Packet Tracer - Internetwork Routing using OSPF Protocol

As a network administrator, you have been tasked to complete an OSPF configuration on an Internetworking network architecture which is already configured and have connectivity within the local LANs. You will be implementing the OSPF by following the requirements left by the Network Engineer.

Use the information provided and the list of requirements to configure the test network. When the task has been successfully completed, all hosts should be able to ping the internet server.
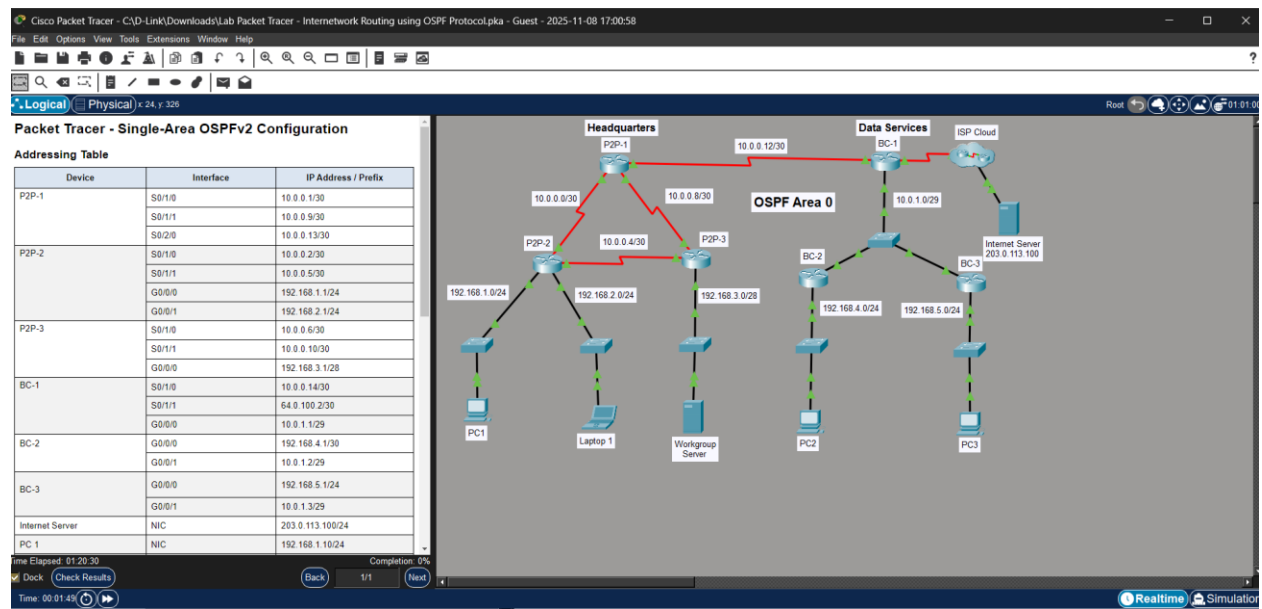
Addressing Table:

Device	Interface	IP Address / Prefix
P2P-1	S0/1/0	10.0.0.1/30
	S0/1/1	10.0.0.9/30
	S0/2/0	10.0.0.13/30
P2P-2	S0/1/0	10.0.0.2/30
	S0/1/1	10.0.0.5/30
	G0/0/0	192.168.1.1/24
	G0/0/1	192.168.2.1/24
P2P-3	S0/1/0	10.0.0.6/30
	S0/1/1	10.0.0.10/30
	G0/0/0	192.168.3.1/28
BC-1	S0/1/0	10.0.0.14/30
	S0/1/1	64.0.100.2/30
	G0/0/0	10.0.1.1/29
BC-2	G0/0/0	192.168.4.1/30
	G0/0/1	10.0.1.2/29
BC-3	G0/0/0	192.168.5.1/24
	G0/0/1	10.0.1.3/29
Internet Server	NIC	203.0.113.100/24
PC 1	NIC	192.168.1.10/24
Laptop 1	NIC	192.168.2.20/24
Workgroup Server	NIC	192.168.3.14/28
PC 2	NIC	192.168.4.40/24
PC 3	NIC	192.168.5.50/24

