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The Prepare, Plan, Design, Implement, Operate, and *Optimize* Methods on *Wireless*- Based Internet Networks

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ABSTRACT

This study aims to improve the quality of the wireless internet network at Neonbat State Junior High School by implementing the PPDIOO (Prepare, Plan, Design, Implement, Operate, and Optimize) method. Problems faced by the school include unstable internet connections, limited network coverage, and the use of networks that still rely on LAN cables so that they are unable to support learning activities optimally. The results of the study show that the implementation of the PPDIOO method successfully improves the quality of the internet network at Neonbat State Junior High School. The network design uses a star topology with Mikrotik devices, switches, and access points placed at strategic points so that the network coverage becomes wider and more evenly distributed. In addition, bandwidth management is implemented using the PCQ and Simple Queue methods. The results of network testing show that connectivity runs well and is stable, with student network download speeds reaching 33.75 Mbps and upload speeds of 18.74 Mbps, while the teacher network reaches download speeds of 34.43 Mbps and upload speeds of 45.68 Mbps.

A. INTRODUCTION

The development of information and communication technology in Indonesia has experienced rapid growth, particularly in the use of internet networks in various sectors such as education, government, business, and public services. The internet has become a crucial requirement for supporting digital activities, particularly in technology-based learning processes in schools. (Jovanka dkk.,2022).

North Central Timor Regency (TTU), one of the regencies in East Nusa Tenggara (NTT), still experiences limited internet access and network quality. This condition is also felt by Neonbat Public Middle School, which relies heavily on the internet to support learning at school. The school's internet access is available with a capacity of 50 Mbps with uneven Wi-Fi coverage and connections are still centralized in the computer laboratory area and still use LAN cables . In network usage there are 50 users, consisting of 20 teacher users and 30 student users, with connected devices originating from computers and user

wireless devices. Unstable internet connections and limited wireless coverage make it difficult for teachers and students to access the internet optimally.

This network problem has impacted the ineffectiveness of technology-based teaching and learning activities at Neonbat Public Middle School. Therefore, a solution is needed to improve the quality of the internet network to be more stable, have a wider reach, and can be used optimally by implementing a *wireless network* and main devices such as *routers, switches, servers,* and several *access points* that function to manage and distribute internet connections throughout the school area. One method that can be applied to overcome this problem is the PPDIOO method, which consists of the stages of *Preparation* , *Planning* , *Design* , *Implementation* , *Operation* , and *Optimization.*) (Ahmad Habibullah dkk., 2022). The PPDIOO method is used as a systematic approach in the development and management of computer networks. (Ramadhan dkk., 2025) Through this method, research is conducted by analyzing existing network conditions, planning network development, designing more efficient topologies, implementing network devices and configurations, and carrying out periodic operations and optimizations (Muhamad Felix dkk., 2025).

1) *A wireless network* is a network that does not use cable media but uses radio wave transmission for interaction or communication between devices that support *wireless connections.* (Rusdan dkk., 2020). *Wireless networks* allow many devices to connect without using cables as a connection. *Wireless networks* are suitable and widely used in today's society (Eko Prasetyo, 2021). 2) Network security is an effort to protect computer networks from various threats, such as hacker attacks, information theft, intrusions, and system damage (Yakub dkk., 2025). These threats can come from external sources, such as *hackers* and viruses, or from within, such as user error. Therefore, the implementation of network security is very important to ensure system protection, data security, and smooth network operations (Eka Putra dkk., 2024). 3) *PPDIOO Method* is an abbreviation of *Prepare* to determine network needs and strategies, *Plan* to create detailed plans, *Design* to create network designs, *Implement to* configure the network, *Operate* to run and monitor the network to keep it stable, and *Optimize* to improve network performance to be more effective and efficient. (Sitompul dkk., 2021). 4) *Cisco Packet Tracer* is a sophisticated computer network visualization and simulation software, which is freely accessible to students enrolled in *the Cisco Network Academy program.* In addition (Jayadi dkk., 2025), this application can also be used to understand how data transfer works by simulating complex network setups (Rachmania dkk., 2024). 5) Network Topology is a term used to describe how computers are connected in a network (Hamonangan dkk., 2021). The basic types of network topologies include *Bus Topology* , *Star Topology* , Ring Topology *, Mesh Topology, and* Tree Topology. (Ramdhani dkk., 2021)A hub or *switch* is placed *in the center and serves to connect one computer to each connected computer,* as well as connecting *file server computers* .

