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ANALYSIS QUALITY OF SERVICE OF INTERNET NETWORK FIBER TO THE HOME SERVICE PT. XYZ USING WIRESHARK

Daffa Aditya Rachman[1*], Yusuf Muhyidin [2], Muhamad Agus Sunandar [3]

[1,2,3]STT Wastukancana; Jl. Cikopak No. 53, Purwakarta, Jawa Barat; (0264) 214952

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Corespondent Email:
daffaaditya13@wastukancana.ac.id

Abstrak. Perkembangan teknologi informasi terus berkembang setiap tahunnya dan berhasil menciptakan teknologi baru yaitu internet. Internet merupakan sistem komputer publik yang terhubung secara global dan menggunakan TCP/IIP sebagai protokol komunikasi packet-switching. Perusahaan telekomunikasi memiliki akses jaringan internet yaitu Fiber to the home (FTTH). FTTH menyediakan layanan agar pelanggan dapat memanfaatkan telekomunikasi optik. Sehingga akan memiliki bandwidth yang lebih besar untuk mengakses telepon, internet, dan TV kabel dalam waktu yang bersamaan. Pada layanan yang telah dilakukan oleh perusahaan xyz, sudah banyak pengguna yang menggunakan layanan ini, namun ada beberapa faktor dalam layanan tersebut mengenai jaringan internet yang lambat dan kurang baik pada jam-jam tertentu, serta tidak menjawab bagaimana solusi untuk mengatasi layanan FTTH dari perusahaan xyz dalam bidang jaringan fisik Penelitian ini dilakukan dengan menggunakan metode Quality of Service (QoS) untuk mengatasi permasalahan tersebut dengan menggunakan empat parameter QoS yaitu throughput, packet loss, delay, dan jitter. QoS adalah kumpulan dari sebuah jaringan untuk menyediakan layanan lalu lintas data yang melewatinya. Hasil penelitian menemukan bahwa kualitas layanan pada 5 SSID/ pelanggan perusahaan XYZ dengan kecepatan 20 Mbps hasilnya "Sangat Memuaskan". Nilai Throughput, packet loss, Delay, dan Jitter pada SSID tersebut dapat menghasilkan indeks yang sangat baik, dan rata-rata mendapatkan nilai indeks yang sangat baik.

Abstract. *The development of information technology continues to grow every year and successfully creates new technology, namely the internet. The internet is a public computer system that is globally connected and uses TCP/IIP as a packet-switching communication protocol. Telecommunication companies have access to internet networks, namely Fiber to the home (FTTH). FTTH provides services so that customers can utilize optical telecommunications. So that it will have a larger bandwidth to access the telephone, internet, and cable TV at the same time. In the service that has been done by xyz company, there have been many users who use this service, but there are several factors in the service regarding the slow and poor internet network at certain hours, and it does not answer how the solution to overcoming FTTH services from xyz company in the field of physical network This research was conducted using the Quality of Service (QoS) method to overcome these problems by using four parameters of QoS: throughput, packet loss, delay, and jitter. QoS is the collection of a network to provide data traffic services that pass through it. The results found that the quality of service on 5 SSIDs/xxyz company customers with a speed of 20 MbpsThe results are "Very Satisfactory". The values of Throughput, packet loss, Delay,*

and Jitter on the SSID can produce a very good index, and the average gets a very good index value.

1. INTRODUCTION

The development of information technology continues to grow every year and successfully creates new technology, namely the internet. The Internet is a public computer system that is globally connected and uses TCP/IP as a packet-switching communication protocol [1]. In order for computers to be connected to each other, a medium is needed to connect them. The media used can be optical cables or fibers, satellites, or telephone lines. The internet is very influential in today's digital era, and in this case, it requires internet access with high speed.

Telecommunication companies have access to internet networks, namely Fiber to the home (FTTH). FTTH provides services so that customers can utilize optical telecommunications. So that they will get a larger bandwidth to access the telephone, internet, and cable TV at the same time[2].

In the services that have been carried out by xyz companies, with FTTH services that already have many customers, there are several factors in these services regarding slow and poor internet networks at certain hours, and it does not answer how the solution to overcoming FTTH services from xyz companies in the field of physical networks.

