

# Expanding Connections & Exploring Industries - The ICT Infrastructure for IoT

Yongjing Zhang

IoT Standard Chief Expert

Cloud Core Network BU

Huawei Technologies Co., Ltd.



# Focus on the ICT Infrastructure to Enable IoT



## Expanding Connections, Exploring Industries

- **Chipset + IoT OS:** Reduce IoT device costs and improve development efficiency
- **Network:** Optimize network connectivity performance
- **IoT Platform :** Facilitate device management & application enablement
- **IoT big data:** Create industry value

## Huawei Does Not

- Provide industry devices
- Develop IoT applications
- Integrate E2E IoT solutions

# Smart City

---

Address Key Issues for Large Scale Commercial Use  
Combine Cloud Services with Industries to Create Value

# Barriers to the Development of Smart Cities

Lack of  
an optimal connection technology  
for things



*High cost*

*Limited coverage*

*Low battery life*

*Low security*

Lack of  
an unified IoT platform for  
multiple industries



I/F1

I/F2

I/F3

I/F4

I/F5

I/F6



Lack of  
a mutual beneficial business  
model

Citizen

Enterprise



Telco

Government

# NB-IoT Is Now in the Large Scale Commercial Deployment Phase

**50**million

connections

**14**

Vertical apps of  
scaled commercial  
use

**50+**

Vertical apps of  
commercial pilots

...



Smart smoke detector  
**5 million connections** by  
the end of this year



E-bike supervision  
**3 million connections**  
by the end of this year



Smart gas  
**8 million connections** by  
the end of this year

...

# Work with Carriers to Resolve Critical Network Issues and Improve Network Performance

## Coverage planning

### Coverage estimation

Coverage simulation

Coverage threshold

Propagation model

Penetration loss

Base station, antenna, and device

Engineering parameters

### Device power consumption estimation

Chipset power consumption estimation

Service transmission Power consumption

Data flow duration

## Access success rate

### Peak load shifting

Base time + (device No. x ratio + x )

0 clock                      Minute-level                      Second-level

### Backoff at BS



+ Backoff time 1



+ Backoff time 2



+ Backoff time 3

## Remote upgrade

### FOTA upgrade

#### LWM2M based differential upgrade



Boudica 150



LiteOS



OceanConnect IoT Platform

### SOTA upgrade

#### IP based differential upgrade



MCU



LiteOS

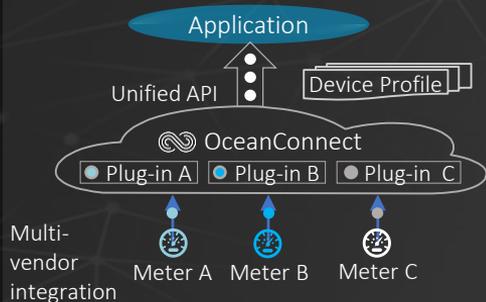


OceanConnect IoT Platform

# OceanConnect IoT Platform Enables Fast and Large Scale Deployment

## Fast device development

### Decoupling between device & app



### Coding-less program for plug-in & profile

```
{  
  "name": "FactoryCode2",  
  "boxId": 0,  
  "isAddr": false,  
  "type": "int16u",  
  "id": "0x02",  
  "lengthType": "",  
}
```

Coding



Drag & drop

Device integration from 1 week to 1 day

## Simplified vertical adaptation



### More device access

Free of heart beat, battery saving and network resource saving



### Faster command delivery

Unlock time from 7 seconds to 2 seconds



### Better flow control

Flow control to assure massive devices successful access, avoid message lose



### More power saving

Longer battery lifecycle:  
4 years (DTLS) → 10 years (DTLS+)

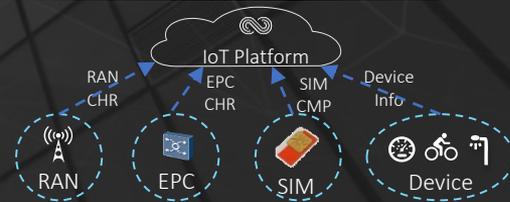
## Improved DM efficiency

### LwM2M & Cloud Interworking Gateway



Simplify device production & distribution

### E2E trouble shooting



Precision diagnosis helps quickly engage responsible party

# Improves Municipal Efficiency of Public Utility Management

12 use cases in scale

35+ use cases in pilot

## Water Metering



- 99.5% metering success rate
- 15.7% → 11% leakage reduction

## Smart Parking



- 1.43 → 3 rotation ratio
- Revenue loss prevention
- Less traffic

## Smart Lighting



- 90% → 97%+ light-on rate
- 30% extra energy saving

## Environment Protection



- Air Quality Index: 76.7% → 80% (days/year)

...

