

# mum

MikroTik User Meeting in Argentina

---

## Migración de Red Inalámbrica a CAPsMan.

---

Por: Maximiliano Dobladez  
MKE Solutions





Buenos Aires, Argentina. Noviembre 2015.



# Presentación Personal

---

- ✓ Nombre: Maximiliano Dobladez
- ✓ CEO - MKE Solutions
- ✓ Experiencia con MikroTik RouterOS desde 1999
- ✓ Consultor y Entrenador *MikroTik*
- ✓  - info@mkesolutions.net
- ✓  - @mdobladez
- ✓  - mdobladez

# Presentación de la Empresa

---

## **Capacitaciones Oficiales**

- ✓ *Entrenamientos Privados*
- ✓ *Entrenamientos Públicos*
- ✓ *Academy Coordinator Latam*

## **Soporte**

- ✓ *Incidencias*
- ✓ *Soporte Mensual (OutSourcing)*

## **Desarrollo**

- ✓ *Desarrollo de Proyectos*
- ✓ *Soluciones llave en mano*

## **Ventas**

- ✓ *Hardware*
- ✓ *Licencias RouterOS*



[www.mkesolutions.net](http://www.mkesolutions.net)



[info@mkesolutions.net](mailto:info@mkesolutions.net)



[@mkesolutions](https://twitter.com/mkesolutions)



[/mkesolutions](https://facebook.com/mkesolutions)

# Presentación de la Empresa



# Academia<sup>®</sup>

DE ENTRENAMIENTOS

## Mis Cursos

Inscribirse a un entrenamiento

MTCNA Rio Cuarto, Argentina

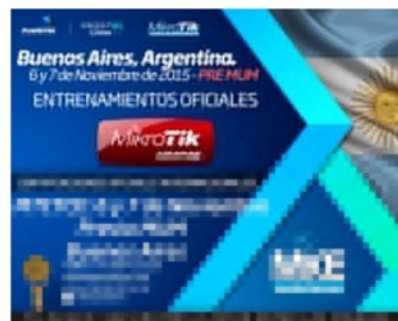
**CONFIRMADO**

MTCNA Rio Cuarto, Argentina

**CERRADO**

## Conceptos Iniciales

	Dificultad
<a href="#">Introducción al cálculo de redes (subneting)</a> Cómo realizar el subneteo en IPv4. Cálculo binario y decimal de mascarar y hosts.	<b>Inicial</b>
<a href="#">Modelo OSI</a> El modelo OSI. Introducción y necesidad del mismo. Descripción de las 7 capas. Relación Modelo OSI y TCP/IP.	<b>Intermedia</b>
<a href="#">DHCP-Option Calculator</a> Calculadora para obtener el dhcp-option en HEX de un network y gateway	<b>Intermedia</b>
<a href="#">IPv6 para operadores de Red.</a> Libro que nos enseña como implementar IPv6 en redes de carriers. BGP de transito. Ejemplos de configuraciones	<b>Alta</b>
<a href="#">Burst Simulator</a> Herramienta para simular una descarga y graficar la ráfaga del Burst con los parámetros ingresados.	<b>Intermedia</b>



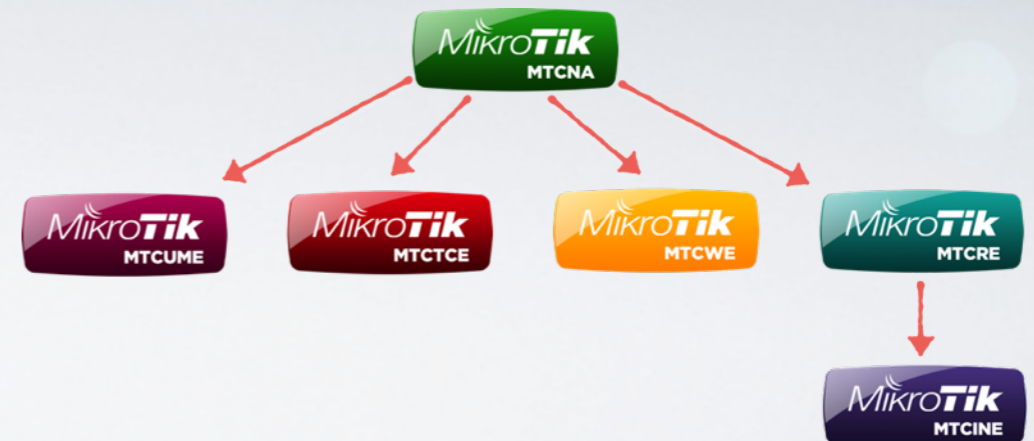
## MTCTCE

MikroTik **20**

2015-11-06 | Buenos Aires, Argentina |

Entrenamiento Oficial MikroTik el 06 de Noviembre de 2015 en la ciudad de Buenos Aires, Argentina.  
Duración: 2 días.

Mas Info



<http://consultores.mkesolutions.net>

<http://www.AcademiaDeEntrenamientos.com>

# Presentación de la Empresa



**REDES SPECTRUM**

# ESCENARIO



# ESCENARIO

## *Situación inicial*

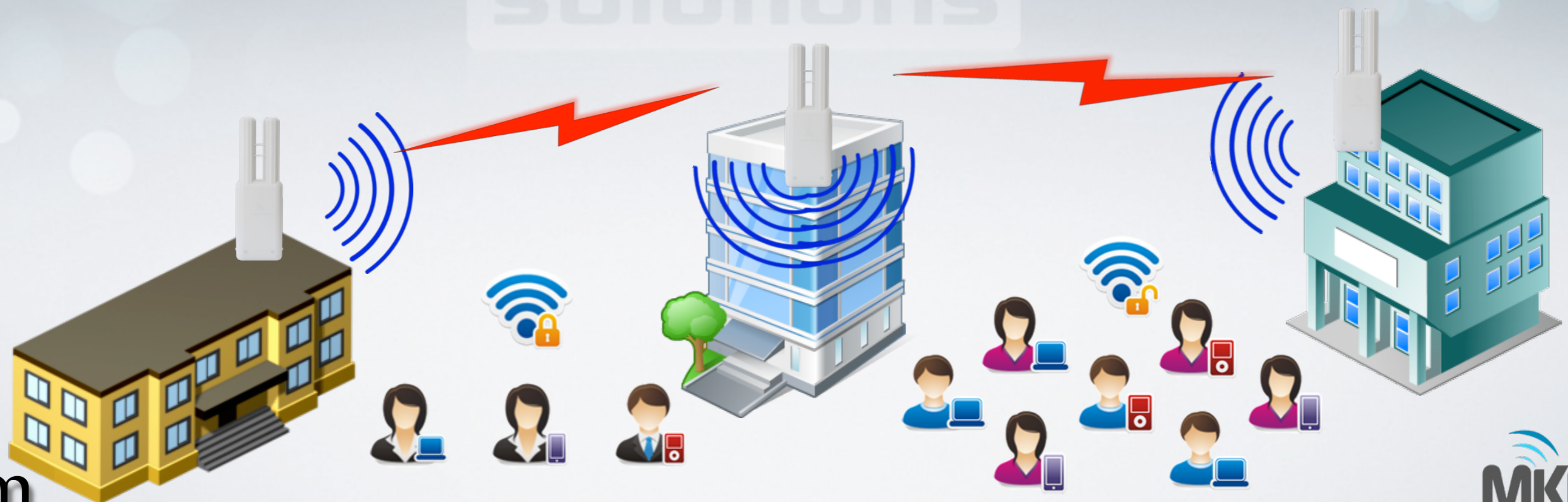
- ✓ Brindar conectividad inalámbrica al campus universitario
- ✓ Dos redes wireless **Profesor** (encriptada) y **Alumnos** (libre)
- ✓ Redes independientes y no se pueden ver mutuamente
- ✓ Acceso a las redes por VLANs diferentes
- ✓ Internet libre pero controlado para **Alumnos**
- ✓ Acceso a SIAL (Sistema de Alumnos) para **Profesores**



