



# Intro To VLANS on the CRS

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MUM 2016 CRS VLans

# Joshua Bio

- ▶ Joshua Gray
  - ▶ Network Engineer Since 2008
  - ▶ Finishing masters degree in Network Engineering and Security at DePaul University.
  - ▶ Ipv6, MTCNA, MTCRE, MTCWE, MTCINE, InfraGuard



# Brian Bio

As the owner of Baltic Networks and a former wireline and wireless ISP, I'm always looking for that next product or service that makes your job as a service provider easier and improves your bottom line. I started in telecommunications in 1986 and got involved with Mikrotik in 2003 deploying large scale hotpots in airports worldwide. I'm also a certified Mikrotik trainer.



# The Swiss Army knife of VLANs

- ▶ The CRS is not your grandfather's switch
- ▶ A cornucopia of VLAN fun awaits you  
(Vlan Tag Switching)
- ▶ Number one request we get on CRS devices

# Benefits of Using VLANS

- ▶ Many switches connected together can create an issue with scalability
  - ▶ The larger the broadcast domain the more traffic that is consumed in just broadcast frames
  - ▶ One might not want a broadcast to reach a certain port for security concerns
  - ▶ VLANS allow a physical layer two network to be split into several virtually isolated networks
  - ▶ QOS- Different VLANS can have different priorities.

# VLAN Planning

- ▶ Ports can be put into a trunk mode or access level mode
- ▶ Broadcasts are sent only to ports that are participating in the VLAN
- ▶ Each VLAN should be a single subnet.

# Inter VLAN Routing?!?!

- ▶ One can route between vlans using a router on a stick.
- ▶ Or using the CRS but keep in mind it is not extremely powerful.



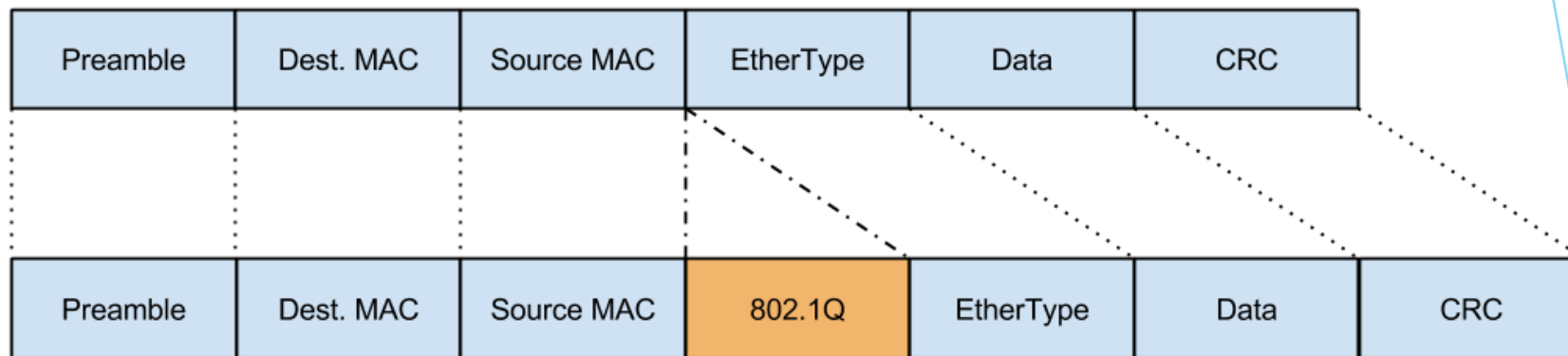
# OSI Model

## OSI Model

7	Application	Data Generation
6	Presentation	Encryption and Formatting
5	Session	Establish Connection
4	Transport	Delivery and Sequencing
3	Network	Routing to Destination
2	Data Link	Local Network Host Delivery
1	Physical	Access to Media



