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Network Security Design Using Virtual Private Network (VPN) Method By Utilizing Point To Point Tunneling Protocol (PPTP) Technology On Local Area Network (LAN)

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ABSTRACT

Computer networks provide the ability as a communication medium that can accelerate the work process both in terms of time and space. In addition, information technology can facilitate access to information. So that the development of information technology is very influential in all human life. communication that is no longer limited by space and time, one way to build data communication security in the internet network is to use a Virtual Private Network (VPN) network. Virtual Private Network (VPN) technology allows users who are in different locations to access resources in the local network, get the same rights and settings as physically being in the place where the local network is located, Virtual Private Network (VPN) is one of the right answers for network security solutions in the scope of Local Area Network (LAN) to the scope of Wide Area Network (WAN) even. VPN is a way to use a public network as a private network safely via the internet. Along with the increasing use of the Internet, many companies have switched to using the internet as part of their network to save costs.

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1. INTRODUCTION

Computer networks provide the ability as a communication medium that can accelerate the work process both in terms of time and space. In addition, information technology can facilitate access to information. So that the development of information technology is very influential in all human life. communication that is no longer limited by space and time, makes the internet increasingly in demand. The internet as a communication mediation is not only very useful but still has weaknesses in its security, especially as an important data transmission medium. for that in the use of the internet as a data transmission medium, it is necessary to increase its security[1].

Network security systems are increasingly developing along with the development of science and technology. Companies have computerized every part of the company to support the company's operational processes. The more a company develops, the company opens new branches to improve

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the quality and quantity of production and increase the company's profits. With the computerization in large companies, a good Network Security System is needed, so that data exchange from the head office to branch offices can be carried out safely and under control. Various software can already overcome these problems, but in terms of data security itself, data leakage is still very worrying. [2]

One way to build data communication security in an internet network is to use a Virtual Private Network (VPN). Virtual Private Network (VPN) technology allows users in different locations to access resources in a local network, get the same rights and settings as if they were physically in the place where the local network is located.

Virtual Private Network (VPN) is one of the right answers for network security solutions in the scope of Local Area Network (LAN) to Wide Area Network (WAN) coverage. VPN is a way to use a public network as a private network safely through the internet. Along with the increasing use of the Internet, many companies have switched to using the internet as part of their network to save costs. However, security issues are still a major factor. One technology that can meet these needs is Point To Point Tunneling Protocol (PPTP), which is a technology that allows a private data network connection on a public network to connect 2 or more offices that are far apart, by implementing an encryption system on the VPN network. [3]

2. RESEARCH METHOD

2.1. Computer network

A computer network is a collection of two or more computers that are interconnected with each other to communicate data using communication protocols through communication media (cable or wireless), so that these computers can share information, data, programs, and use hardware together. In this case, data communication that can be done through a computer network can be in the form of text, images, video, and sound. [2]

2.2. Local Area Network (LAN)

Local area network is a local network created in a closed area. For example, in a building or in one room. Sometimes local networks are also called private networks. LANs are usually used for small networks that use shared resources, such as shared printer use, shared storage media use.

2.3. Mikrotik

Mikrotik is an independent Linux-based operating system specifically for computers that function as routers. Mikrotik is designed to be easy to use and is very good for computer network administration purposes such as designing and building a small to complex scale computer network system.

2.4. System design

System design can be defined as the depiction, planning, and sketching of separate parts into a whole. In this study, the author involves several system requirements in the form of functional and non-functional requirements in designing the security of a Virtual Private Network (VPN) network by utilizing the Point to Point Tunneling Protocol (PPTP) method on a Local Area Network (LAN).

