

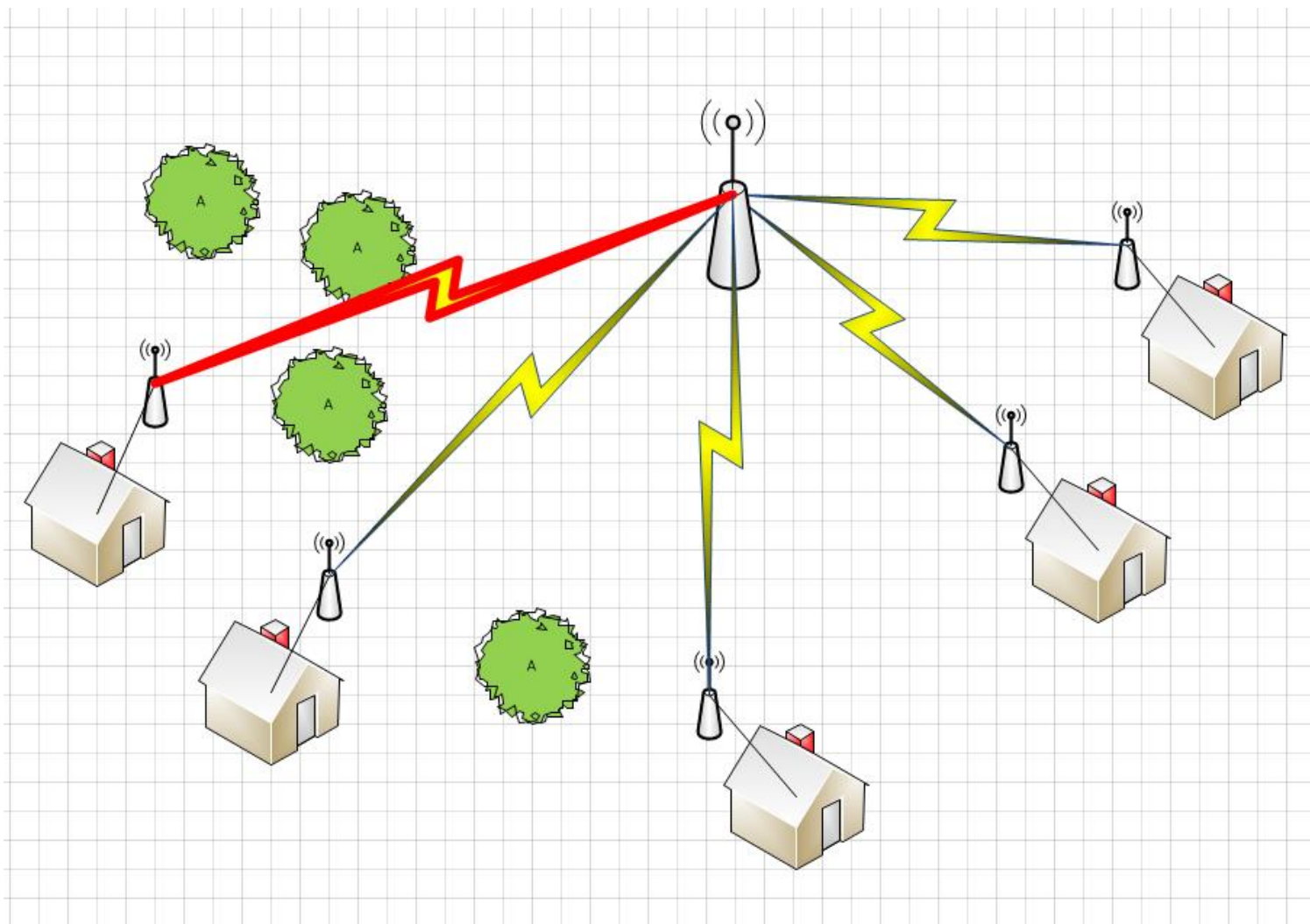
# LANMART

5 историй про MikroTik

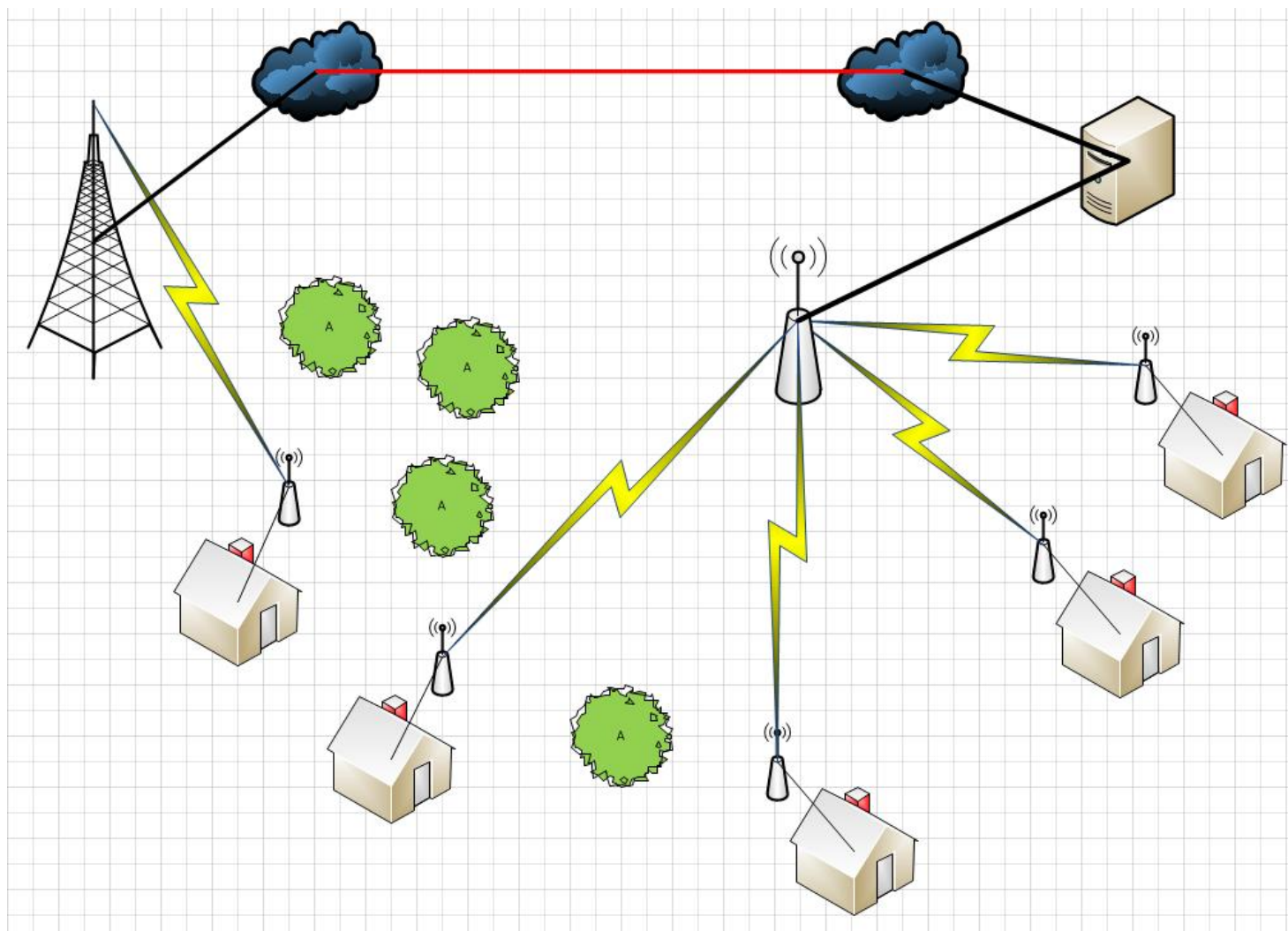
# MikroTik и LTE модем

- Для подключения к сети сотового оператора обычно используют USB-модем, плату MikroTik, корпус, блок питания и шнурок...
- Но есть способ проще 😊

# Весна трудное время



# Пора обратиться к конкурентам



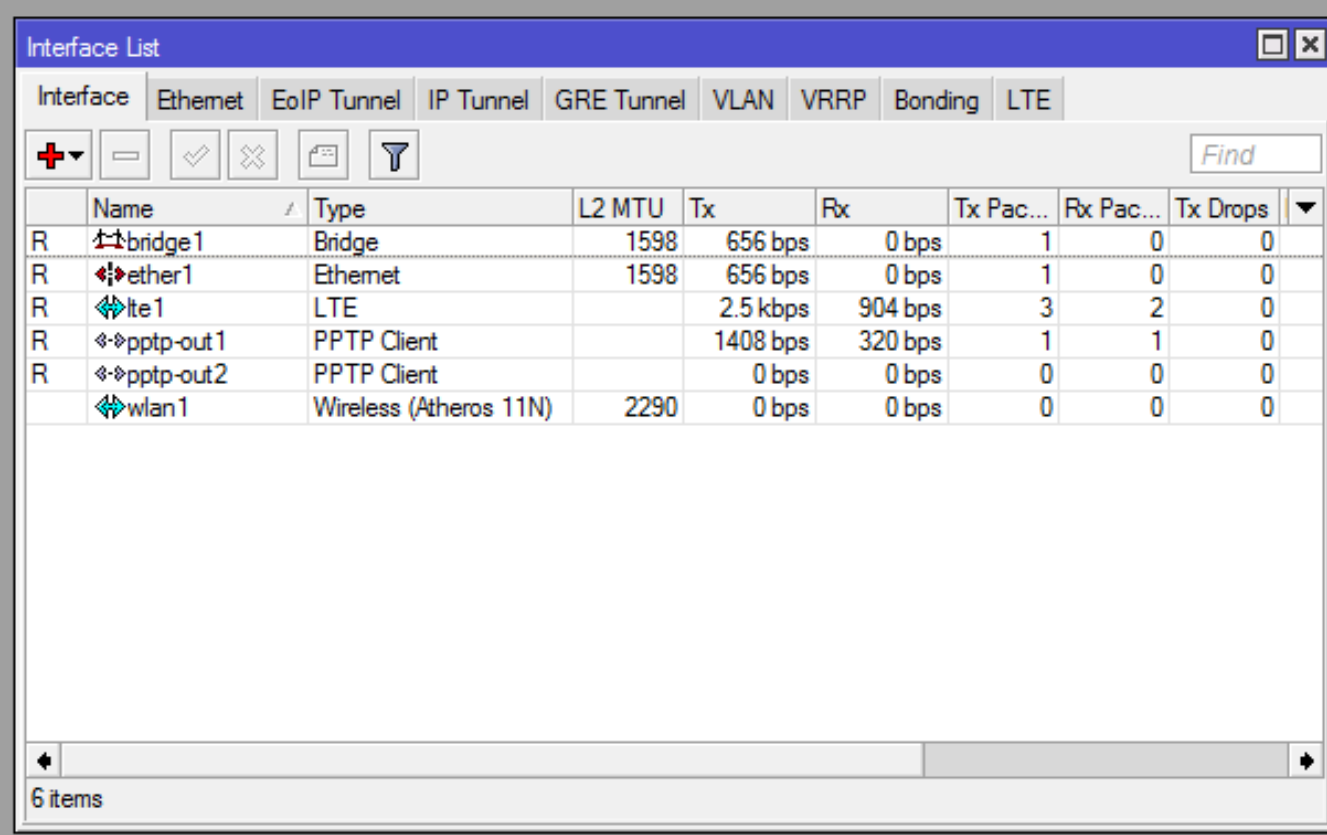
# MikroTik SXT c USB



# А вот и корпус



# Список интерфейсов



The screenshot shows a window titled "Interface List" with a tabbed interface. The "Interface" tab is selected. Below the tabs are several icons: a red plus sign, a minus sign, a checkmark, an 'X', a document icon, and a funnel icon. To the right of these icons is a "Find" text box. The main area contains a table with the following columns: Name, Type, L2 MTU, Tx, Rx, Tx Pac..., Rx Pac..., and Tx Drops. The table lists six interfaces: bridge1 (Bridge), ether1 (Ethernet), lte1 (LTE), ptp-out1 (PPTP Client), ptp-out2 (PPTP Client), and wlan1 (Wireless (Atheros 11N)). At the bottom of the window, a status bar indicates "6 items".

	Name	Type	L2 MTU	Tx	Rx	Tx Pac...	Rx Pac...	Tx Drops
R	bridge1	Bridge	1598	656 bps	0 bps	1	0	0
R	ether1	Ethernet	1598	656 bps	0 bps	1	0	0
R	lte1	LTE		2.5 kbps	904 bps	3	2	0
R	ptp-out1	PPTP Client		1408 bps	320 bps	1	1	0
R	ptp-out2	PPTP Client		0 bps	0 bps	0	0	0
	wlan1	Wireless (Atheros 11N)	2290	0 bps	0 bps	0	0	0

6 items

# Что бы большие пакеты ходили

Interface <pptp-out1>

General | Dial Out | Status | Traffic

Name: pptp-out1

Type: PPTP Client

L2 MTU:

Max MTU: 1460

Max MRU: 1460

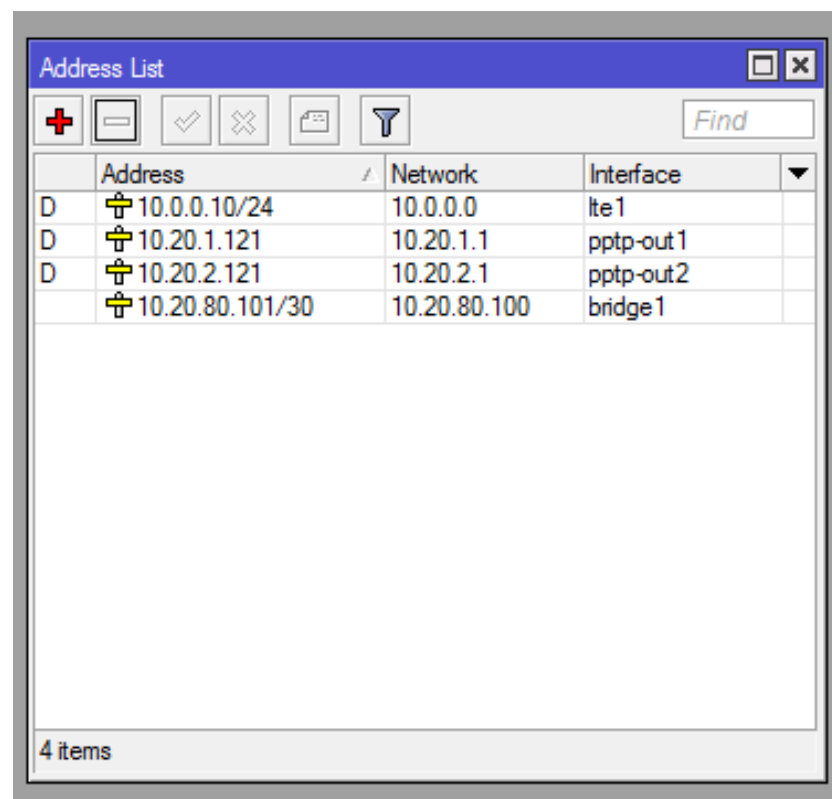
MRRU: 1500 ▲

OK  
Cancel  
Apply  
Disable  
Comment  
Copy  
Remove  
Torch

enabled | running | slave | Status: connected



# Указываем адрес для клиента

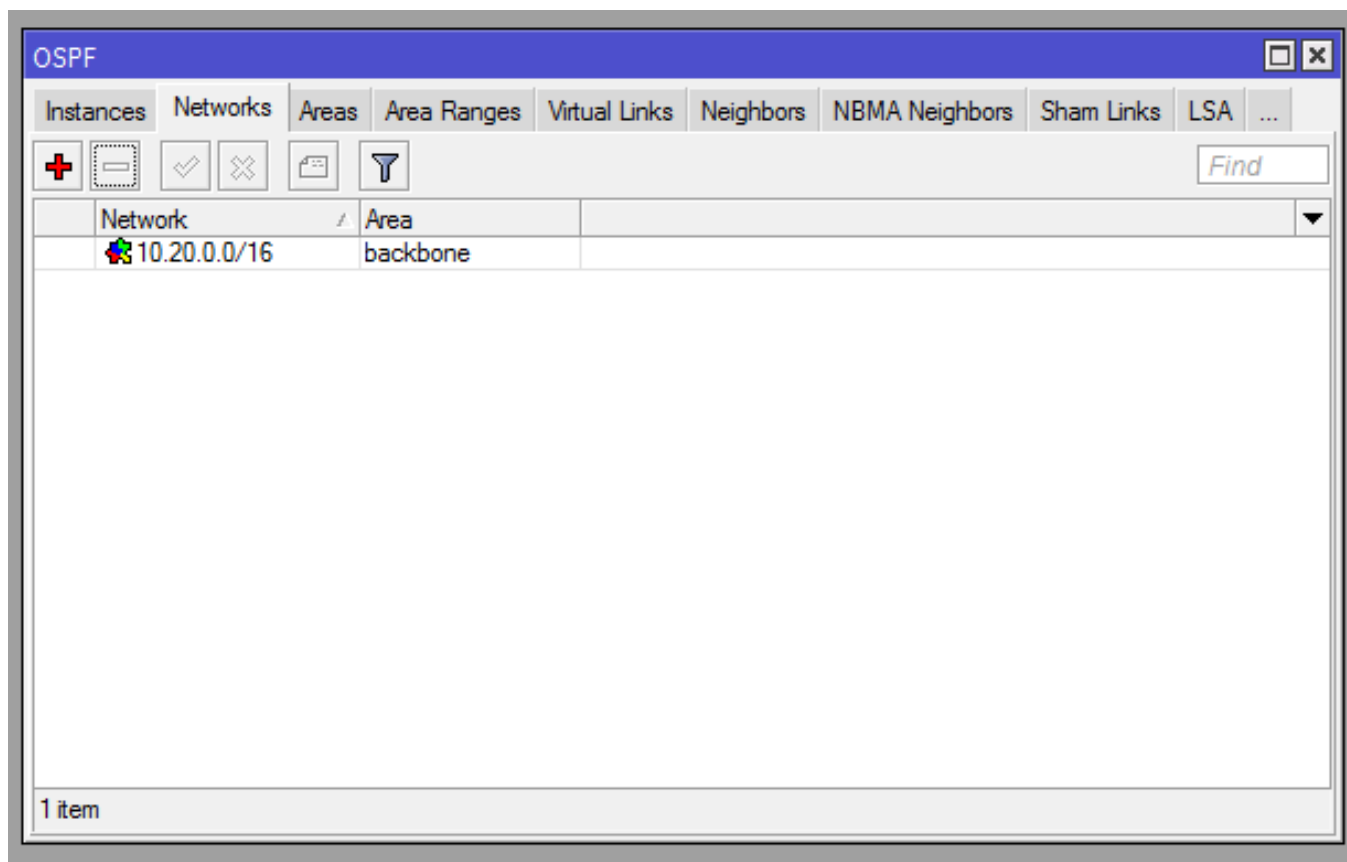


The screenshot shows a window titled "Address List" with a toolbar containing icons for adding, deleting, checking, unchecking, and filtering, along with a "Find" search box. The table below lists four items, each with a status "D", a plus icon, an address, a network, and an interface.

	Address	Network	Interface
D	+ 10.0.0.10/24	10.0.0.0	lte1
D	+ 10.20.1.121	10.20.1.1	pptp-out1
D	+ 10.20.2.121	10.20.2.1	pptp-out2
	+ 10.20.80.101/30	10.20.80.100	bridge1

4 items

# И включаем OSPF



# OSPF работает!

OSPF

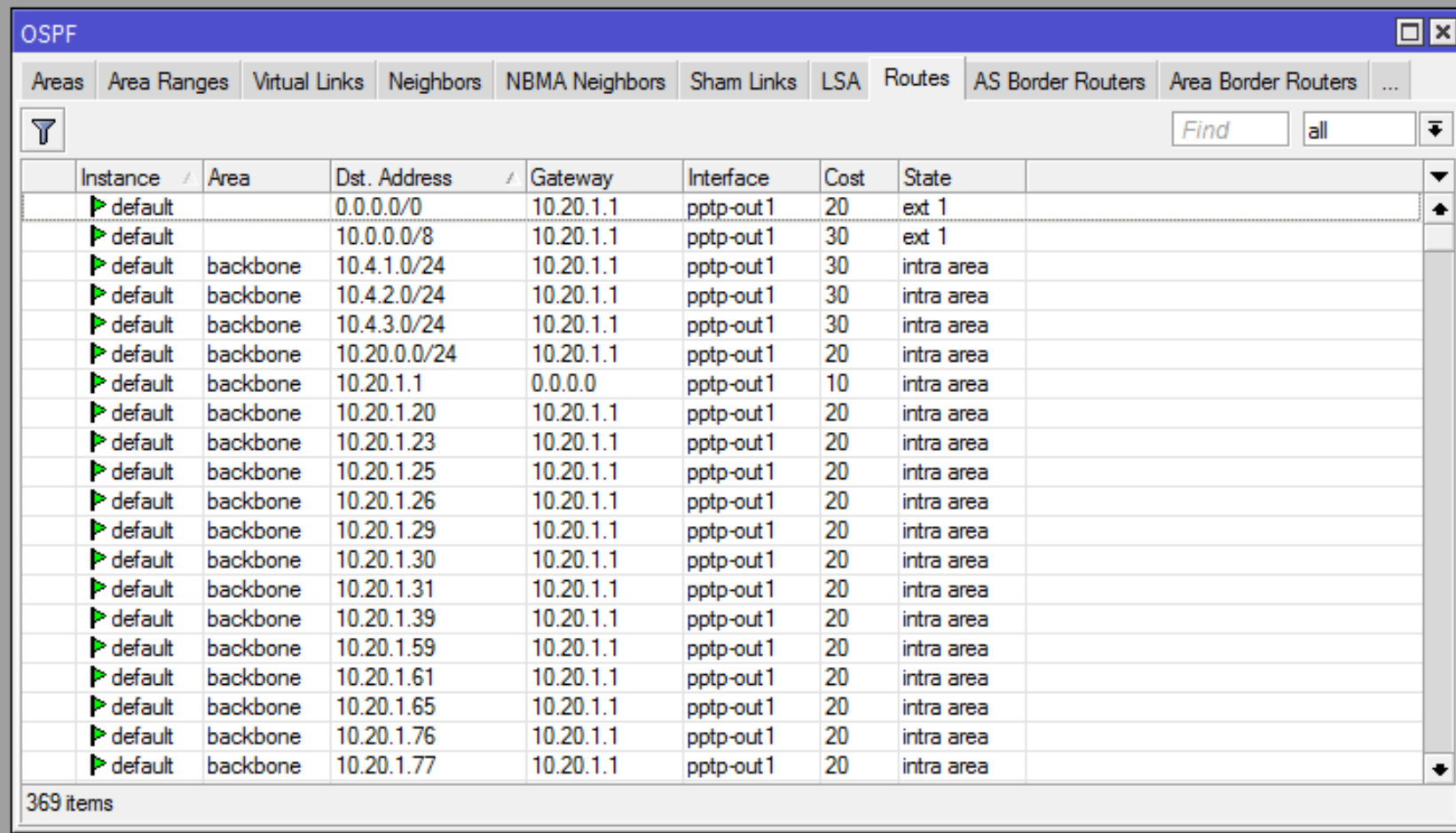
Interfaces Instances Networks Areas Area Ranges Virtual Links Neighbors NBMA Neighbors Sham Links LSA Routes ...

