MikroTik RouterOS v6
Whats new??

Moscow,

MUM Russia 2013

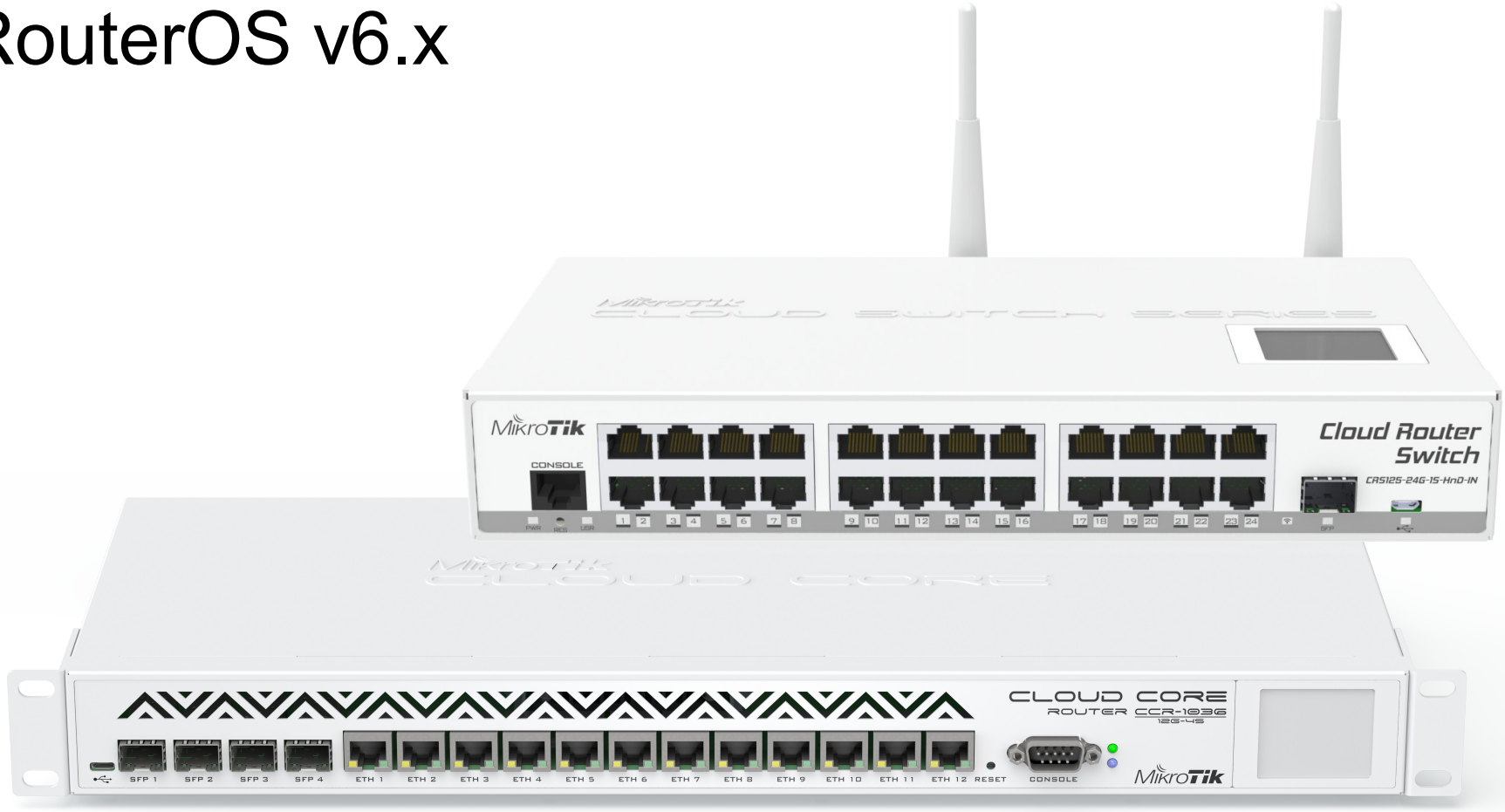
Good News Everyone!!!

RouterOS v6.x full release is here!!!

(available on our download page since 20.05.2013)

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+

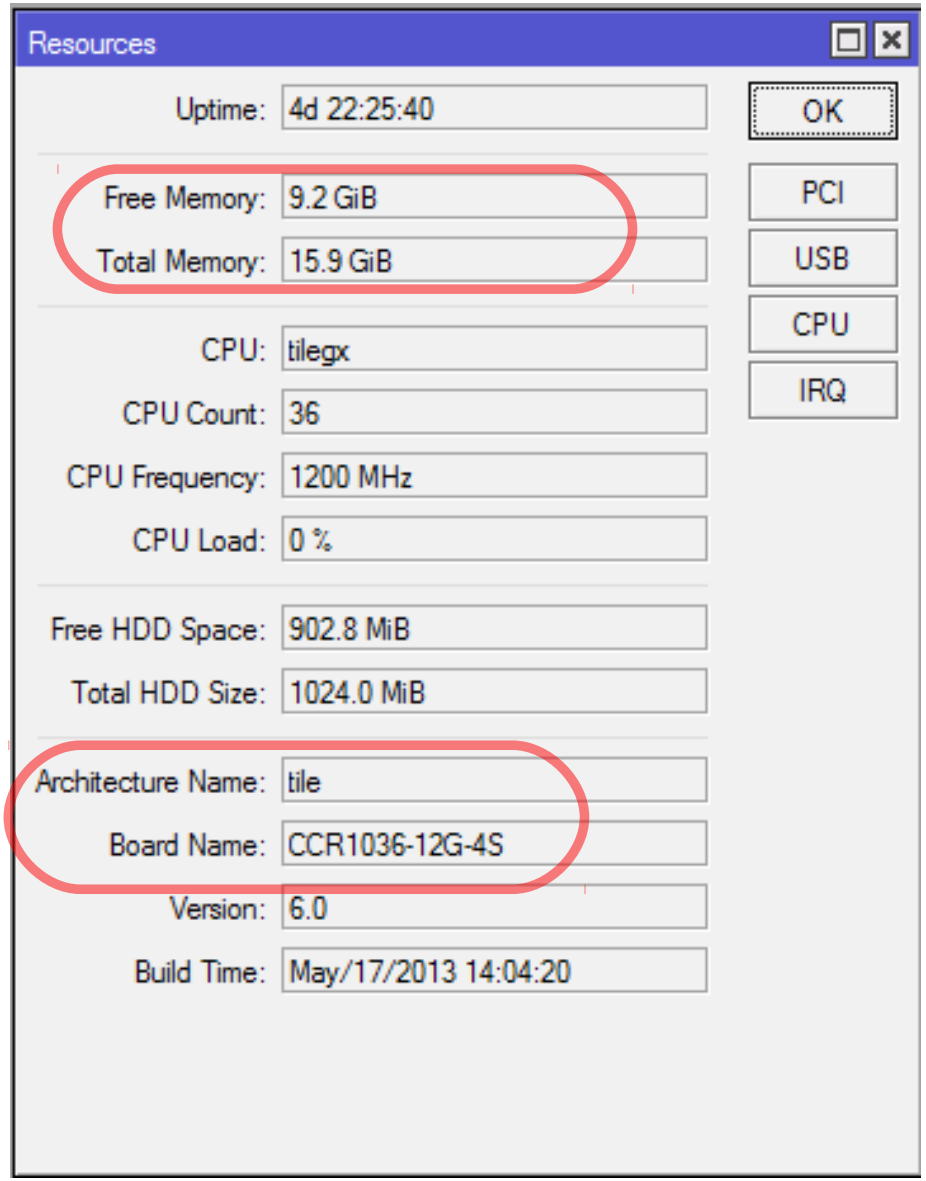
- For more detailed information see:
  http://www.kernel.org/

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)

