Research on the Design of Cloud Computing Platform in Intelligent Campus

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Abstract: Constructing intelligent campus is the inevitable trend of educational informationization development. With the development of technology and the deepening of application, users demand a more humane and intelligent user experience, and put forward new functional requirements for the construction of intelligent campus. The construction of cloud-based IT system platform and its application mode can solve the above problems fundamentally, so as to promote the leap-forward development of educational informationization construction.

1. Introduction
With the deepening of educational informationization construction, it is urgent to build a intelligent campus, which is the inevitable trend of social development. However, there are some problems in the informationization construction of some schools, such as the lack of unified planning, overlapping and intersecting systems, different types of resources and the existence of information silos. With the development and deep application of the Internet of things, big data, users generally demand more convenient, more comprehensive, more intimate, more intelligent services. How to adapt to the change of user's demand under the new situation will be an urgent problem to be solved in the construction of intelligent campus at present. The construction of cloud-based IT system platform and its application mode can effectively solve the above problems. Studying and using cloud computing technology to build intelligent campus is an important content of school informationization construction at present.

2. Analysis on the Background and Demand (Present Situation) of Intelligent Campus Construction
Intelligent campus is a higher level stage of digital campus development, and its core is integration and intelligentization. Cloud computing technology is one of the core technologies of Intelligent campus, which can not only effectively realize the unified management and flexible distribution of hardware and software resources of information system, but also effectively share teaching resources, improve teaching mode and provide all kinds of convenient information services. Since the concept of cloud computing is put forward, its technical advantages and application value have been recognized by the society, cloud computing in the education informationization construction more and more play a huge role. The United States is the first country to research and apply cloud computing technology, in Pike County, Kentucky State, the county's original batch of more than 1400 computers intended to be abandoned due to lack of function, by building a cloud service platform and a virtualized environment, this batch of computers came back to life, greatly reducing equipment investment, but also gets into unexpected high-function data processing capabilities.

China's cloud computing started late, but its application in the education industry should not be
underestimated. Huawei, Lenovo, Ruijie Network, Hkust News fly and other cloud computing services leading enterprises are the first in the education industry arrangement. Build an educational cloud platform that covers all aspects of portal, management, teaching, learning, and the environment, including smart campus, smart classroom, digital campus, cloud desktop and many other products. Education informationization is for school service, practical, being usable and easy to use is the school's biggest ultimate demand, only finding the effective combination point of cloud computing technology and informationization construction of our university, pry up the effective fulcrum of the application of cloud computing technology, we can make full and effective use of informationization to improve the efficiency of school management and improve the quality of education and teaching service. Therefore, schools can combine their own situation and develop cloud platform independently.

3. The Application Value of Cloud Computing Technology in the Construction of Intelligent Campus

Compared to traditional IT systems, cloud computing technology can make campuses more humane, advanced and intelligent.

3.1. Campuses is more humane. The use of cloud computing technology for the centralized management and flexible allocation of resources can provide personalized customized services for each user.

3.2. Campuses is more advanced. Using open source cloud computing technology can significantly reduce input and maintenance costs while gaining efficient, high-reliability computing power and storage capabilities to be smarter and more advanced in resource management and data sharing.

3.3. Campuses is more intelligent. Combined with big data technology, through data mining and analysis, the school's state data can be fully monitored and managed, while by the decision-making system to produce better service, so as to bring users a more intelligent experience.

4. Design of Cloud Computing Platform for Smart Campus

4.1. Design of Whole Framework

The overall framework of smart campus is divided into portal layer, business application layer, basic platform service layer, cloud computing platform and hardware layer. As shown in the following figure 1:
External and internal portals access internal application pools and external applications by applying the interfaces and standards provided by the support platform, providing end users with a personalized portal service that allows end users to truly do one "desktop" per person. Only the things you care about and related are on the desktop. Portals and businesses are irrelevant, and the exchange of data and the sharing of functions and services between the business and the business can be carried out through the application support platform.

The business application layer is a custom-developed business subsystem.

The platform service layer provides public platform services for use by portals and business systems, as well as for new applications in the future, including directories, portals, messages, workflows, search, data management, files, media, application integration, monitoring, and other services (solutions).

Cloud computing platforms provide compute, storage, network interconnection, and management services at the infrastructure level, including:

4.1.1. **Cloud Management Platform**: Through the analysis of user requirements, determine the cloud architecture adopted by the platform, design the architecture and topology of the smart campus service platform. Consolidate infrastructure resources (including compute, storage, and networking) and their associated policies into a virtual data center resource pool, and quickly deploy and automate the maintenance and management of cloud hardware resources and business processes.

