

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
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- ✓ Experiencia con MikroTik RouterOS desde 1999
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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*



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Presentación de la Empresa



Academia[®]

DE ENTRENAMIENTOS

Mis Cursos

Inscribirse a un entrenamiento 

 MTCNA Rio Cuarto, Argentina

 Info

CONFIRMADO

 MTCNA Rio Cuarto, Argentina

 Info

CERRADO



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

 Inscribirse

Conceptos Iniciales

Dificultad



[Introducción al cálculo de redes \(subnetting\)](#)

Cómo realizar el subneteo en IPv4. Cálculo binario y decimal de máscaras y hosts.

Inicial



[Modelo OSI](#)

El modelo OSI. Introducción y necesidad del mismo. Descripción de las 7 capas. Relación Modelo OSI y TCP/IP.

Intermedia



[DHCP-Option Calculator](#)

Calculadora para obtener el dhcp-option en HEX de un network y gateway

Intermedia



[IPv6 para operadores de Red.](#)

Libro que nos enseña como implementar IPv6 en redes de carriers. BGP de transito. Ejemplos de configuraciones

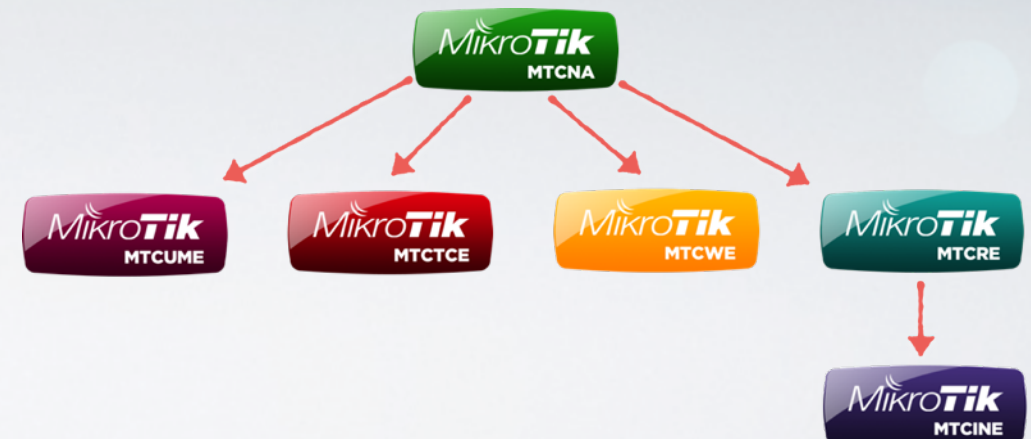
Alta



[Burst Simulator](#)

Herramienta para simular una descarga y graficar la ráfaga del Burst con los parámetros ingresados.

Intermedia



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Presentación de la Empresa



REDES SPECTRUM

ESCENARIO

ESCENARIO

Situación inicial

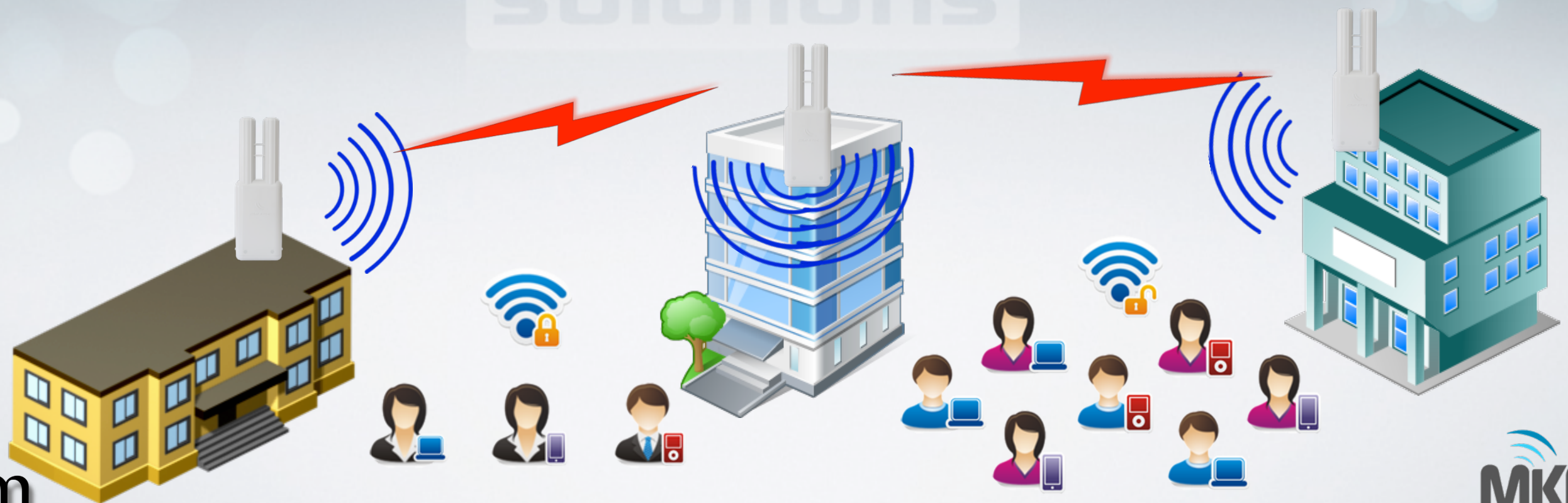
- ✓ Brindar conectividad inalámbrica al campus universitario
- ✓ Dos redes wireless **Profesor** (encriptada) y **Alumnos** (libre)
- ✓ Redes independientes y no se pueden ver mutuamente
- ✓ Acceso a las redes por VLANs diferentes
- ✓ Internet libre pero controlado para **Alumnos**
- ✓ Acceso a SIAL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



