



HUAWEI

Make 5G a Reality

30th May 2018

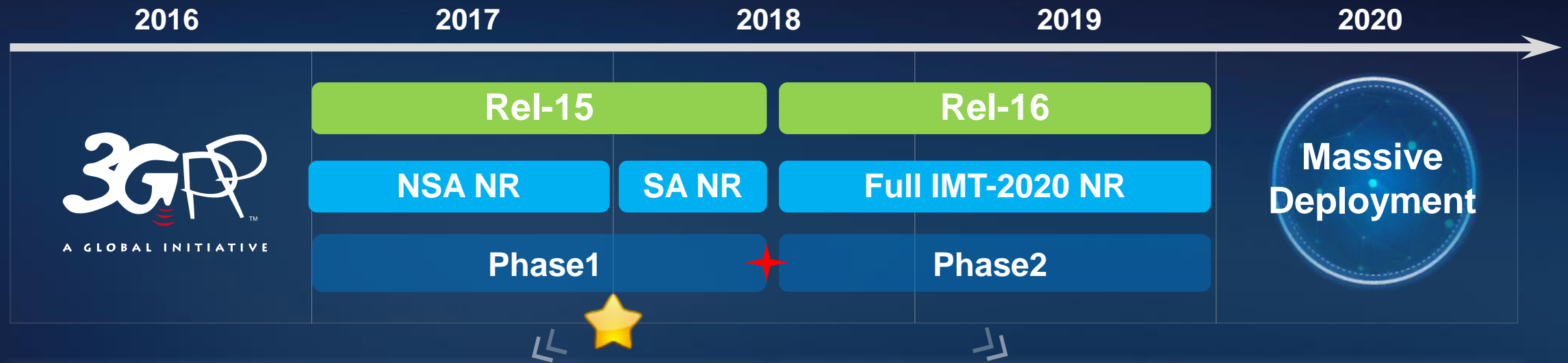
5G Industry Update

- Industry Progress
- Use Cases



Protocol:

R15 Establishes 5G Foundation, R16 for Full IMT-2020 Scenarios



R15: Satisfy eMBB Universal Demands

NR Framework

- Waveform & Channel Coding
- Frame Structure, Numerology
- Native MIMO
- Flexible Duplex

