IUT de La Rochelle

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- TP 9 -
Multi-Protocol Label Switching – MPLS (partie 2)

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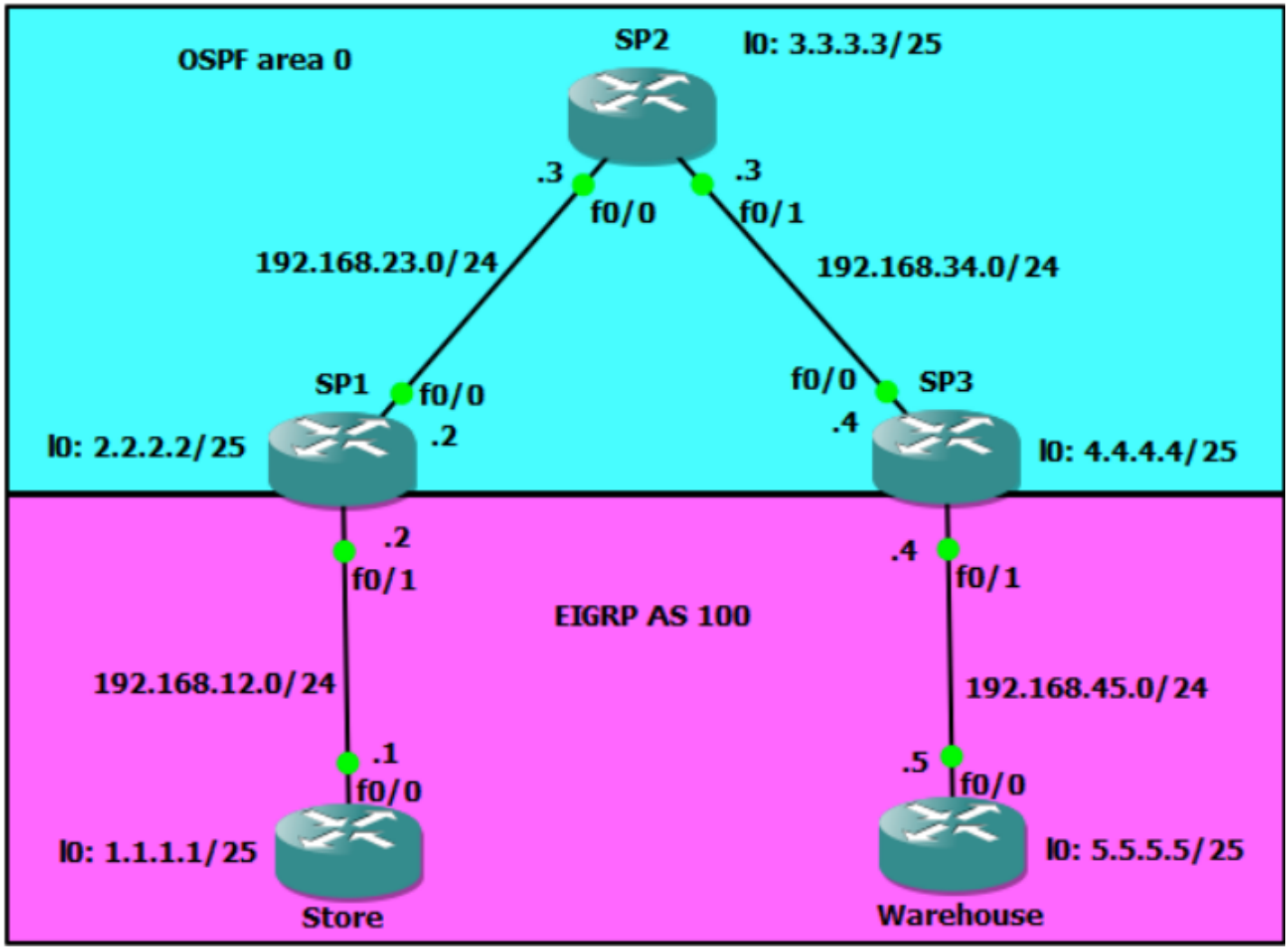
Sommaire

