

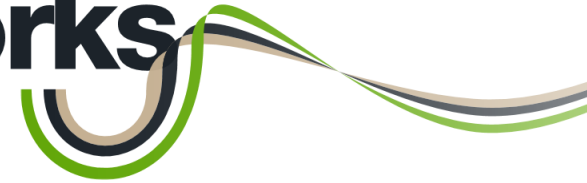
**EXPO**  **TiK**

Conferencias & Exposiciones

Conectando al Mundo

ONLINE

**Optimix  
networks**



# Switching con *MikroTik*



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optimixnetworks



optimixnetworks

*MikroTik*  
MEXICO

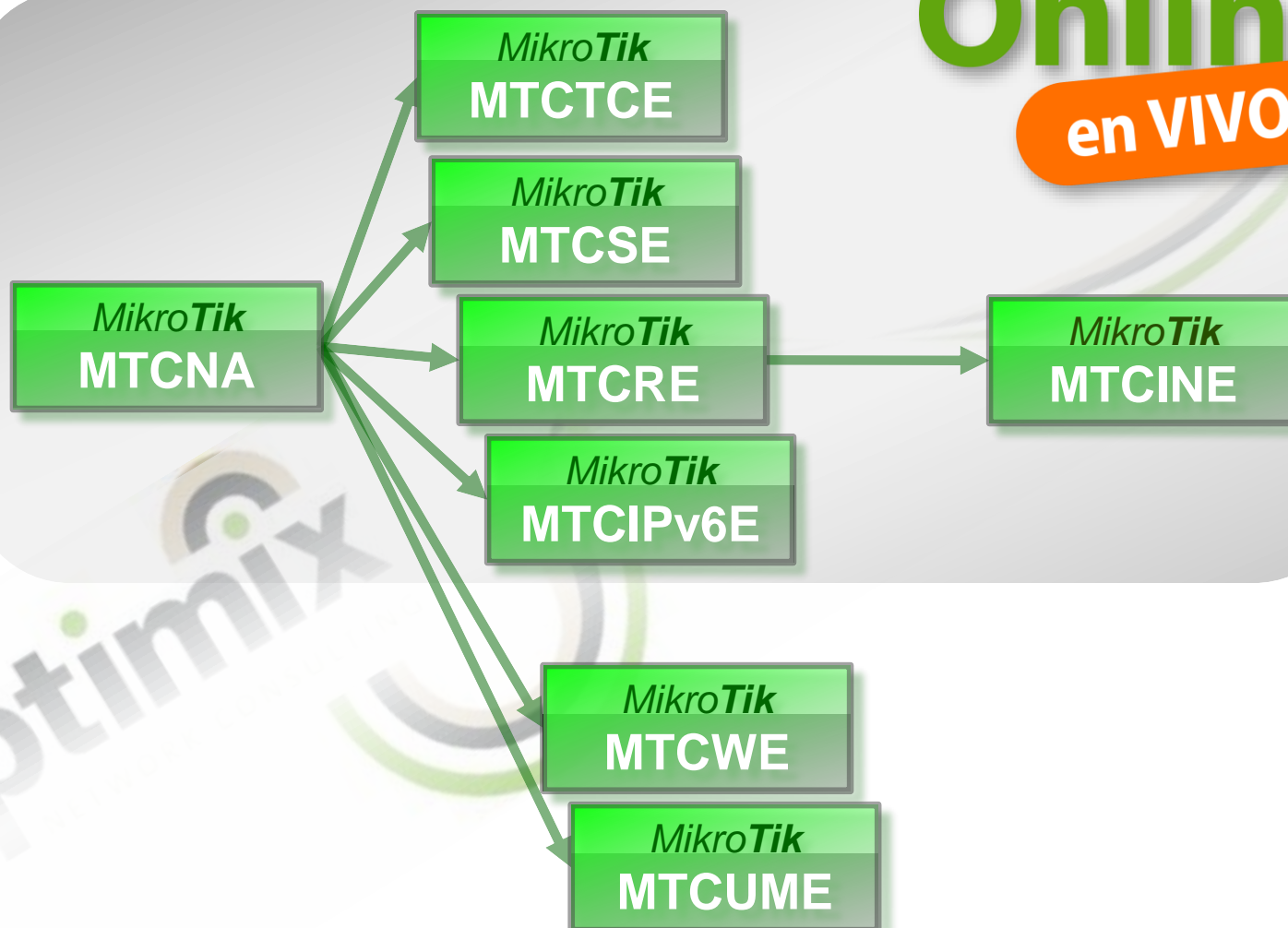
# Objetivos **Optimix networks**

- Proveer consultoría para lograr estrategias de networking **óptimas**.
- Capacitar a quienes gestionan las redes que reciben nuestro apoyo.
- Dictar entrenamientos certificando el conocimiento teórico y práctico de los miembros de la comunidad.

# Entrenamientos Oficiales

# Online

en VIVO!



# Objetivos de esta exposición

- Recorrer los tipos de switches disponibles en una clasificación simple y sintética.
- Analizar las limitaciones de los switches, identificando su finalidad.
- Analizar las configuraciones básicas de bonding, Switching y VLANs.
- Analizar buenas prácticas recomendadas para su uso.



