Application of Microservice Architecture in Battery Monitoring System

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Abstract: Batteries are widely used in power industry, so it is very important to ensure their safety. Therefore, the working parameters and working conditions of batteries should be checked regularly to ensure that all parameters are within the normal range. If abnormal conditions occur, timely protective measures can be taken to ensure that the whole power supply system will not outwork. Traditional manual measurement is time-consuming, laborious and inaccurate. Nowadays, the development of sensor technology and internet technology can be applied in battery measurement and online monitoring system. Considering the huge number of backup energy batteries, the large number of clients uploading data, the large amount of instantaneous access, and the scalability of system functions, backstage data terminals adopt micro-service architecture, which provides good reliability and scalability for the system.

1. Introduction

Batteries play a very important role in industrial production and operation, especially in the power industry [1].

Although the battery group is convenient and reliable to use, but the cost of using it is also a lot, it needs to prepare a lot of supporting equipment, prepare the location, regularly check its health and so on. The most important thing is to ensure that the battery aging or other reasons lead to a decline in health [2], cannot normally provide a stable voltage and cause unpredictable consequences.

Disadvantage of manual measurement

In traditional battery monitoring, digital multimeter [3], clamp ammeter, thermometer and conventional electrical tools are used to measure the voltage, current and temperature of charging and discharging by hand. Such a measurement method requires manual participation of staff, and the accuracy of measurement results cannot be guaranteed [4]. With the development of computer technology, more and more measuring tools combining sensors with computers have been developed. At the same time, with the development of the Internet, measuring data will be transmitted to the database through the network for persistence, which facilitates staff to monitor the working status of storage batteries at any time.

Monomer architecture

In the traditional battery monitoring system, the background data processing module adopts the monomer architecture, which has common shortcomings [5]. After a system is developed, it will be constantly improved and adjusted. The code will become more and more complex and difficult to maintain. After the modularization of the monolithic architecture, there is still data duplication and verbosity, which cannot be decoupled. This requires a re-decomposition of the business and a reorganization of the duplicated coupling parts, so that each part of the formation becomes a service. Each service can be developed and deployed independently.

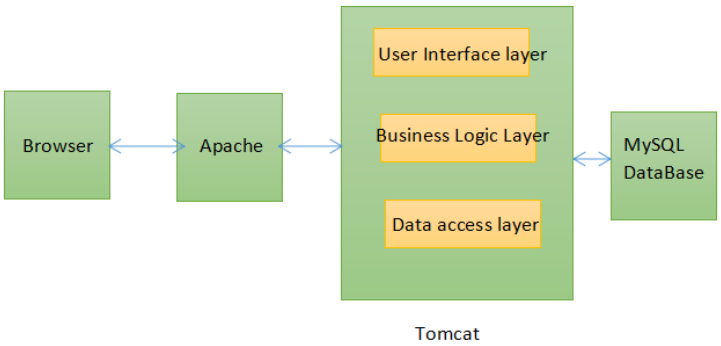

Figure 1 Monomer Architecture picture

Micro service architecture

Microsoft Service Architecture is a kind of background development architecture [6]. It solves some shortcomings of monolithic architecture, achieves agile development and deployment, and makes project maintenance more convenient and simpler.

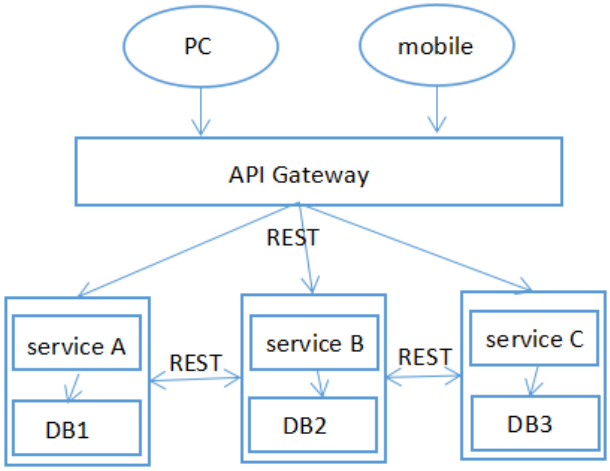

Figure 2 micro service architecture

2. Spring cloud architecture

This paper mainly introduces the application of micro-service architecture in battery monitoring system. Spring Cloud framework is used [7]. Mysql is used to store user data and battery detailed data to achieve persistence. The docker container is used in the deployment project. The combination of these technologies can achieve agile development and deployment. The micro-service architecture makes the maintenance, development and stability of the back-end software part of the battery monitoring system more reliable.

Spring Cloud framework is a framework for implementing micro services. It provides the functions required by micro services. The development and governance of micro services can be achieved by using this framework alone. It provides configuration management, service registration and discovery, load balancing, service fault tolerance, service invocation, message bus and other functions for the development of micro services. Make the development of micro services integrated.

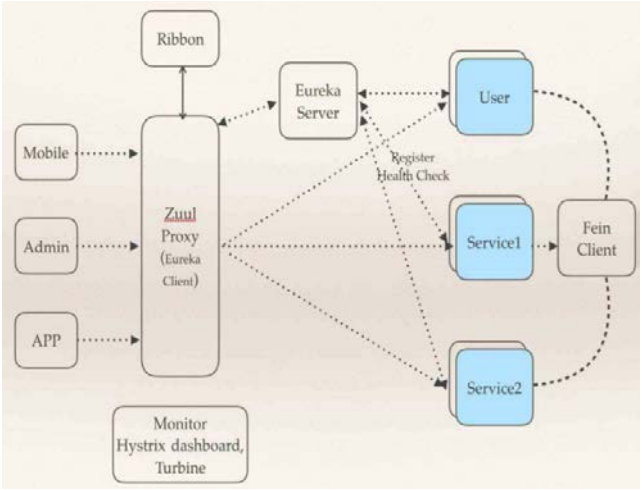

Figure 3 Spring Cloud architecture

Eureka

Eureka architecture consists of three identities: service registry, producer and consumer. The service producer registers with the service registry, which records the information of the service producer and the services provided. The heartbeat mechanism detects whether the service is working properly. The service consumer registers with the service registry, and after successful registration, he can obtain the services provided by the registry producer.

