S5820 IPV6 MPLS VPN OPTION-A典型组网配置案例

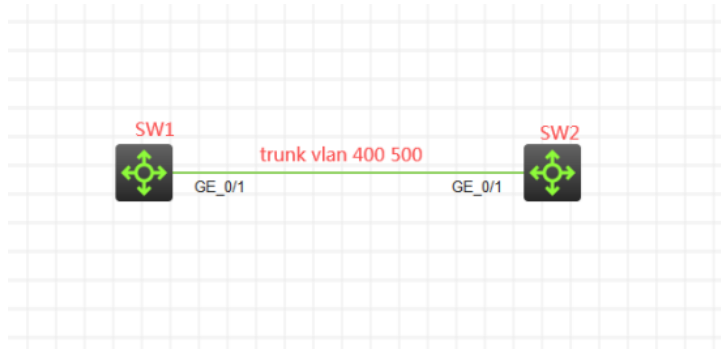IPv6   BGP   H3C模拟器   **韦家宁**   2020-04-05 发表

组网及说明

组网说明：

本案例采用H3C HCL模拟器的S5820交换机来模拟IPV6 MPLS VPN OPTION-A典型组网配置。为了实现业务的相互隔离，需要将不同的业务绑定到不同的VPN实例中进行业务的互通，因此在本案例引入多实例VPN，将相关的业务进行捆绑。SW1与SW2的互联使用trunk，允许VLAN 400 VLAN 500通过，其中SW1属于AS100，SW2属于AS200，最终建立多VPN实例EBGP邻居关系，宣告业务网段，使得相同VPN实例的业务能互通，不同VPN实例的业务不能互通。

VPN实例规划如下：

VPN实例名称	RD值	RT值	业务类型	备注
vpn-rt	100:1	100:1	实时业务	
vpn-nrt	200:1	200:1	非实时业务	

IP地址规划如下：

设备名称	接口/VLAN	IPV4/IPV6地址	IPV4/IPV6地址位数	所属VPN实例	备注
SW1	VLAN 400	1::1	64	vpn-rt	互联
	VLAN 500	1::1	64	vpn-nrt	互联
	Loopback 10	2::1	64	vpn-rt	模拟业务
	Loopback 20	3::1	64	vpn-nrt	模拟业务
	Loopback 0	1.1.1.1	32	vpn-rt	作为vpn-rt router-id
	Loopback 1	2.2.2.2	32	vpn-nrt	作为vpn-nrt router-id
SW2	VLAN 400	1::2	64	vpn-rt	互联
	VLAN 500	1::2	64	vpn-nrt	互联
	Loopback 10	4::1	64	vpn-rt	模拟业务
	Loopback 20	5::1	64	vpn-nrt	模拟业务
	Loopback 0	3.3.3.3	32	vpn-rt	作为vpn-rt router-id
	Loopback 1	4.4.4.4	32	vpn-nrt	作为vpn-nrt router-id

配置步骤

SW1：

sys

System View: return to User View with Ctrl+Z.

