

**New**  
**Obvious and Obscure**  
**MikroTik RouterOS v5 features**

Budapest, Hungary  
MUM Europe 2011

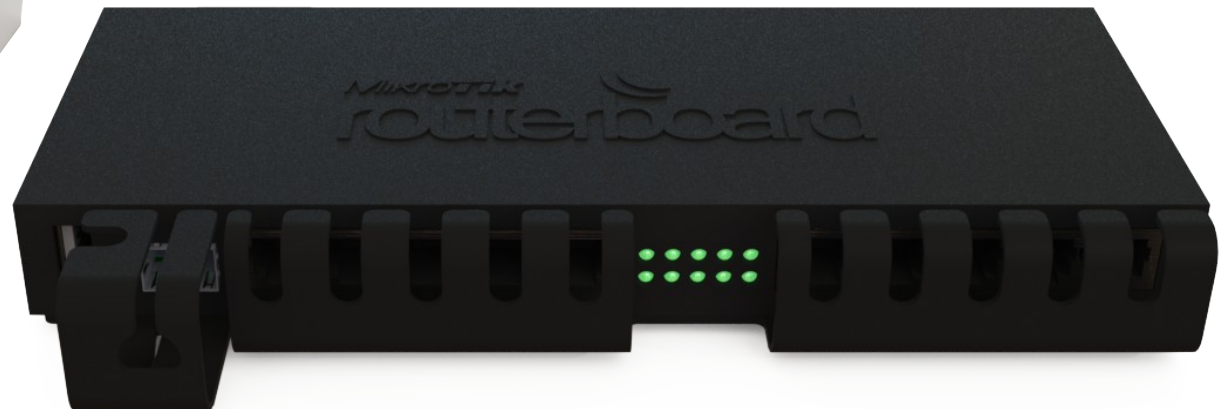
*Good News Everyone!!!*

**RouterOS v5.0 full release  
is almost here!!!**

(there is still chance to delay it by reporting nice errors – it is all in your hands)

# Support for New Products

- Full support of announced and unannounced new RouterBOARD devices will be added only for RouterOS v5.x (and above)

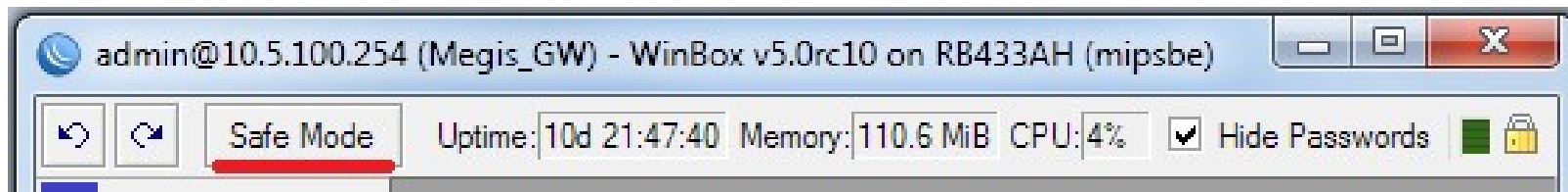


# Linux Kernel

- RouterOS 4.17
  - Linux kernel version 2.6.27.39
- RouterOS 5.0
  - Linux kernel version 2.6.35
- For more detailed information see:  
<http://www.kernel.org/>

# Updated features: Winbox

- Much more usable for low resolution screens
- More independence from Windows
- Faster and less resource demanding
- Suitable for further improvements
- Safe mode



