

CO323 - Lab 04
Dynamic Routing - OSPF

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1. Explain the terms DR and BDR. What are the criteria/parameters used during the election of DR and BDR within an OSPF network?

-OSPF configured networks share the information about their link states with LSAs. If one change such as breaking of a link or one router shut offs , then all of the routers try to send that information to all the other routers. This can be messy and can make a LSA flood. To resolve this issue two special routers called DR and BDR are selected in the network.

-DR(Designated Router): collection and distribution point for LSAs sent and received.

-BDR(Backup Designated Router): Do the same job that the DR does in the event where DR fails.

-There are two main parameters to elect the DR and BDR of a network.

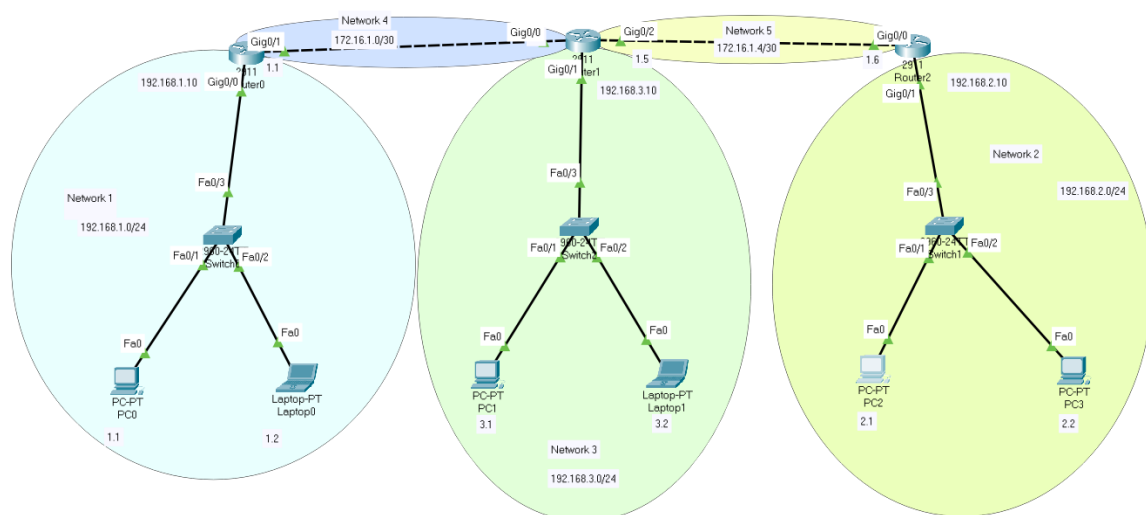
1.Routers with the highest and second highest OSPF interface priority get to be the DR and BDR. By default , all the routers have the same priority of 1.

2.Routers with the highest ip address selects the DR and BDR. This happens when the priority of the routers are the same.

A. Configure OSPF

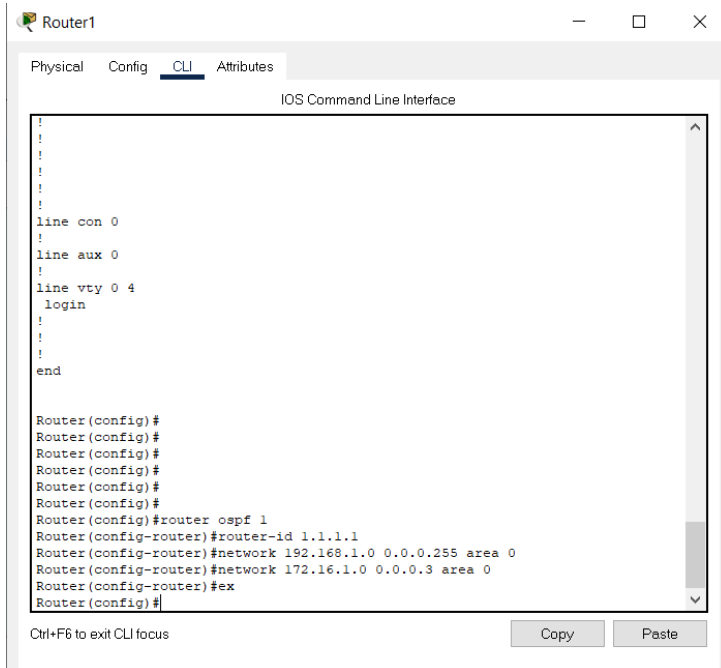
a. Draw the topology given in Figure 01, in Packet Tracer using appropriate networking and end devices.

