

Monitoring Networks Based on Simple Network Management Protocol With Cacti Application and Telegram Notifications on Linux Ubuntu

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Abstract

This study discusses the implementation of SNMP-based network monitoring with tools such as Cacti, Telegram, and The Dude. A common problem in networks is damage to router interfaces. In this study, notifications of problematic interfaces and bandwidth usage are sent via Telegram. The main objectives of this network monitoring are to monitor network stability, bandwidth usage, remote device monitoring, and to detect problems with interfaces. Cacti is used to monitor and analyze network performance. Telegram plays a role in receiving notifications related to problematic interfaces and bandwidth usage. Meanwhile, The Dude is used to automatically monitor and manage network devices by detecting connected devices. This study uses four routers and one server in its implementation. This monitoring focuses on interfaces that manage network distribution and data traffic. The results of this study show that on August 14, 2023, from 14:00 to 17:20, bandwidth measurements from the Cacti and Graphing charts. For inbound traffic, the maximum value on ether1 (CORE) with the Cacti application was 10.27 Mbps and on Graphing it was 11.56 Mbps with a difference of 1.29 Mbps. In comparing the maximum values for inbound traffic, the difference between the data obtained from Cacti and Graphing ranged from only 3.2% to 12.9%. This demonstrates the accuracy of the monitoring tools used in this study.

Keywords: *Bandwidth, Cacti, Monitoring, SNMP, Telegram, The Dude*

1. Introduction

Currently, network monitoring has become quite difficult to perform when the computer network in a given environment has become very large and complex. One of the common network problems is damage to the router interface. Due to the importance of computer networks in today's life, it is necessary to maintain the stability of the computer network used. This is where a network administrator positions himself to maintain the stability of the computer network [1]. To maintain optimal network conditions, it is necessary to monitor network devices, such as in the research object of SNMP-based network device monitoring, which can then be displayed in the form of a web page and Telegram notifications. This aims to make it easier for administrators to perform network monitoring tasks [2]. This study uses bandwidth monitoring in the form of graphs monitored by Cacti and will send Telegram notifications used by in monitoring the network. Therefore, as a form of implementation of Continuous Improvement in the IT department in a specific environment, the improvement steps that need to be taken are to install a supporting facility, namely a network connection monitoring tool or Network Monitoring System that runs continuously and provides information on problematic interfaces and bandwidth usage that does not exceed the limit, so that the network administrator can immediately check and handle the problem as quickly as possible to resolve the problematic interface and limit the bandwidth [3].

This research is related to previous research entitled "Design and Development of a Mikrotik OS Router Network Monitoring System Using a Virtual Private Network (VPN)". This research aims to build a VPN network using a hotspot and develop a web monitoring system that displays bandwidth graphs, Mikrotik logs, and firewalls that can be accessed anywhere and uses QoS testing. This study uses the Cacti application to display bandwidth graphs and Telegram notifications to alert users of problems and bandwidth usage on the local network, particularly on

the interface, and does not focus on the hotspot network using traffic intensity (bandwidth) testing per hour[4] .

This research is related to previous research entitled "Implementation and Comparison of Simple Network Management Protocol (SNMP)-Based Network Monitoring Using Cacti and Munin at SMK Negeri 1 Pekanbaru". This research aims to monitor bandwidth usage using Cacti and Munin, which then compares bandwidth usage with Cacti and Munin [5]. This study is related to a previous study titled "Network Monitoring Service Based on Simple Network Management Protocol Using the Cacti Application." This study only monitors network traffic on devices when they go down and then sends an email notification [6]. This research is related to previous research entitled "Designing Network Monitoring and Bandwidth Monitoring Using the Cacti Application at PT. XYZ." This research aims to analyze bandwidth and test the accuracy of GoS (Grade of Service) monitoring using Cacti [7] .

2. Methods

This research uses four routers and one server in its implementation. Monitoring focuses on interfaces that manage network distribution and data traffic. Testing is carried out by analyzing the processes involved in network management to identify existing problems and the configuration of network traffic monitoring applications, and then implementing them so that the data can be displayed in graphs.