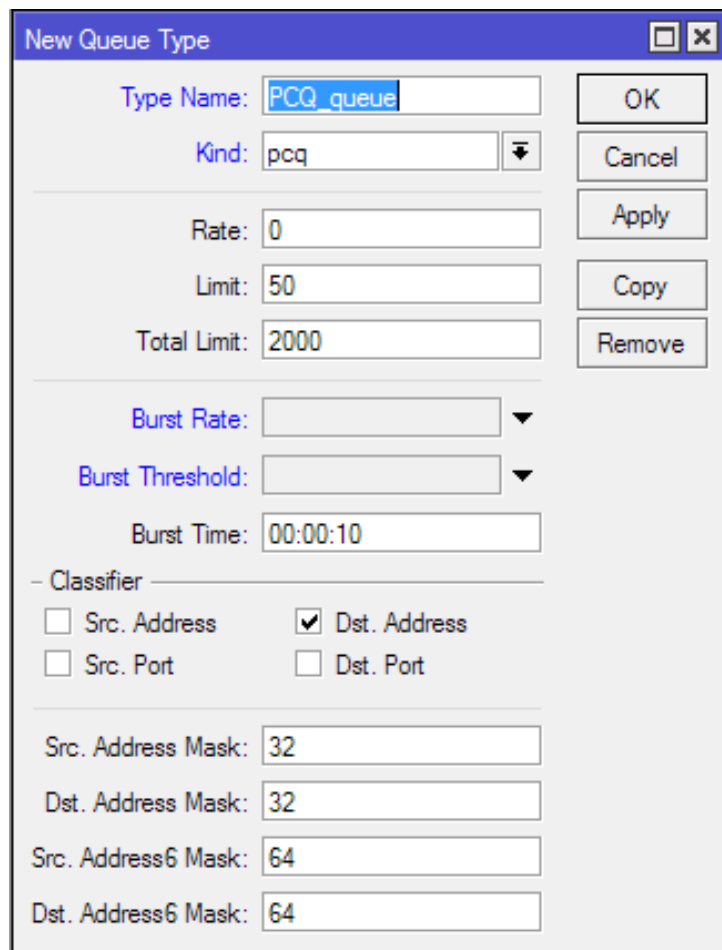
# Updated features: IPSec

- Added new and updated cyphers
- Added IPv6Sec (IPv6 support for IPSec)
- Added support for NAT-T drafts
- Now works on EOIP, GRE
- Also works on PPTP and L2TP tunnels

# Updated features: SSH

- Completely MikroTik rewritten SSH
- Up to date with all the newest improvements
- SSH is now reduced to only necessary functionality, so it uses less resources
- SFTP, SCP works faster

# Updated features: PCQ



The screenshot shows a 'New Queue Type' dialog box with the following fields and options:

- Type Name: PCQ\_queue
- Kind: pcq
- Rate: 0
- Limit: 50
- Total Limit: 2000
- Burst Rate: (empty)
- Burst Threshold: (empty)
- Burst Time: 00:00:10
- Classifier:
  - Src. Address
  - Dst. Address
  - Src. Port
  - Dst. Port
- Src. Address Mask: 32
- Dst. Address Mask: 32
- Src. Address6 Mask: 64
- Dst. Address6 Mask: 64

Buttons on the right: OK, Cancel, Apply, Copy, Remove.

- PCQ was completely rewritten to optimize it for high throughput both in Mbps and pps
- Added burst feature for sub-streams
- Added option that allows you to specify sub-stream size by network mask



# New Features: WebFig



- WebFig is a web based RouterOS configuration utility. It is accessible directly from the router

# New Features: WebFig (2)

- Alternative of WinBox, similar layouts and access to almost any feature of RouterOS.

The screenshot displays the WebFig web interface. On the left is a vertical navigation menu with categories like Interfaces, PPP, Bridge, Mesh, IP, MPLS, IPv6, Routing, System, Queues, Log, Tools, BTest Server, Bandwidth Test, Email, Flood Ping, Graphing, IP Scan, MAC Server, Netwatch, Packet Sniffer, Ping, Ping Speed, Profile, Torch, Traceroute, and Traffic Monitor. The main content area shows the 'Interface List' table, which is currently filtered to show 'Ethernet' interfaces. The table includes columns for Name, Type, L2 MTU, Tx, Rx, Tx Pac, Rx Pac, Tx Dro, Rx Dro, Tx Errc, and Rx Errc. A 'Start' button is visible above the table, and a 'Log out' button is in the top right corner of the interface.

		Name	Type	L2 MTU	Tx	Rx	Tx Pac	Rx Pac	Tx Dro	Rx Dro	Tx Errc	Rx Errc
<input type="checkbox"/>	R	ether1	Ethernet	1600	114.2 Kbps	17.7 Kbps	14	14	0	0	0	0
<input type="checkbox"/>	R	ether2-Out	Ethernet	1600	2.3 Kbps	1360 bps	3	2	0	0	0	0
<input type="checkbox"/>	R	ether3-Tst	Ethernet	1600	0 bps	0 bps	0	0	0	0	0	0
<input type="checkbox"/>		ether4	Ethernet	1600	0 bps	0 bps	0	0	0	0	0	0
<input type="checkbox"/>	D	lo	Bridge	1600	114.2 Kbps	16.1 Kbps	14	14	0	0	0	0
<input type="checkbox"/>	D	DR vif2	Virtual Ethernet		0 bps	0 bps	0	0	0	0	0	0
<input type="checkbox"/>	D	R ve1	Virtual Ethernet		0 bps	0 bps	0	0	0	0	0	0

