

Assignment 6 (Macro Assignment 4)

Important Notes:

1. Many of the below screenshots are clubbed, each one will be having more than one task.
2. For the setup in OSPF I have used different first pointers of IP in some links. This is because I faced some problems in having the same first pointer(172.***,192.** etc) at multiple slots in a single router. The change is only in the first pointer; the second is still my roll number. These changes are clearly mentioned in respective assignment steps.
3. The capture files are filtered and comments are added to specific packets from assignment step -2 of section 2
4. The capture files are present in zip -> project files -> captures.
5. All the routers are c3660 (from moodle) and the slots are 1/0, 1/1 etc unlike given 0/0, 0/1 for every setup
6. The link to the project folder is [here](#)
(<https://drive.google.com/drive/folders/1taqMrE1jU8W4FZ3RmBoGAaAsAwxm9IDW?usp=sharing>)

Section 1: RIP Protocol

Assignment Steps - 1:

```

PC1> ping 192.05.1.101
84 bytes from 192.5.1.101 icmp_seq=1 ttl=255 time=9.734 ms
84 bytes from 192.5.1.101 icmp_seq=2 ttl=255 time=6.203 ms
84 bytes from 192.5.1.101 icmp_seq=3 ttl=255 time=6.958 ms
^C
PC1> ping 192.05.2.101
84 bytes from 192.5.2.101 icmp_seq=1 ttl=255 time=6.714 ms
84 bytes from 192.5.2.101 icmp_seq=2 ttl=255 time=5.460 ms
^C
PC1> ping 192.05.2.102
84 bytes from 192.5.2.102 icmp_seq=1 ttl=254 time=11.549 ms
84 bytes from 192.5.2.102 icmp_seq=2 ttl=254 time=16.420 ms
84 bytes from 192.5.2.102 icmp_seq=3 ttl=254 time=17.318 ms
^C
PC1> ping 192.05.3.102
84 bytes from 192.5.3.102 icmp_seq=1 ttl=254 time=20.383 ms
84 bytes from 192.5.3.102 icmp_seq=2 ttl=254 time=16.729 ms
84 bytes from 192.5.3.102 icmp_seq=3 ttl=254 time=16.242 ms
^C
PC1> ping 192.05.3.2
192.05.3.2 icmp_seq=1 timeout
84 bytes from 192.5.3.2 icmp_seq=2 ttl=62 time=30.071 ms
84 bytes from 192.5.3.2 icmp_seq=3 ttl=62 time=28.025 ms
84 bytes from 192.5.3.2 icmp_seq=4 ttl=62 time=28.308 ms
^C
PC1> 

Gateway of last resort is not set

C      192.5.1.0/24 is directly connected, Ethernet1/0
C      192.5.2.0/24 is directly connected, Ethernet1/1
R      192.5.3.0/24 [120/1] via 192.5.2.102, 00:00:06, Ethernet1/1
R1# 

Gateway of last resort is not set

R      192.5.1.0/24 [120/1] via 192.5.2.101, 00:00:21, Ethernet1/1
C      192.5.2.0/24 is directly connected, Ethernet1/1
C      192.5.3.0/24 is directly connected, Ethernet1/0
R2# 

```

1. Screenshots of ip route and ping. We can see that R and C in ip route screenshot indicate RIP and Direct connections respectively
2. The wireshark captures also show the exchange of this information between routers with RIPv2 protocol

Assignment Steps - 2:

1. Below are ip routes showing connection is complete. We can see the IP of the router that provided this information following via, indicating the path to reach the destination.
2. The trace route indicates successful connection.
3. Below screenshot shows expanded RIPv2 packets we can see that multicast MAC address. We would have seen the broadcast MAC address if it is version 1.
4. The destination address is not general this is because v2 use CIDR - Classless Inter Domain Routing

```

Gateway of last resort is not set
Gateway of last resort is not set

C 192.5.4.0/24 is directly connected, Ethernet1/2      R  192.5.4.0/24 [120/1] via 192.5.2.102, 00:00:06, Ethernet1/1
R 192.5.5.0/24 [120/1] via 192.5.4.103, 00:00:23, Ethernet1/2 R  192.5.5.0/24 [120/2] via 192.5.2.102, 00:00:06, Ethernet1/1
R 192.5.6.0/24 [120/1] via 192.5.4.103, 00:00:23, Ethernet1/2 R  192.5.6.0/24 [120/2] via 192.5.2.102, 00:00:06, Ethernet1/1
R 192.5.7.0/24 [120/2] via 192.5.4.103, 00:00:23, Ethernet1/2 R  192.5.7.0/24 [120/3] via 192.5.2.102, 00:00:06, Ethernet1/1
R 192.5.1.0/24 [120/1] via 192.5.2.101, 00:00:19, Ethernet1/1 C  192.5.1.0/24 is directly connected, Ethernet1/0
C 192.5.2.0/24 is directly connected, Ethernet1/1      C  192.5.2.0/24 is directly connected, Ethernet1/1
C 192.5.3.0/24 is directly connected, Ethernet1/0      R  192.5.3.0/24 [120/1] via 192.5.2.102, 00:00:06, Ethernet1/1
R2# R1#]

R  192.5.4.0/24 [120/1] via 192.5.6.103, 00:00:07, Ethernet1/1 C  192.5.4.0/24 is directly connected, Ethernet1/1
R  192.5.5.0/24 [120/1] via 192.5.6.103, 00:00:07, Ethernet1/1 C  192.5.5.0/24 is directly connected, Ethernet1/0
C  192.5.6.0/24 is directly connected, Ethernet1/1      C  192.5.6.0/24 is directly connected, Ethernet1/2
C  192.5.7.0/24 is directly connected, Ethernet1/0      R  192.5.7.0/24 [120/1] via 192.5.6.104, 00:00:14, Ethernet1/2
R  192.5.1.0/24 [120/3] via 192.5.6.103, 00:00:07, Ethernet1/1 R  192.5.1.0/24 [120/2] via 192.5.4.102, 00:00:09, Ethernet1/1
R  192.5.2.0/24 [120/2] via 192.5.6.103, 00:00:07, Ethernet1/1 R  192.5.2.0/24 [120/1] via 192.5.4.102, 00:00:09, Ethernet1/1
R  192.5.3.0/24 [120/2] via 192.5.6.103, 00:00:07, Ethernet1/1 R  192.5.3.0/24 [120/1] via 192.5.4.102, 00:00:09, Ethernet1/1
R4# R3#]
```

Capturing from - [R1 Ethernet1/1 to R2 Ethernet1/1]

