

Analysis and Implementation of Computer Networks to Support Learning (Case study: Adiluwih Islamic Vocational High School)

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Abstract-In the increasingly rapid development of technology, various aspects of work, education, health, and the community environment in the world and Indonesia. In desperate need of various technological developments that are used to support the smoothness and convenience of these various aspects. And one of them is the development of technology in the field of computer networks. To design a network architecture that can be implemented, defining a network architecture that can be arranged and defined, to be able to create a network architecture that has the proper functions and uses and as desired. The method used is the Network Development Life Cycle (NDLC). The researchers analyzed the existing network design at SMK Islam Adiluwih. The results of the analysis and design of the Internet network at SMK Adiluwih are expected to help and meet the needs of teachers and all students in accessing the Internet as desired.

Keywords: School, Learning, NDLC, Packet Tracer, Star Topology

I. INTRODUCTION

The rapid development of technology in various aspects of work, education, health, and the community environment in the world and Indonesia is in dire need of various technological developments that are used to support the smoothness and convenience of these various aspects. One of them is the need for technological developments in the field of computer networks. APJII Secretary General Henri Kasyfi Soemartono explained the main results of the 2019-2020 Indonesian Internet User survey. "Currently, the penetration of Indonesian internet users is 73.7 percent, up from 64.8 percent from 2018," he said[1]. With the increase in internet users in Indonesia, the need for networks in the education sector is also very much needed because it becomes

a communication for teachers, staff, and students in schools.

According to Ahmad Tantoni, Khairul Imtihan, and Wira Bagye (2020) in their research using the Implementation of the Inter-Vlan Routing Network Based on Mikrotik RB260GS and Mikrotik RB1100AHX4, whose research can be expected to reduce broadcast domains and collision domains.[2]. According to Nunu Nugraha P. and Muhammad Iqbal (2020) in their research using Subang State Polytechnic Computer Network Design and Simulation Using Packet Tracer Version 6.2 with the PPDIIO Method, whose research is expected to build a Computer Network at the Subang State Polytechnic.[3]. According to Eko Purwanto (2015) in his research using a Mikrotik Router as a Learning Support at SMK Sultan Agung Tirtomoyo Wonogiri, whose research is expected to build a Computer Network of SMK Sultan Agung Tirtomoyo[4]. According to Saepul Rochman, Asri Mulyani, and Yosep Septiana (2019) in their research using the Dude Server Concept in designing network architecture at SMK [5]. According to Harun Sujadi and Aqis Mutaqin (2017) in their research using the Network Development Life Cycle method (NDLC)[6].

Based on previous research using the concept of Mikrotik Routing, Packet Tracer, The Dude Server, and NDLC. In this study, researchers used the Cisco packet tracer Star topology which is expected to provide better service and make it easier to make policies regarding the network architecture to be implemented. In this software, some tools are commonly used in designing a network system. So that it can make it easier to simulate a computer network. Cisco packet tracer can also be used as information about the state of the connection of a computer in a network if there is a problem in the internetwork connection.

In this research concept, what researchers do is to easily design a network architecture and to place network devices that can be set and

determined properly. Configuration - configuration can also be done carefully so that network devices can be connected properly. At the stage of installing the Cisco packet tracer application, it is also not too difficult and can be obtained free of charge. So that it really can help this network researcher to implement a network topology before it is applied to a real area.

With this research, it is hoped that it can help design a network in a simulation. Provide information about patterns and flows in designing network architecture designs that have the right and desired functions and uses. This research expected to make it easier to find out the weaknesses and advantages of a network made using the Cisco packet tracer application. Then helps the development of computer network science through experiments.

II. LITERATURE REVIEW

School

According to Nur Widiya (2018) School is a social interaction system of an entire organization consisting of personal interactions linked together in an organic relationship [7]. Meanwhile, according to Parta Ibeng (2021) school is an educational institution that is formal, non-formal, and informal, where the establishment is carried out by the state or also the private sector with the main objective is to teach, manage, and also educate students through guidance provided by educators or teachers[8].

Analysis

According to Rofika (2018), Analysis is an activity that contains several activities, for example, parsing, differentiating, selecting something to be classified and regrouped according to certain criteria, then look for the meaning and interpret the meaning[9]. Meanwhile, according to Adzikra Ibrahim (2020), Analysis is an attempt to observe in detail a thing or object by describing its constituent components or arranging these components for further study.[10].

