

---

## Queue System Implementation at PT. Mulia Persada Indonesia Call Center Services

Haryani<sup>1</sup>, Choirunisa Iqbar Qurota'aini<sup>2</sup>, Cucu Ika Agustyaningrum<sup>3</sup>, Artika Surniandari<sup>4</sup>, Dedi Saputra<sup>5</sup>

<sup>1,2,3,4,5</sup> Fakultas Teknik dan Informatika  
Universitas Bina Sarana Informatika  
Jakarta, Indonesia

---

### ARTICLE INFORMATION

*Artikel History:*

Received: August 11, 2023

Revised: August 31, 2023

Accepted: September 1, 2023

---

*Keyword:*

Call Center  
PPTP

Queue System  
Voice Over Internet Protocol  
(VoIP)  
VPN

---

### ABSTRACT

In this modern era, call centers have become an important element in providing efficient and responsive customer service. One of the main challenges faced by call centers is how to efficiently manage customer call queues. This study aims to implement a queuing system at PT Mulia Persada Indonesia's call center service by utilizing a computer network, with the aim of increasing the efficiency and effectiveness of customer service. This research also includes an analysis of network security using a Virtual Private Network (VPN) and point-to-Point Tunneling Protocol (PPTP) as a security method for call center network connections. The results of the study show that the use of PPTP in PT Mulia Persada Indonesia's network security provides significant benefits. Call center employees can connect to the corporate network through a secure connection, even from an external location such as home. This access allows them to access the queuing system and perform call center tasks effectively without having to be in a physical office. Meanwhile, the implementation of a queue system at PT Mulia Persada Indonesia's call center service has had a positive impact, namely increasing customer satisfaction. With an effective queuing system, customer waiting time can be minimized and calls can be handled quickly.

---

### Corresponding Author:

Cucu Ika Agustyaningrum,  
Sistem Informasi Akuntansi,  
Fakultas Teknik dan Informatika,  
Universitas Bina Sarana Informatika,  
Jakarta, Indonesia  
Email: [cucu.cuk@bsi.ac.id](mailto:cucu.cuk@bsi.ac.id)

---

### INTRODUCTION

VoIP (Voice Over Internet Protocol) is a server that utilizes the Internet Protocol (IP) to provide voice communications digitally (Syarifudin et al., 2022). Analog voice received by an IP Phone in analog form is converted to digital format and can be transmitted over a network using the internet, so it does not pass through an analog network like a conventional telephone. VoIP refers to sending voice over the internet protocol, or IP (Kusuma & Adityo N, 2020).

In a study entitled VoIP Communication Services Using Raspberry PI and RASPBX at

Integrated Al-Insan Vocational High School, it was found that with VoIP technology, communication in areas connected to LAN networks can become easier (Dwiyatno & Nugraheni, 2019). Another study entitled Building an Asterisk-Based Voip Server by Enabling VoIP as a Form of Optimizing Existing Intranet Networks to Reduce Operational Expenses (Berlian, 2020). Based on the results of research entitled Implementation of Linux-Based Voice Over Internet Protocol (VoIP) (Studi Kasus Smk Negeri 03 Bengkulu), it can be stated that VoIP is an innovative technology that utilizes the internet network as a

---

DOI: <https://doi.org/10.31294/paradigma.v25i2.>



This work is licensed under a [Creative Commons Attribution-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-sa/4.0/)

medium for sending digital voice signals so that users can interact with each other. In terms of waiting time or delay when making voice calls, VoIP is superior to WhatsApp. This can be seen from the delay difference between VoIP and WhatsApp calls, which reaches 14 seconds. In addition, During Beta testing, all clients can connect to the server and connect to each other so that voice and video calls can run smoothly between client 1 and client 2 (Muntahanah et al., 2020).

Development of Mobile Services and Analysis of Quality of Service in SIP Protocol-Based IPPBX At PT Melvar Lintasnusa, the result is that the IPPBX system can be expanded, so it can be reached via the internet using smartphone media. QoS analysis shows that by optimizing the system using a priority queue, the resulting delay is lower than VoIP without a priority queue. In this case, the use of a priority queue improves mobile service performance on IPPBX because it is able to maintain voice quality and stability (Ahmad & Budi Setiawan, 2020). Simple Queue for User and Bandwidth Management on Hotspot Networks Using Mikrotik, before implementing user access rights management and bandwidth configuration methods, the bandwidth quality obtained by hotspot clients did not reach the expected standards because there was no user management and fair bandwidth allocation between hotspot users. By implementing a simple queue, each client can get a stable IP Address and bandwidth usage (Simpony, 2021). Designing a VPN Network Using the Point-to-Point Tunneling Protocol Method proves that a VPN using the PPTP method can be used as a solution to support computer network infrastructure between the head office in West Jakarta and branch offices in North Jakarta. The tunneling process with PPTP provides additional security by encrypting every data packet sent (Supriyanto & Suharyanto, 2022).

