

mum

MikroTik User Meeting in Peru

Migración de Red Inalámbrica a CAPsMan.



Por: Maximiliano Dobladez
MKE Solutions



Lima, Perú. Febrero 2016.



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



info@mkesolutions.net



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Presentación de la Empresa



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Mis Cursos

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Info

CONFIRMADO

MTCNA Rio Cuarto, Argentina

Info

CERRADO

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 tránsito. Ejemplos de configuraciones.	Alta
Burst Simulator Herramienta para simular una descarga y graficar la rifaga del Burst con los parámetros ingresados.	Intermedia

MTCUME

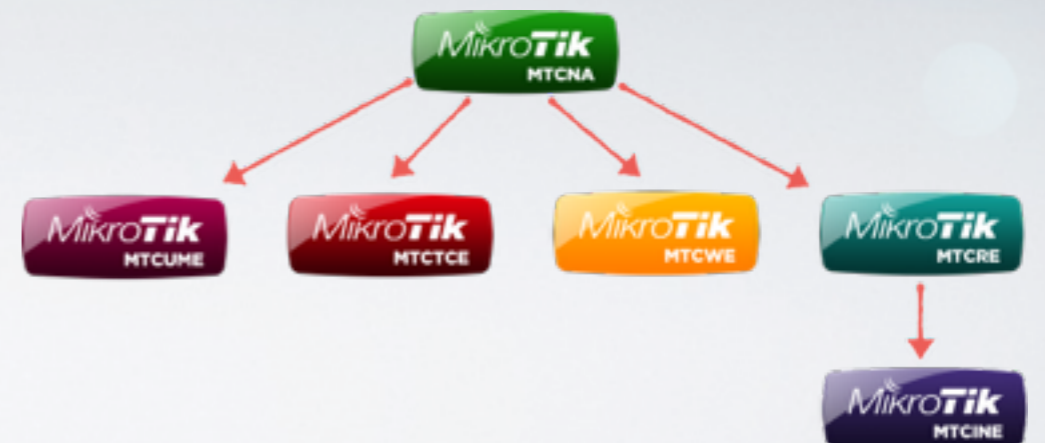
MikroTik 18

2016-02-15 | Lima, Peru |

Entrenamiento Oficial MikroTik el 15 de Febrero de 2016 en la ciudad de Lima, Peru. Duración: 2 días.

Mas Info

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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

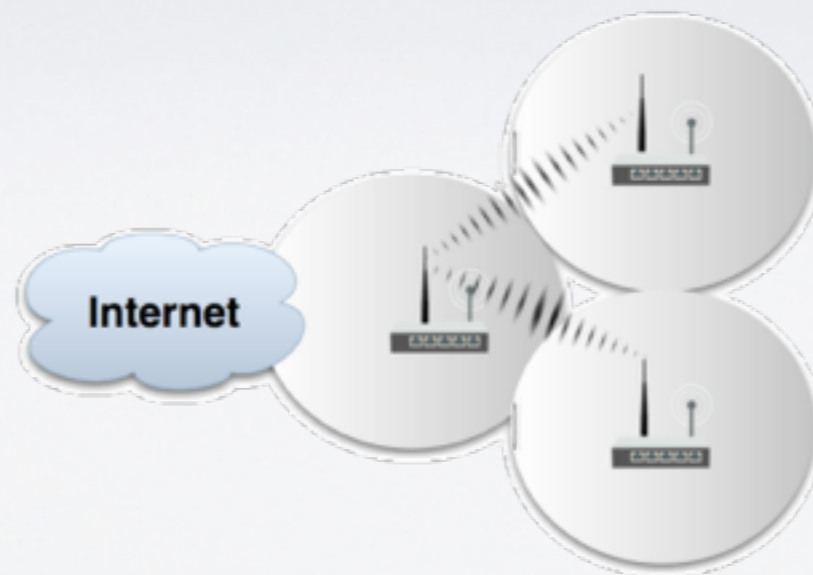
- ✓ Realizar una red MESH dual con varios APs para cubrir la zona solicitada
- ✓ Crear dos redes inalámbricas a través de AP Virtuales
- ✓ Posibilidad de brindar roaming entre APs
- ✓ Niveles de seguridad básicos



