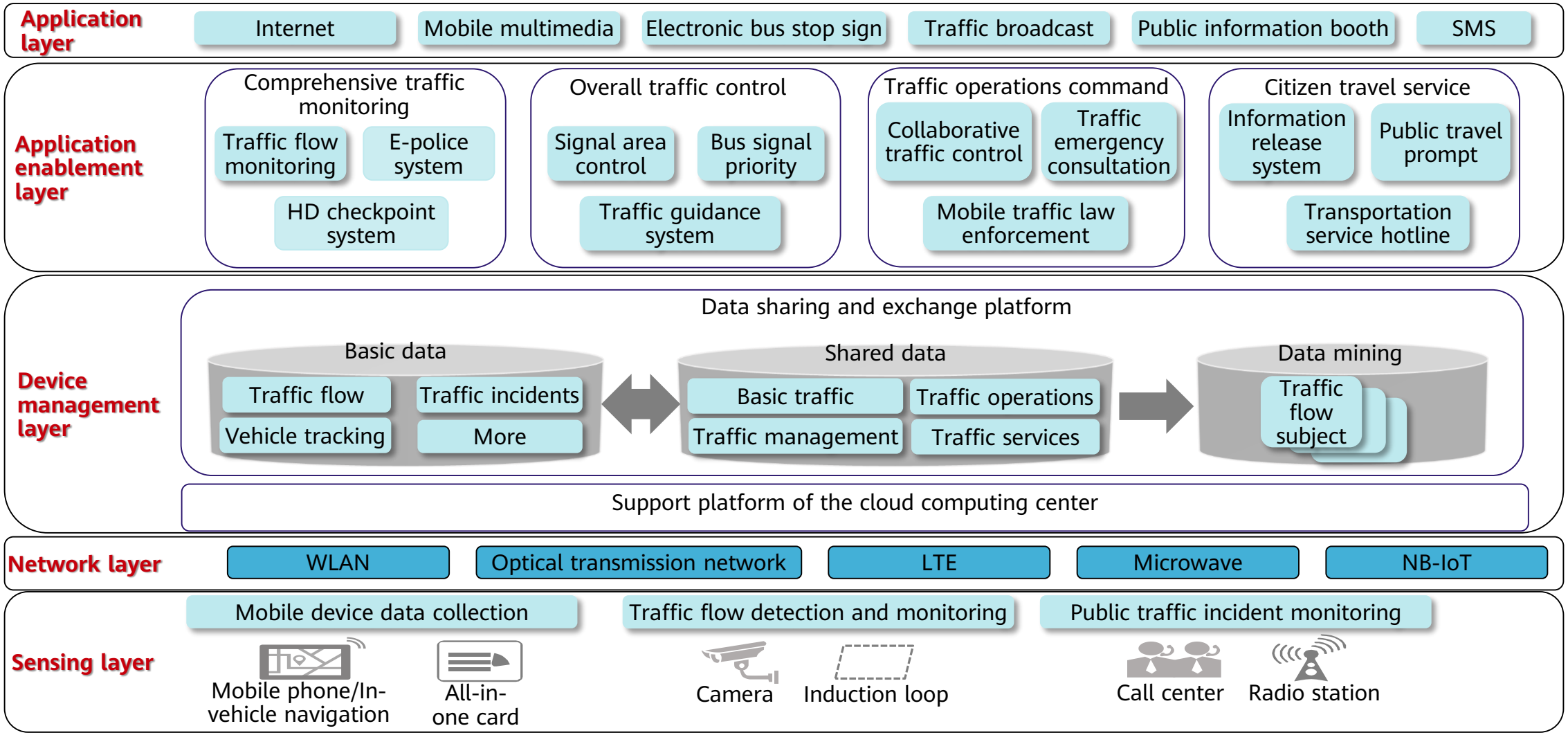
Smart Transportation Solution (1)



Smart Transportation Solution (2)

Relieve traffic congestion

- Constructs application systems such as e-police, speed detection, signal control, and guidance systems to maximize traffic guidance, reduce traffic accidents, and reduce accidents and property loss.
- Improves road patrol methods and patrol efficiency by displaying road conditions in multiple modes to implement electronic and automatic patrol.
- Uses mobile law enforcement to efficiently and quickly process traffic violation information, vehicle information, and driver information.

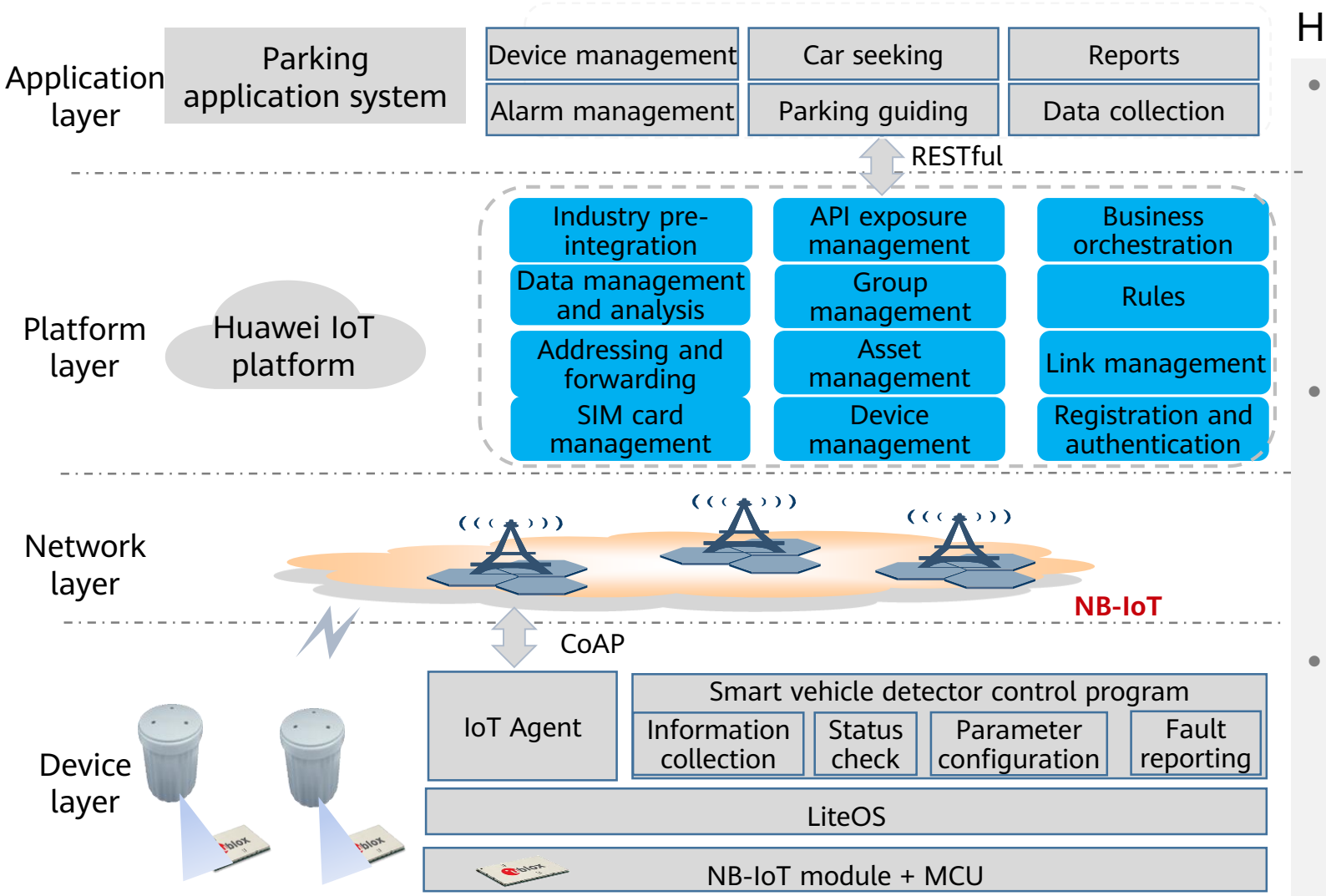
Facilitate citizen travels

- Collects details about rush hour commutes to optimize travel routes and reduce travel times.
- Citizens can obtain real-time traffic details and plan travel routes accordingly.
- Reduced commute times improve citizen satisfaction.

Improve environmental protection

- Smooth traffic improves vehicle speeds and reduces emissions.
- Optimizes public transportation to encourage citizens to choose public transport and reduce exhaust emissions.
- Improves urban environments so that citizens choose eco-friendly travel modes to further reduce emissions.

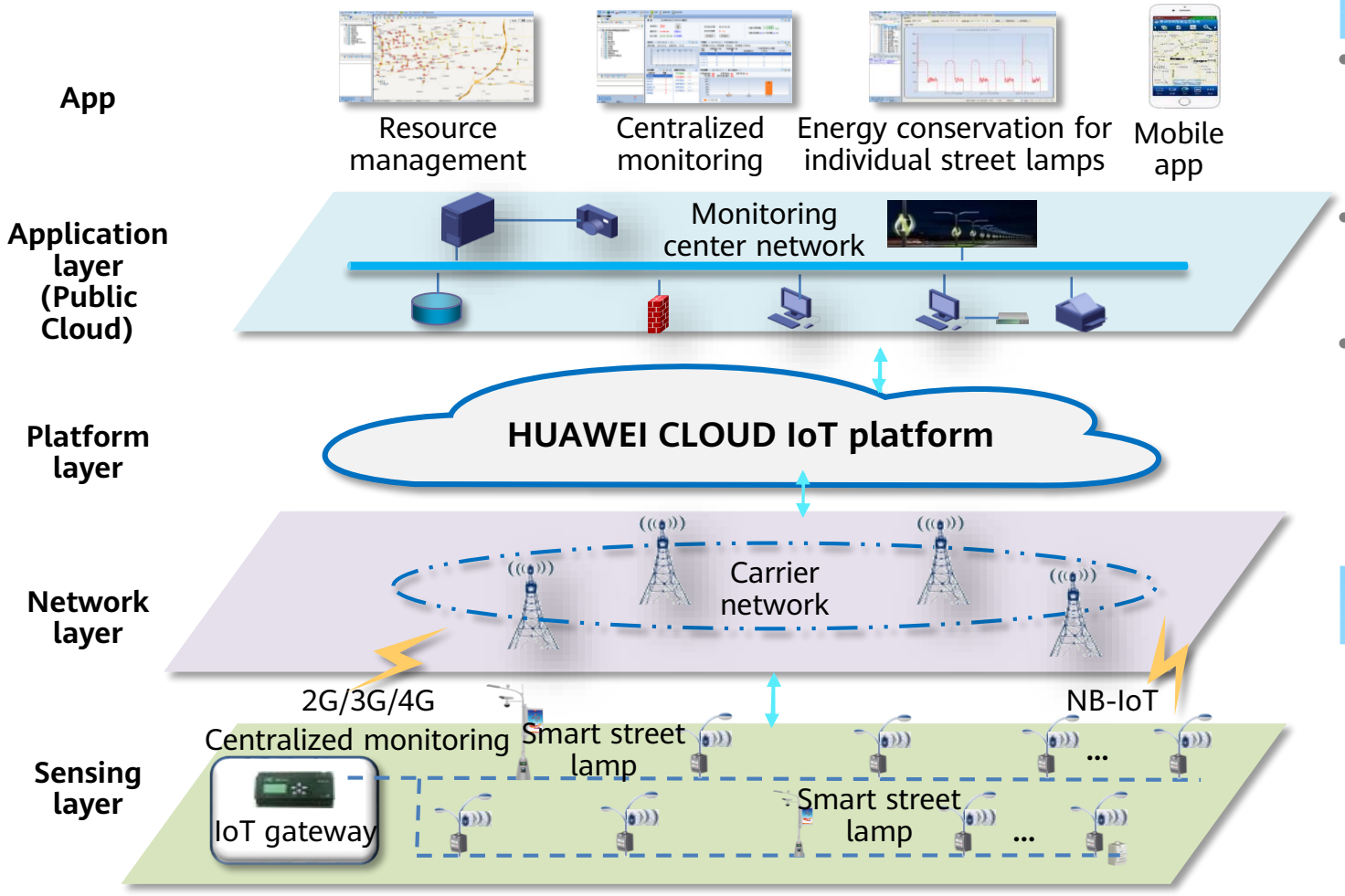
Smart Parking Solution



Highlights

- Platform layer: The IoT platform provides smart parking applications with basic connectivity management, data management, and device management capabilities, enabling flexible and quick deployment through open, standard APIs.
- Network layer: NB-IoT features wide coverage, massive connections, and simplified architecture, satisfying the requirements of discrete parking to reduce operator costs of installation and maintenance.
- Device layer: Integrated NB-IoT modules allow for data parsing on devices to mask access differences.

