

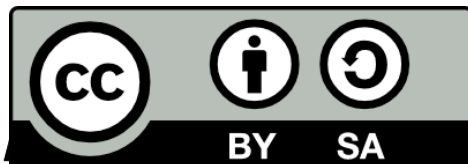


HTB vs PCQ

by: **Valens Riyadi**

Citraweb Nusa Infomedia, Indonesia

www.mikrotik.co.id



Introduction



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

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".

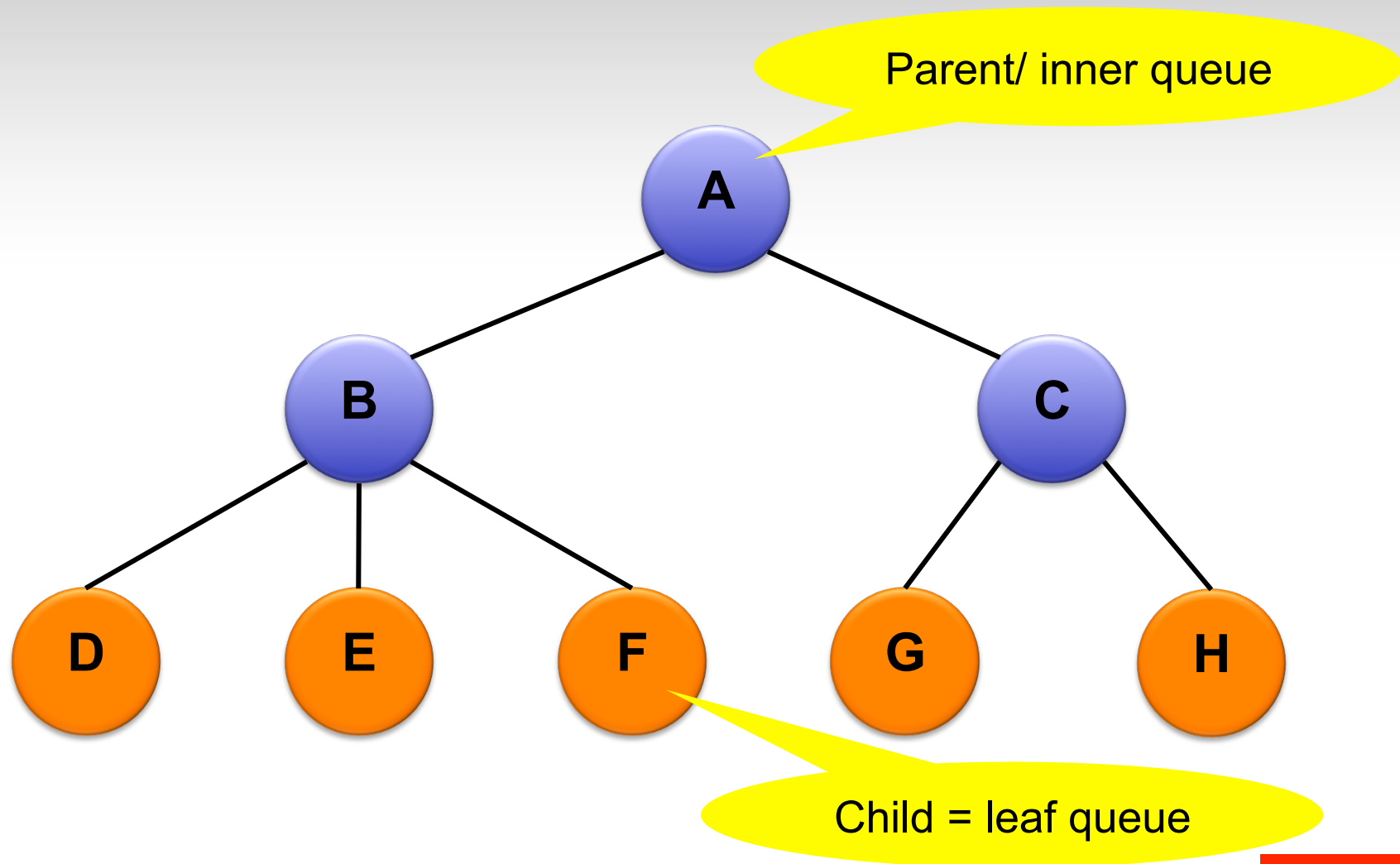
Basic Concept

- 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

HTB Sample



HTB Sample

Queue List

Simple Queues Interface Queues Queue Tree Queue Types

+ - ✓ ✗ 📄 🔍 ⚙️ Reset Counters 00 Reset All Counters Find

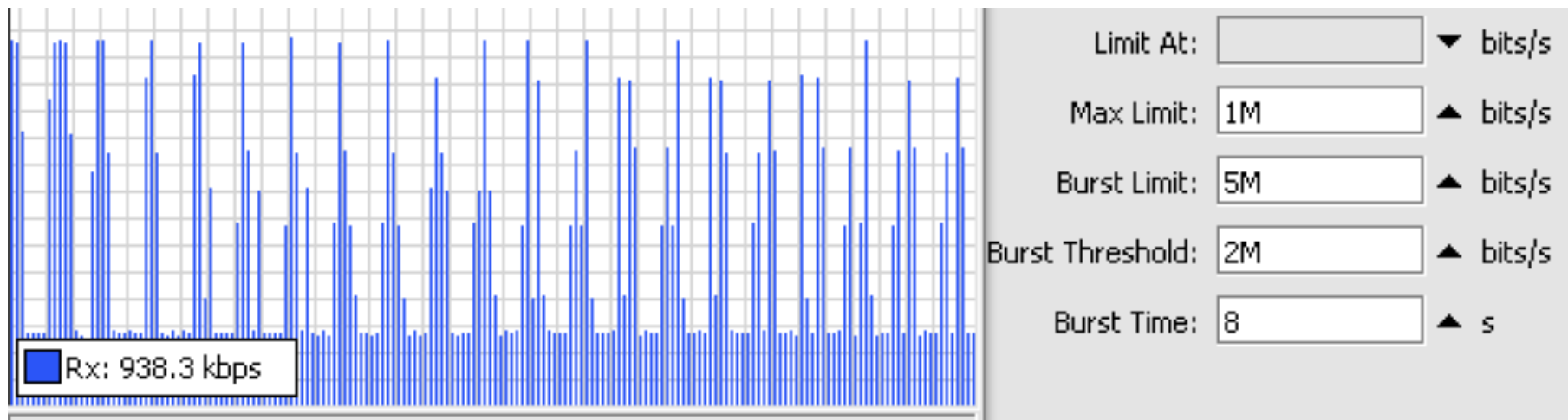
Name	Parent	Packet Marks	Limit At (bits/s)	Max Limit (bits/s)	Avg. R...	Queued Bytes	Bytes	Packets	
queue_0	ether2			10M	0 bps	0 B	0 B	0	
queue_1	queue_0	packet_1551	468904	9800k	0 bps	0 B	0 B	0	
queue_2	queue_1	packet_9220	268289	9600k	0 bps	0 B	0 B	0	
queue_17	queue_2	packet_8507	613074	6600k	0 bps	0 B	0 B	0	
queue_41	queue_17	packet_8440	371117	1800k	0 bps	0 B	0 B	0	
queue_6	queue_2	packet_2299	687353	8800k	0 bps	0 B	0 B	0	
queue_18	queue_6	packet_1165	366627	6400k	0 bps	0 B	0 B	0	
queue_23	queue_18	packet_1093	538294	5400k	0 bps	0 B	0 B	0	
queue_3	queue_0	packet_3333	166813	9400k	0 bps	0 B	0 B	0	
