

**I H C QU C GIA THÀNH PH H CHÍ MINH
TR NG I H C KHOA H C T NHIÊN**

**KHOA CÔNG NGH THÔNG TIN
MÔN:TH C T P M NG MÁY TÍNH**

BÁO CÁO BÀI T P TU N 3

OSPF Routing Protocol

L p: 09HCA

H tên : Võ Hu nh an

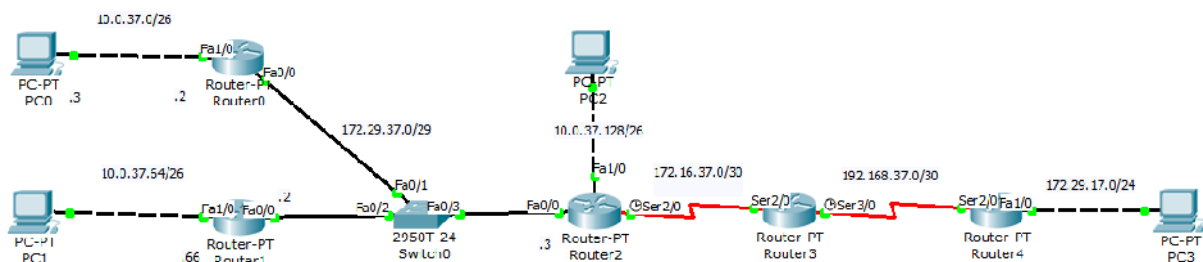
MSSV : 0941037

Yêu cầu:

- Cấu hình OSPF trên các router để các PC có thể liên lạc được với nhau.
 - Router nào sẽ được chọn là DR/BDR?
 - Nếu router là DR, quá trình bầu chọn có xảy ra không? Tại sao?
 - Thay đổi băng thông của R2 và R3 là 64kbs. Kiểm tra metric thay đổi như thế nào trong cách tính đường đi từ router.
- Trên Default Gateway của
Router của mạng

Bài làm:

1. Mô hình thực hiện.



2. Cấu hình OSPF trên các router để các PC có thể liên lạc được với nhau.

Cấu hình OSPF cho Router0

```
R0(config)#router ospf 1
R0(config-router)#network 10.0.0.0 0.255.255.255 area 1
R0(config-router)#network 172.29.37.0 0.0.0.255 area 1
```

Kết quả

```
Router#show ip ospf nei
Neighbor ID      Pri   State           Dead Time   Address        Interface
172.29.37.2      1     FULL/BDR        00:00:37   172.29.37.2   FastEthernet0/
0
172.29.37.3      1     FULL/DROTHER    00:00:38   172.29.37.3   FastEthernet0/
0
```

C u hình OSPF cho Router1

```
R1(config)#router ospf 1
R1(config-router)#network 10.0.0.0 0.255.255.255 area 1
R1(config-router)#network 172.29.37.0 0.0.0.255 area 1
```

K t qu

```
Router#show ip ospf nei
Neighbor ID      Pri   State           Dead Time   Address      Interface
172.29.37.1      1     FULL/DR         00:00:37    172.29.37.1  FastEthernet0/
0
172.29.37.3      1     FULL/DROTHER    00:00:34    172.29.37.3  FastEthernet0/
0
```

C u hình OSPF cho Router2

```
R2(config)#router ospf 1
R2(config-router)#network 10.0.0.0 0.255.255.255 area 1
R2(config-router)#network 172.29.37.0 0.0.0.255 area 1
R2(config-router)#network 172.16.37.0 0.0.0.255 area 1
```

K t qu

```
Router#show ip ospf nei
Neighbor ID      Pri   State           Dead Time   Address      Interface
172.29.37.1      1     FULL/DR         00:00:36    172.29.37.1  FastEthernet0/
0
172.29.37.2      1     FULL/BDR        00:00:32    172.29.37.2  FastEthernet0/
0
192.168.37.1      1     FULL/-          00:00:32    172.16.37.2  Serial2/0
```

