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SIMULATION OF RUSUNAWA UHAMKA INTERNET NETWORK USING CISCO PACKET TRACER WITH PPDIOO METHOD

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Abstract: Computer networks are not just additional facilities in the campus environment, but computer networks help the overall academic activities and social relations of students. This research aims to overcome the problem of uneven wifi internet networks and less than optimal SSID management in UHAMKA flats, which has an impact on student access to information and communication. The method used is PPDIOO with simulation using Cisco Packet Tracer and the chosen star topology to provide a stable connection and easy network management. The results of the simulation show that all devices are well connected to each other, as indicated by the successful IP ping test between devices. The research concluded that the PPDIOO method was successful in designing an effective and structured internet network in the students' living environment. So that it can improve access to academic activities and good communication.

Keywords: cisco packet tracer; computer networks; PPDIOO

Abstrak: Jaringan komputer bukan hanya sekedar fasilitas tambahan dalam lingkungan kampus, tetapi jaringan komputer membantu keseluruan aktivitas akademik dan hubungan sosial mahasiswa. Penelitian ini bertujuan mengatasi permasalahan jaringan internet wifi yang belum merata dan pengelolaan SSID yang kurang optimal di rusunawa UHAMKA, sehingga berdampak pada akses informasi dan komunikasi mahasiswa. Metode yang digunakan adalah PPDIOO dengan simulasi menggunakan cisco packet tracer dan topologi star yang dipilih untuk memberikan koneksi stabil dan pengelolaan jaringan yang mudah. Hasil dari simulasi menunjukan seluruh perangkat saling terhubung dengan baik, ditandai dengan berhasilnya pengujian ping IP antar perangkat. Penelitian menyimpulkan metode PPDIOO berhasil dalam merancang jaringan internet yang efektif dan terstruktur di lingkungan tempat tinggal mahasiswa. Sehingga dapat meningkatkan akses aktivitas akademik dan komunikasi secara baik.

Kata kunci: cisco packet tracer; jaringan komputer; PPDIOO

INTRODUCTION

The development of information technology in Indonesia is very rapid, it can be seen from the results of the 2024 Indonesian internet penetration survey released by the Indonesian Internet Service Providers Association (APJII), the data shows that Indonesia's internet penetration level has reached 79.5% or around 221 million users[1]. In the education sector, students are the largest internet users, reaching 98.3% of the number of students in Indonesia[2]. This confirms

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that almost all students are very dependent on the internet network to support their academic and social activities. The development of computer network technology is currently increasingly rapid in line with the needs of society, especially educational institutions[3]. This plays a very important role in the use of the internet in managing information so that work becomes more effective, namely services that utilize computer networks.

One of the important facilities provided in the campus environment is student housing, such as Rusunawa UHAMKA which provides various facilities, including beds, bathrooms, wardrobes and wifi internet networks, however, in practice, the wifi internet network facilities in Rusunawa UHAMKA cannot be utilized optimally by all residents of the flats. Using the internet is very important for students to access information such as academics and communication[4]. The main problems faced are uneven network coverage and less than optimal SSID management. This condition can have an impact on online learning materials, disrupt online communication and reduce productivity in completing academic assignments. Therefore, there is a need for changes to develop the management of computer networks within the UHAMKA flats.

This research focuses on computer networks in terms of internet (wifi) network simulation which will be assisted by the PPDIOO method which provides systematic work stages[5] and the topology that will be used for the simulation is a star topology because it provides a more stable connection and makes network management easier[6]. Cisco Packet Tracer is a tool that allows users to create very realistic computer network simulations and allows users to understand how computer networks work in detail[7]. Cisco Packet Tracer, this application can be used as a simulation to carry out network tests with various network devices, such as routers, switches, servers, etc. without requiring expensive costs to buy various devices[8].

Various previous studies have discussed the design and simulation of WiFi internet networks in school and office environments. For example, previous research has proven that WiFi network designs using a star topology have been successfully implemented[6]. Other research shows that network designs simulated using the Cisco Packet Tracer application show that all devices are well connected according to the predetermined IP division[9]. Other research confirms that applying the PPDIOO method, researchers can design networks that suit agency needs, including topology mapping and network architecture to be used [4].

Other research proves that the use of Cisco Packet Tracer as a simulation tool for designing and configuring computer networks has succeeded in increasing the efficiency of network management in a Vocational High School environment[10]. Another study concluded that the results of the analysis and design of the VLSM network at Smait Al-Usnah Surabaya using Cisco Packet Tracer were successfully designed and implemented using Cisco Packet Tracer through a ping test between devices showing that the network was functioning well[11]. However, most of the previous research focused on school or office environments, while this research focuses on the novelty of implementing WiFi internet networks in student residential environments, namely the UHAMKA rusunawa.