# ESCENARIO

## *Propuesta Original*

- ✓ Realizar una red MESH dual con varios APs para cubrir la zona solicitada
- ✓ Crear dos redes inalámbricas a través de AP Virtuales
- ✓ Posibilidad de brindar roaming entre APs
- ✓ Niveles de seguridad básicos

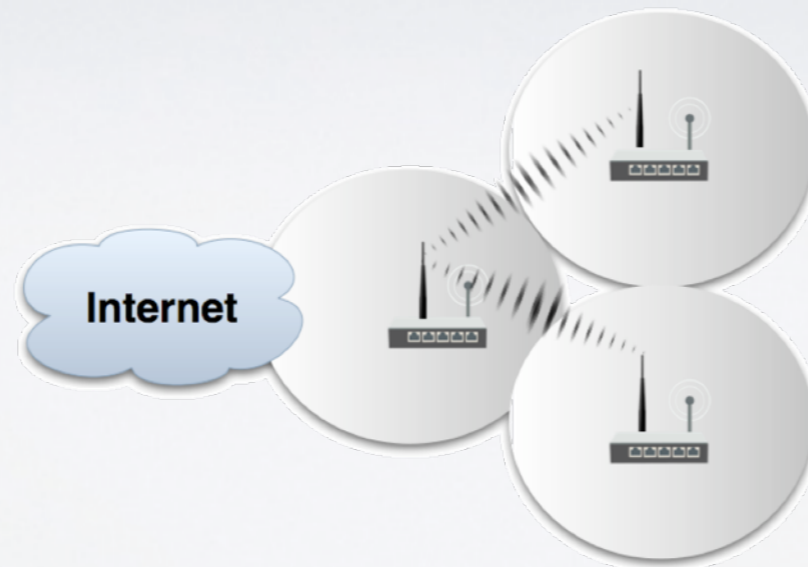




# ESCENARIO

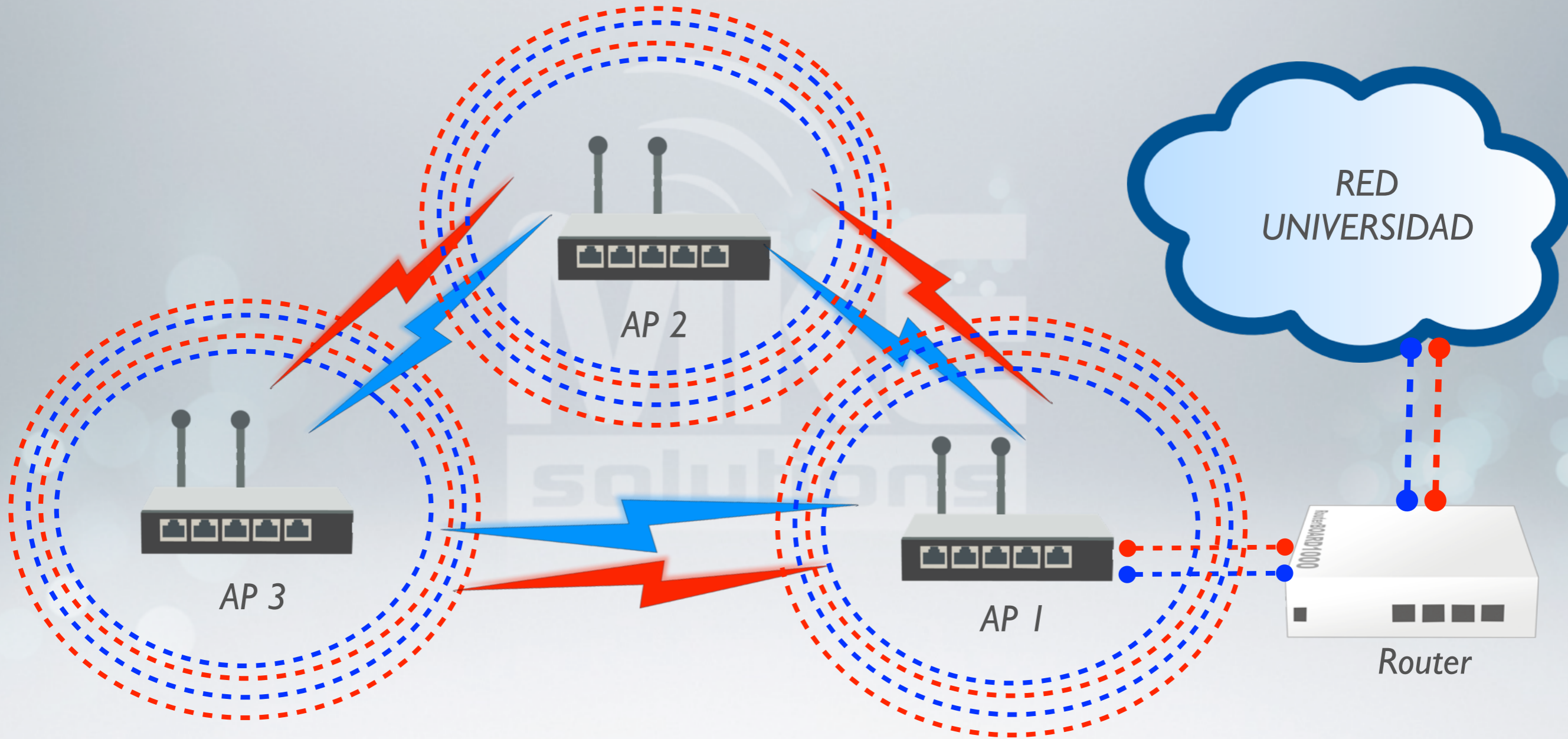
## *Diseño de la red original*

- ✓ MESH basada en **WDS + RSTP**
- ✓ MESH Dual - *5Ghz Backbone - 2Ghz Acceso*
- ✓ Canales diferentes para evitar traslape (red acceso)
- ✓ Trabaja en Capa 2 (OSI)
- ✓ RSTP para evitar bucles y convergencia ante cambios
- ✓ Lista de acceso para limitar niveles de señal inalámbrica