# New Features: SSTP

- Secure Socket Tunneling Protocol is a method to transport PPP tunnel over SSL 3.0 channel.
- The use of SSL over TCP port 443 allows SSTP to pass through virtually all firewalls and proxy servers.
- If both client and server are MikroTik routers, then it is possible to establish SSTP tunnel without certificates

# New Features: GRE Tunnel

- Generic Routing Encapsulation (GRE) tunnel is one of the most popular tunneling solutions
- RouterOS GRE tunnel is compatible with all other vendor implementations
- GRE tunnels are completely stateless, but it uses keep-alive mechanisms to tear down the tunnel in case of failure.

# IPv6 Support

- RouterOS v5 has obtained overall “Ipv6ization”
  - most of the features now have IPv6 support
- IPv6 address example:
  - fe80::/10 – link-local addresses
  - 2001:db8::/32 – documentation only addresses
  - face:dead:co1d:beef:02:f1ee::1  
(in theory perfect IP address for steak house)
- There are way too many to mention them in slides – so lets take a look at what few features are still coming.

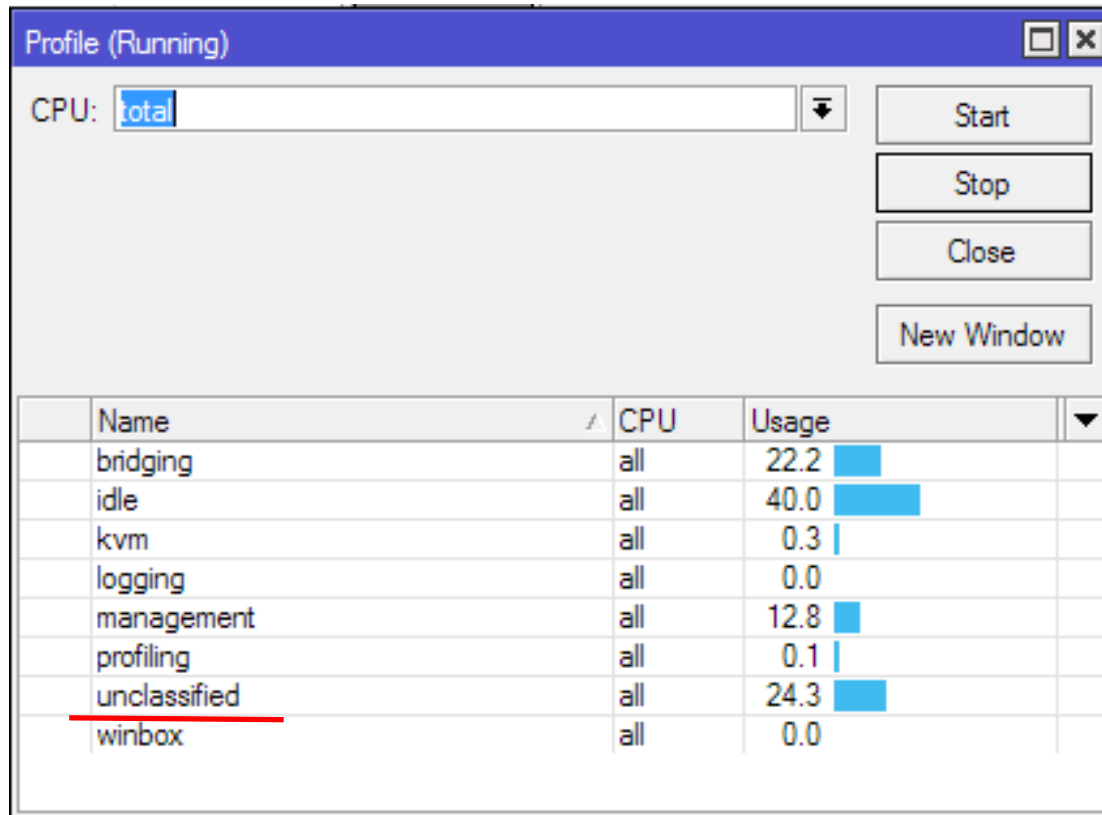
# IPv6 Planned Features

- In RouterOS v5 IPv6 support is planned for:
  - IP Pools
  - PPP
  - DHCP
  - Hotspot
  - Webproxy
  - SSTP
  - L2TP