+ - ✓ ✕ ⚙ Find

	Interface	Cost	Priority	Authentic...	Authenticatio...	Network Type	Instance	Area	Neig...	State
D	bridge1	10	1	none	*****	broadcast	default	backbone	0	waiting
D	ptp-out1	10	1	none	*****	point to point	default	backbone	1	point to point
D	ptp-out2	10	1	none	*****	point to point	default	backbone	0	point to point

3 items out of 0

# И получил таблицу маршрутов



OSPF

Areas Area Ranges Virtual Links Neighbors NBMA Neighbors Sham Links LSA Routes AS Border Routers Area Border Routers ...

Find all

Instance	Area	Dst. Address	Gateway	Interface	Cost	State
▶ default		0.0.0.0/0	10.20.1.1	pptp-out 1	20	ext 1
▶ default		10.0.0.0/8	10.20.1.1	pptp-out 1	30	ext 1
▶ default	backbone	10.4.1.0/24	10.20.1.1	pptp-out 1	30	intra area
▶ default	backbone	10.4.2.0/24	10.20.1.1	pptp-out 1	30	intra area
▶ default	backbone	10.4.3.0/24	10.20.1.1	pptp-out 1	30	intra area
▶ default	backbone	10.20.0.0/24	10.20.1.1	pptp-out 1	20	intra area
▶ default	backbone	10.20.1.1	0.0.0.0	pptp-out 1	10	intra area
▶ default	backbone	10.20.1.20	10.20.1.1	pptp-out 1	20	intra area
▶ default	backbone	10.20.1.23	10.20.1.1	pptp-out 1	20	intra area
▶ default	backbone	10.20.1.25	10.20.1.1	pptp-out 1	20	intra area
▶ default	backbone	10.20.1.26	10.20.1.1	pptp-out 1	20	intra area
▶ default	backbone	10.20.1.29	10.20.1.1	pptp-out 1	20	intra area
▶ default	backbone	10.20.1.30	10.20.1.1	pptp-out 1	20	intra area
▶ default	backbone	10.20.1.31	10.20.1.1	pptp-out 1	20	intra area
▶ default	backbone	10.20.1.39	10.20.1.1	pptp-out 1	20	intra area
▶ default	backbone	10.20.1.59	10.20.1.1	pptp-out 1	20	intra area
▶ default	backbone	10.20.1.61	10.20.1.1	pptp-out 1	20	intra area
▶ default	backbone	10.20.1.65	10.20.1.1	pptp-out 1	20	intra area
▶ default	backbone	10.20.1.76	10.20.1.1	pptp-out 1	20	intra area
▶ default	backbone	10.20.1.77	10.20.1.1	pptp-out 1	20	intra area

369 items

# Но нам нужен только дефолтный

Route Filter <0.0.0.0>

Matchers BGP Actions BGP Actions

Chain: ospf-in

Prefix: ☐ 0.0.0.0

Prefix Length: ☐ 0

Match Chain:

Protocol:

Distance:

Scope:

Target Scope:

Pref. Source:

Routing Mark:

Route Comment:

Route Tag:

Route Targets:

☐ Invert Route Targets

Site Of Origin:

☐ Invert Site Of Origin

Address Family:

OSPF Type:

☐ Invert Match

OK

Cancel

Apply

Disable

Comment

Copy

Remove

enabled

# Вешаем на него метку

The image shows a screenshot of a network configuration window titled "Route Filter <0.0.0.0>". The window has four tabs: "Matchers", "BGP", "Actions", and "BGP Actions". The "BGP Actions" tab is currently selected. On the right side of the window, there are buttons for "OK", "Cancel", "Apply", "Disable", "Comment", "Copy", and "Remove".

Under the "BGP Actions" tab, there is a list of configuration options, each with a text input field and a dropdown arrow:

- Action:
- Jump Target:
- Set Distance:
- Set Scope:
- Set Target Scope:
- Set Pref. Source:
- Set In Nexthop:
- Set In Nexthop Direct:
- Set Out Nexthop:
- Set Routing Mark:
- Set Route Comment:
- Set Check Gateway:
- Set Disabled:
- Set Type:
- Set Route Tag:
- Set Use TE Nexthop:

Below these options, there are three expandable sections, each with a minus sign icon and a label:

- Set Route Targets
- Append Route Targets
- Set Site Of Origin

At the bottom left of the window, there is a checkbox labeled "enabled" which is currently checked.

# Два маршрута в Интернет

Route List

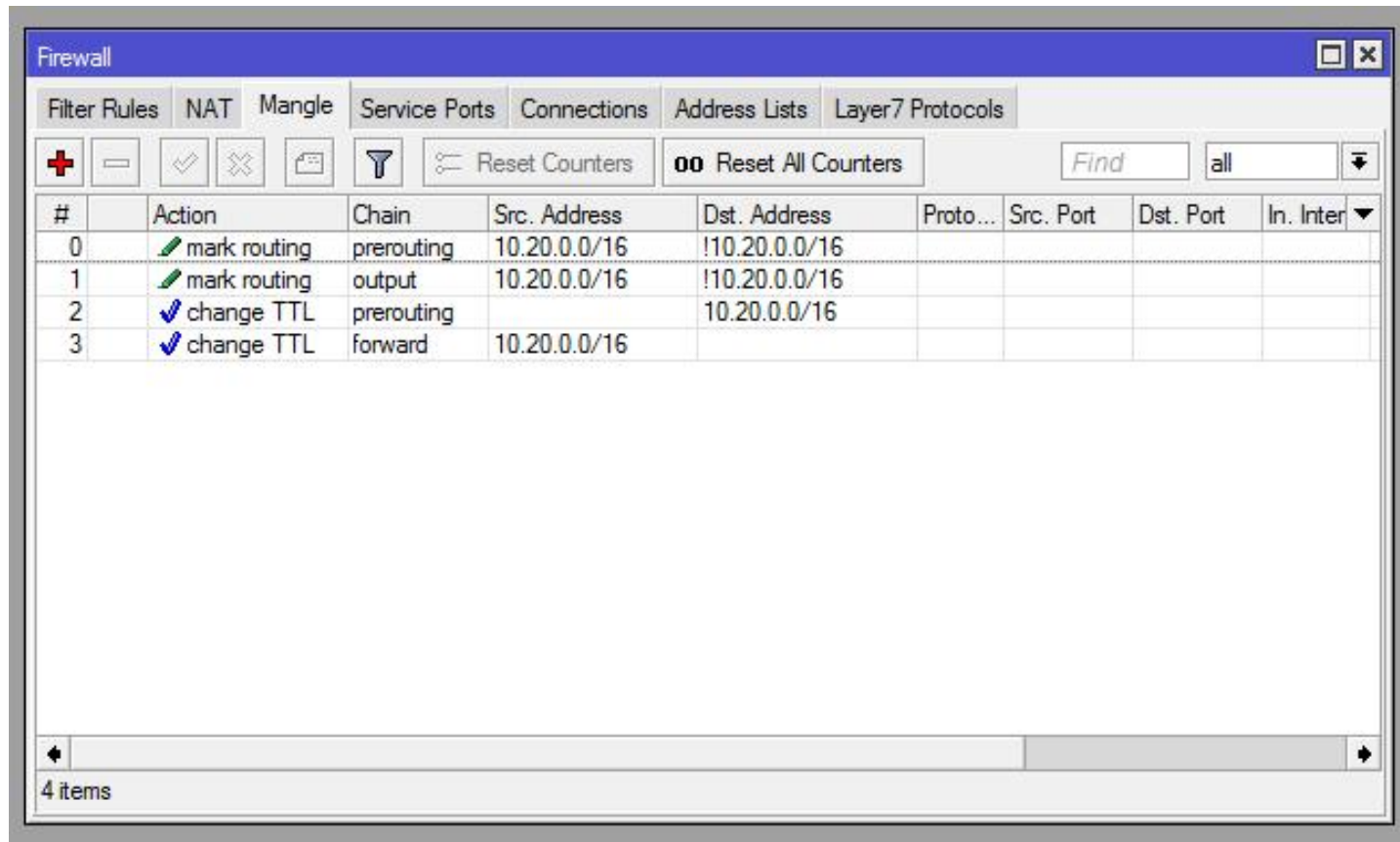
Routes Nexthops Rules VRF

Find all

	Dst. Address	Gateway	Distance	Routing Mark	Pref. Source
DAS	0.0.0.0/0	10.0.0.1 reachable lte1	0		
DAo	0.0.0.0/0	10.20.1.1 reachable ptp-out 1	110	to_M9	
DAo	10.0.0.0/8	10.20.1.1 reachable ptp-out 1	110		
DAC	10.0.0.0/24	lte1 reachable	0		10.0.0.10
DAo	10.4.1.0/24	10.20.1.1 reachable ptp-out 1	110		
DAo	10.4.2.0/24	10.20.1.1 reachable ptp-out 1	110		
DAo	10.4.3.0/24	10.20.1.1 reachable ptp-out 1	110		
DAo	10.20.0.0/24	10.20.1.1 reachable ptp-out 1	110		
DAC	10.20.1.1	pptp-out 1 reachable	0		10.20.1.121
DAo	10.20.1.20	10.20.1.1 reachable ptp-out 1	110		
DAo	10.20.1.23	10.20.1.1 reachable ptp-out 1	110		
DAo	10.20.1.25	10.20.1.1 reachable ptp-out 1	110		
DAo	10.20.1.26	10.20.1.1 reachable ptp-out 1	110		
DAo	10.20.1.29	10.20.1.1 reachable ptp-out 1	110		
DAo	10.20.1.30	10.20.1.1 reachable ptp-out 1	110		
DAo	10.20.1.31	10.20.1.1 reachable ptp-out 1	110		
DAo	10.20.1.39	10.20.1.1 reachable ptp-out 1	110		
DAo	10.20.1.59	10.20.1.1 reachable ptp-out 1	110		
DAo	10.20.1.61	10.20.1.1 reachable ptp-out 1	110		
DAo	10.20.1.65	10.20.1.1 reachable ptp-out 1	110		
DAo	10.20.1.76	10.20.1.1 reachable ptp-out 1	110		
DAo	10.20.1.77	10.20.1.1 reachable ptp-out 1	110		
DAo	10.20.1.79	10.20.1.1 reachable ptp-out 1	110		

372 items

# Заворачиваем и обманываем





# Маркируем маршрут

Mangle Rule <10.20.0.0/16->!10.20.0.0/16>

General Advanced Extra Action Statistics

Action: mark routing

New Routing Mark: to\_M9

☒ Passthrough

OK

Cancel

Apply

Disable

Comment

Copy

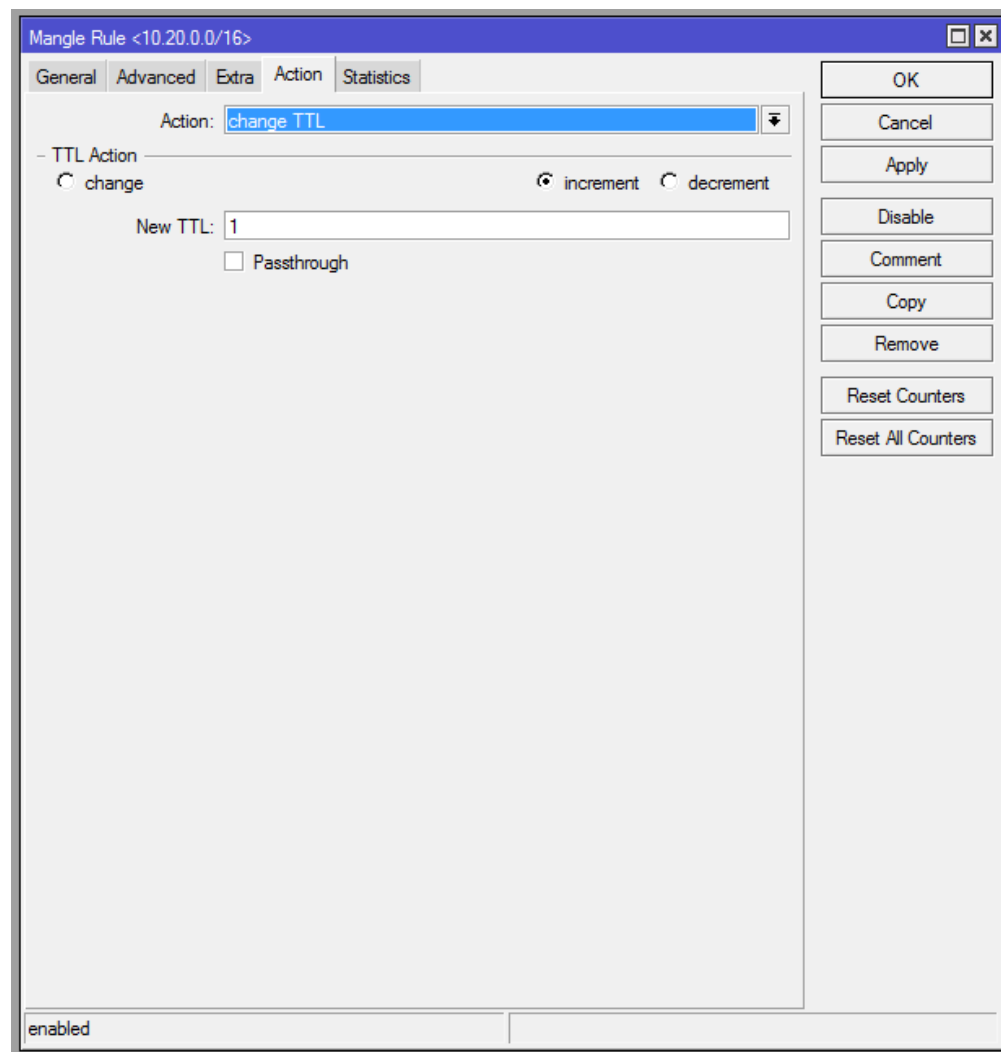
Remove

Reset Counters

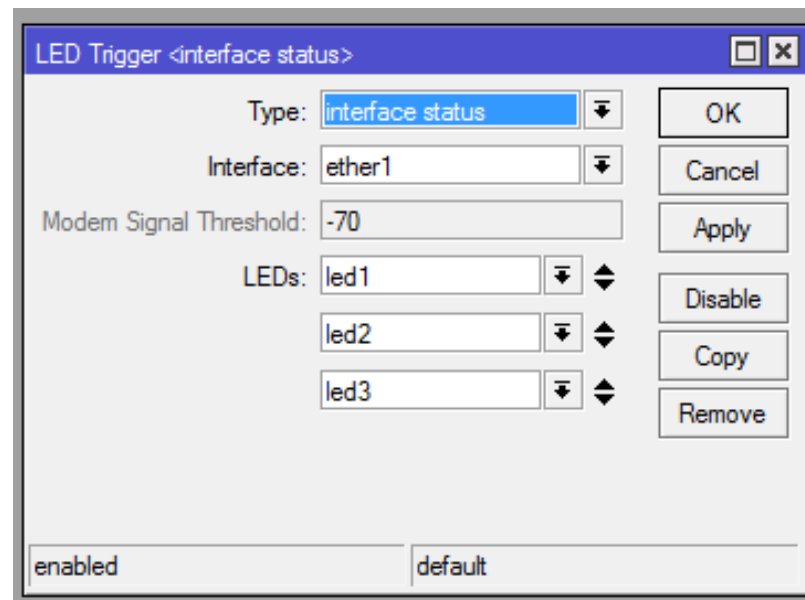
Reset All Counters

enabled

# Прячем роутер от трейса



# Сколько палочек ловит? 😊



LED Trigger <interface status>

Type:

Interface:

Modem Signal Threshold:

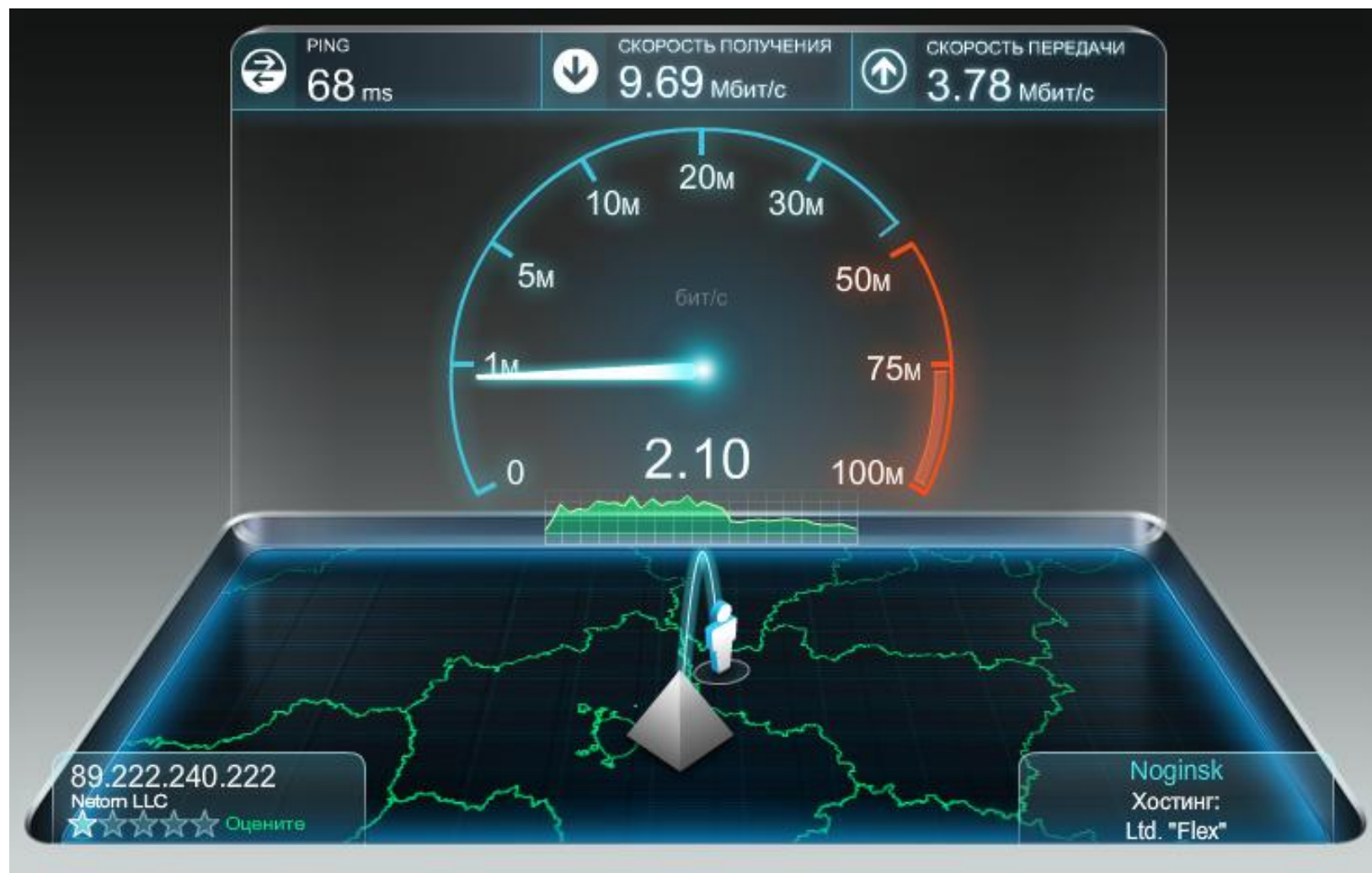
LEDs:

- 
- 
- 

Buttons: OK, Cancel, Apply, Disable, Copy, Remove

enabled default

# Только ping не обмануть



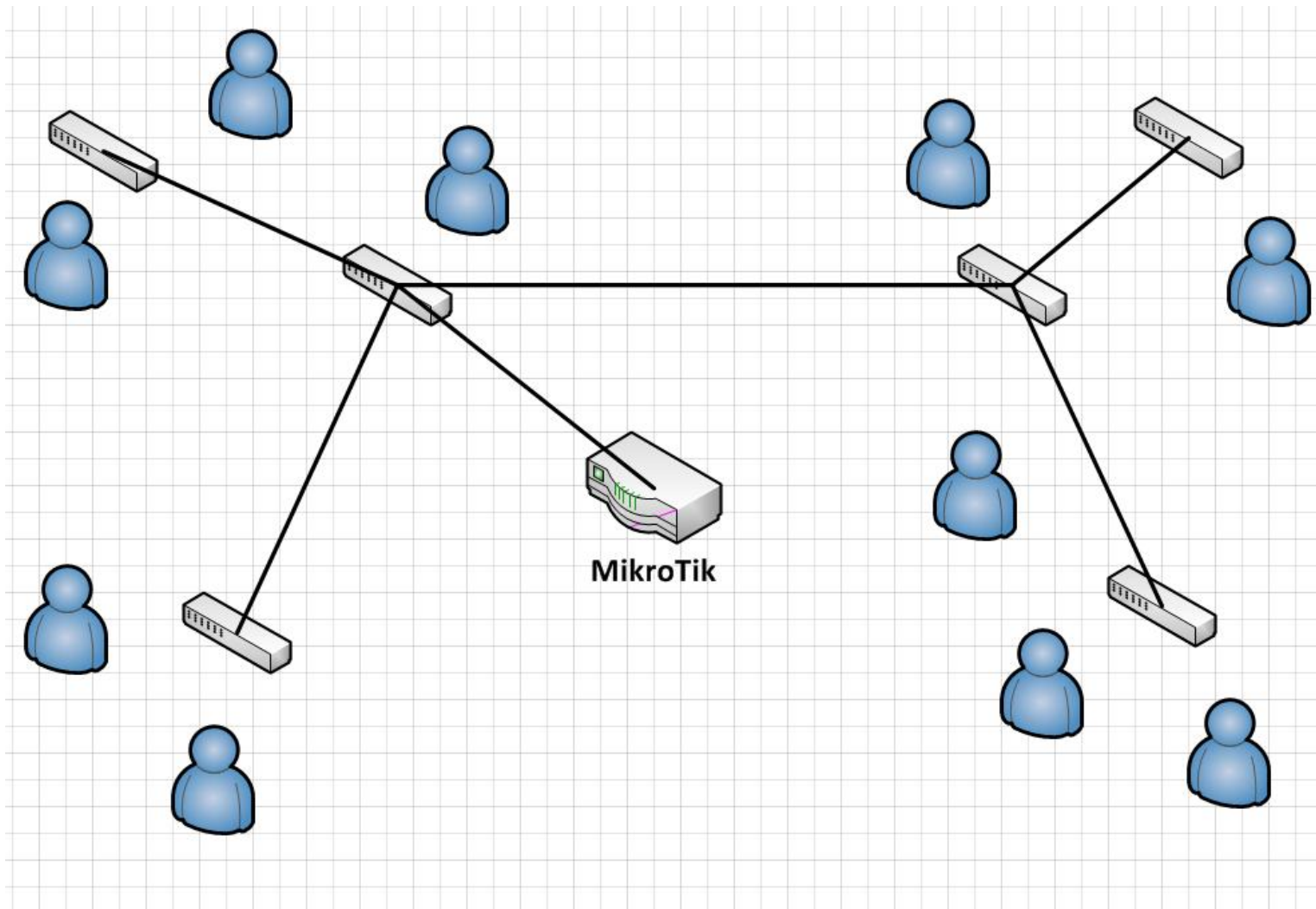
# MikroTik позволяет

- Восстановить доступ в сеть, если видимость перекрыли деревья.
- Предоставлять доступ к сети при отсутствии технической возможности подключения.
- Создать свою беспроводную сеть поверх сети оператора 😊

