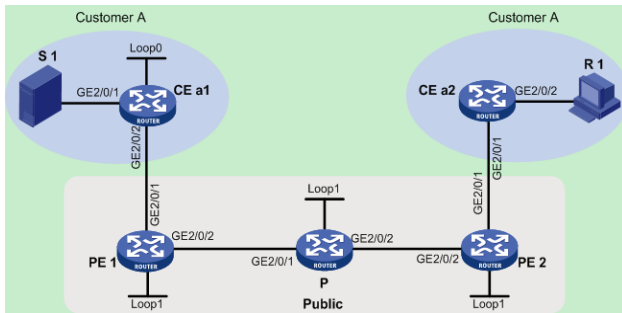


Customer A有位于两地的分支机构，这两个分支机构已通过同一个运营商的MPLS L3VPN网络实现了两地间单播路由信息的正常交互。目前Customer A中的组播源与接收者分别位于不同的分支机构中，且各分支机构内运行的PIM协议模式为PIM-SM。现要求通过MD VPN技术，实现组播接收者能够正常接收到组播源发来的组播数据。



为了实现上述组网需求，需要在公网的各设备上运行PIM协议（与私网中的PIM协议模式相互独立），并在各PE设备上配置MD VPN。

配置MD VPN时，只有在指定了Default-Group和MD源接口，并获取到MD源接口的公网IP地址之后，MTI才会生效。此外，当在SPC和MPE-1104单板上配置组播VPN业务时，还必须先使用service-loopback group命令创建Multicast tunnel类型的业务环回组，MTI才能正常转发。

属于同一VPN的所有接口（包括PE上绑定VPN实例的接口）上必须运行相同模式的PIM协议。

在不同的PE上，应该为相同VPN实例的MD指定相同的Default-Group。

MD源接口必须与建立BGP对等体时所使用的源接口相同，否则将无法获取正确的路由信息。

1.1 配置步骤

1.1.1 配置各设备接口IP地址

按图配置各设备上的接口IP地址和子网掩码。

```
system-view
[CEa1] interface gigabitethernet 2/0/1
[CEa1-GigabitEthernet2/0/1] ip address 10.11.3.1 24
[CEa1-GigabitEthernet2/0/1] quit
[CEa1] interface loopback 0
[CEa1-LoopBack0] ip address 2.2.2.2 32
[CEa1-LoopBack0] quit
[CEa1] interface gigabitethernet 2/0/2
[CEa1-GigabitEthernet2/0/2] ip address 10.11.1.2 24
[CEa1-GigabitEthernet2/0/2] quit
PE 1、P、PE 2和CE a2的配置与CE a1相似，配置过程略。
```

1.1.2 配置路由及基本MPLS L3VPN

配置路由由协议及基本MPLS L3VPN，实现两地间单播路由信息互通。具体配置请参见“MPLS配置指导”中的“MPLS L3VPN”。

1.1.3 配置组播路由由相关功能及MD VPN

(1) 在公网实例中使能IP组播路由、公网接口上配置PIM-SM功能（包括LoopBack接口）

在PE 1上使能IP组播路由，在公网接口上配置PIM-SM。

```
system-view
[PE1] multicast routing
[PE1-mrib] quit
[PE1] interface gigabitethernet 2/0/2
[PE1-GigabitEthernet2/0/2] pim sm
[PE1-GigabitEthernet2/0/2] quit
[PE1] interface loopback 1
[PE1-LoopBack1] pim sm
[PE1-LoopBack1] quit
# 在P上使能IP组播路由，在公网接口上配置PIM-SM，并将LoopBack 1接口指定为公网的C-BSR和C-RP，其中C-RP服务于公网实例中所有组播组。
```

