Experiment 6:

Aim: To set VLAN

Procedure:

Setting up VLANs (Virtual Local Area Networks) in Cisco Packet Tracer involves creating virtual LANs to logically segment a network. Here's a step-by-step guide on how to set up VLANs in Cisco Packet Tracer:

1. Open Cisco Packet Tracer:
   - Launch Cisco Packet Tracer on your computer.

2. Create a Network Topology:
   - Set up the basic network topology that you want to work with. Add switches and routers as needed.

3. Access Switch Configuration:
   - Double-click on the switch you want to configure for VLANs.

4. Enter CLI (Command Line Interface):
   - Click on the "CLI" tab to access the command line interface of the switch.

5. Enter Privileged Exec Mode
   - If you are not already in privileged exec mode, enter the following command:

```
Switch> enable
```

6. Enter Global Configuration Mode:
   - Enter global configuration mode by typing:

```
Switch# configure terminal
```

7. Create VLANs:
   - Create VLANs by using the following command for each VLAN you want to add. Replace `vlan_id` with the VLAN number:

```
Switch(config)# vlan vlan_id
```

8. Name VLANs (Optional):
   - You can optionally assign names to VLANs using the following command:

```
Switch(config-vlan)# name VLAN_Name
```

9. Assign VLANs to Ports:

- Go to the interface configuration mode for each port and assign it to a VLAN. For example, to assign a port to VLAN 10:

```
Switch(config)# interface interface_type interface_number
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 10
```

10. Exit Configuration Mode:
- After configuring the VLANs and assigning ports, exit configuration mode:

```
Switch(config-if)# exit
Switch(config)# exit
```

11. Save Configuration:
- Save the configuration to ensure that it is retained after a restart:

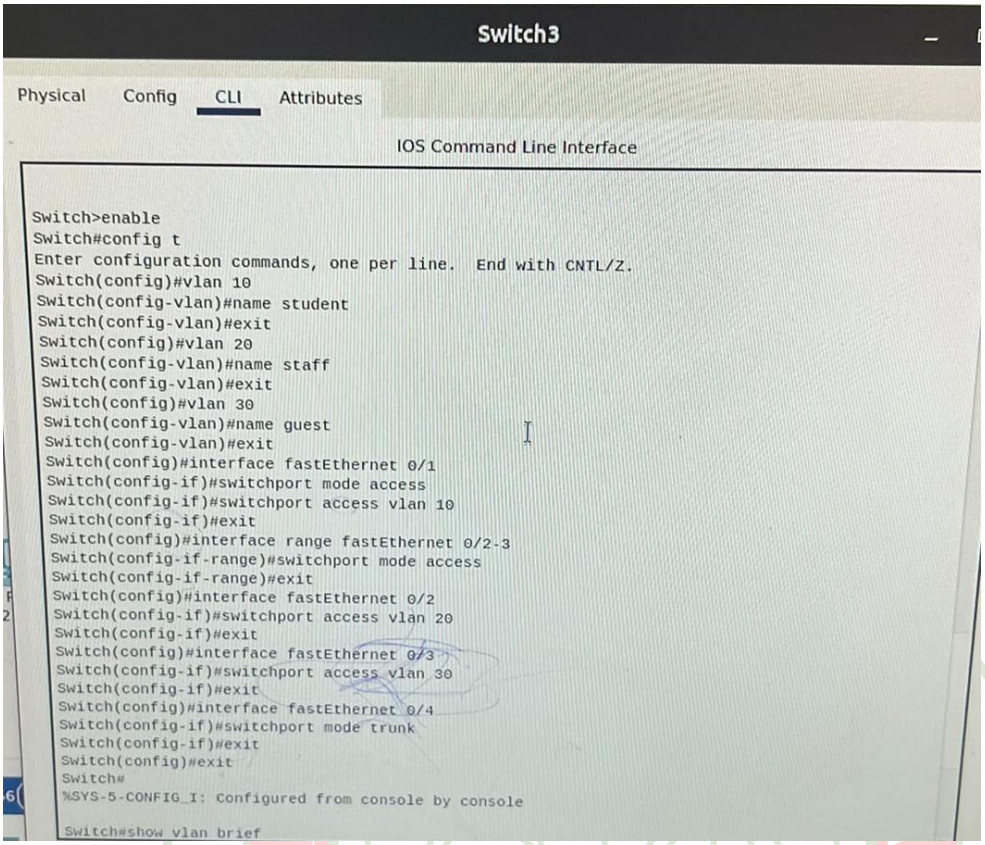
```
Switch# copy running-config startup-config
```

