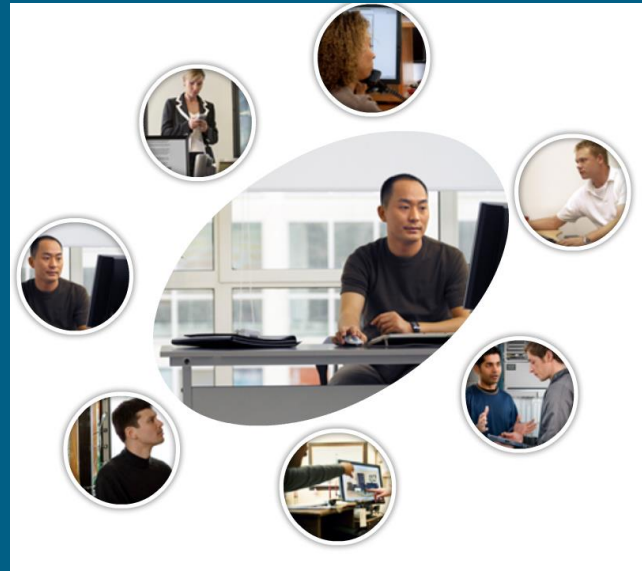
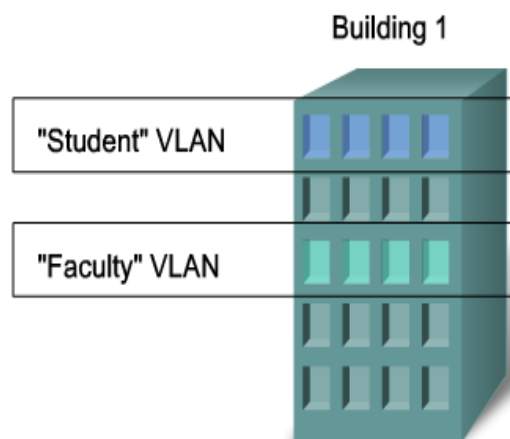


Virtual LAN



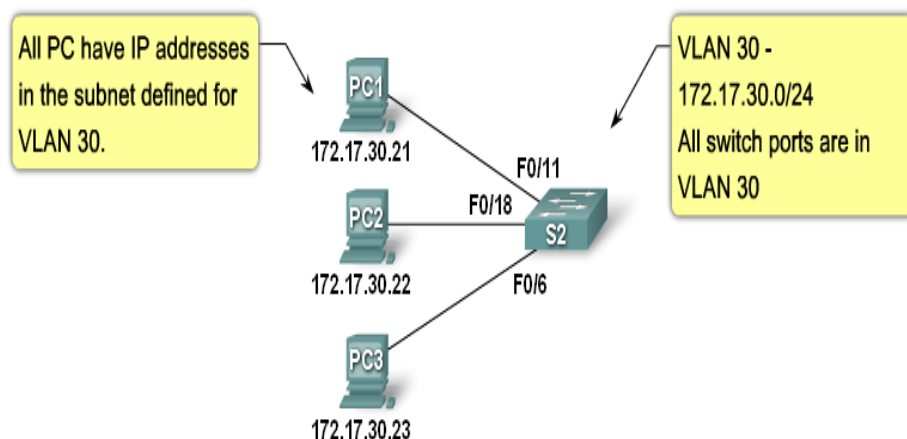
Virtual Local Area Network (VLAN)

What is a VLAN?



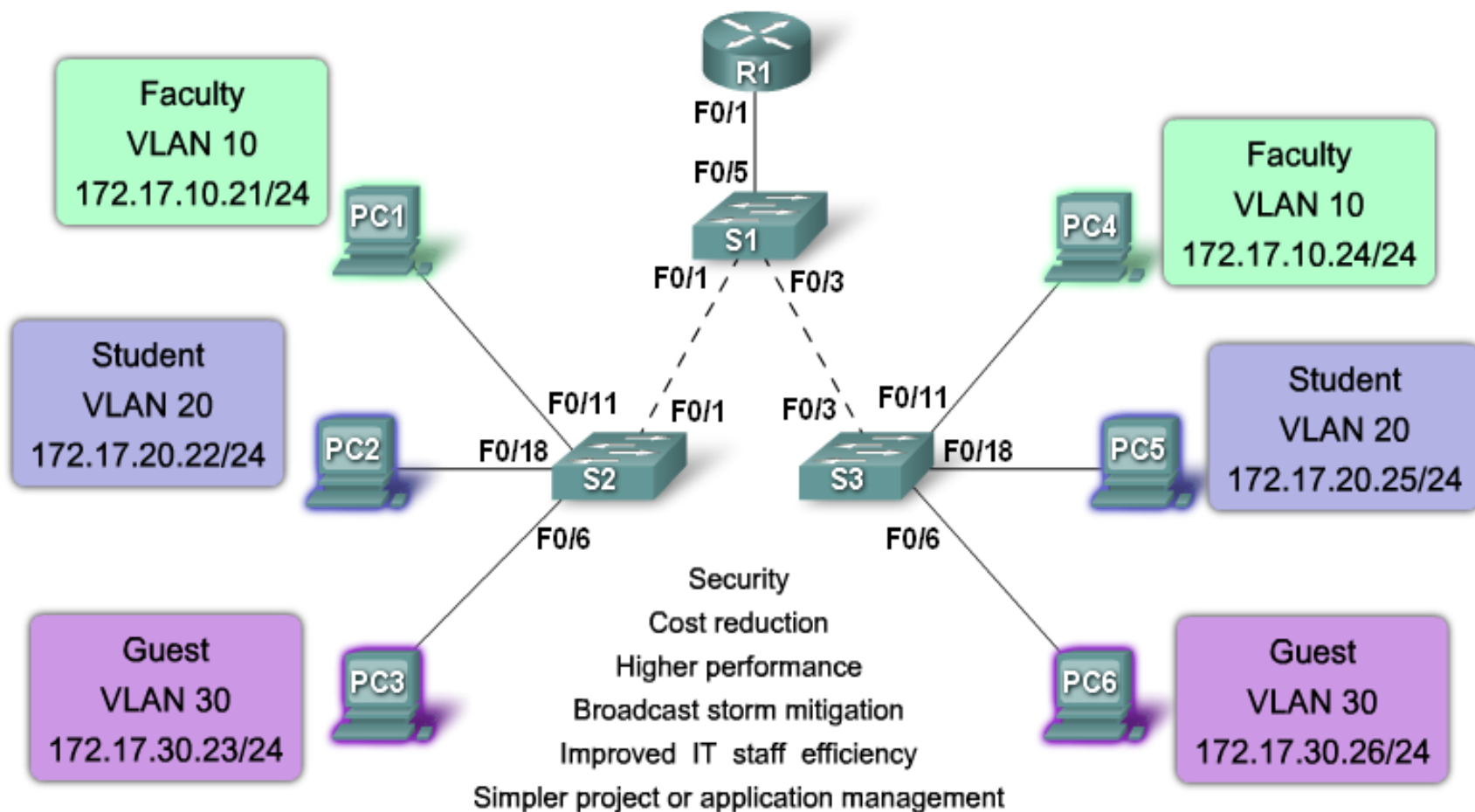
- A VLAN is an independent LAN network.
- A VLAN allows student and faculty PCs to be separated although they share the same infrastructure.
- A VLAN can be named for easier identification

