Computer Networks COE 351

Final Project

Contents

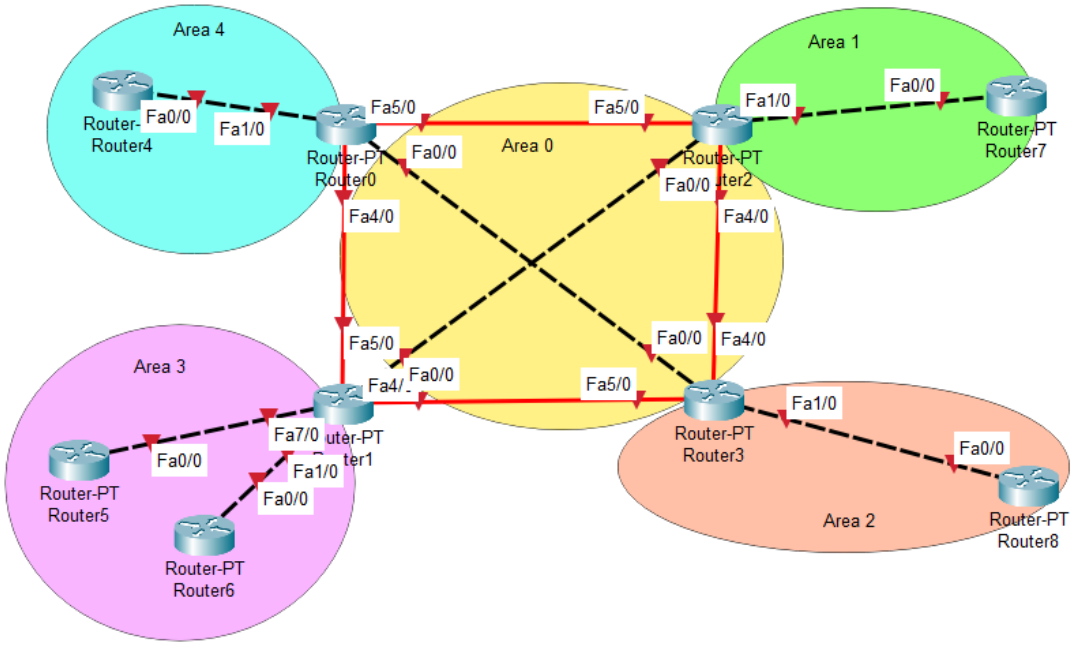


Figure 1 Topology

You need to do the followed:

1. **Choose the IP's for the routers and use subnet 30, and write why we used that? (write the IP addresses next to the interface).**

1. IP's for the routers

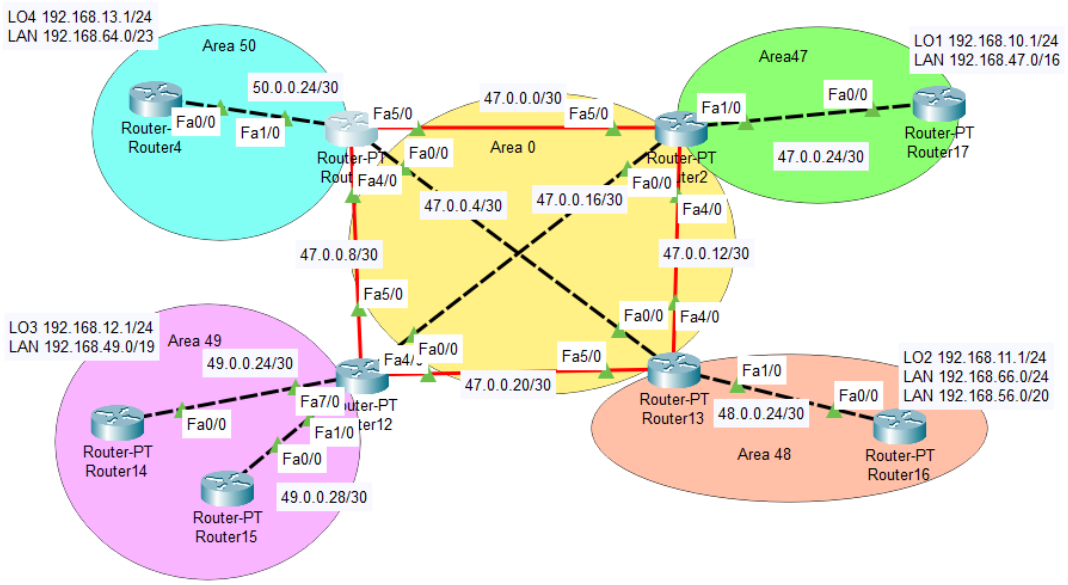


Figure 2 Topology with added addresses

Student id : 391202847

x = 47

Table 1 addresssing table

Router 11		
Fa5/0	47.0.0.1	255.255.255.252
Fa0/0	47.0.0.5	255.255.255.252
F4/0	47.0.0.9	255.255.255.252
Router 12		
Fa5/0	47.0.0.10	255.255.255.252
Fa4/0	47.0.0.21	255.255.255.252
Fa0/0	47.0.0.17	255.255.255.252

Router 2		
Fa5/0	47.0.0.2	255.255.255.252
Fa0/0	47.0.0.18	255.255.255.252
Fa4/0	47.0.0.13	255.255.255.252
Fa1/0	47.0.0.26	255.255.255.252
Router 13		
Fa4/0	47.0.0.14	255.255.255.252
Fa0/0	47.0.0.6	255.255.255.252
Fa5/0	47.0.0.22	255.255.255.252

why we used that?

Table 2 area table

47.0.0.0 /30	47.0.0.1	47.0.0.2	255.255.255.252
47.0.0.4/30	47.0.0.5	47.0.0.6	255.255.255.252
47.0.0.8/30	47.0.0.9	47.0.0.10	255.255.255.252
47.0.0.12/30	47.0.0.13	47.0.0.14	255.255.255.252
47.0.0.16/30	47.0.0.17	47.0.0.18	255.255.255.252
47.0.0.20/30	47.0.0.21	47.0.0.22	255.255.255.252

2. **Area number should match of X except the one in area 0. EX if IP is 10.10.0.0 area should be area 10. For LANs use 192.168.X.0 change X to be the same as your area ID. on area 2, the second VLAN X will be (area ID + 4).**

2. New areas ip addresses

Table 3 address range in each area

Area 0		
Area 1 = > Area 47		
Area Subnet	**Start IP**	**second IP**
47.0.0.24/30	47.0.0.25	47.0.0.26
Area 2 = > Area 48		
Area Subnet	**Start IP**	**second IP**
48.0.0.24/30	48.0.0.25	48.0.0.26
Area 3 = > Area 49		
Area Subnet	**Start IP**	**second IP**
49.0.0.24/30	49.0.0.25	49.0.0.26
49.0.0.28/30	49.0.0.29	49.0.0.30
Area 4 = > Area 50		
Area Subnet	**Start IP**	**second IP**
50.0.0.24/30	50.0.0.25	50.0.0.26

Area 47

Table 4 area 47

Area 47		
Router 2		
Fa1/0	47.0.0.26	255.255.255.252
Router 17		
Fa0/0	47.0.0.25	255.255.255.252

Area 48

Table 5 area 48

Area 48		
Router 13		

Fa1/0	48.0.0.25	255.255.255.252
Router 16		
Fa0/0	48.0.0.26	255.255.255.252

Area 49

Table 6 area 49

Area 49		
Router 14		
Fa0/0	49.0.0.26	255.255.255.252
Router 15		
Fa0/0	49.0.0.29	255.255.255.252
Router 12		
Fa1/0	49.0.0.25	255.255.255.252
Fa7/0	49.0.0.30	255.255.255.252

Area 50

Table 7 area 50

Area 50		
Router 11		
Fa1/0	50.0.0.25	255.255.255.252
Router 4	**Area 50**	
Fa0/0	50.0.0.26	255.255.255.252

3. For the LAN's:

1. LAN in area 3 should have around 8000 users. (chose the closest number to 8000 users but not less than 8000 users).

2. Lan in area 4 should have 500 users.

3. Area 2 should contain two VLANs:

1. VLAN 1 should be class C

2. VLAN 2 should have 3000 users.

4. LAN in area 1 should have around 60000 users.

4. Each LAN and VLAN should have DHCP service.

For LAN in each area

3.1 LAN in area 1 should have around 60000 users.

LAN : 192.168.47.0/16 = 65536 users

Enable DHCP service

Start 192.168.0.1 End 192.168.255.254

Table 8 lan in area 47

Area 47
Router 17
! ip dhcp pool router17 network 192.168.74.0 255.255.0.0 default-router 192.168.0.1

3.2 Area 2 should contain two VLANs:

1. VLAN 1 should be class C

2. VLAN 2 should have 3000 users.

LAN 192.168.66.0/ 24= class C

Enable DHCP service

Start 192.168.66.1 End 192.168.66.254

LAN 192.168.56.0/ 20= 4094 users

Enable DHCP service

Start 192.168.16.1 End 192.168.31.254

Table 9 lan in area 48

Area 48
Router 16
! ip dhcp pool router16 network 192.168.66.0 255.255.255.0 default-router 192.168.66.1 ! ip dhcp pool router16-2 network 192.168.56.0 255.255.240.0 default-router 192.168.16.1

3.3 LAN in area 3 should have around 8000 users.

(chose the closest number to 8000 users but not less than 8000 users).

LAN 192.168.31.0/24 class C

Enable DHCP service

Start 192.168.31.1 end 192.168.31.254

LAN 192.168.49.0/19 = 8,192 users

Enable DHCP service

Start 192.168.32.1 end 192.168.63.254

Table 10 lan in area 49

Area 49
Router 14
! ip dhcp pool router14 network 192.168.49.0 255.255.224.0 default-router 192.168.32.1 ! ! ip dhcp pool router14-2 network 192.168.31.0 255.255.255.0 default-router 192.168.31.1 !

3.4 Lan in area 4 should have 500 users.

LAN : 192.168.64.0/23= 512 users

Enable DHCP service

End 192.168.65.254

Table 11 lan in area 50

Area 50
Router 4
! ip dhcp pool router4 network 192.168.49.0 255.255.254.0 default-router 192.168.64.1

Table 12 whole lans in each area

Area 47			
LAN : 192.168.47.0/16 = 65536 users			
Start	192.168.0.1	End	192.168.255.254
Area 48			
LAN 192.168.66.0/ 24= class C			
LAN 192.168.56.0/ 20= 4094 users			
Start	192.168.16.1	End	192.168.31.254
Area 49			
LAN 192.168.31.0/24 class C			
LAN 192.168.49.0/19 = 8,192 users			
Start	192.168.32.1	end	192.168.63.254
Area 50			
LAN : 192.168.64.0/23= 512 users			
Start	192.168.64.1	End	192.168.65.254

Address table after add all interfaces

Table 13 whole addressing table

Router 11		
Fa5/0	47.0.0.1	255.255.255.252
Fa0/0	47.0.0.5	255.255.255.252
F4/0	47.0.0.9	255.255.255.252
Fa1/0	50.0.0.25	255.255.255.252
Router 12		
Fa5/0	47.0.0.10	255.255.255.252
Fa4/0	47.0.0.21	255.255.255.252
Fa0/0	47.0.0.17	255.255.255.252
Fa1/0	49.0.0.25	255.255.255.252
Fa7/0	49.0.0.30	255.255.255.252
Router 2		
Fa5/0	47.0.0.2	255.255.255.252
Fa0/0	47.0.0.18	255.255.255.252
Fa4/0	47.0.0.13	255.255.255.252
Fa1/0	47.0.0.26	255.255.255.252
Router 13		
Fa4/0	47.0.0.14	255.255.255.252
Fa0/0	47.0.0.6	255.255.255.252
Fa5/0	47.0.0.22	255.255.255.252
Fa1/0	48.0.0.25	255.255.255.252
Router 4	Area 50	
Fa0/0	50.0.0.26	255.255.255.252
LO4	192.168.13.0	255.255.255.0
LAN	192.168.64.0	255.255.254.0
Router 14	Area 49	
Fa0/0	49.0.0.26	255.255.255.252
LO3	192.168.12.0	255.255.255.0
Router 15	Area 49	
Fa0/0	49.0.0.29	255.255.255.252

LAN	192.168.49.0	255.255.224.0
Router 17	Area 47	
Fa0/0	47.0.0.25	255.255.255.252
LO1	192.168.10.0	255.255.255.0
LAN	192.168.47.0	255.255.0.0
Router 16	Area 48	
Fa0/0	48.0.0.26	255.255.255.252
LO2	192.168.11.0	255.255.255.0
LAN	192.168.66.0	255.255.255.0
LAN	192.168.56.0	255.255.240.0

OSPF routing protocol

4. Use OSPF routing protocol with the areas shown on the figure. (copy the commands on your report)

Table 14 ospf configuration in each router

Router 11 router ospf 1 router-id 11.11.11.11 log-adjacency-changes network 47.0.0.0 0.0.0.3 area 0 network 47.0.0.4 0.0.0.3 area 0 network 47.0.0.8 0.0.0.3 area 0 network 50.0.0.24 0.0.0.3 area 50 !
Router 2 ! router ospf 1 router-id 2.2.2.2 log-adjacency-changes network 47.0.0.0 0.0.0.3 area 0 network 47.0.0.12 0.0.0.3 area 0 network 47.0.0.16 0.0.0.3 area 0 network 47.0.0.24 0.0.0.3 area 47 !
Router 12 !

```
router ospf 1
router-id 12.12.12.12
log-adjacency-changes
network 47.0.0.8 0.0.0.3 area 0
network 47.0.0.16 0.0.0.3 area 0
network 47.0.0.20 0.0.0.3 area 0
network 49.0.0.24 0.0.0.3 area 49
network 49.0.0.28 0.0.0.3 area 49
!
```

Router 13

```
!
router ospf 1
router-id 13.13.13.13
log-adjacency-changes
network 47.0.0.12 0.0.0.3 area 0
network 47.0.0.4 0.0.0.3 area 0
network 47.0.0.20 0.0.0.3 area 0
network 48.0.0.24 0.0.0.3 area 48
!
```

Router 4

```
!
router ospf 1
log-adjacency-changes
network 50.0.0.24 0.0.0.3 area 50
```

Router 17

```
router ospf 1
log-adjacency-changes
network 47.0.0.24 0.0.0.3 area 47
!
```

Router 16

```
!
router ospf 1
log-adjacency-changes
network 48.0.0.24 0.0.0.3 area 48
!
```

Router 14

```
!
router ospf 1
```

log-adjacency-changes network 49.0.0.24 0.0.0.3 area 49 !
Router 15 ! router ospf 1 log-adjacency-changes network 49.0.0.28 0.0.0.3 area 49 !