Instructions

Carry out the task given according to the requirements documented below by the network engineer.
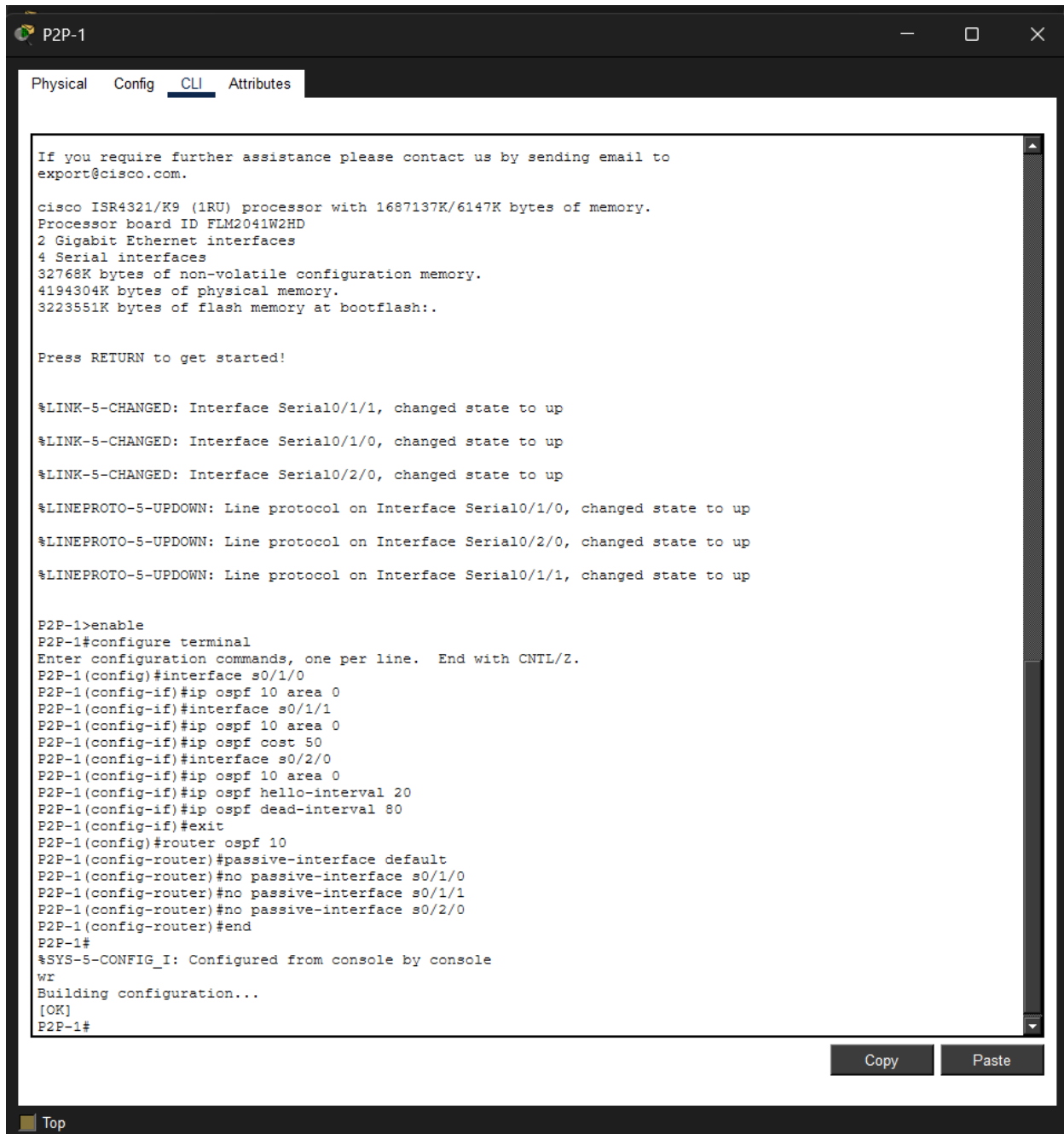
Requirements: Use process ID 10 for OSPF activation on all routers.

- Activate OSPF using network statements and inverse masks on the routers in the Headquarters network.

- Activate OSPF by configuring the interfaces of the network devices in the Data Service network, where required.

- Configure router IDs on the multiaccess network routers as follows:

  - BC-1: 6.6.6.6

  - BC-2: 5.5.5.5

  - BC-3: 4.4.4.4

- Configure OSPF so that routing updates are not sent into networks where they are not required.

- Configure router BC-1 with the highest OSPF interface priority so that it will always be the designated router of the multiaccess network.

- Configure a default route to the ISP cloud using the exit interface command argument.

- Automatically distribute the default route to all routers in the network.

- Configure the OSPF routers so that the Gigabit Ethernet interface cost will be 10 and the Fast Ethernet cost will be 100.

- Configure the OSPF cost value of P2P-1 interface Serial0/1/1 to 50.

- Configure the hello and dead timer values on the interfaces that connect P2P-1 and BC-1 to be twice the default values.

Cisco Packet Tracer - C:\D-Link\Downloads\Lab Packet Tracer - Internetwork Routing using OSPF Protocol.pka - Guest - 2025-11-08 17:00:58

Packet Tracer - Single-Area OSPFv2 Configuration

Addressing Table

Device	Interface	IP Address / Prefix
P2P-1	S0/1/0	10.0.0.1/30
	S0/1/1	10.0.0.9/30
	S0/2/0	10.0.0.13/30
P2P-2	S0/1/0	10.0.0.2/30
	S0/1/1	10.0.0.5/30
	G0/0/0	192.168.1.1/24
	G0/0/1	192.168.2.1/24
P2P-3	S0/1/0	10.0.0.6/30
	S0/1/1	10.0.0.10/30
	G0/0/0	192.168.3.1/28
BC-1	S0/1/0	10.0.0.14/30
	S0/1/1	64.0.100.2/30
	G0/0/0	10.0.1.1/29
BC-2	G0/0/0	192.168.4.1/30
	G0/0/1	10.0.1.2/29
BC-3	G0/0/0	192.168.5.1/24
	G0/0/1	10.0.1.3/29
Internet Server	NIC	203.0.113.100/24
PC 1	NIC	192.168.1.10/24

Topology labels:

Headquarters — P2P-1

Data Services — BC-1

ISP Cloud

10.0.0.12/30

10.0.1.0/29

OSPF Area 0

10.0.0.0/30

10.0.0.8/30

P2P-2

10.0.0.4/30

P2P-3

BC-2

BC-3

Internet Server 203.0.113.100

192.168.1.0/24

192.168.2.0/24

192.168.3.0/28

192.168.4.0/24

192.168.5.0/24

PC1

Laptop 1

Workgroup Server

PC2

PC3

Time Elapsed: 01:20:30 — Completion: 0%

SOLUTION:

P2P-1 Configuration: Interfaces: S0/1/0=10.0.0.1/30, S0/1/1=10.0.0.9/30, S0/2/0=10.0.0.13/30 (to **BC-1**)

```
P2P-1                                                              —    □    ✕

  Physical    Config    CLI    Attributes


  If you require further assistance please contact us by sending email to
  export@cisco.com.

  cisco ISR4321/K9 (1RU) processor with 1687137K/6147K bytes of memory.
  Processor board ID FLM2041W2HD
  2 Gigabit Ethernet interfaces
  4 Serial interfaces
  32768K bytes of non-volatile configuration memory.
  4194304K bytes of physical memory.
  3223551K bytes of flash memory at bootflash:.


  Press RETURN to get started!


  %LINK-5-CHANGED: Interface Serial0/1/1, changed state to up

  %LINK-5-CHANGED: Interface Serial0/1/0, changed state to up

  %LINK-5-CHANGED: Interface Serial0/2/0, changed state to up

  %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up

  %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/2/0, changed state to up

  %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/1, changed state to up


  P2P-1>enable
  P2P-1#configure terminal
  Enter configuration commands, one per line.  End with CNTL/Z.
  P2P-1(config)#interface s0/1/0
  P2P-1(config-if)#ip ospf 10 area 0
  P2P-1(config-if)#interface s0/1/1
  P2P-1(config-if)#ip ospf 10 area 0
  P2P-1(config-if)#ip ospf cost 50
  P2P-1(config-if)#interface s0/2/0
  P2P-1(config-if)#ip ospf 10 area 0
  P2P-1(config-if)#ip ospf hello-interval 20
  P2P-1(config-if)#ip ospf dead-interval 80
  P2P-1(config-if)#exit
  P2P-1(config)#router ospf 10
  P2P-1(config-router)#passive-interface default
  P2P-1(config-router)#no passive-interface s0/1/0
  P2P-1(config-router)#no passive-interface s0/1/1
  P2P-1(config-router)#no passive-interface s0/2/0
  P2P-1(config-router)#end
  P2P-1#
  %SYS-5-CONFIG_I: Configured from console by console
  wr
  Building configuration...
  [OK]
  P2P-1#

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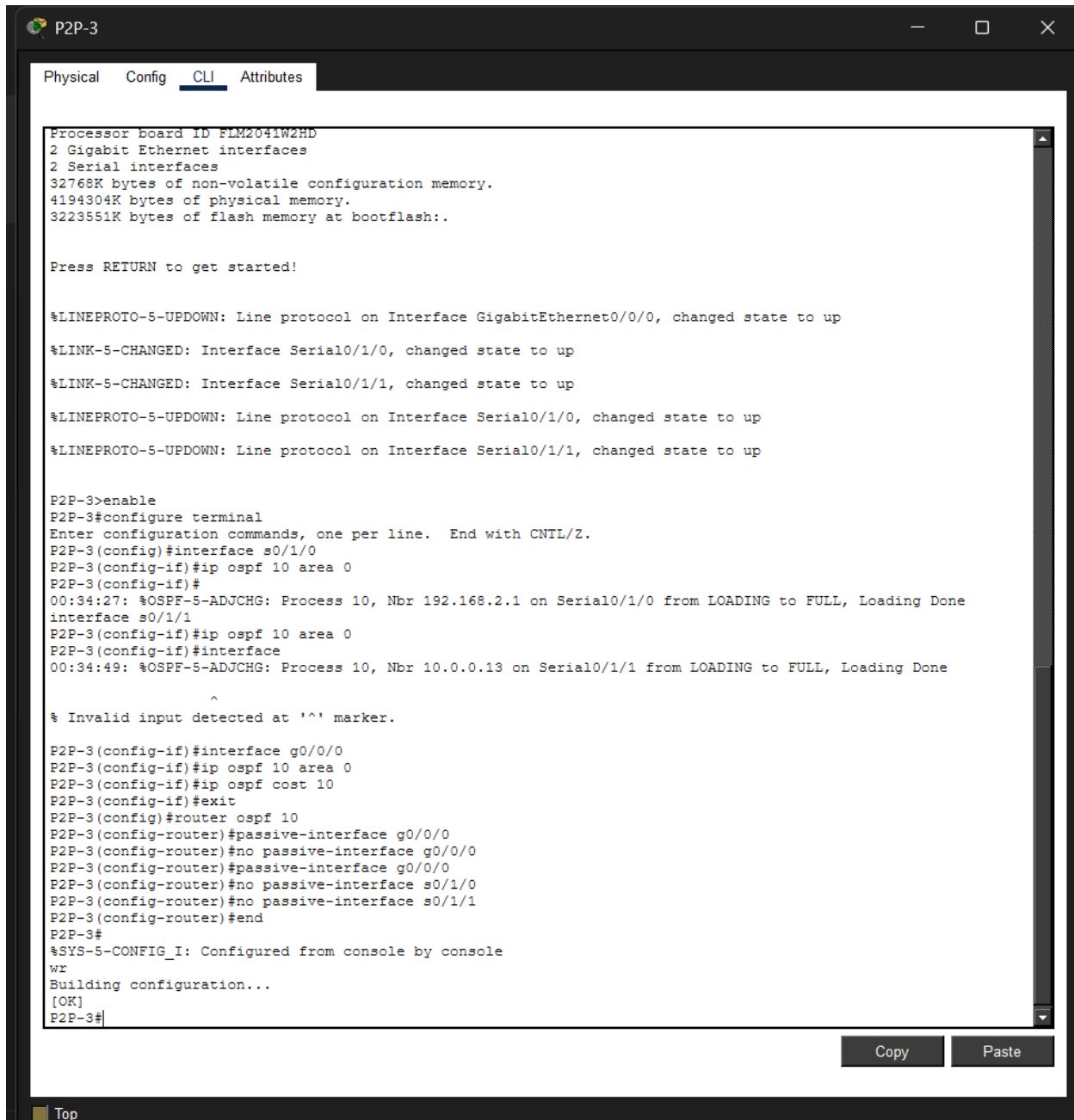
P2P-2

Interfaces: S0/1/0=10.0.0.2/30, S0/1/1=10.0.0.5/30, G0/0/0=192.168.1.1/24,
G0/0/1=192.168.2.1/24:

```
P2P-2                                                    —      □      ✕

  Physical   Config   CLI   Attributes

   cisco ISR4321/K9 (1RU) processor with 1687137K/6147K bytes of memory.
   Processor board ID FLM2041W2HD
   2 Gigabit Ethernet interfaces
   2 Serial interfaces
   32768K bytes of non-volatile configuration memory.
   4194304K bytes of physical memory.
   3223551K bytes of flash memory at bootflash:.


   Press RETURN to get started!


   %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0, changed state to up

   %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/1, changed state to up

   %LINK-5-CHANGED: Interface Serial0/1/1, changed state to up

   %LINK-5-CHANGED: Interface Serial0/1/0, changed state to up

   %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up

   %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/1, changed state to up


   P2P-2>enable
   P2P-2#configure terminal
   Enter configuration commands, one per line.  End with CNTL/Z.
   P2P-2(config)#interface s0/1/0
   P2P-2(config-if)#ip ospf 10 area 0
   P2P-2(config-if)#
   00:24:06: %OSPF-5-ADJCHG: Process 10, Nbr 10.0.0.13 on Serial0/1/0 from LOADING to FULL, Loading Done

   P2P-2(config-if)#interface s0/1/1
   P2P-2(config-if)#ip ospf 10 area 0
   P2P-2(config-if)#interface g0/0/0
   P2P-2(config-if)#ip ospf 10 area 0
   P2P-2(config-if)#ip ospf cost 10
   P2P-2(config-if)#interface g0/0/1
   P2P-2(config-if)#ip ospf 10 area 0
   P2P-2(config-if)#ip ospf cost 10
   P2P-2(config-if)#exit
   P2P-2(config)#router ospf 10
   P2P-2(config-router)#passive-interface g0/0/0
   P2P-2(config-router)#passive-interface g0/0/1
   P2P-2(config-router)#no passive-interface s0/1/0
   P2P-2(config-router)#no passive-interface s0/1/1
   P2P-2(config-router)#end
   P2P-2#
   %SYS-5-CONFIG_I: Configured from console by console
   wr
   Building configuration...
   [OK]
   P2P-2#

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  Top
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P2P-3

Interfaces: S0/1/0=10.0.0.6/30, S0/1/1=10.0.0.10/30, G0/0/0=192.168.3.1/28

```
P2P-3                                                          —    □    ✕

Physical   Config   CLI   Attributes

Processor board ID FLM2041W2HD
2 Gigabit Ethernet interfaces
2 Serial interfaces
32768K bytes of non-volatile configuration memory.
4194304K bytes of physical memory.
3223551K bytes of flash memory at bootflash:.


Press RETURN to get started!


%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0, changed state to up

%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up

%LINK-5-CHANGED: Interface Serial0/1/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/1, changed state to up


P2P-3>enable
P2P-3#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
P2P-3(config)#interface s0/1/0
P2P-3(config-if)#ip ospf 10 area 0
P2P-3(config-if)#
00:34:27: %OSPF-5-ADJCHG: Process 10, Nbr 192.168.2.1 on Serial0/1/0 from LOADING to FULL, Loading Done
interface s0/1/1
P2P-3(config-if)#ip ospf 10 area 0
P2P-3(config-if)#interface
00:34:49: %OSPF-5-ADJCHG: Process 10, Nbr 10.0.0.13 on Serial0/1/1 from LOADING to FULL, Loading Done

                  ^
% Invalid input detected at '^' marker.

P2P-3(config-if)#interface g0/0/0
P2P-3(config-if)#ip ospf 10 area 0
P2P-3(config-if)#ip ospf cost 10
P2P-3(config-if)#exit
P2P-3(config)#router ospf 10
P2P-3(config-router)#passive-interface g0/0/0
P2P-3(config-router)#no passive-interface g0/0/0
P2P-3(config-router)#passive-interface g0/0/0
P2P-3(config-router)#no passive-interface s0/1/0
P2P-3(config-router)#no passive-interface s0/1/1
P2P-3(config-router)#end
P2P-3#
%SYS-5-CONFIG_I: Configured from console by console
wr
Building configuration...
[OK]
P2P-3#

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```

BC-1 (multiaccess core + ISP)

Interfaces: S0/1/0=10.0.0.14/30 (to P2P-1), S0/1/1=64.0.100.2/30 (to ISP), G0/0/0=10.0.1.1/29 (shared with BC-2/BC-3)

