

CRS3xx:

Recursos básicos e avançados de switching para a construção de redes layer 2 resilientes e de alto desempenho



MikroTik

(MUM BR 2019)
Foz do Iguaçu

Sobre o apresentador

- ▶ **Nome:** João Alberto Barbosa de Oliveira
- ▶ **Minicurriculum:**
 - ▶ Fundador da Pro Networks
 - ▶ Pós Graduado em gestão e segurança em redes de computadores - UEG 2016;
 - ▶ Consultor e Instrutor Oficial com todas as certificações Mikrotik;
 - ▶ Gerente de Redes nas empresas Radar WISP LTDA e InternetUP;
 - ▶ Instrutor Parceiro - Redes Brasil
 - ▶ Certificações Extras: Exin Ethical Hacking Foundation;



pronetworks 

Cronograma



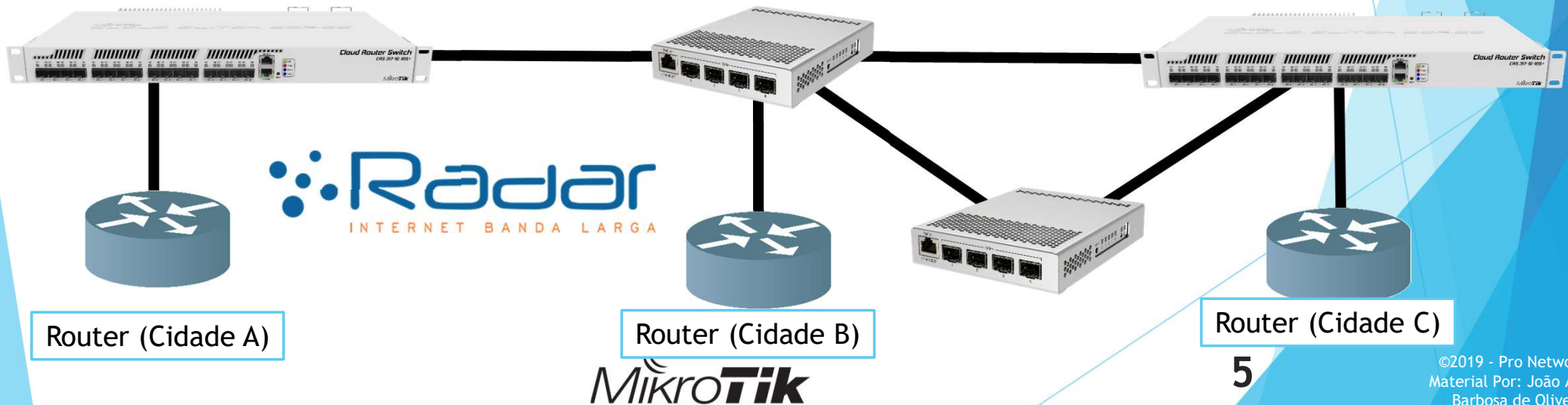
- ▶ Case Real de uso em Backbone;
- ▶ Introdução à série CRS 3xx;
- ▶ Hardware Offload;
- ▶ VLAN's;
- ▶ LACP;
- ▶ Port Mirroring;
- ▶ Prevenindo ataques de "MAC Flooding";
- ▶ DHCP Snooping;
- ▶ BPDU Guard;
- ▶ Limitação de Tráfego;
- ▶ MPLS Hardware Offload

Objetivos:

- ▶ Difundir as características dessa fantástica linha de switches;
- ▶ Desmistificar que é possível desfrutar de performance e estabilidade em redes comutadas em L2;
- ▶ Todos os recursos aqui apresentados serão recursos possíveis via **HARDWARE**;
- ▶ Propagar a **MANEIRA CORRETA** de configurar alguns recursos.

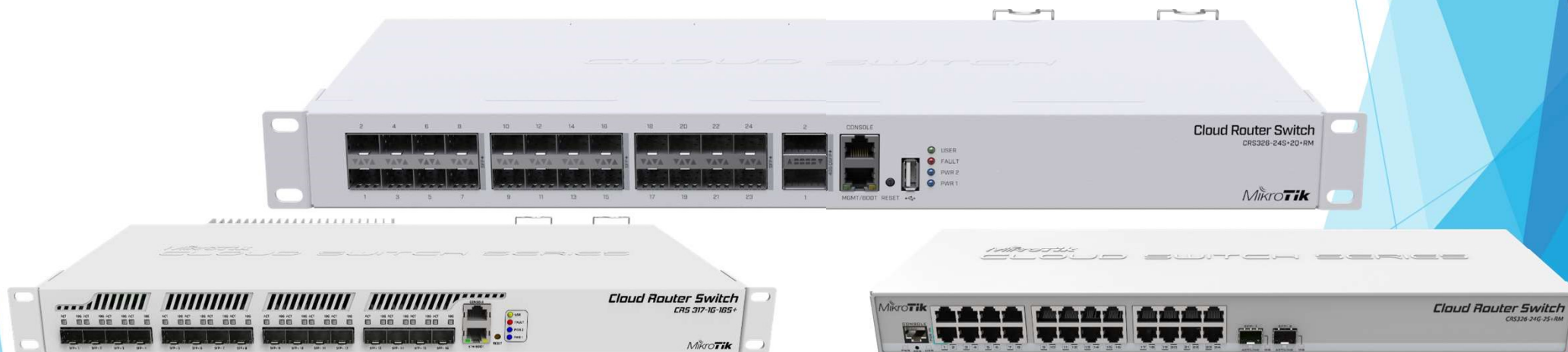
Case de backbone: ISP Radar Internet

- ▶ Backbone óptico com 10 e 20Gbps;
- ▶ Mais de 240 dispositivos com RouterOS, sendo 30 Switchs CRS3xx;
- ▶ 650km de backbone óptico;



Introdução à Série CRS3xx

- ▶ Switches com excelente custo x benefício;
- ▶ Aplicáveis desde redes de acesso até backbones;
- ▶ Opções com portas de até 40Gbps;
- ▶ Switches com características de roteador;
- ▶ **Comutação em Hardware** (Atende cenários mais exigentes);



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CRS326-24G-2S+RM



Suggested price: \$139.00

Principais Características:

- ▶ 2 portas SFP+ (10Gbps);
- ▶ 24 portas ethernet 100/1000;
- ▶ Alimentação PoE;
- ▶ Útil para redes ópticas/Acesso

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CRS305-1G-4S+IN

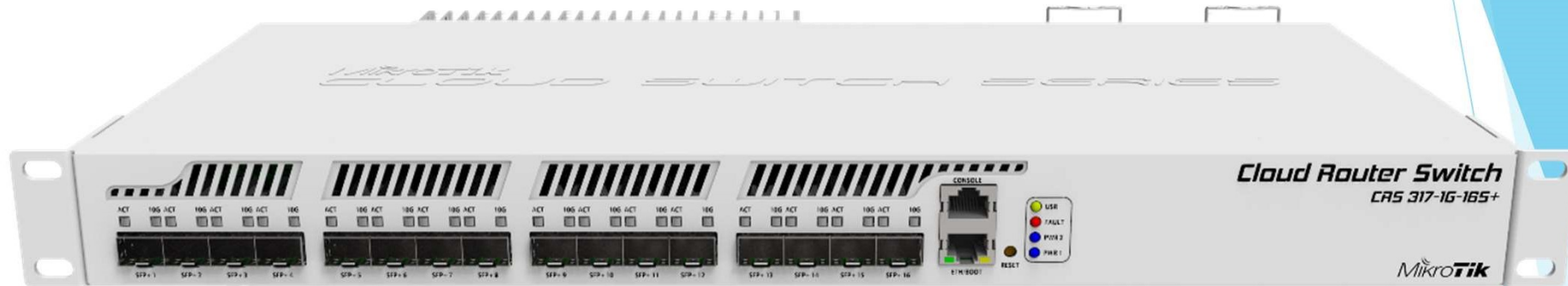


Suggested price: \$149.00

- ▶ 1 porta ethernet 100/1000;
- ▶ 4 portas SFP+ (10Gbps);
- ▶ Alimentação via PoE;
- ▶ Alimentação DC Redundante;
- ▶ Design compacto e baixíssimo consumo de energia;

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CRS 317



Suggested price: \$399.00

- ▶ 16 portas de SFP+ (10Gbps);
- ▶ Fonte Redundante;
- ▶ Excelente para Backbones/Datacenters;
- ▶ Capacidade máxima de switching: 322 Gbps
- ▶ MPLS Hardware Offload;

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CRS326-24S+2Q+RM



Suggested price: \$499.00

- ▶ 24 portas (SFP+) de 10Gbps;
- ▶ 2 Portas (QSFP+) de 40Gbps;
- ▶ Capacidade máxima de switching: 640 Gbps
- ▶ Excelente para Backbones/Datacenters;

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CRS 3xx conta com o poder...



Name:

Type:



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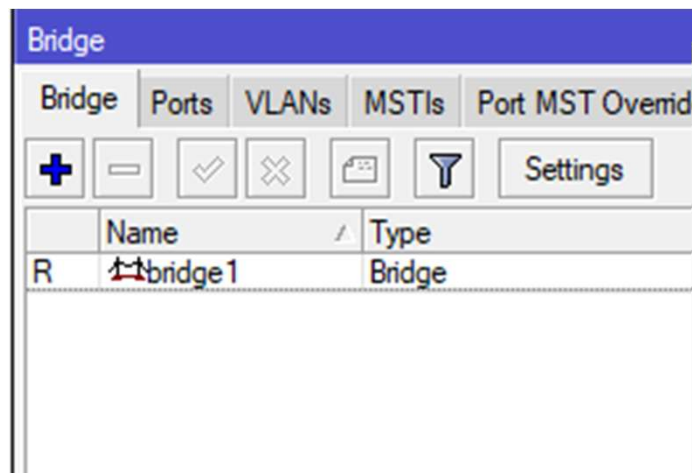
Características base:

Models

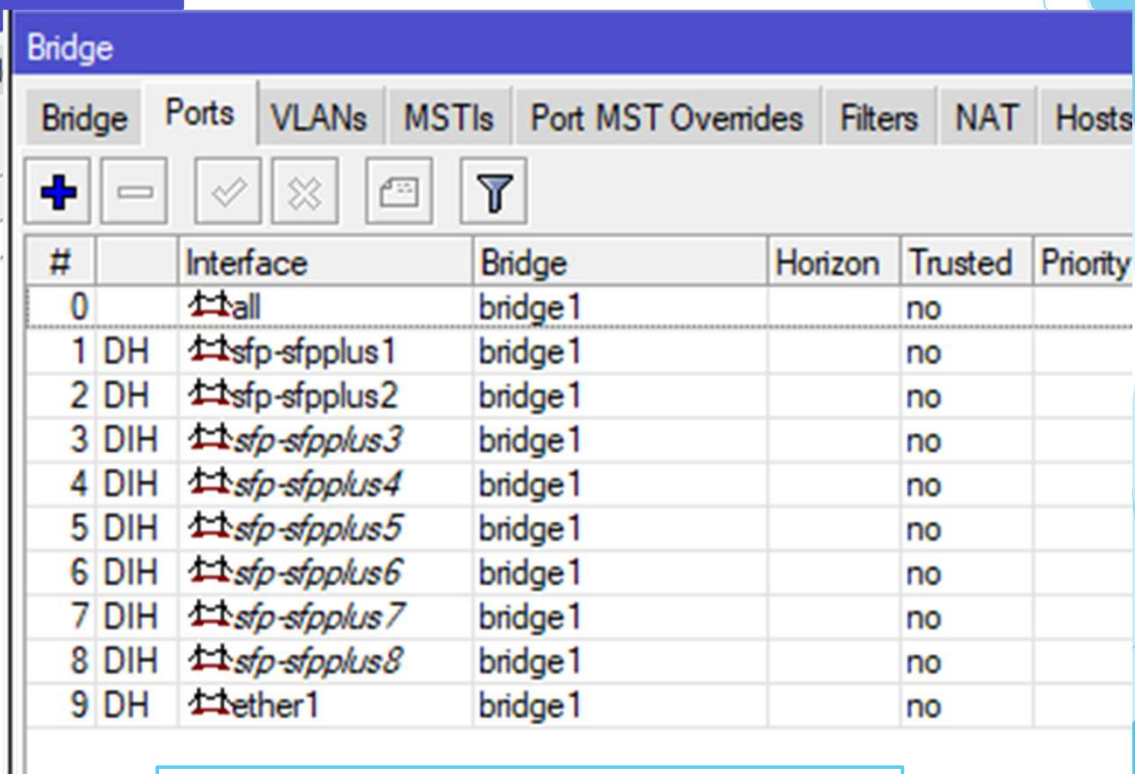
This table clarifies main differences between Cloud Router Switch models.

<u>Model</u>	Switch Chip	CPU	Cores	Wireless	SFP+ port	ACL rules	Jumbo Frame (Bytes)
CRS326-24G-2S+	Marvell-98DX3236	800MHz	1	-	+	128	10218
CRS328-24P-4S+	Marvell-98DX3236	800MHz	1	-	+	128	10218
CRS328-4C-20S-4S+	Marvell-98DX3236	800MHz	1	-	+	128	10218
CRS305-1G-4S+	Marvell-98DX3236	800MHz	1	-	+	128	10218
CRS309-1G-8S+	Marvell-98DX8208	800MHz	2	-	+	680	10218
CRS317-1G-16S+	Marvell-98DX8216	800MHz	2	-	+	680	10218
CRS312-4C+8XG	Marvell-98DX8212	650MHz	1	-	+	341	10218
CRS326-24S+2Q+	Marvell-98DX8332	650MHz	1	-	+	170	10218

Como Geralmente as pessoas fazem...



1° Cria uma Bridge



2° Adiciona Todas as portas na Bridge



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Hardware Offload

Bridge			
Bridge Ports VLANs MSTIs Port MST Ov			
+ - ✓ ✕ [icon] [icon]			
#		Interface	Bridge
0	H	sfp-sfpplus1	bridge1
1	H	sfp-sfpplus2	bridge1
2	H	sfp-sfpplus4	bridge1
3	H	sfp-sfpplus5	bridge1
4	H	sfp-sfpplus6	bridge1
5	H	H - Hw. Offload s7	bridge1
6	H	sfp-sfpplus8	bridge1
7	H	sfp-sfpplus10-v...	bridge1
8	H	sfp-sfpplus11-s...	bridge1
9	H	sfp-sfpplus12-l...	bridge1
10	H	sfp-sfpplus13-l...	bridge1
11	H	sfp-sfpplus16	bridge1
12	H	bonding1-lacp-...	bridge1
13	H	sfp-sfpplus15	bridge1



Hardware Offload



SEM
Hardware
Offload



CPU: 100%



COM
Hardware
Offload



CPU: 0%

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VLANs

JAMAIS FAÇA ISSO!

