Virtual LANS and Trunking

Objectives

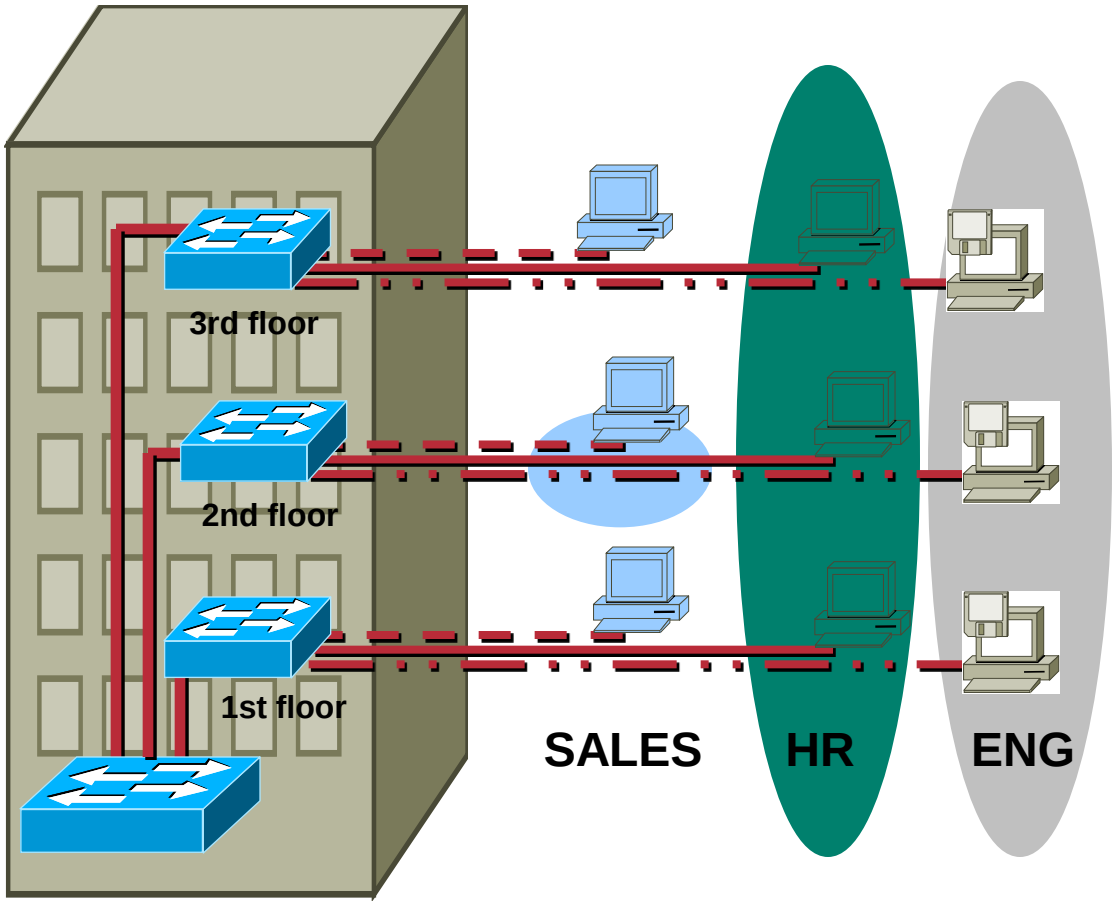
Upon completion of this chapter, you will be able to perform the following tasks:

- **Configure a VLAN**
- **Configure VLAN Trunking Protocol (VTP)**
- **Configure a switch for trunking**
- **Verify VLAN connectivity**
- **Verify spanning-tree operations**

VLAN Concepts

- A VLAN is a way of micro-segmenting a L2 / L3 topology into separate broadcast domains.
- Each VLAN is a separate broadcast domain (meaning that all broadcasts are seen by all ports within the same VLAN).
- Any port on a Catalyst switch can be placed in any VLAN desired.
- Ports that are in the same VLAN will share the same broadcast domain.
- Inter-VLAN communication is restricted, requires a L3 routing device to communicate between broadcast domains.

