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COMPARATIVE ANALYSIS OF QUALITY OF SERVICE PERFORMANCE OF VIDEO STREAMING SERVICES USING OSPF AND EIGRP NETWORKS

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Abstract

In the current digital era, video streaming services are increasingly popular and have become one of the most widely used services by the public. The quality of video streaming services is the key to providing a good user experience. However, unstable networks and suboptimal Quality of Service (QoS) can affect the quality of video streaming services, resulting in buffering or poor picture quality. To overcome these problems, reliable networks and optimal QoS settings are needed. OSPF and EIGRP are routing protocols used in computer networks to optimize the user experience when using video streaming services. The aim of this study is to compare the QoS performance of video streaming services on OSPF and EIGRP networks with measured parameters including delay, jitter, packet loss, and throughput. Additionally, this study aims to determine which routing protocol is better at supporting video streaming services with good quality. The final result of the study is a comparison of the QoS performance of OSPF and EIGRP networks. Overall, the OSPF network has better performance compared to the EIGRP network, with a difference in performance values of 13.3%.

Keywords: *OSPF, EIGRP, Video Streaming, QoS, Routing protocol*

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1. INTRODUCTION

In the current digital era, video streaming services are becoming increasingly popular and are one of the most widely used services by the public. The quality of video streaming services is key to providing a good user experience. However, unstable networks and suboptimal Quality of Service (QoS) can affect the quality of video streaming services, resulting in buffering or poor picture quality. To overcome these problems, a reliable network and optimal QoS settings are required.

OSPF and EIGRP are routing protocols used in computer networks to optimize the user experience when using video streaming services. The aim of this research is to compare the QoS performance of video streaming services on OSPF and EIGRP networks with measured parameters including delay, jitter, packet loss, and throughput. In addition, this research also aims to determine which routing protocol is better at supporting video streaming services with good quality, there are two types of routing commonly used, namely static routing and dynamic routing.

Static routing involves a network configuration where the routes are predetermined, making it a fixed network. This type of routing is preferred for its quick and dependable service, and it does not rely on complex algorithms or mechanisms. Network administrators manually configure static routers, and it is not possible to add or remove nodes after the network has been established. Static routing is generally utilized in small networks where routing demands are minimal[1].

Dynamic routing is a network configuration where routers update their routing tables dynamically in response to changes occurring within the network or in remote networks. As a result, network administrators do not need to make any reconfigurations manually. The use of dynamic routing allows for easy management of the routing process in complex and large-scale networks[2].

To realize an ideal long-distance communication system, a routing protocol is needed to manage the data flow and path selection on the network[3]. Therefore, it is crucial to choose the appropriate routing protocol to strengthen traffic management. There are several types of routing protocols commonly used, but the OSPF and EIGRP routing protocols are the most widely used today[4].

When doing real-time streaming, buffering and delay often occur, and this can also result in suboptimal streaming quality, which can affect the Quality of Service (QoS) of a streaming service, including packet loss, delay, throughput, and jitter. Quality of Service can be defined as a measure of how well a network performs, and an effort to determine the characteristics of a network[5].

In a previous research on Quality of Service (QoS), Unung Verawardina stated that network administrators must be aware of the performance comparison of a routing in order to design and create a good and high-quality network service system in accordance with Quality of Service (QoS) standards, which include delay, packet loss, and throughput [6]. In a study (Thesman, Noertjahyana, and Lim, 2017), it was explained that the research shows that the delay and throughput values of OSPF are better by 2–15% compared to EIGRP under conditions where the connection is not down, while when the connection is down, EIGRP is better by 45–52% for delay and 38–48% for throughput.

The rapid development of the internet network has made information service systems faster, so research focusing on video conferencing aims to ensure smooth running without disruption and can be implemented using a system where the video conference bandwidth is prioritized for accessing video streaming data. The goal of bandwidth management is to reduce network congestion and prioritize important data packets to ensure the smooth running of video conferencing, as described in[7] research.

There are several measurement parameters for Quality of Service (QoS) in a network. The standard for QoS parameters is THIPON (Telecommunication and World Protocol Harmonization Over Network)[8]. Here is an explanation of the QoS Index in Table 1.