b. Assign IP addresses to each PC/router ports considering Table 01



c. Configure OSPF in each of the routers accordingly (Configure each router with router ID or loopback IP addresses according to the data provided in Table 02)

*Router 1:



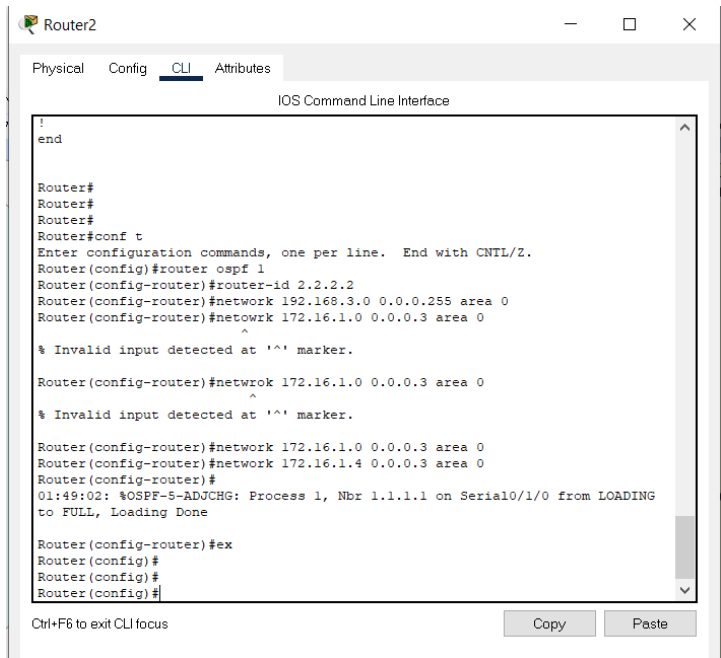
The screenshot shows a window titled "Router1" with tabs for Physical, Config, CLI, and Attributes. The CLI tab is active, displaying the "IOS Command Line Interface". The configuration text is as follows:

```
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end

Router(config)#
Router(config)#
Router(config)#
Router(config)#
Router(config)#
Router(config)#
Router(config)#router ospf 1
Router(config-router)#router-id 1.1.1.1
Router(config-router)#network 192.168.1.0 0.0.0.255 area 0
Router(config-router)#network 172.16.1.0 0.0.0.3 area 0
Router(config-router)#ex
Router(config)#
```

At the bottom of the window, there is a text label "Ctrl+F6 to exit CLI focus" and two buttons: "Copy" and "Paste".

*Router 2:



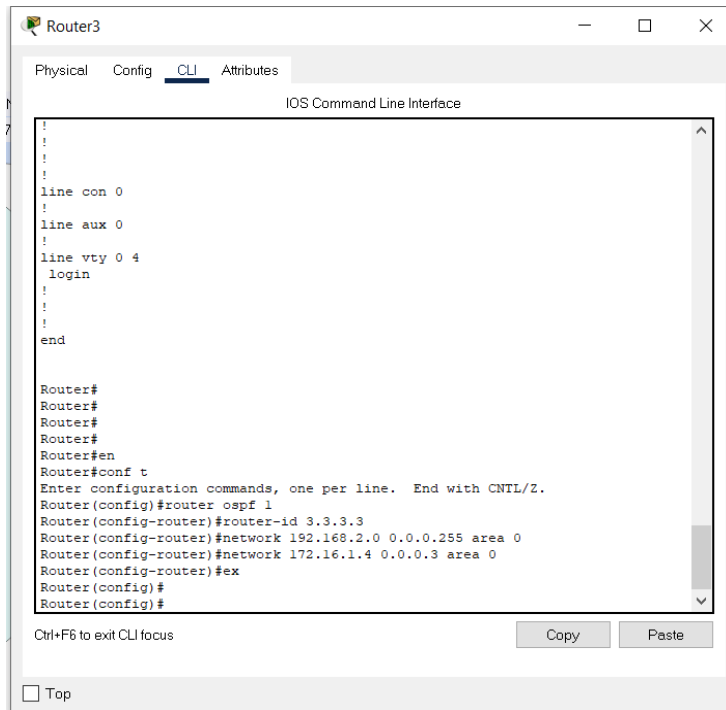
The screenshot shows a window titled "Router2" with tabs for Physical, Config, CLI, and Attributes. The CLI tab is active, displaying the "IOS Command Line Interface". The configuration text is as follows:

```
!
end

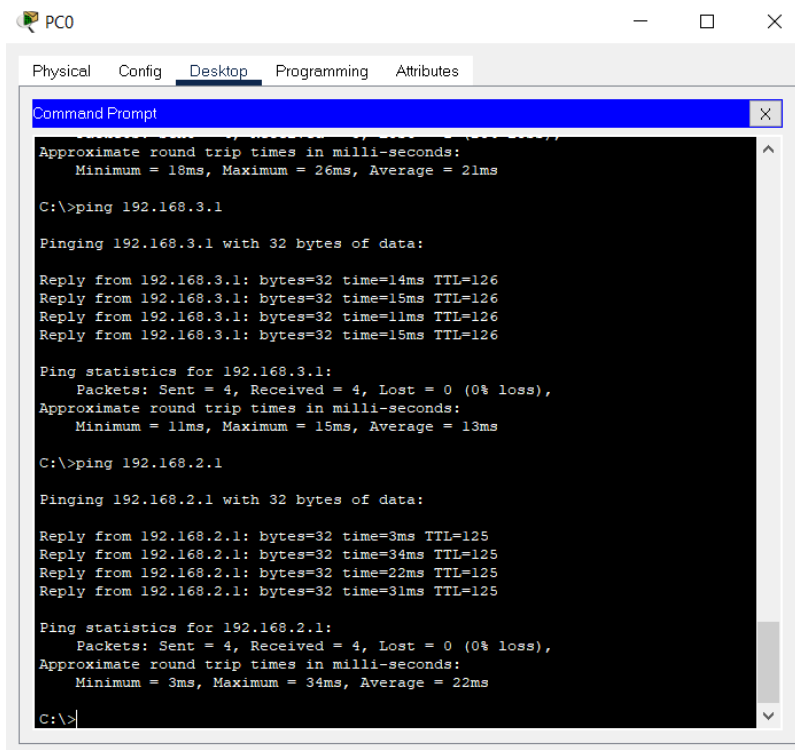
Router#
Router#
Router#
Router#conf t
Enter configuration commands, one per line. End with CNIL/Z.
Router(config)#router ospf 1
Router(config-router)#router-id 2.2.2.2
Router(config-router)#network 192.168.3.0 0.0.0.255 area 0
Router(config-router)#netowrk 172.16.1.0 0.0.0.3 area 0
^
% Invalid input detected at '^' marker.
Router(config-router)#netwrok 172.16.1.0 0.0.0.3 area 0
^
% Invalid input detected at '^' marker.
Router(config-router)#network 172.16.1.0 0.0.0.3 area 0
Router(config-router)#network 172.16.1.4 0.0.0.3 area 0
Router(config-router)#
01:49:02: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on Serial0/1/0 from LOADING
to FULL, Loading Done
Router(config-router)#ex
Router(config)#
Router(config)#
Router(config)#
```

At the bottom of the window, there is a text label "Ctrl+F6 to exit CLI focus" and two buttons: "Copy" and "Paste".

*Router 3



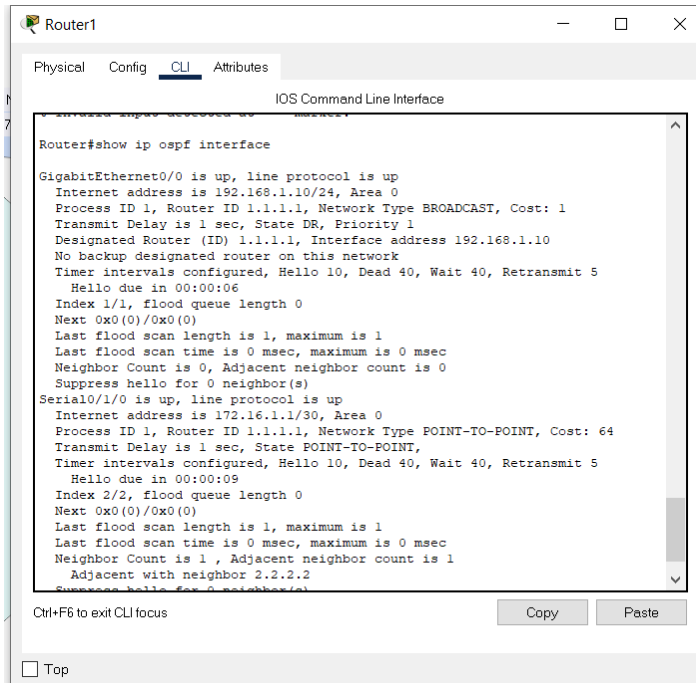
d. Ping from one of the PCs in network 1 to another PCs in network 2 and 3.



