



# Implementation of Bandwidth Management Using Queue Tree at SMK Cipta Karya Bekasi

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## ABSTRACT

Internet usage such as browsing information and downloading data at the Cipta Karya Vocational School in Bekasi City with the use of a computer lab, administrative office and teacher's room when used simultaneously, there is an inappropriate tug of war for bandwidth, so that the bandwidth allocation used is not optimal in its use, thus making administrative activities and teaching and learning activities are not going well, with the quality of service applied to bandwidth management this will make users use the internet to the maximum and there is no waste of bandwidth, then bandwidth management limits at SMK Cipta Karya Bekasi City are needed so that each part has a bandwidth of each so that there is no tug of war between the bandwidths, if used together, for its implementation, a Mikrotik router device is needed. By using a queue tree configuration on a proxy router with a queue tree configuration that can limit bandwidth by splitting each upload and download packet, the priority distribution can be more efficient in the selection of the packet. By using the queue tree configuration, the ideal bandwidth limit is applied at SMK Cipta Karya, Bekasi city.

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## 1. Introduction

The existence of the internet today provides convenience and benefits in several ways from the fields of education, business, community and others. With the internet network, users can exchange information, store data, retrieve data, and send data easily and quickly using only hyperlinks.

As an educational institution for the Cipta Karya Vocational High School (SMK) in Bekasi City, the existence of the internet is very important. The number of users who use the internet and the amount of available bandwidth has a significant effect on its efficiency. At SMK Cipta Karya Bekasi City, the total available bandwidth allocation is 50 Mbps which is used for the Computer Laboratory, administration and teachers, often the internet network has problems when users use excessive bandwidth to download or upload data, due to the absence of bandwidth management for each users, this is complained by some teachers and students when using the internet.

The use of bandwidth at SMK Cipta Karya Bekasi City has not been evenly distributed because the network conditions use a star topology where all users are connected to the switch, the more users connected to the internet through the switch, the smaller the bandwidth capacity that users can get. This can cause the internet connection for each user to be slower and slower. Optimal use of bandwidth requires a network technology facility known as a mikrotik router.

The use of bandwidth on the internet network is currently still very rarely used optimally. This can be attributed to the relatively low bandwidth capacity for internet users, whether they use it for browsing or for downloading or uploading files. Queue Tree has the ability to perform more complex functions in terms of bandwidth limitations on the microcontroller, enabling better performance by using packet tagging. It is used to reduce the speed of a single connection, whether it is a download or an upload.[1]

The problem that will arise on internet networks that do not use bandwidth efficiently is that each client connected to the network will receive a different amount of bandwidth, as well as higher data transmission speeds, resulting in lower data transmission speeds.[2]



In order to obtain stable access with increased bandwidth for each client computer, it is important to implement appropriate protocols for storing and retrieving data across the network. The problem that often occurs is that there is no bandwidth limitation, what happens is the difference in speed between one user and another.[3]

To overcome the problem of receiving bandwidth at the same time or in the same amount without using the bandwidth of other users, a method called "Bandwidth Management Using Queue Trees at SMK Cipta Karya Kota Bekasi" must be applied. computer unit in order to maximize the use of the internet.

## 2. Literature Review

Queue tree method is one of the popular bandwidth management methods for Mikrotik users, because it has very accurate optimization. After the application of the queue tree method, bandwidth management is very optimal. Bandwidth tests performed on the client show a very good connection. [4]

Bandwidth management design, Testing using the queue tree method was also successfully carried out according to the configuration. That is, if the download limit has been met, the user's bandwidth will be reduced according to the configuration. With the queue tree method, it is said to be sufficient to fulfill bandwidth management when the client is active, the internet bandwidth is automatically divided evenly according to the existing bandwidth allocation, and the network becomes stable.[5]

The application of bandwidth management with the queue tree method makes network traffic stable because bandwidth is evenly distributed, and can allocate bandwidth with network priorities and uses, both for download speed and upload speed so that network usage does not attract each other's existing bandwidth. [6]

A computer network is defined as a group of computers (more than one) that are connected to one another using certain media so that it is possible between these computers to interact, exchange data, and share common equipment.[7]

computer networks are divided into several types of networks, which separate based on transmission and based on geography.[8]

computer network by function Client-server network connecting (host) that runs as a server that provides services with a machine that acts as a client requesting and obtaining services or using the facilities provided by the server. The dedicated server acts as a provider server to the workstations and the server cannot act as a workstation in a client-server network. [9]

Peer-to-peer (P2P) computer network is a computer network consisting of two or more computers, where computers in this network environment can share with each other. In other words, you don't need a hub or switch to set up a peer-to-peer network for two computers. As a hint, all you need is one UTP cable connected to each computer's network card.