Based on this concept, this study aims to design and implement a wireless-based internet network at Neonbat State Middle School by applying the PPDIOO method, so that it can increase the reach, stability, security, and network management to support the internet access needs of teachers and students.

A. METHOD

This research uses a qualitative descriptive approach with a case study method. This approach was chosen to understand and describe the implementation process of *the PPDIOO method* on *a wireless-based internet network* at Neonbat Public Middle School and to provide practical solutions to the problems encountered there.

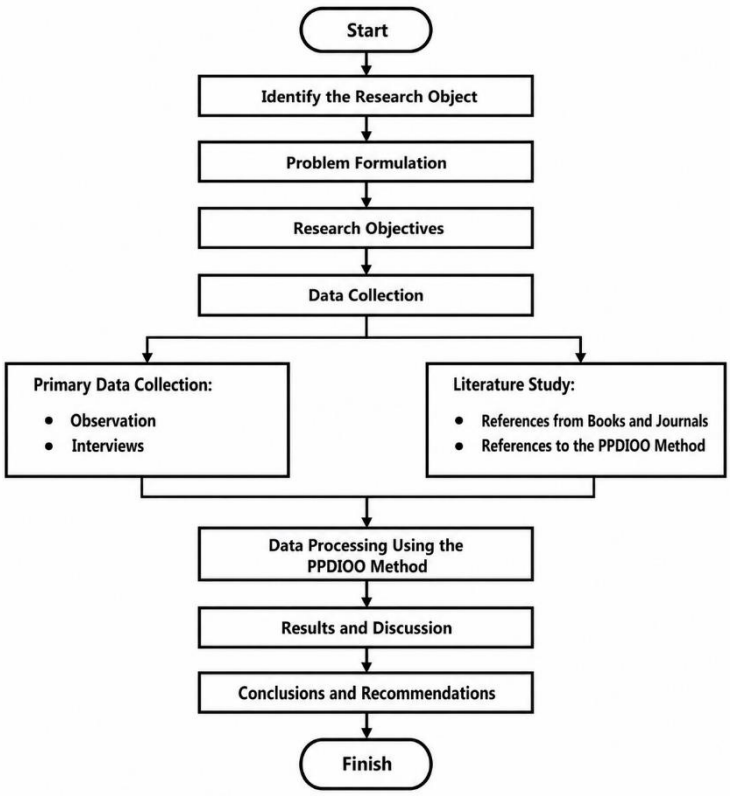

Figure 2. Research Stages

The following are several stages used in this research, namely: 1) Determining the Research Object, the object of this research is the internet network infrastructure at Neonbat State Middle School, 2) Problem Formulation, carried out to identify the main problems such as unstable internet connections and limited internet connections. 3) Research Objectives, the objective of this research is to design and implement *a more effective and secure wireless network system* using *the Planning* , *Preparation* , *Design and Security methods. Implementation, Operation, and Optimization (PPDIOO)* (Al Muzaki dkk., 2025). 4) Data Collection, carried out through primary data and secondary data. 5) Data Processing Using the PPDIOO Method, the collected data is then analyzed and applied at each stage of the PPDIOO method. 6) Results and Discussion, at this stage *the results of the implementation of a wireless-based internet network are displayed* as well as discussions obtained from the application of the PPDIOO method. 7) Conclusions and Suggestions, namely concluding the research results and providing suggestions for future network development to be better.

B. RESULTS AND DISCUSSION

1. Introduction to Neonbat State High School Network

This research was conducted at Neonbat State Middle School, a school that relies heavily on the internet.