# REDES MESH

## Diseño de la red



5Ghz - Backbone



2Ghz - Profesores  
Alumnos



Vlan Profesores

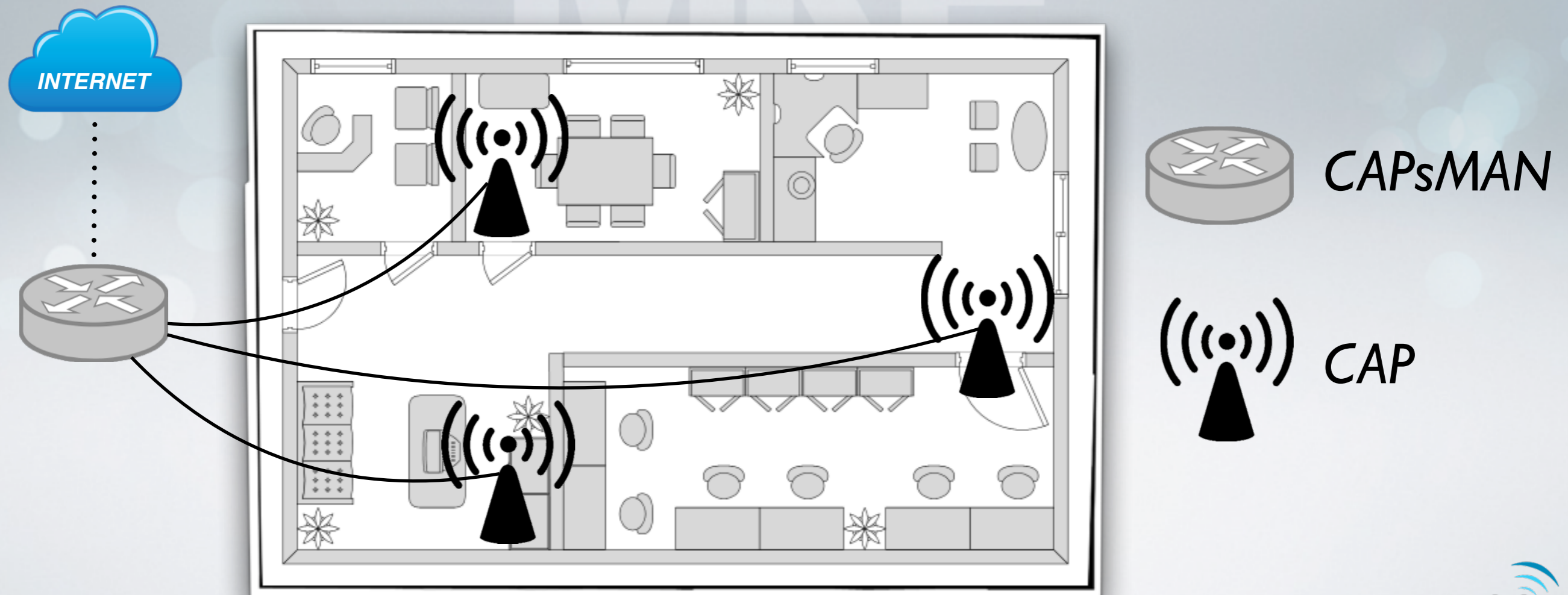


Vlan Alumnos

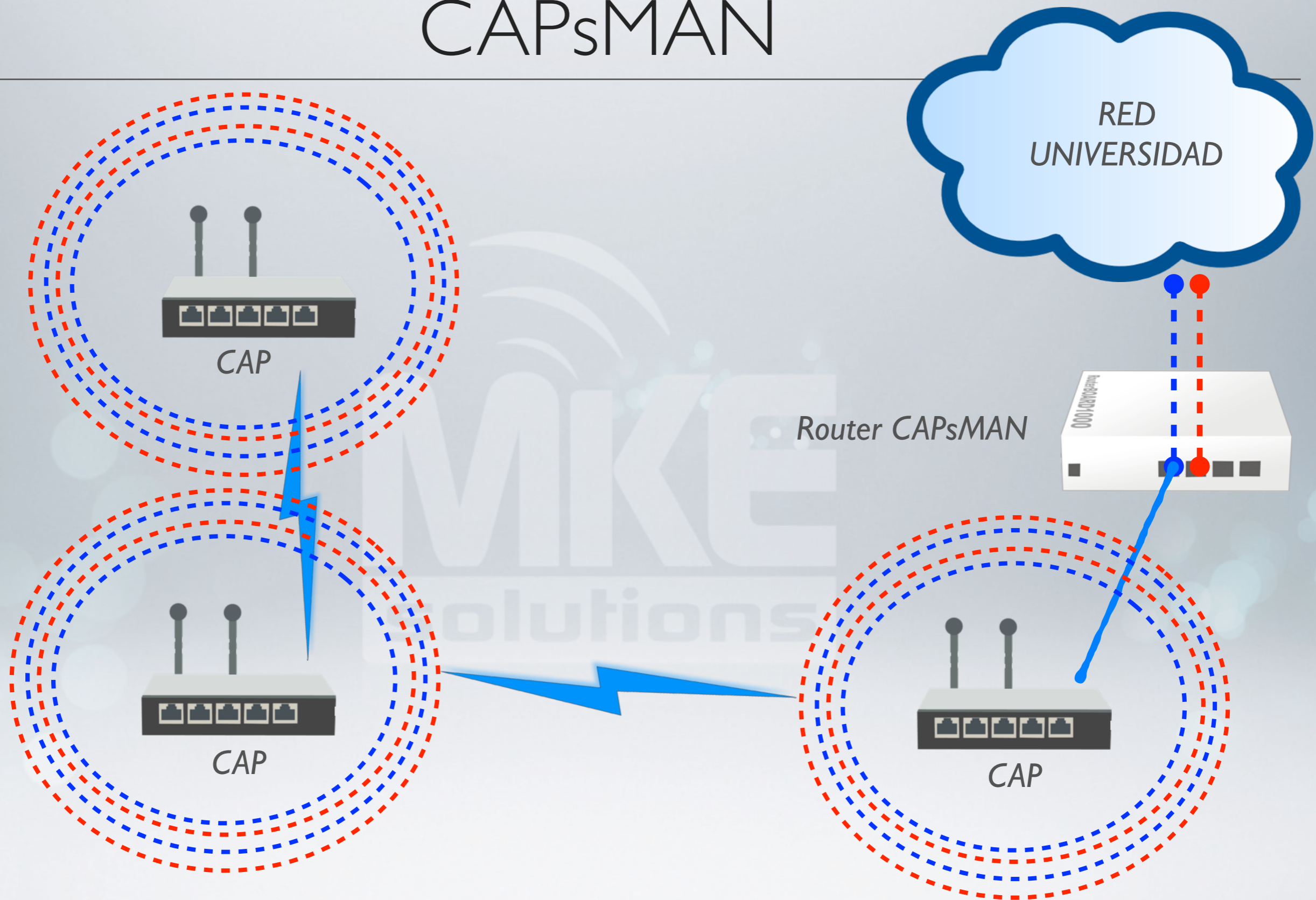
# MIGRACION A CAPSMAN




# CAPsMAN

- ✓ Administración centralizada
- ✓ Comunicación por **MAC** e **IP**.
- ✓ Aprovisionamiento de APs
- ✓ Soporta AP Virtuales
- ✓ Soporta modo *local forwarding*



