

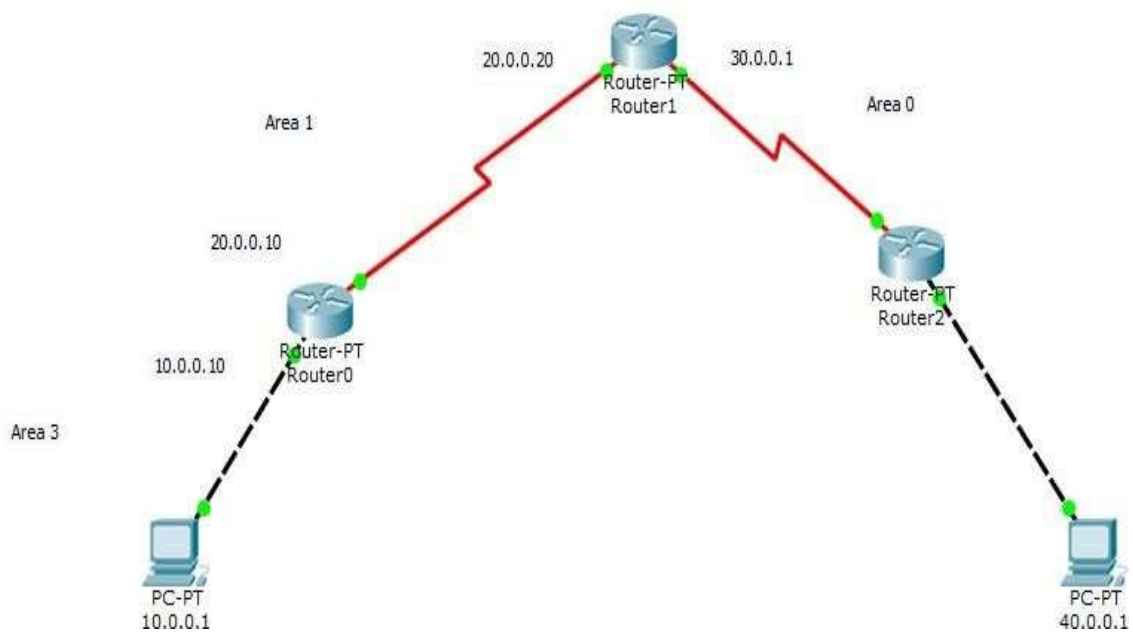
## CN LAB-06(a) (04/08/2023)

USN:1BM21CS271

**Demonstrate OSPF protocol in routers.**

TOPOLOGY:

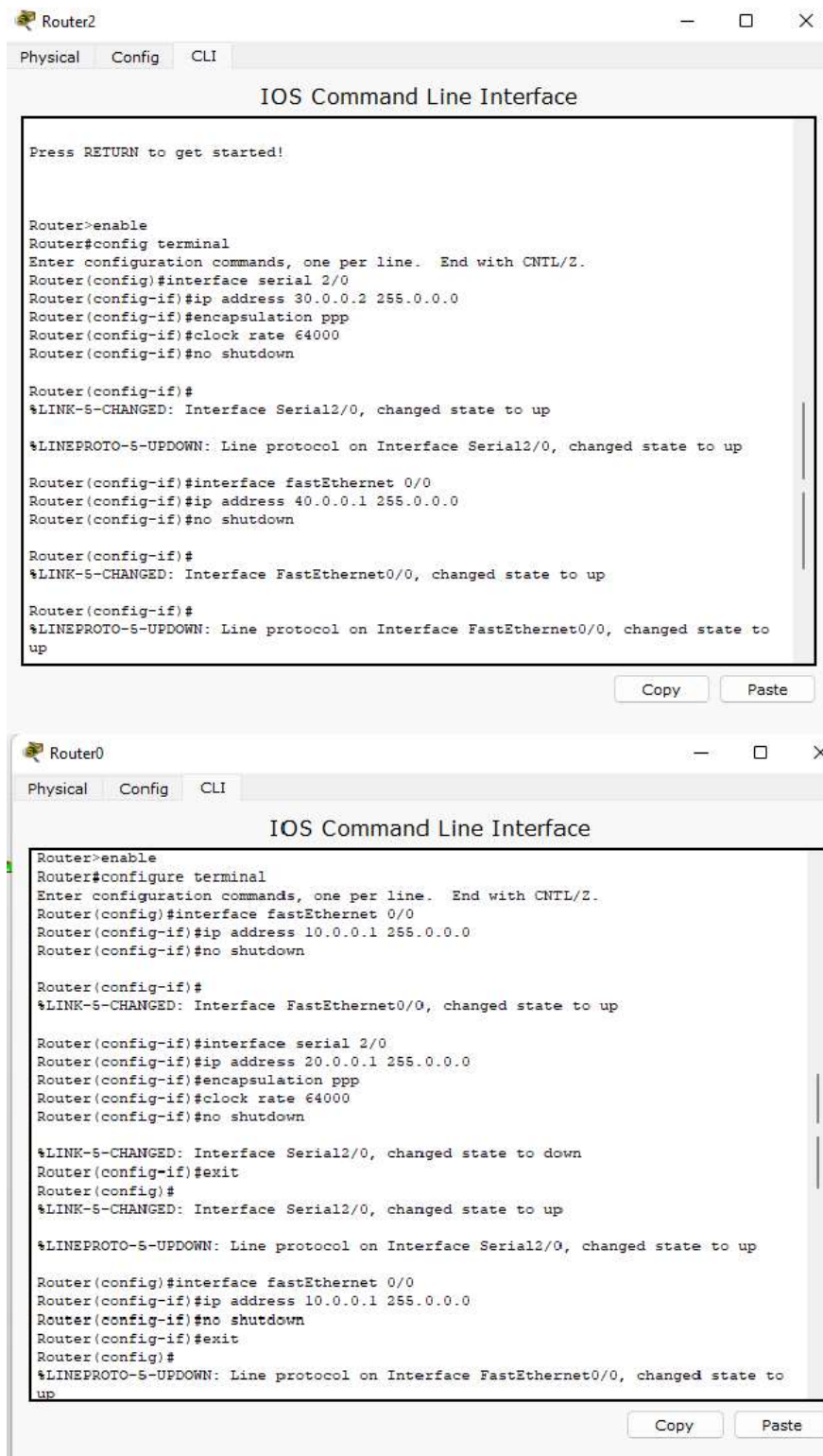
7



1. Configure ip addresses to all interfaces:

(serial-router to router, fastEthernet-router to end device)

