Construction and Application Research of Colleges and Universities Cloud Service Platform

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Abstract: According to the characteristics of university information system application environment, this paper analyzes the value of university cloud service platform, especially the advantages and application significance of saving human resources and enhancing system security, stability and usability. There are many departments in colleges and universities, and the application environment of information is complex, and the use of resources can form a complementary relationship. Taking the data center cloud platform of Jianghan University as an example, this paper summarizes the advantages of cloud service platform and specific application scenarios through real production environment analysis, which provides a reference for the application and expansion of cloud platform in colleges and universities.

1. Introduction

Technology changes life and the development of information technology have brought us into a new cloud era. Cloud computing, cloud service platform, is not a brand new technology or innovation, but a new application service, new software, hardware, network service experience. Cloud computing is a dynamic and easily expandable virtual resource based on network. It has been widely used because of its ease of management, data concentration, security and stability, easy access, and low-cost in large-scale application [1]. Education cloud service is an information environment that uses cloud computing technology to build personalized teaching, providing facilities for resource sharing and storage space, and so on. As early as October 2007, Google and IBM began promoting cloud computing on university campuses, including Carnegie Mellon University, Massachusetts Institute of Technology, Stanford University, University of California, Berkeley and the University of Maryland [2]. This paper takes the Network Information Service Center of Jianghan University as an example and provides necessary information technology support for teaching by combining the existing network cloud application. This paper describes that the Network Information Service Center of Jianghan University uses the EMC storage system based on cloud engine, supports the high-performance blade server of cloud service, and establishes the teaching service system based on cloud platform, based on the service virtualization and desktop virtualization technology of Citrix. It discusses how to implement infrastructure as a service (IaaS) and further software as a service (SaaS) in teaching.

2. Necessity of Cloud Service Platform Construction in Colleges and Universities

2.1 Reduce the cost of informationization construction

The informationization construction of colleges and universities is a "money burning" project, which costs a lot to each school. In the traditional informatization construction, each department needs to establish its own system, from hardware to software, even needs a management team. Low utilization ratio, poor management level, unsatisfactory effect. Take Jianghan U-niversity as an example, before the construction of cloud service platform, there were 37 technicians registered in

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the Network Information Service Center. Only a small number of managers were specialized in managing related equipment, such as the School of Computer Science. Most of them managed the equipment part-time. The Network Information Service Center conducted relevant technical training every year, but with little effect. It was often difficult to restore the network of a certain department within a week or the data was lost, which required data recovery and cost much. Using the cloud service platform, each department declares its resource needs according to its own business, and some technical staff of the Network Information Service Center evaluates it and allocates resources to serve it. The construction of cloud service platform saves the investment of human resources for the school, greatly increases the stability, security and availability of the application system, and comprehensively improves the experience of teachers and students.

2.2 Achieving unified management

With the rapid development of information technology, various application systems, from basic function to information security, are constantly upgrading, and the related databases and middleware are consuming more and more resources [3]. In such a case, there is no unified management, which will lead to many problems, such as self-fighting, repeated investment and low efficiency. After the cloud service platform is adopted, the resources are managed and allocated uniformly, and the system is upgraded, expanded, safeguarded, data backup management and equipment maintenance uniformly. At the same time, training professional and technical personnel to manage the cloud platform of the whole school with high efficiency, high technical level and scientific management is a strong guarantee for the safe and stable operation of the school information environment.

2.3 Integrating software, hardware, data and human resources

Under cloud service platform, unified management is not only on the hardware, but also on the level of unified data. In the traditional informatization construction, different application systems adopt different brands of products, some even individual behavior, so the data transfer and management will be isolated. The cloud service platform provides open data standard management. The application system of each new department needs to be developed and designed according to the new data standard, and the important flow data applied by other departments needs to enter the data center of the cloud platform. Under such a management framework, hardware, software and data production got management to a certain extent, the transformation of traditional department "private property" to schools shared resources, at the same time by the university directly under the Network Information Service Center (cloud platform management department) service for the entire school departments, break the small unit, based on the big development. And then, the integration effect of technical personnel and managerial personnel is also very effective. The training of a small number of professional technical personnel and the cancellation of part-time technical personnel have improved the management of equipment, software and computer environment, as well as the business management level of colleges and universities.

3. Cloud Service Platform Construction Process

The key technologies of cloud service platform are resource pooling and management, and extended management at the time of resource depletion. Resource pooling refers to the unified integration of computing, storage and other resources through virtualization technology to form a resource "pool"[4], whose main object is network resources, storage resources, computing resources and other centralized resources, such as IP address, which are the basis of the cloud. And how to manage after pooling becomes the basic condition that cloud service platform can support application delivery. The resources of cloud service platform are dynamic, random, real-time and dispersive [5]. Therefore, how to effectively manage these dynamic requirements is also the core problem of cloud service platform construction. Finally, cloud platforms need to be dynamically scalable and able to effectively upgrade and extend resources.

