HƯỚNG DẪN LAB
LAB 4 – Định tuyến tĩnh

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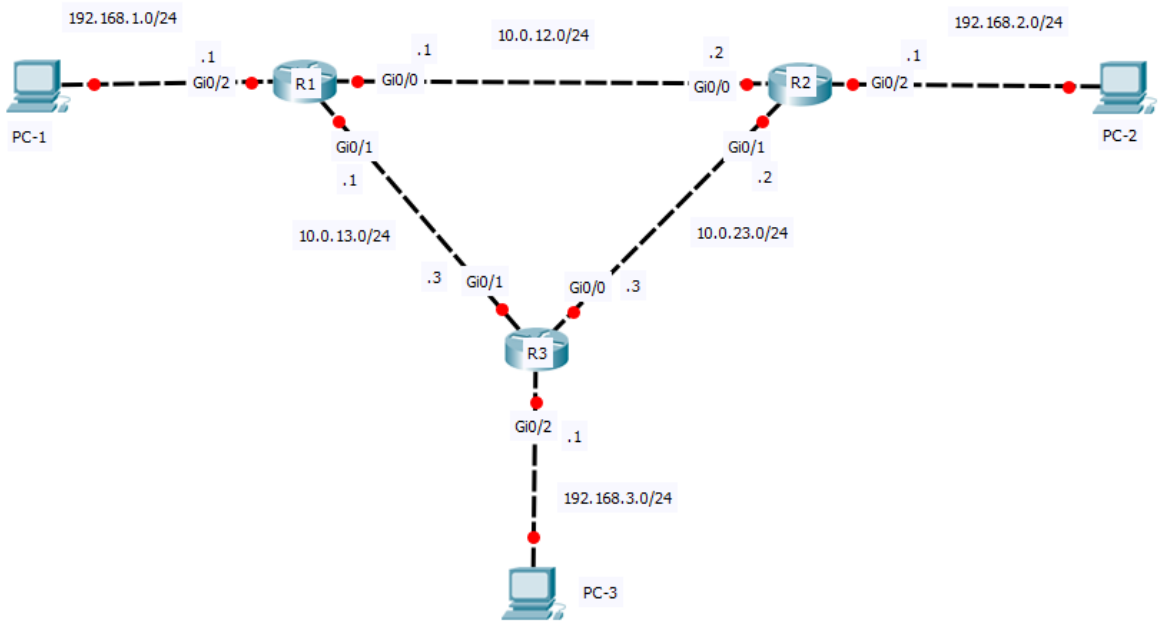
Sơ đồ LAB :



Thiết bị

Tên thiết bị	Chủng loại
R1	Router 2911
R2	Router 2911
R3	Router 2911
PC-1	PC
PC-2	PC
PC-3	PC

Quy hoạch IP

Tên thiết bị	Cổng	IP
R1	Gi0/0	10.0.12.1/24
	Gi0/1	10.0.13.1/24
	Gi0/2	192.168.1.1/24
R2	Gi0/0	10.0.12.2/24
	Gi0/1	10.0.23.2/24
	Gi0/2	192.168.2.1/24
R3	Gi0/0	10.0.23.3/24
	Gi0/1	10.0.13.3/24
	Gi0/2	192.168.3.1/24

Yêu cầu

- Đấu nối và đặt IP như sơ đồ
- Cấu hình DHCP Server cho ba Router như sau :

R1	R2	R3
• Nework : 192.168.1.0/24 • Default GW : 192.168.1.1 • DNS : 8.8.8.8	• Nework : 192.168.2.0/24 • Default GW : 192.168.2.1 • DNS : 8.8.8.8	• Nework : 192.168.3.0/24 • Default GW : 192.168.3.1 • DNS : 8.8.8.8

Lưu ý : đảm bảo các router ping trực tiếp được với nhau. Các PC phải nhận được IP bằng DHCP và phải ping được Gateway

- Cấu hình định tuyến để tất cả các subnet thông được với nhau. Học viên có thể chọn đường đi tùy ý
- Cấu hình đường dự phòng cho các route đến 192.168.1.0/24, 192.168.2.0/24, 192.168.3.0/24

Các bước thực hiện :

