

MIKROTIK ADVANCE TRAFFIC CONTROL

HTB (Hierarchical Token Bucket)

Queue Tree-System

Mikrotik user Meeting
Jakarta, Indonesia(2016)

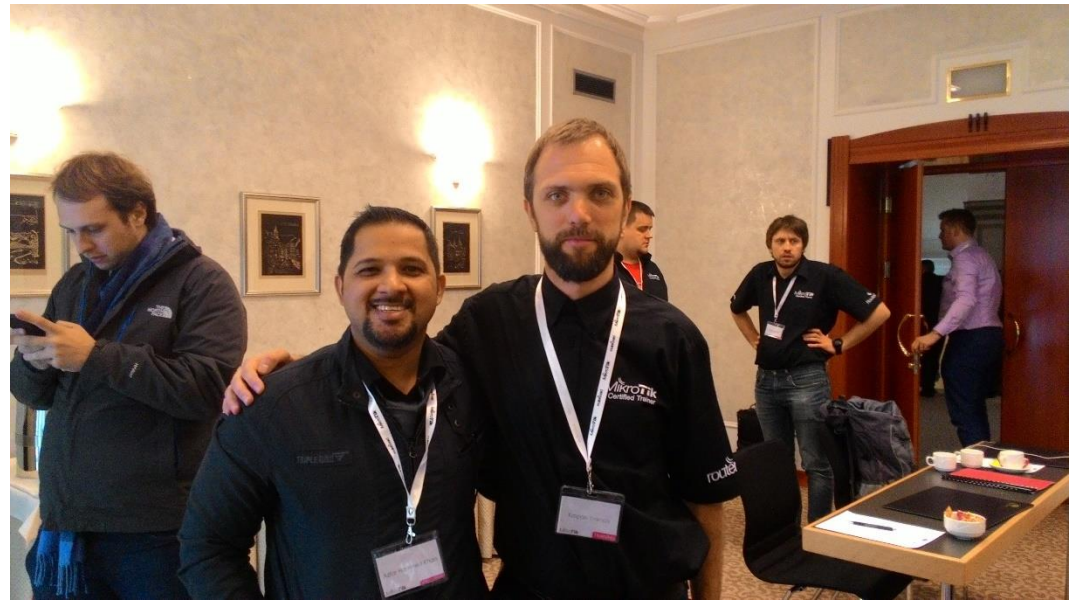

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**Prepared by,
Azfar Hameed Khan**





MOTIF & TUJUAN:

- **Seperti kita tau bandwidth itu mahal, khususnya di daerah-daerah Terpencil dan di Negara-Negara yang sedang berkembang.**
- **Kebanyakan pelanggan memulai nonton youtube di format High definition (HD). Era 4K telah mulai.**
- **Cara cerdas dibutuhkan untuk alokasi bandwidth.**

SMART TV'S & SMART HOMES



WARNING!
TRAFFIC CONTROLERS.
SMART TV AHEAD



DO YOU LIKE SMART TV'S ?



APA YANG TERJADI PADA SAAT KITA NONTON YOUTUBE?

A screenshot of a web browser displaying a YouTube video. The browser's address bar shows the URL <https://www.youtube.com/watch?v=jlQVAlmXqoE>. The YouTube interface includes a search bar with the text "sambalado ayu ting ting". The video player shows a paused video of Ayu Ting Ting with a subtitle "But Bitten". A quality menu is open on the right, showing options from 144p to 1080p. Below the video, the title "Ayu Ting Ting - Sambalado [Official Music Video]" is displayed, along with the channel name "HITS Records" and a subscriber count of 239,424. The video has 47,071,353 views. The right sidebar features an advertisement for Holiday Inn Express and a list of "Up next" videos, including "Ayu Ting Ting - Geboy Mujair [Official Music Video]" and "Mix - Ayu Ting Ting - Sambalado [Official Music Video]".

APA YANG TERJADI PADA SAAT ANDA NONTON YOUTUBE?

DENGAN RESOLUSI.....240 P

Session Settings Dashboard

Session: 10.10.11.2:8292

Uptime: 4d 04:35:08 Memory: 1471.1 MB CPU: 2% Date: Sep/17/2016 Time: 02:07:13

Quick Set

CAPsMAN

Interfaces

Wireless

Bridge

PPP

Switch

Mesh

IP

IPv6

MPLS

Routing

System

Queues

Interface List

Interface

Interface List

Ethernet

EoIP Tunnel

IP Tunnel

GRE Tunnel

VLAN

VRRP

Bonding

LTE

Find

Name	Type	Actual MTU	L2 MTU	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)
ether1_ihome_official	Ethernet	1500	1598	1850.5 kbps	2.3 Mbps	296	
ether2_Latihan_anak_PKL	Ethernet	1500	1598	0 bps	0 bps	0	

Queue List

Simple Queues

Interface Queues

Queue Tree

Queue Types

Reset Counters

Reset All Counters

Find

#	Name	Target	Upload Max Limit	Download Max Limit	Packet Marks	Upload	Download	Total Max Limit (bps)
0	MY_PC	192.168.101.248	10M	100M		5.6 kbps	143.9 kbps	

APA YANG TERJADI PADA SAAT ANDA NONTON YOUTUBE?

DENGAN RESOLUSI.....240 P

The screenshot shows the MikroTik WinBox interface. The top bar displays session information: Session: 10.10.11.2:8292, Uptime: 4d 04:39:21, Memory: 1471.1 MiB, CPU: 1%, Date: Sep/17/2016, Time: 02:11:27. The left sidebar contains a menu with options like Quick Set, CAPsMAN, Interfaces, Wireless, Bridge, PPP, Switch, Mesh, IP, IPv6, MPLS, Routing, System, Queues, Files, Log, Radius, Tools, New Terminal, and MetaROUTER. The main window is divided into two panes. The top pane, titled 'Interface List', shows a table of network interfaces. The bottom pane, titled 'Queue List', shows a table of queue settings. A red circle highlights the 'Upload' and 'Download' columns in the Queue List table, and a red arrow points upwards from below the table.

Name	Type	Actual MTU	L2 MTU	Tx	Rx	Tx Packet (p/s)	Rx
ether1_home_official	Ethernet	1500	1598	1267.9 kbps	4.3 Mbps	344	
ether2_Latihan_anak_PKL	Ethernet	1500	1598	0 bps	0 bps	0	

#	Name	Target	Upload Max Limit	Download Max Limit	Packet Marks	Upload	Download	Total Max Limit (pi...
0	MY_PC	192.168.101.248	10M	100M		128.3 kbps	3.8 Mbps	

APA YANG TERJADI PADA SAAT ANDA NONTON YOUTUBE?

DENGAN RESOLUSI.....240 P

The screenshot shows the MikroTik WinBox interface. The top bar displays session information: Session: 10.10.11.2:8292, Uptime: 4d 04:43:56, Memory: 1471.1 MiB, CPU: 4%, Date: Sep/17/2016, Time: 02:16. The left sidebar contains various configuration menus. The main window is divided into two sections: 'Interface List' and 'Queue List'.

Interface List

Interface	Name	Type	Actual MTU	L2 MTU	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)
R	ether1_1home_official	Ethernet	1500	1598	2.9 Mbps	34.1 Mbps	1 761	0
R	ether2_Latihan_anak_PKL	Ethernet	1500	1598	0 bps	0 bps	0	0

Queue List

#	Name	Target	Upload Max Limit	Download Max Limit	Packet Marks	Upload	Download	Total Max Limit (pi...
0	MY_PC	192.168.101.248	10M	100M		585.7 kbps	18.2 Mbps	

A red circle highlights the 'Upload' and 'Download' columns in the Queue List, and a red arrow points to them.

APA YANG TERJADI PADA SAAT ANDA NONTON YOUTUBE?

