RIP 协议实验报告

组长： 刘育麟 181250090
组员 1：陈泔錞 181250010
组员 2：冯鑫泽 181250031
组员 3：陆张驰 181250095
组员 4：蒋沂霄 181250059

1 实验目的：

实现一个有回路的拓扑，验证 RIP 协议能够有效阻止路由回路。

2 实验要求：

（1） 实现的拓扑能够以 PT5.x 版本的模拟器上打开。
（2） 设计拓扑后，验证 RIP 协议能够有效阻止路由回路。

3 实验环境

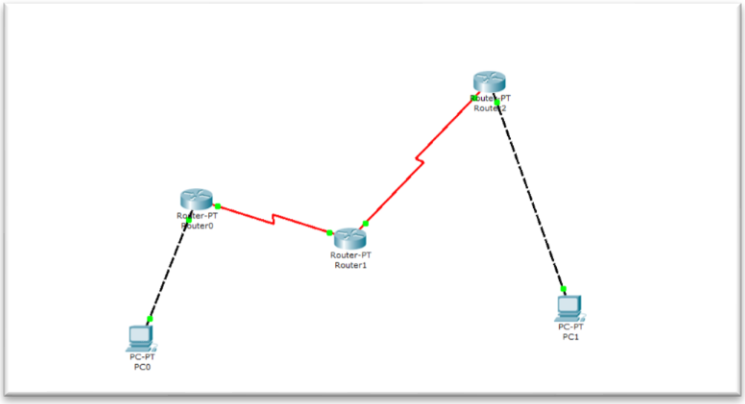
（1） 软件环境：安装了 Windows 系统的计算机
（2） 硬件环境：路由器，pc 等。（详见实验步骤中的实验设备）

4 实验步骤

4.1 实验设备

PC：两台
Router：三台
交叉线
直连线

4.2 实验拓扑



4.3 IP 地址规划

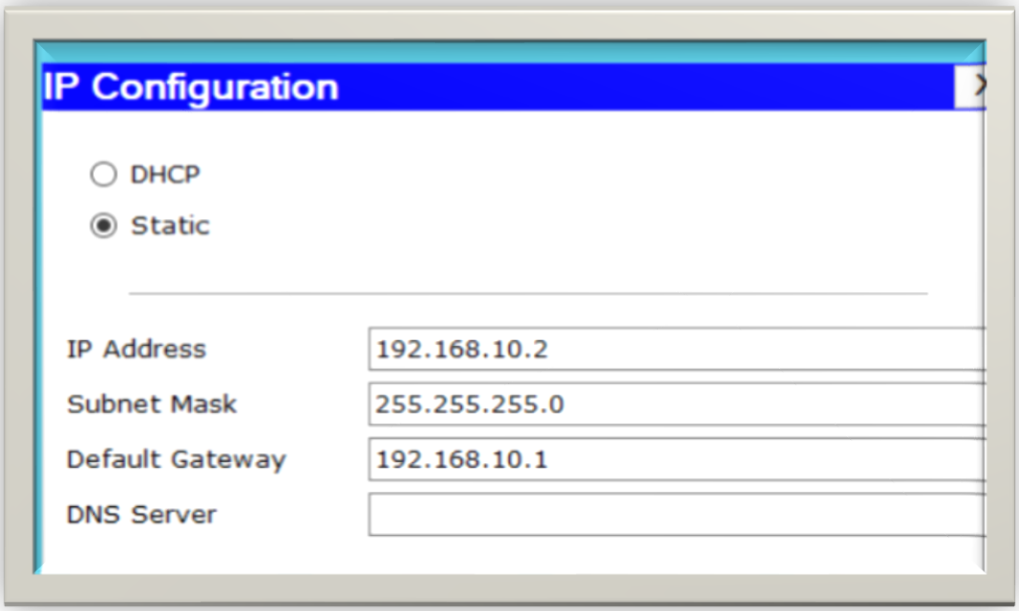
设备名称	端口	地址
PC0	FastEthernet	192.168.10.2

PC1	FastEthernet	192.168.40.2
路由器 0	FastEthernet0/0 Serial2/0	192.168.10.1 192.168.20.1
路由器 1	Serial2/0 Serial3/0	192.168.20.2 192.168.30.1
路由器 2	FastEthernet0/0 Serial3/0	192.168.40.1 192.168.30.2

