



WiFi lab časť 1/3

Topológia a základná konektivita

KIS FRI UNIZA

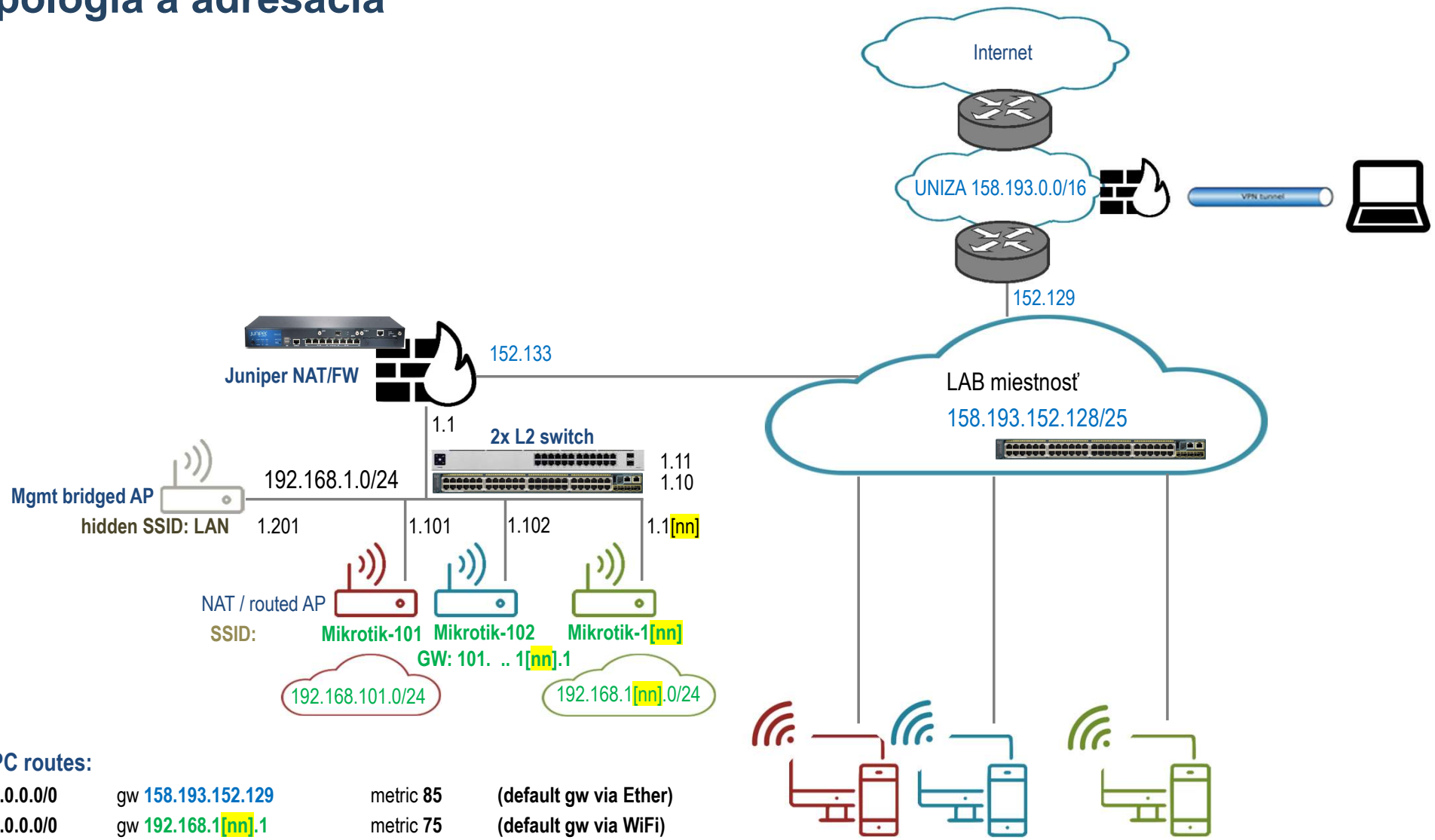


Vytvorené v rámci projektu **KEGA 026TUKE-4/2021**

Agenda

- Topológia a adresácia
- Kontrola základnej konektivity PC
- Základná konfigurácia AP
- Úlohy

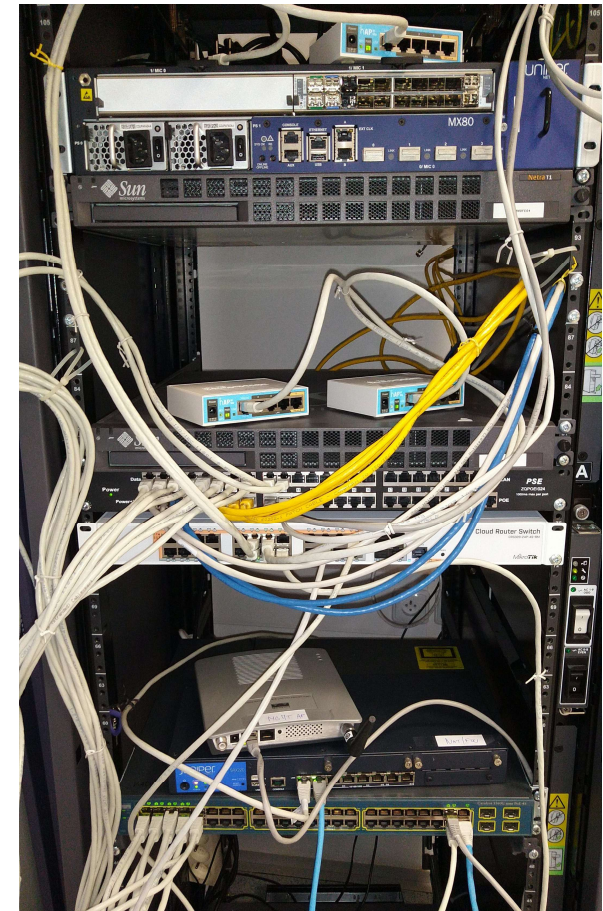
Topológia a adresácia



PC routes:

0.0.0.0/0	gw 158.193.152.129	metric 85	(default gw via Ether)
0.0.0.0/0	gw 192.168.1[nn].1	metric 75	(default gw via WiFi)
158.193.0.0/16	gw 158.193.152.129	metric 25	(UNIZA net)

