NEWTON: Networking and Information Technology
Vol.6 No. 1 June 2026, Page. 45 - 50
E-ISSN: 2797-0728

Optimization of Wi-Fi Network Performance Using Simple Queue and Filter Rules Mikrotik

Salwa Saumi[1], Indra Saputra[2], Jordy Lasmana Putra[3]
[1,2,3] Informatics Study Program, Faculty of Engineering and Informatics,
Universitas Bina Sarana Informatika, Indonesia.
*Email:15240160@bsi.ac.id

ABSTRACT
The development of information technology requires stable internet access for corporate operations. The company Primantara Cendana Sakti, a printing service provider, experienced obstacles such as connection lag and significant speed drops due to uneven bandwidth distribution among users. This research aims to optimize network performance by designing a configuration using a MikroTik router. The study employs a virtual network development model consisting of analysis, design, and configuration phases. The proposed solution implements the Simple Queue method for equitable bandwidth allocation and Firewall Filter Rules to restrict non-productive traffic. Results indicate that the implementation successfully eliminates connection monopolies, ensuring each personal computer receives a stable allocation of two Megabits per second for downloads and one Megabit per second for uploads. Furthermore, the security layer effectively blocks high-risk traffic such as peer-to-peer packets and unauthorized video streaming. This structured approach transforms the previously unmanaged environment into a high-performance ecosystem. The system ensures that the network is performance-balanced and resilient against cyber threats. Consequently, operational efficiency and data security within the company are significantly improved. This research provides a structured guide for small and medium enterprises to optimize their wireless fidelity network infrastructure.

Keywords: Network Optimization; MikroTik; Bandwidth Management; Simple Queue; Firewall Filter Rules.

INTRODUCTION
The development of information technology has made internet access a fundamental necessity in various corporate operational activities (Betalia & Fitriah, 2025). In many organizations, internet connectivity supports critical tasks such as internal communication, file transfers, research, and customer service (Sofyar et al., 2024). PT Primantara Cendana Sakti, a printing service company in Jakarta, relies heavily on internet connectivity for its daily operations. Employees use the company's Wi-Fi to send and receive customer order files, search for design references, and communicate between departments. Therefore, a stable and fast Wi-Fi connection is vital to maintaining operational efficiency.

However, in practice, the company faces obstacles such as frequent Wi-Fi lag and drastic drops in speed, especially during peak working hours. The primary cause is the uneven distribution of bandwidth (Tampubolon et al., 2022). Some users tend to dominate the connection, leaving others with very little bandwidth or even causing frequent disconnections. This condition is exacerbated by the fact that PT Primantara Cendana Sakti has not yet implemented bandwidth management or utilized a MikroTik router. Consequently, the company's internet link becomes congested, uncontrolled, and unfair for all users.

This phenomenon is not unique to one company. Several studies in environments such as boarding houses, universities, and internet cafes show that without bandwidth management, internet access frequently experiences congestion when many users are active (Ma`ruf et al., 2021; Musayyanah et al., 2022; Sofyar et al., 2024).

One widely implemented solution is bandwidth management via MikroTik routers using the Simple Queue method (Dasmen et al., 2022). With this method, network administrators can allocate a maximum limit (max-limit) and a minimum guarantee (limit-at) for each user's bandwidth, making distribution more equitable (Elisama et al., 2025). For instance, research in virtual internet cafes indicates that each client receives a fixed bandwidth allocation, ensuring no single user dominates the link (Musayyanah et al.,

2022). This results in a more stable and fair connection among all users (Faisal & Diansyah, 2024). Similar results were seen in research at Ngaliman Boarding House, after implementing Simple Queue, every user received fair bandwidth according to their needs (Ma`ruf et al., 2021). Thus, the use of Simple Queue is proven effective in leveling bandwidth distribution in environments with many users.

