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Research and Realization of the Smart Campus Construction in Colleges and Universities Based on the "Microservices" Architecture

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Abstract

The rapid development of the Internet not only provides convenience for daily life, but also brings many challenges. At present, colleges and universities in China have basically realized digital teaching and management, and the construction of "digital campus" is basically completed. However, digital teaching and management still have deficiencies to some extent, and the teaching management method is still an urgent problem to be solved. The development of the Internet has spawned a series of emerging technologies such as cloud computing and big data, which also provides new approaches for the education management of colleges and universities. For the moment, as universities in China have gradually begun to transform from digital campus to smart campus, how to use microservices to build smart campus has become a key issue in the transformation. This article takes "microservices" as the basic starting point, aiming to realize the construction of smart campuses in universities.

Keywords

Microservices; Colleges and Universities; Smart Campus.

1. Introduction

With the improvement of science and technology in China, they have been applied in every corner of people's lives. As a result, the informatization construction of Chinese universities has also entered a higher level, basically forming an Internet software and hardware platform suitable for the education, teaching and management of different universities, and providing them with very convenient and comprehensive information resource services. However, Chinese universities have turned to the strategy of open universities nowadays, which requires a higher application level of modern advanced technologies such as cloud computing and big data. The research and construction of "microservices" will help the integration of college education and management with modern network technology, and provide students with more efficient and convenient academic support.

2. Research on "Microservice" Architecture and Smart Campuses in Colleges and Universities

2.1. Basic Concept and Current Situation of "Microservices"

Basic Overview of Microservices

In 2014, Martin Fowler, a well-known object-oriented open field expert, proposed microservices for the first time, which is an unprecedented software design model. It is basically a distributed system consisting of a set of independently delivered business units and it is broken down into a series of small independent applications after wisely dividing the business and the complex large-scale system. Each microservice is a fully functional entity, closely connected to a specific responsible business. From the perspective of system layer

analysis, each independently running microservice is an independent process, only performing a small task by using different types of languages and development tools. Each service can share data and cooperate through a simple communication protocol, and has simple expansion and modification, rapid development and execution, and a relatively simple structure.

Current Situation of Microservices

Microservices are known for their improved scalability and performance, and have been widely used in the construction of web servers in enterprises and other fields, most of which are used for communication; there are also many people who use microservices for continuous integration. However, microservices also have hard problems such as debugging, and the debugging solution adopted by most people today is logging. That is, there are still some shortcomings in the development of microservices, but most people believe that the microservices architecture will become a more complex system or back-end development standard.

2.2. Concept and Significance of Smart Campus in Colleges and Universities

Overview and Overall Structure of Smart Campus

In a sense, smart campus is a product of the development of Internet informatization. It involves using campus information as a way, a carrier and a basic network of the campus, such as wired networks, wireless networks and the Internet, and then use cloud computing, big data and the Internet Technology to achieve the purpose, from training scenarios, training resources to application services. The analysis of information and services on university campuses can promote the organic integration of space and time, so that everyone can easily obtain valuable resources and services at any time and any place. Smart campus is a development and improvement of digital campus and the most advanced form of education informatization.

According to the "Overall Structure of Smart Campus" announced by the National Market Regulatory Authority and the National Standards Committee in June 2018, smart campuses can be divided into four levels: infrastructure level, support platform level, platform layer and application terminal. By establishing clear data specifications and technical specifications, each level is able to conduct data transmission, mutual cooperation and mutual understanding. The information security strategy is implemented throughout campus intelligence construction process, providing communication, data security and personal security throughout the life cycle.

Significance of Building a Smart Campus

The purposes of creating a smart campus is to manage the information of different school companies and integrate different departments of the school closely. As a result, it helps to share information, ensure the authenticity and quality of school data jointly, and provide reliable and powerful theoretical support for school administrators.

In addition, the construction of a smart campus helps to improve work efficiency and establish the level of information application. The smart campus application system will help break the traditional working methods, improve work efficiency, realize data exchange, materials, archives and other departments within and between departments, and also improve the implementation level of teachers and staff data. Besides, building a smart campus is also conducive to advancing education reform and improving the quality of education. The construction of smart campus promotes the transformation of teaching methods, teaching tools, distance multimedia teaching and educational teaching resources, conducts online communication and promotes the improvement of education quality.

3. Design and Implementation of Smart Campus Microservices

At present, the information construction of Chinese universities is still in the transition stage from digital campus to smart campus. Compared with informatization, the establishment of a

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basic application system and business support platform can be called the establishment of a system platform, which is a key step in the smart campus construction. Based on the microservices architecture, the establishment of a system platform with intelligent and flexible design, and simple expansion provides a strong guarantee for the overall stablity of the smart campus. The construction of the system platform under the microservices architecture mainly includes two aspects: one is the main body of the microservices architecture, which includes the renewal and transformation of the existing school business system according to system standards; the other is to strictly follow the microservices-oriented design model and carry out high-level design, overall planning and reasonable system planning.