4.4 拓扑准备

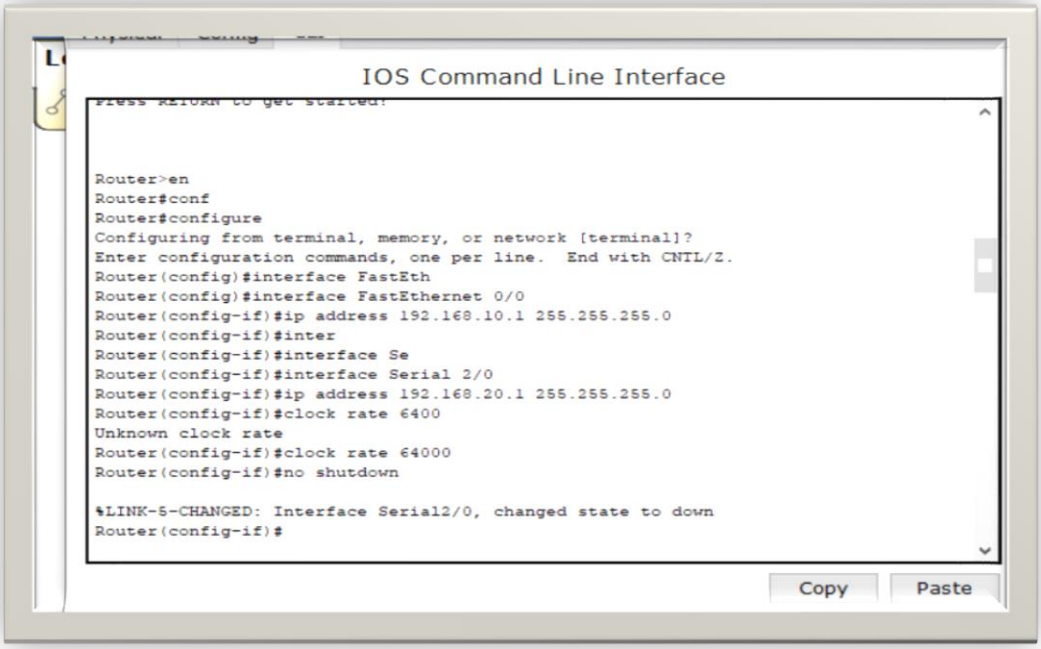
（1）如图连接拓扑图

（2）分别为 PC0,PC1 配置 IP 地址，以及默认网关。



（以 pc0 为例）

（3） 打开路由器 0 的 FastEthernet0/0 端口，设置 IP 地址为 192.168.10.1。并将 Serial2/0 端口打开，设置 Clock Rate 64000, IP Address:192.168.20.1。打开路由器 1 的 Serial2/0、3/0 端口，设置 Clock Rate 64000, IP Address 分别为 192.168.20.2、192.168.30.1。打开路由器 2FastEthernet0/0 端口，设置 IP 地址为 192.168.40.1；并将 Serial3/0 端口打开，设置 Clock Rate 64000, IP Address:192.168.30.2。

