IMT Vision towards 2020 and Beyond

IMT-2020（5G）Promotion Group

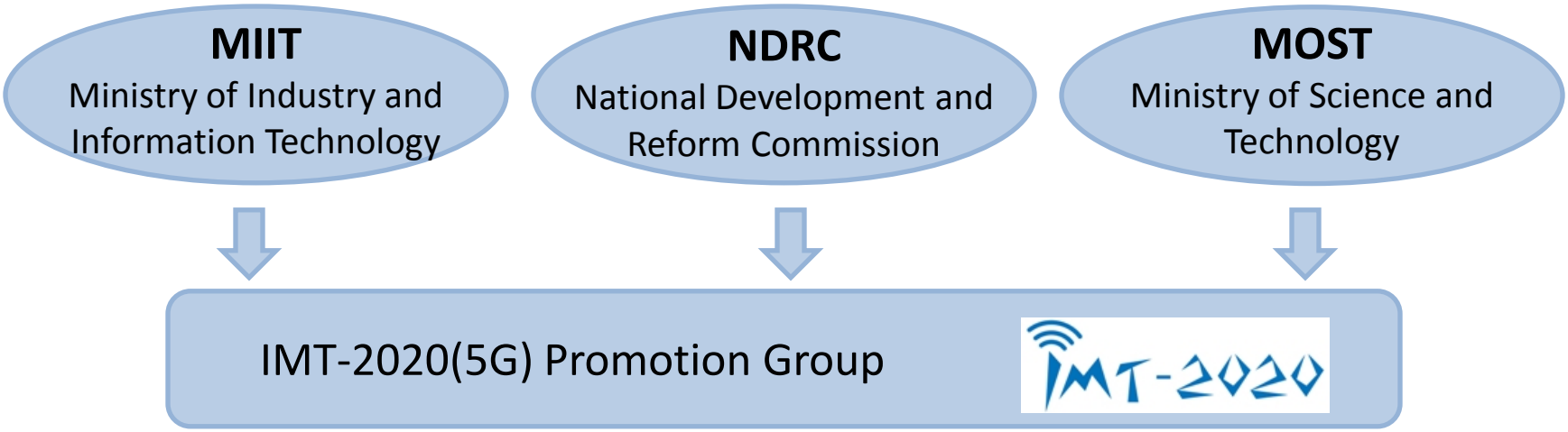
February 2014

Outline

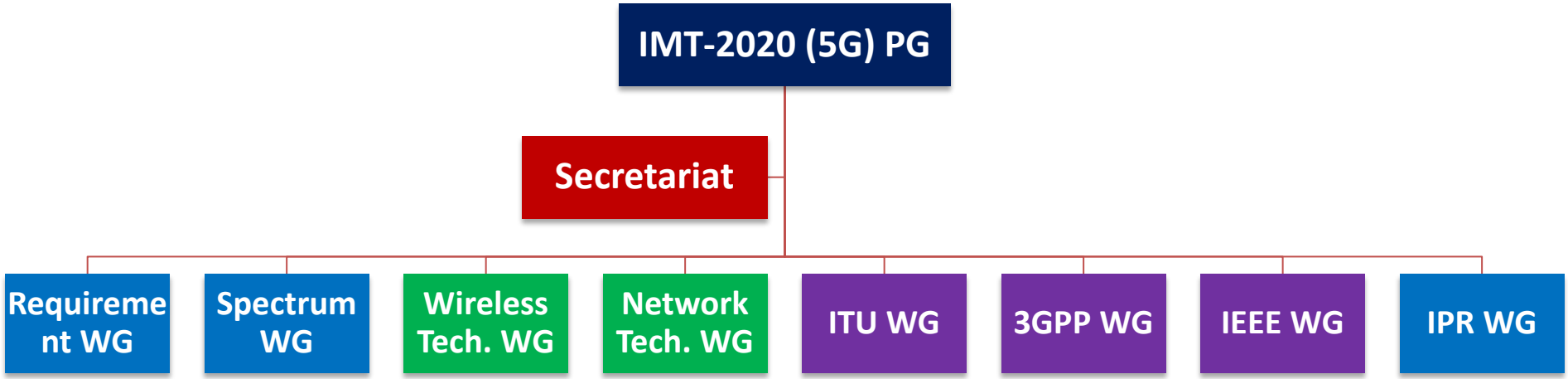
- IMT-2020 (5G) Promotion Group
- 5G Challenges and Requirements
- 5G Potential Technologies and Spectrums
- 5G Objectives and Capabilities

IMT-2020 (5G) Promotion Group

- In February 2013, three ministries of China (MIIT, NDRC and MOST) jointly established “IMT-2020(5G) Promotion group” based on the original IMT-Advanced promotion group.
- Objectives:
  - The platform to promote the development of 5G technologies in China
  - The platform to facilitate cooperation with foreign companies and organizations

