实验 RIP 路由协议基本配置

【实验名称】

RIP 路由协议基本配置。

【实验目的】

掌握在路由器上如何配置 RIP 路由协议。

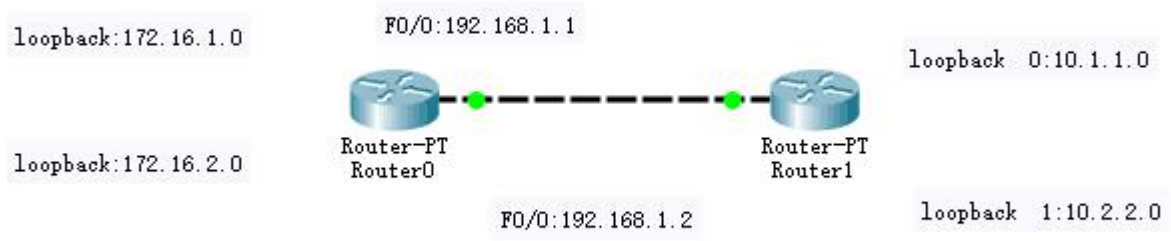
【背景描述】

假设在校园网在地理上分为 2 个区域，每个区域内分别有一台路由器连接了 2 个子网，
需要将两台路由器通过以太网链路连接在一起并进行适当的配置，以实现这 4 个子网之间的
互联互通。为了在未来每个校园区域扩充子网数量的时候，管理员不需要同时更改路由器的
配置，计划使用 RIP 路由协议实现子网之间的互通。

【需求分析】

两台路由器通过快速以太网端口连接在一起，每个路由器上设置 2 个 Loopback 端口模
拟子网，在所有端口运行 RIP 路由协议，实现所有子网间的互通。

【实验拓扑】



【实验设备】

路由器 2 台

【预备知识】

路由器的工作原理和基本配置方法，距离矢量路由协议，RIP 工作原理和配置方法

【实验原理】

RIP（Routing Information Protocols，路由信息协议）是应用较早、使用较普遍的 IGP（Interior Gateway Protocol，内部网关协议），适用于小型同类网络，是典型的距离矢量（distance-vector）协议。

RIP 协议以跳数做为衡量路径开销的，RIP 协议里规定最大跳数为 15。

RIP 在构造路由表时会使用到 3 种计时器：更新计时器、无效计时器、刷新计时器。它让每台路由器周期性地向每个相邻的邻居发送完整的路由表。路由表包括每个网络或子网的信息，以及与之相关的度量值。

【实验步骤】

第一步：配置两台路由器的主机名、接口 **IP** 地址

```
RSR20#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RSR20(config)#hostname RouterA
RouterA(config)#
RouterA(config)#interface fastEthernet 0/0
RouterA(config-if)#ip address 192.168.1.1 255.255.255.0
RouterA(config-if)#no shutdown
RouterA(config-if)#exit
RouterA(config)#
RouterA(config)#interface loopback 0
RouterA(config-if)#Aug 15 23:46:32 RouterA %7:%LINE PROTOCOL CHANGE:
Interface Loopback 0, changed state to UP
RouterA(config-if)#ip address 172.16.1.1 255.255.255.0
RouterA(config-if)#exit
RouterA(config)#
RouterA(config)#interface loopback 1
RouterA(config-if)#Aug 15 23:47:00 RouterA %7:%LINE PROTOCOL CHANGE:
Interface Loopback 1, changed state to UP
RouterA(config-if)#ip address 172.16.2.1 255.255.255.0
RouterA(config-if)#exit
RSR20#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
RSR20(config)#hostname RouterB
RouterB(config)#
RouterB(config)#interface fastEthernet 0/0
RouterB(config-if)#ip address 192.168.1.2 255.255.255.0
RouterB(config-if)#no shutdown
RouterB(config-if)#exit
RouterB(config)#
RouterB(config)#interface loopback 0
RouterB(config-if)#Aug 8 21:00:00 RouterB %7:%LINE PROTOCOL CHANGE:
Interface Loopback 0, changed state to UP
RouterB(config-if)#ip address 10.1.1.1 255.255.255.0
RouterB(config-if)#exit
RouterB(config)#
RouterB(config)#interface loopback 1
RouterB(config-if)#Aug 8 21:00:28 RouterB %7:%LINE PROTOCOL CHANGE:
Interface Loopback 1, changed state to UP
RouterB(config-if)#ip address 10.2.2.1 255.255.255.0 RouterB(config-if)#exit
```

第二步：在两台路由器上配置 **RIP** 路由协议

```
RouterA(config)#router rip
RouterA(config-router)#network 192.168.1.0
```

RouterA(config-router)#network 172.16.1.0
RouterA(config-router)#exit
RouterB(config)#router rip
RouterB(config-router)#network 192.168.1.0
RouterB(config-router)#network 10.0.0.0
RouterB(config-router)#exit