# Better Hardware Management

- RouterOS 5.x allows you to
  - monitor system load per processes
  - monitor load on every CPU core
  - manually distribute load between cores
- Currently we are working on making most of the common and resource demanding processes to utilize advantages of multi-threading

# CPU Load: Tools Profile(r)



- RouterOS 5.x can report system usage by processes
- Work is still in progress

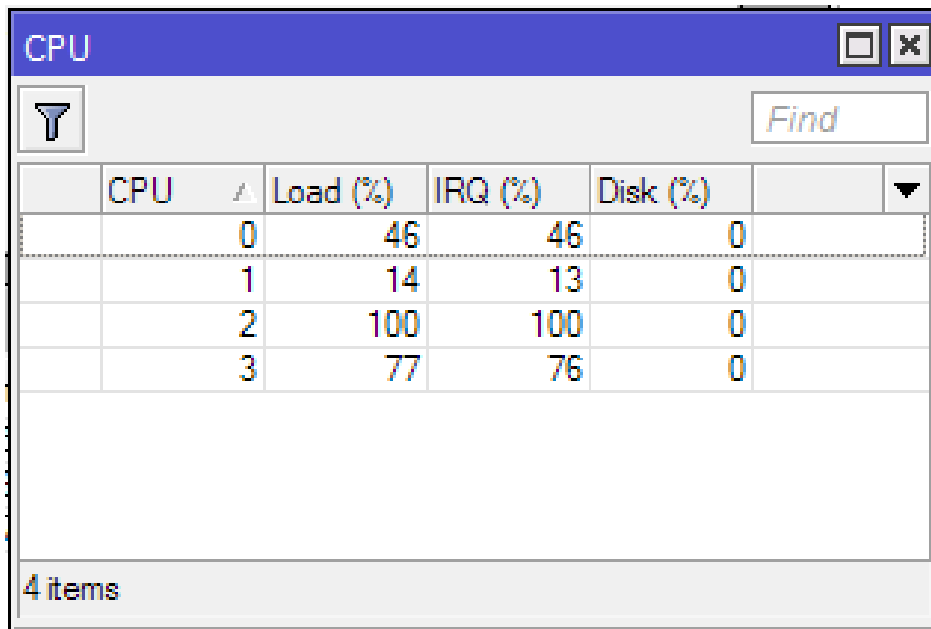
- Please, report all “unclassified” processes to [support@mikrotik.com](mailto:support@mikrotik.com) (with supout.rif)



# CPU Usage

- Common **misconception** is that router works slower (bigger latency, more drops, less throughput) on 70% CPU load, then it does at 20%.
- As long as load is not 100% CPU can handle all that is thrown at it. So 1%, 17%, 50% or 98% - all the calculations are done without delays and there are no slowdowns because of CPU.
- Exceptions are multi-core systems

