

# CAPsMAN Case Study

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November 2014

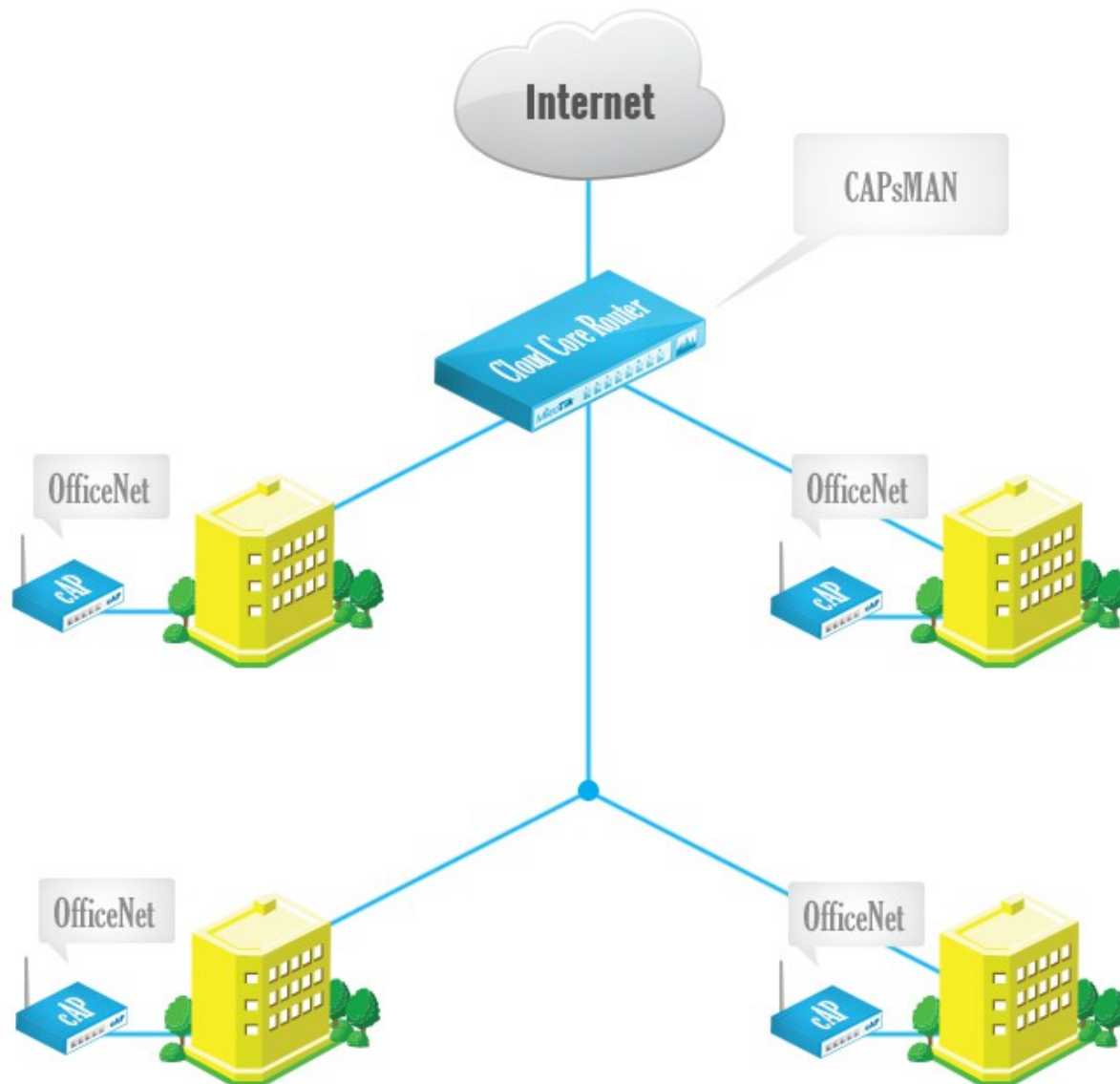
# CAPsMAN Features

- Centralized management of RouterOS APs
- Dual Band AP support
- Provisioning of APs
- MAC and IP Layer communication with APs
- Certificate support for AP communication
- Full and Local data forwarding mode
- RADIUS MAC authentication
- Custom configuration support

# Requirements

- CAPsMAN
  - x86 or RouterBOARD based device
  - Newest RouterOS v6 version
  - Wireless-fp package installed and enabled
- CAP
  - X86 or RouterBOARD based device
  - Newest RouterOS v6 version
  - Atheros chipset (a/b/g/n/ac) wireless card
  - Wireless-fp package installed and enabled
  - At least Level4 RouterOS license

# CAPsMAN Simple Setup

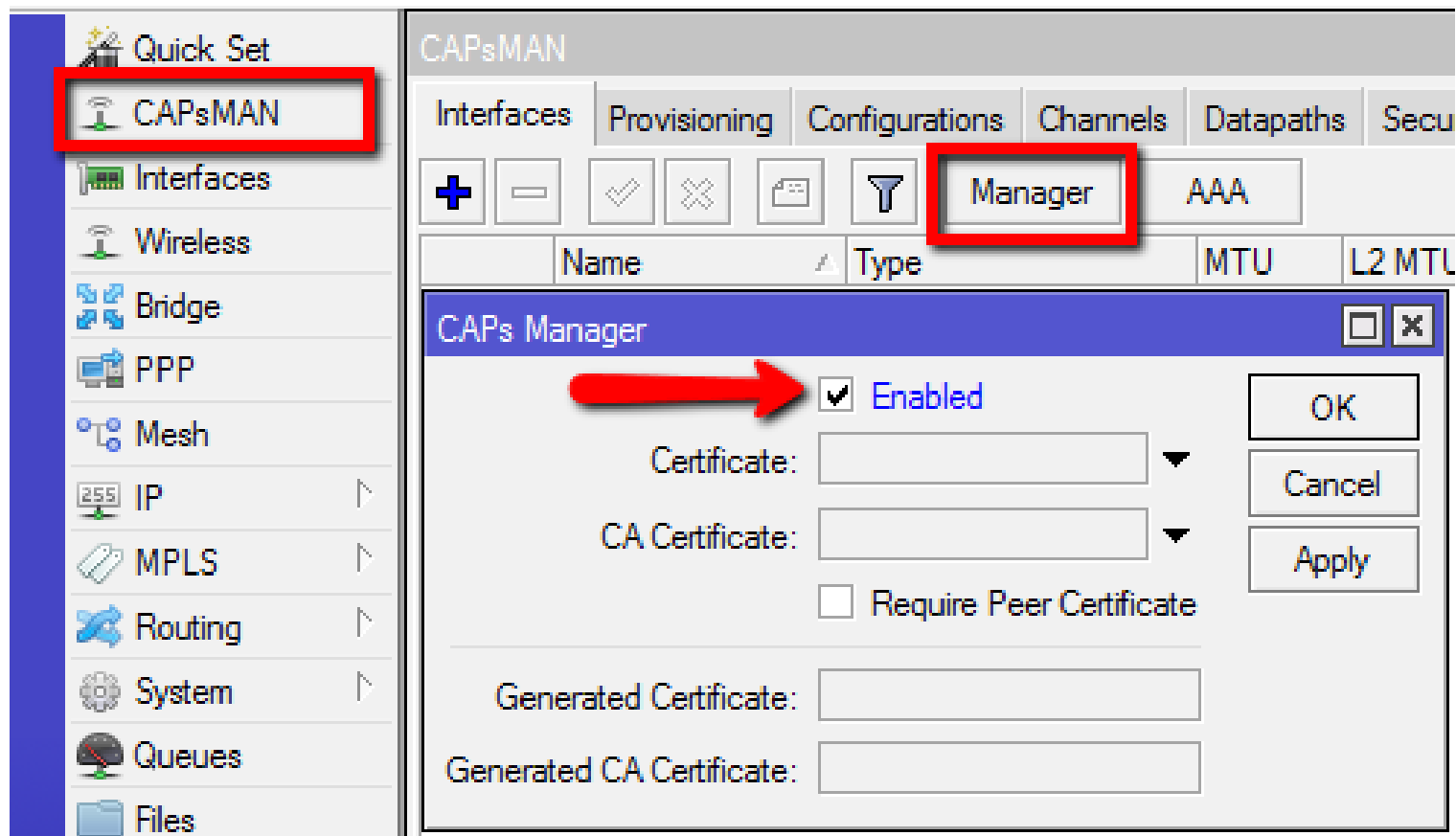


# CAPsMAN Simple Setup

- Enable CAPsMAN service
- Create Bridge interface
- Add IP configuration to Bridge interface
- Create CAPsMAN Configuration
- Create Provisioning rule
- Enable CAP mode on the APs

