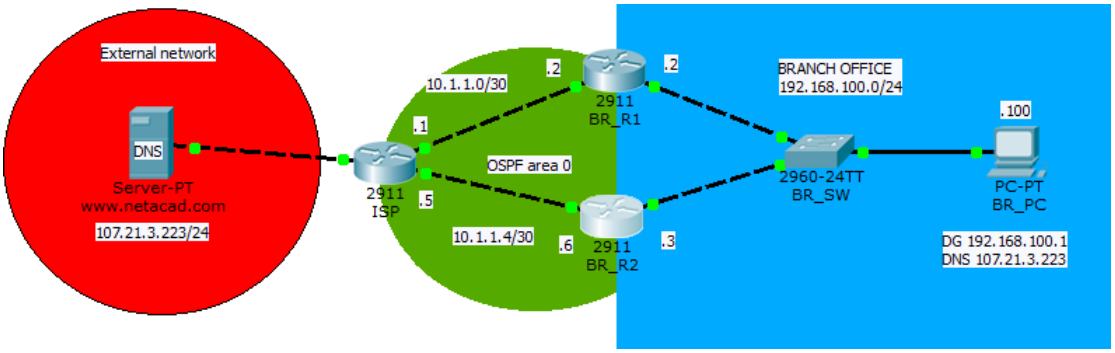
Configuring basic HSRP (Hot Standby Router Protocol)

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
ISP	**Gi0/0**	10.1.1.1	255.255.255.252	N/A
	Gi0/1	10.1.1.5	255.255.255.252	N/A
	Gi0/2	107.21.3.1	255.255.255.0	N/A
BR_R1	**Gi0/0**	192.168.100.2	255.255.255.0	N/A
	Gi0/1	10.1.1.2	255.255.255.252	N/A
BR_R2	**Gi0/0**	192.168.100.3	255.255.255.0	N/A
	Gi0/1	10.1.1.6	255.255.255.252	N/A
BR_PC	**NIC**	192.168.100.100	255.255.255.0	192.168.100.1
Server	**NIC**	107.21.3.223	255.255.255.0	107.21.3.1

Learning Objectives

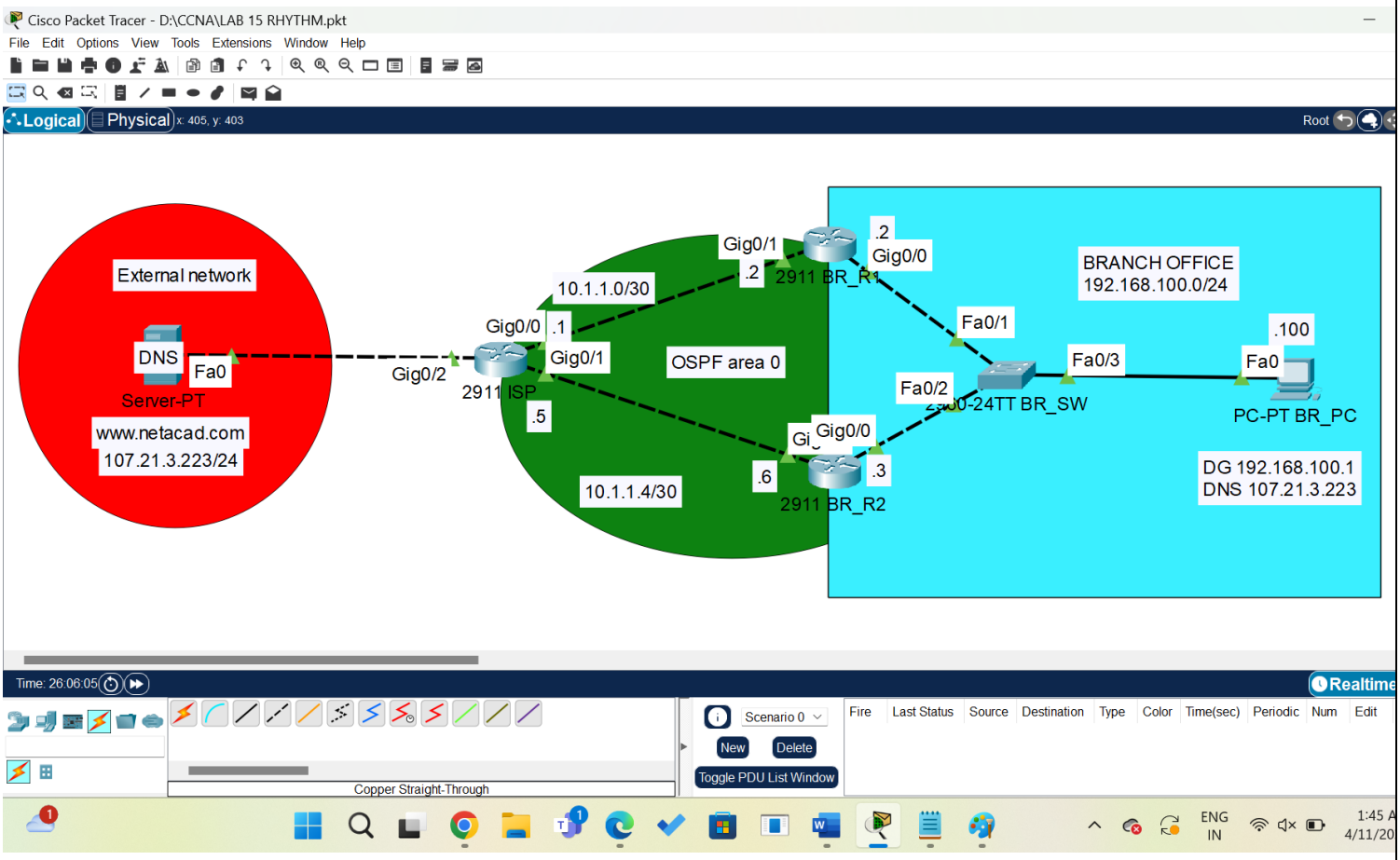
- Configure STP
- Configure OSPF routing and verify functionality
- Configure HSRP and verify functionality
- Configure Ethernet interface on host PC and test failover

Introduction

In this activity, you will perform basic STP and OSPF configuration before activating HSRP on the Branch routers. ISP, BR_R1, BR_R2 have already been preconfigured with hostnames and IP addresses. The DNS/Web server has also been preconfigured.

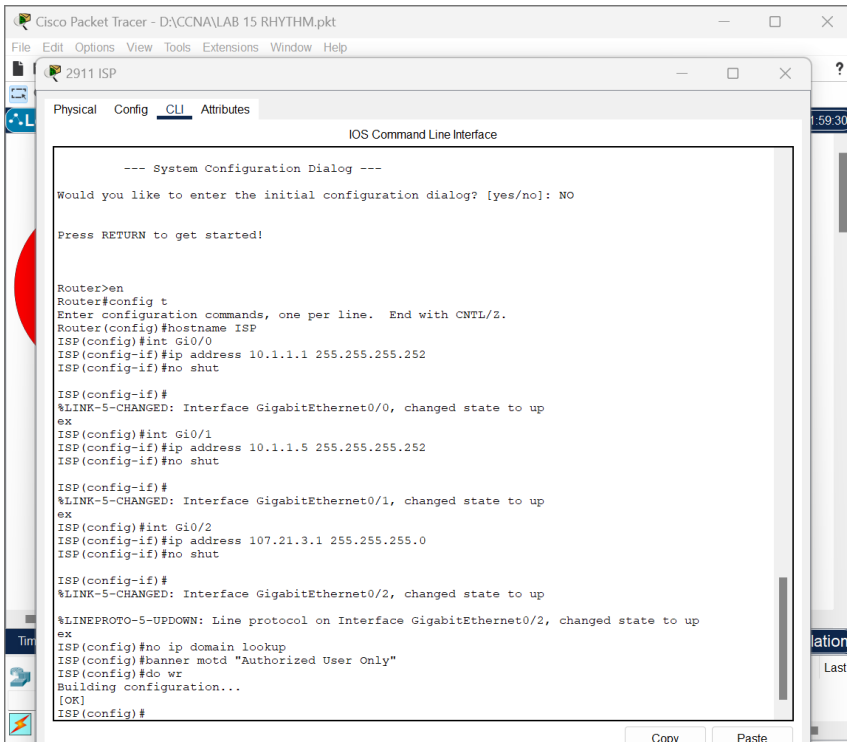
SOLUTION

TOPOLOGY DIAGRAM AS PER TABLE

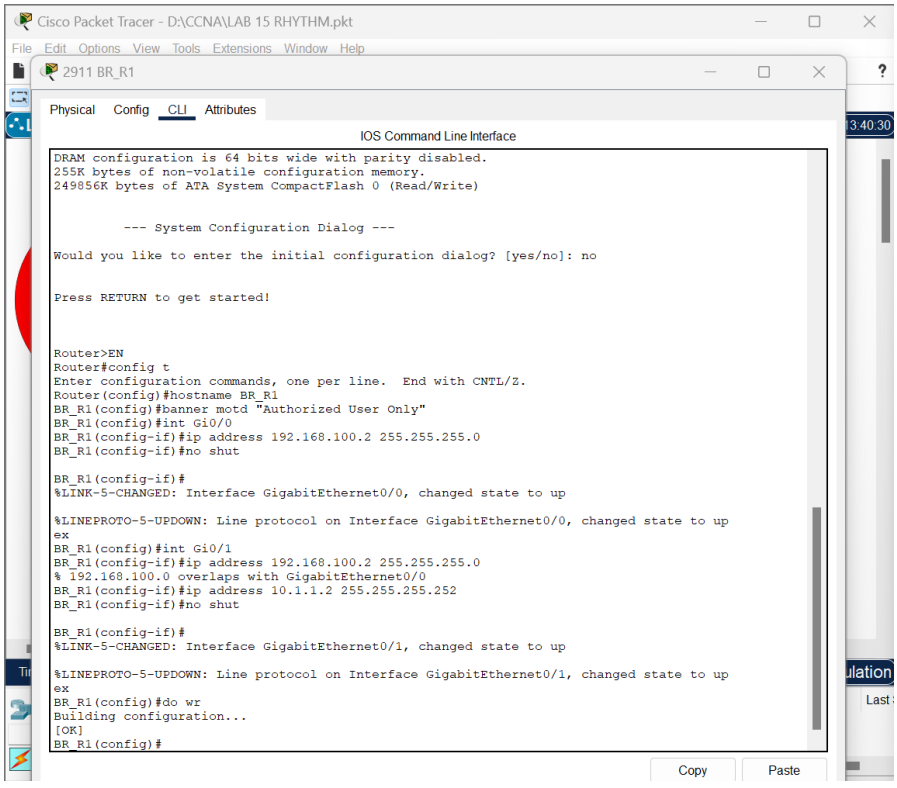


Basic Network Configuration:

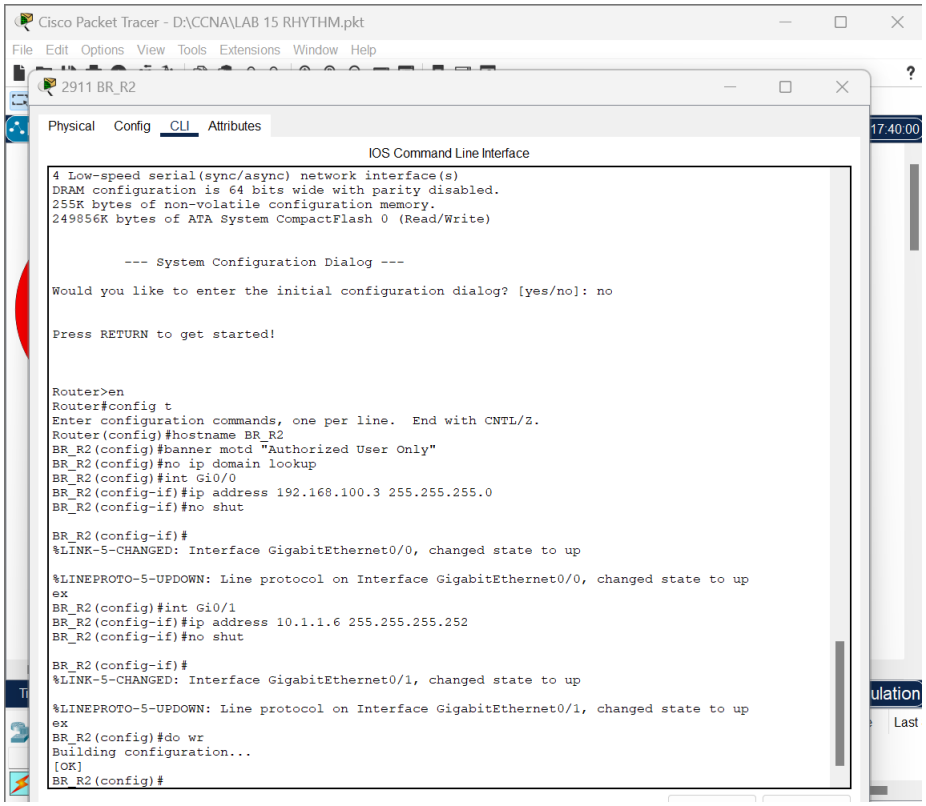
ISP



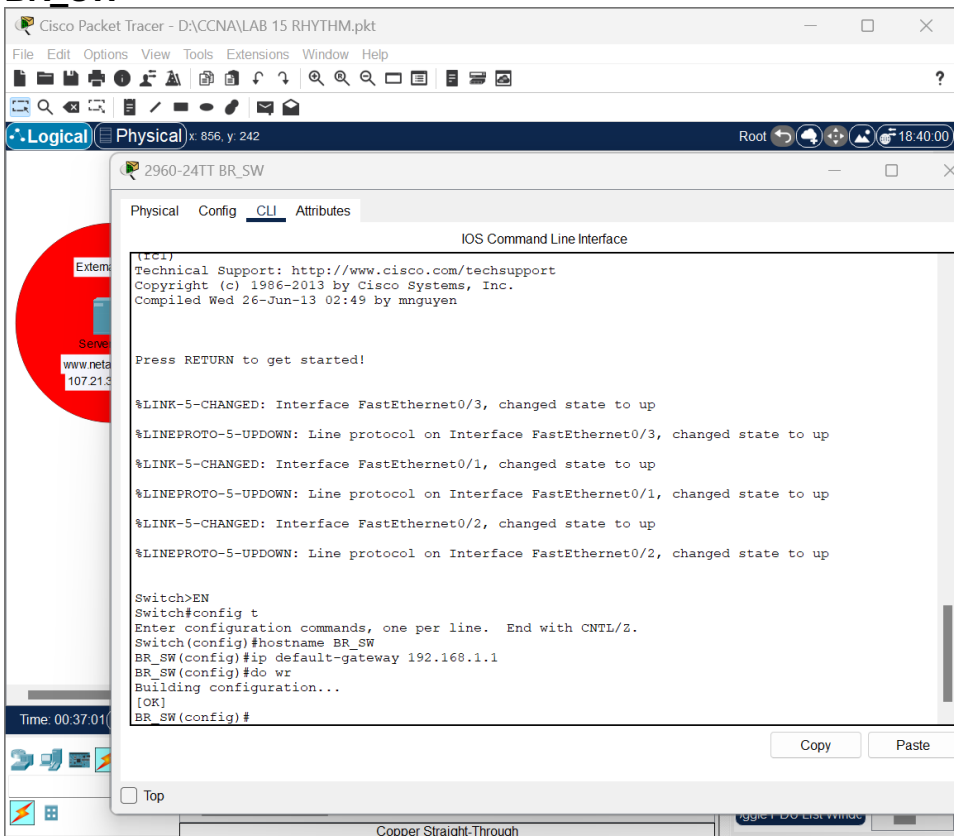
BR_R1



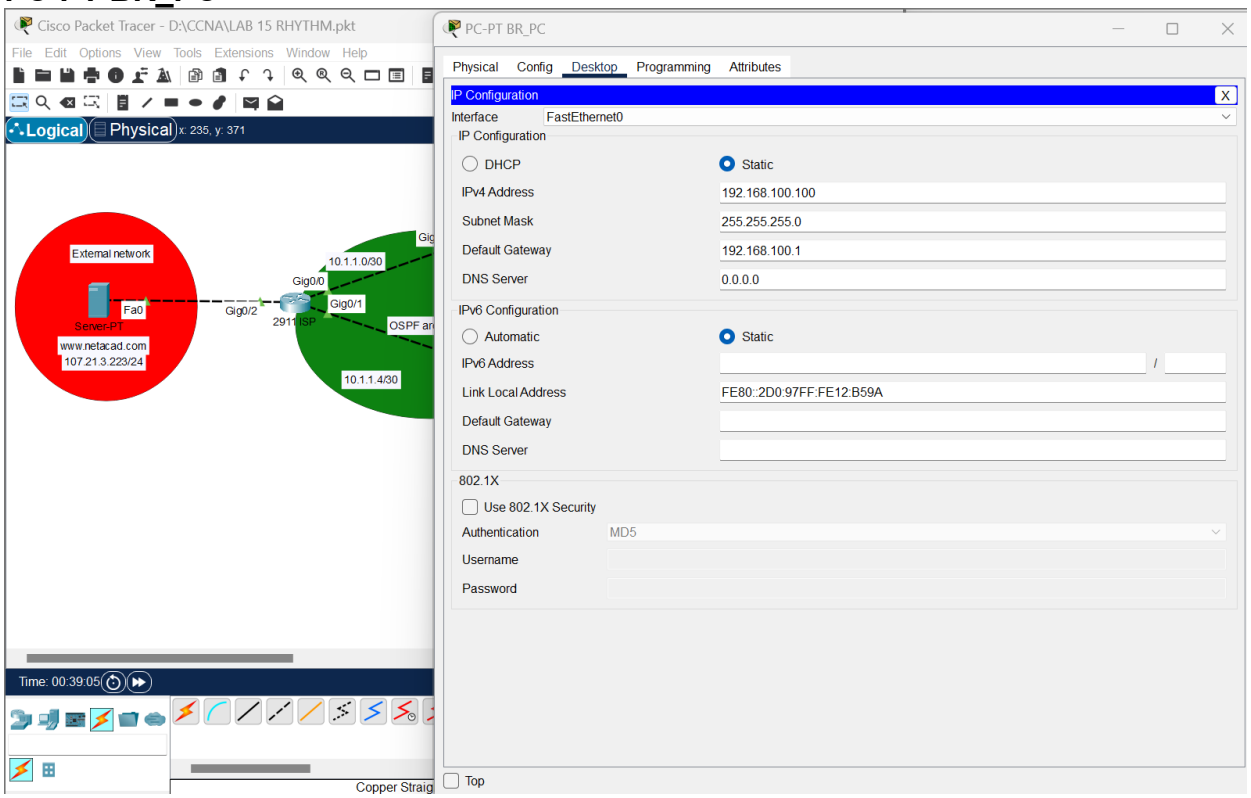
BR_R2


Cisco Packet Tracer - D:\CCNA\LAB 15 RHYTHM.pkt
File Edit Options View Tools Extensions Window Help
2911 BR_R2
Physical Config CLI Attributes
IOS Command Line Interface
4 Low-speed serial(sync/async) network interface(s)
DRAM configuration is 64 bits wide with parity disabled.
255K bytes of non-volatile configuration memory.
249856K bytes of ATA System CompactFlash 0 (Read/Write)
--- System Configuration Dialog ---
Would you like to enter the initial configuration dialog? [yes/no]: no
Press RETURN to get started!
Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname BR_R2
BR_R2(config)#banner motd "Authorized User Only"
BR_R2(config)#no ip domain lookup
BR_R2(config)#int Gi0/0
BR_R2(config-if)#ip address 192.168.100.3 255.255.255.0
BR_R2(config-if)#no shut
BR_R2(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up
ex
BR_R2(config)#int Gi0/1
BR_R2(config-if)#ip address 10.1.1.6 255.255.255.252
BR_R2(config-if)#no shut
BR_R2(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up
ex
BR_R2(config)#do wr
Building configuration...
[OK]
BR_R2(config)#

