DESIGN AND IMPLEMENTATION OF THE DUDE MIKROTIK SERVER USING TELEGRAM BOT AS MONITORING CLIENT NETWORK AND INTERNET CONNECTION

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ABSTRACT

Network management and monitoring are crucial, especially in educational environments such as SMK Wachid Hasjim Maduran, which has a network with various devices and connected clients. The high number of users accessing the network often leads to bandwidth issues. This research aims to implement The Dude, a MikroTik-based network monitoring application, to detect and address bandwidth problems and monitor the status of client devices (up/down). The system is equipped with a notification feature that sends real-time information to network administrators via Telegram regarding the network's condition. Monitoring is conducted using The Dude, which can map all devices in the network and monitor their performance and status. When a bandwidth issue occurs or a client device goes down, the system automatically sends a notification to Telegram. This allows administrators to take the necessary actions promptly without always being in front of the computer. The results of this implementation show that utilizing The Dude in combination with Telegram notifications is effective in real-time network monitoring, reducing downtime, and improving response to network issues. This system is expected to be an efficient solution for network management in educational environments and can be adopted by other institutions facing similar challenges.

Keywords: MikroTik, Monitoring, Telegram Notification, The Dude.

I. INTRODUCTION

The internet has become an important part of daily life, including in the world of

education. At SMK Wachid Hasjim Maduran, the internet plays a key role in supporting the learning process, accessing online educational resources, and facilitating communication

between students and teachers. As the reliance on the internet increases, it is crucial to ensure that the network functions optimally and is able to handle high volumes of traffic. One of the main challenges in networking is bandwidth management. Bandwidth refers to the maximum capacity of a communication line that can transfer data at a time. In a school environment with many users such as SMK Wachid Hasjim Maduran, there are often disruptions due to inefficient bandwidth use. Issues such as data traffic congestion and improper bandwidth allocation can affect the quality of internet services, hinder access to learning applications, and reduce the experience of (Ardianto et al., 2018).

Network monitoring is the process of monitoring and analyzing network activity to detect and resolve problems quickly. With effective monitoring tools, network administrators can identify disturbances such as congestion or device crashes early, and take corrective action before the problem impacts users. A good monitoring system also provides real-time notifications and reports that help in making the right decisions (Ardianto et al., 2018).

The Dude server is a network management tool developed by MikroTik and plays an important role in network monitoring. The Dude provides a graphical interface for visualizing network topology, monitoring device status, and setting notifications. These features allow administrators to manage the network more efficiently and detect problems quickly (Ariyadi & Maulana, 2021). MikroTik, as a provider of RouterOS devices and operating systems, also plays an important role in network management and monitoring. MikroTik products are known for their flexibility in configuration as well as support for a wide range of bandwidth management and network security features. MikroTik's integration with The Dude Server allows for more comprehensive and efficient network management (Ariyadi & Maulana, 2021).

Telegram, as a notification platform in the monitoring system, can improve the response to network problems. By integrating the Telegram bot with The Dude Server, administrators can receive real-time notifications about the status of the network. Telegram provides a fast and accessible communication platform, making it easy for administrators to get notifications and monitor networks that are experiencing outages (Asti et al., 2021).

This research aims to design and implement a solution that integrates The Dude MikroTik Server with Telegram bots to monitor the network at SMK Wachid Hasjim Maduran. It is hoped that with this monitoring system, bandwidth management problems can be overcome more effectively, interference is reduced, and network performance is optimal to support learning activities (Candra & Samsugi, 2021).

II. METHOD

Internet

The Internet is a global network that connects millions of computer devices and servers around the world. The basic technology that supports the internet is the TCP/IP (Transmission Control Protocol/Internet Protocol) protocol, which allows communication and data exchange between devices. The Internet offers a variety of services, including the World Wide Web, email, and web-based applications, that allow users to access information, communicate, and collaborate in real-time (Rakhmat Dwi Jayanto, 2019).

