Virtual LAN

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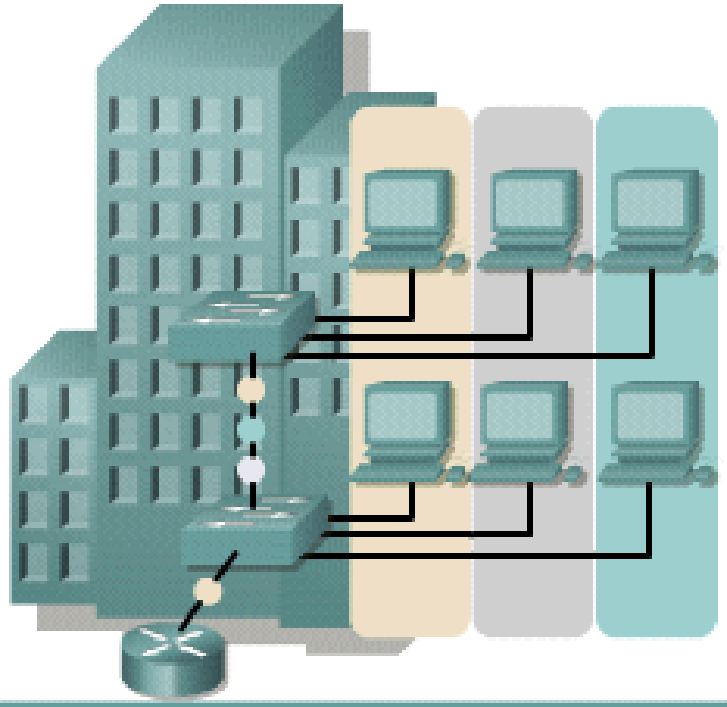
Objectives

- VLAN concepts
- VLAN configuration
- Troubleshooting VLANs

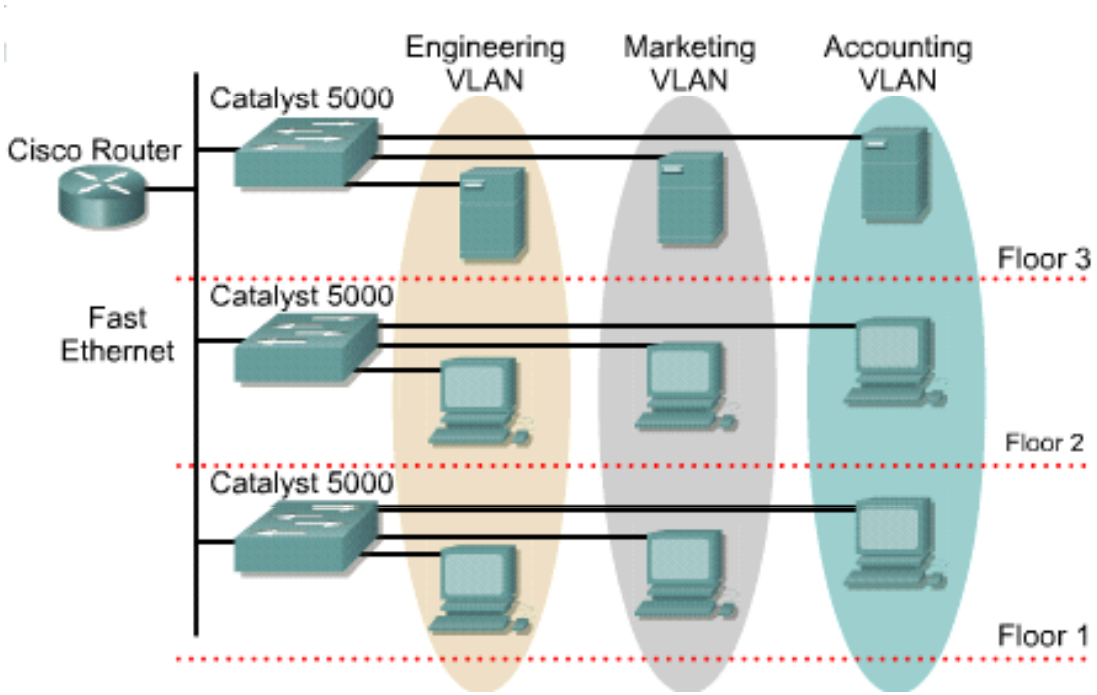
VLAN concepts

Introduction to VLANs



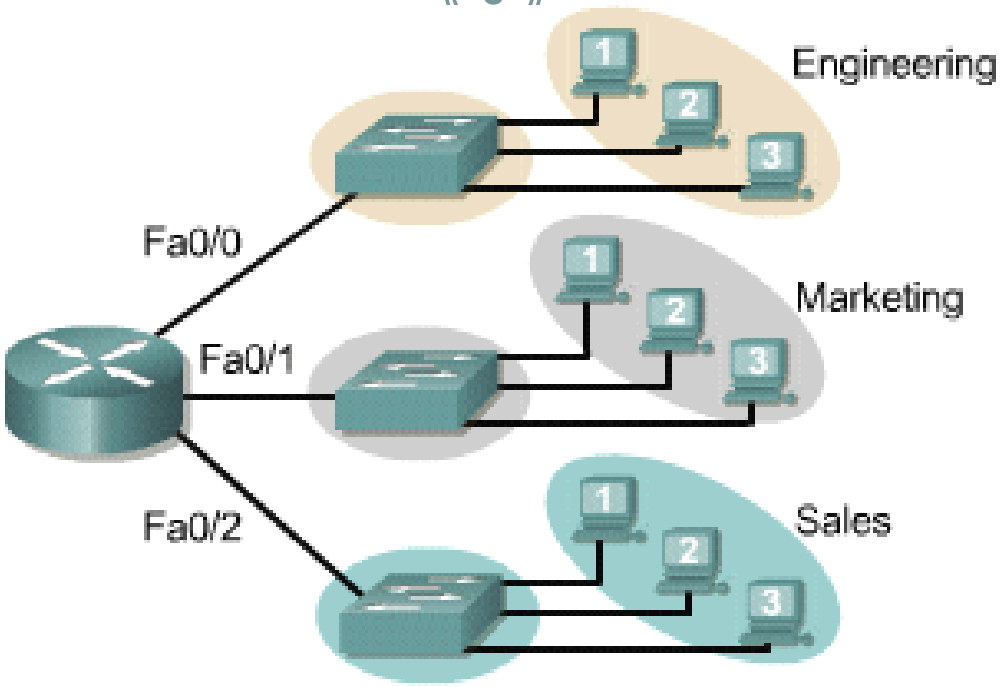
- A group of ports or users in same broadcast domain
- Can be based on port ID, MAC address, protocol, or application
- LAN switches and network management software provide a mechanism to create VLANs
- Frame tagged with VLAN ID