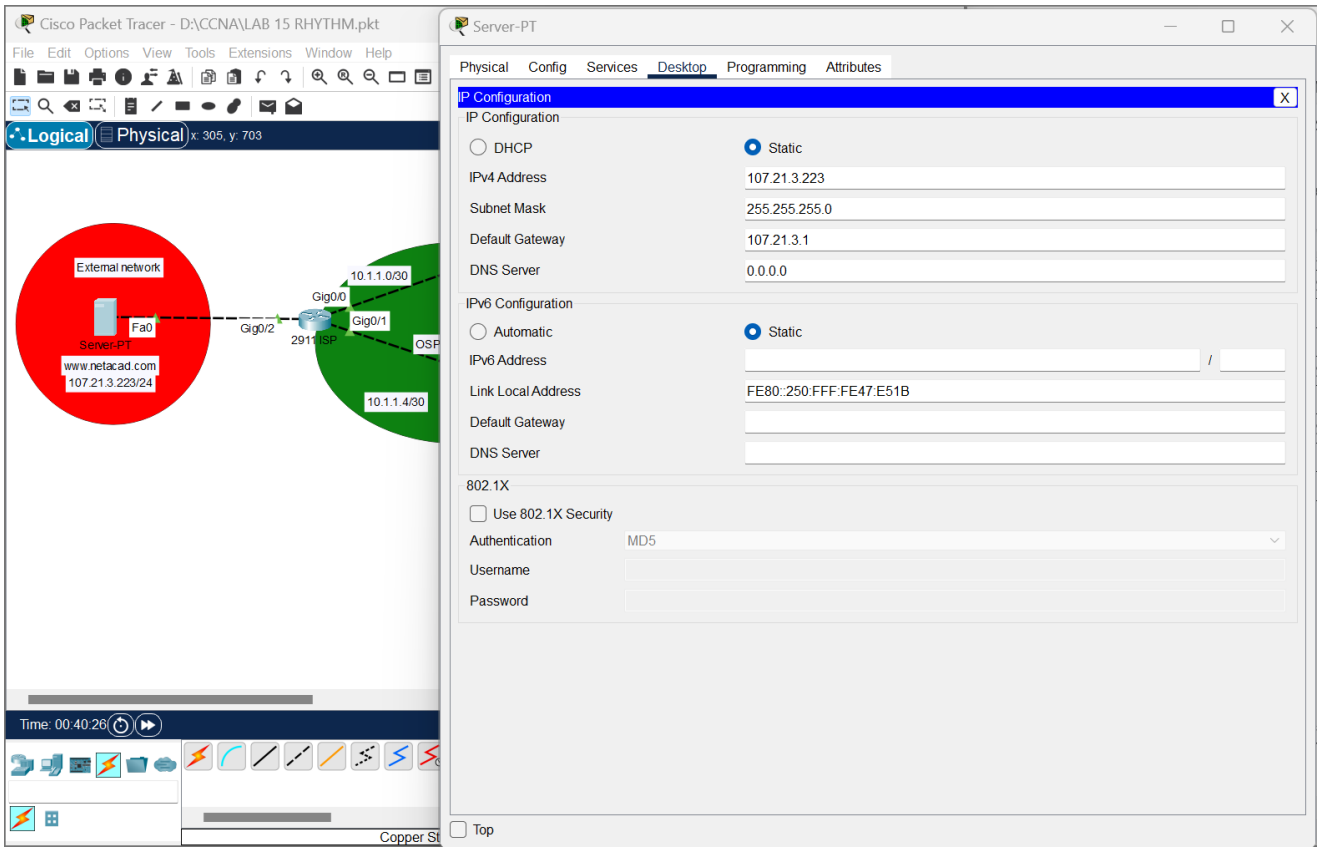
BR_SW

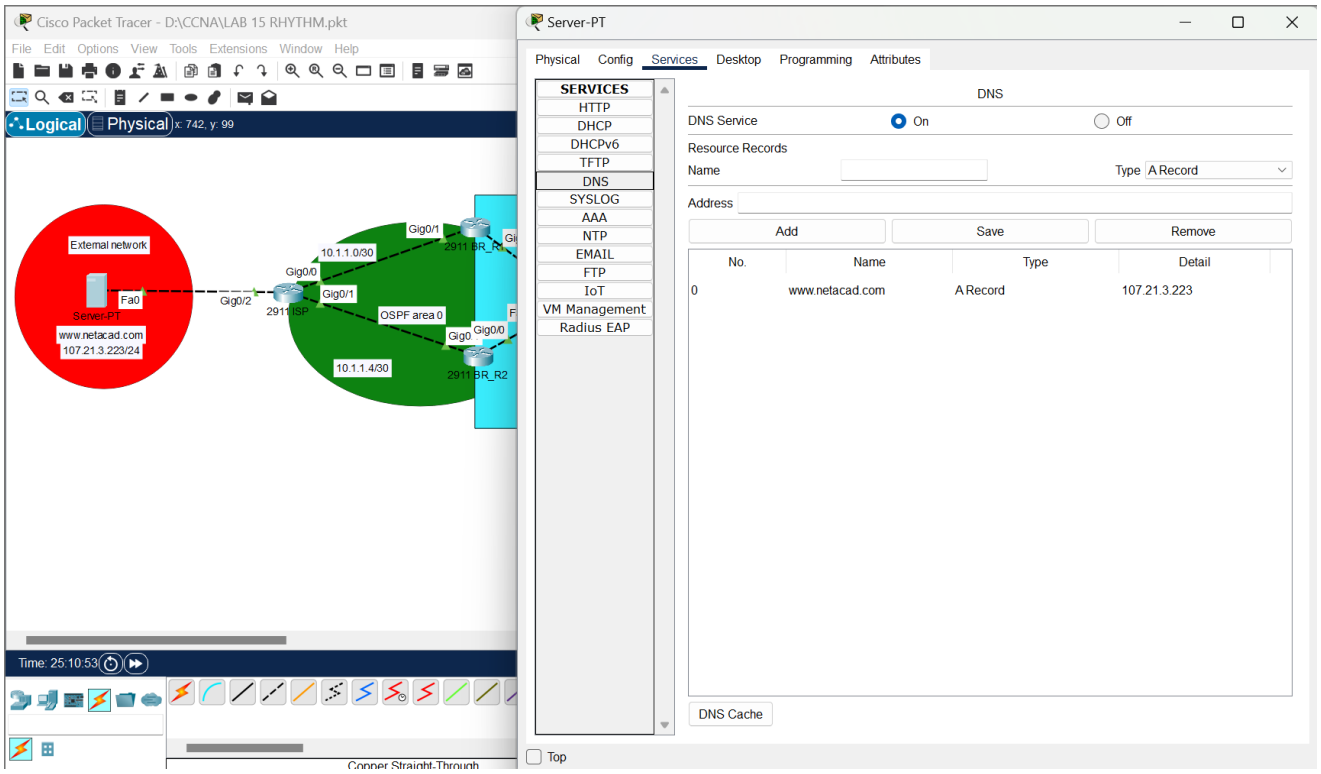

Cisco Packet Tracer - D:\CCNA\LAB 15 RHYTHM.pkt
File Edit Options View Tools Extensions Window Help
Logical Physical x: 856, y: 242
Root 18:40:00
2960-24TT BR_SW
Physical Config CLI Attributes
IOS Command Line Interface
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2013 by Cisco Systems, Inc.
Compiled Wed 26-Jun-13 02:49 by mnguyen
Press RETURN to get started!
%LINK-5-CHANGED: Interface FastEthernet0/3, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up
Switch>EN
Switch#config t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname BR_SW
BR_SW(config)#ip default-gateway 192.168.1.1
BR_SW(config)#do wr
Building configuration...
[OK]
BR_SW(config)#
Copy
Paste
Top
Time: 00:37:01
Copper Straight-Through

PC-PT BR_PC



SERVER-PT

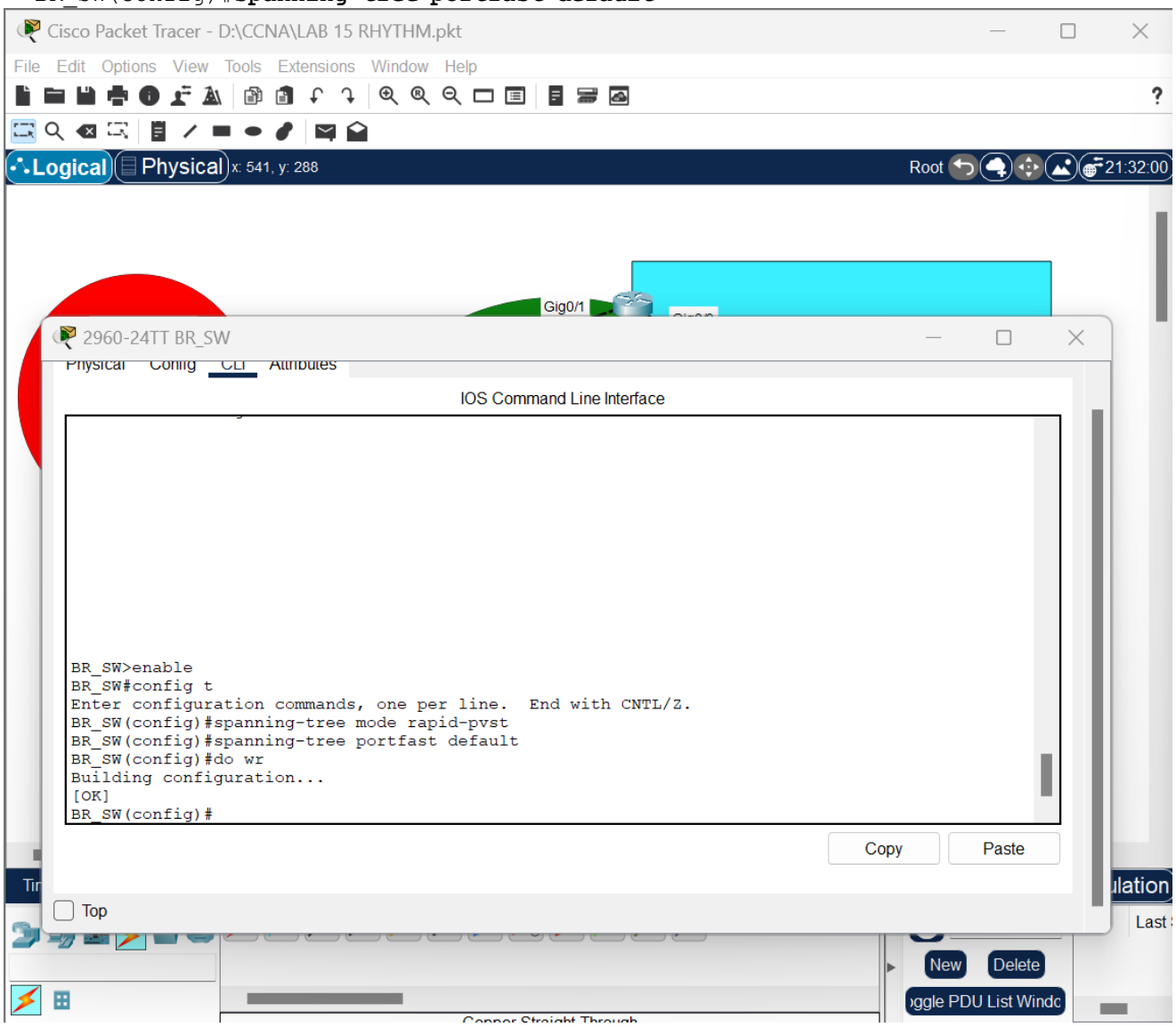



Cisco Packet Tracer - D:\CCNA\LAB 15 RHYTHM.pkt
File Edit Options View Tools Extensions Window Help
Logical Physical x: 742, y: 99
External network
Fa0
Server-PT
www.netacad.com
107.21.3.223/24
Gig0/2
2911 ISP
Gig0/0
Gig0/1
10.1.1.0/30
Gig0/1
2911 BR_R1
OSPF area 0
Gig0
Gig0/0
2911 BR_R2
10.1.1.4/30
Time: 25:10:53
Copper Straight-Through
Server-PT
Physical Config Services Desktop Programming Attributes
SERVICES
HTTP
DHCP
DHCPv6
TFTP
DNS
SYSLOG
AAA
NTP
EMAIL
FTP
IoT
VM Management
Radius EAP
DNS
DNS Service On Off
Resource Records
Name
Type A Record
Address
Add Save Remove
No. Name Type Detail
0 www.netacad.com A Record 107.21.3.223
DNS Cache
Top

Task 1: Configure STP

Configure BR_SW to support Rapid-PVST+ and Port Fast. This will guarantee quicker failover of HSRP:

```
BR_SW>enable
BR_SW#config term
BR_SW(config)#spanning-tree mode rapid-pvst
BR_SW(config)#spanning-tree portfast default
```



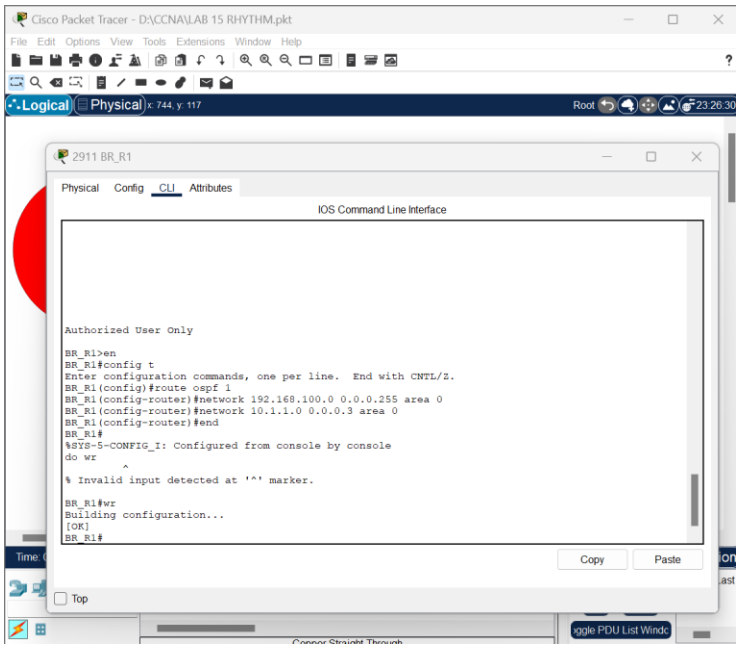
Your completion result should be 8%. If not, check for missing configuration statements.

Task 2: Configure OSPF routing

Configure OSPF on ISP, BR_R1 and BR_R2. Assign all interfaces to Area 0, except for Gi0/2 on ISP. ISP will advertise a default route to BR_R1 and BR_R2.

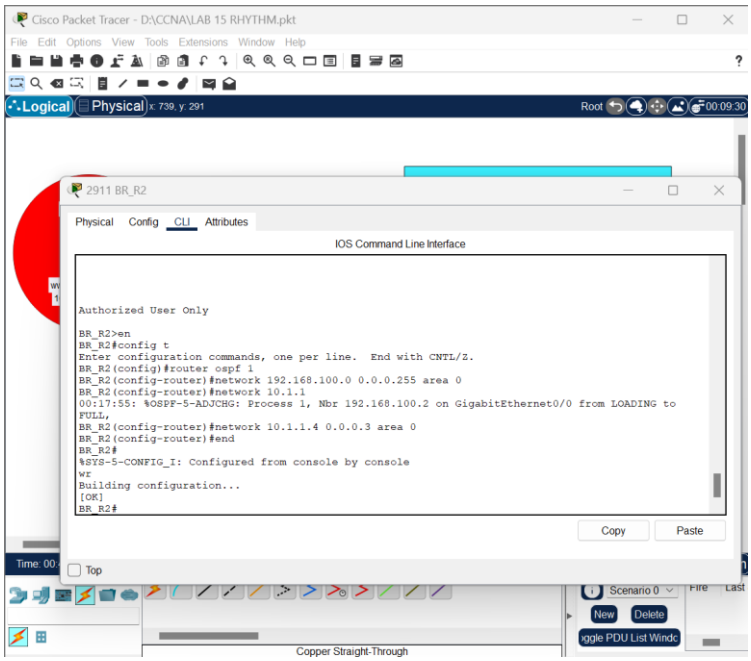
Step 1. Enable OSPF on BR_R1

```
BR_R1(config)#router ospf 1
BR_R1(config-router)#network 192.168.100.0 0.0.0.255 area 0
BR_R1(config-router)#network 10.1.1.0 0.0.0.3 area 0
BR_R1(config-router)#end
```



