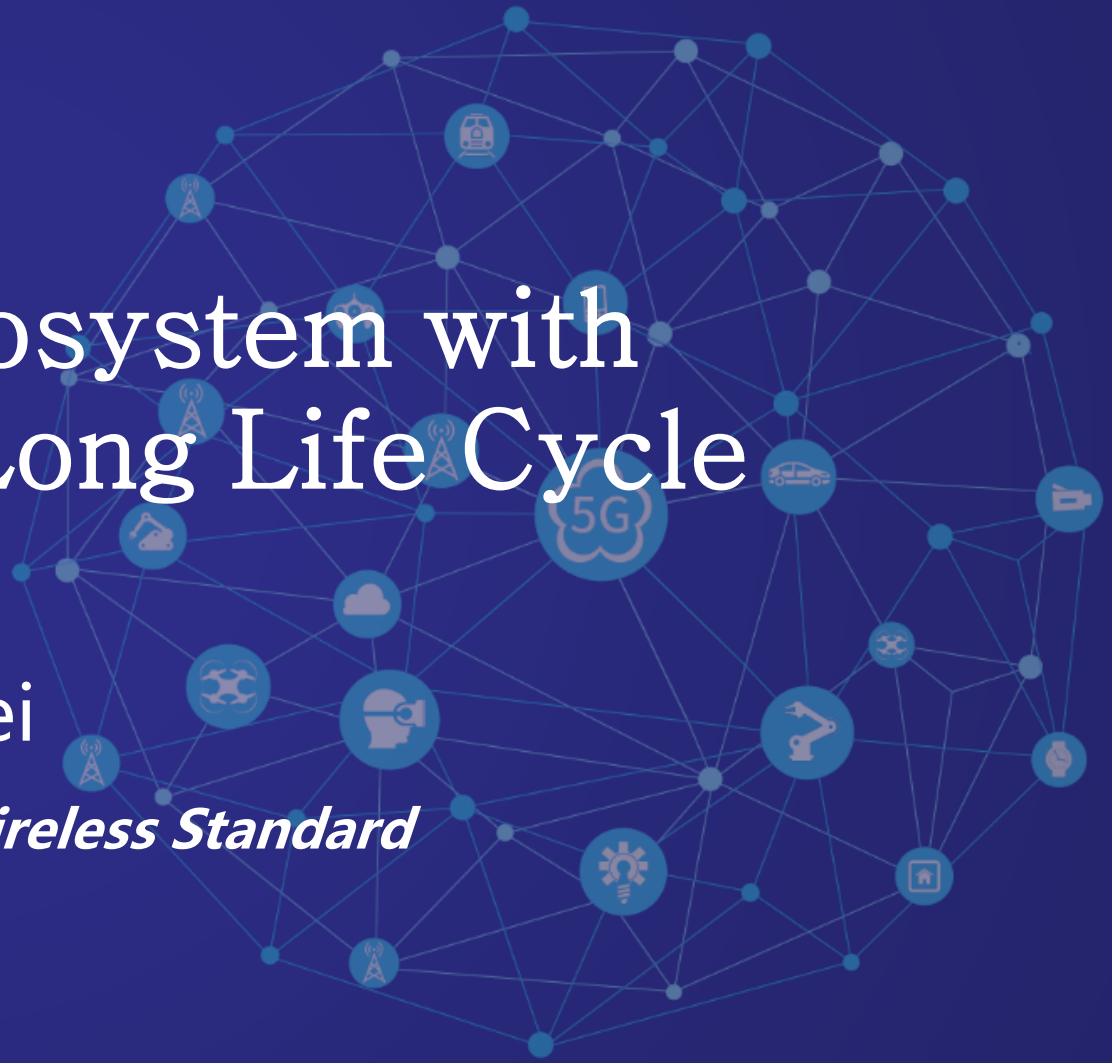
IMT-2020

Toward a 5G Ecosystem with More Vitality and Long Life Cycle



Wan Lei

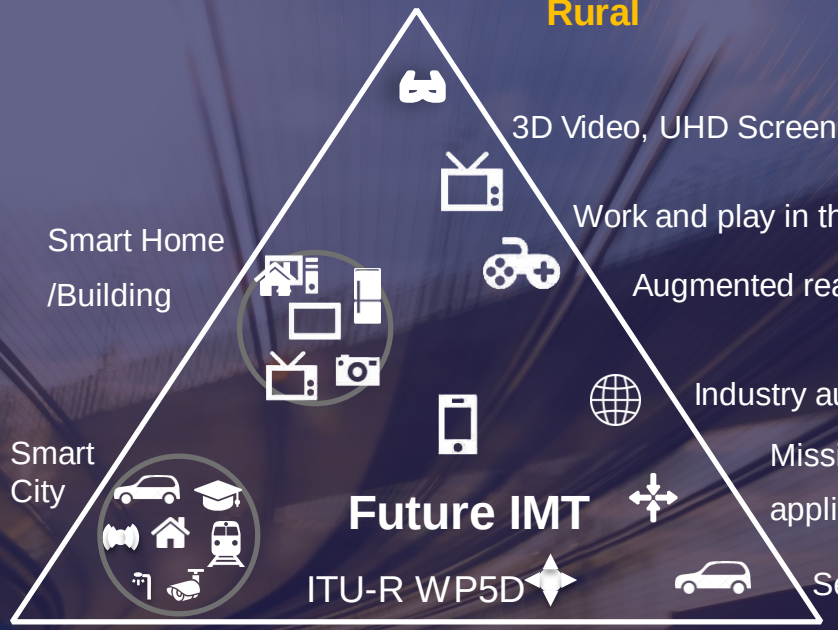
Director of HUAWEI Wireless Standard

5G Use Case Scenario, to Full Connected World

ITU-R IMT2020 Evaluation

5 Scenarios w. 13 Metrics

- Peak rate/SE
- Cell avg./edge SE
- User perceived rate
- Regional load density
- User-plane latency
- Control-plane latency
- Mobility
- Mobility HO latency
- Network/terminal EE
- Connection density
- Reliability



