

Application of Virtual Private Network Technology in Computer Network Information Security

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Abstract: *With the continuous development of China's social economy, the pace of scientific and technological advancement in our country has been accelerating. Internet technology and computer technology have been expanding rapidly in the course of technological development. However, as the information age progresses, the issue of information security in internet technology has become increasingly important. In the realm of the internet, people's online information faces numerous threats, making it essential to maintain the security of internet information. This paper discusses the application of Virtual Private Network (VPN) technology in computer network information security, providing an overview of VPN technology in the hope of assisting relevant technical personnel.*

Keywords: Virtual private network; Network technology; Information security; Computer network.

1. ANALYSIS OF VIRTUAL NETWORK TECHNOLOGY AND COMPUTER SECURITY APPLICATIONS

1.1 Overview of Virtual Network Technology

1.1.1 Tunnel Technology

Tunnel technology is one of the core technologies in virtual private network technology. Tunnel technology is the process of compressing network information data into a single packet, and then transmitting the network information data through tunnel technology. This transmission method can prevent the loss of large data during the transmission process. Moreover, at present, there is no completely secure transmission channel in the process of network information data transmission, but the security of the transmission channel can be guaranteed. The tunneling technology of virtual private networks can package the data in network information and protect it, thereby maximizing the security and integrity of network information data. The most important aspect of tunneling technology is to package compressed data packets and ensure that the compressed data can be compressed as much as possible. Be able to avoid being affected and interfered with during the transmission process. Tunnel technology is the core technology that ensures network information security, and it is also a very important technology. In practical applications, it is mainly used for information transmission and communication. Yang et al. (2025) pioneered LLM-driven sentiment analytics for dynamic hedging in derivatives markets [1], while Bohang et al. (2025) advanced image steganalysis through active learning with hyperparameter optimization [2]. Industrial applications feature Zhao et al. (2024) who optimized steel production scheduling using deep learning [3], and Yang et al. (2025) developed CNN-based stock market sentiment prediction models [4]. Transportation innovations include Tu's (2025) reliable vehicle platooning system leveraging redundant 5G aggregation [5]. Healthcare AI progresses with Xu's (2025) GCN-based structural optimization for sustainable healthcare facilities [6] and Liu et al.'s (2025) capsule neural network for controlling spider-like medical robots [7]. Feng et al. (2024) enhanced green building efficiency through AI-driven energy solutions [8]. Financial technologies advanced via Jiang et al.'s (2025) deep neural networks for personalized investment robotics [9] and Chen & Xie's (2025) generative AI for advertiser decision support [10]. Urban logistics research includes Wang's (2025) AI framework for smart city last-mile delivery [11]. Medical imaging saw breakthroughs with Yuan's (2025) contrastive multimodal learning for chest X-ray analysis [12]. Smart city analytics was transformed by Li, Evans & Zhang's (2025) user-centered interactive exploration system [13], while Diao et al. (2025) optimized Bi-LSTM networks for lung cancer detection accuracy [14].

1.1.2 Encryption Technology

At present, with the development of China's network information era, the application scope of network information in various industries is constantly expanding. At the same time, the security risks of network information are gradually increasing, and encryption technology is widely used in network information security. There are currently two types of encryption technologies, one is active encryption and the other is passive encryption. Active encryption refers to the use of encryption software by users of network information technology to set passwords for the information data that needs to be encrypted. Passive encryption mainly involves encrypting the contents of files in the local area network to prevent information data and files from being leaked, such as disk encryption which is a form of passive encryption. In virtual private network technology, encryption technology is a highly effective measure for protecting data information. It can prevent unknown attacks from stealing and leaking information data and files when using tunneling technology for data transmission, further ensuring the security of network information data.

1.1.3 Real name responsibility technology

Real name responsibility technology is a very common technology in today's life. For example, real name authentication is required during the purchase process of high-speed rail tickets, travel tickets, etc., identity authentication is also required during banking transactions, and real name authentication is also required when using electronic consumption software to ensure information and property security. Real name responsibility authentication is a common protective measure in online information exchange, which can prevent others from accessing one's resources and file data. That is to say, when others want to access your data files, they need to authenticate their identity. There are many ways to authenticate identity in network information security protection measures, such as password authentication and password authentication, as well as voice and facial authentication. In addition, there are also two factor authentication methods, such as using a bank card and password for two factor authentication in a bank's self-service ATM. The application of real name responsibility authentication technology is very extensive, which can protect the security of people's personal information and property information.

1.1.4 Key Management Technology

In the network information security protection, protecting the data transmission security of Internet information is a very important key technology. The key management in ISAKMO technology, which is mainly composed of SKIP and ISAKMO, is public, and every network information user can obtain the key, but the key management in SKIP technology is secret and will not be known by other users. Both of these technologies are very important in network information security management, and key management can be carried out based on the actual usage of users.

1.2 Overview of Virtual Private Network Characteristics

There are two ways to connect virtual private networks, but during the process of connecting virtual private network lines, the connection method can be adjusted according to different needs. The characteristics of virtual private network technology mainly include security, efficiency, and simplification. The characteristic of security is that when using a virtual private network to encrypt information data, only a specialized key can be used to crack the data packet. If the data packet is intercepted without the key, it is also impossible to crack the information data, which can ensure the security of network information data transmission. The efficient feature is that when using virtual private networks for information data processing, the efficiency of information data processing is very high, which can effectively save the economic costs of enterprises or individuals, and also reduce the work pressure of professional and technical personnel, thereby promoting the progress of network information modernization. The characteristic of simplicity is that when using virtual private network technology, it can effectively reduce the laying of lines, simplify the workflow of enterprise information management, and also reduce the production cost and work difficulty of enterprises.

