

MPLS L3VPN典型组网配置案例

关键词：IRF2、OSPF、BGP、MPLS、VPN、MCE

一、组网需求：

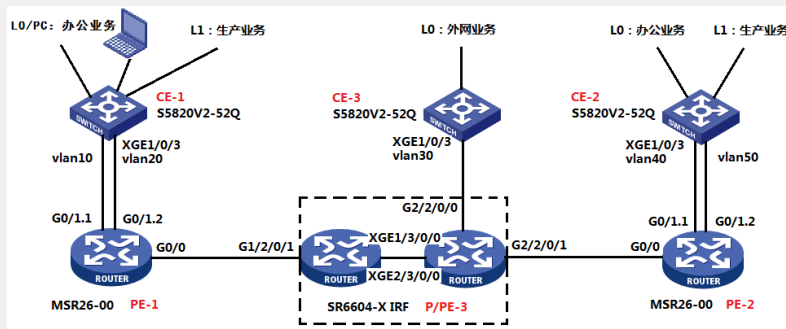
某电力客户部署MPLS VPN网络，其中涉及三个VPN业务（办公业务、生产业务、外网业务），业务开展后，需实现如下功能：

- 1、办公业务VPN中的终端能相互访问。
- 2、生产业务VPN中的终端能相互访问。
- 3、办公业务VPN中的终端和生产业务VPN中的终端不能相互访问。
- 4、办公业务VPN中的终端和生产业务VPN中的终端都能访问外网业务VPN中的终端。

实验设备：2台SR6604-X（Version 5.20, Release 3302）、2台MSR26-00（Version 5.20, Release 2511P02）、3台S5820V2-52Q（Version 7.1.035, Release 2210）。

二、实验组网：

详细组网拓扑图如下：



说明：在CE-1上建立两个Loopback地址L0、L1，分别模拟办公业务终端和生产业务终端，CE-2亦然。

在CE-3上建立一个Loopback地址L0，模拟外网业务。

配置完毕后，需达到的效果：

- 1、CE-1的L0可以访问CE-2的L0和CE-3的L0，无法访问CE-1的L1和CE-2的L1。
- 2、CE-1的L1可以访问CE-2的L1和CE-3的L0，无法访问CE-1的L0和CE-2的L0。

详细IP地址规划如下：

设备	端口	IP地址
PE-1	G0/0	10.0.0.1/24
	G0/1.1	192.168.1.2/24
	G0/1.2	192.168.2.2/24
	L0	1.1.1.1/32

设备	端口	IP地址
PE-2	G0/0	11.0.0.1/24
	G0/1.1	192.168.4.2/24
	G0/1.2	192.168.5.2/24
	L0	3.3.3.3/32

设备	端口	IP地址
P/PE-3	G1/2/0/1	10.0.0.2/24
	G2/2/0/0	192.168.3.2/24
	G2/2/0/1	11.0.0.2/24
	L0	2.2.2.2/32

设备	端口	IP地址
CE-1	vlan10	192.168.1.1/24
	vlan20	192.168.2.1/24
	L0	10.10.10.10/32
	L1	20.20.20.20/32

设备	端口	IP地址
CE-2	vlan40	192.168.4.1/24
	vlan50	192.168.5.1/24
	L0	40.40.40.40/32
	L1	50.50.50.50/32

