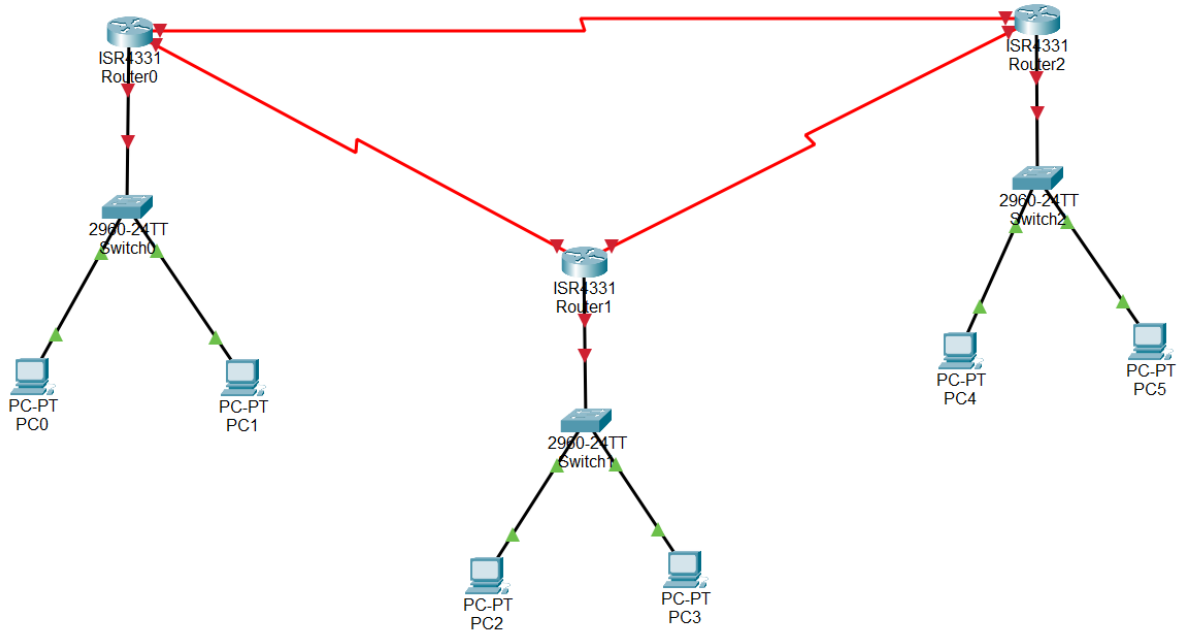
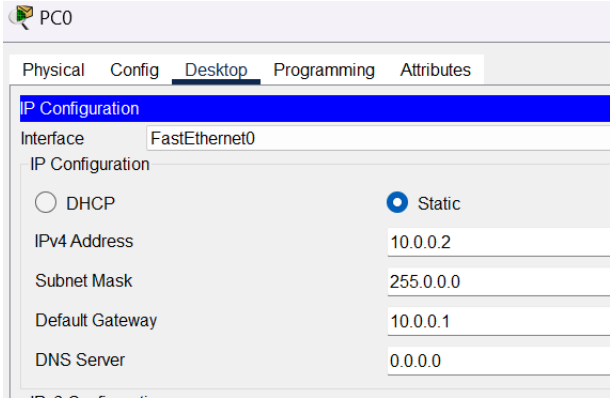
Marwadi University Marwadi Chandarana Group	**Marwadi University** **Faculty of Engineering and Technology** **Department of Information and Communication Technology**	
Subject: Computer Networks (01CT0503)	**Aim:** Perform dynamic routing protocol (OSPF) and analyze the results.	
Experiment No: 07	**Date:**	**Enrolment No: 92200133029**

Aim: **Perform dynamic routing protocol (OSPF) and analyze the results**

Step-1: Open the cisco packet tracer, take Routers, Switches and PCs. Connect the router, switch and PC via cable. For connecting route to the switch and switch to the PC use copper straight cable and for router to router use serial DTE cable



Step-2: Give IP address to all the PC. Also provide the gateway to each PC.