3.1 Cloud service platform network system deployment

Different from the traditional network providing mode, cloud-oriented network service mode is no longer designed for the complex physical layer. Instead, the physical devices in the network information service center are virtualized into network resource pool through virtualization. Through convenient management, multiple complex applications are realized. Jianghan University adopts Cisco Nexus 7000 as the core switch with dual redundancy structure. Cisco Nexus 7000 virtualized two core devices at different levels through Virtual Device Context (VDC): in the control plane, multiple independent control platform routines were created to realize multiple logical topologies and fault domains. In the data plane, data isolation is achieved by partitioning the published data and other databases. In the management plane, each virtual appliance provides a streamlined management environment. Technologically, fault isolation, management isolation, service differentiation domains, address allocation isolation and adaptive resource management of each logical device are realized. Through different levels of virtualization, the cloud service platform is a separate virtual switch device for the library and financial department to provide personalized cloud network services.

3.2 Cloud service platform storage system deployment

Distributed storage is the basic data storage method of cloud computing. The cloud platform of Jianghan University adopts EMC VNX 5500 and EMC VNX 5300 as primary and standby storage of data production, and uses EMC VNX 5100 for data disaster preparedness in remote locations. The system is managed by EMC VPLEX, an enterprise-level federated storage area network-based solution that aggregates and manages storage array pools connected via fiber channels, which can be the same data center or multiple data centers in different geographic locations across regions. EMC VPLEX Metro provides synchronous distance without interruption of heterogeneous data movement and function of volume management, relying on unique longitudinal extension and transverse extension architecture of EMC VPLEX system advanced data cache and distributed cache anastomotic provides the workload of elasticity, automatic storage domain sharing, balancing and failover, and helped realize a predictable service level of local and remote data access.

3.3 Cloud service platform computing system deployment

In order to provide secure and reliable computing services, the platform adopts two Cisco UCS 6248UP redundant hot backup and four Cisco UCS 5108 blade server chassis fully matched unified computing system as a school-wide cloud computing service. The Cisco UCS 5108 blade server has four front-end access single-phase hot plug power, N+1 redundancy and N+N redundancy configurations. The rear end of the chassis includes eight hot-plug fans, four power ports (one per power port), and two I/O brackets for Cisco UCS 2104XP array extension modules. A passive intermediate panel provides up to 20 Gbps of I/O bandwidth for each server slot, two slots for 40 Gbps of I/O bandwidth, and supports future 40Gb Ethernet standards. Cisco Unified Computing System effectively integrates the basic framework of data center, reduces the use of physical equipment such as switches, servers and network cards, and reduces capital investment and management costs. The pooling of resources enables unified scheduling and access in the management domain of computing, storage and network resources, reduces the deployment time and difficulty of new services. It improves the control level of virtualization. Through the innovation of memory expansion technology and I/O, a single server can virtualizes more virtual machines. Server management, network management and storage management are integrated into a unified system UCS Manager for management. At the same time, in order to support the Oracle database of library and campus card, IBM servers are adopted in the system, which realizes the dual-machine hot standby as the data service system, meets the demand of system diversity, and also guarantees the security, stability and reliability of the system.

3.4 Cloud service platform security system deployment

The security management of cloud platform adopts Cisco adaptive security virtual device

ASAv30. ASAv30 is a high performance and scalable virtual security solution. It provides a comprehensive firewall security function for virtualization environment, and reduces management overhead, high flexibility and operational efficiency for data center, private cloud, public cloud and hybrid cloud. Cisco ASAv30 can help cloud platforms identify and eliminate network attacks, maintain network security policy compliance, and provide comprehensive security management for virtualized environments.

3.5 Cloud service platform management system deployment

The cloud platform of Jianghan University uses VMware vSphere 6.0 to manage the platform, and uses Esxi virtualization management program. It has a simplified architecture, smaller security space, simplified deployment and configuration, and simplified patch and update mode. It is the golden standard of virtualization management program. VMwarevSphere based on performance characteristics for hierarchical storage management (to realize data storage area cluster), simplifying the initial storage place, based on the I/O load balancing, eliminate the virtual machine when storage maintenance downtime, shorten the storage planning, allocation of time, reduce the error for the selection and management of storage of virtual machine, by optimizing the placement to improve storage utilization.

4. Direction of College and University Cloud Service Platform

4.1 Curriculum management platform

A good curriculum management platform can make the course information open to all students, including the main content of the course, the introduction of the teachers, the selection of the past students and the evaluation of the course and teaching. After students take elective courses, the students' learning experience, the completion of the course assignment and the interaction with others can be kept on the course platform to form a electronic file. The use of curriculum platform can provide a platform for the accumulation of school teaching materials, and retain valuable teaching resources and achievements.

