

Ihor Hreskiv - MikroTik Certified Trainer



MBUM #5

Warszawa 2021

Ihor Hreskiv

MikroTik Certified Trainer

Jestem miłośnikiem urządzeń
MikroTik-a od kilku lat

Potrafię wyjść z *VIM* :)

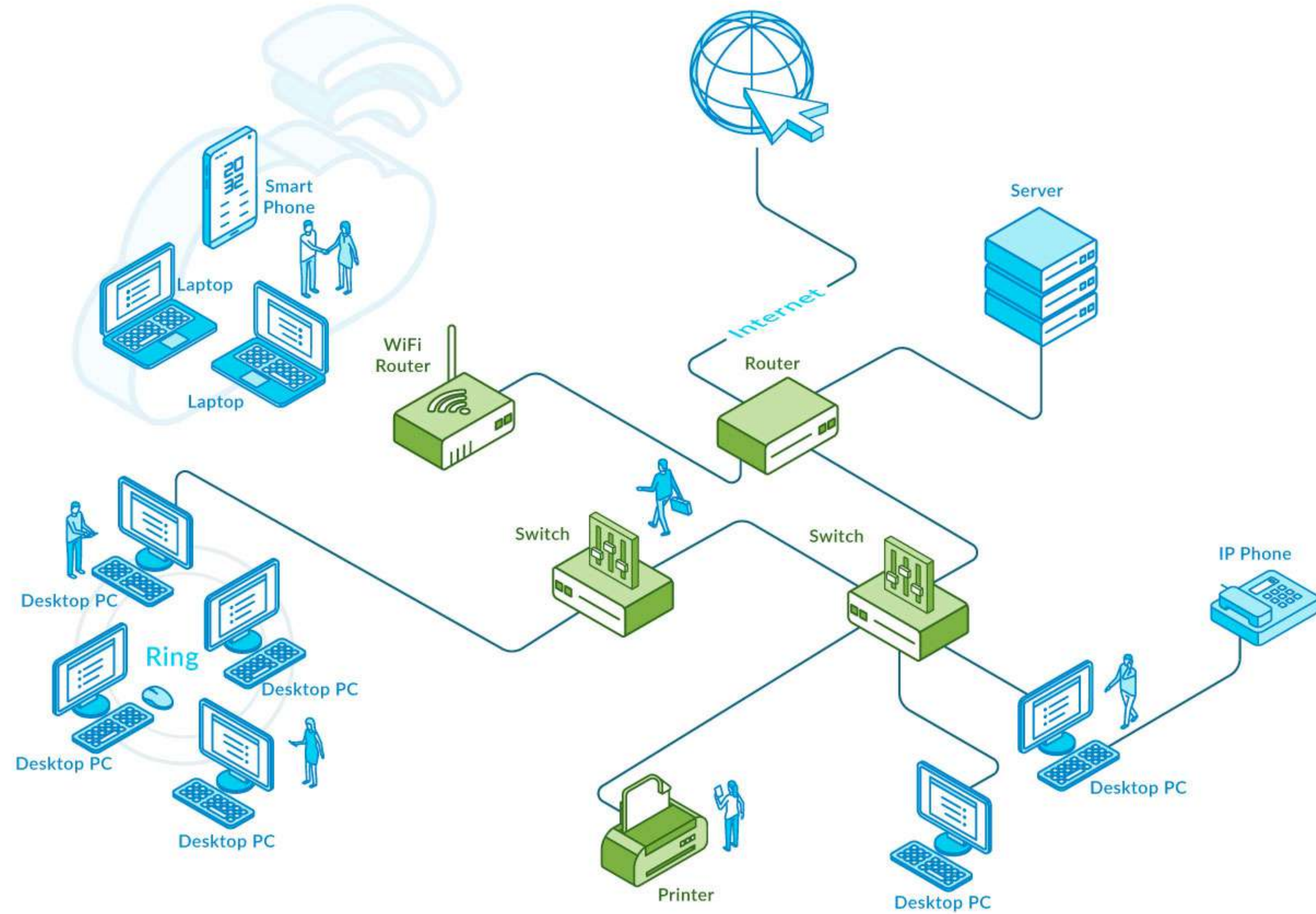
Korzystam z systemów wirtualizacji
dla testowania oraz wdrożenia

