



HTB Implementation on RouterOS QoS

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Introduction



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- Company: Citraweb Nusa Infomedia
 - Mikrotik Distributor (2002), Training Partner (2005)
 - www.mikrotik.co.id
 - Wireless ISP
 - www.citra.net.id
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- Head of National Internet Resources of Indonesian ISP Association / IDNIC
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Outline



- Basic Concept
- Simple HTB
- Terms in HTB
- Common Mistakes
- More detail information

Basic Concept

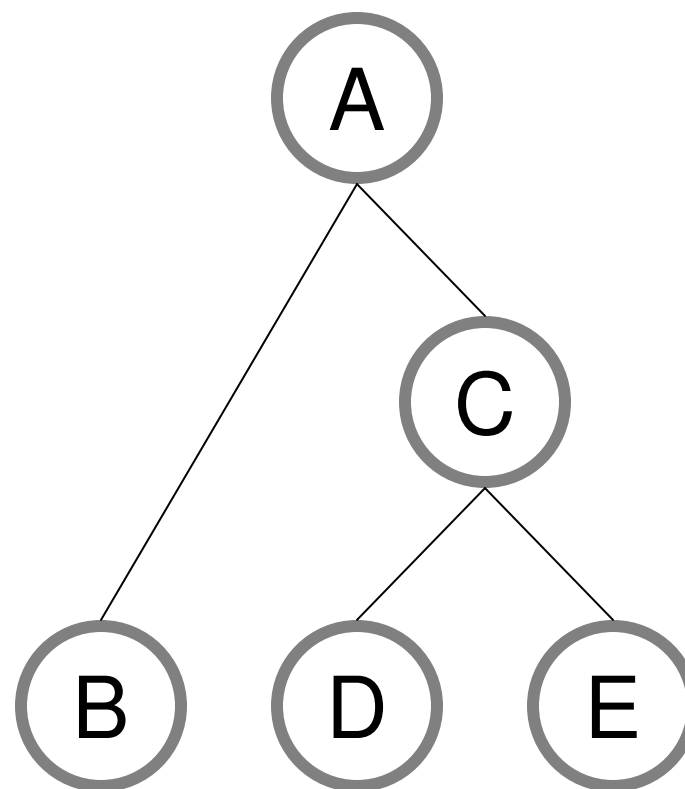
- QoS in RouterOS is not only about bandwidth limitation, but how to distribute the bandwidth fairly
- Things have to consider:
 - How to mangle
 - Check packet flow and firewall documentation on manual and wiki pages
 - Will not covered in this presentation
 - HTB (Hierarchical Token Bucket)

Basic Concept

- HTB (Hierarchical Token Bucket) is part of QoS, to make a hierarchical queue structure and determine relations between queues (priority, burst possibility, etc)
- HTB is meant as a more understandable, intuitive and faster replacement for the CBQ qdisc in Linux.
- HTB assigned to any physical interface or virtual interface (global-in, global-out, global-total)