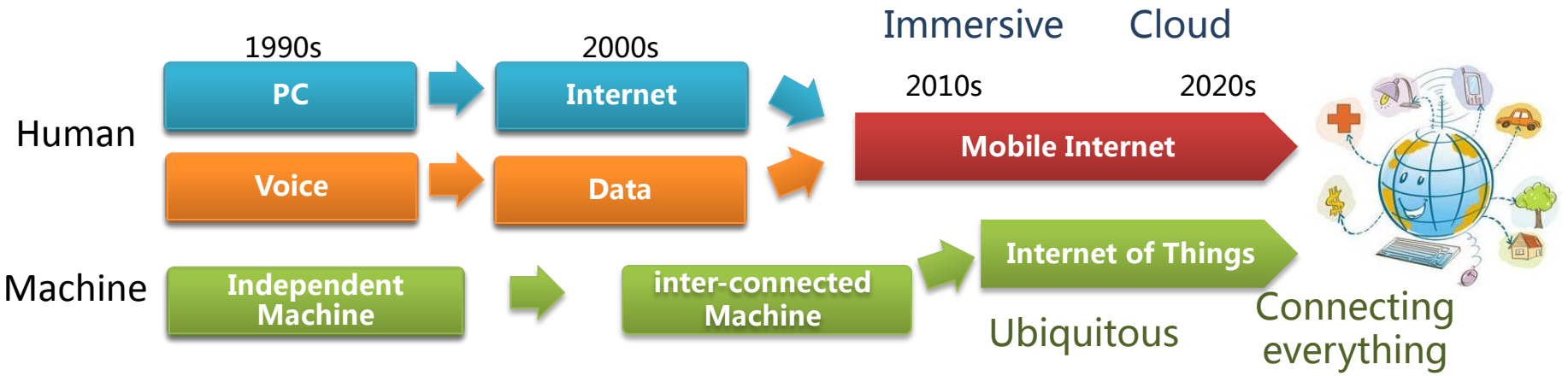


Structure of IMT-2020 (5G) PG

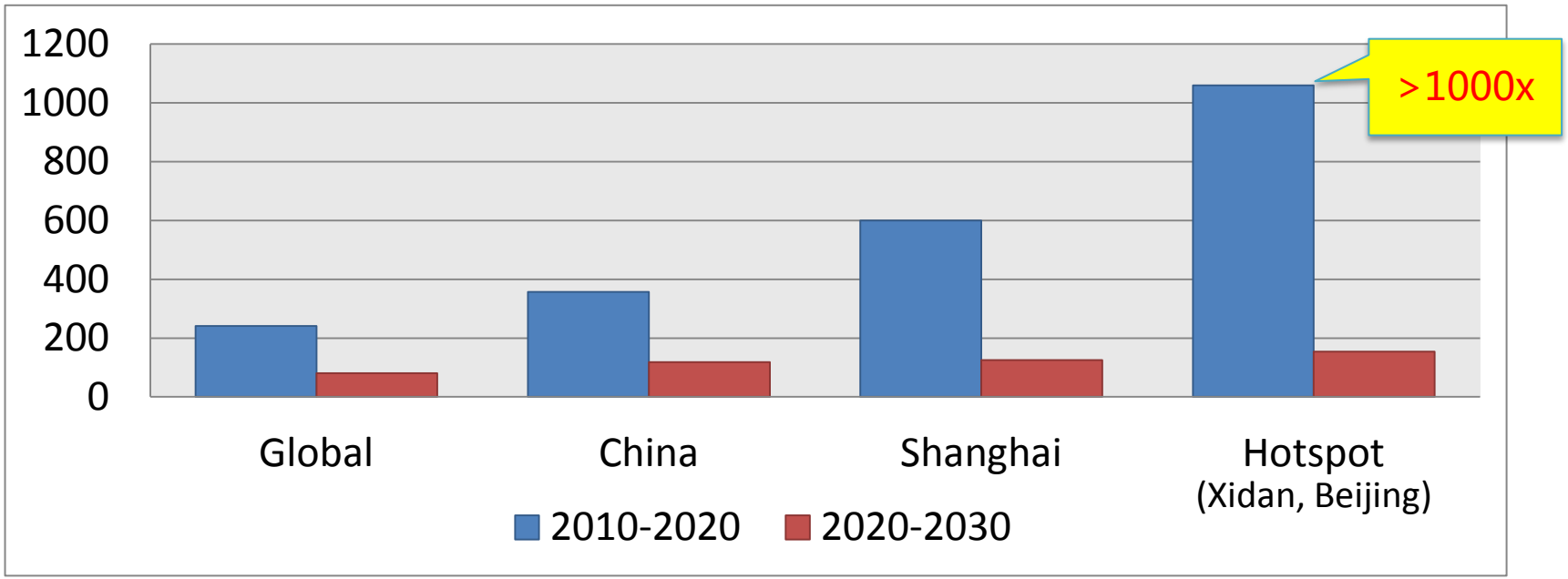


- **Requirement WG**: study 5G vision and requirements towards year 2020 and beyond
- **Wireless Technology WG**: study 5G enabling wireless technologies and 5G system framework
- **Network Technology WG:** study 5G network architecture and key technologies
- **Spectrum WG**: work on spectrum related topics
- **Standards WGs**: interactive with international standard organizations including ITU, 3GPP, IEEE, etc
- **IPR WG:** deal with IPR issues and relevant policy.

