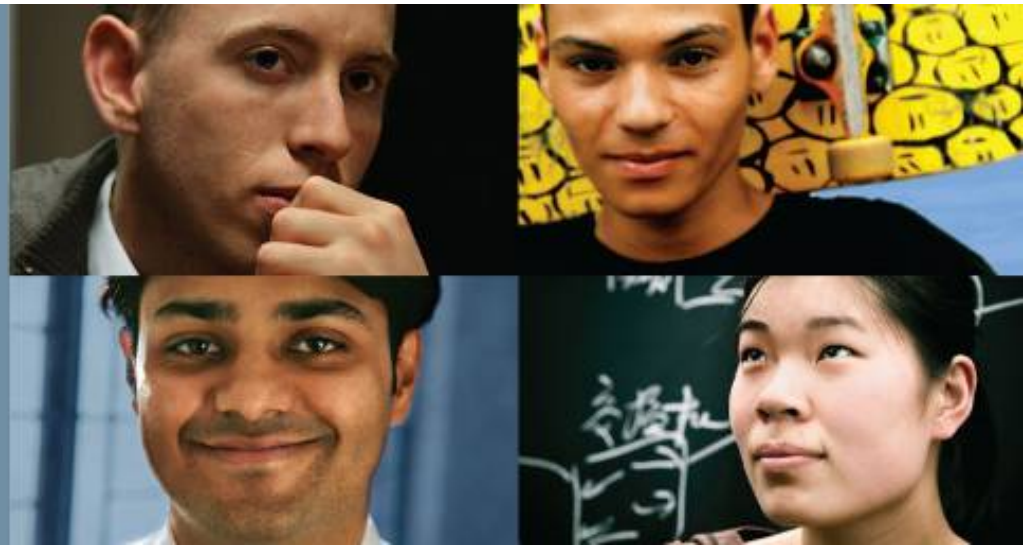
TNE10006/TNE60006: Networks and Switching



VLANs

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Outline

- VLANs
- Intra and Inter VLAN Communications
- Creating VLANs
- VLAN Access Ports
- VLAN Trunking Ports
- DTP – Dynamic Trunking Protocol
- VLAN Types

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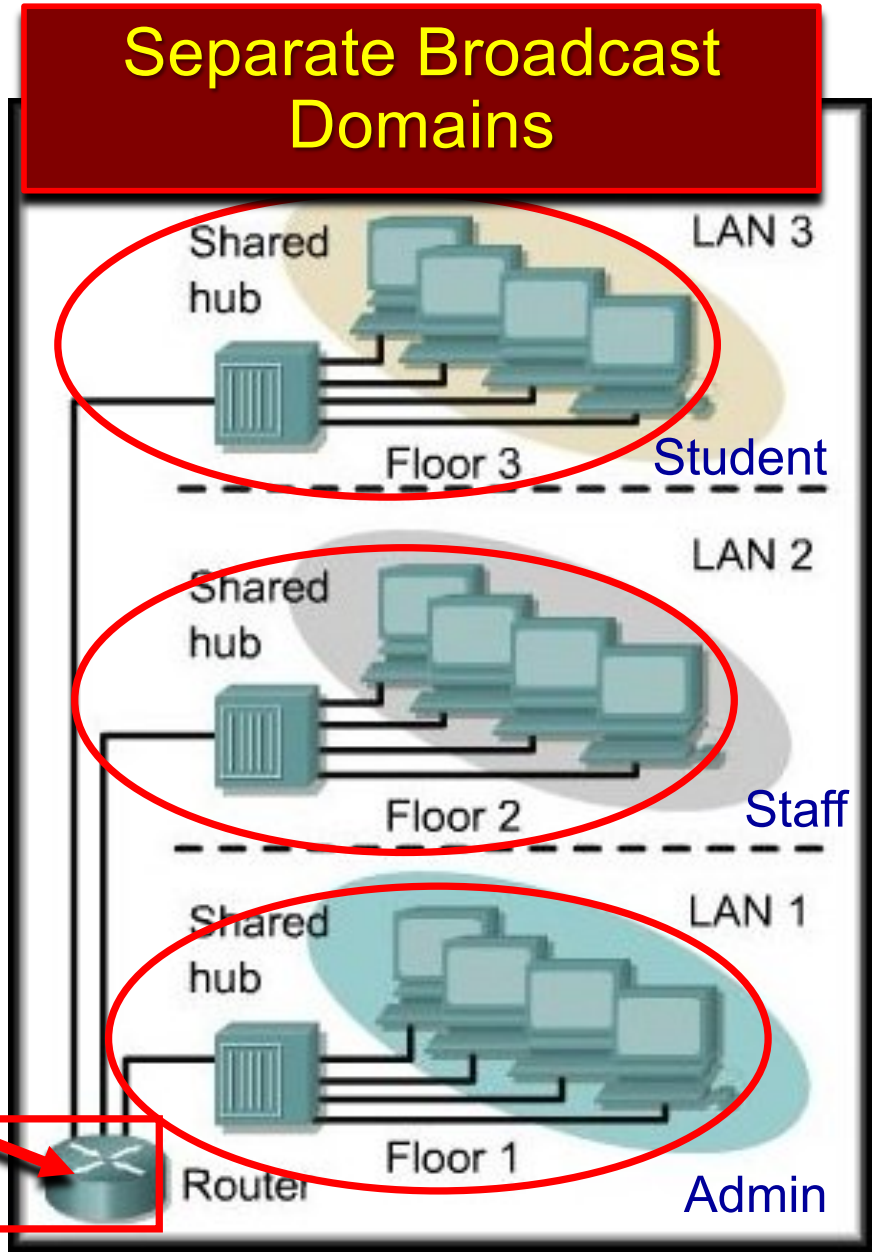
VLAN Definitions