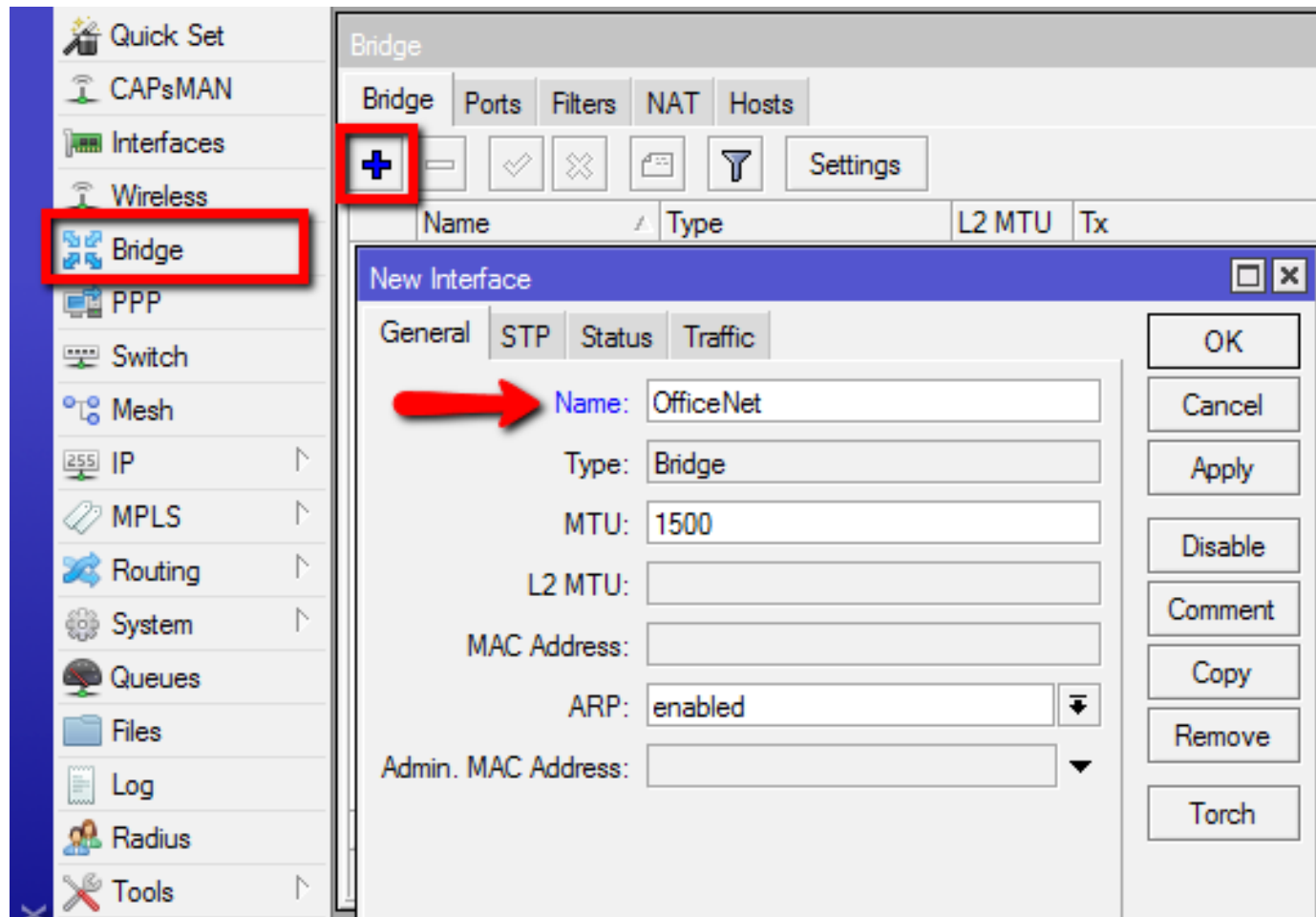
# CAPsMAN Simple Setup

- Enable the CAPsMAN service



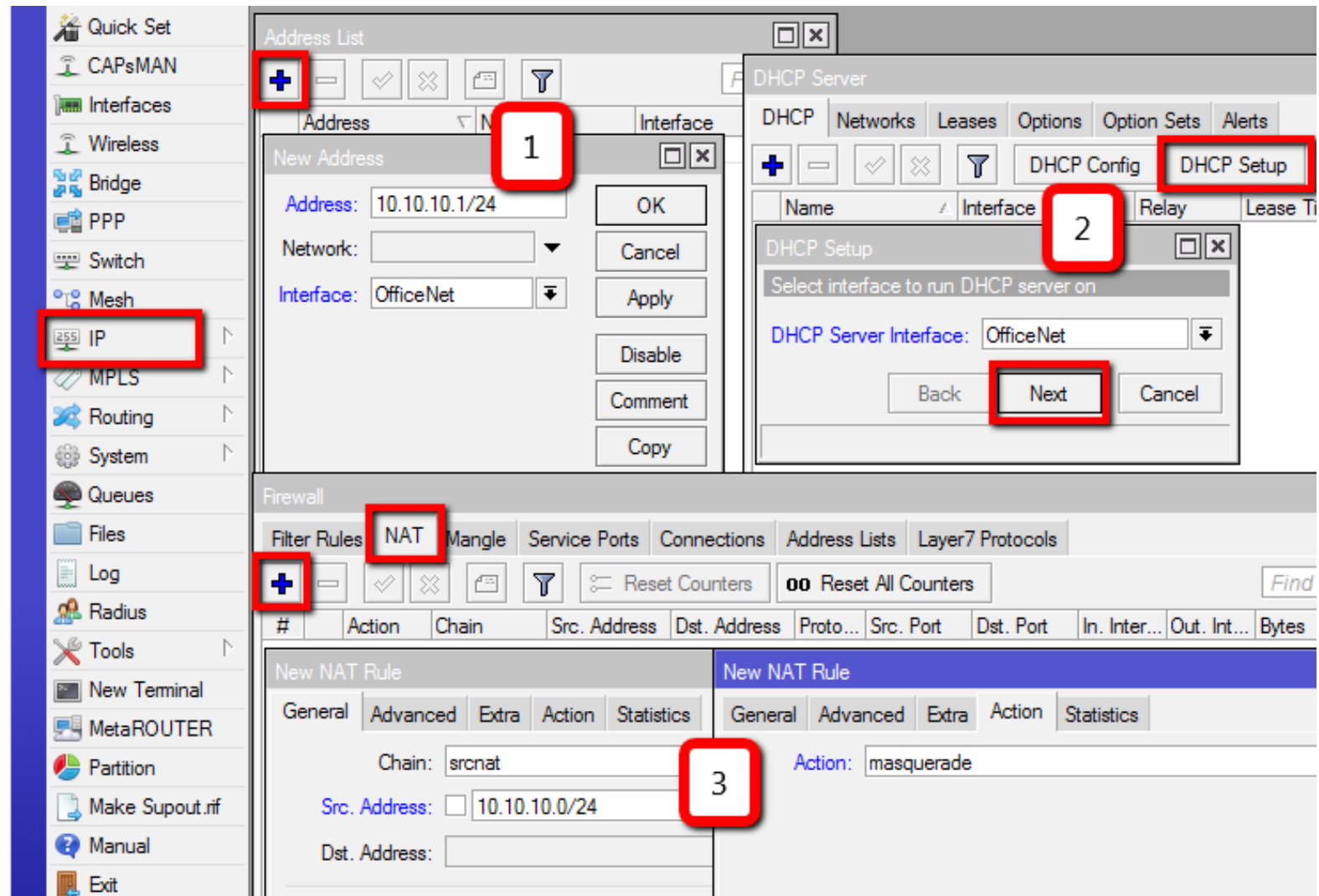
# CAPsMAN Simple Setup

- Create Bridge Interface



# CAPsMAN Simple Setup

1. Add IP address
2. Add DHCP Server
3. Add NAT rule





# CAPsMAN Simple Setup

- Add New CAPsMAN Configuration

The screenshot displays the CAPsMAN web interface. At the top, a navigation bar includes tabs for 'Interfaces', 'Provisioning', 'Configurations' (highlighted with a red box), 'Channels', 'Datapaths', 'Security Cfg.', 'Access List', 'Remote CAP', 'Radio', and 'Registration Table'. Below the navigation bar, a toolbar contains a '+' icon (highlighted with a red box), a '-' icon, a document icon, and a funnel icon. A 'Find' search box is also present. Below the toolbar, a table header lists various configuration parameters: Name, SSID, Hide SSID, Load Bal..., Country, Channel, Frequency, Band, and Datapath. The main content area is divided into three panels, each titled 'New CAPs Configuration'. The first panel has the 'Wireless' tab selected (highlighted with a red box) and shows fields for Name (OfficeNet), Mode, SSID (Office), Hide SSID, Load Balancing Group, Country (united states), Max Station Count, Multicast Helper, HT Tx Chains, HT Rx Chains, and HT Guard Interval. The second panel has the 'Datapath' tab selected (highlighted with a red box) and shows fields for Datapath, Bridge (OfficeNet), Bridge Cost, Bridge Horizon, Local Forwarding, Client To Client Forwarding, VLAN Mode, and VLAN ID. The third panel has the 'Security' tab selected (highlighted with a red box) and shows fields for Security, Authentication Type (WPA PSK, WPA2 PSK, WPA EAP, WPA2 EAP), Encryption (aes ccm, tkip), Group Encryption (aes ccm), Passphrase (OfficeNet), and EAP Methods.

CAPsMAN

Interfaces Provisioning **Configurations** Channels Datapaths Security Cfg. Access List Remote CAP Radio Registration Table

+ - [ ] [ ] Find

Name / SSID Hide SSID Load Bal... Country Channel Frequency Band Datapath

New CAPs Configuration

**Wireless** Channel Datapath Security

Name: OfficeNet

Mode:

SSID: Office

Hide SSID:

Load Balancing Group:

Country: united states

Max Station Count:

Multicast Helper:

HT Tx Chains:

HT Rx Chains:

HT Guard Interval:

New CAPs Configuration

Wireless Channel **Datapath** Security

Datapath:

Bridge: OfficeNet

Bridge Cost:

Bridge Horizon:

Local Forwarding:

Client To Client Forwarding:

VLAN Mode:

VLAN ID:

New CAPs Configuration

Wireless Channel Datapath **Security**

Security:

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

Encryption: ☒ aes ccm ☐ tkip

Group Encryption: aes ccm

Passphrase: OfficeNet

EAP Methods:

# CAPsMAN Simple Setup

- Add new Provisioning rule

The screenshot shows the CAPsMAN software interface. The 'Provisioning' tab is selected and highlighted with a red box. Below the tab, a toolbar contains several icons, with the first icon (a blue plus sign) also highlighted with a red box. A 'New CAPs Provisioning' dialog box is open, displaying the following fields and options:

#	Radio MAC	Action	Master Configurati...	Slave C
<b>New CAPs Provisioning</b>				
Radio MAC:	00:00:00:00:00:00			
Action:	create dynamic enabled	▼		
Master Configuration:	OfficeNet	▼		
Slave Configuration:		▲▼		
Name Prefix:	OfficeAP	▲		

Buttons on the right side of the dialog: OK, Cancel, Apply, Disable, Comment, Copy, Remove.

At the bottom left of the dialog, the text 'enabled' is displayed.