Smart Street Lamp Solution (1)



Customer Benefits

- **Construction of shared collection devices in cities**: Unified installation of functional facilities in multiple cities, and unified data aggregation and backhaul reduce the construction costs of city infrastructure.
- **Platform-based and unified O&M**: Unified O&M and monitoring of sensors mounted in each bureau improves O&M efficiency and reduces costs.
- **On-demand lighting to reduce consumption and save energy**: Lighting duration is adjusted dynamically, and brightness is adjusted based on the time period. An energy conservation plan is made based on comprehensive analysis of overall lighting power consumption.

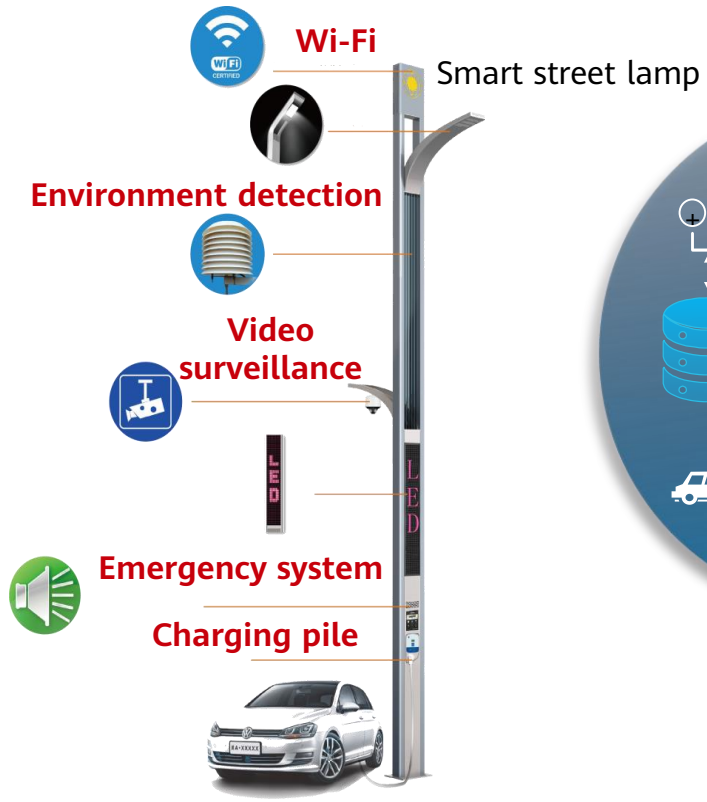
Applicable Scenarios

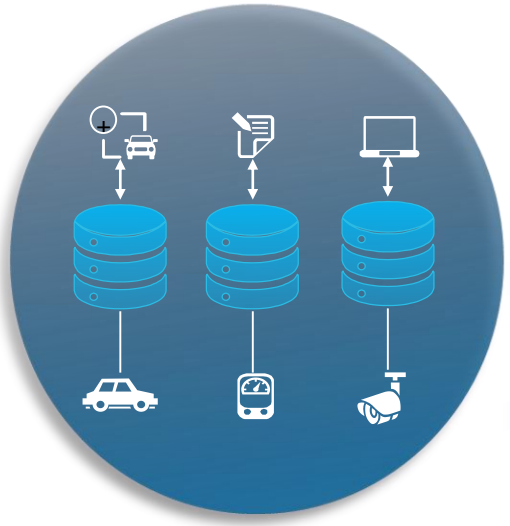
- **Periodic tasks**: enable or disable lamps and adjust brightness during different time segments.
- **Intelligent light adjustment**: automatically detects passing vehicles and adjusts the brightness of lamps based on the actual situation.
- **Automatic O&M**: automatically reports faults to the service system if a street lamp is faulty.

Smart Street Lamp Solution (2)

As natural appendages of smart cities, street lamps are integrating **multiple services**.

As an essential part of smart cities, **the IoT platform** integrates various applications and devices.



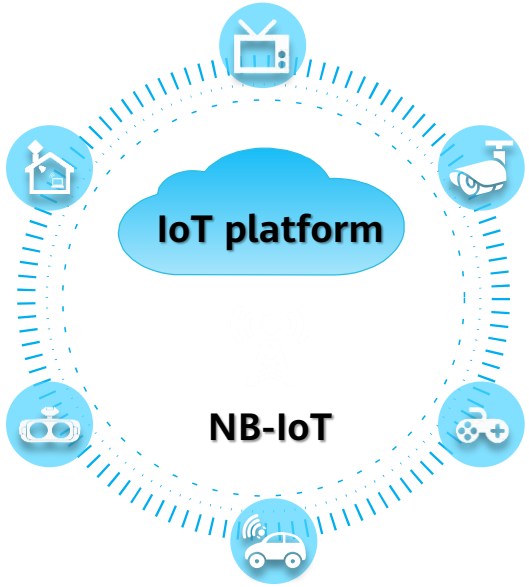


M2M (siloed architecture)

Closed system → Open system
(Application enablement)

Single application → Multiple applications
(Big data)

Single device → Multiple devices
(Device management)



IoT (unified architecture)

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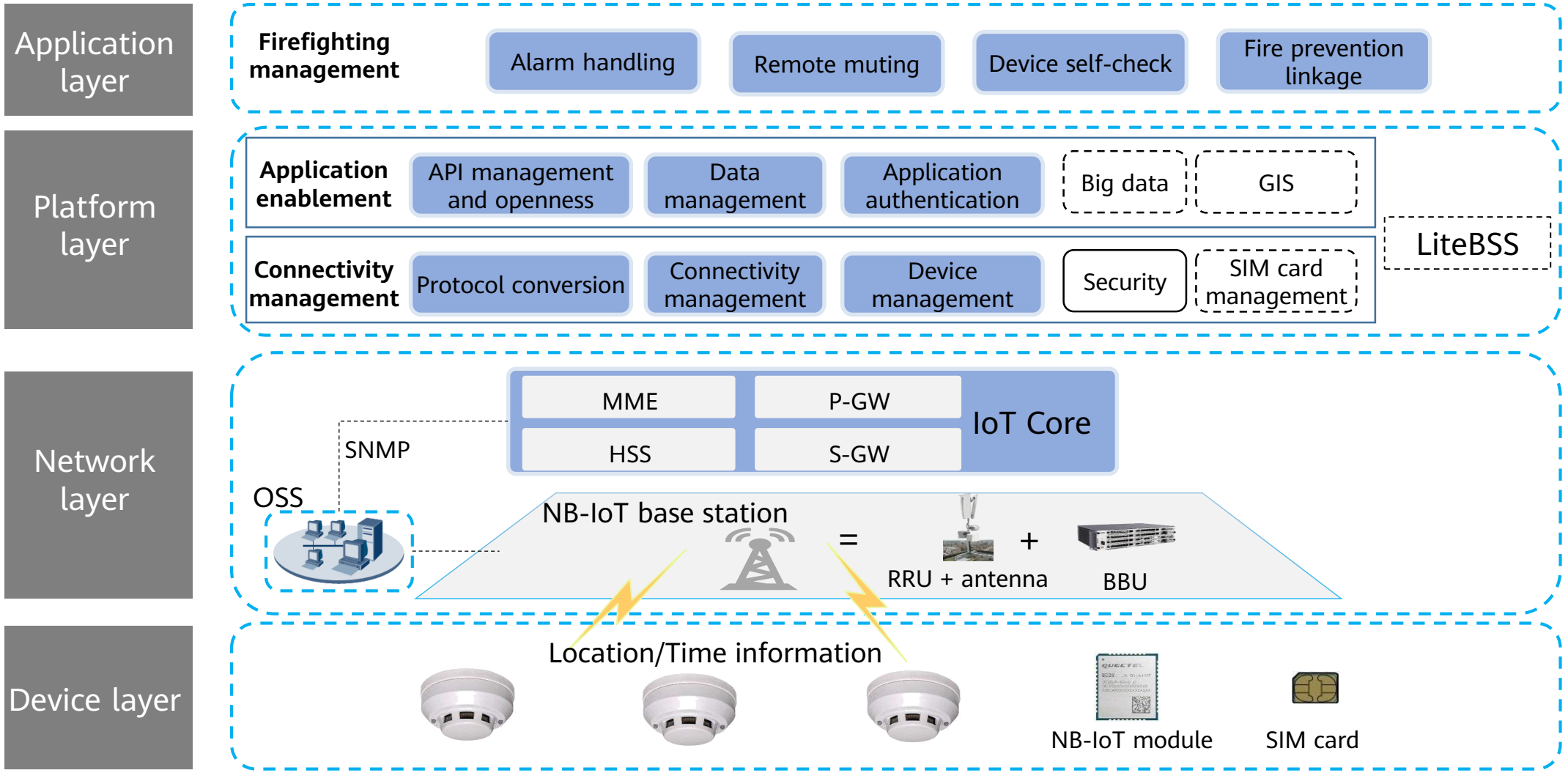
Smart Firefighting Solution



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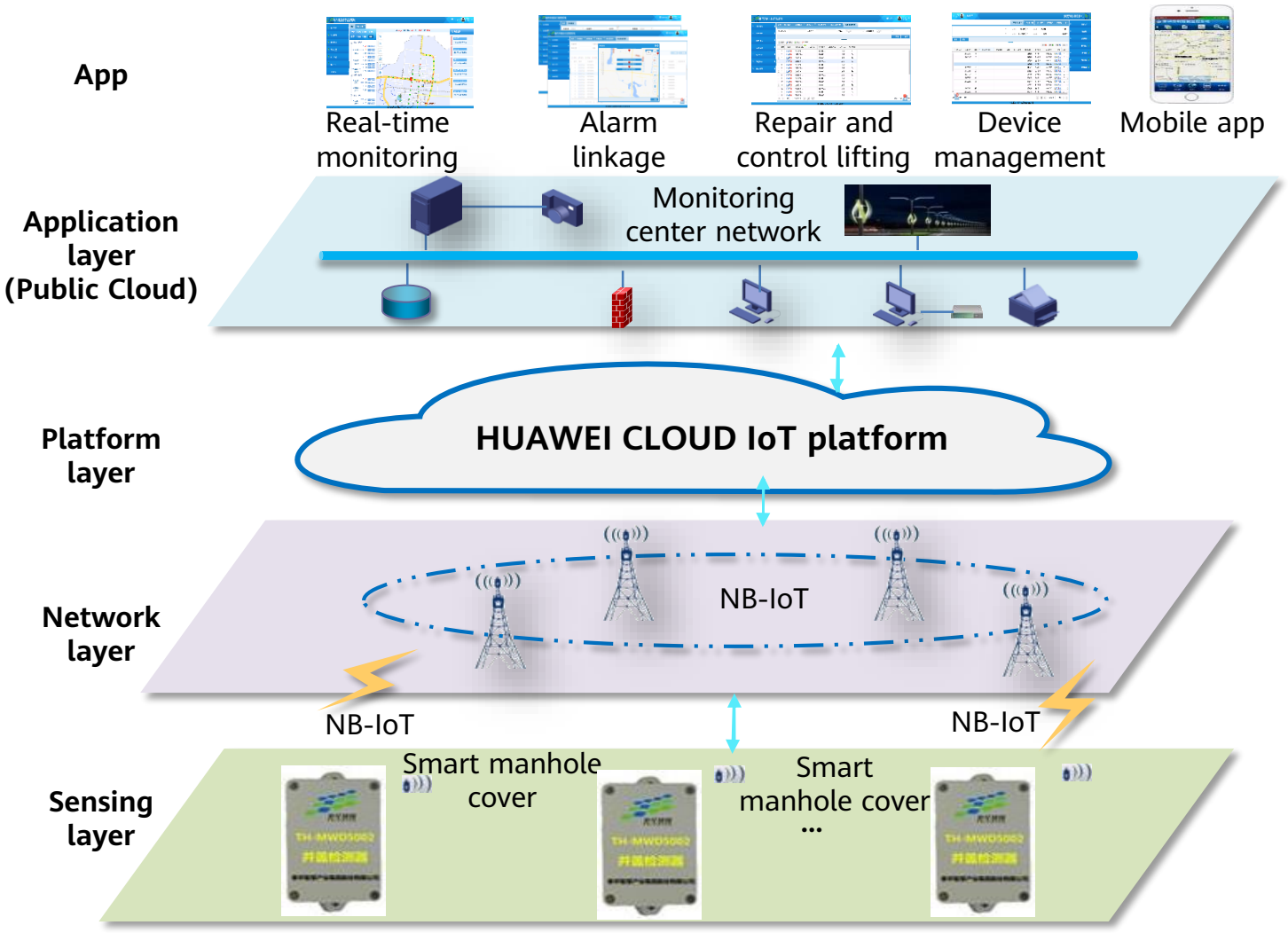
Smart Manhole Cover solution



Customer Benefits

- **Construction of shared collection devices in cities**: Unified installation of functional facilities in multiple cities, and unified data aggregation and backhaul reduce the construction costs of city infrastructure.
- **Platform-based and unified O&M**: Unified O&M and monitoring of sensors mounted in each bureau improves O&M efficiency and reduces costs.
- **Alarm reporting and anti-theft**: By monitoring manhole covers in real time, the system can detect incidents (theft, displacement, and damage), generate alarms, as well as notify construction organizations or policing platforms to take immediate action, eliminating security risks and ensuring city security.

