

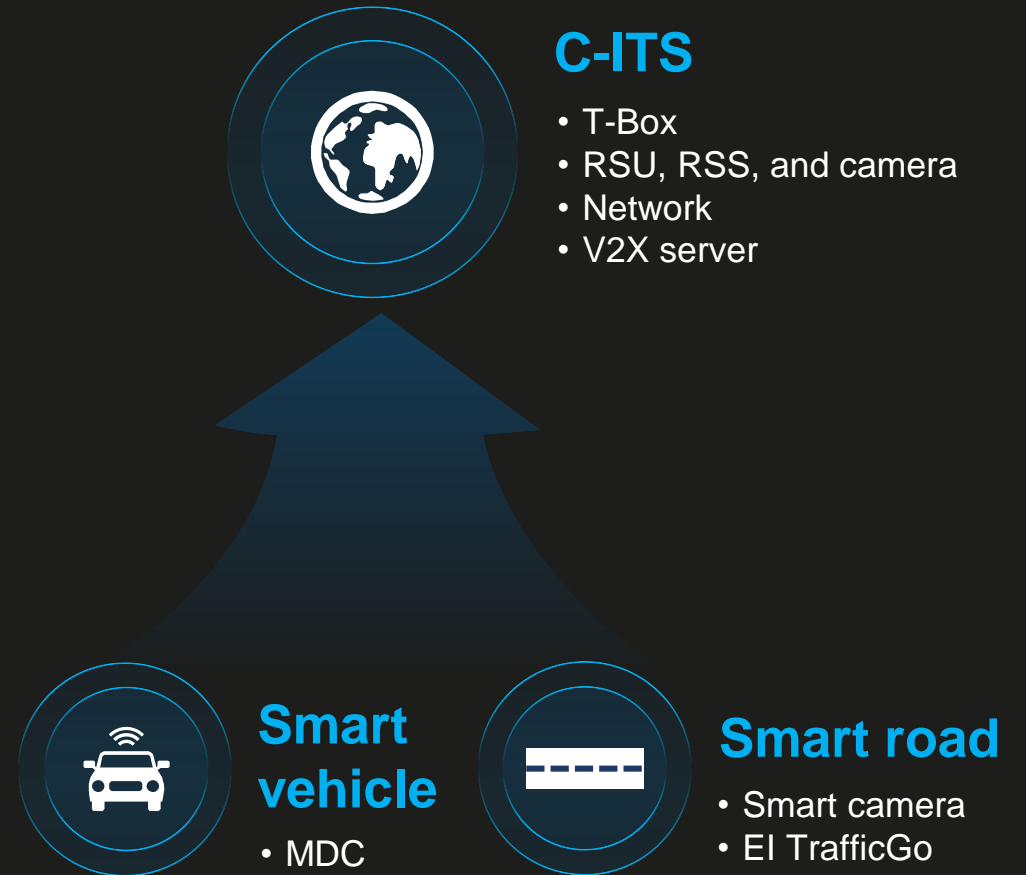
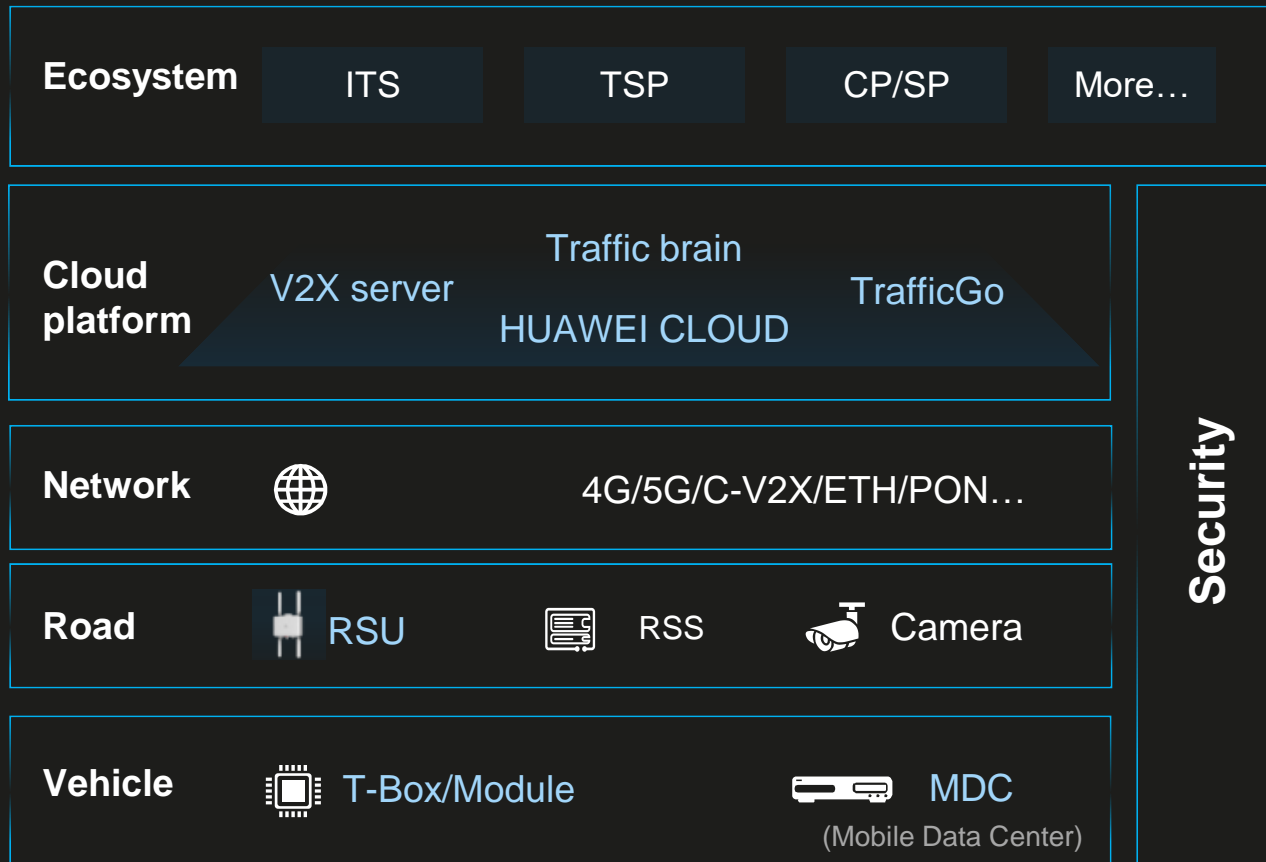