AR/VR

Smart Access

Smart Drive

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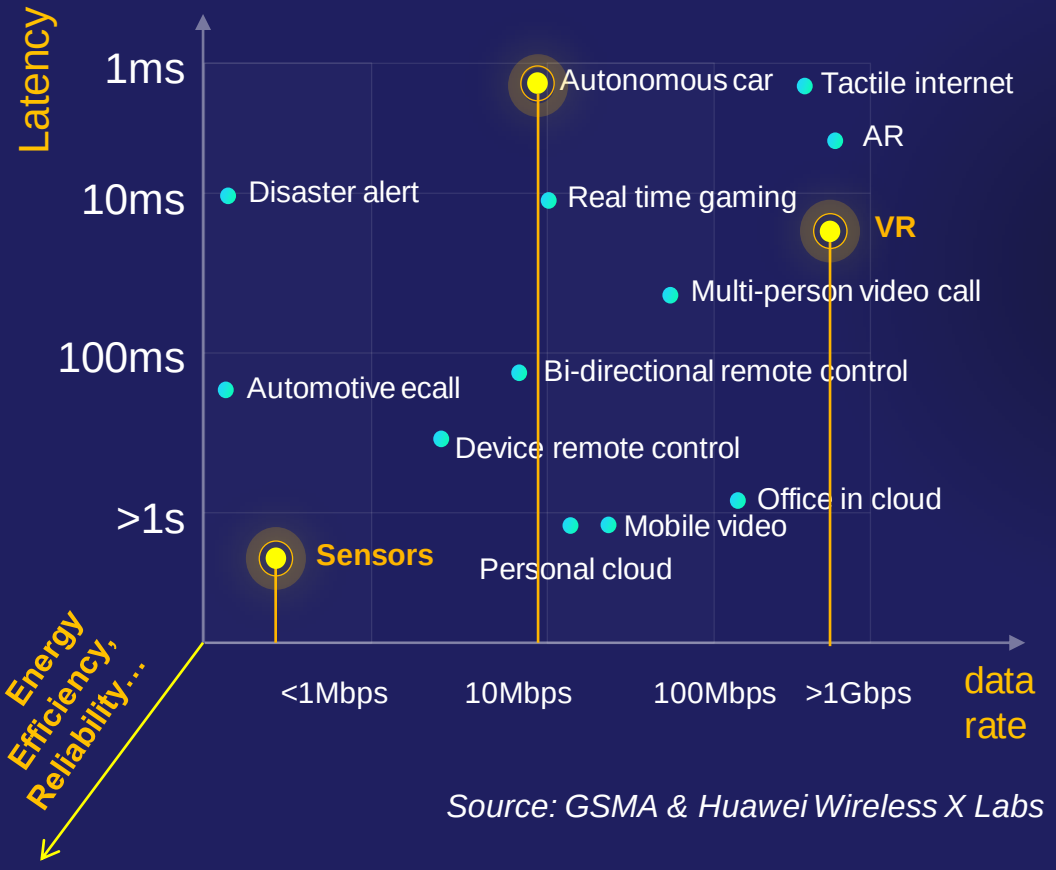
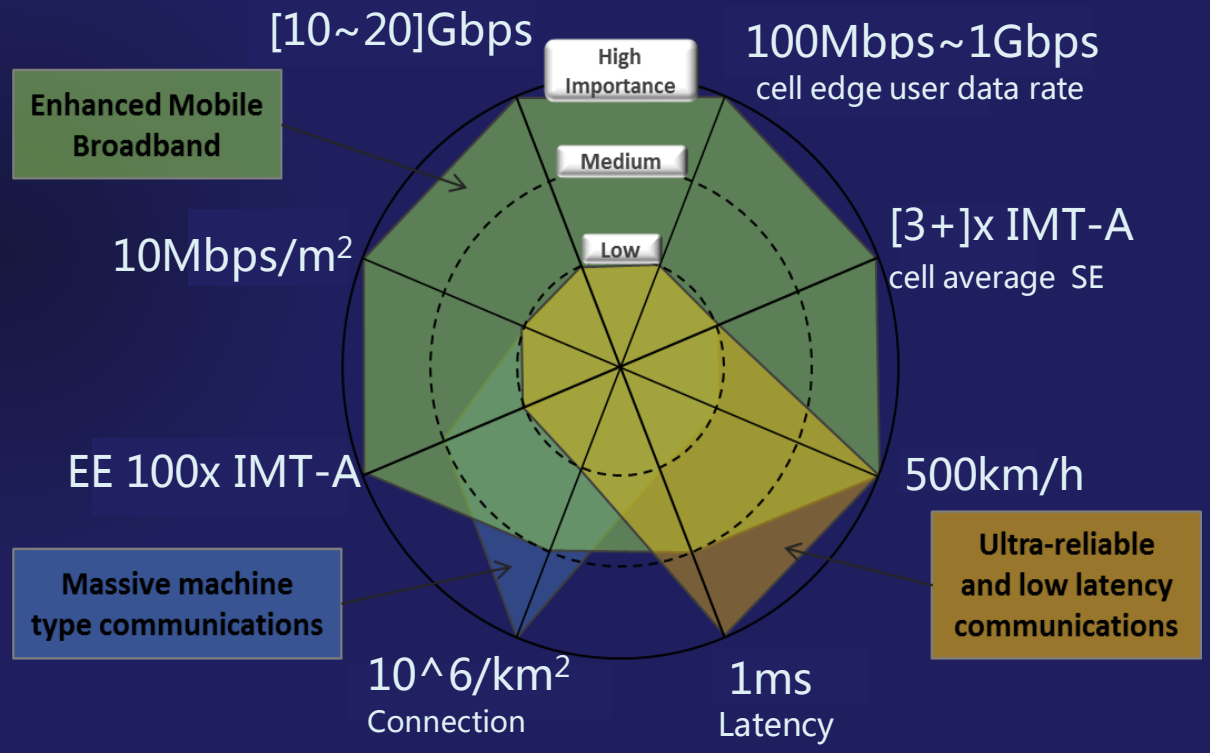
Challenges of Services & Network Requirements

Challenges of Service Experience



Source: GSMA & Huawei Wireless X Labs

Challenges of Network Requirements

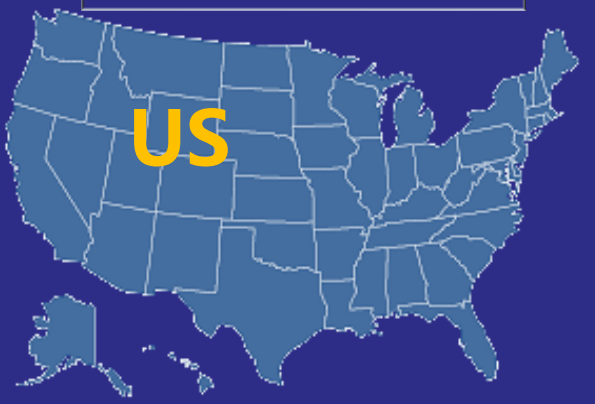


Global 5G Trial Spectrum Plan

- Product R&D Trial : 2018
- 3.4-3.6GHz
- eMBB, NB-IOT, Internet of vehicles
- Standalone

- 2019 Pre commercial
- <6GHz, C-Band
- eMBB、IoT
- Non-Standalone

- 2020 commercial
- <6GHz, C-Band
- eMBB
- Non-Standalone



- 2017
- 28GHz，39GHz
- WTTX
- Standalone

- 2018 Winter Olympic，2020 commercial
- 28GHz, [C-Band]
- eMBB、Internet of vehicles
- Standalone → Non-Standalone?


