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**Institute of Computer Technology
B. Tech Computer Science and Engineering**

**Sub:CN
Practical 8**

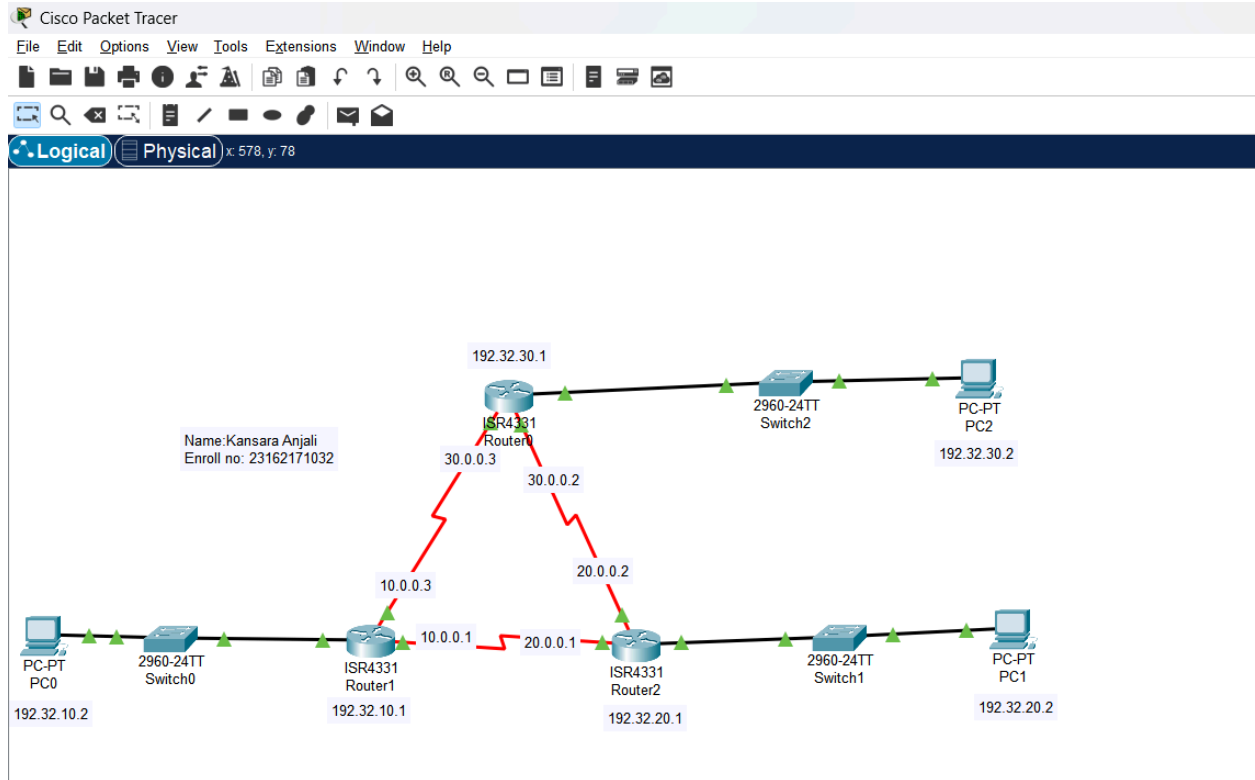
Aim: To design a network using Open Shortest Path First (OSPF) Protocol.

Scenario:

Consider that the organization has three departments and a routing protocol Open Shortest Path First (OSPF) protocol is implemented. Configure network as shown in figure below and implement Open Shortest Path First (OSPF) routing protocol.

Procedure:

- 1) Create network as given below



2) Configure IP address (All Devices, Routers)

Routers:

Router0 Configuration:

- Port Status: ☒ On
- Bandwidth: ☐ 1000 Mbps ☐ 100 Mbps ☐ 10 Mbps ☒ Auto
- Duplex: ☐ Half Duplex ☒ Full Duplex ☒ Auto
- MAC Address: 00E0 5C45 2901
- IP Configuration:
 - IPv4 Address: 192.32.10.1
 - Subnet Mask: 255.255.255.0
- Tx Ring Limit: 10

Router1 Configuration:

- Port Status: ☒ On
- Bandwidth: ☐ 1000 Mbps ☐ 100 Mbps ☐ 10 Mbps ☒ Auto
- Duplex: ☐ Half Duplex ☒ Full Duplex ☒ Auto
- MAC Address: 00E0 8F56 D501
- IP Configuration:
 - IPv4 Address: 192.32.20.1
 - Subnet Mask: 255.255.255.0
- Tx Ring Limit: 10