C u hình OSPF cho Router3

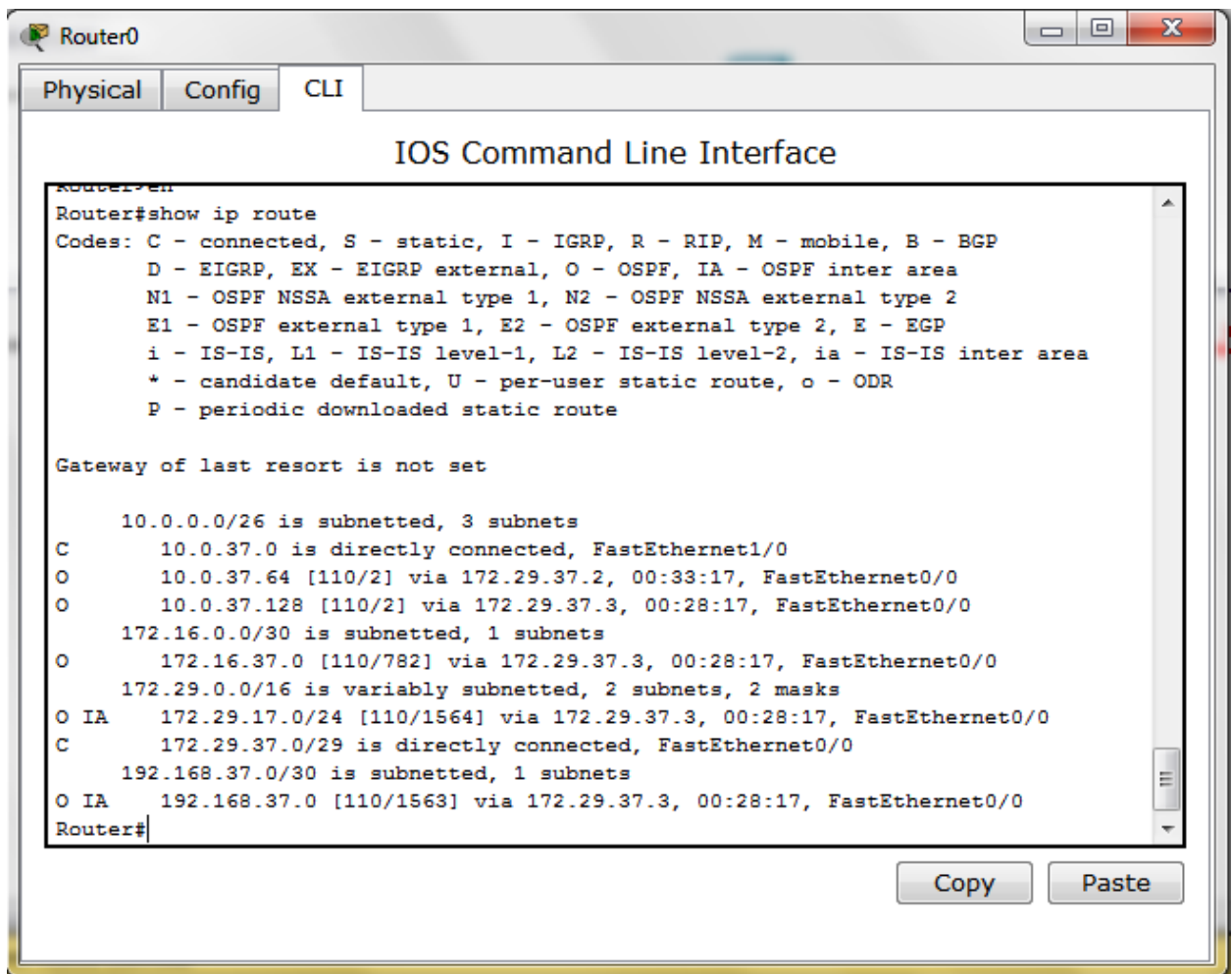
```
R3(config)# router ospf 1
R3(config.router)# network 172.16.37.0 0.0.0.255 area 1
R3(config.router)# network 192.168.37.0 0.0.0.3 area 0
```