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

rip

No.	Time	Source	Destination	Protocol	Length	Info
140	415.853511	192.5.2.101	224.0.0.9	RIPv2	66	Response
144	428.906994	192.5.2.102	224.0.0.9	RIPv2	146	Response
149	441.609222	192.5.2.101	224.0.0.9	RIPv2	66	Response
152	458.216429	192.5.2.102	224.0.0.9	RIPv2	146	Response
156	468.001190	192.5.2.101	224.0.0.9	RIPv2	66	Response

Frame 4: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface -, id 0
Ethernet II, Src: cc:01:2b:d4:00:11 (cc:01:2b:d4:00:11), Dst: IPv4mcast_09 (01:00:5e:00:00:09)
Internet Protocol Version 4, Src: 192.5.2.101, Dst: 224.0.0.9
0100 = Version: 4
.... 0101 = Header Length: 20 bytes (5)
Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
Total Length: 52
Identification: 0x0000 (0)
Flags: 0x0000
Fragment offset: 0
Time to live: 2
Protocol: UDP (17)
Header checksum: 0x1586 [validation disabled]
[Header checksum status: Unverified]
Source: 192.5.2.101
Destination: 224.0.0.9
User Datagram Protocol, Src Port: 520, Dst Port: 520
Routing Information Protocol
Command: Request (1)
Version: RIPv2 (2)
Address not specified, Metric: 16

```

R  192.5.3.0/24 [120/1] via 192.5.2.102, 00:00:06
R1#traceroute 192.5.6.104

Type escape sequence to abort.
Tracing the route to 192.5.6.104

 1 192.5.2.102 12 msec 8 msec 12 msec
 2 192.5.4.103 20 msec 20 msec 20 msec
 3 192.5.6.104 32 msec 32 msec 28 msec
R1#traceroute 192.5.6.103

Type escape sequence to abort.
Tracing the route to 192.5.6.103

 1 192.5.2.102 8 msec 12 msec 8 msec
 2 192.5.4.103 20 msec 24 msec 20 msec
R1#]
```

Capturing from - [R2 Ethernet1/2 to R3 Ethernet1/1]

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

rip

No.	Time	Source	Destination	Protocol	Length	Info
68	220.355723	192.5.4.102	224.0.0.9	RIPv2	106	Response
74	241.215319	192.5.4.103	224.0.0.9	RIPv2	106	Response
77	249.617890	192.5.4.102	224.0.0.9	RIPv2	106	Response
84	269.048309	192.5.4.103	224.0.0.9	RIPv2	106	Response
87	279.037937	192.5.4.102	224.0.0.9	RIPv2	106	Response

Frame 4: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface -, id 0
Ethernet II, Src: cc:02:2b:e4:00:12 (cc:02:2b:e4:00:12), Dst: IPv4mcast_09 (01:00:5e:00:00:09)
Internet Protocol Version 4, Src: 192.5.4.102, Dst: 224.0.0.9
0100 = Version: 4
.... 0101 = Header Length: 20 bytes (5)
Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
Total Length: 52
Identification: 0x0000 (0)
Flags: 0x0000
Fragment offset: 0
Time to live: 2
Protocol: UDP (17)
Header checksum: 0x1385 [validation disabled]
[Header checksum status: Unverified]
Source: 192.5.4.102
Destination: 224.0.0.9
User Datagram Protocol, Src Port: 520, Dst Port: 520
Routing Information Protocol
Command: Request (1)
Version: RIPv2 (2)
Address not specified, Metric: 16

Assignment Steps - 3:

1. The topology alters from that of the previous one, we can see that in the ip route of R1. It shows 2 paths for single IP.
2. Owing to the above ip route - traceroute gives 2 paths to destination in first screenshot.
3. This will be a problem in large systems i.e. storing all paths consume lot of memory. This is avoided in next protocol.

```
R 192.5.3.0/24 [120/1] via 192.5.2.104
R1#traceroute 192.5.6.104
Type escape sequence to abort.
Tracing the route to 192.5.6.104
1 192.5.8.105 16 msec
 192.5.2.102 16 msec
 192.5.8.105 16 msec
2 192.5.4.103 36 msec
 192.5.9.104 28 msec
 192.5.4.103 32 msec
R1#traceroute 192.5.6.103
Type escape sequence to abort.
Tracing the route to 192.5.6.103
1 192.5.8.105 8 msec
 192.5.2.102 16 msec
 192.5.8.105 16 msec
2 192.5.4.103 24 msec
 192.5.9.104 36 msec
 192.5.4.103 24 msec
R1# R3 execute the command "shutdown" at the interface
R1#
```

```
Building configuration...
[OK]                                     Gateway of last resort is not set
R5#show ip route
Codes: C - connected, S - R    192.5.8.0/24 [120/1] via 192.5.9.105, 00:00:01, Ethernet1/2
      D - EIGRP, EX - EIGR  192.5.9.0/24 is directly connected, Ethernet1/2
      N1 - OSPF NSSA exte  192.5.10.0/24 [120/1] via 192.5.9.105, 00:00:01, Ethernet1/2
      R   - OSPF external  192.5.4.0/24 [120/1] via 192.5.6.103, 00:00:03, Ethernet1/1
      E1 - OSPF external  192.5.5.0/24 [120/1] via 192.5.6.103, 00:00:03, Ethernet1/1
      i - IS-IS, su - IS-  192.5.6.0/24 [120/1] via 192.5.6.103, 00:00:03, Ethernet1/1
      ia - IS-IS inter ar 192.5.6.0/24 is directly connected, Ethernet1/1
      o - ODR, P - period  192.5.7.0/24 [120/1] via 192.5.6.103, 00:00:03, Ethernet1/0
      R   - OSPF, P - per-  192.5.2.0/24 [120/2] via 192.5.6.103, 00:00:03, Ethernet1/1
      R   - OSPF, P - per-  192.5.3.0/24 [120/2] via 192.5.6.103, 00:00:04, Ethernet1/1
Gateway of last resort is R4#
```

, M - mobile, B - BGP
 - OSPF, IA - OSPF inter area
 ? - OSPF NSSA external type 2
 ? - OSPF external type 2
 - IS-IS level-1, L2 - IS-IS
 static default, U - per-user static route

Assignment Steps - 4:

1. Compared to above exercise here a link connecting R3-R2 shutdown. The system is still connected but the multiple paths present before are lost. This is shown in both traceroute and ip routes of routers.

```
R1#traceroute 192.5.6.104
Type escape sequence to abort.
Tracing the route to 192.5.6.104
1 192.5.8.105 16 msec 20 msec 12 msec
 2 192.5.9.104 20 msec 20 msec 20 msec
R1#traceroute 192.5.6.103
Type escape sequence to abort.
Tracing the route to 192.5.6.103
1 192.5.8.105 4 msec 8 msec 12 msec
 2 192.5.9.104 24 msec 20 msec 20 msec
 3 192.5.6.103 48 msec 56 msec 40 msec
```

```

Gateway of last resort is not set
Gateway of last resort is not set

C 192.5.8.0/24 is directly connected, Ethernet1/1      R  192.5.8.0/24 [120/1] via 192.5.9.105, 00:00:16, Ethernet1/2
C 192.5.9.0/24 is directly connected, Ethernet1/2      C  192.5.9.0/24 is directly connected, Ethernet1/2
C 192.5.10.0/24 is directly connected, Ethernet1/0      R  192.5.10.0/24 [120/1] via 192.5.9.105, 00:00:16, Ethernet1/2
R  192.5.4.0/24 [120/2] via 192.5.8.101, 00:00:21, Ethernet1/1 R  192.5.4.0/24 [120/3] via 192.5.9.105, 00:00:16, Ethernet1/2
R  192.5.5.0/24 [120/2] via 192.5.9.104, 00:00:17, Ethernet1/2 R  192.5.5.0/24 [120/1] via 192.5.6.103, 00:00:28, Ethernet1/1
R  192.5.6.0/24 [120/1] via 192.5.9.104, 00:00:17, Ethernet1/2 C  192.5.6.0/24 is directly connected, Ethernet1/1
R  192.5.7.0/24 [120/1] via 192.5.9.104, 00:00:17, Ethernet1/2 C  192.5.7.0/24 is directly connected, Ethernet1/0
R  192.5.1.0/24 [120/1] via 192.5.8.101, 00:00:21, Ethernet1/1 R  192.5.1.0/24 [120/2] via 192.5.9.105, 00:00:16, Ethernet1/2
R  192.5.2.0/24 [120/1] via 192.5.8.101, 00:00:22, Ethernet1/1 R  192.5.2.0/24 [120/2] via 192.5.9.105, 00:00:17, Ethernet1/2
R  192.5.3.0/24 [120/2] via 192.5.8.101, 00:00:22, Ethernet1/1 R  192.5.3.0/24 [120/3] via 192.5.9.105, 00:00:17, Ethernet1/2
R5#  R4#

```

```

Gateway of last resort is not set
ed from console by
C  192.5.2.0/24 is directly con mobile, B - BGP
R  192.5.3.0/24 [120/1] via 192.5.9.105, 00:00:02, Ethernet1/1 , IA - OSPF inter a
R1#show ip route Codes: C - connected, S - static, mobile, B - BGP
R  192.5.9.0/24 [120/2] via 192.5.2.101, 00:00:02, Ethernet1/1 , IA - OSPF inter a
R  192.5.10.0/24 [120/2] via 192.5.2.101, 00:00:02, Ethernet1/1 F NSSA external typ
C  192.5.4.0/24 [120/2] via 192.5.2.101, 00:00:02, Ethernet1/1 ernal type 2
C  192.5.4.0/24 is directly connected, Ethernet1/2 S level-1, L2 - IS-
N1 - OSPF NSSA external ty 192.5.5.0/24 [120/4] via 192.5.2.101, 00:00:02, Ethernet1/1 fault, U - per-user
E1 - OSPF external type 1, 192.5.6.0/24 [120/3] via 192.5.2.101, 00:00:02, Ethernet1/1 route
i - IS-IS, su - IS-IS summ 192.5.7.0/24 [120/3] via 192.5.2.101, 00:00:02, Ethernet1/1
ia - IS-IS inter area, * - 192.5.1.0/24 [120/1] via 192.5.2.101, 00:00:02, Ethernet1/1
o - ODR, P - periodic down 192.5.2.0/24 [120/2] via 192.5.2.101, 00:00:02, Ethernet1/1
C  192.5.3.0/24 [120/1] via 192.5.2.101, 00:00:02, Ethernet1/1
C  192.5.3.0/24 is directly connected, Ethernet1/0
Gateway of last resort is not set R2#

```

```

C  192.5.8.0/24 is directly connected, Ethernet1/2      R  192.5.8.0/24 [120/2] via 192.5.6.104, 00:00:13, Ethernet1/2
R  192.5.9.0/24 [120/1] via 192.5.8.105, 00:00:11, Ethernet1/2 R  192.5.9.0/24 [120/1] via 192.5.6.104, 00:00:13, Ethernet1/2
R  192.5.10.0/24 [120/1] via 192.5.8.105, 00:00:11, Ethernet1/2 R  192.5.10.0/24 [120/2] via 192.5.6.104, 00:00:13, Ethernet1/2
R  192.5.4.0/24 [120/2] via 192.5.2.102, 00:00:15, Ethernet1/1 R  192.5.4.0/24 [120/4] via 192.5.6.104, 00:00:13, Ethernet1/2
R  192.5.5.0/24 [120/3] via 192.5.8.105, 00:00:11, Ethernet1/2 C  192.5.5.0/24 is directly connected, Ethernet1/0
R  192.5.6.0/24 [120/2] via 192.5.8.105, 00:00:11, Ethernet1/2 C  192.5.6.0/24 is directly connected, Ethernet1/2
R  192.5.7.0/24 [120/2] via 192.5.8.105, 00:00:11, Ethernet1/2 R  192.5.7.0/24 [120/1] via 192.5.6.104, 00:00:13, Ethernet1/2
C  192.5.1.0/24 is directly connected, Ethernet1/0 R  192.5.1.0/24 [120/3] via 192.5.6.104, 00:00:13, Ethernet1/2
C  192.5.2.0/24 is directly connected, Ethernet1/1 R  192.5.2.0/24 [120/3] via 192.5.6.104, 00:00:14, Ethernet1/2
R  192.5.3.0/24 [120/1] via 192.5.2.102, 00:00:17, Ethernet1/1 R  192.5.3.0/24 [120/4] via 192.5.6.104, 00:00:14, Ethernet1/2
R1#  R3#

```

Section 2: OSPF Protocol

Assignment Steps - 1:

R2#show ip ospf database	PC1> ping 10.5.1.101
OSPF Router with ID (172.5.2.102) (Process ID 1)	84 bytes from 10.5.1.101 icmp_seq=1 ttl=255 time=8.812 ms
Router Link States (Area 0)	84 bytes from 10.5.1.101 icmp_seq=2 ttl=255 time=5.902 ms
Link ID ADV Router Age Seq# Checksum Link count	84 bytes from 10.5.1.101 icmp_seq=3 ttl=255 time=5.629 ms
172.5.2.101 172.5.2.101 312 0x80000002 0x00E1B8 2	^C
172.5.2.102 172.5.2.102 311 0x80000002 0x000A8B 2	PC1> ping 172.5.2.101
Net Link States (Area 0)	84 bytes from 172.5.2.101 icmp_seq=1 ttl=255 time=9.522 ms
Link ID ADV Router Age Seq# Checksum	84 bytes from 172.5.2.101 icmp_seq=2 ttl=255 time=5.650 ms
172.5.2.101 172.5.2.101 312 0x80000001 0x002EA6	84 bytes from 172.5.2.101 icmp_seq=3 ttl=255 time=5.576 ms
R2#	^C
OSPF Router with ID (172.5.2.101) (Process ID 1)	PC1> ping 172.5.2.102
Router Link States (Area 0)	84 bytes from 172.5.2.102 icmp_seq=1 ttl=254 time=17.731 ms
Link ID ADV Router Age Seq# Checksum Link count	84 bytes from 172.5.2.102 icmp_seq=2 ttl=254 time=17.683 ms
172.5.2.101 172.5.2.101 324 0x80000002 0x00E1B8 2	84 bytes from 172.5.2.102 icmp_seq=3 ttl=254 time=16.794 ms
172.5.2.102 172.5.2.102 325 0x80000002 0x000A8B 2	^C
Net Link States (Area 0)	PC1> ping 10.5.3.102
Link ID ADV Router Age Seq# Checksum	84 bytes from 10.5.3.102 icmp_seq=1 ttl=254 time=19.026 ms
172.5.2.101 172.5.2.101 323 0x80000001 0x002EA6	84 bytes from 10.5.3.102 icmp_seq=2 ttl=254 time=16.941 ms
R1#	84 bytes from 10.5.3.102 icmp_seq=3 ttl=254 time=16.920 ms
Net Link States (Area 0)	^C
Link ID ADV Router Age Seq# Checksum	PC1> ping 10.5.3.2
172.5.2.101 172.5.2.101 323 0x80000001 0x002EA6	10.5.3.2 icmp_seq=1 timeout
R1#	84 bytes from 10.5.3.2 icmp_seq=2 ttl=62 time=28.597 ms
Net Link States (Area 0)	84 bytes from 10.5.3.2 icmp_seq=3 ttl=62 time=28.628 ms
Link ID ADV Router Age Seq# Checksum	84 bytes from 10.5.3.2 icmp_seq=4 ttl=62 time=26.342 ms
172.5.2.101 172.5.2.101 323 0x80000001 0x002EA6	^C
R1#	PC1> ^C

```

R2#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    172.5.0.0/16 is directly connected, Ethernet1/1
    10.0.0.0/24 is subnetted, 2 subnets
C      10.5.3.0 is directly connected, Ethernet1/0
O      10.5.1.0 [110/20] via 172.5.2.101, 00:04:07, Ethernet1/1
R2#[]

Gateway of last resort is not set

C    172.5.0.0/16 is directly connected, Ethernet1/1
    10.0.0.0/24 is subnetted, 2 subnets
O      10.5.3.0 [110/20] via 172.5.2.102, 00:04:16, Ethernet1/1
C      10.5.1.0 is directly connected, Ethernet1/0
R1#[]

```

1. The line joining R1 and R2 will be having **172.5.2.***
2. The link databases, ping, ip route are present above in order
3. We can see two types of LSA here - type 1 - Router LSA, type 2 - Network LSA in database screenshot
4. Area 0 indicates that this is a backbone network.
5. We can see in the wireshark captures that in this protocol routers send 'Hello' packets to detect each other. The time gap between successive packets is 10 sec.
6. If a router doesn't receive a packet for 4 rounds i.e for a time gap of 40 sec then it is considered dead
7. After detection is done, routers exchange information via 4 types of packets - LS Request, LS Update, LS Acknowledge, DB Description.

Assignment Steps - 2:

1. The link connecting R1, R2, R3 will be having **172.5.2.***
2. The status of ospf neighbour is empty because R2 and R3 are not activated, the same is shown in first screenshot
3. Third one has IP route, database, neighbour information after R2 is enabled. The DR in state implies the designated router. This information can be seen in the expanded screenshot (second one) of the hello packet - Designated Router - 172.5.2.101, Backup designated Router - 172.5.2.102.
4. Last screenshot has the same information as the third one after R3 is enabled. Its neighbour info. has both R1 and R2 as DR and BDR respectively. The same is shown in the 2nd expanded hello packet.
5. The state of R3 is full wrt neighbours meaning that the databases are synchronized. DBs are synchronized for all the routers belonging to one area.

```

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    172.5.0.0/16 is directly connected, Ethernet1/1
    10.0.0.0/24 is subnetted, 1 subnets
C      10.5.1.0 is directly connected, Ethernet1/0
R1#show ip ospf data
R1#show ip ospf database

      OSPF Router with ID (172.5.2.101) (Process ID 1)

      Router Link States (Area 0)

Link ID      ADV Router      Age      Seq#      Checksum Link count
172.5.2.101      172.5.2.101      81      0x80000001 0x009D7D 2
R1#show ip ospf ne
R1#show ip ospf neighbor
R1#[]

```

Frame 57: 94 bytes on wire (752 bits), 94 bytes captured (752 bits)
 ▶ Ethernet II, Src: cc:02:30:f4:00:11 (cc:02:30:f4:00:11), Dst: IP (00:00:00:00:00:00)
 ▶ Internet Protocol Version 4, Src: 172.5.2.102, Dst: 224.0.0.5
 ▶ Open Shortest Path First
 ▶ OSPF Header
 ▶ OSPF Hello Packet
 Network Mask: 255.255.0.0
 Hello Interval [sec]: 10
 Options: 0x12, (L) LLS Data block, (E) External Routing
 Router Priority: 1
 Router Dead Interval [sec]: 40
 Designated Router: 172.5.2.101
 Backup Designated Router: 172.5.2.102
 Active Neighbor: 172.5.2.101
 ▶ OSPF LLS Data Block

```
R2#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  172.5.0.0/16 is directly connected, Ethernet1/1
  10.0.0.0/24 is subnetted, 2 subnets
C  10.5.3.0 is directly connected, Ethernet1/0
0  10.5.1.0 [110/20] via 172.5.2.101, 00:00:47, Ethernet1/1
```

R2#show ip ospf database

OSPF Router with ID (172.5.2.102) (Process ID 1)

Router Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
172.5.2.101	172.5.2.101	78	0x80000002	0x00E1B8	2
172.5.2.102	172.5.2.102	72	0x80000002	0x00A8B	2

Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
172.5.2.101	172.5.2.101	78	0x80000001	0x002EA6

R2#show ip nei

R2#show ip ospf nei

R2#show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
172.5.2.101	1	FULL/DR	00:00:30	172.5.2.101	Ethernet1/1

