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Enhance Security of the Field Flight Polytechnic Network and the Speed of the Internet Gateway in Virtual Box

M. Amril Siregar[1], Indah Vusvitasari[2], Ivana Wardani[3]
[1,2,3]*Telecommunication and Air Navigation Study Program, Politeknik Penerbangan Medan, Indonesia*
muhammadamril2017@gmail.com, Indahvusvita@gmail.com, ivanawardani27@gmail.com

Abstract

The development of information technology (IT) is currently growing rapidly, many from the lower middle class to businessmen and even entrepreneurs need internet network access. An internet network is a form of communication between computer networks around the world, wherewith the internet each computer located at a distance can communicate with each other, exchange information and resources. Currently, many networks are built using different network devices, one of which is a router. A router is a device for sending data packets between networks through a process called routing. In the market, many companies produce routers, one of which is Mikrotik with its product in the form of Mikrotik RouterOS which has been widely used to handle existing networks. So far, Mikrotik configuration has been a problem for some people because of ignorance in managing the network used so that many errors and fraud occur on the network used, even though products from Mikrotik have configuration programs based on GUI (Graphical User Interface) but still require long and confusing steps even if only to do configurations such as internet gateways.

Keywords
internet gateway; Mikrotik; RouterOS; network

I. Introduction

The development of Information Technology (IT) at this time is growing rapidly, many from the lower middle class to businessmen and even entrepreneurs currently need internet network access. The rapid development of this technology is indicated by the number of Internet Service Providers (ISPs) that have been established. Quoted from the website of the Indonesian Internet Service Providers Association (APJII) that there are around 490 ISPs that have been officially registered in 2018. completely ignoring and not paying attention to the network management used so that there are often many problems and fraud on the network used, including waste of resources, fraud, eavesdropping, data sent slowly, damaged or even not reaching the destination because communication often experiences time-outs. Waste of resources can be seen from using a modem that is not optimally used, so internet access is not optimal.

Therefore, a network requires a router that is configured as a controller and becomes a network gateway (gateway) data traffic so that it is right on target. The use of a router as an internet gateway can answer the challenges of the network problem itself with various facilities owned by the router, it is expected that data communication on the network can run well. Some aspects of router management can include various configurations such as IP address distribution, determining data transmission paths, firewall settings, gateway determination, and so forth. The router itself has various types, one of which is the MikroTik Routerboard. Mikrotik is known for being very complex and running on its operating system and has many features that can be used to configure a network.

II. Review of Literature

2.1. Computer Networks

A computer network is a group of autonomous computers that are interconnected with each other, using a certain media and communication protocol, so that they can share data and information. Computer networks allow for more efficient communication between users (mail and teleconference). (Yudianto: 2012) These devices are connected so that they can share data, information, application programs, and hardware such as printers, scanners, CD-Drives, and hard disks, and enable communication seamlessly electronic. While the home user application, allows communication between users more efficiently (chat), interactive entertainment more multimedia (games, videos, etc.). Computer Networks can be classified as follows: a. Local Area Network (LAN) Computer networks that are interconnected connected to a computer server using a certain topology, usually used in the area of a building or an area that is not more than 1 km away.

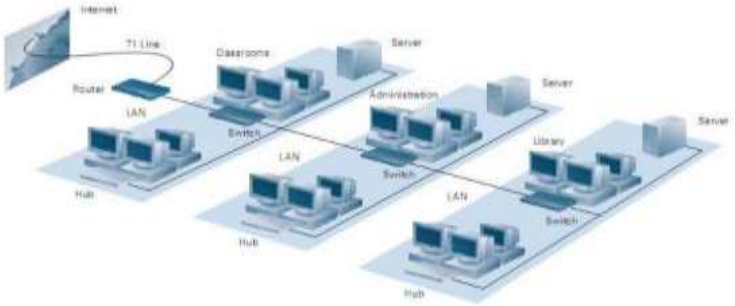

Figure 1. *Local Area Network (LAN)*

A computer network that is interconnected in a city area that can be more than 1 km away. Option to build a computer network between offices in a city, campuses in one city.