K t qu

```
Router#show ip ospf nei
Neighbor ID      Pri   State           Dead Time   Address      Interface
172.29.37.3      1     FULL/-          00:00:37    172.16.37.1  Serial2/0
192.168.37.2      1     FULL/-          00:00:38    192.168.37.2  Serial3/0
```

Theo hình vẽ cho thấy các Router được bố trí như sau : Router1 là DR, Router2 là DROTHER và Router0 là BDR

Bảng cấu hình Router0

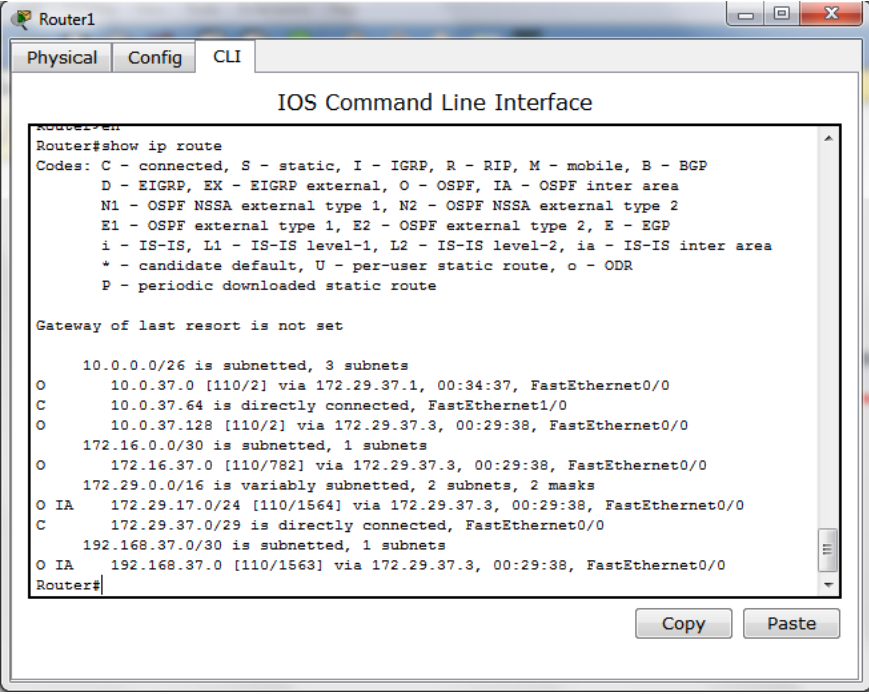


```
Router0
Physical Config CLI
IOS Command Line Interface
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - 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

10.0.0.0/26 is subnetted, 3 subnets
C    10.0.37.0 is directly connected, FastEthernet1/0
O    10.0.37.64 [110/2] via 172.29.37.2, 00:33:17, FastEthernet0/0
O    10.0.37.128 [110/2] via 172.29.37.3, 00:28:17, FastEthernet0/0
172.16.0.0/30 is subnetted, 1 subnets
O    172.16.37.0 [110/782] via 172.29.37.3, 00:28:17, FastEthernet0/0
172.29.0.0/16 is variably subnetted, 2 subnets, 2 masks
O IA  172.29.17.0/24 [110/1564] via 172.29.37.3, 00:28:17, FastEthernet0/0
C    172.29.37.0/29 is directly connected, FastEthernet0/0
192.168.37.0/30 is subnetted, 1 subnets
O IA  192.168.37.0 [110/1563] via 172.29.37.3, 00:28:17, FastEthernet0/0
Router#
```

