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Research paper

Building MPLS Network Simulation Using GNS3 at PT. Telkom

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Abstract

The Backbone Network of PT Telkom Indonesia (PT.Telkom) has architecture from core layer to access layer. In the core layer network PT Telkom has two stage, there are Main pop and Primary pop. This paper proposed MPLS (Multiprotocol Label Switching) for core layer to optimize the network. The principle of MPLS (Multiprotocol Label Switching) Network is labelling MPLS to 2nd header layer and 3rd layer for easier checking the network. By using Graphical Network Simulator (GNS3), PT Telkom can simulate its Network using MPLS and calculate the Quality of Service (QoS). From Wireshark's summary, the parameter of QoS when uploading and downloading data process can be captured. In this research, the packet loss has 0% and if it compared with ITU-T category for packet loss, the proposed network achieved good category. Therefore the proposed method can be be used as an alternative for Telkom's backbone network in the future.

Keywords: *GNS3, MPLS,PT. Telkom, QoS*

1. Introduction

PT Telekomunikasi Indonesia is a company engaged in the public service telecommunications provider for both individuals / organizations, government institutions, educational and Business. To satisfy the needs of customers, PT Telekomunikasi Indonesia implements MPLS network technology at the core layer hierarchical topology.

MPLS is a technology that optimizes the performance of computer networks. MPLS can provide repeatability on the same IP without having to discard IP addressing is used. This technology is also used by reason of use labeling system, then there is no routing lookup and can provide the quickest path routing.

MPLS network built by PT Telekomunikasi Indonesia can be simulated in the network simulator application using the Graphical Network Simulator (GNS3). Simulation is used to analyze the performance of MPLS networks has been implemented by PT Telekomunikasi Indonesia in order to get the data closer to real networks. Meanwhile, to test the reliability of the network has been created, the measurement of performance through measurement of Quality of Service (QoS) by using wireshark and by comparing applications with QoS standards issued by ITU-T.

This paper is divided into two parts, the first chapter discusses the background of the study is accompanied by objectives to be achieved, the theoretical background supporting MPLS research, the methods used for testing the system. And section 2 discusses the analysis of the test data and the conclusion of testing data that used in this experiment. The data used for this study is the data sampling by using the ratio of 1: 10,000,000 to the real data used by PT Telkom.

2. Material and Methods

In this experiment, the research methods follows the flowchart that described in figure.1
Based on Figure 5 above, The Experiment divided into two stages, they are process of designing system of the MPLS using GNS3. And evaluate Quality of Service using Wireshark Application. And the Topology to be built is shown in Figure 2 below.

By PT Telekomunikasi Indonesia Connected via Batam City as an International Gateway Telkom, Kota Jakarta and Surabaya. The reason choosing these city because of fiber optic network that connected these city. Besided that due the geography distance's of these city is shortest. The MPLS topology for this research simulated by GNS3.

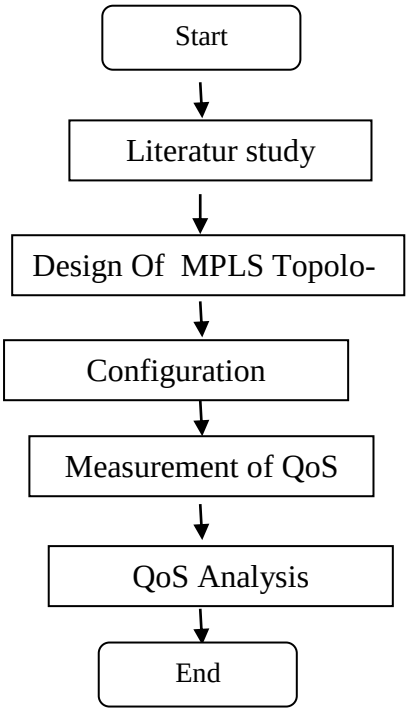

Fig 1: Flowchart of Experiments Methods.

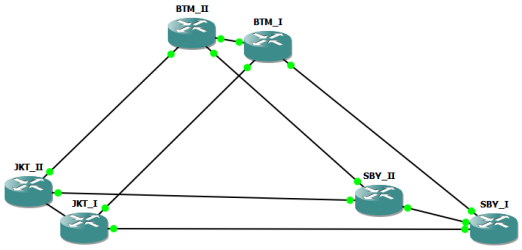

Fig 2: Topology system of MPLS for Telkom Architecture

3. Results and Discussion

For simulating MPLS network at PT Telkom in GNS3, any path that connects each router is assigned an IP address that created just for simulation and not real using in PT Telkom. This IP Address shown in Table 1.

Table 1: IP Address for Topology of MPLS

No	Router	IP Address
1	BTMI-JKTI	203.130.193.1
2	JKTI-BTMI	203.130.193.2
3	BTMI-SBYI	203.130.193.5
4	SBYI-BTMI	203.130.193.6
5	JKTI-SBYI	203.130.193.9
6	SBYI-JKTI	203.130.193.10
7	BTMII-JKTII	203.130.193.13
8	JKTII-BTMII	203.130.193.14
9	BTMII-SBYII	203.130.193.17
10	SBYII-BTMII	203.130.193.18
11	JKTII-SBYII	203.130.193.21
12	SBYII-JKTII	203.130.193.22
13	BTMI-BTMII	203.130.193.25
14	BTMII-BTMI	203.130.193.26
15	JKTI-JKTII	203.130.193.29
16	JKTII-JKTI	203.130.193.30
17	SBYI-SBYII	203.130.193.33
18	SBYII -SBYI	203.130.193.34

While for the bandwidth used in this simulation using a scale 1: 10.000.000, this is because the real bandwidth used in units TBps where-as in this simulation in units MBps,it adapts to the ability of GNS3 to simulate the network.