ESCENARIO

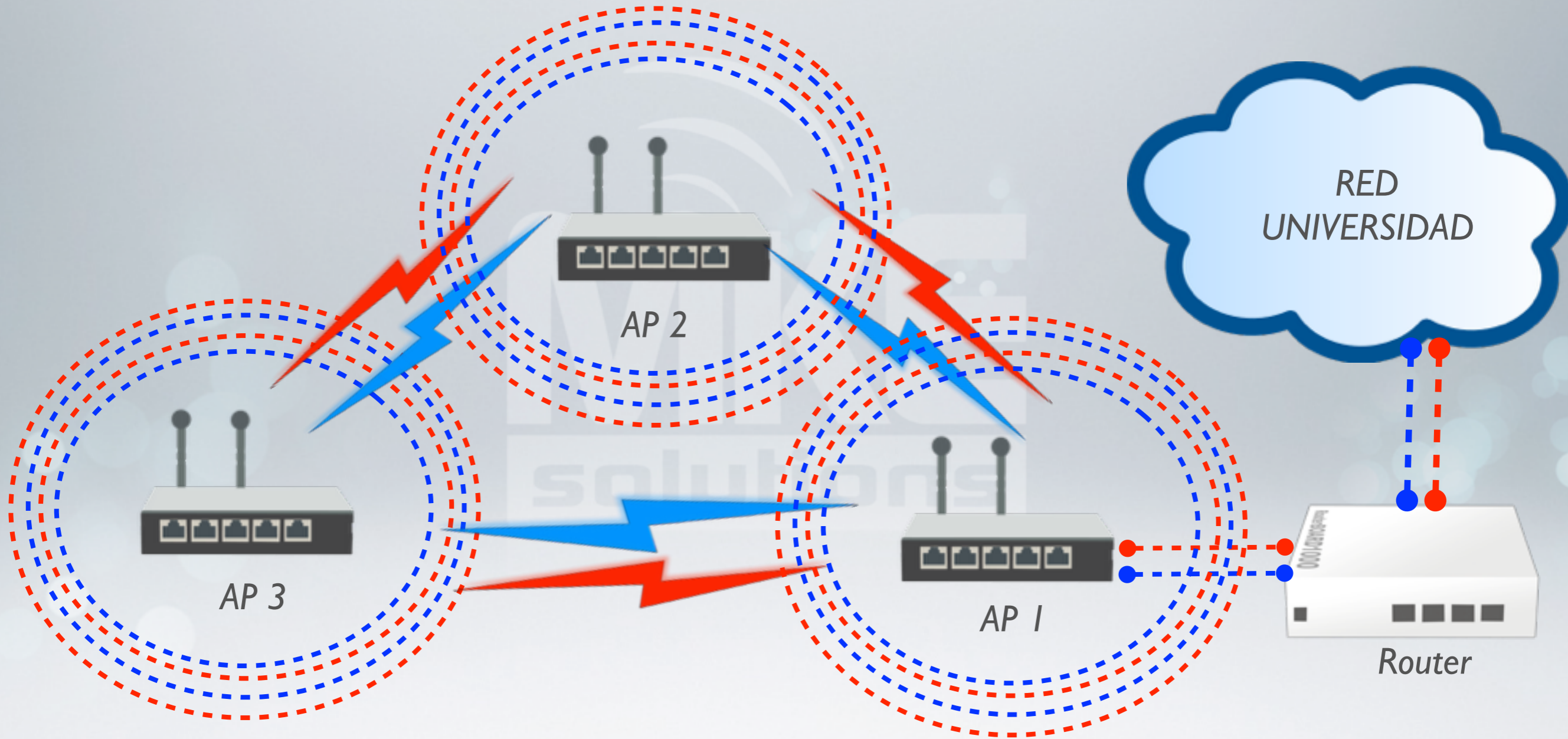
Diseño de la red original

- ✓ 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

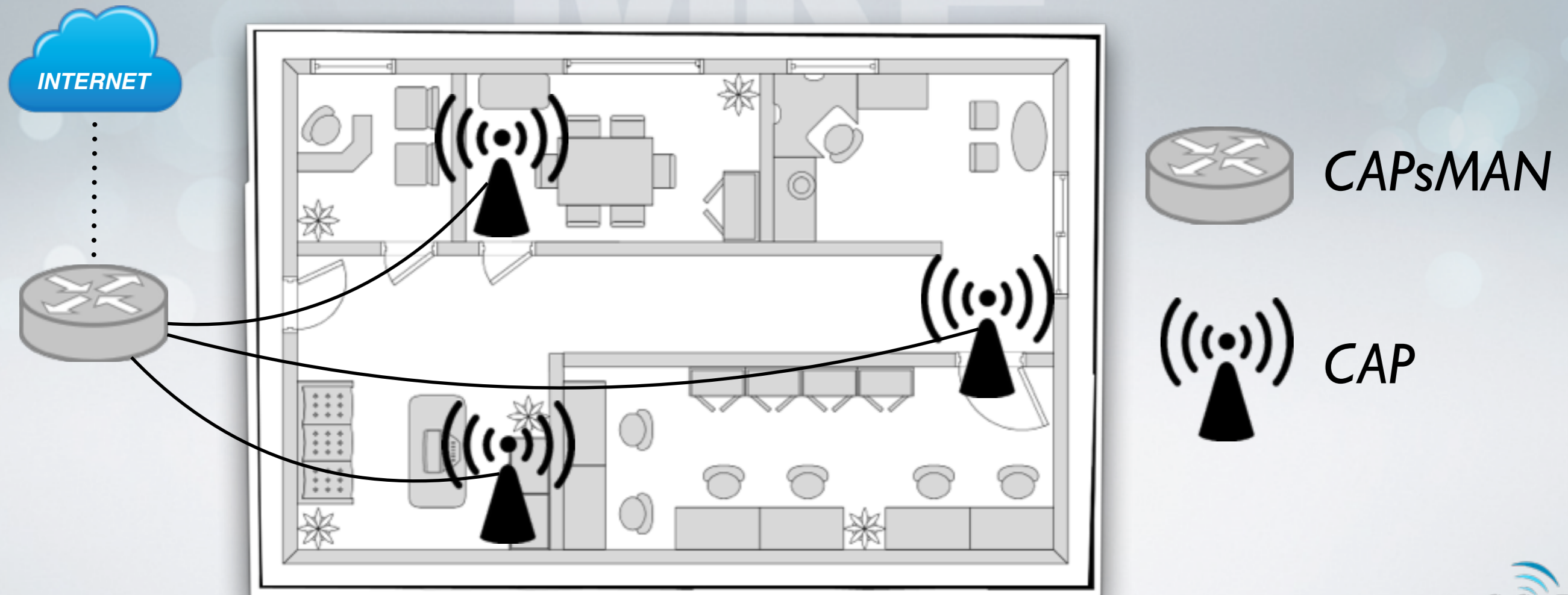


Vlan Alumnos

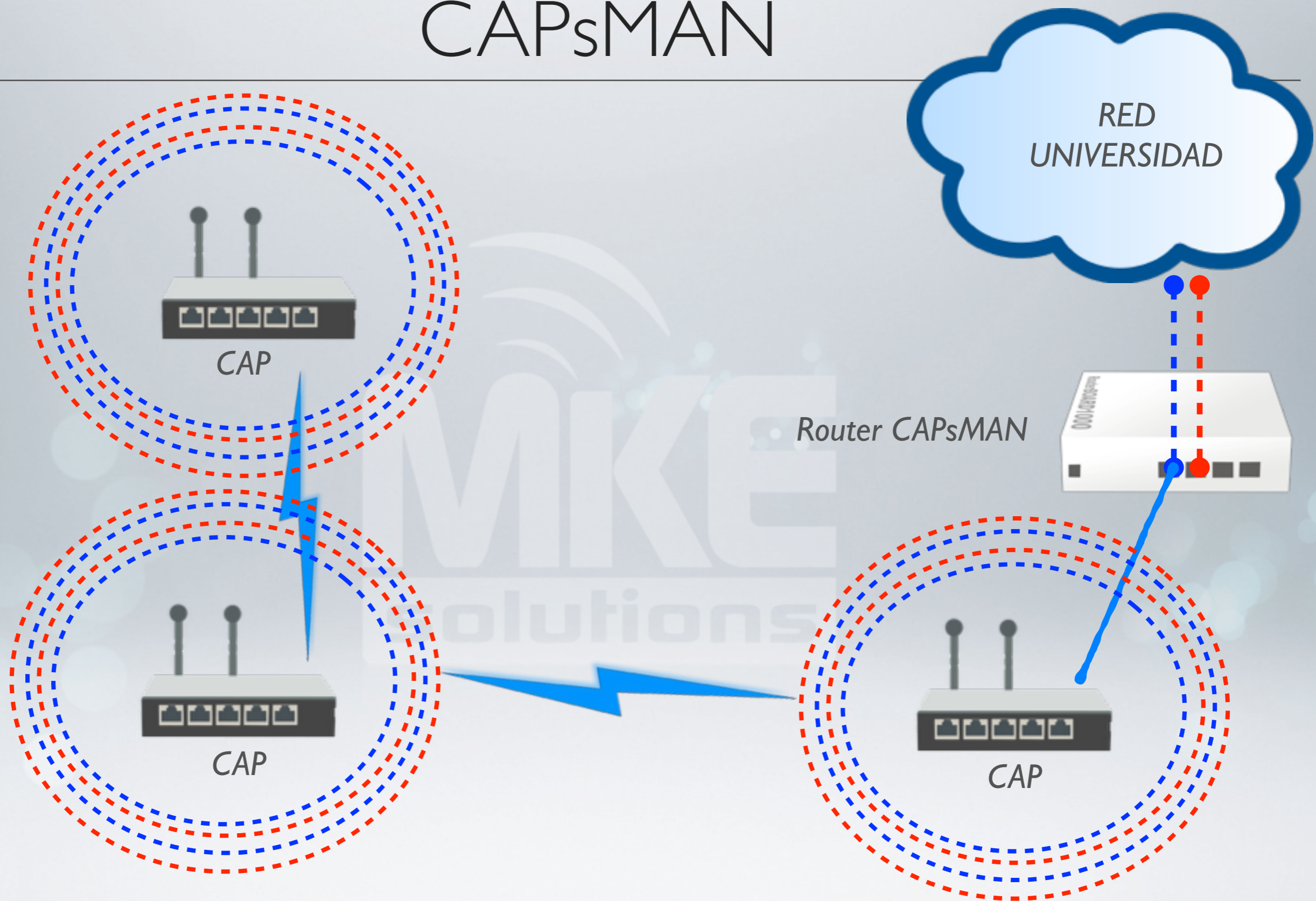