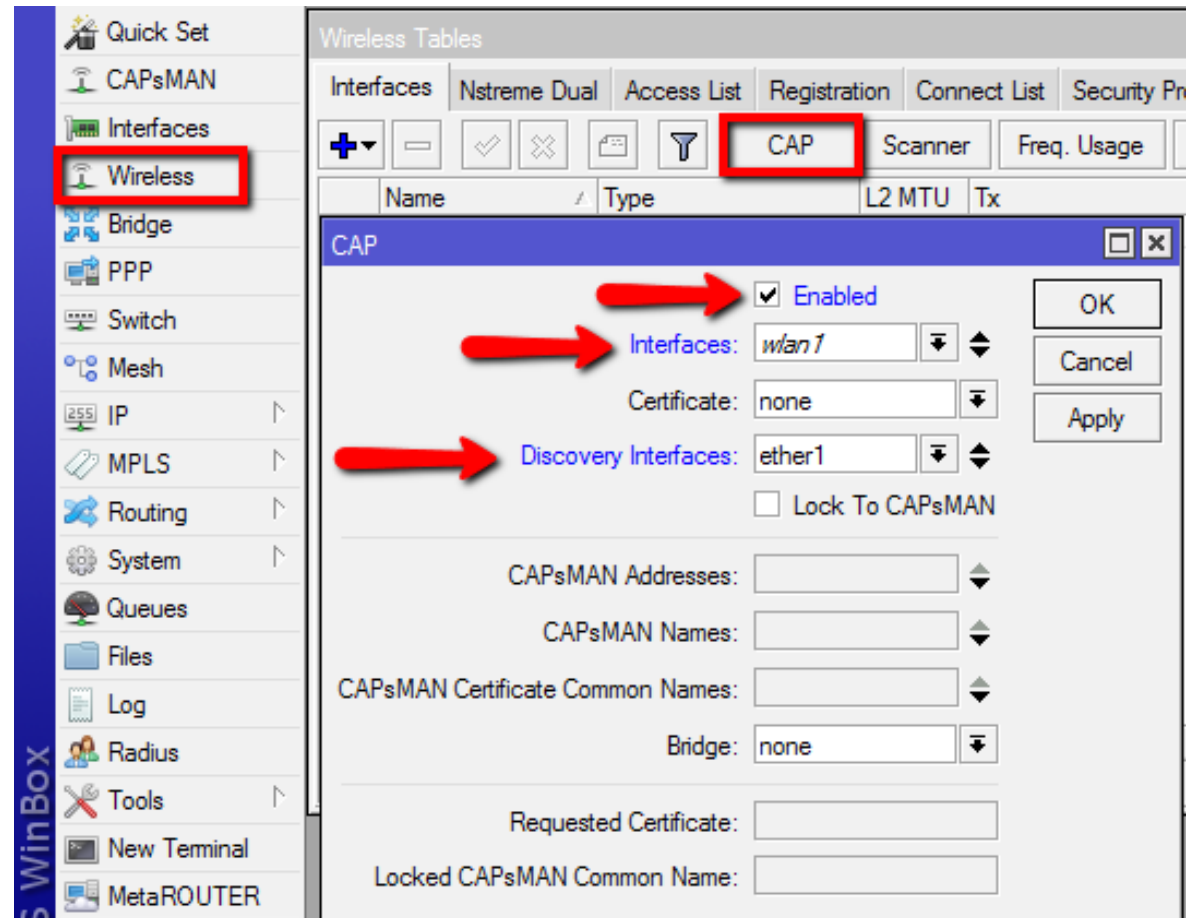
# CAPsMAN Simple Setup

- Configure the AP to use CAP mode

- Enable wireless-fp package

- Enable CAP mode

- By CAP mode button on some boards
- By configuration in Wireless CAP menu



# CAPsMAN Simple Setup

- Check the Status of the CAPsMAN CAP interface

## CAPsMAN

CAPsMAN

Interfaces Provisioning Configurations Channels Datapaths Security

+ - ✓ ✗ [Icon] [Icon] Manager AAA

	Name	Type	MTU	L2 MTU
DSMB	OfficeAP1	Interfaces	1500	1600

Interface <OfficeAP1>

General Wireless Channel Datapath Security Status Traffic

Current State: running-ap

Current Channel: 2427/20-Ce/gn(30dBm)

Current Rate Set: CCK:1-11 OFDM:6-54 BW:1x-2x HT:0-7

Current Basic Rate Set: OFDM:6 BW:1x HT:0-7

## CAP

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security

+ - ✓ ✗ [Icon] [Icon] CAP Scanner Freq. Usage

	Name	Type	L2 MTU	Tx
	--- managed by CAPsMAN			
	--- channel: 2427/20-Ce/gn(30dBm), SSID: Office, CAPsMAN forwarding			
X	wlan1	Wireless (Atheros AR9...	1600	

# CAPsMAN Registration table

CAPsMAN

Interfaces Provisioning Configurations Channels Datapaths Security Cfg. Access List Remote CAP Radio **Registration Table**

1 item

Interface	MAC Address	Tx Rate	Rx Rate	Tx Signal	Rx Signal	Uptime	Tx/Rx Packets	Tx/Rx Bytes
OfficeAP3	18:34:51:41:75:CD	65Mbps-...	65Mbps-...	0	-44	00:03:17...	31 395/33 212	29.8 MiB/29.5 MiB

CAPs AP Client <18:34:51:41:75:CD>

Interface: OfficeAP3

MAC Address: 18:34:51:41:75:CD

Tx Rate: 65Mbps-20MHz/1S

Rx Rate: 65Mbps-20MHz/1S

Tx Rate Set: CCK:1-11 OFDM:6-54 BW:1x HT:0-7

Tx Signal: 0

Rx Signal: -44

Uptime: 00:03:17.70

Tx/Rx Packets: 31 395/33 212

Tx/Rx Bytes: 29.8 MiB/29.5 MiB


OK

Remove

Copy to Access List

# Manual Provisioning

- Changing Provisioning rules doesn't effect already configured CAPs, manual Provisioning required:
  - Remove CAP interface
  - Initiate Provision command on the CAP

CAPsMAN					
Interfaces Provisioning Configurations Channels Datapaths Security Cfg. Access List Remote CAP Radio					
	Provision				
	Radio MAC	Remote CAP Name	Remote CAP Id...	Interface	
	4C:5E:0C:6C:63:28	[4C:5E:0C:6C:63:28]	Room4		
P	4C:5E:0C:6C:63:2B	[4C:5E:0C:6C:63:2B]	Room3	OfficeAP1	
P	4C:5E:0C:6C:63:4C	[4C:5E:0C:6C:63:4C]	Room1	OfficeAP2	
P	4C:5E:0C:6C:63:3A	[4C:5E:0C:6C:63:3A]	Room2	OfficeAP3	

# CAP to CAPsMAN Connection

- MAC Layer2:
  - No IP configuration required
  - CAP and CAPsMAN must be in the same Layer 2 network
- IP (UDP) Layer3:
  - CAP must reach the CAPsMAN using IP protocol
  - Can traverse NAT if necessary
- Management connection between CAP and CAPsMAN is secured using DTLS
- CAP client data traffic is not secured – if necessary additional encryption by using IPSec or encrypted tunnels is needed

# CAPsMAN Selection on CAP

- CAP attempts to contact CAPsMAN and build available CAPsMAN list:
  - List of CAPsMAN IPs
  - List of CAPsMAN IPs obtained from DHCP
  - Broadcasting on configured interfaces using IP and MAC Layer
- CAP selects the CAPsMAN based on such rules:
  - If CAPsMAN names setting is matched it will prefer that CAPsMAN earlier in the list
  - MAC layer connectivity to CAPsMAN is preferred over IP connectivity
  - If list is empty it will connect to any available CAPsMAN



# CAPsMAN with Layer3

- On the CAP specify the IP address of the CAPsMAN

Wireless Tables

Interfaces | Nstreme Dual | Access List | Registration | Connect List | Security Profiles | CAP

Wireless Tables Table:

Name	Type	L2 MTU	Tx	Rx
wlan1	Wireless (Atheros AR9...	1600		0 bps

CAP Configuration Window:

- ☒ Enabled
- Interfaces: wlan1
- Certificate: none
- Discovery Interfaces:
- ☐ Lock To CAPsMAN
- CAPsMAN Addresses: 10.5.125.1
- CAPsMAN Names:
- CAPsMAN Certificate Common Names:
- Bridge: none
- Requested Certificate:
- Locked CAPsMAN Common Name:

Buttons: OK, Cancel, Apply

# CAPsMAN selection using Name

- On the CAP specify the CAPsMAN identity name

The screenshot shows a network management interface with a 'Wireless Tables' tab. The 'CAP' tab is selected and highlighted with a red box. Below the tab, a table lists the CAP configuration. The table has columns for Name, Type, L2 MTU, Tx, and Rx. The first row is highlighted in blue and contains the following values:

Name	Type	L2 MTU	Tx	Rx
CAP	Enabled			

Below the table, the configuration details for the selected CAP are shown. The 'Interfaces' field is set to 'wan1', the 'Certificate' is 'none', and the 'Discovery Interfaces' are 'ether1'. The 'Lock To CAPsMAN' checkbox is unchecked. The 'CAPsMAN Addresses' field is empty. The 'CAPsMAN Names' field is set to 'CAPsMAN1'. The 'CAPsMAN Certificate Common Names' field is empty. The 'Bridge' is set to 'bridgeLocal'. The 'Requested Certificate' and 'Locked CAPsMAN Common Name' fields are also empty. Red arrows point to the 'Interfaces', 'Discovery Interfaces', and 'CAPsMAN Names' fields. The 'OK', 'Cancel', and 'Apply' buttons are visible on the right side of the window.

