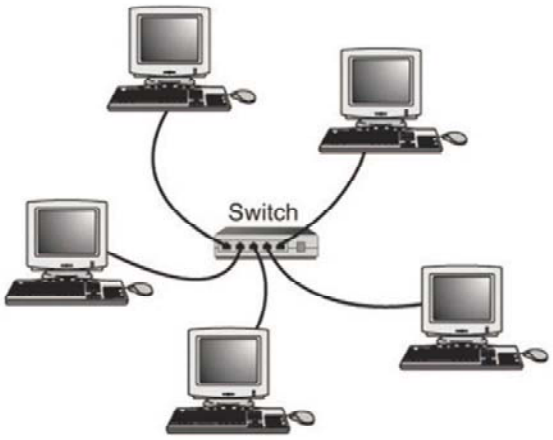
Basic Switching Concepts

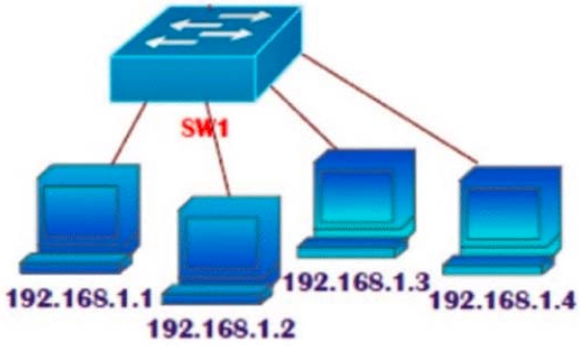
Provides centralized location to connect devices with in the LAN.



Switch

Rj45 Cable

Basic LAN setup



- Connect 4 computers in the LAN using Switch
- Configure IP addressing on all PC using 192.168.1.0/24 network.
- Check Connectivity between all the PC using Ping command

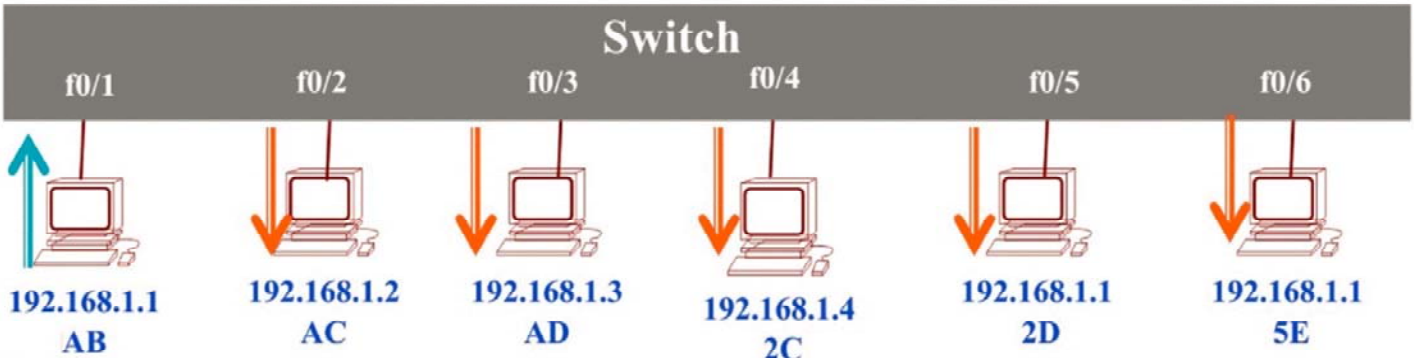
ARP process

Switch identify devices based on Mac-address

S – 192.168.1.1
D - 192.168.1.4

S – MAC=AB
D - MAC= ?

ARP Request
192.168.1.4 MAC= ?

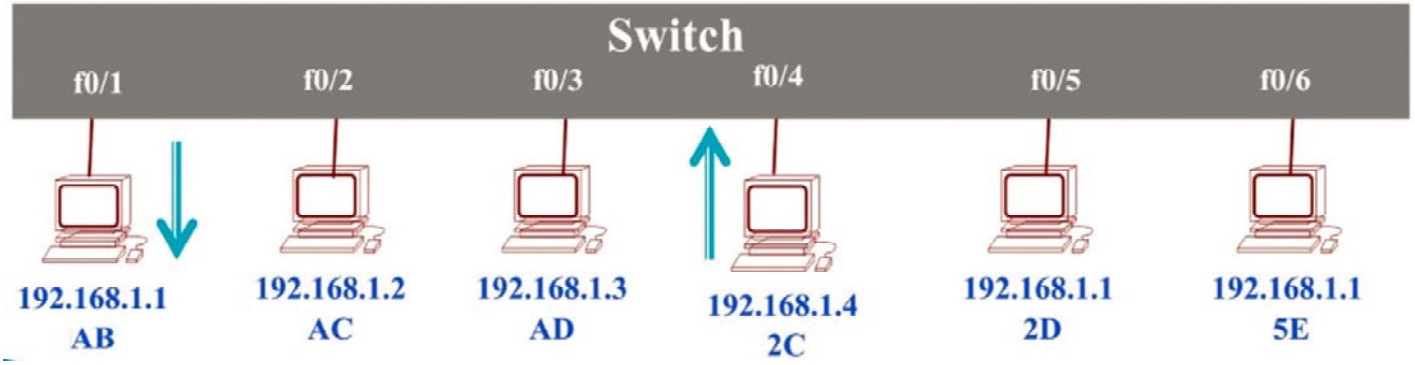


Switch identify devices based on Mac-address

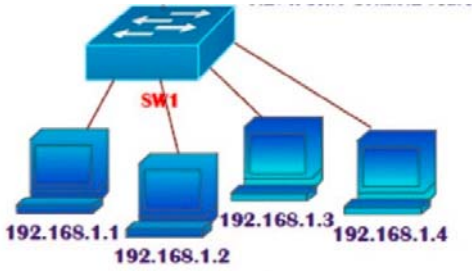
S – 192.168.1.1
D - 192.168.1.4

S – MAC=AB
D - MAC= ?