ESCENARIO

Propuesta Original

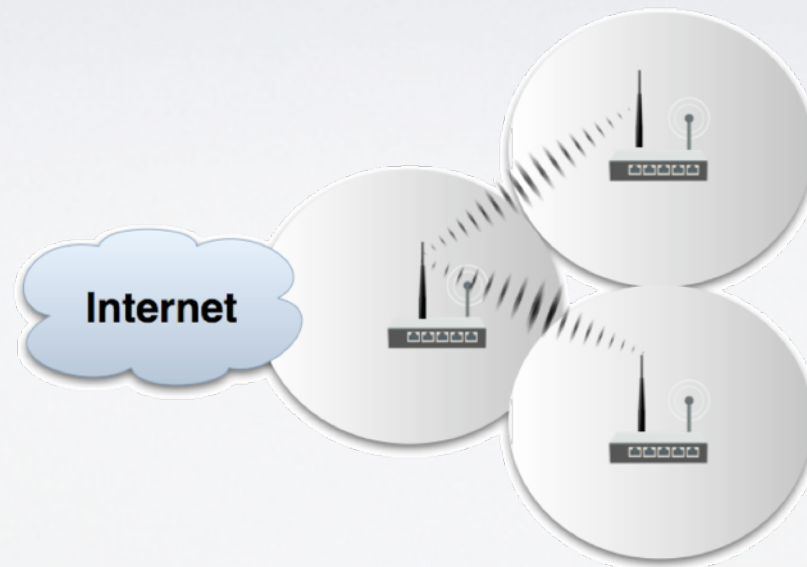
- ✓ Realizar una red MESH dual con varios APs para cubrir la zona solicitada
- ✓ Crear dos redes inalámbricas a través de AP Virtuales
- ✓ Posibilidad de brindar roaming entre APs
- ✓ Niveles de seguridad básicos