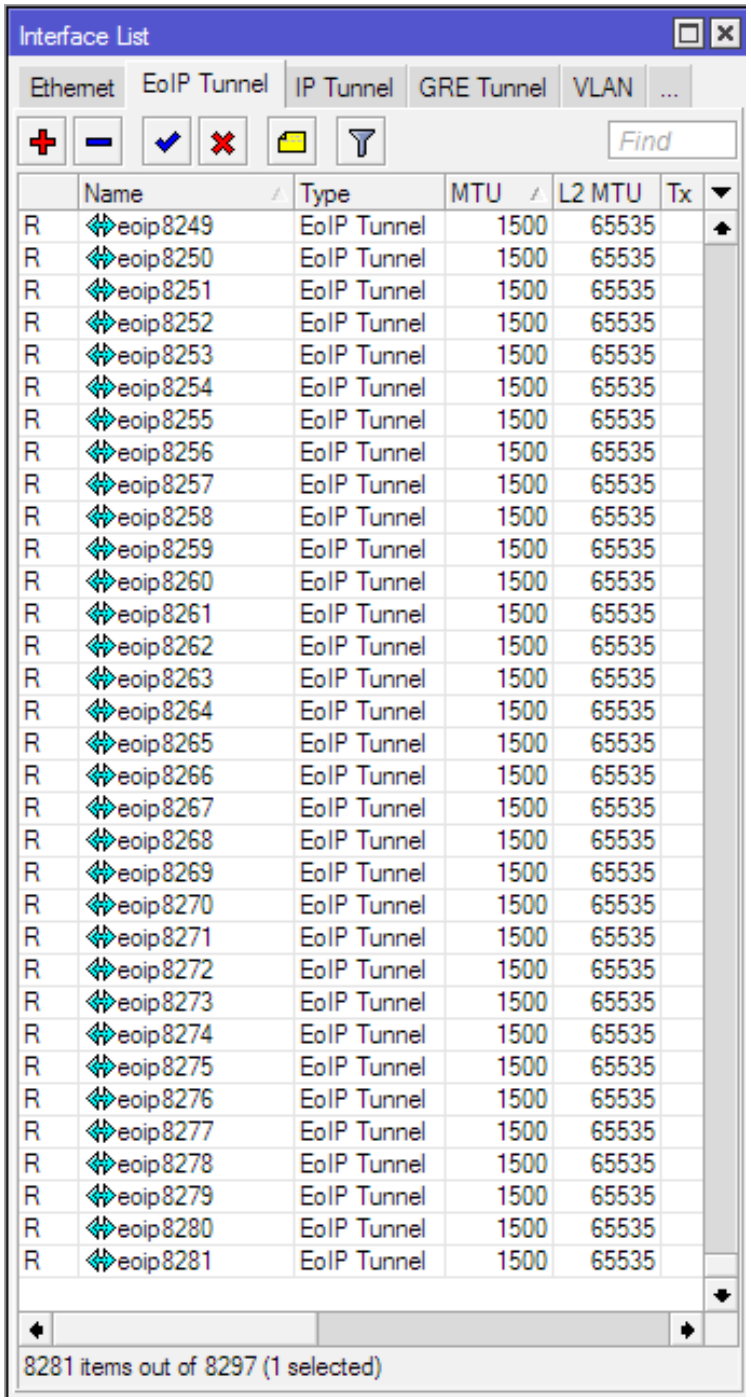
RouterOS Tile architecture

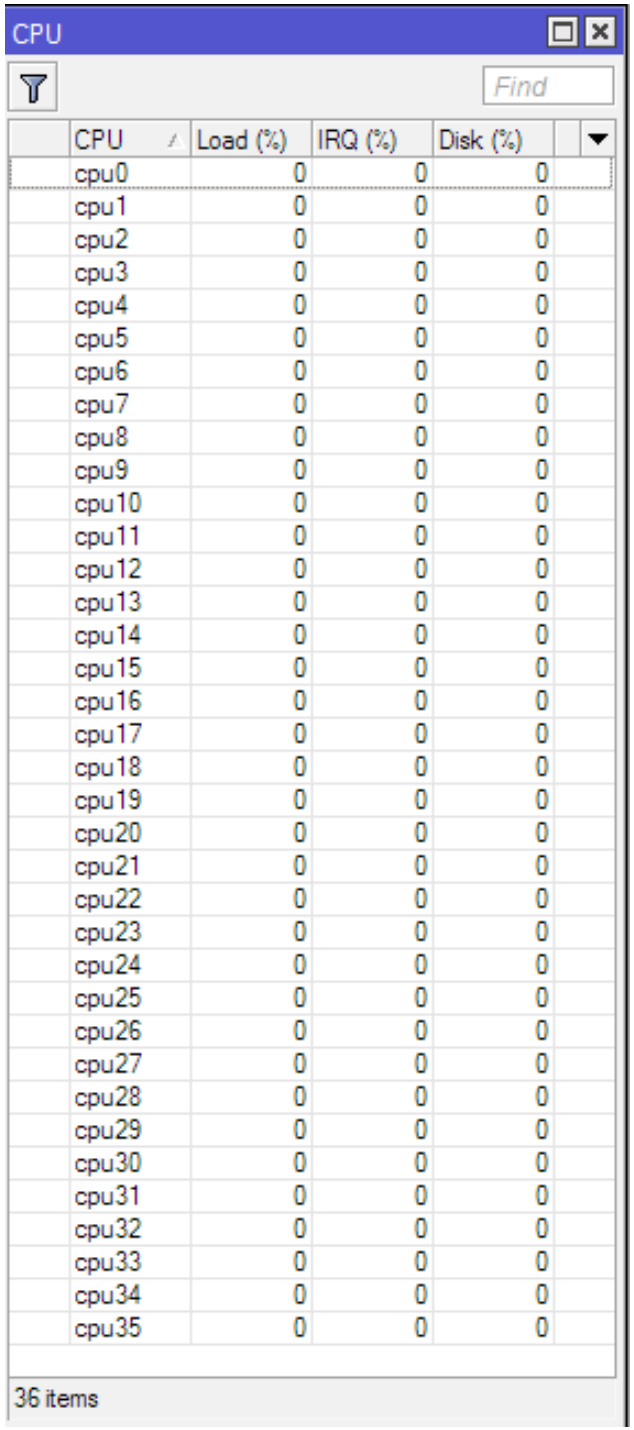
- Only for CCR devices
- 64-bit operating system (more RAM)
- Dual memory channel support (faster RAM)
- Hardware Accelerated Multi-threading (no need for RPS and IRQ management)



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, 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)	1496	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*

Throughput in millions pps

Interface List

Interface | Ethernet | EoIP Tunnel | IP Tunnel | GRE Tunnel | VLAN | VRRP | Bonding | LTE

	Name	Type	MTU	L2 MTU	Tx	Rx	Tx Packet...	Rx Packet (...
RS	ether1	Ethernet	1500	1590	478.5 Mbps	465.8 Mbps	996 885	970 618
RS	ether2	Ethernet	1500	1590	477.2 Mbps	480.3 Mbps	994 356	1 000 701
RS	ether3	Ethernet	1500	1590	475.1 Mbps	513.4 Mbps	989 969	1 069 736
RS	ether4	Ethernet	1500	1590	476.6 Mbps	492.0 Mbps	993 024	1 025 024
RS	ether5	Ethernet	1500	1590	475.8 Mbps	501.4 Mbps	991 399	1 044 710
RS	ether6	Ethernet	1500	1590	478.4 Mbps	469.2 Mbps	996 816	977 502
RS	ether7	Ethernet	1500	1590	478.1 Mbps	471.7 Mbps	996 120	982 714
RS	ether8	Ethernet	1500	1590	482.7 Mbps	408.8 Mbps	1 005 632	851 693
RS	ether9	Ethernet	1500	1590	477.1 Mbps	487.0 Mbps	994 065	1 014 717
RS	ether10	Ethernet	1500	1590	478.2 Mbps	468.2 Mbps	996 343	975 495
RS	ether11	Ethernet	1500	1590	479.2 Mbps	455.3 Mbps	998 539	948 640
R	ether12	Ethernet	1500	15				
RS	sfp1	Ethernet	1500	15				
RS	sfp2	Ethernet	1500	15				
RS	sfp3	Ethernet	1500	15				
RS	sfp4	Ethernet	1500	15				