The application of this internet network must have a service standard, namely Quality of Service (QoS). QoS is the collection of a network to provide data traffic services that pass through it. From this, it is necessary to analyze QoS (Quality of Service) to overcome these problems. The parameters of QoS are throughput, packet loss, and delay[3].

Muh Adnan Maulana and Pirdania's research entitled "Analysis of the Quality of Wireless Lan-Based Internet Network Services on Indihome Services" used three parameters in measuring QoS: throughput, packet loss, and delay. Based on these measurements, the index value is obtained with an average of 3.1, or medium category [4].

In Cut defa Putri Yonasda's research entitled "Analysis of Internet network Quality of Service using the Whireshark application at SMKN 1 MESJID RAYA UJOENG BATEE", four parameters were used in measuring QoS: throughput, packet loss, delay, and jitter. In this study, the measurement obtained an index value with an average of 2.92, which is categorized as unsatisfactory due to the lack of bandwidth management or restrictions on the use of social media during learning, which causes connectivity interference in the internet network [5].

Based on the various phenomena above, it can be concluded that Quality of Service (QoS) refers to throughput, packet loss, delay, and jitter. The factors that determine the good and bad of QoS are the speed of internet service packages, the capacity of users connected to the internet network, and the attenuation of the fiber optic network. Therefore, researchers will analyze the quality of an FTTH service internet network from xyz company for a 20 Mbps service package using the Wireshark application.

2. LITERATURE REVIEW

2.1. Internet Network

A computer network is a group of computers that interact with one another and share data and information using universal communication standards. The Internet can also be seen as a large-scale computer network that benefits the government, media, education, and financial industries [6].

2.2. Fiber to the Home (FTTH)

Fiber to the Home (FTTH) is a fiber-based access network that connects a number of subscribers to a central office (POP) known as a node. Each node consists of active devices that are used to provide applications and services over optical fiber to the subscriber [7].

2.3. Wireless Local Area Network

Wireless Local Area Network (WLAN), commonly called WiFi, has a much wider range than WPAN. Currently, WLAN is experiencing many improvements in terms of speed and coverage area. Initially, WLAN was intended for the use of local network devices, but now it is more widely used to access the internet. more widely used to access the internet [8].

2.4. Quality of Service (QoS)

Quality of Service (QoS) is a method of measuring how good a network is and is an attempt to define the characteristics of the network. network and is an attempt to define the characteristics and properties of a service. QoS is used to measure a set of performance attributes that have been specified and associated with a service. The QoS Monitoring Model consists of the components monitoring application, QoS monitoring, monitor, and monitored object. Monitoring applications are an interface for network administrators. This component functions to retrieve data packet traffic information from the monitor, analyze it, and send the results of the analysis to the user [9]. The QoS parameters used in measuring a network are as follows:

1. Throughput
   Throughput is the effective data transfer rate measured in bps. Througput is the total number of successful packet arrivals observed at the destination during a specified time interval divided by the duration of the specified time interval [10].
2. Packet loss
   Packet loss is the percentage of packets lost while transmitting data. data. This is caused by many factors, such as signal degradation in the network media, network hardware errors, radiation from the network media, network hardware errors, or radiation from the surrounding environment [11].
3. Delay (Latency)
   Delay (Latency) is the failure of an IP packet's transmission to reach its destination. The failure of the packet to reach its destination can be caused by several possibilities [12].
4. Jitter
   Jitter is a variation of delay that is caused by variations in Queue length in data processing time. Queuing delays on routers and switches can cause jitter [13]

2.5. Wireshark

Wireshark is a tool used to analyze data packets in a network. a network performance. Wireshark can capture data packets or information that is on the network, so that the captured data can be analyzed for various network problems, including checking network security and personal data [14].

3. RESEARCH METODE

The research method includes research objects, equipment, and research stages. The research objects studied are several homes that use FTTH internet services with a speed of 20 mbps.

During the research process, the author uses supporting equipment such as the Axioo Mybook Pro D1 Laptop for monitoring and storing data, the ONT/modem Huawei, FiberHome, ZTE, and Whireshark Software to measure throughput, packet loss, delay, and jitter parameters. And Microsoft Excel.