# CAP Identification

- MAC/IP address
- RouterBoard model
- Serial Number of the Board
- RouterOS version
- System Identity
- Main wireless MAC
- State of the CAP
- Provided radio count

CAPsMAN									
Interfaces	Provisioning	Configurations	Channels	Datapaths	Security Cfg.	Access List	Remote CAP	Radio	Registration Table
		Provision							
Address	Name	Board	Serial	Version	Identity	Base MAC	State	Radios	
4C:5E:0C:6C:63:26	[4C:5E:0C:6C:63:28]	RBmAP2n	52760434DCE4	6.19	Room4	4C:5E:0C:6C:63:28	Run	1	
4C:5E:0C:6C:63:29	[4C:5E:0C:6C:63:2B]	RBmAP2n	5276046C9DA3	6.19	Room3	4C:5E:0C:6C:63:2B	Run	1	
4C:5E:0C:6C:63:38	[4C:5E:0C:6C:63:3A]	RBmAP2n	527604845E6A	6.19	Room2	4C:5E:0C:6C:63:3A	Run	1	
4C:5E:0C:6C:63:4A	[4C:5E:0C:6C:63:4C]	RBmAP2n	527604D1D5D4	6.19	Room1	4C:5E:0C:6C:63:4C	Run	1	
:ffff:10.5.125.172	[D4:CA:6D:A2:85:60]	RBmAP2n	527602095F22	6.19	Room5	D4:CA:6D:A2:85:60	Run	1	

# CAPsMAN static CAP interface

- No interface name change or setting change after the reboot
- Additional manual setting override
- Copy dynamic interface to make static interface

The screenshot displays the CAPsMAN web interface. At the top, there's a navigation bar with tabs: Interfaces, Provisioning, Configurations, Channels, Datapaths, Security Cfg., Access List, Remote CAP, Radio, and Registration Table. Below this is a toolbar with icons for adding, deleting, and editing interfaces, along with a 'Find' search box. A table lists the current interfaces, with 'OfficeAP5' selected. Below the table, the 'Interface <OfficeAP5>' configuration window is open, showing fields for Name, Type, MTU, L2 MTU, MAC Address, ARP, and Radio MAC. The 'Copy' button is highlighted with a red box. A red arrow points from the 'Copy' button to the 'New Interface' window, which is also open. In the 'New Interface' window, the 'Name' field is set to 'Room5AP', and the 'OK' button is highlighted with a red box.

Name	Type	MTU	L2 MTU	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)	SSID	Hide SSID
DSMB OfficeAP5	Interfaces	1500	1600	0 bps	0 bps	0	0	Office	

Interface <OfficeAP5>

General Wireless Channel Datapath Security Status Traffic

Name: OfficeAP5  
Type: Interfaces  
MTU: 1500  
L2 MTU: 1600  
MAC Address: D4:CA:6D:A2:85:60  
ARP: enabled  
Radio MAC: D4:CA:6D:A2:85:60  
Master Interface: none

Buttons: OK, Copy, Remove, Torch

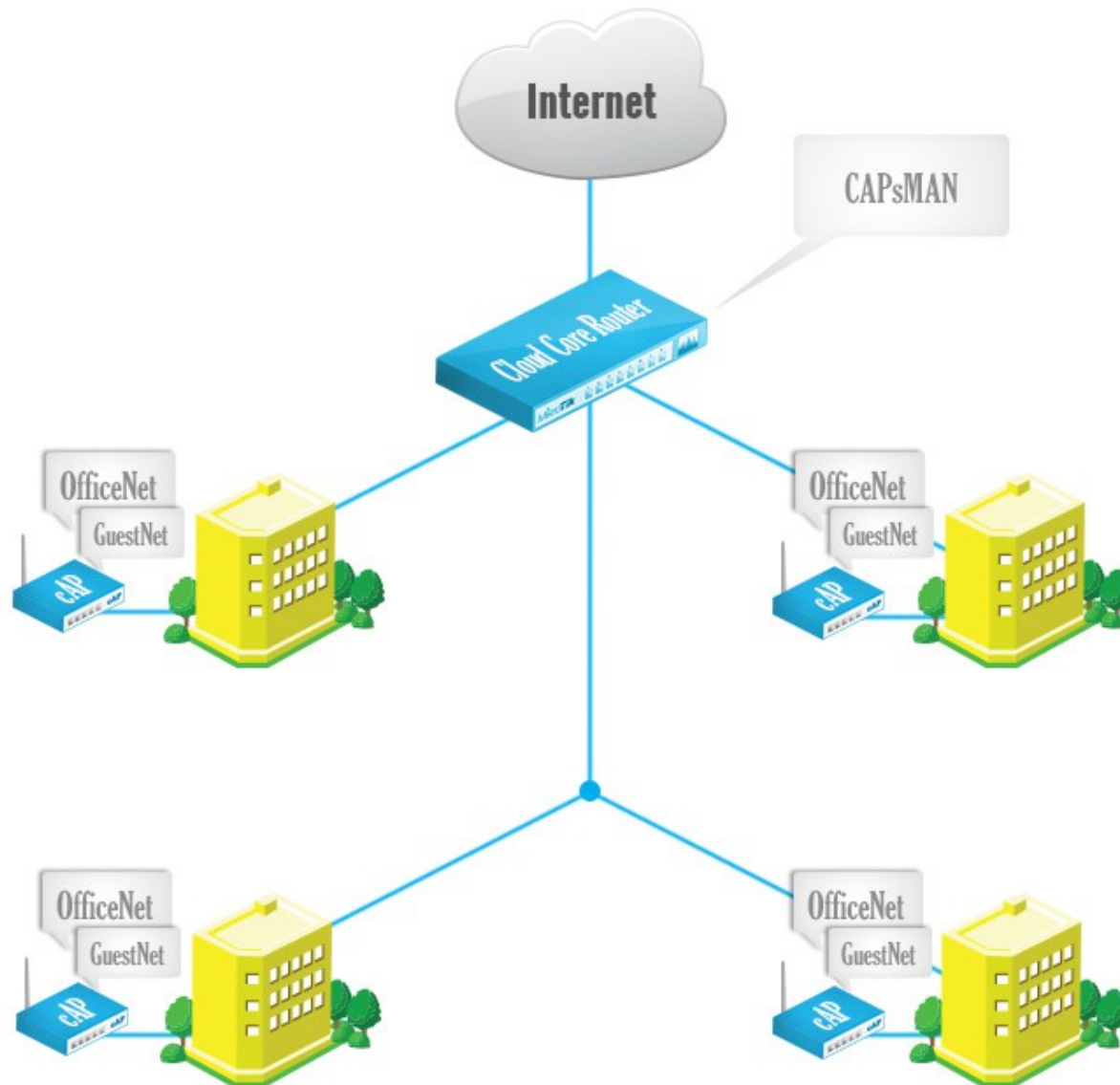
New Interface

General Wireless Channel Datapath Security Status Traffic

Name: Room5AP  
Type: Interfaces  
MTU: 1500  
L2 MTU: 1600  
MAC Address: D4:CA:6D:A2:85:60  
ARP: enabled  
Radio MAC: D4:CA:6D:A2:85:60  
Master Interface: none

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

# CAPsMAN VirtualAP



# CAPsMAN VirtualAP Configuration

- Create new Bridge interface and IP configuration for the VirtualAPs or use the same bridge interface as Master AP
- Create a new configuration for the VirtualAP
- Specify the new configuration in Provisioning rule as Slave Configuration
- Remove all CAP interfaces
- Initiate Manual Provisioning on all the CAPs

# CAPsMAN VirtualAP Setup

CAPsMAN

Interfaces Provisioning **Configurations** Channels Datapaths Security Cfg. Access List Remote CAP Radio Registration Table

**+** - [Icon] [Icon]

Name	SSID	Hide SSID	Load Bal...	Country	Channel	Frequency	Band	D
OfficeNet	Office			united sta...				

New CAPs Configuration

**Wireless** Channel Datapath Security

Name: GuestNet

Mode:

SSID: Guest

Hide SSID:

Load Balancing Group:

Country:

Max Station Count:

Multicast Helper:

HT Tx Chains:

HT Rx Chains:

HT Guard Interval:

New CAPs Configuration

Wireless Channel **Datapath** Security

Datapath:

Bridge: GuestNet

Bridge Cost:

Bridge Horizon:

Local Forwarding:

Client To Client Forwarding:

VLAN Mode:

VLAN ID:

# CAPsMAN VirtualAP Setup

CAPsMAN

Interfaces **Provisioning** Configurations Channels Datapaths Sec

+ - ✓ ✗ 📁 🔍

#	Radio MAC	Action	Master Configurati...	Slave C
0	00:00:00:00:00:00	create dy...	OfficeNet	

CAPs Provisioning <00:00:00:00:00:00> [X] [X]

Radio MAC: 00:00:00:00:00:00 [OK]

Action: create dynamic enabled [Cancel]

Master Configuration: OfficeNet [Apply]

**Slave Configuration: GuestNet [Disable]**

Name Prefix: OfficeAP [Comment]

[Copy]

[Remove]

enabled

CAPsMAN

Interfaces Provisioning Configurations Channels Datapaths

+ - ✓ ✗ 📄 🔍 Manager AAA

	Name	Type	MTU	L
DSMB	OfficeAP1	Interfaces	1500	
DSB	OfficeAP1-1	Interfaces	1500	
DSMB	OfficeAP2	Interfaces	1500	
DSB	OfficeAP2-1	Interfaces	1500	
DSMB	OfficeAP3	Interfaces	1500	
DSB	OfficeAP3-1	Interfaces	1500	
DSMB	OfficeAP4	Interfaces	1500	
DSB	OfficeAP4-1	Interfaces	1500	
SMB	Room5AP	Interfaces	1500	

CAPsMAN

Interfaces Provisioning Configurations Channels Datapaths Security Cfg. Access List Remote CAP **Radio**

🔍 **Provision**







	Radio MAC	Remote CAP Name	Remote CAP Iden...	Interface
P	4C:5E:0C:6C:63:28	[4C:5E:0C:6C:63:...	Room4	OfficeAP1
P	4C:5E:0C:6C:63:2B	[4C:5E:0C:6C:63:...	Room3	OfficeAP3
P	4C:5E:0C:6C:63:3A	[4C:5E:0C:6C:63:...	Room2	OfficeAP5
P	4C:5E:0C:6C:63:4C	[4C:5E:0C:6C:63:...	Room1	OfficeAP2
P	D4:CA:6D:A2:85:60	[D4:CA:6D:A2:85:...	Room5	Room5AP