- A VLAN is a logical partition of a Layer 2 network
- Multiple partitions (VLANs) can be created
- Each VLAN is a broadcast domain
- VLANs are mutually isolated and packets can only pass between them via a Layer 3 device
- The hosts grouped within a VLAN are typically unaware of the VLAN's existence

VLAN Overview

Traditional switched LANs:

- Physical topology is closely related to logical topology
- Workstations must be grouped by their physical proximity to a switch
- To communicate among LANs, each segment must have a separate interface (fa0/0,fa0/1) on the backbone device (router)



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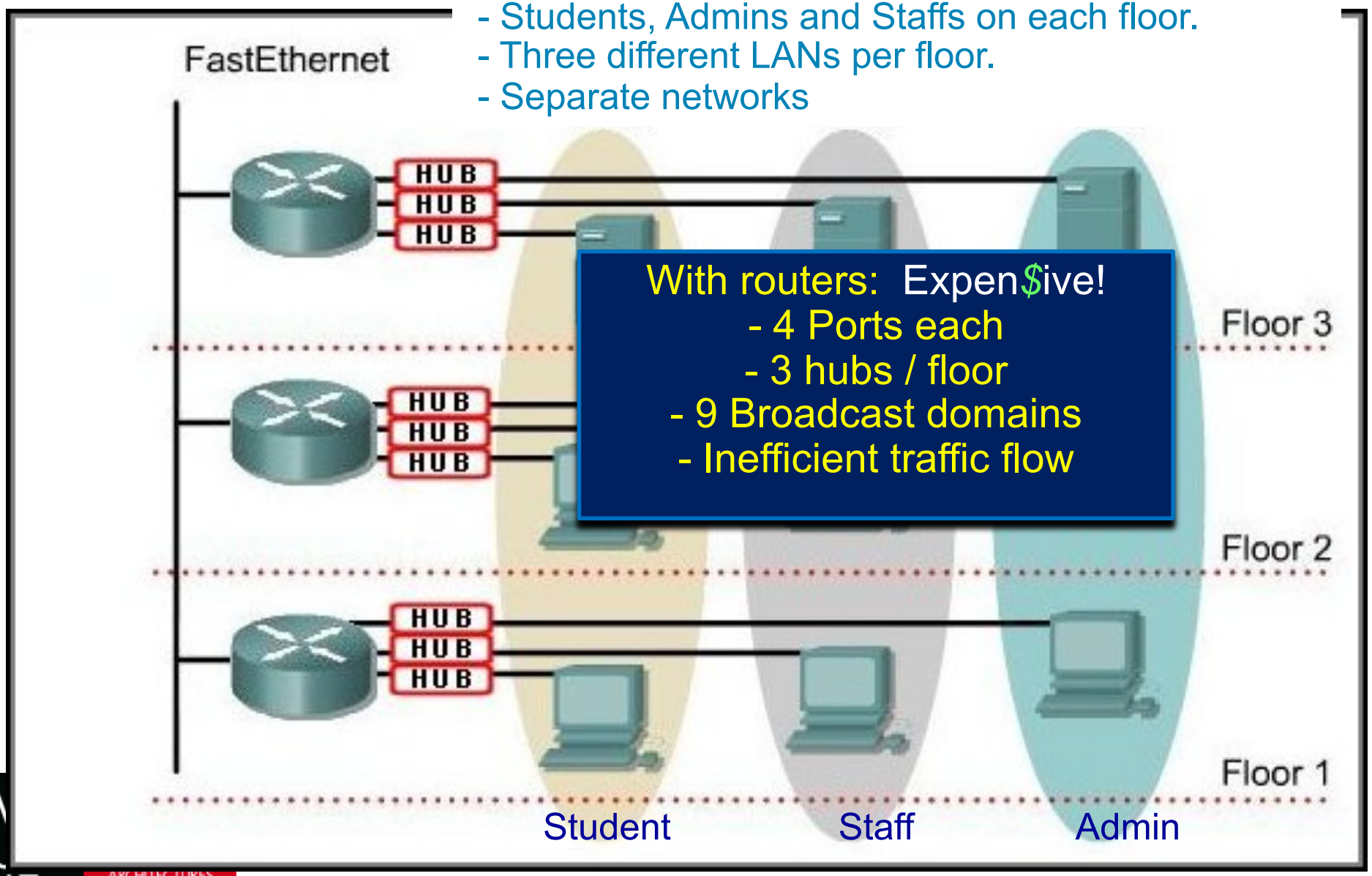
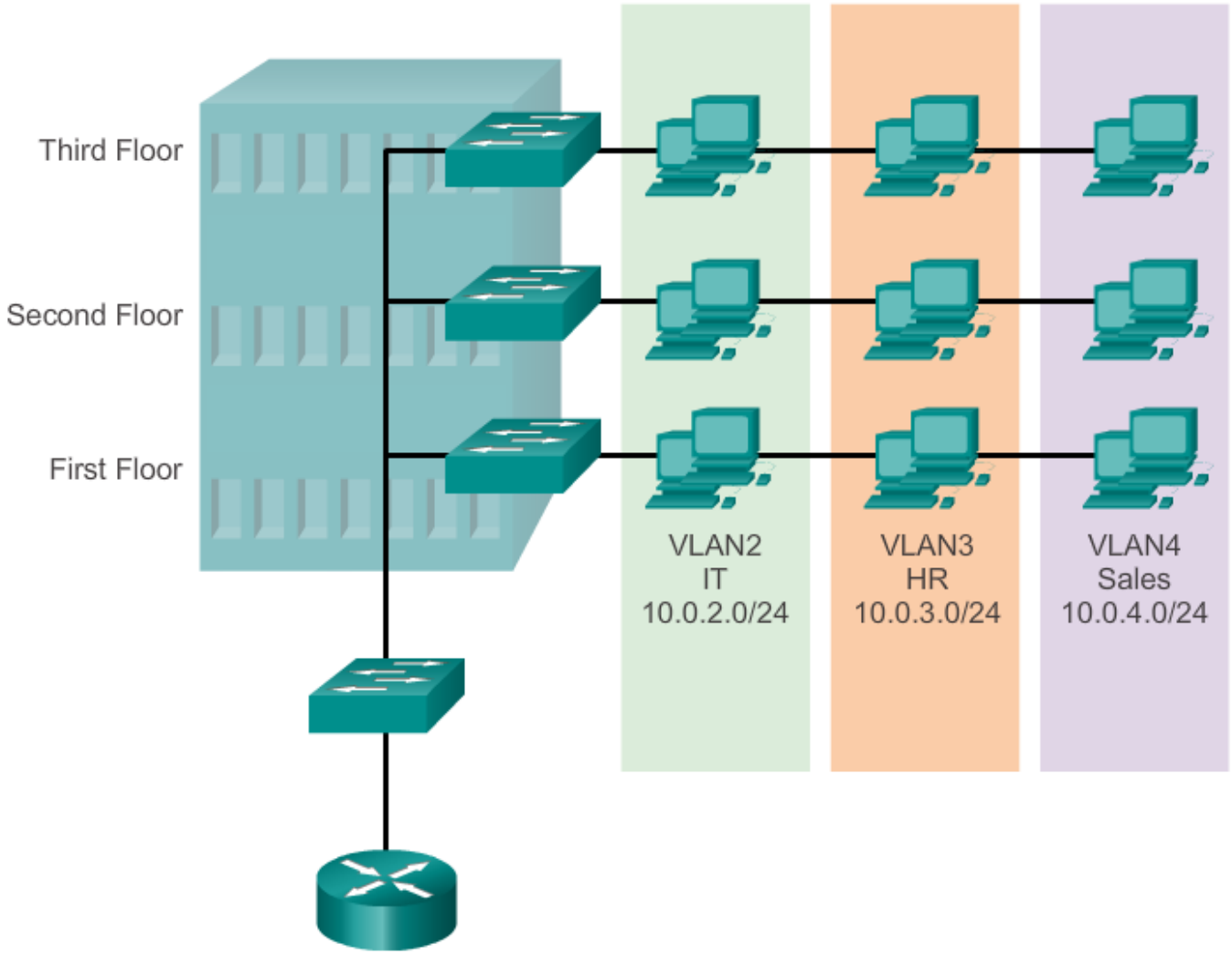
Without VLAN

Requirements:

- Students, Admins and Staffs on each floor.
- Three different LANs per floor.
- Separate networks