Table 1. Quality of Service Index

Index	Percentage	Mark
Weak	25 – 49.75 %	1 – 1.99
Currently	50 – 74.75 %	2 – 2.99
Good	75 – 94.75 %	3 – 3.79
Very good	95 – 100 %	3.8 - 4

The percentage results in Table 1 are used to determine the quality of a network. The QoS index is based on the average value of parameters such as throughput, jitter, packet loss, and delay. Throughput is the speed of a network in the process of data transfer, measured in kbps, by observing the amount of data that will be sent until the data is received by the client[9]. Jitter is a type of packet arrival delay variation in a network. The magnitude of jitter is greatly influenced by the variation in traffic weight and the magnitude of packet collisions (congestion) that exist in a network[10]. Delay is the time required for a data packet to travel from the transmitter to the receiver. Packet loss is the percentage of data packets lost during data transmission, which can also be caused by data collisions in a network[11].

2. RESEARCH METHOD

Quality of Service (QoS) is the ability of a network to provide good service by providing bandwidth and overcoming jitter and delay. QoS is heavily determined by the quality of the network being used. QoS is designed to help end users (clients) become more productive by ensuring that they receive reliable performance from network-based applications. QoS refers to a network's ability to provide better service for certain network traffic through various technologies[12].

OSPF is an interior gateway protocol (IGP) used in IP networks that is based on the Shortest Path First (SPF) algorithm. It collects link state information from routers to construct a topology map of the network and determines the best route for delivering packets within an autonomous system. This makes OSPF one of the most widely used IGPs in large enterprise networks. By analyzing the topology of the network, OSPF generates a routing table that is used by the Internet Layer to make routing decisions based on the destination IP address found in IP packets[13].

EIGRP is a Cisco routing protocol that uses the Diffusing Update Algorithm (DUAL) for route calculation. It combines features of distance vector and link state protocols, and its metrics are based on reliability, MTU, delay, load, and bandwidth. The basic parameters used for metric calculation are delay and bandwidth[14]. Graphical Network Simulator (GNS3) is a network emulator for Cisco devices that can simulate even complex networks. The latest technology of GNS3 provides a platform to design protocols and technologies, as well as test and demonstrate them with realistic scenarios before production[15].

Wireshark is a network analysis and troubleshooting tool that offers a broad range of protocol support. It is available in both command-line and graphical user interface formats. This tool offers a detailed analysis of network activities and is widely utilized across various sectors, such as educational institutions, commercial enterprises, and non-profit organizations[16]. In the research on the analysis of quality of service for video streaming services using OSPF and EIGRP networks to obtain maximum results, there are several stages of the process that must be passed using the research stages developed by Cisco, as follows:

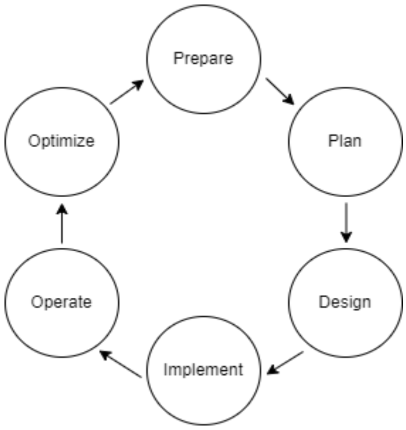

Figure 1. Research Stages

The prepare stage is the initial stage of conducting research and involves identifying the problem and preparing everything needed for the study. In this stage, the problem related to the research topic is identified.

The plan stage is the stage to determine the needed requirements and collect reference data for the literature study needed for the research to achieve its objective. In this stage, research planning is done to not exceed the limits of the research topic.

The design stage is the stage of creating a network topology according to the research needs to meet the research objective. In this stage, a topology is created that meets the specifications and needs of the research.

The implementation stage is the stage where everything needed and collected for the research is processed and executed with GNS3 software. In this stage, if everything needed for the research is already fulfilled, it is directly implemented and processed into GNS3.

Operate stage in this stage, testing is done on each network, namely OSPF and EIGRP networks. Quality of Service testing on video streaming is also carried out using OSPF and EIGRP networks, and data is captured using the Wireshark application. Finally,

Optimize stage is the last stage, after testing and data collection are complete and the results have been obtained. Next, data analysis and evaluation are carried out on the quality of service data obtained from the testing, and conclusions are drawn from the data. Furthermore, system design and development are carried out after the system requirements analysis produces a definite conclusion, so that the system design and development process can run smoothly. The system design process begins with the creation of a network topology based on the requirements.After the topology is completed, it is then implemented into GNS3.

