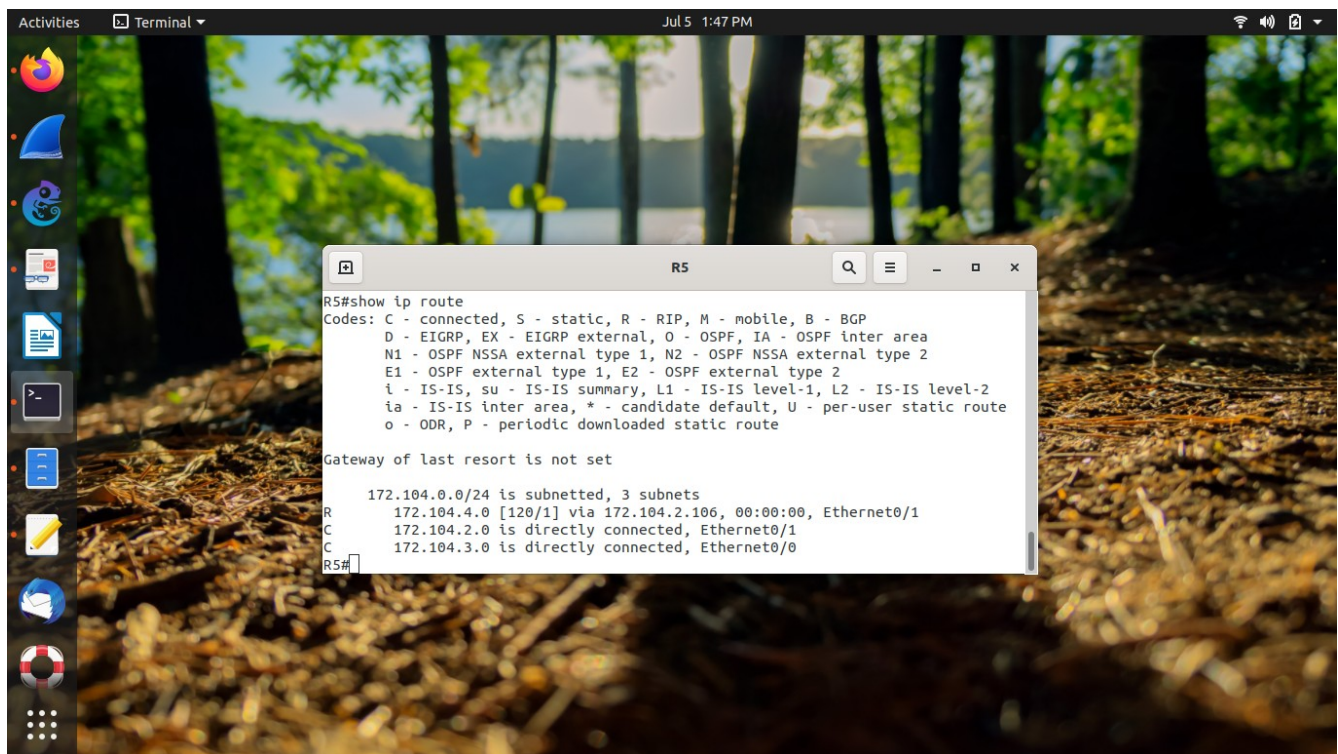


2b. show ip route :-

1) R5 :



```
R5#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

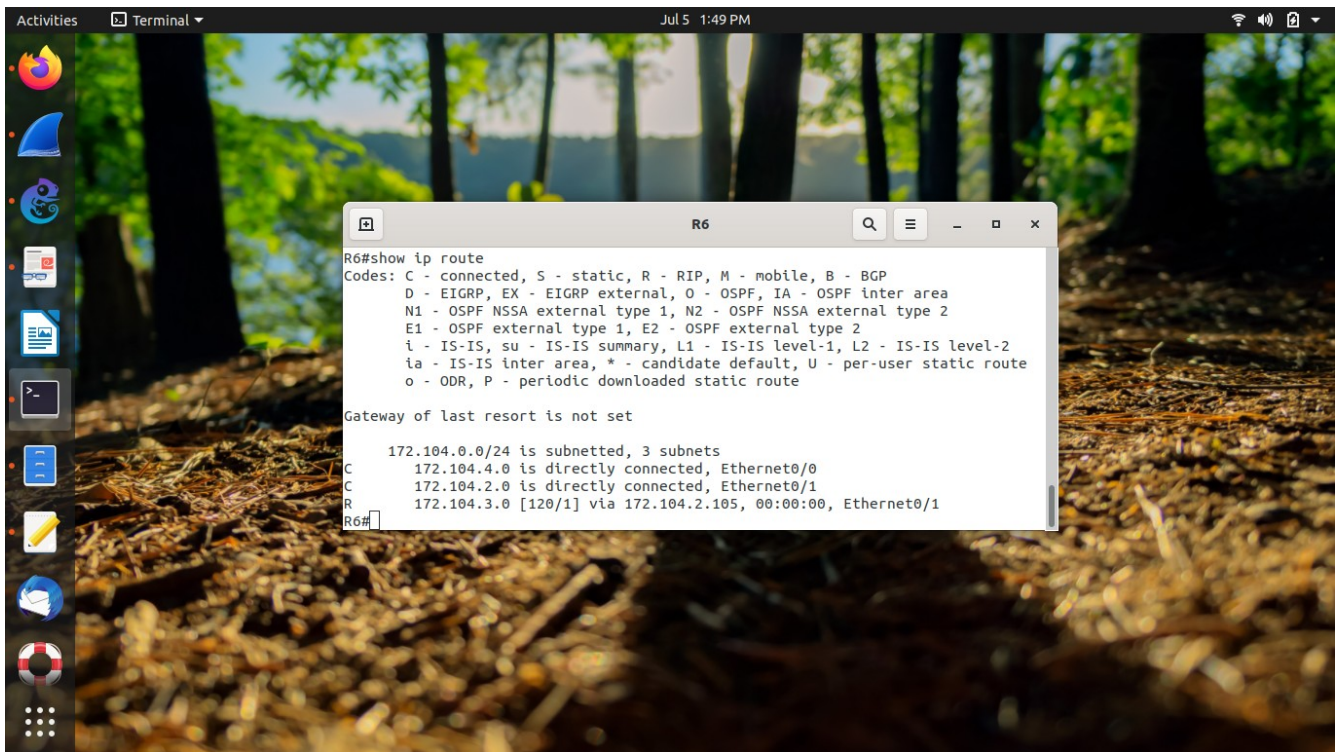
172.104.0.0/24 is subnetted, 3 subnets
R    172.104.4.0 [120/1] via 172.104.2.106, 00:00:00, Ethernet0/1
C    172.104.2.0 is directly connected, Ethernet0/1
C    172.104.3.0 is directly connected, Ethernet0/0
R5#
```

172.104.1.0 network, which connects R1, R5 is disabled.

So, R5 is directly connected to PC5 and R6 via 172.104.3.105 and 172.104.2.0 respectively.

172.104.4.0, which is the network between R6 and PC6 is known via RIP packets.

