



Implementation of RT/RW Net WiFi Network as a Solution to Internet Needs in Motu Village, Pasangkayu Regency, West Sulawesi

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Abstract. Desa Motu is an area that experiences limited internet access due to the unavailability of conventional ISP services and weak cellular signal coverage. This study aims to develop a community-based RT/RW Net network system to provide internet access by utilizing Starlink as the main ISP and distributing connectivity through networking devices such as MikroTik routers, access points, switches, and fiber optic media. Network testing was conducted by measuring download and upload speeds using network testing applications, evaluating connection stability through latency (ping) measurements, and assessing signal coverage at several user locations. The results show that the implemented RT/RW Net network is able to provide a stable internet connection with consistent speeds at different testing times, as well as optimal signal distribution across multiple measurement points. The authentication system using vouchers, PPPoE, hotspot login, and MAC Binding functions properly, and the free educational access feature also operates effectively. These findings indicate that the RT/RW Net-based community network model can serve as an affordable and sustainable solution for expanding internet access in rural areas.

Keywords: MikroTik; RT/RW Net; Rural Internet Access; Starlink; WiFi

1. INTRODUCTION

The rapid development of information alongside advances in communication technology, particularly the internet, has made the internet a primary necessity for various segments of society, such as students, workers, and the general public. Currently, the internet has become an integral part of daily life, in line with advancements in information technology across various fields, including agriculture, education, business, social, cultural, economic, and industrial sectors. The high demand for stable internet access has driven individuals in residential areas to seek reliable networks to support their activities and work [1]. However, internet usage is often limited by data quotas, which ultimately restricts freedom in accessing various available services [2].

Motu Village is one of the villages with a large population where residents still face many obstacles in accessing the internet. These challenges begin with the difficulty of obtaining cellular network coverage, as the area is indeed hard to reach by cellular networks. Furthermore, there are no *Internet Service Providers (ISPs)* available.

Currently, access to technology particularly the internet remains difficult to obtain in some areas, including the village of Motu. Internet networks tend to be concentrated in urban areas, where the cost of internet access is relatively high. Yet, the public urgently needs internet connectivity that can reach rural areas at a more affordable cost. This disparity in access to technology creates a significant gap between rural and urban populations, indicating that the

equitable development of technological infrastructure, particularly in rural areas, has not yet been optimally implemented [3].

In addition to being limited by data caps, one of the problems faced by the community in Motu Village is poor signal quality. Internet connections are often slow and unstable, and there are no internet service providers, especially in areas far from the village center or near geographical obstacles such as hills and forests, as observed through field surveys. Weak or unavailable cellular signals in some locations make mobile internet access unreliable. Limited internet access in Motu Village makes it difficult for students to complete assignments, engage in online learning, and search for information. Furthermore, the village's remote location from internet access points further compounds the challenges in their learning process.

Various studies have demonstrated the effectiveness of the RT/RW Net network, such as a study on the design of an RT/RW Net hotspot network for Kutawargi Village using a Telkom ISP with a bandwidth of 300 Mbps. This service has proven capable of meeting the internet needs of the village residents. Each resident receives a bandwidth allocation of 0.5 Mbps, which is efficiently managed using Mikrotik [4]. Other research also indicates that the implementation of a voucher-based Wi-Fi network using Mikrotik on the RT/RW Net network is highly effective. Through the voucher system, the RT/RW Net network administrators can control and manage user access more effectively, ensuring fair bandwidth distribution and more orderly internet usage [5]. The RT-RW Net internet service provider (ISP) in East Kasiyan Village also demonstrates that by utilizing Indihome's ISP resources, the RT/RW Net can be accessed by local residents through a voucher purchase system. These internet vouchers are distributed via retail vendors in the areas covered by the transmitter. However, each voucher can only be used by a single user at a predetermined maximum speed. After reaching the usage time limit, consumers need to repurchase a voucher to regain internet access [6].

Another study on the design and implementation of Mikrotik in the RT-RW Net hotspot network demonstrates that the RT/RW Net network design using Mikrotik which has been tested and evaluated via a questionnaire functions as expected. This network has successfully addressed various issues faced by residents, resulting in high user satisfaction. Additionally, this system achieves its primary objectives: reducing monthly bandwidth rental costs for unlimited connections, providing stable internet access 24 hours a day, and effectively managing bandwidth to ensure optimal data transfer quality [7]. The design and development of the RT/RW Net Hotspot network using Mikrotik RouterOS as a billing management system also demonstrate that with the new RT/RW Net Hotspot system, customers can experience satisfaction and convenience in accessing the internet more easily. They no longer have to go

to an internet café to enjoy internet services, making access more flexible and practical according to user needs [8].

These studies indicate that the implementation of the RT/RW Net network is highly effective in providing affordable and stable internet access to the community. However, these studies still have limitations, such as infrastructure constraints; not all areas in Indonesia, such as the village of Motu, have internet service providers (ISPs) like Biznet, Indhome, or Iconnect.

Based on the issues outlined above, this study aims to provide internet access in RT and RW areas, particularly in regions that are difficult to reach or currently lack internet connectivity, while also reducing the cost burden of internet access to offer a more affordable alternative compared to commercial services by implementing the RT/RW Net Wi-Fi Network as a Solution for Internet Needs in Motu Village, Pasangkayu Regency, West Sulawesi a solution that will undoubtedly be more cost-effective, and offer a stable and reliable internet connection. Therefore, this study will utilize Starlink or a VSAT system as the primary ISP source. The use of this technology is expected to overcome the limitations of terrestrial network infrastructure, provide broader internet access, and ensure better connection speeds and stability for the village community.

As an innovative approach to its implementation, this study provides free access to educational websites as a form of social contribution aimed at improving the quality of education for the community, particularly in rural areas. This concept leverages the RT/RW Net network infrastructure to not only provide paid internet services but also offer free access when users visit educational websites, digital libraries, or official education portals.

2. LITERATURE REVIEW

Development Research

Research and Development (R&D) is a research approach aimed at creating a product while simultaneously testing its effectiveness. The process begins with a needs analysis as the foundation for product development, followed by effectiveness testing to ensure that the product is feasible and can be widely used by the community [9].

RT/RW Net

RT/RW Net is a concept of local communication network development aimed at providing internet access within neighborhood communities (RT and RW), especially in areas that are difficult to reach or not yet covered by internet services. This concept is designed to make internet access more affordable and efficient for residents. The development of RT/RW Net is based on several theories, one of which involves the use of routers. A router functions

as a device that connects two or more networks and is responsible for forwarding data between them, enabling optimal internet distribution [10].

