# Introduction to IoT

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# Chapter Five
## Intelligent information equipment

The expanding digital world is full of **intelligent devices**. As the most "intelligent" means of information acquisition at the perception and recognition layer, intelligent devices embody diversified features.

This chapter not only reviews the traditional personal computer and PDA, but also looks forward to the new era of intelligent devices, and on the intelligent device operating platform to launch a certain discussion.

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内容提要

# ↺ Review

Chapter 4 expands the definition of location information and introduces common location Systems
This chapter focuses on the introduction of smart devices, involving **traditional smart devices** (personal computer /PDA) and **the new era of smart devices**, and **the operation platform of smart devices** do some introduction. This chapter focuses on the introduction and tries to present the characteristics of diverse means of obtaining information in the perceptual recognition layer

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# Content

## 5.1 Overview of intelligent devices

## 5.2 Intelligent device operation platform *

## 5.3 New trend of intelligent device development

We are not strange to smart devices.
Computers are traditional smart devices.
Besides traditional smart devices,
what new application scenarios
do smart devices in the new era provide?

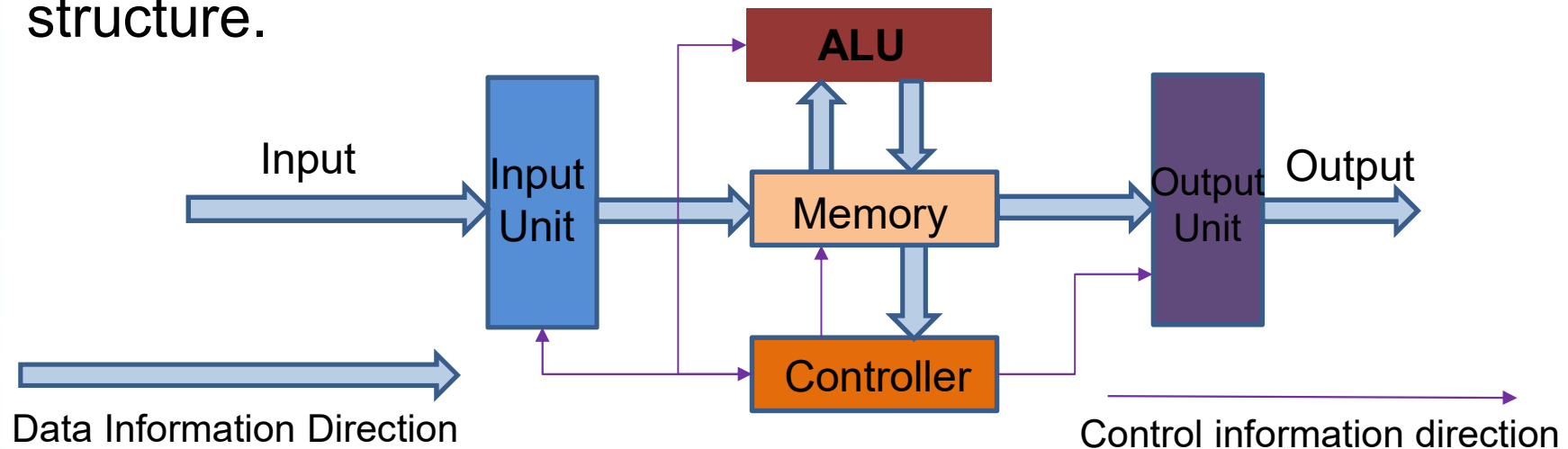# 5.1 intelligent device: generation background

The rapid development and wide application of information technology have changed the traditional way of production and life and brought profound influence to the development of human society. Suitable computing and distributed network technology embed computing into the environment, realize the natural human-computer interaction, and create a new human-oriented information service environment, which is the trend of information technology development.

## ✔ Traditional smart devices: personal computers

Computer is an electronic device which can automatically process and process all kinds of data and information according to instruction pair. It was the first intelligent device, and most personal computers still use the Von Neumann structure.

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                                    ALU

Input          Input                              Output   Output
──────────►    Unit  ──────►  Memory  ──────►     Unit   ──────►

