Research on Design Scheme of Multi-campus College Student Management System Based on Cloud Computing

Chengyi Niu*

Criminal Investigation Police University of China, Shenyang, Liaoning, 110035, China

*Corresponding author: 112634377@qq.com

Abstract. With the continuous expansion of the enrollment scale of colleges and universities, the number of students in school has doubled, and the amount of student information has increased dramatically; In addition, due to the development and merger of colleges and universities, there are many campuses in many colleges and universities, which are accompanied by the dispersion of students and administrators. To facilitate unified management, a multi-campus college student management system based on cloud computing is designed and developed, which integrates information management, statistical analysis, online information publishing and collection. This paper expounds the system analysis, functional module design, system design and key technologies involved in the process of system implementation. Through the interaction among various models, a complete and dynamic system is formed, which is committed to the management of multi-campus students, so as to improve the autonomous management, self-positioning and self-improvement.

Keywords: Cloud computing; Multi-campus; Student management system

1. Introduction

With the rapid development of China's higher education, multi-campus running is becoming a development model in recent twenty years. The surrounding environment of colleges and universities, which students often come into contact with, has a direct impact on the education and management of college students [1]. New campuses are often built in the suburbs, far away from the bustling downtown, lacking urban atmosphere, and municipal facilities such as road traffic need further planning and construction. The multi-campus school-running mode in China is a unified school subject, a unified organization and leadership, a unified management system, a unified development plan and a unified discipline construction [2-3]. At the same time, with the rapid development of computer technology and network technology, as well as the increasing popularity of computers and Internet, how to use modern network technology to realize the co-construction and sharing of teaching resources in one school and multiple campuses, and improve the efficiency of using high-quality teaching resources, has attracted widespread attention in the education sector.

At present, colleges and universities have introduced or developed relevant student management
systems to provide services for daily student management. However, under the current new situation, there are some problems in the practical application of these systems [4-5]. Distributed database system is the product of the combination of database technology and computer network technology. It is usually connected by computer network, and the connected logical units are called nodes or sites. By building an educational cloud resource platform, we will gather excellent resources developed by 100 enterprises and institutions and 10,000 teachers and students to realize the sharing and sustainable development of high-quality resources. This paper aims to use cloud computing technology to try to study the design scheme of multi-campus college student management system.

2. Design of multi-campus college student management system

2.1 Cloud computing architecture diagram

There are three types of cloud computing services of student records management system: IaaS (Infrastructure as a Service), PAAS (Platform as a Service) and SAAS (Software as a Service). The whole virtual cloud architecture needs the cluster environment built by cloud servers as the storage and operation center of the whole system data. The virtualization software integrates the resources of servers to form a resource pool and uniformly distributes these resources to virtualize a plurality of virtual desktops with different operating systems [6]. It is to build various scattered teaching resources into a service platform for teachers and students through virtualization technology. The system structure of the platform adopts four basic layers, which are resource layer, management layer, service layer and user layer.

The standard Web service, the SOA layer, will package the cloud computing capability and bring it into the system of managing and using SOA, including service, service registration, service discovery, service admission, and the interface between service and workflow [7]. The cloud architecture of the multi-campus college student management system is shown in Figure 1.

![Fig.1 Cloud architecture of multi-campus college student management system](image)

In order to achieve high efficiency in the management of multi-campus students, it is necessary to establish a unified network model to achieve the unity of work objectives, work ideas and work methods. The overall network model is an organic system that guides and takes into account various factors at all levels and sub-models. Because of the large number of students, the location of the system is not fixed and the amount of information and data processed is small, which requires running on campus network and Internet, so we adopt B/S structure to realize this part of functions. It is realized by the combination of C/S and B/S. Common operations such as browsing, downloading and commenting resources are realized by using B/S structure and web page [8].

2.2 Design of system function module

The multi-campus college student management system needs to meet the needs of teachers, students and administrators, so each user should have different access rights and functions. The specific system function module diagram is shown in Figure 2.
• Design of system login module

When the user can log in to the virtual desktop through the thin client, the administrator can deploy the attendance management system on the server, and the user can log in to the specific login flow chart of the system through the client on the virtual desktop, as shown in Figure 3.

