Department of Computer Science and Engineering

Islamic University of Technology (IUT)

A subsidiary organ of OIC

Laboratory Report

CSE 4512: Computer Networks Lab

Name: Md Farhan Ishmam
Student ID: 180041120
Section: CSE-1
Semester: Fifth
Academic Year: 2021

Date of Submission: 26-07-21

<u>Title:</u> Understanding the concept of VLAN and configuration of VLAN to multiple user groups in different locations and configuration of Inter VLAN routing.

<u>Objective</u>:

1. Define and describe the concept of VLAN
2. Describe the advantages of VLAN
3. Design and implement inter-VLAN routing

<u>Devices/ software Used</u>:

Device: Windows PC
Software: Cisco Packet Tracer 7.3.0

<u>Theory:</u>

VLAN Definition:
VLAN stands for Virtual Local Area Network. The logical partitioning of networking devices in the data link layer is called VLAN. The primary purpose of logical partitioning is to reduce the broadcast domain.

Usage of VLAN:
As mentioned earlier, using VLAN the broadcast domain can be reduced. Let's say in IUT there are 4 batches right now - Batch 17, 18, 19 and 20. By default if a message is broadcasted, then all 4 batches will receive it. What if we want to restrict the message to a particular batch? Then we need to create separate broadcast domains for each batch. If we want to broadcast the message to Batch 18 in particular, we can implement VLAN and create broadcast domains for each batch. Then if we again send a message for Batch 18, only Batch 18 will receive the message, and consequently all the 3 other batches will receive nothing. We can think of the other batches being in different networks. But these networks weren't created physically. They were created logically in the data link layer. That is why the name is *Virtual* Lan. The example is analogous to the usage of VLAN in real life. Specifically, the usage of VLAN is stated below:

- **Solve broadcast problem:** When a broadcast frame is received by a switch, it is forwarded to every port. By default the network has a single broadcast domain. But this creates performance issues as there can be devices for which the broadcast frame wasn't intended for. To solve this issue VLAN introduces multiple broadcast domains in that network. Each VLAN has its own broadcast domain analogous to a separate subnet. Now the broadcast frame can be forwarded only to the intended group of users under a single VLAN. Thus it solves the broadcast problem.
  In the given example, we asked what if only a particular batch wanted to receive the message instead of all 4 batches. That is the broadcast problem and by using VLAN, we were able to relay this message to a single batch only.

- **Reduce the size of broadcast domains:** By increasing the number of broadcast domains in the network, we have reduced the individual size of the broadcast domain. Previously, it was one big

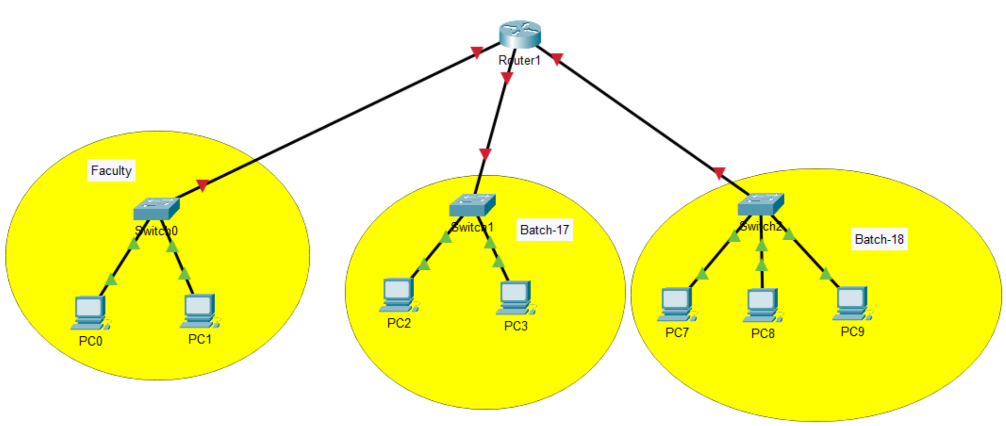
broadcast domain but, now, it has been reduced to multiple smaller broadcast domains.
In the example, the previous broadcast domain was all the students in IUT for all 4 batches. But now, we have 4 broadcast domains, each with a smaller size.

- **Allow us to add an additional layer of security:** By default, the users can see all the devices connected to the network in layer-2. So, any user can connect the network and get access to all the networking resources. But VLAN can solve this issue by putting a group of users in their own VLAN and thus separating them from the rest of the users. Here, unwanted access to networking resources won't be a problem.
In the given example, let's say there is a VLAN for faculties with their own networking resources. This VLAN will prevent students from accessing the faculties' broadcast domain and thus preventing them from using their resources.

- **Make device management easier:** While being connected to the same layer-2 network, the devices can roam around freely since the devices have their own VLAN ID. This is due to the logical approach of VLAN, the devices can be located anywhere in the network and still belong to the same broadcast domain.
In the given example, a device connected to the Batch-18 VLAN can move from one side of the campus to another, then reconnect again while belonging to the same VLAN.

- **Allows us to implement the logical grouping of devices by function instead of location:** As seen in the previous example the geographical location doesn't have any role in the grouping of devices in VLAN.
In the given example - no matter where you are in the campus of IUT and connect to the VLAN, then you will be able to access only your own networking group. So, if you are in Batch-18, then in every place in the IUT campus when you're connected to LAN, you will only have access to the broadcast domain of Batch-18. The geographical position will have no impact on the functionality.

Example:

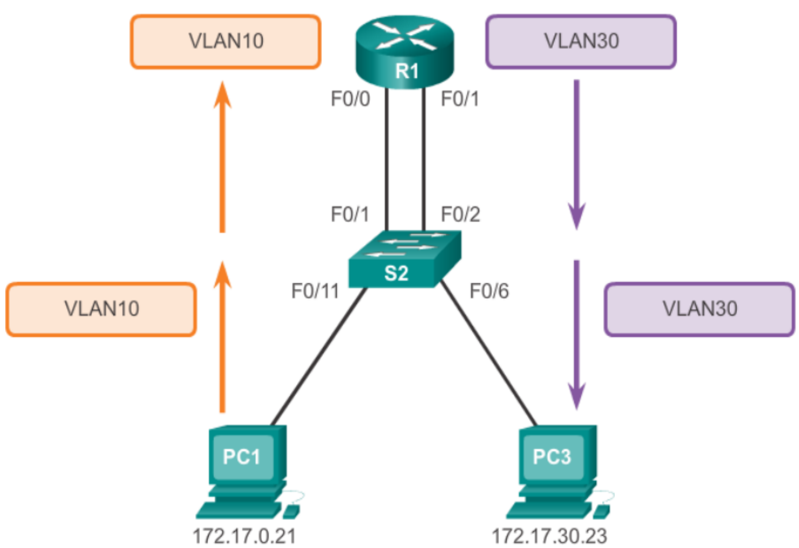


- We have a network with 7 devices connected to switches.
- We have three switches for the three separate broadcast domains: Faculty, Batch-17 and Batch-18
- The 3 smaller networks will be implemented with the help of VLAN
- The 3 VLANs will be connected by a router

Inter VLAN Routing:
Inter-VLAN routing is a process for forwarding network traffic from one VLAN to another, using a layer 3 device.
Two common approaches to inter-VLAN routing are:

- **Router-on-a stick**:
  - One of the router's physical interfaces is configured as the 802.1Q trunk port so that it can understand VLAN tags.
  - Separate logical subinterfaces are created for each VLAN on that trunk port.
  - Each subinterface is configured with an IP address from the VLAN it represents. The configured subinterfaces are software based virtual interfaces.
  - VLAN members (hosts) are configured to use the subinterface address as a default gateway.
  - When VLAN-tagged traffic enters the router interface, it is forwarded to the VLAN subinterface. After a routing decision is made based on the destination IP network address, the router determines the exit 5 interface for the traffic and sends out the packet through that interface.
  - The router-on-a-stick method of inter-VLAN routing does not scale beyond 50 VLANs. For this reason, a layer 3 switch using SVIs is used for a scalable solution.

The figure is an example of Router on a Stick approach of inter-vlan routing:



- **Layer 3 switch using switch virtual interfaces (SVIs):**
    - The layer 3 switch, also known as MultiLayer Switch (MLS) operates in both layer 2 and layer 3.
    - Each VLAN will have its own Switch Virtual Interface or SVI which works similarly to the router interface. It processes incoming and outgoing packets of the VLANs and routes them.
    - The latency is lower since the packets do not leave the switch to be routed. It also has higher scalability and thus is used in modern enterprise systems.

