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Comparative Analysis of Network Quality Using QOS Parameters on Mikrotik Routers Using the Queue Tree and Simple Queue Methods

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Abstract

The research was conducted by researchers at Trienggadeng State Vocational School located on Jl Banda Aceh-Medan KM 152, Kec. Trienggadeng Regency. Pidie Jaya. This research is based on the importance of the network in the ongoing teaching and learning process in the network and computer labs, the network in the lab is currently not managed properly and the distribution of bandwidth is not evenly distributed. To get a good internet connection, it is necessary to distribute bandwidth evenly, which can be done using a proxy router. One of the features for distributing bandwidth evenly in the proxy router can be applied using the simple queue and queue tree methods, knowing network quality can be done using Quality of Service (QoS) measurements. This study aims to determine the analysis of network quality using Qos on proxy routers using the simple queue and queue tree methods. The method used in this study is to use the action research method (action research), the stages of the research are analyzing, data collection, data completeness, making network designs, and taking action. The results obtained for network analysis in a comparative study between simple queue and queue tree networks, the results for the delay obtained by the queue tree are 9 ms, packet loss = 0%, and throughput = 549 k. Whereas the simple queue obtains the value from the QoS measurement by performing calculations with the equation formula to obtain a value of delay = 8 ms, packet loss = 0.15% and throughput = 629 k. Based on the Tiphon standard, it can be concluded that for delay, a queue tree is better with a value above the simple queue with a very good index, the packet loss queue tree is better than the simple queue, the index is very good, the throughput of the simple queue is better compared to the throughput queue tree. This research shows that overall Queue Tree is more optimal for QoS.

Keywords: *Queue Tree, Simple Queue, Delay, Throughput, Packet Loss.*

1. Introduction

The existence of the internet today provides convenience and benefits in several ways, ranging from educational organizations, businesses, communities and others. With the internet network, users can exchange information, store data, retrieve data, and send data easily and quickly using only hyperlinks [1] [2]. The internet requires good infrastructure to produce a good internet connection. Poor infrastructure and management will result in poor internet connection. Therefore, the provision of good infrastructure and good management through the maintenance of existing infrastructure is very necessary [3] [4].

Quality of Service is a network mechanism that enables implemented applications and services to function as they should. The goal of Quality of Service is to meet the needs of different services, which use the same infrastructure. Performance refers to the level of speed and reliability of delivering various types of data loads in a communication [5] [6].

The results of initial observations at Trienggadeng State Vocational School, there are many obstacles that are seen, namely frequent interruptions during the learning process that takes place in the Lab, lack of internet network support in the school for all computers in the lab, and also delays when sending data [7] [8].

2. Methods

The purpose of this study is to analyze and compare network quality using the Quality of Service (QoS) parametric with the queue tree method and so researchers will conduct research using action research methods (action research). Action research is an iterative process that involves researchers and practitioners acting together on certain activity cycles, including problem diagnosis, action intervention, and reflective learning [9] [10] [11].

This research was conducted at Trienggadeng State Vocational School, Trienggadeng State Vocational School which is located at Jl Banda Aceh-Medan KM 152, Kec. Trienggadeng, Kab. Pidie Jaya, Trienggadeng State Vocational School has 13 classrooms, there are 5 talent and interest departments and by 2022 has 155 active students.
The tools and materials used by researchers to analyze this network can be divided into two categories, namely hardware and software [12] [13].
Hardware

Table 1. Hardware

No.	Hardware	
	Nama	Spesifikasi
1.	Laptop/PC	Merk : Asus A455L, Processor : intel core 3 5005U, 2.0 GHz, Memori : 4 GB
2.	Router Mikrotik	RB 951
3.	Access Point	-
4.	UTP cable	2

Software:
a. Windows 10
b. Winbox
c. Wireshark
Action research cycle stages:
1. analyze
2. collect data
3. data completeness
4. make a network design
5. taking action
6. evaluation

3. Result and Discussion

3.1. Configure Simple Queues

Regulating and limiting internet bandwidth is an important thing in internet networks. Both for downloading and for uploading, because without bandwidth management, if a user downloads a file on the network, then the internet connection will fully flow to the user who is downloading the file, and will disrupt the connection for other users [14] [15].