ESCENARIO

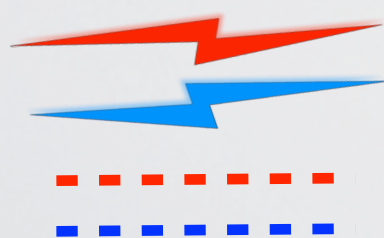
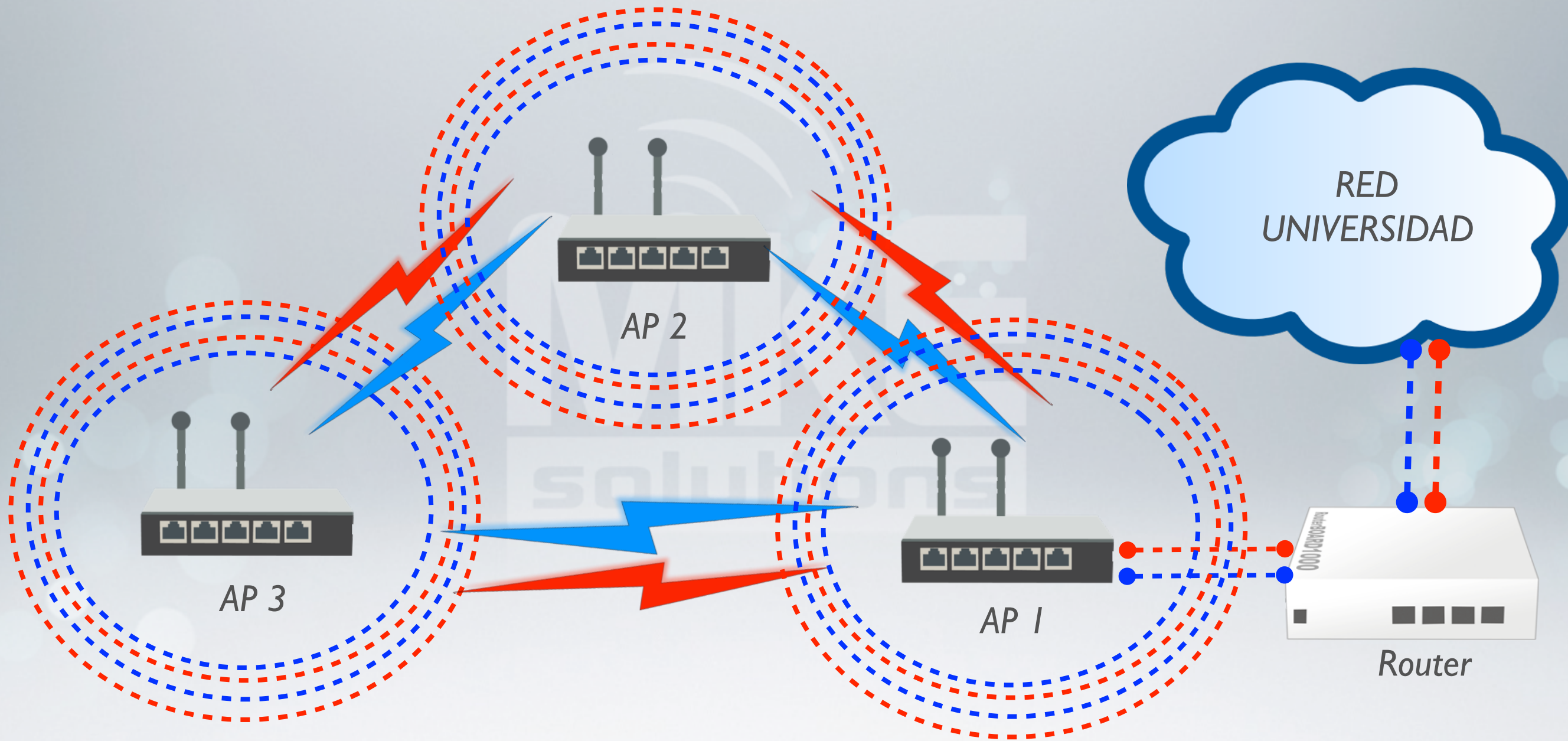
Diseño de la red original