VoIP server implementation in a call center environment must pay attention to several crucial aspects. First, there is the need to maintain network security so that it is not vulnerable to DDoS attacks and attempts to intercept communications. Second, the system used must have sufficient scalability to accommodate call center growth or larger call spikes. Furthermore, it is important to ensure quality of service (QoS) that meets the standards required for a good call experience, including aspects such as low delay, data packet loss, and jitter. Finally, proper security measures must be implemented to protect the VoIP network from DDoS attacks, spoofing, and unauthorized monitoring. By paying attention to these factors, implementing a VoIP server in a call center can run safely and provide satisfactory service quality.

Therefore, in this study, researchers will implement a queuing system in call center services with the aim of increasing agent efficiency in handling incoming complaints. In addition, researchers will also create a PPTP VPN network to provide a secure connection for employees, especially call center agents, so they can work from anywhere and anytime.

This is important considering that call center services operate 24 hours a day. The use of a PPTP VPN is considered a good alternative to ensure secure access to the office's internal network and protect against potential eavesdropping and DDoS attacks.

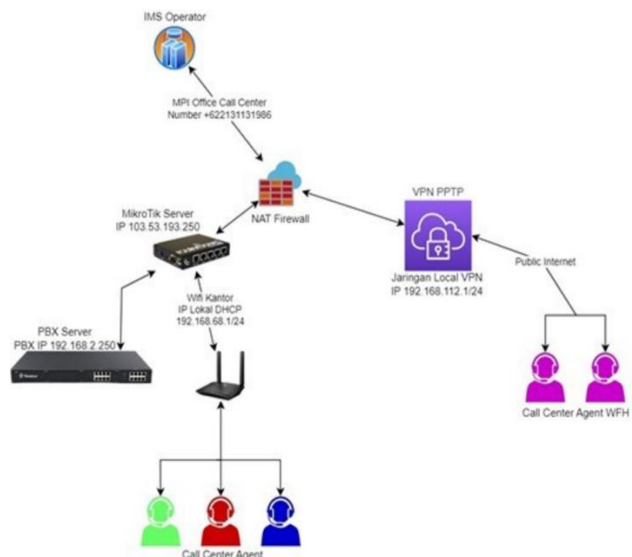
## RESEARCH METHOD

In conducting research at PT Mulia Persada Indonesia, of course researchers need development in terms of a call center service system that uses a queuing system to provide functional convenience for the telecommunication system at PT Mulia Persada Indonesia.

In VoIP server services, a queue is a system that allows users to effectively manage incoming and outgoing call queues. This system allows users to set call priorities in the queue, thereby increasing efficiency and quality of service.

When a call comes in and cannot be answered, it will go into the queue. The call queue is then handled automatically by the available system or operator. Operators can prioritize calls in the queue by call type, call number, or call time order.

The recommended network development method or strategy for implementing a queuing system at PT Mulia Persada Indonesia's call center service is to build a solid and reliable network infrastructure. This is important to ensure the quality and stability of the internet connection required for sending voice data over the internet network.



Source: (Researcher's Design)

Figure 1. PT Mulia Persada Indonesia's queue network topology

A computer network is a telecommunications system that can allow several computers to communicate with each other and share data. Computer networks connect several computers and other devices, such as printers and switches, through intermediary media. The intermediary media can be wired or wireless (Astuti, 2018). Data or information will flow from one computer to another or to other devices,

enabling the exchange of data and the sharing of resources between connected computers, such as disks, applications, and so on (Primartha, 2019).

In computer networks, there are various types, including LAN. A local network (LAN) is created in a limited area, such as a single room, building, or internet cafe, and is used for small networks that share resources such as printers and storage media. Generally, Ethernet technology is used in most LANs (Primartha, 2019). A wide area network (WAN) has a larger coverage area than a LAN, covering an area such as an island, a country, or even a continent. WANs use public infrastructure such as telephone lines, undersea cables, or satellites. WAN development usually requires assistance from telecommunications operators such as Telkom, CSM, or Lintas Artha. Components used in WAN communication consist of transmission cables and switching elements (Primartha, 2019).