This concept is similar to an internet café (warnet), where the owner rents or obtains bandwidth from an Internet Service Provider (ISP) such as Telkom, Indonet, or Indosat, and then redistributes it to users accessing the internet via computers. User activities may include checking email, chatting, browsing, gaming, or enjoying various online entertainment services. In RT/RW Net, internet distribution is carried out through fiber optic (FO) cable configuration and routers, supported by hubs or switches to manage the network efficiently [11].

Review of Relevant Studies

The following are several relevant studies:

Sutan Faisal (2021), in his study titled *Design of RT/RW Net Hotspot Network for Kutawargi Village*, utilized hardware such as a server computer, access points, MikroTik devices, and Winbox software, with an ISP from Telkom providing a bandwidth of 300 Mbps. The results showed that the service was able to meet the internet needs of the village residents, with each user allocated 0.5 Mbps bandwidth managed efficiently using MikroTik [4].

Mohammad Fahim Hidayatullah, Indyah Hartami Santi, and Filda Febrinita (2024), in their study titled *Implementation of Voucher-Based WiFi Network Using MikroTik in RT/RW Net*, developed a system to limit internet speed and usage time. The results demonstrated that the voucher-based system effectively enabled network administrators to control and manage user access, ensuring fair bandwidth distribution and more regulated internet usage [5].

Rahayu Nugraheni Rachmawati and Titi Christina (2021), in their study titled *Design and Development of RT/RW Net Network Using MikroTik*, aimed to reduce monthly bandwidth rental costs while maintaining unlimited internet access, ensuring stable 24-hour connectivity, and optimizing data transfer through bandwidth management. The results indicated that the system functioned as expected, successfully addressing community issues, achieving cost efficiency, maintaining stable connections, and improving overall user satisfaction [7].

Fajar Nur Cahyo (2021), in his study titled *Design and Development of RT/RW Net Hotspot Network Using MikroTik RouterOS as a Billing Management System*, aimed to facilitate easier internet access for users without the need to visit internet cafés. The results showed that users experienced greater convenience and satisfaction, as they could access the internet more flexibly and practically according to their needs [8].

However, this study mainly focused on billing management and did not integrate free internet services for educational purposes. Based on these previous studies, the novelty of the present research lies in the implementation of an RT/RW Net system that not only functions as

a community-based internet service provider but also integrates a free educational access feature. This system is designed to allow the community, especially students, to access educational content without cost, thereby supporting equal access to information and improving the quality of education in rural areas.

3. METHOD

This study employs a Research and Development (R&D) method with a prototype development model, consisting of stages such as needs analysis, design, development, testing, and evaluation. The research was conducted at the JTIK Laboratory of Makassar State University, with field testing carried out in Motu Village over a three-month period (July–September). The initial stage involved identifying potentials and problems related to the community's need for internet access, followed by a needs analysis covering hardware, software, bandwidth, and network security requirements. The next stage focused on designing and developing the RT/RW Net network, including network topology based on an ISP (Starlink), router configuration, network distribution using fiber optic, and a voucher-based authentication system. This process was also supported by system flowchart design for both users and operators to ensure structured network operations [12].

The subsequent stage involved design evaluation by the supervisor, followed by prototype development and real-world implementation. Testing was conducted to evaluate network performance, including speed, stability, security, coverage, and free educational access features. Data were collected through observation, interviews, and network testing and simulation, then analyzed using descriptive quantitative methods to assess system effectiveness and efficiency. The testing instruments included measurements of internet speed, latency (ping), authentication security, network coverage, and performance under simultaneous user conditions. The results of the analysis were used as the basis for system evaluation and improvement, ensuring that the developed RT/RW Net network can serve as an optimal solution to enhance internet availability and quality in Motu Village.

4. RESULTS AND DISCUSSION

Results

This study resulted in the implementation of the RT/RW Net WiFi network as a solution to internet needs in Motu Village, Pasangkayu Regency, West Sulawesi. This network system serves to provide affordable and equitable internet access for the village community. The research results indicate that the design of the RT/RW Net network successfully achieved its

primary development objective: providing stable internet connectivity that can be utilized for various community needs, such as communication, education, and economic activities.

Through the integration of networking devices and optimal bandwidth management, the system is able to distribute internet access fairly among users. Furthermore, the results of this study demonstrate the system's reliability in operating sustainably, enabling the community to access the internet without having to rely solely on conventional providers, whose services are relatively expensive.

The implementation of the RT/RW Net network has also proven effective in boosting community productivity, particularly in supporting online learning, small and medium-sized enterprises, and digital communication. The use of community-based network infrastructure has a positive impact on equitable access to information, while simultaneously reducing the digital divide in rural areas.

Thus, the results of this study provide a strong foundation for the practical implementation of the RT/RW Net WiFi network on a larger scale, not only in Motu Village but also in other villages facing limited internet access in Pasangkayu Regency and West Sulawesi in general.

Needs Analysis

Problem Identification: The main issue in this study is the limited and difficult-to-access internet connectivity among the Motu community, which affects the learning process and some community members who run home-based businesses. Some of the main challenges faced include difficulties in digital communication, limited access to online education, barriers to obtaining information, and challenges for MSME operators in marketing their products digitally. Additionally, the community also faces difficulties in accessing online public services, which further widens the digital divide with urban areas. The objective of this study is to present the results of testing the implementation of the RT/RW Net community network as a solution to the internet needs of the Motu community.

Network Design and Planning

The design of the RT/RW Wi-Fi network as a solution to internet needs in Motu Village, Pasangkayu Regency, West Sulawesi, which is based on satellite internet, involves the following stages:

Preparation Stage: In this stage, a literature review was conducted, tools and materials were gathered, and supporting software was installed to build the RT/RW Net Wi-Fi network as a solution to internet needs in Motu Village, Pasangkayu Regency, West Sulawesi.

Network Design Results: At this stage, a network design was carried out with the aim of establishing the RT/RW Net Wi-Fi network as a solution to meet internet needs in Motu Village, Pasangkayu Regency, West Sulawesi.

Network Device Design



Figure 1. Network Device Design.

In Figure 1 above, the Starlink antenna is designed by placing the Starlink parabolic antenna on the roof of the building to maximize satellite signal reception without obstruction from trees or other structures. This antenna is positioned in an open area to ensure stable signal reception.

