



MikroTik RouterOS Switch Feature

Citraweb Solusi Teknologi, Indonesia

www.mikrotik.co.id



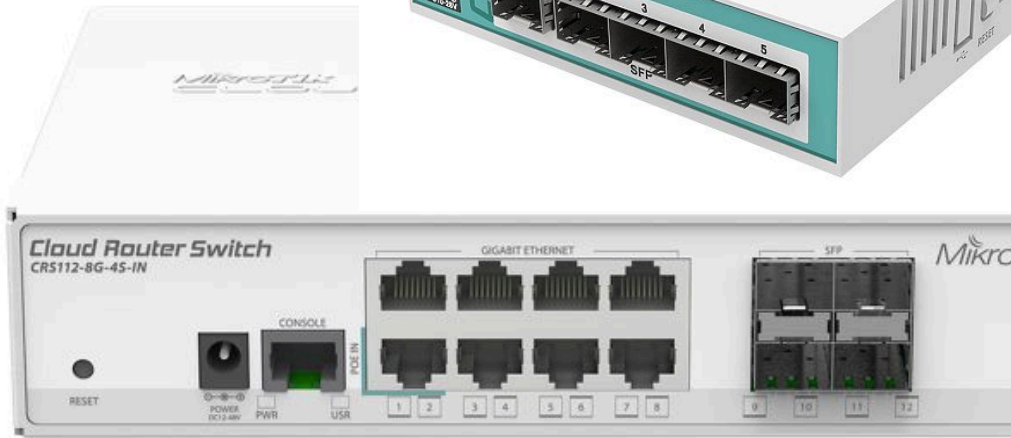
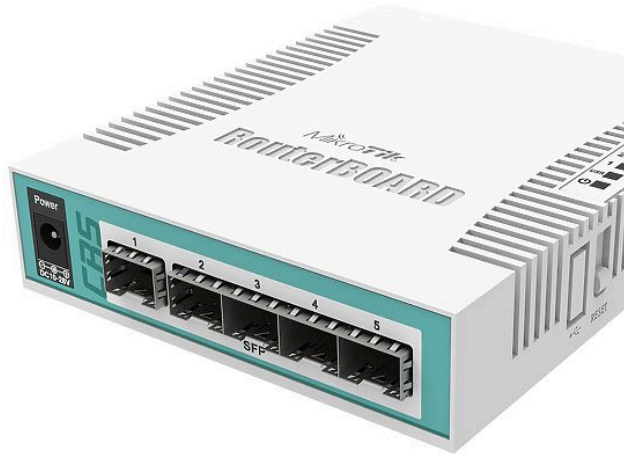
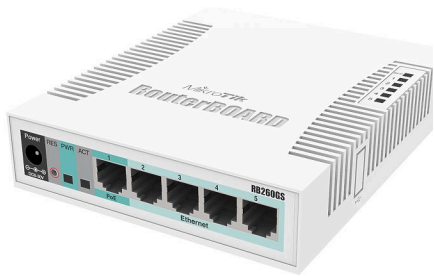
1 nusa
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INDONESIA



Perkenalan



- **Pujo Déwobroto**
- Citraweb Solusi Teknologi
 - Mikrotik distributor, training partner (mikrotik.co.id)
 - ISP (citra.net.id)
 - Web developer (citra.web.id)
- TR0132



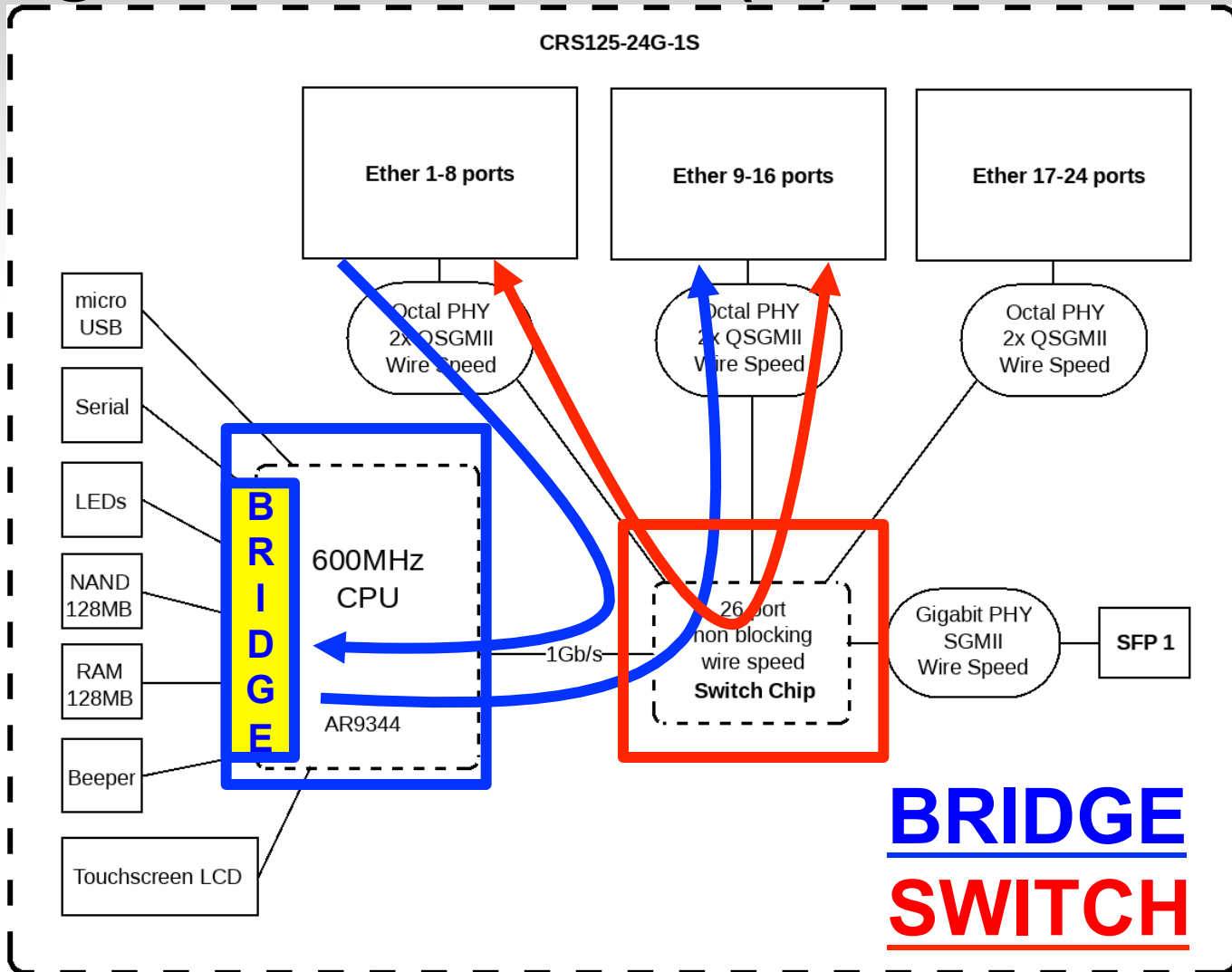
Router != Switch

Router	Switch
OSI Layer 3	OSI Layer 2
IP ADDRESS	MAC ADDRESS
PAKET	FRAME

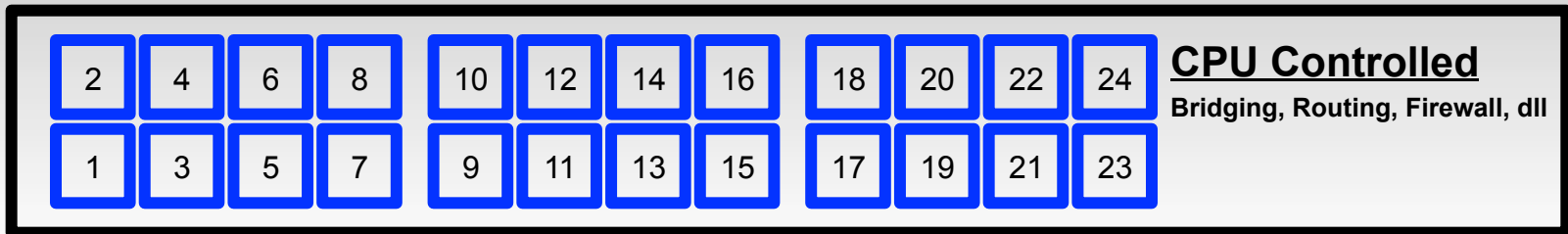
Bridge !== Switch

Bridge	Switch
Software	Hardware
Semua ROS (RB & PC)	Routerboard tertentu
Lambat	Cepat

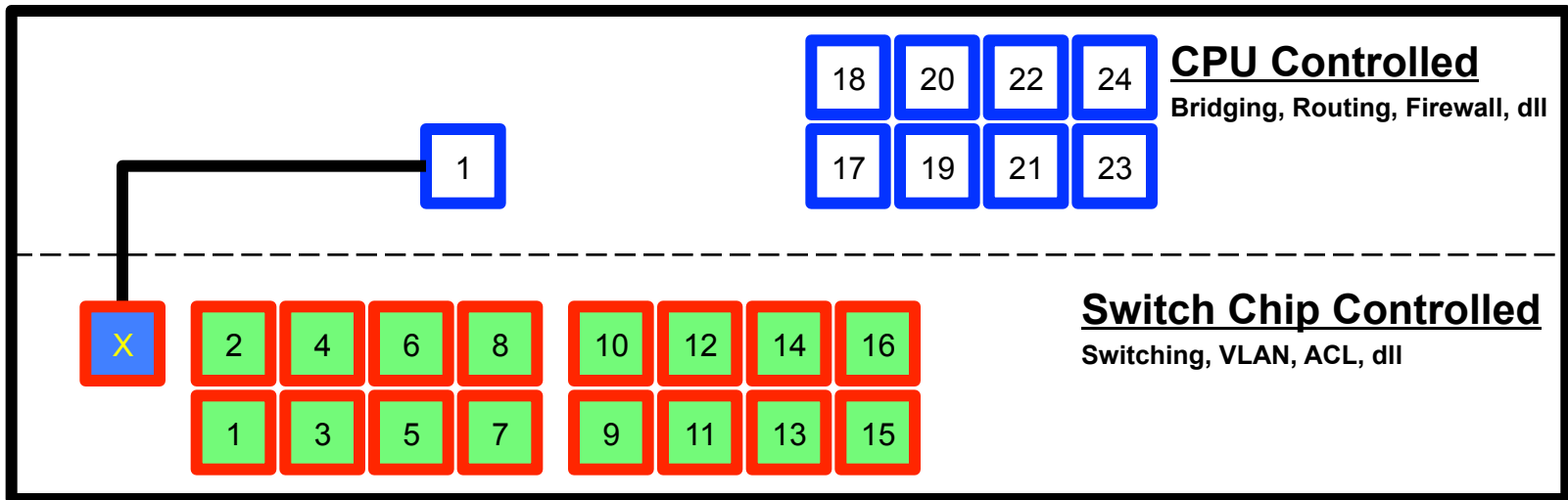
Bridge !== Switch (2)



Logika Switch Chip



ether2-ether16 diset masterport=ether1



 = masterport

 = Switch - CPU Port

Master Port - CPU Port

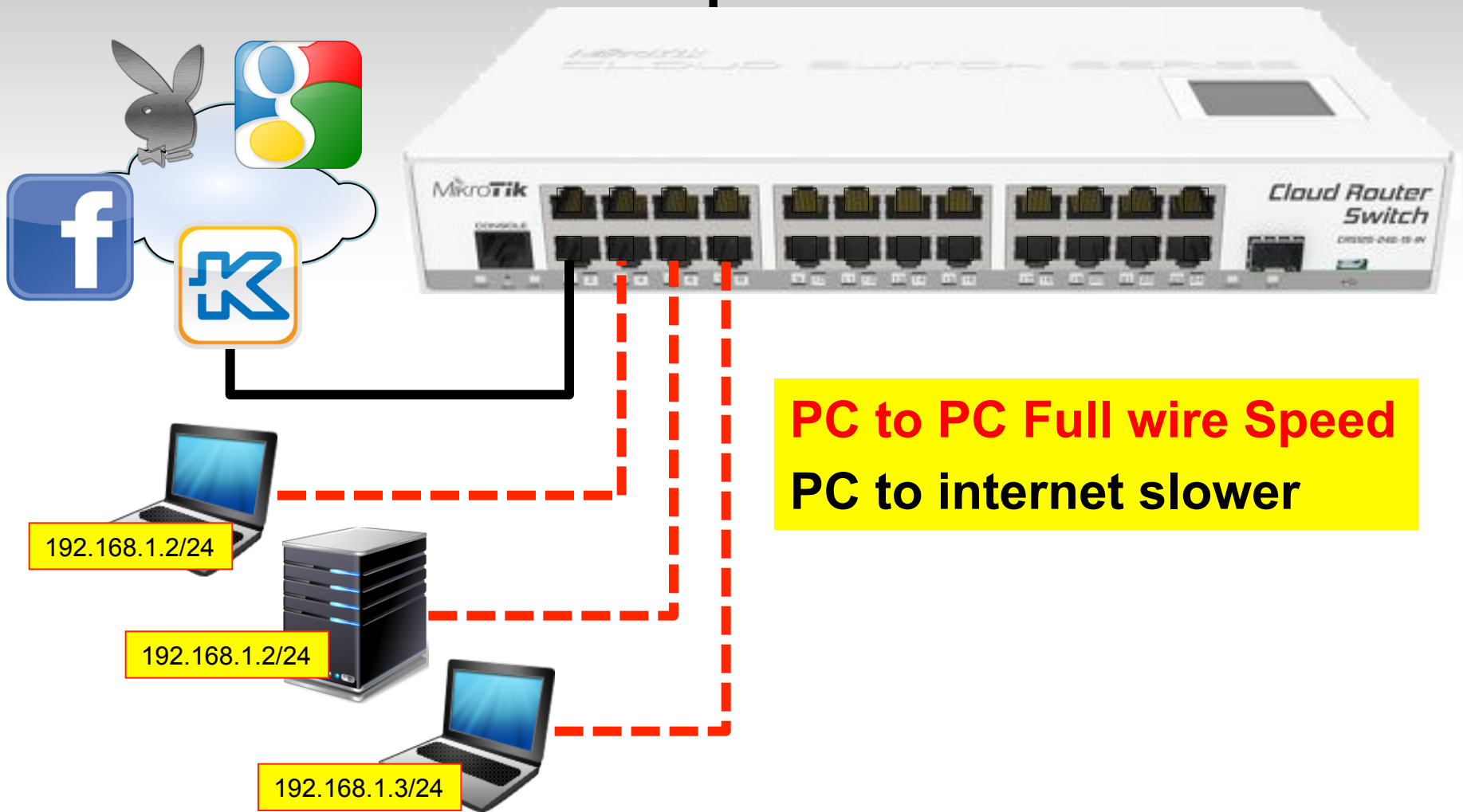
- Master port merupakan penghubung antara interface pada RouterOS dengan interface virtual "Switch-CPU Port" pada switch
- Pada CRS, support multiple "master-port" untuk membentuk banyak switch group dan setiap interface hanya bisa berada dalam 1 switch group. Tetapi fitur Switching tidak akan maksimal.
- Rekomendasi hanya menggunakan 1 master-port untuk semua interface

Fitur MikroTik Switch CRS125series*

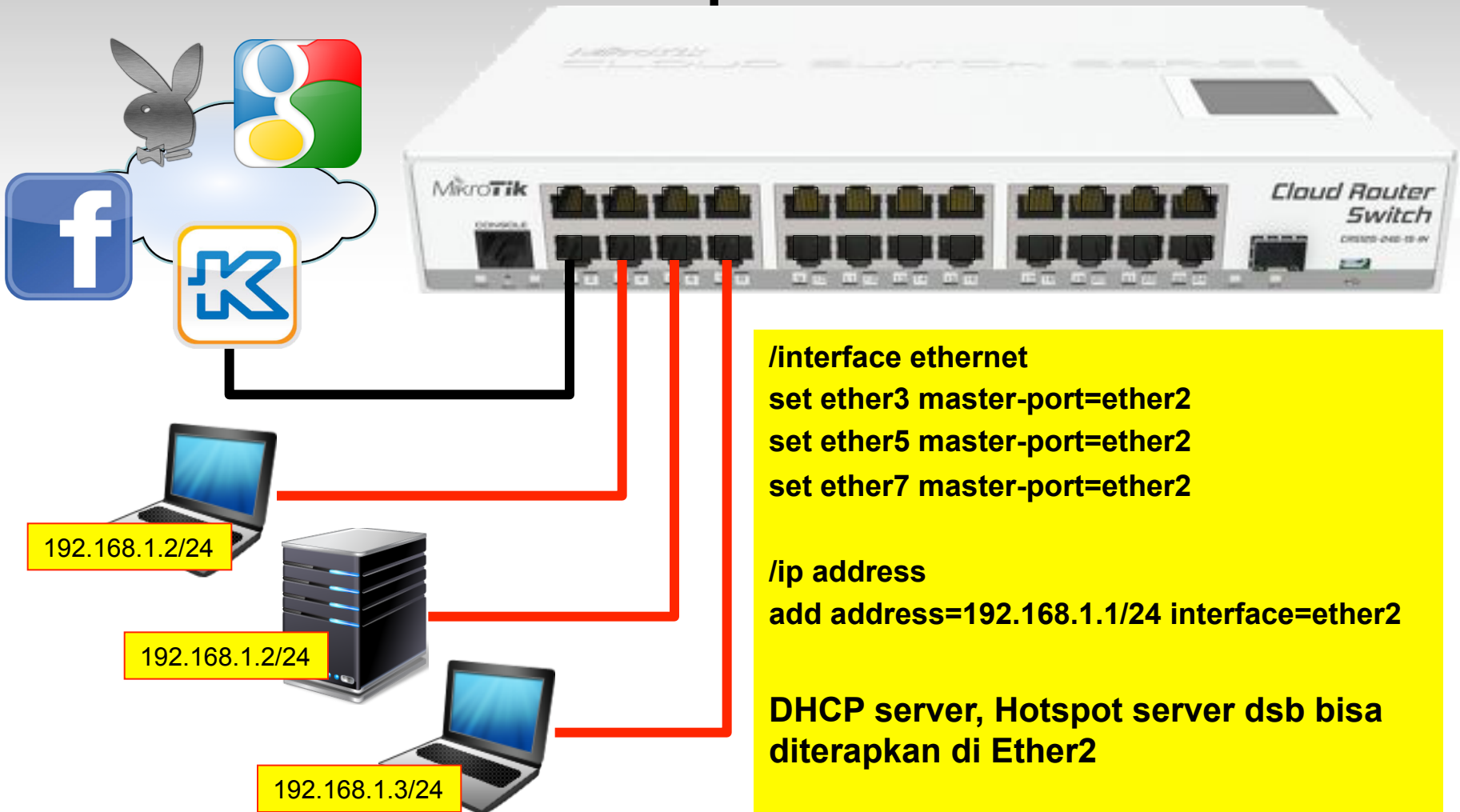
- Forwarding
 - Full non-blocking Wirespeed switching
- Mirroring
 - Port, VLAN, MAC based mirroring
- VLAN
 - Support 802.1Q & 802.1ad
 - Flexible (Port, Protocol, MAC based VLAN)
- Port Isolation & leakage
- Trunking
 - Support Link Aggregation Group
 - Hardware automatic failover & loadbalance
- QoS, Shaping & Scheduling
- Access Control List*