2.1. Topology Design

The network topology design implemented in network monitoring can be seen in Figure 1.

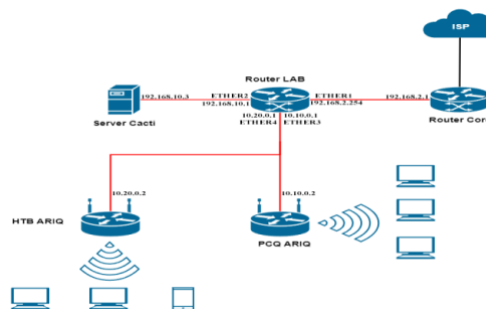


Figure 1. Network Topology

Based on the network topology in Figure 1, which explains the topology used for network monitoring, it is implemented using four routers and one server. For monitoring, Cacti is used in this implementation, which monitors data traffic/internet bandwidth. The device monitored by Cacti is Mikrotik using the SNMP protocol, consisting of interfaces used in Mikrotik to distribute the network or data traffic.

2.2. Monitoring System

[7]A Network Monitoring System is a system within network management that involves the use of software and hardware. Software is used as a system that manages the monitoring process of network functions and performance, including density and traffic in terms of data channel bandwidth usage. This monitoring process can be developed to include resource usage, such as monitoring system uptime/downtime, CPU and memory utilization, and port management.

2.3. Simple Network Management Protocol (SNMP)

Simple Network Management Protocol (SNMP) is an internet standard protocol designed to manage devices on IP networks and monitor and control a computer network remotely or from a single control center. Devices that support SNMP typically include routers, switches, servers, PCs, printers, and so on. This protocol can be used to obtain information about the status and condition of a network. This protocol uses UDP transport on port 161. This processing is carried out by collecting data and setting variables in the managed network elements[2] .

2.4. Cacti Application

Cacti is an open-source, web-based monitoring application. Cacti is generally used to create graphical data such as CPU performance and bandwidth. Cacti is specifically used on switch and router interfaces via SNMP to monitor network traffic. Cacti itself is a complete network graphing solution designed using the PRD tool for data storage and graphing functions[6] . Cacti can be seen in Figure 2.



Figure 2. Cacti

2.5. Bandwidth

Bandwidth refers to the difference between the highest and lowest frequencies used by a network signal. It generally refers to the throughput capacity measured from a protocol or network media. Bandwidth can be used as a reference for the reliability of a network's performance due to its influence on data communication capacity. This is what makes bandwidth play an important role in a network[8] .

2.6. Linux Ubuntu

Ubuntu is one of the most widely used distributions because it has an easy-to-use interface, many developers, and is supported by a large community. Many derivatives have been developed from Ubuntu itself, such as Kubuntu, Edubuntu, and others[3].

2.7. Mikrotik RouterBoard

Mikrotik Routerboard is a router device manufactured by Mikrotik, a company based in Latvia. This device is designed to run a network router and is equipped with a special operating system called RouterOS. In terms of its internal components, Mikrotik Routerboard works similarly to a PC, where the main board is equipped with a processor, RAM, ROM, and flash memory. However, the only operating system that supports it is RouterOS, which is also developed by Mikrotik[9] . Mikortik can be seen in Figure 3.



Figure 3. Mikrotik RouterBoard

2.8. Telegram

Telegram Messenger is a messaging app that focuses on speed, security, simplicity, and is free to download. Telegram can be used on all devices with one account at the same time. Telegram can also send messages, photos, videos, and several types of files, as well as create groups of up to 5000 people or channels for broadcasting to a limited audience[10] . Mikortik can be seen in Figure 4.



Figure 4. Telegram

2.9. The Dude

The Dude Network Monitor is a new application from Mikrotik that can be used to manage network environments. The Dude will automatically and quickly read all devices/computers connected to a local network, draw a map of the local network, observe the services of the devices or computers, and notify you if there are any service problems with the devices/computers in the local network[1] . The Dude can be seen in Figure 5.