At present, most colleges and universities have basically equipped with relatively mature and complete systems of personnel, OA office, student and resource management to build digital campuses, and have basically built some system platforms such as basic data platforms. The operation of each business system is relatively independent, with limited inner connection, and it goes against the mutual invocation of business function modules. After a precise analysis of each system, it can be found that: in addition to the functional modules that are closely related to its own business, the system also has some components that have the same business logic requirements, such as identity authentication, permission allocation and monitoring. After a detailed analysis of the background of the system, some measures need to be taken to ensure that the split and reorganization of the system is smooth, and that the risks are controllable and thus reduce the complexity. Some of the well-grounded original systems was redistributed, in order to fully understand and master the role and significance of microservices. The new smart campus platform architecture is as follows:

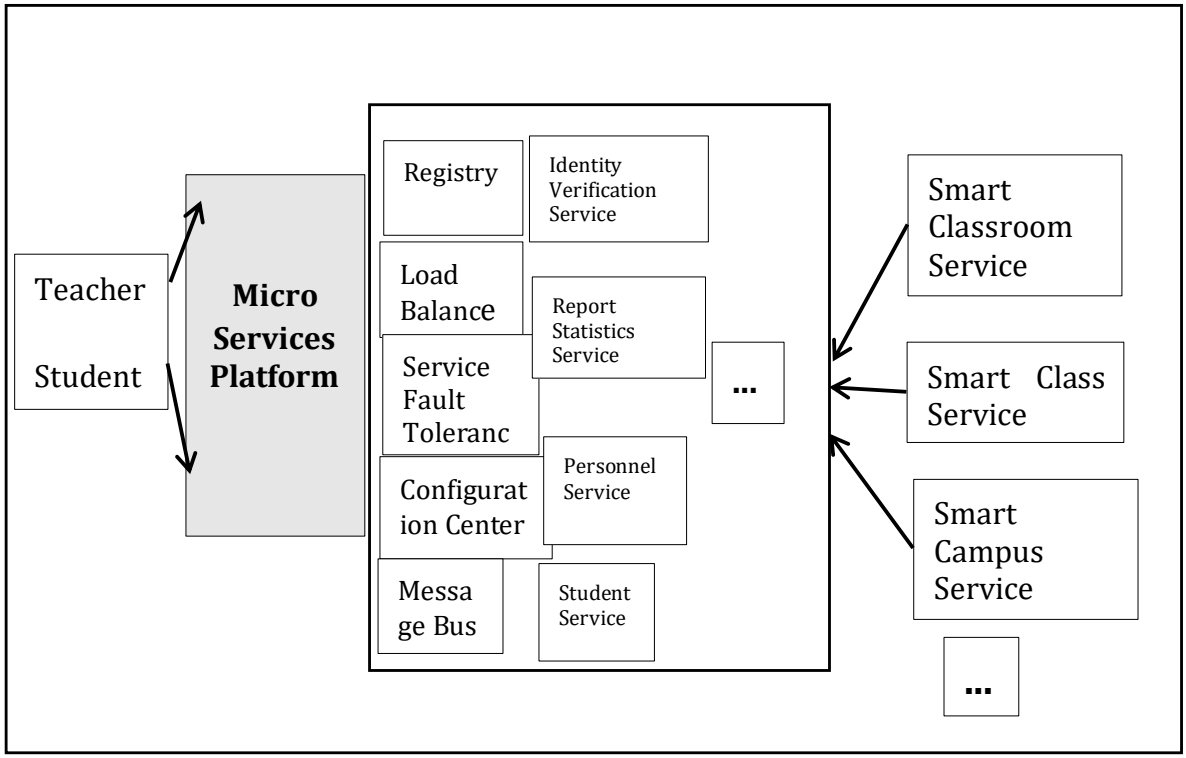

Figure 1: Platform Architecture of Smart Campus

It should be noted that in the process of disassembling, the personnel system, and the student and resource management system in the original system platform of the university in the "digital campus" stage should be disassembled and decomposed according to the functional characteristics of its business level, divided into small and detailed microservices systems. The microservices system executes closely related tasks, and can serve the different needs of teachers and students in colleges and universities well. In addition to the above systems that

exist in the original system, there may be some new systems in the service architecture system of the smart campus, which must follow the standards and rules of the microservices architecture, and clarify the functions and service scope of the system to achieve the maximum utilization. The new system should cooperate with other systems, in order to provide the ultimate business support for users such as college teachers and students.

4. Conclusion

The smart campus application based on the microservices architecture has a complete information interaction interface, a flexible strategic adjustment and an unstable working mechanism, and it is not affected by the middleware language used in development, operating environment and business development. Microservices architecture is the inevitable result of technological development, and it can solve the complex problems of slow iteration and far-reaching impact that traditional software systems face in a single system. Each service has a clear functional goal, clear business boundaries, and a simple communication protocol to respond to service requests. That is, the internal service logic is closely related, while the external communication is very low. In short, the emergence of microservices architecture as a system design method provides a good solution for the design and creation of the intelligent campus system platform, improves the flexibility and efficiency of system development, and reduces the cost of system software development.

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