VLANs



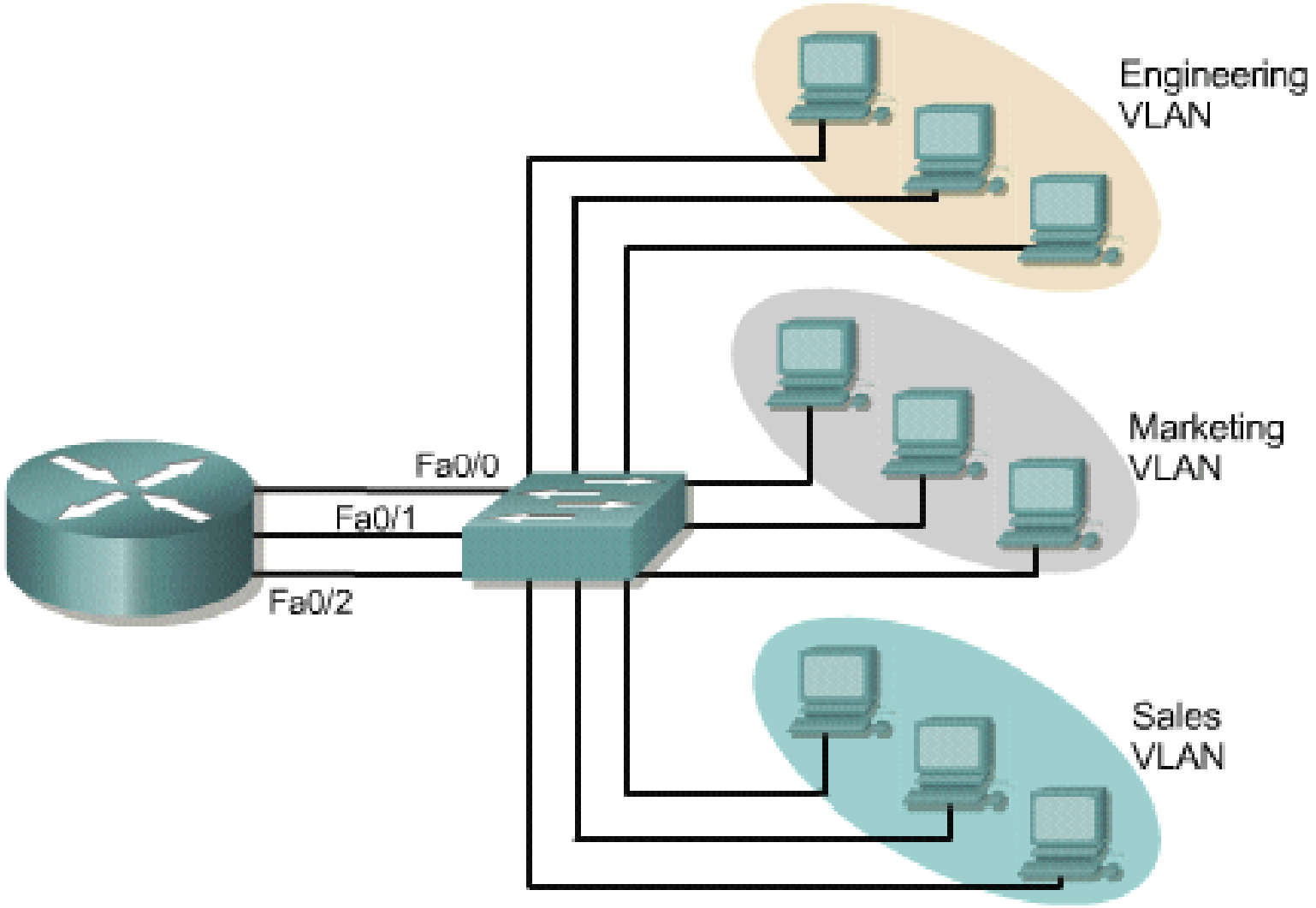
VLANs logically segment switched networks based on an organization's functions, project teams, or applications as opposed to a physical or geographical basis.

Broadcast Domains

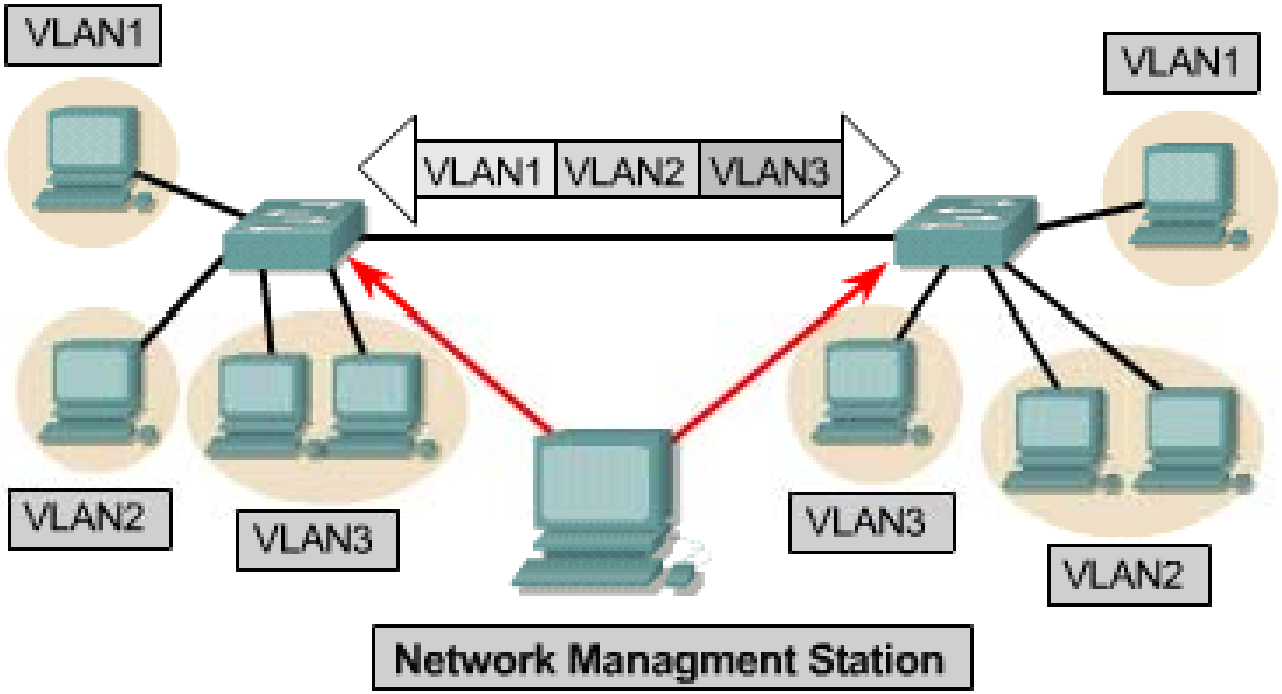


- In this scenario 3 switches & 1 router could be used. No VLANs are used.
- Switch for Engineering.
- Switch for Sales.
- Switch for Marketing.
- Each switch treats all ports as members of one broadcast domain.
- Router is used to route packets among the three broadcast domains.