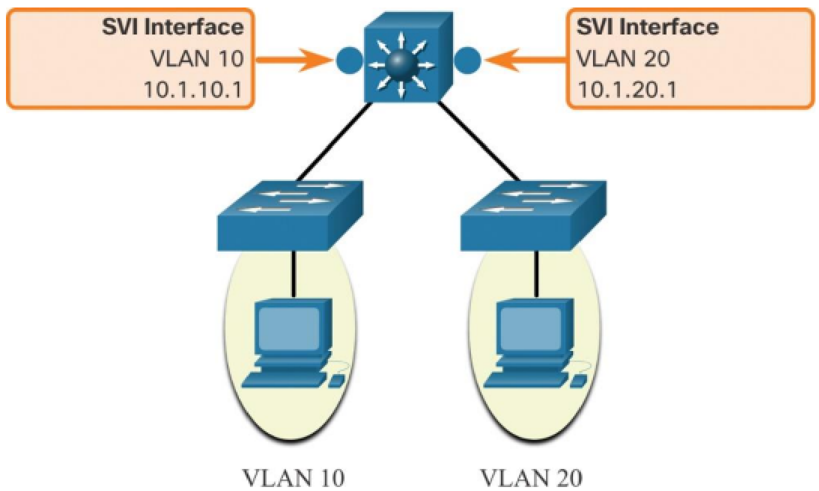
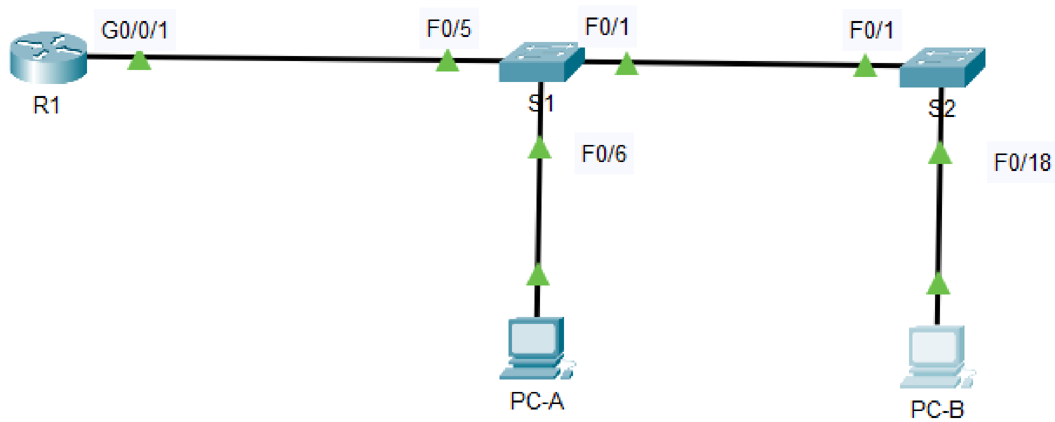
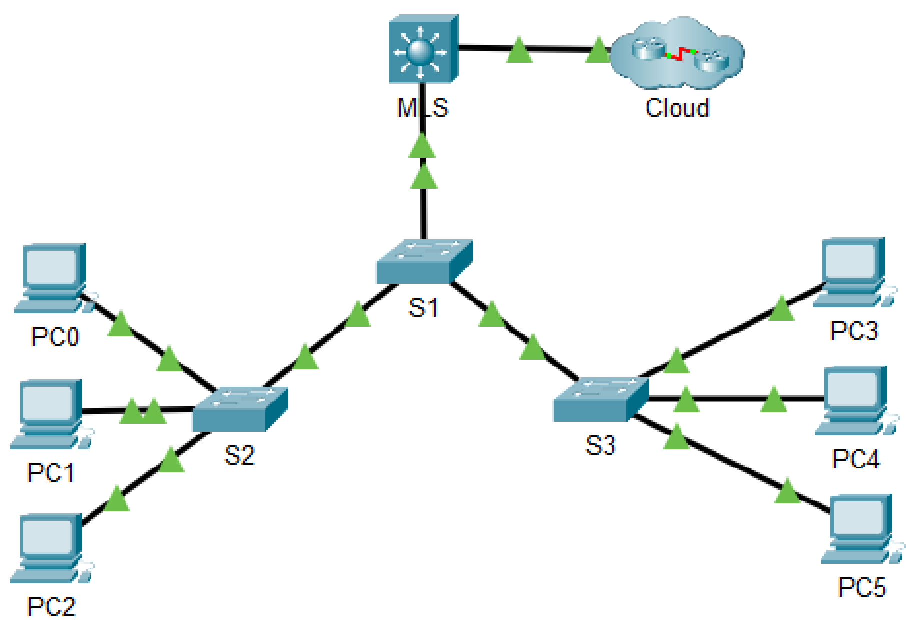


Diagram of the experiment:

Task #01:



Task #02:



Working Procedure:

TASK #01:

Part 1: Build the Network and Configure Basic Device Settings

Step 1: Cable the network as shown in the topology

- First we create the network following the diagram by selecting the required network components and connecting them.

Step 2: Configure basic settings for the router.

- Then we configure the router by using the following commands:

```
Router> enable
Router# config terminal
Router(config)#ho 180041120_Router
180041120_Router(config)#no ip domain lookup
180041120_Router(config)#enable secret class
180041120_Router(config)#line console 0
180041120_Router(config-line)#password cisco
180041120_Router(config-line)#login
180041120_Router(config-line)#exit
180041120_Router(config)#line vty 0 4
180041120_Router(config-line)#password cisco
180041120_Router(config-line)#login
180041120_Router(config-line)#exit
180041120_Router(config)#service password-encryption
180041120_Router(config)#banner motd #
     Unauthorized Access is Prohibited#
180041120_Router(config)#exit
180041120_Router#clock set 14:00:00 21 July 2021
180041120_Router#copy running-config startup-config
```

The above commands assign a device name to the router, disable the DNS lookup and assign passwords to the privileged execution mode, console and vty. Then the passwords are encrypted, and a banner is created that warns about unauthorized access. Finally, the clock is updated and the running configuration of the router is saved to the startup configuration file.

The screenshots of the router's configuration in CLI is given below:

Router0

Physical Config CLI Attributes

IOS Command Line Interface

```
Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#ho 180041120_Router
180041120_Router(config)#no ip domain lookup
180041120_Router(config)#en secret class
% Ambiguous command: "en secret class"
180041120_Router(config)#enable secret class
180041120_Router(config)#line console 0
180041120_Router(config-line)#password cisco
180041120_Router(config-line)#login
180041120_Router(config-line)#exit
180041120_Router(config)#line vty 0 4
180041120_Router(config-line)#password cisco
180041120_Router(config-line)#login
180041120_Router(config-line)#exit
180041120_Router(config)#service password-encryption
180041120_Router(config)#banner motd #
Enter TEXT message.  End with the character '#'.
Unauthorized Access is Prohibited#

180041120_Router(config)#copy running-config startup-config
                                   ^
% Invalid input detected at '^' marker.

180041120_Router(config)#exit
180041120_Router#
%SYS-5-CONFIG_I: Configured from console by console
copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
180041120_Router#
```

Ctrl+F6 to exit CLI focus   Copy   Paste

Top

```
180041120_Router#clock set 14:00:00 21 July 2021
180041120_Router#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
180041120_Router#
```

Ctrl+F6 to exit CLI focus   Copy   Paste

Step 3: Configure basic settings for each switch

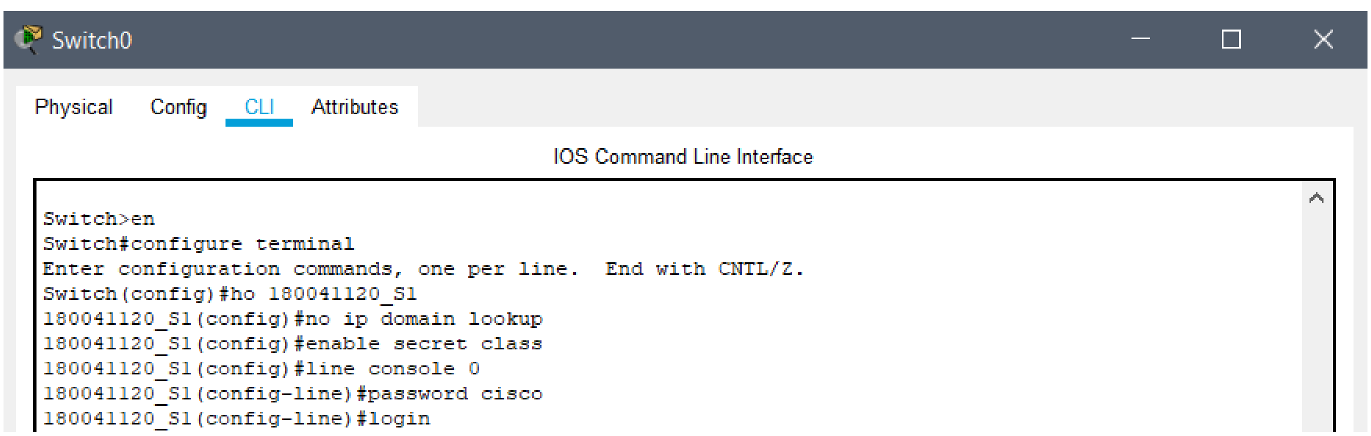
- Now, we configure the switches using the following configuration:

```
Switch>enable
Switch#configure terminal
Switch(config)#ho 180041120_S1
180041120_S1(config)#no ip domain lookup
180041120_S1(config)#enable secret class
180041120_S1(config)#line console 0
180041120_S1(config-line)#password cisco
180041120_S1(config-line)#login
180041120_S1(config-line)#line vty 0 4
180041120_S1(config-line)#password cisco
180041120_S1(config-line)#login
180041120_S1(config-line)#exit
180041120_S1(config)#service password-encryption
180041120_S1(config)#banner motd #
     Unauthorized access is prohibited#
180041120_S1(config)#exit
180041120_S1#clock set 14:00:00 21 July 2021
180041120_S1#copy running-config startup-config
```

The above commands assign a device name to the switch, disable the DNS lookup and assign passwords to the privileged execution mode, console and vty. Then the passwords are encrypted, and a banner is created that warns about unauthorized access. Finally, the clock is updated and the running configuration of the router is saved to the startup configuration file.