                              Controller
──────────►

Data Information Direction                    Control information direction ──────►
```

✅ Traditional smart devices: personal digital assistants

**PDA** is short for Personal Digital Assistant. With <u>small size</u>, <u>light weight</u>, <u>portable</u> and other characteristics. Its original design is to <u>assist personal life chores</u>, so the early PDA is similar to electronic notepad, the construction of <u>the calendar, contacts, work, notes and other basic software</u>, so as long as the built-in four functions and small size (almost palm size), can be called PDA.

PDA can be divided into <u>electronic dictionary</u>, <u>handheld computer</u>, <u>handheld computer equipment</u> and <u>personal communication assistant</u>.

# ✔ Traditional smart devices: Personal digital assistants

PDA in the future will be completely different from today's products. The size of PDA will become **smaller**, and various product functions will be **integrated** and **more personalized functions** can be set.
PDA has endless development in the future. All the functions of a weak desktop computer can be used on a PDA, which will save a lot of space and provide more convenience. PDA is one of the most promising smart devices.



PDA

# Smart devices in new era

The Internet of things has realized the integration of information space and physical space and created a new human-oriented information service environment.

The migration of this kind of computing center from computers to people has triggered the rapid development of intelligent devices, and a variety of intelligent devices emerge at the historic moment
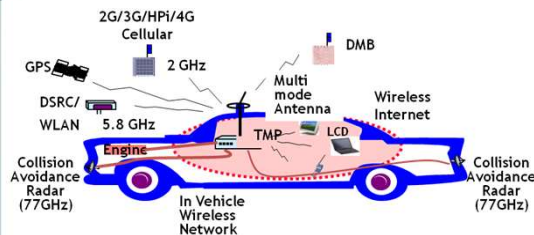
Intelligent vehicle-mounted equipment
Intelligent digital signage
Intelligent medical equipment
Intelligent home appliances
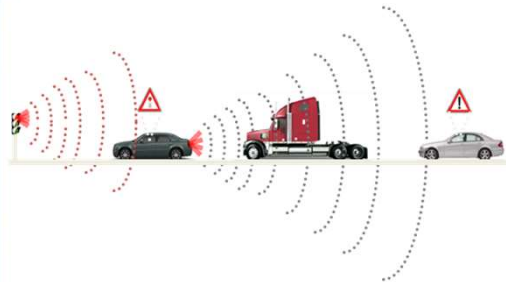A smart phone

# ✔ New era smart devices: vehicle-mounted devices



Automotive electronics accounted for 30% of the cost of cars, in high-end cars also reached 60%!

Three seconds early warning can effectively avoid traffic accidents; Reminding the driver 1.5 seconds in advance can prevent 90% of accidents; Braking 0.5 seconds in advance reduces collision energy by 50%.

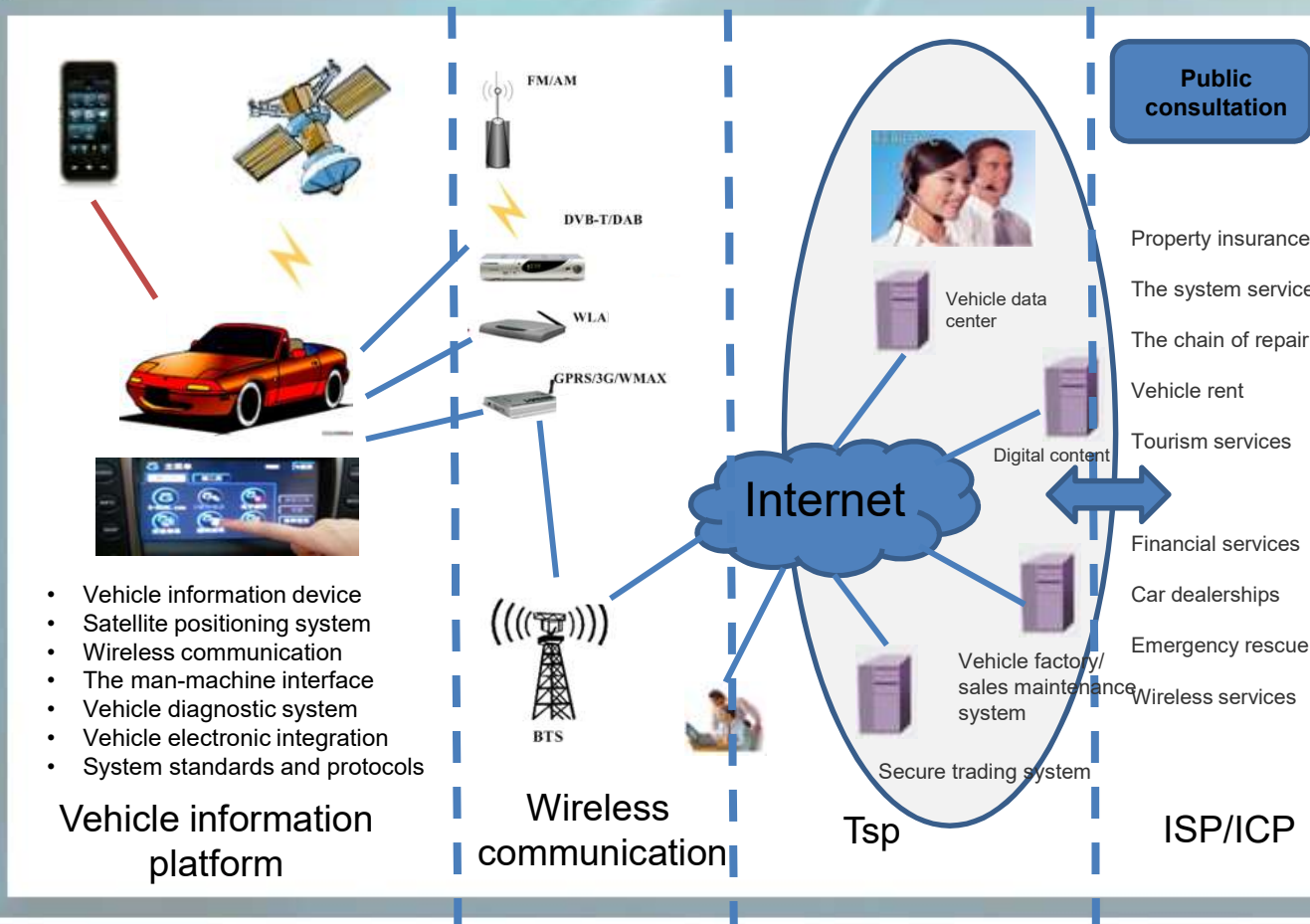Intelligent vehicle equipment and intelligent flow management system can greatly improve traffic efficiency.

