



VLAN and IEEE 802.1Q standard

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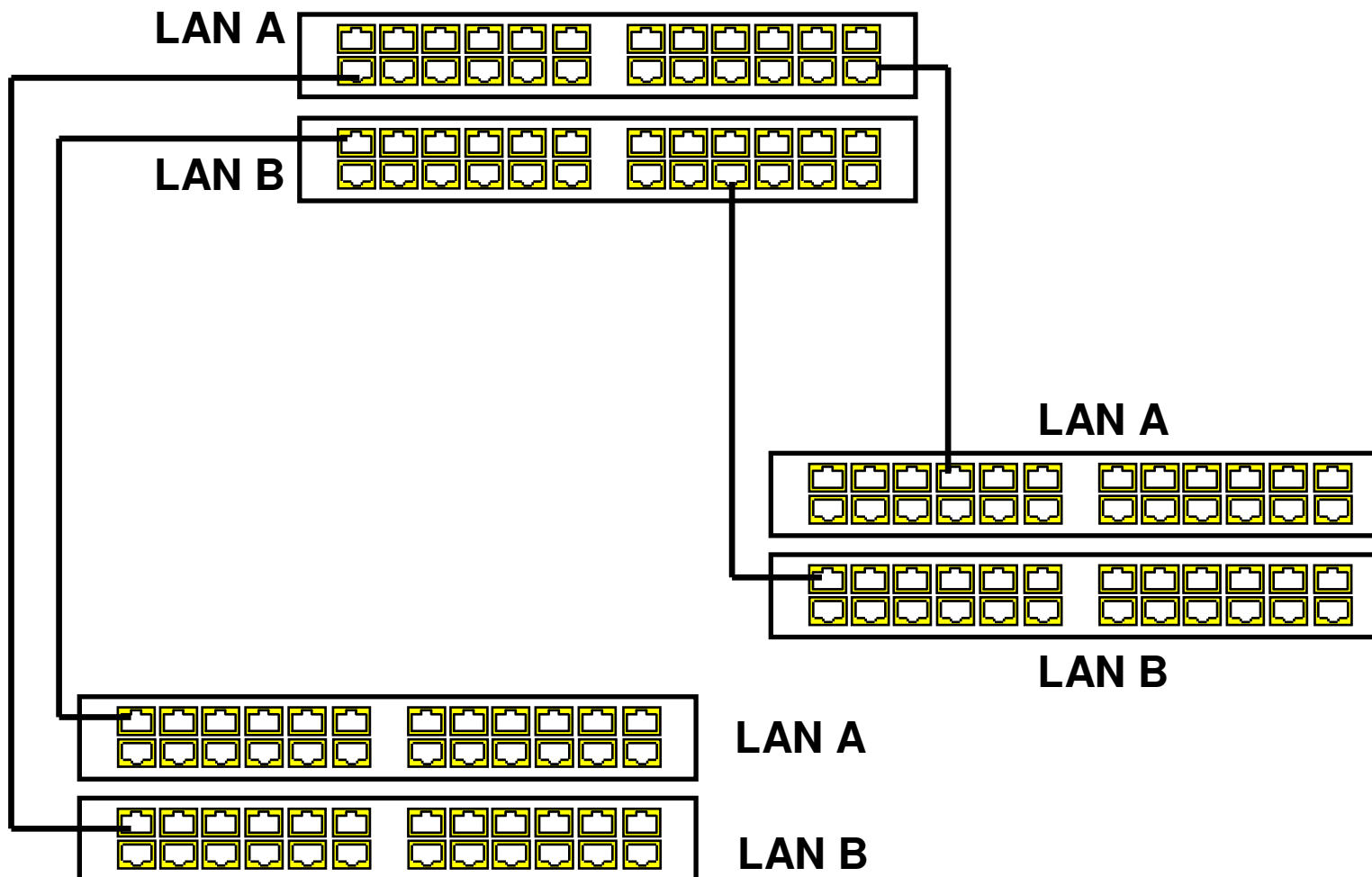


Parallel independent LANs

- Need of separated parallel LANs for privacy and security purpose
 - $n\text{LAN} = n\text{Media} + n\text{Equipment}$ per any distribution point
 - Hardware waste
 - Maximum LAN separation



Parallel independent LANs example





Virtual LAN (VLAN)