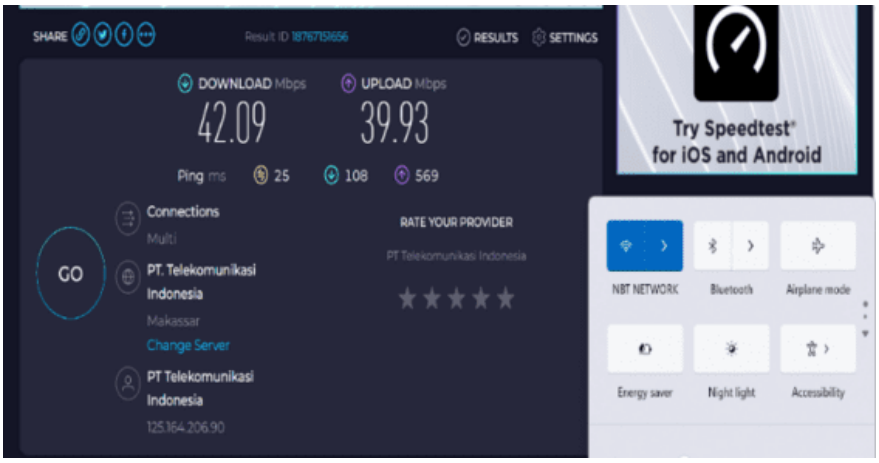

Figure 3. Previous Network Test Results on *Speedtest*

Based on observations, the internet network at Neonbat State Middle School uses *Wi-Fi* with an access speed of 50 Mbps with a download of 42.09 Mbps and an upload of 39.93 Mbps . However, its use is still not optimal because the network coverage is still limited and does not cover the entire school area. The current network still relies on *LAN cables* , which are focused on certain areas such as *laboratories. computers and surrounding areas* , so that classrooms, teachers' rooms, administration rooms, principal's rooms, and other areas do not have good network access.

2. Proposed Floor Plan Mapping

This floor plan mapping aims to determine the overall environmental conditions at Neonbat State Middle School, starting from the position of the rooms, the distance between rooms, to areas that have not been reached by the internet network.

Figure 4. *Wireless* **Layout Design** at Neonbat State Middle School

Figure 4 shows that the *wireless network deployment* at Neonbat State Middle School is centrally designed, with the internet network hub located in the Computer Lab. This room houses key devices such as *routers, switches, servers,* and *access points* , which function to manage and distribute internet connections throughout the school. Connections from *the router* are forwarded to *the switch,* then shared among various devices and *access points* , allowing the network to reach various locations stably. The network is then distributed to various areas such as classrooms, the teacher's lounge, the administration room, and the principal's office. *Access points* are strategically placed to ensure that all classrooms receive an even signal without interference (Oktiana dkk., 2025).

3. Topology Design

The following is a topology design that will be used in *the wireless-based internet network system* at Neonbat State Middle School.

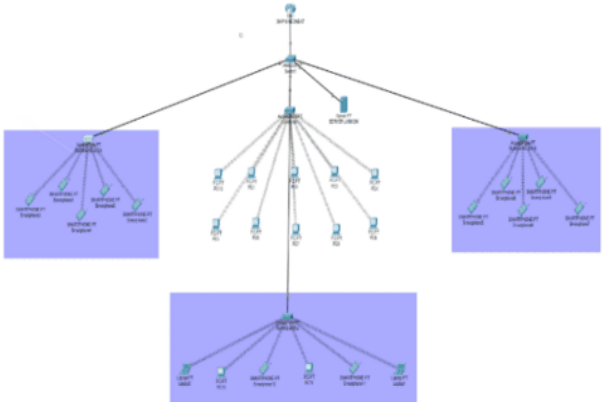

Figure 5 *STAR* Topology Design

Figure 5 shows a star topology design , where all network devices are connected to a central point, the Mikrotik router, which acts as the network controller. The internet connection is routed to *a switch* , which distributes the network to multiple access points that transmit wireless or *Wi-Fi signals* , allowing users such as teachers and students to connect wirelessly. (Putra dkk., 2025) With *a star topology design* , the network becomes more structured, easier to manage, and supports (Pusung dkk., 2025)*more flexible wireless network usage*.

4. *Wireless* Using Mikrotik

1. *Interface* Configuration

The first step to create a network in Mikrotik is to configure *the interface,* which can be seen in Figure 6.