LAB



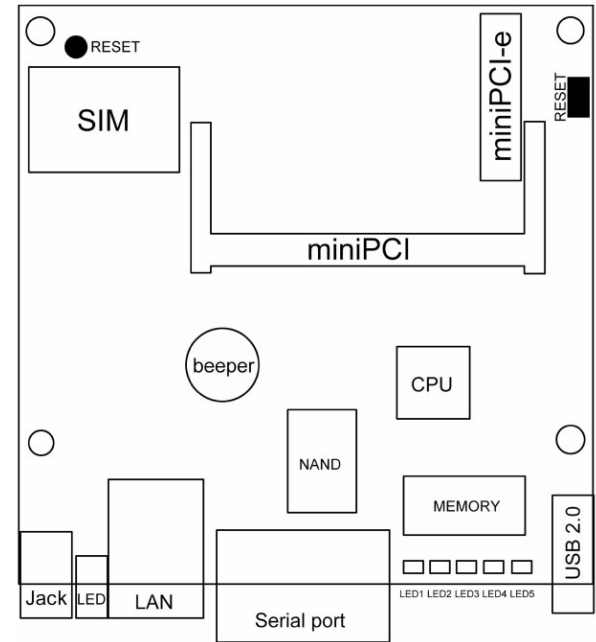
Mikrotik AP



RouterBOARD 411UAHR



Details	
Product code	RB411UAHR
Architecture	MIPSBE
CPU	AR7161
CPU core count	1
CPU nominal frequency	680 MHz
Dimensions	105x105mm
RouterOS license	4
Size of RAM	64 MB
Storage size	64 MB
Storage type	NAND
Tested ambient temperature	-30C to 60C

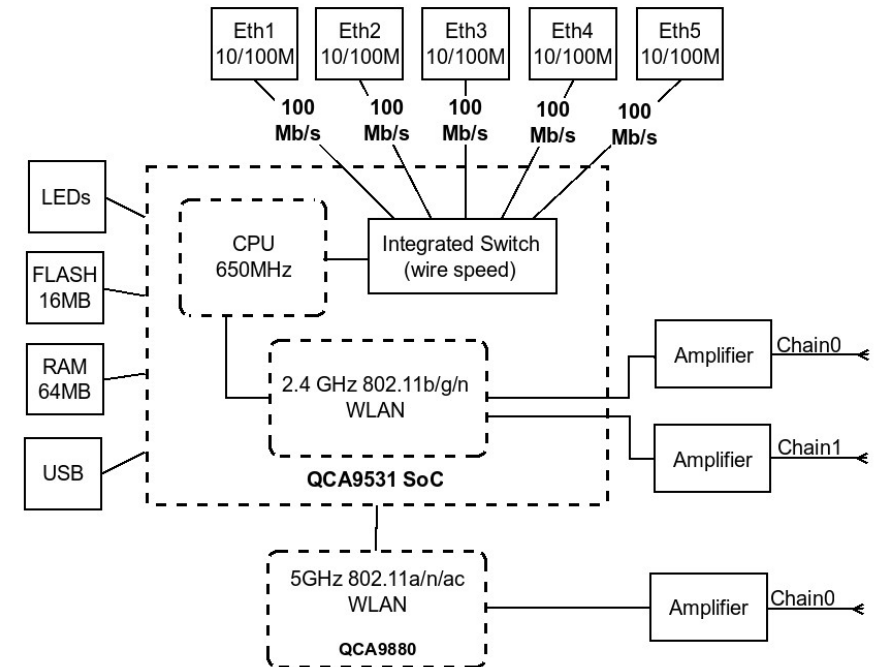


Microtik has different types of CPU: MIPS, ARM, SMIPS, TILE based HW architecture

Mikrotik AP



hAP ac lite (RB952Ui-5ac2nD)



Mikrotik hAP ac lite
RouterBOARD RB952Ui-5ac2nD

650MHz MIPSBE CPU, 64MB RAM, five 10/100Mbps Ethernet ports (PoE output on port #5), dual-chain 802.11b/g/n 2.4GHz wireless, single chain 802.11a/n/ac 5GHz wireless, USB port for 3G/4G modem and a RouterOS L4 license

Adresácia a skupiny

Skupina											
a	Model	Meno	S/N	Wlan MAC	Ether MAC	SSID	WPA2 Pre-shared Key	NET	uplink	login	pass
1	411UAHR	Mikrotik 1	24D10199373A	00:0C:42:44:6F:8E	00:0C:42:44:6F:8D	Mikrotik-101	!234567*	192.168.101.1/24	192.168.1.101	admin	k!s143
2	411UAHR	Mikrotik 2	24D1019445AE	00:0C:42:49:1D:1A	00:0C:42:49:1D:19	Mikrotik-102	!234567*	192.168.102.1/24	192.168.1.102	admin	k!s143
3	411UAHR	Mikrotik 3	24D101944462	00:0C:42:49:1C:D6	00:0C:42:49:1C:D5	Mikrotik-103	!234567*	192.168.103.1/24	192.168.1.103	admin	k!s143
4	411UAHR	Mikrotik 4	24D1019445BE	00:0C:42:49:1D:0A	00:0C:42:49:1D:09	Mikrotik-104	!234567*	192.168.104.1/24	192.168.1.104	admin	k!s143
5	411UAHR	Mikrotik 5	24D10199371A	00:0C:42:44:6F:AE	00:0C:42:44:6F:AD	Mikrotik-105	!234567*	192.168.105.1/24	192.168.1.105	admin	k!s143
6	411UAHR	Mikrotik 6	24D1019445B4	00:0C:42:49:1D:04	00:0C:42:49:1D:03	Mikrotik-106	!234567*	192.168.106.1/24	192.168.1.106	admin	k!s143
7	411UAHR	Mikrotik 7	24D10194447C	00:0C:42:49:1C:CC	00:0C:42:49:1C:CB	Mikrotik-107	!234567*	192.168.107.1/24	192.168.1.107	admin	k!s143
8	411UAHR	Mikrotik 8	24D10199372A	00:0C:42:44:6F:9E	00:0C:42:44:6F:9D	Mikrotik-108	!234567*	192.168.108.1/24	192.168.1.108	admin	k!s143
9	411UAHR	Mikrotik 9	24D10194442A	00:0C:42:49:1C:9E	00:0C:42:49:1C:9D	Mikrotik-109	!234567*	192.168.109.1/24	192.168.1.109	admin	k!s143
10	411UAHR	Mikrotik 10	24D101993724	00:0C:42:44:6F:94	00:0C:42:44:6F:93	Mikrotik-110	!234567*	192.168.110.1/24	192.168.1.110	admin	k!s143
11	RB952Ui-5ac2nD	Mikrotik 11	CC3E0EDD4C25	2C:C8:1B:4C:F9:B6	2C:C8:1B:4C:F9:B0	Mikrotik-111	!234567*	192.168.111.1/24	192.168.1.111	admin	k!s143
12	RB952Ui-5ac2nD	Mikrotik 12	CC3E0E60402C	2C:C8:1B:4C:B0:40	2C:C8:1B:4C:B0:3A	Mikrotik-112	!234567*	192.168.112.1/24	192.168.1.112	admin	k!s143
13	RB952Ui-5ac2nD	Mikrotik 13	CC3E0E52B863	2C:C8:1B:4C:D3:E7	2C:C8:1B:4C:D3:E1	Mikrotik-113	!234567*	192.168.113.1/24	192.168.1.113	admin	k!s143
14	RB952Ui-5ac2nD	Mikrotik 14	CC3E0E83DB79	2C:C8:1B:25:F2:3A	2C:C8:1B:25:F2:34	Mikrotik-114	!234567*	192.168.114.1/24	192.168.1.114	admin	k!s143
15	RB952Ui-5ac2nD	Mikrotik 15	CC3E0EC59727	2C:C8:1B:26:04:26	2C:C8:1B:26:04:20	Mikrotik-115	!234567*	192.168.114.1/24	192.168.1.114	admin	k!s143