ARP reply
192.168.1.4 = 2C



ARP verification



PC>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Reply from 192.168.1.2: bytes=32 time=1ms TTL=128
Reply from 192.168.1.2: bytes=32 time=0ms TTL=128
Reply from 192.168.1.2: bytes=32 time=0ms TTL=128
Reply from 192.168.1.2: bytes=32 time=0ms TTL=128

PC>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time=2ms TTL=128
Reply from 192.168.1.3: bytes=32 time=0ms TTL=128
Reply from 192.168.1.3: bytes=32 time=0ms TTL=128
Reply from 192.168.1.3: bytes=32 time=0ms TTL=128

PC>arp -a

Internet Address	Physical Address	Type
192.168.1.2	000c.8547.85b2	dynamic
192.168.1.3	0060.5c31.6aeb	dynamic

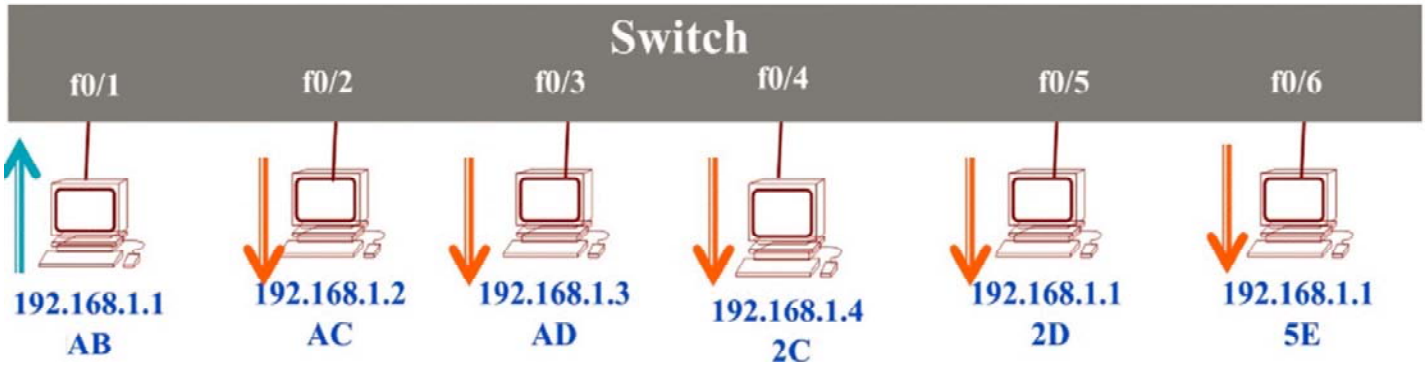
How switch Learn MAC address

S – 192.168.1.1 - AB
D - 192.168.1.4 - 2C

S - AB -- f0/1
D - 2C -- ?

MAC-table Entries

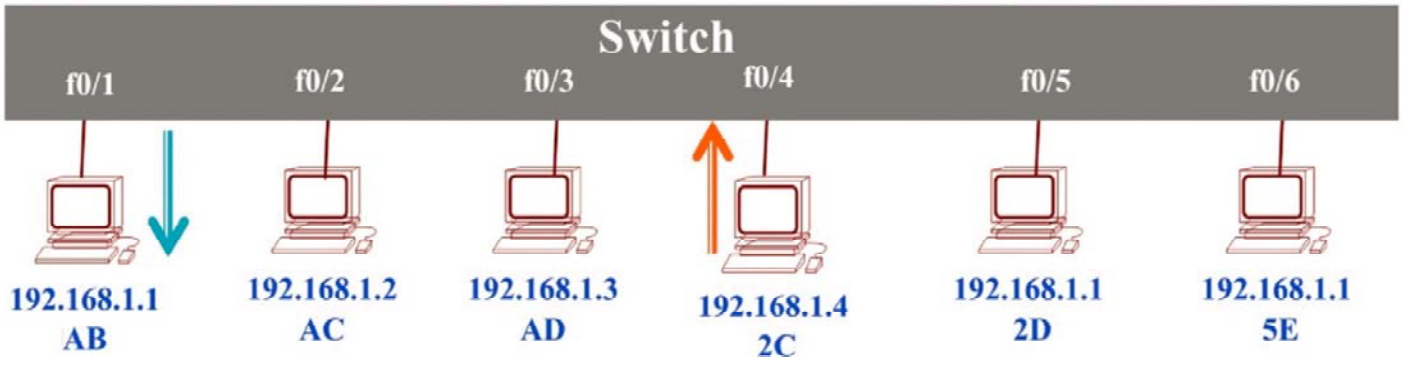
Port	MAC
f0/1	AB



How switch Learn MAC address

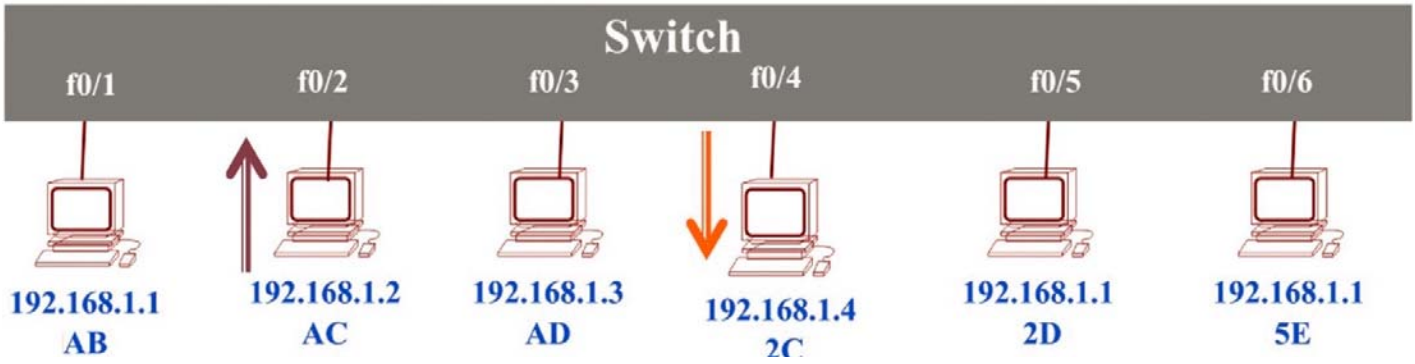
S - 2C – f0/4
D -AB – f0/1

Port	MAC
F0/1	AB
F0/4	2C

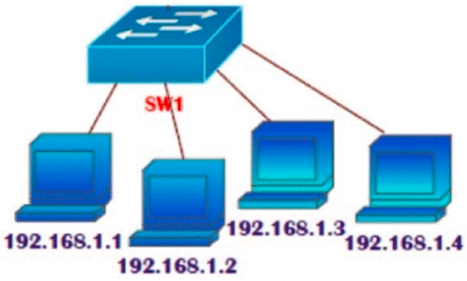


S - 192.168.1.2 AC
D -192.168.1.4 2C

Port	MAC
F0/1	AB
F0/4	2C
F0/2	AC



To check the mac-address entries in the MAC table



Switch# show mac-address-table

Mac Address Table

Vlan	Mac Address	Type	Ports
1	000a.419b.8ca9	DYNAMIC	Fa0/5
1	000c.8547.85b2	DYNAMIC	Fa0/2
1	0060.5c31.6aeb	DYNAMIC	Fa0/4
1	00d0.ff8b.4dad	DYNAMIC	Fa0/1

Switch basic functions

- If destination address present in mac-table - Switch do unicast
- If destination address not present in mac-table - Switch do broadcast (flooding)

- Switches update the MAC-table based on source address .
- Max-age time for mac-entries is 300 seconds of inactivity.

