

Quality of Service (QoS) Analysis using Wireshark on the LAN Network at An Najiyah High School Surabaya

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ABSTRACT

In the realm of information technology, Indonesia has entered the fourth generation, or 4G, which is a fast, widely available internet network that can be used to advance a variety of industries, including the agricultural, social, cultural, economic, and even educational ones. Additionally, from 2020 to the beginning of 2022, you will need to be connected to the internet in order to stay productive during the Covid-19 virus outbreak. This is especially true for the education sector, since online teaching and learning activities are essential for maintaining productivity. An Najiyah Surabaya High School needs reliable internet access in order to provide better support for its online learning students. An Najiyah High School Surabaya employs QOS (Quality of Service) to monitor network quality and data traffic transferred over the network. Three QoS parameters—packet loss, throughput, and delay—will be used in this research's analysis. concentrate on keeping an eye on the local area network (LAN); the value is then retrieved following the network's monitoring. When text data transmission on a LAN network was tested, the results indicated that the network quality at SMA Na Najiyah Surabaya was very good, with values of 2.6 Mbps for throughput, 0% packet loss, and 0% and 0.12 ms delay.

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1. INTRODUCTION

A local computer network, also known as a Local Area Network (LAN), is an essential communication tool in educational institutions because it handles all aspects of school administration and paperless data storage. In order to assess and preserve the network's quality and enable continued use, it is imperative that users of the LAN network keep an eye on the data traffic flowing through the SM AN NAJIYAH Surabaya LAN network. Regular network monitoring will ensure that any issues are quickly resolved and the network is able to operate as intended. This is one method of keeping the network in excellent shape. Additionally, bandwidth control is employed to guarantee adequate bandwidth. sufficient to avoid application competition and fulfill data and information traffic demands (Faisal & Fauzi, 2018).

By reducing jitter and latency, QoS (Quality of Service) technology can be used in computer networks to give users the best possible service. Latency, jitter, packet loss, and throughput are QoS parameters. Nonetheless, the delay, throughput, and packet loss metrics are the main topics of this publication (Siddik, 2019).

By giving particular kinds of network data priority, Quality of Service (QoS) regulates and maintains network resources. The network of an agency must offer scalable and predictable services when applications (including audio, video, and data that is sensitive to delays) move across the network. Based on the measurement results, the QoS value results obtained from the SMA An Najiyah Surabaya network where Packet Loss got the "Very Good" category, it could be

said that there were no packets that failed to be delivered, Delay got the "Very Good" category, it could be said that the time it took for the packet to reach its destination was very fast, and throughput results that match the measurement data.

Quality of Service (QoS), which assigns precedence to specific types of network data, controls and preserves network resources. When apps—such as audio, video, and data that is delay-sensitive—move across an agency's network, it must provide scalable and reliable services. Throughput results that match the measurement data and the QoS value results obtained from the SMA AN NAJIYAH Surabaya network, where Packet Loss got the "Very Good" category, indicating that no packets failed to be delivered, and Delay got the "Very Good" category, indicating that the packets arrived at their destination very quickly, are all based on the measurement results.

One of the programs utilized in this research to monitor data traffic on a network is Wireshark. Three parameters—packet loss, delay, and throughput—are all that are used in this monitoring, and the data collected consists of three types of text: photos, videos, and text.

In Indonesia, schools are currently the main users of the internet, which helps with educational activities in the school. similar to An Najiyah High School in Surabaya, which administers national examinations in the lab. In addition, An Najiyah Surabaya High School serves as a testing facility for students enrolled in online courses.

The purpose of this study is to evaluate internet network service performance. An internet service that is considered good is one that allots bandwidth in an equitable manner. In the context of a Najiyah Surabaya High School, throughput, packet loss, and delay are examples of Quality of Services (QoS) parameters. These parameters are used in the internet network to determine network quality. Therefore, it is intended that this measurement would reveal the state of the internet network's Quality of Service (QoS) in the context of An Najiyah High School Surabaya (Wardhana et al., 2017). The expected benefits from this measurement would also reveal the state needed for the school activities, which administers national examinations in the lab.