Exponential Mobile Traffic Growth Driven by Mobile Internet and IoT

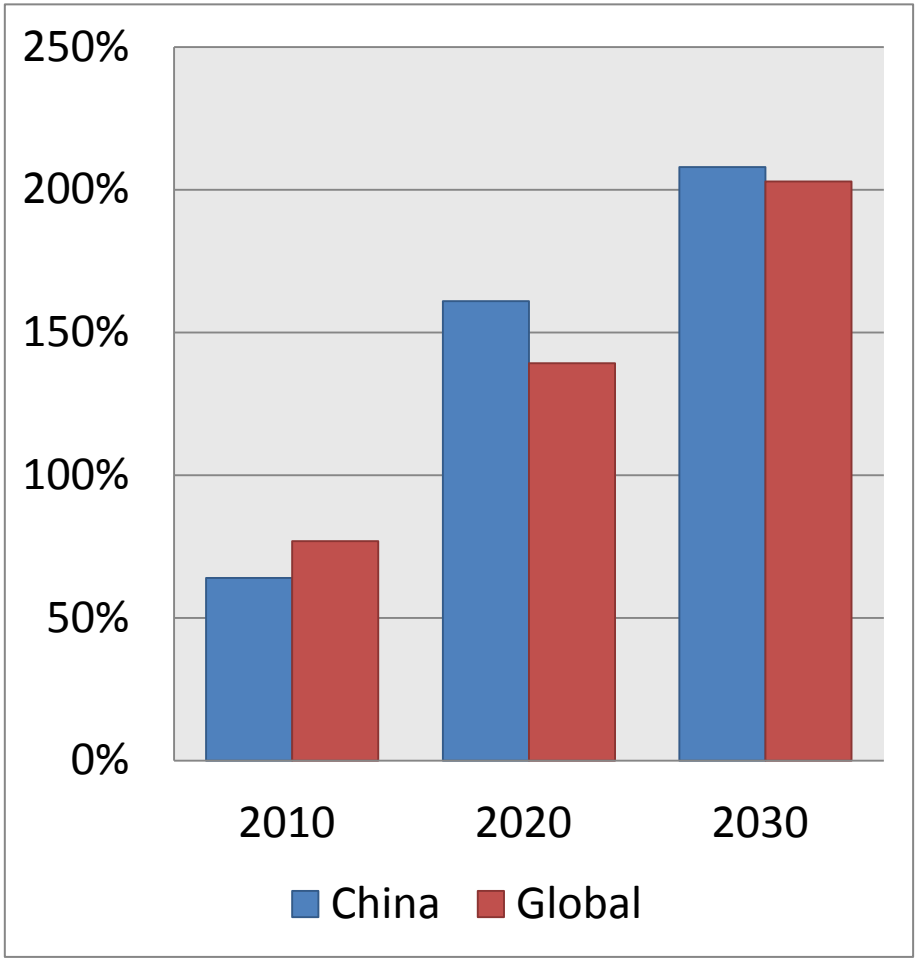


Mobile traffic growth rate

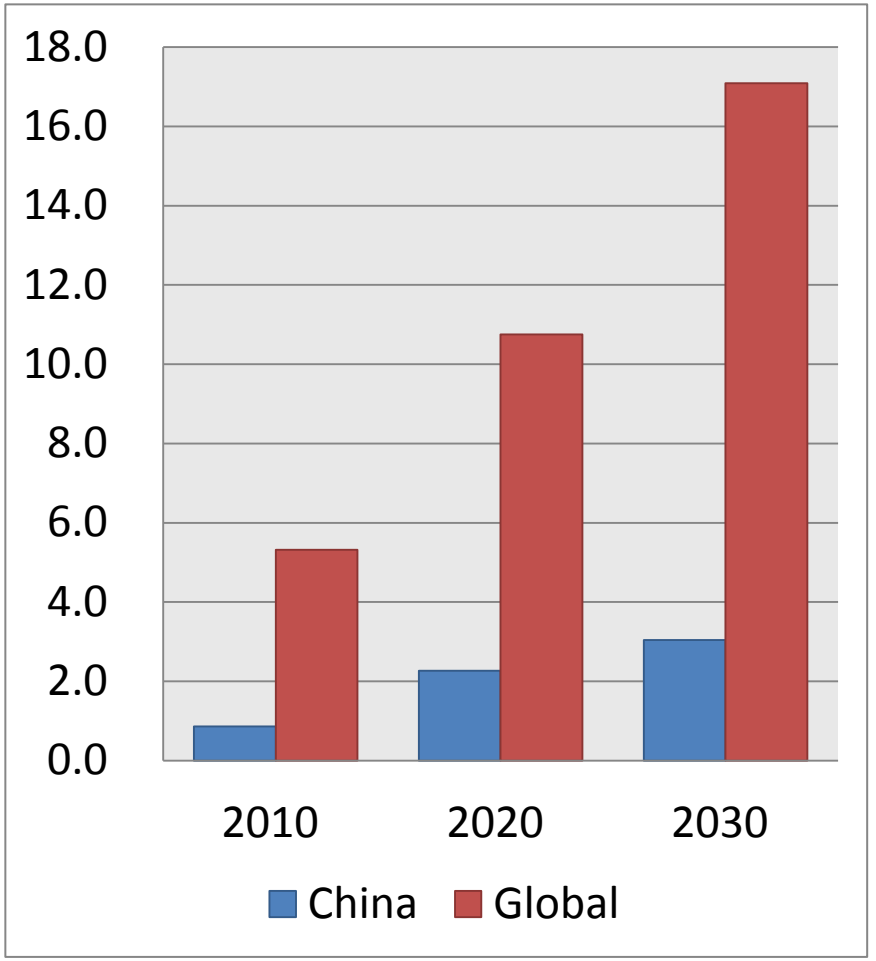


Mobile Subscriber Growth Trends

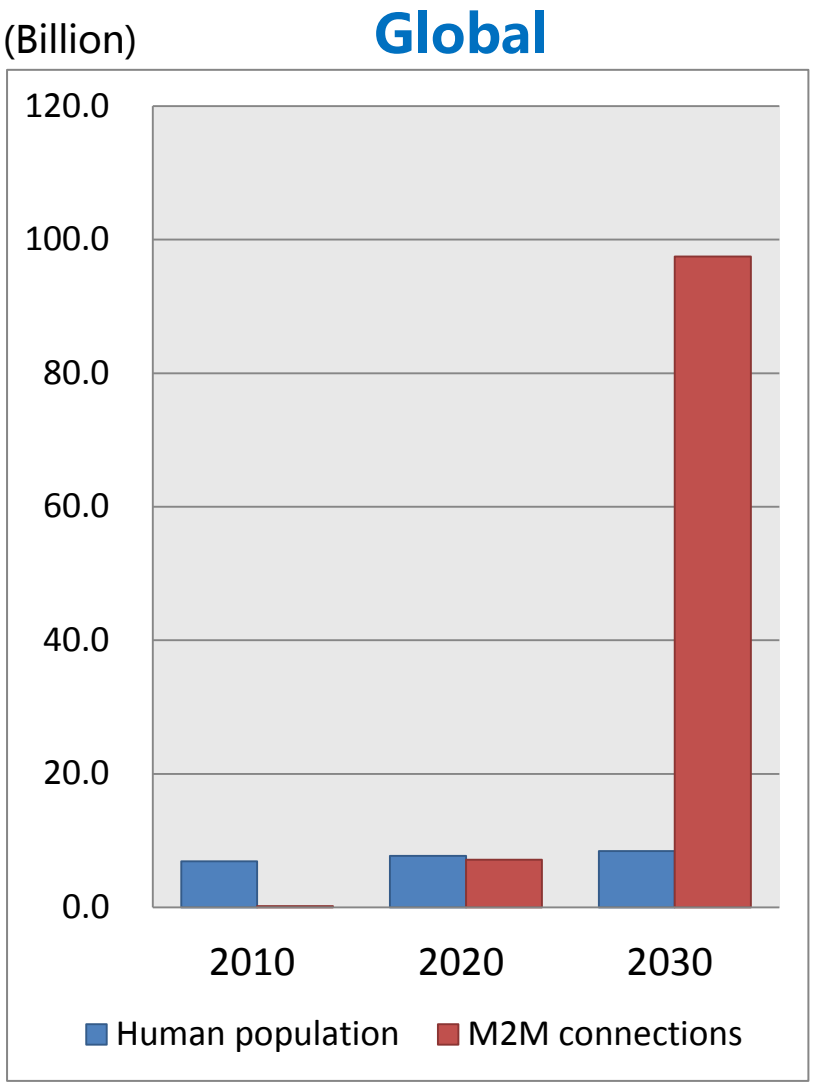
Penetration rates

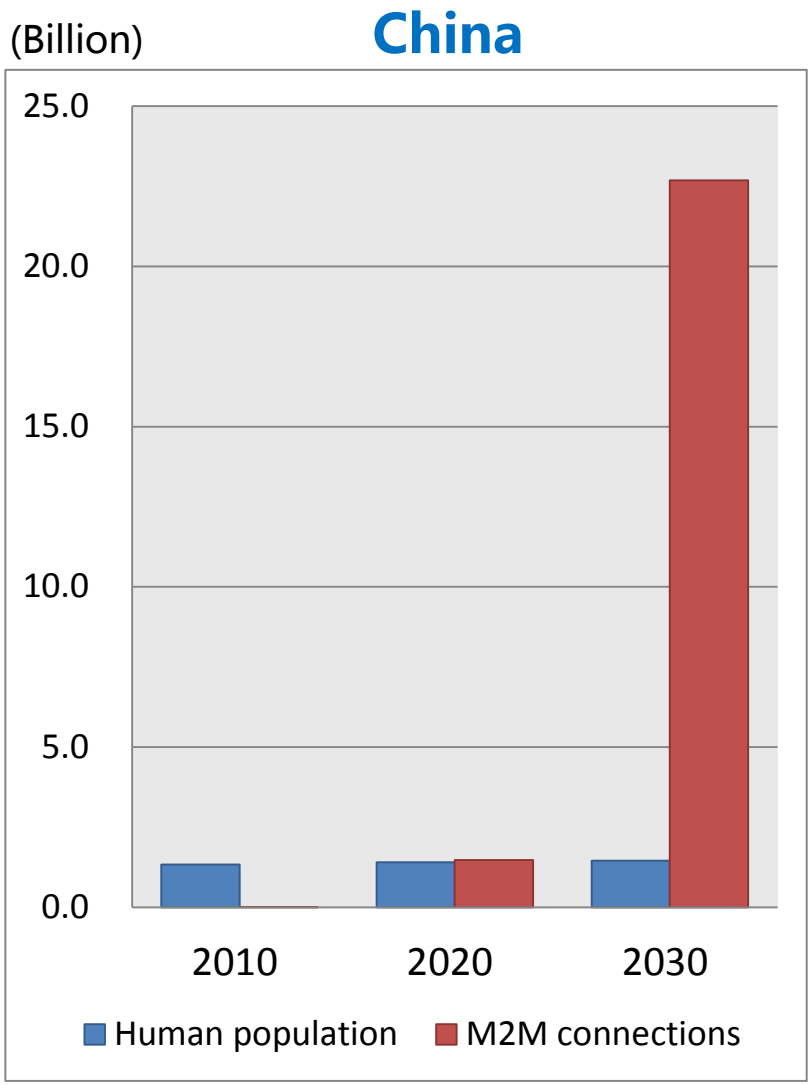


Mobile subscribers



M2M Connection Growth Trends





Typical Scenarios and Services

Typical Scenarios

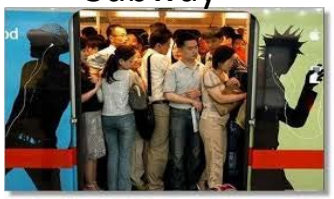
High traffic

Office

Residential Area

High density

Subway



Stadium

High mobility

High-speed Train

Freeway

Typical Services

Mobile Internet services

UHD Video Streaming

Cloud Storage

Augmented Reality

Virtual Reality

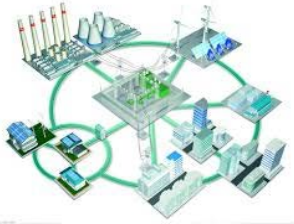
IoT services

ITS

Smart Home

Surveillance

Smart Grid



User Requirements - Mobile Internet

Higher user experienced data rate

Fiber-like access rate

Zero latency experience