System Used

At this stage, the theory of the system used in relation to research is fully explained.

Star Topology

According to Qoriza Rahayu (2018), Star topology is a network topology that is used to connect each node such as CPUs, file servers, workstations, and other devices through a concentrator or hub in a circular circuit like a star [11]. Meanwhile, according to Jagad.id (2020) Star topology, or called star topology is a network topology in the form of convergence from the central node to each user node[12].

Packet Tracer

In the book Creative Material Teaching Collection by Nanda Hidayati (2020), "Cisco

Packet Tracer is an application software created by Cisco Systems to manipulate the actual network topology design [13]. Meanwhile, according to Dian (2016), Cisco Packet Tracer is a computer network simulation software based on GUI (Graphic User Interface) which is often used as a learning or training medium and is also commonly used in the field of computer network simulation research.[14].

III. RESEARCH METHODOLOGY

3.1. Collecting Data

The data collection method is in the form of a statement about nature, condition, activity, and the like. This method is used to provide information about what the researcher will achieve or aim at. In this research, the researcher used four data collection methods which are described as follows:

a. Observation

A data collection method is carried out by observing the object directly and directly retrieving the data in the place where the research was carried out. Observation can also be interpreted as a complex process.

b. Interview

The interview is a data collection method that is carried out by conducting direct questions and answers with sources.

c. Literature Method

In this study, researchers used the literature method, which researchers used previous research journals as references. In this stage the researcher examines, looks for, and reads references related to the problem being researched and makes use of this information as additional material in the research.

3.2. Systems Development Method

At this stage, the research model used, namely the Network Development Life Cycle (NDLC), is a method that relies on previous development processes such as business strategy design, application development, and data distribution analysis.[6]. The stages of NDLC:

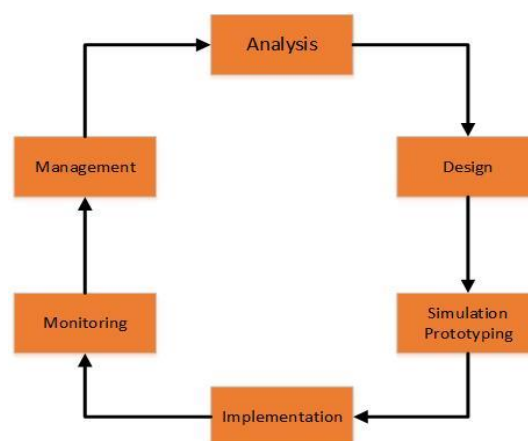


Figure 1. NDLC diagram

The explanation of the stages of the NDLC diagram above is as follows:

1. Analysis

In this stage the researcher analyzes that the existing network design at SMK Islam Adiluwih is still ineffective, it can still be made even better and minimize the use of excessive network devices. Therefore, the researcher analyzed and then thought to make a network design so that it could be applied to the Adiluwih Islamic Vocational School the researcher analyzes that the existing network design at SMK Islam Adiluwih is still ineffective, it can still be made even better and minimize the use of excessive network devices. Therefore, the researcher analyzed and then thought to make a network design so that it could be applied to the Adiluwih Islamic Vocational School.

2. Design

At this stage, the researcher begins to design, design the network. Armed with the Cisco Packet Tracer application which is intended to create network designs as well as implement simulations.

3. Simulation Prototyping

At this stage, network simulation begins. This is intended to see the initial performance of the network to be built and as material for presentation and sharing with teamwork.

2. Implementation

At this stage, it will take longer than the previous stage. In implementing, workers will apply everything that has been planned and designed beforehand.

3. Monitoring

Monitoring is an important stage so that computer and communication networks can run according to the initial wishes and goals of the user at the initial stage of analysis, monitoring activities are necessary.

4. Management

At the management or regulatory stage, one of the issues of particular concern is policy. Policies need to be made to create/regulate so that a system that has been built and runs well can last a long time and maintain the reliability element.

3.3. Research Framework

This research framework explains the results or stages of the research which will be explained through the flowchart below.