Schematic Design of the Network Circuit

Below is the schematic design of the RT/RW Net Wi-Fi network

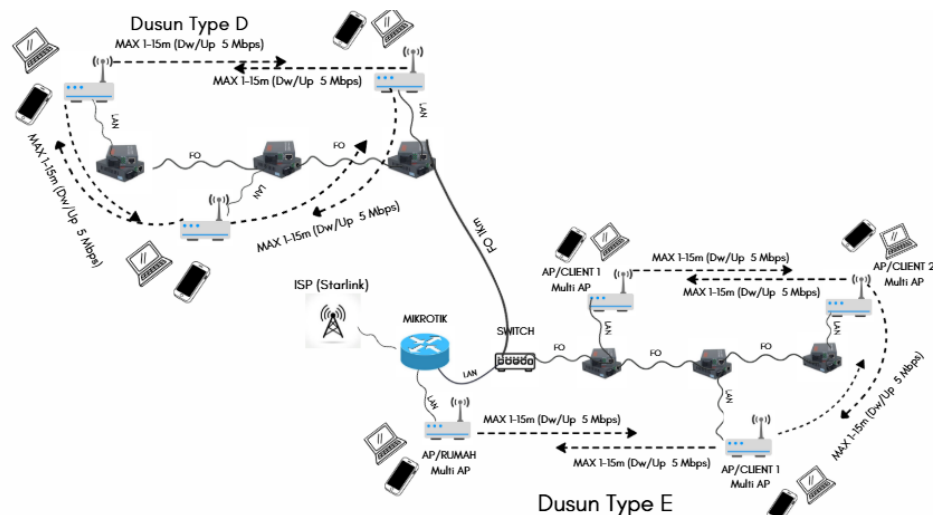


Figure 2. Schematic Design of the Network Circuit.

In Figure 2, the RT/RW Net network topology is divided into several regional segments, namely Type D and Type E hamlets, each of which is connected via a fiber optic (FO) backbone from the network center. At the central hub, the internet connection from the ISP (Starlink) is

routed to a MikroTik router as the primary network controller, then distributed to switches before being transmitted via the FO backbone to each hamlet. In each hamlet, the fiber optic connection is connected to a media converter (HTB) to convert the optical signal into an electrical signal, which is then transmitted to the main access point (Multi AP). Each client access point has a maximum effective range of ± 15 meters with download and upload speeds of up to 5 Mbps, in accordance with the bandwidth management settings applied on the MikroTik. By using a Multi Access Point configuration and the same SSID, users can move between access points without having to reconnect, thereby maintaining user mobility. Additionally, the use of a fiber-optic backbone between village hamlets enables stable network distribution with minimal interference and the ability to cover a wider area compared to the use of standard copper cables. Overall, the network design shown in Figure 2 demonstrates that the RT/RW Net system is structured from the network center to the user end, thereby providing stable, equitable, and efficient internet services for the entire community in the Motu Village area.

Network Testing

Before assembling or installing the RT/RW Net Wi-Fi network as a solution for internet needs in Motu Village, Pasangkayu Regency, West Sulawesi, a trial run is conducted first to determine whether the network is functioning properly. This testing consists of the following tests

ISP Bandwidth Testing

The ISP bandwidth test is conducted to ensure that the bandwidth provided by the ISP or Starlink matches what was promised.

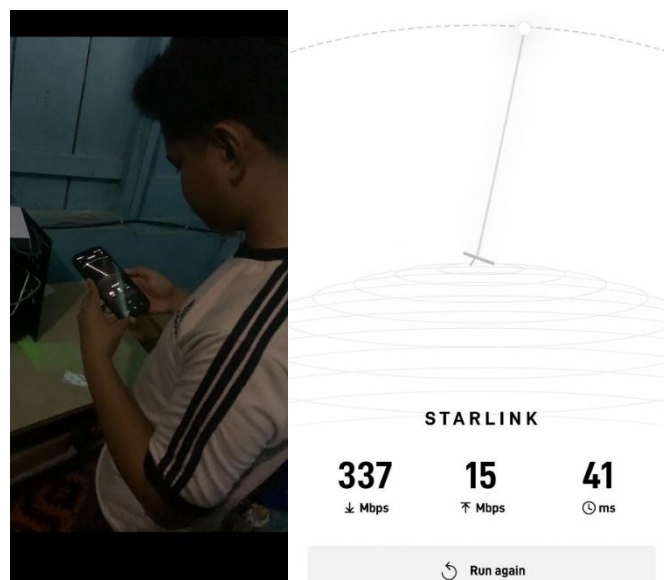


Figure 3. ISP Bandwidth Testing.

Based on the test results in Figure 3 above, the bandwidth provided by the ISP or Starlink matches the promised bandwidth of 300 Mbps. The bandwidth is then divided, with each user receiving 5 Mbps

The test results shown in Figure 3 indicate that the ISP or Starlink has delivered the bandwidth as intended.

Bandwidth Management Testing

Bandwidth management testing was conducted to ensure that the distribution of bandwidth among users is appropriate, with each user receiving 5 Mbps of bandwidth

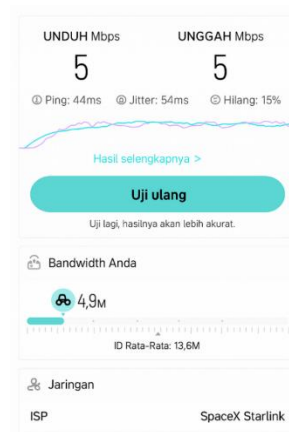


Figure 4. Bandwidth Management Testing.

Figure 4 shows a bandwidth management test using the Speedtest app. The test results shown in Figure 5 indicate that the bandwidth allocated to each user is appropriate, namely 5 Mbps

Network Security Testing (login voucher)

Network security testing to ensure the network is secure from unauthorized access, where only registered users can access the network



Figure 5. Network Security Testing.

Figure 5 above shows the network security testing. This test aims to ensure that only registered users can access the internet network. The test results in Figure 5 show that when a user attempts to log in to using an unregistered account, the system displays the message “invalid username or password.” This proves that the network security system is functioning properly, as it is able to deny access to users without authorization.

Network Development and Implementation Phase

The implementation phase of this study involved the construction of an RT/RW Wi-Fi network as a solution to meet internet needs in Motu Village, Pasangkayu Regency, West Sulawesi. The following are the steps taken during the implementation process

Results of Network Device Assembly and Installation

a. Installation of ISP or Starlink

Installing the ISP or Starlink is a crucial step in the RT/RW Net network deployment process. This installation aims to ensure the primary internet source functions properly and can distribute the connection throughout the entire network. With the Starlink installation, the RT/RW Net network can achieve stable internet access with broad coverage. The following is an image of the Starlink device installed as the primary internet connection provider in the RT/RW Net system.



Figure 6. of the Starlink ISP.