This research aims to design and simulate a uniform WiFi internet network in the UHAMKA flats environment using

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Cisco packet tracer with the PPDIOO method. The topology chosen is star which provides a more stable connection and makes network management easier. It is hoped that this research can be a solution to existing network problems and contribute to the development of WiFi internet networks in campus residential environments, so that access to academic information and communication can run more effectively and efficiently.

METHOD

The type of research used is waterfall combined with the PPDIOO method in the program design section.

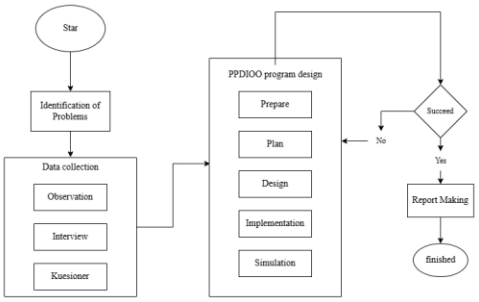

Image 1. Research Diagram

The place of research was carried out in the flat of Muhammadiyah University, Prof. Dr. Hamka is housed in the FKIP UHAMKA faculty. The problems with the UHAMKA Rusunawa computer network include uneven network coverage and poor SSID management.

Data collection in this research was carried out using observation and interview methods at the UHAMKA flats. Researchers made observations at the flat buildings to describe the layout of existing computer network devices. After observing the location, it was continued with an interview with one of the UHAMKA flat administrators. At this stage the researcher looked for information regarding the needs and condition of the computer network in the UHAMKA flats.

The network design that will be used in this research is the PPDIOO method. PPDIOO is an abbreviation of prepare, plan, design, implement, operate, optimize, is a systematic network management framework to ensure effective network planning, implementation and maintenance[12]. These 6 stages can be defined as follows.

Prepare, namely identifying needs and information on a running computer network[13]. Develop a network strategy based on the results of identification. Plan (planning) analyzes network needs, facilities, topology and devices to be used[4].

Design means starting to create a network and system design based on the analysis that has been carried out at the planning stage[14]. An overview of the building plan and network structure is created, explaining how to implement the network system. The selection of network topology and architecture models is also carried out to understand how the entire network system will run.

Implementation is the step where researchers turn plans and designs into reality by installing and configuring network devices using Cisco Packet Tracer according to predetermined specifications [15]. Simulation is a step where the implementation and configuration have been designed for testing[9].

RESULTS AND DISCUSSION

Preapre dan Plan

This flat is a student apartment consisting of several floors with quite a large number of residents, the existing internet network (wifi) infrastructure is

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not yet optimal for the area it reaches. Observations and interviews were carried out to understand the layout of the building, including the location of rooms that require internet network access (wifi). Based on the results of observations and interviews with the UHAMKA rusunawa administrators, there is a floor plan of the building along with floors and the number of rooms that will have an internet network (wifi).

Table 1. Building Plan

Gedung	Lantai	Kamar	Penghuni
Putra	3	16	3 / 4
Putri	3	16	3 / 4

Based on observations and interviews, the tools that will be used in research and simulation are as follows:

Table 2. Device

Nama Perangkat	Jumlah
PC-PT	4
Router	1
Swicth	4
Access Point	12
Server-pt	2

Network topology planning based on the data that has been collected is to use a star network topology where each access point device is connected directly to the network center. The star topology was chosen because it is able to provide a more stable connection and makes network management easier. Apart from that, the placement of access point devices can ensure internet network (wifi) coverage covers the entire flat area. After designing and preparing the tools for the simulation, then create a layout and network plan to make the work easier.

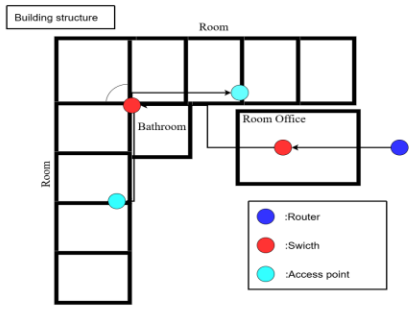

Image 2. Building Layout and Plan

Design

At this stage, the network design will be prepared using Cisco Packet Tracer.