# Remote on-board information service system

FM/AM

DVB-T/DAB

WLA

GPRS/3G/WMAX

BTS

Internet

Vehicle data center

Digital content

Vehicle factory/ sales maintenance system

Secure trading system

**Public consultation**

Property insurance

The system service

The chain of repair

Vehicle rent

Tourism services

Financial services

Car dealerships

Emergency rescue

Wireless services

- Vehicle information device
- Satellite positioning system
- Wireless communication
- The man-machine interface
- Vehicle diagnostic system
- Vehicle electronic integration
- System standards and protocols

Vehicle information platform

Wireless communication

Tsp

ISP/ICP

# Future intelligent vehicle equipment

**Assist the driver to drive the car**
- Accurately judge the distance between the car and the obstacle
- Alert immediately or automatically brake to avoid

**Provide personalized service**
- Identify the driver's driving mood and fatigue level
- Choose different driving modes according to the driver's physical and psychological conditions
- Switch video, which has not finished the journey, to your mobile phone or home computer or TV to continue watching

# ✔ Smart devices in new era: digital signage

<span style="color:red">Digital Signage</span> is a new media concept, which refers to a multimedia professional audio-visual system that releases commercial, financial and entertainment information through large-screen terminal display equipment in large shopping malls, supermarkets, hotel lobbies, restaurants, cinemas and other public places where people gather.

# ✔ Intelligent digital Signage

- Customers can complete the shopping process through the self-service shopping cart
- Through the business management information system, the interaction between merchants and customers is realized

# ✔ 3D digital signage

- 3D digital signage was supposed to be the future of science fiction.
- Last year, the French pavilion at the Shanghai world expo launched the world's first virtual pavilion with a full 3D real-time interactive experience
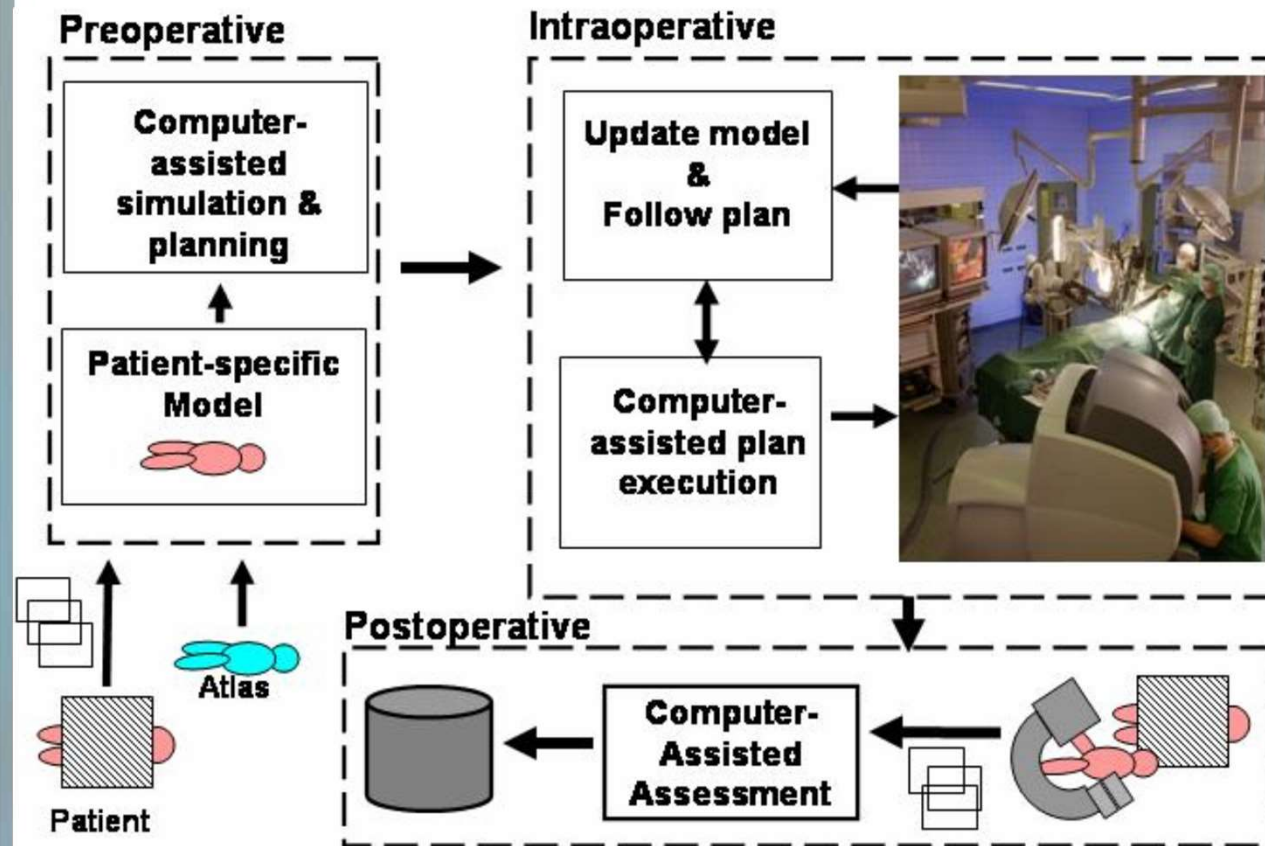
# The application of Internet of things in health monitoring

→ Such PAN can be used in a bag (E-backpack), on a bicycle (E-Bike), on a wheelchair (E-Wheelchair) etc.