# CAPsMAN



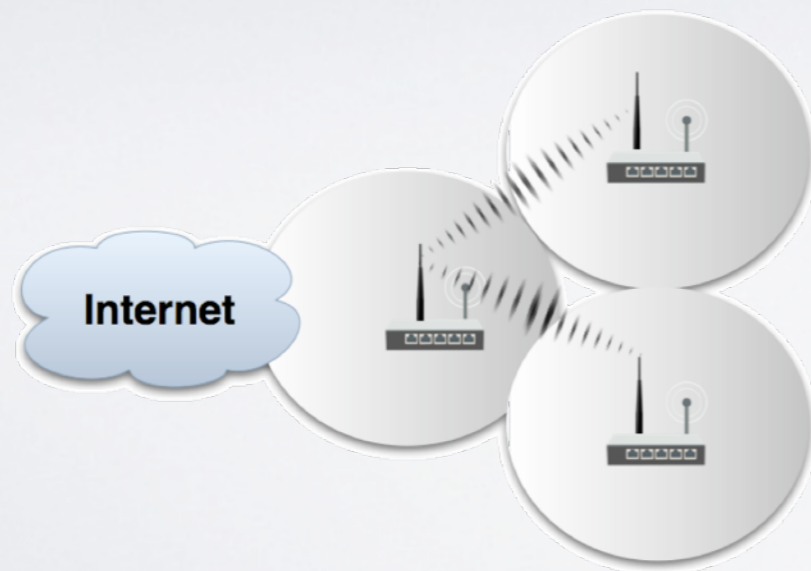
 5Ghz - Backbone  
 2Ghz - Profesores  
 Alumnos

 Vlan Profesores  
 Vlan Alumnos

# CAPsMAN

## *Implementación de CAPsMAN*

- ✓ Crear 2 Bridges (Profesores y Alumnos)
- ✓ Crear red de Backbone en 5Ghz
- ✓ Activar CAPsMAN en router central
- ✓ Configurar el Aprovisionamiento
- ✓ Configurar los CAPs y registrar al CAPsMAN
- ✓ Chequear la configuración



# CONFIGURACION



# CONFIGURACION CAPsMAN

- ✓ Bridge *Profesores y Alumnos*
- ✓ Bridge *BackBone*

The screenshot displays the Mikrotik WinBox interface for configuring bridges. At the top left, a 'Bridge' window shows a table of existing bridges:

	Name	Type	L2 MTU	Tx
R	BACKBONE	Bridge	1600	
R	BRIDGE ALUMNOS	Bridge	1594	
R	BRIDGE PROFESORES	Bridge	1594	

Below this table, three configuration windows are open for each bridge:

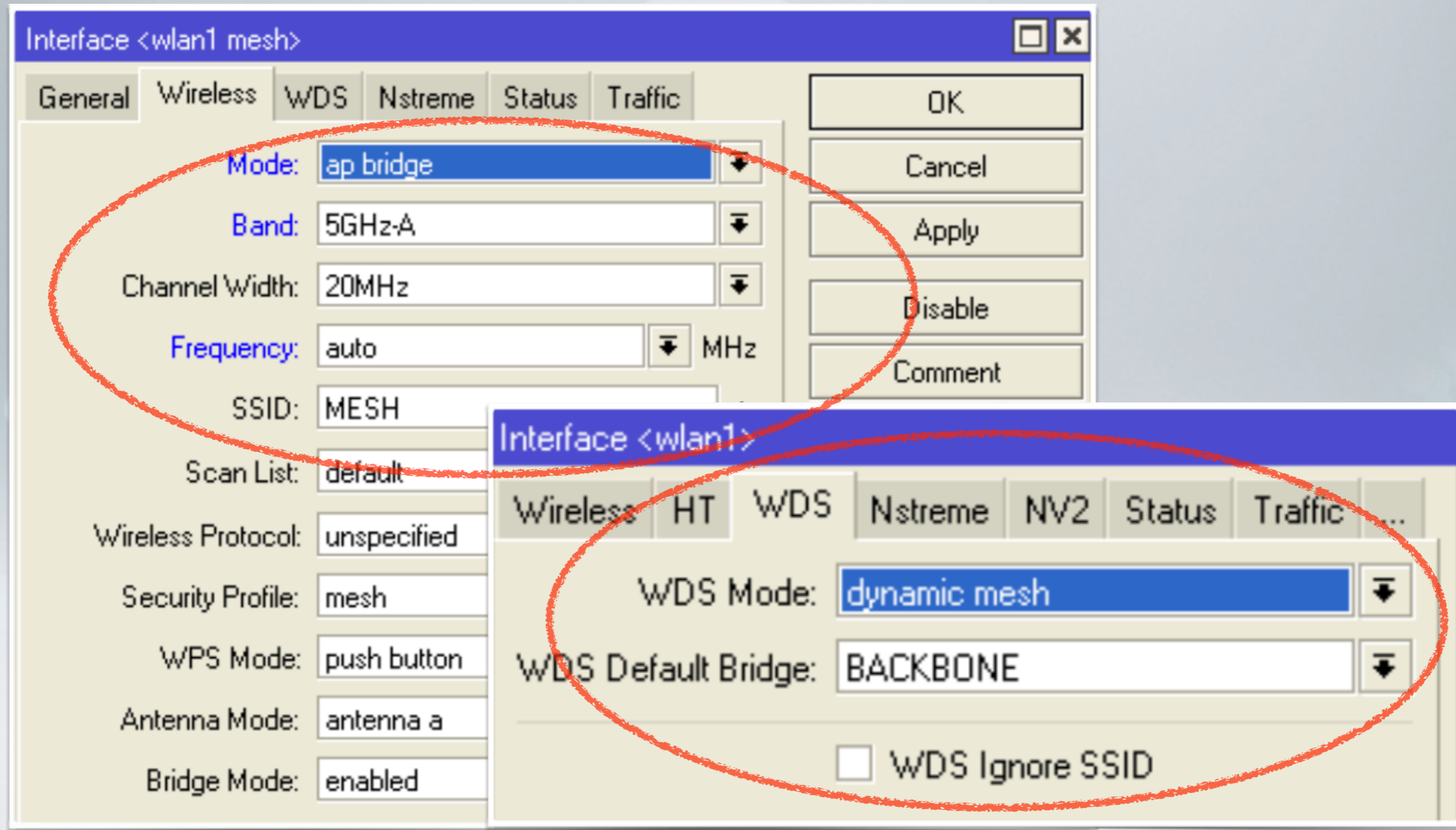
- Interface <BACKBONE>**: Name: BACKBONE, Type: Bridge, MTU: (empty), Actual MTU: 1500, L2 MTU: 1600, MAC Address: D4:CA:6D:2B:A8:82, ARP: enabled.
- Interface <BRIDGE ALUMNOS>**: Name: BRIDGE ALUMNOS, Type: Bridge, MTU: (empty), Actual MTU: 1500, L2 MTU: 1594.
- Interface <BRIDGE PROFESORES>**: Name: BRIDGE PROFESORES, Type: Bridge, MTU: (empty), Actual MTU: 1500, L2 MTU: 1594, MAC Address: 00:0C:42:63:11:0B.