6. Use show command to show the next for router 12, router 17, router 14:
- neighbors

R12 Show ospf neighbor

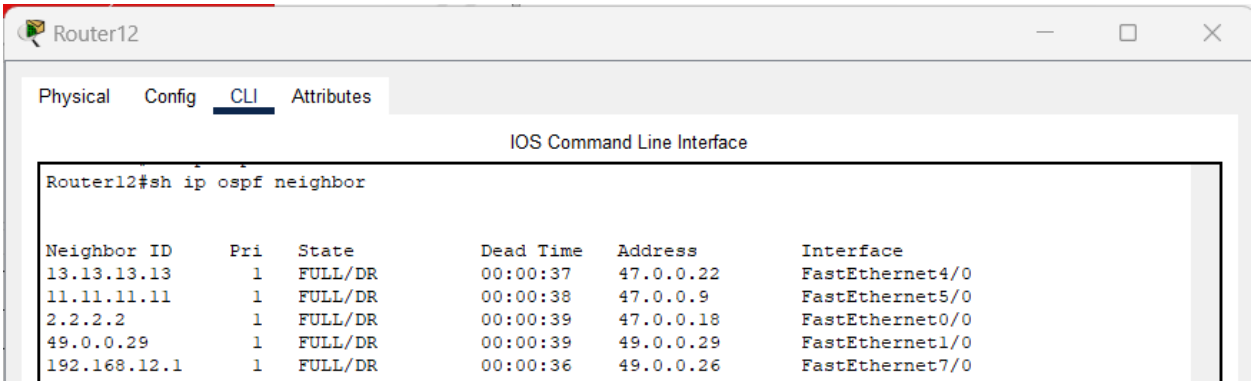


Figure 3 R12 Show ospf neighbor

R17 Show ospf neighbor

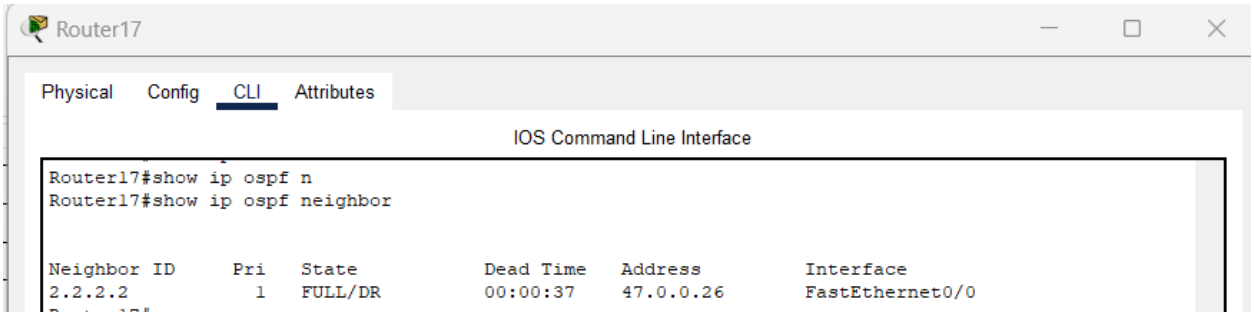


Figure 4 R17 Show ospf neighbor

R14 Show ospf neighbor

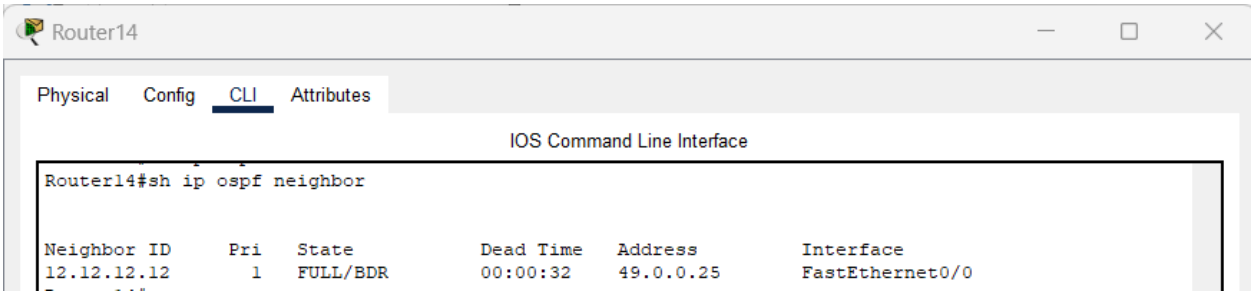
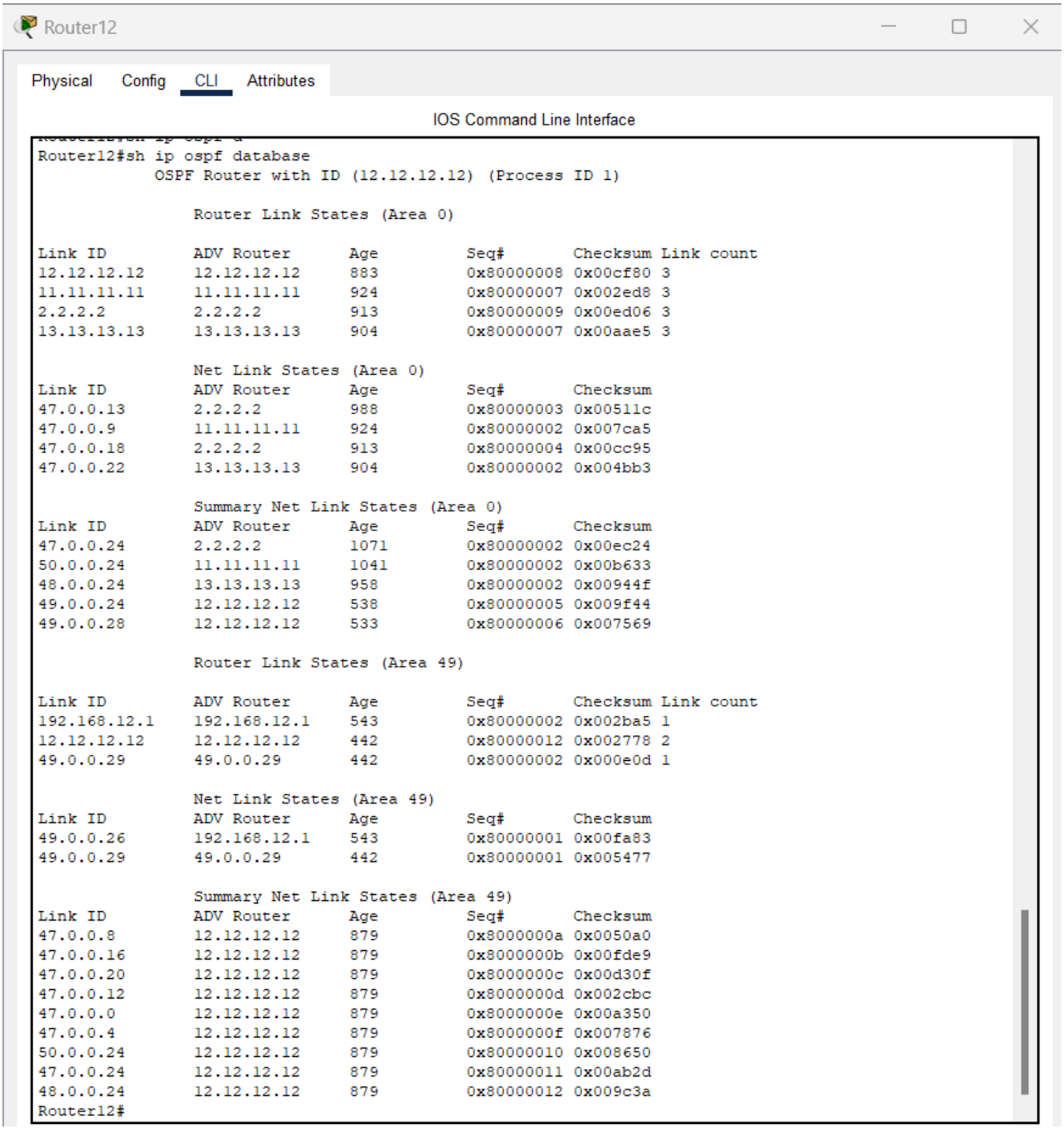


Figure 5 R14 Show ospf neighbor

- database

R12 Show ip ospf database




```
Router12#sh ip ospf database
            OSPF Router with ID (12.12.12.12) (Process ID 1)

                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
12.12.12.12     12.12.12.12     883         0x80000008 0x00cf80 3
11.11.11.11     11.11.11.11     924         0x80000007 0x002ed8 3
2.2.2.2         2.2.2.2         913         0x80000009 0x00ed06 3
13.13.13.13     13.13.13.13     904         0x80000007 0x00aae5 3

                Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#       Checksum
47.0.0.13       2.2.2.2         988         0x80000003 0x00511c
47.0.0.9        11.11.11.11     924         0x80000002 0x007ca5
47.0.0.18       2.2.2.2         913         0x80000004 0x00cc95
47.0.0.22       13.13.13.13     904         0x80000002 0x004bb3

                Summary Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#       Checksum
47.0.0.24       2.2.2.2         1071        0x80000002 0x00ec24
50.0.0.24       11.11.11.11     1041        0x80000002 0x00b633
48.0.0.24       13.13.13.13     958         0x80000002 0x00944f
49.0.0.24       12.12.12.12     538         0x80000005 0x009f44
49.0.0.28       12.12.12.12     533         0x80000006 0x007569

                Router Link States (Area 49)

Link ID         ADV Router      Age         Seq#       Checksum Link count
192.168.12.1    192.168.12.1    543         0x80000002 0x002ba5 1
12.12.12.12     12.12.12.12     442         0x80000012 0x002778 2
49.0.0.29       49.0.0.29       442         0x80000002 0x000e0d 1

                Net Link States (Area 49)
Link ID         ADV Router      Age         Seq#       Checksum
49.0.0.26       192.168.12.1    543         0x80000001 0x00fa83
49.0.0.29       49.0.0.29       442         0x80000001 0x005477

                Summary Net Link States (Area 49)
Link ID         ADV Router      Age         Seq#       Checksum
47.0.0.8        12.12.12.12     879         0x8000000a 0x0050a0
47.0.0.16       12.12.12.12     879         0x8000000b 0x00fde9
47.0.0.20       12.12.12.12     879         0x8000000c 0x00d30f
47.0.0.12       12.12.12.12     879         0x8000000d 0x002cbc
47.0.0.0        12.12.12.12     879         0x8000000e 0x00a350
47.0.0.4        12.12.12.12     879         0x8000000f 0x007876
50.0.0.24       12.12.12.12     879         0x80000010 0x008650
47.0.0.24       12.12.12.12     879         0x80000011 0x00ab2d
48.0.0.24       12.12.12.12     879         0x80000012 0x009c3a
Router12#
```