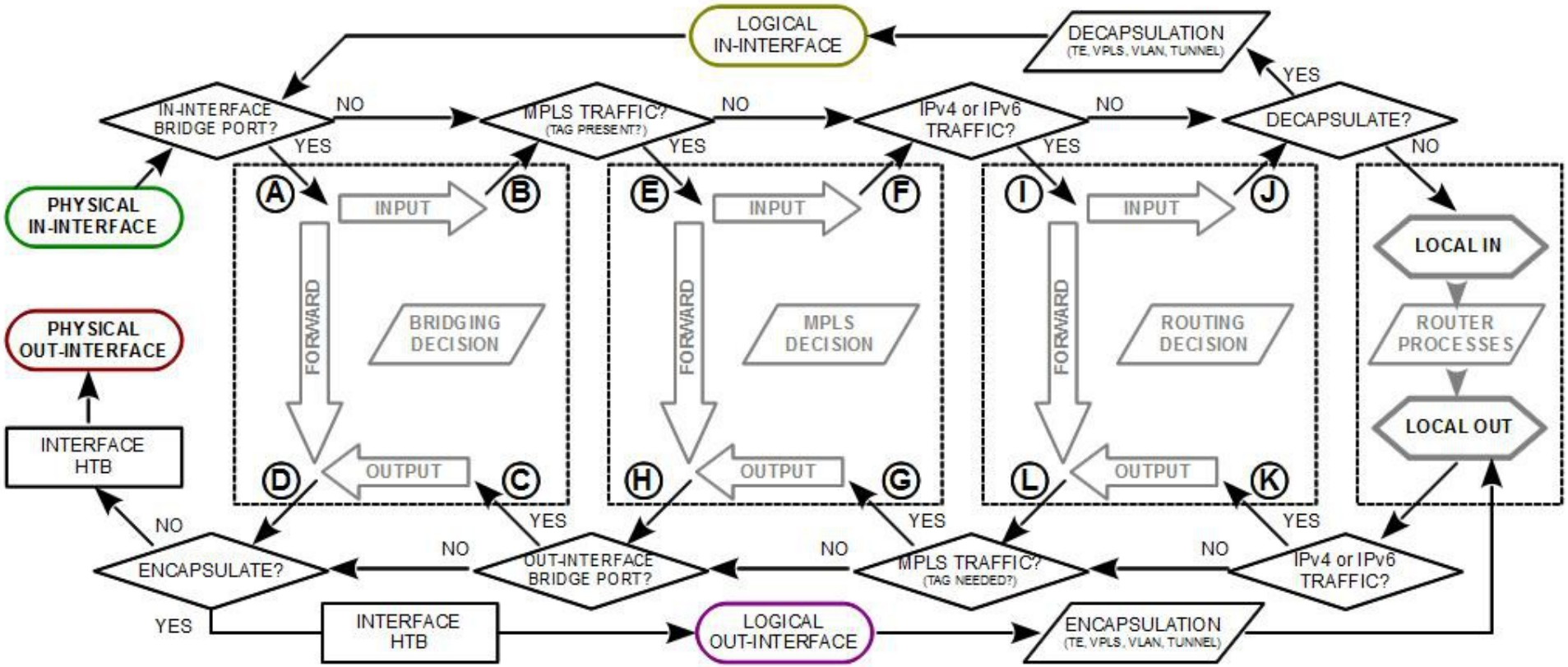
16 items out of 17

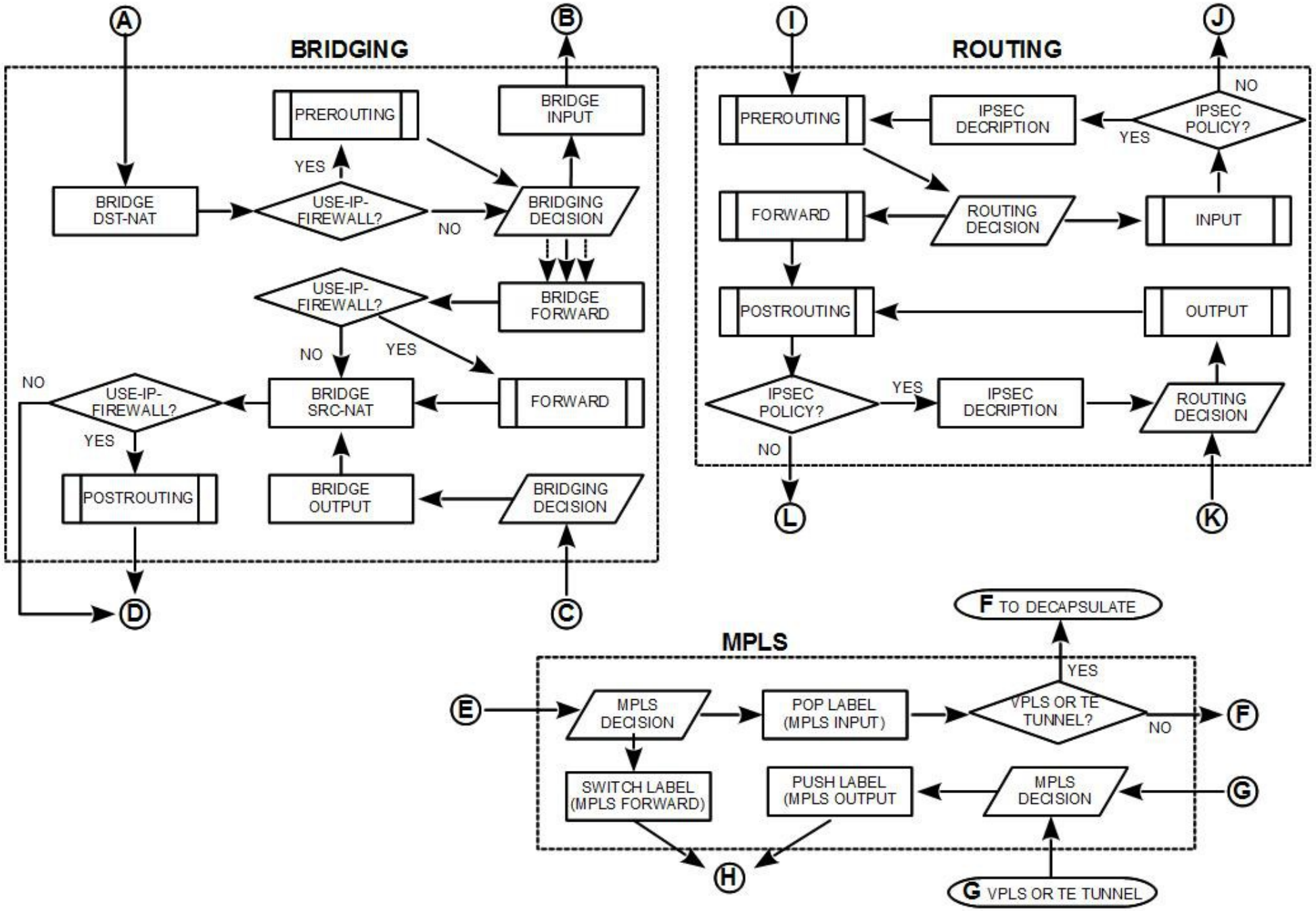
```
[admin@RouterOS] > interface monitor-traffic aggregate
    rx-packets-per-second:  15 577 081
      rx-drops-per-second:            0
     rx-errors-per-second:            0
       rx-bits-per-second:      7.4Gbps
    tx-packets-per-second:  15 576 803
      tx-drops-per-second:            0
     tx-errors-per-second:            0
       tx-bits-per-second:      7.4Gbps
-- [Q quit|D dump|C-z pause]
```