Comparable to local operations

Vehicle

Dense zone

Train

Subway

Excellent experience under various scenarios

Consistent experience under diverse scenarios

Perfect service experience

Immersive audio-visual experience

Smooth control experience

Varieties of personalized services

User Requirements - IoT

Meet the diversified requirements of different industries


Transportation


Medical


Agriculture

Finance


Architecture


Electric power


Industry

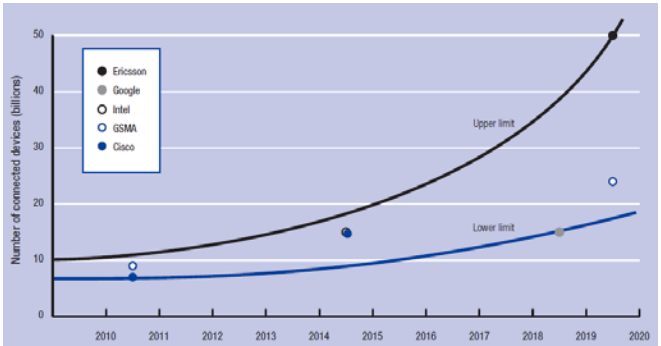

Environment

Various types of wireless connections

Currently connect all kinds of mobile terminals

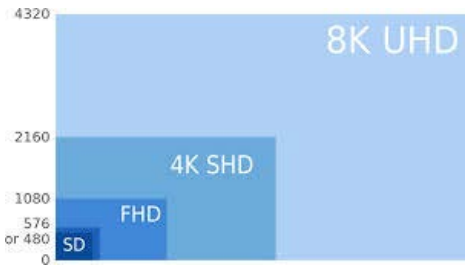
Support massive connections

ITU：2020 : 25 billion connected devices in global

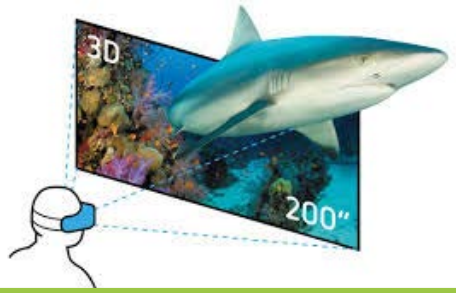


Service Requirements

UHD



3D



Virtual Reality

Continuous growth of video resolution

Require extremely high data rate （~1Gbps）

Augmented Reality

Online games

Cloud Desktop

Huge amount of data exchange in ms level latency

Service Requirements

Cloud Storage

- High data rate
- High traffic volume density

OTT Messaging

- Control signaling overhead

IoT Services

Diverse Requirements

- Massive connected devices
- Low cost
- Low power
- Low latency
- High reliability
- High traffic volume density
- …

Operation Requirements

Network deployment

- Complexity and cost reduction of dense network deployments
- Flexible and efficient use of fragmented spectrum
- Flexible and scalable network architecture and topology for diverse services

Operation and maintenance

- Improve energy efficiency and cost per bit
- Multi-RAT management, including cellular and non-cellular, TDD and FDD
- Smart optimization based on services and users sensing
- Support a diverse set of services and applications with extremely diverging requirements

