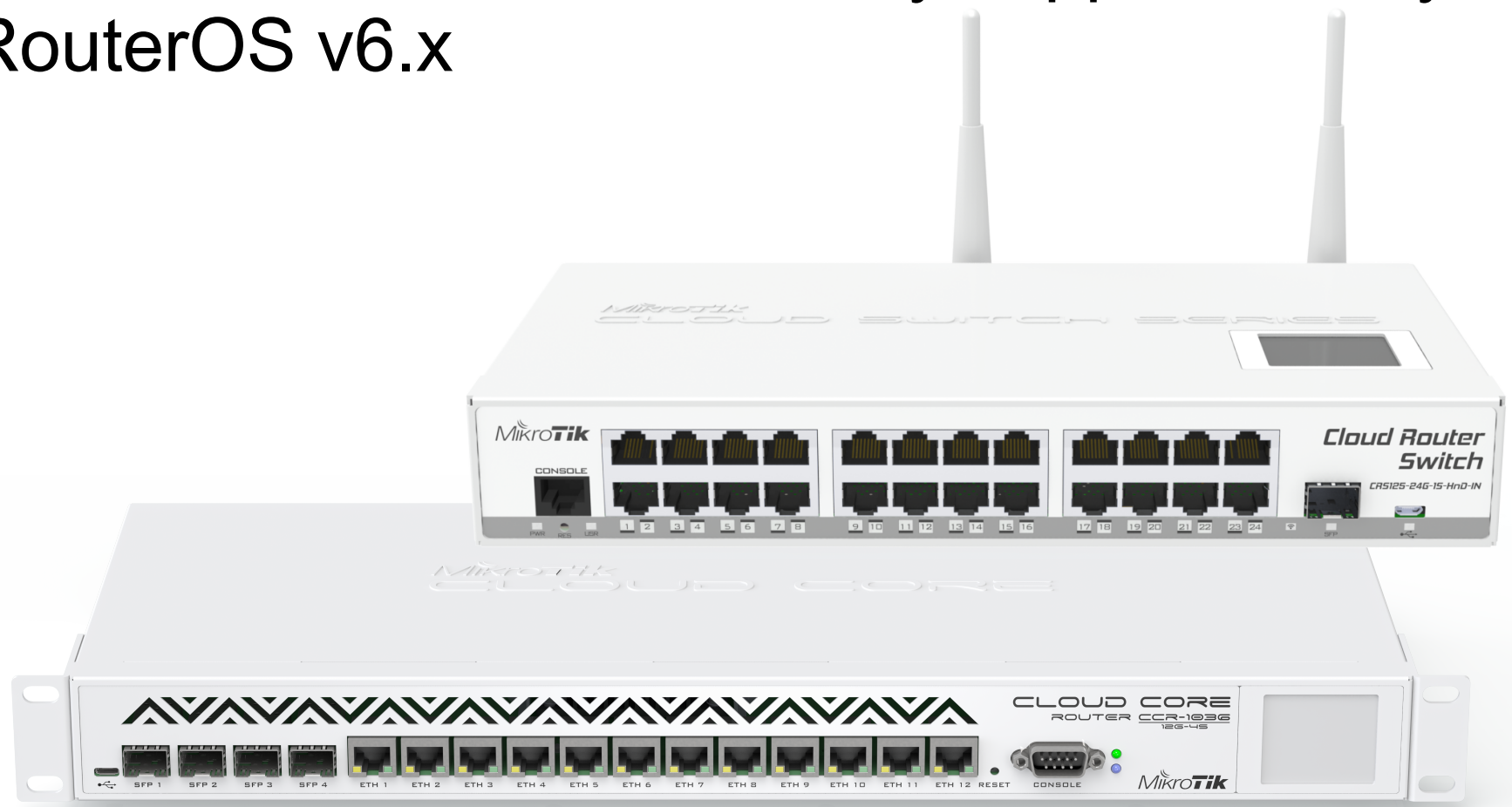# MikroTik RouterOS v6
Whats new??

St. Louis, MO

MUM USA 2013

Support for New Products

- CloudCoreRouter, CloudRouterSwitch and other new devices will be fully supported only in RouterOS v6.x

New Linux Kernel

- RouterOS 5.25
    - Linux Kernel version 2.6.35
- RouterOS 6.x
    - Linux Kernel version 3.3.5+

- For more detailed information see:
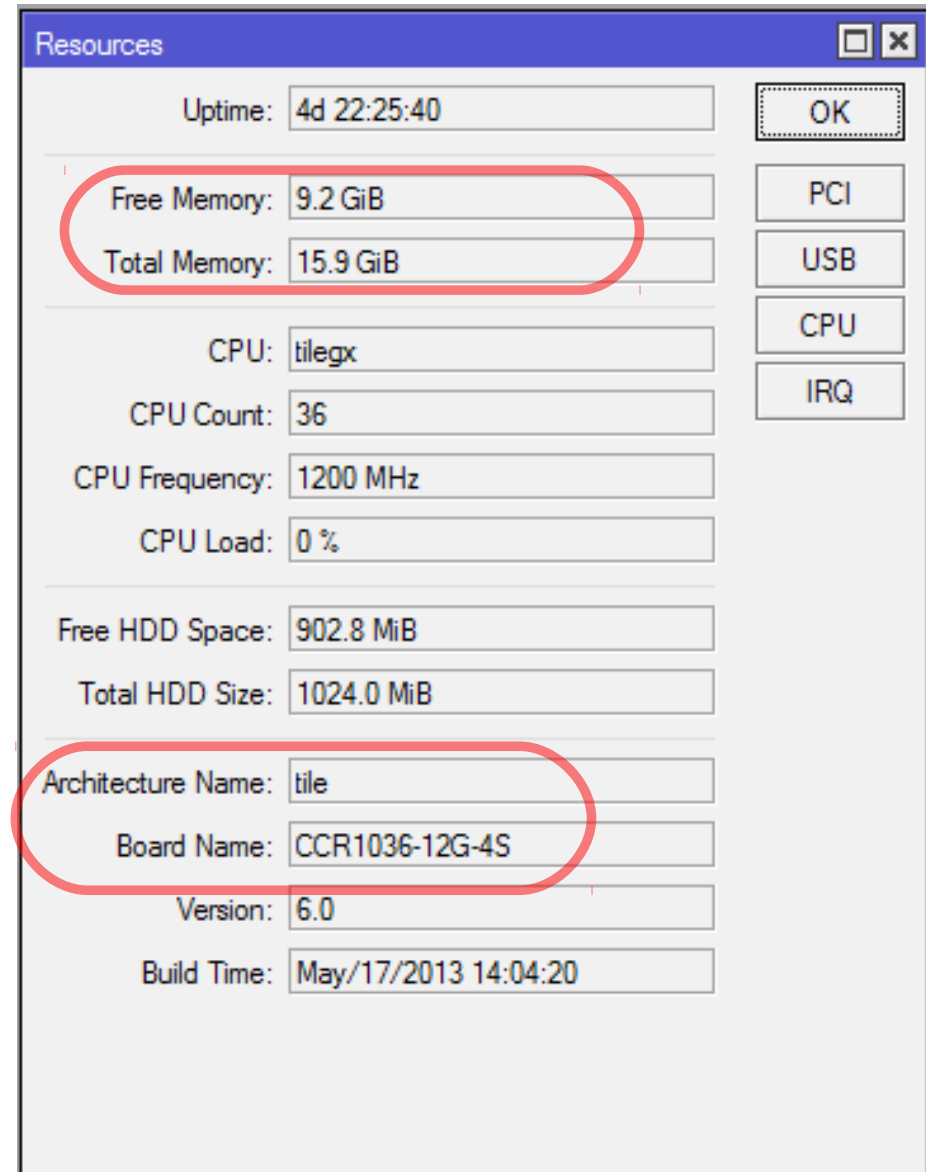   http://www.kernel.org/