C-V2X Enables Intelligent Transportation

Jiang Wangcheng
Huawei IoT Solution President

C-V2X: Cellular Vehicle-to-Everything

Huawei Connected Vehicle Strategy: Leverage ICT to Enable Mobility Transformation, Smart Vehicles, and Smart Roads



MDC: Mobile Data Center;

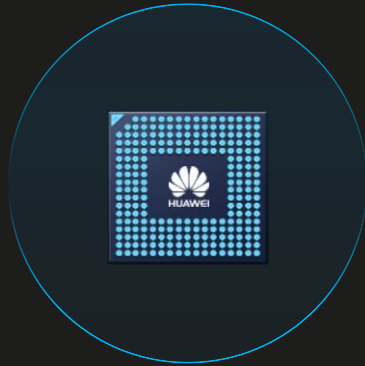
RSS: Road Side Server;

EI: Enterprise Intelligence;

Huawei C-V2X Devices Support OEM and Aftermarket Solutions

Consolidated tech / Open architecture / Smooth evolution / Excellent performance

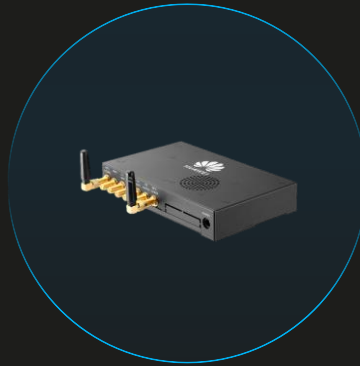
C-V2X chipset (Balong 765)



All-in-one Uu + PC5 + AP

- 3GPP Rel. 14
- Downlink peak rate: 1.6 Gbit/s
- 4CC CA + 4x4 MIMO
- 2CC CA + 8x8 MIMO
- DL 256 QAM

OBU (T-Box)



V2X APIs for secondary development

- Develop V2X applications on the T-Box using Huawei APIs for differentiated design.
- Huawei provides GNSS, V2X stack, Vehicle, and Sensor APIs.