Bước 1: Đấu nối như sơ đồ

Bước 2: Cấu hình hostname và IP cho các router

R1

```
Router(config)#hostname R1
R1(config)#interface Gi0/0
R1(config-if)#ip address 10.0.12.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#exit
R1(config)#interface Gi0/1
R1(config-if)#ip address 10.0.13.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#exit
R1(config)#interface Gi0/2
R1(config-if)#ip add 192.168.1.1 255.255.255.0
R1(config-if)#no shut
```

Kiểm tra :

```
R1#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
```

```
GigabitEthernet0/0     10.0.12.1       YES manual up                    down
GigabitEthernet0/1     10.0.13.1       YES manual up                    down
GigabitEthernet0/2     192.168.1.1     YES manual up                    up
Vlan1                  unassigned      YES unset  administratively down down
```

R2

```
Router(config)#hostname R2
R2(config)#interface Gi0/0
R2(config-if)#ip address 10.0.12.2 255.255.255.0
R2(config-if)#no shut
R2(config-if)#exit
R2(config)#interface Gi0/1
R2(config-if)#ip address 10.0.23.2 255.255.255.0
R2(config-if)#no shut
R2(config-if)#exit
R2(config)#interface Gi0/2
R2(config-if)#ip add 192.168.2.1 255.255.255.0
R2(config-if)#no shut
```

Kiểm tra :

```
R2#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     10.0.12.2       YES manual up                    up
GigabitEthernet0/1     10.0.23.2       YES manual up                    down
GigabitEthernet0/2     192.168.2.1     YES manual up                    up
Vlan1                  unassigned      YES unset  administratively down down
```

R3

```
Router(config)#hostname R3
R3(config)#interface Gi0/0
R3(config-if)#ip address 10.0.23.3 255.255.255.0
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#interface Gi0/1
R3(config-if)#ip address 10.0.13.3 255.255.255.0
R3(config-if)#no shut
R3(config-if)#exit
R3(config)#interface Gi0/2
R3(config-if)#ip address 192.168.3.1 255.255.255.0
R3(config-if)#no shut
```

Kiểm tra :

```
R3#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     10.0.23.3       YES manual up                    up
GigabitEthernet0/1     10.0.13.3       YES manual up                    up
GigabitEthernet0/2     192.168.3.1     YES manual up                    up
Vlan1                  unassigned      YES unset  administratively down down
```

Bước 3 : Cấu hình DHCP Server trên các router

R1

```
R1(config)#ip dhcp pool LAN-1
R1(dhcp-config)#network 192.168.1.0 255.255.255.0
R1(dhcp-config)#default-router 192.168.1.1
R1(dhcp-config)#dns 8.8.8.8
```

R2

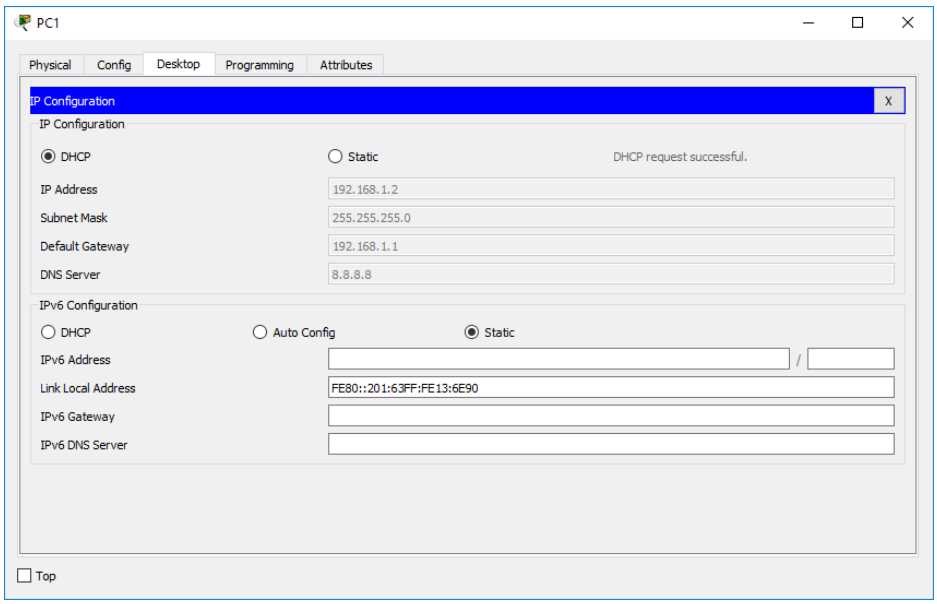
```
R2(config)#ip dhcp pool LAN-2
R2(dhcp-config)#network 192.168.2.0 255.255.255.0
R2(dhcp-config)#default-router 192.168.2.1
R2(dhcp-config)#dns 8.8.8.8
```