- Possibility to realize virtually independent parallel LAN
 - Unique Physical infrastructure
 - LAN virtually or logically separated
- VLAN can be implemented
 - On a single switch
 - On entire extended LAN
- VLAN advantages
 - High flexibility
 - Hardware saving



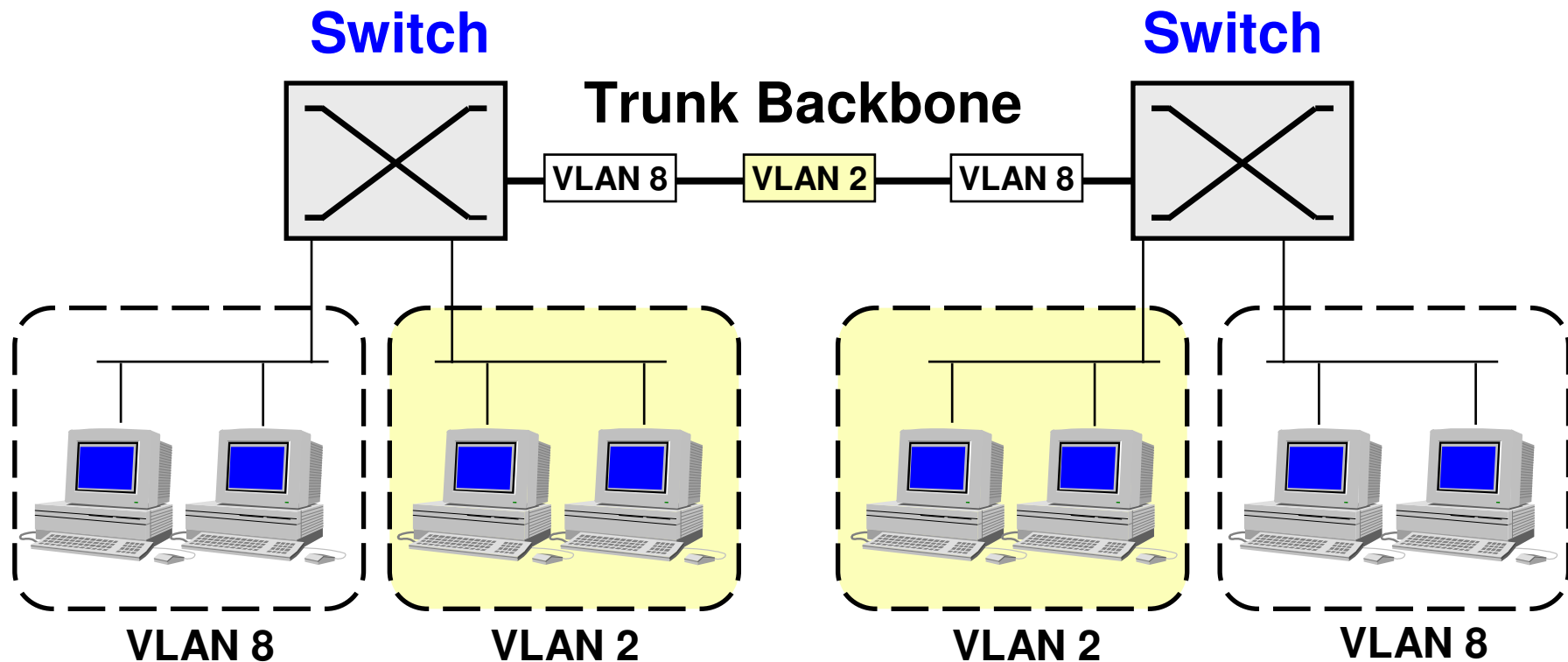
Why VLAN

- Security or privacy purpose
 - Separated VLAN
 - No communication between VLAN
 - VLAN connection enough secure with Access-List configuration on router, Layer 3 Switch or Firewall
- To limit or reduce the broadcast domain
 - VLAN communication trough router or Layer 3 Switch



VLAN Inter-Switch

- VLAN configuration on the switches
 - Need classify packet per VLAN
 - VLAN tagging