Types of Switches

Unmanageable switches

- plug and play (Connect & use)
- No configurations and verifications can be done
- There is no console port.

Manageable switches

- also plug and play (Connect & use)
- It has console port and CLI access.
- We can verify and modify configurations and can implement and test some advance switching technologies (VLAN, trunking , STP)

Cisco's Hierarchical Design Model

Access Layer

1900 & 2900 (L2 switches)

Catalyst 2900

Catalyst 1900

Distribution Layer

3550, 3560, 3750

(L3 switches or multi-layer switches)

Cisco 3550

Cisco 3560

Core Layer

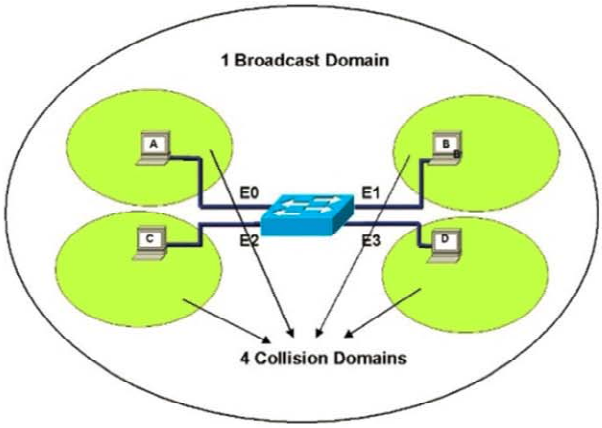
4500, 6500 (L3 switches or multi-layer switches)

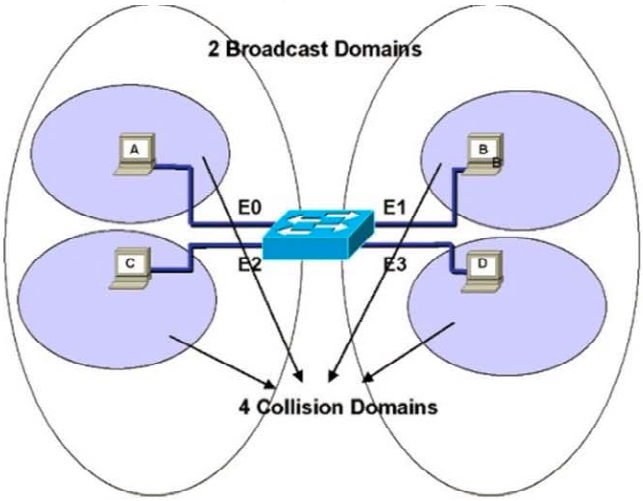
4500 , 6500

VLAN & Trunks

Virtual LAN

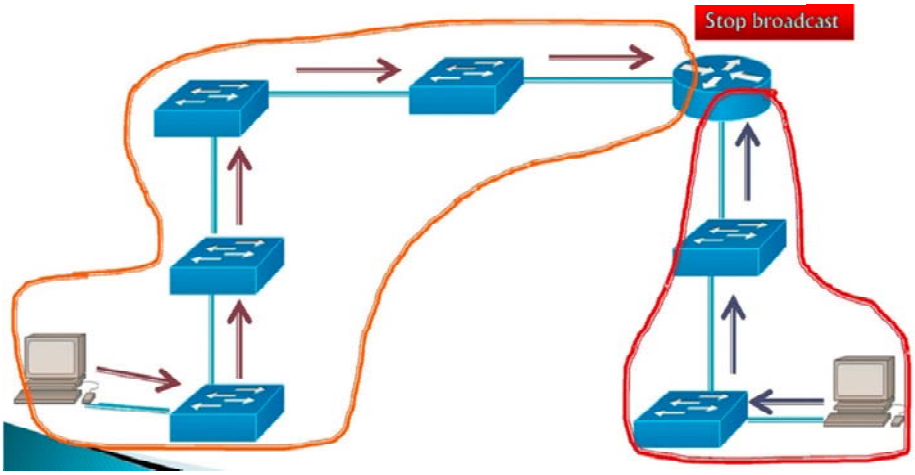
- Divides one single Broadcast domain into Multiple Broadcast domains.
- Layer 2 Security
- Vlan 1 is the default VLAN.
- We can create vlans from 2 – 1001
- Can be Configured on a Manageable switches only





Broadcast Domain

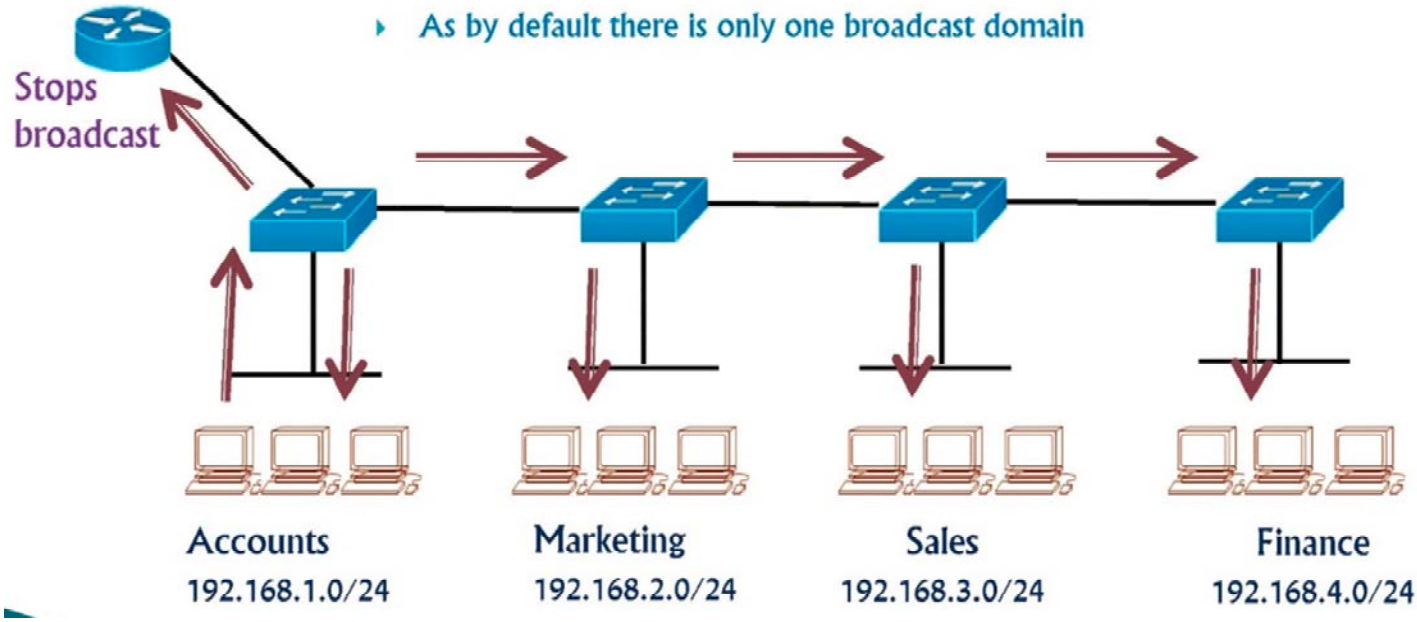
Set of all devices that receive broadcast frames originating from any device within the set.