Example with 3 Broadcast Domains, 3 VLANs

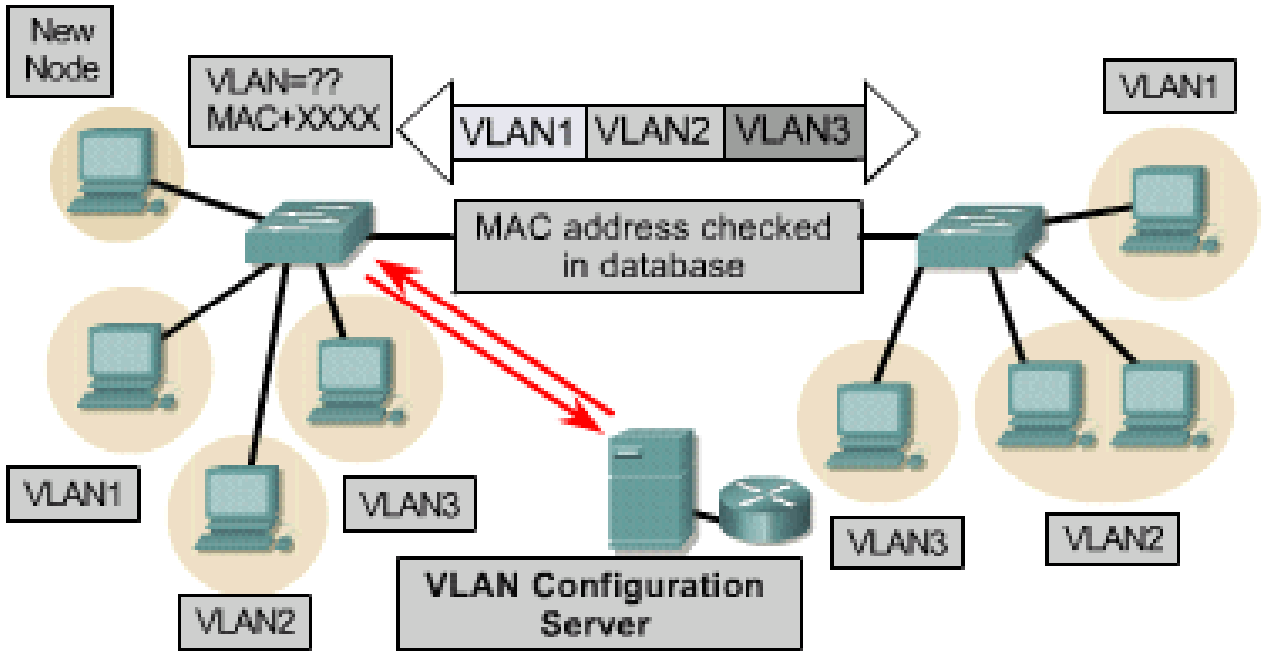


Static VLANs



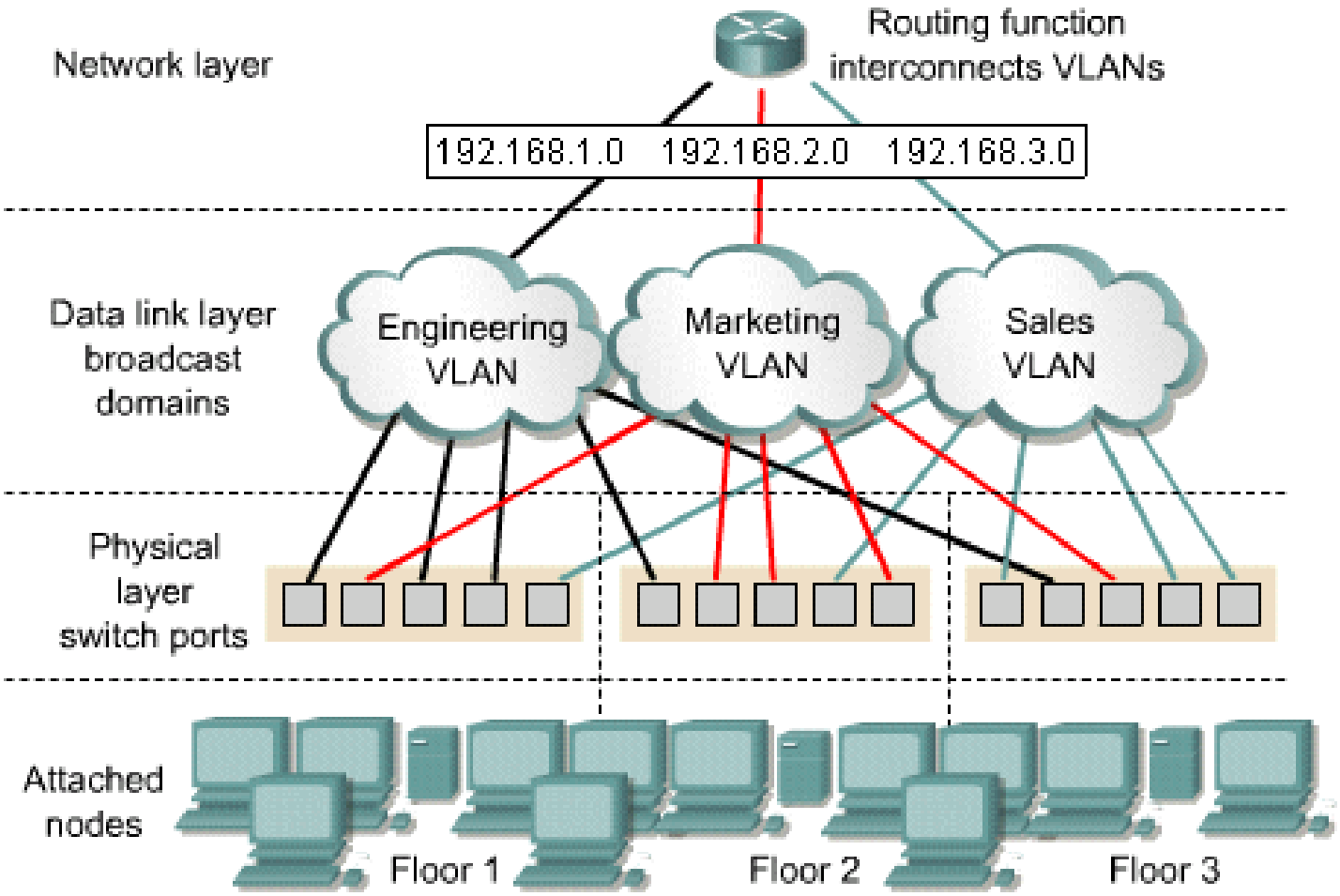
- Assign ports (port-centric)
- Static VLANs are secure, easy to configure and monitor

Dynamic VLANs



- VLANs assigned using centralized VLAN management application
- VLANs based on MAC address, logical address, or protocol type
- Less administration in wiring closet
- Notification when unrecognized user is added to network

Port-Centric VLANs



VLAN Configuration

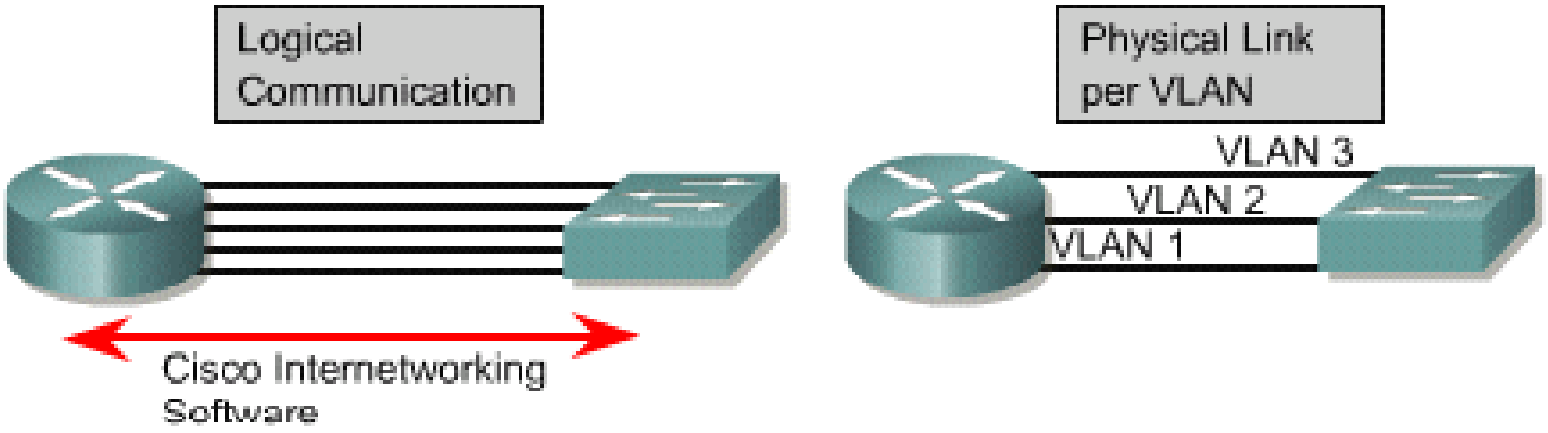
Configuring VLANs	Description
Statically	Network administrators configure port-by-port. Each Port is associated with a specific VLAN. The network administrator is responsible for keying in the mappings between the ports and VLANs.
Dynamically	The ports are able to dynamically work out their VLAN configuration. Uses a software database of MAC address to VLAN mappings (which the network administrator must set up first).

