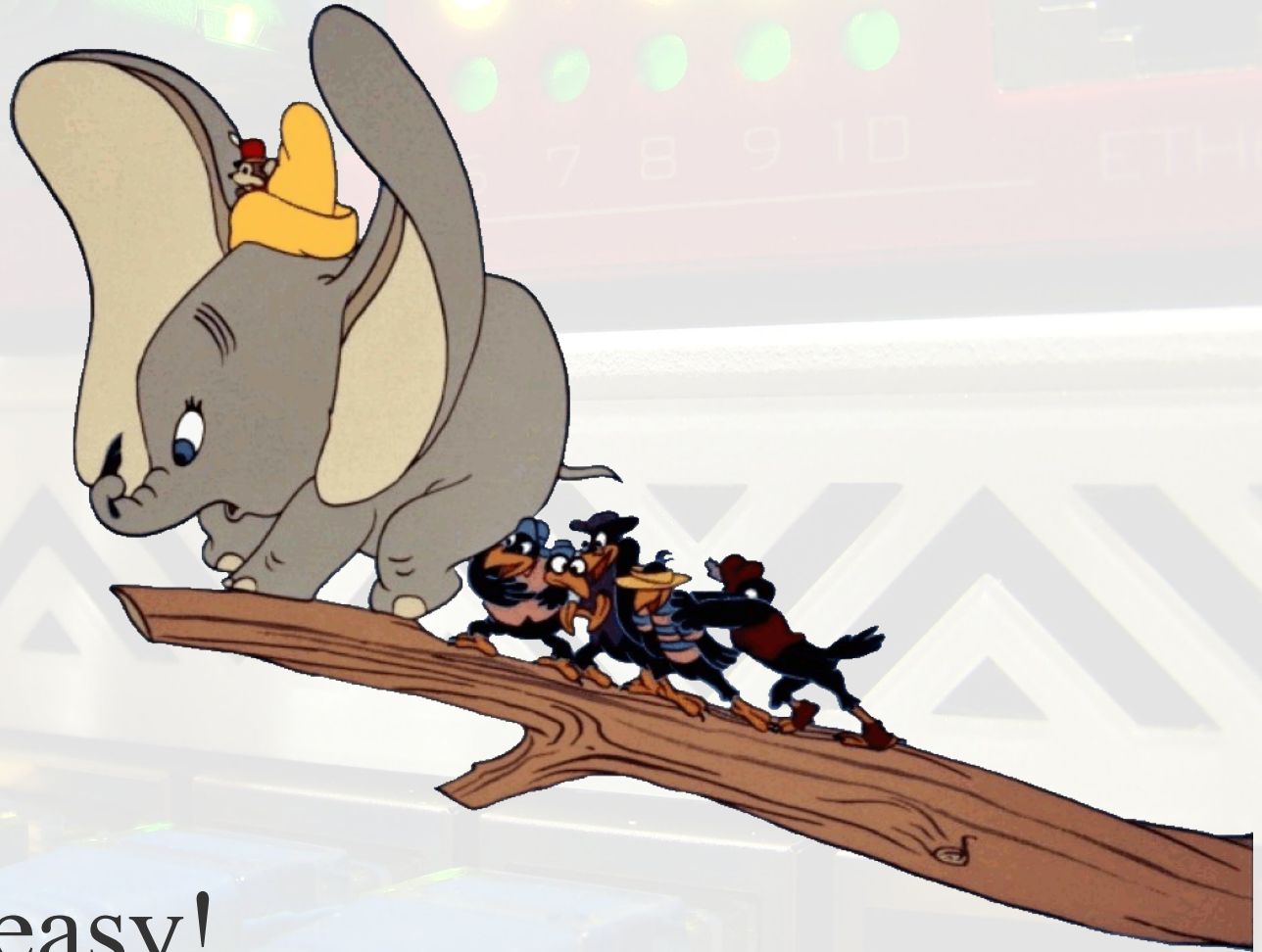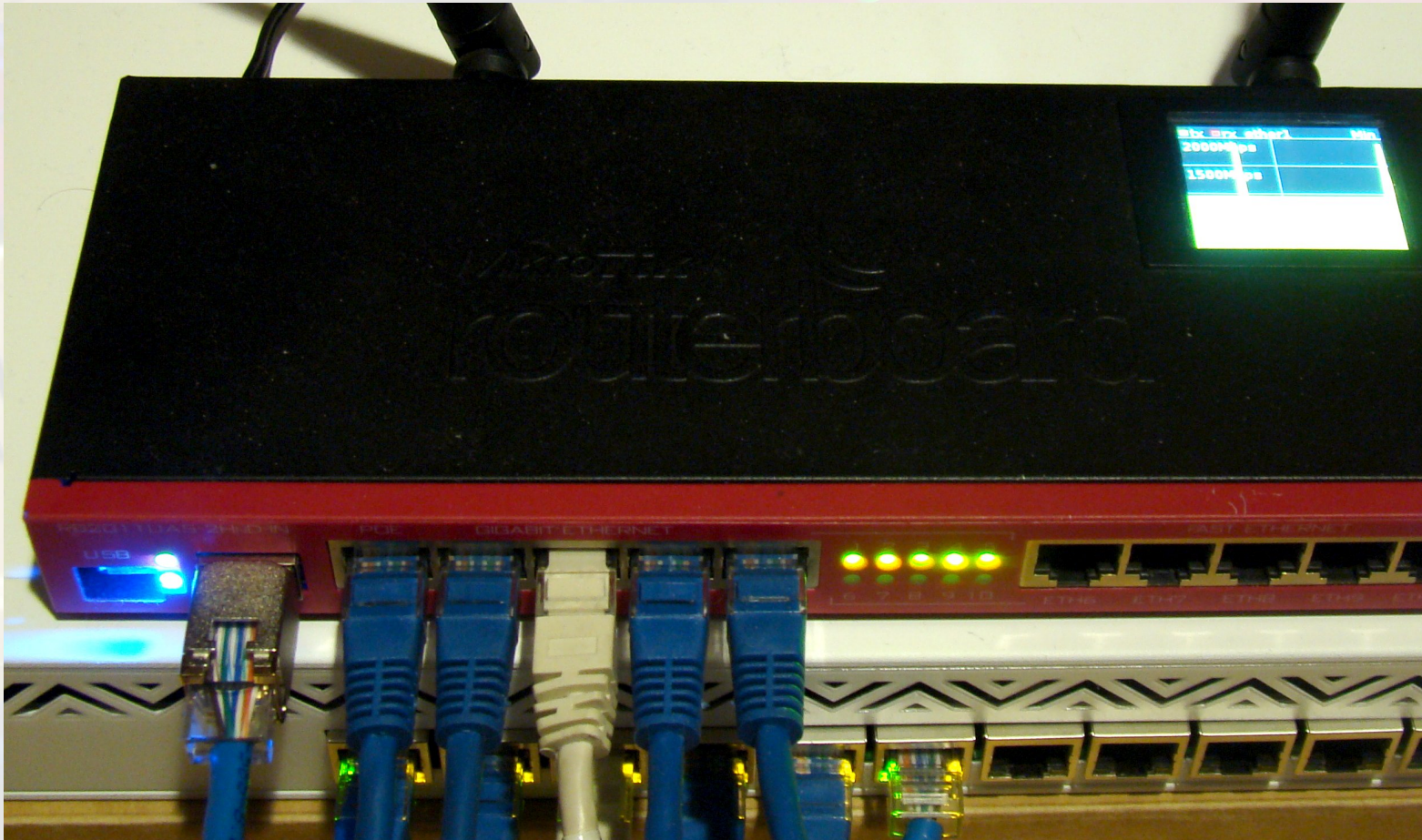# Switch your RouterBoard

- Daniel Starnowski

Switch chip on MikroTik RouterBoard

- It is really easy!