DENGAN RESOLUSI.....1080 P

The screenshot shows the Mikrotik WinBox interface. The top bar indicates the session is '10.10.11.2:8292' with system stats: Uptime: 4d 04:51:12, Memory: 1471.0 MiB, CPU: 19%, Date: Sep/17/2016, Time: 02:23. The left sidebar contains various configuration menus. The main window displays the 'Queue List' configuration for the 'MY_PC' profile. The table below shows the configured limits:

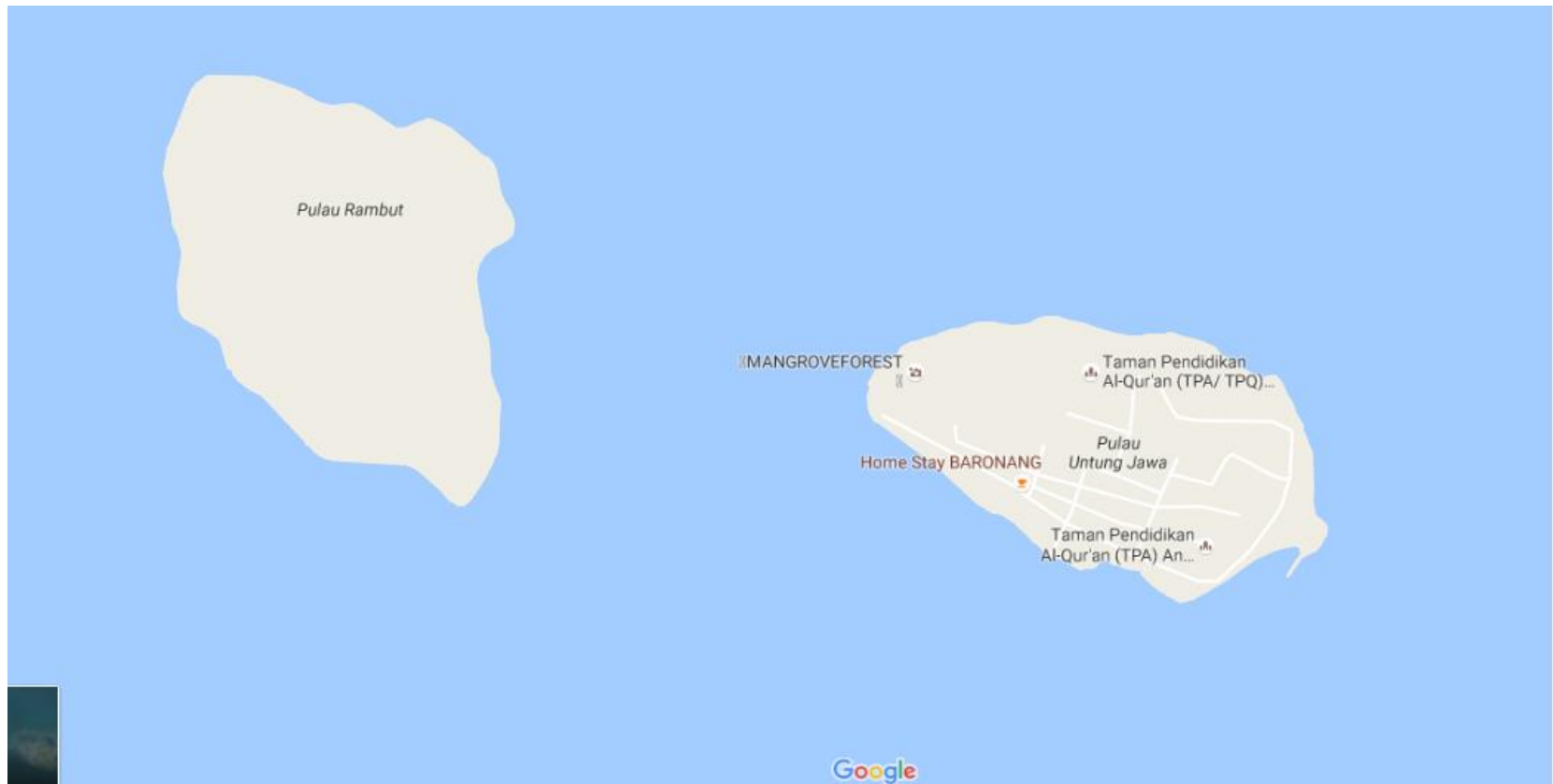
#	Name	Target	Upload Max Limit	Download Max Limit	Packet Marks	Upload	Download	Total Max Limit (bi...
0	MY_PC	192.168.101.248	10M	100M		2.2 Mbps	80.2 Mbps	

KITA BISA BAYANGKAN APA YANG AKAN TERJADI KALAU SAYA PILIH 4K?

SKENARIO



SKENARIO



SKENARIO



PILIHAN UNTUK MENGATUR BANDWIDTH

- **SIMPLE QUEUES**
 - **SEDERHANA UNTUK DI IMPLEMENTASIKAN**
 - **BAGUS UNTUK PEMULA**
 - **DENGAN PERKEMBANGAN DI DUNIA JARINGAN, SIMPLE QUEUE IKUT BERKEMBANG DAN MEMEILIKI BANYAK FITUR FITUR BARU**
 - **DI VERSI 6 SIMPLE QUEUE MEMILIKI HASHING SYSTEM YANG LEBIH EFFISIEN**
- **HTB – QUEUE TREE**
 - **ADVANCE BANDWIDTH MANAGEMENT (LEBIH ADVANCE)**
 - **MEMPUNYAI PILIHAN LEBIH BANYAK UNTUK PENGATURAN BANDWIDTH**

HTB-Queue Tree EXAMPLE

Queue List							
Simple Queues Interface Queues Queue Tree Queue Types + - ✓ ✗ 📁 🔍 00 Reset Counters 00 Reset All Counters Find							
Name	Parent	Packet Marks	Priority	Limit At...	Max Limit...	Avg. Rate	
📁 TOTAL DOWNLOAD	wlan1		8		5M	5.0 Mbps	
📁 THE BOSS DOWNLOADING	TOTAL DOWNLOAD	THE BOSS's packet	7	1M	2M	1010.2 kbps	
📁 THE OFFICE STAFF DOWNLOADING	TOTAL DOWNLOAD		8		4M	4.0 Mbps	
📁 THE MANAGER DOWNLOADING	THE OFFICE STAFF DOWNL...	THE MANAGER's packet	3	1M	2M	2.0 Mbps	
📁 THE OFFICE BOY DOWNLOADING	THE OFFICE STAFF DOWNL...	THE OFFICE BOY's packet	5	1M	2M	1018.5 kbps	
📁 THE SECRETARY DOWNLOADING	THE OFFICE STAFF DOWNL...	THE SECRETARY's packet	8	1M	2M	1005.9 kbps	
📁 TOTAL UPLOAD	ether2_ISP		8		5M	285.1 kbps	
📁 THE BOSS UPLOADING	TOTAL UPLOAD	THE BOSS's packet	8	1M	2M	61.3 kbps	
📁 THE OFFICE STAFF UPLOADING	TOTAL UPLOAD		8		4M	223.7 kbps	
📁 THE MANAGER UPLOADING	THE OFFICE STAFF UPLOAD...	THE MANAGER's packet	3	1M	2M	102.3 kbps	
📁 THE OFFICE BOY UPLOADING	THE OFFICE STAFF UPLOAD...	THE OFFICE BOY's packet	5	1M	2M	61.9 kbps	
📁 THE SECRETARY UPLOADING	THE OFFICE STAFF UPLOAD...	THE SECRETARY's packet	8	1M	2M	59.4 kbps	
12 items (1 selected) 278.3 KiB queued 193 packets queued							

