Network Security Teaching Design and Practice Based on Virtual Simulation Experiment Environment

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Abstract: Experimental teaching is an indispensable part of the training of applied network security talents. Aiming at the plight of network security practice teaching, this article explores the construction of network security virtual simulation experiment centers in political and law colleges. Suggestions are given in the construction of virtual simulation experiment platform, experiment teaching system design, experiment center management, etc., which can promote and learn from the reform of network security experiment teaching.

1. Introduction

The goal of “Computer Network Security” courses offered by colleges and universities is to cultivate network security application talents with network information security and equipment operation and maintenance capabilities, and to solve the problem of insufficient technical talents in network security. Therefore, experimental teaching is an important part of the network security curriculum, which can effectively improve students' practical ability and practical quality. However, the network security-related experimental equipment of many entities is expensive and is not conducive to unified management and maintenance, causing certain economic and management burdens on universities. At the same time, some network security experiments are irreversible, which may cause certain damage to the experimental equipment and increase the cost of course teaching. In order to solve the experimental teaching problems of network security-related courses, the Ministry of Education selected two national network security virtual simulation experiment teaching centers, including Wuhan University and Xidian University in 2014, to undertake the experimental teaching reform tasks of related courses . As one of the application-oriented undergraduate transformation pilot colleges, our school is committed to cultivating network security technical personnel with practical capabilities. Therefore, it is urgent to carry out network security experimental teaching reforms, and experimental teaching based on virtual simulation technology is extremely feasible Method to realize.

2. The Development Status of Network Security Experiment Teaching

Cyberspace security is a major that emphasizes practical innovation and is very practical. For new security technologies and methods, students need to learn and apply in practice. The current teaching system generally emphasizes theory and neglects practice, and lacks the training of students' offensive and defensive capabilities; the teaching process is often separated from theory and experiment, and students cannot get effective theoretical guidance in time in experimental training, and the teaching effect not ideal. The backward laboratory conditions in colleges and universities, especially the insufficient investment in the construction of virtual simulation laboratories, are the main reasons why the practical teaching system of cyberspace security is difficult to implement. The network security experiment itself has certain security risks, and it is easy to have security vulnerabilities. If destructive experiments such as virus injection and network attacks are carried out in the real network, it will seriously threaten the safety of equipment and management in the laboratory, and even lead to disasters. Sexual consequences. In history, there have been precedents of virus experiment samples flowing out to public networks, causing harm.

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The introduction of virtual simulation technology into safety experiment teaching can not only solve the problems of complex network environment for safety experiments, high experiment cost, and avoid potential safety risks, but also the integration of theoretical and practical teaching content, which can improve students' learning Interest, to achieve the mastery of knowledge and the improvement of hands-on skills. Therefore, it is very necessary to introduce virtual simulation experiment technology into the practical teaching of network security major, and it is also the inevitable trend of the future development of experimental teaching. With the continuous improvement of society's awareness of the importance of network security, the training of security talents' practical ability has received unprecedented attention. Many domestic scholars have carried out relevant research on the application of virtual simulation technology in network security. Zhou Feifei, Pan Jie, etc. combined the working principle of the firewall and the characteristics of the DOS nuke attack, and proposed an offensive and defensive model for designing and simulating DOS nuke attacks in the OPNET environment; Network laboratory and online visualization. In the field of cloud computing technology research, Kang Chen and Zhu Zhixiang used KVM virtual machine and Openstack to design a network attack and defense experimental platform based on cloud computing technology; Di Xiaoqiang and others proposed a cloud based on hyper-converged architectureThe computing network security experimental teaching platform construction plan uses the Web platform to provide an experimental environment, which not only facilitates the sharing of experimental resources, but also facilitates the maintenance and management of the experimental platform. These results have a good reference for the construction of the network security virtual simulation experiment center of applied universities.

3. Platform Application Examples

The experiment introduced in this section takes the file virus as an example. Through the description of the experiment, we can understand the platform application method. Computer virus principles and related protection and knowledge of killing are important content of network information security. The computer network virus experiment module of this platform includes multiple modules including boot area virus experiment, file type virus experiment, macro virus experiment, script virus experiment, etc., covering typical computer virus types, including nearly a hundred virus source programs. The virtual simulation experiment platform provides students with an almost real experimental environment. By completing the experiments provided by the platform, students can master the principle of the virus, clarify the mechanism of the virus, analyze the virus infection process, and learn the knowledge of virus protection and methods of killing.