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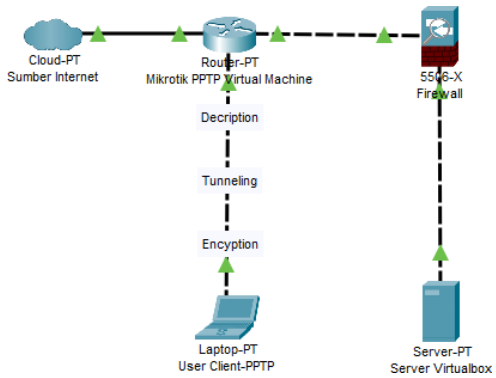

Figure 1. Overview of the Virtual Private Network (VPN) Point to Point Tunneling Protocol (PPTP) network system

Virtual Private Network (VPN) System Flowchart Diagram

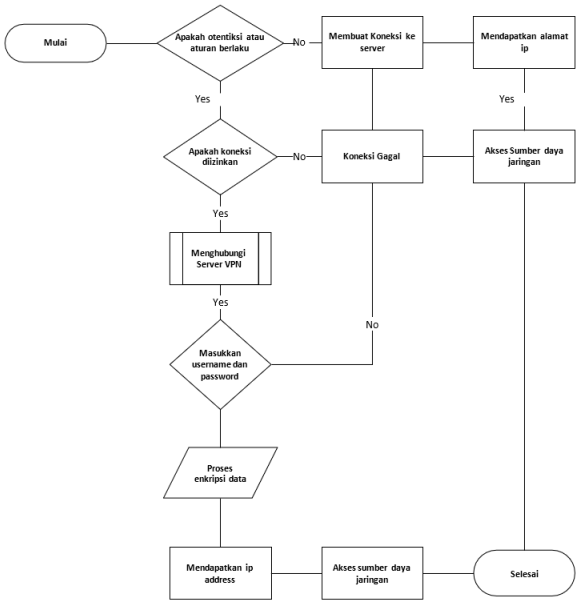

Figure 2. Mikrotik PPTP VPN Network System Flowchart

Activity Diagram

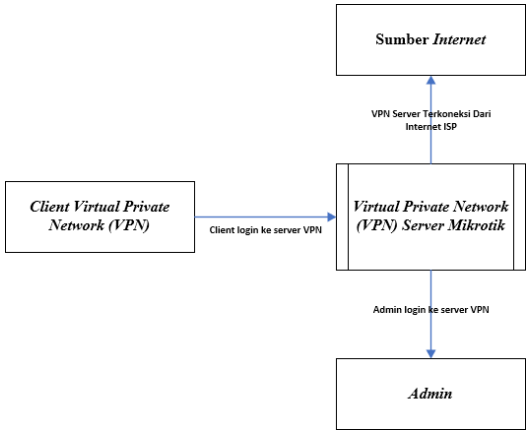

Figure 3. Mikrotik PPTP Network System Activity Diagram

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3. RESULTS AND DISCUSSIONS

At the implementation stage, Mikrotik and the client must first be installed on Virtual Box, then the client server configuration must be continued first, as can be seen in the image below.

