Project, Design and Development System of Fiber Optic Internet Infrastructure for the Sustainability Teaching and Learning with Chromebook during the Pandemic Covid-19

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Abstract:- Along with the times and information technology, as well as the human need for a high work problem demands the role of a technology to answer all these problems. Chromebook is defined as a learning media process based on technology, services, and information that is carried out electronically by utilizing a computer network. One of the networks used is the internet. By connecting the Chromebook computer network to the internet, you can establish an intense relationship as a safe learning medium with both parents and students more efficiently. The use of Chromebook can increase cost efficiency and productivity to improve the ability of students and teachers in the remote teaching and learning process during the COVID-19 pandemic.

Keywords:- Chromebook, fiber optic, infrastructure, project, covid-19).

I. INTRODUCTION

Computer network infrastructure is a set of physical and logical components that provide the foundation for connectivity, routing, access management, and various integral network features, which aims to enable all resources, both hardware and software to communicate and share information and can be managed with good. Today's technology and communication have developed rapidly and are in line with the development of the characteristics of modern society which has high mobility, seeks flexible, easy-to-use services, and pursues efficiency in all fields so that the need for information and communication also increases. Along with the times and information technology, as well as the human need for a high work problem demands the role of a technology to answer all these problems. To support technology in the delivery of information, telecommunications technology is needed in communicating between computers with one another. Telecommunications technology is a computer network [1].

Network infrastructure refers to the hardware and software resources of the entire network that enable network connectivity, communication, operation, and management of corporate, institutional, and school networks [2]. Network infrastructure provides communication paths and services between users, processes, applications, services, and external networks/internet. Network infrastructure is typically part of the IT infrastructure found in most corporate, institutional, school, and game center IT environments [3].

Every educational institution is commanded to runs the online learning due to social distancing policy during the COVID-19 pandemic [4]. One of them is an Islamic elementary school located in the center of Banda Aceh, which during the COVID-19 pandemic carried outdistance learning, both through video conferencing, vlogs, and e-learning. Overall activities were carried out online [5].

In addition, this school has also implemented learning by combining Islamic religious education and technology, including the use of technology [6].

Chromebook devise as a learning medium that is owned by every student [7]. Chromebooks are a new kind of computer designed to help you get things done faster and easier [8]. Chromebooks run Chrome OS, an operating system with cloud storage that has Google's best features built-in, and layered security. So with this, a good internet network is needed in terms of speed, capacity, and stability to support the smooth teaching and learning process at the elementary school [9].

In addition, the entire network infrastructure is interconnected and can be used for internal communication, external communication, or both. Common network infrastructure includes Network Hardware: routers, switches, Cards, LANs, Wireless routers, and Cables. Network Software: Network operations and management, Operating systems, Firewalls, and Network security applications Network Services: DSL, Satellite, Wireless protocols, IP Experience.

II. METHOD

The purpose of this project is to build a computer network that provides technology and information facilities related to teaching and learning activities using Chromebook learning media. This is expected to provide convenience for students and teachers. It consists of several parts [10,11], namely:

The stages of the project approach including: 1. Analysis of the need for the use of computers, hardware, and software to be implemented; 2. Design; 3. System development; 4. Test the Chromebook network connectivity; 5. Develop time scheduling estimation and S graph for implementation.

III. RESULT AND DISCUSSION

The results and discussion in this study are divided into several parts according to the approach applied.

A. Analysis
In this initial stage, a needs analysis is carried out, an analysis of emerging problems, an analysis of user desires, and an analysis of the current topology/network [12]. The methods used at this stage include observing and reviewing current system documents.