1. Mise en place de la maquette



2. Les configurations réseaux des routeurs, d'après la maquette, sont les suivantes :

```
interface Loopback0
 ip address 2.2.2.2 255.255.255.128
!
interface FastEthernet0/0
 ip address 192.168.23.2 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet0/1
 ip address 192.168.12.2 255.255.255.0
 duplex auto
 speed auto
!
```

Configuration SP1

```
interface Loopback0
 ip address 3.3.3.3 255.255.255.128
!
interface FastEthernet0/0
 ip address 192.168.23.3 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet0/1
 ip address 192.168.34.3 255.255.255.0
 duplex auto
 speed auto
!
```

Configuration SP2

```
interface Loopback0
 ip address 4.4.4.4 255.255.255.128
!
interface FastEthernet0/0
 ip address 192.168.34.4 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet0/1
 ip address 192.168.45.4 255.255.255.0
 duplex auto
 speed auto
!
```

Configuration SP3

```
interface Loopback0
 ip address 1.1.1.1 255.255.255.128
!
interface FastEthernet0/0
 ip address 192.168.12.1 255.255.255.0
 duplex auto
 speed auto
!
```

Configuration Store

```
interface Loopback0
 ip address 5.5.5.5 255.255.255.128
!
interface FastEthernet0/0
 ip address 192.168.45.5 255.255.255.0
 duplex auto
 speed auto
!
```

Configuration Warehouse

3. Configuration OSPF

a. On active OSPF sur les routeurs SP1, SP2 et SP3. Pour SP1 par exemple, on a :

```
SP1(config)#router ospf 1
SP1(config-router)#network 2.2.2.0 0.0.0.127 area 0
SP1(config-router)#network 192.168.12.0 0.0.0.255 area 0
SP1(config-router)#network 192.168.23.0 0.0.0.255 area 0
```

b. SP1 a alors pour voisin SP2, de même pour SP3, tandis que SP2 a pour voisins SP1 et SP3 :

```
SP1#show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
3.3.3.3           1   FULL/BDR        00:00:38    192.168.23.3    FastEthernet0/
0
```

Table des voisins OSPF de SP1

```
SP2#show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
4.4.4.4           1   FULL/DR         00:00:35    192.168.34.4    FastEthernet0/
1
2.2.2.2           1   FULL/DR         00:00:39    192.168.23.2    FastEthernet0/
0
```

Table des voisins OSPF de SP2

```
SP3#show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
3.3.3.3           1   FULL/BDR        00:00:38    192.168.34.3    FastEthernet0/
0
```

Table des voisins OSPF de SP3

c. L'ensemble des routeurs du domaine OSPF est accessible :

```
SP3#ping 192.168.23.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.23.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/68/84 ms
SP3#ping 2.2.2.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2.2.2.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/70/84 ms
SP3#ping 192.168.12.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.12.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 76/87/108 ms
SP3#ping 3.3.3.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.3.3.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/63/84 ms
SP3#ping 192.168.34.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.34.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/60/80 ms
```

Tests de ping depuis SP3 vers les différentes adresses de SP1 et SP2

2. Configuration du protocole MPLS

4. Configuration MPLS

   a. On active MPLS grâce à la commande *mpls ip* sur les interfaces : f0/0 de SP1, f0/0 et f0/1 de SP2 et f0/0 de SP3.

   b. La commande de configuration globale *mpls ldp router-id Loopback0 force* permet d'indiquer à MPLS d'utiliser l'adresse de loopback du routeur comme RID.

```
SP1(config-if)#do show mpls ldp neighbor
    Peer LDP Ident: 3.3.3.3:0; Local LDP Ident 2.2.2.2:0
        TCP connection: 3.3.3.3.20673 - 2.2.2.2.646
        State: Oper; Msgs sent/rcvd: 17/17; Downstream
        Up time: 00:04:31
        LDP discovery sources:
          FastEthernet0/0, Src IP addr: 192.168.23.3
        Addresses bound to peer LDP Ident:
          192.168.23.3    192.168.34.3    3.3.3.3
```