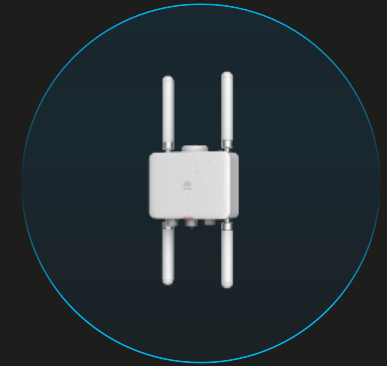
V2X antenna



Performance optimization

- V2X PC5 5.9 GHz RF performance optimized to deliver omnidirectional coverage, with at least 300 meters of direct coverage and at most 1200-meter LOS

RSU



World's first Uu + PC5 concurrency

- 4 kg | 3.5 L | 26 W | 23 dBm
- Uu + PC5 communication encryption
- BDS and GPS dual positioning systems
- Wired and wireless deployment modes

Product Roadmap for Huawei C-V2X Devices

Now

2019

2020

2021

Chipset



Balong 765

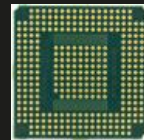
- 3GPP R13/14 LTE Cat16/19
- LTE-V2X



Balong 50xx

- 3GPP R16 5G NR
- C-V2X

Module



ME959

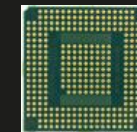
★ March 2019

Marketing sample



★ December 2019

C sample



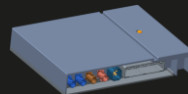
MH5xxx

52 x 52 mm

R16, 5G NR, LTE, C-V2X
E-Call, Open CPU, Ethernet

T-Box

LTE-V Concept Box



DA2300

★ June 2019

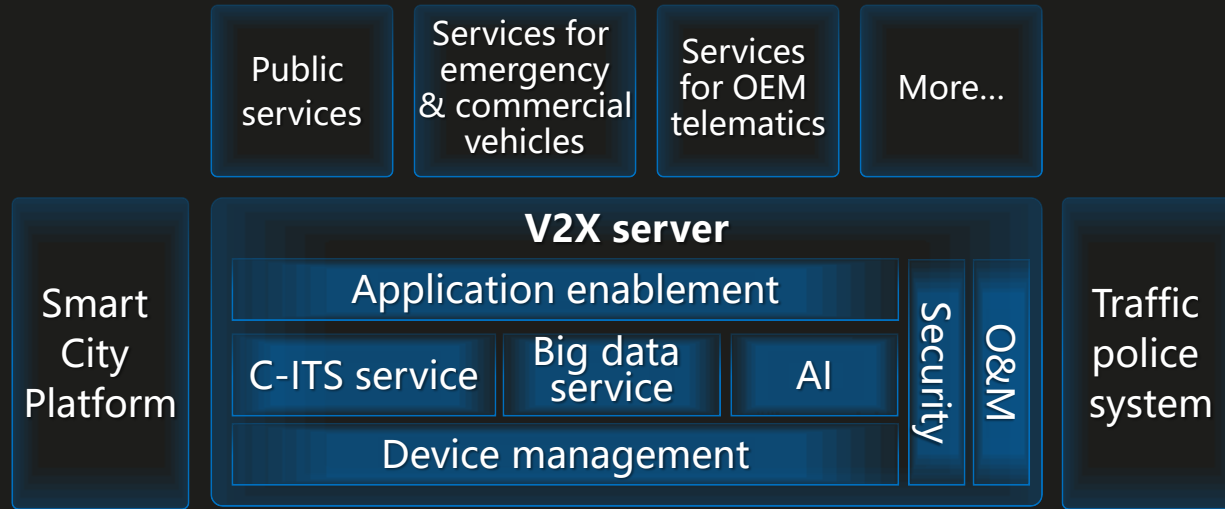
Marketing sample



★ March 2020

C sample

V2X Server, Smart Brain for C-ITS



Trust & reliable

- Link encryption, certificate interaction, and abnormal behavior recognition
- Geographic redundancy, delivering 99.999% reliability

