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Implementation of Mikhmon Server for Qos Optimization and Traffic Control on Mikhmon Hotspot Network at Amicom Net

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Abstract

The increasing demand for stable and fair internet access, particularly on public networks like hotspots, presents challenges in maintaining Quality of Service (QoS) and ensuring balanced traffic distribution. This study aims to implement and evaluate the effectiveness of the Mikhmon Server as a solution for user management and traffic control on the Mikrotik hotspot network at AMICOM NET. A quantitative experimental approach was used by comparing network performance before and after the implementation of Mikhmon. Key QoS parameters measured include latency, throughput, and bandwidth fairness. Mikhmon, a web-based tool for managing Mikrotik users, enables administrators to set speed limits, distribute bandwidth evenly, and monitor user sessions in real-time. The results indicate a significant improvement in traffic management efficiency, with average latency reduced by 52.63% and more equitable bandwidth distribution among users. These findings demonstrate that Mikhmon is a practical and cost-effective tool for optimizing medium-scale hotspot networks.

Keywords: Mikhmon, Mikrotik, QoS, Hotspot, Network Traffic, Bandwidth Management

1. INTRODUCTION

Reliable internet connectivity is increasingly essential in both public and private networks. In public hotspot environments, where many users access the internet simultaneously, network performance often suffers from high latency, uneven bandwidth distribution, and congestion. These issues directly affect the Quality of Service (QoS) and user experience. Mikrotik routers have become a popular solution for managing such networks due to their affordability and flexibility. However, managing bandwidth and users effectively with Mikrotik can be complex, especially without additional management tools. Traditional configurations often lack dynamic traffic control and real-time monitoring features. Mikhmon is a web-based tool that enhances Mikrotik's capabilities by providing a more user-friendly interface for managing user access, traffic monitoring, and bandwidth allocation through voucher-based login systems. While Mikhmon has been adopted in various informal networks (e.g., RT/RW Net), there is limited empirical data evaluating its impact on QoS metrics in structured hotspot environments.

This study aims to fill that gap by implementing Mikhmon Server on the AMICOM NET hotspot network and analyzing its effect on key QoS parameters such as latency, throughput, and bandwidth fairness. The novelty of this research lies in its empirical evaluation of Mikhmon's practical benefits in a real-world medium-scale hotspot, providing a cost-effective alternative to more complex and expensive traffic management systems. This service can also be observed in a world where the Internet is an information technology that cannot be controlled in its development across society at large [1]. Internet connections are not only used by individuals but also by various entities such as companies, hospitals, and the education sector. Mikrotik RouterOS is an operating system used on Mikrotik devices that has many features and capabilities for managing networks [2]. When the number of internet users increases simultaneously, networks often experience congestion, high latency, and significant throughput reduction. In the context of Mikrotik, this includes DHCP Server settings, Hotspot Setup, Firewall Rules, and bandwidth management settings [3].

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This results in some users not experiencing optimal internet access, especially on networks without an efficient traffic management system. A mixed- methods approach was used, combining quantitative performance measurements and qualitative user feedback [4]. Excessive internet usage, along with some home internet users using internet access for gaming or downloading, causes available bandwidth to be concentrated on those users, resulting in other internet users experiencing an unstable internet connection. Mikrotik is a reliable router that can enhance our network system; by using Mikrotik, our network will become more stable [5]. This occurs due to ineffective use of the internet on home internet networks, due to the large amount of sharing. When managing or controlling the internet, every company/office, especially those with unstable bandwidth and excessive internet usage at home [6]. Based on the hotspot system, for example, based on the PPPoE Network and RT/RW Net Hotspot Server, this was built to provide affordable internet to the community [6], [7].