## Sharing Bicycles



- 2 years battery life
- Green transportation

## Fire Detection



- 90% cost reduction
- Mortality rate: 0.21 per 100K

## Smart Fire Hydrants



- 80% cost reduction
- Safety satisfaction index: 80% → 100%

## Smart Manhole Covers



- 60% cost reduction of inspection & maintenance
- Public security

# 1st NB-IoT Smart Town in China – Yingtian, Jiangxi Province, China



- **1.34** Million population
- **970** NB-IoT stations covering the whole city
- **100,000** Connections
- **30+** Commercial cases deployed by end 2017
- Built within **1** year



65,000

Water Meters



2,000

Street Parking



10,000

Street Lights



3,000

Smoke Detectors



10,000

Water Filters



Manhole  
Covers



Sharing  
Bikes



Shoe-pad

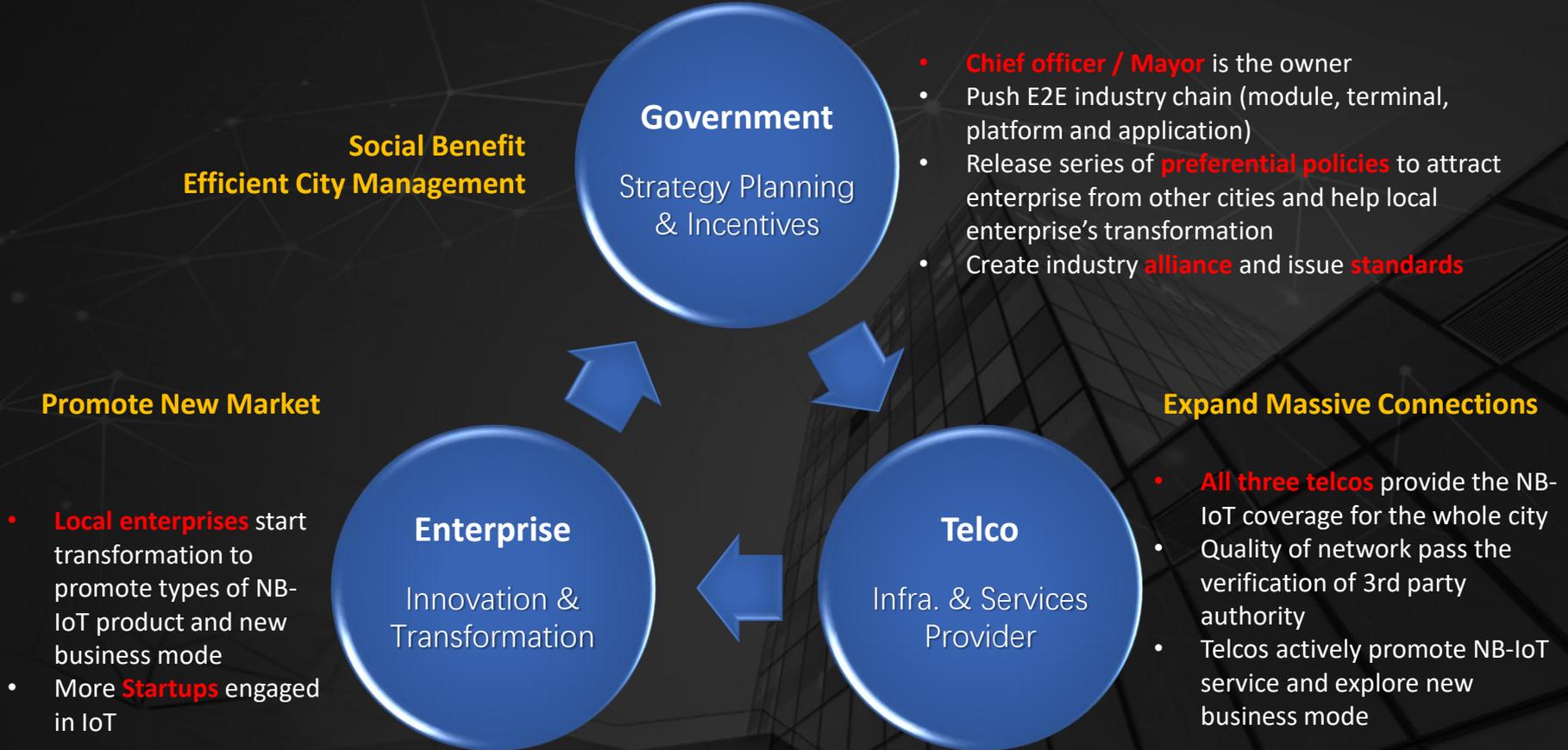


Environment  
Monitoring

MWC2018 - GSMA Award for "Best Mobile Innovation for Smart Cities"



