

# **5G promotes the intelligence connected vehicles**

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# ICT enabled automated driving

- One of the important features of a smart car is automated driving. As far as the current industry status of vehicle research and application is concerned, there are several kinds of ways for ICT applied to the driving system.
- **(1) “laser radar + sensors” mode.** It is a kind of individual behavior, lacking overall coordination behavior of “automobile society”.
- **(2) “Visual identification + sensors” mode.** It’s easily affected by the environment, also the same as that of individual behavior.
- **(3) Vehicle to Everything (V2X) communication mode.** Vehicles can “talk” to every object all around, this way can easily let the motor vehicles follow the behavior criterion of “motor vehicle society”.
- **(4) “High precision positioning + high precision map” mode.** Also the same as that of individual behavior.
- **(5) “Big Data + Edge cloud computing + AI” to remotely control.**
- Broadly speaking, all of the above technology and technical means can be thought as some kind of **Intelligence mode**, so they can only achieve driving assistance / partial automation. Only integrating all these technologies can probably realize the full automated driving.

# Evolving network technology promotes ITS upgrading

3G/4G



## Telematics of ITS

- Route planning
- Navigation, remote diagnosis
- Multimedia downloads
  - 3G/4G Voice and data transmission
  - 100ms delay
  - 20-100Mbps transmission rate

4.5G



## BAS of ITS

- V2I, V2V, V2P to assist in driving
- Traffic safety and traffic efficiency
- Customized communication technology for V2X requirements
  - ✓ DSRC/LTE-V2X Voice and data transmission
  - ✓ <20ms delay
  - ✓ >300Mbps transmission rate

5G



## EAS of ITS

- Cooperation of vehicle, road and environment
- Safe intelligent traffic control
- Fully automated driving, e.g. Platoons
  - ◆ 5G V2X
  - ◆ <1ms delay
  - ◆ >10Gbps transmission rate

# 5G network provides guarantee for the realization of services and automated driving

**\*1ms, Edge computing**  
Car-cloud interaction  
Emergency brake  
Safety response

**Low Delay**

**High Broadband**

**\*\*Gbps level, 10x~100x**  
Real time downloading HD map  
Transmission HDV information  
HD video broadcast

eMBB: artificial intelligence + virtual reality + HD video



**High Reliability**

**Massive Connection**

**\*\*\*Nearly 100% reliability / availability**  
Seamless network coverage  
Network slicing  
Differentiated QoS

**\*\*\*\*Multi-nodes and wide coverage, 10x~100x**  
Support multi-lane, congestion scenarios  
Support massive V2X connections,