Traffic Generator Tool

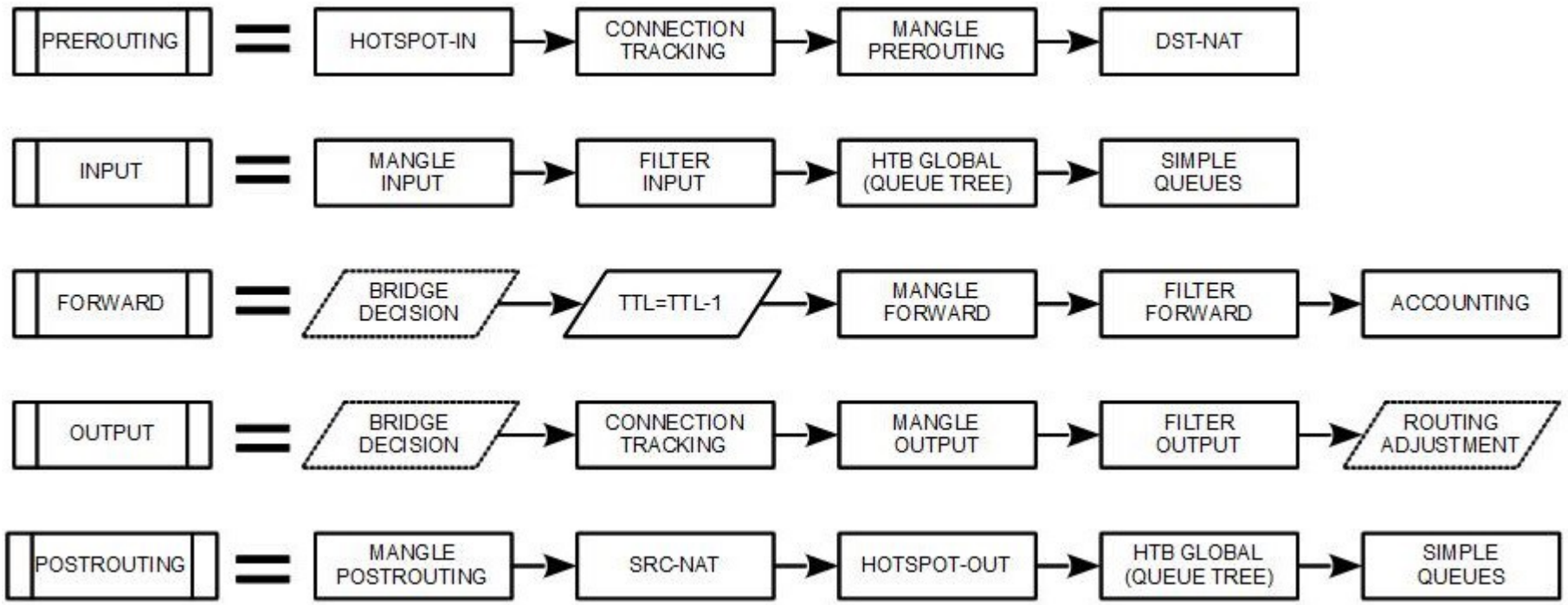
- Traffic Generator is a bandwidth-tool evolution
- Traffic Generator can:
  - Determine transfer rates, packet loss
  - Detect out-of-order packets
  - Collect latency and jitter values
  - Inject and replay *.pcap file (NEW!! in v6.1)
- “Quick” mode
- Full Winbox support coming soon

MikroTik RouterOS Packet Flow Diagram for version 6.x

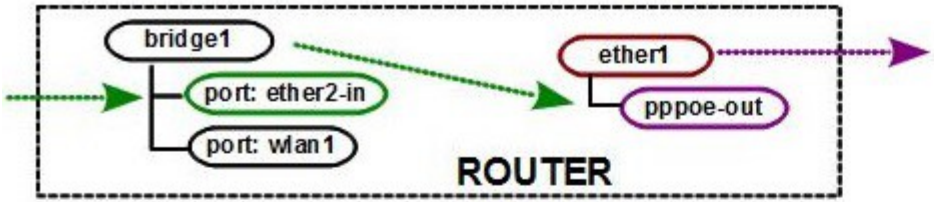



BRIDGING
A
B
PREROUTING
BRIDGE INPUT
YES
BRIDGE DST-NAT
USE-IP-FIREWALL?
NO
BRIDGING DECISION
USE-IP-FIREWALL?
BRIDGE FORWARD
NO
YES
NO
USE-IP-FIREWALL?
BRIDGE SRC-NAT
FORWARD
YES
POSTROUTING
BRIDGE OUTPUT
BRIDGING DECISION
D
C
ROUTING
I
J
PREROUTING
IPSEC DECRIPTION
NO
IPSEC POLICY?
YES
FORWARD
ROUTING DECISION
INPUT
POSTROUTING
OUTPUT
IPSEC POLICY?
YES
IPSEC DECRIPTION
ROUTING DECISION
NO
L
K
MPLS
F TO DECAPSULATE
YES
E
MPLS DECISION
POP LABEL (MPLS INPUT)
VPLS OR TE TUNNEL?
NO
F
SWITCH LABEL (MPLS FORWARD)
PUSH LABEL (MPLS OUTPUT
MPLS DECISION
G
H
G VPLS OR TE TUNNEL

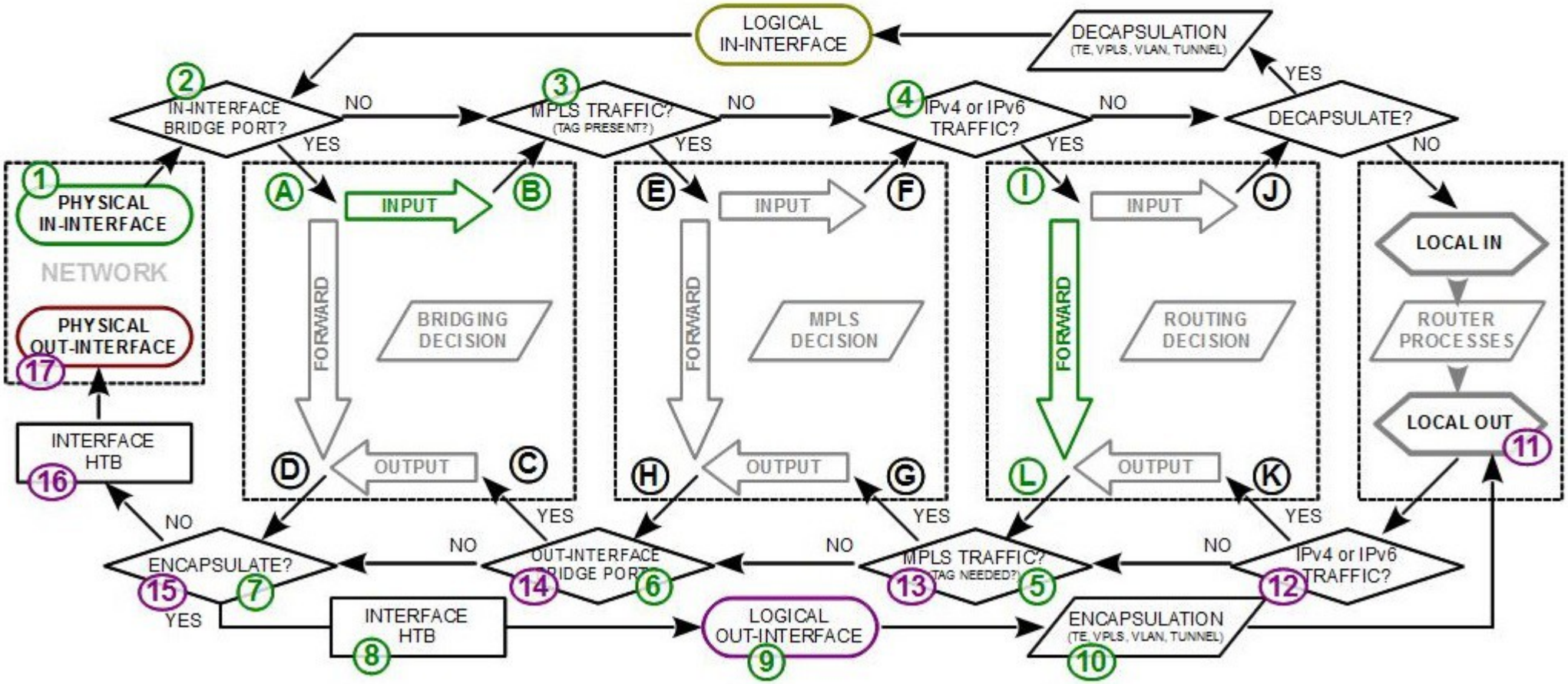
Yes, still - Packet Flow Diagram (page 3)