设备	端口	IP地址
CE-3	vlan30	192.168.3.1/24
	L0	30.30.30.30/32

三、配置步骤:

```

SR6604-X A IRF配置
[H3C]irf priority 16 //配置IRF成员优先级为16
[H3C]irf member 1 //IRF成员编号为1
Info: Member ID change will take effect after the member reboots and operates in IRF mode.
[H3C]irf-port 2
[H3C-irf-port2]port group interface Ten-GigabitEthernet 3/0/0
[H3C]quit
save
The current configuration will be written to the device. Are you sure? [Y/N]:Y
Please input the file name(*.cfg)[cfa0:/startup.cfg]
(To leave the existing filename unchanged, press the enter key):
cfa0:/startup.cfg exists, overwrite? [Y/N]:Y
Validating file. Please wait...
The current configuration is saved to the active main board successfully.
Configuration is saved to device successfully.
sys
System View: return to User View with Ctrl+Z.
[H3C]chassis convert mode irf //设备切换为IRF工作模式, 确认后设备重启
The device will switch to IRF mode and reboot. You are recommended to save the current running configuration and specify the configuration file for the next startup.
Continue? [Y/N]:Y
Do you want to convert the content of the next main startup configuration file cfa0:/startup.cfg to make it available in IRF mode? [Y/N]:Y
Please wait...
Saving the converted configuration file to main board succeeded.
#Apr 20 22:35:51:802 2014 H3c DEVM/1/REBOOT:
Reboot device by command.

SR6604-X B IRF配置
[H3C]irf priority 1 //配置IRF成员优先级为1
[H3C]irf member 2 //配置IRF成员编号为2
Info: Member ID change will take effect after the member reboots and operates in IRF mode.
[H3C]irf-port 1
[H3C-irf-port1]port group interface Ten-GigabitEthernet 3/0/0
[H3C-irf-port1]quit
[H3C]quit
save
The current configuration will be written to the device. Are you sure? [Y/N]:Y
Please input the file name(*.cfg)[cfa0:/startup.cfg]
(To leave the existing filename unchanged, press the enter key):
cfa0:/startup.cfg exists, overwrite? [Y/N]:Y
Validating file. Please wait...
The current configuration is saved to the active main board successfully.
Configuration is saved to device successfully.
sys
System View: return to User View with Ctrl+Z.
[H3C]chassis convert mode irf //设备切换为IRF工作模式, 确认后设备重启
The device will switch to IRF mode and reboot. You are recommended to save the current running configuration and specify the configuration file for the next startup.
Continue? [Y/N]:Y
Do you want to convert the content of the next main startup configuration file cfa0:/startup.cfg to make it available in IRF mode? [Y/N]:Y
Please wait...
Saving the converted configuration file to main board succeeded.
#Apr 20 22:40:36:473 2014 H3c DEVM/1/REBOOT:
Reboot device by command.

```

经过以上配置, SR6604-X-A和SR6604-X-B组成的IRF2搭建成功。设备重启完成后, 可以通过display device命令查看设备情况:

```

[H3C]dis device

System-mode(Current/After Reboot): Normal/Normal
Slot No. Board type Status Primary SubSlots
-----
1/0 RSE-X2 Normal Master 0
1/1 N/A Absent N/A N/A
1/2 FIP-300 Normal N/A 1
1/3 SAP-4EXP Normal N/A 0

```

2/0	RSE-X2	Normal	Slave	0
2/1	N/A	Absent	N/A	N/A
2/2	FIP-240	Normal	N/A	4
2/3	SAP-4EXP	Normal	N/A	0

SR6604-X IRF2搭建完毕后，请按照以下命令配置SR6604-X IRF2系统：

[SR6604-X IRF系统配置](#)

```

#
version 5.20, Release 3302
#
sysname SR66-IRF
#
irf mac-address persistent always
undo irf auto-update enable
undo irf link-delay
irf member 1 priority 16
#
telnet server enable
#
mpls lsr-id 2.2.2.2
#
ip vpn-instance waiwang //外网业务VPN实例
route-distinguisher 300:1
vpn-target 100:1 200:1 export-extcommunity
vpn-target 100:1 200:1 import-extcommunity
#
vlan 1
#
mpls
#
mpls ldp
#
interface LoopBack0
ip address 2.2.2.2 255.255.255.255
#
interface GigabitEthernet1/2/0/1
port link-mode route
ip address 10.0.0.2 255.255.255.0
mpls
mpls ldp
#
interface GigabitEthernet2/2/0/0
port link-mode route
ip binding vpn-instance waiwang //接口与外网业务VPN实例绑定
ip address 192.168.3.2 255.255.255.0
#
interface GigabitEthernet2/2/0/1
port link-mode route
ip address 11.0.0.2 255.255.255.0
mpls
mpls ldp
#
bgp 100
undo synchronization
peer 1.1.1.1 as-number 100
peer 3.3.3.3 as-number 100
peer 1.1.1.1 connect-interface LoopBack0
peer 3.3.3.3 connect-interface LoopBack0
#
ipv4-family vpn-instance waiwang
import-route direct //引入直连路由
import-route ospf 15 //引入OSPF15的路由
#
ipv4-family vpnv4
peer 1.1.1.1 enable
peer 3.3.3.3 enable
#
ospf 1
area 0.0.0.0
network 2.2.2.2 0.0.0.0
network 10.0.0.0 0.0.0.255
network 11.0.0.0 0.0.0.255
#
ospf 15 vpn-instance waiwang
import-route bgp //引入BGP路由
area 0.0.0.0
network 192.168.3.0 0.0.0.255
#
user-interface con 1/0
user-interface con 2/0
user-interface aux 1/0
user-interface aux 2/0
user-interface vty 0 4
authentication-mode none
user privilege level 3
#
irf-port 1/2
port group interface Ten-GigabitEthernet1/3/0/0 mode enhanced
#
irf-port 2/1
port group interface Ten-GigabitEthernet2/3/0/0 mode enhanced
#