What is a VLAN?



- A VLAN = Subnet (in modern switched LANs)
- On the switch
 - Configure the VLAN
 - Assign the port to the VLAN
- On the PC assign an IP address in the VLAN subnet

Virtual Local Area Network (VLAN)



Virtual Local Area Network (VLAN)

Add a VLAN

```
S1#configure terminal
S1(config)#vlan 20
S1(config-vlan)#name student
S1(config-vlan)#end
```

Switch S1:
VLAN 20
"student"

Student PC
172.17.20.22



Virtual Local Area Network (VLAN)

Add a VLAN

```
S1#show vlan brief
```

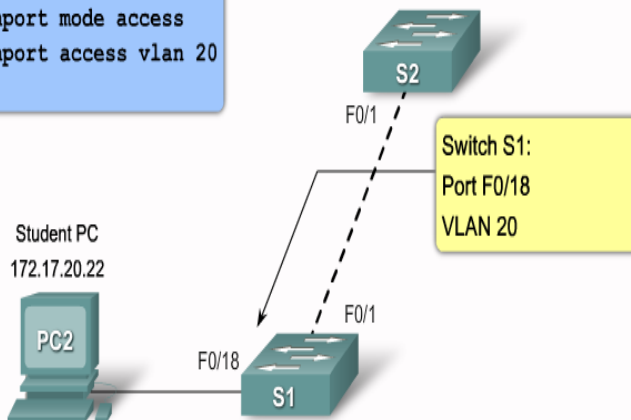
VLAN	Name	Status	Ports
1	default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 Fa0/5, Fa0/6, Fa0/7, Fa0/8 Fa0/9, Fa0/10, Fa0/11, Fa0/12 Fa0/13, Fa0/14, Fa0/15, Fa0/16 Fa0/17, Fa0/18, Fa0/19, Fa0/20 Fa0/21, Fa0/22, Fa0/23, Fa0/24 Gi0/1, Gi0/2
20	student	active	
1002	fddi-default	act/unsup	
1003	token-ring-default	act/unsup	
1004	fddinet-default	act/unsup	
1005	trnet-default	act/unsup	

Access Ports

- A port which carry the data of only one VLAN

Assign A Switch Port

```
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
```