Cloud computing service design

Cloud storage requires multiple servers to work together, and the communication between computers needs to be based on a unified protocol. In the process and data management system, after repeated verification, RPC (Remote Procedure Call Protocol) is finally used. It provides the most basic hardware resources, including computers, storage devices, network devices, servers, databases and so on [9]. Facing the characteristics of multi-campus student management, and combining with the characteristics of political, ideological, guiding, theoretical, affinity and diversity of campus network, a series of sub-models are set up to carry out ideological education effectively and pertinently.

In this system, distributed data storage provides the operation of related files. These operations can be divided into two categories: the file directory structure and the data flow operation of the file. Operation of directory structure, including creating named directories, deleting directories, copying and moving. File flow operations, including creating files, deleting files, writing to a file, and renaming the file. The operation mode of the specific implementation steps is shown in Table 1.

Multi-campus college student management system is a large-scale system for storing and managing teaching resources of various campuses, departments and specialties, involving a huge amount of data. Traditional methods of centralized storage and unified management have exposed many shortcomings in the face of multi-campus and massive resource data. In the existing digital campus life, the networked student education management system is an inevitable trend [10]. Students can enter the system through the campus network or Internet, and then enter the corresponding function pages through the student ID and correct password. In terms of functions, it mainly provides services for students, including personal information management, submission of various applications and other
browsing and inquiry services.

**Table 1 Implementation steps of related operations**

| Related operations | Order | Committed step |
|--------------------|-------|----------------|
| Create a directory | mkdi  | Check whether there is a directory with the same name |
|                    |       | Check whether you have permission |
|                    |       | Create child nodes in this directory |
| Create file        | crefile | Check whether there is a file with the same name |
|                    |       | Divide a file into multiple data blocks |
| Renaming operation | rename | The main control section performs scheduling and task distribution |
|                    |       | Write data blocks to each file server |
|                    |       | Gets the path of the file |
| Delete operation   | delete | Check whether recursive deletion is required |
|                    |       | Check whether you have delete permission |
|                    |       | Delete all child nodes in the directory |
|                    |       | Put the data block in the delete queue |
|                    |       | Empty the data blocks in the delete queue |

- **Design of achievement management module**

  According to the results of demand analysis, it can be known that the functions of the performance management information subsystem are as follows: examination management, performance information entry, performance information deletion, performance information modification and performance information query, etc. It can use the performance management functions of system administrators and teachers, and can also realize the operation of student users on performance query.

  Examination management module is mainly to solve the problem of how to arrange all kinds of examinations in a limited time and limited classroom resources, which is a difficult problem encountered by schools. Examination management mainly includes examination arrangement, score management, make-up examination management and registration examination score management. The data flow chart of examination management is shown in Figure 4.

  ![Fig.4 Examination management data flow chart](image)

- **Design of database**

  Generally speaking, the operation of an application system often needs the support of a background database. At present, many database softwares have been developed at home and abroad, among which
SQL Server is the most commonly used background database software for storing data, and the database plays a very important role in the operation of the system. The data of classroom attendance management system is stored in SQL Server 2008 database, and the background database of the system is named Attendance system, which contains 7 tables for storing different information. Seven tables include: student table, teacher table, administrator table, class table, truancy information table, leave information table and course information table.

The teaching resource base based on cloud computing should import, aggregate and classify the teaching resources distributed everywhere, and form an oversized teaching resource base. Make students from being managed to self-management, to reduce the management difficulties caused by the decline of psychological identity caused by multi-campus in space. In this way, when the publisher and subscriber are reconnected (the connection time interval can be defined in the merge agent scheduling according to specific needs, and the system is set to automatically connect once every hour), and the update is propagated between the publisher and each subscriber, synchronization occurs. Each station periodically sends the latest information of its connection table to other stations, so as to update it in time and reduce the communication cost. At the same time, the semi-join method is used for preprocessing, which can reduce the data volume of the database involved in query and reduce the transmission overhead.

