

27/7/23

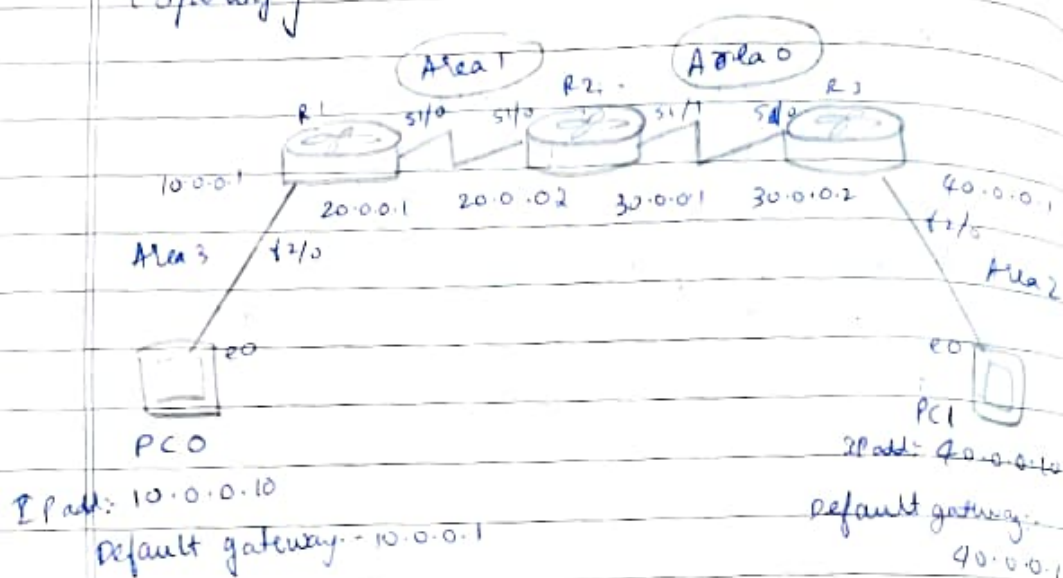
DATE

3

Experiment - 7

Configure OSPF routing Protocol

Topology :-

Procedure:-

- Configure the PC's with IP address & gateway according to the topology seen above
- Configure each of the routers acc. to the IP addresses given for all 4 router interfaces
- encapsulation ppp and clock rate need to set as done in RIP protocol experiment.

In Router R1,

```

R1 (config)# router ospf 1
R1 (config-router)# router-id 1.1.1.1
R1 (config-router)# network 10.0.0.0 0.255.255.255 area 3
R1 (config-router)# network 20.0.0.0 0.255.255.255 area 1
R1 (config-router)# exit

```

In Router R2,

```
R2(config) # router ospf 1
R2(config-router) # router-id 2.2.2.2
R2(config-router) # network 20.0.0.0 0.255.255.255 area 1
R2(config-router) # network 30.0.0.0 0.255.255.255 area 0
R2(config-router) # exit
```

In Router R3,

```
R3(config) # router ospf 1
R3(config-router) # router-id 3.3.3.3
R3(config-router) # network 30.0.0.0 0.255.255.255 area 0
R3(config-router) # network 40.0.0.0 0.255.255.255 area 2
R3(config-router) # exit
```

ii) Now, to keep the routers active we have to configure loopbacks.

In Router R1

```
R1 # config +
R1(config) # interface serial 1/0
R1(config-if) # interface loopback 0
R1(config-if) # ip address 172.16.1.252 255.255.0.0
R1(config-if) # no shut
```

In Router R2

```
R2(config-if) # interface loopback 0
R2(config-if) # ip address 172.16.1.253 255.255.0.0
R2(config-if) # no shut
```

In Router R3

R3(config-if) # interface loopback
 R3(config-if) # ip add 172.16.1.254 255.255.
 R3(config-if) # no shut

- v) create virtual link b/w R1, R2, by this we create a virtual link to connect to area 0

In router R1,

R1(config) # router ospf 1
 R1(config-router) # area 1 virtual-link 2.2.2.2
 R1(config-router) #

In router R2

R2(config) # router ospf 1
 R2(config-router) # area 1 virtual-link 1.1.1.1
 R2(config-router) # exit
 R2(config) #

- v) check show ip route many times.