The stages in the research with QoS (Quality of Service) parameters carried out by the author are as follows:

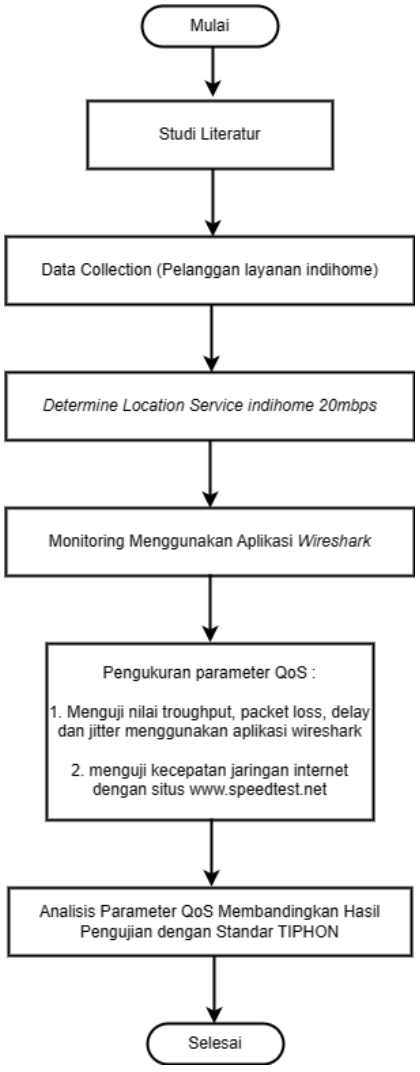

Figure 1. Research Phases

3.1. Study Literlatur

In the early stages of the research, the first thing that will be done is to review several journals regarding the analysis of internet networks in the 4-parameter QoS (Quality of Service) method, namely throughput, packet loss, delay, and jitter. After doing the previous stage, this stage can be used as a reference for the stages of completion used in conducting research.

3.2. Data Collection

This is the stage of collecting customer data that uses internet services on the IndiHome network with a speed of 20 mbps. Data is taken by communicating with the FTTH service ISP from xyz company.

3.3. Determine Location Service

In this stage, researchers observe the location of 20 mbps FTTH service customers, which will be analyzed using Wireshark with the Quality of Service method.

3.4. Monitoring Wireshark

Monitoring can be defined as an activity that is integrated into all stages. In this case, researchers observe packets that appear or are read by wireshark software with a topology that complies with the Telecommunication and Internet Protocol Harmonization Over Network (TIPHON) standard.

3.5. Qos Parameter Measurement

Value of Quality of Service according to network quality standards from TIPHON (Telecommunications and Internet Protocol Harmonization Over Network)[15] described in Table 1.

Table 1. Index Quality of Service

Value	Persentase (%)	index
3,8 – 4	95 – 100	Very Satisfactory
3 – 3,79	75 – 94,75	Satisfactory
2 – 2,99	50 – 74,75	Medium
1 – 1,99	25 – 49,75	Bad

Source : Telecommunication and Internet Protocol Harmonization Over Network (TIPHON)

There are several calculations in the parameters used by researchers.

3.5.1. Throughput calculation technique

In the calculation of Quality of service, the first parameter is Throughput. For the throughput calculation, see Equation 1 [12]:

$$Throughput = \frac{data\ packets\ received}{Time\ span} \quad (1)$$

The smaller the throughput value, the worse the quality. The index or grouping of good and bad network categories based on the throughput value is based on the following table 2:

Table 2. Throughput Category

Throughput Category	Throughput(bps)	index
Very Good	100	4
Good	75	3
Medium	50	2
Bad	<25	1

Source : Telecommunication and Internet Protocol Harmonization Over Network (TIPHON)

3.5.2. Packet loss calculation technique

The packet loss calculation can be seen in Equation 2 [16]:

$$Packetloss = \frac{(Pk-Pt)\times 100\%}{Pk} \quad (2)$$

Description:
Pt = Data packet received
Pk = Data packet sent

The smaller the packet loss value, the better the quality. The categories of good and bad internet network quality when viewed from the packet loss value are classified as shown in Table 3 below:

Table 3. Packetloss Category

Degradasi Category	Packetloss (%)	index
Very Good	0	4
Good	3	3
Medium	15	2
Bad	>25	1

Source : Telecommunication and Internet Protocol Harmonization Over Network (TIPHON)

3.5.3. Delay calculation technique

For the calculation of delay, it cannot be calculated in the statistics that already exist in Wireshark; the data calculation is converted to Excel data and calculated manually. The formula for manual calculation of delay calculations can be seen in Equation 3 [16]:

$$Delay = Tr - Ts \quad (3)$$

Description:
Tr = packet reception time (seconds)
Ts = packet delivery time (seconds)

The average delay calculation will produce units of seconds (s) and convert these units to millisecond (ms) units. The smaller the delay value, the better the quality of the internet network. The quality classification based on the delay value can be seen in Table 4 below:

Table 4. Delay Category

Latency Category	Large delay (ms)	indeks
Very Good	< 150 ms	4
Good	150 – 300 ms	3
Medium	300 – 450 ms	2
Bad	> 450 ms	1

Source : Telecommunication and Internet Protocol Harmonization Over Network (TIPHON)

3.5.4. Jitter calculation technique

To calculate jitter, you can use the following equation 4 [16]:

$$Jitter = \frac{Total\ delay\ variation}{Total\ packages\ received} \quad (4)$$

The smaller the jitter value, the better the network speed and quality. Network classification based on jitter value is presented in Table 5:

Table 5. Jitter Category

Jitter Category	Jitter (ms)	indeks
Very Good	0 ms	4
Good	0 – 75 ms	3
Medium	75 – 125 ms	2
Bad	125 – 225 ms	1

Source : Telecommunication and Internet Protocol Harmonization Over Network (TIPHON)

3.6. TIPHON Standar Test Result

For testing the Telecommunication and Internet Protocol Harmonization Over Network (TIPHON) Standard, there are tables 2 to 4, which explain quality of Service parameters such as TIPHON Standard throughput, packet loss, delay, and jitter.

4. RESULT AND DISCUSSION

4.1. Data Collection

In collecting data that has been obtained through xyz company marketing, several customers are obtained who use FTTH services with a service speed of 20 Mbps. The customer data is in different locations; for the FTTH service, customer data can be seen below:

Table 6. 20 Mbps Customer Data

SSID	Vendor ONT	Lokasi	Kecepatan (Mbps)	Serial Number
Pass tanyammharvi (P1)	FIBER HOME	Maracang	20 Mbps	FHTT9BXXXX
RUANG RIUNG (P2)	ZTE	Simpang	20 Mbps	ZTEGCEXXXX
WIFFI. ID (P3)	HUAWEI	Sadang	20 Mbps	485754XXXX
Terpersona (P4)	HUAWEI	Griya Asri	20 Mbps	485754XXXX
Anouce (P5)	HUAWEI	Jalan Baru	20 Mbps	485754XXXX

4.2. Determine Location Service

Researchers conducted location observations to get wireshark monitoring time, which they obtained three times for further research on wireshark monitoring of service customers contained in the data collection.

Table 7. Timing Data For Monitoring

SSID/ HARI	PAGI	SIANG	MALAM
P1/H1	09.00-11.00 WIB	13.00-15.00 WIB	19.00-21.00 WIB
P2/H2	09.00-11.00 WIB	13.00-15.00 WIB	19.00-21.00 WIB

P3/H3	09.00-11.00 WIB	13.00-15.00 WIB	19.00-21.00 WIB
P4/H5	09.00-11.00 WIB	13.00-15.00 WIB	19.00-21.00 WIB
P5/H6	09.00-11.00 WIB	13.00-15.00 WIB	19.00-21.00 WIB

4.3. Monitoring Wireshart

At this stage, researchers conduct monitoring by requiring 3 different times, and 1 time takes 120 minutes. At this stage, researchers also do browsing and streaming simultaneously to analyze the data packets received by the Quality of Service method, and the monitoring results can help in calculating throughput, packet loss, delay, and jitter parameters.