2) R6 :



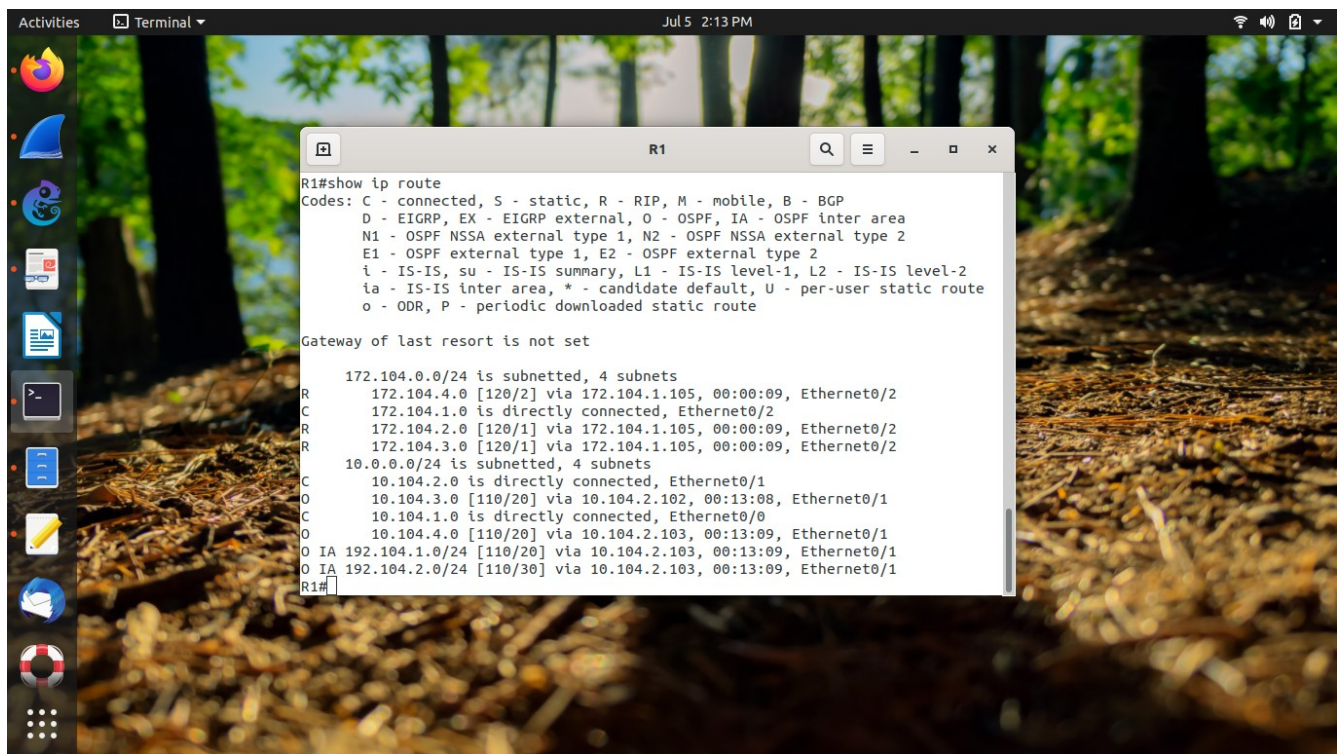
172.104.1.0 network, which connects R1, R5 is disabled.

So, R6 is directly connected to PC6 and R5 via 172.104.4.106 and 172.104.2.0 respectively.

172.104.3.0, which is the network between R5 and PC5 is known via RIP packets.

3 show ip route :-

1) R1 :



```
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

    172.104.0.0/24 is subnetted, 4 subnets
R       172.104.4.0 [120/2] via 172.104.1.105, 00:00:09, Ethernet0/2
C       172.104.1.0 is directly connected, Ethernet0/2
R       172.104.2.0 [120/1] via 172.104.1.105, 00:00:09, Ethernet0/2
R       172.104.3.0 [120/1] via 172.104.1.105, 00:00:09, Ethernet0/2
    10.0.0.0/24 is subnetted, 4 subnets
C       10.104.2.0 is directly connected, Ethernet0/1
O       10.104.3.0 [110/20] via 10.104.2.102, 00:13:08, Ethernet0/1
C       10.104.1.0 is directly connected, Ethernet0/0
O       10.104.4.0 [110/20] via 10.104.2.103, 00:13:09, Ethernet0/1
O IA 192.104.1.0/24 [110/20] via 10.104.2.103, 00:13:09, Ethernet0/1
O IA 192.104.2.0/24 [110/30] via 10.104.2.103, 00:13:09, Ethernet0/1
R1#
```

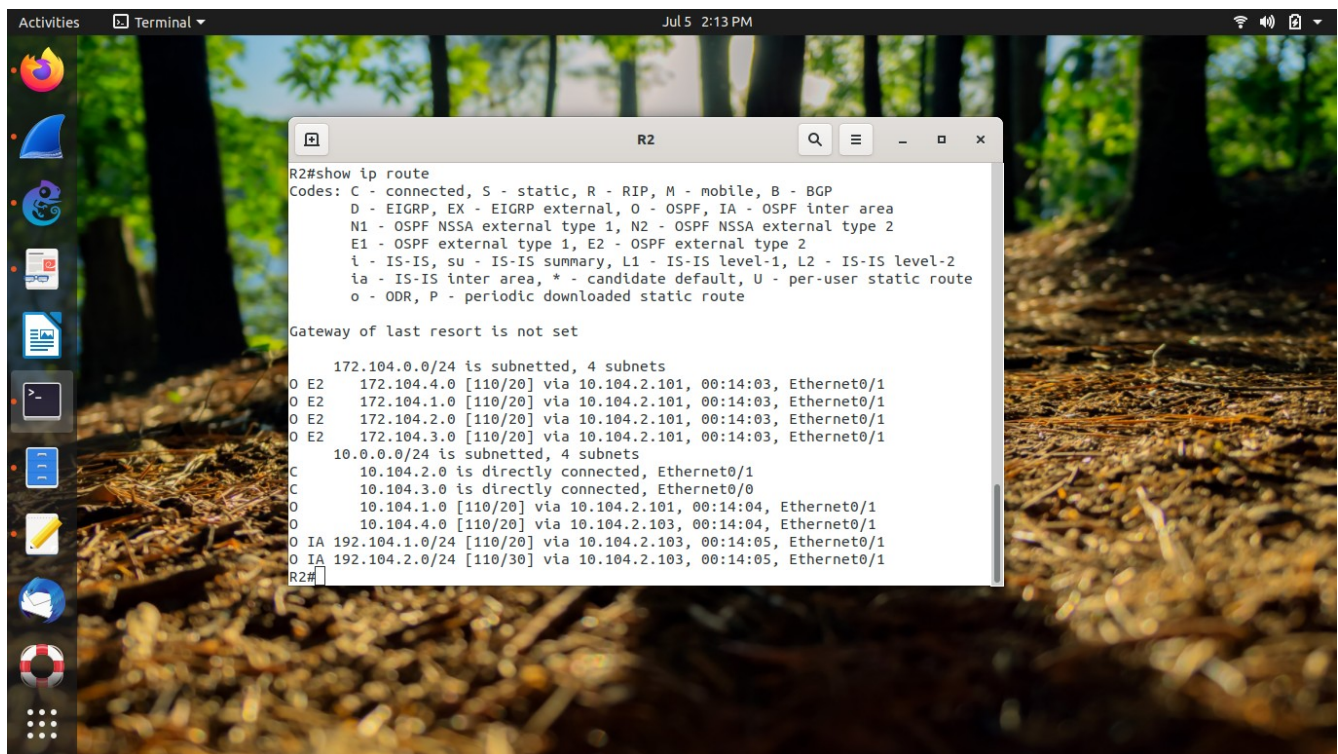
R1 is ASBR, that is, it is used to exchange routing information with other AS, which is 172.104.0.0/24 here.

