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The Implementation of Top-Down Approach Method on Redesign of LAN Harvani Hotel Palembang

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Abstract —In this research, the object was taken from one of the hotels in Palembang, namely Harvani Hotel Palembang. This hotel is one of the hotels in South Sumatra Province, where this hotel has 4 floors. Harvani Hotel Palembang has a Local Area Network (LAN) which consists of several computers. LAN is very important to be applied to Harvani Hotel Palembang in order to support administrative work processes (management of hotel data, employee data, guest data to financial data) and guest needs (internet usage in every room of the Hotel which is one of the services provided by Harvani Hotel Palembang). However, the LAN owned by the Harvani Hotel Palembang still has disadvantages, such as LAN still cannot reach every hotel room on the 2nd floor. In addition, the administration side also faces obstacles because each floor of the Harvani Hotel Palembang has its own administrative section and then at the end of each work shift, reports from each administrative section are submitted to the administrative department on the 1st floor using external storage media. Therefore, it is necessary to redesign the Harvani Hotel Palembang LAN by applying the Top-Down Approach Method. The results of LAN redesign in this research will be displayed using Cisco Packet Tracer simulator software, where from the simulation results it can be seen that the new design of the Harvani LAN Hotel Palembang has connected the entire computer of each room and every floor of the Hotel. Therefore, if the results of this simulation are applied to Harvani Hotel Palembang, then the administrative work process can be managed directly because all data has been stored on the database server. In addition, this new LAN design has also reached all guest rooms of Harvani Hotel Palembang, so guests can access the internet in their respective rooms more comfortable.

Keywords – LAN, Computer, Top-Down Approach, Cisco Packet Tracer

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I. INTRODUCTION

In this research, the example of the object taken is Harvani Hotel Palembang, which is located in Palembang City. This hotel has 4 floors which are divided into 3 parts, namely hotel rooms for guests on the 1st and 2nd floors, a spa place on the 3rd floor and a karaoke room on the 4th floor. At this time, Harvani Hotel Palembang already has a computer network as a communication path and work process at this hotel. Computer Networks are a group of computers that are connected to each other and work automatically. There are two types of relationships in computer networks,

namely by using cables and without cables [1]. Computer networks can also be said as a system consisting of various computers and their resources that are designed to be able to use existing resources, so they can access the information needed. The purpose of building a computer network is to send data or information from the sender to the recipient quickly and accurately [2]. In computer networks, of course, the most needed device is a computer, where the computer is an electronic device capable of performing several tasks such as receiving input, processing input according to the program, storing commands and results of processing, and providing output in the form

of information [3]. This hotel implements a Local Area Network (LAN), where LAN is a network that limited by a relatively small area, generally limited by an environment area such as an office in a building or each room in a building [4]. LAN is used in homes, offices, industries, universities or academics, hospitals and similar areas [5]. In other words, a LAN is a collection of hosts that have a relatively closer range that allows for high data transfer speeds hosted on the same IP network [6]. LAN is very important to be applied to Harvani Hotel Palembang in order to support administrative work processes (management of hotel data, employee data, guest data to financial data) and guest needs (internet usage in every room of the Hotel which is one of the services provided by Harvani Hotel Palembang). But for now, LAN coverage at the Harvani Hotel does not cover every hotel room for guests on the 2nd floor so there are still many guests on the 2nd floor who complain that they don't have access to the internet. In addition, the application of LAN to Harvani Hotel Palembang for administrative work processes has not been maximized where each floor still has different administrative tasks and has not been integrated into a single administrative service that is only centered on the 1st floor. This causes every change of work shift, officer the administration of each floor must submit the report to the administrative officer on the 1st floor to be made into an overall administrative report that takes place on all floors of the Harvani Hotel Palembang. As for the submission of reports from administrative officers, each floor still uses external storage media, not yet able to take advantage of the existing LAN connection.