RouterBoard – just an example

OSI layers

- **Switch** operates on layer 2 and forwards ethernet frames between ports

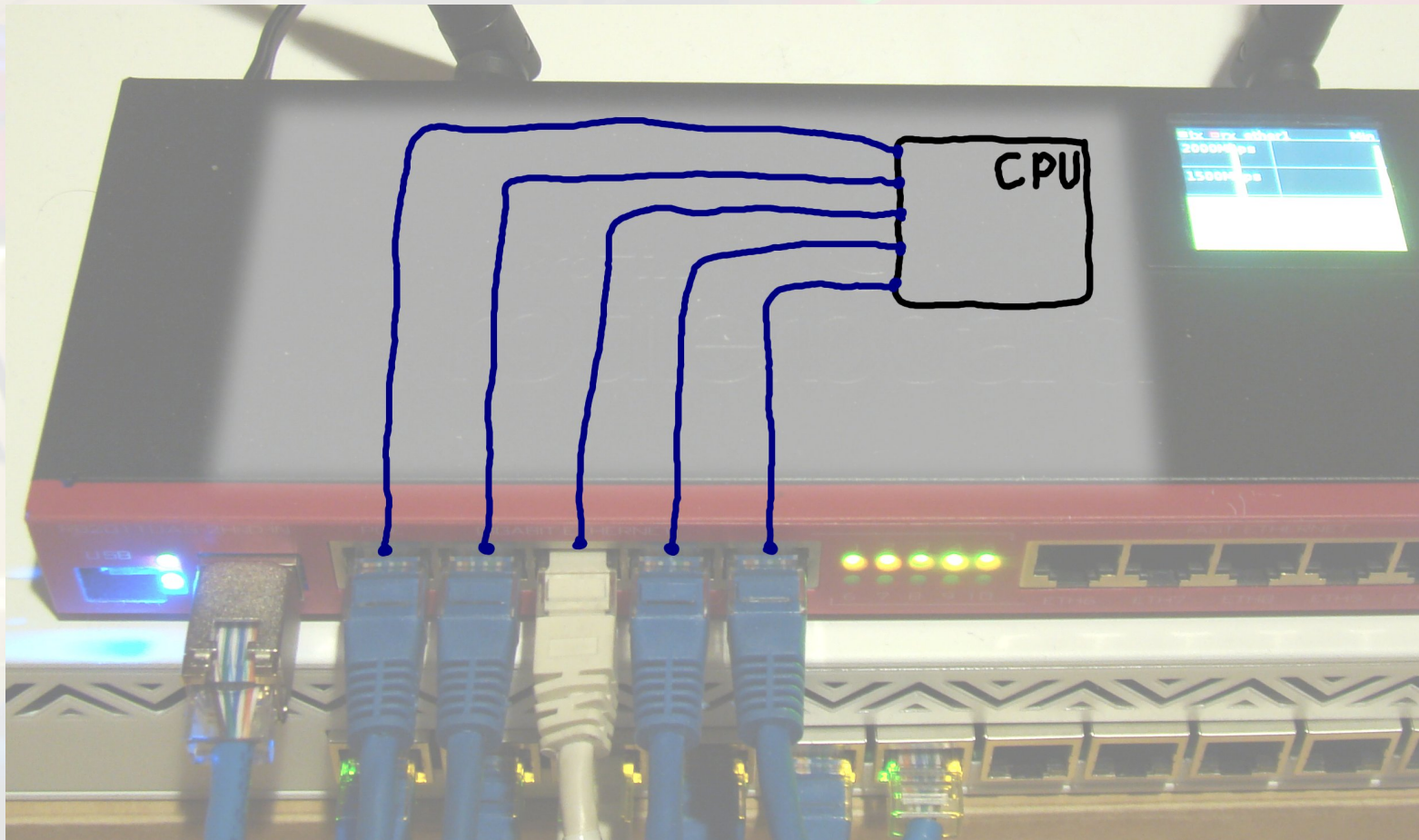- **Router** operates on layer 3 and forwards IP packets decapsulating them from frames
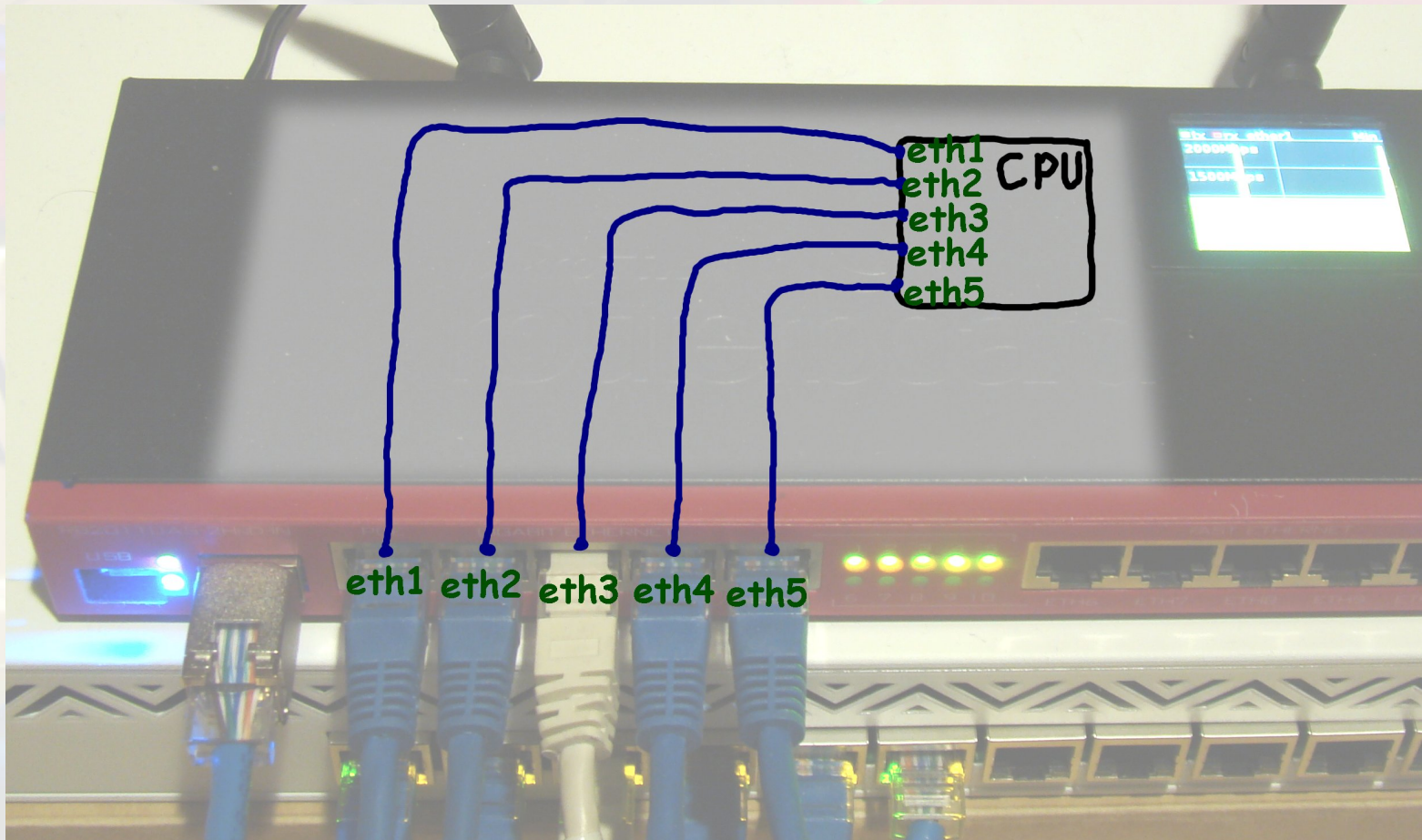
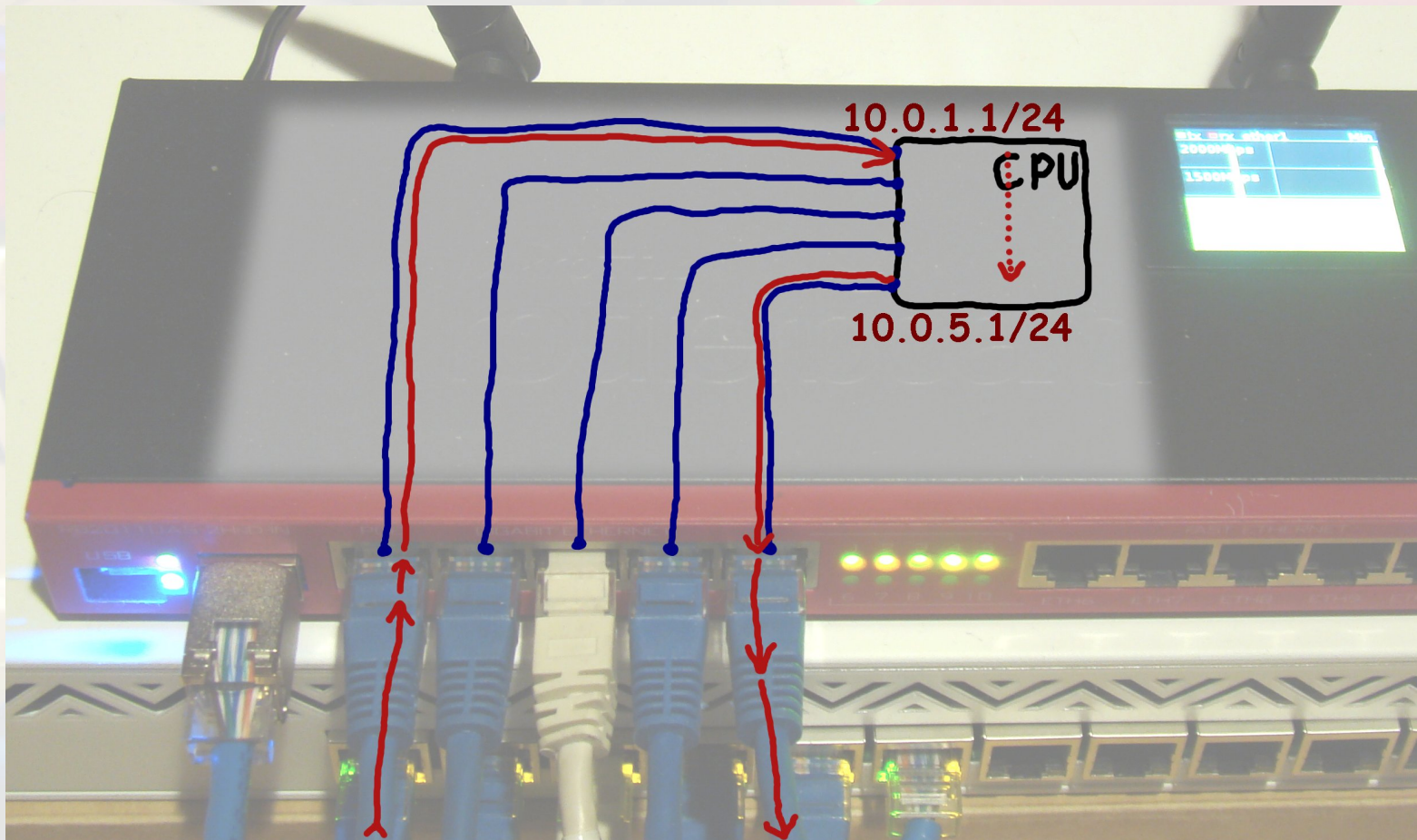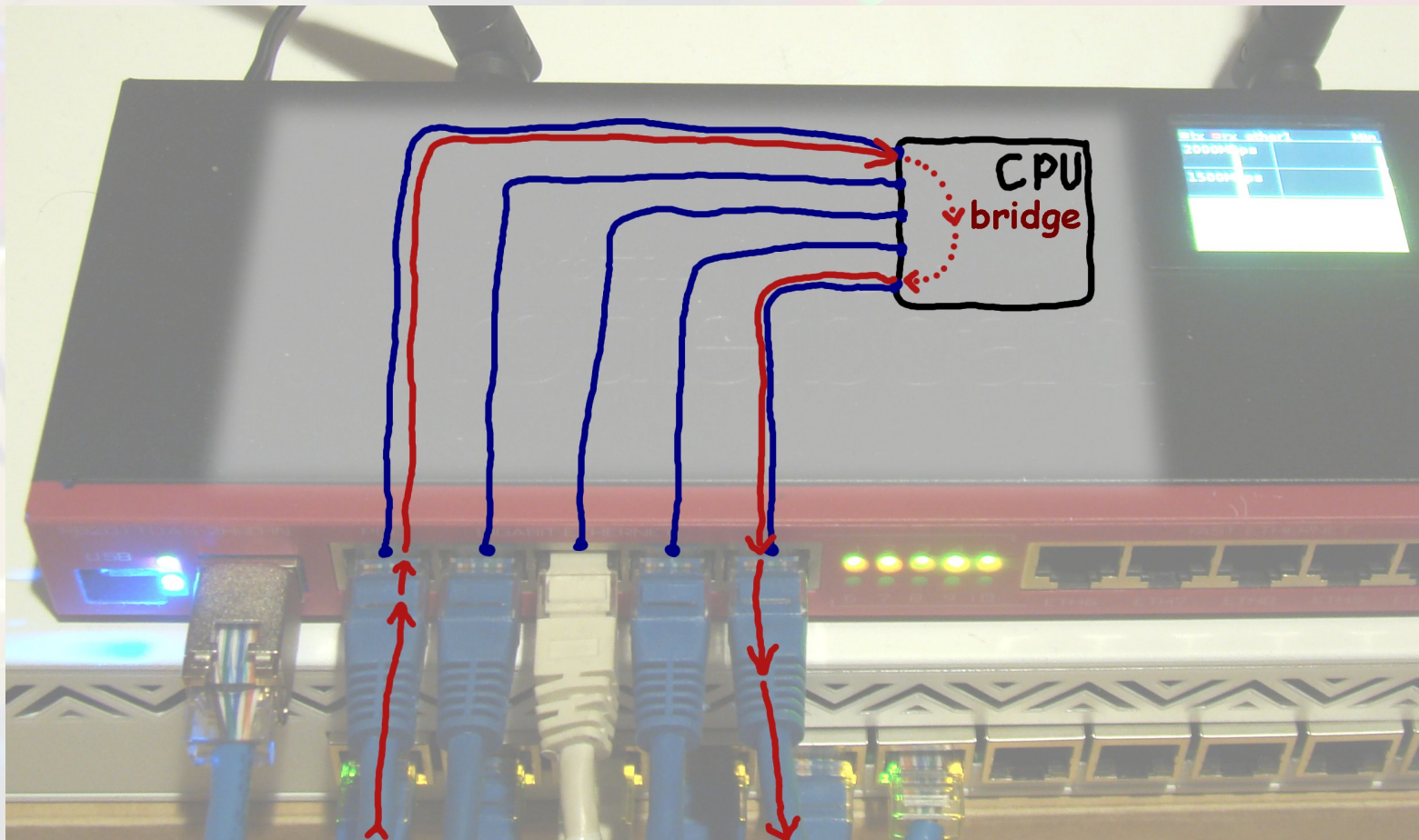| MAC header	IP header	Layer 4 + data	CRC

