

# Intro to MikroTik RouterOS

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**Latvian manufacturer of computer networking equipment**

**It sells wireless products and routers**

**Developers of MikroTik RouterOS**

RouterBOARD series (Level 6)

Standard x86-based computers

# Router OS

Level number	0 (Trial mode)	1 (Free Demo)	3 (WISP CPE)	4 (WISP)	5 (WISP)	6 (Controller)
Price	no key <a href="#">🔗</a>	registration required <a href="#">🔗</a>	volume only <a href="#">🔗</a>	\$45	\$95	\$250
Initial Config Support	-	-	-	15 days	30 days	30 days
Wireless AP	24h trial	-	-	yes	yes	yes
Wireless Client and Bridge	24h trial	-	yes	yes	yes	yes
RIP, OSPF, BGP protocols	24h trial	-	yes(*)	yes	yes	yes
EoIP tunnels	24h trial	1	unlimited	unlimited	unlimited	unlimited
PPPoE tunnels	24h trial	1	200	200	500	unlimited
PPTP tunnels	24h trial	1	200	200	500	unlimited
L2TP tunnels	24h trial	1	200	200	500	unlimited
OVPN tunnels	24h trial	1	200	200	unlimited	unlimited
VLAN interfaces	24h trial	1	unlimited	unlimited	unlimited	unlimited
HotSpot active users	24h trial	1	1	200	500	unlimited
RADIUS client	24h trial	-	yes	yes	yes	yes
Queues	24h trial	1	unlimited	unlimited	unlimited	unlimited
Web proxy	24h trial	-	yes	yes	yes	yes
User manager active sessions	24h trial	1	10	20	50	Unlimited
Number of KVM guests	none	1	Unlimited	Unlimited	Unlimited	Unlimited

# Router OS

**Routing**

**Firewalling**

**Virtual Private Network (VPN)**

**Bandwidth Shaping**

**Quality of service**

**Wireless access point**

# Setting up RouterOS

## Connecting to RouterOS

Via FTP

Via Telnet

Via SSH

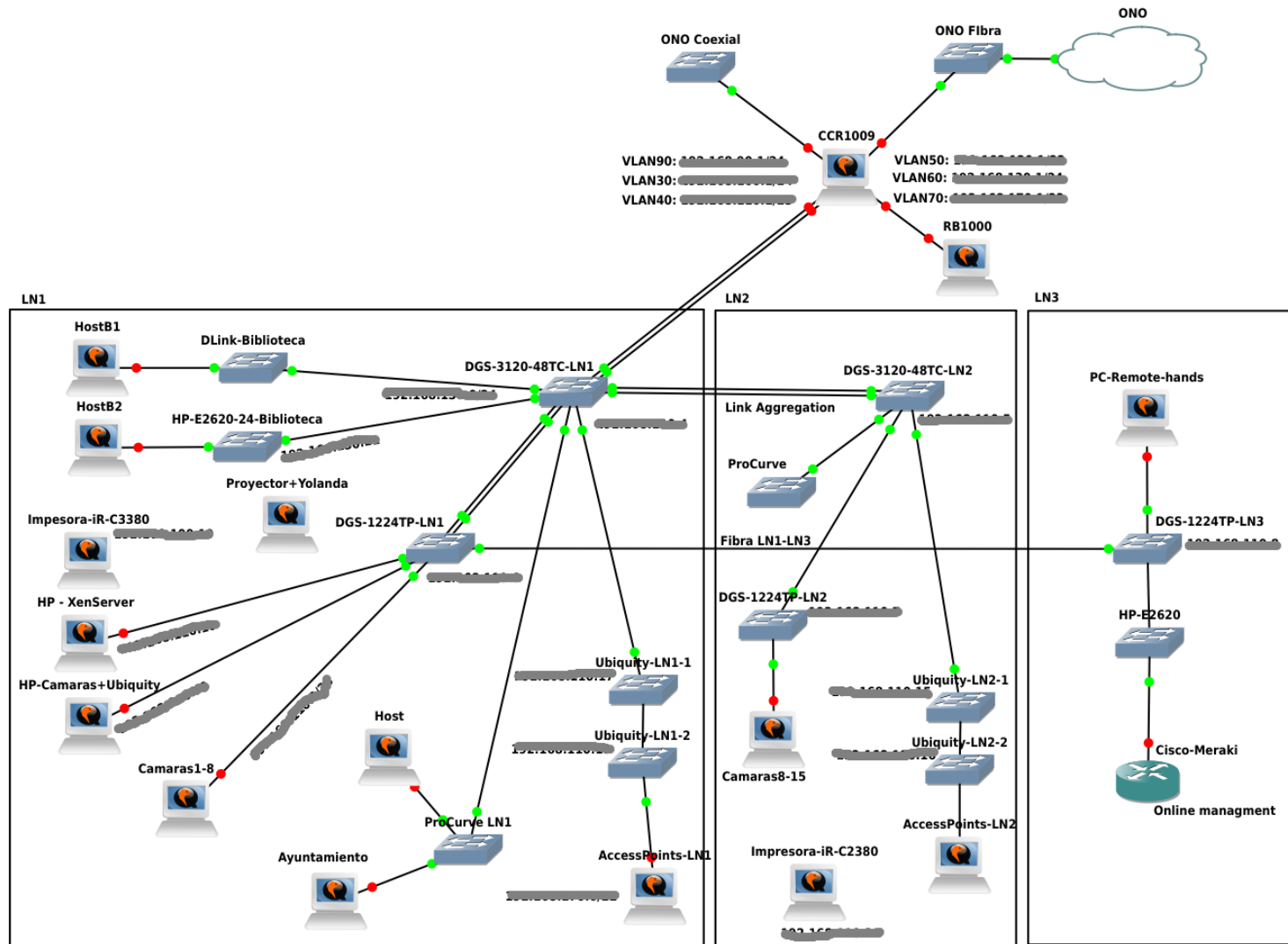
Via HTTP (Web application)