# SwitchOS o RouterOS

# Bridgegear o Switchgear

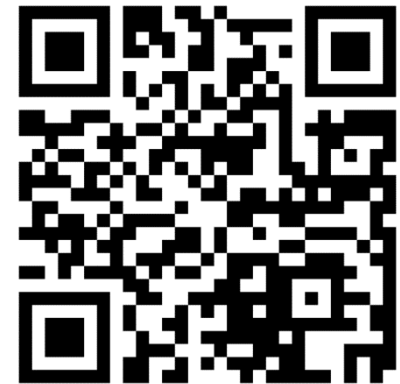
- Switchgear se llama a la acción de interconectar dispositivos de red en capa 2 mediante una inteligencia que opera por hardware.
- Un switch clásicamente se lo asocia a un dispositivo transparente o “invisible” que interconecta dispositivos ethernet.
- Cuando esta funcionalidad es llevada a cabo por un software (un sistema operativo como el RouterOS) la acción se llama Bridgegear.

# Cuando falta ancho de banda

- Un equipo increíble para vínculos a 10Gb/s.



MikroTik.com



# RouterOS

jfilippo@10.227.9.6 (TLW-CampaBT) - WinBox (64bit) v6.44.3 on CRS305-1G-4S+ (arm)

Session Settings Dashboard

Safe Mode Session: Clave jfilippo2039 CPU: 3% Uptime: 5d 00:13:00

RouterOS WinBox

Quick Set  
CAPsMAN  
Interfaces  
Wireless  
Bridge  
PPP  
Switch  
Mesh  
IP  
MPLS  
Routing  
System  
Queues  
Files  
Log  
RADIUS  
Tools  
New Terminal  
LCD  
Partition  
Make Supout.rif  
New WinBox  
Exit  
Windows

Bridge

Bridge Ports VLANs MSTIs Port MST Overrides Filters NAT Hosts MDB

#	Interface	Bridge
0 H	sfpp1-Cabase-x-Metrotel	br-Campa-Cabase
1 H	sfpp4-CampaBGP	br-Campa-Cabase
2 H	bndg-Ponte16Fo	br-Campa-Cabase
3 XI	sfpp3-Ponte16Fo-L2	br-Campa-Cabase
4 XI	sfpp2-Ponte16Fo-L1	br-Campa-Cabase
5 H	ether1-VolP-Coop-FCanios	br-Campa-Cabase

6 items (1 selected)

Interface List

Interface Interface List Ethernet EoIP Tunnel IP Tunnel GRE Tunnel VLAN VRRP Bonding ...

	Name	Tx	Rx	Comment
RS	bndg-Ponte16Fo	7.6 Gbps	129.0 Mbps	
X	vlan2711-SwCoopeVolP	0 bps	0 bps	
X	vlan2712-CoopeCaches	0 bps	0 bps	
R	br-Campa-Cabase	127.8 kbps	8.6 kbps	
RS	ether1-VolP-Coop-FCanios	5.9 kbps	5.7 kbps	
RS	sfpp1-Cabase-x-Metrotel	9.6 Mbps	1901.9 Mbps	
RS	sfpp2-Ponte16Fo-L1	4.1 Gbps	64.0 Mbps	por fibra ruta 21 ...
RS	sfpp3-Ponte16Fo-L2	3.4 Gbps	64.9 Mbps	por fibra oval
RS	sfpp4-CampaBGP	114.3 Mbps	5.6 Gbps	

9 items



# RouterOS

admin@10.227.5.137 (TWN-Ponte16Fo-Mk3) - WinBox (64bit) v6.47.4 on CRS317-1G-16S+ (arm)

Session Settings Dashboard

Safe Mode Session: Clave jfilippo2039

Quick Set  
Interfaces  
Bridge  
PPP  
Switch  
Mesh  
IP  
MPLS  
Routing  
System  
Queues  
Files  
Log  
RADIUS  
Tools  
New Terminal  
Dot1X  
Partition  
Make Supoutrif  
New WinBox  
Exit  
Windows

Interface List

Interface	Name	Tx	Rx	Comment
RS	bndg-Sw-Campa	704.9 Mbps	11.4 Gbps	
RS	bndg-Sw-ConcentraEs2-PonteBGP	15.7 kbps	625.2 Mbps	
R	br	317.7 kbps	19.1 kbps	
S	ether1	0 bps	0 bps	
RS	ether1	1792.5 Mbps	1758.5 Mbps	
RS	ether1	602.4 Mbps	24.4 Mbps	
RS	ether1	351.6 Mbps	5.7 Gbps	
RS	ether1	353.3 Mbps	5.7 Gbps	
RS	ether1	0 bps	0 bps	
RS	ether1	0 bps	0 bps	
RS	ether1	0 bps	0 bps	
RS	ether1	1199.9 Mbps	59.6 Mbps	
RS	ether1	7.8 Gbps	1556.8 Mbps	CRS326-24g-2s+
RS	ether1	1688.2 Mbps	97.2 Mbps	
RS	ether1	2.2 Gbps	146.3 Mbps	
RS	ether1	1827.5 Mbps	84.1 Mbps	
RS	ether1	0 bps	0 bps	

Bridge

#	Interface	Bridge
0 IH	ether1	br
1 H	sfpp11-SRouterPonteRB	br
2 H	sfpp16-Sawerin	br
3 IH	sfpp05	br
4 H	sfpp02-SRouter11RS	br
5 IH	sfpp06	br
6 H	sfpp12-SRouter14RS	br
7 H	bndg-Sw-Campa	br
8 H	sfpp08-SW-AViveroBT	br
9 H	sfpp09-SW-Bondings-SR15-SR12-SR10	br
10 H	sfpp10-Swift-OLT9-OLT10	br
11 H	sfpp01-SRouter16RS	br
12 H	bndg-Sw-ConcentraEs2-PonteBGP	br