```

```
#
version 7.1.035, Release 2210
#
sysname CE-1
#
ip vpn-instance bangong //办公业务VPN实例
route-distinguisher 100:1
vpn-target 100:1 export-extcommunity
vpn-target 100:1 import-extcommunity
#
ip vpn-instance shengchan //生产业务VPN实例
route-distinguisher 200:1
vpn-target 200:1 export-extcommunity
vpn-target 200:1 import-extcommunity
#
system-working-mode standard
fan prefer-direction slot 1 port-to-power //设备期望的风道方向为port-to-power
password-recovery enable
#
vlan 1
#
vlan 10
#
vlan 20
#
interface LoopBack0
ip binding vpn-instance bangong //接口与办公业务VPN实例绑定
ip address 10.10.10.10 255.255.255.255
#
interface LoopBack1
ip binding vpn-instance shengchan //接口与生产业务VPN实例绑定
ip address 20.20.20.20 255.255.255.255
#
interface Vlan-interface10
ip binding vpn-instance bangong //接口与办公业务VPN实例绑定
ip address 192.168.1.1 255.255.255.0
#
interface Vlan-interface20
ip binding vpn-instance shengchan //接口与生产业务VPN实例绑定
ip address 192.168.2.1 255.255.255.0
#
interface Ten-GigabitEthernet1/0/3
port link-type trunk
port trunk permit vlan 1 10 20
#
ospf 10 vpn-instance bangong
vpn-instance-capability simple //关闭OSPF实例的路由环路检测功能
area 0.0.0.0
network 10.10.10.10 0.0.0.0
network 192.168.1.0 0.0.0.255
#
ospf 20 vpn-instance shengchan
vpn-instance-capability simple //关闭OSPF实例的路由环路检测功能
area 0.0.0.0
network 20.20.20.20 0.0.0.0
network 192.168.2.0 0.0.0.255
#
```

配置CE-2 (S5820V2) 交换机

```
#
version 7.1.035, Release 2210
#
sysname CE-2
#
ip vpn-instance bangong //办公业务VPN实例
route-distinguisher 100:1
vpn-target 100:1 export-extcommunity
vpn-target 100:1 import-extcommunity
#
ip vpn-instance shengchan //生产业务VPN实例
route-distinguisher 200:1
vpn-target 200:1 export-extcommunity
vpn-target 200:1 import-extcommunity
#
system-working-mode standard
fan prefer-direction slot 1 port-to-power //设备期望的风道方向为port-to-power
password-recovery enable
#
vlan 1
#
vlan 40
#
vlan 50
#
interface LoopBack0
ip binding vpn-instance bangong //接口与办公业务VPN实例绑定
ip address 40.40.40.40 255.255.255.255
#
interface LoopBack1
ip binding vpn-instance shengchan //接口与生产业务VPN实例绑定
ip address 50.50.50.50 255.255.255.255
#
interface Vlan-interface40
ip binding vpn-instance bangong //接口与办公业务VPN实例绑定
ip address 192.168.4.1 255.255.255.0
#
interface Vlan-interface50
ip binding vpn-instance shengchan //接口与生产业务VPN实例绑定
ip address 192.168.5.1 255.255.255.0
#
interface Ten-GigabitEthernet1/0/3
port link-type trunk
port trunk permit vlan 1 40 50
#
ospf 10 vpn-instance bangong
vpn-instance-capability simple //关闭OSPF实例的路由环路检测功能
area 0.0.0.0
network 40.40.40.40 0.0.0.0
network 192.168.4.0 0.0.0.255
#
ospf 20 vpn-instance shengchan
vpn-instance-capability simple //关闭OSPF实例的路由环路检测功能
area 0.0.0.0
network 50.50.50.50 0.0.0.0
network 192.168.5.0 0.0.0.255
#
```

