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# Analysis of Method Tueed Treedan Filtering Layer to Improve the Effectiveness Bandwidth Management on Network 802.3

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## ABSTRACT

Bandwidth management on the network at the Islamic University of North Sumatra needs further exploration in bandwidth management. The queue method is very simple and bandwidth usage is inefficient because it does not use special methods. The impact of bandwidth distribution is no more structured because there is no guaranteed bandwidth ownership in each client. Compilation of users and heavy traffic, then all internet users overlap increases the possibility of requesting more bandwidth to a few clients (not equally), then filtering data patterns such as streaming traffic or certain websites, are easy to access and have the opportunity to use bandwidth. Solutions from cases like this have been done by researchers who have not been effective enough if using a large campus network such as UISU. Thus this research will develop using the Queue Tree combination method by using traffic priority, the Promised Information Level / Maximum Information Level and the Layer 7 Protocol Screening method to define specific data patterns in the url of the text in order to use bandwidth. The effectiveness of the method is analyzed using the parameter average value (average rate) using the OS proxy router and the ICMP parameter packet using throughput, delay, jitter and packet loss.

***Keywords:*** Bandwidth management, *Kombinasi method, Effectiveness network, Parameter.*

## INTRODUCTION

This research was conducted at the Islamic University of North Sumatra. From the observations that the author has done, there is a fairly simple bandwidth management in the distribution of bandwidth to each client so that when traffic is dense sometimes there is an uneven distribution of bandwidth and overlapping each client. Then the bandwidth quota for each client does not get a definite guarantee other than that streaming traffic and certain websites are still very easy to access by the client so there is a chance of using bandwidth that is not efficient. According to Hendrik Kusbandono & Eva Mirza Syafitri (2019) [1] Bandwidth management is allocating a bandwidth that serves to support the needs or requirements of an internet network in order to provide quality assurance services for a Quality of Services (QoS) network.

From indications like this have been done by previous researchers such as Helmiawan, MA (2015) [2] using a layer 7 web filtering method that produces a healthy internet and saves bandwidth, then Amin, RAA and Indrajit, RE (2016) [3] using the Simple method Queue and Per Connection Queue (PCQ) which results in allocating bandwidth for each client by getting a bandwidth value that is almost evenly distributed. Then Nababan, EB et al (2019) [4] use the Load Balance Algorithm method which results in delay, jitter and packet loss from packets that are shipped is determined as a performance parameter.

Thus from these studies need further analysis regarding bandwidth management. This research will develop using a combination of two methods namely:

Queue Tree method by utilizing traffic priority and Committed Information Rate (CIR) / Maximum Information Rate (MIR) so that there is a guaranteed bandwidth guaranteed, possible acquisition of bandwidth that reaches the maximum limit and categorizing traffic. According to Abdul Malik et al (2017) [5] Queues Tree has a better value of throughput, delay, packet loss compared to Simple Queues.

Layer 7 Protocol Filtering Method to define certain data patterns in the url text so that the router automatically executes dropping and traffic limitations that will enter so that it will further save the use of available bandwidth.

The effectiveness of the method is analyzed using the average value parameter (avg rate) using a proxy operating system router and ICMP packet parameters using delay, jitter and packet loss. The study was conducted using 4 laptop units and using the 802.3 protocol.

## RESEARCH BACKGROUND

From the identification of the problems that have been described above the authors analyze how to combine the performance of two methods when traffic is dense so that the distribution and use of bandwidth is more structured, complex and economical. Then the results of the combination are made an evidence test based on the avg rate parameter using a proxy operating system and the parameters of throughput, delay, jitter and packet loss. Thus the bandwidth management of the 802.3 protocol at the North Sumatra Islamic University is better and more effective.