VLAN tagging

■ Frame Tagging

■ Encapsulation technique

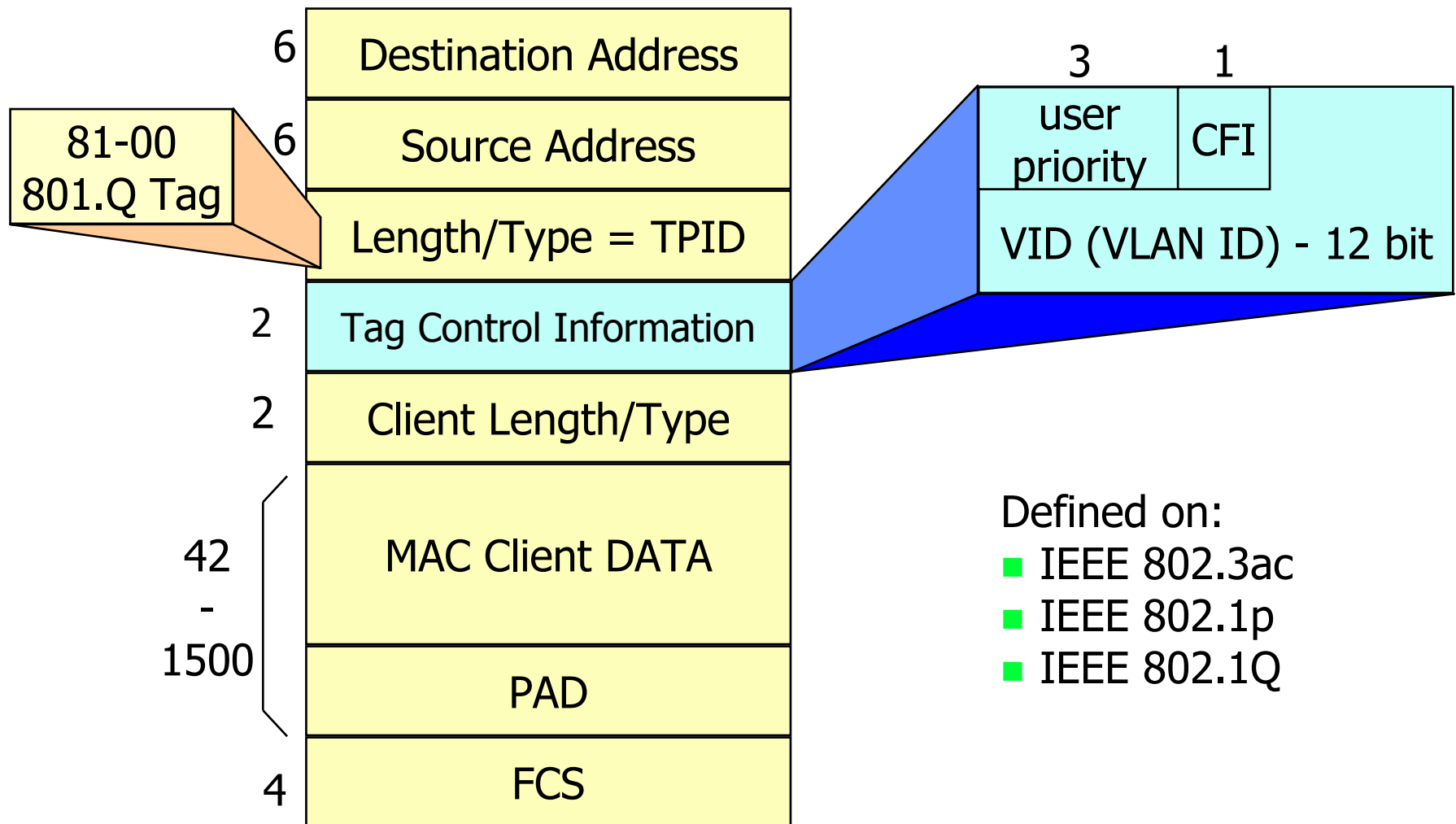
- Ethernet, Token Ring or FDDI frame are encapsulated on VLAN frame
- ISL (Inter Switch Link) Cisco proprietary solution

■ Packet Tagging

- The original Ethernet frame is modified by adding an header witch contain VLAN-ID
- Technique adopted by IEEE 802.1Q standard