Table 8. Monitoring Wireshark Packet Data

SSID	***Packet Data***		
	09.00-11.00	13.00-15.00	19.00-21.00
P1	485.362	1.253.341	2.006.294
P2	2.798.614	2.502.849	3.451.471
P3	2.037.841	837.382	489.894
P4	1.000.001	1.163.552	1.106.118
P5	1.088.518	1.842.985	1.566.079

The first wireshark monitoring on SSID P1 was carried out on Day 1 at 09:00–11:00 WIB and while browsing and streaming simultaneously. And the results of the data packets obtained are 485,362 packets.

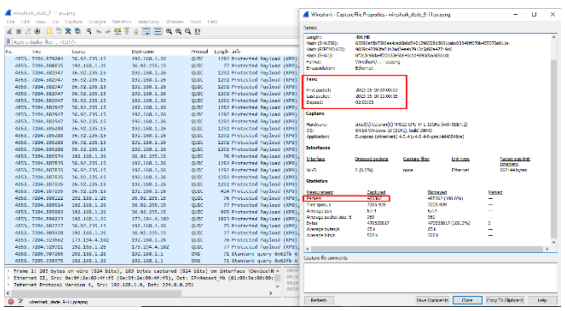

Figure 2. Monitoring Wireshark P1 09.00-11.00 WIB

The second monitoring on SSID P1 was carried out on Day 1 at 13.00–15.00 WIB and while browsing and streaming simultaneously. And the results of the data packets obtained are 1,253,341 packets.

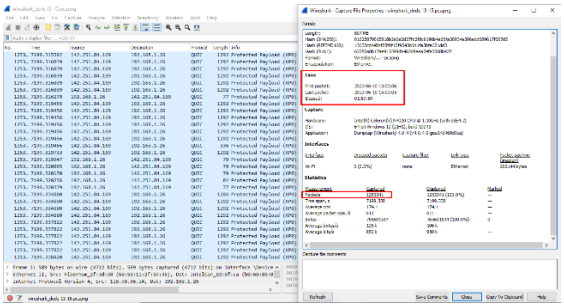

Figure 3. Monitoring Wireshark P1 13.00-15.00 WIB

The third monitoring on SSID P1 was carried out on Day 1 at 19.00–21.00 WIB and while browsing and streaming simultaneously. And the results of the data packets obtained are 2,006,294 packets.

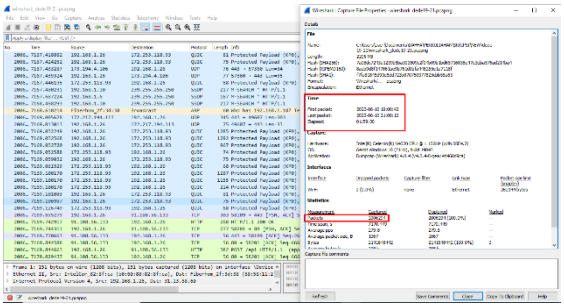

Figure 4. Monitoring Wireshark P1 19.00-21.00 WIB

4.4. Qos Parameter Measurement

After the previous stages of searching for data packets sent and received have been obtained, Quality of Service measurements and parameters can be carried out with technical calculations according to three predetermined times.

4.4.1. Throughput calculation technique

Table 9. Throughput Measurement on 5 SSIDs

SSID	**Throughput**			**Average Throughput**	**Standard TIPHON**	
	09-11	**13-15**	**19-21**		**Index**	**Category**
P1	522	850	2389	1253 bps	4	Very Good
P2	2514	2876	4076	3155 bps	4	Very Good
P3	1855	944	536	1111 bps	4	Very Good

P4	11 39	13 01	12 99	1246 bps	4	Very Good
P5	12 37	17 68	19 52	1652 bps	4	Very Good