eMTC: V2X+ enhanced ITS



uRLLC: automated driving



# ICV Collaborative Innovation Labs

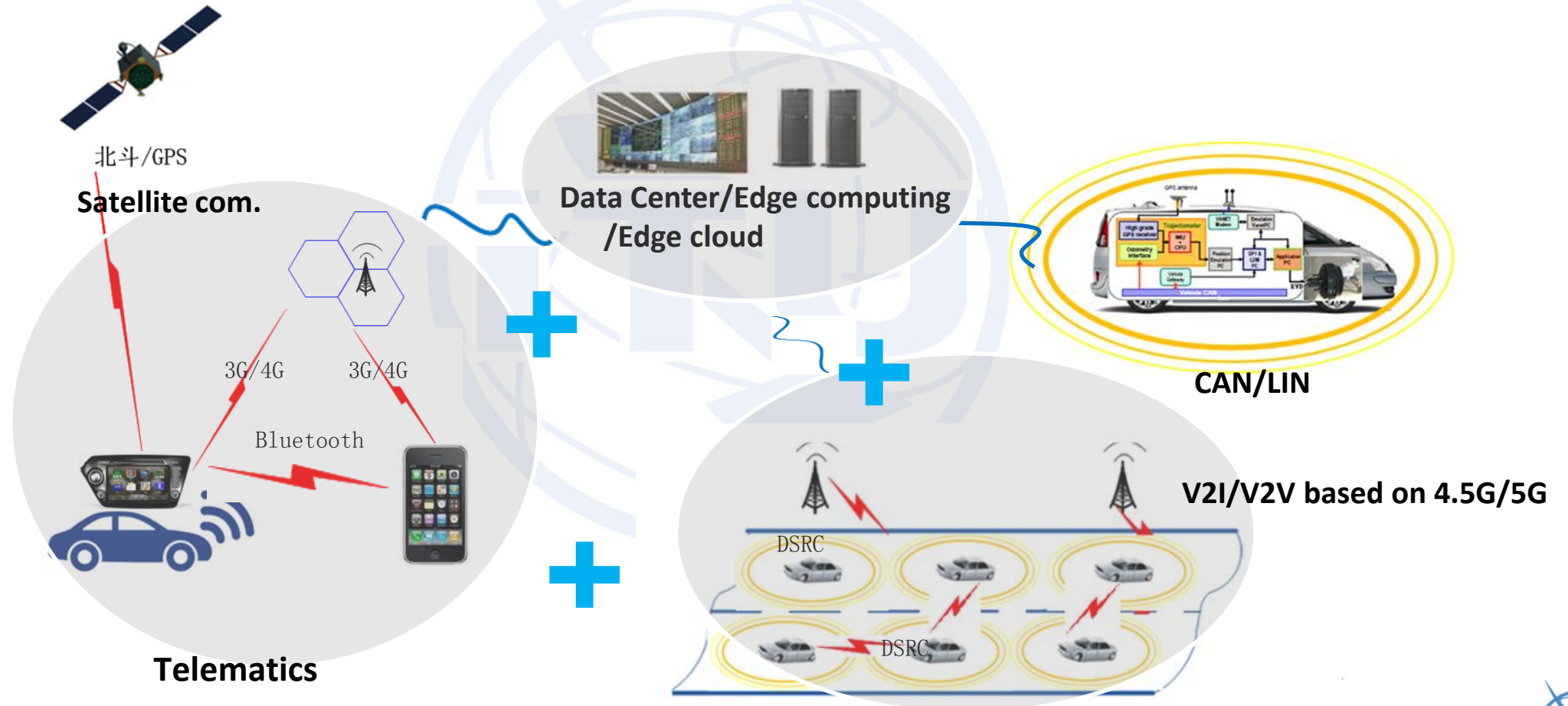


- 5G/V2X research and testing key technologies, standards development and validation
- Carry out ICV demonstration and test environment
- Research and development of innovative products for automated driving
- Provide best end to end solutions
- Establishing a win-win environment for development