Via Winbox (Graphical configuration tool for RouterOS)

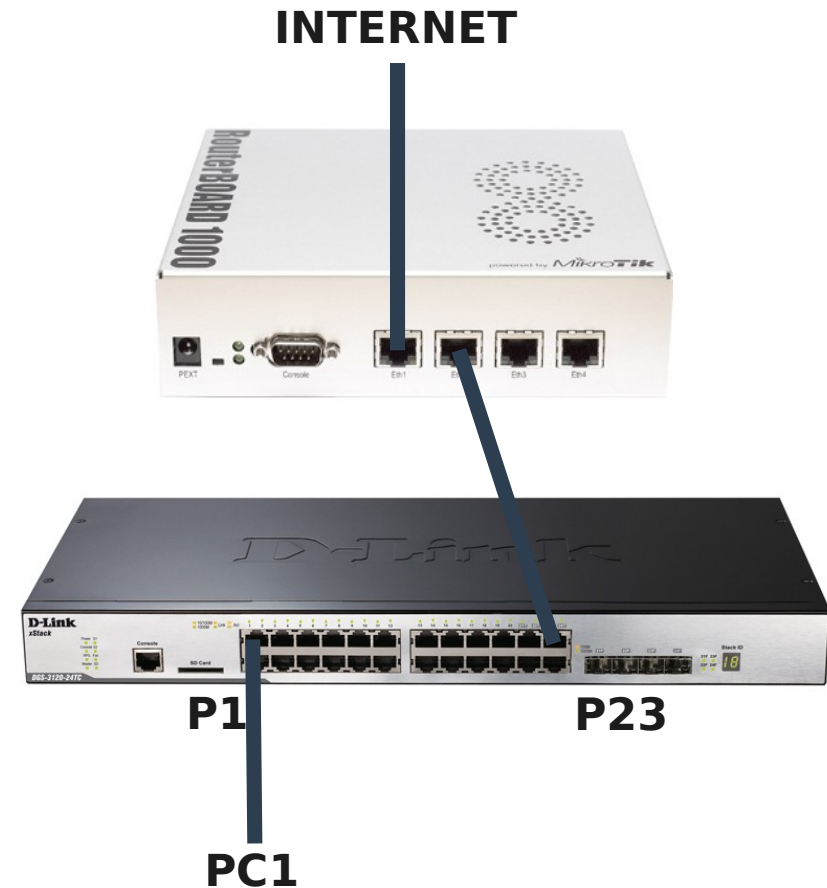
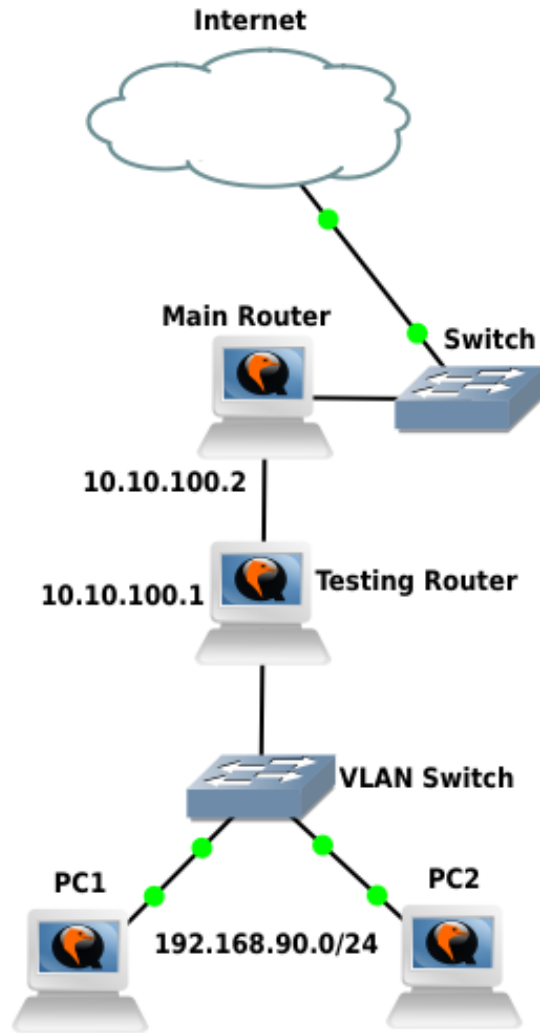
## Network Simulators

