The Application of Virtual Machine Technology in Computer Network Security Teaching in Universities

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Abstract: The complexity of the online teaching environment and the limitations of computer hardware conditions have brought many difficulties to the teaching of computer network courses for teachers. Applying virtual machine technology to computer network course teaching can effectively promote teaching and improve teaching quality. The emergence of virtual machine technology and its powerful virtual functions can build various complex experimental and training platforms. For example, in a virtual machine, you can freely add or remove computer hardware devices, format disks, and install multiple operating systems. This article applies virtual machine technology to computer network security teaching in universities. During the teaching process, examples can be directly demonstrated on multimedia computers to deepen students' understanding. By using a virtual network environment, the actual network situation can be truly simulated, while also reducing the demand for experimental equipment resources for students, without considering the impact of network devices and their connection issues on the effectiveness of the experiment. So that every student can learn theoretical knowledge and hands-on practice in the virtual network environment, freely change software and hardware configurations, and receive better teaching results.

1. Introduction

At present, university teaching mainly adopts the form of multimedia, and for the teaching of computer courses, Power Point documents are generally used, accompanied by relevant software for explanation and operation demonstration. This method can achieve good results in explaining basic and applied software courses. Therefore, in teaching, teachers should ensure that every student has hands-on practical operation and application of network technology, which is the key to improving the quality of teaching. When teaching the course 'Computer Network Security', it is often necessary to configure relevant preventive measures and simulate attack demonstrations in a network environment[1]. This cannot be achieved in a standalone multimedia teaching environment, making it difficult for students to understand and master without seeing examples. However, many schools have brought many difficulties to the teaching process due to hardware limitations. Often, many students share a set of network devices and environment, making it impossible for each student to actually operate on their own. The emergence of virtual machine technology and its powerful virtual functions can build various complex experimental and training platforms, such as the ability to freely add or remove computer hardware devices, format disks, and install multiple operating systems under virtual machines [2-3]. This article applies virtual machine technology to computer network security teaching in universities. The actual physical computer running a virtual machine is called the host computer, which can run multiple virtual computer systems simultaneously, and each virtual computer runs its own operating system without interference with each other. During the teaching process, examples can be directly demonstrated on multimedia computers to deepen students' understanding. Experimental teaching affects the quality of computer network security teaching. Therefore, in the process of teaching, it is necessary to achieve the combination of theory and practice, in order to cultivate high-quality professional talents and further enhance students' practical operation abilities. Innovative talents are the key training content of computer network security teaching in vocational colleges, and can also reduce the demand for experimental equipment resources for students, without considering the impact of network

equipment and connection issues on the effectiveness of experiments [4]. By enabling every student to learn theoretical knowledge and hands-on practice in a virtual network environment, they can freely change software and hardware configurations, and achieve better teaching results.

2. Current situation of computer network security teaching in colleges and universities

In the process of social progress, computer network security technology has risen and been widely used in various industries in China, which on the other hand has increased the demand for computer network security technology talents in the social market, thus making this kind of talents appear in short supply [5]. In the process of teaching, a large number of destructive software contents such as viruses and Trojans will be involved, which increases the difficulty of teaching to a certain extent [6]. At the same time, the network security laboratory also needs to invest a lot of money for construction and maintenance. In order to meet the demand of China's social market, major colleges and universities have set up this course of computer network security. The teaching of computer network security in colleges and universities mainly adopts theoretical teaching, which also makes the utilization rate of network security laboratories relatively low. The curriculum of computer education is not standardized. College students are the basis of cultivating talents. Computer related courses are now listed as compulsory courses in most colleges and universities. As a subject with strong application practice, the computer course must first learn the basic knowledge of computer use in the teaching process, and then apply the theoretical knowledge of computer to the practice of related fields. However, the teaching of computer courses in most colleges and universities is too theoretical, and there is a lack of computer experiments and other related courses. In terms of computer teaching design, schools still arrange courses according to the training mode of ordinary talents. Such teaching cannot meet the professional demand for computer talents in the social industry, and also makes students lack practical knowledge of computer-related applications and incomplete grasp of some computer professional skills during their study at school. It can not meet the social demand for college students' computer application ability. The emphasis on computer curriculum system is not high. As far as colleges and universities are concerned, many computer courses are just the learning activities of modern basic vocational skills in order to adapt to the instructions of higher authorities when the employment pressure increases sharply. Many talents training modes in colleges and universities do not fully consider the mastery of computer skills and knowledge, which makes college students only accept ordinary scientific and cultural knowledge, and lack the learning of basic social skills. After graduation, the employment situation is more severe, and they seem to be at a loss when facing employment choices. In the education of computer courses, many have not reached the level of attention to the compulsory courses, there are no schools that attach importance to the overall education of computer courses in colleges and universities, and there is no systematic arrangement of the process of computer courses, which makes students unable to accept systematic comprehensive computer theory and practice education during the school period, which is not conducive to the overall development of students. There is a mismatch between computer theory and practical application. In computer education and teaching in most colleges and universities, students only pay attention to the necessary theoretical knowledge and simple computer operation education, and students lack the comprehensive use of relevant knowledge of computer application practice. The training requirements of computer education are to achieve in addition to learning basic Internet knowledge, understanding the development process and application operation of contemporary computers, but also to master the relevant practical training such as simple programming. Computer education in colleges and universities is very simple, mostly just learning documents and basic computer operations. There is also a lack of collaboration with off-campus enterprises. Students can't get the chance to practice after learning theoretical knowledge. The school also lacks related activities, so that students can not really understand the operation cases in computer applications.The development of computer network security teaching in colleges and universities is mainly to cultivate high-quality technical application talents, which can meet the needs of social development.

