International Journal of Electrical, Energy and Power System Engineering (IJEEPSE)
e-ISSN: 2654-4644
Vol. 5, No. 1, pp. 12-18, February 2022
Accredited by KEMENRISTEKBRIN, No. 200/M/KPT/2020
http://www.ijeepse.ejournal.unri.ac.id

Quality of Service from a Network when Using Youtube Application

Noveri Lysbetti Marpaung*
Department of Electrical Engineering
Universitas Riau
Pekanbaru, Indonesia
noveri.marpaung@gmail.com

Rizka Dwi Saputri
Department of Electrical Engineering
Universitas Riau
Pekanbaru, Indonesia
rizka.dwi0257@student.unri.ac.id

Rahyul Amri
Department of Electrical Engineering
Universitas Riau
Pekanbaru, Indonesia
rahyulamri@yahoo.com

Edy Ervianto
Department of Electrical Engineering
Universitas Riau
Pekanbaru, Indonesia
edyervianto@gmail.com

Nurhalim
Department of Electrical Engineering
Universitas Riau
Pekanbaru, Indonesia
nurhalim@unri.ac.id

**Corresponding author: Noveri Lysbetti Marpaung, noveri.marpaung@gmail.com*

***Abstract*—Nowadays, utilization of internet services is very important to do all jobs online, especially in pandemic of Corona Virus, whereas all employees from every institution must work from home. Therefore, the number of people using internet services increased dramatically. However, availability of internet network is not enough to complete those tasks. The other mainly important role to arrange all these chores is quality of service of its internet. In addition, other ordinary activity which must be prepared to execute is streaming video about many things. Consequently, all those workers must use YouTube application. Aim of this paper is to determine quality of service in internet network of one private Internet Service Provider company in Pekanbaru, related to real conditions on each of 40 clients, Outputs of this study is qualification of each Throughput, Delay, Packet Loss and QoS Parameters based on TIPHON. Results of the research show that QoS Parameters in this Internet Service Provider are Unsatisfied and tends to be Bad because there are only two users who obtain Satisfied, none of clients procure Very Satisfied, 25 clients experience Bad quality and 13 users face Unsatisfied category when using the internet network.**

Keywords—QoS Parameters, TIPHON Standard, QoS Index, QoS Category, YouTube application.

I. INTRODUCTION

Corona virus has changed the life of humans, in various manners and habbits, in all around the world. All mankind in every country are enforced to stay at home, to avoid the spread of this virus. As a sequence, all activities which are normally done in the office, school, or other market places, now must be done at home. In the case of manage all things in a house, a system must be needed to cope this problem. Internet connection is the answer to keep performing every thing good-naturedly, as long as people are at home.

Nowadays, utilization of internet services is very important to do all jobs online, especially in pandemic of Corona Virus, whereas all employees from every institution must work from home. Daily official businesses must conduct well as usual activities from office, to finish daily duties like as normal, before pandemic started. Based on these conditions, the number of people using internet services increased dramatically. However, the availability of internet network is not enough to complete those tasks. The other part that takes mainly important role to arrange all these chores is the stability of its internet processes. All these circumstances causes internet networking is the most condition that must be considered wisely to perform all those jobs appropriately.

In addition, the other ordinary activity which must be prepared to execute is streaming video about many things. For examples the changes in regulation related to the new condition of environmental jobs, latest reports and new information that must be shared. Normally, all these matters are broadcasted from main office using video, to guarantee that all employees will get the same information. Therefore, all those workers must use YouTube application.

The other parties who also often using YouTube to support assignments are students in schools and in universities. They need YouTube to watch the online/recorded video about their subjects from their teachers/lecturers during this pandemic. These conditions, absolutely, created a new problem when using YouTube. Whereas.

