The Composition and Main Technology of Industrial Control Internet of Things Middleware

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Abstract. Application system engineering method, based on the construction rules of the internet of things, combined with the practical application of the site, to build the middleware of the internet of things in the industrial control system. This paper discusses and studies the architecture and application mode of the industrial control internet of things middleware, the main role and application focus, the function of the industrial control internet of things middleware. This paper provides a theoretical basis for the composition and application of industrial control internet of things middleware, and makes a feasible attempt for the construction and application of industrial control internet of things.

Composition of Industrial Control Internet of Things

The industrial control internet of things is three layer architecture, namely the sensing layer, the network layer, the application layer, the three-tier architecture division forms the basic structure of the industrial control internet of things. The sensing layer is the material foundation, the industrial process control a large number of sensors and data acquisition card, the control information and data information needed by the industrial control system: analog quantity; Digital quantity Switch value and so on. After proper pretreatment, it is transmitted to the system in the form of information needed by the industrial control system. The network layer is the means and method of the system, the network transmission technology is relatively mature, it is the key technology to achieve the internet of things. Application layer processing is the purpose. The use of automation and intelligent technology for analysis, processing, real-time, efficient, intelligent to meet the needs of industrial control system, to achieve the purpose of industrial control.

The industrial control internet of things is to connect the sensor network to the communication network, complete data acquisition, change to the processing of data, extend to a variety of related operations, coupled with intelligent application. The original internet, telecommunications networks are people and people's communication, and now turn into the communication between things and things, and people's communication. From the whole system structure and structure analysis, in the communication network to join the middleware, to achieve the support of objects, so that the objects can communicate through the communication network.

Classification of Industrial Control Internet of Things Middleware

Based on the purpose and implementation mechanism, the industrial control internet middleware is divided into the following categories:

- Process - oriented middleware
- Message - oriented middleware
- Object - oriented agent oriented middleware

Middleware can provide different forms of communication services, on the basic communication platform, can build a variety of frameworks to provide applications in different areas of services, transaction processing, distributed data access, object transaction management. The platform is used to shield the difference of the heterogeneous platform, and the framework of the platform defines the system structure and standard service components of the application in the corresponding
domain. The user only needs the events of interest to the framework, and then provides the code for handling the event. When an event occurs, the framework calls the user's code.

The middleware relationship of the industrial control internet of things is shown in figure 1. The middleware platform relationship of industrial control internet of things.

![Diagram](image)

Figure 1. Diagram of the middleware relationship of industrial control internet of things.

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The user code does not have to call the framework, the user program does not have to care about the framework structure, execution process, system calls, and so on, all of which is done by the framework. The application based on middleware development has good scalability, ease of management, high availability and portability.

**Characteristics of Industrial Control Internet of Things Middleware**

**Independence from the Structure**

Middleware is independent of the internet of things and back-end applications, and can be connected to multiple back-end applications to reduce the complexity of maintenance.

**Data Flow**

The purpose of the internet of things is to convert entity objects into virtual objects in information environment, so data processing is the most important function of middleware. The middleware has the functions of data collection, filtering, integration and transfer, so that the correct object information can be transferred to the upper application system.

**Process Flow**

The middleware of the internet of things provides sequential message flow with the function of program logic and storage and forward, which has the ability of data flow design and management.
Standardization

The Main Function of Industrial Control Internet of Things Middleware

Middleware technology is used to realize the sharing of resources between multiple systems and technologies, and ultimately constitute a rich and powerful service system. Middleware is needed in the internet of things in industrial control system.

Middleware is a software layer between the operating system, including the underlying communication protocol and various distributed applications. Middleware technology provides users with a unified running platform and a feasible development environment. It is an effective solution to help users to reduce the differences between high-rise application requirements and network complexity, which plays an important role in accelerating the large-scale development of the internet of things.

In the industrial system, the complex control object information is collected through the data acquisition module, the collected information is then transformed into a unified identifiable communication protocol through the intermediate conversion platform. The transformed identifiable data information is transmitted to the back-end server for unified storage, analysis and management. Even if different equipment, different manufacturers, different models, different protocols, different formats can also communicate with each other. Transmission, storage, analysis, processing of information.

For the application software development, the middleware is more important than the operating system and network services; The program interface provided by the middleware defines a relatively stable high-level application environment, independent of the underlying computer hardware and system software, as long as the middleware is upgraded to keep the definition of the external interface unchanged, the application software does not need any modification to protect the major investment in the application development and maintenance of industrial enterprises.

Shielding Heterogeneity

The heterogeneous type is represented in the heterogeneous type of computer hardware and software, including hardware, operating system, database, etc. The reasons for the heterogeneity are from market competition, technology upgrading and protection of investment.

Achieve an Interactive Operation

In the industrial control internet of things, the information collected by the same information acquisition equipment may supply multiple application systems, and the data between different application systems also need to be shared and exchanged.

Pre-processing of Data

The sensing layer of the industrial control internet of things will collect the massive information, send these information directly to the control system, the control system to deal with these information will be overwhelmed, the control system wants to get not the original data, but comprehensive information.

To realize the standardization of each small application environment or system and the communication between them, a common platform and interface must be set up, which is the middleware business.

The middleware system of the industrial control internet of things is shown in figure 2:
Application of Internet of Things Middleware in Industrial Control System

Application-oriented Middleware
The middleware is mainly for the purpose of the integration, concatenation and connecting the reader, for the user to connect the back-end and the reader in series. Focus on the front and rear end system connectivity issues.

Infrastructure Middleware
With the basic data search, filtering, connectivity and other functions, to meet the industrial system of multiple connection requirements, with the management and maintenance of the system platform.

Solution Middleware
In the process of data acquisition, data processing, data storage and middleware development, innovative application solutions are proposed for different system applications.

The most important middleware of internet of things is communication middleware, embedded middleware, digital middleware, universal middleware, m2m middleware, application system middleware, architecture middleware, solution middleware.

Conclusion
The industrial control internet of things deployment provides convenient and flexible middleware. It provides the basic structure for the construction of the internet of things in industrial control system, and opens up a new type of application. Storage engineering data, specify engineering data processing tasks, data processing tasks can be recognized and incorporated into the system flow processing.

(1) Construct the architecture and application mode of the industrial control internet of things middleware;
(2) The main role and application focus of middleware in the internet of things;
(3) The function of industrial control internet of things middleware.

Reference