2.2. Internet

Internet stands for Interconnection Networking. "Internet comes from the Latin "inter" which means between. In other words, the internet means a network between or a liaison. So the conclusion from the definition of the internet is the relationship between various types of computers and networks in the world with different operating systems and applications where the relationship takes advantage of advances in communication (telephone and radio) that use standard protocols in communicating, namely TCP or IP (Transmission Control or Internet Protocol) protocols. ”(Esabella:2016). In simple terms, the Internet can be interpreted as a collection of several computers. Even millions of computers around the world are interconnected or connected. The media used generally use cable or fiber optics, radio, or telephone connections. The internet is a modern communication and information medium that can be utilized globally by users around the world in the interconnection between computer networks formed through facilities such as internet access providers so that the internet as a medium Information can be an effective and efficient means to exchange and disseminate information without being hindered by distance, time differences and also geographical factors for someone who wants to access information.

2.3. Gateway

Gateway (Network Gate) is a device that connects a computer network that is one or more computer networks with different communication media so that information when the computer network is transferred will be different from different network media. In today's era where the internet is rampant, often the notion of gateway shifts or is no longer the same as the initial understanding, and also many people associate or equate this gateway with a router which both has slightly different uses or meanings. A gateway can also be interpreted as a computer that can connect 2 or more networks because it has at least 2 network interfaces. To be able to connect 2 networks with different protocols, the gateway must convert each different protocol on each computer network so that they can be connected.

Gateways with different protocols cannot be connected because of different protocols, so automatically when sending information from one computer to another it cannot be accessed, therefore the protocol must be converted so that it can smoothly access information easily. be a path or route to indicate the destination of an address on the internet and the gateway can function as a router. Gateways can also connect one network to another even though each network has a different architecture and topology pattern. In addition, the gateway can connect a large computer network with another large network, not only that the gateway can also connect a large computer network with a smaller computer network. The term gateway usually refers to hardware or software that connects two incompatible applications or networks, and can transfer different data is different. An example of using a gateway is e-mail, and e-mail itself can send data with different systems. The goal is that clients on the local network can communicate with the internet. The router can be set as a gateway where it becomes a communication liaison that can connect 2 or more computer networks and the gateway can connect computer networks with different architectures (network buildings) or with different topological patterns. large with a very small network. (Pengertiandefinisi.com).

2.4. Understanding Operating System

An operating system is a set of software routines that sit between application programs and hardware. The operating system has the task of managing all computer system resources and as a service provider. The operating system provides System Calls in the form of functions or Application Programming interfaces (API).

This System Call provides a high-level abstraction of machines for programming. (Hendriadi: 2014) System Call functions to avoid programming complexities by providing a set of instructions that are easier and more convenient, the operating system as well as the basis for other programs where application programs run on top of the operating system the program utilizes computer system resources by requesting operating system services to control resources for applications so that the use of computer system resources can be carried out correctly and efficiently.

a. Process management,
b. Main memory management,
c. File management,
d. Secondary storage management,
e. I/O system management of network protection system, and
f. Command-interpreter system.

Known operating systems include:

a. a.Windows (95, 98, ME, 2000, XP, VISTA, SERVER, Windows7)
b. b.Linux (Red Hat, Slackware, Ubuntu, Fedora, Mikrotik, Debian, OpenSUSE)

c. UNIX
d. d.FreeBSD (Berkeley Software Distribution)
e. e.SUN (SOLARIS)
f. DOS (MS-DOS)
g. Macintosh (MAC OS, MAC OSX).

As a result, the ICT policy with regard to education aims at integrating ICTs in the education system, including secondary school education. Consequently, there have been efforts to promote and facilitate integration of ICT in the operations of public secondary schools in the country (Njoka, 2020). The usage of Information and communication technology (ICT) in education is very broad, teaching and learning process becomes more creative and does not use the same teaching materials. The use of ICTs makes teaching materials more varied and develops in accordance with the times (Harianja, 2019).