Packet Flow Scenario:



This Scenario in Packet Flow Diagram:



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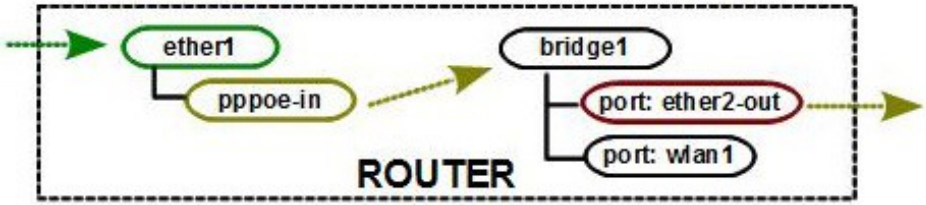

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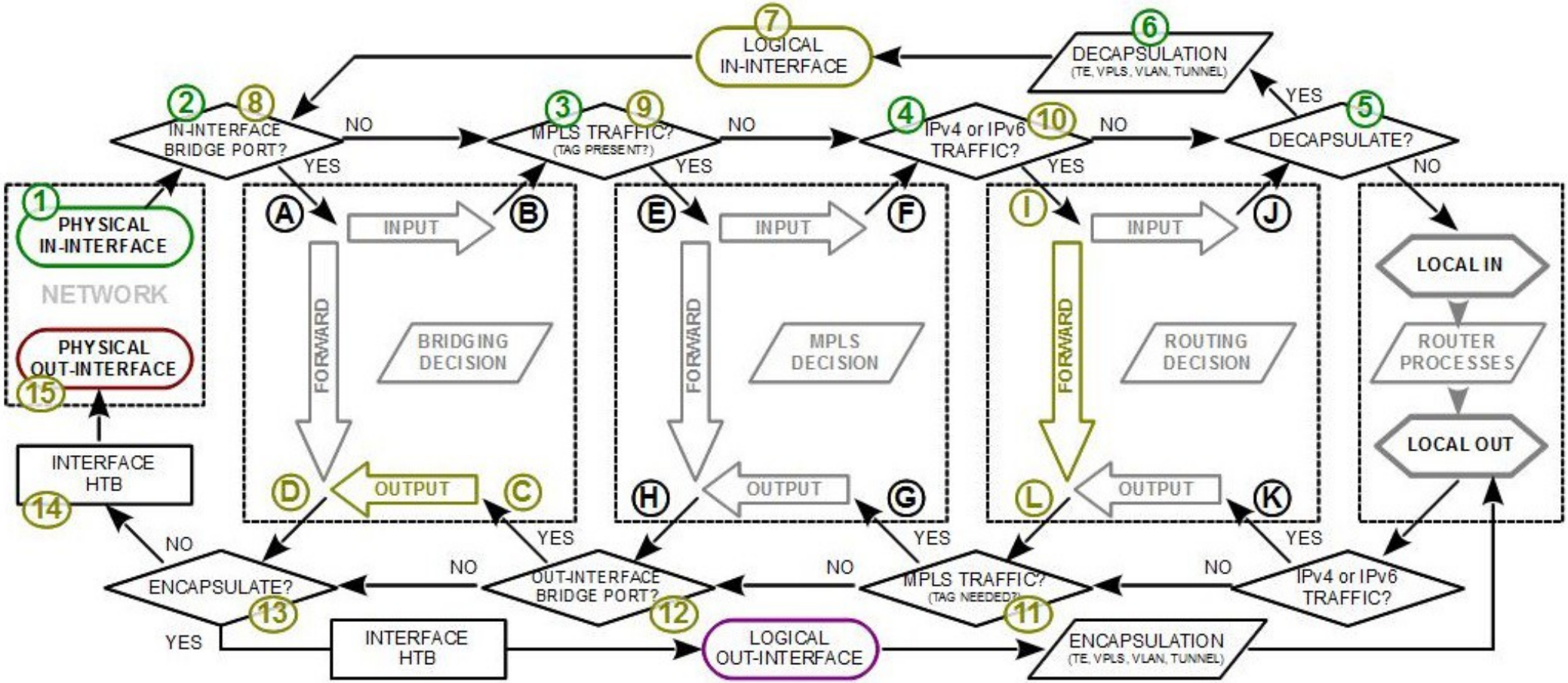

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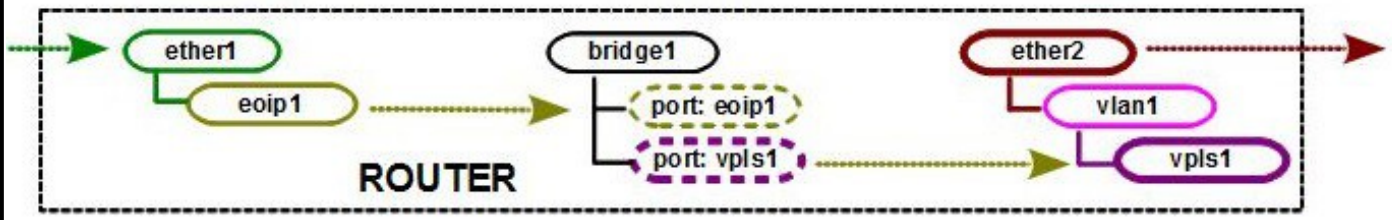