Figure 6 above shows the network device or ISP that will be used on the RT/RW Net Wi-Fi network as a solution to meet internet needs in Motu Village, Pasangkayu Regency, West Sulawesi

b. Network Device Configuration

Configuring network devices is one of the key steps in the process of building an RT/RW Net network to ensure the system functions optimally. The configuration process begins with setting up the Mikrotik router as the network control center. The configuration

involves setting IP addresses, gateways, and DNS, as well as creating NAT rules to connect the local network to the internet provided by the Starlink ISP. Additionally, bandwidth management is configured to ensure an equitable distribution of internet speed among all users. Next, user authentication is configured using the Mikhmon application, which is integrated with the Mikrotik router. At this stage, user accounts (*vouchers*) are created, and bandwidth profiles are configured according to the needs of the RT/RW Net service. Mikhmon functions as a hotspot management system that simplifies administrators' tasks in managing users, monitoring network activity, and setting speed limits and internet access validity periods. With this system in place, the internet connection can be managed in a more structured and stable manner even when used simultaneously by many users. On the access point side, SSID settings, network security, and adjustments to the channel and transmission power are configured to prevent interference between devices. The access points are configured to connect stably to the main network and distribute the signal optimally to customers' homes.



Figure 7. Network Device Configuration.

Figure 7 above shows the network device configuration process used in the RT/RW Net WiFi system as a solution for internet access in Motu Village, Pasangkayu Regency, West Sulawesi. This configuration process includes setting up the Mikrotik router, managing bandwidth, configuring access points, and setting up the user authentication system to ensure the network operates optimally and stably.

c. Server Assembly

Server assembly is one of the critical stages in building the RT/RW Net network. The server serves as the network management hub, handling tasks ranging from user authentication and bandwidth allocation to voucher system management. The server

assembly process involves preparing the necessary hardware and software to ensure the server functions optimally according to its role. The following image shows the server hardware that has been assembled to support the RT/RW Net network operations.



Figure 8. Server.

Figure 8 above shows the server setup used in the RT/RW Net Wi-Fi network system as a solution to meet internet needs in Motu Village, Pasangkayu Regency, West Sulawesi. This server was assembled by mounting several network devices on a rack to ensure a more organized setup and facilitate maintenance. The devices used consist of a main server as the network management center, a Mikrotik router that functions to manage traffic and bandwidth, and a media converter that converts optical signals into electrical signals (and vice versa), ensuring stable connections between devices even over long distances. Additionally, there are power supplies and adapters used as power sources to support the performance of the server, Mikrotik router, and other devices.

d. Access Point Installation

Access point installation is a crucial step in building the RT/RW Net network. An access point functions as both a receiver and a transmitter of wireless signals that distribute internet connections to users in every resident's home



Figure 9. Access Point Installation.

Figure 9 above shows the RT/RW Net installation process, which involves mounting an access point device on the wall of a user's home. This process aims to connect the network cable from the main server to the access point so that the internet signal can be distributed to the surrounding area. The installation is carried out with careful consideration of the device's position to ensure optimal coverage for users.

Network Testing and Evaluation

The network testing and evaluation phase is conducted to ensure that the network functions properly; the results of this testing can be used to make improvements to the network that has been established. The testing is conducted as follows:

Internet Speed Test

- a. Internet speed testing using Speedtest Master

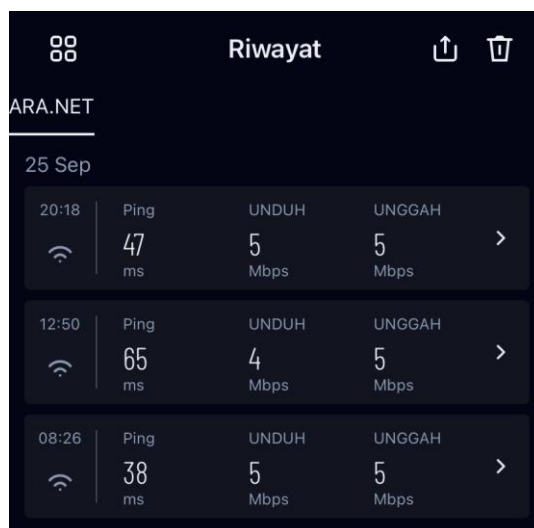


Figure 10. Internet Speed Test Using Speed Test Master.

Figure 10 above shows an internet speed test conducted using the Speed Test Master app. This test was conducted to determine the quality of the internet connection, including download and upload speeds. The network testing process was carried out in the morning, afternoon, and evening starting at 8:00 AM with specific time intervals between each measurement. The results of this test were used to evaluate network speed and ensure that bandwidth distribution aligns with the established configuration.

Table 1. Internet Speed Test Results from Speedtest Master.

No	Test Time	Download (Mbps)	Upload (Mbps)
1	Morning	5 Mbps	5 Mbps
2	Afternoon	4 Mbps	5 Mbps
3	Night	5 Mbps	5 Mbps

Based on the measurement results shown in Table 1 above, the internet speed test results indicate that in the morning, the download speed reached 5 Mbps and the upload speed reached 5 Mbps. Later in the afternoon, there was a slight decrease in download speed to 4 Mbps, while the upload speed remained stable at 5 Mbps. Then, in the evening, internet speeds stabilized again with download speeds of 5 Mbps and upload speeds of 5 Mbps. From these test results, it can be concluded that upload speeds were relatively stable, while download speeds experienced a temporary decrease in the afternoon before returning to normal in the evening.

b. Internet speed testing using Speedtest by Ookla

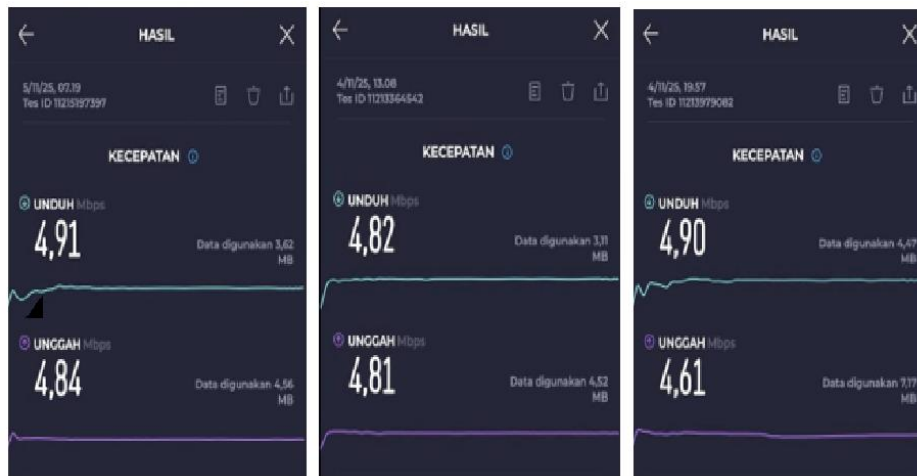


Figure 11. Internet Speed Test Using Speedtest by Ookla.