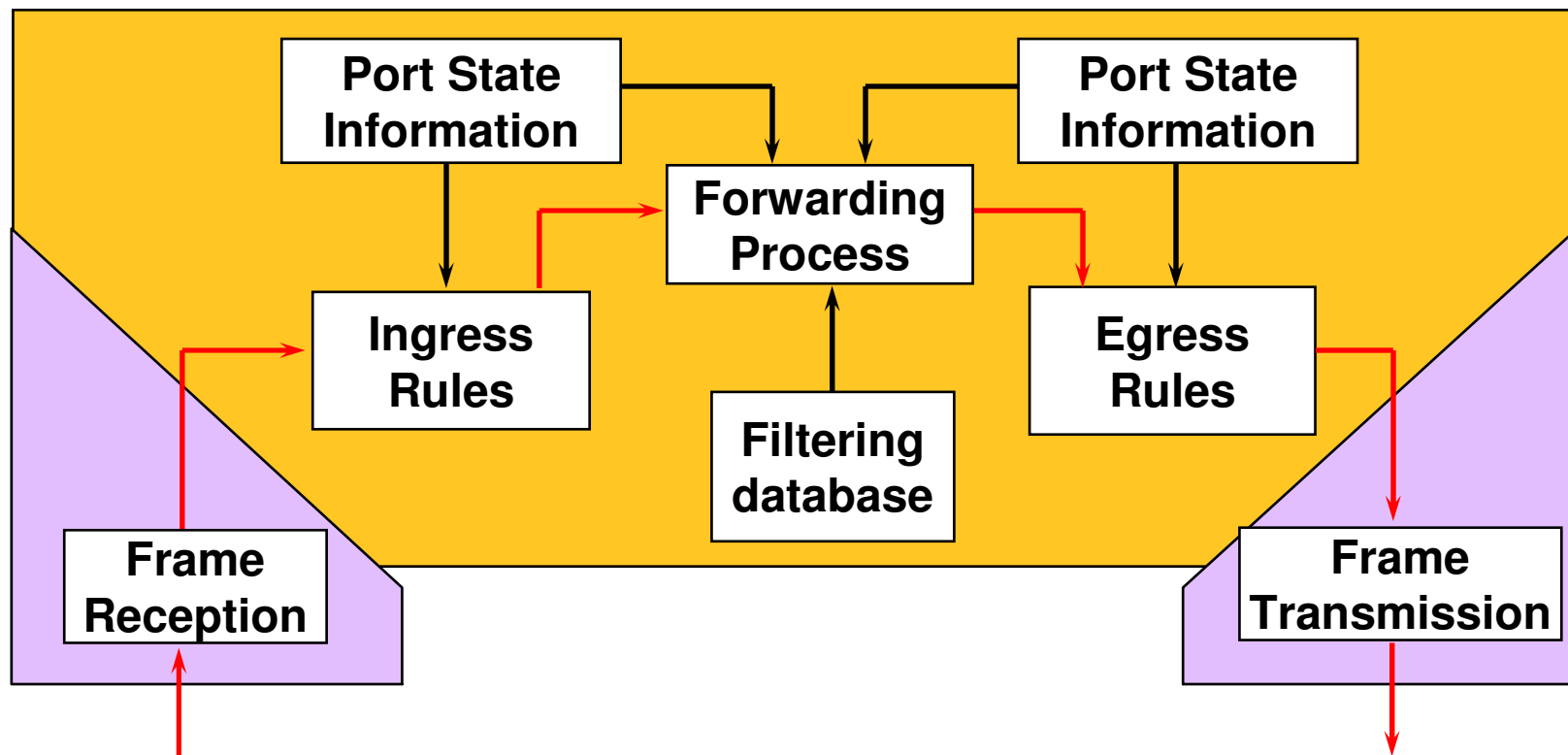
IEEE 802.1Q tagging



- Defined on:
- IEEE 802.3ac
 - IEEE 802.1p
 - IEEE 802.1Q



Bridge 802.1Q



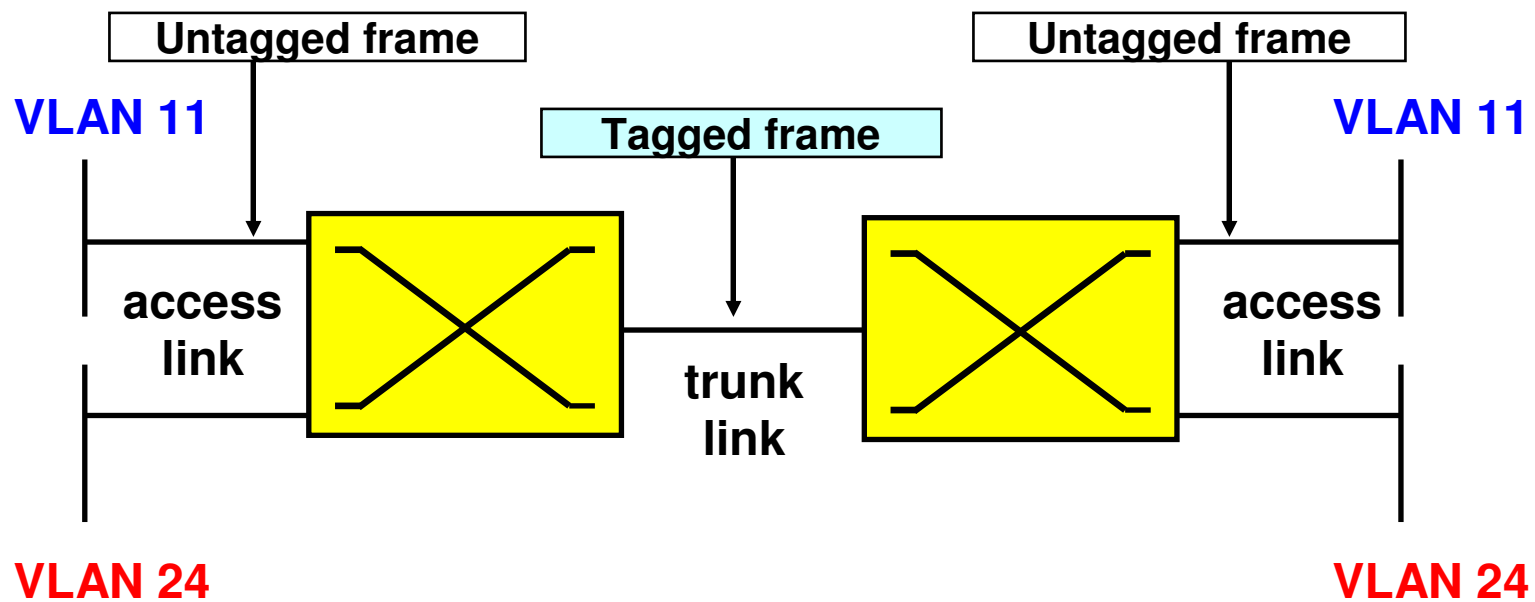


IEEE 802.1Q characteristics

- Per port based VLAN assignment
- Unique spanning tree
- Multiple filtering database identified by FID (Filtering Identifier)
 - Can exist only one entry per MAC address on filtering database
 - A MAC Address may be present in different filtering database



