实验：BGP 双栈

HCIE 综合实验 - BGP 双栈

臧家林制作

BGP 双栈 1： BGP 基础
BGP 双栈 2： BGP4+ 基础
BGP 双栈 3： BGP4 Advance

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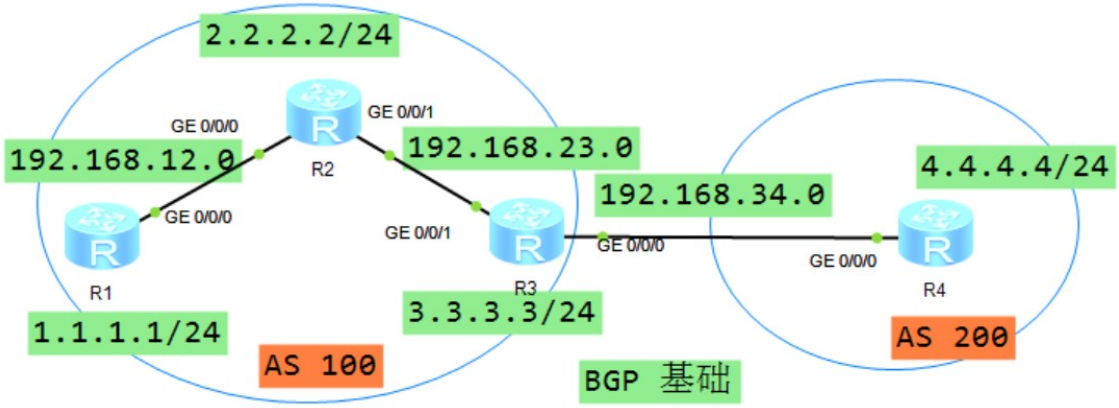
BGP 双栈 1： BGP 基础

为了满足大规模路由的需求，需要通过 BGP（Border Gateway Protocol）在 AS 之间传递数量庞大的 IPv4、v6 路由，并且通过各种策略进行路径的选取，控制等



IBGP 利用环回口建立邻居，IGP 协议为 OSPF， EBGP 通过物理接口建立邻居

IP 地址配置

R1:

```
undo ter mo
sys
sysname R1
user-interface console 0
idle-timeout 0 0
int loop 0
ip add 1.1.1.1 24
int g0/0/0
ip add 192.168.12.1 24
q
```

R2:

```
undo ter mo
sys
sysname R2
user-interface console 0
idle-timeout 0 0
```

```
int loop 0
ip add 2.2.2.2 24
int g0/0/0
ip add 192.168.12.2 24
int g0/0/1
ip add 192.168.23.2 24
q
```

R3:

```
undo ter mo
sys
sysname R3
user-interface console 0
idle-timeout 0 0
int loop 0
ip add 3.3.3.3 24
int g0/0/0
ip add 192.168.34.3 24
int g0/0/1
ip add 192.168.23.3 24
q
```

R4:

```
undo ter mo
sys
sysname R4
user-interface console 0
idle-timeout 0 0
int loop 0
ip add 4.4.4.4 24
```

int g0/0/0
ip add 192.168.34.4 24
q

= = = = = = = =

配置 OSPF 协议

R1:
ospf router-id 1.1.1.1
area 0
net 1.1.1.1 0.0.0.0
net 192.168.12.1 0.0.0.0
q

R2:
ospf router-id 2.2.2.2
area 0
net 2.2.2.2 0.0.0.0
net 192.168.12.2 0.0.0.0
net 192.168.23.2 0.0.0.0
q

R3:
ospf router-id 3.3.3.3
area 0
net 3.3.3.3 0.0.0.0
net 192.168.23.3 0.0.0.0
q

在 BGP 100 内查看 OSPF 邻居关系，邻居是建立好的

```
[R2]dis ospf peer bri

        OSPF Process 1 with Router ID 2.2.2.2
                  Peer Statistic Information
 ----------------------------------------------------------------------------
 Area Id          Interface                       Neighbor id      State
 0.0.0.0          GigabitEthernet0/0/0            1.1.1.1          Full
 0.0.0.0          GigabitEthernet0/0/1            3.3.3.3          Full
 ----------------------------------------------------------------------------
```

= = = = = = = =

配置 BGP 协议

R1:

bgp 100
router-id 1.1.1.1
peer 2.2.2.2 as-n 100
peer 2.2.2.2 con loo0
peer 3.3.3.3 as-n 100
peer 3.3.3.3 con loo0
net 1.1.1.0 24
q

R2:

bgp 100
router-id 2.2.2.2
peer 1.1.1.1 as-n 100
peer 1.1.1.1 con loo0
peer 3.3.3.3 as-n 100
peer 3.3.3.3 con loo0
net 2.2.2.0 24
q

R3:

bgp 100
router-id 3.3.3.3

peer 2.2.2.2 as-n 100
peer 2.2.2.2 con loo0
peer 1.1.1.1 as-n 100
peer 1.1.1.1 con loo0
peer 192.168.34.4 as-n 200
net 3.3.3.0 24
q

R4:
bgp 200
router-id 4.4.4.4
peer 192.168.34.3 as-n 100
net 4.4.4.0 24
q

在 R3 上查看 BGP 的邻居关系，都是已建立

```
[R3]dis bgp peer

 BGP local router ID : 3.3.3.3
 Local AS number : 100
 Total number of peers : 3                 Peers in established state : 3

  Peer            V          AS  MsgRcvd  MsgSent  OutQ  Up/Down       State

  1.1.1.1         4         100        5        7     0 00:02:33 Established
  2.2.2.2         4         100        5        6     0 00:02:42 Established
  192.168.34.4    4         200        5        8     0 00:02:34 Established
[R3]
```