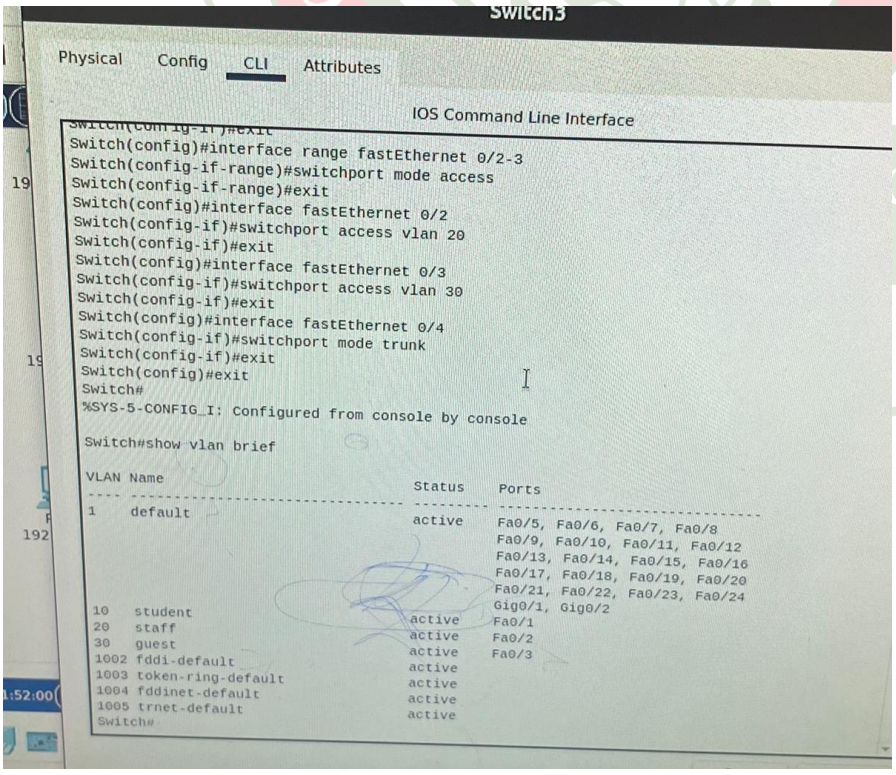
12. Verify Configuration:
- Verify your VLAN configuration using the following commands:

```
Switch# show vlan
Switch# show interfaces switchport
```

This basic configuration should help you set up VLANs in Cisco Packet Tracer. Adjust the VLAN numbers, names, and port assignments based on your specific network requirements.

Output:


Switch3
Physical
Config
CLI
Attributes
IOS Command Line Interface
Switch>enable
Switch#config t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 10
Switch(config-vlan)#name student
Switch(config-vlan)#exit
Switch(config)#vlan 20
Switch(config-vlan)#name staff
Switch(config-vlan)#exit
Switch(config)#vlan 30
Switch(config-vlan)#name guest
Switch(config-vlan)#exit
Switch(config)#interface fastEthernet 0/1
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 10
Switch(config-if)#exit
Switch(config)#interface range fastEthernet 0/2-3
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#exit
Switch(config)#interface fastEthernet 0/2
Switch(config-if)#switchport access vlan 20
Switch(config-if)#exit
Switch(config)#interface fastEthernet 0/3
Switch(config-if)#switchport access vlan 30
Switch(config-if)#exit
Switch(config)#interface fastEthernet 0/4
Switch(config-if)#switchport mode trunk
Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console
Switch#show vlan brief


Switch3
Physical
Config
CLI
Attributes
IOS Command Line Interface
Switch(config)#interface range fastEthernet 0/2-3
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#exit
Switch(config)#interface fastEthernet 0/2
Switch(config-if)#switchport access vlan 20
Switch(config-if)#exit
Switch(config)#interface fastEthernet 0/3
Switch(config-if)#switchport access vlan 30
Switch(config-if)#exit
Switch(config)#interface fastEthernet 0/4
Switch(config-if)#switchport mode trunk
Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console
Switch#show vlan brief
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
Gig0/1, Gig0/2
10 student active Fa0/1
20 staff active Fa0/2
30 guest active Fa0/3
1002 fddi-default active
1003 token-ring-default active
1004 fddinet-default active
1005 trnet-default active
Switch#

Experiment 7:

Aim: Develop various LANs using GNS3. Connect them and explore various subnetting options.