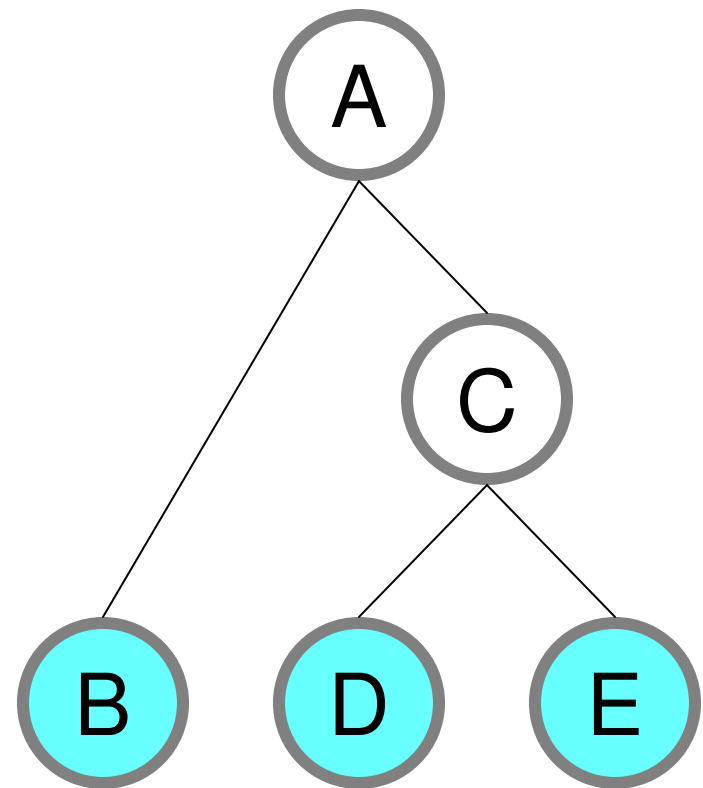
Sample of HTB

- A has 2 children :
 - B
 - C
- C has 2 children :
 - D
 - E



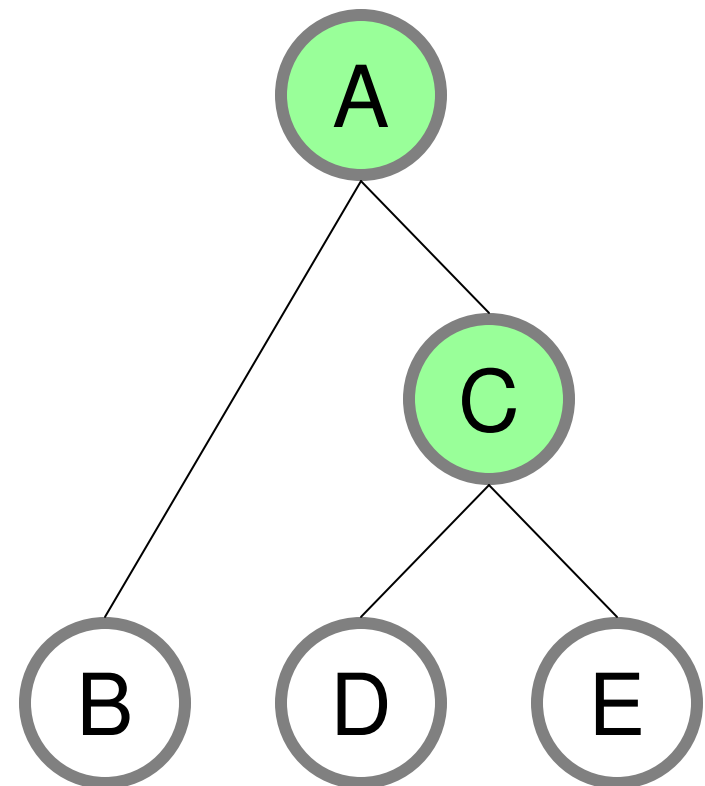
Type of Queues

- Leaf queue
 - Most lower level, has no child
 - Make actual traffic consumption
 - All leaf queues are treated on equal basis
 - All leafs located on the most bottom level of HTB



Type of Queues

- Inner queue
 - Have at least one child
 - Responsible only for traffic distribution



Terms in HTB

- Committed Information Rate (CIR)
 - Limit-at in RouterOS
 - In worst case scenario, flow will get this amount of traffic no matter what (assuming we can actually send so much data)
 - CIR works on both leaf and inner queue

Terms in HTB



- Maximal Information Rate (MIR)
 - Max-limit in RouterOS
 - Rate that flow can get up to, if there queue's parent has spare bandwidth

Terms in HTB



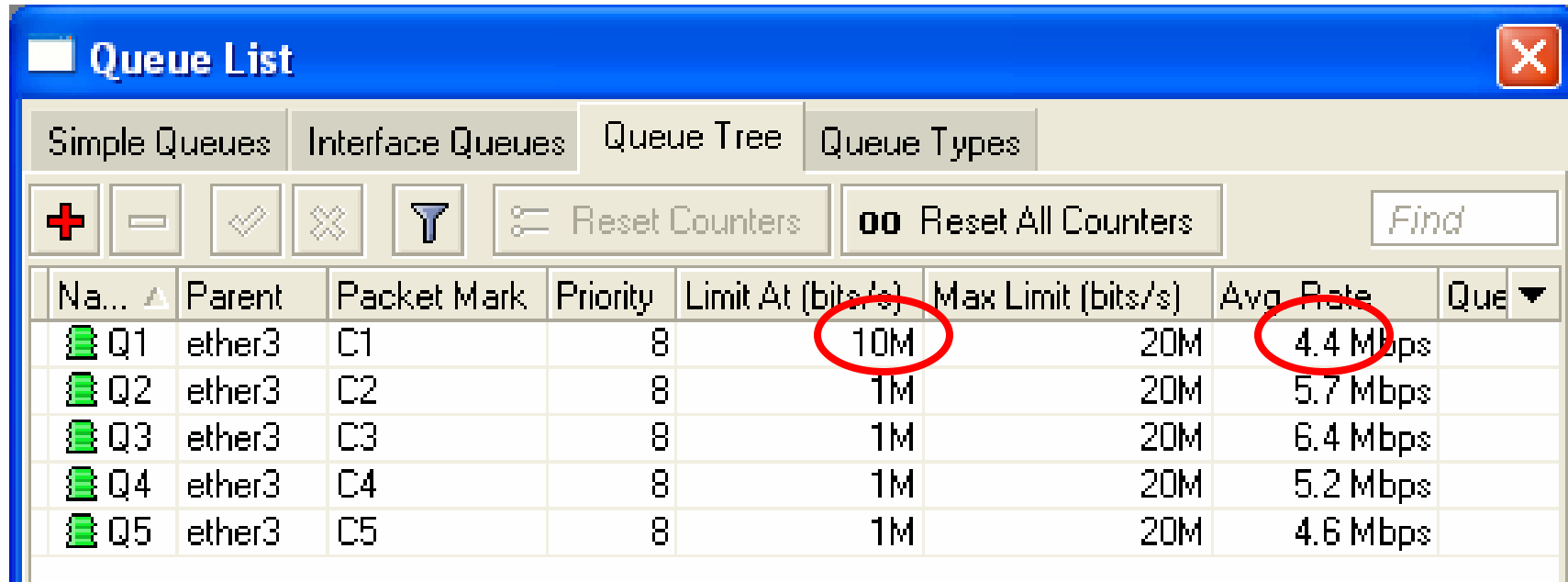
- Priority
 - Work only for leaf (child) queue
 - 1 .. Highest priority, and 8 ... lowest priority
 - Priority will work only if limits are specified
 - Priority calculated only after limit-at achieved