Proactive maintenance

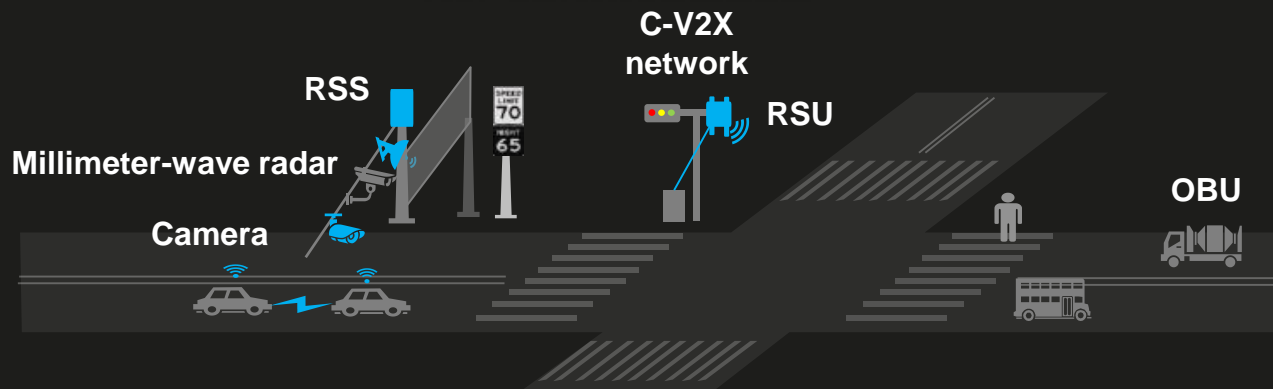
- Proactive maintenance on the entire network
- Quick fault locating and demarcation

Collaboration with Smart City

- Sharing the same technical stack with the Huawei Smart City Platform
- Collaboration with environment monitoring and street lamp management

Open ecosystem

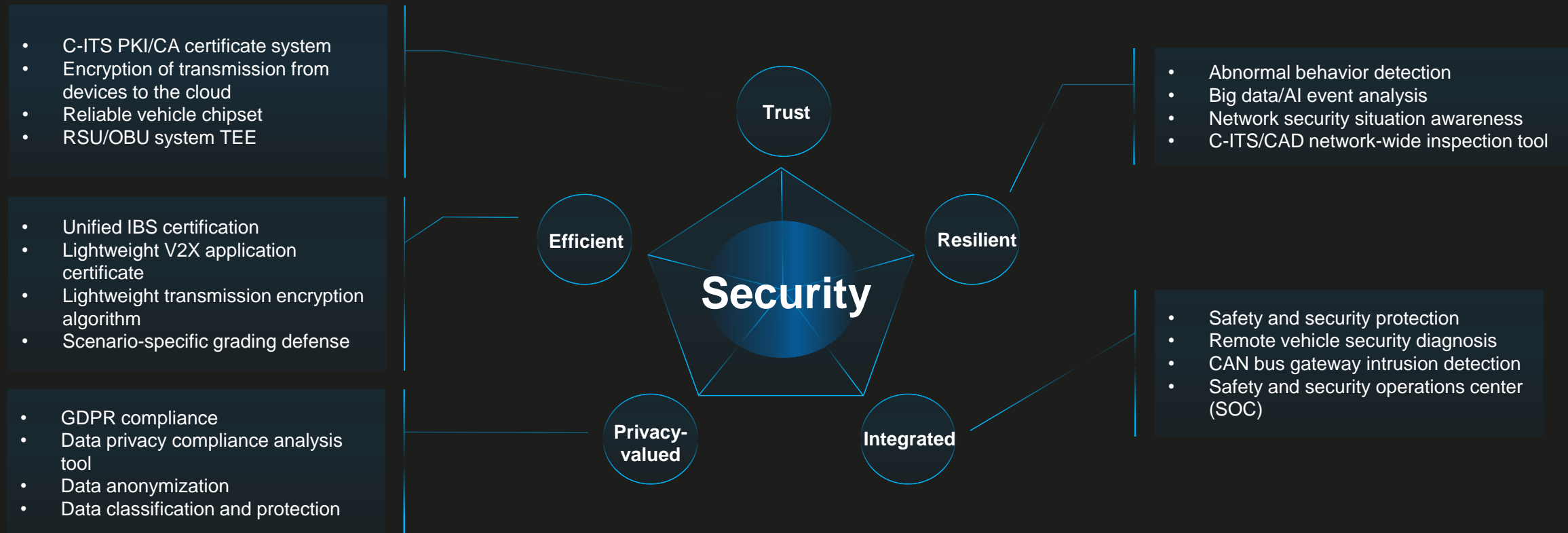
- Open stack, big data, and AI capability
- Third-party algorithm deployment framework