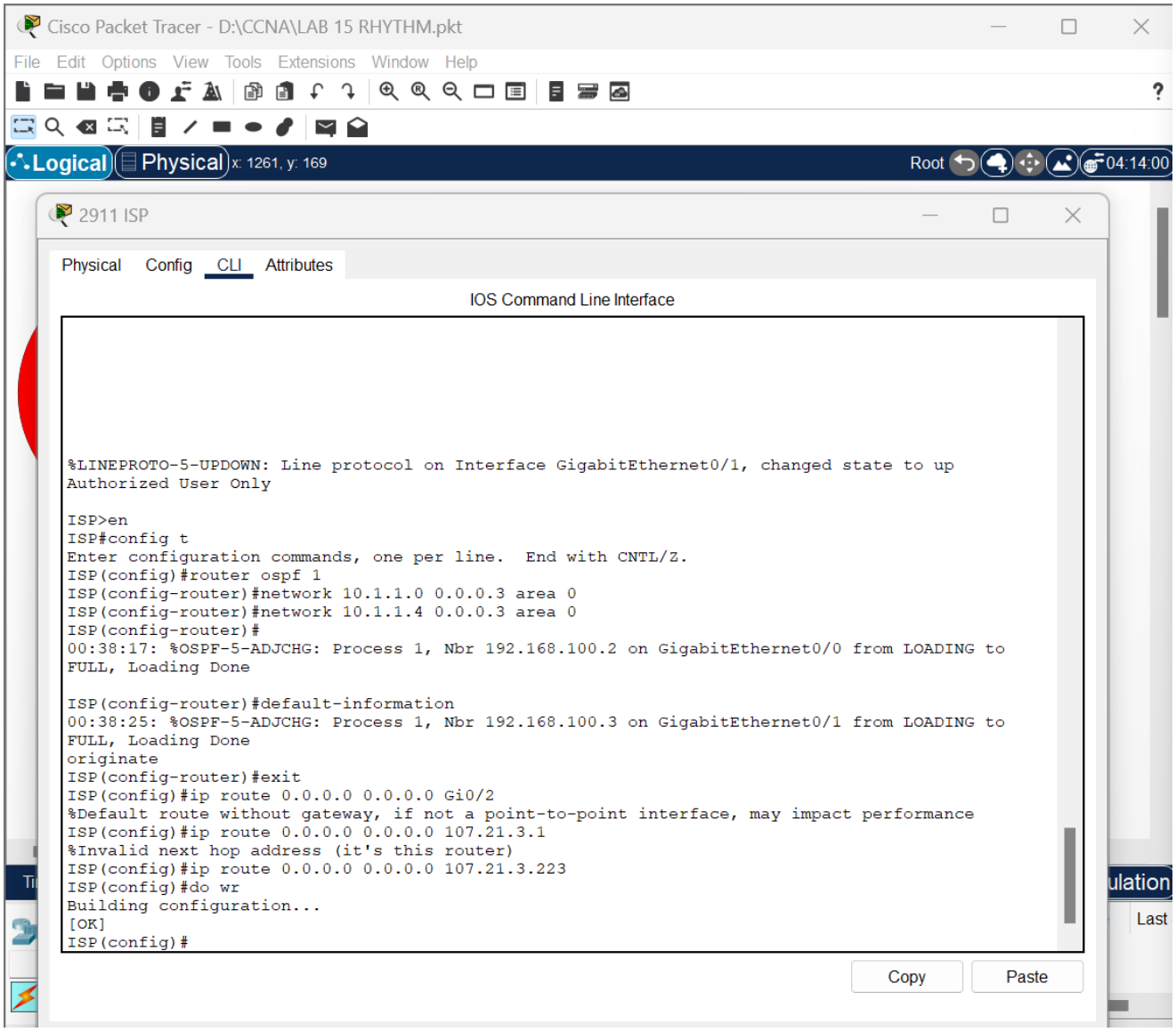
Step 2. Enable OSPF on BR_R2

```
BR_R2(config)#router ospf 1
BR_R2(config-router)#network 192.168.100.0 0.0.0.255 area 0
BR_R2(config-router)#network 10.1.1.4 0.0.0.3 area 0
BR_R2(config-router)#end
```



Step 3. Enable OSPF on ISP

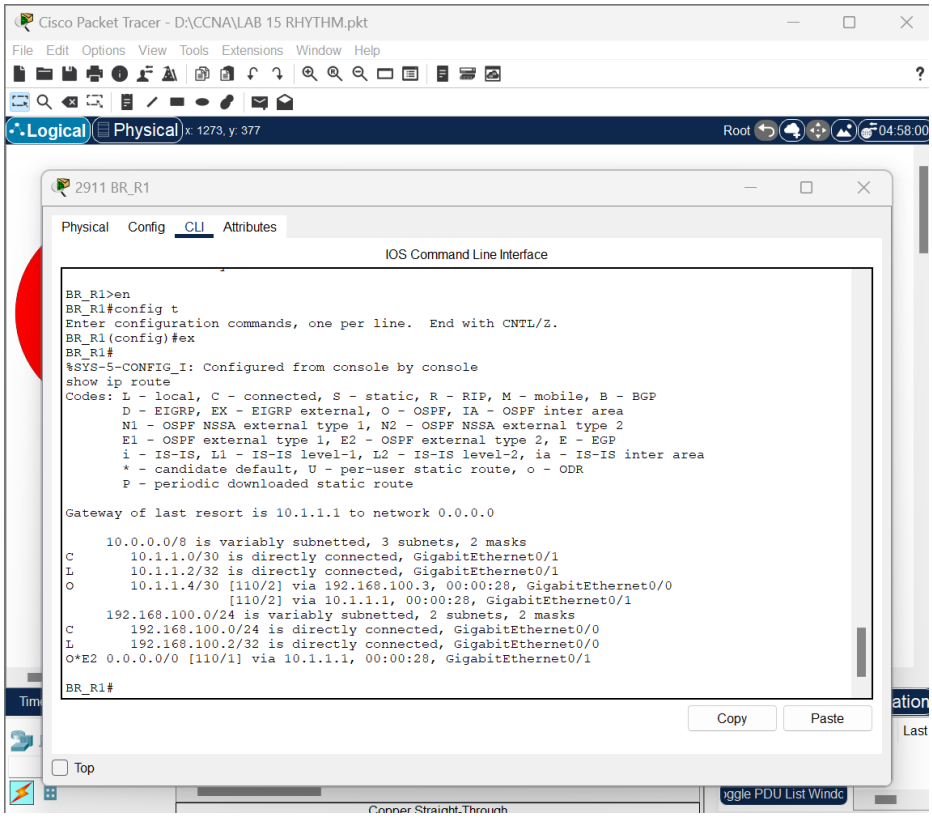
```
ISP(config)#router ospf 1
ISP(config-router)#network 10.1.1.0 0.0.0.3 area 0
ISP(config-router)#network 10.1.1.4 0.0.0.3 area 0
ISP(config-router)#default-information originate
ISP(config-router)#exit
ISP(config)#ip route 0.0.0.0 0.0.0.0 Gi0/2
```



Step 4. Verify routing

Use the **show ip route** command on BR_R1 and BR_R2 to verify that OSPF is operating correctly. Both routers should be receiving a default route (type O*E2) from ISP.

```
BR_R1#show ip route
Codes: L - local, 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, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route
Gateway of last resort is 10.1.1.1 to network 0.0.0.0
     10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C       10.1.1.0/30 is directly connected, GigabitEthernet0/1
L       10.1.1.2/32 is directly connected, GigabitEthernet0/1
O       10.1.1.4/30 [110/2] via 192.168.100.3, 00:17:05, GigabitEthernet0/0
[110/2] via 10.1.1.1, 00:17:05, GigabitEthernet0/1 192.168.100.0/24 is
variably subnetted, 2 subnets, 2 masks
C       192.168.100.0/24 is directly connected, GigabitEthernet0/0
L      192.168.100.2/32 is directly connected, GigabitEthernet0/0
O*E2 0.0.0.0/0 [110/1] via 10.1.1.1, 00:17:05, GigabitEthernet0/1
```



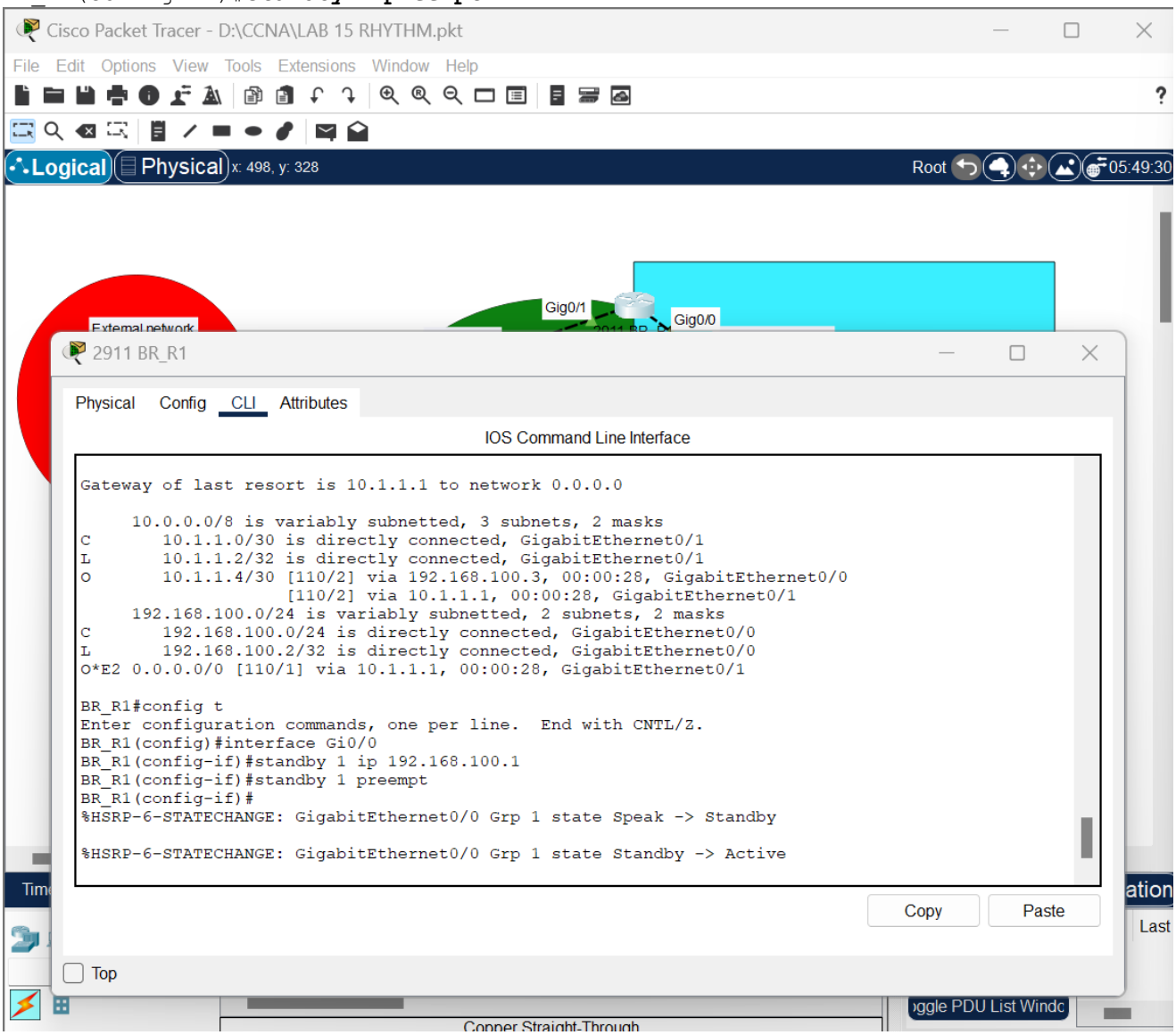
Your completion result should be 56%. If not, check for missing configuration statements.

Task 3: Configure HSRP

Configure HSRP group 1 on BR_R1 and BR_R2 using 192.168.100.1 as the standby virtual IP address. By default, Packet Tracer supports HSRP version 2. BR_R1 will be configured as the Active HSRP default-gateway and BR_R2 will be configured as Standby. Preemption is configured on both routers.