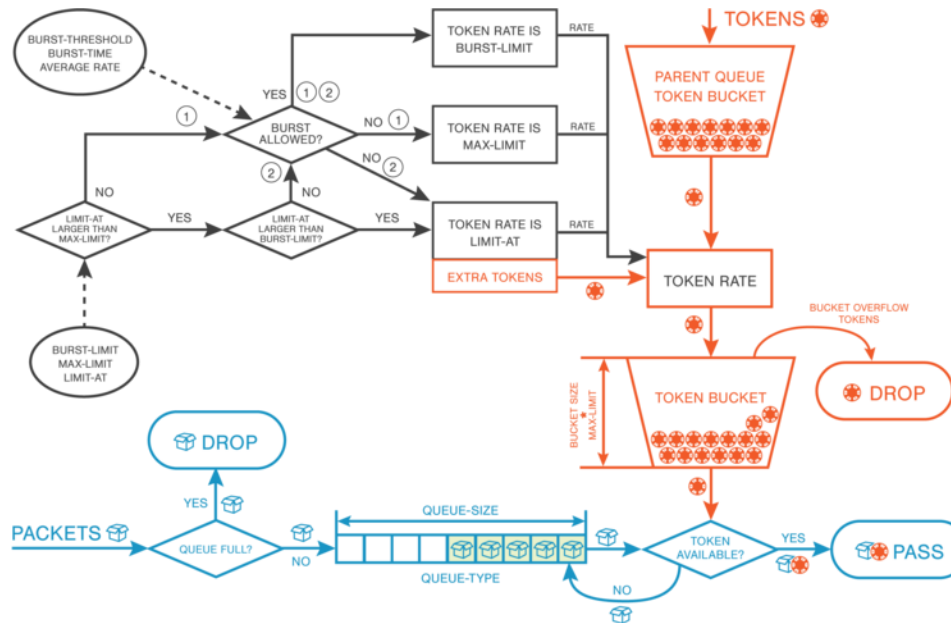
UTAMAKAN TRAFFIC

- Queue Tree

Name	Parent	Packet Marks	Priority	Limit At (bps)	Max Limit	Avg. R...	Queued Bytes	Bytes	Pack
main	global		8	10M	10M	0 bps	0 B	0 B	
background	main	background	8	2M	10M	0 bps	0 B	0 B	
e-mail	main	e-mail	3	4M	10M	0 bps	0 B	0 B	
tcp_sql	main	tcp_sql	2	3M	6M	0 bps	0 B	0 B	
voice	main	voice	1	1M	3M	0 bps	0 B	0 B	

Perkenalan HTB

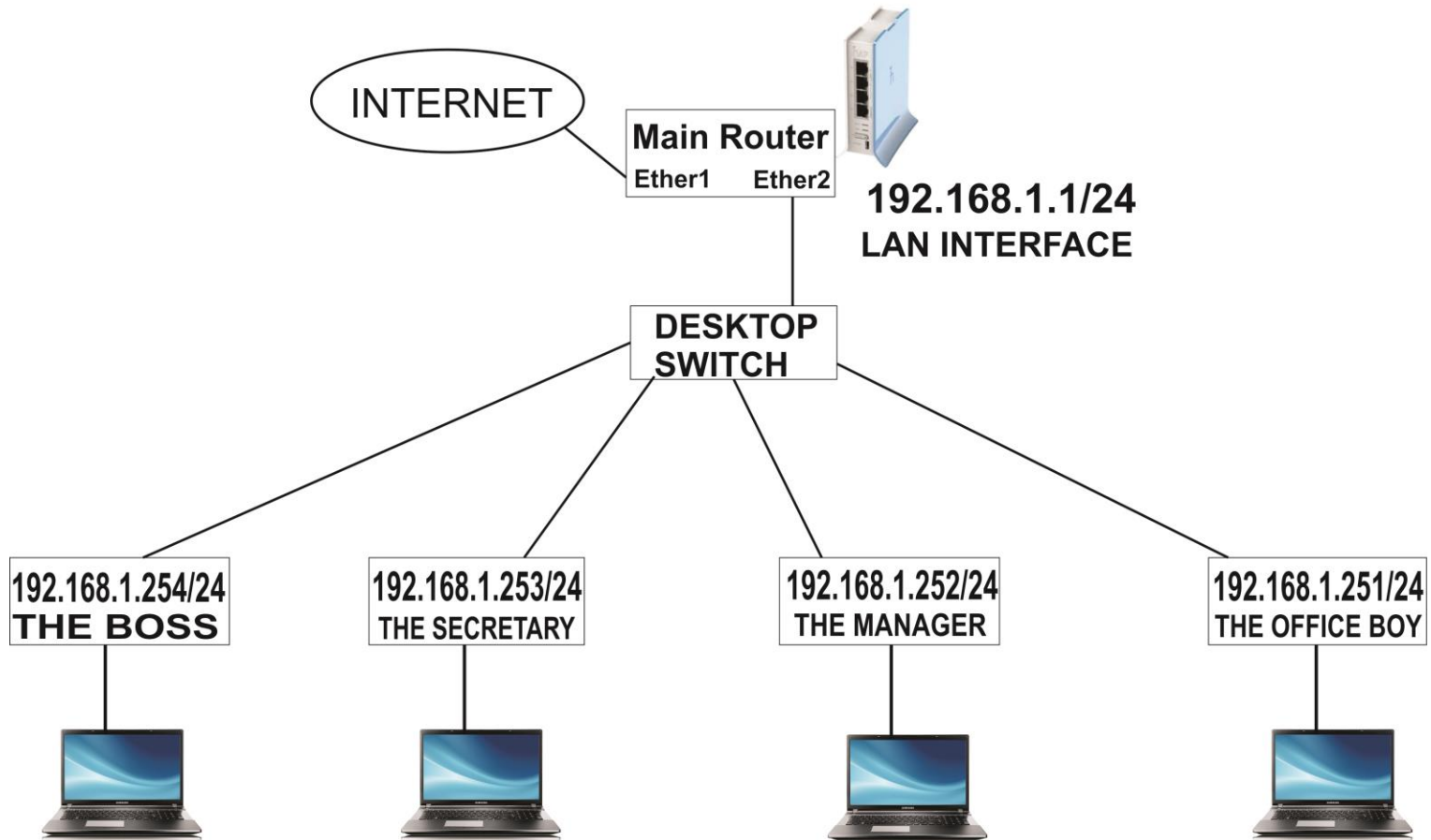
- Apa itu HTB?
- HTB (Hierarchical Token Bucket) adalah metode antrian classful network yang berguna untuk menangani berbagai jenis traffic.



