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Starlink Network Technology Analysis Using Quality of Service Analysis Method (Case Study: Karya Jaya Village, Kertapati)

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ABSTRACT

This study focuses on analyzing the quality of service (QoS) and measuring the quality of the internet network on the Starlink network In Karya Jaya Village, this study uses the QoS parameter measurement method. The parameters used include *delay, jitter, packet loss*, and *throughput*. This measurement is done using the Wireshark application to monitor and capture the traffic of data packets in the network. This application provides detailed information about network performance and can identify potential problems in the data transmission process. The throughput measurement results showed that *the throughput* was higher during sunny weather, with a value of 74k, compared to the rainy weather time which only reached 158k. Despite the difference in *throughput* values, the two values still showed **"Excellent" performance**. *Throughput* is one of the main indicators that shows efficient network performance. These findings offer a unique contribution by providing real-world case-based analysis relevant to the needs of modern networks.

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1. Introduction

In the digital era, the internet has become a basic need for people in various sectors of life. The availability of a reliable, fast, and stable internet network is an important element to support various activities, such as online education, technology-based health services, digital economy transactions, and e-government-based government services. However, not all regions in Indonesia can enjoy adequate internet access, especially in remote areas or areas that have not been reached by cable or fiber optic network infrastructure [1].

Fast and reliable internet access has become a basic need for people around the world, including in Indonesia. However, as the world's largest archipelagic country with more than 17,000 islands, Indonesia still needs help to provide an even internet infrastructure. The digital divide between urban and rural areas is still quite significant, with many marginalized areas still needing an internet experience comparable to urban broadband services [2].

Starlink, a satellite-based internet service developed by SpaceX, emerged as a potential solution to the challenge. By utilizing a constellation of thousands of satellites orbiting at low altitudes, Starlink is designed to provide high-speed, low-latency internet, even in remote areas [3]. The presence of Starlink, an ambitious project of Elon Musk's Spacex company, offers new hope by providing high-speed internet access

to the entire world through a constellation of satellites in low orbit (LEO). With more than 5,000 satellites to be launched, Starlink has the potential to change the landscape of Internet connectivity in Indonesia [4].

Director General of Public Communication Information (IKP) of the Ministry of Communication and Information Technology (Kemkominfo). Usman Kansong, argued that starlink internet services are needed because inter-network internet services from the government still do not reach most people. The results of the 2024 Internet Penetration survey from the Indonesian Internet Service Providers Association (APJII) stated that Indonesia's internet penetration rate was only 79.5 percent, up from the previous year which was 78.19 percent. This means that around 20 percent of the Indonesian population still needs assistance to be able to enjoy internet services [5].

Starlink offers innovative solutions to Indonesia's most pressing development challenges, which is to bridge the digital divide between regions, especially in remote and outermost islands, With its ability to provide high-speed internet in the most remote areas, Starlink's technology can improve performance in the fields of Education, Health, and Regional Economic Empowerment. In a large archipelagic country like Indonesia, where the development of conventional infrastructure is very expensive and complicated, satellite internet can be the most effective alternative to bring connectivity to the Indonesian people [6]. Karya Jaya Village, located in Kertapati District, is one of the areas that faces challenges in accessing the internet with good quality. The network infrastructure in this region is still relatively limited, so many people have difficulty getting a stable internet connection. This has implications for the slow adoption of digital technology in the area, which has an impact on various aspects of people's lives, such as limited access to online education or digital economy opportunities. Although this technology offers great potential, further analysis is needed to assess the performance of the Starlink network in specific contexts, such as in Karya Jaya Village[7].

This research focuses on the analysis of the quality of service (Quality of Service / QoS) of the Starlink network in Karya Jaya Village. By evaluating QoS parameters, such as delay, jitter, throughput, and packet loss, this study aims to provide an overview of the performance of the Starlink network in the region and provide recommendations for optimizing its implementation.