(similar to RIP exp)



The image displays two screenshots of the IOS Command Line Interface (CLI) for two different routers, Router2 and Router0. Both windows have tabs for 'Physical', 'Config', and 'CLI', with 'CLI' being the active tab. The title bar for each window reads 'IOS Command Line Interface'.

**Router2 CLI Screenshot:**

```
Press RETURN to get started!

Router>enable
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface serial 2/0
Router(config-if)#ip address 30.0.0.2 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#clock rate 64000
Router(config-if)#no shutdown

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

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

Router(config-if)#interface fastEthernet 0/0
Router(config-if)#ip address 40.0.0.1 255.0.0.0
Router(config-if)#no shutdown

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

Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
```

**Router0 CLI Screenshot:**

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

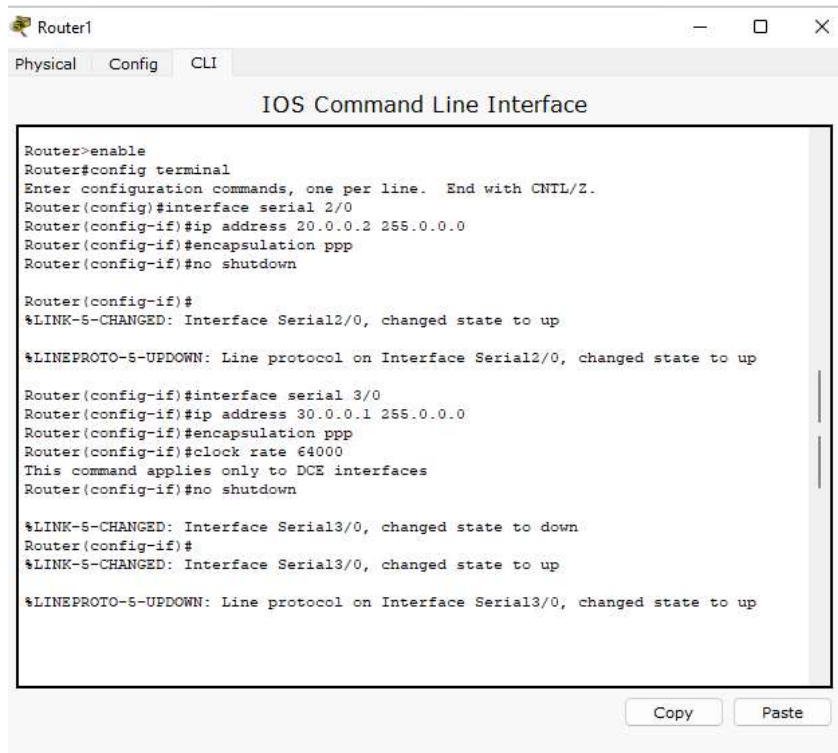
Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

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

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

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

Router(config)#interface fastEthernet 0/0
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
```



Router1

Physical Config CLI

IOS Command Line Interface

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

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

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

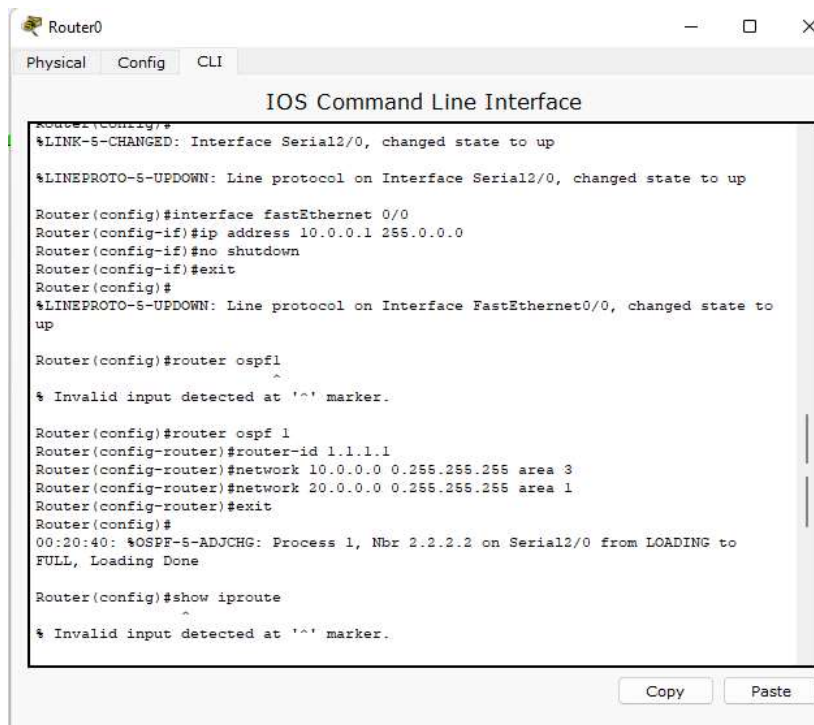
Router(config-if)#interface serial 3/0
Router(config-if)#ip address 30.0.0.1 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#clock rate 64000
This command applies only to DCE interfaces
Router(config-if)#no shutdown

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

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

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2. Enable ip routing by configuring OSPF in all routers:



Router0

Physical Config CLI

IOS Command Line Interface

```
Router0(config)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up

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

Router0(config)#interface fastEthernet 0/0
Router0(config-if)#ip address 10.0.0.1 255.0.0.0
Router0(config-if)#no shutdown
Router0(config-if)#exit
Router0(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router0(config)#router ospf1

% Invalid input detected at '^' marker.