# ✔ Networked digital medical devices

# ✔ Intelligent medical equipment

**Electronic medical records(EMR)**

**Computerized Physician Order Entry(CPOE)**

**Computer clinical decision support system(CDSS)**

Clinical information system(CIS)

Hospital information system(HIS)

Medical informatization
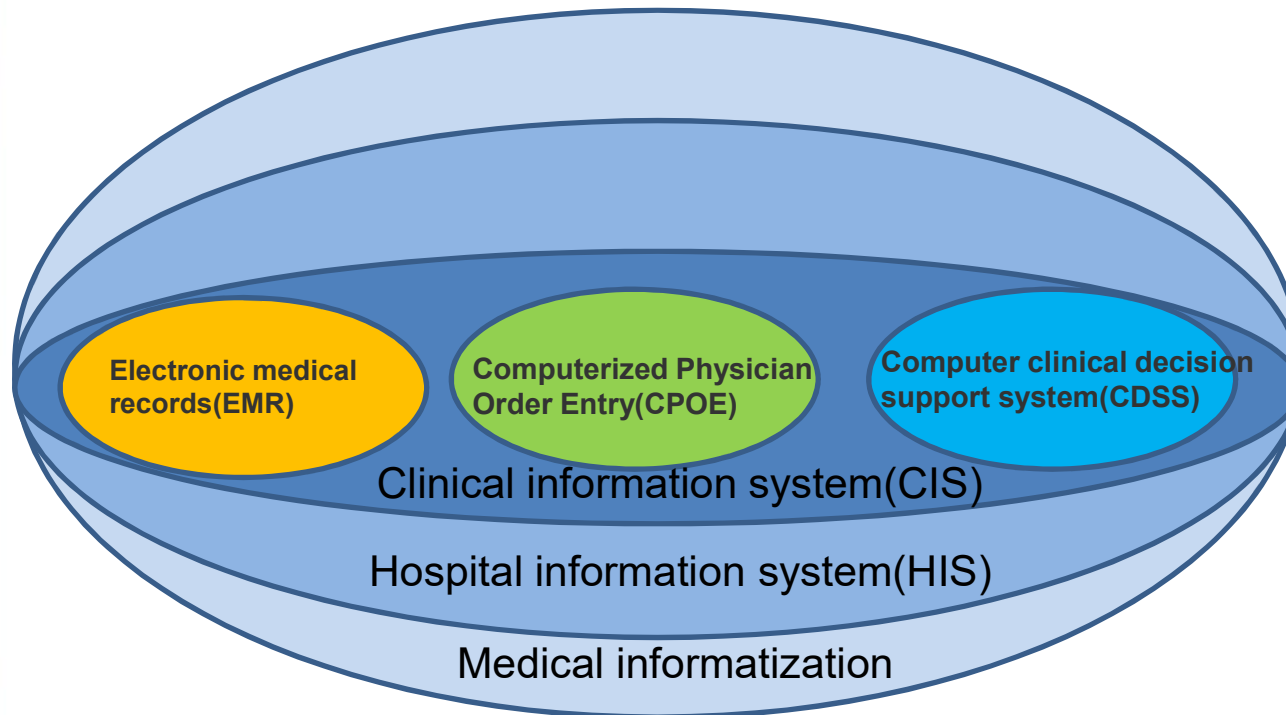
# ✔ Smart devices in new era: Smart TVS

- Traditional TV broadcasting is rapidly shifting to multi-data streaming and network optimization mode, providing consumers with a new TV experience by providing digital entertainment services such as social networking, 3D games and streaming video.

  - Smart TV is changing the TV experience just as smart phones have changed the mobile experience
  - Users can improve the viewing experience with a new TV interface based on voice, gesture and touch

# ✅ Smart devices in new era: Smartphones

- A smart phone, like a personal computer, has an independent operating system, which allows users to install programs provided by third-party service providers such as software and games, through which the functions of the phone can be extended, and wireless network access can be achieved through the mobile communication network.
- The smartphone is an evolution from the handheld computer, a mobile phone with an embedded operating system
- Smartphone operating systems include:

symbian OS   Windows Mobile®   iPhone   palm

android DEVELOPER CHALLENGE   BlackBerry™   Linux

# Content

## 5.1 Overview of intelligent devices

## 5.2 Intelligent device operation platform *

## 5.3 New trend of intelligent device development

The equipment in the Internet of things environment has the characteristics of heterogeneous hardware platform, high dynamic and mobile at any time, so it is necessary to establish a multi-layer adaptive activity resource space model to realize the adaptive management and operation platform of hierarchical intelligent equipment that can smoothly transition

# 5.2 Intelligent Device Operation Platform

| Situational awareness | Task migration | Intelligent collaboration | Multichannel interaction |

Protocol resolution and service normalization

OSGi Service

Device discovery and collaboration mechanisms

Equipment management development kit, runtime development environment

UPnP

iGRS

Sensor
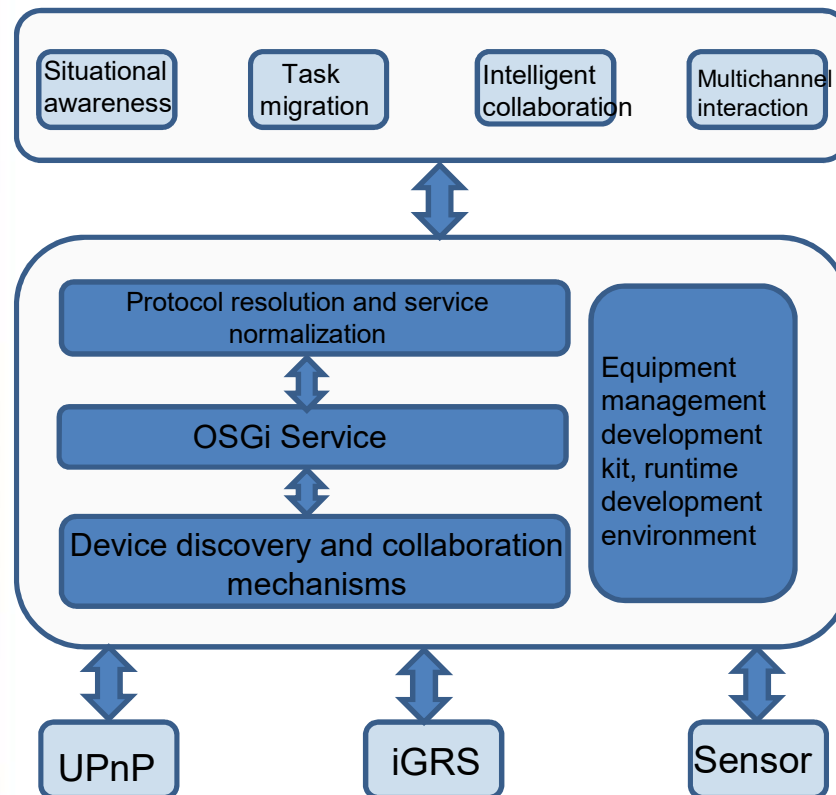