R1 is directly connected to PC1, switch and R5 via 10.104.1.101, 10.104.2.101 and 172.104.1.101 respectively.

The info of subnets of 172.104.0.0, that is, 172.104.2.0, 172.104.3.0, 172.104.4.0 is brought to it by RIP packets via 172.104.1.105, which is R5's interface in R1-R5 link.

Info of the networks 10.104.4.0, 192.104.1.0, 192.104.2.0 is brought to it by 10.104.2.103 (on R3), and that of 10.104.3.0 is brought to it by 10.104.2.102 (on R2).

2) R2 :

A screenshot of a Linux desktop environment. The background is a nature scene with trees and a path. On the left is a vertical dock with various application icons. At the top, a terminal window is open, displaying the output of the 'show ip route' command on a router named R2. The terminal output includes a legend for route codes, a message about the gateway of last resort, and a list of installed routes with their metrics and interfaces. The routes include subnets of 172.104.0.0/24 and 10.104.0.0/24, as well as specific host routes for 192.104.1.0/24 and 192.104.2.0/24.

```
Activities Terminal Jul 5 2:13 PM
R2
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

172.104.0.0/24 is subnetted, 4 subnets
O E2 172.104.4.0 [110/20] via 10.104.2.101, 00:14:03, Ethernet0/1
O E2 172.104.1.0 [110/20] via 10.104.2.101, 00:14:03, Ethernet0/1
O E2 172.104.2.0 [110/20] via 10.104.2.101, 00:14:03, Ethernet0/1
O E2 172.104.3.0 [110/20] via 10.104.2.101, 00:14:03, Ethernet0/1
10.0.0.0/24 is subnetted, 4 subnets
C 10.104.2.0 is directly connected, Ethernet0/1
C 10.104.3.0 is directly connected, Ethernet0/0
O 10.104.1.0 [110/20] via 10.104.2.101, 00:14:04, Ethernet0/1
O 10.104.4.0 [110/20] via 10.104.2.103, 00:14:04, Ethernet0/1
O IA 192.104.1.0/24 [110/20] via 10.104.2.103, 00:14:05, Ethernet0/1
O IA 192.104.2.0/24 [110/30] via 10.104.2.103, 00:14:05, Ethernet0/1
R2#
```

R2 is directly connected to PC2 and switch via 10.104.3.102, 10.104.2.102 respectively. The info of subnets of 172.104.0.0, that is, 172.104.1.0, 172.104.2.0, 172.104.3.0, 172.104.4.0 is brought to it by OSPF packets, which are of E2 type (or OSPF External type). Info of the networks 10.104.4.0, 192.104.1.0, 192.104.2.0 is brought to it by 10.104.2.103 (on R3) which are packets of IA type, and that of 10.104.1.0 is brought to it by 10.104.2.101 (on R1).

3) R3 :

```
R3#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

  172.104.0.0/24 is subnetted, 4 subnets
O E2   172.104.4.0 [110/20] via 10.104.2.101, 00:14:40, Ethernet0/1
O E2   172.104.1.0 [110/20] via 10.104.2.101, 00:14:40, Ethernet0/1
O E2   172.104.2.0 [110/20] via 10.104.2.101, 00:14:40, Ethernet0/1
O E2   172.104.3.0 [110/20] via 10.104.2.101, 00:14:40, Ethernet0/1
  10.0.0.0/24 is subnetted, 4 subnets
C      10.104.2.0 is directly connected, Ethernet0/1
O      10.104.3.0 [110/20] via 10.104.2.102, 00:14:40, Ethernet0/1
O      10.104.1.0 [110/20] via 10.104.2.101, 00:14:41, Ethernet0/1
C      10.104.4.0 is directly connected, Ethernet0/0
C      192.104.1.0/24 is directly connected, Ethernet0/2
O      192.104.2.0/24 [110/20] via 192.104.1.104, 00:49:28, Ethernet0/2
R3#
```

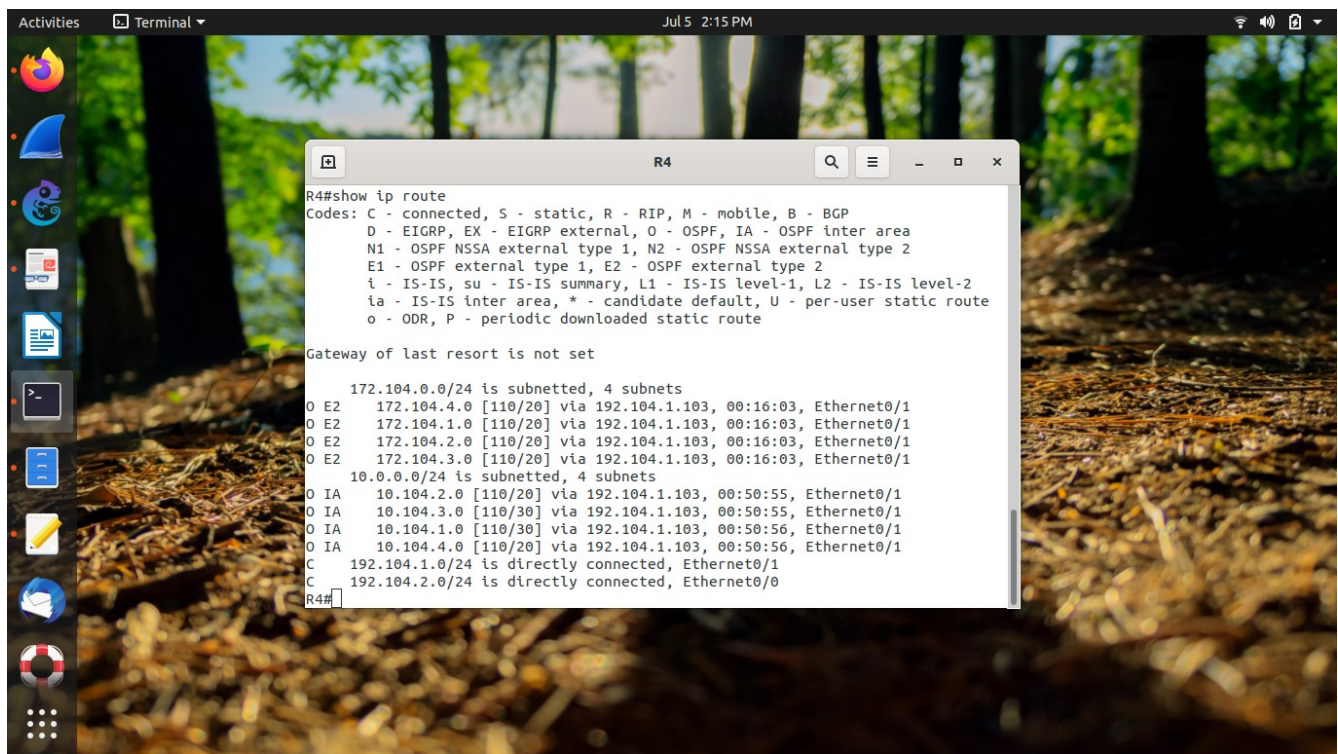
R3 is directly connected to PC3, switch, R4 via 10.104.4.103, 10.104.2.103, 192.104.1.103 respectively. All the subnets of 172.104.0.0/24 is known by the distribution of RIP packets by the ASBR R1, so, 172.104.0.0/24 networks get code of O(OSPF) and E2(External).