Router0(config)#router ospf 1
Router0(config-router)#router-id 1.1.1.1
Router0(config-router)#network 10.0.0.0 0.255.255.255 area 3
Router0(config-router)#network 20.0.0.0 0.255.255.255 area 1
Router0(config-router)#exit
Router0(config)#
00:20:40: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on Serial2/0 from LOADING to FULL, Loading Done

Router0(config)#show iproute

% Invalid input detected at '^' marker.
```

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Router1

Physical Config CLI

## IOS Command Line Interface

```
2outer>enable
2outer#conYig terminal
3nter configuration commands. one per line. 3nd with CWTl/Z.

2outerlconIig-router)#router-id ? ?.?.?

2outerlconYig-router)#network
00:20:38: %OSPF-S-ADJCHG: Process 1, Nbr 1.1.1.1 on Serial?/U from LOADING to
FULL, Loading Done

% Incomplete comosnd.

2outer lcon Yig-router)#exit
2outerlconEig14
00:21:57: %OSPF-S-ADJCHG: Process 1, Nbr 3.3.3.3 on Serial3/U from LOADING to
FULL, Loading Done
```

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Router2

Physical Config CLI

## IOS Command Line Interface

```
Router(config-if)#
%LINR-S-CHANGED: Interface Serial?/1. changed state to up

BLINEPAOTO-S-UPOD1TN: Line protocol on Interface Serial?/0, changed state to up

2outerlconEig-iE1#interEace East3thernet 0/0
AouterlconEig-ifl#ip address 40.1.0.1?SS.0.0.0
Aouterl conEig-iE1 #no shutdown

2outerlconEig-ifl4
%LINR-S-CHANGED: Interface Fast3thernet0/0. changed state to up

AouterlconEig-iE)#
%LINEP2OIO-S-UPDOWW: Line protocol on Interface Fast3themet0/0, changed state to

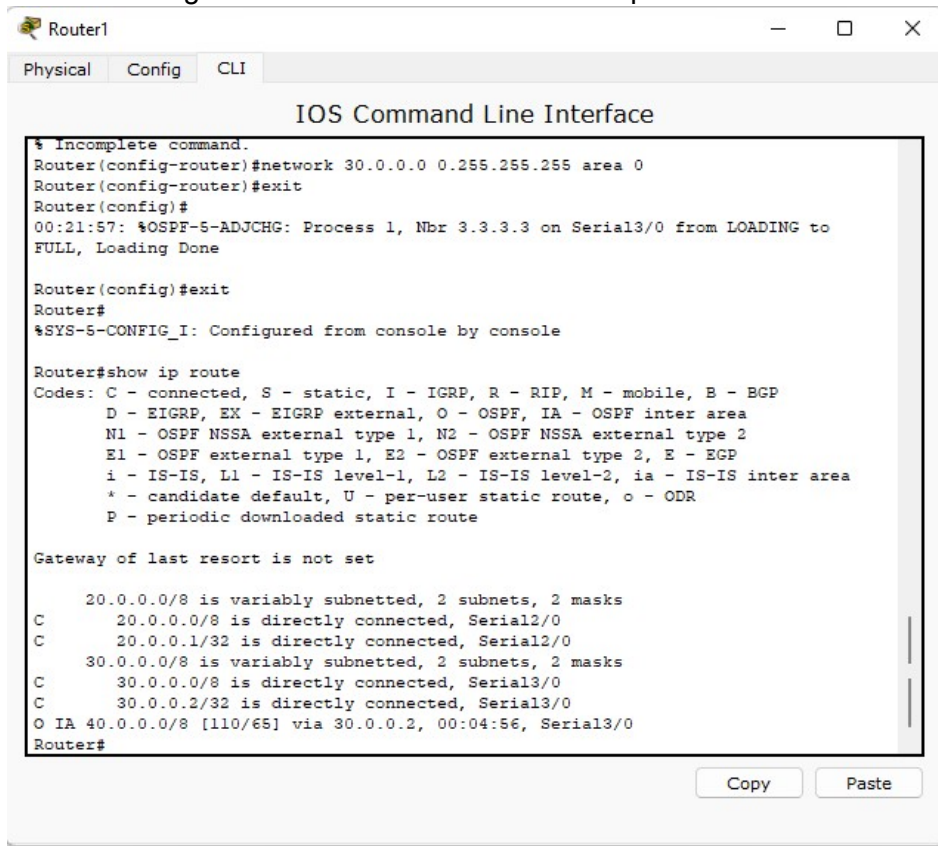
Router(config-if)#exit
2outerlconEig14router ospf 1
AouterlconEig-router)4router-id 3.3.3.3
AouterlconYig-router)#
AouterlconEig-router)#network 30.0.0.0.?SS.?SS.?SS area 0
2outerlconEig-router)#net
10:21:54: %OSPF-S-ADJCHG: Process 1, Nbr ?.?.?.? on Serial?/1 from LOADING to
FULL. Loading Done