Applicable Scenarios

- **Real-time monitoring**: Manhole covers in a large area are monitored in real time and intelligently maintained.
- **Alarm reporting**: Monitoring manhole covers that are abnormally open helps identify incidents such as theft, displacement, and damage. Alarm reports send the location to the monitoring center and policing platform. Then the monitoring center schedules construction vehicles to maintain these manhole covers and the policing platform dispatches officers to the incident location.

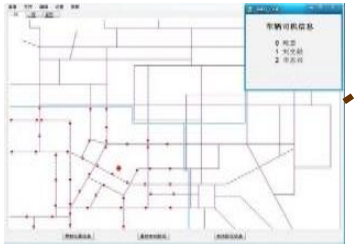
Smart Sanitation Solution

Install RFID tags

Read tags when lifting garbage bins.

Garbage clearance statistics

4G, 5G, ...



Vehicle track and real-time location

Manages people, vehicles, objects, and events in real time.

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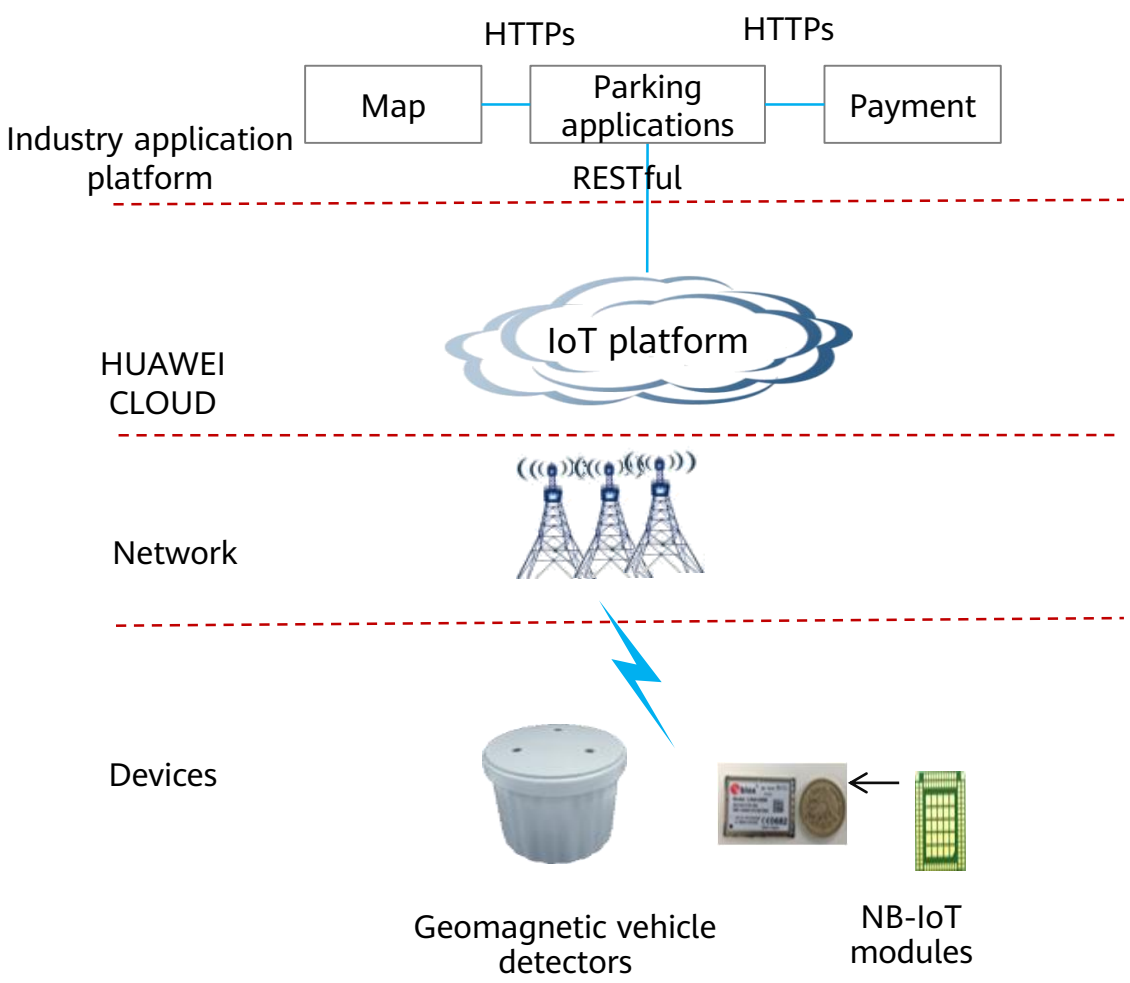
Application Cases - Smart Parking Project of Shanghai Disney Resort



Shanghai Disneyland - First Disneyland in Mainland China

- Disneyland is the **largest** theme park in the world.
- In addition to Shanghai, there are **five** Disney other parks, in Los Angeles, Orlando, Tokyo, Paris, and Hong Kong. Their number of annual visitors reaches about **70 million**.
- Shanghai Disneyland is expected to receive **25 million** visitors a year, ranking **first in the world**.

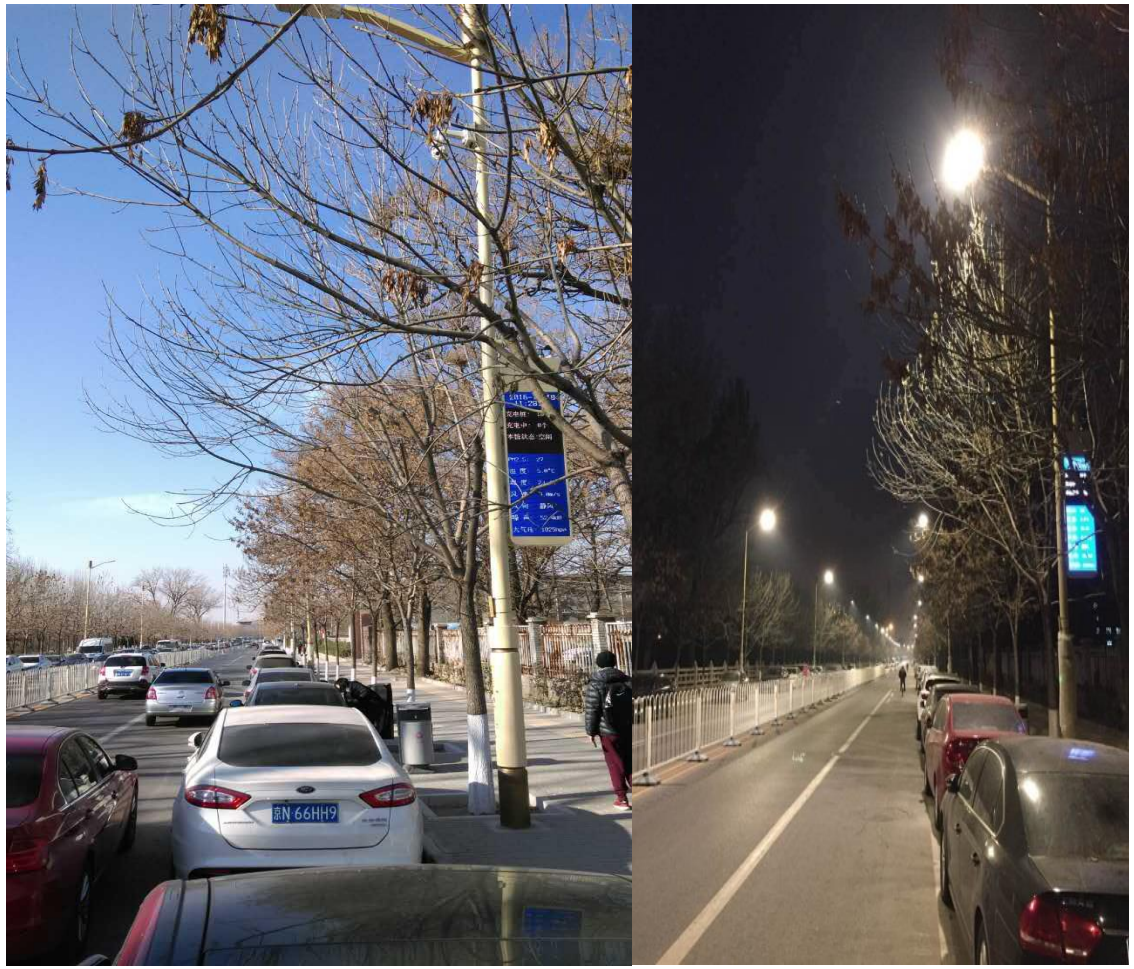
Deploying NB-IoT Networks Through Parking to Build Smart Parks

The NB-IoT solution is used to collect and query parking space information in the park, providing a basis for future smart park construction (such as for vending machines, garbage boxes, smoke sensors, and environment monitoring).

Progress

The Pre NB-IoT version has completed the collection and query of parking space information, and will provide parking guidance and vehicle locating services in the future. **AutoNavi Map and Alipay are being introduced** to provide tourists with better experience in parking and payment.

Application Cases - Smart Street Lamp Project in Zuoanmen, Beijing



Project requirements

- Beijing Lighting Management Center focuses on building smart street lamps and promoting the construction of Beijing Smart City. It integrates Wi-Fi hotspots, wireless carrier networks, environment detection, video surveillance, RFID, and charging pile functions using a wide range of lamp poles, power supplies, and carrier networks. This provides the public and the government with multiple convenient services.
- Due to geographical location, the appearance of the smart pole must comply with the building style of Tiananmen.

Customer benefits

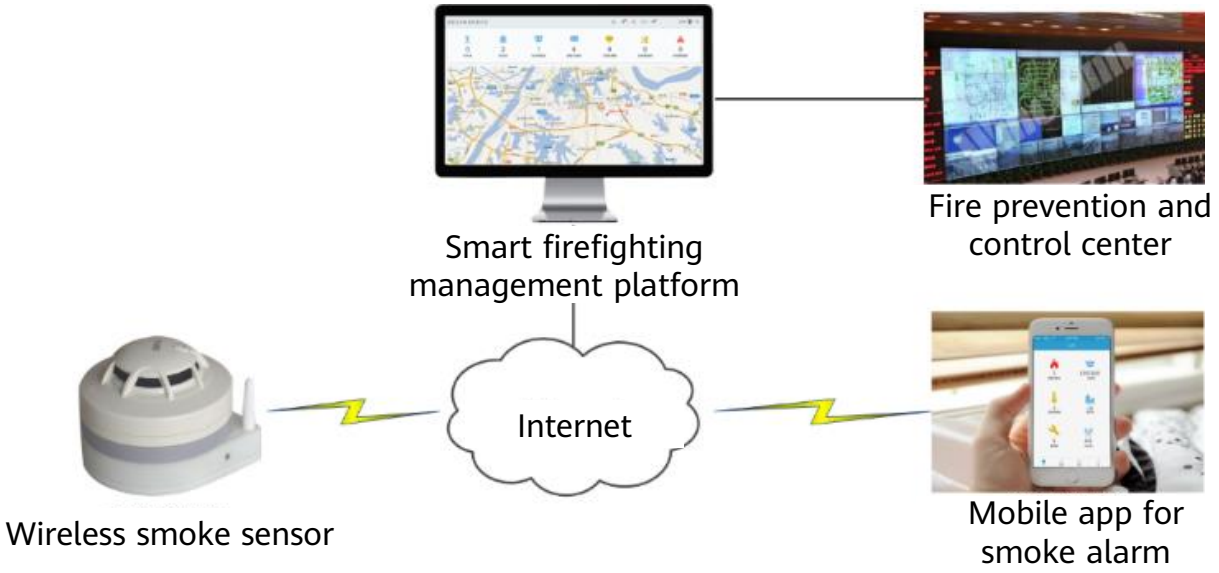
- Helps the government plan the land for charging piles of electric vehicles in cities.
- Helps the government provide services for people's livelihoods and helps people experience smart city scenarios in related areas.

Project achievements

- Built smart street lamps on the existing power distribution and cables.
- Deployed smart street lamp networks in urban areas.
- Connected the management system of smart street lamps to the operation systems of charging piles.

Application Cases - Smart Smoke Detection Project in Zhejiang

- In November 2017, Hangzhou Jianqiao Street used smart smoke detection technology to upgrade applications for the elderly, demolition and resettlement personnel, restricted personnel, and residents in old residential areas. Hangzhou Mobile provided the NB-IoT solution.
- In 2018, the Jianggan District government signed a smoke detection contract with Hangzhou Mobile and installed a smoke detection system after the first phase of the pilot project achieved success.



Application Cases - NB-IoT Smart Manhole Cover Project in Changle

- Bureau of Housing and Urban-Rural Development in Changle, Weifang, are mainly responsible for the county's urban, engineering and town construction. It also manages construction, real estate, gas, heating, and other domains.