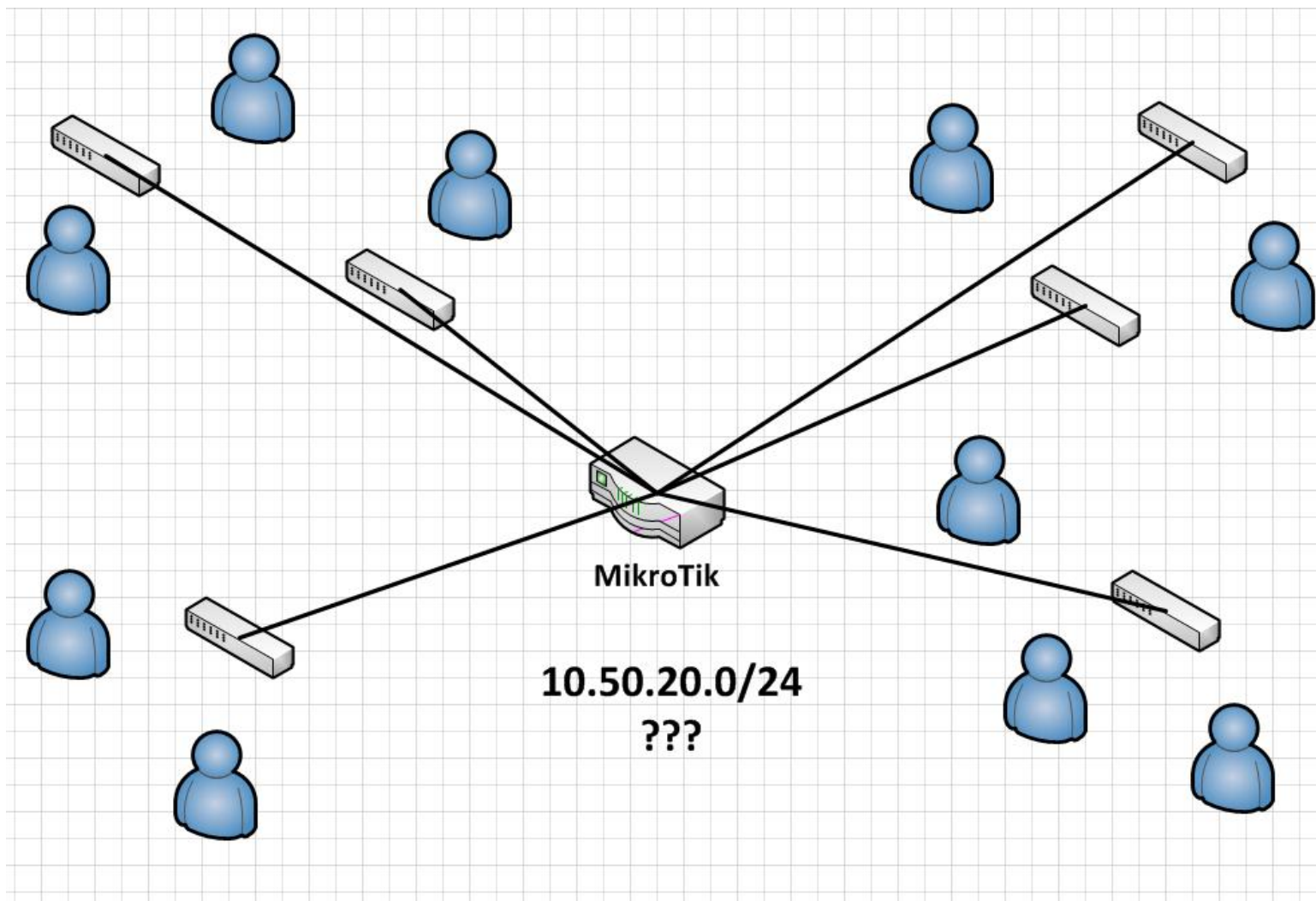
# Мы строили, строили...

- Из-за не правильно выбранной топологии сети на этапе строительства можно потерять клиентов, если начать пытаться ее переделать.
- Если использовать MikroTik клиенты никуда не денутся 😊

# Протянули, подключили и проблемы получили

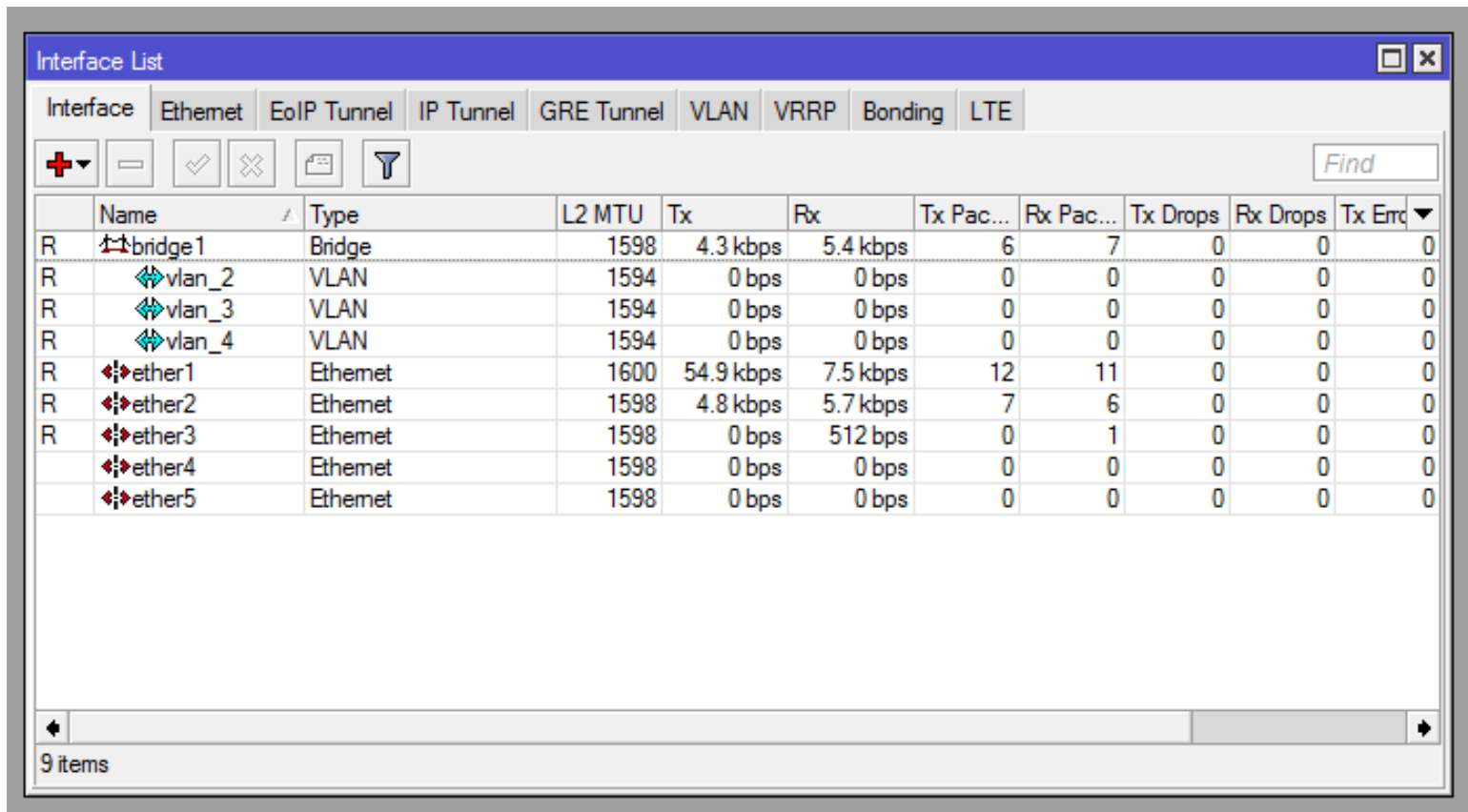


# Как раздать адреса?





# Создаем вланы



Interface List

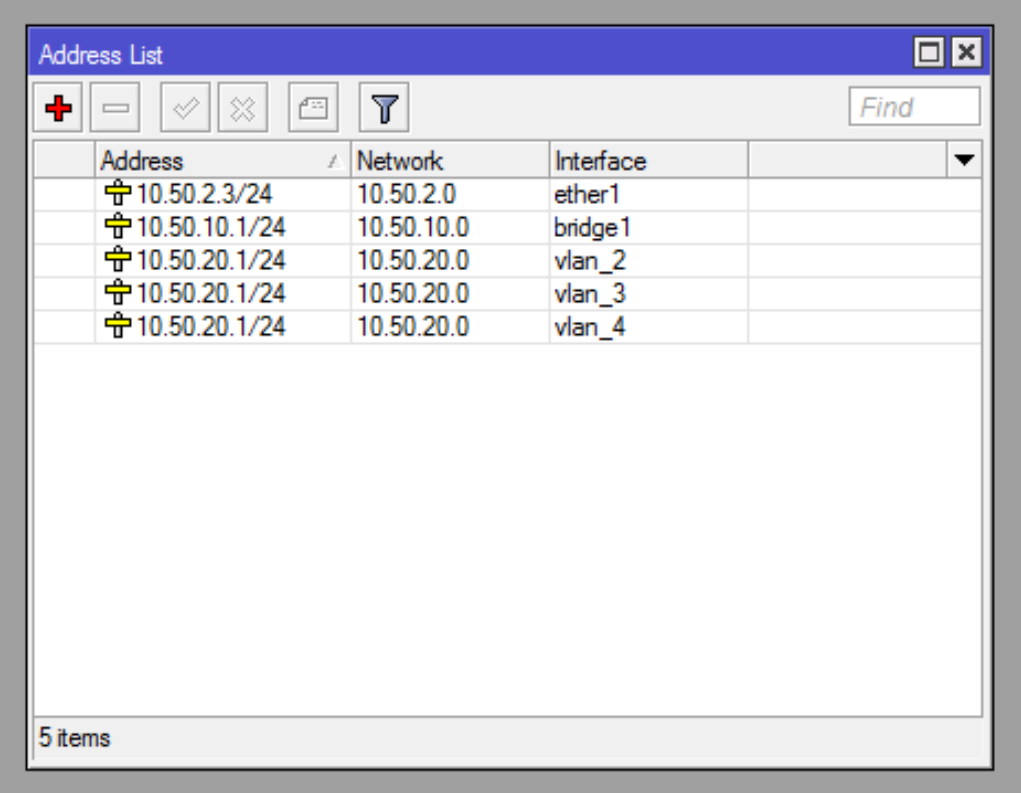
Interface: Ethernet EoIP Tunnel IP Tunnel GRE Tunnel VLAN VRRP Bonding LTE

Find

	Name	Type	L2 MTU	Tx	Rx	Tx Pac...	Rx Pac...	Tx Drops	Rx Drops	Tx Err
R	bridge1	Bridge	1598	4.3 kbps	5.4 kbps	6	7	0	0	0
R	vlan_2	VLAN	1594	0 bps	0 bps	0	0	0	0	0
R	vlan_3	VLAN	1594	0 bps	0 bps	0	0	0	0	0
R	vlan_4	VLAN	1594	0 bps	0 bps	0	0	0	0	0
R	ether1	Ethernet	1600	54.9 kbps	7.5 kbps	12	11	0	0	0
R	ether2	Ethernet	1598	4.8 kbps	5.7 kbps	7	6	0	0	0
R	ether3	Ethernet	1598	0 bps	512 bps	0	1	0	0	0
	ether4	Ethernet	1598	0 bps	0 bps	0	0	0	0	0
	ether5	Ethernet	1598	0 bps	0 bps	0	0	0	0	0

9 items

# Указываем одинаковую подсеть



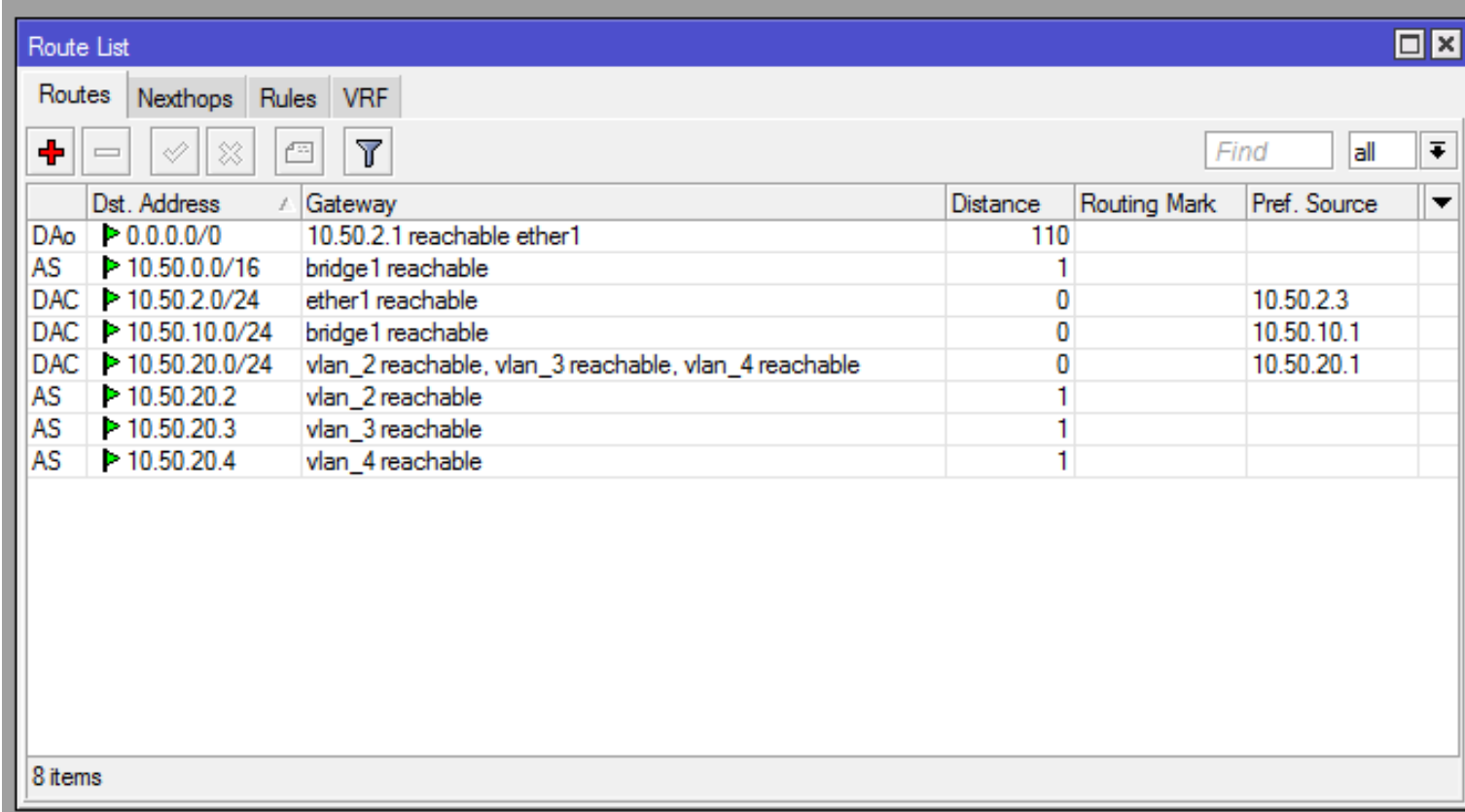
Address List

Find

Address	Network	Interface
10.50.2.3/24	10.50.2.0	ether1
10.50.10.1/24	10.50.10.0	bridge1
10.50.20.1/24	10.50.20.0	vlan_2
10.50.20.1/24	10.50.20.0	vlan_3
10.50.20.1/24	10.50.20.0	vlan_4

5 items

# И маршруты до клиентов



Route List

Routes Nexthops Rules VRF

Find all

	Dst. Address	Gateway	Distance	Routing Mark	Pref. Source	
DAo	0.0.0.0/0	10.50.2.1 reachable ether1	110			
AS	10.50.0.0/16	bridge1 reachable	1			
DAC	10.50.2.0/24	ether1 reachable	0		10.50.2.3	
DAC	10.50.10.0/24	bridge1 reachable	0		10.50.10.1	
DAC	10.50.20.0/24	vlan_2 reachable, vlan_3 reachable, vlan_4 reachable	0		10.50.20.1	
AS	10.50.20.2	vlan_2 reachable	1			
AS	10.50.20.3	vlan_3 reachable	1			
AS	10.50.20.4	vlan_4 reachable	1			

8 items

# Выдаем адреса автоматически

DHCP Server

DHCP

Networks

Leases

Options

Alerts

DHCP Config

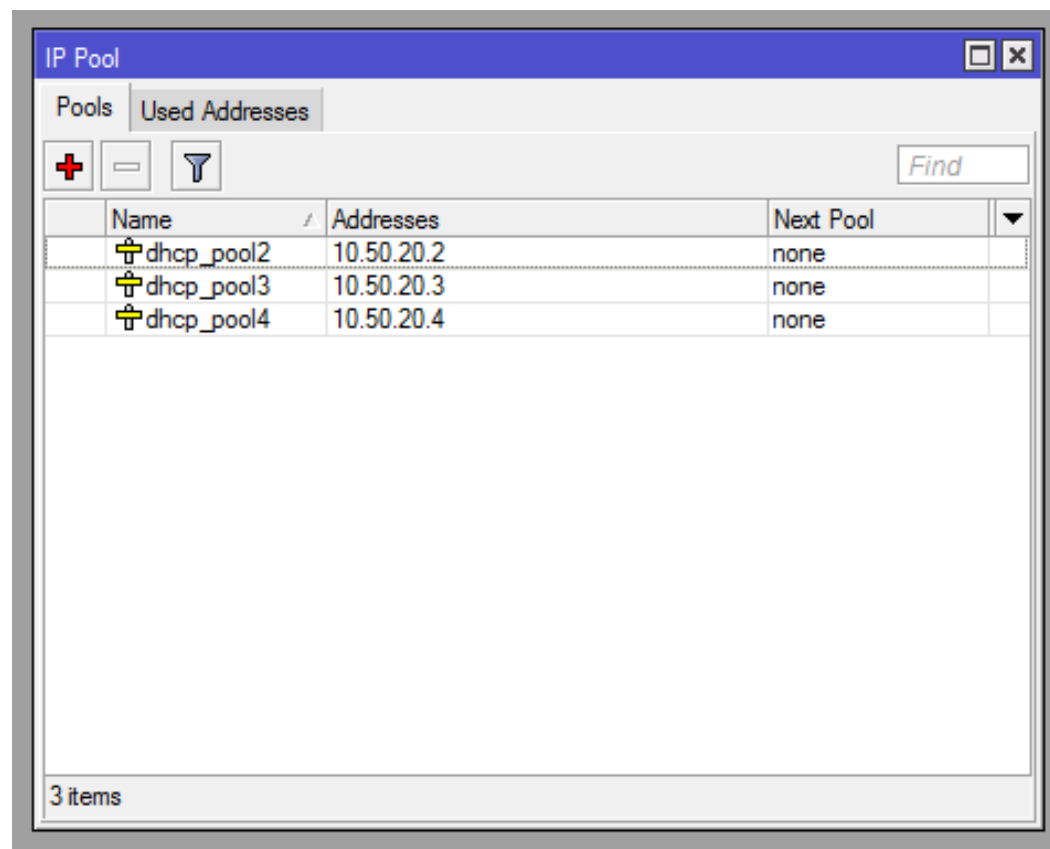
DHCP Setup

Find

	Name	Interface	Relay	Lease Time	Address Pool	Add ARP For Leases	
	dhcp_2	vlan_2		00:10:00	dhcp_pool2	yes	
	dhcp_3	vlan_3		00:10:00	dhcp_pool3	yes	
	dhcp_4	vlan_4		00:10:00	dhcp_pool4	yes	

3 items

# Привязываем статику

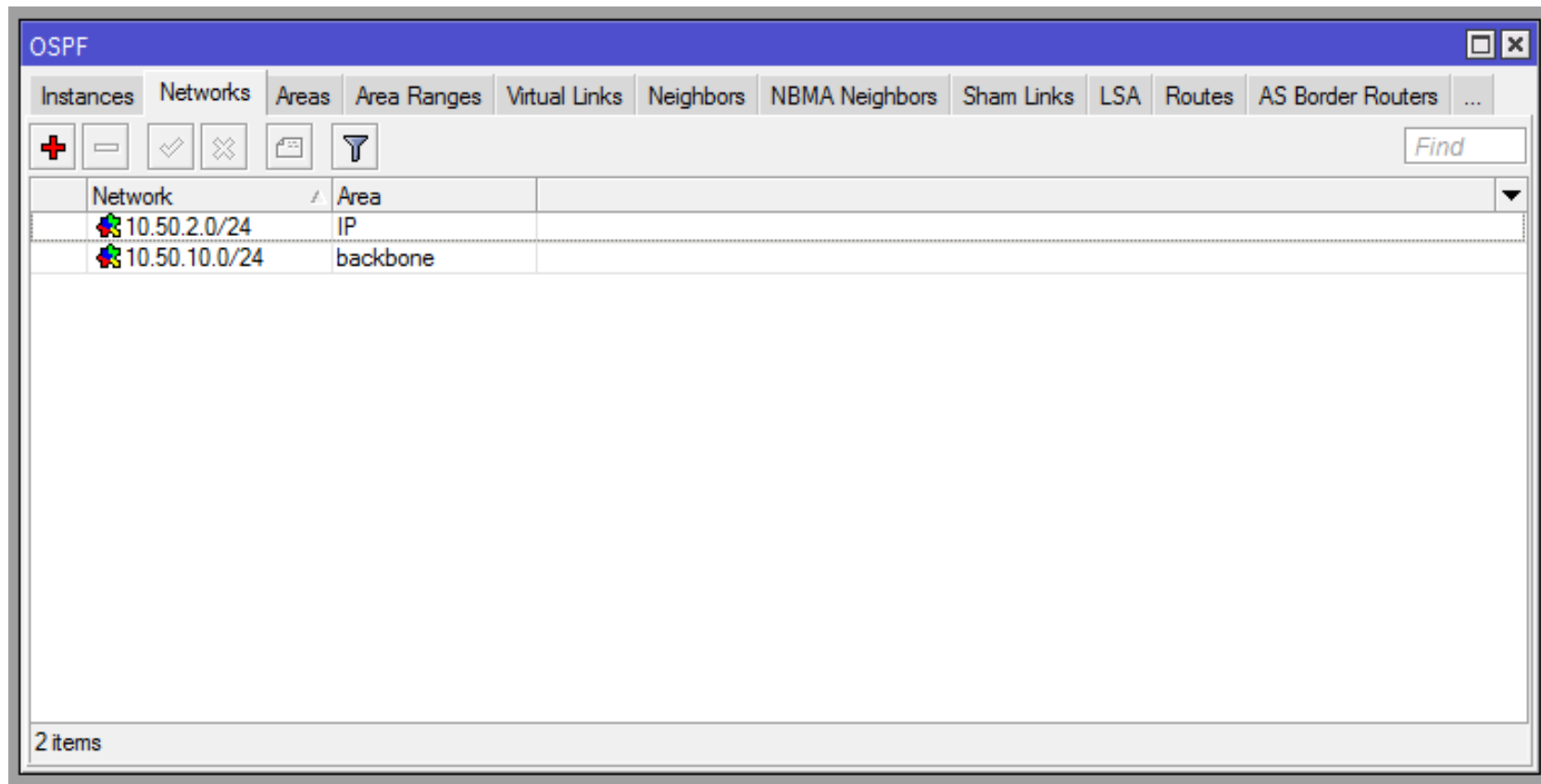


# Конфиг для нового клиента

A screenshot of a text editor window titled "DHCP — Блокнот". The window contains a configuration script for a DHCP server. The script is written in a plain text font and includes commands for adding an interface, an IP pool, a DHCP server, an address, a network, and a route. The configuration is for a new client, with the interface named "vlan\_4" and the DHCP server named "dhcp\_4". The IP pool is "10.50.20.4" and the address is "10.50.20.1/24". The network is "10.50.20.0/24" with a DNS server of "10.50.20.1" and a gateway of "10.50.20.1". The route is "10.50.20.3/32" with a distance of 1 and a gateway of "vlan\_4".

```
#!/interface vlan
add interface=bridge1 name=vlan_4 vlan-id=4
/ip pool
add name=dhcp_pool4 ranges=10.50.20.4
/ip dhcp-server
add address-pool=dhcp_pool4 disabled=no interface=vlan_4 lease-time=10m name=dhcp_4
/ip address
add address=10.50.20.1/24 interface=vlan_4
/ip dhcp-server network
add address=10.50.20.0/24 dns-server=10.50.20.1 gateway=10.50.20.1
/ip route
add distance=1 dst-address=10.50.20.3/32 gateway=vlan_4
```

# Включаем OSPF



# И раздаем маршруты

The screenshot shows a configuration window titled "OSPF Instance <IP>". It has four tabs: "General", "Metrics", "MPLS", and "Status". The "General" tab is active. The window contains several input fields and dropdown menus for configuring OSPF settings. On the right side, there are buttons for "OK", "Cancel", "Apply", "Disable", "Comment", "Copy", and "Remove". At the bottom left, there is a status indicator that says "enabled".