Najczęściej używam CHR

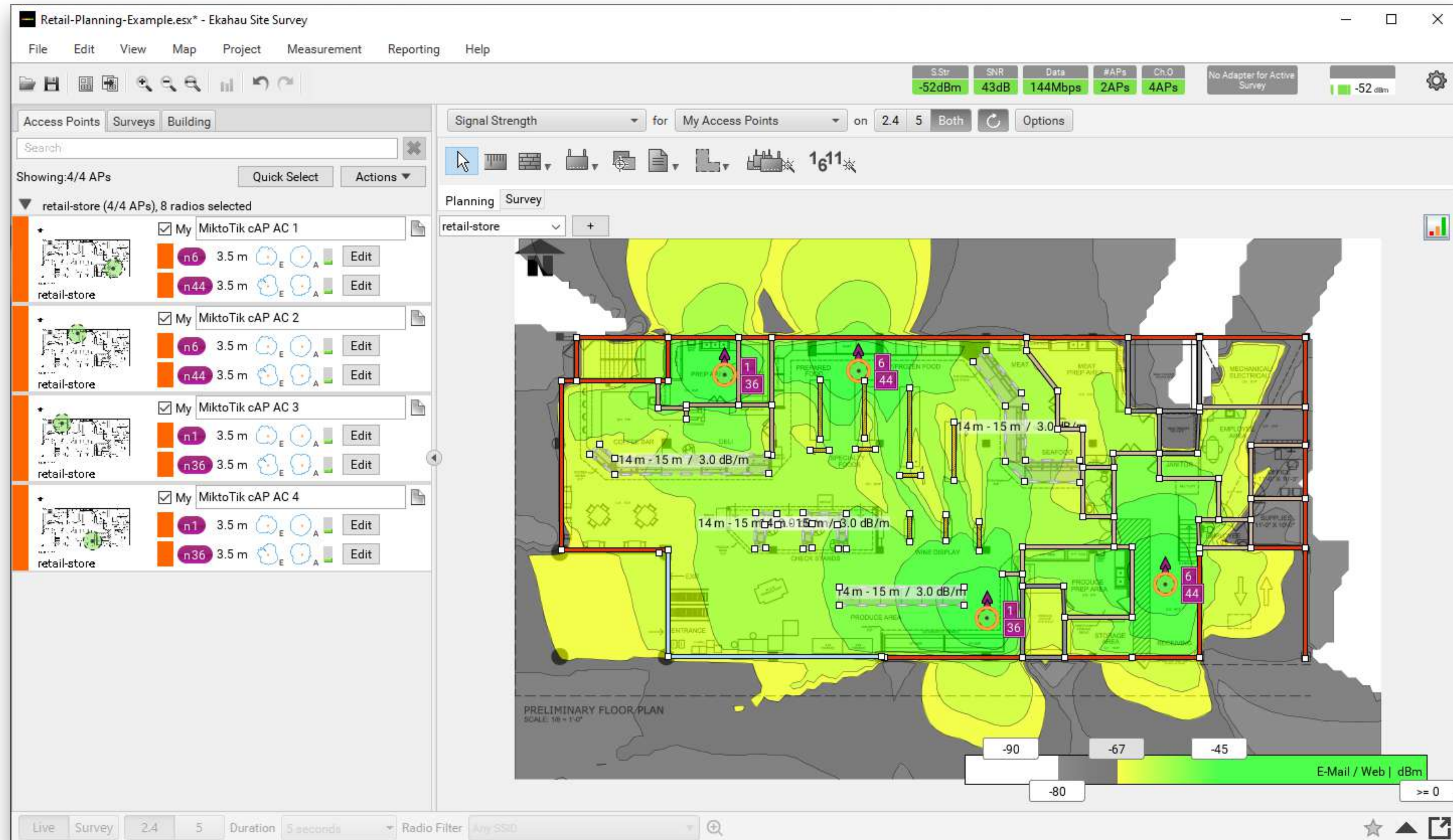


PIERWSZE KROKI

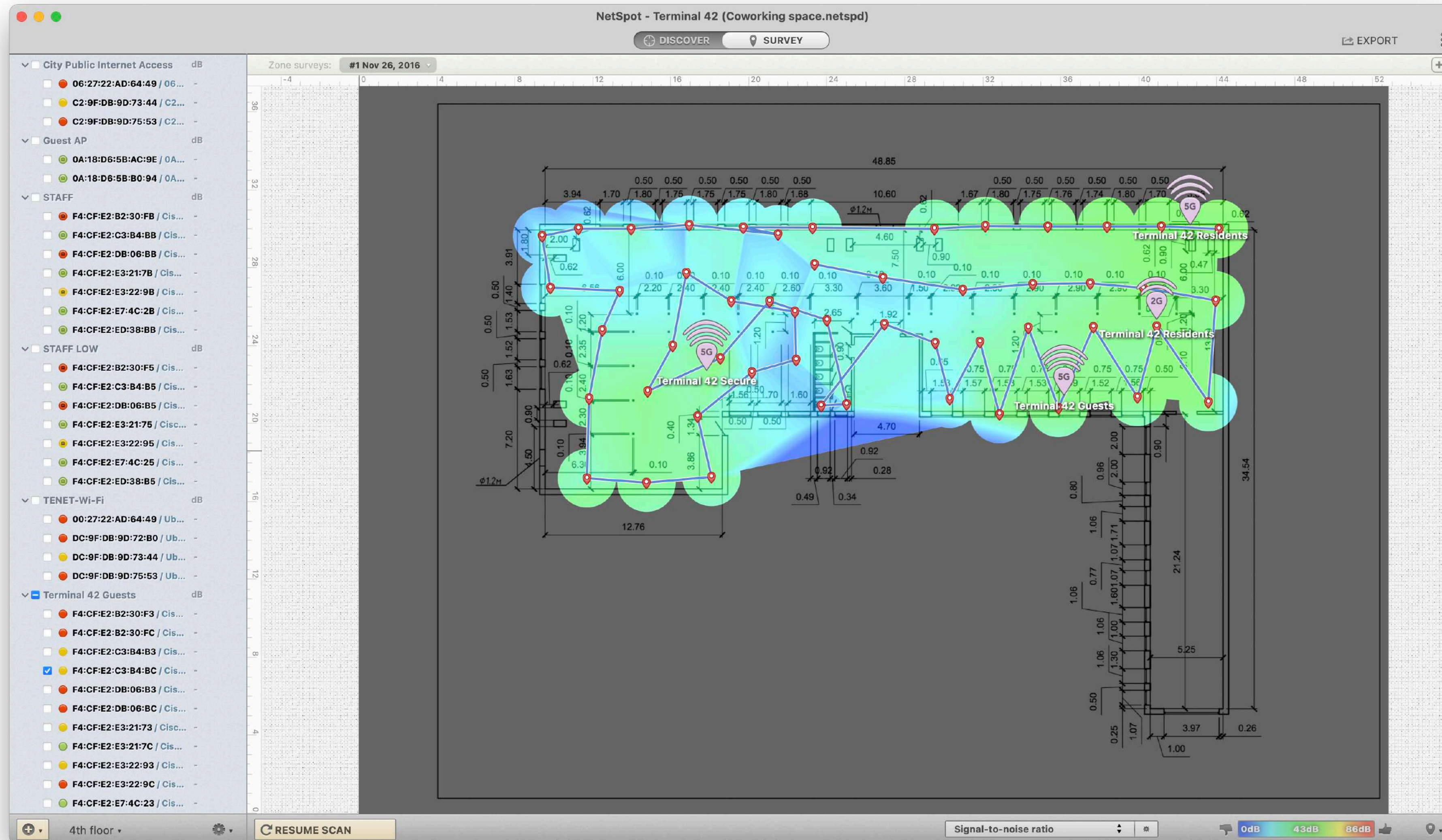
Planowanie



Planowanie Ekahau Pro

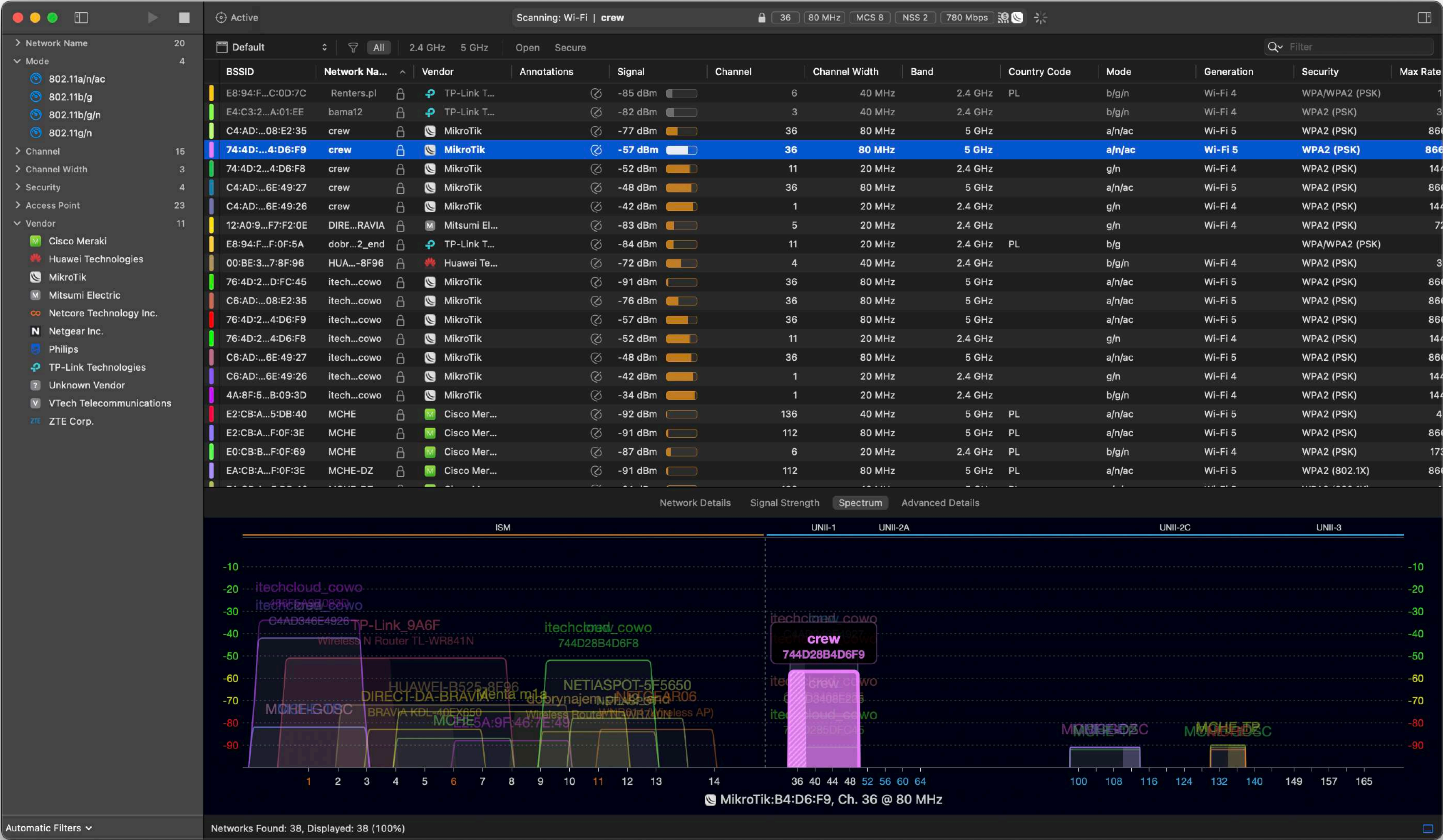


Planowanie NetSpot



Planowanie

WiFi Explorer Pro (MacOS)



HARDWARE / SOFTWARE

Połączenie do sieci testowej

Dostęp do Wi-Fi:

SSID: mbum#5

Login: vip

Hasło: 1234

VLAN: 55

Login: guest

Hasło: 1234

VLAN: 77

Access points

Indoor / Outdoor / Combined



wAP



OmniTik



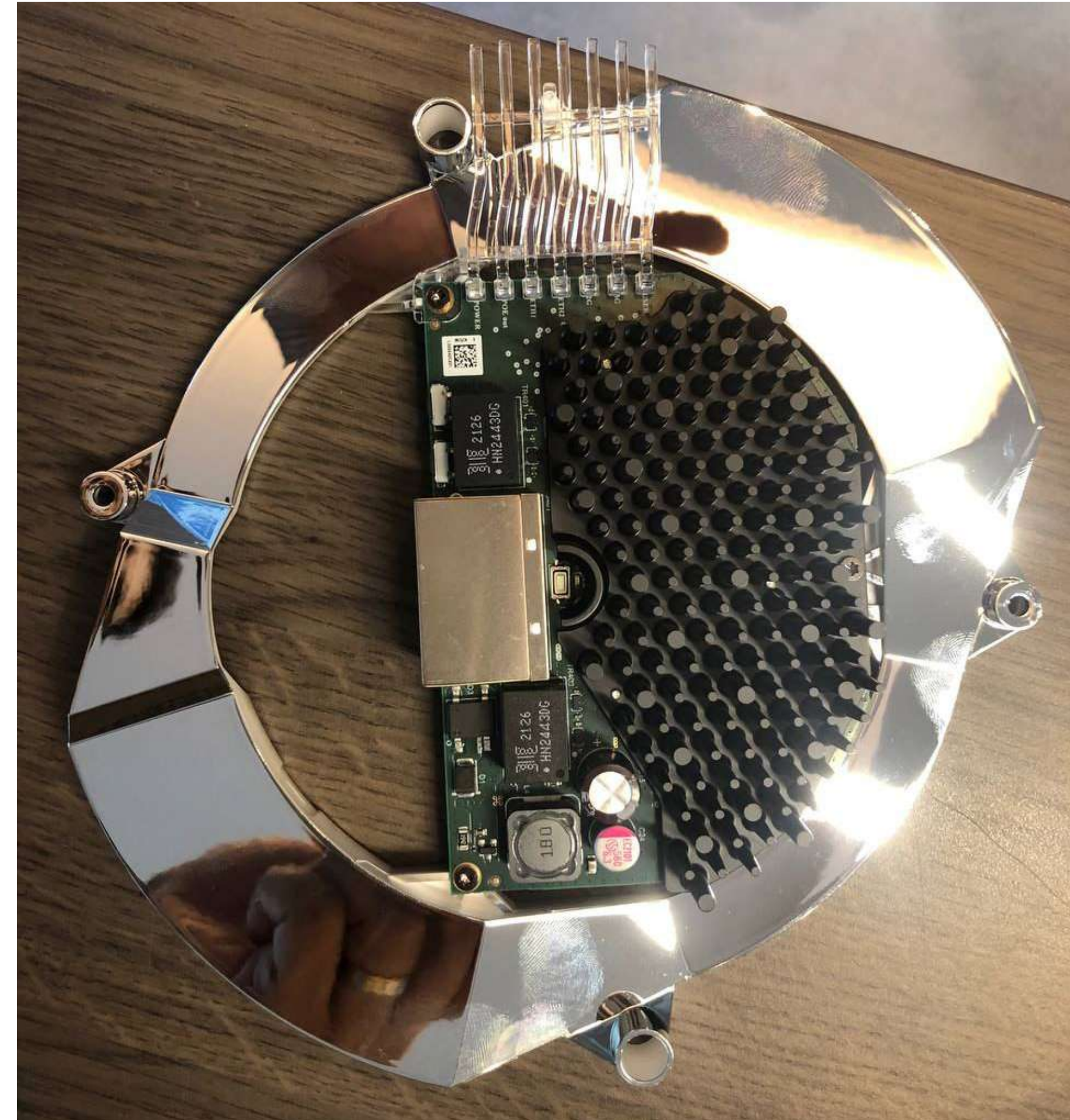
cAP AC



cAP XL ac

Access points

cAP XL ac



Wi-Fi klienci

Wsparcie po stronie klienta / Capabilities

Device	SS	.11	MU-MIMO	.11v	Link
Blackberry Key One	1	ac	Y	N	PCAP
Blackberry Passport	1	ac	N	Y	
Dell XPS 15 7590	2	ax	N	Y	PCAP
Google Pixel 4	2	ac	N		PCAP
iPhone 11	2	ac	N	Y	PCAP
iPhone 11 Pro	2	ax	N	Y	PCAP
iPhone 11 Pro Max	2	ax	N	Y	PCAP
iPhone 12 Pro	2	ax	N	Y	PCAP
Lenovo X1 Carbon	2	ac	N	Y	PCAP
Macbook Pro 2019 16"	3	ac	N	N	PCAP
Samsung Galaxy S10	2	ax	Y	Y	PCAP
Samsung Galaxy S10e	2	ax	Y	Y	PCAP
Samsung Galaxy S10+	2	ax	Y	Y	PCAP
Tesla Model S	2	ac	N	Y	PCAP