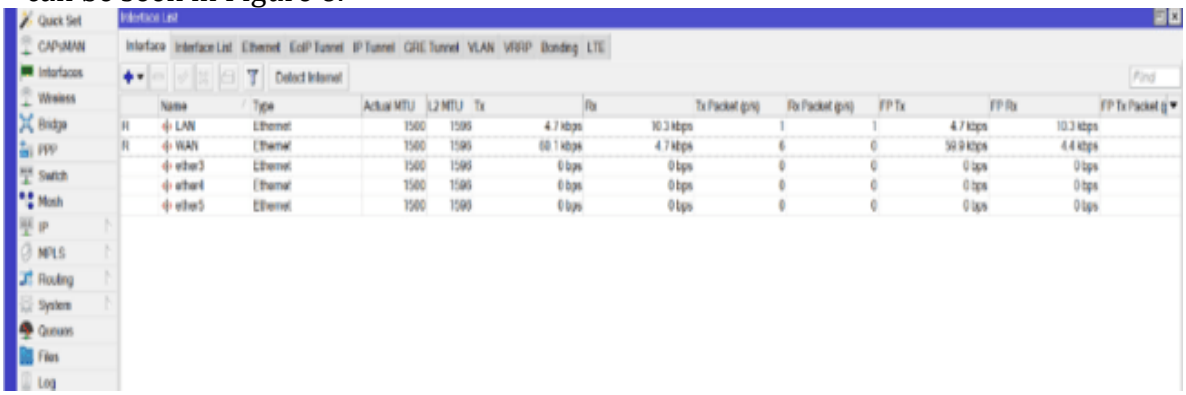

Figure 6. *Interface* Configuration

At this stage , *the interface configuration is performed.* You specify that *ether1* is used as *a WAN* (connected to the internet) and *ether2* as *a LAN* (connected to a local network such as *a PC* or *access point*). Each *interface* is named according to its function for easier identification and management. The subsequent configuration process is easier because each *port* already has a clear role (Sae dkk., 2025). Furthermore, *this interface configuration* also aims to ensure that all connected devices can communicate properly within the network. (Lutfi dkk., 2023)

2. *IP Address* Configuration

The next step is to provide *an address* for *the interface* that has been created, which can be seen in Figure 4.7 below.

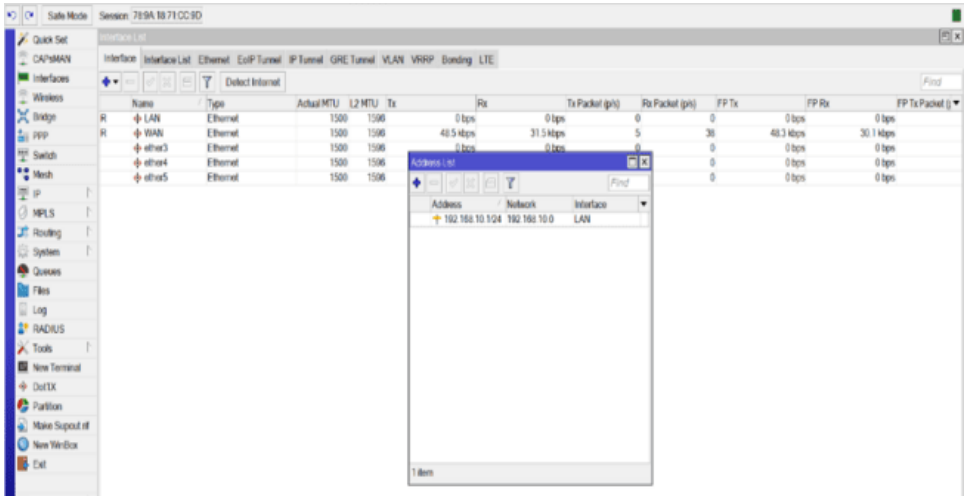

Figure 7 *IP Address* Configuration

At this point, each *interface* is assigned the address 192.168.10.1/24 on *the LAN interface* . This means the router becomes the primary "gateway" *for all devices on the* local network (Usman dkk., 2025). *This address* serves as an identifier for each device on the network so they can communicate with each other (Akbar dkk., 2025).