The commands are to be performed for both of the switches. I have shown the commands for the first switch only.

For switch S1:



```
180041120_S1(config-line)#line vty 0 4
180041120_S1(config-line)#password cisco
180041120_S1(config-line)#login
180041120_S1(config-line)#exit
180041120_S1(config)#service password-encryption
180041120_S1(config)#banner motd#
                                        ^
% Invalid input detected at '^' marker.

180041120_S1(config)#banner motd #
Enter TEXT message.  End with the character '#'.
Unauthorized access is prohibited
#

180041120_S1(config)#exit
180041120_S1#
%SYS-5-CONFIG_I: Configured from console by console

180041120_S1#clock set 14:00:00 21-July 2021
                                        ^
% Invalid input detected at '^' marker.

180041120_S1#clock set 14:00:00 21 July 2021
180041120_S1#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
```

For switch S2:

S2

Physical Config CLI Attributes

IOS Command Line Interface

```
Switch>en
Switch#conf ter
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#ho 180041120_S2
180041120_S2(config)#no ip domain lookup
180041120_S2(config)#enable sec class
180041120_S2(config)#line con 0
180041120_S2(config-line)#pass cisco
180041120_S2(config-line)#log
% Ambiguous command: "log"
180041120_S2(config-line)#login
180041120_S2(config-line)#line vty 0 4
180041120_S2(config-line)#pass cisco
180041120_S2(config-line)#login
180041120_S2(config-line)#exit
180041120_S2(config)#service password-encryption
180041120_S2(config)#banner motd #Unauthorized access is Prohibited#
180041120_S2(config)#exit
180041120_S2#
%SYS-5-CONFIG_I: Configured from console by console

180041120_S2#clock set 14:00:00 21 July 2021
180041120_S2#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
180041120_S2#
```

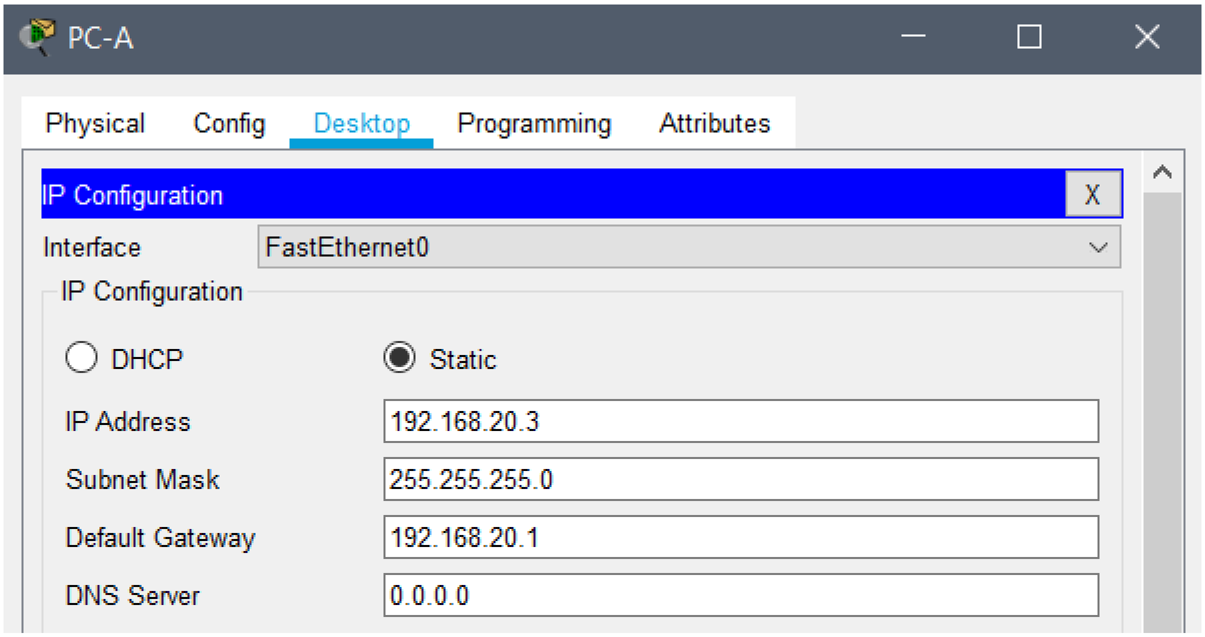
Ctrl+F6 to exit CLI focus

Copy Paste

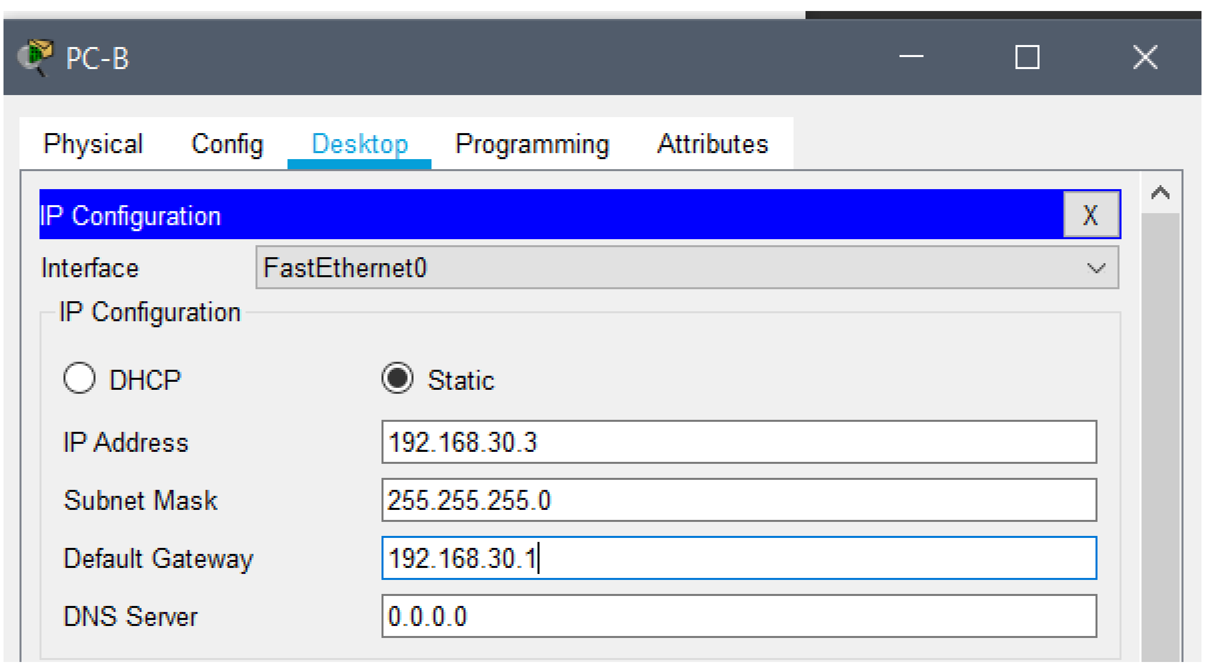
Step 4: Configure PC hosts

- Now, we assign IP addresses, subnet masks and default gateways to the host PCs following the table.