Assign A Switch Port

```
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, Fa0/11, Fa0/12 Fa0/13, Fa0/14, Fa0/15, Fa0/16 Fa0/17, Fa0/19, Fa0/20, Fa0/21 Fa0/22, Fa0/23, Fa0/24, Gi0/1 Gi0/2
20	student	active	Fa0/18
1002	fddi-default	act/unsup	
1003	token-ring-default	act/unsup	
1004	fddinet-default	act/unsup	
1005	trnet-default	act/unsup	

S1#

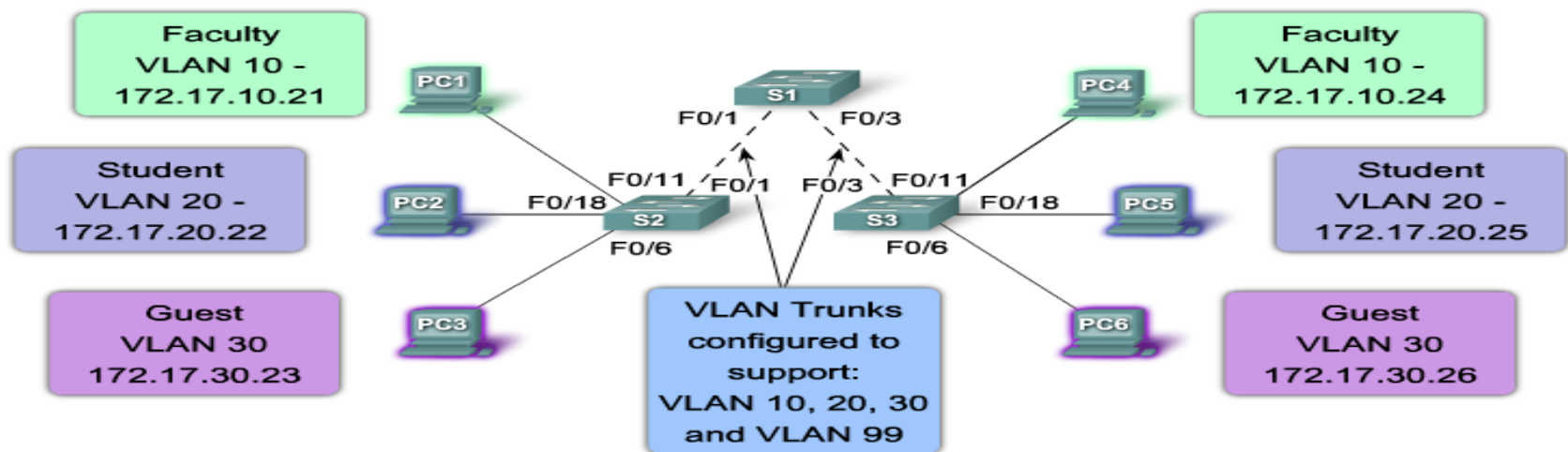
Trunk links

- A port that carry traffic from different VLANs simultaneously

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