R3

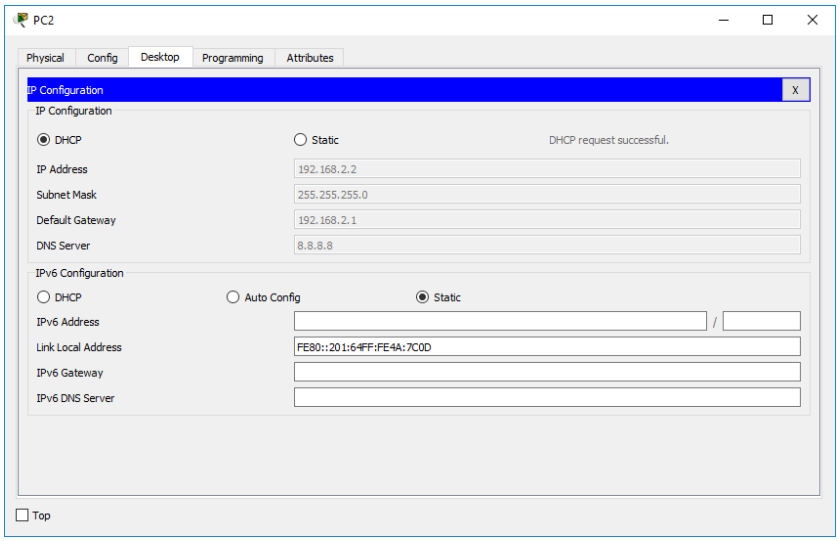
```
R3(config)#ip dhcp pool LAN-3
R3(dhcp-config)#network 192.168.3.0 255.255.255.0
R3(dhcp-config)#default-router 192.168.3.1
R3(dhcp-config)#dns 8.8.8.8
```

Bước 4 : Cho các PC nhận IP bằng DHCP

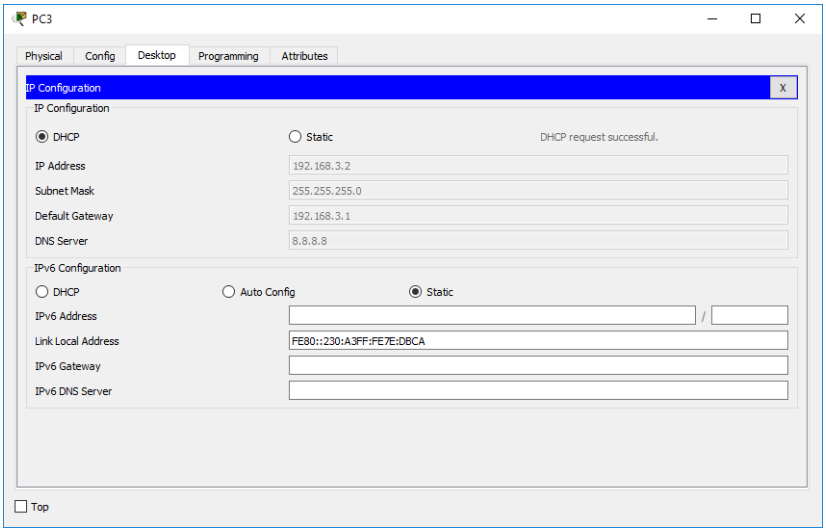
PC-1



PC-2



PC-3



Bước 5 : Cấu hình định tuyến để tất cả các subnet thông được với nhau. Học viên có thể chọn đường đi tùy ý