What happens when a computer connected to the Accounts department

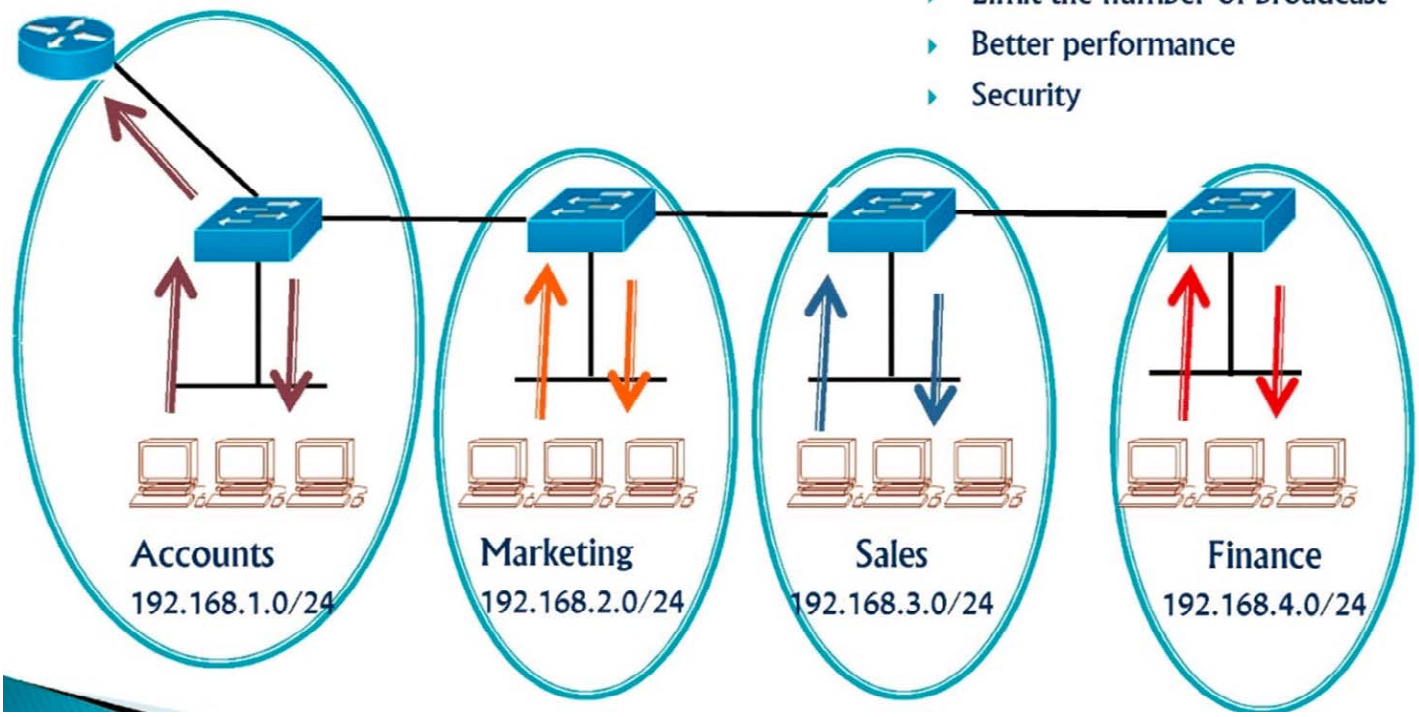
- sends a broadcast like an ARP request?
- Or if the destination mac unknown (not present in mac-table)

- By default the broadcast goes to each and every device in the network.
- As by default there is only one broadcast domain



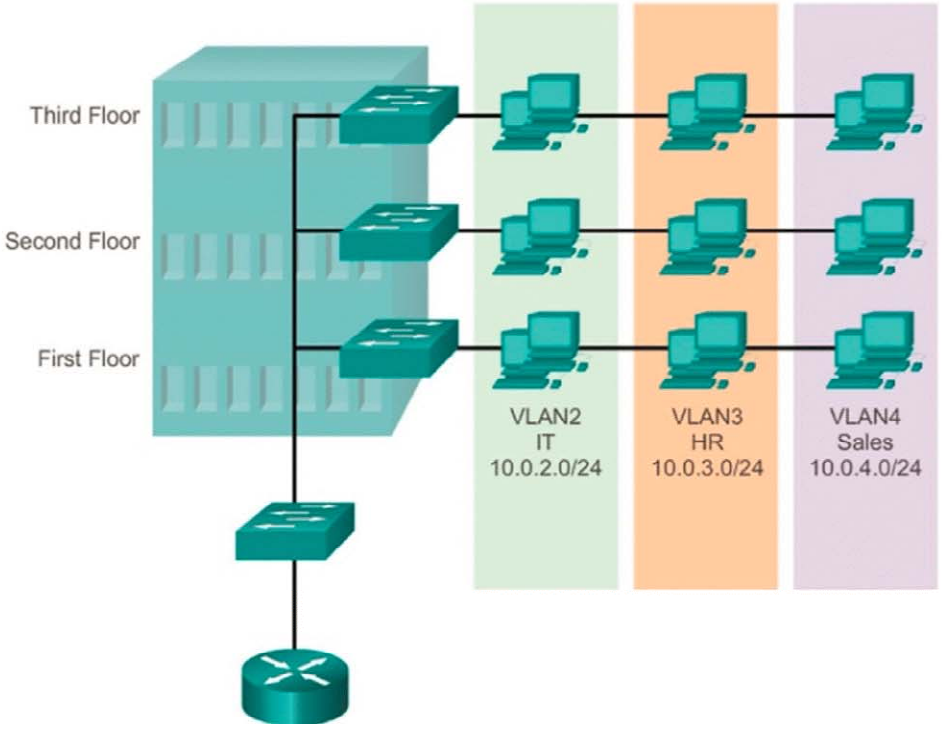
VLAN divides one single broadcast domain in to multiple Broadcast domains

