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# RESEARCH AND ANALYSIS OF EMAIL PROTECTION AGAINST THREATS

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**Abstract.** The article is devoted to the problem of e-mail protection from threats and suggests measures to improve the security and reliability of e-mail correspondence. The Internet is now the mainstay of computer networking technology. Every organization uses the Internet, and they want to protect their information and data. E-mail is one of the most common means of communication in the world. However, as the number of users and the volume of messages sent increases, so does the number of threats that can harm the user and the organization. There are several ways to solve this problem, and one of them is a VPN, a virtual private network. It provides the comfort of an open network and protects the private network by creating a tunnel between the two parties, the sender and the receiver. This paper covers the following tasks: comparison of different types of algorithms, ciphers and protocols; analysis and study of types of network security; study of standards, methods and protocols. With the ever-growing Internet, the communications infrastructure is also growing, and the structure of the network in which computer communications are provided is becoming more complex. In addition to the many benefits it offers, the Internet has become a platform where the importance of information security is at its highest level because of attackers. Small, medium and large institutions and organizations provide their data exchange, for which information security is important, using special lines reserved for them by Internet service providers, due to the fact that the Internet is not secure. However, the high cost of these lines, lack of security and scalability led to the concept of private virtual network (VPN). When using a private virtual network in an unsecured Internet environment, data is exchanged securely using a virtual network.

**Keywords:** VPN, threat, security, encryption, protocol.

## Introduction

With the increase in Internet users, many organizations have switched to virtual private networks (VPNs). Virtual private networks provide many of the benefits of private networks at a lower cost. However, with the introduction of VPNs comes a number of issues and dangers for the organization. A properly built virtual private network can be of great benefit to an organization. If the VPN is not properly implemented, all information transmitted through the VPN can be accessed from the Internet [1].

Any type of traffic can be found on the Internet. Much of this traffic is transmitted in the clear, and any user observing this traffic will be able to recognize it. This applies to most email and web traffic, as well as telnet and FTP sessions. Secure Shell (SSH) and Hypertext Transfer Protocol Secure (HTTPS) traffic is encrypted traffic and cannot be viewed by a packet sniffer. However, traffic such as SSH and HTTPS does not form a virtual private network VPN.



Virtual private networks have several characteristics.

- Traffic is encrypted to provide protection from eavesdropping.
- Authentication of the remote site is performed.
- Virtual private networks provide support for multiple protocols.
- The connection provides communication only between two specific subscribers.

Since SSH and HTTPS are not capable of supporting multiple protocols, the same applies to real virtual private networks. VPN packets are mixed with the flow of normal Internet traffic and exist separately for the reason that this traffic can only be read by the connection endpoints.

There are many threats that can harm email and users. Among them: spam, phishing, viruses, encryption trojans and many others. Threats can lead to leaks of confidential information, identity theft, mail blocking and many other negative consequences. Therefore, email security is a very important concern for organizations and users.

Methods of protection:

1. Sender authentication. Authentication mechanisms can prevent emails from fake senders. SPF (Sender Policy Framework), DKIM (DomainKeys Identified Mail) and DMARC (Domain-based Message Authentication, Reporting & Conformance) are the main methods that provide sender.

2. Encryption is the process of converting information into a form that can only be understood by someone who has the appropriate key. TLS (Transport Layer Security) and S/MIME (Secure/Multipurpose Internet Mail Extensions) are examples of email encryption methods.

3. Spam filtering is the process of removing junk mail from your mailbox. Many email providers provide their own spam filters that can help reduce spam.

4. Updating the software used to send and receive mail helps protect against known vulnerabilities and bugs.

5. User training is one of the most important aspects of email security.

Users must be trained to recognize phishing emails, manage their passwords and accounts, and how to handle sensitive information. Training can take the form of training videos, online courses, lectures, or interactive trainings.

6. Antivirus software can help protect your mailbox from malware, such as viruses and spyware. It should update regularly and scan incoming and outgoing messages.

7. Restricting mailbox access can prevent unauthorized access to sensitive information. This can be achieved by configuring access rights, setting passwords and multi-factor authentication.

8. Backing up your mailbox can help recover data if information is lost or corrupted. Backups should be created regularly and stored in a safe place.

With the growing popularity of email and its use for personal and corporate purposes, there is a need to ensure the security of this important means of communication. The purpose of this article is to describe the development of a browser extension that will protect emails from various threats [2-3].

Extension description:

The browser extension will have several features that will help keep your email safe. Some of these functions are described below:

1. Anti-phishing: The extension will have an anti-phishing feature that will help the user recognize phishing emails. When a user receives an email that might be a phishing email, the extension will automatically check for it in the database of known phishing sites and warn the user if a threat is detected.

