Research on the Practical Application of Server Virtualization Technology in Computer Laboratory

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Abstract. At present, most of the university's conditions and teaching equipment have greater room for improvement, especially the management and teaching mechanism of computer laboratory need further improvement and breakthrough. Due to the rapid update speed of computer information technology related equipment, the update speed of university related equipment can not meet the needs of experimental education. Based on this, this paper first analyzes the application and development status of server virtualization technology, then studies the specific application of server virtualization technology in computer laboratory, and finally gives the application design strategy of server virtualization technology in computer laboratory.

Keywords: Server Virtualization Technology, Computer Laboratory, Practical Application

1. Introduction

With the rapid change of computer technology represented by cloud computing, it brings great possibility to improve the function and performance of computer laboratory[1]. Cloud computing technology based on virtualization technology is based on the virtualization resource configuration of the underlying infrastructure, which converts hardware resources to virtual resource pool, and makes software and hardware form physical isolation. At present, there are various forms of virtualization technology, mainly as shown in Figure 1.

![Figure 1. Various forms of virtualization technology.](attachment:figure1.png)
On the other hand, with the vigorous promotion of higher education and the continuous expansion of university scale, higher requirements are put forward for the structure of higher education and the cultivation of higher quality talents for the society. However, at present, most of the University's school conditions and teaching equipment have greater room for improvement, especially the management and teaching mechanism of computer laboratory need further improvement and breakthrough. Updating the computer experimental teaching equipment and strengthening the practical teaching has become one of the important goals of the current university digital and intelligent education.

Computer experiment course is a subject with high practical requirements. However, due to the rapid updating speed of computer information technology related equipment, the update speed of university related equipment can not meet the needs of experimental education. If the related equipment is constantly updated, it will bring greater pressure on the equipment investment of University. Based on this, the introduction of server virtualization technology and products in the process of laboratory construction and the construction of laboratory teaching platform based on new information concept can improve the service ability and technical support level of computer laboratory, and further improve the utilization efficiency of university equipment investment funds. With the continuous maturity of virtualization technology represented by server, its application in education has been improved rapidly. The application of server virtualization technology can better meet the current needs of universities for computer laboratory service level, and can save the construction cost of university computer laboratory, and help the development process of intelligent education in universities.

In addition, with the development of university education towards the stage of mass education, universities need to integrate with social needs as much as possible through professional courses, experimental operations and other related teaching processes, which requires universities to strengthen the intensity of practical courses. The emergence of virtualization technology has brought revolutionary changes to the implementation of computer laboratory teaching and information construction. The introduction of virtualization technology makes the virtual experimental equipment not only meet the teaching needs, but also saves capital investment, excavates the potential of equipment, and alleviates the shortage of experimental equipment. It not only helps students to study independently in and out of the experimental class, but also further breaks the limitation of time and space, enhances the learning effect of students and relieves the teaching pressure of teachers. Therefore, it is of great practical value to study the practical application of server virtualization technology in computer laboratory.

2. Application and development status of server virtualization technology

2.1. The development of server virtual technology
Server virtual technology is also through continuous iterative development and gradually mature. Virtualization technology was first applied on the mainframe, and gradually appeared in the application of logical partition on the minicomputer\(^2\). With the maturity of the X86 platform architecture, as well as the processor speed constantly exceeding the requirements of software for hardware performance, and the increasing enterprise cost, environmental protection and business pressure, server virtualization technology has been rapidly developed and gradually popularized.

Server virtualization is based on loading hardware, operating system and application into a portable virtual machine archive. Before virtualization, the software of the server must be combined with the hardware. Each machine has a single operating system image, and each operating system has only one application load. After virtualization, each machine has multiple loads, and its software is more independent of the hardware.

2.2. Server virtualization data center architecture
Server virtualization technology makes resource pooling and sharing further improved, and improves hardware utilization through integration. Virtualization enables low utilization server load to be consolidated into one server to achieve high hardware utilization safely and reliably. The architecture of server virtualization data center is shown in Figure 2.