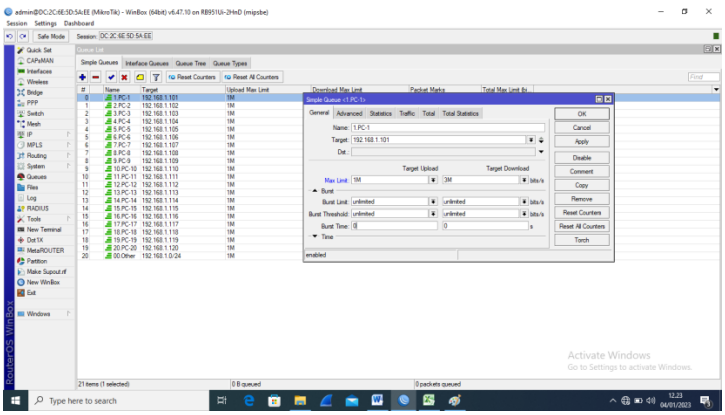

Fig 1. Simple Queue configuration image

Figure 1 The simple queue configuration can be seen that there are 20 clients, each of whom gets an IP, in the name we select the computer name, namely 1-PC1 while for the target we select the IP that corresponds to the appropriate computer or PC, then we select the upload target and the download target for enable this feature [16] [17].

Rule Simple Queue

/ Queue type simple queue
General name = 1.Pc-1 target = IP (192.168.1.101) target upload max limit = 1 M target download max limit = 3 M

3.2. Configuring QueueTree

Queue tree is a bandwidth management facility on Mikrotik, using a queue tree can create multilevel rules by differentiating bandwidth granting priorities, by grouping data based on IP or protocol that was previously declared on the firewall mangle menu. In this study, researchers grouped data based on IP.

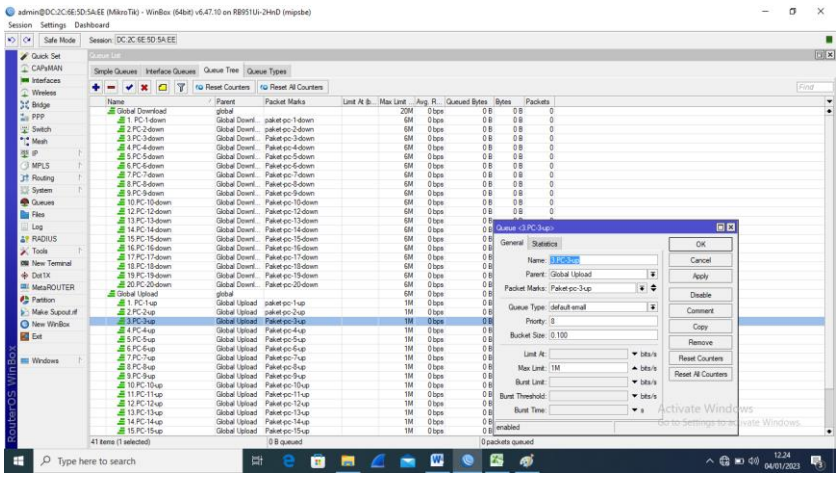

Fig 2. Queue tree configuration image

Figure 2 the Queue Tree configuration in the image above in the queue tree settings. We make two global packages, namely global download and global upload, each global has 20 clients or 20 IPs while global downloads also have 20 clients. For name selection we choose the same name then for IP we enter the IP that matches the PC name, for parent we select download we select global download while for upload we select global upload, in queue type we select default-small, then select max the limit you want to set then click apply and ok

Rule Queue Tree

/ Queue type queue tree
General name = 1. pc.1-up parent = global upload packet marks = packet 1.pc.1-up queue type = default small max limit= 1 M
General name= 1. Pc.1-down parent = global download packet marks = packet 1.pc.1.down
Queue type = default small max limit = 3 M

3.3. QOS Analysis

In the research carried out by QoS analysis on the Network and Computer Lab network at Trienggadeng State Vocational School, the research was carried out by accessing 6 URLs for internet testing from the 6 URLs including browsing, streaming and video conferencing [18]. From each website address, 3 tests were carried out and 1 test each required browsing time for 5 minutes. Of the 6 URLs, internet testing will be carried out using the existing internet, then using the simple queue method and finally using the queue tree method, later from this test we will obtain results for delay, packet loss and throughput for the results we can see using wireshark analysis, CMD, and also speedtest.net [19]. The reason why the link is being tested is because the following link is often used in the teaching and learning process and is also needed by the teacher. Website links include:

1. https://gmail.com
2. https://belajar.id.com
3. https://dapodik.com
4. https://e-learning.
5. https://youtube.com
6. https://zoom.com

3.4. Preliminary Observation Testing

The first test was carried out in the network and computer lab room at 09.00 and 12.00. This test was carried out using speedtest.net. This test was carried out to find out the source of the internet network currently used at school and the amount of uploads and downloads used during the observation.