2. Blocking viruses and spyware: The extension will scan incoming emails for viruses and spyware. If malicious content is detected, the extension will automatically remove it from the email.

3. Encryption: The extension will support email encryption. When the user sends an email, he can select an encryption option that encrypts the contents of the email so that it can only be read by those to whom it is intended.

4. Password management: The extension will have a password management feature. It will allow the user to create complex passwords, save them in a secure vault and automatically fill in password fields on websites.

5. Access restriction: The extension will have the function of restricting access to the mailbox. This feature will allow the user to set a password or use multifactor authentication to access their email, making it more secure from unauthorized access.

6. Automatic update: The extension will automatically update to ensure that it has the latest security updates and protects the user's mailbox most effectively.

7. Blocking unwanted ads: The extension will have the function of blocking unwanted ads and spam, which will make working with e-mail more pleasant and protected [4].

### **Experimental**

Internet use policy is usually included in the main computer use policy. However, in some cases, this policy is presented as a separate policy because of its peculiarities. Organizations give their employees access to the Internet so they can perform their duties more efficiently and therefore bring in more profits. Unfortunately, the Web sites visited by employees on the Internet are far from always related to their work.

The Internet Use Policy defines the appropriate purpose for the Internet (e.g., work-related statistical research, shopping, or e-mail communication). It identifies inappropriate use of the Internet (e.g., visiting non-company related websites, downloading copyrighted content, selling music files, or sending chain letters).

If the policy is separate from the computer use policy, it states that the organization can track online activity, and that employees should not consider sharing data over the Internet as a private transaction.

Some organizations develop a specific policy that defines how e-mail is handled (it may be included in the computer use policy). Email is used by a huge number of organizations in business management. Email poses a threat of leaks of important data. If a decision is made to define a specific email policy, the policy should address both internal and external issues.

Email policy should not conflict with other policies related to the organization's personnel. If the organization prohibits the transmission of obscene jokes via e-mail, the definitions of obscene and indecent comments should be specified within this policy.

If an organization plans to monitor email for certain keywords or file attachments, the policy stipulates this type of monitoring, but should not specify specific words that will cause messages to be flagged. The policy also specifies that an employee should not consider email private.

Outgoing email may contain sensitive information. The postal policy should define under what conditions this circumstance is permissible, and it should include references to the information policy defining methods for protecting sensitive data. In addition, it may be necessary to define a waiver or conclusion at the bottom of outgoing communications that states that proprietary information must be protected.

The email policy stipulates issues related to incoming email. For example, many organizations test incoming files for viruses. The policy should refer to the organization's security policy, which states appropriate measures to combat viruses.

A virtual private network uses a tunneling protocol to maintain its efficiency. A virtual private network uses a tunneling protocol to maintain its efficiency. The tunneling protocol provides a secure mode of network service transmission that the elementary network cannot



support. The virtual private network service can be viewed from the perspective of the customer, the user, and the provider.

A virtual private network creates a logical protective channel for communication between two objects over a network by applying a tunneling method that isolates the IP datagram into the tunneling protocol, consequently hiding the original data from bad people, which of course can be on all networks. In fact, it creates a point-to-point or multipoint connection between connected parties at the transmit and receive points over accessible, open or available networks. A typical virtual private network uses DES, AES and Blowfish to encrypt client information. DES is a data encryption standard, and AES is an advanced encryption standard. A connection that transmits encrypted and isolated data is called a virtual private network connection [5].

Nowadays, almost all companies use virtual private networks, which need to expand their work without much investment in IT infrastructure. Most companies, such as Microsoft, Cisco and others, have begun to develop such products, providing the secure channel for businesses to continue to grow. Today, IPsec-based virtual private networking has become the industry standard because IPsec, along with its protocols, maintains robust encryption, complexity, and security to ensure that data integrity is maintained throughout the session. A virtual private network allows a network-enabled computer or device to securely transmit and receive data across open or accessible networks as if it were connected to a confidential network, while benefiting from the efficiency, usability, and control policies of accessible and open networks. Customer information may include confidential data, voice information, video, photos, and the most valuable financial transactions. This means that the security of client information must be protected, typically designed virtual private network remains limited by data encryption standards algorithm to encode client information within and isolated tunnel packet. DES was found to be very complex and nearly impossible to decrypt without knowing the key, and it was also pointed out that even the most powerful computer would take many years to decrypt a single encrypted standard data packet. But we must also be aware of the development of information systems technology and its threats [6].