Prístupy

PC:

1.) Lokálny prístup alebo 2.) Remote Desktop Connection app - mstsc.exe (resp. iný program na vzdialené ovládanie počítača)

login/pass: RB03-[čísloPC]\student / student

Mikrotik (v default móde):

default login/pass: admin / <blank>

default net: 192.168.88.1/24, alebo 0.0.0.0/0

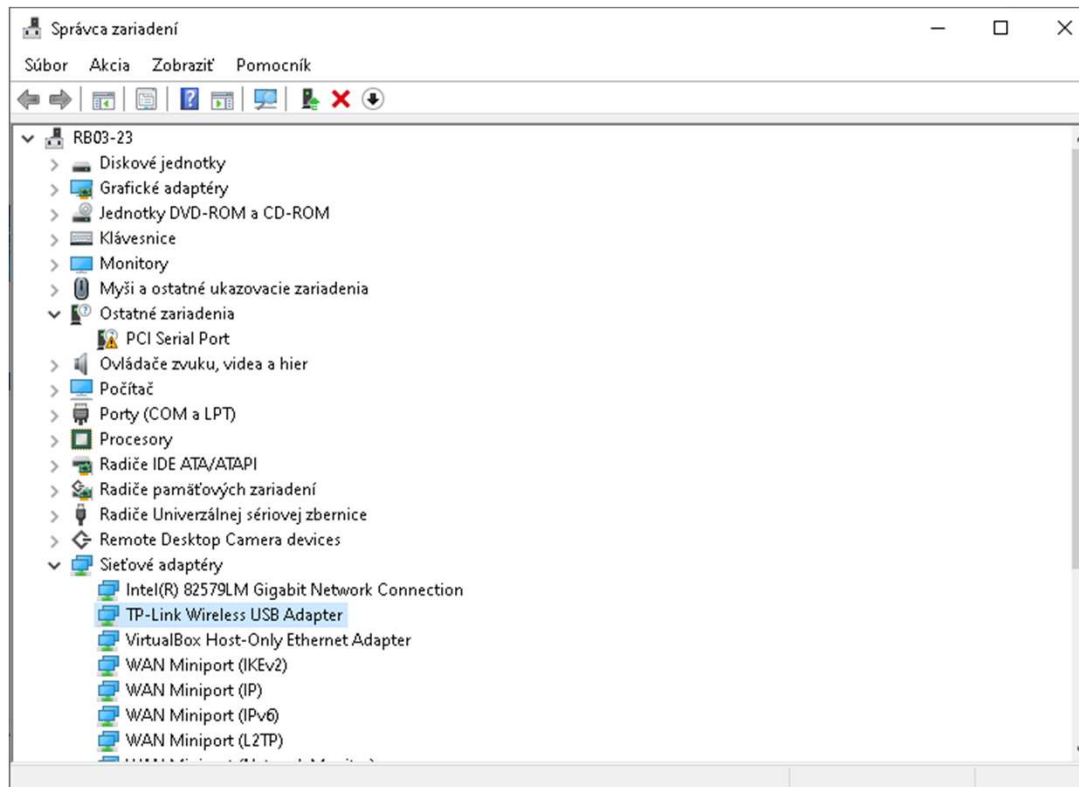
prístup cez program Winbox a MAC adresu



Kontrola základného nastavenia PC

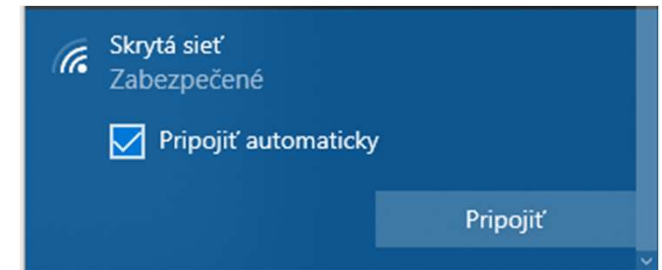
WiFi sieť

1. Skontrolovať inštaláciu USB WiFi adaptéra na PC; **Start + X** Device Manager (Správca zariadení)



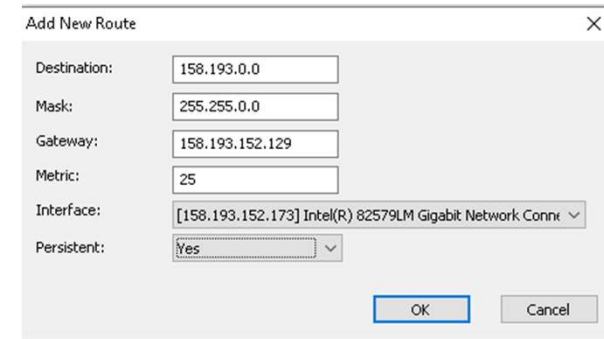
Pripojenie na menežmentovú WiFi sieť

1. Pripojiť sa cez WiFi adaptér na skryté (hidden) SSID LAN
 - SSID viditeľné: nie
 - Kľúč: a123456789
2. Odpojiť WiFi sieť