Build Trust, Resilient, Privacy-valued, Integrated, and Efficient Security Architecture

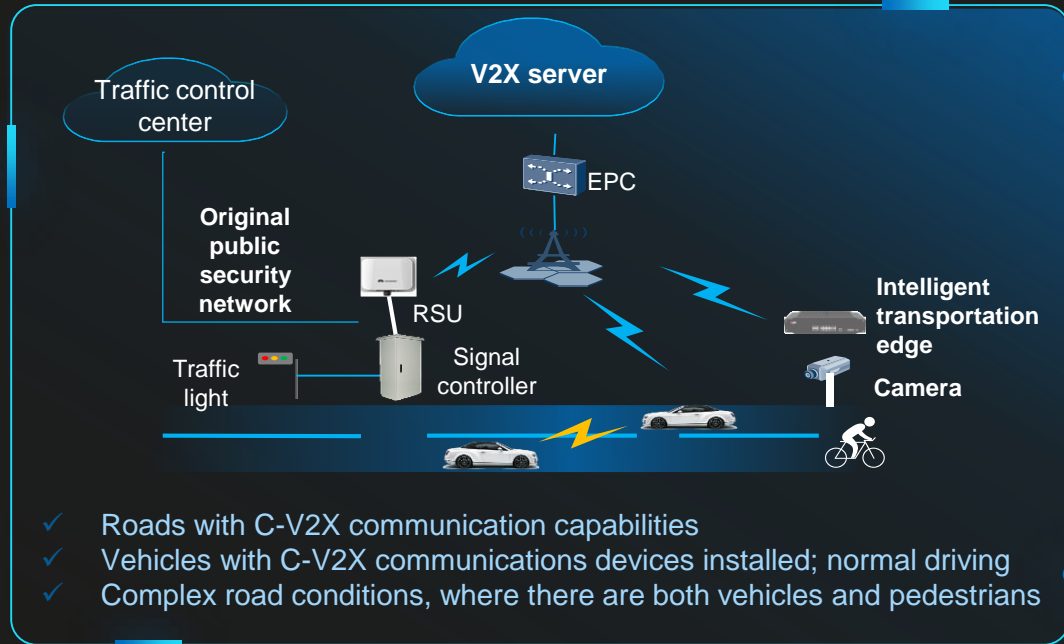
Build trust, resilient defense architecture to deliver high safety and security.

Scenario-specific grading defense resolves security and efficiency issues while complying with privacy requirements.