Bảng nhúng tủy nọc a Router1



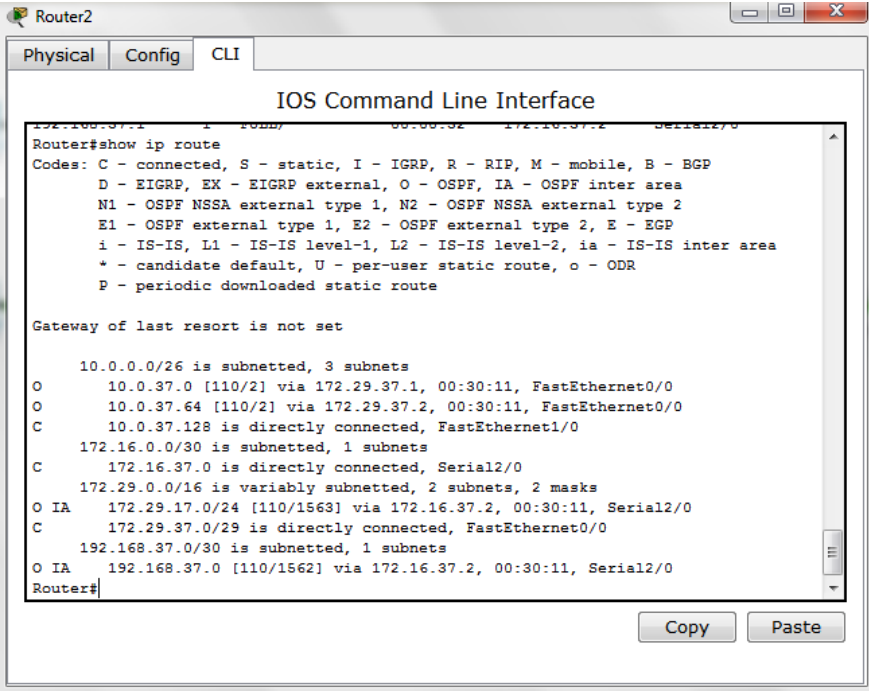
The screenshot shows the CLI of Router1 with the command 'show ip route' executed. The output displays the routing table with various codes and route details. The window has tabs for Physical, Config, and CLI, and buttons for Copy and Paste.

```
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

10.0.0.0/26 is subnetted, 3 subnets
O    10.0.37.0 [110/2] via 172.29.37.1, 00:34:37, FastEthernet0/0
C    10.0.37.64 is directly connected, FastEthernet1/0
O    10.0.37.128 [110/2] via 172.29.37.3, 00:29:38, FastEthernet0/0
172.16.0.0/30 is subnetted, 1 subnets
O    172.16.37.0 [110/782] via 172.29.37.3, 00:29:38, FastEthernet0/0
172.29.0.0/16 is variably subnetted, 2 subnets, 2 masks
O IA  172.29.17.0/24 [110/1564] via 172.29.37.3, 00:29:38, FastEthernet0/0
C    172.29.37.0/29 is directly connected, FastEthernet0/0
192.168.37.0/30 is subnetted, 1 subnets
O IA  192.168.37.0 [110/1563] via 172.29.37.3, 00:29:38, FastEthernet0/0
Router#
```