Figure 6 R12 Show ip ospf database

R14 Show ip ospf database

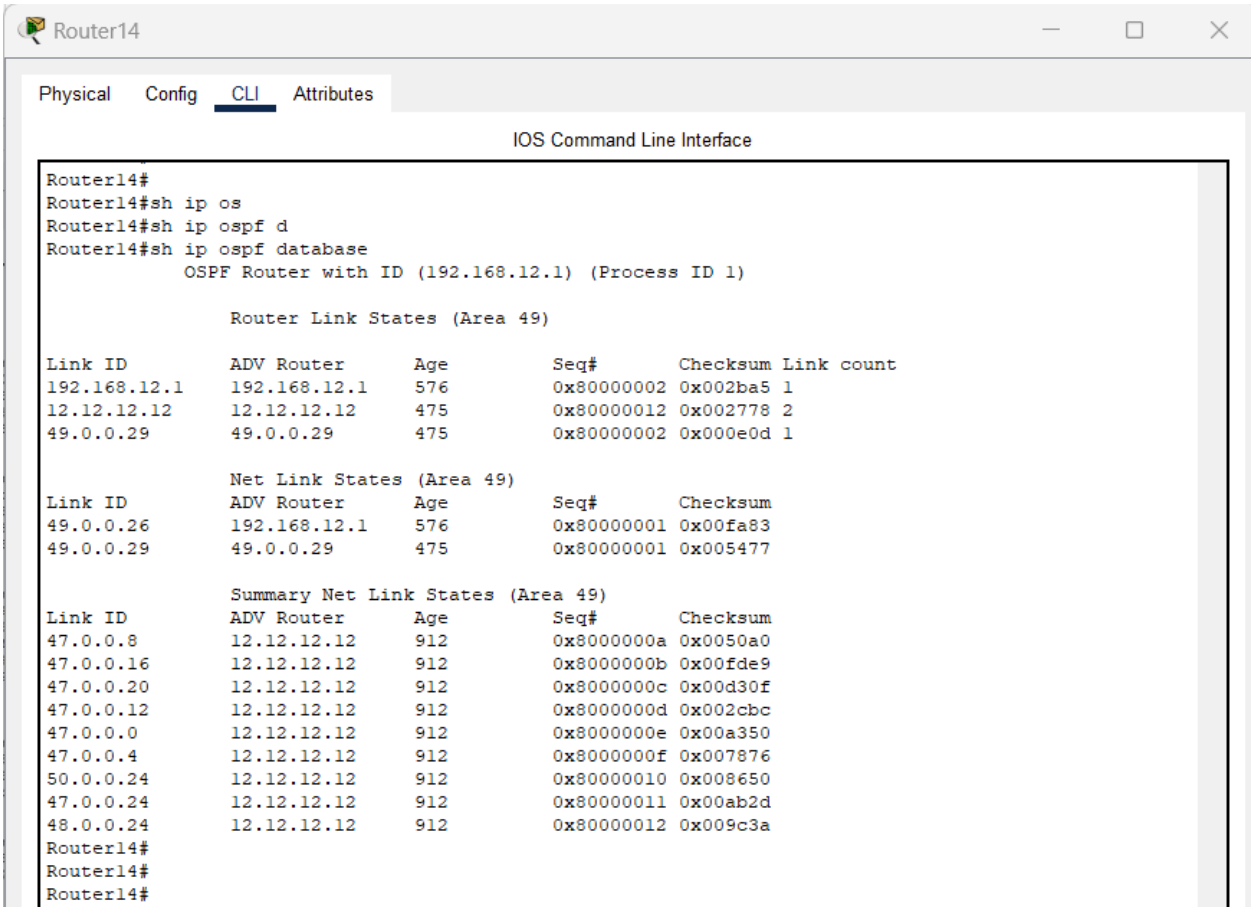


Figure 7 R14 Show ip ospf database

R17 Show ip ospf database

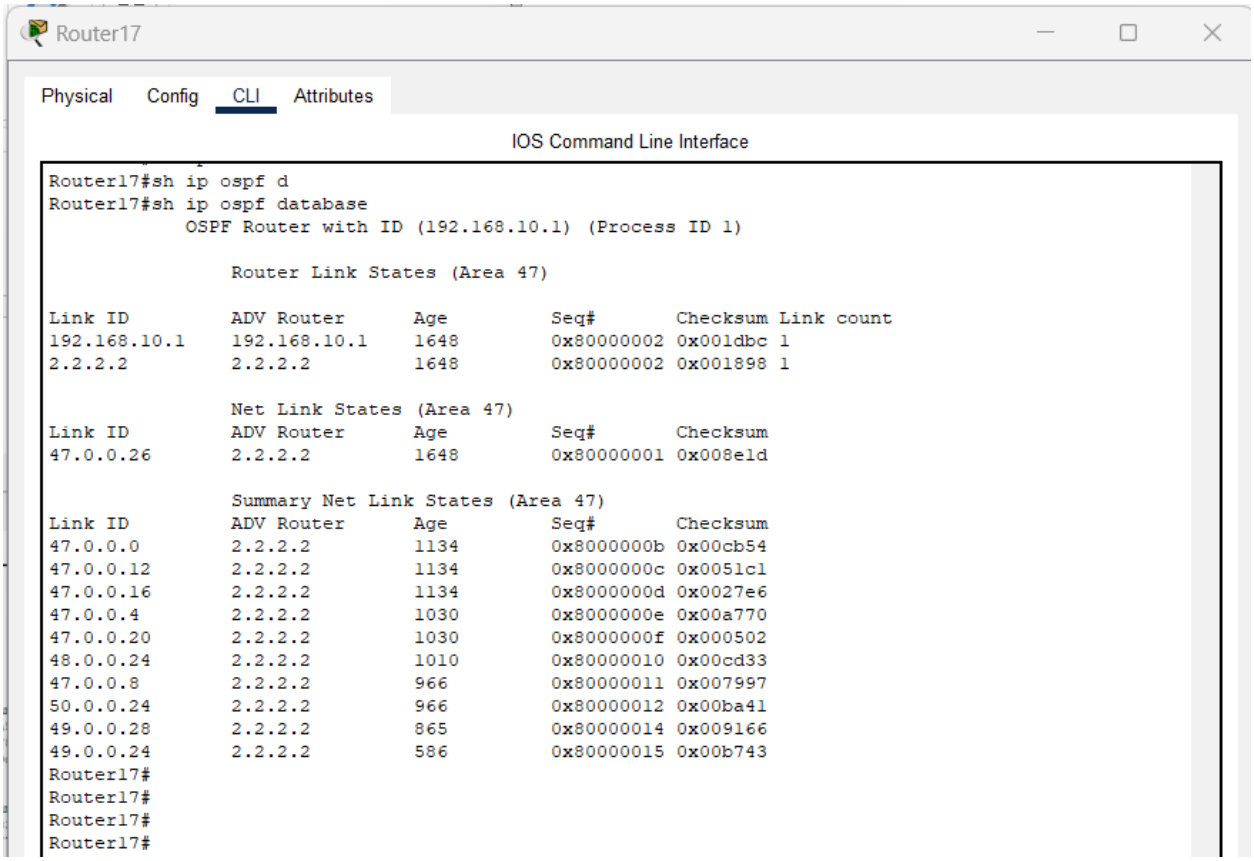


Figure 8 R17 Show ip ospf database

- database summary.

R14 Show ip ospf database summary

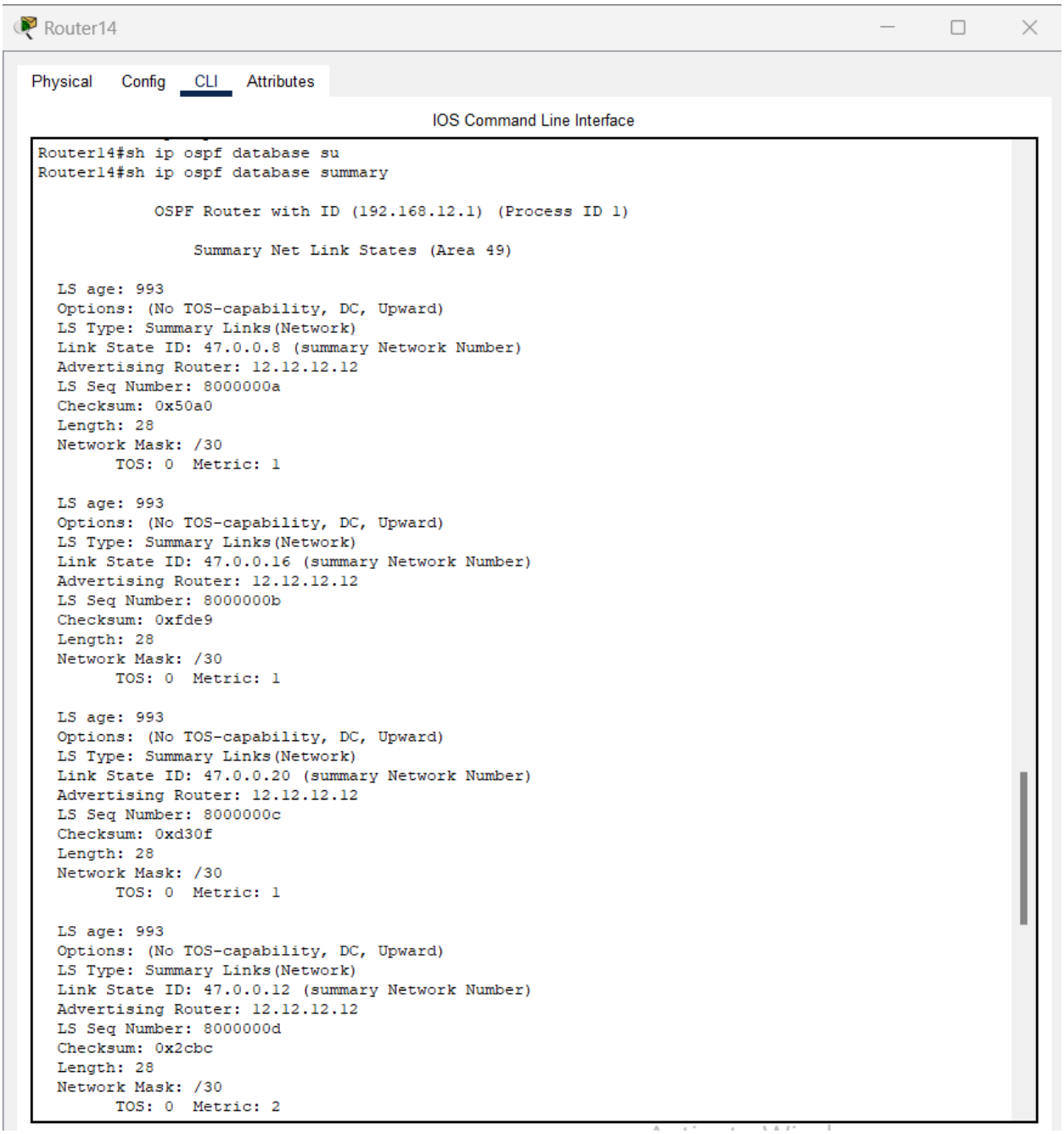


Figure 9 R14 Show ip ospf database summary

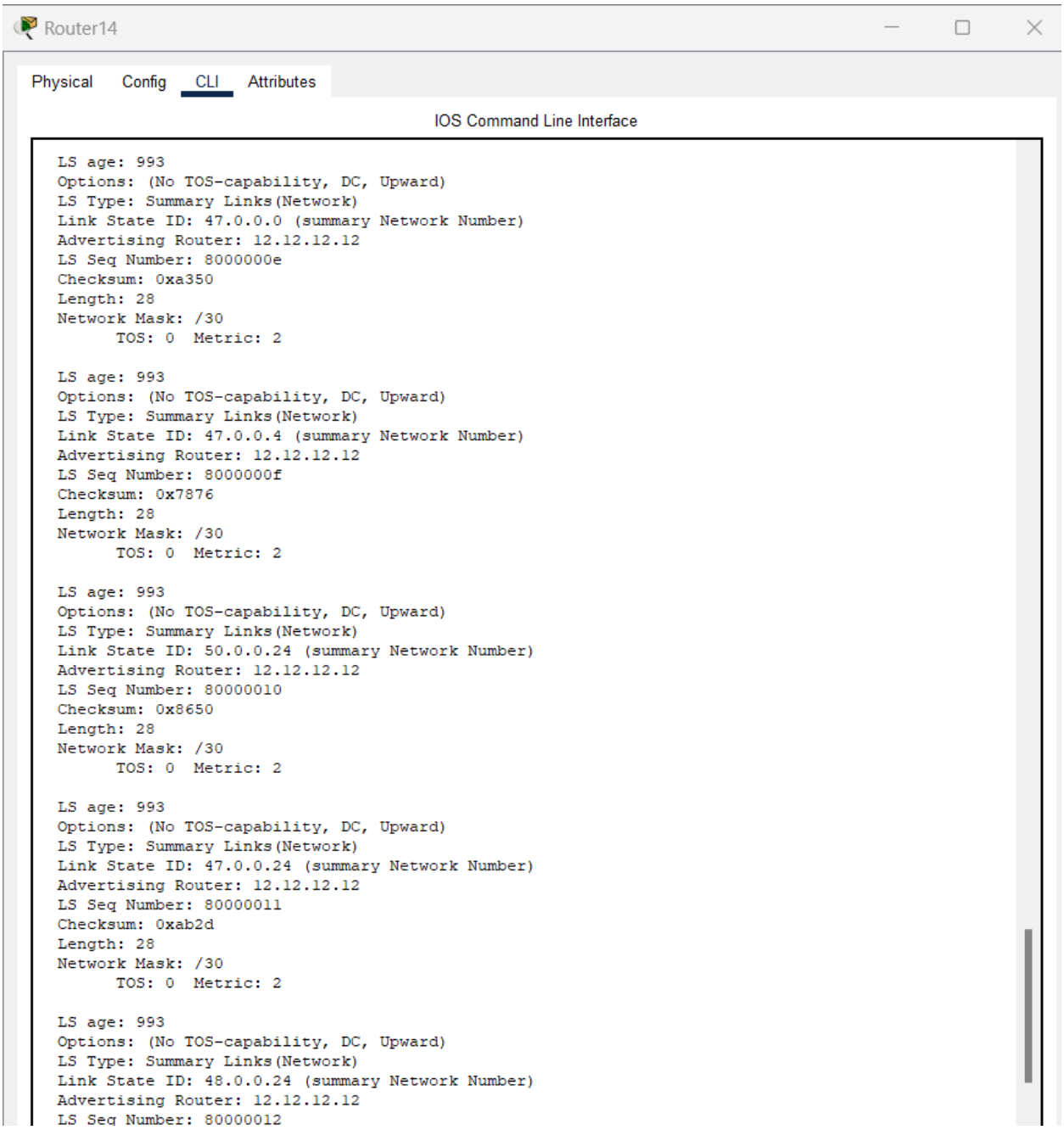
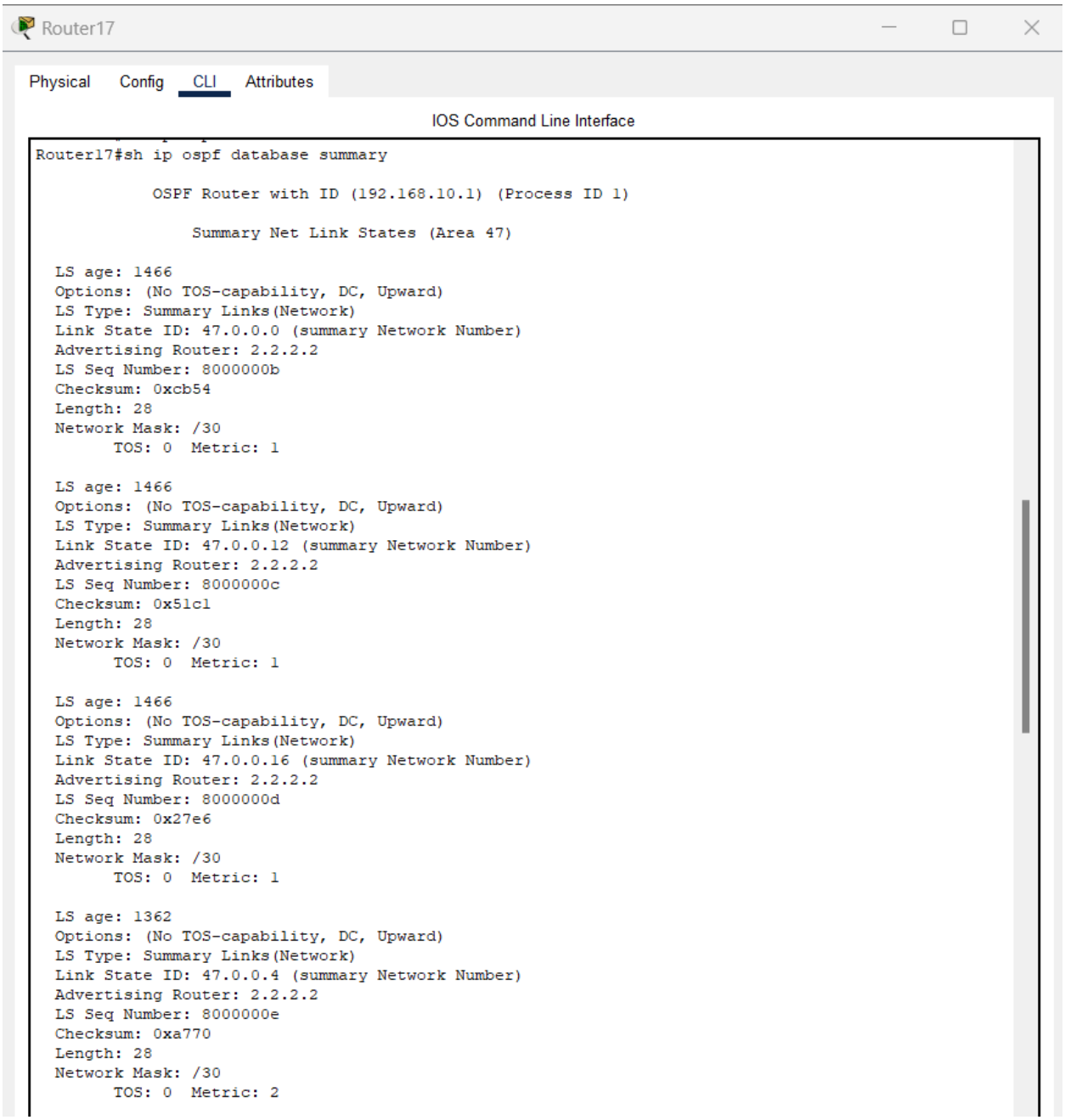