Smart monitoring devices were installed on more than 400 manhole covers in the drainage, heat supply, and gas industries of main roads such as Fangshan Road, Hengan Street, Xinchang Road, Baochang Road, Gucheng Street, and Gushan Street in Changle.

Based on the public information platform, the system was built to monitor manhole covers and handle inspection cases using standard workflows. The system realizes real-time monitoring, anti-theft alarms, and alarm reporting for manhole covers.

An app was launched for mobile inspection. Inspectors now carry portable devices installed with the app to share information with the manhole cover monitoring center through a mobile communication network, facilitating alarm reception, handling, and feedback.

Application Cases - Dezhou Smart City Management Project

The Dezhou City Management Project is the first model project in Shandong Province to implement city-county networking. It aims to build a "large-scale city management" system and integrate data of multiple service departments.

Challenges

- A new urban management system to meet the needs of modern urban management needs to be established.
- Linkage of stereoscopic space, the whole process, and social participation is required.
- Information-based process of urban landscape planning and design, construction, management, and maintenance is required.

Solution

- The digital city management system of Dezhou includes subsystems in the following scenarios: digital urban management standards, mobile supervision, city flood prevention, video and audio management, outdoor advertisement management, GPS vehicle positioning, street lamps and landscapes, construction site supervision, law enforcement, 12345 citizen hotline, administrative approval, and city-county networking.

Customer benefits

- By July 2018, over 520,000 parts and 51 city events of 7 categories and 89 subcategories were surveyed and classified into 5953 unit websites. More than 740,000 city management issues were found, with a handling rate of 95.2%.

Contents

Challenges for Traditional Campuses

Inefficient Operations

Campuses are **mainly managed by humans and management experience cannot be shared effectively**. They do not have comprehensive and E2E IT systems.

More Security Risks

Conventional check in/out management and control systems face many challenges from **increases in the number of people, vehicles, and objects** on campuses. **Security incidents are penetrating campuses**.

Poor Employee Experience

Campuses have poor services, complex management, complicated processes, and manual intervention. As a result, **employees have poor experience and low loyalty**, which affects work efficiency.

Lack of Sensing

There are **few smart applications and devices**. Due to the lack of **effective sensing**, much manpower is required to analyze and process data. Sensors incorrectly report or fail to report alarms, so **real situations cannot be perceived**.

Increasing Operation Costs

Water, electricity, and gas prices keep rising, and campuses waste resources due to extensive management. In addition, labor costs are increasing all over the world, **resulting in high OPEX for campuses.**

Penetration of the Internet Mindset

The Internet mindset is gradually penetrating traditional campuses. **Campuses will not succeed if they continue to stand still.**

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Common Problems - Security Management

Pre-event

Human patrol

In-event

Reactive response

In-event

Manual command and dispatch

Post-event

Manual video check

No alarms are triggered when intruders break into access control systems.

No alarms or linkage policies are triggered when thieves burst into campuses.

Air conditioners do not stop working even when a fire occurs. Verification, evacuation, and police reporting are executed manually.

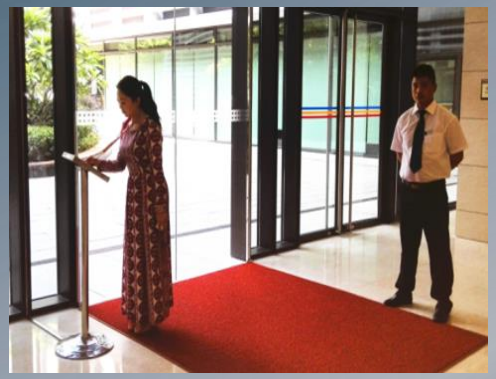
Common Problems - Visitor Management

Visitors

Visitors need to register and obtain visitor cards.

Visitors are allowed to visit only when accompanied by employees.

Employees



Employees need to swipe their cards at entrances.

Employees need to register when they forget their cards.

- Visitors need to wait about 5 minutes for reception by Huawei employees after arriving at Huawei campuses.
- Huawei employees receive about 600,000 visitors every year, spending a total of 50,000 working hours (6300 working days).
- About 30,000 visitor vehicles access Huawei campuses every year. It takes a vehicle 10 minutes on average to go through procedures and pay fees.

- Huawei employees need to swipe their cards when entering the campus. They forget to swipe their cards about 720,000 times and forget to bring their cards about 30,000 times per year. In the latter scenario, they need to manually record attendance data, which takes 5 minutes each time. That is, a total of 62,500 working hours (7800 working days) are wasted each year.

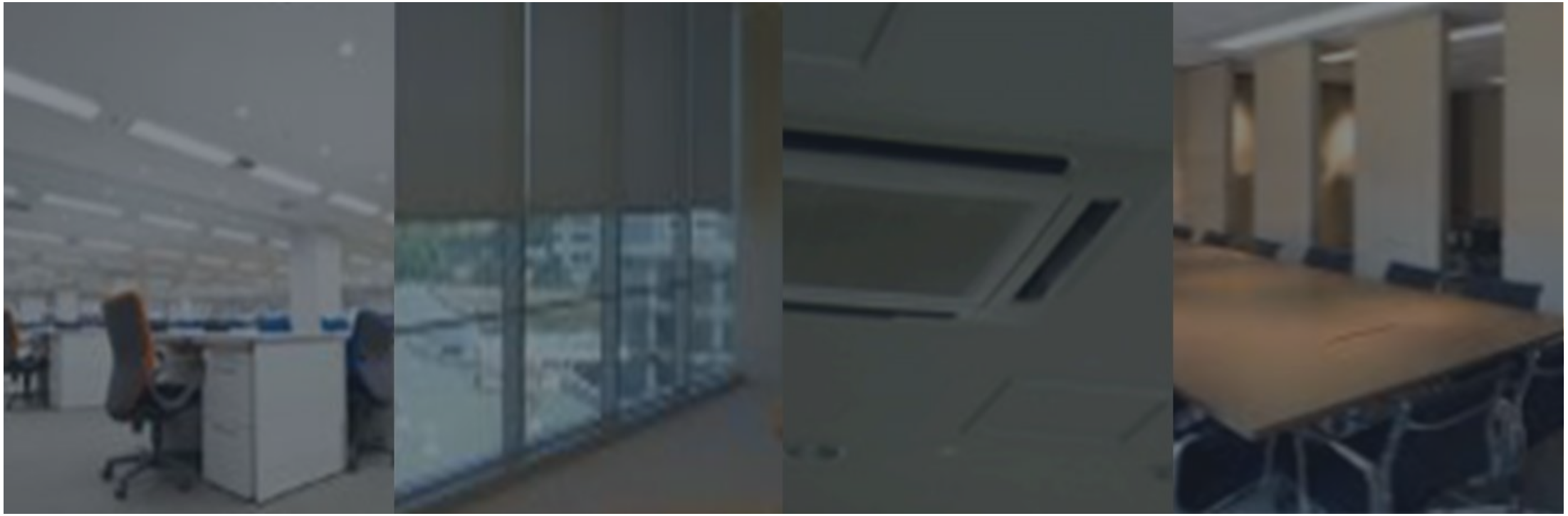
Common Problems - Power Consumption Management

Lights are always on even during non-office hours.

Curtains are always open where the sun shines.

Air conditioners are always on even during non-office hours.

Facility appliances are always on even in idle conference rooms.



Huawei's campuses in China spend CNY2.45 billion each year on management and services, of which power consumption accounts for 57% (CNY1.39 billion).

Problems

High OPEX

Inefficient IT infrastructures and services; mainly **managed by humans**

Unsatisfactory services

These systems are isolated from each other, making it hard to achieve unified monitoring, management, and emergency command for governments, and to provide smart services for citizens.

Extensive management

No intelligent security or property management solutions; reactive response to security risks

Solution - Smart Campus (1)

Smart campus solution

Oriented to campus management, value-added services, and production to support customers' digital transformation

Unified security

Ecosystem application

Campus management Security/building/ energy	**Value-added service** Life/office/ administration	**Production support** Production/operations/ decision-making

Digital platform

Service platform	Industry service	General service	Digital image	**Data & service integration** / **Application building platform**
Data platform	Data lake	Topic connection	Data service	
Universal platform	DaaS	CloudIVS	GIS	ICP / AI
IoT platform				

Security facilities	Building facilities	Vehicle facilities	Smart devices	...

Unified O&M

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Solution - Smart Campus (2)

All-optical access

One fiber
Full-service bearing

10000 Mbit/s
Ultra-broadband access

All-scenario Wi-Fi

80,000 persons
Online concurrently

100%
Seamless coverage

All-scenario IoT

20+
IoT APIs

100%
Complex environment adaptation

100%
Industrial protocol adaptation

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Security Management

Firefighting linkage

- Intelligent pre-event warning
- In-event system linkage and one-click handling
- Post-event intelligent analysis

Perimeter linkage

- Video-assisted alarm acknowledgment
- System linkage handling

Visitor Management

Visitor reservation portal

Visitors log in to a portal, enter personal information (including name, contact information, and license plate), and download a visitor app.

Parking barrier (license plate recognition)

When visitors arrive at a campus, the gate control system automatically allows them to enter after recognizing their registered license plates.

Campus visitor app

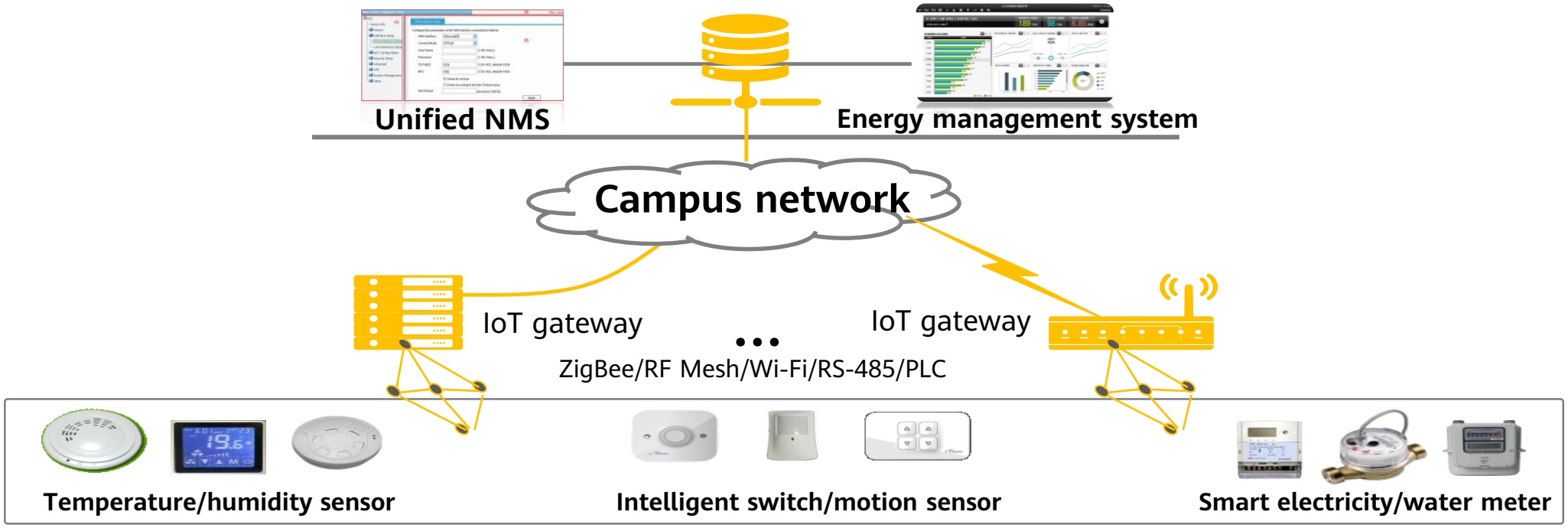
Visitors entering a campus and opening the visitor app:

- 1. Connect to the campus network through Wi-Fi.
- 2. Find the parking garage entrance through navigation services.
- 3. Select one of the following methods to enter an office building:
  - Facial images
  - QR codes

Power Consumption Management (1)

- **Environmental-friendly**, smart PV power generation
- Seamless switchover using standby UPS and stored power, **a special balanced power supply technology**
- **Energy big data platform-based** intelligent analysis and diagnosis models and algorithms, managing and controlling energy comprehensively, improving energy utilization, and reducing O&M costs
- Overall energy saved by **5%–30%;** per-capita O&M efficiency increased by **30%**

Power Consumption Management (2)



Central air conditioners

Vending machines

Lighting

Smart metering

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Application Cases - Huawei Campuses Around the Globe

Beijing

Langfang

Nanjing

Hangzhou

Shanghai

Chengdu

Shenzhen HQ

Dongguan
Southern Factory

India

Democratic
Republic of the Congo

Application Cases - Huawei's Southern Factory in Dongguan

- Facial recognition + license plate recognition reduce the number of security personnel needed by 30%.
- Smart PV + energy efficiency prediction and optimization achieve intelligent power generation, distribution, utilization, and management.
- Intelligent supply chain management enables refined control of orders, warehousing, and logistics.
- Visualized production and operations display multi-dimensional factory information in real time.