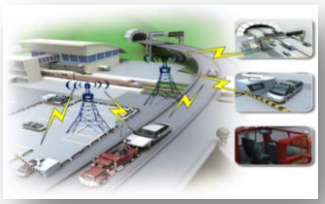
Major Challenges of Future IMT Systems

Challenges in performance

Higher user experienced data rate

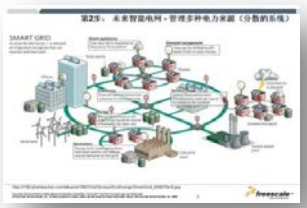
10 – 100 times

"Zero" latency



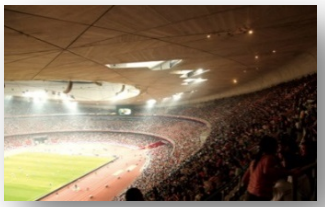
ms level

Higher density of connected devices



Millions of connections per km^2

Higher traffic volume density



Tens of $Tbps/km^2$

Higher Mobility

> 500 km/h

Challenges in efficiency

Higher spectrum efficiency

5 – 15 times

Lower cost per bit

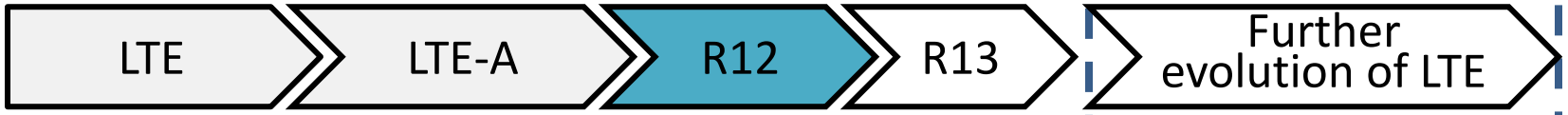
> 100 times reduction

High energy efficiency

> 100 times

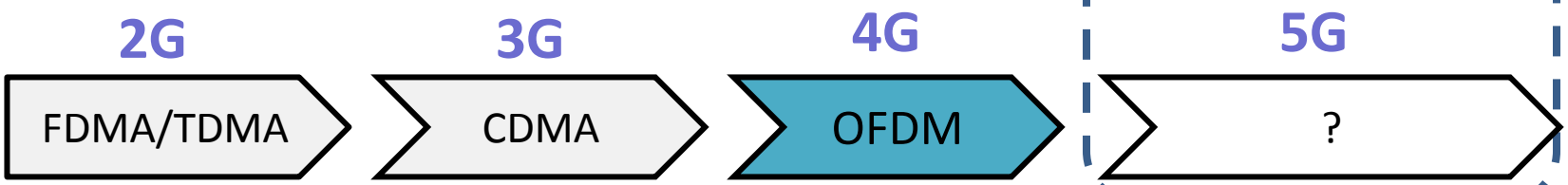
Possible Roadmap of Future IMT Systems

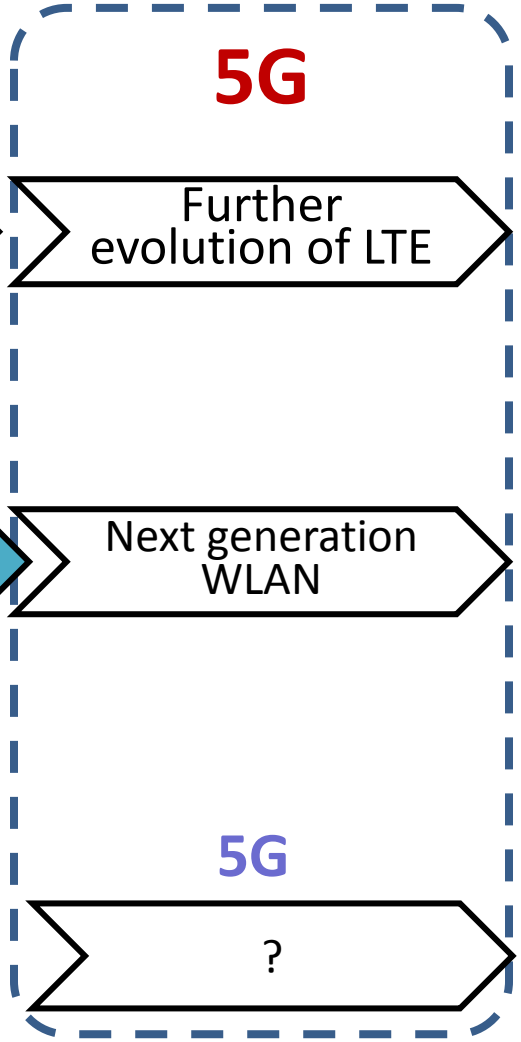
- Evolution of existing technologies
  - LTE Evolution



  - WLAN Evolution

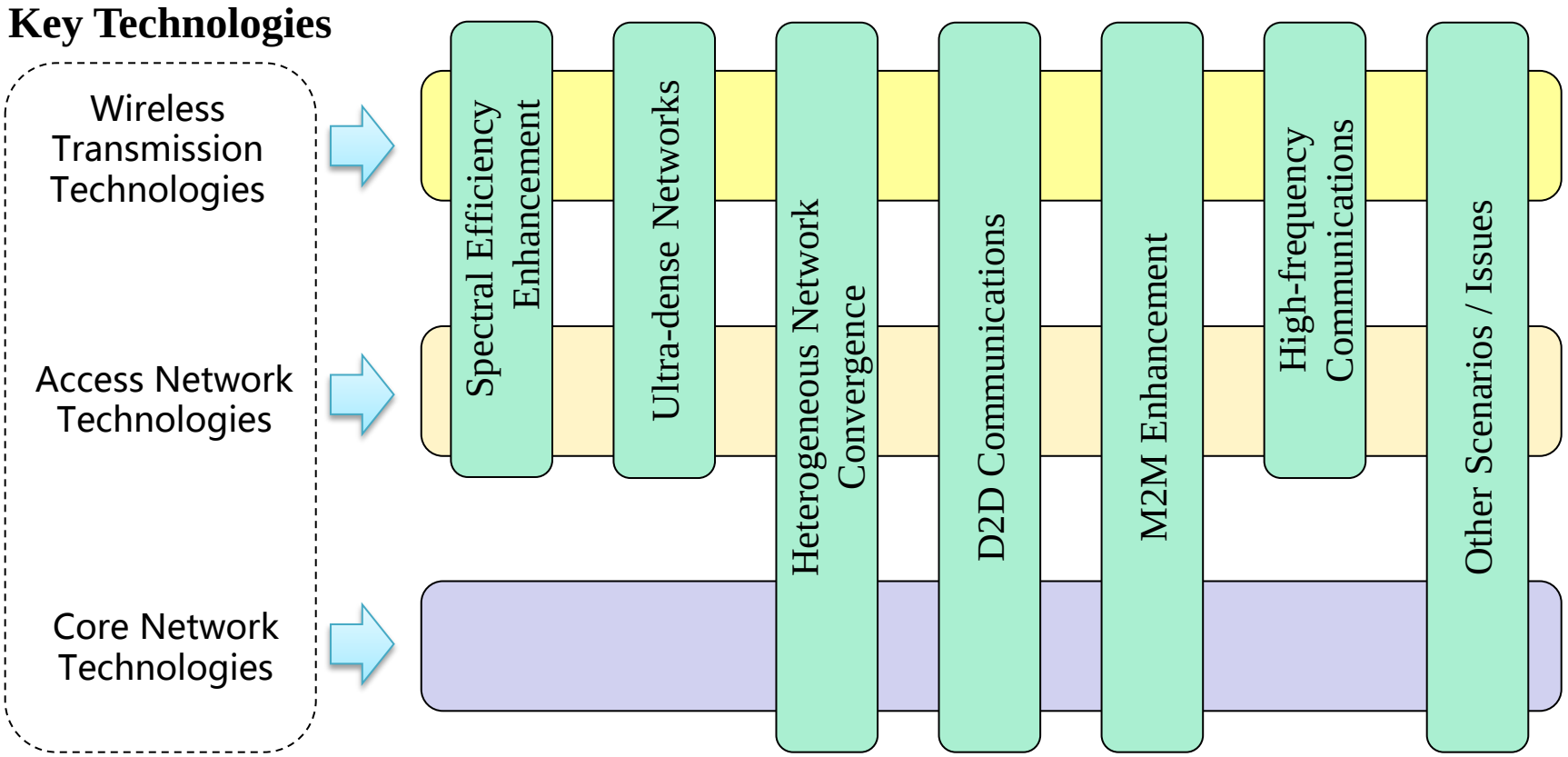
- "Revolutionary" new technologies





Future IMT Technology Framework

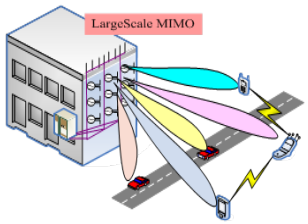
- Technology innovations in areas of wireless transmission and wireless networking (including access network and core network)