RouterBoard – the anatomy

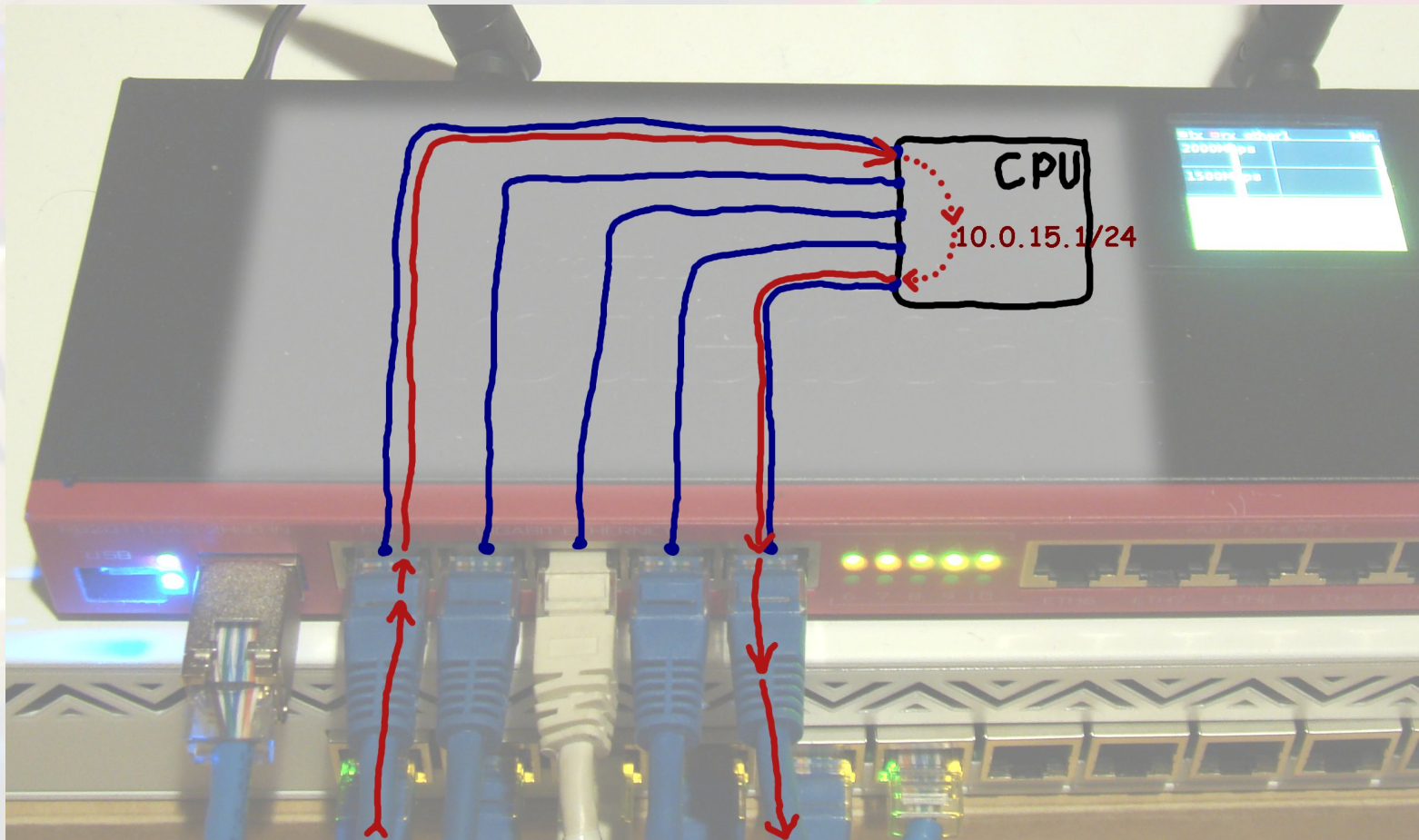# RouterBoard – ports and interfaces

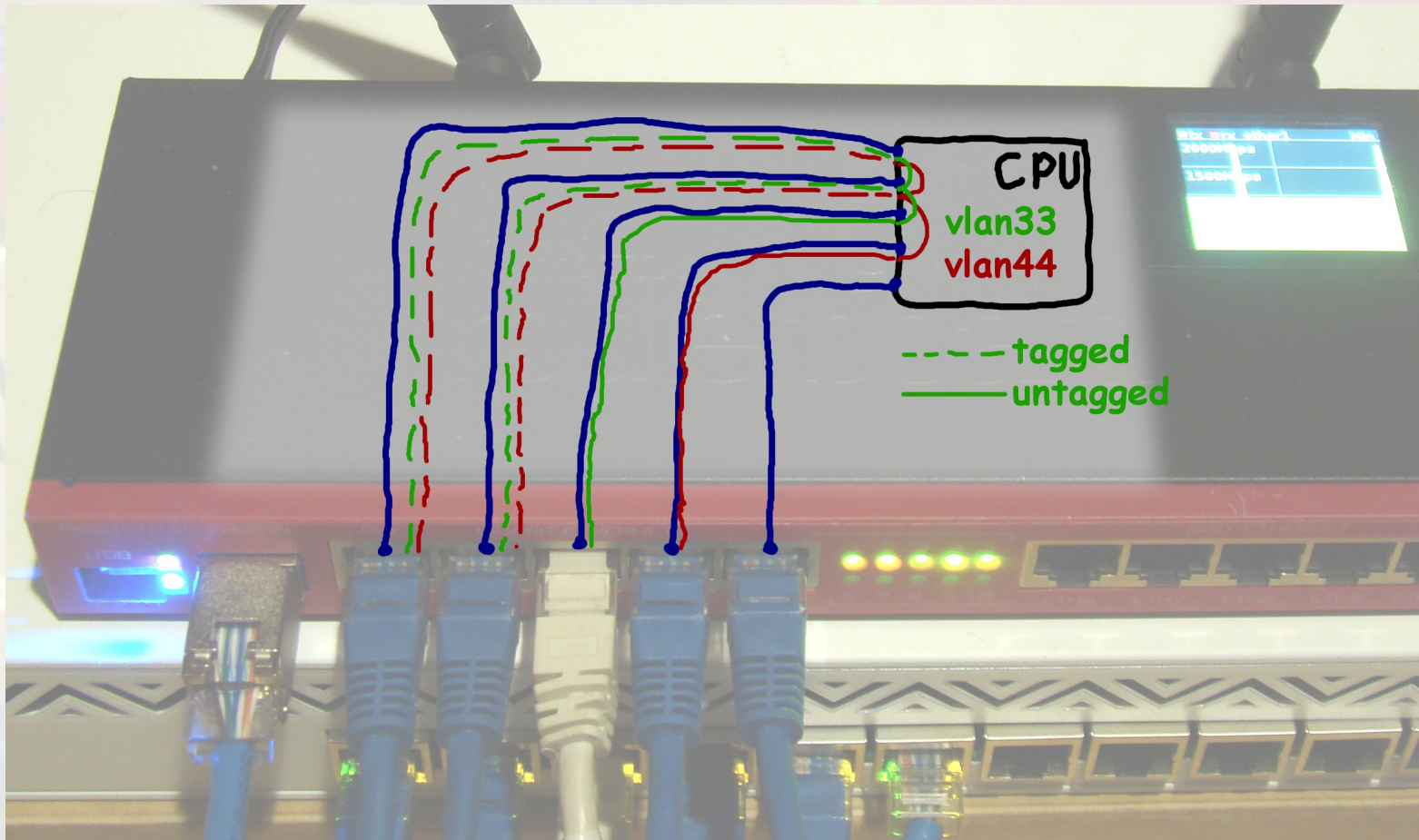# RouterBoard – a routing scenario

RouterBoard – a bridge

RouterBoard – IP address on a bridge

RB2011 – the performance

- fast path:

    ~1500 Mbps with 1500 B packets

    ~150 Mbps with 64 B packets

- without fast path:

    ~1000 Mbps with 1500 B packets

    ~50 Mbps with 64 B packets

RouterBoard – VLAN bridging

RouterBoard – VLAN bridging config

- Create VLAN **vlan33eth1** with tag 33 on interface ether1

- Create VLAN **vlan33eth2** on ether2

- Create bridge **vlan33**

- Add ports vlan33eth1, vlan33eth2 and ether3 to the bridge vlan33

RB2011 – VLAN bridging test

- 8 different streams
- Only 1500 B packets
- 8 x 122 Mbps – 1% packet loss (total 976 Mbps)
- 8 x 60 Mbps – 0,1% packet loss (total **480 Mbps**)
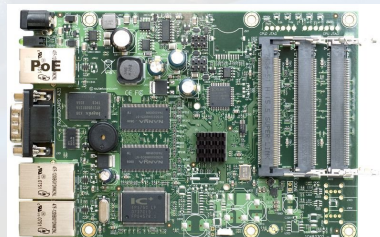
The answer – the switch chip
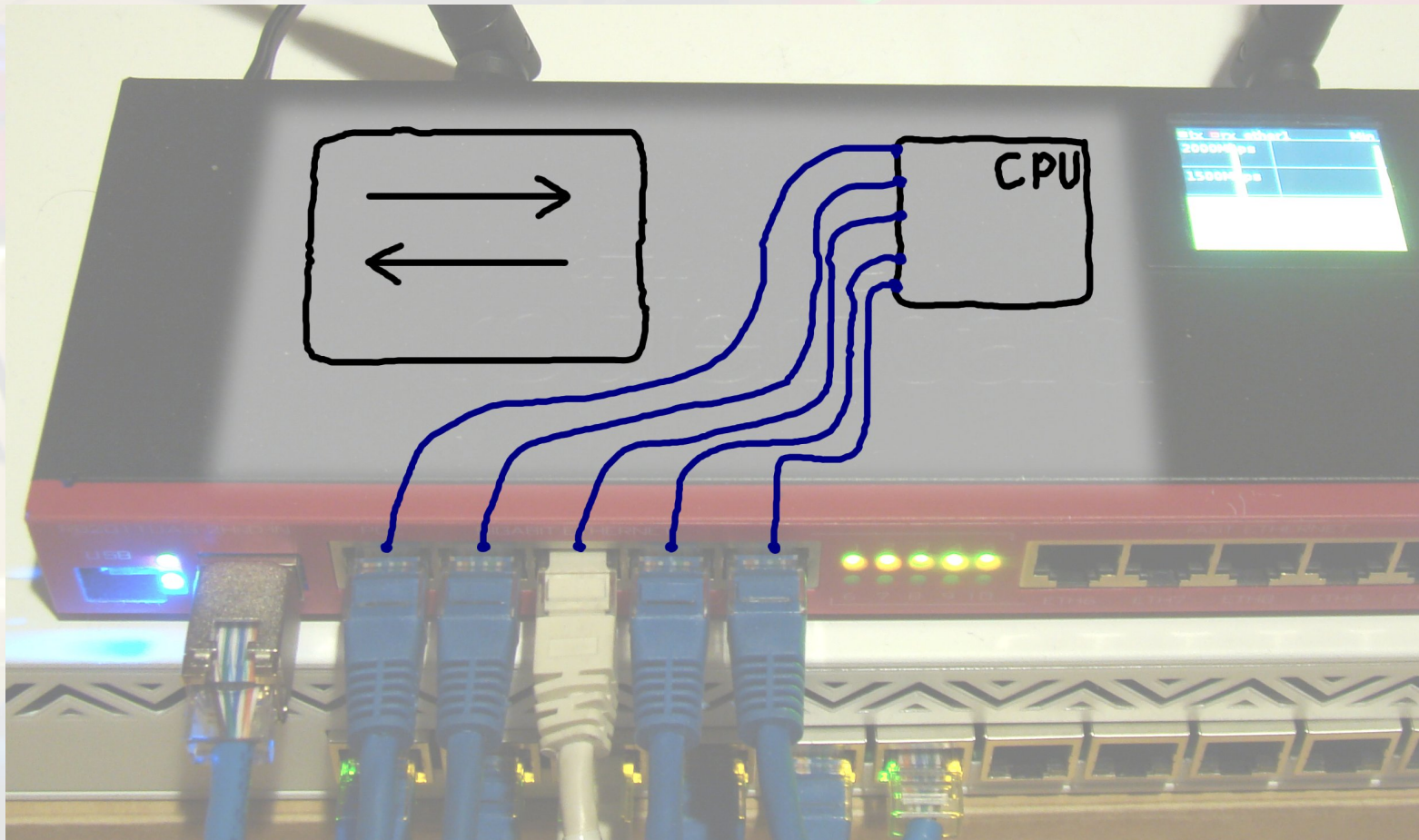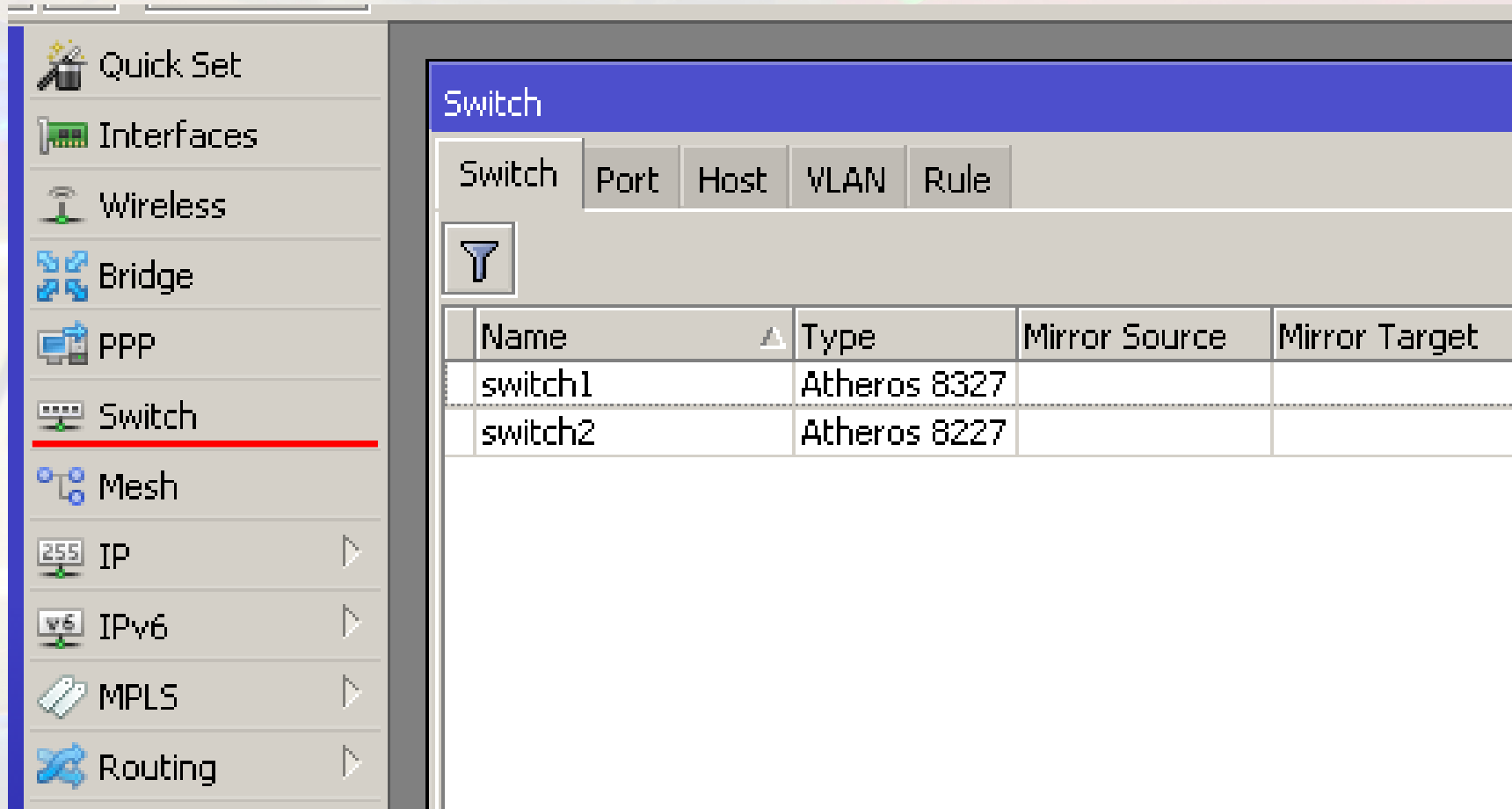
The switch chip

- Almost every new RouterBoard with multiple ethernet interfaces is equipped with a switch chip

- Hardware switch without using CPU

- From ROS v6 – VLAN trunking is possible

Switch chips in MikroTik devices

- Atheros 8316

- Atheros 8327

- Atheros 8227

- Atheros 7240

- other

What chip does my RouterBoard have?

Quick Set				
Interfaces				
Wireless				
Bridge	**Switch**			
PPP	Switch / Port / Host / VLAN / Rule			
Switch				
Mesh	Name △	Type	Mirror Source	Mirror Target
IP ▷	switch1	Atheros 8327		
IPv6 ▷	switch2	Atheros 8227		
MPLS ▷				
Routing ▷				

How to turn the switch chip on?

How to turn the switch chip on?

Activating the switch chip

- If we set „master port" on ether2 to „ether1", we will activate the switch chip.

- How many ports will be active on the chip?