MIGRACION A CAPSMAN




CAPsMAN

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



CAPsMAN



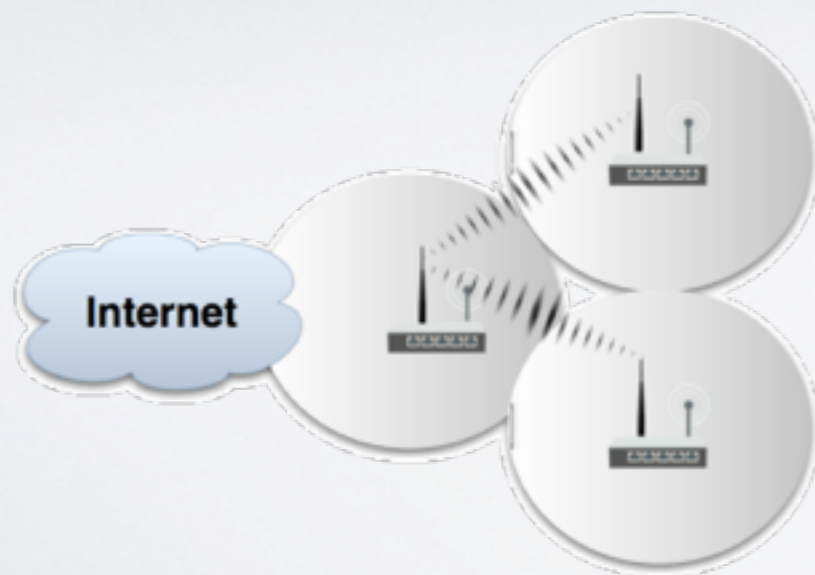
 5Ghz - Backbone
 2Ghz - Profesores
 Alumnos

 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. On