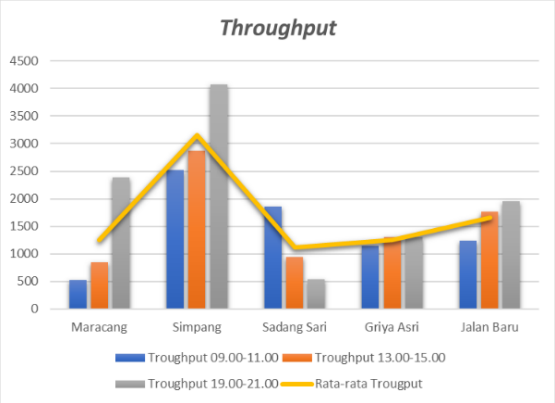

Figure 5. Graph of Throughput Measurement Results

The results of the Throughput value analysis on 5 SSIDs indexed "Very good", with the highest average throughput value on SSID P2 with time at 13.00–15.00 WIB. It can be concluded that P2 produces better data transfer and a higher total number of packet arrivals at 13.00–15.00.

4.4.2. Packet loss calculation technique

Table 10. Packet Loss Measurement Results on SSID

SSID	Packetloss			Averare Packetloss (%)	Standard TIPHON	
	09-11	13-15	19-21		Index	Category
P1	0	0	0	0	4	Very Good
P2	0	0	0	0	4	Very Good
P3	0	0	0	0	4	Very Good
P4	0	0	0	0	4	Very Good
P5	0	0	0	0	4	Very Good

Packetloss measurements on SSIDs P1, P2, P3, P4, and P5 with 3 predetermined times at 09.00–11.00, 13.00–15.00, and 19.00–21.00 WIB, based on the packetloss value with the TIPHON standardization version, got a value of 0% in the "Very Good" category.

4.4.3. Delay calculation technique

In the Delay Measurement of SSID P1, P2, P3, P4, and P5 with 3 predetermined times at 09.00–11.00, 13.00–15.00, and 19.00–21.00 WIB, based on the Delay value with the TIPHON standardization version, get the following results:

Table 11. Delay Measurement Results on SSID

SSID	Delay			Average Delay (ms)	Standard TIPHON	
	09-11	13-15	19-21		Index	Category
P1	5,0	1,6	1,3	2,6 ms	4	Very Good
P2	5,3	4,2	2,2	3,9 ms	4	Very Good
P3	1,0	3,2	1,9	2,0 ms	4	Very Good
P4	4,4	3,2	1,3	2,9 ms	4	Very Good
P5	6,2	8,1	7,2	7,1 ms	4	Very Good

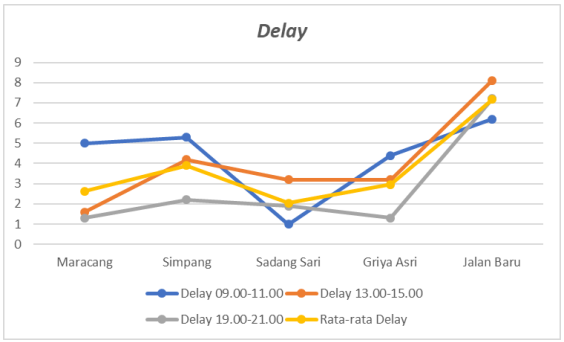

Figure 6. Graph of Delay Measurement Results on TIPHON Standard SSID

From the Delay measurement results on the SSID, determine the largest delay analysis value, namely "SSID P5 at 19.00–21.00 WIB with a value of 7.2 ms" and "Average value of 7.1 ms". With this value, according to TIPHON Standardization, it is included in the "index 4" value and the "Very Good" category.

4.4.4. Jitter calculation technique

Jitter measurements of SSIDs P1, P2, P3, P4, and P5 with 3 predetermined times at 09.00–11.00, 13.00–15.00, and 19.00–21.00 WIB, based on the Jitter value with the TIPHON standardization version, get the following results:

Table 12. Jitter Measurement Results on SSID

SSID	Jitter			Average Jitter (ms)	Standard TIPHON	
	09-11	13-15	19-21		Index	Category
P1	3,4	1,1	1,0	1,8 ms	3	Good
P2	4,5	2,6	1,4	2,8 ms	3	Good
P3	8,8	2,2	1,4	4,1 ms	3	Good
P4	3,9	1,7	5,5	3,7 ms	3	Good
P5	4,3	7,7	5,8	5,9 ms	3	Good