Hotspot

Hotspot refers to a geographical area that provides wireless internet access through Wi-Fi technology. Hotspots generally consist of devices such as routers or access points that transmit internet signals, allowing user devices such as smartphones, laptops, and tablets to connect to the internet wirelessly. Hotspots are often found in public locations such as cafes,

airports, and libraries, making it easy for users in these locations to access the internet.

Understanding System Development

System development is a process that involves designing, developing, and maintaining information systems to meet the specific needs of users or organizations. This process begins with a requirements analysis, followed by a system design that includes structure and functionality, and then continues with the software development stage. After that, the system is tested to ensure that all features are working properly before being implemented (Fathoni et al., 2021).

Bandwith Management

Bandwidth management is a technique used to control and allocate bandwidth usage in a network. This involves prioritizing data traffic, limiting bandwidth allocation for specific applications, and monitoring network activity to ensure optimal usage. With bandwidth management, network administrators can prevent congestion and ensure that critical applications get the resources they need (Fathoni et al., 2021).

System Monitoring

System monitoring is a process of continuous monitoring of the performance, health, and security of a computer or network system. It involves using tools and techniques to monitor various parameters such as CPU usage, memory, and storage, as well as detect any issues or peculiarities that may affect the performance of the system. System monitoring allows administrators to identify and address issues before they impact users (Handoyo & Aprillya, 2021).

Computer Network

A Computer Network is a collection of computer devices that are interconnected through communication media to share resources and information. These networks can vary from local area networks (LANs) that connect devices in a single location, to wide networks (WANs) that connect devices in different geographic locations. Computer networks allow file sharing, access to shared printers, and communication between devices (H. Gunawan & Ghiffari, 2018).

Network monitoring

Network monitoring is a process that involves monitoring and assessing the activity and performance of a computer network. It includes monitoring data traffic, problem detection, and network performance analysis to ensure smooth operations. Network monitoring typically uses specialized tools that can provide real-time information about network health and efficiency (H. Gunawan & Ghiffari, 2018).

Server

A server is a hardware or software device that provides services or resources to other devices known as clients in a network. Servers can perform a variety of functions, such as storing data, running applications, or managing network communications. In the context of networking, servers are often set up to serve requests from many Clients simultaneously (D. Gunawan, 2023).

Client

A client is a device or application that requests services or resources from a server in a network. Clients can be computers, smartphones, or software applications that interact with servers to access data, run programs, or communicate. The client sends a request to the server and receives a response containing the requested information or service (D. Gunawan, 2023).

Firewall

A firewall is a hardware or software that functions to control and protect data traffic between internal and external networks. Firewalls can set up rules that determine the types of traffic that are allowed or blocked based on specific criteria such as IP addresses, ports, or protocols. The main purpose of a firewall is to prevent unauthorized access and protect the network from potential security threats (Handoyo & Aprillya, 2021).

The Dude

The Dude is a network management tool developed by MikroTik to facilitate monitoring and management of network devices. With an intuitive graphical interface, The Dude allows administrators to view network topology, monitor device status, and get notified in case of problems. This tool is designed to assist in network maintenance by providing clear and real-time information (Hariadi et al., 2019).
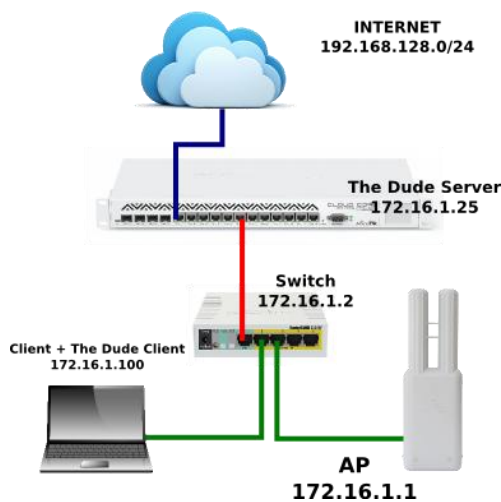

