



Measuring Quality of Service (QoS) on Ki Hajar Dewantoro High School Internet Networks

Siti Maesaroh¹Ita Erliani², Khairul Hidayat³

^{[1],[3]} Computer Science study program, University of Mercu Buana, ^[2] System Information Study Program, University of Raharja

e-mail: ¹siti.maesaroh@mercubuana.ac.id, ²ita.erliyani@raharja.info, ³khairulhidayat0101@gmail.com

Abstract

At SMA Ki Hajar Dewantoro Tangerang, the recurring issues with the internet network are attributed to several problems, including Throughput, Packet loss, Delay, and Jitter. By employing the Quality of Service (QoS) method, the values of these parameters can be measured to assess the performance of the existing internet services. The measurement of parameter values revealed the highest throughput during peak hours for ISP 1, with an average value of 1813 kbps falling into the 'Good' category. Conversely, the lowest throughput was observed during non-peak hours for ISP 2, with an average value of 300 kbps categorized as 'Poor.' The highest packet loss occurred during non-peak hours for ISP 2, with an average value of 1%, classified as 'Very Good.' On the other hand, the lowest packet loss was recorded during peak hours for ISP 1, with an average of 0.036%, categorized as 'Very Good.' Regarding delay, the highest average delay was noted during non-peak hours for ISP 2, with a value of 21.5ms falling into the 'Very Good' category. Conversely, the lowest delay was observed during peak hours for ISP 1, with an average value of 4.25ms categorized as 'Very Good.' For jitter, the highest average jitter occurred during non-peak hours for ISP 2, with a value of 21.5ms in the 'Good' category. In contrast, the lowest jitter was recorded during peak hours for ISP 1, with an average value of 4.25ms categorized as 'Good.'

Keywords: *QoS, Throughput, Packet loss, Delay, Jitter.*

1. Introduction

Currently, the internet plays a crucial role in providing essential information and serves as a means of long-distance communication. It also aids in easing various tasks. Particularly in the field of education, the internet is highly beneficial for both students and educators, facilitating the educational process and contributing to the enhancement of knowledge. However, at Ki Hajar Dewantoro High School, issues frequently arise in the internet network due to various problems such as Throughput, Packet loss, Delay, and Jitter. These issues can impede processes like data retrieval and transmission, hindering activities within the school. Therefore, it is essential for the internet service to support the educational process efficiently, without disrupting school activities, especially teaching and learning. Hence, Quality of Service (QoS) measurements are conducted on the Internet Network at Ki Hajar Dewantoro High School Tangerang, based on Wireshark, to examine the network's performance. This

research aims to measure how well a network service performs by assessing Quality of Service parameters according to TIPHON standards. By monitoring the network in the Ki Hajar Dewantoro High School building, measurements are carried out to ensure that the network operates smoothly using the QoS method. QoS (Quality of Service) is a measurement method to assess network performance and define the characteristics and service properties on the network. QoS measurements using the Wireshark software help obtain parameter values for throughput, packet loss, delay, and jitter. Understanding these parameter values provides insights into the quality of internet services at Ki Hajar Dewantoro High School Tangerang.

2. Research Methodology

2.1. literature review

To support this research, the researcher conducted a literature review on previous studies. The following literature reviews are

relevant to this research:

1. A study by Rizka et al. titled "Quality of Service from a Network when Using Youtube Application." This research focuses on measuring internet network quality when using the YouTube application to determine internet network quality [1].
2. Another study by Muhammad Aguspiant et al. titled "Analysis QoS (Quality of Service) Measurement of delay, jitter, packet loss, bandwidth utility, and resource of Using online video conferencing software." This research discusses measurements when using video conferencing applications to assess internet network quality [2].
3. A study by M. Yasin Simargolang and Adi Widarma titled "Quality of Service (QoS) for Wireless Area Network performance analysis." (WLAN)." This research measures internet networks with WLAN and uses the TIPHON standard [3].
4. Then research conducted by Aprianto Budiman, et al. With the title "Analysis of Quality of Service (QoS) on the internet network of SMK Negeri 7 Jakarta." The discussion in this research is to find out how big the QoS value is on the internet network [4].
5. Furthermore, research was conducted by Priska Restu Utami. With the title "Comparative Analysis of the Quality of Service of Wireless-Based Internet Networks on internet service providers (ISP) Indihome and First Media." This research is to compare the performance of network services between the two ISPs using QoS parameters, namely throughput, packet loss and delay parameters [5].
6. Furthermore, research was carried out by Muhammad Hasbi. With the title "Quality of Service (QoS) analysis of the King Bukopin head office internet network using Wireshark." The research was conducted to analyze the quality of the internet network at the KB BUKOPIN Head Office. The analysis was carried out using the Quality Of Service (QOS) method to determine the performance capabilities of the existing network [6].
7. Then research was carried out by Valian Yoga Pudya Ardhana. With the title "Quality of Service (QoS) Analysis of the Internet Network at Al Mutmainnah Middle School." The discussion in this research is that the desire to achieve adequate internet cannot be separated from improving Quality of Service (QoS).

2.2 Theoretical Basis

1. Quality of Service

Quality of Service (QoS) is a performance service that can determine the level of user satisfaction in a service. The influence of service performance can determine user satisfaction. Quality of Service (QoS) is also the ability of a network to provide the best service by analyzing the values of throughput, packet loss, and delay.

2. Throughput

Throughput is the value of the effective data transfer speed sent through the network in bits per second (bps). The following are the Throughput standards according to TIPHON:

Category	Throughput (bps)
Very good	>2.1 Mbps
Good	1200 kbps 2.1 Mbps
Enough	700 1200 kbps
Not good	338 700 kbps
Bad	0 338 kbps

Table 2. 1 Throughput Standardization according to TIPHON

3. Packet loss

Packet loss is the total number of packets lost during data transmission due to packet buildup in a network. The following is a table of packet loss standards according to TIPHON.

Category	Packet Loss Value (%)
Very good	0 3%
Good	3 15%
Medium	15 -25%
Bad	>25%

Table 2. 2 Standardization of Packet loss according to TIPHON

4. Delay

Delay/Latency is the time it takes for a packet to reach its destination. Delays occur due to queues, or taking another route to avoid piles of data. Several factors influence the delay value, namely physical media, distance, and long processing time.

Category	Delay Value (ms)
Very good	<150 ms
Good	150-300 ms
Medium	300-450 ms
Bad	>450 ms

Table 2. 3 Standardization of Delay according to TIPHON

- Jitter is a variation in delay, which is caused by variations in queue length when processing data. Queuing delays on routers and switches can cause jitter.

Category	Jitter Value
Very good	0 ms
Good	1 ms - 75 ms
Currently	75 ms - 125 ms
Bad	125 ms - 225 ms

Table 2. 4 Jitter Standardization according to TIPHON

6. Wireshark

Wireshark is software that is able to understand the structure of different network protocols. Wireshark is capable of monitoring packets on network types that support pcap. In Wireshark, data can be captured by cable or without label (wireless).

2.3 Research Flow

The research stages carried out are as follows:

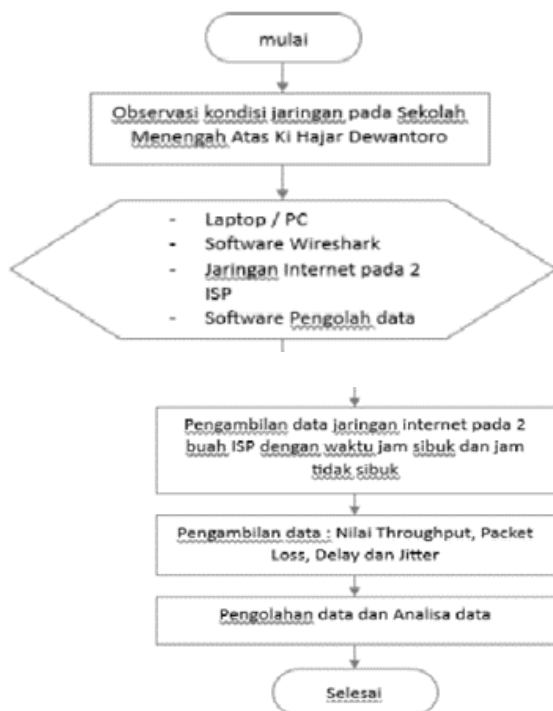


Figure 2.1 Research Flow

3. Results and Discussion

From the results of measurements at Ki Hajar Dewantoro High School, Tangerang. The Quality of Service parameter values obtained using TIPHON standardization as a research reference can be seen in the following table:

A. Test table for peak hour and non-peak

hour throughput of ISP 1 and ISP 2

- ISP peak hour throughput testing 1. A summary of the average throughput values during ISP 1 peak hours can be seen in table 3.1 as follows:

Testing	Throughput	Category
1	3721	Very good
2	1148	Enough
3	287	Bad
4	2097	Good
Average	1813	Good

Table 3. 1 ISP peak hour throughput testing 1

After grouping them into one test table, the throughput value can be seen during ISP 1 peak hours at Ki Hajar Dewantoro High School, Tangerang. With an average throughput value of 1813 kbps in the Good category in the TIPHON standard, namely 1200kbps -2.1 Mbps.

2. ISP peak hour throughput testing 2

A summary of the average throughput values during ISP 2 peak hours can be seen in table 3.2 as follows:

Testing	Throughput	Category
1	2299	Very good
2	977	Enough
3	68	Bad
4	1630	Good
Average	1243	Good

Table 3.2 ISP peak hour throughput testing 2

After grouping them into one test table, the throughput value can be seen during ISP 2 peak hours at Ki Hajar Dewantoro High School, Tangerang. With an average throughput value of 1243 kbps in the Good category in the TIPHON standardization, namely 1200kbps -2.1 Mbps.

3. ISP off-peak hour throughput testing 1

A summary of the average throughput value during ISP 1's off-peak hours can be seen in table 3.3 as follows:

Testing	Throughput	Category
1	429	Not good
2	186	Bad

3	383	Not good
4	3841	Very good
Average	1209	Good

Table 3. 3 ISP 1 off-peak hour throughput testing

After grouping them into one test table, the throughput value during ISP 1 off-peak hours at Ki Hajar Dewantoro High School, Tangerang can be seen. With an average throughput value of 1209 kbps in the Good category in the TIPHON standardization, namely 1200kbps -2.1 Mbps.

- ISP off-peak hour throughput testing 2
A summary of the average throughput value during ISP 2 off-peak hours can be seen in table 3.4 as follows:

Testing	Testing	Category
1	308	Good
2	219	Good
3	472	Not good
4	204	Good
Average	300	Good

Table 3. 4 ISP 2 off-peak hour throughput testing

After grouping them into one test table, the throughput value during ISP 2 off-peak hours at Ki Hajar Dewantoro High School, Tangerang can be seen. With an average throughput value of 300 kbps in the Bad category in the TIPHON standardization, namely 0 kbps - 338 kbps.

B.

- Packet loss test table for busy hours and non-busy hours for ISP 1 and ISP 2

- ISP peak hour packet loss testing 1. A summary of the average packet loss values during ISP 1 peak hours can be seen in table 3.5 as following:

Testing	Packet loss	Category
1	0,012 %	Very good
2	0,045 %	Very good
3	0,070 %	Very good
4	0,017 %	Very good
Average	0,036 %	Very good

Table 3. 5 ISP peak hour packet loss tests 1

After grouping them into one test table, we can find out the value of packet loss during ISP I peak hours at Ki Hajar Dewantoro High School, Tangerang. With average The packet loss value is 0.036% in the Very Good category in the TIPHON

standardization, namely 0-2%.