Others: uRLLC

Architecture

- UL&DL Decoupling
- CU-DU Split
- NSA / SA

R16: Focus on IoT Diversified Requirements

NR Improvement

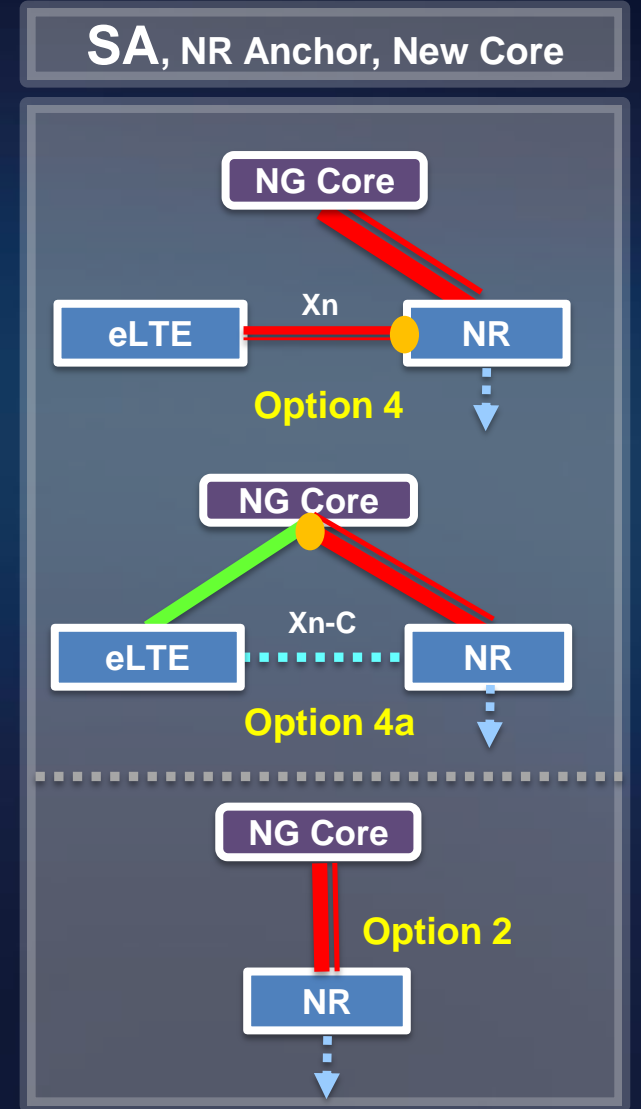
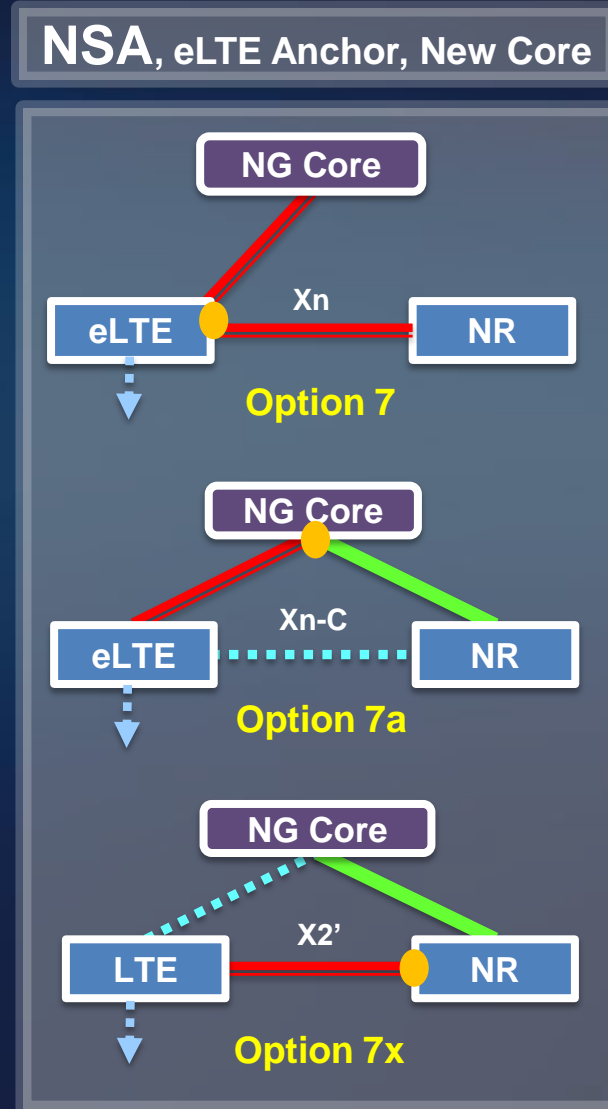
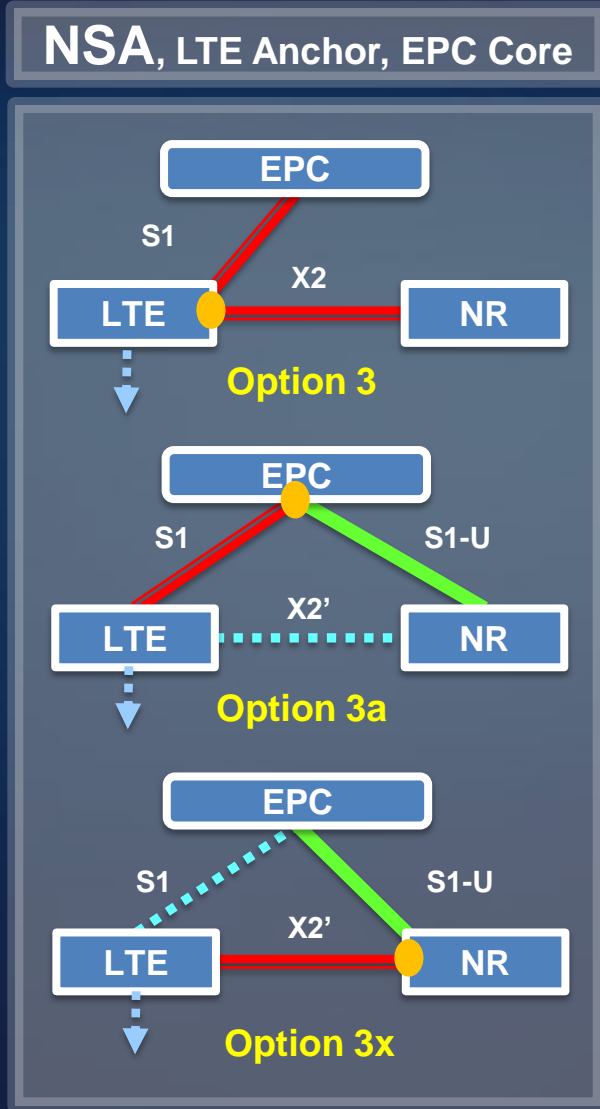
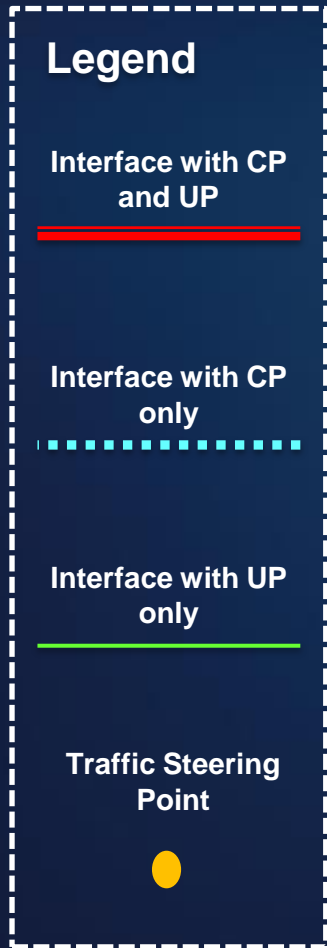
- New Multiple Access
- eMBB Sub6G Enhancement
- Self-Backhaul

