Talking about the Construction of General IOT Application Software Practice Platform

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Abstract—The establishment of a basic service platform for the Internet of Things application can provide the necessary basic technical services for the application of the Internet of Things in various industries in the future. In this way, the in-depth integration of data and business levels in various industries can be realized, so as to fully realize the interconnection of IoT applications. This article will analyze and introduce the technology, principles, and related platform design and deployment required to build a practical platform for IoT application software on the basis of an overview of the technical characteristics, content and composition of the Internet of Things.

1. INTRODUCTION
The Internet of Things is based on a computer network, and realizes the connection between objects and objects through network connections, and performs accurate and comprehensive information processing. The Internet of Things has a complex structure and diverse contents. Its composition includes intelligent embedded, wired sensors, wireless sensors, Internet of Things information publishing services, electronic tags, readers and the radio frequency identification. The IoT system is divided into perception layer, application layer and network layer. Among them, the perception layer includes low-speed and medium-high-speed low-distance transmission technology, sensor technology and radio frequency identification technology, multimedia information technology, two-dimensional code technology. The perception layer is a key part of the entire IoT system structure. Secondly, the network layer is composed of M2M wireless access, next-generation bearer network, mobile private network, Internet and remote control. This layer manages information transmission. In addition, the application layer of the Internet of Things consists of smart power, environmental supervision, middleware, and so on. The application layer can realize direct contact with users, and can also complete information exchange through the application layer.

2. PLATFORM INTRODUCTION
The Internet of Things application software platform is based on the three-tier architecture model of the Internet of Things and consists of a development box, a gateway, and a cloud platform. Its main functions include information collection and system control, information transmission and processing, information storage and application of the Internet of Things platform. It allows users to focus on business system design in the future development of the Internet of Things platform, without the need to design basic services such as network channels and data storage. The development box includes sensors, microcontrollers and ZigBee nodes. Various sensors and single-chip microcomputer systems can be connected to form an information collection and system control module to complete the sensing layer information collection and system control operations. The ZigBee node and the microcontroller
system form a local ZigBee local area network. The gateway includes ZigBee coordinator, microcontroller, and GPRS module. Among them, the ZigBee coordinator, GPRS module and single-chip system form a gateway unit to complete the data communication between the development box and the server. The ZigBee coordinator in the gateway realizes the connection with the sensor through the ZigBee node to complete the gateway communication. The gateway communicates with the Internet server through the GPRS module. The cloud platform provides basic services including data storage, data analysis, and system applications for the application layer in the Internet of Things architecture [1].

3. TECHNICAL ANALYSIS ON THE CONSTRUCTION OF THE APPLICATION SOFTWARE PRACTICE PLATFORM OF THE INTERNET OF THINGS

3.1. Equipment Performance Requirements
The important hardware devices included in the IoT system are in the perception layer and the network layer. It includes routers, sensors, QR codes, radio frequency identification tags, cameras, GPS positioning and other equipment. These devices are divided into the perception layer and network layer structure according to specific application requirements, and they can also play a role in the Internet of Things. These core devices are programmed with the corresponding technical language to process the corresponding operating system interface. In the Internet of Things system, each application software architecture and hardware devices are independent, and there is a greater connection with middleware.

3.2. Middleware Technology
Middleware has its own shielding characteristics. It can not only freely construct the Internet of Things system, but also realize the effective management of the Internet of Things system and provide guarantee for the development and operation of the Internet of Things. The middleware in the Internet of Things has the function of shielding the underlying hardware and the abnormal conditions in the network. This can ensure that the hardware devices can maintain independent existence and operation in the future applications of the Internet of Things, and provide technical support. In the information network era, it is necessary for us to ensure the standardization of intermediate components in the Internet of Things, and use middleware technology to complete the construction of the Internet of Things application software architecture platform. When realizing data exchange control, the Internet of Things middleware standard is OPC, which can be completed under the EPCI interface standard when reading radio frequency identification data. In addition, we can use auxiliary Java programming to promote stable operation of the intermediate components, and proceed according to the OSGI standard. For WSN specifications, middleware is the specification for developing, operating and maintaining sensor networks. It can carry out related operations for the construction of the Internet of Things application software architecture according to the relevant operating standards of the intermediate components. Only in this way can the functions of the middleware be effectively utilized [2].