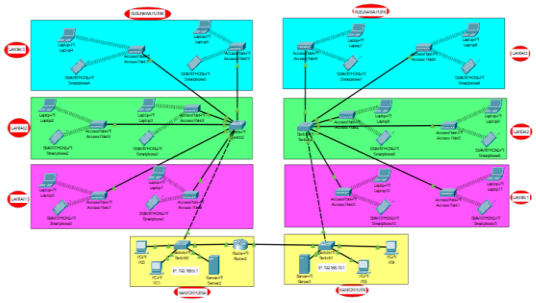

Image 3. Network Design

Figure 3 shows the results of the design that has been made based on the building network plan that has been analyzed. There are two access points on each floor for an even network, one switch in each Rusunawa Putri building to connect the network to the access point, two switches placed in both Rusunawa Putri Putra offices, each Rusunawa building has its own server to manage the IP addresses of network users, and the main router is placed in the Rusunawa Putra office. The management of access points for SSID on each floor is differentiated to avoid accumulation on one network which results in a slow network and the placement of access points is also taken into account to ensure opti-

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mal signal coverage throughout the flat area.

Implementation

Next, configure the devices that have been previously designed, the configuration is carried out in 3 stages, the first is the router configuration to provide an IP gateway to be used in the Rusunawa Putri-putra building, the second is the server configuration to manage the connected network and assign IP addresses automatically (DHCP) to users, the third is the access point configuration to set the SSID and network password for each floor of the Rusunawa.

Configuration Router

Configure the router as the main gateway to the internet network, the router will be configured to provide a gateway IP address to the network that has been designed in each flat building, the IP gateway setting is done so that every device connected to the network can communicate properly via the internet network. The men's building is given a gateway IP 192.168.5.1 and the women's building is given a gateway IP 192.168.10.1.

Here's how to configure the router, first click on the router icon. After that, select the "Config" menu that is available. In the "Config" menu, navigate to the "FastEthernet0/0" section. Next, make sure to check the "Port Status" section to turn on or enable the port. Then, in the "IPv4 Address" section, enter the specified IP address, which is "192.168.10.1". Finally, fill in the "Subnet Mask" section with "255.255.255.0", and the configuration process is complete.

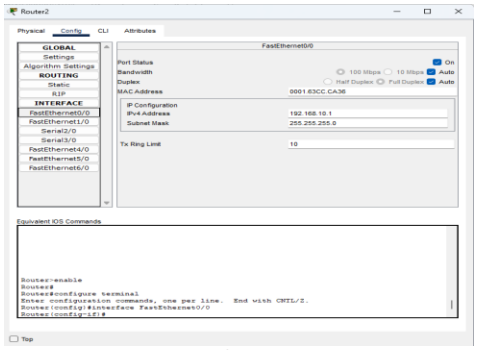

Image 4. Configuration Router

Configuration Server

Configure the server as the internet network control center. The server plays a role in managing network traffic and providing services needed by network users. This configuration will involve setting up the Dynamic Host Configuration Protocol (DHCP) to give user devices an IP address automatically without the need for manual settings. Server configuration as follows:

To configure the server device, first click the server icon. After that, select the "Desktop" menu and then click "IP Configuration". In the "IPv4 Address" section, enter the specified IP, namely "192.168.10.2", pay attention to the difference in the last number. Fill in the "Subnet Mask" with "255.255.255.0" and the "Default Gateway" with the IP "192.168.10.1". After that, click "Close".

Next, to activate the DHCP service, select the "Services" menu and click "DHCP". Make sure to select "On" in the "Service" section. Then, fill in the "Default Gateway" with the IP "192.168.10.1". For "Start IP Address", enter the IP "192.168.10.3"; this last number will be the initial IP given to the user. Then, fill in the "Subnet Mask" with "255.255.255.0" and specify the maximum number of users in the "Maximum Number of Users" by filling in "50". Fi-

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nally, click "Save", and the configuration is complete.

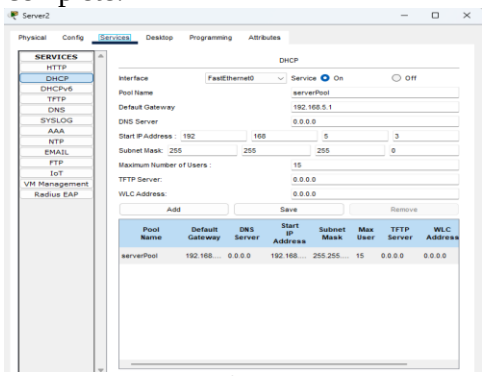

Image 5. Configuration Server

Configuration Access Point

What will be configured at this access point is a unique Service Set Identifier (SSID) for each flat floor to distinguish internet networks and make it easier to identify connections by flat users. Apart from that, network security settings such as WPA2 and password settings are carried out to ensure that only floor users can use the internet network. Table list of SSID names and passwords for each floor of the flat:

Table 3. SSID

Lantai Gedung	Nama SSID	Kata Sandi
Lantai 1 Putra	LT1Putra1	Rusunawa
	LT1Putra2	Rusunawa
Lantai 2 Putra	LT2Putra1	Rusunawa
	LT2Putra2	Rusunawa
Lantai 3 Putra	LT3Putra1	Rusunawa
	LT3Putra2	Rusunawa
Lantai 1 Putri	LT1Putri1	Rusunawa
	LT1Putri2	Rusunawa
Lantai 2 Putri	LT2Putri1	Rusunawa
	LT2Putri2	Rusunawa
Lantai 3 Putri	LT3Putri1	Rusunawa
	LT3Putri2	Rusunawa

How to configure the access point as follows To configure the access point device, start by clicking on the access point icon. After that, select the "Config" menu. Next, click on the "Port 1" section. In the "SSID" section, enter the specified SSID name, which is "LT1Putri". Then, in the "Authentication" section, select the "WPA2-PSK" option and enter the password "Rusunawa" in the column provided. After all these steps are completed, your access point configuration is successful.

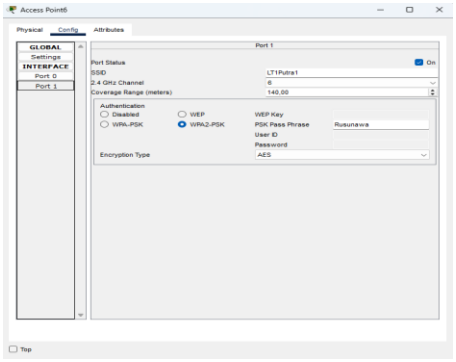

Image 6. Configuration Access Point

Simulation

After the implementation of the device configuration has been completed, now a connection test is carried out to ensure that all devices are connected to each other properly. The test is carried out by pinging and sending data, this is to check whether each device can connect to each other without problems.

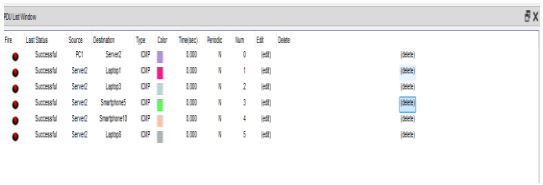

Image 7. Send Data

Sending data is done by clicking on the "letter" icon then directing it to the network device that you want to try then see the results in "PDU" if the status is "successful" the device was successfully connected properly if the status is "Failed" it means it failed to connect. You can see the picture above shows eve-

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rything is connected well, from the server to the user device "PC1" to other devices.

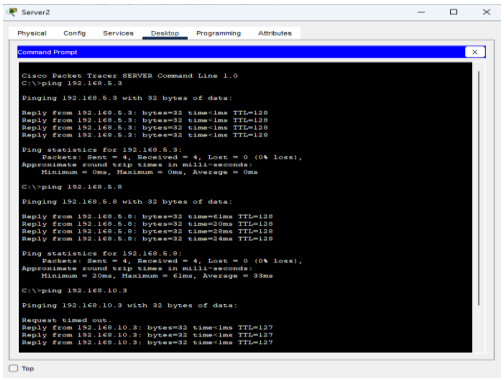

Image 8. Ping Test

The ping test is carried out by selecting the device you want to try, then clicking the "desktop" section, selecting the "command prompt" section, then typing "Ping" followed by the IP address you want to try, then pressing "enter" when it says "TTL" the device has successfully connected properly.

CONCLUSION

This research has succeeded in designing an internet (wifi) network simulation in Rusunawa UHAMKA using the PPDIOO method and Cisco Packet Tracer software. With a systematic approach consisting of preparation, planning, design, implementation and simulation, the resulting network design is able to provide a solution to the need for an even internet network and more optimal SSID management throughout the flat area. The star topology used is proven to make network management easier and increase connection stability between devices, thereby helping students' academic activities in the flats run smoothly. The simulation results show that all devices can be connected to each other well, which shows that the network design has met the needs of users in the UHAMKA flats.

This research opens up opportunities for further development through the application of simulated designs in real environments to test designs that have been designed and connections between devices in real conditions. In addition, further research can compare the performance of the star topology with other topologies to find the best solution that is most suitable for the WiFi internet network needs in each environment.

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