Procedure:

Building various LANs using GNS3 and exploring subnetting options involves creating virtual networks, connecting them, and configuring subnetting within each network. Here's a step-by-step procedure:

1. Install and Set Up GNS3:
   - Download and install GNS3 on your computer.

2. Create Network Topology:
   - Open GNS3 and create a new project.
   - Drag and drop routers and switches onto the workspace to create your desired network topology.
   - Connect devices using appropriate interfaces.

3. Router Configuration:
   - Double-click on each router to access its console.
   - Assign IP addresses to router interfaces using the following commands:

```
bash
Router> enable
Router# configure terminal
Router(config)# interface interface_type interface_number
Router(config-if)# ip address IP_Address Subnet_Mask
Router(config-if)# no shutdown
Router(config-if)# exit
```

4. Interconnect Routers:
   - Connect routers using serial interfaces or any other appropriate interfaces. Configure IP addresses on these interfaces as well.

5. Switch Configuration:
   - Double-click on each switch to access its console.
   - Optionally, assign IP addresses to the management VLAN interface:

```
bash
Switch> enable
Switch# configure terminal
Switch(config)# interface vlan 1
Switch(config-if)# ip address IP_Address Subnet_Mask
Switch(config-if)# no shutdown
Switch(config-if)# exit
```

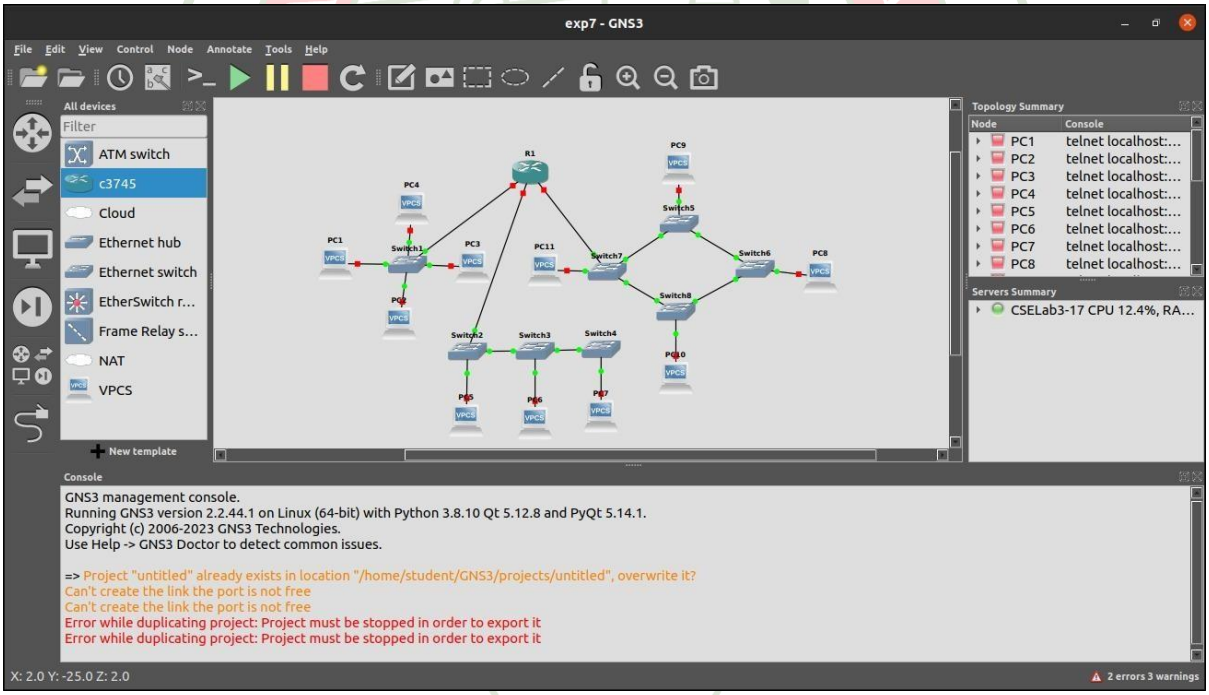
6. LAN Configuration:
   - Connect end devices (computers, servers) to switches.
   - Configure IP addresses on end devices within their respective subnets.