A high-speed network that is larger than a LAN but smaller than a WAN, such as a city or metro area. Most MAN technologies use fiber optics as the main infrastructure. To build a MAN network, telecommunications operators are needed as service providers (Primartha, 2019). WLAN, or wireless network, is a computer network that uses wireless technology such as Wi-Fi to connect devices. WLAN is usually used in public areas such as airports, cafes, or hotels (Ariq Pratama et al., 2019).

Open System Interconnection (OSI), otherwise known as the OSI layer, has a network structure consisting of seven different layers, which are implemented via network protocols. The layers in the OSI layer are designed to allow each data packet in a network to pass through each layer sequentially so that it can be properly connected (Prabowo et al., 2020).

VoIP is a communication technology that runs over the internet network and can transmit data, voice, and video. It should be noted that the security aspect of using VoIP technology is very important because confidential communication can occur, and data flowing through the network does not rule out being intercepted (Putra, 2021).

VPN is a technology that provides facilities for users to access networks from outside via the internet. With a VPN, users can reach assets available in the network and get the same access rights and settings as if they were physically in the network location. Data security and confidentiality in transmission over the internet are important priorities when using a VPN, so features such as encryption and tunneling are always included in the VPN (Dewi et al., 2020).

IPPBX is a PBX system that implements Internet Protocol (IP) technology to connect telephone communications. The IPPBX system is designed as a sophisticated communication network concept and is capable of integrating various types of networks, such as fixed telephone networks (PSTN) with cable connections, mobile networks (GSM/CDMA), satellite networks, cordless networks (DECT), and Internet-

based networks. Internet Protocol packages By utilizing IPPBX, all types of networks can be connected, making it easier for users to make telephone communications (Anggraini et al., 2020).

Queue is a virtual waiting room; customers wait in line to talk to available agents. Once the subscriber calls the PBX and reaches the queue, it hears waiting music and instructions, while the queue sends the call to currently incoming and available agents. Various configuration options on queues can help control how incoming calls are routed to agents and what customers hear and do while waiting in queues (Yeastar, 2023).

PPTP is a network protocol used to secure data transfer from remote clients to private servers by forming a virtual private network (VPN) via the TCP/IP protocol. The PPTP protocol has the ability to convert PPP packets into IP datagrams so that they can be transmitted over the internet. This protocol, originally developed by Microsoft and Cisco, is the result of the development of the point-to-point remote access protocol issued by the Internet Engineering Task Force (IETF) (Pamungkas, 2019).

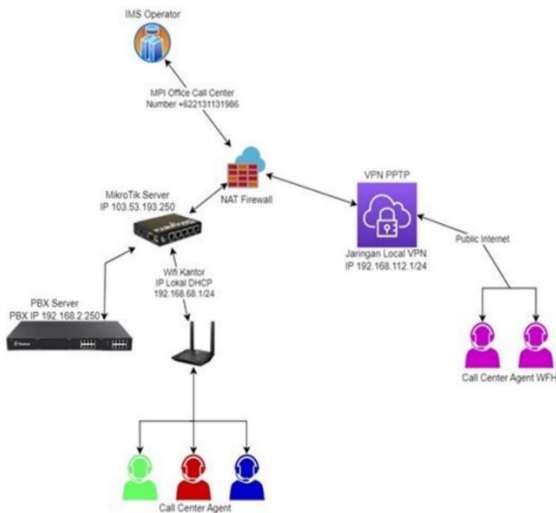
## RESULTS AND DISCUSSION

### 1. Proposed Network

After conducting an analysis of the network system at PT Mulia Persada Indonesia, the researcher recommends making several changes to overcome existing problems. One of the proposals is to add PPTP VPN security. By using PPTP VPN, employees who are working from home can carry out their duties properly, while companies do not need to worry about the security of their office network.

In addition, researchers also propose the implementation of a more efficient queuing system to reduce inbound call queues at PT Mulia Persada Indonesia. This aims to shorten customer waiting times and improve service efficiency. By implementing these suggestions, it is hoped that PT Mulia Persada Indonesia's network system can run better and provide a better experience for users.

The recommended network topology proposal is to use a tree-based topology that has similarities with the existing network structure. One of the suggested changes is the addition of network security by implementing a PPTP VPN. With a PPTP VPN, employees working from home can securely connect to the company network, so they can carry out their tasks effectively. In addition, the PPTP VPN implementation also provides protection for the security of PT Mulia Persada Indonesia's office network. Furthermore, researchers also suggest implementing a more efficient queuing system to reduce call queues (inbound) at PT Mulia Persada Indonesia. The purpose of this implementation is to reduce customer waiting time and increase the efficiency of the services provided by the call center.