Figure 10 R14 Show ip ospf database summary

R17 Show ip ospf database summary

Figure 11 R17 Show ip ospf database summary


Router17
Physical
Config
CLI
Attributes
IOS Command Line Interface
Router17#sh ip ospf database summary
OSPF Router with ID (192.168.10.1) (Process ID 1)
Summary Net Link States (Area 47)
LS age: 1466
Options: (No TOS-capability, DC, Upward)
LS Type: Summary Links(Network)
Link State ID: 47.0.0.0 (summary Network Number)
Advertising Router: 2.2.2.2
LS Seq Number: 8000000b
Checksum: 0xcb54
Length: 28
Network Mask: /30
TOS: 0 Metric: 1
LS age: 1466
Options: (No TOS-capability, DC, Upward)
LS Type: Summary Links(Network)
Link State ID: 47.0.0.12 (summary Network Number)
Advertising Router: 2.2.2.2
LS Seq Number: 8000000c
Checksum: 0x51c1
Length: 28
Network Mask: /30
TOS: 0 Metric: 1
LS age: 1466
Options: (No TOS-capability, DC, Upward)
LS Type: Summary Links(Network)
Link State ID: 47.0.0.16 (summary Network Number)
Advertising Router: 2.2.2.2
LS Seq Number: 8000000d
Checksum: 0x27e6
Length: 28
Network Mask: /30
TOS: 0 Metric: 1
LS age: 1362
Options: (No TOS-capability, DC, Upward)
LS Type: Summary Links(Network)
Link State ID: 47.0.0.4 (summary Network Number)
Advertising Router: 2.2.2.2
LS Seq Number: 8000000e
Checksum: 0xa770
Length: 28
Network Mask: /30
TOS: 0 Metric: 2