Field	Value
Name	IP
Router ID	0.0.0.0
Redistribute Default Route	never
Redistribute Connected Routes	no
Redistribute Static Routes	as type 1
Redistribute RIP Routes	no
Redistribute BGP Routes	no
Redistribute Other OSPF Routes	no
In Filter	ospf-in
Out Filter	ospf-out

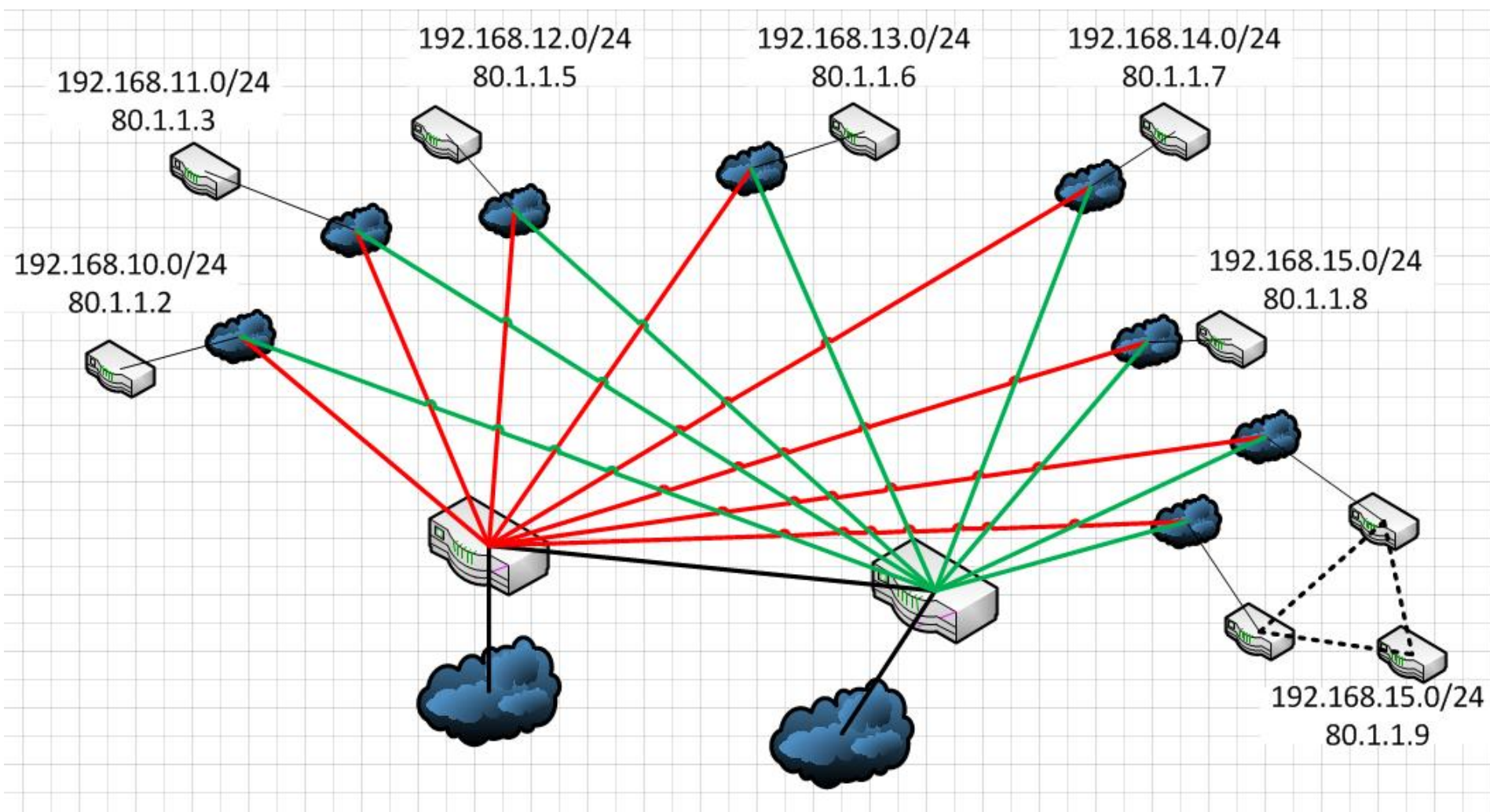
enabled



# Теперь все знают о них

OSPF								
Areas	Area Ranges	Virtual Links	Neighbors	NBMA Neighbors	Sham Links	LSA	Routes	AS Border Routers
							Area Border Routers	...
<div> <div></div> <div>Find</div> <div>all</div> <div></div> </div>								
Instance	Area	Dst. Address	Gateway	Interf...	Cost	State		
IP		0.0.0.0/0			1	imported ext 1		
IP		10.50.0.0/16	10.50.2.3	ether3	30	ext 1		
IP	IP	10.50.2.0/24	0.0.0.0	ether3	10	intra area		
IP		10.50.20.2	10.50.2.3	ether3	30	ext 1		
IP		10.50.20.3	10.50.2.3	ether3	30	ext 1		
IP		10.50.20.4	10.50.2.3	ether3	30	ext 1		
default		0.0.0.0/0			10	imported ext 1		
default		10.0.0.0/8			20	imported ext 1		
default	backbone	10.4.1.0/24	10.20.19.3	vlan_...	20	intra area		
default	backbone	10.4.2.0/24	10.20.19.3	vlan_...	20	intra area		
default	backbone	10.4.3.0/24	10.20.19.3	vlan_...	20	intra area		
default	backbone	10.20.0.0/24	0.0.0.0	bridge1	10	intra area		
default	backbone	10.20.1.1	10.20.1.20, 1...	<12tp-...	20	intra area		
default	backbone	10.20.1.20	0.0.0.0	<12tp-...	10	intra area		
default	backbone	10.20.1.23	0.0.0.0	<12tp-...	10	intra area		
default	backbone	10.20.1.25	0.0.0.0	<12tp-...	10	intra area		
default	backbone	10.20.1.26	0.0.0.0	<12tp-...	10	intra area		
default	backbone	10.20.1.29	0.0.0.0	<12tp-...	10	intra area		
default	backbone	10.20.1.30	0.0.0.0	<12tp-...	10	intra area		
default	backbone	10.20.1.31	0.0.0.0	<12tp-...	10	intra area		
default	backbone	10.20.1.39	0.0.0.0	<pptp...	10	intra area		
default	backbone	10.20.1.59	0.0.0.0	<12tp-...	10	intra area		
375 items								

# То же самое и в офисы



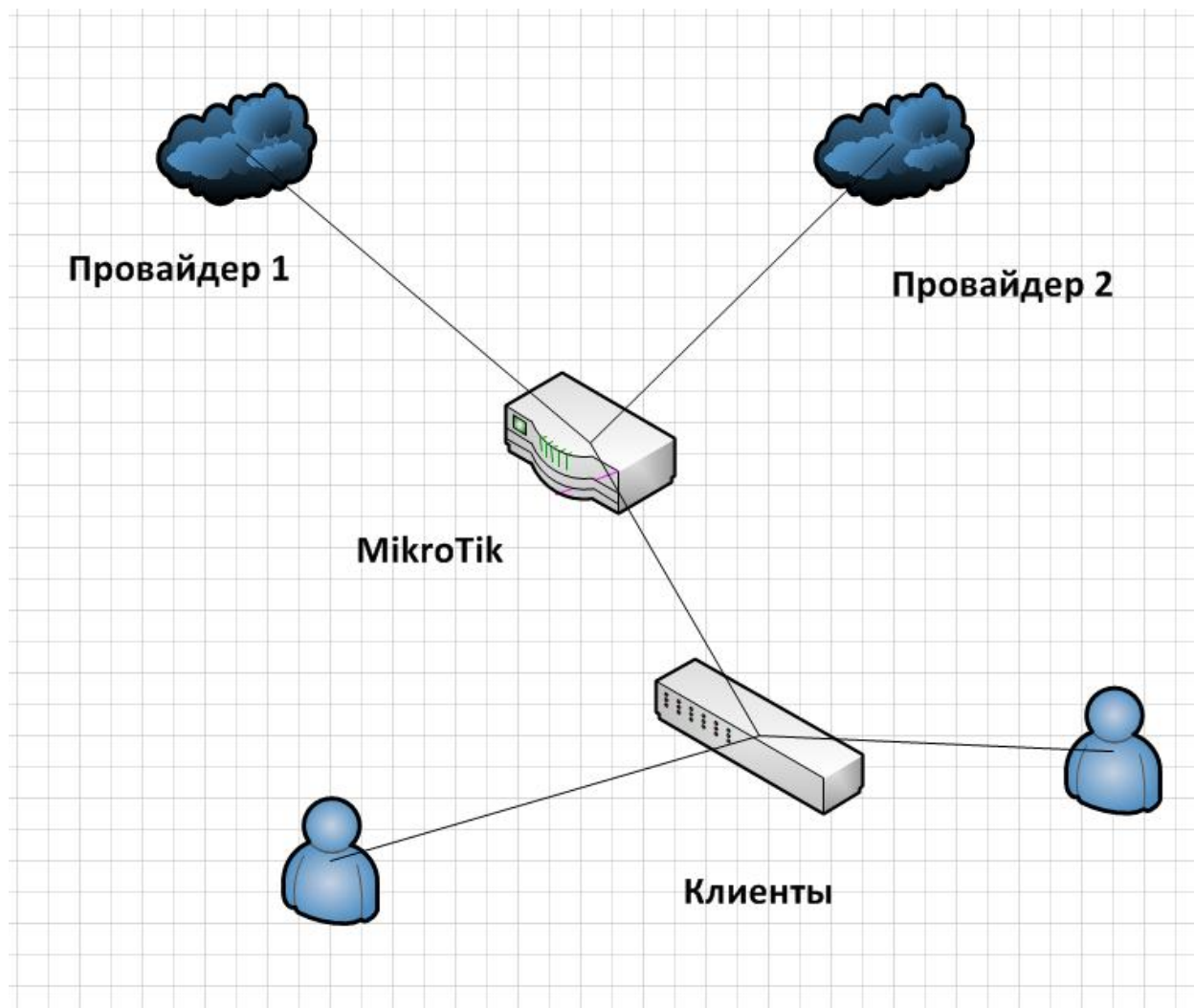
# MikroTik позволяет

- Экономно раздавать белые адреса клиентам.
- То же, но в распределенной сети.
- Vlan на клиента + DHCP.
- IPoE из коробки 😊

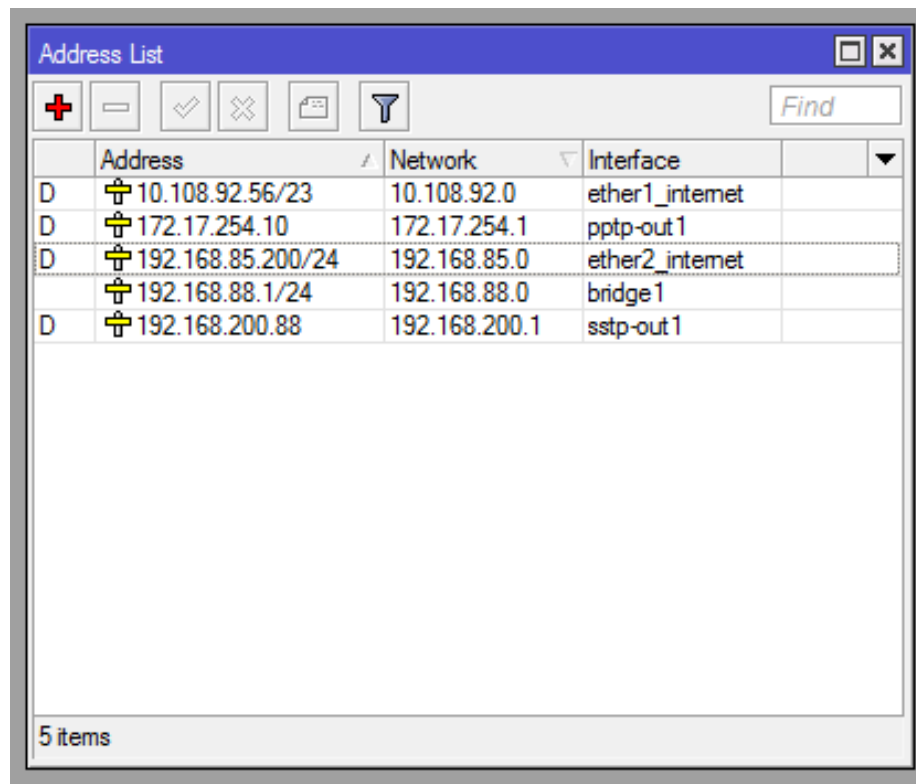
# 1 + 1 без проблем

- Объединяли двух провайдеров по инструкции из Интернета и ничего не получилось?
- Руки не при чем, просто инструкция слишком умная 😊

# А и Б сидели на трубе ...



# Подсети должны быть разные

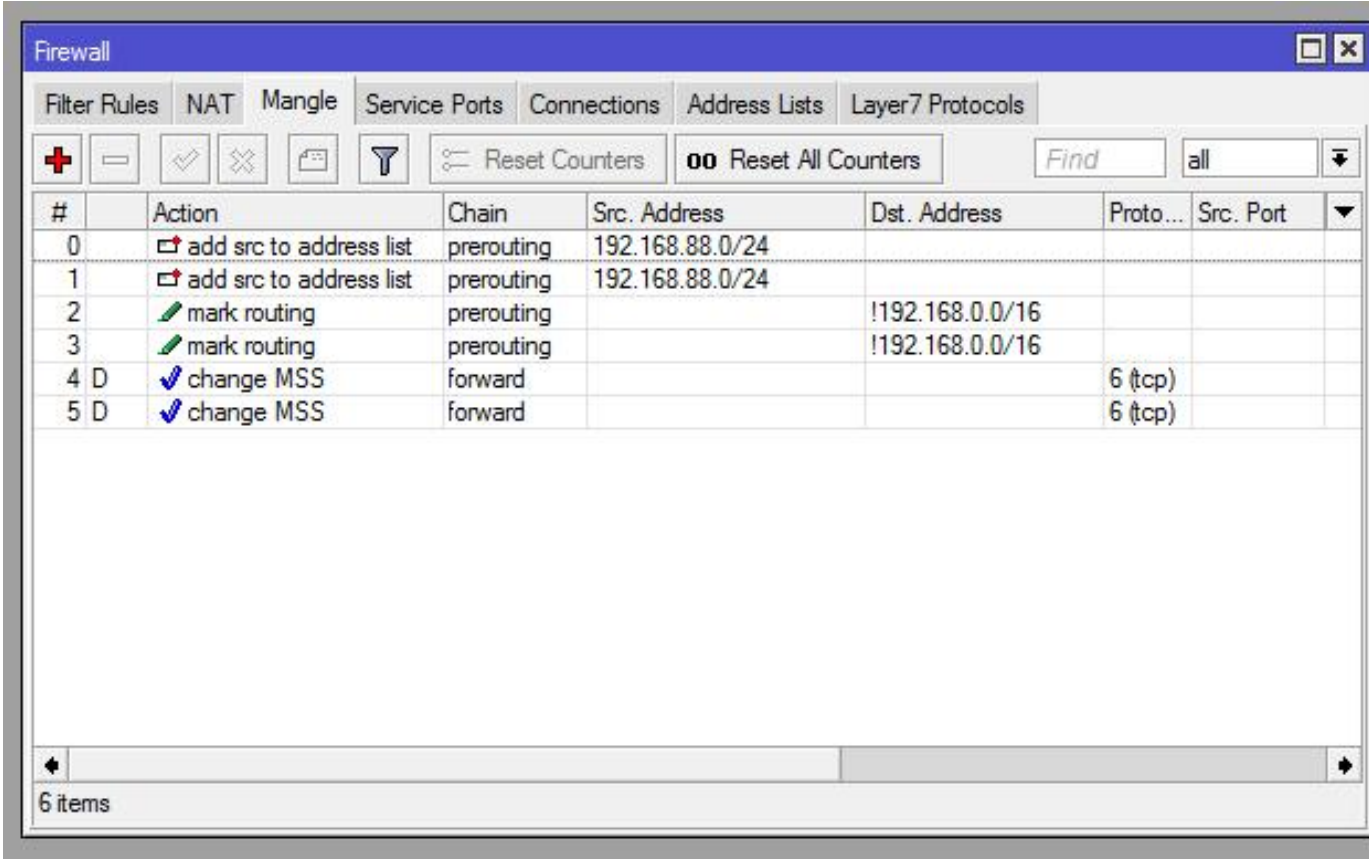


The screenshot shows a window titled "Address List" with a toolbar containing icons for adding (+), removing (-), checking (✓), unchecking (✗), saving (floppy disk), and filtering (funnel), along with a "Find" search box. The table below lists five entries, each with a status "D", an IP address with a subnet mask, a network address, and an interface name. The first three entries have a yellow plus icon in the first column, while the last two do not.

	Address	Network	Interface
D	+ 10.108.92.56/23	10.108.92.0	ether1_internet
D	+ 172.17.254.10	172.17.254.1	pptp-out1
D	+ 192.168.85.200/24	192.168.85.0	ether2_internet
	+ 192.168.88.1/24	192.168.88.0	bridge1
D	+ 192.168.200.88	192.168.200.1	sstp-out1

5 items

# Распределяем клиентов



#	Action	Chain	Src. Address	Dst. Address	Proto...	Src. Port	
0	add src to address list	prerouting	192.168.88.0/24				
1	add src to address list	prerouting	192.168.88.0/24				
2	mark routing	prerouting		!192.168.0.0/16			
3	mark routing	prerouting		!192.168.0.0/16			
4 D	change MSS	forward			6 (tcp)		
5 D	change MSS	forward			6 (tcp)		

6 items

# Берем всех клиентов

Mangle Rule <192.168.88.0/24>

General Advanced Extra Action Statistics

Chain: prerouting

Src. Address: ☐ 192.168.88.0/24

Dst. Address:

Protocol:

Src. Port:

Dst. Port:

Any. Port:

P2P:

In. Interface:

Out. Interface:

Packet Mark:

Connection Mark:

Routing Mark:

Routing Table:

Connection Type:

Connection State:

OK

Cancel

Apply

Disable

Comment

Copy

Remove

Reset Counters

Reset All Counters

enabled



# Делим их пополам

Mangle Rule <192.168.88.0/24>

General Advanced Extra Action Statistics

Src. Address List:

Dst. Address List:

Layer7 Protocol:

Content:

Connection Bytes:

Connection Rate:

Per Connection Classifier: ☐ src address  : 2 / 0

Src. MAC Address:

Out. Bridge Port:

In. Bridge Port:

Ingress Priority:

DSCP (TOS):

TCP MSS:

Packet Size:

Random:

▼ TCP Flags

▼ ICMP Options

IPv4 Options:

TTL:

enabled

OK

Cancel

Apply

Disable

Comment

Copy

Remove

Reset Counters

Reset All Counters

# И половину маркируем

The image shows a screenshot of the 'Mangle Rule' configuration window in Mikrotik WinBox. The window title is 'Mangle Rule <192.168.88.0/24>'. It has five tabs: 'General', 'Advanced', 'Extra', 'Action', and 'Statistics'. The 'General' tab is selected. In the 'General' tab, there are three fields: 'Action' with a dropdown menu showing 'add src to address list', 'Address List' with a dropdown menu showing 'ISP1', and 'Timeout' with a dropdown menu. On the right side of the window, there is a vertical stack of buttons: 'OK', 'Cancel', 'Apply', 'Disable', 'Comment', 'Copy', 'Remove', 'Reset Counters', and 'Reset All Counters'. At the bottom left of the window, there is a checkbox labeled 'enabled' which is checked.