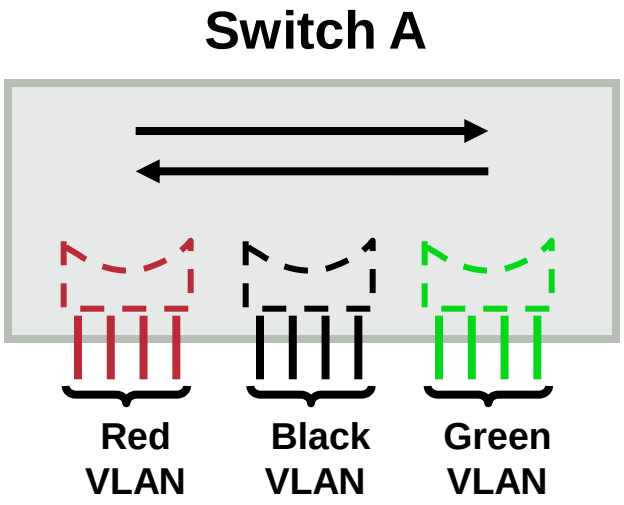
VLAN Overview



- **Segmentation**
- **Flexibility**
- **Security**

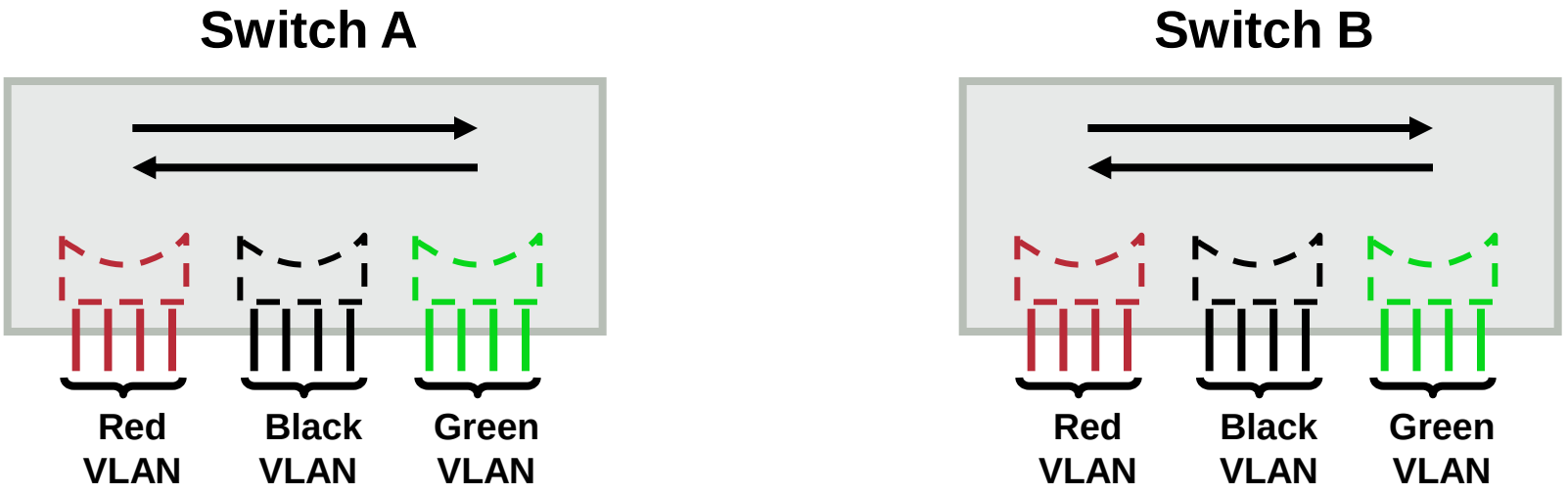
A VLAN = A broadcast domain = Logical network (subnet)

VLAN Operations



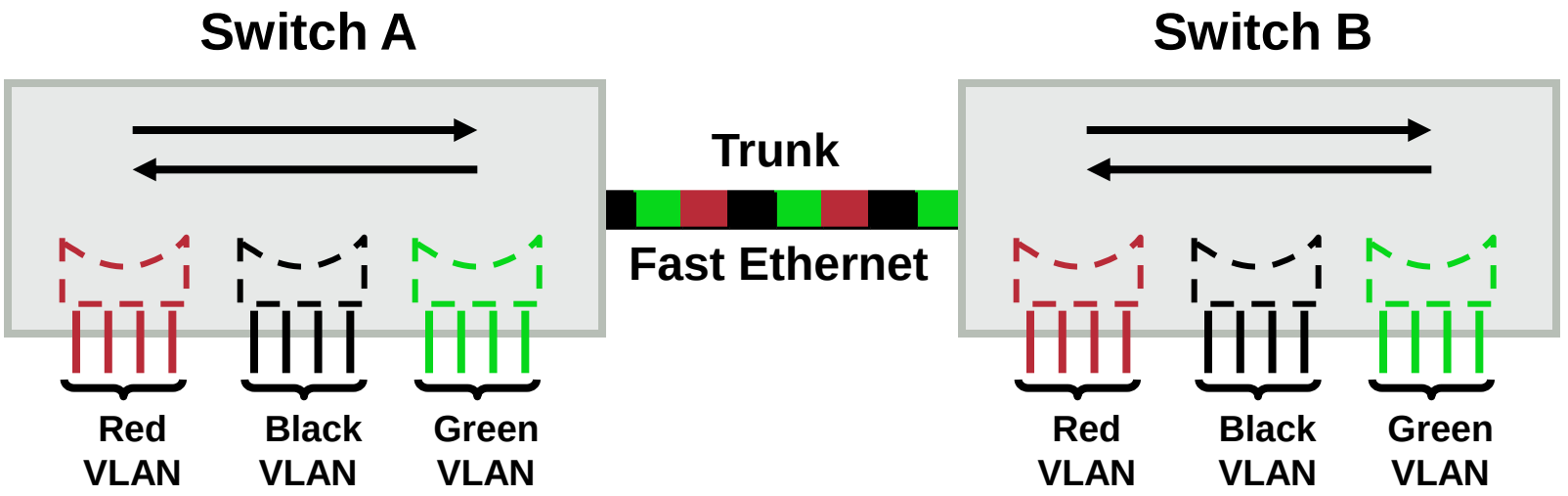
- **Each logical VLAN is like a separate physical bridge**