# CAPsMAN static VirtualAP

CAPsMAN

Interfaces Provisioning Configurations Channels Datapaths Security Cfg. Access List Remote CAP Radio Registration Table

      Manager AAA

	Name	Type	MTU	L2 MTU	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)
DSMB	OfficeAP1	Interfaces	1500	1600	0 bps	0 bps	0	
DSB	OfficeAP1-1	Interfaces	1500	1600	0 bps	0 bps	0	
DSMB	OfficeAP2	Interfaces	1500	1600	0 bps	0 bps	0	
DSB	OfficeAP2-1	Interfaces	1500	1600	0 bps	0 bps	0	
DSMB	OfficeAP3	Interfaces	1500	1600	0 bps	0 bps	0	
DSB	OfficeAP3-1	Interfaces	1500	1600	0 bps	0 bps	0	
DSMB	OfficeAP4	Interfaces	1500	1600	0 bps	0 bps	0	
DSB	OfficeAP4-1	Interfaces	1500	1600	0 bps	0 bps	0	
SMB	Room5AP	Interfaces	1500	1600	0 bps	0 bps	0	

New Interface

General Wireless Channel Datapath Security

Name: Room5VAP

Type: Interfaces

MTU: 1500

L2 MTU:

MAC Address: 00:00:00:00:00:00

ARP: enabled

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

Master Interface: Room5AP

New Interface

General Wireless Channel Datapath Security Status Traffic

Configuration: GuestNet

Mode:

SSID: GuestAP

Hide SSID:

Load Balancing Group:

Country:

Max Station Count:

OK

Cancel

Apply

Disable

Comment

Copy

Remove

Torch

# CAPsMAN Access List Features

- MAC Authentication
- Radius Query support
- MAC Mask support
- Signal Range
- Time
- Private Passphrase
- VLAN ID assignment

# CAPsMAN Access List

- Allow Apple devices to connect
- Rest of the connections pass to the RADIUS

The screenshot displays the CAPsMAN configuration interface with the 'Access List' tab selected. A table lists the configured rules, and two configuration windows are open for editing.

#	MAC Address	MAC Mask	Interface	Signal Ra...	Action	Client To Clie...	VLAN Mo...	VLAN ID
1	18:34:51:00:00:00	FF:FF:FF:00:00:00			accept			
2					query radius			

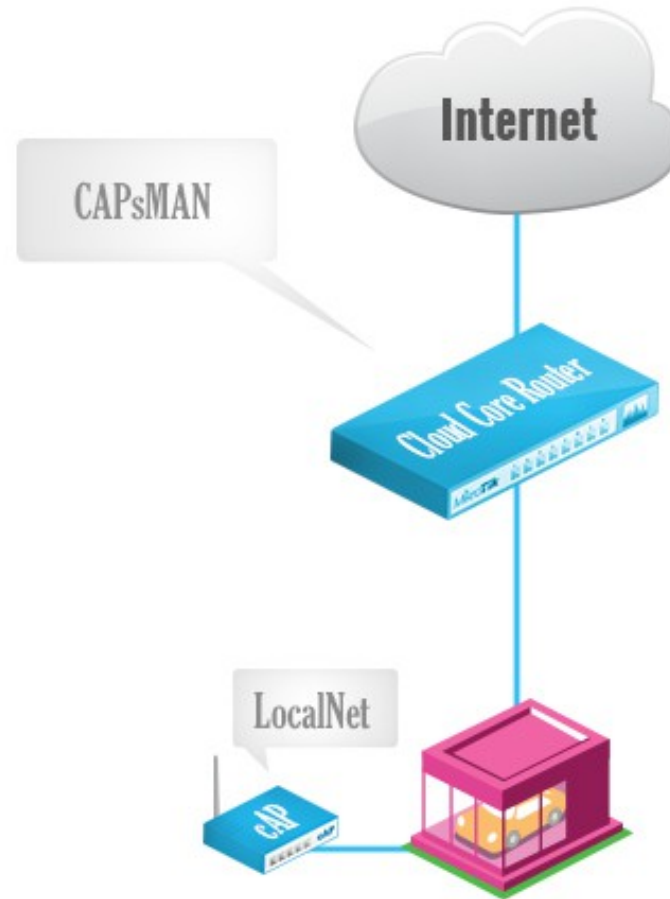
**New CAPs Access Rule (Left Window):**

- MAC Address: 18:34:51:00:00:00
- MAC Mask: FF:FF:FF:00:00:00
- Interface: [Empty]
- Signal Range: [Empty]
- Action: accept
- AP Tx Limit: [Empty]
- Client Tx Limit: [Empty]
- Private Passphrase: [Empty]
- Client To Client Forwarding: [Empty]
- RADIUS Accounting: [Empty]
- VLAN Mode: [Empty]
- VLAN ID: [Empty]
- enabled

**New CAPs Access Rule (Right Window):**

- MAC Address: [Empty]
- MAC Mask: [Empty]
- Interface: [Empty]
- Signal Range: [Empty]
- Action: query radius
- AP Tx Limit: [Empty]
- Client Tx Limit: [Empty]
- Private Passphrase: [Empty]
- Client To Client Forwarding: [Empty]
- RADIUS Accounting: [Empty]
- VLAN Mode: [Empty]
- VLAN ID: [Empty]
- enabled

# CAPsMAN Local Forwarding Setup



# CAPsMAN Local Forwarding

- Create a Local Forwarding configuration

CAPsMAN

Interfaces Provisioning **Configurations** Channels Datapaths Security Cfg. Access List Remote CAP Radio Registration Table

**+**

Name	SSID	Hide SSID	Load Bal...	Country	Channel	Frequency	Band	Datapath	Bridge	VLAN M...
GuestNet	Guest								GuestNet	
OfficeNet	Office			united sta...					OfficeNet	

New CAPs Configuration

**Wireless** Channel Datapath Security

Name: LocalNet

Mode:

SSID: LocalNet

Hide SSID:

Load Balancing Group:

Country: united states

Max Station Count:

Multicast Helper:

HT Tx Chains:

HT Rx Chains:

HT Guard Interval:

New CAPs Configuration

Wireless Channel **Datapath** Security

Datapath:

Bridge:

Bridge Cost:

Bridge Horizon:

Local Forwarding: ☒

Client To Client Forwarding:

VLAN Mode:

VLAN ID:

New CAPs Configuration

Wireless Channel Datapath **Security**

Security:

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

Encryption: ☒ aes ccm ☐ tkip ▲

Group Encryption: aes ccm ▼ ▲

Passphrase: LocalNet ▲

EAP Methods: ▼ ▲

# CAPsMAN Local Forwarding

- Create Provisioning rule
- Move above the default Provisioning rule

CAPsMAN

Interfaces **Provisioning** Configurations Channels Datapaths Security

+ - ✓ ✗ 📄 🔍

#	Radio MAC	Action	Master Configurati...	Slave C
0	00:00:00:00:00:00	create dy...	OfficeNet	GuestM

New CAPs Provisioning

Radio MAC: 4C:5E:0C:3F:98:8B

Action: create enabled

Master Configuration: LocalNet

Slave Configuration:

Name Prefix: LocalAP

OK Cancel Apply Disable Comment Copy Remove

enabled

CAPsMAN

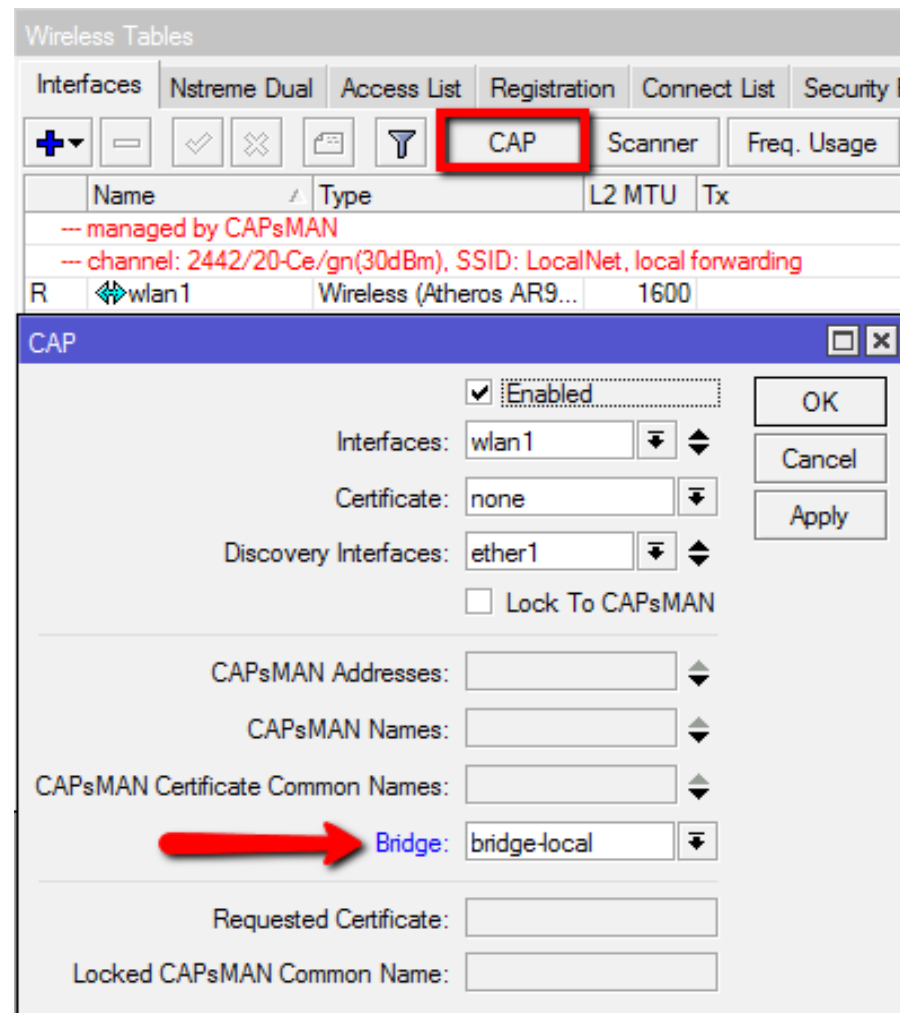
Interfaces **Provisioning** Configurations Channels Datapaths Security Cfg. Access List