D:B7 (NAO-FACA-ISSO!!!) - WinBox (64bit) v6.44.6 on CRS305-1G-4S+ (arm)

hboard

Session: 74:4D:28:89:3D:B7

Interface List

Interface Interface List Ethernet EoIP Tunnel IP Tunnel GRE Tunnel VL

EoIP Tunnel
IP Tunnel
GRE Tunnel
VLAN
VRRP
Bonding
Bridge

Detect Internet

Type

Bridge
Bridge
Bridge
Ethernet

... PORTA-TRUNK

Sfp-sfpplus1 Ethernet

S vlan100 VLAN

S vlan200 VLAN

S vlan300 VLAN

S sfp-sfpplus2 Ethernet

S sfp-sfpplus3 Ethernet

S sfp-sfpplus4 Ethernet

11 items (1 selected)

D:B7 (NAO-FACA-ISSO!!!) - WinBox (64bit) v6.44.6 on CRS305-1G-4S+ (arm)

hboard

Session: 74:4D:28:89:3D:B7

Bridge

Bridge Ports VLANs MSTIs Port MST Overrides Filters NAT Hosts MDE

+ - ✓ ✗ Settings

	Name	Type	L2 MTU	Tx
R	bridge-vlan-100	Bridge	1588	
R	bridge-vlan-200	Bridge	1588	
R	bridge-vlan-300	Bridge	1588	

D:B7 (NAO-FACA-ISSO!!!) - WinBox (64bit) v6.44.6 on CR

hboard

Session: 74:4D:28:89:3D:B7

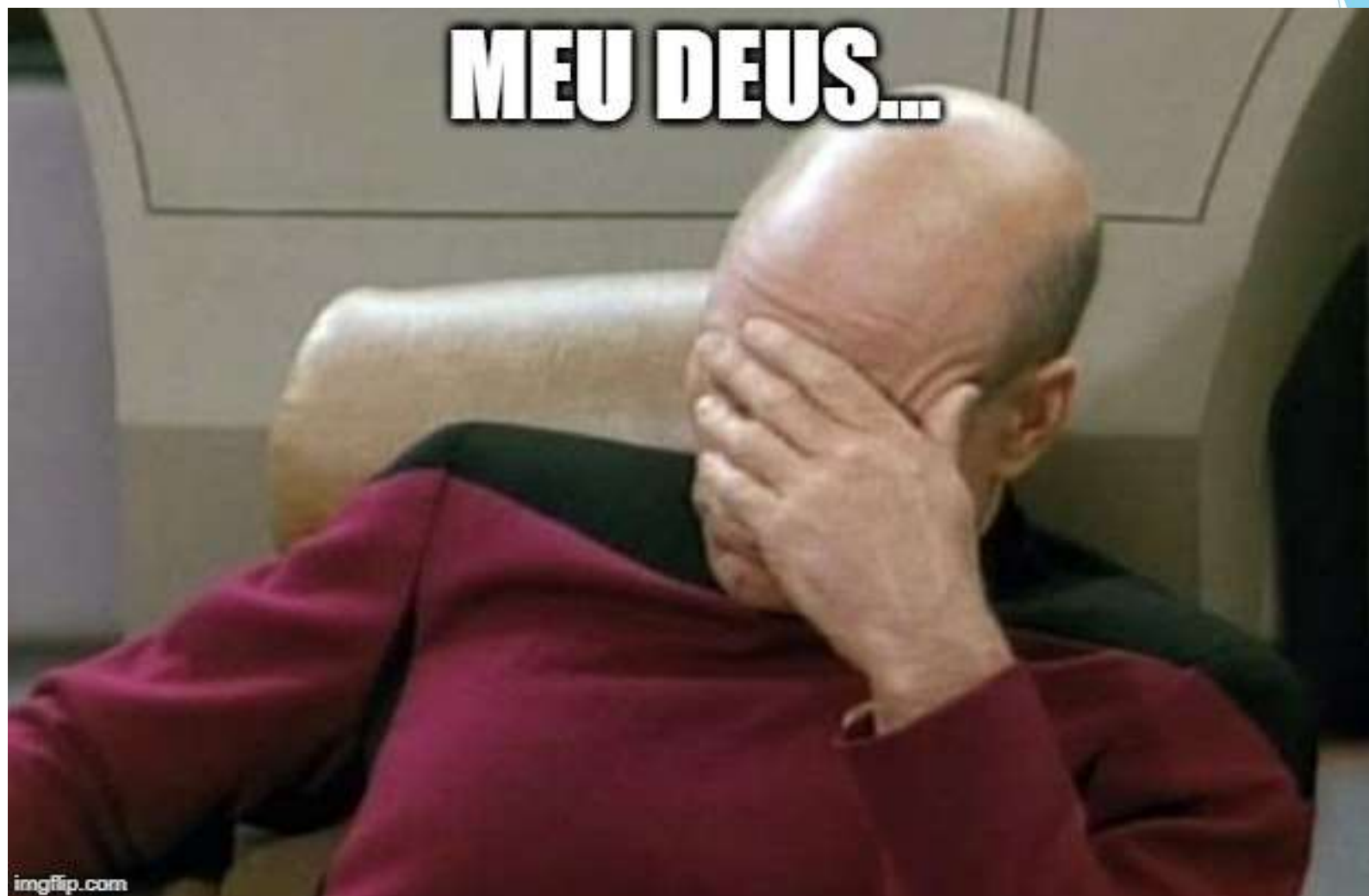
Bridge **Ports** VLANs MSTIs Port MST Overrides Filt

+ - ✓ ✗ Settings

#	Interface	Bridge	Horizon
0 IH	sfp-sfpplus2	bridge-vlan-100	
1 I	vlan100	bridge-vlan-100	
2 I	sfp-sfpplus3	bridge-vlan-200	
3 I	vlan200	bridge-vlan-200	
4 I	sfp-sfpplus4	bridge-vlan-300	
5 I	vlan300	bridge-vlan-300	

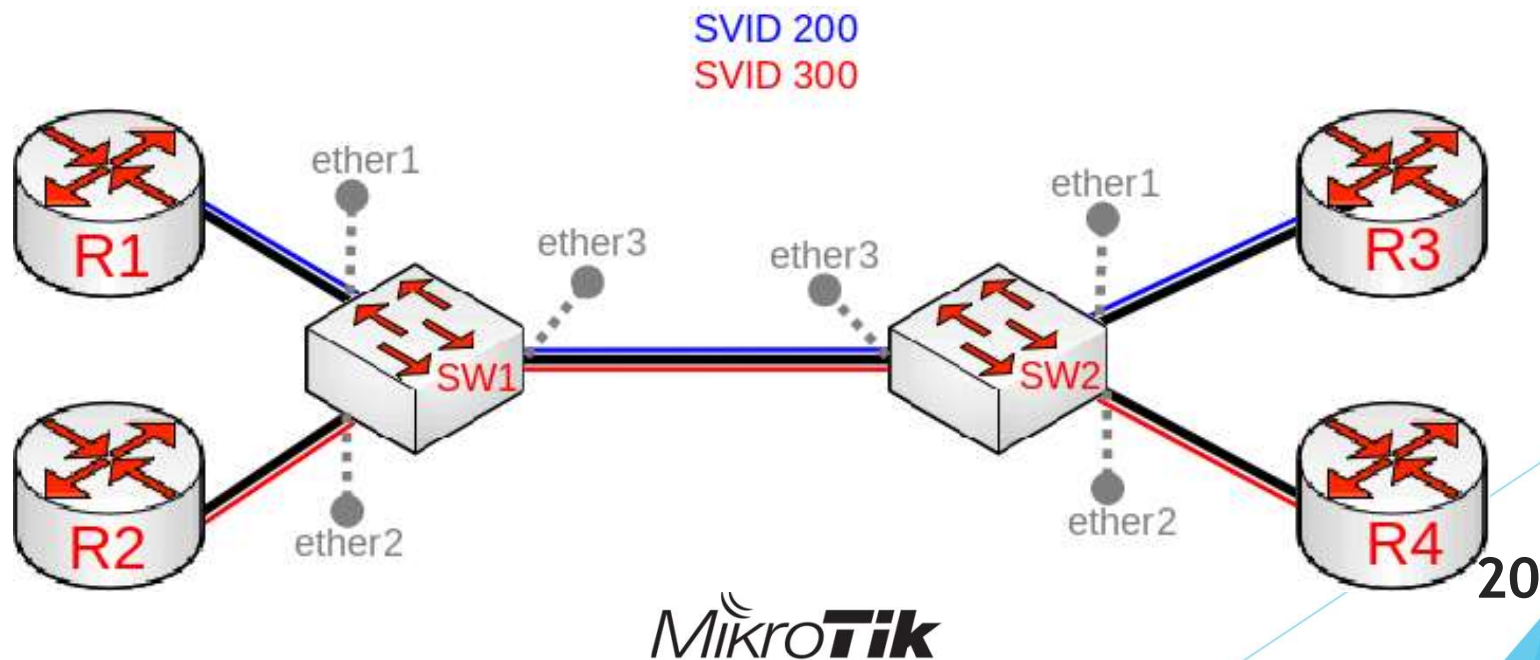
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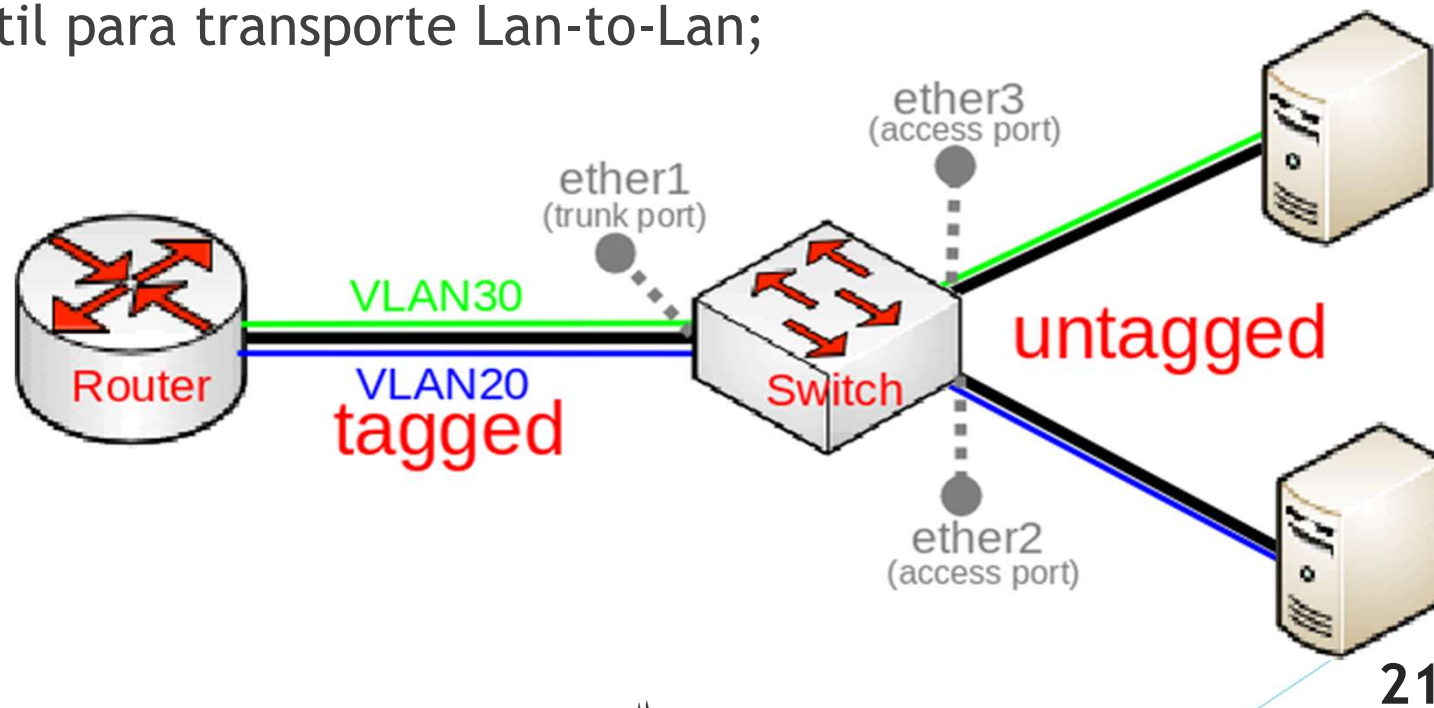
VLANs (Tagged)

- ▶ O switch espera já receber frames com alguma Tag;
- ▶ Útil para isolar domínios de broadcast/gerencia;
- ▶ Útil para transportes Lan-to-Lan;



VLANs (Untagged)

- ▶ O switch recebe ou remove um “Tag” do Frame;
- ▶ Uso em redes de acesso/servidores/gerencia;
- ▶ Útil para transporte Lan-to-Lan;

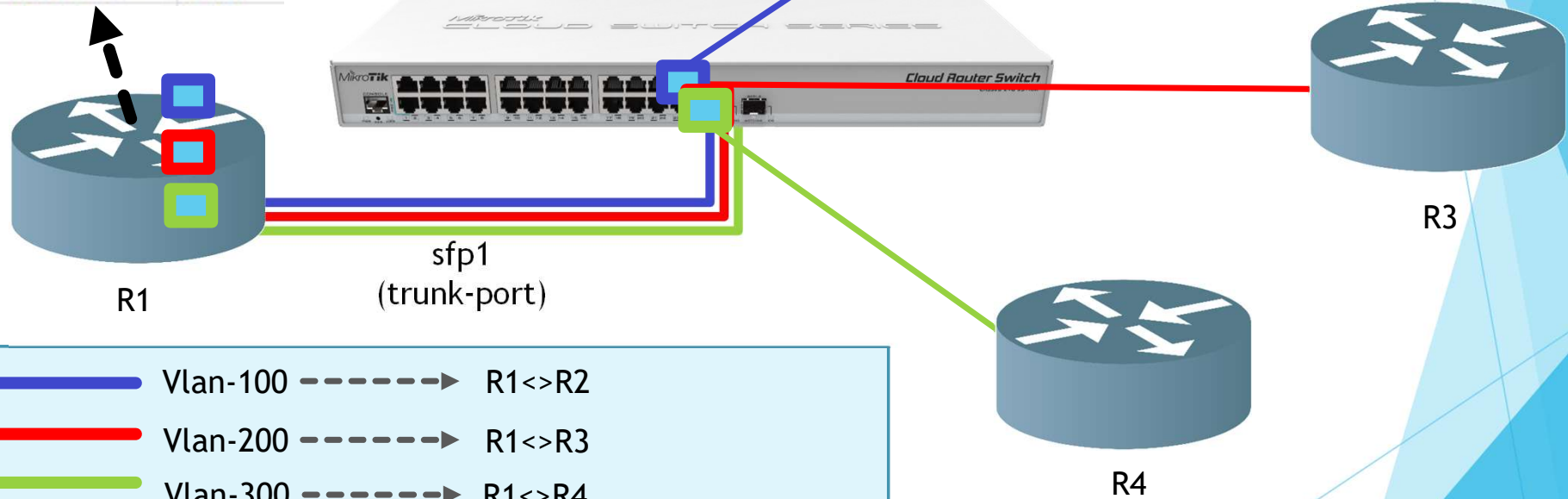


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VLANs (Tagged)

Exemplo simples

R	ether1	Ethernet
R	vlan100	VLAN
R	vlan200	VLAN
R	vlan300	VLAN



- Vlan-100 -----> R1<>R2
- Vlan-200 -----> R1<>R3
- Vlan-300 -----> R1<>R4
- Payload

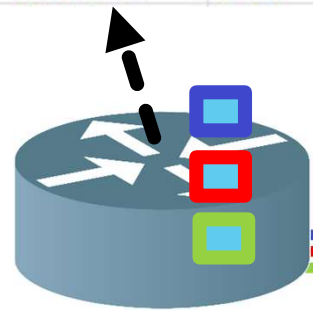
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VLANs (Untagged)

Exemplo simples

R	ether1	Ethernet
R	vlan100	VLAN
R	vlan200	VLAN
R	vlan300	VLAN



sfp1
(trunk-port)

- Vlan-100 -----> Camera
- Vlan-200 -----> OmniTIK
- Vlan-300 -----> DELL Server
- Payload



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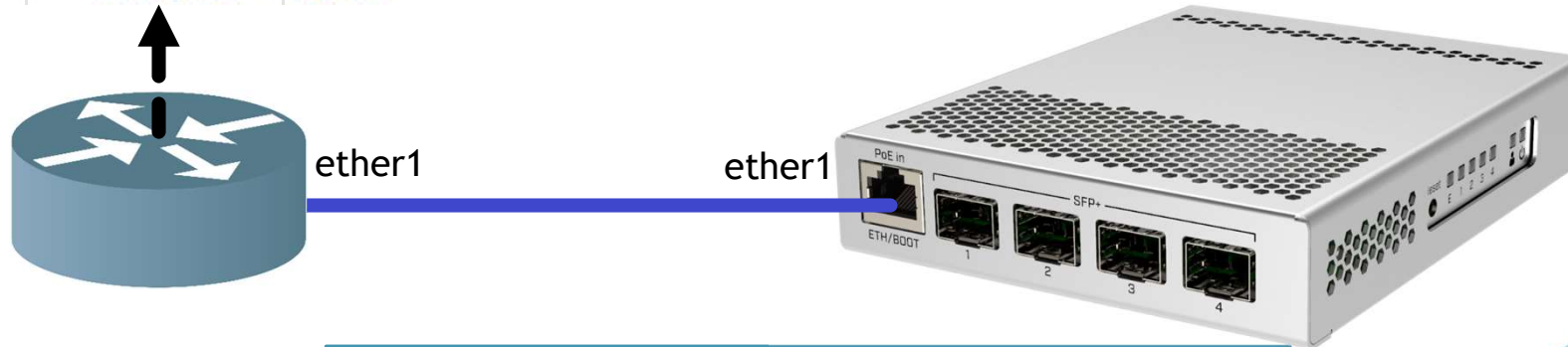
VLAN de Gerencia (tagged)

