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Analysis of LAN networks in a deep Pustu Gelebak Dalam using Cisco Packet Tracer

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ABSTRACT

Recently, the development of information and communication technology, especially computer networks, is now so rapid and has become one of the indicators of human progress. Along with these developments, users' needs for network access quality are increasing, both LAN (Local Area Network) based. The quality in question includes high data transmission speeds, stable connections, and a system that is able to support various activities without interruptions or problems that can reduce work productivity. With the existence of LAN networks, the use of information and communication technology can be an effective connecting medium. This research was carried out with the aim of helping to analyze and simulate the Local Area Network (LAN) network which is equipped with integration using the Cisco Packet Tracer application at the Gelebak Dalam Auxiliary Health Center. The presence of a LAN network will allow various processes and transactions to be carried out more efficiently, reduce potential problems, and improve the quality of services provided by institutions or organizations. This project is for that. This study will assess the condition of the LAN network at the Gelebak Dalam Auxiliary Health Center using Cisco Packet Tracer. It is anticipated that the LAN network in the health center can be optimized to be more efficient.

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1. Introduction

Recently, the development of information and communication technology, especially computer networks, is now so rapid and has become one of the indicators of human progress. Along with these developments, users' needs for network access quality are increasing, both LAN (Local Area Network) based. The quality in question includes high data transmission speeds, stable connections, and a system that is able to support various activities without interruptions or problems that can reduce work productivity. With the existence of a LAN network, various processes and transactions can be carried out more efficiently, reduce the potential for errors, and improve the quality of services provided by agencies or organizations [1].

Technological progress will always develop following the advancement of science. Internet technology has a great influence in all aspects, especially in the implementation of government service functions to every citizen in need. The field of Public Services is related to people in need with the government as a service provider. The government is required to be able to keep up with technological developments in services to the community more effectively, efficiently, quickly and accurately [2].

A network is a system that connects two or more computers with wired or wireless connecting media. This relationship allows each connected computer to exchange data or information and share resources such as files, printers, storage media [3].

The quality of internet access and computer networks has changed many aspects of human life, both in terms of work, education, and social interaction. One of the sectors that greatly benefits from this technological development is the healthcare sector. The use of information and communication technology can be an effective communication medium to improve the quality of health services, both in relationships between employees, between health centers and patients, and with the community around health centers[4]. With an adequate computer network, the health center can improve the efficiency of administrative services, facilitate access to patient data, and support fast and precise communication between medical staff. Two computer units are said to be connected if they can exchange data/information, share their resources, such as: files, printers, storage media (hard disks, floppy disks, cd-roms, flash disks, etc.). [5] Data in the form of text, audio or video moves through wired or wireless media, allowing computer users in a computer network to exchange files/data, print on the same printer and use hardware/software connected to the network together. Based on the area, computer networks are divided into Local Area Network (LAN), Metropolitan Area Network (MAN), and Wide Area Network (WAN)[6].

Therefore, the success of health service management is highly dependent on the reliability of the technological systems used, including existing computer networks. Along with these developments, it is important for every agency, including health centers, to have a computer network. At the Gelebak Dalam Auxiliary Health Center, for example, the implementation of an efficient LAN network will help improve the quality of health services to the community. A good network will facilitate the communication process between medical and administrative personnel, speed up the data processing process, and reduce errors caused by a lack of an effective communication system[7]. In this context, the use of the right information technology will greatly support the achievement of the organization's goals, which are to improve services to the community more quickly and accurately. For this reason, this project aims to help analyze and design the existing LAN network at the Gelebak Dalam Auxiliary Health Center. This simulation will be performed using the Cisco Packet Tracer application [8].

A LAN (Local Area Network) is a local computer network that connects several computers and terminals over a short distance. The transmission medium that is commonly used is cable. But in recent developments, wireless LAN has begun to be developed with implementation costs that are not too expensive as with cables[9].

Using Cisco Packet Tracer, this study will map the condition of the LAN network at the Gelebak Dalam Auxiliary Health Center. It is hoped that with the analysis carried out, the LAN network at the health center can be optimized to be more efficient. In addition, this research will also provide a way to design and manage computer networks both in terms of the devices used, network configuration, and overall network simulation.

2. Research Methods

2.1 Design and Implementation

In this design, a Cisco Packet Tracer network simulation was used in the Gelebak Dalam Pustu which consisted of 1 Administration Room, 1 Examination Room, 1 Maternal & Child Poly Room, and 1 Pharmacy Room.