Source: (Researcher's Design)  
Figure 2. PT Mulia Persada Indonesia's queue network topology

In order to update the current network scheme, researchers recommend adding security through the implementation of a PPTP VPN. This step aims to make it easier for employees working from home to connect securely to the company network, so they can carry out their tasks effectively. In addition, the implementation of PPTP VPN will also provide protection for the security of PT Mulia Persada Indonesia's office network. Furthermore, researchers also suggest implementing a more efficient queuing system to reduce call queues (inbound) at PT Mulia Persada Indonesia. The goal is to reduce customer waiting time and improve the efficiency of the services provided.

In this proposed network system security, PPTP VPN is used as a protection method. By implementing a PPTP VPN, users can secure data transfers between remote clients and private servers, so that sensitive customer information remains protected from security threats and enables PT Mulia Persada Indonesia call center employees who work from external locations, such as from home, to remain connected to the network company via a secure connection. This allows them to access the queuing system and carry out call center tasks effectively without having to be in the office.

## 2. Application Design

In this chapter, we will explain the design of VoIP network applications designed by researchers to make communication more optimal. This application design will cover various configurations on routers and PBX servers that can make network communication easier and more effective. Log in to the proxy using the Winbox software, then make PPTP VPN settings as follows:

Open the PPP menu > PPTP Server >, then check the "enable" section > OK.

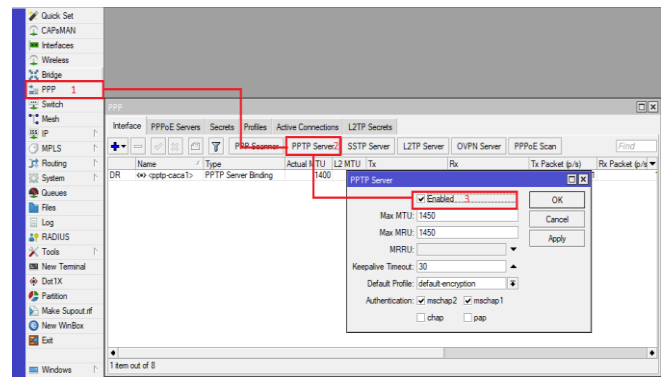


Figure 3. Mikrotik login and PTP VPN settings  
Open it on the IP menu > Pool > Plus > Fill in the name and address according to the desired network > OK. The function of this IP pool is to create a DHCP IP on the PPTP VPN, which will later be created.

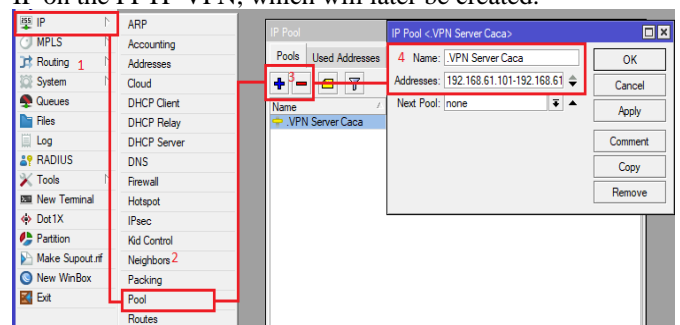


Figure 4. Configuring the IP Pool  
Open the PPP menu above. Plus > Profiles > Plus > Fill in the name as freely as you wish. Local Address is the IP Gateway for VPN, while Remote Address is the IP User VPN. Select the IP pool that was created earlier. Enter the DNS server, and finally, on the Limits tab, select Only One = Yes.

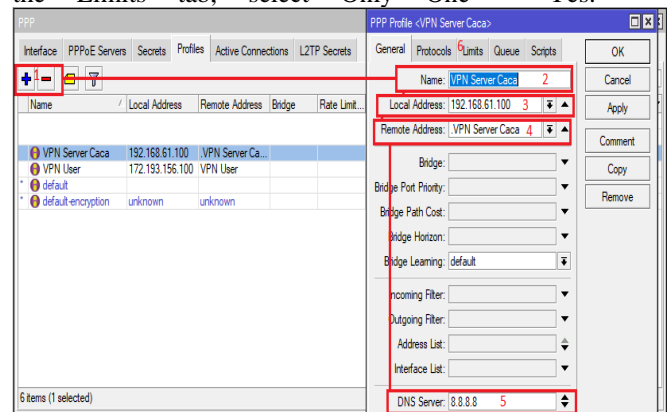


Figure 5. Configuring PPP profiles  
Still on the PPP menu > Secrets > Plus > fill in the desired name and password (for users who log in to access the PPTP VPN), select PPTP on the Service menu, and select the profile that was created earlier on the Profile menu. Configuration has been completed and can be immediately tried to login to PPTP VPN.