查看 BGP 路由，在 R3 上学习到的 BGP 路由，都是可用且最优的

```
 Total Number of Routes: 4
      Network            NextHop         MED        LocPrf    PrefVal Path/Ogn

 *>i  1.1.1.0/24         1.1.1.1          0          100         0      i
 *>i  2.2.2.0/24         2.2.2.2          0          100         0      i
 *>   3.3.3.0/24         0.0.0.0          0                      0      i
 *>   4.4.4.0/24         192.168.34.4     0                      0      200i
[R3]
```

但在 R1 R2 上看到的路由是有问题的，
在 R1 上是无法到达 192.168.34.4 ，下一跳不可达，所以学习到的路由是不可用的
需要在 R3 进行改进

```
Total Number of Routes: 4
     Network            NextHop         MED        LocPrf     PrefVal

*>   1.1.1.0/24         0.0.0.0          0                     0
*>i  2.2.2.0/24         2.2.2.2          0          100        0
*>i  3.3.3.0/24         3.3.3.3          0          100        0
  i  4.4.4.0/24         192.168.34.4     0          100        0
[R1]
```

R3：
bgp 100
peer 1.1.1.1 next-hop-local
peer 2.2.2.2 next-hop-local

在路由传递在 R1 R2 的同时，把下一跳设置成自己，从而让路由变成可达
下一跳为 3.3.3.3 而 R1 是可以通过 OSPF 协议到在 3.3.3.3 的，路由可达了，就是可用且最优的

```
Total Number of Routes: 4
     Network            NextHop         MED        LocPrf     PrefVal

*>   1.1.1.0/24         0.0.0.0          0                     0
*>i  2.2.2.0/24         2.2.2.2          0          100        0
*>i  3.3.3.0/24         3.3.3.3          0          100        0
*>i  4.4.4.0/24         3.3.3.3          0          100        0
[R1]
```

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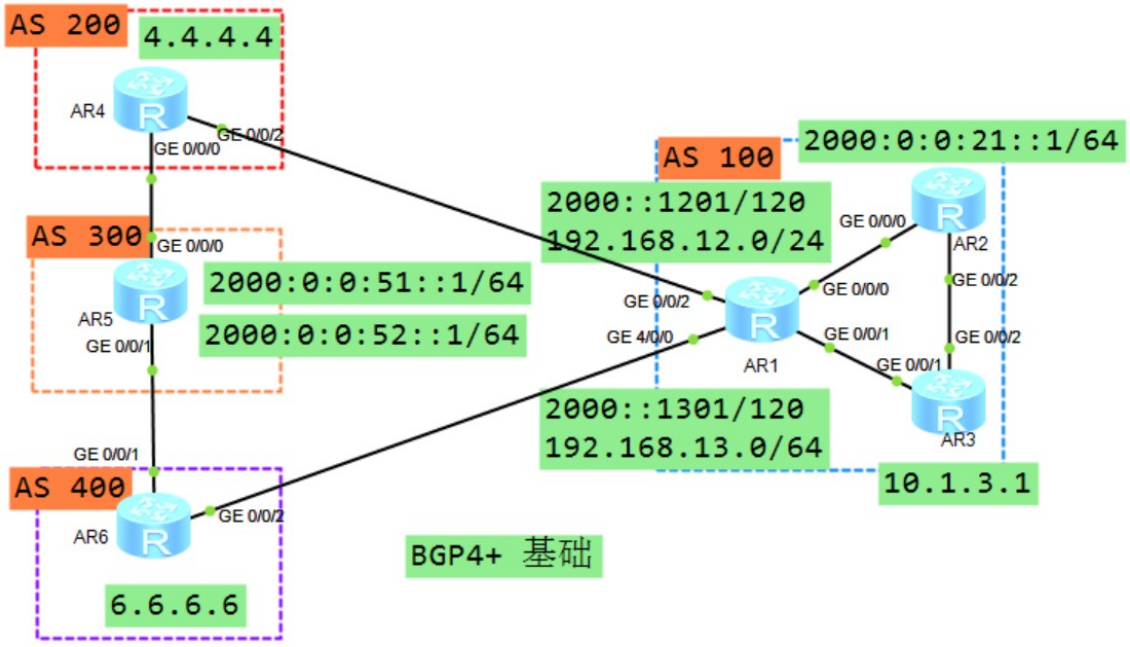
BGP 双栈 2： BGP4+ 基础

本实验通过 BGP 邻居关系配置以及属性的使用，掌握 BGP

基本配置方法以及 AS_Path_Filter 等工具的使用。



1.配置设备接口 IPv4 和 IPv6 地址。
2.在 AS 100 使用 OSPF 和 OSPFv3 做为 IGP 协议。
3.各直连路由器之间建立 IBGP 或 EBGP 邻居关系；其中 AS 100 内的路由器用 LoopBack 地址作为更新源地址来建立 IBGP 邻居关系。R1 与 R4 间使用环回接口借助静态路由建立 EBGP 邻居关系。(包括 IPv6 的 BGP 邻居关系，要求同上)
4.将设备上所有的 LoopBack 0 接口和拓扑中所示的网段宣告到 BGP 当中，使得所有路由器的 LoopBack 口之间能够直接通信。
5.过滤路由
6.路径选择，AS100 访问 2000:0:0:51::1/64 优选经过 AS 200 的路径，访问 2000:0:0:52::1/64 优选经过 AS 400 的路径