<https://clients.mikealbano.com/>

Serwer Radius



Serwer Radius

MikroTik User Manager (v7)

User Manager										
Sessions	Routers	Users	User Groups	Profiles	User Profiles	Limitations	Profile Limitations	Attributes	Payment	
	Close Session	Settings	Generate Report							Find
User	Acct Session ID	NAS IP Address	Calling Station ID	User Address	Started	Ended	Terminate Ca...	Uptime		
ihor	84000001	172.16.254.3	10.10.1.10		Sep/23/2021 08:48:24	Sep/23/2021 08:52:30	User Request	00:04:05		
ihor	84000001	172.16.254.3	10.10.1.19		Sep/24/2021 07:08:45	Sep/24/2021 07:09:04	User Request	00:00:19		
ihor	84000001	172.16.254.2	10.10.1.10		Sep/29/2021 06:39:22	Sep/29/2021 06:49:10	User Request	00:09:47		
oskar	00000086	192.168.10.245	F8-75-A4-6A-80-13		Aug/11/2021 08:58:28	Aug/11/2021 09:00:11	User Request	00:01:43		
oskar	01000086	192.168.10.245	F8-75-A4-6A-80-13		Aug/11/2021 09:00:18	Aug/11/2021 11:36:50	Um Nas Rebo...			
piotr	05000086	192.168.10.240	00-E0-4C-34-74-AD		Aug/11/2021 08:58:23	Aug/11/2021 08:59:41	User Request	00:01:18		
piotr	04000086	192.168.10.240	74-4D-28-84-4C-EB		Aug/11/2021 08:57:11	Aug/11/2021 09:00:08	User Request	00:02:57		
piotr	06000086	192.168.10.240	00-E0-4C-34-74-AD		Aug/11/2021 08:59:47	Aug/11/2021 09:01:25	User Request	00:01:37		
piotr	07000086	192.168.10.240	74-4D-28-84-4C-EB		Aug/11/2021 09:00:14	Aug/11/2021 09:04:18	User Request	00:04:04		
piotr	09000086	192.168.10.240	00-E0-4C-34-74-AD		Aug/11/2021 09:06:00	Aug/11/2021 09:06:58	User Request	00:00:58		
piotr	08000086	192.168.10.240	74-4D-28-84-4C-EB		Aug/11/2021 09:04:21	Aug/11/2021 09:08:44	User Request	00:04:23		
test	84000003	192.168.10.253	94:05:BB:11:EF:D7		Aug/11/2021 07:55:40	Aug/11/2021 07:56:39	User Request	00:00:59		
test	84000003	192.168.10.240	94:05:BB:11:EF:D7		Aug/11/2021 08:41:27	Aug/11/2021 08:41:46	Um Nas Rebo...			
A tomasz	84000004	10.10.1.14	94:05:BB:11:EF:D7		Sep/15/2021 09:25:01					
user-10	03000086	192.168.10.253	2C-C8-1B-47-03-0D		Aug/11/2021 08:20:07	Aug/11/2021 08:22:05	User Request	00:01:58		
171 items										

Kontroler

MikroTik CAPsMAN

Controlled Access Point system Manager (CAPsMAN) pozwala na centralizowane zarządzanie siecią bezprzewodową i, *w razie potrzeby, przetwarzanie danych.*

Jeśli CAP jest kontrolowany przez CAPsMAN, wymagana tylko minimalna konfiguracja do komunikacji z kontrolerem CAPsMAN.

Funkcje, które były zwykle wykonywane przez CAP (np. kontrola dostępu, uwierzytelnianie klienta) są teraz wykonywane przez CAPsMAN.

Kontroler

MikroTik CAPsMAN

CAPsMAN może być uruchomiony na dowolnym RouterBoard oraz CHR

CAP powinien pracować na RouterOS z licencją L4 lub wyższą

Nie limitowana ilość CAP-ów, kontrolowanych CAPsMAN-em

32 moduły radiowe na 1 CAP (access point)

32 wirtualne interfejsy radiowe na jednym master interfejsie

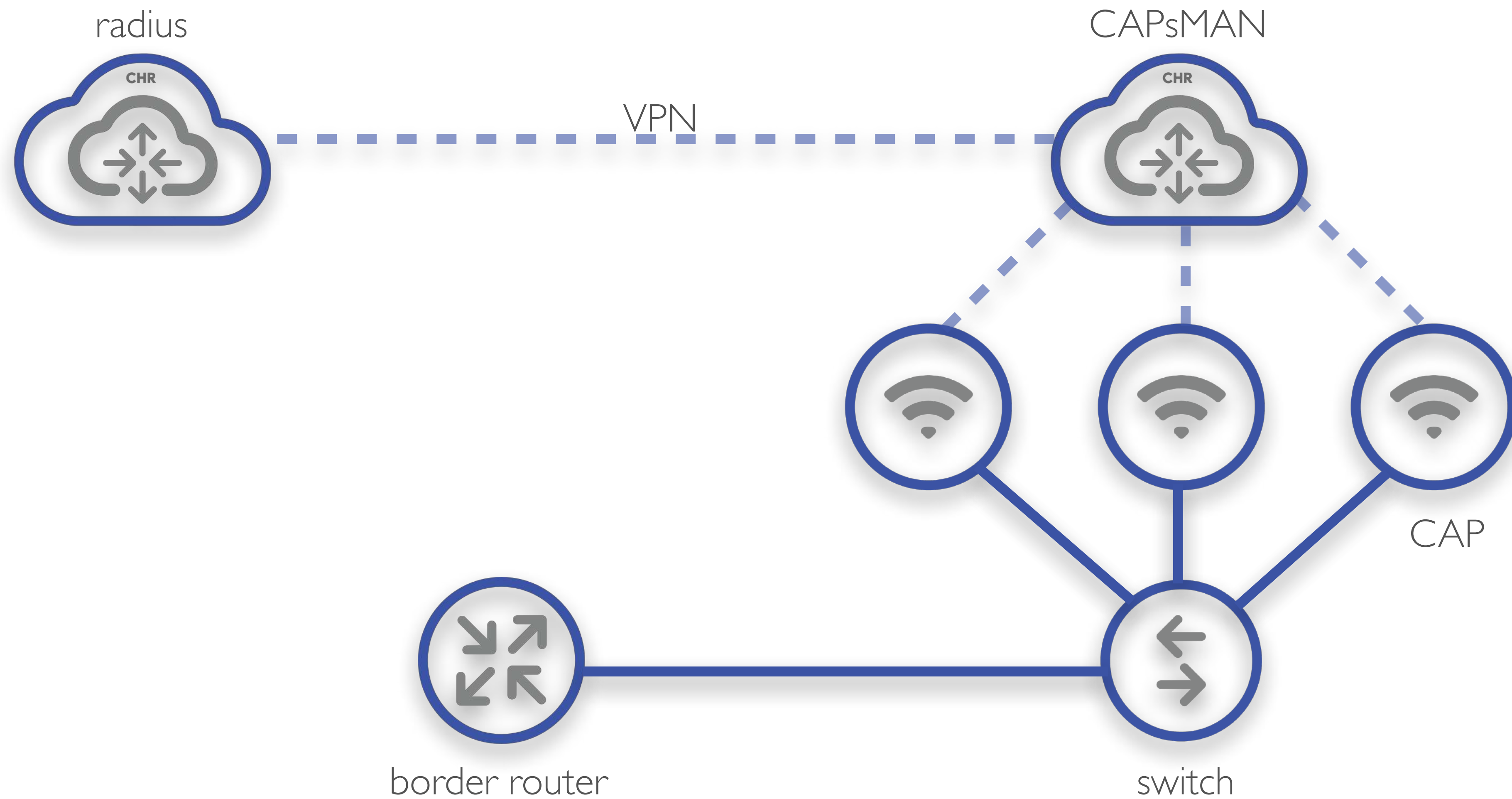
Kontroler

MikroTik CAPsMAN

CAPsMAN													
CAP Interface Provisioning Configurations Channels Datapaths Security Cfg. Access List Rates Remote CAP Radio Registration Table													
<div> <div>+</div> <div>-</div> <div>✓</div> <div>✗</div> <div>📁</div> <div>🔍</div> <div>Reselect Channel</div> <div>Manager</div> <div>AAA</div> <div>Find</div> </div>													
	Name	Type	Actual MTU	L2 MTU	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)	FP Tx	FP Rx	FP Tx Pack		
DSMB	2GHz-AP-conf-1	CAP Interface	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps		⬆	
DSB	2GHz-AP-conf-1-1	CAP Interface	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps			
DRSMB	2GHz-WAP-AC-LTE6-1	CAP Interface	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps			
DSB	2GHz-WAP-AC-LTE6-1-1	CAP Interface	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps			
DSMB	2GHz-cAP-AC-01-OSP-1	CAP Interface	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps			
DSB	2GHz-cAP-AC-01-OSP-1-1	CAP Interface	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps			
DRSMB	2GHz-cAP-AC-office-1	CAP Interface	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps			
DSB	2GHz-cAP-AC-office-1-1	CAP Interface	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps			
DSMB	2GHz-cowo-1	CAP Interface	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps			
DSB	2GHz-cowo-1-1	CAP Interface	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps			
DSMB	5GHz-AP-conf-1	CAP Interface	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps			
DSB	5GHz-AP-conf-1-1	CAP Interface	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps			
DSMB	5GHz-WAP-AC-LTE6-1	CAP Interface	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps			
DSB	5GHz-WAP-AC-LTE6-1-1	CAP Interface	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps			
DSMB	5GHz-cAP-AC-01-OSP-1	CAP Interface	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps		⬇	
<div> <div>⬅</div> <div>➡</div> </div>													
20 items out of 40													

SCHEMAT / KONFIGURACJA

Schemat sieci



Konfiguracja

Certyfikat Let's Encrypt

Dostępny w ROSv7

Certificate <letsencrypt-autogen_2021-09-29T06:58:33Z>

General Key Usage Status

Name: letsencrypt-autogen_2021-09-29T06:58:33Z

Issuer: C=US,O=Let's Encrypt,CN=R3

Country:

State:

Locality:

Organization:

Unit:

Common Name: mbum.mtik.pl

Subject Alt. Name: DNS : mbum.mtik.pl

Key Type: RSA

Key Size: 2048

Days Valid: 89

☒ Trusted

private key crl authority revoked expired smart card key trusted

OK
Cancel
Apply
Copy
Remove
Sign
Sign via SCEP
Create Cert. Request
Import
Card Reinstall
Card Verify
Export
Revoke