```
BC-1                                                                    —    □    ✕

Physical   Config   CLI   Attributes

Press RETURN to get started!

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0, changed state to up

%LINK-5-CHANGED: Interface Serial0/1/1, changed state to up

%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up


BC-1>enable
BC-1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
BC-1(config)#router ospf 10
BC-1(config-router)#router-id 6.6.6.6
BC-1(config-router)#network 10.0.0.12 0.0.0.3 area 0
BC-1(config-router)#network 10.0.1.0 0.0.0.7 area 0
BC-1(config-router)#passive-interface s0/1/1
BC-1(config-router)#interface g0/0/0
BC-1(config-if)#ip ospf priority 255
BC-1(config-if)#ip ospf cost 10
BC-1(config-if)#interface s0/1/0
BC-1(config-if)#ip ospf hello-interval20
                             ^
% Invalid input detected at '^' marker.

BC-1(config-if)#ip ospf hello-interval 20
BC-1(config-if)#ip ospf dead-interval 80
BC-1(config-if)#ip route 0.0.0.0 0.0.0.0
01:36:10: %OSPF-5-ADJCHG: Process 10, Nbr 10.0.0.13 on Serial0/1/0 from LOADING to FULL, Loading Done


              ^
% Invalid input detected at '^' marker.

BC-1(config-if)#ip route 0.0.0.0 0.0.0.0 s0/1/1
%Default route without gateway, if not a point-to-point interface, may impact performance
BC-1(config)#exit interface
              ^
% Invalid input detected at '^' marker.

BC-1(config)#
BC-1(config)#route ospf 10
BC-1(config-router)#default-information originate
BC-1(config-router)#end
BC-1#
%SYS-5-CONFIG_I: Configured from console by console
wr
Building configuration...
[OK]
BC-1#