2. Research Methods

This study uses a quantitative descriptive approach, where the data obtained will be analyzed to describe the performance of the Starlink network in Karya Jaya Village based on Quality of Service (QoS) parameters. This research aims to provide an objective picture of the performance of the Starlink network through quantitative measurement of QoS parameters, such as delay, jitter, throughput, and packet loss [8]. The data collected will be used to analyze whether the Starlink network can meet the quality of service standards required by the communities in the region[9].

The quantitative descriptive approach was chosen because this study aims to measure and explain certain aspects of tissue performance without conducting manipulation or experiments that are experimental. The data generated will describe the real situation regarding the performance of Starlink's internet services.

2.1 Research Time and Place

Implementation time for the Pre-Final Project project, implementation time for 1 day. The location of this research was conducted in Karya Jaya Village, Kertapati District, which is located in the city of Palembang, South Sumatra. This village was chosen as the research location because it is a fairly remote area with limited telecommunication infrastructure that makes it difficult for people to access the internet with good quality.

Figure 1. Research Place

2.2 Data collection techniques

After the data was collected, the analysis was carried out using calculation and evaluation methods from various QoS parameters to assess the performance of the Starlink network in Karya Jaya Village. The data analysis methods used are as follows:

a. Delay Measurement (Latency)

The delays recorded on the measurement will be analyzed to see how far the network response time is acceptable. Compared to the latency standard recommended by the ITU (International Telecommunication Union) for satellite internet services, the results of this measurement will provide an idea of whether the Starlink network in Karya Jaya Village has a latency that can support the use of real-time applications such as video calls and online gaming.

b. Jitter Measurement

Jitter is calculated by measuring the fluctuations in the delay that occur during the test. Jitter that is too high will cause instability in the connection and can affect the sound and image quality in applications that require a stable connection. The jitter standard for video conferencing and voice phone applications should usually not exceed 30 ms.

c. Throughput Measurement

The download and upload speed of the data recorded during the test will be compared to the speed expected by the user. If the throughput is low, it indicates that the network is not able to provide optimal internet speed for users in Karya Jaya Village.

d. Packet Loss Measurement

Packet loss will be calculated to measure the percentage of packets lost during delivery. The lower the packet loss value, the more stable and reliable the quality of the network. The use of the standard threshold from ITU will be used to evaluate whether the value of the packeteit loss on the Starlink network in Karya Jaya Village meets the desired minimum standard. The application used in this data collection is the WideShark Veirsi 4.4.3 application which detects and measures Qos parameters to accurately assess.

3. Results and Discussion

The test was carried out by the author by streaming Youtube for approximately 5 minutes. Figure 2. is the result of data collection when the weather is sunny and Figure 3 is for the collection of rainy weather data using Wireshark software.

Figure 2. Data Capture in Sunny Weather

Figure 3. Data Collection During Rainy Weather

Figure 4. is a collection of data results when the weather is sunny and Figure 4.4 is for the collection of rainy weather data results using Notepad software as a record.

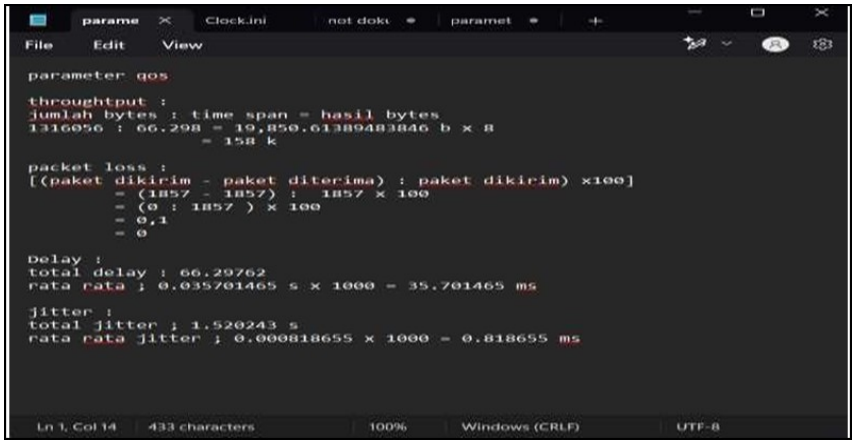

Figure 4. Rainy Weather Data Results.