(1)Experimental tools

The related tools involved in this experiment include OLLYDBGPEExplorerLaborDayVirus.exe, UltraEdit, etc. Among them, OLLYDBG is a 32-bit assembly analysis debugger with a visual interface, and a new dynamic tracking tool; PE Explorer is a powerful visualization of Delphi, C++, The VB program parser can quickly decompile the 32-bit executable program and modify its resources; LaborDayVirus.exe is a file-based virus program; UltraEdit is an excellent text editing tool. On the virtual simulation experiment platform, the tools needed for this experiment have been pre-installed in the experimental virtual machine, which can be called directly during the experiment.

(2) Experimental process

The experiment process is divided into the following steps:

① Place the test.exe file and the virus file LaborDayVirus.exe in the same folder, execute the virus file, infect the test.exe file, execute the test.exe file, check whether it can be executed normally, and record the phenomenon;

②Compare the size changes of the experimental files before and after infection, use OLLYDBG and PE Explorer tools to check the changes in the program entry point, and confirm whether the experimental files are infected;

③Using the file comparison function of UultraEdit, open the original copy of test.exe and the

infected file for binary comparison, view the changes in the file and record;

④Using the routines provided by the system, write the LaborDayVirus.exe virus killing program to remove the virus. Through the above steps, students can master the infection process of a file infected with a virus, the changes that occur after the file is infected with a virus, and the method of virus removal.

3, platform application effect analysis

The abbreviation of the network information security experiment platform based on virtual simulation technology provides the possibility for the application of new courses, new content, and new teaching methods, and provides a technical foundation for practical activities such as teaching reform. At present, the platform has been used to set up experiments for 14 professional courses, with more than 300 experimental questions, which completely breaks the constraints of the laboratory's space and time for learning activities. At the same time, based on this platform, the School of Computer Science and Technology successfully held two network attack and defense competitions, which consolidated the foundation of students' network security and exercised their skills in network security. In the first Jilin Province College Student Network Security Competition held in May 2018, our students won the first place in the group score. Moreover, through further comparison tests, the average experimental scores of students who use the virtual simulation experiment platform for experiments are significantly higher than those who use the platform. It can be said that the development of these tasks and the achievement of these achievements are inseparable from the application of the virtual simulation experiment platform.

4. The Construction of Network Security Virtual Simulation Experiment Center

The experimental teaching model based on virtual simulation technology is a new practical teaching model adapted to the development of the new era, and is an important subject of the current experimental teaching reform in colleges and universities. The construction of the network security virtual simulation experimental teaching center is not only to realize the integration of traditional network security experimental teaching and Internet technology, but also to create a new experimental teaching model, including the construction of experimental platform, experimental teaching system, experimental project development and center Open and manage work.

5. Experimental Platform Construction

The construction of virtual simulation experiment centers in key universities represented by the “211 Project”, “985 Project” and “Double First Class” universities started early. They have received relatively large policy support and financial investment at the national and local levels. These universities have advanced experiments Teaching concept, strong technical strength, and independent research and development methods are mostly used in the construction of experimental platforms. The level of network security laboratory construction is at the forefront of the country, such as Wuhan University and University of Electronic Science and Technology. However, general universities as local universities, especially liberal arts colleges, will mostly purchase commercial network attack and defense systems based on virtual simulation technology for experimental teaching. Commercial systems are highly integrated, with comprehensive functions in teaching presentation, teaching management, and experiment management, but there are deficiencies in the training environment, especially the network environment of a specific industry is not well targeted. When selecting the experimental center, on the one hand, it must fully investigate the teaching needs and the current state of the security market technology; on the other hand, it must be forward-looking and open to facilitate later expansion and interaction with the real physical environment.

6. Conclusion

The application of the virtual simulation platform has played a significant role in promoting the

experimental teaching of network information security related courses. The platform not only enriched the experiment content and reduced the experiment cost, but also broke through the space and time constraints. It moved the laboratory to the Internet. The most important thing is that it greatly stimulated the students' enthusiasm for experimentation and solved the problems proposed at the beginning of the article. Problems existing in experimental teaching at present. It can be said that the application of virtual simulation platform plays an important role in improving the teaching quality of network information security related courses.

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