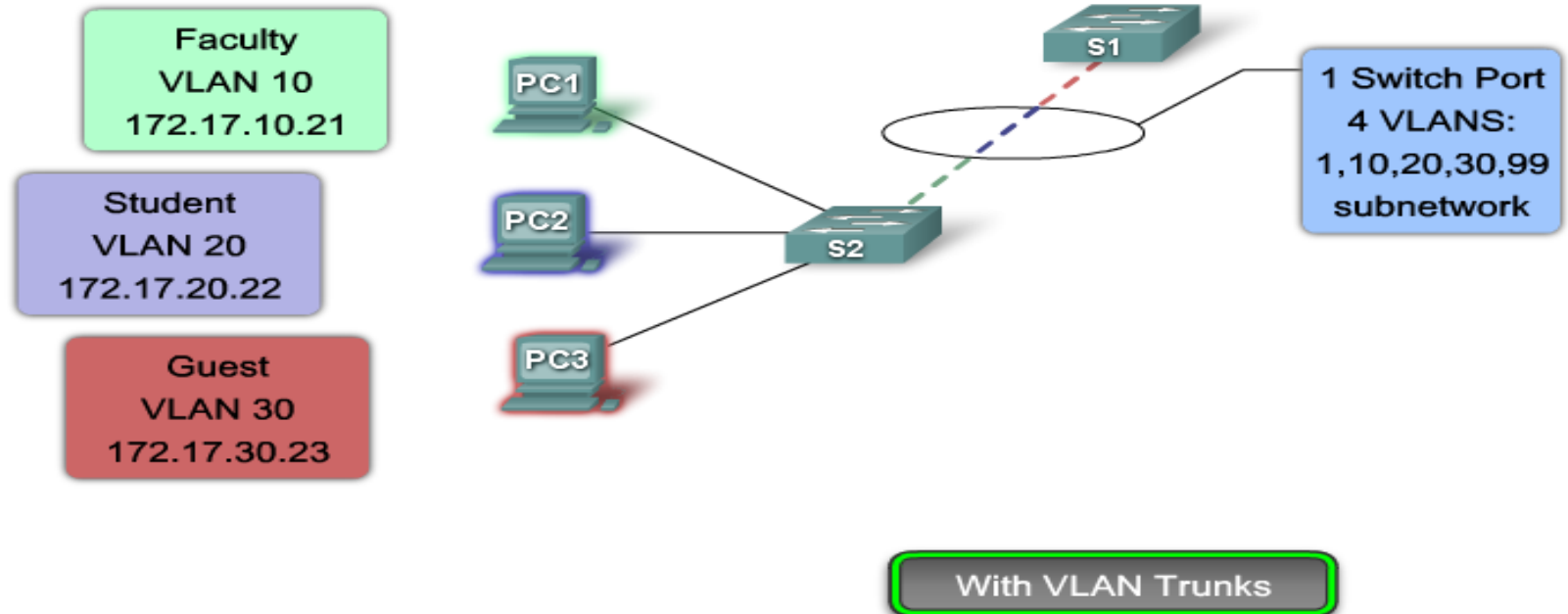
Ports

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

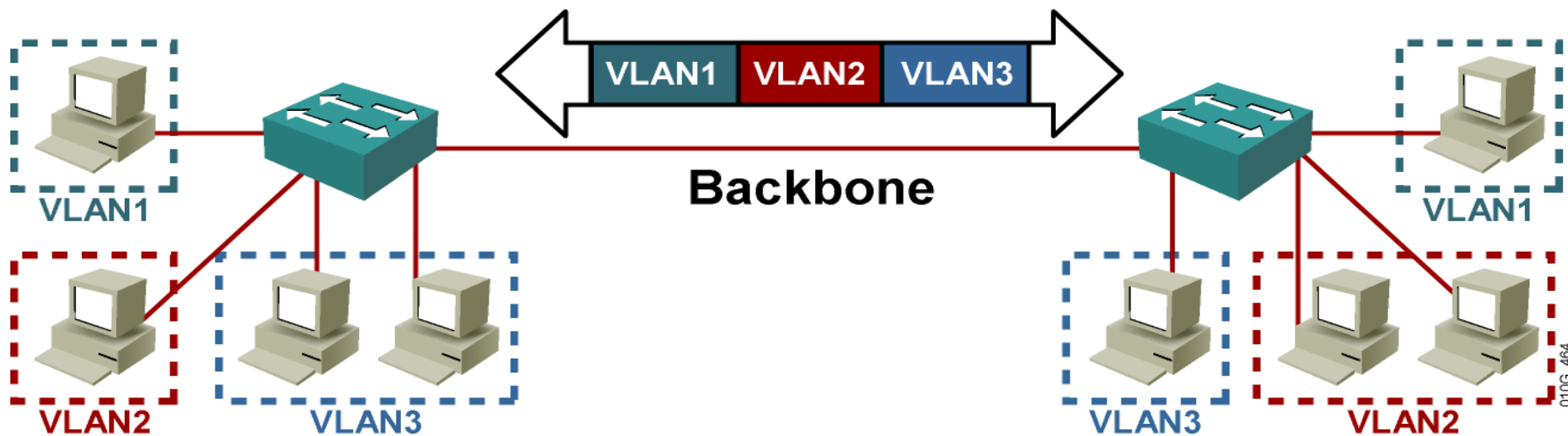


Trunk links

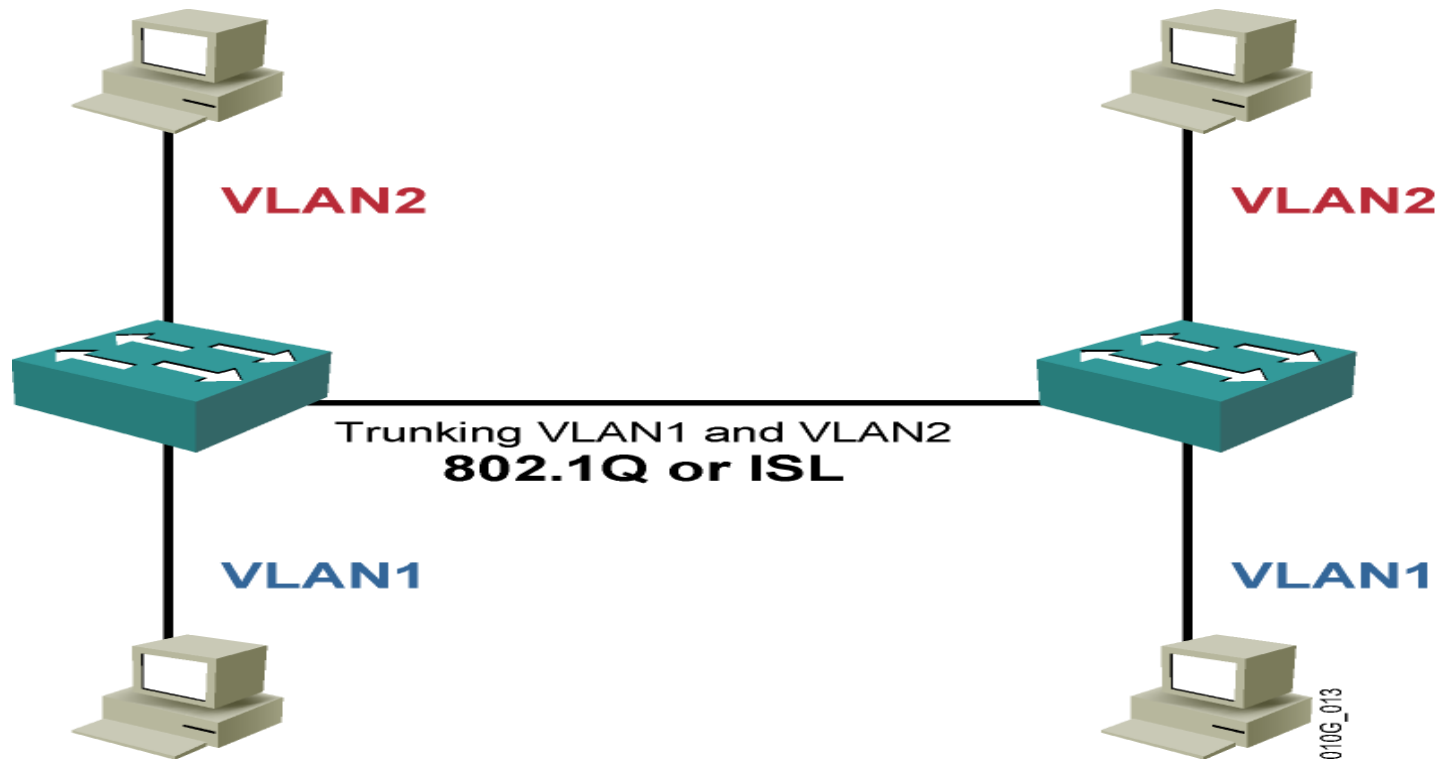
VLAN 10 – Faculty - 172.17.10.0/24
VLAN 20 - Students - 172.17.20.0/24
VLAN 30 – Guest - 172.17.30.0/24
VLAN 99 – Management and Native - 172.17.99.0/24



Trunk links

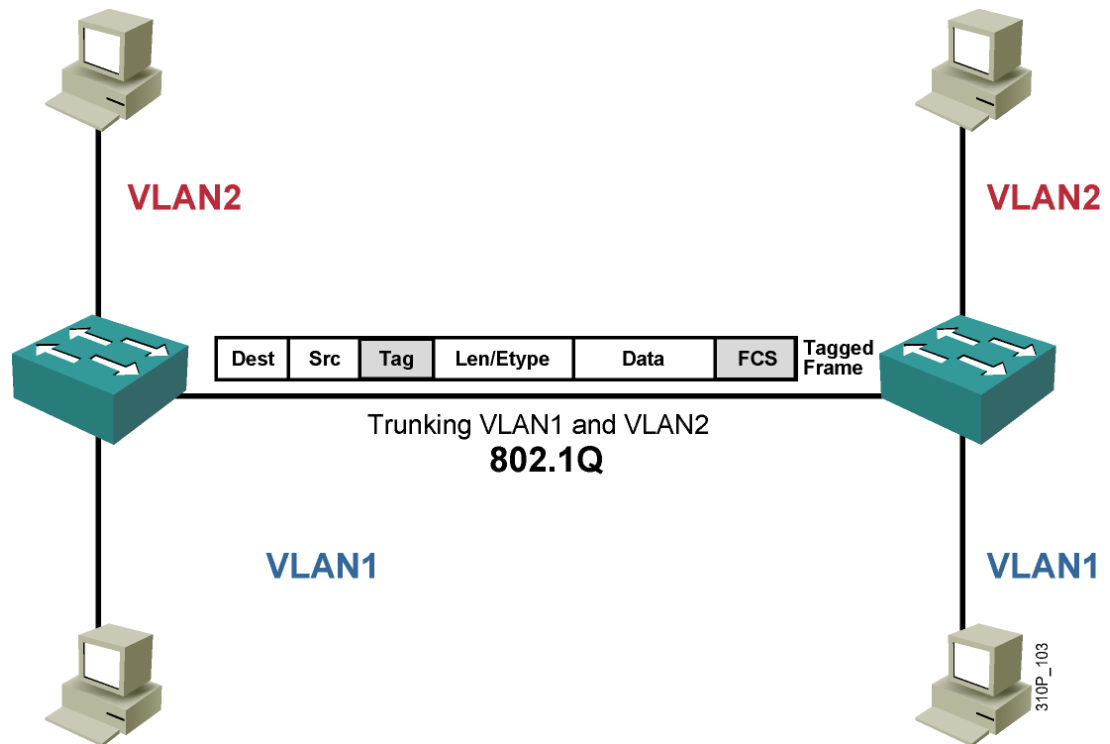


Trunk links protocols



Trunking with 802.1Q

- An IEEE standard