Certificate <letsencrypt-autogen_2021-09-29T06:58:33Z>

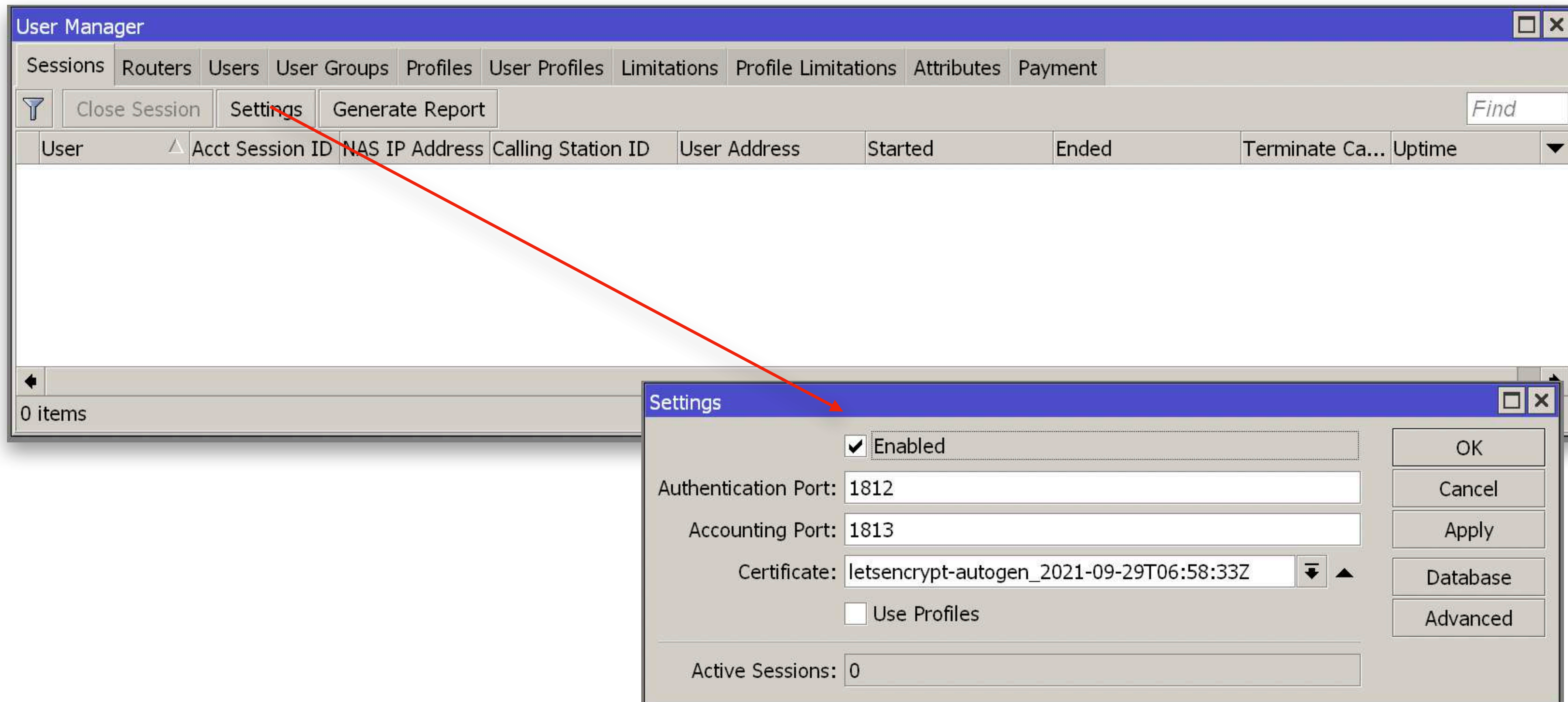
General Key Usage Status

Key Usage: digital signature
key encipherment
tls client
tls server

`/certificate/enable-ssl-certificate dns-name=mbum.mtik.pl`

Konfiguracja

Radius serwer / User Manager (v7)



Konfiguracja

Radius serwer / User Manager (v7)

Router <local-chr>

Name:	local-chr	OK
Shared Secret:	*****	Cancel
Address:	127.0.0.1	Apply
CoA Port:	3799	Disable
Access Requests:	104	Copy
Access Failures:	10	Remove
Broken Requests:	0	Reset Counters
Unknown Requests:	0	
Accounting Requests:	23	
Accounting Failures:	22	
Disconnect Ack:	0	
Disconnect Nak:	0	
CoA Ack:	0	
CoA Nak:	0	
Sent From Cache:	31	

enabled

W danej demonstracji wykorzystano połączenie do **localhost**

W środowisku produkcyjnym należy dodać wszystkie CAP-y lub inne urządzenia który będą korzystać z uwierzytelnienia za pomocą serwera Radius

Konfiguracja

Radius serwer / Użytkownicy

Parametr Mikrotik-Wireless-VLANID podajemy inny dla każdego z użytkowników, dla przypisania do różnych VLAN

*Dla demonstracji wykorzystano parametr **Shared Users - 250**, co pozwoli z wykorzystania takiego samego konta do 250 razy*

The screenshot shows the 'User <guest>' configuration window in Mikrotik WinBox. The 'General' tab is active. The 'Name' field is 'guest', 'Password' is '****', 'OTP Secret' is empty, and 'Group' is 'default'. The 'Caller ID' field is empty. The 'Shared Users' field is set to '250'. Under 'Attributes', 'Mikrotik-Wireless-VLANID' is set to '77' and 'Mikrotik-Wireless-VLANIDtype' is set to '0'. The status at the bottom is 'enabled'. On the right, there are buttons for OK, Cancel, Apply, Disable, Copy, Remove, and Generate Voucher.

The screenshot shows the 'User <vip>' configuration window in Mikrotik WinBox. The 'General' tab is active. The 'Name' field is 'vip', 'Password' is '****', 'OTP Secret' is empty, and 'Group' is 'default'. The 'Caller ID' field is empty. The 'Shared Users' field is set to '250'. Under 'Attributes', 'Mikrotik-Wireless-VLANID' is set to '55' and 'Mikrotik-Wireless-VLANIDtype' is set to '0'. The status at the bottom is 'enabled'. On the right, there are buttons for OK, Cancel, Apply, Disable, Copy, Remove, and Generate Voucher.

Uwierzytelnienie

CAPsMAN / Radius

RADIUS Server <127.0.0.1>

General Status

Service: ☐ ppp ☒ login
☐ hotspot ☒ wireless
☐ dhcp ☐ ipsec
☒ dot1x

Called ID:

Domain:

Address: 127.0.0.1

Protocol: udp

Secret: *****

Authentication Port: 1812

Accounting Port: 1813

Timeout: 300 ms

☐ Accounting Backup

Realm:

Certificate: none

Src. Address: 0.0.0.0

enabled

OK
Cancel
Apply
Disable
Comment
Copy
Remove
Reset Status

Na kontrolerze CAPsMAN
konieczne dodanie korzystania z
serwera Radius

Uwierzytelnienie

CAPsMAN / Security Cfg. / WPA2-EAP

The screenshot shows the 'CAPs Security Configuration <sec-eap>' window. The 'Name' field is 'sec-eap'. Under 'Authentication Type', 'WPA2 EAP' is selected. Under 'Encryption', 'aes ccm' is selected. 'Group Encryption' is 'aes ccm'. 'Group Key Update', 'Passphrase', and 'Disable PMKID' are empty. 'EAP Methods' is set to 'passthrough' and is highlighted with a red box. 'EAP Radius Accounting' is checked. 'TLS Mode' and 'TLS Certificate' are empty. On the right, there are buttons for 'OK', 'Cancel', 'Apply', 'Comment', 'Copy', and 'Remove'.

passthrough przekazuje wszystkie zapytania do serwera Radius

Konfiguracja

CAPsMAN / Datapath

Local Forwarding “rozkazuje”
przetwarzać ruch bezpośrednio na
access point-ach

Dla konfiguracji *Datapath* wskazujemy
VLAN Mode - use tag, ale nie
wskazujemy VLAN ID
Ten parametr będzie przydzielony
dynamicznie z serwera Radius

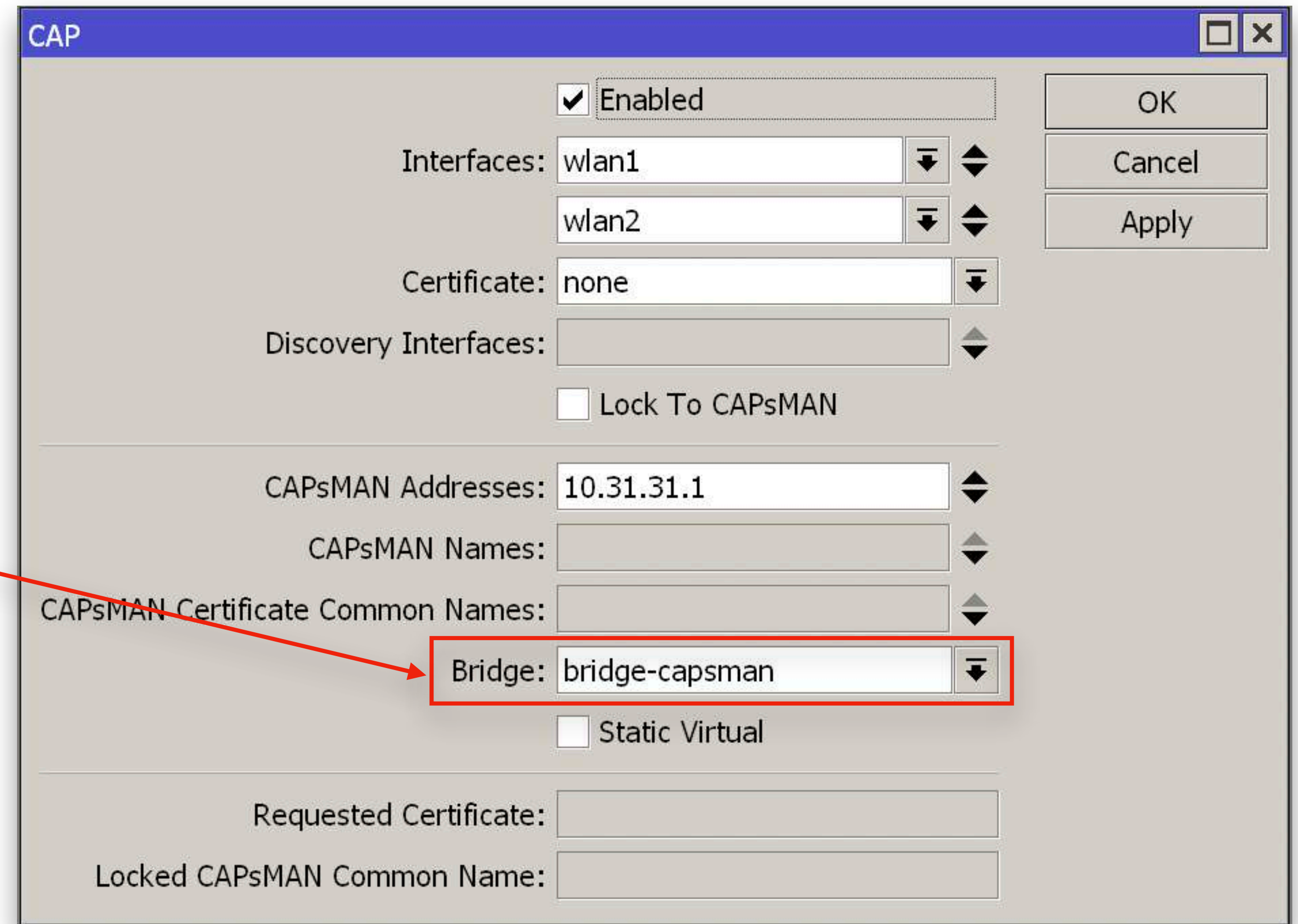
The screenshot shows the 'CAPs Datapath Configuration <data-eap-dynamic>' window. The 'Name' field is set to 'data-eap-dynamic'. The 'Local Forwarding' checkbox is checked and highlighted with a red box. The 'VLAN Mode' dropdown is set to 'use tag' and is also highlighted with a red box. The 'VLAN ID' field is empty. The 'Interface List' field is empty. On the right side, there are buttons for 'OK', 'Cancel', 'Apply', 'Comment', 'Copy', and 'Remove'.