## RESEARCH METHODS

In the research method there is data collection and effectiveness of the research design

1. Data Collection

**Table 3.1. Data acquisition from speedtest**

| PC | Hanya terdapat TX & RX (tidak ada Priority, CIR/MIR & filtering pola data) | |
|---|---|---|
| | TX (Upload) | RX (Download) |
| PC 1 | **12 mbps** | **9097 Kbps** |
| PC 2 | 545 Kbps | 130 Kbps |
| PC 3 | 300 Kbps | 95 Kbps |
| PC 4 | 90 Kbps | 43 Kbps |

**Table 3.2. Data used through ICMP packages**

| Client | Internet Control Message Protocol (ICMP) | | |
|---|---|---|---|
| | Delay (ms) | Jitter | Paket Loss (%) |
| | Average | Rata-rata delay min-max | Sent/ Received |
| PC 1 | 60 ms | Time 1 sampai time akhir variasi nilainya berbeda jauh mulai dari 36 sampai 357 ms | 0 % |
| PC 2 | 310 ms | Time 1 sampai time akhir variasi nilainya berbeda jauh mulai dari 225 sampai 370 ms | 33 % |
| PC 3 | 387 ms | Time 1 sampai time akhir variasi nilainya berbeda jauh mulai dari 213 sampai 341 ms | 41 % |
| PC 4 | 370 ms | Time 1 sampai time akhir variasi nilainya berbeda jauh mulai dari 99 sampai 641 ms | 17 % |

**Table 3.3. Data types are based on traffic that is often accessed by clients**

| Jenis Trafik atau Konten/Website | |
|---|---|
| Streaming | Sosial Media |
| ^.+(youtube.com\|googlevideo.com\|cdn.dailymotion.com\|metacafe.com\|mccont.com).*$ | *^.+(facebook.com\|instagram.com\|twitter.com).*$* |

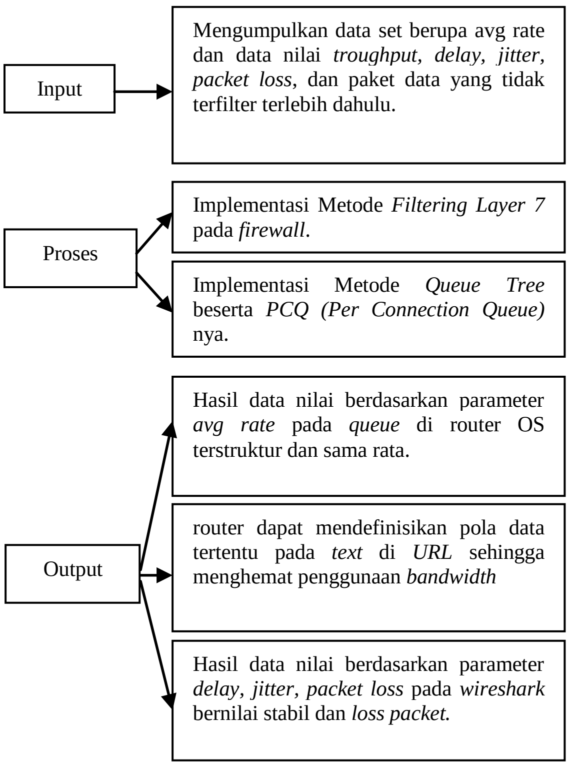


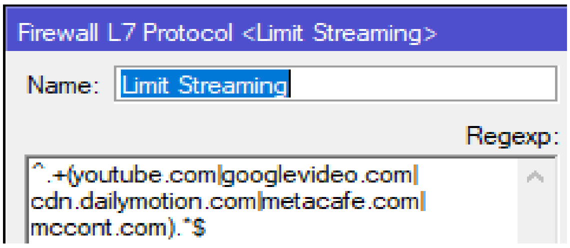

**Figure 3.1. Alur keseluruhan sistem.**

From tables 3.1 and 3.2 above it can be explained that all clients access the internet at the same time, it appears that bandwidth usage in each client is overlapping (uneven). The tendency of bandwidth values is more dominating on PC 1. Testing is done using speed test and ICMP. Whereas in table 3.3. is data in the form of traffic types, and websites that are most often accessed by clients.

**System Configuration**

The system configuration includes the data pattern design on the Regular Expression Script in L7P, the Firewall Mangle design, the Queue Type determination and the Queue Tree design.

Design data patterns on regular expression scripts in L7P.




In designing the Regular Expression L7P Script above, it is a determination of what traffic will be dropped and limited. The script in regex functions to make a tagging in the Filter Rule and Queue Tree so that the router can define certain data patterns in the URL text for auto dropping and later being monitored in Queue so as to save the available bandwidth.