B. Network Verification

a. Use following commands to verify the implemented OSPF network. Include CLI screenshots for each command and mention what kind of information you have been retrieved via each command briefly.

i. #show ip ospf interfaces



```
Router1
Physical Config CLI Attributes
IOS Command Line Interface

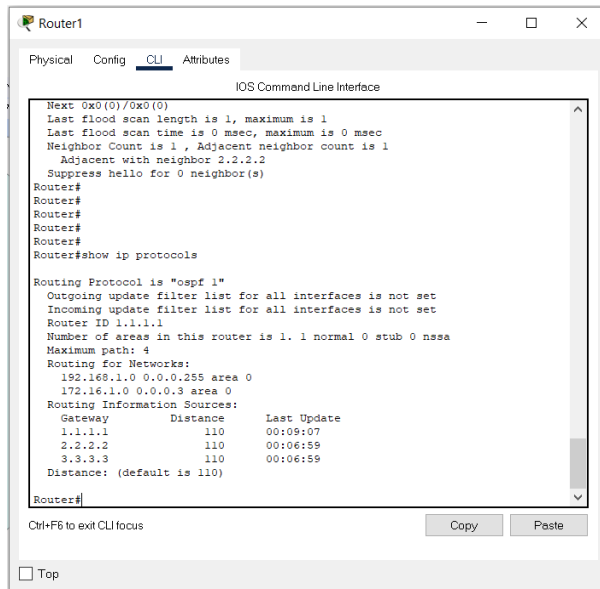
Router#show ip ospf interface

GigabitEthernet0/0 is up, line protocol is up
 Internet address is 192.168.1.10/24, Area 0
 Process ID 1, Router ID 1.1.1.1, Network Type BROADCAST, Cost: 1
 Transmit Delay is 1 sec, State DR, Priority 1
 Designated Router (ID) 1.1.1.1, Interface address 192.168.1.10
 No backup designated router on this network
 Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Hello due in 00:00:06
 Index 1/1, flood queue length 0
 Next 0x0(0)/0x0(0)
 Last flood scan length is 1, maximum is 1
 Last flood scan time is 0 msec, maximum is 0 msec
 Neighbor Count is 0, Adjacent neighbor count is 0
 Suppress hello for 0 neighbor(s)

Serial0/1/0 is up, line protocol is up
 Internet address is 172.16.1.1/30, Area 0
 Process ID 1, Router ID 1.1.1.1, Network Type POINT-TO-POINT, Cost: 64
 Transmit Delay is 1 sec, State POINT-TO-POINT,
 Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Hello due in 00:00:09
 Index 2/2, flood queue length 0
 Next 0x0(0)/0x0(0)
 Last flood scan length is 1, maximum is 1
 Last flood scan time is 0 msec, maximum is 0 msec
 Neighbor Count is 1, Adjacent neighbor count is 1
  Adjacent with neighbor 2.2.2.2
 Suppress hello for 0 neighbor(s)
```

- We can use this command to get the general ospf network information.
- We can get each ip assigned to each interface of the router, area number, router id , state(DR,BDR or DRouter) ,DR router id, BDR router id , Hello message timer intervals.