- Activarles *RSTP*



# CONFIGURACION CAPsMAN

✓ Configurar Red Wireless como *AP Bridge* y *WDS*



# CONFIGURACION CAPsMAN

✓ Activar *CAPsMAN* y crear *Configuraciones*

The screenshot shows the Mikrotik WinBox interface for configuring CAPsMAN. On the left is a sidebar with navigation options like Quick Set, CAPsMAN, Interfaces, Wireless, Bridge, PPP, Switch, Mesh, IP, MPLS, Routing, System, Queues, Files, Log, Radius, Tools, and New Terminal. The main window displays the CAPsMAN configuration tabs: Interfaces, Provisioning, Configurations, Channels, Datapaths, and Security. Below these tabs is a toolbar with icons for adding, deleting, and saving configurations, along with buttons for Manager and AAA. A table with columns for Add, Name, Type, MTU, and L2 MTU is visible. Overlaid on this is the 'CAPs Manager' dialog box, which is highlighted with a red circle. In this dialog, the 'Enabled' checkbox is checked. Below it, the 'Certificate' and 'CA Certificate' dropdown menus are set to 'auto'. The 'Require Peer Certificate' checkbox is unchecked. At the bottom, the 'Generated Certificate' and 'Generated CA Certificate' fields show unique identifiers. The 'Package Path' field is empty, and the 'Upgrade Policy' is set to 'none'. Buttons for OK, Cancel, and Apply are on the right side of the dialog.

# CONFIGURACION CAPsMAN

✓ Activar *CAPsMAN* y crear *Configuraciones*

The screenshot displays the CAPsMAN configuration interface. At the top, there are tabs for 'Interfaces', 'Provisioning', 'Configurations', 'Channels', 'Datapaths', 'Security Cfg.', 'Access List', 'Remote CAP', 'Radio', and 'Registration Table'. Below the tabs is a table of configurations:

Name	SSID	Hide SSID	Load Bal...	Country	Channel	Frequency	Band	Datapath	Bridge
Config ALUMNOS	ALUMNOS								BRIDGE ALUMNOS
Config PROFESO...	PROFESORES				CANAL 1				BRIDGE PROFESORES

Below the table, three configuration windows are shown, each with tabs for 'Wireless', 'Channel', 'Datapath', and 'Security':

- CAPs Configuration <Config ALUMNOS>**: Name: Config ALUMNOS, Mode: ap, SSID: ALUMNOS, Bridge: BRIDGE ALUMNOS.
- CAPs Configuration <Config PROFESORES>**: Name: Config PROFESORES, Mode: ap, SSID: PROFESORES, Bridge: BRIDGE PROFESORES.
- CAPs Configuration <Config PROFESORES>**: Security: PROFESORES SEGURIDAD.

# CONFIGURACION CAPsMAN

## ✓ Crear Aprovisionamiento

The screenshot displays the CAPsMAN provisioning configuration interface. The main window shows a table with one entry for Radio MAC 00:00:00:00:00:00, Action 'create dynamic enabled', Master Configuration 'Config PROFESORES', and Slave Configuration 'Config ALUMNOS'. A modal dialog titled 'CAPs Provisioning <00:00:00:00:00:00>' is open, showing fields for Radio MAC, Identity Regexp, Common Name Regexp, IP Address Ranges, Action (create dynamic enabled), Master Configuration (Config PROFESORES), Slave Configuration (Config ALUMNOS), and Name Format (cap). The dialog also includes buttons for OK, Cancel, Apply, Disable, Comment, Copy, and Remove.

#	Radio MAC	Identity Regexp	Common Nam...	Action	Master Configurati...	Slave Configuration
0	00:00:00:00:00:00			create dy...	Config PROFESO...	Config ALUMNOS

1 item

# CONFIGURACION CAPsMAN

- ✓ Crear *VLANs* y agregarlas al *Bridge* correspondiente

The screenshot displays the Mikrotik WinBox interface. At the top, the 'Bridge' window is open, showing a table of bridge ports. Below it, two configuration windows for VLANs are open: 'Interface <vlan.20 PROFESORES>' and 'Interface <vlan.10 ALUMNOS>'. The 'vlan.20 PROFESORES' window shows a Name of 'vlan.20 PROFESORES', Type of 'VLAN', MTU of 1500, L2 MTU of 1594, MAC Address of D4:CA:6D:2B:A8:81, ARP enabled, VLAN ID of 20, and Interface of ether5. The 'vlan.10 ALUMNOS' window shows a Name of 'vlan.10 ALUMNOS', Type of 'VLAN', MTU of 1500, L2 MTU of 1594, MAC Address of D4:CA:6D:2B:A8:81, ARP enabled, VLAN ID of 10, and Interface of ether5. Both windows have 'Use Service Tag' unchecked.

Interface	Bridge	Priority (h...)	Path Cost	Horizon	Role	R
DI cap6	BRIDGE PROFESORES	80	10		disabled port	
DI cap7	BRIDGE ALUMNOS	80	10		disabled port	
vlan.10 ALUMNOS	BRIDGE ALUMNOS	80	10		designated port	
vlan.20 PROFESORES	BRIDGE PROFESORES	80	10		designated port	
D wds83	BACKBONE	80	74		root port	

**Interface <vlan.20 PROFESORES>**

General | Status | Traffic

Name: vlan.20 PROFESORES

Type: VLAN

MTU: 1500

L2 MTU: 1594

MAC Address: D4:CA:6D:2B:A8:81

ARP: enabled

VLAN ID: 20

Interface: ether5

Use Service Tag

**Interface <vlan.10 ALUMNOS>**

General | Status | Traffic

Name: vlan.10 ALUMNOS

Type: VLAN

MTU: 1500

L2 MTU: 1594

MAC Address: D4:CA:6D:2B:A8:81

ARP: enabled

VLAN ID: 10

Interface: ether5

Use Service Tag

# CONFIGURACION CAPS

# CONFIGURACION CAPs

✓ Crear **Bridge** y agregar la interface wlan **Backbone**

The screenshot displays the Mikrotik WinBox interface for configuring a Bridge. The main window shows the 'Bridge' configuration page with a table listing the bridge instance:

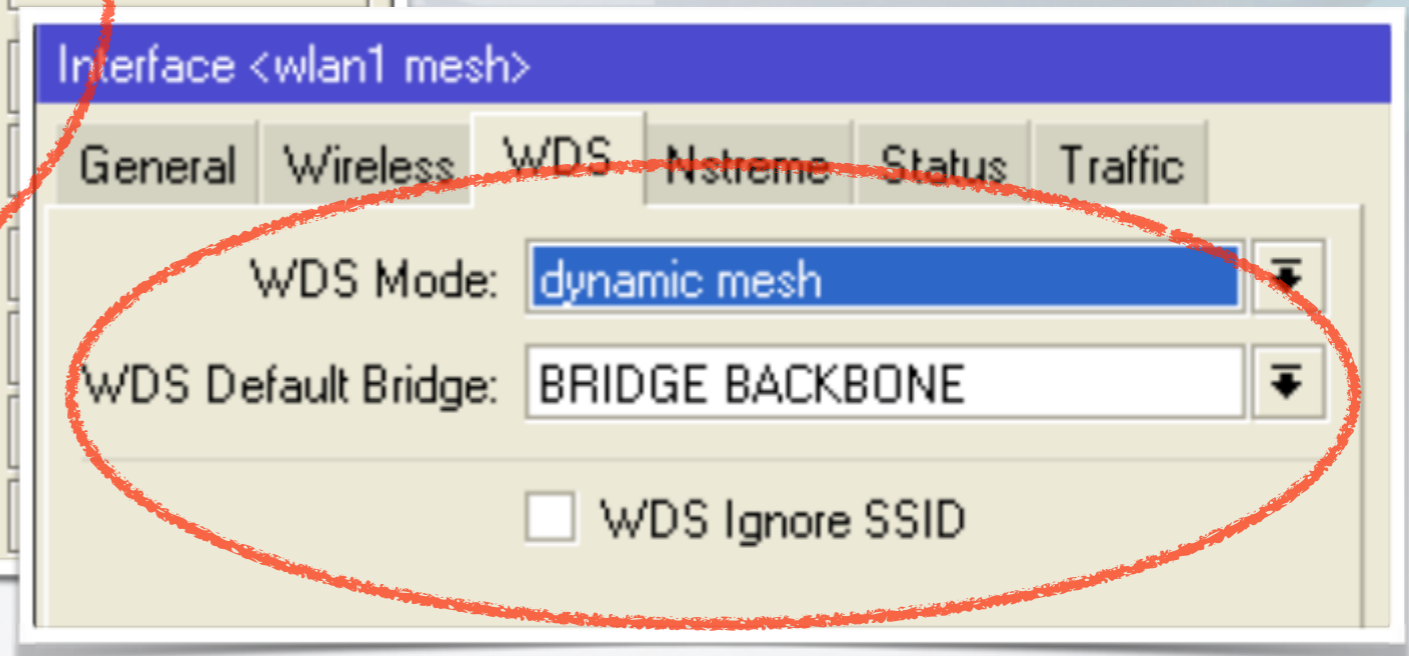
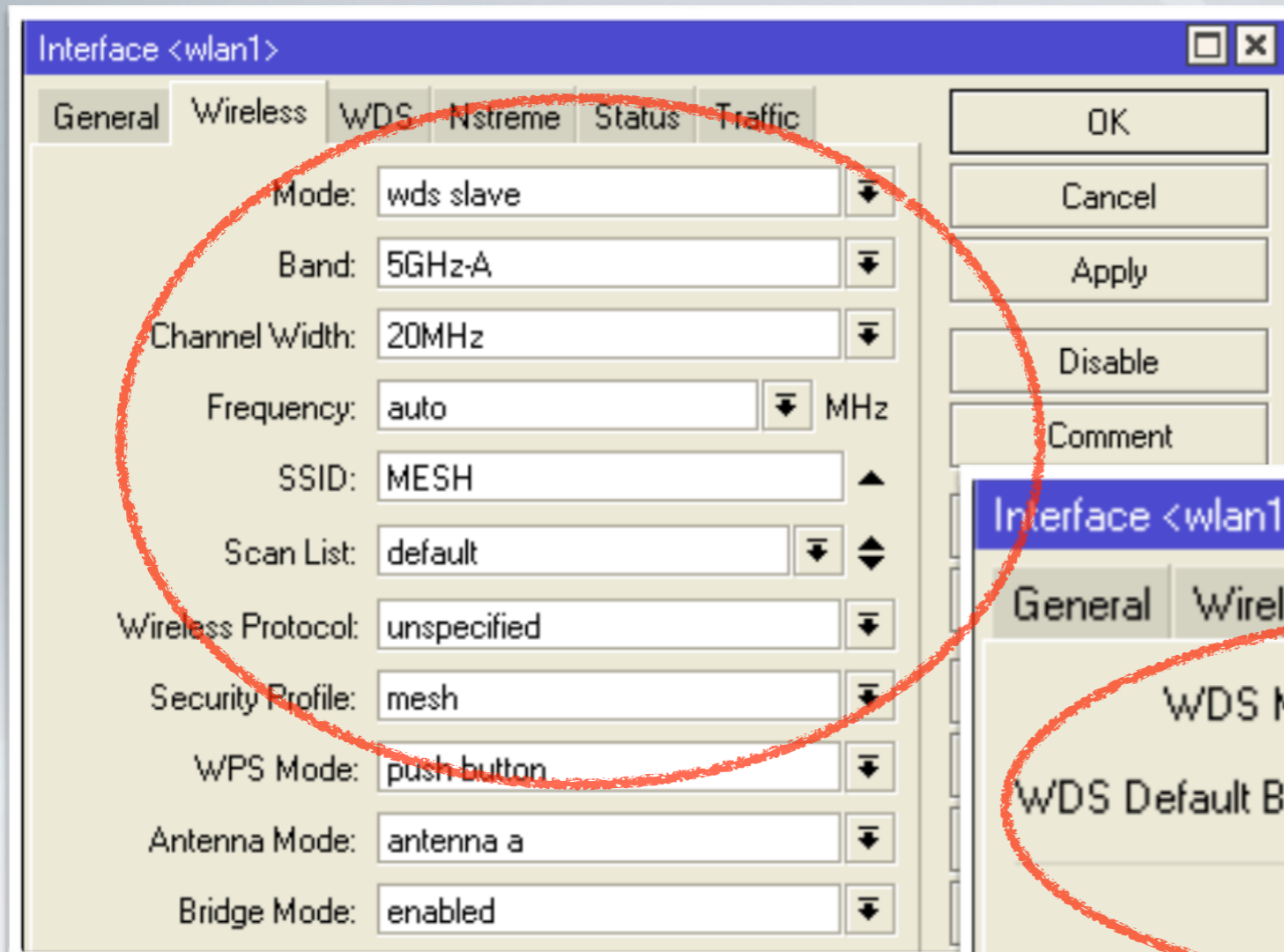
Name	Type
R BRIDGE BACKBONE	Bridge

An inset window shows the 'Ports' tab configuration, displaying a table of interfaces connected to the bridge:

Interface	Bridge	Priority (h...)	Path Cost
wlan1 mesh	BRIDGE BACKBONE	80	10
wds6	BRIDGE BACKBONE	80	101