queue_16	queue_3	packet_6309	529294	6800k	0 bps	0 B	0 B	0	
queue_27	queue_16	packet_8970	562428	4600k	0 bps	0 B	0 B	0	
queue_46	queue_27	packet_1154	420425	800k	0 bps	0 B	0 B	0	
queue_31	queue_16	packet_8523	563538	3800k	0 bps	0 B	0 B	0	
queue_37	queue_16	packet_8389	376173	2600k	0 bps	0 B	0 B	0	
queue_40	queue_37	packet_8521	704484	2M	0 bps	0 B	0 B	0	
queue_42	queue_40	packet_2889	430111	1600k	0 bps	0 B	0 B	0	
queue_39	queue_16	packet_8281	227458	2200k	0 bps	0 B	0 B	0	
queue_22	queue_3	packet_9689	370291	5600k	0 bps	0 B	0 B	0	
queue_43	queue_22	packet_9101	607074	1400k	0 bps	0 B	0 B	0	
queue_8	queue_3	packet_3057	644987	8400k	0 bps	0 B	0 B	0	
queue_9	queue_3	packet_9444	433143	8200k	0 bps	0 B	0 B	0	
queue_35	queue_9	packet_6885	149412	3M	0 bps	0 B	0 B	0	
queue_44	queue_9	packet_6940	508058	1200k	0 bps	0 B	0 B	0	
queue_4	queue_0	packet_1485	587640	9200k	0 bps	0 B	0 B	0	
queue_5	queue_4	packet_8908	661059	9M	0 bps	0 B	0 B	0	
queue_13	queue_5	packet_8132	746955	7400k	0 bps	0 B	0 B	0	
queue_26	queue_13	packet_8397	692964	4800k	0 bps	0 B	0 B	0	
queue_34	queue_13	packet_1227	483167	3200k	0 bps	0 B	0 B	0	
queue_36	queue_13	packet_7635	412515	2800k	0 bps	0 B	0 B	0	



