Expanding Connections & Exploring Industries - The ICT Infrastructure for IoT

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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

OceanConnect IoT Platform

IoT cloud services

V2X server

Chipset (Boudica | Balong)

Huawei LiteOS

OBU

EC-IoT

NB-IoT / eMTC / eLTE / C-V2X / 5G
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

Lack of a unified IoT platform for multiple industries

Lack of a mutual beneficial business model

High cost
Low battery life
Limited coverage
Low security
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
  - Propagation model
  - Base station, antennas, 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

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<td>Device integration from 1 week to 1 day</td>
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- **Multi-vendor integration**
- **Coding-less program for plug-in & profile**
- **Improved DM efficiency**
- **Simplified vertical adaptation**
- **Fast device development**

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**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+)

**Coding-less program for plug-in & profile**
Device integration from 1 week to 1 day

**E2E trouble shooting**
Precision diagnosis helps quickly engage responsible party
Improves Municipal Efficiency of Public Utility Management

12 use cases in scale

- 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)

35+ use cases in pilot

- 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 – Yingtan, 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 Yingtan

- Chief officer / Mayor is the owner
- Push E2E industry chain (module, terminal, platform and application)
- Release series of preferential policies to attract enterprise from other cities and help local enterprise’s transformation
- Create industry alliance and issue standards
- All three telcos provide the NB-IoT coverage for the whole city
- Quality of network pass the verification of 3rd party authority
- Telcos actively promote NB-IoT service and explore new business mode

**Government**
- Strategy Planning & Incentives

**Enterprise**
- Innovation & Transformation

**Telco**
- Infra. & Services Provider

**Promote New Market**
- Local enterprises start transformation to promote types of NB-IoT product and new business mode
- More Startups engaged in IoT

**Expand Massive Connections**

**Social Benefit**

**Efficient City Management**

**Government Strategy Planning & Incentives**
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

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

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

- Road safety
- Traffic efficiency
- Traffic law enforcement
- Information flow

- Traffic management and control platform
- ETC charging
- Violation penalty
- Congestion broadcast
- Intelligent bus
- Emergency rescue
- Public transport

- GNSS
- Security checkpoint
- Road surveillance
- Traffic guidance
- Signal control
- Traffic broadcast
- Traffic sign
- Traffic index line
- Traffic collection
- e-Police
- Commercial vehicle supervision

- Static
- Static

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

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

**APP/ISV**
- Urban ITS
- Freeway ITS
- App

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
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

**C-V2X**

- **C-V2X network**
- **V2X Server**
- Intelligent Transportation Platform
- **GNSS**
- **LTE/LTE-V2X/5G**
- **V2N**
- **V2V**
- **V2P**
- **V2I**
- **OBU (Module/T-Box)**
- **RSU/ITE**
- **RSS, radar, camera**
- **Vehicle platooning**

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

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

**Enable cooperative autonomous driving**
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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

- Advantages of C-V2X and 5G
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
- 500 km/h Relative speed
- > 600 m Reliable communication distance
- < 20 ms Low latency
- > 2000/km² 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)
- Phase II (2018)
- Phase III (2019)

Regional replication

C-V2X open road technology verification
C-V2X city-level commercial use

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Standardization & Ecosystem

Build Open Ecosystem based on Common Standards
Join Hands with Vertical Industries to Develop IoT Standards and Build E2E Open Ecosystems

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<th>CV/ITS</th>
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<tr>
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Bring digital to every person, home and organization for a fully connected, intelligent world.

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