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一、环境准备

1. 软件：GNS3

2. 路由：c7200

二、实验操作

实验要求：

1、 掌握路由重分发的配置基本步骤。

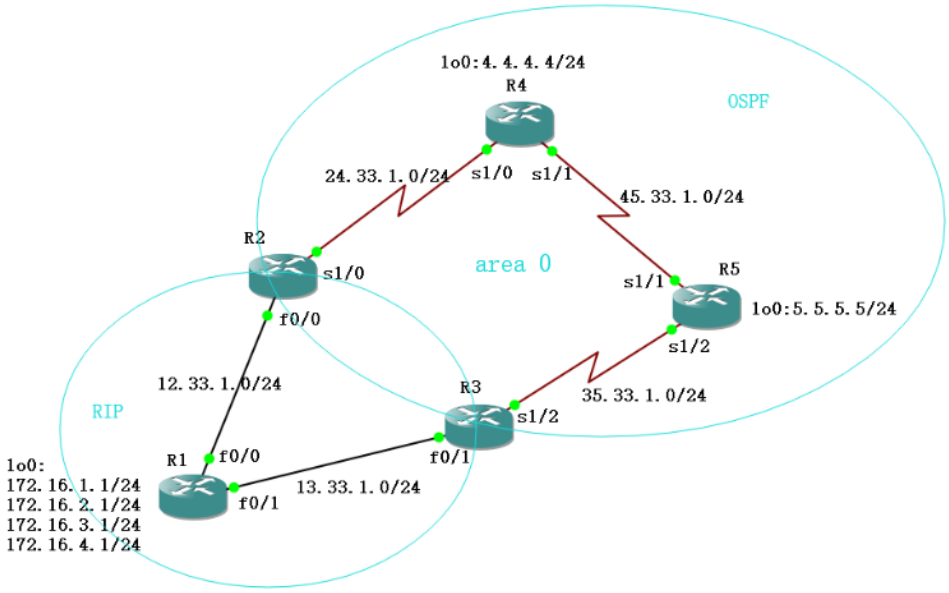
2、 掌握通过修改管理距离解决重发布选择次佳路由问题。

3、 掌握基于 distribute 命令的路由过滤配置方法。

4、 掌握基于 Route-map 的路由过滤配置方法。

5、 掌握 route-map 的命令语法。

实验拓扑：



实验过程：

1、 根据实验拓扑，对路由器各接口配置 IP 地址。

R1 各接口：

```
R1#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            12.33.1.1       YES manual up                    up
FastEthernet0/1            13.33.1.1       YES manual up                    up
Serial1/0                  unassigned      YES unset  administratively down down
Serial1/1                  unassigned      YES unset  administratively down down
Serial1/2                  unassigned      YES unset  administratively down down
Serial1/3                  unassigned      YES unset  administratively down down
SSLVPN-VIF0                unassigned      NO  unset  up                    up
Loopback0                  172.16.1.1      YES manual up                    up
R1#
```

R2 各接口：

```
R2#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            12.33.1.2       YES manual up                    up
FastEthernet0/1            unassigned      YES unset  administratively down down
Serial1/0                  24.33.1.2       YES manual up                    up
Serial1/1                  unassigned      YES unset  administratively down down
Serial1/2                  unassigned      YES unset  administratively down down
Serial1/3                  unassigned      YES unset  administratively down down
SSLVPN-VIF0                unassigned      NO  unset  up                    up
R2#
```

R3 各接口：

```
R3#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            unassigned      YES unset  administratively down down
FastEthernet0/1            13.33.1.3       YES manual up                    up
Serial1/0                  unassigned      YES unset  administratively down down
Serial1/1                  unassigned      YES unset  administratively down down
Serial1/2                  35.33.1.3       YES manual up                    up
Serial1/3                  unassigned      YES unset  administratively down down
SSLVPN-VIF0                unassigned      NO  unset  up                    up
R3#
```