Figure 1. The Dude Configuration

The dude will automatically read or detect any devices connected to the network in a segment as shown in Figure 2.2, in addition to being able to compile the network topology design, and can monitor and provide information if there is a problem with the devices connected to the network (Hariadi et al., 2019).
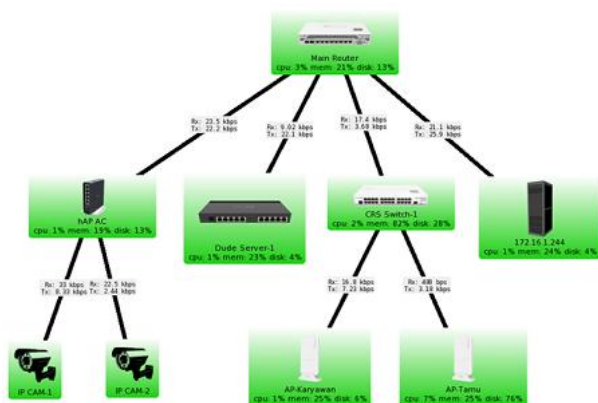

Figure 2. The Dude Monitoring Topology

Winbox

Winbox is a graphical administration tool developed by MikroTik to configure MikroTik RouterOS devices. Winbox provides a user-friendly interface, allowing users to access and manage the MikroTik router via a network connection or directly via cable. With Winbox, network administrators can configure various aspects of the router, including IP settings, bandwidth management, firewalls, routing, and other features, without having to use the command line (Idrus, 2016).

MikroTik

MikroTik is a technology company from Latvia that is famous for its networking products, especially router hardware and RouterOS software. MikroTik products are widely used around the world to build efficient and reliable network infrastructure, both for household use, small business, and ISP networks. RouterOS is MikroTik's flagship operating system, offering a variety of advanced features such as routing, firewall, bandwidth management, VPN, and network monitoring, making it an all-in-one solution for network management (Wijaksana et al., 2024).
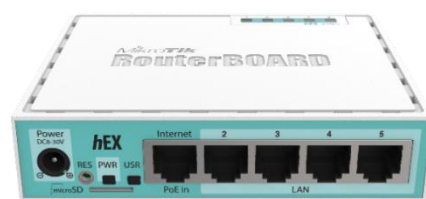

Figure 3. Router MikroTik

Acces Point

An Access Point is a network device that allows Wi-Fi devices to connect to a wired network. Access points serve as a link between wireless devices, such as laptops and smartphones, with existing wired networks, providing internet access and other network resources. In a network, an access point acts as a Wi-Fi signal transmitter that allows wireless devices to communicate with each other and

with a wider network (Kuspandi Putra et al., 2020).

Figure 4. Router Acces Point

Telegram

Telegram is an instant messaging app that focuses on speed and security, allowing users to send text messages, photos, videos, and other files for free. Telegram was founded by Pavel Durov in 2013 and has grown to become one of the most popular messaging apps in the world. The app offers advanced features such as end-to-end encryption, secret chats, and the ability to create groups with up to thousands of members. Telegram also supports bots, channels, and open APIs that allow developers to build a variety of tools and services on top of this platform (Motohashi & Siregar, n.d.).

Telegram Bot API

Telegram bot API is an application programming interface that allows developers to create bots that can interact with users on the Telegram platform. These bots are automated programs that can perform various tasks, such as sending automated messages, answering questions, managing groups, and even executing certain commands given by users. Telegram bot API provides a variety of features, including the ability to receive messages, send notifications, and access a wide range of user data, allowing developers to build bots with complex and useful functionality (Motohashi & Siregar, n.d.).