IP 地址配置

R1:

```
undo ter mo
sys
sysname R1
user-interface console 0
idle-timeout 0 0
ipv6
int loop 0
ip add 1.1.1.1 24
ipv6 enable
ipv6 address 2000::1 128
int g0/0/0
ip add 192.168.12.1 24
ipv6 enable
ipv6 address 2000::1201 120
int g0/0/1
ip add 192.168.13.1 24
ipv6 enable
ipv6 address 2000::1301 120
int g0/0/2
ip add 192.168.14.1 24
ipv6 enable
ipv6 address 2000::1401 120
int g4/0/0
ip add 192.168.16.1 24
ipv6 enable
ipv6 address 2000::1601 120
q
```

R2:

```
undo ter mo
sys
sysname R2
user-interface console 0
idle-timeout 0 0
ipv6
int loop 0
ip add 2.2.2.2 24
ipv6 enable
ipv6 address 2000::2 128
int loo1
ipv6 enable
ipv6 address 2000:0:0:21::1 64
int g0/0/0
ip add 192.168.12.2 24
ipv6 enable
ipv6 address 2000::1202 120
int g0/0/2
ip add 192.168.23.2 24
ipv6 enable
ipv6 address 2000::2302 120
q
```

R3:

```
undo ter mo
sys
sysname R3
user-interface console 0
idle-timeout 0 0
ipv6
```

```
int loop 0
ip add 3.3.3.3 24
ipv6 enable
ipv6 address 2000::3 128
int loo1
ip address 10.1.3.1 24
int g0/0/1
ip add 192.168.13.3 24
ipv6 enable
ipv6 address 2000::1303 120
int g0/0/2
ip add 192.168.23.3 24
ipv6 enable
ipv6 address 2000::2303 120
q
```

R4:

```
undo ter mo
sys
sysname R4
user-interface console 0
idle-timeout 0 0
ipv6
int loop 0
ip add 4.4.4.4 24
ipv6 enable
ipv6 address 2000::4 128
int loo1
ip address 10.1.4.1 24
int g0/0/0
```

```
ip add 192.168.45.4 24
ipv6 enable
ipv6 address 2000::4504 120
int g0/0/2
ip add 192.168.14.4 24
ipv6 enable
ipv6 address 2000::1404 120
q
```

R5:

```
undo ter mo
sys
sysname R5
user-interface console 0
idle-timeout 0 0
ipv6
int loop 0
ip add 5.5.5.5 24
ipv6 enable
ipv6 address 2000::5 128
int loo1
ipv6 enable
ipv6 address 2000:0:0:51::1 64
int loo2
ipv6 enable
ipv6 address 2000:0:0:52::1 64
int g0/0/0
ip add 192.168.45.5 24
ipv6 enable
ipv6 address 2000::4505 120
```

```
int g0/0/1
ip add 192.168.56.5 24
ipv6 enable
ipv6 address 2000::5605 120
q
```

```
R6:
undo ter mo
sys
sysname R6
user-interface console 0
idle-timeout 0 0
ipv6
int loop 0
ip add 6.6.6.6 24
ipv6 enable
ipv6 address 2000::6 128
int loo1
ip address 10.1.6.1 24
int g0/0/1
ip add 192.168.56.6 24
ipv6 enable
ipv6 address 2000::5606 120
int g0/0/2
ip add 192.168.16.6 24
ipv6 enable
ipv6 address 2000::1606 120
q
```

在 AS 100 使用 OSPF 和 OSPFv3 做为 IGP 协议

R1:

```
ospf router-id 1.1.1.1
area 0
net 192.168.12.1 0.0.0.0
net 192.168.13.1 0.0.0.0
net 1.1.1.1 0.0.0.0
q
ospfv3
router-id 1.1.1.1
int loo0
ospfv3 1 area 0
int g0/0/0
ospfv3 1 area 0
int g0/0/1
ospfv3 1 area 0
q
```

R2:

```
ospf router-id 2.2.2.2
area 0
net 192.168.12.2 0.0.0.0
net 192.168.23.2 0.0.0.0
net 2.2.2.2 0.0.0.0
q
ospfv3
router-id 2.2.2.2
int loo0
ospfv3 1 area 0
int g0/0/0
ospfv3 1 area 0
```

int g0/0/2
ospfv3 1 area 0
q

R3:
ospf router-id 3.3.3.3
area 0
net 192.168.13.3 0.0.0.0
net 192.168.23.3 0.0.0.0
net 3.3.3.3 0.0.0.0
q
ospfv3
router-id 3.3.3.3
int loo0
ospfv3 1 area 0
int g0/0/1
ospfv3 1 area 0
int g0/0/2
ospfv3 1 area 0
q

查看 OSPF 邻居
[R1]dis ospf peer bri

OSPF Process 1 with Router ID 1.1.1.1
Peer Statistic Information

Area Id Interface Neighbor id State
0.0.0.0 GigabitEthernet0/0/0 2.2.2.2

Full
0.0.0.0 GigabitEthernet0/0/1 3.3.3.3
Full

[R1]dis ospfv3 peer

OSPFv3 Process (1)
OSPFv3 Area (0.0.0.0)
Neighbor ID Pri State Dead Time Interface
Instance ID
2.2.2.2 1 Full/Backup 00:00:39 GE0/0/0
0
3.3.3.3 1 Full/Backup 00:00:35 GE0/0/1
0