2.5. TCP/IP Protocol

TCP/IP standard is in fact more adopted by network equipment makers than the OSI standard. The TCP/IP standard regulates the connection of network equipment or hosts (computers) in WAN networks, LANs and manages IP addressing consistently. (Prasetyo: 2014)

This 32-bit (4 octet) IP address is better known as IANA-regulated IPv4 and is grouped into 5 parts, namely classes A, B, C, D and E. Classes A, B and C are groups that can be used to provide host addresses (computers in the network) and start with the number 1.0.0.0 to 223.255.255.255. The distribution of IP addresses can be seen as follows: a. Class A -1.0.0.0 to 127.255.255.255 with a netmask of 255.0.0.0 (note: 127.0.0.0/255.0.0.0 is used for loopback purposes).
b. Class B –172.16.0.0 to 172.31.255.255 with a netmask of 255.255.0.0
c. Class C –192.168.0.0 to 192.168.255.255 with a netmask of 255.255.255.0

This private IP cannot be used to hide a host to the internet network without a router and a public IP. 8.IP Address IP Address is a string of binary numbers between 32-bit and 128-bit which is used as the id address for each computer in the network. The current IP addressing system is divided into two, namely IP version 4 (IPv4) and IP version 6 (IPv6).(Agfir:2016).

2.6. Virtualization Technology

Virtualization technology is a technology that allows a physical machine to be used as a shared resource that can be shared and used by several services at once. These services can be configured independently without affecting the configuration of other services even in the same physical machine. Each service can have its operating system. (Harijanto: 2015) Virtualization is a term that can be interpreted as making a form or virtual version of something physical. Another definition is to create a virtual version of a resource (resource) so that one physical resource it can run or store several virtual resources at once. Resources that can be virtualized include computer hardware, data storage media (storage), operating systems (OS), and network services (Networking). Virtualization is possible because of the rapid development of hardware technology so that the ability of a physical resource is far above the needs of its users so that most of the time or its capacity is unused (idle).

III. Research Methods

At this stage it will be explained about the methods and steps that will be carried out in research on the use of internet gateways using the NDLC (Network Development Life Cycle) research method.

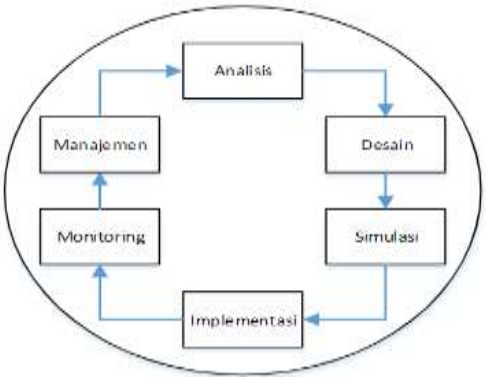

Figure 2. *NDLC Cycles*

In the picture the NDLC method consists of six stages, namely analysis, design, simulation, implementation, monitoring and network management including conducting trials on the network. (Stiawan: 2013).

The explanation of the stages in the NDLC cycle drawing is as follows:

1. Analysis In this initial stage, an analysis of the best network topology will be used in setting the internet gateway to be made. The methods used include interviews with several network engineers and direct surveys on the virtual machines that will be used.
2. Design At this stage, a network topology design drawing will be made that will be used based on the data obtained during analysis and using Cisco Packet Tracer.
3. Simulation The simulation stage is carried out using Cisco Packet Tracer software.
4. Implementation The implementation phase is the process of system development and testing, system installation, and system support plans. The implementation of this system constructs a new system and then the testing phase is carried out.

IV. Results and Discussion

In this study, the implementation and discussion of the system design which was previously discussed in the previous chapter will be carried out. The system implementation stage is the stage of laying out the system requirements so that it is ready for operation and for making discussion reports. This implementation stage is also an activity in writing a script for a micro-router OS network in a virtual machine and documenting the steps to be taken. Implementation is the implementation stage and at the same time testing for the system based on the results of the analysis and design that have been carried out in the previous chapter.

4.1. Implementation Environment

The implementation environment of this application is divided into several environments, namely hardware environment, software environment and human resource environment. Software Environment (Software). The analysis and implementation of the internet gateway using the router board in this virtual box is run on a laptop and requires the following software:

1) Windows, Debian, and MikroTik Routerboard OS An operating system that is used as a host computer, client, and router.
2) Virtual Box as a virtual machine that will run various operating systems for implementation.
3) Cisco Packet Tracer as a virtual network application used in the analysis and design stages.
4) Winbox is an application used for connectivity and as a proxy network configuration.
5) Google Chrome as a web browser to display and run the web fig application program.