New CPU architecture support

- In v5.x there were 4 different architectures
  - **mipsle** (RB1xx, RB5xx)
  - **mipsbe** (RB4xx, RB7xx, RB9xx, RB2011, SXT, Sextant, Groove, Metal, CRS)
  - **ppc** (RB1xxx, RB6xx, RB8xx)
  - **x86**
- In v6.x there will be one more
  - **tile** (CCR1xxx)

RouterOS Tile architecture

- Only for CCR devices
- 64-bit operating system (more RAM)
- Dual memory channel support (faster RAM)
- Hardware Accelerated Multi-threading (no need for RPS and IRQ management)
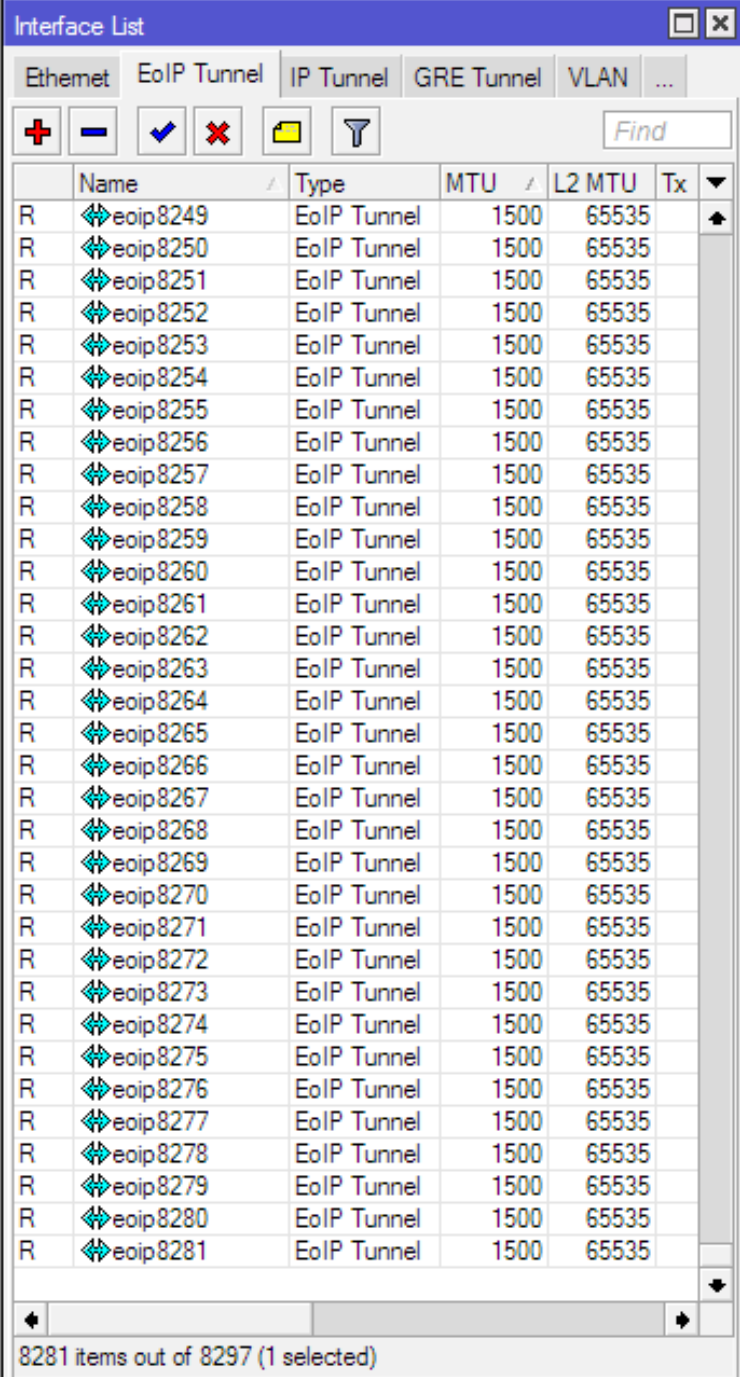

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New Kernel Features

- Newest interface driver support for x86 systems

- Improved interface management - scales well for up to thousands of interfaces and more

- Uses less space on storage - works well with 32MiB flash

What else is new?