Table 1. Recapitulation of Karya Jaya QOS Parameters

Measurement	Packet Loss	Delay (ms)	Jiiter	Throughput
Bright	0%	31,8	0,0	74
Rain	0%	35,7	0,0	158

1. **Throughput**

The results of the throughput measurement for each time and based on the throughput value are in accordance with the TIPHON version as a standardization, namely the average throughput index during the weather on a sunny day and when the weather is rainy.

Table 2. Throughput Parameter Measurement

Yes	Weather	Average Throughput	Index	Category
1.	Bright	74k	4	Very Good
2.	Rain	158k	4	Very Good

2. **Packet loss**

The results of the Packet Loss measurement for each time and based on the packet loss value on the Starlink Server network in Karya Jaya Village are in accordance with the TIPHON version as a standardization of the average Packet Loss index during the weather on sunny days and when the weather is rainy.

Table 3. Measurement of Packet Loss Parameters

Yes	Weather	Rata – Rata Packet Loss	Index	Category
1.	Bright	0%	4	Very Good
2.	Rain	0%	4	Very Good

3. **Delay**

The results of the Delay Measurement for each time the building has a Delay according to the THIPON version as a standardization of QoS parameters, namely the average Delay index at the time of the weather on a sunny day and when the weather is rainy.

Table 4. Measurement of Delay Parameters

Yes	Weather	Average Delay	Index	Category
1.	Bright	31	4	Very Good
2.	Rain	35	4	Very Good

4. Jitter

The results of the jitter measurement for each time have a jitter value according to the THIPON version as a standardization of QoS parameters, namely the average jitter index during the weather during sunny days and when the weather is rainy.

Table 5. Jitter Parametter Measurement

Yes	Weather	Rata – Rata – Rata jitter	Index	Category
1.	Bright	0,1	4	Very Good
2.	rain	0,8	4	Very Good

5. QoS (Quality Of Service*)* Value Recapitulation

The results of the QoS measurement recapitulation can be seen in the QoS parameter calculation table

Table 6. QoS Parameter Measurement

Yes	QoS Parameters	Bright	Rain
1.	*Packet Loss*	0	0
2.	*Delay*	31	35
3.	*Jitter*	0,1	0,8
4.	*Troughput*	74k	158k

3.1 Overview of Karya Jaya Village

Karya Jaya Village, located in Kertapati District, is an area that has significant balancing potential, especially in the economy, education, and community service sectors. However, one of the main challenges faced by people in this region is the limited access to reliable and good quality internet. Part of the beisar area of Keilurahan Karya Jaya is still dependent on seiluleir networks and conventional cables. How many areas experience limited signals, especially located further from the city center or in areas with geographic barriers. This problem has an impact on the rebeautification of community access to digiital services, teirentry peindiidiikan dariing, keiruang keirja onliinei, and keiciil business beirbasiis diiital.

3.2 Discussion

a. Packet Loss

The results of *packet loss* measurement at both times showed excellent values, namely 0% in sunny weather and 0% in rainy weather. According to the TIFON standard, if the average packet loss is in the range of 0%, then the network can be categorized in the "Very Good" category. This shows that Starlink's network technology has excellent performance in terms of *packet loss*, which is important to ensure stable data communication.

b. Delay

The results of *the delay* measurement showed a very low value, namely 31 ms during sunny weather and 35 ms during rainy weather. Both of these values are in the "Very Good" category according to the TIPHON standard, which states that a delay lower than 150 ms is still in the acceptable category. This shows that Starlink's network technology has excellent performance in terms of latency and response time.

c. Jitter

The jitter measurement results showed a slightly higher fluctuation in sunny weather, with a value of 0.1 ms, while during the day the jitter value was only 0.8 ms. Despite the increase in *jitter* in rainy weather, both times were still in the "Excellent" category. Low *jitter* is an important factor to ensure the quality of data communication, especially for applications that require low latency, such as VoIP and streaming video.

d. Throughput

The throughput measurement results showed that the throughput was higher at sunny weather, with a value of 74k, compared to when the rainy season reached only 158k. Despite the difference in throughput values, both values still show "Excellent" throughput performance in the afternoon indicating that the network has enough capacity to handle larger amounts of data, which is important for supporting applications that require high badwidth.