Exemplo

► Objetivo:

- Filtrar a gerencia do Switch em modo “tagged” pela **VLAN ID 10** sobre via ether1;

R	 ether1	Ethernet
R	 vlan10	VLAN



— Vlan-10 (tagged) - - - - - Gerencia

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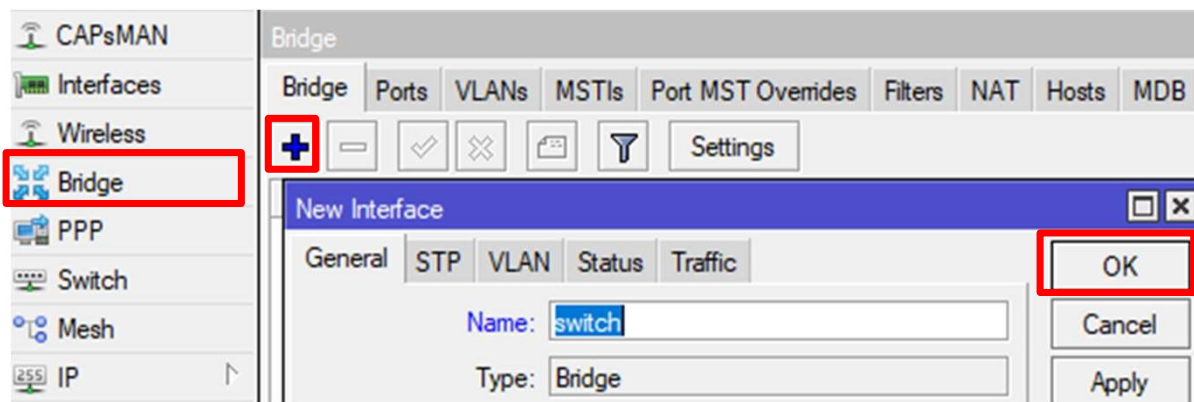
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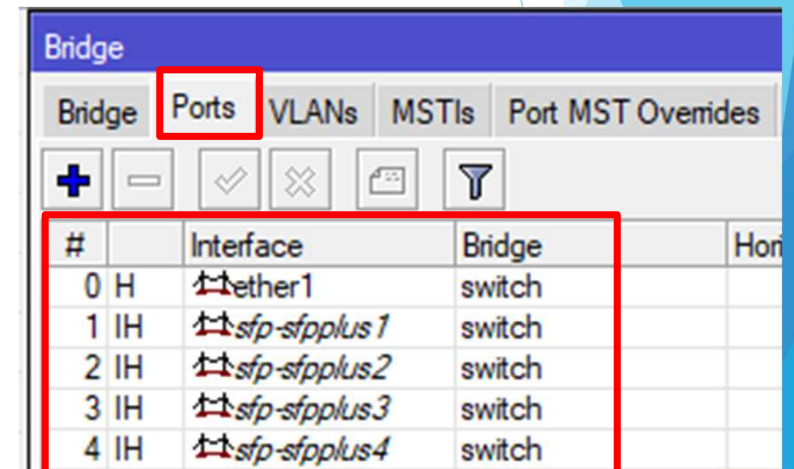
VLAN de Gerencia (tagged)

Exemplo

1- Criar uma bridge



2- Vincular as portas à Bridge



VLAN de Gerencia (tagged)

Exemplo

3- Criar uma vlan (lógica)

Interface List

Interface Detect Internet

Interface <vlan10-gerencia>

General Loop Protect Status Traffic

Name: vlan10-gerencia

Type: VLAN

MTU: 1500

Actual MTU: 1500

L2 MTU: 1588

MAC Address: 74:4D:28:89:3D:B7

ARP: enabled

ARP Timeout:

VLAN ID: 10

Interface: switch

☐ Use Service Tag

OK Cancel Apply Disable Comment Copy Remove Torch

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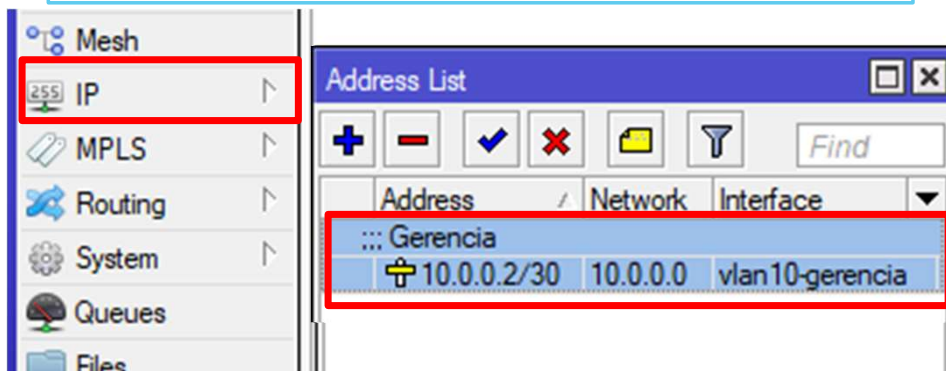
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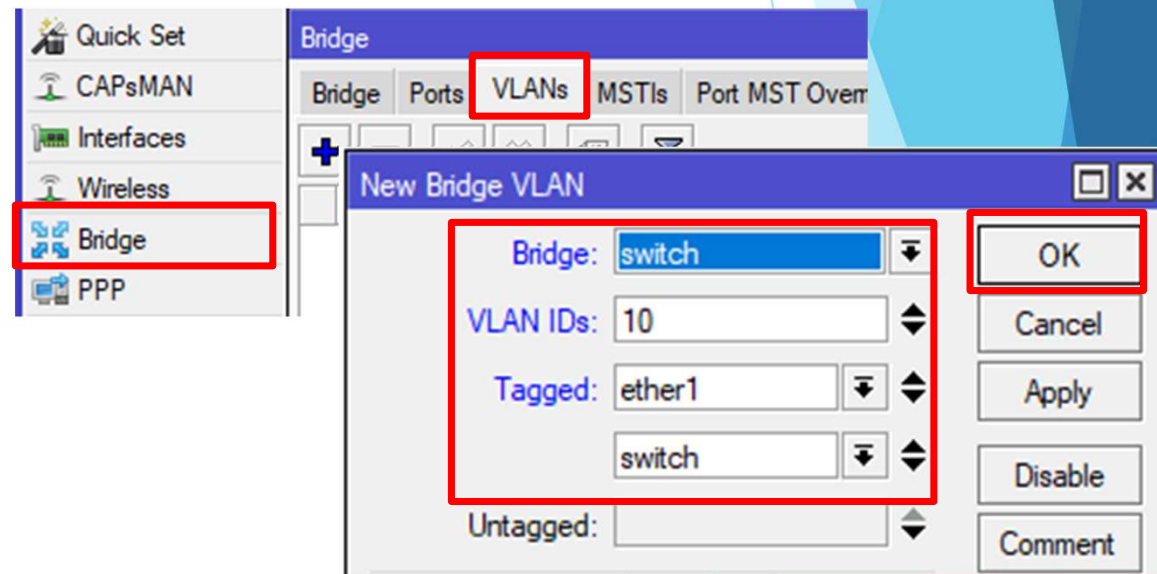
VLAN de Gerencia (tagged)

Exemplo

4- Adicionar o IP de Gerencia à VLAN criada



5- Marcar essa VLAN como “Tagged” nas respectivas interfaces;



VLAN de Gerencia (tagged)

Exemplo

6- Ativar a filtragem de VLAN na Bridge

The screenshot shows the MikroTik WinBox Bridge configuration window. The 'Bridge' tab is selected. Below the tabs, the 'Bridge' button is highlighted. A table lists the bridge configuration:

Name	Type	L2 MTU	Tx
R switch	Bridge	1592	0 bp

The 'Interface <switch>' window is open, showing the 'VLAN' tab. The 'VLAN Filtering' checkbox is checked, and the 'Ingress Filtering' checkbox is also checked. The 'EtherType' is set to 0x8100, the 'PVID' is 1, and the 'Frame Types' are set to 'admit only VLAN tagged'.

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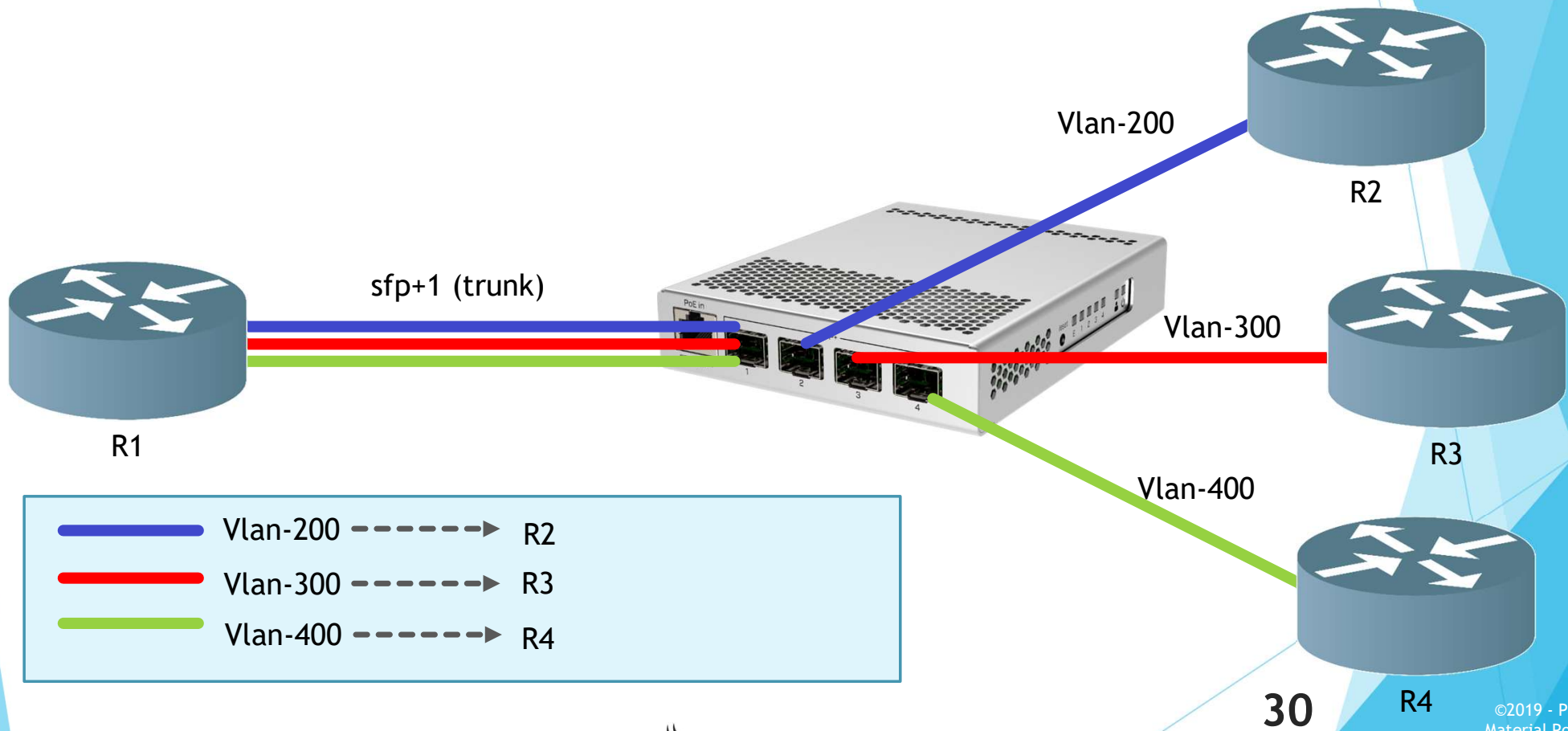
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VLAN de Gerencia (Considerações finais)

- ▶ Preferencialmente faça essa configuração antes das demais (se possível em bancada);
- ▶ Ficar atento à erros (eles podem custar caro);
- ▶ Usar o “Safe mode” e “RoMON para testes/gerencia;
- ▶ A Mikrotik recomenda realizar a ativação do “Vlan Filtering” usando cabo serial (se possível);

VLANs (Tagged)

Como Fazer?

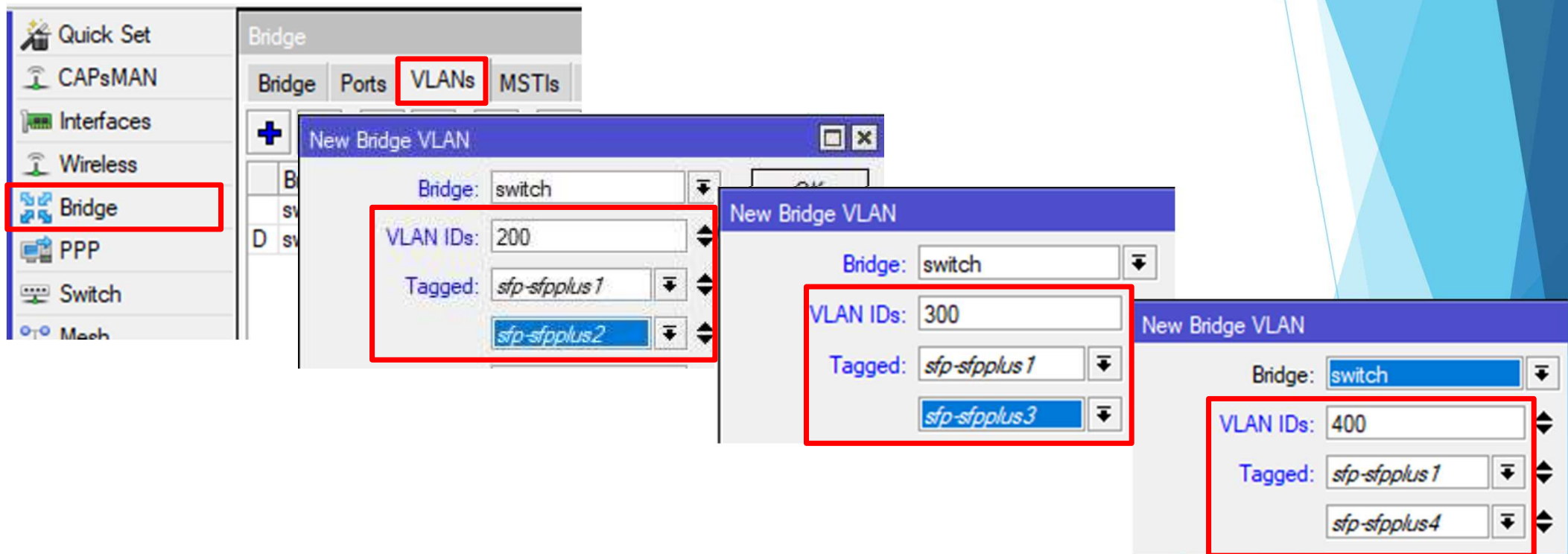


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VLANs (Tagged)

Como Fazer?