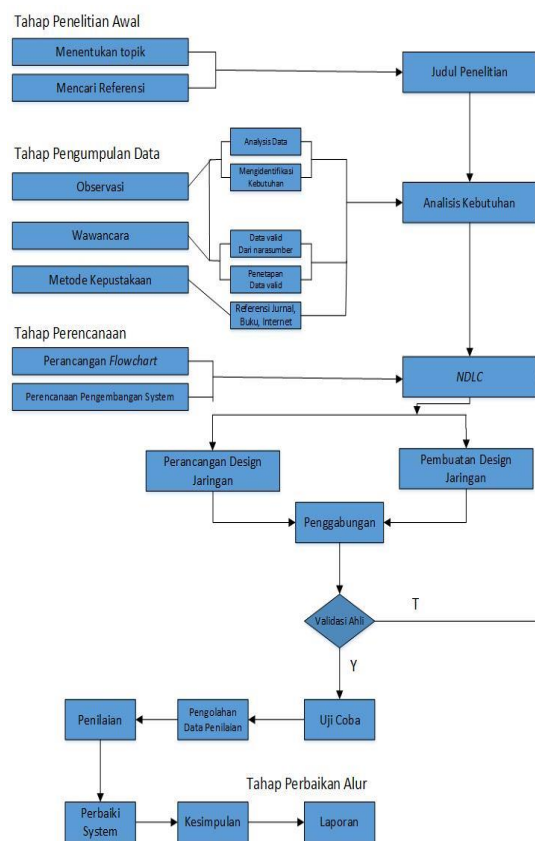


Figure 2. Research Flowchart Diagram

IV. DISCUSSION

4.1. Network Design Simulation Design

This network design uses a simulation in the Package Tracer simulator application. This simulation is applied to every design which will be implemented to simplify the implementation process and reduce the risk of errors and other problems in the implementation process. The benefits of using this simulation can estimate the materials and systems that will be applied to later implementations.

Topology Simulation

The topology used is a star topology designed in the Packet Tracer application. Using a star topology in this design is intended to make it easier to manage bandwidth and share access to each server and user.

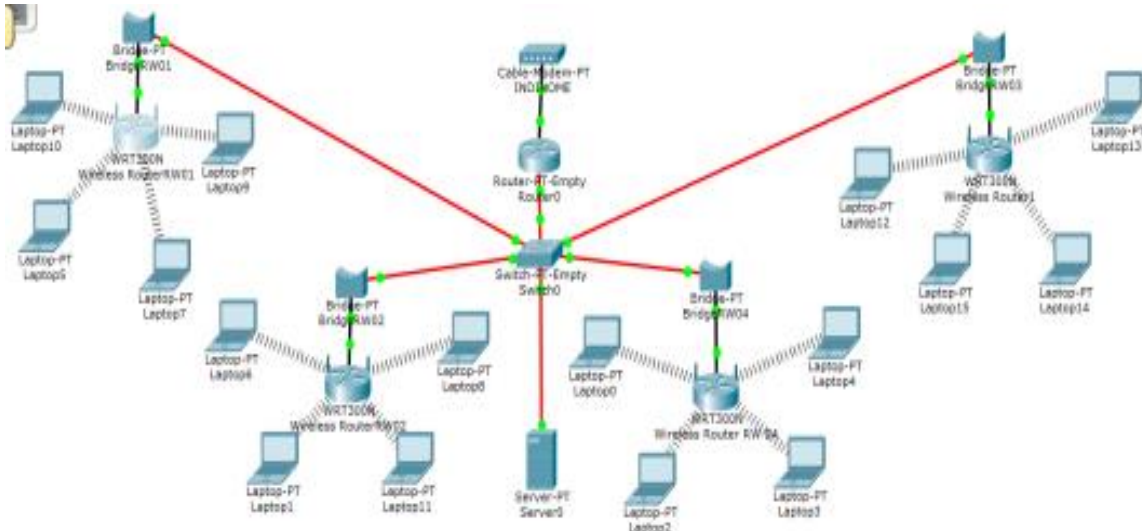


Figure 3. Star Packet Tracer Topology

IP Address Settings

IP Address settings are applied to the IP Address Router Server which is paired near the SMK Islam Adiluwih field. DNS Data Servers, and also on each Access Point Server which is paired at 4 points at each midpoint on 4 Access Point Points at SMK Islam Adiluwih.

