

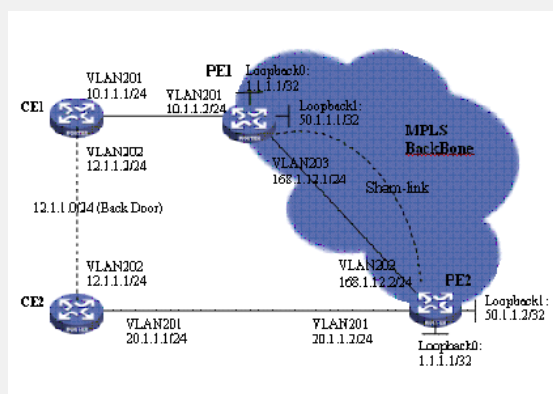
H3C S9500交换机MPLS BGP VPN的OSPF多实例Sham-link组网的配置

一、组网需求：

一个公司通过Quidway路由器的OSPF多实例功能连接到广域网，其中OSPF绑定于VPN1。PE之间是MPLS VPN骨干网，PE和CE之间运行OSPF。在PE1和PE2之间配置一条Sham-link，使得CE1和CE2之间的流量正常情况下不会通过CE1和CE2之间直接相连的链路（Backdoor link），当MPLS骨干网络出现故障时，流量又能切换到CE1和CE2之间直接相连的链路（Backdoor link）。

如下图所示，PE1和PE2为服务运行商PE，CE1和CE2为用户设备，PE1和PE2之间为MPLS骨干网，在PE1和PE2的VPN下配置Sham-link，CE1和CE2之间有一条Back Door链路。网络正常情况下情况数据转发为CE1<->PE1<->PE2<->CE2，当MPLS骨干网络故障时，可以走Back Door，即CE1<->CE2。

二、组网图



三、配置步骤：

软件版本：S9500交换机1200以后软件版本

硬件版本：S9500交换机C/CA/CB类型业务板

配置PE1设备

1) 全局使能MPLS及LDP

```
[PE1] mpls lsr-id 50.1.1.1
```

```
[PE1] mpls
```

```
[PE1] mpls ldp
```

2) 创建VPN实例

```
[PE1] ip vpn-instance vpn1
```

```
[PE1-vpn-vpn1] route-distinguisher 2:1
```

```
[PE1-vpn-vpn1] vpn-target 100:1 export-extcommunity
```

```
[PE1-vpn-vpn1] vpn-target 100:1 import-extcommunity
```

3) 配置MPLS骨干网络的（公网侧）VLAN接口和环回口，并在VLAN接口使能MPLS和LDP

```
[PE1] vlan 203
```

```
[PE1-vlan203] port gigabitethernet 2/1/3
```

```
[PE1] interface vlan-interface 203
```

```
[PE1-vlan-interface203] ip address 168.1.12.1 255.255.255.0
```

```
[PE1-vlan-interface203] mpls
```

```
[PE1-vlan-interface203] mpls ldp enable
```

```
[PE1-vlan-interface203] mpls ldp transport-ip interface
```

```
[PE1] interface loopback1
```

```
[PE1-LoopBack1] ip address 50.1.1.1 255.255.255.255
```

4) 配置VPN的（私网侧）VLAN接口和环回口，并绑定VPN实例

```
[PE1] vlan 201
```

```
[PE1-vlan201] port gigabitethernet 2/1/1
```

```
[PE1] interface vlan-interface 201
```

```
[PE1-vlan-interface201] ip binding vpn-instance vpn1
```

```
[PE1-vlan-interface201] ip address 10.1.1.2 255.255.255.0
```

5) 配置OSPF的花费 (ospf cost配置小于Back Door的cost值)

```
[PE1-vlan-interface201] ospf cost 1
```

6) 配置环回口, 并绑定VPN实例

```
[PE1] interface loopback0
```

```
[PE1-LoopBack0] ip binding vpn-instance vpn1
```

```
[PE1-LoopBack0] ip address 1.1.1.1 255.255.255.255
```

7) 配置公网侧BGP Peer, 并在BGP的VPN实例下引入OSPF和直连路由

```
[PE1] bgp 100
```

```
[PE1-bgp] group group1 internal
```

```
[PE1-bgp] peer 50.1.1.2 group group1
```

```
[PE1-bgp] peer 50.1.1.2 connect-interface LoopBack1
```

```
[PE1-bgp] ipv4-family vpn-instance vpn1
```

```
[PE1-bgp-af-vpn-instance] import-route ospf 100
```

```
[PE1-bgp-af-vpn-instance] import-route ospf-ase 100
```

```
[PE1-bgp-af-vpn-instance] import-route ospf-nssa 100
```

```
[PE1-bgp-af-vpn-instance] import-route direct
```