Router2 Configuration:

- Port Status: ☒ On
- Bandwidth: ☐ 1000 Mbps ☐ 100 Mbps ☐ 10 Mbps ☒ Auto
- Duplex: ☐ Half Duplex ☒ Full Duplex ☒ Auto
- MAC Address: 0090 0C17 8301
- IP Configuration:
 - IPv4 Address: 192.32.30.1
 - Subnet Mask: 255.255.255.0
- Tx Ring Limit: 10

Equivalent IOS Commands:

```

Router0:
configure terminal
interface GigabitEthernet0/0/0
ip address 192.32.10.1 255.255.255.0
no shutdown
exit
Router1:
configure terminal
interface GigabitEthernet0/0/0
ip address 192.32.20.1 255.255.255.0
no shutdown
exit
Router2:
configure terminal
interface GigabitEthernet0/0/0
ip address 192.32.30.1 255.255.255.0
no shutdown
exit
  
```

Router0

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

RIP Routing

Network

Add

Network Address

10.0.0.0

20.0.0.0

192.32.10.0

Remove

Equivalent IOS Commands

not set

Incoming update filter list for all interfaces is not set

Router ID 192.32.10.1

Number of areas in this router is 1. 1 normal 0 stub 0 nssa

Maximum path: 4

Routing for Networks:

192.32.10.0 0.0.0.255 area 0

10.0.0.0 0.255.255.255 area 0

20.0.0.0 0.255.255.255 area 0

Router1

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

RIP Routing

Network

Add

Network Address

20.0.0.0

30.0.0.0

192.32.20.0

Remove

Equivalent IOS Commands

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

Router(config)#interface GigabitEthernet0/0/0

Router(config-if)#

Router(config-if)#exit

Router(config)#interface Serial0/1/0

Router(config-if)#

Router(config-if)#exit

Router(config)#interface Serial0/1/1

Router(config-if)#

Router(config-if)#exit

Router2

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

RIP Routing

Network

Add

Network Address

10.0.0.0

30.0.0.0

192.32.30.0

Remove

Equivalent IOS Commands

Router(config-if)#

%SYS-5-CONFIG_I: Configured from console by console

Router(config-if)#exit

Router(config)#interface Serial0/1/0

Router(config-if)#

Router(config-if)#exit

Router(config)#interface Serial0/1/1

Router(config-if)#

Router(config-if)#exit

Router0

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

Serial0/1/0

Port Status

Duplex

Clock Rate

IP Configuration

IPv4 Address

Subnet Mask

Tx Ring Limit

Full Duplex

2000000

20.0.0.2

255.0.0.0

10

Equivalent IOS Commands

Router(config)#router rip

Router(config-router)#

Router(config-router)#end

Router#configure terminal

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

Router(config)#interface GigabitEthernet0/0/1

Router(config-if)#

%SYS-5-CONFIG_I: Configured from console by console

Router(config-if)#exit

Router(config)#interface Serial0/1/0

Router(config-if)#

Top

Router1

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

Serial0/1/0

Port Status

Duplex

Clock Rate

IP Configuration

IPv4 Address

Subnet Mask

Tx Ring Limit

Full Duplex

2000000

20.0.0.2

255.0.0.0

10

Equivalent IOS Commands

Router(config)#interface Serial0/1/1

Router(config-if)#

Router(config-if)#exit

Router(config)#router rip

Router(config-router)#

Router(config-router)#end

Router#configure terminal

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

Router(config)#interface Serial0/1/0

Router(config-if)#

%SYS-5-CONFIG_I: Configured from console by console

Top

Router2

Physical

Config

CLI

Attributes

GLOBAL

Settings

Algorithm Settings

ROUTING

Static

RIP

SWITCHING

VLAN Database

INTERFACE

GigabitEthernet0/0/0

GigabitEthernet0/0/1

GigabitEthernet0/0/2

Serial0/1/0

Serial0/1/1

Serial0/1/0

Port Status

Duplex

Clock Rate

IP Configuration

IPv4 Address

Subnet Mask

Tx Ring Limit

Full Duplex

2000000

30.0.0.3

255.0.0.0

10

Equivalent IOS Commands

Router(config)#interface Serial0/1/1

Router(config-if)#

Router(config-if)#exit

Router(config)#router rip

Router(config-router)#

Router(config-router)#end

Router#configure terminal

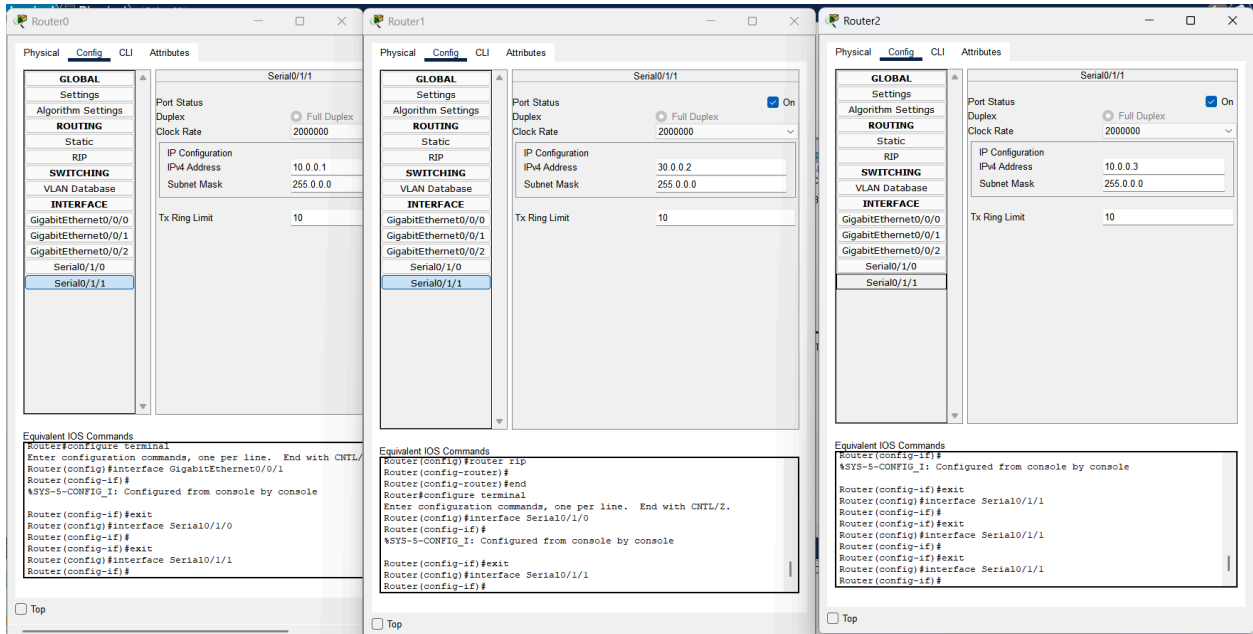
Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#interface Serial0/1/0