3. The Advantages of Virtual Machine Technology Applied in Computer Network Teaching

3.1. Introduction of Virtual Machine Technology

Virtual machine technology is a kind of computer technology integrating multimedia technology, sensor technology, network technology, human-machine interface technology, simulation technology and other technologies. It is an important development direction of simulation technology, and it is a challenging cross technology. Computer virtual technology includes dynamic real-time simulation environment generated by the computer, audio-visual tactile perception, sensing equipment, natural skills, etc., which supports multiple operating systems in parallel on a single physical server, providing the underlying hardware with high efficiency. In a virtual machine, the CPU chips partition the system to create a storage area, so that the operating system and applications officially run in protected mode. If a program is frozen in a virtual machine, the program running outside the virtual machine and the operating system will not be affected. In the real computer system, the hardware resources are effectively controlled by the device drivers that constitute the operating system, specifically transforming the system instructions into the control language of the special equipment. The direct consequence of driving under the assumption that device ownership remains independent is that multiple systems cannot be operated in parallel on a single computer. Virtual machine technology can effectively solve this problem. The virtualization operation principle is that low-level device resources are used to interact with each other, without affecting high-level applications. Customers can use virtual machines to operate multiple systems in parallel on a single computer. Each virtual machine includes a set of virtualized devices, with virtual hardware corresponding to each virtual machine. In addition, guest operating systems and applications can operate on virtual machines without the interaction capabilities of network adapters. Virtual server in the physical Ethernet is only a kind of software simulation equipment, through the server to effectively integrate the Windows system, further effectively avoid the threat of hackers and virus software, this series of operations need to use virtual technology to complete, virtualization makes the computer system highly integrated. From a computer to divide a part of the hard disk and memory can be virtual several machines, each machine operating system to maintain a high degree of independence will not affect each other, this part of the new machine has a relatively independent CMOS, hard disk and operating system, can easily distinguish, and can format, application software and other related operations. These operating systems can also be effectively linked to produce a network. When a virtual system crashes, it can be deleted without affecting the local system. Moreover, the local system crash does not involve the virtual system. After the system is reinstalled, it can be directly added to the virtual system. The Windows and Linux host platform virtual system is the only operating virtual computer software, which does not need to be booted again, can be used on a computer at the same time several OS, easy to operate and very secure. Virtual machines play a decisive role in learning technology.