[H3C]sysname SW1

#创建VPN实例，指定RD值、RT值

[SW1]ip vpn-instance vpn-rt

[SW1-vpn-instance-vpn-rt]route-distinguisher 100:1

[SW1-vpn-instance-vpn-rt]vpn-target 100:1

[SW1-vpn-instance-vpn-rt]quit

[SW1]ip vpn-instance vpn-nrt

[SW1-vpn-instance-vpn-nrt]route-distinguisher 200:1

[SW1-vpn-instance-vpn-nrt]vpn-target 200:1

[SW1-vpn-instance-vpn-nrt]quit

[SW1]vlan 400

[SW1-vlan400]quit

```
[SW1]vlan 500
[SW1-vlan500]quit
[SW1]int vlan 400
[SW1-Vlan-interface400]ip binding vpn-instance vpn-rt //将VLAN绑定到VPN实例
Some configurations on the interface are removed.
[SW1-Vlan-interface400]des
[SW1-Vlan-interface400]ipv6 address 1::1 64
[SW1-Vlan-interface400]quit
[SW1]int vlan 500
[SW1-Vlan-interface500]ip binding vpn-instance vpn-nrt
Some configurations on the interface are removed.
[SW1-Vlan-interface500]des
[SW1-Vlan-interface500]ipv6 address 1::1 64
[SW1-Vlan-interface500]quit
[SW1]int gi 1/0/1
[SW1-GigabitEthernet1/0/1]des
[SW1-GigabitEthernet1/0/1]port link-type trunk
[SW1-GigabitEthernet1/0/1]undo port trunk permit vlan 1
[SW1-GigabitEthernet1/0/1]port trunk permit vlan 400 500
[SW1-GigabitEthernet1/0/1]quit
[SW1]int loopback 10
[SW1-LoopBack10]ip binding vpn-instance vpn-rt
Some configurations on the interface are removed.
[SW1-LoopBack10]ipv6 address 2::1 64
[SW1-LoopBack10]quit
[SW1]int loopback 20
[SW1-LoopBack20]ip binding vpn-instance vpn-nrt
Some configurations on the interface are removed.
[SW1-LoopBack20]ipv6 address 3::1 64
[SW1-LoopBack20]quit
[SW1]int loopback 0
[SW1-LoopBack0]ip binding vpn-instance vpn-rt
Some configurations on the interface are removed.
[SW1-LoopBack0]ip address 1.1.1.1 32
[SW1-LoopBack0]quit
[SW1]int loopback 1
[SW1-LoopBack1]ip binding vpn-instance vpn-nrt
Some configurations on the interface are removed.
[SW1-LoopBack1]ip address 2.2.2.2 32
[SW1-LoopBack1]quit
[SW1]bgp 100
[SW1-bgp-default]router-id 1.1.1.1
[SW1-bgp-default]ip vpn-instance vpn-rt //在BGP内绑定VPN实例
[SW1-bgp-default-vpn-rt]peer 1::2 as-number 200
[SW1-bgp-default-vpn-rt]address-family ipv6 unicast
[SW1-bgp-default-ipv6-vpn-rt]peer 1::2 enable
[SW1-bgp-default-ipv6-vpn-rt]network 2:: 64
[SW1-bgp-default-ipv6-vpn-rt]quit
[SW1-bgp-default-vpn-rt]quit
[SW1-bgp-default]ip vpn-instance vpn-nrt
[SW1-bgp-default-vpn-nrt]peer 1::2 as-number 200
[SW1-bgp-default-vpn-nrt]address-family ipv6 unicast
[SW1-bgp-default-ipv6-vpn-nrt]peer 1::2 enable
[SW1-bgp-default-ipv6-vpn-nrt]network 3:: 64
[SW1-bgp-default-ipv6-vpn-nrt]quit
[SW1-bgp-default-vpn-nrt]quit
[SW1-bgp-default]quit


sys
System View: return to User View with Ctrl+Z.
[H3C]sysname SW2
[SW2]ip vpn-instance vpn-rt
[SW2-vpn-instance-vpn-rt]route-distinguisher 100:1
```

```
[SW2-vpn-instance-vpn-rt]vpn-target 100:1
[SW2-vpn-instance-vpn-rt]quit
[SW2]ip vpn-instance vpn-nrt
[SW2-vpn-instance-vpn-nrt]route-distinguisher 200:1
[SW2-vpn-instance-vpn-nrt]vpn-target 200:1
[SW2-vpn-instance-vpn-nrt]quit
[SW2]vlan 400
[SW2-vlan400]quit
[SW2]vlan 500
[SW2-vlan500]quit
[SW2]int vlan 400
[SW2-Vlan-interface400]ip binding vpn-instance vpn-rt
Some configurations on the interface are removed.
[SW2-Vlan-interface400]des
[SW2-Vlan-interface400]ipv6 address 1::2 64
[SW2-Vlan-interface400]quit
[SW2]int vlan 500
[SW2-Vlan-interface500]ip binding vpn-instance vpn-nrt
Some configurations on the interface are removed.
[SW2-Vlan-interface500]des
[SW2-Vlan-interface500]ipv6 address 1::2 64
[SW2-Vlan-interface500]quit
[SW2]int LoopBack 10
[SW2-LoopBack10]ip binding vpn-instance vpn-rt
Some configurations on the interface are removed.
[SW2-LoopBack10]ipv6 address 4::1 64
[SW2-LoopBack10]quit
[SW2]int loopback 20
[SW2-LoopBack20]ip binding vpn-instance vpn-nrt
Some configurations on the interface are removed.
[SW2-LoopBack20]ipv6 address 5::1 64
[SW2-LoopBack20]quit
[SW2]int loopback 0
[SW2-LoopBack0]ip binding vpn-instance vpn-rt
Some configurations on the interface are removed.
[SW2-LoopBack0]ip address 3.3.3.3 32
[SW2-LoopBack0]quit
[SW2]int loopback 1
[SW2-LoopBack1]ip binding vpn-instance vpn-nrt
Some configurations on the interface are removed.
[SW2-LoopBack1]ip address 4.4.4.4 32
[SW2-LoopBack1]quit
[SW2]int gi 1/0/1
[SW2-GigabitEthernet1/0/1]port link-mode bridge
[SW2-GigabitEthernet1/0/1]des
[SW2-GigabitEthernet1/0/1]port link-type trunk
[SW2-GigabitEthernet1/0/1]undo port trunk permit vlan 1
[SW2-GigabitEthernet1/0/1]port trunk permit vlan 400 500
[SW2-GigabitEthernet1/0/1]quit
[SW2]bgp 200
[SW2-bgp-default]router-id 2.2.2.2
[SW2-bgp-default]ip vpn-instance vpn-rt
[SW2-bgp-default-vpn-rt]peer 1::1 as-number 100
[SW2-bgp-default-vpn-rt]address-family ipv6 unicast
[SW2-bgp-default-ipv6-vpn-rt]peer 1::1 enable
[SW2-bgp-default-ipv6-vpn-rt]network 4:: 64
[SW2-bgp-default-ipv6-vpn-rt]quit
[SW2-bgp-default-vpn-rt]quit
[SW2-bgp-default]ip vpn-instance vpn-nrt
[SW2-bgp-default-vpn-nrt]peer 1::1 as-number 100
[SW2-bgp-default-vpn-nrt]address-family ipv6 unicast
[SW2-bgp-default-ipv6-vpn-nrt]peer 1::1 enable
[SW2-bgp-default-ipv6-vpn-nrt]network 5:: 64
[SW2-bgp-default-ipv6-vpn-nrt]quit
```