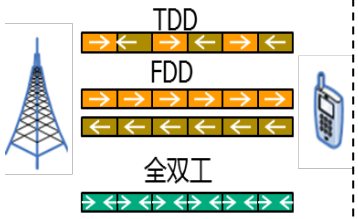
Potential Key Technologies

Potential key technologies in wireless transmission

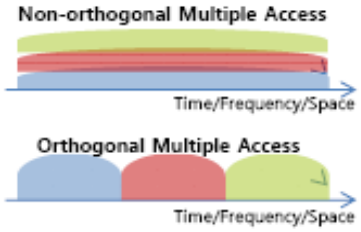
Massive MIMO



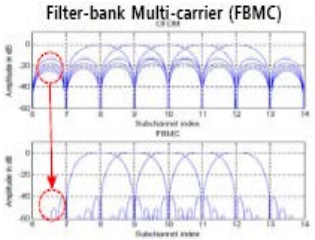
Full-duplex



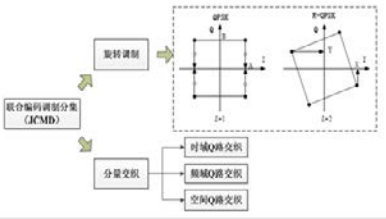
NOMA



Enhanced Multi-carrier



Adv. coding and modulation



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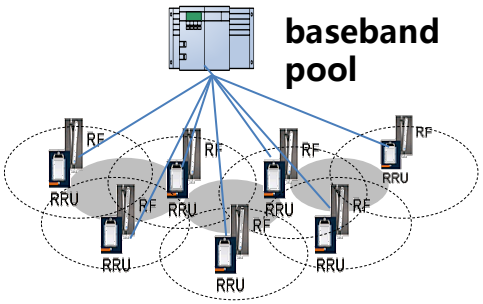
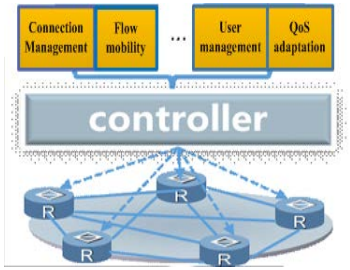
Potential key technologies in wireless networking

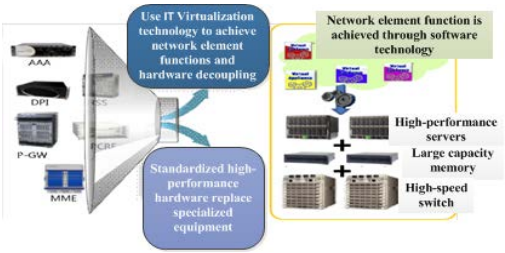
C-RAN



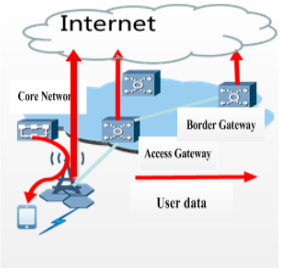
SDN



NFV



Mobile CDN



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Considerations on Future IMT Spectrum

■ Chinese spectrum requirements

Current Planned	687 MHz
Deficit in 2020 and beyond	Up to 1 GHz

Short term

Mid-term

Long term

THREE STEPS FOR POSSIBLE CANDIDATE BANDS

- Possible candidates: 1427-1518MHz、3300-3400MHz、4400-4500MHz、4800-4990MHz, etc.
- Possible candidates: 450-470MHz, 698-806MHz, and 3400-3600MHz.

Objectives and Capabilities of Future IMT Systems

Overall objectives

- Meet the requirements from more than a thousand times of mobile traffic growth in a sustainable way.
- Provide consistent experience under diverse scenarios with ultra high data rate, ultra low latency and massive connections

Fiber-like access data rate

Support of up to 100 billion connections

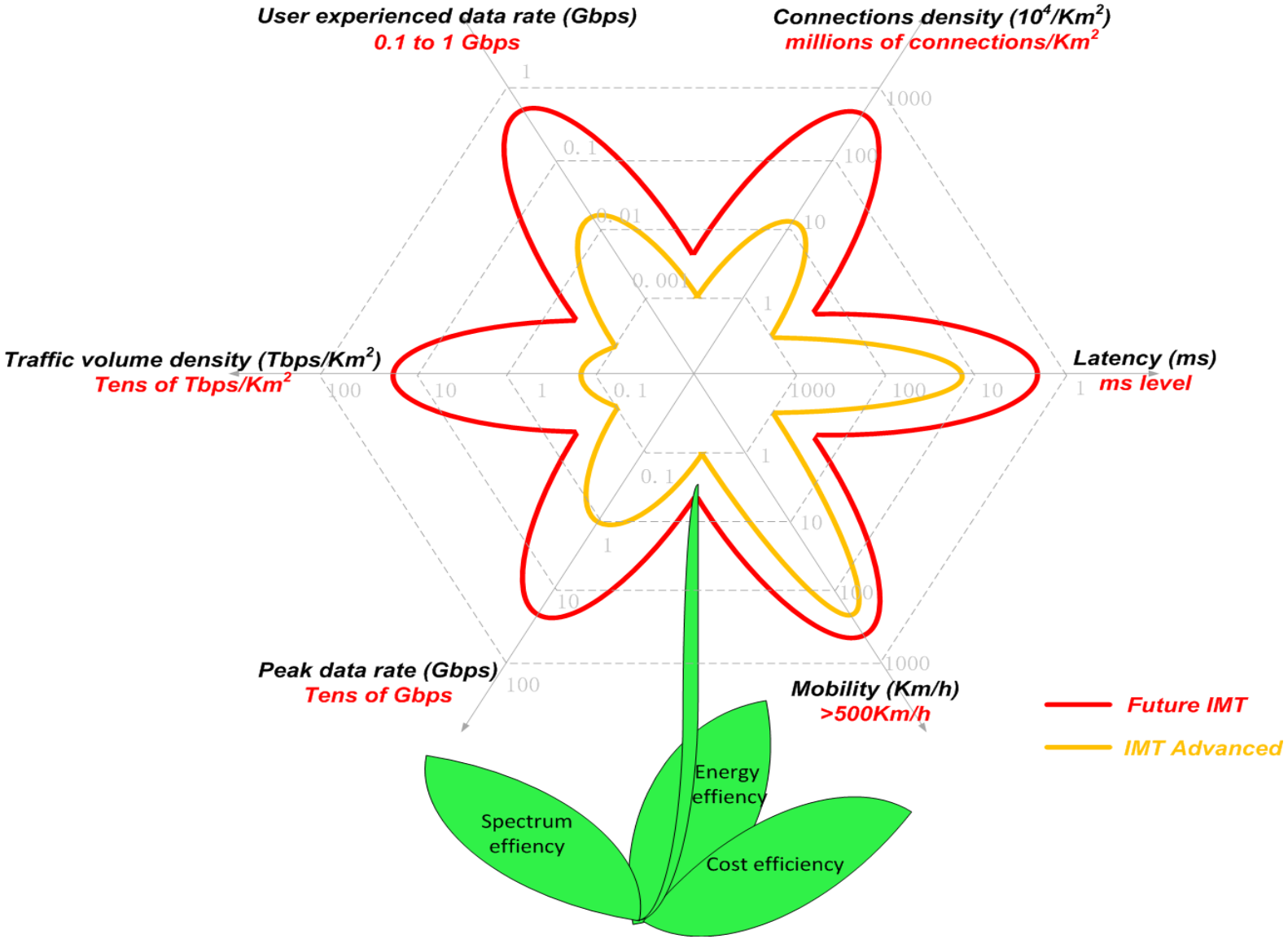
Smart optimization based on services and users sensing

