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Industry-education Integration Oriented Information Security Training System for Smart Grid

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Abstract: *In the field of cybersecurity, industry-education integration can improve students' practical ability and employment competitiveness by cooperating with enterprises and integrating practical cases and technology applications into teaching. The training of smart grid information security talents is a process involving many aspects, which needs to comprehensively consider the training objectives, curriculum settings, practical teaching, employment direction and training mode. By constantly optimizing and improving the contents and measures of these aspects, more high-quality professionals can be cultivated to meet the needs of the future development of the power industry. This paper introduces the main problems faced by smart grid information security, focusing on the corresponding knowledge system of talent training.*

Keywords: *Knowledge System of Information Security, Industry of Smart Grid, Industry-Education Integration*

1. Introduction

1.1. Demand for Cybersecurity Talents in the Power Industry

At the same time that China's network power strategy is further promoted, the industry's demand for professional and technical talents is becoming increasingly urgent, and the huge gap of network security talents has become one of the main problems faced by the security industry, especially the actual combat technical talents are seriously insufficient[1]. Data show that by 2027, China's network security personnel shortage will reach 3.27 million, while the talent training scale of colleges and universities is only 30,000 people/year. The demand for network security industry is growing, involving the government, finance, telecommunications, energy and other fields, the demand for network security talents is also growing[2]. With the construction of smart grid and the rapid development of new energy power generation technology, the demand for network security protection in the power industry is increasing. However, the current power industry network security professional talent reserve is seriously insufficient, the talent gap is large. According to statistics, in the next three years, the demand for network security talents in the power industry will reach hundreds of thousands of people, but the current talent reserve can only meet the basic needs[3,4], and there is a large gap. The specific requirements are mainly reflected in three aspects as Fig.1:

1.1.1. Network security level protection management

The power industry network security level protection management measures aim to regulate the power industry network security level protection management, management objects include power monitoring systems, management information systems and communication network facilities[5]. Improve the power industry network security capacity and level, safeguard national security, social stability and public interests.

1.1.2. Cybersecurity supervision and management

The goal of cybersecurity work in the power industry is to establish and improve the cybersecurity

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protection system and work responsibility system, improve cybersecurity protection capabilities, and ensure the safe and stable operation of the power system and reliable power supply[6]. This goal is achieved by strengthening the supervision and management of network security in the power industry and standardizing the work of network security in the power industry.

1.1.3. Proactive security defense and comprehensive prevention

The power industry network security work adheres to the policy of "active defense, comprehensive prevention", and follows the principle of "management according to law, division of labor, overall planning, highlighting key points". By taking necessary measures to prevent attacks, intrusiveness, interference, destruction and illegal use of the network and accidents, the network is in a stable and reliable state of operation, and the ability to ensure the integrity, confidentiality and availability of network data[7].

1.2. The Knowledge Structure Demand of Network Security Talents in the Power Industry

The demand for network security talents in the power industry covers multiple levels and multiple positions, and the related positions are mainly: network and information security administrators, information communication network operation administrators, information security testers and network security level protection evaluation division[8]. On the one hand, high-end network security talents with deep professional knowledge, such as network security architects, security analysts, etc., are needed to formulate overall security strategies and solutions. On the other hand, there is a need for a large number of cybersecurity engineers with practical skills who are responsible for daily security monitoring, bug fixing, and emergency response. In addition, with the application of new technologies such as cloud computing and big data in the power industry, there is a growing demand for cybersecurity talents with the background of these new technologies.