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.

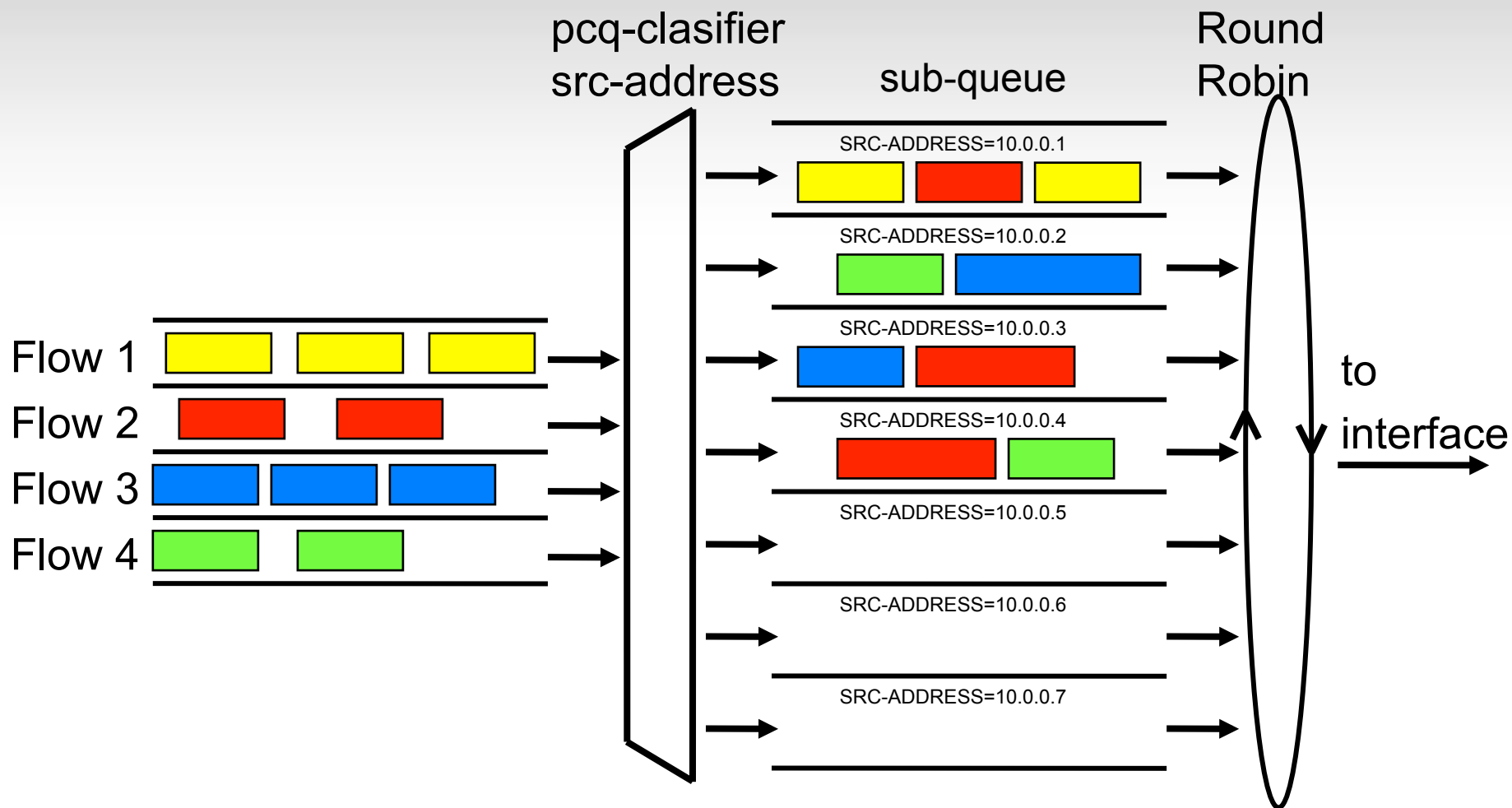


- More detail explanation about HTB :
My presentation MUM USA 2009
