



清華大學

Tsinghua University

A Perspective of China's 6G Researches

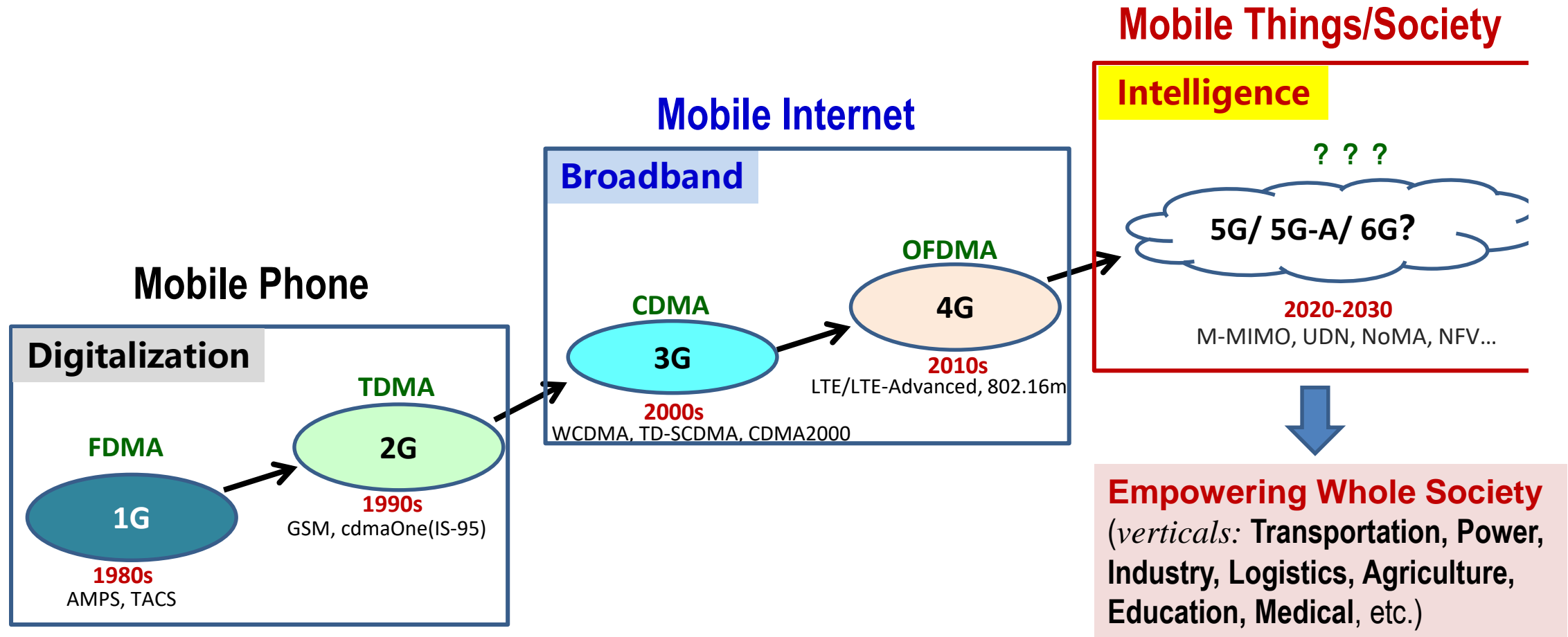
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June 4, 2022 @ Waseda Univ.