3.3. Radio Frequency Identification Technology
Radio frequency identification technology is a kind of wireless identification technology. This operation can be performed without direct contact with special bodies when identifying objects within the radio frequency range, and the information data obtained is accurate and effective. Using this technology, accurate recognition of slow and dynamic objects within close range can be achieved, as well as high-speed dynamic objects. The technology consists of readers, server antennas and identification tags. Its main function is to control and track objects, analyze the status of the identified objects, and process the information in depth. Besides, the signal can be stored in the radio frequency identification software by transmitting the signal according to actual application requirements. This technology is similar to two-dimensional code technology and barcode technology. However, RFID technology can also assist antennas, memories, and control systems to send previously stored information to a specific location. Different types of readers are also included in RFID software. As a
result, it also has certain differences and complexity. When using radio frequency identification technology for information transmission, in order to ensure the accuracy and effectiveness of information transmission, we must process the information in the reader and control it through additional information.

3.4. Sensor Technology
The main functions of sensor technology include monitoring, data collection, data analysis and inspection, and management operations. In the construction of the IoT application software platform, the role of sensors is to ensure the stable operation of the IoT system. Hence, sensor technology must be supported in the development of the Internet of Things. Sensors play a greater value in information acquisition and are currently widely used in people's daily life and work.

3.5. GPS Technology
GPS technology is one of the most common and most widely used technologies. The technology is not restricted by time and space, and can interact with objects and people all day long, regardless of time period and region. Applying it to the construction of the Internet of Things platform, in the perception layer of the Internet of Things, it can play its navigation function when searching for Internet of Things information. GPS technology consists of a satellite part and a ground part. Among them, GPS technology consists of a monitoring station and a master control station in a ground environment. The main content of its work is to send back data information from satellites. The use of computer systems to complete calculation statistics can ensure the safety and accuracy of the received information. In the Internet of Things system, using this technology can ensure that data will not be lost and destroyed due to sudden power failure. Installing a backup power supply in the GPS receiver can ensure that the GPS reader/writer can receive information normally under any circumstances.

4. PRINCIPLES OF CONSTRUCTION OF PRACTICE PLATFORM FOR INTERNET OF THINGS APPLICATION SOFTWARE

4.1. Scalability
The Internet of Things is expected to generate 79.4ZB of data by 2025, and most of it is unstructured data. Because of the multiple types of equipment, the IoT platform needs to implement a distributed design. With the huge amount of data, the construction of the Internet of Things platform needs to rely on the organization and construction of the microservice architecture. It has the characteristics of scalability, extensibility and reusability, and each service is independent and interrelated [3].

4.2. Safety
There are more than 30 billion Internet of Things devices. As the basic architecture platform of the Internet of Things platform, its general application software platform must meet the requirements of security when it is built. We need to deploy and update safely, set up a security gateway terminal for each IoT device, and set up dynamic and static encryption functions. Otherwise, we need to set up a network firewall and other security facilities between the transport layer and the communication layer, and conduct regular data and network security audits. Only in this way can the security of data communication be ensured.

4.3. High Availability
In many application fields, once the IoT system shuts down, it is likely to cause economic property losses and threaten people's lives. To this end, we must make the IoT system run in a highly available environment. At the same time, we need to back up and distribute data in multiple locations to avoid data loss in the event of a catastrophic event, so as to ensure the safety and integrity of the data. In addition, we should develop failover measures to automatically direct user requests to a standby state to achieve seamless data connection between the server and the terminal.
4.4. Rapid Deployment
The solutions provided by the Internet of Things must meet the requirements of rapid deployment and update, and the latest features can be detected and deployed quickly and automatically by using a centralized deployment method. This also enables IoT solutions to be quickly updated to the latest state and solve end-user problems in a timely manner.