# Ethernet Frame



# Packet Capture

Apple USB Ethernet Adapter: en5

Apply a display filter ... <@>

No.	Time	Source	Destination	Protocol	Length	Info
16	7.023645	10.10.5.3	10.10.5.1	ICMP	102	Echo (ping) request id=0x0b11, seq=628/29698, ttl=64 (reply in 17)
17	7.024229	10.10.5.1	10.10.5.3	ICMP	102	Echo (ping) reply id=0x0b11, seq=628/29698, ttl=64 (request in 16)
18	8.026359	10.10.5.3	10.10.5.1	ICMP	102	Echo (ping) request id=0x0b11, seq=629/29954, ttl=64 (reply in 19)
19	8.026858	10.10.5.1	10.10.5.3	ICMP	102	Echo (ping) reply id=0x0b11, seq=629/29954, ttl=64 (request in 18)
20	9.028801	10.10.5.3	10.10.5.1	ICMP	102	Echo (ping) request id=0x0b11, seq=630/30210, ttl=64 (reply in 21)
21	9.029383	10.10.5.1	10.10.5.3	ICMP	102	Echo (ping) reply id=0x0b11, seq=630/30210, ttl=64 (request in 20)
22	10.031777	10.10.5.3	10.10.5.1	ICMP	102	Echo (ping) request id=0x0b11, seq=631/30466, ttl=64 (reply in 23)
23	10.032315	10.10.5.1	10.10.5.3	ICMP	102	Echo (ping) reply id=0x0b11, seq=631/30466, ttl=64 (request in 22)
24	11.031798	10.10.5.3	10.10.5.1	ICMP	102	Echo (ping) request id=0x0b11, seq=632/30722, ttl=64 (reply in 25)
25	11.033958	10.10.5.1	10.10.5.3	ICMP	102	Echo (ping) reply id=0x0b11, seq=632/30722, ttl=64 (request in 24)
26	12.036870	10.10.5.3	10.10.5.1	ICMP	102	Echo (ping) request id=0x0b11, seq=633/30978, ttl=64 (reply in 27)
27	12.037365	10.10.5.1	10.10.5.3	ICMP	102	Echo (ping) reply id=0x0b11, seq=633/30978, ttl=64 (request in 26)
28	13.039694	10.10.5.3	10.10.5.1	ICMP	102	Echo (ping) request id=0x0b11, seq=634/31234, ttl=64 (reply in 29)
29	13.040179	10.10.5.1	10.10.5.3	ICMP	102	Echo (ping) reply id=0x0b11, seq=634/31234, ttl=64 (request in 28)
30	14.042715	10.10.5.3	10.10.5.1	ICMP	102	Echo (ping) request id=0x0b11, seq=635/31490, ttl=64 (reply in 31)
31	14.043235	10.10.5.1	10.10.5.3	ICMP	102	Echo (ping) reply id=0x0b11, seq=635/31490, ttl=64 (request in 30)
32	15.046773	10.10.5.3	10.10.5.1	ICMP	102	Echo (ping) request id=0x0b11, seq=636/31746, ttl=64 (reply in 33)
33	15.047409	10.10.5.1	10.10.5.3	ICMP	102	Echo (ping) reply id=0x0b11, seq=636/31746, ttl=64 (request in 32)

Frame 1: 102 bytes on wire (816 bits), 102 bytes captured (816 bits) on interface 0

Ethernet II, Src: Apple\_31:1c:eb (40:6c:8f:31:1c:eb), Dst: Routerbo\_00:12:e5 (e4:8d:8c:80:12:e5)

- Destination: Routerbo\_00:12:e5 (e4:8d:8c:80:12:e5)
  - Address: Routerbo\_00:12:e5 (e4:8d:8c:80:12:e5)
    - ... .. = LG bit: Globally unique address (factory default)
    - ... .. = IG bit: Individual address (unicast)
- Source: Apple\_31:1c:eb (40:6c:8f:31:1c:eb)
  - Address: Apple\_31:1c:eb (40:6c:8f:31:1c:eb)
    - ... .. = LG bit: Globally unique address (factory default)
    - ... .. = IG bit: Individual address (unicast)
  - Type: 802.1Q Virtual LAN (0x8100)
    - 802.1Q Virtual LAN, PRI: 0, CFI: 0, ID: 400
      - 000. .... = Priority: Best Effort (default) (0)
      - ...0 .... = CFI: Canonical (0)
      - ... 0001 1001 0000 = ID: 400
      - Type: IPv4 (0x0800)
- Internet Protocol Version 4, Src: 10.10.5.3, Dst: 10.10.5.1
- Internet Control Message Protocol

```

0000 e4 8d 8c 80 12 e5 40 6c 8f 31 1c eb 81 00 01 90 .....@l.1....
0010 08 00 45 00 00 54 42 6e 00 00 40 01 1a 24 0a 0a ..E..TbN ..@.$.
0020 05 03 0a 0a 05 01 08 00 00 a3 0b 11 02 6d 57 17 .....mlw.
0030 9e a2 00 00 09 22 08 09 0a 0b 0c 0d 0e 0f 10 11 .....
0040 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f 20 21 .....!
0050 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 "#$%&()*+,-./0!
0060 32 33 34 35 36 37 234567
  
```

VLAN ID (vlan.id), 2 bytes      Packets: 33 · Displayed: 33 (100.0%)      Profile: Default