- ISP peak hour packet loss testing 2. A summary of the average packet loss values during ISP 2 peak hours can be seen in table 3.6 as follows:

Testing	Packet loss	Category
L	1,3 %	Very good
2	0,1 %	Very good
3	0.57 %	Very good
4	1,4 %	Very good
Average	0.84 %	Very good

Table 3.6 ISP 2 peak hour packet loss testing

After grouping them into one test table, we can find out the value of

packet loss during ISP 2 peak hours at Ki Hajar Dewantoro High School, Tangerang. With an average packet loss value of 0.84% in the Very Good category in the TIPHON standardization, namely 0-2%.

- ISP off-peak hour packet loss testing 1. A summary of the average packet loss values during ISP 1's off-peak hours can be seen in table 3.7 as follows:

Testing	Packet loss	Category
1	0.65 %	Very good
2	0,65 %	Very good
3	0,70 %	Very good
4	0.3& %	Very good
Average	0.59 %	Very good

Table 3. 7 Packet loss tests for ISP 1 off-peak hours

After grouping them into one test table, we can find out the value of packet loss during ISP 1 off-peak hours at Ki Hajar Dewantoro High School, Tangerang. With an average packet loss value of 0.59% in the Very Good category in the TIPHON standardization, namely 0-2%.

4. ISP off-peak hour packet loss testing 2. A summary of the average packet loss values during ISP 2 off-peak hours can be seen in table 3.8 as follows:

Testing	Packet Loss	Category
1	1,3 %	Very good
2	0,1 %	Very good
3	0,1 %	Very good
4	2,6 %	Very good
Average	1 %	Very good

Table 3.8 Packet loss testing during ISP 2 off-peak hours

After grouping them into one test table, we can find out the value of packet loss during ISP 2 off-peak hours at Ki Hajar Dewantoro High School, Tangerang. With an average packet loss value of 1% in the Very Good category in the TIPHON standardization, namely 0-2%.

- D. Table of Delay Testing for busy hours and non-busy hours for ISP 1 and ISP 2

1. ISP peak hour delay testing 1. A summary of the average delay values during ISP 1 peak hours can be seen in table 3.9 as follows:

Testing	Delay	Category
1	1 ms	Very good
2	3 ms	Very good
3	11 ms	Very good
4	2 ms	Very good
Average	4,25 ms	Very good

Table 3.9 ISP peak hour delay testing 1

After grouping them into one test table, the delay value can be seen during ISP 1 peak hours at Ki Hajar Dewantoro High School, Tangerang. With an average delay value of 4.25 ms in the Very Good category in the

TIPHON standardization, namely <150 ms.

2. ISP peak hour delay testing 2. A summary of the average delay values during ISP 2 peak hours can be seen in table 3.10 as follows:

Testing	Delay	Category
1	5 ms	Very good
2	3 ms	Very good
3	58 ms	Very good
4	8 m s	Very good
Average	18,5 ms	Very good

Table 3. 10 ISP peak hour delay tests 2 Delay

After grouping them into one test table, the delay value can be seen during ISP 2 peak hours at Ki Hajar Dewantoro High School, Tangerang. With an average delay value of 18.5 ms in the Very Good category in the TIPHON standardization, namely <150 ms.

3. ISP non-busy hour delay testing 1. A summary of the average delay values during ISP 1's off-peak hours can be seen in

Testing	Delay	Category
1	13 ms	Good
2	45 ms	Good
3	21 ms	Good
4	5 ms	Good
Average	21 ms	Good

table 3.11 as

follows:Table 3. 11 ISP non-busy hour delay testing 1

After grouping them into one test table, we can find out the delay value during ISP 1 off-peak hours at Ki Hajar Dewantoro Senior High School, Tangerang. With an average delay value of 21 ms in the Very Good category in the TIPHON standardization, namely <150 ms.

4. ISP non-busy hour delay testing 2. A summary of the average delay values during ISP 2 off-peak hours can be seen in the table 3.12 as follows:

Testing	Delay	Category
1	2 1 ms	Very Good.

2	19 ms	Very Good.
3	12 ms	Very Good.
4	34 ms	Very Good.
Average	21,5 ms	Very Good.