Benefits of VLANs

- Easily move workstations on the LAN
- Easily add workstations to the LAN
- Easily change the LAN configuration
- Easily control network traffic
- Improve security

Communicating Between VLANs

Two Physical Topology Approaches



Using Layer 3 routers to link VLANs provides the following benefits:

- Additional security and management is added.
- Logical links conserve physical ports.
- Depending on the protocol, multimode configurations can be implemented.
- Routers control access to VLANs.
- Up to 255 VLANs or more can be supported per router.

VLAN Types

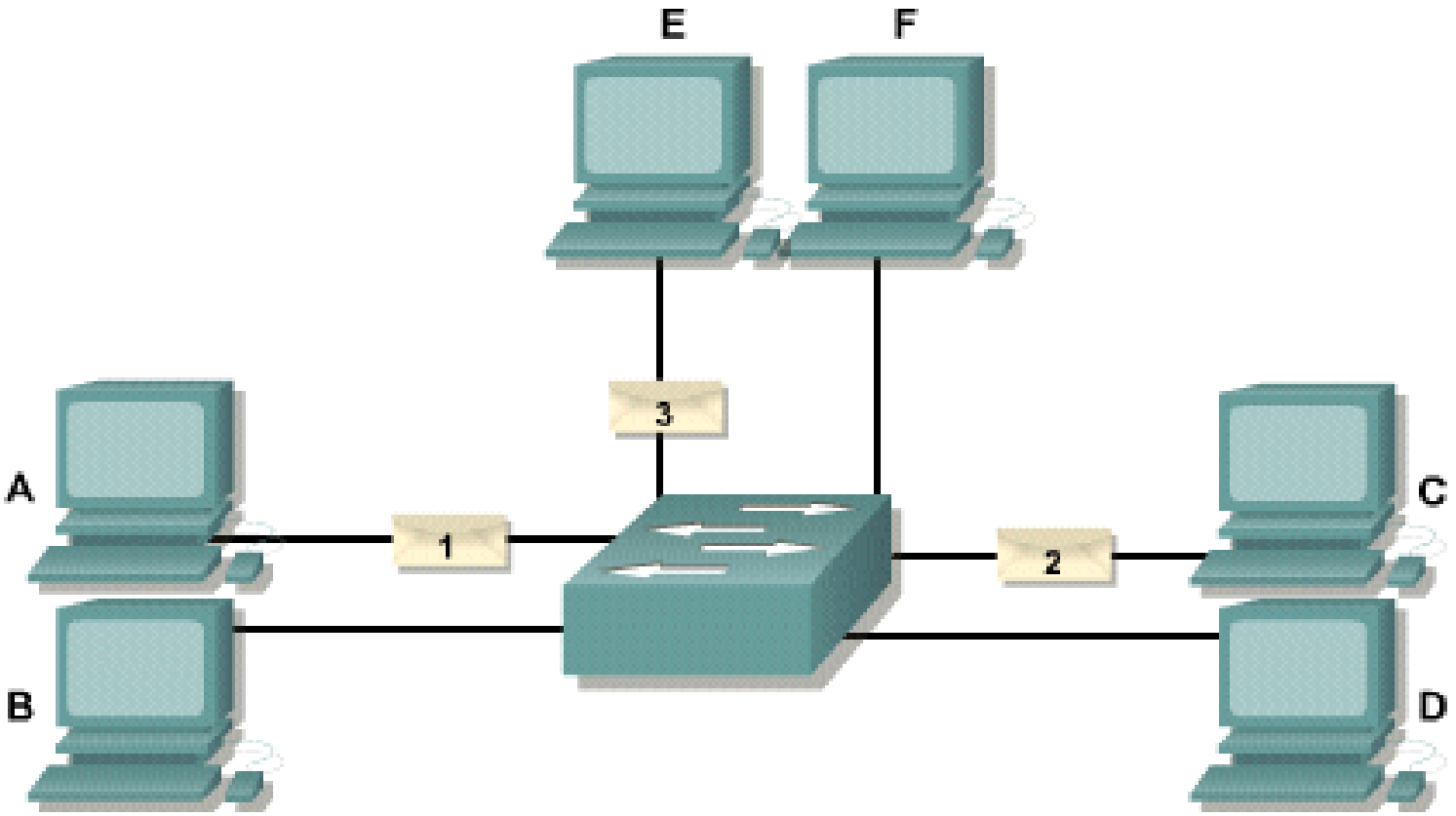
VLAN Types	Description
Port-based	• Most common configuration method. • Ports assigned individually, in groups, in rows, or across 2 or more switches. • Simple to use. • Often implemented where Dynamic Host Control Protocol (DHCP) is used to assign IP addresses to network hosts.
MAC address	• Rarely implemented today. • Each address must be entered into the switch and configured individually. • Users find it useful.oDifficult to administer, troubleshoot and manage.
Protocol Based	• Configured like MAC addresses, but instead uses a logical or IP address. • No longer common because of DHCP.

