Redes II

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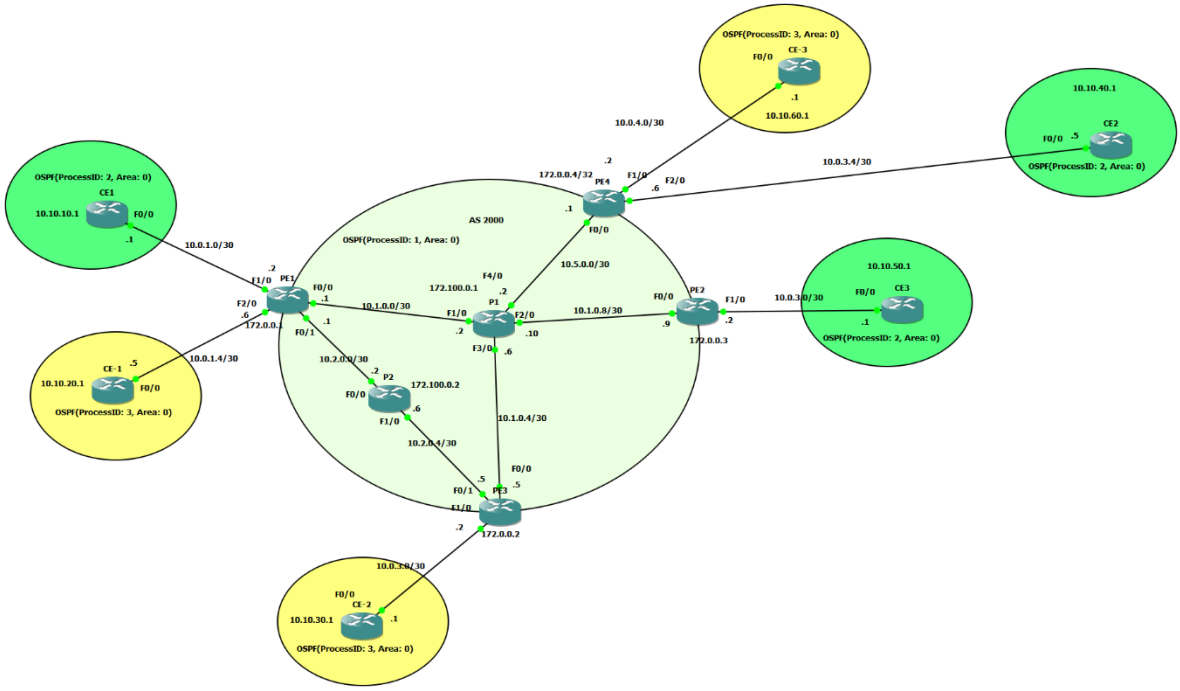
Questão 3.6

Nesta atividade foi solicitado para realizar três modificações na rede apresentado no exercício 3. Foi solicitado adicionar:

I. Um novo Provider, o P2;
II. Um novo Provider Edge, o PE4, e adicionar um novo cliente ao PE4, o CE-3,
III. Modificar o CE2 de Provider, isto é, tirá-lo de PE3 e conectá-lo a PE4.

Essas modificações são comuns na prática de redes MPLS e demonstram a vantagens do uso delas sobre as tecnologias que a antecederam.

Topologia



Modificação I

Para adicionar o P2 à rede MPLS foi necessário configurar as interfaces dos roteadores PE1 e PE3 e ativar o MPLS nelas. No P2 é necessário: (1) atribuir **ip** nas interfaces; (2) ativar o protocolo de roteamento OSPF; (3) ativar o MPLS nas interfaces;

Configuração de PE1

```
configure terminal
    interface F0/1
        ip address 10.2.0.1 255.255.255.252
        mpls ip
        ip ospf 1 area 0
        no shutdown
```

Configuração do PE3

```
configure terminal
    interface F0/1
        ip address 10.2.0.5 255.255.255.252
        mpls ip
        ip ospf 1 area 0
        no shutdown
```

Configuração para P2

```
configure terminal
    interface loopback 0
        ip address 172.100.0.2 255.255.255.255
        mpls ip
        no shutdown

    interface F0/0
        ip address 10.2.0.2 255.255.255.252
        mpls ip
        no shutdown

    interface F1/0
        ip address 10.2.0.6 255.255.255.252
        mpls ip
        no shutdown

    router ospf 1
        network 0.0.0.0 255.255.255.255 area 0
end
```