Sample Configuration

- We have 5 leaf queues:

Queue	Limit-at	Max-limit
C1	10M	20M
C2	1M	20M
C3	1M	20M
C4	1M	20M
C5	1M	20M

Winbox Configuration



Queue List

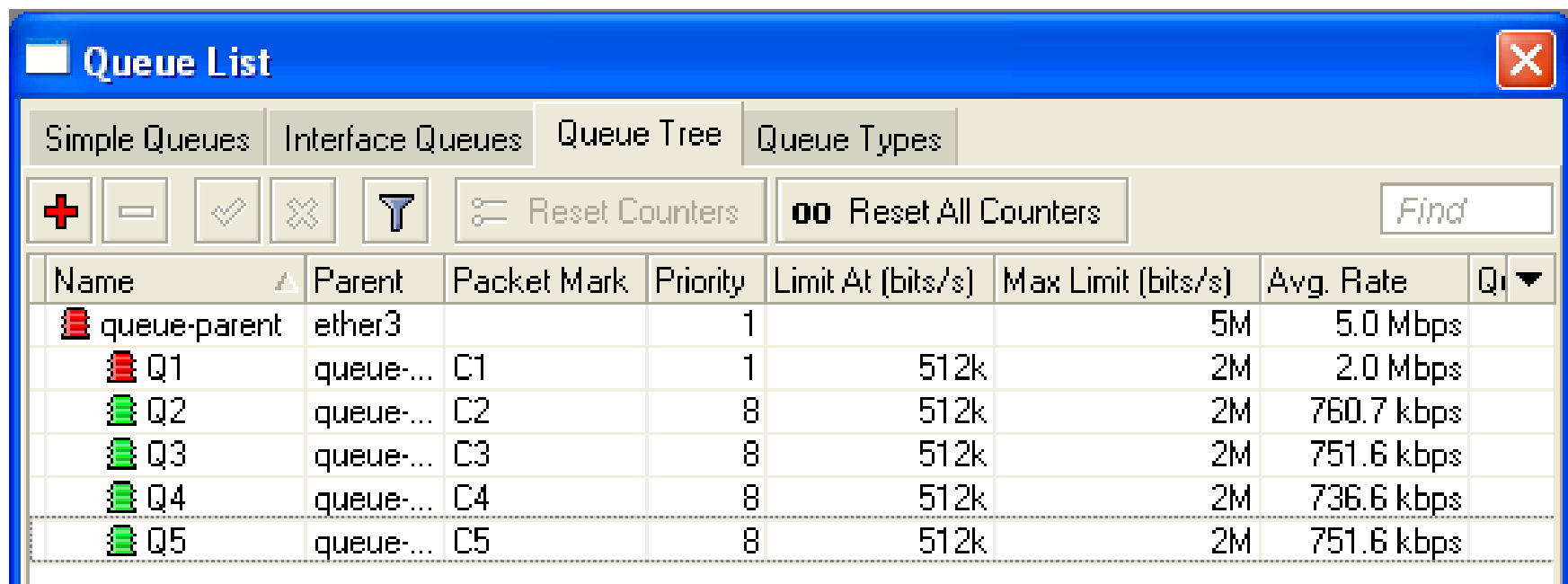
Simple Queues | Interface Queues | Queue Tree | Queue Types

+ - ✓ ✗ ⌵ ⌵ Reset Counters 00 Reset All Counters Find

Na... ▲	Parent	Packet Mark	Priority	Limit At (bits/s)	Max Limit (bits/s)	Avg. Rate	Que ▼
Q1	ether3	C1	8	10M	20M	4.4 Mbps	
Q2	ether3	C2	8	1M	20M	5.7 Mbps	
Q3	ether3	C3	8	1M	20M	6.4 Mbps	
Q4	ether3	C4	8	1M	20M	5.2 Mbps	
Q5	ether3	C5	8	1M	20M	4.6 Mbps	

Router fail to give C1 limit-at (10M)