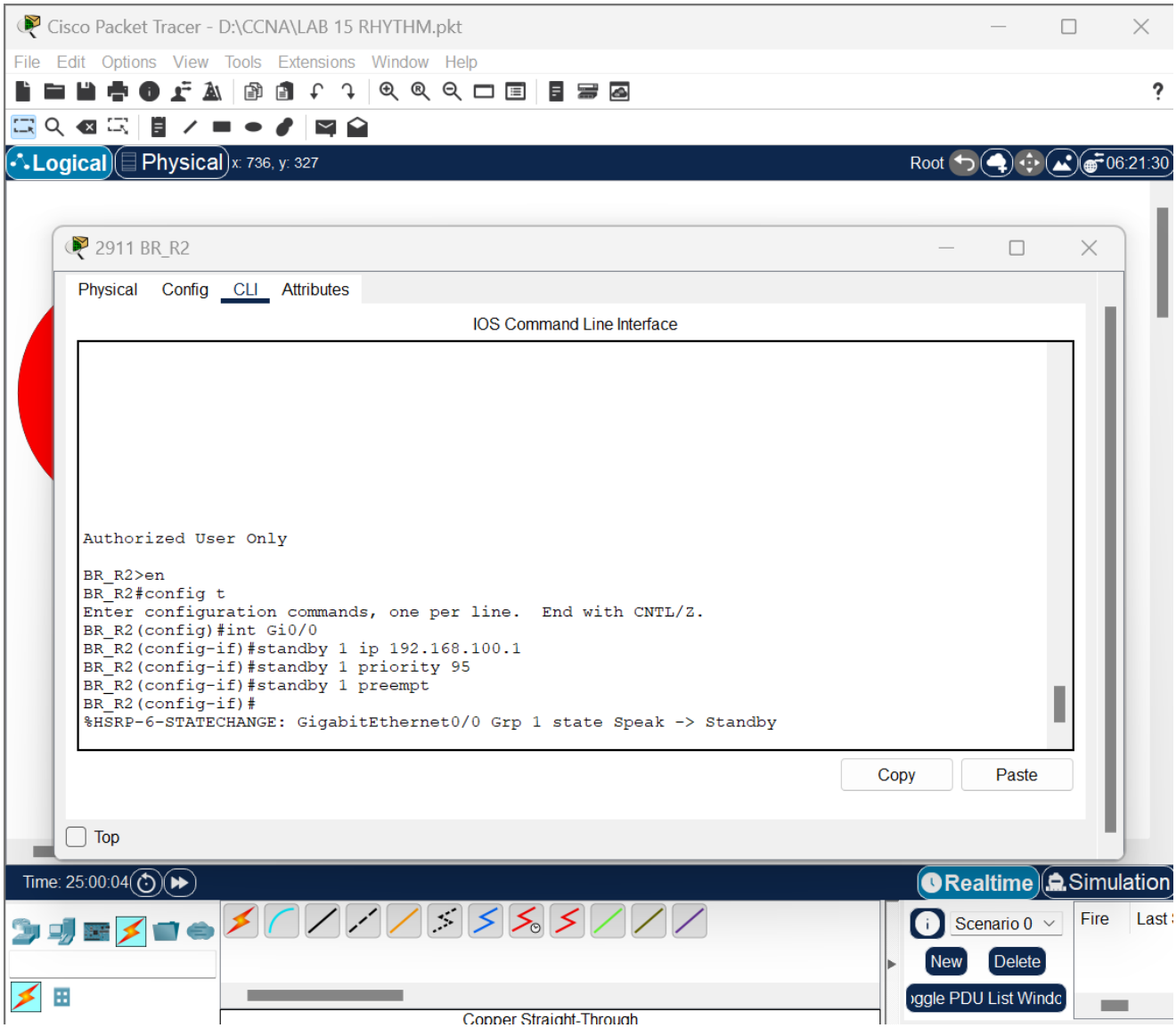
Step 1. Enable HSRP on BR_R1

```
BR_R1(config)#interface gi0/0
BR_R1(config-if)#standby 1 ip 192.168.100.1
BR_R1(config-if)#standby 1 preempt
```



Step 2. Enable HSRP on BR_R2

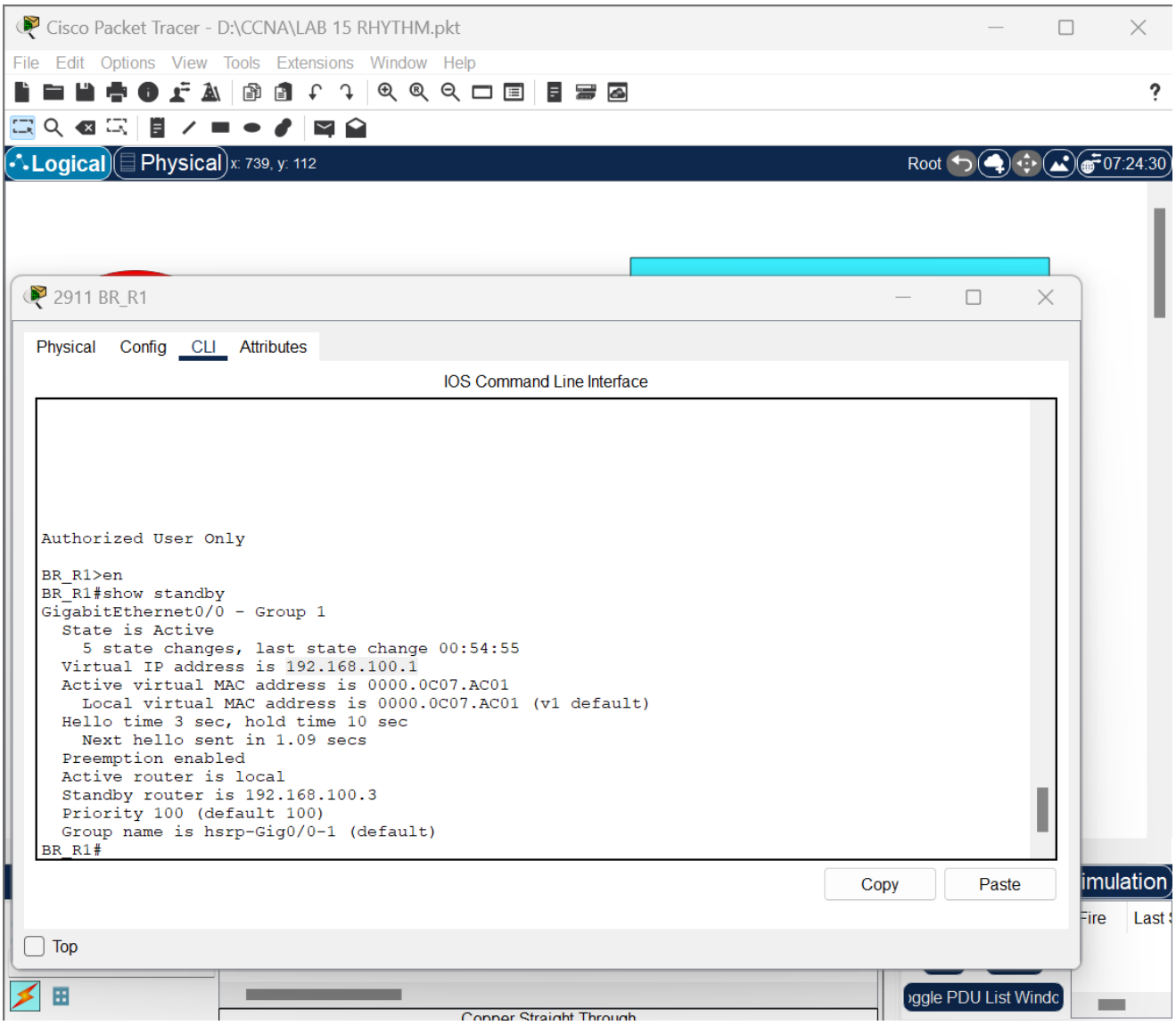
```
BR_R2(config)#interface gi0/0
BR_R2 (config-if)#standby 1 ip 192.168.100.1
BR_R2 (config-if)#standby 1 priority 95
BR_R2 (config-if)#standby 1 preempt
```



Step 3. Verify HSRP

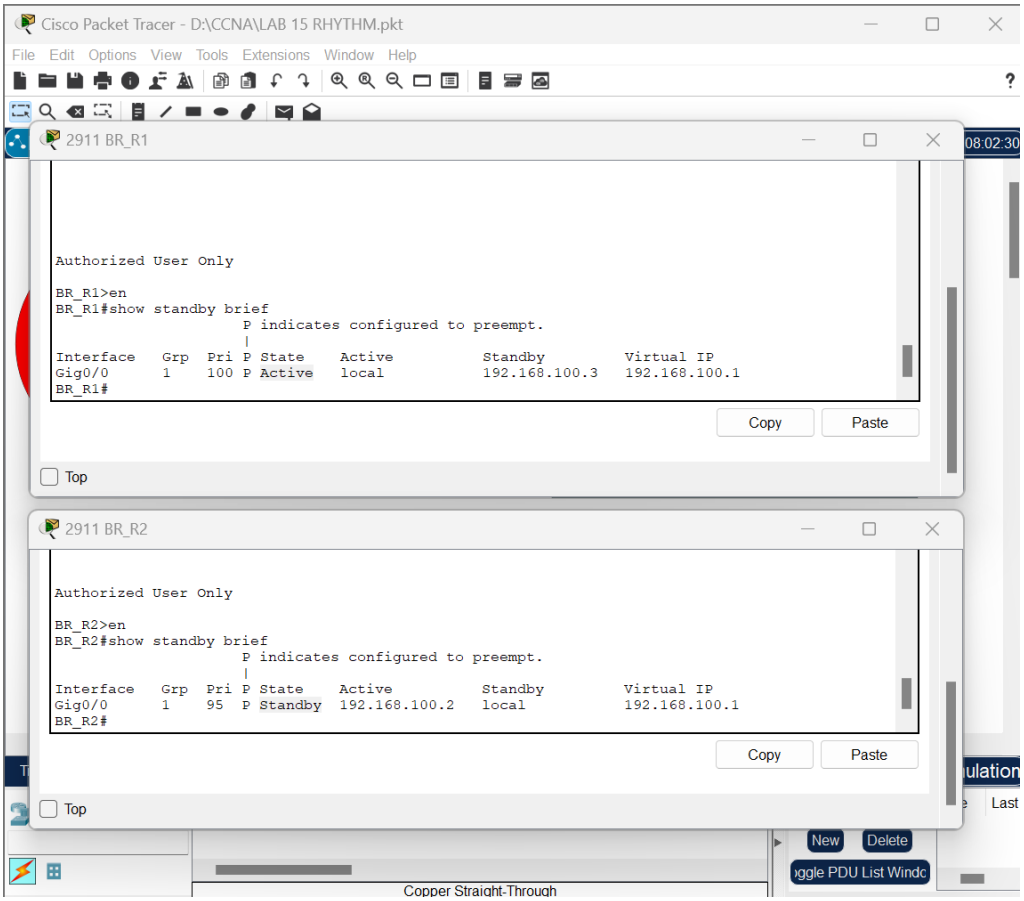
After a few moments, use the **show standby** and **show standby brief** commands on BR_R1 and BR_R2 to verify that HSRP is operating correctly. BR_R1 should be the Active router and BR_R2 should be Standby.

```
BR_R1#show standby
```




```
GigabitEthernet0/0 - Group 1 (version 2)
  State is Active
    5 state changes, last state change 00:00:19
  Virtual IP address is 192.168.100.1
  Active virtual MAC address is 0000.0C9F.F001
    Local virtual MAC address is 0000.0C9F.F001 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.314 secs
  Preemption enabled
  Active router is local
```

```
  Standby router is 192.168.100.3
  Priority 100 (default 100)
  Group name is hsrp-Gig0/0-1 (default)

BR_R1#show standby brief

                     P indicates configured to preempt.
                     |
Interface   Grp  Pri P State   Active          Standby         Virtual IP
Gig0/0      1    100 P Active  local           192.168.100.3   192.168.100.1

BR_R2#sh standby brief
                     P indicates configured to preempt.
                     |
Interface   Grp  Pri P State   Active          Standby         Virtual IP
Gig0/0      1    95  P Standby 192.168.100.2   local           192.168.100.1
```