# CONFIGURACION CAPs

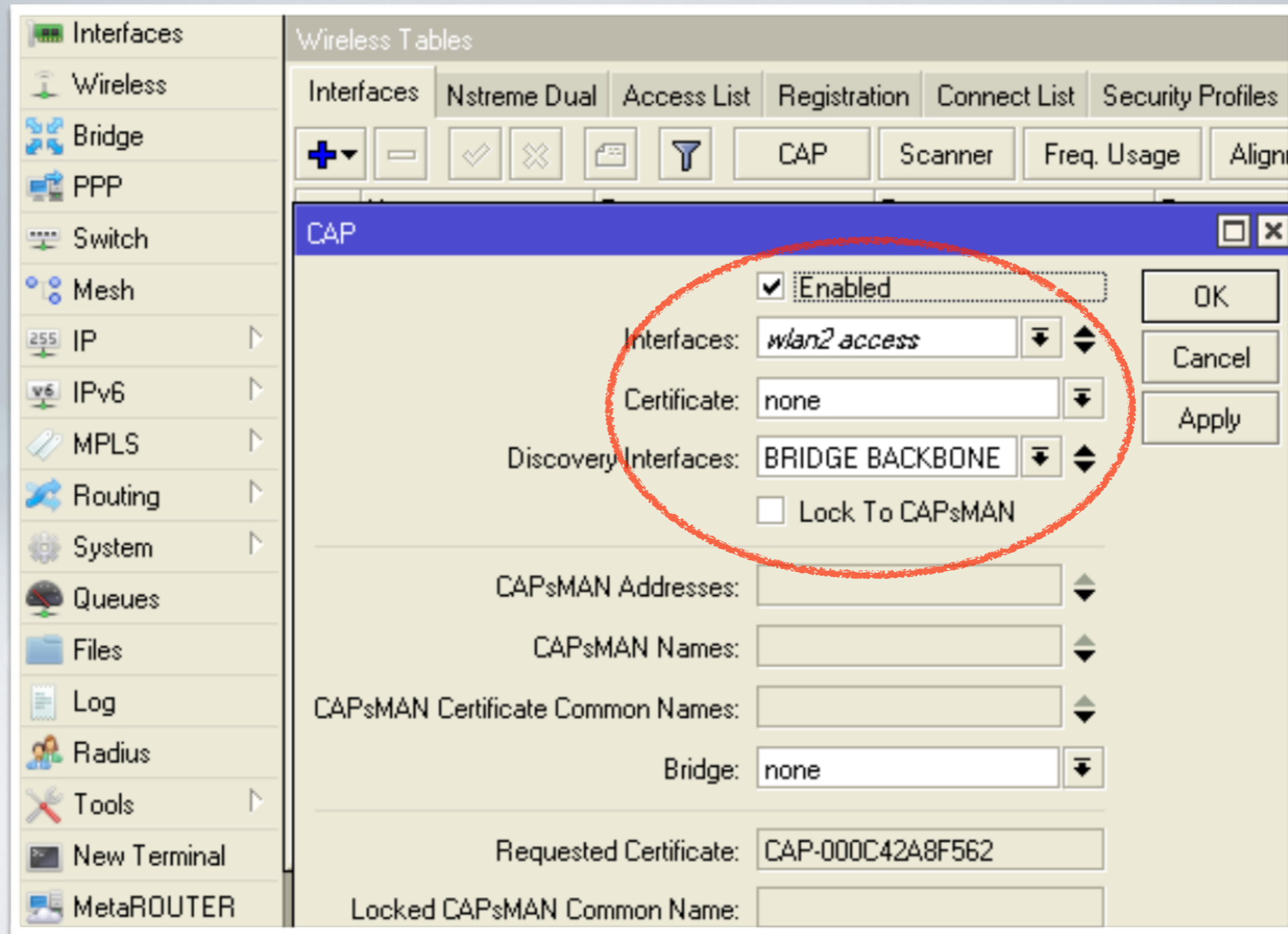
- ✓ Configurar la interface wlan **Backbone** y agregarla al **bridge**





# CONFIGURACION CAPs

✓ Activar *CAP* y configurar *Interfaces*



The screenshot shows the Mikrotik WinBox interface with the 'CAP' configuration window open. The window is titled 'CAP' and has a blue header. The main area contains several configuration fields:

- Enabled
- Interfaces: wlan2 access
- Certificate: none
- Discovery Interfaces: BRIDGE BACKBONE
- Lock To CAPsMAN
- CAPsMAN Addresses: (empty)
- CAPsMAN Names: (empty)
- CAPsMAN Certificate Common Names: (empty)
- Bridge: none
- Requested Certificate: CAP-000C42A8F562
- Locked CAPsMAN Common Name: (empty)

The 'Enabled' checkbox, the 'Interfaces' dropdown, and the 'Discovery Interfaces' dropdown are circled in red. The 'Interfaces' dropdown is set to 'wlan2 access' and the 'Discovery Interfaces' dropdown is set to 'BRIDGE BACKBONE'. The 'Requested Certificate' field contains the value 'CAP-000C42A8F562'. The 'Lock To CAPsMAN' checkbox is unchecked. The 'CAPsMAN Addresses', 'CAPsMAN Names', and 'Locked CAPsMAN Common Name' fields are empty. The 'Bridge' dropdown is set to 'none'. The 'CAPsMAN Certificate Common Names' field is empty. The 'Enabled' checkbox is checked. The 'Interfaces' dropdown is set to 'wlan2 access'. The 'Discovery Interfaces' dropdown is set to 'BRIDGE BACKBONE'. The 'Lock To CAPsMAN' checkbox is unchecked. The 'CAPsMAN Addresses' field is empty. The 'CAPsMAN Names' field is empty. The 'CAPsMAN Certificate Common Names' field is empty. The 'Bridge' dropdown is set to 'none'. The 'Requested Certificate' field contains the value 'CAP-000C42A8F562'. The 'Locked CAPsMAN Common Name' field is empty.