City: China's First Urban C-ITS Demonstration Project

Urban C-ITS architecture



Offer 18 V2X use cases to improve traffic safety and efficiency



Partners



Traffic Management
Research Institute, MPS



Wuxi Traffic
Police



China
Mobile



Huawei



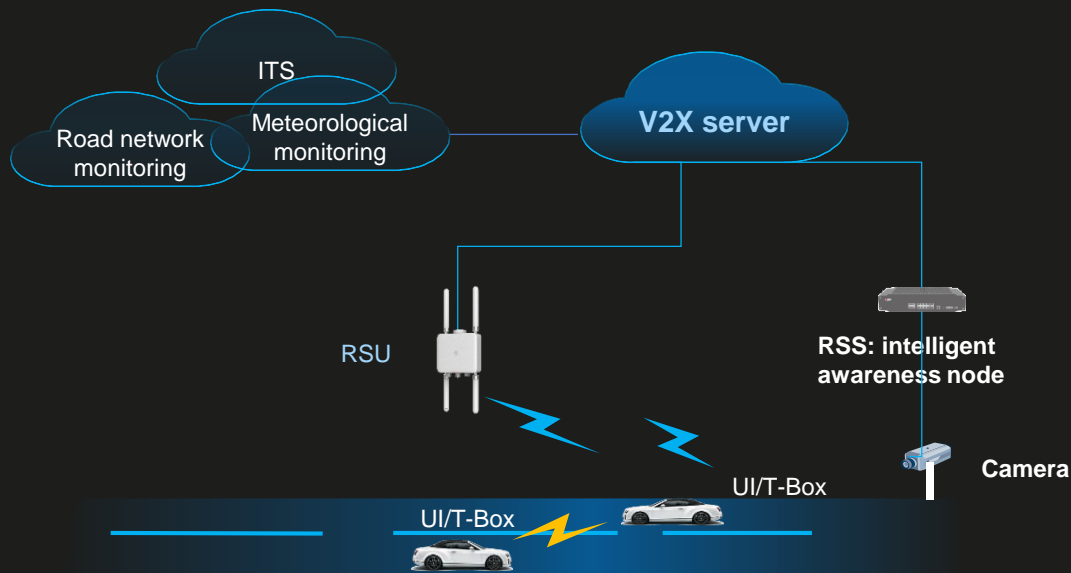
CAICT



TIAN-NET

Highway: China's First Cooperative Automated Driving on Highways

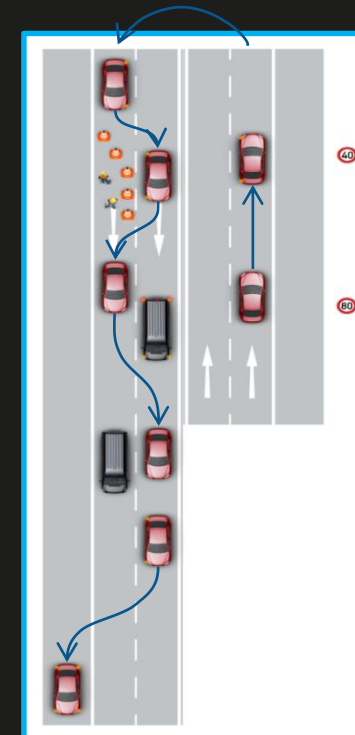
Highway C-ITS architecture



- ✓ Some highway sections with C-V2X communication capabilities
- ✓ Vehicles installed with C-V2X communication devices; driving at high speed
- ✓ Closed road

Use V2X to identify scenarios requiring deceleration and trigger vehicle response

- 2 Reduce speed and change lanes to avoid road construction
- 3 Change lanes for overtaking
- 4 Pull over for emergencies