VLAN Definitions



Overview of VLANs

Benefits of VLANs

- Security
- Cost reduction
- Better performance
- Shrink broadcast domains

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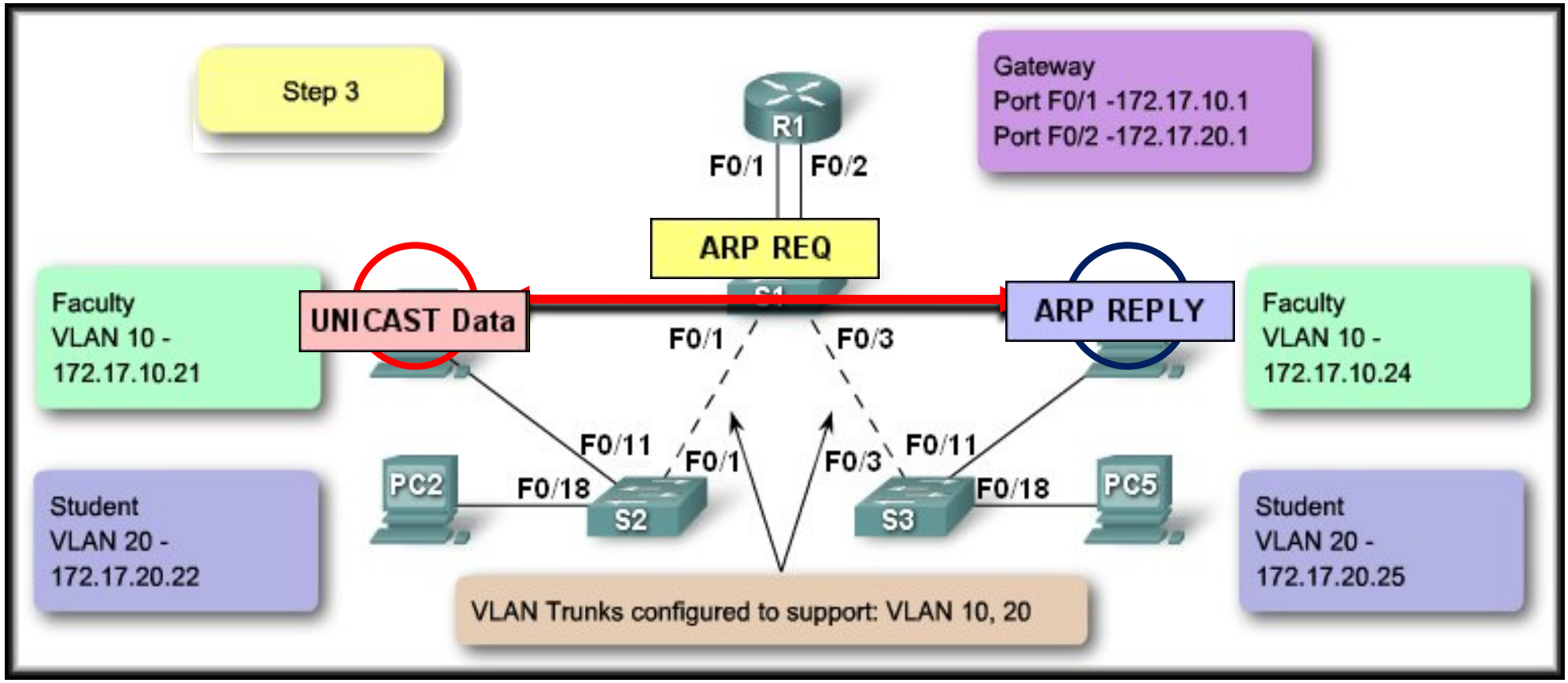
Intra VLAN Communications

- PC1 pings PC4
- PC1 ARP table does not contain MAC address of PC4
- An ARP Request is a Broadcast



VLAN Ranges on Catalyst Switches

- Cisco Catalyst 2960 and 3560 Series switches support over 4,000 VLANs
- VLANs are split into two categories:
  - Normal range VLANs
    - VLAN numbers from 1 to 1,005
    - Configurations stored in the vlan.dat (in the flash memory)
  - Extended Range VLANs
    - VLAN numbers from 1,006 to 4,095
    - Configurations stored in the running configuration (NVRAM)
- Some limitations to Extended VLANs – should limit use to normal VLANs

VLAN Assignment

VLAN Switch Ports

- **Step 1**: Create the VLAN on switch
  - All core/distribution layer switches need to know all VLANs for traffic they will see
  - All access layer switches need to know all VLANs for devices connected to them
- **Step 2**: assign switchports to particular VLAN
  - Default switchport mode is automatic – instead force mode
  - Non-used ports should be shutdown and not assigned to used VLAN
- **Step 3**: for Management VLANs, create the virtual interface and assign the IP address
  - Remember gateway to allow inter-VLAN access