Bảng nhúng tủy nọc a Router2



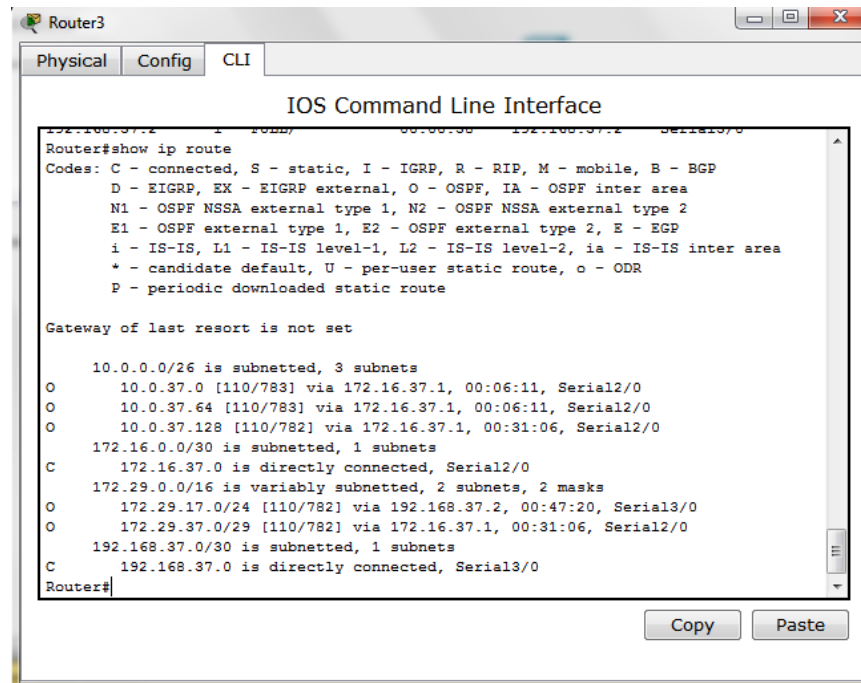
The screenshot shows the CLI of Router2 with the command 'show ip route' executed. The output displays the routing table with various codes and route details. The window has tabs for Physical, Config, and CLI, and buttons for Copy and Paste.

```
Router2
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

10.0.0.0/26 is subnetted, 3 subnets
O    10.0.37.0 [110/2] via 172.29.37.1, 00:30:11, FastEthernet0/0
O    10.0.37.64 [110/2] via 172.29.37.2, 00:30:11, FastEthernet0/0
C    10.0.37.128 is directly connected, FastEthernet1/0
172.16.0.0/30 is subnetted, 1 subnets
C    172.16.37.0 is directly connected, Serial2/0
172.29.0.0/16 is variably subnetted, 2 subnets, 2 masks
O IA  172.29.17.0/24 [110/1563] via 172.16.37.2, 00:30:11, Serial2/0
C    172.29.37.0/29 is directly connected, FastEthernet0/0
192.168.37.0/30 is subnetted, 1 subnets
O IA  192.168.37.0 [110/1562] via 172.16.37.2, 00:30:11, Serial2/0
Router#
```

Bảng nhúng của Router3

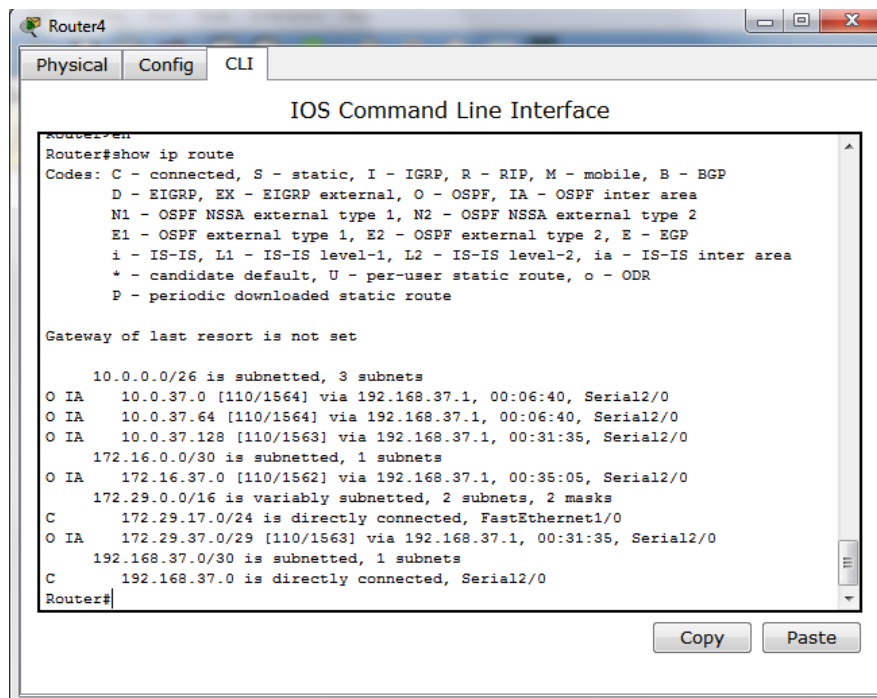


```
Router3
Physical Config CLI
IOS Command Line Interface
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        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

    10.0.0.0/26 is subnetted, 3 subnets
O       10.0.37.0 [110/783] via 172.16.37.1, 00:06:11, Serial2/0
O       10.0.37.64 [110/783] via 172.16.37.1, 00:06:11, Serial2/0
O       10.0.37.128 [110/782] via 172.16.37.1, 00:31:06, Serial2/0
    172.16.0.0/30 is subnetted, 1 subnets
C       172.16.37.0 is directly connected, Serial2/0
    172.29.0.0/16 is variably subnetted, 2 subnets, 2 masks
O       172.29.17.0/24 [110/782] via 192.168.37.2, 00:47:20, Serial3/0
O       172.29.37.0/29 [110/782] via 172.16.37.1, 00:31:06, Serial2/0
    192.168.37.0/30 is subnetted, 1 subnets
C       192.168.37.0 is directly connected, Serial3/0
Router#
```