R2#

Gateway of last resort is not set

```
C  172.5.0.0/16 is directly connected, Ethernet1/1
  10.0.0.0/24 is subnetted, 3 subnets
C  10.5.4.0 is directly connected, Ethernet1/0
0  10.5.3.0 [110/20] via 172.5.2.102, 00:02:27, Ethernet1/1
0  10.5.1.0 [110/20] via 172.5.2.101, 00:02:27, Ethernet1/1
```

R3#show ip ospf database

OSPF Router with ID (172.5.2.103) (Process ID 1)

Router Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
172.5.2.101	172.5.2.101	929	0x80000002	0x00E1B8	2
172.5.2.102	172.5.2.102	923	0x80000002	0x00A8B	2
172.5.2.103	172.5.2.103	166	0x80000002	0x001D74	2

Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
172.5.2.101	172.5.2.101	169	0x80000002	0x000AAA

R3#show ip ospf neighbour

^

% Invalid input detected at '^' marker.

R3#show ip ospf ne

R3#show ip ospf neighbor

Neighbor ID	Pri	State	Dead Time	Address	Interface
172.5.2.101	1	FULL/DR	00:00:39	172.5.2.101	Ethernet1/1
172.5.2.102	1	FULL/BDR	00:00:36	172.5.2.102	Ethernet1/1

R3#

348	917.240501	172.5.2.101	224.0.0.5
▶ Frame 341:	98 bytes on wire (784 bits), 98 bytes captured (784 bits on wire (624 bytes))		
▶ Ethernet II, Src: cc:03:31:04:00:11 (cc:03:31:04:00:11), Dst: 172.5.2.103 (08:00:27:00:00:03)			
▶ Internet Protocol Version 4, Src: 172.5.2.103, Dst: 224.0.0.5			
▶ Open Shortest Path First			
▶ OSPF Header			
▶ OSPF Hello Packet			
Network Mask: 255.255.0.0			
Hello Interval [sec]: 10			
Options: 0x12, (L) LLS Data block, (E) External Routing			
Router Priority: 1			
Router Dead Interval [sec]: 40			
Designated Router: 172.5.2.101			
Backup Designated Router: 172.5.2.102			
Active Neighbor: 172.5.2.101			
Active Neighbor: 172.5.2.102			
OSPF LLS Data Block			

Assignment Steps - 3:

1. The link connecting R1, R2, R3 will be having **172.5.2.*** and R3, R4 will be having **174.5.1.***
2. The first 3 screenshots are R1, R2, R3 ip route and link state database. We can see another LS type because R4 is disabled but R3 has area 100 OSPF configured
3. Following that is R4 after all are enabled. It has 3rd type - Summary Network LS. It has information about routers in area 0. Here R3 is an area boundary router connecting area 0 and 100.
4. The last screenshot is of the R3 LS database after everything is enabled. First part of it is of area 0 which is same for all routers in area 0 i.e. R1 and R2. Second part is of area 100 which is the same as that of R4 database in the 4th screenshot.
5. The IA in the ip route table implies the connection is inter area.

```
Gateway of last resort is not set

0 IA 174.5.0.0/16 [110/20] via 172.5.2.103, 00:00:47, Ethernet1/1
C   172.5.0.0/16 is directly connected, Ethernet1/1
    10.0.0.0/24 is subnetted, 3 subnets
0     10.5.4.0 [110/20] via 172.5.2.103, 00:00:47, Ethernet1/1
0     10.5.3.0 [110/20] via 172.5.2.102, 00:00:47, Ethernet1/1
C     10.5.1.0 is directly connected, Ethernet1/0
R1#show ip ospf database
```

```
      OSPF Router with ID (172.5.2.101) (Process ID 1)
```

```
        Router Link States (Area 0)
```

Link ID	ADV Router	Age	Seq#	Checksum	Link count
172.5.2.101	172.5.2.101	62	0x80000002	0x00F5A2	2
172.5.2.102	172.5.2.102	63	0x80000002	0x001E75	2
174.5.1.103	174.5.1.103	63	0x80000002	0x001A72	2

```
        Net Link States (Area 0)
```

Link ID	ADV Router	Age	Seq#	Checksum
172.5.2.103	174.5.1.103	63	0x80000001	0x00D9D5

```
        Summary Net Link States (Area 0)
```

Link ID	ADV Router	Age	Seq#	Checksum
174.5.0.0	174.5.1.103	99	0x80000001	0x001350

```
R1#
```

```
Gateway of last resort is not set
```

```
0 IA 174.5.0.0/16 [110/20] via 172.5.2.103, 00:02:38, Ethernet1/1
C   172.5.0.0/16 is directly connected, Ethernet1/1
    10.0.0.0/24 is subnetted, 3 subnets
0     10.5.4.0 [110/20] via 172.5.2.103, 00:02:38, Ethernet1/1
C     10.5.3.0 is directly connected, Ethernet1/0
0     10.5.1.0 [110/20] via 172.5.2.101, 00:02:38, Ethernet1/1
R2#show ip ospf database
```

```
      OSPF Router with ID (172.5.2.102) (Process ID 1)
```

```
        Router Link States (Area 0)
```

Link ID	ADV Router	Age	Seq#	Checksum	Link count
172.5.2.101	172.5.2.101	179	0x80000002	0x00F5A2	2
172.5.2.102	172.5.2.102	178	0x80000002	0x001E75	2
174.5.1.103	174.5.1.103	179	0x80000002	0x001A72	2

```
        Net Link States (Area 0)
```

Link ID	ADV Router	Age	Seq#	Checksum
172.5.2.103	174.5.1.103	179	0x80000001	0x00D9D5

```
        Summary Net Link States (Area 0)
```

Link ID	ADV Router	Age	Seq#	Checksum
174.5.0.0	174.5.1.103	215	0x80000001	0x001350

```
R2#
```

```
C   174.5.0.0/16 is directly connected, Ethernet1/2
C   172.5.0.0/16 is directly connected, Ethernet1/1
    10.0.0.0/24 is subnetted, 3 subnets
C     10.5.4.0 is directly connected, Ethernet1/0
0     10.5.3.0 [110/20] via 172.5.2.102, 00:04:07, Ethernet1/1
0     10.5.1.0 [110/20] via 172.5.2.101, 00:04:07, Ethernet1/1
R3#show ip ospf database
```

```
      OSPF Router with ID (174.5.1.103) (Process ID 1)
```

```
        Router Link States (Area 0)
```