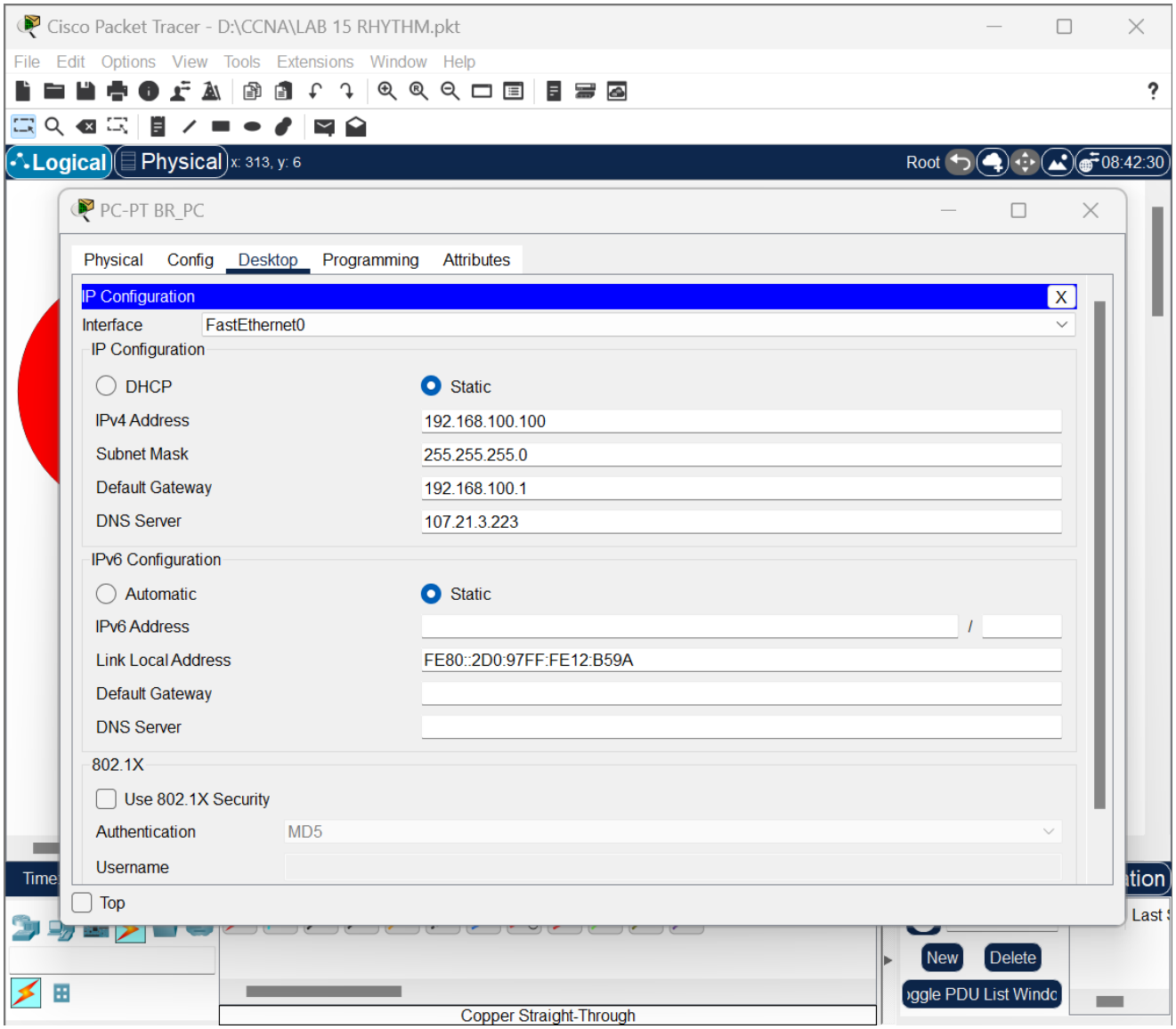


Your completion result should be 82%. If not, check for missing configuration statements.

Task 4: Configure Ethernet interface on host PC and test HSRP failover functionality

Step 1. Configure host PC

Configure the NIC on BR_PC according to the information in the table. Also configure BR_PC to use **107.21.3.223** as its DNS server.

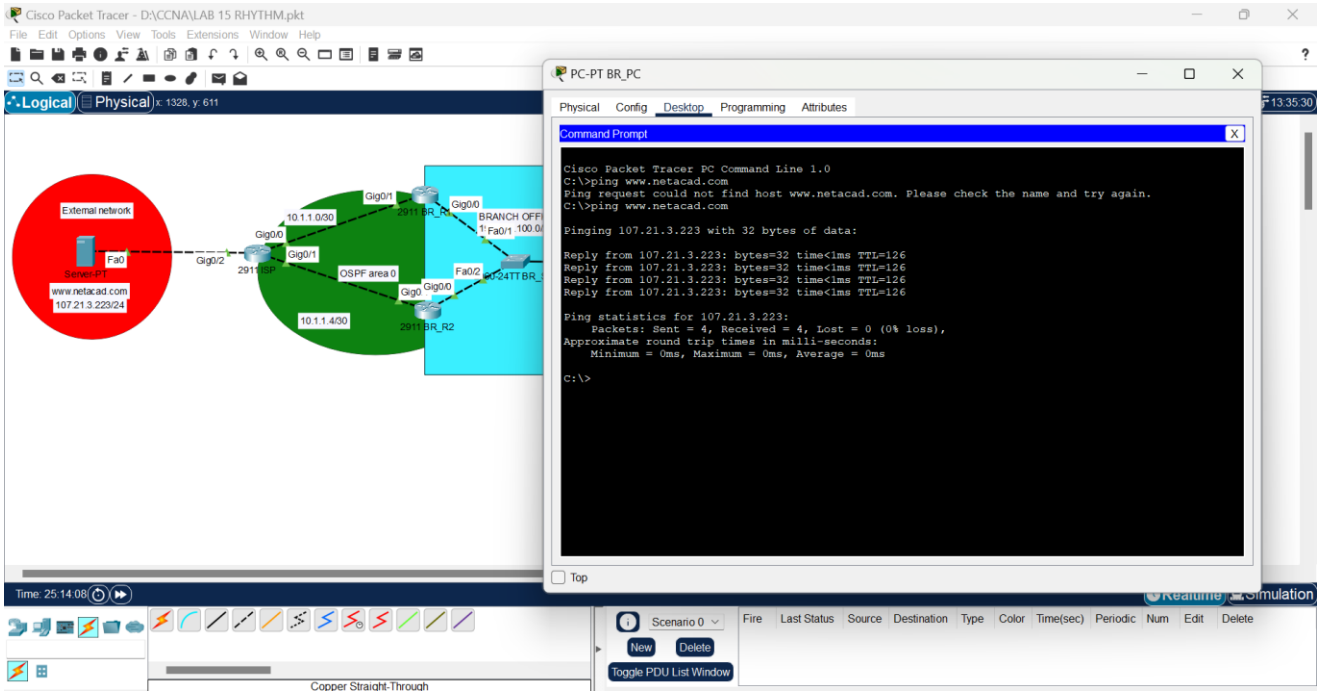


Step 2. Test connectivity using Ping

Use a command prompt on BR_PC to Ping the server using the URL http://**www.netacad.com**

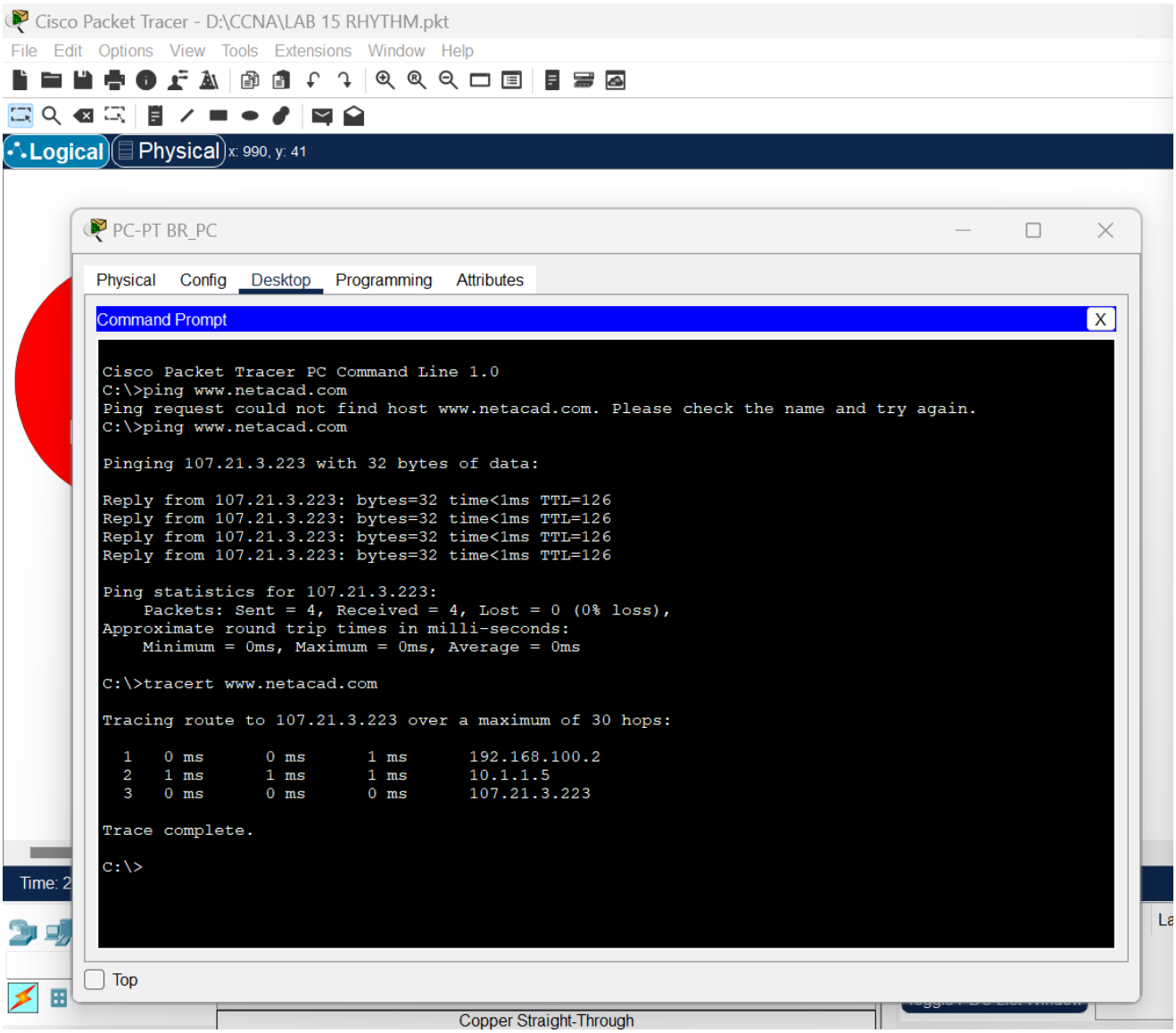
```
PC>ping www.netacad.com
Pinging 107.21.3.223 with 32 bytes of data:

Reply from 107.21.3.223: bytes=32 time=13ms TTL=126
Reply from 107.21.3.223: bytes=32 time=1ms TTL=126
Reply from 107.21.3.223: bytes=32 time=0ms TTL=126
Reply from 107.21.3.223: bytes=32 time=1ms TTL=126
```

```
Ping statistics for 107.21.3.223:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 13ms, Average = 3ms
```



Step 3. Test connectivity using Tracert

Use a command prompt to trace the physical path taken from BR_PC to the Server. Confirm that the first hop is the physical address of BR_R1 Gi0/0 interface (192.168.100.2)

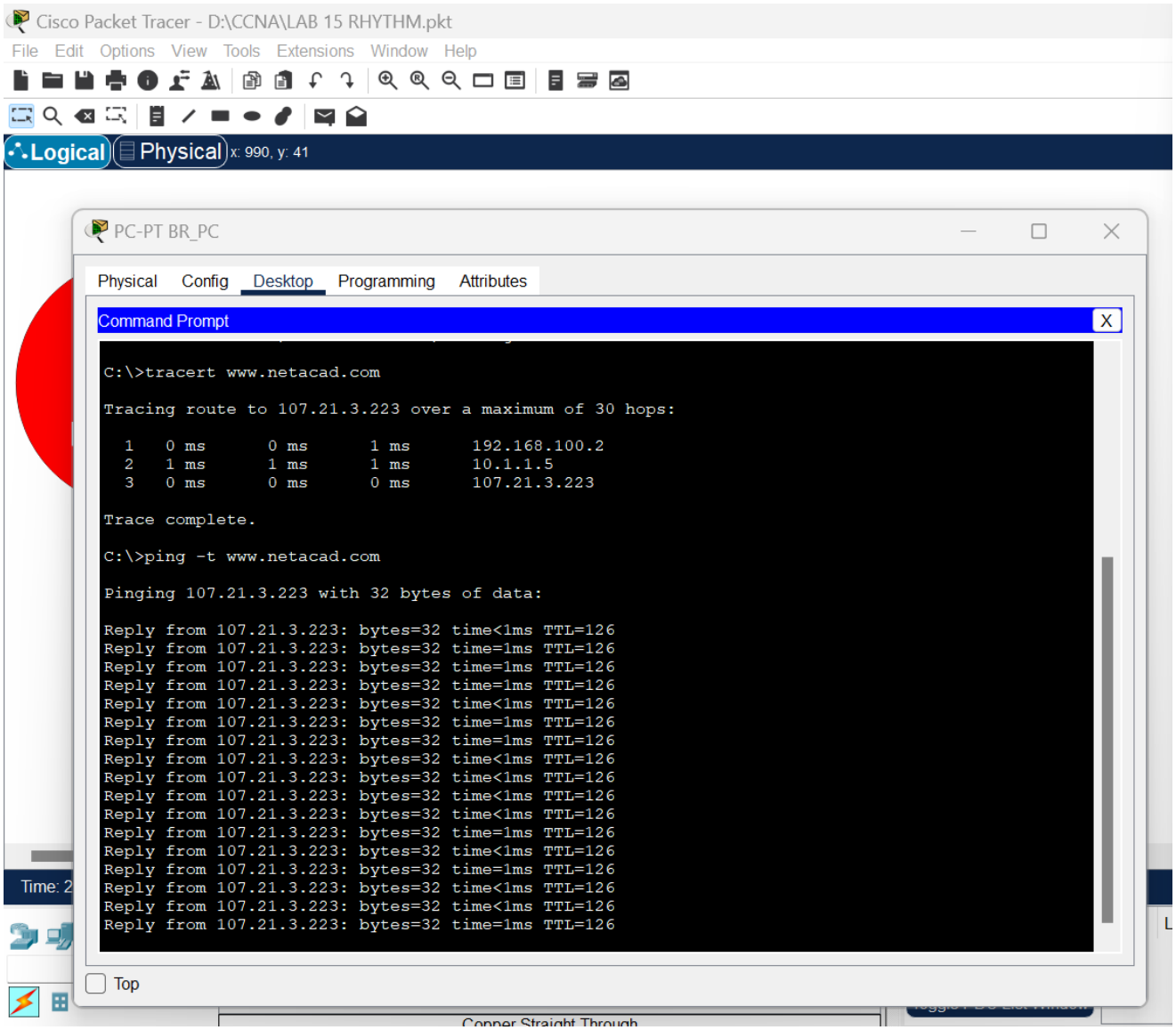



```
PC>tracert www.netacad.com

Tracing route to 107.21.3.223 over a maximum of 30 hops:

  1    1 ms       0 ms       1 ms       192.168.100.2
  2    1 ms       0 ms       0 ms       10.1.1.5
  3    0 ms       1 ms       0 ms       107.21.3.223

Trace complete.
```