"Zero" latency user experience

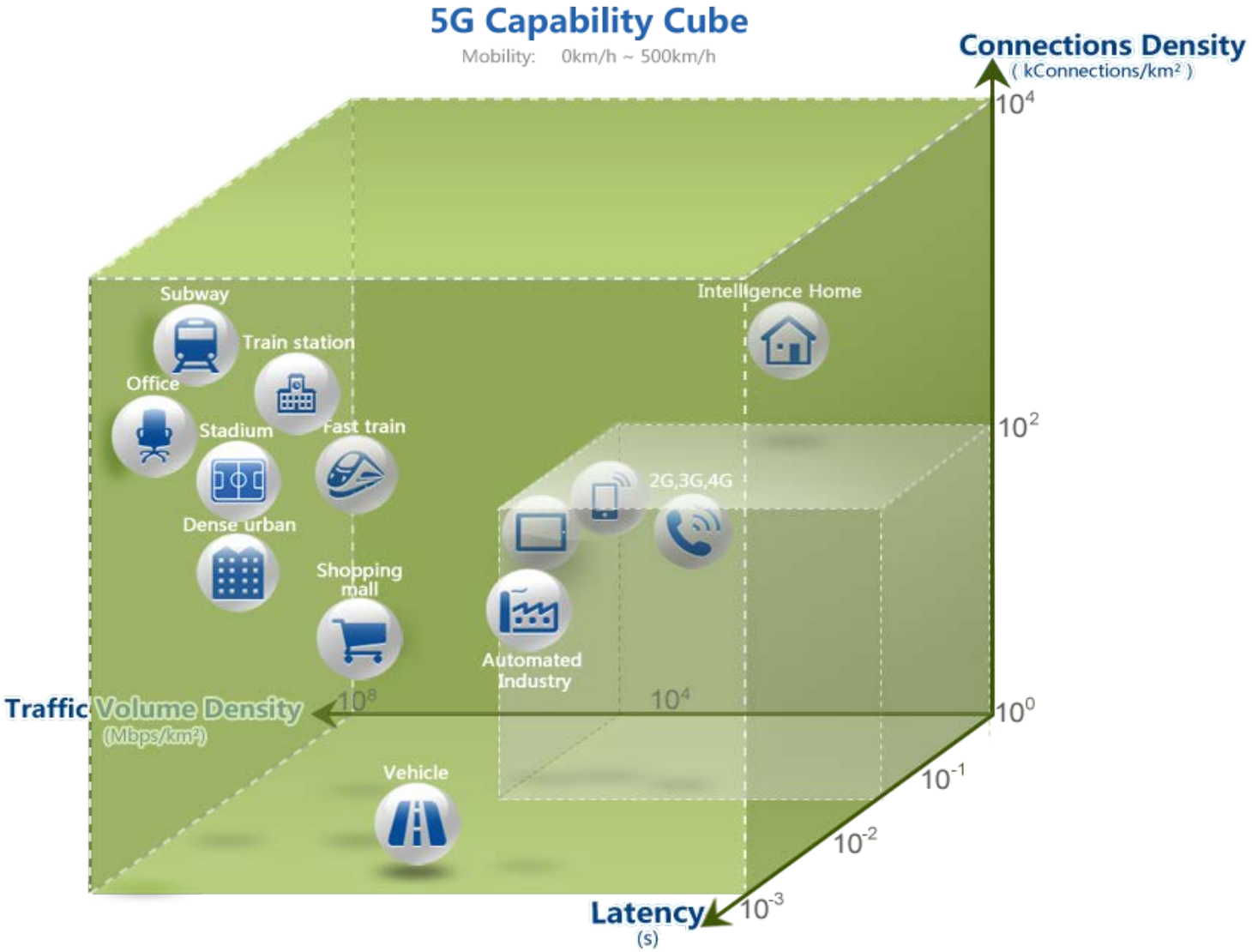
Consistent experience under diverse scenarios

More than 100 times improvement in energy efficiency and cost per bit

Key Capability and Efficiency Requirements



Capability Cube of Future IMT Systems



Thanks for your attention