Modificação II

Para criar um novo Provider Edge (PE), chamado de PE4, e conectar a ele um cliente, chamado de CE-3, pertencente a VRF “Cliente_B” é preciso configurar a interface de P1 para conectar com o PE4. É, também, necessário configurar os demais PEs na rede, para declará-los como vizinhos de PE4. Ao conectar o PE4 ao cliente é necessário ativar *forwarding* da interface a VRF “Cliente_B”. A configuração do novo roteador (CE-3) é simples, basta definir o **ip** da interface e ativar o protocolo de roteamento iGP, neste caso, OSPF com *ProcessID* igual a 3.

Configuração do PE4

```
configure terminal
    ip vrf Cliente_A
        rd 2000:1
        route-target both 2000:1
    ip vrf Cliente_B
        rd 2000:2
        route-target both 2000:2

    interface loopback 0
        ip address 172.0.0.4 255.255.255.255
        ip ospf 1 area 0
        no shutdown
    interface F0/0
        ip address 10.5.0.1 255.255.255.252
        mpls ip
        ip ospf 1 area 0
        no shutdown
    interface F1/0
        ip vrf forwarding Cliente_B
        ip address 10.0.4.2 255.255.255.252
        ip ospf 3 area 0
        no shutdown
    interface F2/0
        ip vrf forwarding Cliente_A
        ip address 10.0.3.6 255.255.255.252
        ip ospf 2 area 0
        no shutdown

    router bgp 2000
        neighbor 172.0.0.3 remote-as 2000
        neighbor 172.0.0.3 update-source loopback 0

        neighbor 172.0.0.2 remote-as 2000
        neighbor 172.0.0.2 update-source loopback 0

        neighbor 172.0.0.1 remote-as 2000
        neighbor 172.0.0.1 update-source loopback 0
```

```
        address-family vpnv4
            neighbor 172.0.0.2 activate
            neighbor 172.0.0.3 activate
            neighbor 172.0.0.1 activate
        address-family ipv4 vrf Cliente_A
            redistribute ospf 2
        address-family ipv4 vrf Cliente_B
            redistribute ospf 3

    router ospf 2
        redistribute bgp 2000 subnets
    router ospf 3
        redistribute bgp 2000 subnets
end
```

Configuração do CE-3

```
configure terminal
    interface loopback 0
        ip address 10.10.60.1 255.255.255.255
        no shutdown
    interface F0/0
        ip address 10.0.4.1 255.255.255.252
        no shutdown
    router ospf 3
        network 0.0.0.0 255.255.255.255 area 0
end
```

Modificação no P1

```
configure terminal
    interface F4/0
        ip address 10.5.0.2 255.255.255.252
        mpls ip
        no shutdown
end
```

Modificação III

Para modificar o cliente CE2 na VRF “Cliente_A” do PE3 para o PE4 é necessário apenas ajustar a interface do PE4. Isto inclui: (1) atribuir endereço; (2) ativar o protocolo de roteamento; (3) habilitar o *forwarding* da VRF “Cliente_A” nessa interface. No roteador PE3 é recomendável desativar a interface que antes estava conectada ao cliente CE2.

Configuração para o PE3

```
configure terminal
    interface F2/0
        ip vrf forwarding Cliente_A
        ip address 10.0.3.6 255.255.255.252
        ip ospf 2 area 0
        shutdown !-- shutdown porque ele foi movido
end
```

Configuração para o PE4

```
configure terminal
    ip vrf Cliente_A
        rd 2000:1
        route-target both 2000:1
    ip vrf Cliente_B
        rd 2000:2
        route-target both 2000:2

    interface F2/0
        ip vrf forwarding Cliente_A
        ip address 10.0.3.6 255.255.255.252
        ip ospf 2 area 0
        no shutdown
end
```