配置CE-3 (S5820V2) 交换机

```
#
version 7.1.035, Release 2210
#
sysname CE-3
#
ip vpn-instance waiwang //外网业务VPN实例
route-distinguisher 300:1
vpn-target 100:1 200:1 export-extcommunity
vpn-target 100:1 200:1 import-extcommunity
#
system-working-mode standard
fan prefer-direction slot 1 port-to-power //设备期望的风道方向为port-to-power
password-recovery enable
#
vlan 1
#
vlan 30
#
interface LoopBack0
ip binding vpn-instance waiwang //接口与外网业务VPN实例绑定
ip address 30.30.30.30 255.255.255.255
#
interface Vlan-interface30
ip binding vpn-instance waiwang //接口与外网业务VPN实例绑定
ip address 192.168.3.1 255.255.255.0
#
interface Ten-GigabitEthernet1/0/3
port access vlan 30
#
ospf 15 vpn-instance waiwang
vpn-instance-capability simple //关闭OSPF实例的路由环路检测功能
area 0.0.0.0
network 30.30.30.30 0.0.0.0
network 192.168.3.0 0.0.0.255
#
```

配置PE-1 (MSR26-00) 路由器

```

#
version 5.20, Release 2511P02
#
sysname PE-1
#
telnet server enable
#
mpls lsr-id 1.1.1.1
#
ip vpn-instance bangong //办公业务VPN实例
route-distinguisher 100:1
vpn-target 100:1 export-extcommunity
vpn-target 100:1 import-extcommunity
#
ip vpn-instance shengchan //生产业务VPN实例
route-distinguisher 200:1
vpn-target 200:1 export-extcommunity
vpn-target 200:1 import-extcommunity
#
vlan 1
#
mpls
#
mpls ldp
#
interface LoopBack0
ip address 1.1.1.1 255.255.255.255
#
interface GigabitEthernet0/0
port link-mode route
ip address 10.0.0.1 255.255.255.0
mpls
mpls ldp
#
interface GigabitEthernet0/1
port link-mode route
#
interface GigabitEthernet0/1.1
vlan-type dot1q vid 10
ip binding vpn-instance bangong //接口与办公业务VPN实例绑定
ip address 192.168.1.2 255.255.255.0
#
interface GigabitEthernet0/1.2
vlan-type dot1q vid 20
ip binding vpn-instance shengchan //接口与生产业务VPN实例绑定
ip address 192.168.2.2 255.255.255.0
#
bgp 100
undo synchronization
peer 2.2.2.2 as-number 100
peer 3.3.3.3 as-number 100
peer 2.2.2.2 connect-interface LoopBack0
peer 3.3.3.3 connect-interface LoopBack0
#
ipv4-family vpn-instance bangong
import-route direct //引入直连路由
import-route ospf 10 //引入OSPF10的路由
#
ipv4-family vpn-instance shengchan
import-route direct //引入直连路由
import-route ospf 20 //引入OSPF20的路由
#
ipv4-family vpnv4
peer 2.2.2.2 enable
peer 3.3.3.3 enable
#
ospf 1
area 0.0.0.0
network 1.1.1.1 0.0.0.0
network 10.0.0.0 0.0.0.255
#
ospf 10 vpn-instance bangong
import-route bgp //引入BGP路由
area 0.0.0.0
network 192.168.1.0 0.0.0.255
#
ospf 20 vpn-instance shengchan
import-route bgp //引入BGP路由
area 0.0.0.0
network 192.168.2.0 0.0.0.255
#
user-interface vty 0 4
authentication-mode none
user privilege level 3
#