Vertical Digitalization

- uRLLC Enhancement
- mMTC
- D2D
- V2X
- Unlicensed

★ NSA Architecture Option7 and option 4 may delay to end of Y2018

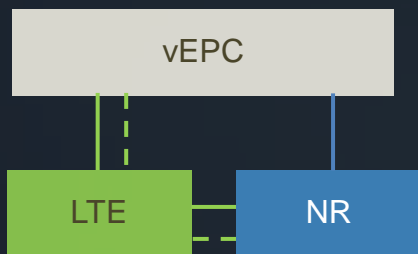
Architectures Evolution Path to 5G Coming Clear



NSA For Early Fast Deployment, SA is Strategy Target

NSA for Early Deployment

Option 3x



- eMBB, FWA
- LTE as anchor, vEPC, fast NR introduction
- Voice : VoLTE or CSFB

NSA for Migration Phase

Option 7x



- eMBB, FWA
- New Core(Integrating anchor in EPC), minimum impact to current LTE
- Voice : VoLTE or CSFB

SA for Final Target

Option 2



- eMBB/uRLLC/mMTC
- E2E Network Slicing
- New Core(Integrating anchor in EPC), minimum impact to current LTE
- Voice : VoNR

Deploy NSA, migrate to SA



Deploy SA (Most likely)