配置 BGP 邻居关系

配置 BGP 邻居关系，AS100 内用 LoopBack 0 建立 IBGP 邻居关系，R1 与 R4 以 LoopBack 0 口建立 EBGP 邻居关系，其他 EBGP 邻居关系均用直连接口建立
R1：
ip route-static 4.4.4.0 24 192.168.14.4
ipv6 route-static 2000::4 128 2000::1404

bgp 100
router-id 1.1.1.1
peer 2.2.2.2 as-n 100
peer 2.2.2.2 connect-interface loo0
peer 2.2.2.2 next-hop-local
peer 3.3.3.3 as-n 100

peer 3.3.3.3 connect-interface loo0
peer 3.3.3.3 next-hop-local
peer 4.4.4.4 as-n 200
peer 4.4.4.4 connect-interface loo0
peer 4.4.4.4 ebgp-max-hop 255
peer 192.168.16.6 as-n 400
net 1.1.1.0 24
peer 2000::2 as-n 100
peer 2000::2 con loo0
peer 2000::3 as-n 100
peer 2000::3 con loo0
peer 2000::4 as-n 200
peer 2000::4 con loo0
peer 2000::4 ebgp-max-hop 255
peer 2000::1606 as-n 400
ipv6-family unicast
peer 2000::2 enable
peer 2000::2 next-hop-local
peer 2000::3 en
peer 2000::3 next-hop-local
peer 2000::4 enable
peer 2000::1606 enable
network 2000::1 128
q

R2 :
bgp 100
router-id 2.2.2.2
peer 1.1.1.1 as-n 100
peer 1.1.1.1 connect-interface loo0

peer 3.3.3.3 as-n 100
peer 3.3.3.3 connect-interface loo0
net 2.2.2.0 24
peer 2000::1 as-n 100
peer 2000::1 con loo0
peer 2000::3 as-n 100
peer 2000::3 con loo0
ipv6-family unicast
peer 2000::1 enable
peer 2000::3 enable
net 2000::2 128
net 2000:0:0:21::1 64
q

R3 :
bgp 100
router-id 3.3.3.3
peer 1.1.1.1 as-n 100
peer 1.1.1.1 connect-interface loo0
peer 2.2.2.2 as-n 100
peer 2.2.2.2 connect-interface loo0
net 3.3.3.0 24
net 10.1.3.0 24
peer 2000::1 as-n 100
peer 2000::1 con loo0
peer 2000::2 as-n 100
peer 2000::2 con loo0
ipv6-family unicast
peer 2000::1 enable
peer 2000::2 enable

net 2000::3 128
q

R4 :
ip route-static 1.1.1.0 24 192.168.14.1
ipv6 route-static 2000::1 128 2000::1401

bgp 200
router-id 4.4.4.4
peer 1.1.1.1 as-n 100
peer 1.1.1.1 connect-interface loo0
peer 1.1.1.1 ebgp-max-hop 255
peer 192.168.45.5 as-n 300
net 4.4.4.0 24
net 10.1.4.0 24
peer 2000::1 as-n 100
peer 2000::1 con loo0
peer 2000::1 ebgp-max-hop 255
peer 2000::4505 as-n 300
ipv6-family unicast
peer 2000::1 enable
peer 2000::4505 enable
network 2000::4 128
q

R5 :
bgp 300
router-id 5.5.5.5
peer 192.168.45.4 as-n 200
peer 192.168.56.6 as-n 400
net 5.5.5.0 24

peer 2000::4504 as-n 200
peer 2000::5606 as-n 400
ipv6-family unicast
net 2000::5 128
peer 2000::4504 enable
peer 2000::5606 enable
net 2000:0:0:51:: 64
net 2000:0:0:52:: 64
q

R6：
bgp 400
router-id 6.6.6.6
peer 192.168.16.1 as-n 100
peer 192.168.56.5 as-n 300
net 6.6.6.0 24
net 10.1.6.0 24
peer 2000::1601 as-n 100
peer 2000::5605 as-n 300
ipv6-family unicast
peer 2000::1601 enable
peer 2000::5605 enable
net 2000::6 128
q

配置结束后，在 R1 上查看 BGP ipv4　ipv6　邻居

```
[R1]dis bgp peer

 BGP local router ID : 1.1.1.1
```

```
 Local AS number : 100
 Total number of peers : 4           Peers
in established state : 4

    Peer                            V
AS    MsgRcvd    MsgSent    OutQ    Up/Down
2.2.2.2         4               100         77
83       0 01:14:47 Established
3.3.3.3         4               100         4
7           0 00:00:13 Established
4.4.4.4         4               200         21
22       0 00:11:31 Established
192.168.16.6          4    400       16
16           0 00:05:11 Established


[R1]dis bgp ipv6 peer

 BGP local router ID : 1.1.1.1
 Local AS number : 100
 Total number of peers : 4           Peers
in established state : 4

    Peer                            V
AS    MsgRcvd    MsgSent    OutQ    Up/Down
State Pre

2000::2         4           100
28             215           0 00:24:33
Established
```

```
2000::3         4           100
4             117           0 00:01:34
Established
2000::4         4           200
5               10           0 00:01:03
Established
2000::1606     4         400                  3
11           0 00:00:00 Established
```

路由过滤

R4 不接收直接从 AS 100 发送过来的路由

R4:

```
ip as-path-filter as100 deny 100$
bgp 200
peer 1.1.1.1 as-path-filter as100 import
```

