Construction of Management System Based on Cloud Technology

Lin Shao
School of Media & Communication, Wuhan Textile University, Wuhan, Hubei, 430073, China

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Abstract: This article explores the construction of a management system based on cloud computing technology. With the rapid development of cloud computing technology, enterprises and organizations are increasingly relying on cloud services to optimize their business processes and improve efficiency. This article first analyzes the characteristics and advantages of cloud computing technology, such as flexibility, scalability, and cost-effectiveness. Then, a cloud based management system architecture was proposed, which includes three levels: cloud infrastructure, cloud platform, and cloud application. Next, the core functions of the management system, such as data management, user management, and system monitoring, were introduced in detail, and how to utilize cloud computing technology to achieve these functions was discussed. Finally, this article discusses the implementation challenges and future development directions of cloud based management systems. Experiments and practical application cases have shown that cloud based management systems can significantly improve the operational efficiency of enterprises, reduce costs, and improve data security and reliability.

1 INTRODUCTION

In the environment of information technology development, the application of information technology in experimental teaching has received more and more attention. Experimental teaching is an important practical link in talent training in colleges and universities. It plays an indispensable role in the cultivation of students' ability (Feng, 2017). University laboratories are divided into basic laboratories and professional laboratories, most of which are set up according to their specialties for practical teaching of each specialty (Zhao and Liu, et al. 2019). At present, many colleges and universities have formed disciplines with multiple development directions, such as computer network, computer communication, computer software, multimedia technology, etc., and the laboratories and equipment required in all directions have been completed (Yu and Dong et al. 2017). The management of laboratories plays an indispensable role in experimental teaching in universities all over the world (Cui, 2018). The open laboratory management pays more attention to openness and can be flexibly applied to experimental teaching. With the open laboratory management system, students can make an online reservation for the experimental platform, conduct experiments at the corresponding time, and automatically turn on the corresponding power supply of the experimental platform by swiping the student card (Jing-Bin and Duan, 2019). The reform of laboratory management in colleges and universities has not fundamentally solved the problem of laboratory management in experimental teaching. Laboratory equipment management, computer room management, student experiment management and the opening mode of the laboratory have not been fundamentally improved (Yan, 2018).

Each computer in the laboratory is equipped with a host, which greatly increases the construction cost of the laboratory. The equipment consumes a lot of power, causing waste of resources. When faced with the mutual infection of viruses within the LAN, the upgrading and maintenance of the operating system, and the updating of teaching applications, it takes a lot of time to rebuild the experimental teaching environment, which often affects the normal experimental teaching (Zhang and Zhou, et al. 2018). In addition, the data of students' computer experiments can not be stored on the machine, but can only be stored by themselves through mobile storage devices, which will infect the machines in the laboratory and burden the later maintenance and use (Zhu and Wei, et al. 2017). These problems have seriously affected the development of the laboratory. We should change our concept, establish a modern

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teaching and research laboratory that is compatible with the past, based on the modern, and oriented to the future, so that today's experimental equipment and means can adapt to the rapidly changing era and constantly improving technology (Huang and Quan, et al. 2019). Throughout the development process of instruments, equipment and experimental technology, we can use less money, less experimental system development and maintenance costs, and less time to achieve the experimental environment required for a variety of experiments. Each new major needs to build a corresponding professional laboratory. In addition, the old professional laboratory needs to be constantly updated and transformed, which leads to the increasing task of professional laboratory construction in colleges and universities, and more and more problems need to be studied and discussed (Yujia and Zhang, et al. 2019). Based on cloud technology, this paper further studies the construction of university laboratory and management system.