B. Design
A network topology is a basic geometric layout of how clients and servers are connected to a channel (and hence to each other). Three common network topologies are a star, bus, and ring [13,14]. Topology is associated with channel access (see note on layer-2 protocols), because the way we connect computers to the channel limits, to some extent, how they can access the channel [15,16]. Each channel access method (and hence, every layer-2 protocol), therefore, requires a specific topology.
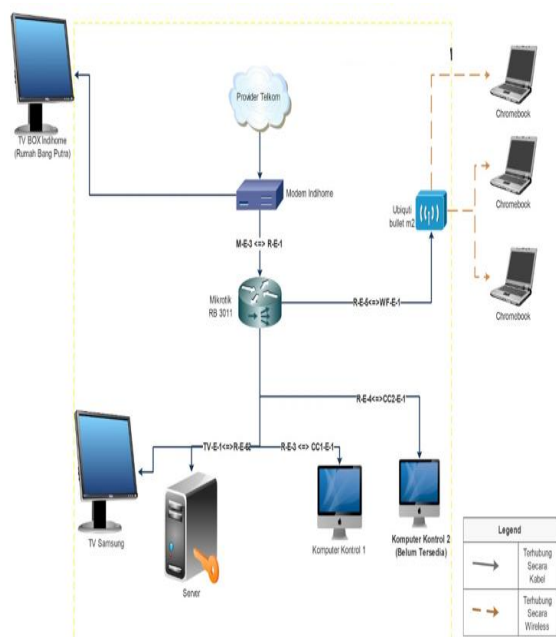

Fig. 1: Chromebook Network Infrastructure Topology

The main server room is located on the first floor of the building, and the topology in Figure 1 shows the main topology of the computer network system. Using one that is connected to the Telkom switch and I Cont + which is used as an internet service provider [17]. The switch used is Switch 2960 which will also be used during implementation.

By using one physical server. The server system uses the Vmware virtual storage appliance (VSA) [18,19]. Inside the server, there are 6 virtual servers, two virtual servers for the active directory, one virtual server for Empirum, two servers for backup and recovery, and one server for the file system, where all the data or files for teachers, students, and staff stored on the server.

Fig. 2: Acer Chromebook

C. Chromebook Network Connectivity Test
In the test results, the values obtained in each category are illustrated in Fig. 3 and Table II:

Fig. 3: Network Speed Test Results.

No	Item (Specification)	Brand	Unit/ Qty	Price (IDR)	Total (IDR)
1	Mikrotik CCR1009-7G-1C-18	Mikrotik	1 Pcs	8,925,000	8,925,000
2	Hub D-Link DGS-1100-18/EA	D-Link	1 Pcs	2,496,000	2,496,000
3	Ubiquiti Unifi AC AP	Ubiquiti	6 Pcs	2,808,000	16,848,000
4	Belden Cable UTP Cat.6e	Belden	2 Pcs	2,205,000	4,410,000
5	Belden RJ45 Cat.6e	Belden	2 Pcs	630,000	1,260,000
6	Plugboots		1 Pcs	156,000	156,000
7	Wallmout Rack BU Indorack	Indorack	1 Pcs	3,675,000	3,675,000
8	Cable Duck		10 Pcs	52,500	525,000
9	Server HP	HP	1 Pcs	14,700,000	14,700,000
10	UPS APC Back-UPS RS 1500VA	APC	1 Pcs	6,825,000	6,825,000
	Total			42,472,500	59,820,000

Table 1: Bill of Quantity (BOQ)

No Test	Ping (ms)	Upload (Mbps)	Download (Mbps)
1	12	21.20	3.9
2	14	20.25	3.94
3	16	21.20	3.96

Table 2: Speed test

D. Gantt Chart and S Chart

Gantt Chart is a kind of bar chart (Bar Chart) that is used to show the tasks on the project as well as the schedule and execution time, such as the start time of the task and also the time limit used to complete the task in question. The person or Department assigned to complete the Tasks in the project should also be listed in the Gantt Chart [20].

Some other names for Gantt Charts include Milestones Chart, Project Bar Chart, and activity chart. The Gantt Chart developed by Henry Laurence Gantt in 1910 is an overview of planning, scheduling, and monitoring the progress of each activity or activity on a project [21].