Mangle Rule <192.168.88.0/24>

General Advanced Extra Action Statistics

Action: add src to address list

Address List: ISP1

Timeout:

OK

Cancel

Apply

Disable

Comment

Copy

Remove

Reset Counters

Reset All Counters

enabled

# Берем все запросы в Интернет

Mangle Rule <192.168.0.0/16>

General Advanced Extra Action Statistics

Chain: prerouting

Src. Address:

Dst. Address: 192.168.0.0/16

Protocol:

Src. Port:

Dst. Port:

Any. Port:

P2P:

In. Interface:

Out. Interface:

Packet Mark:

Connection Mark:

Routing Mark:

Routing Table:

Connection Type:

Connection State:

enabled

OK

Cancel

Apply

Disable

Comment

Copy

Remove

Reset Counters

Reset All Counters

# От первой половины клиентов

Mangle Rule <!192.168.0.0/16>

General Advanced Extra Action Statistics

Src. Address List: ☐ ISP1

Dst. Address List:

Layer7 Protocol:

Content:

Connection Bytes:

Connection Rate:

Per Connection Classifier:

Src. MAC Address:

Out. Bridge Port:

In. Bridge Port:

Ingress Priority:

DSCP (TOS):

TCP MSS:

Packet Size:

Random:

--- TCP Flags ---

--- ICMP Options ---

IPv4 Options:

TTL:

enabled

OK

Cancel

Apply

Disable

Comment

Copy

Remove

Reset Counters

Reset All Counters

# И маркируем маршрут

The screenshot shows the 'Mangle Rule' configuration window in Mikrotik WinBox. The title bar reads 'Mangle Rule <!192.168.0.0/16>'. The window has five tabs: 'General', 'Advanced', 'Extra', 'Action', and 'Statistics'. The 'Action' tab is currently selected. In this tab, the 'Action' dropdown menu is set to 'mark routing', and the 'New Routing Mark' dropdown menu is set to 'to\_ISP1'. There is an unchecked checkbox labeled 'Passthrough'. On the right side of the window, there is a vertical stack of buttons: 'OK', 'Cancel', 'Apply', 'Disable', 'Comment', 'Copy', 'Remove', 'Reset Counters', and 'Reset All Counters'. At the bottom left of the window, there is a status bar that says 'enabled'.

Mangle Rule <!192.168.0.0/16>

General Advanced Extra Action Statistics

Action: mark routing

New Routing Mark: to\_ISP1

☐ Passthrough

OK

Cancel

Apply

Disable

Comment

Copy

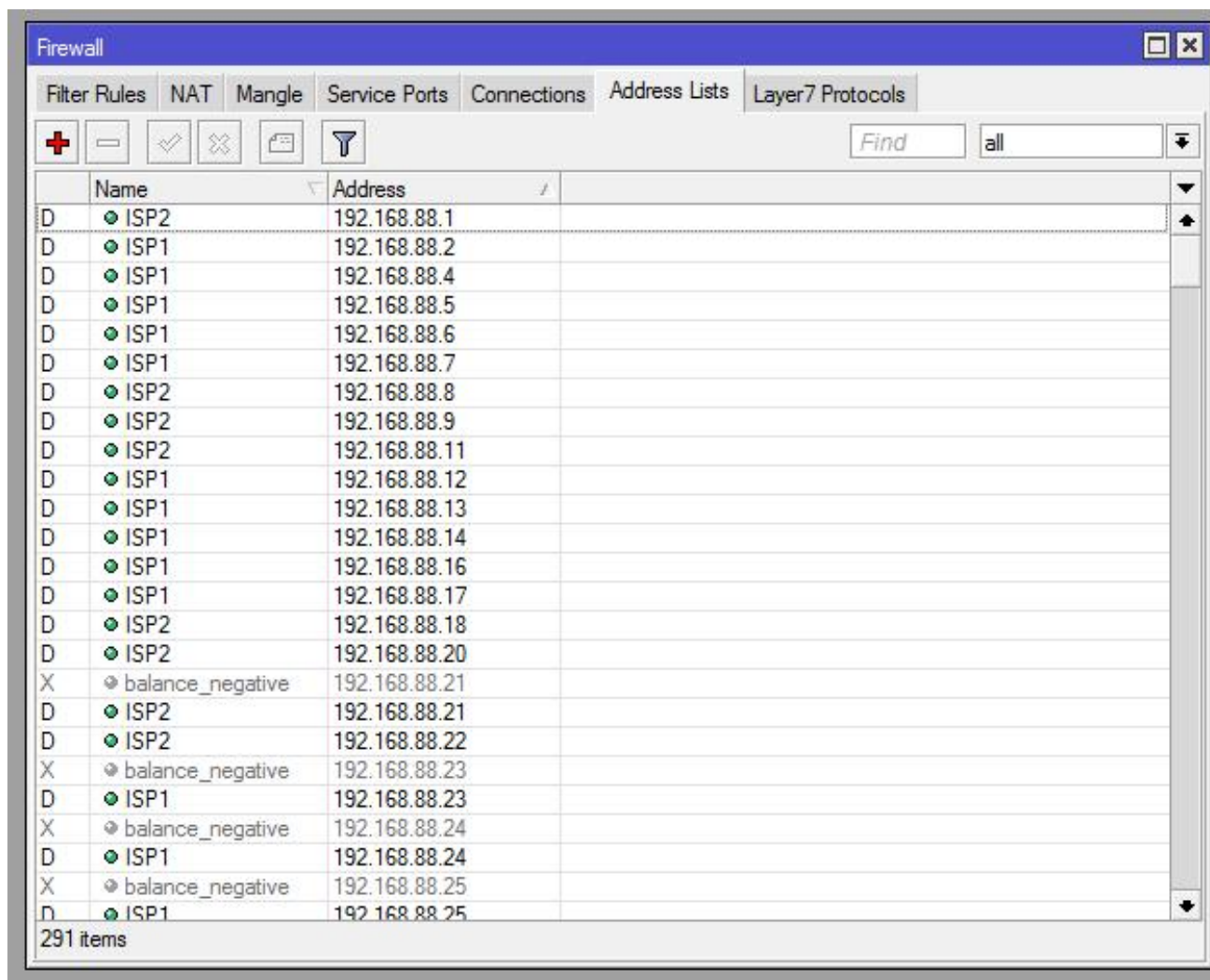
Remove

Reset Counters

Reset All Counters

enabled

# Список клиентов



The screenshot shows the Mikrotik WinBox Firewall configuration window, specifically the 'Address Lists' tab. The window has a blue title bar and a menu bar with 'Filter Rules', 'NAT', 'Mangle', 'Service Ports', 'Connections', 'Address Lists', and 'Layer7 Protocols'. Below the menu bar is a toolbar with icons for adding, deleting, and filtering, along with a search bar containing the text 'Find' and 'all'. The main area is a table with two columns: 'Name' and 'Address'. The table contains 291 items, which are a mix of IP addresses and names like 'balance\_negative'. The status of each item is indicated by a green dot (D) or a red X (X) in the first column. The bottom of the window shows '291 items'.

	Name	Address
D	ISP2	192.168.88.1
D	ISP1	192.168.88.2
D	ISP1	192.168.88.4
D	ISP1	192.168.88.5
D	ISP1	192.168.88.6
D	ISP1	192.168.88.7
D	ISP2	192.168.88.8
D	ISP2	192.168.88.9
D	ISP2	192.168.88.11
D	ISP1	192.168.88.12
D	ISP1	192.168.88.13
D	ISP1	192.168.88.14
D	ISP1	192.168.88.16
D	ISP1	192.168.88.17
D	ISP2	192.168.88.18
D	ISP2	192.168.88.20
X	balance_negative	192.168.88.21
D	ISP2	192.168.88.21
D	ISP2	192.168.88.22
X	balance_negative	192.168.88.23
D	ISP1	192.168.88.23
X	balance_negative	192.168.88.24
D	ISP1	192.168.88.24
X	balance_negative	192.168.88.25
D	ISP1	192.168.88.25

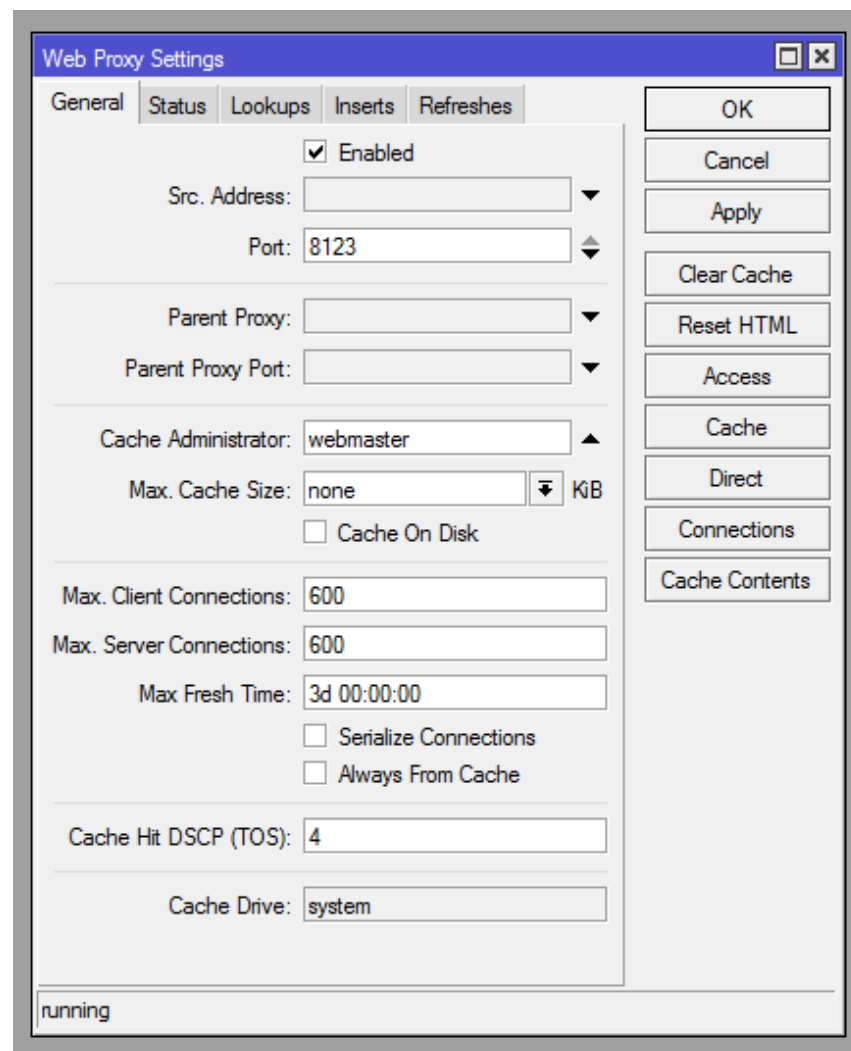
291 items

# Список маршрутов

Route List						
Routes	Nexthops	Rules	VRF			
						Find all
	Dst. Address	/ Gateway	Distance	Routing Mark	Pref. Source	
AS	▶ 0.0.0.0/0	10.108.92.1 reachable ether1_internet	10	to_ISP1		▲
AS	▶ 0.0.0.0/0	192.168.85.1 reachable ether2_internet	10	to_ISP2		
AS	▶ 0.0.0.0/0	10.108.92.1 reachable ether1_internet	1			
S	▶ 0.0.0.0/0	10.108.92.1 reachable ether1_internet	100	to_ISP2		
S	▶ 0.0.0.0/0	192.168.85.1 reachable ether2_internet	100	to_ISP1		
DAC	▶ 10.108.92.0/23	ether1_internet reachable	0		10.108.92.56	
DAC	▶ 172.17.254.1	pptp-out1 reachable	0		172.17.254.10	
DAo	▶ 192.168.80.0/24	192.168.200.1 reachable sstp-out 1	110			
DAo	▶ 192.168.81.0/24	192.168.200.1 reachable sstp-out 1	110			
DAo	▶ 192.168.82.0/24	192.168.200.1 reachable sstp-out 1	110			
DAC	▶ 192.168.85.0/24	ether2_internet reachable	0		192.168.85.200	
DAo	▶ 192.168.87.0/24	192.168.200.1 reachable sstp-out 1	110			
DAC	▶ 192.168.88.0/24	bridge1 reachable	0		192.168.88.1	
DAo	▶ 192.168.89.0/24	192.168.200.1 reachable sstp-out 1	110			
DAo	▶ 192.168.90.10	192.168.200.1 reachable sstp-out 1	110			
DAo	▶ 192.168.90.11	192.168.200.1 reachable sstp-out 1	110			
DAo	▶ 192.168.90.14	192.168.200.1 reachable sstp-out 1	110			
DAo	▶ 192.168.90.18	192.168.200.1 reachable sstp-out 1	110			▼

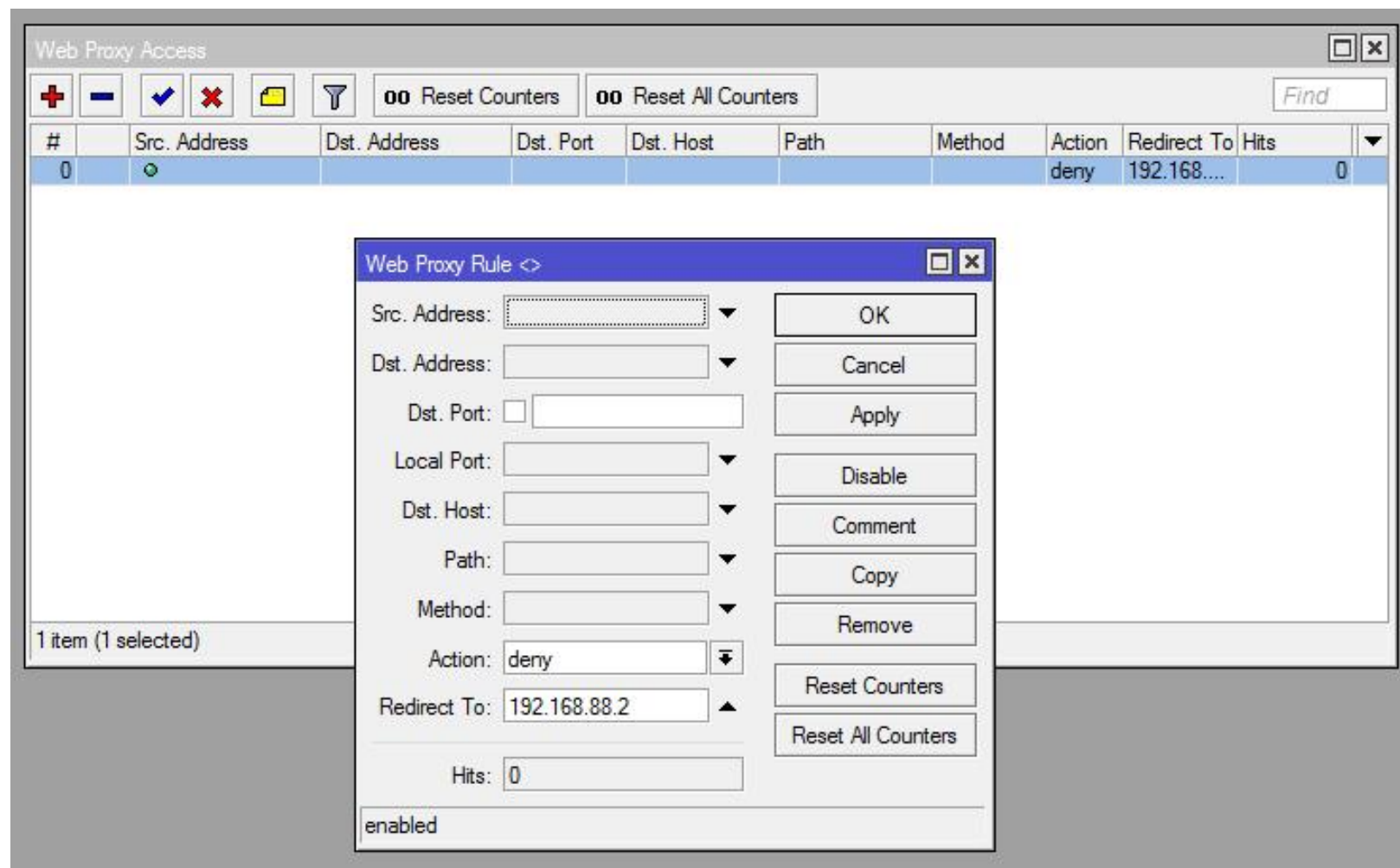
52 items

# Включаем прокси сервер





# И перенаправляем



# На все запросы в Интернет

NAT Rule <!192.168.0.0/16>

General Advanced Extra Action Statistics

Chain: dstnat

Src. Address:

Dst. Address: ! 192.168.0.0/16

Protocol: ☐ 6 (tcp)

Src. Port:

Dst. Port:

Any. Port:

In. Interface:

Out. Interface:

Packet Mark:

Connection Mark:

Routing Mark:

Routing Table:

Connection Type:

OK

Cancel

Apply

Disable

Comment

Copy

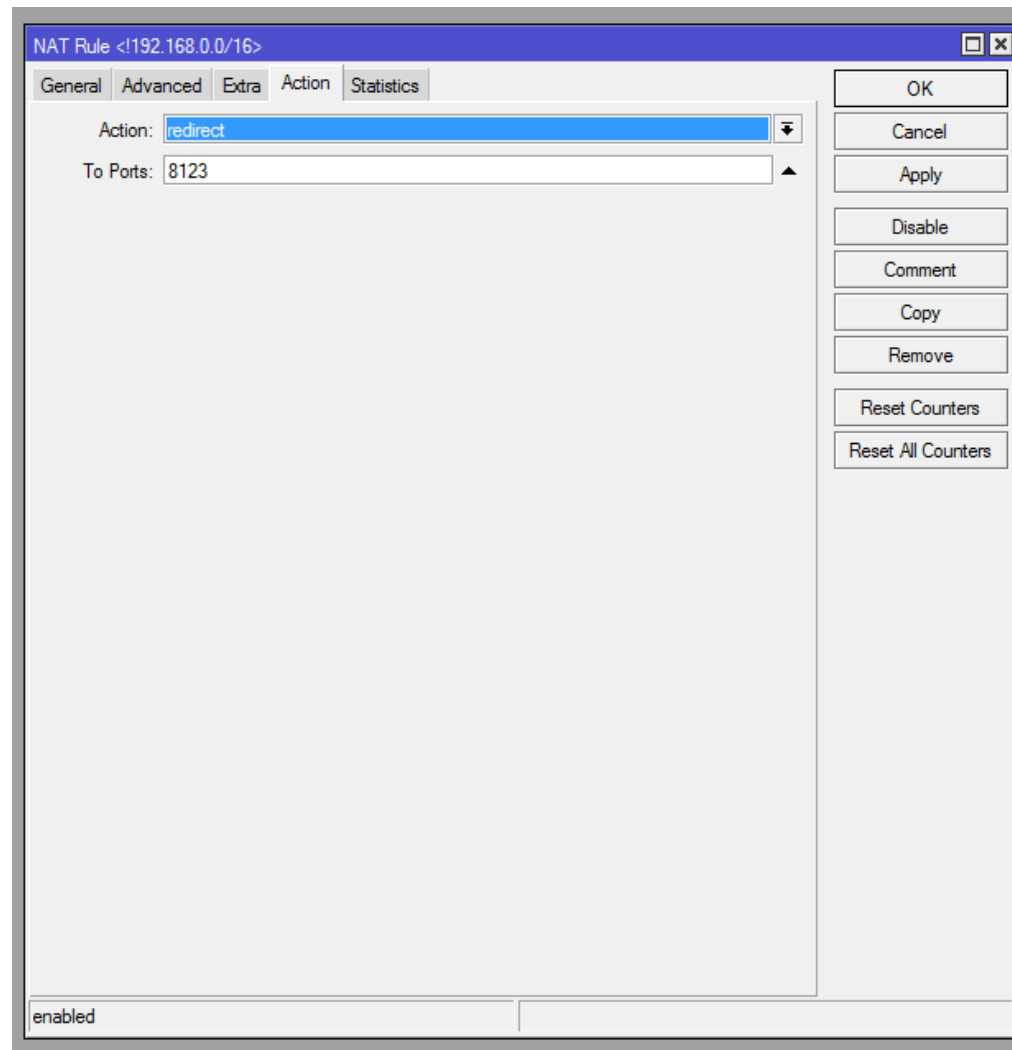
Remove

Reset Counters

Reset All Counters

enabled

# Делаем редирект, если клиент заблокирован



# Оба канала загружены

Interface List										
<div> <div>Interface</div> <div>Ethernet</div> <div>EoIP Tunnel</div> <div>IP Tunnel</div> <div>GRE Tunnel</div> <div>VLAN</div> <div>VRRP</div> <div>Bonding</div> <div>LTE</div> </div> <div> <div>+</div> <div>-</div> <div>✓</div> <div>✗</div> <div>📄</div> <div>🔍</div> <div>Find</div> </div>										
	Name	Type	L2 MTU	Tx	Rx	Tx Packet...	Rx Packe...	Tx Drops	Rx Dro	▼
R	bridge1	Bridge	1520	27.6 Mbps	4.5 Mbps	3 231	2 725	0	0	
R	bridge_OSPF	Bridge	65535	0 bps	0 bps	0	0	0	0	
R	ether1_internet	Ethernet	1520	2.4 Mbps	13.9 Mbps	1 413	1 685	0	0	
R	ether2_internet	Ethernet	1520	2.4 Mbps	13.6 Mbps	1 288	1 540	0	0	
	ether3	Ethernet	1520	0 bps	0 bps	0	0	0	0	
R	ether4	Ethernet	1520	29.2 kbps	235.5 kbps	51	34	0	0	
R	ether5	Ethernet	1520	1050.7 kbps	1682.8 kbps	311	327	0	0	
	ether6	Ethernet	1598	0 bps	0 bps	0	0	0	0	
R	ether7	Ethernet	1598	4.3 Mbps	497.1 kbps	579	511	0	0	
R	ether8	Ethernet	1598	6.5 Mbps	605.1 kbps	680	464	0	0	
R	ether9	Ethernet	1598	11.4 Mbps	1515.6 kbps	1 230	1 010	0	0	
R	ether10	Ethernet	1598	4.3 Mbps	342.2 kbps	517	381	0	0	
R	pptp-out1	PPTP Client		87.5 kbps	0 bps	9	0	0	0	
R	sstp-out1	SSTP Client		0 bps	2.6 kbps	0	6	0	0	