Bảng nhúng của Router4



```
Router4
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

    10.0.0.0/26 is subnetted, 3 subnets
O IA    10.0.37.0 [110/1564] via 192.168.37.1, 00:06:40, Serial2/0
O IA    10.0.37.64 [110/1564] via 192.168.37.1, 00:06:40, Serial2/0
O IA    10.0.37.128 [110/1563] via 192.168.37.1, 00:31:35, Serial2/0
    172.16.0.0/30 is subnetted, 1 subnets
O IA    172.16.37.0 [110/1562] via 192.168.37.1, 00:35:05, Serial2/0
    172.29.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       172.29.17.0/24 is directly connected, FastEthernet1/0
O IA    172.29.37.0/29 [110/1563] via 192.168.37.1, 00:31:35, Serial2/0
    192.168.37.0/30 is subnetted, 1 subnets
C       192.168.37.0 is directly connected, Serial2/0
Router#
```

Kết luận: Các Router đã cấu hình đúng và chính xác.

3. PC có thể liên lạc được với nhau.

Màn hình ping của PC0

Ping từ PC1

```
PC>ping 10.0.37.65

Pinging 10.0.37.65 with 32 bytes of data:

Reply from 10.0.37.65: bytes=32 time=16ms TTL=126
Reply from 10.0.37.65: bytes=32 time=16ms TTL=126
Reply from 10.0.37.65: bytes=32 time=16ms TTL=126
Reply from 10.0.37.65: bytes=32 time=20ms TTL=126

Ping statistics for 10.0.37.65:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 16ms, Maximum = 20ms, Average = 17ms
```

Ping từ PC2

```
PC>ping 10.0.37.130

Pinging 10.0.37.130 with 32 bytes of data:

Reply from 10.0.37.130: bytes=32 time=20ms TTL=126
Reply from 10.0.37.130: bytes=32 time=14ms TTL=126
Reply from 10.0.37.130: bytes=32 time=16ms TTL=126
Reply from 10.0.37.130: bytes=32 time=15ms TTL=126

Ping statistics for 10.0.37.130:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 14ms, Maximum = 20ms, Average = 16ms
```

Ping từ PC3

```
PC>ping 172.29.17.2

Pinging 172.29.17.2 with 32 bytes of data:

Reply from 172.29.17.2: bytes=32 time=26ms TTL=124
Reply from 172.29.17.2: bytes=32 time=20ms TTL=124
Reply from 172.29.17.2: bytes=32 time=22ms TTL=124
Reply from 172.29.17.2: bytes=32 time=26ms TTL=124

Ping statistics for 172.29.17.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 20ms, Maximum = 26ms, Average = 23ms
```

Tăng tốc với các PC1,2,3 và ping các cho nhau

Kết Luận: Các PC và ping các cho nhau chứng tỏ chúng liên lạc với nhau.

4. Router nào sẽ được chọn là DR/BDR ?

Router 1 sẽ được chọn là DR.

Router 0 sẽ được chọn là BDR.

5. Tất cả router là DR, quá trình được chọn có xảy ra không? Tại sao?

Nếu tất cả Router DR, Router BDR sẽ được chọn làm DR mà không cần phải trải qua quá trình được chọn.