Liste des voisins LDP sur SP1

```
SP2(config)#do show mpls ldp neighbor
    Peer LDP Ident: 4.4.4.4:0; Local LDP Ident 3.3.3.3:0
        TCP connection: 4.4.4.4.31253 - 3.3.3.3.646
        State: Oper; Msgs sent/rcvd: 13/13; Downstream
        Up time: 00:02:44
        LDP discovery sources:
          FastEthernet0/1, Src IP addr: 192.168.34.4
        Addresses bound to peer LDP Ident:
          192.168.34.4    192.168.45.4    4.4.4.4
    Peer LDP Ident: 2.2.2.2:0; Local LDP Ident 3.3.3.3:0
        TCP connection: 2.2.2.2.646 - 3.3.3.3.20673
        State: Oper; Msgs sent/rcvd: 12/12; Downstream
        Up time: 00:02:24
        LDP discovery sources:
          FastEthernet0/0, Src IP addr: 192.168.23.2
        Addresses bound to peer LDP Ident:
          192.168.23.2    192.168.12.2    2.2.2.2
```

Liste des voisins LDP sur SP2

```
SP3(config-if)#do show mpls ldp neighbor
    Peer LDP Ident: 3.3.3.3:0; Local LDP Ident 4.4.4.4:0
        TCP connection: 3.3.3.3.646 - 4.4.4.4.31253
        State: Oper; Msgs sent/rcvd: 18/17; Downstream
        Up time: 00:05:07
        LDP discovery sources:
          FastEthernet0/0, Src IP addr: 192.168.34.3
        Addresses bound to peer LDP Ident:
          192.168.23.3    192.168.34.3    3.3.3.3
```

Liste des voisins LDP sur SP3

Les voisins sont bien identifiés avec leurs adresses de loopback.

c. Les tables de routage et de labels sont les suivantes. La commande de configuration d'interface *ip ospf network point-to-point* permet de corriger le mauvais masque concernant les adresses de loopback.

```
      2.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        2.2.2.0/25 is directly connected, Loopback0
L        2.2.2.2/32 is directly connected, Loopback0
      3.0.0.0/25 is subnetted, 1 subnets
O        3.3.3.0 [110/2] via 192.168.23.3, 00:04:45, FastEthernet0/0
      4.0.0.0/25 is subnetted, 1 subnets
O        4.4.4.0 [110/3] via 192.168.23.3, 00:04:22, FastEthernet0/0
      192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.12.0/24 is directly connected, FastEthernet0/1
L        192.168.12.2/32 is directly connected, FastEthernet0/1
      192.168.23.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.23.0/24 is directly connected, FastEthernet0/0
L        192.168.23.2/32 is directly connected, FastEthernet0/0
O     192.168.34.0/24 [110/2] via 192.168.23.3, 00:16:39, FastEthernet0/0
O     192.168.45.0/24 [110/3] via 192.168.23.3, 00:16:39, FastEthernet0/0
```

Table de routage de SP1

```
      2.0.0.0/25 is subnetted, 1 subnets
O        2.2.2.0 [110/2] via 192.168.23.2, 00:03:25, FastEthernet0/0
      3.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        3.3.3.0/25 is directly connected, Loopback0
L        3.3.3.3/32 is directly connected, Loopback0
      4.0.0.0/25 is subnetted, 1 subnets
O        4.4.4.0 [110/2] via 192.168.34.4, 00:03:15, FastEthernet0/1
O     192.168.12.0/24 [110/2] via 192.168.23.2, 00:16:57, FastEthernet0/0
      192.168.23.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.23.0/24 is directly connected, FastEthernet0/0
L        192.168.23.3/32 is directly connected, FastEthernet0/0
      192.168.34.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.34.0/24 is directly connected, FastEthernet0/1
L        192.168.34.3/32 is directly connected, FastEthernet0/1
O     192.168.45.0/24 [110/2] via 192.168.34.4, 00:15:34, FastEthernet0/1
```