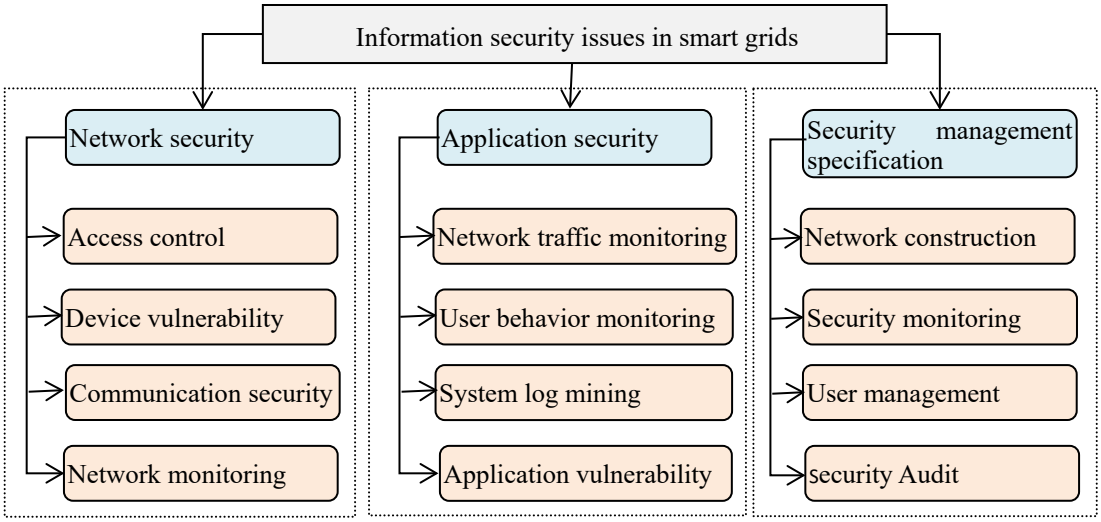

Figure 1: Main information security issues

In order to alleviate the shortage of cybersecurity talents in the power industry, it is necessary to strengthen the construction of the training mechanism for industry-education integration talents. Through cooperation with enterprises, practical cases and technology applications are integrated into teaching to improve students' practical ability and employment competitiveness. Colleges and universities should strengthen the course and practice teaching of network security-related majors, improve students 'professional skills and practical ability, accumulate practical experience, and have practical skills in the field of network security problem analysis and problem solving. At the same time, enterprises should also actively participate in the talent training process, provide internship opportunities, and retain excellent network security talents. We will increase support for the training of cybersecurity talents and promote the deep integration of industry, education, research and application.

2. Information Security Training Knowledge Structure for Power Industry Needs

With the purpose of supporting the development of local digital economy and promoting network security services, the industrial education talent training mode of network security companies is

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introduced to create a closed loop of talent training for the whole process of production, learning, research, training, competition and certification. From the teaching, training practice, scientific research cooperation, technical certification and employment services to build a teaching resource system, the industry needs, academic research, practical training practice, skills competition and professional certification and other links are closely integrated to form a perfect training system[9]. Combined with the rich experience accumulated by network security companies in the field of network security industry, according to the characteristics and skill requirements of employment positions for network security students, the practical training is divided into two technical directions, namely: security services, technical services, according to the knowledge, ability, literacy requirements of these two technical directions, provide differentiated, customized course content and experimental environment, and carry out characteristic personnel training. In the teaching process, we will cooperate with enterprises and scientific research institutions to jointly build teaching resources and improve the quality and effect of teaching.

In order to meet the requirements of the development of network security industry and serve the development of regional economy, we should systematically master the basic theory and professional skills in the field of network security with the fundamental task of cultivating morality and cultivating people and collaborative education between production and education. To cultivate senior professionals with the ability to analyze and solve scientific problems of network security and good engineering practice ability, it emphasizes on cultivating students 'basic theory, professional skills, problem solving ability and practical ability. Security service is the most basic task to maintain enterprise network security, and its knowledge structure mainly includes four aspects, as shown in Fig. 2.