- Lifted 16 CPU core limit

- Improved RouterOS performance on multi-cpu systems (up to 20%)

- Improved RouterBOARD interface driver performance (up to 30%)

- Routerboard package is now merged into system package

Fast Path

- Fast Path allows to forward packets without additional processing in the Linux Kernel. It improves forwarding speeds significantly.

- Fast path requirements

  - Fast Path should be allowed in configuration

  - Interface driver must have support

  - Specific configuration conditions

- Currently RouterOS has fast path handlers for: ipv4 routing, traffic generator, mpls, bridge

- More handlers will be added in future.

New Throughput test results

RB951G-2HnD		Gigabit Ethernet test (600Mhz)		RouterOS v6.0rc5			
Mode	Configuration	64 byte		512 byte		1518 byte	
		kpps	Mbps	kpps	Mbps	kpps	Mbps
Bridging	none (fast path)	269.6	176.9	232	983.7	81	995.3
Bridging	25 Bridge filter rules	87.6	57.5	86	364.6	81	995.3
Routing	none (fast path)	226.9	148.8	210	890.4	81	995.3
Routing	25						
Routing							

RB1100Hx2				RouterOS v6.			
Mode	Configuration	64 byte		512 byte		1518 byte	
		kpps	Mbps	kpps	Mbps	kpps	Mbps
Bridging	none (fast path)	1690	1108.6	704	2985.0	406	4988.9
Bridging	25 Bridge filter rules	412	270.3	396	1679.0	308	3784.7
Routing	none (fast path)	1495	980.7	704	2985.0	345	4239.4
Routing	25						
Routing							

CCR1036-12G-4S				RouterOS v6.			
Mode	Configuration	64 byte		512 byte		1518 byte	
		kpps	Mbps	kpps	Mbps	kpps	Mbps
Bridging	none (fast path)	23808	15618.0	3759	15938.2	1300	15974.4
Bridging	25 Bridge filter rules	7340	4815.0	3759	15938.2	1300	15974.4
Routing	none (fast path)	23808	15618.0	3759	15938.2	1300	15974.4
Routing	25 Simple Queues	7919	5194.9	3759	15938.2	1300	15974.4
Routing	25 IP filter rules	3127	2051.3	2998	12711.5	1300	15974.4

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Throughput in millions pps

Traffic Generator Tool

- Traffic Generator is a bandwidth-tool evolution

- Traffic Generator can:
  - Determine transfer rates, packet loss
  - Detect out-of-order packets
  - Collect latency and jitter values
  - Inject and replay *.pcap file (NEW!! in v6.1)
  - Working on TCP protocol emulation

- "Quick" mode

- Full Winbox support (coming soon)

MikroTik RouterOS Packet Flow Diagram
for version 6.x

BRIDGING

(A) → BRIDGE DST-NAT → USE-IP-FIREWALL?
- YES → PREROUTING → BRIDGING DECISION
- NO → BRIDGING DECISION

BRIDGING DECISION → BRIDGE INPUT → (B)