Table de routage de SP2

```
      2.0.0.0/25 is subnetted, 1 subnets
O        2.2.2.0 [110/3] via 192.168.34.3, 00:04:53, FastEthernet0/0
      3.0.0.0/25 is subnetted, 1 subnets
O        3.3.3.0 [110/2] via 192.168.34.3, 00:05:06, FastEthernet0/0
      4.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        4.4.4.0/25 is directly connected, Loopback0
L        4.4.4.4/32 is directly connected, Loopback0
O     192.168.12.0/24 [110/3] via 192.168.34.3, 00:17:03, FastEthernet0/0
O     192.168.23.0/24 [110/2] via 192.168.34.3, 00:17:03, FastEthernet0/0
      192.168.34.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.34.0/24 is directly connected, FastEthernet0/0
L        192.168.34.4/32 is directly connected, FastEthernet0/0
      192.168.45.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.45.0/24 is directly connected, FastEthernet0/1
L        192.168.45.4/32 is directly connected, FastEthernet0/1
```

Table de routage de SP3

```
SP1#show mpls forwarding-table
Local      Outgoing   Prefix           Bytes Label   Outgoing   Next Hop
Label      Label      or Tunnel Id     Switched      interface
18         Pop Label  192.168.34.0/24  0             Fa0/0      192.168.23.3
19         19         192.168.45.0/24  0             Fa0/0      192.168.23.3
20         Pop Label  3.3.3.0/25       0             Fa0/0      192.168.23.3
21         21         4.4.4.0/25       0             Fa0/0      192.168.23.3
SP1#show mpls ldp bindings
  lib entry: 2.2.2.0/25, rev 2
        local binding:  label: imp-null
        remote binding: lsr: 3.3.3.3:0, label: 20
  lib entry: 3.3.3.0/25, rev 17
        local binding:  label: 20
        remote binding: lsr: 3.3.3.3:0, label: imp-
  lib entry: 4.4.4.0/25, rev 19
        local binding:  label: 21
        remote binding: lsr: 3.3.3.3:0, label: 21
  lib entry: 192.168.12.0/24, rev 8
        local binding:  label: imp-null
        remote binding: lsr: 3.3.3.3:0, label: 18
  lib entry: 192.168.23.0/24, rev 10
        local binding:  label: imp-null
        remote binding: lsr: 3.3.3.3:0, label: imp-
  lib entry: 192.168.34.0/24, rev 12
        local binding:  label: 18
        remote binding: lsr: 3.3.3.3:0, label: imp-
  lib entry: 192.168.45.0/24, rev 14
        local binding:  label: 19
        remote binding: lsr: 3.3.3.3:0, label: 19
```