The most important feature of this network system is the sharing of resources and services, such as shared use of software, data, and printer sharing.[10]

Network management is the ability to monitor, control, and plan the resources and components of a computer system and network in one location. The International\Organization for Standardization (ISO) ISO/IEC number 10040:1998 on Information Technology, Open Systems Interconnection (OSI) and Management System Overview, defines a conceptual model of FCAPS (ISO, 1998). [11]

Mikrotik RouterOS is an operating system that is intended as a network router. Mikrotik routerOS itself is an operating system and software that can make ordinary computers into reliable network routers. Mikrotik Router is a hardware (hardware) router made by Mikrotik that runs the RouterOS system.[12]

Hierarchical Token Bucket (HTB) is a method that serves to regulate the distribution of bandwidth. The division uses a hierarchy that is divided into classes, makes it easier to manage bandwidth appropriately, and maximizes its use.[13]

Class Based Queuing is a queuing discipline technique that is used to group data packets and allow bandwidth sharing between groups that have a user interface. CBQ manages the bandwidth usage given to each user, bandwidth usage that exceeds the set value will be deducted, the advantage of link sharing can provide unused bandwidth for its leaf class before it is given to other agencies.[14]

Random Early Detection is a queue management mechanism to use to avoid full buffers. The process is carried out using the min thresh and max thresh parameters.[15]

The main function of the transport layer is to pass data to the network layer, ensure that all the pieces of



data can arrive at the other side correctly, receive data from the session layer, break the data into smaller parts, pass the data to the network layer. The above is done efficiently with the aim of protecting the layer part from hardware changes. In normal operation, the transport layer creates a unique network connection for each transport connection required by the session layer.[16]

TCP / IP is a data communication used in the process of transferring data from one computer to another. TCP / IP is an open network is independent in the transport on the physical network used, anywhere. This protocol uses a simple addressing scheme known as an IP address (IP Address) which allows many computers to be able to communicate with each other on the Internet. This protocol is also routable, which means it is suitable for forming heterogeneous networks. In the TCP/IP model, there are four layers that each have their own functionality, namely: Physical Layer, Network Access, Internet Layer, Transport Layer, and Application Layer. [17]

Subnetting adalah teknik untuk membagi jaringan menjadi banyak subnetwork yang lebih kecil. IP Address kelas A, IP Address kelas B, dan IP Address kelas C dapat digunakan untuk subnetting.. Subnetting akan membuat lebih banyak jaringan, tetapi juga akan membatasi jumlah host yang dapat ditemukan di setiap jaringan.[18]

### 3. Implementation Methods

The sequence of research from the implementation of bandwidth management at SMK Cipta Karya Bekasi City is as follows:

- a. Needs Analysis  
In this initial stage, a needs analysis is carried out, an analysis of problems that arise, an analysis of user desires and an analysis of the current topology or network.
- b. Design  
Based on the previously collected data, the design process will produce a graphical representation of the network topology to be built.
- c. Testing  
In this testing phase, it aims to see the initial performance of the network to be built and as a consideration before the network will actually be implemented.
- d. Implementation  
At this stage everything that has been planned and designed will be implemented in advance. The stages of implementing this implementation are very decisive stages of the success or failure of the project to be built.

### 4. Network Design

#### 4.1 Skema Jaringan

Pada rancangan jaringan usulan ini untuk mengimplementasikan Mikrotik Routerboard untuk mengkonfigurasi manajemen bandwidth menggunakan metode queue tree. Mikrotik akan terpasang di router tersambung dengan menggunakan port 1, port 2 terhubung untuk switch lab komputer dan port 3 terhubung dengan switch kantor. Untuk port 2 yang terhubung dengan switch lab.