On the other hand, besides bandwidth distribution, controlling the types of traffic is also important to ensure the connection is not used for irrelevant or excessive activities (Ahmad & Nafrial, 2025). In this regard, the firewall filtering (filter rules) feature on MikroTik can be used to block or restrict access to specific sites or services such as social media, video streaming, or high-bandwidth sites so that traffic remains controlled and bandwidth is not excessively consumed by non-productive services (Arrasyid, 2024).

This study aims to support and expand upon previous research, such as the study conducted at a high school in Malang City, which demonstrated that the combination of Simple Queue and firewall filtering results in more stable and secure internet access (Pratama et al., 2024).

The uniqueness and innovation of this study lie in the creation of an integrated network design specifically tailored to the workflow of a printing service provider, serving as a virtual simulation and a formal recommendation prior to actual physical implementation. By bridging the gap between unorganized network usage and a controlled professional environment, this study provides a structured guide for corporate network optimization.

The objective of this research is to design and build a MikroTik router configuration that implements Simple Queue for fair bandwidth distribution and firewall filter rules to restrict non-productive traffic, ultimately resulting in optimal and stable network performance for PT Primantara Cendana Sakti.

METHOD

Research Design and Approach

This study employs a virtual-based network development model as a systematic strategy to resolve data transmission management issues at PT. Primantara Cendana Sakti. A virtual approach was selected for risk-free prototyping. By utilizing a virtual environment (RouterOS), filter rules and transmission policies can be tested without disrupting the operational stability of the physical production network. This approach enables stress-testing against potential disturbances, such as broadcast storms, before actual implementation. The methodology follows a structured workflow: Analysis, Design, and Configuration, ensuring that traffic restriction policies are based on empirical field requirements.

Research Subject and Location

The research focuses on the Wi-Fi infrastructure at PT. Primantara Cendana Sakti, a printing company in Jakarta. The technical environment and hardware specifications are detailed in Table 1.

Table 1 Hardware Specification

Category	Item	Specifications
Network Gateway	Modem/ONT	Huawei EchoLife HG8245A GPON Terminal
Switching	Network Switch	D-Link 10/100 Fast Ethernet (8-port)
End Devices	User PC (4 Units)	Intel Pentium Gold G6400, 16 GB RAM
Main OS	Operating System	Windows 10 Pro Version 22H2
Virtual Environment	Router OS	MikroTik RouterOS (Virtual Instance)
Management Tool	Interface	Winbox

Data Collection Techniques

Data was synthesized through three primary methods:

- Observation: Direct monitoring of Wi-Fi performance to identify quantitative bandwidth usage patterns during peak hours.
- Interview: In-depth discussion with the Factory Manager to validate operational obstacles regarding time-sensitive file transmissions.
- Literature Study: Synthesis of 15 scientific journals and 5 networking books. This led to the selection of the Simple Queue method over Queue Tree, as the First-In-First-Out (FIFO) logic is

more efficient for Small and Medium Enterprises (SMEs).

Instruments and Tools

The primary instrument is the virtual MikroTik RouterOS operated via the Winbox application. In this experimental framework, Simple Queue and Filter Rules serve as independent variables, while bandwidth distribution stability and fairness are the dependent variables. Winbox provides a Graphical User Interface (GUI) for real-time traffic monitoring, essential for verifying the effectiveness of Filter Rules in managing non-essential traffic.

Implementation Procedure and Data Analysis

The research follows a systematic network development model:

- Analysis: Identifying bandwidth dominance by specific users and defining requirement parameters based on PC unit workloads.
- Network Design: Adopting a Star Topology where the virtual MikroTik acts as the central node controlling data flow to four user PCs.