BUCKET SIZE



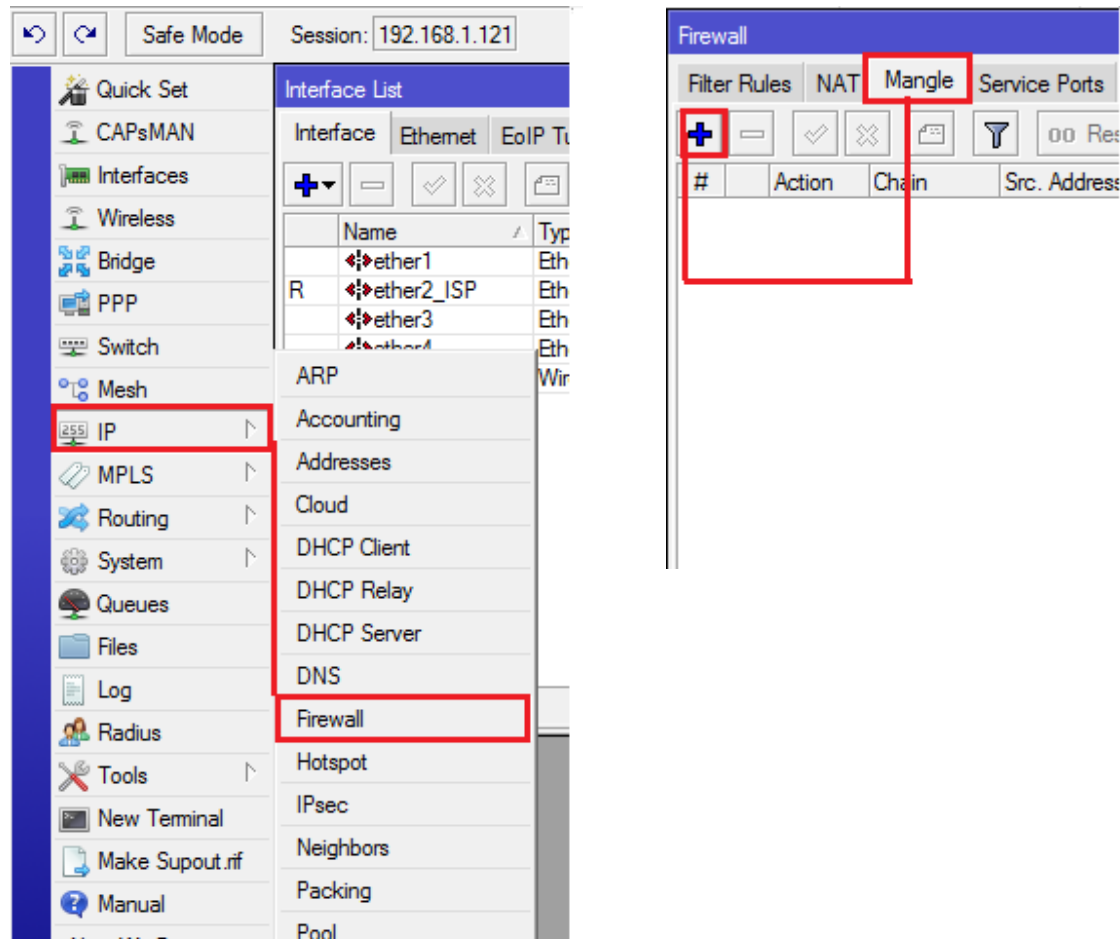
COMMON OFFICE TOPOLOGIES



STEPS TO BE REMEMBERED :

- Before we start make sure that you know your upload and download interfaces.
- 1. Mark Connections
- 2. Mark Packets
- 3. Create an HTB total upload parent queue
- 4. Create an HTB total download parent queue
- 5. Create total Download's child queue
- 6. Create total Upload's child queue

Step 1. Mark Connection Pictorial Explanation.



Step 1-A. Mark Connection Pictorial Explanation.

New Mangle Rule

General Advanced Extra Action Statistics

Chain: forward

Src. Address: ☐ 192.168.1.254 (your Boss's IP address)

Dst. Address:

Protocol:

Src. Port:

Dst. Port:

Any. Port:

P2P:

In. Interface:

OK

Cancel

Apply

Disable

Comment

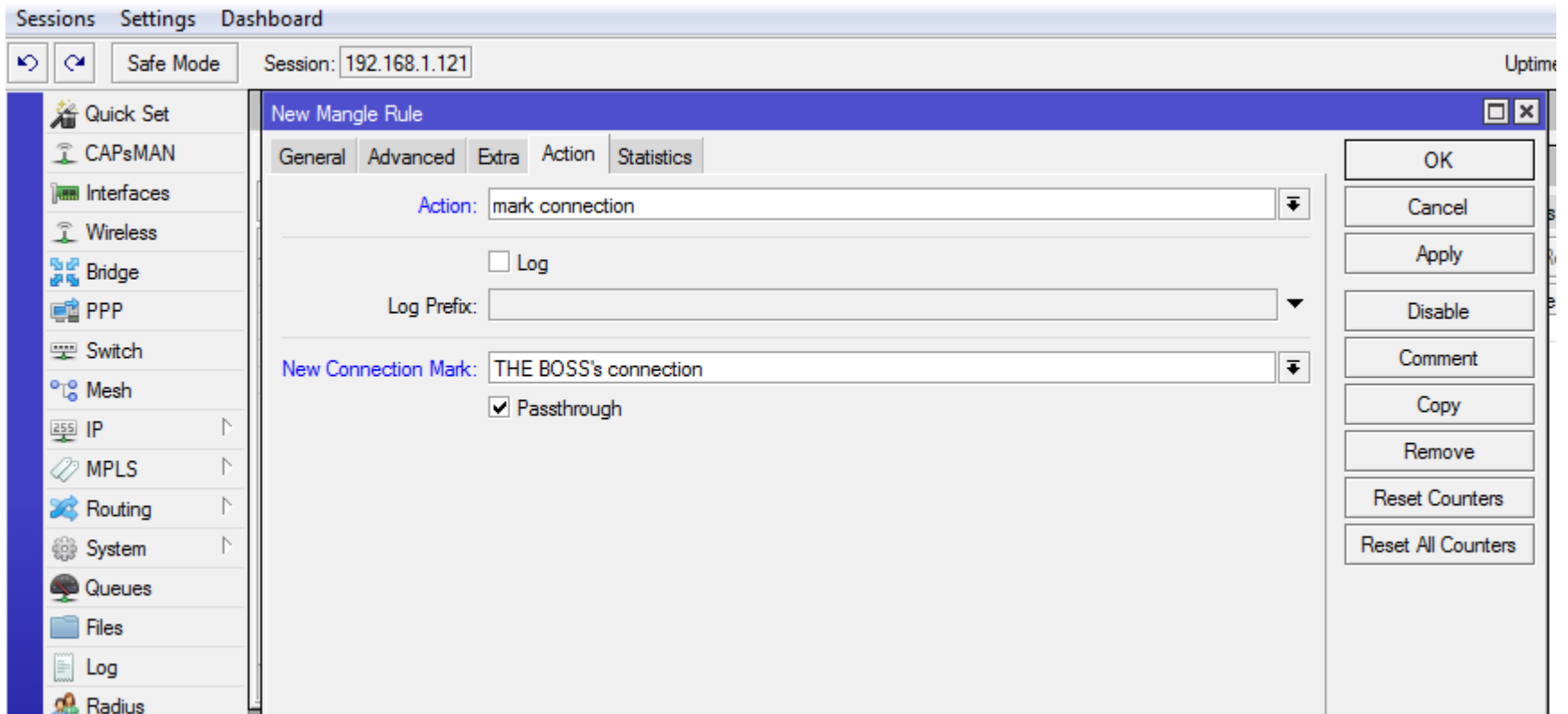
Copy

Remove

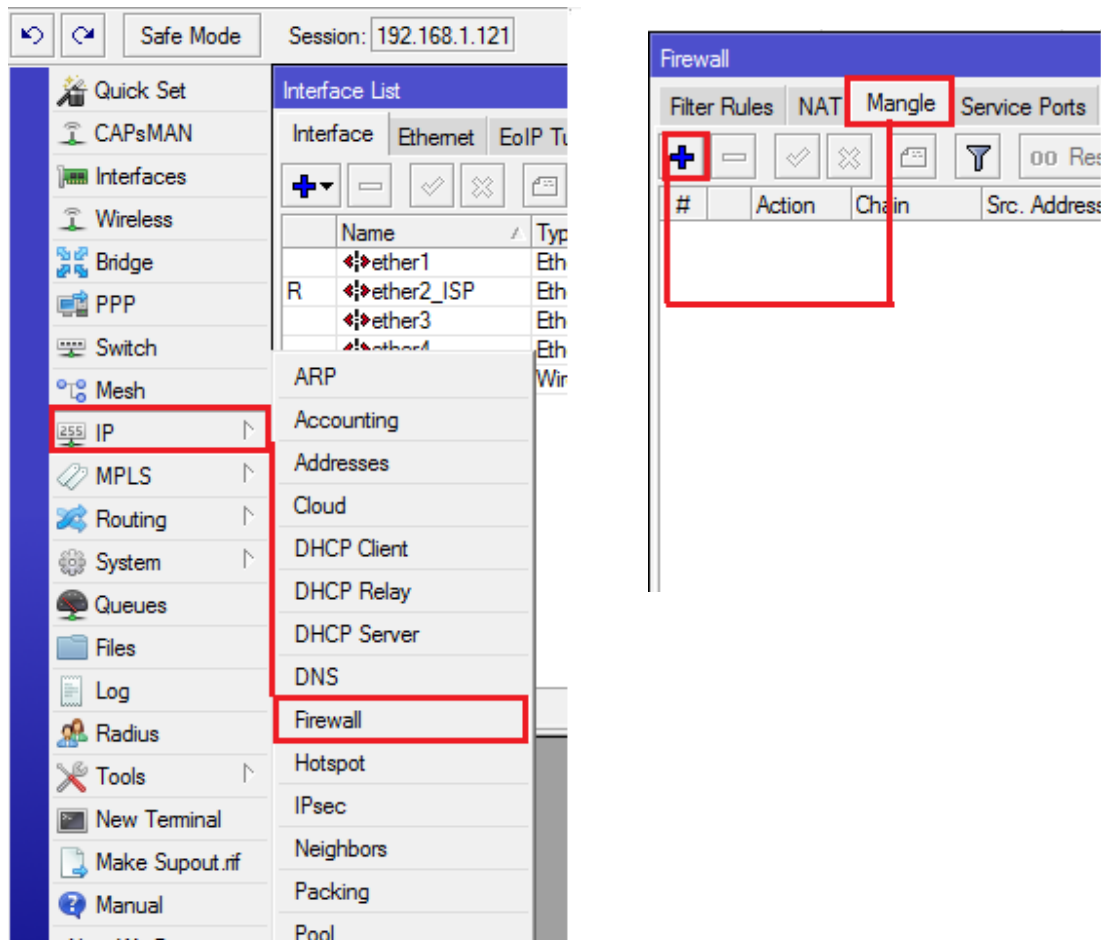
Reset Counters

Reset All Counters

Step 1-B.Mark Connection Pictorial Explanation.



Step 2. Mark Packet Pictorial Explanation.



Step 2-A. Mark Packet Pictorial Explanation.

Mangle Rule <>

General Advanced Extra Action Statistics

Chain: forward

Src. Address:

Dst. Address:

Protocol:

Src. Port:

Dst. Port:

Any. Port:

P2P:

In. Interface:

Out. Interface:

Packet Mark:

Connection Mark: ☐ THE BOSS's connection Don't forget this while marking packets

Routing Mark:

Routing Table:

OK

Cancel

Apply

Disable

Comment

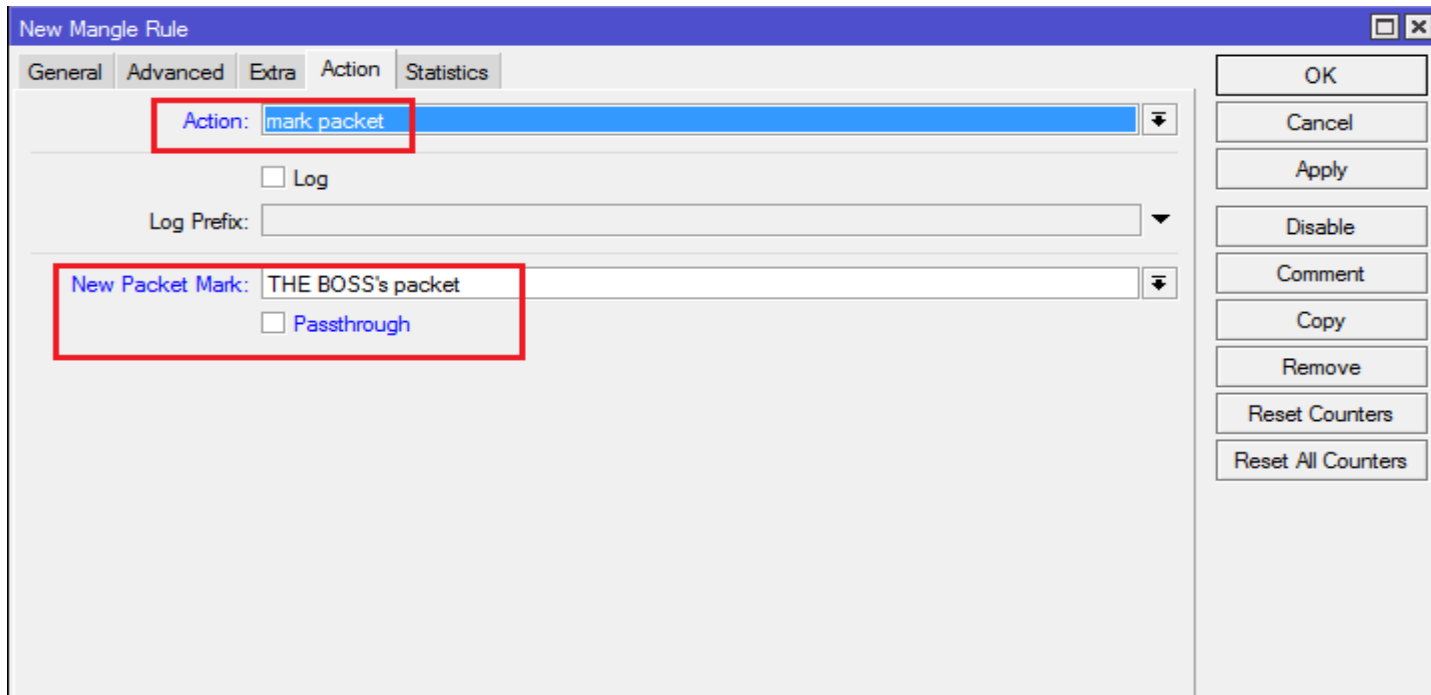
Copy

Remove

Reset Counters

Reset All Counters

Step 2-B. Mark Packet Pictorial Explanation.

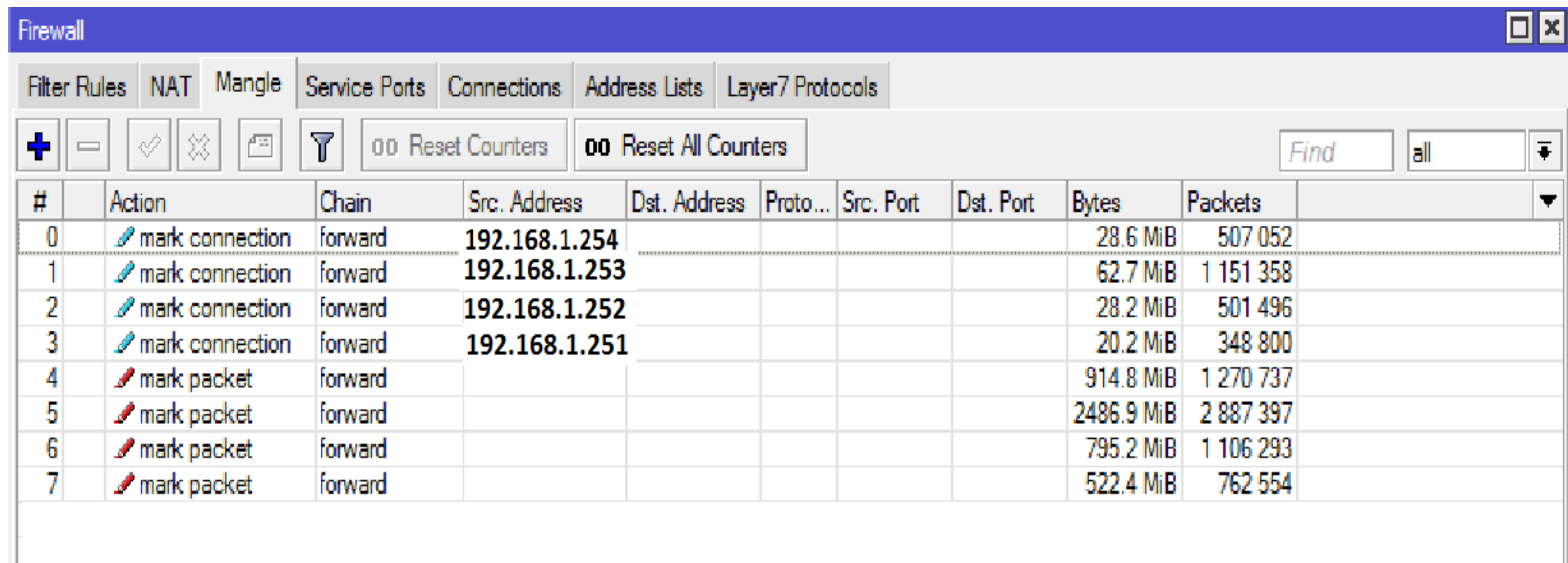


Working mangle winbox view, this is how it should look like.