5G Ecosystem
Spectrum
Global Harmonization
Standard
Unification
Technology
Enabler

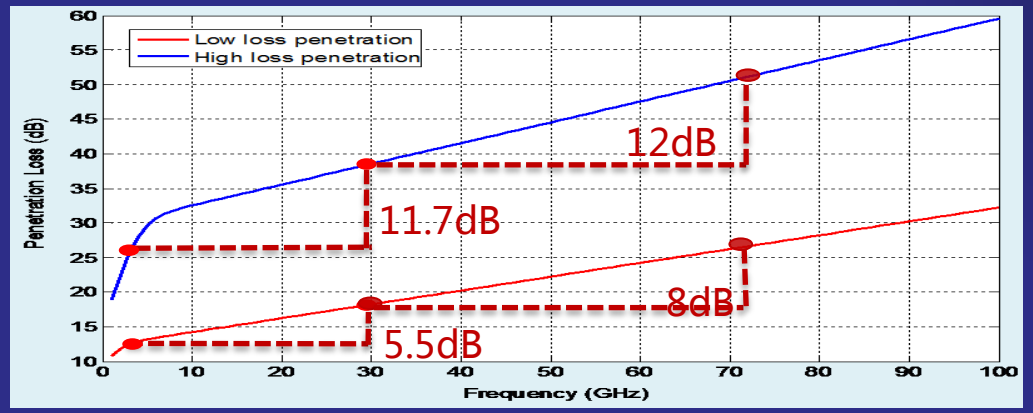
Higher Frequency: G30/G40 as complementary

Coverage

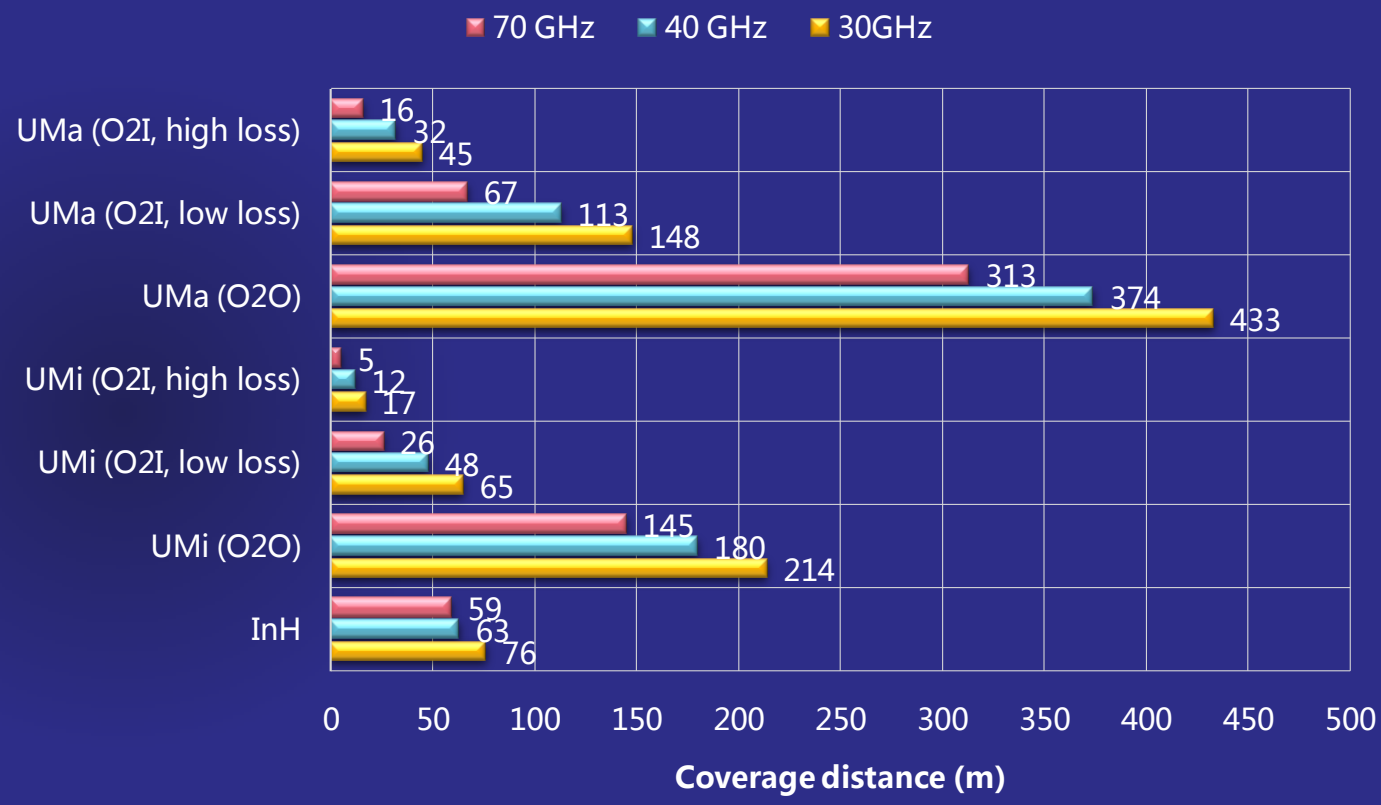
Coverage hole ratio	Low O2I penetration loss			High O2I penetration loss		
	30GHz	40GHz	70GHz	30GHz	40GHz	70GHz
Umi	9 %	18 %	65 %	55 %	70%	80 %
Uma	15%	24 %	66 %	60 %	70 %	81 %

Key assumption: For Group30/40/70, bandwidth is 1/1/2 GHz, BS antenna configuration is (M,N,P) = (8/8/32,16,2), 32ports, MS antenna element number is 32, 80%/20% indoor/outdoor user ratio, 3D indoor user distribution according to TR 36.873.