6G: Mobile 2030



China's 5G: Spectrum

	<ul style="list-style-type: none"> • 2016.07, FCC releases 5G spectrum • 2019.01, 28GHz Auction Completed 	<ul style="list-style-type: none"> • LOW: 600MHz • HIGH: 24.25-24.45GHz, 24.75-25.25GHz, 47.2-48.2GHz, 27.5-28.35GHz, 37-40GHz
	<ul style="list-style-type: none"> • 2016.07, MIC releases 5G policy • 2019.03, 5G spectrum allocated 	<ul style="list-style-type: none"> • MID: 3.7-4.1GHz, 4.5-4.6GHz, 4.6-4.8GHz (Local 5G) • HIGH: 27-28.2GHz, 29.1-29.5GHz, 28.2-28.3GHz (Local 5G)
	<ul style="list-style-type: none"> • 2016.11, 5G policy released • UK/Germany auction completed 	<ul style="list-style-type: none"> • LOW: 700MHz • MID: 3.4-3.8GHz • HIGH: 24.25-27.5GHz (TBD)
	<ul style="list-style-type: none"> • 2018.06, 5G spectrum allocated 	<ul style="list-style-type: none"> • MID: 3.42-3.7GHz • HIGH: 26.5-28.9GHz
	<ul style="list-style-type: none"> • 2018.12, 5G trial spectrum allocated • 2019.06, LOW & MID spectrum allocated, HIGH pending • New operator: China Broadcast (CB) 	<ul style="list-style-type: none"> • LOW: 700MHz (CB) • MID: 160M@2.515-2.675GHz (CM) 100M@4.8G-4.9GHz (CM) 100M@3.4G-3.5GHz (CT) 100M@3.5G-3.6GHz (CU) 60M@4.9GHz (CB) • HIGH: 24.75-27.5GHz (? TBD)

2019.09 announced: **CT** and **CU** will jointly build 5G network
2020.05 announced: **CM** and **CB** will jointly build 5G network

CM: China Mobile; **CT:** China Telecom
CU: China Unicom; **CB:** China Broadcast

China's 5G: Commercialization

- **By 2020, China has**

- invested **~260B** Yuan in 5G networks
- built **718K** 5G BSs (~**70%** of the globe)
- contracted **200M+** 5G users → **822M+** by 2025
- accounted **90%+** 5G handsets of all new handsets



“5G+”