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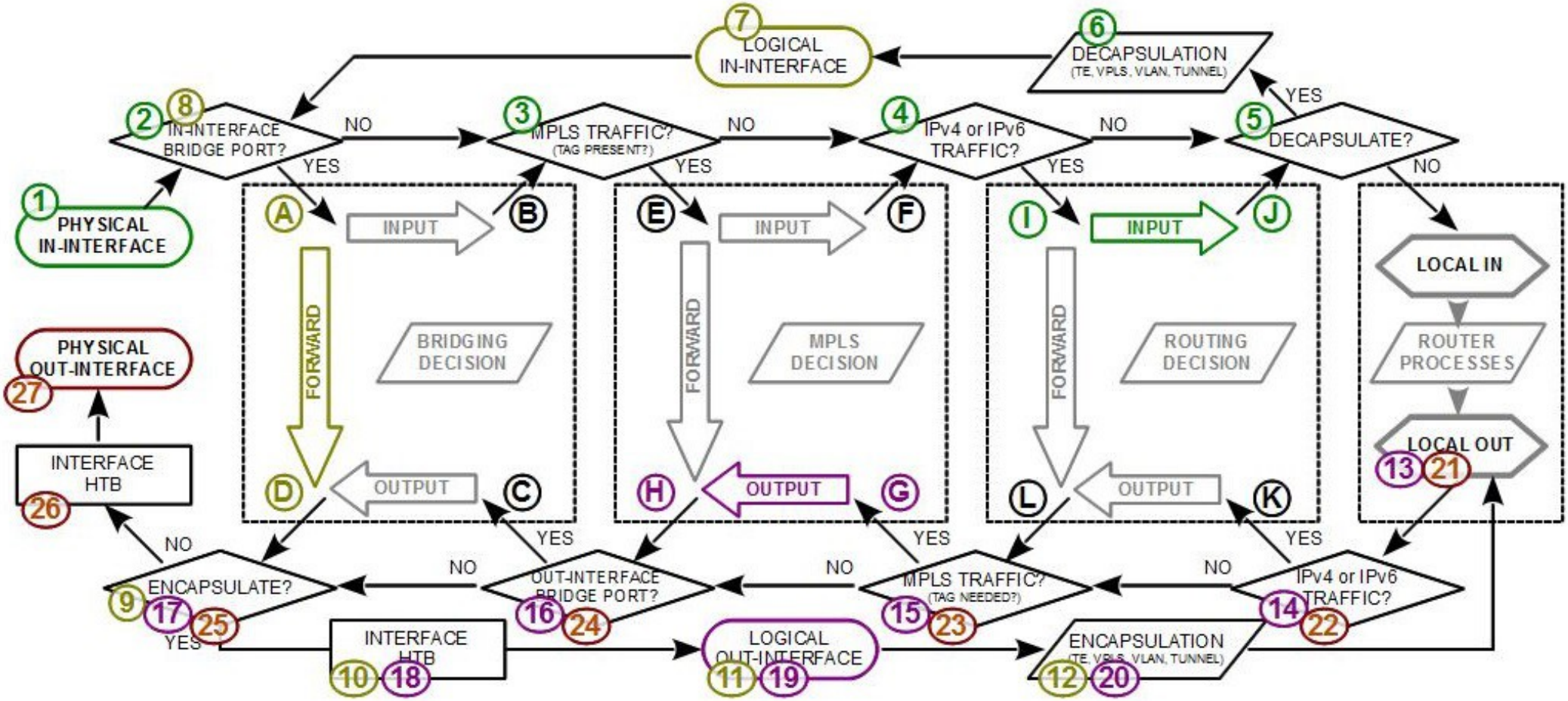


QoS System Reworked

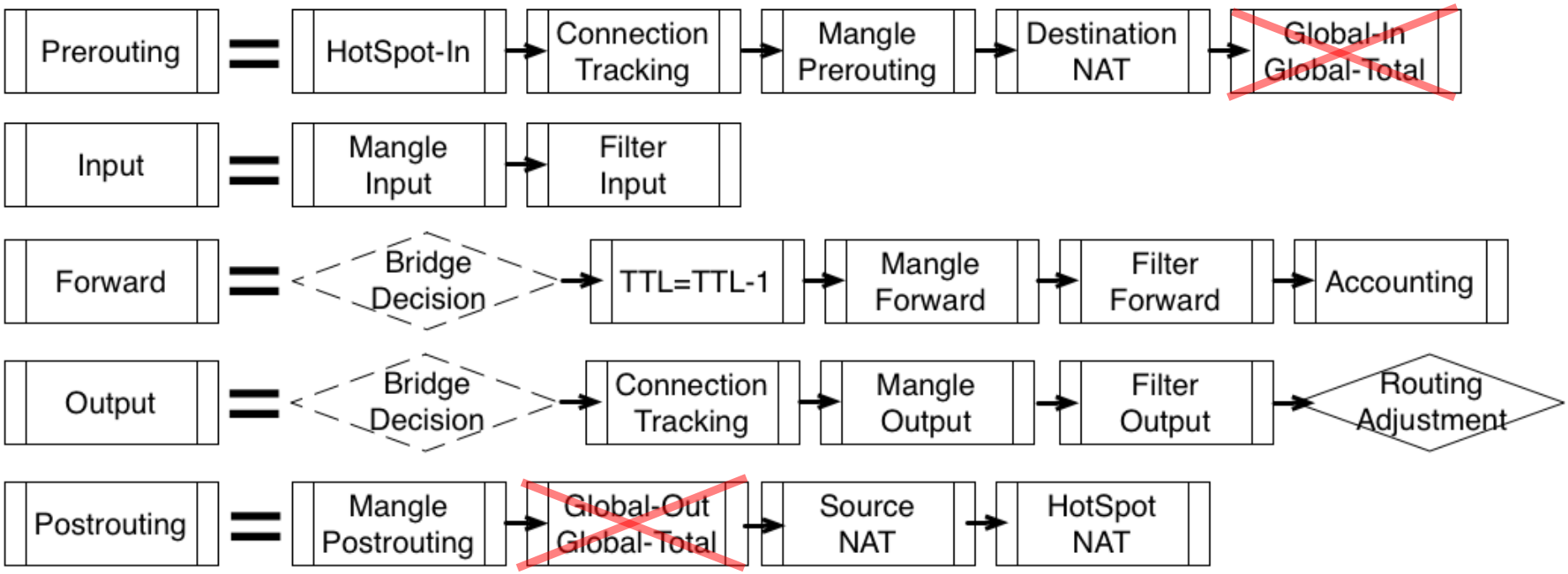
- WARNING!!!
  Simple Queues and Queue Tree queues in some specific configurations might be inactivated after upgrade from RouterOS v3.x, v4.x, v5.x to RouterOS v6.x

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

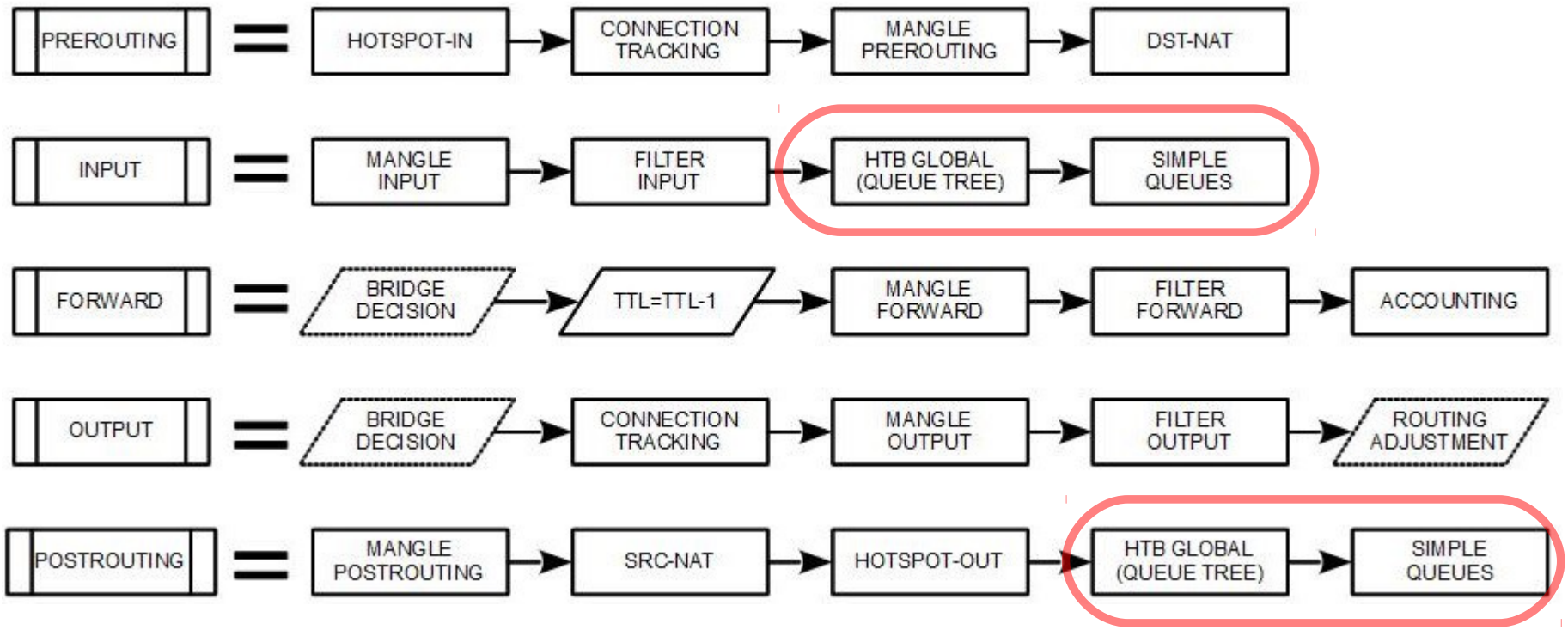
Changes in Packet Flow Diagram

- 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 redesign so that queuing happens is 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