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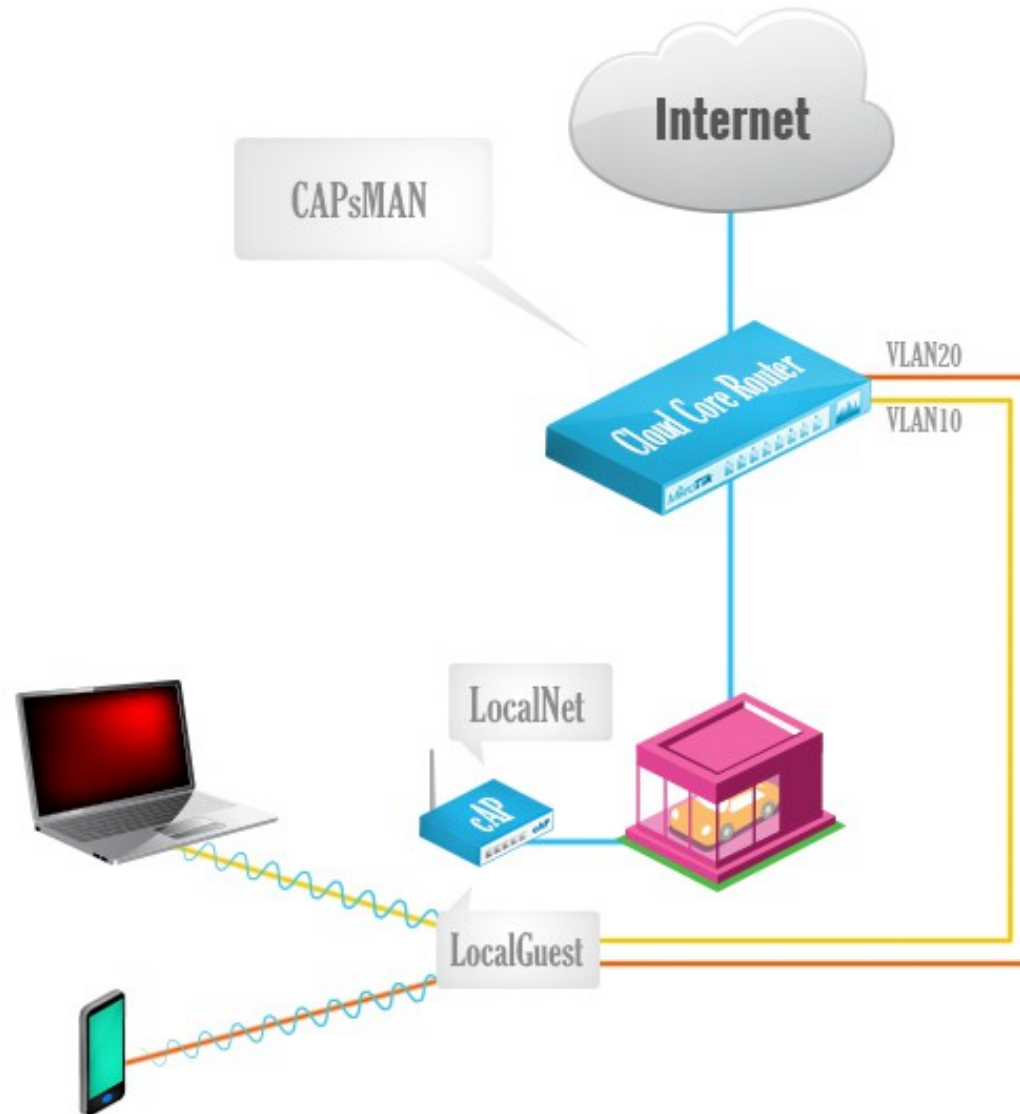
#	Radio MAC	Action	Master Configurati...	Slave Configuration
0	00:00:00:00:00:00	create dy...	OfficeNet	GuestNet
1	4C:5E:0C:3F:98:8B	create en...	LocalNet	

# CAPsMAN Local Forwarding

- On CAP specify the Bridge interface for CAP or use routing for access to network



# CAPsMAN VLAN Assignment





# CAPsMAN VLAN Assignment

- When using Local Forwarding CAPsMAN can assign VLAN ID to specific CAP interface or even specific wireless client
- Create Slave interface with Vlan tag

The screenshot displays the CAPsMAN web interface with the 'Interfaces' tab selected. A table lists existing interfaces, including 'LocalAP1'. Below the table, three configuration panels are visible, each with a red box highlighting a specific tab: 'General', 'Wireless', and 'Datapath'.

**General Tab (Left Panel):**

- Name: LocalAPGuest
- Type: Interfaces
- MTU: 1500
- L2 MTU:
- MAC Address: 00:00:00:00:00:00
- ARP: enabled
- Radio MAC: 00:00:00:00:00:00
- Master Interface: LocalAP1

**Wireless Tab (Middle Panel):**

- Configuration:
- Mode:
- SSID: LocalGuest
- Hide SSID:
- Load Balancing Group:
- Country:
- Max Station Count:
- Multicast Helper:
- HT Tx Chains:
- HT Rx Chains:
- HT Guard Interval:

**Datapath Tab (Right Panel):**

- Datapath:
- Bridge:
- Bridge Cost:
- Bridge Horizon:
- Local Forwarding: ☒
- Client To Client Forwarding:
- VLAN Mode: use tag
- VLAN ID: 10

# CAPsMAN VLAN Assignment

- Create Access List rule for specific client to get tagged to Management Vlan on the same CAP interface
- Move the Access List rule above the previous ones

CAPsMAN

Interfaces Provisioning Configurations Channels Datapaths Security Cfg. **Access List**

+ - ✓ ✗ 📄 🔍

#	MAC Address	MAC Mask	Interface	Signal Ra...	Action
0	18:34:51:00:00:00	FF:FF:FF:00:00:00			accept
1					query ra

**New CAPs Access Rule**

MAC Address: 18:34:51:41:75:CD ▲

MAC Mask: ▼

Interface: LocalAPGuest ▼ ▲

Signal Range: ▼

Time ▼

Action: accept ▼ ▲

AP Tx Limit: ▼

Client Tx Limit: ▼

Private Passphrase: ▼

Client To Client Forwarding: ▼

RADIUS Accounting: ▼

VLAN Mode: use tag ▼ ▲

VLAN ID: 20 ▲

OK Cancel Apply Disable Comment Copy Remove

# CAPsMAN VLAN Assignment

- Create VLAN interfaces on the CAPsMAN router interface where the CAPs are connected

The screenshot displays the 'Interface List' window in the CAPsMAN configuration tool. The 'VLAN' tab is selected and highlighted with a red box. Below the tabs, a toolbar contains a '+' icon, also highlighted with a red box, indicating the 'Add' function. The main area shows two 'New Interface' configuration panels. The left panel is for 'LocalAPGuest-VLAN10' and the right panel is for 'LocalAPGuest-VLAN20'. Both panels have the 'General' tab selected. The configuration fields for both are identical, with only the 'VLAN ID' value differing (10 for the left, 20 for the right).

Name	Type	MTU	L2 MTU	Tx	Rx
LocalAPGuest-VLAN10	VLAN	1500			
LocalAPGuest-VLAN20	VLAN	1500			

**New Interface: LocalAPGuest-VLAN10**

General Traffic

Name: LocalAPGuest-VLAN10

Type: VLAN

MTU: 1500

L2 MTU:

MAC Address:

ARP: enabled

VLAN ID: 10

Interface: local

☐ Use Service Tag

**New Interface: LocalAPGuest-VLAN20**

General Traffic

Name: LocalAPGuest-VLAN20

Type: VLAN

MTU: 1500

L2 MTU:

MAC Address:

ARP: enabled

VLAN ID: 20

Interface: local

☐ Use Service Tag

# CAPsMAN VLAN Assignment

- Assign IPs to VLAN interfaces on CAPsMAN

The screenshot shows the CAPsMAN configuration interface. At the top is the 'Address List' window with a toolbar containing a red-bordered '+' icon, a '-' icon, a checkmark, an 'X', a document icon, and a funnel icon. Below the toolbar is a table with columns 'Address', 'Network', and 'Interface'. Below the table is a 'New Address' dialog box. The dialog box has fields for 'Address' (10.10.12.1/24), 'Network' (empty), and 'Interface' (LocalAPGuest-VLAN10). At the bottom of the dialog box is a checkbox labeled 'enabled'. To the right of the dialog box is another 'New Address' dialog box, which is partially visible. It has fields for 'Address' (10.10.13.1/24), 'Network' (empty), and 'Interface' (LocalAPGuest-VLAN20). At the bottom of this dialog box is a checkbox labeled 'enabled'. To the right of this dialog box are buttons: OK, Cancel, Apply, Disable, Comment, Copy, and Remove.

Address	Network	Interface
---------	---------	-----------

New Address

Address: 10.10.12.1/24

Network:

Interface: LocalAPGuest-VLAN10

enabled

New Address

Address: 10.10.13.1/24

Network:

Interface: LocalAPGuest-VLAN20

enabled

OK

Cancel

Apply

Disable

Comment

Copy

Remove

# CAPsMAN Dual Band CAP

- If the Channel settings are not specified it will automatically use the supported band/channel
- If specific Channel settings are required then specific Provisioning rules are required
  - Custom Channel settings
  - Dual band wireless interface support

# CAPsMAN Dual Band CAP

- Create 3 configurations:
  - Config for both bands radio
  - Config for 5ghz only radio
  - Config for 2.4ghz only radio

The screenshot displays the CAPsMAN web interface. At the top, a navigation bar includes tabs for 'Interfaces', 'Provisioning', 'Configurations' (highlighted with a red box), 'Channels', 'Datapaths', 'Security Cfg.', 'Access List', 'Remote CAP', 'Radio', and 'Registration Table'. Below the navigation bar is a toolbar with icons for adding, deleting, saving, and filtering. The main content area is divided into three panels, each with a 'Wireless' tab and a 'Channel' tab (the 'Channel' tabs are highlighted with red boxes). The first panel is titled 'CAPs Configuration <Both Bands>' and shows fields for Channel, Frequency, Width (set to 20), Band (set to 5ghz-a/n), Extension Channel, and Tx. Power. The second panel is titled 'CAPs Configuration <5ghz Config>' and shows similar fields, with the Band set to 5ghz-a/n. The third panel is titled 'CAPs Configuration <2.4ghz Config>' and shows similar fields, with the Band set to 2ghz-b/g/n.