- Adds a 4-byte tag to the original frame
- Additional tag includes a priority field
- Does not tag frames that belong to the native VLAN
- Supports Cisco IP telephony



Trunk links with 802.1q

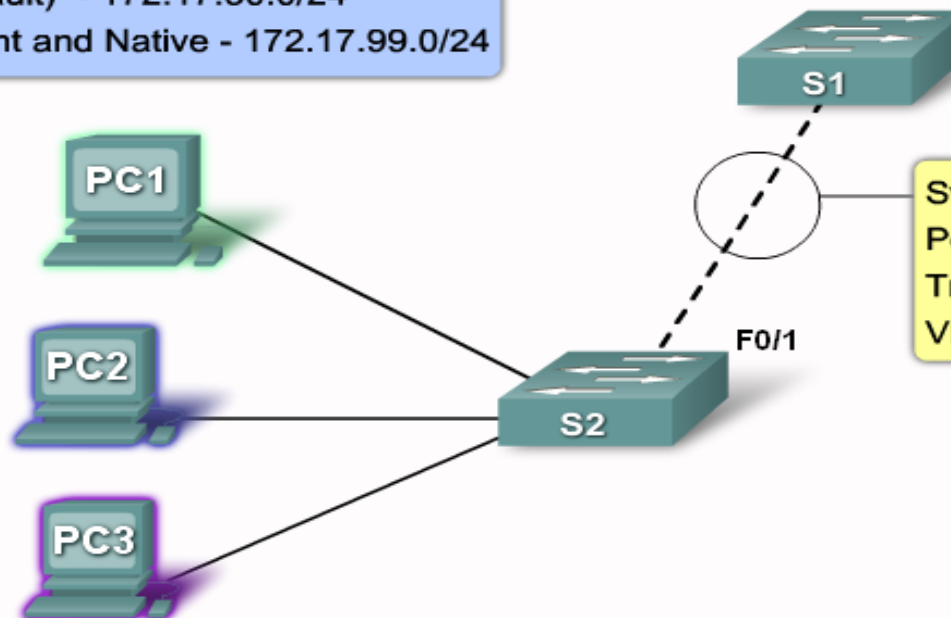
Configure an 802.1Q Trunk

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

Faculty
VLAN 10
172.17.10.21

Student
VLAN 20
172.17.20.22

Guest
VLAN 30
172.17.30.23



Switch S1:
Port F0/1
Trunk Port
VLANS: 10,20,30,99

Topology

How to configure Trunk Link