7. Explore Subnetting Options:
- Decide on a subnetting scheme for each LAN. For example, use Variable Length Subnet Masking (VLSM) to optimize IP address utilization.
- Implement subnetting on routers and switches:

bash
```
Router(config)# interface interface_type interface_number
Router(config-if)# ip address IP_Address Subnet_Mask
Router(config-if)# no shutdown
Router(config-if)# exit
```

8. Routing Configuration:
- Configure routing protocols (e.g., OSPF, EIGRP) on routers to enable communication between different subnets.

9. Test Connectivity:
- Ping devices across different subnets to verify connectivity.
- Troubleshoot and adjust configurations if needed.



Experiment 8:

Aim: Develop various LANs using GNS3. Configure with static routes using two or more Routers.

Procedure:

Assuming Router A and Router B present, each connected to different LANs:

Router A Configuration:

1. Configure the LAN Interface:
   bash
   RouterA> enable
   RouterA# configure terminal
   RouterA(config)# interface gigabitEthernet0/0
   RouterA(config-if)# ip address 192.168.1.1 255.255.255.0
   RouterA(config-if)# no shutdown
   RouterA(config-if)# exit

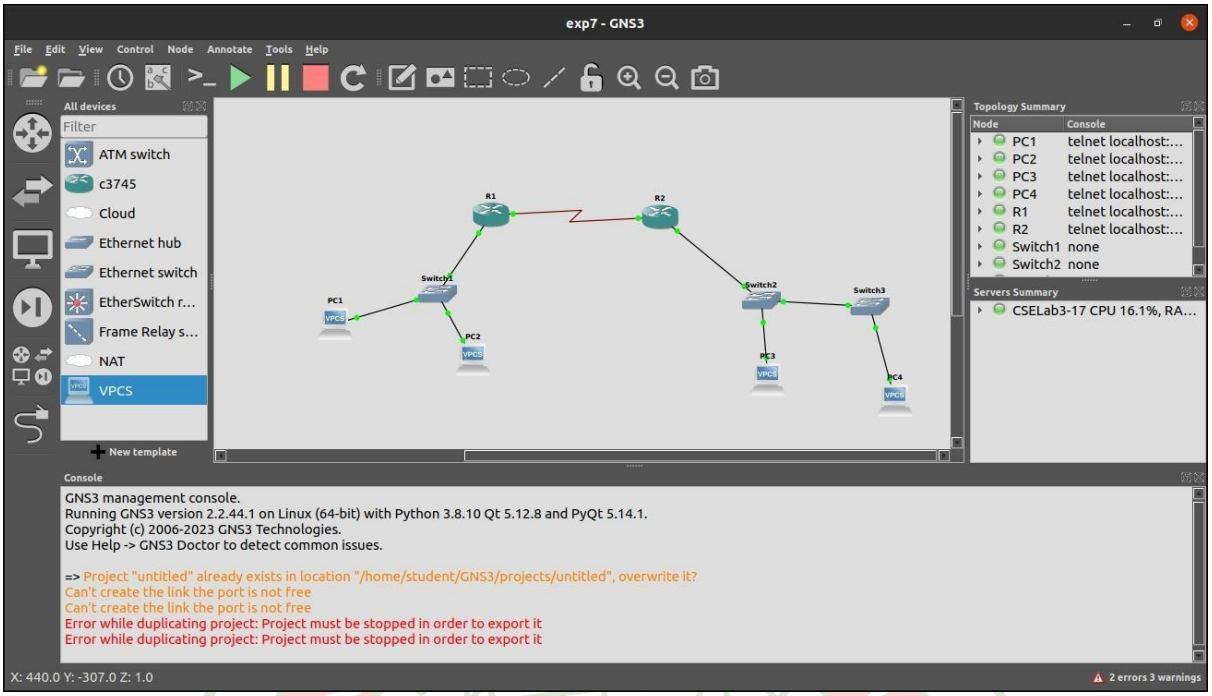
2. Configure a Static Route to Router B's LAN:
   bash
   RouterA(config)# ip route 192.168.2.0 255.255.255.0 192.168.1.2
   ```
   This command tells RouterA that to reach the subnet 192.168.2.0/24, it should forward the traffic to Router B at IP address 192.168.1.2.

Router B Configuration:

1. Configure the LAN Interface:
   bash
   RouterB> enable
   RouterB# configure terminal
   RouterB(config)# interface gigabitEthernet0/0
   RouterB(config-if)# ip address 192.168.2.1 255.255.255.0
   RouterB(config-if)# no shutdown
   RouterB(config-if)# exit

2. Configure a Static Route to Router A's LAN:
   bash
   RouterB(config)# ip route 192.168.1.0 255.255.255.0 192.168.2.2

   This command tells RouterB that to reach the subnet 192.168.1.0/24, it should forward the traffic to Router A at IP address 192.168.2.2.
   ```