2outerlconEig-router)#network 40.0.1.0.?SS.?SS.?SS area ?
Aouterl conEig-router)4exit
AouterlconYig14#
```

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### 3. Show routing table for all three routers #show ip route



Router1

Physical Config CLI

IOS Command Line Interface

```
% Incomplete command.
Router(config-router)#network 30.0.0.0 0.255.255.255 area 0
Router(config-router)#exit
Router(config)#
00:21:57: %OSPF-5-ADJCHG: Process 1, Nbr 3.3.3.3 on Serial3/0 from LOADING to
FULL, Loading Done

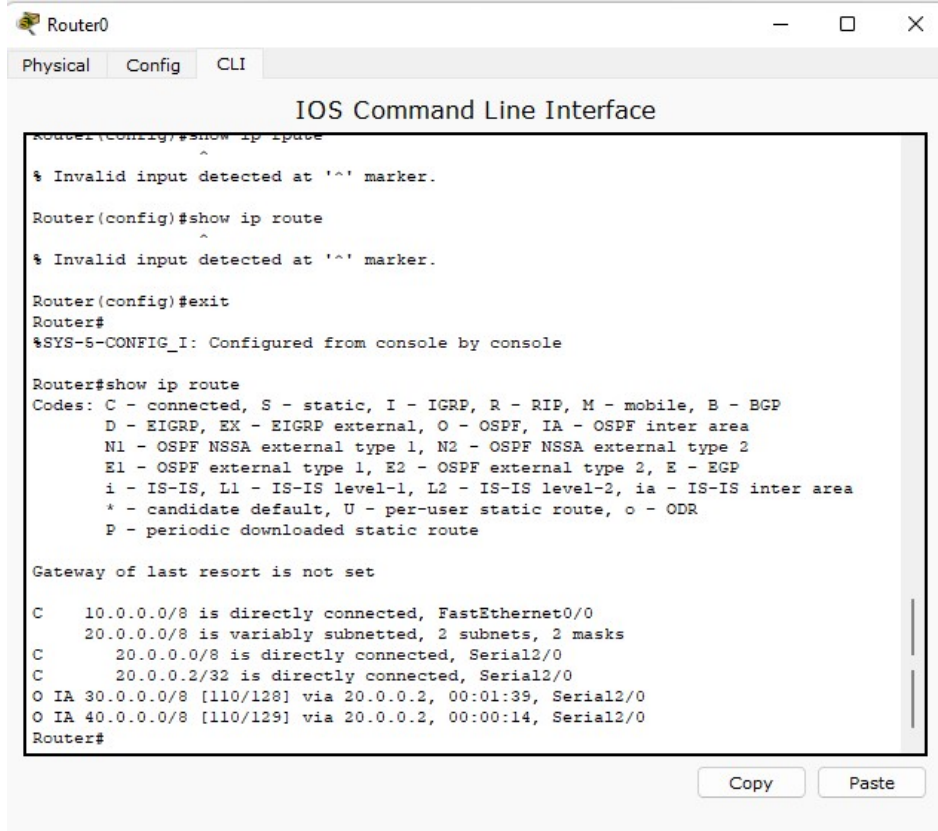
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