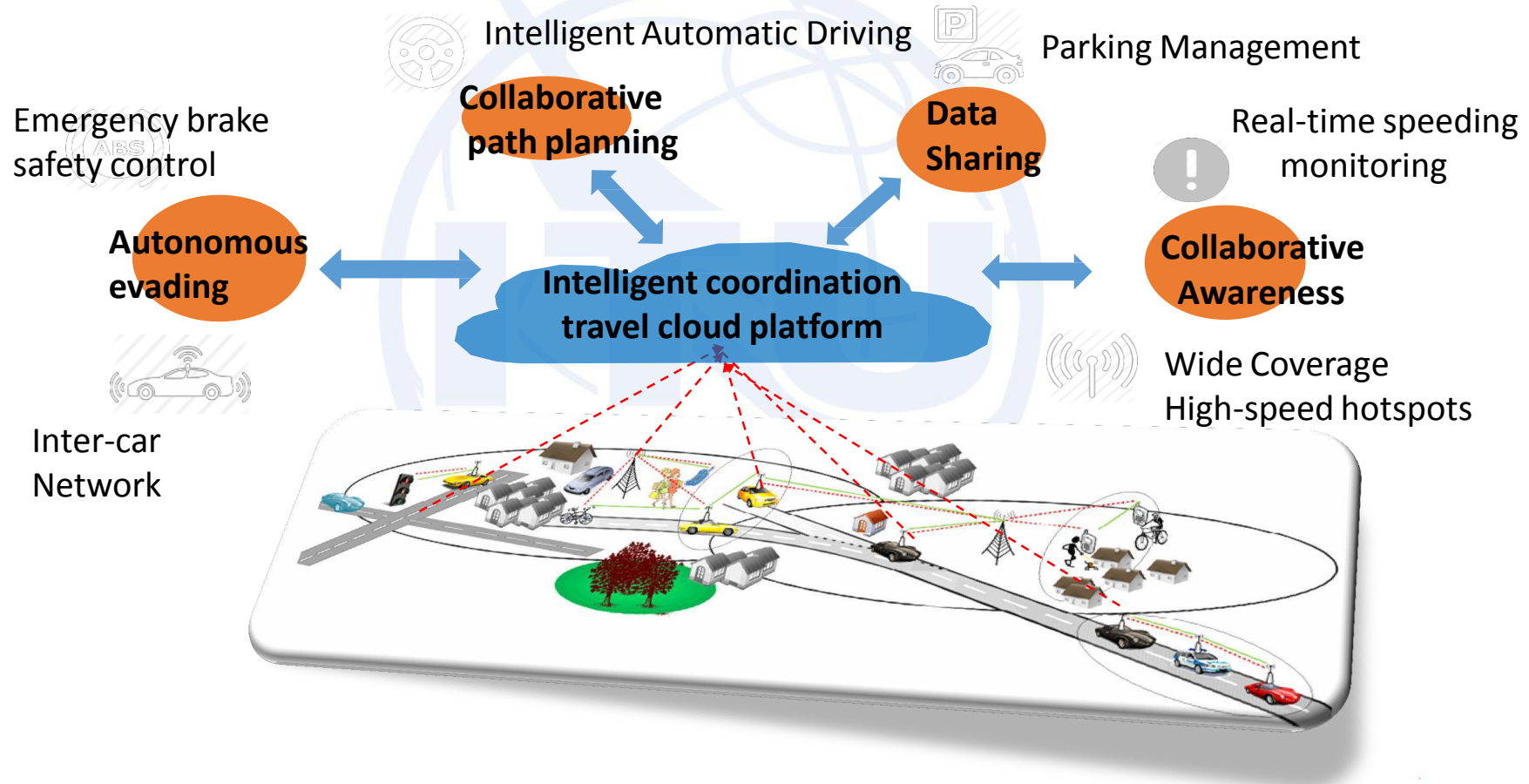
@2017/10/19 , shanghai



# Connected vehicles based on heterogeneous cooperative network

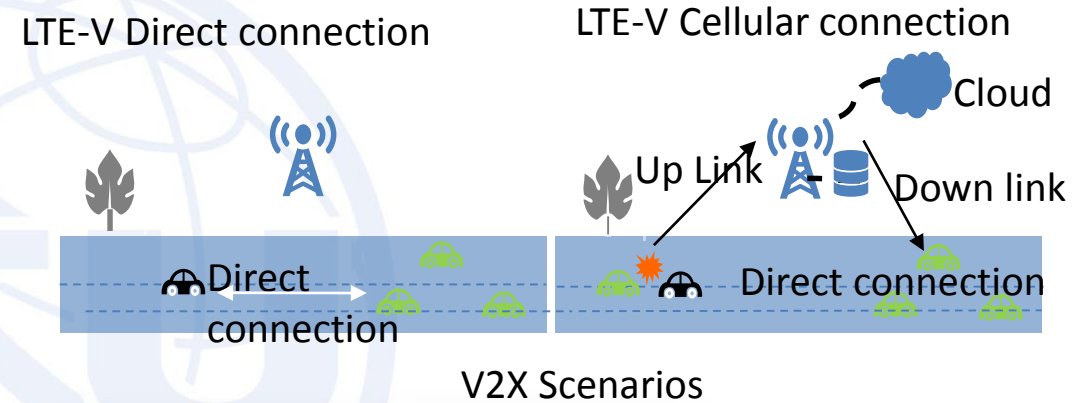


# CU Cloud services to support more intelligent travel scenarios



# Our practice - Key Technologies and Standard Research

- C-V2X
  - 5GAA Gold Member
  - LTE-V Frequency Test Project
  - Core member In China C-V2X work group
- Pre-5G V2X
  - Pr5 interface V2V/V2I -Direct connection scheme
  - eNode B Uu V2V/V2I –Cellular connection scheme
  - MEC and Multi network Cooperation
- 5G – V2X
  - leading companies for the Phase2 eV2X WI in 3GPP
  - Scenarios: Platooning, Extended Sensors, Advanced Driving, Remote Driving