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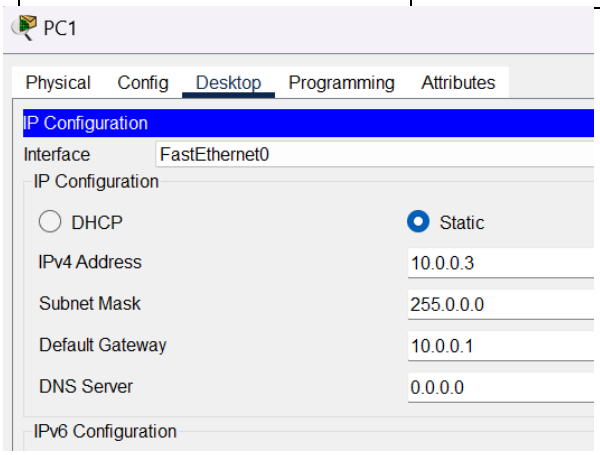

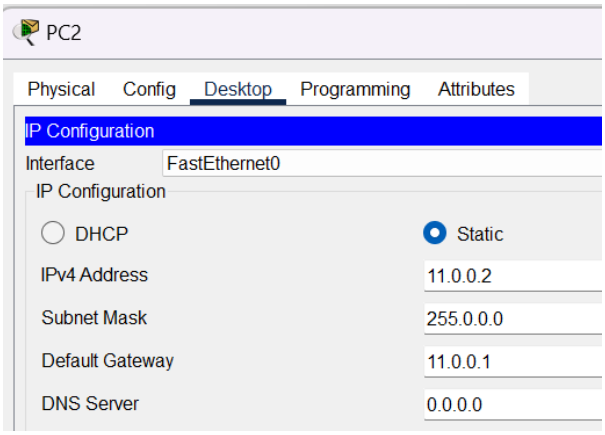

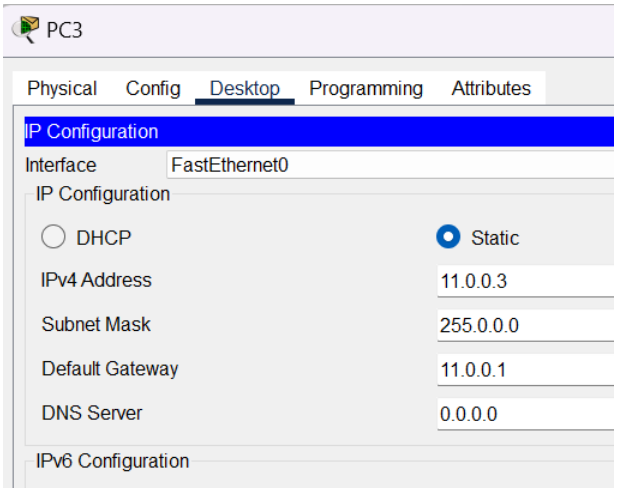

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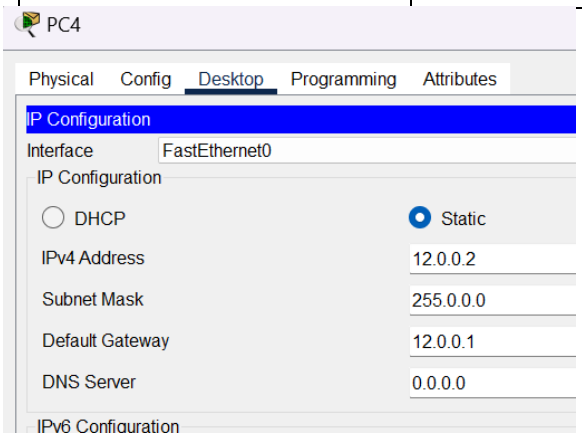

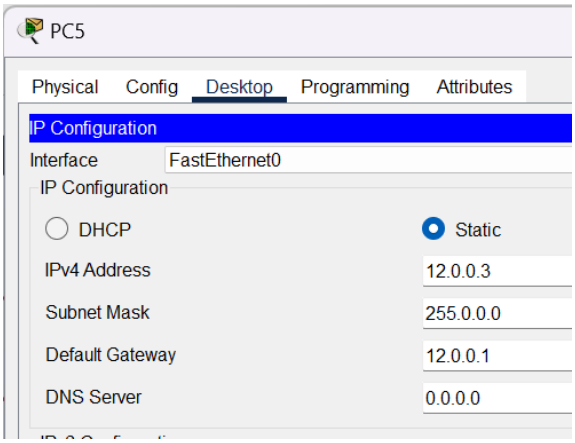

Step-3: Give the Ip add to all the routers. For that click on the router, open the cli and type the following command -

int <port>

Ip add <ip add> <subnetmask>

No shut

For giving the ip add we have to go in the configuration mode.

Give the ip add to all the 3 ports of the router which we are going to use for networking.