VLAN Operations



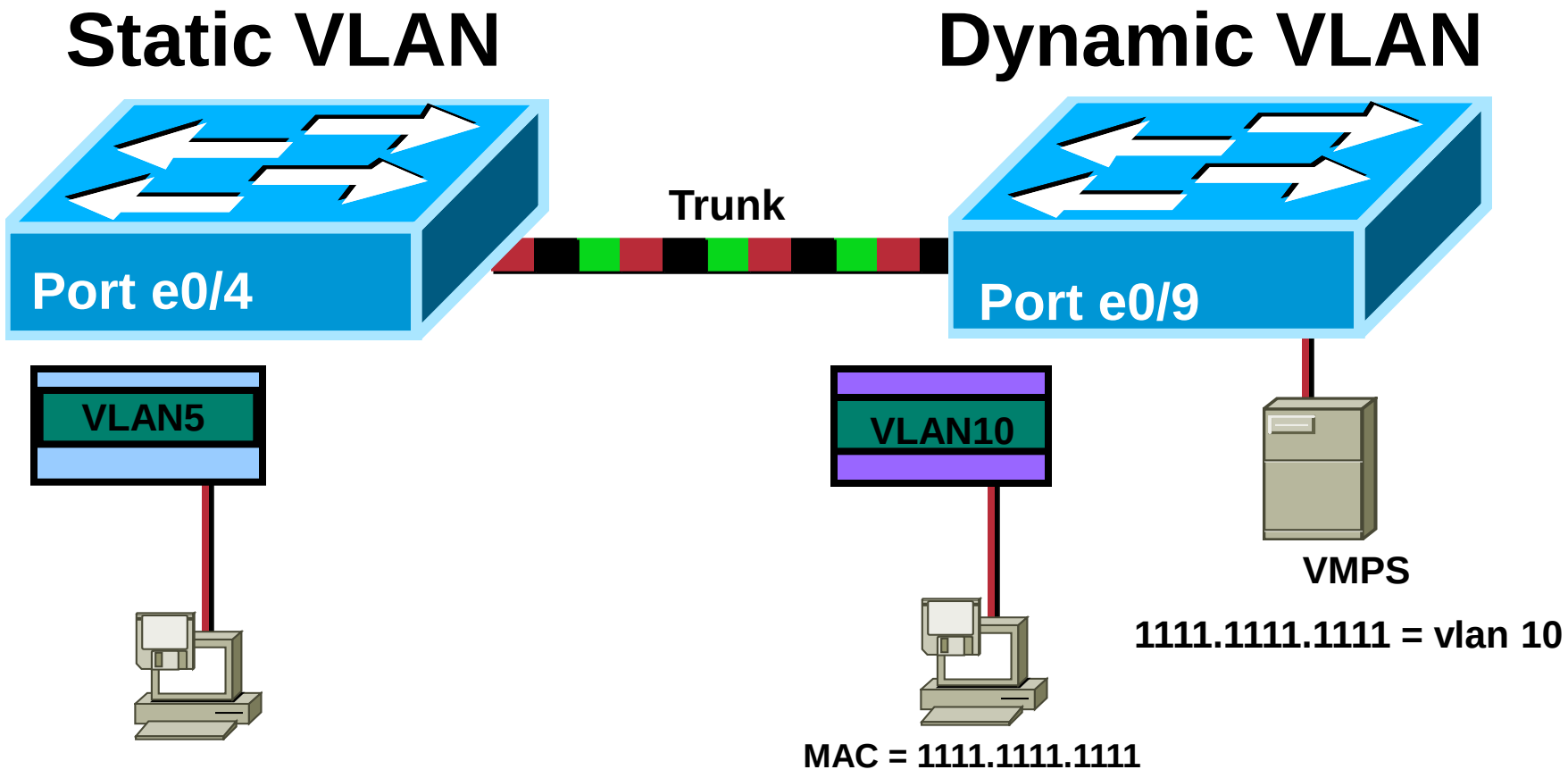
- Each logical VLAN is like a separate physical bridge
- VLANs can span across multiple switches