PC routing table: NetRouterView

1. Priečinok C:\ZBT-SW\netrouterview, spustiť program
2. Skontrolovať metriku 0.0.0.0/0 GW 152.129 -> metrika vyššia ako 200
3. Skontrolovať statické smerovanie 158.193.0.0/16 GW 158.193.152.129
4. Pripojiť /skontrolovať pripojenie/ sa cez WiFi adaptér na SSID LAN
5. Skontrolovať smerovaciu tabuľku, vid' nižšie na pravej strane



Add New Route

Destination: 158.193.0.0

Mask: 255.255.0.0

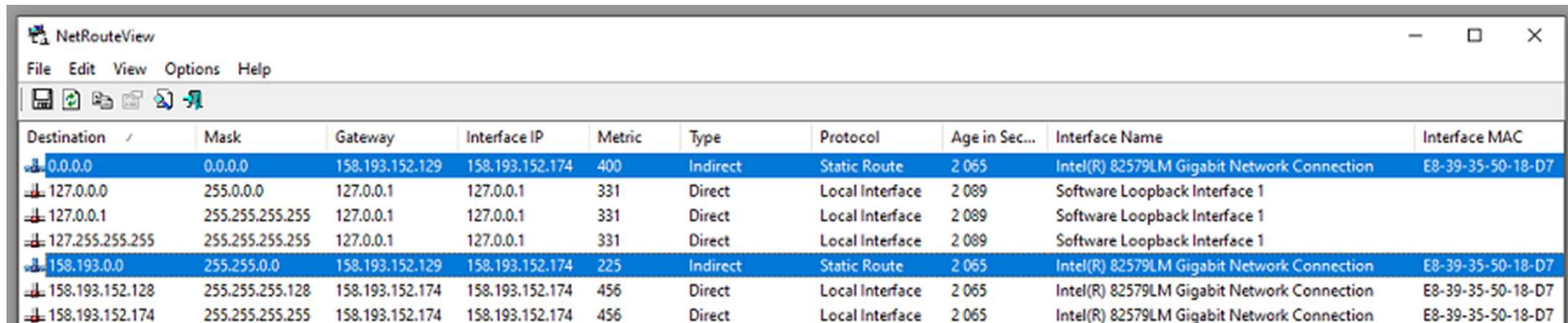
Gateway: 158.193.152.129

Metric: 25

Interface: [158.193.152.173] Intel(R) 82579LM Gigabit Network Conn...

Persistent: Yes

OK Cancel



Destination	Mask	Gateway	Interface IP	Metric	Type	Protocol	Age in Sec...	Interface Name	Interface MAC
0.0.0.0	0.0.0.0	158.193.152.129	158.193.152.174	400	Indirect	Static Route	2 065	Intel(R) 82579LM Gigabit Network Connection	E8-39-35-50-18-D7
127.0.0.0	255.0.0.0	127.0.0.1	127.0.0.1	331	Direct	Local Interface	2 089	Software Loopback Interface 1	
127.0.0.1	255.255.255.255	127.0.0.1	127.0.0.1	331	Direct	Local Interface	2 089	Software Loopback Interface 1	
127.255.255.255	255.255.255.255	127.0.0.1	127.0.0.1	331	Direct	Local Interface	2 089	Software Loopback Interface 1	
158.193.0.0	255.255.0.0	158.193.152.129	158.193.152.174	225	Indirect	Static Route	2 065	Intel(R) 82579LM Gigabit Network Connection	E8-39-35-50-18-D7
158.193.152.128	255.255.255.128	158.193.152.174	158.193.152.174	456	Direct	Local Interface	2 065	Intel(R) 82579LM Gigabit Network Connection	E8-39-35-50-18-D7
158.193.152.174	255.255.255.255	158.193.152.174	158.193.152.174	456	Direct	Local Interface	2 065	Intel(R) 82579LM Gigabit Network Connection	E8-39-35-50-18-D7

Apps WifInfoView alebo WirelessNetView

1. Priečinok C:\ZBT-SW\wifinfoview
2. Spustiť program

The screenshot shows the WifInfoView application in Full Details Mode. The main window displays a table of detected wireless networks. Below the table, several network elements are listed with their respective hex addresses. A 'Properties' dialog box is open, showing detailed information for the selected network, Mikrotik-101.

SSID	MAC Address	PHY Type	RSSI	Signal Quality	Average Signal...	Frequency	Channel	Information Size	Elements Count	Company	Router Model	Router Name	Security	Cipher
eduroam	70-E4-22-C5-24-01	802.11g/n	-47	100	99.9	2,437	6	197	18	Cisco Systems, Inc			WPA2-EAP	CCMP
eduroam	70-E4-22-C5-24-0E	802.11n/ac	-53	94	95.4	5,240	48	229	19	Cisco Systems, Inc			WPA2-EAP	CCMP
eduroam	00-24-38-F3-D9-A0	802.11g/n	-66	68	75.0	2,462	11	195	16	Brocade Communicatio...			WPA2-EAP	CCMP
eduroam	84-B2-61-90-D5-51	802.11g/n	-73	54	59.3	2,437	6	200	18	Cisco Systems, Inc			WPA2-EAP	CCMP
BRAINIT	7C-6B-CA-AF-3F-0E	802.11g/n	-80	40	47.5	2,462	11	214	14	TP-LINK TECHNOLOGIE...			WPA2-PSK	CCMP
DIRECT-pj-9...	9A-AE-D3-40-CE-...	802.11g/n	-61	78	82.0	2,412	1	402	14		EPSON 2247U	EB40CECC	WPA2-PSK	CCMP
KMME_wifi	50-D4-F7-3D-2A-FC	802.11g/n	-79	42	44.2	2,417	2	355	14	TP-LINK TECHNOLOGIE...	TL-WR940N	Wireless Router T...	WPA2-PSK	CCMP
Mikrotik-101	00-0C-42-44-6F-8E	802.11g	-29	100	100.0	2,412	1	108	8	Routerboard.com			WPA2-PSK	CCMP

Element ID: 0 (SSID)
4D 69 6B 72 6F 74 69 6B 2D 31 30 31 Mikrotik-101

Element ID: 1 (Supported Rates)
82 84 8B 96 0C 12 18 24

Element ID: 3 (DS Parameter Set)
01

Element ID: 5 (Traffic Indication Map)
00 01 00 00

Element ID: 42 (802.11g Information)
00

Element ID: 48 (Robust Security Network)
01 00 00 0F AC 04 01 00 00 0F AC 04 01 00 00 0F
AC 02 00 00