The Dude

Figure 5. The Dude

2.10. Hardware Design

The following hardware used for this research can be seen in Table 1.

Table 1. *Hardware*

Hardware	Unit
PC	1
Mikrotik Router	3
UDP Cable	4

2.11. Software Design

The software used in this study can be seen in Table 2.

Table 2. *Software*

Software	Description
Ubuntu	Operating System
Winbox	Remote Mikrotik
The Dude	Monitoring Application
Cacti	Monitoring Application

3. Result and Discussions

3.1. Network Monitoring System Implementation

The implementation was carried out by creating services as designed. It began with the installation of the Cacti application, followed by the installation of The Dude and Notifications.

3.2. Cacti Application Implementation

The first stage involved implementing the Cacti application, which will be analyzed in terms of graphics and interface.

- 1) Cacti Login Page



Figure 6. Cacti login screen

The login page contains the IP Address 192.168.10.3 (stillbagah.my.id) from the server. This login page is used by the admin to access the Cacti Application. To log in to the Cacti Application, a username and password are required, as determined during the Cacti Application Wizard installation.

2) Create Graph Page

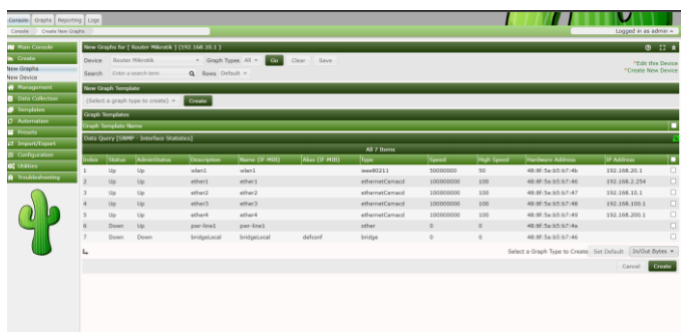


Figure 7. Create Graph Page

The Create Graph page is used to register which interfaces will be displayed in the graph, such as interfaces eth1 to eth4, which will be displayed in the graph.

3) Graph Page

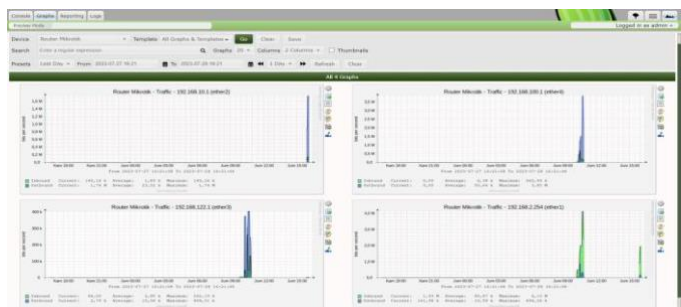


Figure 8. Graph Page

The Graph Page displays the previously created graph, specifically the ether 1 to ether 4 graph that will be monitored.

3.3. Implementation of The Dude and Graphing Tools

The second step involves implementing The Dude application and graphing tools that will be monitored through graphing.