*Tergantung tipe switch chip

Contoh 1 - Simple Switch

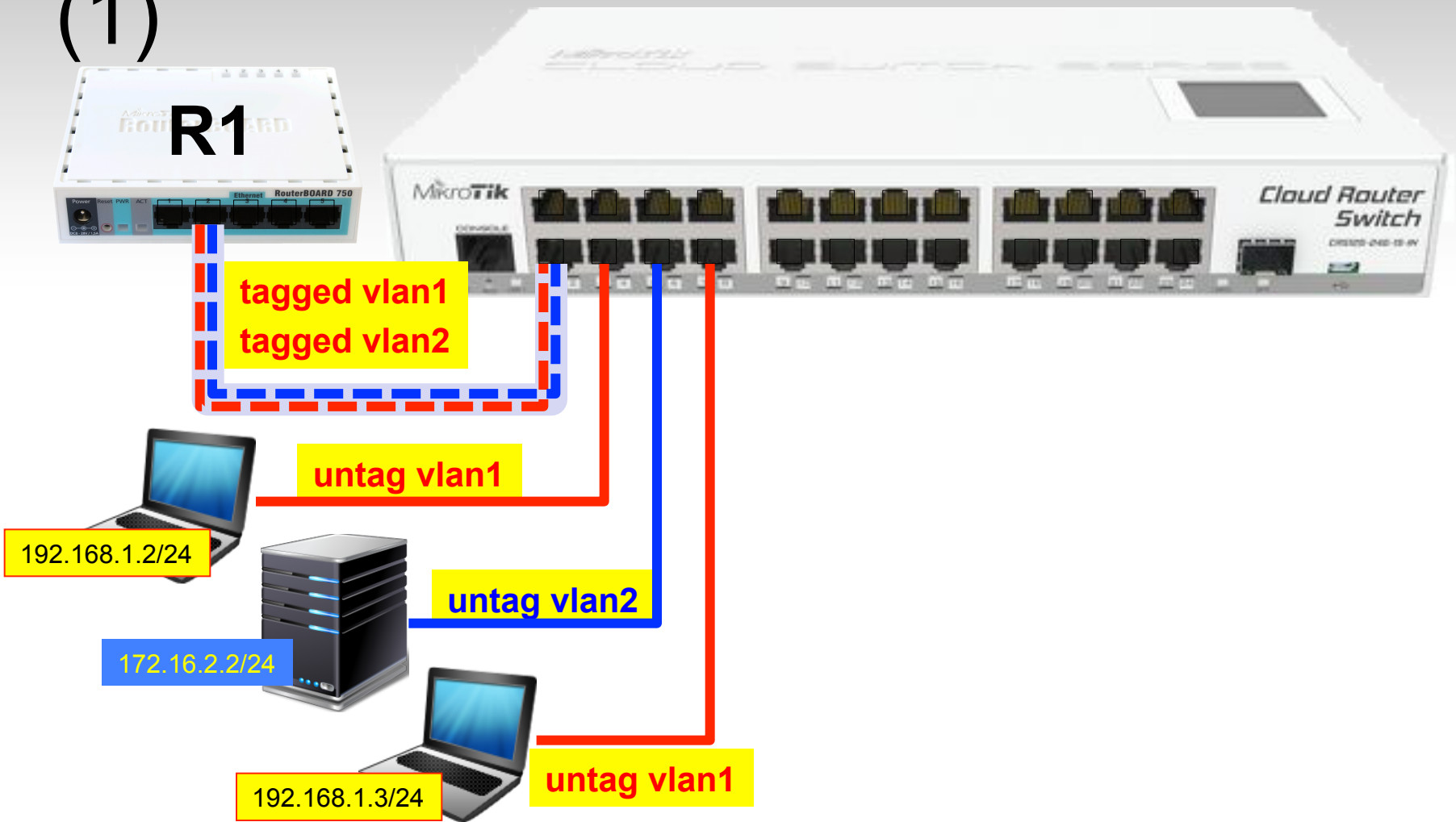


Contoh 1 - Simple Switch

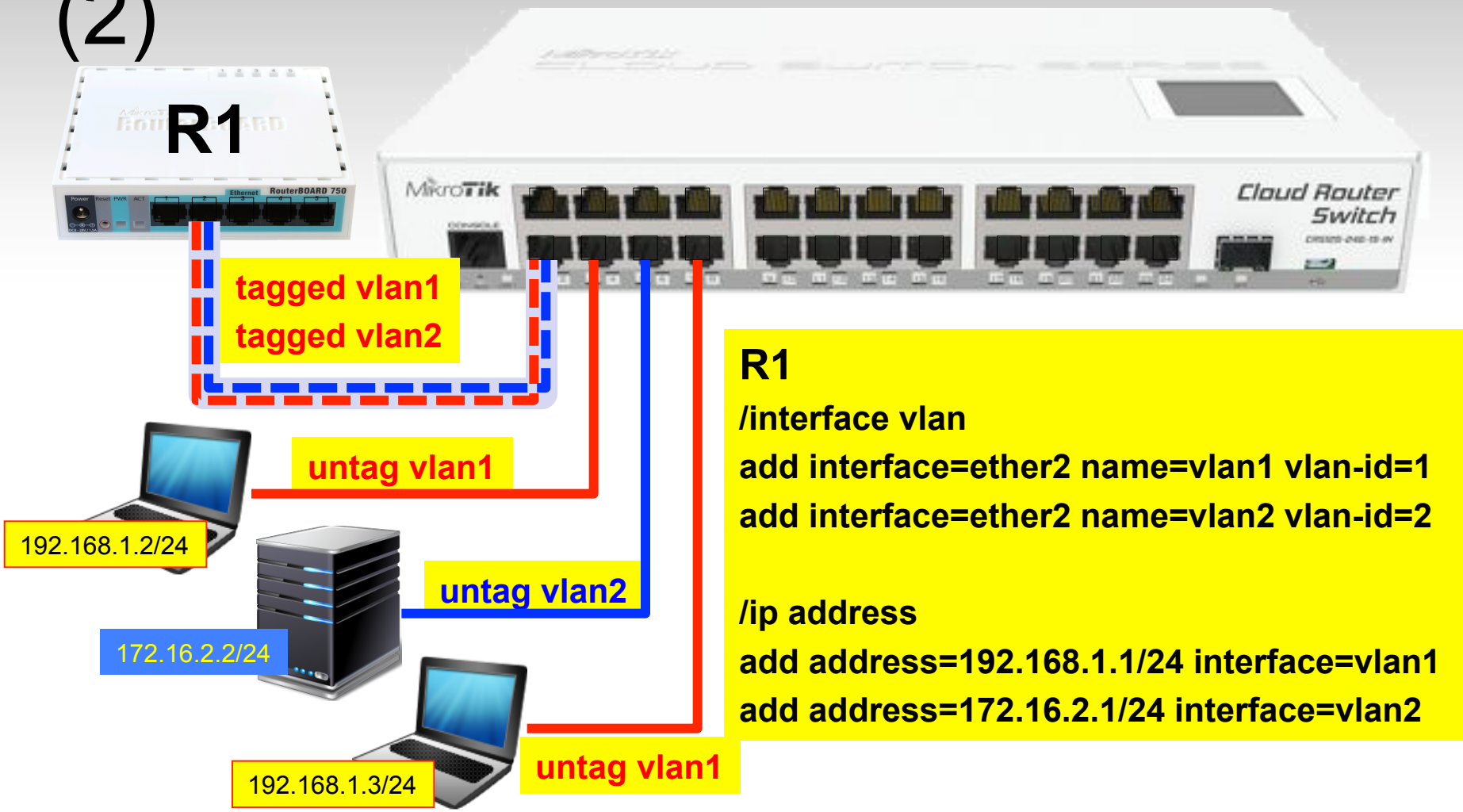


Contoh 2 - Port Based VLAN

(1)



Contoh 2 - Port Based VLAN (2)



Contoh 2 - Port Based VLAN

(3)

- Ether1 CRS berfungsi sebagai trunk port / tagged port
- Ether3 dan Ether7 CRS berfungsi sebagai access port / untagged port dari vlan-id=1
- Ether5 CRS berfungsi sebagai access port / untagged port dari vlan-id=2
- Perangkat dengan vlan-id=1 sudah berbeda broadcast domain dengan perangkat vlan-id=2

Contoh 2 - Port Based VLAN (4)

VLAN	Eg. VLAN Tag	In. VLAN Tran.	Eg. VLAN Tran.	...		
						<input type="text" value="Find"/>
VLAN ID	Ports					
1	ether1, ether3, ether7					
2	ether1, ether5					
D	4095 ether8, ether9, ether10, et...					

Switch VLAN <1>

VLAN ID:

Ports: ether1 ether3 ether7

SVL

SA Learning

OK Cancel Apply Disable Comment

Switch VLAN <2>

VLAN ID:

Ports: ether1 ether5

SVL

SA Learning

Flood

Ingress Mirror

QoS Group:

OK Cancel Apply Disable Comment Copy Remove

Definisikan membership vlan di masing-masing port

Contoh 2 - Port Based VLAN (5)

Egress-vlan-tag untuk mendefinisikan egress port yang butuh menggunakan vlan tag
Jika "tagged-port" tidak cocok maka vlan tag akan diremove

VLAN	Eg. VLAN Tag	In. VLAN Tran.	Eg. VLAN Tran.	...
1	ether1			
2	ether1			
4095				

Switch Egress Tag VLAN <1>

VLAN ID: 1

Tagged Ports: ether1

enabled

Switch Egress Tag VLAN <2>

VLAN ID: 2

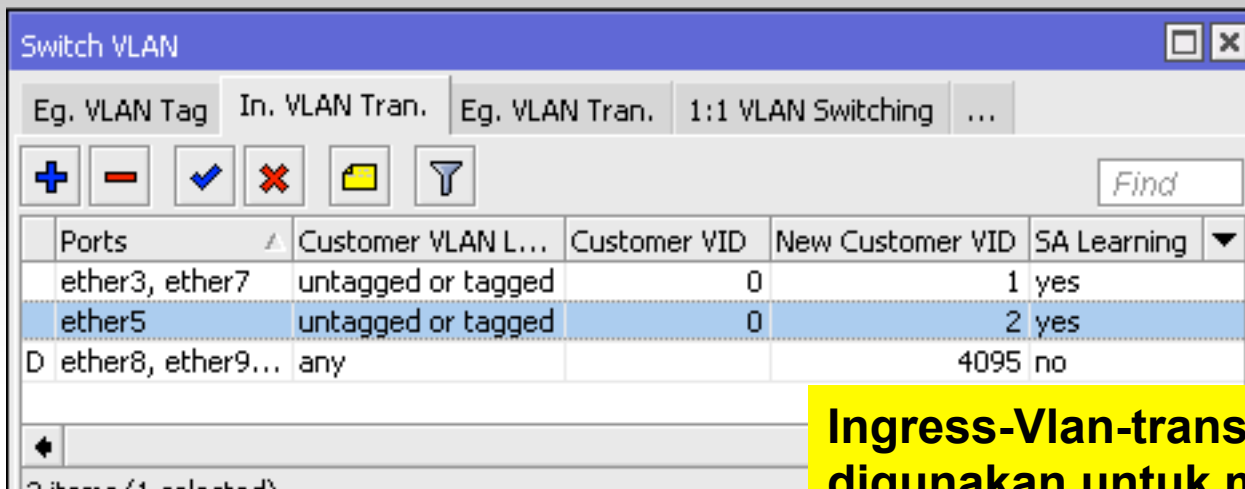
Tagged Ports: ether1

OK
Cancel
Apply
Disable
Comment
Copy
Remove

enabled

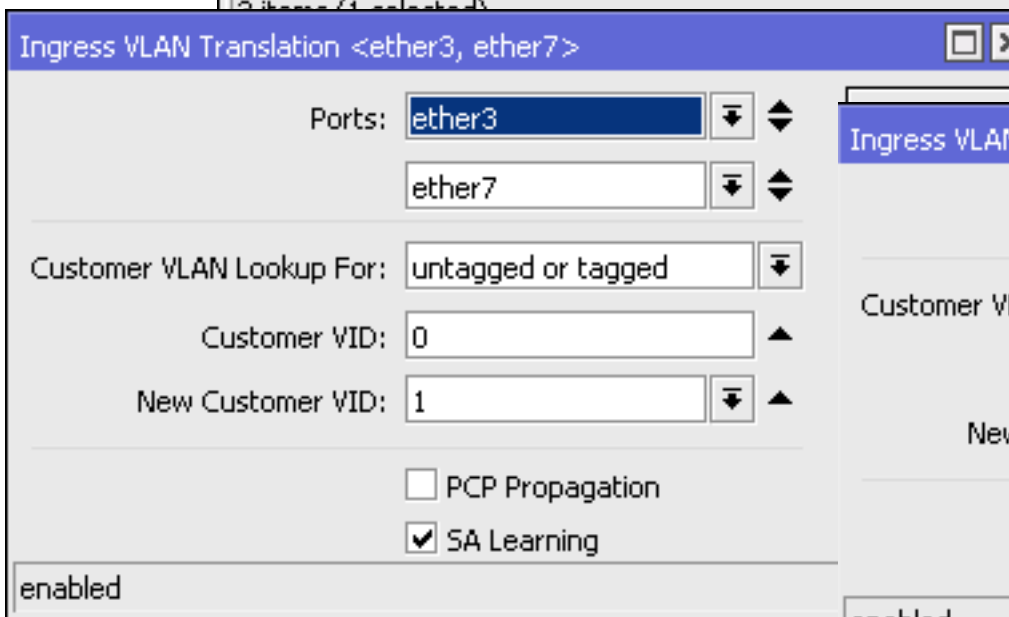
Contoh 2 - Port Based VLAN

(6)



Ports	Customer VLAN L...	Customer VID	New Customer VID	SA Learning
ether3, ether7	untagged or tagged	0	1	yes
ether5	untagged or tagged	0	2	yes
D ether8, ether9...	any		4095	no

Ingress-Vlan-translation, digunakan untuk memodifikasi frame yang masuk ke Switch dari sebuah port



Ingress VLAN Translation <ether3, ether7>

Ports: ether3
ether7

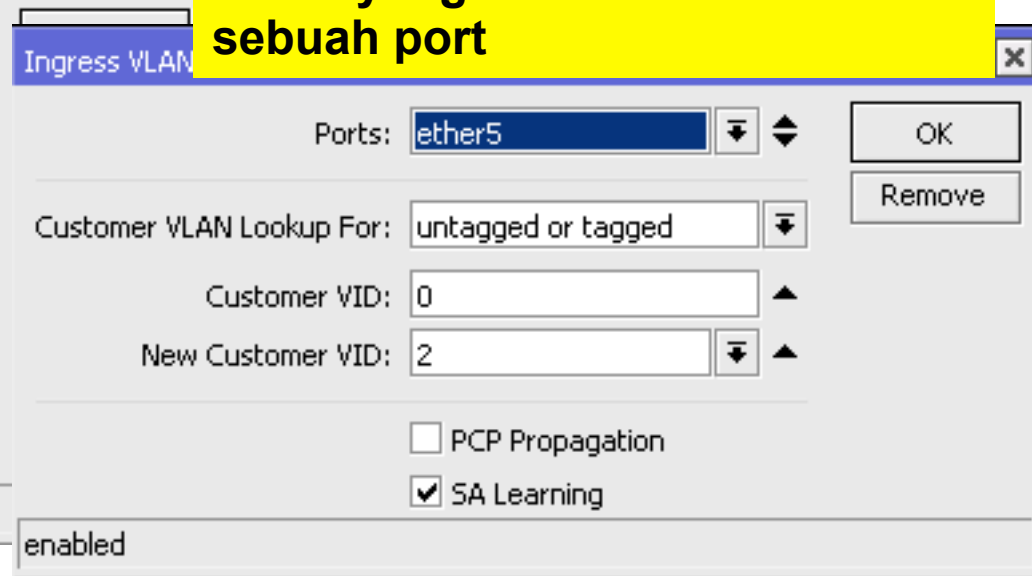
Customer VLAN Lookup For: untagged or tagged

Customer VID: 0

New Customer VID: 1

PCP Propagation
 SA Learning

enabled



Ingress VLAN Translation <ether5>

Ports: ether5

Customer VLAN Lookup For: untagged or tagged

Customer VID: 0

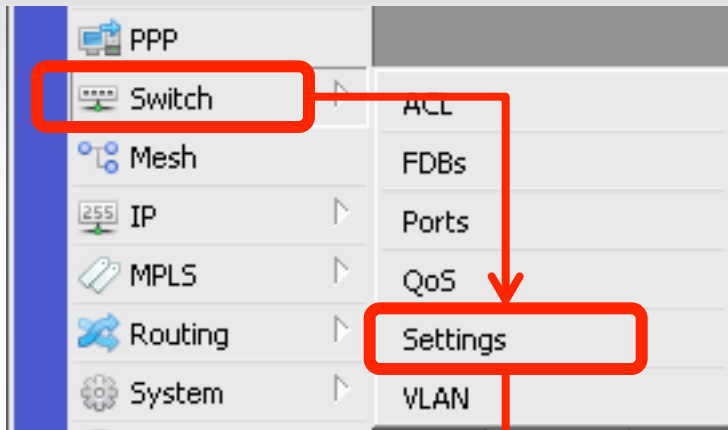
New Customer VID: 2

PCP Propagation
 SA Learning

enabled

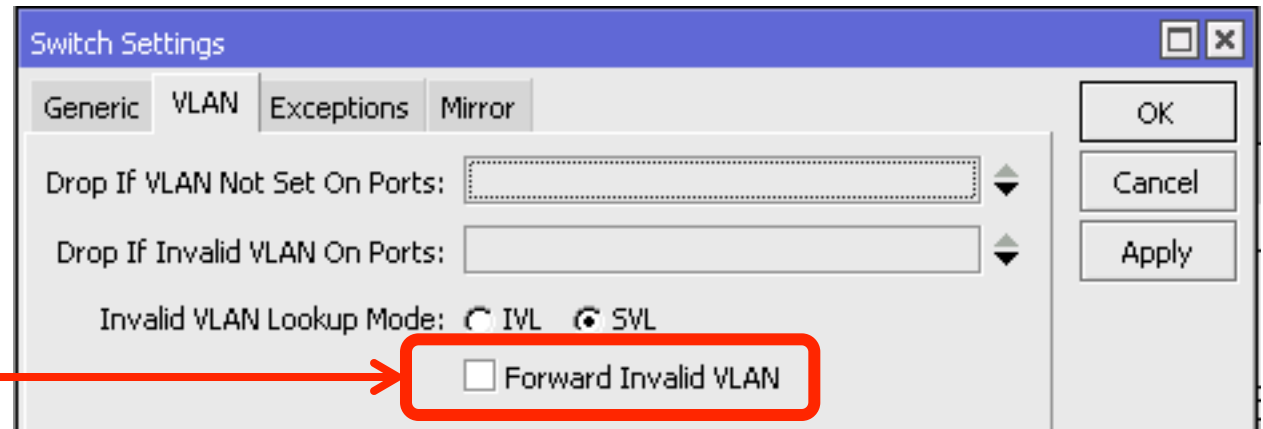
OK
Remove

Contoh 2 - Port Based VLAN (7)



Disable forward-invalid-vlan untuk memblok semua frame yang tidak kita definisikan di vlan table (security purpose)

Lakukan ini setelah yakin semua vlan sudah berjalan!!