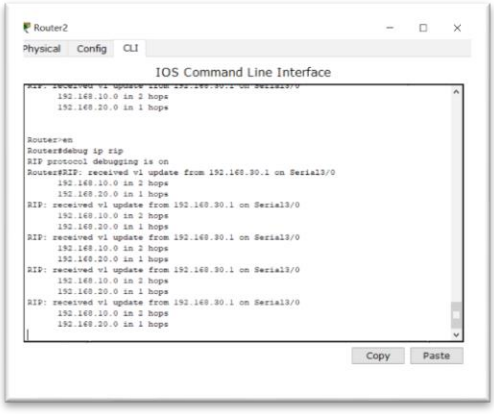


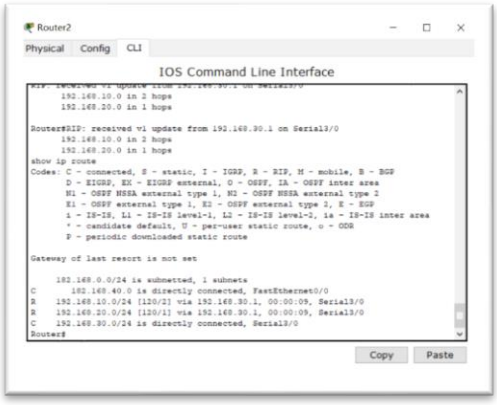
（以 Router0 为例）

（4） R0, R1, R2 打开 rip，以 R0 为例。

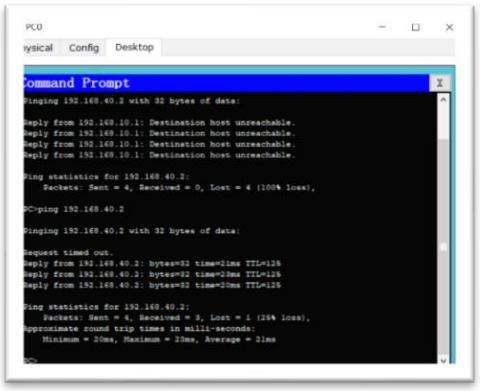
```
Router(config)#router rip
Router(config-router)#network 192.168.10.0
Router(config-router)#network 192.168.20.0
```