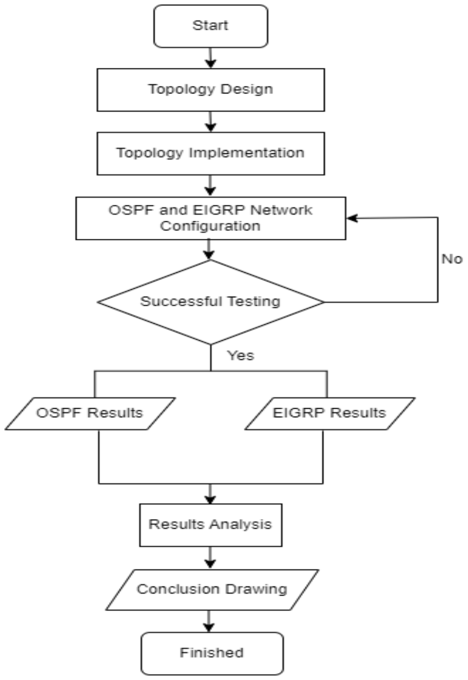

Figure 2. Research Flowchart

As shown in Figure 2, after the topology is implemented in GNS3, configuration is performed on each network, namely OSPF and EIGRP. The next step after configuration is to perform testing and data collection for video streaming services with parameters such as throughput, jitter, delay, and packet loss on each network. After obtaining the test results, analysis and conclusions are drawn.

Next, the network topology is designed according to the requirements, taking into account the available specifications to avoid exceeding the capacity of the existing specifications. In the next step, the topology shown in Figure 3 is implemented in GNS3 and will become the OSPF and EIGRP networks, and the client and server will be installed with the Windows 7 operating system to access the video streaming service. Here is the network topology that will be used:

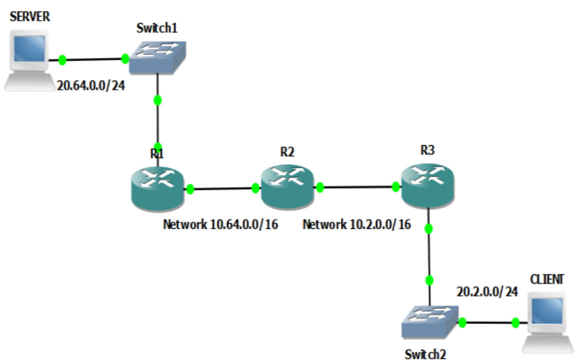

Figure 3. Network Topology

The working principle of OSPF is that when the client accesses the video streaming service from the server, each router (R1, R2, and R3) that has been configured with OSPF and is interconnected with routing will synchronize its databases. Then, each router will store the link state database, which will be used to determine the fastest and shortest path to the final destination of the labeled data packet, which is router R3. The working principle of EIGRP is that when the client accesses the video streaming service from the server, each router (R1, R2, and R3) that has been configured with EIGRP and is interconnected with routing sends the labeled data packet from R1 directly to R3 without synchronization or prior checking. This is because EIGRP uses partial updates, which means it will only send an update if there is a change in the network. Next, configuration is done on the OSPF and EIGRP networks found in Configuration 1 and Configuration 2.

Configuration Code 1 OSPF Configuration

```
R1(config)#interface fastEthernet 0/0
R1(config-if)#ip address 10.64.1.1 255.255
R1(config-if)#ip address 10.64.1.1 255.255.0.0
R1(config-if)#no shutdown
R1(config-if)#
R1(config)#int fastEthernet 0/1
R1(config-if)#ip address 20.64.1.1 255.255.0.0
R1(config-if)#no sh
R1(config-if)#no shutdown
R1(config-if)#
R1(config)#router ospf 1
R1(config-router)#router-id 1.1.1.1
R1(config-router)#network   10.64.0.0   0.0.255.255
area 0
R1(config-router)#end
R1(config)#router ospf 1
R1(config-router)#network   20.64.0.0   0.0.255.255
area 0
R1(config-router)#end
R1#
```

As in configuration code 1, to build an interconnected OSPF network, each device needs an IP address so that the devices can recognize each other. Then, the loopback IP address is configured for each router so that they can connect with OSPF routing. Each router will be able to communicate with each other after being configured with OSPF routing.

Configuration Code 2 EIGRP Configuration

```
R1(config)#interface fastEthernet 0/1
R1(config-if)#ip address 20.64.1.1 255.255.0.0
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#
R1(config)#interface fastEthernet 0/0
R1(config-if)#ip address 10.64.1.1 255.255.0.0
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#end
R1(config)#router eigrp 100
R1(config-router)#no auto-summary
R1(config-router)#network 20.64.0.0 0.0.255.255
R1(config-router)#network 10.64.0.0 0.0.255.255
R1(config-router)#exit
```

In the configuration code 2, just like in the OSPF network, each device in the EIGRP network also needs an IP address so that the devices can recognize each other. After assigning an IP address to each router, the next step is to configure EIGRP on each router. After finishing configuring EIGRP routing, each router can communicate and connect with each other.