8) 在MBGP下建立VPNv4邻居并激活

```
[PE1-bgp-af-vpn] ipv4-family vpnv4
```

```
[PE1-bgp-af-vpn] peer group1 enable
```

```
[PE1-bgp-af-vpn] peer 50.1.1.2 group group1
```

9) 配置私网侧OSPF实例 (绑定到VPN实例), 并引入BGP路由 (一定不可以配置引入直连路由, 也不可以发布Sham-link的环回口IP)

```
[PE1] ospf 100 router-id 1.1.1.1 vpn-instance vpn1
```

```
[PE1-ospf-100] import-route bgp
```

```
[PE1-ospf-100] area 0.0.0.0
```

```
[PE1-ospf-100-area-0.0.0.0] network 10.1.1.0 0.0.0.255
```

10) 配置Sham-link

```
[PE1-ospf-100-area-0.0.0.0] sham-link 1.1.1.1 2.2.2.2
```

11) 配置公网OSPF路由, 使PE1和PE2之间路由可达

```
[PE1] ospf 1000
```

```
[PE1-ospf-1000] area 0
```

```
[PE1-ospf-1000-area-0.0.0.0] network 168.12.1.0 0.0.0.255
```

```
[PE1-ospf-1000-area-0.0.0.0] network 50.1.1.1 0.0.0.0
```

配置PE2设备

1) 全局使能MPLS及LDP

```
[PE2] mpls lsr-id 50.1.1.2
```

```
[PE2] mpls
```

```
[PE2] mpls ldp
```

2) 创建VPN实例

```
[PE2] ip vpn-instance vpn1
```

```
[PE2-vpn-vpn1] route-distinguisher 2:1
```

```
[PE2-vpn-vpn1] vpn-target 100:1 export-extcommunity
```

```
[PE2-vpn-vpn1] vpn-target 100:1 import-extcommunity
```

3) 配置MPLS骨干网络的 (公网侧) VLAN接口和环回口, 并在VLAN接口使能MPLS和LDP

```
[PE2] vlan 203
```

```
[PE2-vlan203] port gigabitethernet 2/1/3
```

```
[PE2] interface vlan-interface 203
```

```
[PE2-vlan-interface203] ip address 168.1.12.2 255.255.255.0
```

```
[PE2-vlan-interface203] mpls
```

```
[PE2-vlan-interface203] mpls ldp enable
```

```
[PE2-vlan-interface203] mpls ldp transport-ip interface
```

```
[PE2] interface LoopBack1
```

```
[PE2-LoopBack1] ip address 50.1.1.2 255.255.255.255
```

4) 配置VPN的 (私网侧) VLAN接口和环回口, 并绑定VPN实例 (ospf cost配置必须小于Back Door的cost值)

```
[PE2] vlan 201
```

```
[PE2-vlan201] port gigabitethernet 2/1/1
```

```
[PE2] interface vlan-interface 201
```

```
[PE2-vlan-interface201] ip binding vpn-instance vpn1
```

```
[PE2-vlan-interface201] ip address 20.1.1.2 255.255.255.0
```

```
[PE2-vlan-interface201] ospf cost 1
```

```
[PE2-vlan-interface201] quit
```

```
[PE2] interface LoopBack0
```

```
[PE2-LoopBack0] ip binding vpn-instance vpn1
[PE2-LoopBack0] ip address 2.2.2.2 255.255.255.255
[PE2-LoopBack0] quit
```

5) 配置公网侧BGP Peer, 并在BGP的VPN实例下引入OSPF和直连路由

```
[PE2] bgp 100
[PE2-bgp] group group1 internal
[PE2-bgp] peer 50.1.1.1 group group1
[PE2-bgp] peer 50.1.1.1 connect-interface LoopBack1
[PE2-bgp] ipv4-family vpn-instance vpn1
[PE2-bgp-af-vpn-instance] import-route direct
[PE2-bgp-af-vpn-instance] import-route ospf-nssa 100
[PE2-bgp-af-vpn-instance] import-route ospf-ase 100
[PE2-bgp-af-vpn-instance] import-route ospf 100
```