# Packet Capture

```
▼ Ethernet II, Src: Apple_31:1c:eb (40:6c:8f:31:1c:eb), Dst: Routerbo_80:12:e5 (e4:8d:8c:80:12:e5)
  ▼ Destination: Routerbo_80:12:e5 (e4:8d:8c:80:12:e5)
    Address: Routerbo_80:12:e5 (e4:8d:8c:80:12:e5)
    .... ..0. .... = LG bit: Globally unique address (factory default)
    .... ...0 .... = IG bit: Individual address (unicast)
  ▼ Source: Apple_31:1c:eb (40:6c:8f:31:1c:eb)
    Address: Apple_31:1c:eb (40:6c:8f:31:1c:eb)
    .... ..0. .... = LG bit: Globally unique address (factory default)
    .... ...0 .... = IG bit: Individual address (unicast)
  Type: 802.1Q Virtual LAN (0x8100)
▼ 802.1Q Virtual LAN, PRI: 0, CFI: 0, ID: 400
  000. .... = Priority: Best Effort (default) (0)
  ...0 .... = CFI: Canonical (0)
  .... 0001 1001 0000 = ID: 400
```

# Packet Capture

## Trunk

```
▼ 802.1Q Virtual LAN, PRI: 0, CFI: 0, ID: 400
  000. .... = Priority: Best Effort (default) (0)
  ...0 .... = CFI: Canonical (0)
  .... 0001 1001 0000 = ID: 400
```

VLAN Tag

## Access Level

```
▼ Ethernet II, Src: Apple_31:1c:eb (40:6c:8f:31:1c:eb), Dst: Routerbo_80:12:e5 (e4:8d:8c:80:12:e5)
  ▼ Destination: Routerbo_80:12:e5 (e4:8d:8c:80:12:e5)
    Address: Routerbo_80:12:e5 (e4:8d:8c:80:12:e5)
    .... ..0. .... = LG bit: Globally unique address (factory default)
    .... ...0 .... = IG bit: Individual address (unicast)
  ▼ Source: Apple_31:1c:eb (40:6c:8f:31:1c:eb)
    Address: Apple_31:1c:eb (40:6c:8f:31:1c:eb)
    .... ..0. .... = LG bit: Globally unique address (factory default)
    .... ...0 .... = IG bit: Individual address (unicast)
```

No VLAN Tag

# Trunk VS Access

- ▶ Trunks
  - ▶ Links between switches
  - ▶ Links to servers with multiple subnets
  - ▶ Links to other network devices that support Vlan
  - ▶ Admin systems that need access to multiple Vlan
- ▶ Access
  - ▶ Links between end user devices
  - ▶ Links to APs that only needs single VLAN
  - ▶ Guest devices

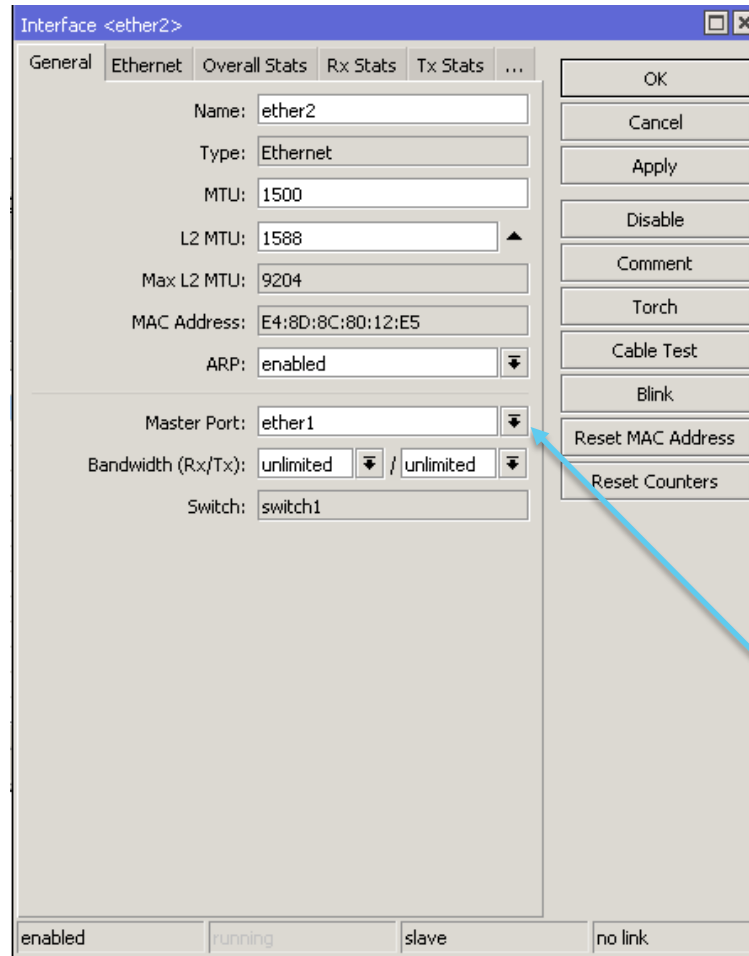
# Setup



- ▶ One trunk back to core switches. (Eth1)
- ▶ Ports 3-6 trunked for multiple SSID on access points
- ▶ Ports 9-13 access ports for Office users (VLAN 11)
- ▶ Ports 17-20 access ports for Guest users (VLAN 21)