Switch LOGIC

DST MAC 6	SRC MAC 6	ETH TYPE 2	DATA PAYLOAD 46-1500	FCS 4
-----------------	-----------------	------------------	----------------------------	----------

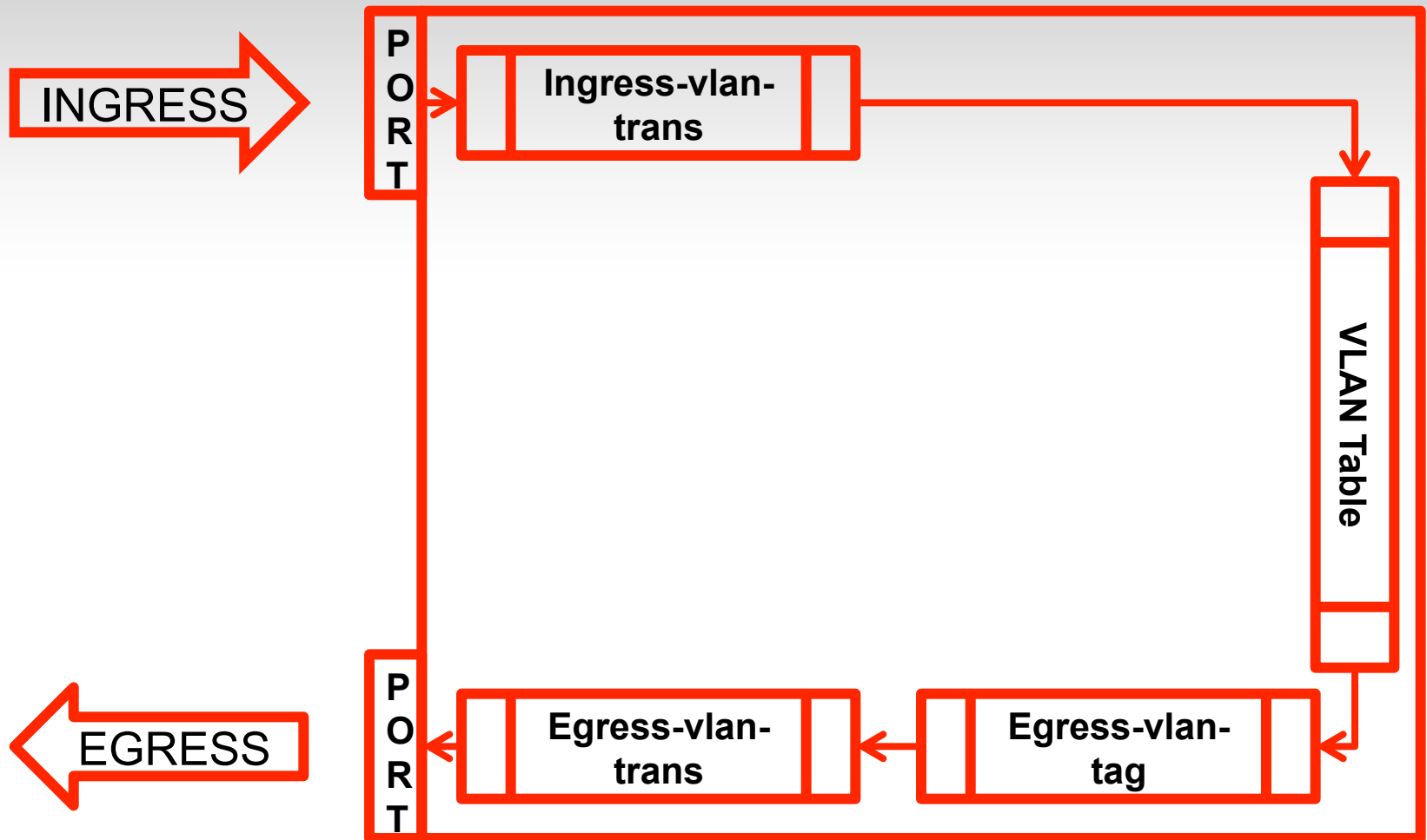
access port / untagged port



trunk port / tagged port

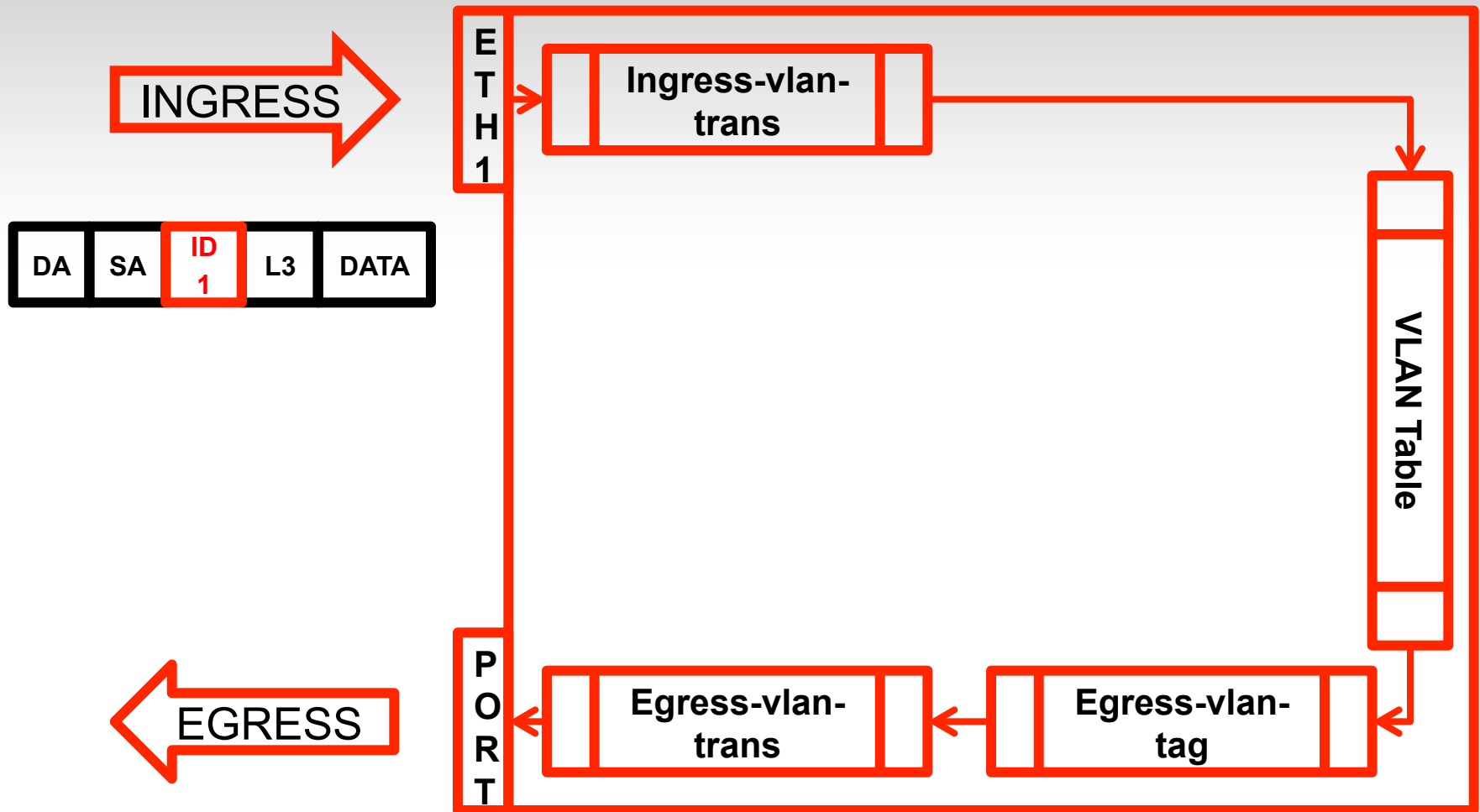
DST MAC 6	SRC MAC 6	802.1Q 4	ETH TYPE 2	DATA PAYLOAD 42-1500	FCS 4
-----------------	-----------------	-------------	------------------	----------------------------	----------

Logika CRS (1)



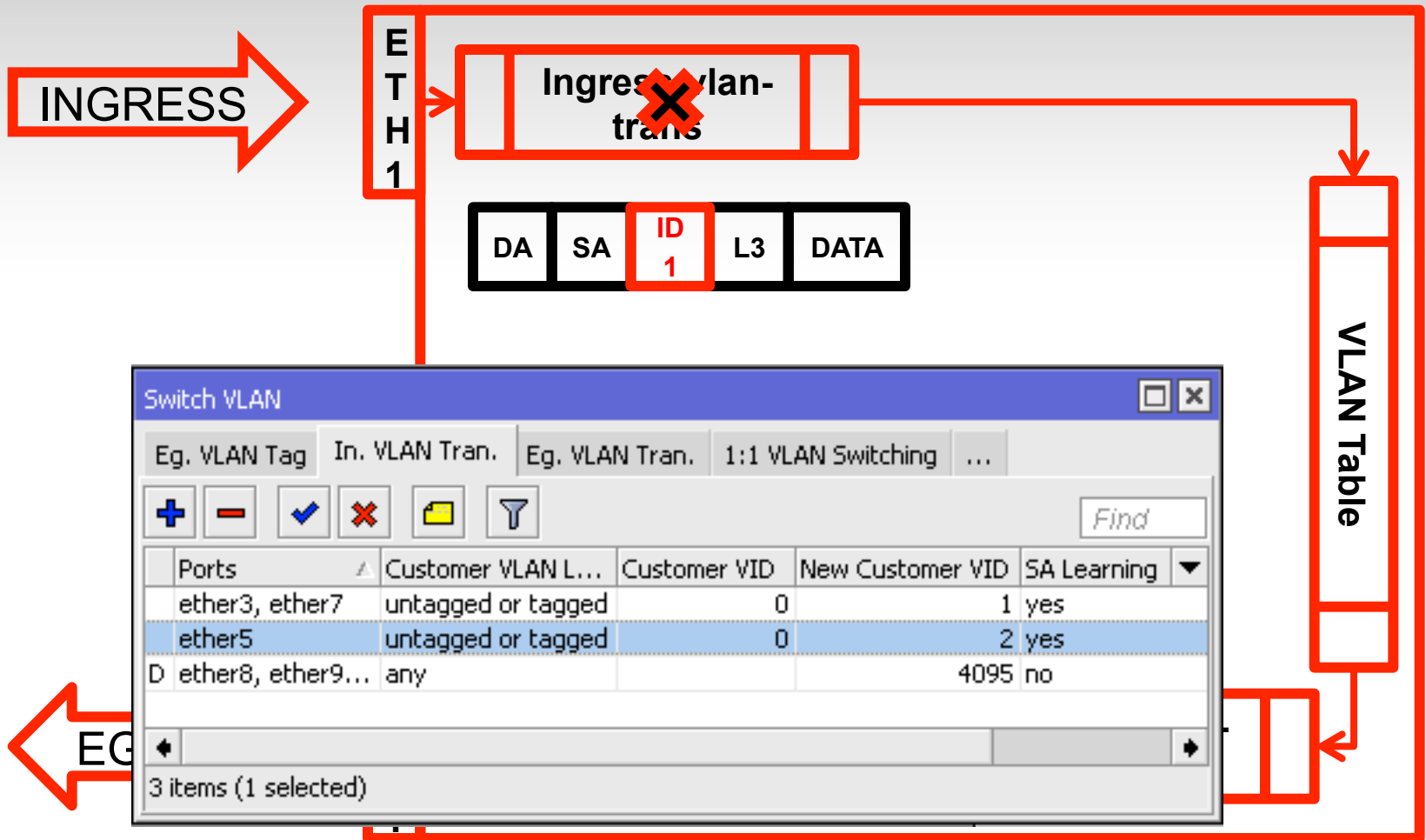
Logika CRS (2)

R1 tagged to PC untagged vid=1



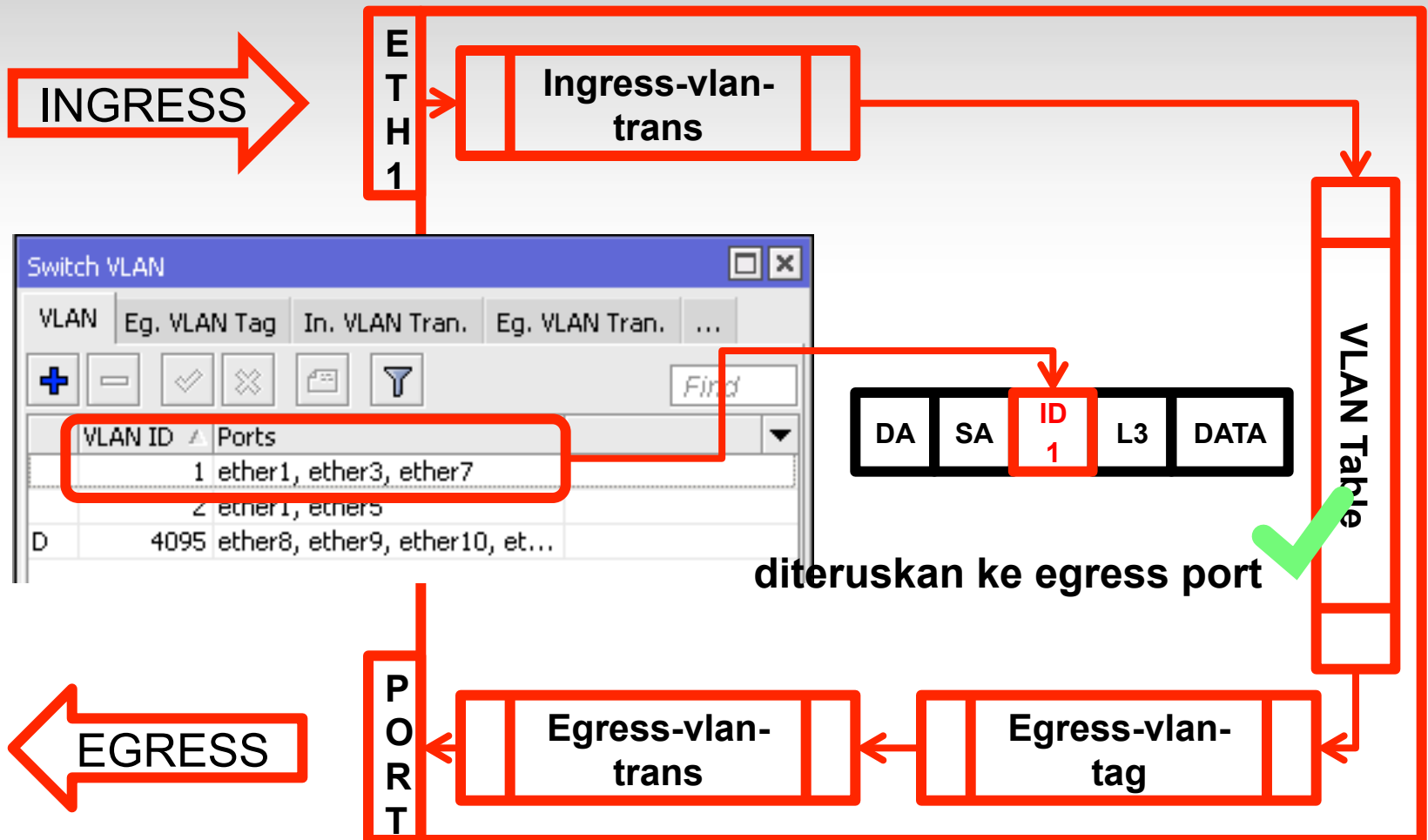
Logika CRS (3)

R1 tagged to PC untagged vid=1



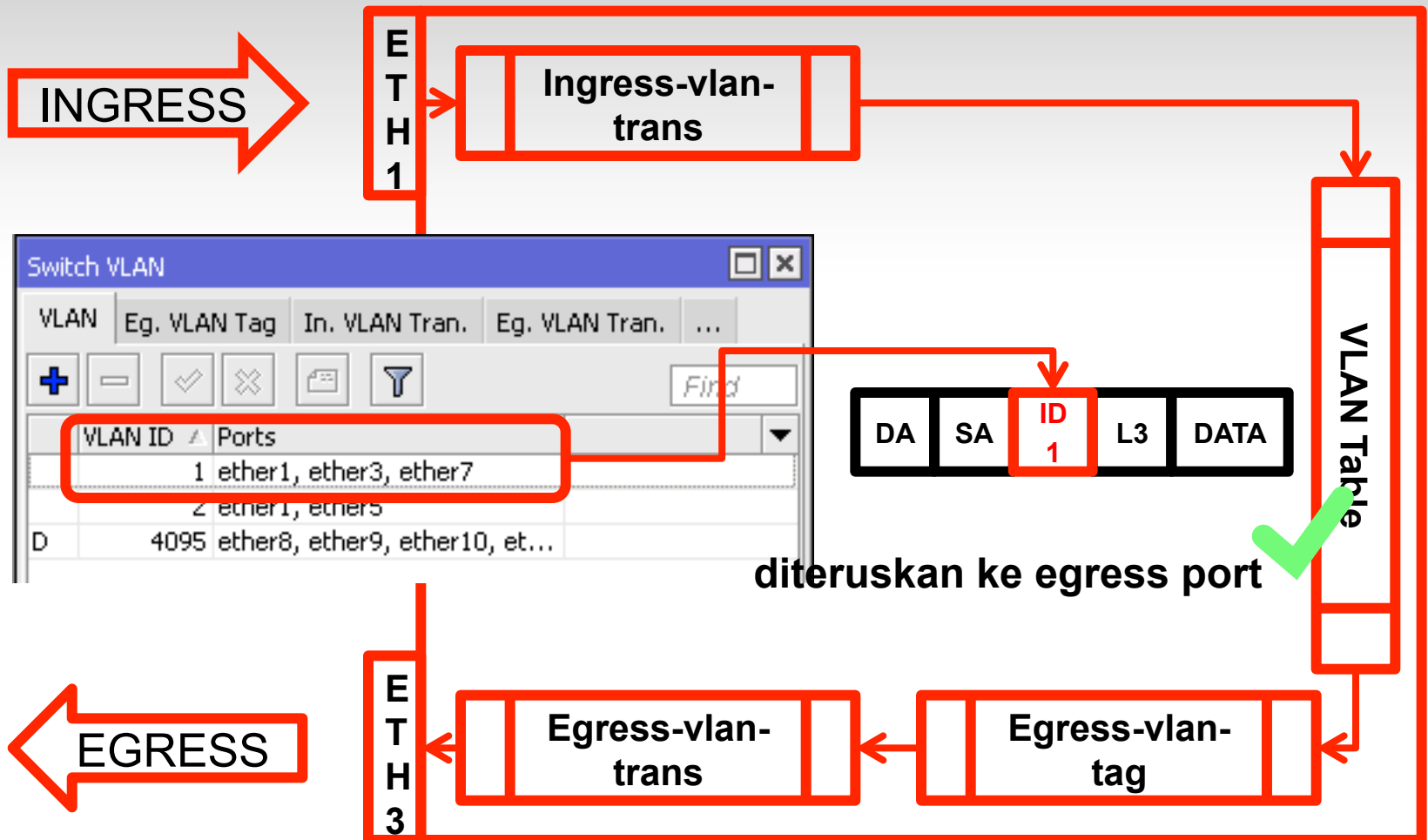
Logika CRS (4)