the left, a table lists the configured bridges:

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

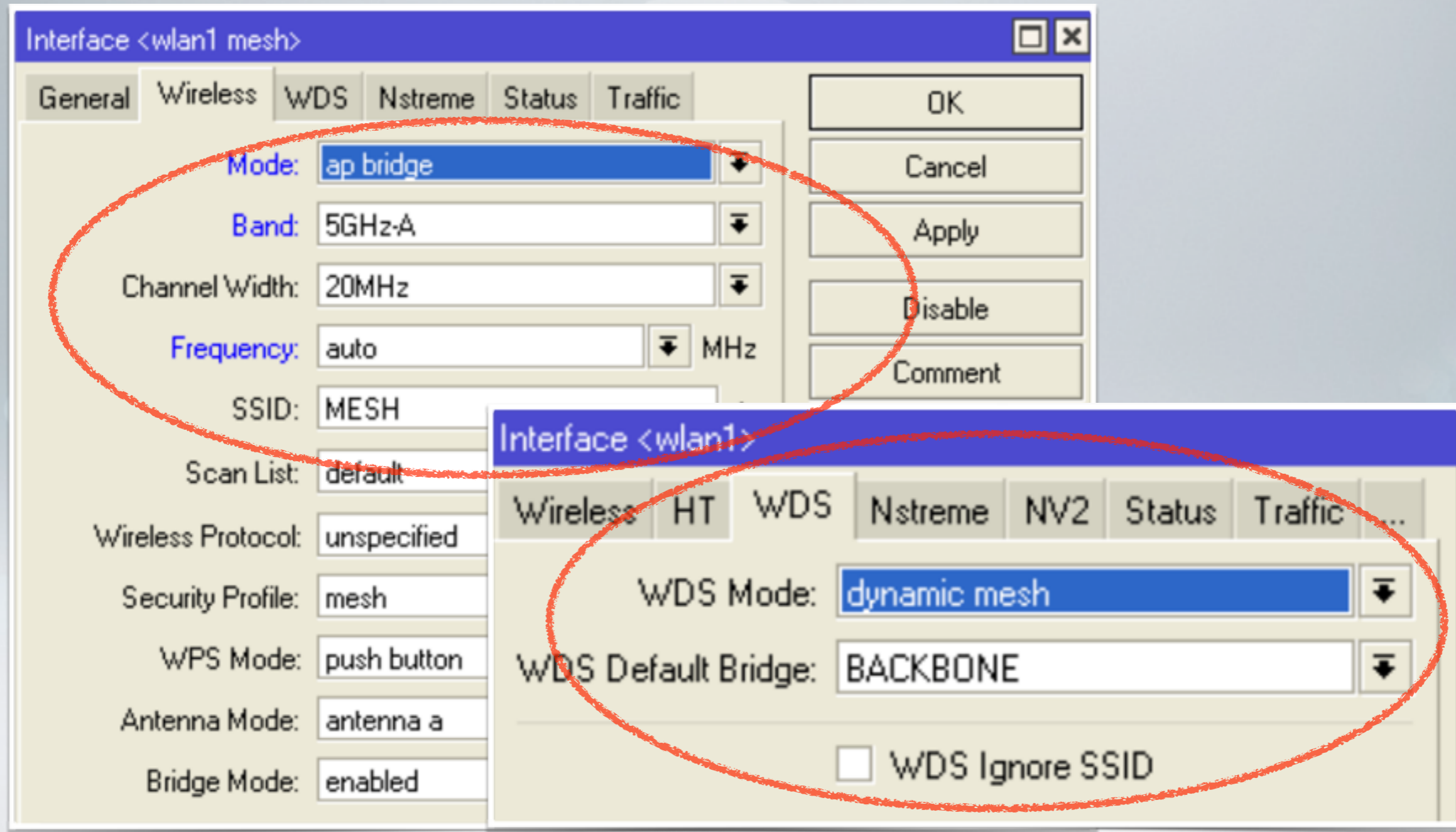
Three configuration windows are open, showing the 'General' tab for each bridge:

- 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 page with tabs for Interfaces, Provisioning, Configurations, Channels, Datapaths, and Security. Below the tabs are control buttons for adding, deleting, and saving configurations. A 'CAPs Manager' dialog box is overlaid on the main window, with the 'Enabled' checkbox checked and highlighted by a red circle. Other options in the dialog include 'Certificate' and 'CA Certificate' set to 'auto', 'Require Peer Certificate' unchecked, and fields for 'Generated Certificate', 'Generated CA Certificate', 'Package Path', and 'Upgrade Policy'.

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:

- CAPs Configuration <Config ALUMNOS>**: Shows the 'Wireless' tab with fields for Name (Config ALUMNOS), Mode (ap), SSID (ALUMNOS), and Hide SSID.
- CAPs Configuration <Config PROFESORES>**: Shows the 'Wireless' tab with fields for Name (Config PROFESORES), Mode (ap), and SSID (PROFESORES).
- CAPs Configuration <Config PROFESORES>**: Shows the 'Security' tab with the Security field set to 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

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

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

OK

Cancel

Apply

Disable

Comment

Copy

Remove

1 item

Name Format: cap

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:

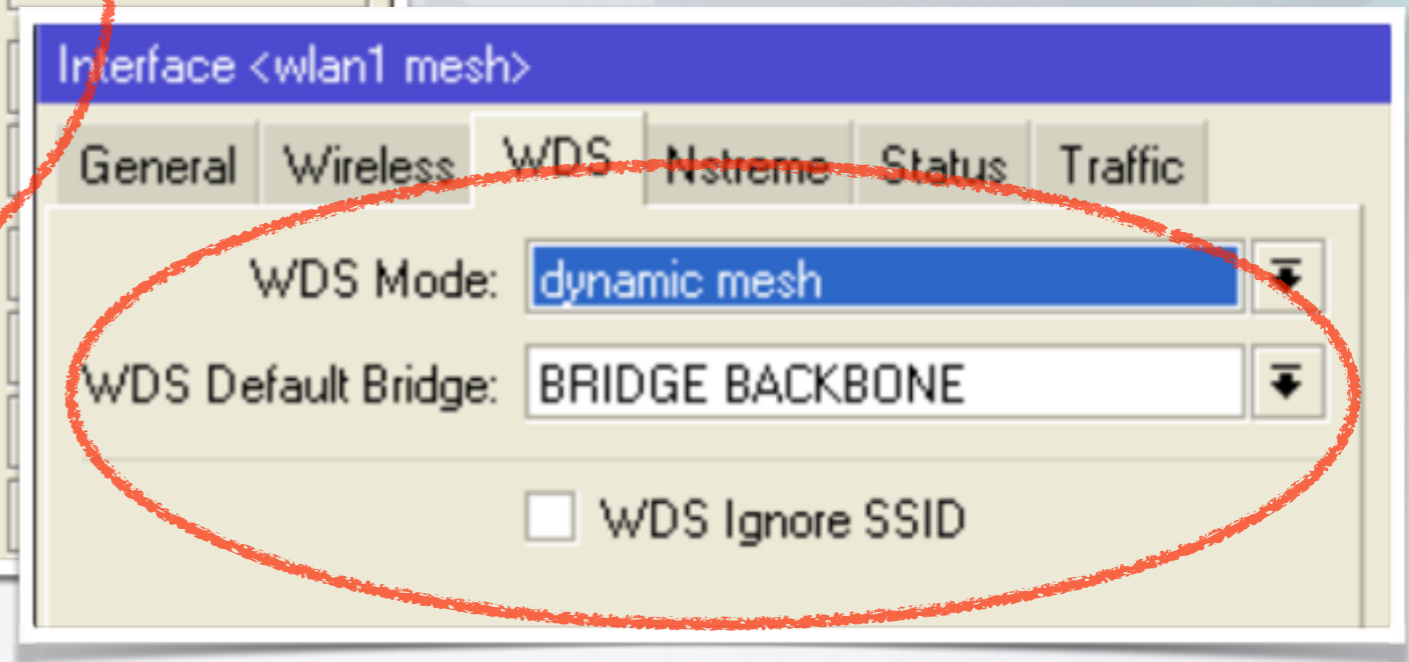
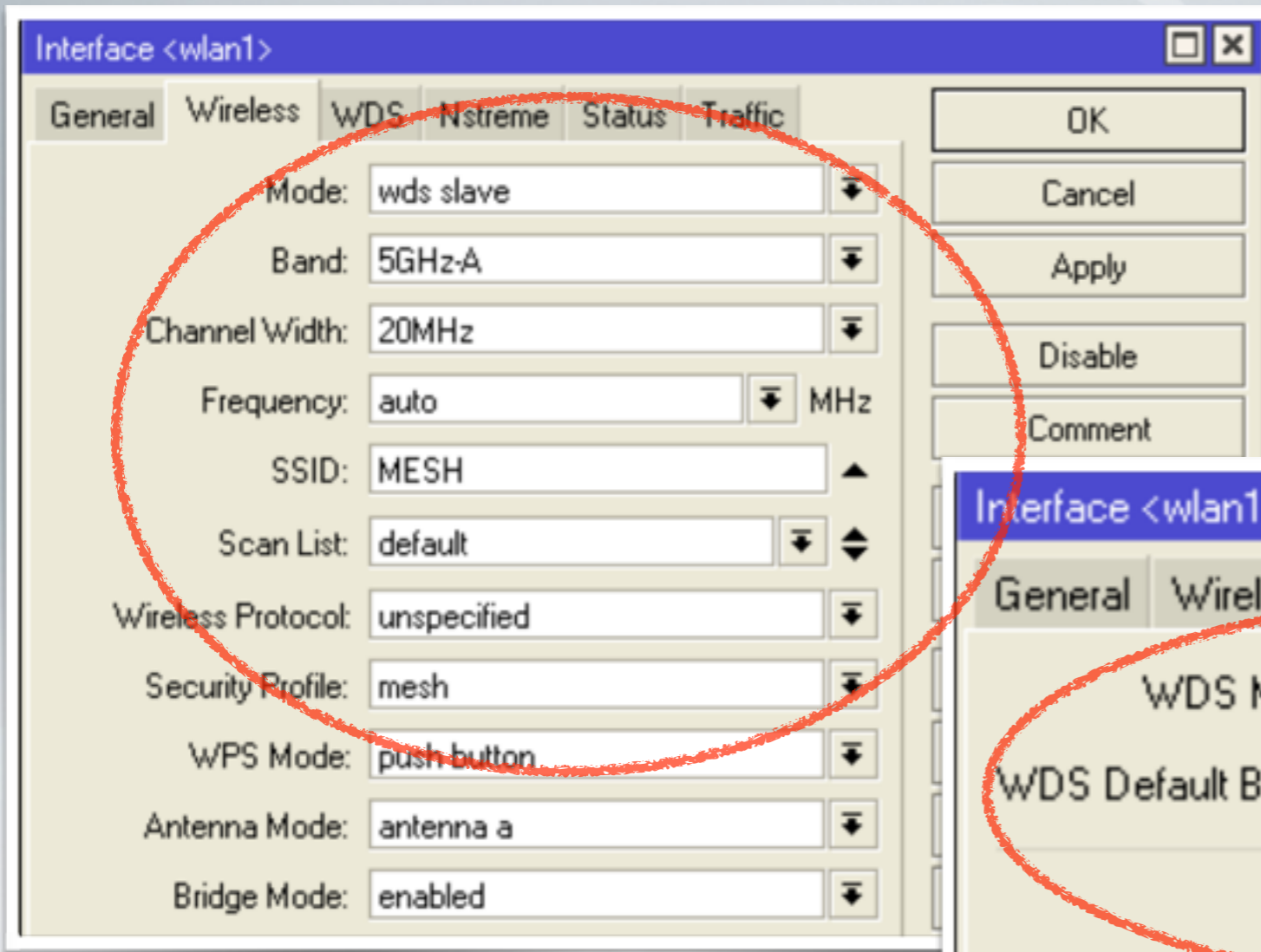
	Name	Type
R	BRIDGE BACKBONE	Bridge