Figure 11 above shows an internet speed test conducted using the Speedtest by Ookla app. This test was performed to assess the quality of the internet connection and compare the results obtained with those from the Speedtest Master app. The network testing process was conducted in the morning, afternoon, and evening, starting at 8:00 AM with specific time intervals between each measurement. The results of this test were used to evaluate network speed and ensure that bandwidth distribution aligns with the established configuration

Table 2. Results of the Internet Speed Test by Ookla.

No	Test Time	Download (Mbps)	Upload (Mbps)
1	Morning	4.91 Mbps	4.84 Mbps
2	Afternoon	4.82 Mbps	4.81 Mbps
3	Night	4.90 Mbps	4.61 Mbps

Based on the test results in Table 2 above, which used the Speedtest by Ookla app, the average download and upload speeds were in the range of 4.8–4.9 Mbps, approaching

the maximum limit of 5 Mbps. The differences between test times (morning, afternoon, evening) were very small, only about 0.1–0.3 Mbps, indicating good network stability.

Meanwhile, the results based on the tests in Table 1, which used Speedtest Master, show download and upload speeds in the range of 4–5 Mbps, with slightly rounded results (generally displayed as 5 Mbps due to rounding in the app). The daytime test results dropped slightly to 4 Mbps for downloads, but this remains within reasonable limits and does not indicate significant disruption.

Based on both test results, the Rt/Rw Net Wi-Fi network as a solution for internet needs in Motu Village, Pasangkayu Regency, West Sulawesi, can be considered relatively stable, with consistent download and upload speeds in the range of 4–5 Mbps at various times of the day (morning, afternoon, evening). There was no significant drop in speed, indicating that bandwidth management within the network system is functioning normally. Therefore, it can be concluded that the network is operating stably and in line with its configured capacity, as confirmed by tests using both Speedtest by Ookla and Speedtest Master.

Network Stability Testing

a. Network stability testing using the Speedtest Master app

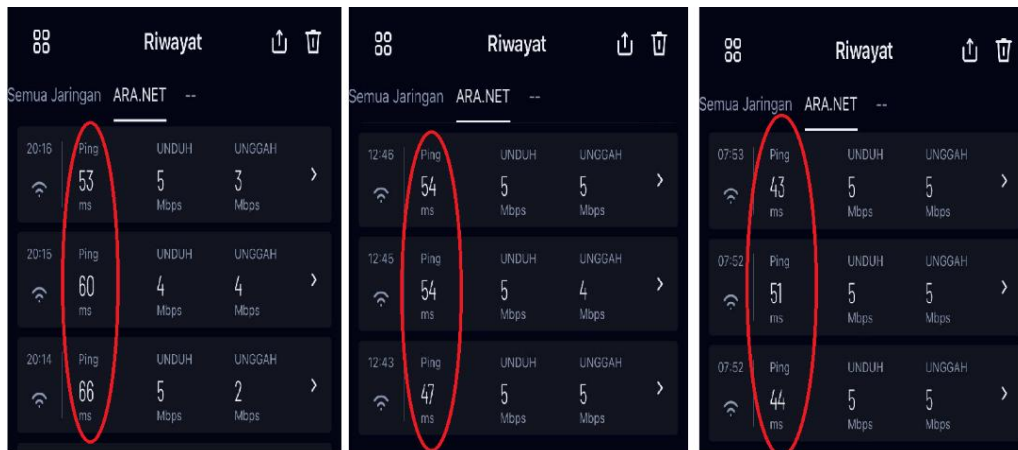


Figure 12. Network Stability Testing Using Speedtest Master.

Figure 12 above shows a network stability test. The network stability test uses the Speedtest Master app by examining ping results at different times to determine the stability level of the internet connection. The results of this ping test are used to assess whether the RT/RW Net network has a stable connection quality and can optimally support users' internet access needs.

Table 3. Network Stability Test Results 1.

Test Time	Test No.	Ping Result (ms)
7:53 AM	1	43 ms
	2	51 ms
	3	44 ms
12:45 PM	4	54 ms
	5	54 ms
	6	47 ms
20.15	7	53 ms
	8	60 ms
	9	66 ms
Average Morning Ping	-	$(43+51+44) \div 3 = 46$ ms
Average Ping in the Afternoon	-	$(54+54+47) \div 3 = 51$ ms
Average Ping at Night	-	$(53+60+66) \div 3 = 59$ ms
Overall Average Ping	-	$(46+51+59) \div 3 = 52$ ms

The results in Table 3 above show that after conducting 9 tests at three different times, the average ping values were 46 ms in the morning, 51 ms in the afternoon, and 59 ms at night. The overall average from these tests is 52 ms. These results indicate that network quality is more stable and responsive in the morning due to lower ping values. During the afternoon, the ping values increased slightly, indicating a rise in network load, while the highest ping values occurred at night due to heavy user activity. Overall, the average ping value of 52 ms is still considered stable, as it remains below the 100 ms threshold commonly used as an indicator of network connection stability.

b. Network stability testing using the Speedtest by Ookla app

Tanggal	JenisKoneksi	L	B	Kecepatan unduh	Kecepatan unggah	Latensi	Server	IpInternal	IpEksternal	URL
05/11/2025, 07.19	Wifi	-1.5416803	119.4011843	4.908832	4.840296	54	Mamuju	170.0.172.91	202.65.233.97	https://www.speedtest.net/my-result/a/11215197397
05/11/2025, 07.19	Wifi	-1.5416803	119.4011843	4.824704	4.824768	57	Mamuju	170.0.172.91	202.65.233.97	https://www.speedtest.net/my-result/a/11215196819
05/11/2025, 07.18	Wifi	-1.5416803	119.4011843	4.920952	4.785824	55	Mamuju	170.0.172.91	202.65.233.97	https://www.speedtest.net/my-result/a/11215196316
04/11/2025, 19.58	Wifi	-1.5417547	119.4012049	4.809408	4.541312	47	Mamuju	170.0.172.91	202.65.231.162	https://www.speedtest.net/my-result/a/11213981078
04/11/2025, 19.57	Wifi	-1.5417547	119.4012049	4.902024	4.6088	49	Mamuju	170.0.172.91	202.65.231.162	https://www.speedtest.net/my-result/a/11213979082
04/11/2025, 19.54	Wifi	-1.5419047	119.401286	5.109424	4.163376	50	Mamuju	170.0.172.91	202.65.231.162	https://www.speedtest.net/my-result/a/11213973415
04/11/2025, 13.09	Wifi	-1.5417104	119.4011547	4.693176	4.81864	41	Mamuju	170.0.172.91	202.65.234.91	https://www.speedtest.net/my-result/a/11213365102
04/11/2025, 13.08	Wifi	-1.5417104	119.4011547	4.820088	4.807272	51	Mamuju	170.0.172.91	202.65.234.91	https://www.speedtest.net/my-result/a/11213364542
04/11/2025, 13.08	Wifi	-1.5417161	119.401102	4.6614	4.557528	44	Mamuju	170.0.172.91	202.65.234.91	https://www.speedtest.net/my-result/a/11213363935