All devices in the physical environment have their own service functions. The middle layer combines the services of the discovered devices and provides uniform excuses for the upper application through protocol resolution and normalization. The intelligence of Internet of things devices is reflected in the situational awareness, task migration, intelligent collaboration and multi-channel interaction of heterogeneous devices.

# Situational Awareness

Situational awareness applications capture, analyze, and respond to relationships between multiple objects. The process of situational awareness involves **the collection of situational information**, **situational modeling** and **general adaptation based on situational models**. The research of situational awareness modeling can be divided into **ontology-based methods** and **logic-based methods**.。
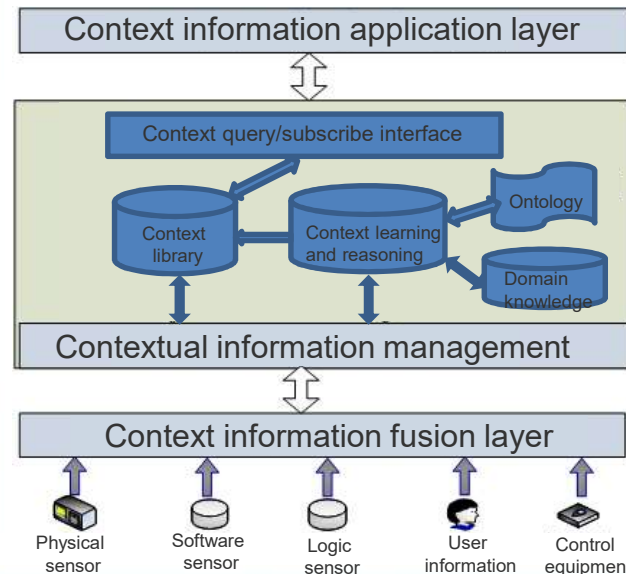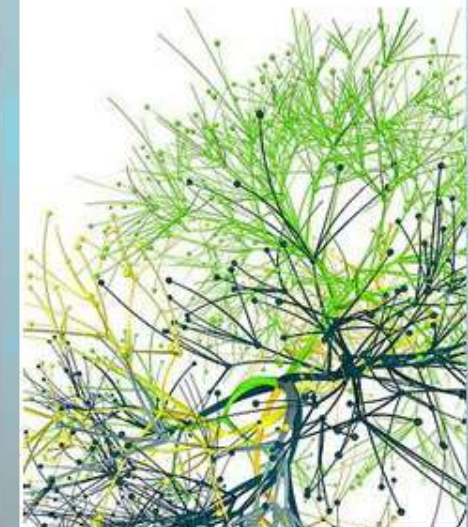


**Ontology-based approach**
　　Ontology method is used to describe various objects in the Internet of things and their relationships

**A logical approach**
　　Context-aware interfaces contain context information tuples, action tuples, derived contexts, and logical context expressions**.**

# Task Migration

The overall framework of seamless migration platform adopts client/server mode, as shown in the figure
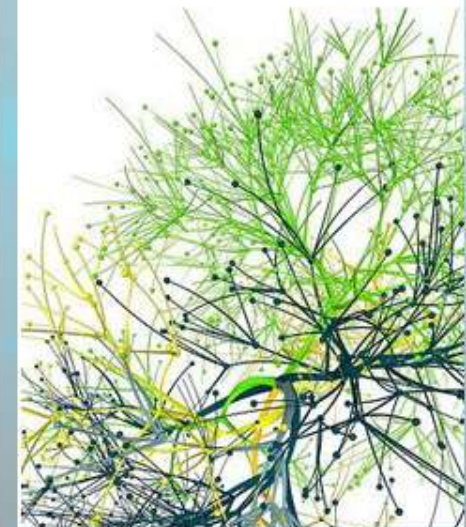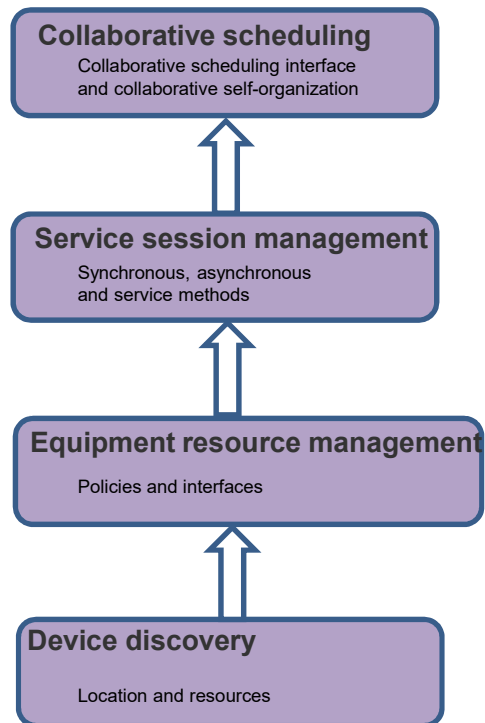
Server | component | Task manager | data

Internet/Intranet

Application layer

| Management transfer | trigger | task store | task restore | Module match | Resource manage | Scene manage |

| basic service | Event manage | State manage | Task manage | Module deploy | Equipment manage | |

OSGi Framework
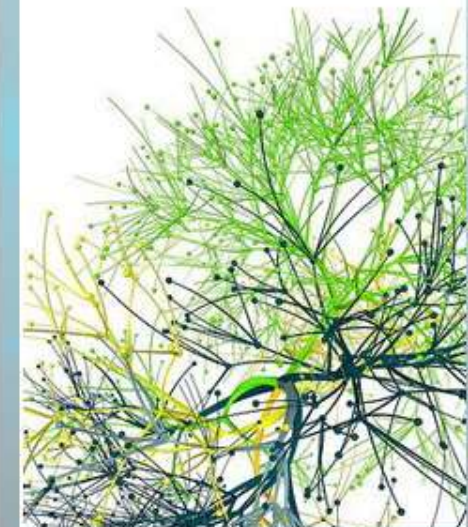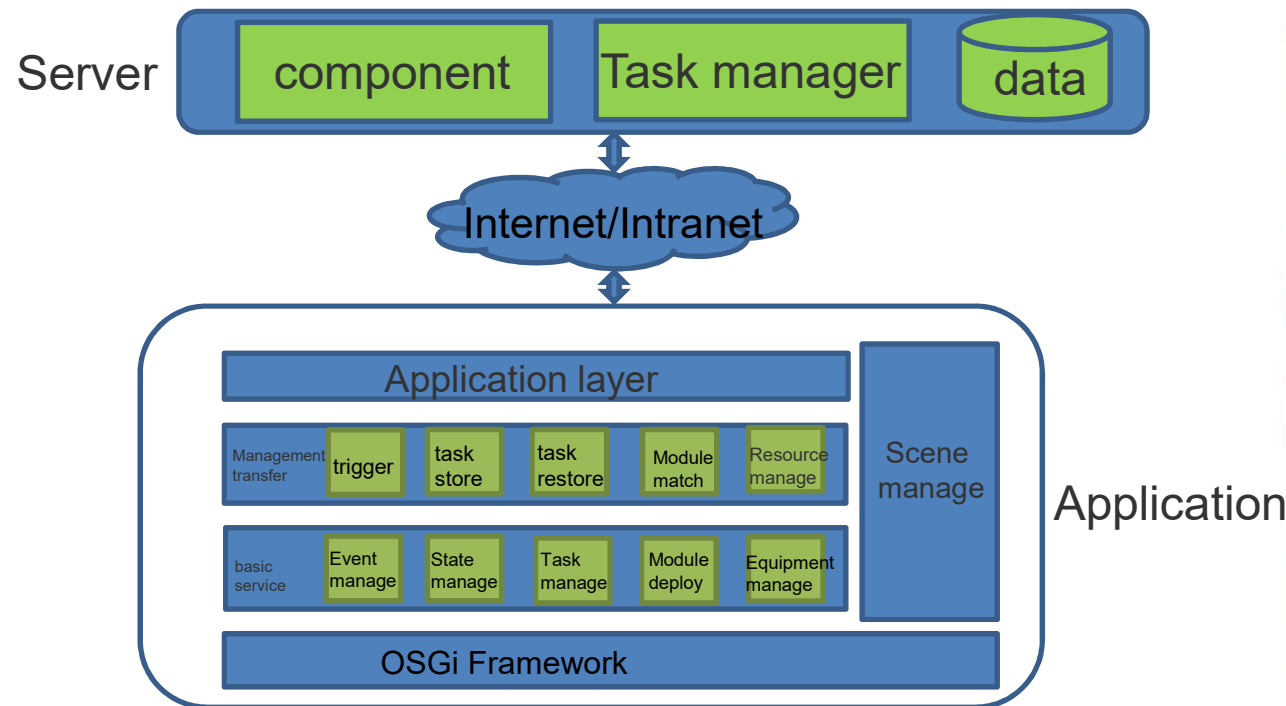
Application

# Task Migration

**The server side** mainly provides <u>component download</u>, <u>cache management of migration tasks</u> and <u>storage of data related to application migration</u>. The application side is the core of the seamless migration platform, which realizes <u>the interruption and recovery of tasks</u>.