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
D	wds6	BRIDGE BACKBONE	80	101

CONFIGURACION CAPs

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



CONFIGURACION CAPs

✓ Activar *CAP* y configurar *Interfaces*

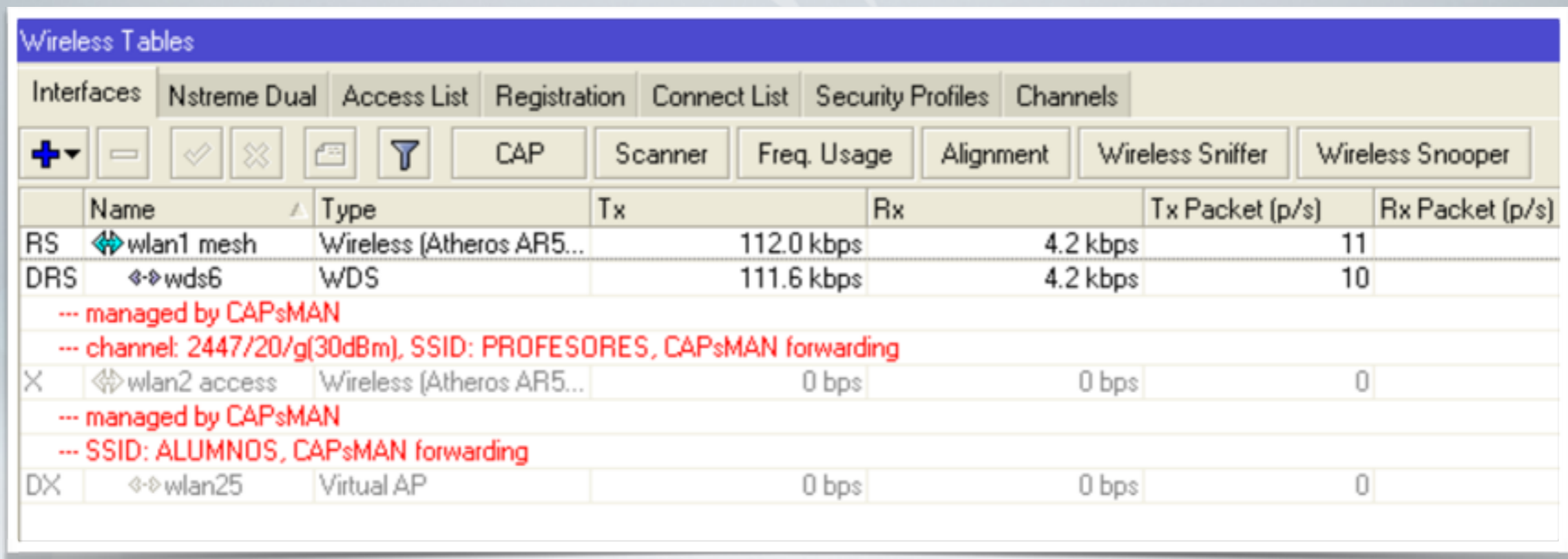
The screenshot displays the Mikrotik WinBox interface for configuring a CAP (Controlled Access Point). The left sidebar shows the navigation menu with categories like Interfaces, Wireless, Bridge, PPP, Switch, Mesh, IP, IPv6, MPLS, Routing, System, Queues, Files, Log, Radius, Tools, New Terminal, and MetaROUTER. The main window is titled 'Wireless Tables' and has tabs for 'Interfaces', 'Nstreme Dual', 'Access List', 'Registration', 'Connect List', and 'Security Profiles'. Below the tabs is a toolbar with icons for adding, deleting, and filtering, along with buttons for 'CAP', 'Scanner', 'Freq. Usage', and 'Align'. A 'CAP' configuration dialog box is open, showing the following settings:

- 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 in the original image.