- **By 2021, China has**

- built **1.42M** 5G BSs
- contracted **400M+** 5G users



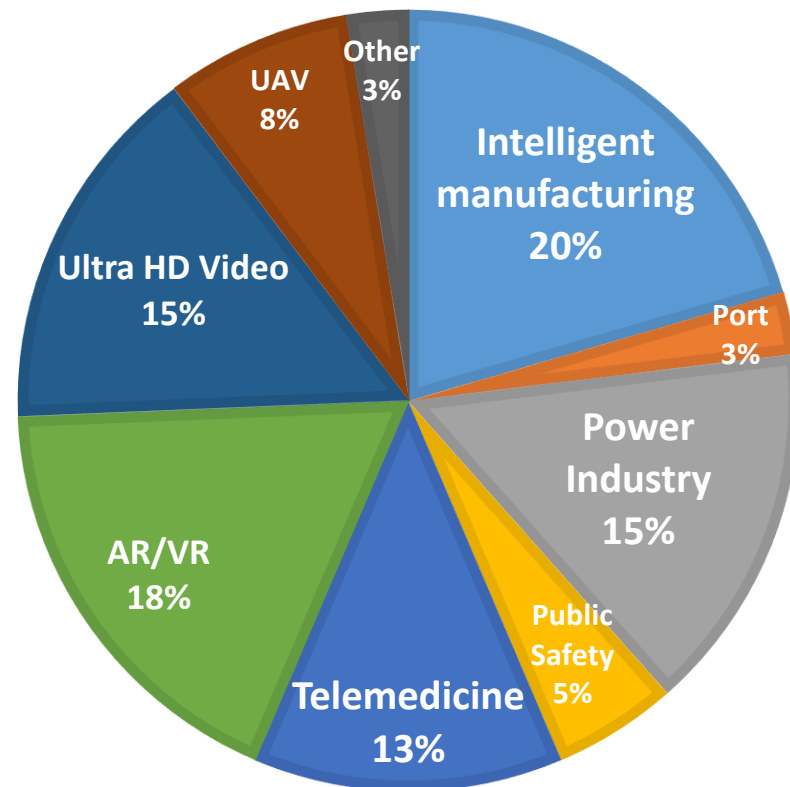
- **By 2022, China will**

- build **2.0M+** 5G BSs



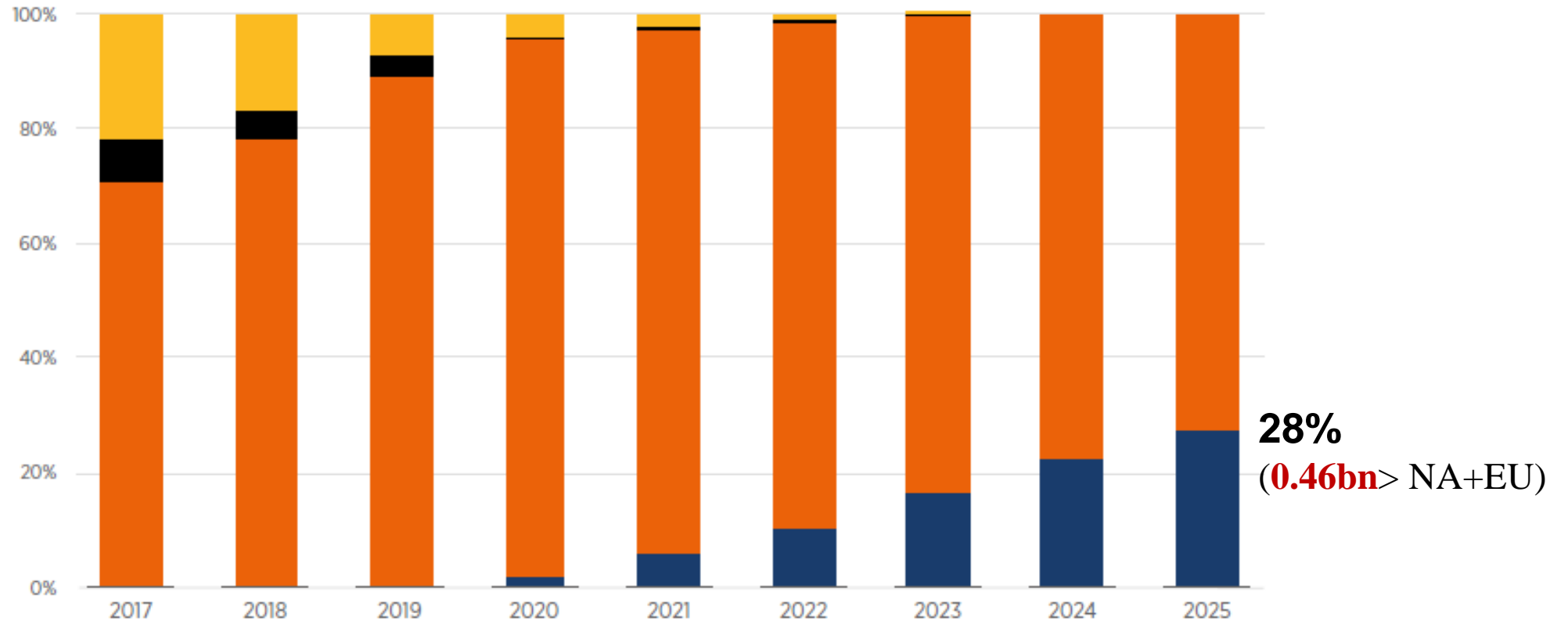
China's 5G: Killer Applications

- **Killer Apps:** 4K/8K, AR/VR, UAV, MobiRobot take ~50% share
- **Verticals:** Industrial Internet (Manufacturing, Power, Telemedicine, ...)
- **e-Commerce:** Mobile payment (81% China vs 25% Japan & 12% France in 2018)