Penetration Loss

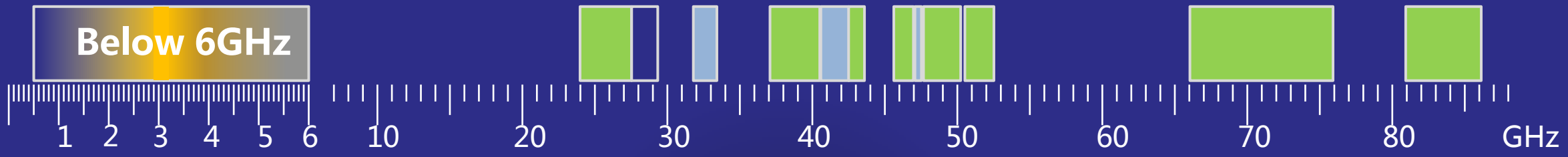


DL link-budget for 1Gbps

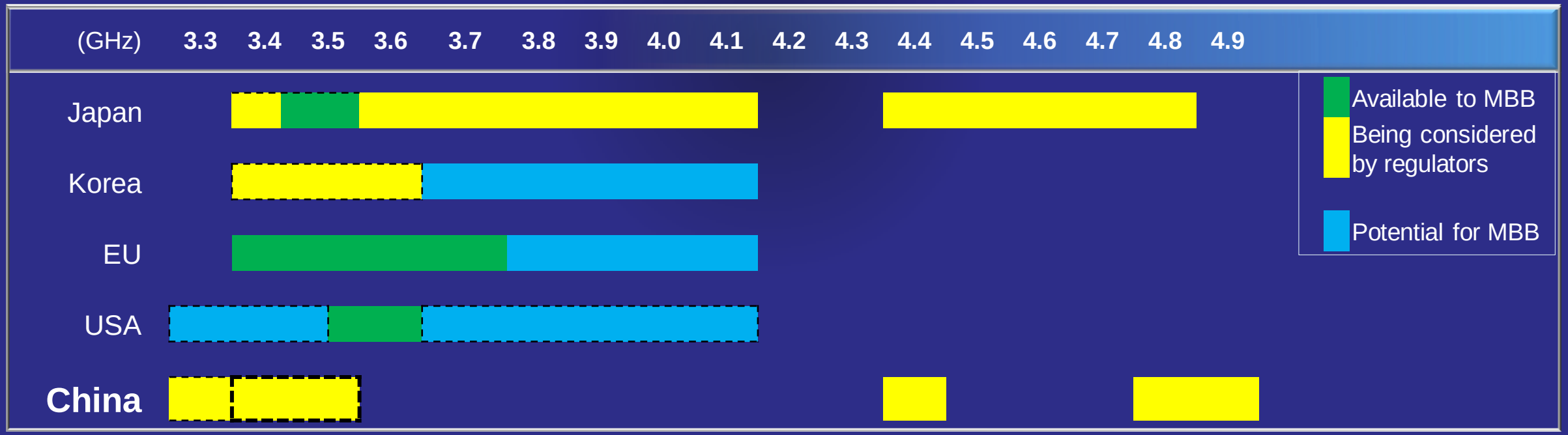


- **G30/G40 Bands: for hotspot O2O & indoor deployment**
- **30GHz over 3.5GHz: 12dB Extra penetration loss**