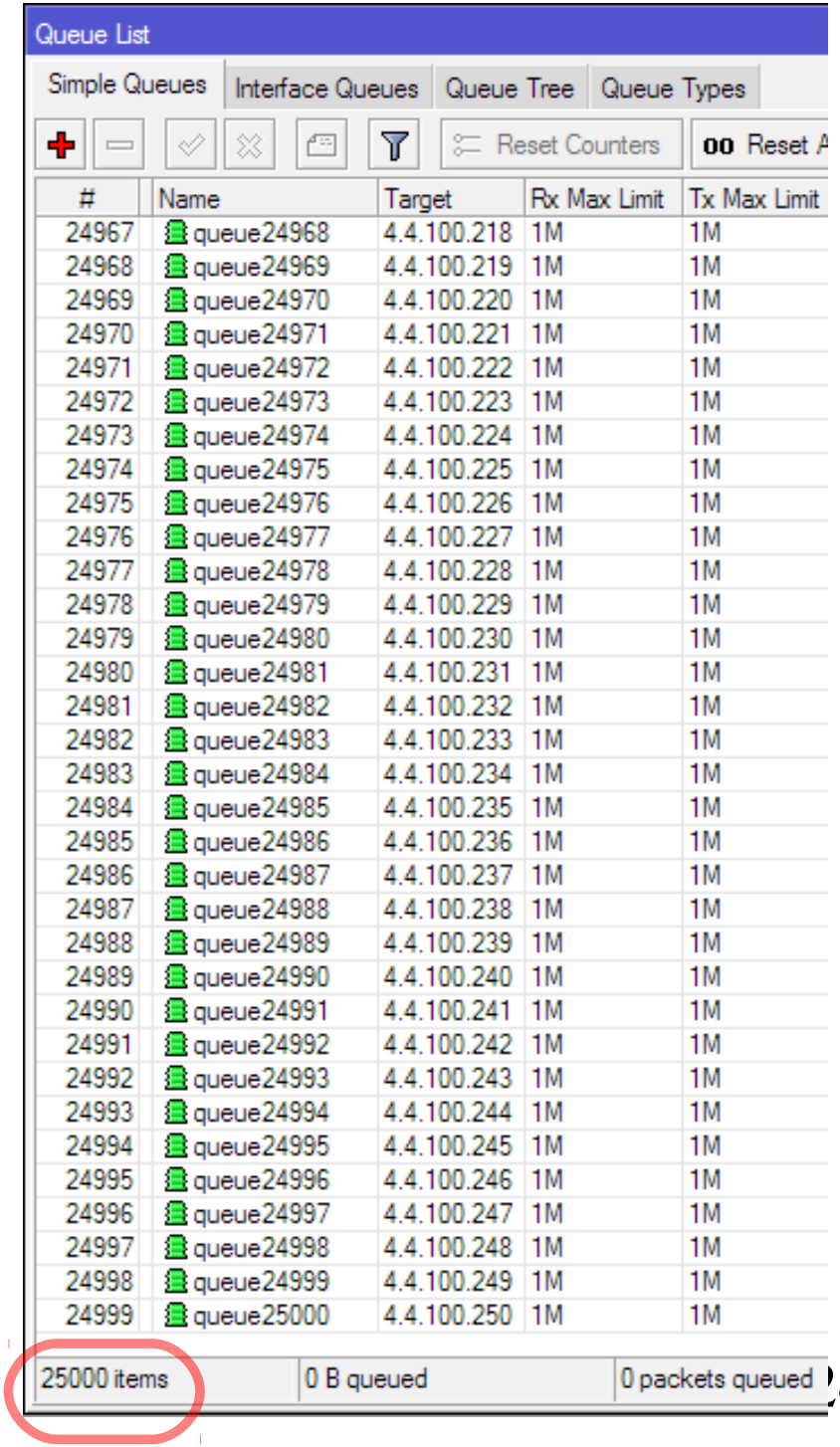


Additional changes

- Simple queues are now separated from Queue Tree completely – 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 so 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

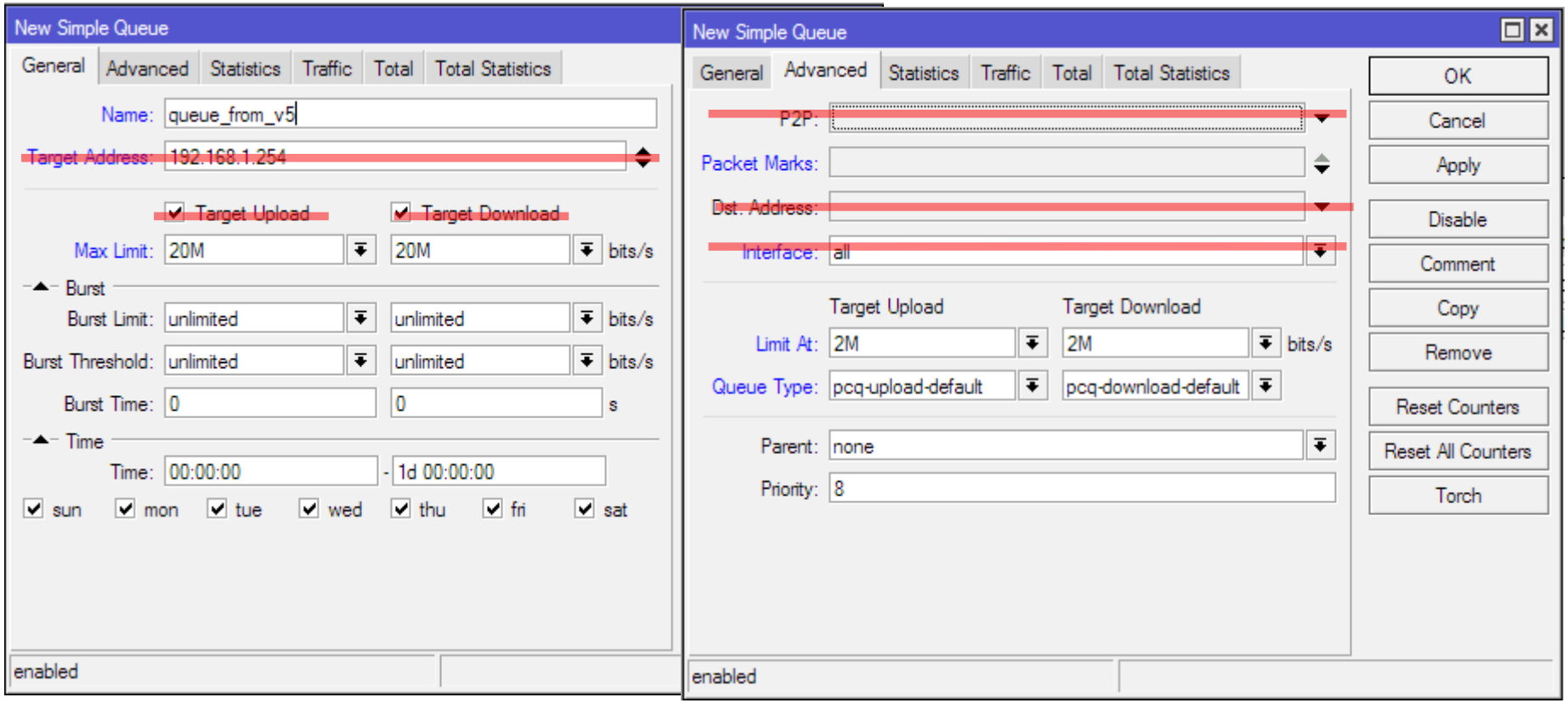
- Simple queue matching algorithm updated
- Very small overhead for packets that miss existing simple queues
- Top level simple queues are now balanced between CPU cores (32 queues 9x faster than 1 queue on CCR1036)