Step 4. Test HSRP failover

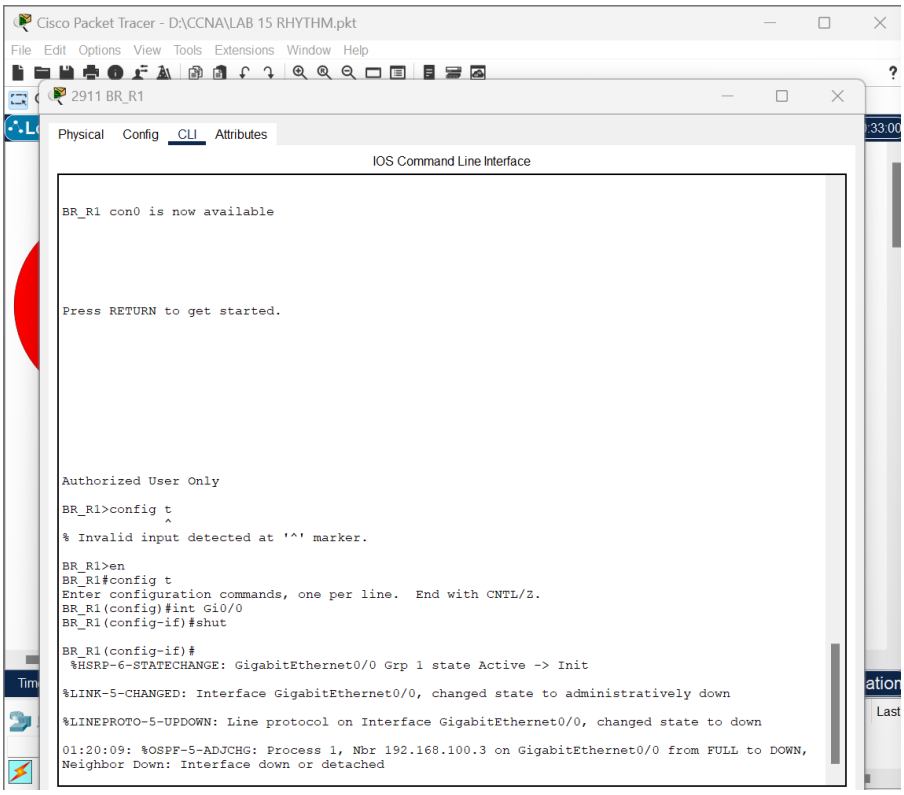
From BR_PC, use the **ping -t** command to start a continuous sequence of pings to the Server.

```
PC>ping -t www.netacad.com
```



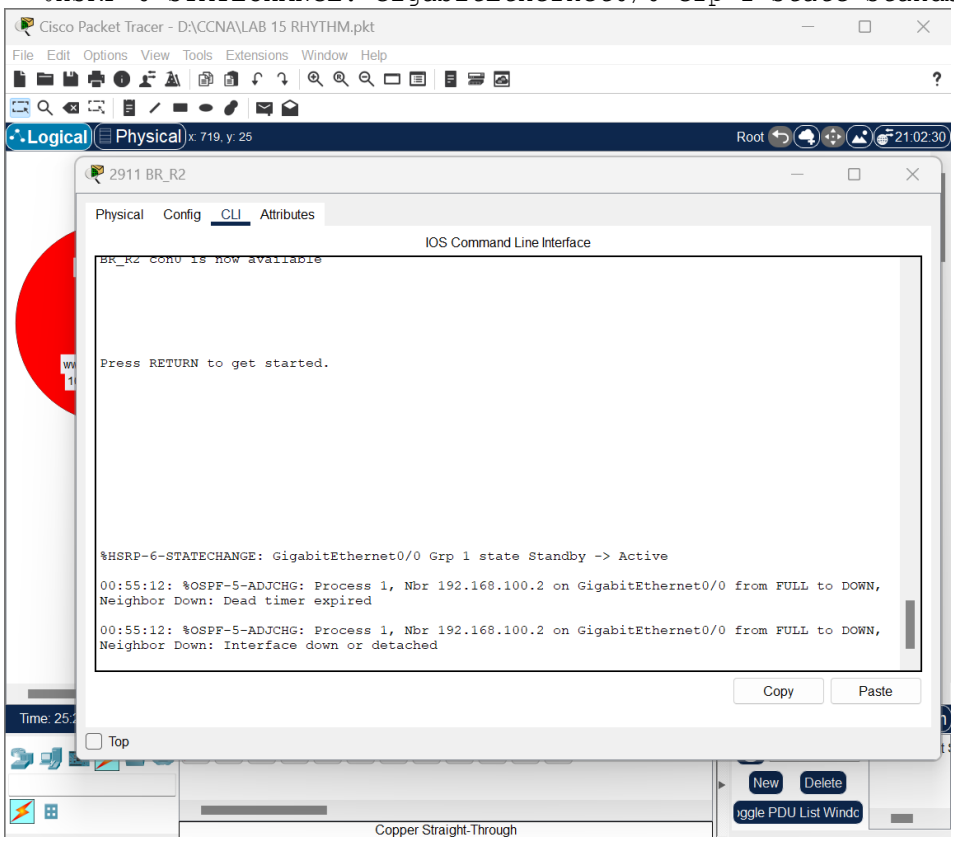
On BR_R1, shutdown the Gi0/0 interface.

```
BR_R1#config term
BR_R1(config)#interface gi0/0
BR_R1(config-if)#shutdown
%HSRP-6-STATECHANGE: GigabitEthernet0/0 Grp 1 state Active -> Init
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to
administratively down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed
state to down
00:18:26: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.100.3 on GigabitEthernet0/0
from FULL to DOWN, Neighbor Down: Interface down or detached
```



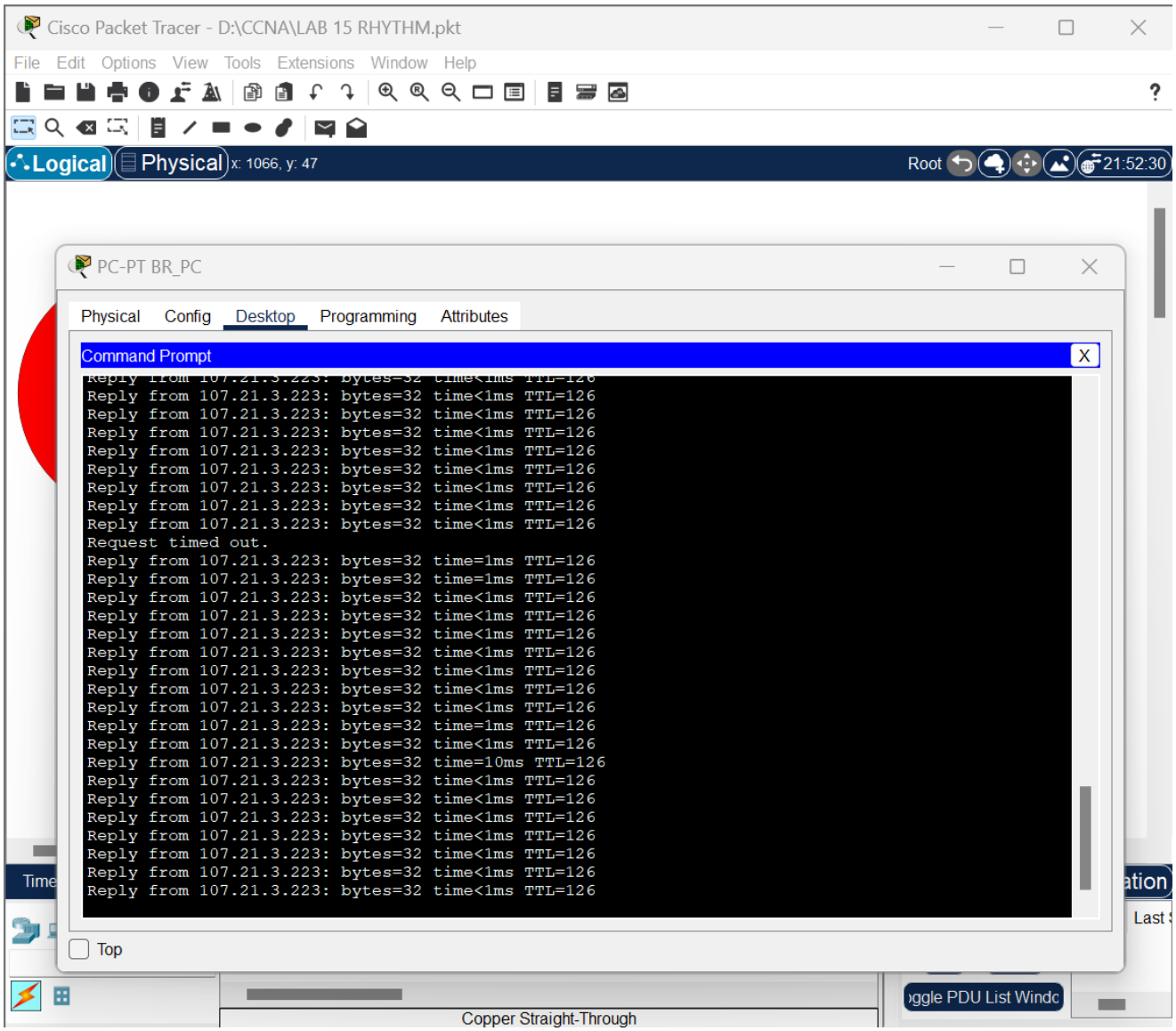
Notice that BR_R2 becomes the new Active router.

```
BR_R2#
%HSRP-6-STATECHANGE: GigabitEthernet0/0 Grp 1 state Standby -> Active
```



Notice what occurs on BR_PC. A change in physical gateway has occurred, but this is transparent to the host PC. It is possible for one or two pings to drop depending on how quickly BR_R2's hold time expires. The default hold time for HSRP is 10 seconds.

```
Reply from 107.21.3.223: bytes=32 time=0ms TTL=126
Reply from 107.21.3.223: bytes=32 time=0ms TTL=126
Reply from 107.21.3.223: bytes=32 time=0ms TTL=126
Request timed out.
Reply from 107.21.3.223: bytes=32 time=1ms TTL=126
Reply from 107.21.3.223: bytes=32 time=1ms TTL=126
Reply from 107.21.3.223: bytes=32 time=1ms TTL=126
```