Inter-Switch Link

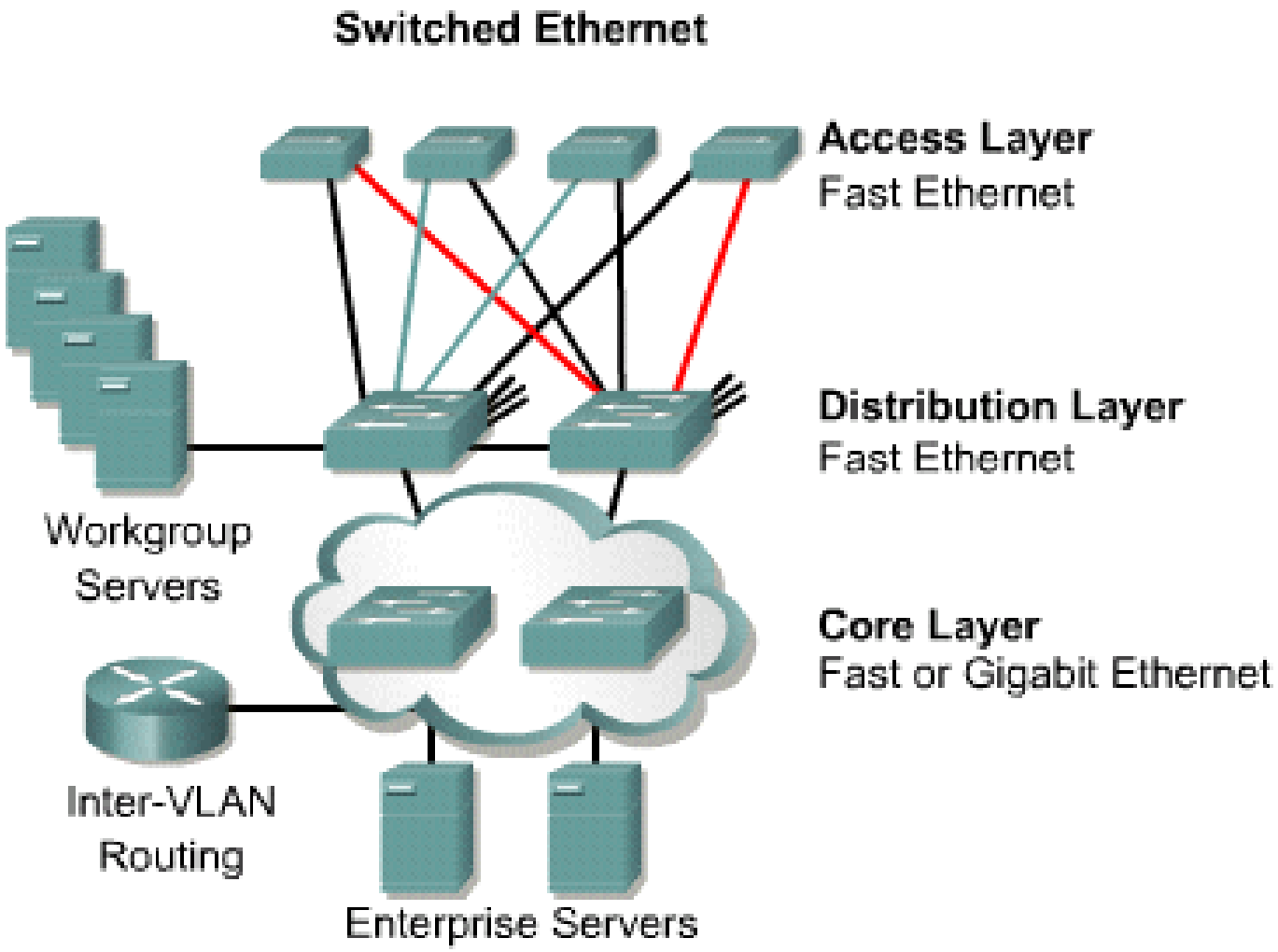
Tagging	Method	Media	Description
Inter-Switch Link (ISL)	Fast Ethernet	ISL header encapsulates the LAN frame and there is a VLAN ID field in the ISL header	Frame is lengthened
802.IQ	Fast Ethernet	IEEE defined Ethernet VLAN protocol	Header is modified
802.IQ	FDDI	IEEE defined standard: The 802.10 protocol incorporates a mechanism whereby LAN traffic can carry a VLAN identifier	VLAN ID is the essential piece of required header information.
LAN Emulation (LANE)	ATM	No tagging	Virtual connection implies a VLAN id.

VLAN configuration

Concurrent Transmissions in a Switch



End-to-End VLANs



Static VLANs

- Static VLANs work well in networks where the following is true:
  - Moves are controlled and managed.
  - There is robust VLAN management software to configure the ports.
  - It is not desirable to assume the additional overhead required when maintaining end-station MAC addresses and custom filtering tables.

Verifying VLAN Configuration

Cisco

```
SydneySwitch#show vlan

VLAN Name                Status    Ports
---- ------------------- ------- -------------------------------

VLAN Name                Status    Ports
---- ------------------- ------- -------------------------------
1    default             active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
2    VLAN2               active    Fa0/5, Fa0/6, Fa0/7
3    VLAN3               active    Fa0/8, Fa0/9, Fa0/10, Fa0/11,
                                   Fa0/12
1002 fddi-default        active
1003 token-ring-default  active
1004 fddinet-default     active
1005 trnet-default       active

VLAN Type SAID MTU  Parent RingNo BridgeNo Stp BrdgMode Trans1 Trans2
---- ---- ---- ---- ------ ------ -------- ---------- ------ -------
1    enet 100001 1500  -      -      -        -
2    enet 100002 1500  -      -      -        -
```

Cisco

```
SydneySwitch#show vlan brief

VLAN Name                Status    Ports
---- ------------------- --------- -------------------------------
1    default             active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
2    VLAN2               active    Fa0/5, Fa0/6, Fa0/7
3    VLAN3               active    Fa0/8, Fa0/9, Fa0/10, Fa0/11,
                                   Fa0/12
1002 fddi-default        active
1003 token-ring-default  active
1004 fddinet-default     active
1005 trnet-default       active
```

Deleting VLANs


```
Switch(config)#interface fastethernet 0/9
Switch(config-if)#no switchport access vlan 300
```

Catalyst IOS show vlan Command

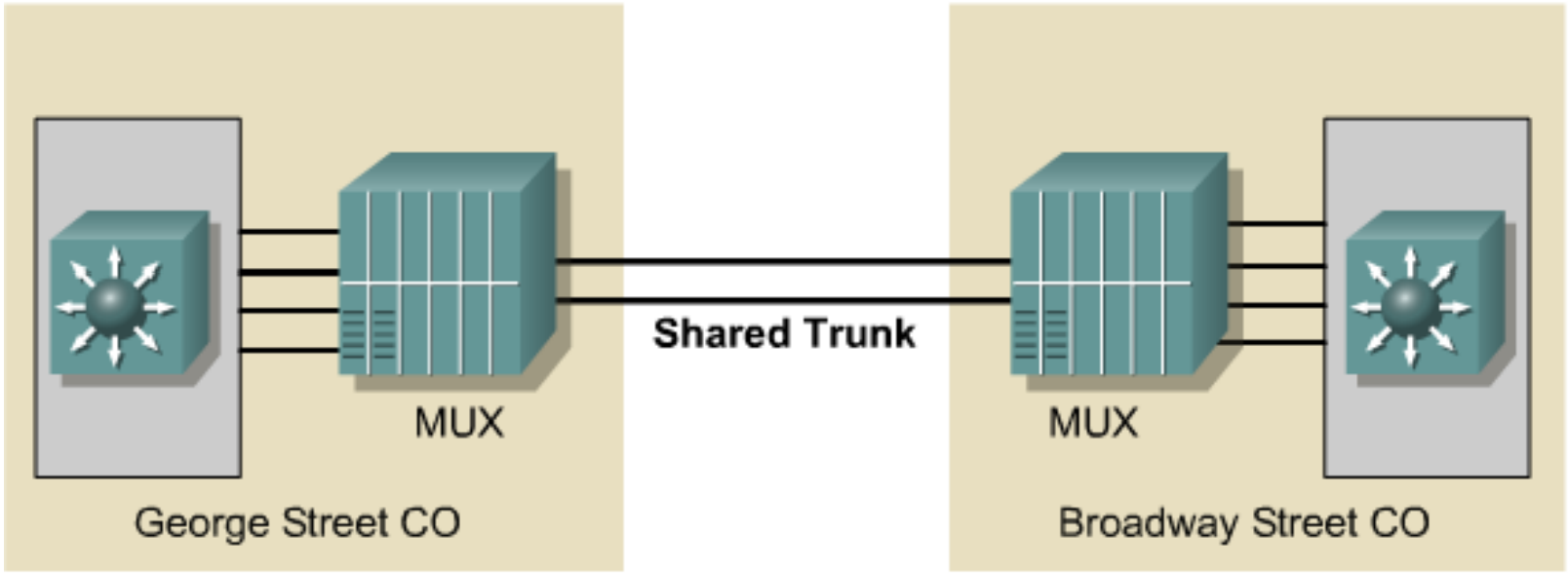

```
Cat4000 (enable) show vlan
VLAN Name                             Status    IfIndex Mod/Ports,
Vlans
---- ---------------------------- --------- ------- --------------
1    default                          active    45      1/1-2
                                                      2/9-29,2/31-34
100  VLAN0100                         active    53      2/4-5
200  VLAN0200                         active    54      2/6-7
300  VLAN0300                         active    56      2/3,2/30
1002 fddi-default                     active    46
1003 token-ring-default               active    49
1004 fddinet-default                  active    47
1005 trnet-default                    active    48


VLAN Type  SAID       MTU   Parent RingNo BrdgNo Stp  BrdgMode
Trans1 Trans2
---- ----- ---------- ----- ------ ------ ------ ---- -------- --
1    enet  100001     1500  -      -      -      -    -        0
0
```