Name	SSID	Hide SSID	Load Bal...	Country	Channel	Frequency	Band
CAPs Configuration <Both Bands>							
Wireless	Channel	Datapath	Security				
Channel:							
Frequency:							
Width:				20			
Band:				5ghz-a/n			
Extension Channel:							
Tx. Power:							
CAPs Configuration <5ghz Config>							
Wireless	Channel	Datapath	Security				
Channel:							
Frequency:							
Width:				20			
Band:				5ghz-a/n			
Extension Channel:							
Tx. Power:							
CAPs Configuration <2.4ghz Config>							
Wireless	Channel	Datapath	Security				
Channel:							
Frequency:							
Width:							
Band:				2ghz-b/g/n			
Extension Channel:							
Tx. Power:							

# CAPsMAN Dual Band CAP

- Create 3 Provisioning rules
  - For A/N,G/N hardware use Both Bands config
  - For A/N hardware use 5ghz config
  - For G/N hardware use 2.4ghz config

CAPsMAN

Interfaces **Provisioning** Configurations Channels Datapaths Security Cfg. Access List Remote CAP Radio Registration Table

+ - ✓ ✗ 📄 🔍

#	Radio MAC	Action	Master Configurati...	Slave Configuration
New CAPs Provisioning				
Radio MAC: 00:00:00:00:00:00				
Hw. Supported Modes: an				
gn				
Action: create dynamic enabled				
Master Configuration: Both Bands				
Slave Configuration:				
Name Prefix:				
New CAPs Provisioning				
Radio MAC: 00:00:00:00:00:00				
Hw. Supported Modes: an				
Action: create dynamic enabled				
Master Configuration: 5ghz Config				
Slave Configuration:				
Name Prefix:				
New CAPs Provisioning				
Radio MAC: 00:00:00:00:00:00				
Hw. Supported Modes: gn				
Action: create dynamic enabled				
Master Configuration: 2.4ghz Config				
Slave Configuration:				
Name Prefix:				

# CAPsMAN Dual Band CAP

CAPsMAN

Interfaces Provisioning Configurations Channels Datapaths Security Cfg. Access List Remote CAP Radio Registr

+ - ✓ ✗ ⌨ ⚙ Manager AAA

	Name	Type	MTU	L2 MTU	Tx	Rx	T
DMB	cap10	Interfaces	1500	1600	0 bps	0 bps	
DMB	cap9	Interfaces	1500	1600	0 bps	0 bps	

Interface <cap9>

General Wireless Channel Datapath Security

Configuration: 2.4ghz Config

Mode:

SSID: 2.4ghz band

Hide SSID:

Interface <cap10>

General Wireless Channel Datapath Security Status Traffic

Configuration: 5ghz Config

Mode:

SSID: 5ghz band

Hide SSID:

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security Profiles Channels

+ - ✓ ✗ ⌨ ⚙ CAP Scanner Freq. Usage Alignment Wireless Sniffer

	Name	Type	L2 MTU	Tx	Rx	Tx
	--- managed by CAPsMAN					
	--- channel: 5220/20-Ce/an(17dBm), SSID: 5ghz band, CAPsMAN forwarding					
X	wlan1	Wireless (Atheros AR9...	1600	0 bps	0 bps	
	--- managed by CAPsMAN					
	--- channel: 2427/20-Ce/gn(30dBm), SSID: 2.4ghz band, CAPsMAN forwarding					
X	wlan2	Wireless (Atheros AR9...	1600	0 bps	0 bps	



# CAPsMAN Configuration override

- Configuration overrides Channel setting
- Interface overrides Channel and Configuration setting



New CAPs Channel

Name:

Frequency:  MHz ▲

Width:

OK Cancel Apply

New CAPs Configuration

Wireless Channel Datapath Security

Channel:  ▼ ▲

Frequency:  MHz ▲

Width:

New Interface

General Wireless Channel Datapath Security Status Traffic

Channel:  ▼ ▲

Frequency:  MHz ▲

Width:

Interface <cap1>

General Wireless Channel Datapath Security Status Traffic

Current State:

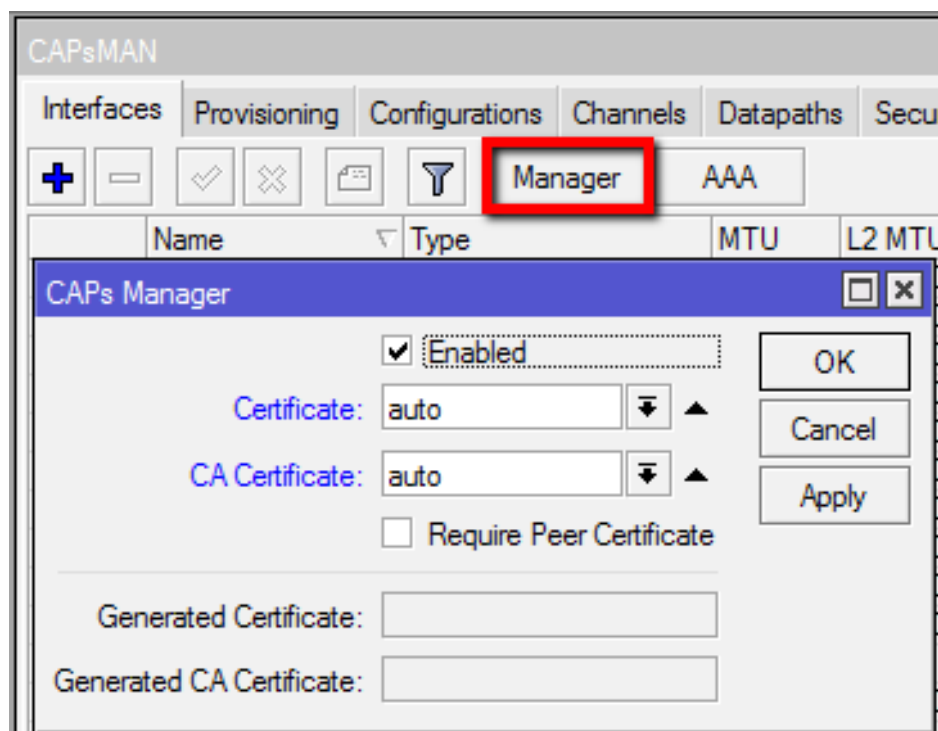
Current Channel:

Current Rate Set:

Current Basic Rate Set:

# CAPsMAN Auto Certificate

- Enable Certificate and CA Certificate on CAPsMAN



The image shows the CAPsMAN Manager configuration window. The 'Manager' tab is selected and highlighted with a red box. The 'CAPs Manager' sub-window is open, showing the 'Enabled' checkbox checked. The 'Certificate' and 'CA Certificate' fields are both set to 'auto'. The 'Require Peer Certificate' checkbox is unchecked. The 'Generated Certificate' and 'Generated CA Certificate' fields are empty.

Name	Type	MTU	L2 MTU
CAPs Manager			

☒ Enabled

Certificate: auto

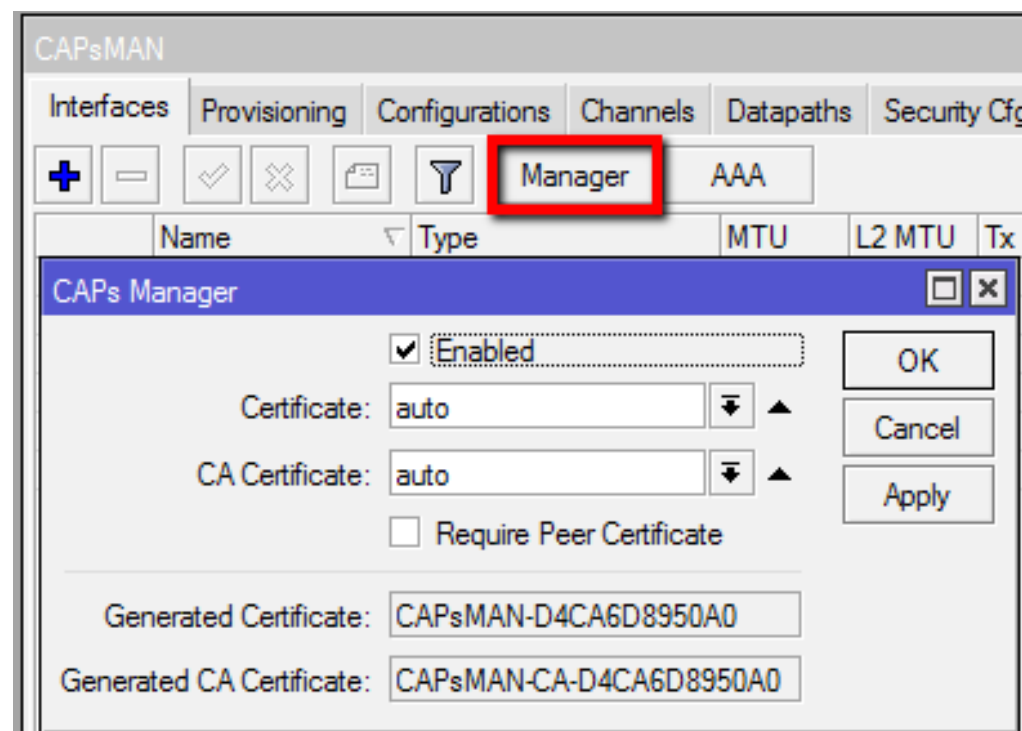
CA Certificate: auto

☐ Require Peer Certificate

Generated Certificate:

Generated CA Certificate:

OK Cancel Apply



The image shows the CAPsMAN Manager configuration window. The 'Manager' tab is selected and highlighted with a red box. The 'CAPs Manager' sub-window is open, showing the 'Enabled' checkbox checked. The 'Certificate' and 'CA Certificate' fields are both set to 'auto'. The 'Require Peer Certificate' checkbox is unchecked. The 'Generated Certificate' field contains the value 'CAPsMAN-D4CA6D8950A0' and the 'Generated CA Certificate' field contains the value 'CAPsMAN-CA-D4CA6D8950A0'.