Sub 6GHz: the core 5G Spectrum

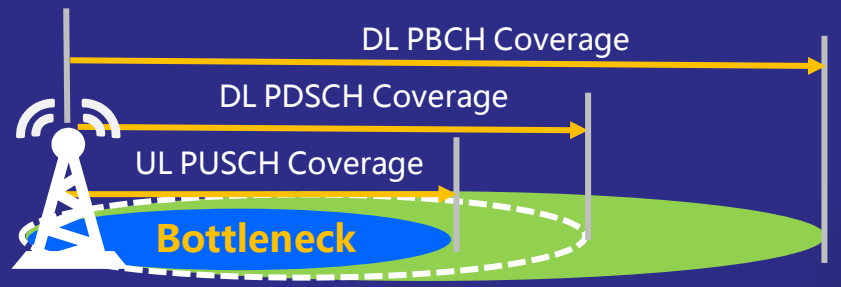


C-band: Global Harmonization

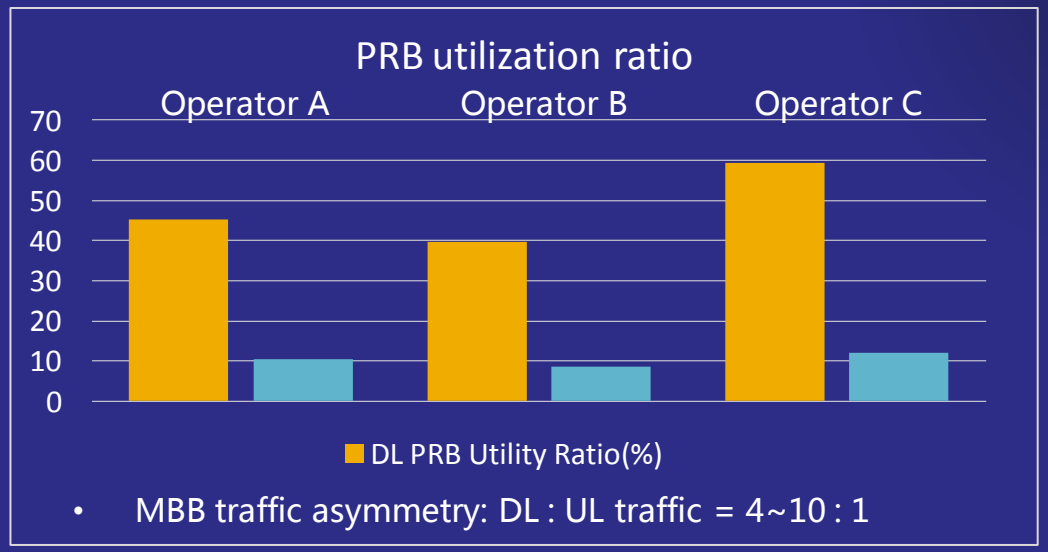


C-Band Deployment Speeded up w. UL/DL Decoupling

UL is the Coverage Bottleneck



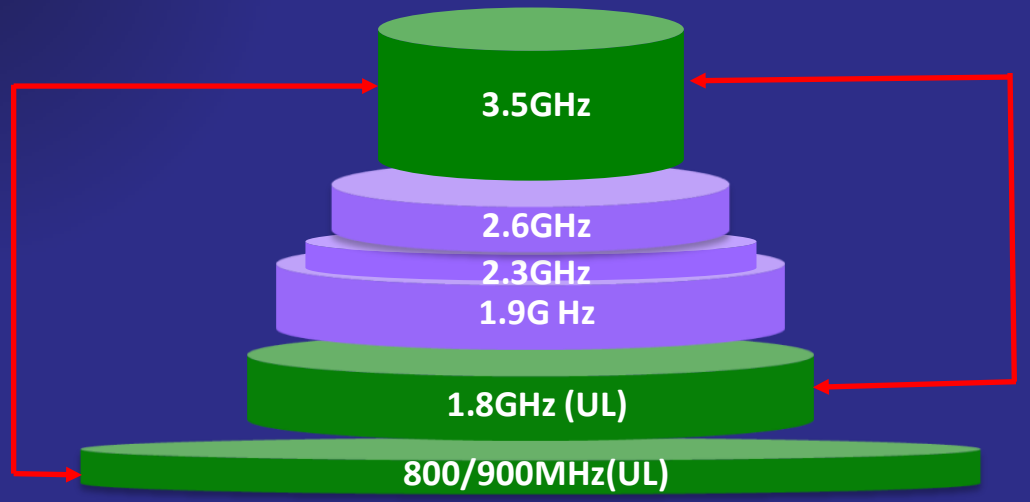
Low UL traffic load in LTE at Sub3GHz



- MBB traffic asymmetry: DL : UL traffic = 4~10 : 1

Sub3GHz for UL, C-Band for DL&UL

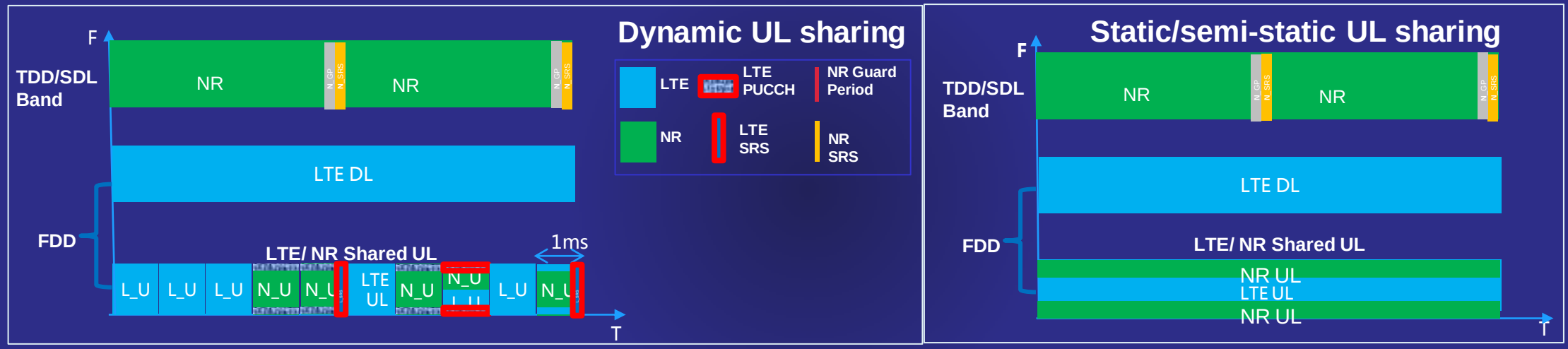
- **Co-site** deployment of C-band with LTE low freq. band
- **UL/DL** decoupling to eliminate C-band UL coverage bottleneck.
- **Fast introduction** of NR with **spectrum sharing** instead of refarming to protect LTE investment.



C-Band/SUL Combination Standardization

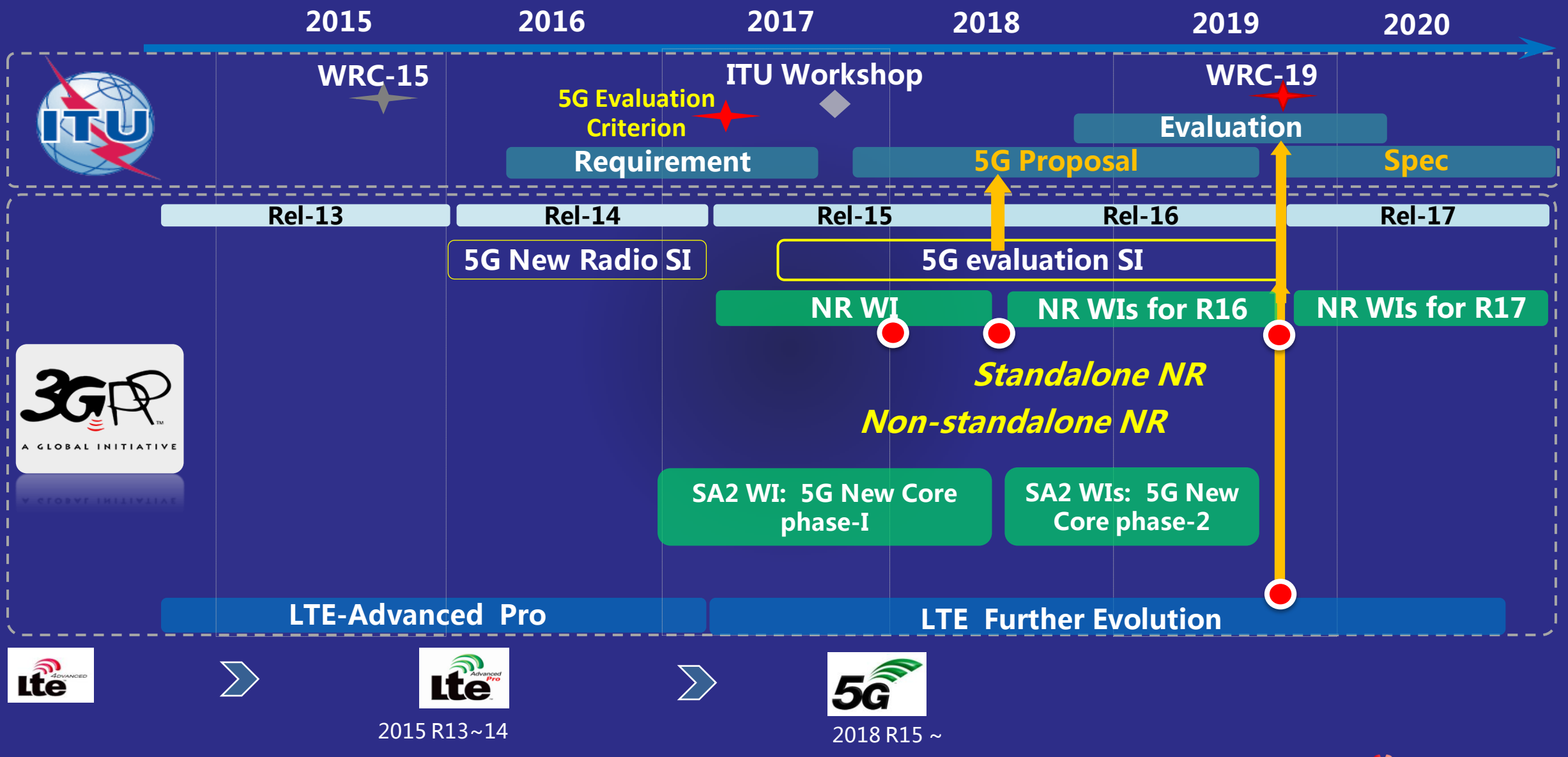
NR-LTE co-existence has been adopted into R15 NR-WID scope(RAN#75)

- Support co-existence of LTE UL and NR UL within the bandwidth of an LTE component carrier
- specify at least one NR band/LTE-NR band combination for this operation