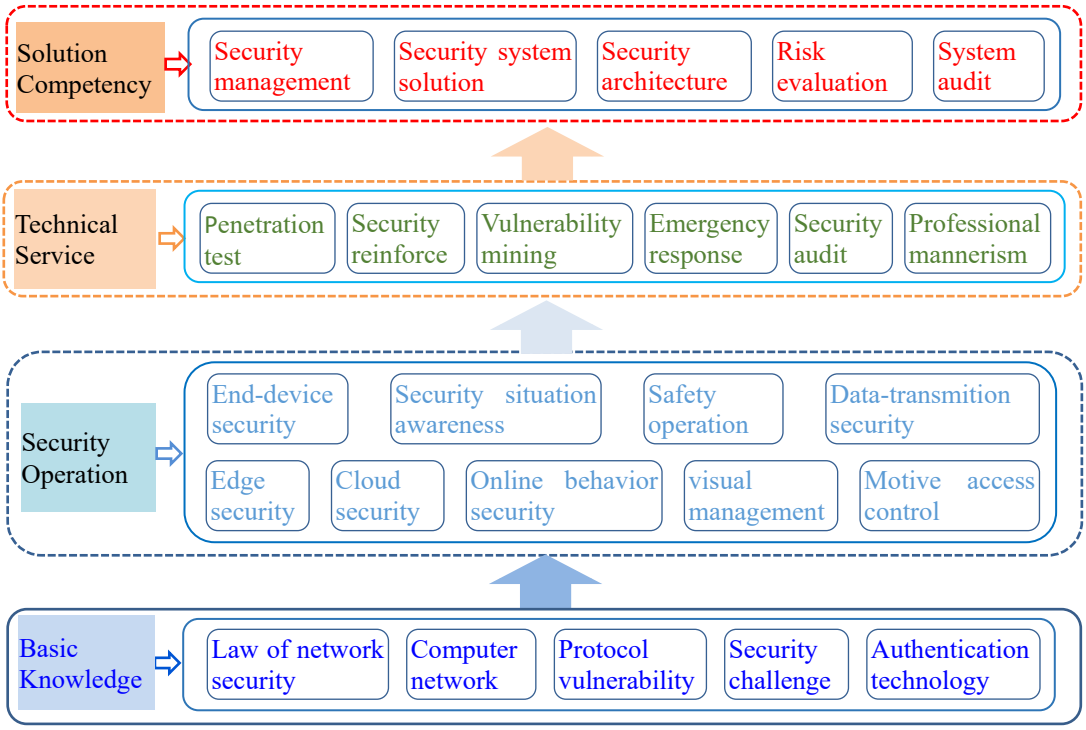

Figure 2: Network security service capability training knowledge structure

The knowledge system of network security technical ability training is constructed from the perspective of technology development and industrial employment, as shown in Fig.3. The construction of "multi-level, modular, systematic" teaching resources, not only pan-industrialization of general technology courses and practical resources, but also the industry in multiple industries mature network security project case implantation, characteristics and universality are taken into account[10]. And the curriculum system and content with the update of industrial technology regularly iterative upgrade, through close cooperation between production, education and research, network security industry to cultivate a highly professional and practical ability of senior talents, to maximize the network security industry talent training and growth needs.

In the process of knowledge system construction, it is necessary to revise and update the knowledge system in time according to the characteristics of students and cognitive laws, keep up with the industrial development, so as to ensure that the content of curriculum resources is synchronized with

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the application of industrial technology, thereby continuously enrich and improve the knowledge system.