192.104.2.0 is known by OSPF packets again.

Note that as R3 is ABR, so, 192.104.1.0 and 192.104.2.0 are not coded as IA(Inter area).

All other 10.104.0.0/24 networks are known by OSPF.

4) R4 :



```
R4#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

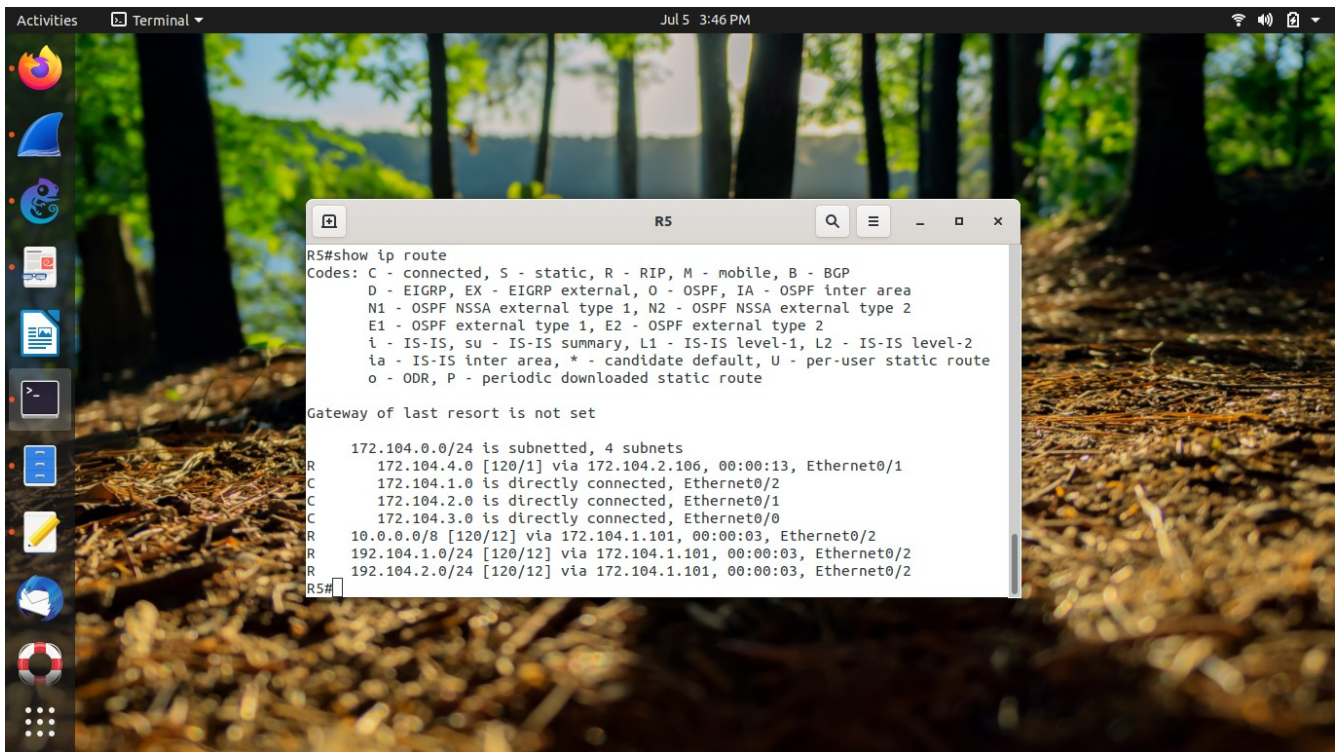
Gateway of last resort is not set

    172.104.0.0/24 is subnetted, 4 subnets
O E2   172.104.4.0 [110/20] via 192.104.1.103, 00:16:03, Ethernet0/1
O E2   172.104.1.0 [110/20] via 192.104.1.103, 00:16:03, Ethernet0/1
O E2   172.104.2.0 [110/20] via 192.104.1.103, 00:16:03, Ethernet0/1
O E2   172.104.3.0 [110/20] via 192.104.1.103, 00:16:03, Ethernet0/1
    10.0.0.0/24 is subnetted, 4 subnets
O IA   10.104.2.0 [110/20] via 192.104.1.103, 00:50:55, Ethernet0/1
O IA   10.104.3.0 [110/30] via 192.104.1.103, 00:50:55, Ethernet0/1
O IA   10.104.1.0 [110/30] via 192.104.1.103, 00:50:56, Ethernet0/1
O IA   10.104.4.0 [110/20] via 192.104.1.103, 00:50:56, Ethernet0/1
C      192.104.1.0/24 is directly connected, Ethernet0/1
C      192.104.2.0/24 is directly connected, Ethernet0/0
R4#
```

R4 is directly connected to PC4, R3 via 192.104.2.104, 192.104.1.104 respectively. All the subnets of 172.104.0.0/24 is known by the distribution of RIP packets by the ASBR R1, so, 172.104.0.0/24 networks get code of O(OSPF) and E2(External). All these are known via 192.104.1.103(R3).

All the networks of subnet of 10.104.0.0/24 are in area 0, and so are known by O and IA, via 192.104.1.103.

5) R5 :