Element ID: 50 (Extended Supported Rates)
30 48 60 6C 0H'1

Element ID: 221 (Vendor Specific)
00 0C 42 00 00 01 1E 00 10 00 00 03 66 30 06 ..B.....f0.
00 00 30 30 30 43 34 32 34 34 36 46 38 45 00 00 ..000C42446F8E.
00 00 00 00 00 00 05 02 6C 09

Properties

SSID: Mikrotik-101

MAC Address: 00-0C-42-44-6F-8E

PHY Type: 802.11g

RSSI: -29

Signal Quality: 100

Average Signal Quality: 100.0

Frequency: 2,412

Channel: 1

Information Size: 108

Elements Count: 8

Company: Routerboard.com

Router Model:

Router Name:

Security: WPA2-PSK

Cipher: CCMP

Maximum Speed: 54 Mbps

Channel Width: 20 MHz

Channels Range: 1 - 3

BSS Type: Infrastructure

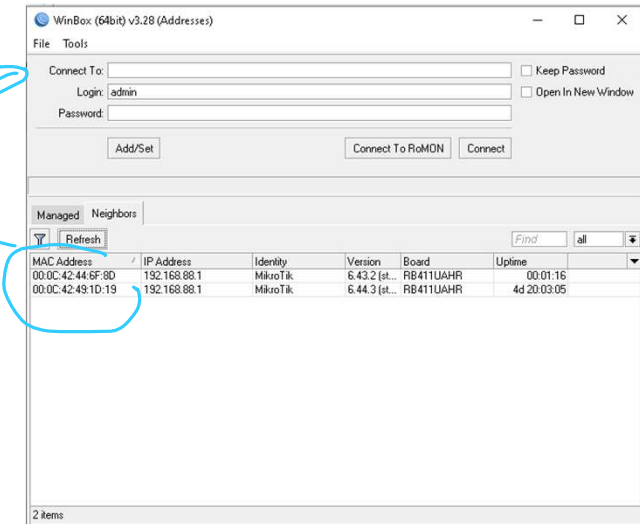
WPS Support: No



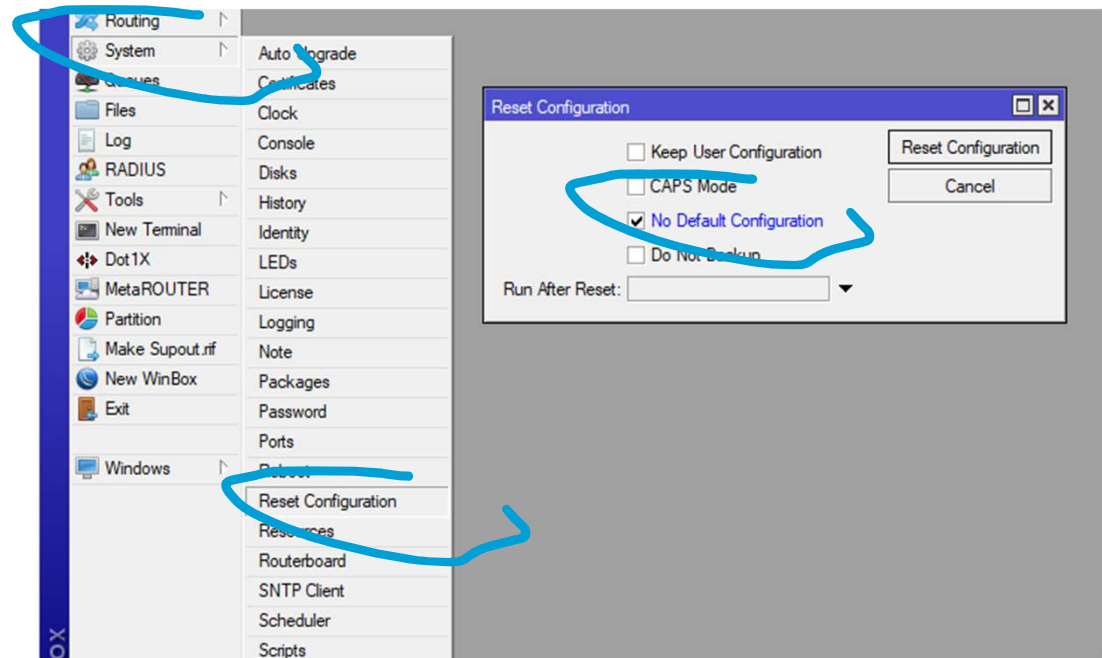
Mikrotik AP – základná konektivita

Program WinBox, základné nastavenie Mikrotik AP

1. Priečinkok C:\ZBT-SW\winbox
2. Pripojiť /skontrolovať pripojenie/ sa na SSID: LAN
3. Spustiť program Winbox.exe,
5. Zobrazit' všetky pripojené Mikrotik APs na Wifi sieti v default nastavení
6. Pripojiť sa na pridelené zariadenie prostredníctvom MAC adresy (right click na MAC adresu), vid' rozdelenie do skupín (snímka 4)



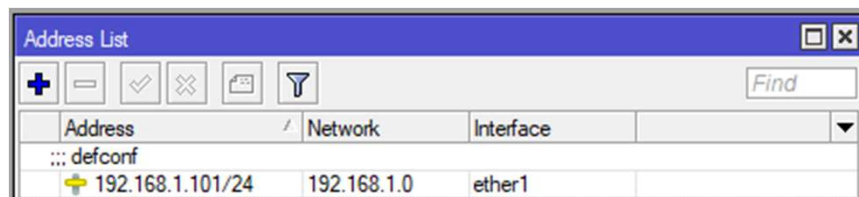
Vymazať existujúcu konfiguráciu:
(System -> Reset configuration -> No Default Configuration)



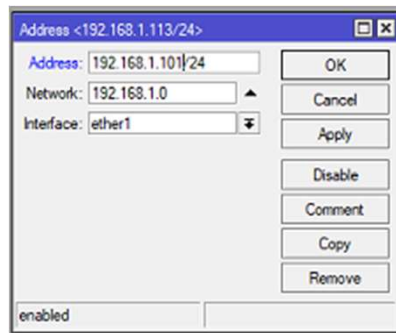
Program WinBox, základné nastavenie Mikrotik AP

1. Pripojiť sa na MAC adresu AP prostredníctvom programu Winbox
2. Nakonfigurovať/zmeniť pridelenú IP adresu na Ethernet rozhraní, vid' tabuľka vyššie

(IP - Addresses)