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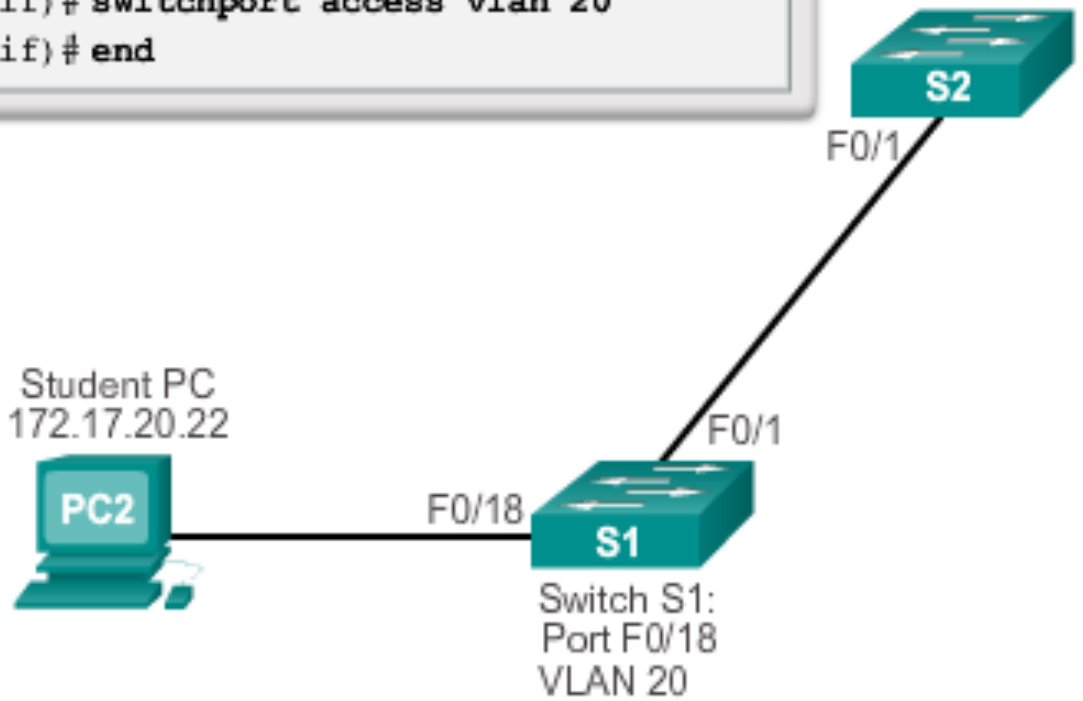
VLAN Assignment

VLAN Switch Ports

```
s1# configure terminal
s1(config)# interface F0/18
s1(config-if)# switchport mode access
s1(config-if)# switchport access vlan 20
s1(config-if)# end
```



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VLAN Assignment

Confirming VLAN Port Membership

```
S1# config t
S1(config)# int fa0/11
S1(config-if)# switchport mode access
S1(config-if)# switchport access vlan 20
S1(config-if)# end
S1#
S1# 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, Fa0/12, Fa0/1
                                     Fa0/14, Fa0/15, Fa0/16, Fa0/
                                     Fa0/18, Fa0/19, Fa0/20, Fa0/
                                     Fa0/22, Fa0/23, Fa0/24, Gi0/
                                     Gi0/2
20   student              active     Fa0/11
1002 fddi-default         act/unsup
1003 token-ring-default   act/unsup
1004 fddinet-default      act/unsup
1005 trnet-default        act/unsup
S1#
```

VLAN Access Ports

- Port can only belong to one VLAN
- Traffic is normal – *untagged* – Ethernet frames
- Network devices are unaware of VLAN
- Network devices see normal Ethernet network
- Traffic is restricted based on
  - Only traffic for that VLAN
  - Contents of switch CAM Table

VLAN Membership

Static VLAN

- Ports manually assigned to a VLAN
- Configured with:

```
switchport access vlan XX
```

- Requires reconfiguration if circumstances change

Dynamic VLAN

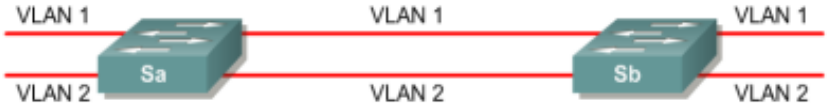
- Membership is configured using a VMPS – VLAN Membership Policy Server
- Based on source Mac address of device

VLAN Trunks

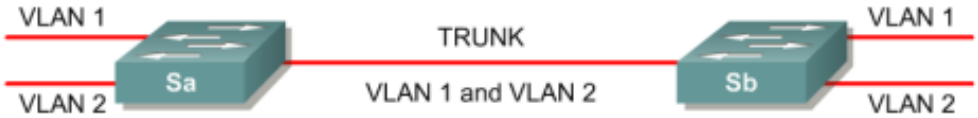
- Inefficient to connect switches using Access Ports – need one connection for each VLAN
- Trunks allow a single connection to carry traffic of multiple VLANs
- Traffic is still segmented
- Frames are tagged to allow receiving switch to ***know*** which VLAN traffic ***belongs*** to

VLAN Tagging

No VLAN Tagging



VLAN Tagging



VLAN Tagging is used when a link needs to carry traffic for more than one VLAN.