    20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       20.0.0.0/8 is directly connected, Serial2/0
C       20.0.0.1/32 is directly connected, Serial2/0
    30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       30.0.0.0/8 is directly connected, Serial3/0
C       30.0.0.2/32 is directly connected, Serial3/0
O IA 40.0.0.0/8 [110/65] via 30.0.0.2, 00:04:56, Serial3/0
Router#
```

Copy Paste



Router0

Physical Config CLI

IOS Command Line Interface

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

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

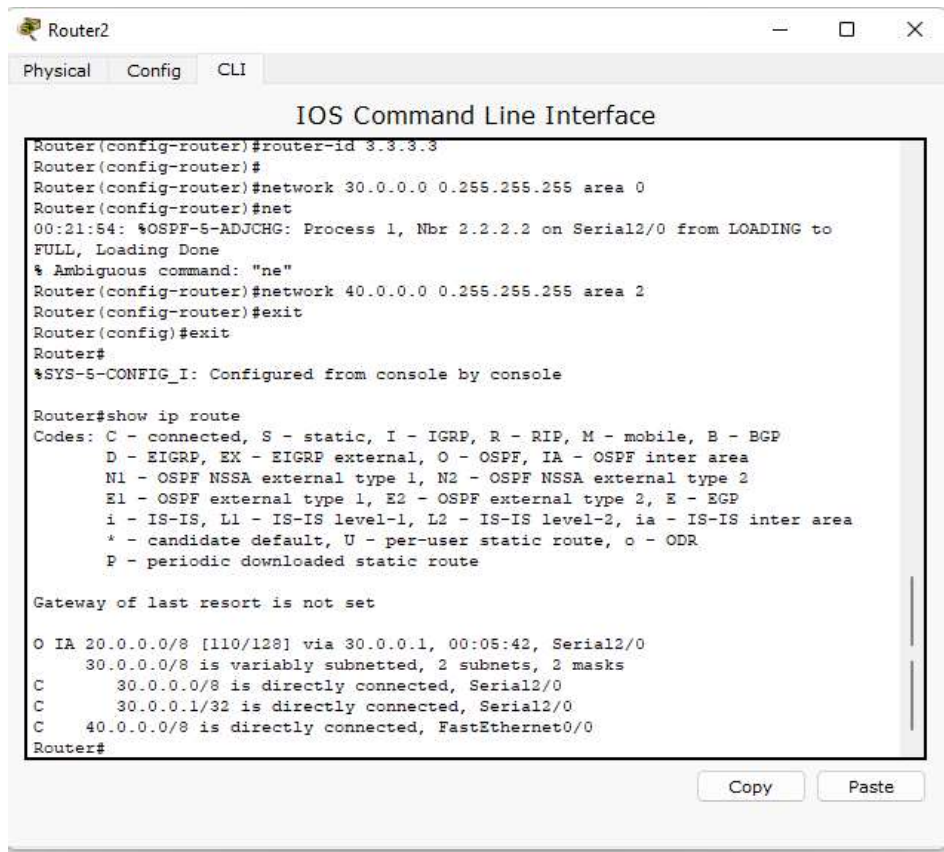
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

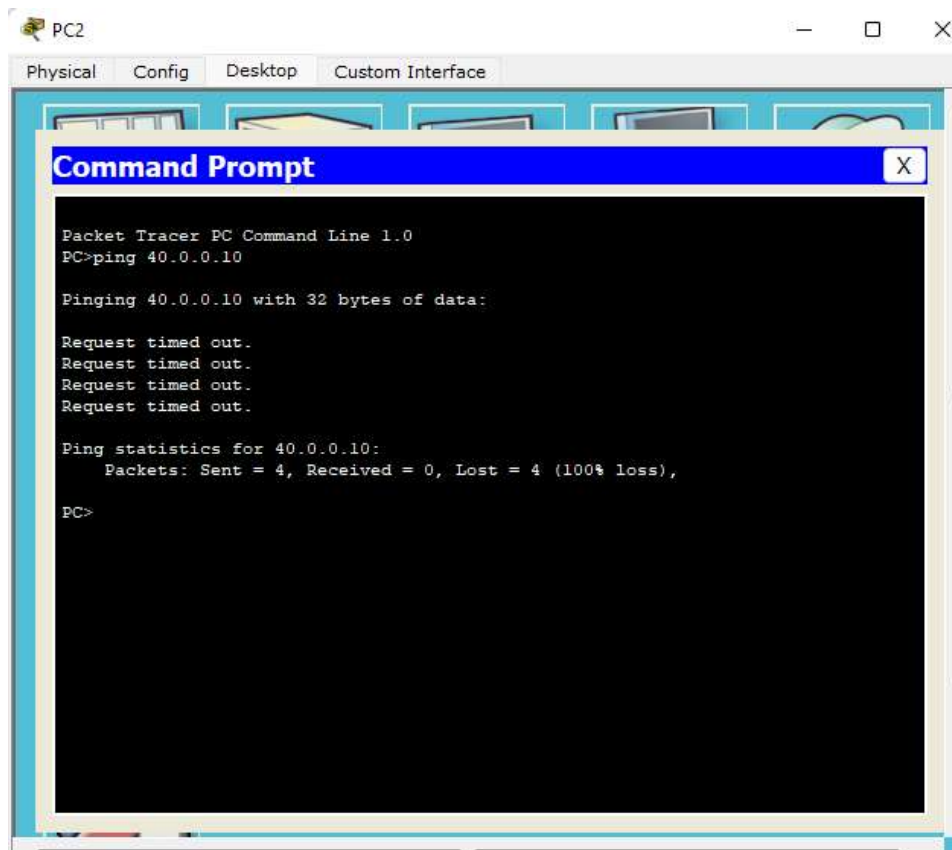
Gateway of last resort is not set

C       10.0.0.0/8 is directly connected, FastEthernet0/0
    20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       20.0.0.0/8 is directly connected, Serial2/0
C       20.0.0.2/32 is directly connected, Serial2/0
O IA 30.0.0.0/8 [110/128] via 20.0.0.2, 00:01:39, Serial2/0
O IA 40.0.0.0/8 [110/129] via 20.0.0.2, 00:00:14, Serial2/0
Router#
```

Copy Paste



#### 4. Ping from end device to other end device





## 5. Create dedicated loopback interface for all the routers

Router1

Physical Config CLI

IOS Command Line Interface

```
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

    20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       20.0.0.0/8 is directly connected, Serial2/0
C       20.0.0.1/32 is directly connected, Serial2/0
    30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       30.0.0.0/8 is directly connected, Serial3/0
C       30.0.0.2/32 is directly connected, Serial3/0
O IA 40.0.0.0/8 [110/65] via 30.0.0.2, 00:04:56, Serial3/0
Router#config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface loopback 0

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

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up
ip add 172.16.1.253 255.255.0.0
Router(config-if)#no shutdown
Router(config-if)#
```