For PC-A:



For PC-B:



Part 2: Create VLANs and Assign Switch Ports

Step 1: Create VLANs on both switches

- First we create the required VLANs, and name them following the table for the two switches. The following commands were used to create the VLAN: in switch S1:

```
180041120_S1#configure terminal
180041120_S1(config)#vlan 10
180041120_S1(config-vlan)#name Management
180041120_S1(config-vlan)#vlan 20
180041120_S1(config-vlan)#name Sales
180041120_S1(config-vlan)#vlan 30
180041120_S1(config-vlan)#name Operations
180041120_S1(config-vlan)#vlan 999
180041120_S1(config-vlan)#name Parking_Lot
180041120_S1(config-vlan)#vlan 1000
180041120_S1(config-vlan)#name Native
180041120_S1(config-vlan)#exit
```

For switch S1:

```
180041120_S1#
180041120_S1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
180041120_S1(config)#vlan 10
180041120_S1(config-vlan)#name Management
180041120_S1(config-vlan)#vlan 20
180041120_S1(config-vlan)#name Sales
180041120_S1(config-vlan)#vlan 30
180041120_S1(config-vlan)#name Operations
180041120_S1(config-vlan)#vlan 999
180041120_S1(config-vlan)#name Parking_Lot
180041120_S1(config-vlan)#vlan 1000
180041120_S1(config-vlan)#name Native
180041120_S1(config-vlan)#exit
180041120_S1(config)#
```

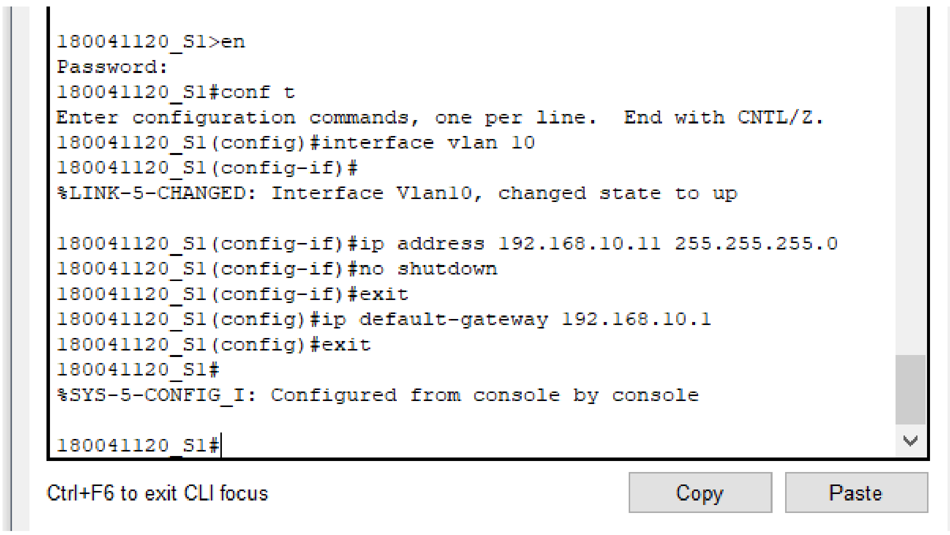
For switch S2:

```
180041120_S2(config)#vlan 10
180041120_S2(config-vlan)#name Management
180041120_S2(config-vlan)#vlan 20
180041120_S2(config-vlan)#name Sales
180041120_S2(config-vlan)#vlan 30
180041120_S2(config-vlan)#name Operations
180041120_S2(config-vlan)#vlan 999
180041120_S2(config-vlan)#name Parking_Lot
180041120_S2(config-vlan)#vlan 1000
180041120_S2(config-vlan)#name Native
180041120_S2(config-vlan)#exit
180041120_S2(config)#
```

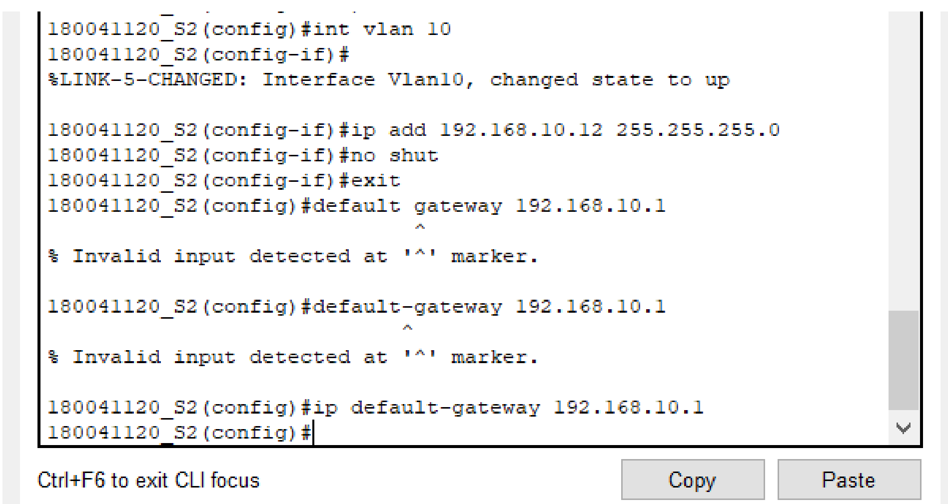
- Then we configure the management interface and default gateway on each switch using the IP address information in the Addressing Table. The following commands are to be implemented for switch S1:

```
180041120_S1(config)#interface vlan 10
180041120_S1(config-if)#ip address 192.168.10.11 255.255.255.0
180041120_S1(config-if)#no shutdown
180041120_S1(config-if)#exit
180041120_S1(config)#ip default-gateway 192.168.10.1
180041120_S1(config)#exit
```

For switch S1:



For switch S2:



Step 2: Assign VLANs to the correct switch interfaces

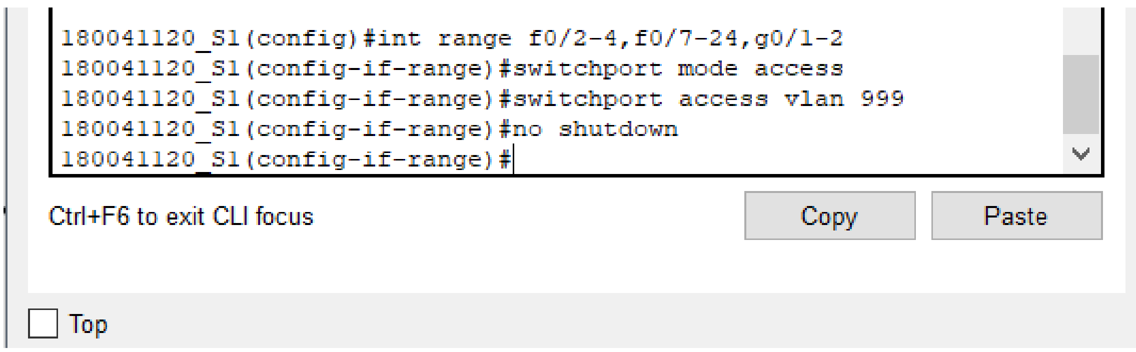
- Then we assign all unused ports on the switch to the Parking_Lot VLAN, configure them for static access mode, and administratively deactivate them. The following commands were used for switch S1 to accomplish this task:

  ```
  180041120_S1(config)#int range f0/2-4,f0/7-24,g0/1-2
  180041120_S1(config-if-range)#switchport mode access
  180041120_S1(config-if-range)#switchport access vlan 999
  180041120_S1(config-if-range)#no shutdown
  ```

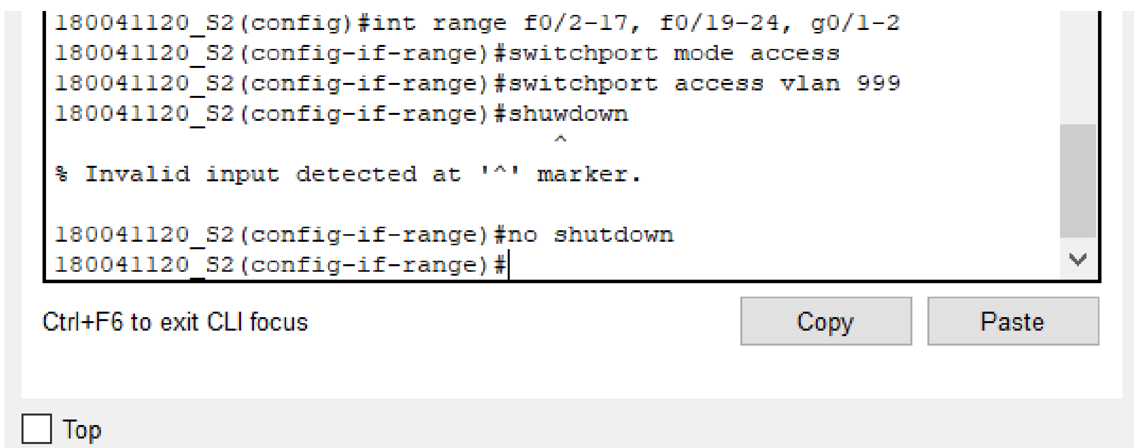
  For switch S1, the ports **1, 5 and 6** are used. For switch S2, the ports **1 and 18** are used. This can be seen in the diagram of the task.