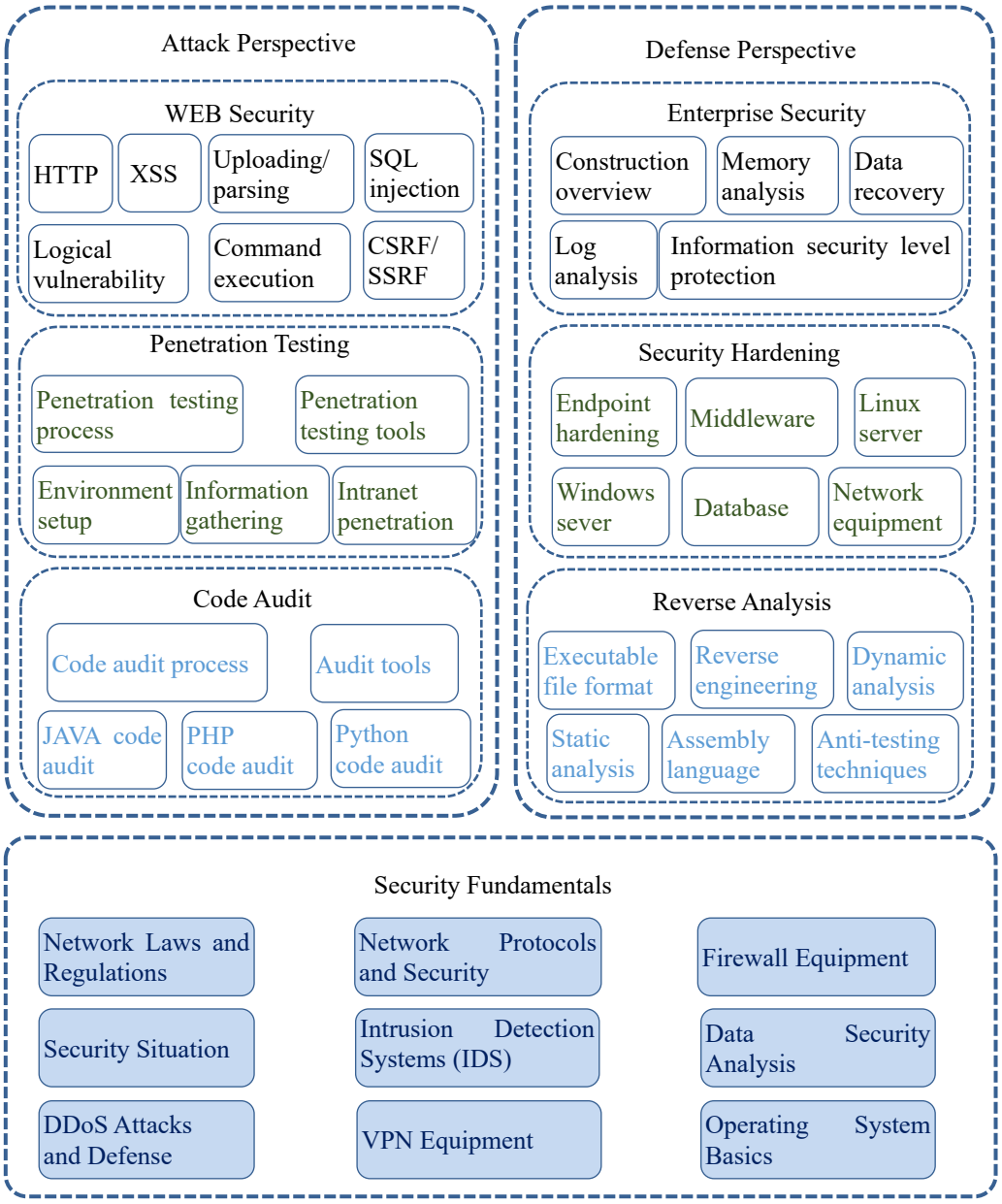

Figure 3: The knowledge system of information security technology capability training

3. Information Security Training Knowledge Structure for Power Industry Needs

The talent training of network security is a complex and continuous process, which needs to combine theoretical learning and practical operation. With the support of network security companies, the knowledge structure of cloud resources can be optimized to guide students to organize practical teaching according to their own interests and industrial needs. Through the practice of practical teaching, the implementation plan is constantly optimized to improve the quality and effect of teaching. Through the practice of practical teaching, the implementation plan is constantly optimized. By establishing a cooperative relationship with colleges and universities, we can jointly develop the curriculum system and practical teaching plan of network security, which can ensure that students not only master theoretical knowledge, but also have practical ability in the learning process. Internship opportunities are provided for students to learn and apply their knowledge in real work. This helps students to better understand the actual application scenarios of network security and improve their practical ability. Students are encouraged to participate in innovation and research projects related to

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cybersecurity to develop their innovation and teamwork skills. This helps students to continuously improve their skill level in practice.

3.1. Build a cloud practice environment

Based on the practical and actual characteristics of network security, it is necessary to build a comprehensive experimental real combat environment covering the mainstream technology environment of network security and real combat training projects, supplement and improve the weak links of professional talent training in practical teaching and project real combat training, and improve students' ability to find problems, solve problems and innovative thinking.

3.2. Combination training system

Combined with the job demand of the network security industry, following the teaching law, a set of knowledge and skills demand based on industry front-line posts is designed, relying on the industrial education cloud platform of the network security company and the enterprise-level training practice environment, the integration of theory and practice teaching mode is used to build a progressive and three-level student training system to meet the actual needs of the industry for elementary, middle and high different levels of professionals.

3.3. Customized implementation of teaching programs

Optimization is all the cloud teaching resources of the network security technology range laboratory. Each student can customize the network security professional ability training program with the platform as the carrier, which can not only meet the basic requirements of network security, but also adapt to the independent requirements of students' learning.

