

Implementation of QoS-HTB in Internet Bandwidth Management in Computer Networks at the Integrated Computer Laboratory

Akhmad Fathurohman^{1*}, Asdani Kindarto¹, Feri Reiza Maulana¹

¹Faculty of Engineering, Universitas Muhammadiyah Semarang, Indonesia

*Corresponding author : akhmadfathur@unimus.ac.id

ABSTRACT

Universitas Muhammadiyah Semarang has 6 computer laboratory rooms, one server management room, and one main network room. The condition of full load for all laboratories is 240 work stations and at least 6 access for instructors/lecturers, must get guaranteed smooth access, both downloading and uploading data as needed. According to internet needs in buildings, the Information and Communication Technology Technical Implementation Unit (UPT ICT) provides integrated internet access supplies with computer networks between buildings on campus. GKB II is connected to a bandwidth of 500 megabytes per second (mbps) which is supplied from 2 (two) providers and can be added at any time when greater access is needed, especially in the computer laboratory. To regulate internet bandwidth usage for all users, efforts are made to guarantee internet bandwidth quality to optimal users by implementing Quality of Services (QoS) bandwidth management on routers by implementing a Hierarchical Token Bucket (HTB) which functions to regulate the distribution of bandwidth in a hierarchical manner. into network classes to make it easier to set up. This method allows it to be managed easily so that all network users can be properly controlled. The QoS method, which is a dynamic routing method, allows routing and network load sharing automatically according to the rules set for each connection access point installed on each floor of the building, especially in laboratories. User access to data in the laboratory network is optimally managed according to user load requirements. The results showed that at full load each work station smoothly used the internet with a maximum access limitation of 2 mbps download and 2 mbps upload. Laboratories with a capacity of 30 computers have access restrictions of 40 mbps, and laboratories with a capacity of 50 computers have access restrictions of 60 mbps. This is adjusted to the QoS-HTB method and the observation that at full load bandwidth in each laboratory used is as much as 30-50%, the restrictions given to each laboratory above have met the access needs of their users with an excess of 10% of the full load required. occur. The implementation of this model, the QoS-HTB model, is an effective choice in bandwidth management in the Unimus integrated computer laboratory.

Keywords: Computer Network, Bandwidth Management, QoS-HTB

1. INTRODUCTION

The integrated Computer Laboratory of the University of Muhammadiyah Semarang (Unimus) was built on the II Floor of the Joint Lecture II building (GKB II) an 8-floor building consisting of two L-shaped towers on the integrated campus Jl. Kedungmundu Raya No. 18 Semarang. As a support for the main practicum in the Computer Science Study

Program and other study programs that require a computer laboratory. There are 6 (six) laboratory rooms and 1 (one) management, server and main network room. Each room consists of 50 (fifty) computers in 3 (three) rooms, and 30 (thirty) computers in 3 (three) rooms. To meet the needs of internet and network services, a Local Area Network (LAN) computer network is created which is integrated and divided into each laboratory.

Of course, internet access services in the laboratory must be adequate according to practicum access needs. Under full load conditions for all laboratories of 240 work stations and at least 6 instructor/lecturer access, guarantees for smooth access, both downloading and uploading data as needed. According to internet needs in buildings especially for laboratory needs through the Information and Communication Technology Technical Implementation Unit (UPI) providing integrated internet access supplies with computer networks between buildings on campus. GKB II is connected with a bandwidth of 500 mega bytes per second (mbps) which is supplied from 2 (two) providers and can be added at any time when greater access is needed, especially in the computer laboratory.

In order to regulate the use of internet bandwidth for all users, efforts are made to guarantee the quality of internet bandwidth to optimal users by implementing Quality of Services (QoS) bandwidth management on routers by implementing a Hierarchical Token Bucket (HTB) which functions to regulate the distribution of bandwidth in a hierarchical manner. into network classes to make it easier to set up. This method allows it to be managed easily so that all network users can be properly controlled. The QoS method, which is a dynamic routing method, allows routing and network load sharing automatically according to the rules set for each connection access point installed on each floor of the building, especially in laboratories. User access to data in the laboratory network is optimally managed according to user load requirements.