Ecosystem: Commercialization of 5G Device is in 2019

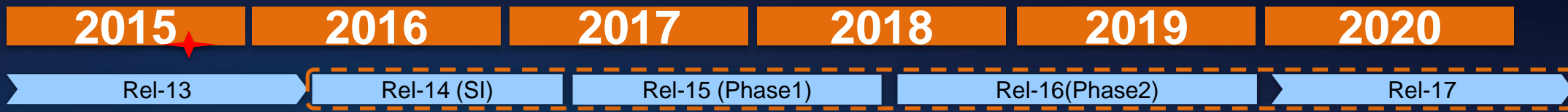


5G Marketing Progress

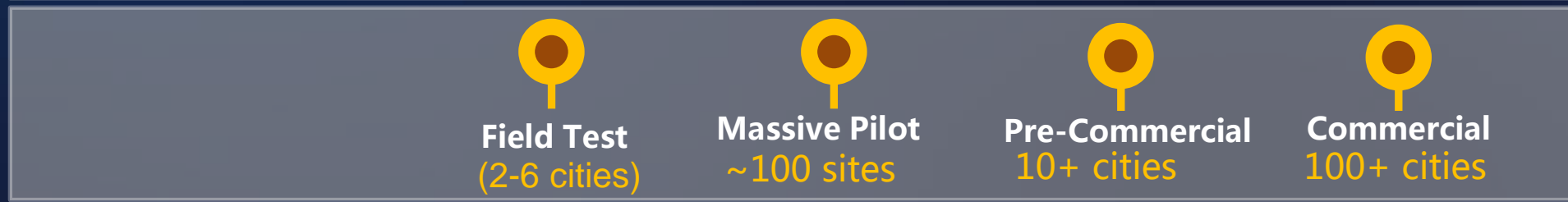
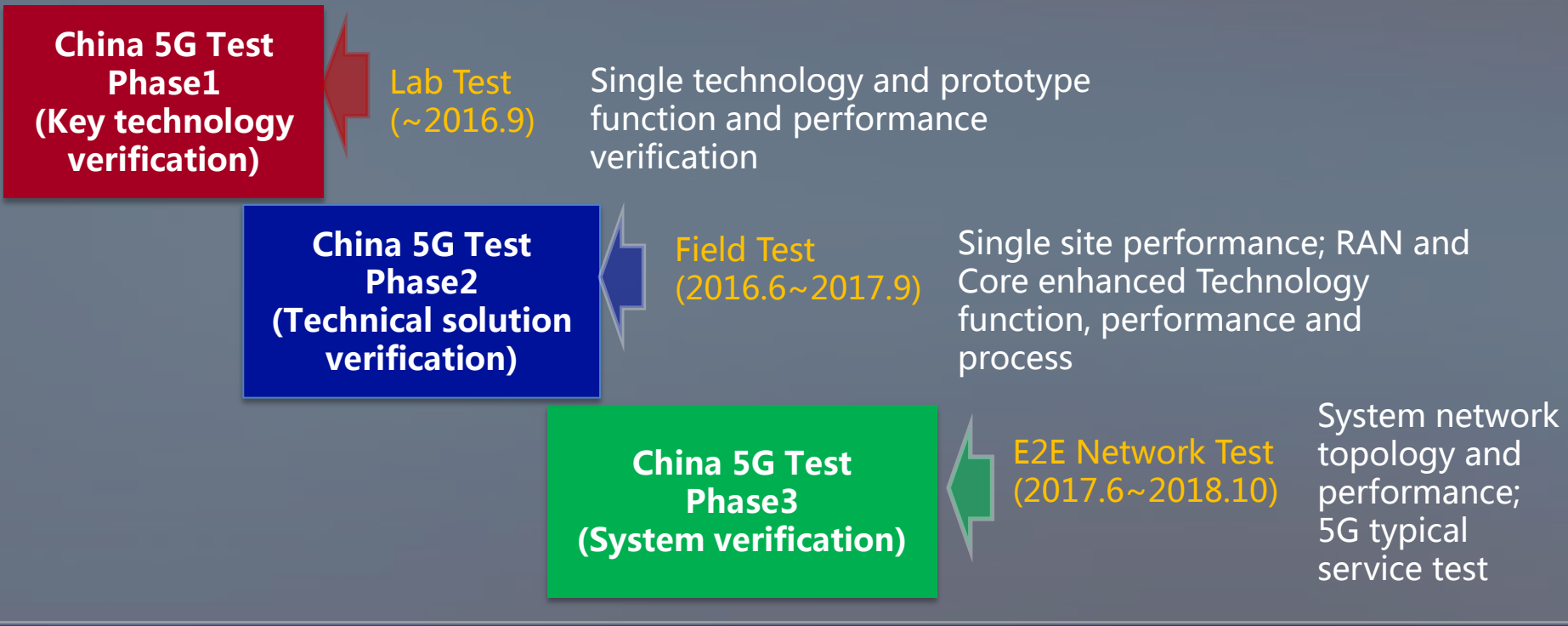


5G Global Commercial Launch will Start from 2020

China 5G Plan is on Going, 5G Commercial Plan is Accelerated



IMT-2020



5G is Accelerated in Japan & Korea Market

2016 2017 2018 2019 2020



▲ 2016.H1 Release 5G while paper
 ▲ 2017.H1 Announce use case POC plan
 ▲ 2018.H2 5G Spectrum Deliver
 ▲ 2020

DCM

5G Key Tech. Research & Verification
 System Trial with Use case & Scenario
 Confirm 5G Vendor, Pre-Commercial LF+HF

Commercial Launch



SBM

5G Low latency & Coverage Verification & FT
 5G V2X@ E2E Slicing 5G NR Perf. Verification@MM
 LF+HF Pre-Commercialization



KDDI

5G Demo Cloud RAN/Slicing Design
 HF+LF Competition FT 5G Use cases
 LF+HF Pre-Commercialization



▲ 2017.H2 Global 5G Event
 ▲ Pre-Commercial
 ▲ 2018.Q3 5G Spectrum Deliver
 ▲ Commercial Launch

KT

HF Verification & E2E Design
 PyeongChang 5G HF wide Deployment
 HF+LF 5G Commercialization eMBB + V2X