1. The design of the application of Firewall Mangle.

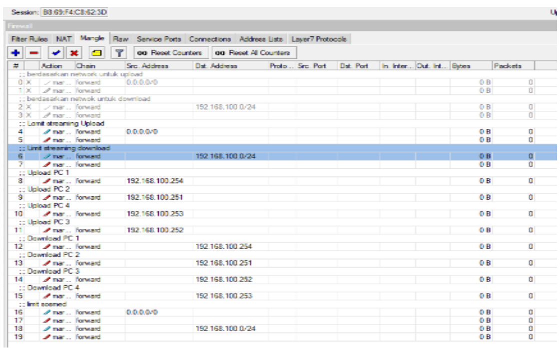


**Figure 3.3. The design of the application of Firewall Mangle**

The design of the firewall mangle signifies each of the traffic. Namely PC traffic 1,2,3 and 4 for TX and RX, then limit social media traffic and streaming traffic drop. This marking is done for the Queue Tree method later.

### 1. Queue Type Determination.

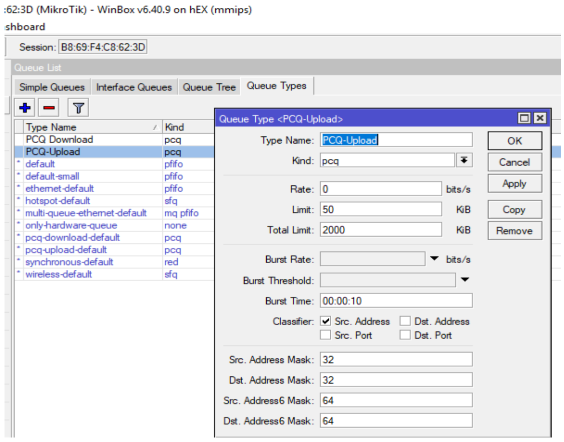


**Figure 3.4. *Queue Type Determination***

In Figure 3.4. above explains that before applying Queue Tree, it determines the Queue Type for the Classifier and its Kind type. It is intended that each client does not overlap and get bandwidth fairly and evenly for both TX and RX and applies to access the traffic that has been made. This type of Queue also marks the Queue Tree

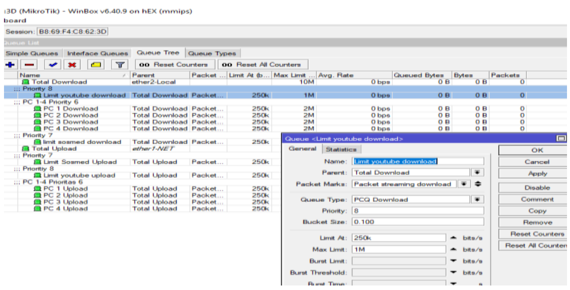


**Figure 3.5. *Queue Tree Determination***

In this process determine the queue structure for both Queue Parrent and Child Queue. Available bandwidths have a total of 20 Mbps, then simplified into 2 categories namely upload and download traffic, each of which is given 10 Mbps. For TX traffic (upload) has a child upload of 8 Mbps for MIR and 1 Mbps for CIR, then child social media limit and child limit streaming 1 Mbps for MIR and 250 Kbps for CIR. Whereas for RX traffic (download) has the same bandwidth and child values as TX (Upload). The mechanism of queuing bandwidth distribution in the Queue Tree method is that bandwidth will be allocated to the limit at (Committed Information Rate (CIR)) first then if the bandwidth is still remaining then the remaining bandwidth will be given to the highest priority where the highest priority in this test is child download traffic and child upload with a large bandwidth of 8 Mbps. Then if there are only a few bandwidth users and accessing a small bandwidth value, the router will provide full bandwidth but only limited to the Maximum Information Rate and its priority value.

## RESULT

Here will be discussed the results of research evidence based on the speed test that is equipped with a graph diagram and the results of throughput, delay, jitter and packet loss.

Bandwidth achievement based on speedtest from TX (upload) and RX (download).