VLAN Operations



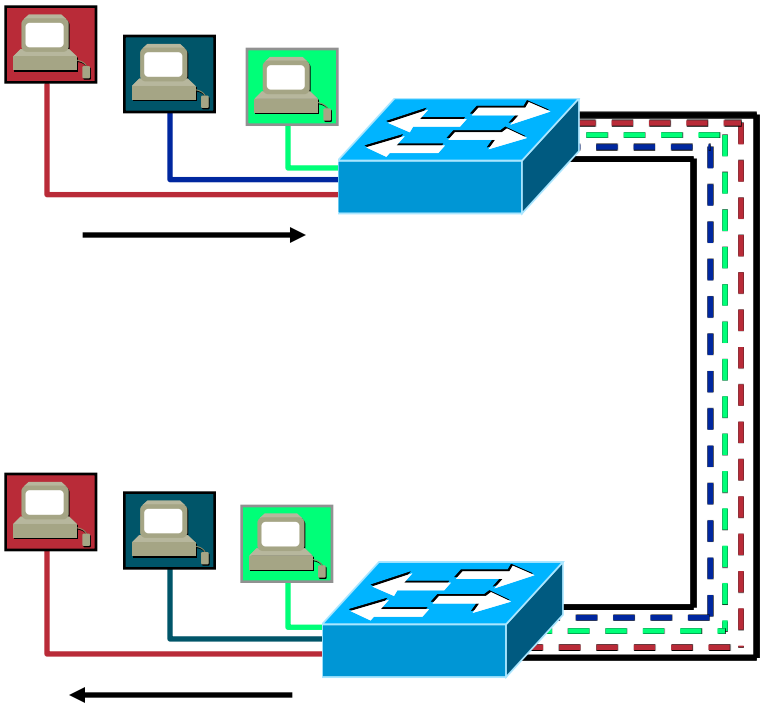
- Each logical VLAN is like a separate physical bridge
- VLANs can span across multiple switches
- Trunks carries traffic for multiple VLANs

VLAN Membership Modes

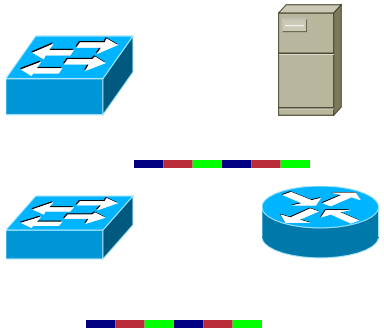


ISL Tagging

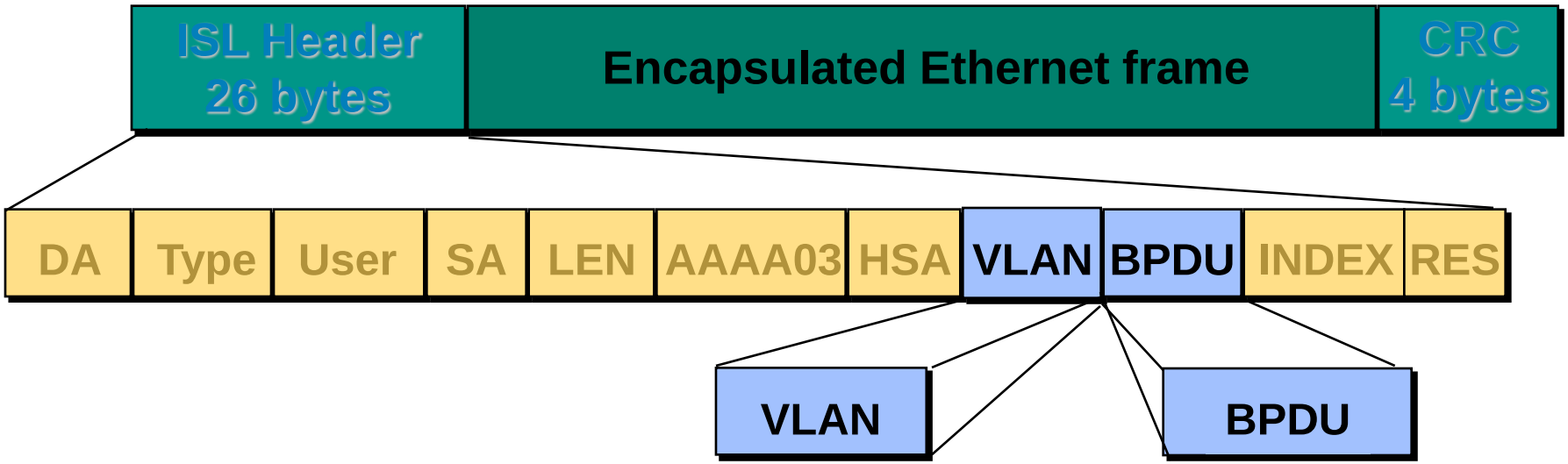
ISL trunks enable VLANs across a backbone



- Performed with ASIC
- Not intrusive to client stations, client does not see the ISL header
- Effective between switches, routers and switches, switches and servers with ISL network interface cards