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```
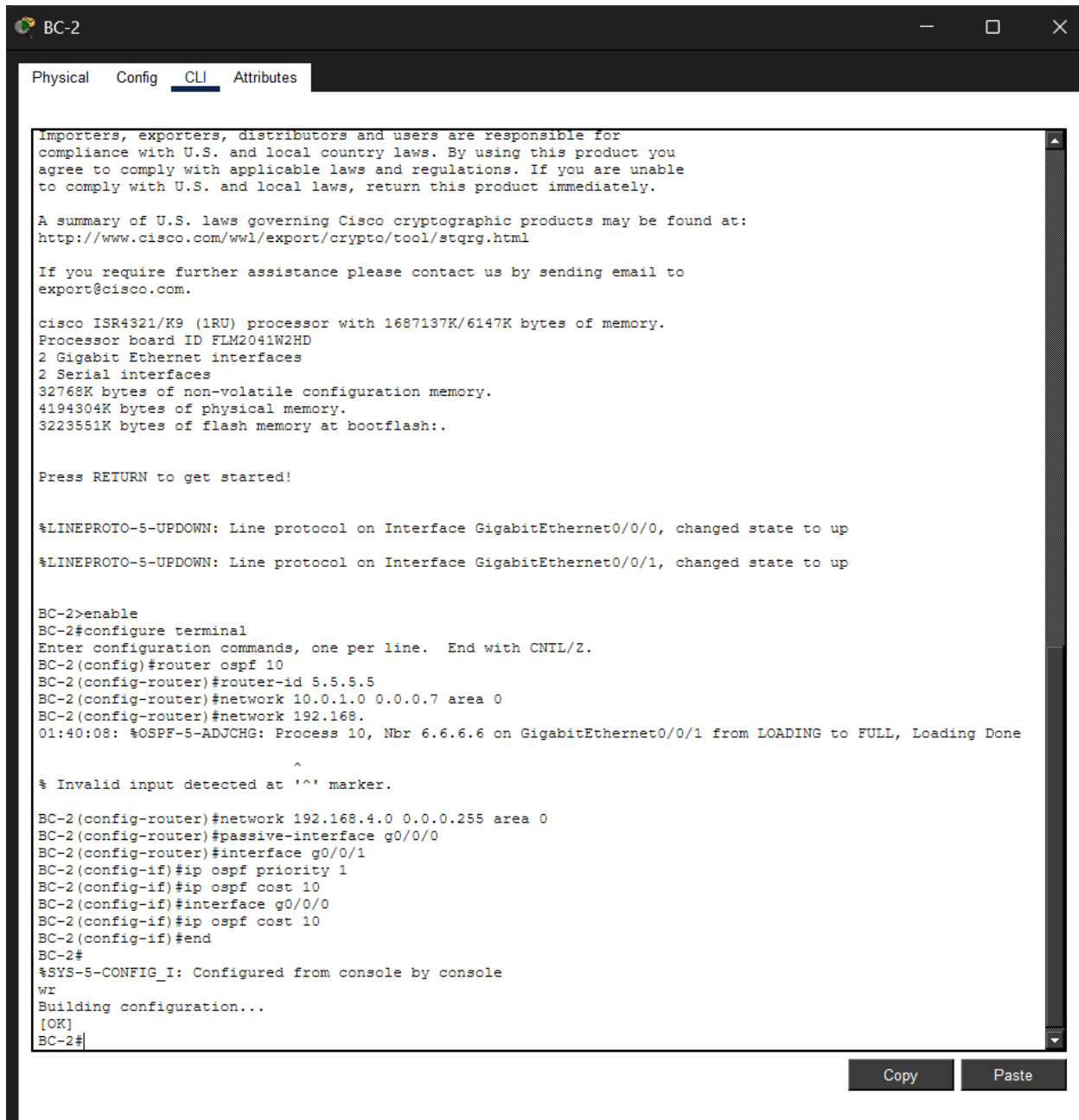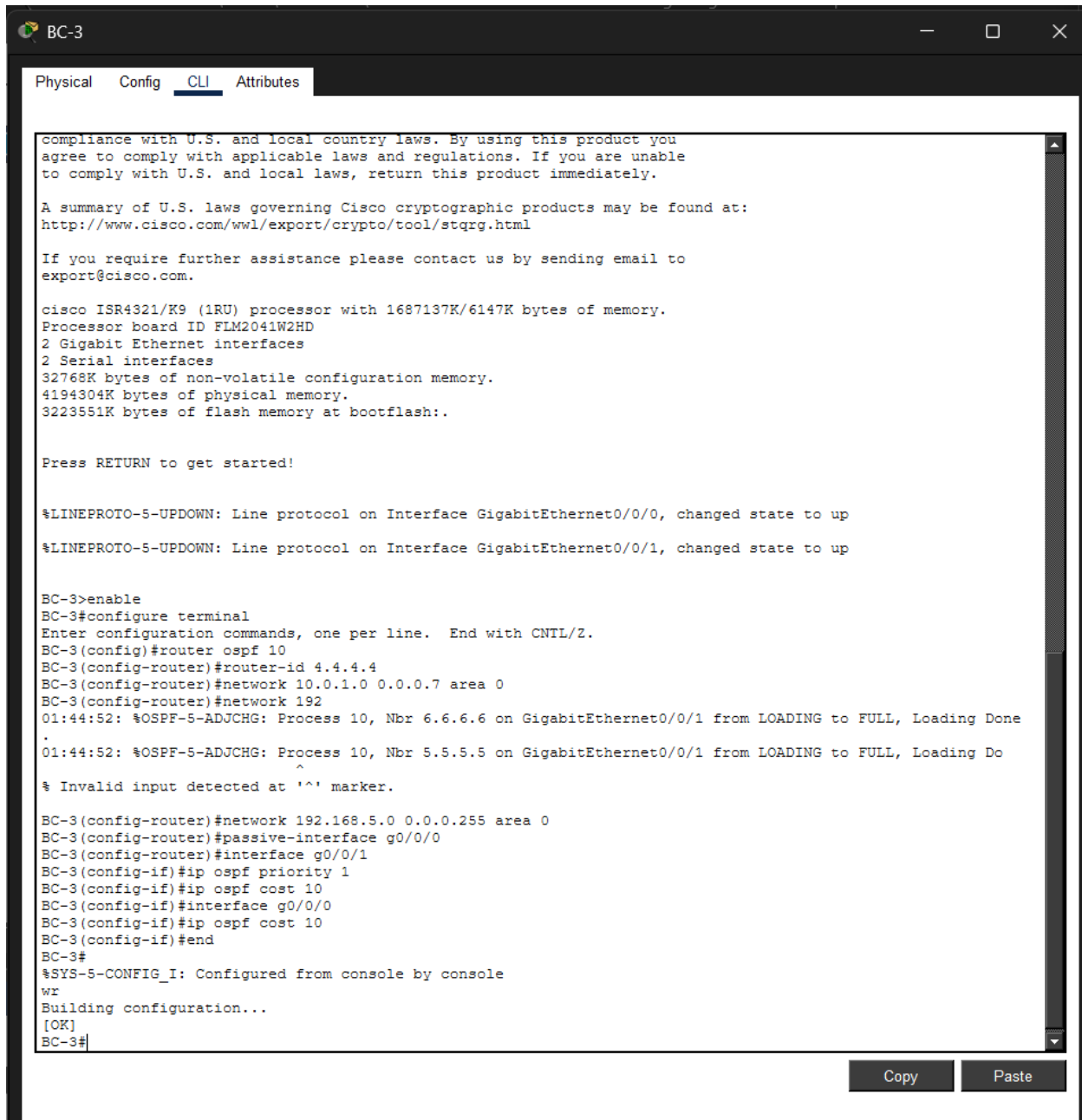
BC-2 (on the shared 10.0.1.0/29)