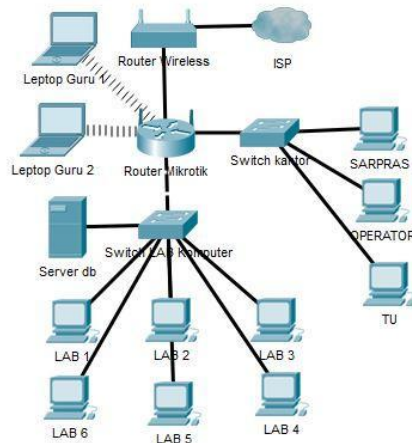


Fig 1 Suggested network scheme

#### 4.2 Application Design

In this case, to implement the Queue Tree bandwidth management configuration using the Mikrotik Router RB951Ui-2HnD.

For the implementation of bandwidth management in the computer lab of SMK Cipta Karya, Bekasi, the author makes a bandwidth division from 50 Mbps to 6 Mbps specifically for the computer lab while the remaining bandwidth is used for the administrative office and teacher's room.

The author uses Winbox software to configure the proxy router while the winbox that the author uses is WinBox V6.48.1 there are several configurations that are carried out to manage bandwidth with a mikrotik router::

- a. Connecting the proxy to the internet, the author uses a DHCP Client on port 1 of the proxy router that is connected to the ISP router.
- b. Making an IP Address on the proxy router port 2 for the computer Lab local network using Static IP with IP Network 192.168.2.0/24.
- c. Create a Marking Connection for the user by:
  - 1) On the general tab
    - a) Chain : prerouting
    - b) Src. Address : 192.168.2.1 (adjusted to the IP User that will be used)
    - c) In. Interface : ether2
  - 2) Pada tab Action
    - a) Action : mark connection
    - b) New Connection Mark: Client-1- Connection i (According to the IP used by the client)

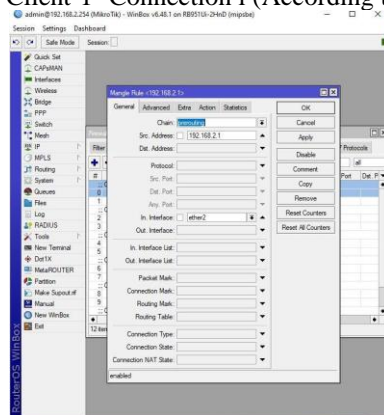
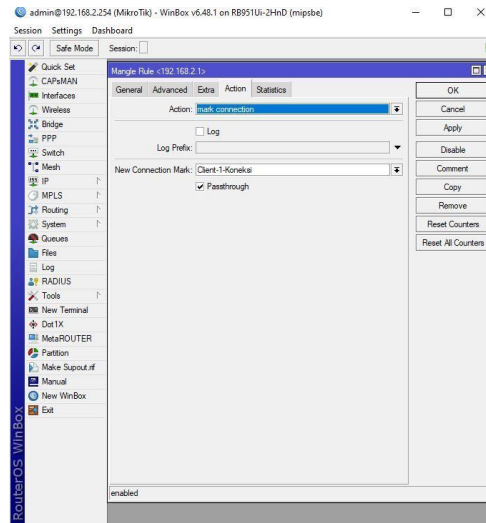
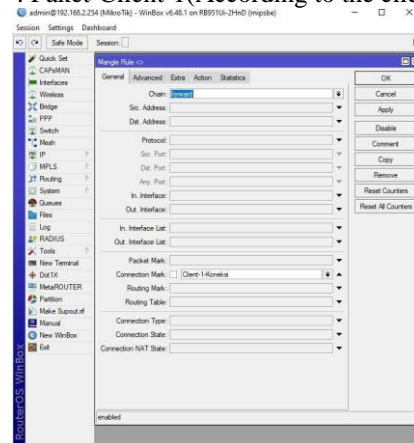