Therefore, a solution is needed that can optimize traffic management functions without overburdening available technical resources. Mikhmon Server emerges as an alternative solution capable of simplifying user management processes on Mikrotik hotspot networks. The advantages of Mikhmon in hotspot bandwidth management compared to User Manager. This study shows that Mikhmon has more stable throughput approaching the bandwidth limit, lower packet loss, and lower delay. Findings [6], [8]. Therefore, Mikhmon Server can be used as a tool to simplify user authentication management. MikroTik routers have been extensively adopted as internet gateways in router-on-a-stick (RoaS) networks [6], [9]. With Mikhmon Server, network administrators can effectively manage and monitor users. Bandwidth management is the proper allocation of bandwidth to support the needs and requirements of applications or network services [6]. The results show that the use of Mikhmon can reduce excessive bandwidth consumption by individual users by 35%, thereby improving the fairness of traffic distribution on the hotspot network. In addition, by building an efficient infrastructure network and using Fiber Optic network technology, Fast.net can provide high-speed internet access with better quality. Furthermore, by implementing a MikroTik-based Hotspot Server with Mikhmon features [2], [10], [11], [12], it was revealed that the combination of MikroTik routers is one of the operating systems that can be used as a network router, encompassing a wide range of features for both wired and wireless networks. MikroTik has become a common choice in the information technology world due to its designation as a reliable computer router network.

The open-source nature of MikroTik makes it a highly favored router in the information technology field [13]. Mikhmon enhances the efficiency of QoS management in voucher-based RT/RW-net network environments by up to 40% compared to manual management with MikroTik router configurations at the research location [13], [14], [15]. MikroTik has become one of the popular solutions for providing widespread and easily accessible wireless internet access. However, the main challenge in operating a network is the development of appropriate and effective network infrastructure, which has become an urgent need for system administrators using Mikhmon [16], [17], [18]. QoS methods are a crucial component in ensuring network service performance, especially in the context of public hotspot networks with high traffic dynamics. QoS parameters such as latency, jitter, and packet loss serve as performance indicators that determine the quality of the user experience [19], [20], [21]. The primary purpose of constructing a computer network is to transmit data and information from the sender to the recipient quickly and accurately without errors through a specific transmission medium or communication medium [22], [23].

2. METHODS

This study uses an experimental quantitative method with a case study approach conducted on the Mikrotik hotspot network at AMICOM NET, can be seen in the Figure 1. The purpose of this method is to measure the impact of Mikhmon Server implementation on service quality (Quality of Service/QoS) parameters and network traffic control [24], [25]. Data collection was conducted through direct observation before and after the implementation of the Mikhmon-based management system, and then analyzed using technical parameters such as latency, throughput, and bandwidth usage. The Design Thinking as show on Figure 1 stages applied in this study include:

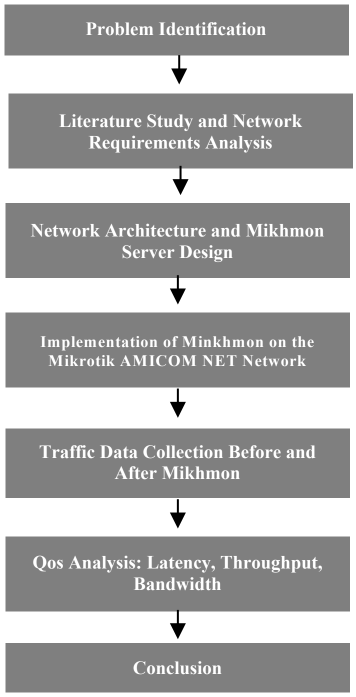

Figure 1. Flowchart Design Thinking

2.1 Problem Identification

This study used a quantitative experimental method by comparing QoS parameters before and after the implementation of Mikhmon Server on the AMICOM NET Mikrotik hotspot network. The experiment involved 60 users daily, with approximately 30 actives simultaneously. Baseline data were recorded before implementing Mikhmon, and follow-up data were gathered after full deployment of the server. The evaluation focused on three main indicators: **latency, throughput**, and **bandwidth fairness**. Data were collected over a one-week period during peak usage hours (12:00–14:00 and 19:00–21:00).