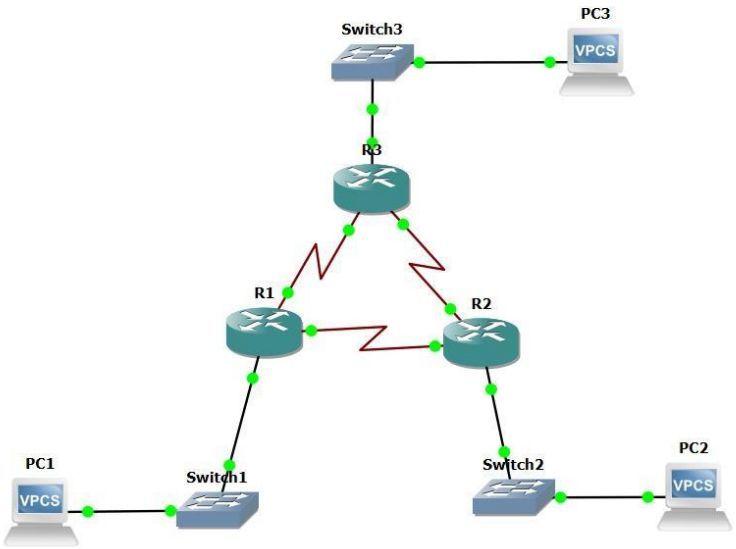


Experiment 9:

Aim: Basic OSPF configuration using GNS3 tool.

Procedure:

Part 1: Prepare the network as shown:



Part 2 : Configure Basic Network Device Settings.

Configure the interfaces on the R1, R2, and R3 routers with the IP addresses from the table under the Topology Diagram.

R1#configure terminal
R1(config)#interface fastEthernet 0/0
R1(config-if)#ip address 192.168.1.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#exit
R1(config)#interface serial 1/0
R1(config-if)#ip address 192.168.4.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#exit
R1(config)#interface serial 1/1
R1(config-if)#ip address 192.168.5.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#exit
Use the show ip interface brief command to verify that the IP addressing is correct and that the interfaces are active.
R1# show ip interface brief

```
R2#configure terminal
R2(config)#interface fastEthernet 0/0
R2(config-if)#ip address 192.168.2.1 255.255.255.0
R2(config-if)#no shut
R2(config-if)#exit
R2(config)#interface serial 1/0
R2(config-if)#ip address 192.168.4.2 255.255.255.0
R2(config-if)#no shut
R2(config-if)#exit
R2(config)#interface serial 1/1
R2(config-if)#ip address 192.168.6.1 255.255.255.0
R2(config-if)#no shut
R2(config-if)#exit
R2(config)#exit
```

Use the show ip interface brief command to verify that the IP addressing is correct and that the interfaces are active.

```
R2# show ip interface brief
```

```
R3#configure terminal
R3(config)#interface fastEthernet 0/0
R3(config-if)#ip address 192.168.3.1 255.255.255.0
R3(config-if)#no shut
R3(config-if)#exit
R3(config)#interface serial 1/0
R3(config-if)#ip address 192.168.5.2 255.255.255.0
R3(config-if)#no shut
R3(config-if)#exit
R3(config)#interface serial 1/1
R3(config-if)#ip address 192.168.6.2 255.255.255.0
R3(config-if)#no shut
R3(config-if)#exit
R3(config)#exit
```