Name:	data-eap-dynamic
MTU:	
L2 MTU:	
ARP:	
Bridge:	
Bridge Cost:	
Bridge Horizon:	
Local Forwarding:	<input checked="" type="checkbox"/>
Client To Client Forwarding:	
VLAN Mode:	use tag
VLAN ID:	
Interface List:	

Konfiguracja CAP

Local forwarding

Wskazanie Bridge jest obowiązkowe na CAP, dla dodania bezprzewodowych interfejsów do lokalnego bridge-a oraz przetwarzania ruchu klientów Wi-Fi na access point a nie CAPsMAN-ie, co zwiększa wydajność całego systemu.



The screenshot shows the 'CAP' configuration window with the following settings:

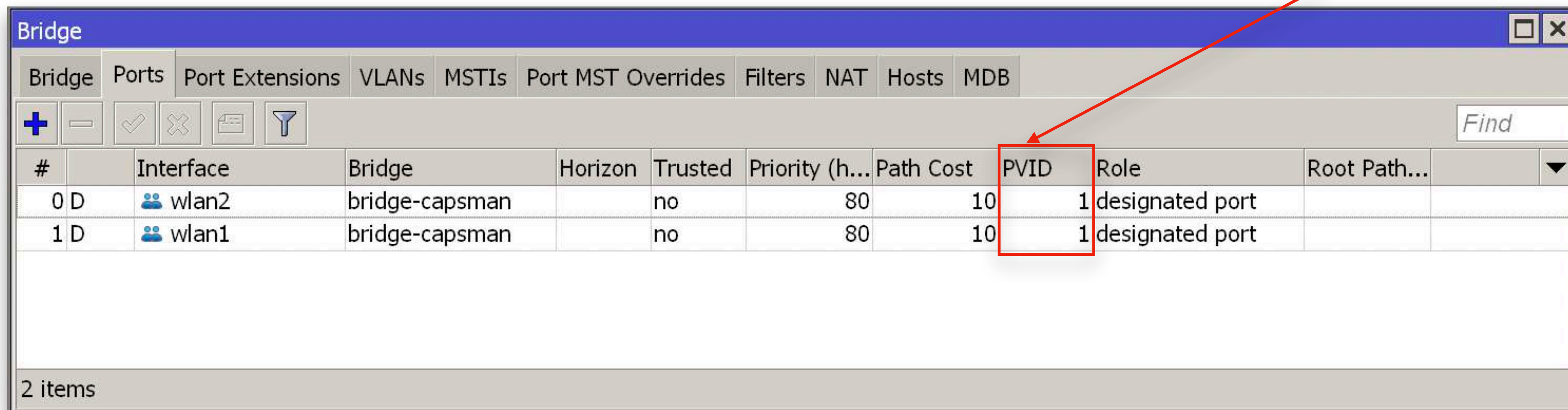
- ☒ Enabled
- Interfaces: wlan1, wlan2
- Certificate: none
- Discovery Interfaces: (empty)
- ☐ Lock To CAPsMAN
- CAPsMAN Addresses: 10.31.31.1
- CAPsMAN Names: (empty)
- CAPsMAN Certificate Common Names: (empty)
- Bridge: bridge-capsman** (highlighted with a red box and a red arrow)
- ☐ Static Virtual
- Requested Certificate: (empty)
- Locked CAPsMAN Common Name: (empty)

Buttons: OK, Cancel, Apply

Konfiguracja CAP

Bridge

Radiowe interfejsy dodają się jako porty tagowane (trunk)



Bridge											
Bridge Ports											
Bridge Ports											
#		Interface	Bridge	Horizon	Trusted	Priority (h...	Path Cost	PVID	Role	Root Path...	
0 D		wlan2	bridge-capsman		no	80	10	1	designated port		
1 D		wlan1	bridge-capsman		no	80	10	1	designated port		

2 items

Ważne jest nie włączenie Bridge VLAN Filtering, inaczej nie będzie możliwości dynamicznego przydziału VLAN-ów dla klientów!!!

<https://forum.mikrotik.com/viewtopic.php?f=7&t=176572>

Uwierzytelnienie WPA2-EAP



CAPsMAN

CAP InterfaceProvisioningConfigurationsChannelsDatapathsSecurity Cfg.Access ListRatesRemote CAPRadi

CAPs Scanner

Interface	SSID	MAC Address	EAP Identity	Tx Rate	Rx Rate	Tx Signal	Rx
2GHz-cAP-XL-AC-1	mbum#5	9C:E0:63:92:4C:4D	vip	54Mbps	65Mbps-...	0	
5GHz-cAP-XL-AC-1	mbum#5	90:9C:4A:BA:F1:C7	guest	6Mbps	780Mbps...	0	

Klienci na liście Registration Table, poprawnie uwierzytelnione z nazwami użytkowników *vip* oraz *guest*

 mbum#5 

IP Address: 192.168.77.253

Router: 192.168.77.1

Security: WPA2 Enterprise

BSSID: 2c:c8:1b:ef:63:27

Channel: 36 (5 GHz, 80 MHz)

Country Code: PL

RSSI: -44 dBm

Noise: -92 dBm

Tx Rate: 780 Mbps

PHY Mode: 802.11ac

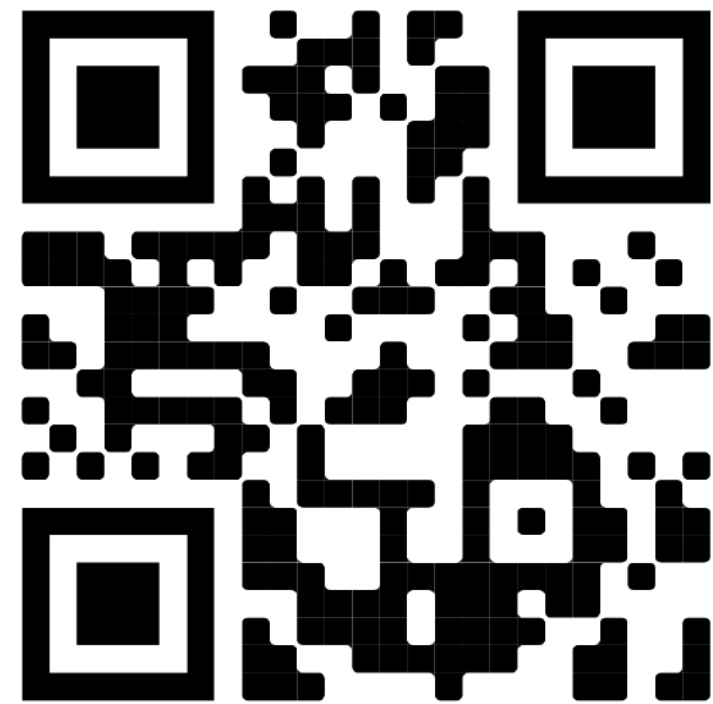
MCS Index: 9

NSS: 2

Klient MAC OS

Dziękuję za uwagę

Materiały oraz konfigurację
<https://ua.mwtc.pl/mbum5/>



Kontakt do mnie:
e-mail: *ihor@hreskiv.pl*

Koniec?