Name	Type	MTU	L2 MTU	Tx
CAPs Manager				

☒ Enabled

Certificate: auto

CA Certificate: auto

☐ Require Peer Certificate

Generated Certificate: CAPsMAN-D4CA6D8950A0

Generated CA Certificate: CAPsMAN-CA-D4CA6D8950A0

OK Cancel Apply

# CAPsMAN Auto Certificate

- Enable request Certificate on CAP

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security Pr

+ - ✓ ✗ [CAP] Scanner Freq. Usage

Name	Type	L2 MTU	Tx
CAP			

☒ Enabled

Interfaces: wlan1

Certificate: request

Discovery Interfaces: ether1

☐ Lock To CAPsMAN

CAPsMAN Addresses:

CAPsMAN Names:

CAPsMAN Certificate Common Names:

Bridge: bridgeLocal

Requested Certificate:

Locked CAPsMAN Common Name:

OK Cancel Apply

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security Pr

+ - ✓ ✗ [CAP] Scanner Freq. Usage

Name	Type	L2 MTU	Tx
CAP			

☒ Enabled

Interfaces: wlan1

Certificate: request

Discovery Interfaces: ether1

☐ Lock To CAPsMAN

CAPsMAN Addresses:

CAPsMAN Names:

CAPsMAN Certificate Common Names:

Bridge: bridgeLocal

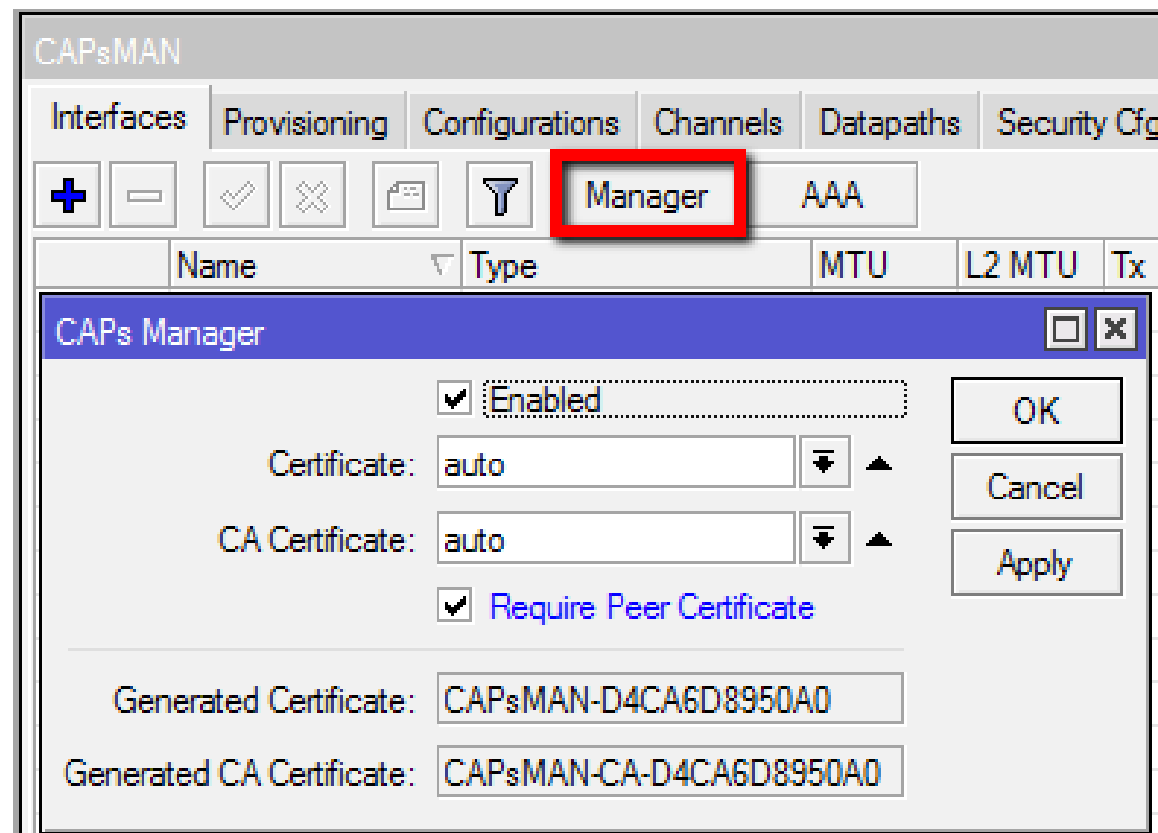
Requested Certificate: CAP-4C5E0C6C634A

Locked CAPsMAN Common Name:

OK Cancel Apply

# CAPsMAN Auto Certificate

- Allow CAPsMAN to accept connections only from CAPs with valid certificate



# CAP Lock To CAPsMAN

- Enable Lock To CAPsMAN on CAP – certificate is required

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security Profiles

+ - ✓ ✗ CAP Scanner Freq. Usage

Name	Type	L2 MTU	Tx
CAP			

☒ Enabled

Interfaces: wlan1

Certificate: request

Discovery Interfaces: ether1

☒ Lock To CAPsMAN

CAPsMAN Addresses:

CAPsMAN Names:

CAPsMAN Certificate Common Names:

Bridge: bridgeLocal

Requested Certificate: CAP-4C5E0C6C634A

Locked CAPsMAN Common Name:

OK Cancel Apply

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security Profiles

+ - ✓ ✗ CAP Scanner Freq. Usage Align

Name	Type	L2 MTU	Tx
CAP			

☒ Enabled

Interfaces: wlan1

Certificate: request

Discovery Interfaces: ether1

☒ Lock To CAPsMAN

CAPsMAN Addresses:

CAPsMAN Names:

CAPsMAN Certificate Common Names:

Bridge: bridgeLocal

Requested Certificate: CAP-4C5E0C6C634A

Locked CAPsMAN Common Name: CAPsMAN-D4CA6D8950A0

OK Cancel Apply

# CAPsMAN and CAP in one board

- Enable CAPsMAN Manager and create the configuration
- Configure the CAP to look for IP 127.0.0.1

Wireless Tables

Interfaces | Nstreme Dual | Access List | Registration | Connect List | Security

+ - ✓ ✗ [CAP] Scanner Freq. Usage

Name	Type	L2 MTU	Tx
CAP			
<input checked="" type="checkbox"/> Enabled			
Interfaces:		wlan1	
Certificate:		none	
Discovery Interfaces:			
<input type="checkbox"/> Lock To CAPsMAN			
CAPsMAN Addresses:		127.0.0.1	
CAPsMAN Names:			
CAPsMAN Certificate Common Names:			
Bridge:		none	
Requested Certificate:			
Locked CAPsMAN Common Name:			

# CAPsMAN Antenna-gain

- Antenna-gain value is taken from the CAP interface
- Must be configured on AP before enable radio in CAP mode
- Example with 6db antenna-gain and 30db EIRP

The screenshot displays the CAPsMAN configuration interface. The top section shows a table of interfaces, including 'cap1' with MTU 1500 and L2 MTU 1600. Below this, the 'Wireless Tables' section shows a table with columns for Name, Type, L2 MTU, Tx, and Rx. A red box highlights the entry for 'cap1', showing its configuration: 'managed by CAPsMAN' and 'channel: 2442/20-Ce/gn(24dBm), SSID: LocalAP, CAPsMAN forwarding'. The bottom section shows the 'Interface <cap1>' configuration, with tabs for General, Wireless, Channel, Datapath, Security, Status, and Traffic. A red box highlights the 'Current Channel' field, which is set to '2442/20-Ce/gn(30dBm)'. Other fields include 'Current State: running-ap', 'Current Rate Set: CCK:1-11 OFDM:6-54 BW:1x-2x HT:0-15', and 'Current Basic Rate Set: OFDM:6 BW:1x HT:0-7'.

Name	Type	MTU	L2 MTU	Tx
cap1	Interfaces	1500	1600	

Name	Type	L2 MTU	Tx	Rx
cap1	managed by CAPsMAN			
cap1	channel: 2442/20-Ce/gn(24dBm), SSID: LocalAP, CAPsMAN forwarding			

Interface <cap1>

General Wireless Channel Datapath Security Status Traffic

Current State: running-ap

Current Channel: 2442/20-Ce/gn(30dBm)

Current Rate Set: CCK:1-11 OFDM:6-54 BW:1x-2x HT:0-15

Current Basic Rate Set: OFDM:6 BW:1x HT:0-7

# CAPsMAN v2 features

- CAPsMAN automatic upgrade of all CAP clients (configurable)
- Improved CAP<->CAPsMAN data connection protocol
- Added "Name Format" and "Name Prefix" setting for Provision rules
- Improved logging entries when client roams between the CAPs
- Added L2 Path MTU discovery



# CAPsMAN v2 compatibility

- CAPsMAN v2 is NOT compatible with current CAPsMAN v1 (CAPsMAN v1 CAP devices will not be able to connect to CAPsMAN v2 and CAPsMAN v2 CAP devices will not be able to connect to CAPsMAN v1).
- Both CAPsMAN and CAP devices should have wireless-cm2 package installed in order to make CAPsMAN v2 system to work.

# Upgrade to CAPsMAN v2

- Option1: Install a new temporary CAPsMAN v2 router in same network where the current CAPsMAN router is and start upgrading CAPs with wireless-cm2 package. All CAPs with the v2 will connect to the new temporary CAPsMAN v2 router. After every CAP is upgraded to v2, upgrade your current CAPsMAN to v2 and then turn off the temporary CAPsMAN v2 router.
- Option2: Upgrade your CAPs and then CAPsMAN to v2 at the same time. In this case you could have little more downtime unless you schedule all the CAPs to reboot/install at the same time.