R1 tagged to PC untagged vid=1



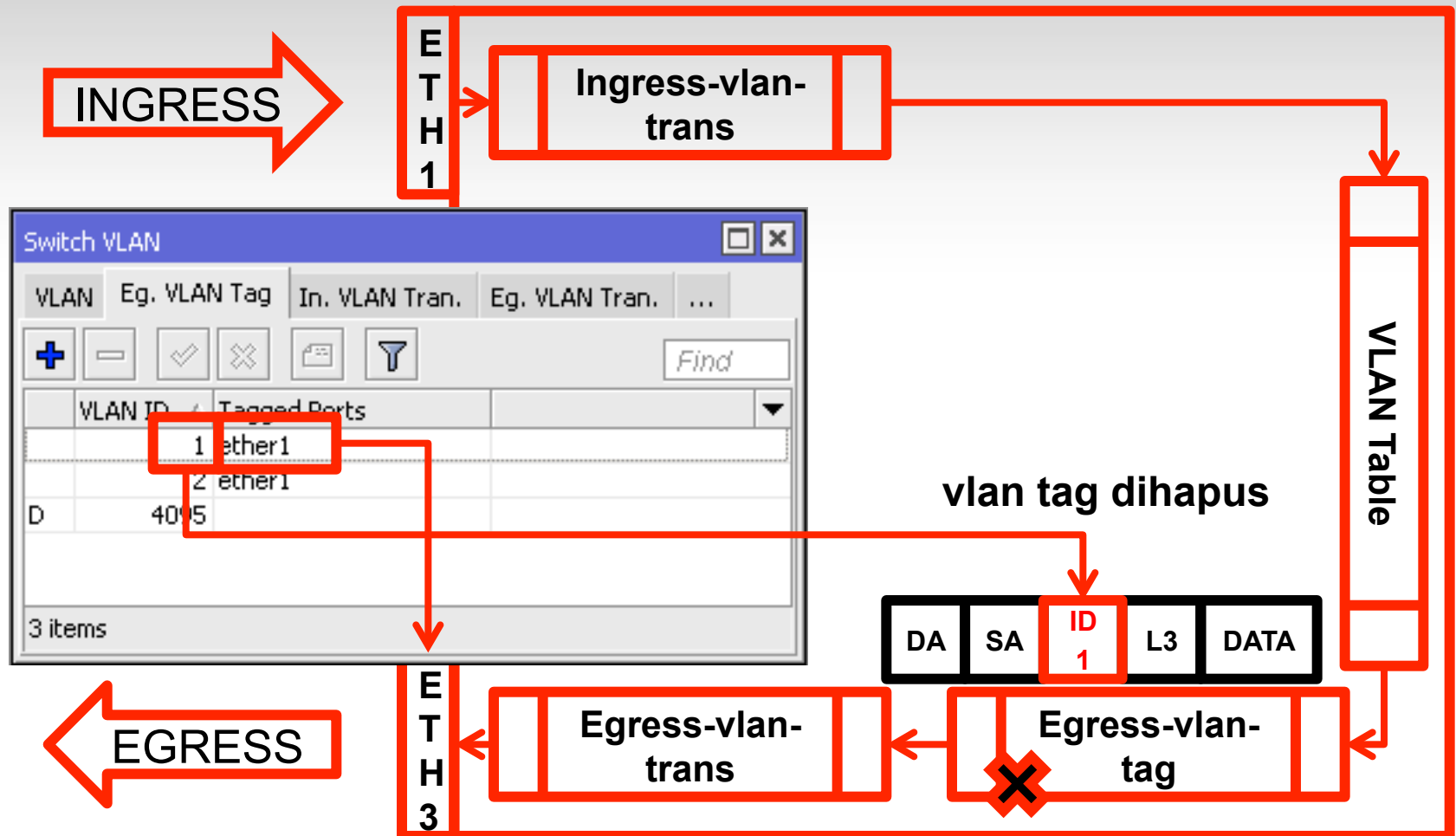
Logika CRS (5)

R1 tagged to PC untagged vid=1



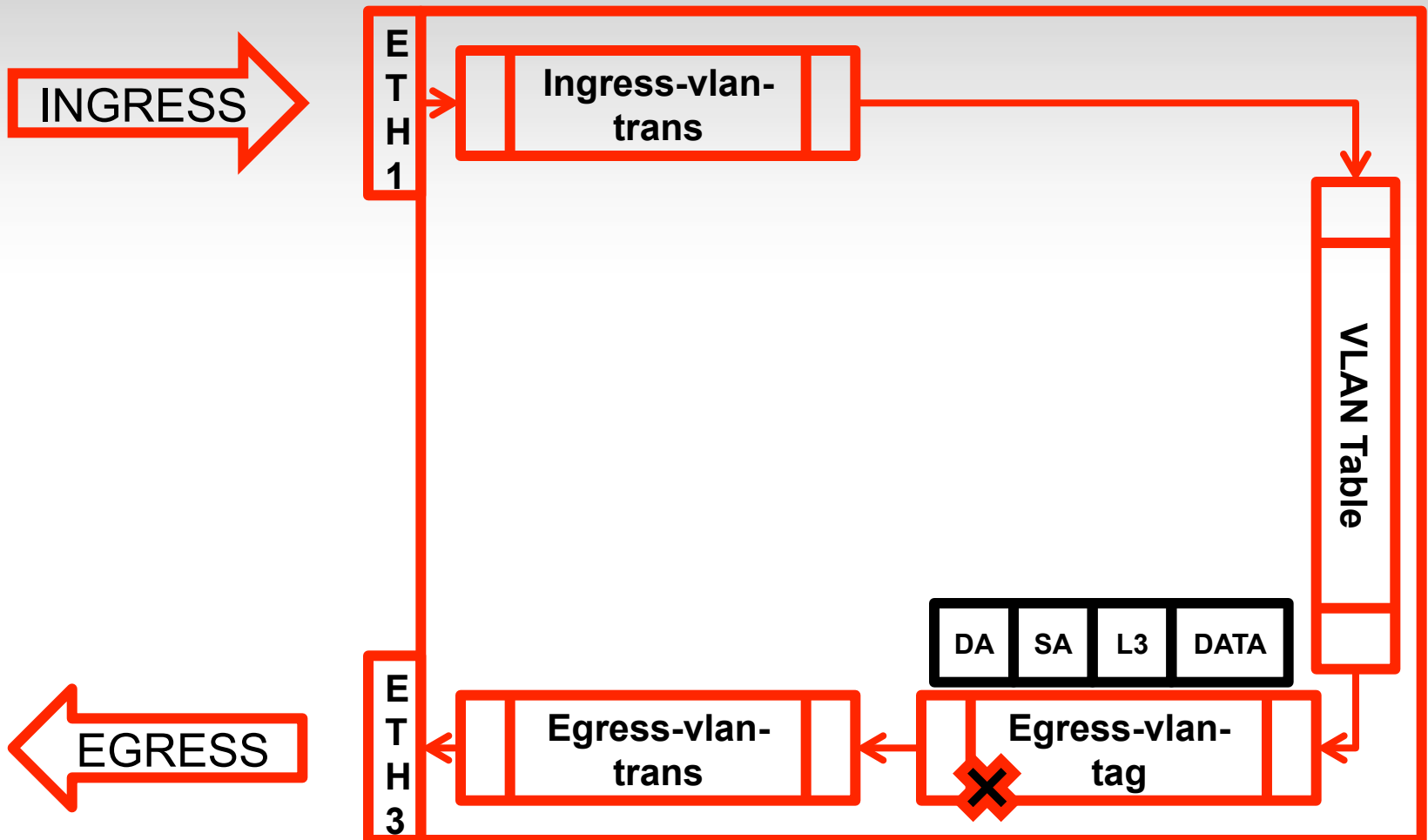
Logika CRS (6)

R1 tagged to PC untagged vid=1



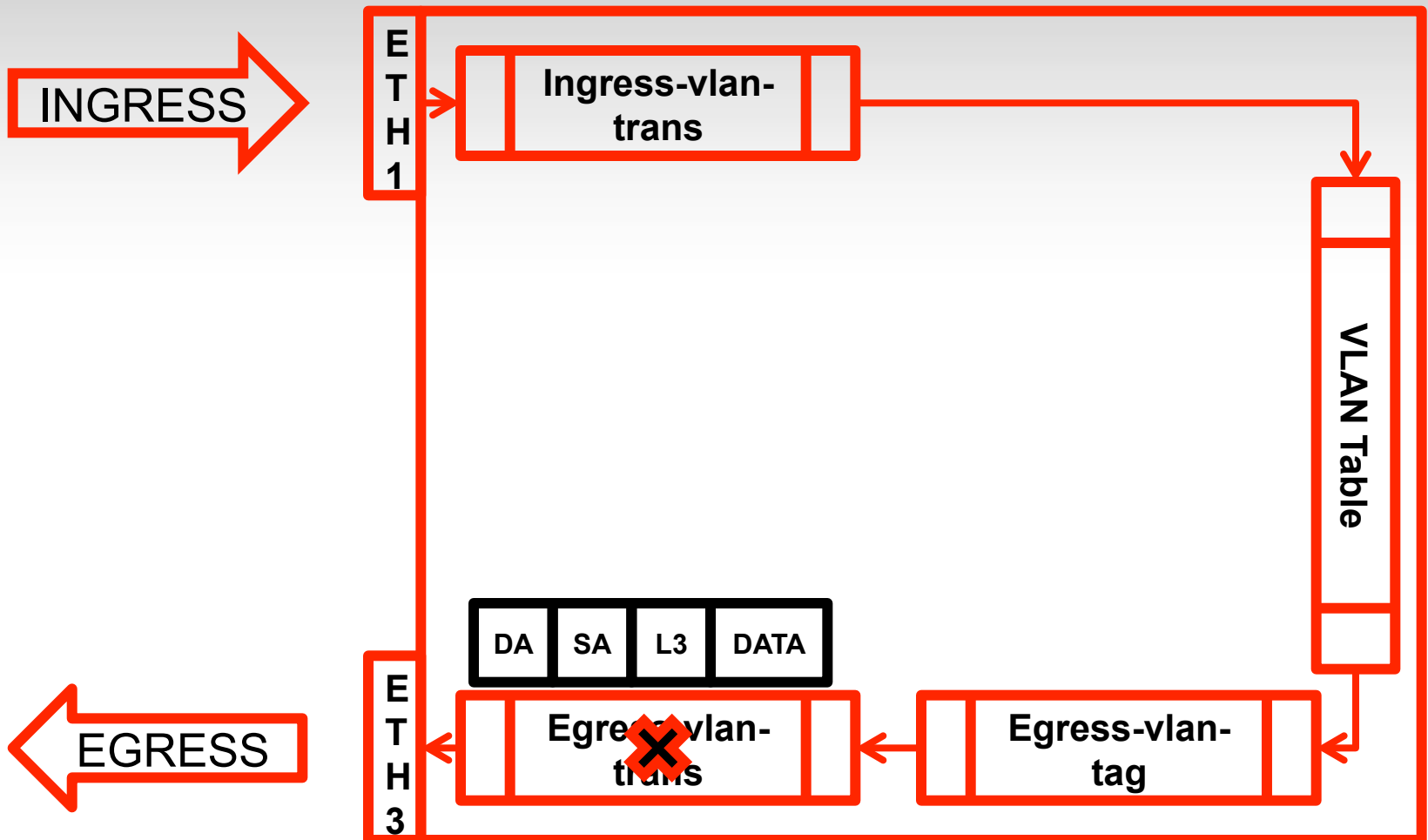
Logika CRS (7)

R1 tagged to PC untagged vid=1



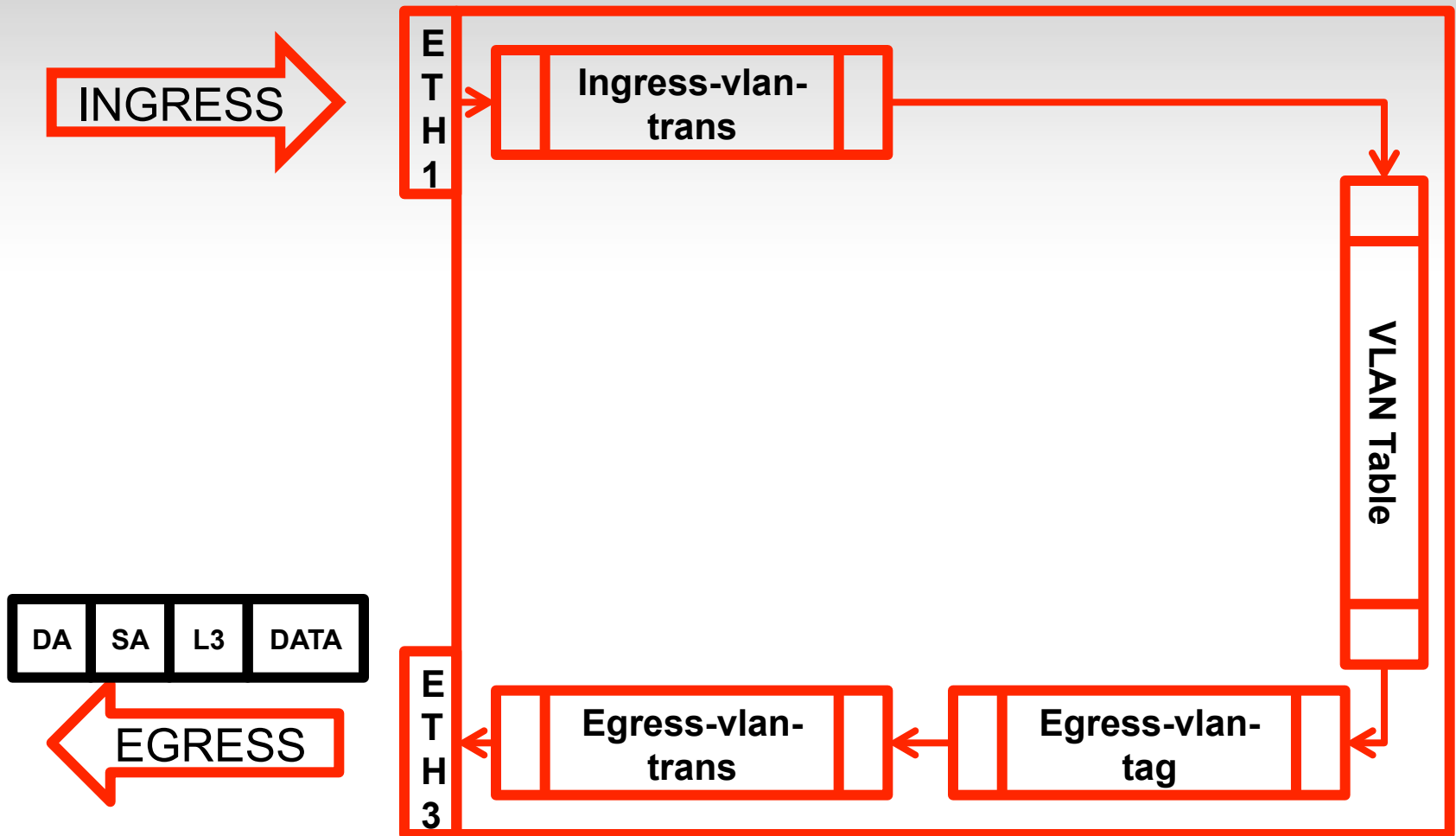
Logika CRS (8)

R1 tagged to PC untagged vid=1



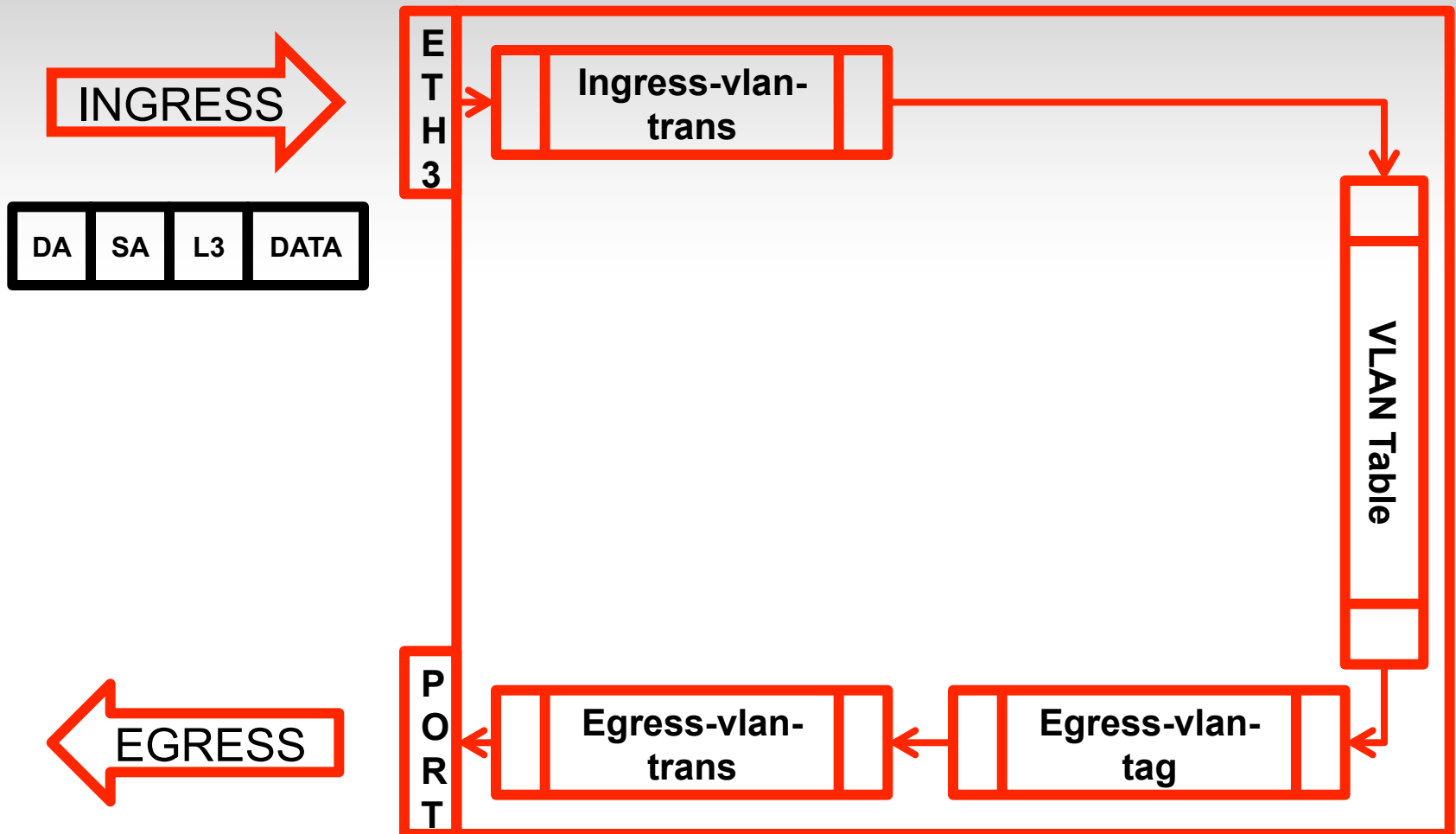
Logika CRS (9)