Prior to entering university education, SMA (Senior High School) is the highest level of secondary school education. At the upper secondary level, MA (Madrasah Aliyah) and SMK (Vocational High School) are equivalent. The origins of high school can be traced back to Indonesia, specifically to Hogere Burger School, or HBS for short. Only the Dutch elite, chosen Europeans, and natives may enrol in the five-year program at HBS after completing their elementary education at ELS or HIS. After completing their studies at HBS, graduates can continue their education in Dutch universities. There were just four HBS campuses in Indonesia up until 1916: Jakarta, Surabaya, Semarang, and Bandung.

Using Wireshark software, you can measure the parameters of throughput, delay, jitter, and packet loss at access points designated as samples in each building. This application monitors networks such as LANs (local area networks), MANs (metropolitan area networks), and WANs (wide area networks). It also allows you to discover the ports and protocols used in the network and can be used to track down issues that arise in the computer network under observation (Nur et al., 2022). Typically, the snippet includes protocols like TCP, UDP, HTTP, etc. Several results from ACK, REQ, and IP are also displayed here. These results are IPV4 or IPV6, and they can be seen using binary or hexadecimal values. One program that helps with network QOS monitoring is called Wireshark.

Given that a LAN network is restricted to a single local location, such as a single office or school building, it is among the least complex computer network models available. UTP cables, hubs, switches, and routers are frequently seen in LAN networks. Computers in businesses, educational institutions, and internet cafés are examples of this network. Typically, the network in this little space is a LAN network. You can move text files, photos, or videos across a LAN network. You can also share printers and engage in network-wide chat.

Pertains to any technique that controls data flow to lower network jitter, latency, and packet loss. By giving particular kinds of data on the network priority, QoS regulates and maintains network resources. In addition, QOS performs the duties of a network system analyzer (Sari, 2022). Enterprise networks must offer scalable and reliable services to support applications that move over the network, including phone, video, and data that is sensitive to delays. Businesses utilize QoS to avoid quality degradation brought on by packet loss, delays, and jitter, as well as to fulfill the traffic demands of sensitive applications like real-time speech and video. By utilizing specific tools and methods, such traffic shaping and jitter buffers, organizations can achieve QoS.

In order to ensure a specific degree of performance, many enterprises incorporate quality of service (QoS) in their service-level agreement (SLA) with the network service provider.

The effective data transfer rate, or throughput, is expressed in bps (bits per second). Throughput is calculated by dividing the total number of packets that arrive at a destination successfully over a certain period of time by the length of that period. The term "throughput" describes the volume of data that may be moved in a predetermined length of time between two locations. It is used to monitor network and internet connections, as well as the performance of hard drives and RAM.

A hard drive with a 100 Mbps maximum transfer rate, for instance, may transport data twice as fast as a drive with a 50 Mbps maximum transfer rate. Similarly, the throughput of a 54 Mbps wireless connection is approximately five times that of an 11 Mbps connection. However, other elements like the speed of the internet connection and other network traffic may limit the actual data transmission speed. It's important to keep in mind that a device or network's maximum throughput could be far higher than the actual throughput that's attained in regular operation.

The amount of time that data needs to travel from its origin to its destination is known as latency. Long processing times, physical media, congestion, and distance can all affect delays. The inability of an IP packet transmission to reach its intended recipient is known as packet loss. Numerous factors may contribute to a packet's inability to arrive at its intended destination. The Wireshark program was utilized in this investigation to track packet loss (Budiman et al., 2020).

2. RESEARCH METHOD

There are a few procedures that need to be prepared for the study approach, starting with understanding the Najiyah School in Surabaya's network architecture and the apps that will be used to monitor network traffic on the school's local area network (LAN). Clear monitoring of QOS parameters is possible with the Wireshark application. In the meantime, a PC or computer linked to a local area network (LAN) that hosts the Wireshark program and additional components acting as clients in the network serves as the research instrument (Tuli, 2023). The following flow diagram illustrates the research flow process:



Figure 1. Research flowchart

An Najiyah Surabaya High School's network architecture uses a BUS topology from the laboratory, teachers', library, and administration rooms, which is connected to the connecting center / Mikrotik Router CRS, and a star topology from each LAB room, which is connected to a central switch/hub terminal. The Mikrotik Router CRS, CAT6 ethernet cable, fiber optic cable, switch/hub, server, and computer are the components that make up the network architecture. Every laboratory is linked to the network so that information can be shared throughout them. The Najiyah High School's LAN network is connected not only to the laboratory but also to other areas including the principal's office, library, and teacher's room (Najiyah et al., 2023).