This factory occupies a total area of about 1 million m^2, and accommodates about 30,000 employees in three districts.

Application Cases - Smart Industrial City in Yanbu, Saudi Arabia

- Effects:
  - Average incident response time < 7 minutes
  - Yearly traffic accidents < 1200
  - Fiber coverage rate in Yanbu's industrial city > 59%
  - Free Wi-Fi coverage rate in public areas > 70%
  - Garbage disposal efficiency: 30% increase
  - Public lighting costs: 30% reduction
  - Road maintenance costs: 20% reduction
- Economic benefits:
  - Investment growth rate: from 3.5% to 16%
  - Industrial talent in the past three years: 22.5% increase

Application Cases - Tian An Cloud Park Phase 1

- Tian An Cloud Park is located to the north of Huawei Industrial Base, Bantian, Shenzhen. It occupies an area of 760,000 m2 and covers a building area of 2.89 million m2. It is a large complex that consists of offices, businesses, residential buildings, and hotels.
- It focuses on leading industries such as cloud computing, mobile Internet, robot, and intelligent devices. It is a base for developing modern and productive services based on these industries.

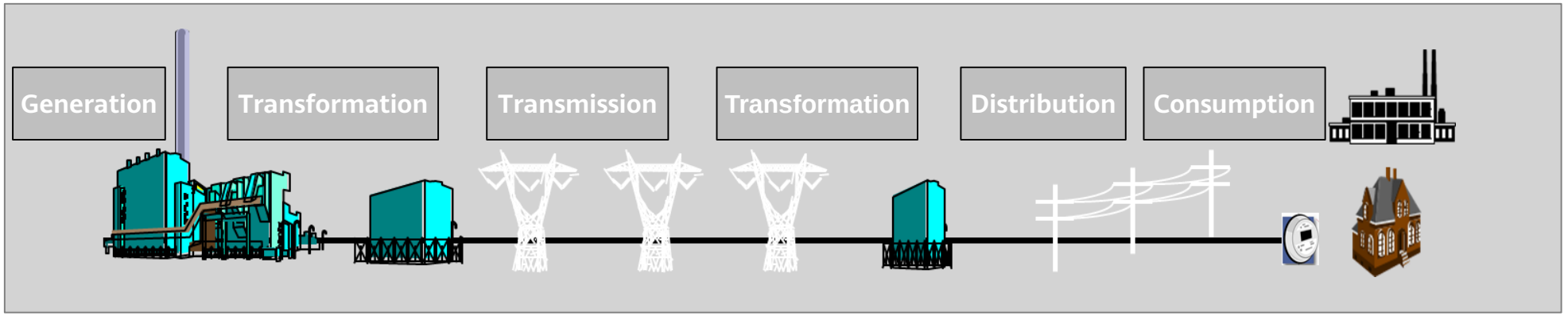
Tian An Cloud Park Phase 1

Introduction: Tian An Cloud Park Phase 1 consists of seven 30-floor buildings. Offices are located on the sixth floor or above, businesses on the first to fifth floors, and parking lots on the first and second basements. There are XXX enterprises in this park.
Key ICT requirements: Providing high-speed networks, data centers, and intelligent infrastructures for enterprises and campus operations personnel.

- Use the Cloud Community+ (CC+) campus operations and service platform to provide enterprises with property management, office, and enterprise ICT leasing services.
- Use a local cloud to provide cloud IT and communications services for enterprises, reducing their O&M costs.
- Use a converged network to carry the campus IoT, Wi-Fi, and property management office networks, delivering high Internet access speeds.

Contents

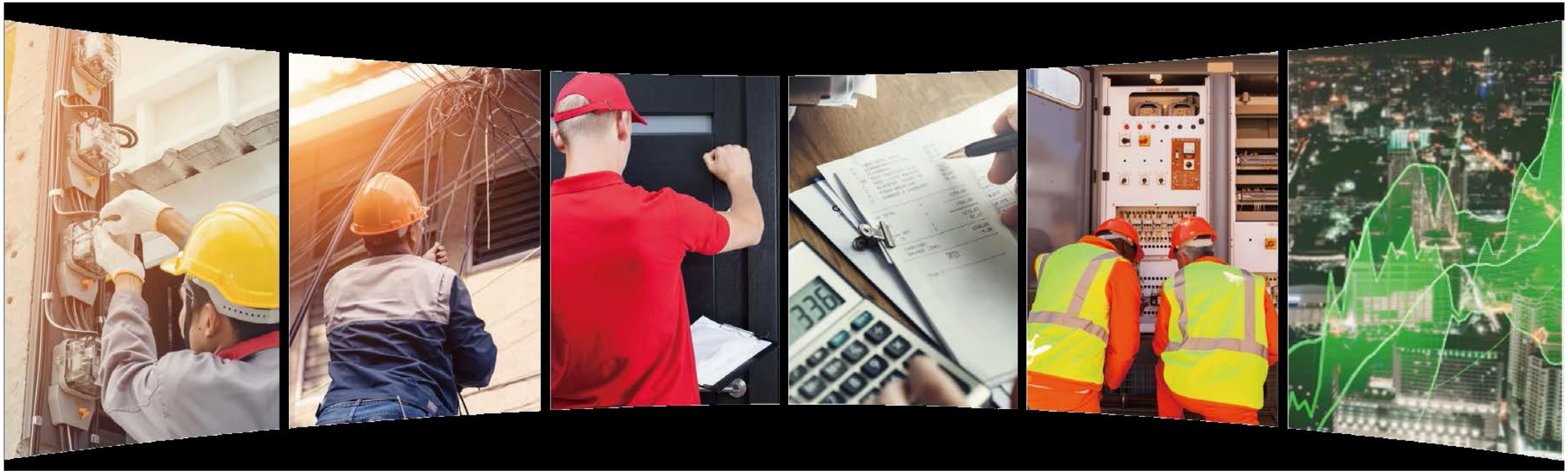
Overview of the Electric Power Supply System



Power generation	Power transformation	Power transmission	Power distribution	Power consumption	Scheduling
• Electric power generation • Source: coal, nuclear, hydro, solar power, and others • Generator outlet voltage: 6 kV to 30 kV • Controlled by a scheduling center with automatic generation control (AGC) and automatic voltage control (AVC)	• Voltage increase or decrease • Higher voltage yields lower transmission loss. • Voltage: 6 kV to 1000 kV • Department involved: scheduling center (responsible for safe operation of the grid)	• Electric power transmission across long distances • Higher voltage yields lower transmission loss. • Voltage: 110 kV to 1000 kV • Department involved: scheduling center (responsible for safe operation of the grid)	• Electric power distribution and sales • Voltage: 110 V to 110 kV • Department involved: power supply bureau/company and marketing/electricity department in the electric power company	• Type: civil, commercial, industrial electricity, and others • Voltage: 110 V to 6 kV • The power dispatching data network carries the production scheduling service. It is one of the core networks of electric power informatization.	• End-to-end electric power system management and monitoring • Hierarchical management • The power dispatching data network carries the production scheduling service. It is one of the core networks of electric power informatization.

Long-Term Pain Points of Electric Power Companies

- High line loss, low efficiency, and high investment are the long-term pain points of low-voltage power distribution network operations in electric power companies.



Characteristics of Traditional Grids

Power generation

Transmission

Expenditure

Simultaneity

- Power generation, transmission, and consumption are performed at the same time.
- Power generation cannot be interrupted, and electricity cannot be stored during generation.

Randomness

- The grid status changes rapidly.
- Monitoring on the change status and emergencies is required.

Integration

- All parts of the grid are unified.
- If any problem occurs, the entire system is affected.

Security

- Grid security affects national security.
- Power automation and informatization, which can enhance the safety coefficient of the grid, are absent.

Rigid systems

- Access of large-scale intermittent power and distributed power is not supported. The access, exit, and transmission of power supply are not flexible.

Unbalanced power generation and consumption areas

- Power generation is concentrated in the northwest of China.
- Electric power is mainly consumed in the central, eastern, and coastal areas of China, requiring long-distance and high-voltage power transmission.

Challenges of Traditional Grids

Distributed power supply access

- Access of large-scale intermittent power and distributed power is not supported.
- The access, exit, and transmission of power supply are not flexible. As a result, the grid is not dynamic and flexible.

Massive transmission loss

- Massive transmission loss is caused by unbalanced power generation and consumption.

Management mechanism problem

- Inconsistent standards
- Weak security with flooding vulnerabilities and risks
- Single product development and lack of network planning
- Closed system which restricts service development

Unbalanced power supply and demand

- The demand for power consumption increases rapidly.
- The power supply system cannot meet the demand.
- Power use is limited due to insufficient power supply.

Security issues

- Due to the increasing demand for power, power supply equipment is overloaded for a long time. Outdated equipment causes massive loss.
- The security and reliability of the power supply and distribution system are not planned, which creates security risks.

In the face of challenges, electrical grids need to be managed intelligently and delicately. Advanced Metering Infrastructure (AMI) comes into being.

Poor power quality

- Simple user services and one-way information hinder user interaction.
- User power consumption information cannot be obtained immediately, and power quality cannot be ensured.

Difficult information sharing

- The system structure design is flawed. Multiple information silos exist in the system, hindering information sharing.

Lack of power distribution automation

- Fault discovery, isolation, and troubleshooting take a long time due to inefficient methods, requiring informatization means.

Challenges Faced by Electric Power Companies

Insufficient service supervision and serious economic losses

- Transformers are overloaded in high temperatures, and equipment is severely damaged.
- Lack of effective monitoring methods for VIP users
- Power consumption is not analyzed in real time, and electricity theft is a serious issue.

Low operation efficiency and high labor costs

- Line loss cannot be effectively decreased.
- Electricity fees are difficult to collect, collection periods are long, and arrears are significant.
- Power consumption is not transparent and causes many complaints.

Lack of real-time data support for service decision-making

- Power outage management is disorganized.
- Power line reconstruction is unfeasible.
- Household electricity relationships are complicated.

Different Grid Requirements in Different Countries and Regions

Prepayment option (Africa and Latin America)

- Collect electricity fees on time using prepayment options and gradually implement tiered electricity billing.

Line loss reduction (Africa and Latin America)

- Reduce non-technical line loss caused by electricity theft, which is equivalent to directly increasing revenue.
- Send alarms when electricity theft is detected and locate the area the theft occurred.

Customer satisfaction improvement (all regions)

- Provide detailed bills to customers for confirmation of detailed electricity usage and billing results.
- Provide power saving suggestions based on intelligent analysis and guide users to save power.

Safe grid operations (China, Europe, and America)

- Reduce power failures and quickly locate and rectify faults.
- Limit power consumption during peak hours.
- Balance renewable and non-renewable energy yield.

Balance between supply and demand (China, Europe, and America)

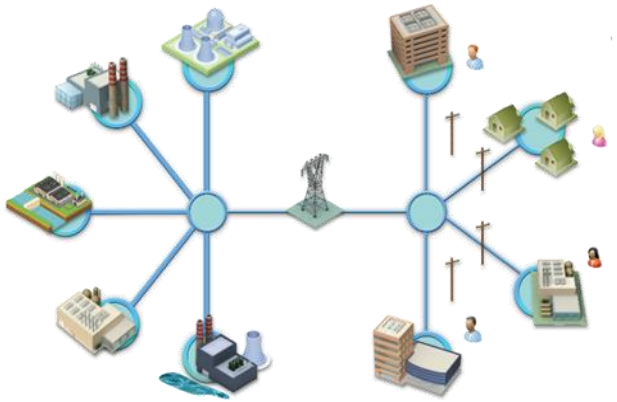
- Balance between supply and demand can reduce waste caused by extra power generation and ensure the security of the grid.

New value-added services (China, Europe, and America)

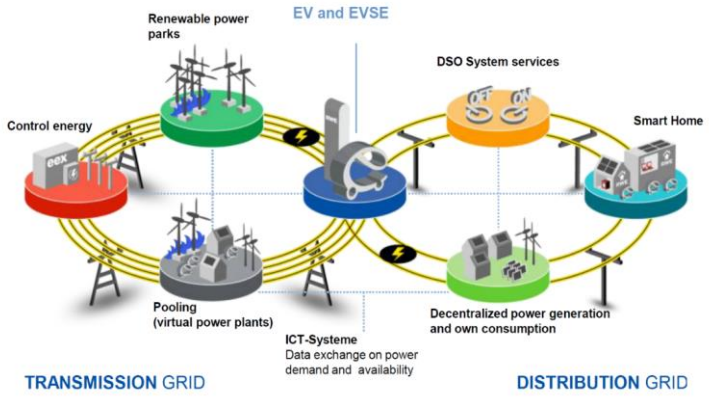
- AMI is the foundation of smart grids.
- Based on AMI, new technologies such as requirement response, distributed energy management, CVR, and new services can be applied to further improve the profitability of electric power companies.