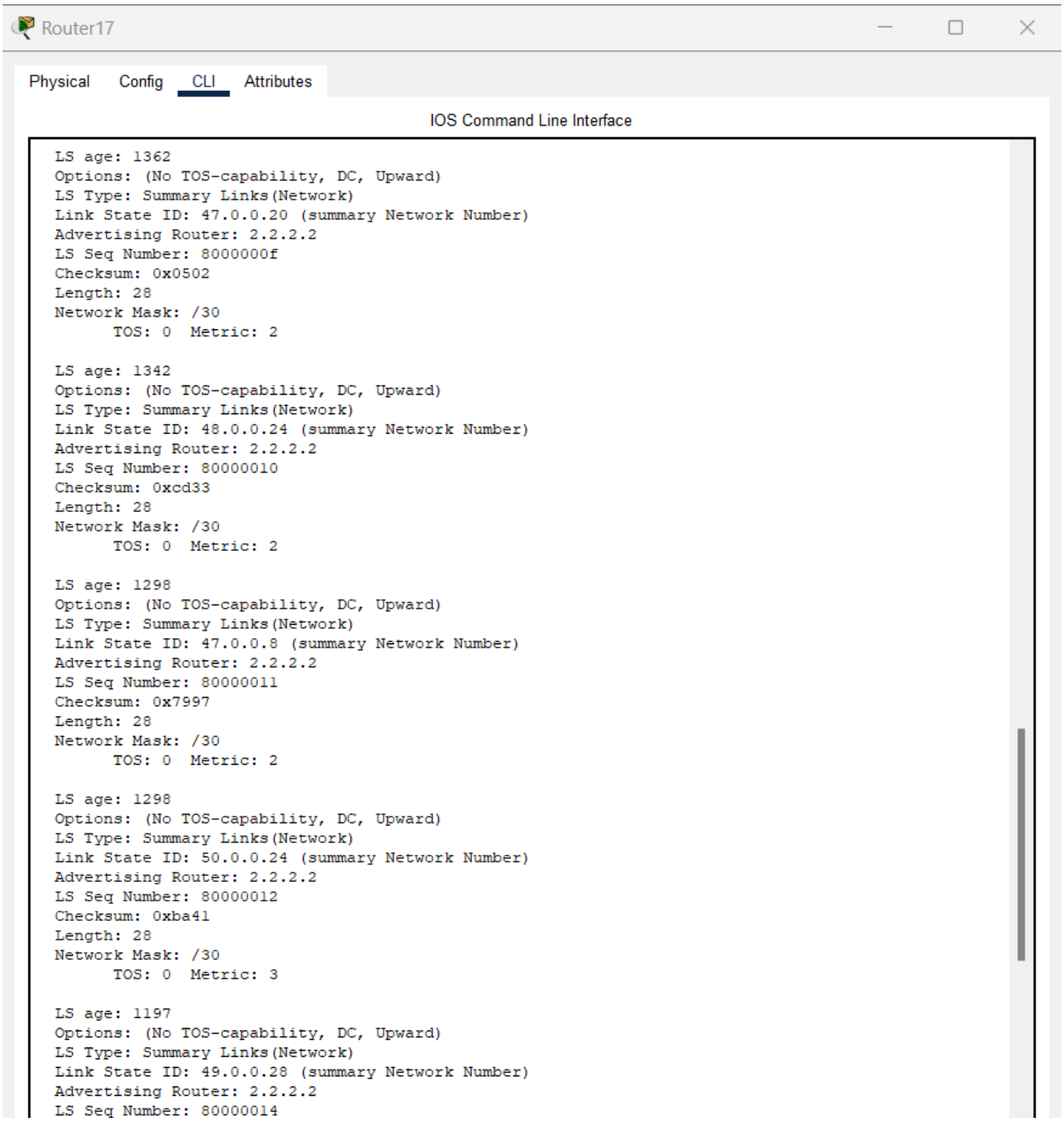


Figure 12 R17 Show ip ospf database summary

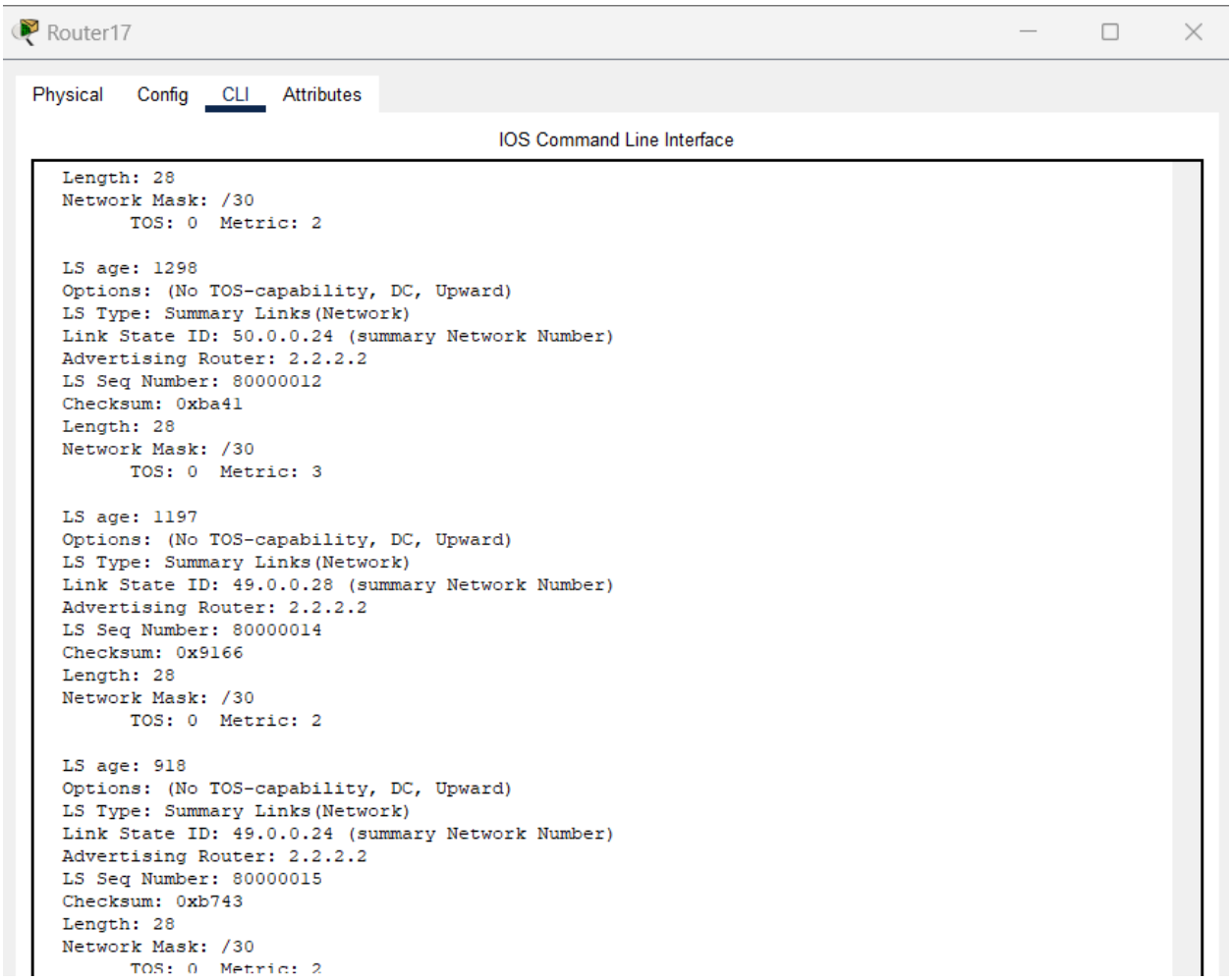


Figure 13 R17 Show ip ospf database summary

R12 Show ip ospf database summary

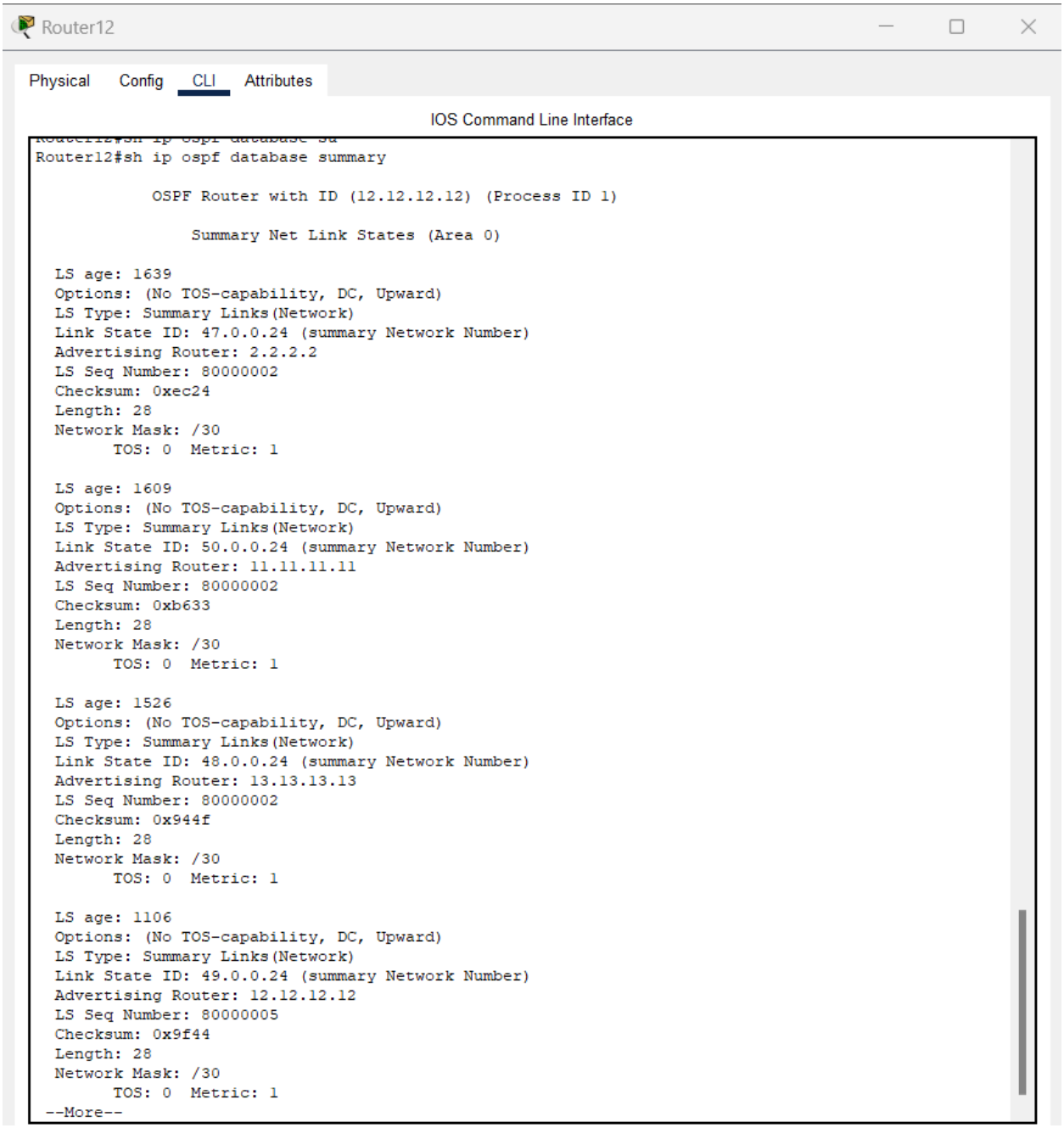


Figure 14 R12 Show ip ospf database summary

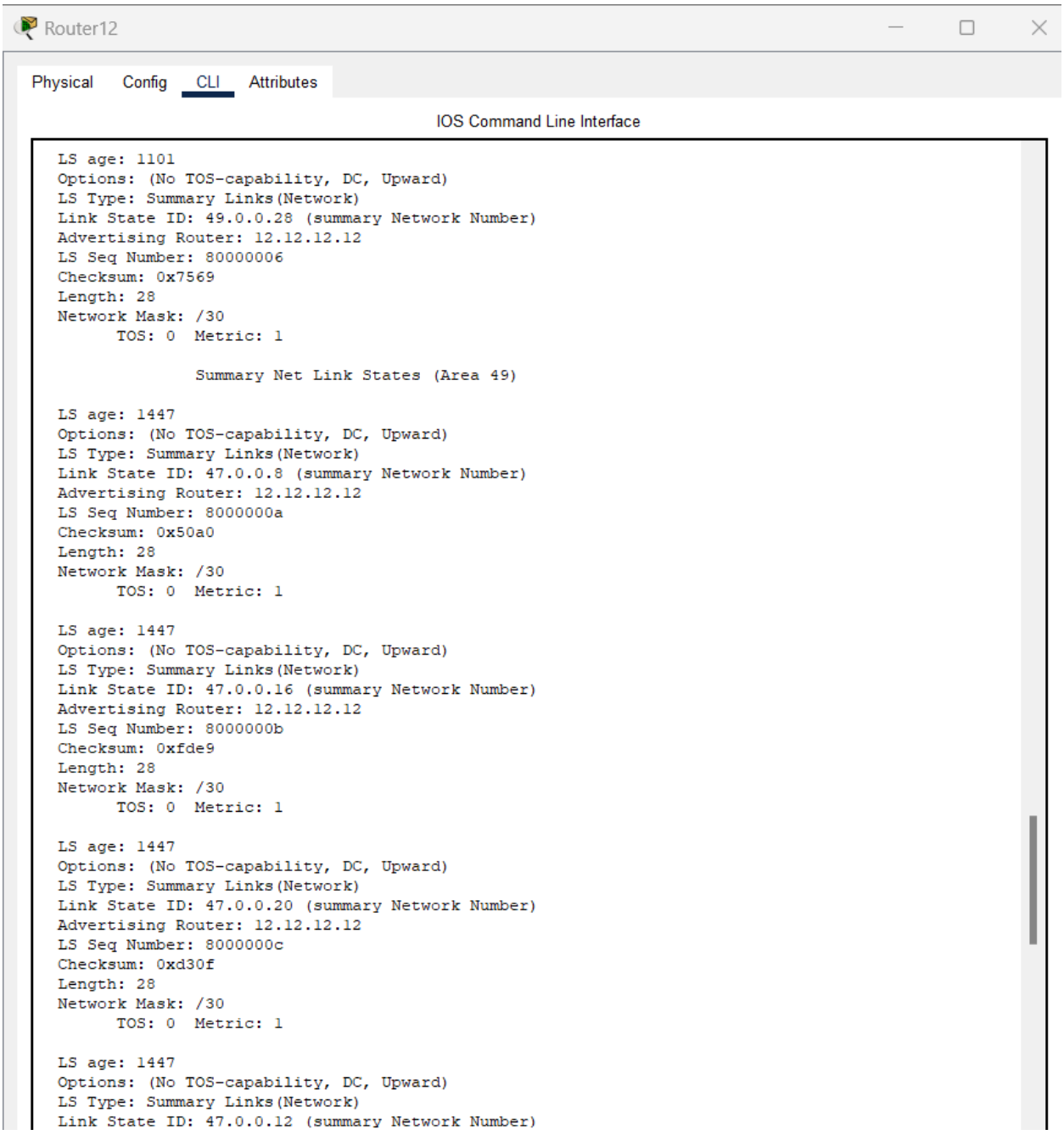


Figure 15 R12 Show ip ospf database summary

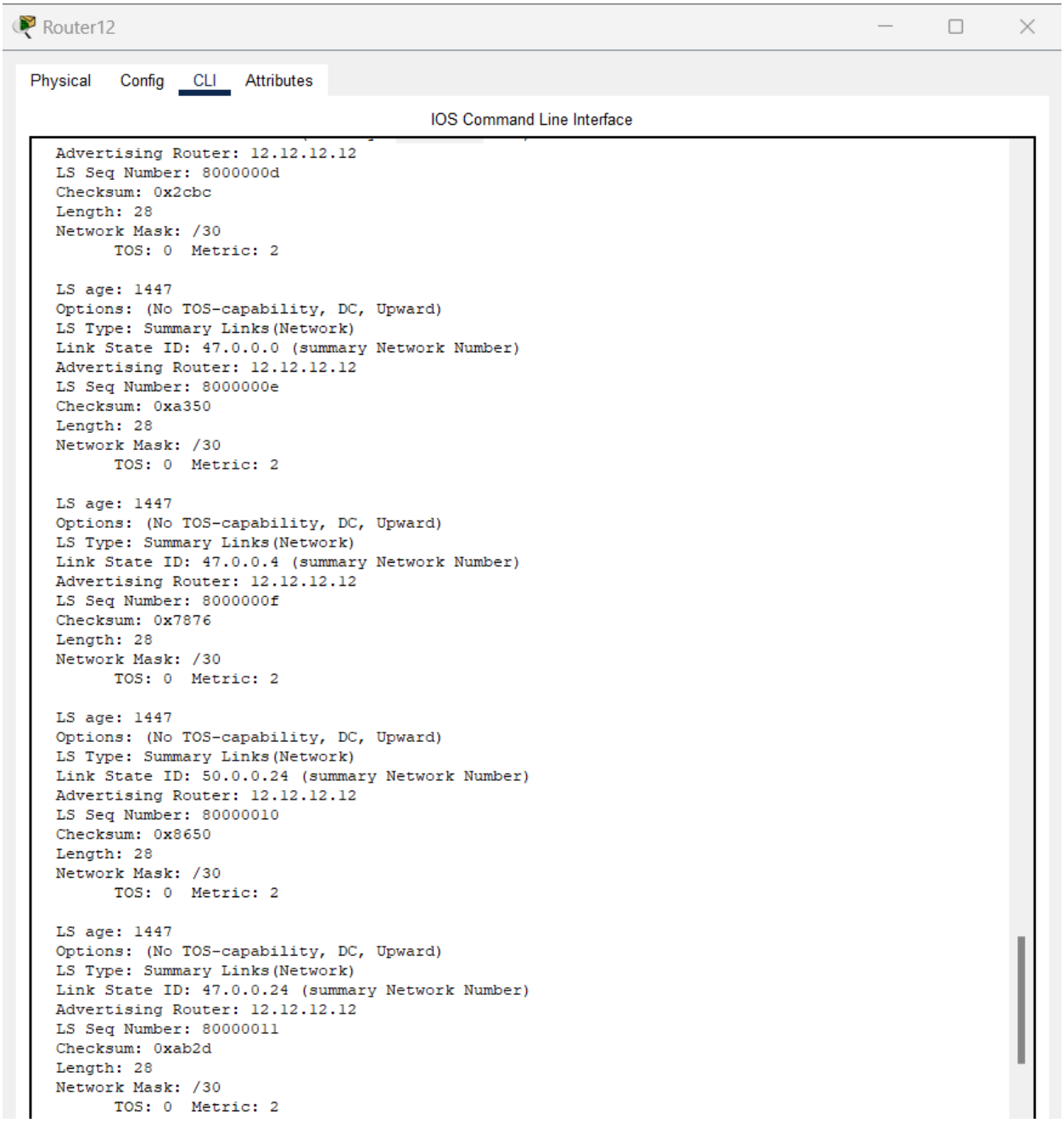


Figure 16 R12 Show ip ospf database summary

7. Chose the area type carefully and write the reason why have chosen it for each area.

Table 15 area names and addresses

Area 0		
Area 1 = Area 47		
47.0.0.24/30	47.0.0.25	47.0.0.26
Area 2 = Area 47+1 = Area 48		
48.0.0.24/30	48.0.0.25	48.0.0.26
Area 3 = Area x+2 = 47+2 = 49		
49.0.0.24/30	49.0.0.25	49.0.0.26
49.0.0.28/30	49.0.0.29	49.0.0.30
Area 4 = Area x+3 = 50		
50.0.0.24/30	50.0.0.25	50.0.0.26

cost from Router 14 to Router 17

8. Show the cost from Router 14 to Router 17 and show all the paths. Define which one is shorter. Do Q.8 with the default reference B/W and see if you have to change it, Explain.