R1 tagged to PC untagged vid=1



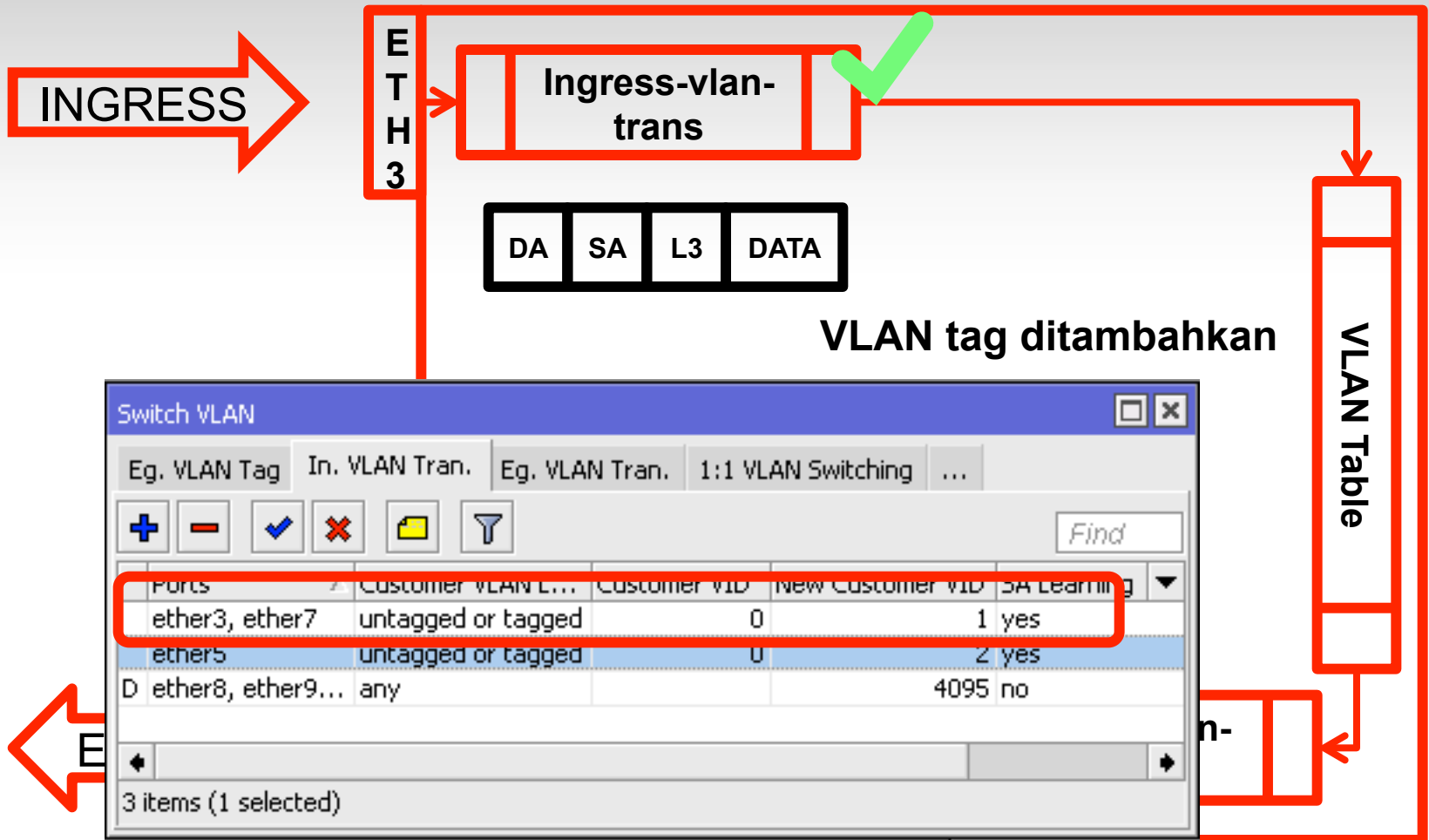
Logika CRS (10)

Untagged PC ke R1 tagged vid=1



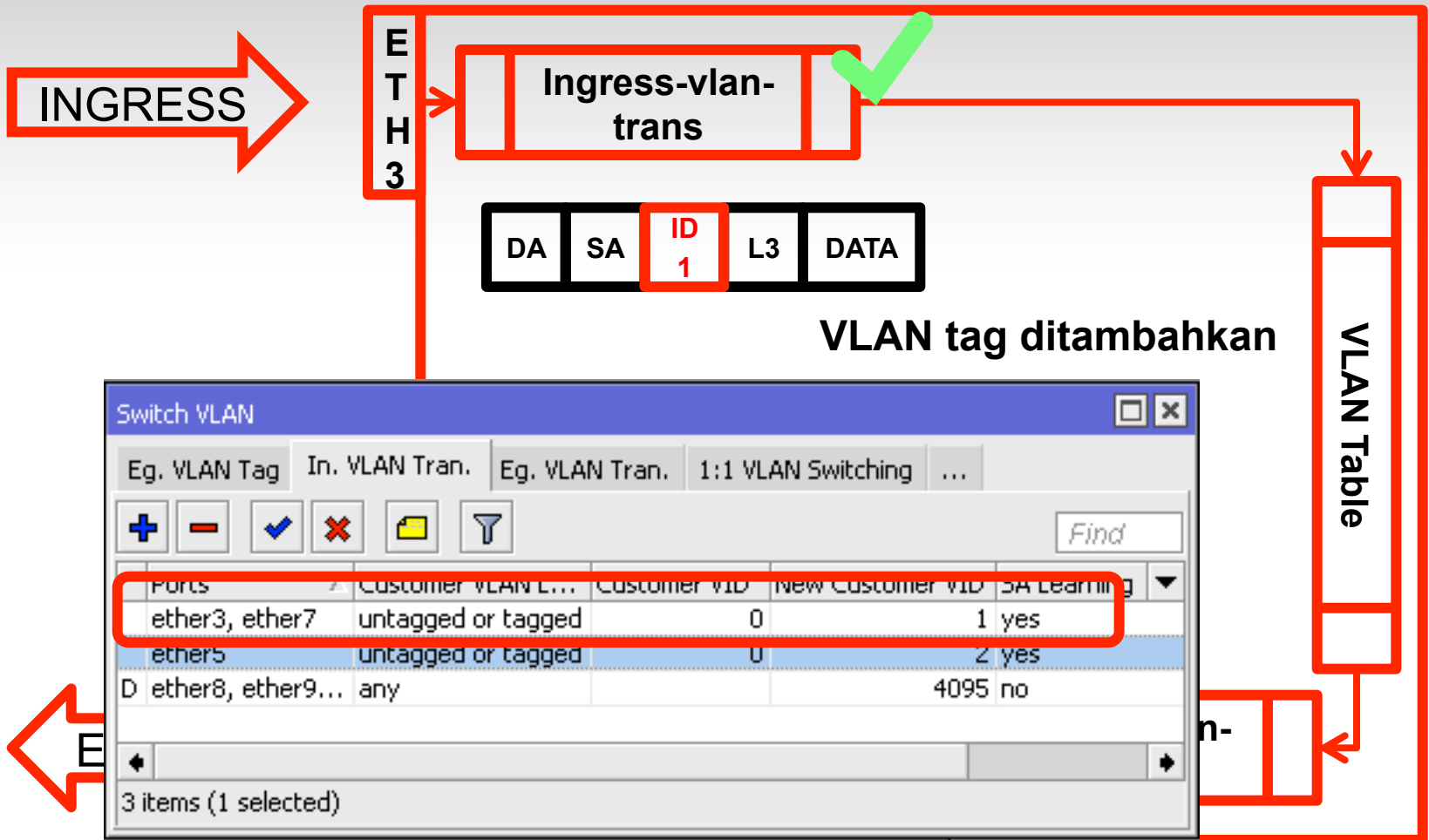
Logika CRS (11)

Untagged PC ke R1 tagged vid=1



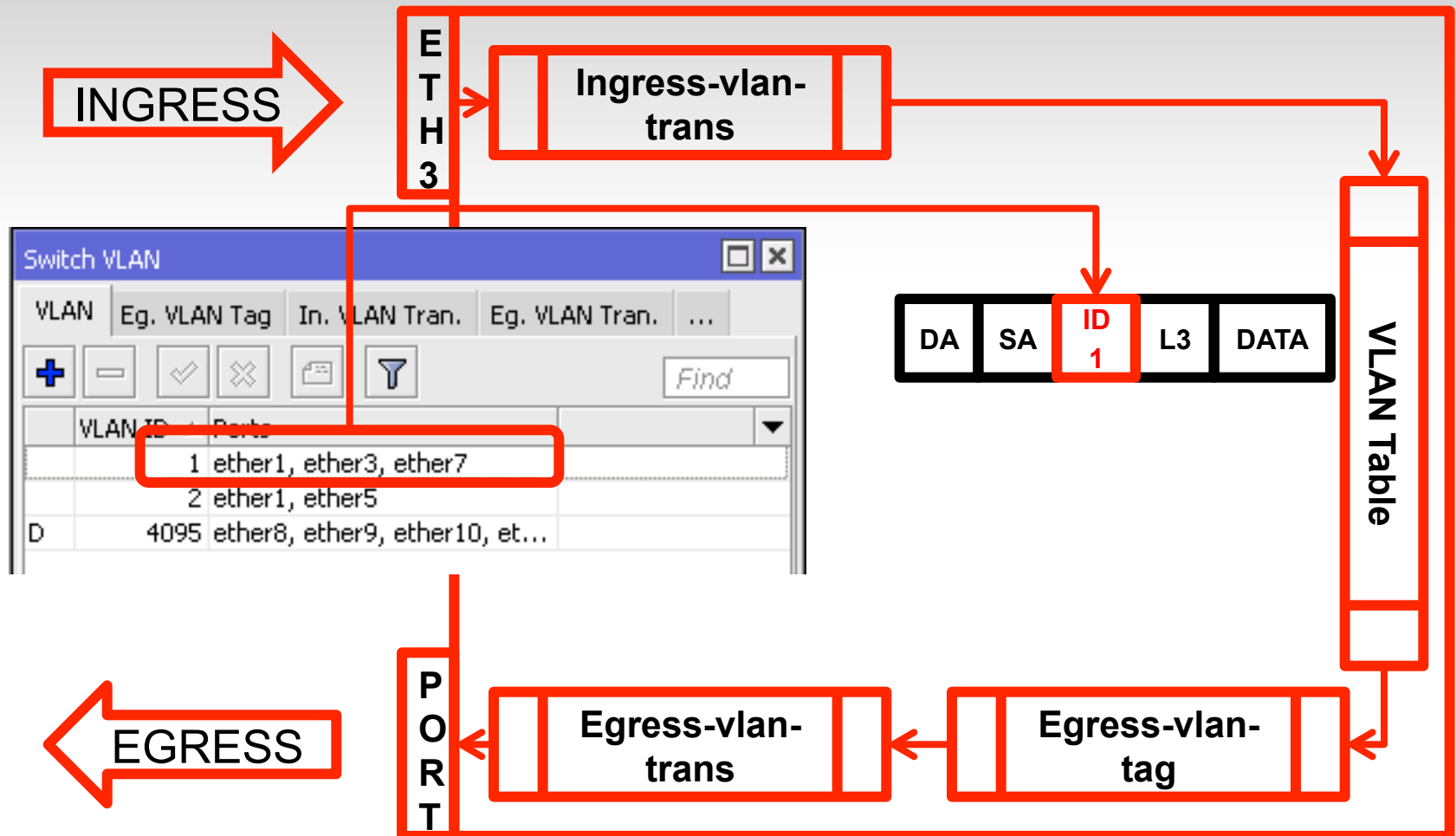
Logika CRS (12)

Untagged PC ke R1 tagged vid=1



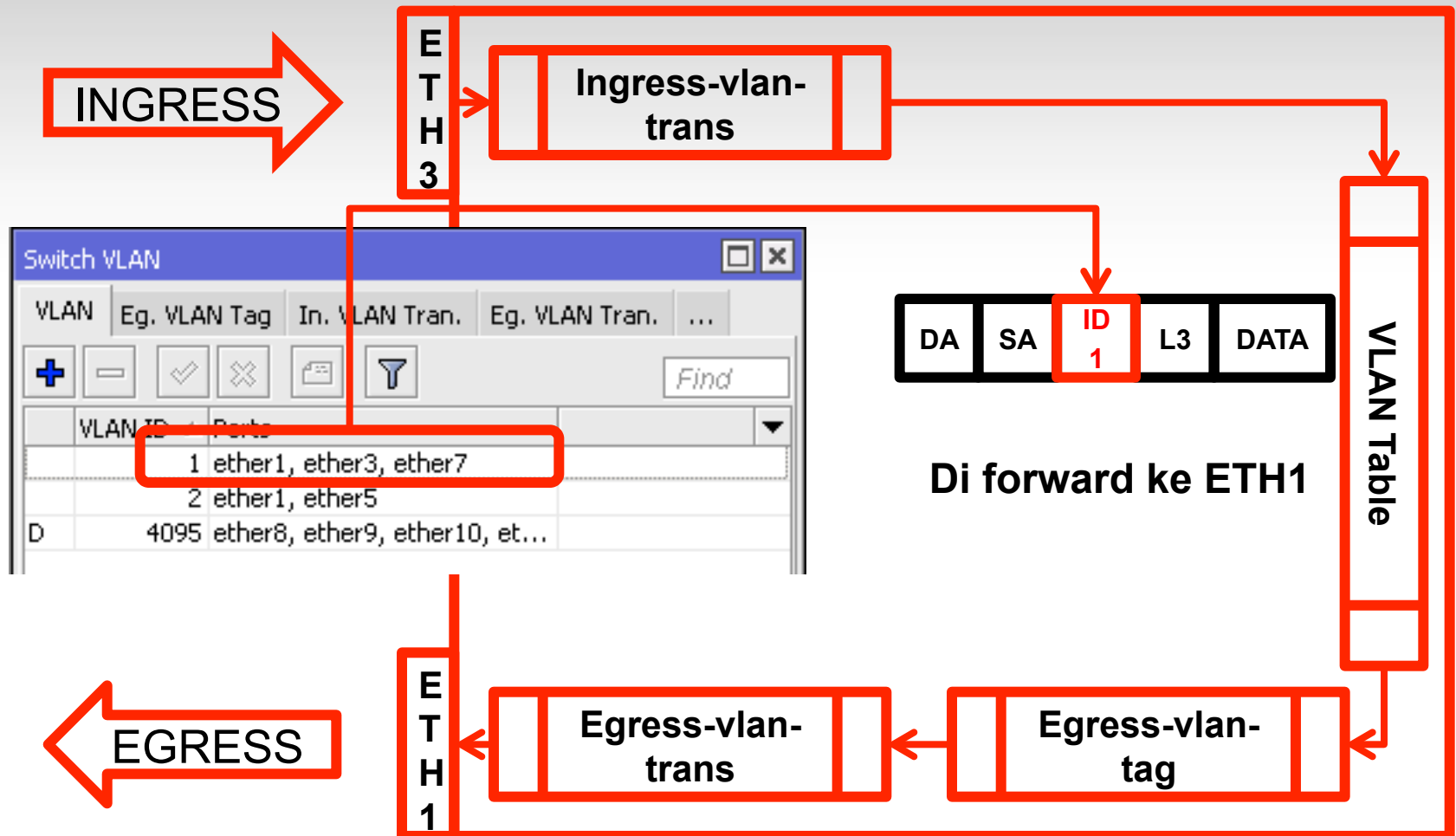
Logika CRS (13)

Untagged PC ke R1 tagged vid=1



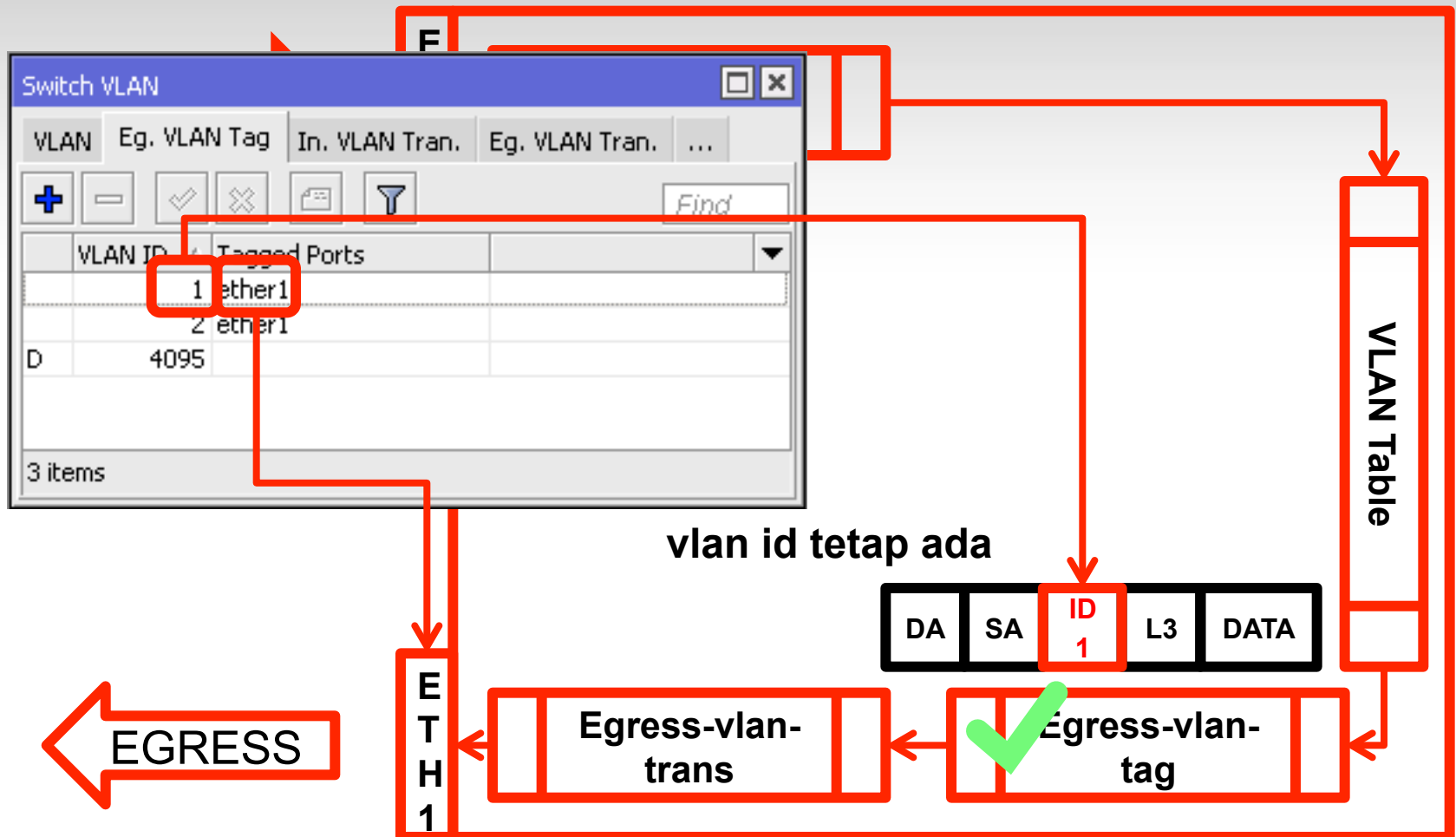
Logika CRS (14)