Of course, to get the good quality of YouTube, all those citizen need excellent internet connection. To provide a

Received: Oct 1, 2021 | Revised: Oct 29, 2021 | Accepted: Feb 28, 2022

superb networking of internet is responsibility of Internet Service Provider. There is one agency of private Internet Provider in Pekanbaru who suppy the internet services to its customers. All these clients often using application of YouTube to reinforce their normal interests. However, recently they complaint about the service of internet because they could not enjoy the performance of internet working. During streaming video, they faced that the videos stopped/freezed suddenly or ran slowly. It is disturbing and troubling for the consumers.

For this reason, this study aims to determine the qualification of internet network in a private Internet Service Provider institution in Pekanbaru, related to the real conditions on each clients when using YouTube. To reach the goal, so the research uses QoS Parameters, such as Throughput, Delay and Packet Loss based on TIPHON.

The outputs of this paper is qualification of each Throughput, Delay, Packet Loss and QoS Parameters, refers to the existing condition based on Telecommunications and Internet Protocol Harmonization Over Network (TIPHON). TIPHON is a marking standard of QoS Parameters, which is produced by standard institution of European Telecommunications Standards Institute (ETSI). Values of all QoS Parameters are analized to decide the qualification of an internet network based on all parts of QoS Parameters [1].

II. Literature Review

A. Quality of Service

Quality of Service (QoS) is the ability of a network to provide good service with different levels of service guarantee. Support from QoS is very important to guarantee many various classes of service [2]. Index of QoS Parameter is shown in Table 1. There are three Parameters of QoS that used in this study, namely:

a) Throughput is the sum of total of observed packet arrivals and destination during the specified time interval divided by duration of that time interval [3]. To calculate Throughput [3] using (1).

$$Throughput = \frac{Recieved\ Data\ Packet}{Observation\ time} \quad (1)$$

whereas:

Received Data Packet: Total packets was observed
Observation Time: Observation time duration

TABLE I. Index of QoS Parameter [4]

QoS Value	Percentage (%)	Index
3.8 – 4	95 – 100	Very Satisfied
3 – 3.79	74 – 94.75	Satisfied
2 – 2.99	50 – 74.75	Un-satisfied
1 – 1.99	25 – 49.75	Bad

TABLE II. Standardization of Throughput on TIPHON [5]

Throughput Category	Throughput	Index
Very Good	> 2.1 Mbps	5
Good	1200 Kbps – 2.1 Mbps	4
Average	700 Kbps – 1200 Kbps	3
Bad	338 Kbps – 700 Kbps	2
Very Bad	0 Kbps – 338 Kbps	1

Throughput Standardization based on TIPHON is illustrated in Table 2.

i) Packet Loss is a parameter that describes condition by showing the total number of lost packets and the presence of collision and congestion on a network [3]. To procure Packet Loss, (2) is used [3].

$$Packet\ Loss = \frac{Y}{A}\ x\ 100\% \quad (2)$$

Whereas:
Y = Sent Data Packet– Received Data Packet
A = Sent Data Packet
B = Received Data Packet

Standard of Packet Loss using TIPHON can be seen in the Table 3.

ii) Delay is time needed to travel the distance from source to destination. To calculate Delay [7], (3) is applied.

$$AverageDelay = \frac{Delay\ Total}{Total\ of\ Recieved\ Data\ Packet} \quad (3)$$

Whereas:
Delay Total = Time spent in distance from source to destination (second)
Total of received data packet = Number of packets that reached destination

TIPHON for Delay Category is displayed in Table 4.

B. YouTube Application

YouTube application is an application that is used to watch and share videos with other users. The videos on YouTube application are made by content creators to document their activities, online or recorded. In addition, YouTube application provides benefit to its customers, such as share information needed by its users [8].

C. Wireshark Application

Wireshark Application is an open-source application used as a network protocol analyzer tool. Wireshark is a free packet sniffer in computer application. Wireshark has a tool to capture, view and analyze of data packets [9].