Source: China Academy of Telecom Research

China's 5G: Facts and Prediction



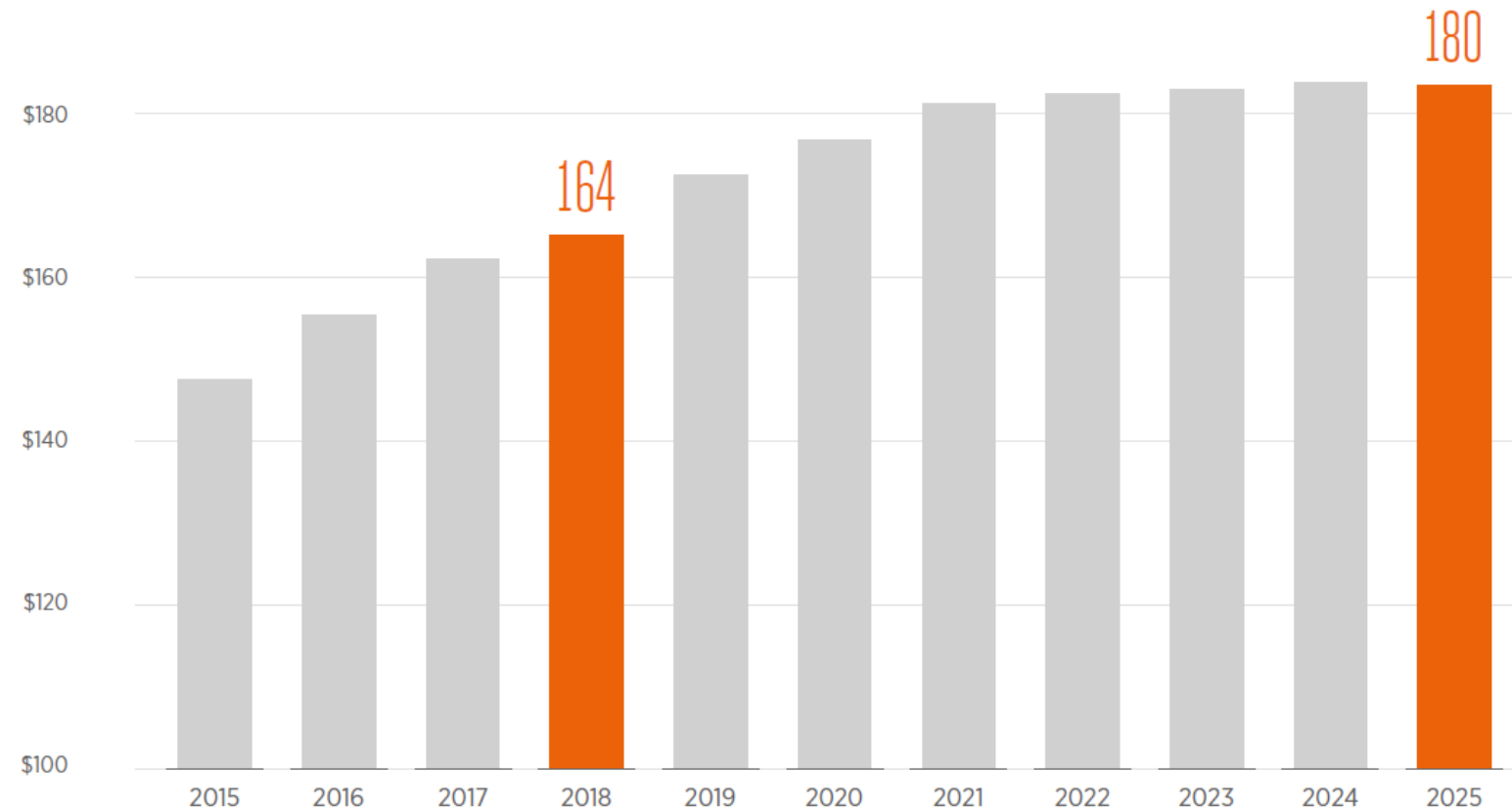
Connections (%) in China by technology (Source: GSMA Intelligence)