- Students' growth space

"Students' Growth Space" provides personalized service for students, including two modules: "Student Growth Management" and "Personalized Management". Student Growth Management: This module includes personal files: it provides the management of personal files, for example, students may browse files and modify personal files, for example, the management of various contents in files. Study Notes: Record is a course that explains the content. Students can generate, edit, query and browse study notes in real time. Personalized management module includes five functions of personalized service (Figure 5).

![Fig.5 Personalized service for students](image)

Students can customize and select resources, programs and services according to their own interests and needs. Users can set up conditional combination queries, such as multiple attributes of files (such as title, keywords, types, etc.) to find them.

3. System implementation

3.1 System implementation environment

In the process of implementation, the distributed network application software architecture adopted in this system is a three-tier B/S architecture, so the platform of the development system needs to support network operation function and database processing function. The server operating system used in this paper is Windows 2008 Server, the database operating system is Microsoft SQL Server 2005, the client operating system is Window XP, and the software development environment of the system is Visual Studio 2005.
3.2 Login module
The login module is used to verify the correctness of the user name and password entered by the user, and divide different user rights according to their user names. There are two kinds of permissions in this system, which are system administrator and ordinary user. When a user logs in, he can submit the information to the system for query only by entering the user name and password and selecting the identity permission type. If the authentication is passed, the user can enter the system and operate other functional modules. If the user name and password are incorrectly entered or the identity permission type is incorrectly selected, the system will pop up an error prompt box and set the maximum number of errors. If the threshold is exceeded, the user login process will end.

3.3 Implementation of key services in cloud computing
• Adaptive scheduling management
  In cloud computing, the adapter is responsible for scheduling the interaction between the client and the cloud server. For example, when the client submits an inquiry application, the scheduling management module is adapted to inquire the virtual machine group to monitor the current state of the virtual machine group. In order to establish a real adaptive scheduling strategy, it is necessary to establish a sound underlying cloud computing service layer. In VMware View environment, domains must be used, and View uses the existing Microsoft Active Direction to verify the identities of users in the network and manage them. In order to achieve the largest range of teaching resources and information sharing, so that users can obtain and enjoy the best and shortcut services.
  The adapter of cloud computing needs to provide external API to encapsulate cloud operations. Scheduling is managed through the interface provided by cloud computing. The cloud adapter has designed the following interfaces:
    - Get Template Lists() Query the template list of cloud
    - Up data Template() Update the template of the cloud
    - Set Author() Set the owner identity information
    - Add New Template Create a new template
    - Up data Template Time When the template was modified
    - Start VM Start virtual machine
    - Shoudown VM Shut down virtual machine
  After the interface with the adapter is defined, it is necessary to design the concrete implementation of the method according to the scheduling mode of the cloud.
  • Virtual resource management
  Practical teaching is an effective way to consolidate theoretical knowledge and deepen theoretical understanding, an important link to train high-quality engineering and technical personnel with innovative consciousness, and an important means to train students to master scientific methods and improve their practical ability. By carrying out various psychological counseling and guidance activities, students are trained to have healthy physical and mental qualities. Use career planning guidance to help students establish the concept of lifelong learning.
  In the multi-campus college student management system, the view layer, control layer and business logic layer are made according to MVC. For virtual resource management, it belongs to business logic layer. When using MVC framework to design, the configuration information is obtained by the controller. The management of virtual resources needs to design the following functions:
    1) Acquisition of template list. Include the name and creator of the template.
    2) The specific information in the template is realized by the controller, including the parameters and images in the template.
    3) The synchronization requirements of templates are realized through the cloud controller. You can send data to the database through a one-time query.
    4) The image information in the template is realized by the action method of the controller. When the template reads the information, it immediately executes the scheduling of the adapter and transmits the information to the cloud.
3.4 Achievement inquiry
Educational administrators, teachers, students and other users can query students' scores. The academic administrators, teachers and students can query a student's grades by entering the student's student number. Meanwhile, the academic administration can also query the grades of students in a certain subject, and teachers can query the grades of their professors according to their classes. When the user inputs the query information, the system will return to the query structure in time after processing the user's query request. If the query result does not exist, it will indicate that the query result information has not been entered.