Address	Network	Interface
192.168.1.101/24	192.168.1.0	ether1

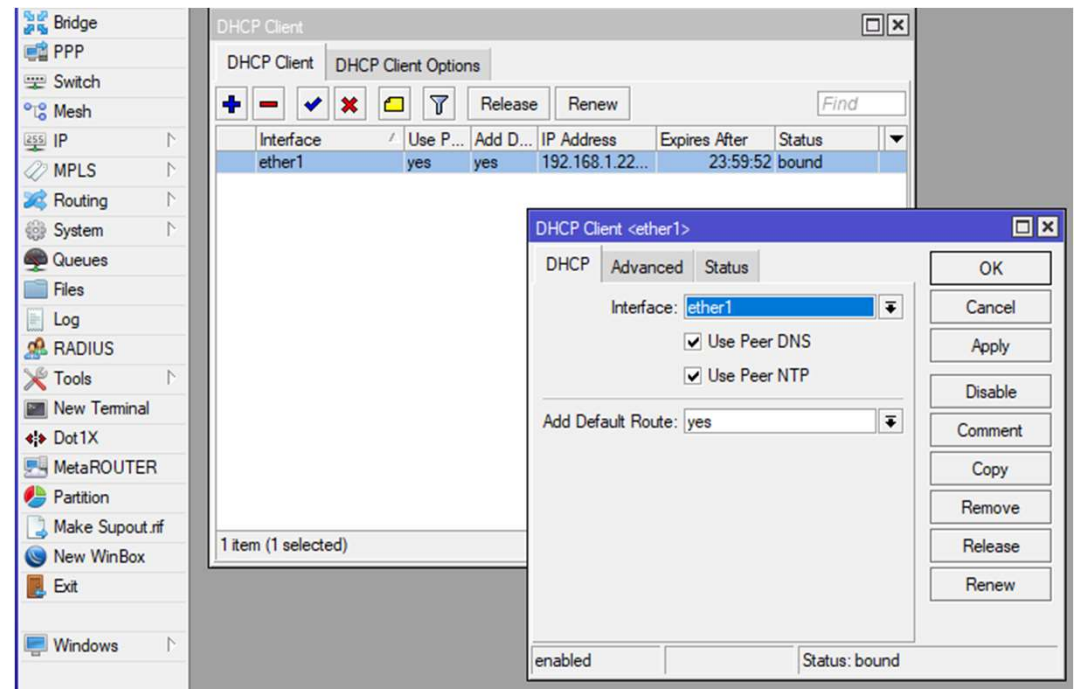


Address: 192.168.1.101/24
Network: 192.168.1.0
Interface: ether1

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

Status: enabled

Alternatívna možnosť (nie pre LAB cvičenie):
Spustiť DHCP klienta na Ethernet rozhraní
(IP – DHCP Client)

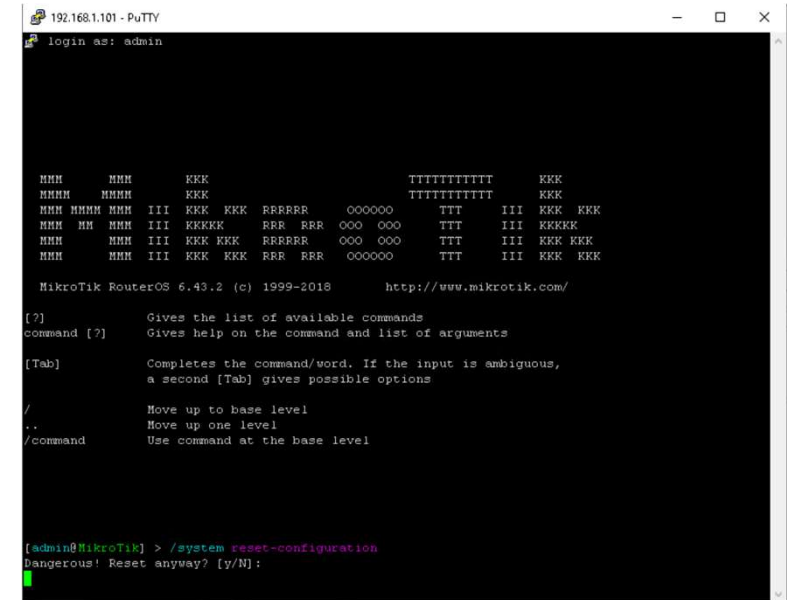


WinBox DHCP Client configuration window showing the DHCP Client list and the configuration dialog for ether1.

WinBox DHCP Client configuration dialog for ether1 showing options like Use Peer DNS and Use Peer NTP.

Overiť SSH prístup na AP zariadenie prostredníctvom aplikácie Putty

1. Pripojiť sa /skontrolovať pripojenie/ na SSID: LAN
2. Otestovať SSH pripojenie na Mikrotik AP prostredníctvom programu Putty a zmenenej IP adresy
3. Zobrazit' konfiguráciu
/export
4. **OPTIONAL - vrátiť Mikrotik zariadenie do default stavu**
/system reset-configuration no-defaults=yes



```
192.168.1.101 - PuTTY
login as: admin

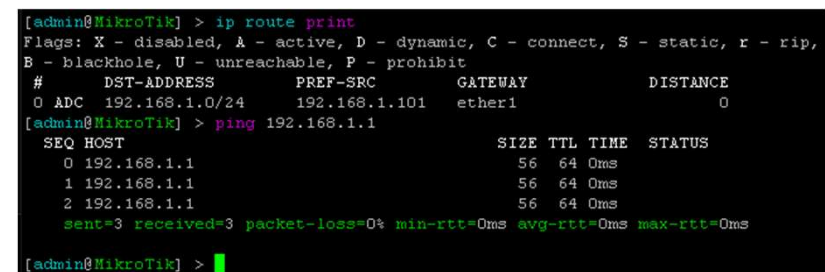
MMM   MMM   KKK               TTTTTTTTTT   KKK
MMMM  MMMM  KKK               TTTTTTTTTT   KKK
MMM  MMM  MMM  III  KKK  KKK  RRRRRR  OOOOOO  TTT  III  KKK  KKK
MMM  MM  MMM  III  KKKKK  RRR  RRR  OOO  OOO  TTT  III  KKKKK
MMM  MMM  III  KKK  KKK  RRRRRR  OOO  OOO  TTT  III  KKK  KKK
MMM  MMM  III  KKK  KKK  RRR  RRR  OOOOOO  TTT  III  KKK  KKK

MikroTik RouterOS 6.43.2 (c) 1999-2018      http://www.mikrotik.com/

[?] Gives the list of available commands
command [?] Gives help on the command and list of arguments
[Tab] Completes the command/word. If the input is ambiguous,
a second [Tab] gives possible options

/ Move up to base level
.. Move up one level
/command Use command at the base level

[admin@MikroTik] > /system reset-configuration
Dangerous! Reset anyway? [y/N]:
```



```
[admin@MikroTik] > ip route print
Flags: X - disabled, A - active, D - dynamic, C - connect, S - static, r - rip,
B - blackhole, U - unreachable, P - prohibit
# DST-ADDRESS      PREF-SRC  GATEWAY      DISTANCE
0 ADC 192.168.1.0/24 192.168.1.101 ether1        0
[admin@MikroTik] > ping 192.168.1.1
SEQ HOST          SIZE TTL TIME STATUS
0 192.168.1.1     56 64 0ms
1 192.168.1.1     56 64 0ms
2 192.168.1.1     56 64 0ms
sent=3 received=3 packet-loss=0% min-rtt=0ms avg-rtt=0ms max-rtt=0ms
[admin@MikroTik] >
```