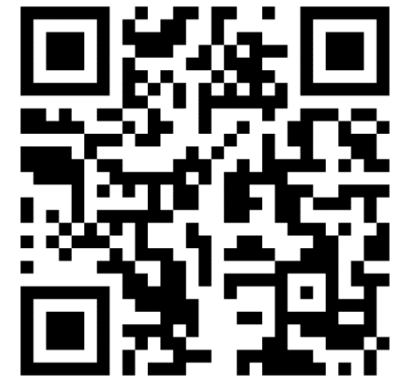
13 items (1 selected)

# Cuando no hay CRS

- Otro equipo útil para vínculos a 10Gb/s.



MikroTik.com



# SwitchOS

MikroTik SwOS Lite

No seguro | 10.224.32.19/index.html#system

OM JF UBNT BG\$ BF\$ BM2 \$Master Drive Google UniFi Airtm AFIP SN SC Otros favoritos

MikroTik SwOS Lite Logout

Link SFP Port Isolation LAG Forwarding RSTP Stats Errors Hist VLAN VLANs Hosts IGMP SNMP ACL ACL Stats System Upgrade

### General

Address Acquisition: static

Static IP Address: 10.224.32.19

Identity: SCN-R58-Lacarra

Allow From:

Allow From Ports: ☒ ☒ ☒ ☒ ☒ ☒ ☒ ☒ ☒ ☒

Allow From VLAN:

Watchdog: ☒

IGMP Snooping: ☐

Mikrotik Discovery Protocol: ☒ ☒ ☒ ☒ ☒ ☒ ☒ ☒ ☒ ☒

Serial Number: DF930E9341B6

MAC Address: 2c:c8:1b:3e:a8:80

Board Name: CSS610-8G-2S+

Uptime: 17:25:20

### DHCP & PPPoE Snooping

Trusted Ports: ☒ ☒ ☒ ☒ ☒ ☒ ☒ ☒ ☒ ☒

Add Information Option: ☒



¡La clave!

# Un switch llamado bridge

admin@10.227.5.137 (TWN-Ponte16Fo-Mk3) - WinBox (64bit) v6.47.4 on CRS317-1G-16S+ (arm)

Session Settings Dashboard

Safe Mode Session: Clave jfilippo2039 Uptime: 20d 14:37:19

RouterOS WinBox

Quick Set  
Interfaces  
Bridge  
PPP  
Switch  
Mesh  
IP  
MPLS  
Routing  
System  
Queues  
Files  
Log  
RADIUS  
Tools  
New Terminal  
Dot1X  
Partition  
Make Supout.rif  
New WinBox  
Exit  
Windows

Bridge

Bridge Ports VLANs MSTIs Port MST Overrides Filters NAT Hosts MDB

Find

#	Interface	Bridge
0 IH	ether1	br
1 H	sfpp11-SRouterPonteRB	
2 H	sfpp16-Sawerin	
3 IH	sfpp05	
4 H	sfpp02-SRouter11RS	
5 IH	sfpp06	
6 H	sfpp12-SRouter14RS	
7 H	bndg-Sw-Campa	
8 H	sfpp08-SW-AViveroBT	
9 H	sfpp09-SW-Bondings-SR15	
10 H	sfpp10-Swift-OLT9-OLT10	
11 H	sfpp01-SRouter16RS	
12 H	bndg-Sw-ConcentraEs2-Por	

13 items (1 selected)

Bridge Port <sfpp12-SRouter14RS>

General STP VLAN Status

Interface: sfpp12-SRouter14RS

Bridge: br

Horizon:

Learn: auto

☒ Unknown Unicast Flood

☒ Unknown Multicast Flood

☒ Broadcast Flood

☐ Trusted

☒ Hardware Offload

enabled inactive Hw. Offload

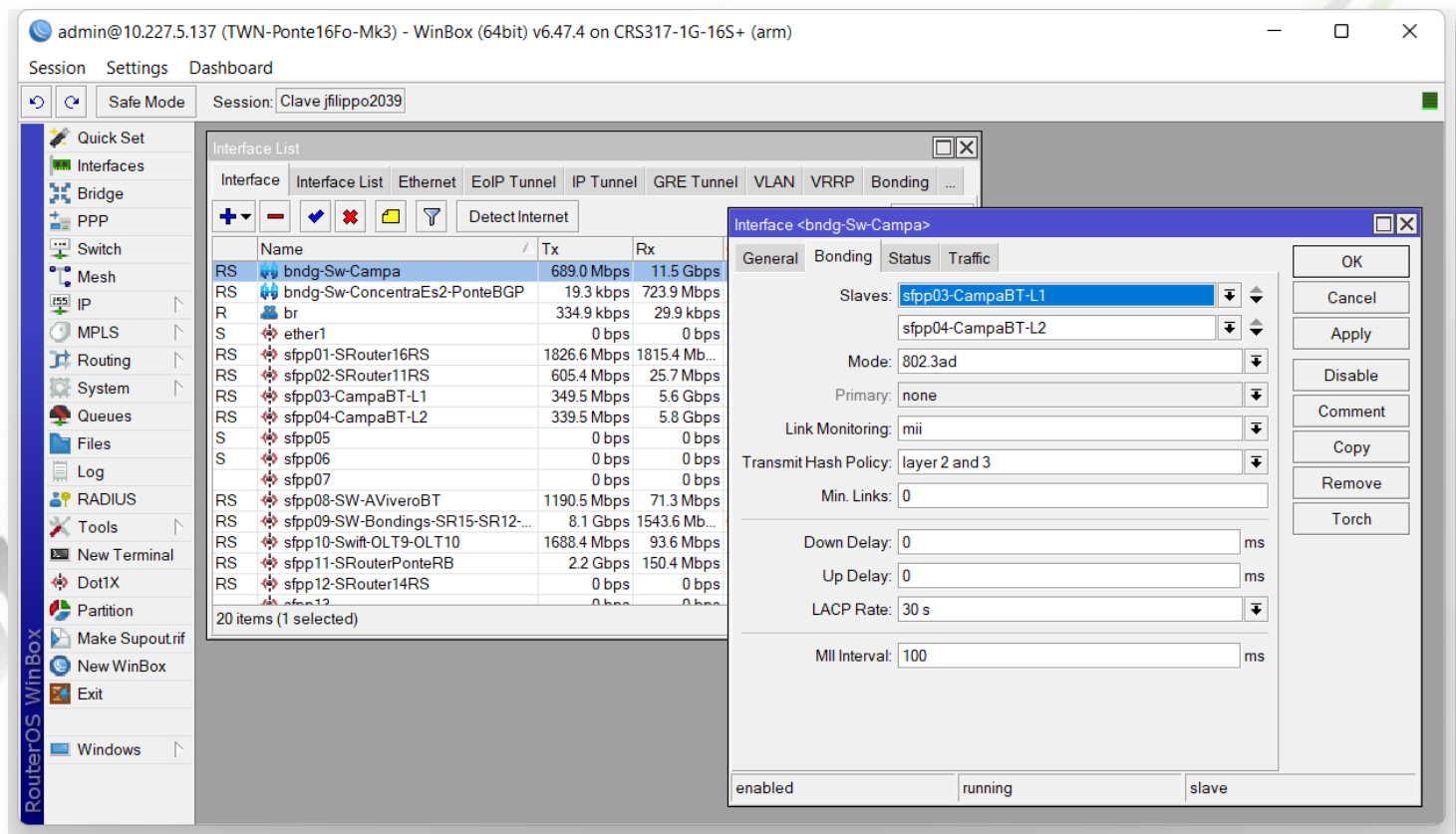
OK Cancel Apply Disable Comment Copy Remove

A decorative graphic on the left side of the slide consists of a grid of squares in shades of green and brown, arranged in a pattern that suggests a staircase or a stepped surface.

# Bonding

# Vínculo multiconexión

- Bonding nos permite multiplicar la capacidad de un vínculo tantas veces como conexiones hayan.