  The following screenshots are implemented in the CLI of the switches:

  For switch S1:



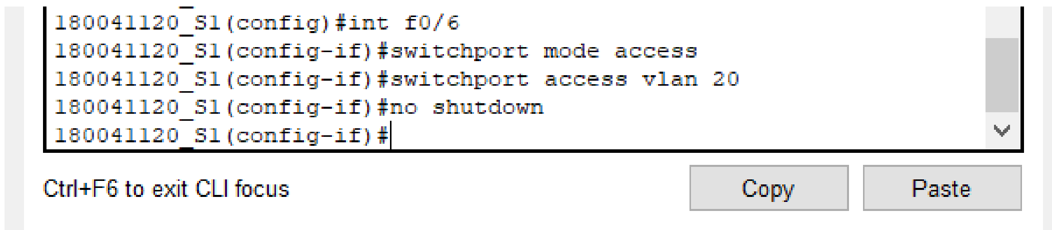
  For switch S2:



- Now, we assign used ports to the appropriate VLAN as specified in the VLAN table and configure them for static access mode.
  The following commands are used to assign ports to appropriate VLANs for switch S1:

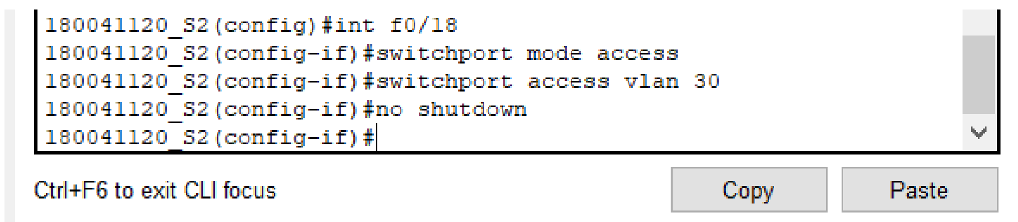
```
180041120_S1(config)#int f0/6
180041120_S1(config-if)#switchport mode access
180041120_S1(config-if)#switchport access vlan 20
180041120_S1(config-if)#no shutdown
```

For switch S1:



```
180041120_S1(config)#int f0/6
180041120_S1(config-if)#switchport mode access
180041120_S1(config-if)#switchport access vlan 20
180041120_S1(config-if)#no shutdown
180041120_S1(config-if)#
```


For switch S2:

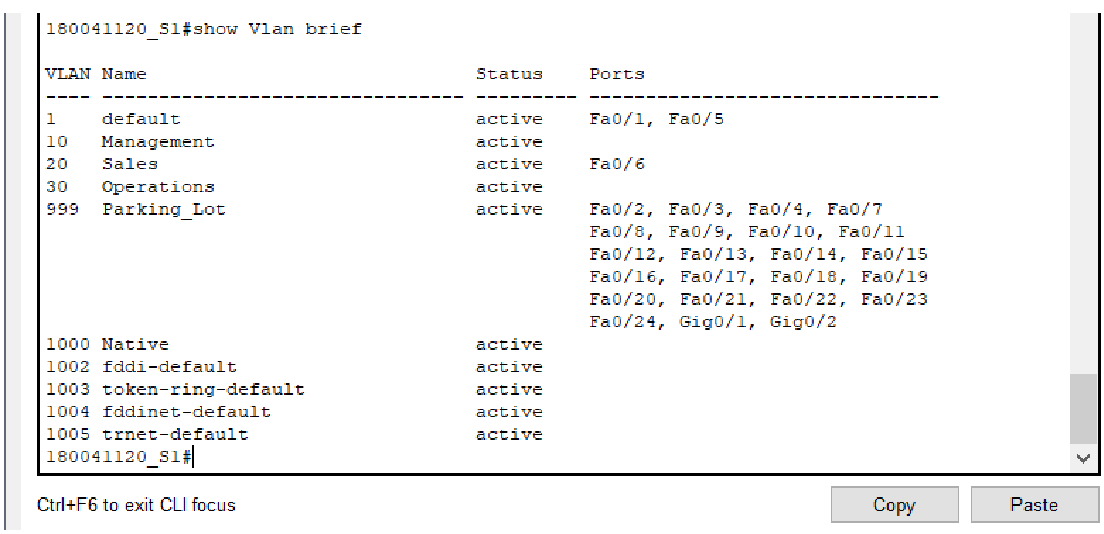


```
180041120_S2(config)#int f0/18
180041120_S2(config-if)#switchport mode access
180041120_S2(config-if)#switchport access vlan 30
180041120_S2(config-if)#no shutdown
180041120_S2(config-if)#
```


- Now, we verify the configured interfaces on our switches using the following command:

```
180041120_S1#show Vlan brief
```

For switch S1:



```
180041120_S1#show Vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/5
10   Management                       active
20   Sales                            active    Fa0/6
30   Operations                       active
999  Parking_Lot                      active    Fa0/2, Fa0/3, Fa0/4, 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, Gig0/1, Gig0/2
1000 Native                           active
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
180041120_S1#
```

For Switch S2:

```
180041120_S2#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1
10   Management                       active
20   Sales                            active
30   Operations                       active    Fa0/18
999  Parking_Lot                      active    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, Gig0/1, Gig0/2
1000 Native                           active
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
180041120_S2#
```

Ctrl+F6 to exit CLI focus   Copy   Paste

Part 3: Configure an 802.1Q Trunk Between the Switches

Step 1: Manually configure trunk interface F0/1 on switch S1 and S2

- We configure static trunking on interface F0/1 for both switches. We do this by setting the native VLAN to 1000 on both switches. Then we specify that VLANs 10, 20, 30, and 1000 are allowed to cross the trunk.
  The following commands were implemented for switch S1:

```
180041120_S1(config)#int f0/1
180041120_S1(config-if)#switchport mode trunk
180041120_S1(config-if)#switchport trunk native vlan 1000
180041120_S1(config-if)#switchport trunk allowed vlan 10,20,30,1000
```

For switch S1:

```
180041120_S1(config)#int f0/1
180041120_S1(config-if)#switchport mode trunk

180041120_S1(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan10, changed state to up

180041120_S1(config-if)#switchport trunk native vlan 1000
180041120_S1(config-if)#switchport trunk allowed vlan 10,20,30,1000
```

For switch S2:

```
180041120_S2(config)#int f0/1
180041120_S2(config-if)#switchport mode trunk
180041120_S2(config-if)#switchport trunk native vlan 1000
180041120_S2(config-if)#%SPANTREE-2-UNBLOCK_CONSIST_PORT: Unblocking FastEthernet0/1 on
VLAN1000. Port consistency restored.

%SPANTREE-2-UNBLOCK_CONSIST_PORT: Unblocking FastEthernet0/1 on VLAN0001. Port
consistency restored.

switchport trunk allowed vlan 10,20,30,1000
180041120_S2(config-if)#switchport trunk allowed vlan 10,20,30,1000
```

- Then we verify trunking ports, the Native VLAN, and VLANs allowed across the trunk
  The following command is used for switch S1, which can be done on S2 as well:

  `180041120_S1#show interfaces trunk`

For switch S1:

```
180041120_S1#show interfaces trunk
Port        Mode         Encapsulation  Status        Native vlan
Fa0/1       on           802.1q         trunking      1000

Port        Vlans allowed on trunk
Fa0/1       10,20,30,1000

Port        Vlans allowed and active in management domain
Fa0/1       10,20,30,1000

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/1       10,20,30,1000
```

For switch S2:

```
180041120_S2#show interfaces trunk
Port        Mode         Encapsulation  Status        Native vlan
Fa0/1       on           802.1q         trunking      1000

Port        Vlans allowed on trunk
Fa0/1       10,20,30,1000

Port        Vlans allowed and active in management domain
Fa0/1       10,20,30,1000

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/1       10,20,30,1000
```

Step 2: Manually configure S1's trunk interface F0/5

- We configure S1's interface F0/5 with the same trunk parameters as F0/1. This is the trunk to the router. Then we save the running configuration to the startup configuration file.

```
180041120_S1(config)#interface f0/5
180041120_S1(config-if)#switchport mode trunk
180041120_S1(config-if)#switchport trunk native vlan 1000
180041120_S1(config-if)#no shutdown
180041120_S1(config-if)#exit
180041120_S1(config)#exit
180041120_S1#copy running-config startup-config
```

For switch S1:

```
180041120_S1(config)#interface f0/5
180041120_S1(config-if)#switchport mode trunk
180041120_S1(config-if)#switchport trunk native vlan 1000
180041120_S1(config-if)#no shutdown
180041120_S1(config-if)#exit
180041120_S1(config)#exit
180041120_S1#
%SYS-5-CONFIG_I: Configured from console by console

180041120_S1#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
```

- Then we verify the trunking by running:

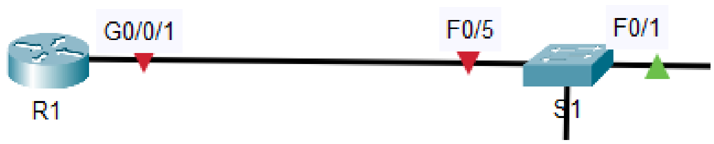
```
180041120_S1#show interfaces trunk
```

For switch S1:

```
180041120_S1#show interfaces trunk
Port        Mode         Encapsulation  Status        Native vlan
Fa0/1       on           802.1q         trunking      1000

Port        Vlans allowed on trunk
Fa0/1       10,20,30,1000

Port        Vlans allowed and active in management domain
Fa0/1       10,20,30,1000

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/1       10,20,30,1000
```

- **What happens if G0/0/1 on R1 is down?**
  Ans: If G0/0/1 on R1 is down then the switch S1 won't be able to communicate with the router R1. So Inter VLAN routing will not be possible. Here, the red triangle is shown in S1's F0/5

because G0/0/1 is down.