6) 在MBGP下建立VPNv4邻居并激活

```
[PE2-bgp-af-vpn] ipv4-family vpnv4
[PE2-bgp-af-vpn] peer group1 enable
[PE2-bgp-af-vpn] peer 50.1.1.1 group group1
```

7) 配置私网侧OSPF实例 (绑定到VPN实例), 并引入BGP路由 (一定不可以配置引入直连路由, 且不可以发布Sham-link的环回口IP)

```
[PE2] ospf 100 router-id 2.2.2.2 vpn-instance vpn1
[PE2-ospf-100] import-route bgp
[PE2-ospf-100] import-route static
[PE2-ospf-100] area 0.0.0.0
[PE2-ospf-100-area-0.0.0.0] network 20.1.1.0 0.0.0.255
```

8) 配置Sham-link

```
[PE2-ospf-100-area-0.0.0.0] sham-link 2.2.2.2 1.1.1.1
```

9) 配置公网OSPF路由, 使PE1和PE2之间路由可达

```
[PE2] ospf 1000
[PE2-ospf-1000] area 0
[PE2-ospf-1000-area-0.0.0.0] network 168.12.1.0 0.0.0.255
[PE2-ospf-1000-area-0.0.0.0] network 50.1.1.2 0.0.0.0
```

配置CE1设备

1) 配置VLAN及接口地址, 配置OSPF的花费 (CE间互连VLAN的ospf cost大于MPLS骨干的cost值总和, CE和PE互连VLAN的ospf cost配置小于Back Door的cost值)

```
[CE1] vlan 202
[CE1-vlan202] port gigabitethernet 2/1/2
[CE1-vlan202] quit
[CE1] interface vlan-interface 202
[CE1-vlan-interface202] ip address 12.1.1.1 255.255.255.0
[CE1-vlan-interface202] ospf cost 100
[CE1] vlan 201
[CE1-vlan201] port gigabitethernet 2/1/1
[CE1] interface vlan-interface 201
[CE1-vlan-interface201] ip address 10.1.1.1 255.255.255.0
[CE1-vlan-interface201] ospf cost 1
```

2) 配置OSPF路由, 使CE1和CE2以及CE1和PE1之间路由可达。

```
[CE1] ospf 100 router-id 10.10.10.10
[CE1-ospf-100] import-route direct
[CE1-ospf-100] area 0.0.0.0
[CE1-ospf-100-area-0.0.0.0] network 10.1.1.0 0.0.0.255
[CE1-ospf-100-area-0.0.0.0] network 12.1.1.0 0.0.0.255
```

四、配置CE2

1) 配置VLAN及接口地址, 配置OSPF的花费 (CE间互连VLAN的ospf cost大于MPLS骨干的cost值总和, CE和PE互连VLAN的ospf cost配置小于Back Door的cost值)

```
[CE2] vlan 202
[CE2-vlan202] port gigabitethernet 2/1/2
[CE2] interface vlan-interface 202
[CE2-vlan-interface202] ip address 12.1.1.2 255.255.255.0
[CE2-vlan-interface202] ospf cost 100
[CE2] vlan 201
[CE2-vlan201] port gigabitethernet 2/1/1
[CE2] interface vlan-interface 201
[CE2-vlan-interface201] ip address 20.1.1.1 255.255.255.0
[CE2-vlan-interface201] ospf cost 1
```

2) 配置OSPF路由, 使CE1和CE2以及CE2和PE2之间路由可达

```
[CE2] ospf 100 router-id 20.20.20.20
```

```
[CE2-ospf-100] area 0.0.0.0
```

```
[CE2-ospf-100-area-0.0.0.0] network 12.1.1.0 0.0.0.255
```

```
[CE2-ospf-100-area-0.0.0.0] network 20.1.1.0 0.0.0.255
```

四、配置关键点:

- 1) PE公网侧端口的单板需要支持MPLS的单板;
- 2) 配置BGP邻居时, 必须指定源IP (Peer x.x.x.x connect-interface xx);
- 3) OSPF的VPN实例下不可以引入直连路由或者使用network发布Sham-link环回口 (因为Sham-link环回口路由需要BGP发布到对方);
- 4) OSPF的VPN实例下需要引入BGP; BGP的VPN实例下需要引入OSPF/OSPF-ASE/OSPF-NSSA等。