# Set up Switch Chip

- ▶ Slave all all ports to Eth1



# Set up Switch Chip

- ▶ Slave all all ports to Eth1

```
/interface ethernet
set [ find default-name=ether2 ] master-port=ether1
set [ find default-name=ether3 ] master-port=ether1
set [ find default-name=ether4 ] master-port=ether1
set [ find default-name=ether5 ] master-port=ether1
set [ find default-name=ether6 ] master-port=ether1
set [ find default-name=ether7 ] master-port=ether1
set [ find default-name=ether8 ] master-port=ether1
set [ find default-name=ether9 ] master-port=ether1
set [ find default-name=ether10 ] master-port=ether1
set [ find default-name=ether11 ] master-port=ether1
set [ find default-name=ether12 ] master-port=ether1
...
```



# Add Vlans

- ▶ Switch > VLAN +
  - ▶ Add Vlan 11
  - ▶ Add Ports 1,2,3,4,5,6 (Will Be Trunk)
  - ▶ Add Ports 9,10,11,12,13 (Will be Access Layer)
  - ▶ These ports are for the office network.

Switch VLAN <11>

VLAN ID: 11

Ports: ether1, ether2, ether3, ether4, ether5, ether6, ether9, ether10, ether11, ether12, ether13

SVL  
 SA Learning  
 Flood  
 Ingress Mirror

QoS Group: none

enabled

# Add Vlans

- ▶ Switch > VLAN +
  - ▶ Add Vlan 21
  - ▶ Add Ports 1,3,4,5,6 (Trunk ports)
  - ▶ Add Ports 17,18,19,20 (Will be Access Layer)
  - ▶ These ports are for the office network.

New Switch VLAN

VLAN ID: 21

Ports: ether1, ether3, ether4, ether5, ether6, ether17, ether18, ether19, ether20

SVL  
 SA Learning  
 Flood  
 Ingress Mirror

QoS Group: none

enabled

# Add Vlans

- ▶ Switch > VLAN +
  - ▶ Add Vlan 11
  - ▶ Add Vlan 21

```
/interface ethernet switch vlan  
add ports="ether1,ether2,ether3,ether4,ether5,ether6,\  
ether9,ether10,ether11,ether12,ether13" vlan-id=11  
  
add ports=ether1,ether3,ether4,ether5,ether6,ether17,\  
ether18,ether19,ether20 vlan-id=21
```

# Setup Trunk Ports

- ▶ Switch > VLAN > Eg. VLAN TAG

The screenshot shows a configuration window titled "New Switch Egress Tag VLAN". The "VLAN ID" field contains the number 21. Below it, a list of "Tagged Ports" includes ether1, ether2, ether3, ether4, ether5, and ether6. Each port name is in a text box with a dropdown arrow and a double-headed arrow to its right. On the right side of the window, there are buttons for "OK", "Cancel", "Apply", "Disable", "Copy", and "Remove". At the bottom left, the status "enabled" is displayed.

The screenshot shows a configuration window titled "Switch Egress Tag VLAN <11>". The "VLAN ID" field contains the number 11. Below it, a list of "Tagged Ports" includes ether1, ether2, ether3, ether4, ether5, and ether6. Each port name is in a text box with a dropdown arrow and a double-headed arrow to its right. On the right side of the window, there are buttons for "OK", "Cancel", "Apply", "Disable", "Copy", and "Remove". At the bottom left, the status "enabled" is displayed.

