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Implementation of a LAN Network in a Computer Laboratory Using MikroTik RB750Gr3

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Abstract. *This research aims to implement a Local Area Network (LAN) in a school computer laboratory using the Mikrotik RB750-GR3 device and additional switches. The methods used in implementation include designing IP addresses using class C subnetting techniques with a /27 subnet mask, configuring IP addresses on each interface, activating the DHCP Server, and implementing NAT (Network Address Translation) so that client devices can access the internet. All configuration is done through the Winbox application. Testing was carried out on network connectivity and internet access speed. The results show that the network can run optimally for a limited number of devices. The client's internet connection was stable, and no IP conflicts or connection issues were found. In conclusion, a LAN network can be implemented effectively using switches, so that all computers in the laboratory can be connected to a single network.*

Keywords: LAN Network, Mikrotik RB750-GR3, Subnetting, Bandwidth Management.

INTRODUCTION

With the rapid advancement of technology, the need for reliable network infrastructure in education continues to increase. Computer networks have become a crucial tool for communication and resource sharing. One vital infrastructure in a school environment is the internet. Local Area Network(LAN), which allows multiple devices in one location, such as a computer lab, to connect to each other. To optimize the use of internet, careful network design is required so that the system runs normally, safely and is easily accessible. Yasmida Vocational School in Ambarawa faces challenges related to unstable and slow internet connections, especially when used by many students simultaneously. This problem is caused by management.bandwidthunlimited, resulting in resource competition that results in decreased network performance. To address this issue, this study focuses on implementing a LAN network using the Mikrotik RB750-GR3 router, which is capable of managing data traffic and allocation.bandwidthevenly for many users. Several previous studies have addressed similar topics. Research by Suarezsaga et al. (2023) demonstrated an increase in students' understanding of LAN networks through hands-on training. Mustofa et al. (2022) successfully implemented network management. bandwidth using Mikrotik RB750-GR3 for RT/RW Net network

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with PPPoE protocol. Another study by Sangi et al. (2023) also succeeded in building a stable and secure Mikrotik-based network at SMP Negeri 3 Tondano using the Network Development Life Cycle(NDLC). Different from those studies, this study focuses on the direct implementation of a LAN network with a star topology in a vocational high school computer laboratory, with an emphasis on the Mikrotik RB750-GR3 configuration to overcome specific problems related to connection instability and contention.bandwidthin the teaching and learning environment. The purpose of this study is to design and implement an efficient and stable LAN network in the Computer Laboratory of SMK Yasmida Ambarawa using MikroTik RB750- GR3, as well as to analyze the effectiveness of network management.bandwidthon network performance and user experience.

LITERATURE REVIEW

The increasing reliance on information technology in educational institutions has made the availability of a reliable Local Area Network (LAN) essential, particularly in computer laboratory environments. A well-implemented LAN supports academic activities such as practical learning, access to online resources, and collaborative tasks. Therefore, network performance, stability, and security are key factors in the design and implementation of laboratory networks. Previous studies indicate that LAN implementation in educational laboratories requires effective network management to handle multiple simultaneous users. According to Tanenbaum and Wetherall, LANs are designed to provide high-speed communication within a limited area, making them suitable for computer laboratories. However, improper network configuration may lead to bandwidth congestion, high latency, and unequal resource allocation, which can negatively affect learning processes. MikroTik routers are commonly used in small- and medium-scale networks due to their cost efficiency and comprehensive features. MikroTik RouterOS provides essential network services, including routing, firewall, Network Address Translation (NAT), and bandwidth management.

The MikroTik RB750Gr3 (hEX) is a compact router equipped with Gigabit Ethernet interfaces and a dual-core processor, allowing it to manage moderate network traffic effectively. Several studies report that MikroTik-based network implementations are capable of improving network performance and administrative control in educational

environments. Research focusing on MikroTik implementation in computer laboratories shows that proper bandwidth management and traffic control can enhance fairness and network efficiency. Techniques such as Simple Queue and Queue Tree have been widely applied to prevent bandwidth domination by specific users.

In addition, firewall configuration on MikroTik routers has been shown to improve network security by restricting unauthorized access and reducing potential network threats. Furthermore, centralized network management using MikroTik devices simplifies network monitoring and maintenance. Studies suggest that structured IP addressing and network segmentation contribute to better scalability and easier troubleshooting. These findings highlight the importance of proper network design and configuration in achieving optimal LAN performance in laboratory settings. Based on the reviewed literature, the implementation of a LAN network using the MikroTik RB750Gr3 router is a practical solution for computer laboratory environments. Nevertheless, empirical evaluation of network performance parameters such as throughput, latency, and packet loss is still required. This study aims to analyze the implementation and performance of a LAN network in a computer laboratory using the MikroTik RB750Gr3 to support effective and reliable academic activities.