![Figure 2](image)

**Figure 2.** The architecture of server virtualization data center.

### 2.3. Advantages of server virtualization consolidation

First of all, the application of server virtualization can quickly and uniformly deploy servers. Before the virtualization consolidation, not only the hardware procurement cycle of the server is longer, but also the installation time of the operating system and application program of the server is also long\[^3\]. After the server virtualization is consolidated, use the template and auto deployment wizard or copy the virtual machine to start. The differences before and after server virtualization consolidation are shown in Table 1.

| Differences                              | Before server virtualization                        | After server virtualization                        |
|------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|
| Procurement cycle                        | Long Hardware installation                           | Short                                               |
| Install operating system and applications | Configure security policy                           | Copy the virtual machine and restart                |
|                                          | Configuration storage                               |                                                     |
|                                          | Install system software                             |                                                     |
|                                          | Install and configure software                       |                                                     |
|                                          | Test application                                     |                                                     |
|                                          | Schedule downtime                                    |                                                     |
|                                          | Data migration                                       |                                                     |

From table 1, it can be seen that the application of server virtualization can reduce the cost of server investment first, and virtualization of different application loads enables users to greatly reduce the number of servers. Secondly, server virtualization can further save energy and reduce consumption, thus reducing the server power cost, including the loss of the server running smoothly, and also energy consumption in the aspects of voltage changing equipment, power supply, lighting and cooling system heat dissipation. In addition, server virtualization also further improves the availability of the whole system. After the physical host is virtualized, the computing resources are all pooled. When a node in the resource pool fails, the virtual machine running on it will automatically migrate to a healthy physical host.

### 2.4. Implementation of server virtualization

The realization of server virtualization is to load the hardware, operating system and application program into a portable virtual machine archive file. Each machine has multiple loads and the software
is independent of hardware. This improves the disadvantages of the combination of software and hardware before virtualization, a single operating system image on each machine, and only one application load per operating system[4]. First, when creating a virtual machine, select the device and memory capacity. Second, map the virtual machine device to the physical device on the host. In addition, the virtual machine is independent of the host system and hardware devices, so that multiple virtual machines can run at the same time. The server virtualization architecture is shown in Figure 3.

![Server virtualization architecture](image)

Figure 3. The server virtualization architecture.

3. Application of server virtual technology in computer laboratory

3.1. Teaching application of server virtualization computer laboratory platform

Based on the application of server virtualization computer laboratory platform, first of all, help to divide the corresponding virtual machine according to the number of students, so as to carry out teaching according to their aptitude, and configure and optimize the application software of each system[5]. In addition, the virtual experimental platform can also realize the physical isolation of multiple systems, and can run multiple isolated virtual machines at the same time. Many virtual machines are configured in the network parameters to debug the programs written by ourselves to test the compatibility, so that the students' practical ability is constantly strengthened.

3.2. Management application of server virtualization computer laboratory platform

The application of server virtualization computer laboratory platform management is mainly through the method of backup and copy virtual machine files for template installation of virtual machine[6]. This kind of installation can greatly improve the deployment efficiency of computer laboratory, so as to realize the construction of complex experimental environment and ensure the normal and effective development of related computer teaching work. In addition, due to the physical isolation of multiple systems realized by the virtual experimental platform, it can ensure the stable operation of the whole virtual machine system when a virtual machine can not run normally, so as to ensure the normal development of computer laboratory teaching.

4. Application design of server virtualization technology in computer laboratory

4.1. Extending the life cycle of existing computer laboratory systems
With the aging of computer laboratory hardware, it is necessary to constantly upgrade the system. However, due to the high cost of hardware and software upgrading and the long period of upgrading, it is difficult to guarantee the stable development of computer experimental teaching. The migration of computer laboratory business system to the virtualization platform can realize the function independent of hardware platform, so as to ensure the compatibility of the system, promote the smooth transition of the system, and completely replace the original system function. In addition, the application of server virtualization technology can make the computer laboratory room more energy-saving and efficient, the server management is more convenient, and the maintenance cost is reduced.

4.2. Guarantee the continuity of computer laboratory business
In order to ensure the uninterrupted operation of computer laboratory information system or reduce the interruption time as far as possible, the solution before the emergence of virtualization technology has a series of shortcomings, such as high cost and complex technology, which leads to the implementation of computer experiment related experiments is greatly restricted, and the application of server virtualization makes its implementation easier, deployment faster and more flexible. It can migrate the running virtual machine when the server is down for maintenance, so as to minimize the impact of server failure and downtime on laboratory related experiments. In addition, under the virtualization environment, the fault recovery management of computer laboratory equipment has become more simplified and flexible, and the deployment cost has been significantly reduced.

5. Conclusion
In summary, in the process of laboratory construction, the introduction of server virtualization technology and products, and the construction of laboratory teaching platform based on new information concept can improve the service ability and technical support level of computer laboratory, and further improve the utilization efficiency of university equipment investment funds. With the continuous maturity of virtualization technology represented by server, its application in education has been improved rapidly. Through the research of the application of server virtualization technology in computer laboratory, this paper analyzes the realization methods and advantages of server virtualization, and studies the teaching and management application of server virtualization computer laboratory platform through the analysis of the application of server virtual technology in computer laboratory. Through the research on the application design of server virtualization technology in computer laboratory, this paper analyzes the specific application strategies in ensuring the business continuity and life cycle of computer laboratory.

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