Firewall											
Filter Rules NAT Mangle Service Ports Connections Address Lists Layer7 Protocols											
      00 Reset Counters 00 Reset All Counters											
#	Action	Chain	Src. Address	Dst. Address	Proto...	Src. Port	Dst. Port	In. Inter...	Out. Int...	Bytes	Packets
0	 mar...	forward	192.168.1.254	THE BOSS						0 B	0
1	 mar...	forward	192.168.1.253	THE SECRETARY						0 B	0
2	 mar...	forward	192.168.1.252	THE MANAGER						0 B	0
3	 mar...	forward	192.168.1.251	THE OFFICE BOY						0 B	0
4	 mar...	forward								0 B	0
5	 mar...	forward								0 B	0
6	 mar...	forward								0 B	0
7	 mar...	forward								0 B	0

PLEASE CHECK

1. Check if the bytes and the packets have started running in their respective columns. (mangle facility)



The screenshot shows the Mikrotik WinBox Firewall configuration window, specifically the Mangle tab. The window has a title bar 'Firewall' and a menu bar with 'Filter Rules', 'NAT', 'Mangle', 'Service Ports', 'Connections', 'Address Lists', and 'Layer7 Protocols'. Below the menu bar is a toolbar with icons for adding, removing, enabling, disabling, and applying rules, along with buttons for 'Reset Counters' and 'Reset All Counters'. A search bar with 'Find' and 'all' is also present. The main area displays a table of mangle rules.

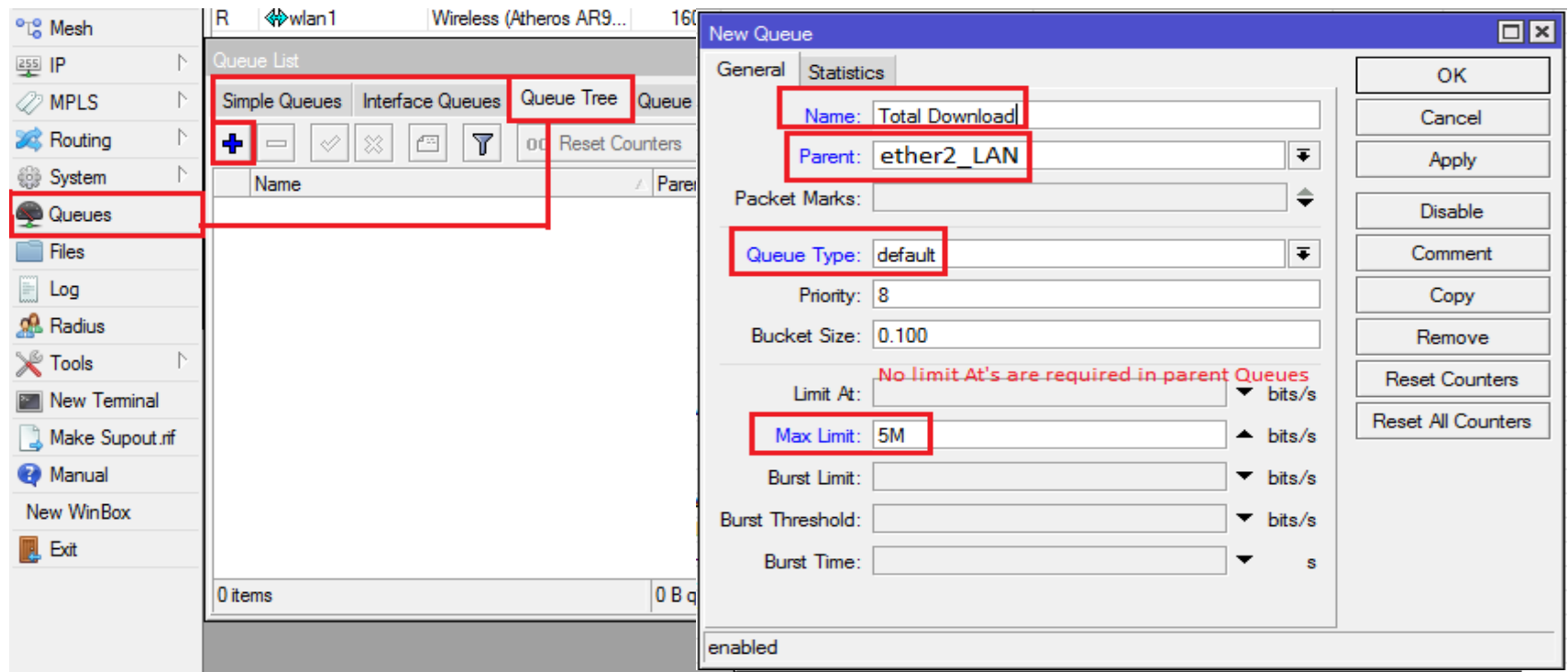
#	Action	Chain	Src. Address	Dst. Address	Proto...	Src. Port	Dst. Port	Bytes	Packets
0	mark connection	forward	192.168.1.254					28.6 MiB	507 052
1	mark connection	forward	192.168.1.253					62.7 MiB	1 151 358
2	mark connection	forward	192.168.1.252					28.2 MiB	501 496
3	mark connection	forward	192.168.1.251					20.2 MiB	348 800
4	mark packet	forward						914.8 MiB	1 270 737
5	mark packet	forward						2486.9 MiB	2 887 397
6	mark packet	forward						795.2 MiB	1 106 293
7	mark packet	forward						522.4 MiB	762 554

Step 3. Create A Total Upload Queue

The screenshot shows the Mikrotik WinBox interface. On the left, the 'Queues' menu is highlighted. In the center, the 'Queue List' table shows two queues: 'Total Download' and 'Total Upload'. The 'New Queue' dialog box is open, showing the 'General' tab. The 'Name' field is 'TOTAL UPLOAD', the 'Parent' is 'ether1_ISP', and the 'Queue Type' is 'default-small'. The 'Bucket Size' is set to '0.100', which is highlighted with a red box and a red arrow pointing to it with the text 'NEW FEATURE'. The 'Limit At' field is empty, 'Max Limit' is '5M', 'Burst Limit' is empty, 'Burst Threshold' is empty, and 'Burst Time' is empty. The 'enabled' checkbox is checked.

Name	Parent	Queue Type	Priority	Bucket Size	Limit At	Max Limit	Burst Limit	Burst Threshold	Burst Time	enabled
Total Download	ether1	default-small	8	0.100		5M				
Total Upload	ether1	default-small	8	0.100		5M				

Step 4. Create A Total Download Queue



Step 5. CREATE Total Download's child queue

The screenshot shows the Mikrotik WinBox interface. On the left, the 'Queues' menu item is highlighted in the sidebar. In the main window, the 'Queue List' tab is active, showing a table with two entries: 'Total Download' and 'Total Upload'. The 'Total Download' entry is selected. A red box highlights the '+' icon in the toolbar, indicating the action to create a new queue.

The 'New Queue' dialog box is open, showing the 'General' tab. The following fields are highlighted with red boxes:

- Name: THE BOSS DOWNLOADING
- Parent: TOTAL DOWNLOAD
- Packet Marks: THE BOSS's packet
- Queue Type: default
- Priority: 7
- Bucket Size: 0.100
- Limit At: 1M
- Max Limit: 2M

The dialog also includes fields for Burst Limit, Burst Threshold, and Burst Time, which are currently empty. The 'enabled' checkbox at the bottom is checked.