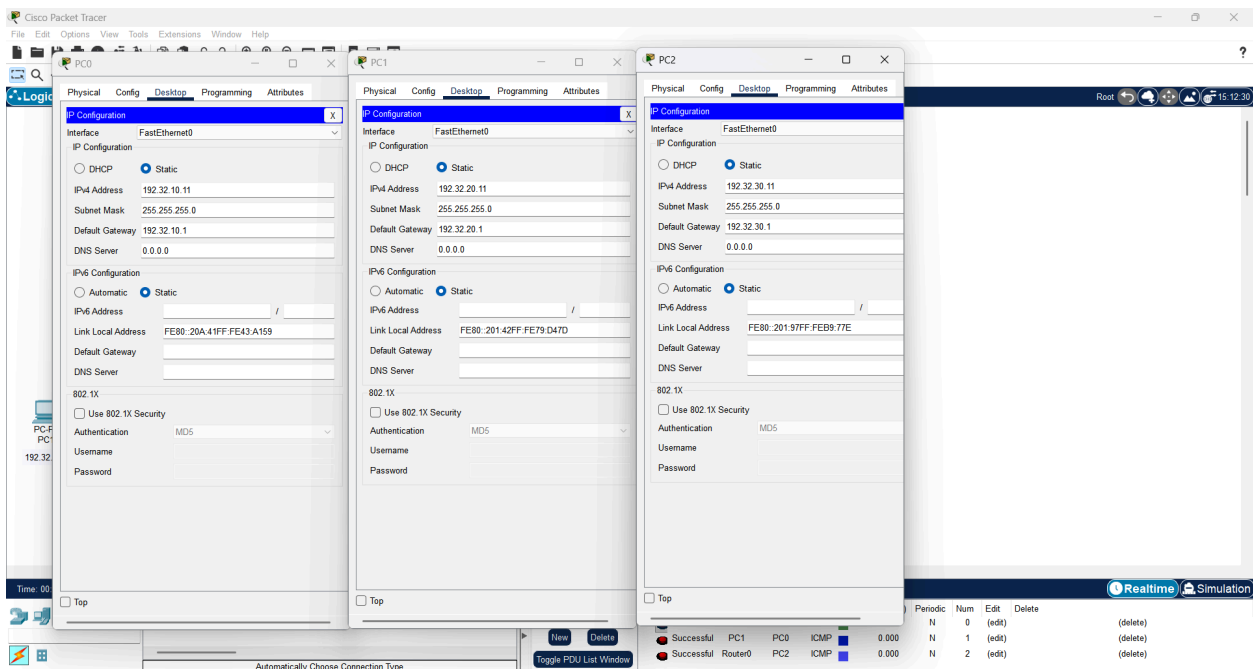
Router(config-if)#

%SYS-5-CONFIG_I: Configured from console by console

Top



PCs:



3) Configure open short path first routing table (OSPF in routers)

Router0

PhysicalConfigCLIAttributes

IOS Command Line Interface

```
Router(config)#do show ip int brief
Interface      IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0/0  192.32.30.1    YES manual up          up
GigabitEthernet0/0/1  unassigned      YES unset  administratively down down
GigabitEthernet0/0/2  unassigned      YES unset  administratively down down
Serial0/1/0        30.0.0.3        YES manual up          up
Serial0/1/1        10.0.0.3        YES manual up          up
Vlan1            unassigned      YES unset  administratively down down

Router(config)#router
% Unknown command or computer name, or unable to find computer address

Router(config)# router ospf 1
Router(config-router)#network 192.32.30.0 0.0.0.255 area 0
Router(config-router)#network 30.0.0.0 0.255.255.255 area 0
Router(config-router)#network 10.0.0.0 0.255.255.255 area 0
Router(config-router)#do 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

      10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.0.0.0/8 is directly connected, Serial0/1/1
L       10.0.0.3/32 is directly connected, Serial0/1/1
      30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       30.0.0.0/8 is directly connected, Serial0/1/0
L       30.0.0.3/32 is directly connected, Serial0/1/0
      192.32.30.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.32.30.0/24 is directly connected, GigabitEthernet0/0/0
L       192.32.30.1/32 is directly connected, GigabitEthernet0/0/0

Router(config-router)#do show ip protocol
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 3 seconds
Invalid after 180 seconds, hold down 180, flushed after 240
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Redistributing via
```

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Router0

Physical Config CLI Attributes

IOS Command Line Interface

```
C      192.32.30.0/24 is directly connected, GigabitEthernet0/0/0
L      192.32.30.1/32 is directly connected, GigabitEthernet0/0/0
```

```
Router(config-router)#do show ip protocol
```

```
Routing Protocol is "rip"
```

```
Sending updates every 30 seconds, next due in 3 seconds
```

```
Invalid after 180 seconds, hold down 180, flushed after 240
```

```
Outgoing update filter list for all interfaces is not set
```

```
Incoming update filter list for all interfaces is not set
```

```
Redistributing: rip
```

```
Default version control: send version 1, receive any version
```

Interface	Send	Recv	Triggered	RIP	Key-chain
-----------	------	------	-----------	-----	-----------

GigabitEthernet0/0/0	12	1			
----------------------	----	---	--	--	--

Serial0/1/0	12	1			
-------------	----	---	--	--	--

Serial0/1/1	12	1			
-------------	----	---	--	--	--

```
Automatic network summarization is in effect
```

```
Maximum path: 4
```

```
Routing for Networks:
```

```
10.0.0.0
```

```
30.0.0.0
```

```
192.32.30.0
```

```
Passive Interface(s):
```

```
Routing Information Sources:
```

Gateway	Distance	Last Update
---------	----------	-------------

```
Distance: (default is 120)
```

```
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 192.32.30.1
```

```
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
```

```
Maximum path: 4
```

```
Routing for Networks:
```

```
192.32.30.0 0.0.0.255 area 0
```

```
30.0.0.0 0.255.255.255 area 0
```

```
10.0.0.0 0.255.255.255 area 0
```

```
Routing Information Sources:
```