GNS3([www.gns3.com](http://www.gns3.com))

# Real Case



# Straight Forward Example



# Virtual LANs

**Virtual Local Area Network (VLAN)**

**Used protocol: 802.1Q**

**OSI Layer 2 (Data Link Layer)**

**Adds 4 byte tag into an Ethernet frame**

**Each VLAN is treated as separate subnet. Though Mikrotik supports Vlan over Vlan**

**Multiple LAN in a single physical interface**

**VLANs increase security**

**Priority**



# Virtual LANs - Type of ports

## Edge ports

Untagged or Access Ports

Used for PCs, printers, servers, etc

## Core ports

Tagged or Trunk Ports

Send 4 byte

Used for devices that support VLANs technology (Switch, Router, etc)

# OSI Layers

OSI Model			
Layer		Protocol data unit (PDU)	Function <sup>[3]</sup>
Host layers	7. Application	Data	High-level APIs, including resource sharing, remote file access
	6. Presentation		Translation of data between a networking service and an application; including character encoding, data compression and encryption/decryption
	5. Session		Managing communication sessions, i.e. continuous exchange of information in the form of multiple back-and-forth transmissions between two nodes
	4. Transport	Segment (TCP) / Datagram (UDP)	Reliable transmission of data segments between points on a network, including segmentation, acknowledgement and multiplexing
Media layers	3. Network	Packet	Structuring and managing a multi-node network, including addressing, routing and traffic control
	2. Data link	Frame	Reliable transmission of data frames between two nodes connected by a physical layer
	1. Physical	Bit	Transmission and reception of raw bit streams over a physical medium

# VLAN Switch Configuration

**DGS-3120-48TC**

- System Configuration
- Management
- L2 Features
  - VLAN**
    - 802.1Q VLAN Settings**
    - 802.1v Protocol VLAN
    - Asymmetric VLAN Settings
    - GVRP
    - MAC-based VLAN Settings
    - Private VLAN Settings
    - PVID Auto Assign Settings
    - Voice VLAN
    - VLAN Trunk Settings
    - Browse VLAN
    - Show VLAN Ports
  - Layer 2 Protocol Tunneling Settings

**802.1Q VLAN Settings** Safeguard

VLAN List | Add/Edit VLAN | Find VLAN | VLAN Batch Settings | Total Entries: 16

VID: 90 | VLAN Name: lab (Max: 32 characters) | Apply

Unit: 1 | Advertisement: Disabled

Port	Select All	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Tagged	All																								
Untagged	All																								
Forbidden	All																								
Not Member	All																								