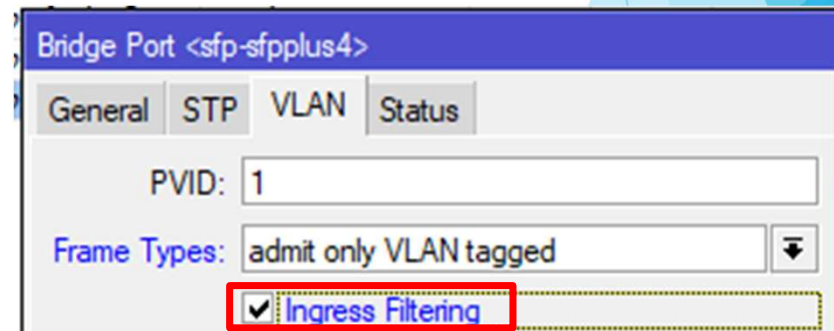
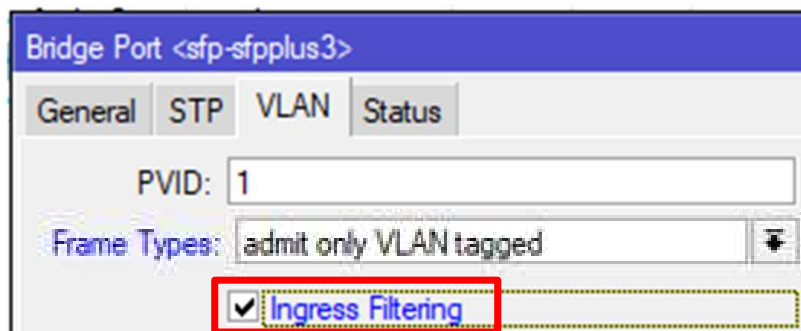
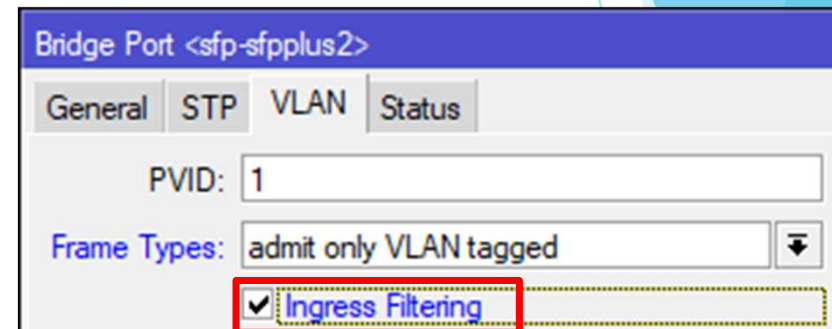
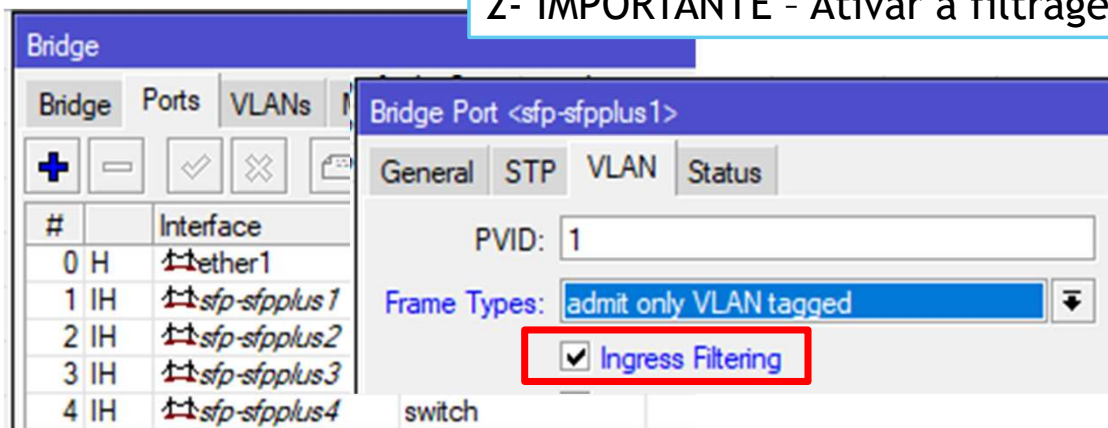
1- Criar os grupos de portas que permitirão a passagem das VLANs tipo “Tagged”



VLANs (Tagged)

Como Fazer?

2- IMPORTANTE - Ativar a filtragem nas respectivas portas físicas



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VLANs (Tagged)

Exemplo de uso

Bridge VLAN <200, 300, 400>

Bridge:

VLAN IDs:

Tagged:

Bridge VLAN <200, 300, 400>

Bridge:

VLAN IDs:

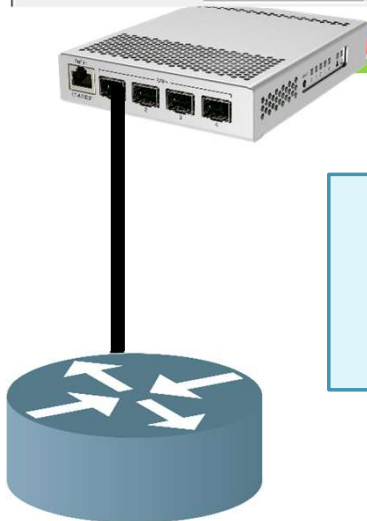
Tagged:

Bridge VLAN <200, 300, 400>

Bridge:

VLAN IDs:

Tagged:



Router (Cidade A)



Router (Cidade B)



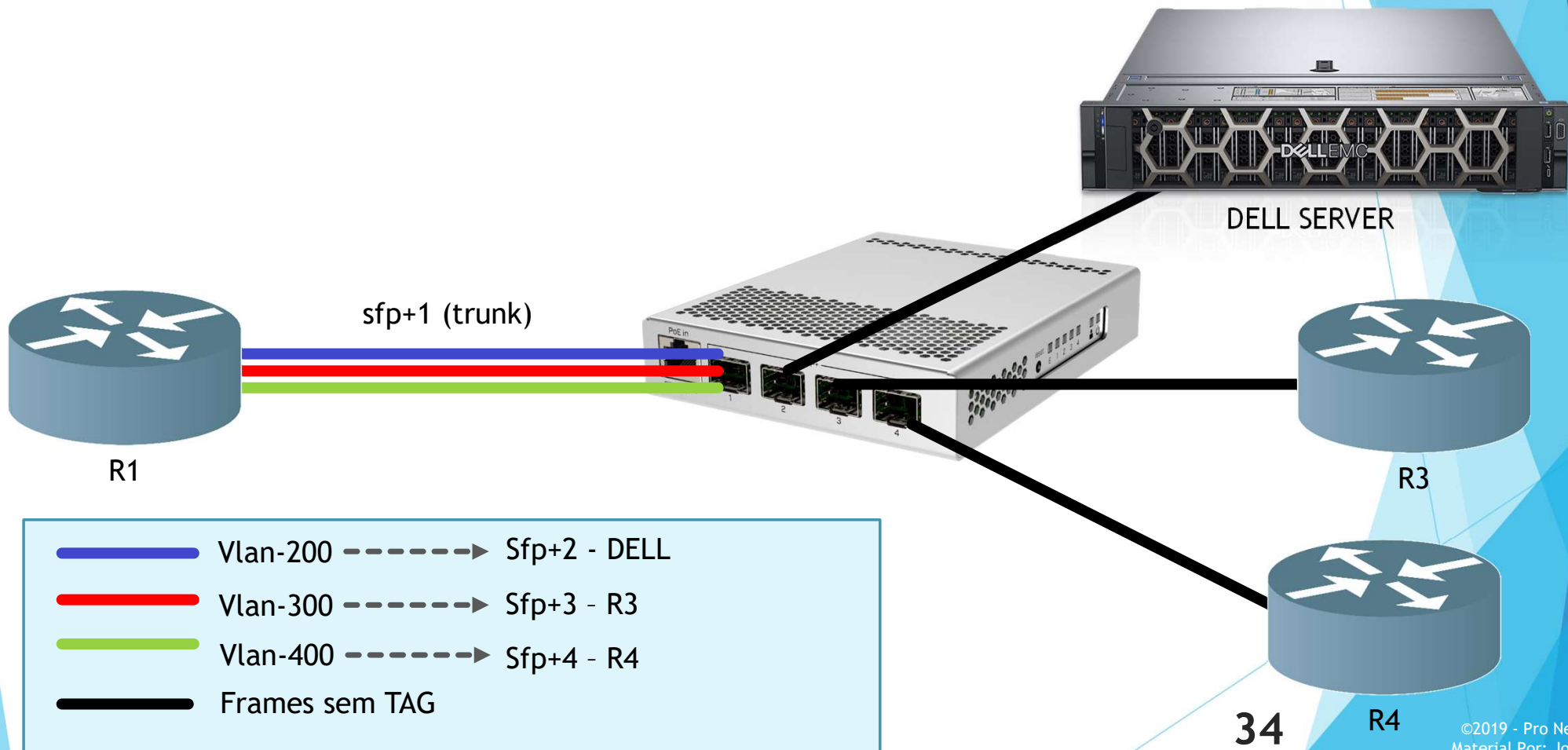
Router (Cidade C)

- Vlan-200
- Vlan-300
- Vlan-400

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VLANs (Untagged)

Como Fazer?



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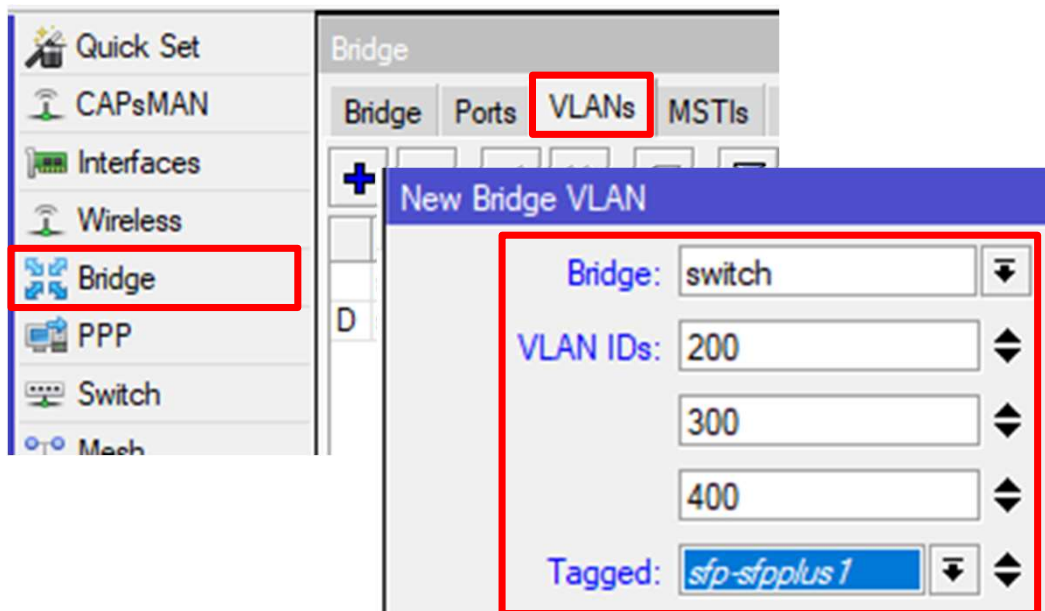
R4

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VLANs (Untagged)

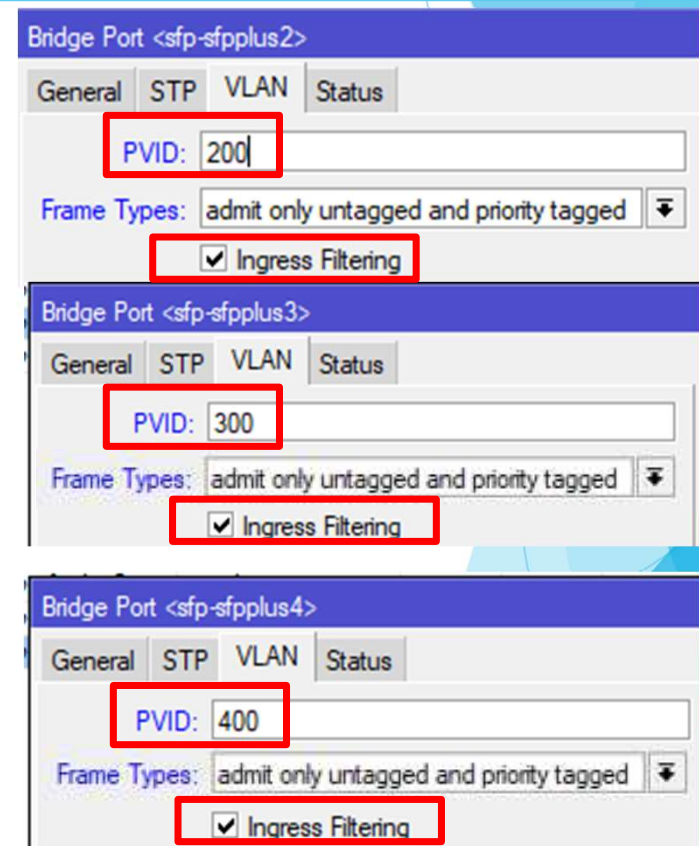
Como Fazer?

1- Adicionar a Trunk Port e VLANs Tagged



Menu "Bridge > Ports"

2- EM PVID dizer qual tratará frames "Untagged"



VLANs

Considerações Gerais

- ✓ Sempre usar “ingress filtering” nas interfaces para garantir o isolamento de broadcast;
- ✓ Essas configurações são válidas exclusivamente para a série CRS3xx (modo hardware);
- ✓ Existem diferentes formas de se configurar (dependendo do hardware/série);

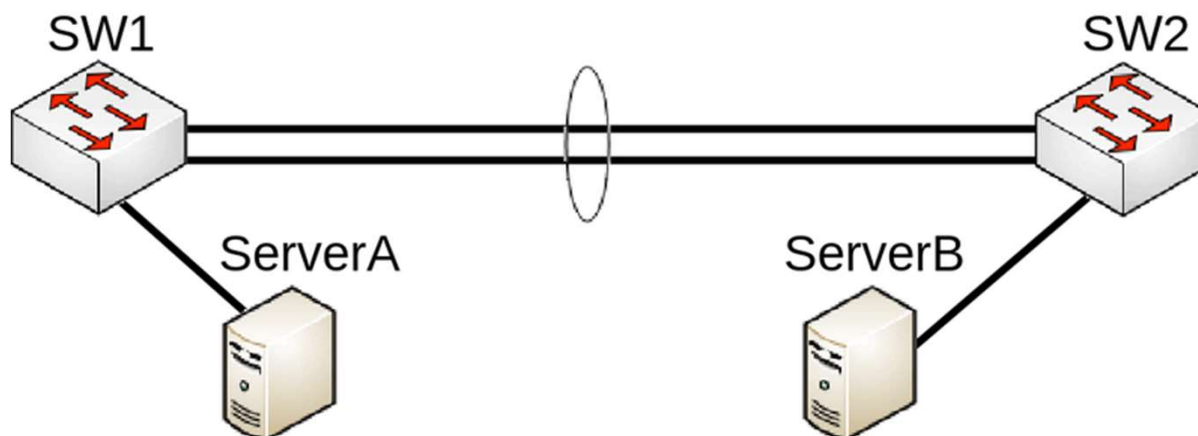


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LACP

(Link Aggregation Control Protocol)

- ▶ Útil para agregar 1 ou mais circuitos/Interfaces;
- ▶ Possibilidade de transportar VLANs (Tagged ou Untagged);
- ▶ Proporciona também HA;
- ▶ É possível agregar até 8 portas pro grupo;
- ▶ **Sempre observar o “Hash” correto para seu cenário;**