Interfaces: G0/0/0=192.168.4.1 (mask per your file), G0/0/1=10.0.1.2/29

```
BC-2                                                            —    □    ✕

 Physical   Config   CLI   Attributes

Importers, exporters, distributors and users are responsible for
compliance with U.S. and local country laws. By using this product you
agree to comply with applicable laws and regulations. If you are unable
to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html

If you require further assistance please contact us by sending email to
export@cisco.com.

cisco ISR4321/K9 (1RU) processor with 1687137K/6147K bytes of memory.
Processor board ID FLM2041W2HD
2 Gigabit Ethernet interfaces
2 Serial interfaces
32768K bytes of non-volatile configuration memory.
4194304K bytes of physical memory.
3223551K bytes of flash memory at bootflash:.


Press RETURN to get started!


%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/1, changed state to up


BC-2>enable
BC-2#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
BC-2(config)#router ospf 10
BC-2(config-router)#router-id 5.5.5.5
BC-2(config-router)#network 10.0.1.0 0.0.0.7 area 0
BC-2(config-router)#network 192.168.
01:40:08: %OSPF-5-ADJCHG: Process 10, Nbr 6.6.6.6 on GigabitEthernet0/0/1 from LOADING to FULL, Loading Done

                       ^
% Invalid input detected at '^' marker.

BC-2(config-router)#network 192.168.4.0 0.0.0.255 area 0
BC-2(config-router)#passive-interface g0/0/0
BC-2(config-router)#interface g0/0/1
BC-2(config-if)#ip ospf priority 1
BC-2(config-if)#ip ospf cost 10
BC-2(config-if)#interface g0/0/0
BC-2(config-if)#ip ospf cost 10
BC-2(config-if)#end
BC-2#
%SYS-5-CONFIG_I: Configured from console by console
wr
Building configuration...
[OK]
BC-2#

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```
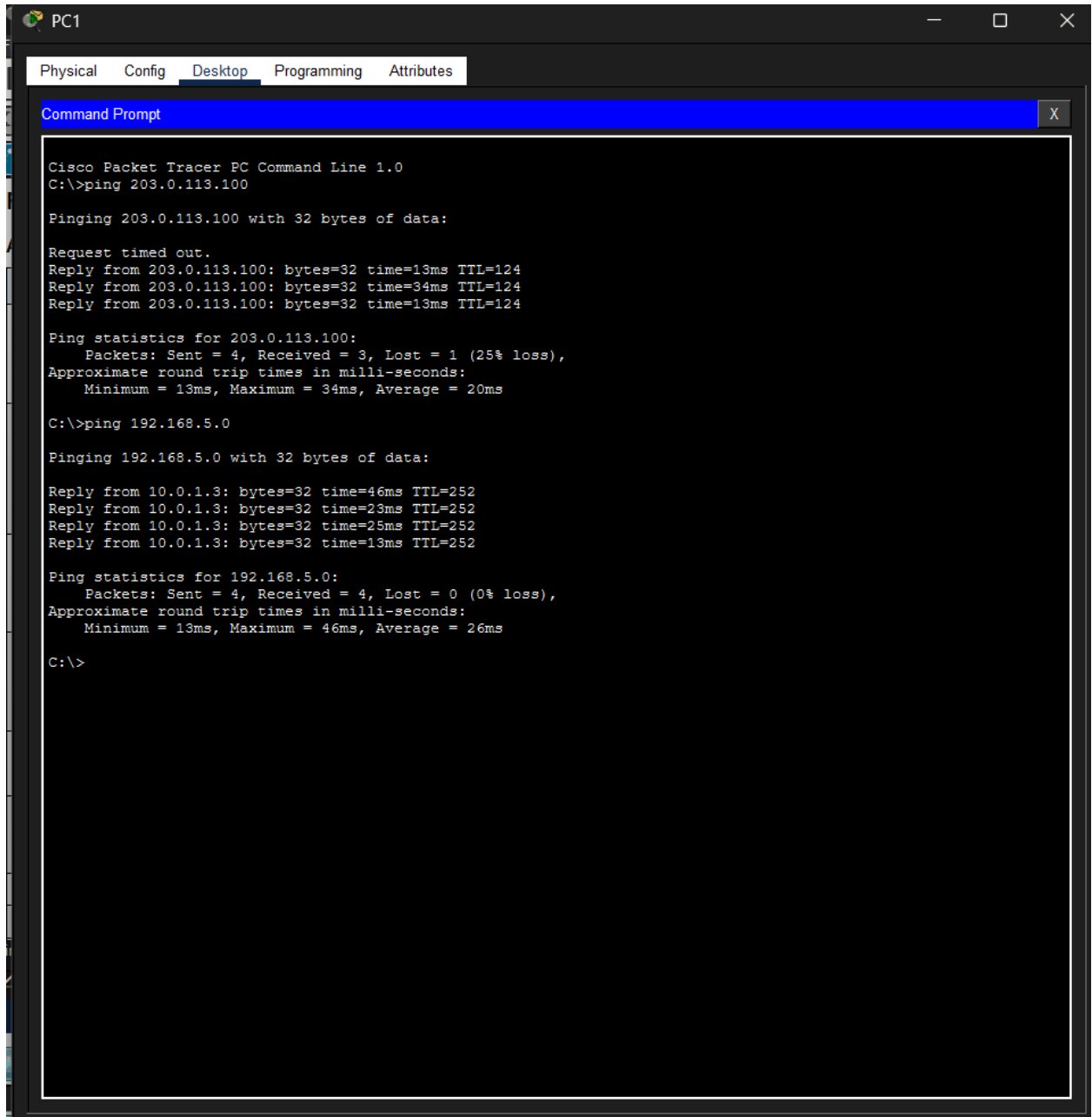
BC-3 (on the shared 10.0.1.0/29)

Interfaces: G0/0/0=192.168.5.1/24, G0/0/1=10.0.1.3/29

End-to-end tests

- From **PC1**.

- Ping **203.0.113.100** (Internet Server), and PC3