# Interface & VLAN

Interface List									
Interface	Ethernet	EoIP Tunnel	IP Tunnel	GRE Tunnel	VLAN	VRRP	Bonding	LTE	
+	-	✓	✗	📁	🔍				
Name	Type	L2 MTU	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)	FP Tx	FP Rx	
::: Entrada LAN por ether3									
R LAN	Ethernet	1600	3.0 kbps	4.0 kbps	1				
X administracion	VLAN		0 bps	0 bps	0				
X biblioteca	VLAN		0 bps	0 bps	0				
X colaborative	VLAN		0 bps	0 bps	0				
R infra2	VLAN	1596	3.0 kbps	3.9 kbps	1				
X infraestructura	VLAN		0 bps	0 bps	0				
::: Enlace Router LasNaves por ether1									
R LasNaves	Ethernet	1600	3.9 kbps	3.0 kbps	2				
::: Entrada WAN coaxial por ether2									
R WAN - COAXIAL	Ethernet	1600	0 bps	0 bps	0				
R ether4	Ethernet	1600	62.1 kbps	7.0 kbps	6				

Interface List									
Interface	Ethernet	EoIP Tunnel	IP Tunnel	GRE Tunnel	VLAN	VRRP	Bonding	LTE	
+	-	✓	✗	📁	🔍				
Name	Type	MTU	L2 MTU	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)	FP Tx	FP Rx
X administracion	VLAN	1500		0 bps	0 bps	0	0	0	0
X biblioteca	VLAN	1500		0 bps	0 bps	0	0	0	0
X colaborative	VLAN	1500		0 bps	0 bps	0	0	0	0
R infra2	VLAN	1500	1596	0 bps	0 bps	0	0	0	0
X infraestructura	VLAN	1500		0 bps	0 bps	0	0	0	0

5 items out of 9

```
/interface vlan add name=test vlan-id=66 interface=LAN disabled=no
```

# IP Addresses

The screenshot displays a network configuration window. On the left, the 'Address List' table shows five entries. The entry '192.168.180.1/24' is selected. On the right, a detailed view for this address is shown, including fields for Address, Network, and Interface, along with action buttons like OK, Cancel, Apply, Disable, Comment, Copy, and Remove. The status 'enabled' is also visible.

	Address	Network	Interface
X	5.40.111.162/27	5.40.111.160	LasNaves
	10.10.100.1/24	10.10.100.0	LasNaves
X	62.43.203.81/27	62.43.203.64	WAN - COAXIAL
	192.168.110.2/23	192.168.110.0	ether4
	192.168.180.1/24	192.168.180.0	infra2

5 items (1 selected)

Address <192.168.180.1/24>

Address: 192.168.180.1/24  
Network: 192.168.180.0  
Interface: infra2

enabled

/ip address  
add address=10.10.10.3/24 interface=infra2

# Routing

The screenshot displays two windows from a network configuration tool. The left window, titled 'Route List', shows a table of routes. The right window, titled 'Route <192.168.180.0/24>', provides detailed configuration for the selected route.

**Route List Window:**

	Dst. Address	Gateway
AS	0.0.0.0/0	10.10.100.2 reachable LasNaves
XS	0.0.0.0/0	62.43.203.65
DAC	10.10.100.0/24	LasNaves reachable
DAC	192.168.110.0/23	ether4 reachable
DAC	192.168.180.0/24	infra2 reachable

5 items (1 selected)

**Route <192.168.180.0/24> Window:**

**General Tab:**

- Dst. Address: 192.168.180.0/24
- Gateway: infra2 reachable
- Check Gateway:
- Type: unicast
- Distance: 0
- Scope: 10
- Target Scope: 10
- Routing Mark:
- Pref. Source: 192.168.180.1