TABLE III. Standard of Packet Loss based on TIPHON [6]

Packet Loss Category	Packet Loss (%)	Index
Very Good	$0 \leq p < 3$	4
Good	$3 \leq p < 15$	3
Average	$15 \leq p \leq 25$	2
Bad	≥ 25	1

TABLE IV. Delay Category refer to TIPHON [7]

Delay Category	Delay (ms)	Index
Very Good	< 150	4
Good	150 - 300	3
Average	300 - 450	2
Bad	> 450	1

Received: Oct 1, 2021 | Revised: Oct 29, 2021 | Accepted: Feb 28, 2022

D. Literature References

Reference [7] discussed bandwidth management on the client by allocate bandwidth using PCQ – HTB Methods. Client network performance was tested by using Quality of Service parameters, such as Packet Loss, Delay and Jitter. The result of this research was value Packet Loss reached 3.4%, Delay achieved 5.83 ms and jitter produced 10.59 ms.

Reference [10] produced qualification of internet network based on TIPHON by doing some testings to get qualification of internet network such as throughput, delay and packet loss, using Access Point from different distances to assure that internet network connection is suitable to be used on Vocational Senior Highschool. Results of the research stated that all values of throughput were Bad, all averages of delay daily were Best and all packet losses were Perfect based on TIPHON. In general, network qualification from seven computers in this school is Medium, based on TIPHON Standard.

Reference [11] conducted bandwidth management on internet network. In this study, bandwidth management was used to control and allocate customers' bandwidth by giving priority to the highest bandwidth of the top, while the low-capacity bandwidth is at the bottom. The result of the research was achieved Throughput values from Client 1 up to Client 5. In this case, Client 1 and Client 2 got 210 Kbps and 203 Kbps of Throughput in chronological order. Client 3, 4 and 5 obtained 209 Kbps, 204 Kbps and 218 Kbps Throughput in series.

Reference [12] used QoS analysis of Wireless network for IoT based on temperature and humidity monitoring of soybeans. Testing was performed by placing sensor nodes at three points using Star Topology. The results showed that optimum network conditions from those three nodes was in four-meter distance with delivery interval in 40 second. Packet Loss value achieved 0-20%, delay reached 1.154 – 5.92 ms, Jitter was 0.241 – 7.57 ms and throughput was about 66,32 bit/s.

Reference [13] designed the performance of computer network conditions based on observations. In this case, there were two factors that affect network quality performance, like as Delay and Throughput. The results of the study produced 26.01 ms Delay and 16 Kbps Throughput.

Reference [14] surveyed and assesed many various impact of QoS mechanisms on the transported applications performances under simulator of Riverbed Modeler. To focus on the network, File Transfer Protocol, HTTP applications and Voice over IP (VoIP) were used to simulate it. The assesment based on jitter, end-to-end delay, and the VoIP loss rate.

Reference [15] stated that Quality of Service (QoS) had become an important thing of web service characteristic for users to choose appropriate web services for a spread application by identifying which characteristics prepared service more qualified to be selected. From technical norotion, lack of a whole model for evaluating of web services in terms of procedural and non-procedural QoS qualities was important.

III. Methodology

The research was conducted in one of private Internet Service Provider in Pekanbaru, Indonesia. Related to Fig. 1, can be stated that the research is started by surveying and literaturing study. As a result, problem can be identified. Then, YouTube Application is used by 40 customers to get network condition which is captured by Woreshark Application. After few parameters obtained from Wireshark, QoS Parameters such as Throughput, Packet Loss and Delay can be calculated. All the results of those produce index and category for each parameter. The indexes of QoS parameters are calculated to get QoS Value. Based on QoS Value, index and parameter of QoS is obtained. If QoS Index is in 3.8 – 4, so qualification of internet network is Very Satisfied based on TIPHON Standard. Network qualifications of internet are Satisfied and Unsatisfied using TIPHON if QoS Indexes are in 3 – 3.79 and 2 – 2.99, respectively. Otherwise, it is Bad based on Standard of TIPHON.

IV. Results and Discussion

Network Testing is performed by Wireshark. The result of Network Testing can be described in Figure 1.