A screenshot of a Linux desktop environment. The background is a nature scene with trees and a lake. On the left is a vertical dock with various application icons. At the top, a status bar shows 'Activities', 'Terminal', and the date/time 'Jul 5 3:46 PM'. A terminal window titled 'R5' is open in the center, displaying the output of the command 'R5#show ip route'. The output shows a list of routes with their codes, metrics, and next hops. The codes are explained in a legend: C for connected, S for static, R for RIP, M for mobile, B for BGP, D for EIGRP, EX for EIGRP external, O for OSPF, IA for OSPF inter area, N1 and N2 for OSPF NSSA external types, E1 and E2 for OSPF external types, I for IS-IS, su for IS-IS summary, L1 and L2 for IS-IS levels, ia for IS-IS inter area, * for candidate default, U for per-user static route, and ODR for ODR. The routes listed include 172.104.0.0/24 (subnetted), 172.104.4.0 (via 172.104.2.106), 172.104.1.0 (directly connected), 172.104.2.0 (directly connected), 172.104.3.0 (directly connected), 10.0.0.0/8 (via 172.104.1.101), 192.104.1.0/24 (via 172.104.1.101), and 192.104.2.0/24 (via 172.104.1.101).

```
R5#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

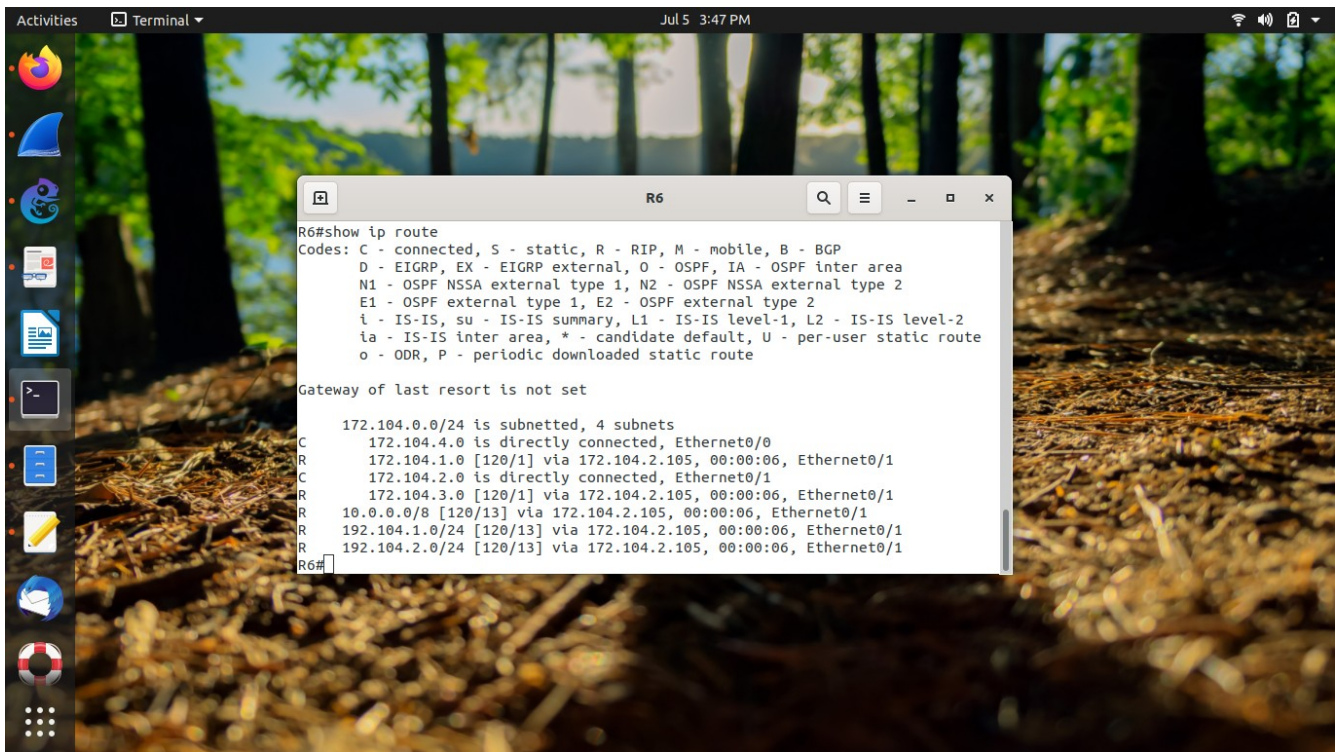
172.104.0.0/24 is subnetted, 4 subnets
R    172.104.4.0 [120/1] via 172.104.2.106, 00:00:13, Ethernet0/1
C    172.104.1.0 is directly connected, Ethernet0/2
C    172.104.2.0 is directly connected, Ethernet0/1
C    172.104.3.0 is directly connected, Ethernet0/0
R    10.0.0.0/8 [120/12] via 172.104.1.101, 00:00:03, Ethernet0/2
R    192.104.1.0/24 [120/12] via 172.104.1.101, 00:00:03, Ethernet0/2
R    192.104.2.0/24 [120/12] via 172.104.1.101, 00:00:03, Ethernet0/2
R5#
```

OSPF network info is exchanged in R1, which is ASBR, to make it appear as if other networks are being known RIP. Thus, 192.104.1.0, 192.104.2.0, all subnets of 10.0.0.0/8 are known by OSPF info in R1 but have code RIP, and are seen by R5 after 172.104.1.101 (R1's interface) gives it those.

R5 is directly connected to R1, PC5, R6 via 172.104.1.105, 172.104.3.105 and 172.104.2.105 respectively.

172.104.4.0 is known by RIP packets, given to it via R6 via 172.104.2.106.

6) R6 :



OSPF network info is exchanged in R1, which is ASBR, to make it appear as if other networks are being known RIP. Thus, 192.104.1.0, 192.104.2.0, all subnets of 10.0.0.0/8 are known by OSPF info in R1 but have code RIP, and are seen by R5 after 172.104.1.101 (R1's interface) gives it those.

R6 is directly connected to PC6, R5 via 172.104.4.106, 172.104.2.106 respectively.

172.104.3.0 is known by RIP packets, given to it via R5 via 172.104.2.105.

2c. show ip ospf database :-

1) R1 :


```
Activities Terminal Jul 5 3:51 PM
R1#show ip ospf database
OSPF Router with ID (10.104.2.101) (Process ID 2)
Router Link States (Area 0)
Link ID      ADV Router   Age         Seq#         Checksum Link count
10.104.2.101 10.104.2.101 169         0x80000007  0x002C01 2
10.104.3.102 10.104.3.102 408         0x80000006  0x0029FF 2
192.104.1.103 192.104.1.103 324         0x80000007  0x00AD0C 2
Net Link States (Area 0)
Link ID      ADV Router   Age         Seq#         Checksum
10.104.2.101 10.104.2.101 420         0x80000005  0x00ED49
Summary Net Link States (Area 0)
Link ID      ADV Router   Age         Seq#         Checksum
192.104.1.0  192.104.1.103 324         0x80000004  0x00B0C3
192.104.2.0  192.104.1.103 324         0x80000004  0x000A5F
Type-5 AS External Link States
Link ID      ADV Router   Age         Seq#         Checksum Tag
172.104.1.0  10.104.2.101 169         0x80000003  0x00238B 0
172.104.2.0  10.104.2.101 172         0x80000003  0x001895 0
172.104.3.0  10.104.2.101 173         0x80000003  0x000D9F 0
172.104.4.0  10.104.2.101 173         0x80000003  0x0002A9 0
R1#
R1#
```

Router ID given to R1 is 10.104.2.101.

3 Router Link states are present in area 0, where R2 is present. These are 10.104.2.101(R1), 10.104.3.102(R2) and 192.104.1.103(R3). 2 links of 10.104.2.101 are 10.104.1.0, 10.104.2.0. 2 links of 10.104.3.102 are 10.104.2.0, 10.104.3.0. 2 links of 192.104.2.103 are 10.104.2.0, 10.104.4.0.

Network Link state exists. 10.104.2.101 is Link state id and Advertising router. So, R1 is DR.

Summary or Type-3 LSA exist. These give the 2 networks in other area, which have link IDs as 192.104.1.0 and 192.104.2.0. ADV router is 192.104.1.103 (R3).

External Link States or Type-5 LSA exists. It has all the networks in external network, in this case, which uses RIP. These are subnets of 172.104.0.0/24. All these have ADV router as 10.104.2.101(R1).