3. *DHCP Configuration Client*

Figure 8 shows *the DHCP Client configuration* . *The DHCP Client* is used to allow *the WAN interface* to automatically obtain *an IP address* from the internet provider.

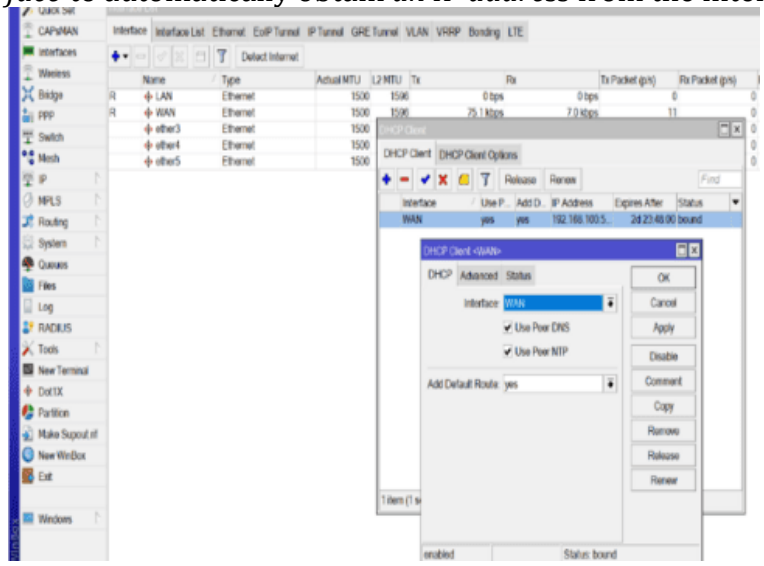

Figure 8 *DHCP Client* Configuration

Automatically (Haryanto, 2021)receive *an IP address from your internet service provider* . By using *a DHCP Client* , MikroTik does not need to be manually configured to obtain *an IP address* from the internet, as everything is assigned automatically (Izzaturrahmah dkk., 2025).

4. *Firewall Filter*

Next, configure *the filter* in *the firewall* . This configuration can be seen in Figure 9.

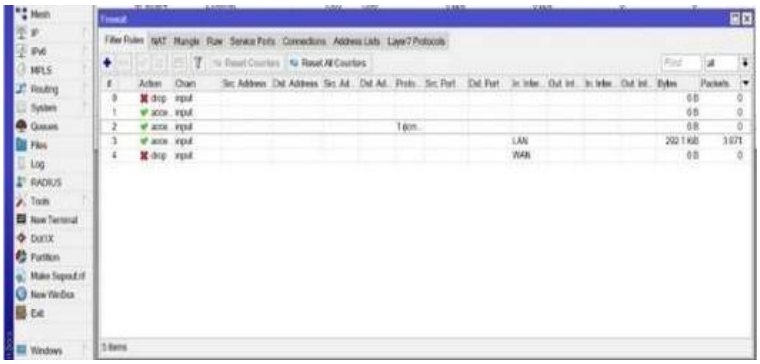

Figure 9 *Firewall Filter* Configuration

The primary function *of a firewall filter* in a network configuration is to protect *the router* and network from unauthorized access and external attacks (Ilham dkk., 2022). In addition, *firewall filters* are also used to control connections so that only certain traffic is allowed, such as allowing established connections , allowing related connections , and blocking invalid connections . (Gafira dkk., 2025)With *firewall filters* , network administrators can ensure that the network is accessible only to authorized users (Roberts Tamu Umbu dkk., 2024).

5. *Firewall Blocks MAC Address*

At this stage, *the MAC address blocking process is performed* on *the firewall.* The configuration can be seen in Figure 4.10.