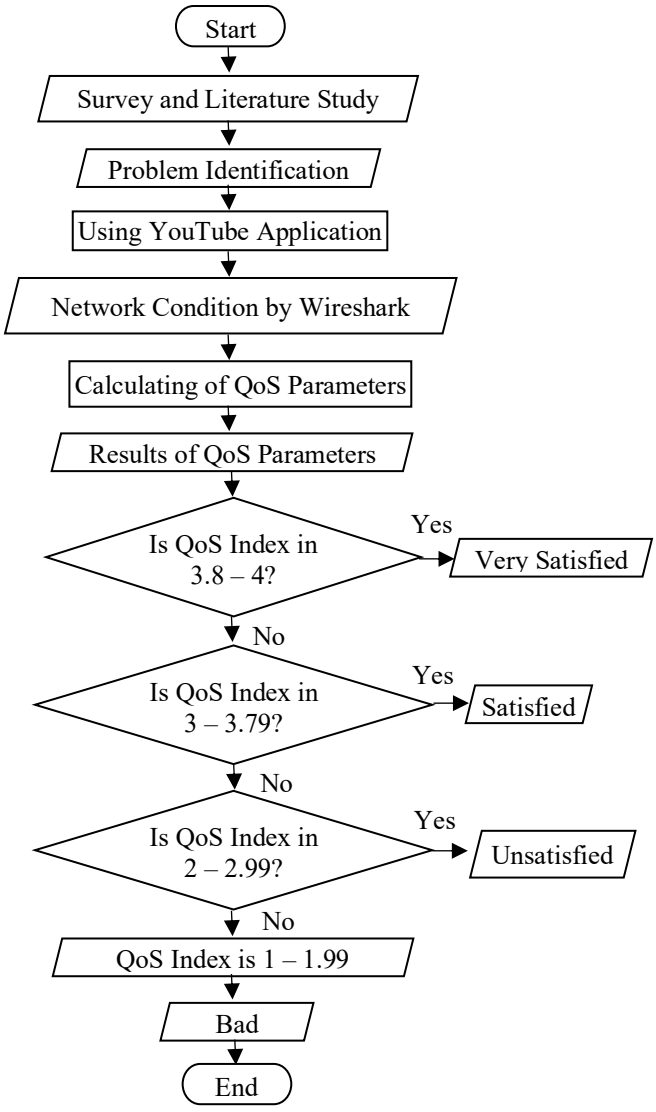

Fig. 1. Flowchart of research

Based on Fig. 2, Parameters of QoS can be obtained such as Throughput, Delay and Packet Loss.

A. Throughput

Based on Fig. 2. it can be revealed that:
Data packet received (Bytes) = *4760924 bytes*
Observation Time (Time span, s) = *291.58 sec*

To obtain Throughput, equation (1) is used.

$$Throughput = \frac{4760924 \text{ Bytes}}{291.58 \text{ second}} = \frac{16328.13\ Byte}{sec}\ x\ 8\ bits$$

$$Throughput = \frac{130624.16\ bps}{1024} = 127.56\ Kbps$$

Hash (RIPEMD160): 86484e2555972b4049e093604ac2a14c45e5d9e7
Hash (SHA1): 5d81cac4e6873ee8b5b951f463d6623dfdac4e43
Format: Wireshark/... - pcapng
Encapsulation: Ethernet

Time

First packet: 2021-07-28 09:30:32
Last packet: 2021-07-28 09:35:24
Elapsed: 00:04:51

Capture

Hardware: AMD A8-7410 APU with AMD Radeon R5 Graphics (with SSE4.2)
OS: 64-bit Windows 10 (2009), build 19043
Application: Dumpcap (Wireshark) 3.4.0 (v3.4.0-0-g9733f173ea5e)

Interfaces

Interface	Dropped packets	Capture filter	Link type	Packet size limit
Wi-Fi	0 (0.0%)	none	Ethernet	262144 bytes

Statistics

Measurement	Captured	Displayed	Marked
Packets	6342	189 (3.0%)	—
Time span, s	291.578	291.578	—
Average pps	21.8	0.7	—
Average packet size, B	751	127	—
Bytes	4760924	4760924 (100.0%)	0
Average bytes/s	16k	16k	—
Average bits/s	130k	130k	—

Fig. 2. Network conditions during testing by Wireshark

Refer to Table 2, Throughput Category (127.56 Kbps) is Good in Index 4. By doing the same procedure, the other values of Throughput with its Category and Index are stated in Table 5.