For router 2

Router # show ip route

O 1A 10.0.0.0/8 via 20.0.0.1, 00:00:00
 Serial0/0

20.0.0.0/8 is variably subnetted, 2 subnets
 2 marks

C 20.0.0.0/8 is directly connected, Serial 0/0

C 20.0.0.1/32 is directly connected, Serial 0/0

30.0.0.0/8 is variably subnetted, 2 subnets
 2 marks

C 30.0.0.0/8 is directly connected, Serial 0/0

C 30.0.0.1/32 is directly connected, Serial 0/0

O 1B 16.0.0.0/8 via 30.0.0.2, 00:00:00
 Serial 0/0

c 172.16.0.0/16 is directly connected,
✓ loopback 0

Result:

> ping 40.0.0.10

Pinging 40.0.0.10 with 32 bytes of data:

Reply from 40.0.0.10: bytes = 32 time = 9ms TTL=64
Reply from 40.0.0.10: bytes = 32 time = 9ms TTL=64
Reply from 40.0.0.10: bytes = 32 time = 9ms TTL=64
Reply from 40.0.0.10: bytes = 32 time = 9ms TTL=64

Ping statistics for 40.0.0.10:

Packets: sent = 4, received = 4, lost = 0

Approximate round trip times in milliseconds:

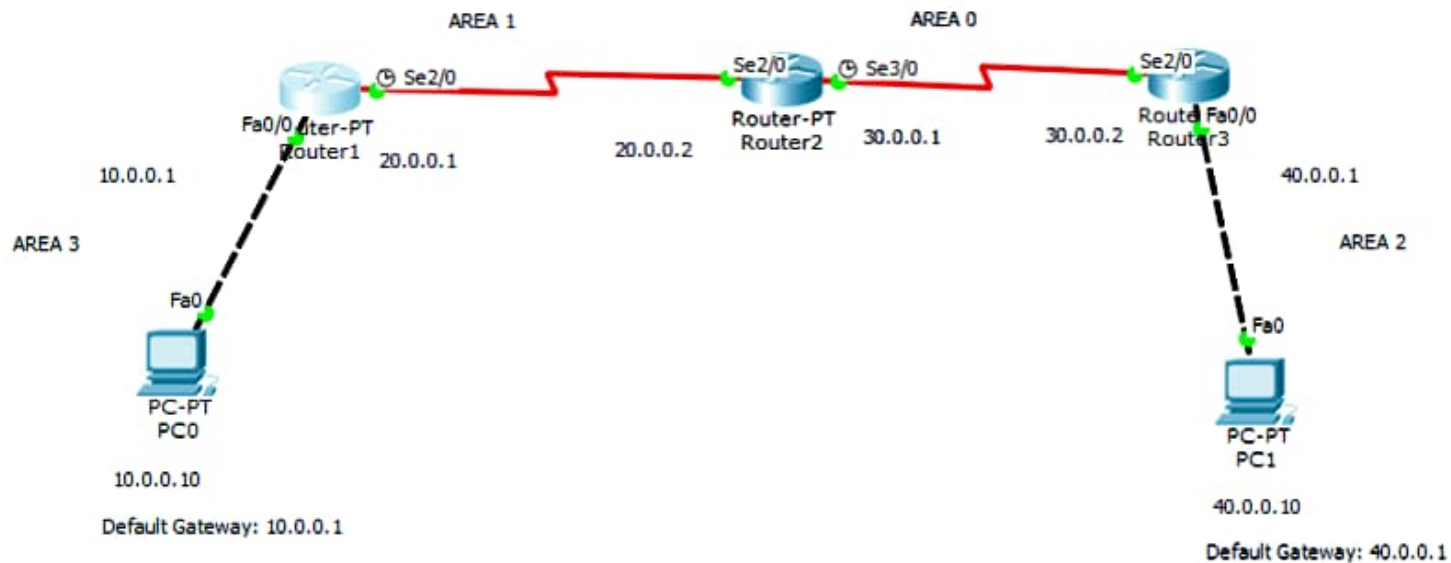
Minimum = 6ms, Maximum = 12ms, Average = 8ms.