R4 各接口：

```
R4#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            unassigned      YES unset  administratively down down
FastEthernet0/1            unassigned      YES unset  administratively down down
Serial1/0                  24.33.1.4       YES manual up                    up
Serial1/1                  45.33.1.4       YES manual up                    up
Serial1/2                  unassigned      YES unset  administratively down down
Serial1/3                  unassigned      YES unset  administratively down down
SSLVPN-VIF0                unassigned      NO  unset  up                    up
Loopback0                  4.4.4.4         YES manual up                    up
R4#
```

R5 各接口：

```
R5#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            unassigned      YES unset  administratively down down
FastEthernet0/1            unassigned      YES unset  administratively down down
Serial1/0                  unassigned      YES unset  administratively down down
Serial1/1                  45.33.1.5       YES manual up                    up
Serial1/2                  35.33.1.5       YES manual up                    up
Serial1/3                  unassigned      YES unset  administratively down down
SSLVPN-VIF0                unassigned      NO  unset  up                    up
Loopback0                  5.5.5.5         YES manual up                    up
R5#
```

2、 在路由器 R1、R2、R3 上配置 RIPv2 协议，关闭自动汇总。

3、 在路由器 R2、R3、R4、R5 上配置 OSPF 协议，进程号为自己学号后 3 位，区域号为 0。

4、 在路由器 R2 和 R3 上做路由重分发。

参考命令如下：

```
R2(config)#router rip

R2(config-router)#redistribute ospf 33 metric 10

R2(config)#router ospf 33

R2(config-router)#redistribute rip metric 33 metric-type 1 subnets

R3(config)#router rip

R3(config-router)#redistribute ospf 33 metric 10

R3(config)#router ospf 33

R3(config-router)#redistribute rip metric 33 metric-type 1 subnets
```

5、 查看 R2 和 R3 的路由表

问题 1：在 R2 和 R3 中所看到的路由表到达 172.16.2.0 的下一条地址分别是多少？根据拓扑结构是否为最佳路由？将非最佳路由条目截图。

答：R2 到达 172.16.2.0 的下一条地址是：12.33.1.1（最佳路由）、R3 到达 172.16.2.0 的下一条地址是：35.33.1.5（非最佳路由）

```
Gateway of last resort is not set

     35.0.0.0/24 is subnetted, 1 subnets
C       35.33.1.0 is directly connected, Serial1/2
     4.0.0.0/32 is subnetted, 1 subnets
O       4.4.4.4 [110/129] via 35.33.1.5, 00:04:12, Serial1/2
     5.0.0.0/32 is subnetted, 1 subnets
O       5.5.5.5 [110/65] via 35.33.1.5, 00:04:12, Serial1/2
     172.16.0.0/24 is subnetted, 4 subnets
O E1    172.16.4.0 [110/225] via 35.33.1.5, 00:02:52, Serial1/2
O E1    172.16.1.0 [110/225] via 35.33.1.5, 00:02:52, Serial1/2
O E1    172.16.2.0 [110/225] via 35.33.1.5, 00:02:52, Serial1/2
O E1    172.16.3.0 [110/225] via 35.33.1.5, 00:02:52, Serial1/2
     24.0.0.0/24 is subnetted, 1 subnets
O       24.33.1.0 [110/192] via 35.33.1.5, 00:04:12, Serial1/2
     12.0.0.0/24 is subnetted, 1 subnets
O E1    12.33.1.0 [110/225] via 35.33.1.5, 00:02:57, Serial1/2
     13.0.0.0/24 is subnetted, 1 subnets
C       13.33.1.0 is directly connected, FastEthernet0/1
     45.0.0.0/24 is subnetted, 1 subnets
O       45.33.1.0 [110/128] via 35.33.1.5, 00:04:17, Serial1/2
R3#
R3#
```