◀

14 items

▶

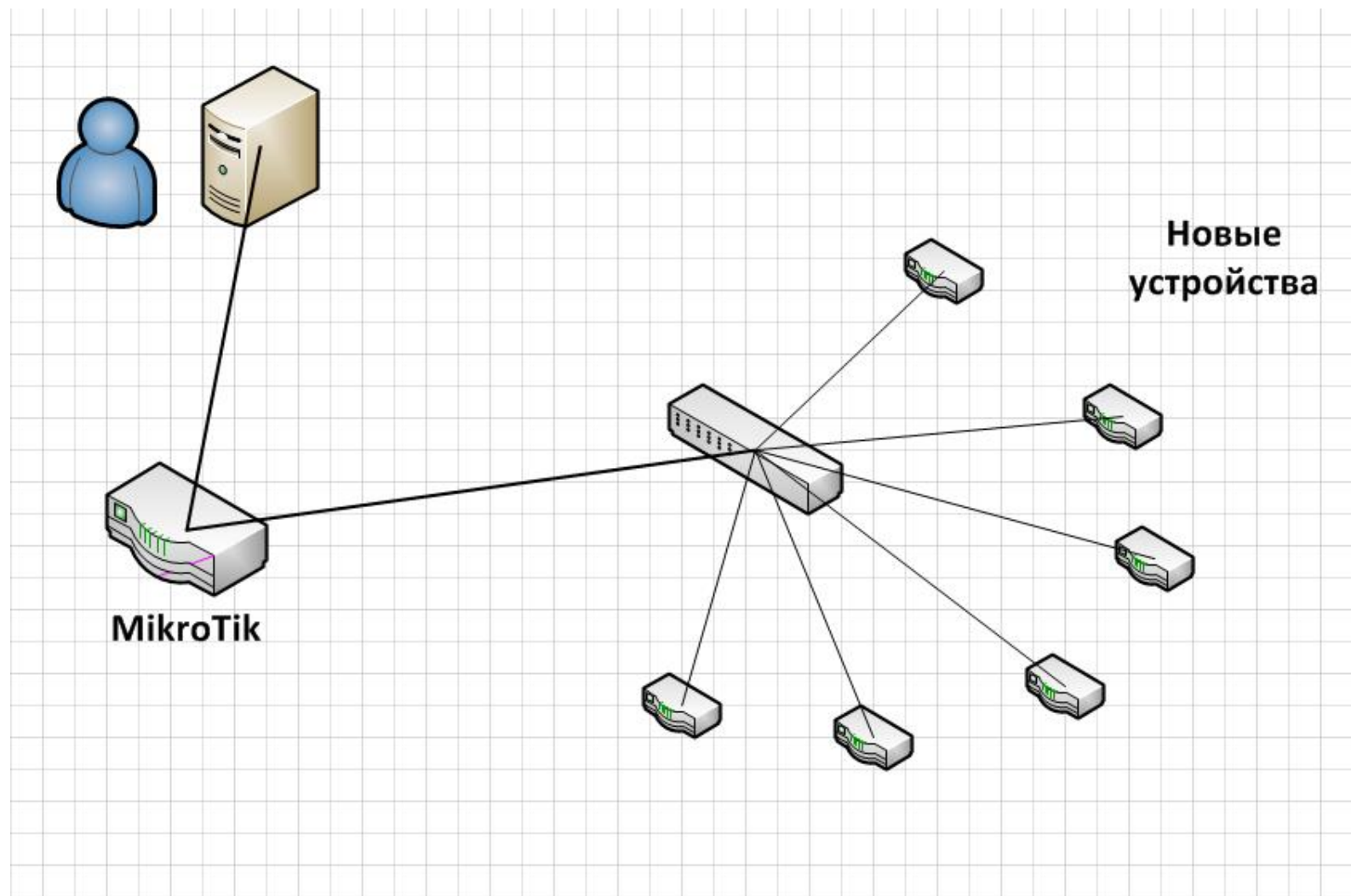
# MikroTik позволяет

- Объединять 2, 3, 4 и более каналов, автоматически распределяя клиентов между ними.
- Не требуется изменять адреса клиентов.
- Возможность переадресации на информационную страницу при отсутствии средств 😊

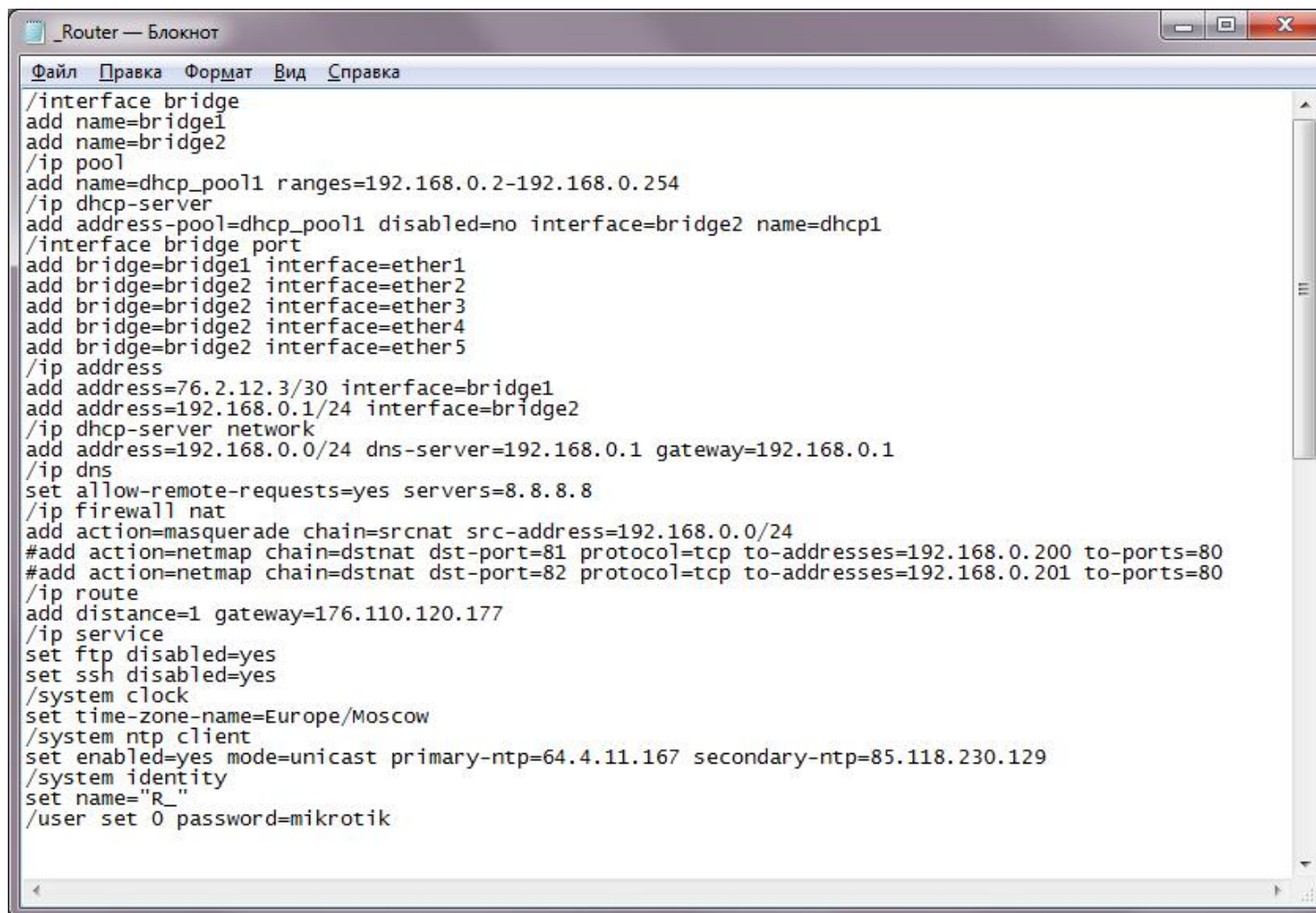
# Ходят слухи что

- MikroTik очень сложен в настройке.
- Нельзя переносить конфигурацию между разными устройствами.
- Много времени требуется для настройки большого количества устройств 😊

# Есть много новых устройств



# Делаем типовой конфиг

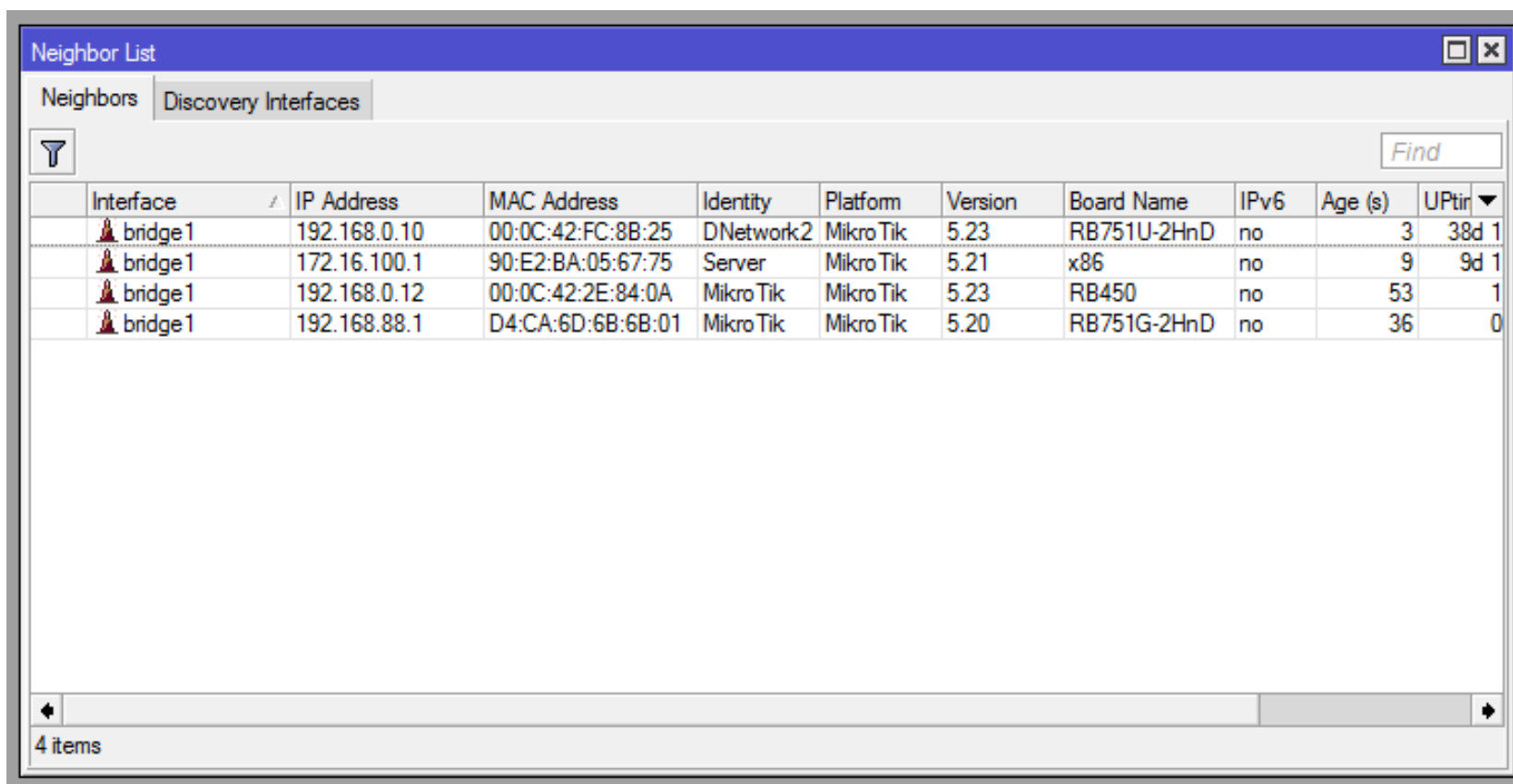


```
_Router — Блокнот
Файл  Правка  Формат  Вид  Справка

/interface bridge
add name=bridge1
add name=bridge2
/ip pool
add name=dhcp_pool1 ranges=192.168.0.2-192.168.0.254
/ip dhcp-server
add address-pool=dhcp_pool1 disabled=no interface=bridge2 name=dhcp1
/interface bridge port
add bridge=bridge1 interface=ether1
add bridge=bridge2 interface=ether2
add bridge=bridge2 interface=ether3
add bridge=bridge2 interface=ether4
add bridge=bridge2 interface=ether5
/ip address
add address=76.2.12.3/30 interface=bridge1
add address=192.168.0.1/24 interface=bridge2
/ip dhcp-server network
add address=192.168.0.0/24 dns-server=192.168.0.1 gateway=192.168.0.1
/ip dns
set allow-remote-requests=yes servers=8.8.8.8
/ip firewall nat
add action=masquerade chain=srcnat src-address=192.168.0.0/24
#add action=netmap chain=dstnat dst-port=81 protocol=tcp to-addresses=192.168.0.200 to-ports=80
#add action=netmap chain=dstnat dst-port=82 protocol=tcp to-addresses=192.168.0.201 to-ports=80
/ip route
add distance=1 gateway=176.110.120.177
/ip service
set ftp disabled=yes
set ssh disabled=yes
/system clock
set time-zone-name=Europe/Moscow
/system ntp client
set enabled=yes mode=unicast primary-ntp=64.4.11.167 secondary-ntp=85.118.230.129
/system identity
set name="R_"
/user set 0 password=mikrotik
```

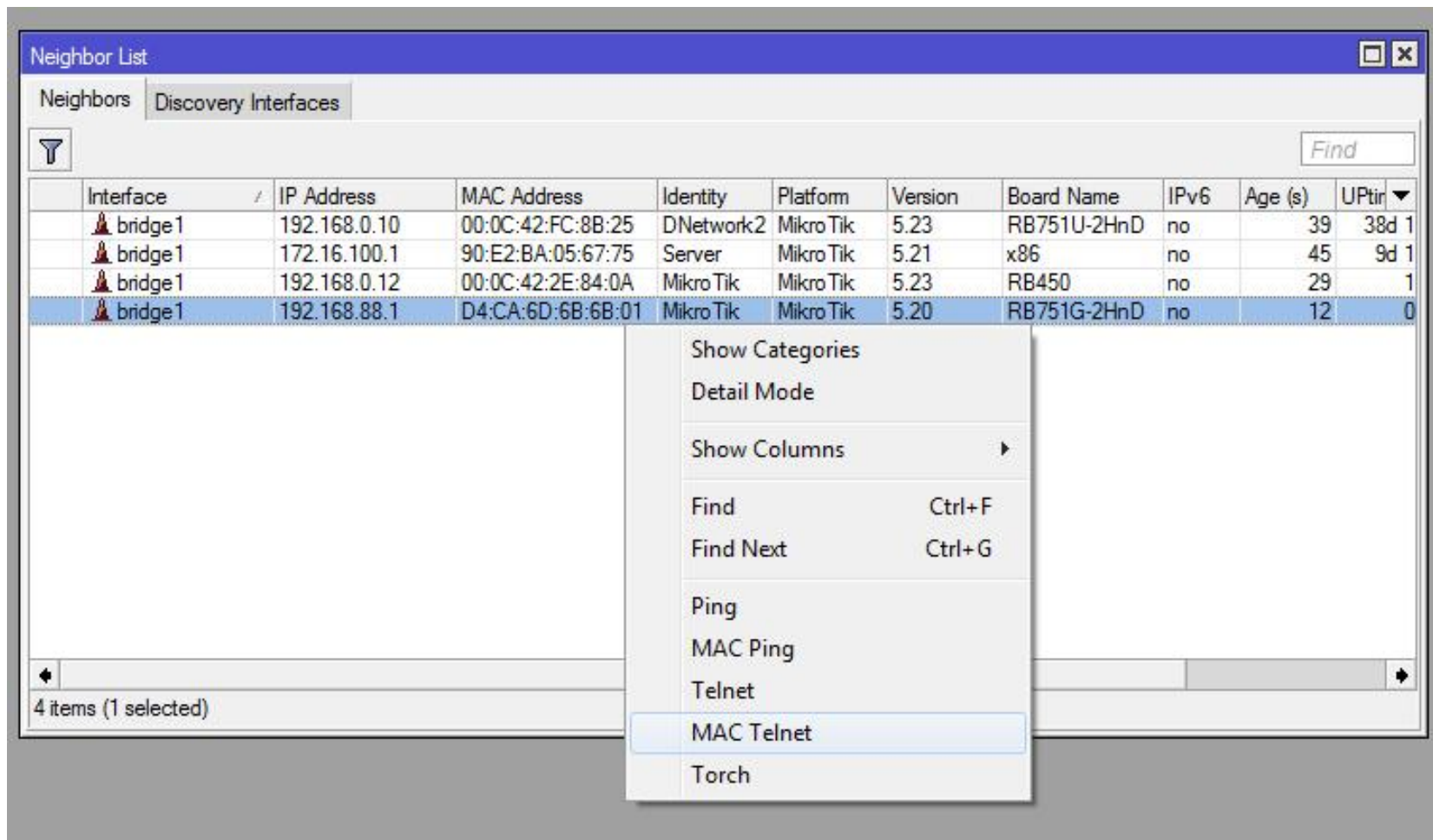


# Открываем список соседей

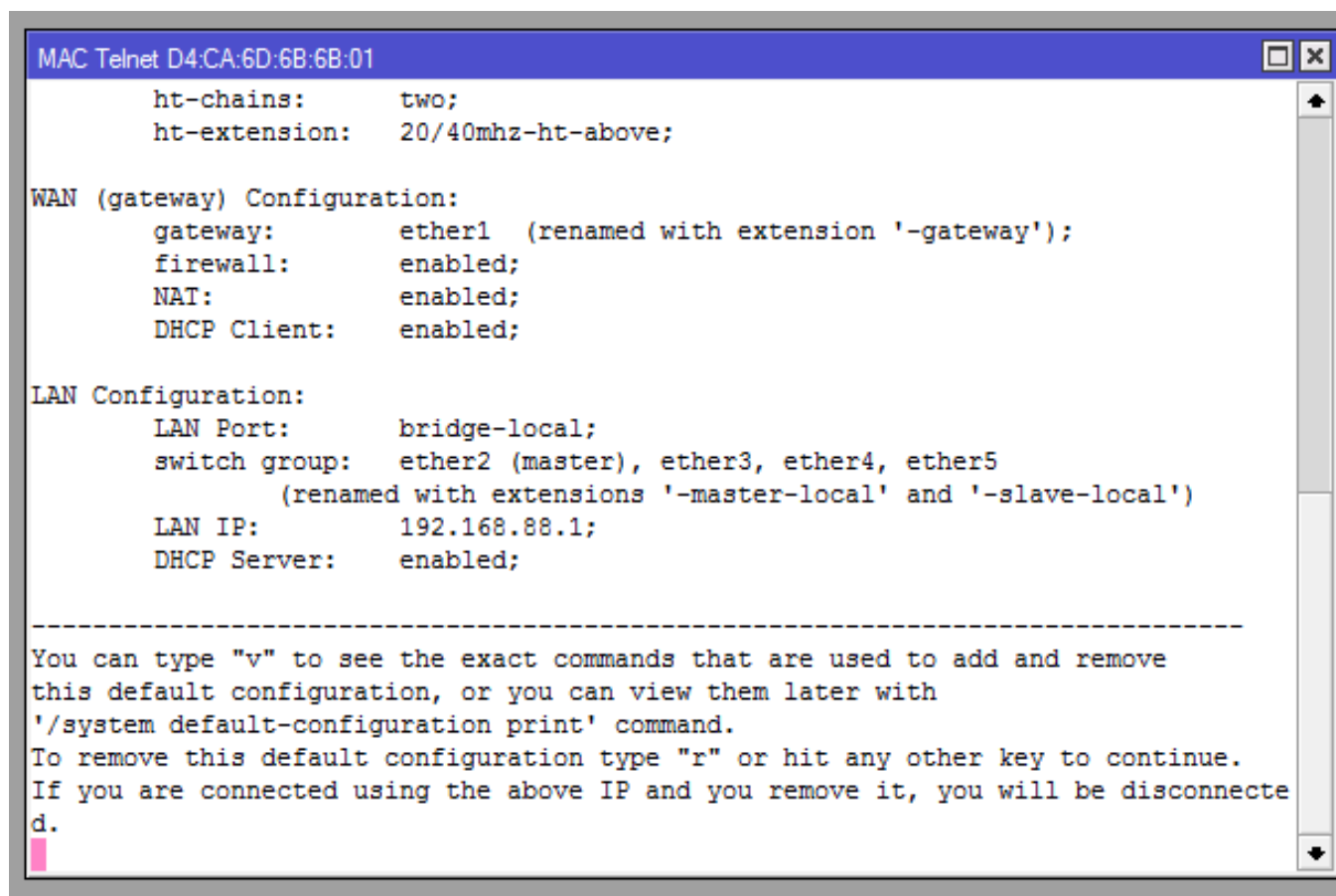


Interface	IP Address	MAC Address	Identity	Platform	Version	Board Name	IPv6	Age (s)	Uptime
bridge1	192.168.0.10	00:0C:42:FC:8B:25	DNetwork2	MikroTik	5.23	RB751U-2HnD	no	3	38d 1
bridge1	172.16.100.1	90:E2:BA:05:67:75	Server	MikroTik	5.21	x86	no	9	9d 1
bridge1	192.168.0.12	00:0C:42:2E:84:0A	MikroTik	MikroTik	5.23	RB450	no	53	1
bridge1	192.168.88.1	D4:CA:6D:6B:6B:01	MikroTik	MikroTik	5.20	RB751G-2HnD	no	36	0

# Заходим по MAC Telnet



# Отменяем начальный конфиг

A screenshot of a Telnet window titled "MAC Telnet D4:CA:6D:6B:6B:01". The window displays Mikrotik configuration commands and their outputs. The configuration includes HT settings, WAN (gateway) settings, and LAN settings. At the bottom, there is a message explaining how to view or remove the default configuration using 'v' or 'r' keys.

```
MAC Telnet D4:CA:6D:6B:6B:01

    ht-chains:      two;
    ht-extension:   20/40mhz-ht-above;

WAN (gateway) Configuration:
    gateway:        ether1 (renamed with extension '-gateway');
    firewall:       enabled;
    NAT:            enabled;
    DHCP Client:    enabled;

LAN Configuration:
    LAN Port:       bridge-local;
    switch group:   ether2 (master), ether3, ether4, ether5
                  (renamed with extensions '-master-local' and '-slave-local')
    LAN IP:         192.168.88.1;
    DHCP Server:    enabled;

-----
You can type "v" to see the exact commands that are used to add and remove
this default configuration, or you can view them later with
'/system default-configuration print' command.
To remove this default configuration type "r" or hit any other key to continue.
If you are connected using the above IP and you remove it, you will be disconnecte
d.
█
```

# И вставляем свой

```
MAC Telnet D4:CA:6D:6B:6B:01
[admin@MikroTik] /ip dhcp-server network> /ip dns
[admin@MikroTik] /ip dns> set allow-remote-requests=yes servers=8.8.8.8
[admin@MikroTik] /ip dns> /ip firewall nat
[admin@MikroTik] /ip firewall nat> add action=masquerade chain=srcnat src-address=
192.168.0.0/24
[admin@MikroTik] /ip firewall nat> #add action=netmap chain=dstnat dst-port=81 pro
tocol=tcp to-addresses=192.168.0.200 to-ports=80
[admin@MikroTik] /ip firewall nat> #add action=netmap chain=dstnat dst-port=82 pro
tocol=tcp to-addresses=192.168.0.201 to-ports=80
[admin@MikroTik] /ip firewall nat> /ip route
[admin@MikroTik] /ip route> add distance=1 gateway=176.110.120.177
[admin@MikroTik] /ip route> /ip service
[admin@MikroTik] /ip service> set ftp disabled=yes
[admin@MikroTik] /ip service> set ssh disabled=yes
[admin@MikroTik] /ip service> /system clock
[admin@MikroTik] /system clock> set time-zone-name=Europe/Moscow
[admin@MikroTik] /system clock> /system ntp client
[admin@MikroTik] /system ntp client> set enabled=yes mode=unicast primary-ntp=64.4
.11.167 secondary-ntp=85.118.230.129
[admin@MikroTik] /system ntp client> /system identity
[admin@MikroTik] /system identity> set name="R_"
[admin@R_] /system identity> /user set 0 password=mikrotik
[admin@R_] /system identity>
[admin@R_] /system identity>
```