Gateway	Distance	Last Update
---------	----------	-------------

192.32.30.1	110	00:00:33
-------------	-----	----------

```
Distance: (default is 110)
```

```
Router(config-router)#
```

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Router1

Physical
Config
CLI
Attributes

IOS Command Line Interface

```

Router(config)#router rip
Router(config-router)#network 10.0.0.0
Router(config-router)#network 20.0.0.0
Router(config-router)#network 192.32.10.0
Router(config-router)#
Router(config-router)#exit
Router(config)#do show ip int brief
Interface                IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0/0     192.32.10.1     YES manual up          up
GigabitEthernet0/0/1     unassigned      YES unset   administratively down down
GigabitEthernet0/0/2     unassigned      YES unset   administratively down down
Serial0/1/0              10.0.0.1        YES manual up          up
Serial0/1/1              20.0.0.1        YES manual up          up
Vlan1                    unassigned      YES unset   administratively down down
Router(config)#router ospf 1
      ^
% Invalid input detected at '^' marker.

Router(config)#router ospf 1
Router(config-router)#network 192.32.10.0 0.0.0.255 area 0
Router(config-router)#network 10.0.0.0 0.255.255.255 area 0
Router(config-router)#network 20.0.0.0 0.255.255.255 area 0
Router(config-router)#do 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

    10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.0.0.0/8 is directly connected, Serial0/1/0
L       10.0.0.1/32 is directly connected, Serial0/1/0
    20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       20.0.0.0/8 is directly connected, Serial0/1/1
L       20.0.0.1/32 is directly connected, Serial0/1/1
    192.32.10.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.32.10.0/24 is directly connected, GigabitEthernet0/0/0
L       192.32.10.1/32 is directly connected, GigabitEthernet0/0/0

```

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Router1

PhysicalConfigCLIAttributes

IOS Command Line Interface

```
C      192.32.10.0/24 is directly connected, GigabitEthernet0/0/0
L      192.32.10.1/32 is directly connected, GigabitEthernet0/0/0

Router(config-router)#do show ip protocol
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 19 seconds
Invalid after 180 seconds, hold down 180, flushed after 240
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Redistributing: rip
Default version control: send version 1, receive any version
  Interface          Send Recv Triggered RIP Key-chain
  GigabitEthernet0/0/0 12 1
  Serial0/1/0         12 1
  Serial0/1/1         12 1
Automatic network summarization is in effect
Maximum path: 4
Routing for Networks:
  10.0.0.0
  20.0.0.0
  192.32.10.0
Passive Interface(s):
Routing Information Sources:
  Gateway            Distance      Last Update
Distance: (default is 120)

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 192.32.10.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.32.10.0 0.0.0.255 area 0
    10.0.0.0 0.255.255.255 area 0
    20.0.0.0 0.255.255.255 area 0
  Routing Information Sources:
    Gateway            Distance      Last Update
    192.32.10.1         110          00:00:58
  Distance: (default is 110)

Router(config-router)#
```

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Router2

Physical
Config
CLI
Attributes

IOS Command Line Interface

```

Router(config)#router rip
Router(config-router)#network 20.0.0.0
Router(config-router)#network 30.0.0.0
Router(config-router)#network 192.32.20.0
Router(config-router)#
Router(config-router)#exit
Router(config)#do show ip int brief
Interface                IP-Address      OK? Method Status        Protocol
GigabitEthernet0/0/0     192.32.20.1     YES manual  up            up
GigabitEthernet0/0/1     unassigned      YES unset   administratively down down
GigabitEthernet0/0/2     unassigned      YES unset   administratively down down
Serial0/1/0              20.0.0.2        YES manual  up            up
Serial0/1/1              30.0.0.2        YES manual  up            up
Vlan1                    unassigned      YES unset   administratively down down
Router(config)#do 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

    20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       20.0.0.0/8 is directly connected, Serial0/1/0
L       20.0.0.2/32 is directly connected, Serial0/1/0
    30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       30.0.0.0/8 is directly connected, Serial0/1/1
L       30.0.0.2/32 is directly connected, Serial0/1/1
    192.32.20.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.32.20.0/24 is directly connected, GigabitEthernet0/0/0
L       192.32.20.1/32 is directly connected, GigabitEthernet0/0/0

Router(config)#router ospf 1
Router(config-router)#network 192.32.20.0 0.0.0.255 area 0
Router(config-router)#network 20.0.0.0 0.255.255.255 area 0
Router(config-router)#network 30.0.0.0 0.255.255.255 area 0
Router(config-router)#do 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