```
S1#configure terminal
```

```
Enter configuration commands, one per line.  End with CNTL/Z.
```

```
S1(config)#vlan 10
```

```
S1(config-vlan)#vlan 30
```

```
S1(config-vlan)#exit
```

```
S1(config)#interface f0/5
```

```
S1(config-if)#switchport mode trunk
```

```
S1(config-if)#end
```

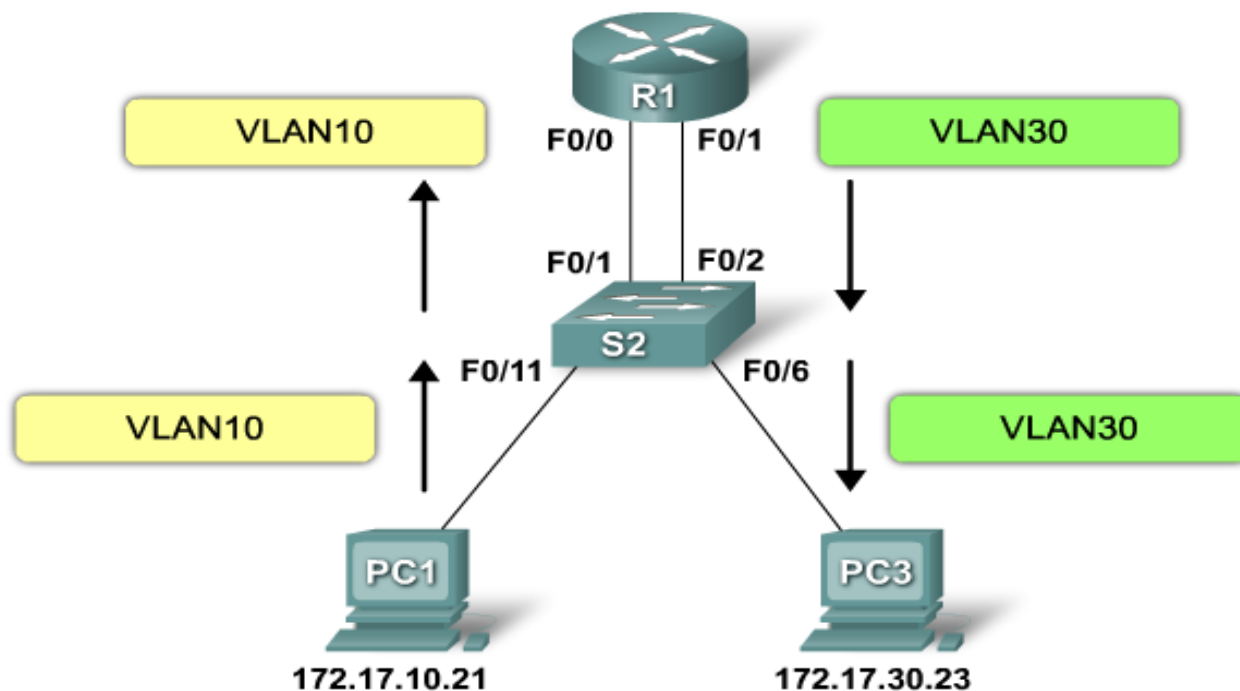
```
S1#
```

Inter-VLAN routing



Inter-VLAN routing

What is Inter-VLAN Routing?



Router-based Inter-VLAN routing is a process for forwarding network traffic from one VLAN to another VLAN using a router.

Inter-VLAN Routing (router on a stick)

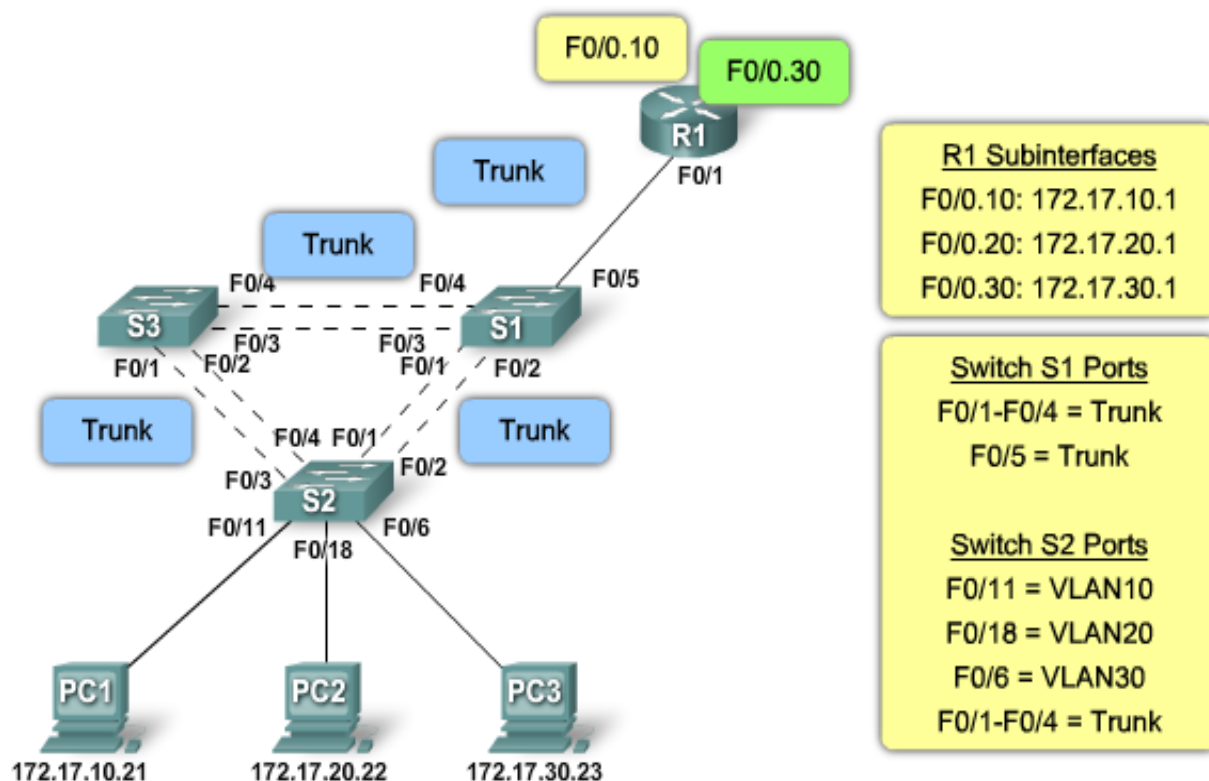