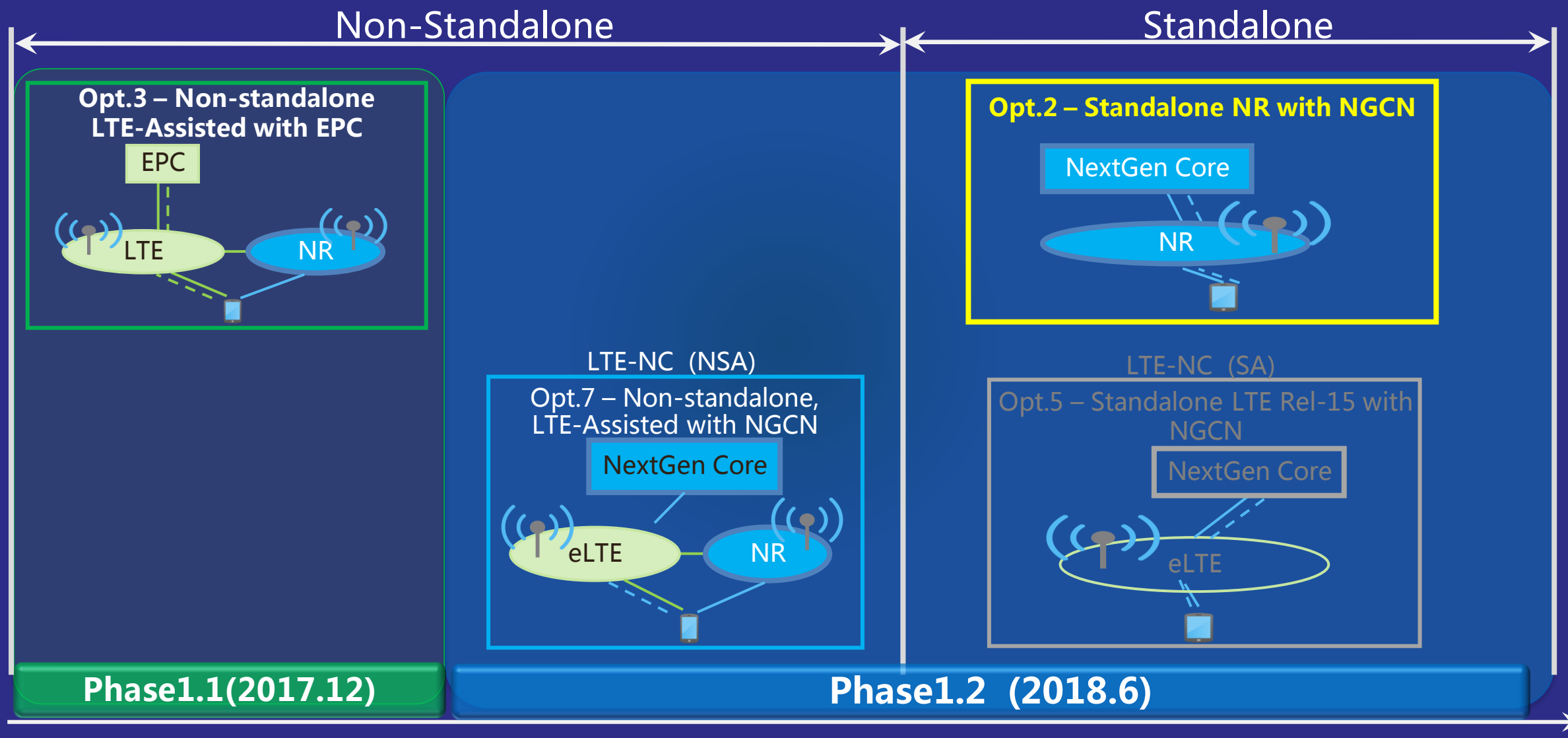


Proposed frequency ranges for NR/LTE Co-existence	Operators
1710-1785MHz (UL)/3.3-4.2 GHz*(DL&UL)	CTC, CUC, CMCC, DT (1800MHz)
832-862MHz (UL)/3.3-4.2 GHz*(DL&UL)	Orange, Telefonica, DT, ET (800MHz)
880-915MHz (UL)/3.3-4.2 GHz*(DL&UL)	CMCC (900MHz)
703-748MHz (UL)/3.3-4.2 GHz* (DL&UL)	Orange, Telefonica, ET (700MHz)

3GPP 5G Standard Roadmap



3GPP Rel-15 5G Deployment Options



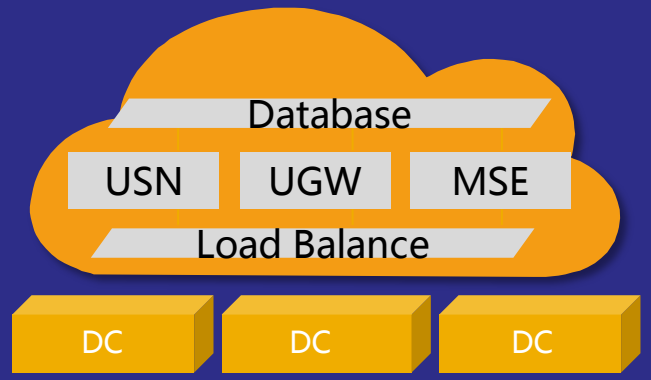
5G RAN Key Enabling Technologies

	Higher Spectral Efficiency	UAI (Unified Air Interface)	UCNC (User Centric No Cell)	RAT Agnostic Technologies
Framework				
Focus	• Multi-antenna • UL/DL traffic asymmetric • Light overhead	•Mix-Numerology •Narrow band & wide band •Low Latency	•UDN & Hetnet •Simplify Mobility	•Further eMBB enh. •MMTC •URLLC
Enablers	• CCH BF & M-MIMO • Flexible duplex • F-OFDM	•Self-contained sub-frame •F-OFDM / Polar code	• Hyper Cell • CloudRAN • CloudAir	• Massive MIMO • NB-IoT • Grant Free