3.2. Strong simulation

Because virtual machines can virtualize independent computer software and hardware systems, whether it's partitioning and formatting of computer hard disks, installation and configuration of operating systems, or network connections and configurations of multiple virtual machines in a virtual local area network, all operate exactly the same as on a real physical computer [7]. The feature of having multiple virtual machines on one computer allows students to conduct experiments on their own virtual machines, ensuring that everyone has one machine and does not affect each other's experimental environment on their virtual machines. Virtual machine technology is a type of virtual computer technology. Its biggest function is to simulate another or even several operating systems that can run independently on a regular computer, and even connect these operating systems into a virtual local area network[8]. Therefore, this article analyzes the necessity of using virtual machines, which can be mainly divided into the following four aspects, as shown in Figure 1.
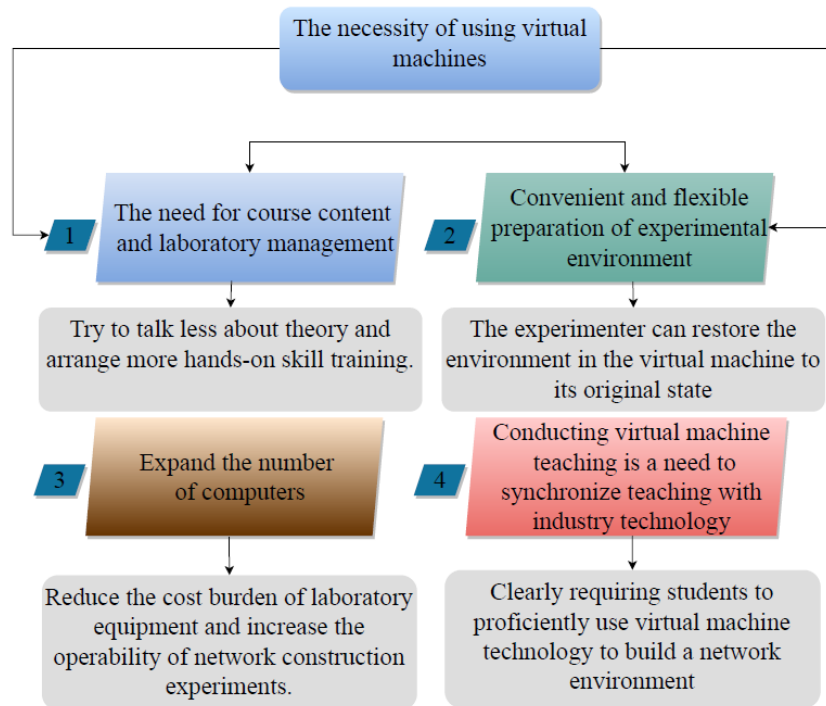
Figure 1 Necessity of using virtual machines

Virtual machine software can provide a nearly real computer hardware environment, and experiments can be completed on real machines on virtual machines. At the same time, it can integrate several virtual client operating systems on a single host to form a virtual machine local area network environment[9]. The behavior of this network is completely consistent with that of the real network, and it can eliminate the possibility of various trivial hardware conflicts in the real network. Avoid situations such as information loss. There are two main types of computer network security: physical security and logical security. In physical security, it is to prevent computer equipment from being damaged. And logical security mainly refers to the integrity and confidentiality of the collected information.

3.3. High security

For the host environment, each virtual client is just an application running on it, but for the applications running in the client, it is like working in a real computer, and they can be partitioned, formatted, installed with system and application software like ordinary computers [10]. Therefore, for computer network courses or computer assembly and maintenance courses, it is difficult for students to disassemble computers themselves, install systems repeatedly, or set up and debug networks for multiple computers. In the whole teaching process of computer network security, teachers will teach students some teaching contents with systematic dangers, such as the harm caused by computer Trojans to the system. Therefore, at this time, the teacher can reasonably apply the virtual machine technology to the actual teaching process, and use the virtual machine to demonstrate the teaching content on the spot. Objectively, it has improved the demand of various industries and society for computer network security technicians. After teaching with virtual machines, different systems can be installed in different virtual machines. And each virtual machine is a file on the hard disk. In order to meet this social demand, colleges and universities have set up computer network security courses one after another, hoping to meet the needs of various industries for computer network security technicians. When different system environments are needed, it is enough to open the virtual machine file of the corresponding system with virtual machine software, thus avoiding repeated installation and configuration of the network environment and facilitating management and maintenance. When different system environments are needed, it is enough to open the virtual machine file of the corresponding system with virtual machine software, thus avoiding repeated installation and configuration of the network environment and facilitating

management and maintenance.

3.4. Intensive management of resources

Administrators no longer have to run up and down to process hosts on each workstation, and all daily operations are done remotely. Functions such as replication and snapshot provide powerful tools for daily maintenance. Improve hardware utilization. There are two aspects: 1) In general, physical resource utilization in enterprise IT is very low, because all physical resources must meet the "peak" computing needs of the present and even several years from now. With the advent of virtualization, the "peak" problem can be solved by dynamically scaling/adjusting, having multiple virtual machines running on a single physical machine to take advantage of this additional "idle" capacity without having to add a lot of physical resources; 2) Before virtualization, in order to ensure the reliability and availability of applications and avoid conflicts and mutual influence between them, each physical machine generally does not run multiple important applications, which means that physical resources are generally not effectively utilized. The isolation feature of virtualization solves this problem well, which also improves the utilization of hardware. Dynamically adjust machine/resource configuration. Virtualization separates the operating system and applications from the server hardware, providing greatly increased flexibility. You can add or remove resources for a VM without shutting down or removing a physical server. High reliability. Reduce server or application downtime and improve reliability by deploying additional functions and solutions to deliver a highly reliable server application environment with transparent load balancing, dynamic migration, and fast replication. Reduce overall costs. One of the biggest advantages of using this technology in your IT infrastructure is that you don't need to invest in expensive equipment, and in-house professionals can easily access a variety of software and servers. In addition, the price of virtualization is also acceptable, because there is no need to purchase the equipment directly, which means more overhead can be saved. We only pay for the virtualization services to the third party that owns and maintains all the servers, at no additional cost. Reduce the number of terminal devices. By integrating multiple network management systems into one host through virtualization technology, one system can still be guaranteed to have one server. In this way, the number of hardware devices and power consumption are reduced without affecting the use of network management services. Reduce the number of empty rack positions required by devices to avoid the environment modification caused by the increase in the number of devices. In addition, virtualization technology also has good improvements in security, availability, and scalability.