- **Latency** was measured using the Ping command to a stable external server (8.8.8.8), with 100 pings per session.
- **Throughput** was tested using Speedtest CLI and monitored via Winbox's real-time traffic graphs.
- **Bandwidth fairness** was evaluated using the coefficient of variation from per-user bandwidth logs retrieved from Mikhmon.

2.2 Literature Study and Network Requirements Analysis

Literature on QoS, Mikrotik, and Mikhmon was reviewed to establish a theoretical basis and determine the parameters to be used. Technical network requirements such as the number of users, hotspot topology, and bandwidth capacity were analyzed as the basis for the design [24].

2.3 Network Architecture and Mikhmon Server Design

The network architecture was developed by integrating a Mikhmon Server into the existing Mikrotik topology. The server was installed on a local computer and configured to communicate with the Mikrotik router through the API. In this setup, the network operates with a total bandwidth of 50 Mbps, serving an average of 60 users per day, and employs a login system based on user vouchers generated via Mikhmon.

2.3.1 Network Parameters

The analysis of network requirements and performance is based on several key parameters: a total bandwidth (B) of 50 Mbps, an average of 60 users per day (N), and an access model that utilizes voucher-based logins through Mikhmon.

2.3.2 Estimated Bandwidth Per User

To ensure quality of service (QoS), it is necessary to estimate the bandwidth requirements per user. This bandwidth is calculated by dividing the total bandwidth by the maximum number of concurrent users. It is assumed that not all 60 users are active at the same time. In a general network, it is assumed that the simultaneous usage ratio is 40%–60% of the total number of users. Assumptions:

$$N_a = 0,5 \times 60 = 30 \text{ user}$$

Bandwidth per User Calculation (B_u):

$$B_u = \frac{B}{N_a} = \frac{50 \text{ Mbps}}{30} = 1,67 \text{ Mbps/user}$$

So, each user will get an average bandwidth allocation of ±1.67 Mbps, which is sufficient for light to moderate activities such as browsing, SD (Standard Definition) video streaming, and social media use.

2.3.3 Mikhmon Server Requirements

The primary function of the Mikhmon server is to create, manage, and monitor user vouchers. In its analysis, several components were considered: the stability of the Mikrotik API connection, ensuring it does not exceed the router's simultaneous connection limit; the CPU and RAM requirements, which vary depending on the frequency of user logins; and the estimated number of login queries per day (Q_l), calculated based on the assumption that each user logs in once per day on average.

$$Q_l = N = 60 \text{ login/day}$$

Assuming that the login duration is evenly distributed over 10 active hours:

$$\text{Query per Minute } (Q_m) = \frac{Q_l}{10 \times 60} = \frac{60}{600} = 0,1 \text{ login/minute}$$

This workload is relatively light and can be efficiently handled by a mid-range server computer, with minimum specifications including a dual-core 2.0 GHz CPU, 2 GB of RAM, and a 20 GB SSD to ensure fast access to log files and voucher databases.

2.3.4 Advantages of This Architecture

Integrating a Mikhmon Server into the network topology enhances system control, particularly in user management and bandwidth distribution [19]. This addition enables network administrators to easily create and print vouchers, monitor user time and data usage, and implement dynamic bandwidth restrictions and controls.

2.4 Implementation of Mikhmon on the Mikrotik AMICOM NET Network

At this stage, Mikhmon is implemented as a system voucher-based user management. Several features such as speed limits, session timeouts, auto disconnect, and real-time monitoring are enabled [20]. QoS configuration is performed using Simple Queue and PCQ (Per Connection Queue) on the Mikrotik router.