III. RESULT AND DISCUSSION

This study uses the Network Development Life Cycle (NDLC) method, which consists of 5 modeling steps: Analysis, Design, Simulation Prototype, Implementation, and Monitoring. NDLC was chosen because it allows for the development of a structured and systematic system, ensuring each step is completed before moving on to the next stage, as well as allowing for development evaluation. This method is used in research procedures for internet network monitoring systems.
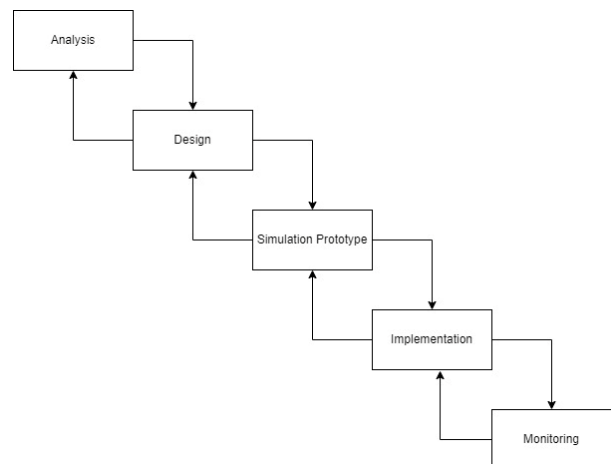

Figure 5. Research Procedure

1. Analysis

The analysis stage is the first step in the Network Development Life Cycle (NDLC) procedure, which aims to identify needs and problems in the network system. At this stage, data and information about the network at SMK Wachid Hasjim Maduran are collected, including network performance, bandwidth usage, and problems that often arise, such as unstable internet connections. In addition, the need to monitor the network in real-time and provide notifications via Telegram was also identified. The results of this analysis will be the basis for the planning and design of the system to be developed.

2. Design

At the design stage of the network monitoring system at SMK Wachid Hasjim Maduran, the process began by using Cisco Packet Tracer to simulate the integration of various system components. The network topology design involves MikroTik, The Dude Server, Access Point, Switch, and its integration with Telegram. In this simulation, MikroTik acts as a network traffic manager,

monitors bandwidth, and provides the necessary data for The Dude Server. The Dude Server, which is also simulated, maps and monitors devices such as MikroTik, Access Points, and Switches, detects outages in the network, as well as manages overall monitoring. Once the design is complete, users can run simulations to ensure that all components are functioning properly and integrating effectively. Notifications from The Dude Server were also tested to ensure notifications related to network outages were sent correctly via Telegram. By using Cisco Packet Tracer.
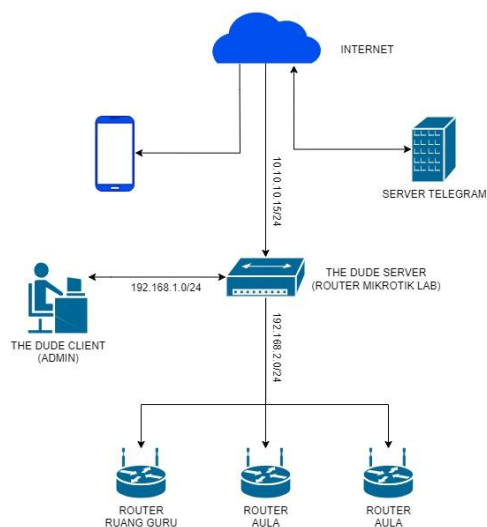
Figure 6. System design

3. Simulation Prototype

Once the design is complete, the next step is to simulate the prototype. At this stage, the prototype of the designed system is tested in a simulation environment to assess its performance before being fully implemented. A prototype of The Dude Server was created and tested to ensure all monitoring functions were running as planned. This simulation includes testing the monitoring of network devices, setting notifications via Telegram, as well as the system's response to various network conditions, such as connection fluctuations or high bandwidth usage.

The results of this simulation provide an overview of potential problems or shortcomings in the design, which can be corrected before actual implementation. This

stage of simulation is crucial to ensure that the implemented system will function properly in a real environment and meet the needs that have been identified beforehand.