4.2. Configuration and Implementation

Internet Gateway (IP Static) a. Using CLI (Command-line Interface) The steps for configuring Mikrotik as an internet gateway are as follows: Mikrotik Router OS that has been connected to the ISP in this section uses a cellular hotspot that is bridged by the host computer so that it can register an IP address with the same segmentation internet network that will be used for routing on Mikrotik in the future.

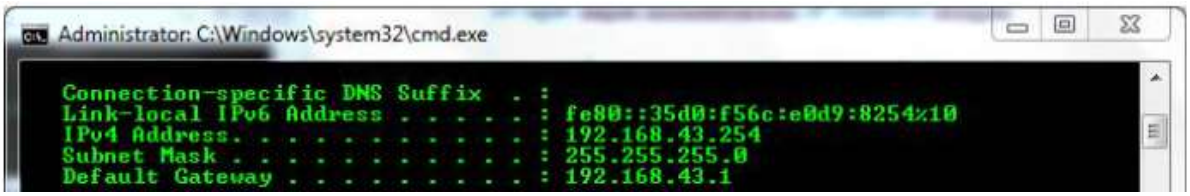

Figure 3. *See the IP Address of the computerhost that is connected to the cellular hotspot*

Then run MikroTik Router OS and log in according to the registered user and password. In this section, the researcher uses the default user and password, namely user: admin and password: no password or directly press enter.

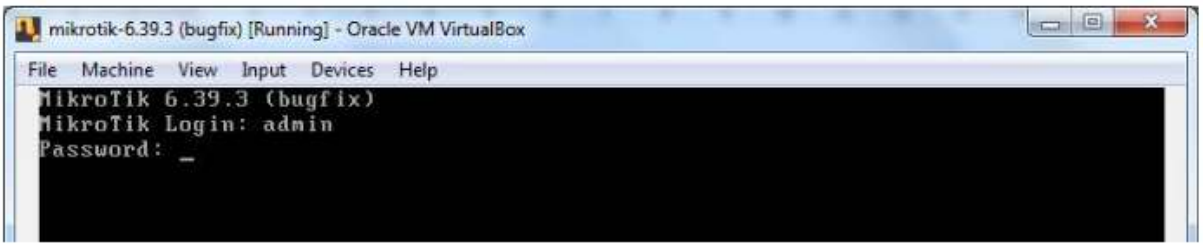

Figure 4. *Display Login form*

Then set the IP address so that Mikrotik can access the internet which will be routed from the IP address of the internet source that will be used. Internet Gateway Configuration and Implementation (IP DHCP) On the Mikrotik router board there is a feature that functions to manage the distribution of IP addresses, namely DHCP (Dynamic Host Configuration Protocol). Among the DHCP features that have been supported by MikroTi include DHCP Server, DHCP Client and DHCP Relay. The implementation of this DHCP IP addressing configuration is used to assign addresses automatically, which is different from the previous configuration, namely manual addressing. Assigning an ip address, where the ip address that has been previously set will be deleted. Here is the implementation of the Dynamic Host Configuration Protocol (DHCP) addressing configuration. The first step is to add a dhcp address to ether1 which is the source of the bridged internet. Then ipdhcp-client print command to display the previous configuration, if there is an address and the status has been bound then we mikrotik automatically have got the address automatically.

V. Conclusion

Based on the discussion of the research that has been done, it can be concluded that the Mikrotik Routerboard as a replacement operating system for the Mikrotik router hardware which is specially designed for networking purposes with many features and easy use.

From the observations that have been made, several main conclusions can be drawn including the following:

1. Mikrotik router os is a Linux-based operating system that is intended as a network router.
2. The configuration carried out on the internet gateway acts as a converting protocol to connect one network to another.
3. The use of an internet gateway has many advantages, one of which is using internet resources together and then redistributing them using a MikroTik router.
4. High reliability with computer networks having alternative sources of internet supplies that configure internet gateways.
5. The use of an internet gateway can save money because it only takes one internet source to be redistributed.

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