```
PC1                                                          —    □    X

Physical    Config    Desktop    Programming    Attributes

Command Prompt                                                        X

Cisco Packet Tracer PC Command Line 1.0
C:\>ping 203.0.113.100

Pinging 203.0.113.100 with 32 bytes of data:

Request timed out.
Reply from 203.0.113.100: bytes=32 time=13ms TTL=124
Reply from 203.0.113.100: bytes=32 time=34ms TTL=124
Reply from 203.0.113.100: bytes=32 time=13ms TTL=124

Ping statistics for 203.0.113.100:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 13ms, Maximum = 34ms, Average = 20ms

C:\>ping 192.168.5.0

Pinging 192.168.5.0 with 32 bytes of data:

Reply from 10.0.1.3: bytes=32 time=46ms TTL=252
Reply from 10.0.1.3: bytes=32 time=23ms TTL=252
Reply from 10.0.1.3: bytes=32 time=25ms TTL=252
Reply from 10.0.1.3: bytes=32 time=13ms TTL=252

Ping statistics for 192.168.5.0:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 13ms, Maximum = 46ms, Average = 26ms

C:\>
```

Packet Tracer Report

1. Objective

The goal of this assignment is to implement OSPF routing across a multi-router internetwork to ensure end-to-end communication between all local networks and external Internet access. The network was preconfigured with LAN connectivity, and this exercise focused on activating and tuning OSPF routing, propagating a default route from the headquarters router to all routers, optimizing routing parameters such as interface costs, timers, and router priorities, and verifying successful reachability from all end devices to the Internet server.

2. Network Topology Overview

The internetwork consists of three P2P routers connecting regional subnets, three BC (Backbone Core) routers forming the headquarters/multi-access area, and several end-user hosts and servers representing internal departments and external connectivity.

Device	Interfaces	IP Addresses/Prefix
P2P-1	S0/1/0, S0/1/1, S0/2/0	10.0.0.1/30, 10.0.0.9/30, 10.0.0.13/30
P2P-2	S0/1/0, S0/1/1, G0/0/0, G0/0/1	10.0.0.2/30, 10.0.0.5/30, 192.168.1.1/24, 192.168.2.1/24
P2P-3	S0/1/0, S0/1/1, G0/0/0	10.0.0.6/30, 10.0.0.10/30, 192.168.3.1/28
BC-1	S0/1/0, S0/1/1, G0/0/0	10.0.0.14/30, 64.0.100.2/30, 10.0.1.1/29
BC-2	G0/0/0, G0/0/1	192.168.4.1/30, 10.0.1.2/29
BC-3	G0/0/0, G0/0/1	192.168.5.1/24, 10.0.1.3/29
Internet Server	NIC	203.0.113.100/24
PC1, Laptop1, Workgroup Server, PC2, PC3	NIC	Host IPs within local subnets

3. Configuration Tasks

A. OSPF Process Setup
- Process ID 10 used across all routers.
- Area 0 configured throughout.
- HQ routers (BC-1, BC-2, BC-3) used network statements; Data routers (P2P-1, P2P-2, P2P-3) configured per-interface.

B. Router IDs
BC-1: 6.6.6.6
BC-2: 5.5.5.5
BC-3: 4.4.4.4

C. OSPF Optimization
- Interface costs: GigabitEthernet = 10, FastEthernet = 100.
- P2P-1 S0/1/1 cost = 50.
- Hello/Dead timers on BC-1 ↔ P2P-1 link doubled (20 / 80).
- BC-1 priority = 255 (DR).
- Passive interfaces applied on LANs.

D. Default Route
BC-1 configured with default route using exit interface:
ip route 0.0.0.0 0.0.0.0 s0/1/1
Propagated using 'default-information originate' under OSPF process 10.

4. Verification

Commands used:
- show ip ospf neighbor
- show ip ospf interface brief
- show ip route ospf
- show ip route 0.0.0.0
- ping 203.0.113.100

Results: All routers formed FULL adjacencies, default routes visible (O*E2), and all hosts successfully pinged the Internet Server.

5. Challenges and Troubleshooting

- Timer mismatch between BC-1 and P2P-1 initially prevented adjacency formation.
- BC-1 DR election corrected by setting priority to 255.
- Default route propagation confirmed only after adding 'default-information originate'.

6. Conclusion

OSPF routing was successfully deployed with verified connectivity to the Internet Server. All configuration requirements—including router IDs, interface costs, DR/BDR election, and default route propagation—were satisfied.

7. Recommendations

- Implement OSPF authentication for security.
- Use loopback interfaces as router IDs.
- Maintain a link and timer reference table for future troubleshooting.