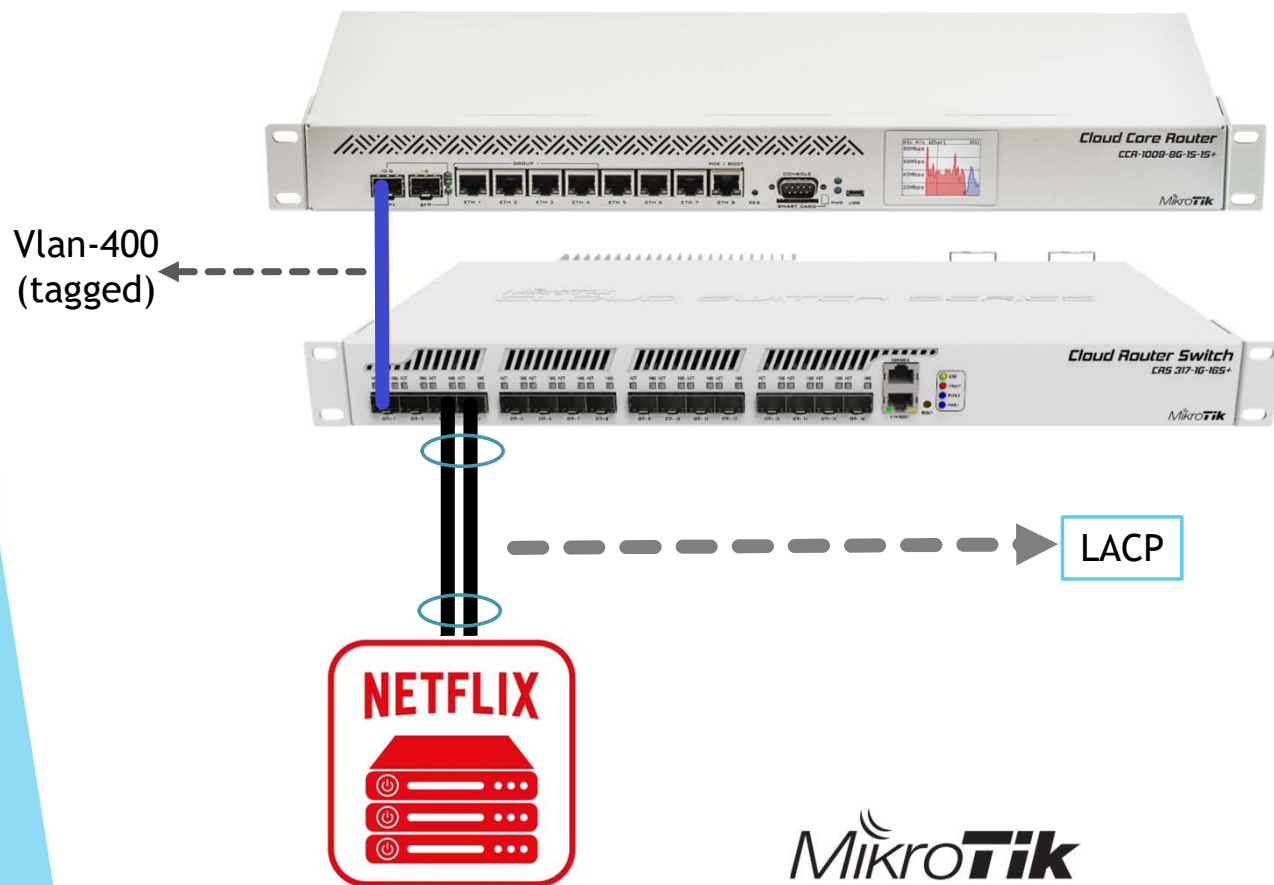
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LACP

(Caso de uso)

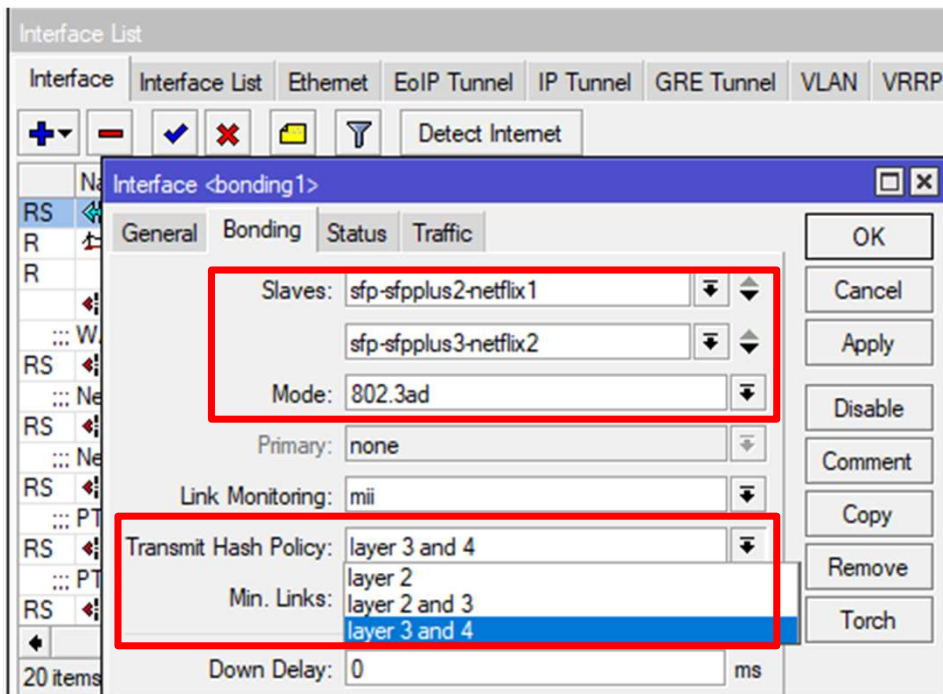
- ▶ Exemplo com CDN (Netflix) (LACP + VLAN)



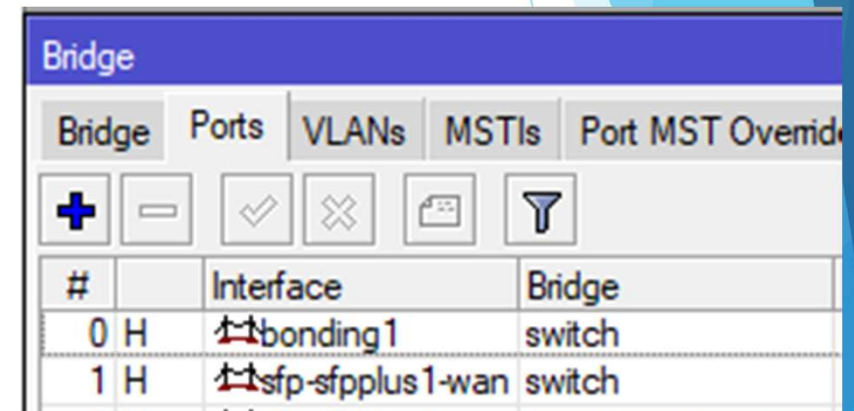
LACP

(Como fazer?)

1- Criar uma interface “Bonding” no modo 802.3ad



2- Adicionar o Bonding na Bridge

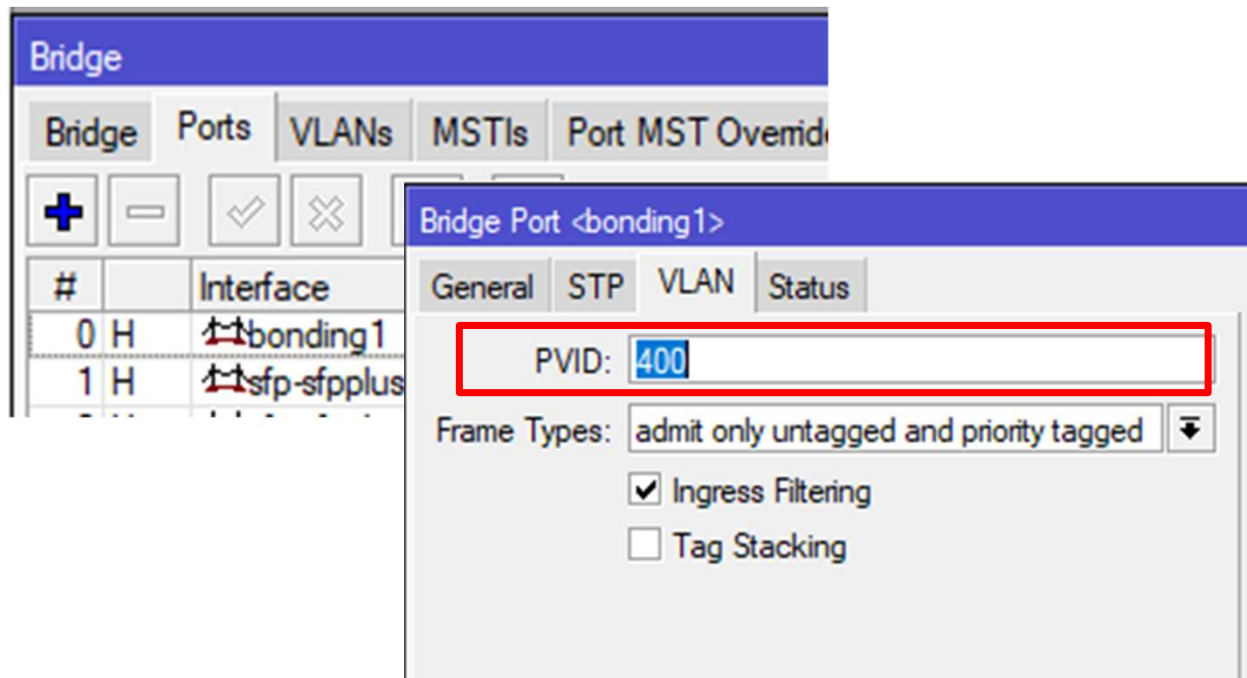


*É possível também em modo “balance-xor”

LACP

(Como fazer?)

3- Colocar o PVID 400 (untagged) no Bonding



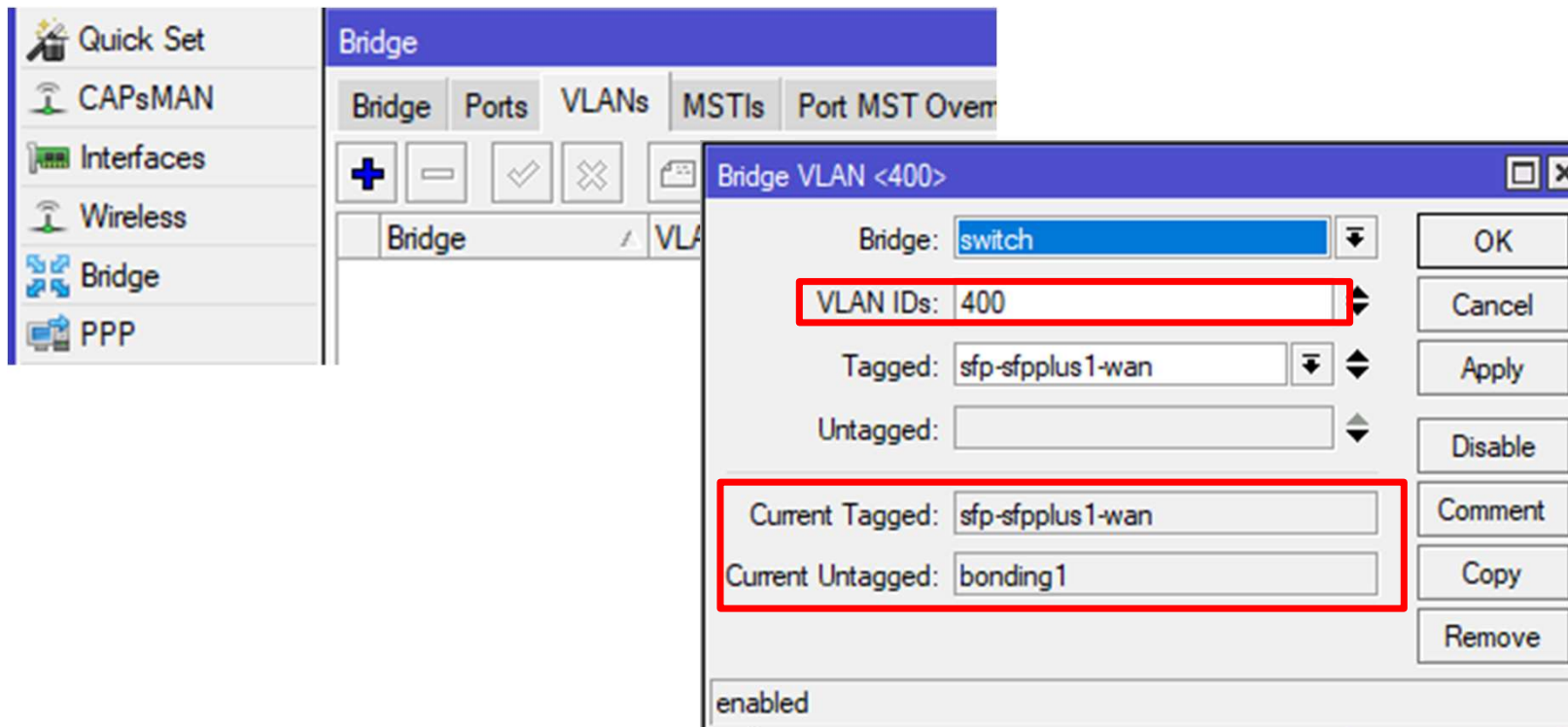
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LACP

(Como fazer?)

4- Marcar a porta Trunk como VID 400 “tagged”



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LACP

(Resultado)

Bridge			
Bridge		Ports	VLANs
+		-	✓
#		Interface	Bridge
0	H	1 bonding1	switch
1	H	H - Hw. Offload	switch
2	H	1 sfp-sfpplus4	switch
3	H	1 sfp-sfpplus5	switch
4	H	1 sfp-sfpplus6	switch
5	H	1 sfp-sfpplus9	switch
6	H	1 sfp-sfpplus8	switch
7	H	1 sfp-sfpplus10	switch

0	H	1 bonding1	switch
1	H	H - Hw. Offload	switch
2	H		switch

LACP

(Resultado)

Time: 10:27:56 CPU: 0% Uptime: 37d 00:23:17

Interface List

Interface

Interface List

Ethernet

EoIP Tunnel

IP Tunnel

GRE Tunnel

VLAN

VRRP

Bonding

LTE

+

-

✓

✗

📄

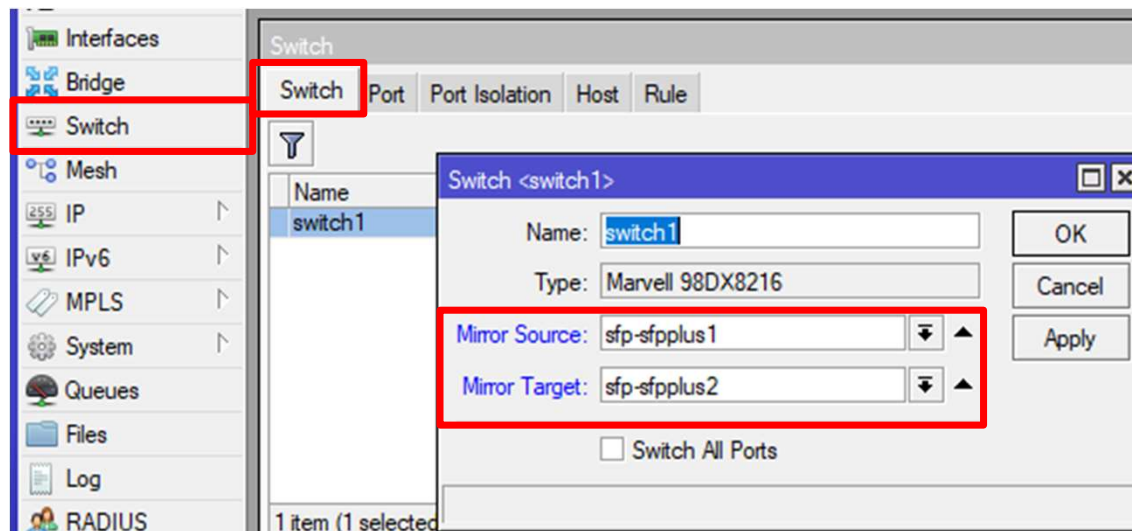
🔍

Detect Internet

	Name	Type	Actual MTU	L2 MTU	Tx	Rx	Tx P.
RS	bonding1	Bonding	1500	1592	42.9 Mbps	2.3 Gbps	
	ether1	Ethernet	1500	1592	0 bps	0 bps	
... WAN							
RS	sfp-sfpplus1-wan	Ethernet	1500	1592	2.5 Gbps	2.3 Gbps	
... Netflix Cache							
RS	sfp-sfpplus2-n...	Ethernet	1500	1592	19.1 Mbps	1180.4 Mbps	
... Netflix Cache							
RS	sfp-sfpplus3-n...	Ethernet	1500	1592	23.8 Mbps	1124.4 Mbps	
... Netflix Cache							

Port Mirroring (espelhamento de portas)

- ▶ O Chip permite que haja o “espelhamento” de pacotes a uma determinada(s) porta/vlans/MACs;
- ▶ Útil para análises avançadas com algum packet sniffer (Ex: Wireshark)
- ▶ Interessante para analisar comportamentos de ataques.