- Limit the number of broadcast
- Better performance
- Security



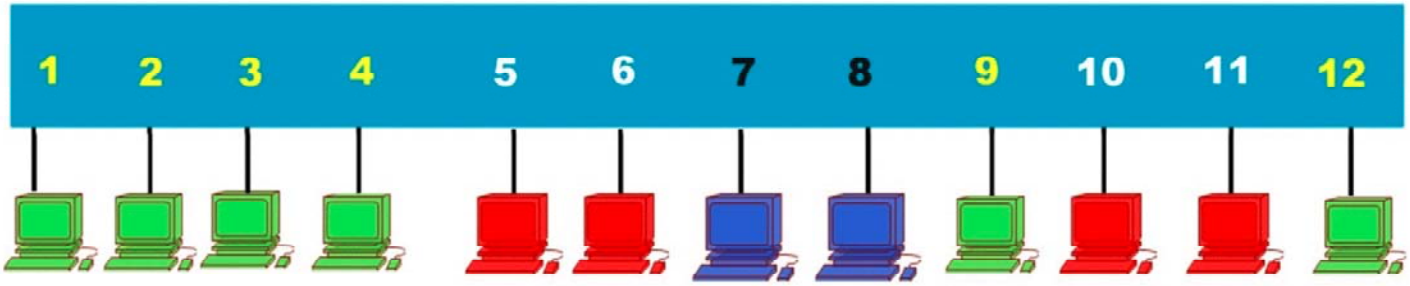
Benefits of VLANs

- Limit the number of broadcast
- Better performance
- Security



VLAN

- Work based on port numbers
- Default all ports will be in vlan 1
- Need to manually assign a port on a switch to a VLAN
- One port can be a member of only one VLAN



vlan 10 (Green) = 1, 2, 3, 4, 9 , 12

vlan 20 (Red) = 5, 6, 10, 11

vlan 30 (Blue) = 7 , 8

```
Switch#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
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active
```

Creating VLAN

```
Switch(config)# vlan <no>
Switch(config-Vlan)# name <name>
Switch(config-Vlan)# Exit
```

```
Switch(config)#vlan 10
Switch(config-vlan)#name Green
Switch(config-vlan)#vlan 20
Switch(config-vlan)#name Red
Switch(config-vlan)#vlan 30
Switch(config-vlan)#name Blue
Switch(config-vlan)#end
```

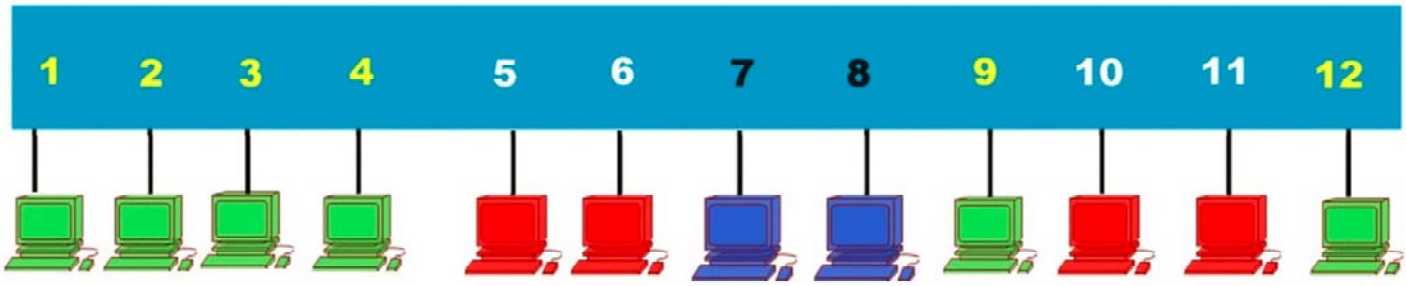
```
Switch#sh vlan brief

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
10   Green                             active
20   Red                               active
30   Blue                              active
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active
```

Assigning ports - VLAN

Switch(config)# **interface** <interface type> <interface no.>

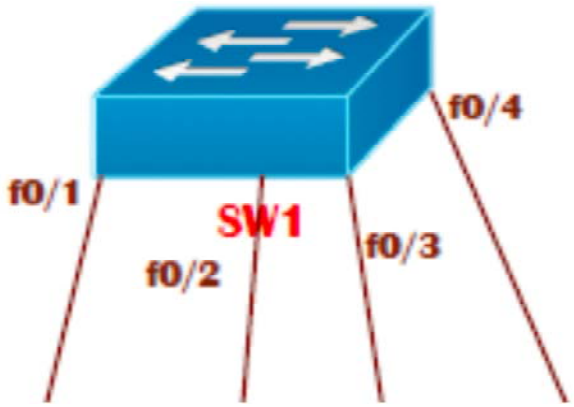
Switch(config-if)# **switchport mode access**

Switch(config-if)# **switchport access Vlan** <no>




```
Switch(config)#interface range f0/1 - 4 , f0/9 , f0/12
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 10
Switch(config-if-range)#exit

Switch(config)#interface range f0/5 - 6 , f0/10 - 11
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 20
Switch(config-if-range)#exit

Switch(config)#int range f0/7 - 8
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 30
Switch(config-if-range)#exit
```