[SW2-bgp-default-vpn-nrt]quit
[SW2-bgp-default]quit

测试：
在SW1使用loopback 10作为源，带VPN能PING通FW2的loopback 10，PING不通FW2的loopback 20
：

```
[SW1]ping ipv6 -vpn-instance vpn-rt -a 2::1 4::1
Ping6(56 data bytes) 2::1 --> 4::1, press CTRL_C to break
56 bytes from 4::1, icmp_seq=0 hlim=64 time=3.000 ms
56 bytes from 4::1, icmp_seq=1 hlim=64 time=1.000 ms
56 bytes from 4::1, icmp_seq=2 hlim=64 time=1.000 ms
56 bytes from 4::1, icmp_seq=3 hlim=64 time=1.000 ms
56 bytes from 4::1, icmp_seq=4 hlim=64 time=0.000 ms

--- Ping6 statistics for 4::1 in VPN instance vpn-rt ---
5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss
round-trip min/avg/max/std-dev = 0.000/1.200/3.000/0.980 ms
[SW1]%Apr  5 13:54:58:111 2020 SW1 PING/6/PING_VPN_STATISTICS: Ping6 statistics for 4::1 i
n VPN instance vpn-rt: 5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss, ro
und-trip min/avg/max/std-dev = 0.000/1.200/3.000/0.980 ms.

[SW1]
```

```
[SW1]ping ipv6 -vpn-instance vpn-rt -a 2::1 5::1
Ping6(56 data bytes) 2::1 --> 5::1, press CTRL_C to break
Request time out
Request time out
Request time out
Request time out
Request time out

--- Ping6 statistics for 5::1 in VPN instance vpn-rt ---
5 packet(s) transmitted, 0 packet(s) received, 100.0% packet loss
[SW1]%Apr  5 13:55:34:178 2020 SW1 PING/6/PING_VPN_STATISTICS: Ping6 statistics for 5::1 i
n VPN instance vpn-rt: 5 packet(s) transmitted, 0 packet(s) received, 100.0% packet loss.
```