Therefore, in this study, a redesign of the Local Area Network (LAN) topology owned by Harvani Hotel Palembang was carried out. The network topology is an arrangement or mapping of interconnections between nodes, from a network, both physical (real) and logical (virtual) [7]. In the world of computer networks, when viewed from the type of relationship, there are 3 types of network topology available to connect computers to one another. These networks have certain characteristics and there are also advantages and disadvantages that exist. Here are some types of network topology, namely ring topology (ring topology), bus topology (bus topology) and star topology (star topology) [8]. In this research, star topology was used because the star topology uses a concentrator (hub or switch) as a data packet regulator [9]. Star topology is a topology type that describes the shape of a simple network that is star-shaped or often called a star topology, each workstation is connected to the server using a concentrator. Each workstation is not interconnected. So users who are connected to the server will not be able to interact and do anything before the server computer is turned on [10].

This redesign is done in order to solve the problems experienced by the Harvani Hotel Palembang at this time. The process of this research uses the Top Down

approach which is one way that can be done in redesigning LAN (Local Area Network) by focusing on the application layer. Thus, the Top Down approach method can find out the characteristics and all the weaknesses that exist as well as the strategic planning reference for designing new computer networks later. The results of this study are physical (physical) design using Cisco Packet Tracer software. This software is a simulator of Cisco network tools that are often used as a medium of learning and training, and also in the field of computer network simulation research [11]. Cisco Packet Tracer is made to make it easier to work on making computer networks. One of the advantages in the configuration in Cisco Packet Tracer is not too complicated and does not require a long time in the process of understanding [12]. In carrying out the simulation needed hardware in the form of a Laptop or Personal Computer (PC) [13].

II. RESEARCH METHOD

A. Top-Down Approach Method

In this research, the research method used was the Top Down approach. Top-Down Approach Method is a method used to build a local network that each unit is built simultaneously with the same specifications in a work project. There are several stages in the Top Down approach as follows [14]:

a) Analyze

This section covers the requirements analysis phase. This phase begins by identifying business objectives and technical requirements. The task is to characterize existing networks, including the architecture and performance of the main network segments and devices.

b) Logical Network Design

This stage the author designed an existing network and a new network. With the customer needs analysis phase, Depending on network size and characteristic traffic, topologies can range from simple to complex, requiring hierarchy and modularity.

c) Physical Network Design

This stage the author determines the physical network design begins with the selection of technology and specifications for Harvani Hotel Palembang computer network devices, including cables, switches, access points, and routers.

d) Testing, Optimizing and Documentation Network Design

The final steps in the top-down approach are that the writer carries out a test plan, builds a prototype or pilot, optimizes network design, and documents the results of work.

B. Initial Network Design

Harvani Hotel Palembang has 4-floor plans which are divided into 1 and 2 floors of the hotel, a 3rd floor is a spa place, and a 4th floor is a karaoke place. The following shows the network plan and structure of the

Harvani Hotel Palembang building. Can be seen in the plan in Fig.1 below that on the first floor there are 17 computers, 1 server, router, and switches

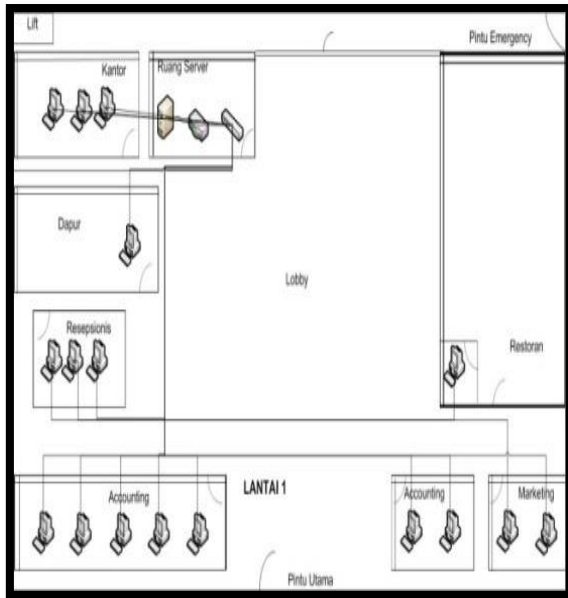


Fig.1. The Initial Design of The 1st Floor

Thus, can be seen in the plan above that, on the 2nd floor there are only 5 switches.