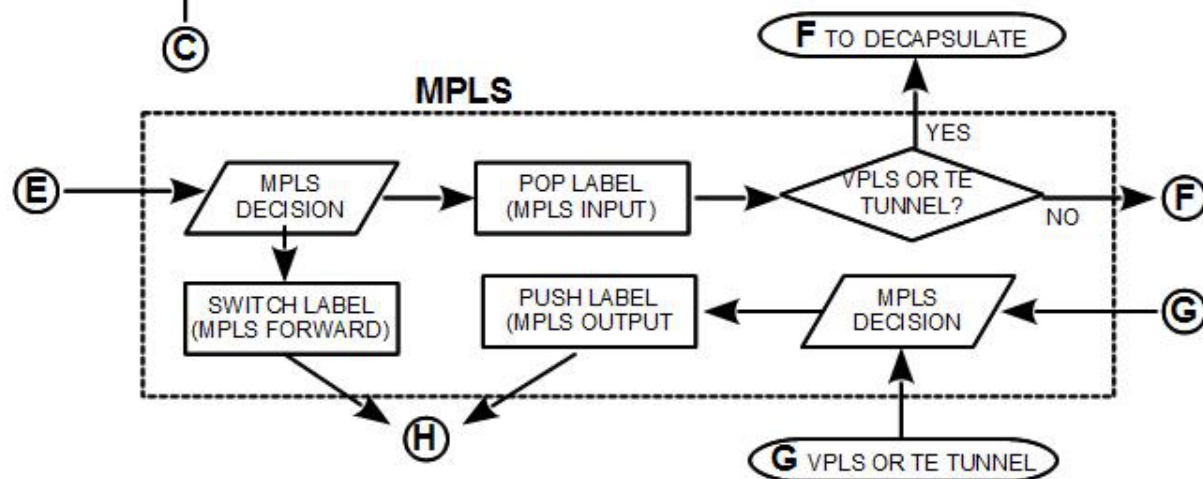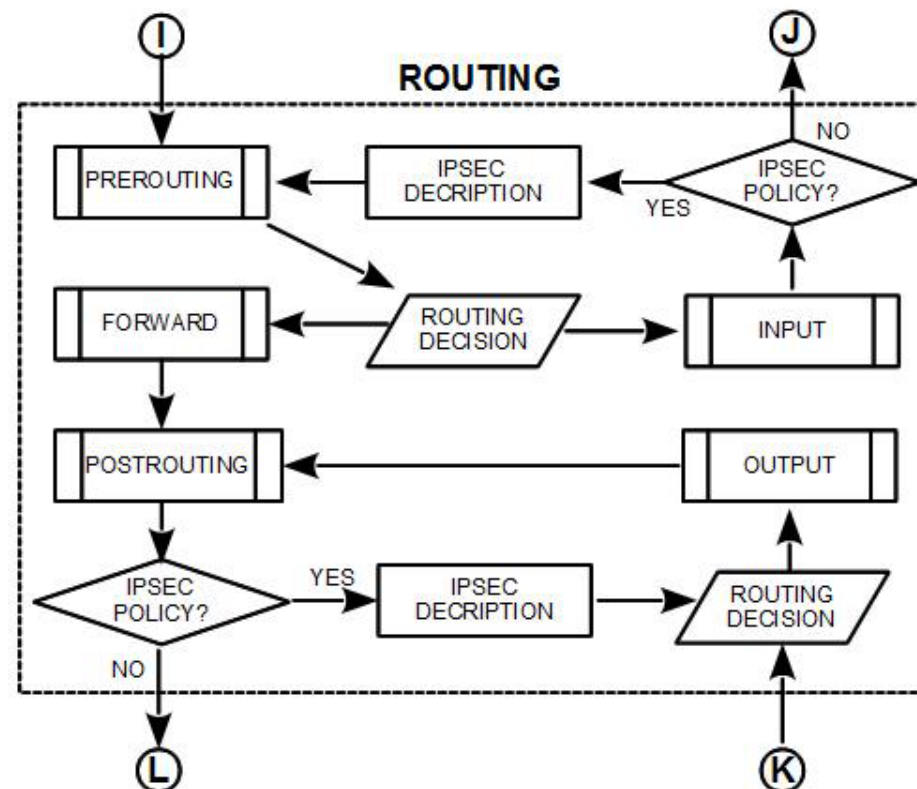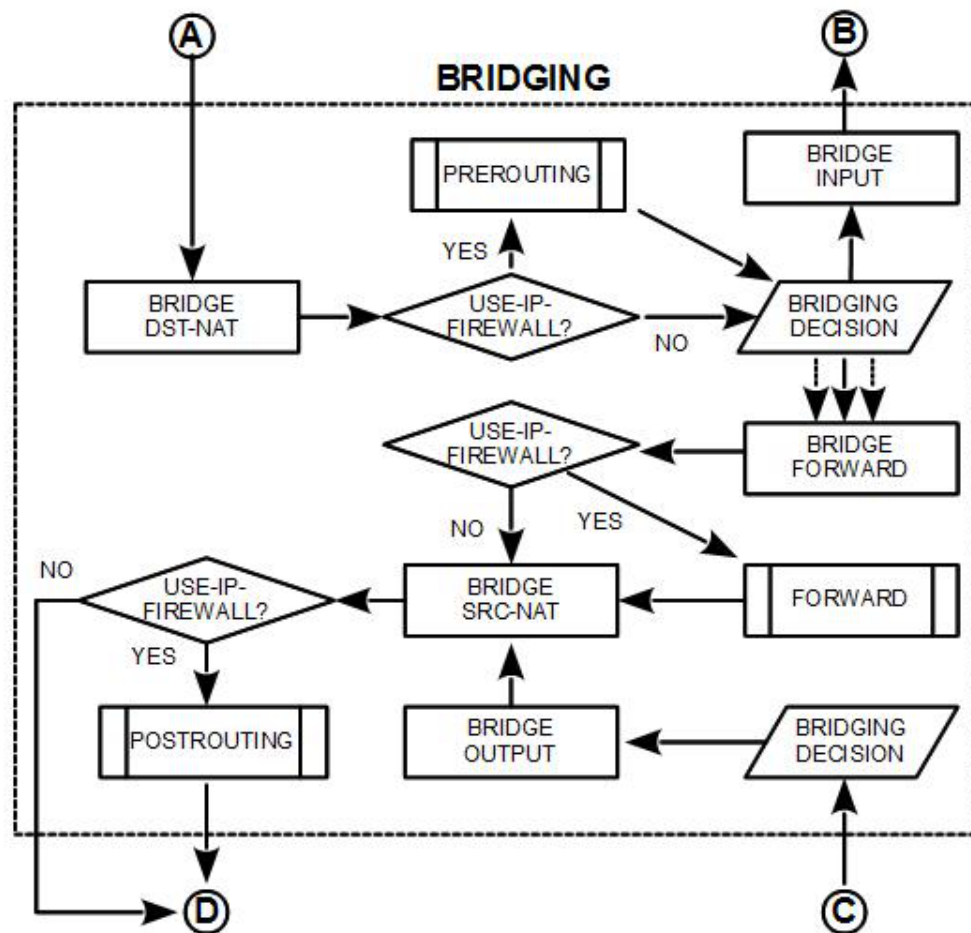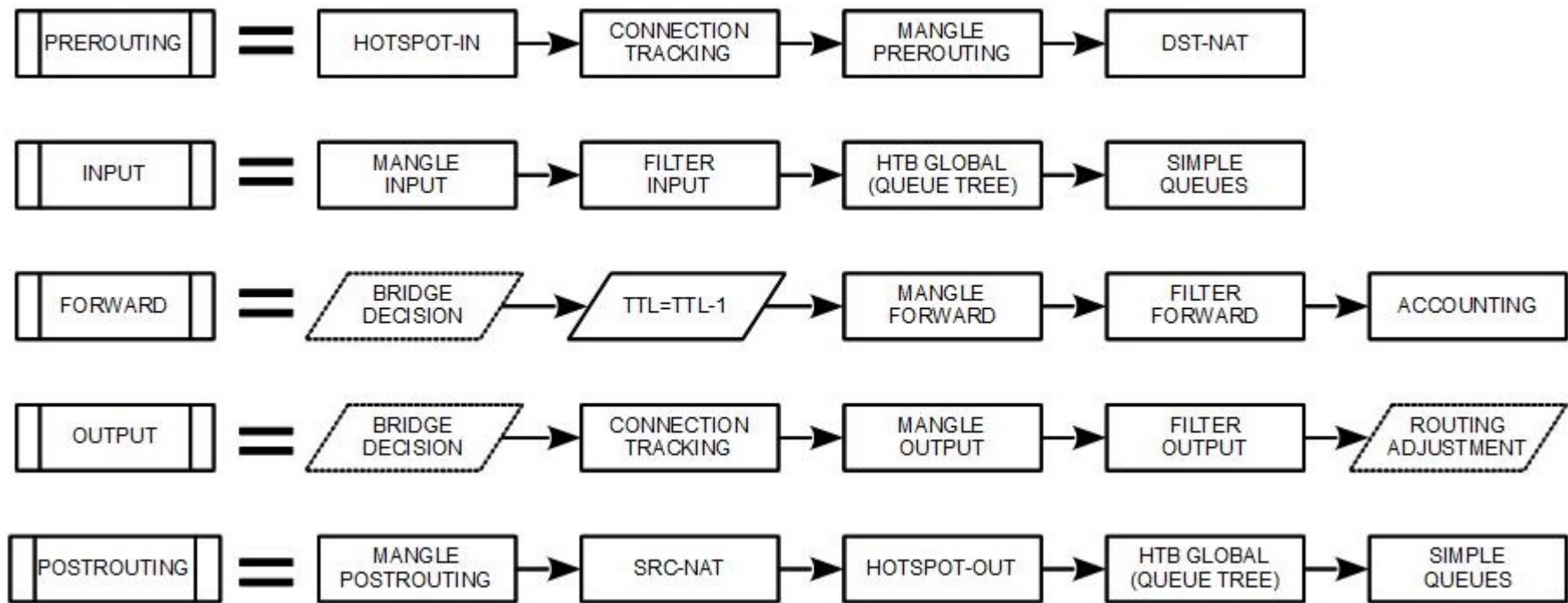BRIDGING DECISION ⇢ BRIDGE FORWARD → USE-IP-FIREWALL?
- YES → FORWARD
- NO → BRIDGE SRC-NAT