2 CLOUD TECHNOLOGY THEORY

Cloud technology is a usage mode of IT resources. It is a technology that provides ubiquitous, convenient and on-demand network access to shared and configurable computing resources. The use and release of resources can be carried out quickly without much management cost. Cloud computing is a mode that can acquire computing resources and improve their usability in a convenient and on-demand way through the network. These resources come from a shared and configurable resource pool, and can acquire and release resources in a simple and unattended way. At present, there are many explanations and definitions of cloud computing in the network. It can be understood as a commercial product of the comprehensive development of distributed computing, parallel processing and grid computing. It is an abstract method to represent computer resources. Through virtualization, the abstract resources can be accessed in the same way as the pre-abstract resources, thus reducing the operating cost. High flexibility and automation, service creation, resource allocation, service configuration, service online and service start-up, service stop, service offline, service configuration deletion and resource recovery, and dynamic management of service life cycle. A common abstract interface set can be provided for a group of similar resources, thus hiding the differences between attributes and operations, and allowing resources to be viewed and maintained in a common way, including server virtualization, storage virtualization, application virtualization, platform virtualization, desktop virtualization.

The primary value of cloud computing is mainly manifested in scale expansion, resource sharing can greatly reduce the unit cost of operation and increase the number of users; Service sharing can reduce the cost paid by users, bridge between users and services, and rapidly increase the number of shared services and resources, resulting in the multiplier effect of economic scale. Use virtualization technology to build virtual resource pool, shield specific hardware architecture and diversified software system platforms, dynamically allocate resources according to users' needs, and monitor the allocation of resources in real time through management software.

3 SYSTEM DESIGN REQUIREMENTS AND MAIN ARCHITECTURE

3.1 System Functional Architecture Design

University laboratories are important bases for experimental teaching, training high-level talents, conducting scientific research and serving the society. The specialized laboratory is an indispensable part of the teaching process, which plays an irreplaceable role in teaching theoretical knowledge in the classroom. With the development of cloud computing and virtualization technology, virtualization has been used in various production environments. For this reason, the laboratory is built by building a virtual cloud platform to provide students with a learning and research and development environment. Using cloud computing platform to build university laboratories can provide an ideal solution, reduce the investment in computer software technology and hardware equipment updating, reduce the investment in laboratory personnel maintenance and training, save time, and reuse abandoned equipment. The concept of distributed storage and server virtualization is adopted to organically integrate cloud computing technology with the software and hardware resource system of laboratory management in conventional colleges and universities, and build a high-speed cloud platform architecture for laboratory management. Specifically, the core architecture of the system consists of three parts, namely: infrastructure

layer, management communication layer and application interaction layer, as shown in Fig. 1.