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```
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int g0/0/0
Router(config-if)#ip add 10.0.0.1 255.0.0.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed state to up

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

Router(config-if)#exit
Router(config)#int s0/1/0
Router(config-if)#ip add 13.0.0.1 255.0.0.0
Router(config-if)#no shut

%LINK-5-CHANGED: Interface Serial0/1/0, changed state to down
Router(config-if)#exit
Router(config)#int s0/1/1
Router(config-if)#ip add 15.0.0.1 255.0.0.0
Router(config-if)#no shut

%LINK-5-CHANGED: Interface Serial0/1/1, changed state to down
Router(config-if)#exit
Router(config)#
```

```
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int g0/0/0
Router(config-if)#ip add 11.0.0.1 255.0.0.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed state to up

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

Router(config-if)#exit
Router(config)#int s0/1/1
Router(config-if)#ip add
% Incomplete command.
Router(config-if)#ip add 14.0.0.1 255.0.0.0
Router(config-if)#no shut

%LINK-5-CHANGED: Interface Serial0/1/1, changed state to down
Router(config-if)#exit
Router(config)#int s0/1/0
Router(config-if)#
Router(config-if)#ip add 13.0.0.2 255.0.0.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up

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

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```
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#intg0/0/0
                ^
% Invalid input detected at '^' marker.

Router(config)#int g0/0/0
Router(config-if)#ip add 12.0.0.1 255.0.0.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed state to up

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

Router(config-if)#exit
Router(config)#int s0/1/0
Router(config-if)#ip add 14.0.0.2 255.0.0.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up

Router(config-if)#exit
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up

Router(config)#int s0/1/1
Router(config-if)#ip add 15.0.0.2 255.0.0.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/1/1, changed state to up

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

Step – 4: Enable OSPF using **`router ospf 1`**, and add networks with **`network <IP> <wildcard-mask> area <area-id>.`**

The wildcard mask is the inverse of a subnet mask. It specifies which bits in an IP address should be considered for OSPF matching.

The Area ID organizes the OSPF domain into smaller, manageable sections to improve scalability and reduce routing overhead.
All routers in the same area share the same Area ID and maintain identical link-state databases.

Area 0 is mandatory and acts as the central hub to which all other areas must connect.

Non-backbone areas like area 1, area 2 are used for networks that connect to the backbone.

```
Router#
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
Router(config)#router ospf 1
Router(config-router)#network 10.0.0.0 0.0.0.255 area 0
Router(config-router)#network 13.0.0.0 0.0.0.255 area 0
Router(config-router)#network 15.0.0.0 0.0.0.255 area 1
Router(config-router)#
```

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```
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 2
Router(config-router)#network 11.0.0.0 0.0.0.255 area 2
Router(config-router)#network 13.0.0.0 0.0.0.255 area 0
Router(config-router)#network 14.0.0.0 0.0.0.255 area 2
Router(config-router)#
Router(config-router)#exit
Router(config)#
Router(config)#
```

```
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# router ospf 3
Router(config-router)#network 12.0.0.0 0.0.0.255 area 1
Router(config-router)#network 14.0.0.0 0.0.0.255 area 2
Router(config-router)#network 15.0.0.0 0.0.0.255 area 1
Router(config-router)#
Router(config-router)#exit
Router(config)#
Router(config)#
```

Step-5: Verify OSPF neighbors using **`show ip ospf neighbor`** to ensure adjacencies are established and check states, priorities, timers, and interfaces.

```
Router#
Router#sh ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
15.0.0.2          0   FULL/  -        00:00:38    14.0.0.2        Serial0/1/1
15.0.0.1          0   FULL/  -        00:00:31    13.0.0.1        Serial0/1/0
Router#
Router#
Router#
Router#
Router#
Router#
Router#
```

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Step-6 : Run **`show ip ospf database`** to verify OSPF's link-state database, checking router link states, advertised routers, and area details for accurate OSPF operation.