Connections without using the chip
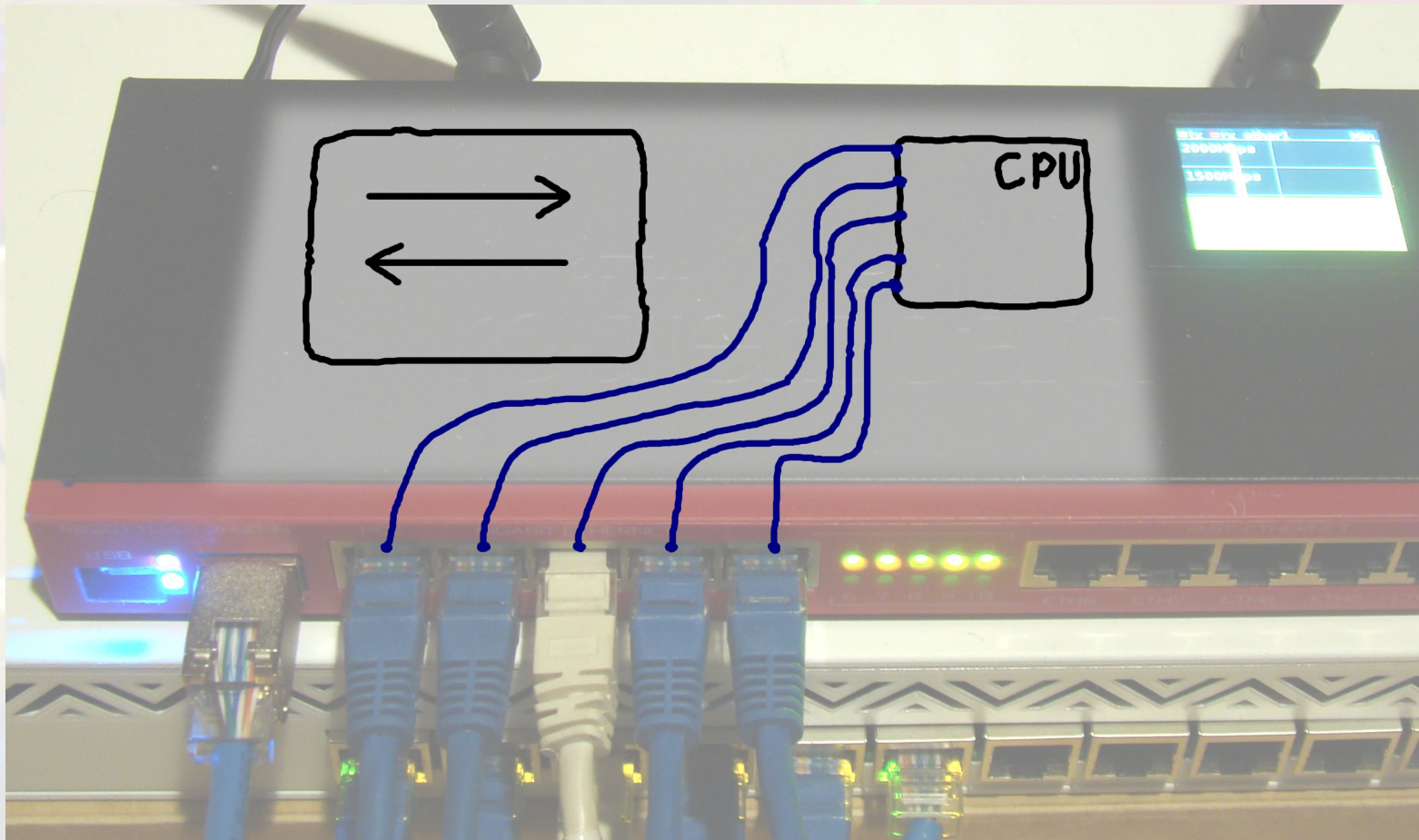
Activating the switch chip
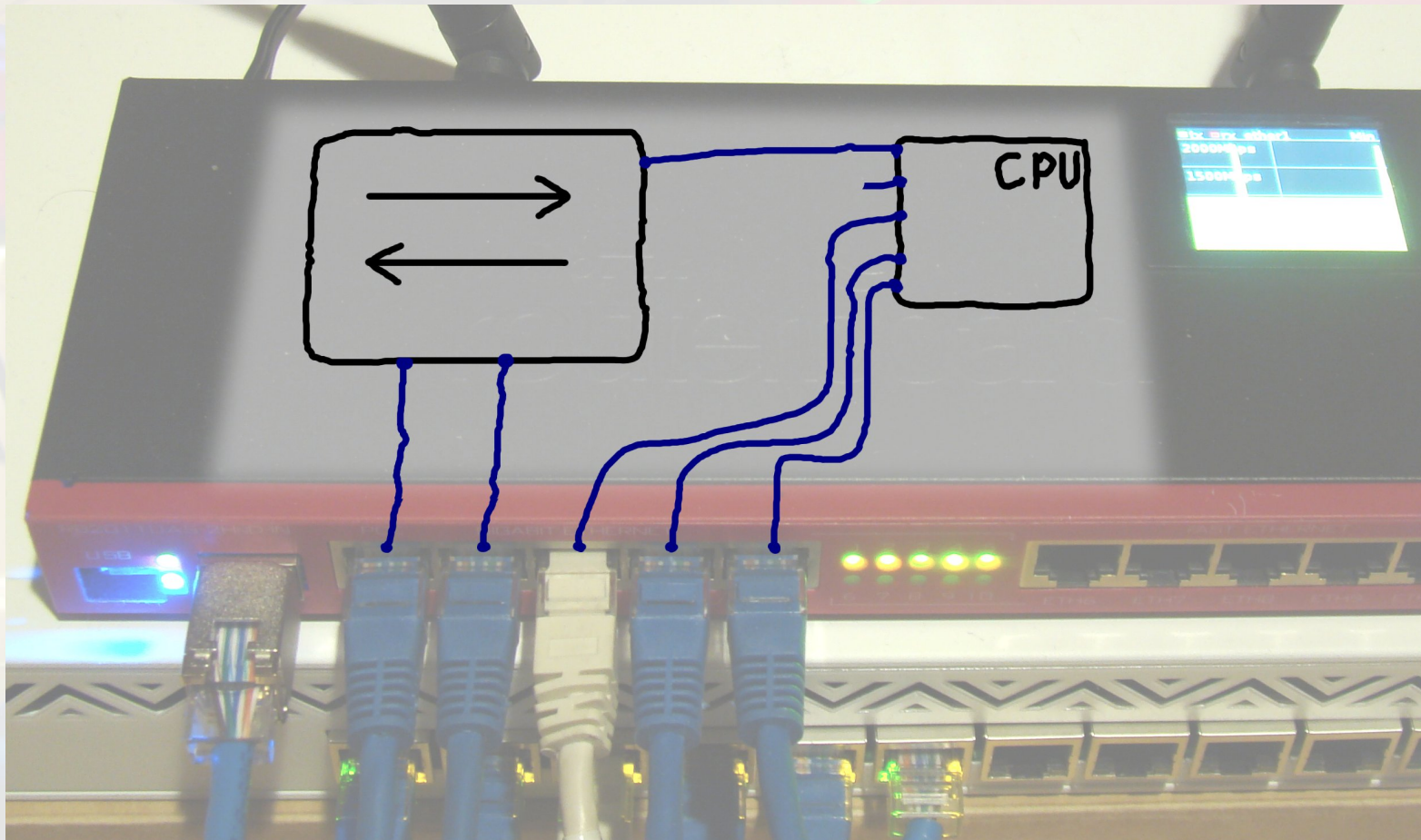
Switch chip – the master port

- Master port – only in the same chip
- Only 1 master port possible for a chip
- The master and „slave" ports are equal for the switch chip
- Only one difference – the interface, the chip will be visible on

Switch chip – port names
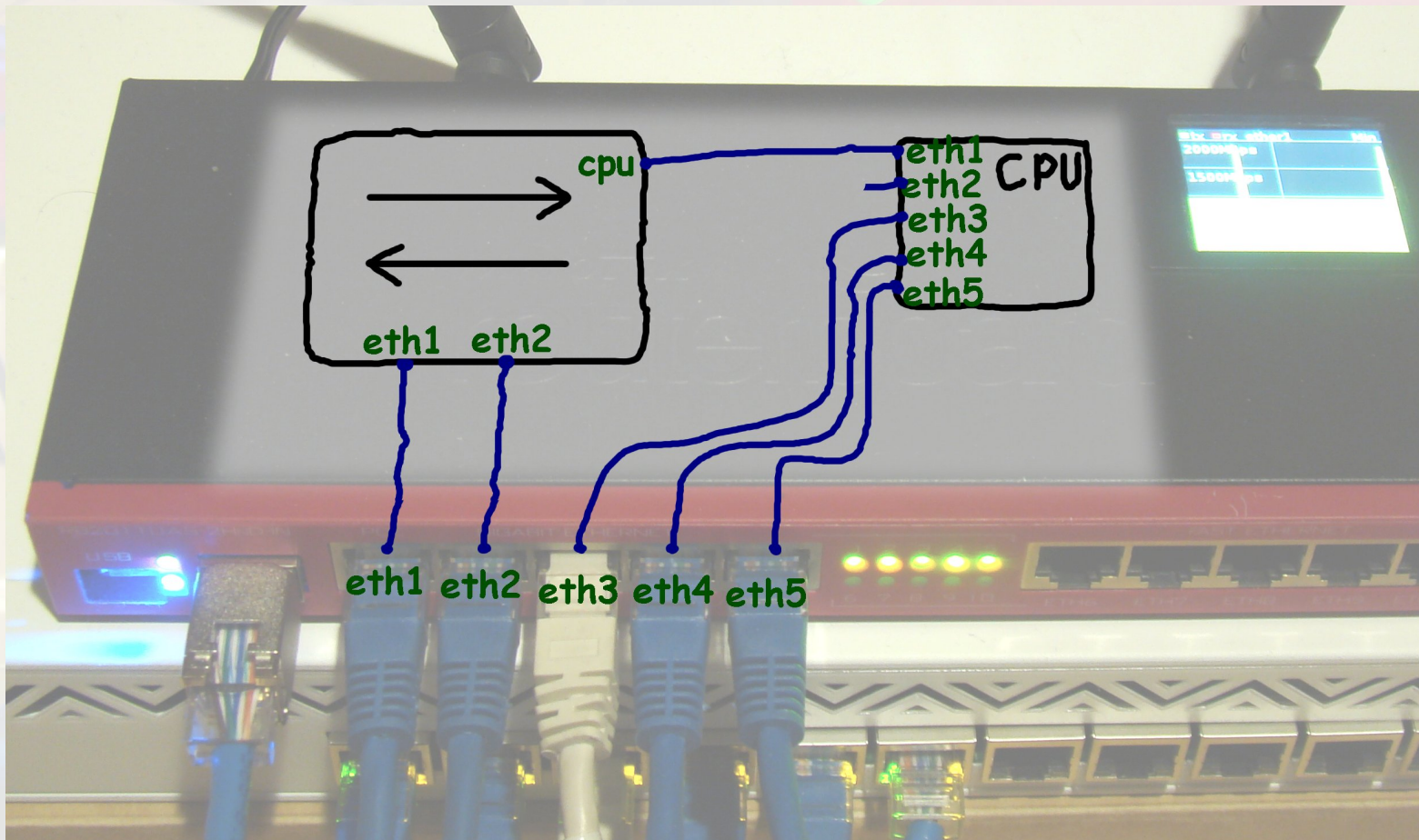
Switch chip – port names