可以查看过滤前与过滤后 AS 号的变化

路径选择

AS 100 要求访问 2000:0:0:51::/64 网段时经过 AS 200,访问 2000:0:0:52::/64 时经过 AS400，在 R1 进行配置。 R1 默认通过 R4 到达 2000:0:0:51::/64 和 2000:0:0:52::/64

R1：

```
ip ipv6-prefix R4 permit 2000:0:0:51:: 64
ip ipv6-prefix R6 permit 2000:0:0:52:: 64

route-policy R4 permit node 10
if-match ipv6 address prefix-list R4
apply local-preference 150
```

route-policy R4 permit node 20

route-policy R6 permit node 10
if-match ipv6 address prefix-list R6
apply local-preference 200
route-policy R6 permit node 20
bgp 100
ipv6-family unicast
peer 2000::4 route-policy R4 import
peer 2000::1606 route-policy R6 import
q

在 R1 上查看 ipv6 的路由表

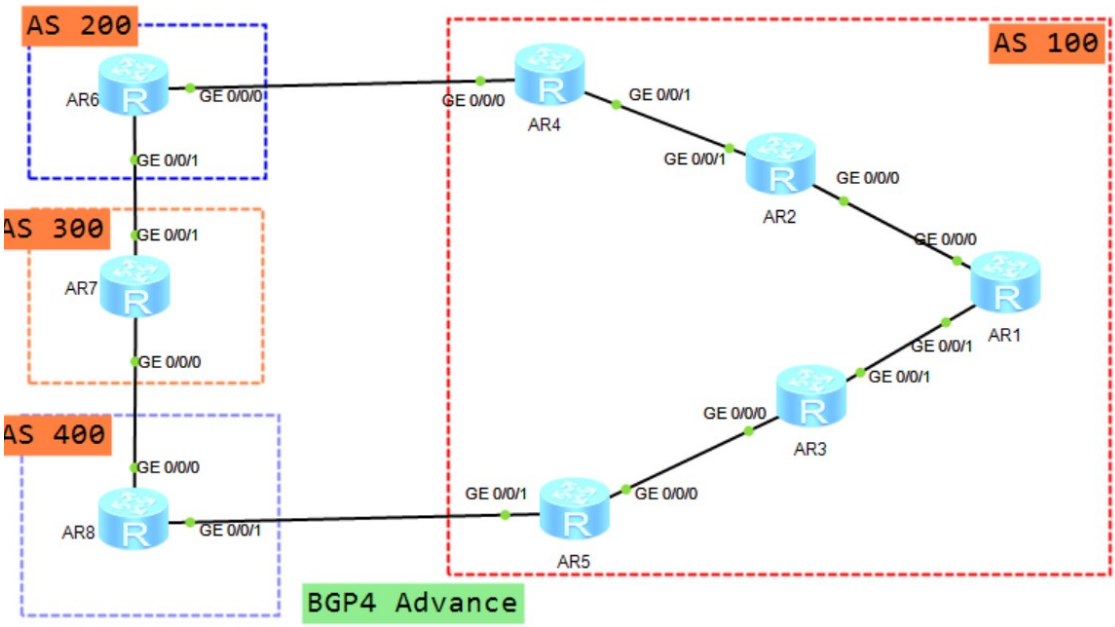
```
*>    Network     : 2000:0:0:51::
PrefixLen : 64
       NextHop     : 2000::4
LocPrf         : 150
          MED             :
PrefVal       : 0
          Label          :
         Path/Ogn : 200 300    i
 *
          NextHop     : 2000::1606
LocPrf          :
          MED             :
PrefVal       : 0
          Label          :
          Path/Ogn : 400 300    i
 *>    Network     : 2000:0:0:52::
```

```
PrefixLen : 64
        NextHop     : 2000::1606
LocPrf          : 200
          MED               :
PrefVal       : 0
          Label          :
          Path/Ogn : 400 300     i

= = = = = = = = =
```

BGP 双栈 3： BGP4 Advance

实验通过配置以及使用 BGP 的各种工具，熟悉并掌握常见的 BGP 应用场景及属性、特性用法。



1.配置设备接口 IPv4 和 IPv6 地址。
2.在 AS 100 使用 OSPF 和 OSPFv3 做为 IGP 协议。
3.各直连路由器之间建立 IBGP 或 EBGP 邻居关系；IBGP 邻

居使用 LoopBack 口建立邻居关系，EBGP 采用直连接口建立邻居关系，AS 100 的出口路由器 R4 和对端 AS200 的 R6 需要对邻居进行验证。
4.R2 和 R3 分别作为 R4 和 R5 的反射器，同时 R2 和 R3 又作为 R1 的客户机。
5.所有设备上直连的网段全部宣告到 BGP 当中 ，由于 AS 200 和 AS 400 为不同 ISP, 而 221.12.128.1/24 和 115.192.0.0/24 分属两个 ISP，为了实现不用 ISP 的用户访问对应 ISP 所拥有 IP 地址的服务器的需求 115.192.0.0/24 打上 100:200 标记 ，221.12.128.1/24 打上 100:400 标记
注：需通过 Community 属性实现。
6.AS 100 访问 2000:0:0:70:: /64、2000:0:0:71:: /64、2000:0:0:72:: /64 和 2000:0:0:73:: /64 这四个网段，同时需做到尽量减小这几个网络震荡对整个网络的影响以及防止环路的发生。
7.要求 R1 上的 10.1.1.0/24 网段访问 10.1.7.0/24 时能够充分利用链路带宽，并且做到冗余备份。