MANUAL KROK PO KROKU

Dostęp do «żywego» CHR

Dostęp do CHR (Radius+CAPsMAN):

Host: mbum.mtik.pl

Login: admin

Hasło: brak

SSTP użytkownik (dla tunelu):






















Login: remote-cap

Hasło: mbum#5

Konfiguracja user-manager

Instalowanie paczki

Należy pobrać paczkę user-manager dla odpowiedniej architektury ze strony mikrotik.com/download/

RouterOS 					
	6.47.10 (Long-term)	6.48.4 (Stable)	6.49rc2 (Testing)	7.1rc4 (Development)	
MIPSBE	CRS1xx, CRS2xx, CRS312-4C+8XG, CRS326-24S+2Q+, CRS354, Cube Lite60, DISC, FiberBox, hAP, hAP ac, hAP ac lite, LDF, LHG, LHG Lite60, ItAP mini, mANTBox, mANTBox 2, mAP, mAP lite, NetBox, NetMetal, PowerBox, PWR-Line, QRT, RB9xx, SXTsq, cAP, hEX Lite, RB4xx, wAP, BaseBox, DynaDish, RB2011, SXT, OmniTik, Groove, Metal, Sextant, RB7xx, hEX PoE				
Main package					
Extra packages					
ARM64	nRAY, CCR2004, LHGGR				
Main package					
Extra packages					
The Dude server				-	

Konfiguracja user-manager

Instalowanie paczki

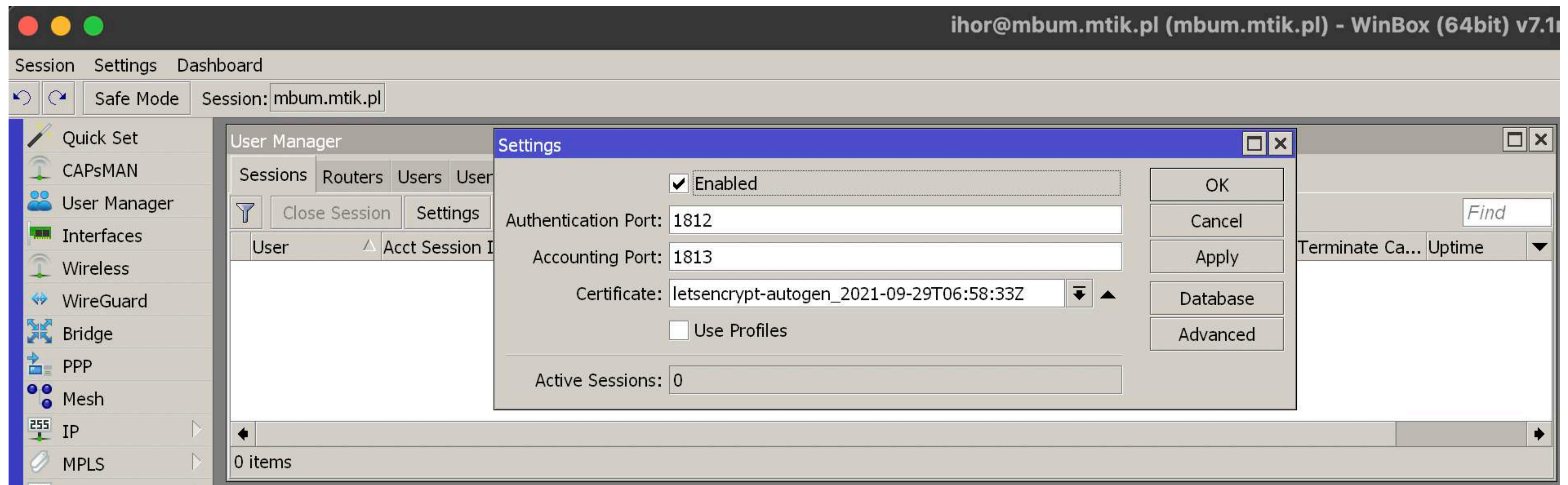
Po rozpakowaniu archiwum .zip za pomocą ftp, webfig lub winbox-a przekazać plik user-manager-7.1rc4.npk do folderu korzeniowego (root folder) i zrestartować urządzenie.

```
calea-7.1rc4.npk  
container-7.1rc4.npk  
gps-7.1rc4.npk  
iot-7.1rc4.npk  
tr069-client-7.1rc4.npk  
user-manager-7.1rc4.npk
```

Konfiguracja user-manager

Uruchomienie serwera Radius

Po restarcie urządzenia należy uruchomić serwer Radius, podając certyfikat



/user-manager

set certificate=letsencrypt-autogen_2021-09-29T06:58:33Z enabled=yes

Konfiguracja user-manager

Dodawanie router-a

Dodajemy router do user-managera

Router <local-chr>

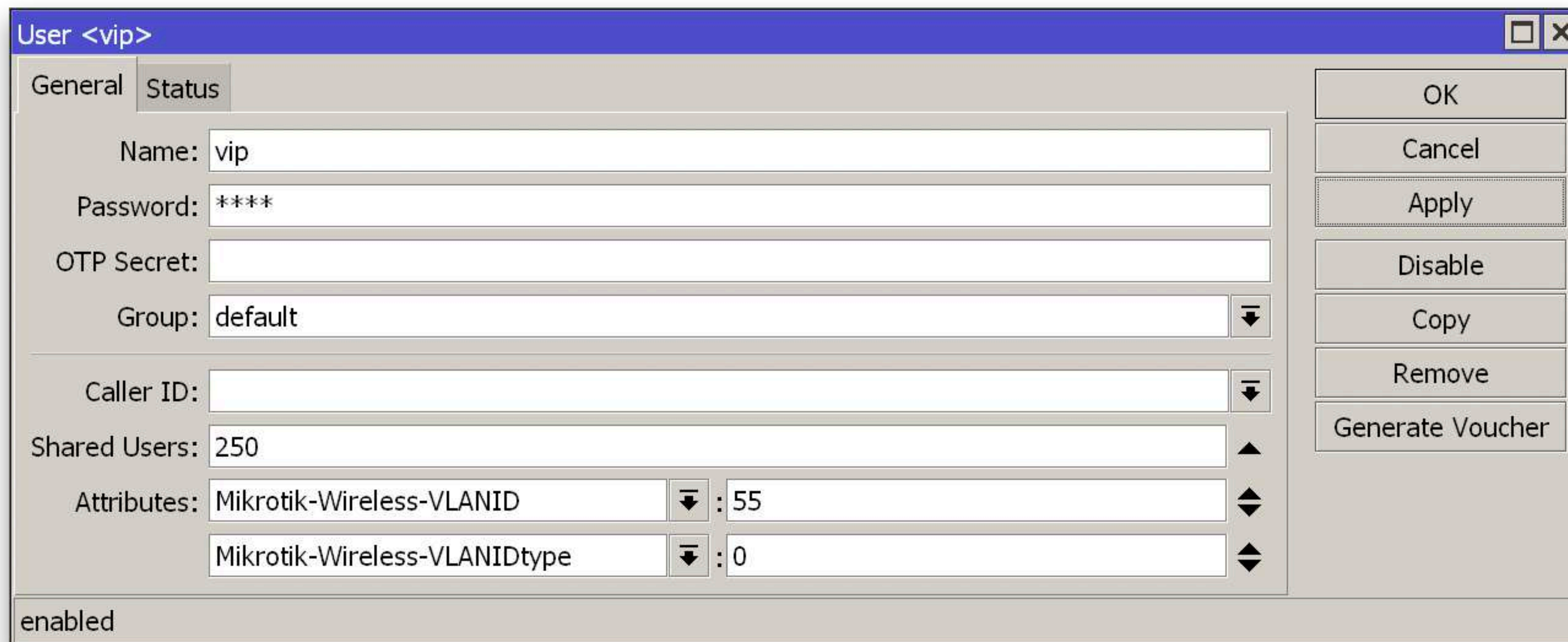
Name:	local-chr	OK
Shared Secret:	*****	Cancel
Address:	127.0.0.1	Apply
CoA Port:	3799	Disable
Access Requests:	125	Copy
Access Failures:	27	Remove
Broken Requests:	0	Reset Counters
Unknown Requests:	0	
Accounting Requests:	1	
Accounting Failures:	0	
Disconnect Ack:	0	
Disconnect Nak:	0	
CoA Ack:	0	
CoA Nak:	0	
Sent From Cache:	54	

enabled

```
/user-manager/router/add shared-secret=1234 address=127.0.0.1
```

Konfiguracja user-manager

Dodawanie użytkownika



The screenshot shows a window titled "User <vip>". It has two tabs: "General" and "Status". The "General" tab is active. The form contains the following fields:

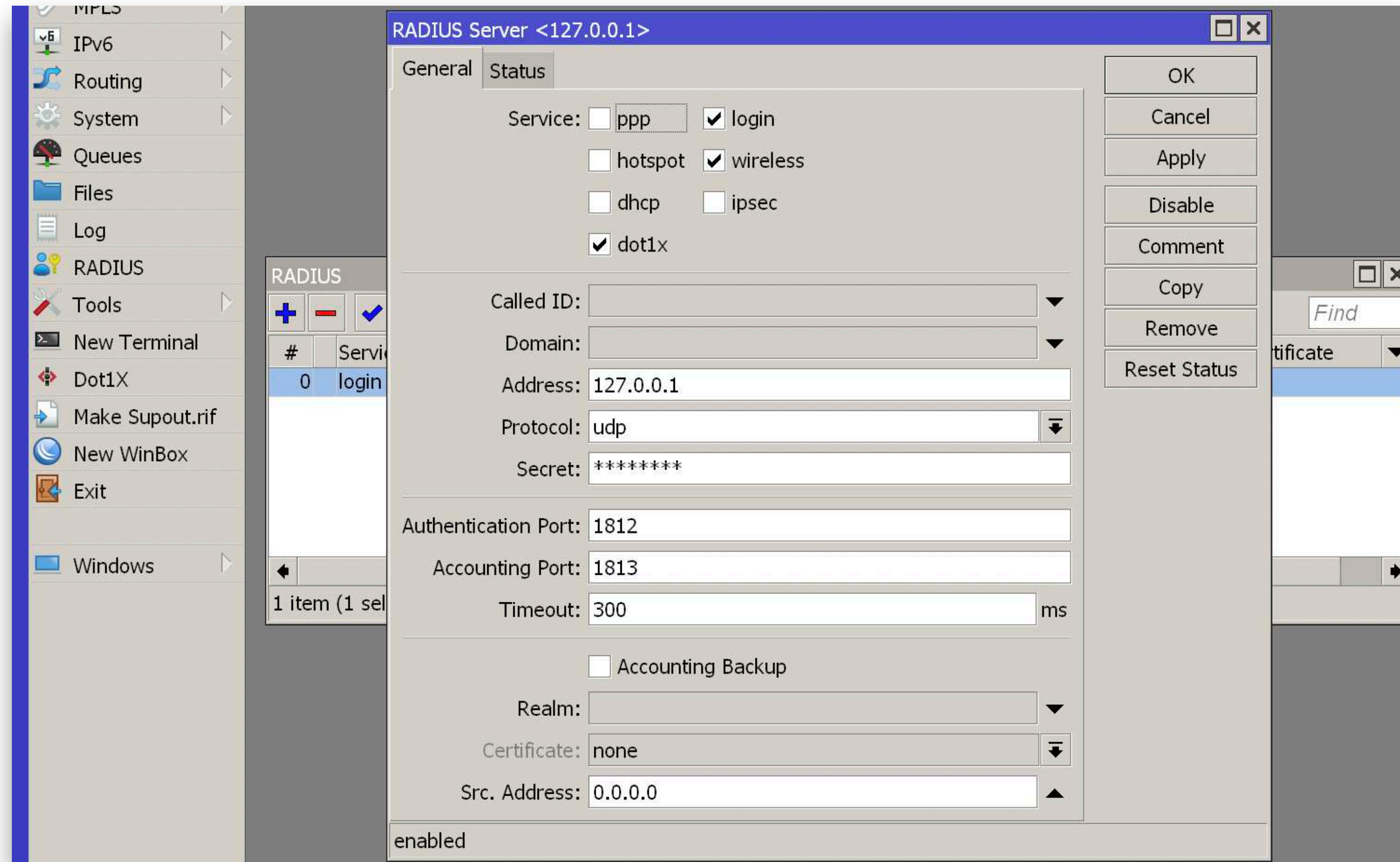
- Name: vip
- Password: ****
- OTP Secret: (empty)
- Group: default (dropdown arrow)
- Caller ID: (empty) (dropdown arrow)
- Shared Users: 250
- Attributes: Mikrotik-Wireless-VLANID (dropdown arrow) : 55 (dropdown arrow)
- Mikrotik-Wireless-VLANIDtype (dropdown arrow) : 0 (dropdown arrow)

At the bottom left, the status "enabled" is shown. On the right side, there are buttons: OK, Cancel, Apply, Disable, Copy, Remove, and Generate Voucher.

```
/user-manager user  
add attributes=Mikrotik-Wireless-VLANID:55,Mikrotik-Wireless-VLANIDtype:0  
name=vip shared-users=250
```


Konfiguracja Radius

Dodajemy korzystanie z Radius-a



/radius

add address=127.0.0.1 service=login,wireless,dot1x secret=1234

Konfiguracja CAPsMAN

Security Cfg.