2.5 Traffic Data Collection Before and After Mikhmon

Technical performance data, including latency, jitter, and bandwidth usage, were collected using tools such as Ping Test, Winbox, and Speedtest CLI. Before the implementation of Mikhmon, the average latency was 95 ms, and bandwidth usage was highly uneven, with some users consuming over 10 Mbps while others had less than 512 Kbps. After integrating Mikhmon, the average latency improved to 45 ms, and bandwidth distribution became more balanced, averaging between 1.5 and 2 Mbps per user.

2.5.1 Comparison of Latency Before and After Mikhmon

To evaluate the impact of implementing Mikhmon on network performance, the percentage improvement in latency was calculated. Latency, which measures the time delay in data transmission, is a critical indicator of network responsiveness. By comparing the average latency before and after Mikhmon integration, it is possible to quantify the efficiency gains in routing and traffic management. The following formula was used to determine the Latency Improvement Percentage (ΔL%) Formula:

$$\Delta L\% = \left(\frac{L_{before} - L_{after}}{L_{before}}\right) \times 100\%$$

- Before Mikhmon: $L_{before} = 95$ ms
- After Mikhmon: $L_{before} = 95$ ms

$$\Delta L\% = \left(\frac{95 - 45}{95}\right) \times 100\% = \left(\frac{50}{95}\right) \times 100\% \approx 52.63\%$$

The results indicate a 52.63% reduction in average latency, reflecting a significant improvement in routing efficiency and overall traffic management. This enhancement can be attributed to the more balanced bandwidth allocation achieved through the Mikhmon system, which prevents excessive usage by individual users and ensures fairer resource distribution across the network.

2.5.2 Bandwidth Distribution per User

Before the implementation of Mikhmon, bandwidth allocation was highly uneven, with certain users receiving more than 10 Mbps while others had less than 512 Kbps. After applying Mikhmon with per-user bandwidth limits, distribution became more uniform. The Bandwidth Inequality Coefficient (K_k) can be determined using the Range Coefficient formula:

$$K_k = \frac{B_{max} - B_{min}}{B_{max} + B_{min}}$$

In this case, before Mikhmon:

$$B_{max} = 10\ Mbps$$

$$B_{min} = 0.5 Mbps$$

$$K_k^{before} = \frac{10 - 0.5}{10 + 0.5} = \frac{0.5}{3.5} \approx 0.905$$

After use Mikhmon (assumed range between 1.5 – 2 Mbps) :

$$K_k^{after} = \frac{2 - 1.5}{2 + 1.5} = \frac{0.5}{3.5} \approx 0.143$$

The results show a substantial reduction in the bandwidth inequality coefficient, dropping from 0.905 to 0.143. This indicates that bandwidth distribution among users became significantly more balanced, enhancing fairness in network access. Such an improvement not only ensures that no single user monopolizes resources but also helps minimize potential latency and jitter, leading to a smoother and more consistent user experience across the network.

2.5.3 Impact on the Network

Although jitter data is not explicitly mentioned, the significant decrease in latency and more even distribution of bandwidth among users indicates that jitter has been reduced. This is consistent with the increased stability of network traffic.

2.5.4 Summary of Comparison Results

Table 1. Internet Performance Before and After Using Mikhmon

Parameter	**Before Mikhmon**	**After Mikhmon**	**Alteration**
Latency Average (ms)	95	45	↓ 52.63 %
Highest Bandwidth	>10 Mbps	2 Mbps	Limited
Lowest Bandwidth	<512 Kbps	1.5 Mbps	Improve
Inequality Coefficient	0.905	0.143	↓ 84.2 %

From the data table 1 presented that the average latency before using Mikhmon was 95, while after using Mikhmon it became 45, indicating a change of 52.63%. The use of Mikhmon also significantly impacts bandwidth performance, which previously reached over 10 Mbps at its highest for some user and less than 512 Kbps at its lowest, now reaching 2 Mbps at its highest and 1.5 Mbps at its lowest for all the users. This has narrowed the coefficient of variation from 0.905 to 0.143, representing a decrease of 84.2%.