Step 6. CREATE Total Upload's child queue

The screenshot shows the Mikrotik WinBox interface. On the left, the 'Queues' menu item is highlighted. In the main window, the 'Queue List' tab is active, showing a table with columns 'Name', 'Parent', and 'Queue Type'. The table contains three entries: 'Total Download' (parent: wlan1), 'The Boss Downloading' (parent: Total Download), and 'Total Upload' (parent: ether2). The 'Queue Tree' tab is also visible. A 'New Queue' dialog box is open, showing the 'General' tab. The dialog has the following fields:

- Name: The Boss Uploading
- Parent: Total Upload
- Packet Marks: THE BOSS's packet
- Queue Type: default
- Priority: 8
- Bucket Size: 0.100
- Limit At: 1M
- Max Limit: 2M
- Burst Limit: (empty)
- Burst Threshold: (empty)
- Burst Time: (empty)

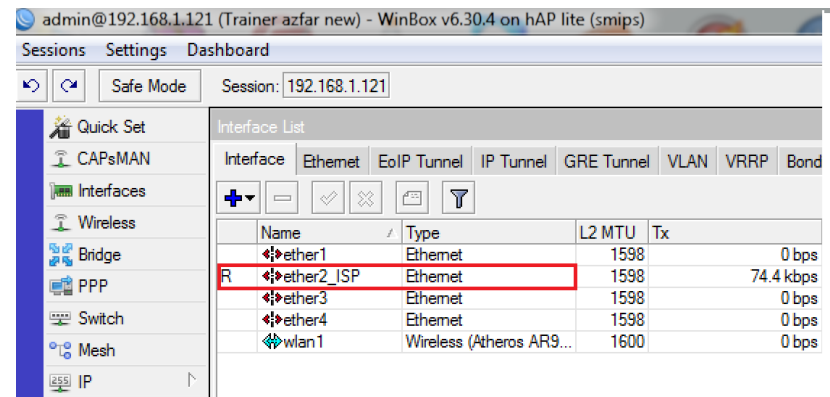
The 'enabled' checkbox at the bottom of the dialog is checked.

QUEUE TREE WINBOX VIEW

Queue List							
Simple Queues Interface Queues Queue Tree Queue Types + - ✓ ✗ 📄 🔍 00 Reset Counters 00 Reset All Counters Find							
Name	Parent	Packet Marks	Priority	Limit At (b...	Max Limi...	Avg. Rate	
🔴 TOTAL DOWNLOAD	Ether2_LAN		8		5M	5.0 Mbps	
🔴 THE BOSS DOWNLOADING	TOTAL DOWNLOAD	THE BOSS's packet	7	1M	2M	2.0 Mbps	
🟡 THE MANAGER DOWNLOADING	TOTAL DOWNLOAD	THE MANAGER's packet	8	1M	2M	1010.3 kbps	
🟡 THE OFFICE BOY DOWNLOADING	TOTAL DOWNLOAD	THE OFFICE BOY's packet	8	1M	2M	1002.2 kbps	
🟡 THE SECRETARY DOWNLOADING	TOTAL DOWNLOAD	THE SECRETARY's packet	8	1M	2M	1003.0 kbps	
🟢 TOTAL UPLOAD	Ether1_ISP		8		5M	290.2 kbps	
🟢 THE BOSS UPLOADING	TOTAL UPLOAD	THE BOSS's packet	8	1M	2M	103.2 kbps	
🟢 THE MANAGER UPLOADING	TOTAL UPLOAD	THE MANAGER's packet	8	1M	2M	62.8 kbps	
🟢 THE OFFICE BOY UPLOADING	TOTAL UPLOAD	THE OFFICE BOY's packet	8	1M	2M	62.0 kbps	
🟢 THE SECRETARY UPLOADING	TOTAL UPLOAD	THE SECRETARY's packet	8	1M	2M	62.1 kbps	
10 items 276.9 KiB queued 192 packets queued							

ADVANTAGES OF HTB QUEUE-TREE SYSTEM

- Queue Tree is one directional only and can be placed in any of the available Interface. Upload interface or download interface.

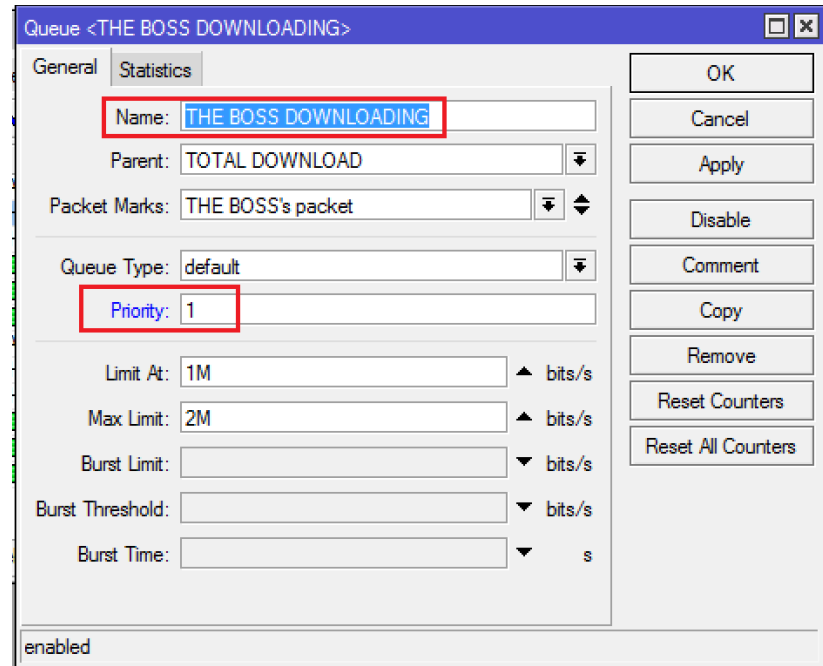


The screenshot shows the WinBox v6.30.4 interface on hAP lite (smips). The 'Interface List' tab is active, displaying a table of network interfaces. The 'ether2_JSP' interface is highlighted with a red box.

Name	Type	L2 MTU	Tx
ether1	Ethernet	1598	0 bps
R ether2_JSP	Ethernet	1598	74.4 kbps
ether3	Ethernet	1598	0 bps
ether4	Ethernet	1598	0 bps
wlan1	Wireless (Atheros AR9...	1600	0 bps

ADVANTAGES OF HTB QUEUE-TREE SYSTEM

- We can prioritize our Bosses, directors and managers over the poor office boy but still giving him maximum available bandwidth whenever its available.



ADVANTAGES OF HTB QUEUE-TREE SYSTEM

- we can have dual limitations on a single user, allowing that user to use maximum available bandwidth in **non-rush hours**? (CIR/Limit At & MIR/Maximum Limit).

The screenshot shows the Mikrotik WinBox Queue Manager configuration window for a queue named 'THE OFFICE BOY DOWNLOADING'. The 'General' tab is selected. The configuration includes:

- Name:** THE OFFICE BOY DOWNLOADING
- Parent:** THE OFFICE STAFF DOWNLOADING
- Packet Marks:** THE OFFICE BOY's packet
- Queue Type:** default
- Priority:** 8
- Limit At:** 1M (bits/s)
- Max Limit:** 2M (bits/s)
- Burst Limit:** (bits/s)
- Burst Threshold:** (bits/s)
- Burst Time:** (s)

The queue is currently **enabled**. On the right side, there are buttons for OK, Cancel, Apply, Disable, Comment, Copy, Remove, Reset Counters, and Reset All Counters.