Next, after all the configurations are complete, the data collection process will be carried out using the Wireshark application, with the data collected being the data on the current network traffic, and then the quality of service will be analyzed with parameters such as throughput, jitter, delay, and packet loss. The data to be collected will be from the video streaming service that will be running for 3 minutes with 3 types of video resolutions, namely 360p, 480p, and 720p. This testing will be carried out on the OSPF and EIGRP networks.

3. RESULT AND DISCUSSION

The following are the tests that have been carried out and data captured using Wireshark on each OSPF network and EIGRP network, and the results that have been obtained. The following are the results of the captured data on the OSPF network and EIGRP network while running the video streaming service.

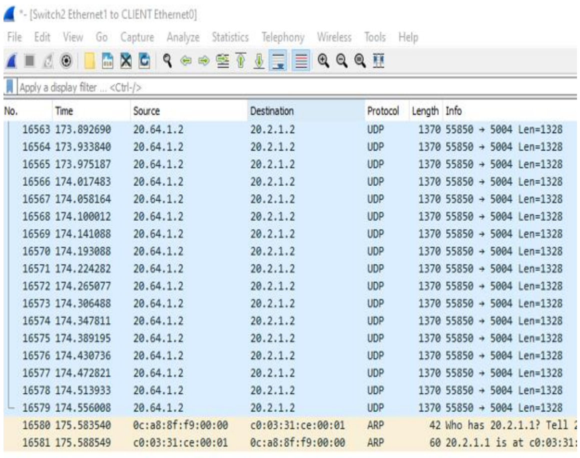

Figure 4. OSPF Network Capture

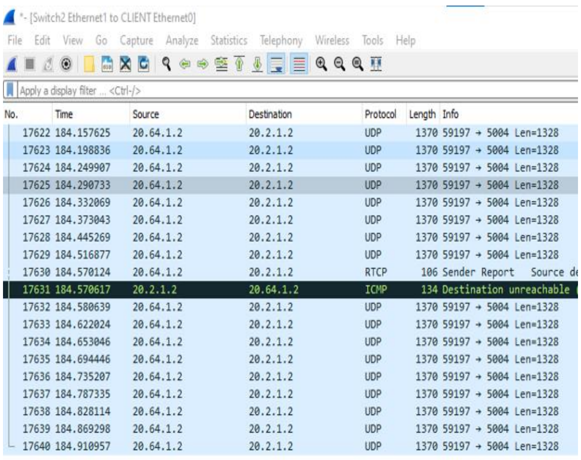

Figure 5. EIGRP Network Capture

The results of the video streaming data capture from the OSPF and EIGRP networks for 3 minutes are shown in Figures 4 and 5. The results have been obtained and will be analyzed for each network based on the QoS parameters that have been set, namely throughput, jitter, delay, and packet loss.

Then, the results obtained will be compared with each QoS parameter, and the following are the results obtained: The QoS testing results using the throughput parameter showed that the throughput of OSPF and EIGRP routing has a significant difference depending on the video quality used. In the case of 360p and 480p video quality, the throughput of OSPF and EIGRP routing tends to be the same, but in the case of 720p video quality, the throughput of EIGRP routing is much higher than OSPF routing.

This indicates that EIGRP routing has an advantage in terms of data transmission speed on the network, while OSPF routing has an advantage in terms of network stability and reliability. The selection between OSPF and EIGRP routing should be based on the desired network priorities. If the network prioritizes stability and reliability, then OSPF routing is recommended. OSPF routing has the ability to optimize data transmission paths and ensure that the network operates well and is free from problems such as poor user experience or downtime.

However, if the network prioritizes data transmission speed, then EIGRP routing is recommended. EIGRP routing has the ability to optimize data transmission speed and ensure that data can be forwarded quickly and efficiently through the network. Overall, the selection between OSPF and EIGRP routing should be based on careful analysis and consideration of the desired network priorities. Both routing methods have their own advantages and should be chosen according to the network's needs to work optimally and achieve the desired results. The testing results using the throughput parameter are presented in Table 6.