1.1. Purpose

Research purposes:

1. To find out the implementation of the computer network structure in the Unimus integrated computer laboratory
2. To find out the implementation of QoS with the HTB algorithm in bandwidth management in the Unimus integrated computer laboratory
3. Increasing the convenience of internet users at in the Unimus integrated computer laboratory by using optimal internet bandwidth.

1.2. Urgency

Bandwidth management is needed in various computer network access needs, especially with many users with high access needs such as in computer laboratories. Proper bandwidth management in the laboratory determines the quality of information access services which greatly supports the quality of service and the success of students in carrying out computer practicums.

1.3. Internet Bandwidth Usage

The internet bandwidth from the provider that unimus subscribes to for the building according to upt ict unimus is 500 mbps (mega bytes per second), while the access requirement for more than 1800 users means that the average per user is only 140 kbps (kilo bytes per second), the special supply for laboratories is 300 mbps. For access to information in the form of text, such a large bandwidth is indeed sufficient, but for quality learning content, of course, access to images and videos is needed with a greater internet bandwidth requirement per user. For example, access videos on Youtube. According to a source from google, the recommended video access is to get smooth streaming video quality as shown in Table 2.

Table 2. Google's Recommendations eor Accessing Videos on Youtube

Video Resolution	Recommended sustained speed
4K	20 Mbps
HD 1080p	5 Mbps
HD 720p	2.5 Mbps
SD 480p	1.1 Mbps
SD 360p	0.7 Mbps

Sources: Support Google[1]

From Table 2 it is clear that to access videos on YouTube with a minimum resolution of 360 pixels, internet bandwidth is needed at 0.7 Mbps (700 kbps), especially for high-density video resolutions. High Density (HD) requires even greater internet bandwidth. the best known as 4K (2000 pixel) requires a bandwidth of 20 Mbps.

The condition of the existing bandwidth is 250Mbps, if users access HD video (720p to 1080p) on YouTube at the same time, only 50 to 60 users can use internet access. Therefore, good bandwidth management is needed so that all users can feel the comfort of internet access, especially video access according to their needs.

1.4. Quality of Services (QoS)

To overcome this problem, there is a Quality of Services (QoS) internet bandwidth management method as an alternative that can be implemented in the Unimus GKB II Building network. This method, which is a dynamic routing method, allows automatic routing and distribution of network load bandwidth according to rules, which are set for each connection access point installed on each floor of the building and can be accessed by all users.[2]

One of IGRP's dynamic routing models is Quality of Service (QoS) which can be used in routers to manage bandwidth services, in managing data traffic to reduce packet loss, latency , and jitter on the network. QoS controls and manages network resources by setting priorities for certain data types on the network [3].

The network in an agency that has large enough services needs to provide predictable and scalable services as data traffic controllers, especially data that requires wide bandwidth (such as voice, video, and data that is sensitive to delays) to traverse the network. QoS is

included in a service-level agreement (SLA) with network service providers to ensure a level of performance that can be tailored to the needs.[4]

The QoS Monitoring model consists of monitoring application components, QoS monitoring, monitors, and monitored objects[5].

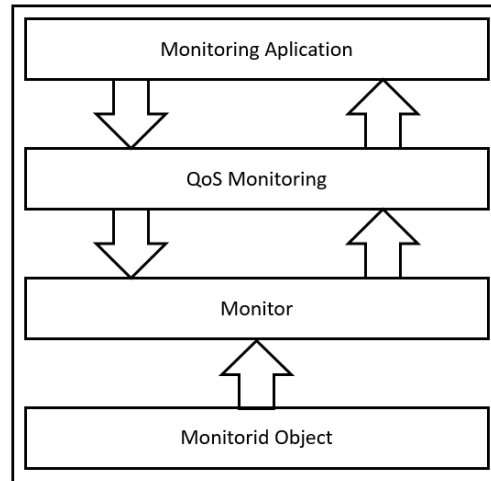


Figure 1. QoS Monitoring Model

1.5. Implementation QoS with HTB

The algorithm can be implemented on routers, namely the which functions to regulate the distribution of bandwidth hierarchically which is divided into network classes to make it easier to manage. This method allows easy management so that all network users can be well controlled.