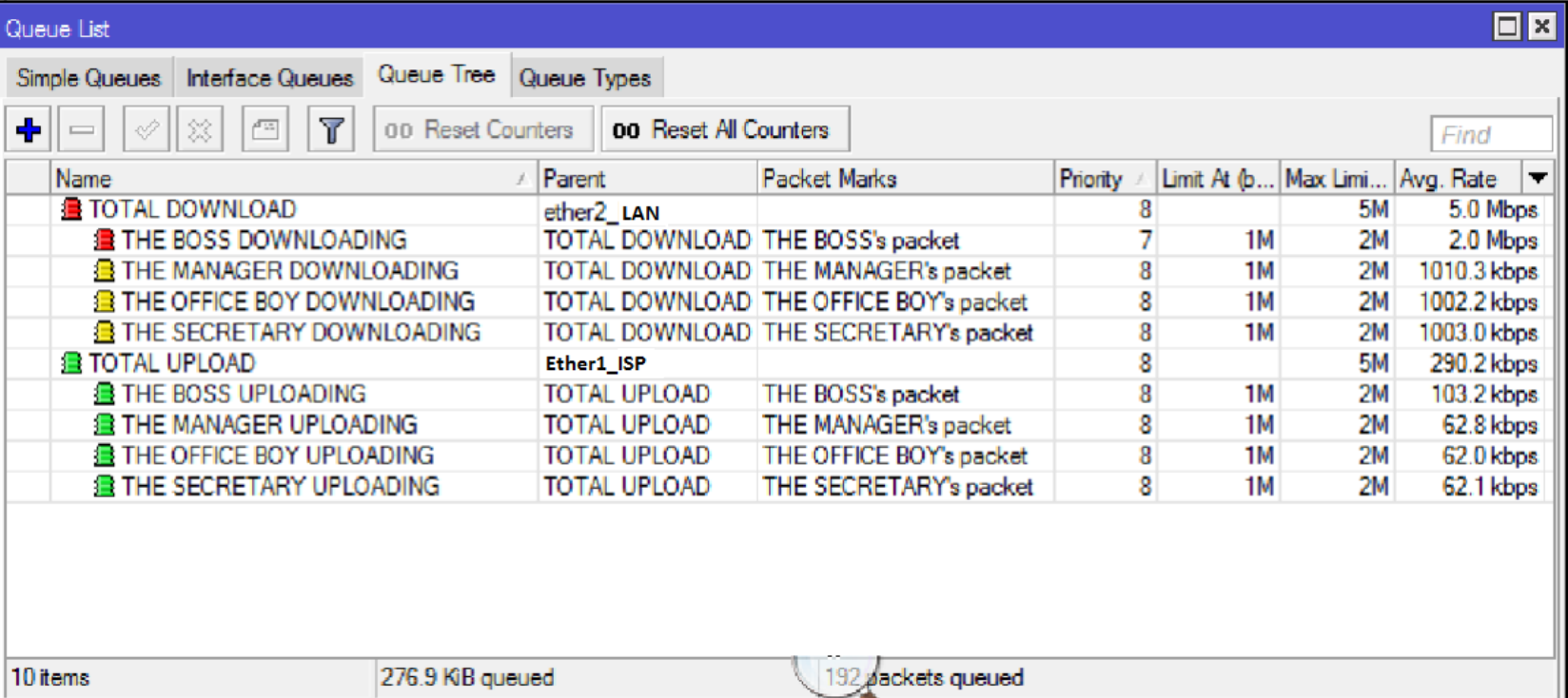
ADVANTAGES OF HTB QUEUE-TREE SYSTEM

- Queue-Tree queues don't have any order – all traffic is processed simultaneously.
- Every single user can use maximum bandwidth available .

IMPORTANT POINTS

- Parent queues don't need limit At's.
- Priority only works at the lowest child queue.
(so put the boss at the bottom of the queue tree)
- Priority starts working when all the limit At's have already been full filled.
- All child queues must have packet marks from “/IP firewall mangle” facility assigned to them.
(PARENT QUEUES DON'T NEED PACKET MARKS)

Working queue Tree winbox view



The screenshot shows the 'Queue List' window in Mikrotik WinBox. The 'Queue Tree' tab is selected. The table displays a hierarchical structure of queues. Download queues are under 'ether2_LAN' and upload queues are under 'Ether1_ISP'. Each queue has a name, parent, packet marks, priority, limit, and average rate.

Name	Parent	Packet Marks	Priority	Limit At (b...	Max Limi...	Avg. Rate
TOTAL DOWNLOAD	ether2_LAN		8		5M	5.0 Mbps
THE BOSS DOWNLOADING	TOTAL DOWNLOAD	THE BOSS's packet	7	1M	2M	2.0 Mbps
THE MANAGER DOWNLOADING	TOTAL DOWNLOAD	THE MANAGER's packet	8	1M	2M	1010.3 kbps
THE OFFICE BOY DOWNLOADING	TOTAL DOWNLOAD	THE OFFICE BOY's packet	8	1M	2M	1002.2 kbps
THE SECRETARY DOWNLOADING	TOTAL DOWNLOAD	THE SECRETARY's packet	8	1M	2M	1003.0 kbps
TOTAL UPLOAD	Ether1_ISP		8		5M	290.2 kbps
THE BOSS UPLOADING	TOTAL UPLOAD	THE BOSS's packet	8	1M	2M	103.2 kbps
THE MANAGER UPLOADING	TOTAL UPLOAD	THE MANAGER's packet	8	1M	2M	62.8 kbps
THE OFFICE BOY UPLOADING	TOTAL UPLOAD	THE OFFICE BOY's packet	8	1M	2M	62.0 kbps
THE SECRETARY UPLOADING	TOTAL UPLOAD	THE SECRETARY's packet	8	1M	2M	62.1 kbps

10 items 276.9 KiB queued 192 packets queued

INNER QUEUE TREE WINBOX VIEW

Queue List

Simple Queues

Interface Queues

Queue Tree

Queue Types

00

Reset Counters

00

Reset All Counters

Find

Name	Parent	Packet Marks	Priority	Limit At...	Max Limit...	Avg. Rate	
TOTAL DOWNLOAD	wlan1		8		5M	5.0 Mbps	
THE BOSS DOWNLOADING	TOTAL DOWNLOAD	THE BOSS's packet	7	1M	2M	1010.2 kbps	
THE OFFICE STAFF DOWNLOADING	TOTAL DOWNLOAD		8		4M	4.0 Mbps	
THE MANAGER DOWNLOADING	THE OFFICE STAFF DOWNL...	THE MANAGER's packet	3	1M	2M	2.0 Mbps	
THE OFFICE BOY DOWNLOADING	THE OFFICE STAFF DOWNL...	THE OFFICE BOY's packet	5	1M	2M	1018.5 kbps	
THE SECRETARY DOWNLOADING	THE OFFICE STAFF DOWNL...	THE SECRETARY's packet	8	1M	2M	1005.9 kbps	
TOTAL UPLOAD	ether2_ISP		8		5M	285.1 kbps	
THE BOSS UPLOADING	TOTAL UPLOAD	THE BOSS's packet	8	1M	2M	61.3 kbps	
THE OFFICE STAFF UPLOADING	TOTAL UPLOAD		8		4M	223.7 kbps	
THE MANAGER UPLOADING	THE OFFICE STAFF UPLOAD...	THE MANAGER's packet	3	1M	2M	102.3 kbps	
THE OFFICE BOY UPLOADING	THE OFFICE STAFF UPLOAD...	THE OFFICE BOY's packet	5	1M	2M	61.9 kbps	
THE SECRETARY UPLOADING	THE OFFICE STAFF UPLOAD...	THE SECRETARY's packet	8	1M	2M	59.4 kbps	

12 items (1 selected)

278.3 KiB queued

193 packets queued

CONCLUSION

- **For low bandwidth network, Use:**
 - Queue Tree, HTB, Burst
- **Your network has been maximized to use every single bit of your available bandwidth without wasting “even” a single bit.**



THANK YOU!
Questions Please?