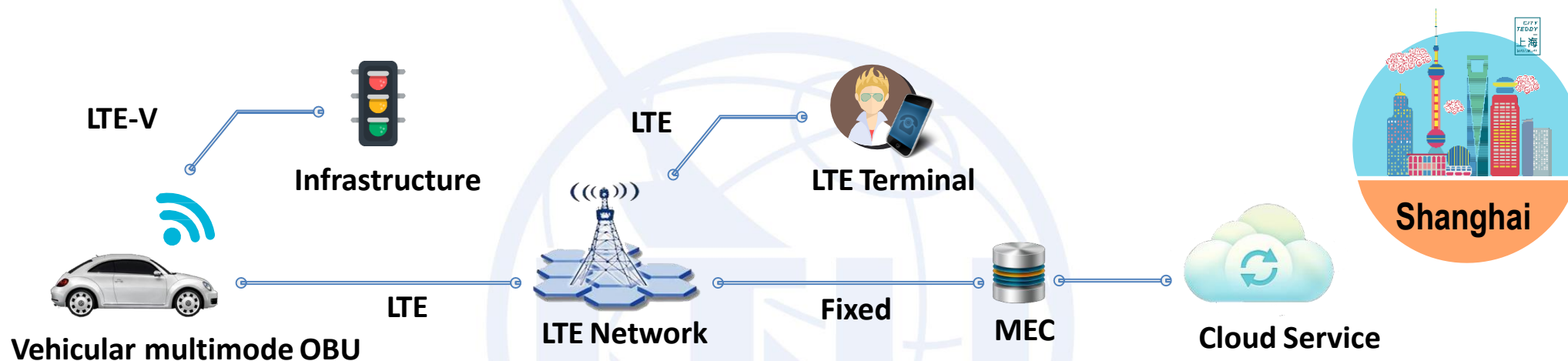


White Paper and Standards





# Practice 1 - Application Test of V2X Under Multi Protocol Condition



✓ Flexible network architecture

✓ LTE / LTE-V / DSRC Coordination

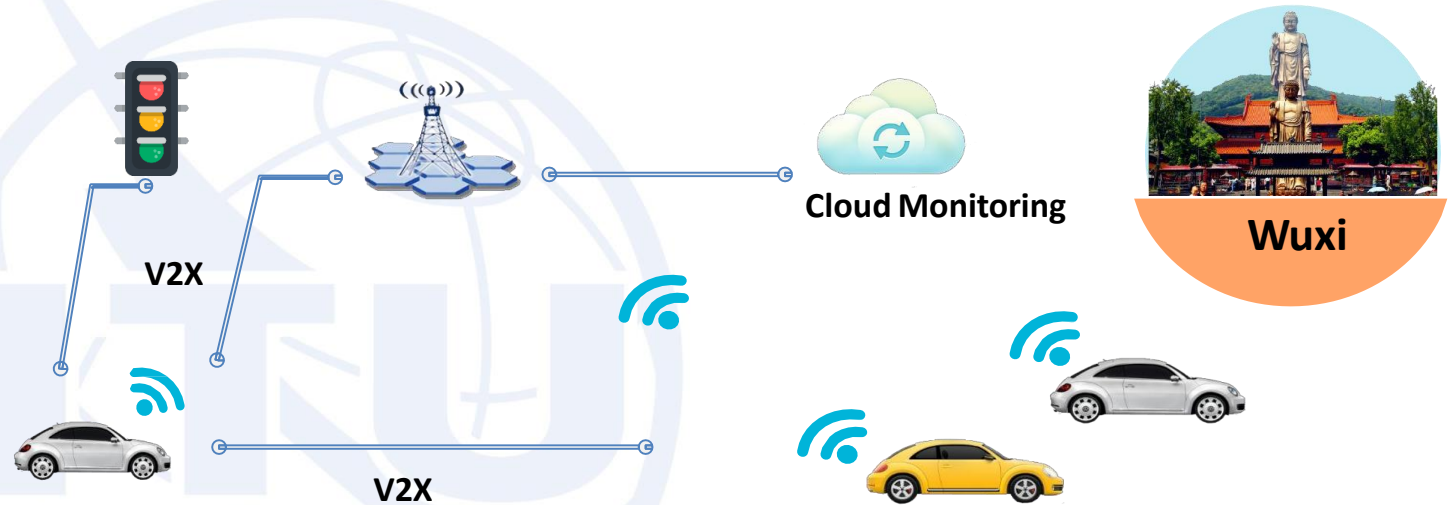
✓ Support Multi scene of V2V / V2P / V2I / V2N