R1

```
R1(config)#ip route 192.168.2.0 255.255.255.0 10.0.12.2
R1(config)#ip route 192.168.3.0 255.255.255.0 10.0.13.3
R1(config)#ip route 10.0.23.0 255.255.255.0 10.0.12.2
```

Kiểm tra :

```
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 area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
C       10.0.12.0/24 is directly connected, GigabitEthernet0/0
L       10.0.12.1/32 is directly connected, GigabitEthernet0/0
C       10.0.13.0/24 is directly connected, GigabitEthernet0/1
L       10.0.13.1/32 is directly connected, GigabitEthernet0/1
S       10.0.23.0/24 [1/0] via 10.0.12.2
     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/2
L       192.168.1.1/32 is directly connected, GigabitEthernet0/2
S    192.168.2.0/24 [1/0] via 10.0.12.2
S    192.168.3.0/24 [1/0] via 10.0.13.3
```

R2

```
R2(config)#ip route 192.168.1.0 255.255.255.0 10.0.12.1
R2(config)#ip route 192.168.3.0 255.255.255.0 10.0.23.3
R2(config)#ip route 10.0.13.0 255.255.255.0 10.0.12.1
```

Kiểm tra :

```
R2#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 area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
C       10.0.12.0/24 is directly connected, GigabitEthernet0/0
L       10.0.12.2/32 is directly connected, GigabitEthernet0/0
S       10.0.13.0/24 [1/0] via 10.0.12.1
C       10.0.23.0/24 is directly connected, GigabitEthernet0/1
L       10.0.23.2/32 is directly connected, GigabitEthernet0/1
S    192.168.1.0/24 [1/0] via 10.0.12.1
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, GigabitEthernet0/2
L       192.168.2.1/32 is directly connected, GigabitEthernet0/2
S    192.168.3.0/24 [1/0] via 10.0.23.3
```

R3

```
R3(config)#ip route 192.168.1.0 255.255.255.0 10.0.13.1
R3(config)#ip route 192.168.2.0 255.255.255.0 10.0.23.2
R3(config)#ip route 10.0.12.0 255.255.255.0 10.0.13.1
```

Kiểm tra :

```
R3#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 area
       * - candidate default, U - per-user static route, o - ODR
```

```
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
S       10.0.12.0/24 [1/0] via 10.0.13.1
C       10.0.13.0/24 is directly connected, GigabitEthernet0/1
L       10.0.13.3/32 is directly connected, GigabitEthernet0/1
C       10.0.23.0/24 is directly connected, GigabitEthernet0/0
L       10.0.23.3/32 is directly connected, GigabitEthernet0/0
S    192.168.1.0/24 [1/0] via 10.0.13.1
S    192.168.2.0/24 [1/0] via 10.0.23.2
     192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.3.0/24 is directly connected, GigabitEthernet0/2
L       192.168.3.1/32 is directly connected, GigabitEthernet0/2
```

Bước 5 : Kiểm tra

Trên PC1, ping các địa chỉ IP sau :

IP	Kết quả

PC2 : 192.168.2.2	C:\>**ping 192.168.2.2**
	
	Pinging 192.168.2.2 with 32 bytes of data:
	
	Request timed out.
	Request timed out.
	Reply from 192.168.2.2: bytes=32 time=11ms TTL=126
	Reply from 192.168.2.2: bytes=32 time<1ms TTL=126
	
	Ping statistics for 192.168.2.2:
	    Packets: Sent = 4, Received = 2, Lost = 2 (50% loss),
	Approximate round trip times in milli-seconds:
	    Minimum = 0ms, Maximum = 11ms, Average = 5ms

PC3 : 192.168.3.2	C:\>**ping 192.168.3.2**
	
	Pinging 192.168.3.2 with 32 bytes of data:
	
	Request timed out.
	Request timed out.
	Reply from 192.168.3.2: bytes=32 time<1ms TTL=126
	Reply from 192.168.3.2: bytes=32 time=44ms TTL=126
	
	Ping statistics for 192.168.3.2:
	    Packets: Sent = 4, Received = 2, Lost = 2 (50% loss),
	Approximate round trip times in milli-seconds:
	    Minimum = 0ms, Maximum = 44ms, Average = 22ms

10.0.12.2	C:\>**ping 10.0.12.2**
	
	Pinging 10.0.12.2 with 32 bytes of data:
	