Lables MPLS sur SP1

```
SP2#show mpls forwarding-table
Local      Outgoing   Prefix           Bytes Label   Outgoing   Next Hop
Label      Label      or Tunnel Id     Switched      interface
18         Pop Label  192.168.12.0/24  0             Fa0/0      192.168.23.2
19         Pop Label  192.168.45.0/24  0             Fa0/1      192.168.34.4
20         Pop Label  2.2.2.0/25       0             Fa0/0      192.168.23.2
21         Pop Label  4.4.4.0/25       0             Fa0/1      192.168.34.4
SP2#show mpls ldp bindings
  lib entry: 2.2.2.0/25, rev 18
        local binding:  label: 20
        remote binding: lsr: 2.2.2.2:0, label: imp-null
        remote binding: lsr: 4.4.4.4:0, label: 21
  lib entry: 3.3.3.0/25, rev 4
        local binding:  label: imp-null
        remote binding: lsr: 2.2.2.2:0, label: 20
        remote binding: lsr: 4.4.4.4:0, label: 20
  lib entry: 4.4.4.0/25, rev 19
        local binding:  label: 21
        remote binding: lsr: 4.4.4.4:0, label: imp-null
        remote binding: lsr: 2.2.2.2:0, label: 21
  lib entry: 192.168.12.0/24, rev 8
        local binding:  label: 18
        remote binding: lsr: 4.4.4.4:0, label: 18
        remote binding: lsr: 2.2.2.2:0, label: imp-null
  lib entry: 192.168.23.0/24, rev 10
        local binding:  label: imp-null
        remote binding: lsr: 4.4.4.4:0, label: 19
        remote binding: lsr: 2.2.2.2:0, label: imp-null
  lib entry: 192.168.34.0/24, rev 12
        local binding:  label: imp-null
        remote binding: lsr: 4.4.4.4:0, label: imp-null
        remote binding: lsr: 2.2.2.2:0, label: 18
  lib entry: 192.168.45.0/24, rev 14
        local binding:  label: 19
        remote binding: lsr: 4.4.4.4:0, label: imp-null
        remote binding: lsr: 2.2.2.2:0, label: 19
```

Lables MPLS sur SP2

```
SP3#show mpls forwarding-table
Local      Outgoing   Prefix           Bytes Label   Outgoing   Next Hop
Label      Label      or Tunnel Id     Switched      interface
16         No Label   2.2.2.2/32       0             drop
18         18         192.168.12.0/24  0             Fa0/0      192.168.34.3
19         Pop Label  192.168.23.0/24  0             Fa0/0      192.168.34.3
20         Pop Label  3.3.3.0/25       0             Fa0/0      192.168.34.3
21         20         2.2.2.0/25       0             Fa0/0      192.168.34.3
SP3#show mpls ldp bindings
  lib entry: 2.2.2.0/25, rev 19
        local binding:  label: 21
        remote binding: lsr: 3.3.3.3:0, label: 20
  lib entry: 3.3.3.0/25, rev 17
        local binding:  label: 20
        remote binding: lsr: 3.3.3.3:0, label: imp-null
  lib entry: 4.4.4.0/25, rev 6
        local binding:  label: imp-null
        remote binding: lsr: 3.3.3.3:0, label: 21
  lib entry: 192.168.12.0/24, rev 8
        local binding:  label: 18
        remote binding: lsr: 3.3.3.3:0, label: 18
  lib entry: 192.168.23.0/24, rev 10
        local binding:  label: 19
        remote binding: lsr: 3.3.3.3:0, label: imp-null
  lib entry: 192.168.34.0/24, rev 12
        local binding:  label: imp-null
        remote binding: lsr: 3.3.3.3:0, label: imp-null
  lib entry: 192.168.45.0/24, rev 14
        local binding:  label: imp-null
        remote binding: lsr: 3.3.3.3:0, label: 19
```

Lables MPLS sur SP3

Le ping SP1 → SP3 va partir de SP1 avec le label 18

3. Configuration de VRF

5. Configuration de la liaison VPN (VRF)

Terminologie

RT (Route Target) : communauté BGP faisant le lien entre les routes VRF et BGP au sein d'une topologie MPLS VPN. Cela permet de contrôler l'import/export des routes entre BGP et VRF.

RD (Route Distinguisher) : cette valeur codée sur 64 bits (dans le format AS:NN) permet d'identifier chaque adresse IP de chaque client de façon unique.

