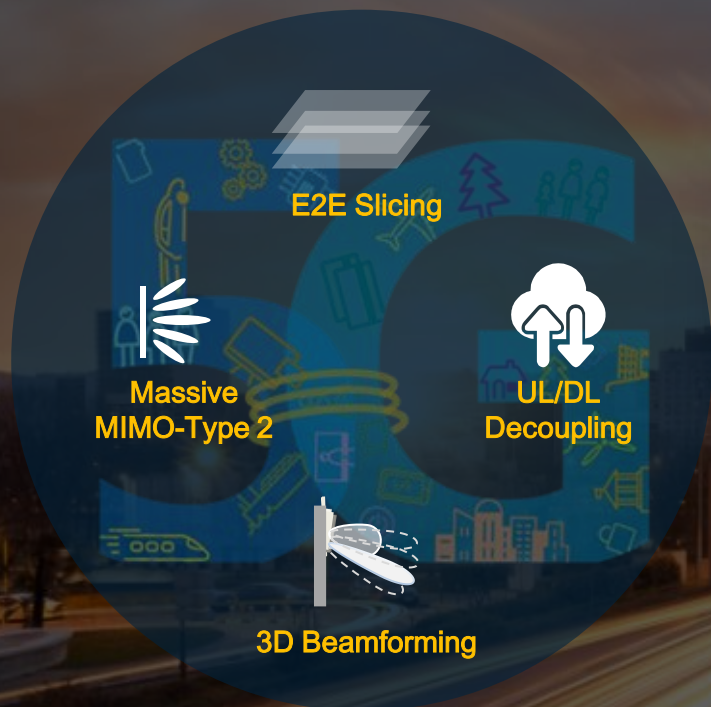


All Businesses Connected: Redefining the Fundamental Network

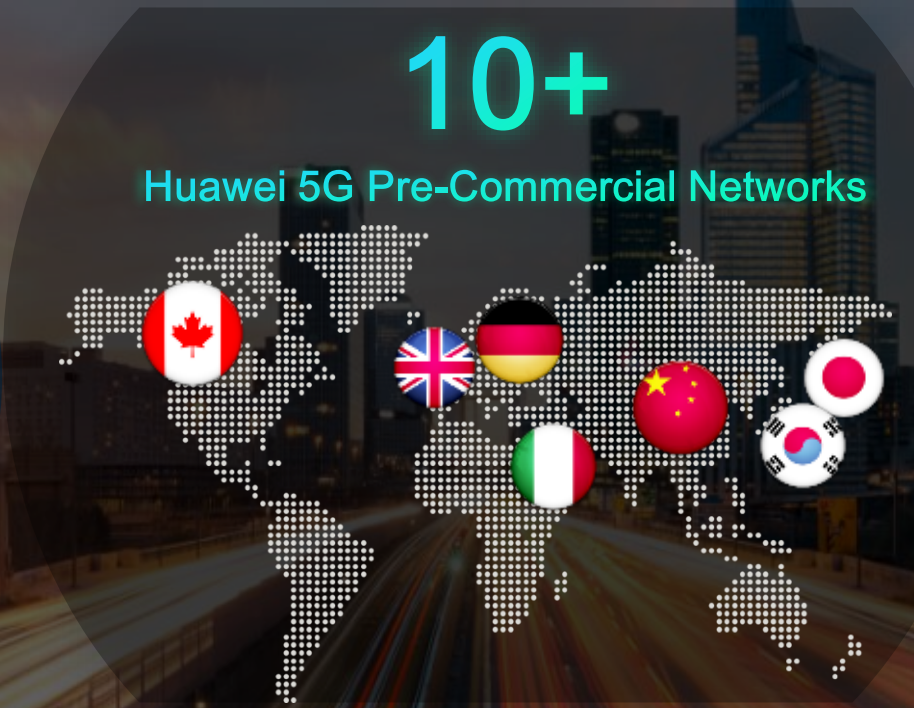


Huawei Leads the 5G Industry Development

Pioneering 5G NR Standardization



Launching 5G Products With 10 Years' Persistence Investment



Mature M-MIMO



Smallest C-Band M-MIMO AAU



Best Power (-65dBm) Widest BW (1GHz) mmWave Radio



UL DL Decoupling for Extended 5G Coverage



Building Ecosystem & Exploring 5G Services



Thank You.

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