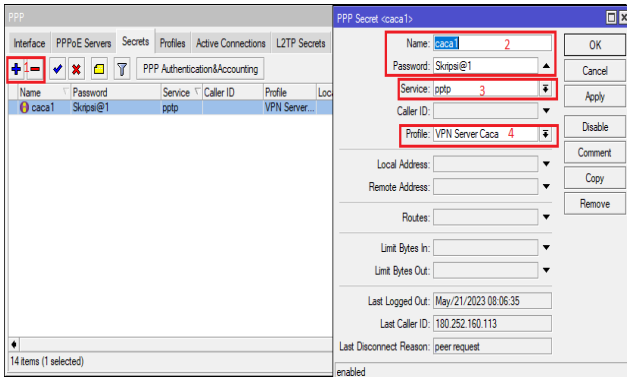


Figure 6. Configuring PPP with PPP

### 3. Network Management

Network management on the use of PPTP VPN for WFH employee access is very important to ensure optimal network performance and maintained data security. Some things that need to be considered in network management include:

- a. PPTP VPN configuration, administrators must pay attention to the appropriate configuration and as needed on their VPN network for smooth access to the server.
- b. Monitoring the queue system at the call center needs to pay attention to the effectiveness of agents in receiving calls so that no complaints are missed and monitor the network regularly to detect network problems.

### 4. Network Testing

In the early stages of network testing, the focus is on the office call center system, which is accessed through the internal network using a computer or laptop by the agent on duty. To get started, agents need to log in to a computer or laptop at the office using the account that has been provided. After successfully logging in, the agent can open the softphone application that has been installed on the computer or laptop.

With the softphone application open, agents are ready to receive incoming calls. When there is a telephone call, agents can immediately respond and interact with customers through the softphone application used.

Please sign in to the SIP account that has been issued by the admin for each agent on the MicroSIP screen that appears. The following details should be entered in the relevant columns:

- a. "Account Name" field: Enter the desired identification name.
- b. Columns "SIP Server" and "domain": Fill in the call center server IP address.
- c. "Username" and "Login" fields: Use the SIP extension account and password provided by the admin.
- d. Once successful, you will see an "online" status in the column below MicroSIP.

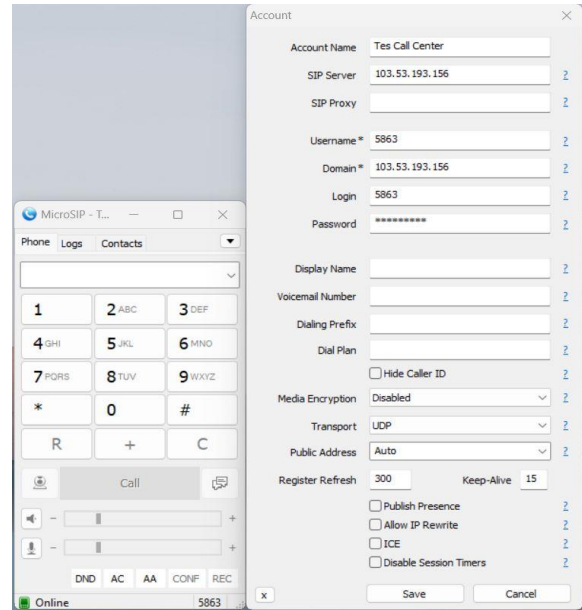


Figure 7. Logging into a SIP account on MicroSIP

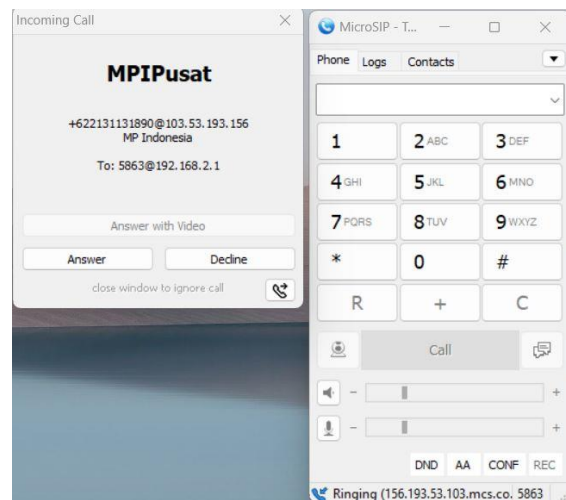


Figure 8. The agent is receiving a call (inbound)