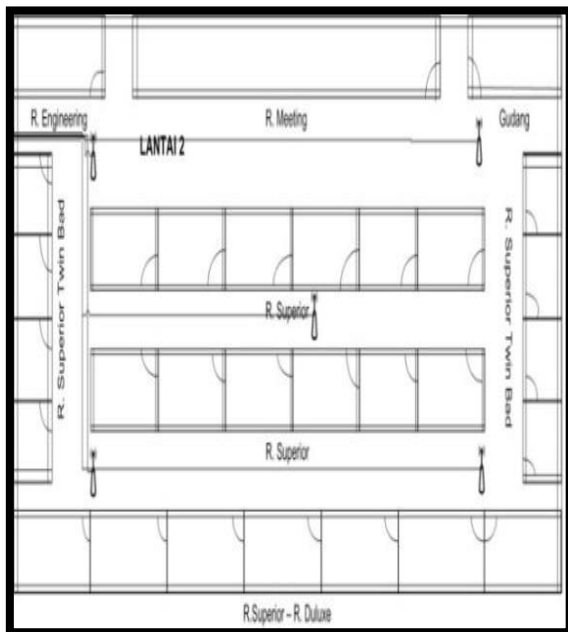


Fig.2. The Initial Design of The 2nd Floor

On the 3rd floor, there are 4 computers, 4 access points, and 1 server, router, and switch.

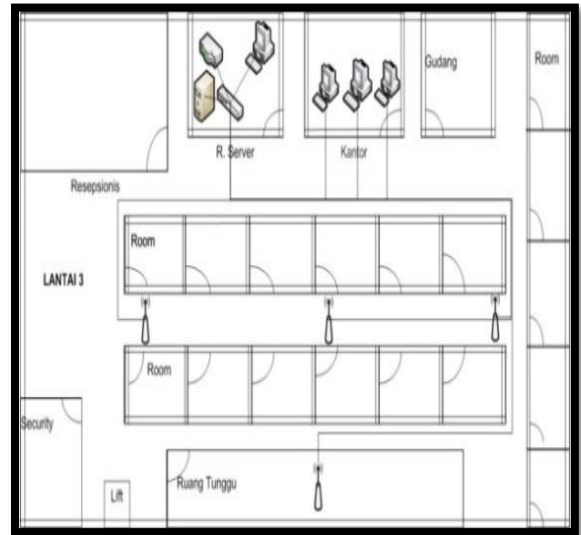


Fig.3. The initial design of the 3rd floor

On the 4th floor, there are 31 computers, 3 switches, 1 server, and router.

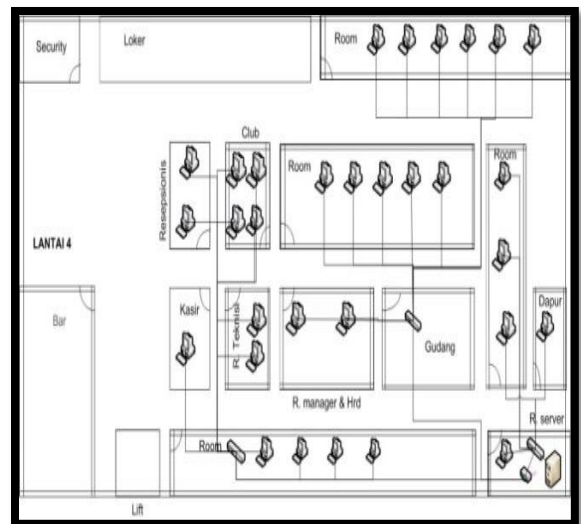


Fig.4. The Initial Design of The 4th Floor

III. RESULT

A. Logical Network Design Results

Designing a network topology is the first step in the logical design stage of the top down network design methodology. It is important for the architect of the logical topology before choosing a physical or technological product. During the topology design phase, identify the network and the interconnection point, the size, and scope of the network, and the type of device that will be needed, but not the actual device. Logical Network Design or Logic Network is a network that discusses focusing the connectivity of a computer network logically and does not take into account things that support physical connectivity such as the length of the cable. A logic network is made as an illustration of a network in the form of topology that plays a role as a characteristic of the physical form of the network itself.

And this design will add a VLAN application and a DHCP server.

- Ease of detection of errors on the network, due to centralized control and one cable for one computer.