system-view

```
[P] multicast routing
[P-mrib] quit
[P] interface gigabitethernet 2/0/1
[P-GigabitEthernet2/0/1] pim sm
[P-GigabitEthernet2/0/1] quit
[P] interface gigabitethernet 2/0/2
[P-GigabitEthernet2/0/2] pim sm
[P-GigabitEthernet2/0/2] quit
[P] interface loopback 1
[P-LoopBack1] pim sm
[P-LoopBack1] quit
[P] pim
[P-pim] c-bsr 3.3.3.3
[P-pim] c-rp 3.3.3.3
[P-pim] quit
# 在PE 2上使能IP组播路由, 在公网接口上配置PIM-SM。
```

system-view

```
[PE2] multicast routing
[PE2-mrib] quit
[PE2] interface gigabitethernet 2/0/2
[PE2-GigabitEthernet2/0/2] pim sm
[PE2-GigabitEthernet2/0/2] quit
[PE2] interface loopback 1
[PE2-LoopBack1] pim sm
[PE2-LoopBack1] quit
(2) 在VPN私网实例中使能IP组播路由、私网接口上配置PIM-SM功能, 并在连接有接收者的CE上配置IGMP
# 在CE a1上使能IP组播路由, 在各接口上配置PIM-SM, 并将LoopBack 0接口指定为私网的C-BSR和C-RP, 其中C-RP服务于Customer A实例中所有组播组。
```

system-view

```
[CEa1] multicast routing
[CEa1-mrib] quit
[CEa1] interface gigabitethernet 2/0/1
[CEa1-GigabitEthernet2/0/1] pim sm
[CEa1-GigabitEthernet2/0/1] quit
[CEa1] interface gigabitethernet 2/0/2
[CEa1-GigabitEthernet2/0/2] pim sm
[CEa1-GigabitEthernet2/0/2] quit
[CEa1] interface loopback 0
[CEa1-LoopBack0] pim sm
[CEa1-LoopBack0] quit
[CEa1] pim
[CEa1-pim] c-bsr 2.2.2.2
[CEa1-pim] c-rp 2.2.2.2
[CEa1-pim] quit
# 在CE a2上使能IP组播路由, 在连接有接收者的接口上使能IGMP, 其余各接口上配置PIM-SM。
```

system-view

```
[CEa2] multicast routing
[CEa2-mrib] quit
[CEa2] interface gigabitethernet 2/0/1
[CEa2-GigabitEthernet2/0/1] pim sm
[CEa2-GigabitEthernet2/0/1] quit
[CEa2] interface gigabitethernet 2/0/2
[CEa2-GigabitEthernet2/0/2] igmp enable
[CEa2-GigabitEthernet2/0/2] quit
# 在PE 1上配置VPN实例Customer A, 将接口GigabitEthernet2/0/1与该实例其进行关联, 并使能该实例中的IP组播路由及在关联接口上配置PIM-SM。
```

```
[PE1] ip vpn-instance customerA
[PE1-vpn-instance-customerA] route-distinguisher 100:1
[PE1-vpn-instance-customerA] vpn-target 100:1
[PE1-vpn-instance-customerA] quit
[PE1] interface gigabitethernet 2/0/1
[PE1-GigabitEthernet2/0/1] ip binding vpn-instance customerA
[PE1-GigabitEthernet2/0/1] quit
[PE1] multicast routing vpn-instance customerA
[PE1-mrib-customerA] quit
[PE1] interface gigabitethernet 2/0/1
[PE1-GigabitEthernet2/0/1] pim sm
[PE1-GigabitEthernet2/0/1] quit
# 在PE 2上配置VPN实例Customer A, 将接口GigabitEthernet2/0/1与该实例其进行关联, 并使
能该实例中的IP组播路由及在关联接口上配置PIM-SM。
```

```
[PE2] ip vpn-instance customerA
[PE2-vpn-instance-customerA] route-distinguisher 100:1
[PE2-vpn-instance-customerA] vpn-target 100:1
[PE2-vpn-instance-customerA] quit
[PE2] interface gigabitethernet 2/0/1
[PE2-GigabitEthernet2/0/1] ip binding vpn-instance customerA
[PE2-GigabitEthernet2/0/1] quit
[PE2] multicast routing vpn-instance customerA
[PE2-mrib-customerA] quit
[PE2] interface gigabitethernet 2/0/1
[PE2-GigabitEthernet2/0/1] pim sm
[PE2-GigabitEthernet2/0/1] quit
```