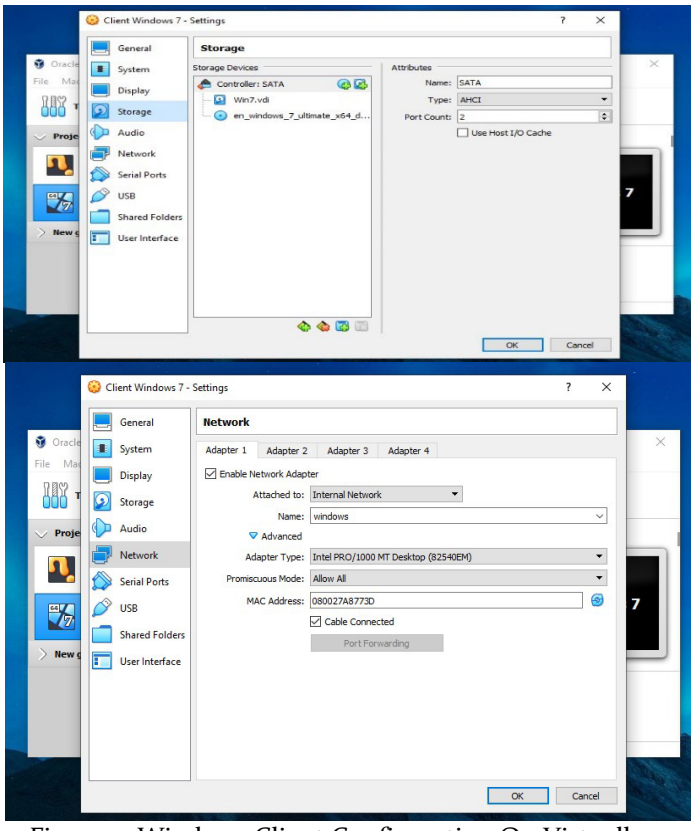

Figure 4. Windows Client Configuration On Virtualbox

Continued Domain Name System (DNS) Configuration on Mikrotik Router.

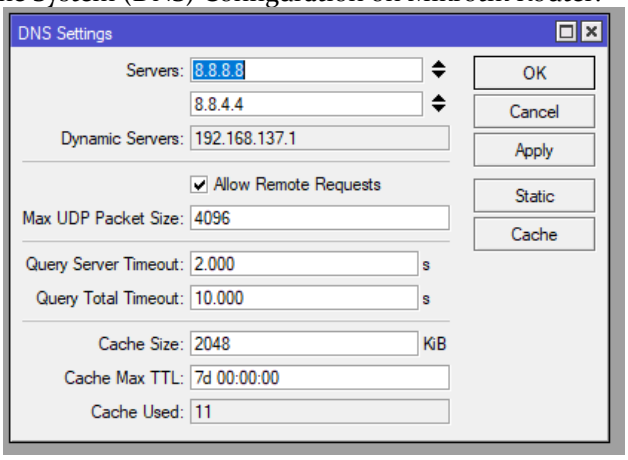

Figure 5. Domain Name System (DNS) Configuration on Mikrotik Router

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Configuring the NAT Firewall on the Mikrotik Router