Figure 9. Screen display if connected, and agents can start communicating with customers



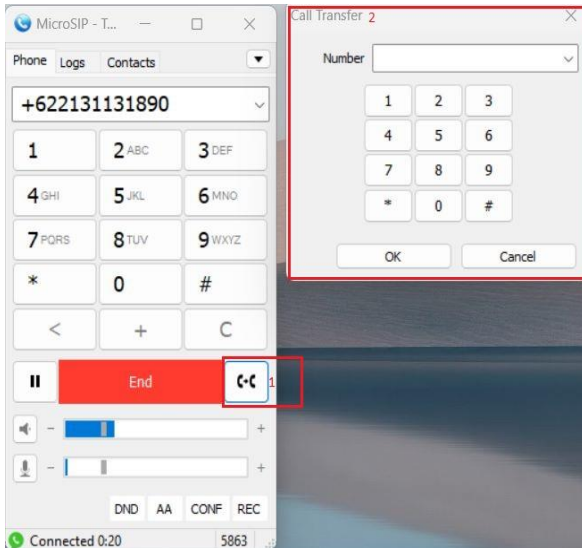


Figure 10. Display customers when they want

Talk to the agent, of course, then the agent can select button number 1, enter the extension number of the destination agent, and press OK.

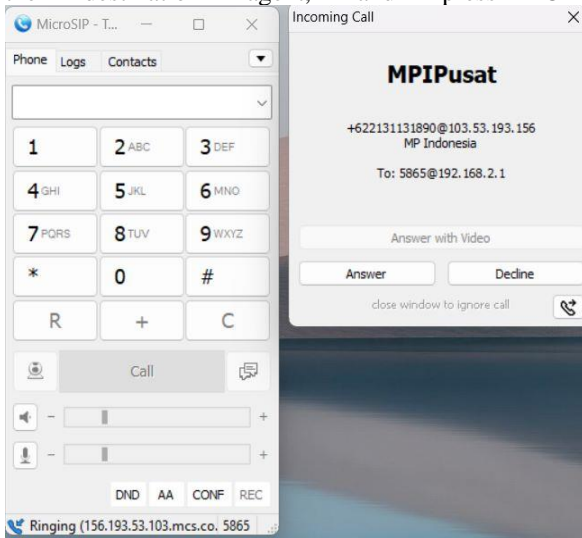


Figure 11. The display shows that the agent is in standby status and is ready to receive calls.

Final network testing is focused on verifying the capability of the call center system to be accessed via a connection line from an external network using a PPTP VPN. The first step that needs to be done is that the agent must login to their respective PPTP VPN account provided by the administrator, with the following steps:

On a laptop or computer, open settings > Network & Internet > VPN > Add VPN.

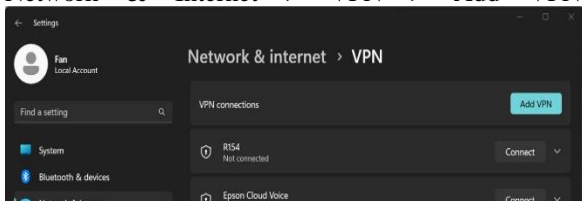


Figure 12. PPTP VPN account login

Next, complete the following data according to the user provided by the admin: To access PPTP, enter the VPN name identification in the "connection name" column on the agent's laptop or PC, then enter the office Router Server IP address in the "server name or address" column. Select the VPN type as PPTP and enter the username and password provided by the admin. After that, save the settings.