Every client and server computer must first be configured before the LAN network topology can be designed. The LAN computer network can be utilized for communication once the configuration is finished. An Najiyah High School Surabaya's internet network topology connecting labs is a star topology (Mustofa et al., 2023), as seen in the graphic below:

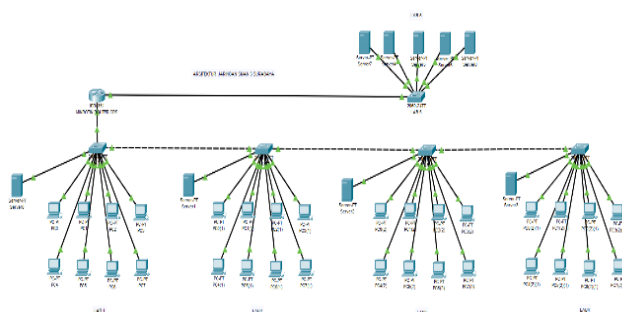


Figure 2. An Najiyah High School Surabaya LAN network architecture

The method used to collect data for this study is QoS measurement. In this presentation, a number of apps are utilized, including Wireshark, which measures packet loss, throughput, and internet network delay. The basic procedure is to establish a connection to the network to be measured, launch multiple programs, and begin collecting data. The Wireshark program was utilized in this study to calculate packet loss (Hendrawan1 et al., 2022). The basic procedure is to first establish a connection to the network that will be measured, then launch the Wireshark application, choose the network to monitor, and begin collecting data by uploading files to Google Drive. Subsequently, begin measuring the network and displaying the results, looking for packet loss or applying a TCP filter. segmentation. lost analysis.

Tabel 1. Packet loss category

Packet Loss Category	Packet Loss (%)	Indeks
Very Good	0	4
Good	3	3
Average	15	2
Bad	25	1

The following equation is used to calculate the Packet Loss value:

$$Packet\ Loss = \frac{y}{A} \times 100\%$$

Where:

y = Data packet send – data packet receive

A = Data packet send

In this study, delay was measured using Microsoft Excel and the Wireshark program. The basic procedure is to first establish a connection to the network that needs to be measured, then launch the Wireshark application, choose the network that needs to be measured, and begin collecting data by uploading files to Google Drive (Lackner et al., 2022). The collected results are then processed in Microsoft Excel.

Tabel 2. Delay category

Delay Category	Delay Time (ms)	Indeks
Very Good	< 150	4
Good	150 – 300	3
Average	300 – 450	2
Bad	> 450	1

By dividing the entire delay by the number of packets received, one may find the latency. The equation is used to calculate the Delay value:

$$\text{Delay Average} = \frac{\text{Total Delay}}{\text{Packet Receive}}$$

The Wireshark program was utilized in this study to gauge throughput. The method involves connecting to the network to be measured first, opening Wireshark, selecting the network, and capturing data by uploading files to Google Drive (Liu et al., 2023). Once the data is captured, measurements are taken based on the average bits or throughput. Throughput is displayed in the table below:

Tabel 3. Throughput category

Throughput Category	Throughput	Indeks
Very Good	> 2,1 Mbps	4
Good	700 – 1200 kbps	3
Average	338 – 700 kbps	2
Bad	0 – 338 kbps	1

To measure the Throughput value, the equation is used:

$$\text{Throughput} = \frac{\text{Data Packet Recieve}}{\text{Length of observation}}$$

3. RESULTS AND DISCUSSIONS

For the Packet Loss category in Table 5, the packet loss measurement is based on the packet loss value as specified by the TIPHON (Aryandi et al., 2023; Rofi Assilmi et al., 2023) version as standardized. In Table 5, the result suggest that all of the result, from the picture data, the video data and the text data get an average index and drop on very good category.