4. Implementation

The implementation stage is the moment when the system that has been designed and simulated is implemented in a real environment. At this stage, The Dude Server is installed on a network device at SMK Wachid Hasjim Maduran, and integration with the Telegram bot API is carried out to ensure that notifications work as intended. All the required hardware and software are configured according to the design that has been designed, and the system starts operating to monitor the network in real time.

This implementation is carried out in stages to minimize disruption to existing network operations. Post-implementation testing is also carried out to ensure that the system is functioning properly and that all issues identified during the simulation have been resolved. After this stage is completed, the monitoring system begins to be officially used for daily operations.

5. Monitoring

The monitoring stage is an ongoing process where the system that has been implemented is monitored and evaluated to ensure that its performance is in accordance with expectations. In this context, The Dude Server will continue to monitor network performance at SMK Wachid Hasjim Maduran, with Telegram being used as a tool to provide real-time notifications. The data generated from this monitoring system will be analyzed periodically to identify potential new problems or improvement needs.

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Implementation

Implementation is an application design process that has been made to be used as a research object. The process will be carried out step by step. The design has been made based on the analysis carried out and the diagram has been drawn in accordance with the process of running the application. This research has also tested the applications that have been made. However, in the midst of testing, there were difficulties with The Dude application, so they found a solution to keep the application running. Here are the results of an experiment from The Dude application that has been created for network connections from The Dude Application to bring up notifications of connected networks in the Telegram bot.

a. Telegram Application

In this design, the first stage is to create a bot through the BOT Father system. BOT Father is a channel created by Telegram as a coding robot system that will be run automatically. In this stage, the bot name is created as needed.
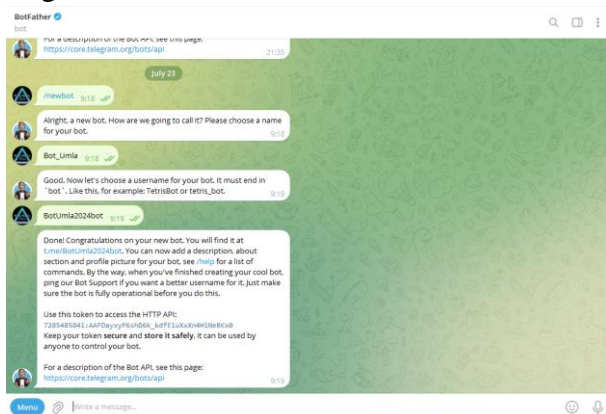

Figure 7. BotFather Channel Views

After the User has the Bot name, they will be given a Telgram API Token. API (Application Programming Interface) is a Script Interface that can connect to other applications. API Token is an authentication script used to give commands in the URL Link. After getting

the API Token the link is copied into the web link to get the command.

Figure 8. Command System of API Token

After getting the command from the API Token, the User BOT will activate the notification and put it in a special group of network notifications. Here is the name of the BOT used and also the group entered. Here is the name of the group.
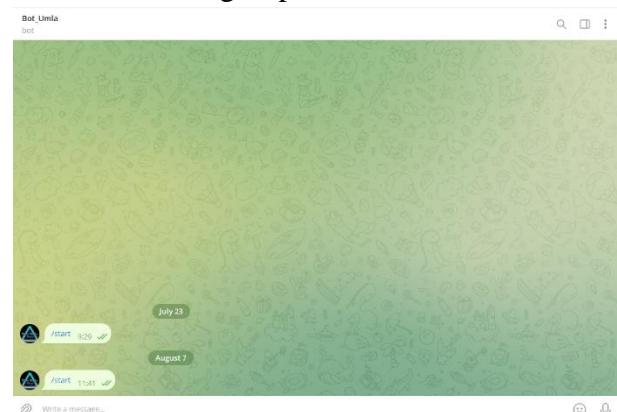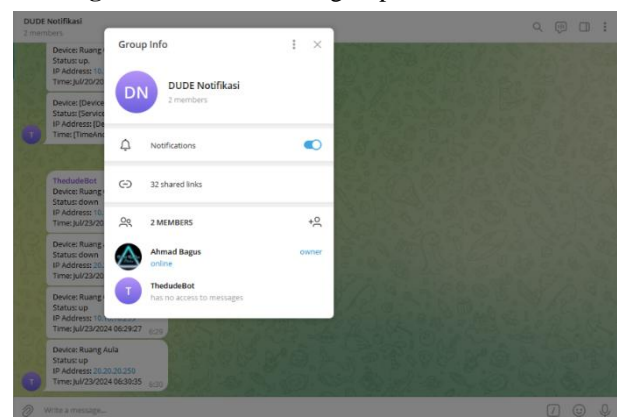