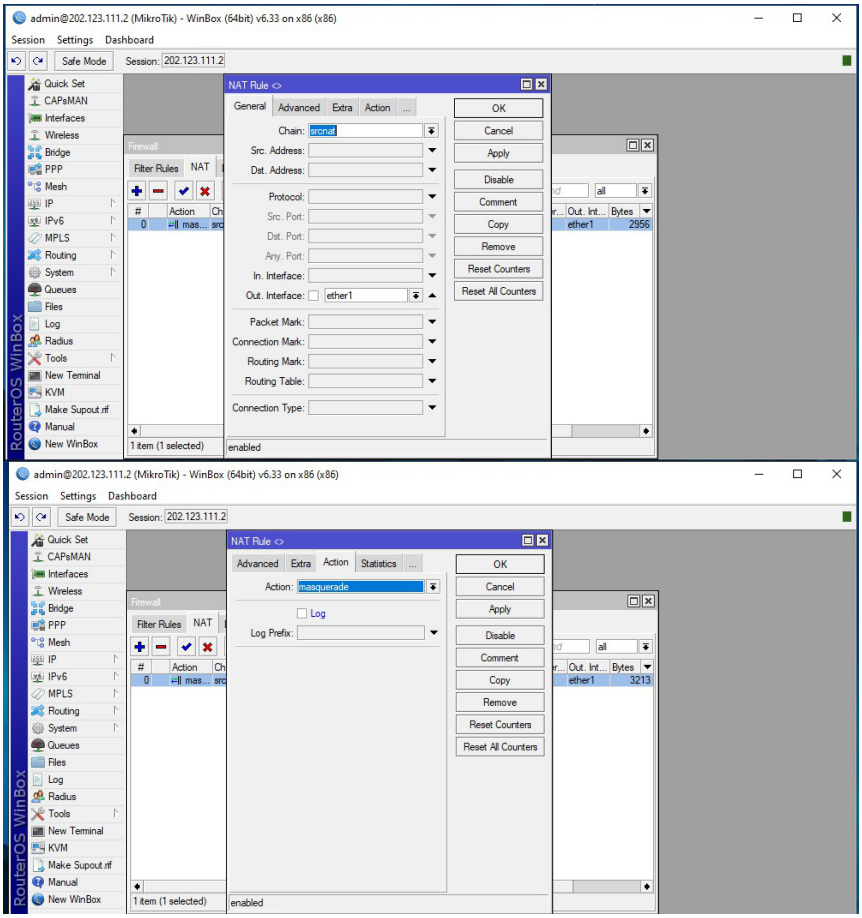

Figure 6. NAT Firewall Configuration On Mikrotik Router

IP Address Configuration On Mikrotik Router

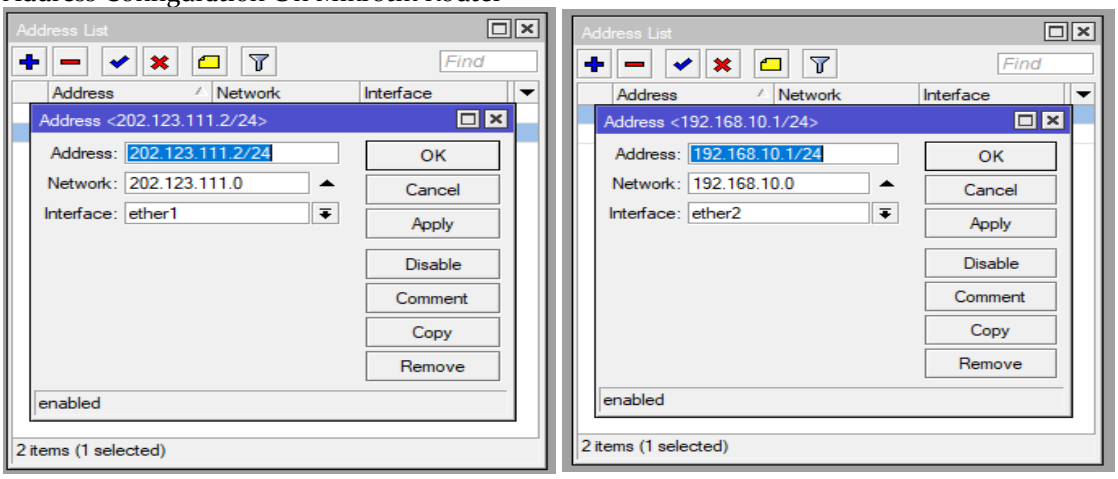

Figure 7. IP Address Configuration On Mikrotik Router

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IP Route Configuration On Mikrotik Router