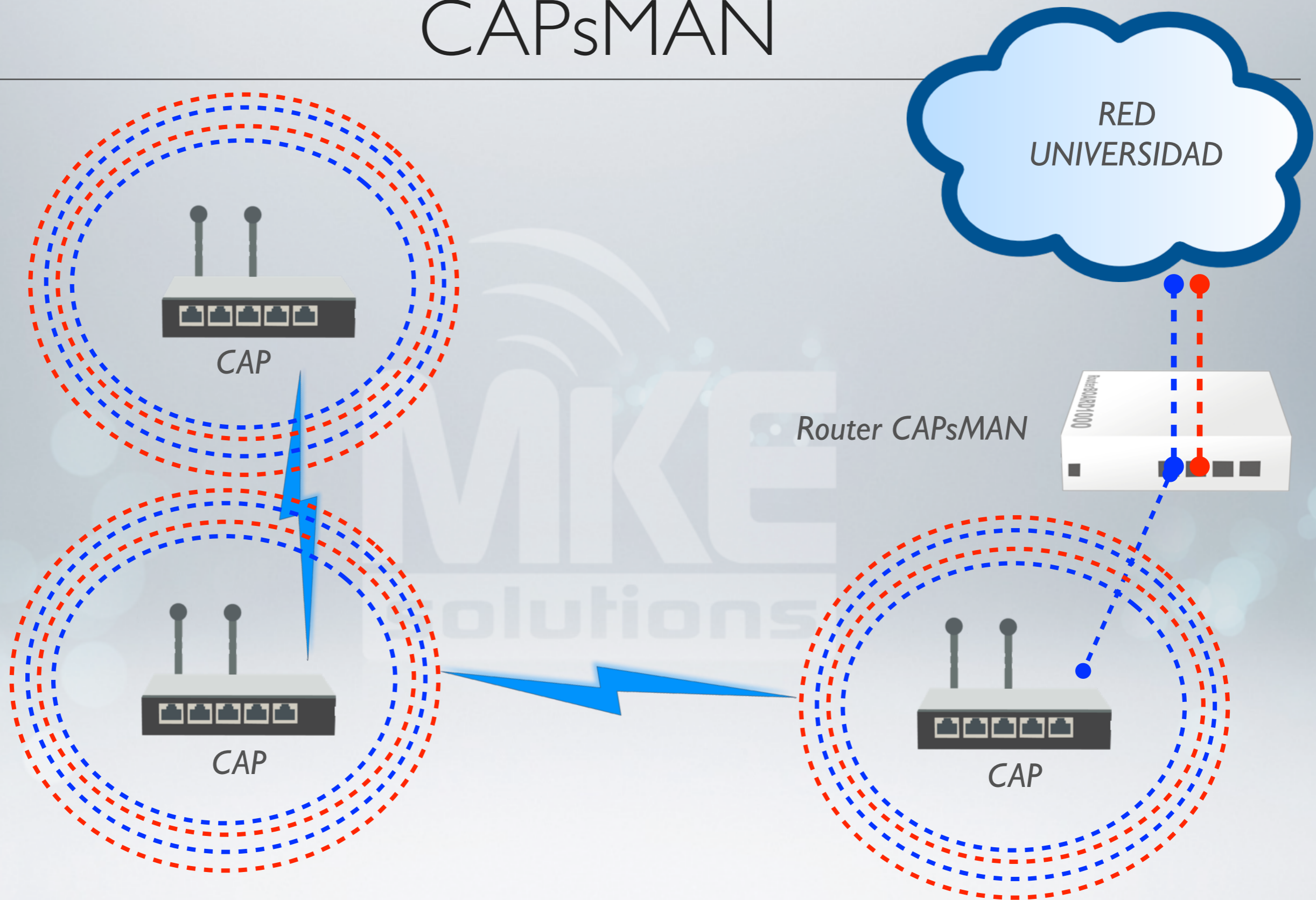
# CONFIGURACION CAPs




- ✓ Se espera conexión al CAPsMAN y el aprovisionamiento

The screenshot shows the 'Wireless Tables' window in Mikrotik WinBox. It features a tabbed interface with 'Interfases' selected. Below the tabs are various tool buttons like '+', '-', checkmarks, and filters. The main area is a table with columns for Name, Type, Tx, Rx, Tx Packet (p/s), and Rx Packet (p/s). The table lists four wireless interfaces: wlan1 mesh (Wireless), wds6 (WDS), wlan2 access (Wireless), and wlan25 (Virtual AP). Red text annotations indicate that wlan1 mesh and wlan2 access are managed by CAPsMAN and are forwarding traffic.

	Name	Type	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)
RS	wlan1 mesh	Wireless (Atheros AR5...	112.0 kbps	4.2 kbps	11	
DRS	wds6	WDS	111.6 kbps	4.2 kbps	10	
	--- managed by CAPsMAN					
	--- channel: 2447/20/g(30dBm), SSID: PROFESORES, CAPsMAN forwarding					
X	wlan2 access	Wireless (Atheros AR5...	0 bps	0 bps	0	
	--- managed by CAPsMAN					
	--- SSID: ALUMNOS, CAPsMAN forwarding					
DX	wlan25	Virtual AP	0 bps	0 bps	0	

# CAPsMAN



 **5Ghz** - Backbone  
 **2Ghz** - Profesores  
 Alumnos

 Vlan Profesores  
 Vlan Alumnos

# MONITOREO DE CONEXIONES

## ✓ Monitoreo centralizado

CAPsMAN

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

Interface	SSID	MAC Address	Tx Rate	Rx Rate	Tx Signal	Rx Signal	Uptime	Tx/Rx Packets	Tx/Rx Bytes
cap113	MKE-Max-2	00:25:56:BC:CA:9D	54Mbps	48Mbps	0	-57	01:40:37.70	72 976/64 513	40.1 MiB/12.0 MiB
cap113	MKE-Max-2	F8:CF:C5:7D:83:8B	11Mbps	11Mbps	0	-74	01:32:16.75	12 057/7 630	13.8 MiB/827.7 KiB
cap113	MKE-Max-2	00:1C:BF:00:29:F8	48Mbps	54Mbps	0	-66	00:42:38.20	57 275/43 439	59.1 MiB/5.1 MiB
cap116	MKE-Max	2C:41:38:2D:74:F6	1Mbps	52Mbps-20MHz/15	0	-79	01:40:38	1/49	42 B/27.9 KiB
cap116	MKE-Max	48:5D:60:1D:DF:2A	216Mbps-40MHz/25	13.5Mbps-40MHz/15	0	-61	01:40:36.88	3 845/3 830	565.3 KiB/453.4 KiB
cap116	MKE-Max	D4:CA:6D:30:C3:C3	135Mbps-40MHz/15	135Mbps-40MHz/15	-41	-57	01:40:35.34	3 629/5 003	1147.3 KiB/981.4 KiB
cap116	MKE-Max	80:22:75:1C:C1:BF	54Mbps	39Mbps-20MHz/15					
cap116	MKE-Max	5C:B5:24:EC:B1:F8	5.5Mbps	58.5Mbps-20MHz/15					
cap116	MKE-Max	CC:29:F5:5F:C7:ED	52Mbps-20MHz/15	19.5Mbps-20MHz/15					
cap116	MKE-Max	CC:FA:00:EE:6E:F9	48Mbps	1Mbps					
cap27	MKE-Max-5	14:10:9F:D5:7B:05	270Mbps-40MHz/25	216Mbps-40MHz/25					
cap27	MKE-Max-5	14:10:9F:D3:C0:93	243Mbps-40MHz/25	135Mbps-40MHz/15					

Bridge

Bridge Ports Filters NAT Hosts

Interface	Bridge	Priority (...)	Path Cost	Horizon	Role
D cap113	local_lan	80	10		designated port
DI cap114	RED GUEST	80	10		disabled port
DI cap115	RED TRAINING	80	10		disabled port
D cap116	local_lan	80	10		designated port
D cap27	local_lan	80	10		designated port
DI cap28	RED GUEST	80	10		disabled port
DI cap29	RED TRAINING	80	10		disabled port
ether2	local_lan	80	10		designated port
ether3	dmz_bridge	80	10		designated port
;;; GSM					
ether4	dmz_bridge	80	10		designated port
;;; ATA VOIP					
ether7	local_lan	80	10		designated port

CAPsMAN

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

Manager AAA

Name	Type	MTU	L2 MTU	Tx	Rx
DRSMB cap27	Interfaces	1500	1600	485.0 kbps	69.9 kbps
DSB cap28	Interfaces	1500	1600	0 bps	0 bps
DSB cap29	Interfaces	1500	1600	0 bps	0 bps
DRSMB cap113	Interfaces	1500	1600	133.9 kbps	10.1 kbps
DSB cap114	Interfaces	1500	1600	0 bps	0 bps
DSB cap115	Interfaces	1500	1600	0 bps	0 bps
DRSB cap116	Interfaces	1500	1600	1176 bps	4.4 kbps

U	U	U	U
16	12	MKE-Max-2	
0	0	MKE-Guest	
0	0	MKE Training	
3	3	MKE-Max	

# RECOMENDACIONES FINALES

---

- ✓ Hacer aprovisionamientos personalizados
- ✓ Hacer reglas de filtrado por niveles de señal
- ✓ Activar **WMM** en toda la red Wireless
- ✓ Hacer filtrado *netbios / smb* en *firewall bridge*
- ✓ Colocar protección de **DHCP intrusos** y *alertas* al detectarlos



# REFERENCIAS

---

Enlaces y Documentaciones:

## ✓ MikroTik RouterOS Wiki

- Manual CAPsMAN

## ✓ MikroTik User Meeting MUM

- CAPsMAN - Uldis (India 2015)
- Redes MESH - Maia (Brasil 2008)
- Redes MESH para Universidad: Maxi (Bolivia 2014)

## ✓ MKE Solutions

- <http://www.mkesolutions.net>
- <http://www.AcademiaDeEntrenamientos.com>



# ¿PREGUNTAS?

## *Muchas Gracias!*

- ▶ [info@mkesolutions.net](mailto:info@mkesolutions.net)
- ▶ <http://www.mkesolutions.net>
- ▶ <http://www.AcademiaDeEntrenamientos.com>
- ▶ <http://maxid.com.ar>
- ▶ <http://twitter.com/mdobladez>



**Academia**<sup>®</sup>  
DE ENTRENAMIENTOS