Figure 1. Design Block Diagram

Network design for the Puskesmas with 4 rooms (Administration, Examination, Maternal & Child Poly, Pharmacy) using a tree topology. The devices used include switches, PCs in each room, and servers to store data. IP addresses are used for devices, e.g. 192.168.1.2 for the administration room, 192.168.1.3 for the examination room, and so on.

2.2 Research Methods

The method used in this study is a qualitative method. The qualitative method is research that is carried out intensively and systematically to obtain information. This type of research approach is a case study. Case studies are investigative activities to describe and analyze intensively and in detail a specific phenomenon or social unit[18]. The data collection technique was carried out by observation, literature study to analyze the Cisco network at Pustu Gelebak Dalam[4]. The time for this research was carried out from November to December and took place at the Pustu of Gelebak Dalam Village, Rambutan District, Banyuasin Regency.

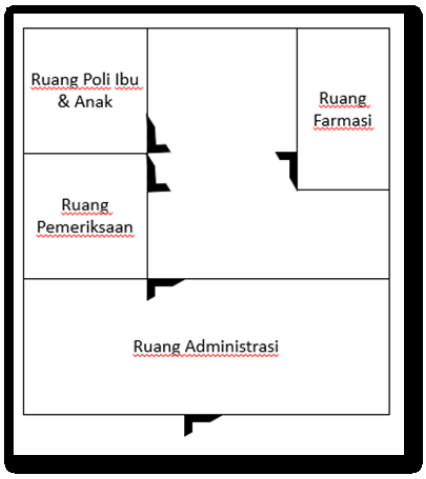

Figure 2. Pustu Gelebak Dalam Plan

2.3 Research Flowchart

The following are the steps that must be done if you want to do a network simulation using Cisco.

1. The first stage of the user designing the network topology
2. The second stage of the user sets *the IP Address, Server, Switch*
3. The third stage of the user configuring the device
4. The fourth stage of the user performs connectivity testing such as ping
5. The fifth stage analyzes the simulation results

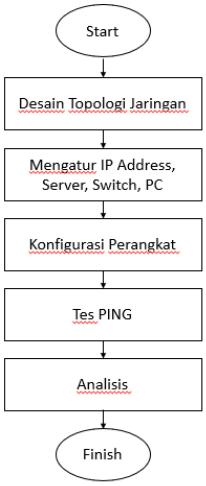

Figure 3 Research Flowchart

2.4 System Development Methods

In this study, the system development method used by the researcher is the Network Development Life Cycle (NDLC) model development method with the stages of analysis, design, simulation prototyping,

implementation, monitoring, and management, where specifically for the implementation, monitoring and management stages are not implemented. NDLC is the key behind the computer network design process. NDLC is a model that defines the development process cycle or computer network system[19].

3. Results and Discussion

In the study, a Local Area Network (LAN) network analysis was carried out using the cisco packet tracer 8.2.1 simulator application, then a network scheme was made according to the data obtained in the field. There are supporting devices, namely, 1 server, 3 switches/hubs, and 4 computers that are already in this center.

A LAN Computer Network or Local Area Network is a computer network consisting of several computers that are connected to each other in a relatively small area such as a building, campus, or office. LANs allow these computers to communicate and share resources efficiently. These networks are usually used by companies or institutions that need quick and easy access to data and information[8].

A LAN (Local Area Network) is a local computer network that connects several computers and terminals over a short distance. The transmission medium that is commonly used is cable. But in recent developments, wireless LAN has begun to be developed with implementation costs that are not too expensive as with cables[9]. To be able to determine the topology of the computer network to be used, you can take advantage of the work area of the Cisco packet tracer and then select the end device to determine the device to be connected and the type of concentrator that is tailored to your needs. After all have been selected, connect each end device to a concentrator with a connection facility.