Link ID	ADV Router	Age	Seq#	Checksum	Link count
172.5.2.101	172.5.2.101	266	0x80000002	0x00F5A2	2
172.5.2.102	172.5.2.102	266	0x80000002	0x001E75	2
174.5.1.103	174.5.1.103	265	0x80000002	0x001A72	2

```
        Net Link States (Area 0)
```

Link ID	ADV Router	Age	Seq#	Checksum
172.5.2.103	174.5.1.103	265	0x80000001	0x00D9D5

```
        Summary Net Link States (Area 0)
```

Link ID	ADV Router	Age	Seq#	Checksum
174.5.0.0	174.5.1.103	301	0x80000001	0x001350

```
        Router Link States (Area 100)
```

Link ID	ADV Router	Age	Seq#	Checksum	Link count
174.5.1.103	174.5.1.103	305	0x80000001	0x009F9C	1

```

C 174.5.0.0/16 is directly connected, Ethernet1/1
0 IA 172.5.0.0/16 [110/20] via 174.5.1.103, 00:01:05, Ethernet1/1
  10.0.0.0/24 is subnetted, 3 subnets
0 IA 10.5.4.0 [110/20] via 174.5.1.103, 00:01:05, Ethernet1/1
0 IA 10.5.3.0 [110/30] via 174.5.1.103, 00:01:05, Ethernet1/1
0 IA 10.5.1.0 [110/30] via 174.5.1.103, 00:01:05, Ethernet1/1
C 192.5.0.0/16 is directly connected, Ethernet1/0
R4#show ip ospf database

      OSPF Router with ID (192.5.2.104) (Process ID 1)

      Router Link States (Area 100)

Link ID      ADV Router      Age      Seq#      Checksum Link count
174.5.1.103  174.5.1.103  87       0x80000002 0x0014A3 1
192.5.2.104  192.5.2.104  81       0x80000002 0x001C93 2

      Net Link States (Area 100)

Link ID      ADV Router      Age      Seq#      Checksum
174.5.1.103  174.5.1.103  87       0x80000001 0x0006AF

      Summary Net Link States (Area 100)

Link ID      ADV Router      Age      Seq#      Checksum
10.5.1.0     174.5.1.103  441      0x80000001 0x00C834
10.5.3.0     174.5.1.103  441      0x80000001 0x00B248
10.5.4.0     174.5.1.103  482      0x80000001 0x0043C0
172.5.0.0    174.5.1.103  482      0x80000001 0x002D38
R4#

```

```

      OSPF Router with ID (174.5.1.103) (Process ID 1)

      Router Link States (Area 0)

Link ID      ADV Router      Age      Seq#      Checksum Link count
172.5.2.101  172.5.2.101  555      0x80000002 0x00F5A2 2
172.5.2.102  172.5.2.102  555      0x80000002 0x001E75 2
174.5.1.103  174.5.1.103  554      0x80000002 0x001A72 2

      Net Link States (Area 0)

Link ID      ADV Router      Age      Seq#      Checksum
172.5.2.103  174.5.1.103  554      0x80000001 0x00D9D5

      Summary Net Link States (Area 0)

Link ID      ADV Router      Age      Seq#      Checksum
174.5.0.0    174.5.1.103  590      0x80000001 0x001350
192.5.0.0    174.5.1.103  180      0x80000001 0x008CBA

      Router Link States (Area 100)

Link ID      ADV Router      Age      Seq#      Checksum Link count
174.5.1.103  174.5.1.103  194      0x80000002 0x0014A3 1
192.5.2.104  192.5.2.104  193      0x80000002 0x001C93 2

      Net Link States (Area 100)

Link ID      ADV Router      Age      Seq#      Checksum
174.5.1.103  174.5.1.103  197      0x80000001 0x0006AF

      Summary Net Link States (Area 100)

Link ID      ADV Router      Age      Seq#      Checksum
10.5.1.0     174.5.1.103  554      0x80000001 0x00C834
10.5.3.0     174.5.1.103  555      0x80000001 0x00B248
10.5.4.0     174.5.1.103  595      0x80000001 0x0043C0
172.5.0.0    174.5.1.103  596      0x80000001 0x002D38
R4#

```

Section 3: OSPFv2 and RIPv2 Combined deployment

Assignment Steps - 1

1. The link connecting R1, R2, R3 will be having **172.5.2.*** and R3, R4 will be having **174.5.1.*** and the R5, R6, R1 chain will be having **170.5.*.***
2. First screenshot is of R5 and R6 ip route before redistribution. Three wireshark captures are available for each configuration in the assignment
3. Next 5 screenshots show ip route of all routers after whole system is enabled
4. The E2 in R2, R3, R4 indicate OSPF external type 2 routing - the priority is based on external cost
5. Next 5 screenshots show the LS database of routers in area 0. R3 has 2 screenshots