Grid Evolution Trends

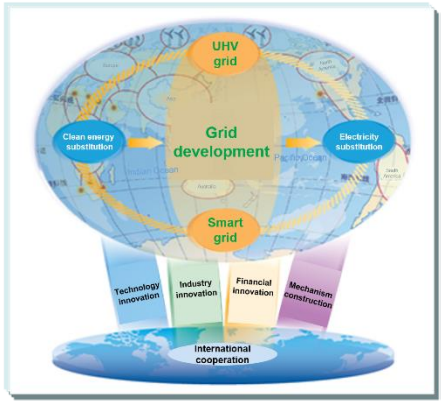
Traditional grids



Smart grids



Energy Internet Industry Group



Continuous access to new energy and services

- Solar and wind energy
- Charging piles, smart homes, and smart street lamps

Control extension

- Expansion from transmission and transformation control to distribution networks, distributed power supply, and the user side
- Number of control points: from 100,000-level to million-level. Controller latency: from quasi-real-time to real-time. Control frequency: from low to high.

Explosive growth of information collection requirements

- Increasing collection points and collection volume
- Higher collection frequency and real-time performance

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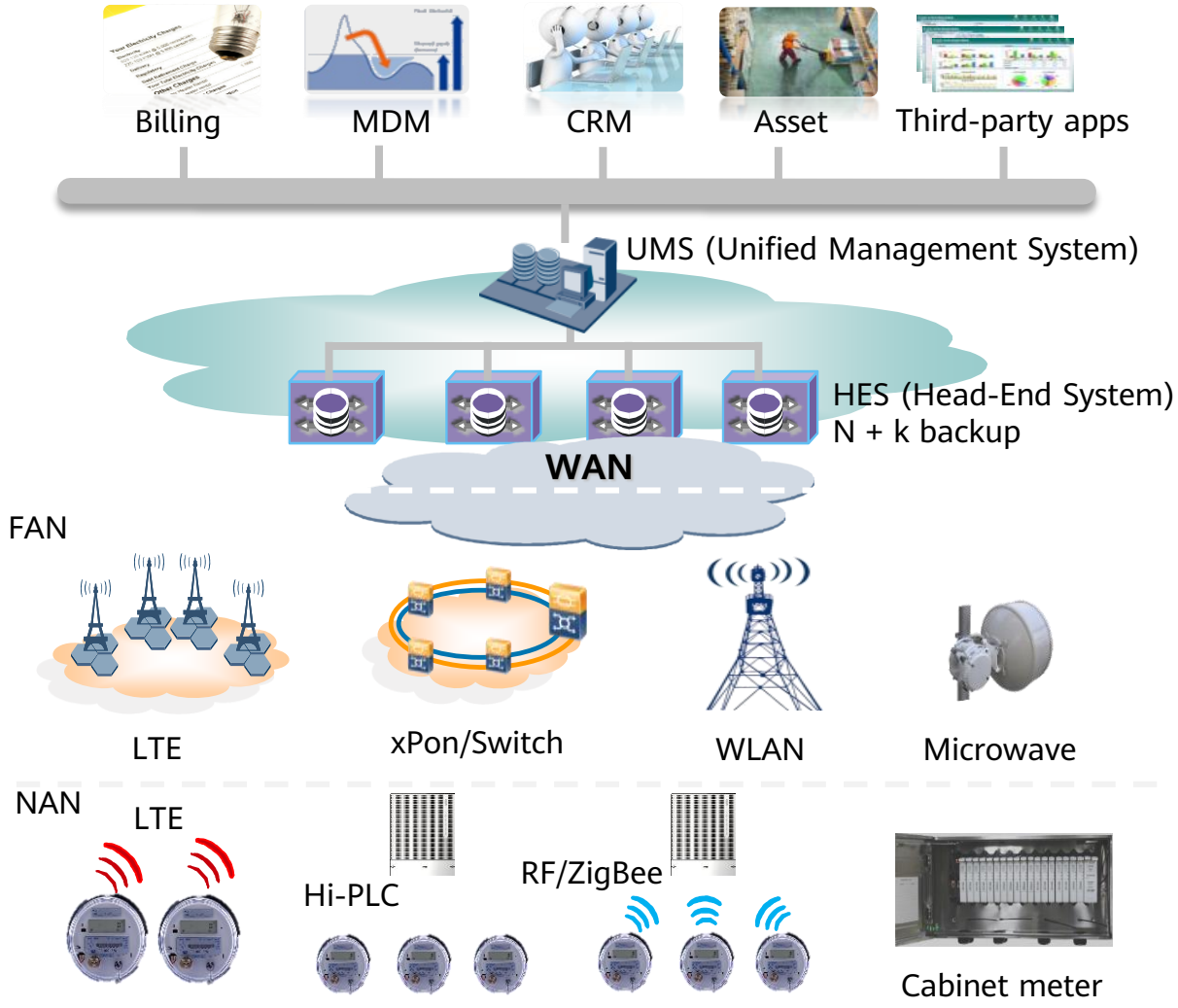
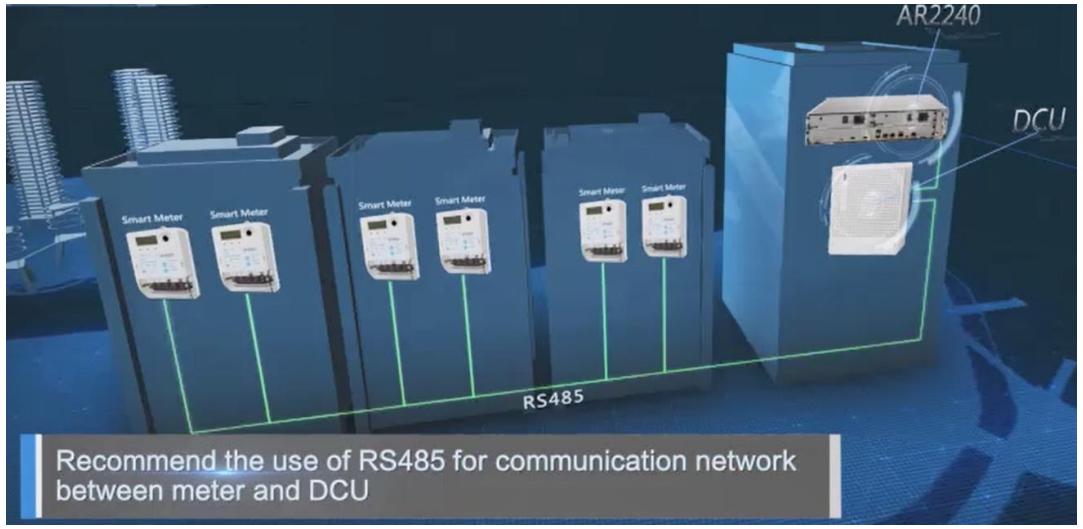
AMI Solution (1)

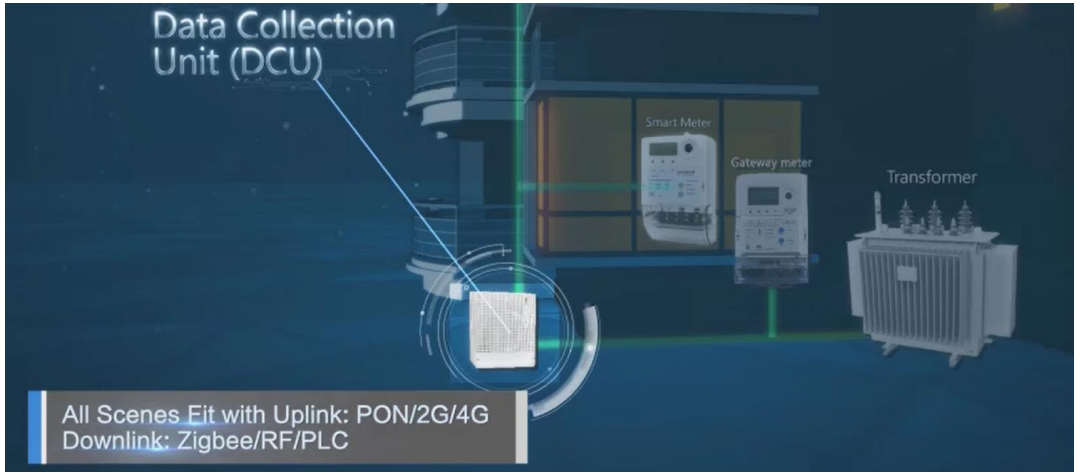


- AMI is **a complete system** that includes smart electricity meters, advanced communications networks, collectors, concentrators, and back-end software. It can use a **bidirectional communications** system to record user load details, and periodically and instantly obtain various metering values from users. It supports remote setting, power connection or disconnection, two-way metering, and scheduled or random meter reading. It connects and provides users with visibility within the grid to establish close contact with them.
- An AMI system consists of hardware devices, software, communications networks, user interfaces, DCP, UMS, and systems at the application layer. The system can **share part of the manual response mechanism** and automatically collect information from users and send information to them. The system changes the normal consumption mode of users and **displays power consumption information transparently**. Users can **plan appropriate consumption** according to the information to avoid waste. For suppliers, consumption based on pricing plans can limit increasing power use during peak hours and **balance power supply**.
- AMI components contain upper-layer application systems, collection systems, devices, and communications networks.

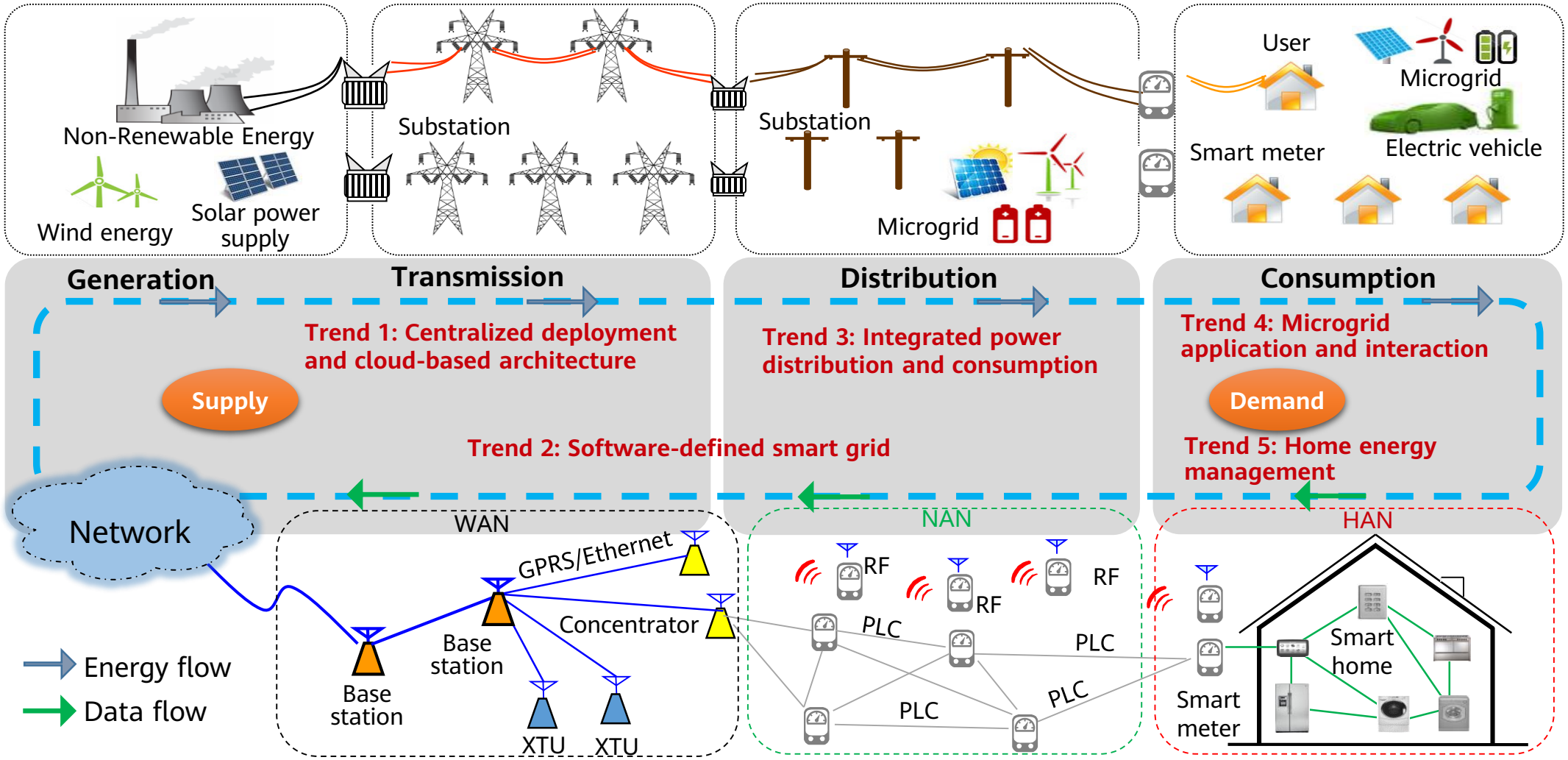
AMI Solution (2)

- Huawei provides an end-to-end smart metering solution for electric power companies to implement a full upgrade from meters to applications.
  - **Smart electricity meters:** Traditional mechanical electricity meters are replaced with prepaid smart electricity meters with a communications function. Multiple electricity theft detection methods are provided, such as open cover alarms, reverse wiring alarms, and strong magnetic field alarms. The PLC-IoT technology is used to report information such as current, voltage, power, and power consumption in real time.
  - **A meter reading network:** Concentrators communicate with electricity meters through communications methods such as power line carriers, converge data to the industrial gateways, and then send the data back to the main control center through the carrier's public network. This achieves a 100% meter reading success rate.
  - **An application system deployed on the IoT platform:** Huawei provides the IoT platform to manage data, connection, and devices, and pre-integrates partners' powerful application systems for billing, prepayment, and payment. The IoT platform provides advanced functions, such as data statistics analysis, real-time line loss analysis, and electricity theft behavior analysis, to help customers operate services effectively.