1) The Dude Devices Display

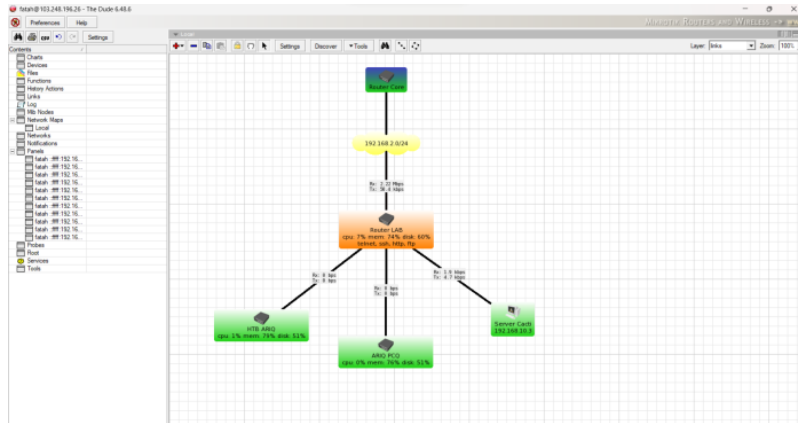


Figure 9. The Dude Devices Display

Automatic Device Addition The Dude will automatically scan devices on the connected internet network so that the scan results can clearly show devices such as Core Routers, LAB Routers, HTB ARIQ, PCQ ARIQ, and Cacti Servers. If a device cannot be scanned, you can also add the device manually to find out some or all of the traffic from the monitoring results of existing internet network devices.

2) Graphing Tools Configuration

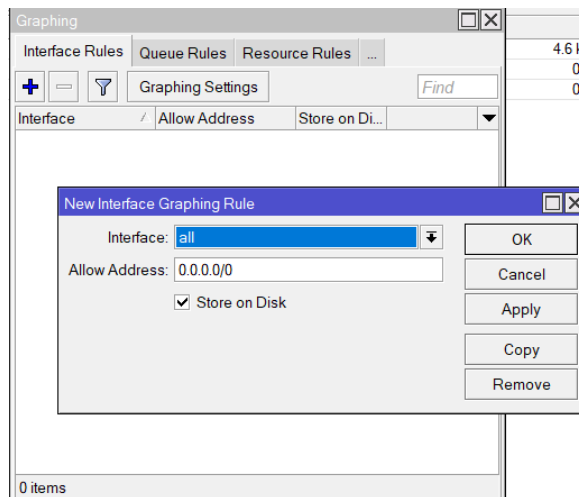


Figure 10. Graphing Tools Configuration

Enable graphing in Tools/Graph, which will be accessed via webfig to view graphs with IP addresses.

3) Initial Graphing Tools Display



Figure 11. Initial Graphing Tools Display

The initial view of graphing accessed via IP Address, where several interfaces are visible on the initial view, namely ether1 to ether4.

3.4. Telegram Notification Implementation

The third stage involves implementing a Telegram Bot as a notification system for interface issues in the monitoring system.

1) Creating a Telegram Notification Script

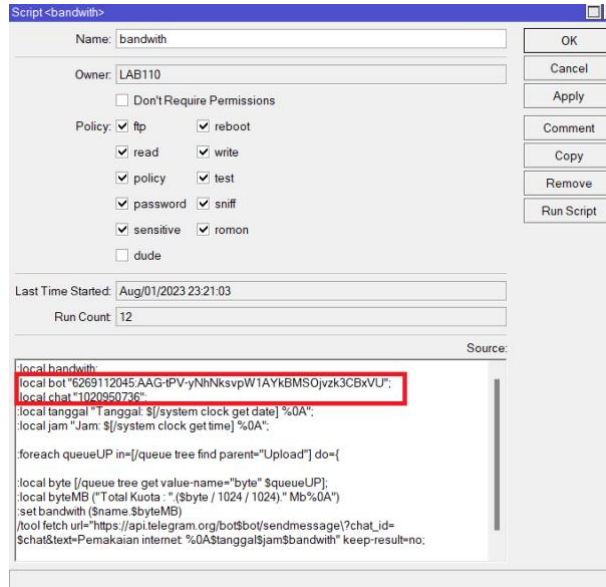


Figure 12. Telegram Notification Script

Integrating the Router and Telegram by creating a notification script and entering the chat ID using the Telegram API.