```



```
#
version 5.20, Release 2511P02
#
sysname PE-2
#
telnet server enable
#
mpls lsr-id 3.3.3.3
#
ip vpn-instance bangong //办公业务VPN实例
route-distinguisher 100:1
vpn-target 100:1 export-extcommunity
vpn-target 100:1 import-extcommunity
#
ip vpn-instance shengchan //生产业务VPN实例
route-distinguisher 200:1
vpn-target 200:1 export-extcommunity
vpn-target 200:1 import-extcommunity
#
vlan 1
#
mpls
#
mpls ldp
#
interface LoopBack0
ip address 3.3.3.3 255.255.255.255
#
interface GigabitEthernet0/0
port link-mode route
ip address 11.0.0.1 255.255.255.0
mpls
mpls ldp
#
interface GigabitEthernet0/1
port link-mode route
#
interface GigabitEthernet0/1.1
vlan-type dot1q vid 40
ip binding vpn-instance bangong //接口与办公业务VPN实例绑定
ip address 192.168.4.2 255.255.255.0
#
interface GigabitEthernet0/1.2
vlan-type dot1q vid 50
ip binding vpn-instance shengchan //接口与生产业务VPN实例绑定
ip address 192.168.5.2 255.255.255.0
#
bgp 100
undo synchronization
peer 1.1.1.1 as-number 100
peer 2.2.2.2 as-number 100
peer 1.1.1.1 connect-interface LoopBack0
peer 2.2.2.2 connect-interface LoopBack0
#
ipv4-family vpn-instance bangong
import-route direct //引入直连路由
import-route ospf 10 //引入OSPF10路由
#
ipv4-family vpn-instance shengchan
import-route direct //引入直连路由
import-route ospf 20 //引入OSPF20路由
#
ipv4-family vpnv4
peer 1.1.1.1 enable
peer 2.2.2.2 enable
#
ospf 1
area 0.0.0.0
network 3.3.3.3 0.0.0.0
network 11.0.0.0 0.0.0.255
#
ospf 10 vpn-instance bangong
import-route bgp //引入BGP路由
area 0.0.0.0
network 192.168.4.0 0.0.0.255
#
ospf 20 vpn-instance shengchan
import-route bgp //引入BGP路由
area 0.0.0.0
network 192.168.5.0 0.0.0.255
#
user-interface vty 0 4
authentication-mode none
user privilege level 3
#
```

四、实验效果:

1、PE上能生成公网OSPF路由表。使用PE-1举例，路由表如下所示，可见存在去往各个MP LS LSR-ID的OSPF路由：

```
dis ip routing-table
```

```
Routing Tables: Public
```

```
Destinations : 8    Routes : 8
```

Destination/Mask	Proto	Pre	Cost	NextHop	Interface
1.1.1.1/32	Direct	0	0	127.0.0.1	InLoop0
2.2.2.2/32	OSPF	10	1	10.0.0.2	GE0/0
3.3.3.3/32	OSPF	10	2	10.0.0.2	GE0/0
10.0.0.0/24	Direct	0	0	10.0.0.1	GE0/0
10.0.0.1/32	Direct	0	0	127.0.0.1	InLoop0
11.0.0.0/24	OSPF	10	2	10.0.0.2	GE0/0
127.0.0.0/8	Direct	0	0	127.0.0.1	InLoop0
127.0.0.1/32	Direct	0	0	127.0.0.1	InLoop0

2、PE上能收到对端PE发过来的BGP私网路由。使用PE-1举例，路由表如下：

```
dis ip routing-table vpn-instance bangong
```

```
Routing Tables: bangong
```

```
Destinations : 9    Routes : 9
```