**The application side** is designed in three layers: <u>application layer</u>, <u>migration management layer and basic service layer</u>. The application layer supports task migration and develops specific applications based on the programming model. Migration management controls the flow of task migration on the application side; The base services layer provides services that extend beyond the OSGi specification. In addition, situational management, as a third-party component, decides whether to initiate application migration based on changes such as user information or environment changes.

# The intelligent collaboration

**Collaborative scheduling**
Collaborative scheduling interface and collaborative self-organization

↑

**Service session management**
Synchronous, asynchronous and service methods

↑

**Equipment resource management**
Policies and interfaces

↑

**Device discovery**
Location and resources

Device collaboration refers to the integration of functions of existing available services and the construction of new composite services with more abundant functions by coordinating services provided by different devices.

In the Internet of things system, the execution of user tasks can be migrated from one node to another as the user's location changes.
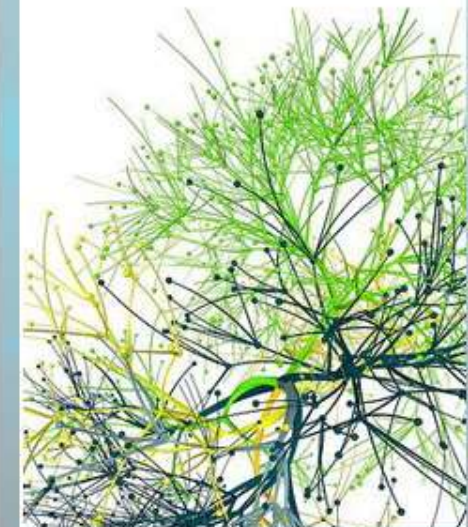
# Multichannel Interaction

Multi-channel interaction refers to a human-computer interaction mode in which multiple channels are used to communicate with computers. Among them, "channel" refers to a communication method in which user expresses intentions, execute actions or perceive feedback information.

Research on multi-channel interaction at home and abroad is carried out from multiple aspects. Among them, the psychology foundation of multi-channel interface, software architecture, multi-channel information integration model and algorithm, network multi-channel user interface and practical application of multi-channel software are the key points.

At present, the main research models of multi-channel information integration technology include task-oriented multi-channel interface structure model, hierarchical integration model and probability-based referential integration model.
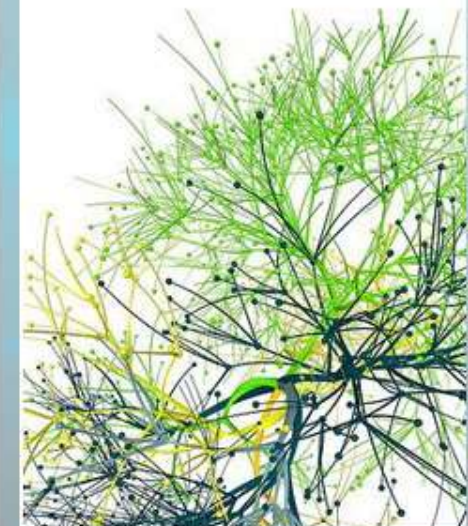
# Multichannel Interaction
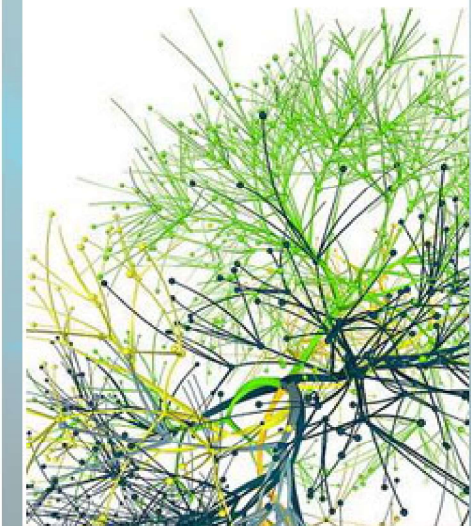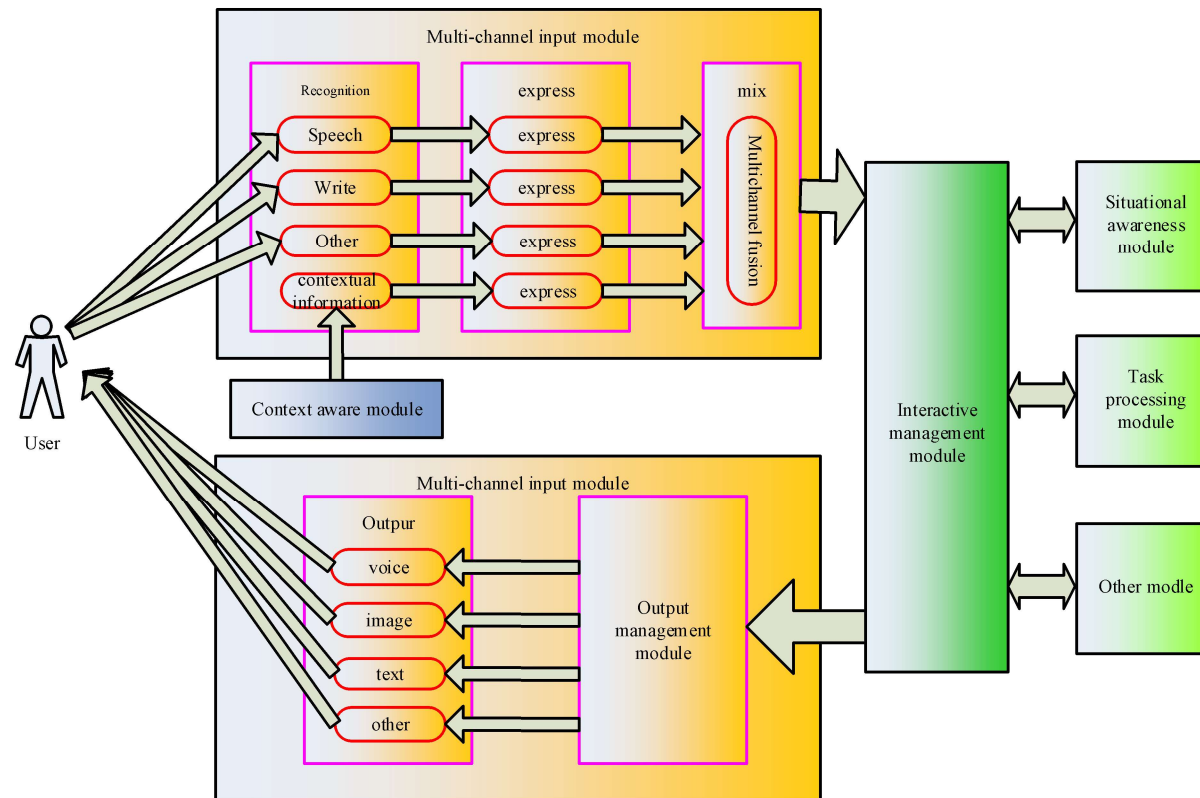
# Content

## 5.1 Overview of intelligent devices
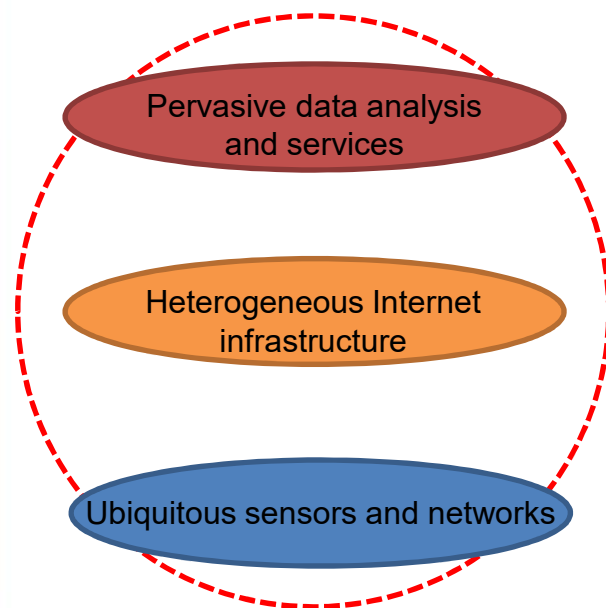## 5.2 Intelligent device operation platform *