Observation:

- i) OSPF - open Shortest Path First is a routing protocol for Internet Protocol networks. E
- ii) It uses a link state routing algorithm and falls into the group of interior gateway protocols, operating within a single autonomous system.
- iii) If we don't write encapsulation ppp, the destination host becomes unreachable.

10/10

2/5/23



IOS Command Line Interface

```
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface fastethernet0/0
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#interface serial 2/0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#clock rate 64000
Router(config-if)#no shut

%LINK-5-CHANGED: Interface Serial2/0, changed state to down
Router(config-if)#
Router(config-if)#exit
Router(config)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

Router(config)#router ospf 1
Router(config-router)#router-id 1.1.1.1
Router(config-router)#network 10.0.0.0 0.255.255.255 area 3
Router(config-router)#network 20.0.0.0 0.255.255.255 area 1
Router(config-router)#exit
Router(config)#
00:14:36: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on Serial2/0 from LOADING to FULL, Loading Done

Router(config)#interface serial 2/0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#interface loopback 0

Router(config-if)#
%LINK-5-CHANGED: Interface Loopback0, changed state to up
```

IOS Command Line Interface

```

Router(config)#interface serial 2/0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#interface loopback 0

Router(config-if)#
%LINK-5-CHANGED: Interface Loopback0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

Router(config-if)#ip address 172.16.1.252 255.255.0.0
Router(config-if)#no shut
Router(config-if)#exit
Router(config)#router ospf 1
Router(config-router)#area 1 virtual-link 2.2.2.2
Router(config-router)#
00:26:12: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on OSPF_VL0 from LOADING to FULL, Loading Done

Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#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    10.0.0.0/8 is directly connected, FastEthernet0/0
    20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C    20.0.0.0/8 is directly connected, Serial2/0
C    20.0.0.2/32 is directly connected, Serial2/0
O    30.0.0.0/8 [110/129] via 20.0.0.2, 00:03:32, Serial2/0
O IA 40.0.0.0/8 [110/129] via 20.0.0.2, 00:03:32, Serial2/0
C    172.16.0.0/16 is directly connected, Loopback0
Router#

```

IOS Command Line Interface

```
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface serial 2/0
Router(config-if)#ip address 20.0.0.2 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up

Router(config-if)#exi
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
t
Router(config)#interface serial 3/0
Router(config-if)#ip address 30.0.0.1 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#clock rate 64000
Router(config-if)#no shut

%LINK-5-CHANGED: Interface Serial3/0, changed state to down
Router(config-if)#exit
Router(config)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up

Router(config)#router ospf 1
Router(config-router)#router-id 2.2.2.2
Router(config-router)#network 20.0.0.0 0.255.255.255 area 1
Router(config-router)#network 30.0.0.0 0.
00:14:11: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on Serial2/0 from LOADING to FULL, Loading Done
255.255.255 area 0
Router(config-router)#exit
Router(config)#
00:15:26: %OSPF-5-ADJCHG: Process 1, Nbr 3.3.3.3 on Serial3/0 from LOADING to FULL, Loading Done

Router(config)#interface serial 3/0
Router(config-if)#ip address 30.0.0.1 255.0.0.0
Router(config-if)#interface loopback 0

Router(config-if)#
```


IOS Command Line Interface

```

Router(config-if)#
%LINK-5-CHANGED: Interface Loopback0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

Router(config-if)#ip address 172.16.1.252 255.255.0.0
Router(config-if)#no shut
Router(config-if)#exit
Router(config)#router ospf 1
Router(config-router)#area 1 virtual
00:25:21: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone area must be virtual-link but not found from 20.0.0.2, Serial2/0
-link 1.1.1.1
00:25:31: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone area must be virtual-link but not found from 20.0.0.2, Serial2/0

Router(config-router)#exit
Router(config)#
00:25:46: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on OSPF_VL0 from LOADING to FULL, Loading Done

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

Router#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

O IA 10.0.0.0/8 [110/65] via 20.0.0.1, 00:05:24, Serial2/0
    20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C    20.0.0.0/8 is directly connected, Serial2/0
C    20.0.0.1/32 is directly connected, Serial2/0
    30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C    30.0.0.0/8 is directly connected, Serial3/0
C    30.0.0.2/32 is directly connected, Serial3/0
O IA 40.0.0.0/8 [110/65] via 30.0.0.2, 00:14:32, Serial3/0
C    172.16.0.0/16 is directly connected, Loopback0