Table 2. Initial Observation Testing

Ping	419	407
Download	481	443
Upload	426	308
O'clock	09.00	12.00

3.5. Analysis Of Network Quality Using Quality Of Service (Qos) Using The Simple Queue Method

In testing this network the researchers conducted tests in one week 3 days at different hours. In this test to get the results of the qos parameter using the equation formula and using the wireshark application and also using cmd [20].

Table 3. Browsing Simple Queue

Parameter Qos	Simple Queue		
	Delay		
	Test 1	Test 2	Test 3

Gmail	8.2 ms	7.7 ms	8.9 ms
Dapodik	6.6 ms	9.5 ms	9.5 ms
learn.id	8.2 ms	9.6 ms	7.6 ms
E learning	7.8 ms	9.8 ms	9.4 ms
Packet Loss			
Gmail	0.1 %	0%	0,36%
Dapodik	0.9%	0%	0%
Learn.id	0%	0%	0%
E-Learning	0%	0.1%	0%
Throughput			
Gmail	531 k	588 k	490 k
Dapodik	702 k	453 k	449 k
Learn.id	537 k	468 k	613 k
E-Learning	577 k	450 k	475 k

In Table 3. Browsing Simple queue is the result of testing browsing using the simple queue method, in this test there are 3 tests, namely on the first day the test is carried out at 10.00 WIB, the second test is carried out on different days which is carried out at 12.00 WIB while for the last test, namely the 3rd test, was carried out the next day at 08.00 WIB. In the browsing test, access to gmail, dapodik, studi.id and e-learning will each get a long access limit of 5 minutes each. It can be concluded by finding the average of the results on test one, then obtaining a value for delay = 7.7 ms, throughput = 586.78 k and packet loss = 0.25%, test two obtains a value for delay = 9.15 ms, throughput = 489.75 k and packet loss = 0.025% and in the third test obtained a value of delay = 8.85 ms, throughput = 506.75 k and packet loss = 0.09%.

So from the overall results it can be taken that the average of the network is with 6 websites that are accessed on three times the test for the delay value = 8 ms with the perfect category according to, while for packet loss which is = 0.15% it is still classified as a very category good and for throughput = 639.33 k with a very good category. Based on the results of the analysis by testing using the simple queue method it is good to apply because it has a high throughput value where throughput is the speed of data transfer so it can overcome problems that occur in schools.

3.6. Analysis Of Network Quality Using Quality Of Service (Qos) Using The Queue Tree Method

In this test the researcher used the Queue Tree method to get the results the researcher tested 3 times at different times, for browsing it will access 4 different websites with a long access time of 5 minutes each. Furthermore, to get results for the Qos parameter, you can use the equation formula or use the wireshark application and for packet loss you can also use ping cmd.

Table 4. Browsing Queue Tree

Parameter Qos	Queue Tree		
	Delay		
	Pengujian 1	Pengujian 2	Pengujian 3
Gmail	10 ms	9.6 ms	8.4 ms
Dapodik	7.6 ms	10 ms	9.7 ms
Learn.id	9.3 ms	10 ms	10 ms
E learning	9.2 ms	9.9 ms	9.6 ms
Packet Loss			
Gmail	0%	0%	0%
Dapodik	0.3%	0%	0%
Learn.id	0%	0%	0%
E-Learning	0%	0%	0%
Throughput			
Gmail	435k	464 k	545 k
Dapodik	598k	440 k	451 k
Learn.id	453k	439 k	438 k
E-Learning	478k	443 k	474 k

In Table 4. Queue tree browsing test results from browsing testing using the queue tree method, in this test there were 3 tests, namely on the first day the test was carried out at 10.00 WIB, on the second test it was carried out on a different day which was carried out at 12.00 WIB while for the last test, namely the 3rd test, was carried out the next day at 08.00 WIB. In the browsing test, access to gmail, dapodik, studi.id and e-learning will each get a long access limit of 5 minutes each. It can be concluded by finding the average of the results on test one, then obtaining a value for delay = 9,025 ms, throughput = 491 k and packet loss = 0.075%, test two obtains a value for delay = 9,875 ms, throughput = 446.5 k and packet loss = 0% and the third test obtained a value of delay = 9,425 ms, throughput = 477 k and packet loss = 0%.