4.5. Data Access within the Application
Data accessed by IoT devices should be stored in close proximity to reduce the cost of network latency and improve data security. The Internet of Things devices connect securely through the terminal and realize the receiving and sending of data, and each step requires the device to be authenticated.

4.6. Data Management and Equipment Management
Internet of Things devices will generate some redundant data to filter these unnecessary data. This ensures that end users can obtain the valuable data information they want. Therefore, we must comprehensively view the generated data and take necessary measures for data and equipment management to ensure its safety and compliance. The automatic update of equipment can reduce the occurrence of equipment failure problems.

4.7. Platform Monitoring
Every application in the Internet of Things has preventive control of events that may cause interruptions. These applications include automatic alarm signals, rapid diagnosis and location of faults, and rapid troubleshooting.

5. Analysis of the Construction of a General IoT Application Software Practice Platform

5.1. Overall Structure and Composition
The overall architecture of the IoT application software practice platform is shown in Figure 1 below, which includes a front-end program part and a server-side part. Among them, the front-end program part is the FLEX client, which is a free open source framework. Under this framework, it includes view interface, control interface and data model. We can use this framework to build expressive web applications and mobile phone programs, and use Adobe Flash Player and Adobe AIR to implement unified deployment and operation of browsers, desktops and operating systems. Using the corresponding operating system in an integrated environment enables the deployment of smart phone or tablet client programs. The server side includes MINA framework, mybatis framework or hibernate framework and web program. Among several frameworks, MINA provides a convenient framework for high-performance and high-availability network applications, and supports the development and design of TCP/UDP applications based on Java NIO technology and the development of serial communication programs. In the construction of the application software practice platform of the Internet of Things, the use of MINA framework technology and interaction with the underlying hardware devices can support serial port and network communication. As an open source framework, the Hibernate framework has the advantage of being able to manipulate the database using object programming thinking without writing SQL statements. Using this framework to build an IoT application platform can realize routine operations such as adding and deleting databases. If you want to sort, multi-field query and other operations, you still need to write HQL statements to achieve. Mybatis framework is similar to hibernate framework, and it is also the persistence layer framework of Java language. However, the framework requires programmers to write some SQL statements and some HQL statements. Therefore, the hibernate framework is used in the construction of this platform. Furthermore, in order to realize the communication function between server and client, it is necessary to use blazeds technology to make the server-side Java application communicate with the flex client.
program running on the browser, and the flex client is realized through the http service control, webs service and other controls and the server-side application interaction [4].

![Figure 1. Platform Software Structure Diagram](image)

### 5.2. Software System Development

Take the construction of a digital urban management Internet of Things platform as an example. The Internet of Things construction needs to rely on external network resources and platforms to realize the interconnection of Internet of Things units and network elements. The system operation platform includes a network communication bearing platform and an operation support platform. The system software and hardware deployment environment is divided into a network communication environment, a server environment and a storage backup system environment, an information security system and system software. In the development of the system operation platform, the network communication platform relies on the mobile communication provider to realize the unified private line access of the digital urban management information system and the operator's mobile communication network and the access of the SMS platform. In this way, data communication, terminal data access and intelligent terminal construction can be realized. The operation support platform is constructed based on external network resources, including server systems, storage backup systems, information security systems and system software. Moreover, we can use virtual technology to reduce the number of system servers and improve server utilization. This can improve resource utilization and data center space utilization.

### 5.3. M2M Platform Technical Specifications and Requirements

#### 5.3.1. Composition

M2M is composed of intelligent machines, hardware, communication networks and middleware. The intelligent machines enable the machine to have the functions of information perception, information processing and wireless processing. M2M hardware enables the machine to have networking and remote communication components, extracting required information from different devices and transmitting it to the analysis part. The communication network is the core of the M2M technology framework, and the M2M hardware is transmitted to the designated delivery location of the information
through the wide area network, local area network and other networks. Middleware is the component that converts under different protocols in the M2M gateway and builds a bridge between the communication network and the computer system.