3.5 Analysis and Testing

1) Monitoring Results with the Cacti Application

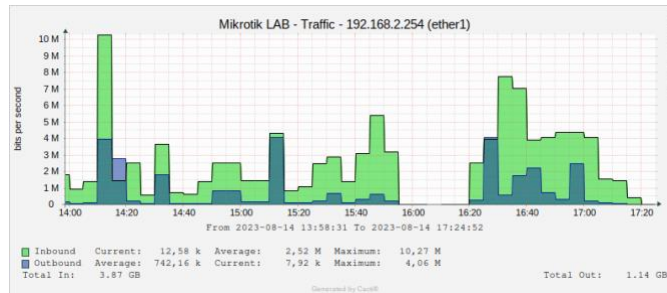


Figure 13. Cacti Monitoring Results ether1 CORE

Bandwidth activity on ether1 (CORE) can be seen from August 14, 2023, at 13:58 to August 14, 2023, at 17:24. For inbound activity, the current traffic usage is 12.58 Kbps, the average traffic usage is 2.52 Mbps, the maximum traffic usage is 10.27 Mbps, and the inbound traffic from the start of the day () has a total of 3.87 Gb. Meanwhile, for outbound activity, the current traffic usage is 742.16 Kbps, the average traffic usage is 742.16 Kbps, the maximum traffic usage is 4.06 Mbps, and the total outbound is 1.14 Gb. The results of the monitoring graph from the Cacti application can be seen in Table 3.

Table 3. Monitoring Results of Ether1 Cacti Application ether 1 (CORE)

Time	Inbound	Outbound
August 14, 2023, 1:58 PM to August 14, 2023, 5:24 PM.	Current:12,58Kbps Average:2,52Mbps Max : 10,27Mbps Total : 3,87Gb	Current : 7,92 Kbps Average:742,16Kbps Max : 4,06 Mbps Total : 1,14 Gb

2) Monitoring results with Graphing Tools

Interface <ether1> Statistics

Last update: Mon Aug 14 23:33:00 2023

"Daily" Graph (5 Minute Average)

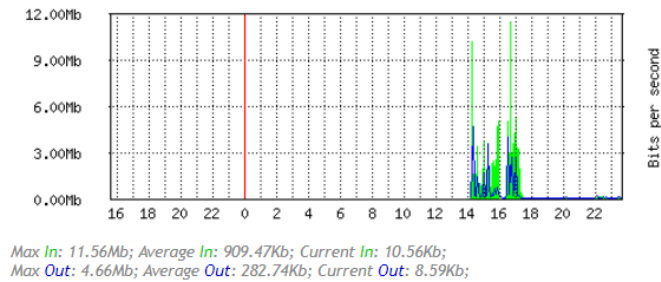


Figure 14. Results of ether1 monitoring using Graphing Tools

Bandwidth activity on ether1 (CORE) during peak hours on August 14, 2023, starting at 14:00, showed inbound traffic with a maximum value of approximately 10 Mbps and outbound traffic with a value of approximately 4.66 Mbps. at 16:00 with an inbound value of around 5 Mbps and an outbound value of around 800 Kbps, at 16:50 there was an inbound value of around 11.56 Mbps and an outbound value of around 4 Mbps, and it returned to normal at 18:00 until 23:33. The results of the ether1 graphing monitoring can be seen in Table 4.

Table 4. Results of Ether1 Graphing Tools Monitoring ether 1 (CORE)

Time	Inbound	Outbound
14 Agustus 2023, 13:58 sampai 14 Agustus 2023, 17:24.	Current :10,56Kbps Average :909,47Mbps Max : 11,56 Mbps	Current : 8,59Kbps Average :282,74Kbps Max : 4,66 Mbps

3) Telegram Notification Results



Figure 15. Display of down interfaces on Cacti

The display on the Cacti monitor shows several devices in green, indicating that they are up, and red, indicating that they are down. There is one device that is down, namely ether4 or HTB ARIQ.