Invest >100M, 7 Cities/2High Way



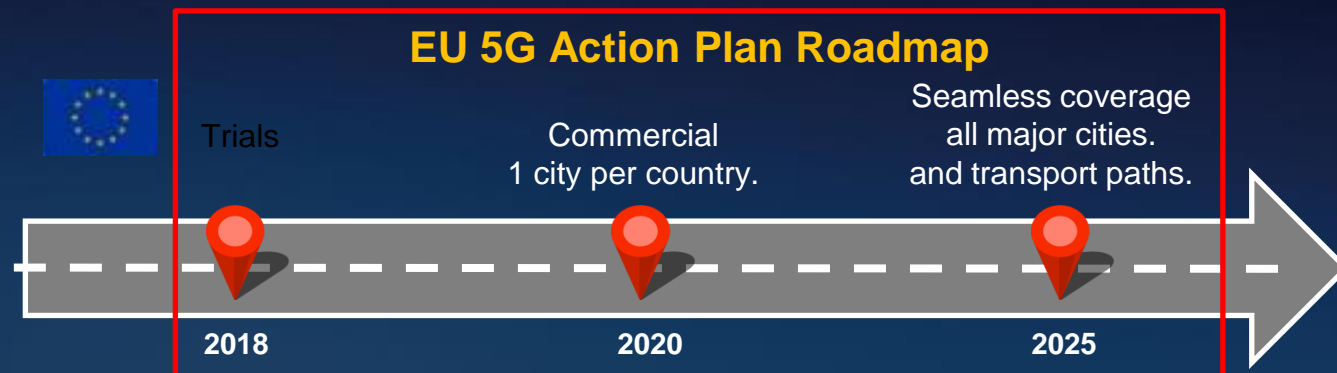
SKT

HF Field Trial
 RFI/RFP Pre-commercial Demo
 HF+LF 5G Commercialization E2E Slicing + eMBB+ Connected Car

LGU+





HF Performance Verification
 HF+LF Use case Experience Center
 HF+LF 5G Commercialization IPTV over WTTx + eMBB

EU Release 5G Action Plan To Accelerate 5G Commercial



Operator	RFI	RFP	Pre-Commercial	Commercial
Orange	2017.03 , Done.	RFP for trial : 2018Q1 RFP for commercial;: 2019Q1	2018	2020
TI	2017.05 , Done.	No plan yet.	No plan yet.	2020
Vodafone	2017.04 , Italy Done. 2017.06. Group level.	No plan yet.	2019	2020
DT	2017.07	RFQ: 2018	2019	2020
BT/EE	2017.10 (TBD)	No plan yet.	2019H1	2020
Telefonica	2017Q4	No plan yet.	2019	2020

5G Status in U.S. Market, mmWave is the First Wave

	2016	2017	2018	2019	2020
 <p>39G (200-700MHz) 28G (550-850MHz)</p>		11 cities trial, 20~30 sites/city	Massive volume trial, up to 2k sites	Massive commercial deployment, 100k site till 2023	
 <p>39G (700MHz) 28G (400MHz)</p>		2 cities trial, 10 sites/city	Large scale trial, up to 200 sites	Massive commercial deployment, 100k site till 2023	
 <p>2.5G (160MHz)</p>				Large scale trial in 2 cities, 100 sites / city	Commercial deployment
 <p>600M (30MHz)</p>				Large scale trial in 2 cities, 100 sites / city	Commercial deployment

3GPP-Based 5G Pre-Commercial Network in Leading Cities

10+

3GPP-Based 5G Pre-Commercial Network



Toronto, Canada



London, UK



Berlin, Germany



Tokyo, Japan



Dubai, UAE



Seoul, Korea



Milan, Italy



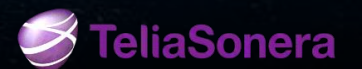
Shanghai, China



Beijing, China ...