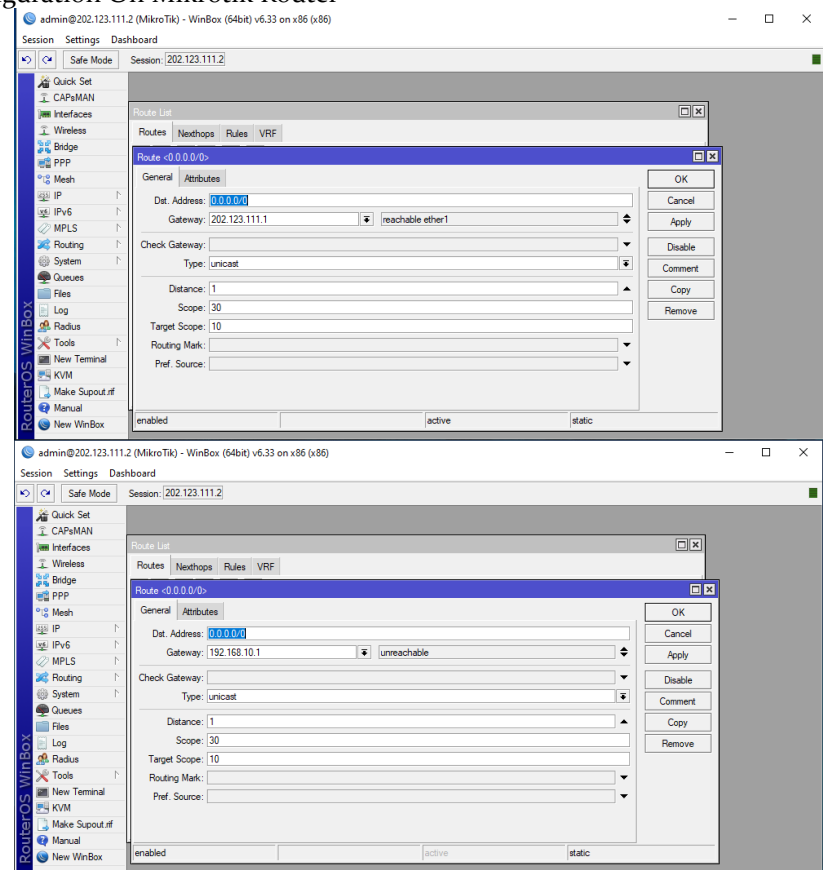

Figure 8. IP Route Configuration On Mikrotik Router

PPTP Server Configuration On Mikrotik Router

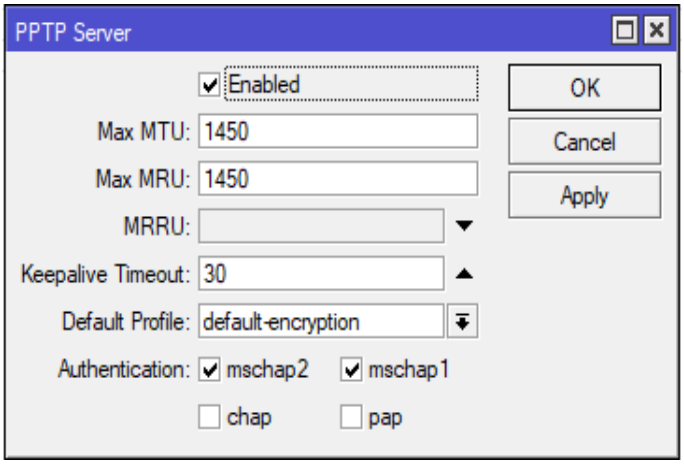

Figure 9. PPTP Server Configuration On Mikrotik Router

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PPTP Client Configuration On Mikrotik Router