4.2 Teaching resource management platform

Teaching resources are the embodiment of the comprehensive strength of schools. In the past, colleges and universities have built quality courses on a large scale, but due to lack of management, the quality of some courses is not real high, so they are not supported by students. But some high-quality courses have tens of millions of hits. At the same time, the open courses abroad also have the functions of answering questions online and assessing. These teaching resources and management platforms are the direction of school development. The combination of resource management platform and curriculum management platform can improve the quality of teachers' courseware, provide more teaching materials, retain excellent students' works and accumulate rich cultural connotations.

4.3 Virtual application, virtual desktop platform

Virtual application and virtual desktop are the basic and effective ways to realize Software as a Service. Virtual applications and virtual desktops on cloud platform can provide real-time online applications for teachers and students. Users can tailor their applications to their needs and use them arbitrarily within the scope of the campus network. At the same time, the functions of cloud platform software maintenance and upgrading, virus scanning and vulnerability prevention are all handed over to the professional monitoring platform, which greatly improves the security of personal use. The provision of SaaS eliminates the need for schools to purchase, construct and maintain infrastructure and applications. The use of SaaS also saves the workload of computer virus or software upgrade and maintenance. Especially for most non-professional faculty and students, SaaS is an efficient platform for them to enjoy the achievements of information technology.

4.4 Solve the problem of legitimate edition

The issue of university edition has always been a matter of great importance to the Ministry of Education and the Ministry of Information Industry. Authentication is the basic requirement for China to enter the international commercial competition. Colleges and universities are the frontier of cultivating social people, and the important period for teenagers to form their outlook on life, values and world outlook. To realize the authenticity of college education and teaching is an important guarantee for teaching and educating people. Cloud service platform adopts centralized installation and centralized management, which changes the previous mode of decentralized terminals and difficult to manage. Implementing genuinization on cloud platform also realizes the genuinization of school-level applications and guarantees the implementation of the genuinization.

5. Benefit Analysis of Cloud Service Platform

First, unified planning and deployment save school funds and human resources. The unified installation and deployment integrates the information systems of the original departments, integrates the scattered resources, saves the construction and maintenance costs, and solves the problems of low management efficiency of non-professional personnel and numerous management personnel of the school information system. The school integrates 87 independent information systems, and more than 35 teachers are no longer required to be the part-time information system administrator.

Secondly, high reliability improves the information service ability of colleges and universities. The traditional construction mode of each system for its own sake leads to the low efficiency of the implementation of each system. Some units of equipment are good, but the application is not resource intensive and runs at very low utilization. On the contrary, some units do not update the aging equipment, and system resources run at a high level, often resulting in application use obstacles. Since the construction of the cloud platform, the application system running on the cloud platform has not failed for more than two hours, and the entire cloud platform has not stopped. Cloud platform adopts unified management, dynamic resource allocation and professional technical personnel as guarantee, with low failure rate, excellent equipment operating environment, scientific management and high efficiency in fault handling, which greatly improves the information service capacity and level of colleges and universities.

Thirdly, uniform standards promote the integration and sharing of resources. In addition to integrating existing hardware, software and personnel, effectively integrating the data of each department and connecting with the original production data of each department. At present, the data of the academic affairs office, personnel office, finance office, campus card office and other departments have been settled in the data center of the cloud platform. Each department can use the corresponding data to improve the work efficiency between departments.

Finally, the abundant application supports the teaching, scientific research and management of the whole university, so as to improve the overall teaching and scientific research level of the university.

6. Conclusion

Although cloud computing is not a new business, it is a comprehensive innovation of multiple technologies, providing a new technical support for the construction of information-based environment of teaching, scientific research and management in colleges and universities. In this paper, the cloud service platform of Jianghan University is described by module according to the construction method, experience and mode. At the same time, according to the current situation of the university, the application direction of the university cloud service platform is proposed, and the benefits of the cloud service platform for the university are summarized. The construction of hardware is the foundation, and only rich application construction can provide modern means for teaching, scientific research and management and informatization support for the development of

schools. The construction plan of cloud service platform in this paper provides reference basis for the construction of cloud platform in colleges and universities, and further research on application development direction is the fundamental way to realize SaaS comprehensively, and the destination of cloud service platform.

References

[1] GE Lei, WU Jianjun. Research and Exploration of Colleges Cloud Platform Construction [J]. Software Engineering.2016.01,p50-52.

[2] Yan Wenliang. Research Under The Cloud of Virtual Machine Resource Allocation[D].Beijing: Beijing University of Posts and Telecommunications. 2015.p2-3.

[3] XU Xiang. Building the Cloud Platform of University Data Center Based on VMware Virtualization Technology[J]. Information Technology and Informatization.2014.05,p278-280.

[4] SU Yu, WANG Dongxiu, HE Shiheng. Computer Room Desktop Cloud Based on VMware View[J].Computer Knowledge and Technology. 2018.08,p218-220.

[5] CAI Wei-Shan, FENG Jian-wen, DENG Lin-lin. Research on the Architecture of University Cloud Experimental Platform Based on Hybrid Cloud[J].Modern Computer.2018.08(23), p89-93.