# CPU Load per Core

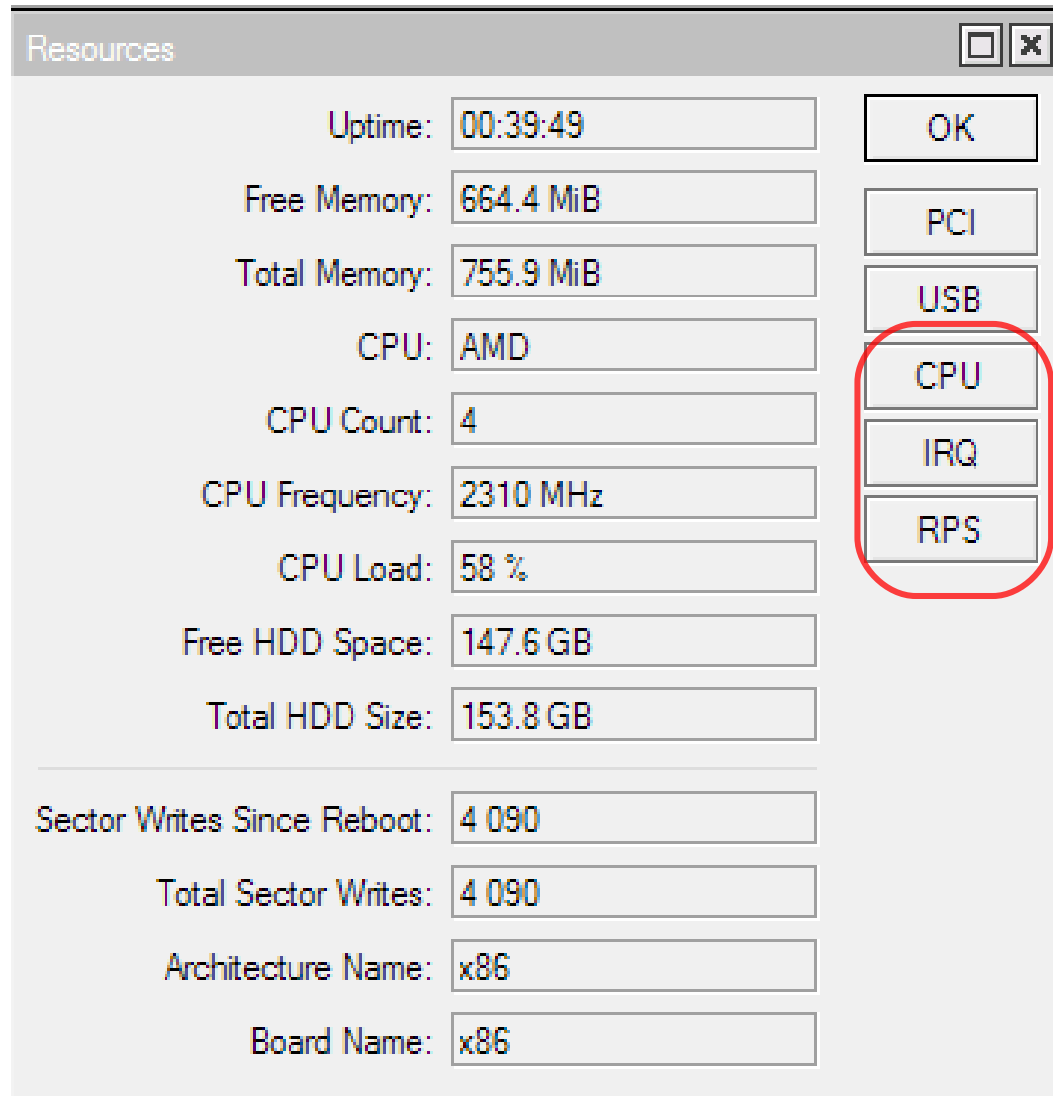


CPU	Load (%)	IRQ (%)	Disk (%)
0	46	46	0
1	14	13	0
2	100	100	0
3	77	76	0

- In RouterOS version 5.x multi-core routers can report CPU load per core

- At this point it is possible to recognize CPU usage from disk operation and interrupt request handling (most common usage)
- From CLI just use “/tool resources cpu print”

# System Resources Menu



Label	Value
Uptime:	00:39:49
Free Memory:	664.4 MiB
Total Memory:	755.9 MiB
CPU:	AMD
CPU Count:	4
CPU Frequency:	2310 MHz
CPU Load:	58 %
Free HDD Space:	147.6 GB
Total HDD Size:	153.8 GB
<hr/>	
Sector Writes Since Reboot:	4 090
Total Sector Writes:	4 090
Architecture Name:	x86
Board Name:	x86