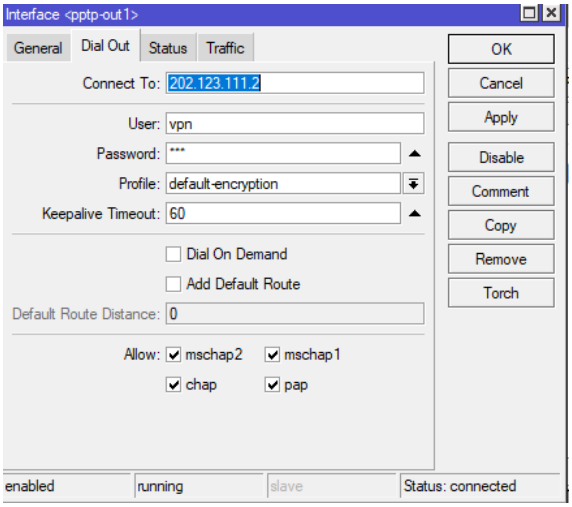


Figure 10. PPTP Client Configuration On Mikrotik Router

PPP Secret PPTP Configuration On Mikrotik Router

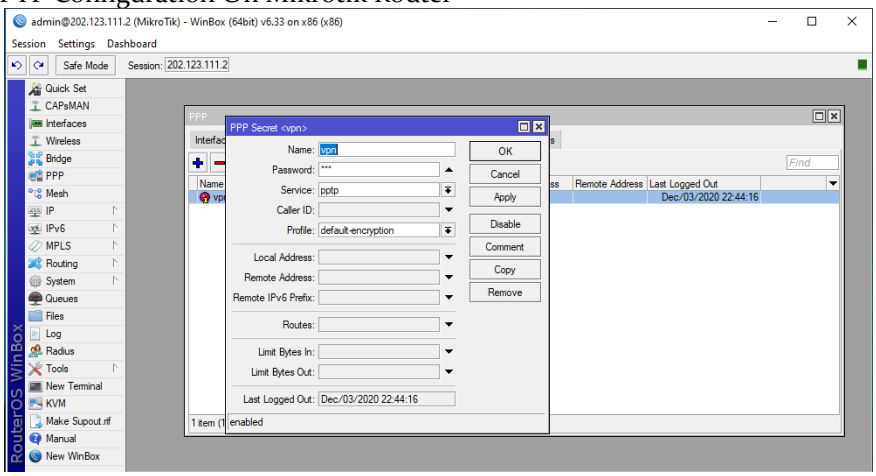
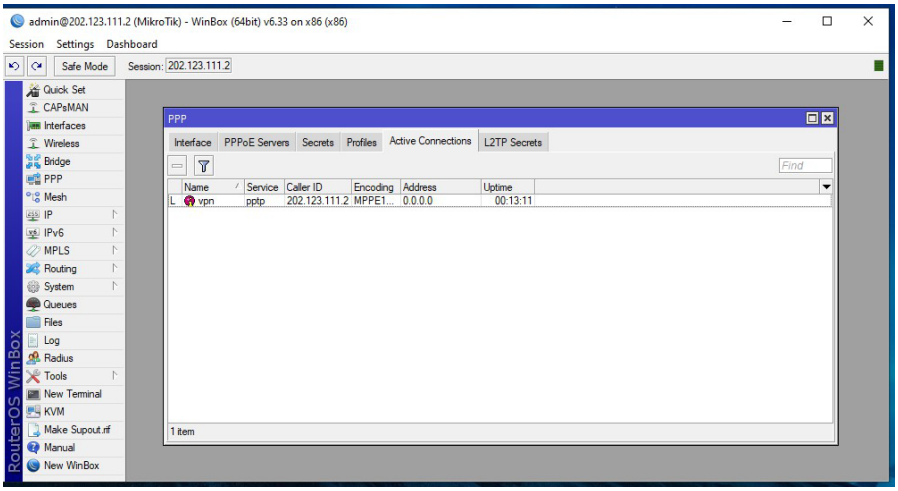


Figure 11. PPP Secret PPTP Configuration On Mikrotik Router

PPTP Connection Test Results for Mikrotik Routers on Virtualbox



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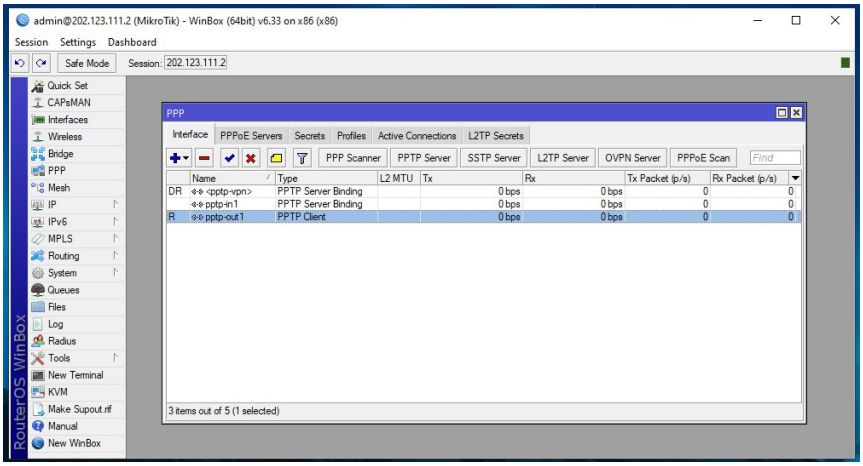