AMI Solution: Fully-Connected Grid (1)



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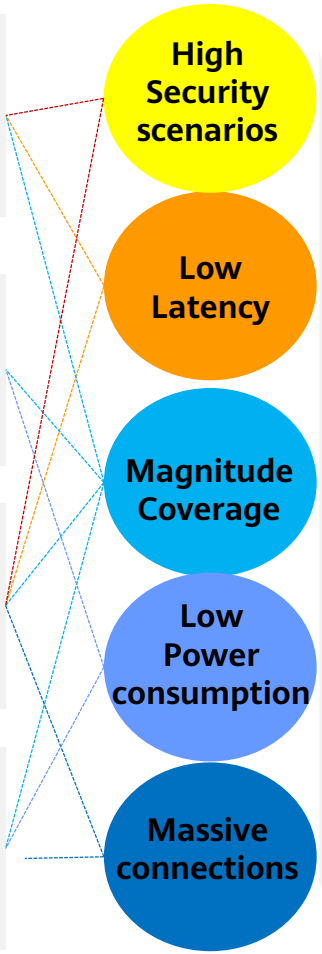
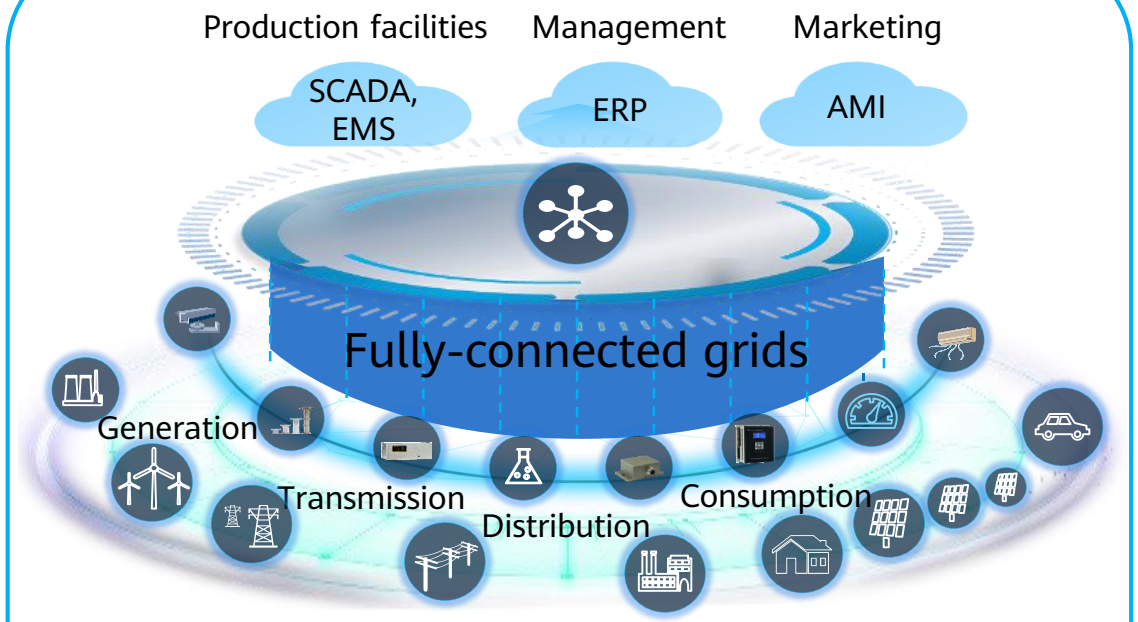
AMI Solution: Fully-Connected Grid (2)

Power generation	• More new energy access and power generation devices are becoming distributed.
Power transmission	• Transmission lines are gradually monitored in real time. WAN connections are required.
Power distribution	• Distribution network control is gradually shifting from 10 kV to 0.4 kV, connecting tens of millions of nodes.
Power consumption	• High frequency and high-precision meter reading of 450 million meters requires new access technologies.





Connections increase from tens of thousands to hundreds of millions and go from covering backbone lines to full grids. Wireless is the key.

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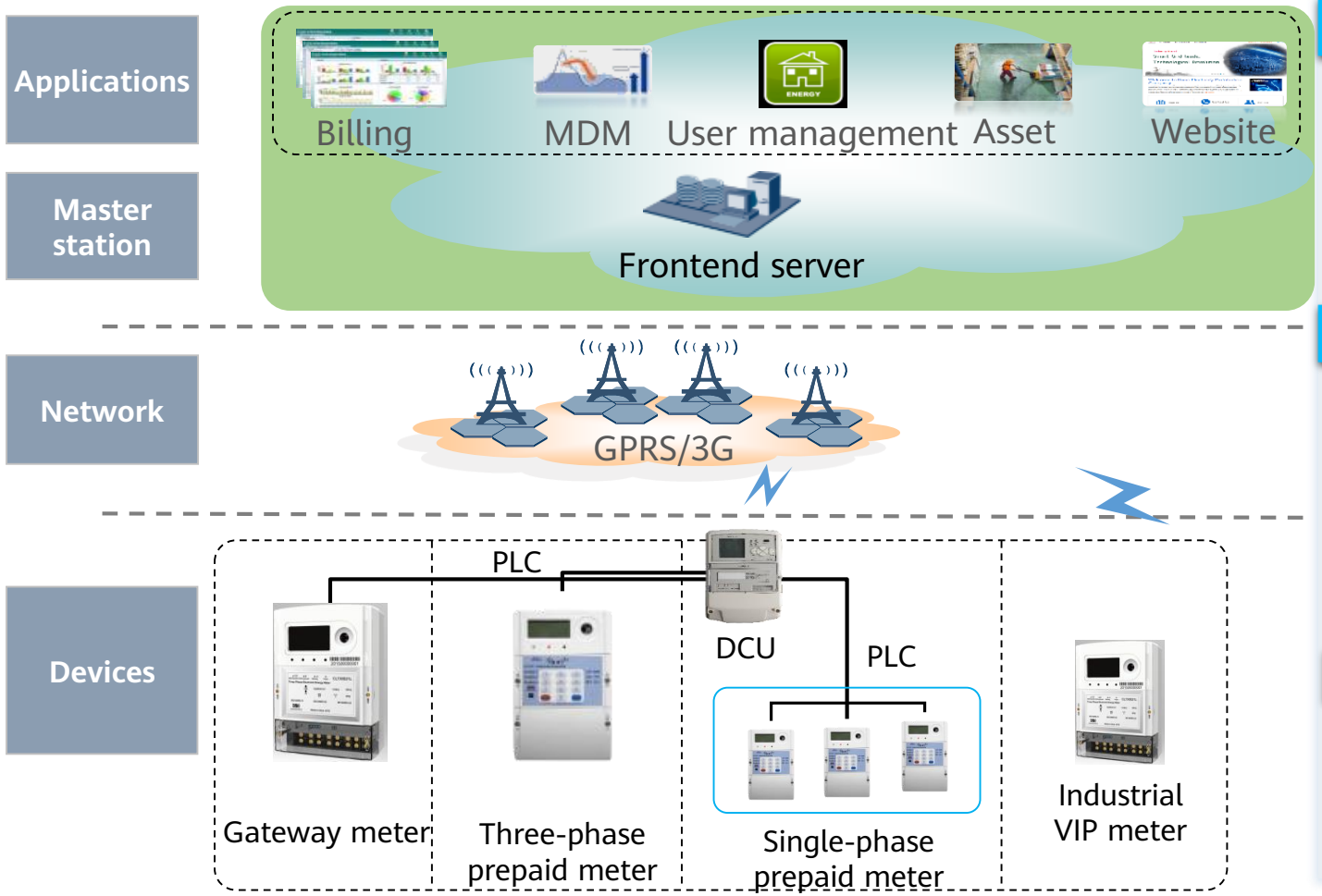
Application Cases - Electric Power Company of Togo (CEET)



Background

- High line loss of 17.88% in 2014
- The peak load increases rapidly. The peak load in 2013 was 181.76 MW. If the peak load can be reduced by 10% after consumption analysis, it will be reduced by about 18.176 MW.

Huawei Case

- Number of residential meters: XX0,000
- Number of meters for VIP users: XX
- Number of meters in power distribution station: XX
- An end-to-end AMI solution, involving meters, concentrators, master station systems, and marketing systems, is provided.

Customer benefits

- Line loss reduction by 11% to 17.88%
- Peak load reduction
- User experience improvement
- Accelerated cash return

Application Cases - State Grid Jiangsu Electric Power Co., Ltd.

Load control

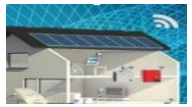
Substation video surveillance

Distributed energy

Consumption data collection

Automated power distribution

Switching station monitoring



Smart home

Inspection of the transformer district

- **Large scale and biggest services**: **50+** 1.8 GHz wireless communications sites, **5,000+** devices, and **10+** services are operating in three cities.
- **100%** device online rate: The network performance test results meet the service requirements of the state grid of China.
- **First application of an end-to-end physical security isolation solution**: One network bears three types of services: power distribution, precise control, and procurement.
- **First application of the public and private integration modules**: Service availability is improved and the cost of converting from public to private networks is reduced.

Contents

Common Problems for IoV

- Delayed detection of vehicle status faults
- Impact of faulty vehicles on safety of other vehicles
- Influence of natural weather changes on safe driving

- Traffic citations for speeding
- Traffic congestion caused by road repairs
- Inconvenient use of in-vehicle multimedia devices
- Inefficient traffic lights

- No obvious differentiation of insurance rates
- Private use of company vehicles
- Difficult fleet management
- ETC, parking fee recharging, etc.

Requirements and Driving Forces of Development

National mandatory requirements

- **Ministry of Transport of the People's Republic of China (MOT)**: Since August 1, 2011, a satellite positioning device that meets the requirements of *GNSS System for Operating Vehicles-Technical Specification for Vehicle Terminals* must be installed on key commercial vehicles in China. Since the end of 2015, MOT requires that in-vehicle devices be installed on vehicles before delivery.
- The scope includes coach buses, shuttle buses, dangerous goods transportation vehicles, heavy cargo vehicles, and semi-trailer towing vehicles.
- **Mandatory technical standards**: JT/T/794, JT/T/796, JT/T 808, and JT/T 809

Customer operations requirements

- **Cost control for fuel consumption**: Fuel costs are up to 50% of the operating cost. If a truck costs more than CNY300,000 on fuel consumption, CNY30,000 can be saved per year by using IoV.
- **Improving punctuality of maintenance**: IoV detects component wear status, intelligently arranges preventive maintenance, and maintains good vehicle conditions and rescue maintenance.
- Real-time data collection and online driving behavior analysis optimize fleet operations and reduce the accident rates.