**Attributes Tab:**

dynamic | active | connected

**Buttons:** OK, Copy, Remove

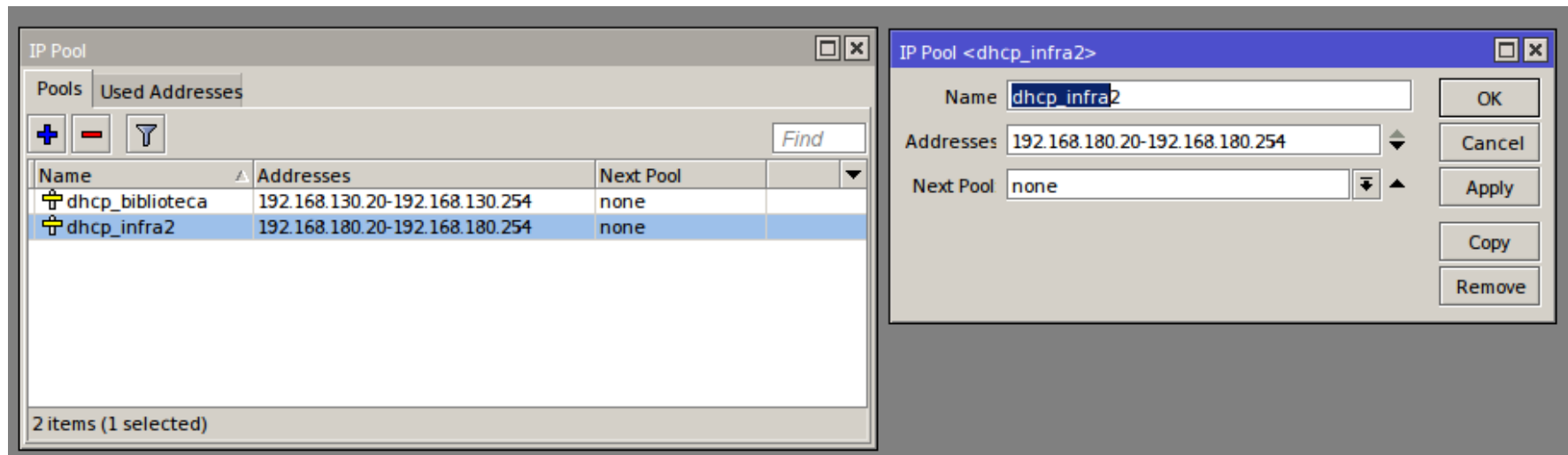
# DHCP Server

DHCP Server							
DHCP Networks Leases Options Option Sets Alerts							
+ - ✓ ✗ ⏏ DHCP Config DHCP Setup Find							
	Name	Interface	Relay	Lease Time	Address Pool	Add A...	
X	dhcp_biblioteca	biblioteca		00:10:00	dhcp_bibliotec	no	
	dhcp_infra2	infra2		00:10:00	dhcp_infra2	no	
2 items (1 selected)							

DHCP Server							
DHCP Networks Leases Options Option Sets Alerts							
+ - 📁 ⏏ Find							
	Address	Gateway	DNS Servers	Domain	WINS Servers	Next Ser...	
	192.168.100.0/22	192.168.100.1					
	192.168.130.0/24	192.168.130.1					
	192.168.180.0/24	192.168.180.1					
3 items (1 selected)							