LAB -2 CREATING BASIC VLAN CONFIGURATION ON SWITCHES

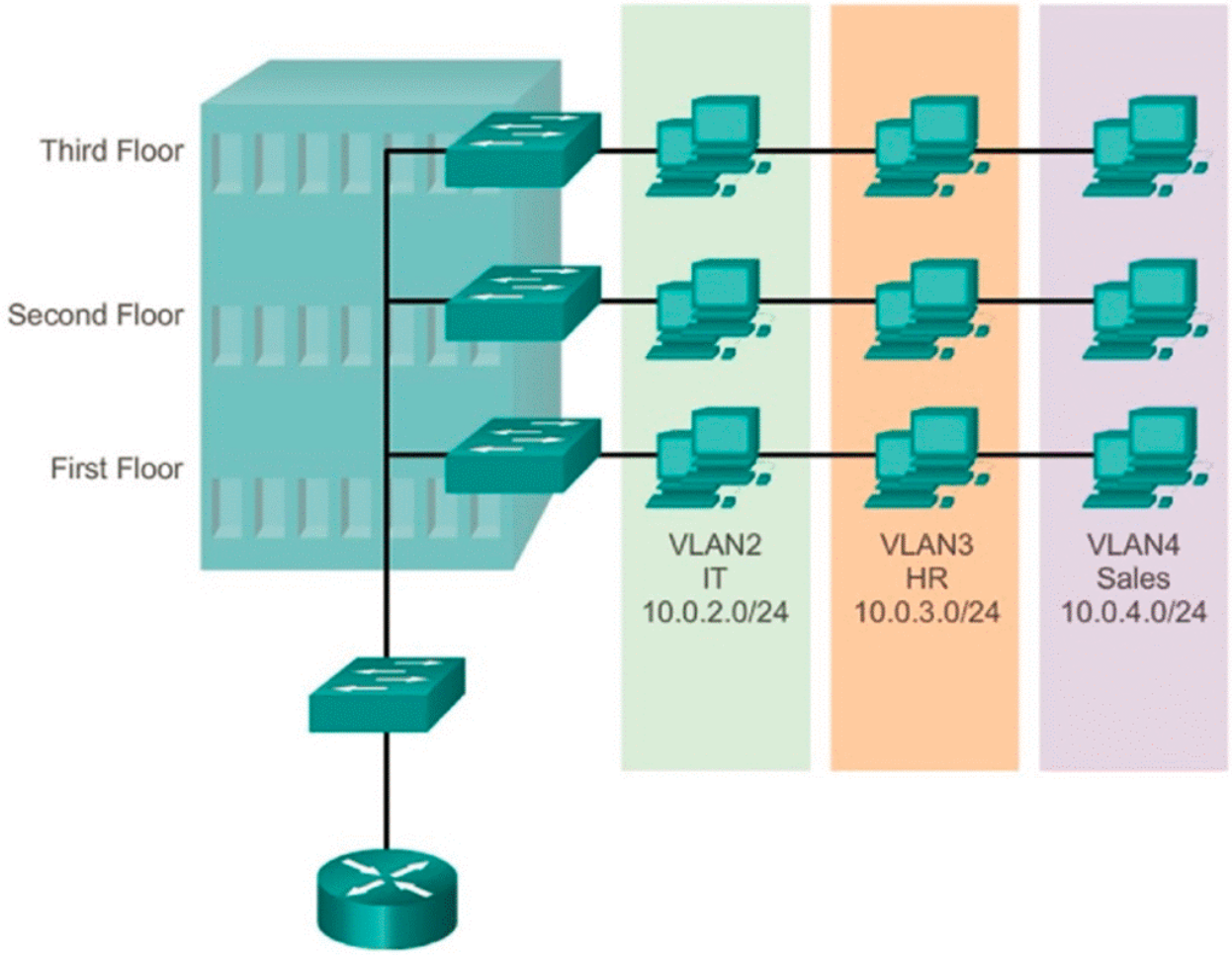


TASK:

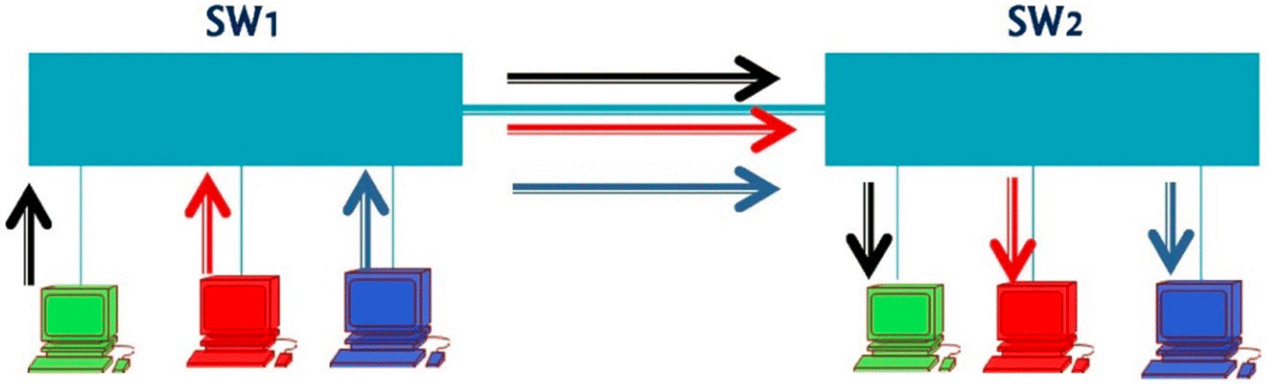
- Create four VLANs (VLAN 10,20,30,40)
- Configure port fa0/8 in to vlan 10
- Configure multiple ports (4 – 7 and 10) to vlan 20

Trunking

- A single VLAN can span over Multiple Switches
- Users of the same VLAN – may connect on two or more switches with in the LAN



Passing same VLAN Traffic between switches using Single Link.