	Reply from 10.0.12.2: bytes=32 time=1ms TTL=254
	Reply from 10.0.12.2: bytes=32 time=3ms TTL=254
	Reply from 10.0.12.2: bytes=32 time<1ms TTL=254
	Reply from 10.0.12.2: bytes=32 time<1ms TTL=254
	
	Ping statistics for 10.0.12.2:
	    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
	Approximate round trip times in milli-seconds:
	    Minimum = 0ms, Maximum = 3ms, Average = 1ms

10.0.23.2	C:\>**ping 10.0.23.2** Pinging 10.0.23.2 with 32 bytes of data: Request timed out. Reply from 10.0.23.2: bytes=32 time<1ms TTL=254 Reply from 10.0.23.2: bytes=32 time<1ms TTL=254 Reply from 10.0.23.2: bytes=32 time<1ms TTL=254 Ping statistics for 10.0.23.2: Packets: Sent = 4, Received = 3, Lost = 1 (25% loss), Approximate round trip times in milli-seconds: Minimum = 0ms, Maximum = 0ms, Average = 0ms
10.0.13.3	C:\>**ping 10.0.13.3** Pinging 10.0.13.3 with 32 bytes of data: Request timed out. Reply from 10.0.13.3: bytes=32 time<1ms TTL=254 Reply from 10.0.13.3: bytes=32 time<1ms TTL=254 Reply from 10.0.13.3: bytes=32 time<1ms TTL=254 Ping statistics for 10.0.13.3: Packets: Sent = 4, Received = 3, Lost = 1 (25% loss), Approximate round trip times in milli-seconds: Minimum = 0ms, Maximum = 0ms, Average = 0ms

Bước 6 : cấu hình đường dự phòng cho các route đến 192.168.1.0/24, 192.168.2.0/24, 192.168.3.0/24

R1

```
R1(config)# ip route 192.168.2.0 255.255.255.0 10.0.13.3 10
R1(config)# ip route 192.168.3.0 255.255.255.0 10.0.12.2 10
```

R2

```
R2(config)#ip route 192.168.1.0 255.255.255.0 10.0.23.3 10
R2(config)#ip route 192.168.3.0 255.255.255.0 10.0.12.1 10
```

R3

```
R3(config)#ip route 192.168.1.0 255.255.255.0 10.0.23.2 10
R3(config)#ip route 192.168.2.0 255.255.255.0 10.0.13.1 10
```

Bước 7 : Kiểm tra lại bảng định tuyến

Trên mỗi router, thực hiện câu lệnh sau:

```
# show ip route
```

Đảm bảo vẫn đủ route đến tất cả subnet, nhưng chỉ có 1 đường đi đến 1 subnet (không load balance)

R1

```
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 area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
C       10.0.12.0/24 is directly connected, GigabitEthernet0/0
L       10.0.12.1/32 is directly connected, GigabitEthernet0/0
C       10.0.13.0/24 is directly connected, GigabitEthernet0/1
L       10.0.13.1/32 is directly connected, GigabitEthernet0/1
S       10.0.23.0/24 [1/0] via 10.0.12.2
     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/2
L       192.168.1.1/32 is directly connected, GigabitEthernet0/2
S    192.168.2.0/24 [1/0] via 10.0.12.2
S    192.168.3.0/24 [1/0] via 10.0.13.3
```

R2

```
R2#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 area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
C       10.0.12.0/24 is directly connected, GigabitEthernet0/0
L       10.0.12.2/32 is directly connected, GigabitEthernet0/0
S       10.0.13.0/24 [1/0] via 10.0.12.1
C       10.0.23.0/24 is directly connected, GigabitEthernet0/1
L       10.0.23.2/32 is directly connected, GigabitEthernet0/1
S    192.168.1.0/24 [1/0] via 10.0.12.1
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, GigabitEthernet0/2
L       192.168.2.1/32 is directly connected, GigabitEthernet0/2
S    192.168.3.0/24 [1/0] via 10.0.23.3
```

