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QUALITY OF SERVICES (QOS) NETWORK COMMUNICATION EQUIPMENT USING ELECTRICAL CABLES AT POLITEKNIK PELAYARAN SURABAYA

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ABSTRACT

This study compares internet network communication performance using electrical and network cables. Data passed using power lines is converted using power line Communication (PLC). The quality of service results on the PLC obtained a throughput value of 1,834 Kb/s, Packet loss of 0.045, delay of 34.958, and Jitter of 41.648. Data measurement using Wireshark software, by using typhoon data to convert values, the measurement results show that the throughput value is excellent, the packet loss value is excellent, the delay value is excellent, and the jitter value is good.

Keywords: PLC, QoS, throughput, packet loss, delay, Jitter

1. Introduction

The development of network infrastructure and the rapid growth of technology has created many innovations(Cano et al., 2016; Chen et al., 2014; Li & Lin, 2015). One of them is in the field of technology and networks. The development of networks in this millennium era is very rapid, from those who use cable media to using wireless media.

Power Line Communication (PLC) is a network media that uses the installation of an electrical network in one phase(Adhau et al., 2018; Huan et al., 2020; Huang et al., 2012; Prasad & Lampe, 2019; Sendin et al., 2014). The PLC made a breakthrough in the field of networks because PLC does not require data cables such as multipair cables, fiber optics, or UTP but uses electrical wires that are in the same phase to send data packets, it makes the expenditure to buy new data cables reduced and makes it easier to connect networks between backbones that are far apart

The internet network is needed by cadets when it is barraged as a tool to carry out educational activities carried out online, to make it easier for all cadets to access the internet network, wifi is needed, for the installation of the internet, of course, it requires media as a link, namely the Unshielded Twisted Pair (UTP) cable. The UTP cable is most widely used to connect to the internet network that will require wifi. Still, there are difficulties in installing UTP cables in a building that is neatly arranged or in different rooms because you have to pull the UTP cable. Then the type of UTP cable transmission media requires a large amount, so it requires high costs in the realization, installation, and maintenance of the UTP cable(Ghasempour, 2019; Jaradat et al., 2015; Karakus & Durresi, 2019)

So the development of network infrastructure and the rapid growth of technology makes many innovations create a network media that uses the installation of the power grid in one phase. To realize the idea of Power Line Communication (PLC), namely utilizing the electricity distribution network as internet data distribution, it can be suggested to be an alternative solution to reduce costs in maintenance or installation. Therefore, the author made a "Design for the Use of Electrical Cable Networks as Internet Data Communication Media at the Politeknik Pelayaran Surabaya."

2. Method

We will innovates with advances in technology and science by looking for alternative transmission media using Power Line Communication (PLC). Which will be used to supply power to several router boards that use Micro USB, and data will be transmitted through the power grid using PLC to reduce the cost of installing or maintaining the old transmission media so as to facilitate the installation of new internet/wifi in rooms that are difficult to reach by the internet.

We will make a transmission media design using PLC, which will be used to supply power on the router board that uses Micro USB, which will transmit internet data through electrical cable media, for how the PLC communication works cannot stand alone, so to connect between rooms requires 2 PLC so that in room 1 and room 2 a PLC

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is installed, for plc such communication is used between the transmitter and receiver systems.

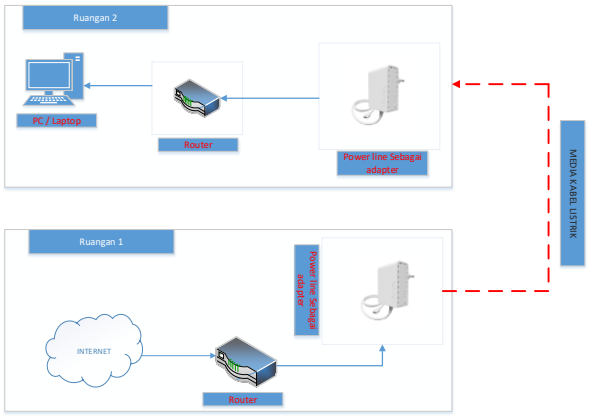

Figure 1. Research design design

In receiving and transmitting signals through the PLC line by using the electrical cable line medium, one current / MCB. With this, the author also uses switches to connect different MCBs. The following is a tool design that consists of the creation of the tool and how it works then, including the hardware and software components used in making the design.