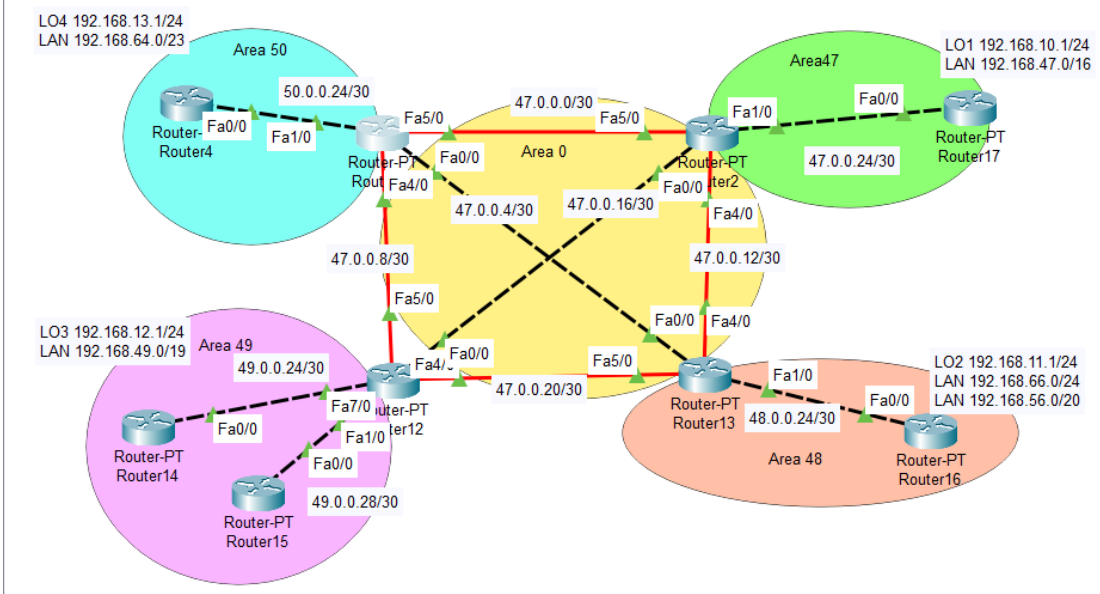


Figure 17 topology

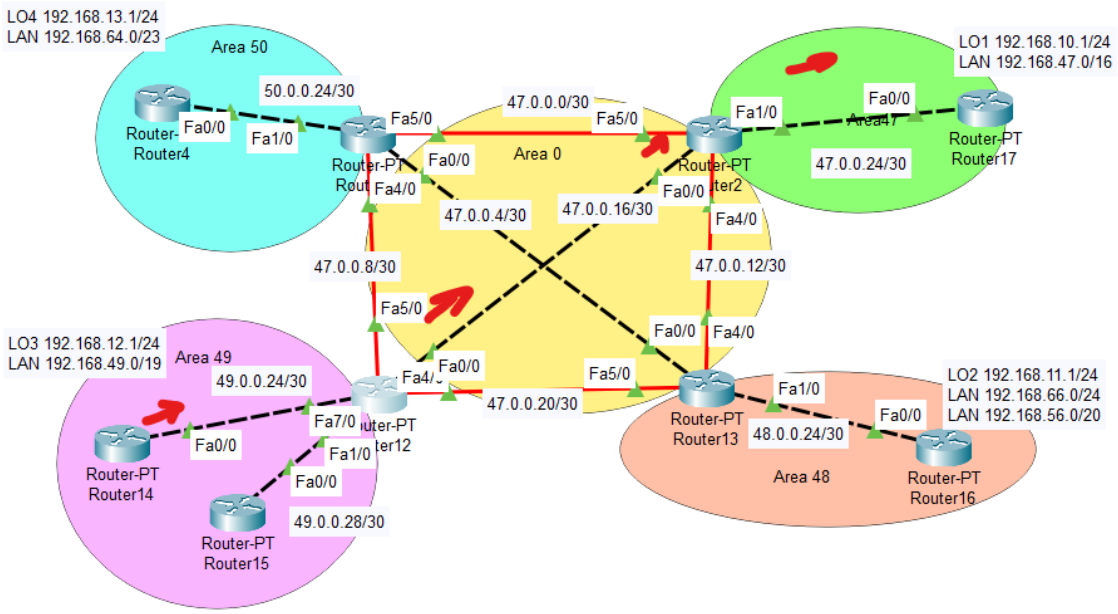


Figure 18 optimal path from R14 to R17

show ip ospf interface brief

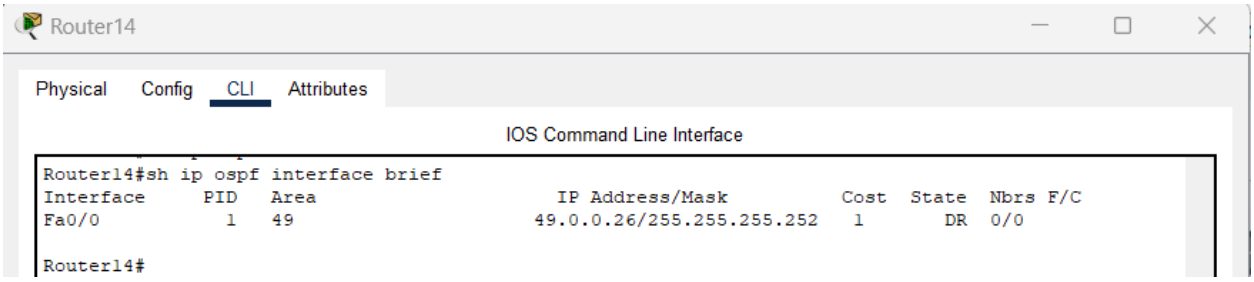


Figure 19 Router 14 show ip ospf interface brief

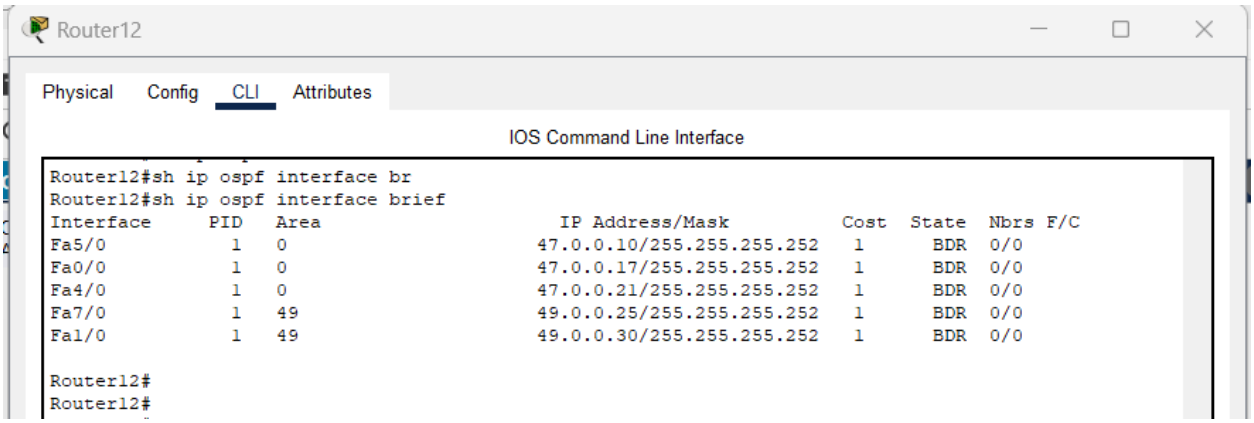


Figure 20 Router 12 show ip ospf interface brief

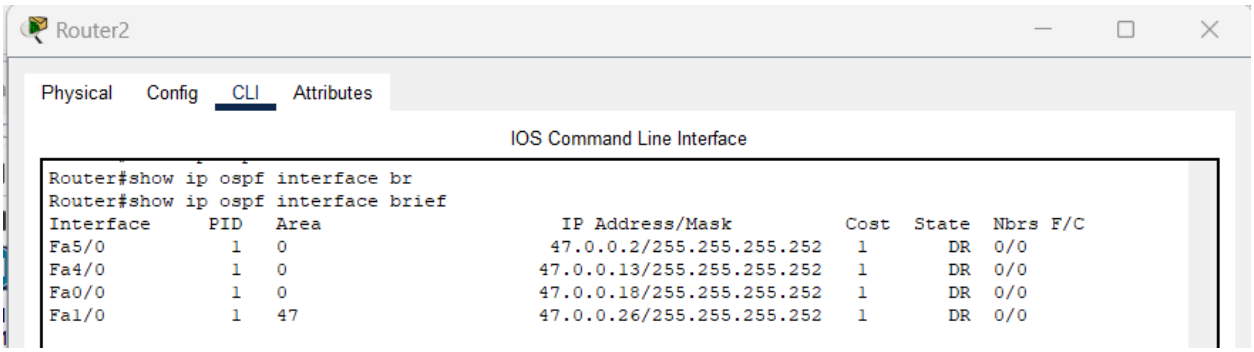


Figure 21 Router 2 show ip ospf interface brief

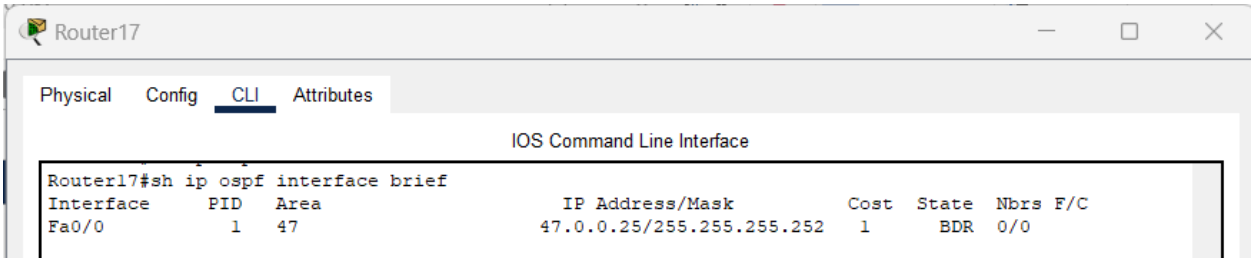


Figure 22 Router 17 show ip ospf interface brief

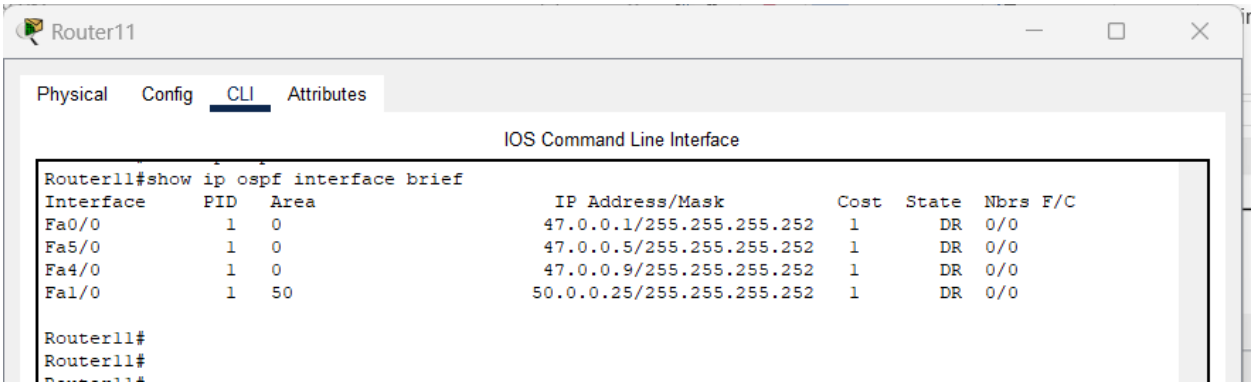


Figure 23 Router 11 show ip ospf interface brief

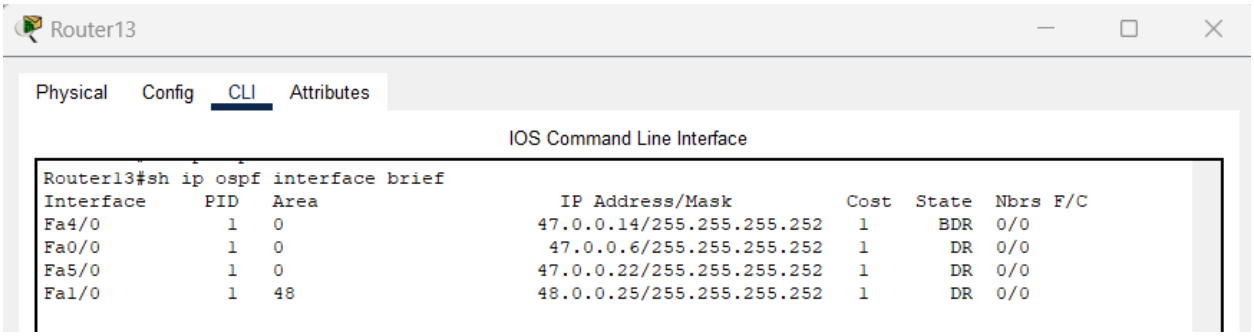


Figure 24 Router 13 show ip ospf interface brief

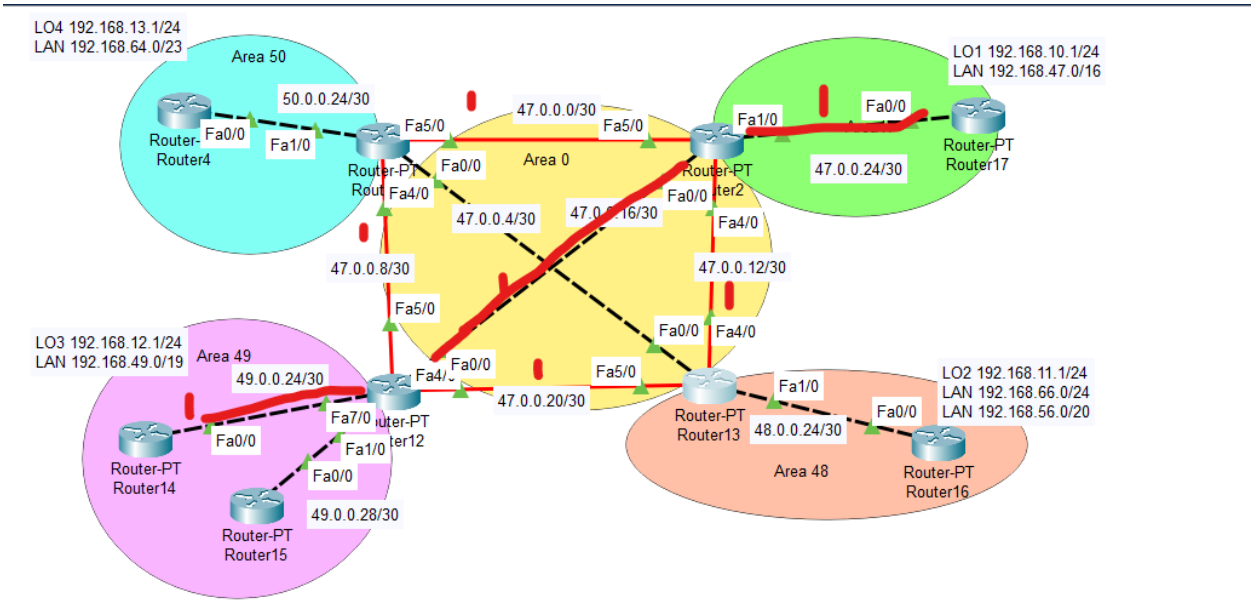


Figure 25 cost at each path

Shortest path from Router 14 to Router 17

R14 > R12 > R2 > R17 is the shortest path

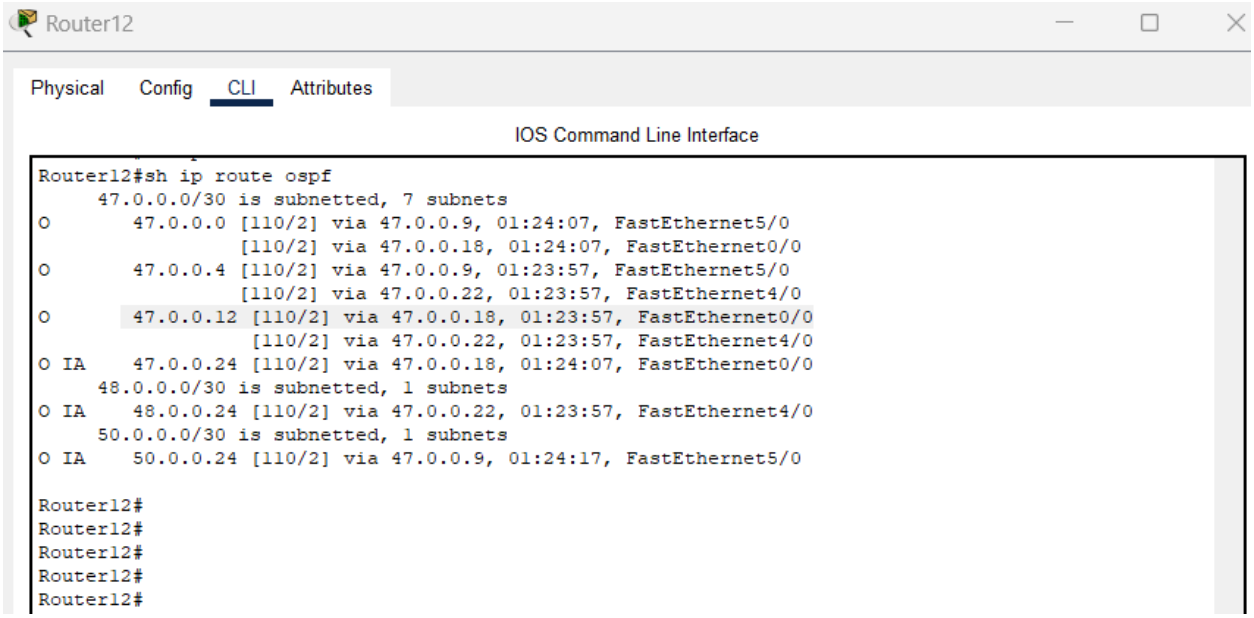


Figure 26 Router 12 show ip route ospf

Cost from Router 14 to Router 17

8. Show the cost from Router 14 to Router 17 with the default reference B/W and see if you have to change it, Explain.

All interfaces are fastEthernet which are equal all over this topology

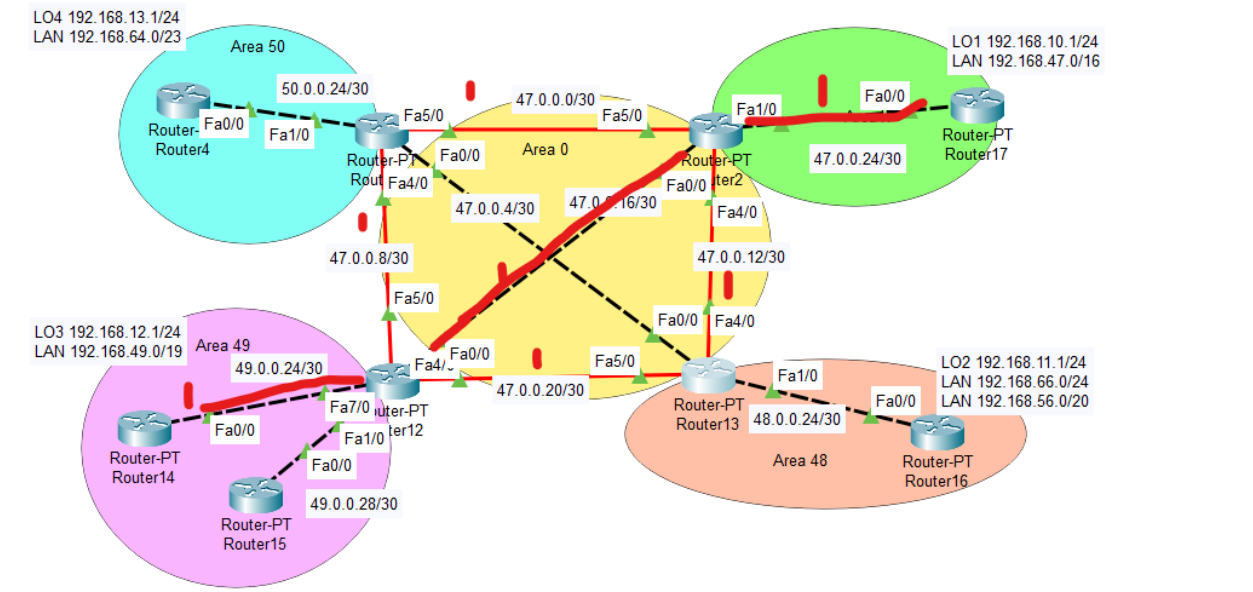


Figure 27 shortest path cost selection

R14 > R12 > R2 > R17 is the shortest path

This path remains the optimal path based on b/w

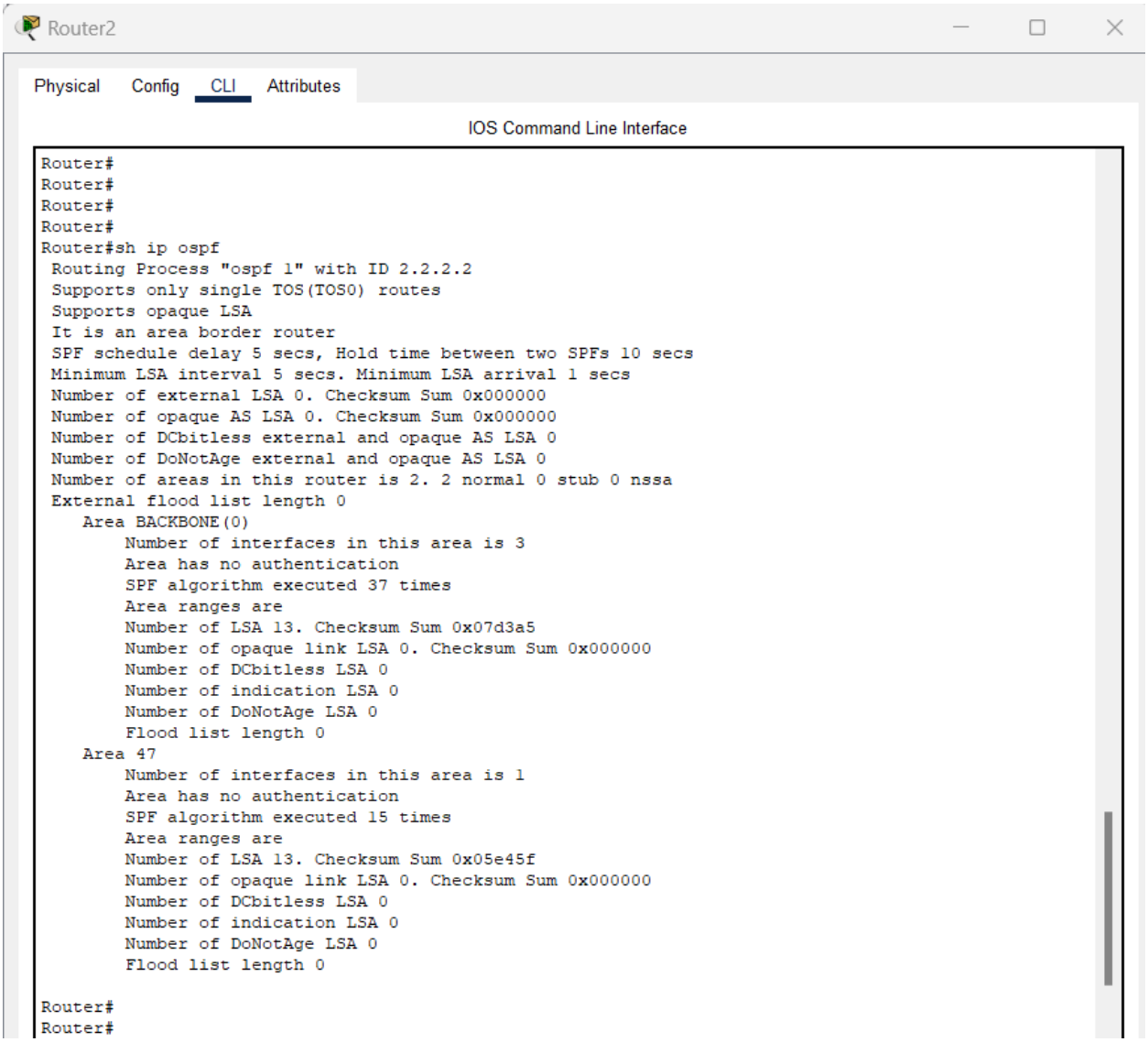


Figure 28 Router 2 show ip ospf

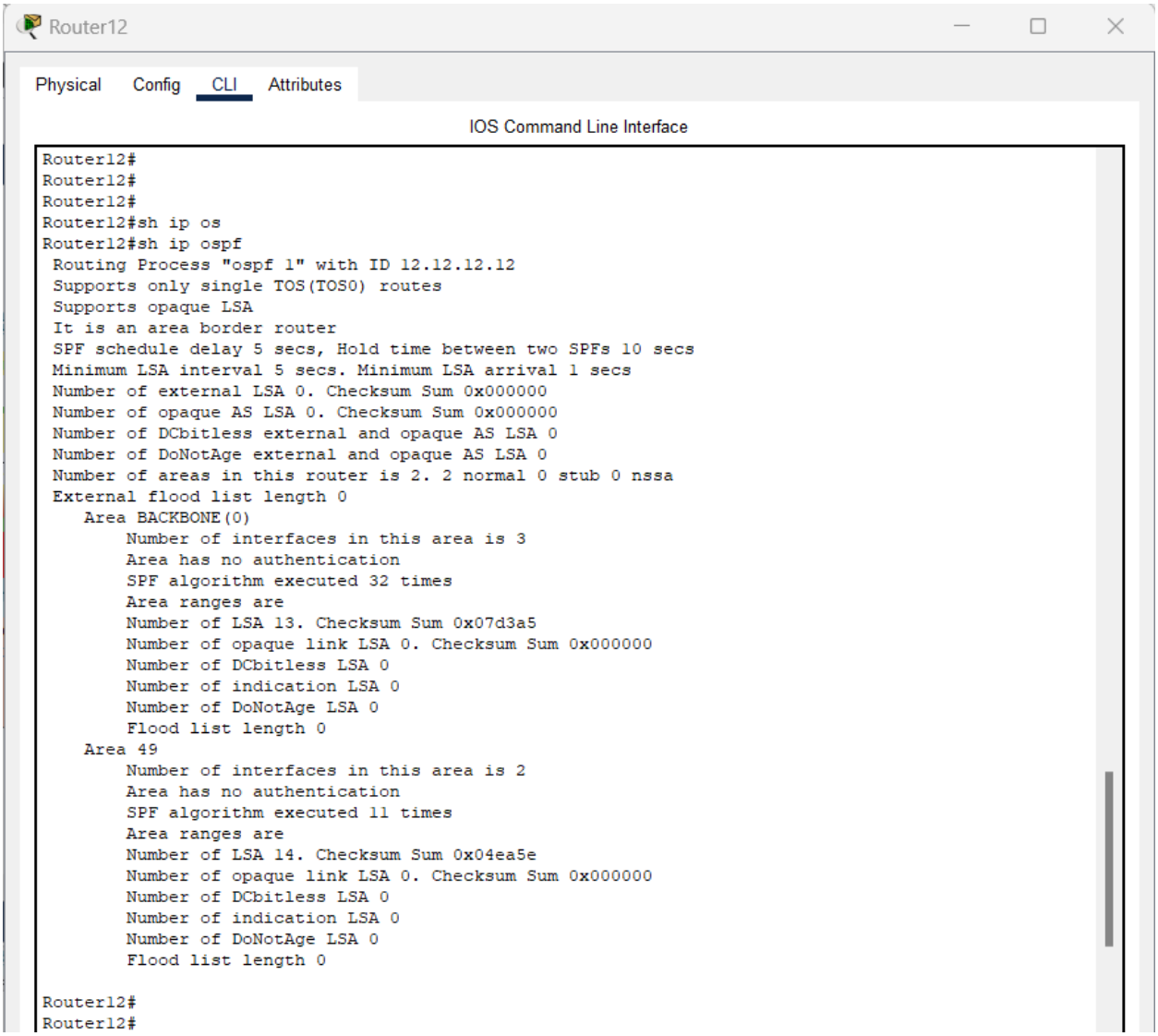


Figure 29 Router 12 show ip ospf

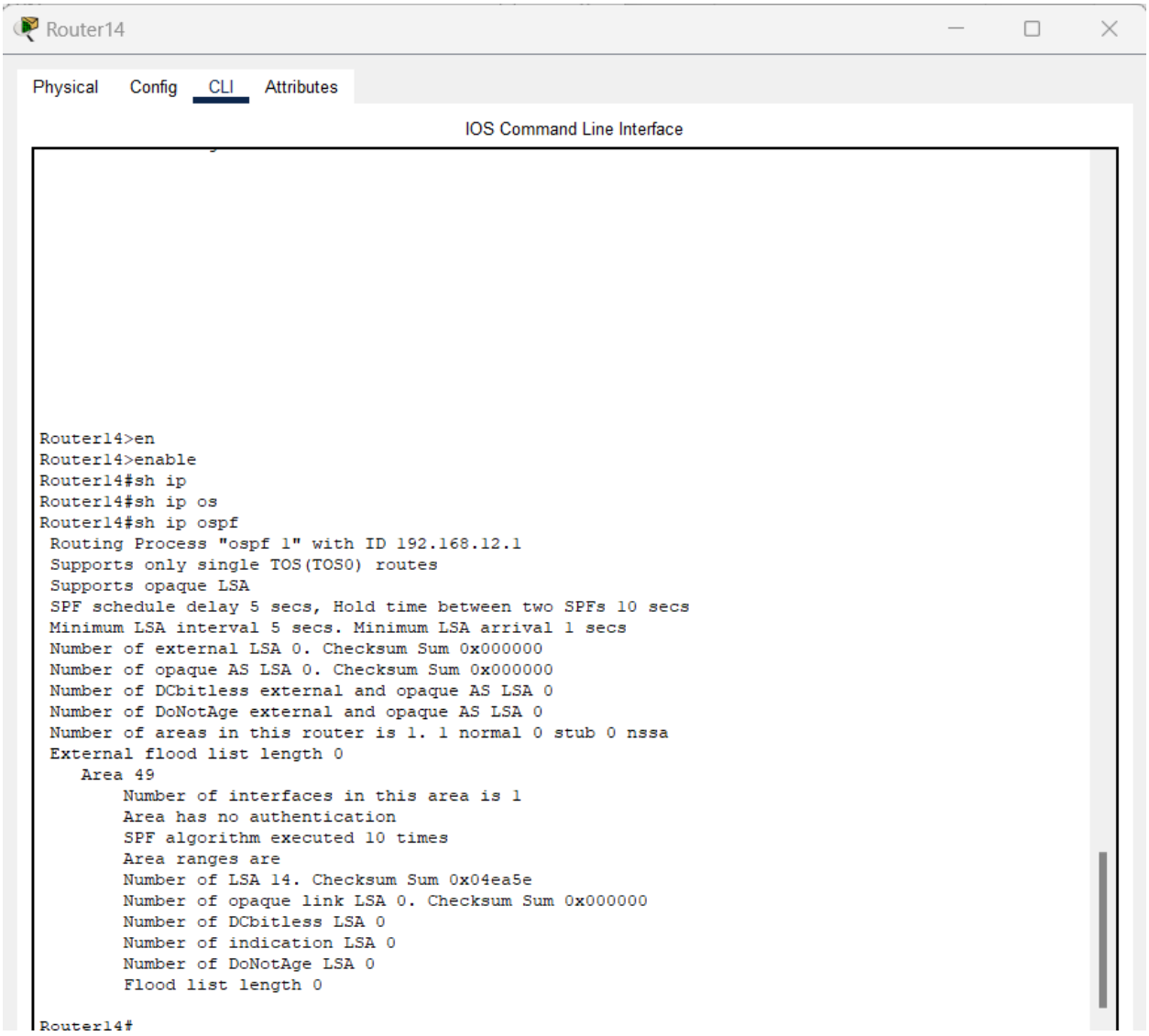


Figure 30 Router 14 show ip ospf

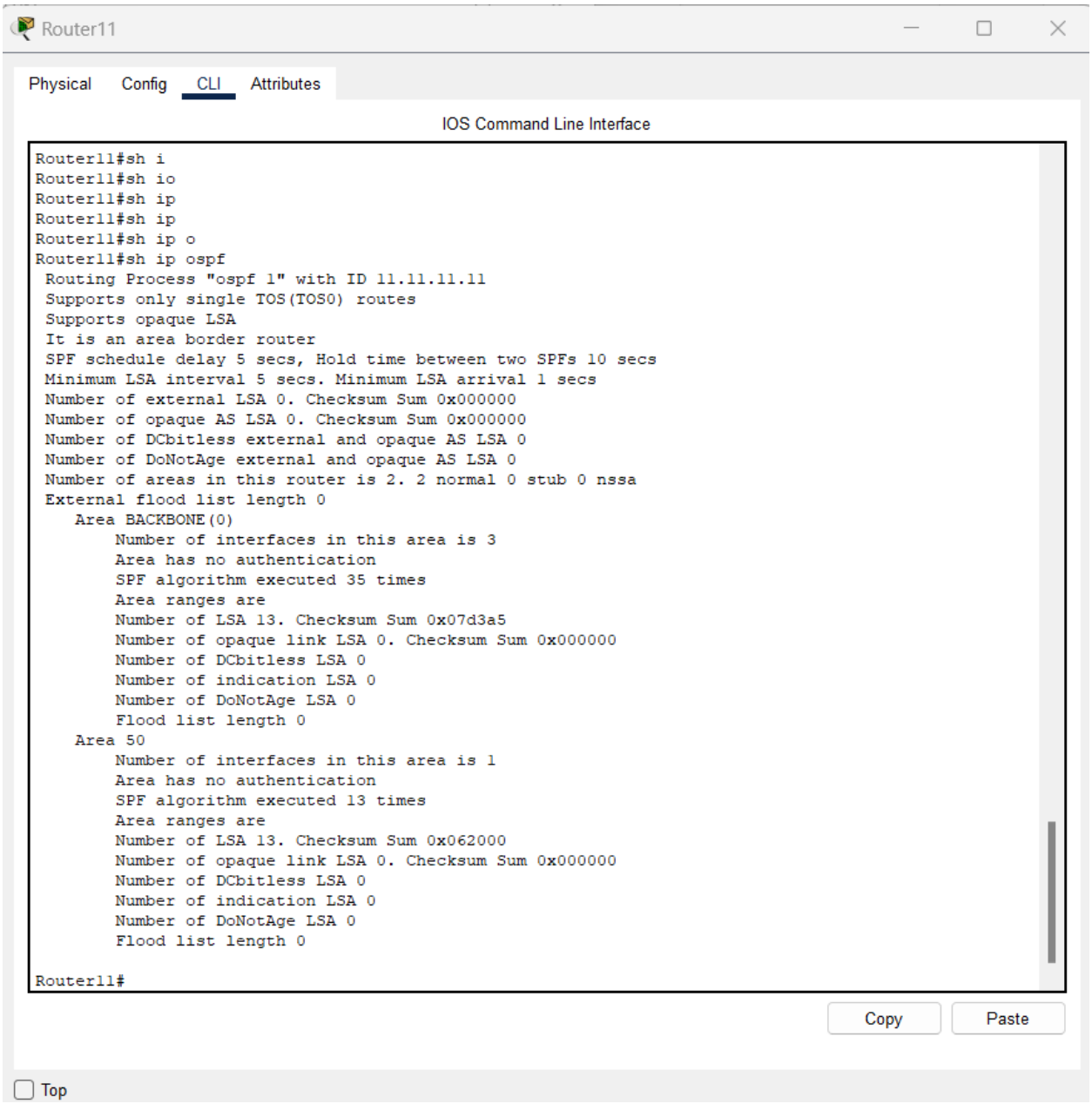


Figure 31 Router 11 show ip ospf

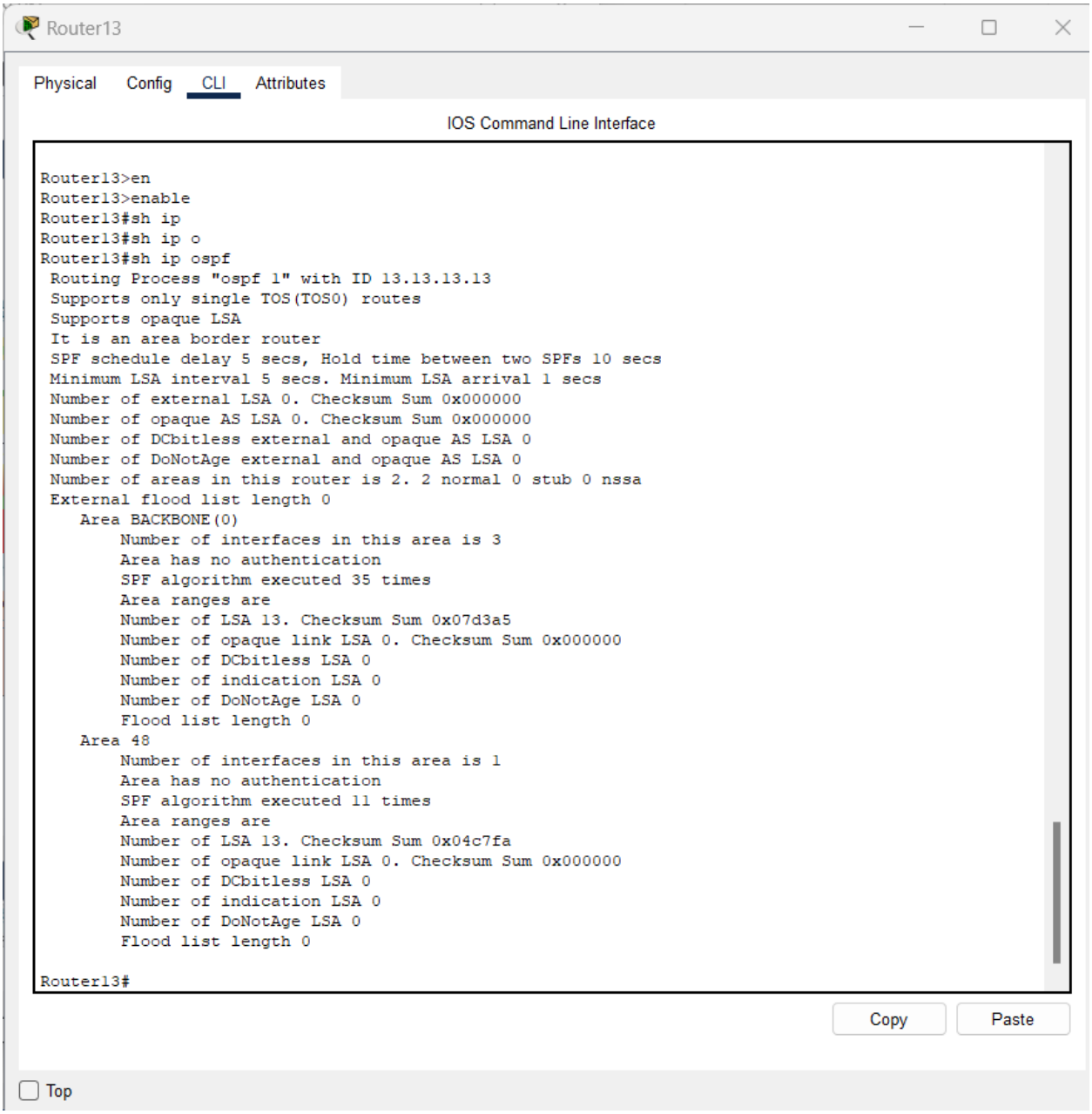


Figure 32 Router 13 show ip ospf

Router 11

```
Router11#show running-config
Building configuration...

Current configuration : 1048 bytes
!
version 12.2
```

```
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router11
!
!
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
interface FastEthernet0/0
ip address 47.0.0.1 255.255.255.252
duplex auto
speed auto
!
interface FastEthernet1/0
ip address 50.0.0.25 255.255.255.252
duplex auto
speed auto
!
interface Serial2/0
no ip address
clock rate 2000000
```

```
shutdown
!
interface Serial3/0
no ip address
clock rate 2000000
shutdown
!
interface FastEthernet4/0
ip address 47.0.0.9 255.255.255.252
!
interface FastEthernet5/0
ip address 47.0.0.5 255.255.255.252
!
interface Modem8/0
no ip address
!
interface Modem9/0
no ip address
!
router ospf 1
router-id 11.11.11.11
log-adjacency-changes
network 47.0.0.0 0.0.0.3 area 0
network 47.0.0.4 0.0.0.3 area 0
network 47.0.0.8 0.0.0.3 area 0
network 50.0.0.24 0.0.0.3 area 50
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
```

```
!
end


Router11#
```

Router 12

```
Router12#show running-config
Building configuration...

Current configuration : 1263 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router12
!
!
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
```

```
!
interface FastEthernet0/0
ip address 47.0.0.17 255.255.255.252
duplex auto
speed auto
!
interface FastEthernet1/0
ip address 49.0.0.30 255.255.255.252
duplex auto
speed auto
!
interface Serial2/0
no ip address
clock rate 2000000
shutdown
!
interface Serial3/0
no ip address
clock rate 2000000
shutdown
!
interface FastEthernet4/0
ip address 47.0.0.21 255.255.255.252
!
interface FastEthernet5/0
ip address 47.0.0.10 255.255.255.252
!
interface FastEthernet6/0
no ip address
duplex auto
speed auto