30+

Leading Operators



Huawei Leads IMT-2020 5G Trial



Most Complete E2E System



Most Comprehensive Spectrum



Highest Cell Throughput



Lowest Latency



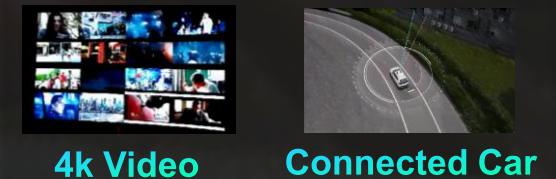
Massive Connections



Most Comprehensive Interoperability Test



Live Use Cases to verify NR capability



5G Industry Update

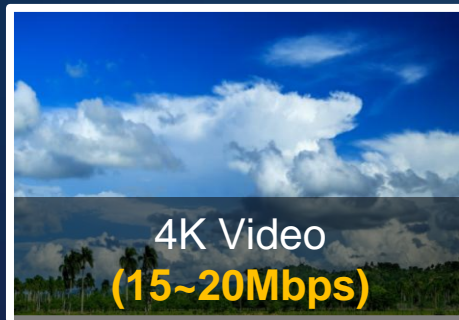
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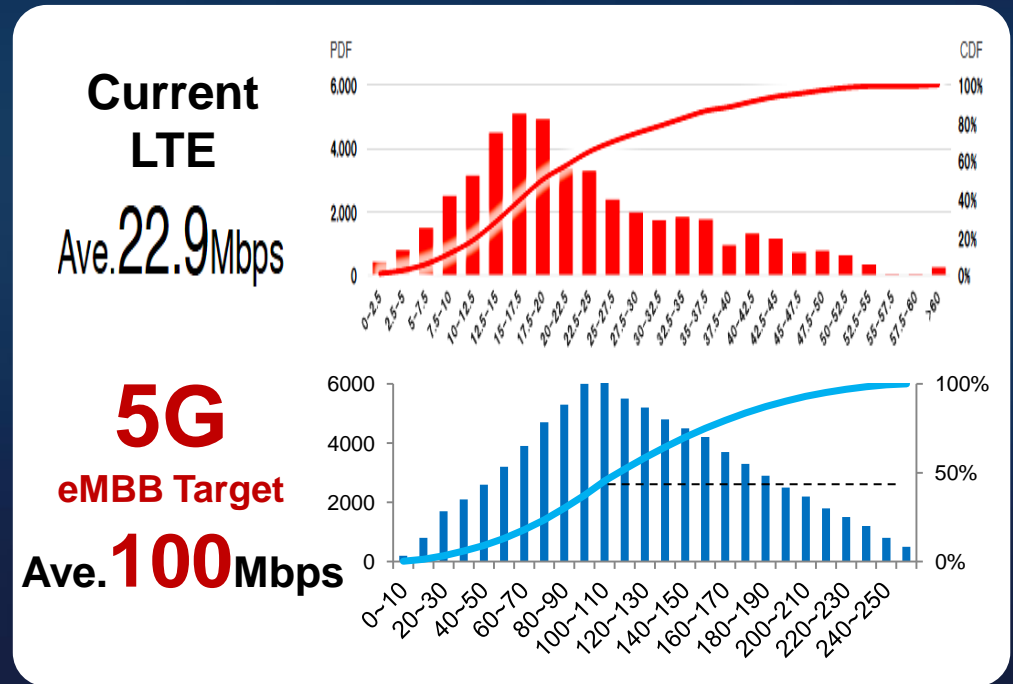


Use Case #1: 100Mbps Everywhere is Benchmark to Deliver Better MBB Experience

100Mbps Satisfy Most Applications

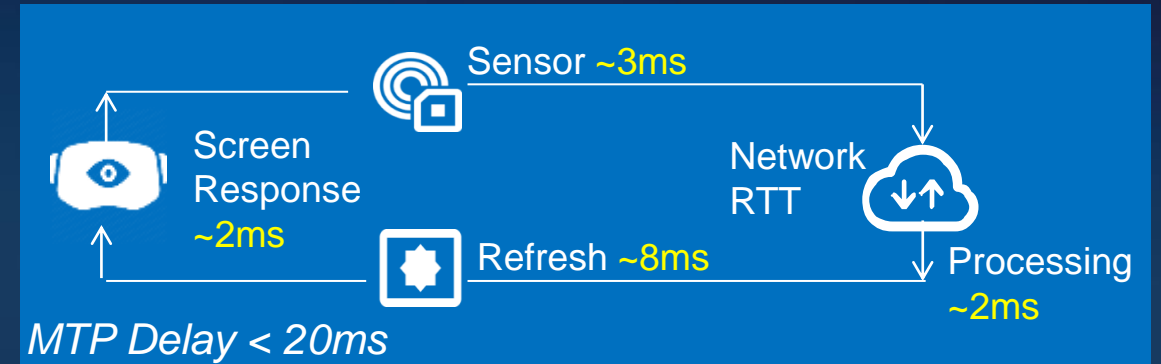


5G Target: Ave. Speed 100Mbps



Source: Huawei Wireless X Labs

Use Case #2: Cloud Based AR/VR with High Requirements on Network



Acceptable
Experience

125Mbps

RTT Latency

Ultra Retina
Experience

3.2Gbps

< 5ms

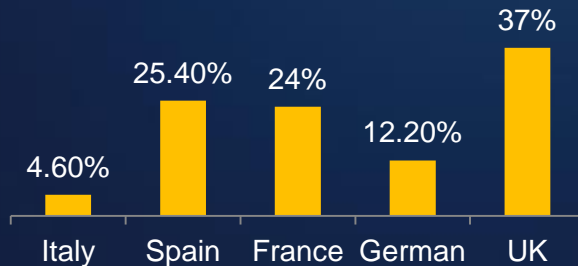
Use Case #3: Fixed Wireless Access for Home Broadband