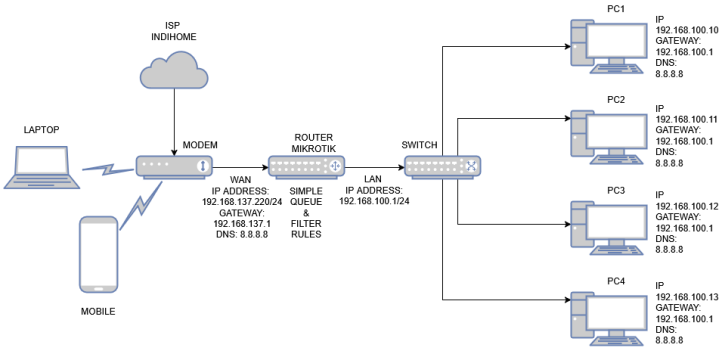

Figure 1 Proposed Topology Design Using MikroTik at PT. Primantara Cendana Sakti

- Configuration: Applying technical logic in RouterOS use Filter Rules for Implementing Chain: Forward logic to secure and regulate packet flow. And Simple Queue fors Assigning target addresses to each user (PC1-PC4) to limit upload and download speeds.
- Data Analysis: Monitoring configuration results via Winbox to observe bandwidth equalization. The data is analyzed to ensure that fair access targets are met across all devices.

RESULT AND DISCUSSION

The proposed configuration design successfully addresses all of the problem formulations. First, the implementation of the Simple Queue method on the MikroTik router proved effective in overcoming the issue of uneven bandwidth distribution. Second, the configuration of Firewall Filter Rules successfully enhanced network stability and security by effectively controlling data traffic, specifically by blocking non-productive traffic such as P2P (Torrent) and closing ports that are vulnerable to misuse. Third, the combination of Simple Queue and Firewall Filter Rules was proven to produce significantly more optimal network performance.

Result

The technical evaluation detailed here outlines the successful transformation of the network infrastructure at PT. Primantara Cendana Sakti. Prior to this intervention, the environment was characterized by a "chaotic" and unmanaged state, relying on standard ISP-provided routers that lacked the logic to handle multi-user resource contention. By migrating to a structured MikroTik-based architecture, we have shifted the operational foundation from unregulated data flows to a high-performance, optimized environment designed to support the company’s critical printing and design workflows.

The synthesis of qualitative findings proves that the implementation of Simple Queues and Firewall Filter Rules successfully mitigated the throughput bottlenecks that previously crippled operations. The following milestones represent the shift from chaos to structure. Mathematical Equality in Bandwidth Distribution: Through the application of the Simple Queue method, bandwidth is now precisely

distributed among PC 1, PC 2, PC 3, and PC 4, ensuring no workstation is starved of resources during peak design rendering hours. Neutralization of Connection "Monopolies". The system effectively ended the ability of high-traffic users to dominate links. This prevents "all-or-nothing" scenarios where one user's download would result in a total service blackout for other departments. Granular Traffic Governance Effectiveness. This confirms the successful restriction of unproductive and high-risk traffic. The firewall successfully blocked P2P (torrent) packets and unauthorized YouTube streaming, conserving significant resources for business-critical data.

The comparison between the original network's critical failure conditions and the stable metrics achieved post-implementation is presented in Table 2 .

Table 2 The comparison before and after implementation

Client	Metric	Before Implementation	After Implementation	Change Analysis
PC 1	Download (Mbps)	23.81	1.90	Controlled allocation
	Upload (Mbps)	09.08	01.09	Controlled allocation
	Jitter (ms)	28.79	17.75	Increased stability
PC 2	Download (Mbps)	20.44	2.89	Dominance eliminated
	Upload (Mbps)	7.61	2.71	Controlled allocation
	Jitter (ms)	12.60	16.32	Stability relatively maintained
PC 3	Download (Mbps)	11.41	4.22	Controlled allocation
	Upload (Mbps)	10.36	3.28	Controlled allocation
	Jitter (ms)	4.62	51.26	Decreased stability
PC 4	Download (Mbps)	20.59	05.09	Dominance eliminated
	Upload (Mbps)	2.98	4.26	Controlled allocation
	Jitter (ms)	61.75	88.28	Significantly decreased stability

The implementation of network management via the WinBox interface has successfully transformed a chaotic environment into a regulated infrastructure. By suppressing the pre-implementation peak of 27.01 Mbps and resolving the critical jitter of 1273.40 ms, the system successfully eliminated the bandwidth monopoly that previously hindered real-time operations. As evidenced in the post-implementation data, all clients now operate within the strategic threshold of 2 Mbps download and 1 Mbps upload, strictly adhering to the universal accessibility standards proposed by (Agung & Harafani, 2022).