- ✓ 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

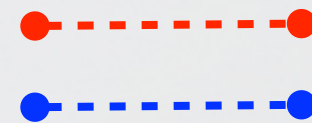


REDES MESH

Diseño de la red



5Ghz - Backbone
2Ghz - Profesores
Alumnos

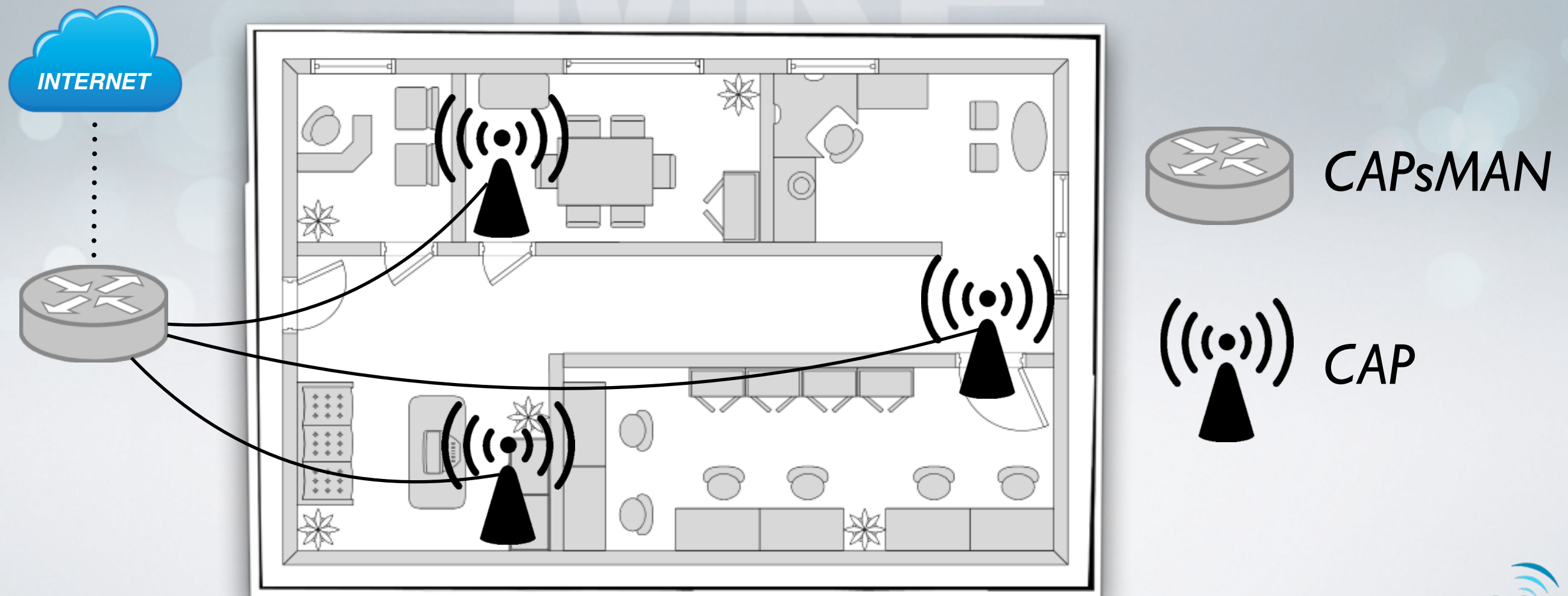


Vlan Profesores
Vlan Alumnos

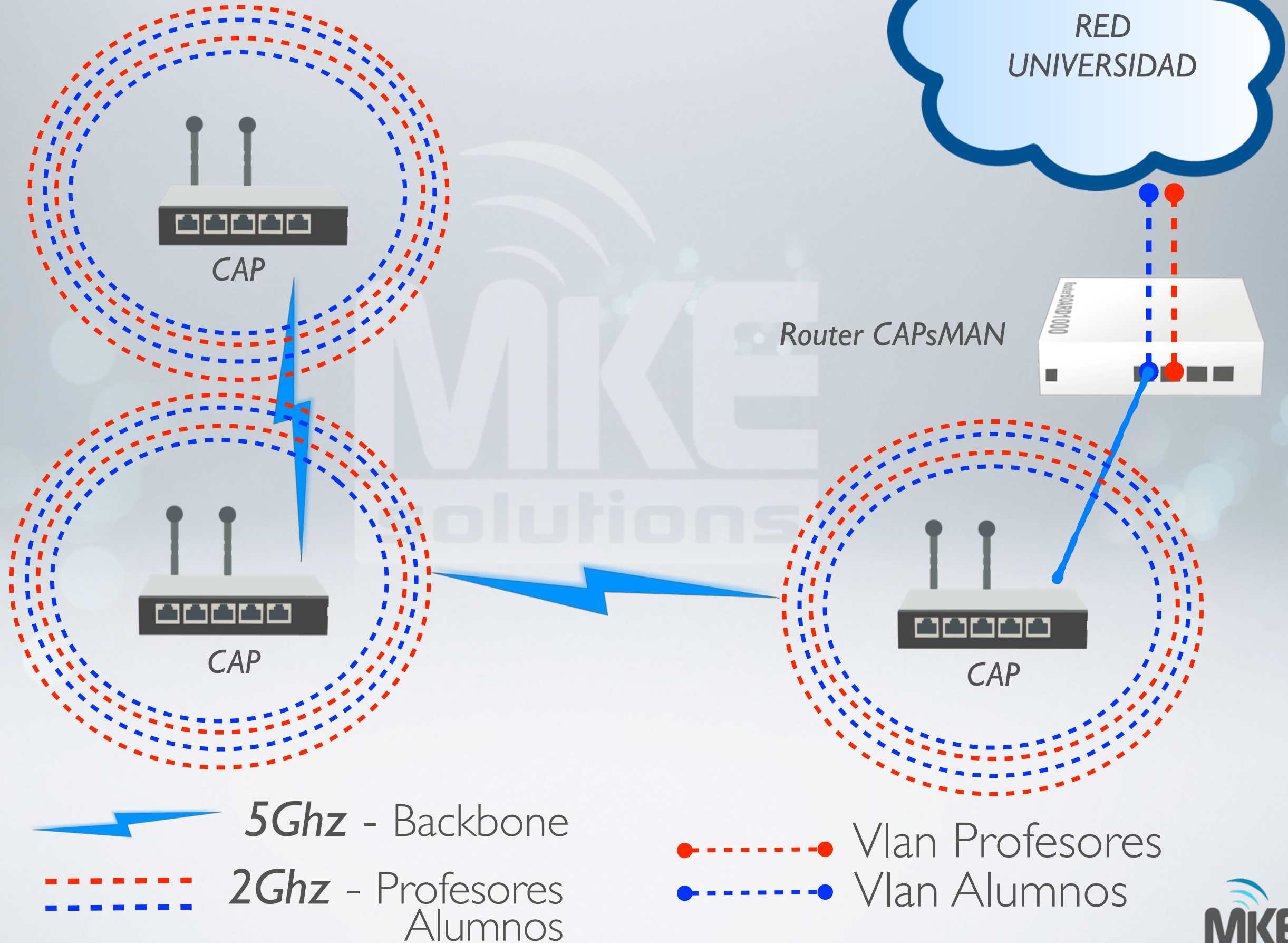
MIGRACION A CAPSMAN

CAPsMAN

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



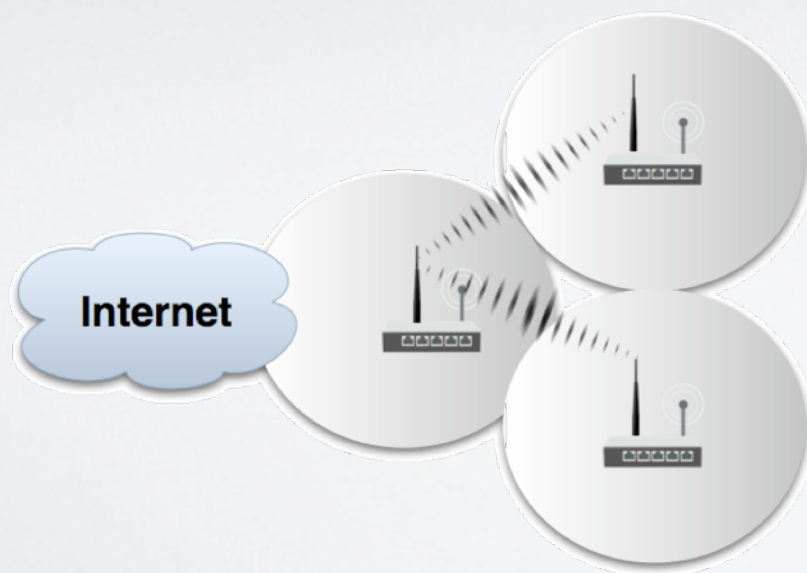
CAPsMAN



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. The main window shows a list of bridges:

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

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, Admin. MAC Address: (empty).
- 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, ARP: enabled, Admin. MAC Address: (empty).

- Activarles *RSTP*

CONFIGURACION CAPsMAN

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

The image displays two screenshots of the Mikrotik WinBox configuration interface, showing the settings for the `wlan1` interface. Both windows have a red hand-drawn oval highlighting the key configuration options.