**Table 4.1 Bandwidth results are based on TX in each traffic.**

| Client | Bandwidth Tersedia 20 Mbps | | | | | |
|---|---|---|---|---|---|---|
| | TX (Upload) 10 Mbps | | | | | |
| | Priority 6 | | Priority 7 | | Priority 8 | |
| | Trafik Child Upload | | Trafik Child Limit Sosial Media | | Trafik Child Limit Streaming | |
| | Maximum Information Rate (MIR) 8 Mbps (2 Mbps x 4) | Commited Information Rate (CIR) 1 Mbps (250 Kbps x 4) | Maximum Information Rate (MIR) 1 Mbps | Commited Information Rate (CIR) 250 Kbps | Maximum Information Rate (MIR) 1 Mbps | Commited Information Rate (CIR) 250 Kbps |
| | Avg. Rate | | Avg. Rate | | Avg. Rate | |
| PC 1 | 2.0 Mbps | | - | | - | |
| PC 2 | 2.0 Mbps | | | | | |
| PC 3 | 1984.6 kbps | | | | | |
| PC 4 | 1992.0 kbps | | | | | |

**Table 4.2 Bandwidth results based on RX in each traffic**

| Client | RX (Download) 10 Mbps | | | | | |
|---|---|---|---|---|---|---|
| | Priority 6 | | Priority 7 | | Priority 8 | |
| | Trafik Child Download | | Trafik Child Limit Sosial Media | | Trafik Child Limit Streaming | |
| | Maximum Information Rate (MIR) 8 Mbps (2 Mbps x 4) | Commited Information Rate (CIR) 1 Mbps (250 Kbps x 4) | Maximum Information Rate (MIR) 1 Mbps | Commited Information Rate (CIR) 250 Kbps | Maximum Information Rate (MIR) 1 Mbps | Commited Information Rate (CIR) 250 Kbps |
| | Avg. Rate | | Avg. Rate | | Avg. Rate | |
| PC 1 | 1986.7 kbps | | 286,6 kbps | | 977,8 kbps | |
| PC 2 | 1991.6 kbps | | | | | |
| PC 3 | 1952.2 kbps | | | | | |
| PC 4 | 1980.0 kbps | | | | | |

In tables 4.1 and 4.2 above it can be explained that the acquisition of bandwidth on each client is equal and does not dominate, this applies to every traffic. Each client has been guaranteed to get a Committed Information Rate, even reaching the Maximum Information Rate value of its avg rate. The mechanism of bandwidth distribution is explained in Figure 3.5 above.

To more clearly see the results of the acquisition of bandwidth achieved can be seen in

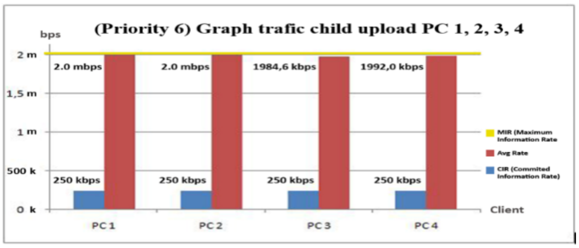



**Figure 4.1. Acquired upload and download bandwidth**

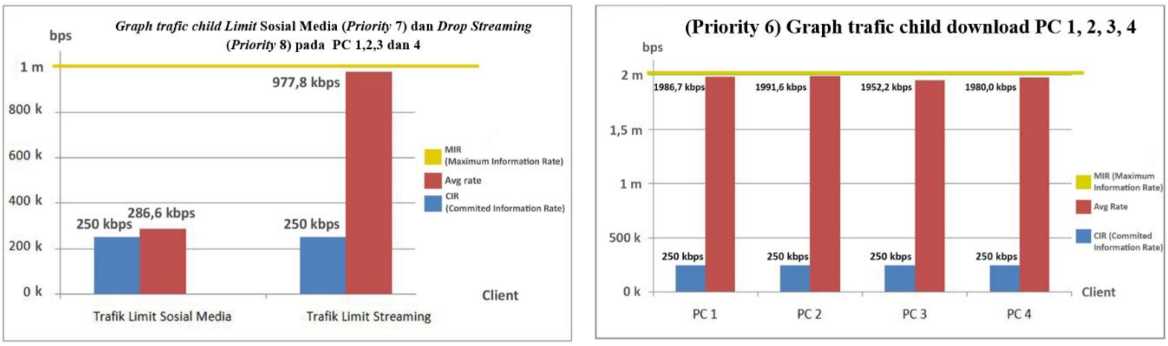



**Figure 4.2. Acquiring social media limit bandwidth and drop streaming traffic.**

Achievement of value based on ICMP packet (throughput, delay, jitter and packet loss).