Figure 12. PPTP Connection Test Results for Mikrotik Routers on Virtualbox

PPTP Connection Test Results On Windows Client Side

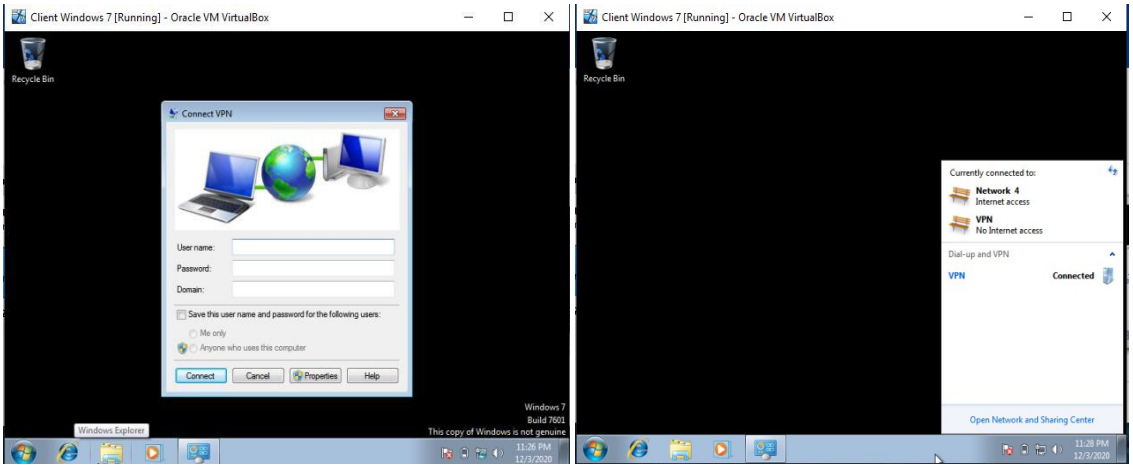

Figure 13. PPTP Connection Test Results On Windows Client Side

4. CONCLUSION (10 PT)

Based on the discussion in the creation of Network Security Design using Virtual Private Network (VPN) Technology With Point To Point Tunneling Protocol (PPTP) Method On Local Area Network, that to build a network security system there needs to be continuous upgrading so that security on the computer network remains stable and secure, virtual Private Network with Point to point method makes security on the network controlled so that it is not easily cracked by irresponsible users and analysis and determining the security needs of computer networks in designing virtual private networks (vpn) in the form of software and hardware on local area networks (LAN) can work effectively and run in accordance with network security standards.

REFERENCES

[1] Burhanuddin, Burhanuddin, and Mohammad Badrul. "Penerapan Metode Open Vpn-access Server sebagai Rancangan Jaringan Wide Area Network." *Techno Nusa Mandiri* 11.2 (2014): 227370.

[2] Putra, Jordy Lasmana, Luthfi Indriyani, and Yeni Angraini. "Penerapan sistem keamanan jaringan menggunakan VPN dengan metode PPTP pada pt. asri pancawarna." *IJCIT (Indonesian Journal on Computer and Information Technology)* 3.2 (2018).