METHODS

This study employs the Network Development Life Cycle (NDLC) approach, which is a systematic method for the design and evaluation of computer networks. The stages applied in this study include:

1. Analysis: Identifying problems in the existing computer laboratory network, such as low internet speed (2–4 Mbps) and unstable connectivity.
2. Design: Designing a new network architecture using a star topology, IP addressing scheme, and bandwidth allocation plan utilizing the MikroTik RB750Gr3 router.
3. Simulation: Conducting network design simulations using Cisco Packet Tracer software to ensure that the proposed design functions as intended prior to physical implementation.
4. Implementation: Installing hardware components such as UTP cables, switches, and the MikroTik router, followed by configuration of firewall rules, user management, and bandwidth allocation.

5. Monitoring: Monitoring network performance after implementation to ensure connection stability and the effectiveness of bandwidth distribution.
6. Management: Adjusting network configurations if issues are identified to ensure the network continues to operate optimally.

The proposed network architecture employs a star topology, in which each client computer is connected to a switch, and the switch is linked to the MikroTik RB750Gr3 router as the central network management device. This architecture is designed to support up to 30 simultaneous clients while providing efficient and optimal bandwidth management.

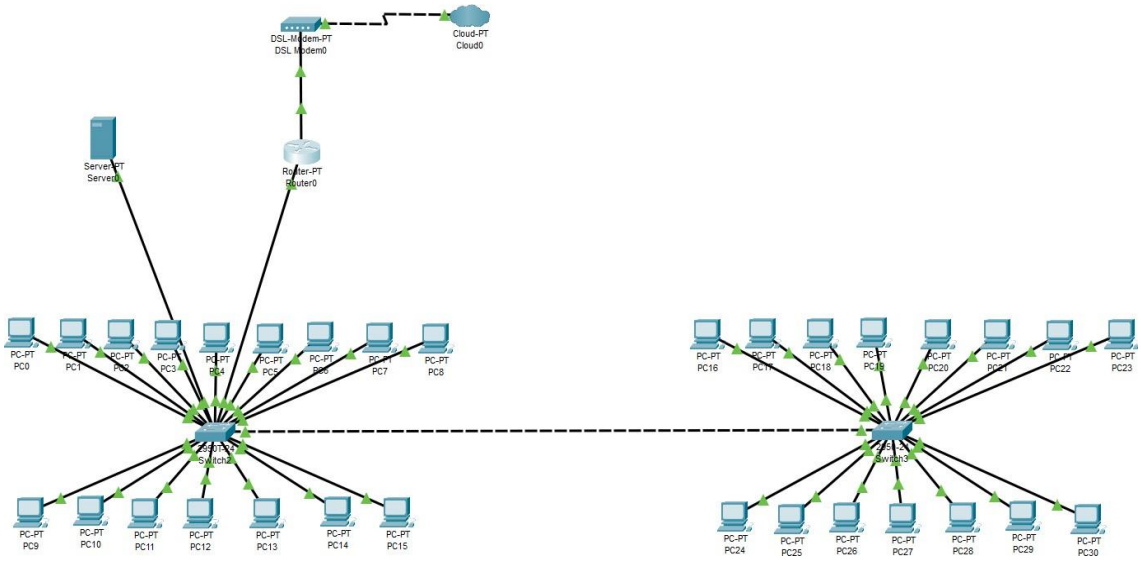

Figure 1. Network Architecture Design

Data collection was conducted through direct observation, interviews with teachers and students, documentation of the implementation process, and internet speed testing using Speedtest.net. The collected data were analyzed using a descriptive qualitative approach to compare network conditions before and after the implementation of the MikroTik router.

RESULTS

The implementation of a LAN network in the computer laboratory of SMK Yasmida Ambarawa was successfully carried out using the MikroTik RB750Gr3 as the

main router. The network was designed with a star topology, with the MikroTik router serving as the central controller for data traffic.

3.1 MikroTik RB750Gr3 Configuration

The configuration process was performed using the Winbox application with the following steps:

1. Subnetting Calculation: For 30 client computers, a base IP address of 192.168.10.0/24 was used with a /27 subnet, which provides 30 usable IP addresses for hosts.
2. IP Address Configuration: Ether2 port on the MikroTik router, which is connected to the local network, was assigned the IP address 192.168.10.1/27 to function as the gateway.