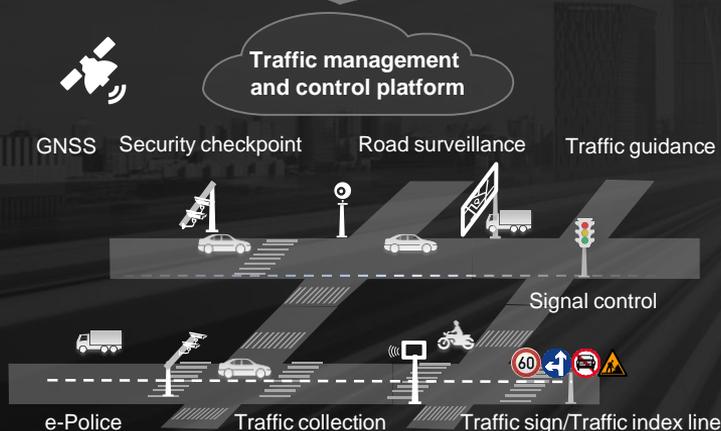
# The Innovation Framework of Yingtian



# Connected Vehicle & Smart Transportation

Vehicle-Road-Network Co-operation Enables Evolution to  
Cooperative Intelligent Transportation and Smart Mobility

# Traffic Supervision and Law Enforcement Are the Main Purposes of the Current ITS, Leaving a Space for Industry Upgrade



	Road safety	Traffic efficiency	Traffic law enforcement	Information flow
Security checkpoint			✓	↑
Road surveillance		✓	✓	↑
Traffic guidance		✓		↓
Signal control	✓	✓	✓	↓
Traffic broadcast	✓	✓		↓
Traffic sign	✓	✓	✓	Static
Traffic index line	✓		✓	Static
Traffic collection		✓		↑
e-Police			✓	↑
Commercial vehicle supervision	✓		✓	↑

- 1** Insufficient road information
- 2** Non-real-time road conditions
- 3** Asymmetrical vehicle and road information

**Vehicle-road cooperation improves traffic safety and efficiency  
It is the evolution direction of intelligent transportation systems**

# Connected Vehicle & C-ITS Development Nurtures Industry Opportunities

**CNY 15 trillion**

Total investment in transportation during the 13th Five-Year Plan by 2020

**230,000 km**

Estimated freeway mileage in China by 2022

**140,000+**

Estimated urban intersections in China by 2022

## Device

- OEM: HU, etc
- Aftermarket: rear-view mirror, HU, HUD, etc

## HD Map / Positioning

- Positioning in centimeters
- Lane level map

## OBU / Edge / Network / Cloud



HUAWEI

## aPaaS

- Machine vision
- Traffic analysis and prediction algorithm
- Real-time traffic control algorithm

## APP/ISV

- Urban ITS
- Freeway ITS
- App

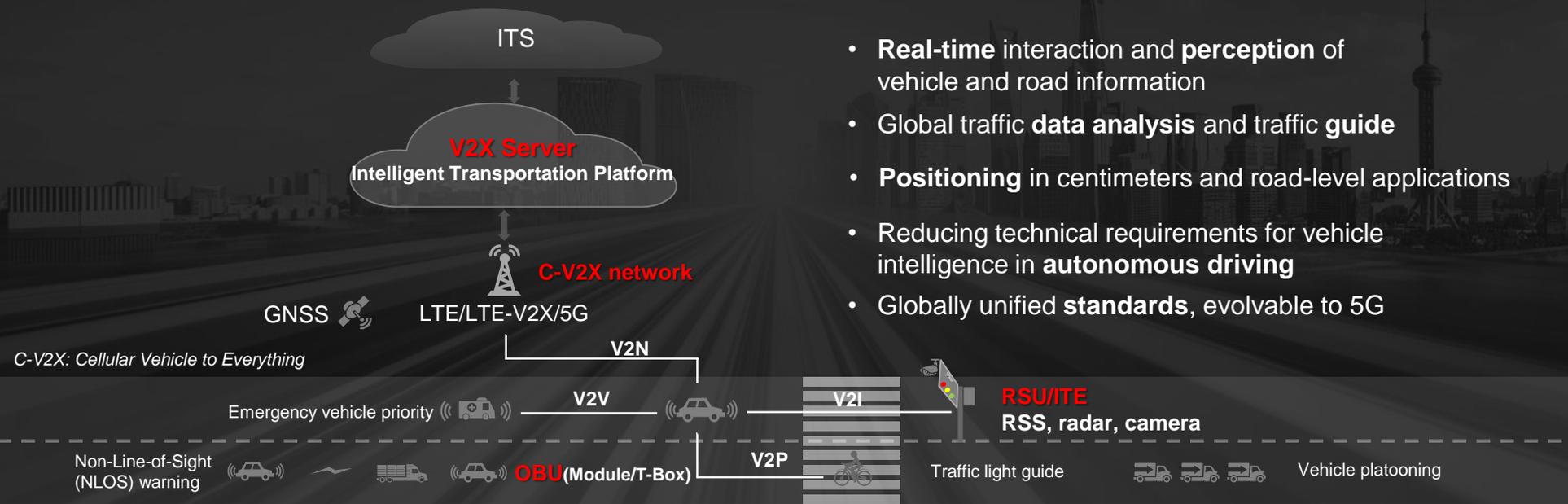
# Builds a Cooperative Intelligent Transportation System That Features Vehicle-Road Cooperation Based on C-V2X