- The same names:
  - **interfaces** seen from the CPU (ether1, ether2, ...)
  - **physical ports** seen from the chip (ether1, ether2, ...)
- Only one connection between the chip (the cpu port) and the CPU (master port)

Default configuration of switch chip
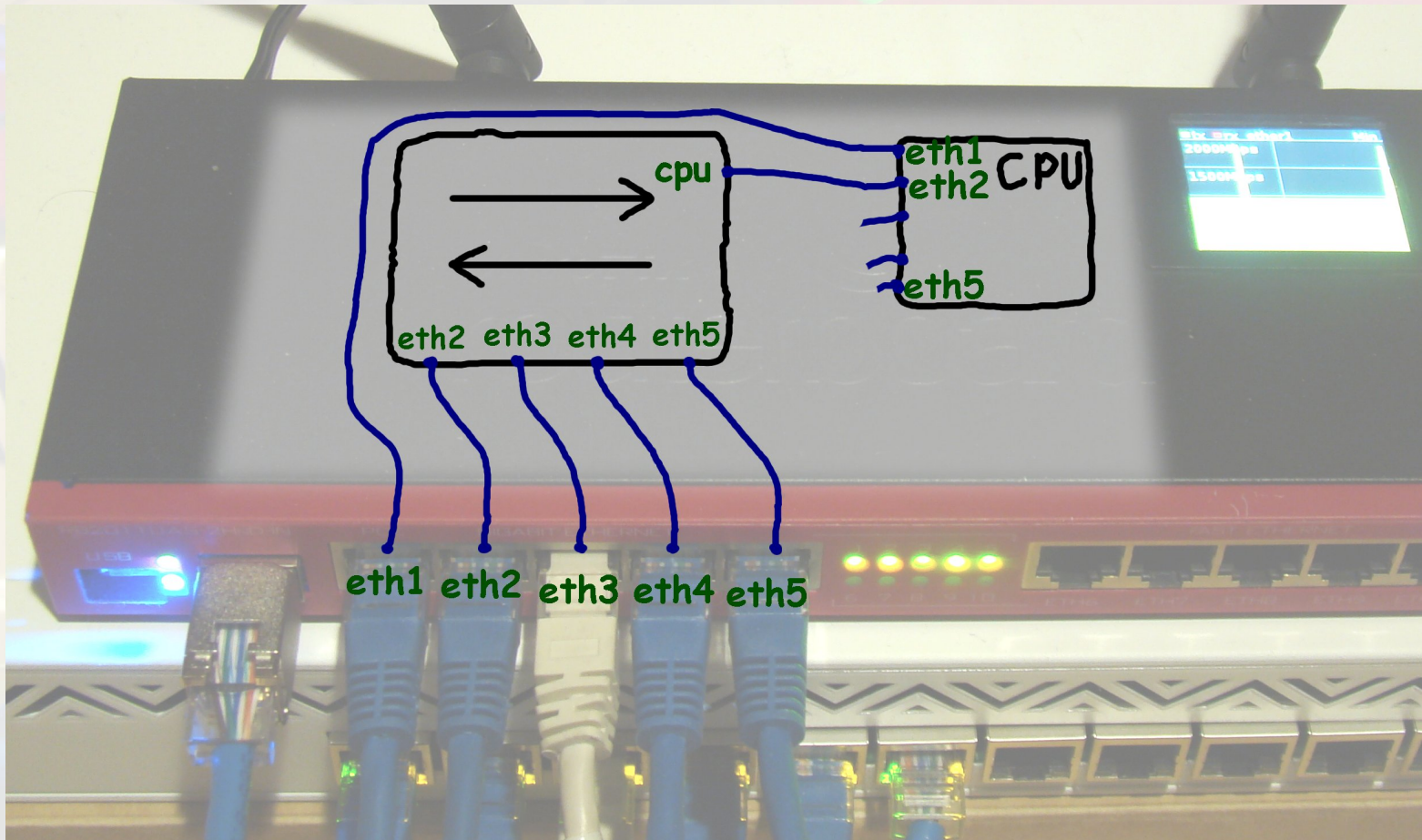
Default configuration of switch chip

- In RouterBoards like 2011 or 951
- ether1 – gateway port (not included in the switch group)
- ether2-ether5 – switched ports
- ether2 – master port, used when configuring IP address, bridge, etc.

VLAN bridging – the software version

VLAN bridging with the switch chip
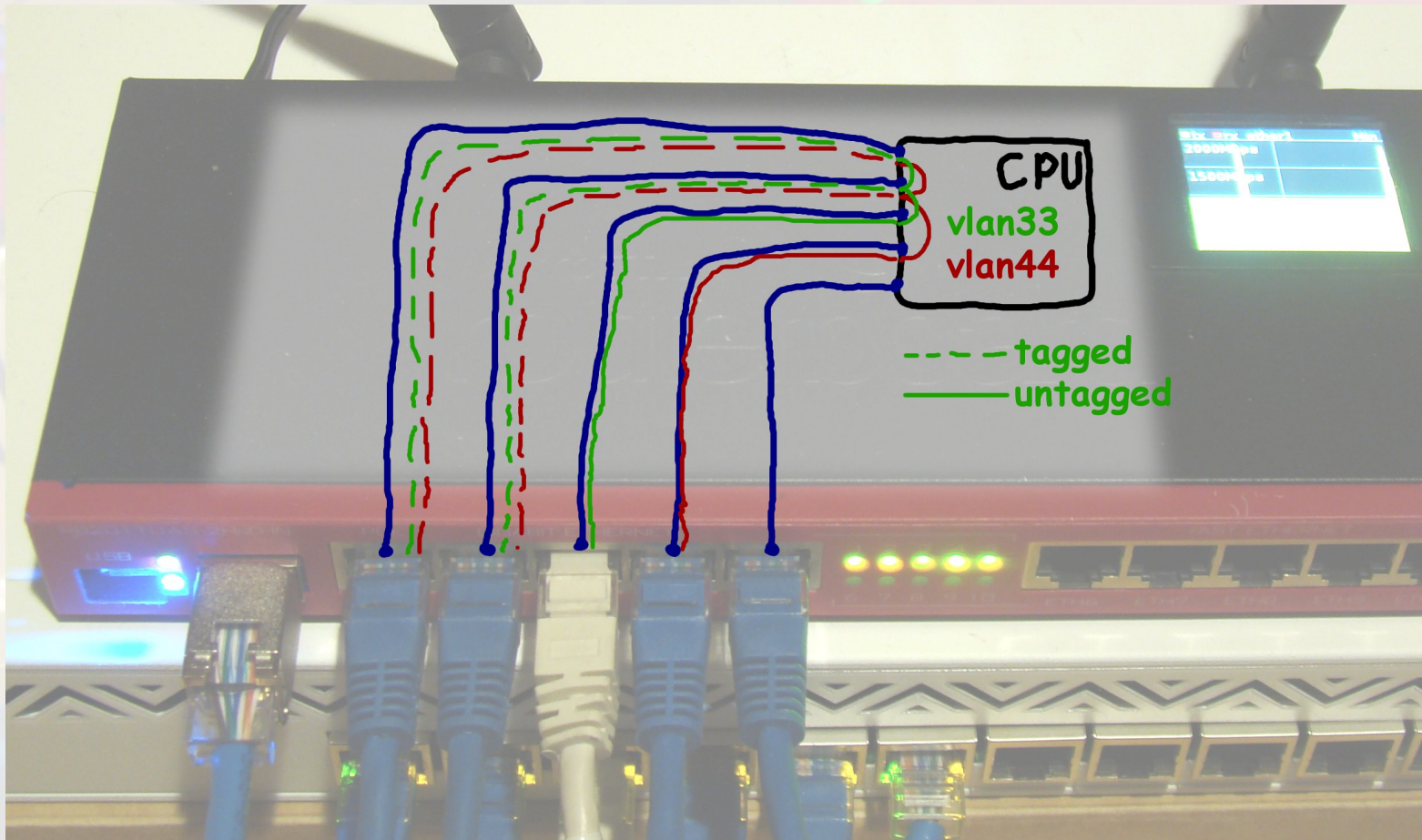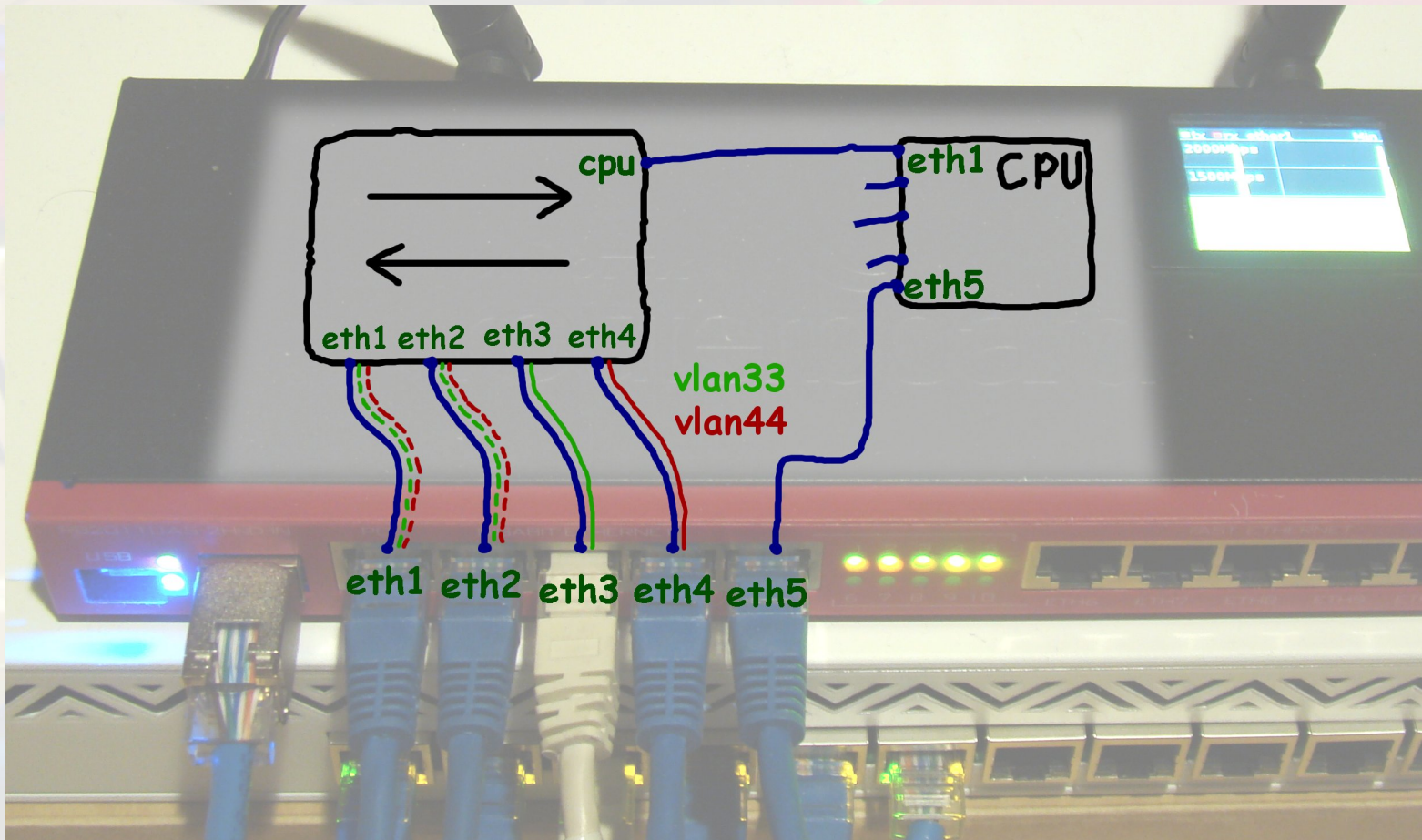
Switch chip – preparing the vlans