Basic Navigation

[?]	Gives the list of available commands
command [?]	Gives help on the command and list of arguments
[Tab]	Completes the command/word. If the input is ambiguous, a second [Tab] gives possible options
/	Move up to base level
..	Move up one level
/command	Use command at the base level

Example: move from / base level to /system sub-level:

/ system

<https://wiki.mikrotik.com/wiki/Manual:Console>

SSH spojenie na konzolu AP zariadenie – počiatočné nastavenie cez CLI

Nastaviť prihlasovacie heslo, default gw, zakázať nepotrebné služby a nastaviť systémový čas

```
/user set 0 password="kls143"
```

```
/ip route add distance=1 gateway=192.168.1.1
```

```
/ip service
```

```
set telnet disabled=yes
```

```
set ftp disabled=yes
```

```
set www disabled=yes
```

```
set api disabled=yes
```

```
set api-ssl disabled=yes
```

```
/system clock
```

```
set time-zone-name=Europe/Bratislava
```

```
--
```

```
/interface print
```

```
/system resource print
```

```
[admin@MikroTik] >
[admin@MikroTik] > /ip service
[admin@MikroTik] /ip service> print
Flags: X - disabled, I - invalid
#  NAME                PORT ADDRESS
0  telnet                23
1  ftp                   21
2  www                   80
3  ssh                   22
4  XI www-ssl            443
5  api                   8728
6  winbox                8291
7  api-ssl               8729
[admin@MikroTik] /ip service> set telnet disabled=yes
[admin@MikroTik] /ip service> set ftp disabled=yes
[admin@MikroTik] /ip service> set www disabled=yes
[admin@MikroTik] /ip service> set api disabled=yes
[admin@MikroTik] /ip service> set api-ssl disabled=yes
[admin@MikroTik] /ip service> print
Flags: X - disabled, I - invalid
#  NAME                PORT ADDRESS
0  XI telnet            23
1  XI ftp               21
2  XI www               80
3  ssh                  22
4  XI www-ssl           443
5  XI api               8728
6  winbox               8291
7  XI api-ssl           8729
[admin@MikroTik] /ip service>
```

WiFi Access; router mode with NAT

1. Prostredníctvom aplikácie WinBox a pripojenia sa cez IP adresu (nie MAC adresu) nakonfigurovať základný WiFi prístup - pozrieť tabuľku s adresáciou a rozdelenie do skupín:

(IP - Addresses)

IP address on interface wlan1 192.168.1[nn].1/24

(Wireless - WiFi Interfaces)

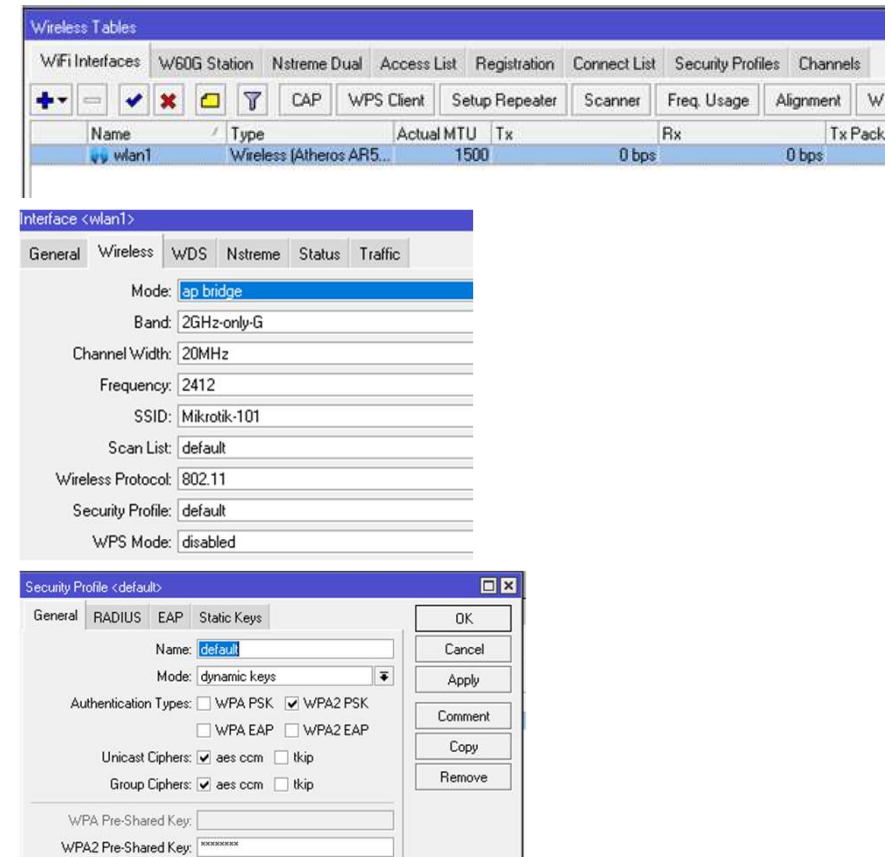
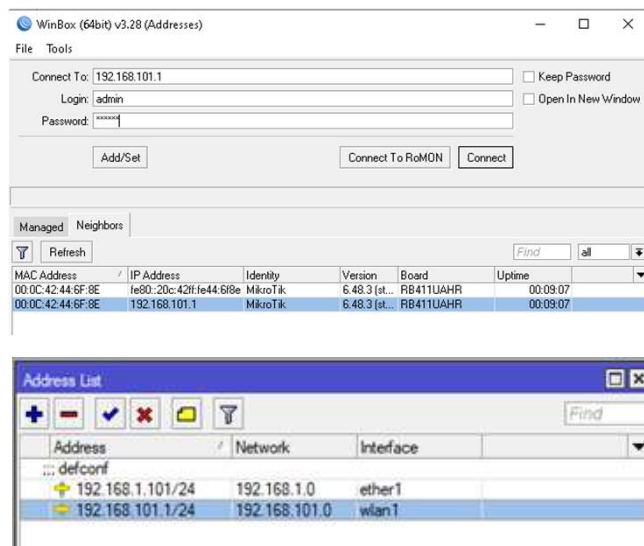
Enable wlan1 interface; <Double click>