### **Result and discussion**

To further improve the protection of client information, a sophisticated algorithm is needed in the virtual private network header to avoid information tampering even if the connection is compromised. Multiphase encryption provides such a sophisticated and robust technique to protect the information in the package by performing encryption using multiple encryption algorithms in multiple phases and multiple times, which has also been proven to be a very secure encryption mode by applying a standard encryption function, even the old algorithm can be applied to improve the complexity of the cipher text and generally makes the package more secure.

The multiphase coding algorithm has been proven to be more secure than conventional coding methods, such as data encryption standard, advanced encryption standard and digital signature algorithm. By applying this encryption method, we will ensure the confidentiality and integrity of valuable customer information inside an isolated channel packet, which is applied by the virtual private network [7].

The method considered does not suspend any of the processes of the virtual private network and its tunneling, but only contains client information in a packet isolated from the channel, using multiple encoding several times, the ciphertext created is very complex and tamper-proof. Using this method with client information in each session packet will create a very complex and secure cipher-text that will be very difficult for a hacker to pass or reverse the algorithm. Thus, customers will have the advantage of increasing the level of protection of their price data.

Companies such as e-commerce, legal, medical and others can benefit from an open communications network without compromising privacy and confidentiality. The method under consideration will offer very sophisticated, secure and tamper-proof solutions for those users who are more concerned about their privacy. Moreover, for business companies, military operations, such as in the event of a terrorist attack, disaster, etc., the virtual private network can also be useful because of the proposed encryption method [8].

Table 1 – Evaluation of DES, AES and Blowfish encryption

Algorithm	Plaintext	After encryption	After decryption
DES	240 KB	328 KB	240 KB
AES	240 KB	847 KB	240 KB
Blowfish	240 KB	955 KB	240 KB

There are several isolation protocols that already work for tunneling a virtual private network, such as PPTP, L2TP, SSTP, each of the protocols requires certain system requirements and has its own advantages and disadvantages.

PPTP tunnel protocol has become the standard protocol for virtual private networks. Because it is the first VPN protocol supported by Windows, it is supported on many platforms and is very easy to install. This makes the protocol one of the fastest among existing protocols to handle a small number of calculations. Despite the fact that data transmission is carried out using 128-bit encryption, there are serious vulnerabilities [9].

L2TP, unlike other VPN protocols, does not provide privacy or encryption of traffic flow. Therefore, it is usually implemented using a set of protocols known as IPsec to encrypt data before transmission and ensure user privacy and security. L2TP, unlike other VPN protocols, does not provide privacy or encryption of traffic flow. Therefore, it is usually implemented using a set of protocols known as IPsec to encrypt data before transmission and ensure user privacy and security. IPsec encryption has no significant vulnerabilities and, if implemented correctly, can provide security. Because the data is encapsulated twice with this protocol, processing speed is low compared to other.

SSTP is supported on Windows and Linux. Because it uses SSL and TLS, it does not cause firewall problems. It is stable and easy to use because it is a Windows-specific protocol by weight. SSTP is very successful in terms of security because it supports passwords, smartcards and several certificate-based authentication methods [10-11].