ii. #show ip protocols



```
Router1
Physical Config CLI Attributes
IOS Command Line Interface

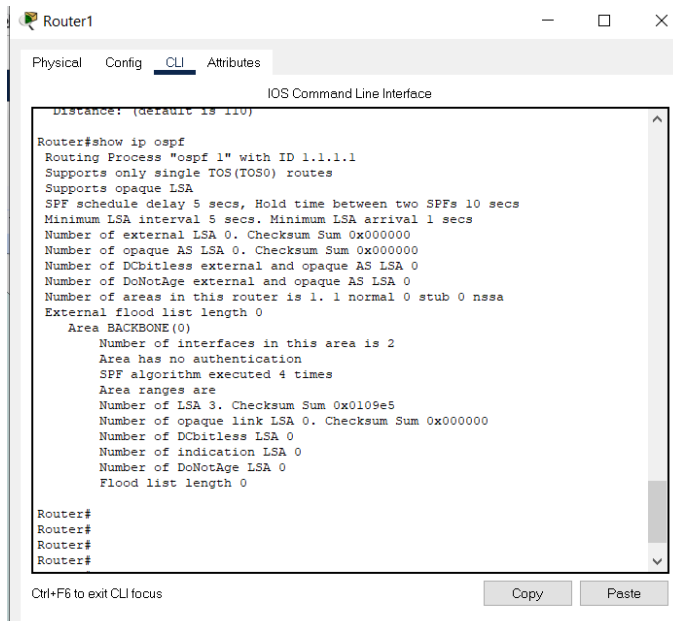
Next 0x0(0)/0x0(0)
Last flood scan length is 1, maximum is 1
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 1 , Adjacent neighbor count is 1
Adjacent with neighbor 2.2.2.2
Suppress hello for 0 neighbor(s)
Router#
Router#
Router#
Router#
Router#
Router#show ip protocols

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 1.1.1.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    172.16.1.0 0.0.0.3 area 0
  Routing Information Sources:
    Gateway         Distance      Last Update
    1.1.1.1          110          00:09:07
    2.2.2.2          110          00:06:59
    3.3.3.3          110          00:06:59
  Distance: (default is 110)

Router#
```

-This command can be used to get the currently configured dynamic routing protocol information of the router. We can see the priority id of the ospf protocol , router id, routing networks which are associated with the router , distances to each router and their router ids, last update time.

iii. #show ip ospf



```
Router1
Physical Config CLI Attributes
IOS Command Line Interface

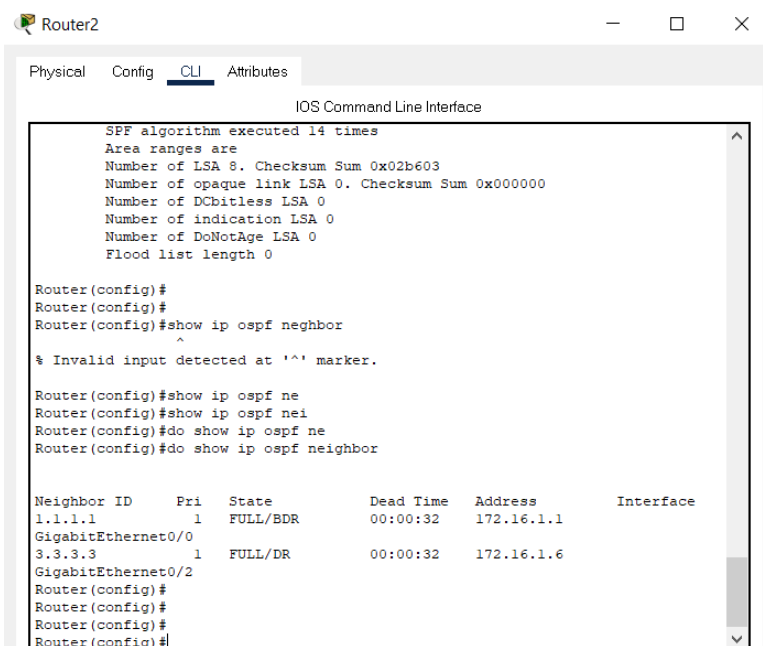
Distance: (default is 110)

Router#show ip ospf
Routing Process "ospf 1" with ID 1.1.1.1
Supports only single TOS(TOS0) routes
Supports opaque LSA
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
Number of external LSA 0. Checksum Sum 0x00000000
Number of opaque AS LSA 0. Checksum Sum 0x00000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
External flood list length 0
  Area BACKBONE(0)
    Number of interfaces in this area is 2
    Area has no authentication
    SPF algorithm executed 4 times
    Area ranges are
      Number of LSA 3. Checksum Sum 0x0109e5
      Number of opaque link LSA 0. Checksum Sum 0x00000000
      Number of DCbitless LSA 0
      Number of indication LSA 0
      Number of DoNotAge LSA 0
      Flood list length 0

Router#
Router#
Router#
Router#
```