shutdown
!
interface FastEthernet7/0
ip address 49.0.0.25 255.255.255.252
duplex auto
speed auto
!
interface FastEthernet9/0
no ip address
duplex auto
speed auto
shutdown
!
router ospf 1
router-id 12.12.12.12
```

```
log-adjacency-changes
network 47.0.0.8 0.0.0.3 area 0
network 47.0.0.16 0.0.0.3 area 0
network 47.0.0.20 0.0.0.3 area 0
network 49.0.0.24 0.0.0.3 area 49
network 49.0.0.28 0.0.0.3 area 49
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end


Router12#
```

Router 2

```
Router#show running-config
Building configuration...

Current configuration : 1122 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
```

```
!
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
interface FastEthernet0/0
ip address 47.0.0.18 255.255.255.252
duplex auto
speed auto
!
interface FastEthernet1/0
ip address 47.0.0.26 255.255.255.252
duplex auto
speed auto
!
interface Serial2/0
no ip address
clock rate 2000000
shutdown
!
interface Serial3/0
no ip address
clock rate 2000000
shutdown
```

```
!
interface FastEthernet4/0
ip address 47.0.0.13 255.255.255.252
!
interface FastEthernet5/0
ip address 47.0.0.2 255.255.255.252
!
interface Ethernet8/0
no ip address
duplex auto
speed auto
shutdown
!
interface Ethernet9/0
no ip address
duplex auto
speed auto
shutdown
!
router ospf 1
router-id 2.2.2.2
log-adjacency-changes
network 47.0.0.0 0.0.0.3 area 0
network 47.0.0.12 0.0.0.3 area 0
network 47.0.0.16 0.0.0.3 area 0
network 47.0.0.24 0.0.0.3 area 47
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
```

```
!
end


Router#
```

Router 13

```
Router13#show running-config
Building configuration...

Current configuration : 1128 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router13
!
!
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
```

```
!
interface FastEthernet0/0
ip address 47.0.0.6 255.255.255.252
duplex auto
speed auto
!
interface FastEthernet1/0
ip address 48.0.0.25 255.255.255.252
duplex auto
speed auto
!
interface Serial2/0
no ip address
clock rate 2000000
shutdown
!
interface Serial3/0
no ip address
clock rate 2000000
shutdown
!
interface FastEthernet4/0
ip address 47.0.0.14 255.255.255.252
!
interface FastEthernet5/0
ip address 47.0.0.22 255.255.255.252
!
interface Ethernet8/0
no ip address
duplex auto
speed auto
shutdown
!
interface Ethernet9/0
no ip address
duplex auto
speed auto
shutdown
!
router ospf 1
router-id 13.13.13.13
log-adjacency-changes
network 47.0.0.12 0.0.0.3 area 0
network 47.0.0.4 0.0.0.3 area 0
network 47.0.0.20 0.0.0.3 area 0
network 48.0.0.24 0.0.0.3 area 48
```

```
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end


Router13#
```

Router 4

```
Router#sh run
Building configuration...

Current configuration : 960 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
```

```
ip dhcp pool router4
network 192.168.48.0 255.255.254.0
default-router 192.168.64.1
!
!
!
ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
interface Loopback4
ip address 192.168.13.1 255.255.255.0
!
interface FastEthernet0/0
ip address 50.0.0.26 255.255.255.252
duplex auto
speed auto
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
!
interface Serial2/0
no ip address
clock rate 2000000
shutdown
!
interface Serial3/0
```

```
no ip address
clock rate 2000000
shutdown
!
interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
shutdown
!
router ospf 1
log-adjacency-changes
network 50.0.0.24 0.0.0.3 area 50
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end


Router#
```

Router 17

```
Router17#sh run
Building configuration...