4.1.2. **Cloud Computing Units**: Provide powerful, scalable computing power for business applications based on servers with high-performance x86 architectures. Through server virtualization technology, use the integration and flexible utilization of computing resources, form virtual resource pool to provide automation services for the upper layer applications. Specific functions include: virtual computing, high reliability, dynamic resource scheduling, virtual machine disaster tolerance and backup, virtual machine template management, cluster file system, virtual switch strategy and so on.

4.1.3. **Cloud Storage Units**: Provide shared storage for compute virtualization, provide the foundation for compute cluster applications and HA; Provide a centralized data storage pool for business applications, the program uses advanced IP trunking storage technology to ensure that storage capacity and performance are scaled linearly to seamlessly meet business growth needs.

4.1.4. **Cloud Internet Units**: achieve the interconnection of cloud servers through data center-level devices, cloud storage, complete the construction of computing, storage resource pool, through the network virtualization and virtual machine network access new standards (EVB) and other technologies to achieve the network infrastructure platform on the cloud computing virtualization environment good support, to meet the cloud operations management platform through the network to achieve the arrangement of resources, scheduling and delivery, and simplify the operation and maintenance management of the network.

4.2. **Design of Resources Pool**

Cloud computing integrates all compute, storage, network, and security resources into resource pools, and then builds applications based on the resource pools of these infrastructures to deliver resources in a service manner.

4.2.1. **Design of Computing Resources Pool**

Cloud computing environments form a cloud computing resources pool through host virtualization technology. Computing resources are made up of physical hardware and resource virtualization, and virtualization is the basic technology to realize cloud computing.

In the case of Hyper-V virtualization technology, it provides software infrastructure and basic management tools in the operating system that can be used to create, manage, and monitor virtualized server computing environments. The schema is shown in the following figure 2:
4.2.2. Design of Storage Resources Pool
The storage resource pool uses the local dual-center plan, two two-live data center can provide the service to the outside at the same time, uses the database synchronization software to synchronize the database. Keep the load balanced. As shown in the following figure 3:

4.2.2.1. Data Bank Copy
Database replication service utilizes the data replication function provided by snapshots, materialized views and other technologies to meet the distribution and use of production data, so as to achieve the goal of unified maintenance.
4.2.2.2. Data Warehouse
Data warehouse is for the school data center to achieve statistical aggregation, data mining, BI analysis and planning, is the Data warehouse and data mart collectively. Through the integration, transformation and separation of the functions of the existing system, the functions of data query, analysis and statistics scattered across the systems are summarized into the data decision support system, and the unified centralized data query, data analysis and decision support functions are used.

4.2.2.3. Data Collect
Data extraction and integration is mainly reflected in the ETL link of the data warehouse system, that is, the extraction, loading, conversion and cleaning of data, which is responsible for extracting data from each relevant data source and converting the data.

4.2.2.4. Data Dig
Establish a comprehensive analysis model of smart campus, these models can provide analytical, executable and quantifiable conclusions and solutions in a variety of rendering forms.

4.2.2.5. Extra Copy Recover
Database backups prevent failures from affecting the accuracy of database system operations and data, prevent all or part of data loss due to database damage, and quickly recover databases.

4.2.3. Design of Internet Resources
There are multiple virtual switches above the Hyper-V host, they access to a single network resource pool, then connect directly to the network resource pool when the virtual machine is plugged in, when one of the virtual switches breaks down, the virtual opportunity uses the other virtual switch directly, if two virtual machines create a network resource pool with the same name, they can perform the migration operation, the underlying virtual switch names can be different, but the network resource pool names must be consistent.

4.2.4. Design of Safety Resources Pool
According to the construction principle of divided domain, the design of security resource pool mainly includes the following contents: server security protection, internal maintenance terminal and office terminal protection, external network access zone safety construction, security management area construction, user identity identification, forced access control, system security audit, user data integrity protection, user data confidentiality protection, object security reuse, program executable protection, regional boundary access control, regional boundary packet filtering, regional boundary security audit, regional boundary integrity protection. Its deployment is shown in the following figure 4:

According to the construction principle of divided domain, the security construction of each region mainly includes the following contents:
4.2.4.1. **Server Zone Security**

Increase the operating system layer of the server security reinforcement system, constitute a secure application support platform for the application system of the website/application server equipment, and deploy a unified identity authentication gateway to implement unified authentication for people accessing the application server. Control the access behavior implemented over the network to prevent illegal attacks on the server. Establish a dual-machine hot standby mechanism for website servers to ensure the continuous availability of website services. Deploy the database audit system, monitor the behavior of accessing the database, accurately locate and respond to it in a timely manner.

4.2.4.2. **Internal Maintenance Terminal Protection**

For the application server maintenance terminal of the intelligent campus platform foundation database, the terminal security protection system of the operating system layer is deployed, which ensures the credibility of the terminal computing environment and the authentication of the system from the aspects of user identification, forced access control, execution program consistency verification, important information sensitivity and integrity protection, security object reuse, audit, etc., control, audit and effective implementation of management mechanisms.