-We can use this to view general information of the ospf protocol. We can see the router id and other general LSA information about the protocol.

iv. #show ip ospf neighbor



```
Router2
Physical Config CLI Attributes
IOS Command Line Interface

SPF algorithm executed 14 times
Area ranges are
Number of LSA 8. Checksum Sum 0x02b603
Number of opaque link LSA 0. Checksum Sum 0x000000
Number of DCbitless LSA 0
Number of indication LSA 0
Number of DoNotAge LSA 0
Flood list length 0

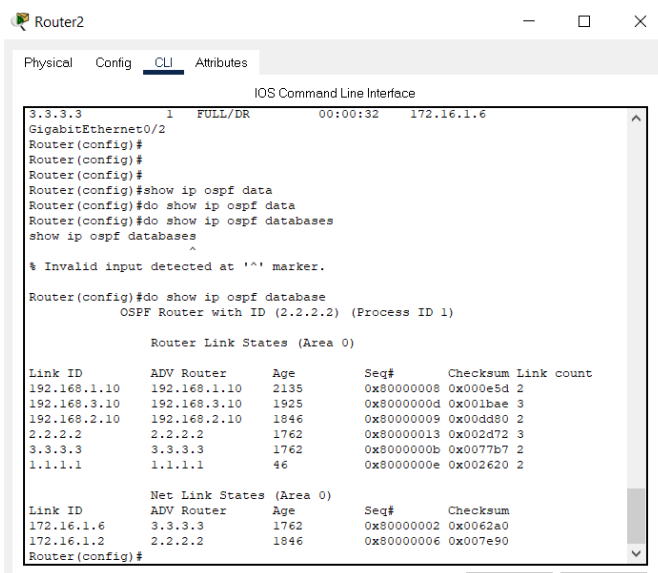
Router(config)#
Router(config)#
Router(config)#show ip ospf neighbor
^
% Invalid input detected at '^' marker.

Router(config)#show ip ospf ne
Router(config)#show ip ospf nei
Router(config)#do show ip ospf ne
Router(config)#do show ip ospf neighbor

Neighbor ID      Pri   State           Dead Time   Address        Interface
1.1.1.1          1     FULL/BDR        00:00:32    172.16.1.1     GigabitEthernet0/0
3.3.3.3          1     FULL/DR         00:00:32    172.16.1.6     GigabitEthernet0/2
Router(config)#
Router(config)#
Router(config)#
Router(config)#
```

-We can use this to view neighbor information which is directly connected to the router. We can obtain neighbor id, interface ip address, interface of the router which is connected to the neighbor, dead time and the state of the neighbour.

v. #show ip ospf database



```
Router2
Physical Config CLI Attributes
IOS Command Line Interface

3.3.3.3          1     FULL/DR         00:00:32    172.16.1.6     GigabitEthernet0/2
Router(config)#
Router(config)#
Router(config)#
Router(config)#show ip ospf data
Router(config)#do show ip ospf data
Router(config)#do show ip ospf databases
show ip ospf databases
^
% Invalid input detected at '^' marker.

Router(config)#do show ip ospf database
  OSPF Router with ID (2.2.2.2) (Process ID 1)

      Router Link States (Area 0)

Link ID        ADV Router   Age         Seq#          Checksum Link count
192.168.1.10   192.168.1.10 2135        0x80000008   0x000e5d 2
192.168.3.10   192.168.3.10 1925        0x8000000d   0x001bae 3
192.168.2.10   192.168.2.10 1846        0x80000009   0x00dd80 2
2.2.2.2        2.2.2.2      1762        0x80000013   0x002d72 3
3.3.3.3        3.3.3.3      1762        0x8000000b   0x0077b7 2
1.1.1.1        1.1.1.1      46          0x8000000e   0x002620 2

      Net Link States (Area 0)

Link ID        ADV Router   Age         Seq#          Checksum
172.16.1.6     3.3.3.3     1762        0x80000002   0x0062a0
172.16.1.2     2.2.2.2     1846        0x80000006   0x007e90
Router(config)#
```

-We can use this command to get information of all the routers in the network segment and participate in the ospf protocol. We can grab information such as router id of each router, Age / time since the initialization of the ospf protocol, sequence and error calculating checksum value of each router.