```

```
Current configuration : 959 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router17
!
!
!
!
!
ip dhcp pool router17
network 192.168.0.0 255.255.0.0
default-router 192.168.0.1
!
!
!
ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
interface Loopback1
ip address 192.168.10.1 255.255.255.0
!
interface FastEthernet0/0
ip address 47.0.0.25 255.255.255.252
duplex auto
speed auto
```

```
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
!
interface Serial2/0
no ip address
clock rate 2000000
shutdown
!
interface Serial3/0
no ip address
clock rate 2000000
shutdown
!
interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
shutdown
!
router ospf 1
log-adjacency-changes
network 47.0.0.24 0.0.0.3 area 47
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
```

```
!
!
!
end


Router17#
```

Router 16

```
Router16#sh run
Building configuration...

Current configuration : 1052 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router16
!
!
!
!
!
ip dhcp pool router16
network 192.168.66.0 255.255.255.0
default-router 192.168.66.1
ip dhcp pool router16-2
network 192.168.48.0 255.255.240.0
default-router 192.168.16.1
!
!
!
ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
```

```
!
!
!
!
!
!
!
!
!
interface Loopback2
ip address 192.168.11.1 255.255.255.0
!
interface FastEthernet0/0
ip address 48.0.0.26 255.255.255.252
duplex auto
speed auto
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
!
interface Serial2/0
no ip address
clock rate 2000000
shutdown
!
interface Serial3/0
no ip address
clock rate 2000000
shutdown
!
interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
shutdown
!
router ospf 1
log-adjacency-changes
network 48.0.0.24 0.0.0.3 area 48
!
ip classless
```

```
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end


Router16#
```

Router 15

```
Router15#sh run
Building configuration...

Current configuration : 815 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router15
!
!
!
!
!
!
!
!
ip cef
```

```
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
interface FastEthernet0/0
ip address 49.0.0.29 255.255.255.252
duplex auto
speed auto
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
!
interface Serial2/0
no ip address
clock rate 2000000
shutdown
!
interface Serial3/0
no ip address
clock rate 2000000
shutdown
!
interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
```

```
shutdown
!
router ospf 1
log-adjacency-changes
network 49.0.0.28 0.0.0.3 area 49
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end


Router15#
```

Router 14

```
Router14#sh run
Router14#sh running-config
Building configuration...

Current configuration : 1052 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router14
!
```

```
!
!
!
!
ip dhcp pool router14
network 192.168.32.0 255.255.224.0
default-router 192.168.32.1
ip dhcp pool router14-2
network 192.168.31.0 255.255.255.0
default-router 192.168.31.1
!
!
!
ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
interface Loopback3
ip address 192.168.12.1 255.255.255.0
!
interface FastEthernet0/0
ip address 49.0.0.26 255.255.255.252
duplex auto
speed auto
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
```

```
!
interface Serial2/0
no ip address
clock rate 2000000
shutdown
!
interface Serial3/0
no ip address
clock rate 2000000
shutdown
!
interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
shutdown
!
router ospf 1
log-adjacency-changes
network 49.0.0.24 0.0.0.3 area 49
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end
```

```
Router14#
```