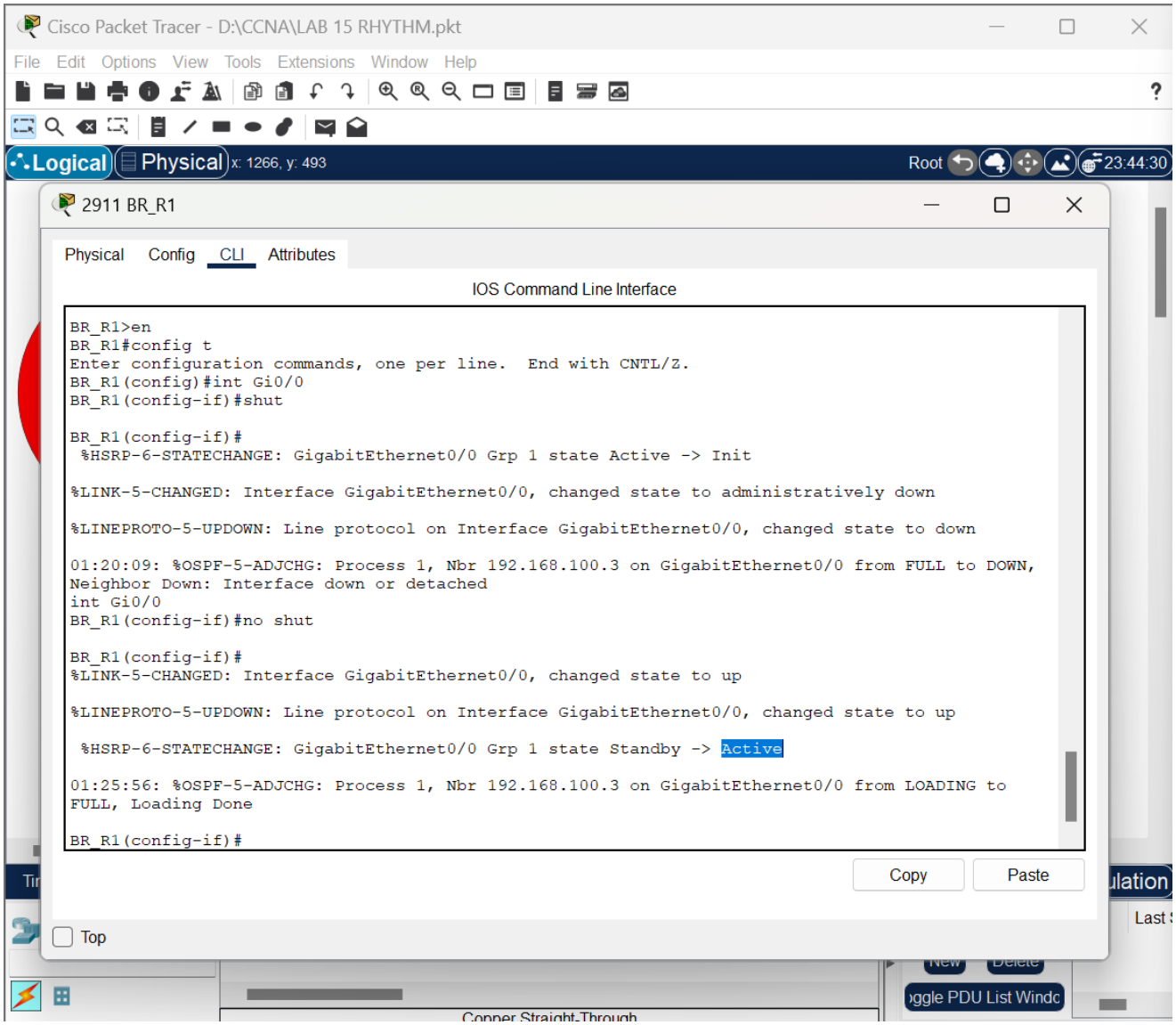


Your completion result should be 100%. If not, check for missing configuration statements.

Task 5: Verify HSRP packet exchange

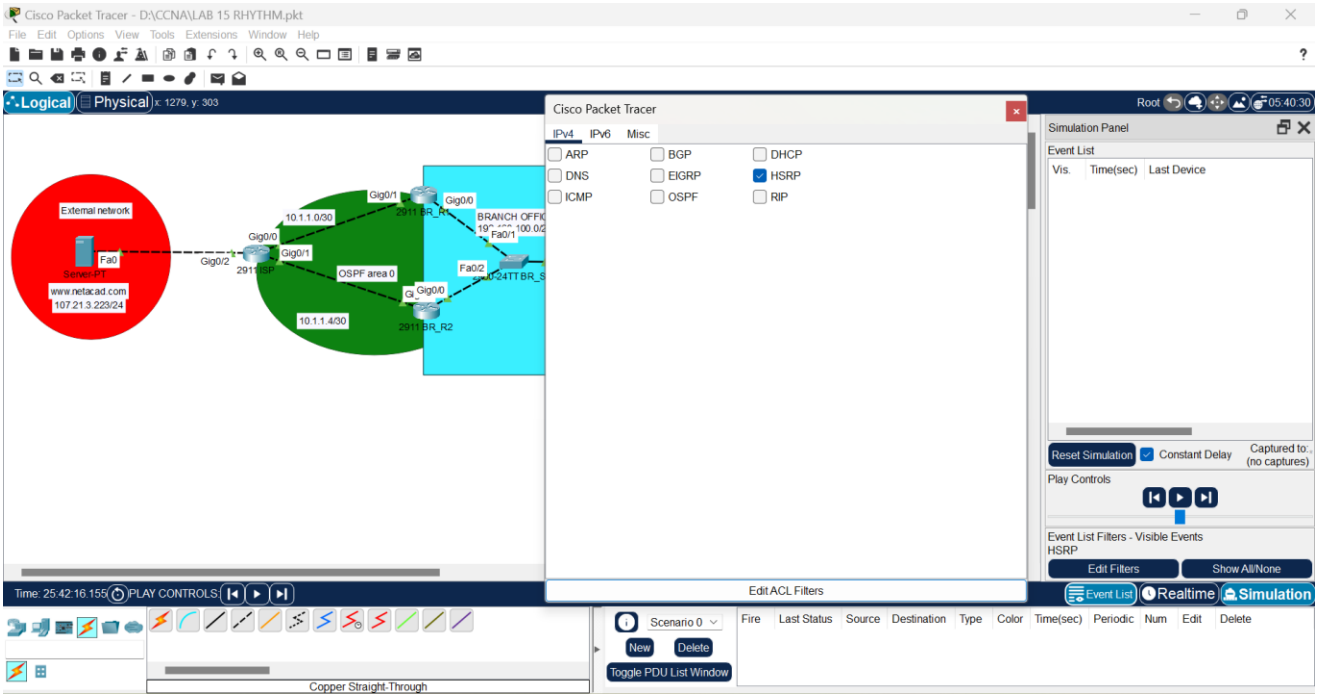
Step 1. Activate BR_R1 Gi0/0 interface to allow the router to reclaim the Active status

```
BR_R1#config term
BR_R1(config)#interface gi0/0
BR_R1(config-if)#no shutdown
BR_R1(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed
state to up
 %HSRP-6-STATECHANGE: GigabitEthernet0/0 Grp 1 state Standby -> Active
BR_R1(config-if)#
```

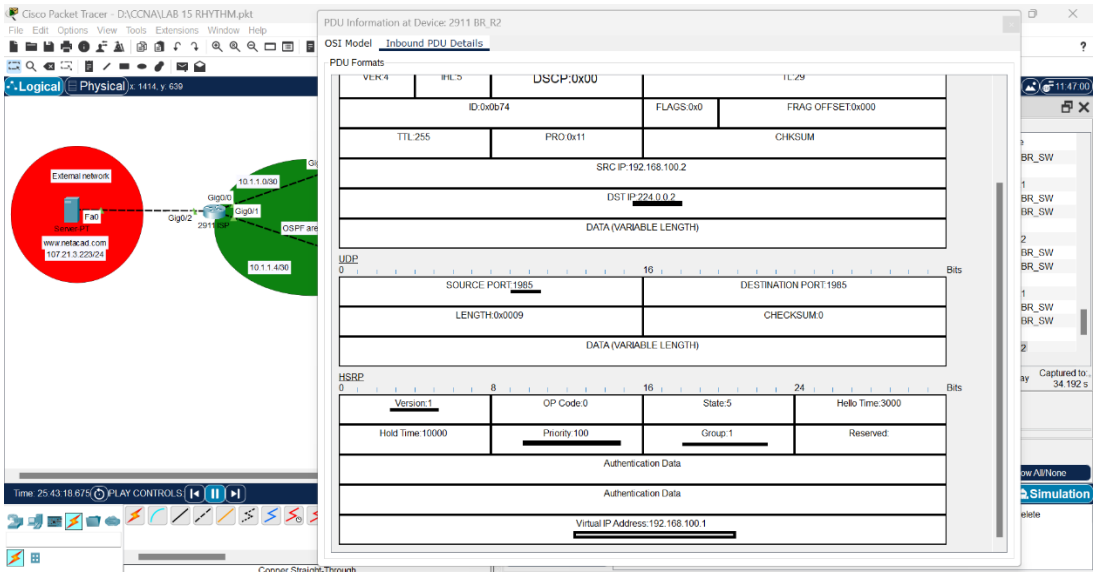


Step 2. Use Simulation mode to view HSRP Hello packets

Enter Simulation mode. Select only HSRP in the filter window. Click Auto Capture / Play to see the multicast HSRP Hello packets being sent and received by both BR_R1 and BR_R2. Confirm the following by observing the PDU details of some of the packets:

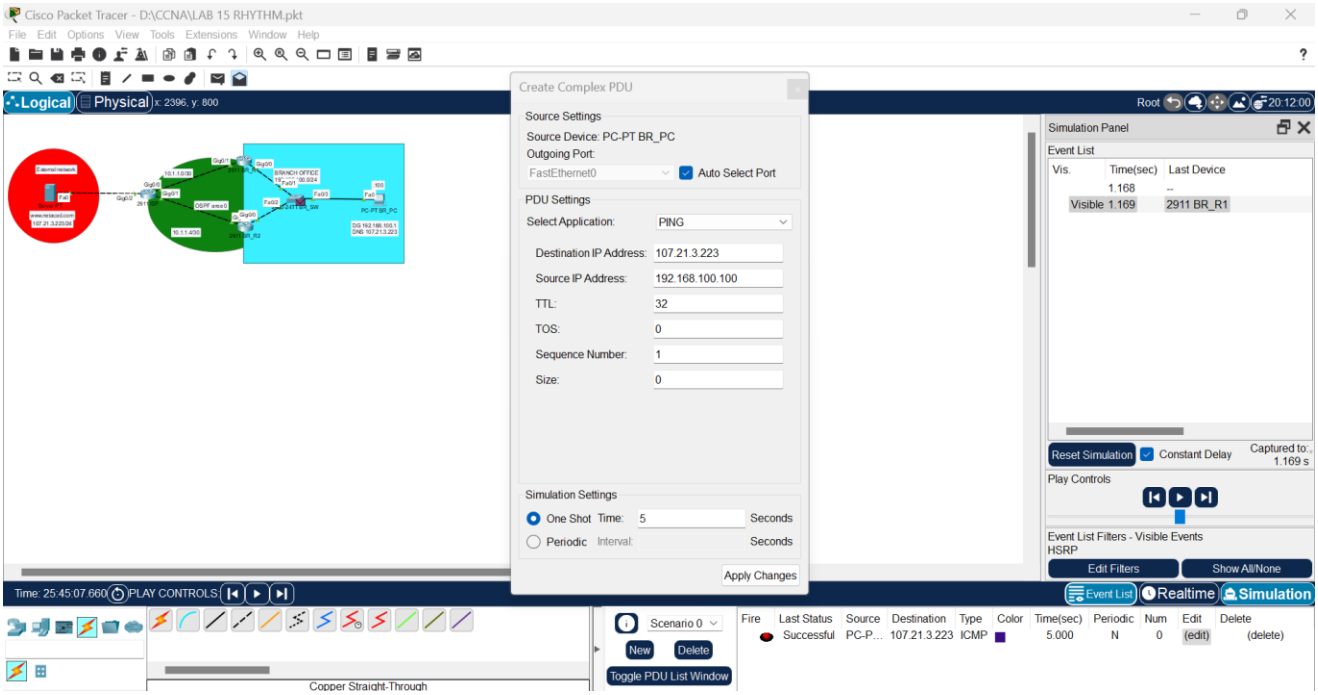


1. Destination IP address is 224.0.0.2 instead of 224.0.0.102
2. UDP port is 1985
3. HSRP version is 1 instead of 0x2
4. Priority is either 100 or 95 depending on Hello viewed.
5. Group number is 1
6. Virtual IP is 192.168.100.1



Step 3. Use Simulation mode to view ICMP packet flow from BR_PC to Netacad server

Create a complex PDU. Use 192.168.100.100 as the source IP address. Use 107.21.3.223 as the destination IP address. Use a sequence number if 1 and configure a one-shot time of 5 seconds. Use the Capture/Forward button to view the ICMP packet flow to and from the Netacad server, **via the BR_R1 router.**



Delete the cable between BR_R1 and BR_SW. Run the simulation again and view the packets flow to and from the server **via BR_R2** after it has become the new Active HSRP router.