Création de VRF

On crée un VRF puis on l'associe à l'interface côté client sur SP1 et SP3 :

```
SP1(config)#ip vrf CUSTOMER
SP1(config-vrf)#rd 100:1
SP1(config-vrf)#route-target both 1:100
SP1(config-vrf)#exit
SP1(config)#interface fa0/1
SP1(config-if)#ip vrf forwarding CUSTOMER
SP1(config-if)#ip address 192.168.12.2 255.255.255.0
```

```
SP3(config)#ip vrf CUSTOMER
SP3(config-vrf)#rd 100:1
SP3(config-vrf)#route-target both 1:100
SP3(config-vrf)#exit
SP3(config)#interface fa0/1
SP3(config-if)#ip vrf forwarding CUSTOMER
SP3(config-if)#ip address 192.168.45.4 255.255.255.0
```

On vérifie ensuite la connectivité entre SP1 et son client (Store) et entre SP3 et Warehouse via VRF. La commande est *ping vrf CUSTOMER 192.168.12.1* sur SP1 (*192.168.45.5* sur SP3). Le test de ping est fonctionnel.

6. Configuration d'EIGRP sur Store et Warehouse

```
router eigrp 100
 network 1.0.0.0
 network 192.168.12.0
 no auto-summary
!
```
Config Store

```
router eigrp 100
 network 5.0.0.0
 network 192.168.45.0
 no auto-summary
!
```
Config Warehouse

7. Configuration d'EIGRP sur SP1 et SP3

```
router eigrp 1
 !
 address-family ipv4 vrf CUSTOMER
  network 192.168.12.0
  autonomous-system 100
  no auto-summary
 exit-address-family
!
```
Configuration SP1


```
router eigrp 1
 !
 address-family ipv4 vrf CUSTOMER
  network 192.168.45.0
  autonomous-system 100
  no auto-summary
 exit-address-family
!
```
Configuration SP3

8. On affiche les listes des voisins EIGRP de SP1 et de SP3 :

```
SP1#show ip eigrp vrf CUSTOMER neighbors
EIGRP-IPv4 Neighbors for AS(100) VRF(CUSTOMER)
H   Address                 Interface              Hold Uptime   SRTT   RTO  Q  Seq
                                                   (sec)         (ms)       Cnt Num
0   192.168.12.1            Fa0/1                    12 00:01:38   64   384  0  2
```

Table des voisins EIGRP de SP1

```
SP3#show ip eigrp vrf CUSTOMER neighbors
EIGRP-IPv4 Neighbors for AS(100) VRF(CUSTOMER)
H   Address                 Interface              Hold Uptime   SRTT   RTO  Q  Seq
                                                   (sec)         (ms)       Cnt Num
0   192.168.45.5            Fa0/1                    10 00:04:26   91   546  0  2
```

Table des voisins EIGRP de SP3

Sur SP1, on voit qu'il y a un voisin : 192.168.12.1, soit Store. Ensuite, sur SP3, il y a bien un voisin dans la table EIGRP : 192.168.45.5, soit Warehouse.

9. On vérifie et on compare les tables de routage globale et celle concernant le VRF sur SP1 et SP3 :

```
      1.0.0.0/25 is subnetted, 1 subnets
D        1.1.1.0 [90/156160] via 192.168.12.1, 00:05:28, FastEthernet0/1
      192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.12.0/24 is directly connected, FastEthernet0/1
L        192.168.12.2/32 is directly connected, FastEthernet0/1
```

Table de routage CUSTOMER (VRF) de SP1

```
      2.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        2.2.2.0/25 is directly connected, Loopback0
L        2.2.2.2/32 is directly connected, Loopback0
      3.0.0.0/25 is subnetted, 1 subnets
O        3.3.3.0 [110/2] via 192.168.23.3, 00:36:38, FastEthernet0/0
      4.0.0.0/25 is subnetted, 1 subnets
O        4.4.4.0 [110/3] via 192.168.23.3, 00:36:15, FastEthernet0/0
      192.168.23.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.23.0/24 is directly connected, FastEthernet0/0
L        192.168.23.2/32 is directly connected, FastEthernet0/0
O     192.168.34.0/24 [110/2] via 192.168.23.3, 00:48:32, FastEthernet0/0
```