4. The main applications of virtual machine technology in teaching

4.1. Virtual machine technology provides services for teaching experiments

During the entire teaching process of computer network security, educators will teach students some teaching content with systemic risks, such as the harm caused by computer trojans to the system. Therefore, at this point, educators can reasonably apply virtual machine technology to the actual teaching process and use virtual machines to demonstrate the teaching content on-site. Due to the simulation of two or more virtual machines in the computer, the hardware requirements for real computers are relatively high, requiring a CPU speed of 800MHz and a memory of 512MB or more. And the more memory capacity, the better, which can increase the speed of virtual machines and the stability of network experimental environments. Operations such as disk partitioning, formatting, and installing operating systems can have certain destructive effects on physical computer disk data, so such risky operations can be carried out on virtual machines in teaching. It can allow students to hands-on practice without causing unnecessary damage to physical computers. The actual physical computer running a virtual machine is called the host computer, which can run multiple virtual computer systems simultaneously, and each virtual computer runs its own operating system without interference with each other. Computer network courses cannot be separated from the explanation of network security knowledge. When teachers explain network security knowledge, they often need to demonstrate to students the impact of a virus outbreak on the computer, how Trojan hacker

programs attack and control the computer, and the harm of randomly deleting system files to the computer.

4.2. The role of virtual machine technology in compute network security teaching

When students study computer networking technology or configuration courses related to networking, VMware can set up a VLAN(Virtual Local Area Network), without assigning multiple microcomputers to each person and purchasing network equipment such as switches, routers and network cables, which is convenient for various network experiments. In the process of each student's experiments, teachers need to patrol for counseling and inspection to determine what problems students have in the experiment process, so as to correct them in the summary. Teachers can create multiple virtual machines on one of their own teachers' computers, and according to the needs of teaching, the virtual machines will form the corresponding virtual LAN. Teachers can switch between different virtual computers to make the teaching process natural and smooth. Teachers can even distribute their own virtual machine files equipped with network environment to each student's computer. However, in the case of a large number of students, teachers can't only coach individual students in a limited time, otherwise they can't solve the common problems of most students. The application of virtual machine technology in computer network security teaching in colleges and universities is briefly analyzed and summarized as follows, as shown in Figure 2.
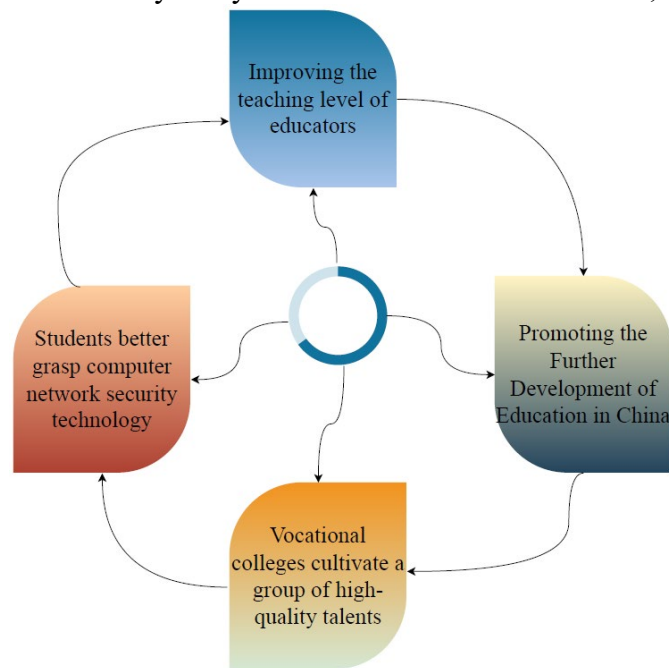

Figure 2 The Role of Virtual Machine Technology in Computer Network Security Teaching

When students create virtual machines, they also need to know the network settings for the virtual machines. Mainly setting up the network card of the virtual machine. Virtual machine technology is the most important component of computer network security teaching in universities. There are three types of network card settings for virtual machines, which actually determine the specific location of virtual machines in network topology. Therefore, in the process of teaching, it is necessary to achieve the combination of theory and practice, in order to cultivate high-quality professional talents and further enhance students' practical operation abilities. Innovative talents are the key training content of computer network security teaching in vocational colleges, and can also reduce the demand for experimental equipment resources for students, without considering the impact of network equipment and connection issues on the effectiveness of experiments. It can enable universities to cultivate more professional technical talents and fully leverage the role of computer network security. At the same time, it can also promote the development of China's education industry.