ISL Encapsulation



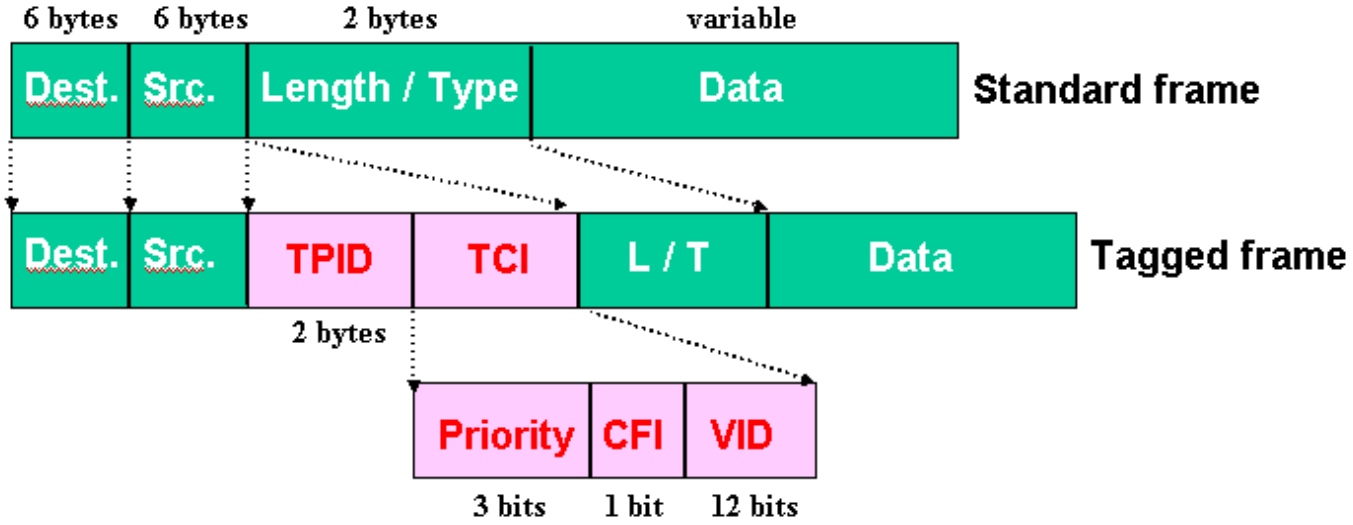
Frames encapsulated with ISL header and CRC

Support for many VLANs (1024)

VLAN field

BPDU bit

802.1q Encapsulation



Tag Protocol ID has a defined value of 8100 in hex.

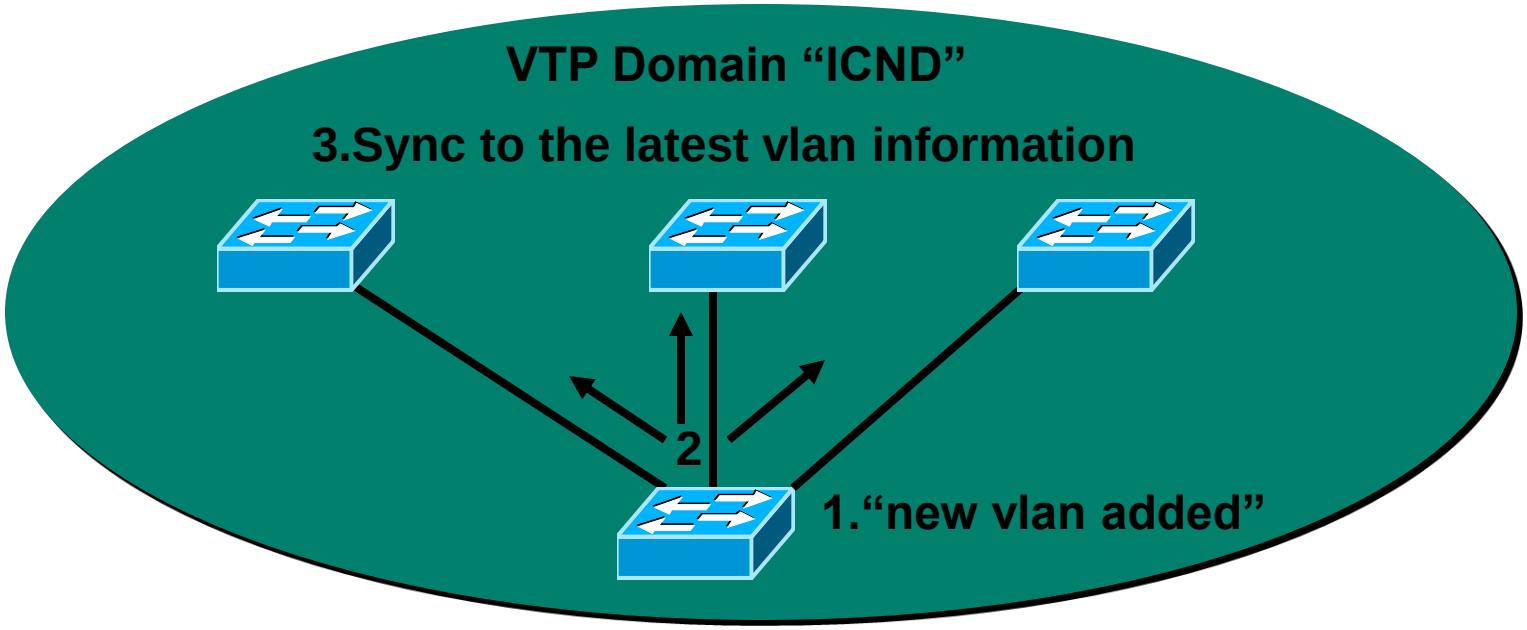
Priority : The first three bits of the TCI define user priority, giving eight (2^3) priority levels.

CFI : Canonical Format Indicator is a single-bit flag, always set to zero for Ethernet switches.