Fig 2 Configure General Mangle Mark Connection

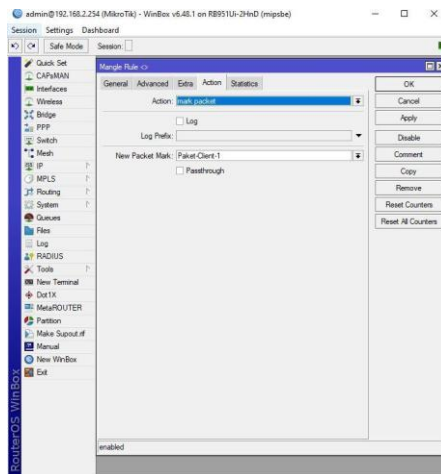


**Fig 1** Configure Action Mangle Mark Connection

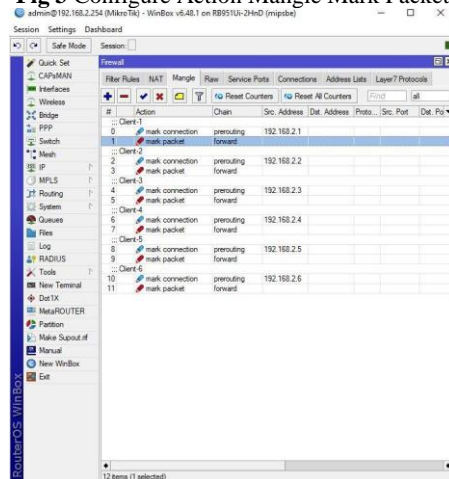
- d. Make a Marking Packet by :
- 1) On the general tab menu
    - a) Chain : forward
    - b) Connection Mark : Client-1-Connection (adjusted with the connection mark on the client that has been created)
  - 2) On the action menu
    - 1) Action : mark packet
    - 2) New packet mart : Paket-Client-1 (According to the client packet that has been made)



**Fig 2** General Mangle Mark Packet Configuration



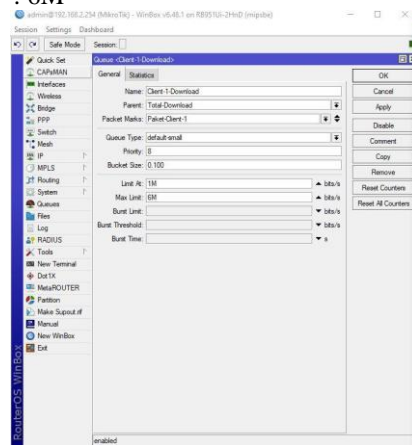
**Fig 3** Configure Action Mangle Mark Packet



**Fig 4** Mangle Mark Connection and Packet Configuration results

e. Create a Total Downloaded Queue Tree:

- 1) On the general tab menu
  - a) Name : Total download
  - b) Parent : ether2
  - c) Max Limite : 6M



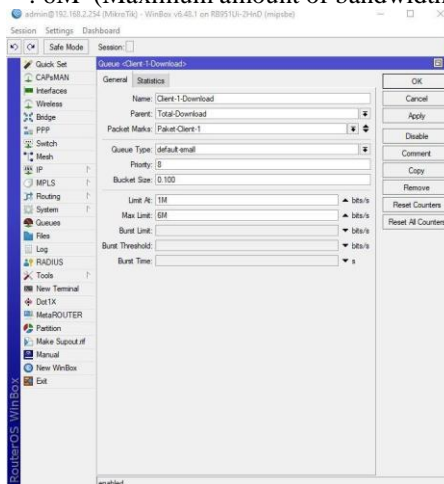
**Fig 5** Configure Queue Tree Total Download

f. Create Queue Tree for User Total Download

- 1) On the general tab menu



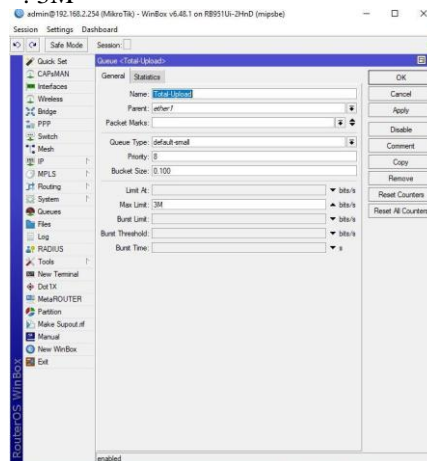
- a) Nama : Client-1-Download
- b) Parent : Total-Download
- c) Packet Marks : Paket-Client-1
- d) Limit At : 1M (Minimum amount of bandwidth that can be used by the user)
- e) Max Limit : 6M (Maximum amount of bandwidth that can be used by the user)



