HTB vs PCQ

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Introduction

• Valens Riyadi
• Work for Citraweb/Citraranet
  – Mikrotik distributor, training partner
  – ISP, web developer
• Using Mikrotik since 2.3.15 (2001)
• MTCNA, MTCTCE, MTCUME, MTCRE, MTCWE, MTCINE, Certified Trainer

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Remote Access

- Remote Access to my router:
  - SSID : MUM-QOS
  - IP Address : 10.3.2.1
  - Username : demo
  - Password : [empty]
Bandwidth Management

• MikroTik RouterOS is one of the most advanced (and easy to configure) OS/application for bandwidth management.

• Bandwidth management done by utilize shaper and scheduler
  – Shaper : HTB and PCQ
  – Scheduler : FIFO, RED, SFQ
Question

- Which one is better, HTB or PCQ?
- When we need to use HTB, or PCQ?
Hierarchical Token Bucket (HTB)

- Hierarchical Token Bucket (HTB) allows to create a hierarchical queue structure and determine relations between queues, like "parent-child" or "child-child".
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)
HTB Features

• Hierarchy
  – Almost no hierarchy limit, the limit is your imagination

• Grouping
  – We can group several clients, into one parent
  – One client can borrow bandwidth from another client in same group, if needed.

• Independent setting for each leaf queue
Parent/ inner queue

Child = leaf queue
### HTB Sample

#### Queue List

<table>
<thead>
<tr>
<th>Name</th>
<th>Parent</th>
<th>Packet Name</th>
<th>Limit At (bits/s)</th>
<th>Max Limit (bits/s)</th>
<th>Avg. Rate</th>
<th>Queued Bytes</th>
<th>Bytes</th>
<th>Packets</th>
</tr>
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<tbody>
<tr>
<td>queue_0</td>
<td>other2</td>
<td>packet_1551</td>
<td>466904</td>
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<td>0</td>
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<td>0</td>
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<td>queue_16</td>
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<td>644967</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td>queue_35</td>
<td>packet_6905</td>
<td>145912</td>
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<td>0</td>
<td>0</td>
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<td>0</td>
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<td>0</td>
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<td>queue_5</td>
<td>packet_6132</td>
<td>746585</td>
<td>74000</td>
<td>0 bps</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>queue_13</td>
<td>packet_8397</td>
<td>692964</td>
<td>40000</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>queue_34</td>
<td>queue_13</td>
<td>packet_1227</td>
<td>483167</td>
<td>32000</td>
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<td>0</td>
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<td>queue_36</td>
<td>queue_13</td>
<td>packet_7635</td>
<td>412515</td>
<td>20000</td>
<td>0 bps</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
limit-at and priority work only if you use hierarchy (parent)
Independent setting for leaf

- We can set different limit and burst for each leaf.
- Certain burst parameter will make “normal” customer think their bandwidth fast.
• More detail explanation about HTB: My presentation MUM USA 2009
Per Connection Queuing (PCQ)

- Using flow identifiers (dst-address, dst-port, src-address or src-port) to differentiate traffic into sub-streams.
- Introduced to optimize massive QoS systems, where most of the queues are exactly the same for each sub-streams.
- 1 rule can handle hundreds customer, and limit them individually.
PCQ Flow

Flow 1
Flow 2
Flow 3
Flow 4

pcq-classifier
src-address

sub-queue

Round Robin
to interface

SRC-ADDRESS=10.0.0.1
SRC-ADDRESS=10.0.0.2
SRC-ADDRESS=10.0.0.3
SRC-ADDRESS=10.0.0.4
SRC-ADDRESS=10.0.0.5
SRC-ADDRESS=10.0.0.6
SRC-ADDRESS=10.0.0.7
PCQ Sample

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PCQ Configuration

New parameters since RoS 5rc4

- Burst
- Mask (for IPv4 and IPv6)
PCQ Configuration

- Rate = sub-stream max-limit
- Total-limit (packet in queue) = Limit \* number of sub-stream
- Ex: 100 customers, 100 packets per customer (limit), and total-limit=10,000
Burst on Sub-Stream

Queue <queue1>

- **Name:** queue1
- **Parent:** wlan1
- **Packet Marks:** packet-queue
- **Queue Type:** queue-pcq
- **Priority:** 8
- **Limit At:** 
- **Max Limit:** 20M 
- **Burst Limit:** 
- **Burst Threshold:** 
- **Burst Time:** 8

Queue Type <queue-pcq>

- **Type Name:** queue-pcq
- **Kind:** pcq
- **Rate:** 1M
- **Limit:** 50
- **Total Limit:** 2000
- **Burst Rate:** 5M
- **Burst Threshold:** 2M
- **Burst Time:** 00:00:10
- **Classifier**
  - **Src. Address**
  - **Dst. Address**
  - **Src. Port**
  - **Dst. Port**
Burst on Sub-Stream
• Now we can group customer that have same subnet size, not only /32
• PCQ now work in IPv6 also, and we can set the subnet
PCQ with Queue Tree

• PCQ (with src-address classifier) and Queue Tree (interface based) on NATed network will not work for uplink traffic.
  – Because interface queue for uplink located after src-nat process → all src-addresses become same

• Suggestions:
  – change the interface to global-in, or
  – use simple queue and set the interface parameter.
Note:

- In PCQ, if both limits (pcq-rate and max-limit) are unspecified, queue behavior can be imprecise. So it is strongly suggested to have at least one of these options set.
PCQ with HTB

- In HTB, we can not set priority on inner queue (groups of clients)
- PCW rule is a leaf queue, we can set priority as the priority of group of clients
  - One group more prioritized than another

<table>
<thead>
<tr>
<th>Name</th>
<th>Parent</th>
<th>Queue Type</th>
<th>Priority</th>
<th>Max Li...</th>
<th>Avg. R...</th>
</tr>
</thead>
<tbody>
<tr>
<td>queue3-parent</td>
<td>wlan1</td>
<td>default</td>
<td>8</td>
<td>5M</td>
<td>4.9 Mbps</td>
</tr>
<tr>
<td>queue1</td>
<td>queue3-parent</td>
<td>default</td>
<td>8</td>
<td>5M</td>
<td>60.5 k...</td>
</tr>
<tr>
<td>queue2-pcq</td>
<td>queue3-parent</td>
<td>queue-pcq</td>
<td>1</td>
<td>5M</td>
<td>4.8 Mbps</td>
</tr>
</tbody>
</table>
Conclusions

• Faster configuration with PCQ, one rule for all clients (with same treatment)
• HTB used if clients have different speed and setting
• Since v5rc4, PCQ have sub-stream’s burst parameter, this give similar function as in HTB
• MikroTik is ready to queue IPv4 and IPv6
Thank You!

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