3.4. Implement diversified teaching

Based on the network security company industry talent ability model as the benchmark, the cutting-edge technologies such as cloud computing and virtualization are comprehensively applied to meet the combination of online and offline diversified experimental teaching mode. Realize online course preparation and scheduling, certification training, online examination and other functions, highlighting the immersion of teaching and experimental combat.

The perfect implementation plan is inseparable from the construction of teaching staff, it is necessary to strengthen the construction of network security professional teaching staff, improve the teaching level and practical ability of teachers, which helps to improve the quality of teaching and cultivate more excellent network security talents.

In short, the cultivation of talents in network security needs many efforts, including cooperation with universities, providing internship opportunities, holding training and seminars, encouraging innovation and research, establishing an evaluation system, and strengthening the construction of teachers. Through these measures, we can better cultivate network security talents with practical skills and contribute to the development of the industry.

4. Effective Personnel Training Mechanism

Through several years of practice of in-depth cooperation with industrial companies, the implementation of industry-education integration has proved that for local colleges and universities, this is an important way to improve the quality of education and cultivate talents with practical ability and innovation ability. Effective personnel training mechanism is mainly reflected in three aspects:

(1)Relying on the high-quality resources of the power industry, build a training platform for industry-education integration. Continue to promote in-depth cooperation with industrial companies, and invite enterprise experts to participate in the course design to ensure that the teaching content matches the needs of enterprises. The actual project of the enterprise is introduced into the classroom, so that students can learn and apply knowledge in a real environment. With the help of the company's rich cloud teaching resources to build a training platform, and even use the technical resources of the enterprise to establish training bases and laboratories inside and outside the school. Research and implement the network security training program, improve the content system of theoretical course

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teaching and practical teaching, reform teaching methods, take teaching as the basis, practice as a means, jointly carry out practical teaching cooperation and oriented talent training, and promote professional practice teaching with network security certification.

(2)Integrate enterprise teachers and build professional teachers. Strengthen the cooperation with network security enterprises, jointly carry out personnel training, curriculum construction and teaching research and other activities. Enterprise experts regularly come to the school to teach, and encourage teachers to work in enterprises to learn the latest industry trends. The introduction of enterprise quality practice teaching strength, regularly organize teachers to participate in enterprise practice and training activities, improve teachers' network security industry background knowledge and practical ability. Teachers are encouraged to participate in enterprise practical projects, accumulate practical experience, improve their own teaching level and practical ability, improve teachers' knowledge structure, and transform enterprise needs into teaching content. These can optimize the teacher evaluation system, promote the incentive management of teachers, and ensure the construction of teachers.

(3)Implement practical teaching reform and promote the cultivation of innovation ability. Adhere to the talent training mode of "school-enterprise cooperation, industry-education integration", promote the characteristic training of professional talents, improve the characteristics of professional construction and practical teaching ability. Relying on the network security cloud resource platform, the reform of network security professional course teaching and project practice teaching is carried out, and the training standards of network security operation and maintenance, network security development, network security evaluation, and classified protection industry talents are introduced to promote the cultivation of innovative ability of network security talents. Through the project-oriented teaching mode of electric power network security maintenance, the actual security maintenance problems are solved, and students 'network security technical ability is cultivated. Based on the innovation center to carry out training services, certification and assessment services, to further improve the quality of professional training, for social and industrial needs, output high-quality network security industry talents.

Through the above measures, we can effectively cooperate with industrial companies to realize the sharing of educational resources and complementary advantages, which can not only improve students' practical ability and innovation ability, but also promote the development of industry economy and technological progress.

5. Conclusions

According to the development trend of network security in the power industry, optimize the curriculum, increase the practical courses, such as network security experiments, project development, strengthen communication with enterprises, understand the needs of enterprises for talents, adjust the teaching content, and cultivate talents more in line with market demand. The training platform needs to implement the deep integration of colleges and enterprises, and jointly establish a network security training platform to provide students with practical operation opportunities, so that students can learn and grow in practical work. At the same time, enterprises can select excellent talents through the internship training base to inject fresh blood for the development of enterprises. Universities, enterprises and research institutes can strengthen cooperation and jointly carry out research and innovation of network security technologies. Through industry-university-research cooperation, the transformation of technological achievements can be accelerated and the technological progress of network security industry can be promoted.

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