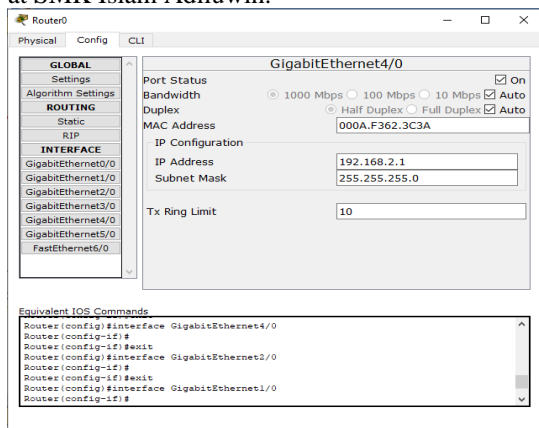


Figure 4. Configuring the Router Server IP Address

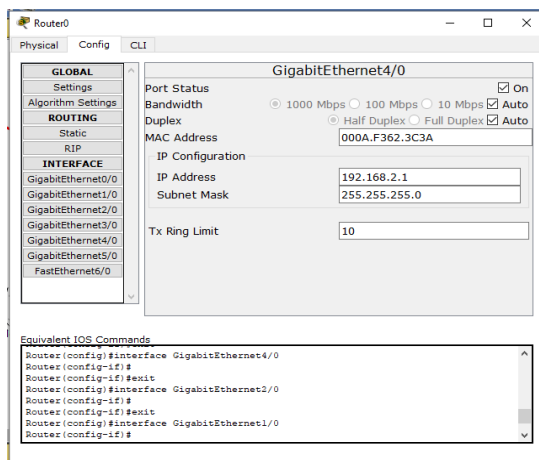


Figure 5. Configuring the IP Address DNS Data Server

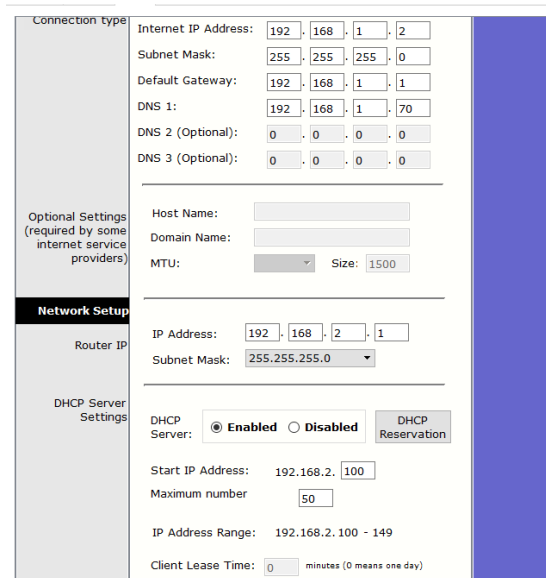


Figure 6. Configuration of IP Address Server Access Point 1

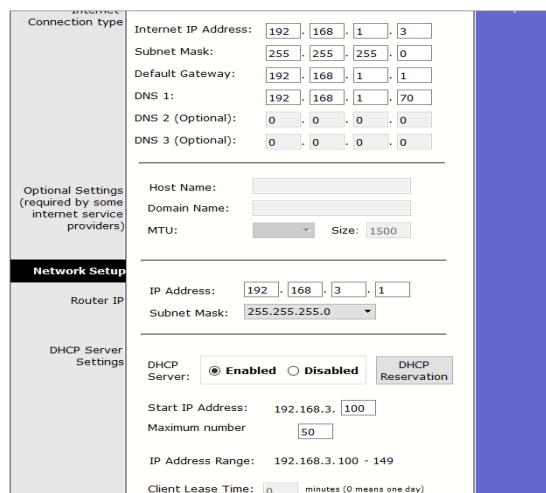


Figure 7. Configuration of IP Address Server Access Point 2

Internet IP Address: 192 . 168 . 1 . 4
 Subnet Mask: 255 . 255 . 255 . 0
 Default Gateway: 192 . 168 . 1 . 1
 DNS 1: 192 . 168 . 1 . 70
 DNS 2 (Optional): 0 . 0 . 0 . 0
 DNS 3 (Optional): 0 . 0 . 0 . 0