配置设备接口 IPv4 和 IPv6 地址

基本 IP 地址配置

R1:

```
undo ter mo
sys
sysname R1
user-interface console 0
idle-timeout 0 0
ipv6
int loop 0
ip add 1.1.1.1 24
ipv6 enable
ipv6 address 2000::1 128
int loo1
```

```
ip add 221.12.128.1 24
int loo2
ip add 115.192.0.1 24
int loo3
ipv6 enable
ip add 10.1.1.1 24
ipv6 add 2000:0:0:11::1 64
int g0/0/0
ip add 192.168.12.1 24
ipv6 enable
ipv6 address 2000::1201 120
int g0/0/1
ip add 192.168.13.1 24
ipv6 enable
ipv6 address 2000::1301 120
q
```

R2:

```
undo ter mo
sys
sysname R2
user-interface console 0
idle-timeout 0 0
ipv6
int loop 0
ip add 2.2.2.2 24
ipv6 enable
ipv6 address 2000::2 128
int g0/0/0
ip add 192.168.12.2 24
ipv6 enable
ipv6 address 2000::1202 120
int g0/0/1
ip add 192.168.24.2 24
```

```
ipv6 enable
ipv6 address 2000::2402 120
q
```

R3:

```
undo ter mo
sys
sysname R3
user-interface console 0
idle-timeout 0 0
ipv6
int loop 0
ip add 3.3.3.3 24
ipv6 enable
ipv6 address 2000::3 128
int g0/0/0
ip add 192.168.35.3 24
ipv6 enable
ipv6 address 2000::3503 120
int g0/0/1
ip add 192.168.13.3 24
ipv6 enable
ipv6 address 2000::1303 120
q
```

R4:

```
undo ter mo
sys
sysname R4
user-interface console 0
idle-timeout 0 0
ipv6
int loop 0
ip add 4.4.4.4 24
```

```
ipv6 enable
ipv6 address 2000::4 128
int g0/0/0
ip add 192.168.46.4 24
ipv6 enable
ipv6 address 2000::4604 120
int g0/0/1
ip add 192.168.24.4 24
ipv6 enable
ipv6 address 2000::2404 120
q
```

R5:

```
undo ter mo
sys
sysname R5
user-interface console 0
idle-timeout 0 0
ipv6
int loop 0
ip add 5.5.5.5 24
ipv6 enable
ipv6 address 2000::5 128
int g0/0/0
ip add 192.168.35.5 24
ipv6 enable
ipv6 address 2000::3505 120
int g0/0/1
ip add 192.168.58.5 24
ipv6 enable
ipv6 address 2000::5805 120
q
```

R6:

```
undo ter mo
sys
sysname R6
user-interface console 0
idle-timeout 0 0
ipv6
int loop 0
ip add 6.6.6.6 24
ipv6 enable
ipv6 address 2000::6 128
int loo1
ip add 10.1.6.1 24
int g0/0/0
ip add 192.168.46.6 24
ipv6 enable
ipv6 address 2000::4606 120
int g0/0/1
ip add 192.168.67.6 24
ipv6 enable
ipv6 address 2000::6706 120
q
```

R7:

```
undo ter mo
sys
sysname R7
user-interface console 0
idle-timeout 0 0
ipv6
int loop 0
ip add 7.7.7.7 24
ipv6 enable
ipv6 address 2000::7 128
int loo1
```

```
ip add 10.1.7.1 24
int loo2
ipv6 enable
ipv6 add 2000:0:0:70::1 64
int loo3
ipv6 enable
ipv6 add 2000:0:0:71::1 64
int loo4
ipv6 enable
ipv6 add 2000:0:0:72::1 64
int loo5
ipv6 enable
ipv6 add 2000:0:0:73::1 64
int g0/0/0
ip add 192.168.78.7 24
ipv6 enable
ipv6 address 2000::7807 120
int g0/0/1
ip add 192.168.67.7 24
ipv6 enable
ipv6 address 2000::6707 120
q
```

R8:

```
undo ter mo
sys
sysname R8
user-interface console 0
idle-timeout 0 0
ipv6
int loop 0
ip add 8.8.8.8 24
ipv6 enable
ipv6 address 2000::8 128
```

```
int loo1
ip add 10.1.8.1 24
int g0/0/0
ip add 192.168.78.8 24
ipv6 enable
ipv6 address 2000::7808 120
int g0/0/1
ip add 192.168.58.8 24
ipv6 enable
ipv6 address 2000::5808 120
q
```

在 AS 100 使用 OSPF 和 OSPFv3

R1:

```
ospf router-id 1.1.1.1
area 0
net 192.168.12.1 0.0.0.0
net 192.168.13.1 0.0.0.0
net 1.1.1.1 0.0.0.0
net 10.1.1.1 0.0.0.0
q
ospfv3
router-id 1.1.1.1
int loo0
ospfv3 1 area 0
int g0/0/0
ospfv3 1 area 0
int g0/0/1
ospfv3 1 area 0
q
```

R2:

```
ospf router-id 2.2.2.2
area 0
```

net 192.168.12.2 0.0.0.0
net 192.168.24.2 0.0.0.0
net 2.2.2.2 0.0.0.0
q
ospfv3
router-id 2.2.2.2
int loo0
ospfv3 1 area 0
int g0/0/0
ospfv3 1 area 0
int g0/0/1
ospfv3 1 area 0
q