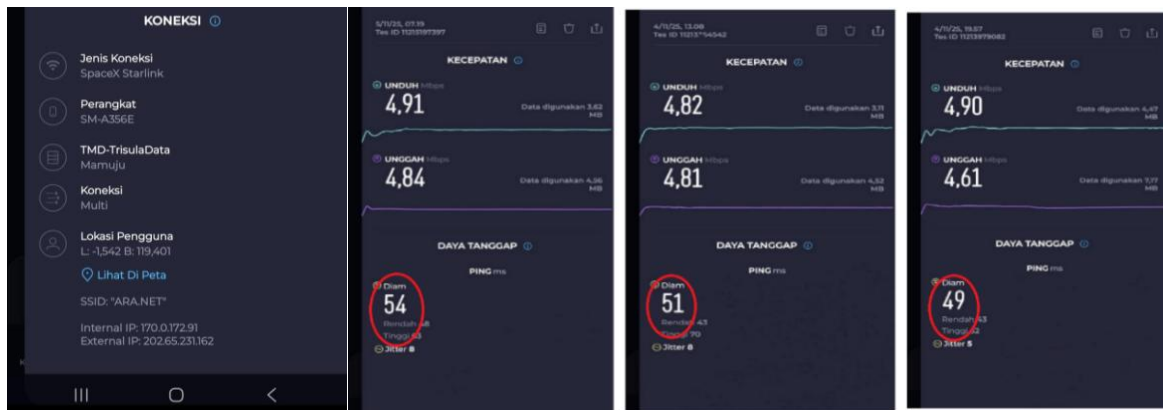


Figure 13. Testing Network Stability Using Speedtest by Ookla.

Figure 13 above shows the results of network stability testing using the Speedtest by Ookla app, examining the ping results at different times. This test was conducted to assess the level of network stability and compare the results obtained with those from the Speedtest Master app.

Table 4. Network Stability Test Results 2.

Test Time	Test No.	Ping Result (ms)
Morning	1	54 ms
	2	57 ms
	3	55 ms
Afternoon	4	41 ms
	5	51 ms
	6	44 ms
Night	7	47 ms
	8	49 ms
	9	50 ms
Average Morning Ping	-	$(54+57+55) \div 3 = 55$ ms
Average Afternoon Ping	-	$(41+51+44) \div 3 = 45$ ms
Average Nighttime Ping	-	$(47+49+50) \div 3 = 48$ ms
Overall Average Ping	-	$(55+45+48) \div 3 = 49$ ms

Based on the test results in Table 3 above, conducted at three different times (morning, afternoon, and evening), the average ping values were 46 ms in the morning, 51 ms in the afternoon, and 59 ms in the evening, with an overall average of 52 ms. These values indicate that the network in the morning has a faster and more stable response compared to other times, while at night there is a slight increase in ping values due to the increased number of active users.

Meanwhile, the test results in the following Table 4 show an average ping value of 55 ms in the morning, 45 ms in the afternoon, and 48 ms at night, with an overall average of 49 ms.

Based on a comparison of the two test results, it can be concluded that the RT/RW Net WiFi network in Motu Village, Pasangkayu Regency, West Sulawesi, exhibits good stability, with an overall average ping in the range of 49–52 ms well below the 100 ms threshold typically used as a benchmark for a stable connection. This indicates that network management is functioning optimally, with fast connection response times and relatively minimal fluctuations in ping over time. Thus, it can be concluded that the network is operating stably and in line with its configured capacity, based on both the first and second tests.

Network Security Testing

Network security testing was conducted to ensure that the RT/RW net Wi-Fi network system that has been built has adequate protection against unauthorized access. This testing focused on user authentication, data protection, and network access restrictions.

Table 5. Network Security Test Results.

No	Observation Variable	Unit	Observation Results
1	PPPoE	Present/Absent	The PPPoE system is working properly, allowing only users with valid voucher codes to connect to the internet.
2	Hotspot Login	Yes/No	Available – The login page appears automatically, and internet access is granted only after successful authentication.
3	Voucher System	Available/Not Available	Available – The voucher system works properly, where vouchers can only be used once and are valid for a predetermined period of time.
4	Free Access with MAC Binding	Yes/No	Yes – The free access feature with MAC Binding functions as expected, where only registered devices receive full access, while other devices are restricted.

Table 5 above is a security testing table for the RT/RW Net Wi-Fi network as a solution for internet needs in Motu Village, Pasangkayu Regency, West Sulawesi. This table is used to verify the security of the RT/RW Net Wi-Fi network, ensuring that all network security measures are functioning properly and in accordance with the established security protocols.

- a. During PPPoE account testing, the system was able to authenticate users correctly. Users who entered a valid username and password were able to connect to the internet, while users who entered incorrect credentials were denied access by the system. This demonstrates that the PPPoE feature successfully restricts access to registered users only, thereby enhancing network security.
- b. Furthermore, during the hotspot login testing, the system was able to automatically display the login page when a device connected to the WiFi network. After the user correctly entered their username and password, the internet connection could be used without any issues. This feature demonstrates that the hotspot-based authentication system functions as intended to verify the user’s identity before granting network access.
- c. In the voucher system testing, the results showed that vouchers created with a specific time limit (e.g., 3 minutes) functioned as configured. Once the usage time expired, the system

automatically disconnected the user. This indicates that the voucher system effectively limits the time and duration of internet usage for RT/RW Net users.

- d. In the free access test with MAC Binding, the results showed that only devices with registered MAC addresses could access the internet fully. Other unregistered devices could not access the internet, or could only access free educational websites even if they knew the Wi-Fi password. Thus, the MAC Binding feature works well to provide access control based on device identity.