# Setup Trunk Ports

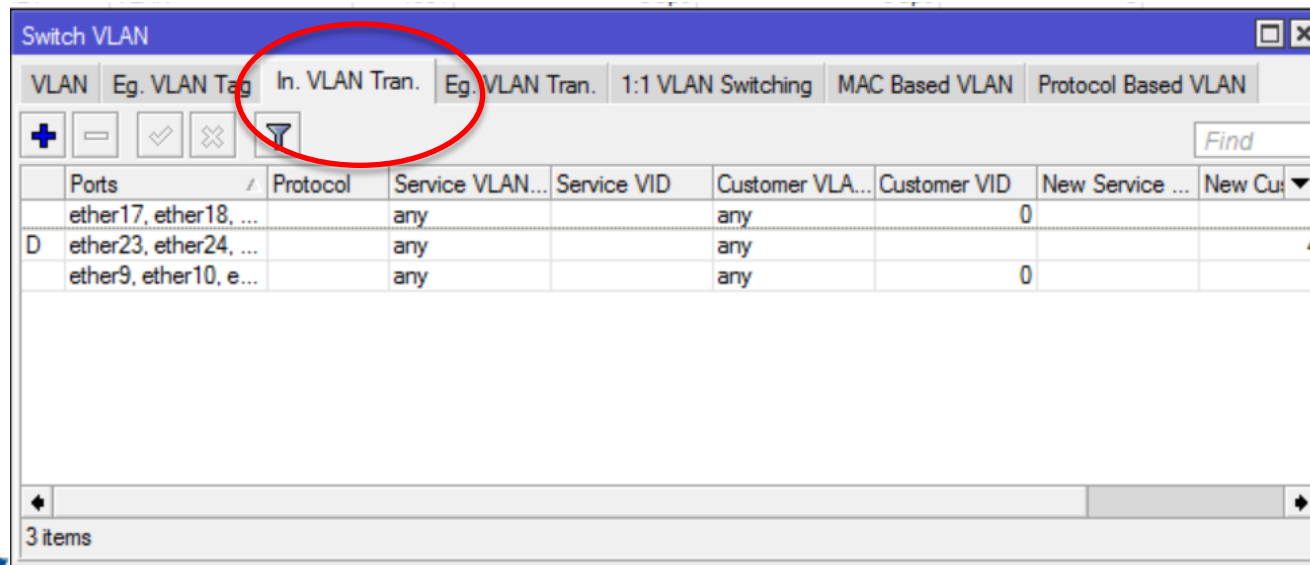
- ▶ Switch > VLAN > Eg. VLAN TAG

```
/interface ethernet switch egress-vlan-tag  
add tagged-ports=ether1,ether2,ether3,ether4,ether5,\  
ether6 vlan-id=21
```

```
add tagged-ports=ether1,ether2,ether3,ether4,ether5,\  
ether6 vlan-id=11
```

# Ingress Ports

- ▶ Setup access level ports to tag traffic that comes in appropriately.
- ▶ Switch > VLAN > In. VLAN TAG
- ▶ Service VID: Used for service provider tagging
- ▶ PCP: Used to set priority
- ▶ DEI: Drop eligibility indicator



VLAN	Eg. VLAN Tag	In. VLAN Tran.	Eg. VLAN Tran.	1:1 VLAN Switching	MAC Based VLAN	Protocol Based VLAN

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# Ingress Ports

- ▶ Set access level ports for the office network
  - ▶ Traffic inbound to the switch
  - ▶ Ports 9, 10, 11,12, 13

Ingress VLAN Translation <ether9, ether10, ether11, ether12, ethe... [X]

Ports: ether9 ether10 ether11 ether12 ether13

Protocol: [ ]

Service VLAN Lookup For: any

Service VID: [ ]

Service PCP: [ ]

Service DEI: [ ]

Customer VLAN Lookup For: any

Customer VID: 0

Customer PCP: [ ]

Customer DEI: [ ]

New Service VID: [ ]

New Customer VID: 11

PCP Propagation

SA Learning

enabled

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# Ingress Ports

- ▶ Set access level ports for the Guest network
  - ▶ Traffic inbound to the switch
  - ▶ Ports 17,18,19,20

Ingress VLAN Translation <ether17, ether18, ether19, ether20>

Ports: ether17 ether18 ether19 ether20

Protocol:

Service VLAN Lookup For: any

Service VID:

Service PCP:

Service DEI:

Customer VLAN Lookup For: any

Customer VID: 0

Customer PCP:

Customer DEI:

New Service VID:

New Customer VID: 21

PCP Propagation

SA Learning

enabled

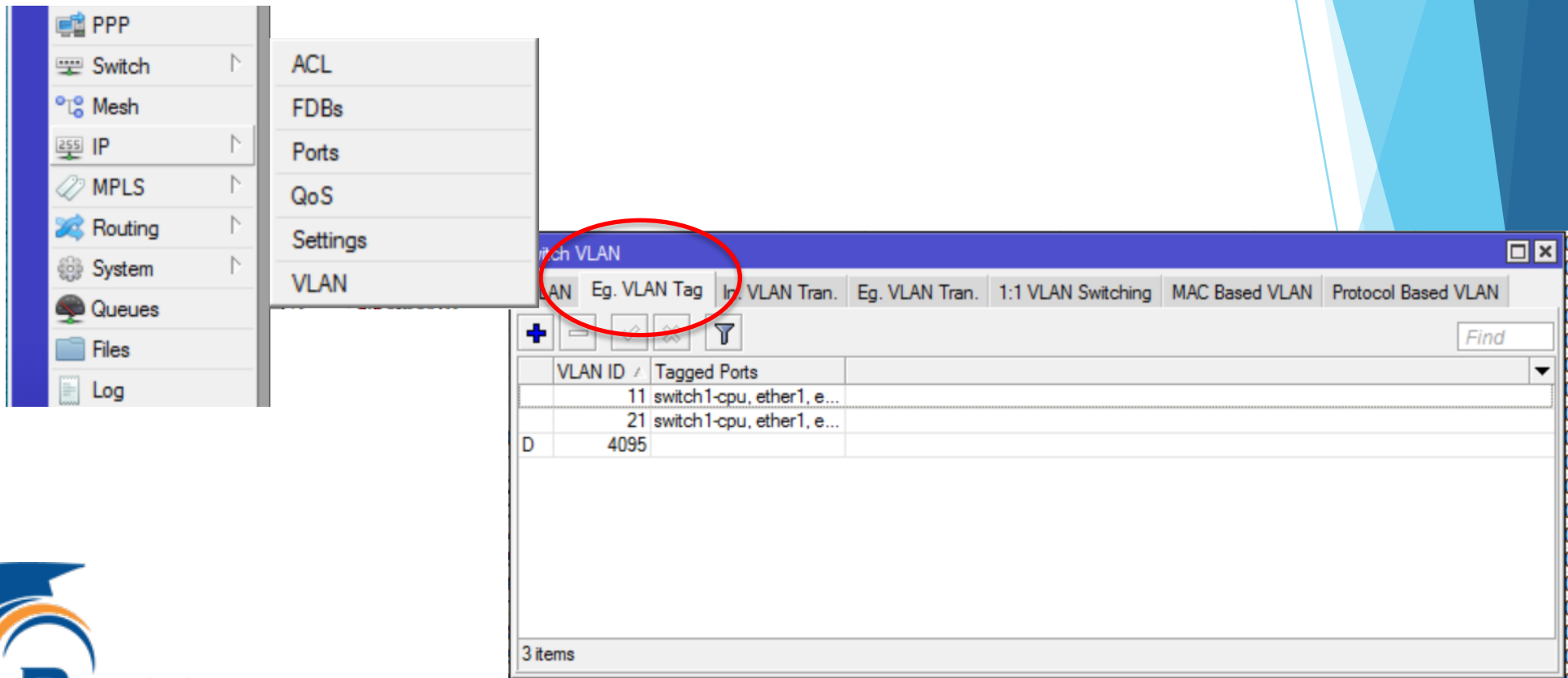


# Ingress Ports

```
/interface ethernet switch ingress-vlan-translation  
  
add customer-vid=0 new-customer-vid=11 ports=\  
    ether9,ether10,ether11,ether12,ether13  
  
add customer-vid=0 new-customer-vid=21 ports=ether17\  
    ether18,ether19,ether20
```

# Egress

- ▶ Setup access level ports to tag traffic that comes in appropriately.
- ▶ Switch > VLAN > Eg. VLAN TAG



The screenshot displays a network configuration interface. On the left, a sidebar menu lists various configuration categories: PPP, Switch, Mesh, IP, MPLS, Routing, System, Queues, Files, and Log. A secondary menu is open, showing options: ACL, FDBs, Ports, QoS, Settings, and VLAN. The 'VLAN' option is selected, leading to the 'Switch VLAN' configuration window. This window has several tabs: 'VLAN', 'Eg. VLAN Tag', 'Int. VLAN Tran.', 'Eg. VLAN Tran.', '1:1 VLAN Switching', 'MAC Based VLAN', and 'Protocol Based VLAN'. The 'Eg. VLAN Tag' tab is highlighted with a red circle. Below the tabs is a table with the following data:

VLAN ID	Tagged Ports
11	switch1-cpu, ether1, e...
21	switch1-cpu, ether1, e...
D 4095	

At the bottom of the window, it indicates '3 items'.

# Egress

- ▶ Set access level ports for the Guest network
  - ▶ Traffic outbound from the switch
  - ▶ Ports 9, 10, 11,12, 13

The screenshot shows a configuration window titled "Egress VLAN Translation <ether9, ether10, ether11, ether12, ether...". The window contains several sections for configuring VLAN translation on specific ports.