Use the show ip interface brief command to verify that the IP addressing is correct and that the interfaces are active.

```
R3# show ip interface brief
```

Configure the Ethernet interfaces of PC1, PC2, and PC3 with the IP addresses and default gateways from the table under the Topology Diagram.
Refer to the Addressing Table for PC host address information.

```
PC1>ip 192.168.1.2/24 192.168.1.1
PC2>ip 192.168.2.2/24 192.168.2.1
```

```
R1
R1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#interface fastEthernet 0/0
R1(config-if)#ip address 192.168.1.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#exit
R1(config)#
*Mar  1 00:03:48.451: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state t
o up
*Mar  1 00:03:49.451: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
et0/0, changed state to up
R1(config)#interface serial 2/0
R1(config-if)#ip address 192.168.4.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#exit
R1(config)#
*Mar  1 00:05:41.199: %LINK-3-UPDOWN: Interface Serial2/0, changed state to up
R1(config)#
*Mar  1 00:05:42.203: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0,
 changed state to up
R1(config)#interface serial 2/1
R1(config-if)#ip address 192.168.4.1 255.255.255.0
*Mar  1 00:06:02.619: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0,
 changed state to down
R1(config-if)#ip address 192.168.5.1 255.255.255.0
R1(config-if)#no shut
```

Part 3 : Configure OSPF

Configure OSPF on R1
Use the router ospf command in global configuration mode to enable OSPF on the R1 router. Enter a process ID of 1 for the process-ID parameter.

R1(config)#router ospf 1
R1(config-router)# network 192.168.1.0 0.0.0.255 area 0
R1(config-router)# network 192.168.4.0 0.0.0.255 area 0
R1(config-router)# network 192.168.5.0 0.0.0.255 area 0

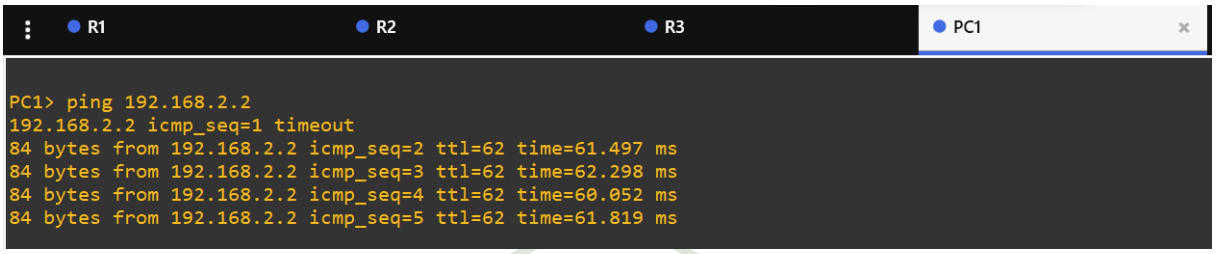
Configuring OSPF on R2
R2(config)#router ospf 1
R2(config-router)# network 192.168.2.0 0.0.0.255 area 0
R2(config-router)# network 192.168.4.0 0.0.0.255 area 0
R2(config-router)# network 192.168.6.0 0.0.0.255 area 0

Configuring OSPF on R3
R3(config)#router ospf 1
R3(config-router)# network 192.168.3.0 0.0.0.255 area 0
R3(config-router)# network 192.168.5.0 0.0.0.255 area 0
R3(config-router)# network 192.168.6.0 0.0.0.255 area 0

```
R2#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#router ospf 1
R2(config-router)#network 192.168.2.0 0.0.0.255 area 0
R2(config-router)#network 192.168.4.0 0.0.0.255 area 0
R2(config-router)#network 192.168.4.0 0.0.0.255 area 0
*Mar  1 00:13:27.319: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.5.1 on Serial2/0 from LOADING to FULL, Loading D
one
R2(config-router)#network 192.168.6.0 0.0.0.255 area 0
R2(config-router)#
*Mar  1 00:15:14.803: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.6.2 on Serial2/1 from LOADING to FULL, Loading D
one
```

