**利用mpls解决BGP路由黑洞配置命令全解析**

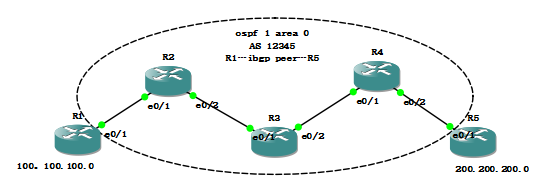
**——By Jim**

**什么是BGP路由黑洞？**

**BGP规定无论路由器是否启动bgp都要无条件地转发BGP消息和更新包（凌驾于IGP之上），违背了IGP“非igp路由器阻断igp域”的原则，因而辗转造成了BGP路由器“居然ping不通路由表中的条目”的现象，也就是所谓的路由黑洞。**

**本实验用gns3模拟器3640路由器完成，笔者将配置全拷贝，读者按图搭建拓扑后直接右击复制命令行即可完成实验。**

**实验拓扑：**



**第一步：底层基础配置**

**R1:**

**int e0/1**

**no shu**

**ip add 12.12.12.1 255.255.255.0**

**int loo 0**

**ip add 1.1.1.1 255.255.255.0**

**int loo 100**

**ip add 100.100.100.1 255.255.255.0**

**router os 1**

**router-id 1.1.1.1**

**net 12.12.12.1 255.255.255.0 a 0**

**net 1.1.1.1 255.255.255.0 a 0**

**！**

**！**

**！**

**R2:**

**int e0/1**

**no shu**

**ip add 12.12.12.2 255.255.255.0**

**int e0/2**

**no shu**

**ip add 23.23.23.2 255.255.255.0**

**no shu**

**int loo 0**

**ip add 2.2.2.2 255.255.255.0**

**router os 1**

**router-id 2.2.2.2**

**net 12.12.12.2 255.255.255.0 a 0**

**net 2.2.2.2 255.255.255.0 a 0**

**net 23.23.23.2 255.255.255.0 a 0**

**！**

**！**

**!**

**R3:**

**int e0/1**

**ip add 23.23.23.3 255.255.255.0**

**int e0/2**

**ip add 34.34.34.3 255.255.255.0**

**int lo 0**

**ip add 3.3.3.3 255.255.255.0**

**router os 1**

**router-id 3.3.3.3**

**net 23.23.23.3 255.255.255.0 a 0**

**net 34.34.34.3 255.255.255.0 a 0**

**net 3.3.3.3 255.255.255.0 a 0**

**！**

**！**

**！**

**R4**

**int e0/1**

**no shu**

**ip add 34.34.34.4 255.255.255.0**

**int e0/2**

**no shu**

**ip add 45.45.45.4 255.255.255.0**

**int loo 0**

**ip add 4.4.4.4 255.255.255.0**

**ROUTER OS 1**

**router-id 4.4.4.4**

**net 34.34.34.4 255.255.255.0 a 0**

**net 45.45.45.4 255.255.255.0 a 0**

**net 4.4.4.4 255.255.255.0 a 0**

**！**

**！**

**！**

**R5**

**int e0/1**

**no shu**

**ip add 45.45.45.5 255.255.255.0**

**int loo 0**

**ip add 5.5.5.5 255.255.255.0**

**int loo 200**

**ip add 200.200.200.1 255.255.255.0**

**router os 1**

**router-id 5.5.5.5**

**net 45.45.45.5 255.255.255.0 a 0**

**net 5.5.5.5 255.255.255.0 a 0**

**！**

**！**

**！**

**！**

**第二步：进行bgp的配置**

**R1**

**router bgp 12345**

**no au**

**no syn**

**bgp router-id 1.1.1.1**

**neighbor 5.5.5.5 remote-as 12345**

**neighbor 5.5.5.5 update-source loo 0**

**neighbor 5.5.5.5 next-hop-self**

**net 100.100.100.0 mask 255.255.255.0**

**！**

**！**

**！**

**R5：**

**router bgp 12345**

**no au**

**no syn**

**bgp router-id 5.5.5.5**

**neighbor 1.1.1.1 remote-as 12345**

**neighbor 1.1.1.1 update-source loopback 0**

**neighbor 1.1.1.1 next-hop-self**

**net 200.200.200.0 mask 255.255.255.0**

**！**

**！**

**！**

**=====================================================================**

**！**

**！**

**！**

**第三步：校验**

**R1#show ip route bgp**

**B 200.200.200.0/24 [200/0] via 5.5.5.5, 00:55:29**

**！**

**R5#show ip route bgp**

**100.0.0.0/24 is subnetted, 1 subnets**

**B 100.100.100.0 [200/0] via 1.1.1.1, 00:57:47**

**此时R1和R5都通过BGP学到了AS外的路由。**

**但是！！！**

**R1#ping 200.200.200.0**

**Type escape sequence to abort.**

**Sending 5, 100-byte ICMP Echos to 200.200.200.0, timeout is 2 seconds:**

**UUUUU**

**Success rate is 0 percent (0/5)**

**!**

**R1#trace 200.200.200.0**

**Type escape sequence to abort.**

**Tracing the route to 200.200.200.0**

**1 12.12.12.2 36 msec 56 msec 16 msec**

**2 12.12.12.2 !H !H !H**

**同理，R5也ping不通100.100.100.0，直接原因都是卡在第一条。**

**根本原因：出现了路由黑洞，R2R3R4上没有自治系统外的路由条目，收到该路由包直接丢弃！**

**第四步：配置mpls ldp**

**R1：**

**mpls ldp router-id loopback 0**

**mpls label range 100 199**

**int e0/1**

**mpls ip**

**！**

**！**

**！**

**R2：**

**mpls ldp router-id loopback 0**

**mpls label range 200 299**

**int e0/1**

**mpls ip**

**int e0/2**

**mpls ip**

**！**

**！**

**！**

**！**

**R3：**

**mpls ldp router-id loopback 0**

**mpls label range 300 399**

**int e0/1**

**mpls ip**

**int e0/2**

**mpls ip**

**!**

**!**

**!**

**R4：**

**mpls ldp router-id loopback 0**

**mpls label range 400 499**

**int e0/1**

**mpls ip**

**int e0/2**

**mpls ip**

**!**

**!**

**!**

**!**

**R5：**

**mpls ldp router-id loo 0**

**mpls label range 500 599**

**int e0/1**

**mpls ip**

**=====================================================================**

**第五步：验证**

**R1#ping 200.200.200.0**

**Type escape sequence to abort.**

**Sending 5, 100-byte ICMP Echos to 200.200.200.0, timeout is 2 seconds:**

**!!!!!**

**Success rate is 100 percent (5/5), round-trip min/avg/max = 104/128/176 ms**

**!**

**!**

**R1#trace 200.200.200.0**

**Type escape sequence to abort.**

**Tracing the route to 200.200.200.0**

**1 12.12.12.2 [MPLS: Label 204 Exp 0] 120 msec 112 msec 136 msec**

**2 23.23.23.3 [MPLS: Label 303 Exp 0] 124 msec 120 msec 128 msec**

**3 34.34.34.4 [MPLS: Label 403 Exp 0] 108 msec 92 msec 112 msec**

**4 45.45.45.5 124 msec 140 msec 124 msec**

**同理R5也能ping通100.100.100.0**

**……………………成功…………………………**