Untagged PC ke R1 tagged vid=1



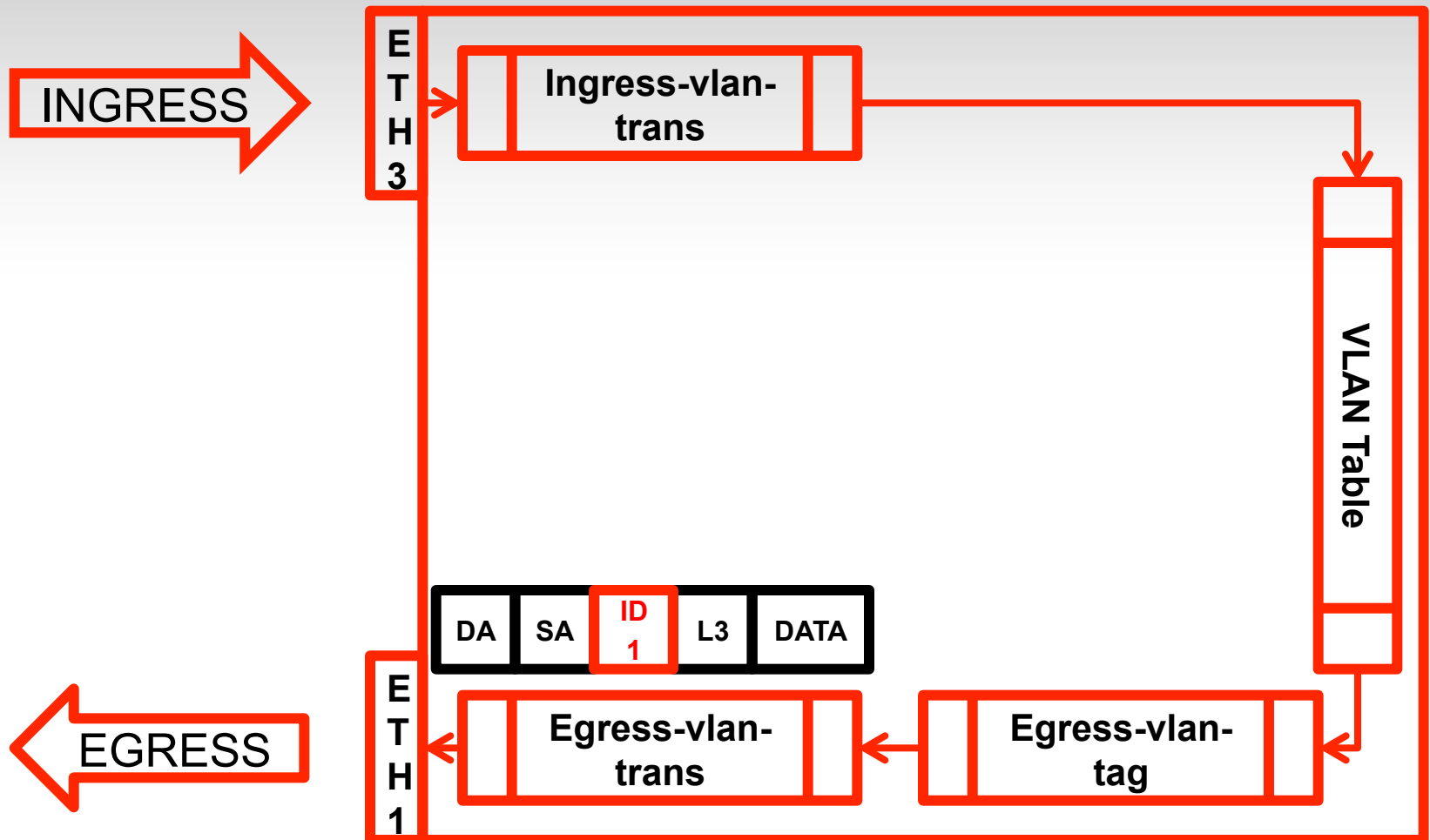
Logika CRS (15)

Untagged PC ke R1 tagged vid=1



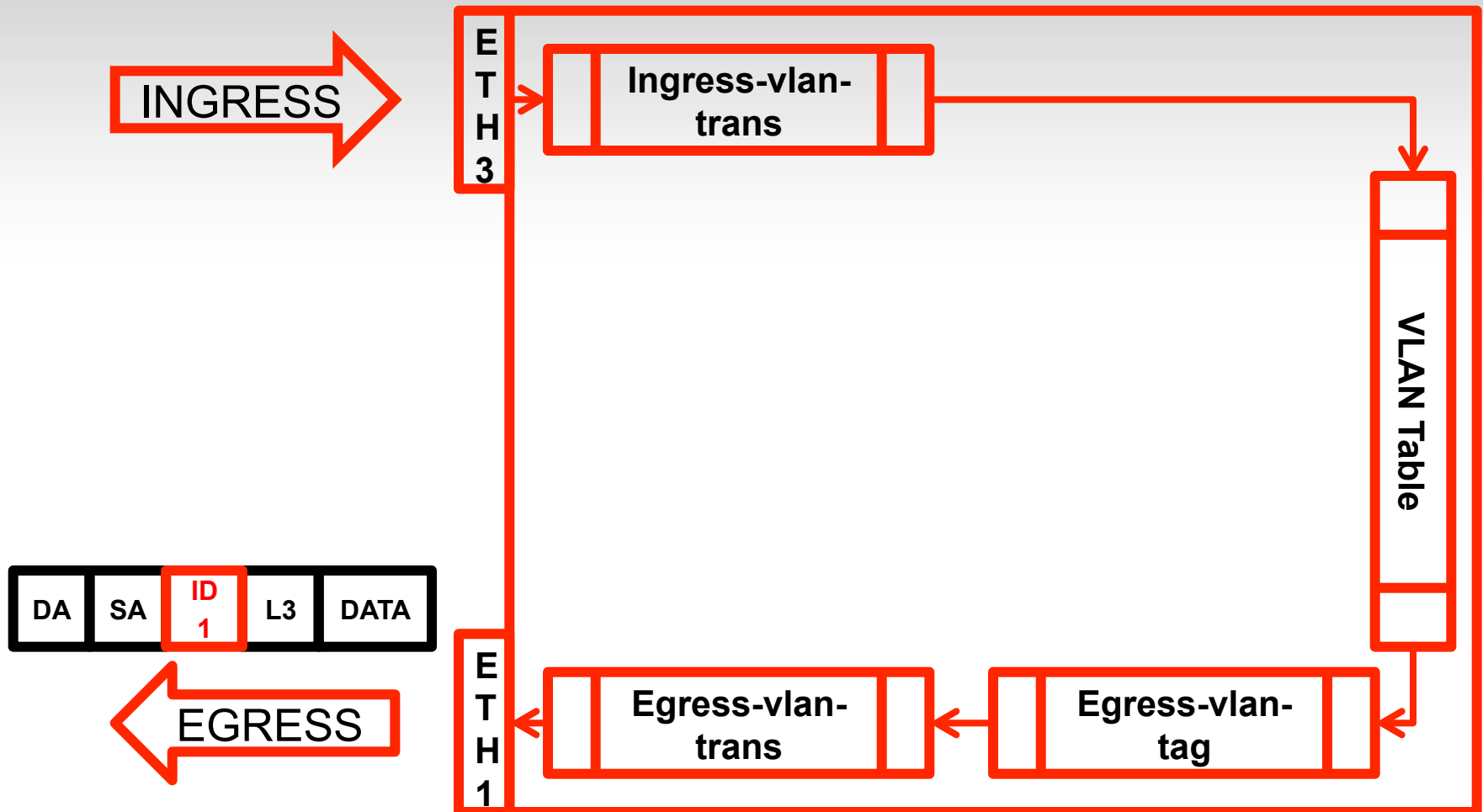
Logika CRS (16)

Untagged PC ke R1 tagged vid=1



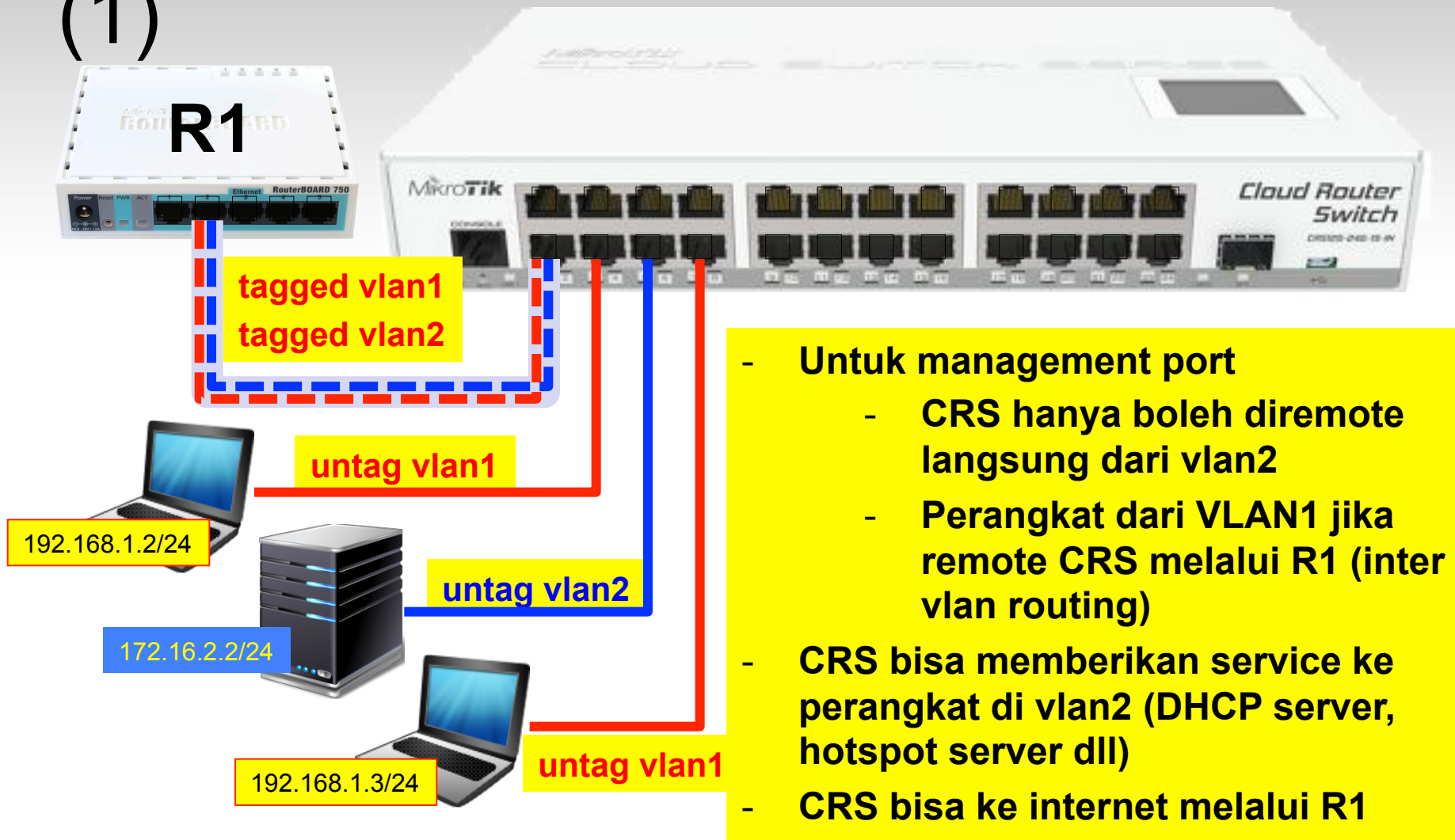
Logika CRS (17)

Untagged PC ke R1 tagged vid=1



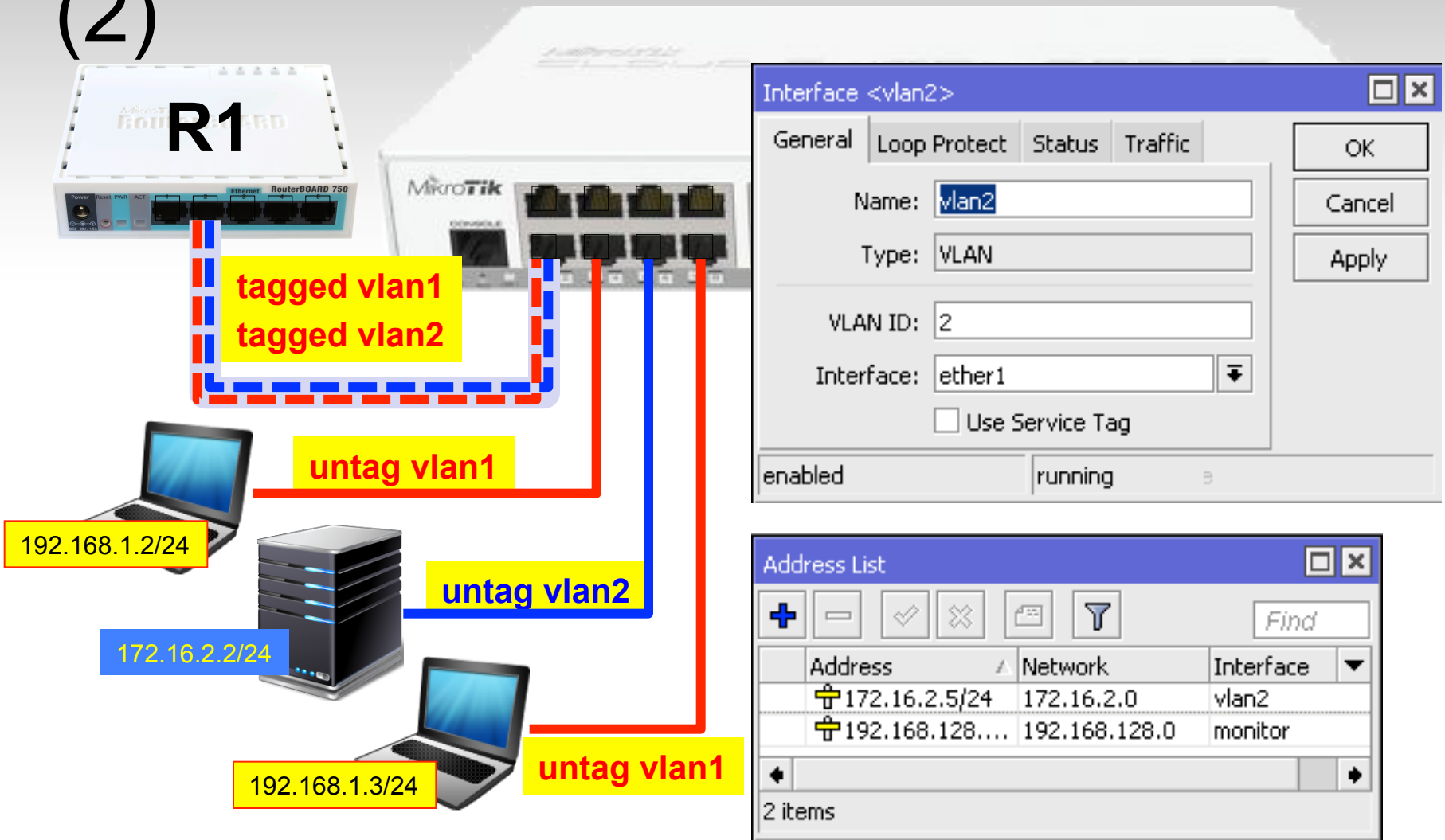
Contoh 3 - Komunikasi Switch

(1)



- Untuk management port
 - CRS hanya boleh diremote langsung dari vlan2
 - Perangkat dari VLAN1 jika remote CRS melalui R1 (inter vlan routing)
- CRS bisa memberikan service ke perangkat di vlan2 (DHCP server, hotspot server dll)
- CRS bisa ke internet melalui R1

Contoh 3 - Komunikasi Switch (2)



Contoh 3 - Komunikasi Switch (3)

Switch VLAN

VLAN	Eg. VLAN Tag	In. VLAN Tran.	Eg. VLAN Tran.	1:1 VLAN Switching
+	-	✓	✗	📄
VLAN ID	Ports	SVL	SA Learn...	Flo
1	ether1, ether3, ether7	no	yes	no
2	ether1, ether5, switch1-cpu	no	yes	no
4095	ether0, ether9, ether10, ether...	no	no	no

3 items

Switch VLAN <2>

VLAN ID: 2

Ports: ether1, ether5, switch1-cpu

SVL

SA Learning

Flood

Ingress Mirror

QoS Group: none

enabled

OK, Cancel, Apply, Disable, Comment, Copy, Remove

Contoh 3 - Komunikasi Switch (4)

Switch VLAN

VLAN	Eg. VLAN Tag	In. VLAN Tran.	Eg. VLAN Tran.	1:1 VLAN Sw
1	ether1			
2	ether1, switch1-cpu			

3 items (1 selected)

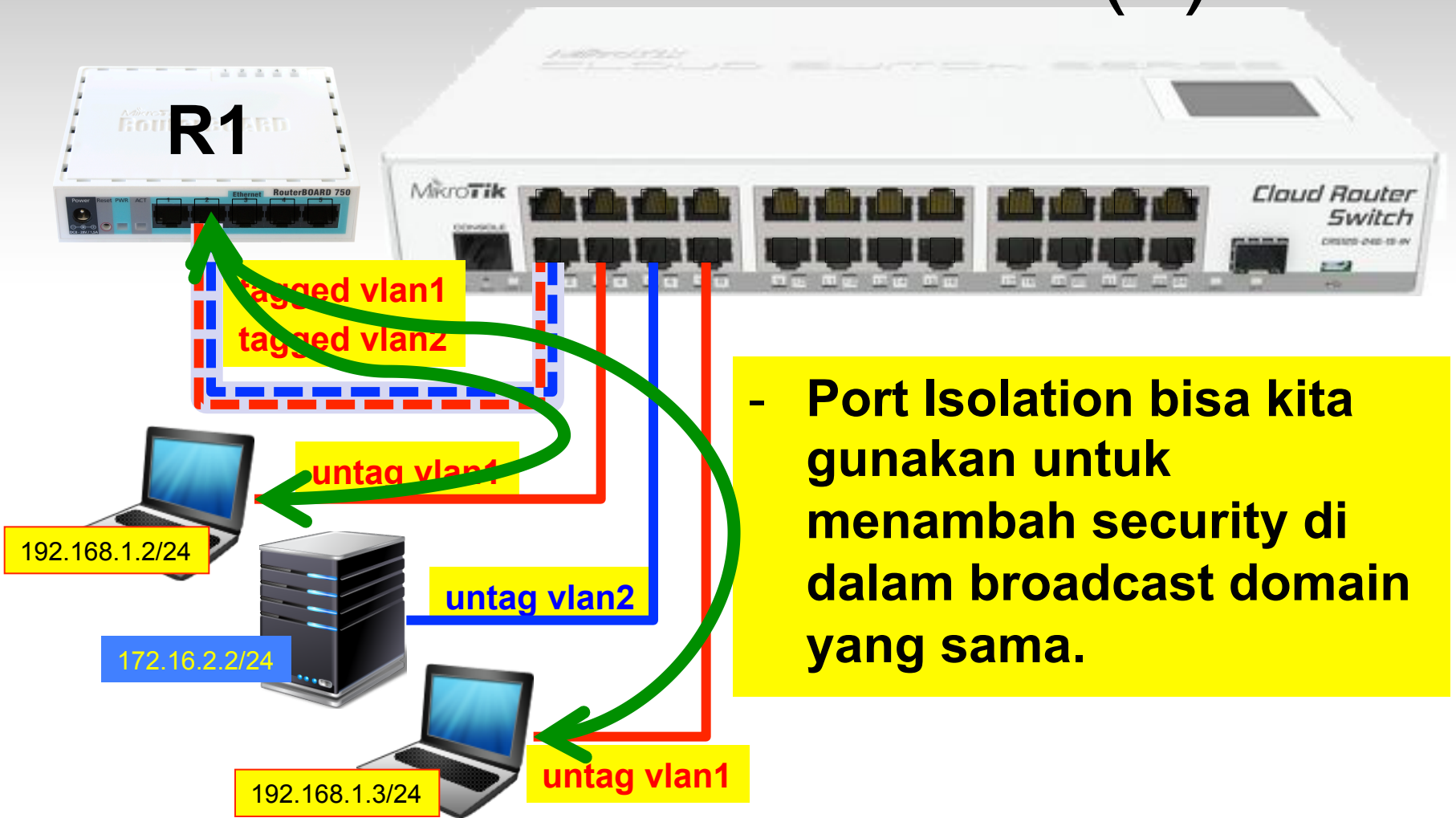
Switch Egress Tag VLAN <2>

VLAN ID: 2

Tagged Ports: ether1, switch1-cpu

enabled

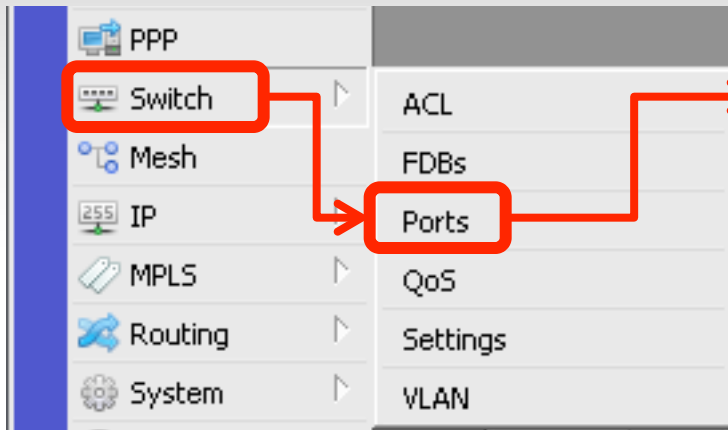
Contoh 4 - Port Isolation (1)