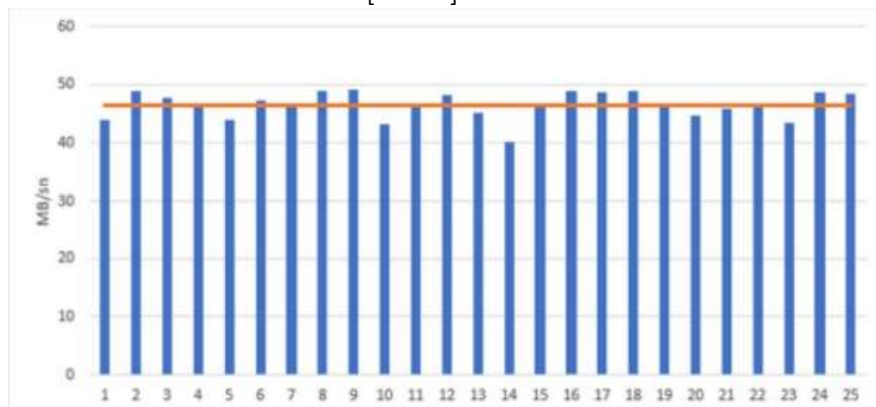


Figure 1 – Standard download speed

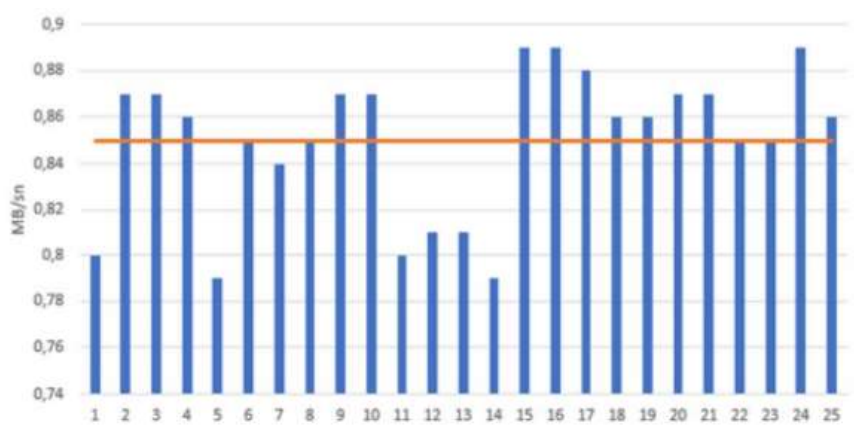


Figure 2 – PPTP download speed

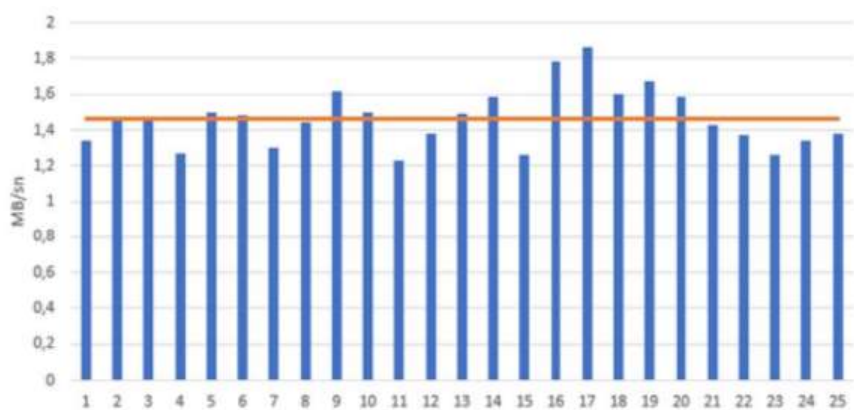


Figure 3 – L2TP download speed

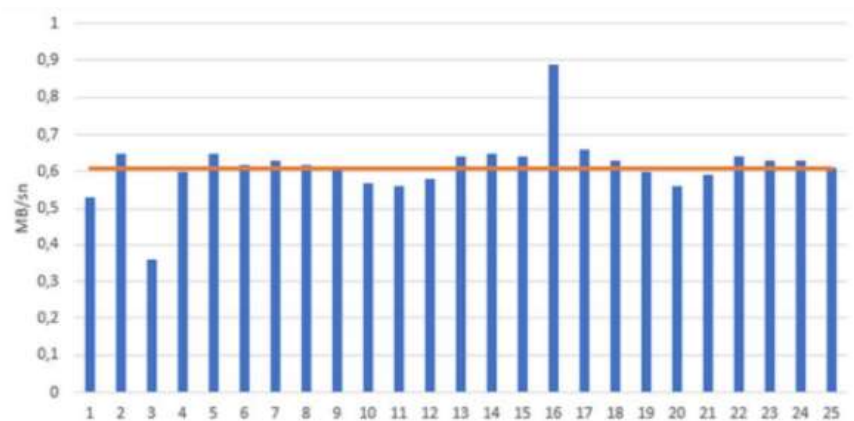


Figure 4 – SSTP download speed

Table 2 – Average download speed of tunnel protocols

Type	Average speed (25 attempts)
Standard	46,54
PPTP	0,86
L2TP	1,45
SSTP	0,62

In Figures 1, 2, 3 and 4, in a speed test conducted on 4 different tunneling protocols, the connection speed obtained with a normal connection is reduced by about 98% when using tunneling protocols. The speed was measured 25 times with the tunneling protocols, and L2TP

showed the best performance. This protocol is followed by PPTP and SFTP, respectively. Although PPTP was inferior to L2TP in the measurements taken, it was the protocol with the smallest standard deviation in connection speed. As a result, PPTP is outdated, and L2TP/IPsec vulnerabilities and slow performance due to firewall issues, on the contrary, this protocol was more stable, with fewer security vulnerabilities, and concluded that this is due to the fact that SSTP data is more profitable to use.

### Conclusions

The browser extension described in this article will help users ensure the security of their email. It features anti-phishing, virus and spyware blocking, encryption, password management, access restriction, automatic updates, and blocking unwanted ads. All of these features work together to provide maximum protection against threats. Creating such an extension for the browser will improve email security and make working with it more convenient and pleasant for users. Protecting email from threats is an important challenge for users and organizations. Many security methods are available to secure electronic correspondence, and the effectiveness of these methods will depend on their proper implementation and updating. User training is also an important aspect of protection because users can become the first lines of defense against threats if they have sufficient knowledge and skills.

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