TABLE V. THROUGHPUT WITH ITS CATEGORY AND INDEX

Customer	Received Data Packet	Throughput (Kbps)	Index	Category
1	4760924	127.56	1	Very Bad
2	2457331	78.13	1	Very Bad
3	10595715	298.12	1	Very Bad
4	155093	4.27	1	Very Bad
5	3016177	490.50	2	Bad
6	4941665	156.89	1	Very Bad
7	20681439	546.92	2	Bad
8	*10107145*	*350.96*	*2*	*Bad*
9	87714	4.41	1	Very Bad
10	14838740	453.14	2	Bad
11	13433662	364.46	2	Bad
12	646357	26.39	1	Very Bad
13	229133	5.10	1	Very Bad
14	76504	2.48	1	Very Bad
15	127981	4.54	1	Very Bad
16	216596	5.22	1	Very Bad
17	167480	5.69	1	Very Bad
18	231745	6.95	1	Very Bad
19	194952	5.83	1	Very Bad
20	205539	5.51	1	Very Bad
21	90355	3.17	1	Very Bad
22	15332441	382.18	2	Bad
23	7135263	230.51	1	Very Bad
24	17823121	519.82	2	Bad
25	10795515	439.96	2	Bad
26	*8124968*	*329.35*	*1*	*Very Bad*
27	*15240795*	*696.35*	*2*	*Bad*
28	124148	3.86	1	Very Bad
29	487877	17.48	1	Very Bad
30	325281	10.08	1	Very Bad
31	146431	4.12	1	Very Bad
32	89830	2.95	1	Very Bad
33	165053	5.56	1	Very Bad
34	86410	2.76	1	Very Bad
35	130677	4.58	1	Very Bad
36	116307	2.28	1	Very Bad
37	*48692*	*1.55*	*1*	*Very Bad*
38	63784	1.85	1	Very Bad
39	357443	11.35	1	Very Bad
40	91503	2.10	1	Very Bad

Based on Table 5, 31 clients get Throughput is Very Bad Category in Index 1. The smallest value of Very Bad Category in Througput is 1.55 Kbps on Customer 37 and the biggest value of Througput in same condition is 329.35 Kbps on Customer 26. On the other side, there are 9 users who face Bad Category of Throughput in Index 2. The least value in this category is 350.96 Kbps on user 8 and 696.35 Kbps on Customer 27. Based on these resuts, it can be said that Throughput on all customers in average are 1.23 Kbps in Index 1 with Very Bad Category. As a consequence, all clients have problem when open video using YouTube Application because the internet connection is absolutely worst.

B. Packet Loss

TABLE VI. PACKET LOSS WITH ITS CATEGORY AND INDEX

Customer	Packet Loss (%)	Index	Category
1	97	1	Bad
2	85	1	Bad
3	94	1	Bad
4	69	1	Bad
5	*38*	*1*	*Bad*
6	98	1	Bad
7	82	1	Bad
8	93	1	Bad
9	87	1	Bad
10	*99*	*1*	*Bad*
11	*99*	*1*	*Bad*
12	91	1	Bad
13	61	1	Bad
14	57	1	Bad
15	72	1	Bad
16	91	1	Bad
17	71	1	Bad
18	56	1	Bad
19	67	1	Bad
20	79	1	Bad
21	64	1	Bad
22	98	1	Bad
23	91	1	Bad
24	95	1	Bad
25	96	1	Bad
26	98	1	Bad