2G 3G 4G 5G

Licensed cellular IoT connections in 2025: **1.9bn**

China's 5G: Investment vs Revenue

\$200 Revenue (Billion): Increasing but Plateau



(Source: GSMA Intelligence)

- In 2010-2018, mobile operators in China spent **\$268bn** (RMB1.9tn)
- In 2020-2030, MIIT predicts the investment will be **\$405bn** (RMB2.8tn)

Pre-Study of B5G/6G in China

- **Jan. 2018: National Key R&D Project** (2016-2020, MOST) **incubated B5G/6G researches**
 - Fundamental theory for massive communications
 - mmWave & THz communications
 - Space-Air-Ground Integrated Networks
 - Network Intelligence
- **Mar. 2018: National Major S&T Project** (2006-2020, MOST) **incubated “Mobile Information Networks” researches**
 - **Full Coverage; Full Spectrum; Full Applications**
- **May 2019: MIIT IMT-2020 kicked off 6G Technical WG**
- **Nov. 2019: MOST Kicked off “National 6G Expert Committee”**
- **Jul. 2020: MOST released Call for Proposals on 6G researches**
- **Dec. 2020: MOST granted 15 research projects on 6G** (*under the framework of “National Key R&D Project”*)

MOST: Ministry of Science & Technology

MIIT: Ministry of Industry and Information Technology

Major 6G Research Topics in China

- **6G Vision and User Cases**
- **6G Network Architecture**
 - Coverage extension technologies
 - Integrated Space-Air-Ground Network
 - AI-native & Security-embedded
- **6G Wireless Transmission Technologies**
 - mmWave and Tera-Hertz communication
 - Reconfigurable Intelligent Surface (RIS)
 - Spectrum Sharing and Coexistence Technology
 - Distributed Computing & Federated Learning
- **6G Full-scene & On-demand Services & Applications**
 - Integrated Space-Air-Ground Network and On-demand Services
 - 6G Wireless Network Security Architecture
- **Green and Low-carbon**



全球6G技术大会 GLOBAL 6G CONFERENCE

指导单位：国家6G技术研发推进工作组和总体专家组
主办单位：未来移动通信论坛(FUTURE FORUM)
会议时间：2020年9月16-18日
会议地点：中国·北京

Conference Co-chairs



2nd Global 6G Conference (Mar.22-24, 2022)



**General
Co-chairs**

**TPC
Co-chairs**



International Panel I



Moderator
Qi Bi: China Telecom

Panelists:

1. **Harish Viswanathan: Bell Labs.**
2. **Peiying Zhu: Huawei Technologies**
3. **Junyi Li: Qualcomm**
4. **Rath Vannithamby: Intel Labs.**
5. **Zhu Han: Univ. of Huston**



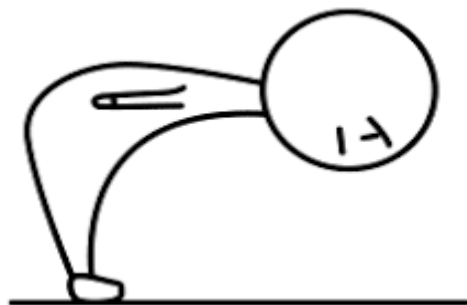
International Panel II



Moderator:
Chih-Lin I: China Mobile

Panelists:

1. **John Smeed**: Qualcomm
2. **Shuguang Cui**: Chinese Univ. of HongKong Shenzhen (CUHK-SZ)
3. **Jaafar Elmirghani**: Univ. of Leeds
4. **Stefan Parkvall**: Ericsson Labs.
5. **Pingzhi Fan**: Southwest Jiaotong Univ.
6. **Mohamed-Slim Alouini**: King Abdullah Univ. of Sci. & Tech. (KAUST)



ご清聴ありがとうございました

Comments & Discussions?