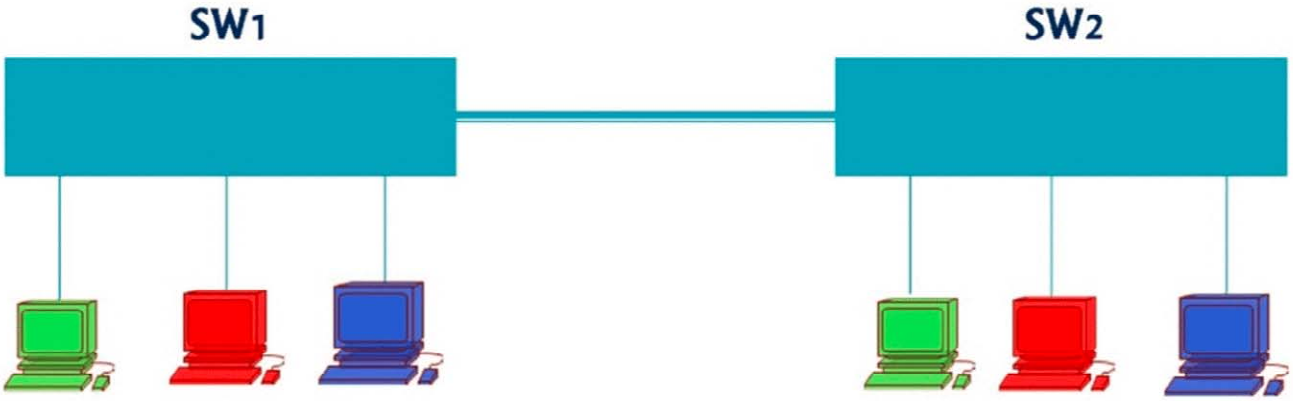
Types of links/ports

Access links

- Connecting to end devices (Hosts or router)
- part of one VLAN

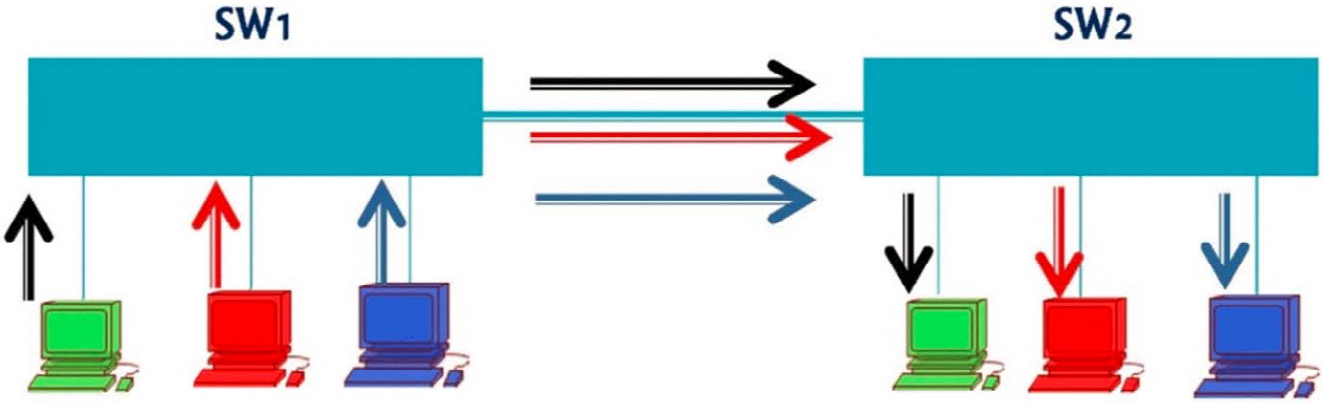
Trunk links

- Do not belong to any VLAN
- carry multiple VLANs traffic.
- link between two switches.



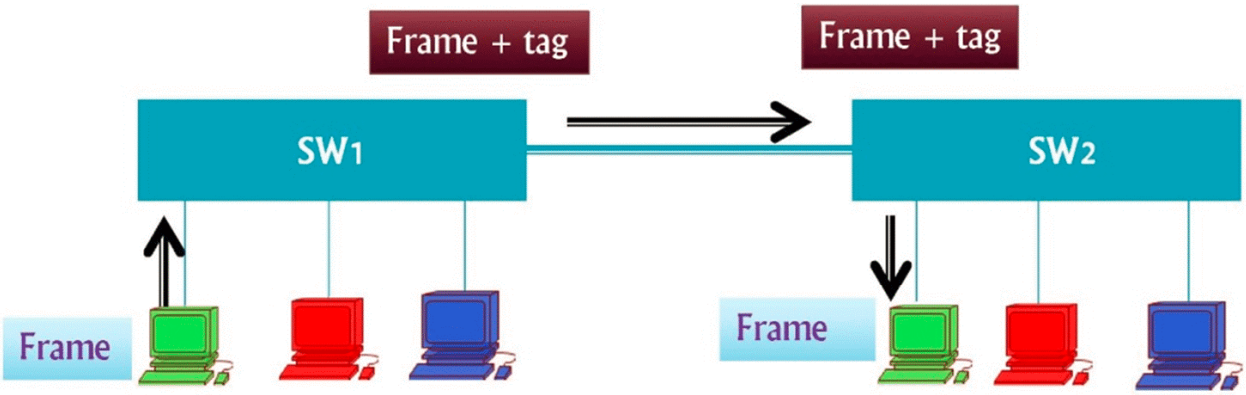
Frame Tagging

Passing same VLAN Traffic between switches using Single Link.



Frame Tagging

- In order to make sure that same VLAN users on different switches communicate with each other there is a method of tagging happens on trunk links .
- Tag is added before a frame is send and removed once it is received on trunk link.
- Frame tagging happens only on the trunk links



- Frame includes source and destination MAC entries
- Tag includes the VLAN- ID

Trunking protocols

Responsible for adding and removing tags on trunk links

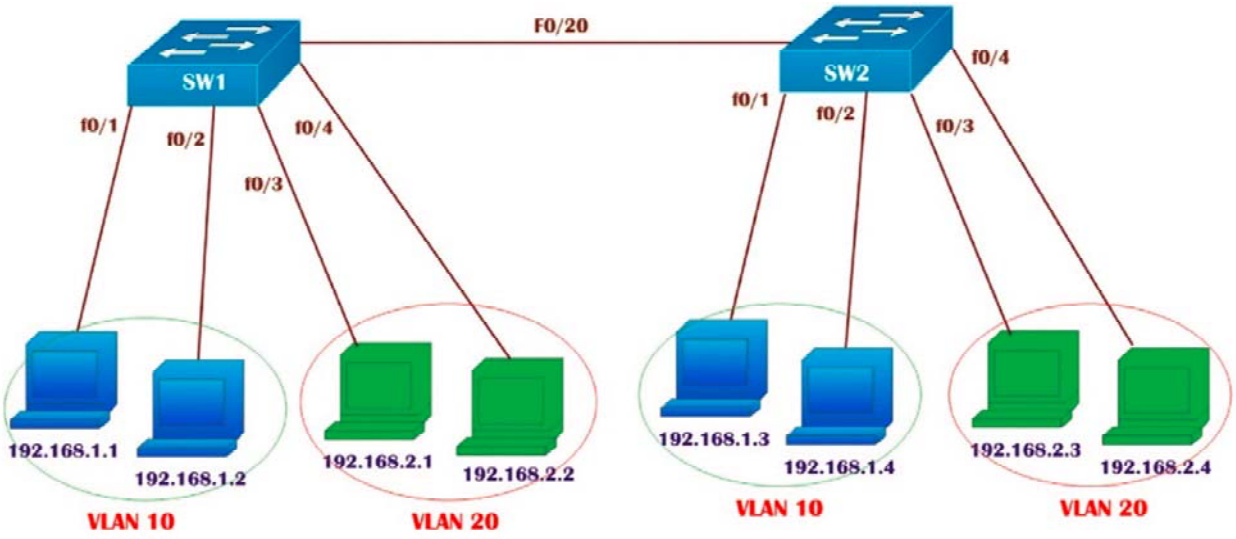
ISL (Inter-switch link)	IEEE 802.1Q
• It's a Cisco proprietary • It works with Ethernet, Token ring, FDDI • It adds 30 bytes of tag • No more supported on new cisco platforms	• IEEE Open standard • It works only on Ethernet • Only 4 Byte tag will be added to original frame.