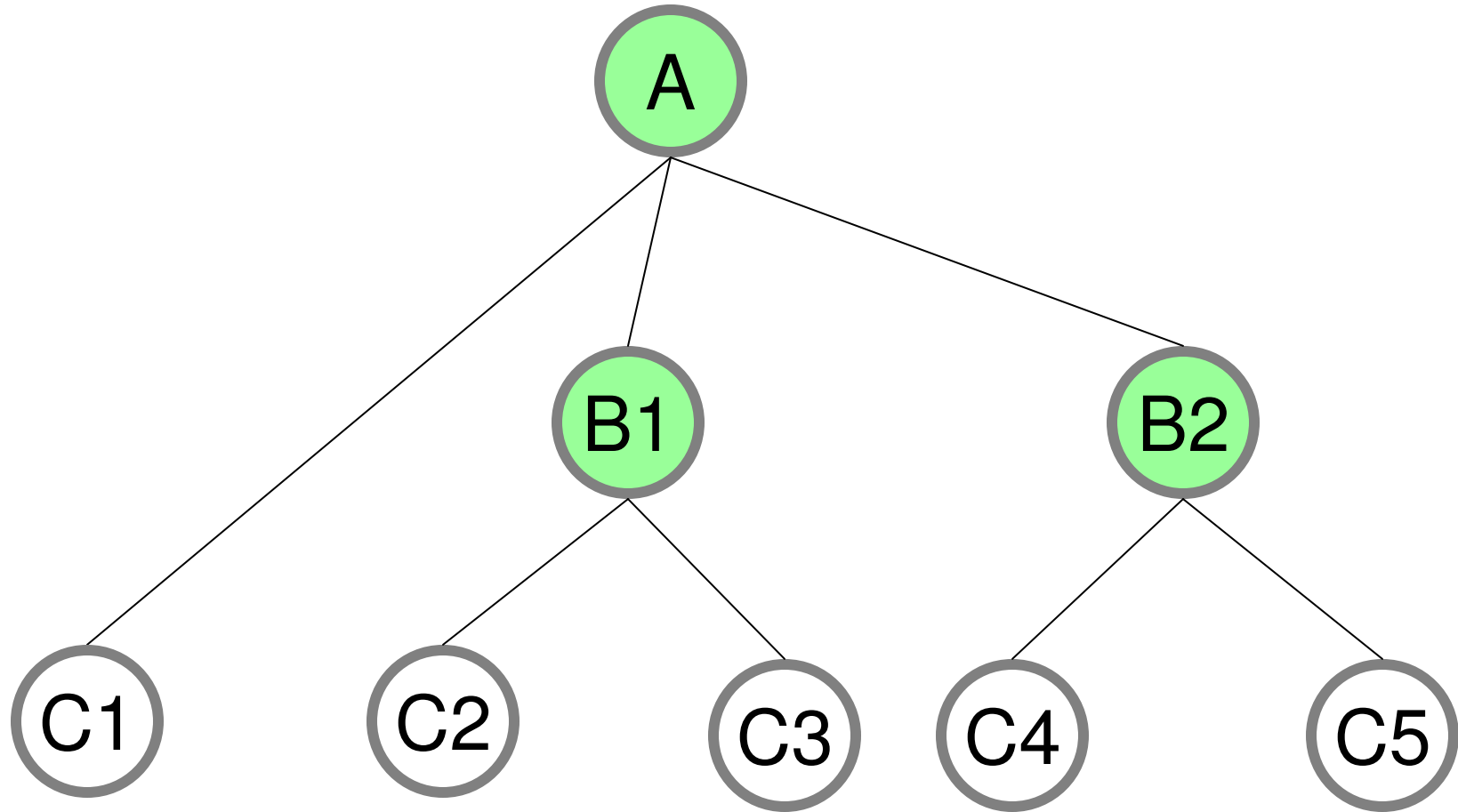
With Parent



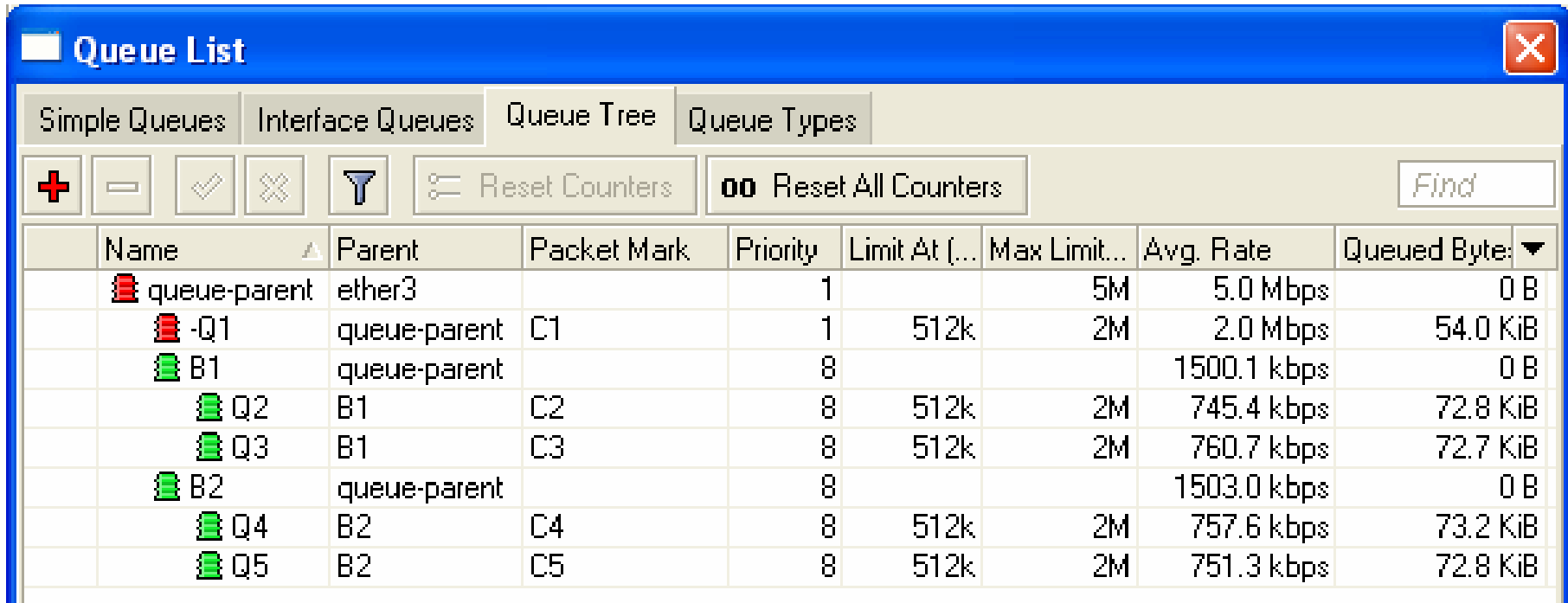
The screenshot shows the 'Queue List' window in Mikrotik WinBox. It features a blue title bar with a close button. Below the title bar are tabs for 'Simple Queues', 'Interface Queues', 'Queue Tree', and 'Queue Types'. A toolbar contains icons for adding, deleting, checking, and unchecking, along with 'Reset Counters' and 'Reset All Counters' buttons, and a search field labeled 'Find'. The main area is a table with columns: Name, Parent, Packet Mark, Priority, Limit At (bits/s), Max Limit (bits/s), Avg. Rate, and Q. The table lists a parent queue 'queue-parent' on interface 'ether3' with priority 1 and a 5M limit. It has five child queues (Q1-Q5) with priority 8 and a 512k limit. Q1 has a 2M max limit and 2.0 Mbps avg rate. Q2-Q5 have a 2M max limit and approximately 750 kbps avg rate.

Name	Parent	Packet Mark	Priority	Limit At (bits/s)	Max Limit (bits/s)	Avg. Rate	Q
queue-parent	ether3		1		5M	5.0 Mbps	
Q1	queue-...	C1	1	512k	2M	2.0 Mbps	
Q2	queue-...	C2	8	512k	2M	760.7 kbps	
Q3	queue-...	C3	8	512k	2M	751.6 kbps	
Q4	queue-...	C4	8	512k	2M	736.6 kbps	
Q5	queue-...	C5	8	512k	2M	751.6 kbps	