Target & Existing Gap



Target: By 2020 **50%**
Households > **100Mbps**

Households > 30Mbps(%)



Target: By 2020 **100M**
Households > **100Mbps**

Households > 100Mbps(million)



5G Home Access

X Gbps Throughput

Fast TTM & ROI

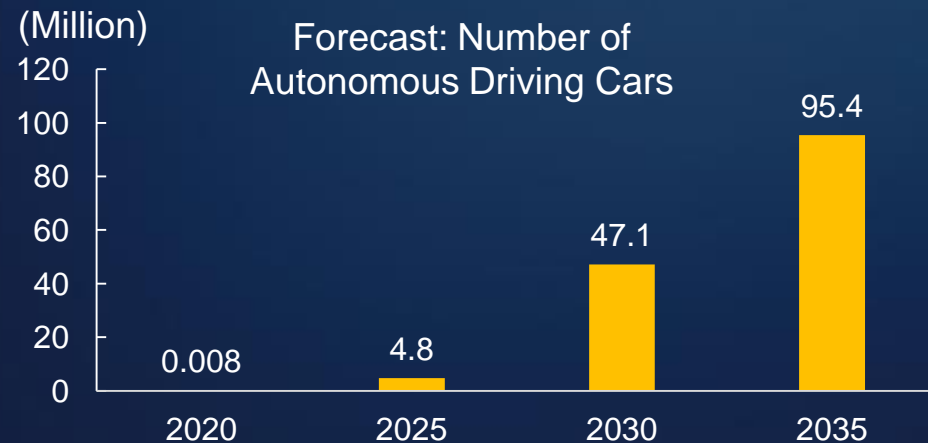
Major use case for 5G
early deployment

Source: Broadband Europe Strategy 2015/ FCC 2016

Use Case #4: Connected Car is Strategic Focus by Leading Countries

2020 Opens Autonomous Driving Era

Policy is Making for Connected Cars



Source: NAVIGANT RESEARCH, Autonomous Vehicles

Connected Car Benefits Whole World



Save
1.2M
people
annually

Save
3.1bn
gallon oil
annually

Source:
Global Status Report on Road Safety,
World Health Organization, 2015

Source:
Texas Transportation Institute Urban
Mobility Report, 2015

Autonomous Driving Will Commercialize in 5G Era

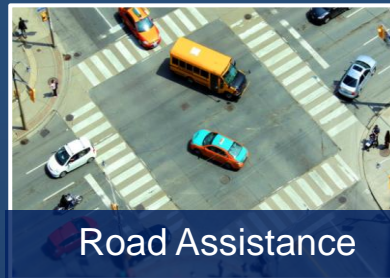
Stage 4 **Full Automation**
2020~



...

5G

Stage 3 **Partial Automation**
2015~



LTE-V

Stage 2 **Telematics**
2000~

infotainment, on-line navigation, remote diagnostics, e-call communications...

2G/3G/4G

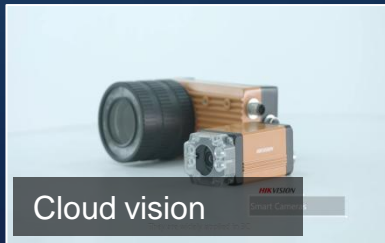
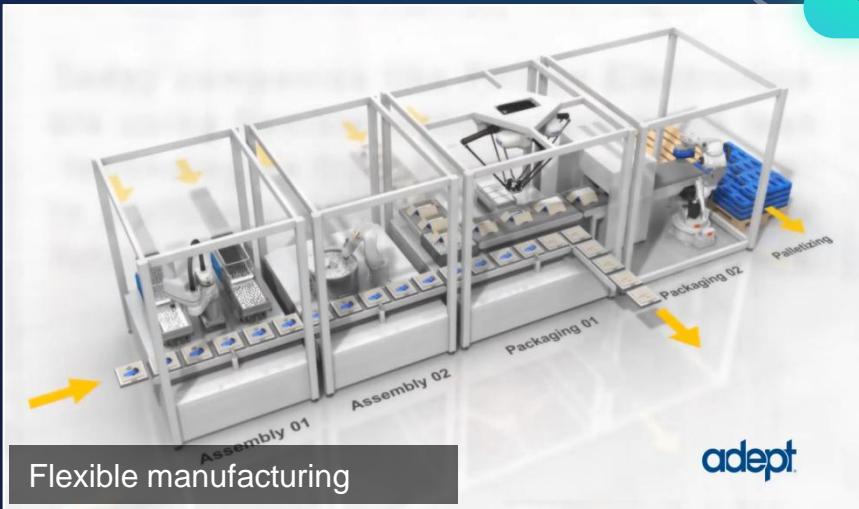
Stage 1 **Roadside Communication**
1990~