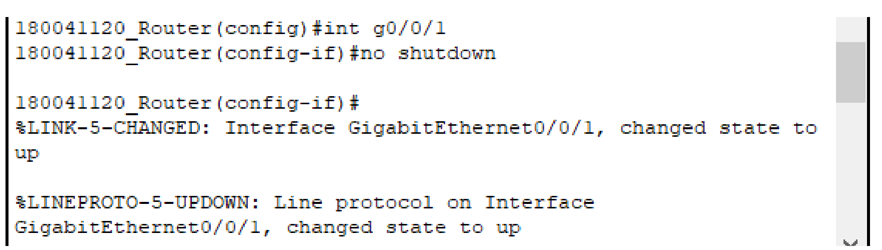
Part 4: Configure Inter-VLAN Routing on the Router

Step 1: Configure the router

- We activate interface G0/0/1 on the router, and configure subinterfaces for each VLAN. The following commands are given for the router:

```
180041120_Router(config)#int g0/0/1
180041120_Router(config-if)#no shutdown
180041120_Router(config-if)#exit

180041120_Router(config)#int g0/0/1.10
180041120_Router(config-subif)#desc Management
180041120_Router(config-subif)#encapsulation dot1q 10
180041120_Router(config-subif)#ip add 192.168.10.1 255.255.255.0

180041120_Router(config-subif)#int g0/0/1.20
180041120_Router(config-subif)#encapsulation dot1q 20
180041120_Router(config-subif)#desc Sales
180041120_Router(config-subif)#ip address 192.168.20.1 255.255.255.0

180041120_Router(config-subif)#int g0/0/1.30
180041120_Router(config-subif)#encapsulation dot1q 30
180041120_Router(config-subif)#desc Operations
180041120_Router(config-subif)#ip add 192.168.30.1 255.255.255.0

180041120_Router(config-subif)#int g0/0/1.1000
180041120_Router(config-subif)#encapsulation dot1q 1000 native
180041120_Router(config-subif)#desc Native
180041120_Router(config-subif)#exit
```

The above commands configure the subinterfaces by accessing it and turning it on, then giving it a name
The screenshots for the router are given below:



```
180041120_Router(config)#int g0/0/1.10
180041120_Router(config-subif)#desc Management
180041120_Router(config-subif)#encapsulation dot1q 10
180041120_Router(config-subif)#ip add 192.168.10.1 255.255.255.0
180041120_Router(config-subif)#int g0/0/1.20
180041120_Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/1.20, changed state
to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/0/1.20, changed state to up

180041120_Router(config-subif)#encapsulation dot1q 20
180041120_Router(config-subif)#desc Sales
180041120_Router(config-subif)#ip address 192.168.20.1
255.255.255.0
180041120_Router(config-subif)#int g0/0/1.30
180041120_Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/1.30, changed state
to up
```

```
180041120_Router(config-subif)#encapsulation dot1q 30
180041120_Router(config-subif)#desc Operations
180041120_Router(config-subif)#ip add 192.168.30.1 255.255.255.0
180041120_Router(config-subif)#int g0/0/1.1000
180041120_Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/1.1000, changed
state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/0/1.1000, changed state to up

180041120_Router(config-subif)#encapsulation  dot1q 1000 native
180041120_Router(config-subif)#desc Native
180041120_Router(config-subif)#exit
180041120_Router(config)#
```

Ctrl+F6 to exit CLI focus Copy Paste

- Then we verify the connection using:

```
180041120_Router#show ip interface brief
```

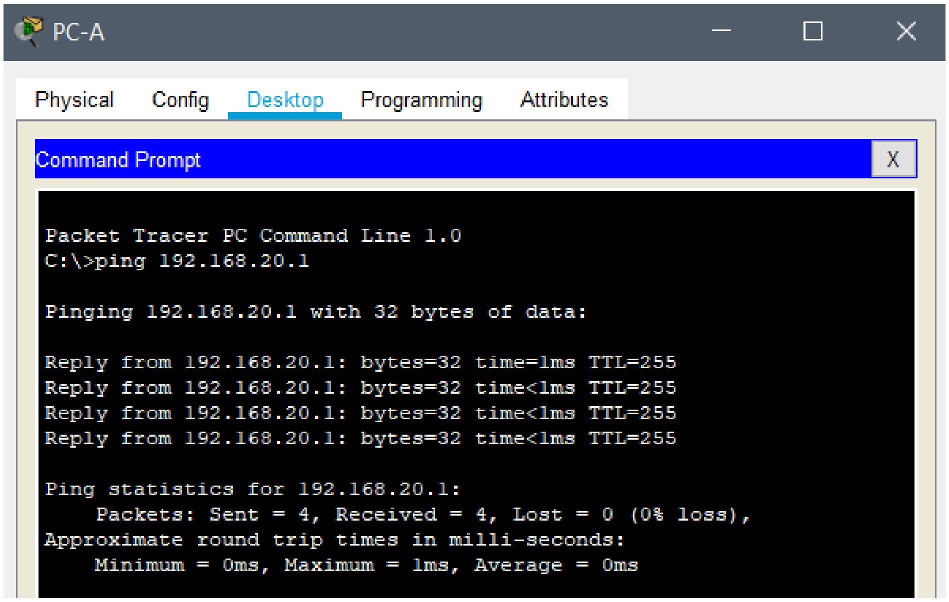
```
180041120_Router#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0/0   unassigned      YES unset  administratively down down
GigabitEthernet0/0/1   unassigned      YES unset  up                    up
GigabitEthernet0/0/1.10192.168.10.1    YES manual up                    up
GigabitEthernet0/0/1.20192.168.20.1    YES manual up                    up
GigabitEthernet0/0/1.30192.168.30.1    YES manual up                    up
GigabitEthernet0/0/1.1000unassigned      YES unset  up                    up
GigabitEthernet0/0/2   unassigned      YES unset  administratively down down
Vlan1                  unassigned      YES unset  administratively down down
180041120_Router#
```

Ctrl+F6 to exit CLI focus Copy Paste

Step 2: Complete the following tests from PC-A

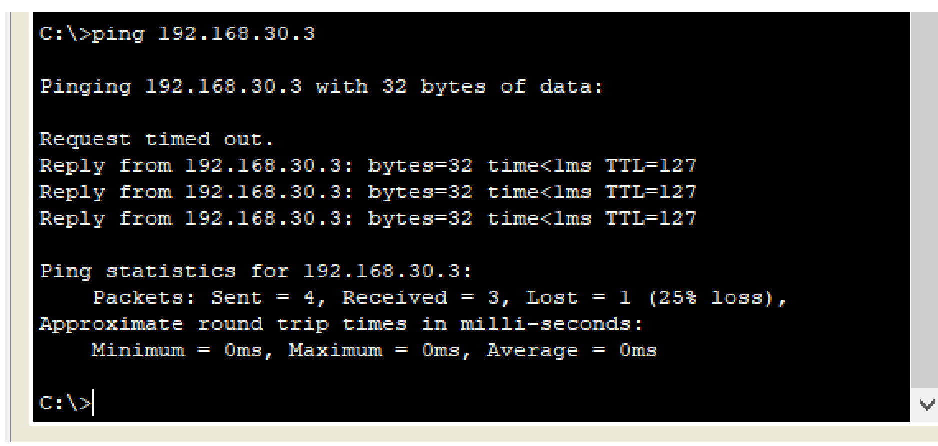
- We ping from PC-A to its default gateway by going to Desktop> Command Prompt

```
ping 192.168.20.1
```



- We ping from PC-A to PC-B similarly

```
ping 192.168.30.3
```



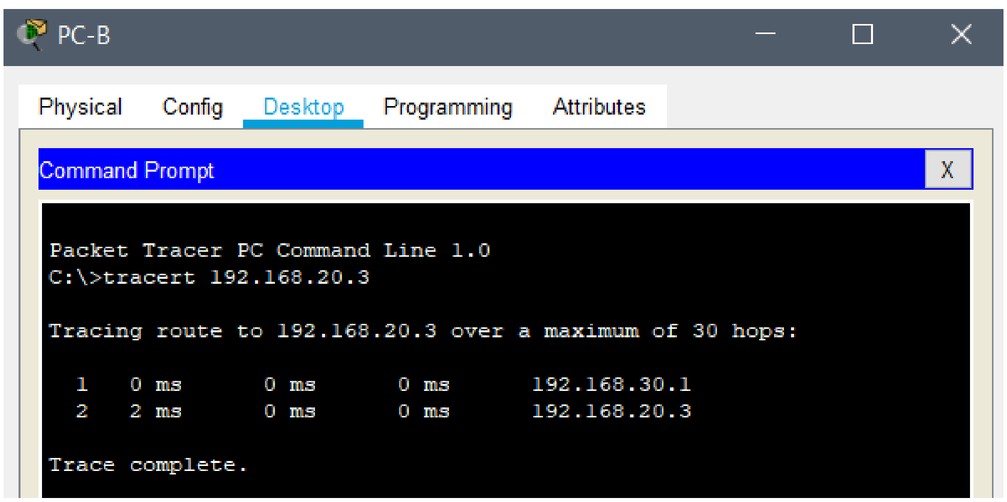
- We ping from PC-A to S2 similarly

```
ping 192.168.10.12
```

```
C:\>ping 192.168.10.12

Pinging 192.168.10.12 with 32 bytes of data:

Reply from 192.168.10.12: bytes=32 time=1ms TTL=254
Reply from 192.168.10.12: bytes=32 time<1ms TTL=254
Reply from 192.168.10.12: bytes=32 time=2ms TTL=254
Reply from 192.168.10.12: bytes=32 time=1ms TTL=254

Ping statistics for 192.168.10.12:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 2ms, Average = 1ms
```

- Then from the Command Prompt window on PC-B, we issue the tracert command to the address of PC-A:

```
tracert 192.168.20.3
```



- **What intermediate IP addresses are shown in the results?**
  Ans: 192.168.30.1 and 192.168.20.3 are shown which are IP addresses of the default gateway of the router and PC-A respectively.