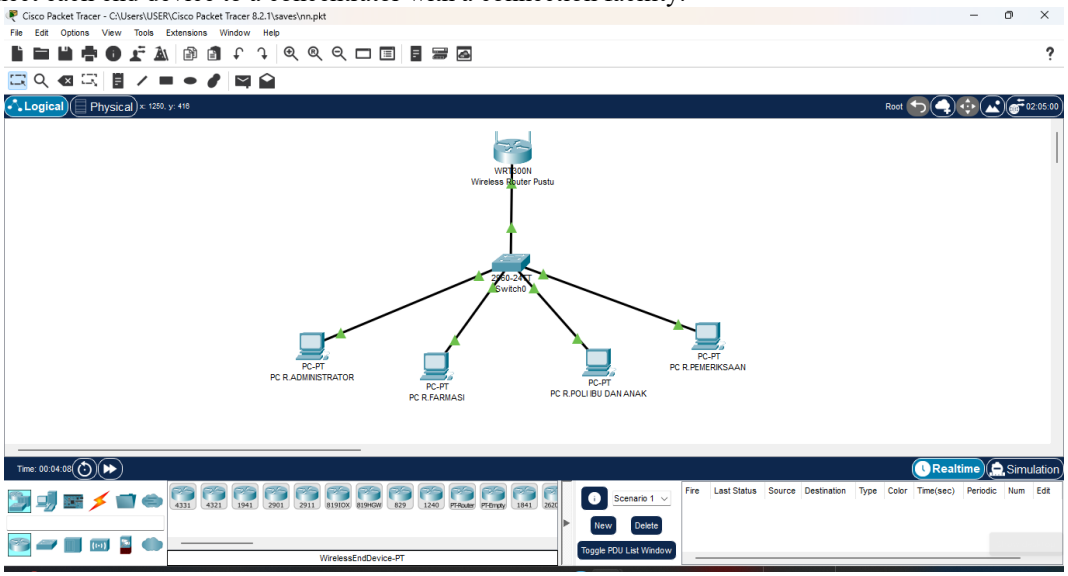

Figure 4. Creating a Network Topology

3.1 Specifying an IP Address

To create an IP address by double-clicking on the device where the IP address will be created, then select the desktop menu, select IP configuration, enter the IP number according to the specified class. An IP address is the identity or address of a device in a computer network.

Table 1 IP Address

Yes	Pc	Room	IP Address	Subnet Mask
1	PC PT PC 0	R. Administration	192.168.1.2	255.255.255.0
3	PC PT PC 1	R. Inspection	192.168.1.3	255.255.255.0
4	PC PT PC 2	R. Poly Mother & Child	192.168.1.4	255.255.255.0
5	PC PT PC 3	R. Pharmacy	192.168.1.5	255.255.255.0

3.2 Computer Network Simulation

In the study, a Local Area Network (LAN) network analysis was carried out using the cisco packet tracer 8.2.1 simulator application, Cisco Packet Tracer is a computer network simulation software. Cisco packet tracer is a cross-platform visual simulation tool designed by Cisco Systems that allows users to create network topologies and mimic modern computer networks through computers. Packet tracer helps students to understand the topology and design of a network. This software can be used to design, configure, and

troubleshoot networks without the need for physical hardware. Cisco Packet Tracer is very useful for students, network professionals, and educators to learn and teach how to conceptualize computer networks in an interactive and comprehensive manner[12].

Using Cisco Packet Tracer, users can create complex virtual network topologies and simulate interactions between various network devices such as routers, switches, servers, and other devices. It allows users to test network configurations, observe network traffic, and see how data is being transmitted over the network. In this case, the author will create and implement a computer network for use in the laboratory and then simulate using the Cisco Packet Tracer simulator[13]. Then a network scheme is made according to the data obtained in the field. There are supporting devices, namely, 1 wireless router, 1 switch/hub and 4 computers that are already in this center, the scheme of the lan network network is as follows

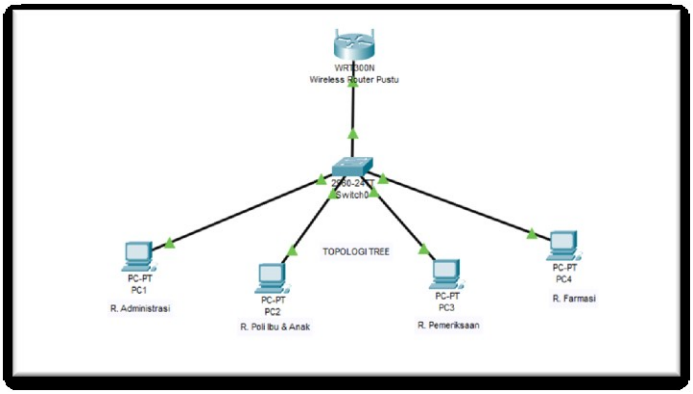

Figure 5 LAN Network Topology Schema

In this study, computer networks have been simulated using a network simulator application, namely Cisco Packet Tracer Version 8.2.1. The network was previously arranged according to the situation in the field, then the network connection was checked again with the PING command, and it was found that the server network connection to computer network 1 (administration room) was connected, the server network connection to computer network connection 2 (examination room) was connected, the server network connection to computer 3 (mother and child poly room) was connected, and the server network connection to computer 4 (pharmacy room) was connected. From this study, it was also found that the network used in Pustu Gelebak Dalam is a type of LAN network with a tree topology. Next, test send data in the Cisco Packet Tracer application, to find out if all the computers are connected:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	PC1	PC2	ICMP		0.000	N	0	(ec