VID : VLAN ID is the identification of the VLAN

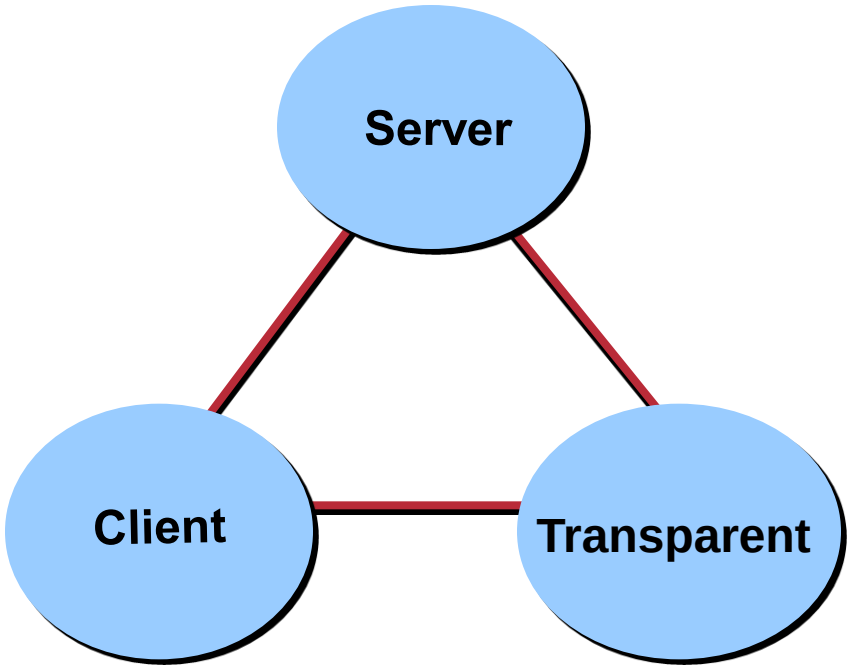
VLAN Trunking Protocol (VTP)

- A messaging system that advertises VLAN configuration information
- Maintains VLAN configuration consistency throughout a common administrative domain
- VTP sends advertisements on trunk ports only
- Support mixed media trunks (Fast Ethernet, FDDI, ATM)



VTP Modes

- Create vlans
- Modify vlans
- Delete vlans
- Sends/forwards advertisements
- Synchronize
- Saved in NVRAM



- Sends/forwards advertisements
- Synchronize
- Not saved in NVRAM

- Create vlans
- Modify vlans
- Delete vlans
- Forwards advertisements
- Does not synchronize
- Saved in NVRAM

How VTP Works

- VTP advertisements are sent as multicast frames
- VTP servers and clients synchronized to latest revision number
- VTP advertisement are sent every five minutes or when there is a change