Received: Oct 1, 2021 | Revised: Oct 29, 2021 | Accepted: Feb 28, 2022

27	*99*	*1*	*Bad*
28	72	1	Bad
29	63	1	Bad
30	59	1	Bad
31	74	1	Bad
32	84	1	Bad
33	83	1	Bad
34	83	1	Bad
35	76	1	Bad
36	81	1	Bad
37	76	1	Bad
38	66	1	Bad
39	39	1	Bad
40	76	1	Bad

By looking at Fig. 2. it is obtained that:
Data packet sent/captured (A) = *6342 Kbps*
Data packet received/displayed (B) = *189 Kbps*

To procure Packet Loss, (2) is used.

$$Packet\ Loss = \frac{6342 - 189}{6342}\ x\ 100\% = 97.02\%$$

In accordance with Table 3, the Category of Packet Loss (97.02%) is Bad in Index 1. Conducting same steps, the other values of Packet Loss with its Category and Index are illustrated in Table 6. According to Table 6, all users of internet service, in general, experience Packet Loss are in Very Bad level in Index 1. The smallest value of Packet Loss in this level is 38% on Customer 5 and the biggest value in same level is 99% on three Customers, namely Customer 10, 11, 27. Can be summarized that all packets cannot be obtained by the users because all packets are really lost.

C. Delay

TABLE VII. DELAY WITH ITS CATEGORY AND INDEX

Customer	Delay (ms)	Index	Category
1	1510	1	Bad
2	410	2	Average
3	410	2	Average
4	1010	1	Bad
5	450	1	Average
6	2230	1	Bad
7	*70*	*4*	*Very Good*
8	310	2	Average
9	2320	1	Bad
10	340	2	Average
11	1370	1	Bad
12	1690	1	Bad
13	910	1	Bad
14	1280	1	Bad
15	1500	1	Bad
16	*3960*	*1*	*Bad*
17	1050	1	Bad
18	620	1	Bad
19	930	1	Bad
20	1630	1	Bad
21	1360	1	Bad
22	2370	1	Bad
23	360	2	Average
24	300	2	Average
25	*30*	*4*	*Very Good*
26	2480	1	Bad
27	480	1	Bad
28	1520	1	Bad
29	1110	1	Bad
30	610	1	Bad
31	1620	1	Bad
32	2820	1	Bad
33	2270	1	Bad
34	3130	1	Bad
35	820	1	Bad
36	2900	1	Bad
37	3050	1	Bad
38	2250	1	Bad
39	*460*	*1*	*Bad*
40	2670	1	Bad

Figure 2. it is obtained that:
Sent/captured Data packet = *285 sec*
Received/displayed Data packet = *189*
To get Delay, (3) is used.

$$Delay = \frac{285}{189} = 1.51\ \text{s x}\ 1000 = 1510\ \text{ms}$$

Regarding with Table 4, Delay Category of 1510 ms is Bad in Index 1. Performing same sequences, the other values of Delay with its Category and Index are illustrated in Table 7. Regarding with Table 7, there are 31 consumers who had delay is Bad Category in Index 1, with various value from 460 ms upto 3960 ms, whereas Client 39 gets the smallest value and Consumer 16. By this circumstance, Client 16 faces the longest delay in 3,96 s , whereas User 39 procures delay just 1.1 second. However, this delay is classified as a bad delay in Index 1. Vice versa, there are seven people get delay in Average Category, which is in Index 2. The rest of clients who get Very Good delay are on User 7 and 17. They just waiting in 40 ms and 70 ms, respectively. Even the highest value of delay is around 3.96 ms, however, this delay is grouped as Bad Category in Index 1 because delay should not happen during client using internet network, not even when running YouTube. The results of QoS Parameters from each customer is represented in Table 8.