[3] Umam, Chairul, Emilia Roza, and Irfan Irfan. "Perancangan Jaringan Keamanan Virtual Private Network (VPN) Site to Site." (2016).
[4] Iqbal, Muhammad, and Imam Riadi. "Analysis of security virtual private network (VPN) using openVPN." *International Journal of Cyber-Security and Digital Forensics* 8.1 (2019): 58-65.
[5] Cheung, Kwok Ho, and J. Mišić. "On virtual private networks security design issues." *Computer Networks* 38.2 (2002): 165-179.
[6] Akinsanya, Michael Oladipo, Cynthia Chizoba Ekechi, and Chukwuekem David Okeke. "Virtual private networks (vpn): a conceptual review of security protocols and their application in modern networks." *Engineering Science & Technology Journal* 5.4 (2024): 1452-1472.
[7] Ezra, Paul Joan, et al. "Secured communication using virtual private network (VPN)." *Cyber Security and Digital Forensics: Proceedings of ICCSDF 2021* (2022): 309-319.
[8] Ezra, Paul Joan, et al. "Secured communication using virtual private network (VPN)." *Cyber Security and Digital Forensics: Proceedings of ICCSDF 2021* (2022): 309-319.
[9] Scott, Charlie, Paul Wolfe, and Mike Erwin. *Virtual private networks*. " O'Reilly Media, Inc.", 1999.
[10] Afira, Riandana, Radius Prawiro, and Annisa Izzaty Jamhur. "VIRTUAL PRIVATE NETWORK (VPN) BASED ON IP SECURITY DESIGN ON TOPOLOGY." *JOURNAL OF DYNAMICS (International Journal of Dynamics in Engineering and Sciences)* 8.2 (2023): 56-59.
[11] Schneier, Bruce, and Mudge. "Cryptanalysis of Microsoft's point-to-point tunneling protocol (PPTP)." *Proceedings of the 5th ACM Conference on Computer and Communications Security*. 1998.
[12] Hamzeh, K., et al. "RFC2637: Point-to-Point Tunneling Protocol." (1999).
[13] Putra, Chrystia Aji, Yisti Vita Via, and Wahyu SJ Saputra. "Point to Point Protocol Tunneling VPN Simulation and Analysis on Sniffing." *International Conference on Science and Technology (ICST 2018)*. Atlantis Press, 2018.
[14] Jahan, Sohely, Md Saifur Rahman, and Sajeeb Saha. "Application specific tunneling protocol selection for Virtual Private Networks." *2017 international conference on networking, systems and security (nsyss)*. IEEE, 2017.
[15] Oktivasari, Prihatin, and Andri Budhi Utomo. "Analysis Of Virtual Private Network Using Openvpn And Point To Point Tunneling Protocol-Analisa Virtual Private Network Menggunakan Openvpn Dan Point To Point Tunneling Protocol." *Jurnal Penelitian Komunikasi dan Opini Publik* 20.2 (2016).
[16] Satryawati, Eka, Dwi Agung Pangestu, and Ade Surya Budiman. "Implementasi virtual private networ menggunakan point-to-point tunneling protocol." *Jurnal Elektro dan Informatika Swadharma* 2.1 (2022): 36-42.
[17] Febrianti, Riana, and Muhamad Ryansyah. "Implementation of virtual private network using point to point tunneling protocol mikrotik router at state fighter vocational school haurgeulis indramayu." *Jurnal Mantik* 6.3 (2022): 3350-3357.
[18] Arora, Poonam, Prem R. Vemuganti, and Praveen Allani. "Comparison of VPN protocols–IPSec, PPTP, and L2TP." *Department of Electrical and Computer Engineering George Mason University, Project Report ECE* 646 (2011).
[19] Siadi, Ilham Wahyudi, Iskandar Fitri, and Rini Nuraini. "Tunneling Design with Point to Point Protocol over Ethernet (PPPoE) using Mikrotik RB-941 (Case Study of SMK Taruna Bhakti): Tunneling Design with Point to Point Protocol over Ethernet (PPPoE) using Mikrotik RB-941 (Case Study of SMK Taruna Bhakti)." *Jurnal Mantik* 4.1 (2020): 238-247.
[20] Raj, T. Mohan, S. Shahul Hammed, and A. Amala Deepan. "Enhancing security measures by tunnelling protocol in distributed grid network." *International Journal of Computer Applications* 38.1 (2012).
[21] Haya, Aqilla Fadia, et al. "BUILDING A LINUX-BASED VPN SERVER USING POINT TO POINT TUNNELING PROTOCOL (PPTP)." *Jurnal ilmiah Sistem Informasi dan Ilmu Komputer* 1.2 (2021): 11-17.
[22] Kazemi, Keihan, and Ali Fanian. "Tunneling protocols identification using light packet inspection." *2015 12th International Iranian Society of Cryptology Conference on Information Security and Cryptology (ISCISC)*. IEEE, 2015.
[23] Audrey, Berby Febriana. "Virtual Private Network Menggunakan Point To Point Tunnel Protocol Berbasis Mikrotik." *Journal Of Network And Computer Applications (ISSN: 2964-6669)* 1.1 (2022): 1-10.
[24] Schwenk, Jörg. "Point-to-Point Security." *Guide to Internet Cryptography: Security Protocols and Real-World Attack Implications*. Cham: Springer International Publishing, 2022. 85-97.
[25] Narayan, Shaneel, et al. "Performance analysis of 4to6 and 6to4 transition mechanisms over point to point and IPSec VPN protocols." *2016 Thirteenth International Conference on Wireless and Optical Communications Networks (WOCN)*. IEEE, 2016.