4.2.4.3. **Safety Construction of External Network Access Area**

The purpose of the security construction of the external access zone of the platform foundation database is to monitor and manage the external users and devices connected from the intranet. To this end, the traffic analysis control gateway and UTM unified threat management security gateway device are deployed in the external access zone, and the function modules such as firewall, antivirus, intrusion prevention, anti-denial service and so on are configured.

4.2.4.4. **Construction Plan of Safety Management Area**

(1) Arrange the security management center (including policy server), apply the server maintenance platform to implement unified security management for the computing environment security support platform, and in order to adapt to the remote maintenance mechanism of the basic database of the smart
campus platform, we can adopt the multi-level management mode to arrange the security management sub-center in each system maintenance area.

(2) Arrange the audit management platform, receive the regional audit logs, provide a platform for the storage, analysis and processing of audit information, as the basis for administrators to implement event tracking, responsibility identification and implementation of emergency response.

4.3. Design and Realization of Cloud Management Platform

4.3.1. Function Frame
Through the previous analysis, the system should have a functional architecture to meet the needs of users, the overall functional architecture of the system as shown in the following figure 5:

![Figure 5: Functional architecture design](image)

4.3.2. Cloud Management Configuration Module
The modules of the system are connected properly, and have strong adaptability, it is necessary to have unified management and configuration ability for the hardware and software resources of the whole system. Configure the basic information required by the operation of different modules and monitor the operation of the tracking system through a unified configuration, management module.

4.3.3. Cloud Computing Process Control Module
In the process of using computing resources, it is necessary to carry out relevant configuration management for the processes used, so that the application system can define the process of a particular business according to its own actual situation. The main functions of the process control module include:

- Support of Standard Process Definition Languages: Provide support for BPEL (business process execution language) to define business processes using standard BPEL languages;
- Provide basic process control capabilities, including conditions, loops, and more, while supporting advanced process control functions such as transactions, compensation, and so on.

4.3.4. Cloud Computing Business Rules Engine
The engine needs to set up business rules in advance to guide and determine the selection of routes and the nodes to be executed next, so that the process and routing choices can be configured according to the actual situation without the need to change the program.

4.3.5. Data Storage Switching Storage Based on XML Technology
Considering that the information of each business system exists in a variety of different data forms, in order to ensure that the system can perform normal data exchange storage with each other, the entire data exchange storage must use the format and standard of the standard data description. Therefore,
using XML with very high international versatility, the encapsulation description of data and information has become the standard of data exchange storage. XML-based data exchange storage module is the key to building the whole cloud computing platform, only unified norms and standards, data exchange storage between systems can be possible, which is the key link in the construction of the entire platform.

4.3.6. Network Transport Modules and Adapters
Once the application has passed through the XML data description layer, it is logical to have the ability to interact with each other. However, considering that the whole system is a more complex distributed application system, the data exchange of each node needs to pass through the complex network environment, so the module dealing with the transmission of information data between specific networks is independent of the network data transmission layer.

Network data transmission layer mainly includes WEB service, reliable message, Http/Ftp protocol and other functional modules and adapters. The basic requirements of its construction are: The system should be able to provide multiple transmission modules at the same time to choose flexible according to the actual situation and apply easily under specific conditions.

4.3.7. Network Routing Control Module
When building the system, from the point of view of the system manager, it is necessary to configure and manage the "path" of the data exchange of the whole system, including the external system. This function is implemented by the network routing control module.

The main principles of network routing control module construction are: configurable, flexible has been convenient management. Because of the different business, the specific exchange path required is also different, the relevant rules and configuration should be very convenient at the same time, and should have a strong adaptability.

4.3.8. Safety Control Module
The entire data exchange center is the hub for data and information exchange, a lot of key and sensitive information is exchanged here, therefore, the security of the system is put forward higher requirements. The security control module provides the security function to guarantee the exchange of information, including the role-based authentication and auditing of support and AD integration, the support X.509 certificate mechanism, and so on.

4.3.9. the Tools of Design and Development
The whole exchange is the basis for mutual information and data exchange of other applications. Many application systems need to use the services provided by the system to develop on the basis of the system, while managers also need to use effective tools for the effective management of the system, this module provides developers, managers to facilitate the work of a series of tools collection.

5. Conclusion
Intelligent campus is the key construction content of educational informationization, and also an important driving force to promote the reform of education and teaching and improve the quality of education and teaching. However, at present, most schools are still relatively low degree of intelligence, and have not been able to meet the growing needs of teachers and students of information services, intelligent campus construction urgently need to achieve technology replacement and mode update. By building a cloud computing platform, you can effectively manage hardware and software resources, improve resource utilization, reduce operation and maintenance costs, and rapidly deploy business applications, and provide fast, convenient and intelligent services for the majority of teachers and students with great economic and social benefits.
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