3. RESULT AND DISCUSSIONS

The implementation of Mikhmon on the hotspot network introduces structured network usage management through voucher login. Each usage is accompanied by dynamic bandwidth restrictions using Mikrotik's PCQ (Per Connection Queue) feature. This enables real-time monitoring and control of each user session, resulting in a more balanced network allocation. For example, before implementation, bandwidth usage varied significantly from 512 Kbps to over 10 Mbps per user. This caused congestion and uneven access. After the Mikhmon policy was implemented, each user was limited to 2 Mbps. This made data distribution traffic more even, as shown by the decrease in the bandwidth inequality coefficient from 0.905 to 0.143. These results are consistent with previous studies [13][19], which emphasize the role of automatic bandwidth management in improving QoS in network sharing. Unlike manual settings, Mikhmon simplifies network traffic control by integrating user authentication, monitoring, and rule enforcement into a single platform. This significantly improves the ability to fairly share the network and reduce load during peak hours.

3.1 Mikhmon Server Implementation

The implementation of Mikhmon Server makes the network system more evenly distributed. Traffic can be monitored more easily based on IP allocation and user monitoring, thereby fulfilling QoS analysis through usage graphs and tables, can be seen in the Figure 2.

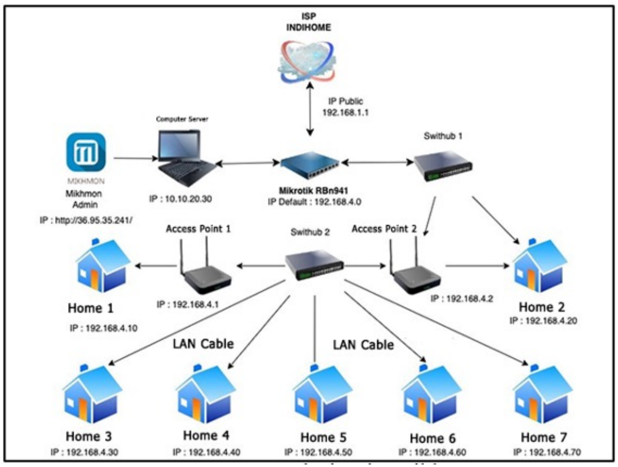

Figure 2. QoS system design in Mikhmon

Based on Fig. 2, it can be seen that the network distribution is becoming more evenly distributed. Through the IP address, Mikhmon is connected to Mikrotik. Swithub is connected to the

Access Point, and then the network are distributed through a LAN cable. Figure 3 shows the dashboard display of the **MikMon (Mikrotik Monitor)** application, which is used to monitor and manage Mikrotik hotspots.

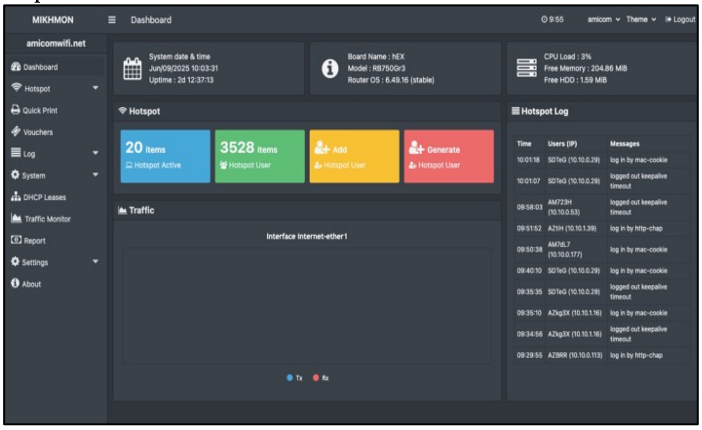

Figure 3. Traffic monitoring and table from Mikhmon

The Figure above shows that after Mikhmon is implemented, the quality and quantity of network management servers can be improved, both in terms of management and monitoring. This minimizes data traffic imbalances, thereby increasing customer satisfaction. In addition, its implementation can identify network problems in homes and at specific access points. Figure 4 shows the **User Profile** page of the MikMon (Mikrotik Monitor) application, which is used to manage hotspot user account profiles.