Wireless: Mode <ap_bridge>, SSID: <Mikrotik-1nn>

(Wireless - Security Profile)

General: Mode <dynamic keys>; Auth type <wpa2 psk>;

WPA2 pre-shared key <wpa2 kľúč zo snímky 7>



WiFi Access; router mode with NAT

1. DHCP server config

(IP – Pool) Rozsah adries pre Wifi klientov

Name <name>

192.168.1.1[nn].201-192.168.1[nn].221

(IP – DHCP Server - DHCP)

Name <DHCP_service_name>;

Interface <wlan1>; Address pool <name>

(IP – DHCP Server - Networks)

Network address <192.168.1nn.0/24

GW <192.168.1nn.1

DNS servers 8.8.8.8

The image displays several screenshots from the Mikrotik WinBox interface:

- IP Pool:** A window showing a table with columns 'Name', 'Addresses', and 'Next Pool'. A row for 'pool1' is selected, with addresses '192.168.101.201-192.168.101.221' and 'none' as the next pool.
- IP Pool <pool1>:** A configuration dialog for the selected pool, with 'Name' set to 'pool1', 'Addresses' set to '192.168.101.201-192.168.101.221', and 'Next Pool' set to 'none'.
- DHCP Server:** A window with tabs for 'DHCP', 'Networks', 'Leases', 'Options', 'Option Sets', 'Vendor Classes', and 'Alerts'. A table shows a server named 'server1' on interface 'wlan1' with a lease time of '00:10:00' and address pool 'pool1'. Below is the 'DHCP Server <server1>' configuration dialog, where 'Name' is 'server1', 'Interface' is 'wlan1', 'Lease Time' is '00:10:00', and 'Address Pool' is 'pool1'.
- Firewall:** A window showing a table of filter rules. A NAT rule is selected, and the 'NAT Rule <>' configuration dialog is open. The 'Chain' is set to 'srcnat' and the 'Out. Interface' is 'ether1'.
- DHCP Network <192.168.101.0/24>:** A configuration dialog for a DHCP network, with 'Address' set to '192.168.101.0/24', 'Gateway' set to '192.168.101.1', and 'DNS Servers' set to '8.8.8.8'.

- Pripojiť sa z PC na novú nakonfigurovanú WiFi sieť (SSID: Mikrotik-1nn) a otestovať základnú konektivitu, pozri zadanie na nasledujúcom snímku

WiFi Access; router mode with NAT

1. Source NAT config

Nastavenie prekladu (Source NAT) WiFi IP adres klientov na IP adresu uplink rozhrania AP zariadenia

(IP – Firewall- NAT)

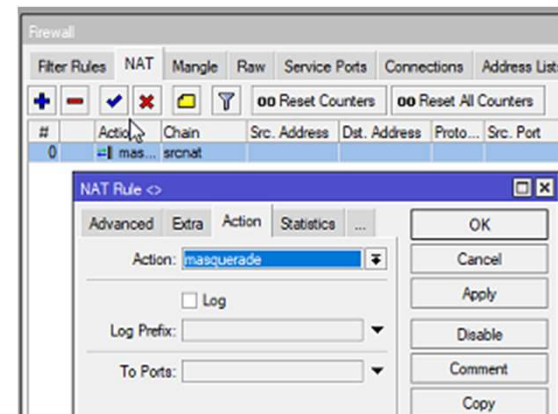
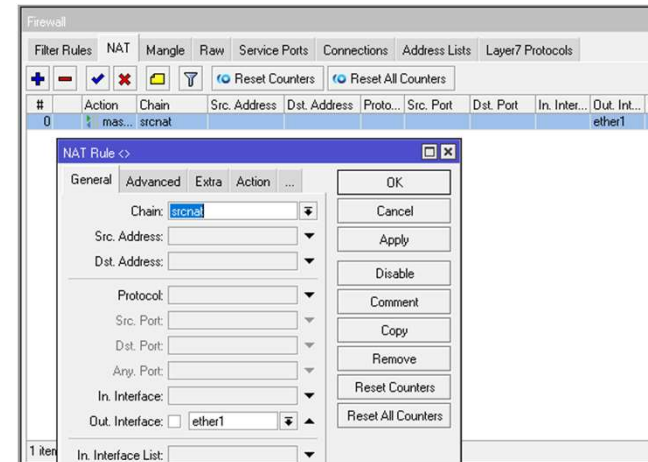
General:

Chain: <srcnat>

Out interface: <ether1>

Action:

Action: masquerade



2. Pripojiť sa z PC na novú nakonfigurovanú WiFi sieť (SSID: Mikrotik-1nn) a otestovať základnú konektivitu
3. Pozri a vypracuj zadania na nasledujúcom snímku

Úlohy, vypracovať stručnú PPT prezentáciu:

1. Záhlavie - číslo skupiny, názov cvičenia, rok a mená
2. Vaša topológia skupiny, adresácia
3. Zdokumentovať Mikrotik AP konfiguráciu, ktorú ste nakonfigurovali prostredníctvom SSH a WinBox
4. Zdokumentovať pridelenú IP, def GW a DNS na WiFi rozhraní na PC (príkaz `ipconfig`), a taktiež na zariadení Mikrotik AP *`/ip dhcp lease print`*
5. Zdokumentovať ping a tracert z PC na 192.168.1.1, 8.8.8.8 a www.google.com ; použiť aj príkaz *`/ip firewall connection print`* na zariadení Mikrotik AP)
6. Zdokumentovať smerovaciu tabuľku na PC
7. Vysvetliť, prečo príkaz `tracert 158.193.7.1` nesmeruje ICMP pakety cez Mikrotik AP
8. Aký autentikačný a šifrovací protocol používa AP s SSID LAN a zariadenie Mikrotik AP (app WifiInfoView resp. WirelessNetView a `C:\Users\student>netsh wlan show interfaces`)



Ďakujem za pozornosť.

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- Vytvorené v rámci projektu KEGA 026TUKE-4/2021