Destination/Mask	Proto	Pre	Cost	NextHop	Interface
10.10.10.10/32	OSPF	10	1	192.168.1.1	GE0/1.1
30.30.30.30/32	BGP	255	2	2.2.2.2	NULL0
40.40.40.40/32	BGP	255	2	3.3.3.3	NULL0
127.0.0.0/8	Direct	0	0	127.0.0.1	InLoop0
127.0.0.1/32	Direct	0	0	127.0.0.1	InLoop0
192.168.1.0/24	Direct	0	0	192.168.1.2	GE0/1.1
192.168.1.2/32	Direct	0	0	127.0.0.1	InLoop0
192.168.3.0/24	BGP	255	0	2.2.2.2	NULL0
192.168.4.0/24	BGP	255	0	3.3.3.3	NULL0

```
dis ip routing-table vpn-instance shengchan
```

```
Routing Tables: shengchan
```

```
Destinations : 9    Routes : 9
```

Destination/Mask	Proto	Pre	Cost	NextHop	Interface
20.20.20.20/32	OSPF	10	1	192.168.2.1	GE0/1.2
30.30.30.30/32	BGP	255	2	2.2.2.2	NULL0
50.50.50.50/32	BGP	255	2	3.3.3.3	NULL0
127.0.0.0/8	Direct	0	0	127.0.0.1	InLoop0
127.0.0.1/32	Direct	0	0	127.0.0.1	InLoop0
192.168.2.0/24	Direct	0	0	192.168.2.2	GE0/1.2
192.168.2.2/32	Direct	0	0	127.0.0.1	InLoop0
192.168.3.0/24	BGP	255	0	2.2.2.2	NULL0
192.168.5.0/24	BGP	255	0	3.3.3.3	NULL0

3、CE上能生成去往目的网段的OSPF路由。使用CE-1举例，路由表如下：

```
dis ip routing-table vpn-instance bangong
```

```
Destinations : 17    Routes : 17
```

Destination/Mask	Proto	Pre	Cost	NextHop	Interface
0.0.0.0/32	Direct	0	0	127.0.0.1	InLoop0
10.10.10.10/32	Direct	0	0	127.0.0.1	InLoop0
30.30.30.30/32	OSPF	10	3	192.168.1.2	Vlan10
40.40.40.40/32	OSPF	10	3	192.168.1.2	Vlan10
127.0.0.0/8	Direct	0	0	127.0.0.1	InLoop0
127.0.0.0/32	Direct	0	0	127.0.0.1	InLoop0

```

127.0.0.1/32   Direct 0 0      127.0.0.1   InLoop0
127.255.255.255/32 Direct 0 0      127.0.0.1   InLoop0
192.168.1.0/24   Direct 0 0      192.168.1.1   Vlan10
192.168.1.0/32   Direct 0 0      192.168.1.1   Vlan10
192.168.1.1/32   Direct 0 0      127.0.0.1   InLoop0
192.168.1.255/32 Direct 0 0      192.168.1.1   Vlan10
192.168.3.0/24   OSPF 150 1      192.168.1.2   Vlan10
192.168.4.0/24   OSPF 150 1      192.168.1.2   Vlan10
224.0.0.0/4      Direct 0 0      0.0.0.0      NULL0
224.0.0.0/24     Direct 0 0      0.0.0.0      NULL0
255.255.255.255/32 Direct 0 0      127.0.0.1   InLoop0

```

```
dis ip routing-table vpn-instance shengchan
```

```
Destinations : 17   Routes : 17
```

Destination/Mask	Proto	Pre	Cost	NextHop	Interface
0.0.0.0/32	Direct	0	0	127.0.0.1	InLoop0
20.20.20.20/32	Direct	0	0	127.0.0.1	InLoop0
30.30.30.30/32	OSPF	10	3	192.168.2.2	Vlan20
50.50.50.50/32	OSPF	10	3	192.168.2.2	Vlan20
127.0.0.0/8	Direct	0	0	127.0.0.1	InLoop0
127.0.0.0/32	Direct	0	0	127.0.0.1	InLoop0
127.0.0.1/32	Direct	0	0	127.0.0.1	InLoop0
127.255.255.255/32	Direct	0	0	127.0.0.1	InLoop0
192.168.2.0/24	Direct	0	0	192.168.2.1	Vlan20
192.168.2.0/32	Direct	0	0	192.168.2.1	Vlan20
192.168.2.1/32	Direct	0	0	127.0.0.1	InLoop0
192.168.2.255/32	Direct	0	0	192.168.2.1	Vlan20
192.168.3.0/24	OSPF	150	1	192.168.2.2	Vlan20
192.168.5.0/24	OSPF	150	1	192.168.2.2	Vlan20
224.0.0.0/4	Direct	0	0	0.0.0.0	NULL0
224.0.0.0/24	Direct	0	0	0.0.0.0	NULL0
255.255.255.255/32	Direct	0	0	127.0.0.1	InLoop0