Top Window: Interface <wlan1 mesh>

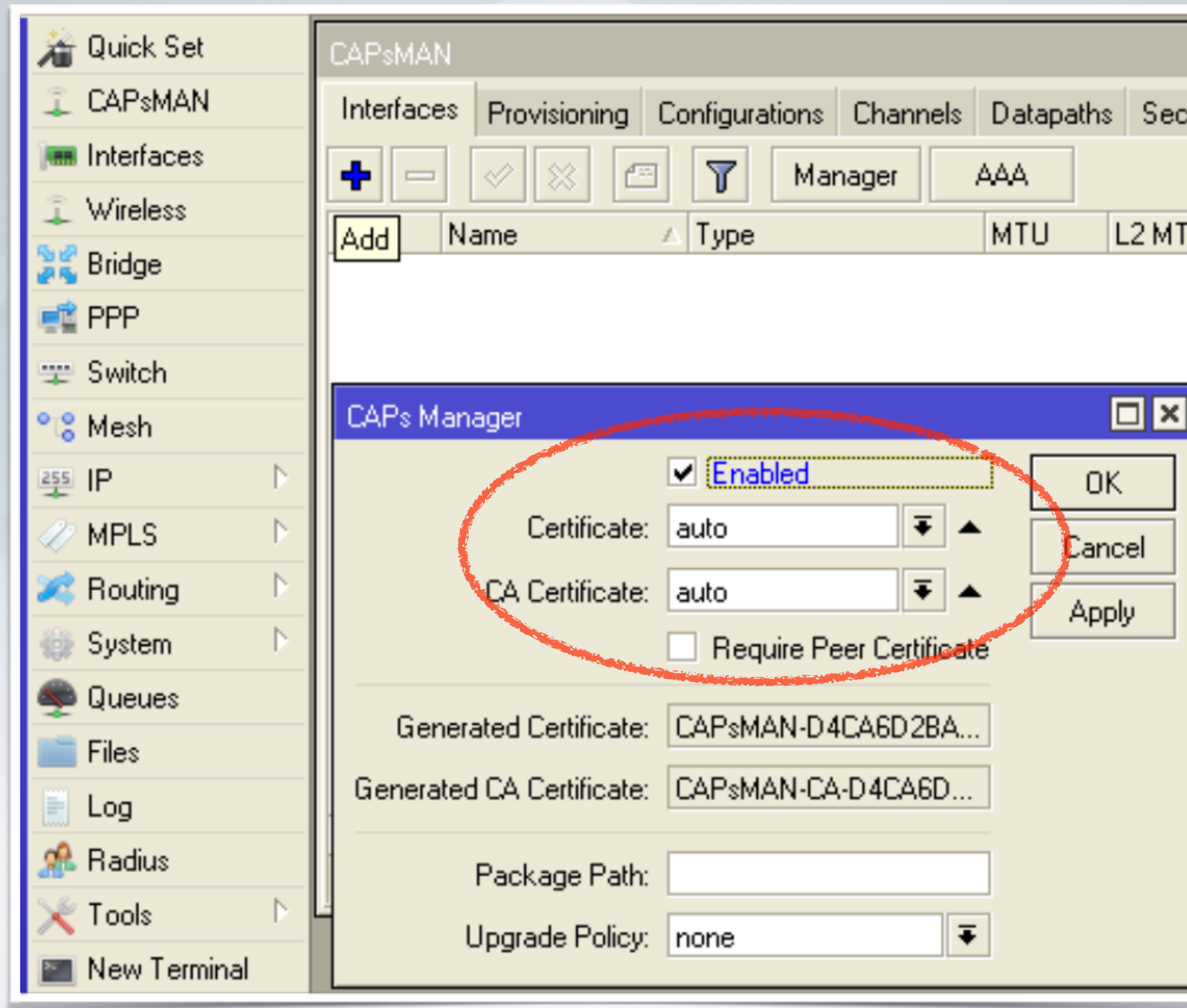
- Mode: `ap bridge`
- Band: `5GHz-A`
- Channel Width: `20MHz`
- Frequency: `auto` MHz
- SSID: `MESH`
- Scan List: `default`
- Wireless Protocol: `unspecified`
- Security Profile: `mesh`
- WPS Mode: `push button`
- Antenna Mode: `antenna a`
- Bridge Mode: `enabled`

Bottom Window: Interface <wlan1>

- WDS Mode: `dynamic mesh`
- WDS Default Bridge: `BACKBONE`
- ☐ WDS Ignore SSID

CONFIGURACION CAPsMAN

✓ Activar *CAPsMAN* y crear *Configuraciones*



CONFIGURACION CAPsMAN

✓ Activar *CAPsMAN* y crear *Configuraciones*

CAPsMAN

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

+ - [Folder Icon] [Filter Icon]

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

CAPs Configuration <Config ALUMNOS>

Wireless Channel Datapath Security

Name: Config ALUMNOS

Mode: ap

SSID: ALUMNOS

Hide SSID:

CAPs Configuration <Config PROFESORES>

Wireless Channel Datapath Security

Name: Config PROFESORES

Mode: ap

SSID: PROFESORES

CAPs Configuration <Config ALUMNOS>

Wireless Channel Datapath Security

Datapath:

Bridge: BRIDGE ALUMNOS

CAPs Configuration <Config PROFESORES>

Wireless Channel Datapath Security

Datapath:

Bridge: BRIDGE PROFESORES

CAPs Configuration <Config PROFESORES>

Wireless Channel Datapath Security

Security: PROFESORES SEGURIDAD

CONFIGURACION CAPsMAN

✓ Crear Aprovisionamiento

CAPsMAN

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

+ - ✓ ✗ 📄 🔍

#	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

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

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

Hw. Supported Modes: ▾

Identity Regexp:

Common Name Regexp:

IP Address Ranges: ▾

Action: create dynamic enabled ▾

Master Configuration: Config PROFESORES ▾

Slave Configuration: Config ALUMNOS ▾

Name Format: cap ▾

Name Prefix: ▾

OK

Cancel

Apply

Disable

Comment

Copy

Remove

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>'. Both windows show the 'General' tab with fields for Name, Type, MTU, L2 MTU, MAC Address, ARP, VLAN ID, and Interface.

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	
DI vlan.10 ALUMNOS	BRIDGE ALUMNOS	80	10		designated port	
DI 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 left sidebar shows the navigation menu with options: Quick Set, CAPsMAN, Interfaces, Wireless, Bridge, PPP, Switch, and Mesh. The main window is titled 'Bridge' and has tabs for Bridge, Ports, Filters, NAT, and Hosts. The 'Bridge' tab is active, showing a table with one entry: 'R' with name 'BRIDGE BACKBONE' and type 'Bridge'. An inset window shows the 'Ports' tab, which lists the interfaces connected to the bridge. The table in the inset window has columns: Interface, Bridge, Priority (h...), and Path Cost.

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

CONFIGURACION CAPs

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

Interface <wlan1>

General Wireless **WDS** Nstreme Status Traffic

Mode: wds slave

Band: 5GHz-A

Channel Width: 20MHz

Frequency: auto MHz

SSID: MESH

Scan List: default

Wireless Protocol: unspecified

Security Profile: mesh

WPS Mode: push button

Antenna Mode: antenna a

Bridge Mode: enabled

OK Cancel Apply Disable Comment

Interface <wlan1 mesh>

General Wireless **WDS** Nstreme Status Traffic

WDS Mode: dynamic mesh

WDS Default Bridge: BRIDGE BACKBONE

☐ WDS Ignore SSID

CONFIGURACION CAPs

✓ Activar *CAP* y configurar *Interfaces*

The screenshot shows the MikroTik WinBox interface with the 'CAP' configuration window open. The left sidebar contains a tree view with categories like Interfaces, Wireless, Bridge, PPP, Switch, Mesh, IP, IPv6, MPLS, Routing, System, Queues, Files, Log, Radius, Tools, New Terminal, and MetaROUTER. The main panel is titled 'Wireless Tables' and has tabs for Interfaces, Nstreme Dual, Access List, Registration, Connect List, and Security Profiles. Below these tabs are buttons for CAP, Scanner, Freq. Usage, and Align. The CAP configuration window has a title bar with a close button. Inside, the 'Enabled' checkbox is checked. The 'Interfaces' dropdown is set to 'wlan2 access'. The 'Certificate' dropdown is set to 'none'. The 'Discovery Interfaces' dropdown is set to 'BRIDGE BACKBONE'. There is an unchecked checkbox for 'Lock To CAPsMAN'. Below these are fields for 'CAPsMAN Addresses', 'CAPsMAN Names', 'CAPsMAN Certificate Common Names', 'Bridge' (set to 'none'), 'Requested Certificate' (set to 'CAP-000C42A8F562'), and 'Locked CAPsMAN Common Name'. The 'OK', 'Cancel', and 'Apply' buttons are on the right.