Figure 9. User Bot with group name "bot_umla"

Figure 10. Groups used for Network Notifications

b. Application The Dude

The Dude is a Network Monitoring application created by MikroTik that is useful

for analyzing, and monitoring server networks. The application will be used to undergo a network notification process system on the Telegram application. In the application, there are several stages that must be done so that the network notification can run. Here is the front view of the existing The Dude app. In this display, Admin will look for the IP Address found, the IP used is IP 192.168.0.100/24. This IP will be used to configure the network into the Telegram application so that it can undergo the notification system.
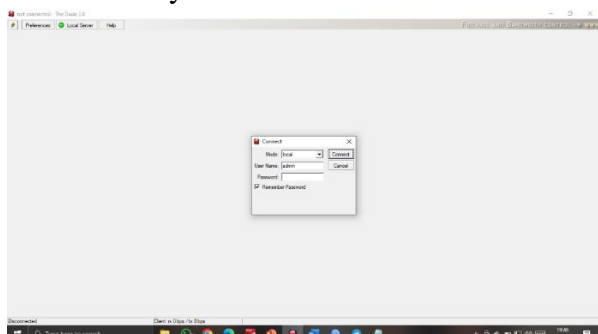

Figure 11. The Dude App View

After logging in, the admin will enter The Dude Dashboard where the display has a lot of features in the application. In fiture Network Maps there are 3 types of Networks, including ISP Routers, MikroTik Server, and PC Serve. However, the server used is a PC Server and MikroTik Server in MikroTik Server there are several IP devices installed. The IP used for network notifications is IP 10.10.10.253 which is in the teacher's room and IP 20.20.20.250 which is in the hall room, while MikroTik Server with IP 192.168.0.100 is the main router located in the server room, here is the Network Server display displayed.
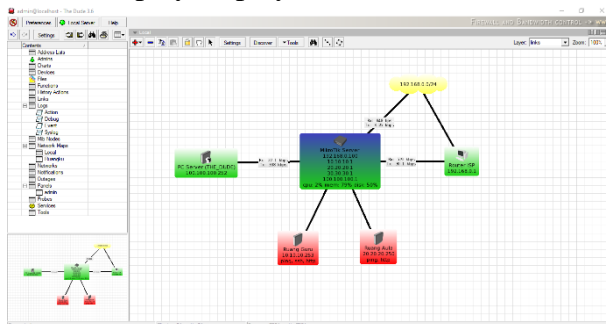

Figure 12. Server of SMK Wachid Hasjim Building

As shown in the picture above, is a display of a Server located in the Wachid Hasjim Vocational School Building, but judging from the colors they have their respective functions. If the server is green it indicates that the network is safe to use, if it is orange or red it indicates that the server has two possibilities, including that the server is safe or it may be experiencing an error. And if it is red, it is confirmed that the server is experiencing Down or Error. Therefore, if it experiences red. The admin will try how to solve the network error/down.