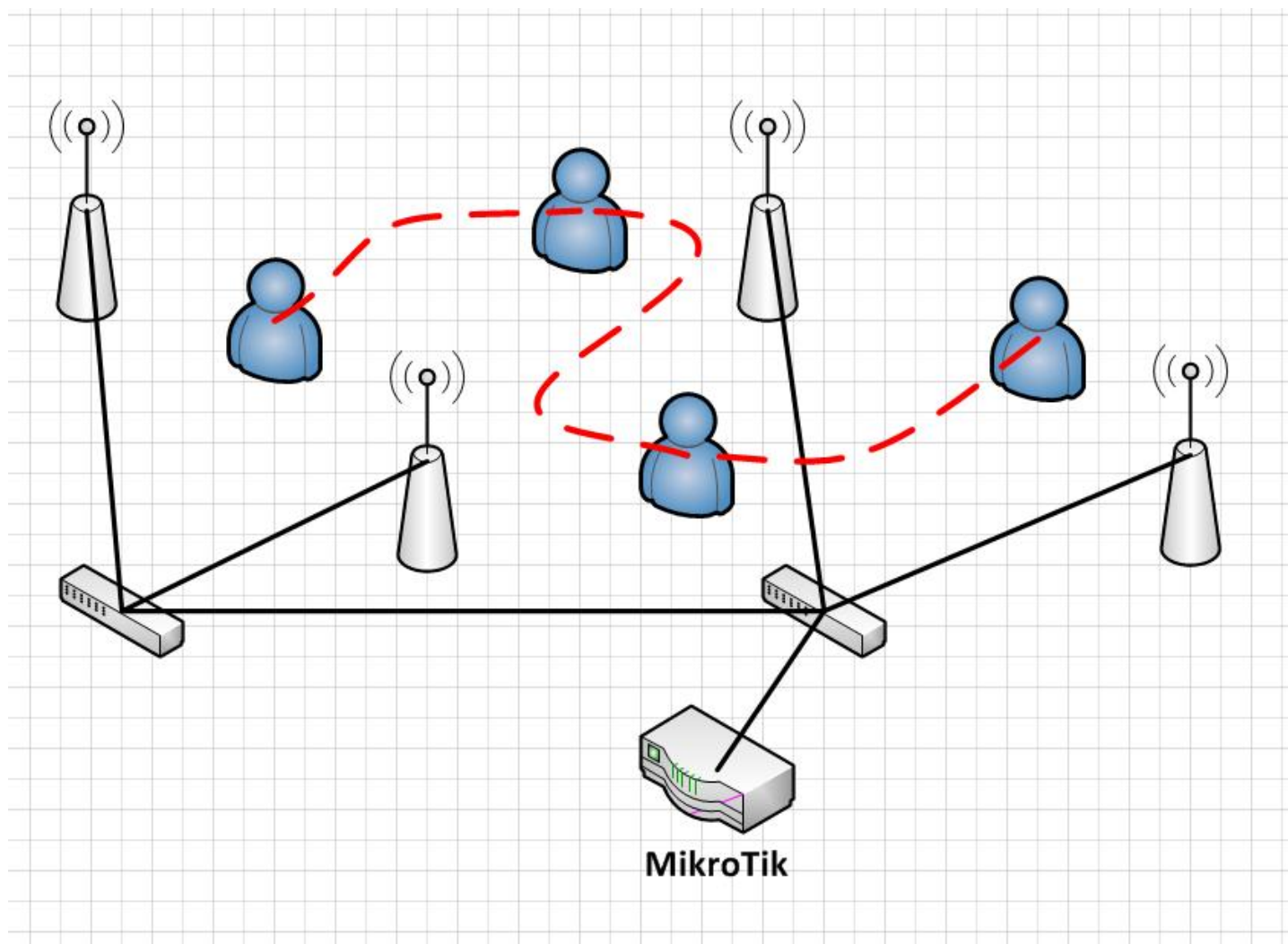
# MikroTik позволяет

- Настроить конфигурацию за 5 секунд.
- Настраивать большое количество устройств одновременно (записывать конфигурацию и обновлять прошивку).
- Научиться всегда переворачивать коробку 😊

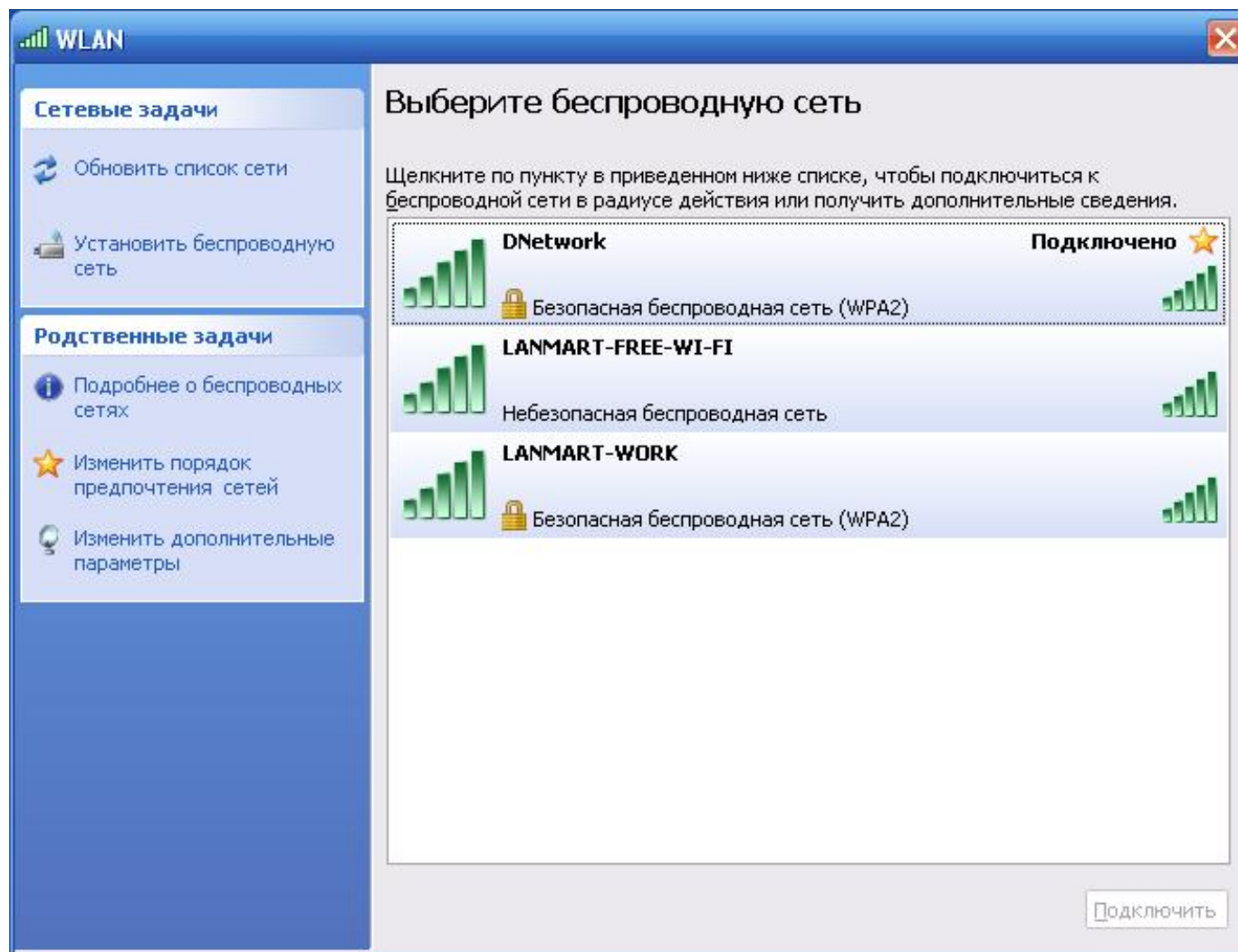
# Wi-Fi с роумингом дорого

- Говорят что беспроводная сеть на территории офиса или гостиницы это дорого.
- Говорят что управлять большим количеством точек без контроллера сложно.
- А зачем ими управлять? 😊

# Клиенты перемещаются

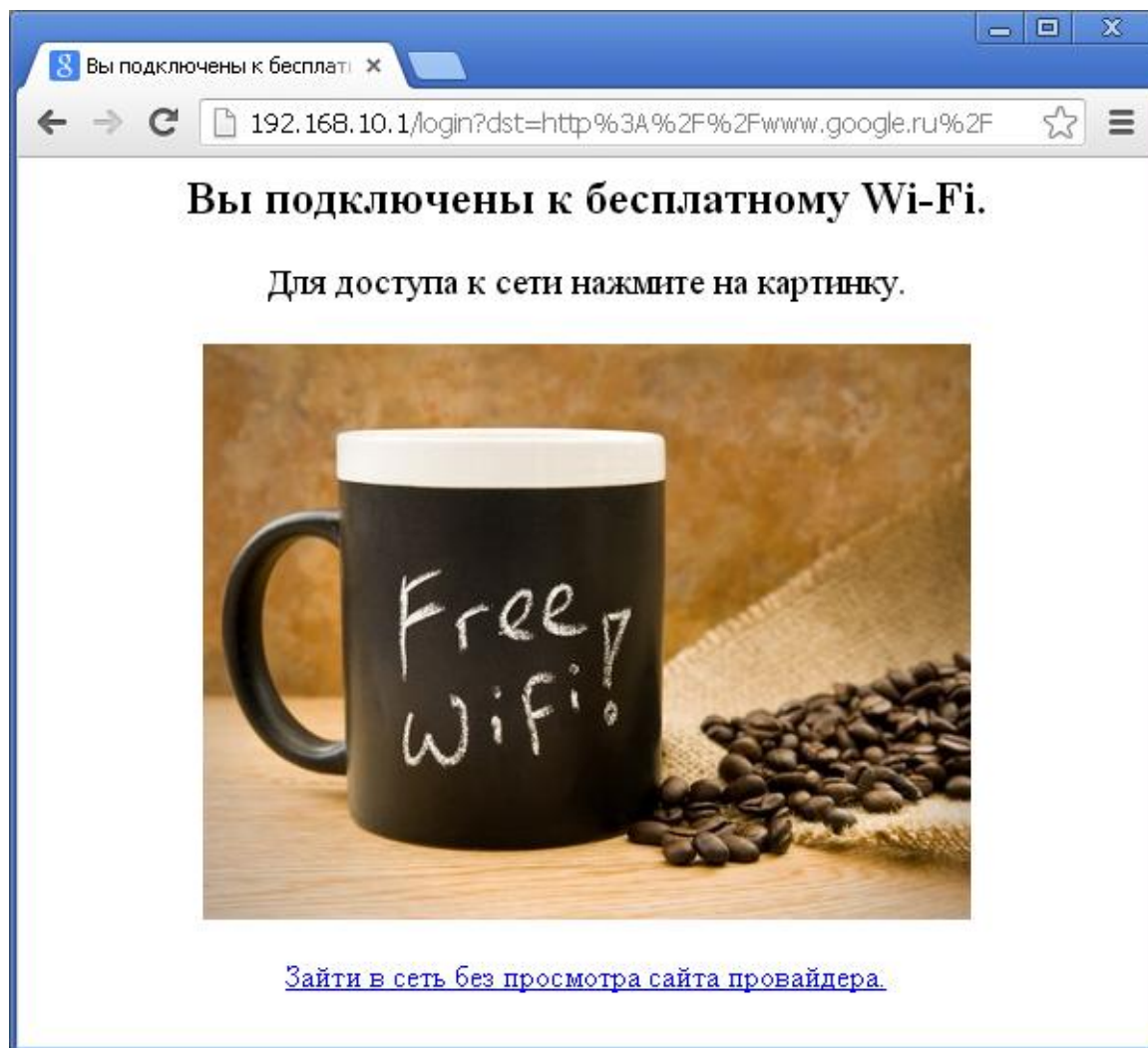


# Сканируют сеть

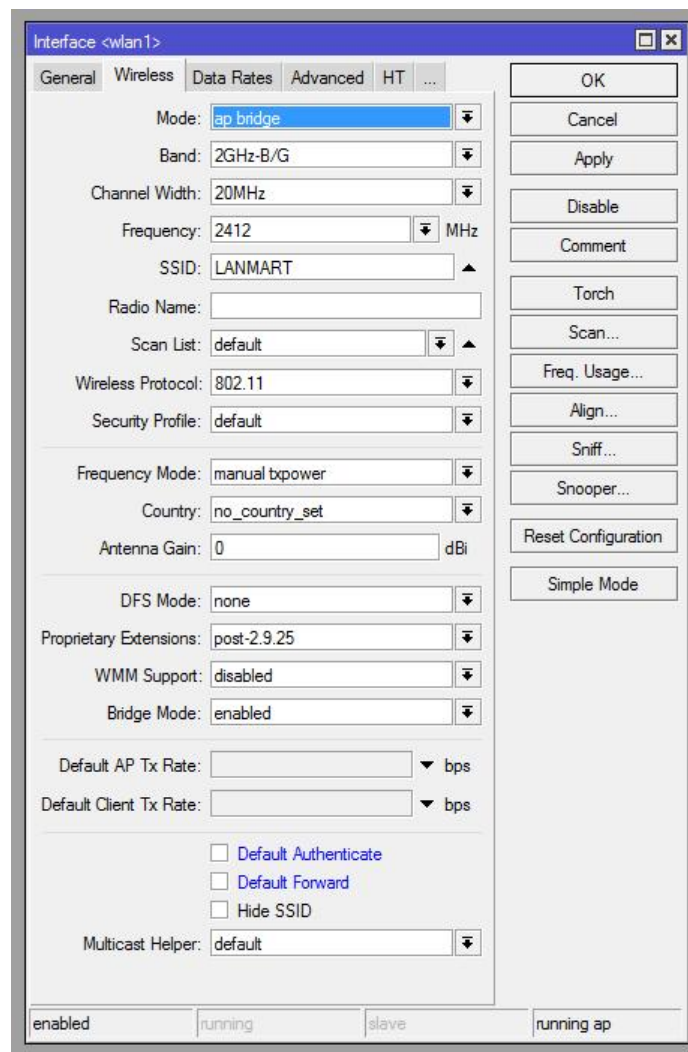




# И подключаются



# Снимаем галочки



# Ограничение по уровням сигналов от клиентов

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security Profiles

+ - ✓ ✗ [icon] [icon] Find

#	MAC Address	Interface	Signal Str...	Authentication	Forwarding	
0 items						

New AP Access Rule

MAC Address: [text box] ▼

Interface: all ▼

Signal Strength Range: -75..120

AP Tx Limit: [text box] ▼

Client Tx Limit: [text box] ▼

☒ Authentication

☒ Forwarding

Private Key: none ▼ 0x [text box]

Private Pre Shared Key: [text box]

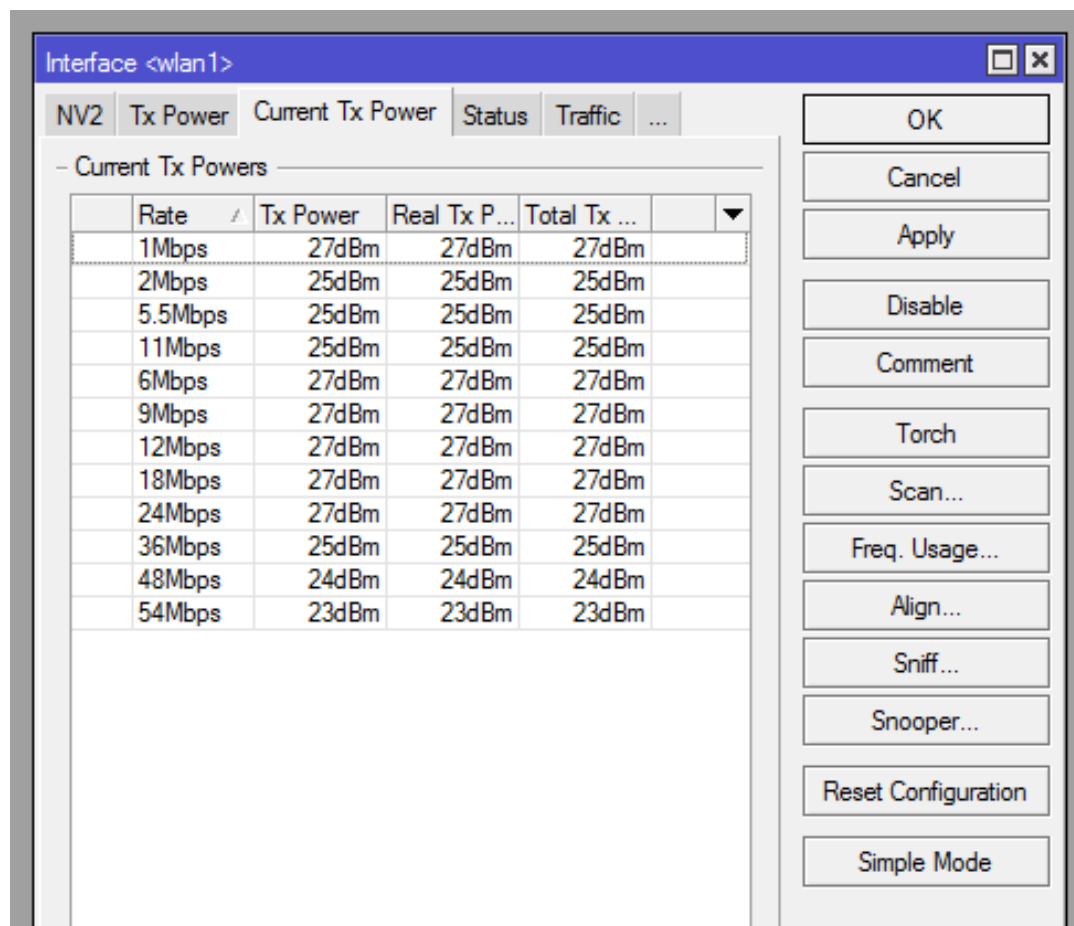
Management Protection Key: [text box]

Time [text box]