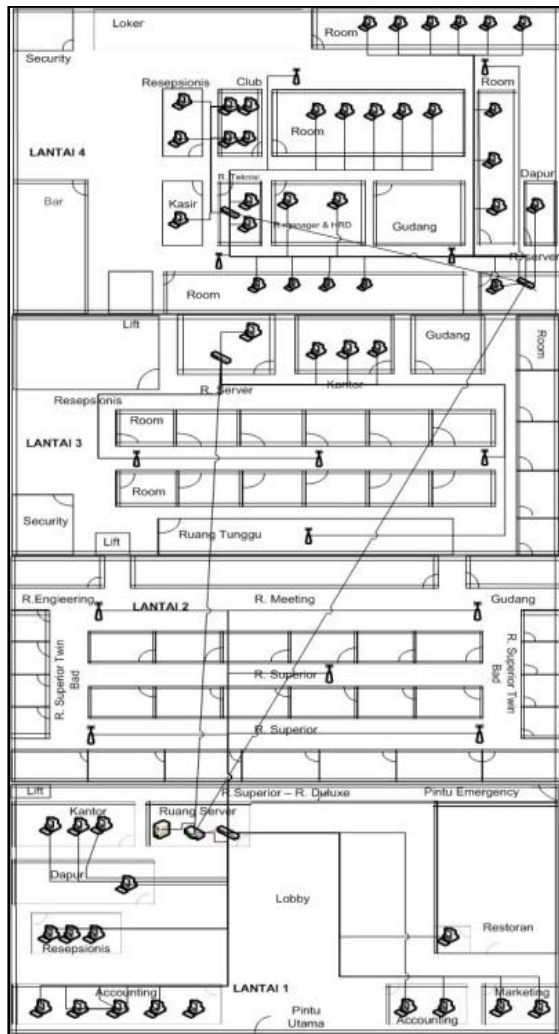


Fig.5. New Design of Hotel Harvani

B. Physical Network Design Results

The researcher chooses a star topology for the new design that will be used at the Harvani Hotel Palembang. Star topology is a form of network topology in the form of convergence of the middle node to each node or user. The choice of topology is based on the number of loops and the number of switches that correspond to the testing criteria [15]. Each workstation is connected directly to the Server or Switch. This topology uses switches to connect from one computer to another. The switch functions to receive signals from the computer and forward to all computers connected to the Switch. Star network topology includes network topology with medium costs. The advantages of using a star topology are:

- More flexible compared to other topologies
- Installation of a new workstation is very easy and does not interfere with other computers activities
- Centralized control, making it easier to check network errors

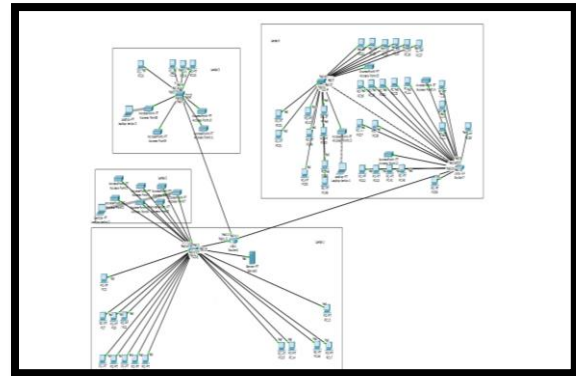


Fig.6. Physical Network Design of Harvani Hotel Palembang

The new network architecture of the Harvani Hotel Palembang is divided into 3 network IDs, namely the 1st and 2nd floors, 3rd floor, and 4th floor. Where each floor is connected. Here the author will explain the new network structure on each floor.

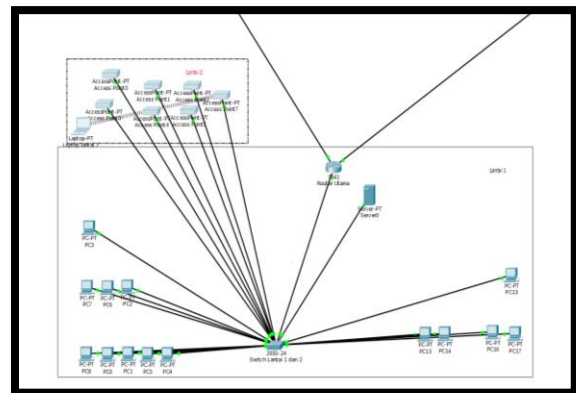


Fig.7. Network Designs for Floors 1 and 2

On the 1st floor there is a main router that divides the network into 3 parts connected to 3 switches, on the first switch that connects the 1st and 2nd floors there is 1 router, 1 switch, 1 server, and 13 computers, 2nd floor has an added access point, which previously totaled 5 access points to 7 access points.