Port-based VLAN





Equipment e Link type

- Equipment:
 - VLAN-Aware manage tagged and untagged frames
 - VLAN-Unaware don't manage tagged frames
- Access link:
 - Receive and transmit Untagged frames
 - default port configuration on the switch
- Trunk link:
 - Receive and transmit Tagged frames



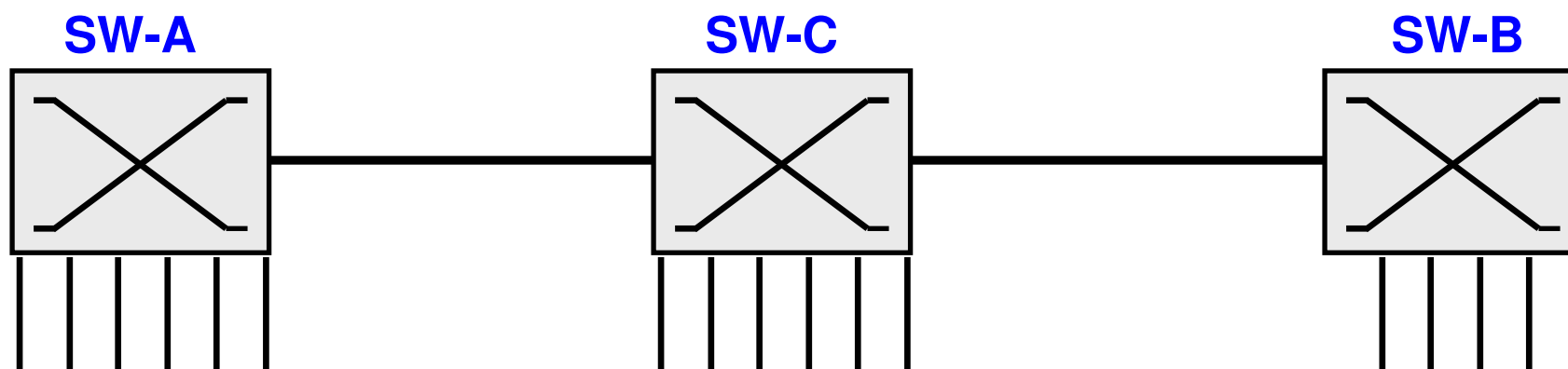
VLAN configuration on the switch

- 3 typical steps:
 - VLAN creation on the switch;
 - VLAN port association;
 - Trunk ports definition.