Catalyst IOS Keyword Syntax Description

Keyword	Description
trunk	(Optional) Keyword that specifies to force the display to show information only on trunk ports.
vlan	Number of the VLAN. If the VLAN number is not specified, all VLANs are displayed.
notrunk	(Optional) Keyword that specifies to force the display to show information only on nontrunk ports.
mapping	Keyword to display VLAN mapping table information.
type	Type of VLAN; valid values are Ethernet, FDDI, FDDInet, TrBRF, and TrCRF.

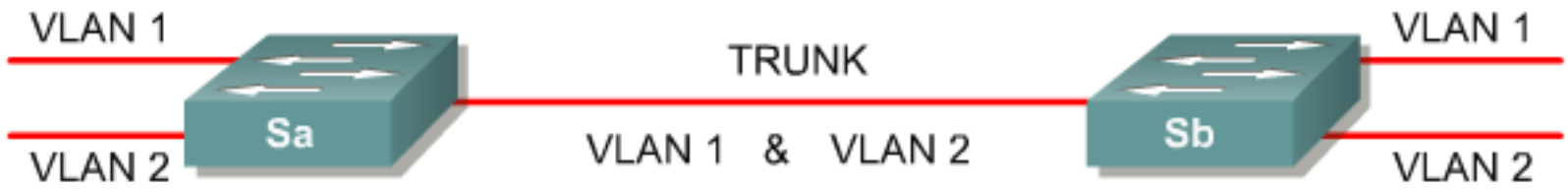
Trunking

History of Trunking

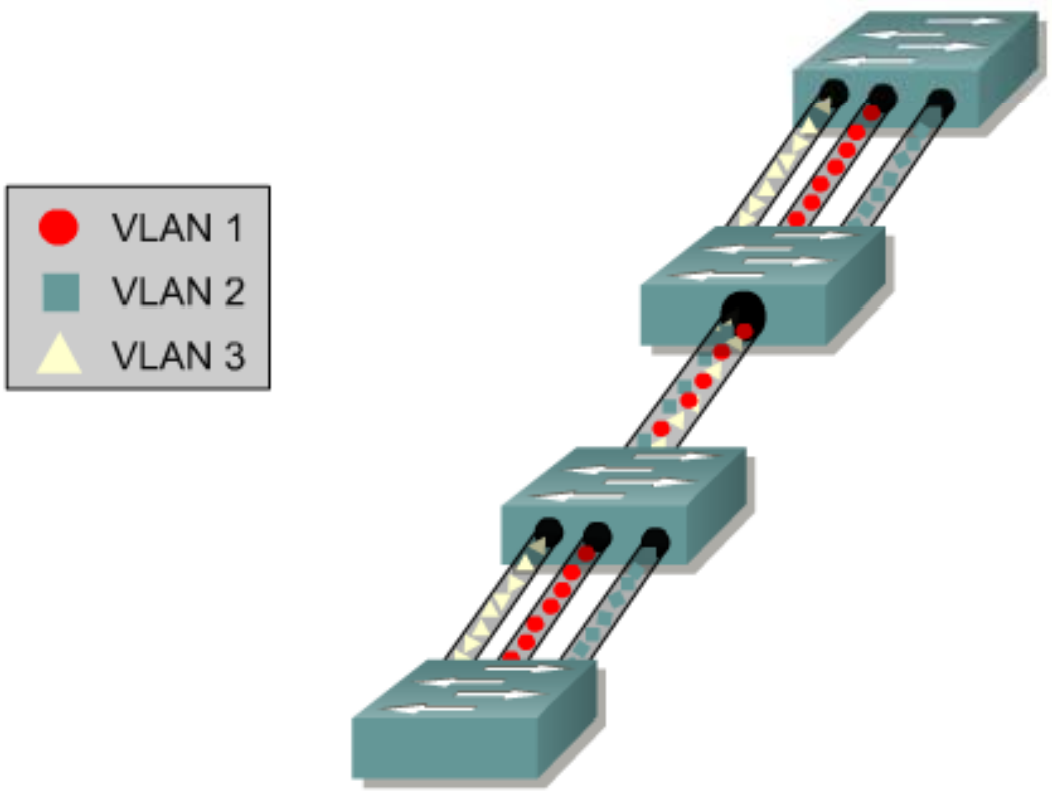


The telephone industry used multiplexers to carry multiple voice signals on a single trunk between COs.