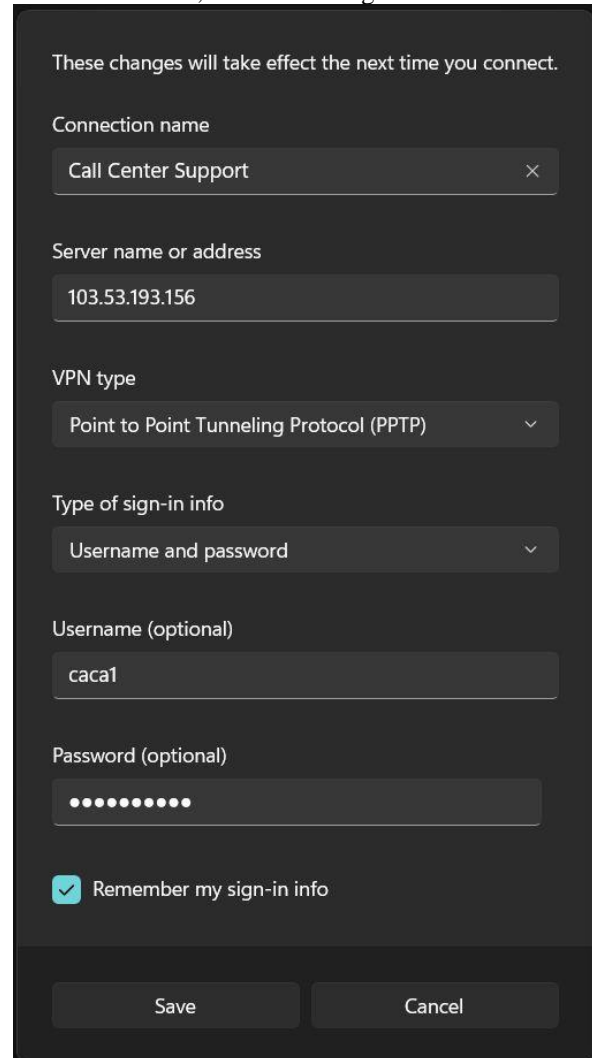


Figure 13. Doing PPTP access login



Figure 14. Status Connected when Connecting

To log into each agent's individual SIP account, use the information provided. In the following MicroSIP display, fill in the "Account Name" column with the identification name, "SIP Server" and "domain" with the Call Center Server IP address, and "username" and "login" with the SIP account extension and password provided by the admin. If successful, you will see an "online" status in the column below MicroSIP.

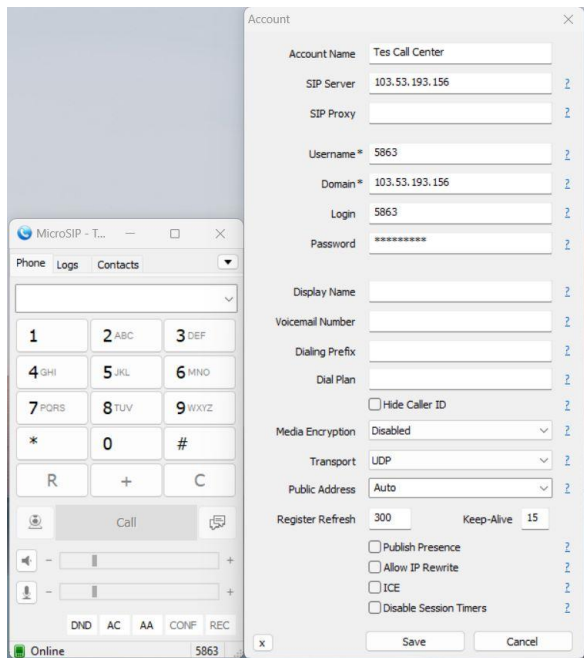


Figure 15. Display of successful login and visible online status in the column below MicroSIP

Time	From	To	Duration	Direction	Status
2023-09-22 10:29:02	Mulia Persada Indonesia (+622131131802)	0665-61130865	00:00:31	Outgoing	Answered
2023-09-22 10:29:00	Mulia Persada Indonesia (+622131131802)	0665-61130865	00:00:19	Outgoing	Answered

Figure 16. Phone Call Log Records

## CONCLUSION

After conducting research on PT Mulia Persada Indonesia and analyzing its network security system by adopting PPTP VPN and implementing a queuing system for call center services, researchers concluded that the use of PPTP in PT Mulia Persada Indonesia's network security provides significant benefits. Call center employees can connect to the corporate network through a secure connection, even from an external location such as home.

This access allows them to access the queuing system and carry out call center tasks effectively without having to be in a physical office. With an effective queuing system, call centers can provide a better customer experience with short waiting times and fast call handling. This has an impact on increasing customer satisfaction and the positive image of the company.

## REFERENCES

Ahmad, id, & Budi Setiawan, E. (2020). *Jurnal Ilmiah Komputer dan Informatika (KOMPUTA) Pengembangan Layanan Mobile dan Analisis Quality of Service Pada IP-PBX Berbasis Protokol SIP Di PT. Melvar Lintasnusa*.