Resources

OK

PCI

USB

**CPU**

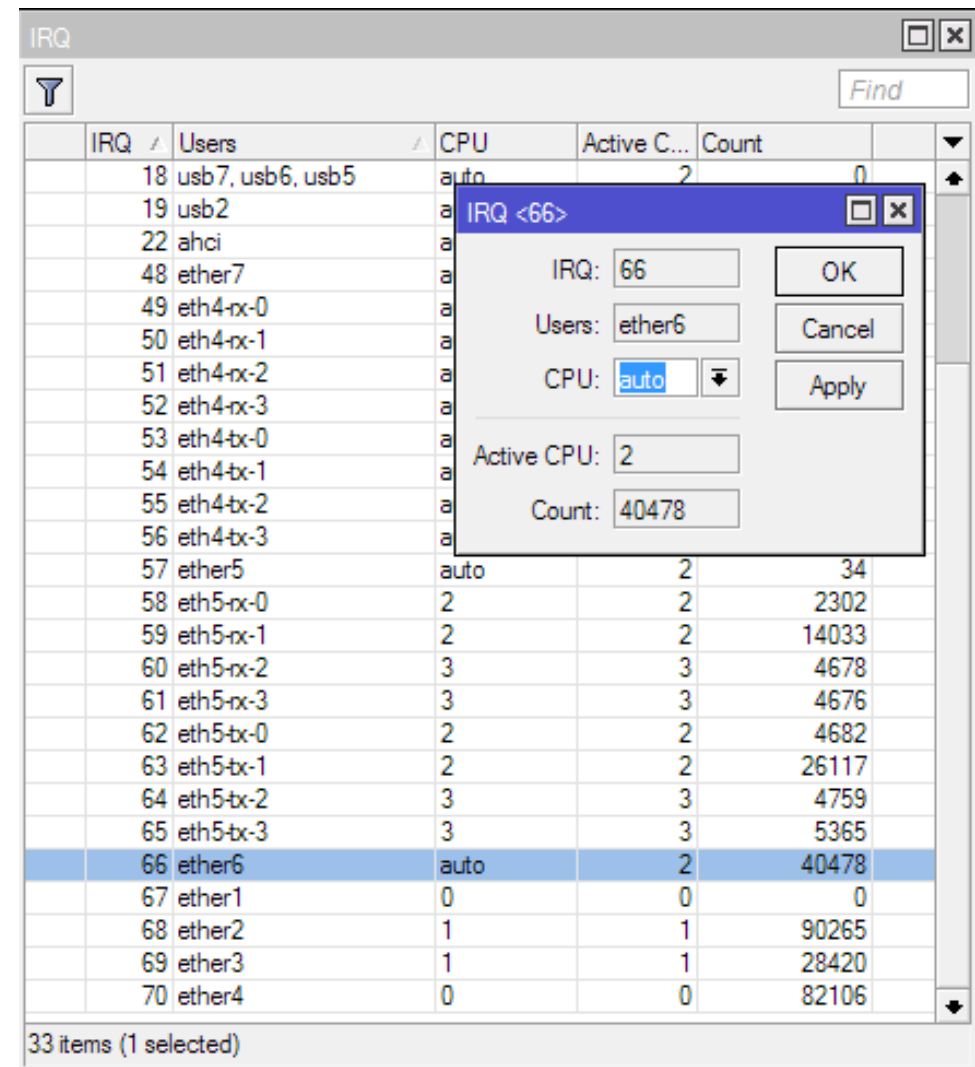
IRQ

RPS

- RouterOS version 5.x users will have much more control over their multi-core routers
- Controls can be found in “/system resources” menu.

# IRQ Load Balancing

- It is possible to assign CPU cores to specific IRQ's
- Device distribution to IRQ's is done by hardware (not RouterOS)
- Auto mode works based on number of interrupts



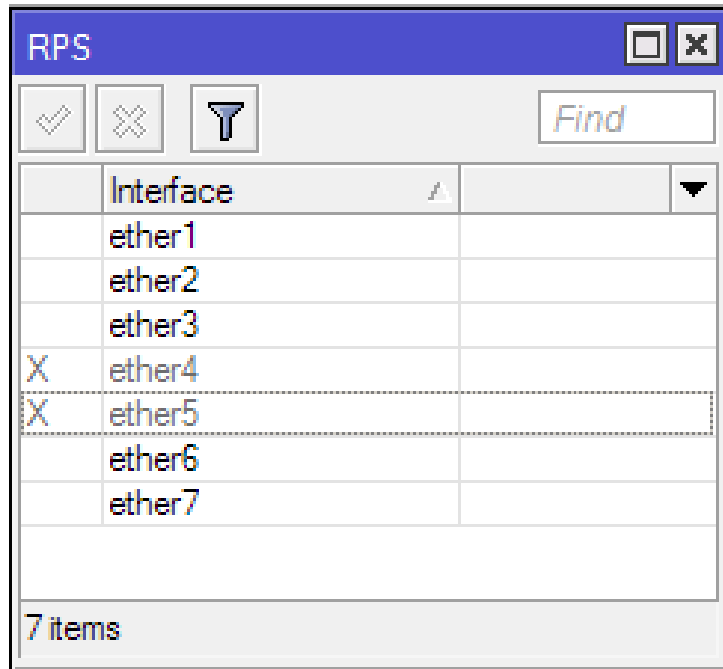
IRQ	Users	CPU	Active C...	Count
18	usb7, usb6, usb5	auto	2	0
19	usb2			
22	ahci			
48	ether7			
49	eth4-rx-0			
50	eth4-rx-1			
51	eth4-rx-2			
52	eth4-rx-3			
53	eth4-tx-0			
54	eth4-tx-1			
55	eth4-tx-2			
56	eth4-tx-3			
57	ether5	auto	2	34
58	eth5-rx-0	2	2	2302
59	eth5-rx-1	2	2	14033
60	eth5-rx-2	3	3	4678
61	eth5-rx-3	3	3	4676
62	eth5-tx-0	2	2	4682
63	eth5-tx-1	2	2	26117
64	eth5-tx-2	3	3	4759
65	eth5-tx-3	3	3	5365
66	ether6	auto	2	40478
67	ether1	0	0	0
68	ether2	1	1	90265
69	ether3	1	1	28420
70	ether4	0	0	82106