 - PDF : <http://bit.ly/aotax9>
 - Video : <http://bit.ly/bFrRiP>

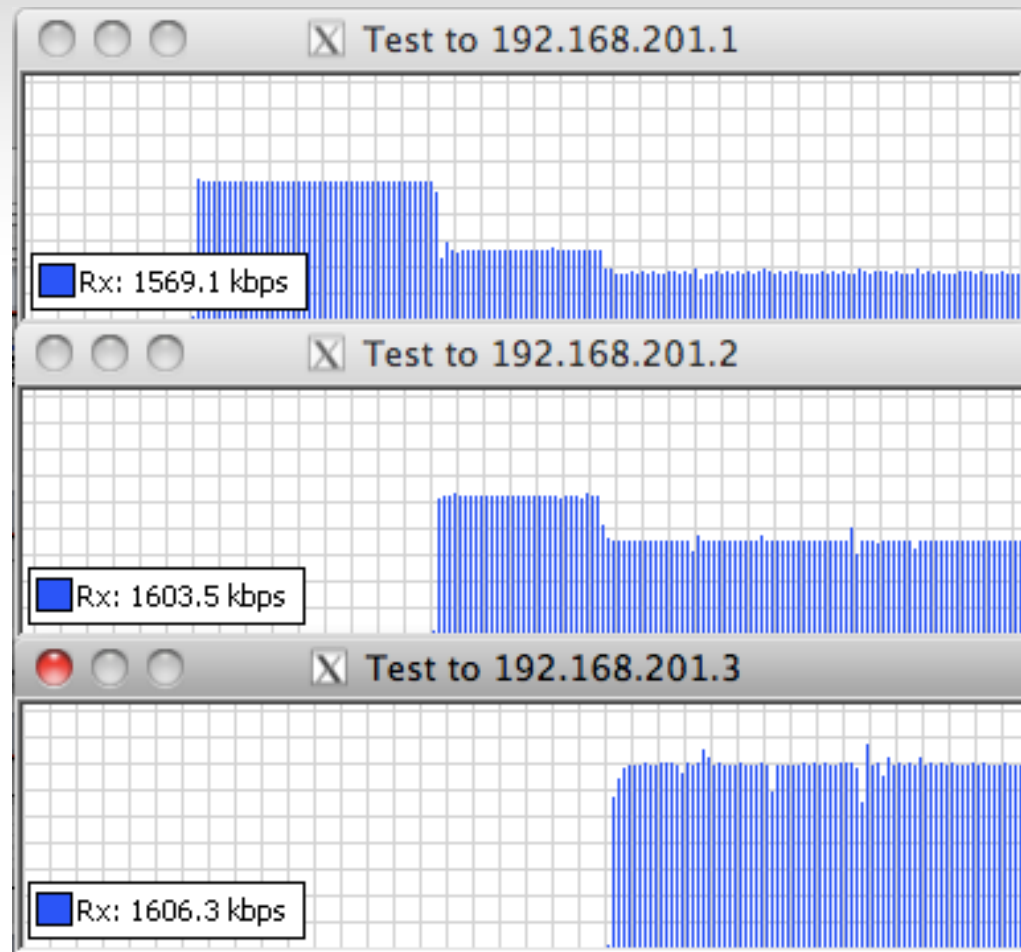
Per Connection Queuing (PCQ)