**Table 4.3. The results are obtained through the Internet Control Message Protocol package**

| Client | Internet Control Message Protocol (ICMP) | | | |
|---|---|---|---|---|
| | Troughput (bps) | Delay (ms) | Jitter (ms) | Paket Loss (%) |
| | | Average | Rata-rata delay min-max | Sent/ Received |
| PC 1 | 188 kbps | -7917478 ms | 20 ms | 0% |
| PC 2 | 198 kbps | -7917478 ms | 20 ms | 0% |
| PC 3 | 16 kbps | -7917478 ms | 20 ms | 0% |
| PC 4 | 25 kbps | -7917478 ms | 20 ms | 0% |

Following the process of achieving the value of throughput, delay, jitter and packet loss;

***Troughput***

The throughput value is obtained from the formula (Throughput = Amount of data sent / Time of sending data x 8) where the result is:PC 1 = 1209421 Bytes : 51.238 Time Span, S = 23 kbps x 8 = 188 kbps.
PC 2 = 1685285 Bytes : 68.004 Time Span, S = 24 kbps x 8 = 198 kbps.
PC 3 = 123838 Bytes : 59.841 Time Span, S = 2069 kbps x 8 = 16 kbps.
PC 4 = 236479 Bytes : 75.026 Time Span, S = 3151 kbps X 8 25 kbps.
Here's an example of the screenshot;

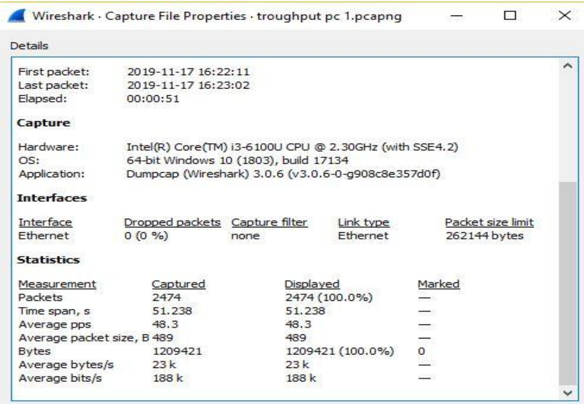



**Figure 4.3. The process of obtaining the value of throughput**

***Delay***

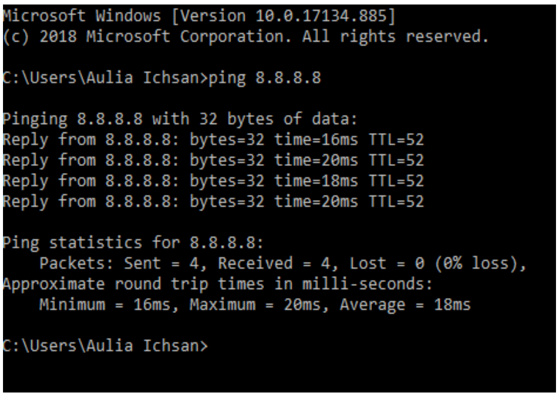
To obtain the average value of delay using the formula (Average delay = Total Delay / Total packets received)
The following is an example of a calculation screenshot:

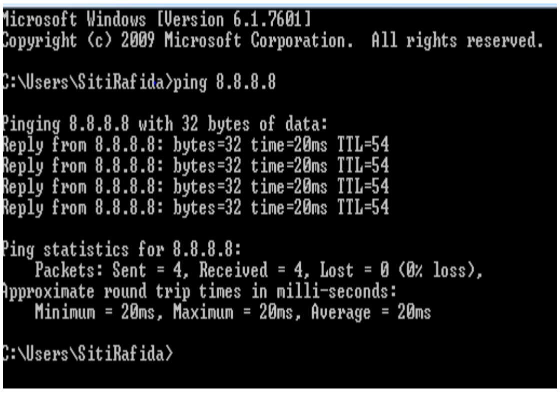
| Time 2 | Time 1 | Delay |
|---|---|---|
| 1,127,478 | 1,087,464 | 0.040.014 |
| 11,087,181 | 1,127,478 | 9,959,703 |
| 11,088,928 | 11,087,181 | 0.001747 |
| 11,116,248 | 11,088,928 | 0.02732 |
| 11,116,327 | 11,116,248 | 0.000079 |
| 11,166,476 | 11,116,327 | 0.050149 |
| 11,193,929 | 11,166,476 | 0.027453 |
| 11,194,013 | 11,193,929 | 0.000084 |
| 11,194,392 | 11,194,013 | 0.000379 |
| 11,222,592 | 11,194,392 | 0.0279 |
| 11,225,042 | 11,222,592 | 0.00245 |
| 11,227,600 | 11,225,042 | 0.002558 |
| 11,227,639 | 11,227,600 | 0.000039 |
| 11,228,858 | 11,227,639 | 0.001219 |
| 11,233,723 | 11,228,858 | 0.004865 |
| 11,264,712 | 11,233,723 | 0.030989 |
| 11,266,536 | 11,264,712 | 0.001824 |
| 11,297,410 | 11,266,536 | 0.030874 |
| 11,877,618 | 11,297,410 | 0.580208 |
| 11,918,487 | 11,877,618 | 0.040869 |
| 41,877,183 | 11,918,487 | 29,958,696 |
| 41,918,664 | 41,877,183 | -41,877,183 |
| | Total Delay | -1,958,784 |
| | Rata-rata Delay | -7917478 |

**Figure 4.4. proses perolehan mencari nilai rata-rata *delay*.**

***Jitter* dan *Packet Loss***

The variation in the value of jitter from time 1 to the end time is almost equal and stable in each client. Each client also has no packet loss with a gain of 0%. packet loss obtained from the formula (Packet loss = (Data sent - data received) x 100%).
The following screenshots of the results of the acquisition of jitter and packet loss.



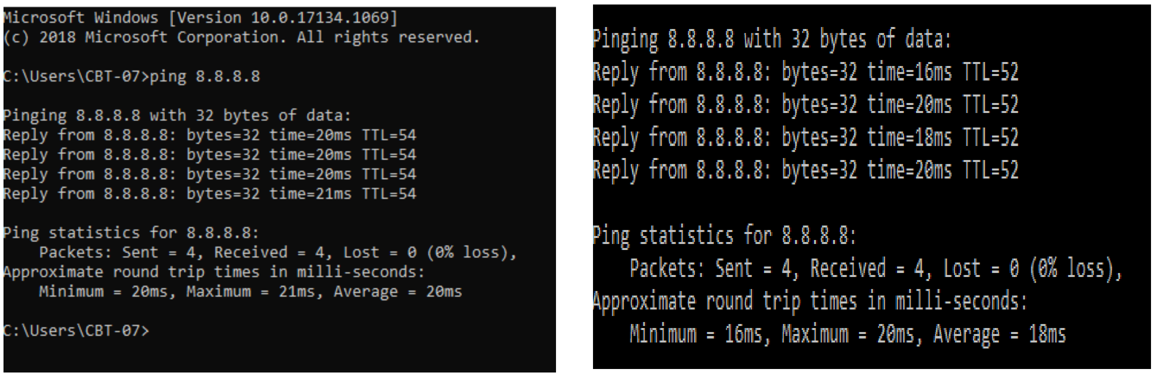



**Figure 4.5 The results of the acquisition of jitter and packet loss.**

## CONCLUSION

Routers can allocate bandwidth to all clients to be more structured. Where every cilent is given a limit at first or Committed Information Rate so that all clients get a definite bandwidth ration, after the limit at work then if the bandwidth is still remaining the bandwidth will be allocated to the traffic priority with the highest value first namely priority 6 if it still remains then bandwidth will be allocated to a smaller traffic that is priority 7 and so on until the bandwidth is used up. But if there is a lot of bandwidth left, the client with the highest priority can get a max limit / Maximum Information Rate.\

The result of this Queue Tree method is that traffic can be categorized into 3 parts, namely TX / RX traffic, social media traffic limits, and traffic limit streaming. The acquisition of bandwidth on each client becomes equally even by adding the function Per Connection Queue (PCQ) to the Queue Tree.

With the implementation of the Layer 7 Filtering method on a firewall router it can automatically define certain data patterns in the url text for auto dropping or limitation so that it can result in reduced bandwidth usage.

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