（5） 在 R2 中开启 debug 模式，并查看路由表。





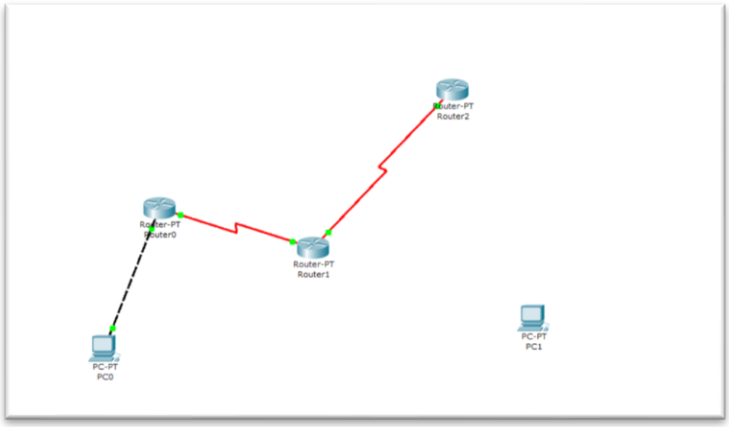
（6） PC0 ping PC1，说明拓扑无误。



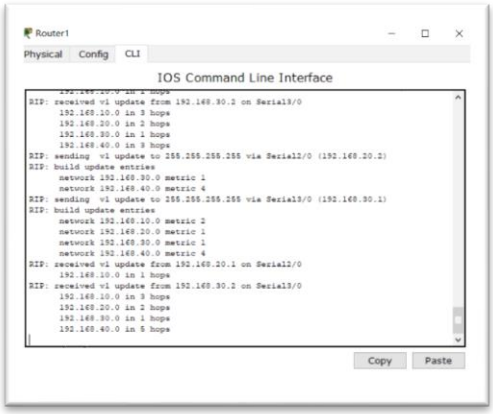
4.5 构造路由回路

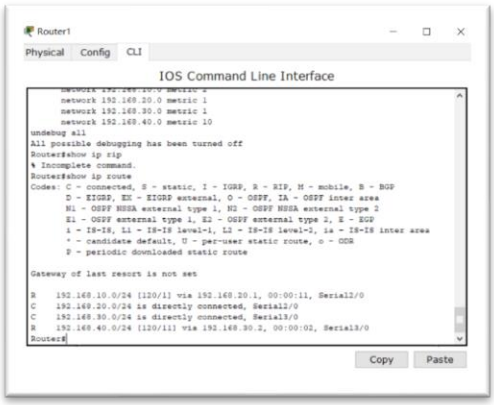
（1）为了构造路由回路，我们需要先关闭 R1 与 R2 之间的水平分割。

（2）将 PC1 与 R2 之间的链路断开

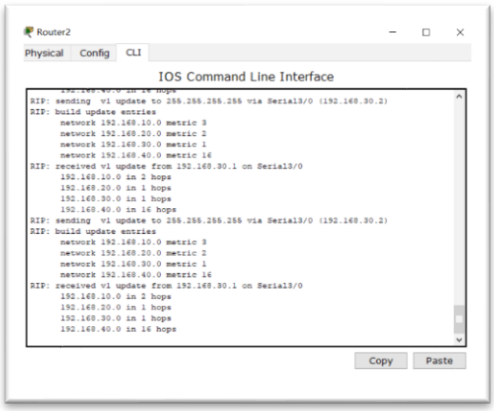


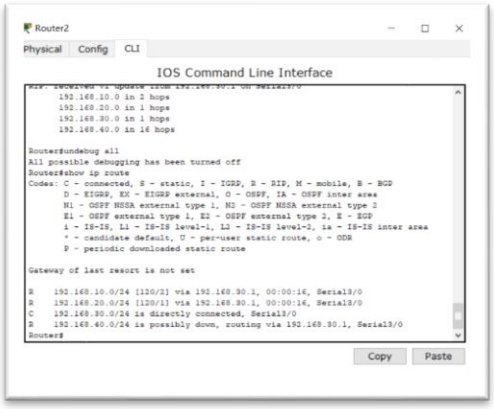
（3） 在 debug 模式下观察 R1，R2 的 rip 及路由表。


Router1
Physical
Config
CLI
IOS Command Line Interface
RIP: received v1 update from 192.168.30.2 on Serial3/0
192.168.10.0 in 3 hops
192.168.20.0 in 2 hops
192.168.30.0 in 1 hops
192.168.40.0 in 3 hops
RIP: sending v1 update to 255.255.255.255 via Serial2/0 (192.168.20.2)
RIP: build update entries
network 192.168.30.0 metric 1
network 192.168.40.0 metric 4
RIP: sending v1 update to 255.255.255.255 via Serial3/0 (192.168.30.1)
RIP: build update entries
network 192.168.10.0 metric 2
network 192.168.20.0 metric 1
network 192.168.30.0 metric 1
network 192.168.40.0 metric 4
RIP: received v1 update from 192.168.20.1 on Serial2/0
192.168.10.0 in 1 hops
RIP: received v1 update from 192.168.30.2 on Serial3/0
192.168.10.0 in 3 hops
192.168.20.0 in 2 hops
192.168.30.0 in 1 hops
192.168.40.0 in 5 hops
Copy
Paste


Router1
Physical
Config
CLI
IOS Command Line Interface
network 192.168.20.0 metric 1
network 192.168.30.0 metric 1
network 192.168.40.0 metric 10
undebug all
All possible debugging has been turned off
Router#show ip rip
% Incomplete command.
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
Gateway of last resort is not set
R 192.168.10.0/24 [120/1] via 192.168.20.1, 00:00:11, Serial2/0
C 192.168.20.0/24 is directly connected, Serial2/0
C 192.168.30.0/24 is directly connected, Serial3/0
R 192.168.40.0/24 [120/1] via 192.168.30.2, 00:00:02, Serial3/0
Router#
Copy
Paste

（R1 的路由表）


Router2
Physical
Config
CLI
IOS Command Line Interface
RIP: sending v1 update to 255.255.255.255 via Serial3/0 (192.168.30.2)
RIP: build update entries
network 192.168.10.0 metric 3
network 192.168.20.0 metric 2
network 192.168.30.0 metric 1
network 192.168.40.0 metric 16
RIP: received v1 update from 192.168.30.1 on Serial3/0
192.168.10.0 in 2 hops
192.168.20.0 in 1 hops
192.168.30.0 in 1 hops
192.168.40.0 in 16 hops
RIP: sending v1 update to 255.255.255.255 via Serial3/0 (192.168.30.2)
RIP: build update entries
network 192.168.10.0 metric 3
network 192.168.20.0 metric 2
network 192.168.30.0 metric 1
network 192.168.40.0 metric 16
RIP: received v1 update from 192.168.30.1 on Serial3/0
192.168.10.0 in 2 hops
192.168.20.0 in 1 hops
192.168.30.0 in 1 hops
192.168.40.0 in 16 hops
Copy
Paste