Isolation Port

- Pada CRS, kita bisa menerapkan isolation berdasarkan profile di masing-masing port sesuai kebutuhan misalnya
 - Promiscuous Port (profile 0), digunakan pada Trunk port agar frame dari trunk port bisa ke semua port
 - Isolated Port (profile 1), digunakan untuk port yang hanya bisa akses ke trunk port
 - Community port (profile 2-31), digunakan untuk membentuk custom group

Contoh 4 - Port Isolation (2)



A screenshot of the Mikrotik WinBox 'Switch Ports' window. The 'Ports' tab is selected. A table lists various ports and their isolation profiles. The 'Isolation Profile' column is highlighted with a red box. The table shows the following data:

Name	VLAN	Type	Isolation Profile	Isolation Prof...
ether1	29	network port	0 (promiscuous)	
ether3	29	network port	1 (isolated)	
ether5	29	network port	1 (isolated)	
ether7	29	network port	1 (isolated)	
ether2	30	network port		
ether4	30	network port		
ether6	30	network port		
ether8	30	network port		
ether9	30	network port		
ether10	30	network port		
ether11	30	network port		
ether12	30	network port		
ether13	30	network port		
ether14	30	network port		
ether15	30	network port		

26 items (1 selected)

Contoh 4 - Port Isolation (3)

Switch Port <ether1>

Generic Ingress VLAN Egress VLAN Mirroring QoS Queues TPIDs Counters

Name: ether1

VLAN Type: network port

Isolation Profile: 29

Isolation Profile Override: 0 (promiscuous)

TRUNK

Isolated

Switch Port <ether3>

Generic Ingress VLAN Egress VLAN Mirroring QoS Queues TPIDs Counters

Name: ether3

VLAN Type: network port

Isolation Profile: 29

Isolation Profile Override: 1 (isolated)

Switch Port <ether7>

Generic Ingress VLAN Egress VLAN Mirroring QoS Queues TPIDs Counters

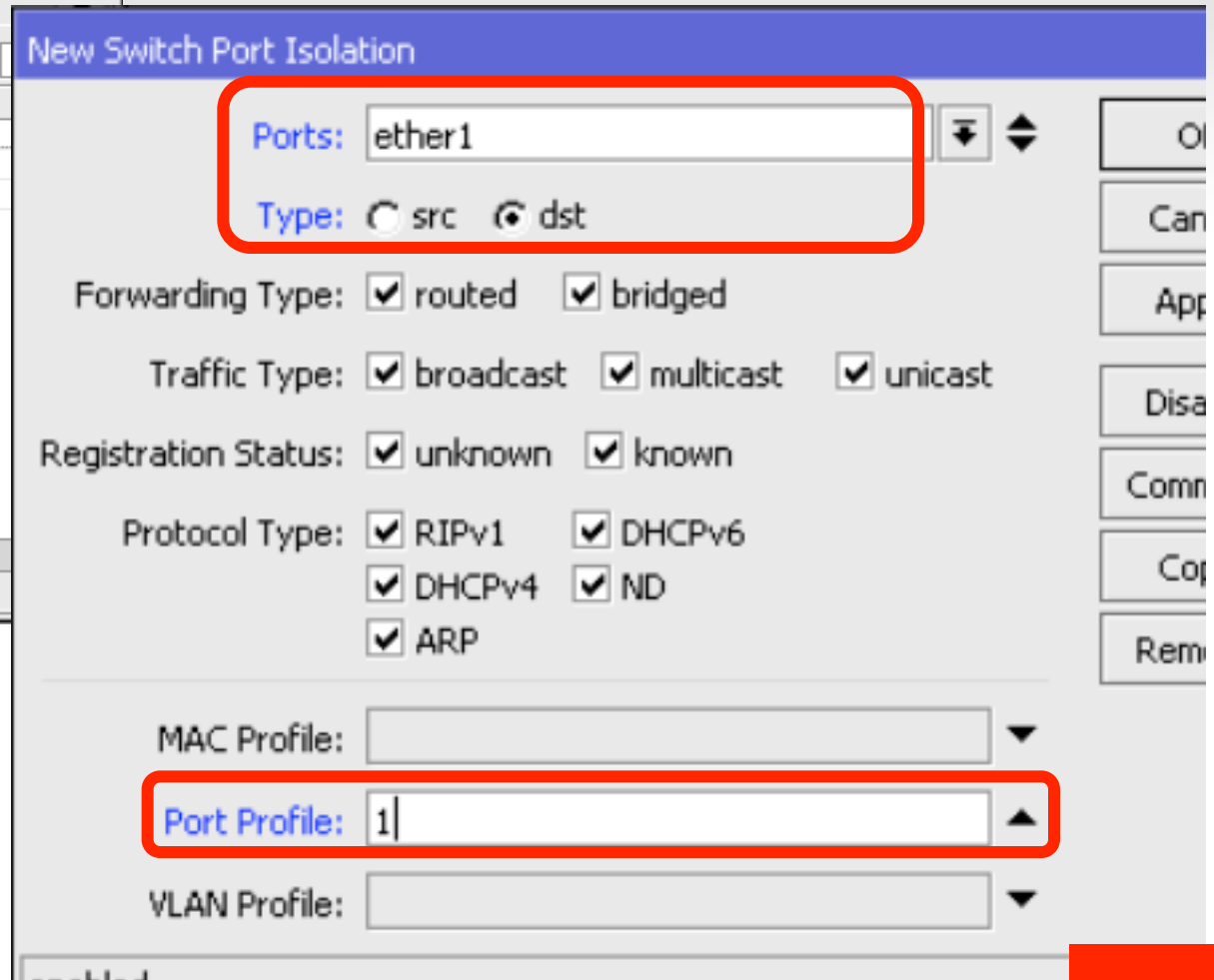
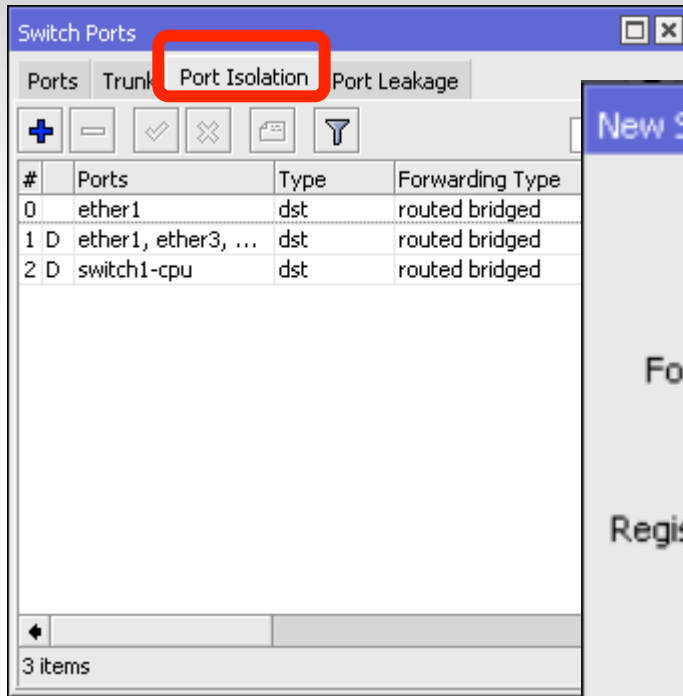
Name: ether7

VLAN Type: network port

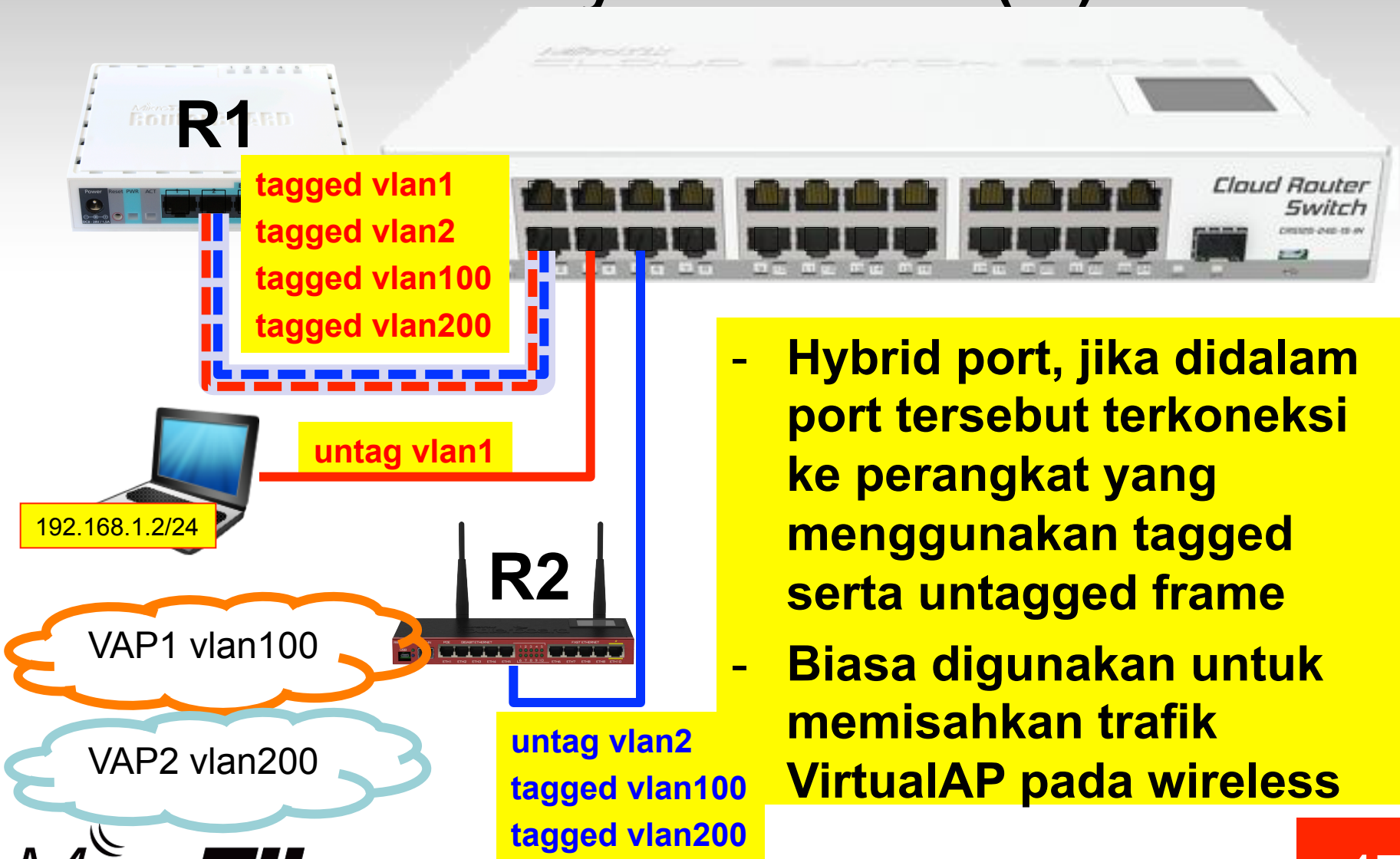
Isolation Profile: 29

Isolation Profile Override: 1 (isolated)

Contoh 4 - Port Isolation (4)



Contoh 5 - Hybrid Port (1)



- Hybrid port, jika didalam port tersebut terkoneksi ke perangkat yang menggunakan tagged serta untagged frame
- Biasa digunakan untuk memisahkan trafik VirtualAP pada wireless

Contoh 5 - Hybrid Port (2)

R1

The screenshot shows two windows in Mikrotik WinBox for router R1. The top window is 'Interface List' with the 'VLAN' tab selected. It displays a table with 4 items:

Name	Type	VLAN ID	Interface
vlan1	VLAN	1	ether1
vlan2	VLAN	2	ether1
vlan100	VLAN	100	ether1
vlan200	VLAN	200	ether1

The bottom window is 'Address List' showing 6 items:

Address	Network	Interface
172.16.1.1/24	172.16.1.0	vlan1
172.16.2.1/24	172.16.2.0	vlan2
172.16.100.1/24	172.16.100.0	vlan100
172.16.200.1/24	172.16.200.0	vlan200

R2

The screenshot shows two windows in Mikrotik WinBox for router R2. The top window is 'Interface List' with the 'VLAN' tab selected. It displays a table with 2 items:

Name	Type	VLAN ID	Interface
vlan100	VLAN	100	ether1
vlan200	VLAN	200	ether1

The bottom window is 'Address List' showing 2 items:

Address	Network	Interface
172.16.2.3/24	172.16.2.0	ether1
192.168.128....	192.168.128.0	ether2

Contoh 5 - Hybrid Port (2)

CRS

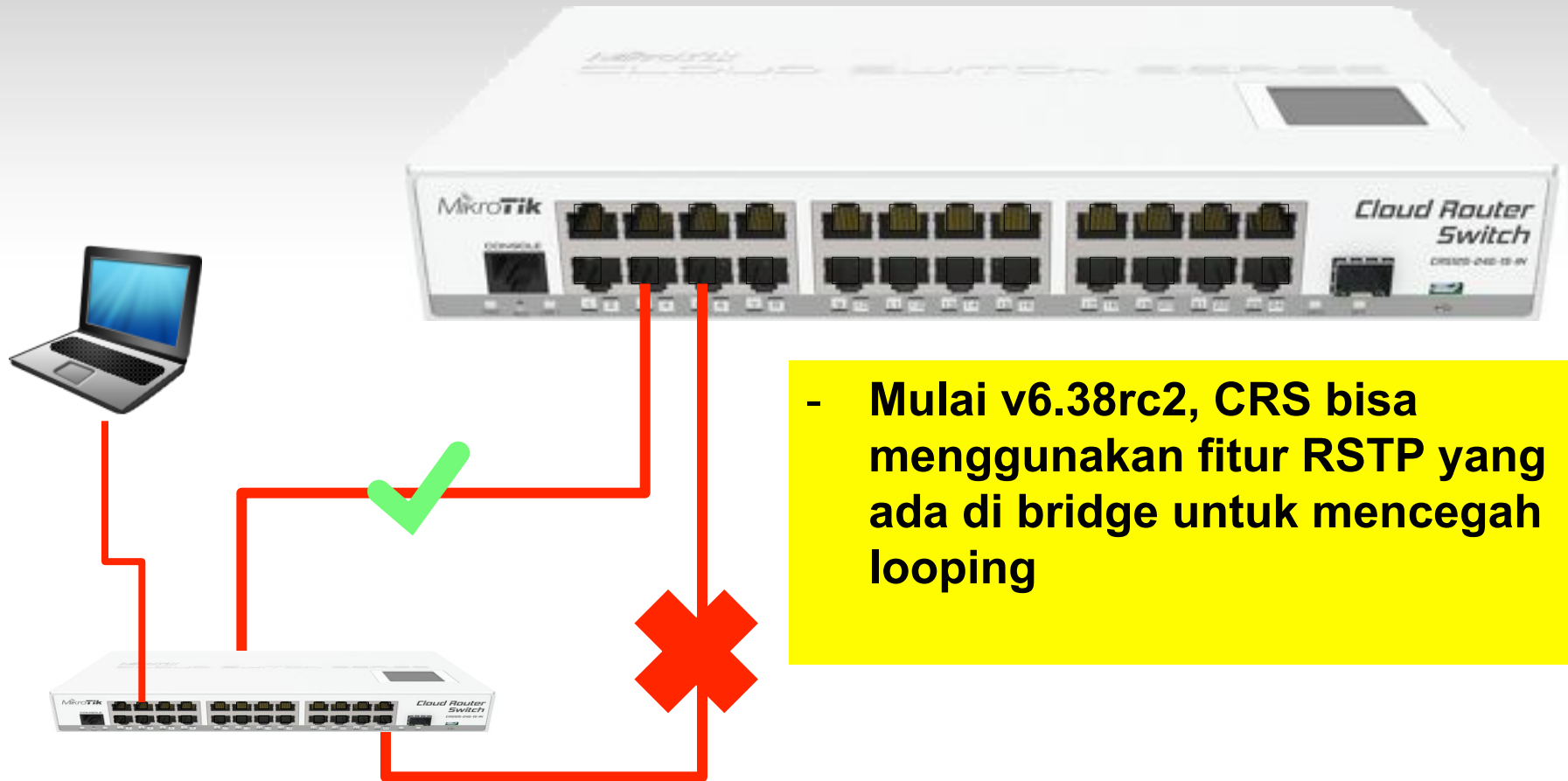
VLAN	Eg. VLAN Tag	In. VLAN Tran.	Eg. VLAN Tran.	...
+	-	✓	✗	Find
VLAN ID	Ports	SVL	SA ...	f
1	ether1, ether3, ether7	no	yes	no
2	ether1, ether5, switch1-cpu	no	yes	no
100	ether1, ether5	no	yes	no
200	ether1, ether5	no	yes	no
D	4095 ether2, ether4, ether6, ether...	no	no	no

5 items (2 selected)

VLAN	Eg. VLAN Tag	In. VLAN Tran.	Eg. VLAN Tran.	...
+	-	✓	✗	Find
VLAN ID	Tagged Ports			
1	ether1			
2	ether1, switch1-cpu			
100	ether1, ether5			
200	ether1, ether5			
D	4095			

5 items (2 selected)

Contoh 6 - Loop Protection (1)



- Mulai v6.38rc2, CRS bisa menggunakan fitur RSTP yang ada di bridge untuk mencegah looping

Contoh 6 - Loop Protection (2)

The image shows two overlapping windows from the Mikrotik WinBox interface. The background window is titled 'Interface <bridge-for-switching>' and has tabs for 'General', 'STP', 'Status', and 'Traffic'. The 'General' tab is active, showing fields for Name (bridge-for-switching), Type (Bridge), MTU, Actual MTU (1500), L2 MTU (65535), MAC Address, ARP (enabled), ARP Timeout, and Admin. MAC Address. The foreground window is titled 'New Interface' and has tabs for 'General', 'STP', 'Status', and 'Traffic'. The 'STP' tab is active, showing 'Protocol Mode' with radio buttons for 'none', 'stp', and 'rstp' (selected). Other fields include 'Priority' (8000 hex), 'Max Message Age' (00:00:20), 'Forward Delay' (00:00:15), 'Transmit Hold Count' (6), and 'Ageing Time' (00:05:00). Buttons for 'OK', 'Cancel', 'Apply', 'Disable', 'Comment', 'Copy', 'Remove', and 'Torch' are visible on the right side of the 'New Interface' window.