(3) 创建VPN实例的MD, 并指定Default-Group、MD源接口和Data-Group范围

在PE1上创建Multicast tunnel类型的业务环回组1, 并选择一个未被使用的端口, 将其加入该业务环回组。

```
[PE1] service-loopback group 1 type multicast-tunnel
[PE1] interface gigabitethernet 1/0/4
[PE1-GigabitEthernet1/0/4] port link-mode bridge
[PE1-GigabitEthernet1/0/4] port service-loopback group 1
[PE1-GigabitEthernet1/0/4] quit
# 在PE1上创建VPN实例的MD, 并指定Default-Group、MD源接口和Data-Group范围。
```

```
[PE1] multicast-domain vpn-instance customerA
[PE1-md-customerA] default-group 239.1.1.1
[PE1-md-customerA] source loopback 1
[PE1-md-customerA] data-group 225.2.2.0 28
[PE1-md-customerA] quit
```

配置PE 2

在PE 2上创建Multicast tunnel类型的业务环回组1, 并选择一个未被使用的端口, 将其加入该业务环回组。

```
[PE2] service-loopback group 1 type multicast-tunnel
[PE2] interface gigabitethernet 1/0/4
[PE2-GigabitEthernet1/0/4] port link-mode bridge
[PE2-GigabitEthernet1/0/4] port service-loopback group 1
[PE2-GigabitEthernet1/0/4] quit
# 在PE 2上创建VPN实例的MD, 并指定Default-Group、MD源接口和Data-Group范围。
```

```
[PE2] multicast-domain vpn-instance customerA
[PE2-md-customerA] default-group 239.1.1.1
[PE2-md-customerA] source loopback 1
[PE2-md-customerA] data-group 225.2.2.0 28
[PE2-md-customerA] quit
```

1.2 验证配置

按照如上配置后, 通过在PE及P设备上执行display pim routing-table命令, 可以检查公网Default-MDT建立情况, 以P设备为例:

```
[P]display pim routing-table
Total 1 (*, G) entry; 2 (S, G) entry
```

(* , 239.1.1.1)

RP: 3.3.3.3 (local)

Protocol: pim-sm, Flag: SPT LOC ACT

UpTime: 02:54:43

Upstream interface: Register

Upstream neighbor: NULL

RPF prime neighbor: NULL

Downstream interface(s) information:

Total number of downstreams: 2

1: GigabitEthernet2/0/1

Protocol: pim-sm, UpTime: 02:54:43, Expires: -

2: GigabitEthernet2/0/2

Protocol: pim-sm, UpTime: 02:33:57, Expires: -

(1.1.1.1, 239.1.1.1)

RP: 3.3.3.3 (local)

Protocol: pim-sm, Flag: SPT LOC ACT

UpTime: 01:57:13

Upstream interface: GigabitEthernet2/0/1

Upstream neighbor: 192.168.1.2

RPF prime neighbor: 192.168.1.2

Downstream interface(s) information: None

(1.1.1.2, 239.1.1.1)

RP: 3.3.3.3 (local)

Protocol: pim-sm, Flag: SPT LOC ACT

UpTime: 01:57:13

Upstream interface: GigabitEthernet2/0/2

Upstream neighbor: 192.168.2.2

RPF prime neighbor: 192.168.2.2

Downstream interface(s) information: None

由此可见，公网P设备上已建立RPT (* , 239.1.1.1) 和两棵相互独立的SPT树，这三棵树共同组成了该公网上的Default-MDT。