VPN业务之间相互访问操作:

1、CE-1的L0可以访问CE-2的L0和CE-3的L0，无法访问CE-1的L1和CE-2的L1。

```
ping -vpn-instance bangong -a 10.10.10.10 40.40.40.40
```

```
PING 40.40.40.40 (40.40.40.40) from 10.10.10.10: 56 data bytes, press CTRL_C to break
```

```
56 bytes from 40.40.40.40: icmp_seq=0 ttl=253 time=2.312 ms
```

```
56 bytes from 40.40.40.40: icmp_seq=1 ttl=253 time=1.486 ms
```

```
56 bytes from 40.40.40.40: icmp_seq=2 ttl=253 time=2.593 ms
```

```
56 bytes from 40.40.40.40: icmp_seq=3 ttl=253 time=1.560 ms
```

```
56 bytes from 40.40.40.40: icmp_seq=4 ttl=253 time=1.787 ms
```

```
--- 40.40.40.40 ping statistics ---
```

```
5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss
```

```
round-trip min/avg/max/std-dev = 1.486/1.948/2.593/0.433 ms
```

```
ping -vpn-instance bangong -a 10.10.10.10 30.30.30.30
```

```
PING 30.30.30.30 (30.30.30.30) from 10.10.10.10: 56 data bytes, press CTRL_C to break
```

```
56 bytes from 30.30.30.30: icmp_seq=0 ttl=253 time=1.878 ms
```

```
56 bytes from 30.30.30.30: icmp_seq=1 ttl=253 time=1.403 ms
```

```
56 bytes from 30.30.30.30: icmp_seq=2 ttl=253 time=1.570 ms
```

```
56 bytes from 30.30.30.30: icmp_seq=3 ttl=253 time=1.220 ms
```

```
56 bytes from 30.30.30.30: icmp_seq=4 ttl=253 time=1.598 ms
```

```
--- 30.30.30.30 ping statistics ---
```

```
5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss
```

```
round-trip min/avg/max/std-dev = 1.220/1.534/1.878/0.219 ms
```

```
ping -vpn-instance bangong -a 10.10.10.10 20.20.20.20
```

```
PING 20.20.20.20 (20.20.20.20) from 10.10.10.10: 56 data bytes, press CTRL_C to break
```

```
Request time out
Request time out
Request time out
Request time out
Request time out

--- 20.20.20.20 ping statistics ---
5 packet(s) transmitted, 0 packet(s) received, 100.0% packet loss

ping -vpn-instance bangong -a 10.10.10.10 50.50.50.50
PING 50.50.50.50 (50.50.50.50) from 10.10.10.10: 56 data bytes, press CTRL_C to break
Request time out
Request time out
Request time out
Request time out
Request time out

--- 50.50.50.50 ping statistics ---
5 packet(s) transmitted, 0 packet(s) received, 100.0% packet loss

2、CE-1的L1可以访问CE-2的L1和CE-3的L0，无法访问CE-1的L0和CE-2的L0。
ping -vpn-instance shengchan -a 20.20.20.20 50.50.50.50
PING 50.50.50.50 (50.50.50.50) from 20.20.20.20: 56 data bytes, press CTRL_C to break
56 bytes from 50.50.50.50: icmp_seq=0 ttl=253 time=2.237 ms
56 bytes from 50.50.50.50: icmp_seq=1 ttl=253 time=1.429 ms
56 bytes from 50.50.50.50: icmp_seq=2 ttl=253 time=1.817 ms
56 bytes from 50.50.50.50: icmp_seq=3 ttl=253 time=1.463 ms
56 bytes from 50.50.50.50: icmp_seq=4 ttl=253 time=1.414 ms

--- 50.50.50.50 ping statistics ---
5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss
round-trip min/avg/max/std-dev = 1.414/1.672/2.237/0.319 ms

ping -vpn-instance shengchan -a 20.20.20.20 30.30.30.30
PING 30.30.30.30 (30.30.30.30) from 20.20.20.20: 56 data bytes, press CTRL_C to break
56 bytes from 30.30.30.30: icmp_seq=0 ttl=253 time=2.090 ms
56 bytes from 30.30.30.30: icmp_seq=1 ttl=253 time=1.211 ms
56 bytes from 30.30.30.30: icmp_seq=2 ttl=253 time=1.517 ms
56 bytes from 30.30.30.30: icmp_seq=3 ttl=253 time=1.284 ms
56 bytes from 30.30.30.30: icmp_seq=4 ttl=253 time=1.468 ms

--- 30.30.30.30 ping statistics ---
5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss
round-trip min/avg/max/std-dev = 1.211/1.514/2.090/0.309 ms

ping -vpn-instance shengchan -a 20.20.20.20 10.10.10.10
PING 10.10.10.10 (10.10.10.10) from 20.20.20.20: 56 data bytes, press CTRL_C to break
Request time out
Request time out
Request time out
Request time out
Request time out

--- 10.10.10.10 ping statistics ---
5 packet(s) transmitted, 0 packet(s) received, 100.0% packet loss

ping -vpn-instance shengchan -a 20.20.20.20 40.40.40.40
PING 40.40.40.40 (40.40.40.40) from 20.20.20.20: 56 data bytes, press CTRL_C to break
Request time out
Request time out
Request time out
Request time out
Request time out
```