在SW1使用loopback 20作为源，带VPN能PING通FW2的loopback20，PING不通FW2的loopback 10
：

```
[SW1]ping ipv6 -vpn-instance vpn-nrt -a 3::1 5::1
Ping6(56 data bytes) 3::1 --> 5::1, press CTRL_C to break
56 bytes from 5::1, icmp_seq=0 hlim=64 time=2.000 ms
56 bytes from 5::1, icmp_seq=1 hlim=64 time=1.000 ms
56 bytes from 5::1, icmp_seq=2 hlim=64 time=1.000 ms
56 bytes from 5::1, icmp_seq=3 hlim=64 time=1.000 ms
56 bytes from 5::1, icmp_seq=4 hlim=64 time=1.000 ms

--- Ping6 statistics for 5::1 in VPN instance vpn-nrt ---
5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss
round-trip min/avg/max/std-dev = 1.000/1.200/2.000/0.400 ms
[SW1]%Apr  5 13:56:38:143 2020 SW1 PING/6/PING_VPN_STATISTICS: Ping6 statistics for 5::1 i
n VPN instance vpn-nrt: 5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss, r
ound-trip min/avg/max/std-dev = 1.000/1.200/2.000/0.400 ms.

[SW1]
```

```
[SW1]ping ipv6 -vpn-instance vpn-nrt -a 3::1 4::1
Ping6(56 data bytes) 3::1 --> 4::1, press CTRL_C to break
Request time out
Request time out
Request time out
Request time out
Request time out

--- Ping6 statistics for 4::1 in VPN instance vpn-nrt ---
5 packet(s) transmitted, 0 packet(s) received, 100.0% packet loss
[SW1]%Apr  5 13:57:03:552 2020 SW1 PING/6/PING_VPN_STATISTICS: Ping6 statistics for 4::1 i
n VPN instance vpn-nrt: 5 packet(s) transmitted, 0 packet(s) received, 100.0% packet loss.

[SW1]
```

在SW2使用loopback 10作为源，带VPN能PING通FW1的loopback 10，PING不通FW1的loopback 20
：

```
[SW2]ping ipv6 -vpn-instance vpn-rt -a 4::1 2::1
Ping6(56 data bytes) 4::1 --> 2::1, press CTRL_C to break
56 bytes from 2::1, icmp_seq=0 hlim=64 time=2.000 ms
56 bytes from 2::1, icmp_seq=1 hlim=64 time=1.000 ms
56 bytes from 2::1, icmp_seq=2 hlim=64 time=0.000 ms
56 bytes from 2::1, icmp_seq=3 hlim=64 time=1.000 ms
56 bytes from 2::1, icmp_seq=4 hlim=64 time=1.000 ms

--- Ping6 statistics for 2::1 in VPN instance vpn-rt ---
5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss
round-trip min/avg/max/std-dev = 0.000/1.000/2.000/0.632 ms
[SW2]%Apr  5 13:57:45:483 2020 SW2 PING/6/PING_VPN_STATISTICS: Ping6 statistics for 2::1 i
n VPN instance vpn-rt: 5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss, ro
und-trip min/avg/max/std-dev = 0.000/1.000/2.000/0.632 ms.
```