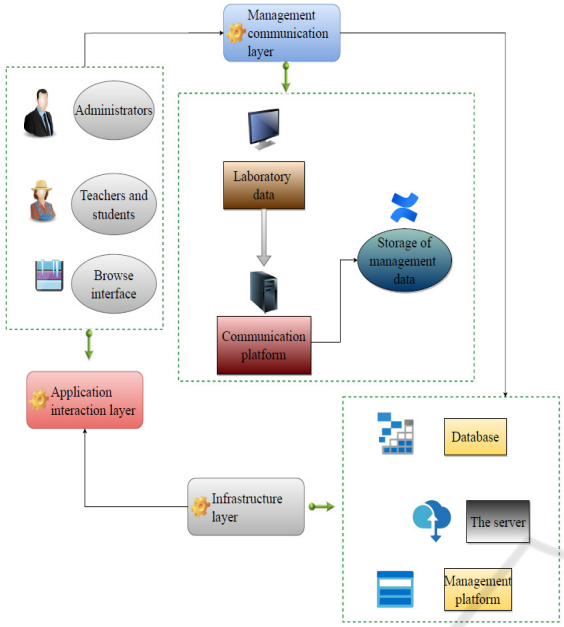

Figure 1: Architecture diagram of laboratory management system

The infrastructure layer is built with cloud computing virtual technology as the core, and the Linux operating system is used to design the virtual infrastructure server cluster of the laboratory. Compared with the traditional way, the cost of software laboratory using cloud computing platform will save 3/4 of the investment. In the later stage, if the computer laboratory wants to expand the hardware or update the software. The communication layer uses Hadoop to build a cloud environment, and HDFS to design files, information and data to access the distributed system, which greatly improves the access throughput and speed of laboratory management information. The laboratory of cloud computing platform only needs to consider expanding the hardware equipment on the cloud terminal server and updating the software of the cloud terminal. The application interaction layer builds the application interaction layer based on Hadoop cloud environment to realize the cloud sharing of laboratory management information. In order to improve the application experience of administrators, teachers and students, the traditional method needs to consider the hardware update and software update of each computer, so that the cost invested will far exceed the cost of adopting cloud computing platform. Web browser is used to design the access interface, which is simple and easy to operate.

3.2 Overview of System Functions

The laboratory management system adopts two modes, and the open laboratory management system website adopts B/S mode; The client swiping and management of the laboratory site adopts the C/S mode. Students can book experiments, manage reservation information, view experiment records and experiment scores through the browser. On the client side, students can turn on the power supply of the reserved experimental platform at the corresponding time by swiping their cards, and students can perform corresponding experiment operations. Under the traditional mode, university laboratory management systems are usually designed based on B/S architecture. Most of them can only achieve the management effect within the LAN, and the data storage and reading speed is slow. With the continuous expansion of domestic university laboratories, there are more and more laboratory data and projects to be managed. The traditional laboratory management system is difficult to adapt to the diversified management requirements under the new situation. By designing the circuit, the wireless module and the server interact with each other to control the relay of the circuit, so as to control the circuit of the experimental platform. The client system connects to the virtual machine through the protocol to obtain the corresponding cloud desktop.

Through the characteristics of the school laboratory and the design and arrangement of the curriculum, we fully set the open model of the laboratory to achieve an open laboratory management system. Then, on the basis of fully demonstrating the feasibility and necessity of the construction of the professional laboratory, defining the purpose, main technical indicators, workload, investment benefits of the instrument, and implementing water, electricity, environmental protection, installation conditions, housing, personnel, funds, etc. item by item, we will concentrate funds to build key laboratories with high-end instruments and equipment. Students can make an online reservation for the experimental platform according to their spare time, connect the open laboratory management system through the browser, and select the corresponding laboratory platform and corresponding time period. In the laboratory site, the corresponding power supply of the test bench can be turned on by swiping the card. As shown in Fig. 2, student appointment flow chart.

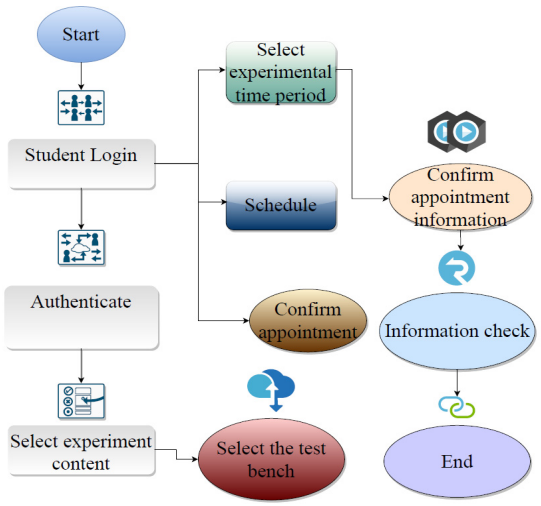

Figure 2: Flow chart of student appointment

The server generates a large number of virtual desktops through virtualization technology, and uses the remote desktop display protocol to send desktops to terminal devices through the network. Administrators can access the service management platform through IE browser to manage and maintain the server cluster and all virtual desktops, thus realizing centralized management of desktop environment, zero maintenance of terminals and flexible allocation of hardware resources. The design of this system is based on the above functional requirements. On the basis of realizing the functions of system user information management, laboratory course information management, discipline construction management and experimental project management, it is introduced into cloud computing to improve the speed of system management information management and file storage capacity.