3.7 Comparison Of Network Quality Using The Simple Queue And Queue Tree Methods

Table 5. Table Video Conferens

	Parameter	Tanpa qos	Simple queue	Queue tree
		Delay		
		Zoom		
A	Test 1	9.7 ms	9.4 ms	7.8 ms
	Test 2	8.6 ms	9.6 ms	9.1 ms
	Test 3	9.3 ms	7.4 ms	8.7 ms
		Packet loss		
		Zoom		
B	Test 1	0 %	0 %	0.1 %
	Test 2	0 %	0 %	0 %
	Test 3	0 %	0 %	0 %
		Throughput		
		Zoom		
C	Test 1	437 k	450 k	564 k
	Test 2	545 k	452 k	466 k
	Test 3	523 k	591 k	511 k

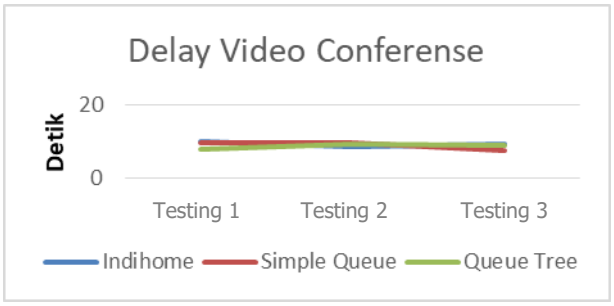

Fig 3. Delay Video Conference

Figure 3 Video conference delay in the graph above shows the delay from the video conference testing table using the zoom website address. The test was carried out using the existing network at the school, simple queue and queue tree by conducting three tests on the same website address. can be seen for testing using a network that already exists in a stable school, for the simple queue method the network is stable when accessing it has increased slightly during test two while for the queue tree method it has decreased when accessing on test two, for delay on video conferencing it is better with using the network at school.

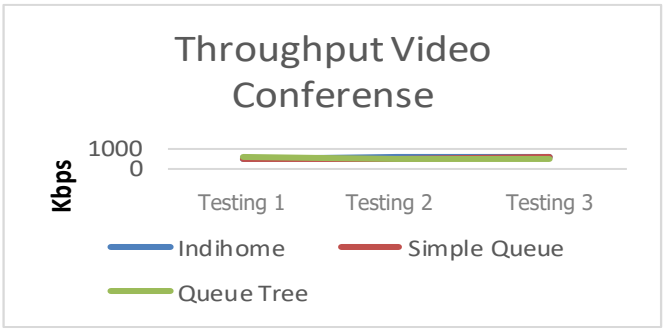

Fig 4. Video Conference Throughput

Figure 4 Video conference throughput in the graph above shows the throughput of the video conference testing table using the zoom website address, tests carried out using the existing network at school, simple queue and queue tree by conducting three tests on the same website address, It can be seen that the throughput in video conferencing testing has almost the same value, for throughput in video conferencing testing it is higher by using the queue tree method.

Based on the table from the results of research that has been carried out at Triengadeng State Vocational School which was carried out for 3 days, using the queue tree method, simple queue and without using the method. Testing the three methods using the same website address and the same length of access time, obtained an average value of simple queue delay = 8 ms, packet loss = 0.15% and throughput = 629 k. For the queue tree to obtain delay = 9 ms,packet loss = 0% and throughput = 549k. Without using the method to obtain the value of delay = 8 ms, packet loss = 0.015% and throughput = 512 k.So it can be concluded that the test analysis using the Simple queue method will produce a high throughput value with a value = 629k with standardized typhon, get a very good category with index 4 and produce a low delay with a value = 8 ms, using standardized typhon, get a very good category with index 4. Using the queue tree method will be able to minimize packet loss by getting 0% packet loss meaning that no packets are lost when testing using the queue tree method, while using the queue tree method also gets a low delay with a value = 9 ms . Whereas without using the method, you get a low delay with a value = 8ms, and there is a packet loss with a value = 0.015%, meaning that there are a few packets lost when sending data.

4. Conclusion

Bandwidth management method with Simple Queue will produce better throughput where Simple Queue does not require a lot of traffic tagging processes on the firewall. Simple Queue is suitable for limiting bandwidth on a network without requiring a certain priority. Overall, the Queue Tree method can be concluded as the most optimal bandwidth management method because it can prioritize QoS for applications, ports, IPs, and protocols. Analysis using the queue tree method can minimize the results of packet loss. This study concludes that Simple Queue is suitable for bandwidth management that only applies limits, while Queue Tree is better for bandwidth management that implements Quality of Service (QoS).

Acknowledgment

Based on the research that has been done, it is suggested for the next work:
The next researcher can use a Cisco router as a supporting medium and add variable components.The next researcher can add other methods that are still related to Qos in comparative analysis. To improve the quality of schools, it is necessary to upgrade network devices that support if one day the school experiences an increase.

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