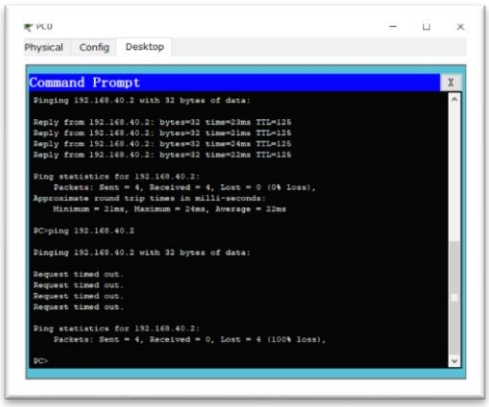


（R2 的路由表）

（4） 由以上几图可以看出

路由器	目的网段	下一路由器
R1	192.168.40.0	R2
R2	192.168.40.0	R1

（5） 进入模拟模式，PC0 上 ping PC1（192.168.40.2）可以看到 ICMP 包在 R1,R2 间不断传递，这就造成了路由回路，产生超时。



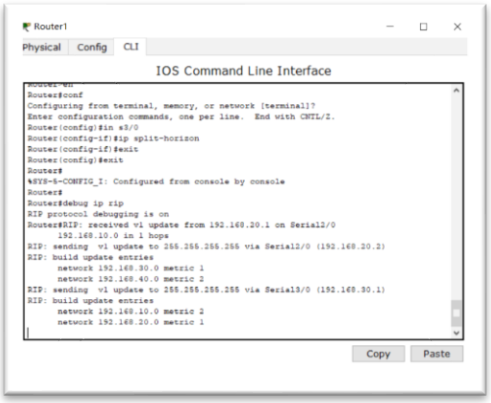
4.6 RIP 协议避免路由回路

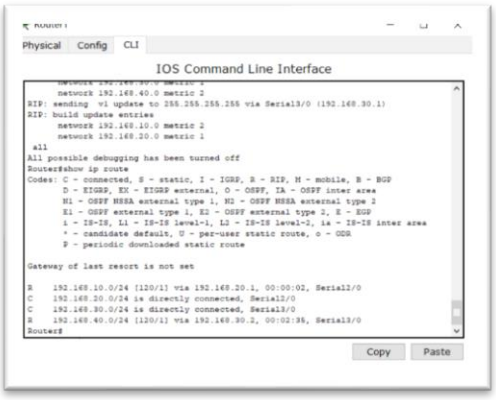
（1）恢复链路，并开启 R2,R1 之间的水平分割

```
Router>en
Router#conf
Configuring from terminal, memory, or network [terminal]?
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#in s3/0
Router(config-if)#ip split-horizon
Router(config-if)#
```

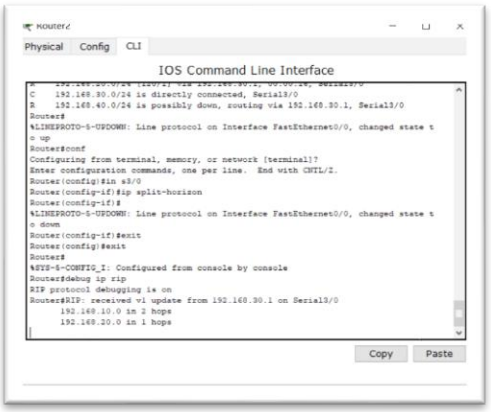
（2）断开 PC1 与 R2 之间的链路

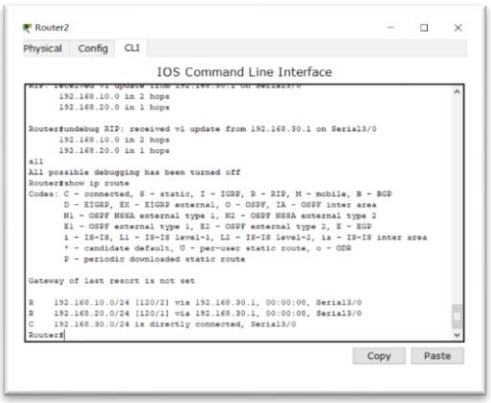
（3）在 debug 模式下观察 R2,R3 的 rip 及路由表


Router1
Physical
Config
CLI
IOS Command Line Interface
Router#conf
Configuring from terminal, memory, or network [terminal]?
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#in s3/0
Router(config-if)#ip split-horizon
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
Router#
Router#debug ip rip
RIP protocol debugging is on
Router#RIP: received v1 update from 192.168.20.1 on Serial2/0
192.168.10.0 in 1 hops
RIP: sending v1 update to 255.255.255.255 via Serial2/0 (192.168.20.2)
RIP: build update entries
network 192.168.30.0 metric 1
network 192.168.40.0 metric 2
RIP: sending v1 update to 255.255.255.255 via Serial3/0 (192.168.30.1)
RIP: build update entries
network 192.168.10.0 metric 2
network 192.168.20.0 metric 1
Copy
Paste