```

IOS Command Line Interface

```
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface serial 2/0
Router(config-if)#ip address 30.0.0.2 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up

Router(config-if)#exit
Router(config)#int
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
Router(config-if)#ip address 40.0.0.1 255.0.0.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
exit
Router(config)#router ospf 1
Router(config-router)#router-id 3.3.3.3
Router(config-router)#network 30.0.0.0 0.255.255.255 area 0
Router(config-router)#netwr
00:15:23: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on Serial2/0 from LOADING to FULL, Loading
Router(config-router)#network 40.0.0.0 0.255.255.255 area 2
Router(config-router)#exit
Router(config)#interface serial 2/0
Router(config-if)#ip address 30.0.0.2 255.0.0.0
Router(config-if)#interface loopback 0

Router(config-if)#
%LINK-5-CHANGED: Interface Loopback0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

Router(config-if)#ip address 172.16.1.254 255.255.0.0
Router(config-if)#no shut
Router(config-if)#exit
```

IOS Command Line Interface

```

Router(config-router)#network 30.0.0.0 0.255.255.255 area 0
Router(config-router)#netwr
00:16:23: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on Serial2/0 from LOADING to FULL, Loading
Router(config-router)#network 40.0.0.0 0.255.255.255 area 2
Router(config-router)#exit
Router(config)#interface serial 2/0
Router(config-if)#ip address 30.0.0.2 255.0.0.0
Router(config-if)#interface loopback 0

Router(config-if)#
%LINK-5-CHANGED: Interface Loopback0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

Router(config-if)#ip address 172.16.1.254 255.255.0.0
Router(config-if)#no shut
Router(config-if)#exit
Router(config)#interface serial 2/0
Router(config-if)#encapsulation ppp
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
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

O IA 10.0.0.0/8 [110/129] via 30.0.0.1, 00:01:16, Serial2/0
O IA 20.0.0.0/8 [110/129] via 30.0.0.1, 00:11:36, Serial2/0
   30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C     30.0.0.0/8 is directly connected, Serial2/0
C     30.0.0.1/32 is directly connected, Serial2/0
C     40.0.0.0/8 is directly connected, FastEthernet0/0
C     172.16.0.0/16 is directly connected, Loopback0
Router#

```

Command Prompt



```
PC>ping 10.0.0.10
```

```
Pinging 10.0.0.10 with 32 bytes of data:
```

```
Request timed out.
```

```
Reply from 10.0.0.10: bytes=32 time=10ms TTL=125
```

```
Reply from 10.0.0.10: bytes=32 time=2ms TTL=125
```

```
Reply from 10.0.0.10: bytes=32 time=9ms TTL=125
```

```
Ping statistics for 10.0.0.10:
```

```
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
```

```
Approximate round trip times in milli-seconds:
```

```
    Minimum = 2ms, Maximum = 10ms, Average = 7ms
```

```
PC>ping 10.0.0.10
```

```
Pinging 10.0.0.10 with 32 bytes of data:
```

```
Reply from 10.0.0.10: bytes=32 time=11ms TTL=125
```

```
Reply from 10.0.0.10: bytes=32 time=21ms TTL=125
```

```
Reply from 10.0.0.10: bytes=32 time=2ms TTL=125
```

```
Reply from 10.0.0.10: bytes=32 time=20ms TTL=125
```

```
Ping statistics for 10.0.0.10:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

```
Approximate round trip times in milli-seconds:
```

```
    Minimum = 2ms, Maximum = 21ms, Average = 13ms
```

```
PC>
```




PC0



Physical

Config

Desktop

Custom Interface

Command Prompt



Packet Tracer PC Command Line 1.0

PC>ping 40.0.0.10

Pinging 40.0.0.10 with 32 bytes of data:

Reply from 40.0.0.10: bytes=32 time=10ms TTL=125

Reply from 40.0.0.10: bytes=32 time=27ms TTL=125

Reply from 40.0.0.10: bytes=32 time=10ms TTL=125

Reply from 40.0.0.10: bytes=32 time=2ms TTL=125

Ping statistics for 40.0.0.10:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 2ms, Maximum = 27ms, Average = 12ms

PC>