Port Mirroring (espelhamento de portas)

► Exemplo com base em VLANs

- VLAN Based Mirroring

```
/interface bridge
set bridge1 vlan-filtering=yes
/interface ethernet switch
set switch1 mirror-target=ether3 mirror-source=none
/interface ethernet switch rule
add mirror=yes ports=ether1 switch=switch1 vlan-id=11
```

Mais em: https://wiki.mikrotik.com/wiki/Manual:CRS3xx_series_switches#Mirroring

Port Mirroring (exemplo real de analise)

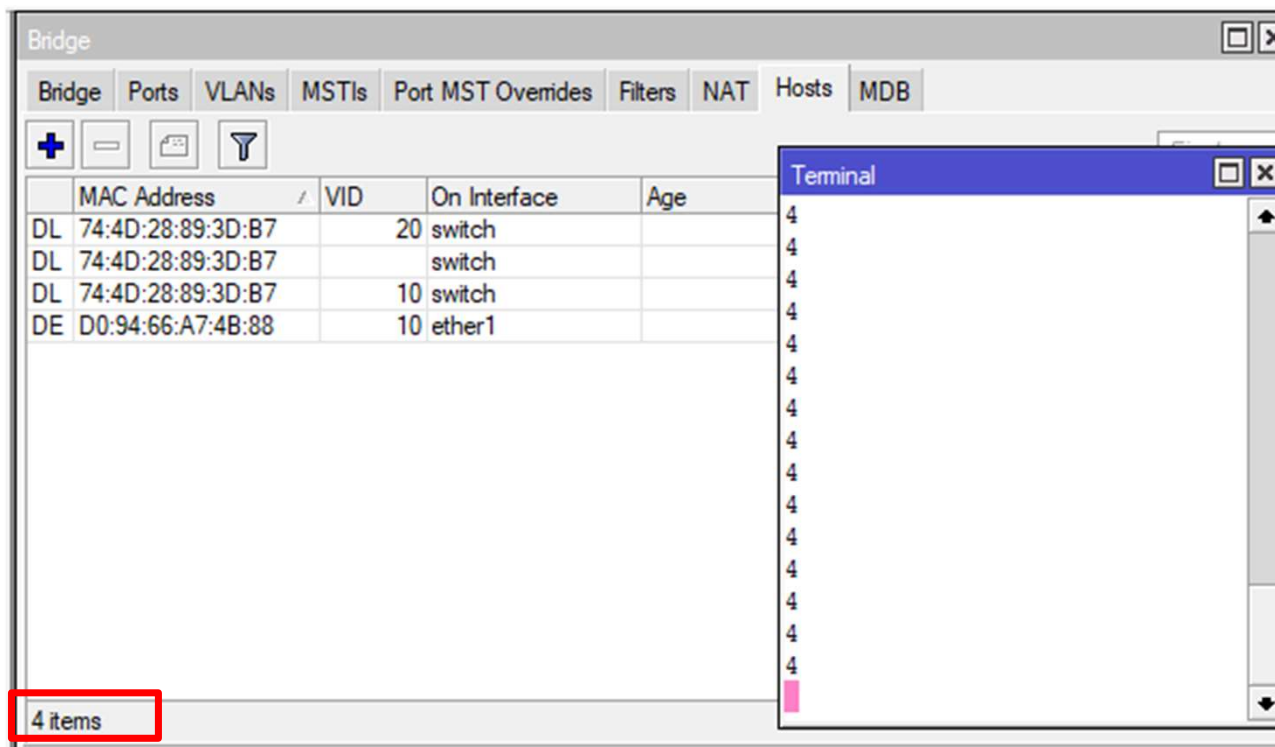
22	0.005995	87.144.224.98	154.213.28.254	TCP	909 33162 → 8600 [SYN, NS, Reserved] Seq=0 Win=62247 Len=851[Packet size
23	0.006007	73.118.27.115	154.213.28.254	TCP	934 37573 → 8600 [SYN, NS, Reserved] Seq=0 Win=60763 Len=876[Packet size
24	0.004966	84.61.186.232	154.213.28.254	TCP	939 1893 → 8600 [SYN, ECN, CWR, Reserved] Seq=0 Win=63723 Len=881[Packet
25	0.005009	96.87.31.42	154.213.28.254	TCP	931 18889 → 8600 [SYN] Seq=0 Win=61714 Len=873[Packet size limited during
26	0.005136	54.128.231.102	154.213.28.254	TCP	917 34193 → 8600 [SYN] Seq=0 Win=64043 Len=859[Packet size limited during
27	0.005139	100.26.42.182	154.213.28.254	TCP	907 54740 → 8600 [SYN] Seq=0 Win=64670 Len=849[Packet size limited during
28	0.005155	14.8.106.21	154.213.28.254	TCP	908 13332 → 8600 [SYN, NS, Reserved] Seq=0 Win=65172 Len=850[Packet size
29	0.005162	70.118.81.153	154.213.28.254	TCP	920 47355 → 8600 [SYN, ECN, CWR, Reserved] Seq=0 Win=63555 Len=862[Packet

> Frame 1: 913 bytes on wire (7304 bits), 60 bytes captured (480 bits)	
> Ethernet II, Src: JuniperN_f9:29:44 (d8:b1:22:), Dst: JuniperN_52:35:4d (20:4e:71:)	
> 802.1Q Virtual LAN, PRI: 0, DEI: 0, ID: 1503	

0000	20 4e 71 52 35 4d d8 b1 22 f9 29 44 81 00 05 df	NqR5M - ")D . . .
0010	08 00 45 00 03 7f 39 f6 40 00 cd 06 46 a5 25 f0	..E..9 @..F.%

Ethernet (eth), 14 bytes	Packets: 269474 · Display
--------------------------	---------------------------

Mac Flooding (antes de um ataque)



Mac Flooding (durante um ataque)

```
89547:69289547(0) win 512
1a:ee:85:7f:ac:4a 91:7b:71:6f:3b:ce 192.168.10.1.30193 > 192.168.10.2.260: S 1964
865226:1964865226(0) win 512
83:11:71:56:77:71 a6:34:2f:18:41:cb 192.168.10.1.61818 > 192.168.10.2.59654: S 72
6165499:726165499(0) win 512
a2:92:2c:43:51:80 60:f2:cb:61:6d:c4 192.168.10.1.16136 > 192.168.10.2.43526: S 73
5161923:735161923(0) win 512
ae:1e:cf:23:8c:76 3f:43:3f:12:ef:72 192.168.10.1.17168 > 192.168.10.2.40938: S 57
5154376:575154376(0) win 512
d9:66:bd:3:12:b6 b3:ae:38:50:87:e0 192.168.10.1.46871 > 192.168.10.2.27348: S 206
4090581:2064090581(0) win 512
2a:5e:21:7e:b2:cd ec:20:62:49:c6:4d 192.168.10.1.46777 > 192.168.10.2.64913: S 13
26680840:1326680840(0) win 512
dd:5:7:78:47:ae 31:82:c5:4e:ec:3c 192.168.10.1.22606 > 192.168.10.2.43787: S 2573
71017:257371017(0) win 512
99:42:fe:5e:5e:90 d8:8c:e3:0:a7:64 192.168.10.1.12361 > 192.168.10.2.55499: S 104
2306871:1042306871(0) win 512
f9:59:e5:34:44:14 8e:9:da:71:f6:45 192.168.10.1.32536 > 192.168.10.2.64581: S 190
6275171:1906275171(0) win 512
e0:49:18:0:50:cf c3:7e:66:2a:b2:0 192.168.10.1.19682 > 192.168.10.2.33605: S 1800
774116:1800774116(0) win 512
34:87:59:2a:30:5e c4:e8:ed:1e:dc:9 192.168.10.1.35132 > 192.168.10.2.17043: S 169
6513929:1696513929(0) win 512
16:83:db:4f:63:b2 ff:ec:7c:22:3b:83 192.168.10.1.2863 > 192.168.10.2.42195: S 113
2911253:1132911253(0) win 512
21:4a:f6:6e:84:19 e7:39:1d:26:2f:b8 192.168.10.1.38345 > 192.168.10.2.50438: S 34
3277341:343277341(0) win 512
root@kali:~#
```

Mac Flooding (durante um ataque)

Bridge

Bridge Ports VLANs MSTIs Port MST Overrides Filters NAT Hosts MDB

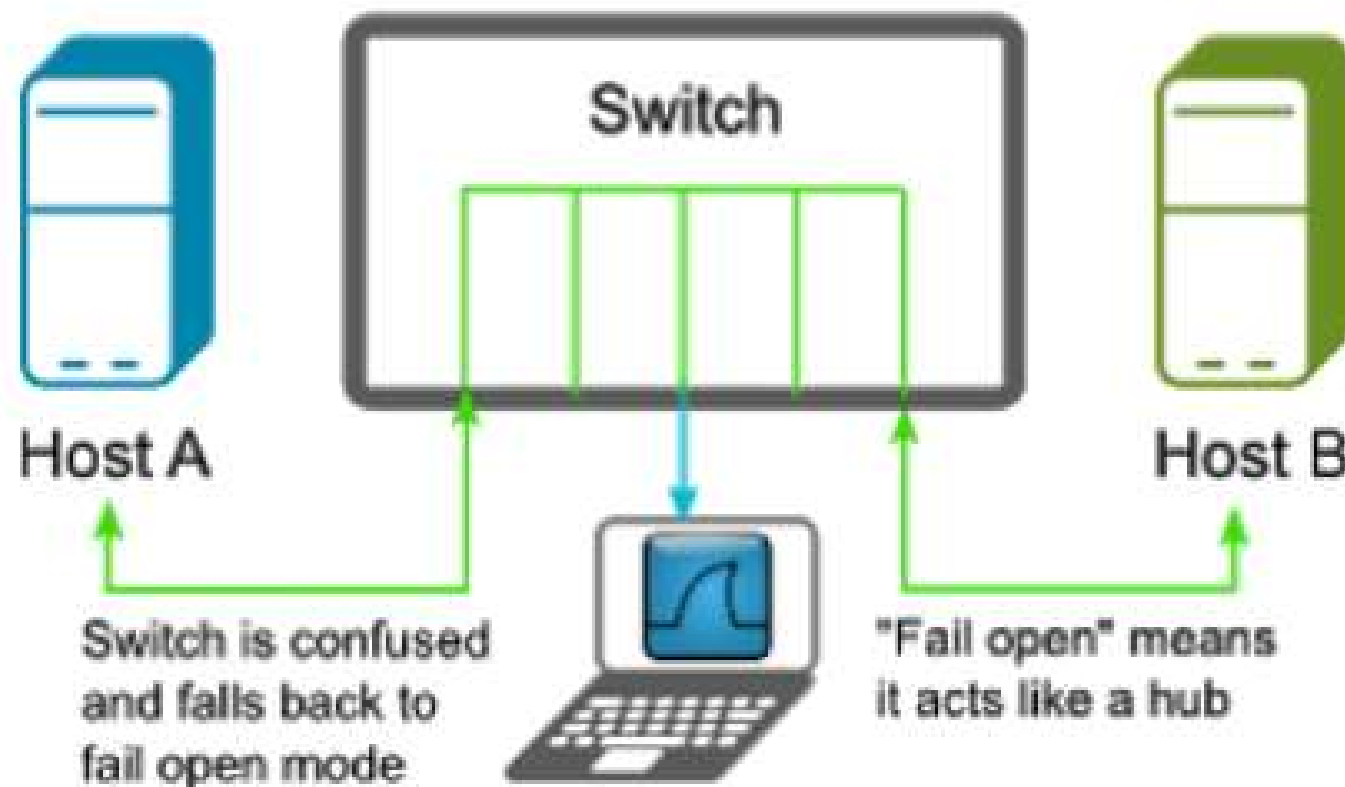
	MAC Address	VID	On Interface	Age
DE	00:00:D7:47:A9:66	10	ether1	0
DE	00:02:80:2E:3E:8F	10	ether1	0
D	00:02:EB:5C:D3:FE	10	ether1	0
D	00:03:6F:29:87:42	10	ether1	0
D	00:09:31:10:A7:C5	10	ether1	0
DE	00:09:D1:02:88:BD	10	ether1	0
D	00:12:5B:4B:6E:6B	10	ether1	0
D	00:15:DB:4D:AB:6D	10	ether1	0
D	00:17:C5:08:3E:E2	10	ether1	0
DE	00:1B:DD:49:F0:4D	10	ether1	0
D	00:1C:1A:13:B9:23	10	ether1	0
D	00:1D:73:12:45:55	10	ether1	0
D	00:1D:99:6E:EE:46	10	ether1	0
D	00:1D:A1:55:7B:D8	10	ether1	0
D	00:1E:67:56:92:D5	10	ether1	0

Terminal

4306
9575
12525
12525
12525
12525
12525
12525
12525

12525 items

Mac Flooding (após um ataque)



<https://rummytips.com/cam-flow-attack-on-switch-network/>

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Mac Flooding (alternativa)

- Create an ACL rule to allow the given MAC address and drop all other traffic on **ether1** (for ingress traffic):

```
/interface ethernet switch rule
add ports=ether1 src-mac-address=64:D1:54:81:EF:8E/FF:FF:FF:FF:FF:FF switch=switch1
add new-dst-ports="" ports=ether1 switch=switch1
```

- Switch all required ports together, disable MAC learning and disable unknown unicast flooding on **ether1**:

```
/interface bridge
add name=bridge1
/interface bridge port
add bridge=bridge1 interface=ether1 hw=yes learn=no unknown-unicast-flood=no
add bridge=bridge1 interface=ether2 hw=yes
```