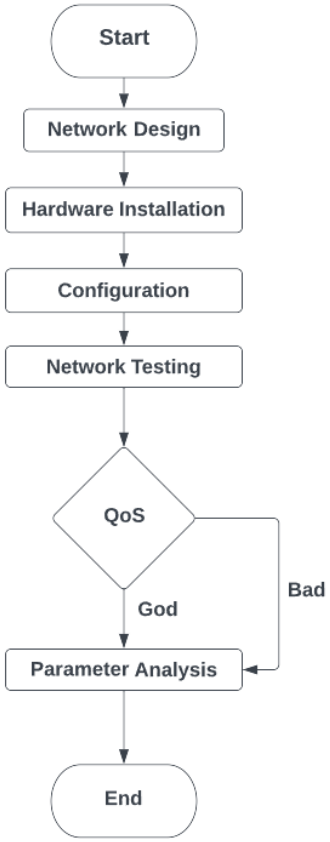

Figure 2. Research design flowchart

How the Research Project works Design for sending internet data through the transmission of electrical cables uses Power Line Communication, a power adapter connected to a router that a modem or wifi has connected. Then the Power Line Communication will transmit the internet data through the power cable.

3. Result and Discussion

This test is carried out to determine QoS by comparing network topologies using PWR Line through electrical cable network transmission and by using Ethernet cables that are generally used, the data retrieval process is carried out based on the QoS parameters applied. This is done to find out how reliable the performance is carried out in applications that are run on a network of parameters – the parameters used include:

Throughput

Throughput is the data transfer rate measured in bits per second (bps)(Guck et al., 2018), and throughput parameters are applied based on TIPHON (telecommunication and Internet Protocol Harmonization Over Networks) standardization.

Table 1. Tiphon Troughput Data

Categories	Throughput	Index
Very Good	100 %	4
Good	75%	3
Keep	50%	2
Ugly	<25%	1

Table 2. Throughput Calculation Results

Category	Transmission Media		
	Ethernet cable	Plc	Result
Steaming Video	801 Kb/s	1,834 Kb/s	Very Good

The results of the calculation of the throughput value obtained can be observed in table 2. For the resulting Video Streaming experiments tend to be stable in the network topology of the PWR Line system. This PWR Line system network is characterized by data passed on the power cable at the same speed as data passed through an Ethernet cable even though all electrical equipment

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conditions are used. Although the data superimposed on the power cable network is greater than without the PWR Line system. However, between the two network topologies, it produces a throughput value with a very good category.

Packet Loss

Packet Loss is a condition where the number of packets lost occurs due to collisions and congestion on the network, which is viewed in percentage units (%)(Bello et al., 2017). The Packet loss parameter is applied based on TIPHON standardization (Telecommunication and Internet Protocol Harmonization Over Network).

Table 3. Data Tiphon Packet Loss

Degradation Categories	Packet Loss	Index
Very Good	0% - 2%	4
Good	3% - 14%	3
Keep	15% - 24%	2
Bad	>25%	1

Table 4. Packet Loss Calculation Results

Category	Transmission Media		
	Ethernet cable	Plc	Result
Steaming Video	0.083	0.045	Good

The results of the average Packet loss value obtained can be observed in table 4 for experiments conducted. Packet loss generated tends to decrease in video streaming experiments in the network topology used. This is inseparable from data collection, which is carried out simultaneously. However, this does not mean that the resulting Packet loss is getting better or worse. When viewed in terms of the range of Packet loss obtained for video streaming experiments, it is due to the load on the electrical equipment network used for data retrieval, but the impact seen is only on video streaming experiments. Not very impactful.