- 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



PCQ Sample



Queue <queue1>

General Statistics

Name:

Parent:

Packet Marks:

Queue Type:

Priority:

Limit At: bits/s

Max Limit: bits/s

Burst Limit: bits/s

Burst Threshold: bits/s

Queue Type <queue-pcq>

Type Name:

Kind:

Rate:

Limit:

Total Limit:

PCQ Configuration

New Queue Type

Type Name:

Kind:

Rate:

Limit:

Total Limit:

Burst Rate:

Burst Threshold:

Burst Time:

— Classifier —

☐ Src. Address ☒ Dst. Address

☐ Src. Port ☐ Dst. Port

Src. Address Mask:

Dst. Address Mask:

Src. Address6 Mask:

Dst. Address6 Mask:

OK Cancel Apply Copy Remove

New parameters since
RoS 5rc4

- Burst
- Mask (for IPv4 and IPv6)

PCQ Configuration

Rate:	<input type="text" value="0"/>
Limit:	<input type="text" value="50"/>
Total Limit:	<input type="text" value="2000"/>

- 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

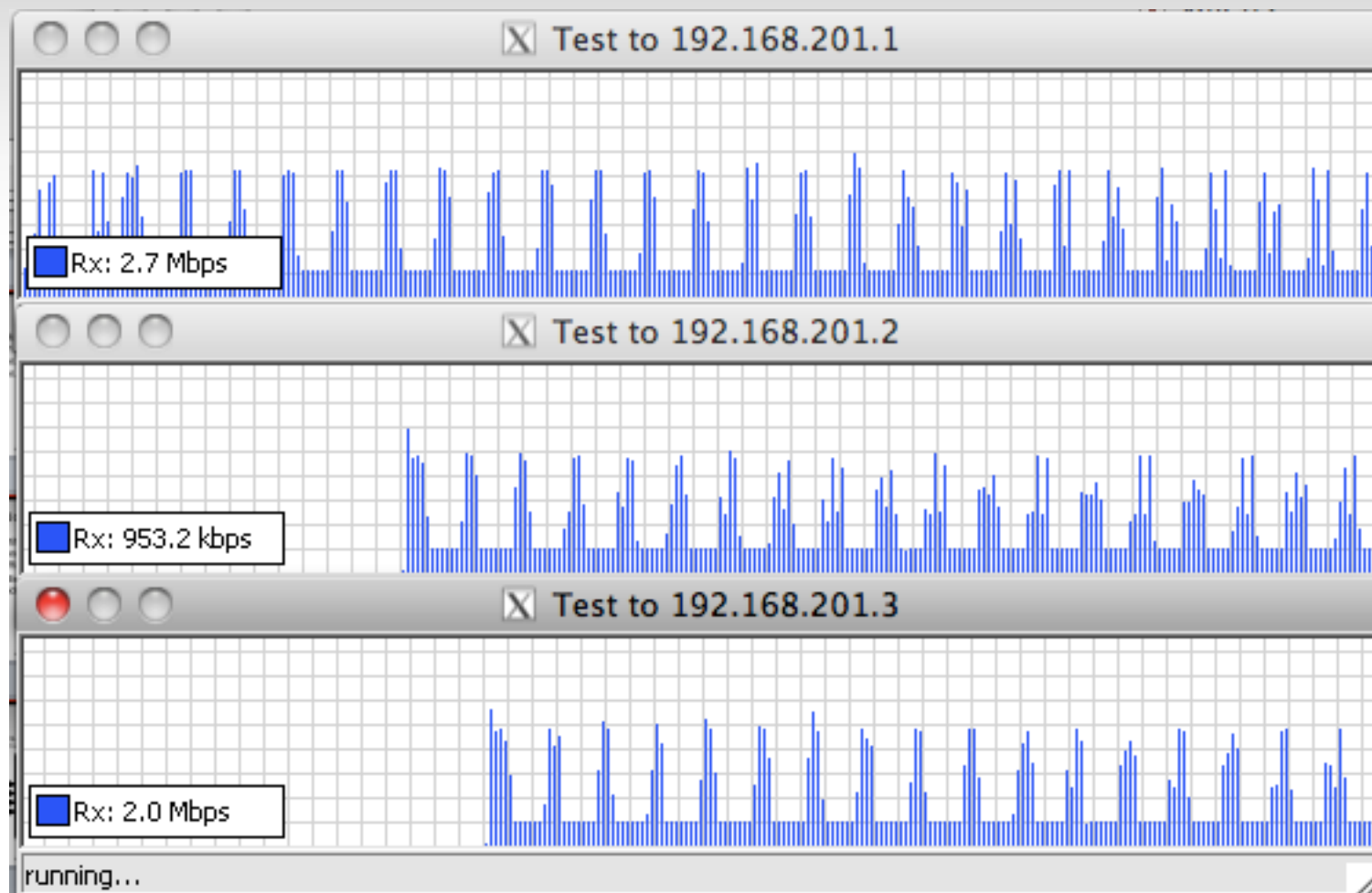
NEW

Burst on Sub-Stream

Queue <queue1>	Queue Type <queue-pcq>
General Statistics	Type Name: <input type="text" value="queue-pcq"/>
Name: <input type="text" value="queue1"/>	Kind: <input type="text" value="pcq"/>
Parent: <input type="text" value="wlan1"/>	Rate: <input type="text" value="1M"/>
Packet Marks: <input type="text" value="packet-queue"/>	Limit: <input type="text" value="50"/>