Trunking Concepts

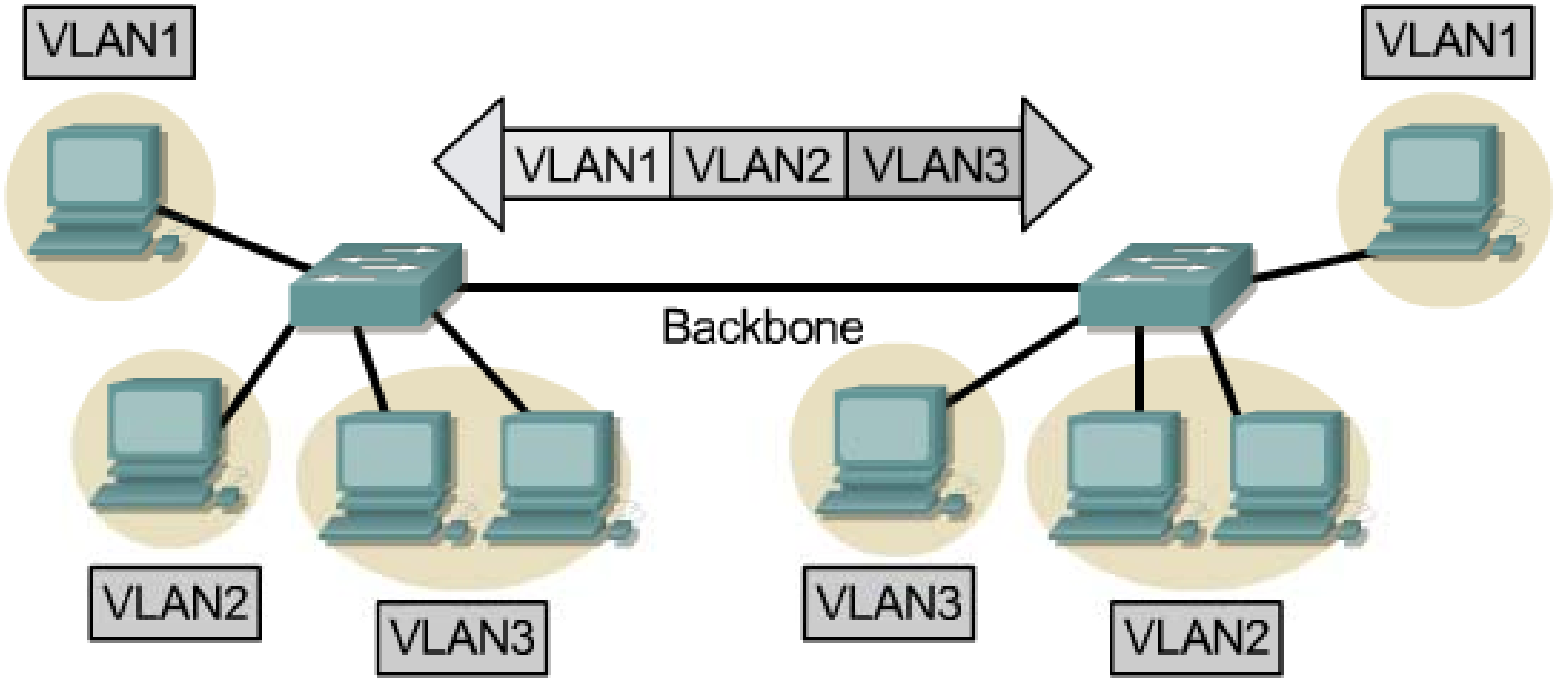


VLANs and Trunking



Trunking provides effective communication between switches in a network.

Frame Tagging

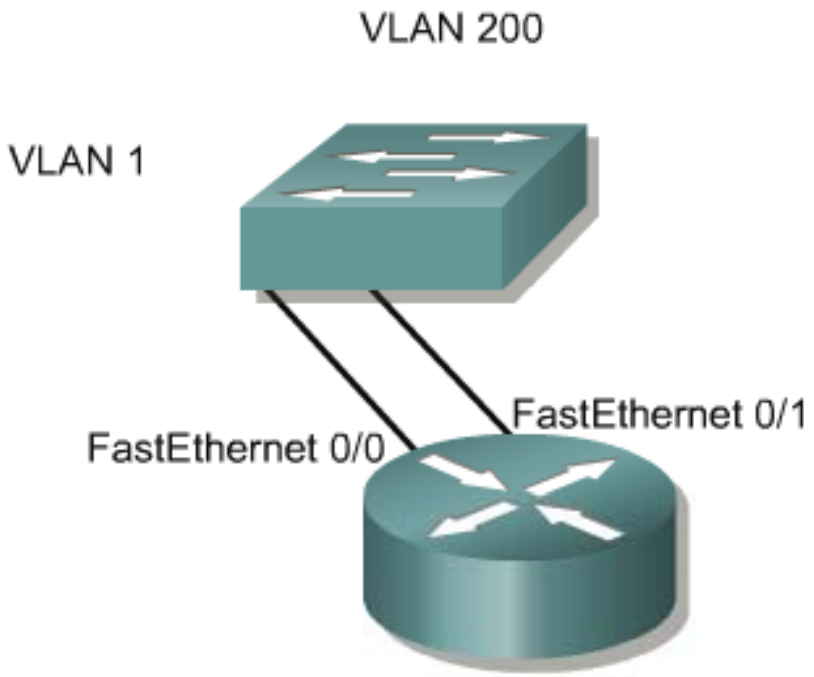


Frame Tagging and Encapsulation Methods

Identification Method	Encapsulation	Tagging (insertion into frame)	Media
802.1Q	No	Yes	Ethernet
ISL	Yes	No	Ethernet
802.10	No	No	FDDI
LANE	No	No	ATM

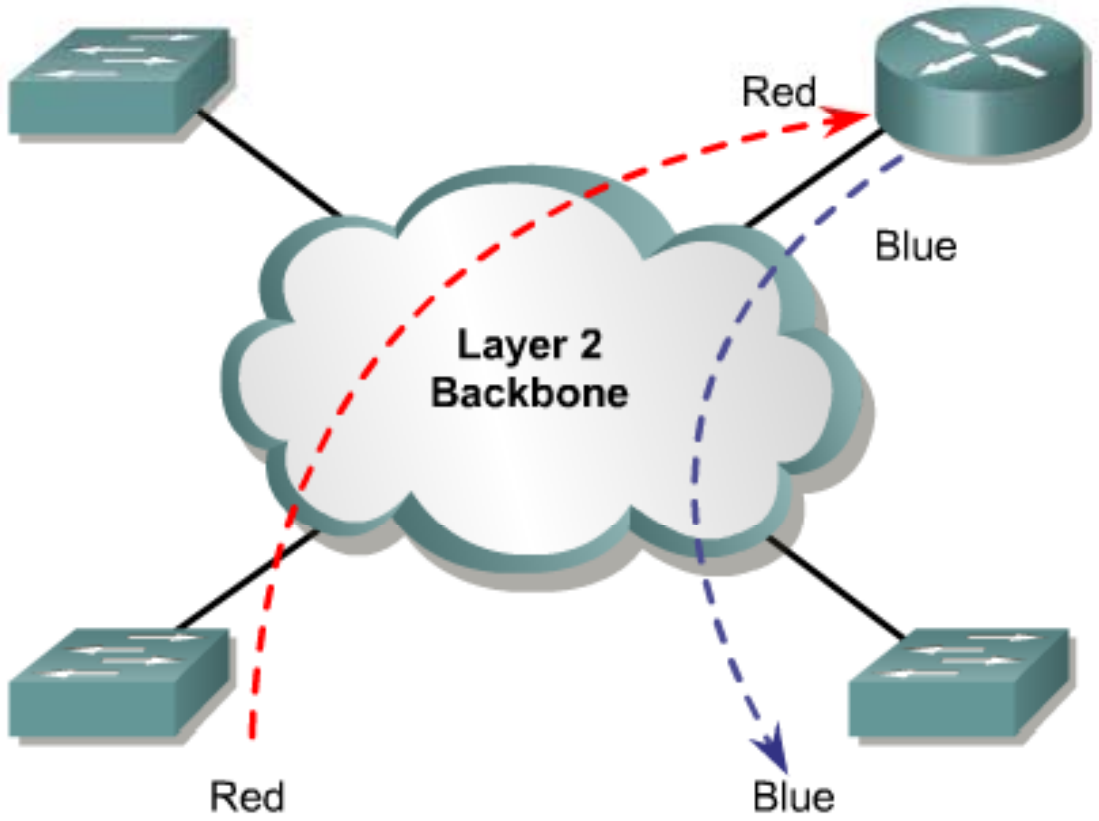
Inter-VLAN routing

Inter-VLAN Routing



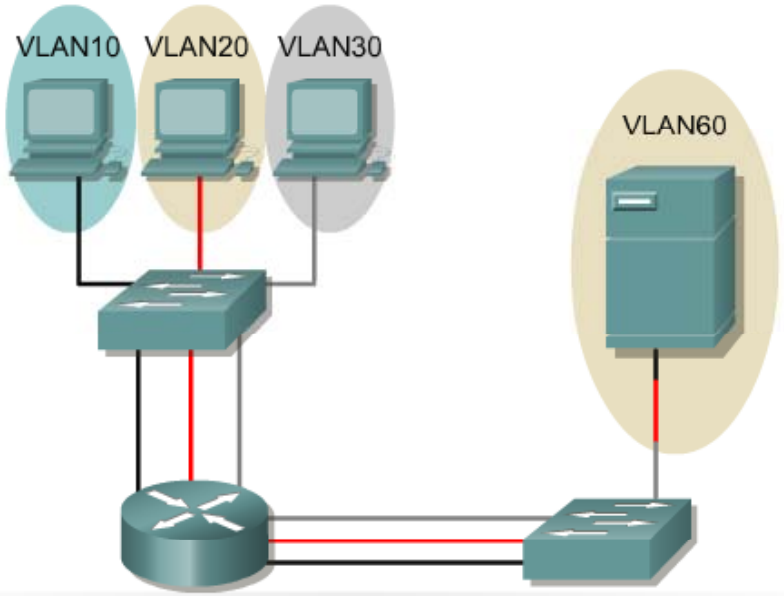
To route traffic between VLAN 1 and VLAN 200 in a non-VLAN-trunk environment, a router must be connected to a port in VLAN1 and a port in VLAN 200.