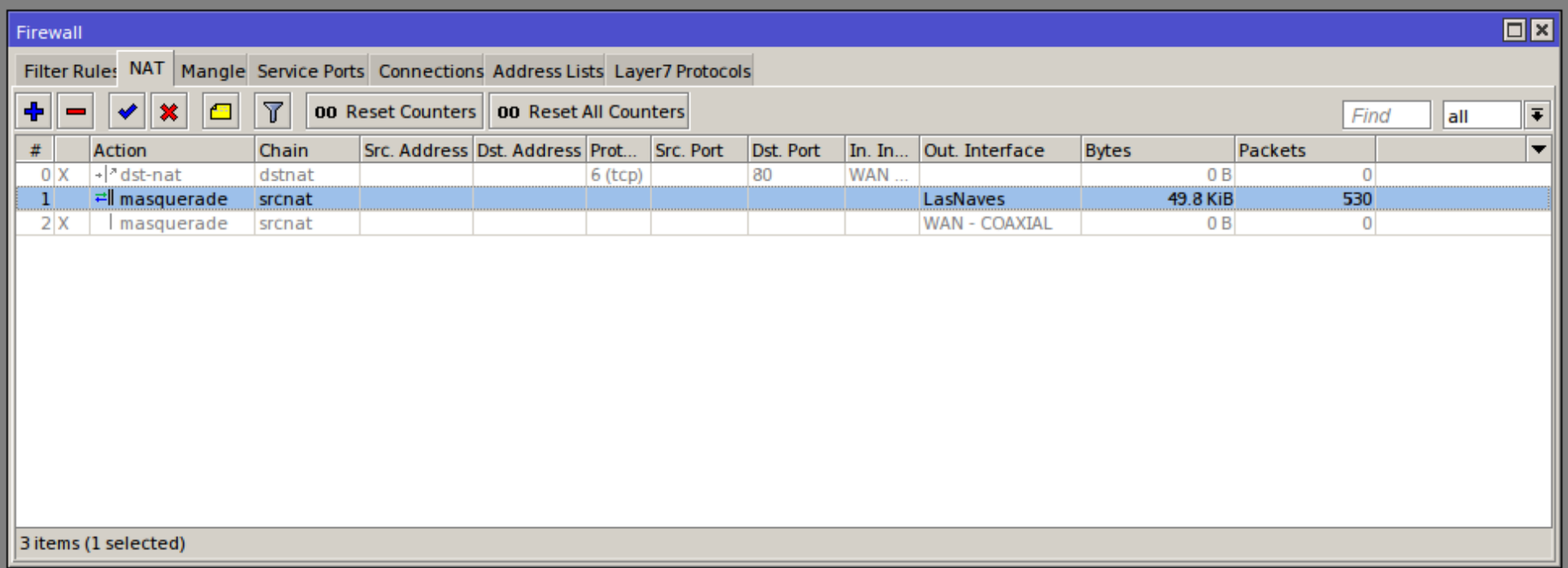
DHCP Server									
DHCP Networks Leases Options Option Sets Alerts									
+ - ✓ ✗ 📄 ⏏ Check Status Find									
	Address	MAC Address	Client ID	Server	Active Address	Active MAC Addr...	Active Ho...	Expires After	Status
D	192.168.180...	34:15:9E:21:1F:96	1-34:15:9e:21:1f:96	dhcp_infra2	192.168.180...	34:15:9E:21:1F:96	eventos-...	00:08:52	bound
1 item									

# DHCP Pool





# Firewall - NAT



The screenshot shows the Mikrotik WinBox Firewall configuration window, specifically the NAT tab. The window has a blue title bar and a menu bar with options: Filter Rules, NAT, Mangle, Service Ports, Connections, Address Lists, and Layer7 Protocols. Below the menu bar is a toolbar with icons for adding, deleting, enabling, disabling, and saving rules, as well as buttons for 'Reset Counters' and 'Reset All Counters'. A search bar with the text 'Find' and a dropdown menu with 'all' is also present. The main area contains a table of NAT rules. Rule 1 is selected and highlighted in blue. The table has columns for #, Action, Chain, Src. Address, Dst. Address, Prot..., Src. Port, Dst. Port, In. In..., Out. Interface, Bytes, and Packets. At the bottom of the window, it says '3 items (1 selected)'.

#	Action	Chain	Src. Address	Dst. Address	Prot...	Src. Port	Dst. Port	In. In...	Out. Interface	Bytes	Packets
0 X	dst-nat	dstnat			6 (tcp)		80	WAN ...		0 B	0
1	masquerade	srcnat							LasNaves	49.8 KiB	530
2 X	masquerade	srcnat							WAN - COAXIAL	0 B	0

# Firewall - Service Ports

Firewall				
Filter Rules NAT Mangle Service Ports Connections Address Lists Layer7 Protocols				
<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>				
Name	Ports	SIP Direct Media		
ftp	21			
h323				
irc	6667			
pptp				
sip	5060, 5061	yes		
tftp	69			
6 items				

# Firewall - Rules

Firewall											
Filter Rules NAT Mangle Service Ports Connections Address Lists Layer7 Protocols											
<div><div><div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div></div></div><div><div>00</div><div>Reset Counters</div></div><div><div>00</div><div>Reset All Counters</div></div></div>											
#	Action	Chain	Src. Address	Dst. Address	Protocol	Src. Port	...	In...	Out. In...	Bytes	Packets
0	✓ accept	input			1 (icmp)			p...		119.8 KiB	1 521
1	✓ accept	input			6 (tcp)			p...		597.7 KiB	9 159
2	✓ accept	input			6 (tcp)			p...		400 B	7
3	✓ accept	input	8.8.8.8		17 (udp)	53		p...		33.9 MiB	257 963
4	✓ accept	input	8.8.4.4		17 (udp)	53		p...		29.3 MiB	221 265
;;; Allow PPTP											
5	✓ accept	input			6 (tcp)					10.0 KiB	187
;;; Allow PPTP protocol 47											
6	✓ accept	input			47 (gre)					297.0 MiB	1 935 950
;;; Allow OpenVPN											
7 X	✓ accept	input			6 (tcp)					0 B	0
8	✗ drop	input						p...		37.2 MiB	420 162