Queue Type: <input type="text" value="queue-pcq"/>	Total Limit: <input type="text" value="2000"/>
Priority: <input type="text" value="8"/>	Burst Rate: <input type="text" value="5M"/>
Limit At: <input type="text" value=""/>	Burst Threshold: <input type="text" value="2M"/>
Max Limit: <input type="text" value="20M"/>	Burst Time: <input type="text" value="00:00:10"/>
Burst Limit: <input type="text" value=""/>	— Classifier —
Burst Threshold: <input type="text" value=""/>	<input checked="" type="checkbox"/> Src. Address <input type="checkbox"/> Dst. Address
Burst Time: <input type="text" value="8"/>	<input type="checkbox"/> Src. Port <input type="checkbox"/> Dst. Port

NEW

Burst on Sub-Stream





Burst on Sub-Stream

Src. Address Mask:	<input type="text" value="32"/>
Dst. Address Mask:	<input type="text" value="32"/>
Src. Address6 Mask:	<input type="text" value="64"/>
Dst. Address6 Mask:	<input type="text" value="64"/>

- 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

Name	Parent	Queue Type	Priority	Max Li...	Avg. R...
 queue3-parent	wlan1	default	8	5M	4.9 Mbps
 queue1	queue3-parent	default	8	5M	60.5 k...
 queue2-pcq	queue3-parent	queue-pcq	1	5M	4.8 Mbps

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!

info@mikrotik.co.id