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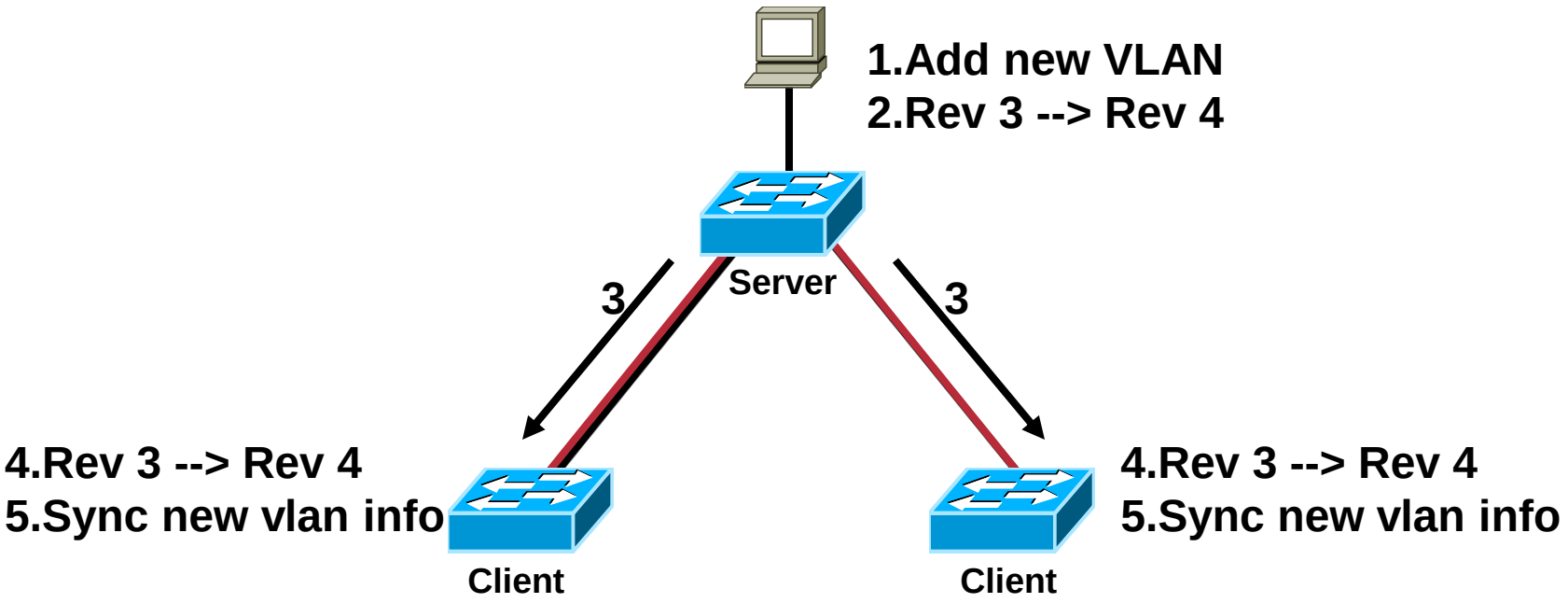
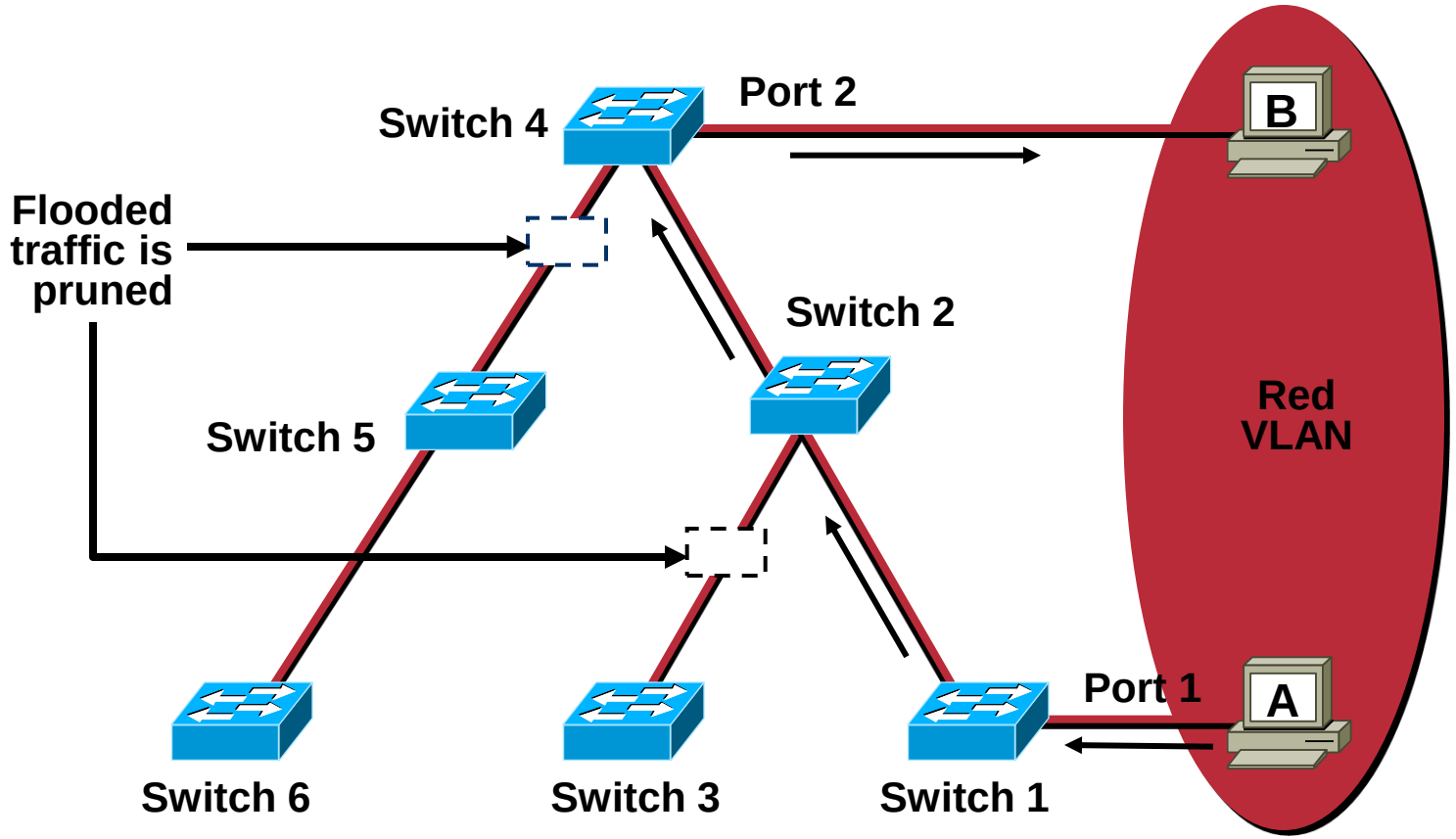


VTP Pruning

Increases available bandwidth by reducing unnecessary flooded traffic

Example: Station A sends broadcast, broadcast is only flooded toward any switch with ports assigned to the red VLAN



VLAN Configuration Guidelines

Maximum number of VLANs is switch-dependent

VLAN1 is One of the factory default VLANs

CDP and VTP advertisements are sent on VLAN1

Must be in VTP server or transparent mode to create, add, or delete VLANs

VLAN Configuration Steps

Enable VTP (optional)

Enable trunking

Create VLANs

Assign VLAN to ports

VTP Configuration Guidelines

- VTP domain name
- VTP mode (server/client/transparent)—VTP server mode is the default
- VTP pruning
- VTP password
- VTP trap

Use caution when adding a new switch into an existing domain. A new switch should be added in client mode to prevent the new switch from propagating incorrect VLANs information