Part 4 : Verify and test network connectivity

PC1> ping 192.168.2.2



View routing protocol information.
R1#show ip protocols

```
R1#show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 192.168.5.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    192.168.4.0 0.0.0.255 area 0
    192.168.5.0 0.0.0.255 area 0
 Reference bandwidth unit is 100 mbps
  Routing Information Sources:
    Gateway         Distance      Last Update
    192.168.6.2           110      00:22:40
    192.168.6.1           110      00:22:40
  Distance: (default is 110)

R1#
```

View the routing table on the R1 router.
R1#show ip route

```
R1#show ip route
Codes: C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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    192.168.4.0/24 is directly connected, Serial2/0
C    192.168.5.0/24 is directly connected, Serial2/1
O    192.168.6.0/24 [110/128] via 192.168.5.2, 00:23:28, Serial2/1
                    [110/128] via 192.168.4.2, 00:23:28, Serial2/0
C    192.168.1.0/24 is directly connected, FastEthernet0/0
O    192.168.2.0/24 [110/74] via 192.168.4.2, 00:23:28, Serial2/0
O    192.168.3.0/24 [110/74] via 192.168.5.2, 00:23:28, Serial2/1
```

Verify ospf Operation
R1#show ip ospf neighbors

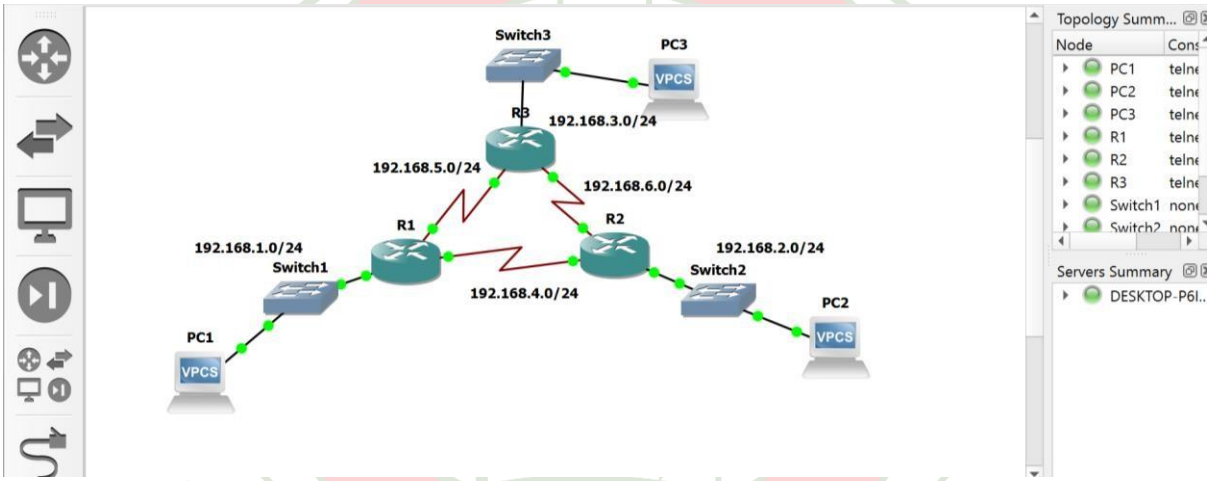
```
R1#show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.6.2       0   FULL/  -        00:00:37    192.168.5.2     Serial2/1
192.168.6.1       0   FULL/  -        00:00:37    192.168.4.2     Serial2/0
R1#
```

AIM: Basic EIGRP configuration using GNS3 tool.

Description:

Enhanced Interior Gateway Routing Protocol is an interior gateway protocol suited for many different topologies and media. In a well-designed network, EIGRP scales well and provides. extremely quick convergence times with minimal network traffic. It has very low usage of network resources during normal operations; only hello packets are transmitted on a stable network.
When a change occurs, only routing table changes are propagated, not the entire routing table this reduces the load on the routing protocol itself places on the network. It has rapid convergence times for changes in the network topology (in some situations convergence can be almost instantaneous). It is an enhanced distance vector protocol, relying on the Diffused Update Algorithm (DUAL) to calculate the shortest path to a destination within a network.