c. Network Notification Configuration

The next stage, Admin does network notifications. Admin configures the network contained in The Dude application in the Notification feature. In this feature there are several types of notifications, then the Admin enters the notification script with the name Telegram Notification.
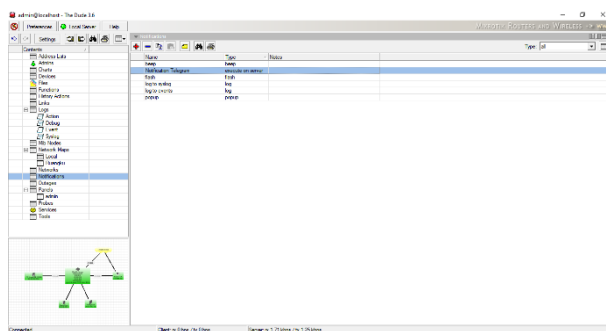

Figure 13. Notifications Feature in The Dude App

Then, the Admin enters the API Token link that has been provided by the BOT Father from the Telegram application into the network notification configuration.
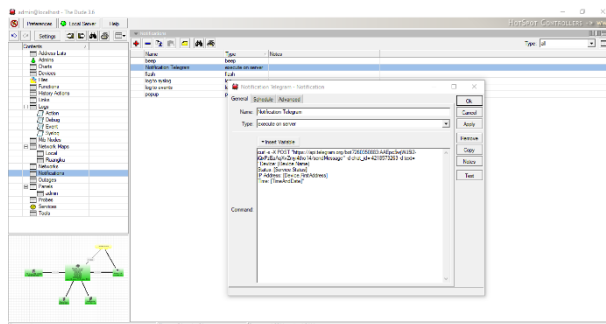

Figure 14. Script Code included in Notifications

d. Network Notifications

After the network configuration is complete, the next step is to perform network

notifications. Admin selects one of the IP Servers to perform network notifications. The IP it uses is 192.168.1.13, then click on it and it will appear with the Device view. In the picture, there are several types of Device Services that exist. Then turn on the notification on the Device with the Type "ping". If Type "Ping" is turned on, the network notification is automatically connected to the Telegram application.
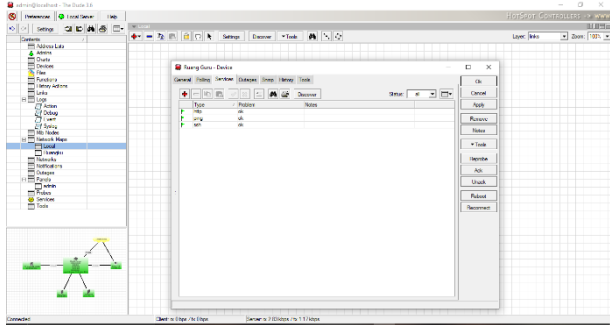

Figure 15. Device Notifications Display

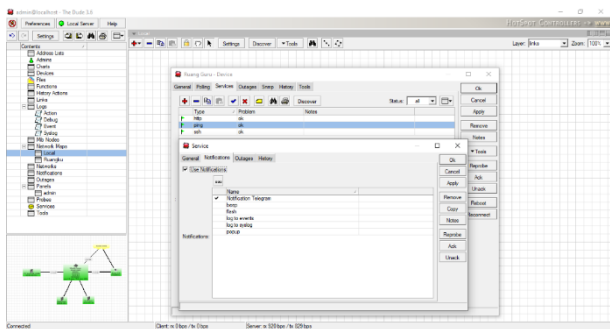Then the next step is to turn on Telegram notifications on the Device Service.

Figure 16. Types of Notifications in Device Service

If the notification has been turned on, the Admin tries to turn off the IP Server to conduct a test on the network notification by turning off the Device "ping". After turning it off, a network notification that has been configured from The Dude application will appear. Here are the results of network notifications that have entered the Telegram application. In the results, there are two notifications, namely "Server 10.10.10.253 is UP" which means that the Server can be used if the Device "ping" is turned on. However, if the device "ping" is turned off, a notification will appear with the command "Server 10.10.10.253 is down".
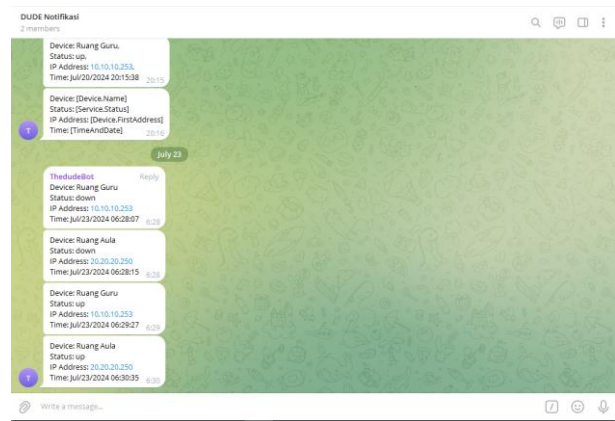