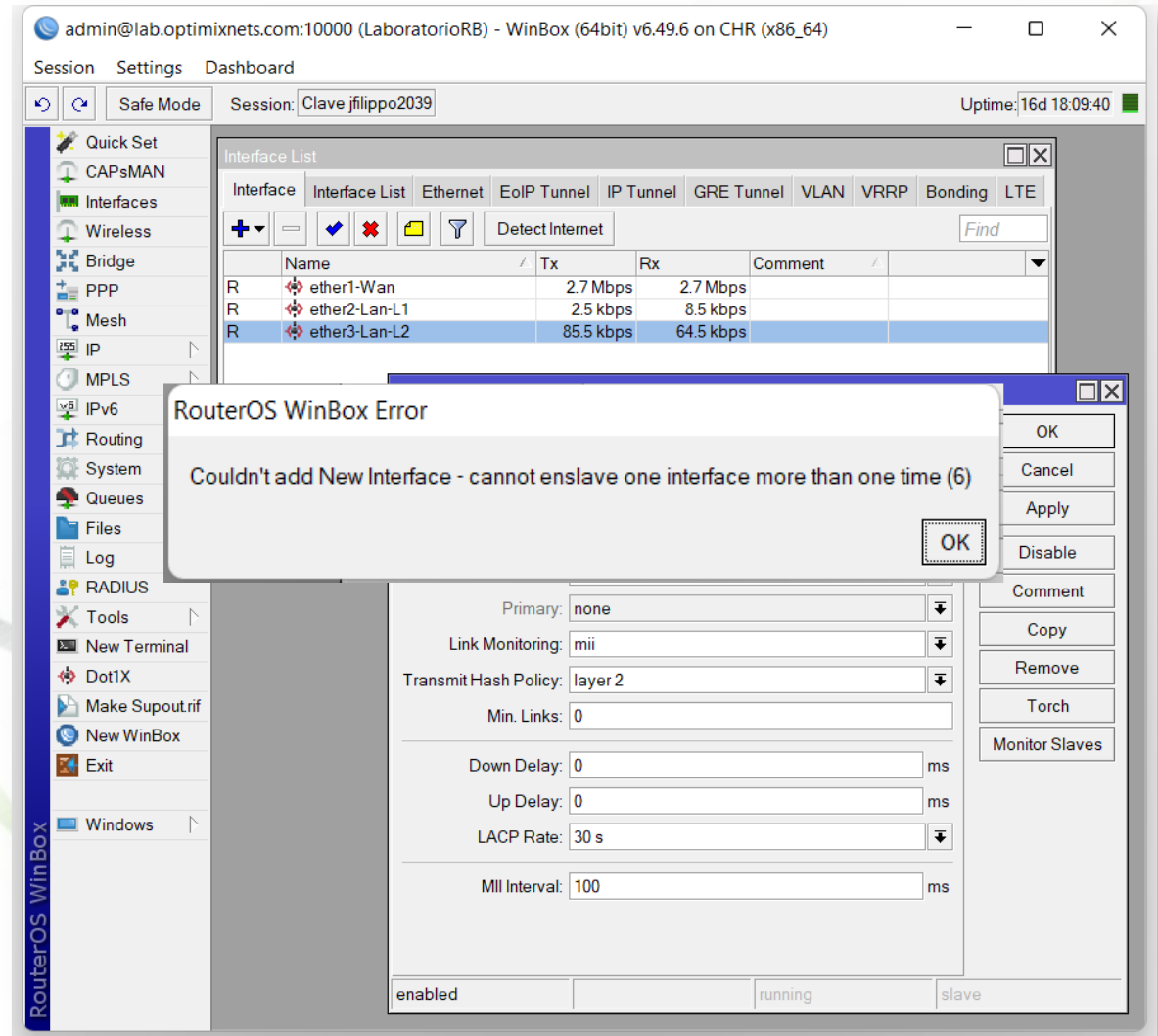


The screenshot shows the MikroTik WinBox interface. The left sidebar contains a menu with options like Quick Set, Interfaces, Bridge, PPP, Switch, Mesh, IP, MPLS, Routing, System, Queues, Files, Log, RADIUS, Tools, New Terminal, Dot1X, Partition, Make Supout.tif, New WinBox, and Exit. The main window displays the 'Interface List' table, which includes columns for Name, Tx, and Rx. The table lists various interfaces, including 'bndg-Sw-Campa' and 'bndg-Sw-ConcentraEs2-PonteBGP'. The 'bndg-Sw-Campa' interface is selected, and its configuration is shown in the 'Interface <bndg-Sw-Campa>' dialog box. The 'Bonding' tab is active, showing the 'Slaves' list with 'sfpp03-CampaBT-L1' and 'sfpp04-CampaBT-L2'. The 'Mode' is set to '802.3ad', 'Link Monitoring' is 'mii', 'Transmit Hash Policy' is 'layer 2 and 3', 'Min. Links' is '0', 'Down Delay' is '0 ms', 'Up Delay' is '0 ms', 'LACP Rate' is '30 s', and 'MII Interval' is '100 ms'. The 'enabled' checkbox is checked, and the 'running' status is displayed.

Interface	Name	Tx	Rx
RS	bndg-Sw-Campa	689.0 Mbps	11.5 Gbps
RS	bndg-Sw-ConcentraEs2-PonteBGP	19.3 kbps	723.9 Mbps
R	br	334.9 kbps	29.9 kbps
S	ether1	0 bps	0 bps
RS	sfpp01-SRouter16RS	1826.6 Mbps	1815.4 Mb...
RS	sfpp02-SRouter11RS	605.4 Mbps	25.7 Mbps
RS	sfpp03-CampaBT-L1	349.5 Mbps	5.6 Gbps
RS	sfpp04-CampaBT-L2	339.5 Mbps	5.8 Gbps
S	sfpp05	0 bps	0 bps
S	sfpp06	0 bps	0 bps
S	sfpp07	0 bps	0 bps
RS	sfpp08-SW-AViveroBT	1190.5 Mbps	71.3 Mbps
RS	sfpp09-SW-Bondings-SR15-SR12...	8.1 Gbps	1543.6 Mb...
RS	sfpp10-Swift-OLT9-OLT10	1688.4 Mbps	93.6 Mbps
RS	sfpp11-SRouterPonteRB	2.2 Gbps	150.4 Mbps
RS	sfpp12-SRouter14RS	0 bps	0 bps

# Partes iguales

- Bonding multiplica la velocidad del enlace más lento.



The screenshot shows the RouterOS WinBox interface. The top bar indicates the user is 'admin@lab.optimixnets.com:10000 (LaboratorioRB)' using 'WinBox (64bit) v6.49.6 on CHR (x86\_64)'. The 'Session' tab is active, showing 'Safe Mode' and 'Session: Clave jflippo2039'. The 'Uptime' is '16d 18:09:40'.

The left sidebar contains a menu with options: Quick Set, CAPsMAN, Interfaces, Wireless, Bridge, PPP, Mesh, IP, MPLS, IPv6, Routing, System, Queues, Files, Log, RADIUS, Tools, New Terminal, Dot1X, Make Supout.rif, New WinBox, Exit, and Windows.

The main window displays the 'Interface List' tab. It shows a table of interfaces:

Interface	Name	Tx	Rx	Comment
R	ether1-Wan	2.7 Mbps	2.7 Mbps	
R	ether2-Lan-L1	2.5 kbps	8.5 kbps	
R	ether3-Lan-L2	85.5 kbps	64.5 kbps	

An error dialog box titled 'RouterOS WinBox Error' is displayed in the center, stating: 'Couldn't add New Interface - cannot enslave one interface more than one time (6)'. The dialog has 'OK', 'Cancel', 'Apply', 'Disable', 'Comment', 'Copy', 'Remove', 'Torch', and 'Monitor Slaves' buttons.