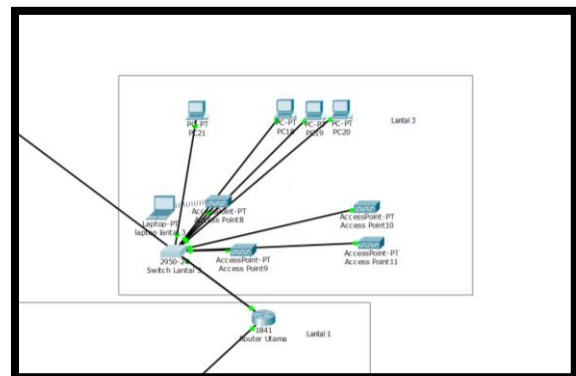


Fig.8. Network Design on The 3rd Floor

The second switch connects the main router to 4 computers and 4 access points. Then, on the third switch connects the main router to 31 computers, switches, and 4 new access points are added. Can be seen in Fig.9 below:

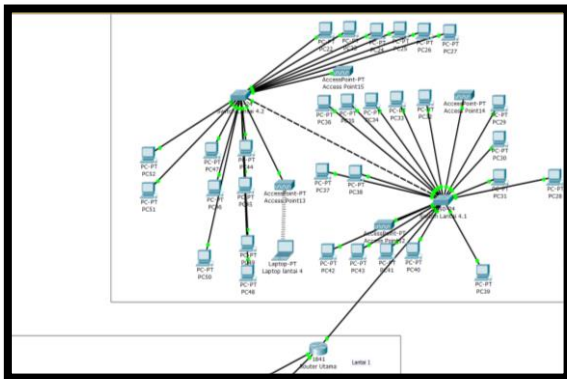


Fig.9. 4th-Floor Network Design

C. Physical Network Design Settings

At this stage the researcher configures the VLAN and DHCP on the router and server using Cisco Packet Tracer as shown in the following picture:

- a) VLAN data that has been configured on a VLAN database.

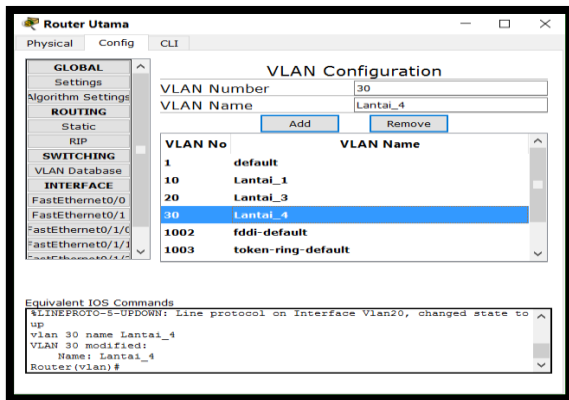


Fig.10. Display of VLAN Databases

- b) DHCP service data and default gateway on the server configured using Cisco Packet Tracer.

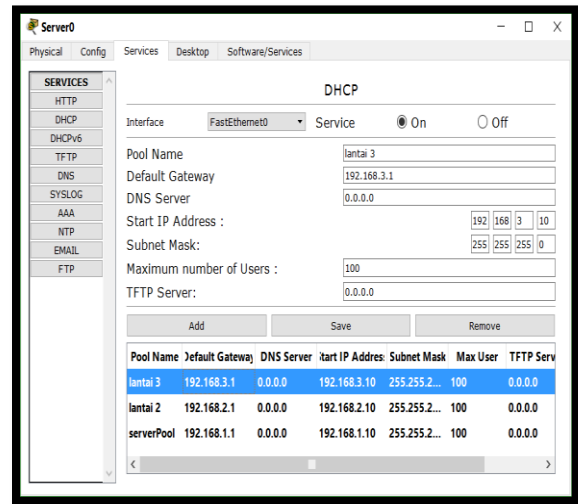


Fig.11. Display DHCP Service

IV. DISCUSSION

This stage is the Network Design Testing stage which greatly determines the success of the design that has been built. Testing will be very helpful in proving to the Harvani Hotel Palembang that the design is built successfully and provides solutions to existing problems. The designs that have been made will be tested using the simple PDU feature and ping features in the prompt command. The use of the Simple PDU feature can facilitate testing because ping actions can be performed on many devices at the same time. Following are the test results using the simple PDU feature.