Table de routage globale de SP1

La table de routage CUSTOMER contient une route EIGRP, vers l'adresse de loopback de Store. La table de routage globale quant à elle ne contient que les routes OSPF et elle ne contient plus de route vers 192.168.12.0/24. En effet, cette route correspond au VRF configuré donc c'est dans la table de routage CUSTOMER qu'elle apparaît. Il en va de même pour le routeur SP3 *(voir page suivante)*.

```
      5.0.0.0/25 is subnetted, 1 subnets
D        5.5.5.0 [90/156160] via 192.168.45.5, 00:08:04, FastEthernet0/1
     192.168.45.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.45.0/24 is directly connected, FastEthernet0/1
L       192.168.45.4/32 is directly connected, FastEthernet0/1
```

Table de routage CUSTOMER (VRF) de SP3

```
      2.0.0.0/25 is subnetted, 1 subnets
O        2.2.2.0 [110/3] via 192.168.34.3, 00:38:07, FastEthernet0/0
      3.0.0.0/25 is subnetted, 1 subnets
O        3.3.3.0 [110/2] via 192.168.34.3, 00:38:20, FastEthernet0/0
      4.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        4.4.4.0/25 is directly connected, Loopback0
L        4.4.4.4/32 is directly connected, Loopback0
O     192.168.23.0/24 [110/2] via 192.168.34.3, 00:50:17, FastEthernet0/0
      192.168.34.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.34.0/24 is directly connected, FastEthernet0/0
L        192.168.34.4/32 is directly connected, FastEthernet0/0
```

Table de routage globale de SP3

10. On configure BGP sur les routeurs SP1 et SP3, avec la redistribution des routes EIGRP :

```
router bgp 1
 neighbor 4.4.4.4 remote-as 1
 neighbor 4.4.4.4 update-source Loopback0
 !
 address-family vpnv4
  neighbor 4.4.4.4 activate
  neighbor 4.4.4.4 send-community extended
 exit-address-family
 !
 address-family ipv4 vrf CUSTOMER
  redistribute eigrp 100
 exit-address-family
!
```

Configuration de SP1 (extrait)

```
router bgp 1
 neighbor 2.2.2.2 remote-as 1
 neighbor 2.2.2.2 update-source Loopback0
 !
 address-family vpnv4
  neighbor 2.2.2.2 activate
  neighbor 2.2.2.2 send-community extended
 exit-address-family
 !
 address-family ipv4 vrf CUSTOMER
  redistribute eigrp 100
 exit-address-family
!
```

Configuration de SP3 (extrait)

12. On redistribue également les routes BGP dans EIGRP sur les deux précédents routeurs :

```
SPx(config)#router eigrp 1
SPx(config-router)#address-family ipv4 vrf CUSTOMER
SPx(config-router-af)#redistribute bgp 1
SPx(config-router-af)#redistribute bgp 1 metric 64 1000 255 1 1500
SPx(config-router-af)#exit
```

13. Vérification de BGP – VRF

```
SP1#show ip bgp vpnv4 vrf CUSTOMER
BGP table version is 7, local router ID is 2.2.2.2
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

     Network          Next Hop            Metric LocPrf Weight Path
Route Distinguisher: 100:1 (default for vrf CUSTOMER)
 *>  1.1.1.0/25      192.168.12.1             156160         32768 ?
 *>i 5.5.5.0/25      4.4.4.4                  156160    100      0 ?
 *>  192.168.12.0    0.0.0.0                       0         32768 ?
 *>i 192.168.45.0    4.4.4.4                       0    100      0 ?
SP1#show ip bgp vpnv4 vrf CUSTOMER tags
   Network          Next Hop      In tag/Out tag
Route Distinguisher: 100:1 (CUSTOMER)
   1.1.1.0/25       192.168.12.1    16/notag
   5.5.5.0/25       4.4.4.4         notag/17
   192.168.12.0     0.0.0.0         17/nolabel(CUSTOMER)
   192.168.45.0     4.4.4.4         notag/16
```