6. Here R1 is an autonomous system boundary router and R5-R6 is an external set (Using RIPV2). The connections pertaining to these routers are present in the database as ASB (Autonomous System Boundary) LA and AS External LA area 0 routers. We can see the AS External does not belong to any area it is shared as it is in all the connected areas.
7. With above mentioned LA we have seen 5 types of Link Access in databases
8. R1 generates external summary after the redistribute command (redistribute rip metric 200 subnets). It uses LS Update PDU to send this information. These packets are commented in the capture
9. An Update packet with ASBR info is sent following that the external LS is requested. The same is provided as mentioned in 8th point. This way LS update Type 4 LSA is generated. These packets are commented in the capture
10. Another redistribute command (redistribute ospf 1 match external metric 1) will share this information to R5 and R6. We can see that the routing table in the 6th screenshot shows the area 0 routers as subnets. They use the standard RIPV2 request to transfer this information.
11. Following screenshots are of successful ping and traceroute of asked connections

```
Gateway of last resort is not set

 170.5.0.0/24 is subnetted, 4 subnets
R    170.5.4.0 [120/1] via 170.5.2.106, 00:00:16, Ethernet1/2
C    170.5.3.0 is directly connected, Ethernet1/0
C    170.5.2.0 is directly connected, Ethernet1/2
C    170.5.1.0 is directly connected, Ethernet1/1
R5#
```



```
Gateway of last resort is not set

 170.5.0.0/24 is subnetted, 4 subnets
C    170.5.4.0 is directly connected, Ethernet1/0
R    170.5.3.0 [120/1] via 170.5.2.105, 00:00:25, Ethernet1/1
C    170.5.2.0 is directly connected, Ethernet1/1
R    170.5.1.0 [120/1] via 170.5.2.105, 00:00:25, Ethernet1/1
R6#
```

```
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

 170.5.0.0/24 is subnetted, 4 subnets
R    170.5.4.0 [120/2] via 170.5.1.105, 00:00:20, Ethernet1/2
R    170.5.3.0 [120/1] via 170.5.1.105, 00:00:20, Ethernet1/2
R    170.5.2.0 [120/1] via 170.5.1.105, 00:00:20, Ethernet1/2
C    170.5.1.0 is directly connected, Ethernet1/2
O IA 174.5.0.0/16 [110/20] via 172.5.2.103, 00:04:52, Ethernet1/1
C    172.5.0.0/16 is directly connected, Ethernet1/1
      10.0.0.0/24 is subnetted, 3 subnets
O     10.5.4.0 [110/20] via 172.5.2.103, 00:04:52, Ethernet1/1
O     10.5.3.0 [110/20] via 172.5.2.102, 00:04:53, Ethernet1/1
C     10.5.1.0 is directly connected, Ethernet1/0
O IA 192.5.0.0/16 [110/30] via 172.5.2.103, 00:04:53, Ethernet1/1
R1#show ip ospf database
```

```
R2#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

 170.5.0.0/24 is subnetted, 4 subnets
O E2   170.5.4.0 [110/200] via 172.5.2.101, 00:34:29, Ethernet1/1
O E2   170.5.3.0 [110/200] via 172.5.2.101, 00:34:29, Ethernet1/1
O E2   170.5.2.0 [110/200] via 172.5.2.101, 00:34:29, Ethernet1/1
O E2   170.5.1.0 [110/200] via 172.5.2.101, 00:34:49, Ethernet1/1
O IA 174.5.0.0/16 [110/20] via 172.5.2.103, 00:34:49, Ethernet1/1
C    172.5.0.0/16 is directly connected, Ethernet1/1
      10.0.0.0/24 is subnetted, 3 subnets
O     10.5.4.0 [110/20] via 172.5.2.103, 00:34:50, Ethernet1/1
C     10.5.3.0 is directly connected, Ethernet1/0
O     10.5.1.0 [110/20] via 172.5.2.101, 00:34:50, Ethernet1/1
O IA 192.5.0.0/16 [110/30] via 172.5.2.103, 00:34:50, Ethernet1/1
R2#show ip ospf database
```

```
Activities Terminal ▾ Jul 13 11:53 R3
```



```
Gateway of last resort is not set

 170.5.0.0/24 is subnetted, 4 subnets
O E2   170.5.4.0 [110/200] via 172.5.2.101, 00:07:46, Ethernet1/1
O E2   170.5.3.0 [110/200] via 172.5.2.101, 00:07:46, Ethernet1/1
O E2   170.5.2.0 [110/200] via 172.5.2.101, 00:07:46, Ethernet1/1
O E2   170.5.1.0 [110/200] via 172.5.2.101, 00:08:06, Ethernet1/1
C    174.5.0.0/16 is directly connected, Ethernet1/2
C    172.5.0.0/16 is directly connected, Ethernet1/1
      10.0.0.0/24 is subnetted, 3 subnets
C      10.5.4.0 is directly connected, Ethernet1/0
O     10.5.3.0 [110/20] via 172.5.2.102, 00:08:07, Ethernet1/1
O     10.5.1.0 [110/20] via 172.5.2.101, 00:08:07, Ethernet1/1
O     192.5.0.0/16 [110/20] via 174.5.1.104, 00:21:01, Ethernet1/2
R3#show ip ospf database
```

```
Gateway of last resort is not set

 170.5.0.0/24 is subnetted, 4 subnets
O E2   170.5.4.0 [110/200] via 174.5.1.103, 00:32:58, Ethernet1/1
O E2   170.5.3.0 [110/200] via 174.5.1.103, 00:32:58, Ethernet1/1
O E2   170.5.2.0 [110/200] via 174.5.1.103, 00:32:58, Ethernet1/1
O E2   170.5.1.0 [110/200] via 174.5.1.103, 00:33:13, Ethernet1/1
C    174.5.0.0/16 is directly connected, Ethernet1/1
O IA 172.5.0.0/16 [110/20] via 174.5.1.103, 00:46:08, Ethernet1/1
      10.0.0.0/24 is subnetted, 3 subnets
O     10.5.4.0 [110/20] via 174.5.1.103, 00:46:09, Ethernet1/1
O     10.5.3.0 [110/30] via 174.5.1.103, 00:46:09, Ethernet1/1
O     10.5.1.0 [110/30] via 174.5.1.103, 00:46:09, Ethernet1/1
C    192.5.0.0/16 is directly connected, Ethernet1/0
R4#show ip ospf database
```

```

R 170.5.0.0/24 is subnetted, 4 subnets
R     170.5.4.0 [120/1] via 170.5.2.106, 00:00:01, Ethernet1/2
C     170.5.3.0 is directly connected, Ethernet1/0
C     170.5.2.0 is directly connected, Ethernet1/2
C     170.5.1.0 is directly connected, Ethernet1/1
R 174.5.0.0/16 [120/1] via 170.5.1.101, 00:00:15, Ethernet1/1
R 172.5.0.0/16 [120/1] via 170.5.1.101, 00:00:15, Ethernet1/1
  10.0.0.0/24 is subnetted, 3 subnets
R     10.5.4.0 [120/1] via 170.5.1.101, 00:00:15, Ethernet1/1
R     10.5.3.0 [120/1] via 170.5.1.101, 00:00:16, Ethernet1/1
R     10.5.1.0 [120/1] via 170.5.1.101, 00:00:16, Ethernet1/1
R 192.5.0.0/16 [120/1] via 170.5.1.101, 00:00:16, Ethernet1/1
R5#
```

```

R6#
```

R1#show ip ospf database

OSPF Router with ID (172.5.2.101) (Process ID 1)

Router Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
172.5.2.101	172.5.2.101	338	0x80000003	0x00F99B	2
172.5.2.102	172.5.2.102	1122	0x80000002	0x001E75	2
174.5.1.103	174.5.1.103	1123	0x80000002	0x001A72	2

Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
172.5.2.103	174.5.1.103	1122	0x80000001	0x00D9D5

Summary Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
174.5.0.0	174.5.1.103	1158	0x80000001	0x001350
192.5.0.0	174.5.1.103	1108	0x80000001	0x008CBA

Type-5 AS External Link States

Link ID	ADV Router	Age	Seq#	Checksum	Tag
170.5.1.0	172.5.2.101	338	0x80000001	0x005CC5	0
170.5.2.0	172.5.2.101	318	0x80000001	0x0051CF	0
170.5.3.0	172.5.2.101	318	0x80000001	0x0046D9	0
170.5.4.0	172.5.2.101	318	0x80000001	0x003BE3	0

R2#show ip ospf database

OSPF Router with ID (172.5.2.102) (Process ID 1)