**1** *Improve driving safety*  
Warnings for 96% of accidents

**2** *Improve traffic efficiency*  
15%+ efficiency improvement

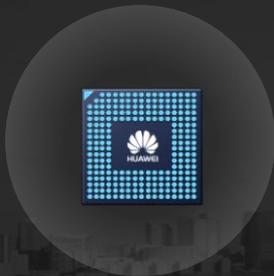
**3** *Enable cooperative autonomous driving*  
One-click ride hailing, vehicle platooning

- **Real-time** interaction and **perception** of vehicle and road information
- Global traffic **data analysis** and traffic **guide**
- **Positioning** in centimeters and road-level applications
- Reducing technical requirements for vehicle intelligence in **autonomous driving**
- Globally unified **standards**, evolvable to 5G



# Commercial-Ready Chipset, Vehicle-Side, Road-Side, and Platform Products

## C-V2X chipset (Balong 765)



- C-V2X feature
- PC5 + Uu concurrency
- Mode 3 + Mode 4
- MBB feature
- 3GPP Rel. 14
- Downlink peak rate: 1.6 Gbit/s
- 4CC CA + 4x4 MIMO
- 2CC CA + 8x8 MIMO
- DL 256 QAM

## OBU Module/T-Box



- T-Box recognized by many automotive enterprises
- Advantages of C-V2X and 5G



## RSU



- World's first Uu + PC5 concurrency
- Uu + PC5 communications encryption
- BDS and GPS dual positioning systems
- Wired and wireless deployment modes

## V2X server



- Layered deployment
- Positioning in centimeters
- Third-party algorithm deployment framework
- Evolution to cooperative autonomous driving

# Accelerates the Global Commercial Process for C-V2X

**C-V2X has been verified and tested globally**

**China's Ministry of Industry and Information Technology released the 5.9 GHz commercial spectrum at the end of June 2018**

**Excellent road test performance**

<p>Germany</p> <p>500km/h Relative Speed Test Fulfilled</p>	<p>Pan-European test</p> <p>TestBed For More Vehicle Maker / Tier1</p>	<p>Chongqing</p> <p>5.9GHz Direct link spectrum CAERI / STRC Field Trial</p>	<p>Beijing</p> <p>3GPP Terminal / RF/ Baseband requirements fulfilled</p>
---	--	--	---

500 km/h Relative speed	> 600 m Reliable communication distance
< 20 ms Low latency	> 2000/km <sup>2</sup> High density

## Wuxi: First city-level commercial project in the world

City-level coverage deployment 220+ traffic lights 100,000 vehicles



## C-V2X Application Demonstration Project

Phase I (2017)

C-V2X open road technology verification

Phase II (2018)

C-V2X city-level commercial use

Phase III (2019)

Regional replication

# Standardization & Ecosystem

Build Open Ecosystem based on Common Standards

# Join Hands with Vertical Industries to Develop IoT Standards and Build E2E Open Ecosystems

	City	CV/ITS	Industrial	Home	
	  	 	 	 	
	  	 	 	 	
	  	 	 		
Platform		 	 	 	 
Network		 		 	
Device					
Security		 		 	

# Thank you.

把数字世界带入每个人、每个家庭、  
每个组织，构建万物互联的智能世界。

Bring digital to every person, home and  
organization for a fully connected,  
intelligent world.

Copyright©2018 Huawei Technologies Co., Ltd.  
All Rights Reserved.

The information in this document may contain predictive statements including, without limitation, statements regarding the future financial and operating results, future product portfolio, new technology, etc. There are a number of factors that could cause actual results and developments to differ materially from those expressed or implied in the predictive statements. Therefore, such information is provided for reference purpose only and constitutes neither an offer nor an acceptance. Huawei may change the information at any time without notice.

Huawei Confidential