6、 为了解决此问题，我们可以通过修改本地某条路由的管理距离来强制路由器选择最佳路由。

参考命令如下：

```
R2(config)#access-list 33 permit 172.16.0.0 0.0.255.255

R2(config)#access-list 33 permit 13.33.1.0 0.0.0.255

R2(config)#access-list 33 permit 12.33.1.0 0.0.0.255

R2(config)#router rip

R2(config-router)#distance 33 12.33.1.1 0.0.0.0 33
```

```
R3(config)#access-list 33 permit 172.16.0.0 0.0.255.255

R3(config)#access-list 33 permit 13.33.1.0 0.0.0.255

R3(config)#access-list 33 permit 12.33.1.0 0.0.0.255

R3(config)#router rip

R3(config-router)#distance 33 13.33.1.1 0.0.0.0 33
```

问题 2：在路由器 R2 和 R3 中查看路由表，和刚才有什么不同？

```
Gateway of last resort is not set

     35.0.0.0/24 is subnetted, 1 subnets
O       35.33.1.0 [110/192] via 24.33.1.4, 00:39:01, Serial1/0
     4.0.0.0/32 is subnetted, 1 subnets
O       4.4.4.4 [110/65] via 24.33.1.4, 00:39:01, Serial1/0
     5.0.0.0/32 is subnetted, 1 subnets
O       5.5.5.5 [110/129] via 24.33.1.4, 00:39:01, Serial1/0
     172.16.0.0/24 is subnetted, 4 subnets
R       172.16.4.0 [33/1] via 12.33.1.1, 00:00:13, FastEthernet0/0
R       172.16.1.0 [33/1] via 12.33.1.1, 00:00:13, FastEthernet0/0
R       172.16.2.0 [33/1] via 12.33.1.1, 00:00:13, FastEthernet0/0
R       172.16.3.0 [33/1] via 12.33.1.1, 00:00:13, FastEthernet0/0
     24.0.0.0/24 is subnetted, 1 subnets
C       24.33.1.0 is directly connected, Serial1/0
     12.0.0.0/24 is subnetted, 1 subnets
C       12.33.1.0 is directly connected, FastEthernet0/0
     13.0.0.0/24 is subnetted, 1 subnets
R       13.33.1.0 [33/1] via 12.33.1.1, 00:00:14, FastEthernet0/0
     45.0.0.0/24 is subnetted, 1 subnets
O       45.33.1.0 [110/128] via 24.33.1.4, 00:39:03, Serial1/0
R2#
R2#
```

```
Gateway of last resort is not set

     35.0.0.0/24 is subnetted, 1 subnets
C       35.33.1.0 is directly connected, Serial1/2
     4.0.0.0/32 is subnetted, 1 subnets
O       4.4.4.4 [110/129] via 35.33.1.5, 00:04:16, Serial1/2
     5.0.0.0/32 is subnetted, 1 subnets
O       5.5.5.5 [110/65] via 35.33.1.5, 00:04:16, Serial1/2
     172.16.0.0/24 is subnetted, 4 subnets
R       172.16.4.0 [33/1] via 13.33.1.1, 00:00:14, FastEthernet0/1
R       172.16.1.0 [33/1] via 13.33.1.1, 00:00:14, FastEthernet0/1
R       172.16.2.0 [33/1] via 13.33.1.1, 00:00:14, FastEthernet0/1
R       172.16.3.0 [33/1] via 13.33.1.1, 00:00:14, FastEthernet0/1
     24.0.0.0/24 is subnetted, 1 subnets
O       24.33.1.0 [110/192] via 35.33.1.5, 00:04:16, Serial1/2
     12.0.0.0/24 is subnetted, 1 subnets
R       12.33.1.0 [33/1] via 13.33.1.1, 00:00:15, FastEthernet0/1
     13.0.0.0/24 is subnetted, 1 subnets
C       13.33.1.0 is directly connected, FastEthernet0/1
     45.0.0.0/24 is subnetted, 1 subnets
O       45.33.1.0 [110/128] via 35.33.1.5, 00:04:17, Serial1/2
R3#
R3#
```