```

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Router2

Physical

Config

CLI

Attributes

IOS Command Line Interface

```
C      192.32.20.0/24 is directly connected, GigabitEthernet0/0/0
L      192.32.20.1/32 is directly connected, GigabitEthernet0/0/0

Router(config-router)#do show ip protocol
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 25 seconds
Invalid after 180 seconds, hold down 180, flushed after 240
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Redistributing: rip
Default version control: send version 1, receive any version
  Interface          Send Recv Triggered RIP Key-chain
  GigabitEthernet0/0/0 12  1
  Serial0/1/0         12  1
  Serial0/1/1         12  1
Automatic network summarization is in effect
Maximum path: 4
Routing for Networks:
  20.0.0.0
  30.0.0.0
  192.32.20.0
Passive Interface(s):
Routing Information Sources:
  Gateway         Distance      Last Update
Distance: (default is 120)

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 192.32.20.1
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Maximum path: 4
Routing for Networks:
  192.32.20.0 0.0.0.255 area 0
  20.0.0.0 0.255.255.255 area 0
  30.0.0.0 0.255.255.255 area 0
Routing Information Sources:
  Gateway         Distance      Last Update
  192.32.20.1      110          00:00:46
Distance: (default is 110)

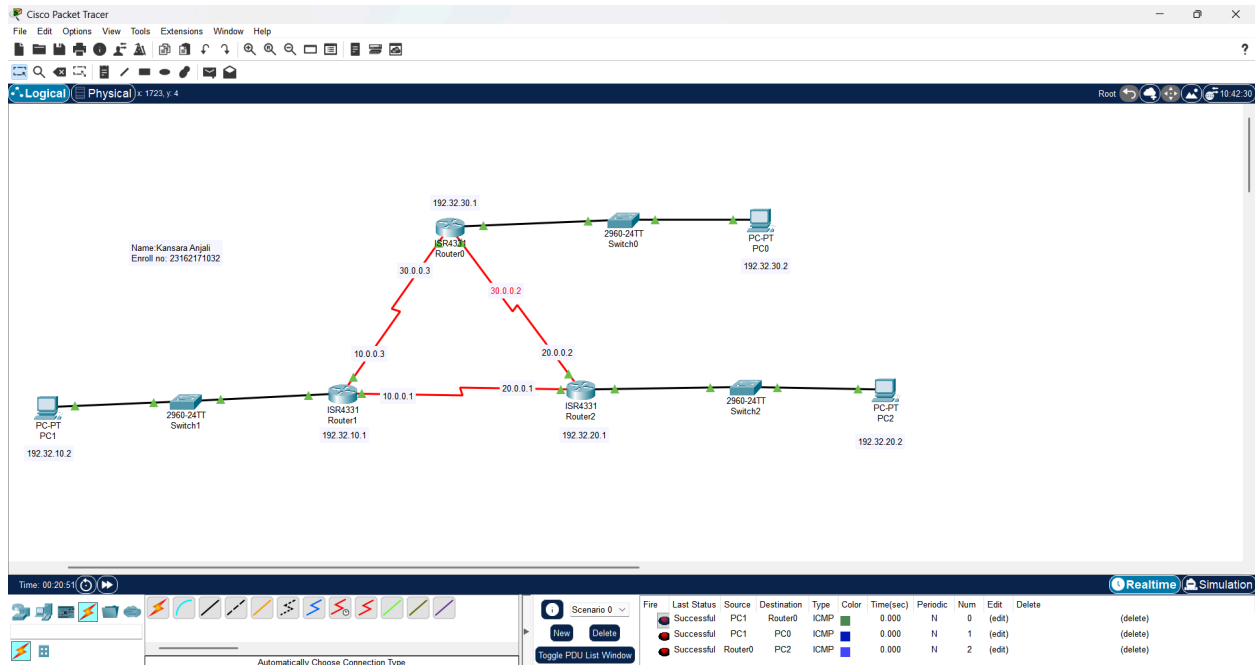
Router(config-router)#
```

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Output:



Conclusion:

IP addresses were configured on all routers and end devices, and OSPF was enabled on each router using Area 0. After configuration, the routers formed OSPF neighbor relationships and exchanged routing information dynamically. The routing table verified that all networks were reachable, and OSPF ensured efficient path selection based on cost.