Part 1: Prepare the Network

Cable a network that is like the one in the Topology Diagram**.**

Part 2: Configure Basic Network Device Settings.

Configure the interfaces on the R1, R2, and R3 routers with the IP addresses from the table under the Topology Diagram.

```
R1#configure terminal
R1(config)#interface fastEthernet 0/0
R1(config-if)#ip address 192.168.1.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#exit
R1(config)#interface serial 1/0
R1(config-if)#ip address 192.168.4.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#exit
R1(config)#interface serial 1/1
R1(config-if)#ip address 192.168.5.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#exit
```

Use the show ip interface brief command to verify that the IP addressing is correct and that the interfaces are active.
R1# show ip interface brief

Configuring interfaces on R2
R2#configure terminal
R2(config)#interface fastEthernet 0/0
R2(config-if)#ip address 192.168.2.1 255.255.255.0
R2(config-if)#no shut
R2(config-if)#exit
R2(config)#interface serial 1/0
R2(config-if)#ip address 192.168.4.2 255.255.255.0
R2(config-if)#no shut
R2(config-if)#exit
R2(config)#interface serial 1/1
R2(config-if)#ip address 192.168.6.1 255.255.255.0
R2(config-if)#no shut
R2(config-if)#exit
R2(config)#exit
Use the show ip interface brief command to verify that the IP addressing is correct and that the interfaces are active.
R2# show ip interface brief

Configuring interfaces on R3

R3#configure terminal
R3(config)#interface fastEthernet 0/0
R3(config-if)#ip address 192.168.3.1 255.255.255.0
R3(config-if)#no shut
R3(config-if)#exit
R3(config)#interface serial 1/0
R3(config-if)#ip address 192.168.5.2 255.255.255.0
R3(config-if)#no shut
R3(config-if)#exit
R3(config)#interface serial 1/1
R3(config-if)#ip address 192.168.6.2 255.255.255.0
R3(config-if)#no shut
R3(config-if)#exit
R3(config)#exit
Use the show ip interface brief command to verify that the IP addressing is correct and that the interfaces are active.
R3# show ip interface brief
Configure the Ethernet interfaces of PC1, PC2, and PC3 with the IP addresses and default gateways from the table under the Topology Diagram.
Refer to the Addressing Table for PC host address information.
PC1>ip 192.168.1.2/24 192.168.1.1
PC2>ip 192.168.2.2/24 192.168.2.1

Part 3: Configure EIGRP

Configure EIGRP on R1

Use the router eigrp command in global configuration mode to enable EIGRP on the R1 router.
Enter 1 for the autonomous-system parameter.
R1(config)#router eigrp 1
Once you are in the Router EIGRP configuration sub-mode, configure the classful network 192.168.1.0 to be included in the EIGRP updates that are sent out of R1.
R1(config-router)# network 192.168.1.0
The router will begin to send EIGRP update messages out each interface belonging to the 192 .168.1.0 network. EIGRP updates will be sent out of the FastEthernet0/0 and Serial1/0 interfa ces because they are both on subnets of the 192.168.1.0 network.
R1(config-router)# network 192.168.4.0
R1(config-router)# network 192.168.5.0
R1(config-router)#**Configuring EIGRP on R2**
R2(config)#router EIGRP 1
R2(config-router)# network 192.168.2.0
Notice that DUAL sends a notification message to the console stating that a neighbor relation ship with another EIGRP router has been established.
R2(config-router)# network 192.168.4.0
R2(config-router)# network 192.168.6.0

Configuring EIGRP on R3

R3(config)#router EIGRP 1
R3(config-router)# network 192.168.3.0
R3(config-router)# network 192.168.5.0
R3(config-router)# network 192.168.6.0
R3(config-router)#

Part 4: Verify and Test Network Connectivity.

PC1> ping 192.168.2.2
Verify EIGRP Operation
R1#show ip eigrp neighbors
View routing protocol information.
R1#show ip protocols
Notice that the output specifies the autonomous system number used by EIGRP. Remember, the autonomous system number must be the same on all routers for EIGRP to establish neighbor adjacencies and share routing information.
View the routing table on the R1 router.
R1#show ip route