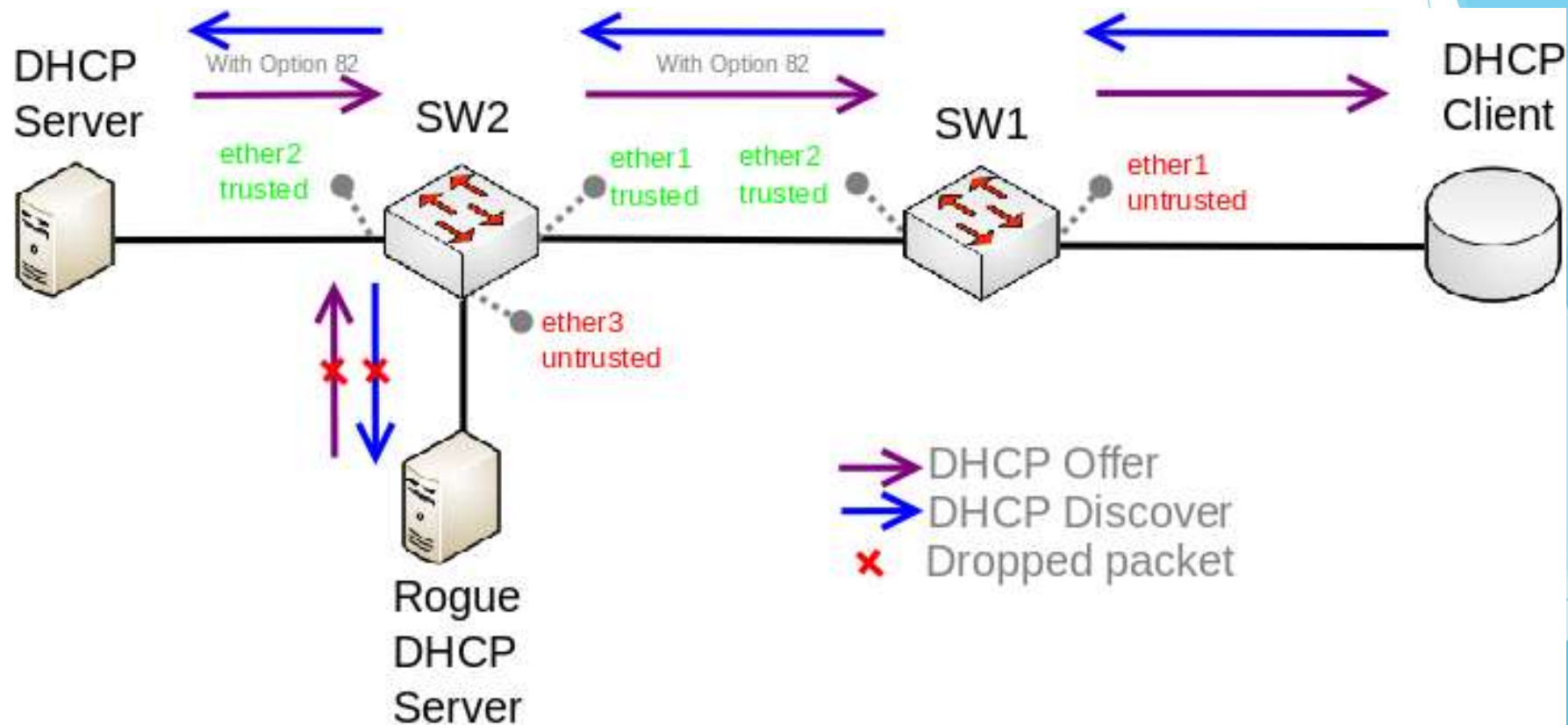
- Add a static hosts entry for 64:D1:54:81:EF:8E (for egress traffic):

```
/interface bridge host
add bridge=bridge1 interface=ether1 mac-address=64:D1:54:81:EF:8E
```

Mais em: https://wiki.mikrotik.com/wiki/Manual:CRS3xx_series_switches#Port_Security



DHCP Snooping



Fonte: https://wiki.mikrotik.com/wiki/File:Dhcp_snooping.png

DHCP Snooping

1- Habilitar a opção na Bridge

Interface <bridge1>

General STP VLAN Status Traffic

Name: bridge1

Type: Bridge

MTU:

Actual MTU: 1500

L2 MTU: 1592

MAC Address: CC:2D:E0:A2:D3:F2

ARP: enabled

ARP Timeout:

Admin. MAC Address:

Ageing Time: 00:05:00

☐ IGMP Snooping

☒ DHCP Snooping

2- Marcar as portas que são confiáveis

Bridge Port <sfp-sfpplus1>

General STP VLAN Status

Interface: sfp-sfpplus1

Bridge: bridge1

Horizon:

Learn: auto

☒ Unknown Unicast Flood

☒ Unknown Multicast Flood

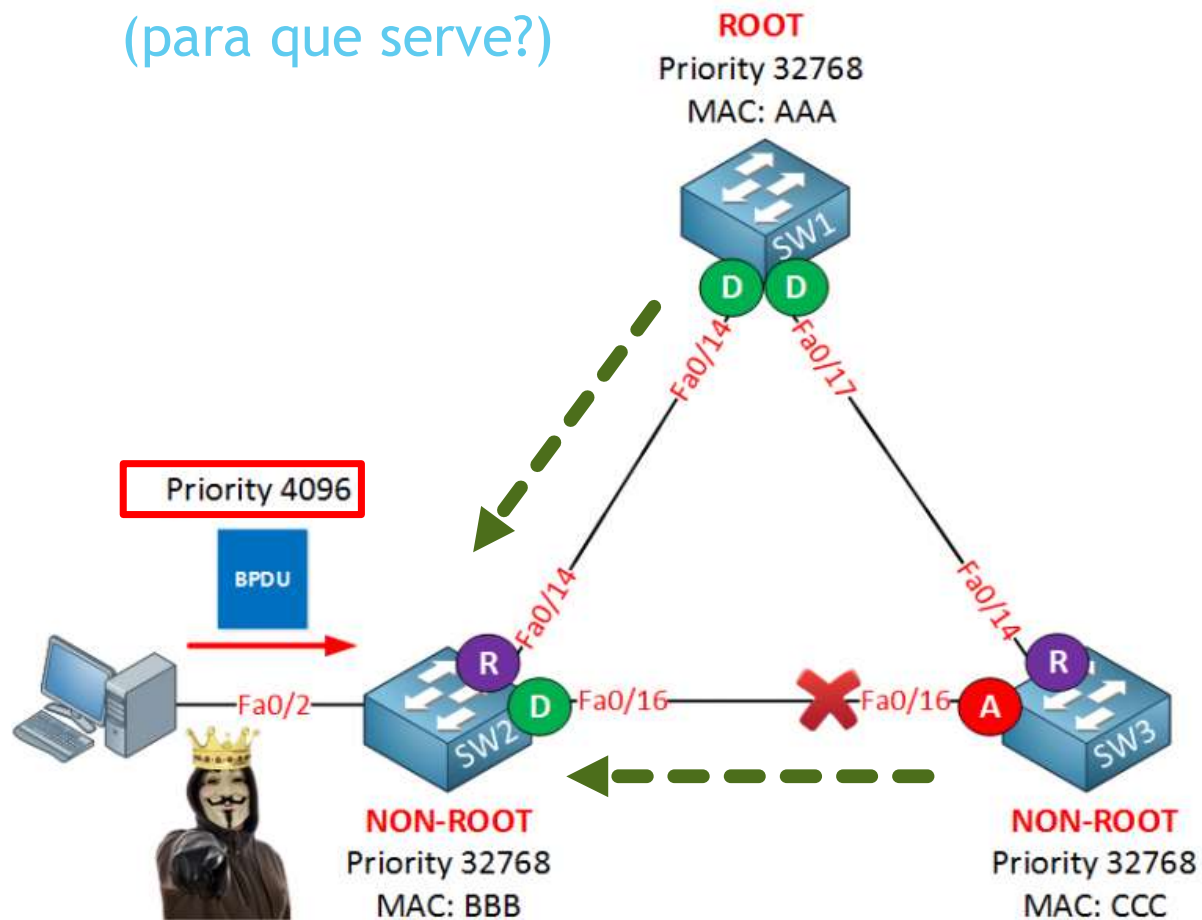
☒ Broadcast Flood

☒ Trusted

☒ Hardware Offload

BPDUGuard

(para que serve?)



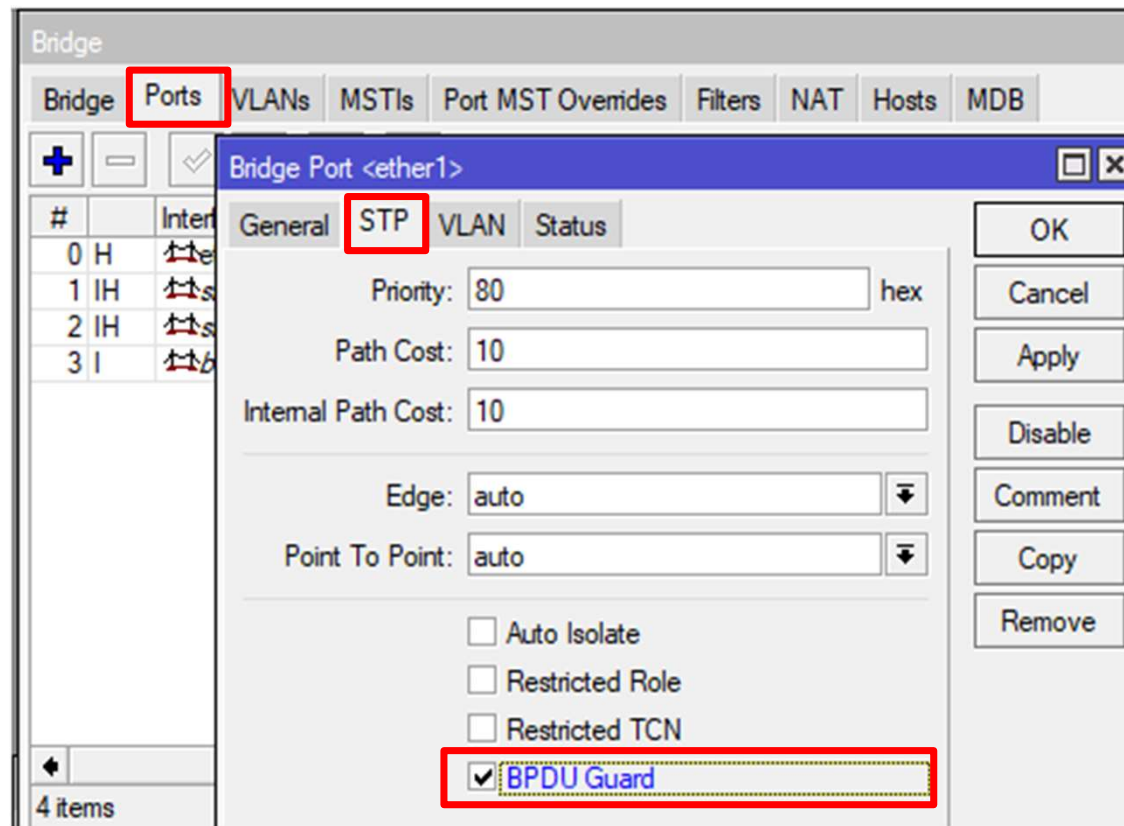
Fonte: <https://networklessons.com/cisco/ccie-routing-switching-written/spanning-tree-bpduguard>

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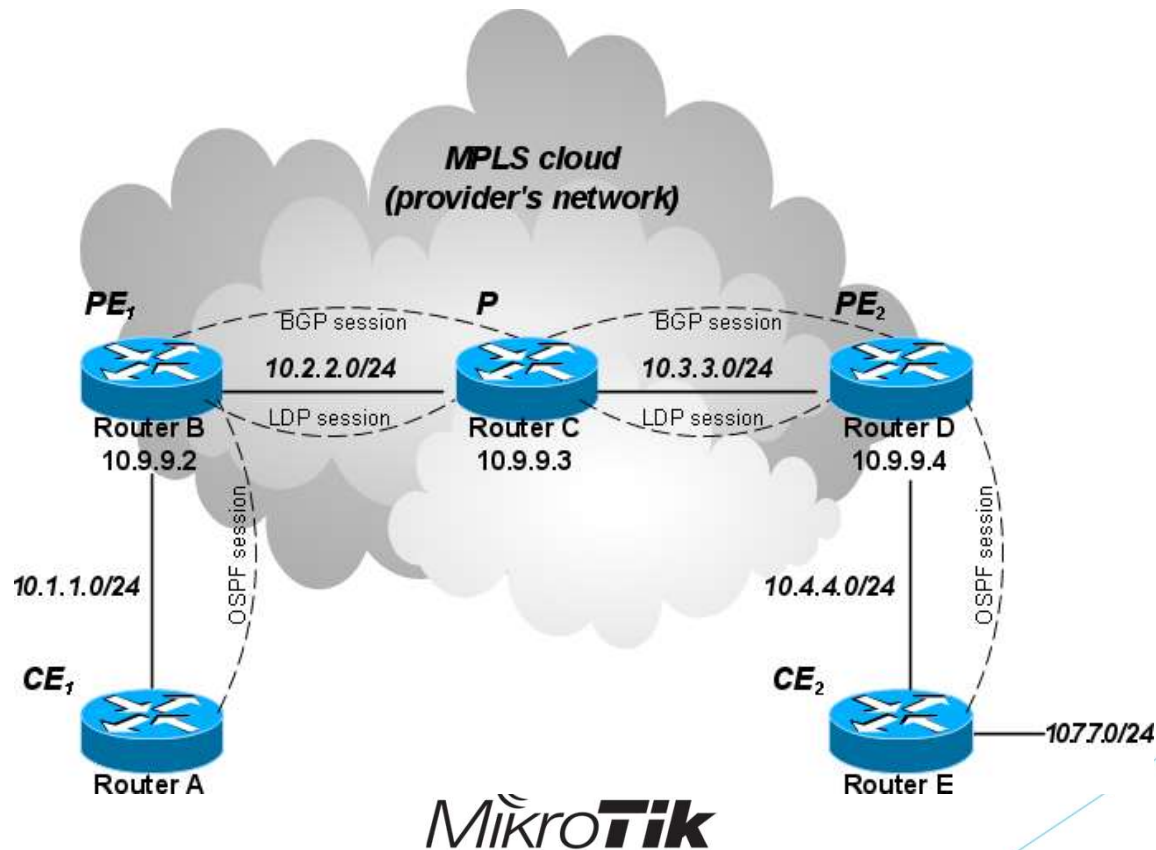
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BPDU Guard

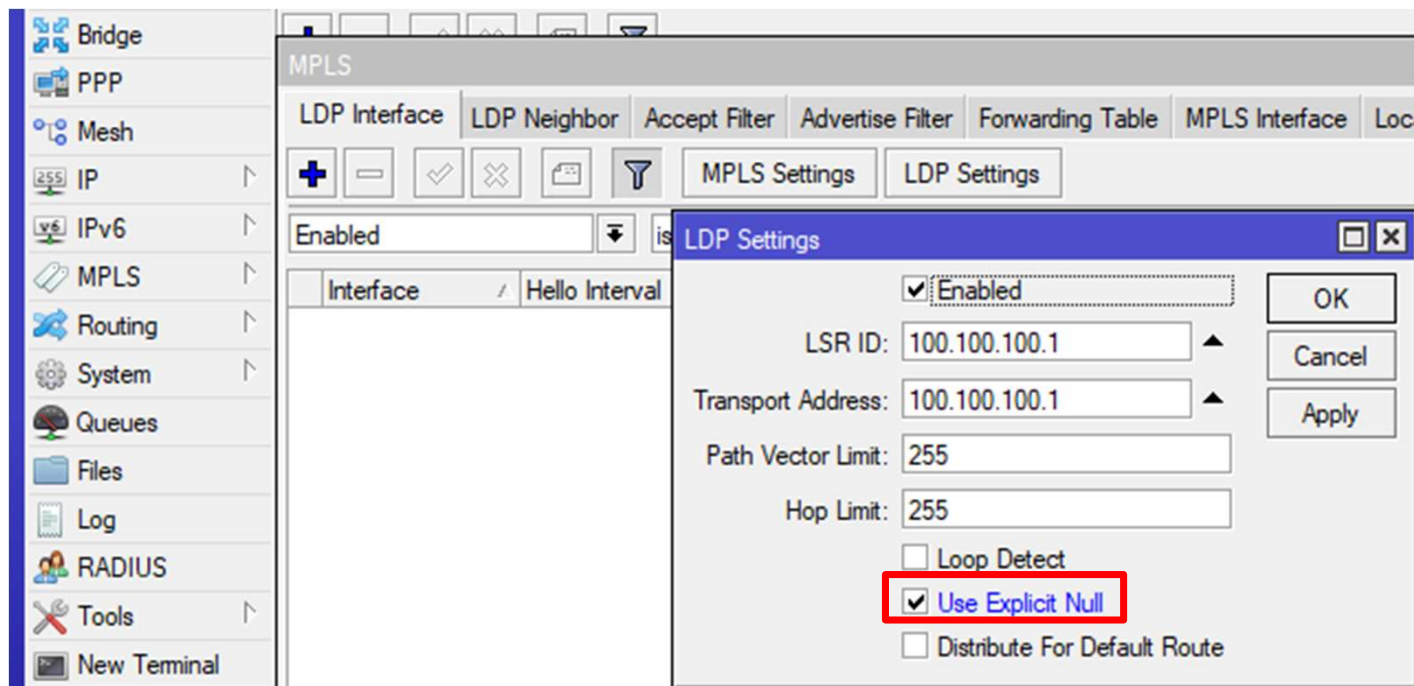


MPLS Hardware Offload

- ▶ Em uma nuvem MPLS, é necessário que o Switch Comute os Labels;
- ▶ Não se aplica ao processo de POP/PHP;
- ▶ Necessário ser um “P”, se caso antecipar um destino é necessário ter “Explicit Null”;