Router Subinterfaces and Inter-VLAN Routing

PC1 sends an ARP request for the MAC address of its default gateway, which is the VLAN subinterface on router R1.

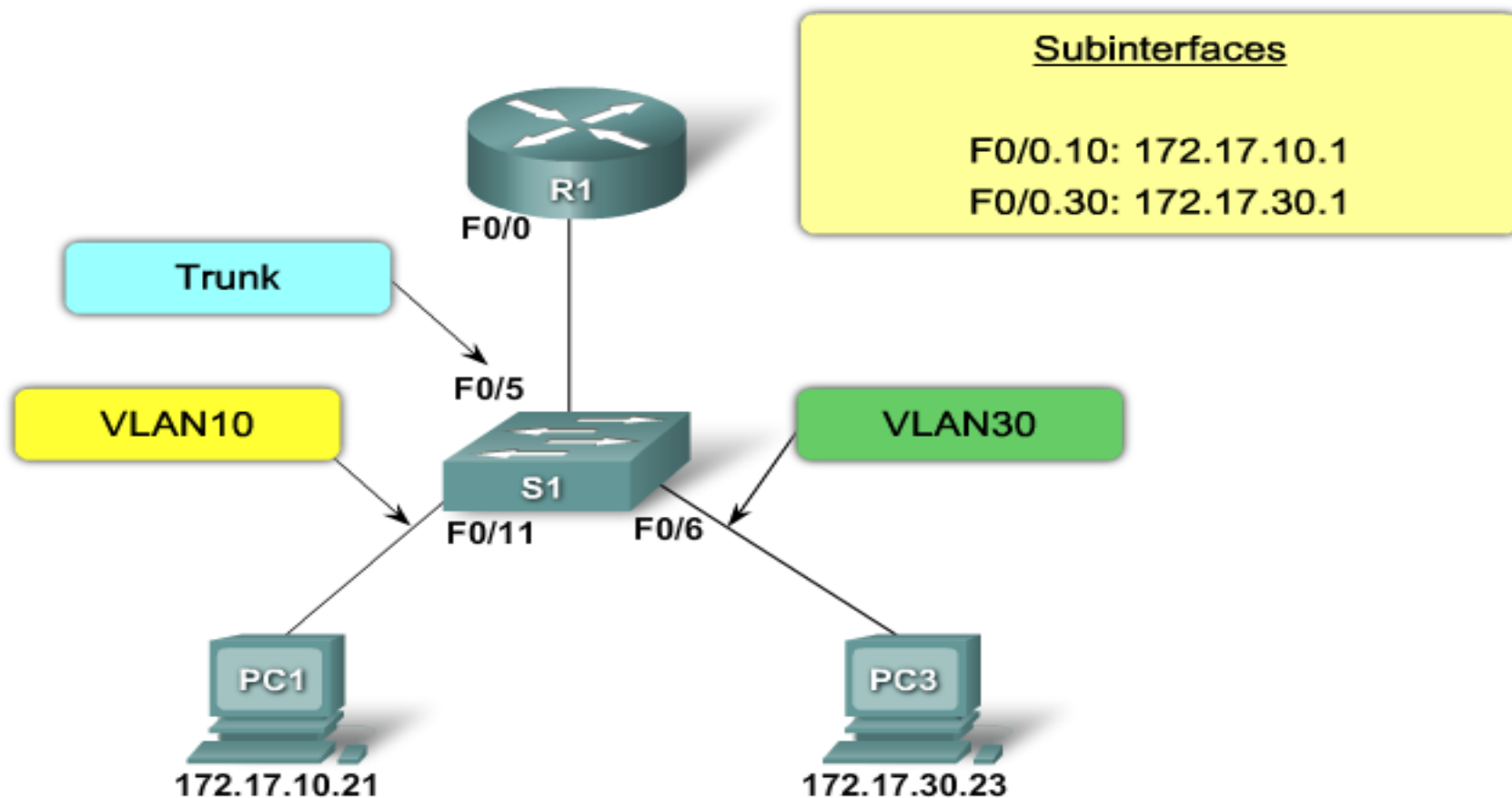
The ARP request is sent out for the IP address 172.16.10.1, which corresponds to the subnet PC1 is connected to.

The ARP request is sent to switch S2 on VLAN10, and is tagged and forwarded out the trunk link to switch S1.

Switch S1 maintains the VLAN tag on the broadcast frame as it forwards it out the other trunk link connected to router R1.



How to configure inter-VLAN routing ?



How to configure inter-VLAN routing ?

Subinterface Configuration