Figure 17. Network Notification Results

The image above explains that the notification results have been connected to the Telegram BOT group which says that "Server 10.10.10.253 is up" which means that the server has improved or reconnected. And the notification that says "Server 10.10.10.253 is Down" says that the server is experiencing an outage on the IP of the server so that network access cannot be connected to the existing device.

Testing

Testing of The Dude's monitoring results with Telegram notifications was carried out to ensure the system's ability to detect network disruptions in real-time and send automatic notifications. First, the devices monitored by The Dude Server are configured correctly, and Telegram bots are set up to send notifications. Network interference is then simulated by turning off one of the devices or disconnecting the connection. The Dude Server successfully detects an offline device and updates its status to "down" on the monitoring interface.

Once the glitch is detected, the server sends a notification via Telegram bot to the administrator, containing information such as the name of the device in question, the time of the incident, and the status of the device. This test proved that The Dude worked effectively in detecting outages and automatically sending Telegram notifications, helping administrators in responding quickly to network issues.

Table 1. Test Results

No.	Testing	Expected results	Test results
1.	Device can send death notifications	Displays information notification, device is turned off	Succeed
2.	Monitoring using The Dude software	Displays device history log	Succeed
3.	Device can send live notifications Showing	Displaying information notification, device comes back to life	Succeed

The results of the analysis from network monitoring at SMK Wachid Hasjim Maduran show that the overall network performance is quite stable, with some performance declines that occur during peak hours. These disruptions mainly occur when many teachers and students access the network for the purposes of teaching and learning activities. In addition, some devices, such as routers and switches, experienced temporary outages, but generally recovered on their own or after being handled by an administrator.

Table 2. Device status

No,	device name	IP Address	Date	Status
1.	Asus	192.168.20.123	05/July/2024	UP
2.	Samsung	192.168.20.127	05/July/2024	Up
3.	Asus	192.168.20.134	05/July/2024	Down
4.	Samsung	192.168.20.127	05/July/2024	Down

Based on the results of monitoring analysis conducted at SMK Wachid Hasjim Maduran for one month, information was obtained in the form of device name, IP address, date, clock, and device status. The next stage is management, where the researcher is not involved in this stage. This is because this stage is the responsibility of the network administrator at SMK Wachid Hasjim Maduran, who has full access rights to implement security policies, add devices, monitor network data traffic regularly, and

make modifications to the existing network or system structure. Bandwidth usage has also increased during school hours, especially during activities that require internet access at the same time. However, the network can still function properly without disturbances that too hinder daily activities. The results of this monitoring provide a clear picture of network conditions, and can be used as a reference for further optimization, especially on devices that experience frequent outages.

IV. CONCLUSION

Based on monitoring research at SMK Wachid Hasjim Maduran which has been successfully implemented using Telegram messenger on The Dude application which utilizes the Telegram Bot API, the following conclusions can be drawn:

The system that has been built at SMK Wachid Hasjim Maduran is able to send messages in real time to network administrators, both monitoring from the local network and remote access from outside the local network through Telegram messenger.

Notifications that are successfully monitored and sent are device resources and device services that are up and down.

The use of The Dude and Telegram bots for monitoring not only focuses on device status notifications but can also be developed such as displaying more detailed information such as connection time, packet loss and displaying the percentage of CPU usage on each connected device.

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