The 'Bonding' configuration window is also visible, showing settings for a new interface. The 'Primary' is set to 'none', 'Link Monitoring' is 'mii', 'Transmit Hash Policy' is 'layer 2', 'Min. Links' is '0', 'Down Delay' is '0 ms', 'Up Delay' is '0 ms', 'LACP Rate' is '30 s', and 'MII Interval' is '100 ms'. The 'enabled' checkbox is checked, and the 'running' checkbox is also checked.



# En switches *MikroTik*

- En switches *MikroTik* es vital que el modo de operación ***Bonding*** elegido sea ***802.3ad***. Eso nos brindará compatibilidad de uso con switches de otras marcas y activará la operación por hardware en *MikroTik*.
- Además, la política de ***Link Monitoring*** recomendada debe configurarse en ***mii***.

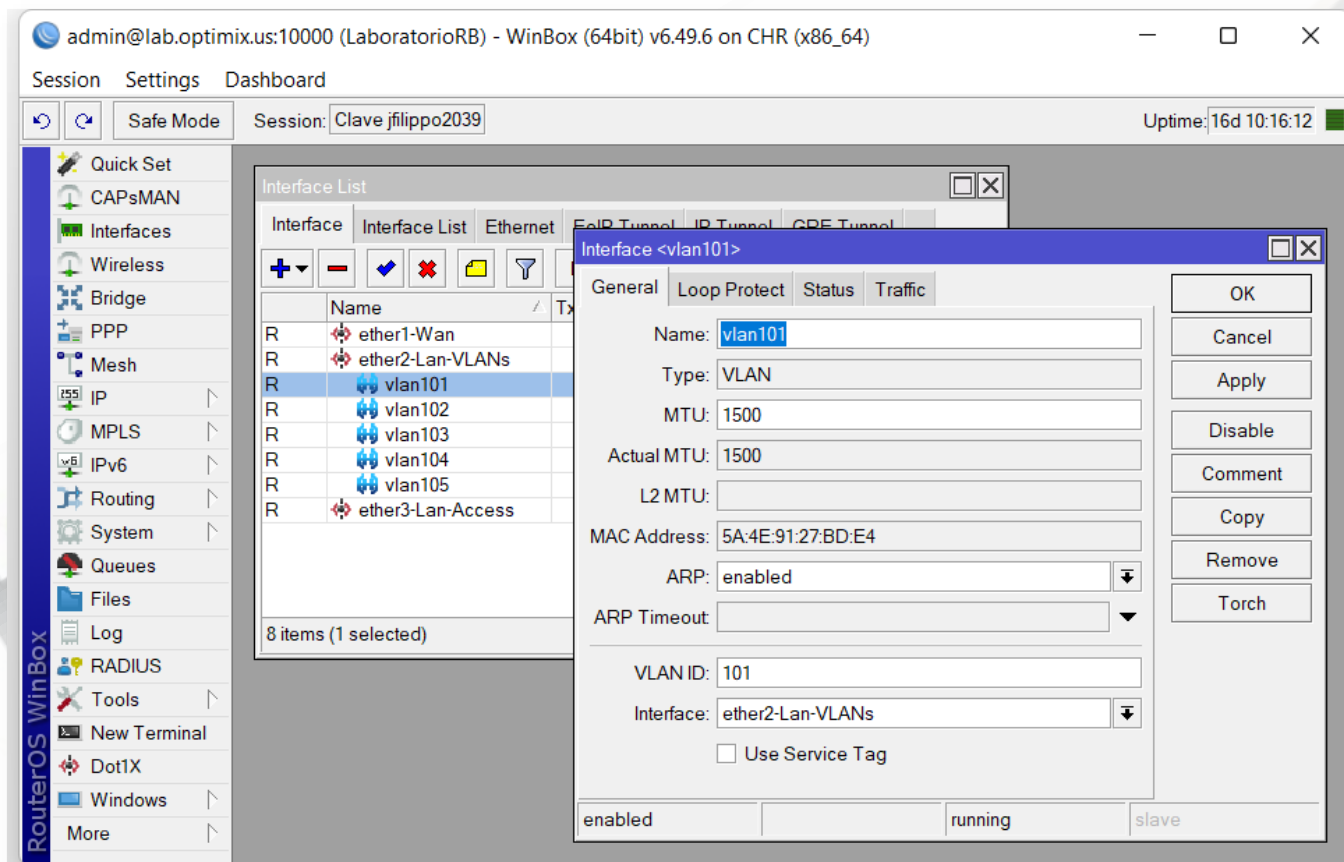




# VLANs

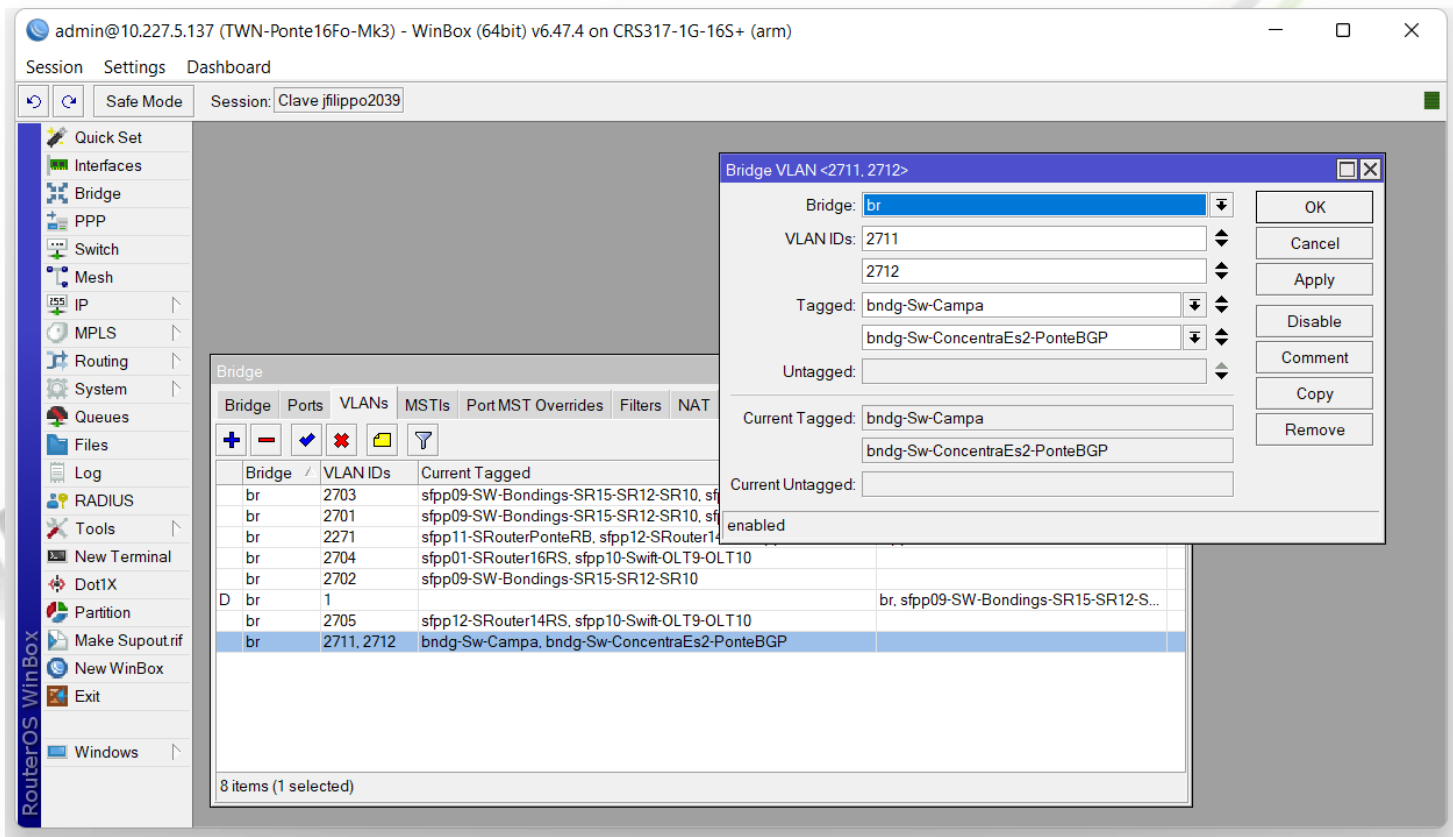
# Creación de una VLAN

- En Interfaces, VLANs, se crean las VLANs que enviarán el tráfico etiquetado a la red.



# Segmentación en capa 2

- Un solo vínculo físico puede transportar múltiples entornos de broadcast aislados unos de otros.



The screenshot shows the MikroTik WinBox interface for a WinBox (64bit) v6.47.4 on a CRS317-1G-16S+ (arm) device. The user is logged in as admin@10.227.5.137 (TWN-Ponte16Fo-Mk3). The interface displays the Bridge configuration