Hierarchical Token Bucket (HTB) is a packet scheduling technique that is often used for Linux-based routers such as the Mikrotik Router Operating System (Router OS).[6] The way HTB works is no different from its predecessor, namely CBQ, only the General Scheduler HTB uses the Deficit Round Robin (DRR) mechanism and in the feedback block, the HTB Estimator does not use the Exponential Weighted Moving Average (EWMA) but the Token Bucket Filter (TBF).[7]

In HTB there is a ceil parameter so that the class will always get the bandwidth between the base link and the ceil link value. This parameter can be considered as a second estimator, so that each class can borrow bandwidth as long as the total bandwidth obtained has a value below the ceil value. This is easy to implement by not allowing bandwidth borrowing once the class has gone beyond this link (both leaves and interiors can have ceils). As a note, if the ceil value is the same as the base link value, it will have the same function as the bounded parameter in CBQ, where classes are not allowed to borrow bandwidth. Meanwhile, if the ceil value is set to unlimited or with a higher value such as the link speed you have, you will get the same function as the nonbounded class [13].

The implementation of QoS (Quality of Services) at Mikrotik relies a lot on the HTB (Hierarchical Token Bucket) system. HTB allows us to make queues more structured, by performing multilevel groupings. What many do not realize is, if we don't implement HTB on Queue (both Simple Queue and Queue Tree), it turns out that there are some parameters

that don't work as we want. Some parameters that don't work are priority, and dual imitation (CIR / MIR). [6]

To make monitoring and verification easier, we will use a queue tree. The easiest way to queue with a queue tree, is to specify the following parameters:

- parent (which must be filled with outgoing-interface),
- packet-mark (must be created first in ip-firewall-mangle),
- max-limit (which is the maximum speed limit), also known as MIR (Maximum Information Rate)

2. METHOD

The research design used was in the form of Pretest – Post-test Design with one type of treatment which is one of the simplest research methods to test the effectiveness of the intervention in the experiment.[8]



Figure 2. Pretest-Posttest Research Design

The pretest was carried out at the beginning after the router installation and physical network management in the Unimus Computer Center Laboratory were completed, and it was confirmed that the network could be used but the new router was given user access rights, the HTB QoS rule had not been implemented. The test is carried out on the user's bandwidth access in using the internet for a certain period of time.

Treatment is the implementation of HTB QoS on the router by applying rules for all users to be served on the Unimus Computer Center Laboratory computer network.

The posttest is carried out on the user's bandwidth access after the HTB QoS is applied to the router in using the internet for a certain period of time.

3. RESULT

Network model in The Integrated Computer Laboratory Unimus is shown in Figure 3.

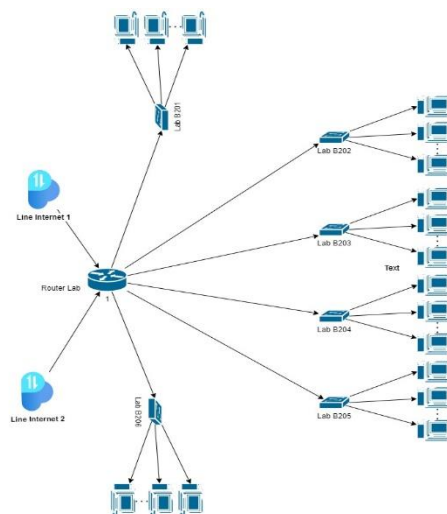


Figure 3. Network Model in The Integrated Computer Laboratory Unimus

The laboratory computer network is made separately for each laboratory room. There are 6 (six) laboratory rooms, namely Laboratories B201, B202, B203, B294, B295, and B206, each of which is a Local Area Network (LAN) network with a subnet of /26 (255.255.255.192).

Laboratories B201, B202m and B205 each with a capacity of 50 computers get a maximum bandwidth limit of 60mbps, while Laboratories B204, B205, and B206 each have 30 computers that get a bandwidth of 40 mbps. Each user gets a maximum limit of 2 mbps and a minimum of 500 kbps.