Use the delete vtp command to reset the VTP revision number

Creating a VTP Domain

wg_sw_a(config)#

```
vtp [server | transparent] [domain domain-name] [trap {enable | disable}]
[password password] [pruning {enable | disable}
```

wg_sw_a#conf terminal
Enter configuration commands, one per line. End with CNTL/Z
wg_sw_a(config)#vtp transparent
wg_sw_a(config)#vtp domain switchlab

Verifying VTP Configurations

wg_sw_a#show vtp status

```
wg_sw_a#show vtp status
    VTP version: 1
    Configuration revision: 4
    Maximum VLANs supported locally: 1005
    Number of existing VLANs: 6
    VTP domain name        : switchlab
    VTP password           :
    VTP operating mode     : Transparent
    VTP pruning mode       : Enabled
    VTP traps generation   : Enabled
    Configuration last modified by: 10.1.1.40 at 00-00-0000 00:00:00
```

Defining a Trunk

wg_sw_a(config-if)#

```
switchport mode dynamic auto | desirable
Switchport mode trunk
switchport nonegotiate
```

- **Desirable = Negotiate with other side.**
  Trunk on if other side is on, desirable, or auto
- **Auto = Will be a trunk only if the other side is on or desirable**
- **Non-negotiate = Set trunk on and will not negotiate**

```
wg_sw_a#conf terminal
Enter configuration commands, one per line.  End with CNTL/Z
wg_sw_a(config)#interface f0/26
wg_sw_a(config-if)#switchport trunk encap dot1q
wg_sw_a(config-if)#switchport mode trunk
```

First trunk port(Port A)

Verifying a Trunk


```
wg_sw_a#show int fa0/23 switchport
```

```
wg_sw_a#show int fa0/23 switchport

Name: Fa0/23
Switchport: Enabled
Administrative mode: trunk
Operational Mode: trunk
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: dot1q
Negotiation of Trunking: Disabled
Access Mode VLAN: 0 ((Inactive))
Trunking Native Mode VLAN: 1 (default)
Trunking VLANs Enabled: 1-100,102-1005
Trunking VLANs Active: 1,10,20,30,299
Pruning VLANs Enabled: NONE
```

Adding a VLAN

wg_sw_a(config)#

vlan *vlan#* [name *vlan-name*]

wg_sw_a#conf terminal
Enter configuration commands, one per line. End with CNTL/Z
wg_sw_a(config)#vlan 9 name switchlab2

Verifying a VLAN


```
wg_sw_a#show vlan id [vlan#]
```

```
wg_sw_a#sh vlan  id 9

VLAN Name              Status    Ports
---------------------------------------------
9   switchlab2         Enabled
---------------------------------------------

VLAN Type         SAID   MTU   Parent RingNo BridgeNo Stp  Trans1 Trans2
------------------------------------------------------------------------------
9   Ethernet      100009 1500      0        1        1        Unkn    0       0
------------------------------------------------------------------------------
```

Modifying a VLAN Name


```
wg_sw_a(config)#
```

vlan *vlan# name vlan-name*

```
wg_sw_a#conf terminal
Enter configuration commands, one per line.  End with CNTL/Z
wg_sw_a(config)#vlan 9 name switchlab90

wg_sw_a#show vlan id 9

VLAN Name              Status    Ports
---------------------------------------------
9   switchlab90        Enabled
---------------------------------------------
```

Assigning Switch Ports to a VLAN


```
wg_sw_a#conf terminal
Enter configuration commands, one per line.  End with CNTL/Z
wg_sw_a(config)#interface fastethernet 0/8
wg_sw_a(config-if)#switchport access vlan 9
```

Verifying VLAN Membership


```
Switch#show vlan

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
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup
.
.
Rest of output omitted
```

Verifying Spanning Tree

wg_sw_a#show spanning-tree vlan {*vlan number*}

```
wg_sw_a#show spanning-tree vlan 1

VLAN1 is executing the IEEE compatible Spanning Tree Protocol
   Bridge Identifier has priority 32768, address 0050.F037.DA00
   Configured hello time 2, max age 20, forward delay 15
   Current root has priority 0, address 00D0.588F.B600
   Root port is FastEthernet 0/26, cost of root path is 10
   Topology change flag not set, detected flag not set
   Topology changes 53, last topology change occured 0d00h17m14s ago
   Times:  hold 1, topology change 8960
           hello 2, max age 20, forward delay 15
   Timers: hello 2, topology change 35, notification 2
Port Ethernet 0/1 of VLAN1 is Forwarding
   Port path cost 100, Port priority 128
   Designated root has priority 0, address 00D0.588F.B600
   Designated bridge has priority 32768, address 0050.F037.DA00
   Designated port is Ethernet 0/1, path cost 10
   Timers: message age 20, forward delay 15, hold 1
```

Summary

- **After completing this chapter, you should be able to perform the following tasks:**
  - **Configuring VLAN**
  - **Configuring VTP**
  - **Configuring a trunk**
  - **Verifing Spanning Tree Operations**

LABS

Using the CLI, configure the following

- **Add unique vlans to each pod**
- **Configure VTP (choose 1 server)**
- **Add VLAN at server**
- **Enable trunk interfaces**
- **save config**