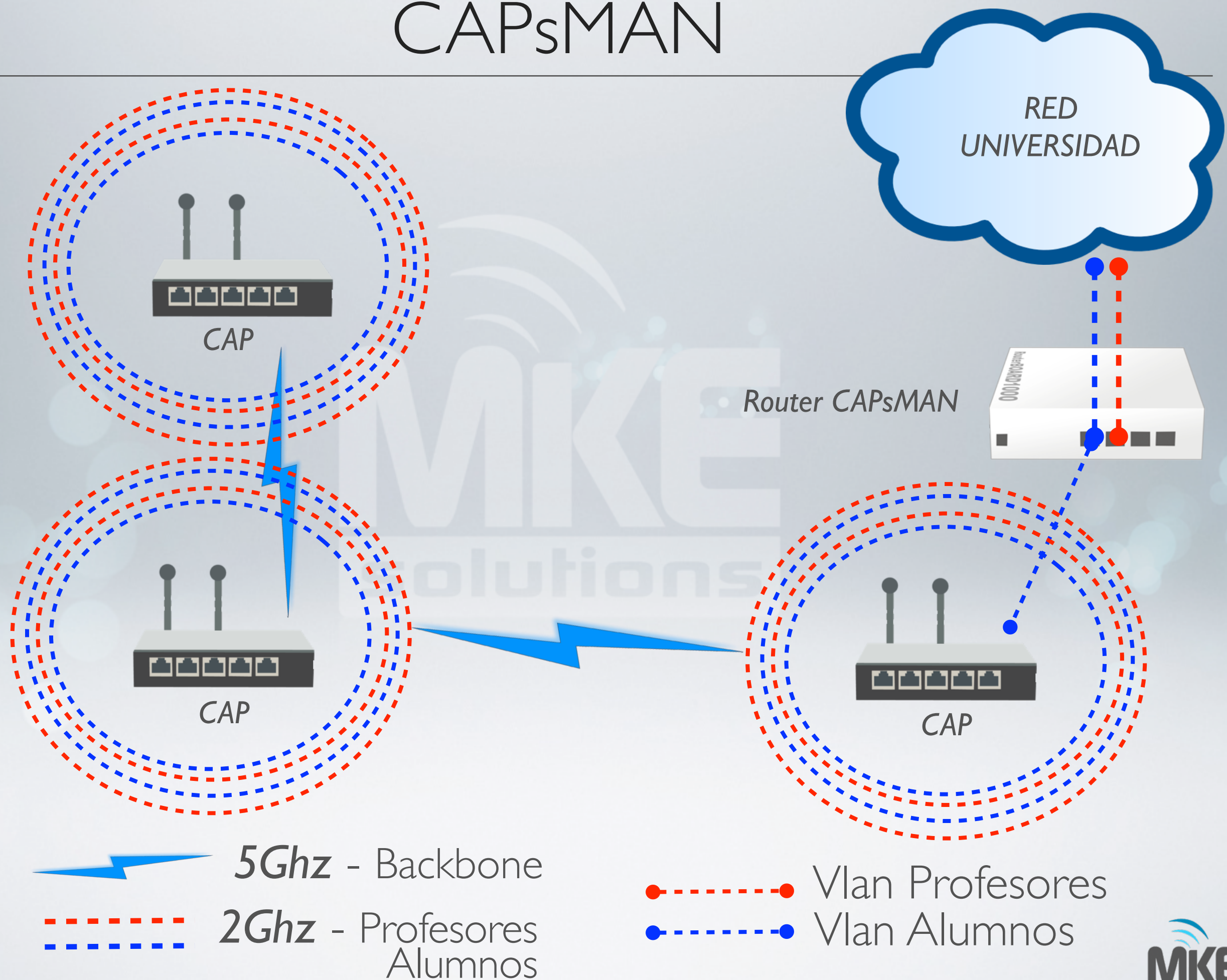
Field	Value
Enabled	☒
Interfaces	wlan2 access
Certificate	none
Discovery Interfaces	BRIDGE BACKBONE
Lock To CAPsMAN	☐
CAPsMAN Addresses	
CAPsMAN Names	
CAPsMAN Certificate Common Names	
Bridge	none
Requested Certificate	CAP-000C42A8F562
Locked CAPsMAN Common Name	

CONFIGURACION CAPs

- ✓ Se espera conexión al CAPsMAN y el aprovisionamiento

Wireless Tables						
Interfaces						
Nstreme Dual						
Access List						
Registration						
Connect List						
Security Profiles						
Channels						
CAP						
Scanner						
Freq. Usage						
Alignment						
Wireless Sniffer						
Wireless Snooper						
	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



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 Registration Table							
+ - ✓ ✕ [icon] [icon] 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		

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!

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