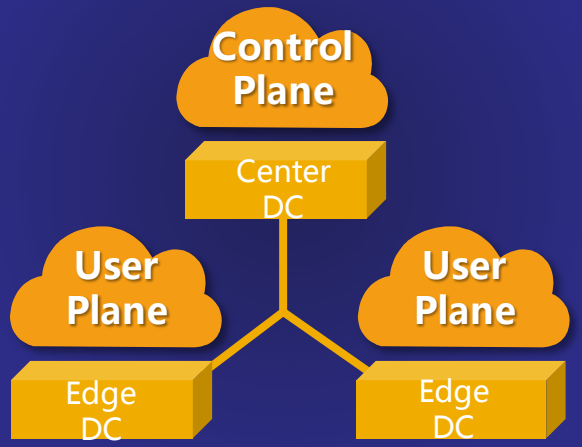
5G is much more than Massive MIMO

5G Core Network Evolution Roadmap

Cloudified Architecture

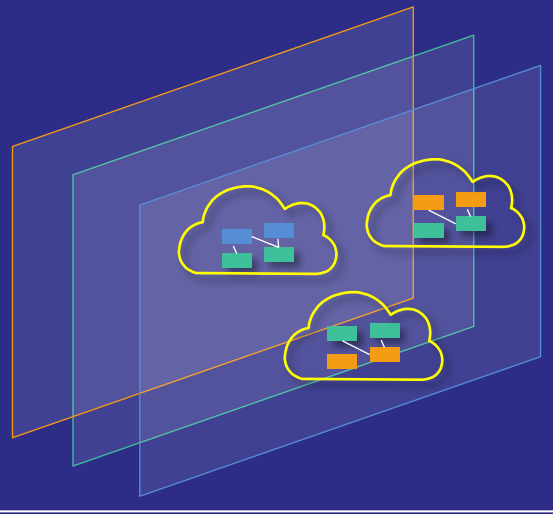


Distributed Deployment



- CUPS Based
- On demand deployment
- MEC, mCDN, Smart Campus, Smart Stadium

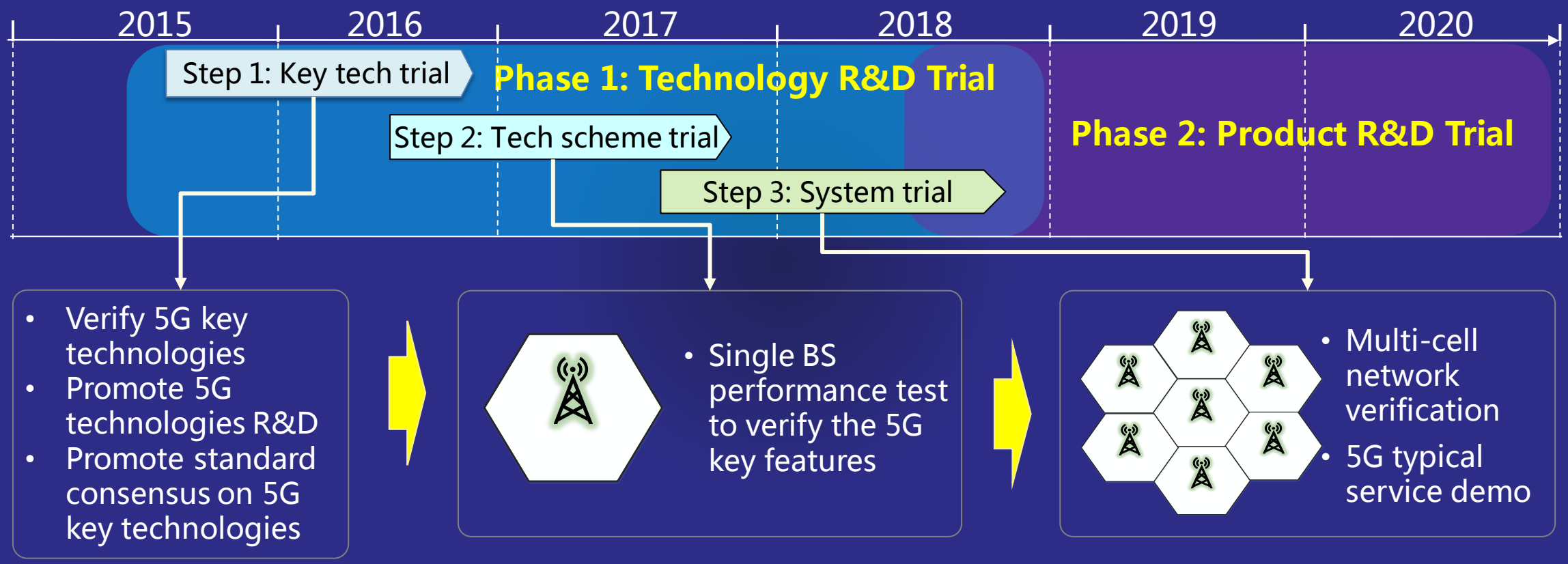
SOC (Service Oriented Core)



- Service Based Architecture
- On demand slicing
- Access Agnostic
- AR/VR, V2X, undirected connection, Industry internet..

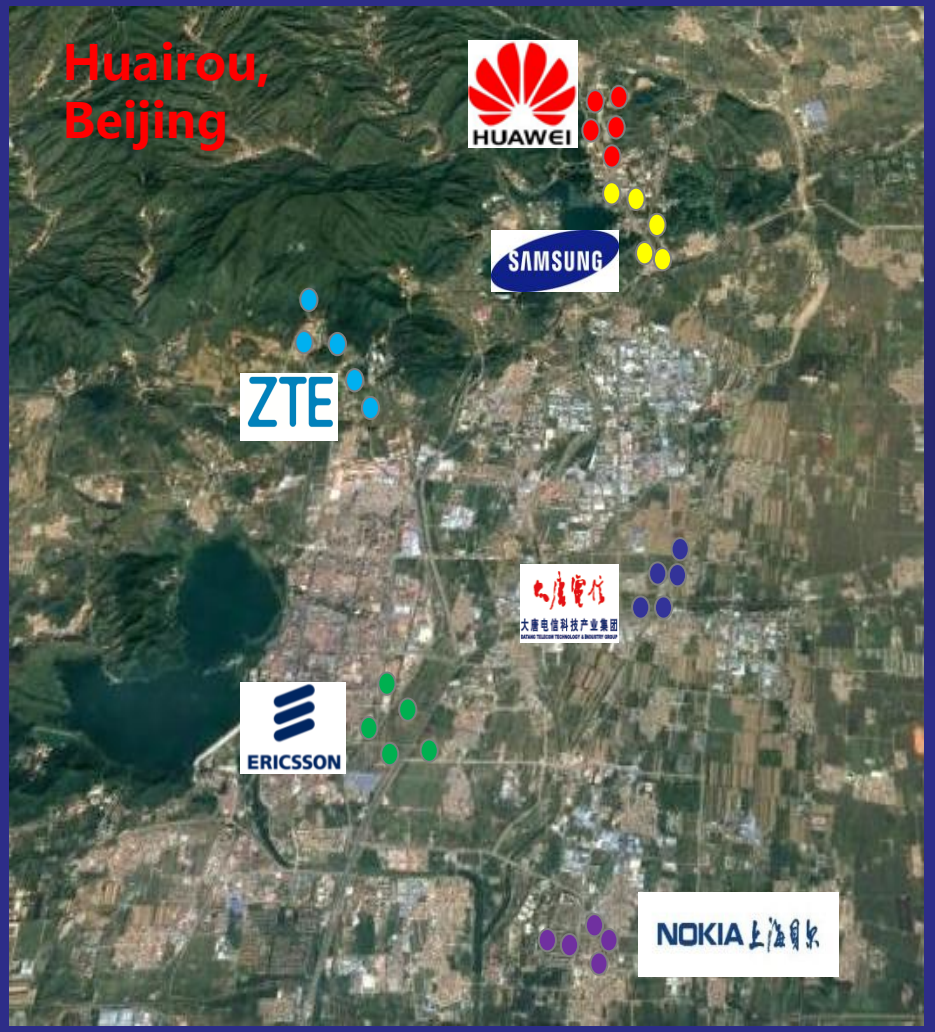
5G Trial in China

5G Technology R&D Trial Launched in China



Step-2 of 5G Technology R&D Trial

Six leading vendors participation



Requirements

- **Common Test/Trial Sites**
- **Common Test Requirement**
  - Common trial equipment specification and trial platform
  - Common trial test specifications and test cases
  - Open test interface
- **Common Test Frequency**
  - Low Frequency：3.4-3.6GHz (might expand)
  - High Frequency：Encourage the system vendor to conduct the high frequency test, in the absence of allocation of specific trial high frequency band, the trial can be conducted at indoor lab.