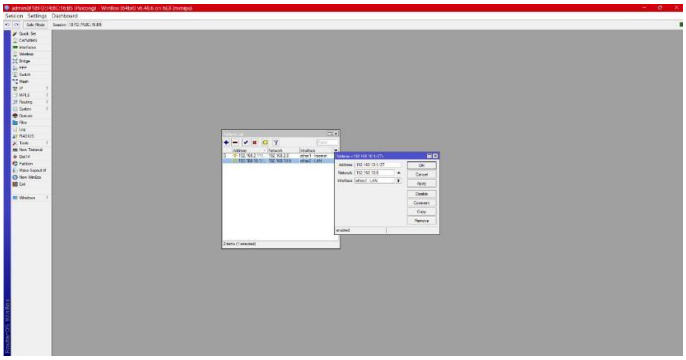

Figure 2. MikroTik IP Address Configuration

3. DHCP Server Configuration: The DHCP server was enabled to provide automatic IP address assignment for clients in the range 192.168.10.2–192.168.10.30.

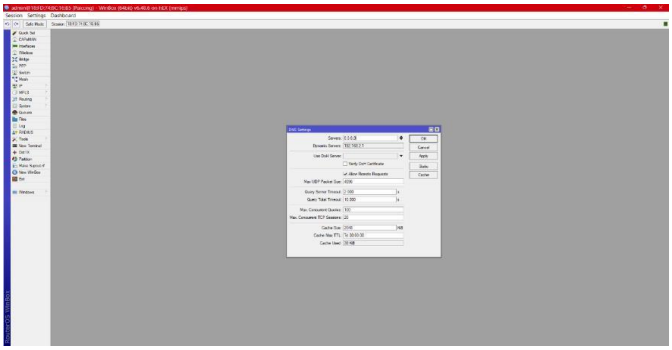

Figure 3. DHCP Server Configuration

4. DNS and NAT Configuration:

   The DNS service was configured to use Google's public DNS server (8.8.8.8). Network Address Translation (NAT) was implemented using a srcnat

rule with the masquerade action on the outgoing interface, enabling all client devices within the local network to access the internet.

5. Bandwidth Management:

Bandwidth control was implemented using the Simple Queue feature on the MikroTik router. Individual bandwidth limits were assigned to each client to ensure fair and consistent bandwidth distribution and to prevent network congestion caused by excessive usage.

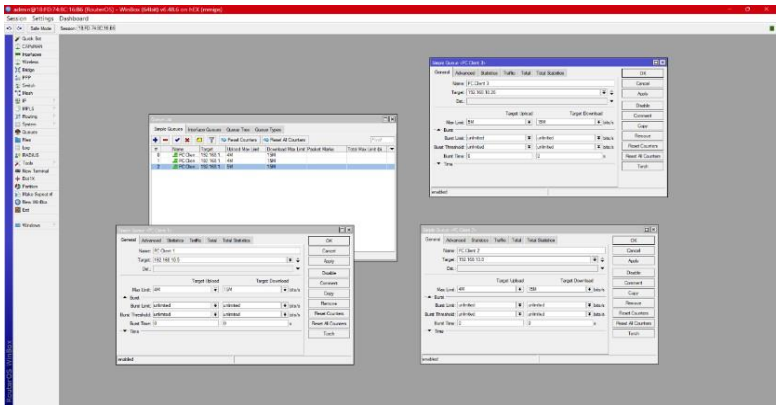

Figure 4. Bandwidth Limit Settings

3.2 Test Results

Connectivity testing using the ping command to the gateway and Google DNS server (8.8.8.8) showed that all clients were successfully connected to the local network and the internet without any issues.

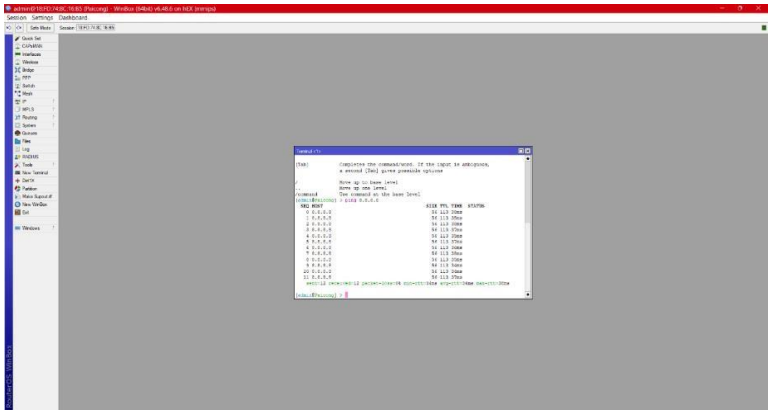

Figure 5. Ping Results to Google DNS (8.8.8.8)

Internet speed tests conducted using Speedtest.net indicated a significant improvement following the implementation.