33 items (1 selected)

# NAPI ("New API") feature

- NAPI is an optional modification to the device driver packet processing framework.
- NAPI allows drivers to run with significantly lower number of interrupts during times of high traffic.
- NAPI-compliant drivers can often cause packets to be dropped in the network adapter itself, before the Kernel sees them at all
- NAPI can force "auto" mode to use only one core

# RPS: Receive Packet Steering



- NAPI can become a bottleneck under high packet load because it is serialized per device queue
- RPS allows you to distribute the load of received packet processing across multiple cores

# Performance before optimization

- IRQ balancing = auto
- NAPI working (lots of packets)
- RPS disabled

The screenshot shows two windows from a network monitoring application. The 'Interface List' window displays a table of network interfaces with their respective transmission and reception rates. The 'CPU' window shows the load and IRQ percentages for each CPU core.

Interface	Ethernet	EoIP Tunnel	IP Tunnel	GRE Tunnel	VLAN	VRRP	Bonding
R	ether1	273.6 Mbps	273.5 Mbps	42 862	42 847		
R	ether2	273.6 Mbps	273.5 Mbps	42 860	42 854		
R	ether3	273.5 Mbps	273.5 Mbps	42 854	42 856		
R	ether4	273.5 Mbps	273.5 Mbps	42 841	42 856		
R	ether5	272.7 Mbps	272.1 Mbps	42 694	42 676		
R	ether6	41.9 kbps	5.5 kbps	6	8		
R	ether7	272.1 Mbps	272.6 Mbps	42 676	42 677		

CPU	Load (%)	IRQ (%)	Disk (%)
0	100	100	0
1	0	0	0
2	1	0	0
3	0	0	0

# Performance after optimization

- IRQ balancing – static assignation (mostly)
- NAPI enabled (even more packets)
- RPS enabled only on interfaces with “RX drops”

The image shows two overlapping windows from a network monitoring application. The 'Interface List' window displays a table of network interfaces with their respective Tx and Rx rates and packet counts. The 'CPU' window displays a table of CPU load, IRQ percentage, and disk usage for four different processors.

Interface	Ethernet	EoIP Tunnel	IP Tunnel	GRE Tunnel	VLAN	VRRP	Bonding
✓	✗	☰	⌵				
Name	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)	Tx D		
R ether1	500.6 Mbps	500.7 Mbps	78 134	78 163			
R ether2	500.7 Mbps	501.1 Mbps	78 165	78 215			
R ether3	500.0 Mbps	499.5 Mbps	78 027	77 973			
R ether4	500.0 Mbps	500.3 Mbps	78 027	78 061			
R ether5	497.0 Mbps	497.5 Mbps	77 814	77 745			
R ether6	41.9 kbps	5.5 kbps	6	8			
R ether7	497.5 Mbps	497.0 Mbps	77 746	77 815			

7 items out of 14

CPU	Load (%)	IRQ (%)	Disk (%)	
0	87	88	0	
1	90	88	0	
2	95	95	0	
3	91	91	0	

4 items



There are lots of new wireless features, but those was covered by Uldis presentation yesterday

**Questions!!!**