Delay

Delay is the time it takes for a package to travel the distance from the beginning to the destination or from one titi to another point that makes its destination with millisecond units (ms)(Egilmez et al., 2013; Guck et al., 2018). The delay parameter is applied based on the standardization of TIPHON (Telecommunication and Internet Protocol Harmonization Over Network).

Table 5. Data Delay

Latency Categories	Great Delay	Index
Very Good	<150 ms	4
Good	150 to 300	3
Keep	300 to 450 ms	2
Bad	>450 ms	1

Table 6. Delay calculation results

Category	Transmission Media		
	Ethernet cable	Plc	Result
Steaming Video	10.7 ms	3 4.9 ms	Very Good

The results of the average Delay value obtained can be observed in table 6 for testing using the PWR Line system, such as video streaming experiments tend to increase in testing the PWR Line system. This happens because there is a decrease in the checking time for each package sent in the video streaming experiment has increased when checking for each package that is dating. In addition to the delay obtained in the two network topologies respectively due to the influence of the use of a load of electrical equipment used when the resulting one enters the category of very good because the delay result is less than or <150 ms if in units of ms (millisecond). However, the delay parameter of the electrical load used has a sufficient impact on the video streaming experiment.

Jitter

Jitter is caused by delay variations in data processing time and packet re-collection time(Karakus & Durresi, 2019) – packets ended jitter travel with millisecond units (ms) delay parameters applied based on TIPHON (Telecommunication and Internet Protocol Harmonization Over Network) standardization.

Table 7. Data Jitter

Relegation Categories	Peak Jitter	Index
Very Good	0 ms	4
Good	1 to 75 ms	3
Keep	75 to 125 ms	2
Bad	>225 ms	1

Table 8. Jitter Calculation Results

Category	Transmission Media		
	Ethernet cable	Plc	Result
Steaming Video	1 3.5 ms	41.6 ms	Good

The results of the average Jitter obtained can be observed in table 4.8 for experiments conducted directly proportional to the delayed chart in table 4.6. The resulting Jitter tends to decrease on topology networks that use Ethernet. On PWR Network Line, Jitter on the resulting video stream tends to increase. This indicates that the delay on each packet sent varies on both network topologies tested. In addition, the Jitter used at the time it was done, the Jitter value used at entering the category was excellent, but when compared to experiments on topology networks with the PWR Line system, it was better than using an Ethernet network. The result of the difference was not far from the Ethernet network topology system.

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4. Conclusion

In designing and making the system and then testing, measuring, and analyzing the system that has been made in such a way, the author can conclude several things as follows:

a) The design to build an internet network that uses the transmission of the power cable network provides convenience for Cadets and Cadets in the shipping Aviation Polytechnic barracks that can flexibly connect to computers or wifi routers on the cadet and cadet barracks without installation adding new cables.
b) Network development that uses the transmission of electrical cable networks is more efficient than Ethernet cable media because the installation and maintenance time is easier and reduces costs.
c) Maximizing the electricity network and being a voltage source also functions as a data transmission medium by superimposing data on conductors also used for electrical power transmission.
d) The PWR Line installation uses two devices: hardware and software.
e) In testing the calculation of QoS, the network topology between using Ethernet and PWR Line networks with Streaming Video experiments for the results of QoS calculations, the topology of the two networks was not much different with excellent results.

Suggestion

Realizing that the design of utilizing power line communication technology as a medium for transmitting internet data communication is still not perfect. Some suggestions that can be given for the improvement of the tool include:

design of using power line communication technology as a transmission medium must pay attention to electrical installation techniques so that the power line can transmit data. If the electrical installation technique is different, the power line communication cannot distribute data.

a) The PWR Line is very sensitive, so it is expected to be more careful to use it on components with a possible minor tolerance.
b) The installation distance of the PWR Line also affects the speed of internet data use, so the use of the PWR Line pays more attention to the installation distance of the tool.

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