page, specifically the VLANs tab. A modal window titled "Bridge VLAN <2711, 2712>" is open, showing the configuration for bridge 'br' with VLANs 2711 and 2712. The tagged ports are 'bndg-Sw-Campa' and 'bndg-Sw-ConcentraEs2-PonteBGP'. The current tagged ports are also 'bndg-Sw-Campa' and 'bndg-Sw-ConcentraEs2-PonteBGP'. The current untagged port is empty. The modal window has buttons for OK, Cancel, Apply, Disable, Comment, Copy, and Remove.

Bridge	Ports	VLANs	MSTIs	Port MST Overrides	Filters	NAT
br	2703	sfp09-SW-Bondings-SR15-SR12-SR10, sfp09-SW-Bondings-SR15-SR12-SR10, sfp09-SW-Bondings-SR15-SR12-SR10				
br	2701	sfp09-SW-Bondings-SR15-SR12-SR10, sfp09-SW-Bondings-SR15-SR12-SR10, sfp09-SW-Bondings-SR15-SR12-SR10				
br	2271	sfp11-SRouterPonteRB, sfp12-SRouter14, sfp12-SRouter14, sfp12-SRouter14, sfp12-SRouter14				
br	2704	sfp01-SRouter16RS, sfp10-Swift-OLT9-OLT10, sfp10-Swift-OLT9-OLT10, sfp10-Swift-OLT9-OLT10				
br	2702	sfp09-SW-Bondings-SR15-SR12-SR10, sfp09-SW-Bondings-SR15-SR12-SR10, sfp09-SW-Bondings-SR15-SR12-SR10				
D br	1					
br	2705	sfp12-SRouter14RS, sfp10-Swift-OLT9-OLT10, sfp10-Swift-OLT9-OLT10, sfp10-Swift-OLT9-OLT10				
br	2711, 2712	bndg-Sw-Campa, bndg-Sw-ConcentraEs2-PonteBGP, bndg-Sw-ConcentraEs2-PonteBGP, bndg-Sw-ConcentraEs2-PonteBGP				