R3:
ospf router-id 3.3.3.3
area 0
net 192.168.13.3 0.0.0.0
net 192.168.35.3 0.0.0.0
net 3.3.3.3 0.0.0.0
q
ospfv3
router-id 3.3.3.3
int loo0
ospfv3 1 area 0
int g0/0/0
ospfv3 1 area 0
int g0/0/1
ospfv3 1 area 0
q

R4:
ospf router-id 4.4.4.4
area 0

net 192.168.24.4 0.0.0.0
net 4.4.4.4 0.0.0.0
q
ospfv3
router-id 4.4.4.4
int loo0
ospfv3 1 area 0
int g0/0/1
ospfv3 1 area 0
q

R5:
ospf router-id 5.5.5.5
area 0
net 192.168.35.5 0.0.0.0
net 5.5.5.5 0.0.0.0
q
ospfv3
router-id 5.5.5.5
int loo0
ospfv3 1 area 0
int g0/0/0
ospfv3 1 area 0
q

查看 OSPF 的邻居，OSPFv3 的邻居
dis ospf peer brief
dis ospfv3 peer
dis ospfv3 routing

配置 IBGP 或 EBGP 邻居

各直连路由器之间建立 IBGP 或 EBGP 邻居关系；其中 AS 100 内的路由器用 LoopBack 地址作为更新源地址来建立 IBGP

邻居关系。R4 和 R5 需对其 EBGP 邻居进行认证
R1：
bgp 100
router-id 1.1.1.1
peer 2.2.2.2 as-n 100
peer 2.2.2.2 con loo0
peer 3.3.3.3 as-n 100
peer 3.3.3.3 con loo0
peer 2000::2 as-n 100
peer 2000::2 con loo0
peer 2000::3 as-n 100
peer 2000::3 con loo0
net 1.1.1.0 24
ipv6-family unicast
peer 2000::2 enable
peer 2000::3 enable
net 2000:0:0:11:: 64
net 2000::1 128
q

R2：
bgp 100
router-id 2.2.2.2
peer 1.1.1.1 as-n 100
peer 1.1.1.1 con loo0
peer 4.4.4.4 as-n 100
peer 4.4.4.4 con loo0
peer 2000::1 as-n 100
peer 2000::1 con loo0
peer 2000::4 as-n 100

```
peer 2000::4 con loo0
net 2.2.2.0 24
ipv6-family unicast
peer 2000::1 enable
peer 2000::4 enable
net 2000::2 128
q
```

R3:

```
bgp 100
router-id 3.3.3.3
peer 1.1.1.1 as-n 100
peer 1.1.1.1 con loo0
peer 5.5.5.5 as-n 100
peer 5.5.5.5 con loo0
peer 2000::1 as-n 100
peer 2000::1 con loo0
peer 2000::5 as-n 100
peer 2000::5 con loo0
net 3.3.3.0 24
ipv6-family unicast
peer 2000::1 enable
peer 2000::5 enable
net 2000::3 128
q
```

R4:

```
bgp 100
router-id 4.4.4.4
peer 2.2.2.2 as-n 100
```

peer 2.2.2.2 con loo0
peer 2.2.2.2 next-hop-local
peer 192.168.46.6 as-n 200
peer 192.168.46.6 password cipher huawei
peer 2000::2 as-n 100
peer 2000::2 con loo0
peer 2000::4606 as-n 200
peer 2000::4606 password cipher huawei
net 4.4.4.0 24
ipv6-family unicast
peer 2000::2 enable
peer 2000::2 next-hop-local
peer 2000::4606 enable
net 2000::4 128
q

R5:
bgp 100
router-id 5.5.5.5
peer 3.3.3.3 as-n 100
peer 3.3.3.3 con loo0
peer 3.3.3.3 next-hop-local
peer 192.168.58.8 as-n 400
peer 2000::3 as-n 100
peer 2000::3 con loo0
peer 2000::5808 as-n 400
net 5.5.5.0 24
ipv6-family unicast
peer 2000::3 enable
peer 2000::3 next-hop-local

peer 2000::5808 ena
net 2000::5 128
q

R6:
bgp 200
router-id 6.6.6.6
peer 192.168.46.4 as-n 100
peer 192.168.46.4 password cipher huawei
peer 192.168.67.7 as-n 300
peer 2000::4604 as-n 100
peer 2000::4604 password cipher huawei
peer 2000::6707 as-n 300
net 6.6.6.0 24
net 10.1.6.0 24
ipv6-family unicast
peer 2000::4604 enable
peer 2000::6707 ena
net 2000::6 128
q

R7:
bgp 300
router-id 7.7.7.7
peer 192.168.78.8 as-n 400
peer 192.168.67.6 as-n 200
peer 2000::7808 as-n 400
peer 2000::6706 as-n 200
net 7.7.7.0 24
net 10.1.7.0 24

ipv6-family unicast
peer 2000::7808 enable
peer 2000::6706 ena
net 2000::7 128
net 2000:0:0:70:: 64
net 2000:0:0:71:: 64
net 2000:0:0:72:: 64
net 2000:0:0:73:: 64
q

R8:
bgp 400
router-id 8.8.8.8
peer 192.168.78.7 as-n 300
peer 192.168.58.5 as-n 100
peer 2000::7807 as-n 300
peer 2000::5805 as-n 100
net 8.8.8.0 24
net 10.1.8.0 24
ipv6-family unicast
peer 2000::7807 enable
peer 2000::5805 ena
net 2000::8 128
q