FORWARD → BRIDGE SRC-NAT → USE-IP-FIREWALL?
- NO → (D)
- YES → POSTROUTING → (D)

BRIDGE SRC-NAT ← BRIDGE OUTPUT ← BRIDGING DECISION

BRIDGING DECISION → (C)

ROUTING

(I) → PREROUTING → ROUTING DECISION
ROUTING DECISION → FORWARD
ROUTING DECISION → INPUT

IPSEC DECRIPTION → PREROUTING

IPSEC POLICY?
- NO → (J)
- YES → IPSEC DECRIPTION

FORWARD → POSTROUTING
POSTROUTING → IPSEC POLICY?
- YES → IPSEC DECRIPTION → ROUTING DECISION
- NO → (L)

OUTPUT → POSTROUTING
ROUTING DECISION → OUTPUT
(K) → ROUTING DECISION

MPLS

(E) → MPLS DECISION → POP LABEL (MPLS INPUT) → VPLS OR TE TUNNEL?
- YES → (F) TO DECAPSULATE
- NO → (F)

MPLS DECISION → SWITCH LABEL (MPLS FORWARD) → (H)

(G) → MPLS DECISION → PUSH LABEL (MPLS OUTPUT) → (H)
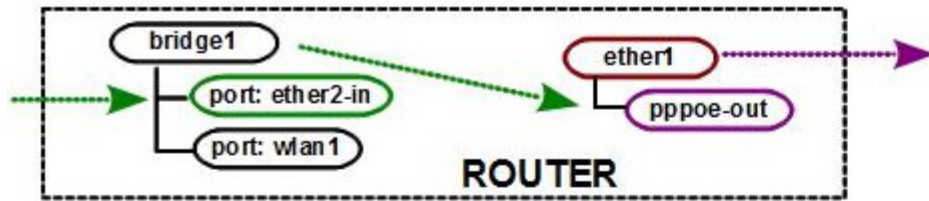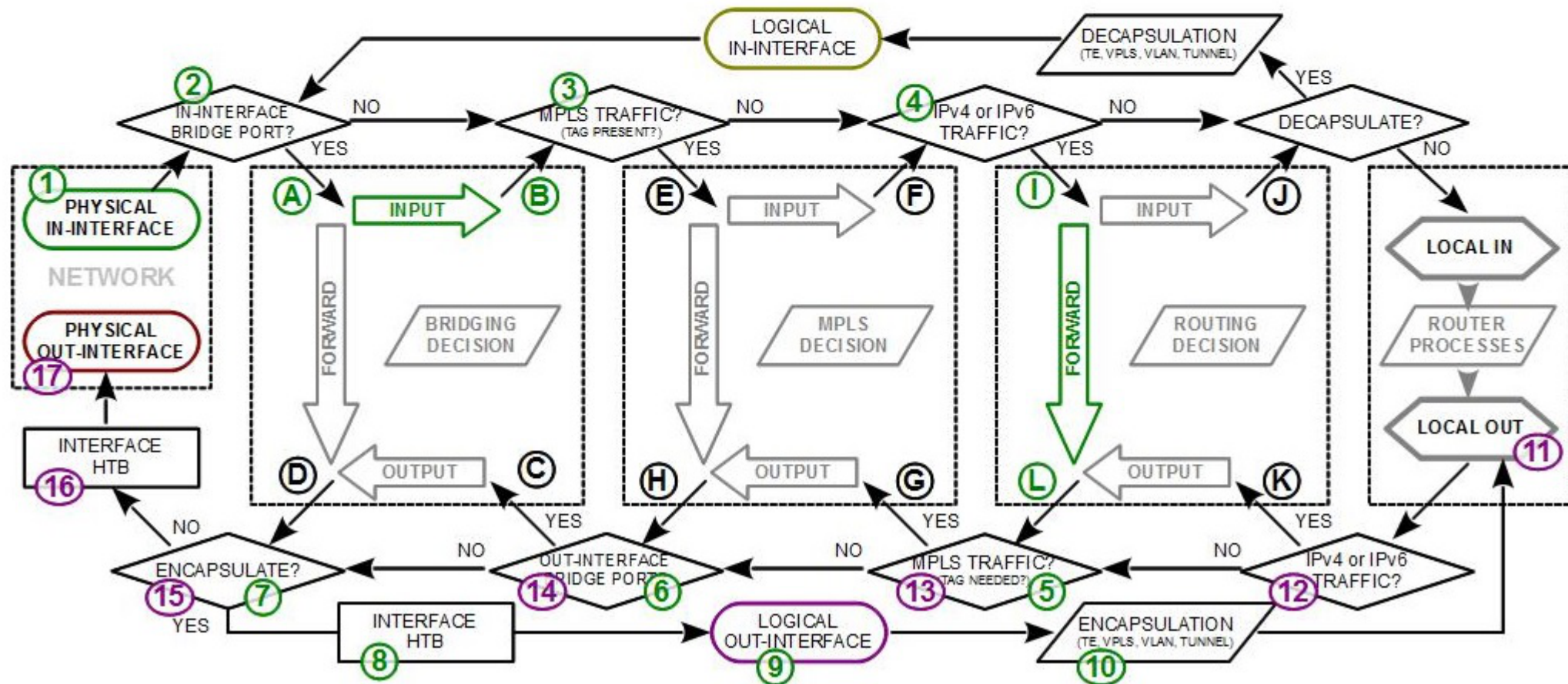
(G) VPLS OR TE TUNNEL → MPLS DECISION