Demonstrações

```
CE1#traceroute 10.10.40.1

Type escape sequence to abort.
Tracing the route to 10.10.40.1

  1 10.0.1.2 28 msec 24 msec 20 msec
  2 10.1.0.2 [MPLS: Labels 20/27 Exp 0] 84 msec 48 msec 56 msec
  3 10.0.3.6 [MPLS: Label 27 Exp 0] 48 msec 68 msec 52 msec
  4 10.0.3.5 64 msec 96 msec 80 msec
CE1#
```

```
CE2#show ip route
Codes: 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
       i - IS-IS, su - IS-IS summary, 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, 6 subnets, 2 masks
O IA    10.0.3.0/30 [110/2] via 10.0.3.6, 00:23:55, FastEthernet0/0
O IA    10.10.10.1/32 [110/3] via 10.0.3.6, 00:23:55, FastEthernet0/0
O IA    10.0.1.0/30 [110/2] via 10.0.3.6, 00:23:55, FastEthernet0/0
C       10.0.3.4/30 is directly connected, FastEthernet0/0
C       10.10.40.1/32 is directly connected, Loopback0
O IA    10.10.50.1/32 [110/3] via 10.0.3.6, 00:23:55, FastEthernet0/0
CE2#
```

```
PE4#show ip route vrf Cliente_A

Routing Table: Cliente_A
Codes: 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
       i - IS-IS, su - IS-IS summary, 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, 6 subnets, 2 masks
B       10.0.3.0/30 [200/0] via 172.0.0.3, 00:24:55
B       10.10.10.1/32 [200/2] via 172.0.0.1, 00:24:55
B       10.0.1.0/30 [200/0] via 172.0.0.1, 00:24:55
C       10.0.3.4/30 is directly connected, FastEthernet2/0
O       10.10.40.1/32 [110/2] via 10.0.3.5, 00:26:21, FastEthernet2/0
B       10.10.50.1/32 [200/2] via 172.0.0.3, 00:24:55
PE4#
```

```
P2#show ip route
Codes: 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
       i - IS-IS, su - IS-IS summary, 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

     172.100.0.0/32 is subnetted, 2 subnets
O       172.100.0.1 [110/3] via 10.2.0.5, 00:27:15, FastEthernet1/0
                    [110/3] via 10.2.0.1, 00:27:15, FastEthernet0/0
C       172.100.0.2 is directly connected, Loopback0
     172.0.0.0/32 is subnetted, 4 subnets
O       172.0.0.4 [110/4] via 10.2.0.5, 00:27:05, FastEthernet1/0
                  [110/4] via 10.2.0.1, 00:27:05, FastEthernet0/0
O       172.0.0.1 [110/2] via 10.2.0.1, 00:27:15, FastEthernet0/0
O       172.0.0.2 [110/2] via 10.2.0.5, 00:27:15, FastEthernet1/0
O       172.0.0.3 [110/4] via 10.2.0.5, 00:27:05, FastEthernet1/0
                  [110/4] via 10.2.0.1, 00:27:05, FastEthernet0/0
     10.0.0.0/30 is subnetted, 6 subnets
O       10.1.0.8 [110/3] via 10.2.0.5, 00:27:15, FastEthernet1/0
                 [110/3] via 10.2.0.1, 00:27:15, FastEthernet0/0
C       10.2.0.0 is directly connected, FastEthernet0/0
O       10.1.0.0 [110/2] via 10.2.0.1, 00:27:23, FastEthernet0/0
C       10.2.0.4 is directly connected, FastEthernet1/0
O       10.5.0.0 [110/3] via 10.2.0.5, 00:27:24, FastEthernet1/0
                 [110/3] via 10.2.0.1, 00:27:24, FastEthernet0/0
O       10.1.0.4 [110/2] via 10.2.0.5, 00:27:25, FastEthernet1/0
P2#
```

```
CE-3#show ip route
Codes: 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
       i - IS-IS, su - IS-IS summary, 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, 6 subnets, 2 masks
O IA    10.0.3.0/30 [110/2] via 10.0.4.2, 00:26:40, FastEthernet0/0
C       10.0.4.0/30 is directly connected, FastEthernet0/0
O IA    10.0.1.4/30 [110/2] via 10.0.4.2, 00:26:40, FastEthernet0/0
O IA    10.10.20.1/32 [110/3] via 10.0.4.2, 00:26:40, FastEthernet0/0
O IA    10.10.30.1/32 [110/3] via 10.0.4.2, 00:26:40, FastEthernet0/0
C       10.10.60.1/32 is directly connected, Loopback0
CE-3#
```