Vérification sur SP1

```
SP3#show ip bgp vpnv4 vrf CUSTOMER
BGP table version is 7, local router ID is 4.4.4.4
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
              x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

     Network          Next Hop            Metric LocPrf Weight Path
Route Distinguisher: 100:1 (default for vrf CUSTOMER)
 *>i 1.1.1.0/25      2.2.2.2                  156160    100      0 ?
 *>  5.5.5.0/25      192.168.45.5             156160         32768 ?
 *>i 192.168.12.0    2.2.2.2                       0    100      0 ?
 *>  192.168.45.0    0.0.0.0                       0         32768 ?
SP3#show ip bgp vpnv4 vrf CUSTOMER tags
   Network          Next Hop      In tag/Out tag
Route Distinguisher: 100:1 (CUSTOMER)
   1.1.1.0/25       2.2.2.2         notag/16
   5.5.5.0/25       192.168.45.5    17/notag
   192.168.12.0     2.2.2.2         notag/17
   192.168.45.0     0.0.0.0         16/nolabel(CUSTOMER)
```

Vérification sur SP3

Les routes BGP notées 'i' sont les routes importées depuis EIGRP. Par exemple, sur SP1 on voit que les réseaux 5.5.5.0/25 et 192.168.45.0/24 figurent dans sa table BGP. Ils sont accessibles grâce aux routes EIGRP configurées sur SP3.

14. Vérification de la connectivité entre les deux sites via le VPN.

```
Store#ping 192.168.45.5
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.45.5, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 76/96/104 ms
Store#traceroute 192.168.45.5
Type escape sequence to abort.
Tracing the route to 192.168.45.5
VRF info: (vrf in name/id, vrf out name/id)
  1 192.168.12.2 40 msec 56 msec 80 msec
  2 192.168.23.3 [MPLS: Labels 21/16 Exp 0] 92 msec 64 msec 60 msec
  3 192.168.45.4 104 msec 80 msec 104 msec
  4 192.168.45.5 116 msec *  84 msec
```

Test de connectivité entre Store et Warehouse

Le test de ping est concluant. Un traceroute nous montre les différents sauts entre les deux sites distants. On peut voir que les différents sauts sont : SP1 (côté client), SP2 (côté SP1), SP3 (côté client) puis Warehouse (destination). Le deuxième saut est lié au protocole MPLS car on se trouve alors dans le backbone MPLS. Les deux autres sauts correspondent aux deux extrémités du VPN que l'on a configuré.

```
      1.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        1.1.1.0/25 is directly connected, Loopback0
L        1.1.1.1/32 is directly connected, Loopback0
      5.0.0.0/25 is subnetted, 1 subnets
D        5.5.5.0 [90/158720] via 192.168.12.2, 00:06:29, FastEthernet0/0
      192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.12.0/24 is directly connected, FastEthernet0/0
L        192.168.12.1/32 is directly connected, FastEthernet0/0
D     192.168.45.0/24 [90/30720] via 192.168.12.2, 00:06:29, FastEthernet0/0
```

Table de routage globale de Store

Dans la table de routage de Store, on voit que les réseaux 5.5.5.0/25 et 192.168.45.0/24 sont bien présents et accessibles via des routes EIGRP (**D**).

15. On affiche enfin sur SP1 la pile de labels imposée pour atteindre Warehouse depuis Store :

```
SP1#show ip cef vrf CUSTOMER 192.168.45.5
192.168.45.0/24
  nexthop 192.168.23.3 FastEthernet0/0 label 21 16
```

Pile de labels sur SP1

La pile de labels que l'on voit ici est la même que l'on peut voir sur le traceroute (cf page précédente). Comme on peut le voir à la question 4, depuis SP1 vers 4.4.4.0/25 (SP3 pour le VPN), le label utilisé est le label 21. C'est donc ce premier label que l'on trouve. Ensuite, le label 16 est ajouté au niveau de SP3 car il identifie le réseau 2.2.2.0/25 soit SP1 (source).