4. Conclusion

From the results of the QoS (*Quality of Service*) analysis carried out on the Starlink network in Karya Jaya Village, some conclusions that can be drawn are as follows:

a. Network Quality Measurement Method

To measure the quality of the internet network on the Starlink network in Karya Jaya Village, this study uses the QoS parameter measurement method. The parameters used include delay, jitter, packet loss, and throughput. This measurement is done using the Wireshark application to monitor and capture the traffic of data packets in the network. This application provides detailed information about network performance and can identify potential problems in the data transmission process.

b. Difference in Data Transmission Time (Delay)

Based on the measurement results, there is a difference in the data transmission time received between data packets sent to the router (delay) during working time in sunny and rainy weather. On a sunny day, the delay value is recorded at 31 ms, which falls into the category of "Very Good." Meanwhile, in rainy weather, the delay value is slightly higher, which is 35 ms, but still falls into the same category, "Very Good." This shows that despite the slight differences, the two times show excellent performance, with low latency and supporting smooth data communication on the network.

c. Packet Loss

The measurement results showed that during the data transmission process, no packages were lost on the starlink network of Karya Jaya Village, both during working hours in sunny and rainy weather. At both times, the *packet loss* value was recorded at 0%, which is in the category of "Very Good." This shows that the network has very stable performance in terms of data transmission and can avoid packet loss that can disrupt the smooth communication

d. Throughput

Although the throughput *measurement results* show that *the throughput* is higher in rain (158k) compared to sunny weather (74k), both values are still in the excellent category. *The high throughput* on rainy days shows that the Starlink Technology network of Karya Jaya Village is able to handle larger amounts of data and supports applications that require high *bandwidth* without sacrificing connection quality. Therefore, *throughput* is one of the main indicators that indicates efficient network performance.

Based on the results of the research that has been carried out, some suggestions that can be submitted for the continuation of the research and development of the Starlink network in Karya Jaya sub-district are as follows:

a. Infrastructure improvement and satellite network management

To reduce high latency values and slightly annoying jitters, it is recommended that the service provider, in this case Starlink, conduct an evaluation of the position and management of satellites in the region. Adding a ground station or increasing the number of satellites in the constellation can help reduce latency and jitteir, as well as improve the overall stability of the connection.

b. Network quality improvement and development

In order to maintain high throughput and low packet loss despite the increase in the number of users, Starlink conducts regular maintenance and capacity development. This capacity increase will ensure that all users in Karya Jaya Village can enjoy stable and fast service quality and are comfortable in using this technology.

c. Regular QoS Monitoring

In addition to system maintenance, regular QoS monitoring using tools such as Wireshark or other network monitoring systems is highly recommended. This monitoring aims to identify any previously undetected performance degradation and to anticipate network issues before they have a greater impact. With regular monitoring, Starlink can immediately make improvements or optimizations to network parameters that do not meet the standards that have been set.

d. Advanced Research

Further research can be done by balancing case studies in various other locations with different geographical and demographic conditions. This will provide a broader picture of the performance of the Starlink

network in various remote areas and provide a more holistic overview of the future use of this satellite technology.

e. Long-Term Planning for Network Improvement

Starlink also needs to plan for long-term network development and upgrades that refer to future needs. As technology evolves and the number of connected users and devices increases, network capacity and quality need to be adjusted to continue to support operations efficiently.

f. Hope For Improved Starlink network technology

With the development of Starlink technology and the increasing number of satellites being launched into low orbit, it is hoped that the quality of internet services through Starlink can further improve. In the future, with the improvement of network quality, it is hoped that Starlink can have a greater effect.

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