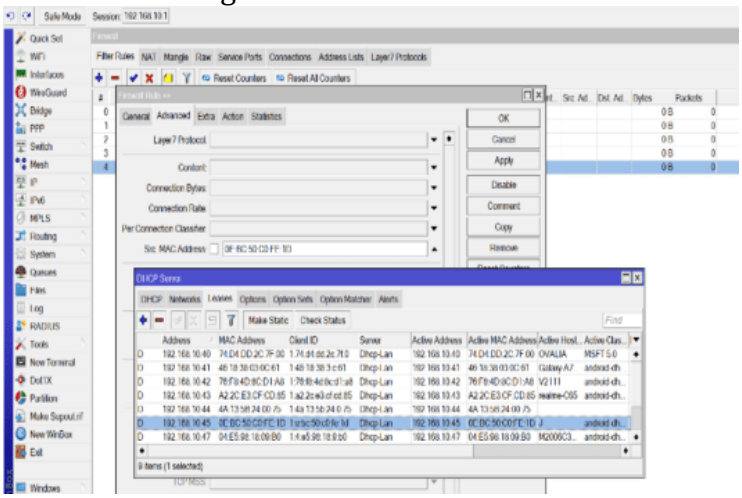

Figure 4.10 *Firewall Blocking MAC Address Configuration*

MAC address blocking , as shown in Figure 4.10, is done through *the IP Firewall Filter Rules menu* . Before creating *a rule, first enter* the device's MAC address in *the DHCP Server menu, then* the Lease menu. After that, create *a new rule* and fill in *the Source MAC Address* with *the MAC address* of the device to be blocked in the (Reyfaldi dkk., 2024)*Advanced tab* . Next, select *Drop to Block in the Action tab.*

6. *Simple Queue Configuration*

Next, *a simple configuration is performed. Queue.* The configuration can be seen in Figure 12.

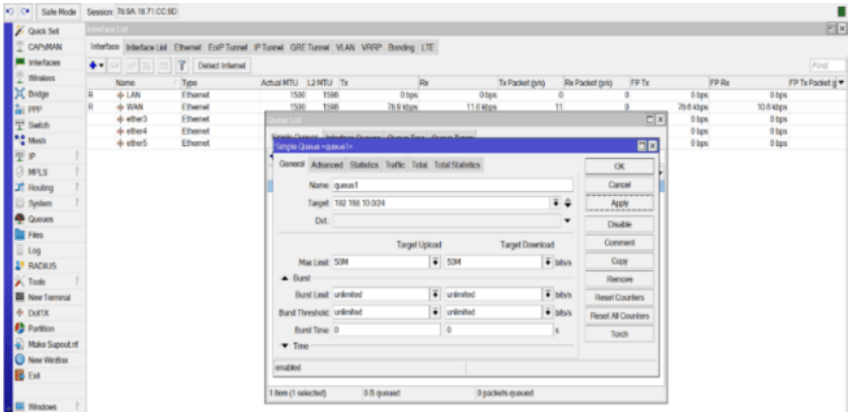

Figure 12 *Simple Queue* Configuration

At this stage, *Simple Queue configuration is performed on Mikrotik to set bandwidth* restrictions for the entire 192.168.10.0/24 network, with a total *upload* and download limit *of 50 Mbps* . *Simple Queue* is used to limit internet speed for individual users or groups of users, such as teachers and students (Miftahur Rahman dkk., 2024).

5. Teacher and Student Network Testing at Neonbat State Middle School

The following is a network test and distribution for teachers and students.