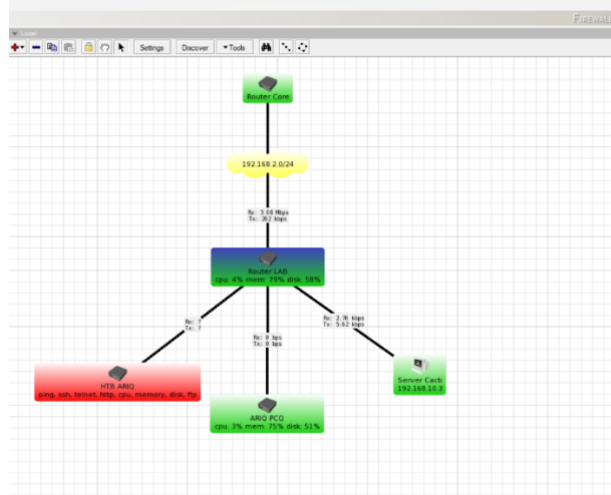


Figure 16. Interface down display on The Dude

The monitoring results for the down interface on The Dude for the ether4 HTB ARIQ interface will be sent via Telegram notification.

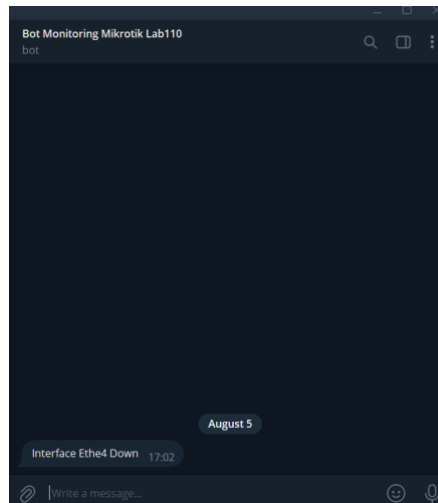


Figure 17. Display of the down notification on Telegram

The monitoring results indicate that the ether4 HTB ARIQ interface is down, and the notification is sent via Telegram.

3.5. Discussion

A comparison of bandwidth results from monitoring using Cacti and Graphing Tools can be seen in Table

5.

Table 5. Monitoring Graph Comparison

Interface	Traffic	Cacti	Graphing	Selisih
Ether 1	Max in	10,27Mbps	11,56Mbps	1,29Mbps
	Max out	4,06Mbps	4,66Mbps	0,60Mbps
Ether 2	Max in	4,08Mbps	4,64Mbps	0,56Mbps
	Max out	9,77Mbps	10,15Mbps	0,38Mbps
Ether 3	Max in	536,62Kbp	554,58Kbp	17,96Kbp
	Max out	4,61Mbps	4,44Mbps	0,17Mbps
Ether 4	Max in	604,44Kbp	562,20Kbp	42,24Kbp
	Max out	4,12Mbps	3,67 Mbps	0,45Mbps

The difference in maximum inbound bandwidth on ether1 (CORE) for the Cacti application is 10.27 Mbps and graphing is 11.56 Mbps, with a difference of 1.29 Mbps, approximately 11.2%. ether2 (Server) Cacti application with a value of 4.08 Mbps and graphing 4.64 Mbps with a difference of 0.56 Mbps, approximately 12.1%, ether3 (PCQ) Cacti application with a value of 536.62 Kbps and graphing 554.58 Kbps with a difference of 17.96 Kbps, approximately 3.2%, and ether4 (HTB) cacti application with a value of 604.44 Kbps and graphing 562.20 Kbps with a difference of 42.24 Kbps, approximately 7.0%. Meanwhile, the maximum outbound value on ether1 (CORE) cacti application with a value of 4.06 Mbps and graphing 4.66 Mbps with a difference of 0.60 Mbps, approximately 12.9%, ether2 (Server) cacti application with a value of 9.77 Mbps and graphing 10.15 Mbps with a difference of 0.38 Mbps, approximately 3.7%, ether3 (PCQ) cacti application with a value of 4.44 Mbps and graphing 11.56 Mbps with a difference of 0.17 Mbps or around 3.7%, and ether4 (HTB) cacti application with a value of 4.12 Mbps and graphing 3.67 Mbps with a difference of 0.45 Mbps or around 10.9%.