More Hierarchy



HTB

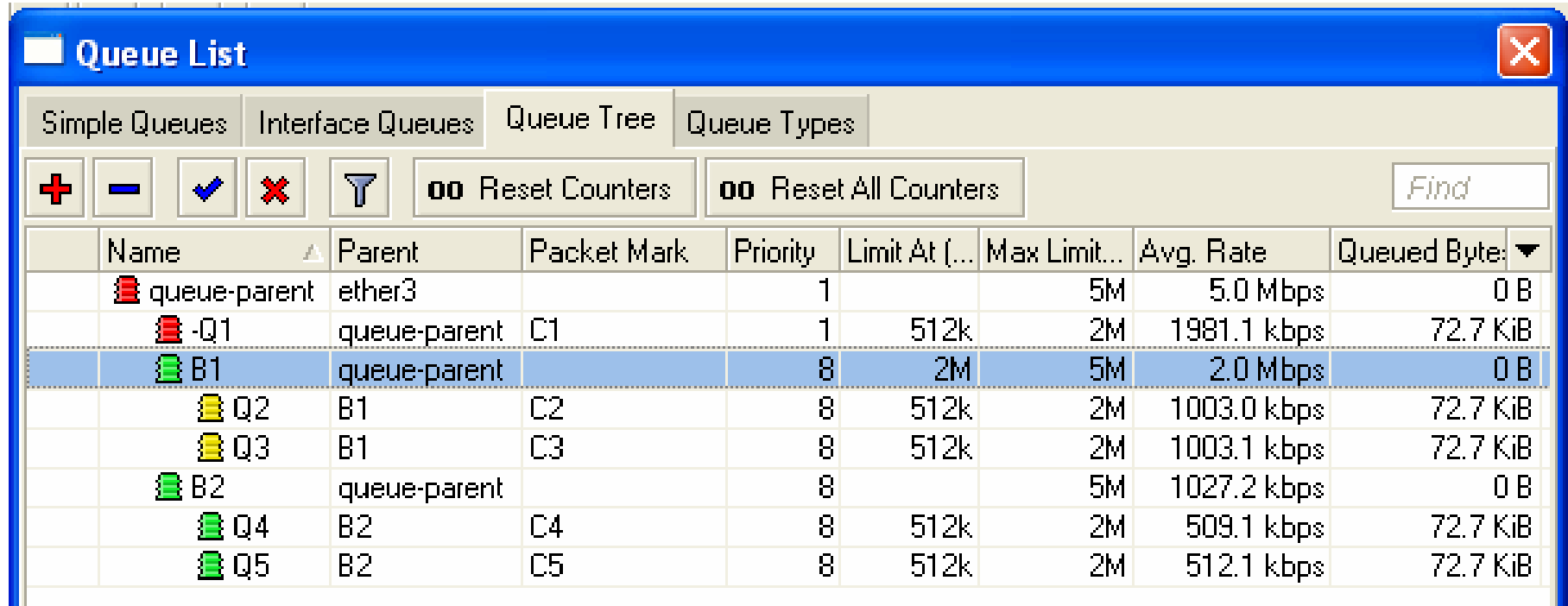


The screenshot shows the Mikrotik WinBox 'Queue List' window. It has a blue title bar with a close button. Below the title bar are tabs for 'Simple Queues', 'Interface Queues', 'Queue Tree', and 'Queue Types'. A toolbar contains icons for adding, deleting, and filtering, along with buttons for 'Reset Counters' and 'Reset All Counters', and a search field labeled 'Find'. The main area is a table with the following columns: Name, Parent, Packet Mark, Priority, Limit At (...), Max Limit..., Avg. Rate, and Queued Byte: (with a dropdown arrow). The table lists a hierarchy of queues: 'queue-parent' (parent: ether3, priority: 1, limit: 5M) has children '-Q1' (priority: 1, limit: 512k) and 'B1' (priority: 8, limit: none). '-Q1' has children 'Q2', 'Q3', and 'Q4'. 'B1' has children 'Q2', 'Q3', and 'Q5'. 'B2' (priority: 8, limit: none) has children 'Q4' and 'Q5'. The 'Queued Byte' column shows 0 B for the parent and leaf queues, and 54.0 KiB for -Q1, 72.8 KiB for Q2, 72.7 KiB for Q3, 73.2 KiB for Q4, and 72.8 KiB for Q5.

Name	Parent	Packet Mark	Priority	Limit At (...)	Max Limit...	Avg. Rate	Queued Byte:
queue-parent	ether3		1		5M	5.0 Mbps	0 B
-Q1	queue-parent	C1	1	512k	2M	2.0 Mbps	54.0 KiB
B1	queue-parent		8			1500.1 kbps	0 B
Q2	B1	C2	8	512k	2M	745.4 kbps	72.8 KiB
Q3	B1	C3	8	512k	2M	760.7 kbps	72.7 KiB
B2	queue-parent		8			1503.0 kbps	0 B
Q4	B2	C4	8	512k	2M	757.6 kbps	73.2 KiB
Q5	B2	C5	8	512k	2M	751.3 kbps	72.8 KiB

C1 have better priority, get up to max-limit,
all other capacity split for other leaf queue