**Ports:** ether9, ether10, ether11, ether12, ether13. Each port has a dropdown arrow and a double-headed arrow icon.

**Service VLAN Lookup For:** untagged or tagged (dropdown). Buttons: OK, Cancel, Apply, Disable, Copy, Remove.

**Service VID:** (empty dropdown)

**Service PCP:** (empty dropdown)

**Service DEI:** (empty dropdown)

**Customer VLAN Lookup For:** untagged or tagged (dropdown)

**Customer VID:** 11 (text input)

**Customer PCP:** (empty dropdown)

**Customer DEI:** (empty dropdown)

**New Service VID:** (empty dropdown)

**New Customer VID:** 0 (text input)

PCP Propagation

enabled

# Egress

- ▶ Set access level ports for the Guest network
  - ▶ Traffic inbound to the switch
  - ▶ Ports 17,18,19,20

Egress VLAN Translation <ether17, ether18, ether19, ether20>

Ports: ether17 ether18 ether19 ether20

Service VLAN Lookup For: untagged or tagged

Service VID: Service PCP: Service DEI:

Customer VLAN Lookup For: untagged or tagged

Customer VID: 21 Customer PCP: Customer DEI:

New Service VID: New Customer VID: 0

PCP Propagation

enabled

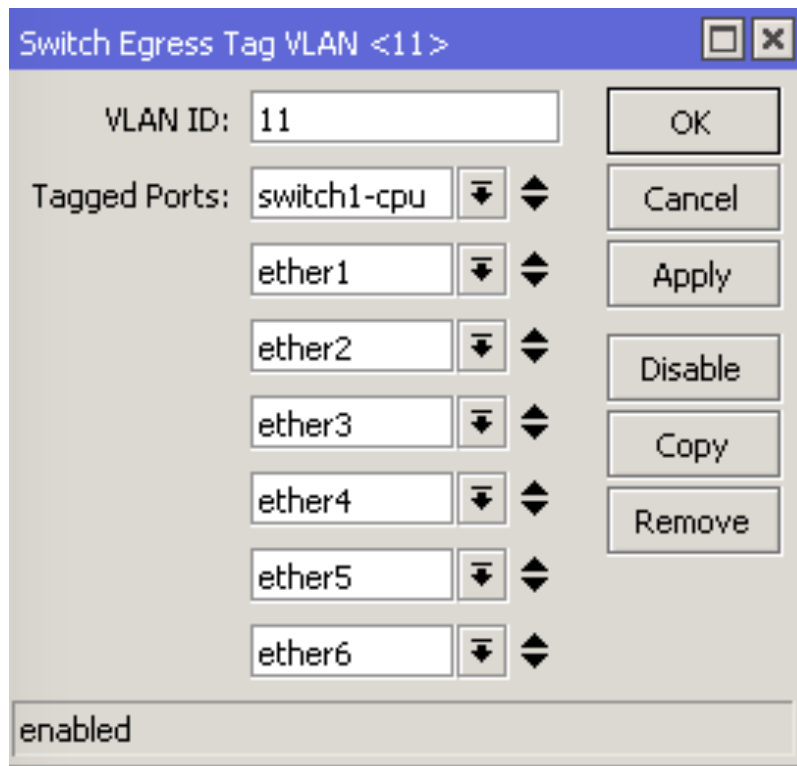
# Egress

```
/interface ethernet switch egress-vlan-translation  
add customer-vid=11 customer-vlan-format=untagged-or-tagged\  
  new-customer-vid=0 ports=ether9,ether10,ether11,ether12\  
,ether13 ports=untagged-or-tagged
```

```
add customer-vid=21 customer-vlan-format=untagged-or-tagged\  
  new-customer-vid=0 ports=ether17,ether18,ether19,ether20\  
  customer-vlan-format=untagged-or-tagged
```

# CRS IP on the VLAN?

- ▶ Add switch chip to VLAN and Eg. VLAN Tag.