Tabel 4. Results of packet loss measurement

Data	Packet Loss Average	Average	
		Index	Category
5 Picture Data	0%	4	Very Good
5 Video Data	0%	4	Very Good
5 Text Data	0%	4	Very Good

For the TIPHON category in Tables 5, 6, and 7, the throughput measurement is based on the throughput value according to the TIPHON version as standardized. All of the result received from the measurement of throughput outcomes, from the 5 text data, 5 video data and 5 text data have given an acceptable result.

Tabel 5. Measurement of throughput outcomes utilizing written data

Data	Throughput (bps)
Text 1	145477
Text 2	432838
Text 3	281904
Text 4	148680
Text 5	12111488

Tabel 6. Measurement of throughput findings using picture data

Data	Throughput (bps)
Picture 1	1254138
Picture 2	102450
Picture 3	253229
Picture 4	239943
Picture 5	1838455

Tabel 7. Measurement of throughput findings utilizing video data

Data	Throughput (bps)
Video 1	8903918
Video 2	7108736
Video 3	9227599
Video 4	17595288
Video 5	22295007

For the delay category in Table 8, the delay measurement (Alnur et al., 2023) is based on the delay value according to the THIPON version as standardized. In the last table, the result suggest that all of the result, from the picture data, the video data and the text data get an average delay measurement index and drop on very good category.

Tabel 8. Delay measurement results

Data	Delay Average (ms)	Average	
		Index	Category
Text 1	25,077	4	Very Good
Text 2	13,372	4	Very Good
Text 3	19,272	4	Very Good
Text 4	26,975	4	Very Good
Text 5	0,752	4	Very Good
Picture 1	6,169	4	Very Good
Picture 2	40,39	4	Very Good
Picture 3	21,568	4	Very Good
Picture 4	20,652	4	Very Good
Picture 5	4,506	4	Very Good
Video 1	0,803	4	Very Good
Video 2	1,009	4	Very Good
Video 3	0,78	4	Very Good
Video 4	0,41	4	Very Good
Video 5	0,33	4	Very Good

4. CONCLUSION

The following conclusions can be made based on the outcomes of the Quality of Service (QoS) analysis conducted on the internet network at SMA An Najiyah Surabaya. The first finding is that based on the THIPON table and the excellent throughput monitoring findings, it can be said that data communication traffic on the Najiyah High School network is at a very good level and can function properly. The second finding is that based on the THIPON table, which shows excellent delay monitoring findings, it can be said that data communication traffic on the Najiyah High School network is at a very good level and can function well.

While based on the THIPON table, the packet loss monitoring findings are excellent or at a value of 0%, indicating that data communication traffic on the Najiyah High School network is at a very good level and can function properly. The aforementioned table indicates that when delivering video, the throughput, latency, and packet loss metrics have higher values than when sending text and image data.

With subsequent releases, the throughput, latency, and packet loss can all be individually changed to better the data. The upload plays a crucial role in the implementation of industrial applications, like cyber-physical systems that use the 5G network to send data to an edge cloud. To configure and test the upload of deterministic data packets within a tight cycling time, more research is therefore required. The measurements ought to be expanded to include mMTC and NLOS communication cases as well. Based on these findings, additional study is presently being

done to create a framework that assesses the viability of 5G-enabled industrial applications in private networks while taking into account the variables that affect the wireless 5G in industry.

Several research directions can be pursued in light of these findings in order to enhance network performance depending on the assessed parameters. Although the delay has extremely good values, there is still room for improvement, particularly in the packet loss and throughput sectors. The following are some suggested enhancements to think about: The user experience and network quality may suffer from high packet loss. Use of more dependable and effective communication protocols, appropriate buffer settings on network devices to prevent overflow, and physical examination and repair of loose or damaged network cables are among actions that can be performed to limit packet loss. Low throughput might impede the network's ability to transfer data quickly. Choosing more potent network hardware that is suitable for the network load, choosing a data compression technology to minimize the amount of data transferred, and fine-tuning the network setup to prevent bottlenecks are some methods to boost throughput.

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