2) R2 :

```
Activities Terminal Jul 5 3:53 PM
R2
R2#show ip ospf database
      OSPF Router with ID (10.104.3.102) (Process ID 2)
      Router Link States (Area 0)
Link ID      ADV Router    Age      Seq#          Checksum Link count
10.104.2.101 10.104.2.101    226      0x80000007    0x002C01 2
10.104.3.102 10.104.3.102    464      0x80000006    0x0029FF 2
192.104.1.103 192.104.1.103   380      0x80000007    0x00AD0C 2
      Net Link States (Area 0)
Link ID      ADV Router    Age      Seq#          Checksum
10.104.2.101 10.104.2.101    477      0x80000005    0x00ED49
      Summary Net Link States (Area 0)
Link ID      ADV Router    Age      Seq#          Checksum
192.104.1.0  192.104.1.103   380      0x80000004    0x00B0C3
192.104.2.0  192.104.1.103   380      0x80000004    0x000A5F
      Type-5 AS External Link States
Link ID      ADV Router    Age      Seq#          Checksum Tag
172.104.1.0  10.104.2.101    226      0x80000003    0x00238B 0
172.104.2.0  10.104.2.101    229      0x80000003    0x001895 0
172.104.3.0  10.104.2.101    230      0x80000003    0x000D9F 0
172.104.4.0  10.104.2.101    230      0x80000003    0x0002A9 0
R2#
```

Router ID given to R2 is 10.104.3.102.

3 Router Link states are present in area 0, where R3 is present. These are 10.104.2.101(R1), 10.104.3.102(R2) and 192.104.1.103(R3). 2 links of 10.104.2.101 are 10.104.1.0, 10.104.2.0. 2 links of 10.104.3.102 are 10.104.2.0, 10.104.3.0. 2 links of 192.104.2.103 are 10.104.2.0, 10.104.4.0.

Network Link state exists. 10.104.2.101 is Link state id and Advertising router. So, R1 is DR.

Summary or Type-3 LSA exist. These give the 2 networks in other area, which have link IDs as 192.104.1.0 and 192.104.2.0. ADV router is 192.104.1.103 (R3).

External Link States or Type-5 LSA exists. It has all the networks in external network, in this case, which uses RIP. These are subnets of 172.104.0.0/24. All these have ADV router as 10.104.2.101(R1).

3) R3 :


```
Activities Terminal Jul 5 3:56 PM
R3
R3#show ip ospf database

      OSPF Router with ID (192.104.1.103) (Process ID 2)

      Router Link States (Area 0)

Link ID      ADV Router    Age      Seq#          Checksum Link count
10.104.2.101 10.104.2.101  340      0x80000007   0x002C01 2
10.104.3.102 10.104.3.102  578      0x80000006   0x0029FF 2
192.104.1.103 192.104.1.103 493      0x80000007   0x00AD0C 2

      Net Link States (Area 0)

Link ID      ADV Router    Age      Seq#          Checksum
10.104.2.101 10.104.2.101  591      0x80000005   0x00ED49

      Summary Net Link States (Area 0)

Link ID      ADV Router    Age      Seq#          Checksum
192.104.1.0  192.104.1.103 493      0x80000004   0x00B0C3
192.104.2.0  192.104.1.103 493      0x80000004   0x000A5F

      Router Link States (Area 100)

Link ID      ADV Router    Age      Seq#          Checksum Link count
192.104.1.103 192.104.1.103 493      0x80000005   0x00C519 1
192.104.2.104 192.104.2.104 409      0x80000006   0x00890B 2

      Net Link States (Area 100)

Link ID      ADV Router    Age      Seq#          Checksum
192.104.1.103 192.104.1.103 496      0x80000004   0x00F0FD

      Summary Net Link States (Area 100)

Link ID      ADV Router    Age      Seq#          Checksum
10.104.1.0  192.104.1.103 499      0x80000004   0x005CC4
```

```
Activities Terminal Jul 5 3:58 PM
R3
Link ID      ADV Router    Age      Seq#          Checksum
192.104.1.0  192.104.1.103 493      0x80000004   0x00B0C3
192.104.2.0  192.104.1.103 493      0x80000004   0x000A5F

      Router Link States (Area 100)

Link ID      ADV Router    Age      Seq#          Checksum Link count
192.104.1.103 192.104.1.103 493      0x80000005   0x00C519 1
192.104.2.104 192.104.2.104 409      0x80000006   0x00890B 2

      Net Link States (Area 100)

Link ID      ADV Router    Age      Seq#          Checksum
192.104.1.103 192.104.1.103 496      0x80000004   0x00F0FD

      Summary Net Link States (Area 100)

Link ID      ADV Router    Age      Seq#          Checksum
10.104.1.0  192.104.1.103 499      0x80000004   0x005CC4
10.104.2.0  192.104.1.103 504      0x80000004   0x00EC3D
10.104.3.0  192.104.1.103 504      0x80000004   0x004608
10.104.4.0  192.104.1.103 505      0x80000004   0x00D651

      Summary ASB Link States (Area 100)

Link ID      ADV Router    Age      Seq#          Checksum
10.104.2.101 192.104.1.103 248      0x80000003   0x00EAD9

      Type-5 AS External Link States

Link ID      ADV Router    Age      Seq#          Checksum Tag
172.104.1.0  10.104.2.101 356      0x80000003   0x00238B 0
172.104.2.0  10.104.2.101 358      0x80000003   0x001895 0
172.104.3.0  10.104.2.101 359      0x80000003   0x000D9F 0
172.104.4.0  10.104.2.101 359      0x80000003   0x0002A9 0
R3#
```

R3 is ABR, between area 0 and area 100.
Router ID given to R3 is 192.104.1.103.

3 Router Link states are present in area 0, where R1 is present. These are 10.104.2.101(R1), 10.104.3.102(R2) and 192.104.1.103(R3). 2 links of 10.104.2.101 are 10.104.1.0, 10.104.2.0. 2 links of 10.104.3.102 are 10.104.2.0, 10.104.3.0. 2 links of 192.104.2.103 are 10.104.2.0, 10.104.4.0.

Network Link state exists. 10.104.2.101 is Link state id and Advertising router. So, R1 is DR.

Summary or Type-3 LSA exist. These give the 2 networks in other area, which have link IDs as 192.104.1.0 and 192.104.2.0. ADV router is 192.104.1.103 (R3).

External Link States or Type-5 LSA exists. It has all the networks in external network, in this case, which uses RIP. These are subnets of 172.104.0.0/24. All these have ADV router as 10.104.2.101(R1).

As R3 is ABR, states of area 100 are also mentioned.

2 Router Link states are present in area 100, where R4 is present. These are 192.104.1.103(R3), 192.104.2.104(R4). ADV router and Link state id are same for router LSA.

Network Link state exists. 192.104.1.103 is Link state id and Advertising router. So, R3 is DR.

Summary or Type-3 LSA exist. These give the 4 networks in other area, which are subnets of 10.104.0.0/24.

Type-4 LSA or Summary ASB Link states exist. It has link id as 10.104.2.101 and ADV router as 192.104.1.103. The type 4 LSA is an LSA that instructs the rest of the OSPF domain how to get to the ASBR so that other routes in the OSPF domain can route to external prefixes redistributed into OSPF by the ASBR. If we have no way to reach the actual ASBR that redistributed the route, we obviously can't reach the external route.

External Link States or Type-5 LSA exists. It has all the networks in external network, in this case, which uses RIP. These are subnets of 172.104.0.0/24. All these have ADV router as 10.104.2.101(R1).