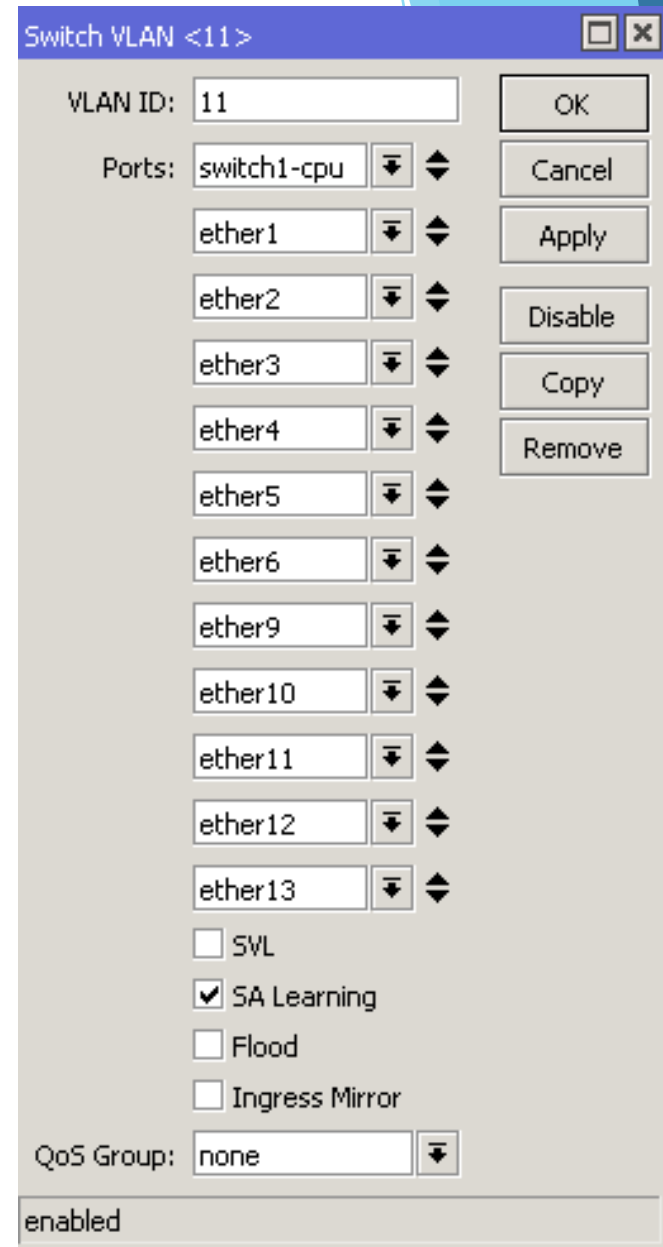
Switch Egress Tag VLAN <11>

VLAN ID: 11

Tagged Ports: switch1-cpu, ether1, ether2, ether3, ether4, ether5, ether6

Buttons: OK, Cancel, Apply, Disable, Copy, Remove

enabled



Switch VLAN <11>

VLAN ID: 11

Ports: switch1-cpu, ether1, ether2, ether3, ether4, ether5, ether6, ether9, ether10, ether11, ether12, ether13

Buttons: OK, Cancel, Apply, Disable, Copy, Remove

SVL  
 SA Learning  
 Flood  
 Ingress Mirror

QoS Group: none

enabled

# CRS IP on the VLAN?

- ▶ Create VLAN on Master Port.

Interface <vlan11>

General Status Traffic

Name: vlan11

Type: VLAN

MTU: 1500

L2 MTU: 1584

MAC Address: E4:8D:8C:80:12:E4

ARP: enabled

VLAN ID: 11

Interface: ether1

Use Service Tag

OK

Cancel

Apply

Disable

Comment

Copy

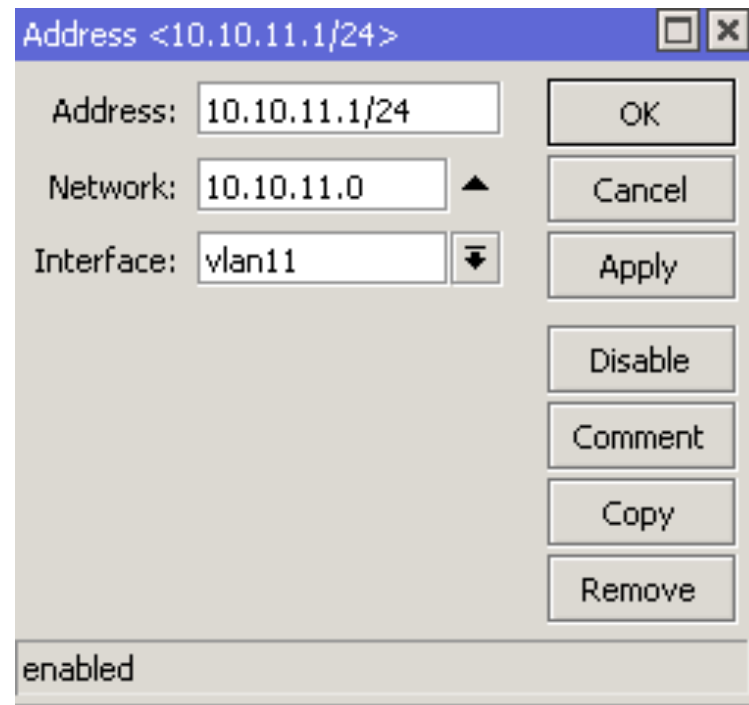
Remove

Torch

enabled running slave

# CRS IP on the VLAN?

- ▶ Assign IP to that port.



The screenshot shows a network configuration dialog box titled "Address <10.10.11.1/24>". It contains three input fields: "Address" with the value "10.10.11.1/24", "Network" with the value "10.10.11.0", and "Interface" with the value "vlan11". To the right of these fields are several buttons: "OK", "Cancel", "Apply", "Disable", "Comment", "Copy", and "Remove". At the bottom left of the dialog, the status "enabled" is displayed.



# Questions?



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