配置反射器

为了 BGP 路由能在 AS 100 内能够顺利传递，配置 R4 为 R2 的客户机，R5 为 R3 的客户机，R1 同时作为 R2 和 R3 的反射器。

R1:

```
bgp 100
peer 2.2.2.2 reflect-client
peer 3.3.3.3 reflect-client
ipv6-family unicast
peer 2000::2 reflect-client
peer 2000::3 reflect-client
q
```

R2:

```
bgp 100
peer 4.4.4.4 reflect-client
ipv6-family unicast
peer 2000::4 reflect-client
q
```

R3:

```
bgp 100
peer 5.5.5.5 reflect-client
ipv6-family unicast
peer 2000::5 reflect-client
q
```

配置完成后在 R1 上查看 BGP 路由

```
dis bgp routing-table

 Network                 NextHop           MED           LocPrf
PrefVal Path/Ogn

 *>    1.1.1.0/24              0.0.0.0             0
```

```
0          i
 *>i   2.2.2.0/24          2.2.2.2          0          100
0          i
 *>i   3.3.3.0/24          3.3.3.3          0          100
0          i
 *>i   4.4.4.0/24          4.4.4.4          0          100
0          i
 *>i   6.6.6.0/24          4.4.4.4          0          100
0          200i
 *>i   7.7.7.0/24          4.4.4.4                     100
0          200 300i
 *>i   8.8.8.0/24          4.4.4.4                     100
0          200 300 400i
 *>i   10.1.6.0/24         4.4.4.4          0          100
0          200i
 *>i   10.1.7.0/24         4.4.4.4                     100
0          200 300i
 *>i   10.1.8.0/24         4.4.4.4                     100
0          200 300 400i
```

路由过滤

将相应的路由引入到 BGP，并使用 Community 属性按照要求进行路由过滤

在 R1 上配置路由策略，在引入 221.12.128.1/24 和 115.192.0.0/24 这两条路由时，附加上相应的 community 属性。

additive：再原有的 community 属性上，再增加一个 community 值，后边要加上 additive 关键字，如果不加，就会覆盖掉先前的 community 值。

R6 不直接从 AS 100 学习 115.192.0.0 ，R8 不直接从 AS 10

0 学习 221.12.128.0
R1 :
ip ip-prefix noto200 permit 115.192.0.0 24
ip ip-prefix noto400 permit 221.12.128.0 24

route-policy adcom permit node 10
if-match ip-prefix noto200
apply community 100:200 add
route-policy adcom permit node 20
if-match ip-prefix 400
apply community 100:400 add
route-policy abcom permit node 30

bgp 100
peer 2.2.2.2 advertise-community
peer 3.3.3.3 advertise-community
net 115.192.0.0 24 route-policy adcom
net 221.12.128.0 24 route-policy adcom
q

R2:
bgp 100
peer 4.4.4.4 advertise-community

R3:
bgp 100
peer 5.5.5.5 advertise-community

R4:
bgp 100

peer 192.168.46.6 advertise-community

R5:
bgp 100
peer 192.168.58.8 advertise-community

R6 :
ip community-filter 10 permit 100:200
route-policy 10 deny node 10
if-match community-filter 10
route-policy 10 permit node 20
bgp 200
peer 192.168.46.4 route-policy 10 import
q

R8:
ip community-filter 10 permit 100:400
route-policy 10 deny node 10
if-match community-filter 10
route-policy 10 permit node 20
bgp 400
peer 192.168.58.5 route-policy 10 import
q

R6 dis bgp routing-table
*> 115.192.0.0/24 192.168.67.7 0 30
0 400 100i
*> 221.12.128.0 192.168.46.4 0 10
0i

R8　dis bgp routing-table
*>　115.192.0.0/24　　192.168.58.5　　0
100i
*>　221.12.128.0　　192.168.78.7　　0
300 200 100i

路由聚合以及路径选择

在 R4 和 R5 进行 4 条指定路由的聚合，聚合后的条目为 2000:0:0:70:: /62，同时为了防止环路并且实现优先走 AS 200 的需求，需要进行明细路由的抑制以及属性的修改。
在没有聚合前在 R1 看到的是 4 条明细
dis bgp ipv6 routing　，
2000:0:0:70::　2000:0:0:71:: 2000:0:0:72::　2000:0:0:73::

R4:
ip ipv6-prefix ag permit 2000:0:0:70:: 62

route-policy ag permit node 10
if-match ipv6 address prefix-list ag
apply local-preference 200
route-policy ag permit node 20
bgp 100
ipv6-family unicast
aggregate 2000:0:0:70:: 62 as-set detail-suppressed attribut
e-policy ag
q

R5:
bgp 100

ipv6-family unicast
aggregate 2000:0:0:70:: 62 as-set detail-suppressed
q

在 R1 上查看 dis bgp ipv6 routi
只有聚合后的路由，local pre 也修改为 200 ，明细没有

*>i Network : 2000:0:0:70:: PrefixLen : 62
NextHop : 2000::4 LocPrf : 200
MED :
PrefVal : 0
Label :
Path/Ogn : i

负载分担配置
在 R1 上配置 IBGP 邻居的负载分担功能，同时由于两条 10.1.7.0/24 路由的 AS_Path 属性内容不同，需要关闭形成负载分担时比较 AS_Path 属性的机制。
R1：
bgp 100
maximum load-balancing 2
load-balancing as-path-ignore
q

在 R1 上查看 dis ip routing-table 在全局路由表中，有两个下一跳

7.7.7.0/24 IBGP 255 0 RD 4.4.4.4 GigabitEthernet0/0/0
IBGP 255 0 RD 5.5.5.5 GigabitEthernet0/0/1