Thus, clearly, LSDB of R3 has combined LSDBs of area 0(R1) and area 100(R4), and so, all LSDBs are not equal in size.

4) R4:

```
Activities Terminal Jul 5 3:59 PM
R4
R4#show ip ospf database

OSPF Router with ID (192.104.2.104) (Process ID 2)

Router Link States (Area 100)

Link ID      ADV Router   Age         Seq#         Checksum Link count
192.104.1.103 192.104.1.103 791         0x80000005  0x00C519 1
192.104.2.104 192.104.2.104 702         0x80000006  0x00890B 2

Net Link States (Area 100)

Link ID      ADV Router   Age         Seq#         Checksum
192.104.1.103 192.104.1.103 791         0x80000004  0x00F0FD

Summary Net Link States (Area 100)

Link ID      ADV Router   Age         Seq#         Checksum
10.104.1.0   192.104.1.103 791         0x80000004  0x005CC4
10.104.2.0   192.104.1.103 791         0x80000004  0x00EC3D
10.104.3.0   192.104.1.103 791         0x80000004  0x0046D8
10.104.4.0   192.104.1.103 791         0x80000004  0x00D651

Summary ASB Link States (Area 100)

Link ID      ADV Router   Age         Seq#         Checksum
10.104.2.101 192.104.1.103 534         0x80000003  0x00EAD9

Type-5 AS External Link States

Link ID      ADV Router   Age         Seq#         Checksum Tag
172.104.1.0  10.104.2.101 641         0x80000003  0x00238B 0
172.104.2.0  10.104.2.101 644         0x80000003  0x001895 0
172.104.3.0  10.104.2.101 645         0x80000003  0x000D9F 0
172.104.4.0  10.104.2.101 645         0x80000003  0x002A9 0
R4#
```

2 Router Link states are present in area 100, where R4 is present. These are 192.104.1.103(R3), 192.104.2.104(R4). ADV router and Link state id are same for router LSA.

Network Link state exists. 192.104.1.103 is Link state id and Advertising router. So, R3 is DR.

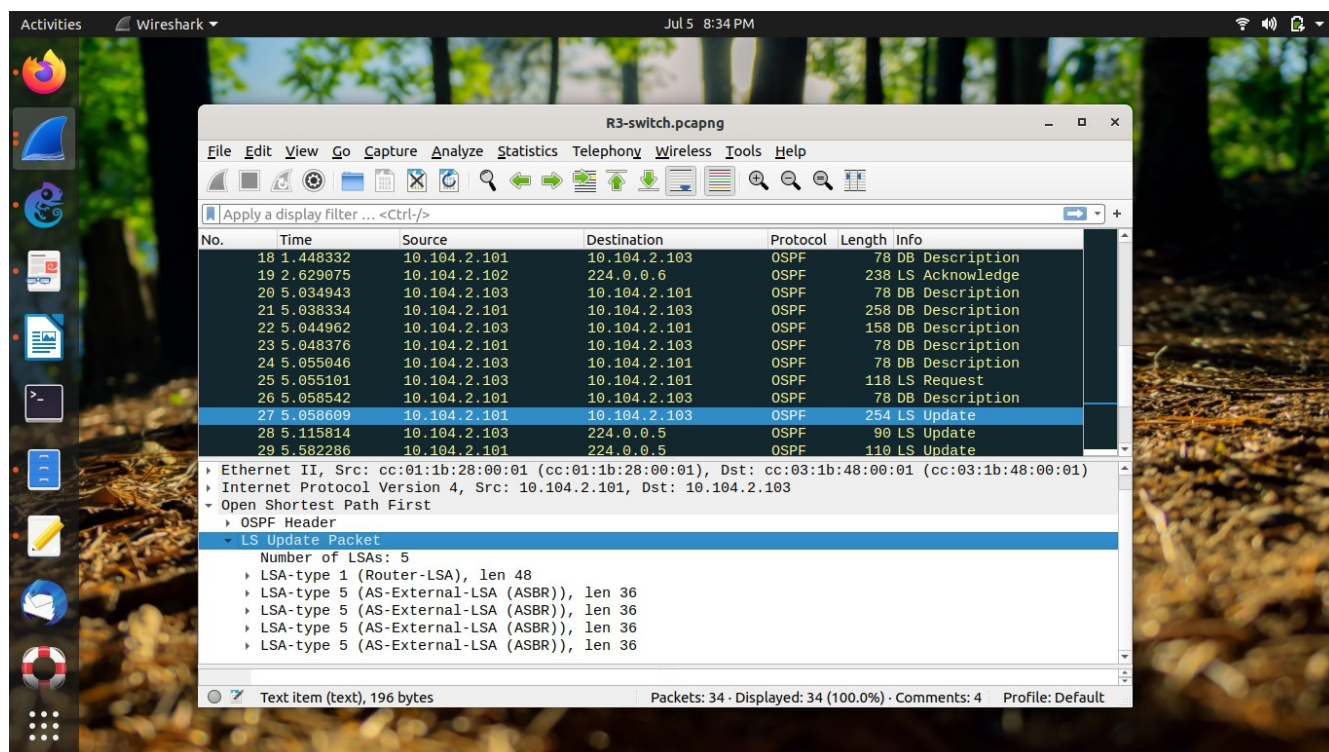
Summary or Type-3 LSA exist. These give the 4 networks in other area, which are subnets of 10.104.0.0/24.

Type-4 LSA or Summary ASB Link states exist. It has link id as 10.104.2.101 and ADV router as 192.104.1.103. The type 4 LSA is an LSA that instructs the rest of the OSPF domain how to get to the ASBR so that other routes in the OSPF domain can route to external prefixes redistributed into OSPF by the ASBR. If we have no way to reach the actual ASBR that redistributed the route, we obviously can't reach the external route

External Link States or Type-5 LSA exists. It has all the networks in external network, in this case, which uses RIP. These are subnets of 172.104.0.0/24. All these have ADV router as 10.104.2.101(R1).

Wireshark Capture :

