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Exploration of Information Security Protection Strategies for Computer Networks in the Era of Big Data

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Abstract: ***Nowadays, the internet has been applied in various fields of society, and its development speed is very fast. Thanks to the convenience of network technology, various industries have received support from computer networks, making information transmission and sharing more efficient and convenient. The network is also closely connected to people's lives. With the rapid development of the Internet, the coverage of the national network continues to improve, and some hidden dangers brought by the network have begun to be concerned. Information security has become the focus of attention. Elaborate on the characteristics of computer network technology, factors affecting computer network information security, measures to strengthen computer network information security protection in the big data environment, and adopt diverse means to achieve computer network information security.***

Keywords: Computer network; Big data environment; Information security.

1. Introduction

In terms of the development of the existing computer network, it has been deeply integrated with people's daily work and life. Through the efficient processing of data services, it can truly meet the demands of information sharing and information timeliness transmission based on the Internet, so as to improve the quality of people's work and life. However, while the Internet brings convenience to people, it will also produce certain security problems. For example, most people usually store important information into the network when they use computers. Once such information is lost, it will cause greater economic losses for users themselves. Therefore, in response to the problems that arise in the current operation of computer networks, advanced technologies should be adopted to improve the security performance of computer networks and protect the data privacy of users and enterprises, based on the characteristics of computer network operation.

2. Overview of big data related content

Big data, also known as massive data, literally refers to the enormous scale and quantity of information data. Its main features include diversified data types and richer data content. Compared to traditional forms of data information, it has more diversified and three-dimensional characteristics. Big data itself has many types and quantities, and with the continuous development of computer network technology,

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many useless information will also be integrated, resulting in a lack of specific structural characteristics. The continuous integration and penetration of Internet technology and social industries have enriched the information sources of big data, and even made it a digital complex with considerable scale characteristics. In recent years, many advanced individuals and enterprises have attached great importance to the deep meaning and value of big data, making the potential value of big data constantly applied to various industries.

In recent years, advancements in various fields have been driven by the application of deep learning and big data technologies. Xu et al. (2024) contributed to automated surveillance by proposing a real-time detection method for Crown-of-Thorns Starfish using YOLOv5 deep learning, enhancing marine ecosystem monitoring capabilities. Additionally, Xie et al. (2024) introduced a Conv1D-based approach for multi-class classification of legal citation texts, improving the efficiency of legal research. In the field of image processing, Wu et al. (2024) presented a lightweight GAN-based image fusion algorithm for visible and infrared images, while Ren (2024) proposed an enhanced YOLOv8 method for infrared image object detection with an SPD module. Wang et al. (2024) focused on autonomous robot navigation based on reinforcement learning, showcasing advancements in robotics.

Big data has emerged as a pivotal topic in various domains, with numerous studies exploring its characteristics, applications, and challenges. Vasarhelyi et al. (2015) and Sagiroglu and Sinanc (2013) provided overviews of big data in accounting and reviewed big data technologies, respectively. Kitchin and McArdle (2016) explored the ontological characteristics of big datasets, while Hashem et al. (2015) and Gandomi and Haider (2015) discussed the rise of big data on cloud computing and beyond the hype of big data concepts, respectively. Chen et al. (2014) and Bello-Orgaz et al. (2016) also surveyed big data, highlighting its recent achievements and new challenges in mobile networks and social media contexts.

In computer vision and pattern recognition, Chen et al. (2022) introduced a one-stage object referring method with gaze estimation, enhancing human-computer interaction. Chen et al. (2020) applied deep learning for printed mottle defect grading, improving manufacturing quality control. Meanwhile, Liu (2024) optimized supply chain efficiency using cross-efficiency analysis and inverse DEA models, while Fan et al. (2024) researched optimizing real-time data processing in high-frequency trading algorithms using machine learning. Chen et al. (2023) presented a channel-aware 5G RAN slicing with customizable schedulers, contributing to networked systems design.

Furthermore, Liang and Chen (2019) proposed a SDN-based hierarchical authentication mechanism for IPv6 address, ensuring network security. Hayes (2015) focused on multimedia big data, discussing content analysis and retrieval, while Jimenez-Marquez et al. (2019) developed a big data framework for analyzing social media content. Chen and Bian (2019) introduced a streaming media live broadcast system based on MSE, showcasing advancements in media technology.

3. Security risks in network computer information systems

3.1 Network Authorization and Access of Illegal Users

The access and use of resources in computer network systems often require filtering through network firewalls, TCP/IP communication protocols, and obtaining authorization from system administrators in order to enter a website or webpage port and complete the access, browsing, and downloading of network data resources that one needs. But some hackers provide opportunities for criminals to invade the code and program vulnerabilities that exist in network systems. Hackers can infiltrate computer information systems through program debugging and rewriting, and access, tamper with, and

download important documents, websites, or web pages. Illegal authorization or access can cause serious attacks and damage to computer portal websites, important data resources, functional services, etc., posing a serious security threat to existing backend information and code execution.

3.2 Hacker attacks and virus intrusions

Hacker attacks and virus attacks are the main factors causing computer security issues, and these two types of attack behaviors may cause serious irreparable information problems for users, reduce the security of computer networks, and expose users to serious economic losses. Under the big data network system, the multi architecture transmission mode of data information increases the complexity of data information transmission. For the inherent operating mode of computer equipment, high-capacity and multi-threaded data transmission will increase the probability of computer network security risks. Hacker attacks belong to proactive attack behaviors, which are targeted intrusions into computer systems by hackers to steal internal user data. Compared with hacker attacks, viruses can be seen as a passive form that relies on data information to invade computer devices. They have concealment, spread, storage, and other properties, which reduce the operational efficiency of computer devices. In severe cases, they may cause the entire network to be paralyzed and unable to operate, causing great security damage to the computer network.