Wired / Wireless for RSU

Use Case #5: 5G will Make Factories Smarter and More Efficient

Cellular see a CAGR of
in industry IoT, 2022-2026 | **464%**

Factory Cloud



+200%
productivity

-30%
reduced energy

+30%
longer product life
source: ABI

**Mobile
beyond Giga**

**Real Time
World**

**All-online
Everywhere**

20Gbps

<4ms

1mn /km²

Connected devices Automation to Autonomous Product digitalization
Process digitalization Cyber physical systems

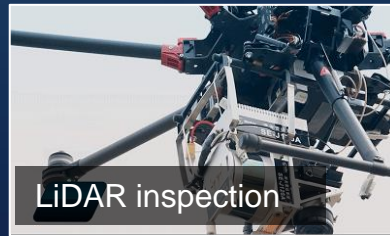
Mobility +
Cloud

Use Case #6: Drones in a wireless connected world

Connected drones' impacted market in 2020 **\$254bn**

Drone Cloud

- Cloud based application
- Cellular positioning
- Flight management
- Drone call center



1st digital low airspace hub
Lingang, Shanghai

Low altitude airspace coverage
10 – 300 meter

Connected drones' application

Flight safety & data monetize
Drone marketplace

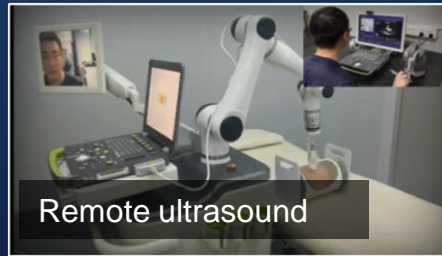
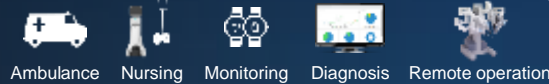
- mining
- Security
- Agriculture
- Telecom
- Insurance
- Transport
- Infrastructure

Digital +
Low airspace coverage

Use Case #7: AI assisted eHealth in a wireless connected world

by 2025
Smart healthcare
to eclipse **\$230bn**

eHealth Cloud



AI
assisted medical
image process
23mbps 10ms

Remote diagnosis via video 4K 20mbps	VR for medical training Cloud VR 100mbps	Ambulance assist <30ms
Remote monitoring Massive IoT	Remote surgery >20mbps <10ms	By 2025 300mn health device connected

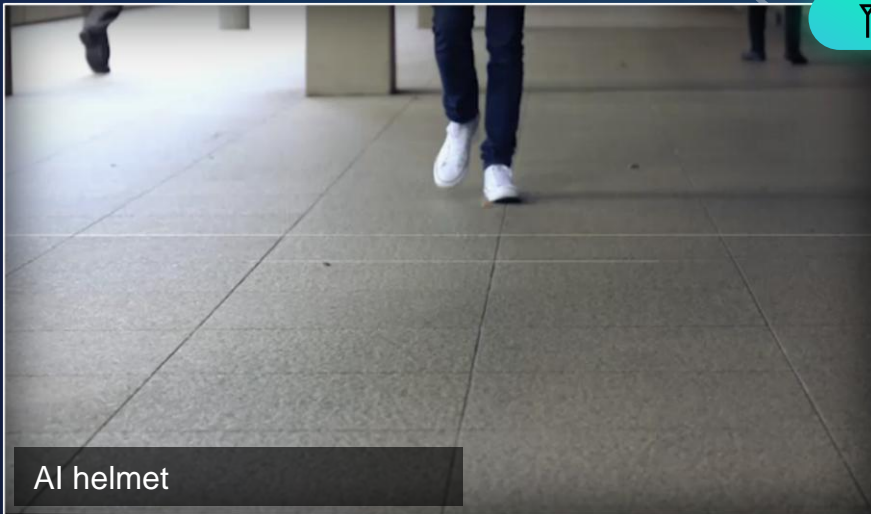
Mobility +
eHealth Everywhere

Use Case #8: Cloud intelligence in a wireless connected world

by 2025
AI related service
market size **\$36.8bn**

AI in Cloud

- Navigation
- Voice AI
- Motion Feedback
- Object Recognition



Human neural
network delay

100 ms



Network latency
requirement

< 20 ms



AI process time is expected to
decrease from 180 ms to

80 ms



Mobility +
Cloud AI

Thank you

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