4 REALIZATION OF LABORATORY MANAGEMENT SYSTEM

4.1 System Function Design

Through the construction of the cloud technology comprehensive laboratory, we can make full use of the existing software and hardware resources of the experimental teaching computer from the design, use cloud computing technology, expand and extend the use of existing computer resources, and meet the requirements of realizing the originally unattainable computer experimental teaching functions under the existing equipment. This system has four functions: user information management, laboratory curriculum information management, discipline construction management and experimental project management. First, user information management. The "resource pool" is used to organize and manage resources such as CPU, memory, disk, etc. The resources in this resource pool can be shared in the same resource pool. The administrator can flexibly configure the resources in the resource pool according to the resource requirements of the end user, thereby greatly reducing idle resources and improving resource utilization. In view of the large number of experimental course teaching video, audio, PPT, e-books and other document resources in the experimental center, the system uses cloud technology to build a distributed file system, improve the system data storage capacity, and make full use of the computer software and hardware resources in the experimental center. The cloud platform tool uses CloudSIM, and the cloud node server is implemented by 34 hosts in the experimental center machine room. The node configuration is shown in Table 1.

Table 1: Node Configuration of System Background Cloud Platform

Host No	Node Name	IP address
#1	Master standby node	196.128.0.36
#2	Master node	196.128.0.37
#3	DataNode	196.128.0.38
#4	Logic logical node	196.128.0.39

In the application, the system searches according to the name, number and key words of the experimental teaching resource file saved in the database, and the main node of the Cloud SIM Cloud platform is responsible for the function scheduling of data reading of the distributed file system. In the design, the course collection and available laboratory resources are defined in the form of linked lists. The node definition of each linked list is as follows:

$$Node = Class(T, N, Y) \tag{1}$$

$$Node_1 = Lib(Y, T, A) \tag{2}$$

Where $Node$ indicates unmatched courses, $Node_1$ indicates available laboratories at each teaching time point, and Y and T in formulas (1) and (2) respectively indicate the types of

experimental courses and laboratories and teaching time points.

Server resources can be dynamically allocated by the administrator of the computer room. When idle terminals appear, dedicated virtual desktops can be allocated to other end users. Realize remote cloud management of laboratory course information, including: remote cloud course selection, adding and modifying course information, asking for resumption of leave, etc. Thirdly, discipline construction management. It has realized the project construction management of laboratory practice courses, including discipline construction and development management, experimental paper management, experimental discipline conference management, etc.

4.2 Analysis of Experimental Data

In the process of laboratory management, we should actively apply cloud technology and build a more scientific and reasonable laboratory model, so as to better serve the experimental teaching and practical teaching. There are some hidden dangers in the security of the virtual terminal configured by the cloud platform. We can configure several network segments separately in the campus intranet and set the access mode, so that the external network can't access the terminal and server of the cloud platform, but can only access it in the campus, thus obtaining certain security. Compared with the traditional laboratory management system, the biggest advantage of the university laboratory management system based on cloud computing technology is that the reading and writing rate of large-capacity data is faster, and the storage throughput is larger. In order to test the performance of the designed system, a targeted laboratory data upload and download test was