测试：

```
[SW2]ping ipv6 -vpn-instance vpn-rt -a 4::1 3::1
Ping6(56 data bytes) 4::1 --> 3::1, press CTRL_C to break
Request time out
Request time out
Request time out
Request time out
Request time out

--- Ping6 statistics for 3::1 in VPN instance vpn-rt ---
5 packet(s) transmitted, 0 packet(s) received, 100.0% packet loss
[SW2]%Apr  5 14:00:30:783 2020 SW2 PING/6/PING_VPN_STATISTICS: Ping6 statistics for 3::1 i
n VPN instance vpn-rt: 5 packet(s) transmitted, 0 packet(s) received, 100.0% packet loss.
```

在SW2使用loopback 20作为源，带VPN能PING通FW1的loopback20，PING不通FW1的loopback 10
：

```
[SW2]ping ipv6 -vpn-instance vpn-nrt -a 5::1 3::1
Ping6(56 data bytes) 5::1 --> 3::1, press CTRL_C to break
56 bytes from 3::1, icmp_seq=0 hlim=64 time=2.000 ms
56 bytes from 3::1, icmp_seq=1 hlim=64 time=1.000 ms
56 bytes from 3::1, icmp_seq=2 hlim=64 time=0.000 ms
56 bytes from 3::1, icmp_seq=3 hlim=64 time=0.000 ms
56 bytes from 3::1, icmp_seq=4 hlim=64 time=0.000 ms

--- Ping6 statistics for 3::1 in VPN instance vpn-nrt ---
5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss
round-trip min/avg/max/std-dev = 0.000/0.600/2.000/0.800 ms
[SW2]%Apr  5 14:01:11:636 2020 SW2 PING/6/PING_VPN_STATISTICS: Ping6 statistics for 3::1 i
n VPN instance vpn-nrt: 5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss, r
ound-trip min/avg/max/std-dev = 0.000/0.600/2.000/0.800 ms.

[SW2]
```

```
[SW2]ping ipv6 -vpn-instance vpn-nrt -a 5::1 2::1
Ping6(56 data bytes) 5::1 --> 2::1, press CTRL_C to break
Request time out
Request time out
Request time out
Request time out
Request time out

--- Ping6 statistics for 2::1 in VPN instance vpn-nrt ---
5 packet(s) transmitted, 0 packet(s) received, 100.0% packet loss
[SW2]%Apr  5 14:01:35:351 2020 SW2 PING/6/PING_VPN_STATISTICS: Ping6 statistics for 2::1 i
n VPN instance vpn-nrt: 5 packet(s) transmitted, 0 packet(s) received, 100.0% packet loss.

[SW2]
```

根据测试结果得知，相同VPN实例内的业务可以互通，不同VPN实例内的业务不能互通，达到了隔离
的效果。

查看SW1的BGP邻居信息：

```
[SW1]dis bgp peer ipv6 vpn-instance vpn-rt

 BGP local router ID: 1.1.1.1
 Local AS number: 100
 Total number of peers: 1              Peers in established state: 1

  * - Dynamically created peer
  Peer                        AS  MsgRcvd  MsgSent OutQ PrefRcv Up/Down  State

  1::2                        200       6        6    0       1 00:02:05 Established
[SW1]dis bgp peer ipv6 vpn-instance vpn-nrt

 BGP local router ID: 1.1.1.1
 Local AS number: 100
 Total number of peers: 1              Peers in established state: 1

  * - Dynamically created peer
  Peer                        AS  MsgRcvd  MsgSent OutQ PrefRcv Up/Down  State

  1::2                        200       6        6    0       1 00:02:08 Established
[SW1]
```