Physical
Config
CLI
IOS Command Line Interface
network 192.168.40.0 metric 2
RIP: sending v1 update to 255.255.255.255 via Serial3/0 (192.168.30.1)
RIP: build update entries
network 192.168.10.0 metric 2
network 192.168.20.0 metric 1
all
All possible debugging has been turned off
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
Gateway of last resort is not set
R 192.168.10.0/24 [120/1] via 192.168.20.1, 00:00:02, Serial2/0
C 192.168.20.0/24 is directly connected, Serial2/0
C 192.168.30.0/24 is directly connected, Serial3/0
R 192.168.40.0/24 [120/1] via 192.168.30.2, 00:02:36, Serial3/0
Router#
Copy
Paste

（图为 R1 的例子）

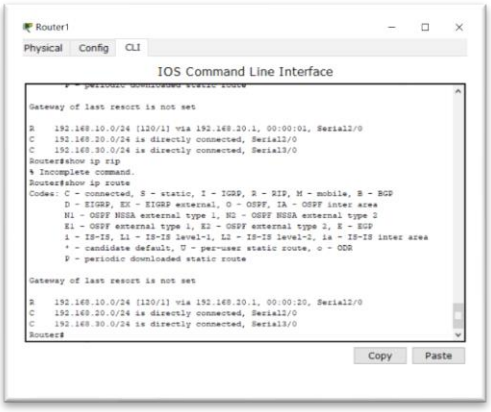

Physical
Config
CLI
IOS Command Line Interface
C 192.168.30.0/24 is directly connected, Serial3/0
R 192.168.40.0/24 is possibly down, routing via 192.168.30.1, Serial3/0
Router#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state t
o up
Router#conf
Configuring from terminal, memory, or network [terminal]?
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#in s3/0
Router(config-if)#ip split-horizon
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state t
o down
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
Router#debug ip rip
RIP protocol debugging is on
Router#RIP: received v1 update from 192.168.30.1 on Serial3/0
192.168.10.0 in 2 hops
192.168.20.0 in 1 hops
Copy
Paste


Router2
Physical
Config
CLI
IOS Command Line Interface
192.168.10.0 in 2 hops
192.168.20.0 in 1 hops
Router#undebug RIP: received v1 update from 192.168.30.1 on Serial3/0
192.168.10.0 in 2 hops
192.168.20.0 in 1 hops
all
All possible debugging has been turned off
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
Gateway of last resort is not set
R 192.168.10.0/24 [120/2] via 192.168.30.1, 00:00:08, Serial3/0
R 192.168.20.0/24 [120/1] via 192.168.30.1, 00:00:08, Serial3/0
C 192.168.30.0/24 is directly connected, Serial3/0
Router#
Copy
Paste

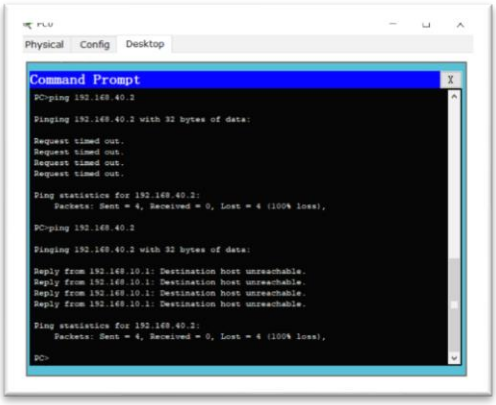
（图为 R2 的例子）

从上图我们可以发现，开启水平分割后 R2 不会收到 R1 关于 192.168.40.0 的信息，R1 也不会向 R2 发送 192.168.40.0 的信息。

（4）180 秒后，查看 R1 的路由表



（6） 此时，在 PC0 上 ping 192.168.40.2



5 实验结论

RIP 协议可以避免路由回路。