Table 3. 12 ISP 2 off-peak hour delay tests

After grouping them into one test table, the delay value can be seen during ISP 2 off-peak hours at Ki Hajar Dewantoro High School, Tangerang. With an average delay value of 21.5 ms in the Very Good category in the TIPHON standardization, namely <150 ms.

E. Table of Jitter Testing for busy hours and non-busy hours for ISP 1 and ISP 2

1. ISP peak hour Jitter Testing 1. A summary of the average jitter values during ISP 1 peak hours can be seen in table 3.13 as follows:

Testing	Jitter	Category
1	1 ms	Good
2	3 ms	Good
3	11 ms	Good
4	2 ms	Good
Average	4,25 ms	Good

Table 3. 13 ISP peak hour Jitter Test 1

After grouping them into one test table, the jitter value can be seen during ISP 1 peak hours at Ki Hajar Dewantoro High School, Tangerang. With an average delay value of 4.25 ms in the Good category in the TIPHON standardization, namely 1-75 ms.

2. ISP peak hour Jitter testing 2. A summary of the average jitter values during ISP 2 peak hours can be seen in table 3.14 as follows:

Testing	Jitter	Category
1	5 ms	Very Good
2	3 ms	Very Good
3	58 ms	Very Good
4	8 m s	Very Good
Average	18,5 ms	Very Good

Table 3. 14 ISP 2 peak hour Jitter Testing

After grouping them into one test table, the jitter value can be seen during ISP 2 peak hours at Ki Hajar Dewantoro High School, Tangerang. With an average jitter value of 18.5 ms in the Good category in the TIPHON standardization, namely 1 - 75 ms.

3. ISP non-busy hour jitter testing 1. A summary of the average jitter value during ISP 1's off-peak hours can be seen in table 3.15 as follows

Testing	Jitter	Category
1	13 ms	Bagus
2	45 ms	Bagus
3	21 ms	Bagus
4	5 ms	Bagus
Average	21 ms	Bagus

Table 3. 15 Jitter Testing for ISP 1 off-peak hours

After grouping them into one test table, the jitter value can be seen during ISP 1 off-peak hours at Ki Hajar Dewantoro High School, Tangerang. With an average jitter value of 21 ms in the Good category in the TIPHON standardization, namely 1-75 ms.

4. ISP non-busy hour jitter testing 2. A summary of the average jitter values during ISP 2 off-peak hours can be seen in table 3.16 as follows:

Testing	Jitter	Category
1	2 1 ms	Very Good
2	19 ms	Very Good
3	12 ms	Very Good
4	34 ms	Very Good
Average	21,5 ms	Very Good

Table 3. 16 Jitter Testing for ISP 2 off-peak hours

After grouping them into one test table, the jitter value can be seen during ISP 2 off-peak hours at Ki Hajar Dewantoro High School, Tangerang. With an average jitter value of 21.5 ms in the Good category in the TIPHON standardization,

namely 1-75 ms.

4. Conclusion

Based on the results of measuring the Quality of Services (QoS) on the Wireshark-based Internet Network at Ki Hajar Dewantoro Tangerang High School, the quality of the Internet Network at Ki Hajar Dewantoro Tangerang High School, based on the TIPHON standardization using parameter value measurements, obtained the highest throughput value, namely at ISP 1's peak hours with an average value of 1813 kbps are in the Good category, while the lowest throughput value is during ISP 2's off-peak hours with an average value of 300 kbps in the Bad category. The highest packet loss value is during ISP 2 off-peak hours with an average value of 1% in the Very Good category, while the lowest packet loss value is during ISP 1 peak hours with an average value of 0.036% in the Very Good category. Highest delay value namely at ISP 2 off-peak hours with an average value of 21.5ms in the Very Good category, while the lowest delay value is at ISP 1 peak hours with an average value of 4.25ms in the Very Good category. The highest jitter value is at ISP 2 off-peak hours with an average value of 21.5ms in the Good category, while the lowest jitter value is at ISP 1 peak hours with an average value of 4.25ms in the Good Category.

5. Recommendations

For further research, you can use additional parameters from Quality of Service, such as echo cancellation, Out of Delivery error and MOS to get more detailed information. THANK YOU.

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