Router on a Stick

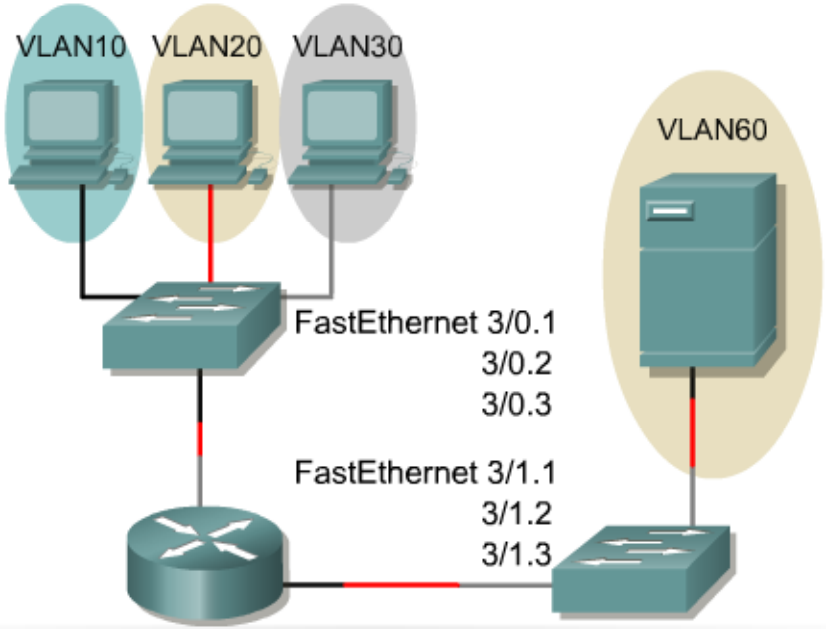


In order for traffic to move from one VLAN to another, it must go through the router.

Physical and Logical Interfaces

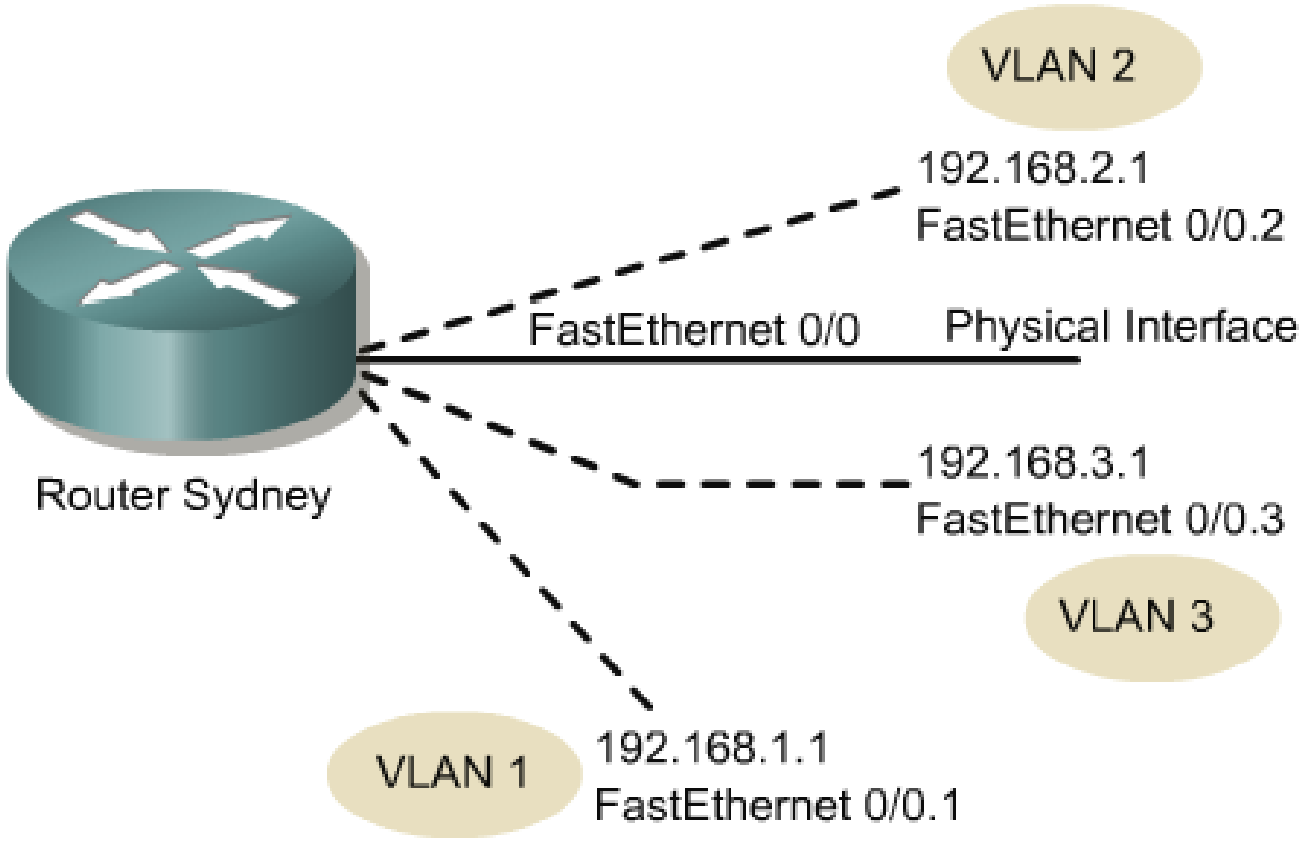


The router supports one VLAN per interface.



A single ISL link can support multiple VLANs.

Dividing Physical Interfaces into Subinterfaces



Each VLAN is its own IP network or subnet.

Configuring Inter-VLAN Routing


```
Sydney(config)#interface FastEthernet 0/0.1
Sydney(config-subif)#description Management VLAN1
Sydney(config-subif)#encapsulation 802.1q 1
Sydney(config-subif)#ip address 192.168.1.1
255.255.255.0
oSydney(config)#interface FastEthernet 0/0.2
Sydney(config-subif)#description Accounting VLAN 20
Sydney(config-subif)#encapsulation 802.1q 20
Sydney(config-subif)#ip address 192.168.2.1
255.255.255.0
Sydney(config)#interface FastEthernet 0/0.3
Sydney(config-subif)#description Sales VLAN 30
Sydney(config-subif)#encapsulation 802.1q 30
Sydney(config-subif)#ip address 192.168.3.1
255.255.255.0
```