--- 40.40.40.40 ping statistics ---

5 packet(s) transmitted, 0 packet(s) received, 100.0% packet loss

五、配置关键点:

- 1、 S5820V2-52Q交换机上有两个风扇模块插槽，为了保证设备的正常散热，交换机上必须同时安装两个风扇模块（两个风扇模块的型号及风向标识必须一致），在交换机上没有安装风扇模块的情况下，禁止交换机上电运行。
- 2、 S5820V2-52Q交换机上，需保证风扇模块的风向与设备的期望风向一致（可以使用fan prefer-direction slot slot-number { power-to-port | port-to-power }调整），否则设备会产生告警并发出较大噪声。

dis fan

Slot 1

FAN 1

State : Normal

Wind Direction :Port-to-Power //两者需保持一致

Prefer Wind Direction :Port-to-Power

FAN 2

State : Normal

Wind Direction :Port-to-Power //两者需保持一致

Prefer Wind Direction :Port-to-Power

- 3、 由于本案例涉及到三个业务VPN互访的问题，请保证各个业务VPN中VPN-TARGET的配置正确。
- 4、 本案例在CE上使用了Loopback地址模拟客户终端。事实上，也可以使用真正的终端来完成实验，比如在CE-1的XGE1/0/1上串接一台PC（100.100.100.100/24），并在CE-1设备上进行如下配置：

#

vlan 100

#

interface Vlan-interface100

ip binding vpn-instance bangong

ip address 100.100.100.1 255.255.255.0

#

interface Ten-GigabitEthernet1/0/1

port access vlan 100

#

ospf 10 vpn-instance bangong

vpn-instance-capability simple

area 0.0.0.0

network 10.10.10.10 0.0.0.0

network 100.100.100.0 0.0.0.255 //在原有的配置上加上这条配置

network 192.168.1.0 0.0.0.255

#

此时，该PC即成为办公业务VPN的终端。可以在PC上访问10.10.10.10/32、30.30.30.30/32、40.40.40.40/32，但无法访问20.20.20.20/32、50.50.50.50/32。

- 5、 开始配置两台SR6604-X的IRF2时，需保证两台设备工作在独立模式。可以通过chassis convert mode irf/undo chassis convert mode命令使SR6604-X在IRF模式/独立运行模式切换（切换后设备会重启）。
- 6、 本配置中使用了MPLS MCE技术，由S5820V2交换机作为MCE。配置MCE的OSPF功能时，需配置vpn-instance-capability simple命令关闭OSPF实例的路由环路检测功能，否则，MCE不会接受PE发送过来的OSPF路由，导致路由丢失。