4. Conclusion

Based on the implementation and analysis that has been carried out, the following conclusions can be drawn:

1. Developing a system that assists in network monitoring to track the up or down status of the interface.
2. The monitoring graph results provide a report on inbound and outbound bandwidth activity on August 14 from 2:00 p.m. to 5:20 p.m. From the current bandwidth, average bandwidth, and maximum bandwidth on each interface, a comparison of the difference between Cacti and Graphing was made, with the difference ranging from only 3.2% to 12.9%.
3. For high accuracy in bandwidth monitoring on MikroTik devices, the built-in Graphing tool may be more accurate. However, Cacti is better in terms of flexibility in data visualization and comprehensive network monitoring capabilities.
4. Successful notifications sent include bandwidth usage and up and down interfaces.
5. The current values generated from the three monitoring systems are not too different because the processes for displaying the data are different.

REFERENCES

- [1] S. Supandi and H. Hermanto, "Implementasi Aplikasi Dude Sebagai Network Management SMKN1 Gunung Guruh dengan Notifikasi Telegram," *MEANS (Media Inf. Anal. dan Sist.*, vol. 6, no. 2, pp. 219–224, 2022, doi: 10.54367/means.v6i2.1578.

- [2] A. Hidayat and A. Rizki, "Monitor Jaringan Komputer Berbasis Web Menggunakan Cacti," *JUTEKIN (Jurnal Tek. Inform.,* vol. 8, no. 1, pp. 1–10, 2020, doi: 10.51530/jutekin.v8i1.439.
- [3] O. G. Athallah, "Sistem Operasi LINUX dan Pemanfaatannya dalam Sistem Informasi Manajemen," 2022.
- [4] A. Farhan, Anwar, "Rancang Bangun Sistem Monitoring Jaringan Router Mikrotik OS Menggunakan Virtual Private Network (VPN)," vol. 3, no. 4, pp. 391–395, 2022.
- [5] Basorudin and Mi'rajul Rifqi, "Implementasi Dan Perbandingan Monitoring Jaringan Berbasis Simple Network Management Protocol (Snmp) Menggunakan Cacti Dan Munin Di Smk Negeri 1 Pekanbaru," *Zo. J. Sist. Inf.,* vol. 1, no. 2, pp. 58–74, 2019, doi: 10.31849/zn.v1i2.3249.
- [6] I. Bayunadi, A. F. Rochim, and K. I. Satoto, "Network Monitoring Service Berbasis Simple Network Management Protocol Menggunakan Aplikasi Cacti," *Transmisi,* vol. 15, no. 4, pp. 191–198, 2013.
- [7] A. Anggoro and U. Daniel, "Rancang Bangun Network Monitoring dan Bandwidth Monitoring dengan Menggunakan Aplikasi Cacti Pada PT. XYZ," *JATISI (Jurnal Tek. Inform. dan Sist. Informasi),* vol. 6, no. 1, pp. 1–17, 2019, doi: 10.35957/jatisi.v6i1.155.
- [8] E. Febriyanti, S. Raharjo, and M. Sholeh, "Perbandingan Manajemen Bandwidth Menggunakan Metode FIFO (First In First Out) dan PCQ (Peer Connection Queue) Pada Router Mikrotik (Studi Kasus Pada Laboratorium Komputer Jaringan, Institut Sains & Teknologi AKPRIND Yogyakarta)," *J. JARKOM,* vol. 5, no. 2, pp. 89–98, 2017.
- [9] I. Riadi, "Keamanan Jaringan Menggunakan Pemfilteran Aplikasi Berbasis Mikrotik, Optimalisasi," *Jusi,* vol. 1, no. 1, pp. 71–80, 2013.
- [10] N. Fernando, Humaira, and E. Asri, "Monitoring Jaringan dan Notifikasi dengan Telegram pada Dinas Komunikasi dan Informatika Kota Padang," *JITSI J. Ilm. Teknol. Sist. Inf.,* vol. 1, no. 4, pp. 121–126, 2020, doi: 10.30630/jitsi.1.4.17.