Switch chip – preparing the vlans

- Vlan settings not important as long as **VLAN Mode** is **disabled** (default)

- Independent learning – when some MACs can be visible on different ports in different vlans
  - Keeps separate table for the VLAN

Switch chip – the trunk port

Switch chip – the access port

Switch chip – trunk and access ports

- Trunk port:
  - Mode: **secure**
  - Header: **add if missing**
- Access port:
  - Mode: **secure**
  - Header: **always strip**
  - Default VLAN ID (a.k.a. PVID)
- No „hybrid" ports!

Switch chip – the speed test

	Name	Type	L2 MTU	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)
R	bridge-local	Bridge	1598	0 bps	0 bps	0	0
R	ether1	Ethernet	1598	960.3 Mbps	961.3 Mbps	82 333	82 418
RS	ether2	Ethernet	1598	960.4 Mbps	960.6 Mbps	82 346	82 360
RS	ether3	Ethernet	1598	958.2 Mbps	958.2 Mbps	82 383	82 378
RS	ether4	Ethernet	1598	958.1 Mbps	957.6 Mbps	82 371	82 330
R	ether5	Ethernet	1598	0 bps	0 bps	0	0
RS	ether6	Ethernet	1598	0 bps	0 bps	0	0
RS	ether7	Ethernet	1598	0 bps	0 bps	0	0
RS	ether8	Ethernet	1598	0 bps	0 bps	0	0
S	ether9	Ethernet	1598	0 bps	0 bps	0	0
S	ether10	Ethernet	1598	0 bps	0 bps	0	0
S	sfp1	Ethernet	1598	0 bps	0 bps	0	0
R	wlan1	Wireless (Atheros AR...)	2290	109.5 kbps	7.9 kbps	11	13

Uptime: 1d 05:02:51 CPU: 8% ☑ Hide Pas

Interface List

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

Switch chip – the speed test

- With bridging – more than 0.1% loss visible with 8*60 = **480 Mbps** (and CPU ~ 50%)

- Switch chip – almost no loss with 8*490 Mbps = **3920 Mbps** (4 ports **wire speed**), CPU unchanged