Test Scenarios and Baseline in Step-2

7 scenarios

ITU scenarios

Wide Area Coverage

Low Power Consumption Massive Connections

Ultra-reliable Low latency

Hotspot with High capacity

Lower Frequency

Higher Frequency

Hybrid Scenarios

Higher bands and lower bands

Other Scenarios

Baseline for passing the test

- Test completion in scenarios with wide area coverage and IoT.
- Support to interconnect and interwork with at least one chip manufacturer and one instrument manufacturers .

Huawei Trial in Huairou

Wide Area Coverage

Cell peak data rate > 11.7Gbps
Single user data rate > 1.6Gbps

64 Channels
200MHz BW
12 UEs

Massive Connections

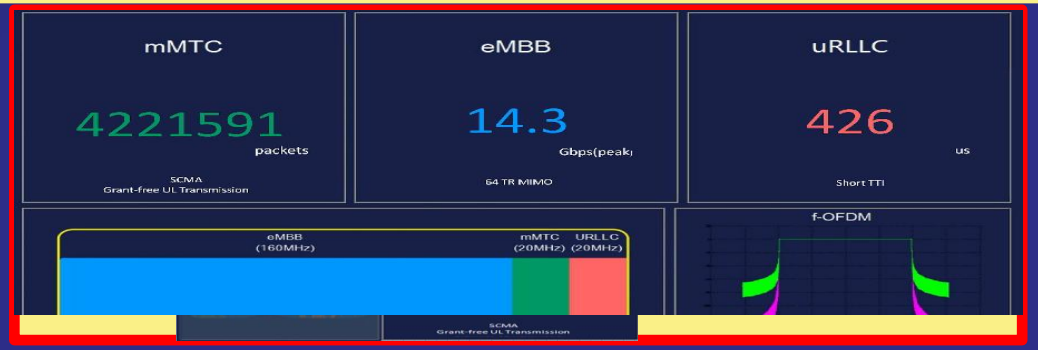
4 million/MHz/cell

Ultra-reliable Low latency

User plane air-interface delay < 1ms

Hybrid Scenarios

Cell peak data rate>8.29Gbs; delay<1ms,
4million connections



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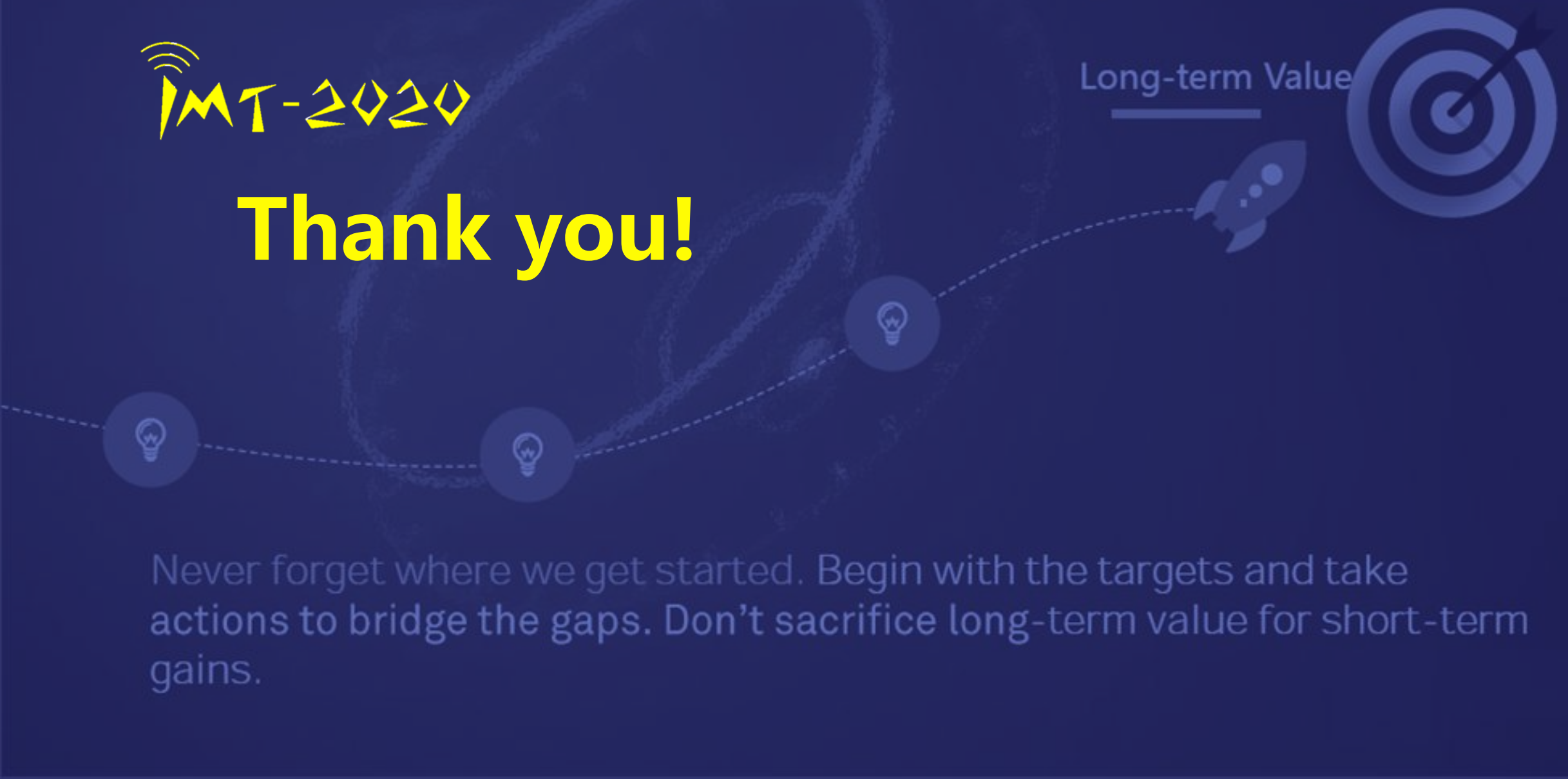

Thank you!

Never forget where we get started. Begin with the targets and take actions to bridge the gaps. Don’t sacrifice long-term value for short-term gains.