**Fig 6** Configure Queue Tree Total Download User

g. Create a Total Upload Queue Tree:

- 1) On the general tab menu
  - a) Name : Total Upload
  - b) Parent : ether1
  - c) Max Limite : 3M



**Fig 7** Configure Queue Tree Total Upload

h. Create a Queue Tree for User Total Upload

- 1) On the general tab menu
  - a) Nama : Client-1-Upload
  - b) Parent : Total-Upload
  - c) Packet Marks : Paket-Client-1
  - d) Limit At : 512k (Minimum amount of bandwidth that can be used by the user)
  - e) Max Limit : 3M (Maximum amount of bandwidth that can be used by the user)

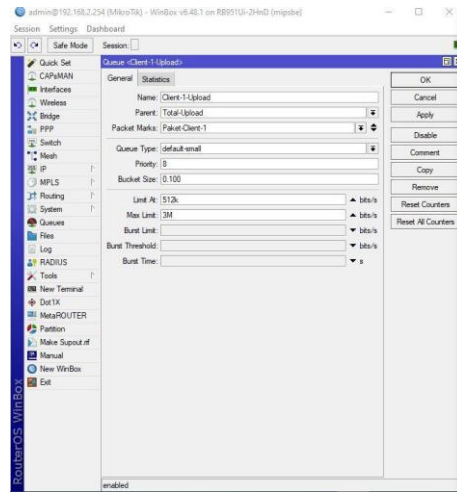


Fig 8 Configure Queue Tree Total Upload User

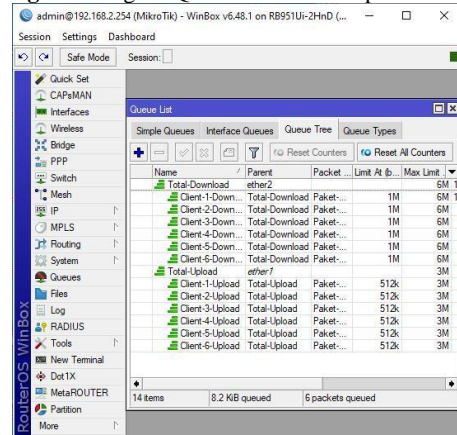


Fig 9 Configuring Queue Tree Total Download and Upload

### 4.3 Network Testing

To check bandwidth management with 6 users downloading files simultaneously with bandwidth

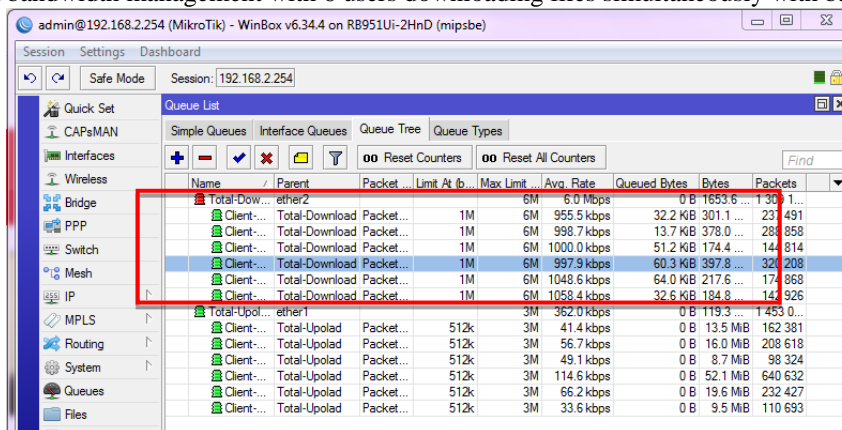


Fig 12 Checking Client 6 User Bandwidth Configuration

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