```
Router#sh ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
15.0.0.2          0   FULL/  -        00:00:38    14.0.0.2        Serial0/1/1
15.0.0.1          0   FULL/  -        00:00:31    13.0.0.1        Serial0/1/0
Router#
Router#
Router#
Router#
Router#
Router#
Router#sh ip ospf database
            OSPF Router with ID (14.0.0.1) (Process ID 1)

                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
14.0.0.1        14.0.0.1        7           0x80000007 0x00ff0c 5
15.0.0.1        15.0.0.1        498         0x8000000c 0x00ce86 3
15.0.0.2        15.0.0.2        465         0x80000007 0x00cf25 4

                Summary Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#       Checksum
15.0.0.0        15.0.0.1        488         0x80000001 0x0042fc
            OSPF Router with ID (13.0.0.2) (Process ID 2)

                Router Link States (Area 2)

Link ID         ADV Router      Age         Seq#       Checksum Link count
13.0.0.2        13.0.0.2        401         0x80000001 0x0061e4 0
Router#
```

Step – 7: The show ip route command displays the router's routing table. It showing all known networks and the paths to reach them. It incudes directly connected networks and also the routes that are learned from routing protocols.

```
Router#
Router#show ip route
Codes: L - local, 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, 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

O    10.0.0.0/8 [110/65] via 13.0.0.1, 00:30:22, Serial0/1/0
     11.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       11.0.0.0/8 is directly connected, GigabitEthernet0/0/0
L       11.0.0.1/32 is directly connected, GigabitEthernet0/0/0
O    12.0.0.0/8 [110/2] via 14.0.0.2, 00:30:42, Serial0/1/1
     13.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       13.0.0.0/8 is directly connected, Serial0/1/0
L       13.0.0.2/32 is directly connected, Serial0/1/0
     14.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       14.0.0.0/8 is directly connected, Serial0/1/1
L       14.0.0.1/32 is directly connected, Serial0/1/1
O    15.0.0.0/8 [110/65] via 14.0.0.2, 00:08:34, Serial0/1/1
                [110/65] via 13.0.0.1, 00:08:34, Serial0/1/0

Router#
```

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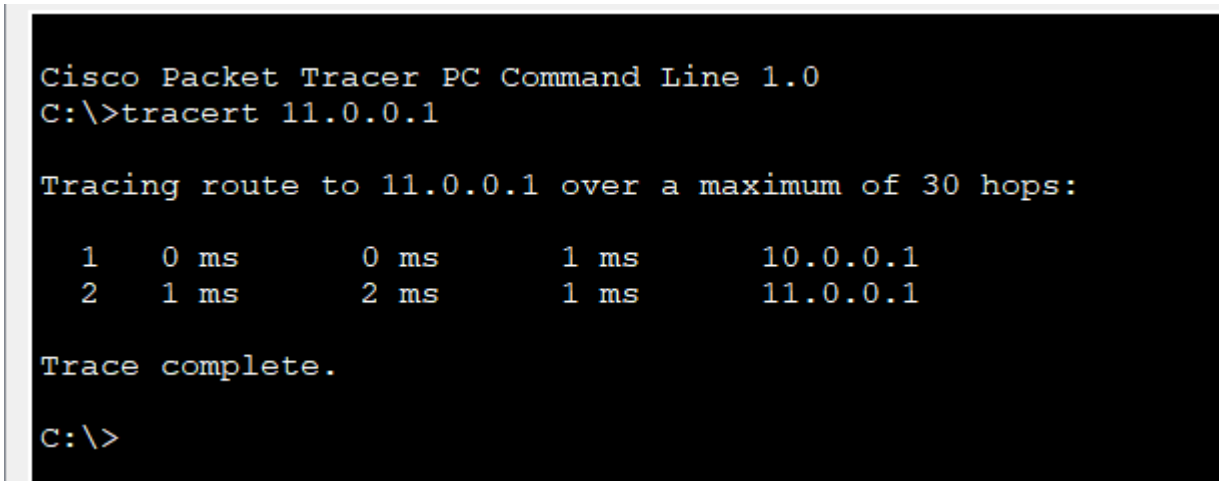
Step – 8 : Now for finding that on which route the packets are travel from source to destination, use the command – tracert <destination ip add>

This command shows the path that packet takes as it travels thorough different routers to reach its destination. It also tells how much time it takes to reach each stop.

If we make the high bandwidth of one path than if the second route is shortest path then also the packet will route from the path whose bandhwidth is high



Conclusion :

After performing this experiment, I learned how to configure and analyze OSPF dynamic routing using Cisco Packet Tracer. I successfully set up routers, switches, and PCs, assigned IP addresses, and enabled OSPF with appropriate commands. I verified neighbor adjacencies, examined the link-state database, and analyzed the routing table to ensure proper functionality. Using the **tracert** command, I traced packet paths and observed that OSPF prioritizes paths with higher bandwidth, even if they are not the shortest. This experiment helped me understand OSPF's operation and how it manages routing decisions effectively.

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