Table 2: Bandwith in MPLS Topolgy

Router Name	IP Loopback	Bandwidth(TBps)	Bandwidth Simulation (MBps)
BTMI	1.1.1.1/32	40	4
BTMII	2.2.2.2/32	40	4
JKTI	3.3.3.3/32	60	6
JKTII	4.4.4.4/32	60	6
SBYI	5.5.5.5/32	40	4
SBYII	6.6.6.6/32	40	4

As for testing the MPLS network that has been built, this research uses Wireshark Network Protocol Analyzer can capture LDP packet is formed through each router as shown in Figure 3 below.

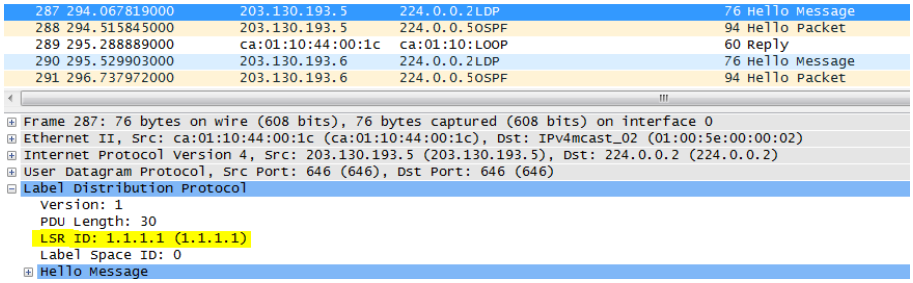

Fig 3: LDP packets passing through the router BTM-I

At the figure 3 shows packet LDP that built in this topology, This indicates the system is ready to be used to perform data communications. This communication is done in a way to download and upload files that are performed by the client as showed by figure 4.

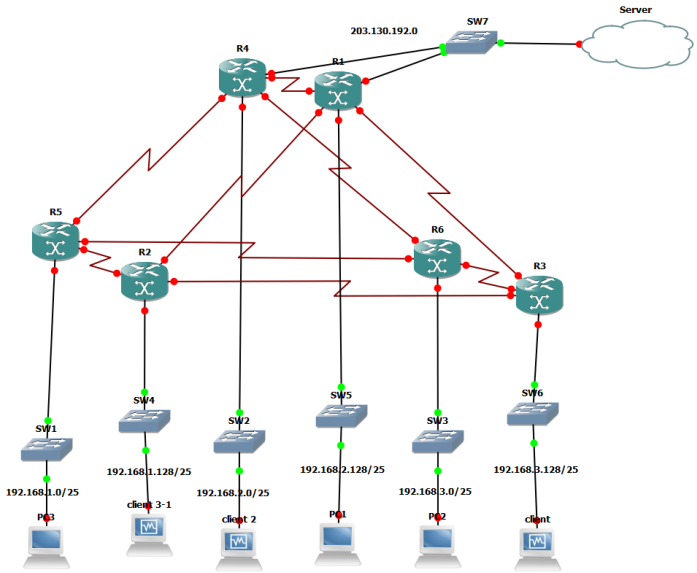

Fig 4: Data Communication Testing by Client

At figure 4 shows data communication using MPLS Topolgy. At that figure any client upload and download file from server in the amount of 322 MB. For traffic analysis can use wireshark application as shown at figure 5.

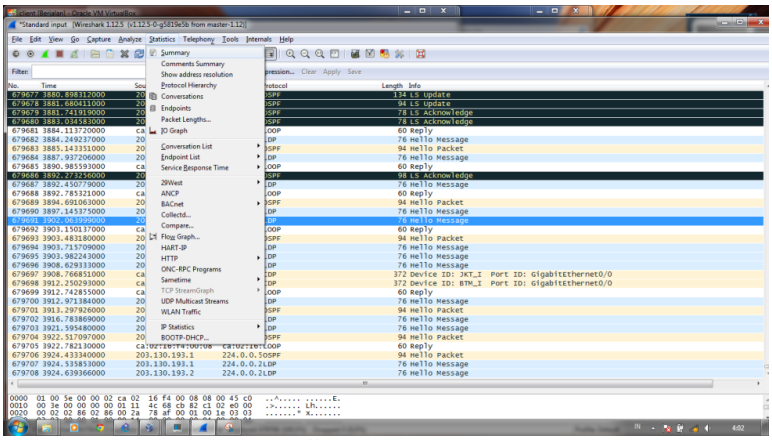

Fig 5: Traffic analysis using Wireshark

At figure 5 shows traffic of data through MPLS Network at PT Telkom Network Simulation. From the summary of wireshark we can calculate delay, Troughput and packet loss as shown at table 3 (testing for 322 MB download files at 2 client and upload 322 MB on a single client.

Table 3: Quality of Service the MPLS Network

No.	Troughput (MBps)	Packet Loss	Delay (ms)
1	1,229	0	6,586,730,189
2	1,34	0	6,023,155,514
3	0,824	0	1,056,498,513
4	0,762	0	1,083,349,374
5	1,336	0	619,619,112
6	1,283	0	6,757,129,832
7	1,403	0	6,048,816,585
8	1,285	0	639,551,582
9	1,485	0	5,579,274,286
10	1,228	0	4,536,257,059
Rata-rata	12,175	0	6,952,154,928

4. Conclusion

Transmission of files with a large data capacity can be simulated using GNS3, and for MPLS Network which adopt PT. Telkom Topology obtained the value of packet loss is zero, but the value of delay shows bad category when compared standar of ITU-T. So in the future network have to simulate MPLS Network with good delays value using different router.

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