Router Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
172.5.2.101	172.5.2.101	145	0x80000004	0x00F79C	2
172.5.2.102	172.5.2.102	938	0x80000003	0x001C76	2
174.5.1.103	174.5.1.103	952	0x80000003	0x001873	2

Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
172.5.2.103	174.5.1.103	952	0x80000002	0x00D7D6

Summary Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
174.5.0.0	174.5.1.103	952	0x80000002	0x001151
192.5.0.0	174.5.1.103	952	0x80000002	0x008ABB

Type-5 AS External Link States

Link ID	ADV Router	Age	Seq#	Checksum	Tag
170.5.1.0	172.5.2.101	145	0x80000002	0x005AC6	0
170.5.2.0	172.5.2.101	148	0x80000002	0x004FD0	0
170.5.3.0	172.5.2.101	148	0x80000002	0x0044DA	0
170.5.4.0	172.5.2.101	149	0x80000002	0x0039E4	0

R2#

```
R3#show ip ospf database
OSPF Router with ID (174.5.1.103) (Process ID 1)

Router Link States (Area 0)

Link ID      ADV Router    Age      Seq#      Checksum Link count
172.5.2.101  172.5.2.101  514       0x80000003 0x00F99B 2
172.5.2.102  172.5.2.102  1298     0x80000002 0x001E75 2
174.5.1.103  174.5.1.103  1297     0x80000002 0x001A72 2

Net Link States (Area 0)

Link ID      ADV Router    Age      Seq#      Checksum
172.5.2.103  174.5.1.103  1297     0x80000001 0x00D9D5

Summary Net Link States (Area 0)

Link ID      ADV Router    Age      Seq#      Checksum
174.5.0.0    174.5.1.103  1332     0x80000001 0x001350
192.5.0.0    174.5.1.103  1282     0x80000001 0x008CBA

Router Link States (Area 100)
```

```
Link ID      ADV Router    Age      Seq#      Checksum
174.5.0.0    174.5.1.103  1332     0x80000001 0x001350
192.5.0.0    174.5.1.103  1282     0x80000001 0x008CBA
```

Router Link States (Area 100)

```
Link ID      ADV Router    Age      Seq#      Checksum Link count
174.5.1.103  174.5.1.103  1283     0x80000002 0x001E98 1
192.5.2.104  192.5.2.104  1287     0x80000002 0x00327C 2
```

Net Link States (Area 100)

```
Link ID      ADV Router    Age      Seq#      Checksum
174.5.1.104  192.5.2.104  1287     0x80000001 0x00FBAA
```

Summary Net Link States (Area 100)

```
Link ID      ADV Router    Age      Seq#      Checksum
10.5.1.0    174.5.1.103  1297     0x80000001 0x00C834
10.5.3.0    174.5.1.103  1298     0x80000001 0x00B248
10.5.4.0    174.5.1.103  1338     0x80000001 0x0043C0
172.5.0.0    174.5.1.103  1338     0x80000001 0x002D38
```

Summary ASB Link States (Area 100)

```
Link ID      ADV Router    Age      Seq#      Checksum
172.5.2.101  174.5.1.103  514       0x80000001 0x0013E9
```

Type-5 AS External Link States

```
Link ID      ADV Router    Age      Seq#      Checksum Tag
170.5.1.0    172.5.2.101  522       0x80000001 0x005CC5 0
170.5.2.0    172.5.2.101  498       0x80000001 0x0051CF 0
170.5.3.0    172.5.2.101  499       0x80000001 0x0046D9 0
170.5.4.0    172.5.2.101  499       0x80000001 0x003BE3 0
```

R3#

```
PC4> ping 170.5.3.5
170.5.3.5 icmp_seq=1 timeout
170.5.3.5 icmp_seq=2 timeout
84 bytes from 170.5.3.5 icmp_seq=3 ttl=60 time=47.896 ms
84 bytes from 170.5.3.5 icmp_seq=4 ttl=60 time=57.609 ms
84 bytes from 170.5.3.5 icmp_seq=5 ttl=60 time=48.871 ms
```

PC4> []

```
R4#show ip ospf database
OSPF Router with ID (192.5.2.104) (Process ID 1)

Router Link States (Area 100)

Link ID      ADV Router    Age      Seq#      Checksum Link co
174.5.1.103  174.5.1.103  861      0x80000003 0x001C99 1
192.5.2.104  192.5.2.104  821      0x80000003 0x00307D 2

Net Link States (Area 100)

Link ID      ADV Router    Age      Seq#      Checksum
174.5.1.104  192.5.2.104  821      0x80000002 0x00F9A5

Summary Net Link States (Area 100)

Link ID      ADV Router    Age      Seq#      Checksum
10.5.1.0    174.5.1.103  861      0x80000002 0x00C635
10.5.3.0    174.5.1.103  861      0x80000002 0x00B049
10.5.4.0    174.5.1.103  861      0x80000002 0x0041C1
172.5.0.0    174.5.1.103  861      0x80000002 0x002B39

Summary ASB Link States (Area 100)

Link ID      ADV Router    Age      Seq#      Checksum
172.5.2.101  174.5.1.103  105     0x80000002 0x0011EA

Type-5 AS External Link States

Link ID      ADV Router    Age      Seq#      Checksum Tag
170.5.1.0    172.5.2.101  59       0x80000002 0x005AC6 0
170.5.2.0    172.5.2.101  60       0x80000002 0x004FD0 0
170.5.3.0    172.5.2.101  60       0x80000002 0x0044DA 0
170.5.4.0    172.5.2.101  60       0x80000002 0x0039E4 0
```

```
R4#
```

PC6> ping 10.5.4.3
10.5.4.3 icmp_seq=1 timeout
84 bytes from 10.5.4.3 icmp_seq=2 ttl=60 time=44.969 ms
84 bytes from 10.5.4.3 icmp_seq=3 ttl=60 time=46.040 ms
84 bytes from 10.5.4.3 icmp_seq=4 ttl=60 time=46.448 ms
84 bytes from 10.5.4.3 icmp_seq=5 ttl=60 time=48.383 ms

```
R4#traceroute 170.5.3.105
Type escape sequence to abort.
Tracing the route to 170.5.3.105
 1 174.5.1.103 20 msec 24 msec 20 msec
 2 172.5.2.101 40 msec 28 msec 24 msec
 3 170.5.1.105 28 msec 32 msec 28 msec
R4#[ ]
```

```
R6#traceroute 10.5.4.103
Type escape sequence to abort.
Tracing the route to 10.5.4.103
 1 170.5.2.105 8 msec 12 msec 8 msec
 2 170.5.1.101 20 msec 20 msec 24 msec
 3 172.5.2.103 32 msec 32 msec 32 msec
R6#[ ]
```