Copy Paste

Router0

Physical Config CLI

IOS Command Line Interface

```
% periodic downloaded static route

Gateway of last resort is not set

C       10.0.0.0/8 is directly connected, FastEthernet0/0
    20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       20.0.0.0/8 is directly connected, Serial2/0
C       20.0.0.2/32 is directly connected, Serial2/0
O IA 30.0.0.0/8 [110/128] via 20.0.0.2, 00:01:39, Serial2/0
O IA 40.0.0.0/8 [110/129] via 20.0.0.2, 00:00:14, Serial2/0
Router#config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface loopback 0

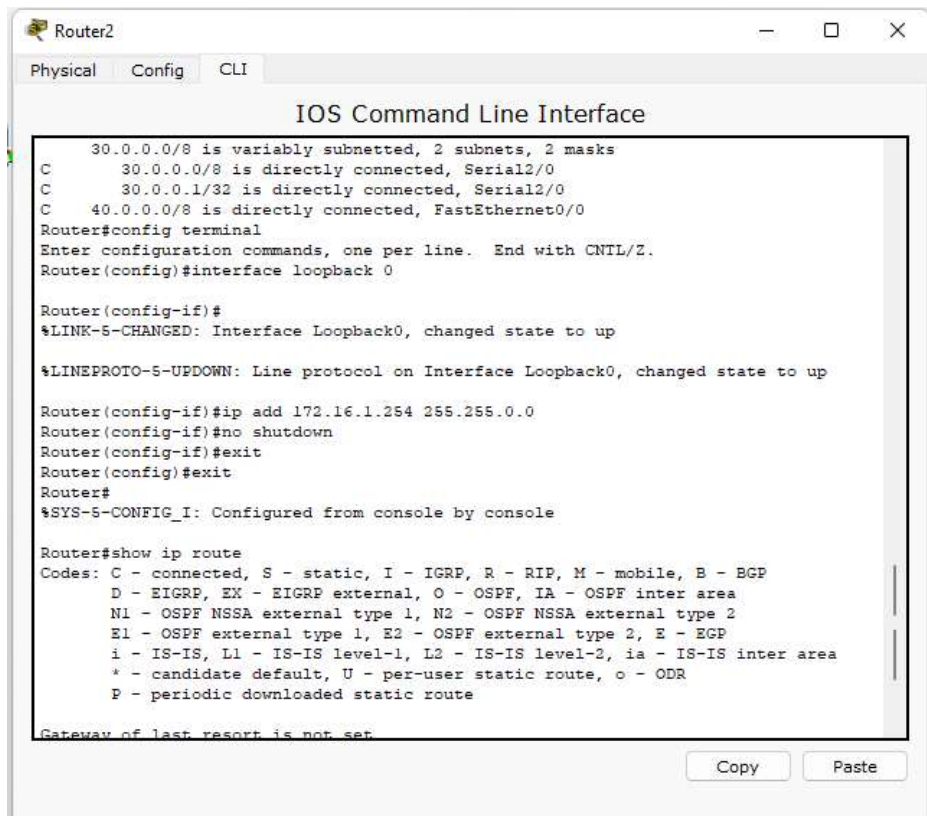
Router(config-if)#
%LINK-5-CHANGED: Interface Loopback0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up
Router(config-if)#ip add 172.16.1.252 255.255.255.0.0
^
% Invalid input detected at '^' marker.

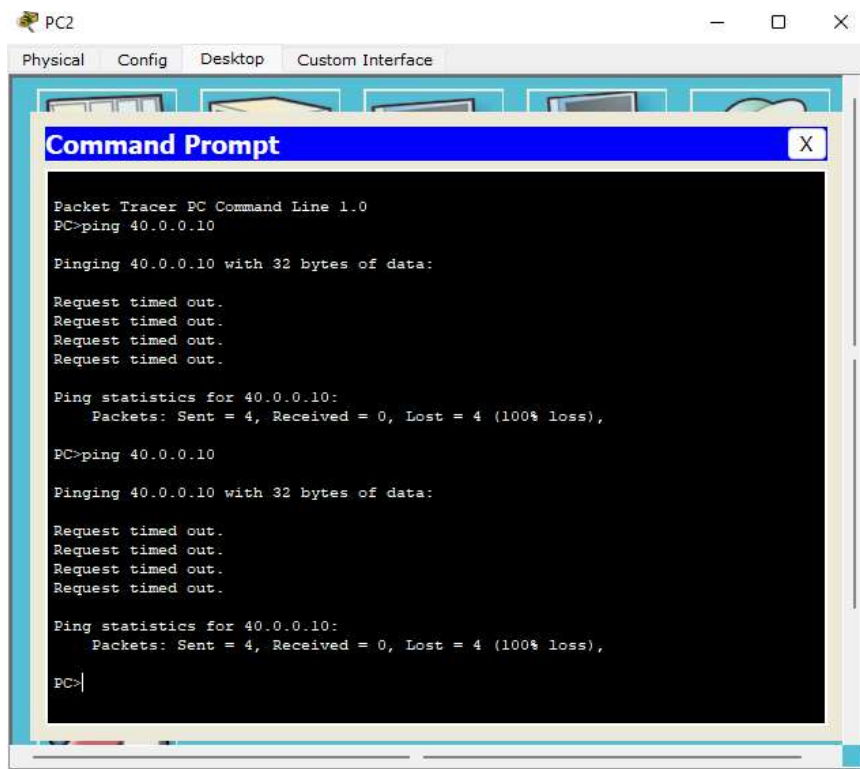
Router(config-if)#ip add 172.16.1.252 255.255.0.0
Router(config-if)#no shutdown'
^
% Invalid input detected at '^' marker.

Router(config-if)#no shutdown
Router(config-if)#
```