VLAN configuration example

- Network before VLAN configuration





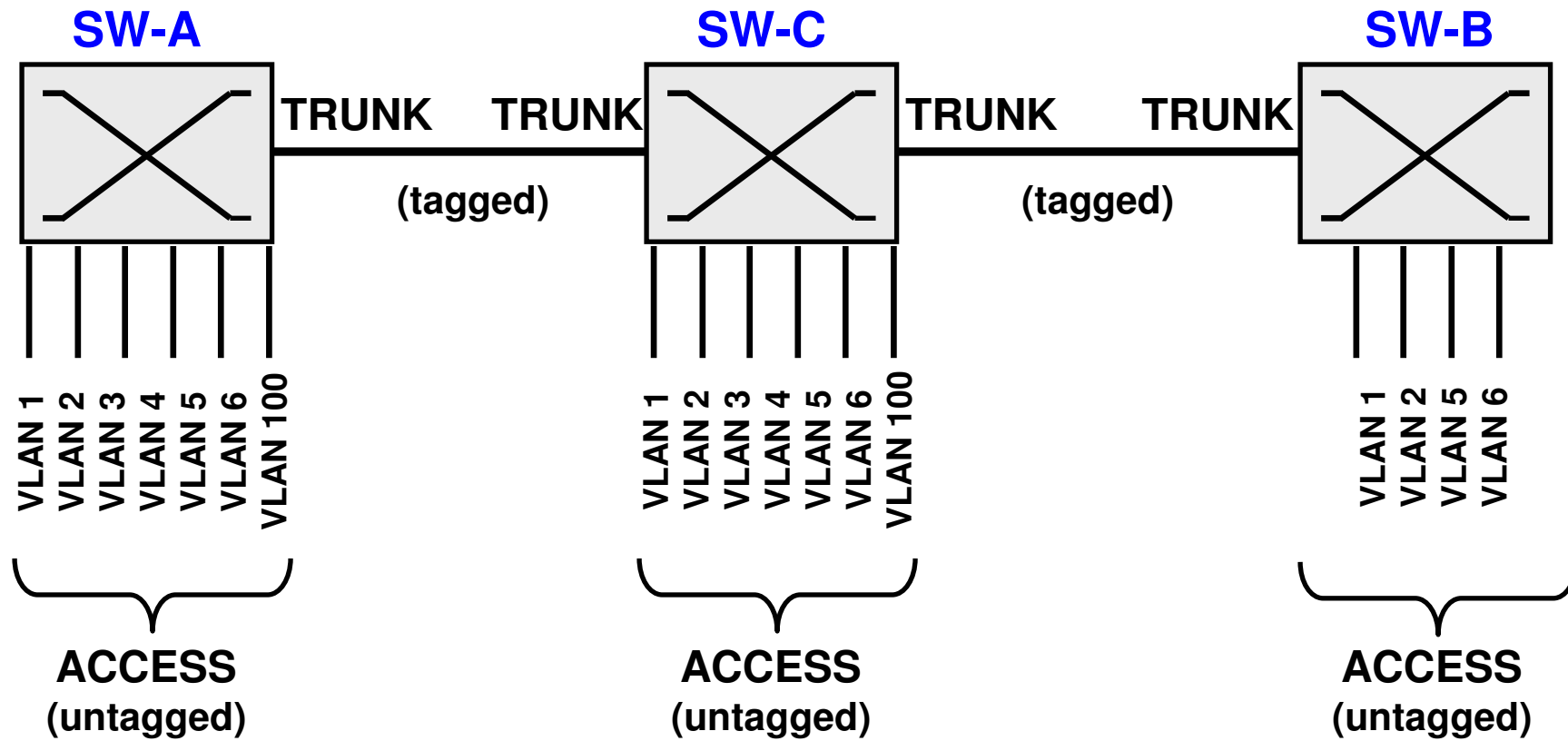
Ports association before VLAN configuration

```
SW-C#sho vlan brief
```