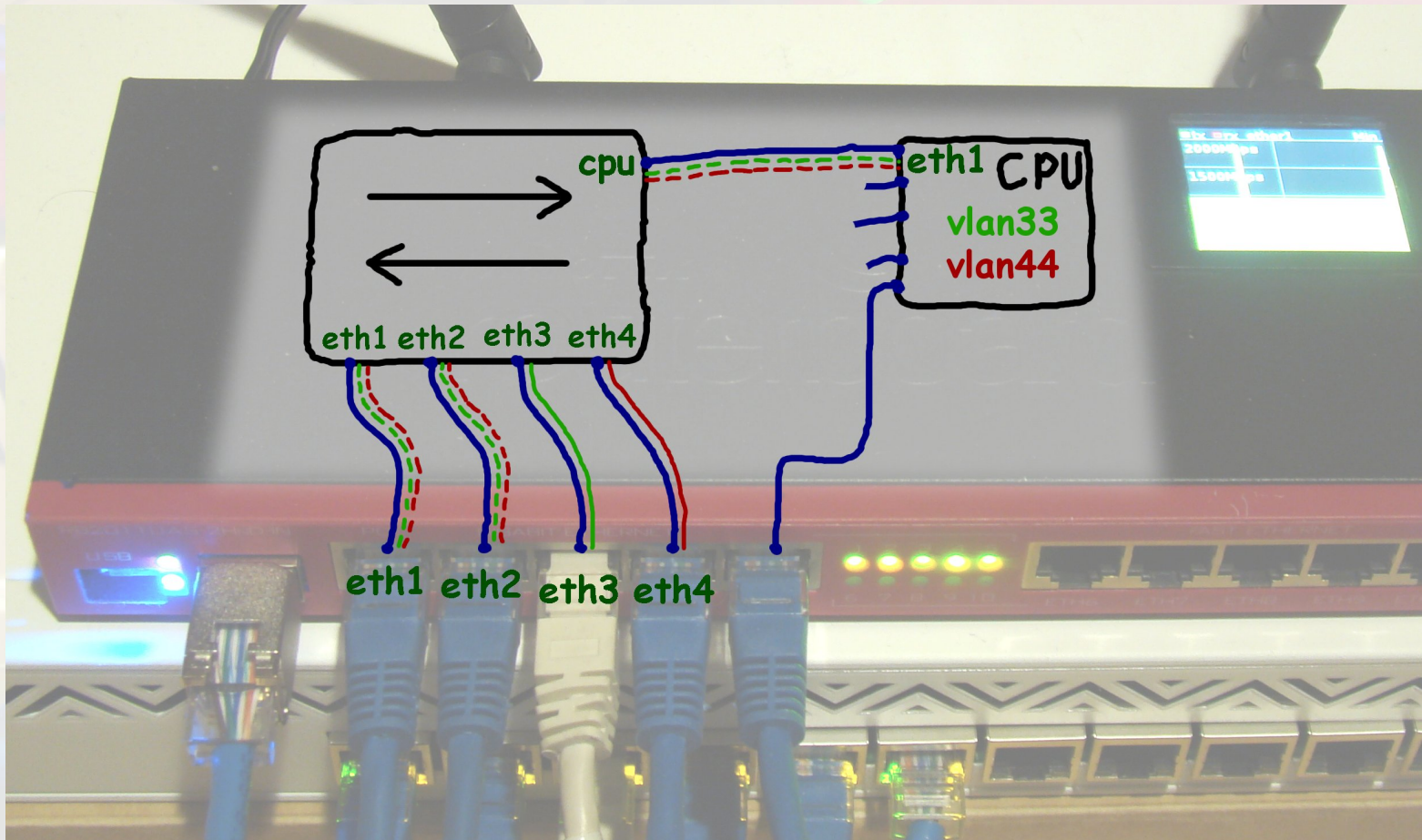- From ROS 6.5 – port stats available

Switch chip – port stats

- From ROS 6.5 stats available for the switch ports (traffic doesn't need to go through CPU
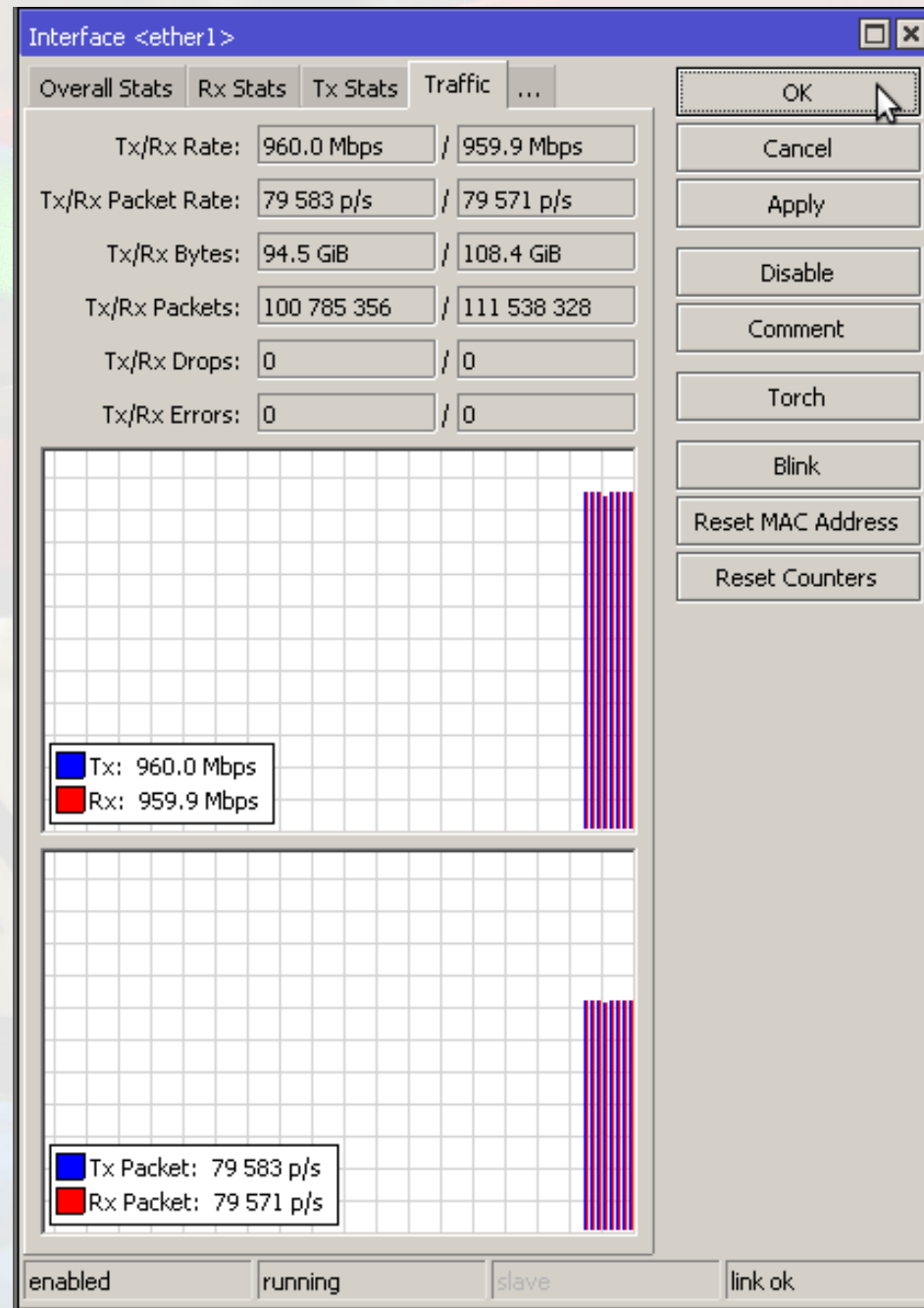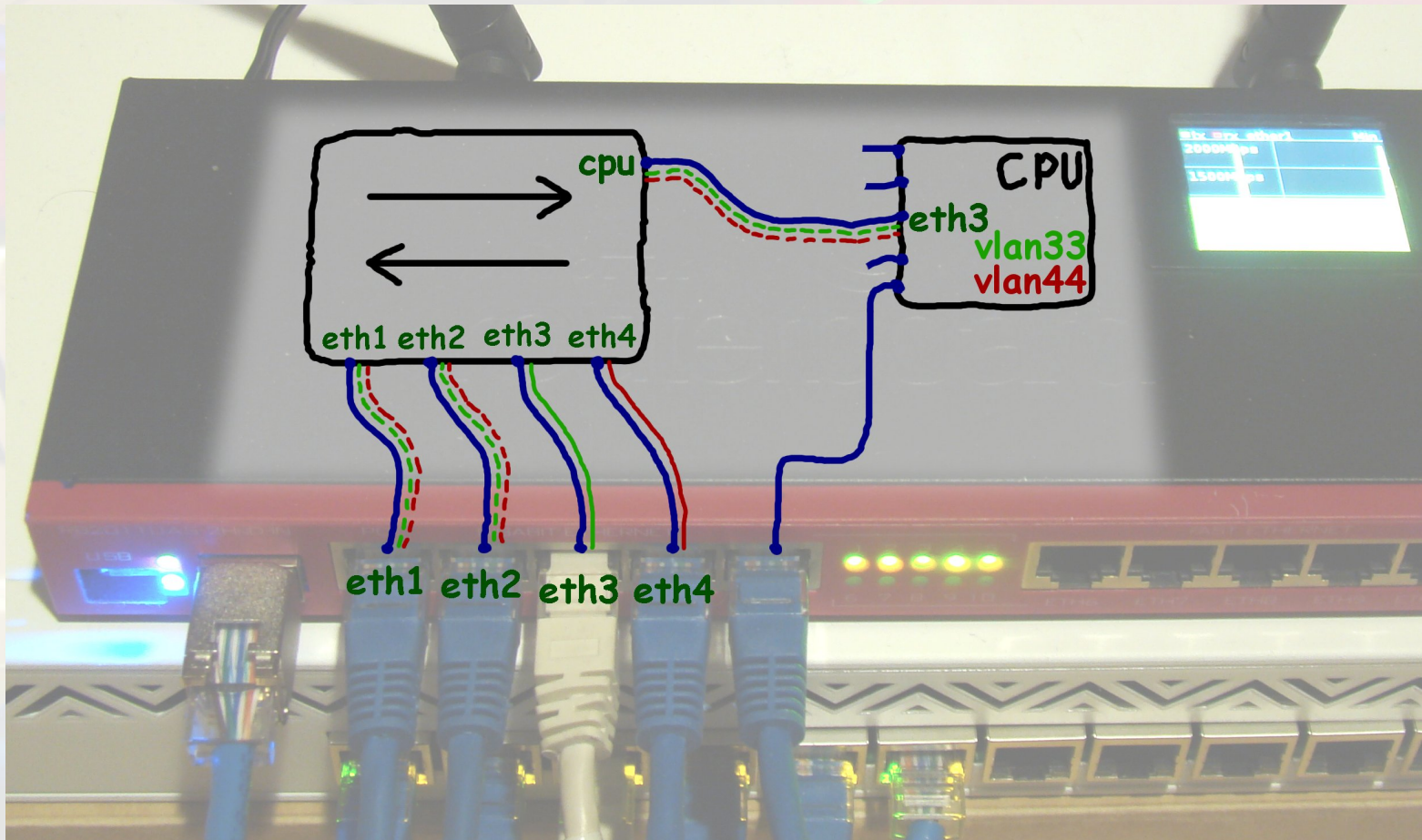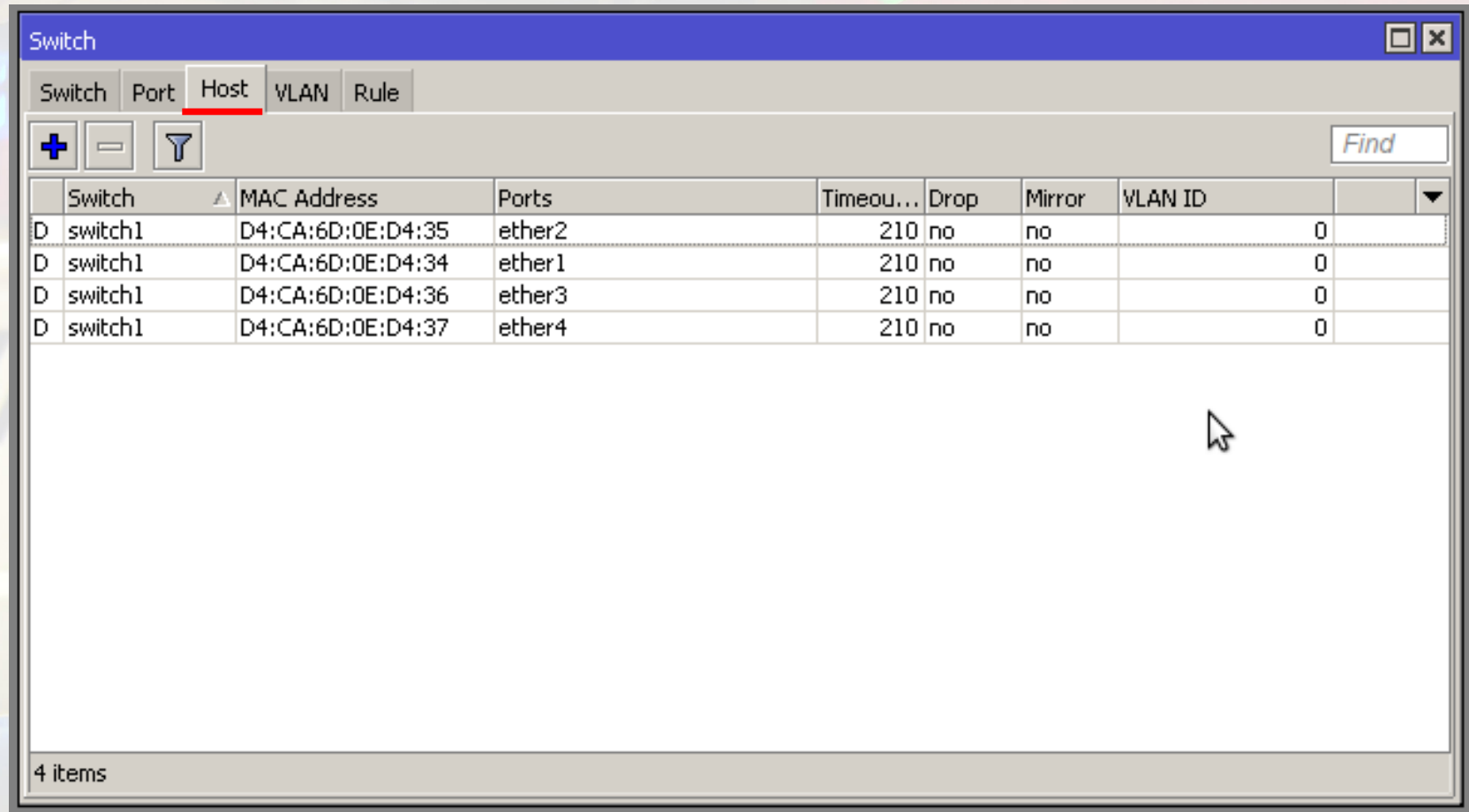
Switch chip – routing the VLANs

Switch chip – routing the VLANs

- Include **cpu** in selected VLANs configuration on the switch chip

- Change VLAN Mode to **secure** (header can be **leave as is**)

- Add VLAN interfaces on the master port (in the example – ether1)

What if ether3 was the master port?

Hosts table

Switch chip's limitations

Feature	Atheros8327	Atheros8316	Atheros8227	Atheros7240	ICPlus175D	Other
Port Switching	yes	yes	yes	yes	yes	yes
Port Mirroring	yes	yes	yes	yes	yes	no
Host table	2048 entries	2048 entries	1024 entries	2048 entries	no	no
Vlan table	4096 entries	4096 entries	4096 entries	16 entries	no	no
Rule table	92 rules	32 rules	no	no	no	no

- Mirroring – copies of all frames (in and out) from **source** sent to **target**
- Rules – if we want to mirror or block (etc.) a selected packets

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Thank you!

- I told you it was easy!