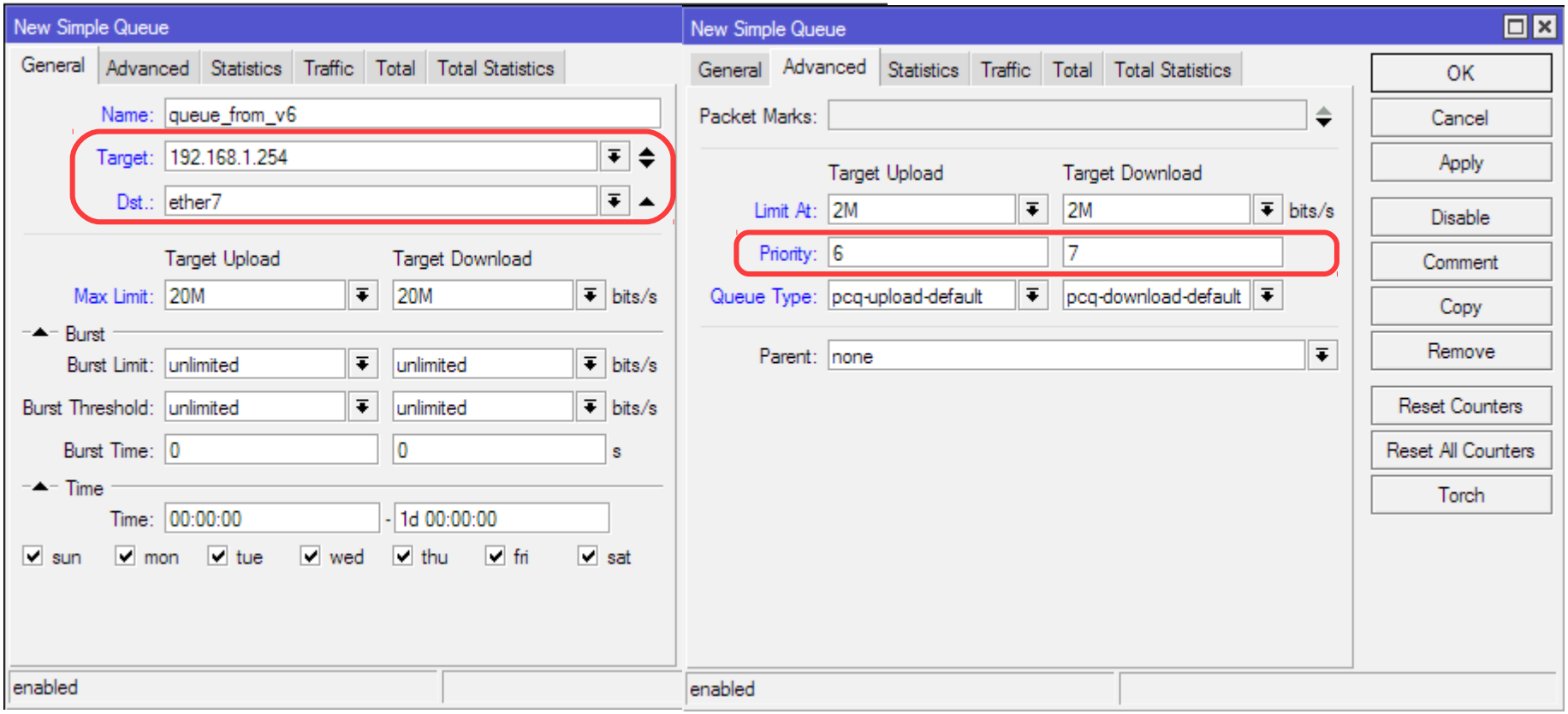
Simpler Simple Queues

- “target-addresses” and “interface” parameters are joined into one “target” parameter
- “dst-address” parameter is changed to “dst” and now can be specified as interface as well
- direction and p2p parameters removed
- “target” now must be specified on 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 have “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 Tunnels

- SSTP can now force AES encryption instead of default RC4
- PPP profile now has “bridge-path-cost” and “bridge-port-priority” parameters
- PPP secrets shows last-logged-out date and time
- Hotspot and PPP now support multiple address-lists from RADIUS
- Only 2 dynamic “change-mss” mangle rules are created for “all-ppp” interfaces;

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

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

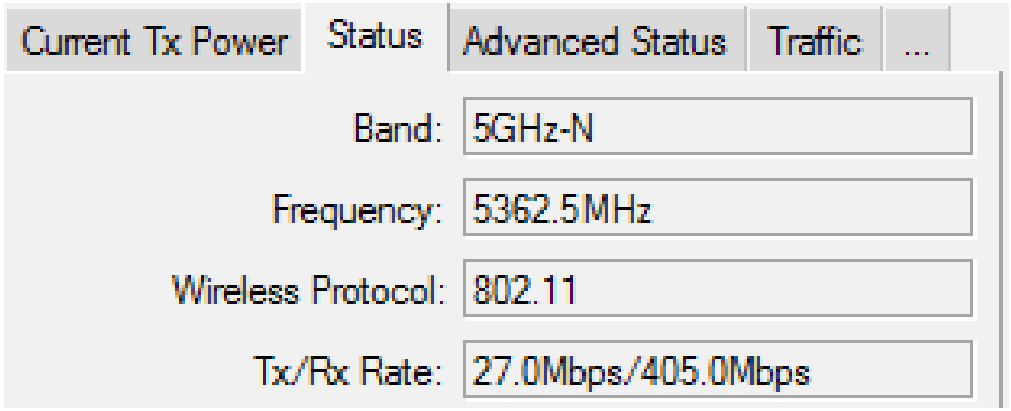
Wireless Advanced Channels

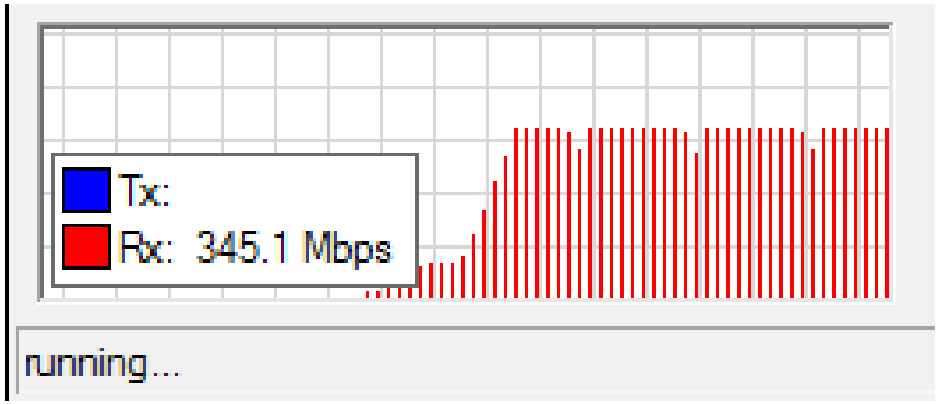
- Works only between Atheros AR92xx chips and only between MikroTik devices
  - center frequency range:
    - 2192-2734mhz
    - 4800-6100mhz
- Choose precise center frequency (0.5MHz step)
- Choose channel width (2.5-30MHz, 0.5MHz step)
- Super-channel license is required to use advanced channels – 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!!!