<u>TASK #02:</u>

Part 1: Configure Layer 3 Switching :

- On the MLS, we configure G0/2 as router port and assign an IP address following the addressing table.

```
MLS>en
MLS#conf ter
Enter configuration commands, one per line.  End with CNTL/Z.
MLS(config)#int g0/2
MLS(config-if)#no switchport
MLS(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/2, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/2, changed state to up

MLS(config-if)#ip add 209.165.200.225 255.255.255.252
MLS(config-if)#exit
```

- Then we verify the connection to the Cloud by pinging 209.165.200.226

```
MLS#ping 209.165.200.226

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 209.165.200.226, timeout is 2
seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/1
ms

MLS#
```

Ctrl+F6 to exit CLI focus Copy Paste

Part 2: Configure Inter-VLAN Routing

Step 1 & 2: Add VLANs, configure SVI on MLS

- We add the VLANs and configure SVI on MLS

```
MLS#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
MLS(config)#vlan 10
MLS(config-vlan)#name Staff
MLS(config-vlan)#int vlan 10
MLS(config-if)#
%LINK-5-CHANGED: Interface Vlan10, changed state to up

MLS(config-if)#ip add 192.168.10.254 255.255.255.0
MLS(config-if)#vlan 20
MLS(config-vlan)#name Student
MLS(config-vlan)#int vlan 20
MLS(config-if)#
%LINK-5-CHANGED: Interface Vlan20, changed state to up

MLS(config-if)#ip add 192.168.20.254 255.255.255.0
MLS(config-if)#vlan 30
MLS(config-vlan)#name Faculty
MLS(config-vlan)#int vlan 30
MLS(config-if)#
%LINK-5-CHANGED: Interface Vlan30, changed state to up

MLS(config-if)#ip add 192.168.30.254 255.255.255.0
MLS(config-if)#int vlan 99
MLS(config-if)#
%LINK-5-CHANGED: Interface Vlan99, changed state to up

MLS(config-if)#ip add 192.168.99.254 255.255.255.0
MLS(config-if)#
```

Ctrl+F6 to exit CLI focus   Copy   Paste

Step 3: Configure Trunking on MLS

- We configure g0/1, making it a static trunk, specify the native VLAN as 99, and encapsulate the link with the dot1q protocol.

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

MLS(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed
state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed
state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan10, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan20, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan30, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan99, changed state to up

MLS(config-if)#switchport trunk native vlan 99
MLS(config-if)#switchport trunk encapsulation dotlq
MLS(config-if)#
```

Ctrl+F6 to exit CLI focus   Copy   Paste

Step 4: Configure trunking on S1

- We configure trunking on S1by configuring g0/1 of S1 as static trunk and configuring the native VLAN on the trunk

```
S1>en
S1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
S1(config)#interface g0/1
S1(config-if)#switchport mode trunk

S1(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/1, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/1, changed state to up

S1(config-if)#switchport trunk native vlan 99
S1(config-if)#
```

Step 5: Enable routing

- Q: After using the **show ip route** command, are there any active routes?
  Ans: No, there aren’t any active routers.

```
MLS>show ip route
Default gateway is not set

Host               Gateway           Last Use    Total Uses  Interface
ICMP redirect cache is empty

MLS>
```

Ctrl+F6 to exit CLI focus   Copy   Paste

- Then we enter the **ip routing** command to enable routing in global configuration mode. We use the **show ip route** command to verify routing is enabled.

```
MLS>en
MLS#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
MLS(config)#ip routing
MLS(config)#exit
MLS#
%SYS-5-CONFIG_I: Configured from console by console

MLS#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

C    192.168.10.0/24 is directly connected, Vlan10
C    192.168.20.0/24 is directly connected, Vlan20
C    192.168.30.0/24 is directly connected, Vlan30
C    192.168.99.0/24 is directly connected, Vlan99
     209.165.200.0/30 is subnetted, 1 subnets
C       209.165.200.224 is directly connected, GigabitEthernet0/2

MLS#
```

Step 6: Verify end-to-end connectivity

- From PC0, we ping PC3 or MLS to verify connectivity within VLAN 10

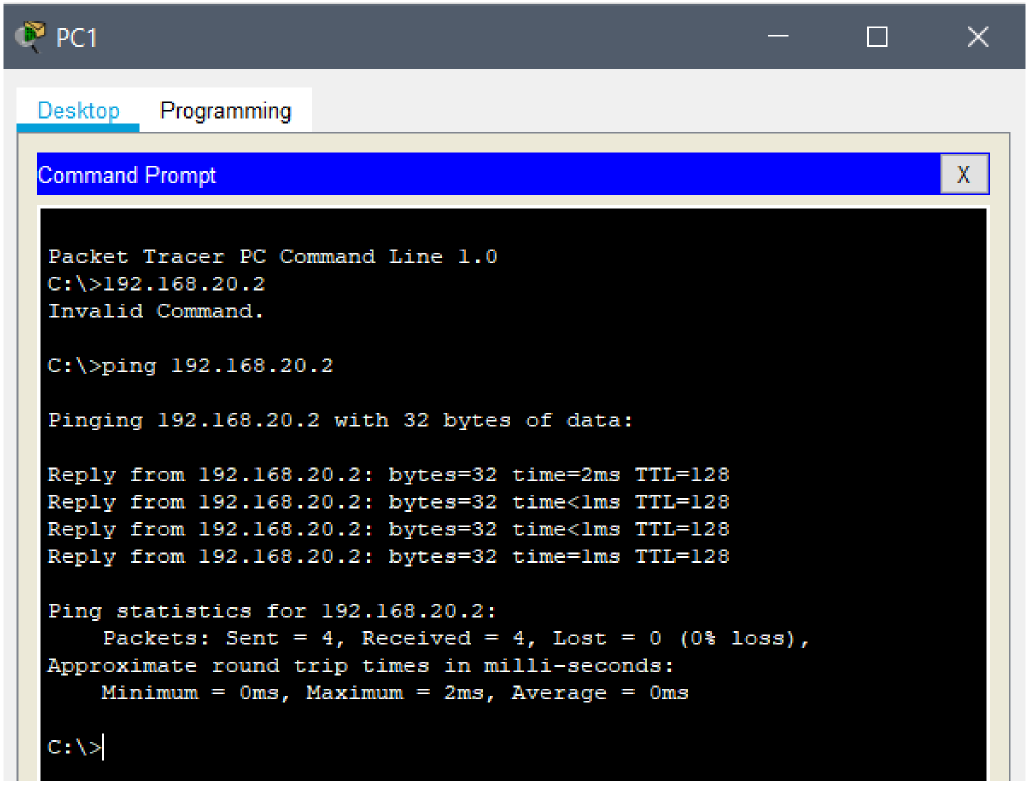
PC0

Desktop Programming

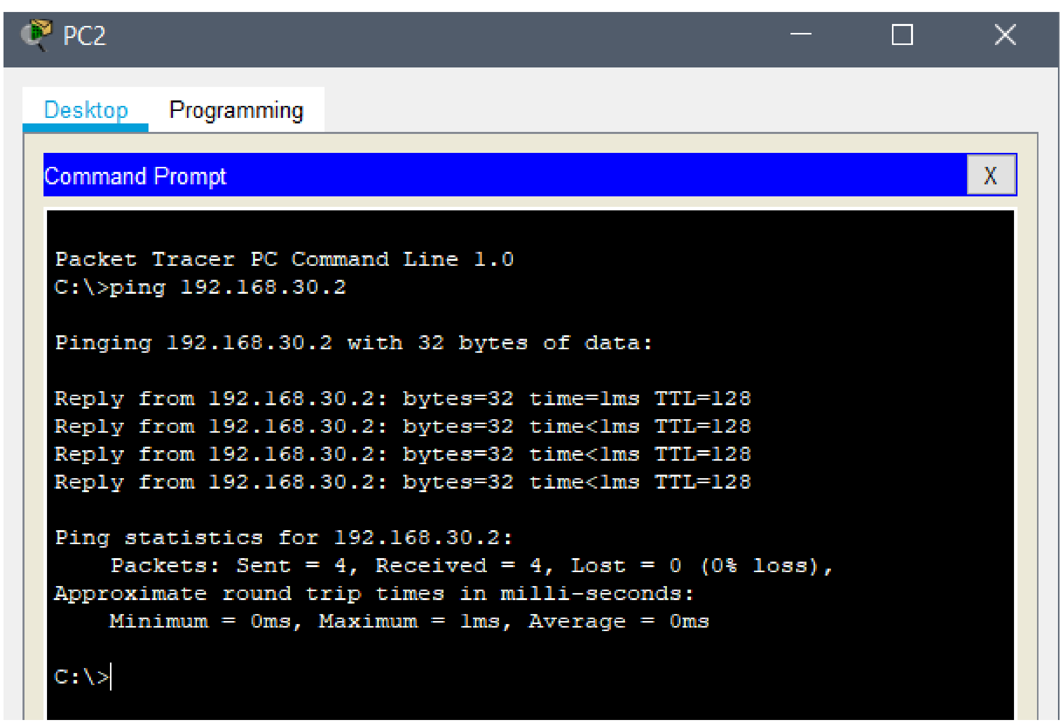
Command Prompt X