Trunk Configuration

Switch(config)# **interface <interface type> <interface no.>**

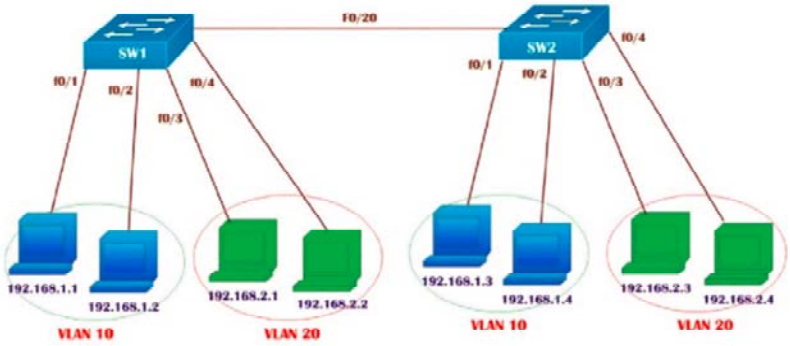
Switch(config-if)# **switchport mode trunk**

Switch(config-if)# **switchport trunk encapsulation dot1q**



LAB : Trunking

- Create Vlan 10 , Vlan 20 on both Switches
- Shift ports in to their respective VLAN as per the diagram.



SW-2(config)#**interface range f0/1 - 2**
SW-2(config-if-range)#**switchport mode access**
SW-2(config-if-range)#**switchport access vlan 10**
SW-2(config-if-range)#**exit**

SW-2(config)#**interface range f0/3 - 4**
SW-2(config-if-range)#**switchport mode access**
SW-2(config-if-range)#**switchport access vlan 20**
SW-2(config-if-range)#**end**

SW-1(config)#**interface range f0/1 - 2**
SW-1(config-if-range)#**switchport mode access**
SW-1(config-if-range)#**switchport access vlan 10**
SW-1(config-if-range)#**exit**

SW-1(config)#**interface range f0/3 - 4**
SW-1(config-if-range)#**switchport mode access**
SW-1(config-if-range)#**switchport access vlan 20**
SW-1(config-if-range)#**end**

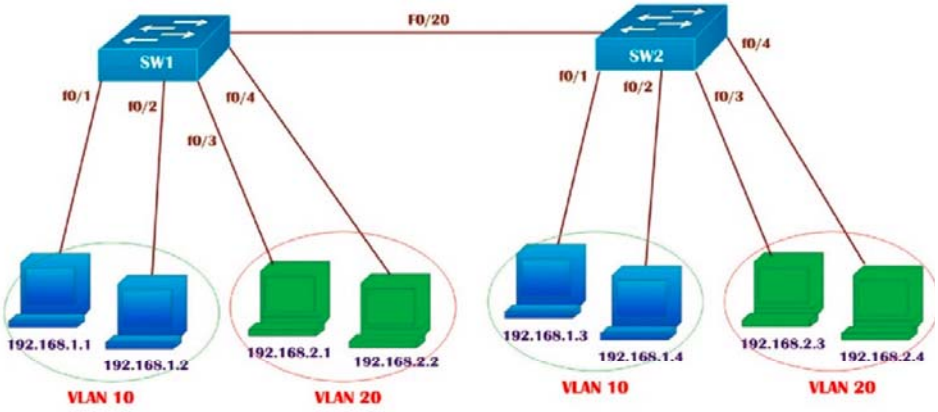
SW-2#show vlan

VLAN	Name	Status	Ports
1	default	active	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 Gig1/1, Gig1/2
10	VLAN0010	active	Fa0/1, Fa0/2
20	VLAN0020	active	Fa0/3, Fa0/4

SW-1#show vlan

VLAN	Name	Status	Ports
1	default	active	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 Gig1/1, Gig1/2
10	VLAN0010	active	Fa0/1, Fa0/2
20	VLAN0020	active	Fa0/3, Fa0/4

Configure F0/20 port between SW1 and SW2 as Trunk link



On both switches

SW-x(config)#**interface fastEthernet 0/20**

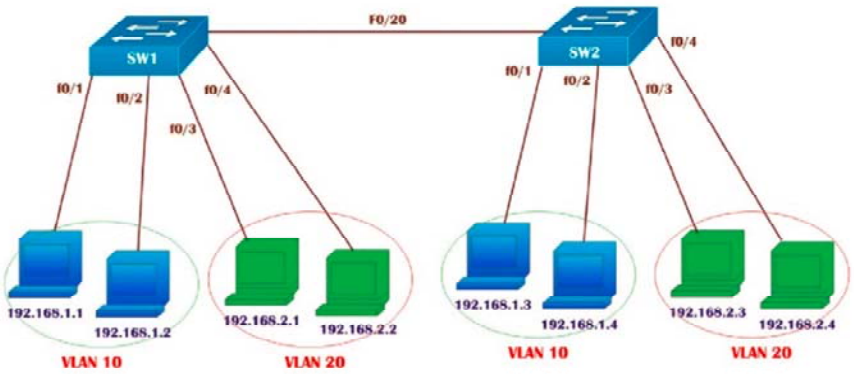
SW-x(config-if)#**switchport mode trunk**

SW-x(config-if)#**switchport trunk encapsulation dot1q**

SW-1#sh interfaces trunk

Port	Mode	Encapsulation	Status	Native vlan
Fa0/20	on	802.1q	trunking	1

Ensure That users of same VLAN on different Switches must communicate with each other



PC>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time=17ms TTL=128
Reply from 192.168.1.3: bytes=32 time=13ms TTL=128
Reply from 192.168.1.3: bytes=32 time=12ms TTL=128
Reply from 192.168.1.3: bytes=32 time=10ms TTL=128

PC>ping 192.168.2.3

Pinging 192.168.2.3 with 32 bytes of data:

Reply from 192.168.2.3: bytes=32 time=13ms TTL=128
Reply from 192.168.2.3: bytes=32 time=12ms TTL=128
Reply from 192.168.2.3: bytes=32 time=13ms TTL=128
Reply from 192.168.2.3: bytes=32 time=13ms TTL=128

LAB: TRUNKING