TABLE VIII. QUALIFICATION OF QOS PARAMETER

Customer	Throughput Index	Packet Loss Index	Delay Index	QoS Parameter	
				Index	Category
1	4	1	1	2	Unsatisfied
2	3	1	2	2	Unsatisfied
3	4	1	2	2.33	Unsatisfied
4	1	1	1	1	Bad
5	4	1	1	2	Unsatisfied
6	4	1	1	2	Unsatisfied
7	*4*	*1*	*4*	*3*	*Satisfied*
8	4	1	2	2.33	Unsatisfied
9	1	1	1	1	Bad
10	4	1	2	2.33	Unsatisfied
11	4	1	1	2	Unsatisfied
12	1	1	1	1	Bad
13	1	1	1	1	Bad
14	1	1	1	1	Bad
15	1	1	1	1	Bad
16	1	1	1	1	Bad
17	1	1	1	1	Bad
18	1	1	1	1	Bad
19	1	1	1	1	Bad
20	1	1	1	1	Bad
21	1	1	1	1	Bad
22	4	1	1	2	Unsatisfied
23	4	1	2	2.33	Unsatisfied

24	4	1	2	2.33	Unsatisfied
25	*4*	*1*	*4*	*3*	*Satisfied*
26	4	1	1	2	Unsatisfied
27	4	1	1	2	Unsatisfied
28	1	1	1	1	Bad
29	1	1	1	1	Bad
30	1	1	1	1	Bad
31	1	1	1	1	Bad
32	1	1	1	1	Bad
33	1	1	1	1	Bad
34	1	1	1	1	Bad
35	1	1	1	1	Bad
36	1	1	1	1	Bad
37	1	1	1	1	Bad
38	1	1	1	1	Bad
39	1	1	1	1	Bad
40	1	1	1	1	Bad

Refer to Table 8, 25 clients experience Bad quality and 13 users face Unsatisfied category of QoS Parameter, with Index 1 and Index 2 upto 2.33 in sequence. On the other side, there are just two people who get Satisfied qualification of Parameter of QoS. They are customers 7 and 25. Overall, the quality of QoS Parameter in this private Internet Service Provider are Unsatisfied and tends to be Bad. However, there are just two users who obtain Satisfied when using the internet network and none of clients procure Very Satisfied. As a consequent, the Internet Service Provider should increase bandwidth to improve the quality of QoS Parameters in general, hence also recover the Parameters of QoS in each customer from this private Internet Service Provider.

V. CONCLUSION

The average of Throughput on 40 customers is 1.23 Kbps in Index 1 with Category is Very Bad. Therefore all users have problem when open video using YouTube Application because the internet connection is absolutely worst. Generally, all users who using internet service experience Packet Loss are Very Bad in Index 1. It means all packets cannot be gained by the clients because all packets are really lost. The highest delay is about 3.96 ms and this delay is still categorized as Bad Category in Index 1 because delay should not happen during client using internet network, not even when running YouTube. Quality of QoS Parameter in this private Internet Service Provider are Unsatisfied and tends to be Bad because there are only two users who obtain Satisfied, none of clients procure Very Satisfied, 25 clients experience Bad quality and 13 users face Unsatisfied category when using the internet network from this Internet Service Provider. To improve the quality of QoS Parameters, Internet Service Provider should enhance bandwidth in general, hence also recover the Parameters of QoS in each customer.

ACKNOWLEDGMENT

The researchers would like to thank the Institute for Research and Community Service (LPPM) of the Universitas Riau.

REFERENCES

[1] Utami, R. E, "Comparison Analysis of Quality of Service from Internet Network Based on Wireless on Service of Internet Service Provider Indihome and First Media", Journal of Ilmiah Teknologi dan Rekayasa Vol. 2, pp: 125 – 137, 2020.

[2] Golla, P. Damm, G. and Ozugur, T, "Traffic Management Mechanism For Fast Arbitrations With QoS Parameters", IEEE, 2003.

[3] Faisal, I. and Fauzi, A, "Qos Analysis on Implementation of Bandwidth Management Using Queue Tree and Peer Connection Queueing Methods", Journal of Penelitian Teknik Informatika Vol. 1, pp: 137-142, 2018.

[4] Wulandari, R, "Internet Network – Case Study on UPT Loka in Mining Engineering Testing of Jampang Kulon", LIPI, UPT Loka Uji Teknik Penambangan Jampang Kulon, LIPI), JuTISI, Vol. 2, pp: 162-172, 2016.