MPLS Hardware Offload



Atualmente este Recurso funciona apenas para as Routerboards:
CRS317-1G-16S+RM e CRS309-1G-8S+IN

MPLS Hardware Offload

admin@CC:2D:E0:A2:EB:6B (SW-01-MASCOTE-JOAO-ALBERTO) - WinBox (64bit) v6.45.7 on CRS317-1G-16S+ (arm)

Session Settings Dashboard

Safe Mode Session: CC:2D:E0:A2:EB:6B CPU: 1% Uptime: 00:27:39

MPLS

LDP Interface LDP Neighbor Accept Filter Advertise Filter Forwarding Table **MPLS Interface** Local Bindings Remote Bindings

	In Label	Out Labels	Interface	Nexthop	Destination	Bytes	Packets	Hw. Bytes	Hw.Pack..
LH	40	35	sfp-sfpplus2	10.0.1.2	4.4.4.4	16.3 KiB	12	13.2 GiB	9303682
L	41		sfp-sfpplus1	10.0.0.2	2.2.2.2	0 B	0	0 B	0
L	42	expl-null	sfp-sfpplus2	10.0.1.2	10.0.2.0/30	0 B	0	0 B	0
L	43	expl-null	sfp-sfpplus2	10.0.1.2	3.3.3.3	28.0 KiB	19	27.2 GiB	19117128

Interface List

Interface	Name	Act...	L2 ...	Tx	Rx	Tx Pack
R	ether1		1500 1592	362.8 kbps	30.2 kbps	
R	sfp-sfpplus1		1500 1592	2.4 kbps	987.0 Mbps	
R	sfp-sfpplus2		1500 1592	987.0 Mbps	131.8 kbps	
R	sfp-sfpplus3		1500 1592	0 bps	0 bps	
R	sfp-sfpplus4		1500 1592	0 bps	0 bps	
R	sfp-sfpplus5		1500 1592	0 bps	0 bps	
R	sfp-sfpplus6		1500 1592	0 bps	0 bps	
R	sfp-sfpplus7		1500 1592	0 bps	0 bps	
R	sfp-sfpplus8		1500 1592	0 bps	0 bps	
R	sfp-sfpplus9		1500 1592	0 bps	0 bps	
R	sfp-sfpplus10		1500 1592	0 bps	0 bps	
R	sfp-sfpplus11		1500 1592	0 bps	0 bps	
R	sfp-sfpplus12		1500 1592	0 bps	0 bps	
R	sfp-sfpplus13		1500 1592	0 bps	0 bps	

18 items (1 selected)

Terminal

```

rx-packets-per-second: 80 917
rx-bits-per-second: 987.2Mbps
fp-rx-packets-per-second: 62
fp-rx-bits-per-second: 164.3kbps
rx-drops-per-second: 0
rx-errors-per-second: 0
tx-packets-per-second: 80 918
tx-bits-per-second: 987.4Mbps
fp-tx-packets-per-second: 62
fp-tx-bits-per-second: 164.3kbps
tx-drops-per-second: 0
tx-queue-drops-per-second: 0
tx-errors-per-second: 0
[Q quit|D dump|C-z pause]
    
```

CPU: 1%

987.2Mbps

LH

In Label	Out Labels
expl-null	
40	35

Hw. Bytes	Hw.Pack..
0 B	0
13.2 GiB	9303682

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MPLS Hardware Offload

admin@CC:2D:E0:A2:EB:6B (SW-01-MASCOTE-JOAO-ALBERTO) - WinBox (64bit) v6.45.7 on CRS317-

Session Settings Dashboard

Safe Mode Session: CC:2D:E0:A2:EB:6B

MPLS

LDP Interface LDP Neighbor Accept Filter Advertise Filter Forwarding Table

	In Label	Out Labels	Interface	Nexthop	Desti
LH	40	35	sfp-sfpplus2	10.0.1.2	4.4.4
L	41		sfp-sfpplus1	10.0.0.2	2.2.2
L	42	expl-null	sfp-sfpplus2	10.0.1.2	10.0.
L	43	expl-null	sfp-sfpplus2	10.0.1.2	3.3.3

Interface List

Interface	Interface List	Ethernet	EoIP Tunnel	IP Tunnel	GRE Tunnel	...
R	ether1	1592	362.8 kbps	30.2 kbps		
R	sfp-sfpplus1	1500 1592	2.4 kbps	987.0 Mbps		
R	sfp-sfpplus2	1500 1592	987.0 Mbps	131.8 kbps		
	sfp-sfpplus3	1500 1592	0 bps	0 bps		
	sfp-sfpplus4	1500 1592	0 bps	0 bps		
	sfp-sfpplus5	1500 1592	0 bps	0 bps		
	sfp-sfpplus6	1500 1592	0 bps	0 bps		
	sfp-sfpplus7	1500 1592	0 bps	0 bps		
	sfp-sfpplus8	1500 1592	0 bps	0 bps		
	sfp-sfpplus9	1500 1592	0 bps	0 bps		
	sfp-sfpplus10	1500 1592	0 bps	0 bps		
	sfp-sfpplus11	1500 1592	0 bps	0 bps		
	sfp-sfpplus12	1500 1592	0 bps	0 bps		
	sfp-sfpplus13	1500 1592	0 bps	0 bps		

18 items (1 selected)



Limitação de Tráfego

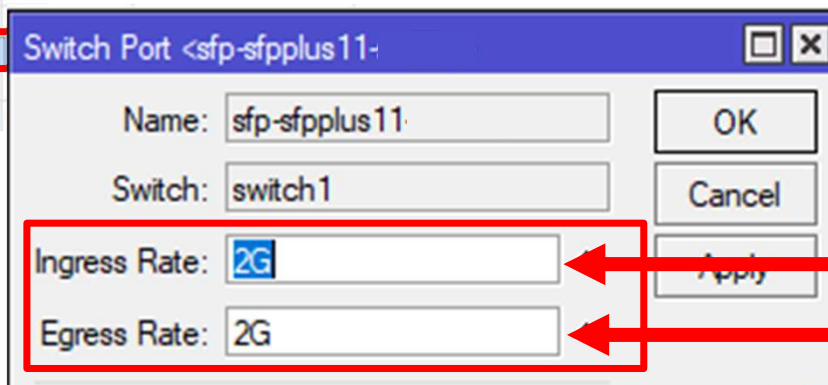
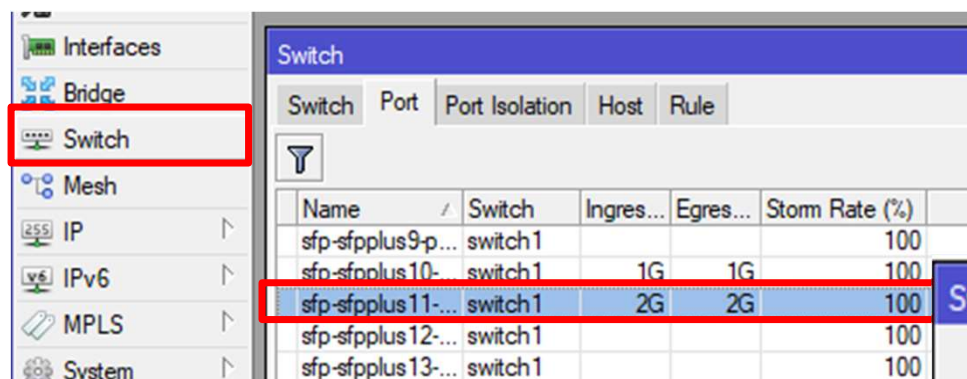
JAMAIS FAÇA ISSO NO SWITCH!

The screenshot shows the Mikrotik WinBox interface. On the left sidebar, the 'Queues' menu item is highlighted with a red box. The main window displays the 'New Simple Queue' configuration. The 'General' tab is active. The 'Name' field is set to 'queue1' and the 'Target' is set to 'ether3'. Below these, the 'Target Upload' and 'Target Download' sections are highlighted with a red box, showing 'Max Limit' set to '500M' bits/s. The 'Burst' section shows 'Burst Limit' and 'Burst Threshold' set to 'unlimited' bits/s, and 'Burst Time' set to '0' s.



Limitação de tráfego

- ▶ Plenamente possível em Hardware;
- ▶ Possibilidade de limitar tráfego acima de 1Gbps com muita facilidade

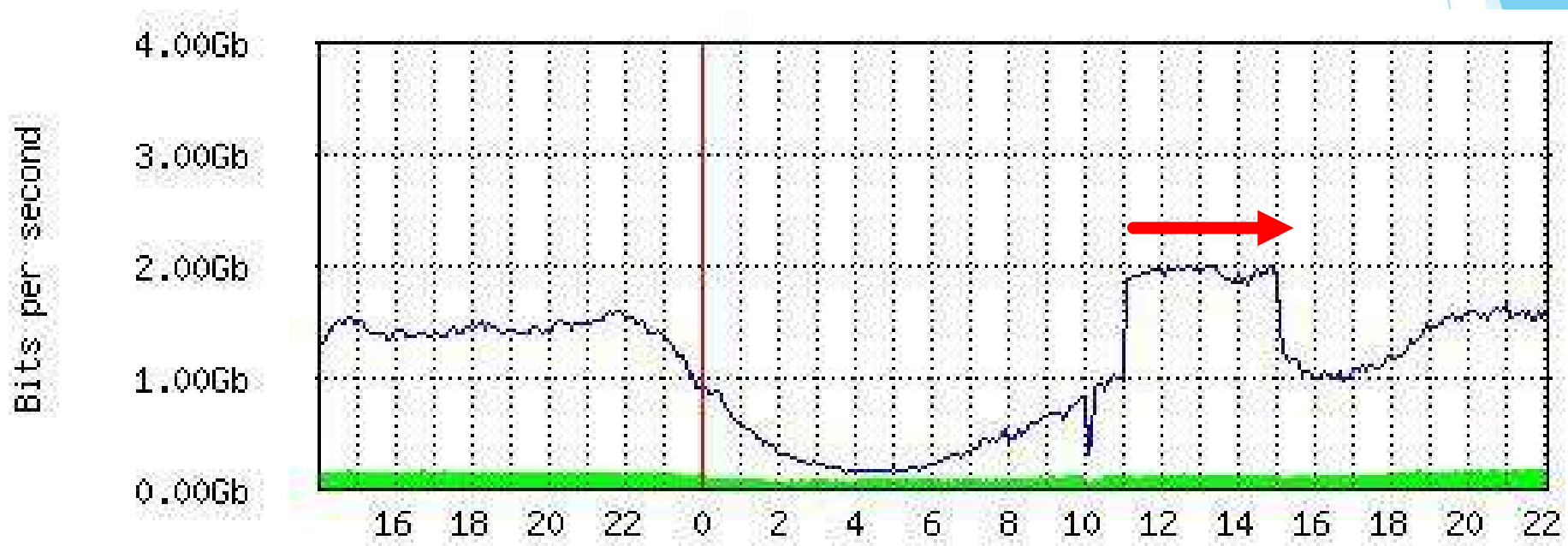


Upload (cliente)

Download (cliente)

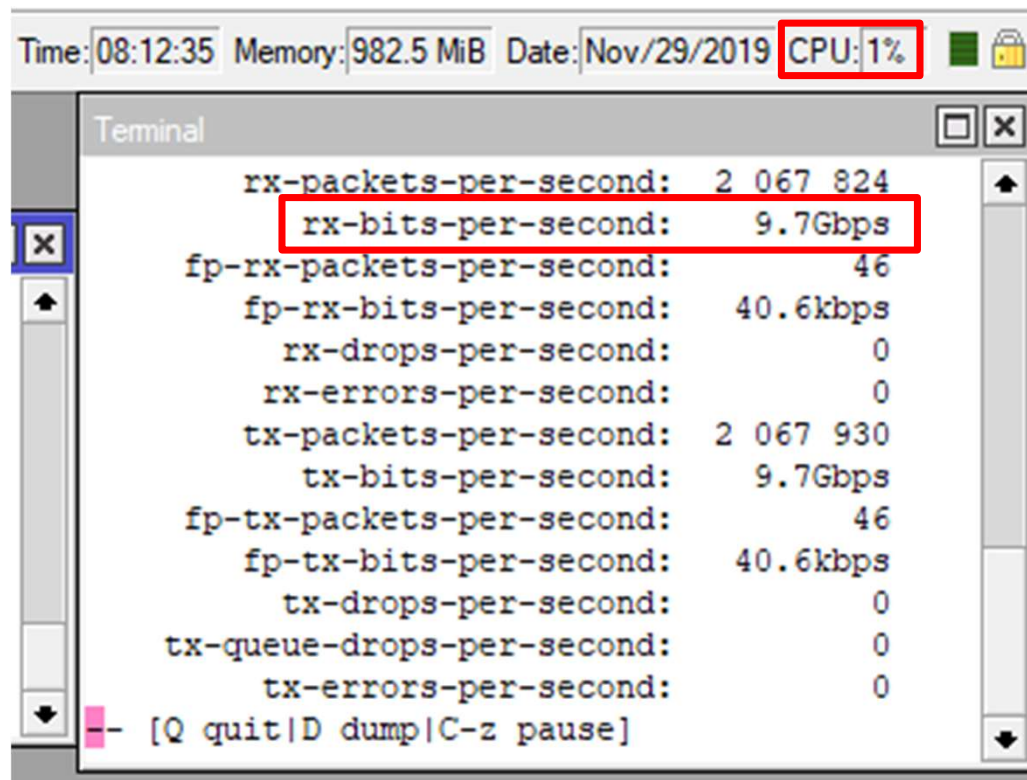
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Limitação de tráfego (resultado)



Resultado Real

(preservando o Hardware offload)



Time: 08:12:35 Memory: 982.5 MiB Date: Nov/29/2019 CPU: 1%

```
rx-packets-per-second: 2 067 824
rx-bits-per-second: 9.7Gbps
fp-rx-packets-per-second: 46
fp-rx-bits-per-second: 40.6kbps
rx-drops-per-second: 0
rx-errors-per-second: 0
tx-packets-per-second: 2 067 930
tx-bits-per-second: 9.7Gbps
fp-tx-packets-per-second: 46
fp-tx-bits-per-second: 40.6kbps
tx-drops-per-second: 0
tx-queue-drops-per-second: 0
tx-errors-per-second: 0
-- [Q quit|D dump|C-z pause]
```

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Resultado Real

(preservando o Hardware offload)

```
Time: 20:25:49 Date: Jun/18/2019 CPU: 2% Uptime: 55d 18:12:19
Terminal
rx-packets-per-second: 7 034 041
rx-bits-per-second: 51.8Gbps
fp-rx-packets-per-second: 84
fp-rx-bits-per-second: 73.6kbps
rx-drops-per-second: 0
rx-errors-per-second: 0
tx-packets-per-second: 6 989 038
tx-bits-per-second: 51.5Gbps
fp-tx-packets-per-second: 84
fp-tx-bits-per-second: 73.6kbps
tx-drops-per-second: 0
tx-queue-drops-per-second: 0
tx-errors-per-second: 0
-- [Q quit|D dump|C-z pause]
```

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Referências e informações adicionais:

- ▶ https://wiki.mikrotik.com/wiki/Manual:CRS3xx_series_switches
- ▶ https://wiki.mikrotik.com/wiki/Manual:Bridge_VLAN_Table
- ▶ <https://youtu.be/CKgyf9N-wR0> -> (Overview da CRS326-24S+2Q+)

Dúvidas??
Obrigado!



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