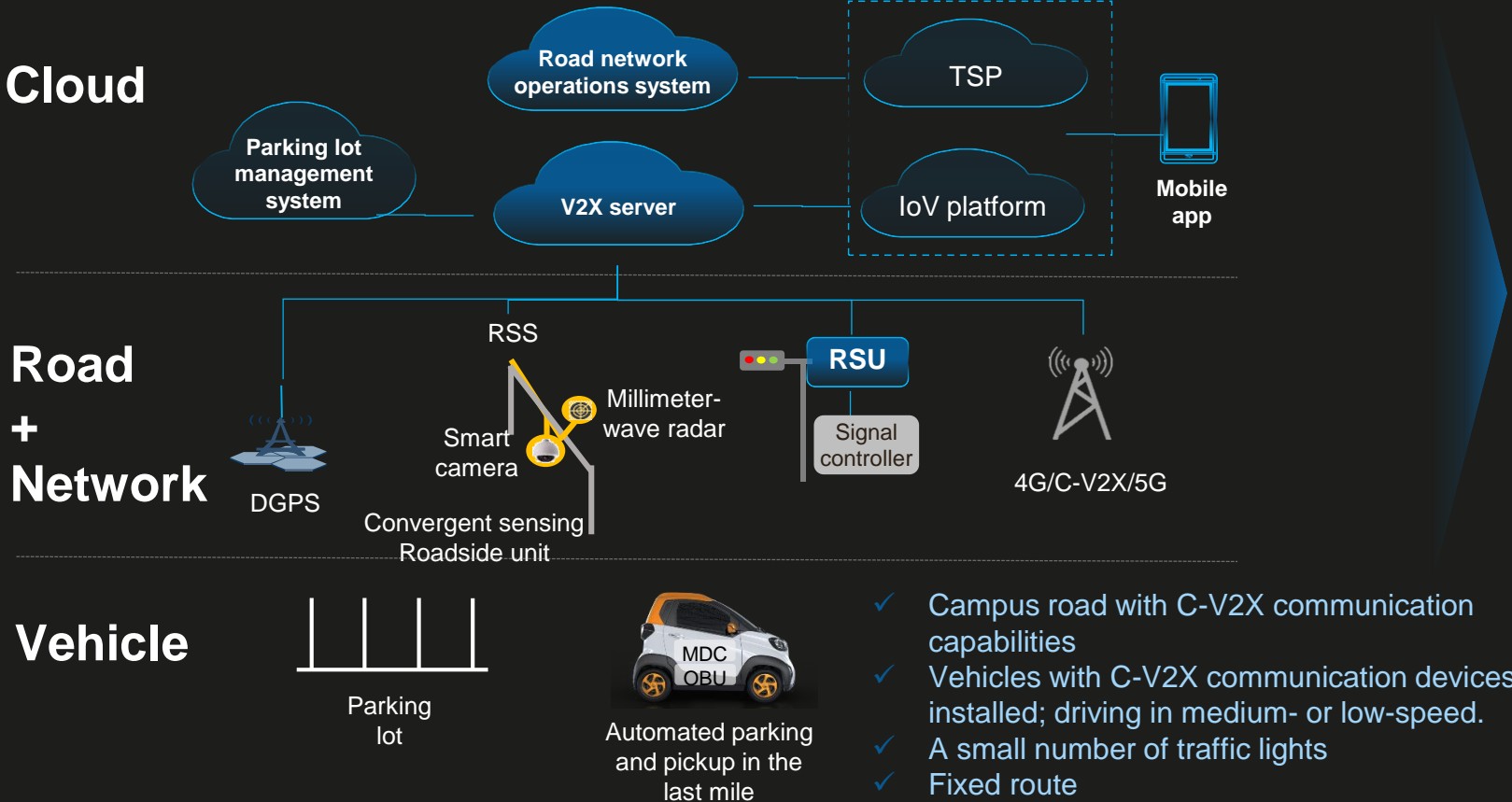


- 1 Speed limit sign recognition and response (V2X)



Campus: Smart Roads and Smart Vehicles Enable Automated Parking and Pickup in the Last Mile

C-ITS architecture in medium- or low-speed scenarios in the campus (in planning)