Table 6. Parameter analysis Throughput

No	Video Quality	OSPF	EIGRP
1	360p	691159.6 kbps	759087.7 kbps
2	480p	683623.5 kbps	728497.8 kbps
3	720p	1030845.4 kbps	129901.6 kbps

Here are the results of Quality of Service testing using the Jitter parameter: The jitter values in OSPF and EIGRP routing vary depending on the video quality being used. In 360p and 480p video quality, jitter in OSPF routing is lower than in EIGRP routing. This indicates that OSPF routing has an advantage in terms of packet reception time stability, which is critical for ensuring good video quality for users. Unstable packet reception times can negatively affect video quality.

However, in 720p video quality, jitter in EIGRP routing is significantly lower than in OSPF routing. This shows that EIGRP routing has an advantage in terms of network adaptability and flexibility. EIGRP can automatically adjust to changing network conditions and ensure that packets are received by users optimally.

In conclusion, OSPF routing has an advantage in terms of packet reception time stability, while EIGRP routing has an advantage in network adaptability and flexibility. The choice of using OSPF or EIGRP routing should be based on network priorities. If the network prioritizes stable packet reception times, OSPF is recommended. However, if the network prioritizes network adaptability and flexibility, EIGRP is recommended. The results of the testing using the jitter parameter are shown in table 7.

Table 7. Parameter analysis Jitter

No	Video Quality	OSPF	EIGRP
1	360p	7.072 ms	14.334 ms
2	480p	7.377 ms	13.209 ms
3	720p	0.633 ms	10.484 ms

Next, the results of Quality of Service testing using the Delay parameter showed that there were differences in the delay times experienced for each video quality when using OSPF and EIGRP. Delay time is the time required to send a data packet from one point to another. This is important because an excessive delay can reduce the quality of the received video. However, the difference in delay time seen in Table 8 is not significant and only differs by a few milliseconds. This indicates that both routings are able to provide stable delay times that do not significantly affect video quality. Therefore, both routings can be used according to each user's needs and preferences.However, if network stability and avoiding delays are a priority, both routing methods can be used interchangeably. This can help maintain stable video quality and minimize unwanted delays. It is recommended that a trial run be performed on the intended network to determine which routing is best suited to the needs and preferences. In addition, regularly monitoring and evaluating the network is important to ensure that network quality remains stable and meets expected standards. The following are the test results using the delay parameter in.table 8.

Table 8. Parameter analysis delay

No	Video Quality	OSPF	EIGRP
1	360p	14.733 ms	15.308 ms
2	480p	14.698 ms	15.103 ms
3	720p	10.589 ms	10.482 ms

The results of the latest test, which is the quality of service test using the packet loss parameter, showed that at all levels of video quality, no packets were lost using both OSPF and EIGRP routing. This indicates that both types of routing perform well in handling packets and ensuring no packet loss, which is crucial in maintaining the quality of video and preventing issues such as repetitive or faulty images or sound.

Since both routing methods perform well in this aspect, OSPF and EIGRP can be used according to the needs and preferences of the user. However, it should be noted that in certain situations, one routing method may perform better than the other. Therefore, it is important to conduct a detailed analysis and test to determine the routing method that is most suitable for specific situations and conditions.

In terms of packet loss, network reliability and stability are crucial factors that users should consider. Therefore, factors such as the number of packets, traffic levels, and network quality should be taken into account when choosing routing methods. This will help ensure that the network performs well and can address packet loss issues.

Overall, OSPF routing and EIGRP routing both perform well in terms of packet loss. Therefore, users should consider specific factors and conduct detailed analysis and testing to determine the routing method that is most suitable for specific situations and conditions. The results of the test using the packet loss parameter are shown in Table 9.

Table 9. Parameter analysis*Packet Loss*

No	Video Quality	OSPF	EIGRP
1	360p	0	0
2	480p	0	0
3	720p	0	0

4. CONCLUSION

Based on the results of the Quality of Service analysis for video streaming services using OSPF and EIGRP networks, it can be concluded that OSPF routing performance is superior to EIGRP routing in terms of throughput, jitter, and delay for all three tested video qualities (360p, 480p, and 720p). OSPF showed better results than EIGRP in all tested parameters.

In terms of the throughput parameter, OSPF performance is 3.7% better than EIGRP. When it comes to the jitter parameter, OSPF outperforms EIGRP by 44.3%. For the delay parameter, OSPF performance is 7.7% better than EIGRP. Meanwhile, for the packet loss parameter, both performances reached 0%. Therefore, overall, it can be concluded that OSPF has better performance than EIGRP, with a performance difference of 13.3%.

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