Yes, still - Packet Flow Diagram (page 3)

Packet Flow Scenario:

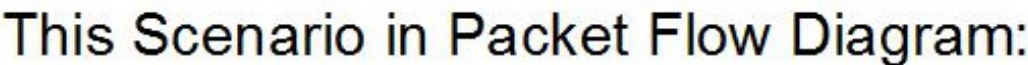# This Scenario in Packet Flow Diagram:

15

Packet Flow Scenario:

This Scenario in Packet Flow Diagram:

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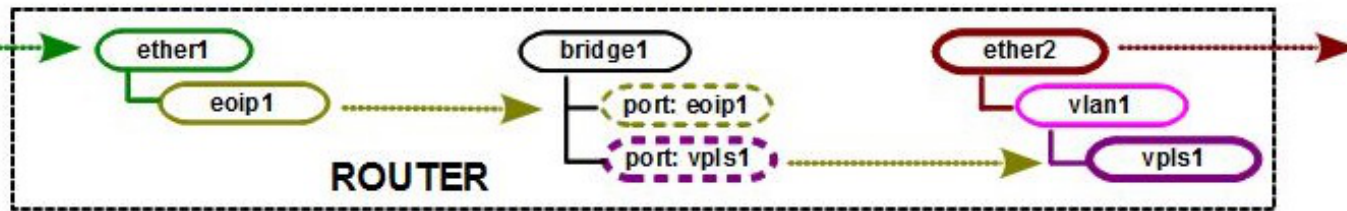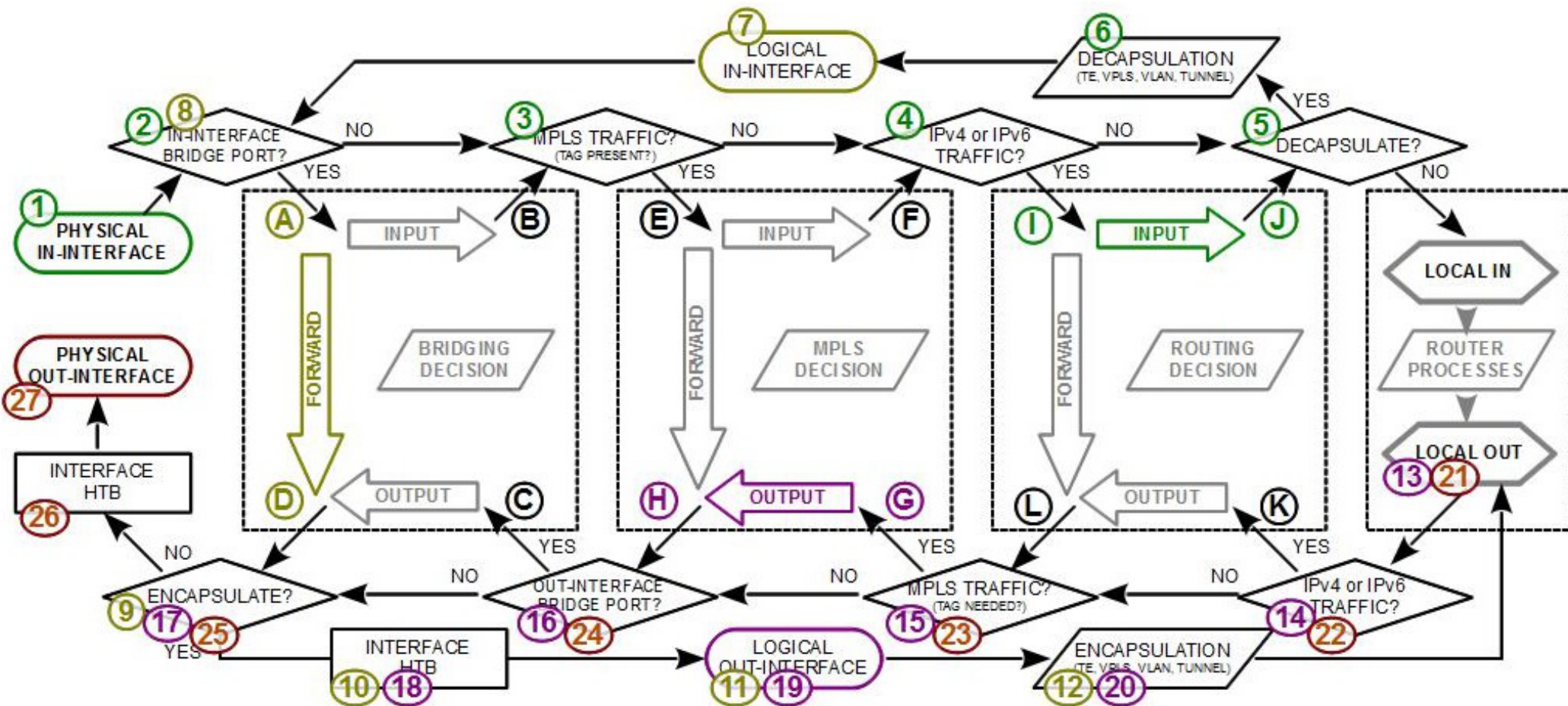
Packet Flow Scenario:

This Scenario in Packet Flow Diagram:

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QoS System Reworked

- WARNING!!!
  Simple Queues and Queue Tree queues in some specific configurations might be inactivated after upgrade from RouterOS v3.x, v4.x, v5.x to RouterOS v6.x

  Automatic configuration transition is unavailable cause in some configurations might result in inability to access router.

Changes in Packet Flow Diagram

- Queuing packet in several different places in its "life-cycle" causes enormous performance degradation in multi-threading environment

- In RouterOS v6.x QoS system was redesigned so that queuing happens is the same place respectively to other processes in the router.