答：R2 和 R3 到达 172.16.2.0 的路由均为最佳

7、 根据需要在 R2 和 R3 上使用分发列表过滤 RIP 路由。

参考命令如下：

```
R2(config)#access-list 34 deny 172.16.1.0 0.0.0.255


R2(config)#access-list 34 deny 172.16.2.0 0.0.0.255


R2(config)#access-list 34 permit any
```

```
R2(config)#router ospf 33

R2(config-router)#distribute-list 34 out rip
```

参考 R2 的配置，在路由器 R3 中做同样的配置。

问题 3：查看路由器 R4 的路由表，还能否看到 172.16.1.0 和 172.16.2.0 的路由表选项？

```
Gateway of last resort is not set

     35.0.0.0/24 is subnetted, 1 subnets
O       35.33.1.0 [110/128] via 45.33.1.5, 00:53:23, Serial1/1
     4.0.0.0/24 is subnetted, 1 subnets
C       4.4.4.0 is directly connected, Loopback0
     5.0.0.0/32 is subnetted, 1 subnets
O       5.5.5.5 [110/65] via 45.33.1.5, 00:53:23, Serial1/1
     172.16.0.0/24 is subnetted, 2 subnets
O E1    172.16.4.0 [110/97] via 24.33.1.2, 00:14:53, Serial1/0
O E1    172.16.3.0 [110/97] via 24.33.1.2, 00:14:53, Serial1/0
     24.0.0.0/24 is subnetted, 1 subnets
C       24.33.1.0 is directly connected, Serial1/0
     12.0.0.0/24 is subnetted, 1 subnets
O E1    12.33.1.0 [110/97] via 24.33.1.2, 00:51:53, Serial1/0
     13.0.0.0/24 is subnetted, 1 subnets
O E1    13.33.1.0 [110/97] via 24.33.1.2, 00:14:54, Serial1/0
     45.0.0.0/24 is subnetted, 1 subnets
C       45.33.1.0 is directly connected, Serial1/1
R4#
R4#
R4#
```

答：不能看到 172.16.1.0 和 172.16.2.0 的路由表选项。

问题 4：查看路由器 R1 的路由表，从 OSPF 重分发过来的路由是否合理？截图并说明。

```
Gateway of last resort is not set

     35.0.0.0/24 is subnetted, 1 subnets
R       35.33.1.0 [120/10] via 13.33.1.3, 00:00:19, FastEthernet0/1
                  [120/10] via 12.33.1.2, 00:00:03, FastEthernet0/0
     4.0.0.0/32 is subnetted, 1 subnets
R       4.4.4.4 [120/10] via 13.33.1.3, 00:00:03, FastEthernet0/1
                [120/10] via 12.33.1.2, 00:00:03, FastEthernet0/0
     5.0.0.0/32 is subnetted, 1 subnets
R       5.5.5.5 [120/10] via 13.33.1.3, 00:00:03, FastEthernet0/1
                [120/10] via 12.33.1.2, 00:00:03, FastEthernet0/0
     172.16.0.0/24 is subnetted, 4 subnets
C       172.16.4.0 is directly connected, Loopback0
C       172.16.1.0 is directly connected, Loopback0
C       172.16.2.0 is directly connected, Loopback0
C       172.16.3.0 is directly connected, Loopback0
     24.0.0.0/24 is subnetted, 1 subnets
R       24.33.1.0 [120/10] via 13.33.1.3, 00:00:04, FastEthernet0/1
                  [120/10] via 12.33.1.2, 00:00:20, FastEthernet0/0
     12.0.0.0/24 is subnetted, 1 subnets
C       12.33.1.0 is directly connected, FastEthernet0/0
     13.0.0.0/24 is subnetted, 1 subnets
C       13.33.1.0 is directly connected, FastEthernet0/1
     45.0.0.0/24 is subnetted, 1 subnets
R       45.33.1.0 [120/10] via 13.33.1.3, 00:00:04, FastEthernet0/1
                  [120/10] via 12.33.1.2, 00:00:04, FastEthernet0/0
R1#
```