Hystrix Service Fusion

In the whole micro-service system, each unit is connected by the way of service registration and consumption of eureka. If one part of the system is in trouble, the operation of the whole system may cause avalanche effect. Hystrix can avoid this effect. When a service is unavailable, it automatically starts the self-protection function, which guarantees the construction of a stable and reliable micro-service system.

Hystrix means porcupine, because its back is full of thorns, so it has the ability of self-protection. It is a fault-tolerant framework of Netflix open source. By adding delay tolerance and fault tolerance logic, the interaction between micro services is controlled. Hystrix achieves this by isolating access points between services, stopping cascading failures, and providing fallback options, all of which can improve the overall resilience of the system.

Ribbon Service Call and Load Balancing

Load balancing is used to solve the problem that when one or more servers in the cluster are short of resources or downtime, requests are automatically distributed to the normal working servers to ensure the reliable response of the service. Load balancing has many common strategies: random, polling, consistency hashing, hashing, weighting strategy and so on. Spring Cloud provides two ways of calling and load balancing between micro services. One is Ribbon. It is a service that provides load balancing function for clients. The internal LoadBalance interface is an abstract operation of load balancing, such as adding, selecting server operations and obtaining server lists. Load balancing is to get a list of services from EurekaClient, route them according to IRule, and judge the availability of services according to IPing.

Zuul Gateway

In micro-service architecture, there are usually multiple service providers, and the number of services of each type will increase and change with the increase of the whole system volume. When presenting pages, data may need to be aggregated from multiple micro-services, and service structure and location may change. Zuul Gateway can only expose these aggregated APIs and shield the details inside micro-services.

These are the key technologies of micro-service development provided by Spring Cloud framework, which can divide an overall architecture into different micro-services according to the fine-grained business. The functions of service registration and discovery provided by the framework,

client load balancing and routing distribution make the micro-services interconnected and invoked to provide users with the required requirements. Business functions.

3. Battery monitoring system architecture

Battery acquisition system is divided according to the fine-grained business functions of micro-service. By analyzing the business functions of battery monitoring system, this design divides micro-service into several parts:

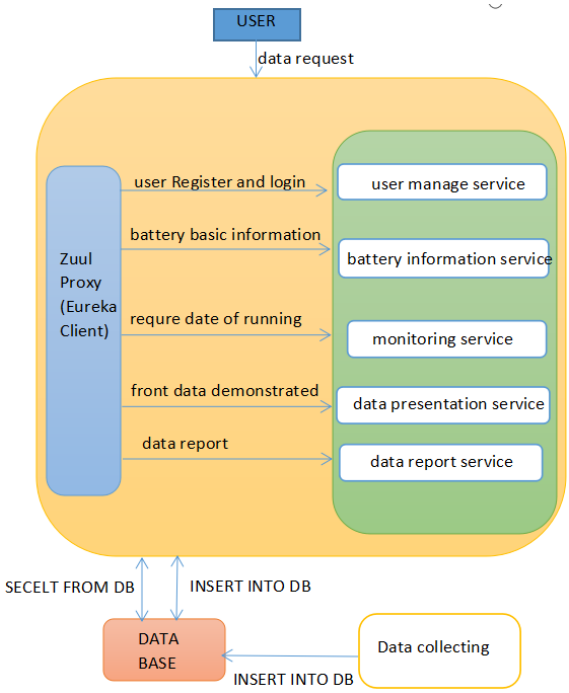

Figure 4 battery monitoring architecture

Battery data integration service

Battery data integration service: The charging and discharging parameters collected by sensors are transmitted to the server through the field main control machine using Ethernet to complete data persistence operation. Detailed parameters such as battery number, group number, voltage, current, temperature, acquisition time are saved in the tables corresponding to the database. It can be used by other services such as data query service or data analysis service.

Battery data inquiry service

Battery data inquiry service: according to the collection time, the detailed data in the database of battery parameters can be inquired: battery number, group number, voltage, current, temperature and other parameters, and through the front-end visualization display icon data, so that staff can more intuitively and clearly see the working status of the battery through the table.

Battery data analysis service

Battery data analysis service: Through real-time analysis of the data in the database of battery parameters, the health status of the battery can be obtained.

User service

User service: divided into administrator users and ordinary staff users. Administrator users have the management authority of the system, can add, delete and modify the operation of ordinary users. Ordinary users are battery monitoring administrators. They use this system to check the working status of batteries, find and deal with batteries with problems in working parameters in time, and ensure the safety and reliability of back energy.

Front-end micro-service

Front-end micro-service: data visualization, front-end page display, so that users can more clearly and intuitively view the battery working status.

4. Conclusion

The above micro-services constitute the whole battery monitoring system. Each service is deployed independently, maintained independently, and handles user requests independently. When other services need to be invoked to complete their functions [8], they can initiate requests and obtain results by simulating http requests. A micro-service can be deployed as a cluster at the same time and load balancing technology is used. When calling each other within the service, the registry provided by Eureka to the local area can complete load balancing through feign component, which reduces the pressure of a single server and ensures the stability of the system.

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