## 5.3 New trend of intelligent device development

With the birth and development of the Internet of things,
intelligent devices have a new understanding
and positioning, showing three new trends
of deeper intelligence, more thorough
perception and more comprehensive connectivity.

# 5.3 New trend of intelligent device development

Pervasive data analysis and services

Heterogeneous Internet infrastructure

Ubiquitous sensors and networks

**More intelligent:** Use data mining and analysis tools, scientific models and computing systems to process complex data analysis, summary and calculation, and integrate and analyze vast amounts of information across regions and industries to support decisions and actions.

**More comprehensive connectivity:** Interaction and sharing of information stored in personal electronic devices, organizations and government information systems, real-time monitoring of the environment and business conditions.

**Greater awareness:** Any device, system, or process that senses, measures, captures, and delivers information anytime, anywhere facilitates immediate action and long-term planning.

# 5.3 New trend of intelligent device development

**Deeper intelligence:**
Devices in the Internet of things incorporate deeper intelligence, which has two meanings: horizontal intelligence and vertical intelligence.
**Vertical intelligence** is the traditional intelligence, that is, the improvement of the performance of individual equipment, and the use of more diverse functions and more powerful processing capacity of hardware equipment to achieve intelligent equipment.
**Horizontal intelligence** means to improve the breadth of intelligence and integrate simple equipment without processing capacity into the whole intelligent system. By providing more abundant information to other intelligent devices and implementing the feedback and decisions made by other intelligent devices, the intelligent system can be realized.
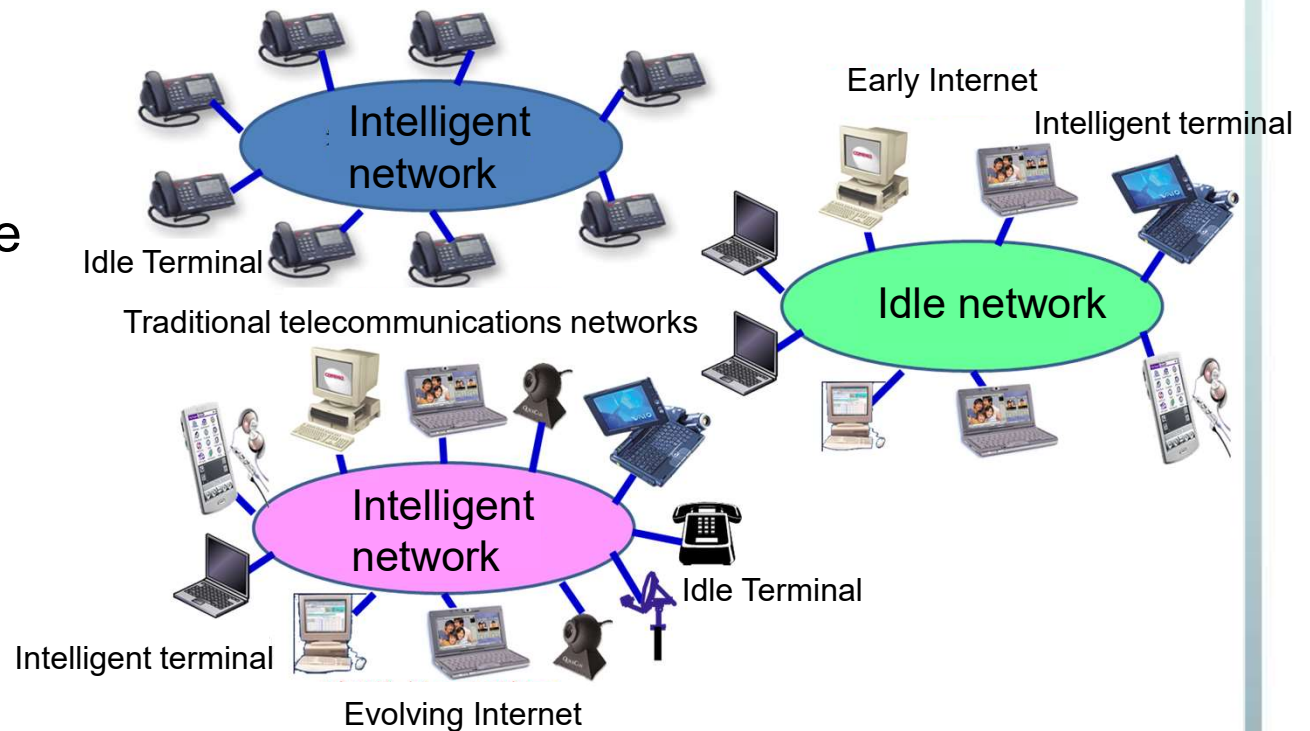
# ✅ Deeper intelligence

Sensor

IPv6 & m2m-x

m2m-x

宽带

广播
(IPTV, Cable, Satellite)

移动/无线

物理介质

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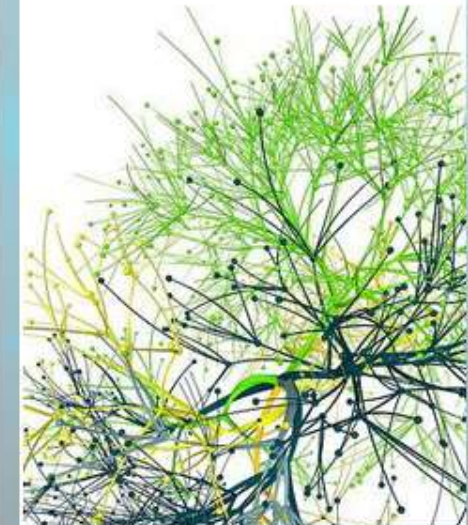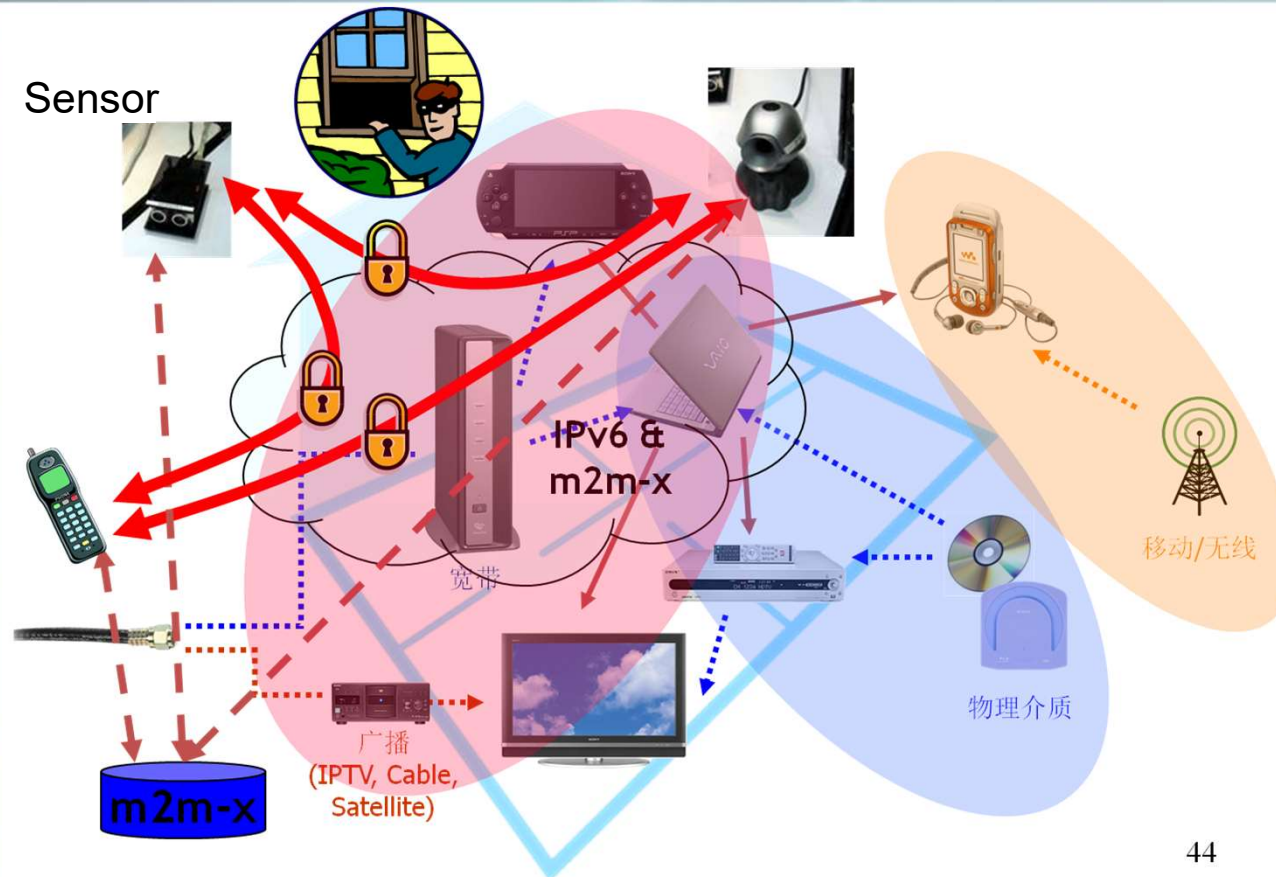
## 5.3 New trend of intelligent device development

**More comprehensive connectivity:**
All devices are connected to each other freely through the Internet to achieve a wider range of connectivity. Form a large number of fully functional equipment group.