8 items (1 selected)

# Tagueada o destagueada

jfilippo@10.227.9.6 (TLW-CampaBT) - WinBox (64bit) v6.44.3 on CRS305-1G-4S+ (arm)

Session Settings Dashboard

Safe Mode Session: CL-Nilton

CPU: 7%

Quick Set

CAPsMAN

Interfaces

Wireless

Bridge

PPP

Switch

Mesh

IP

MPLS

Routing

System

Queues

Files

Log

RADIUS

Tools

New Terminal

LCD

Partition

Make Supout.rif

New WinBox

Exit

Windows

Interface List

Interface	Name	Type	Actual MTU	L2 MTU	Tx	Rx
RS	bndg-Ponte16Fo	Bonding	1500	1592	6.5 Gbps	56.3 Mbps
X	vlan2711-SwCoopeVoIP	VLAN			0 bps	0 bps
X	vlan2712-CoopeCaches	VLAN			0 bps	0 bps
R	br-Campa-Cabase	Bridge	1500	1592	349.2 kbps	440.7 kbps
R	ether1-VoIP-Coop-FCarios	Ethernet	1500	1592	435.4 kbps	149.3 kbps
RS	sfpp1-Cabase-x-Metrotel	Ethernet	1500	1592	861.6 kbps	2.5 Gbps
RS	sfpp2-Ponte16Fo-L1	Ethernet	1500	1592	3.3 Gbps	29.2 Mbps
RS	sfpp3-Ponte16Fo-L2	Ethernet	1500	1592	3.2 Gbps	27.0 Mbps
RS	sfpp4-CampaBGP	Ethernet	1500	1592	52.7 Mbps	4.0 Gbps

9 items (1 selected)

Bridge

#	Interface	Bridge	enabled
0 H	sfpp1-Cabase...	br-Campa-Cabas	enabled
1 H	sfpp4-CampaB...	br-Campa-Cabase	
2 H	bndg-Ponte16Fo	br-Campa-Cabase	
3 XI	sfpp3-Ponte16...	br-Campa-Cabase	
4 XI	sfpp2-Ponte16...	br-Campa-Cabase	
5 XI	ether1-VoIP-C...	br-Campa-Cabase	

6 items (1 selected)

Bridge VLAN <2712>

Bridge: br-Campa-Cabase

VLAN IDs: 2712

Tagged: bndg-Ponte16Fo

Untagged: sfpp4-CampaBGP

Current Tagged: bndg-Ponte16Fo

Current Untagged: sfpp4-CampaBGP

OK

Cancel

Apply

Disable

Comment

Copy

Remove

Bridge Port <sfpp4-CampaBGP>

General

STP

VLAN

Status

PVID: 2712

Frame Types: admit all

Ingress Filtering

Tag Stacking

OK

Cancel

Apply

Disable

Comment

Copy

Remove

enabled

inactive

Hw. Offload

Watchdog

Watchdog Timer

Watch Address:

Ping Start After Boot: 00:05:00

Ping Timeout: 60 s

Automatic Supout

Auto Send Supout

Send Email To:

Send Email From:

OK

Cancel

Apply

A decorative graphic on the left side of the slide consists of a grid of squares in various shades of green and brown, arranged in a stepped pattern that extends from the top left towards the center.

# Conclusiones

# Switchear o no switchear

- Si abusamos de la flexibilidad que nos ofrece *MikroTik* anularemos las virtudes que sus tecnologías nos brindan.
- No perder de vista:
  - La misión de un switch no es rutear.
  - Un PoE no puede entregar más corriente que lo que entrega la fuente que lo alimenta.
  - El balanceo bonding debe ser 802.3ad.
  - Las VLANs se deben configurar en el bridge, no en las interfaces.
- Apoyarse en un switch para interconexión de interfaces potenciará nuestra operación de ruteo.



# Certificación



# Certificación Optimix

- La **Certificación Optimix** fiscalizada por **MikroTik-México** respalda la aprobación de este curso fast track por aprobar el ***Examen*** de opción múltiple y el ***Laboratorio Final***.
- Para esto, entre los componentes de este curso, encontrará un examen de opción múltiple, que para aprobar deberá resolver contestando más del 60% de las preguntas de forma correcta.
- Además, deberá cumplir el laboratorio explicado durante la segunda clase, consistente en:
  - Configurar una interface Bonding en su router de alumno.
  - Definir una configuración de VLANs para darle servicio a su usuario.

# Certificación Optimix

- Usted puede mostrarle a sus colegas la certificación lograda, compartiendo la URL de dicho certificado Online por ejemplo citándolo en su currículum, para avalar así el aprendizaje conquistado por aprobar el ***Examen de Certificación*** y lograr configurar el ***Laboratorio Final***.
- En caso de desaprobado, puede volver a participar de este Entrenamiento fast track en futuras ediciones para volver a intentar conquistar esta ***Certificación***.

A decorative graphic on the left side of the slide consists of a grid of squares in various shades of green and beige, arranged in a pattern that suggests a staircase or a stepped wall.

Laboratorio  
-> Próximo apunte



¡Gracias!



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