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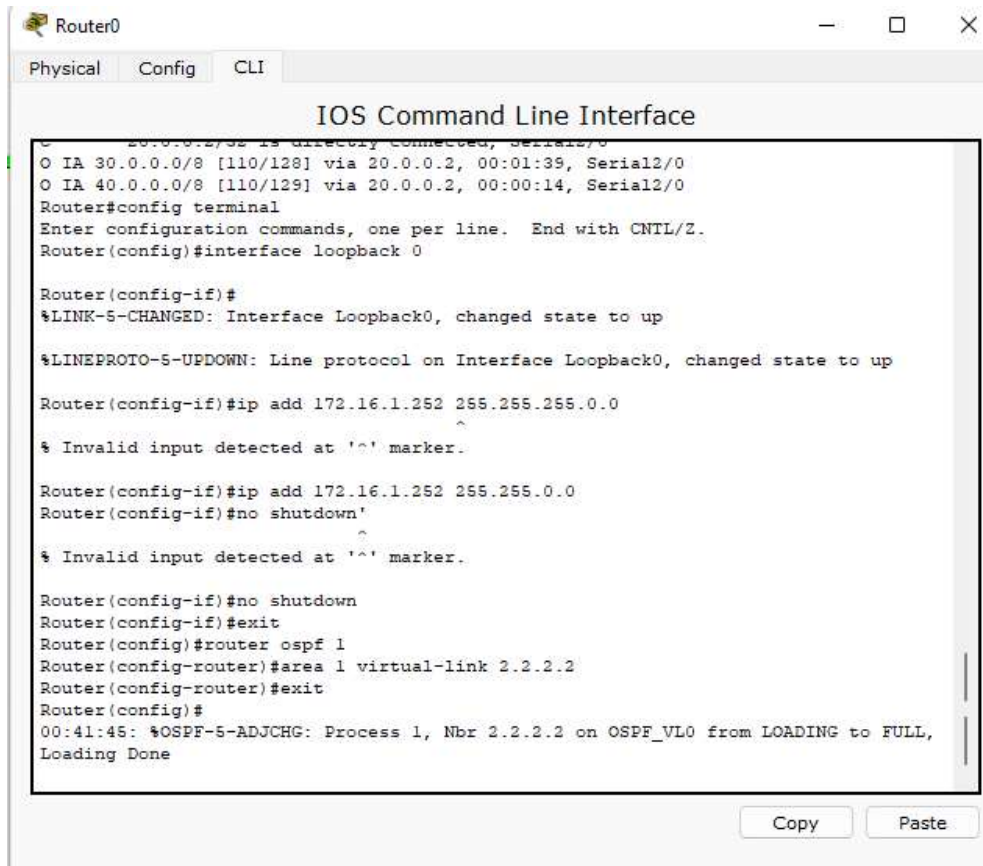