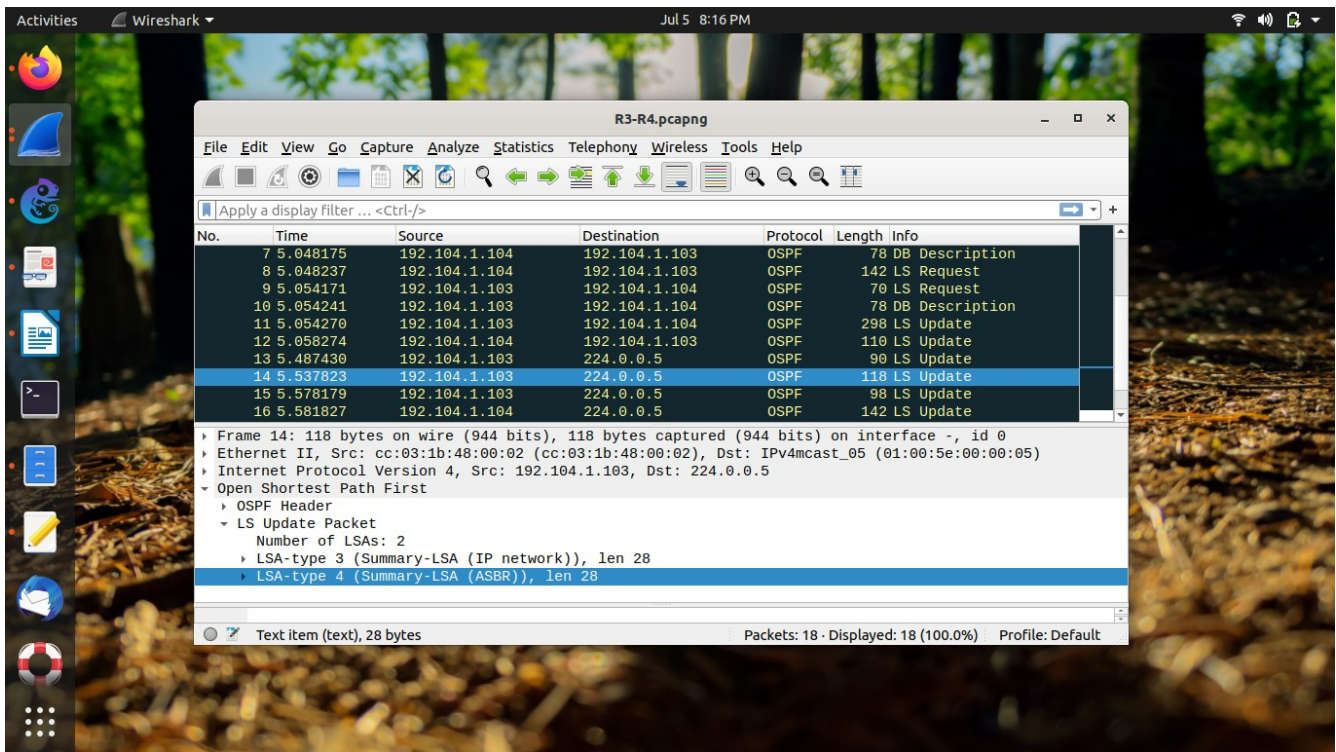
A) Between R3-switch :



In file R3-switch.pcapng- packet number 21 (DB type) has this info and R3(10.104.2.103) is being informed by R1(10.104.2.101) about the external LSA. In packet 25, on seeing this DB, R3 is giving LSRequest to R1. In 27, R1 is sending an LSUpdate to R3, which has 1 Router LSA of R1, and other 4 External LSA, about the 4 172.104.0.0/24 subnets. In packet 32, R3 is acknowledging this update via LSack to multicast (224.0.0.5).

The contents of the the 4 AS-External-LSA are- One with link state id as 172.104.1.0 and advertising router as 172.104.1.101, 2nd with link state id as 172.104.2.0 and advertising router as 172.104.1.101, 3rd with link state id as 172.104.3.0 and advertising router as 172.104.1.101, 4th with link state id as 172.104.4.0 and advertising router as 172.104.1.101.

B) Between R3-R4:



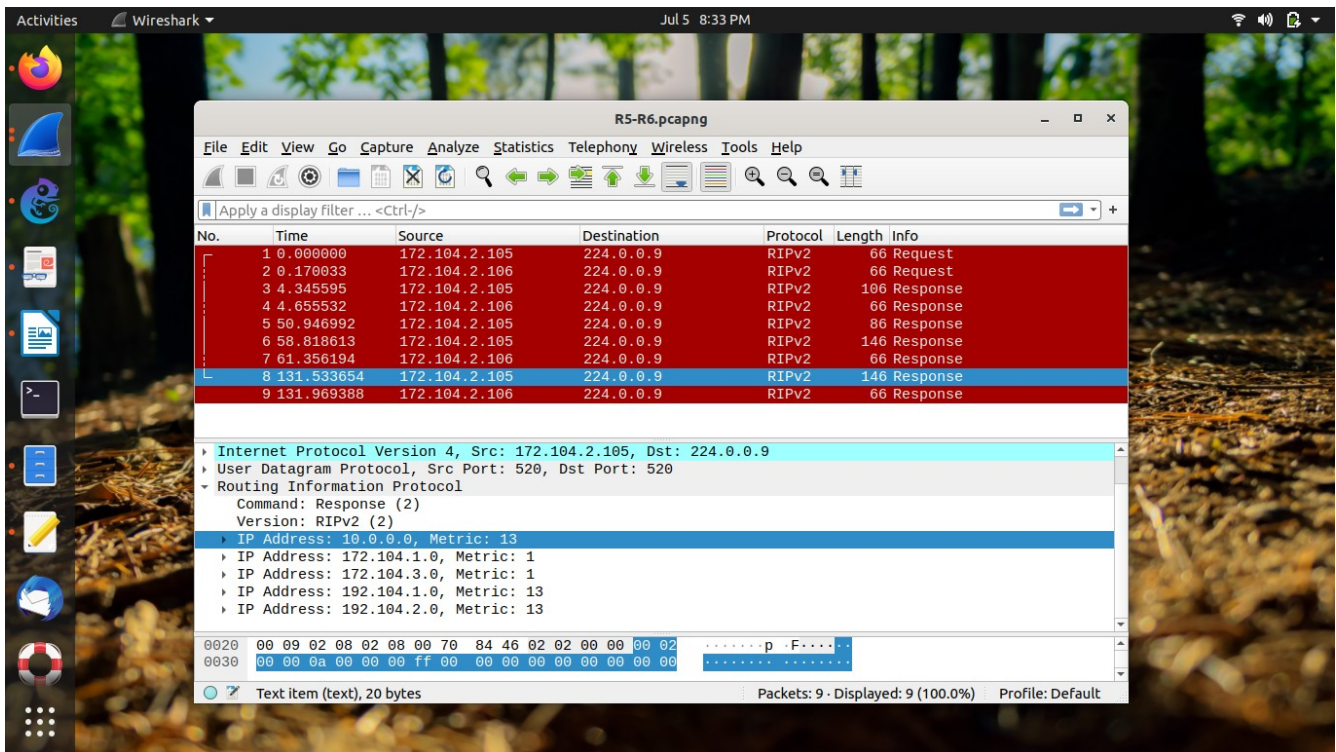
In file R3-R4.pcapng-

In packet 14, R3 (192.104.1.103) gives out a multicast LSUpdate regarding LSA-type 4 (Summary LSA (ASBR)). It has link state id as 172.104.1.101, and advertising router as 192.104.1.103(R3). Thus, R3 is telling R4 and PC4 about the location of the ASBR R1, as the IP 172.104.1.101. Using this, they can reach 172.104.0.0/24.

In packet 8, R4 (192.104.1.104) is making LSRequest from R3 for 2 LSA-3, and the 4 LSA-5.

In packet 11, R3 gives LSUpdate to R4 regarding these LSAs. And at packet 14, R3 multicasts LSA-4.

C) Between R5-R6 :



In file R5-R6.pcapng-

In packet 3, R5(172.104.2.105) gives out a packet to 224.0.0.9(to all RIPv2 enabled packets in network), that has 172.104.1.0 network (between R1 and R5) and 172.104.3.0 (R5-PC5).

In packet 5, the networks 192.104.1.0 and 192.104.2.0 are put by R5 to 224.0.0.9

In packet 8, besides 172.104.1.0, 172.104.3.0, 192.104.1.0, 192.104.3.0; 10.0.0.0 networks are also there.

So, by packet 8, R6 knows about all the external networks from R5.