Optional Settings (required by some internet service providers)
 Host Name:
 Domain Name:
 MTU: Size: 1500

Network Setup
 Router IP
 IP Address: 192 . 168 . 1 . 1
 Subnet Mask: 255.255.255.0

DHCP Server Settings
 DHCP Server: Enabled Disabled
 Start IP Address: 192.168.1.100
 Maximum number: 50
 IP Address Range: 192.168.1.100 - 149
 Client Lease Time: 0 minutes (0 means one day)

Figure 8. Configuring IP Address for Server Access Point 3

Internet IP Address: 192 . 168 . 1 . 6
 Subnet Mask: 255 . 255 . 255 . 0
 Default Gateway: 192 . 168 . 1 . 1
 DNS 1: 192 . 168 . 1 . 70
 DNS 2 (Optional): 0 . 0 . 0 . 0
 DNS 3 (Optional): 0 . 0 . 0 . 0

Optional Settings (required by some internet service providers)
 Host Name:
 Domain Name:
 MTU: Size: 1500

Network Setup
 Router IP
 IP Address: 192 . 168 . 6 . 1
 Subnet Mask: 255.255.255.0

DHCP Server Settings
 DHCP Server: Enabled Disabled
 Start IP Address: 192.168.6.100
 Maximum number: 50
 IP Address Range: 192.168.6.100 - 149
 Client Lease Time: 0 minutes (0 means one day)

Figure 9. Configuring IP Address Server Access Point 4

4.2. Implementation

Tool used

The implementation that will be applied from the design that has been made in the previous stage is using the following tools:

1. Internet Indie Home Telkom, as a source of internet access that will be used by every client or user.
2. Mikrotik router, as a server router that will regulate the bandwidth access that will be used on each access point server. It also acts as a data server by connecting to the storage drive and setting up a DNS server that will be used as a Landing Page for the User login process.
3. Tower pole measuring 10 meters high, as a support pillar for Server Access Point which will be placed at the center point in each SMK Islam Adiluwih.
4. Ubiquity Bullet M2 Access Point Server, as an Access Point Server that will be placed at

the top of the Tower Pole so that it can reach the signal at the maximum distance.

5. Omni Antenna, as an antenna that will spread a wireless signal with a maximum area of 200 meters which will be attached to each Access Point Server.
6. Fiber cable, as a router from the Router Server with each Access Point Server to maintain the speed and quality of internet access.
7. Switch, as a terminal to connect all Access Point Servers to the Router Server.
8. Bridge, as a Converter from Fiber Port to UTP RJ45 Fast Ethernet Port which will be placed on each Access Point Server.

At this stage, the system, tools and materials will be applied directly to the planned location and place, namely:

1. Installation of Internet source from IndieHome Provider which is installed on the Internet Server at SMK Islam Adiluwih as a source of internet access for the Network.
2. Installation of the Mikrotik Server Router to be installed on the Internet Server and connected to the Indie Home internet using a Fiber Optic cable so that internet quality and speed can be maintained.
3. Installation of the Ubiquity Access Point Server which will be installed at each peak of the Tower Pole, and connected to the Router Server using a Fiber Optic Cable.
4. Installation of the Omni Antenna which will be attached to each Antenna Port that is available on each Ubiquity Access Point Server.
5. Installation of Tower Pole which will be installed at each Access Point point at SMK Islam Adiluwih.

Before installing all hardware, system preparation settings have been made beforehand, such as IP settings, cable installation, system programming, and others. And system testing is carried out before the Server Access Point device is installed at the top of the Tower Pole.

V. CONCLUSION

The network designed at SMK Islam Adiluwih based on the initial network form consisting of only 1 access point will become a complex network consisting of a Router Server that will manage all existing Internet network users and 4 Access Point Servers will be installed which will connect the User. The user will access the network using Wi-Fi (Wireless). The Internet network design at the Adiluwih Islamic Vocational School was developed using a Cisco packet tracer which is equipped with a troubleshooting configuration. By selecting the

Troubleshooting setting, the problems experienced can be detected and resolved.

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