- HTB "global-in", "global-out" and "global-total" was deleted, and replaced with HTB "global" and placed at the very end of packet's "life-cycle" in the router.
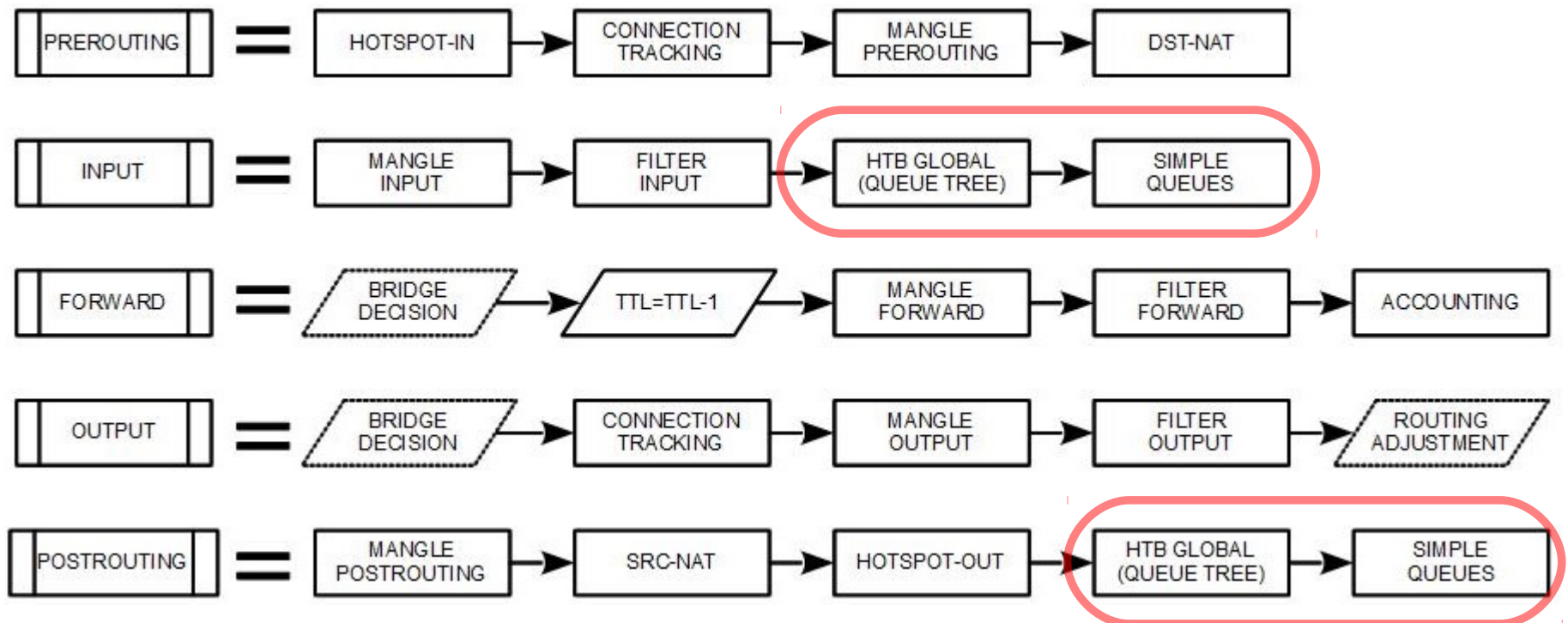
HTB in RouterOS v5
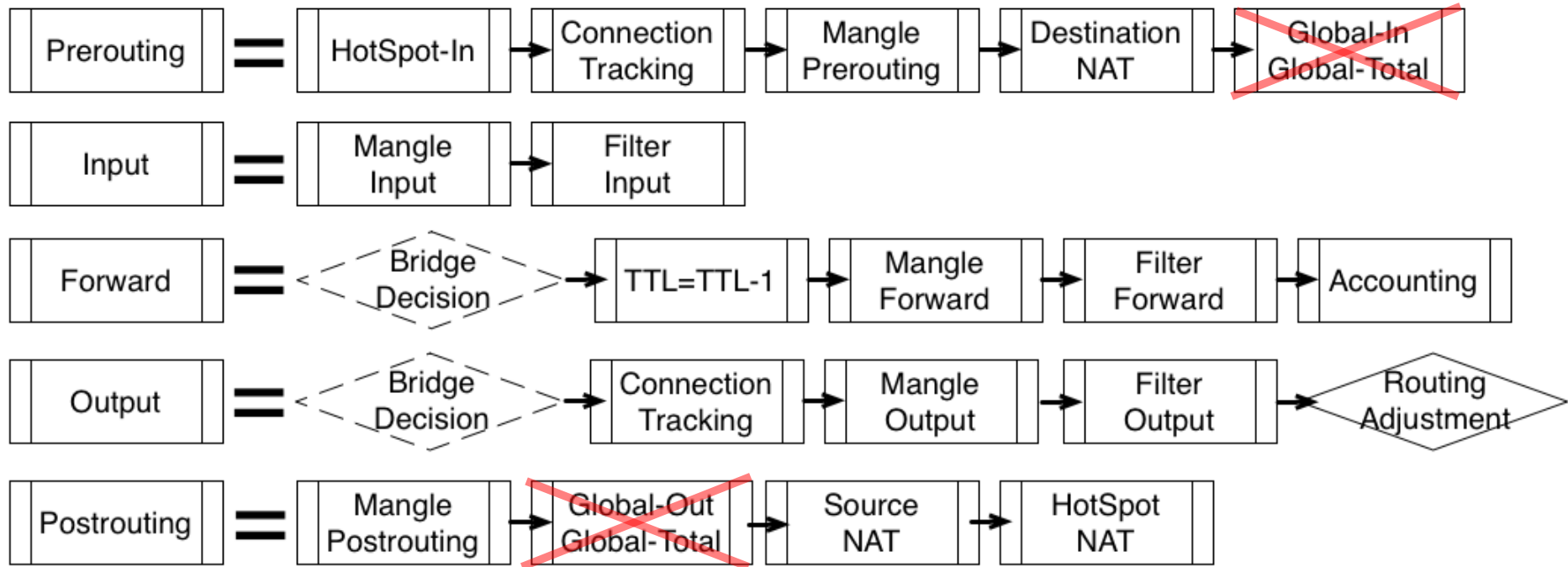
HTB in RouterOS v6