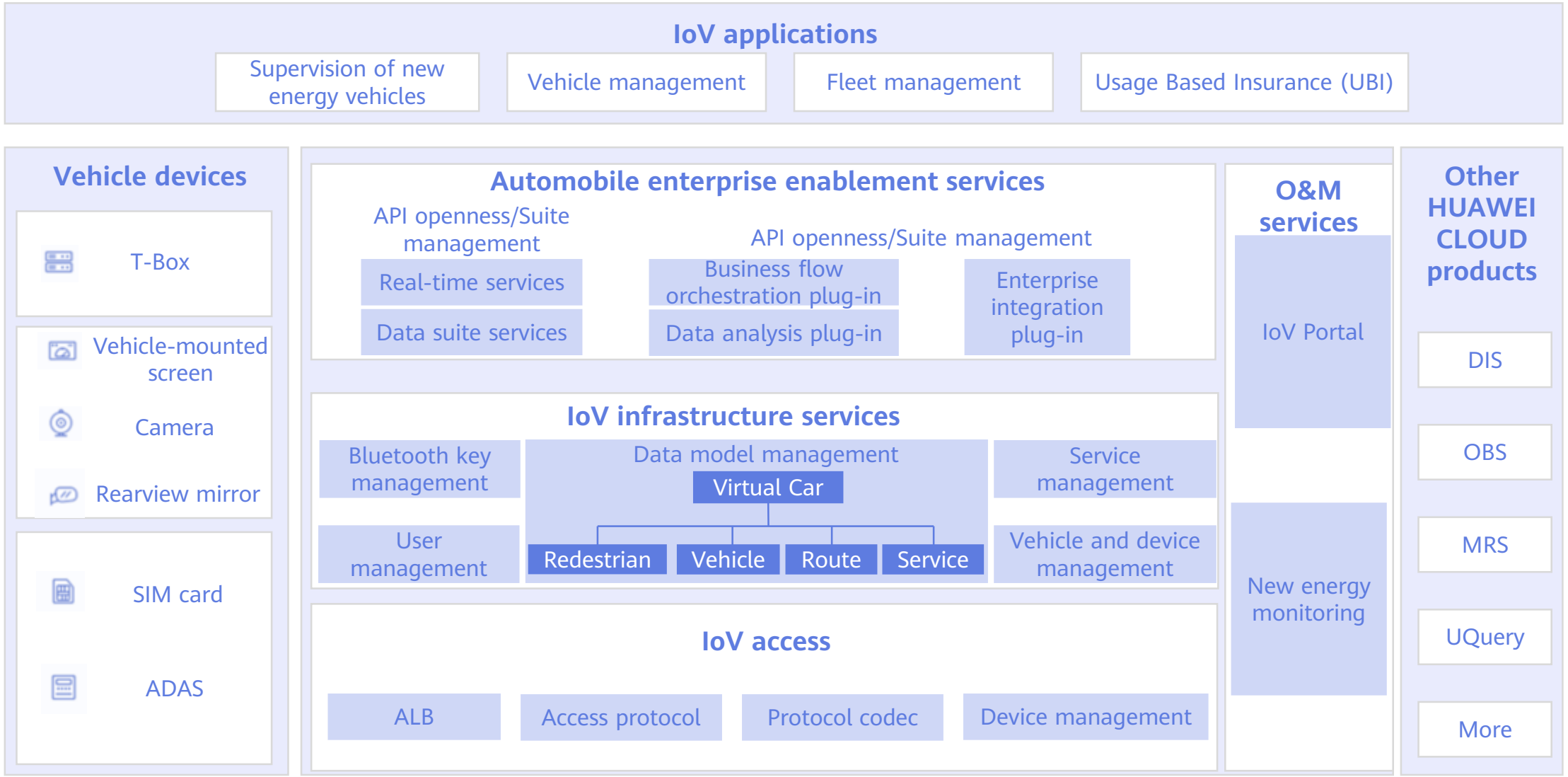
Insurance industry requirements

- **Improving profitability of vehicle insurance companies**: In 2013, after more than 10 years of operations in China's vehicle insurance market, all of the 46 companies were losing money, except for the three listed companies: PICC, Ping An Insurance, Pacific Insurance. The main reason for this was high compensation.
- **Reform of vehicle insurance premium rates**: In February 2015, the China Insurance Regulatory Commission (CIRC) released the *Work Plan for Deepening the Pilot System Reform of the Administration of the Commercial Motor Vehicle Insurance Clauses and Premium Rates*. According to this work plan, driving behavior and other factors affect vehicle insurance pricing, and good driving behavior has lower premiums.
- **Automatic collection of driving behavior**: Safe drivers (evaluated based on the driving behavior data automatically collected by the IoV system) enjoy lower premiums, which helps insurance companies reduce compensation risks and increase profits.

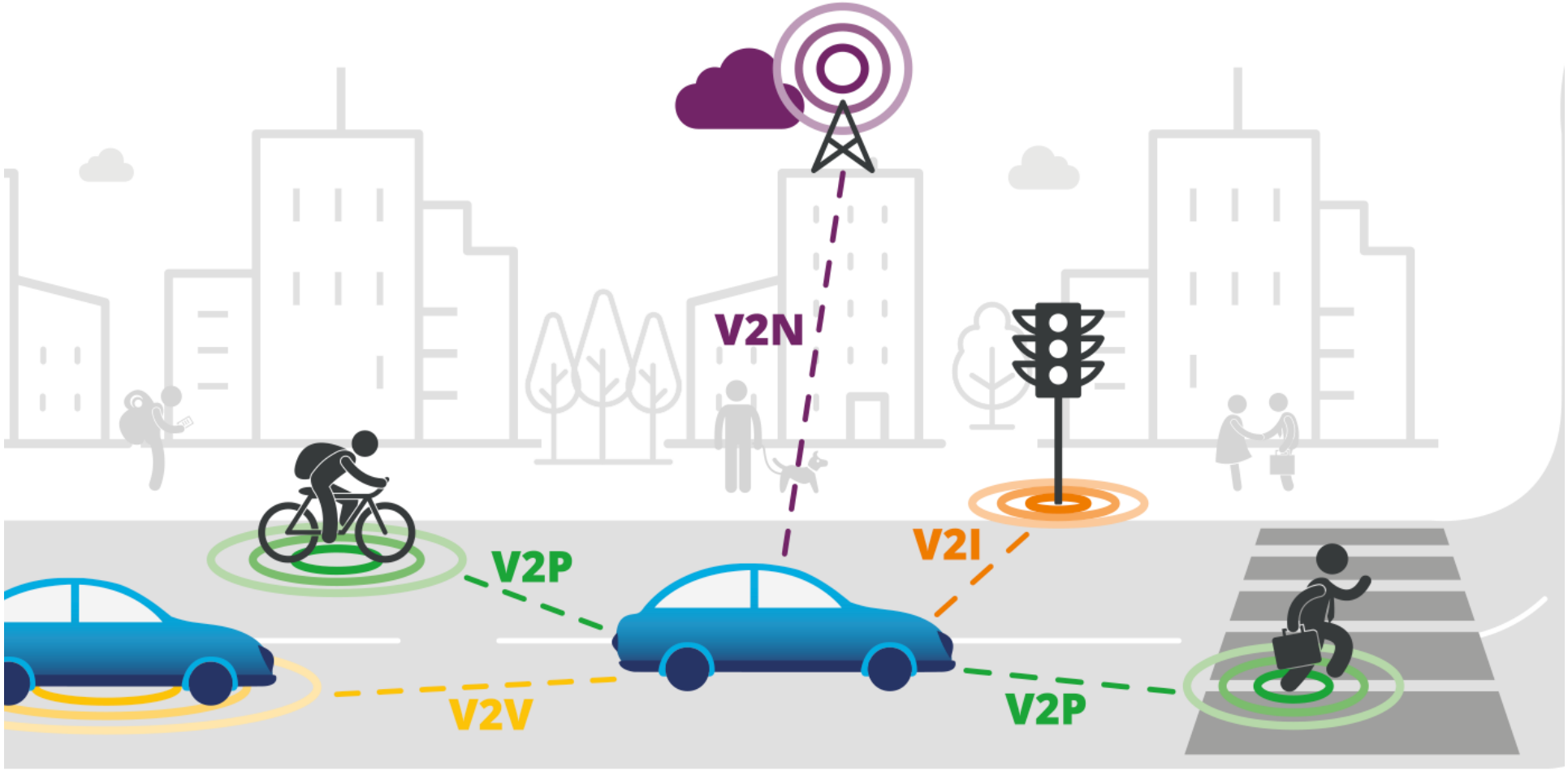
What is IoV?

- Internet of Vehicles (IoV) means that **in-vehicle devices** on vehicles use **wireless communication technologies** to make full use of all dynamic vehicle information on **the information network platform** and **provide various functions** and services during vehicle running.
- IoV **has the following characteristics**:
  - It provides assurance of the distance between vehicles to reduce vehicle collisions.
  - It provides real-time navigation for drivers and communicates with other drivers and network systems to improve traffic efficiency.

IoV Solution



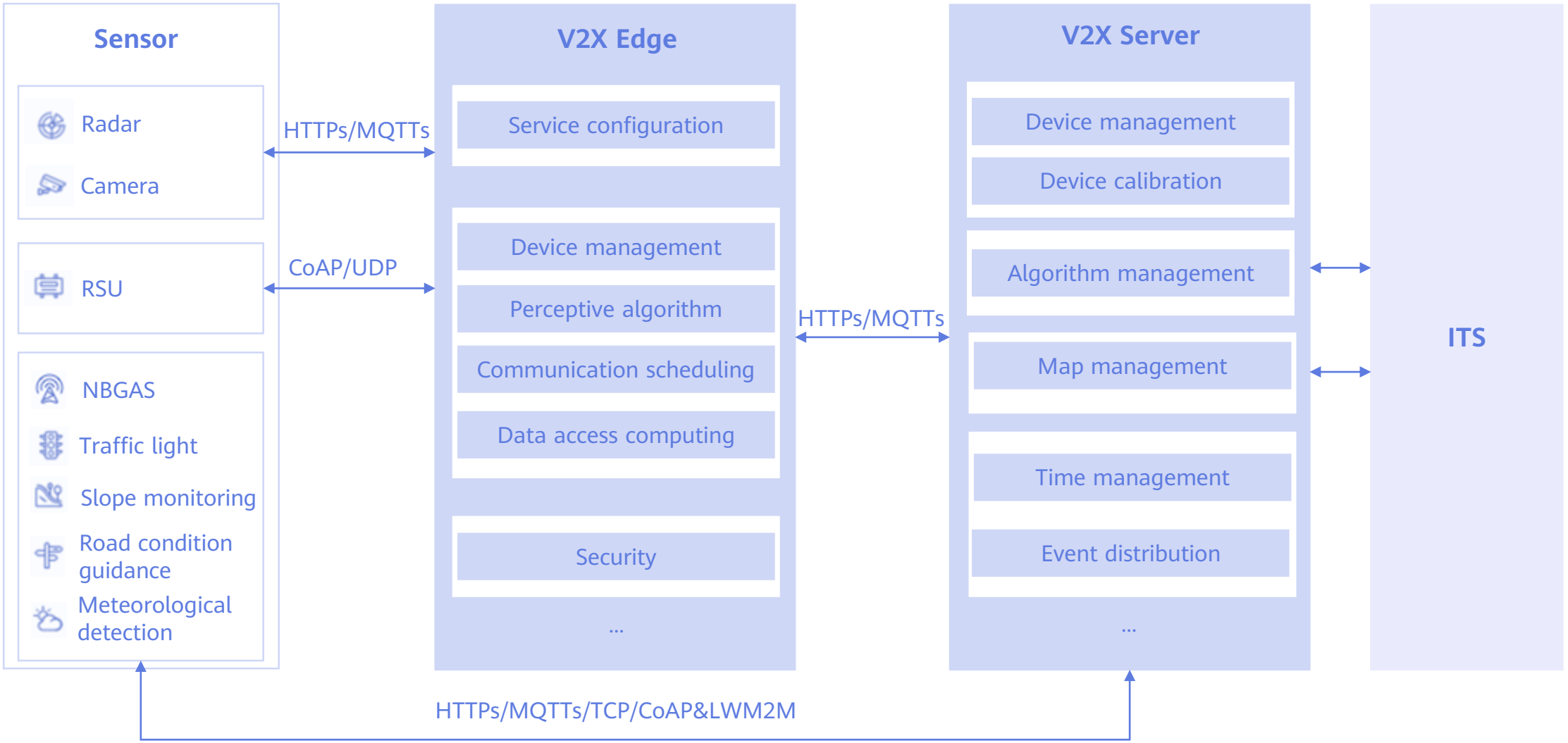
V2X



DRIS Solution

- Digital Road Infrastructure Service (DRIS) implements digital information exchange among people, vehicles, roads, and networks, improves driving safety and road traffic efficiency. This facilitates large-scale commercial use of automated driving.
- DRIS consists of **V2X Server** and **V2X Edge**.
  - V2X Server provides digital road infrastructure services and edge-cloud synergy services such as data analysis and roadside computing unit management.
  - V2X Edge provides real-time service processing capabilities at the edge such as roadside sensor data access, DRIS event identification, and communication forwarding.
- The goal of DRIS is to connect multiple roadside sensors to implement digital perception of roads and provide information for traffic participants to facilitate traffic operation.

DRIS Architecture



IoV Service Development (1)

Road information collection and communications

Improve the efficiency of partial roads with the traffic control and monitoring system of a single-point or partial roads as a core.

Partial traffic control

Telematics

Vehicle-to-network WAN communication implements online navigation, remote diagnosis and control, infotainment, and vehicle alarm through in-vehicle communication modules and cellular communication.

Online navigation/IVI

ITS - BSA

V2V or V2I short-distance communication implements reminding or even controls the potential collision risks of vehicles, improving vehicle safety and traffic efficiency (basic application set).

ADAS

ITS - ESA

Realize automatic control and automated driving without accidents for real convergence of pedestrians, vehicles, roads, and environments. It is the future ITS.

Automated driving

Wired and wireless roadside equipment communication

2G/3G/4G

802.11p/LTE-V

Future technologies

1990s' 2005s' 2015s' 2020s' 2025s' 2030s'