# Firewall - Mangle

The screenshot displays the Mikrotik WinBox Firewall Mangle configuration interface. It is divided into three main sections: a list of existing rules, and two detailed views of specific rules.

**Firewall Mangle Rules List:**

#	Action	Chain	Src. Address	Dst. Address	Prot...	Src
0	✓ change MSS	forward			6 (tcp)	
1	✓ change MSS	forward			6 (tcp)	
;;; A CENTRALETA IP						
2	✎ mark packet	prerouting	178.33.1...			
3	✎ mark packet	postrouting		178.33.1...		
;;; ALTRES DESTINACIONES						
4	✎ mark packet	prerouting				
5	✎ mark packet	postrouting				

6 items (1 selected)

**Rule Configuration 1 (Left):**

- Action: mark packet
- Log: ☐
- Log Prefix:
- New Packet Mark: altres\_pack\_down
- Passthrough: ☐

**Rule Configuration 2 (Right):**

- Action: mark packet
- Log: ☐
- Log Prefix:
- New Packet Mark: voip\_pack\_down
- Passthrough: ☐

# Quality Of Service

Queue List										
Simple Queues Interface Queue Queue Tree Queue Types										
+ - ✓ ✗ [icon] [icon] Reset Counters 00 Reset All Counters Find										
Name	Parent	Packet Marks	Limit At (bits/s)	Max Limit (bit..	Avg. Rate	Queued Bytes	Bytes	Packets		
DOWNLOAD	global			100M	4.2 kbps	0 B	127.6 GiB	136 223 364		
ALTRES_DOWNLOAD	DOWNLOAD	altres_pack_down		85M	4.2 kbps	0 B	126.5 GiB	129 618 327		
VOIP_DOWNLOAD	DOWNLOAD	voip_pack_down	1M	10M	0 bps	0 B	1162.5 MiB	6 605 037		
UPLOAD	global			10M	13.6 kbps	0 B	30.5 GiB	94 742 317		
ALTRES_UPLOAD	UPLOAD	altres_pack_up		8M	13.6 kbps	0 B	29.2 GiB	86 854 894		
VOIP_UPLOAD	UPLOAD	voip_pack_up	1M	8M	0 bps	0 B	1403.5 MiB	7 887 423		

# PPTP o VPN

**PPTP Server**

☒ Enabled

Max MTU: 1450

Max MRU: 1450

MRRU:

Keepalive Timeout: 30

Default Profile: default-encryption

Authentication: ☒ mschap2 ☒ mschap1 ☐ chap ☐ pap

OK Cancel Apply

**PPP Profile <pptp-encryption>**

General Protocols Limits Queue Scripts

Name: pptp-encryption

Local Address: 10.10.10.1

Remote Address: dhcp\_pptp

Bridge:

Bridge Port Priority:

Bridge Path Cost:

OK Cancel Apply Comment Copy Remove

**IP Pool <dhcp\_pptp>**

Name: dhcp\_pptp

Addresses: 10.10.10.20-10.10.10.100

Next Pool: none

OK Cancel Apply Copy Remove

**PPP**

Interface PPPoE Servers Secrets Profiles Active Connections L2TP Secrets

PPP Authentication&Accounting

Na...	Password	Service	Caller ID	Profile	Local Address	Remote Address	Last Logged Out
g...	*****	pptp		pptp-ency...			
ju...	*****	pptp		pptp-ency...			
n...	*****	pptp		pptp-ency...			Jun/21/2016 18:20:42
o...	*****	ovpn		openvpn			Apr/19/2016 16:37:09
p...	*****	ovpn		openvpn			Mar/31/2016 13:18:47
p...	*****	pptp		pptp-ency...			May/10/2016 18:15:29
ra...	*****	pptp		pptp-ency...			Apr/21/2016 10:54:11

7 items

# Thank You

## Any Questions?