R3

```
R3#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 area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
S       10.0.12.0/24 [1/0] via 10.0.13.1
C       10.0.13.0/24 is directly connected, GigabitEthernet0/1
L       10.0.13.3/32 is directly connected, GigabitEthernet0/1
C       10.0.23.0/24 is directly connected, GigabitEthernet0/0
L       10.0.23.3/32 is directly connected, GigabitEthernet0/0
```

```
S     192.168.1.0/24 [1/0] via 10.0.13.1
S     192.168.2.0/24 [1/0] via 10.0.23.2
      192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.3.0/24 is directly connected, GigabitEthernet0/2
L        192.168.3.1/32 is directly connected, GigabitEthernet0/2
```

Bước 8 : Kiểm tra tính dự phòng

Trên PC-1, ping PC-2

```
C:\>ping 192.168.2.2

Pinging 192.168.2.2 with 32 bytes of data:

Request timed out.
Reply from 192.168.2.2: bytes=32 time=11ms TTL=126
Reply from 192.168.2.2: bytes=32 time=10ms TTL=126
Reply from 192.168.2.2: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.2.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 11ms, Average = 7ms
```

Kiểm tra đường đi từ PC-1 đến PC-2

```
C:\>tracert 192.168.2.2

Tracing route to 192.168.2.2 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      192.168.1.1
  2    0 ms      0 ms      0 ms      10.0.12.2
  3    0 ms      0 ms      0 ms      192.168.2.2

Trace complete.
```

Nhìn vào kết quả có thể thấy đường đi như sau : **PC-1 > R1 > R2 > PC-2**

Trên PC-1, **ping –t** đến địa chỉ IP của PC-2.

Trong lúc ping, ngắt đường đi chính (ví dụ, ngắt kết nối giữa R1 và R2)

Quan sát kết quả :

```
C:\>ping -t 192.168.2.2

Pinging 192.168.2.2 with 32 bytes of data:

Reply from 192.168.2.2: bytes=32 time=1ms TTL=126
Reply from 192.168.2.2: bytes=32 time=11ms TTL=126
Reply from 192.168.2.2: bytes=32 time<1ms TTL=126
Reply from 192.168.2.2: bytes=32 time<1ms TTL=126
Reply from 192.168.2.2: bytes=32 time=15ms TTL=126
Reply from 192.168.2.2: bytes=32 time=11ms TTL=126
Reply from 192.168.2.2: bytes=32 time<1ms TTL=126
Request timed out.
Reply from 192.168.2.2: bytes=32 time=13ms TTL=125
Reply from 192.168.2.2: bytes=32 time=13ms TTL=125
Reply from 192.168.2.2: bytes=32 time=12ms TTL=125
Reply from 192.168.2.2: bytes=32 time=13ms TTL=125
Reply from 192.168.2.2: bytes=32 time<1ms TTL=125
Reply from 192.168.2.2: bytes=32 time<1ms TTL=125
```

```
Reply from 192.168.2.2: bytes=32 time=1ms TTL=125
Reply from 192.168.2.2: bytes=32 time=3ms TTL=125
Reply from 192.168.2.2: bytes=32 time<1ms TTL=125
Reply from 192.168.2.2: bytes=32 time=11ms TTL=125
Reply from 192.168.2.2: bytes=32 time=5ms TTL=125
```

Kiểm tra lại đường đi từ PC-1 đến PC-2

```
C:\>tracert 192.168.2.2

Tracing route to 192.168.2.2 over a maximum of 30 hops:

  1    0 ms      0 ms      25 ms     192.168.1.1
  2    0 ms      0 ms      0 ms      10.0.13.3
  3    0 ms      0 ms      0 ms      10.0.23.2
  4    13 ms     11 ms     0 ms      192.168.2.2

Trace complete.
```

Nhìn vào kết quả có thể thấy đường đi như sau : **PC-1 > R1 > R3 > R2 > PC-2**

Khôi phục lại kết nối

Kiểm tra lại đường đi từ PC-1 đến PC-2

```
C:\>tracert 192.168.2.2

Tracing route to 192.168.2.2 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      192.168.1.1
  2    *         0 ms      0 ms      10.0.12.2
  3    0 ms      0 ms      1 ms      192.168.2.2

Trace complete.
```

Nhìn vào kết quả có thể thấy đường đi như sau : **PC-1 > R1 > R2 > PC-2**