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	PC2	PC3	ICMP		0.000	N	1	(ec
	Successful	PC3	PC4	ICMP		0.000	N	2	(ec
	Successful	PC4	PC1	ICMP		0.000	N	3	(ec

Figure 6. Data Send Test

3.3 Test Results

From the simulations that have been carried out, data is obtained for each of the network performance parameters that have been calculated.

a. Delay

The result of the delay between the Administration and Examination rooms was 40.2 ms, for the Examination room with the Mother & Child Poly was 35.9 ms, for the Mother & Child Poly room with Pharmacy was 43.4 ms, and the delay produced between the Pharmacy and Administration rooms was 50.1 ms. Where the delay was included in the very good category.

The results of the delay simulation are shown in Table

Table 2. Delay

Parameters	**Simulation Room**	**Simulation Results**
Delay (ms)	R. Administration – R. Examination	40.2 ms
	R. Examination – R. Mother & Child Poly	35.9 ms
	R. Poly Mother & Child – R. Pharmacy	43.4 ms

	R. Pharmacy – R. Administration	50.1 ms

b. Packet Loss

The packet loss results are shown in the Table

Table 3. Packet Loss

Parameters	Simulation Room	Simulation Results
Packet Loss (ms)	R. Administration – R. Examination	0%
	R. Examination – R. Mother & Child Poly	0%
	R. Poly Mother & Child – R. Pharmacy	0%
	R. Pharmacy – R. Administration	0%

From the test results using cisco packet tracer during the simulation process, the packet loss results obtained by 0%, can be seen in Table 2 where the packet loss value is included in the category is very good.

c. Throughput

Throughput is the effective data transfer rate, which is measured in bps (bits per second). Throughput is the total number of successful packet arrivals observed at a destination during a given time interval divided by the duration of that time interval[11]. To get the throughput value can be calculated with the equation:

$$\text{Troughput} = \frac{\text{Amount of Data Sent}}{\text{Data Delivery Time}}$$

The results of the throughput simulation are shown in the Table

Table 4. Throughput Results

Parameters	Simulation Room	Simulation Results
Troughput (kbps)	R. Administration - R. Inspection	0.51 kbps
	R. Examination - R. Poly Mother & Child	0.38 kbps
	R. Poly Mother & Child - R. Pharmacy	0.39 kbps
	R. Pharmacy - R. Administration	0.44 kbps

The result of the Throughput between the Administration and Examination rooms was 0.51 kbps, for the Examination room with Mother & Child Poly was 0.38 kbps, for the Mother & Child Poly room with Pharmacy was 0.39s, and the resulting throughput between the Pharmacy and Administration rooms was 0.44 kbps. Based on the simulation results, a good throughput value occurred in the Administration and Inspection room of 0.51 kbps, where the greater the throughput produced by the simulation process, the better it is and conversely the small throughput produced by the simulation process is not good.

4. Conclusion

Based on the results of the research that has been carried out at Pustu Gelebak In, it can be concluded that the process of analyzing the Local Area Network (LAN) network uses the Cisco Packet Tracer application, and the network topology used is the LAN Star network topology. In the creation of the Pustu network simulation, the step-by-step steps used in development include the design of the network topology, setting the IP address, switch, and PC configuration of the device. Then a PING test is carried out and connects 1 PC to another PC. And the results of the analysis went well. From the results of the simulation, it can be seen that the delay that occurred at the Pustu occurred. For the test results, the entire room did not experience packet loss during the simulation process. Based on the simulation results, a good

throughput value occurred in the administration and inspection room of 0.51 kbps compared to the throughput value in other rooms.

Suggestion

It is hoped that with this design, development can be carried out in the following directions:

1. Handle Delay by optimizing routing to reduce latency spikes.
2. Fine-tuning throughput to accommodate user growth and future increased network load.
3. Conduct network testing with various tools to make the data obtained more accurate.

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