3.5 User information management module
The module is mainly composed of three parts, namely, adding user information, modifying password and deleting user information. Add user information: the administrator enters the setting user information window and inputs the information of the new user. The system will automatically check whether the input information meets the system data requirements. If yes, it will be entered into the database, and the user will be prompted that the input is successful; otherwise, the user will be prompted that "the input data format is wrong, please re-enter". Change password: The user enters the password modification information window, inputs the required information, and searches the database. If the user name and password are correct, the user is prompted to change the password successfully; otherwise, "the user name or password is incorrect" is prompted. Delete user information: the user enters the delete user information window and selects the user to be deleted. If the user exists, the user will be prompted to delete successfully, otherwise, "the user does not exist" will be prompted.

4. Testing of the system
System testing is the last stage of system research and development, and it is an essential stage. Through the functional testing of the whole system and each part, we can not only find out the problems or defects of the system, but also find out the defects and solve the problems, so as to make the system function more perfect.

The integrity test of the system is mainly to check the completion degree of the system, find and solve problems through the test. The test of this paper is mainly divided into two parts, including the test of virtual desktop and the test of attendance management system. After building the virtual desktop and writing all the codes of the attendance management system, we tested according to the following steps, and the test cases are shown in Table 2.

| Use case description         | Operating procedure                      | Expected result                                      | Test result |
|------------------------------|------------------------------------------|------------------------------------------------------|-------------|
| Virtual desktop login        | Log in to the virtual desktop using terminal | Virtual desktop functions are consistent with templates | Pass        |
| Attendance system login      | Log in to the system with different users | The functions and permissions of each account are complete | Pass        |
| Interface test               | Click the tabs and buttons of each account interface repeatedly | The function is available and the operation is stable | Pass        |
| Functional test              | Test each function of the system          | Complete function                                    | Pass        |

5. Conclusion
The university student management system based on multi-campus has solved the difficulty of sharing
teaching resources among multi-campuses, effectively reduced the occurrence of resource islands, and improved the information communication and resource sharing among campuses. At the same time, it also has certain reference significance for the sharing of teaching resources among universities.

References
[1] Luo Guohua. Research on the construction of senior student cadres under the multi-campus model of colleges and universities. Fujian Quality Management, vol. 000, no. 003, pp. 291,289, 2020.
[2] Huang Zhaocui, Chen Hui, Zhang Pengliang, et al. Design of a distributed smart campus video service system for multiple campuses in different places. China Education Informatization· Higher Education and Vocational Education, vol. 000, no. 011, pp. 80-85, 2018.
[3] Chen Jian. Practical research on the construction of multi-campus network and teaching management system. Jiangsu Science and Technology Information, vol. 036, no. 028, pp. 35-37, 2019.
[4] Xiao Jianfang. Research and design of the management system of public elective courses in multi-campus colleges and universities. Journal of Southern Vocational Education, no. 1, pp. 98-103, 2020.
[5] Wen Yan. Application and thinking of asset management system in multi-campus colleges and universities. Taxation, vol. 13, no. 31, pp. 280-280, 2019.
[6] Wang Youmin, Qin Bin. Solving the pain points of multi-campus network management. China Education Network, vol. 000, no. 001, pp. 72-73, 2019.
[7] Li Kunlun, Zhang Lu, Xu Jiang. Research on the Design and Configuration of University NTP System. Digital Technology and Application, vol. 38, no. 04, pp. 169-170, 2020.
[8] Huang Pin. Based on the innovation and application of the "student guidance system" in the management of college students. Modern Vocational Education, vol. 000, no. 006, pp. 174-175, 2018.
[9] En Zechang. Design and Implementation of Teaching Management Platform in Chinese Universities——Take Zhonghuan Information College of Tianjin University of Technology as an example. Teaching Method Innovation and Practice, 2020, 3no. 14, pp. 136.
[10] Chen Guanfeng [1]. A Probe into the Educational Management of Students in Multi-campus Colleges and Universities. Think Tank Times, vol. 000, no. 013, pp. 123-124, 2019.