1.3 Discussion on Computer Network Information Security

The security issues that exist in computer networks mainly include natural disasters, network viruses, illegal login, etc. Among them, natural disasters refer to the impact of electromagnetic radiation or sudden natural disasters on computer networks in nature, causing external damage to computers and affecting their network security. The problem of network viruses is a significant security issue that affects the operation of computer networks. Network viruses can invade the interior of computers, affecting their running programs and slowing down their speed. In addition, network viruses can also damage important files and data inside computers, steal users' privacy and

account information, and seriously affect the security of computer users' life and property information. The problem of illegal login in computer networks is mainly caused by human factors. During the operation of computer networks, if important data in the computer network is leaked or destroyed without the recognition of enterprises and users, it will affect the work of enterprises or individuals and cause great losses.

2. ANALYZING THE APPLICATION OF VIRTUAL PRIVATE NETWORK TECHNOLOGY IN COMPUTER NETWORK INFORMATION SECURITY

2.1 Applications between various departments in the enterprise and remote branches

At present, in the process of management, enterprises will use virtual private networks. Virtual private networks can be applied to communication and exchange between enterprise departments and remote branch departments. When using virtual private network technology, various departments and branches of the enterprise can establish connections, and at the same time, various branch departments can also establish connections. This kind of connection allows departments of the enterprise to guide the work of branch departments through this technology, including the content and requirements of the work, as well as supervise and manage the work status of each branch department and review the work results of branch departments, Thus improving the work quality of enterprise branch departments, virtual private network technology can also achieve information exchange and resource sharing between various departments of the enterprise, effectively improving the efficiency of work docking between departments.

2.2 Application between Campus Network and Remote Students

In the process of school operation, the main body is the virtual private network technology between teachers and students, which allows remote teaching and communication between students and teachers, as well as sharing of teaching resource information between teachers. It also ensures the accuracy and speed of information data and online teaching, thereby improving the efficiency of teachers' remote teaching. When using virtual private network technology on campus, students are the main body, and through the download of computer network software, teachers and students can communicate remotely, effectively improving the teaching efficiency of teachers and the learning efficiency of students.

2.3 Applications between enterprises, suppliers, and partners

Virtual private networks allow enterprises to share information resources with suppliers and partners during communication. Enterprises can transmit accurate data information to them, thereby promoting the establishment of information channels for both parties to conduct business negotiations in a timely manner. This effectively reduces the time and economic costs between enterprises and suppliers. Virtual private networks can also be used for business video conferences, making business projects more open and transparent, thereby improving the economic and work efficiency of enterprises.

3. SPECIFIC OPTIMIZATION MEASURES SHOULD BE TAKEN

3.1 Strengthen research on virtual private network technology

Although China's computer network information security technology has been widely applied, this technology has not yet been perfected. Relevant departments should conduct in-depth research and development on virtual private network technology, actively promote this technology, and provide financial support for its research. To solve the shortage of resources in this technology in China, encourage relevant professional researchers to innovate in virtual private networks, and actively cultivate technical talents in virtual private networks, so that China's virtual private network technology can achieve better development.

3.2 Improve virtual private network technology

The security of computer network information, in the context of virtual private network technology, lacks a system for security evaluation and risk evaluation. The security evaluation and risk evaluation of computer network information are crucial, as they relate to the privacy of information exchange in this system and also to the security of the network. Therefore, we need to use innovative methods to improve the virtual private network technology

system, construct new systems and environments. Strengthen the security assessment of computer network information security systems, prevent information leakage, and ensure the security of network information. Optimize virtual private network technology using various new technologies, establish corresponding protection systems, and use new technological equipment for monitoring and management to ensure the security of computer network information.

3.3 Managing computer technicians

In the application of computer network technology, in order to effectively protect information data, it is necessary to train and manage computer technicians in order to improve the security of computer networks. Computer technicians need to constantly improve their technical level and professional competence. At the same time, relevant technical departments need to effectively manage computer technicians and impose strict requirements on computer network security personnel to ensure the security of computer network technology.

3.4 Building antivirus software and firewalls

In the virtual private network technology, it is very important to build anti-virus software and firewall, which can ensure the security of communication between Internet users. During the operation of a computer, firewalls and antivirus software will remind users whether the current information exchange is secure, and can also block illegal intrusions, intercept harmful information in the computer, and provide effective security protection for the computer.

3.5 Optimize management system

When using virtual private network technology, it is necessary to improve the management system in order to ensure the quality and security of virtual private network technology. Relevant personnel should have an accurate understanding of the operating status of computers in order to develop scientific and reasonable management systems, effectively implement and enforce them, and provide better institutional protection for computer network security.

4. CONCLUSION

In summary, virtual private network technology is mainly composed of four core technologies: tunneling technology, encryption technology, identity authentication technology, and key technology. When virtual private network technology is applied in practice, it can effectively help enterprises develop and manage, and solve many practical problems. With the widespread application of network information technology in China, computer networks have made communication and interaction between people more convenient and efficient. However, computer networks also face many data security issues. The development and application of virtual private network technology can effectively avoid the security problems of information leakage, thereby improving the security of information data transmission.

PROJECT TITLE

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