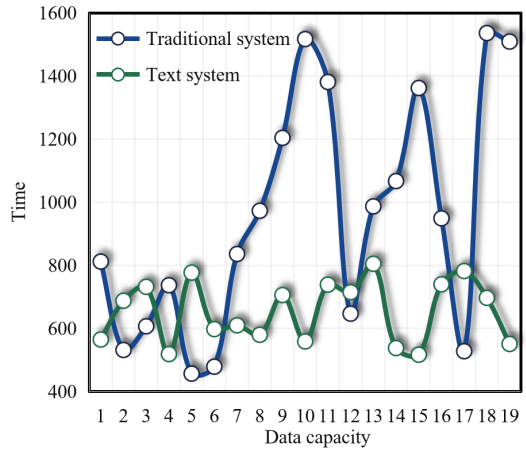

Figure 3: Comparison of reading and writing data test speed

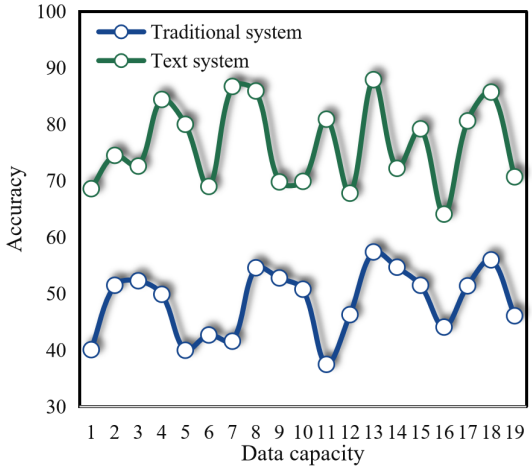

Figure 4: Comparison of test accuracy of reading and writing data

conducted, and the test chart shown in Fig. 3 was obtained. The test chart of data reading and writing test accuracy is shown in Fig. 4.

From the experimental data in Figure 3, it can be found that the system in this paper has a faster read/write rate for cluster high-capacity data, while the data in traditional systems has a slower read/write rate, indicating that the laboratory information storage management system designed based on cloud computing technology has more speed advantages for the read/write storage of massive data. Through the analysis of the experimental data in Figure 3, it can be found that the accuracy of the system designed in this paper is higher than that of the traditional system, and the highest accuracy of the system designed in this paper can reach 90.08%. The highest accuracy of the traditional system is only 61.23%. From the above experimental data, it can be found that the system designed in this paper is generally higher than the traditional system, whether from the comparison of the test speed of read and write data or the comparison of the accuracy of read and write data.

The system in this paper provides more experimental needs for college students and teachers. The target users of the system include the administrators of the experimental center, teachers of experimental courses, etc. The administrators of the experimental center mainly use the laboratory equipment and consumables management of the system, as well as the upload and maintenance of experimental teaching resources; Teachers mainly use the system's laboratory appointment, experimental teaching resources retrieval and application functions. At the same time, it also provides a new way for the rational application and

efficient management of laboratories. For example, when students have experimental needs, they can directly book laboratories online, thus ensuring that students can also carry out experimental activities in their spare time. The management process of experiments has also changed from the traditional timing and fixed-point to more flexible experimental management.

5 CONCLUSIONS

Under the current situation of rapid development of cloud technology, colleges and universities should combine the reality to cultivate cloud technology talents suitable for social needs. In order to make students adapt to the actual development needs of cloud technology and be familiar with the future working environment, the laboratory management system designed in this paper is based on the actual needs of computer experiment centers in colleges and universities. The school computer room and laboratory management system based on cloud computing technology is not only rich in functions, but also interactive, which can provide personalized services for teachers and students and improve the utilization rate of laboratory resources. In view of the large demand for storage capacity of experimental teaching resources, cloud technology is chosen to be stored in distributed file system. Cloud technology comprehensive laboratory should build a simulation application environment, emphasize the application of key technologies, and build a team development environment to cultivate students' team spirit and software architecture development ability. Provide information support for the core work of the experimental center, and improve the efficiency and information level of laboratory management. Under the background of cloud technology, the laboratory of economics and management has realized the sharing of experimental resources of economics and management majors in colleges and universities, enriched experimental teaching resources and teaching means, and ensured the sustainable development of experimental teaching of economics and management majors. Cloud technology will eventually easily meet the challenges faced by the maintenance and management of university laboratories, give full play to students' initiative and innovation in the learning process, and cultivate students' practical ability and innovation ability to the greatest extent.

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