```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.10.2

Pinging 192.168.10.2 with 32 bytes of data:

Reply from 192.168.10.2: bytes=32 time=1ms TTL=128
Reply from 192.168.10.2: bytes=32 time<1ms TTL=128
Reply from 192.168.10.2: bytes=32 time=4ms TTL=128
Reply from 192.168.10.2: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.10.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 4ms, Average = 1ms

C:\>
```

- From PC1, we ping PC4 or MLS to verify connectivity within VLAN 20



- From PC2, we ping PC5 to verify connectivity within VLAN 30



- From S1,we ping S2 to verify connectivity with VLAN 99

```
S1>ping 192.168.99.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.99.2, timeout is 2
seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0
ms

S1>
```

Ctrl+F6 to exit CLI focus   Copy   Paste

- To verify inter-VLAN routing, we ping devices outside the sender's VLAN. We ping PC4 to PC5 which verifies connectivity between VLAN 30 and VLAN 40

PC4

Desktop   Programming

Command Prompt   X

```
Pinging 192.168.30.2 with 32 bytes of data:

Request timed out.
Reply from 192.168.30.2: bytes=32 time=1ms TTL=127
Reply from 192.168.30.2: bytes=32 time<1ms TTL=127
Reply from 192.168.30.2: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.30.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

- From any device, we ping this address inside Cloud, 209.165.200.226. We ping from PC0

```
C:\>ping 209.165.200.226

Pinging 209.165.200.226 with 32 bytes of data:

Request timed out.
Reply from 209.165.200.226: bytes=32 time<1ms TTL=254
Reply from 209.165.200.226: bytes=32 time<1ms TTL=254
Reply from 209.165.200.226: bytes=32 time<1ms TTL=254

Ping statistics for 209.165.200.226:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Observation:

Task-1: Here the show vlan command displays all the VLANs assigned to the ports, their names and their active status. Only one port was assigned to Sales in switch-1 and one port to Operations in switch-2 and the rest were assigned to Parking_Lot. Since we used a router on a stick approach, we can see Fa0/1 missing which was used as a trunk interface. The list of VLAN, their types, and related information is given later on.

Switch-1:

```
180041120_S1>show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active
10   Management                       active
20   Sales                            active    Fa0/6
30   Operations                       active
999  Parking_Lot                      active    Fa0/2, Fa0/3, Fa0/4, 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, Gig0/1, Gig0/2
1000 Native                           active
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  -      -      -        -    -        0      0
10   enet  100010     1500  -      -      -        -    -        0      0
20   enet  100020     1500  -      -      -        -    -        0      0
30   enet  100030     1500  -      -      -        -    -        0      0
999  enet  100999     1500  -      -      -        -    -        0      0
1000 enet  101000     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
1005 trnet 101005     1500  -      -      -        ibm  -        0      0

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------

Remote SPAN VLANs
------------------------------------------------------------------------------

Primary Secondary Type              Ports
------- --------- ----------------- ------------------------------------------
```

Switch-2:

```
180041120_S2>show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active
10   Management                       active
20   Sales                            active
30   Operations                       active    Fa0/18
999  Parking_Lot                      active    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, Gig0/1, Gig0/2
1000 Native                           active
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  -      -      -        -    -        0      0
10   enet  100010     1500  -      -      -        -    -        0      0
20   enet  100020     1500  -      -      -        -    -        0      0
30   enet  100030     1500  -      -      -        -    -        0      0
999  enet  100999     1500  -      -      -        -    -        0      0
1000 enet  101000     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
1005 trnet 101005     1500  -      -      -        ibm  -        0      0

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------

Remote SPAN VLANs
------------------------------------------------------------------------------

Primary Secondary Type              Ports
------- --------- ----------------- ------------------------------------------
```

Task-2: Just like task-1, the show vlan command displays all the VLANs assigned to the individual ports, their names and their active status.

Switch-1: Here, VLAN 1,which is the default VLAN, is assigned to all the ports. Port Fa0/1, Fa0/2, and Gig0/1 are missing which were used to connect with switches and MLS. Since, all the ports have the default VLAN assigned to them, VLAN wasn't created in this switch.

```
S1>show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    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, Gig0/2
10   Staff                            active
20   Student                          active
30   Faculty                          active
99   Management                       active
999  VLAN0999                         active
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  -      -      -        -    -        0      0
10   enet  100010     1500  -      -      -        -    -        0      0
20   enet  100020     1500  -      -      -        -    -        0      0
30   enet  100030     1500  -      -      -        -    -        0      0
99   enet  100099     1500  -      -      -        -    -        0      0
999  enet  100999     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
1005 trnet 101005     1500  -      -      -        ibm  -        0      0

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------

Remote SPAN VLANs
------------------------------------------------------------------------------

Primary Secondary Type              Ports
------- --------- ----------------- ------------------------------------------
```

Switch-2: We assigned VLANs to ports as mentioned in the table. All the VLANs are active. Fa0/1 was used to connect switch-2 with switch-1 and is missing in the ports section.

```
S2>
S2>show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Gig0/1, Gig0/2
10   Staff                            active    Fa0/2, Fa0/3, Fa0/4, Fa0/5
                                                Fa0/6, Fa0/7, Fa0/8
20   Student                          active    Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                                Fa0/13, Fa0/14, Fa0/15, Fa0/16
30   Faculty                          active    Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                                Fa0/21, Fa0/22, Fa0/23, Fa0/24
99   Management                       active
999  VLAN0999                         active
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  -      -      -        -    -        0      0
10   enet  100010     1500  -      -      -        -    -        0      0
20   enet  100020     1500  -      -      -        -    -        0      0
30   enet  100030     1500  -      -      -        -    -        0      0
99   enet  100099     1500  -      -      -        -    -        0      0
999  enet  100999     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
1005 trnet 101005     1500  -      -      -        ibm  -        0      0

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------

Remote SPAN VLANs
------------------------------------------------------------------------------

Primary Secondary Type              Ports
------- --------- ----------------- ------------------------------------------
```

Switch-3: All the VLANs were assigned to ports following the table. Only Fa0/2 doesn't have a vlan since it was used for connecting to switch-1, and that is why this port is missing in the ports section.

```
S3>show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Gig0/1, Gig0/2
10   Staff                            active    Fa0/1, Fa0/3, Fa0/4, Fa0/5
                                                Fa0/6, Fa0/7, Fa0/8
20   Student                          active    Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                                Fa0/13, Fa0/14, Fa0/15, Fa0/16
30   Faculty                          active    Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                                Fa0/21, Fa0/22, Fa0/23, Fa0/24
99   Management                       active    
999  VLAN0999                         active    
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  -      -      -        -    -        0      0
10   enet  100010     1500  -      -      -        -    -        0      0
20   enet  100020     1500  -      -      -        -    -        0      0
30   enet  100030     1500  -      -      -        -    -        0      0
99   enet  100099     1500  -      -      -        -    -        0      0
999  enet  100999     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
1005 trnet 101005     1500  -      -      -        ibm  -        0      0

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------

Remote SPAN VLANs
------------------------------------------------------------------------------

Primary Secondary Type              Ports
------- --------- ----------------- ------------------------------------------
--
```

MLS: The default VLAN was assigned to all the ports. Hence, no VLAN was created in the MLS. The missing ports are used to connect to Switch-1 and Cloud

```
MLS>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
10   Staff                            active
20   Student                          active
30   Faculty                          active
99   Management                       active
999  VLAN0999                         active
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  -      -      -        -    -        0      0
10   enet  100010     1500  -      -      -        -    -        0      0
20   enet  100020     1500  -      -      -        -    -        0      0
30   enet  100030     1500  -      -      -        -    -        0      0
99   enet  100099     1500  -      -      -        -    -        0      0
999  enet  100999     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
1005 trnet 101005     1500  -      -      -        ibm  -        0      0

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------

Remote SPAN VLANs
------------------------------------------------------------------------------

Primary Secondary Type              Ports
------- --------- ----------------- ------------------------------------------
```

Challenges (if any):

- The tasks were relatively lengthy but apart from that I faced no major challenges