Overall, the test results show that the designed RT/RW Net system has functioned optimally. All features, ranging from PPPoE authentication, hotspot login, the voucher system, to MAC Binding-based free access, are working well as intended. This implementation not only provides convenience for users but also maintains security and order in the distribution of internet access within the RT/RW Net environment.

Network Range Testing



Figure 14. Network Range Testing.

Figure 14 above shows a network coverage test. This network coverage test was conducted to determine the extent of the area covered by the WiFi signal from the RT/RW Net system. The results of this test were used to assess signal strength and stability at each measurement point, thereby determining whether the network is capable of adequately covering the entire user area.

Table 6. Network Range Test Results.

No	Test Direction	Distance (m)	Download Speed (Mbps)	Upload Speed (Mbps)	Ping (ms)	Signal Indicator
1.	Front	1–14 m	5 Mbps	5 Mbps	36 ms	green
2.	Front	15–20 m	5 Mbps	5 Mbps	46 ms	yellow
3.	Front	21 m	1 Mbps	1 Mbps	113 ms	Red
4.	Rear	1–10 m	5 Mbps	5 Mbps	44 ms	green
5.	Back	11–13 m	4 Mbps	5 Mbps	44 ms	yellow
6.	Back	14–17 m	1 Mbps	1 Mbps	2295 ms	Red
7.	Right Side	1–10 m	5 Mbps	5 Mbps	54 ms	green
8.	Right Side	11–14 m	5 Mbps	3 Mbps	64 ms	yellow
9.	Right side	15–19 m	1 Mbps	1 Mbps	1985 ms	red
10.	Left Side	1–10 m	5 Mbps	4 Mbps	42 ms	green
11.	Left Side	11–14 m	5 Mbps	5 Mbps	49 ms	yellow
12.	Left Side	15–19 m	1 Mbps	1 Mbps	1461 ms	red

Table 6 above shows the results of the network range test. Based on the table above, it can be seen that network quality and connection stability decrease as the distance between the receiving devices and the signal transmitter (access point) increases.

- a. In the forward direction, the results show that at distances of 1–20 meters, download and upload speeds remain stable at around 5 Mbps, with a green signal indicator and low ping values (36–46 ms). However, at 21 meters, the speed drops to 1 Mbps and the ping increases to 113 ms, indicating that the signal is beginning to weaken.
- b. In the rear direction, similar results were observed. At distances of 1–10 meters, the connection remained stable at 5 Mbps with a ping of 44 ms, but began to degrade at 11–13 meters and became very weak at 14–17 meters, with ping surging to 2295 ms and the signal indicator showing only a red.
- c. For the right side, at distances of 1–10 meters, the speed remains optimal at 5 Mbps, but begins to decline at 11–14 meters to 3 Mbps, and at 15–19 meters drops drastically to 1 Mbps with very high ping (1985 ms)
- d. Meanwhile, on the left side, the results show a similar pattern. At close range (1–14 meters), the connection remains stable with speeds between 4–5 Mbps, while at a distance of 15–19 meters, the signal drops to 1 Mbps with a ping of 1461 ms.

Overall, the test results indicate that the effective range of the RT/RW Net WiFi network is approximately 15 meters from the access point, with stable signal quality and a maximum speed of 5 Mbps. Beyond this distance, signal strength decreases significantly, as evidenced by a drop in data transfer speed and an increase in ping values.

Free Educational Testing

Free educational testing was conducted to ensure that the deployed RT/RW Net WiFi network system can provide exclusive free access to educational websites in accordance with the system's development objectives. This testing focused on user access restrictions, specifically ensuring that users can access educational websites without needing a voucher, yet remain unable to access non-educational websites before logging in or entering a voucher.

Table 7. Results of the Free Educational System Testing.

No	Observation variable	Unit	Observation Results
1.	Access to educational websites without a voucher	Yes/No	Yes Educational websites can be accessed without logging in with a voucher, in accordance with the free access feature
2.	Access to non-educational sites without a voucher	Yes/No	No Access to non-educational sites is blocked before voucher login
3.	Full access using a voucher	Yes/No	Yes After logging in with a voucher, all sites can be accessed normally

Table 7 above shows the results of testing the free educational system. Based on the test results presented in the table,

- a. the free educational system on the RT/RW Net WiFi network demonstrates good performance and functions as expected. From the observations, it is evident that users can access educational websites without needing to use a voucher, indicating that the network configuration to provide free access to educational domains is functioning correctly.
- b. Conversely, when users attempt to access non-educational websites without a voucher, the system automatically denies or blocks access. This demonstrates that the access restriction system is functioning as designed, allowing only educational websites to be accessed for free.
- c. Furthermore, after users log in using a voucher, internet access becomes full and unrestricted, allowing all websites both educational and non-educational to be accessed normally. These results indicate that the authentication and voucher management mechanisms on the network are functioning properly and are capable of distinguishing access rights between free and paid users.

Overall, the test results prove that the free educational feature on the RT/RW Net WiFi system functions optimally, supporting community learning activities without compromising network control and security.

a. Network Speed Test Results When Users Are Active Simultaneously

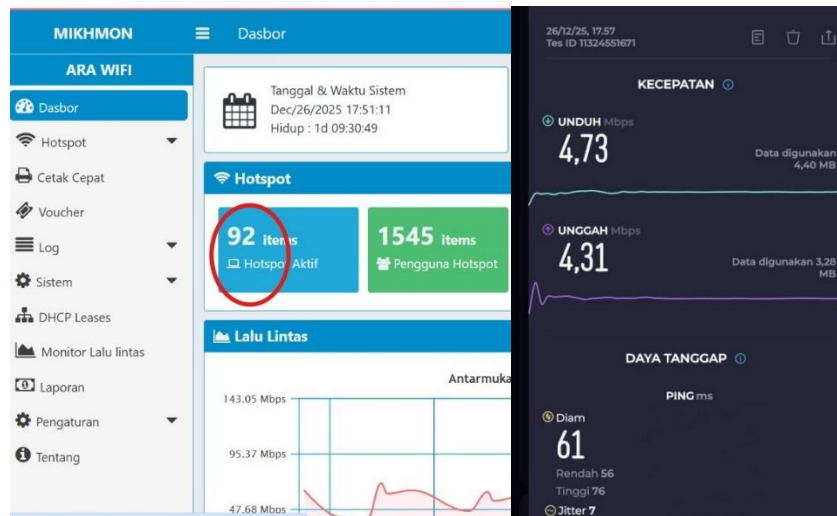


Figure 15. Network Speed Test Results When Users Are Active Simultaneously.