Mobility:
Automated parking and pickup in the last mile



Logistics: unmanned delivery vehicle

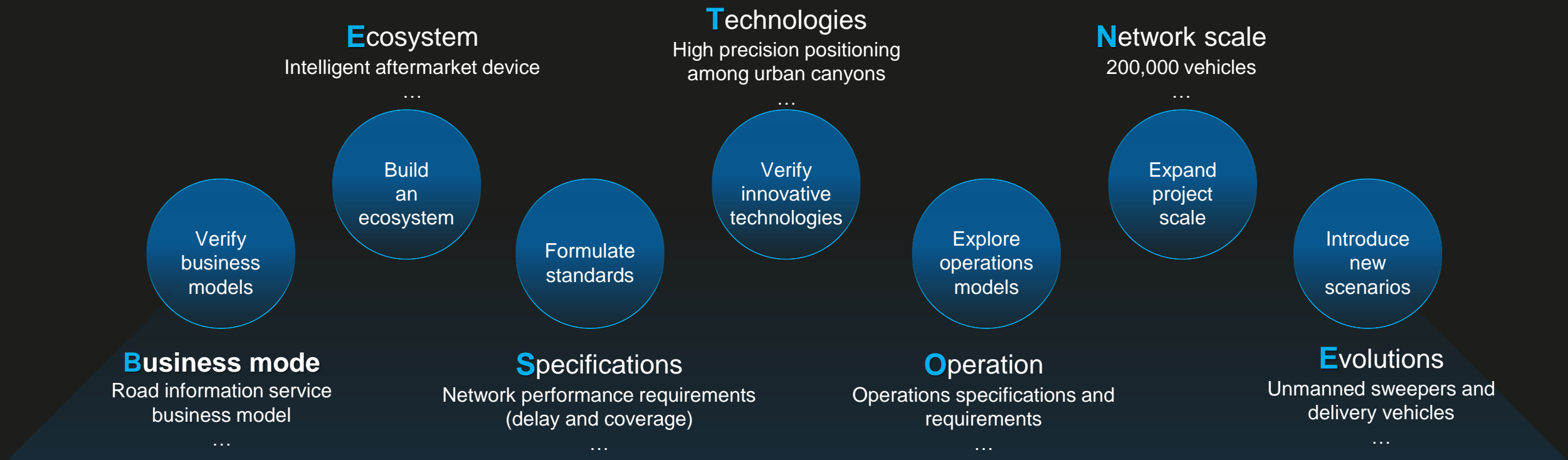


Sanitation:
unmanned sweeper



How Do We Prepare for the Commercial Use of C-V2X in 2020?

- Vertically: Put the top use cases into commercial use to lay a foundation for large-scale commercial use.
- Horizontally: Evolve new functions to stimulate OEM and aftermarket markets.



TO BE THE **BEST ONE**

China Policies and Industry Force Boost C-V2X

Rising to Chinese standards

- LTE-V2X standards rise to national standards in China. LTE-based Vehicle Networking Wireless Communication Technology
- General Technical Requirements
 - Technical Requirements of Air Interface
 - Technical Requirements of Message Layer
 - Technical Requirements of Security
 - Technical Requirements of System

Cooperation between four standards committees

On November 17, 2018, the standards committees of automotive, ITS, and road traffic announced that the communications industry standards would be used for the content related to basic communication.



Release the 5.9 GHz direct-link frequency band

- Administrative Regulations on Use of Frequency Band 5905-5925 MHz in Direct-Link Communication of Internet of Vehicles (Intelligent Connected Vehicles) (Trial)
- Allocated the 5905-5925 MHz band as the dedicated frequency band to be used for direct-link communication technology for intelligent connected vehicles using LTE-V2X technology.

Interoperability test

- Test cross communication modules, in-vehicle devices, and vehicles
- Module: Huawei, Datang, and Qualcomm
 - Device: Huawei, China TRANSINFO, Neusoft, and other five manufacturers
 - Vehicle: 11 automotive OEMs



Jointly Promote the Construction of the C-ITS Standard System

Based on C-ITS, focus on the development of four types of standards to prepare for the large-scale commercial use of C-V2X.

Interconnection standards

Build a foundation for streamlining service flows.

- Air interface application message set
- Interface between V2X entities and ITS devices
- Interfaces between V2X products

Service and application standards

Quantify performance indicators and test specifications in application scenarios.

- Forward collision warning
- Crossroad collision warning
- Second collision warning
- Speed guidance at intersections
- Red light warning
- Collaborative adaptive cruise

Product standards

Develop product specifications for batch production.

- OBU
- RSU
- RSS
- Radar
- Camera
- ESU

Security standards Lay a foundation for trust and reliability.

Basic security standards

- Data interface for C-ITS exception detection
- Classification of IoV information security levels
- General standards for C-ITS OTA security upgrade
- IoV GDPR evaluation criteria

Communication security standards

- V2X security certificate management regulations
- C-ITS PKI digital certificate format
- V2X security application interface specifications
- V2X security test implementation specifications

Basic ICT Capabilities Support Connected Vehicle Ecosystem and Promote the Development of Intelligent Transportation

- Vehicle sensors
- DbW technologies
- Aftermarket OBUs
- HMIs

- Roadside sensors
- Intelligent traffic lights

- Algorithms
- High-precision maps

ITS ISVs

- Mobility
- UBI



Basic ICT capabilities

Chipset, module, mobile data center (MDC), communication module, network, IoT platform, and HUAWEI CLOUD

Huawei C-ITS Vision

- Enable bi-directional interaction between vehicles and roads to become the standard configuration, and infrastructure.
- Use technologies to prevent and restrict unsafe behavior, reduce the accident rate, and improve the controllability of safety.
- Carry out smart traffic management to improve road traffic safety and efficiency.
- Evolve normal automatic driving to use vehicle-road cooperation, and reduce the cost of relying on the vehicle as the sole provider of sensing information.