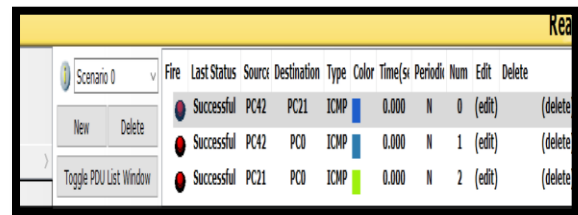


Fig.12. Results of A Simple PDU Test

In Fig.12 above, the PC42 test on the 4th floor to PC21 is tested on the 3rd floor, from PC42 which is on the 4th floor to the PC0 which is located on the 1st floor. is because the PC is in a different network ID.

Not only using the simple PDU feature but also use the ping feature from the prompt command to see if there is a missing package. Trials are done by typing in word 'ping' which is then followed by the IP address of the target computer if successful it will be seen if all packets are sent and no packages are lost. This trial will also show the time taken by the package to get to the destination. The following is the display of the trial using the ping feature.

```

PC42
Physical Config Desktop Software/Services
Command Prompt
PC>ipconfig

FastEthernet0 Connection: (default port)
Link-local IPv6 Address . . . . . : FE80::203:E4FF:FE51:A459
IP Address . . . . . : 192.168.2.11
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.2.1

PC>ping 192.168.2.11

Pinging 192.168.2.11 with 32 bytes of data:

Reply from 192.168.2.11: bytes=32 time=0ms TTL=127
Reply from 192.168.2.11: bytes=32 time=0ms TTL=127
Reply from 192.168.2.11: bytes=32 time=0ms TTL=127
Reply from 192.168.2.11: bytes=32 time=0ms TTL=127

Ping statistics for 192.168.2.11:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 192.168.1.26

Pinging 192.168.1.26 with 32 bytes of data:

Reply from 192.168.1.26: bytes=32 time=1ms TTL=127
Reply from 192.168.1.26: bytes=32 time=0ms TTL=127
Reply from 192.168.1.26: bytes=32 time=0ms TTL=127
Reply from 192.168.1.26: bytes=32 time=0ms TTL=127

Ping statistics for 192.168.1.26:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
  
```

Fig.13. Ping Results from PC42

The above trial was carried out from PC42 to PC 21 and from PC42 to PC0. And you can see the result that no packet is lost. Then the test will be carried out using PC21 to PC0.

```

PC21
Physical Config Desktop Software/Services
Command Prompt
Packet Tracer PC Command Line 1.0
PC>ipconfig

FastEthernet0 Connection: (default port)
Link-local IPv6 Address . . . . . : FE80::203:E4FF:FE51:A459
IP Address . . . . . : 192.168.2.11
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.2.1

PC>ping 192.168.1.26

Pinging 192.168.1.26 with 32 bytes of data:

Reply from 192.168.1.26: bytes=32 time=0ms TTL=127
Reply from 192.168.1.26: bytes=32 time=0ms TTL=127
Reply from 192.168.1.26: bytes=32 time=0ms TTL=127
Reply from 192.168.1.26: bytes=32 time=0ms TTL=127

Ping statistics for 192.168.1.26:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
  
```

Fig.14. Ping Results from PC21

V. CONCLUSION

Conclusions obtained from the results of research that has been done at the Harvani Hotel Palembang, namely:

1. With the new design of a well-implemented computer network, making computer networks more structured and more functionally optimized.
2. In the new computer network design, the hardware used is more efficient than the previous design.
3. With the addition of several access points, it is expected to improve service to customers and by connecting computer networks on each floor will make employee work more efficient.
4. The results of LAN redesign simulations conducted at Harvani Hotel Palembang show that all

computers at Harvani Hotel Palembang that are connected by LAN can communicate well.

5. If the results of the redesign in this study are applied to Harvani Hotel Palembang, then the work process of Harvani Hotel Palembang staff will be faster and more organized because all data managed is stored on the database server. In addition, the results of this redesign will also increase the comfort of guests because they have been able to access the internet properly in their respective rooms.

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