## 5.3 New trend of intelligent device development

More thorough perception:
A more thorough perception is the basis for the extension of the physical network into the physical world. Such perception is also divided into two levels: active perception and passive perception.
Active perception is the traditional sense of perception, through a variety of sensor devices distributed in the physical environment to perceive the complex and changing physical world.
Passive sensing refers to that in addition to the equipment's active perception of the information and status of the environment, the device will automatically broadcast its own functions and status to the surrounding, so as to better cooperate with other devices newly added to the environment. Devices can passively retrieve information from their devices in the environment, including their functions and status.

# ✔ More thorough perception

For example, when entering a room, the sensor devices, such as the data clothes worn, can sense the basic physiological data of the human body. For example, when the temperature is judged to be too high, they will automatically send signals to request the start of air conditioning and other household appliances. The signals will be transmitted through wireless sensor network and control relays for operation.
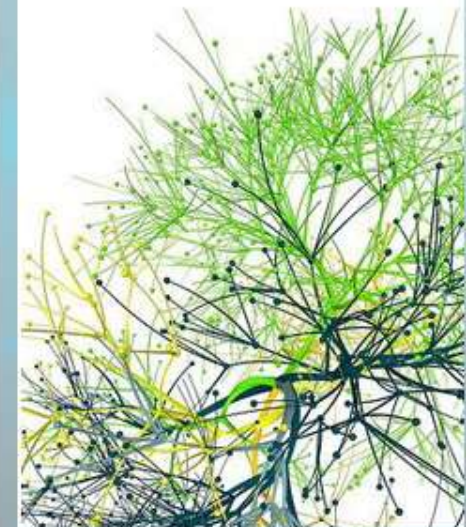
# Conclusion

## Review

This chapter introduces the application of traditional intelligent devices and intelligent devices in the new era, and discusses the characteristics of the operation platform of intelligent devices. Finally, according to the characteristics of the Internet of things, it summarizes the new trend of the development of intelligent devices.
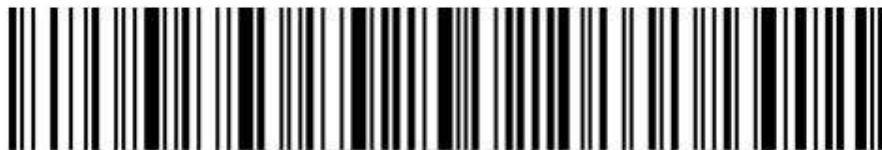
## Key Points

- Illustrate the application of traditional intelligent devices and new intelligent devices.
- Master the main features of intelligent device operating platform (situational awareness, task migration, intelligent collaboration, multi-channel interaction).
- Understand and illustrate new trends in the development of smart devices (deeper intelligence, more thorough perception, more comprehensive connectivity).

Thank you!

Internet of Things