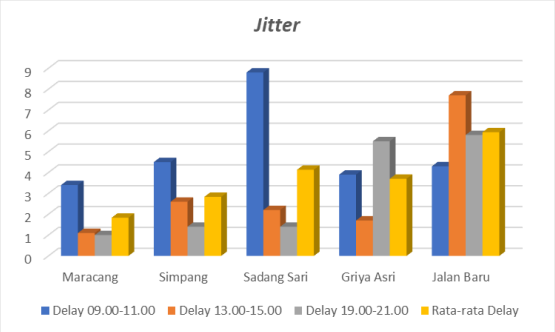

Figure 7. Graph of Jitter Measurement on SSID

From the Jitter measurement results on the SSID, determine the largest Jitter Analysis Value, namely "SSID P3 at 09.00–11.00 WIB with a value of 8.8 ms" and "The largest average jitter is on SSID 5 with a value of 5.9 ms". With this value, according to TIPHON Standardization, it is included in the "index 3" value and the "Good" category.

4.5. TIPHON Standar Test Result

The results of QoS (Quality of Service) Parameter Testing on SSID P1, P2, P3, P4, and P5 with 3 predetermined times at 09.00–11.00, 13.00–15.00, and 19.00–21.00 WIB with the TIPHON standardization version get the following results:

Table 13. Recapitulation of QoS Parameter Calculation

Parameter QoS	Analysis Qos (Quality of Service)				
	P1	P2	P3	P4	P5
Throughput	1253	3155	1111	1246	1652
Packetloss	0	0	0	0	0
Delay	2,6	3,9	2,0	2,9	7,1
Jitter	1,8	2,8	4,1	3,7	5,9
Average	314,35	790,42	279,27	313,15	416,25

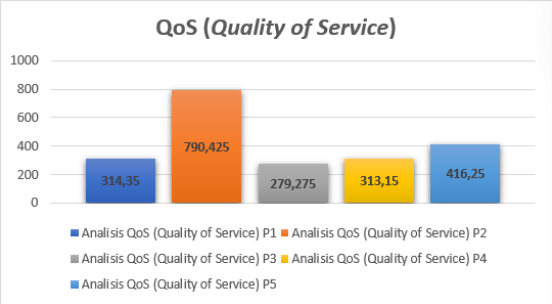

Figure 8. Graph of QoS Value on SSID

In the graph above, the recapitulation of parameter calculations results in the highest average value of QoS, "Average Value of SSID P2 with a Total of 790" and the Index is "Very Satisfactory".

Table 14. QoS Value Index on SSID

Lokasi / SSID	Value *QoS*	Category
Maracang (P1)	314,35	Very Satisfactory
Simpang (P2)	790,42	Very Satisfactory
Sadang Sari (P3)	279,27	Very Satisfactory
Griya Asri (P4)	313,15	Very Satisfactory
Jalan Baru (P5)	416,25	Very Satisfactory
Average	**422,69**	**Very Satisfactory**

The results of the analysis of 5 SSID Internet Service Testing with a speed of 20 Mbps using the Quality of Service (QoS) method in the calculation of Throughput, Packetloss, Delay, and Jitter with TIPHON Standardization can be seen in Table 4.9 that the QoS Value Index is an average of "422.69" and falls into the "Very Satisfactory" category.

5. CONCLUSION

Based on the results of research and discussion of the Analysis of Internet Network

Quality Indihome Services using the Wireshark application with the Quality of Service (QoS) method at 3 predetermined times (9.00-11.00, 13.00-15.00, and 19.00-21.00 WIB), it can be concluded that the Quality of Service on 5 SSID/FFTTH subscribers from xyz company with a speed of 20 Mbps The result is "Very Satisfactory". The values of Throughput, packet loss, Delay, and Jitter on these SSIDs can produce a very good index, and the average gets a very good index value. But please note that there are several throughput values and that the amount of data received is small due to the large number of users connected to the wifi. And that does not affect the Quality of Service (QoS) value, but it will have a big impact when monitoring is not carried out regularly. In the case of this research, we can find out how many users are connected to wifi, or how much traffic there is at certain times and hours. Location and place greatly affect the quality of the internet network due to differences in the ISP's network infrastructure.

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