VLAN	Name	Status	Ports
1	default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4, Fa0/5, Fa0/6, Fa0/7, Fa0/8, Fa0/9, Fa0/10, Fa0/11, Fa0/12, Fa0/13, Fa0/14, Fa0/15, Fa0/16, Fa0/17, Fa0/18, Fa0/19, Fa0/20, Fa0/21, Fa0/22, Fa0/23, Fa0/24, Fa0/25, Fa0/26, Fa0/27, Fa0/28, Fa0/29, Fa0/30, Fa0/31, Fa0/32, Fa0/33, Fa0/34, Fa0/35, Fa0/36, Fa0/37, Fa0/38, Fa0/39, Fa0/40, Fa0/41, Fa0/42, Fa0/43, Fa0/44, Fa0/45, Fa0/46, Fa0/47, Fa0/48, Gi0/1, Gi0/2



VLAN to be created





VLAN Creation

```
SW-C#vlan database
Switch(vlan)#vlan 2 name Administration
VLAN 2 added:
    Name: Amministrazione
Switch(vlan)#vlan 3 name Selling
VLAN 3 added:
    Name: Vendite
Switch(vlan)#vlan 4 name test-1
VLAN 4 added:
    Name: prova-1
Switch(vlan)#vlan 5 name test-2
VLAN 5 added:
    Name: prova-2
Switch(vlan)#vlan 6 name test-3
VLAN 6 added:
    Name: prova-3
Switch(vlan)#vlan 100 name Production
VLAN 100 added:
    Name: Produzione
SW-Prova(vlan)#exit
APPLY completed.
Exiting....
SW-C#
```



Ports VLAN association

```
SW-Prova(config)#int fastEthernet 0/12
SW-Prova(config-if)#switchport access vlan 100
Switch(config-if)#exit

.....
SW-Prova(config)#int fastEthernet 0/16
SW-Prova(config-if)#switchport access vlan 2
SW-Prova(config-if)#exit

.....
SW-Prova(config)#int fastEthernet 0/20
SW-Prova(config-if)#switchport access vlan 3
SW-Prova(config-if)#exit

.....
SW-Prova(config)#int fastEthernet 0/24
SW-Prova(config-if)#switchport access vlan 4
SW-Prova(config-if)#exit

.....
SW-Prova(config)#int fastEthernet 0/28
SW-Prova(config-if)#switchport access vlan 5
SW-Prova(config-if)#exit

.....
SW-Prova(config)#int fastEthernet 0/32
SW-Prova(config-if)#switchport access vlan 6
SW-Prova(config-if)#exit
```



Ports and VLAN after switch configuration

```
SW-Prova#show vlan brief
```

VLAN	Name	Status	Ports
1	default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4, Fa0/5, Fa0/6, Fa0/7, Fa0/8, Fa0/9, Fa0/10, Fa0/11, Fa0/36, Fa0/37, Fa0/38, Fa0/39, Fa0/40, Fa0/41, Fa0/42, Fa0/43, Fa0/44, Fa0/45, Fa0/46, Fa0/47, Fa0/48, Gi0/1, Gi0/2
2	Administration	active	Fa0/16, Fa0/17, Fa0/18, Fa0/19
3	Selling	active	Fa0/20, Fa0/21, Fa0/22, Fa0/23
4	test-1	active	Fa0/24, Fa0/25, Fa0/26, Fa0/27
5	test-2	active	Fa0/28, Fa0/29, Fa0/30, Fa0/31
6	test-3	active	Fa0/32, Fa0/33, Fa0/34, Fa0/35
100	Production	active	Fa0/12, Fa0/13, Fa0/14, Fa0/15



Trunk port static configuration

- Trunk port static configuration without implementation of GVRP protocol

```
SW-C(config)#interface GigabitEthernet 0/1
SW-C(config-if)#switchport mode trunk
SW-C(config-if)#switchport trunk allowed vlan add 1,2,5,6
SW-C(config-if)#exit
SW-C(config)#interface GigabitEthernet 0/2
SW-C(config-if)#switchport mode trunk
SW-C(config-if)#switchport trunk allowed vlan all
```



GVRP protocol

- Garp VLAN Registration Protocol (GVRP)
 - Use to register or cancel dynamically VLAN attribute on the switches
 - Participate to STP active topology



GVRP frame format