1. Teacher Network Testing in the Teachers' Room

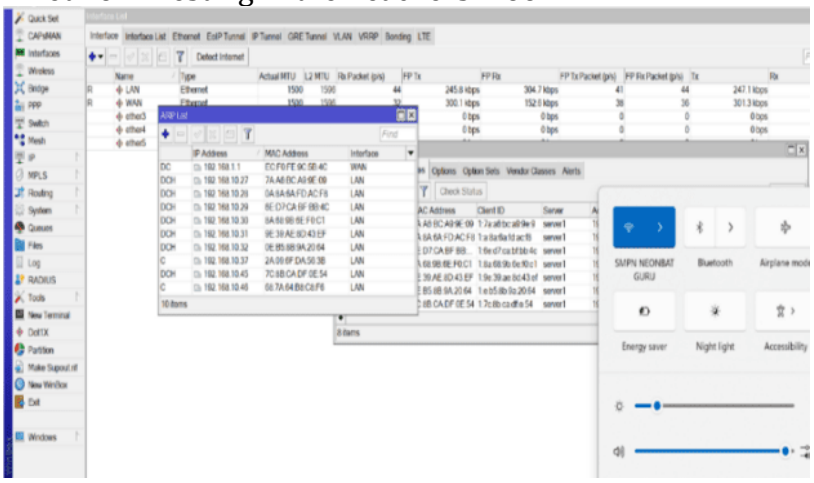

Figure 13 Teacher Network Testing in the Teachers' Room

2. Student Network Testing at Labkom

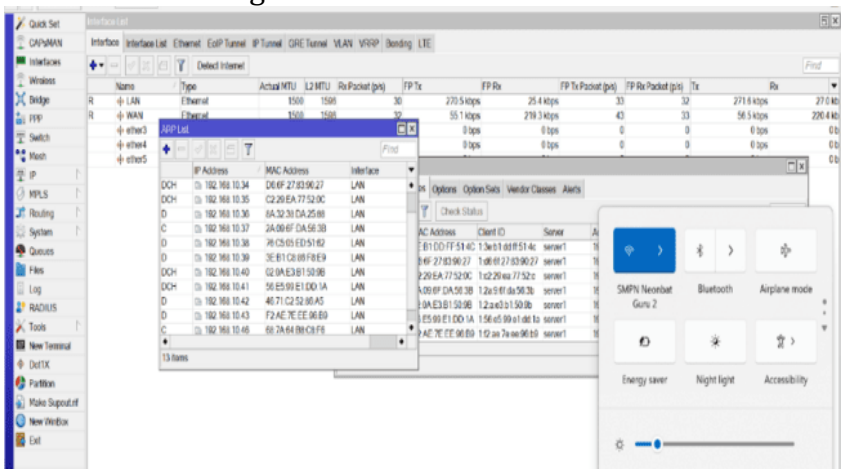

Figure 14 Student Network Usage in Laboratory Room

At this stage, the implemented configuration is tested, particularly regarding *bandwidth sharing* between teachers and students while running the network. This testing aims to ensure that all settings are functioning properly. Teachers have smoother access to learning activities, while students can continue to use the internet within established limits.

6. Teacher and Student Network Test Results on *Speedtest*

Below, in Figure 4.15 and Figure 4.16, are the results of *speed tests* that have been carried out on the teacher and student networks.

Figure 15 Student Network *Speedtest* Results

Figure 16 Teacher Network *Speed Test* Results

Based on the test results using *Speedtest,* the results of the network test after the *bandwidth distribution* and the application of *the ppdioo method* on the network at Neonbat Public Middle School, the internet speed on the student network increased with *a download value* of 33.75 *Mbps* and *an upload* of 18.47 *Mbps* , while on the teacher network it was 34.43 *Mbps* and *an upload* of 45.68 *Mbps. The student ping value* was around 55 *ms and* the teacher ping value was 44 *ms* which is still quite good for daily use. These results indicate that the internet network used is faster and more stable and is able to handle many users simultaneously.

C. CONCLUSION AND SUGGESTIONS

Based on the research results, the application of *the PPDIOO method* to the wireless internet network at Neonbat Public Middle School successfully improved the network quality, which previously experienced unstable connections and limited range due to the network's reliance on LAN cables and a lack of structured network management. The implemented solution was to build *a wireless network* using Mikrotik devices and several *access points.* Strategic placement *points* to ensure wider and more even internet coverage. In addition, *bandwidth management* using Mikrotik helps distribute internet connections fairly between teachers and students, making the network more stable and efficient. Through the stages of *preparation* , *planning* , *design* , *implementation* , *operation* , and *optimization* , *the PPDIOO method* can help the process of designing, implementing, monitoring, and optimizing the network systematically, making the network easier to manage and able to support academic activities effectively. For further development, schools are advised to increase *bandwidth capacity* , add *access These points* include conducting regular network monitoring, and developing *a bandwidth management system* and *real-time network monitoring. so that* network performance is more optimal.

CONFESSION

The author would like to thank all staff at Neonbat Public Junior High School, including the teachers and students, who provided support and contributions to the implementation of this research. He also thanks the University of Timor, particularly the Information Technology study program, for the support and facilities provided during the research process. He also expresses his appreciation to his classmates who provided advice, input, and motivation, which contributed to the successful completion of this research.

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