Based on the Figure 4, it is known that Mikhmon allows user access management. Its use can be configured, ranging from rate limited to expired mode. This certainly makes it easier to manage the network.It can be concluded that data traffic management can affect QoS or service. This allows the service to monitor and regulate user priorities and data traffic speeds on the AMICOM NET network system.

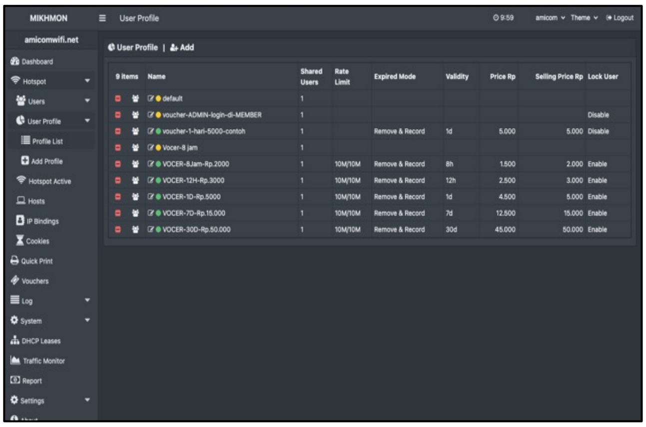

Figure 4. User and Traffic Management

3.2 Not Using Mikhmon Implementation

In this implementation, Mikhmon is not used. Instead, Mikrotik is used directly as part of the network management implementation. However, to use Mikrotik, first you must connect to the internet. This makes the network inaccessible from anywhere. Then, to configure it, you must log in to the main server. Figure 5 shows a **network topology diagram** for an internet distribution setup using a Mikrotik RB941 router.

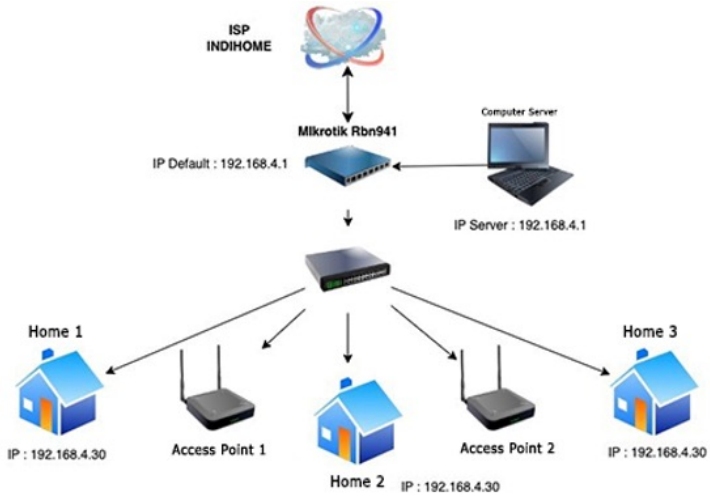

Figure 5. QoS system design without Mikhmon

Schematic of network design without implementing Mikhmon from QoS implementation, taking into account the above design, network management is carried out with mikhrotik with IP: default which can be shared among several users and existing homes. The weakness of this method is that monitoring cannot be carried out on certain networks and settings must be made from the mikrotik system interface.

4. CONCLUSIONS

The implementation of network management in all sectors, both in the business world and the industrial sector, is very important, because the need for internet access has become a vital requirement for data transmission and storage. Mikhmon is here to simplify network management and monitoring, enabling the provision of the best services by monitoring traffic and user activity within the network. The results of this study indicate that the implementation of the Mikhmon tool yields significantly better results compared to not using Mikhmon. Particularly in managing users and data traffic flow.

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