4.3. Virtualization technology Some attention issues

There are many advantages and disadvantages,of course, not every application can be virtualized. Some applications require direct hardware calls, must run in shared memory space, or require a dedicated device driver that is only compatible with a specific device. The upfront cost is higher. In the long run, though, virtualization can be economically beneficial. Of course, considering the longer term, we have to invest more money in hardware. It will certainly save money in the long run, but the real cost is still quite high. Reduces hardware utilization. This seems to contradict the advantages mentioned above, but it is just a different Angle. Virtualization must occupy some resources (CPU/ memory/hard disk), a physical machine can play 100% performance, plus after virtualization, may only play 80% performance, so it will reduce the utilization of resources. Therefore, some resource-hungry applications may not be suitable for virtualized environments.

A bigger mistake. In the conventional configuration, VMS are stored on the hard disk of the local dedicated server. If the physical machine is down, all VMS on it are unavailable. In addition, if the hard disk of the physical machine is damaged, most of the files can be recovered. However, if the VM image file is damaged, all the files in the VM may be damaged. Implementation configuration and management are complex Usually IT administrators and classroom teachers can not well investigate and solve the problems in the use of virtualization, such as often encountered VM can not start or stuck, not as good as the real physical machine to solve. Certain limitation One of the main disadvantages of using virtualization technology is that it involves various restrictions. Not all server and application virtualization is friendly, which means that some aspects of the IT infrastructure for relevant computer courses may be compatible with virtualization solutions. To this end, it should be considered that there are still vendors that do not fully support virtualized environments. Security. Although virtualization technology is already very good in security, virtualization technology itself also has certain security risks. The purpose of the virtualization process is to separate virtualized resources, but there are still cases where servers are accidentally visible to others who aren't supposed to see them.

5. Conclusions

Virtual machine technology has obvious high-tech characteristics and can play an important role in computer network security teaching in colleges and universities. The application of virtual machine technology will further improve teachers' teaching level and ensure the improvement of teaching quality. Virtual machine technology can not only improve the teaching level of teachers, but also make the whole teaching process more colorful. The use of the simulator is very flexible, which can provide a practical environment for many courses of computer network specialty. For example, the management and maintenance of computer systems, the establishment of small and medium-sized networks, the configuration and testing of network servers, network security, Linux clusters and so on. In this way, it can also improve students' learning efficiency to a great extent. Students can comprehensively improve their learning efficiency by learning virtual machine technology, find their own shortcomings in the process of learning, and constantly adjust themselves. The behavior of this network is completely consistent with that of the real network, and it can eliminate the possibility of various trivial hardware conflicts in the real network, Avoid situations such as information loss. There are two main types of computer network security: physical security and logical security. From the harmful results of various attack tools to the system and the relevant preventive measures taken. Students can think and analyze together, further improve their interest in learning and deepen their understanding, which will have a good teaching effect. At the same time, virtual machine is a mainstream technology in the field of server, and it also provides a practical technology for students majoring in computer network. It is worth promoting in the experiment of computer network course in colleges and universities. In addition, virtualization technology realizes the maximum utilization of campus network hardware resources, and fundamentally saves limited financial resources for schools. There has also been a great improvement in the interaction between teachers and students. With interaction, teachers and

students can work together perfectly. For teachers, teaching tasks can be completed successfully. For students only, master the acquired knowledge and skills to better go to the next stage of knowledge. The application of virtualization technology is a huge revolution in computer teaching and has a positive and profound impact on university education. The government and universities should strongly support and promote it. For students only, master the acquired knowledge and skills to better go to the next stage of knowledge. The application of virtualization technology is a huge revolution in computer teaching and has a positive and profound impact on university education. The government and universities should strongly support and promote it. For the majority of college students, especially those majoring in computer science, they should take the initiative to master this technology, which can not only provide great help in computer-related fields, but also be widely used and helped in other non-computer fields. In the information age, information technology is the basic technology of social operation, everyone should master certain information technology.

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