Figure 15 shows the results of network speed tests conducted while users were actively using the Speedtest app simultaneously. These tests were designed to assess network service quality when used by multiple users simultaneously, including measurements of download speed, upload speed, and ping values.

Table 8. Network Speed Test Results When Users Are Active Simultaneously.

No	Number of Active Users	Download Speed (Mbps)	Upload Speed (Mbps)	Ping (ms)
1.	92 Users	4.73 Mbps	4.31 Mbps	61 ms

Based on the measurement results shown in Table 8, it was found that when the number of active users reached 92, the download speed was 4.73 Mbps, while the upload speed was 4.31 Mbps, with a ping value of 61 ms. These test results indicate that even though there were a significant number of users accessing the network simultaneously, the internet connection quality remained fairly stable. A ping value below 70 ms indicates that network response is still considered good, despite a decrease in speed due to high network usage load. This indicates that the implemented network system is still capable of serving user needs simultaneously with fairly optimal performance.

Discussion

Advances in information and communication technology have brought about significant changes in various aspects of human life. The internet is no longer viewed as a secondary need but has become an essential requirement that supports educational, economic, social, and public service activities. This aligns with research indicating that the public's growing reliance on the internet drives the need for stable and reliable networks. The availability of adequate internet

access has been proven to directly contribute to the improvement of human capital and local economic growth, particularly in rural areas. However, the equitable distribution of internet access in Indonesia still faces various challenges, especially in remote areas with limited telecommunications infrastructure. One such area facing these challenges is Motu Village in Pasangkayu Regency, West Sulawesi Province. Difficult-to-reach geographical conditions, weak cellular signals, and the lack of cable network infrastructure and internet service providers have caused the village community to face limitations in obtaining stable, high-speed internet access. This situation reinforces research findings stating that limited data quotas and unstable cellular network quality are the primary barriers to the community's freedom to access internet services optimally. The digital divide between urban and rural areas is widening the gap in the utilization of information technology among rural communities. Students face difficulties participating in online learning, micro and small business owners are unable to develop digital marketing for their products, and the general public has limited access to online government information and services. This phenomenon aligns with research confirming that limited access to technology in rural areas is a key factor hindering digital transformation and equitable development.

In response to this issue, this study developed a solution based on the RT/RW Net WiFi network, specifically the implementation of the RT/RW Net WiFi network as a solution to meet internet needs in Motu Village, Pasangkayu Regency, West Sulawesi, which has proven effective in providing internet access in Motu Village despite infrastructure limitations. The results of this study reinforce previous findings indicating that the RT/RW Net network can meet the internet needs of the village community through efficient bandwidth management using Mikrotik. By sharing a single primary internet source distributed to RT and RW neighborhoods, this network reduces access costs while expanding service coverage.

In this study, the primary internet connection source utilized the Starlink service, which is capable of reaching remote areas without relying on terrestrial network infrastructure. The use of this satellite technology serves as the key distinction from previous studies, which generally relied on cable ISPs such as Indihome or Telkom. The use of Starlink has proven effective in overcoming infrastructure limitations that previously posed a major challenge in Motu Village, while ensuring a stable and sustainable internet connection. The Starlink internet connection is then managed using Mikrotik RouterBoard devices, switches, and access points connected via a fiber-optic network. This implementation aligns with research indicating that the use of Mikrotik in RT/RW Net networks can provide stable 24-hour internet connectivity and effectively manage bandwidth to maintain service quality. In addition to providing internet

access, this study also implements a voucher-based user management system with the assistance of the Mikhmon application. This system enables fair bandwidth allocation, control over user session durations, and enhanced network security through *PPPoE* authentication and *MAC Binding*. These results reinforce research indicating that the *voucher* system on RT/RW Net networks is highly effective in controlling user access and fostering more organized internet usage. This study also implements a policy of free access to educational websites and official government services. This approach not only supports equitable education but also expands the utilization of the RT/RW Net network as a means to enhance digital literacy among rural communities. This step represents an added value compared to previous studies, which generally focused on the technical and commercial aspects of internet services. The system design and testing process was conducted in stages, ranging from network topology design, hardware and software configuration, to direct field testing. The test results showed that the network was capable of providing a stable internet connection with a ping value below 50 ms, indicating a responsive and reliable connection quality.

Thus, this study demonstrates that the implementation of the RT/RW Net Wi-Fi network as a solution to internet needs in Motu Village, Pasangkayu Regency, West Sulawesi using Starlink and Mikrotik represents an innovative step toward achieving equitable access to technology in rural areas. This system not only expands internet connectivity but also supports improved quality of life for the community through easier access to information, education, and economic opportunities. The results of this study are expected to serve as a foundation for the development of similar networks in other regions, so that the vision of national digital equity can be realized in a tangible and sustainable manner.

5. CONCLUSION AND RECOMMENDATIONS

Based on the results of the design, implementation, and testing conducted in this study regarding the implementation of the RT/RW Net Wi-Fi network as a solution to internet needs in Motu Village, Pasangkayu Regency, West Sulawesi, the following conclusions can be drawn:

Based on the results of the design, implementation, and testing that have been conducted, it can be concluded that the implementation of the RT/RW Net Wi-Fi network as a solution to meet internet needs in Motu Village, Pasangkayu Regency, West Sulawesi, has successfully provided internet access in areas previously unreachable by cellular networks or conventional internet service providers (ISPs). The use of Starlink satellite technology as the primary ISP source has proven capable of overcoming the limitations of terrestrial network infrastructure

and the difficult-to-reach geographical conditions of the village, thereby enabling the community to obtain sustainable internet access. The RT/RW Net network, designed using Mikrotik devices, switches, access points, and fiber-optic transmission media, is capable of providing a stable and reliable internet connection.

The results of a three-month network test in Motu Village which included testing of internet speed, network stability, system security, signal coverage, and the free education system demonstrated good performance. In the speed test, the network was able to provide stable download and upload speeds at various times of use. Security testing via PPPoE, hotspot login, *voucher system*, and MAC binding showed that the authentication system worked according to configuration. Network coverage testing in all four cardinal directions showed even signal distribution, accessible to users at a certain distance with consistently stable connection quality. Additionally, the implemented free educational services also operated as intended, allowing access to learning websites without the need for *vouchers*.

Although this study has successfully established the RT/RW Net Wi-Fi network as a solution to meet internet needs in Motu Village, Pasangkayu District, West Sulawesi, several recommendations can be provided for further improvement and development: Increase network capacity as the number of users grows to ensure internet quality remains stable. Conduct periodic evaluations of speed and user complaints. Create a user communication group to expedite the reporting of issues and their resolution.

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