Bởi vì khi DR bị lỗi, một DR mới phải được xác định. Adjacency mới phải được thiết lập lại và tất cả Router trên mạng phải đồng ý để đưa chúng về DR mới. Trong suốt quá trình này thì mạng không hoạt động được.

Trong tình huống này nên gọi là ra khái niệm BDR. Tất cả các router không chỉ thiết lập Adjacency với DR mà còn với BDR. Nếu DR bị lỗi thì BDR sẽ trở thành DR mới mà không phải đồng ý để đưa chúng.

Đây là cách khắc phục sẽ xảy ra khi Router DR gặp sự cố đáng tiếc, giúp cho mạng tiếp tục lưu thông và không bị ngừng trệ.

6. Thay đổi băng thông của R2 và R3 là 64kbs. Kiểm tra metric thay đổi như thế nào trong cách tính đường đi tới mỗi router.

Metric lúc u t i R2 khi ch a thay i b ng thông là 781

```
Router>en
Router#show ip ospf interface s2/0
Serial2/0 is up, line protocol is up
  Internet address is 172.16.37.1/30, Area 1
  Process ID 1, Router ID 172.29.37.3, Network Type POINT-TO-POINT, Cost: 781
  Transmit Delay is 1 sec, State POINT-TO-POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:07
  Index 3/3, 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 172.16.37.2
  Suppress hello for 0 neighbor(s)
Router#
```

Metric lúc u t i R3 khi ch a thay i b ng thông là 781

```
Router>en
Router#show ip ospf interface s2/0
Serial2/0 is up, line protocol is up
  Internet address is 172.16.37.2/30, Area 1
  Process ID 1, Router ID 192.168.37.1, Network Type POINT-TO-POINT, Cost: 781
  Transmit Delay is 1 sec, State POINT-TO-POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:00
  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 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 172.16.37.1
  Suppress hello for 0 neighbor(s)
Router#
```

Sau khi thay i b ng thông c a R2 là 64kbs

```
Router(config)#interface s2/0
Router(config-if)#bandwidth 64
Router(config-if)#end
%SYS-5-CONFIG_I: Configured from console by console
Router#show interface s2/0
Serial2/0 is up, line protocol is up (connected)
  Hardware is HD64570
  Internet address is 172.16.37.1/30
  MTU 1500 bytes, BW 64 Kbit DLY 20000 usec, rely 255/255, load 1/255
```

Metric R2 khi thay i b ng thông là $10^8/64000 = 1562$

```
Router#show ip ospf interface s2/0
Serial2/0 is up, line protocol is up
  Internet address is 172.16.37.1/30, Area 1
  Process ID 1, Router ID 172.29.37.3, Network Type POINT-TO-POINT, Cost: 1562
  Transmit Delay is 1 sec, State POINT-TO-POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:06
  Index 3/3, 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 172.16.37.2
  Suppress hello for 0 neighbor(s)
Router#
```

Sau khi thay i b ng thông c a R3 là 64kbs

```
Router(config-if)#bandwidth 64
Router(config-if)#end
%SYS-5-CONFIG_I: Configured from console by console
Router#show interface s2/0
Serial2/0 is up, line protocol is up (connected)
  Hardware is HD64570
  Internet address is 172.16.37.2/30
  MTU 1500 bytes, BW 64 Kbit DLY 20000 usec, rely 255/255, load 1/255
```

Metric R3 khi thay i b ng thông là $10^8/64000 = 1562$

```
Router(config)#end
%SYS-5-CONFIG_I: Configured from console by console
Router#show ip ospf interface s2/0
Serial2/0 is up, line protocol is up
  Internet address is 172.16.37.2/30, Area 1
  Process ID 1, Router ID 192.168.37.1, Network Type POINT-TO-POINT, Cost: 1562
  Transmit Delay is 1 sec, State POINT-TO-POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:03
  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 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 172.16.37.1
  Suppress hello for 0 neighbor(s)
Router#
```

K t Lu n: Khi thay i Bandwidth s làm metric thay i theo
Công th c tính Metric : $\text{Metric} = 10^8 / \text{Bandwidth}$.