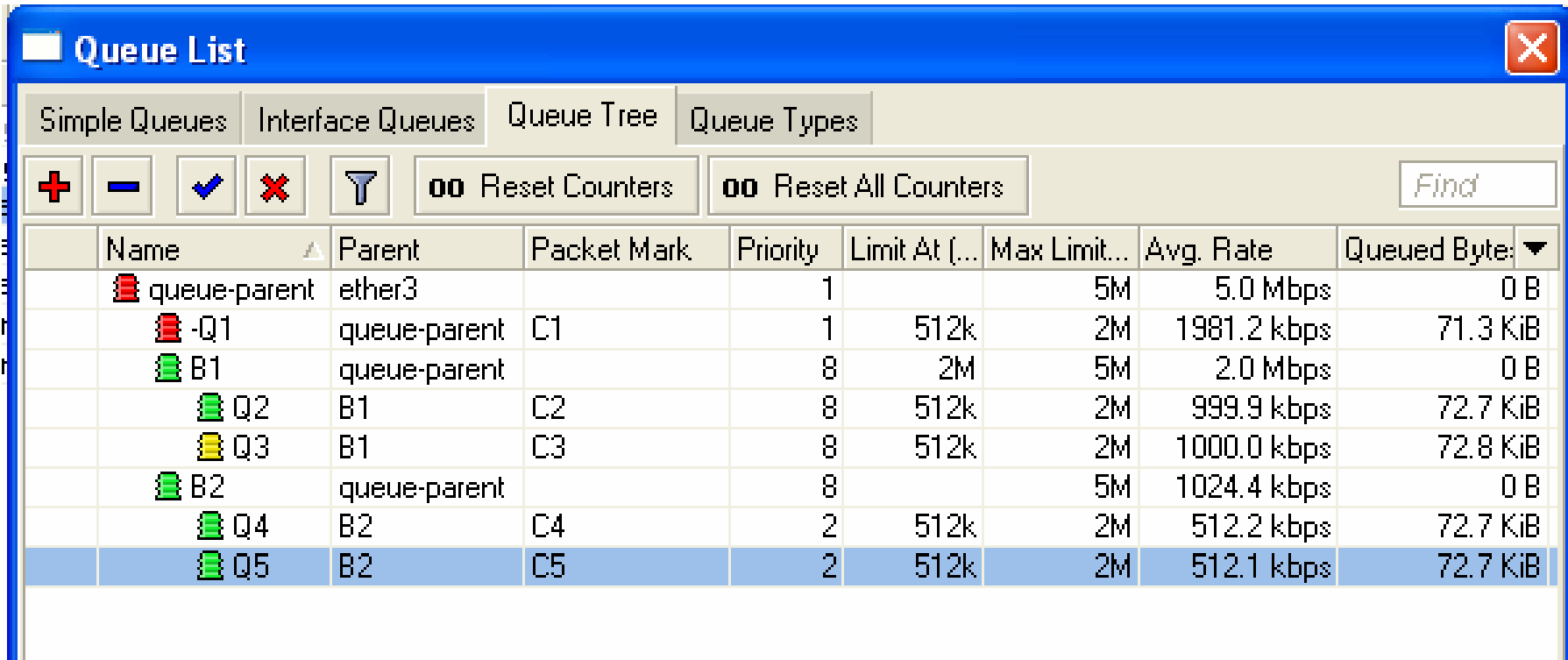
Limit-at on Inner Queue



The screenshot shows the Mikrotik WinBox 'Queue List' window. It features a blue title bar with a close button. Below the title bar are tabs for 'Simple Queues', 'Interface Queues', 'Queue Tree', and 'Queue Types'. A toolbar contains icons for adding, deleting, and filtering queues, along with buttons for 'Reset Counters' and 'Reset All Counters', and a search field labeled 'Find'. The main area is a table with columns: Name, Parent, Packet Mark, Priority, Limit At (...), Max Limit..., Avg. Rate, and Queued Byte:.

Name	Parent	Packet Mark	Priority	Limit At (...)	Max Limit...	Avg. Rate	Queued Byte:
queue-parent	ether3		1		5M	5.0 Mbps	0 B
-Q1	queue-parent	C1	1	512k	2M	1981.1 kbps	72.7 KiB
B1	queue-parent		8	2M	5M	2.0 Mbps	0 B
Q2	B1	C2	8	512k	2M	1003.0 kbps	72.7 KiB
Q3	B1	C3	8	512k	2M	1003.1 kbps	72.7 KiB
B2	queue-parent		8		5M	1027.2 kbps	0 B
Q4	B2	C4	8	512k	2M	509.1 kbps	72.7 KiB
Q5	B2	C5	8	512k	2M	512.1 kbps	72.7 KiB