Gantt Chart is a very useful tool in planning, scheduling, and monitoring activities on a project, communicating the activities that must be carried out and also the status of their implementation. In the Gantt Chart, you can also see the sequence of activities or tasks that must be carried out based on the specified time priority. [22,23]. The following is a Gantt chart of each activity which is displayed in the form of a Gantt chart, the longest time in work is on the D-Link DGS-1100-18EA hub for 10.2, while the fastest time is in the work (fig. 4).

| No	Item Pekerjaan	Bobot	5	6	7	8	9	10	11	12	13
B	Outdoor and Indoor Area										
1	Mikrotik CCR1009-7G-1C-18	4.15	0.8								
2	Hub D-Link DGS-1100-18/EA	20.35					10.2	10.2			
3	Ubiquiti Unifi AC AP	8.43					4.2	4.2			
4	Belden Cable UTP Cat.6e	20.17						10.1	10.1		
5	Belden RJ45 Cat.6e	1.79								1.8	
6	Plugboots	0.12								0.1	
7	Wallmout Rack BU Indorack	0.00								0.0	
8	Cable Duck	0.00								0.0	
9	Cable Ties 20 cm	0.18								0.2	
10	Server HP	2.23								2.2	
11	UPS APC Back-UPS RS 1500VA	0.49						0.2	0.2		
12	Supply and Install Accessories Tiang Besi	1.96						1.0	1.0		
13	Supply and install slack support	0.00							0.0		
C	Connection and Testing										
14	Splicing	6.96								7.0	
15	Testing end to end	4.15								2.1	2.1
	TOTAL	100	1.3	0.0	13.4	13.4	14.4	25.7	11.3	13.4	2.1
	% Progress		6.4	6.4	19.8	33.2	47.5	73.3	84.6	97.9	100

Table 3: Gantt Chart Project
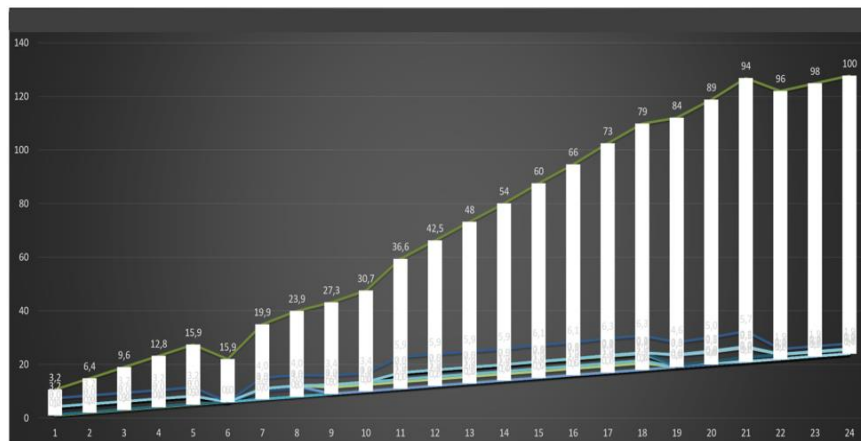
Fig. 4: Curve S Project

IV. CONCLUSION

The implementation of computer network infrastructure combined with management through remote control is very helpful for the company because technically, the network administrator in charge of managing computer networks can monitor, maintain and repair whenever and wherever they are, so this is considered more effective and efficient;

In building the internet network infrastructure, an architectural framework consisting of various building blocks is used. These block entities are like children's games, namely lego, which can be easily removed and installed at will according to their needs and desires, to build architecture as desired.

This architecture is built by various building blocks which can be configured according to user needs. Each of these components can flexibly be easily disassembled according to the user's specific requirements. The following is a brief explanation of the functions of several components that are in the network system architecture:

Research shows that the project accelerates in the 1st to 2nd observation period. And the project began to experience delays from the 5th observation period to the 6th observation period with the maximum delay occurring at the 6th observation period for 4 days and gradually starting to decrease until the 9th observation period for 7 days. Research using the S Curve method shows that the project accelerated in the 7th to 13th observation period. And the project began to experience delays since the 11th observation period with a trend that was getting late until the 13th observation period with a progress value of 8, 51.22% which in the plan should have been carried out for 12 days, resulting in a delay of 15 days, while the S Curve method shows that the project has been delayed since the 11th observation period. Furthermore, both methods show results.

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