3.3 Insufficient awareness of information security

Nowadays, with more and more personal information being leaked online, the public's awareness of information security has also increased. Strengthen the popularization of network security education, truly integrate information security into the daily lives of netizens, and enhance their awareness of network information security. When necessary, a disciplinary system can be established to regulate the behavior of every netizen through laws, fundamentally reducing the possibility of online dangers. In addition, cybersecurity training institutions can also accelerate the research and development of information security products, creating a secure, efficient, healthy, and free information product for every netizen. The popularization of online knowledge should reflect the characteristics of universality, from the makers of online rules to every ordinary netizen, so that every netizen in the information security network can benefit.

4. Measures to enhance computer network information security in the era of big data

4.1 Application of Identity Authentication Technology in Information Security Protection

Faced with the increasing amount of data and information resources in computer networks, identity collection and authentication technologies such as usernames and passwords alone are no longer sufficient to meet the user access and data transmission needs of enterprise business scenarios. In this case, the first step is to introduce identity authentication technology based on big data networks, utilizing functions such as API resource invocation, SAML identity authentication, and Kerberos authorized access to read a user's digital signature and API request. Afterwards, the backend cloud server sends a dynamic password to the user, and uses the Ker beros authorization protocol to dynamically match the user's access request and key K. Only when the dynamic password, data key, and digital signature match, can the user enter the system for access, data viewing, or mobilization to complete identity authentication and data transmission control in complex environments.

4.2 Strengthen the construction of management systems for computer information networks

In the context of the big data era, computers have been widely used in various aspects of social and industry development, and the value of computer network information itself continues to increase, playing an extremely important role in the daily operation and development of countries, enterprises, and related departments. Therefore, it is necessary to attach importance to the construction and improvement of relevant management systems. Only a scientific, reasonable, and efficient management system is the fundamental guarantee and important measure for the development of all work. In the process of building management systems for computer networks, it is necessary to fully rely on and leverage the functions of national government departments, and improve the efficiency and quality of network management through the development of more scientific and comprehensive control systems by relevant government departments.

At the same time, relevant government departments also need to introduce normative management systems that are in line with the development of the computer industry, strengthen the guidance and leading role of government departments, and increase the standardization and management of the development process of the computer industry, in order to strengthen the management of computer network information security. At the same time, relevant government departments should continuously utilize modern and diversified innovative technologies to apply them to computer network security management and enhance technical control.

Finally, the country and relevant government departments need to continuously increase the cultivation and construction of high-end talents in the field of computer networks. Intensify the construction of relevant majors in universities, strengthen the cultivation of high-end skilled talents, and make them an important driving force for the development of China's computer network industry, in order to combat network hackers and improve the quality of computer network information security management.

4.3 Protection strategies for firewall systems

The application of firewall technology is to construct a security detection barrier between the information flow path inside and outside the computer, ensuring that external information flows into the computer and blocks various types of information with security risks.

Firstly, in the application of access policies. Firewall technology is based on user internet habits and data transmission characteristics, and formulates protection measures based on time nodes and network nodes. For example, through vulnerability patches, it detects problems in the operation of various software and provides corresponding solutions in a timely manner to ensure the security performance of computer networks.

Secondly, the application in log monitoring. Firewall technology can monitor various types of logs generated during the operation of computer networks throughout the entire process. Based on the verification form of data information, it ensures the extraction of the most valuable data information from massive amounts of data. This process can effectively reduce the operational burden of human resources, and at the same time, it can achieve targeted processing of network operation before, during, and after the event through data technology, improving the actual detection quality.

Finally, in the application of security configuration. Firewall technology can provide targeted protection for network system operation, such as site information, IP address information, etc. Through reasonable configuration of security levels, it can achieve full process monitoring of relevant data information, laying a solid foundation for the operation of the entire computer network.

4.4 Strengthen network information security management

Computer network technology has been widely applied in various industries and has also generated an increasing amount of valuable data information. In order to ensure network information security, it is necessary to strengthen relevant supervision and management work. Therefore, relevant national departments should attach great importance to this, establish a specialized network security supervision department based on the actual situation, introduce relevant laws and policies, organize high-quality professionals, regularly conduct inspections of network operation code, and strengthen the review of network risks through manual operations. This can avoid more problems and vulnerabilities and effectively enhance the operational security of computer network systems.

4.5 Strengthen the management and monitoring of computer network systems

With the increasing demand and dependence of modern enterprises on computer network information, strengthening enterprise management plays an important role in their own information security. Therefore, relevant enterprises need to strengthen the management and monitoring of their internal computer network systems. The most commonly used technology for monitoring computer systems in daily life is intrusion detection technology. The application of this technology can effectively reduce the risk of computer network systems being invaded during operation. By monitoring data, hidden dangers in network security can be discovered in a timely manner. This technology mainly uses statistical techniques and signature analysis methods. This technology mainly uses statistical methods and relevant theoretical knowledge to statistically analyze the relevant data obtained during the process of computer network information monitoring, and then determine whether there are security risks and hidden dangers.

5. Conclusion

With the wide application of the Internet, based on the current era of big data, the security and reliability of computer network information have a great impact on social development and national construction. From the current actual situation, there are still countless problems in computer network information security. In order to better solve these drawbacks and vulnerabilities, relevant personnel must attach great importance to them, have good security awareness, adopt diversified measures to strengthen network information security management, and actively develop new network security protection technologies. They should summarize and improve every aspect, so as to effectively enhance the security and reliability of computer network systems and make better contributions to society.

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