- There are two major methods of frame tagging, Cisco proprietary **Inter-Switch Link (ISL)** and **IEEE 802.1Q**.
- Cisco recommends using 802.1Q.

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
LAN Emulation (LANE)	ATM	No tagging	Virtual connection implies a VLAN ID

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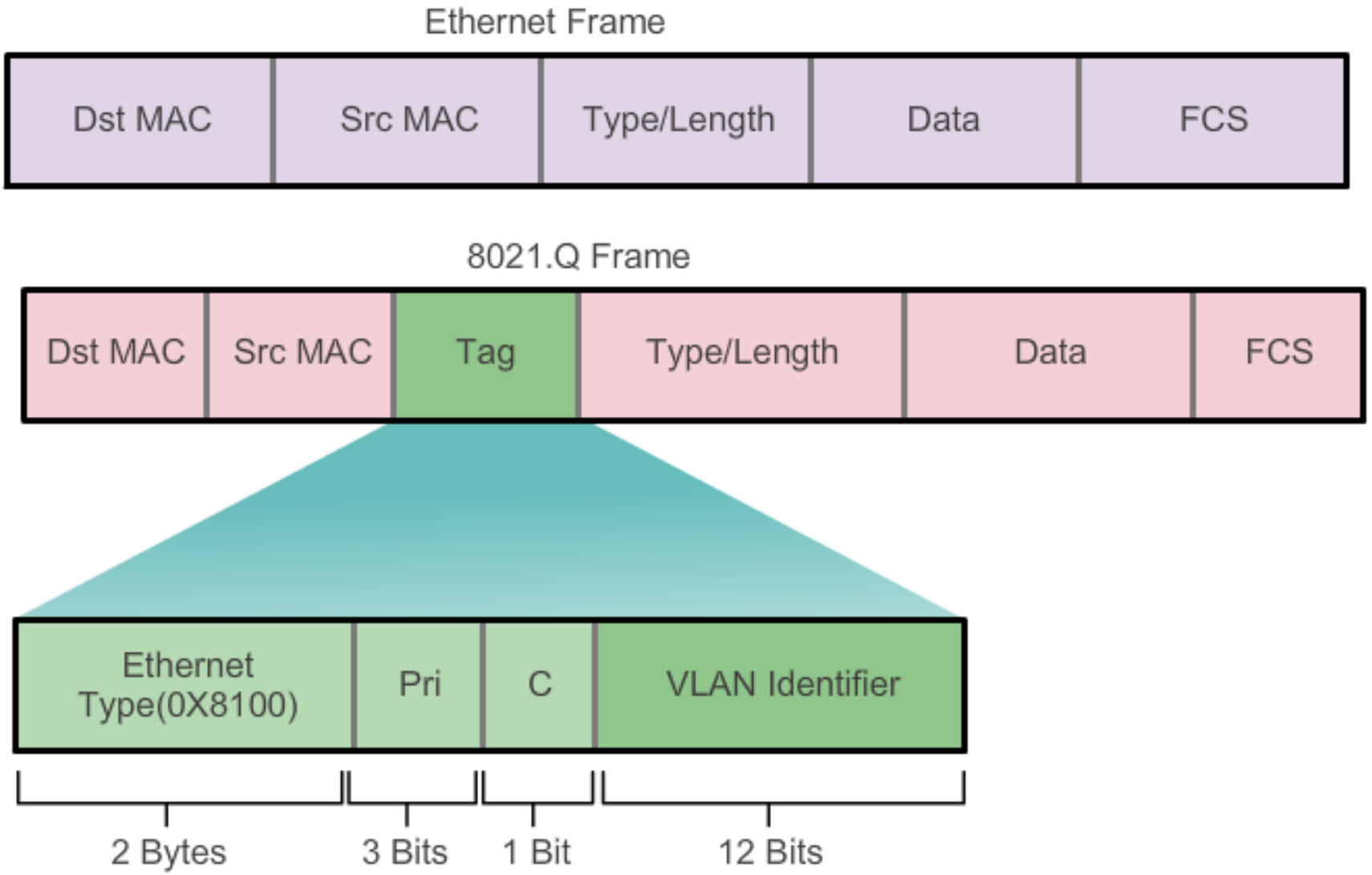
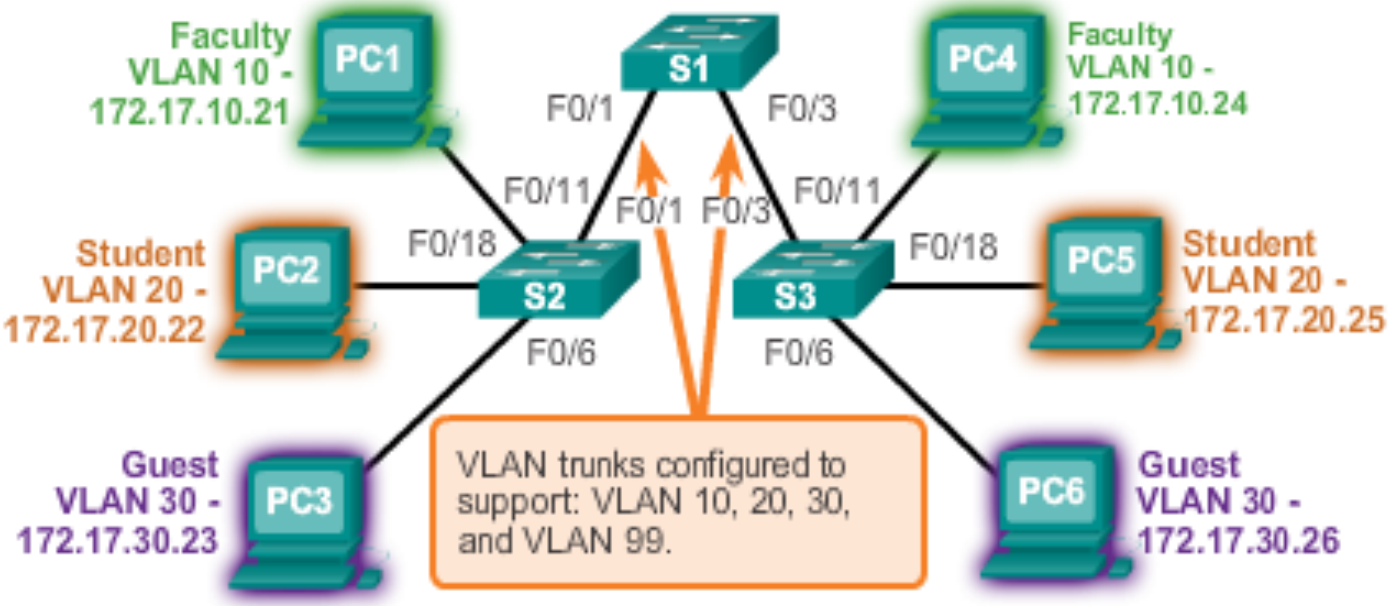
Tagging Ethernet Frames for VLAN Identification