CONFIGURACION CAPs

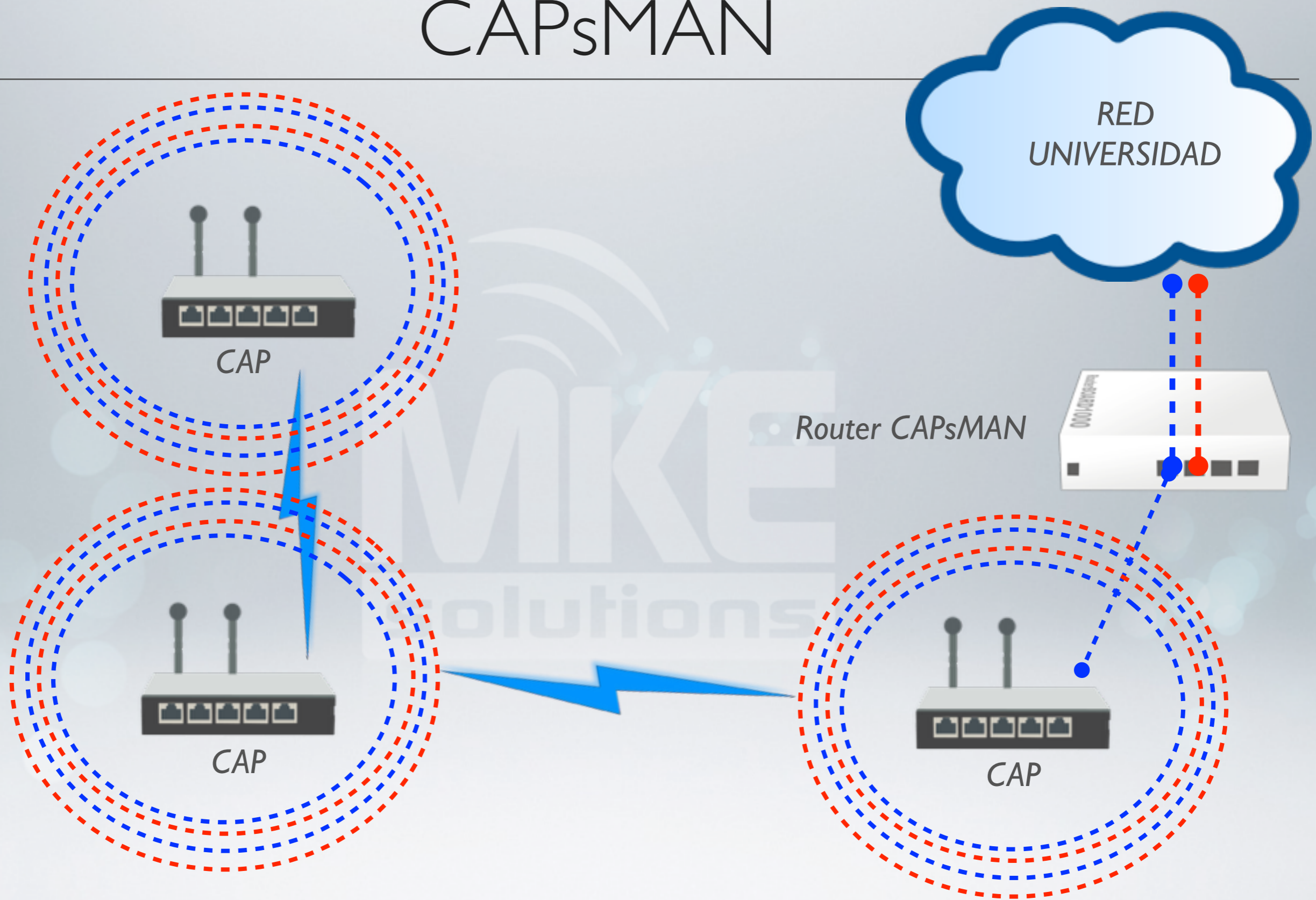
- ✓ Se espera conexión al CAPsMAN y el aprovisionamiento






The screenshot displays the 'Wireless Tables' window in Mikrotik WinBox. It features a tabbed interface with 'Interfaces' selected. Below the tabs are various tool buttons like '+', '-', checkmark, X, printer, funnel, CAP, Scanner, Freq. Usage, Alignment, Wireless Sniffer, and Wireless Snooper. The main table lists wireless interfaces with columns for Name, Type, Tx, Rx, Tx Packet (p/s), and Rx Packet (p/s). Red text annotations indicate that wlan1 mesh and wlan2 access are managed by CAPsMAN, with specific channel and SSID details provided for wlan1 mesh.

	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 MB/12.0 MIB
cap113	MKE-Max-2	F8:CF:C5:7D:83:88	11Mbps	11Mbps	0	-74	01:32:16.75	12 057/7 630	13.8 MB/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 MB/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
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 Registr

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

- ✓ Usar paquete *wireless-cm2*
- ✓ 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

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