Anggraini, D., Atmadja, M. D., & Suharto, N. (2020). Analysis of FXS (Foreign Exchange Subscriber) Port on IPPBX (Internet Protocol Private Branch Exchange). *Jurnal Jartel: Jurnal Jaringan*

*Telekomunikasi*, 10(1), 26–30. <https://doi.org/10.33795/jartel.v10i1.163>

Ariq Pratama, J., Heru, Y., Junus, M., Studi Jaringan Telekomunikasi Digital, P., Elektro, T., & Negeri Malang, P. (2019). *Implementasi Keamanan Jaringan Dengan Metode Whitelist Pada Server Jurusan Elektro Di Politeknik Negeri Malang*, 8, 66.

Astuti, I. K. (2018). *JARINGAN KOMPUTER. Jaringan Komputer*, 8. <https://id.scribd.com/document/503304719/jaringan-komputer>

Bambang Supriyanto, & Suharyanto. (2022). Analisa Sentimen Perkembangan Vtuber Dengan Metode Support Vector Machine Berbasis SMOTE. *Jurnal Teknik Komputer AMIK BSI*, 8(2), 174–180. <https://doi.org/10.31294/jtk.v4i2>

Berlian, B. (2020). Membangun Server VOIP berbasis Asterisk. *Jurnal Media Infotama*, 16(1), 24–31. <https://doi.org/10.37676/jmi.v16i1.1117>

Dewi, S., Riyadi, F., Suwastitaratu, T., & Hikmah, N. (2020). Keamanan Jaringan Menggunakan VPN (Virtual Private Network) Dengan Metode PPTP (Point To Point Tunneling Protocol) Pada Kantor Desa Kertaraharja Ciamis. *EVOLUSI: Jurnal Sains Dan Manajemen*, 8(1), 128–139. <https://doi.org/10.31294/evolusi.v8i1.7658>

Dwiyatno, S., & Nugraheni, M. (2019). Layanan Komunikasi Voip Menggunakan Raspberry Pi Dan Raspbx Pada Smk Al-Insan Terpadu. *Jurnal PROSISKO*, 6(2), 117–130. <http://e-jurnal.lppmunsera.org/index.php/PROSISKO/article/view/1630>

Kusuma, G. H. A., & Adityo N, C. (2020). Implementasi Voip Elastix Server Pada PT XYZ. *Journal of Informatics and Advanced Computing*, 1(1), 1–7.

Muntahanah, M., Toyib, R., & Wardiman, I. (2020). Implementasi Voice Over Internet Protocol (VOIP) Berbasis Linux (Studi Kasus SMK Negeri 03 Bengkulu). *Pseudocode*, 7(1), 41–50. <https://doi.org/10.33369/pseudocode.7.1.41-50>

Pamungkas, N. C. D. (2019). *Analisis Perbandingan Kinerja PPTP dan L2TP Pada Layanan*. 672015263.

Prabowo, M. A., Darusalam, U., & Ningsih, S. (2020). Perancangan Keamanan Server Linux Dengan Metode Hardening Pada Layer 1 dan Layer 7. *Jurnal Media Informatika Budidarma*, 4(3), 591. <https://doi.org/10.30865/mib.v4i3.2157>

Primartha, R. (2019). Manajemen Jaringan Komputer Teori Dan Praktik. *Jurnal Informatika Bandung*.

Putra, D. P. (2021). Analisis Keamanan Voice Over Internet Protocol (Voip) Over Virtual Private Network (Vpn). *Jurnal Informatika Dan Rekayasa Perangkat Lunak*, 2(3), 324–333. <https://doi.org/10.33365/jatika.v2i3.1232>

Simpony, B. K. (2021). Simple Queue Untuk Manajemen User dan Bandwidth di Jaringan Hotspot Menggunakan Mikrotik. *Jurnal*

- Informatika*, 8(1), 87–92.  
<https://doi.org/10.31294/ji.v8i1.9385>
- Syaifudin, I., Rahman, A., & Redaksi, D. (2022). Penggunaan Voice Over Internet Protocol (Voip) Dengan Mpls Di Pt. Semen Baturaja. *Jurnal Intech*, 3(1), 22–26.
- Yeastar. (2023). *Admin Guide Yeastar S-Series VoIP PBX* (pp. 191–194).  
<https://help.yeastar.com/download/docs/s-series-admin-guide-en.pdf>