The national ICV demonstration area @2017.6

# Practice 2 - Collaborative Test of V2X and Autonomous Driving

- ✓ Automatic start shift
- ✓ Automatic straight line travel
- ✓ Automatic perception of traffic lights
- ✓ Automatic curve driving
- ✓ Automatic following / emergency braking
- ✓ Automatic construction section warning



**V2X provides more effective information to the vehicle intelligent brain**

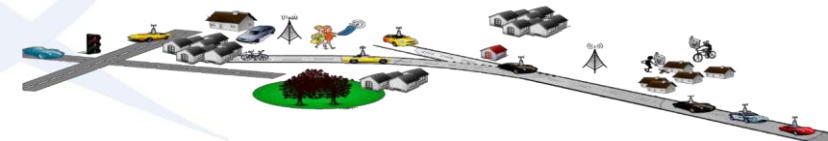
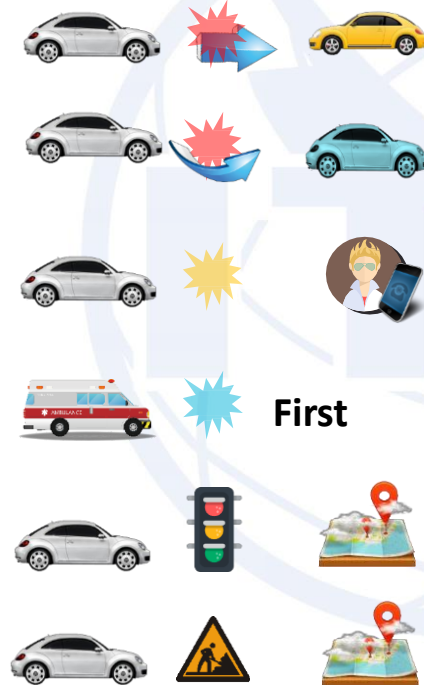


Wuxi World IOT Exposition Public open day @2017.9



# Practice 3 - More V2X Landing Scenes And Products

- ✓ Based on V2V  
Forward collision warning
- ✓ Based on V2V  
Lane change collision warning
- ✓ Based on V2P  
Emergency brake warning
- ✓ Based on V2V  
Emergency vehicle priority
- ✓ Based on V2I  
Traffic state display
- ✓ Based on V2I  
Road information tips



The 4th China International Forum on intelligent vehicles in Chengdu V2X Open experience day @2017.9

# China United Network Communications Group Co., Ltd.



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4,000 million  
terminal users



Focus on  
Industry  
innovation

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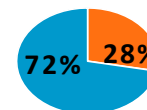
A wholly-owned subsidiary of China Unicom Group., innovation pilot enterprise; Founded in August 2015, 6 regional branches, 2 research and development centers, more than 200 employees.

- ✓ Service for autonomous driving and intelligent transportation
- ✓ Integration of communication and application scenarios
- ✓ Achieve continuous and efficient safe operation
- ✓ Provide customers and users with quality service

# Rich Operation Experiences of Professional Services

- 10 Years
- 63 OEMs

- 3 million TSP customers
- 10 million Communication customers



Service revenue  
Communication revenue

## Integrated communication services



## Call center services



## Platform integration & operation services



## Business operation services



## Online store services



# China Unicom Mixed Ownership Reform

The only pilot State-owned enterprise to adopt entire-group based mixed-ownership reform.

Large Internet Corporation

Tencent 腾讯

阿里巴巴  
Alibaba.com

Baidu 百度

JD.COM 京东

SUNING  
苏宁云商

Vertical Industry Corporation

Kuang-Chi 光启

滴滴出行  
滴滴一下 美好出行

网宿科技  
ChinaNetCenter

用友  
yonyou

宜通世纪  
EASTONE

Finance Corporate Industry Group

中国人寿  
CHINA LIFE

中国中车  
CRRC

Industry Fund

中国国有企业结构调整基金股份有限公司  
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All the business from strategic investors is highly related to the main business of China Unicom, China Unicom will cooperate in the fields of cloud computing, IoT, big data and industrial Internet, to promote the innovation of resources and service advantages.





To be the Enabler of Wonderful Carlife

Thank you for your attention.

China Unicom Smart Connection Technology Co., Ltd.