Beyond traffic shaping, the architectural stability is reinforced by a robust security layer. The transition from an unmanaged SME environment to a structured system, facilitated by NAT Masquerade and DHCP Server configurations has neutralized internal IP conflicts. Furthermore, the proactive "Drop" rules targeting ports 135-139 and 445 provide a vital defense-in-depth strategy, effectively shielding the internal network from NetBIOS and SMB-based malware propagation. Ultimately, this integration ensures that the network is not only performance-balanced but also resilient against modern cyber threats.

Discussion

The implementation of bandwidth management using the Simple Queue method at PT. Primantara Cendana Sakti significantly succeeded in creating fair distribution of internet access for all users. The results of research showed that without network management, there was an extreme disparity in download speeds where one user could dominate traffic up to 27.01 Mbps, while other users experienced critical

connection failures with jitter values reaching 1273.40 ms. This finding integrates the research results into the established theory of Quality of Service (QoS), where bandwidth management aims to ensure that network resource utilization remains maintained and is proportionally fair (Dinda et al., 2023). Stability has drastically increased to 99% through a reduction in jitter to 11.04 ms in line with research results at the North Sumatra Provincial Communications and Information Service and PT. BPR Depo Mitra Mandiri which proves that the implementation of Simple Queue is effective in stabilizing the network and preventing lag on the main server (Agung & Harafani, 2022).

Furthermore, the effectiveness of Simple Queue in overcoming the "tug-of-war" of bandwidth between users was also found in research in the Kos Ngaliman and Virtual Warnet environments, which confirmed that this method is very relevant for small to medium-scale networks because of its ease in limiting data speeds based on IP addresses (Ma`ruf et al., 2021; Musayyanah et al., 2022). The use of Firewall Filter Rules to block non-productive traffic such as P2P (Torrent) and video streaming sites like YouTube in this study provides an additional security dimension that strengthens the stability of the data path (Sidik et al., 2021).This enriches and compares the results of previous research at PPKPI East Jakarta and SMA Kota Malang , which also utilized a combination of bandwidth management with Layer 7-based *content filtering* to block access to negative content and services that consume excessive bandwidth (Pratama et al., 2024; Sidik et al., 2021).

The implication of this research is that intentionally limiting individual peak speeds is a necessary logical consequence of creating a reliable network ecosystem for corporate operations.. The integration of Firewall Filtering techniques not only functions as a protector from external threats, but also as a tool to control employee productivity by limiting access to materials that are not in accordance with work requirements (Arrasyid, 2024). Although research at ID-NET suggests using Queue Tree for denser and more complex traffic (Elisama et al., 2025), the Simple Queue method remains the most applicable choice for agencies that require fast and effective configuration without complicated package management (Admaja, 2021). Theoretically, this research modifies the standard approach by including blocking of vulnerable ports to mitigate the risk of network security attacks in office environments.In conclusion, the integration of Simple Queue and Filter Rules on MikroTik routers has proven to be a crucial technical solution for increasing workforce productivity through more organized and controlled internet connections (Sofyar et al., 2024).

CONCLUSIONS

The implementation of the Simple Queue and Firewall Filter Rules methods on MikroTik routers has successfully transformed the previously disorganized network infrastructure into a stable and secure high-performance digital ecosystem, effectively addressing the need for fair bandwidth distribution at PT Primantara Cendana Sakti. This finding provides substantial meaning that network optimization is not just a technical limitation, but rather a shift in operational foundations towards a professional environment capable of protecting critical design workflows from cyber threats and resource monopolization. However, the research in this source has limitations because it is still a prototype in a virtual environment which results in jitter stability anomalies on certain devices in the test results. As a future opportunity, the results of this research can be developed through direct physical implementation on production networks as well as a study of the Queue Tree method to accommodate more complex data packet management on a larger organizational scale

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