```
R1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#interface f0/0.10
R1(config-subif)#encapsulation dot1q 10
R1(config-subif)#ip address 172.17.10.1 255.255.255.0
R1(config-subif)#interface f0/0.30
R1(config-subif)#encapsulation dot1q 30
R1(config-subif)#ip address 172.17.30.1 255.255.255.0
R1(config-subif)#interface f0/0
R1(config-if)#no shutdown
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/0.10, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/0.30, changed state to up
R1(config-if)#end
R1#
```

How to configure inter-VLAN routing ?

Subinterface Configuration

```
R1#show ip route
```

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B -  
BGP
```

```
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
```

```
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
```

```
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
```

```
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS
```

```
inter area
```

```
       * - candidate default, U - per-user static route, o - ODR
```

```
       P - periodic downloaded static route
```

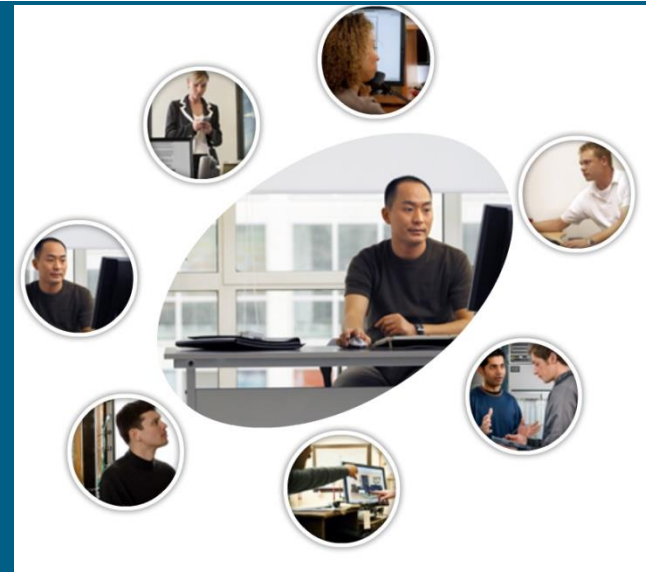
```
Gateway of last resort is not set
```

```
172.17.0.0/24 is subnetted, 2 subnets
```

```
C      172.17.10.0 is directly connected, FastEthernet0/0.10
```

```
C      172.17.30.0 is directly connected, FastEthernet0/0.30
```

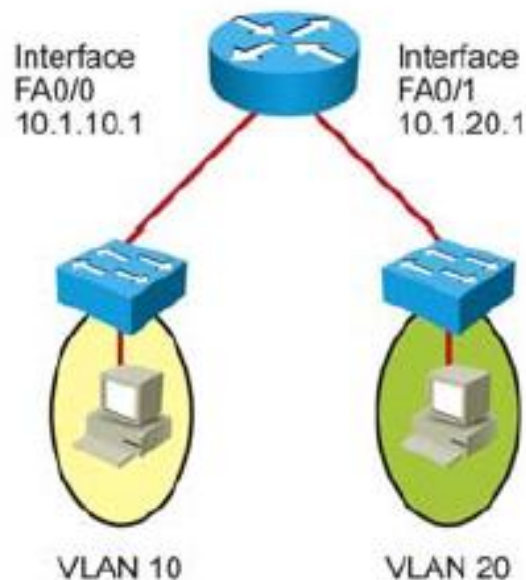
Inter-VLAN routing using Multilayer Switch



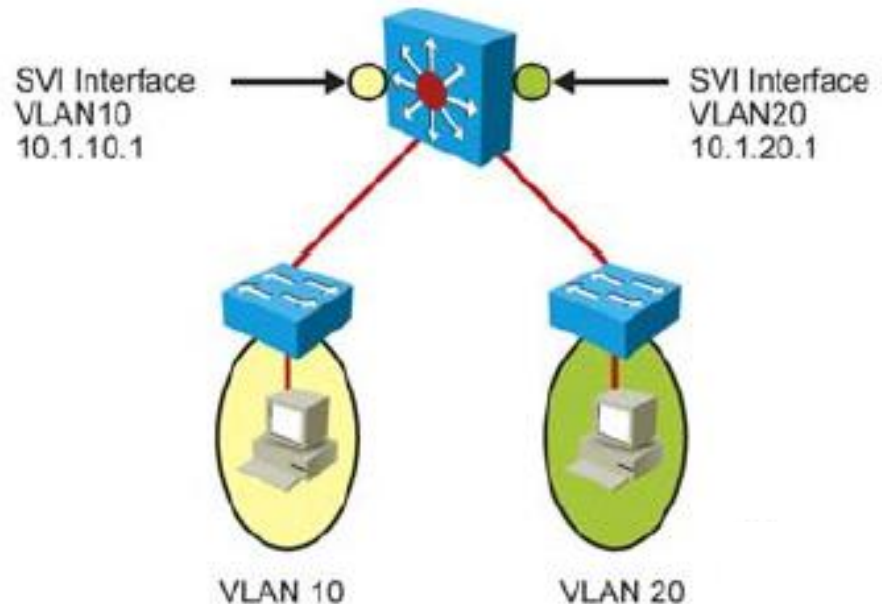
Switched Virtual Interface (SVI)

Switch Virtual Interfaces

Routers use interfaces or subinterfaces to interconnect multiple VLANs.

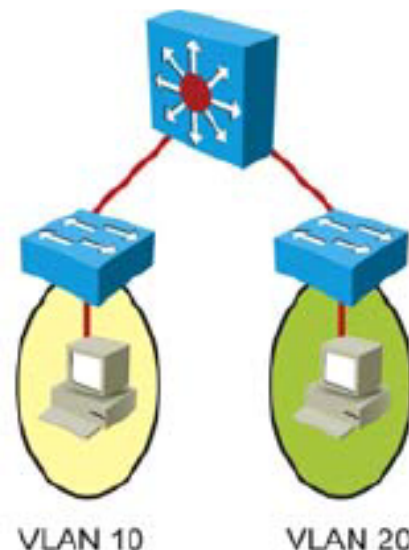


Multilayer switches use SVIs for routing between VLANs.



SVI Configuration

- Enable IP routing.
- Configure an SVI for each VLAN.
- Configure an IP address.
- Enable the SVI.
- Configure the routing protocol.



```
switch(config)# ip routing
switch(config)# interface vlan10
switch(config-if)# ip address 10.1.10.1 255.255.255.0
switch(config-if)# no shutdown
switch(config)# interface vlan20
switch(config-if)# ip address 10.1.20.1 255.255.255.0
switch(config-if)# no shutdown
```