CAPs Security Configuration <sec-eap>

Name:

Authentication Type: ☐ WPA PSK ☐ WPA2 PSK ☐ WPA EAP ☒ WPA2 EAP ▲

Encryption: ☒ aes ccm ☐ tkip ▲

Group Encryption: ▼ ▲

Group Key Update: ▼

Passphrase: ▼

Disable PMKID: ▼

EAP Methods: ▼ ◆

EAP Radius Accounting: ☒ ▲

TLS Mode: ▼

TLS Certificate: ▼

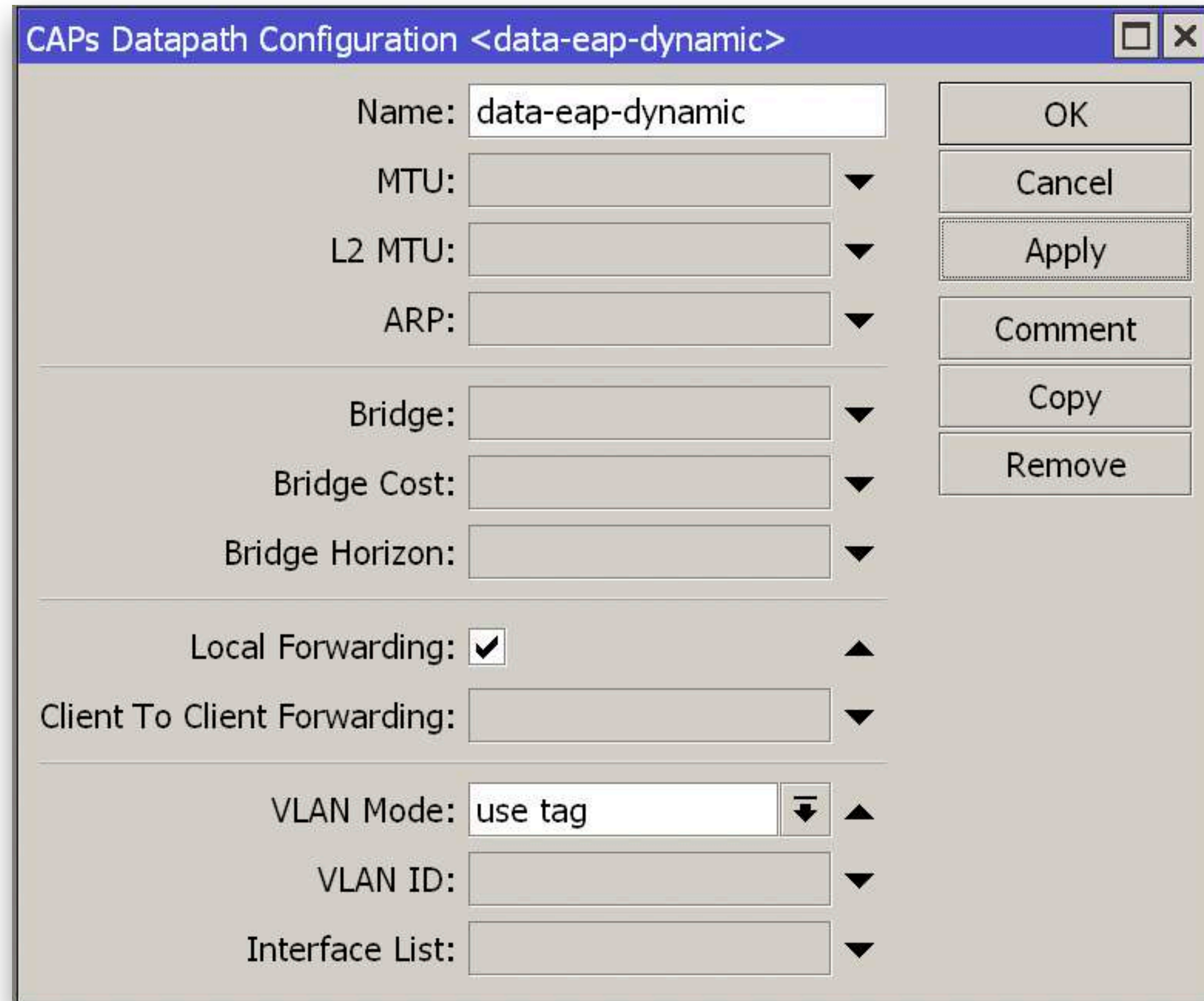
OK
Cancel
Apply
Comment
Copy
Remove

```
/caps-man security
```

```
add authentication-types=wpa2-eap eap-methods=passthrough eap-radius-  
accounting=yes encryption=aes-ccm group-encryption=aes-ccm name=sec-eap
```


Konfiguracja CAPsMAN

Datapath



The image shows a 'CAPs Datapath Configuration' dialog box for a configuration named '<data-eap-dynamic>'. The dialog contains several input fields and a set of action buttons on the right. The fields are organized into sections: the top section for basic identification (Name, MTU, L2 MTU, ARP), a bridge section (Bridge, Bridge Cost, Bridge Horizon), a forwarding section (Local Forwarding, Client To Client Forwarding), and a VLAN section (VLAN Mode, VLAN ID, Interface List). The 'Local Forwarding' checkbox is checked, and 'VLAN Mode' is set to 'use tag'. The action buttons on the right include OK, Cancel, Apply, Comment, Copy, and Remove.

Field	Value
Name	data-eap-dynamic
MTU	
L2 MTU	
ARP	
Bridge	
Bridge Cost	
Bridge Horizon	
Local Forwarding	<input checked="" type="checkbox"/>
Client To Client Forwarding	
VLAN Mode	use tag
VLAN ID	
Interface List	

```
/caps-man datapath
```

```
add local-forwarding=yes name=data-eap-dynamic vlan-mode=use-tag
```

Konfiguracja CAPsMAN

Channels

CAPs Channel <ch-2>

Name:	ch-2	OK
Frequency:	2412	Cancel
	2432	Apply
	2452	Comment
Secondary Frequency:		Copy
Control Channel Width:	20Mhz	Remove
Band:	2ghz-onlyn	
Extension Channel:	disabled	
Tx Power:	13	
Save Selected:		
Reselect Interval:		
Skip DFS Channels:		

CAPs Channel <ch-5>

Name:	ch-5	OK
Frequency:		Cancel
Secondary Frequency:		Apply
Control Channel Width:	20Mhz	Comment
Band:	5ghz-onlyac	Copy
Extension Channel:	XXXX	Remove
Tx Power:	20	
Save Selected:		
Reselect Interval:		
Skip DFS Channels:	<input checked="" type="checkbox"/>	

`/caps-man channel`

`add band=2ghz-onlyn control-channel-width=20mhz extension-channel=disabled
frequency=2412,2432,2452 name=ch-2 tx-power=13`

`add band=5ghz-onlyac control-channel-width=20mhz extension-channel=XXXX
name=ch-5 skip-dfs-channels=yes tx-power=20`

Konfiguracja CAPsMAN

Configurations

CAPs Configuration <cfg-vip-2>

Wireless Channel Rates Datapath Security

Name: cfg-vip-2

Mode: ap

SSID: mbum#5

Hide SSID:

Load Balancing Group:

Distance: indoors km

Hw. Retries:

Hw. Protection Mode: rts cts

Frame Lifetime:

Disconnect Timeout:

Keepalive Frames:

Country: poland

Installation: indoor

Max Station Count:

Multicast Helper: full

HT Tx Chains:

HT Rx Chains:

HT Guard Interval:

OK

Cancel

Apply

Comment

Copy

Remove

CAPs Configuration <cfg-vip-2>

Wireless Channel Rates Datapath Security

Channel: ch-2

Frequency:

OK

Cancel

Apply

CAPs Configuration <cfg-vip-2>

Wireless Channel Rates Datapath Security

Rate: rates-2

Basic Rates

OK

Cancel

Apply

CAPs Configuration <cfg-vip-2>

Wireless Channel Rates Datapath Security

Datapath: data-eap-dynamic

MTU:

OK

Cancel

Apply

CAPs Configuration <cfg-vip-2>

Wireless Channel Rates Datapath Security

Security: sec-eap

Authentication Type:

OK

Cancel

Apply

Konfiguracja CAPsMAN

Configurations

```
/caps-man configuration
add channel=ch-2 country=poland datapath=data-eap-dynamic
distance=indoors hw-protection-mode=rts-cts installation=indoor mode=ap
multicast-helper=full name=cfg-vip-2 rates=rates-2 security=sec-eap
ssid=mbum#5
add channel=ch-5 country=poland datapath=data-eap-dynamic
distance=indoors hw-protection-mode=rts-cts installation=indoor mode=ap
multicast-helper=full name=cfg-vip-5 security=sec-eap ssid=mbum#5
```


Konfiguracja CAPsMAN

Provisioning

CAPs Provisioning <00:00:00:00:00:00>

Radio MAC: 00:00:00:00:00:00

Hw. Supported Modes: gn

Identity Regexp:

Common Name Regexp:

IP Address Ranges:

Action: create dynamic enabled

Master Configuration: cfg-vip-2

Slave Configuration:

Name Format: prefix identity

Name Prefix: 2GHz

OK

Cancel

Apply

Disable

Comment

Copy

Remove

enabled

CAPs Provisioning <00:00:00:00:00:00>

Radio MAC: 00:00:00:00:00:00

Hw. Supported Modes: ac

Identity Regexp:

Common Name Regexp:

IP Address Ranges:

Action: create dynamic enabled

Master Configuration: cfg-vip-5

Slave Configuration:

Name Format: prefix identity

Name Prefix: 5GHz

OK

Cancel

Apply

Disable

Comment

Copy

Remove

enabled

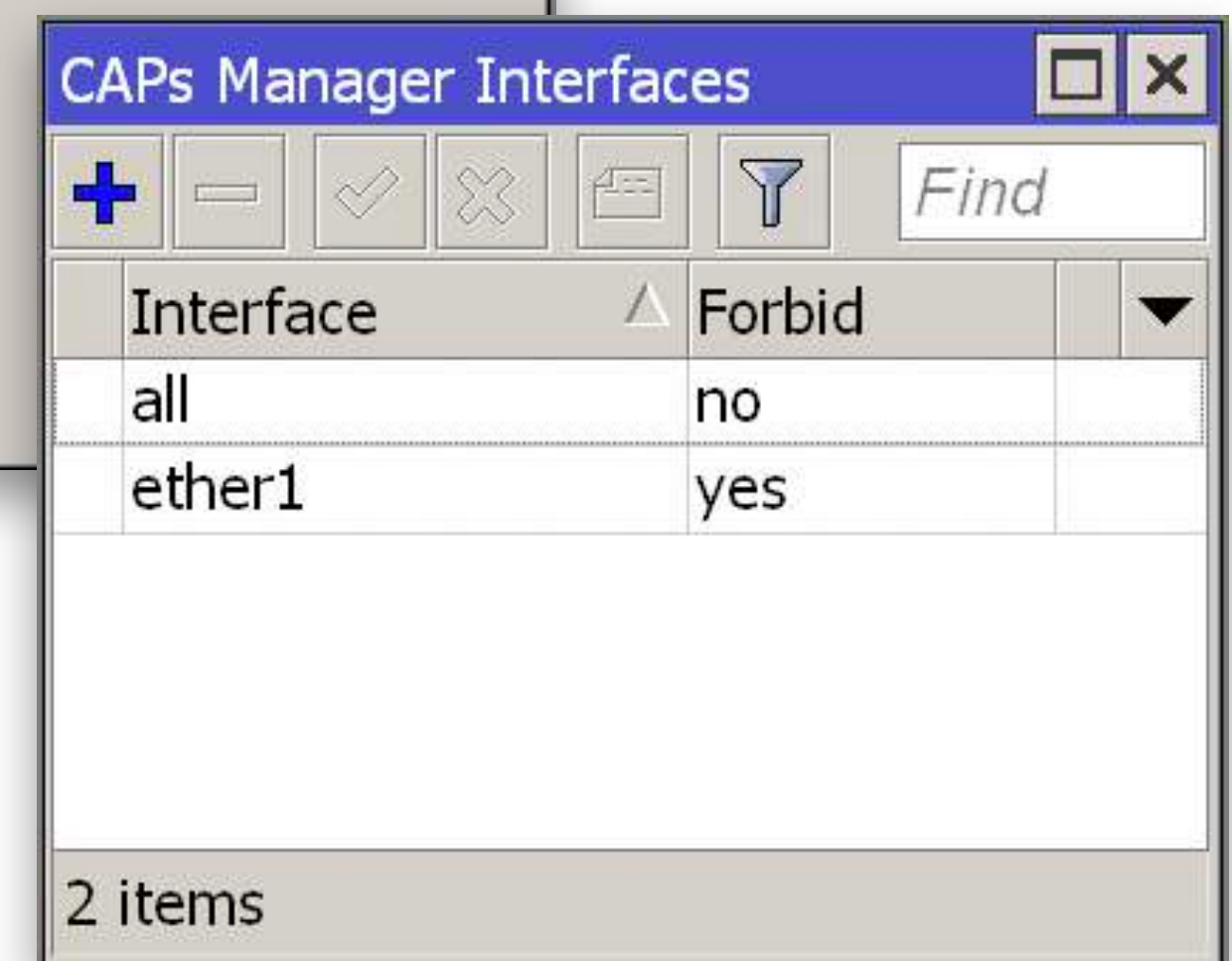
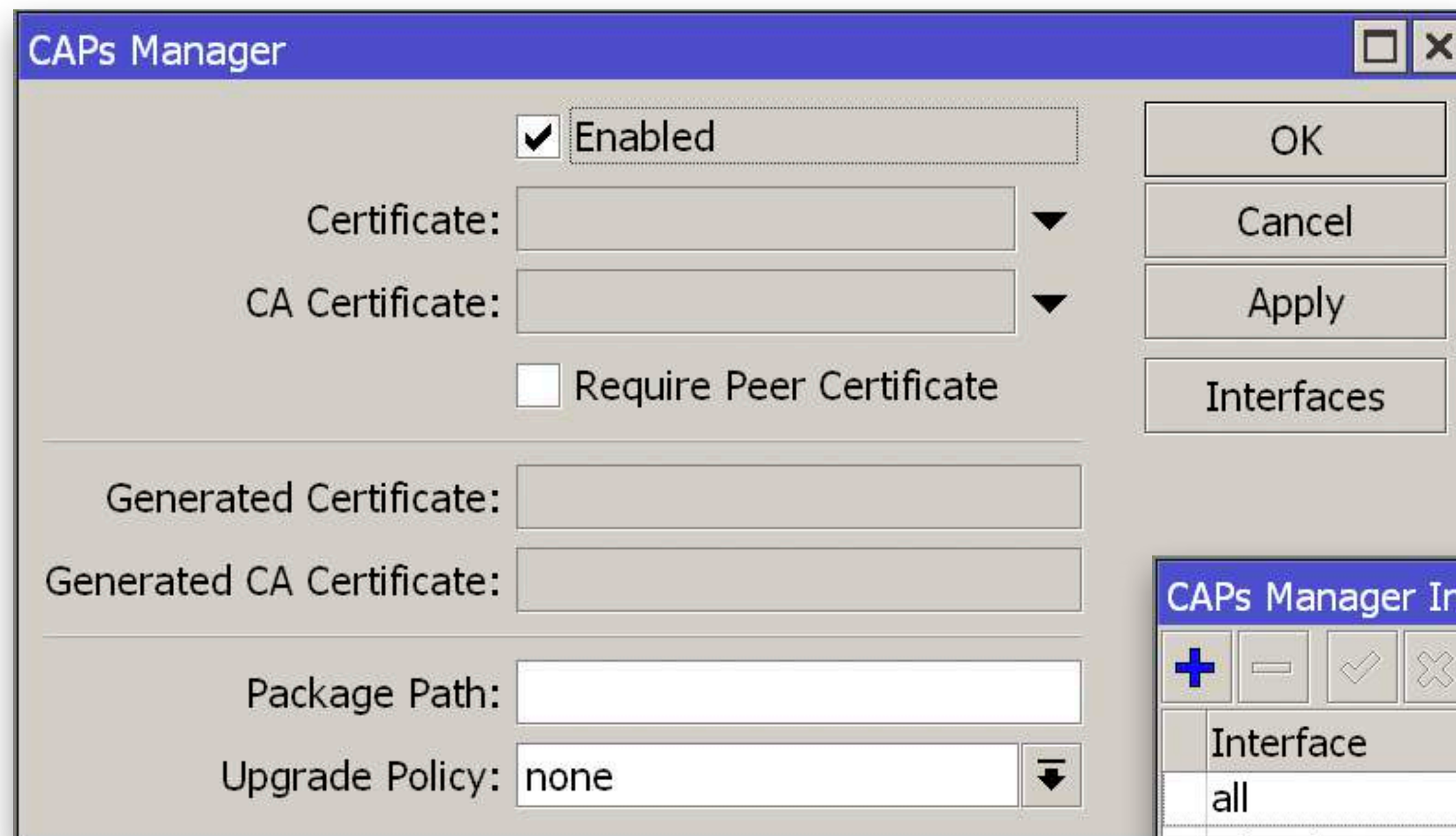
Konfiguracja CAPsMAN

Provisioning

```
/caps-man provisioning
add action=create-dynamic-enabled hw-supported-modes=gn \
    master-configuration=config-vip-2 name-format=prefix-identity \
    name-prefix=2GHz
add action=create-dynamic-enabled hw-supported-modes=ac \
    master-configuration=config-vip-5 name-format=prefix-identity \
    name-prefix=5GHz
```


Konfiguracja CAPsMAN

Uruchomienie kontrolera



```
/caps-man manager  
set enabled=yes  
/caps-man manager interface  
add disabled=no forbid=yes interface=ether1
```

Konfiguracja CAP

Bridge

Interface <bridge-capsman>

General STP VLAN Status Traffic

Name: bridge-capsman

Type: Bridge

MTU:

Actual MTU: 1500

L2 MTU: 1600

MAC Address: 2C:C8:1B:EF:63:27

ARP: enabled

ARP Timeout:

Admin. MAC Address:

Ageing Time: 00:05:00

☐ IGMP Snooping

☐ DHCP Snooping

☒ Fast Forward

OK

Cancel

Apply

Disable

Comment

Copy

Remove

Torch

enabled running slave

Interface <bridge-capsman>

General STP VLAN Status Traffic

Protocol Mode: ☒ none ☐ STP ☐ RSTP ☐ MSTP

Priority: 8000 hex

Region Name:

Region Revision: 0

OK

Cancel

Apply

Disable

Comment

Interface <bridge-capsman>

General STP VLAN Status Traffic

☐ VLAN Filtering

OK

Cancel

Apply

```
/interface bridge  
add name=bridge-capsman protocol-mode=none vlan-filtering=no
```


Konfiguracja CAPsMAN

Wireless / CAP

CAP

☒ Enabled

OK

Interfaces: wlan1 wlan2

Cancel

Certificate: none

Discovery Interfaces:

Apply

☐ Lock To CAPsMAN

CAPsMAN Addresses: 10.31.31.1

CAPsMAN Names:

CAPsMAN Certificate Common Names:

Bridge: bridge-capsman

☐ Static Virtual

Requested Certificate:

Locked CAPsMAN Common Name:

CAPsMAN Addresses należy
zmienić na swój

```
/interface wireless cap  
set bridge=bridge-capsman caps-man-addresses=10.31.31.1 enabled=yes  
interfaces=wlan1,wlan2
```

Koniec