Interface <bridge-for-switching>

General STP Status Traffic

Name: bridge-for-switching

Type: Bridge

MTU:

Actual MTU: 1500

L2 MTU: 65535

MAC Address:

ARP: enabled

ARP Timeout:

Admin. MAC Address:

OK

Cancel

Apply

New Interface

General STP Status Traffic

Protocol Mode: none stp rstp

Priority: 8000 hex

Max Message Age: 00:00:20

Forward Delay: 00:00:15

Transmit Hold Count: 6

Ageing Time: 00:05:00

OK

Cancel

Apply

Disable

Comment

Copy

Remove

Torch

Contoh 6 - Loop Protection (3)

The image shows two screenshots from Mikrotik WinBox. The left screenshot displays the 'Bridge' configuration window with a table of ports. The right screenshot shows the 'New Bridge Port' dialog box.

Bridge Configuration Table:

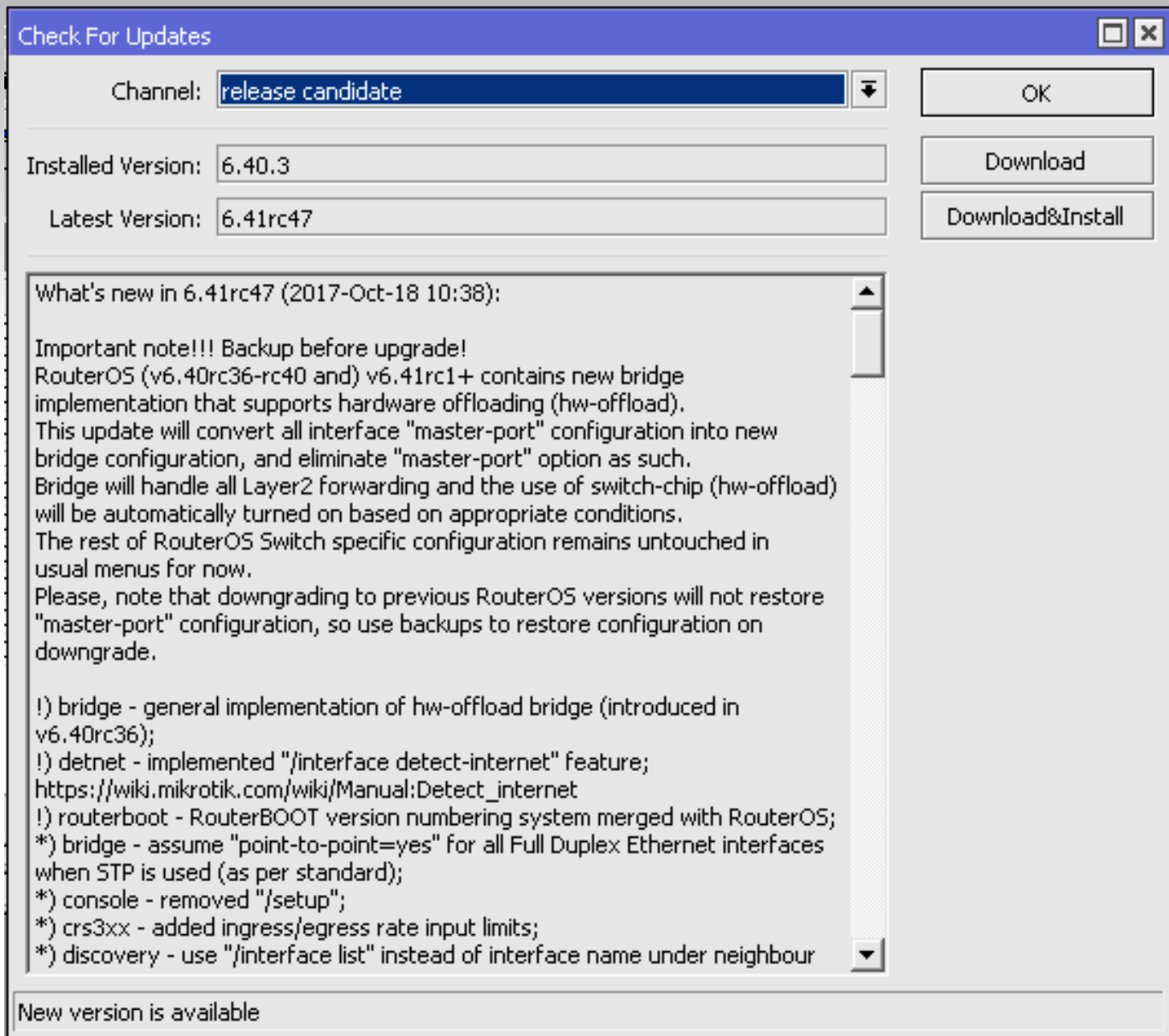
Interface	Bridge	Role
ether1	bridge-for-switch...	designated port
D ether3	bridge-for-switch...	backup port
DI ether5	bridge-for-switch...	disabled port
D ether7	bridge-for-switch...	designated port

New Bridge Port Dialog (General Tab):

- Interface: ether1
- Bridge: bridge-for-switching
- Priority: 80 (hex)
- Path Cost: 10
- Horizon: (dropdown)
- Edge: auto
- Point To Point: auto
- External FDB: auto

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

Cukup masterport yang dimasukkan ke dalam bridge port, otomatis slave-port akan ditambahkan



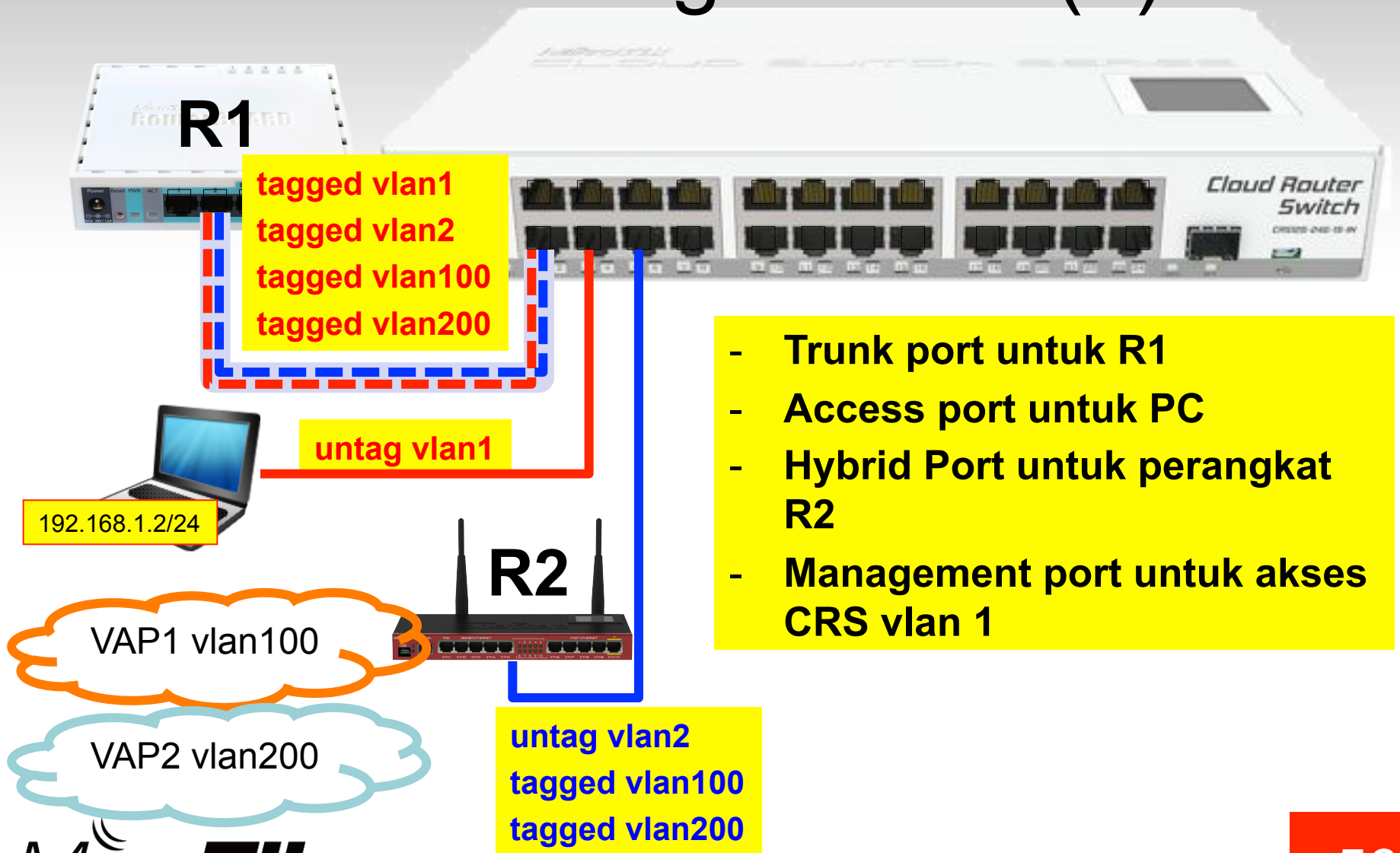
HW-Offloading

- Mulai versi 6.40rc36, Interface bridge pada RouterOS akan handle L2 Forwarding dan bisa menggunakan switch-chip (Hw-offloading) jika kondisi memungkinkan
- Tidak ada lagi pengaturan masterport pada interface
- Hati-hati jika sudah diupgrade ke versi baru, jika di downgrade tidak akan otomatis menggunakan setting masterport

Fitur HW-Offload

Switch Routerboard	Switch Menu	Bridge R/STP	Bridge MSTP	Bridge IGMP Snoop	Bridge VLAN Filtering	Bonding
CRS3xx	Y	Y	Y	Y	Y	N
CRS1xx	Y	Y	N	Y	N	N
CRS2xx	Y	Y	N	N	N	N
QCA8377	Y	Y	N	N	N	N
AR8327	Y	Y	N	N	N	N
AR8227	Y	Y	N	N	N	N
AR8316	Y	Y	N	N	N	N
AR7240	Y	Y	N	N	N	N
MT7621	Y	N	N	N	N	N
RTL8367	Y	N	N	N	N	N
ICPlus175D	Y	N	N	N	N	N

Contoh 7 - Bridge VLAN (1)



Contoh 7 - Bridge VLAN (2)

The screenshot displays the Mikrotik WinBox interface for configuring a bridge. The main window shows a list of bridges with the following data:

Name	Type	L2 MTU	Tx	Rx
bridge-mainan-vlan	Bridge	1588	0 bps	0

Below the table, it indicates "1 item out of 32 (1 selected)".

Two configuration panels are overlaid on the right side:

- Interface <bridge-mainan-vlan> - General:** This panel shows the configuration for the bridge interface. The "Name" is "bridge-mainan-vlan", "Type" is "Bridge", "MTU" is empty, "Actual MTU" is 1500, "L2 MTU" is 65535, "MAC Address" is A2:E2:C3:FC:F8:31, and "ARP" is enabled.
- Interface <bridge-mainan-vlan> - VLAN:** This panel shows the configuration for the VLAN on the interface. The "VLAN Filtering" checkbox is unchecked, and the "PVID" is set to 1.

Contoh 7 - Bridge VLAN (3)

The screenshot displays the Mikrotik WinBox interface for configuring a bridge. The main window shows the 'Bridge' configuration page with tabs for Bridge, Ports, VLANs, MSTIs, Port MST Overrides, Filters, NAT, Hosts, and MDB. A search filter is applied to the bridge list: 'Bridge' contains 'bridge-mainan-vlan'. The resulting table shows three bridge ports:

#	Interface	Bridge	Hardware Offload	PVID	Hw. Offload
16	ether1	bridge-mainan-vlan	yes	1	yes
17	ether3	bridge-mainan-vlan	yes	1	yes
18	ether5	bridge-mainan-vlan	yes	2	yes

Below the table, it indicates '3 items out of 19 (1 selected)'. A secondary window, 'Bridge Port <ether1>', is open, showing the configuration for the selected port. The 'General' tab is active, and the 'Hardware Offload' checkbox is checked and highlighted with a red box.

Bridge Port <ether1> configuration details:

- Interface: ether1
- Bridge: bridge-mainan-vlan
- Horizon: (empty)
- External FDB: auto
- Hardware Offload

Contoh 7 - Bridge VLAN (4)

Bridge Port <ether3>

General STP VLAN Status

Interface: ether3

Bridge: bridge-mainan-vlan

Horizon: [dropdown]

External FDB: auto

Hardware Offload

Bridge Port <ether3>

General STP VLAN Status

PVID: 1

Frame Types: admit all

Ingress Filtering

Bridge Port <ether5>

General STP VLAN Status

Interface: ether5

Bridge: bridge-mainan-vlan

Horizon: [dropdown]

External FDB: auto

Hardware Offload

Bridge Port <ether5>

General STP VLAN Status

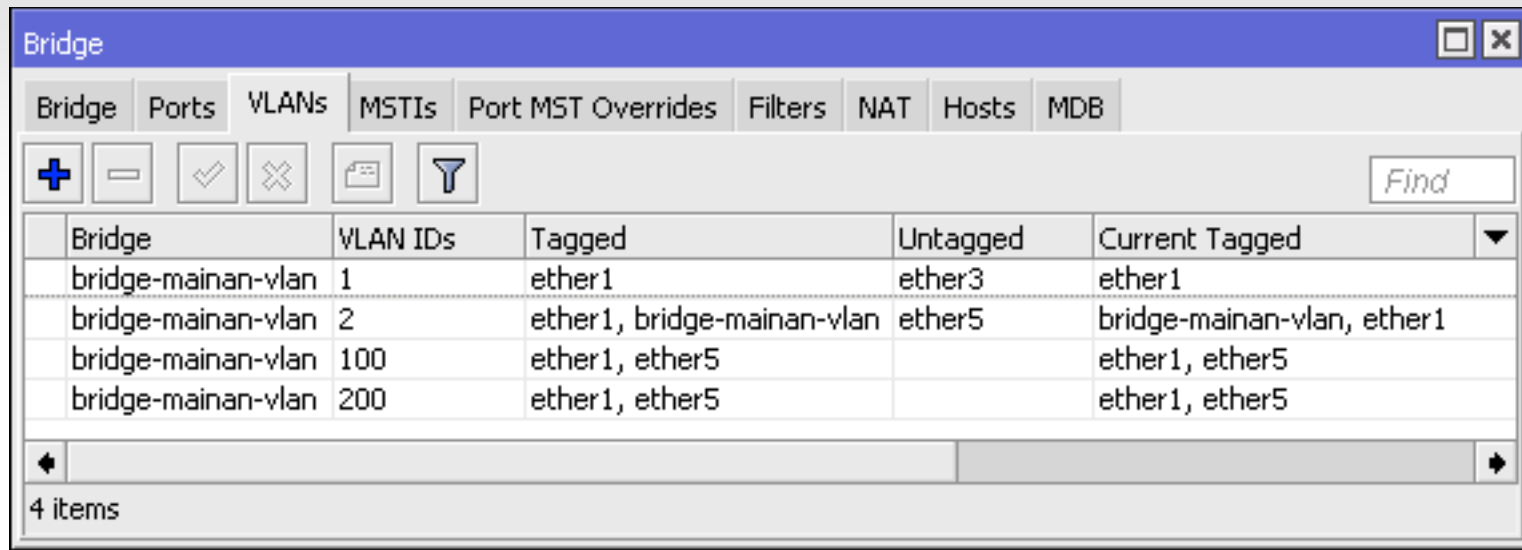
PVID: 2

Frame Types: admit all

Ingress Filtering

PVID digunakan untagged frame

Contoh 7 - Bridge VLAN (5)



The screenshot shows the Mikrotik WinBox interface for configuring Bridge VLANs. The 'VLANs' tab is selected, displaying a table with 4 items. The table columns are Bridge, VLAN IDs, Tagged, Untagged, and Current Tagged. The data rows are as follows:

Bridge	VLAN IDs	Tagged	Untagged	Current Tagged
bridge-mainan-vlan	1	ether1	ether3	ether1
bridge-mainan-vlan	2	ether1, bridge-mainan-vlan	ether5	bridge-mainan-vlan, ether1
bridge-mainan-vlan	100	ether1, ether5		ether1, ether5
bridge-mainan-vlan	200	ether1, ether5		ether1, ether5

di menu bridge-vlan, kita tentukan vlan membership dari masing-masing port

Contoh 7 - Bridge VLAN (6)

Bridge VLAN <1>

Bridge:

VLAN IDs:

Tagged:

Untagged:

Bridge VLAN <2>

Bridge:

VLAN IDs:

Tagged:

Untagged:

Bridge VLAN <100>

Bridge:

VLAN IDs:

Tagged:

Untagged:

Bridge VLAN <200>

Bridge:

VLAN IDs:

Tagged:

Untagged:

Contoh 7 - Bridge VLAN (7)

The screenshot displays the Mikrotik WinBox interface configuration for a bridge VLAN. It consists of three main windows:

- Interface List:** A table showing the configuration of various interfaces. The 'ether2' interface is selected.
- Interface <vlan2>:** A configuration window for the 'vlan2' interface, showing it is a VLAN type with ID 2, attached to the 'bridge-mainan-vlan' interface.
- Address List:** A table showing IP addresses assigned to the 'vlan2' interface.

Interface	Name	Type	Actual
R	bridge-mainan-vlan	Bridge	
R	vlan2	VLAN	
RS	ether1	Ethernet	
RS	ether2	Ethernet	
RS	ether3	Ethernet	
RS	ether4	Ethernet	
RS	ether5	Ethernet	
RS	ether6	Ethernet	
R	ether7	Ethernet	
RS	ether8	Ethernet	
RS	ether9	Ethernet	
RS	ether10	Ethernet	
RS	ether11	Ethernet	
RS	ether12	Ethernet	

General	Loop Protect	Status	Traffic
Name: <input type="text" value="vlan2"/>			
Type: <input type="text" value="VLAN"/>			
VLAN ID: <input type="text" value="2"/>			
Interface: <input type="text" value="bridge-mainan-vlan"/>			
<input type="checkbox"/> Use Service Tag			

Address List		
<input type="text" value="Find"/>		
Address	Network	Interface
<input type="checkbox"/> 172.16.2.5/24	172.16.2.0	vlan2
<input type="checkbox"/> 192.168.128....	192.168.128.0	monitoring

Contoh 7 - Bridge VLAN (8)

The screenshot shows the Mikrotik WinBox interface for configuring a bridge. The 'Bridge' window displays a table with the following data:

Name	Type	L2 MTU	Tx	Rx	Tx Pac...	Rx ...	FP Tx	FP R
bridge-mainan-vlan	Bridge	1588	0 bps	0 bps	0	0	0 bps	

The 'Interface <bridge-mainan-vlan>' window is open, showing the 'VLAN' tab. The 'VLAN Filtering' checkbox is checked, and the 'PVID' is set to 1.

- VLAN filtering diaktifkan **sesudah** semua vlan dibuat
- Berfungsi supaya bridge mengenali vlan dan bisa memodifikasi frame

Tips

- Meskipun di Bridge juga terdapat fitur VLAN, fitur Switch saat ini juga masih bisa digunakan
- Biasakan untuk menyisakan 1 port yang tidak masuk bridge / switch
- Biasakan menggunakan ROS versi sama
- Jika melakukan perubahan konfigurasi switch dan tidak berjalan, Flush table FDB switch
- Pada versi ini, fungsi VLAN pada bridge masih belum bisa menggunakan HW-Offload, gunakan menu switch pada CRS1xx series
- Gunakan CRS untuk switch 😊

Thank You!

Dijinkan menggunakan sebagian atau seluruh materi pada modul ini, baik berupa ide, foto, tulisan, konfigurasi dan diagram selama untuk kepentingan pengajaran, dan memberikan kredit kepada penulis serta link ke www.mikrotik.co.id