Trunk Operation

VLAN 10 Faculty/Staff - 172.17.10.0/24
VLAN 20 Students - 172.17.20.0/24
VLAN 30 Guest - 172.17.30.0/24
VLAN 99 Management and Native - 172.17.99.0/24

F0/1-5 are 802.1Q trunk interfaces with native VLAN 99.
F0/11-17 are in VLAN 10.
F0/18-24 are in VLAN 20.
F0/6-10 are in VLAN 30.



Native VLANs and 802.1Q Tagging

- Frames that belong to the native VLAN are not tagged
- Frames received untagged remain untagged and are placed in the native VLAN when forwarded
- If there are no ports associated to the native VLAN and no other trunk links, an untagged frame is dropped
- In Cisco switches, the native VLAN is VLAN 1, by default

Configuring IEEE 802.1q Trunk Links

Cisco Switch IOS Commands

Enter global configuration mode.	`S1# configure terminal`
Enter interface configuration mode.	`S1(config)# interface interface_id`
Force the link to be a trunk link.	`S1(config-if)# switchport mode trunk`
Specify a native VLAN for untagged 802.1Q trunks.	`S1(config-if)# switchport trunk native vlan vlan_id`
Specify the list of VLANs to be allowed on the trunk link.	`S1(config-if)# switchport trunk allowed vlan vlan-list`
Return to the privileged EXEC mode.	`S1(config-if)# end`

```
S1(config)# interface FastEthernet0/1
S1(config-if)# switchport mode trunk
S1(config-if)# switchport trunk native vlan 99
S1(config-if)# switchport trunk allowed vlan 10,20,30
S1(config-if)# end
```

Introduction to DTP

- Cisco solution to automatically configure switch port state
- Dynamic Trunking Protocol (DTP) manages trunk negotiation
- Cisco proprietary protocol
- Default, enabled in Cisco Catalyst 2960 and 3560 switches
- The default DTP configuration for Cisco Catalyst 2960 and 3560 switches is dynamic auto

Negotiated Interface Modes

- Cisco Catalyst 2960 and 3560 support the following trunk modes:
  - `switchport mode dynamic auto`
  - `switchport mode dynamic desirable`
  - `switchport mode trunk`
  - `switchport nonegotiate`

	Dynamic Auto	Dynamic Desirable	Trunk	Access
Dynamic auto	Access	Trunk	Trunk	Access
Dynamic desirable	Trunk	Trunk	Trunk	Access
Trunk	Trunk	Trunk	**Trunk**	Limited connectivity
Access	Access	Access	Limited connectivity	**Access**