答：从 OSPF 重分发过来的路由合理，因为从 OSPF 重分发过来的路由条目都是最佳路由（管理距离都是 120、metric 值都是 10）。

8、 根据拓扑的需要，在 R2 和 R3 上使用 route-map 配置路由过滤，以过滤 OSPF 的路由。

参考命令如下：

```
R2(config)#access-list 35 permit 24.33.1.0 0.0.0.255

R2(config)#access-list 36 permit 4.4.4.0 0.0.0.255

R2(config)#access-list 36 permit 45.33.1.0 0.0.0.255

R2(config)#access-list 37 permit 5.5.5.0 0.0.0.255

R2(config)#access-list 37 permit 35.33.1.0 0.0.0.255

R2(config)#route-map xcu permit 10

R2(config-route-map)#match ip address 35

R2(config-route-map)#set metric 3
```

```
R2(config)#route-map xcu permit 20

R2(config-route-map)#match ip address 36

R2(config-route-map)#set metric 4

R2(config)#route-map xcu permit 30

R2(config-route-map)#match ip address 37

R2(config-route-map)#set metric 5

R2(config)#router rip

R2(config-router)#redistribute ospf 33 route-map xcu
```

参考 R2 的配置，在路由器 R3 中做同样的配置。

```
R3(config)#access-list 35 permit 35.33.1.0 0.0.0.255

R3(config)#access-list 36 permit 5.5.5.0 0.0.0.255

R3(config)#access-list 36 permit 45.33.1.0 0.0.0.255

R3(config)#access-list 37 permit 4.4.4.0 0.0.0.255

R3(config)#access-list 37 permit 24.33.1.0 0.0.0.255

R3(config)#route-map xcu permit 10

R3(config-route-map)#match ip address 35

R3(config-route-map)#set metric 3

R3(config)#route-map xcu permit 20
```

```
R3(config-route-map)#match ip address 36

R3(config-route-map)#set metric 4

R3(config)#route-map xcu permit 30

R3(config-route-map)#match ip address 37

R3(config-route-map)#set metric 5

R3(config)#router rip

R3(config-router)#redistribute ospf 33 route-map xcu
```

问题 5：查看路由器 R1 的路由表，和刚才有什么不同？理解 route-map 在重分发路由中的作用。

```
Gateway of last resort is not set

     35.0.0.0/24 is subnetted, 1 subnets
R       35.33.1.0 [120/3] via 13.33.1.3, 00:00:20, FastEthernet0/1
     4.0.0.0/32 is subnetted, 1 subnets
R       4.4.4.4 [120/4] via 12.33.1.2, 00:00:15, FastEthernet0/0
     5.0.0.0/32 is subnetted, 1 subnets
R       5.5.5.5 [120/4] via 13.33.1.3, 00:00:20, FastEthernet0/1
     172.16.0.0/24 is subnetted, 4 subnets
C       172.16.4.0 is directly connected, Loopback0
C       172.16.1.0 is directly connected, Loopback0
C       172.16.2.0 is directly connected, Loopback0
C       172.16.3.0 is directly connected, Loopback0
     24.0.0.0/24 is subnetted, 1 subnets
R       24.33.1.0 [120/3] via 12.33.1.2, 00:00:15, FastEthernet0/0
     12.0.0.0/24 is subnetted, 1 subnets
C       12.33.1.0 is directly connected, FastEthernet0/0
     13.0.0.0/24 is subnetted, 1 subnets
C       13.33.1.0 is directly connected, FastEthernet0/1
     45.0.0.0/24 is subnetted, 1 subnets
R       45.33.1.0 [120/4] via 13.33.1.3, 00:00:21, FastEthernet0/1
                  [120/4] via 12.33.1.2, 00:00:16, FastEthernet0/0
R1#
R1#
```

答：R1 到达网络 35.33.1.0、5.5.5.0、4.4.4.0、24.33.1.0 的最佳路由都变成了一条。route-map 在重分发路由中可以起到路由过滤的作用。