## 6. Ping from end device to other end device





7. Create a virtual link (CLI of first two routers) to connect area 3 to area 0.



```
Router0
Physical Config CLI
IOS Command Line Interface
C
20.0.0.2/32 is directly connected, Serial2/0
O IA 30.0.0.0/8 [110/128] via 20.0.0.2, 00:01:39, Serial2/0
O IA 40.0.0.0/8 [110/129] via 20.0.0.2, 00:00:14, Serial2/0
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface loopback 0

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

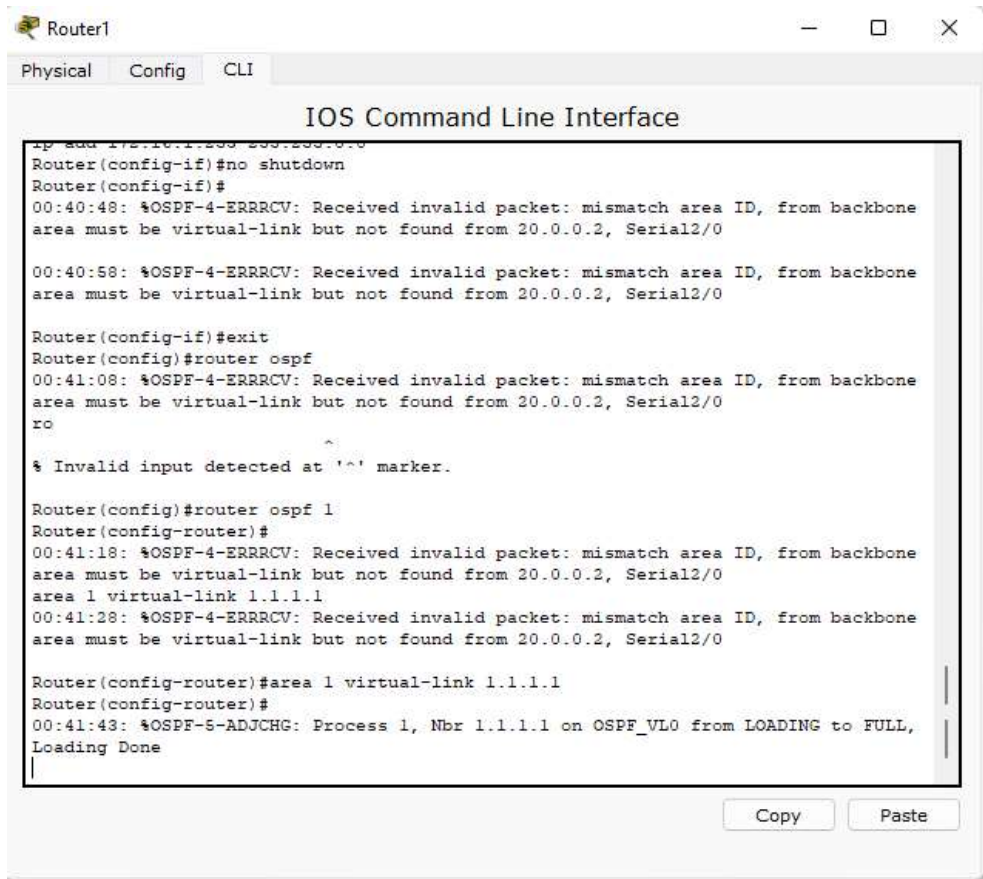
%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

Router(config-if)#ip add 172.16.1.252 255.255.255.0.0
^
% Invalid input detected at '^' marker.

Router(config-if)#ip add 172.16.1.252 255.255.0.0
Router(config-if)#no shutdown'
^
% Invalid input detected at '^' marker.

Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#router ospf 1
Router(config-router)#area 1 virtual-link 2.2.2.2
Router(config-router)#exit
Router(config)#
00:41:45: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on OSPF_VL0 from LOADING to FULL,
Loading Done

Copy Paste
```



```
Router1
Physical Config CLI
IOS Command Line Interface
ip add 172.16.1.252 255.255.0.0
Router(config-if)#no shutdown
Router(config-if)#
00:40:48: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone
area must be virtual-link but not found from 20.0.0.2, Serial2/0

00:40:58: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone
area must be virtual-link but not found from 20.0.0.2, Serial2/0

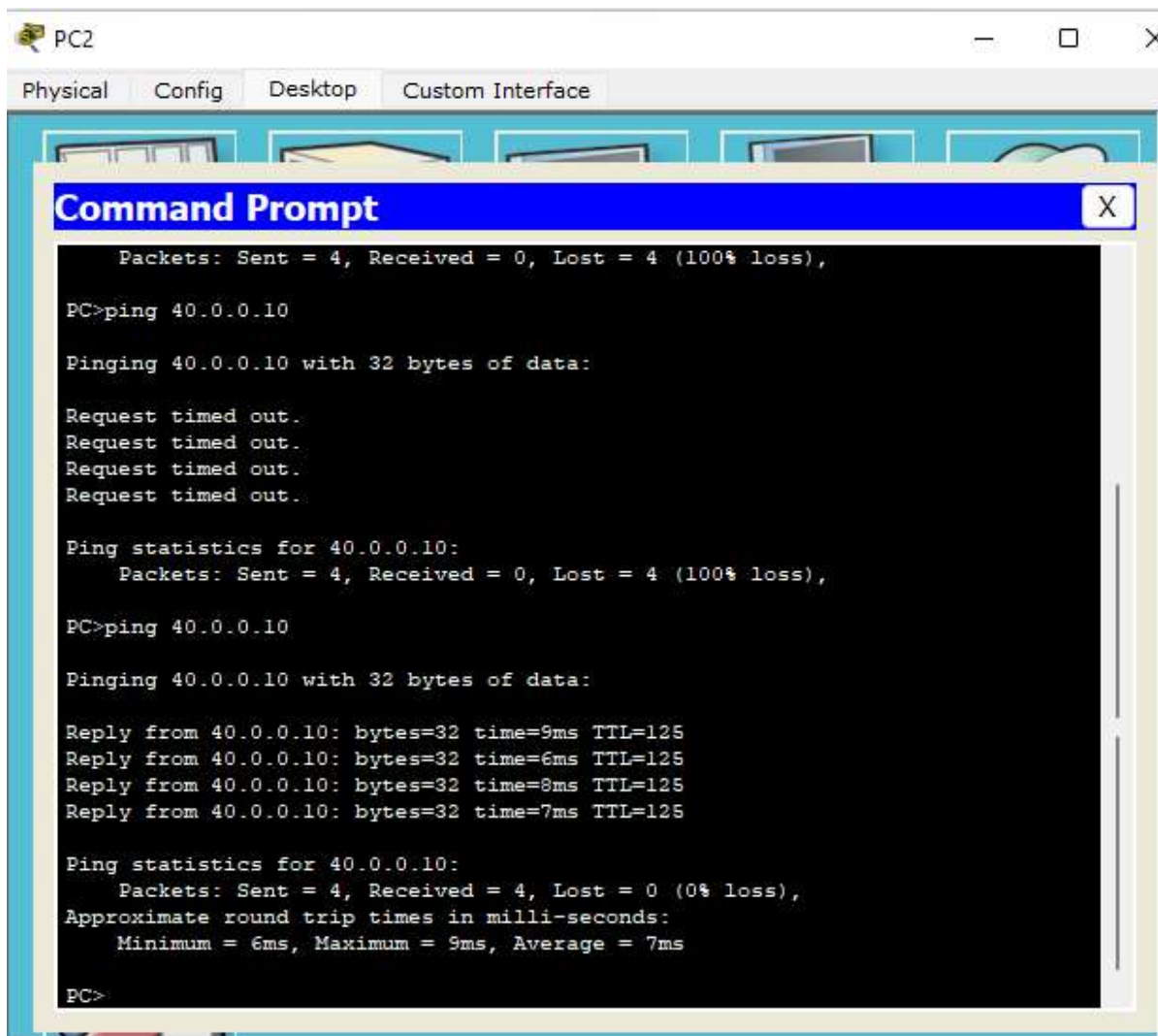
Router(config-if)#exit
Router(config)#router ospf
00:41:08: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone
area must be virtual-link but not found from 20.0.0.2, Serial2/0
ro
^
% Invalid input detected at '^' marker.

Router(config)#router ospf 1
Router(config-router)#
00:41:18: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone
area must be virtual-link but not found from 20.0.0.2, Serial2/0
area 1 virtual-link 1.1.1.1
00:41:28: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone
area must be virtual-link but not found from 20.0.0.2, Serial2/0

Router(config-router)#area 1 virtual-link 1.1.1.1
Router(config-router)#
00:41:43: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on OSPF_VL0 from LOADING to FULL,
Loading Done

Copy Paste
```

8. Final Output(ping from 10.0.0.10 to 40.0.0.10):



The screenshot shows a Packet Tracer PC2 desktop environment. A 'Command Prompt' window is open, displaying the results of a ping command from 10.0.0.10 to 40.0.0.10. The window has a blue title bar and a close button. The background shows a desktop with several icons.

```
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),  
PC>ping 40.0.0.10  
Pinging 40.0.0.10 with 32 bytes of data:  
Request timed out.  
Request timed out.  
Request timed out.  
Request timed out.  
Ping statistics for 40.0.0.10:  
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),  
PC>ping 40.0.0.10  
Pinging 40.0.0.10 with 32 bytes of data:  
Reply from 40.0.0.10: bytes=32 time=9ms TTL=125  
Reply from 40.0.0.10: bytes=32 time=6ms TTL=125  
Reply from 40.0.0.10: bytes=32 time=8ms TTL=125  
Reply from 40.0.0.10: bytes=32 time=7ms TTL=125  
Ping statistics for 40.0.0.10:  
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
Minimum = 6ms, Maximum = 9ms, Average = 7ms  
PC>
```