[5] Terto, A. S. D. and Laksana, E. P, "Analysis of Management Bandwidth Using Queue Tree As Traffic Control With PFIFO Method (Analisa Management Bandwidth Menggunakan Queue Tree Sebagai Traffic Control Dengan Metode PFIFO)", Journal of Maestro Vol. 2, pp: 398 – 407, 2019.

[6] Apriadi, Zainuddin, A. and Irfan, L. A. S, "Computer Area Network Analysis For Quality Of Service (Case Study: Faculty of Engineering in Mataram University)", University of Mataram, 2018.

[7] Iswadi, D. Adriman, R. and Munadi, R, "Adaptive Switching PCQ-HTB Algorithms for Bandwidth Management in RouterOS", IEEE International Conference on Cybernetics and Computational Intelligence (IEEE CYBERNETICSCOM), 2019.

[8] Cayari, C, "The YouTube Effect: How YouTube Has Provided New Ways to Consume, Create, and Share Music, International Journal of Education And The Arts Vol. 12, pp: 1-28, 2011.

[9] Banerjee, U. Vashishtha, A. and Saxena, M, "Evaluation of The Capabilities of Wireshark As A Tool For Intrusion Detection", International Journal of Computer Applications Vol. 6, pp: 1-5, 2010.

[10] Marpaung, N. L. and Silalahi, E. Y. O, "Quality of Service in Internet Network Based on Different Distances from Access Point", 2021 International Conference on Smart-Green Technology in Electrical and Information Systems (ICSGTEIS2021), 2021.

[11] Engel, A, "Bandwidth Management And Quality of Service", Edith Cowan University, 2000.

[12] Sasono, S. H. W. Kusumastuti, S. Supriyanto, E. Widodo, S. and Azizcha, D, "QoS Analysis of Wireless Sensor Networks For Temperature and Humidity Monitoring and Control of Soybean Seed Storage Based IOT Using NodeMCU", Journal of Applied Information and Communication Technologies Vol. 1, pp: 1-11, 2017.

[13] Sugeng, W. Istiyanto, J. E. Mustofa, K. and Ashari, A, "The Impact of QoS Changes Towards Network Performance", International Journal of Computer Networks and Communications Security Vol. 3, pp: 48-53, 2015.

[14] Bensalah, F. Bahnasse A, El Hamzaoui, M, "Quality of Service Performance Evaluation of Next-Generation Network", The 2nd International Conference on Computer Applications & Information Security (ICCAIS), 2019.

[15] Oskooei, M. A, Daud, S. M, "Quality of service (QoS) model for web service selection". International Conference on Computer, Communications, and Control Technology (I4CT), 2014.

BIOGRAPHIES OF AUTHORS

NOVERI LYSBETTI MARPAUNG received MSc Electronics from Newcastle Umoversity, Newcastle, United Kingdom in 2001. Her current research interests include Controlling System, Reliability System, Artificial Inteligence, Computer Network, Wireless Sensor Network.

RIZKA DWI SAPUTRI received the Degree in Computer Based from University of Riau, Pekanbaru, Indonesia in 2021. Her current research interests include Computer Network.

RAHYUL AMRI received Master Degree in Computer Network and Multimedia from Institut Teknologi Sepuluh November Surabaya (ITS), Surabaya, Indonesia in 2006. His current research interests include Computer Network and Multimedia.

EDY ERVIANTO received Master Degree in Electrical Power System from Institut Teknologi Sepuluh November Surabaya (ITS), Surabaya, Indonesia in 2008. His current research interests include Renewable Energy, High Voltage, Power System Control, Grounding System.

NURHALIM received Master Degree in Engineering of Electrical Power from University of Indonesia (UI), Jakarta, Indonesia in 2007. His current research interests include Renewable Energy, Power System Development, Power Quality, Smart Grid.

Received: Oct 1, 2021 | Revised: Oct 29, 2021 | Accepted: Feb 28, 2022