Available VLAN Types

- Data VLAN
- Default VLAN
- Native VLAN
- Management VLAN
- Voice VLAN

Data and Default VLANs

Data VLAN

- Configured to Carry data traffic
- User VLANs for networked devices and computers

Default VLAN

- Default setting on unconfigured switch
- Cisco – VLAN 1
- Same features as other VLANs except it cannot be deleted or renamed
- Default – Carries all Layer 2 control traffic

Native and Management VLANs

Native VLAN

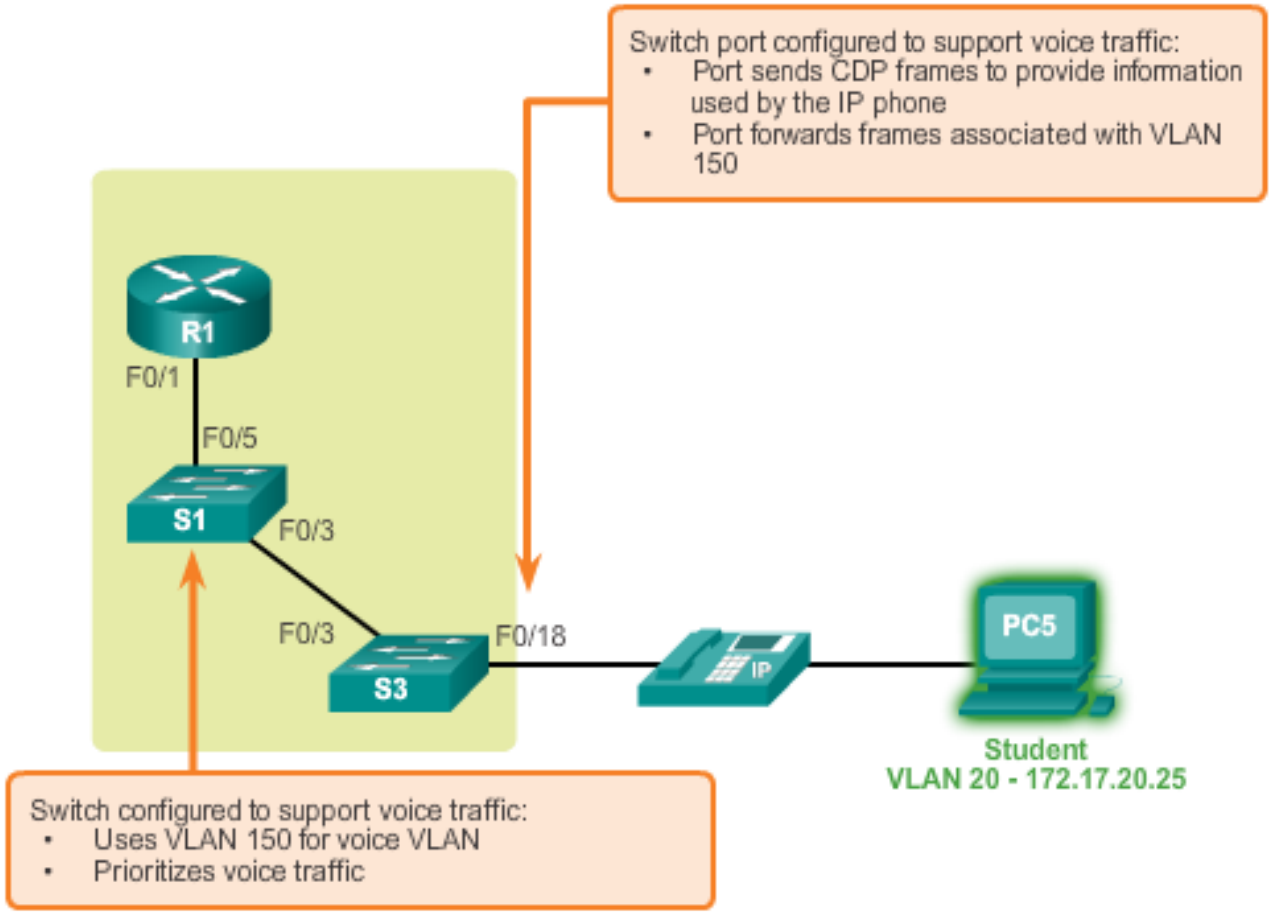
- Backwards compatibility with other switches
- Non tagged frames on an Ethernet Trunk will be assumed to belong to this VLAN
- Best practice – change from VLAN 1

Management VLAN

- Default – VLAN 1
- Assigned with IP address for network layer connectivity to switch

VLAN Types

Voice VLANs



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Summary

In this lecture, we covered:

- VLANs
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- DTP – Dynamic Trunking Protocol
- VLAN Types