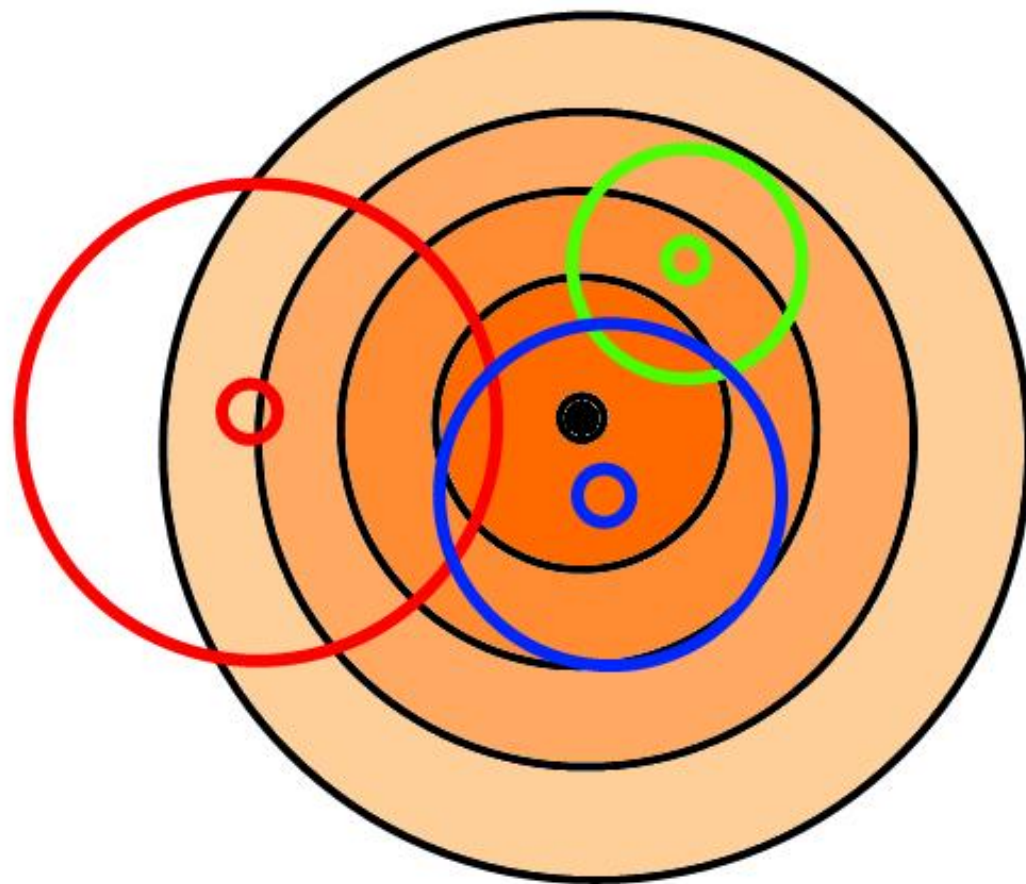
enabled

OK Cancel Apply Disable Comment Copy Remove

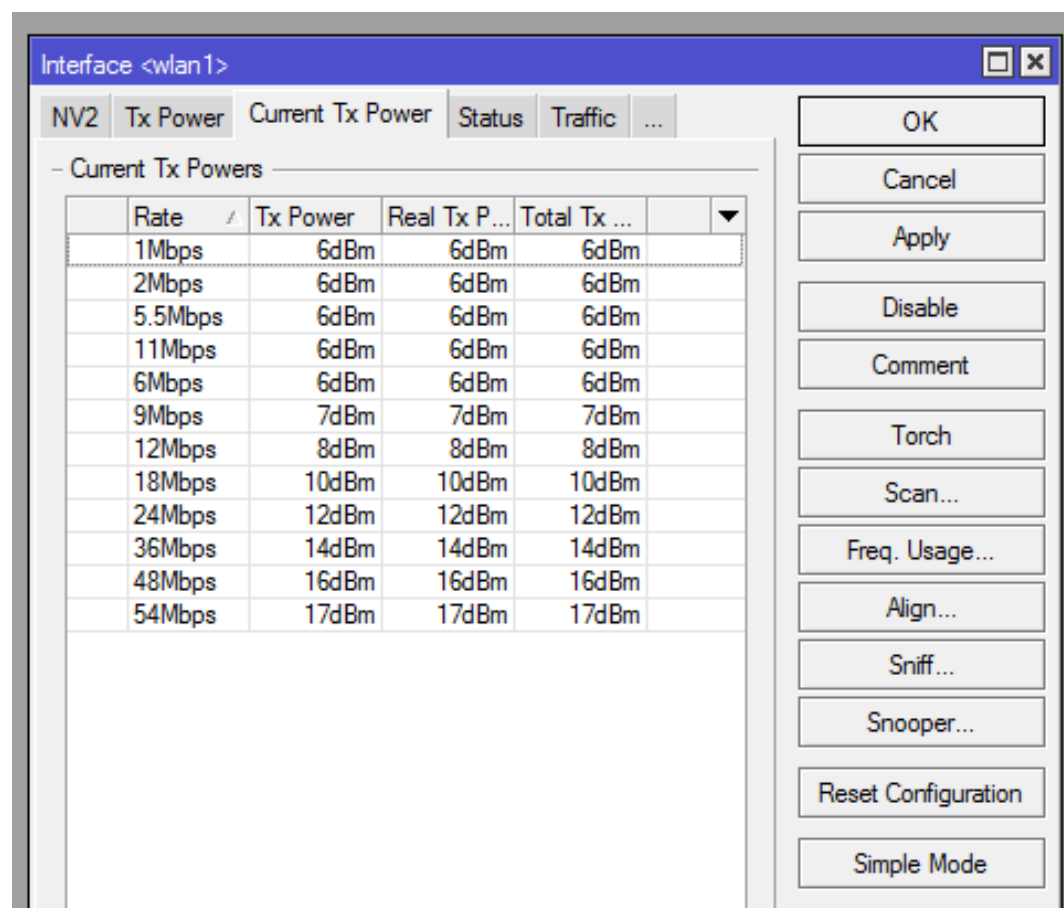
# Стандартная мощность



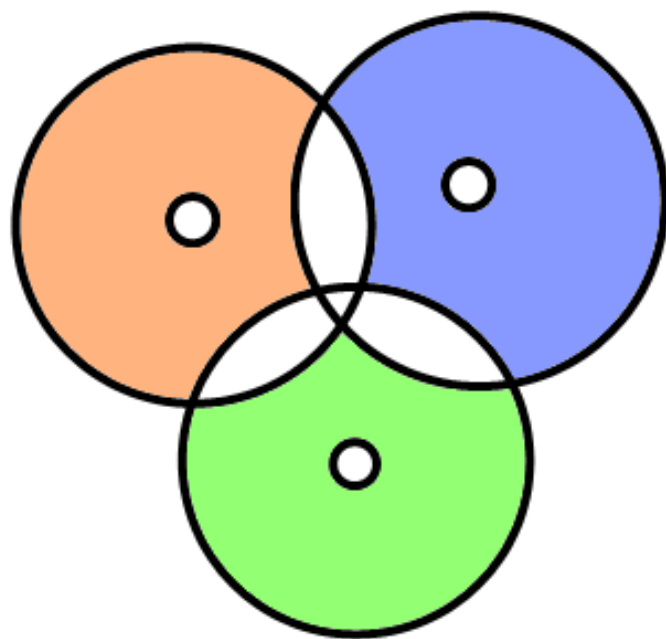
# Результат



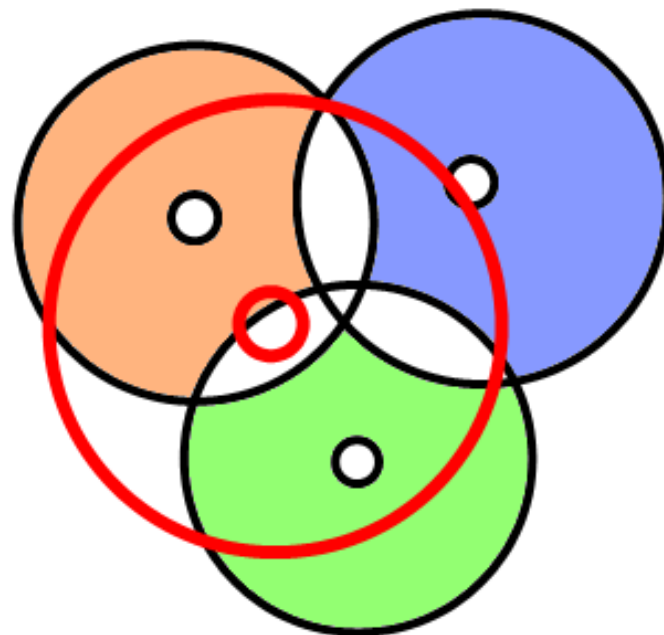
# Мощность сверху-вниз



# Покры́тие



# Результат

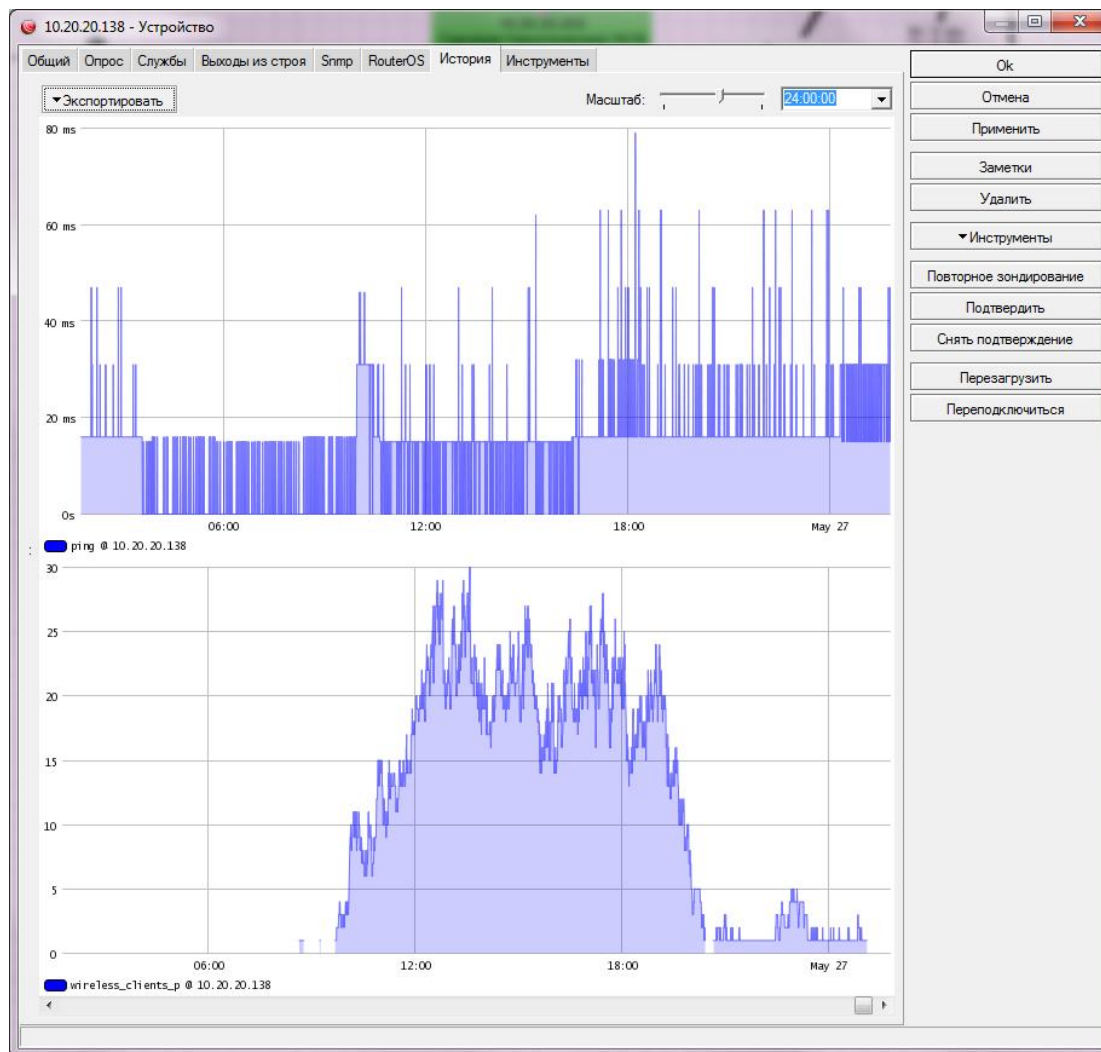




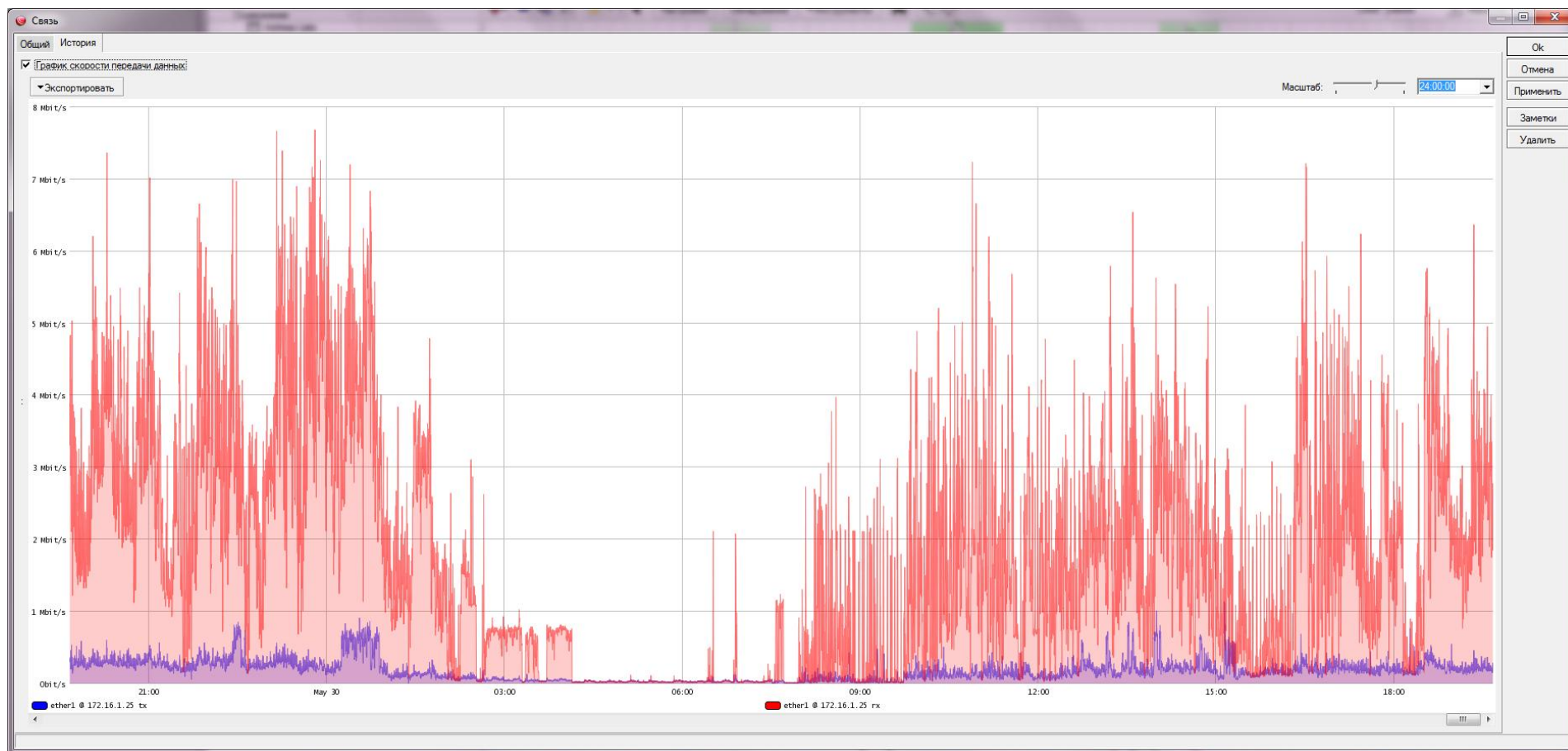
# Пример лога

Log			all	
Jan/02/1970 19:40:14	wireless info	EC:35:86:79:A3:79@wlan1: disconnected, too weak signal		
Jan/02/1970 19:40:14	wireless info	wlan1: data from unknown device EC:35:86:79:A3:79, sent deauth		
Jan/02/1970 19:43:08	wireless info	EC:35:86:79:A3:79@wlan1: connected		
Jan/02/1970 19:43:18	wireless info	EC:35:86:79:A3:79@wlan1: disconnected, too weak signal		
Jan/02/1970 19:43:22	wireless info	wlan1: data from unknown device EC:35:86:79:A3:79, sent deauth		
Jan/02/1970 19:43:22	wireless info	wlan1: data from unknown device EC:35:86:79:A3:79, sent deauth		
Jan/02/1970 19:43:22	wireless info	wlan1: data from unknown device EC:35:86:79:A3:79, sent deauth		
Jan/02/1970 19:43:22	wireless info	wlan1: data from unknown device EC:35:86:79:A3:79, sent deauth		
Jan/02/1970 19:43:26	wireless info	94:39:E5:C4:49:C3@wlan1: connected		
Jan/02/1970 19:43:31	wireless info	EC:35:86:79:A3:79@wlan1: connected		
Jan/02/1970 19:43:41	wireless info	EC:35:86:79:A3:79@wlan1: disconnected, too weak signal		
Jan/02/1970 19:43:43	wireless info	wlan1: data from unknown device EC:35:86:79:A3:79, sent deauth		
Jan/02/1970 19:48:21	wireless info	94:39:E5:C4:49:C3@wlan1: disconnected, extensive data loss		
Jan/02/1970 19:52:51	wireless info	EC:35:86:79:A3:79@wlan1: connected		
Jan/02/1970 19:52:57	wireless info	EC:35:86:79:A3:79@wlan1: disconnected, registered to other device in network		
Jan/02/1970 22:42:26	wireless info	94:39:E5:C4:49:C3@wlan1: connected		
Jan/03/1970 00:11:47	wireless info	94:39:E5:C4:49:C3@wlan1: disconnected, received disassoc: sending station leaving (8)		
Jan/03/1970 00:13:36	wireless info	94:39:E5:C4:49:C3@wlan1: connected		
Jan/03/1970 00:15:38	wireless info	94:39:E5:C4:49:C3@wlan1: disconnected, received disassoc: sending station leaving (8)		
Jan/03/1970 00:27:38	wireless info	EC:35:86:79:A3:79@wlan1: connected		
Jan/03/1970 00:27:42	wireless info	EC:35:86:79:A3:79@wlan1: disconnected, registered to other device in network		
Jan/03/1970 00:29:00	wireless info	94:39:E5:C4:49:C3@wlan1: connected		
Jan/03/1970 01:04:40	wireless info	64:A3:CB:34:BF:BA@wlan1: connected		
Jan/03/1970 01:05:30	wireless info	64:A3:CB:34:BF:BA@wlan1: disconnected, too weak signal		
Jan/03/1970 01:05:31	wireless info	wlan1: data from unknown device 64:A3:CB:34:BF:BA, sent deauth		
Jan/03/1970 02:00:56	wireless info	94:39:E5:C4:49:C3@wlan1: disconnected, received disassoc: sending station leaving (8)		
Jan/03/1970 02:02:34	wireless info	94:39:E5:C4:49:C3@wlan1: connected		
Jan/03/1970 02:29:20	wireless info	94:39:E5:C4:49:C3@wlan1: disconnected, received disassoc: sending station leaving (8)		
Jan/03/1970 02:51:56	system info account	user admin logged in from 192.168.31.31 via winbox		

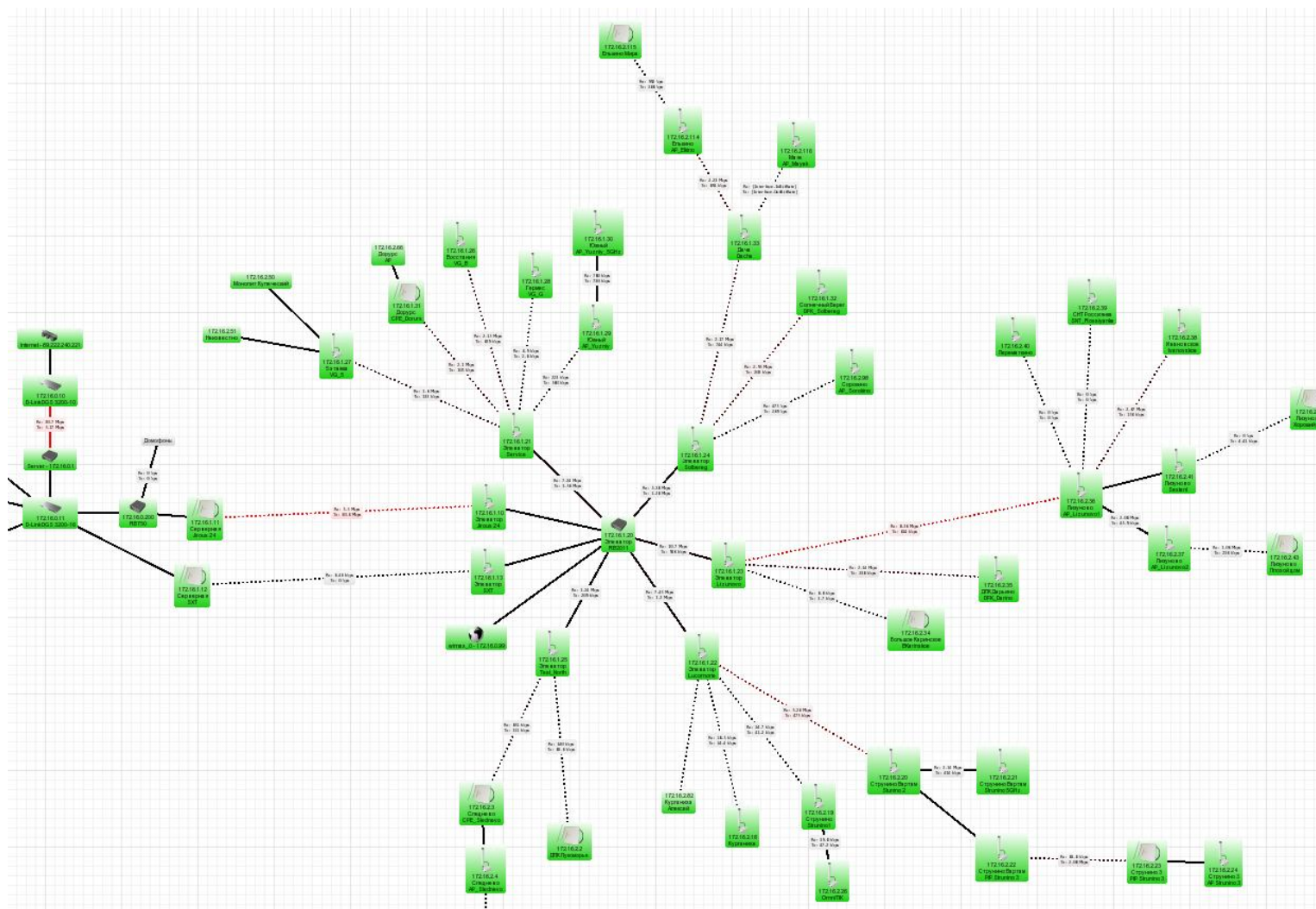
# График количества клиентов



# График потребления



# Управление





# Список клиентов

▼ Устройства

СписокДеревоRouterOSTипыСоответствия Mac

УстройствоГруппаБеспроводная регистрацияПростая очередь

CSV

Устройство /	MAC	AP	WDS	Tx/Rx Rate	Tx/Rx Signal /	Комментарий	
10.100.0.10	Routerboar:D3:ED:85	нет	да	36.0Mbps/48.0Mbps	-67		
10.100.0.100	D4:CA:6D:48:B9:15	нет	да	54.0Mbps	-64/-66		
10.100.0.101	Routerboar:F7:86:75	да	нет	54.0Mbps	-66/-63		
10.100.0.102	D4:CA:6D:47:D7:E3	нет	да	24.0Mbps/36.0Mbps	-79		
10.100.0.103	Routerboar:F1:BB:F5	да	нет	36.0Mbps/24.0Mbps	-79		
10.100.0.104	D4:CA:6D:4E:6C:E9	нет	да	54.0Mbps	-67/-68		
10.100.0.105	Routerboar:F6:05:A6	да	нет	54.0Mbps	-68/-67		
10.100.0.11	Routerboar:F6:06:44	да	нет	36.0Mbps	-68/-67		
10.100.0.122	D4:CA:6D:49:14:C3	нет	да	36.0Mbps/24.0Mbps	-80/-78		
10.100.0.123	D4:CA:6D:6D:54:95	да	да	24.0Mbps/36.0Mbps	-80		
10.100.0.14	Routerboar:F7:0C:77	нет	да	81.0Mbps	-74/-73		
10.100.0.15	Routerboar:F2:40:A0	да	да	81.0Mbps	-73/-75		
10.100.0.18	Routerboar:89:2A:63	нет	да	130.0Mbps	-62/-61		
10.100.0.19	Routerboar:88:68:3D	да	нет	130.0Mbps	-61/-62		
10.100.0.20	Routerboar:F6:00:C6	нет	да	48.0Mbps/54.0Mbps	-61/-63		
10.100.0.21	Routerboar:F2:40:AA	да	да	54.0Mbps/48.0Mbps	-64/-61		
10.100.0.22	Routerboar:F1:49:CD	нет	да	54.0Mbps	-67/-70		
10.100.0.23	Routerboar:F2:40:A8	да	нет	54.0Mbps	-70/-67		
10.100.0.24	Routerboar:F7:0C:79	нет	да	54.0Mbps	-71/-69		
10.100.0.25	Routerboar:F6:00:C2	да	да	54.0Mbps/6.0Mbps	-69/-70		
10.100.0.26	Routerboar:F1:4F:FB	нет	да	36.0Mbps	-73/-74		
10.100.0.26	Routerboar:F7:13:2D	нет	да	54.0Mbps/48.0Mbps	-65/-66		
10.100.0.28	Routerboar:F2:6E:E4	нет	да	54.0Mbps	-69		
10.100.0.29	Routerboar:F6:27:F6	да	нет	54.0Mbps	-69		
10.100.0.30	Routerboar:F7:3A:D1	да	нет	36.0Mbps	-74/-73		
10.100.0.31	Routerboar:F7:3A:D1	да	нет	48.0Mbps/54.0Mbps	-67/-65		
10.100.0.38	D4:CA:6D:50:FF:21	нет	да	130.0Mbps	-56		
10.100.0.39	D4:CA:6D:48:6F:85	да	нет	130.0Mbps	-56		
10.100.0.4	BC:3B:AF:85:9F:82	нет	нет	48.0Mbps/36.0Mbps	0/-75		
10.100.0.4	TRENDwareI:F2:EB:AB	нет	нет	54.0Mbps/1.0Mbps	0/-59		
10.100.0.40	Routerboar:E8:E3:5D	нет	да	48.0Mbps	-74/-75		
10.100.0.40	D4:CA:6D:4E:26:91	нет	да	54.0Mbps/48.0Mbps	-58/-57		
10.100.0.41	Routerboar:F6:71:28	да	нет	48.0Mbps/54.0Mbps	-57		
10.100.0.44	Routerboar:F6:71:28	да	нет	48.0Mbps	-75/-74		
10.100.0.58	Routerboar:F6:73:BE	нет	да	54.0Mbps	-61/-59		
10.100.0.59	Routerboar:F6:73:3A	да	нет	54.0Mbps	-59/-61		
10.100.0.64	Routerboar:E8:7A:33	нет	да	54.0Mbps	-70/-72		
10.100.0.65	Routerboar:F1:BE:35	да	нет	54.0Mbps	-72/-70		
10.100.0.66	D4:CA:6D:6F:AF:39	нет	да	36.0Mbps	-77/-78		

# MikroTik позволяет

- Сделать большую беспроводную сеть, и не только внутри помещения.
- Переадресовывать клиентов на страницу с рекламой.
- Работать от аккумуляторов, получать Интернет по USB модему – создание мобильных хотспотов 😊



Приходите к нам на стенд!

[www.lanmart.ru](http://www.lanmart.ru)