查看SW2的BGP邻居信息：

```
[SW2]dis bgp peer ipv6 vpn-instance vpn-rt

 BGP local router ID: 2.2.2.2
 Local AS number: 200
 Total number of peers: 1              Peers in established state: 1

  * - Dynamically created peer
  Peer                        AS  MsgRcvd  MsgSent OutQ PrefRcv Up/Down  State

  1::1                        100       7        6    0       1 00:02:29 Established
[SW2]dis bgp peer ipv6 vpn-instance vpn-nrt

 BGP local router ID: 2.2.2.2
 Local AS number: 200
 Total number of peers: 1              Peers in established state: 1

  * - Dynamically created peer
  Peer                        AS  MsgRcvd  MsgSent OutQ PrefRcv Up/Down  State

  1::1                        100       8        6    0       1 00:02:32 Established
[SW2]
```

查看SW1 IPV6 VPN的路由表：

```
[SW1]dis ipv6 routing-table vpn-instance vpn-rt

Destinations : 8      Routes : 8

Destination: ::1/128                          Protocol  : Direct
NextHop    : ::1                              Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: 1::/64                           Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : Vlan400                          Cost      : 0

Destination: 1::1/128                         Protocol  : Direct
NextHop    : ::1                              Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: 2::/64                           Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : Loop10                           Cost      : 0

Destination: 2::1/128                         Protocol  : Direct
NextHop    : ::1                              Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: 4::/64                           Protocol  : BGP4+
NextHop    : 1::2                             Preference: 255
Interface  : Vlan400                          Cost      : 0

Destination: FE80::/10                        Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: FF00::/8                         Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : NULL0                            Cost      : 0
[SW1]
```

```
[SW1]dis ipv6 routing-table vpn-instance vpn-nrt

Destinations : 8      Routes : 8

Destination: ::1/128                          Protocol  : Direct
NextHop    : ::1                              Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: 1::/64                           Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : Vlan500                          Cost      : 0

Destination: 1::1/128                         Protocol  : Direct
NextHop    : ::1                              Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: 3::/64                           Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : Loop20                           Cost      : 0

Destination: 3::1/128                         Protocol  : Direct
NextHop    : ::1                              Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: 5::/64                           Protocol  : BGP4+
NextHop    : 1::2                             Preference: 255
Interface  : Vlan500                          Cost      : 0

Destination: FE80::/10                        Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: FF00::/8                         Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : NULL0                            Cost      : 0
[SW1]
```

查看SW2 IPV6 VPN的路由表：

```
[SW2]dis ipv6 routing-table vpn-instance vpn-rt

Destinations : 8        Routes : 8

Destination: ::1/128                          Protocol  : Direct
NextHop    : ::1                              Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: 1::/64                           Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : Vlan400                          Cost      : 0

Destination: 1::2/128                         Protocol  : Direct
NextHop    : ::1                              Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: 2::/64                           Protocol  : BGP4+
NextHop    : 1::1                             Preference: 255
Interface  : Vlan400                          Cost      : 0

Destination: 4::/64                           Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : Loop10                           Cost      : 0

Destination: 4::1/128                         Protocol  : Direct
NextHop    : ::1                              Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: FE80::/10                        Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: FF00::/8                         Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : NULL0                            Cost      : 0
[SW2]
```

```
[SW2]dis ipv6 routing-table vpn-instance vpn-nrt

Destinations : 8        Routes : 8

Destination: ::1/128                          Protocol  : Direct
NextHop    : ::1                              Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: 1::/64                           Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : Vlan500                          Cost      : 0

Destination: 1::2/128                         Protocol  : Direct
NextHop    : ::1                              Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: 3::/64                           Protocol  : BGP4+
NextHop    : 1::1                             Preference: 255
Interface  : Vlan500                          Cost      : 0

Destination: 5::/64                           Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : Loop20                           Cost      : 0

Destination: 5::1/128                         Protocol  : Direct
NextHop    : ::1                              Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: FE80::/10                        Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : InLoop0                          Cost      : 0

Destination: FF00::/8                         Protocol  : Direct
NextHop    : ::                               Preference: 0
Interface  : NULL0                            Cost      : 0
[SW2]
```

至此，S5820 IPV6 MPLS VPN OPTION-A典型组网配置案例已完成!

配置关键点