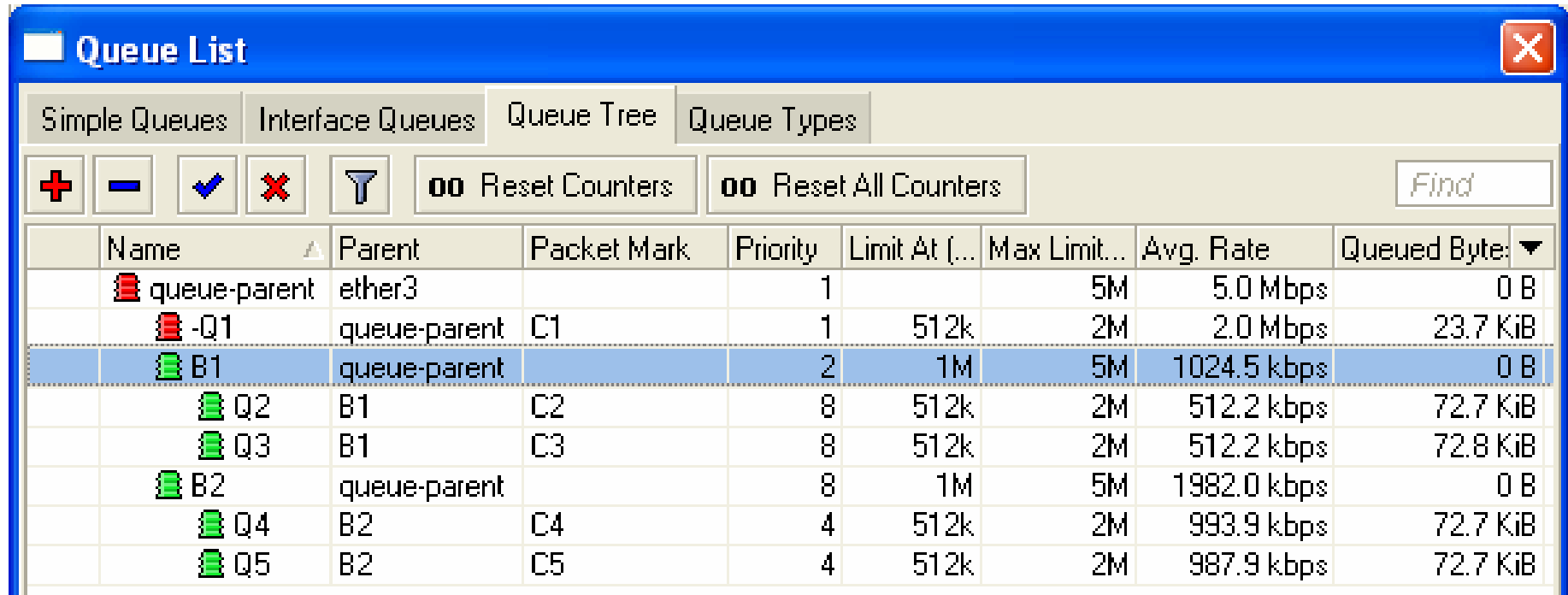
Priority on Leaf Queue



The screenshot shows the Mikrotik WinBox 'Queue List' window. It has a blue title bar with a close button. Below the title bar are tabs for 'Simple Queues', 'Interface Queues', 'Queue Tree', and 'Queue Types'. There are also buttons for adding (+), deleting (-), checking (✓), and deleting (✗) queues, a filter icon, and buttons for 'Reset Counters' and 'Reset All Counters'. A search box labeled 'Find' is on the right. The main area is a table with the following columns: Name, Parent, Packet Mark, Priority, Limit At (...), Max Limit..., Avg. Rate, and Queued Byte: (with a dropdown arrow). The table contains the following data:

Name	Parent	Packet Mark	Priority	Limit At (...)	Max Limit...	Avg. Rate	Queued Byte:
queue-parent	ether3		1		5M	5.0 Mbps	0 B
-Q1	queue-parent	C1	1	512k	2M	1981.2 kbps	71.3 KiB
B1	queue-parent		8	2M	5M	2.0 Mbps	0 B
Q2	B1	C2	8	512k	2M	999.9 kbps	72.7 KiB
Q3	B1	C3	8	512k	2M	1000.0 kbps	72.8 KiB
B2	queue-parent		8		5M	1024.4 kbps	0 B
Q4	B2	C4	2	512k	2M	512.2 kbps	72.7 KiB
Q5	B2	C5	2	512k	2M	512.1 kbps	72.7 KiB

Priority on Inner Queue



The screenshot shows the Mikrotik WinBox 'Queue List' window. It features a blue title bar with a close button. Below the title bar are tabs for 'Simple Queues', 'Interface Queues', 'Queue Tree', and 'Queue Types'. A toolbar contains icons for adding, deleting, and filtering queues, along with buttons for 'Reset Counters' and 'Reset All Counters', and a search field labeled 'Find'. The main area is a table with the following columns: Name, Parent, Packet Mark, Priority, Limit At (...), Max Limit..., Avg. Rate, and Queued Byte: (with a dropdown arrow). The table lists several queues, with 'B1' highlighted in blue. The 'B1' queue is a leaf queue with a priority of 2, while its parent 'queue-parent' has a priority of 1. Other queues like 'Q2', 'Q3', 'Q4', and 'Q5' are child queues of 'B1' with various priorities.

Name	Parent	Packet Mark	Priority	Limit At (...)	Max Limit...	Avg. Rate	Queued Byte:
queue-parent	ether3		1		5M	5.0 Mbps	0 B
-Q1	queue-parent	C1	1	512k	2M	2.0 Mbps	23.7 KiB
B1	queue-parent		2	1M	5M	1024.5 kbps	0 B
Q2	B1	C2	8	512k	2M	512.2 kbps	72.7 KiB
Q3	B1	C3	8	512k	2M	512.2 kbps	72.8 KiB
B2	queue-parent		8	1M	5M	1982.0 kbps	0 B
Q4	B2	C4	4	512k	2M	993.9 kbps	72.7 KiB
Q5	B2	C5	4	512k	2M	987.9 kbps	72.7 KiB

Priority works only on Leaf Queue, will not work on Inner Queue

Common Mistakes



- Leaf queue without parent
- Priority on Inner queue

Test case

- We have 300 hosts on our network
- In worst scenario, 200 hosts will online on the same time
- At least 20 hosts online at minimum.
- All hosts have same priority
- Total bandwidth = 10 Mbps

Tips



- For an office network that all computer have same speed and same priority:
 - Limit-at = Total bandwidth / max hosts
 - Max-limit = Total bandwidth / min hosts

- Max-limit = 10 mbps / 20 (min host)
= 500 kbps
- Limit-at = 10 mbps / 200 (max host)
= 50 kbps

More Detail Information



- <http://wiki.mikrotik.com/wiki/HTB>
- <http://luxik.cdi.cz/~devik/qos/htb/>

Thank you!



- Q&A.....
- Or email to: valens@mikrotik.co.id