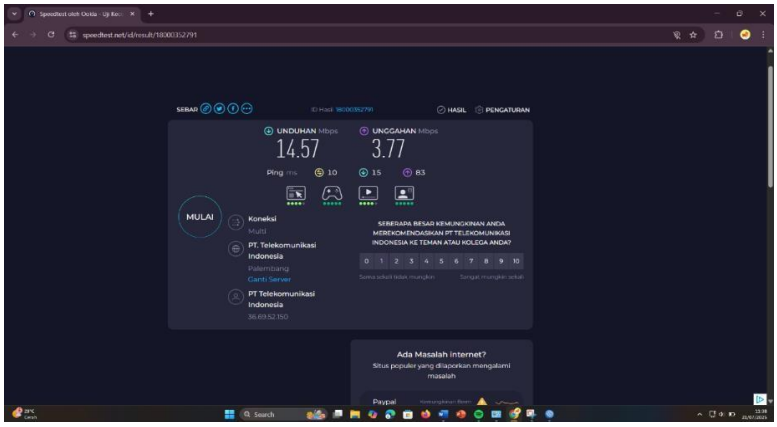

Figure 6. Internet Speed Test on Speedtest

The following table summarizes the comparison of network performance before and after the implementation of the MikroTik RB750Gr3.

No	Parameter	Before	After
1.	Speed Download	2-4 Mbps (unstable)	10-14 Mbps (stable)
2.	Upload Speed	1 Mbps	3-4 Mbps
3.	Latesni (ping)	100-250 ms (often RTO)	10-50 ms (stable)
4.	Number of Devices Active	15-20 (frequent IP conflicts)	30 active devices running stable
5.	Management Bandwidth	There is no (fight over internet speed)	There is a bandwidth division per device
6.	Access Security	No firewall or filter	There is a firewall and site blocking is irrelevant
7.	Satisfaction Users	Low (many complaints)	High (smooth and stable access)

The implementation results show that all computersclientget IP automatically, internet access becomes even, and controlbandwidthmaking data traffic more efficient. This significantly increases the effectiveness of the learning process in the laboratory.

DISCUSSION

The results of this study demonstrate that the implementation of a LAN network using the MikroTik RB750Gr3 significantly improved network performance in the

computer laboratory environment. The application of a star topology, combined with centralized network management through the MikroTik router, contributed to enhanced network stability and more efficient data traffic control.

Connectivity testing confirmed that all client devices were able to access both the local network and the internet without packet loss or connection failures. Furthermore, internet speed testing results indicated a notable improvement after implementation, suggesting that the applied bandwidth management strategy effectively reduced network congestion and uneven bandwidth usage among users.

The use of Simple Queue for bandwidth management played a critical role in ensuring fair bandwidth distribution to each client. This configuration prevented bandwidth domination by individual users, which is a common issue in shared laboratory networks. Additionally, the implementation of DNS and NAT configurations ensured reliable name resolution and seamless internet access for all connected devices.

These findings are consistent with previous studies that report improved network performance and manageability through the use of MikroTik-based routing solutions in educational settings. The results highlight that proper network planning, configuration, and monitoring are essential factors in achieving optimal LAN performance.

However, this study was limited to a single laboratory environment with a relatively small number of clients. Future research may focus on evaluating network performance under higher traffic loads, integrating VLAN-based segmentation, or applying more advanced bandwidth management techniques such as Queue Tree to further enhance scalability and security.

CONCLUSION

Based on the results of design, implementation, and testing, it can be concluded that:

1. Implementation of LAN network using Mikrotik RB750-GR3 and devices switchThe addition successfully distributed connections to 30 computers in the laboratory evenly and stably.
2. Network configuration that includes IP Address, DHCP Server, NAT, and DNS runs optimally, supported by calculations, subnetting efficient for IP allocation.

3. Network performance is proven to be stable, as shown by consistent internet speed test results on the side. download, upload, and latency, so that it can meet the need for internet access for learning activities at school.

LIMITATION

This study has several limitations. The implementation and evaluation were conducted in a single computer laboratory with a limited number of client devices, which may not fully represent larger or more complex network environments. Network performance analysis was primarily based on connectivity testing and internet speed measurements, without detailed quantitative metrics such as packet loss, jitter, or long-term traffic analysis. In addition, the bandwidth management configuration was limited to the Simple Queue method; more advanced techniques such as Queue Tree and VLAN-based segmentation were not explored. These limitations provide opportunities for future research to further improve network scalability, performance evaluation, and security.

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