5.3.2. Skills Requirement
The positioning of the platform has the following aspects. First, it can provide a unified terminal access platform and a basic application operating platform. That is to say, through this platform, a unified data access scheme and a unified operating environment can be provided for all Internet of Things application terminals to achieve efficient data processing and ensure data consistency. Second, it can provide a unified security authentication and data exchange platform, and integrate the authentication information of various business systems with user information system authority as the core. It can provide a highly integrated and unified authentication platform, and connect heterogeneous systems, applications and data sources related to each business through middleware to meet the requirements of seamless sharing and data exchange between systems. Third, it can provide a unified portal support platform and business infrastructure components, so that information collection, content management, and information search can be performed across the entire network. It can not only directly organize various types of information and basic business information, but also provide development aids for applications in various industries, including rapid control, geographic information services, and authority management.

5.3.3. Technical Framework
The overall design idea of the M2M platform is divided into terminal access, data forwarding, industry platform, capability provision and unified portal. In the terminal access design, the terminal sends data to the platform by specifying the IP address and port of the data access server, and then the data access server receives it. Data forwarding refers to the conversion of the data structure after unifying the received data, converting the data into a data structure that can be processed by the platform, and then the gateway server determines which industry platform the data should be sent to. The industry platform is an independent platform for each industry. After the terminal data is forwarded to each industry platform, the industry platform will process the data logically and display it to users. Capability refers to the functions and services that can be used by all industry platforms provided by the platform. The unified portal refers to the unified management portal for functions such as certification authority, assessment and resources of all industry platforms. The platform system structure is divided into terminal layer, communication layer, business and data processing layer, and user layer. Among them, the terminal layer includes all terminal equipment involved in all walks of life. The communication layer contains various devices that support wireless communication, and its role is to provide transparent data transmission. The business and data processing layer includes the core data and business processing user layer such as the basic service platform of the Internet of Things application and various industry application platforms of the Internet of Things, management portals, as well as the unified management portal of the Internet of Things and all users of various industry applications[5].

5.3.4. Application Basic Operating Platform
Internet of Things application software has the characteristics of multiple bottom-level terminals and complex upper-level industry applications. This requires that the basic operation platform can maintain a large amount of shared data and basic service data, ensure data consistency and can process complex data in real time. The application basic operating platform is the data processing core of the M2M platform and the operating environment of each component. Its functions include managing dynamic and static data in the memory, realizing data circulation, historical data processing and real-time data processing and storage. The application basic operating platform also has multiple module functions such as alarm, communication, strategy, script, etc., and each module can be refined into multiple logical units.
5.3.5. Security Identity Authentication System and Data Application Integration Center
The unified security identity authentication system is to realize the integration of authentication information systems of various business systems with user information and system permissions as the core, and to provide a highly integrated and unified identity authentication platform for various industry applications. Its functions include identity authentication and authority management, and it has the characteristics of flexible structure, safe and reliable system data, mobile remote office, and integrated business processing.

The unified data application integration center refers to the data exchange center and agency center where the data exchange platform uses the unified XML protocol specification based on metadata. Each application system can complete data exchange through the center, perform metadata management, service management and authority management, and directly serve data exchange participants.

5.3.6. Platform Interface Design and Business Integration Design
Platform interface design includes interface design with industry terminals, industry application interface design, and interface design with other systems. The design of the interface with the industry terminal should be kept as uniform as possible, and the supported industry terminals include city management system terminals and environmental protection monitoring terminals. The design of the industry application interface, that is, the M2M platform, as the basic service platform for various IoT industry applications, has a complete interface and exchange data with each application. It can provide a standardized interface to realize the platform's external data interaction. Business integration design includes video surveillance integration and GIS platform integration.

6. CONCLUSION
In summary, the purpose of building an IoT application software platform is to further develop IoT application software for different industries on this platform. In the future, the difficulty of IoT application software architecture will continue to increase. Therefore, the development of a complete IoT software architecture, continuous expansion of its functions, and the use of the advantages of various technologies can provide technical support for the subsequent construction of the IoT platform. Meanwhile, in the information age, the use of Internet of Things technology has also improved the communication between people. This can also lay a good foundation for the realization of the Internet of Everything.

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