Additional changes

- Simple queues are now separated from the Queue Tree completely – the same packet can be captured in HTB "global" and Simple Queues (in v5 Simple Queues shared global-HTBs)

- As all queuing now happens after SRC-NAT the PCQ queue type is updated and now is NAT aware (from connection tracking)

- You can now specify multiple packet-marks per single queue

Simple Queues

- Simple queue matching algorithm has been updated

- Very small overhead for packets that miss existing simple queues

- Top level simple queues are now balanced between CPU cores (32 queues 9x faster than 1 queue on CCR1036)

Simpler Simple Queues

- "target-addresses" and "interface" parameters are joined into one "target" parameter

- "dst-address" parameter is changed to "dst" and now can be specified as an interface as well

- direction and p2p parameters removed

- "target" now must be specified on a simple queue creation

- Separate "priority" parameter for download, upload and total

Simple Queue Interface v5

Simple Queue Interface v6

Changes in the Firewall

- Firewall now has "all-ether","all-wireless","all-vlan","all-ppp" as possibilities in interface matching

- New priority matcher

- New "change-dscp" options "from-priority" and "from priority-to-high-3-bits"

- New Mangle Actions "snif-tzsp","snif-pc" to send packet stream to remote sniffer.

Changes in Dynamic stuff

- Only 2 dynamic "change-mss" mangle rules are created for "all-ppp" interfaces

- In PPTP, L2TP, SSTP, HotSpot profiles you can specify:

  - dynamic simple queue position (also true for DHCP leases)

  - dynamic simple queue parent

  - dynamic simple queue type

- PPP,PPTP,L2TP,SSTP - added default-route-distance parameter

Changes in Tunnels

- PPTP, L2TP, SSTP – allows you to specify server via DNS name

- SSTP can now forces AES encryption instead of default RC4

- PPP profile now has a "bridge-path-cost" and "bridge-port-priority" parameters

- PPPoE server - allow service with empty service-name to accept all pppoe clients

- Hotspot and PPP now support multiple address-lists from RADIUS

Changes in DHCP

- dhcp-options now can be specified by mixing different data types

- dhcp-client have custom dhcp-option feature (examples at: /ip dhcp-client option print)

- DHCPv4 client now have special-classless option for add-default-route parameter

- Possibility to add DHCP relay agent information option (Option 82)

- DHCPv6 DNS option support

Changes in scripts

- ':global', ':local' and ':set' commands have new parameter 'do' that allows assigning a block of commands to the variable;

- Added "on-error" argument to ':do' command that is executed if the command raises an error

- Added a new ':return' command that interrupts execution of script and passes argument as return value if script was called as function

- Added 'verbose' argument to '/import' command that enables line-by-line script import

Other Changes

- Slave flag now will show up for interfaces that are in bridge, bonding or switch group

- "/export compact" now is as default for "/export", use "/export verbose" to get previous behavior

- Connected routes become inactive when Interface goes down.

- Configurable Linux Kernel options in /ip settings and /ipv6 settings menus

- Initial OpenFlow support

IPSec Road Warrior

- RoadWarrior setups are now supported
    - Mode Conf support
    - passive IPSec peer mode
    - Xauth support (xauth PSK and Hybrid RSA)
    - Policy templates and generate-policy
    - Peer groups
    - Multiple peers with the same IP can be used.
    - and more...

SCEP Protocol Support

- Simple Certificate Enrollment protocol (SCEP)

- This protocol allows to:
    - get CA certificate from CA server or RA
    - create self-signed certificate with temp key
    - send certificate request to the server
    - protect CA operations with CA passphrase

- More info at:
  http://wiki.mikrotik.com/wiki/Manual:System/Certificates#SCEP

Wireless Advanced Channels

- Works only between Atheros AR92xx chips and only between MikroTik devices

  - center frequency range:

    - 2192-2734mhz

    - 4800-6100mhz

- Choose precise center frequency (0.5MHz step)

- Choose channel width (2.5-30MHz, 0.5MHz step)

- Super-channel license is required to use advanced channels – it is free of charge (only signed document required about proper usage)
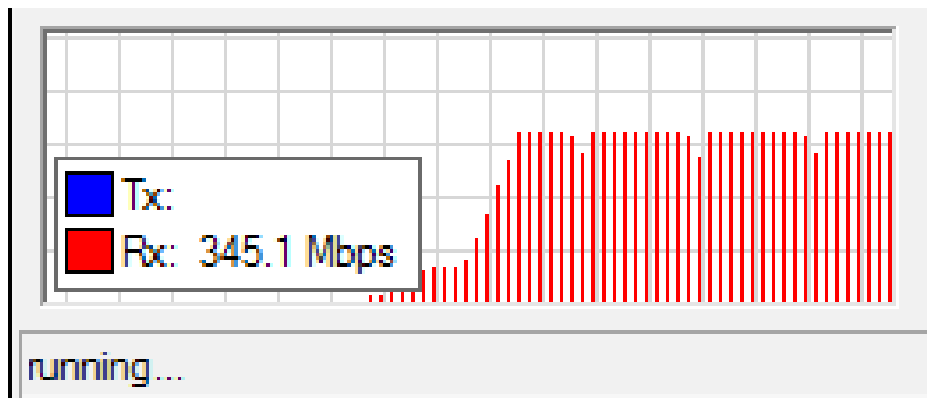
Wireless Advanced Channels

- Located in /interface wireless channels

- Allows to name each advanced channel and group them into custom lists

- These names and list names later should be use in wireless clients scan-list, to enable them to see advanced channel APs (old style scan-list entries will not work)

- Custom scan-list options:
    - default, frequency, frequency range
    - advanced channel name or list name

Advanced Channel Test

- Center frequency - 5362.5MHz

- Channel width - 30MHz

- Extension channel – Above

- Maximal data rate – MCS-15, 405Mbps

- Wireless protocol – 802.11n

Questions!!!