To facilitate monitoring of internet bandwidth usage in each laboratory, a monitoring dashboard is created using Mikrotik Dude as shown in Figure 4. After the QoS-HTB has been carried out on each laboratory network, the bandwidth usage is monitored, especially when the load is full (the laboratory is used). The priority for each user is the same as priority 8, so that each user has the same opportunity to use bandwidth in each laboratory. Further monitoring is carried out with the following monitoring results.

The image above shows that in one laboratory with a capacity of 50 (fifty) workstations (Lab B203) with a maximum capacity of 60 mbps when all computers are used for internet access, the average upload bandwidth usage is 13.9 mbps and download is 41, 6 mbps. With each user the maximum upload/download average is 2 mbps and a minimum of 0.5 mbps. At that time Python online programming.

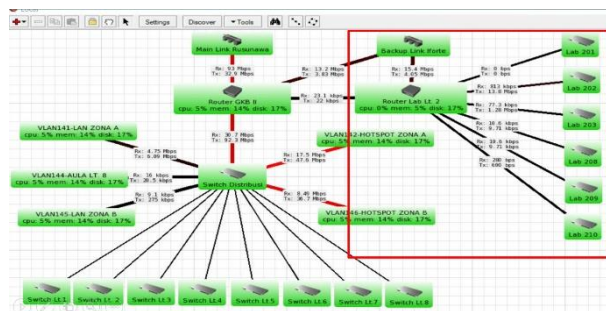


Figure 4. Network dashboard monitoring bandwidth model

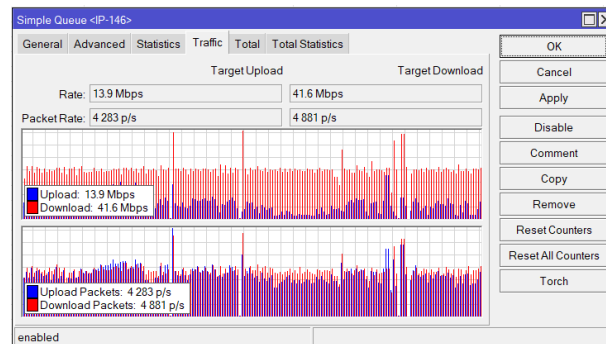


Figure 5. Bandwidth usage in Lab B203 with a maximum of 60 mbps

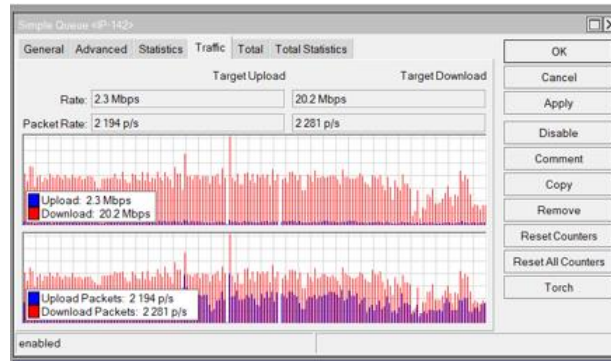


Figure 6. Bandwidth usage in Lab B209 with a maximum of 40 mbps

The picture above shows that in one laboratory with a capacity of 30 (thirty) workstations (Lab B209) with a maximum capacity of 40 mbps when all computers are used for internet access, the average upload bandwidth usage is 2.3 mbps and download is 20, 2 mbps. With each user, the average maximum upload/download is 2 mbps and a minimum of 0.5 mbps. The current use is reference access and another internet usage.

The results showed that at full load each work station smoothly used the internet with a maximum access limitation of 2 mbps download and 2 mbps upload. Laboratories with a capacity of 30 computers have access restrictions of 40 mbps, and laboratories with a capacity of 50 computers have access restrictions of 60 mbps. This is adjusted to the QoS-HTB method and the observation that at full load bandwidth in each laboratory used is as much as 30-50%, the restrictions given to each laboratory above have met the access needs of their users with an excess of 10% of the full load required. occur.

4. CONCLUSION

The implementation of this model, the QoS-HTB model, is an effective choice in bandwidth management in the Unimus integrated computer laboratory. However, in this study, the use of QoS-HTB in the laboratory has not been monitored for access to image processing and artificial intelligent programming, which of course requires higher bandwidth

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