第三步：查看 **RIP** 配置信息，路由表

RouterA#show ip route
Codes: C - connected, S - static, R - RIP B - BGP
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
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default
Gateway of last resort is no set
R 10.0.0.0/8 [120/1] via 192.168.1.2, 00:00:17, FastEthernet 0/0
C 172.16.1.0/24 is directly connected, Loopback 0
C 172.16.1.1/32 is local host.
C 172.16.2.0/24 is directly connected, Loopback 1
C 172.16.2.1/32 is local host.
C 192.168.1.0/24 is directly connected, FastEthernet 0/0
C 192.168.1.1/32 is local host.
RouterA# show ip protocols #显示路由器上当前开启并运行的路由协议
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 21 seconds
Invalid after 180 seconds, flushed after 120 seconds
Outgoing update filter list for all interface is: not set
Incoming update filter list for all interface is: not set
Default redistribution metric is 1
Redistributing:
Default version control: send version 1, receive any version
Interface Send Recv Key-chain
FastEthernet 0/0 1 1 2
Loopback 0 1 1 2
Loopback 1 1 1 2
Routing for Networks: 172.16.0.0
192.168.1.0
Distance: (default is 120)
RouterA#
RouterB#show ip route
Codes: C - connected, S - static, R - RIP B - BGP
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
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default
Gateway of last resort is no set
C 10.1.1.0/24 is directly connected, Loopback 0
C 10.1.1.1/32 is local host.
C 10.2.2.0/24 is directly connected, Loopback 1
C 10.2.2.1/32 is local host.
R 172.16.0.0/16 [120/1] via 192.168.1.1, 00:00:12, FastEthernet 0/0
C 192.168.1.0/24 is directly connected, FastEthernet 0/0
C 192.168.1.2/32 is local host.
RouterA#show ip rip database
10.0.0.0/8 auto-summary
10.0.0.0/8
[1] via 192.168.1.2 FastEthernet 0/0 00:09
172.16.0.0/16 auto-summary
172.16.1.0/24
[1] directly connected, Loopback 0
172.16.2.0/24
[1] directly connected, Loopback 1
192.168.1.0/24 auto-summary
192.168.1.0/24
[1] directly connected, FastEthernet 0/0

RouterB#show ip rip database
10.0.0.0/8 auto-summary
10.1.1.0/24
[1] directly connected, Loopback 0
10.2.2.0/24
[1] directly connected, Loopback 1
172.16.0.0/16 auto-summary
172.16.0.0/16
[1] via 192.168.1.1 FastEthernet 0/0 00:08
192.168.1.0/24 auto-summary
192.168.1.0/24
[1] directly connected, FastEthernet 0/0

第四步：测试网络连通性

RouterA#ping 10.1.1.1
Sending 5, 100-byte ICMP Echoes to 10.1.1.1, timeout is 2 seconds:
< press Ctrl+C to break >
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
RouterA#ping 10.2.2.1

Sending 5, 100-byte ICMP Echoes to 10.2.2.1, timeout is 2 seconds:
< press Ctrl+C to break >
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/10 ms
RouterB#ping 172.16.1.1
Sending 5, 100-byte ICMP Echoes to 172.16.1.1, timeout is 2 seconds:
< press Ctrl+C to break >
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
RouterB#ping 172.16.2.1
Sending 5, 100-byte ICMP Echoes to 172.16.2.1, timeout is 2 seconds:
< press Ctrl+C to break >
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms

第五步：用 debug 命令观察路由器接收和发生路由更新的情况

下面是一个完整的 RIP 路由器接收更新和发送更新的过程，从中可以看到 RouterB 接收到了 RouterA 发送的更新，其中包含一条路由信息 172.16.0.0（可以看到水平分割原则的作用），然后刷新了路由表。

RouterB 本身发送的更新报文则在 Fa0/0、Lo0 和 Lo1 三个端口发出，采用广播的方式，广播地址分别为 192.168.1.255，10.1.1.255，10.2.2.255，使用 UDP 的 520 端口。在水平分割的原则下，每个端口发送的路由信息均不相同。

RouterB#debug ip rip
Aug 8 21:06:08 RouterB %7: [RIP] RIP recveived packet, sock=2125
src=192.168.1.1 len=24
Aug 8 21:06:08 RouterB %7: [RIP] Cancel peer remove timer
Aug 8 21:06:08 RouterB %7:[RIP] Peer remove timer shedule...
Aug 8 21:06:08 RouterB %7: route-entry: family 2 ip 172.16.0.0 metric 1
Aug 8 21:06:08 RouterB %7: [RIP] Received version 1 response packet
Aug 8 21:06:08 RouterB %7: [RIP] Translate mask to 16
Aug 8 21:06:08 RouterB %7: [RIP] Old path is: nhop=192.168.1.1
routesrc=192.168.1.1 intf=1
Aug 8 21:06:08 RouterB %7: [RIP] New path is: nhop=192.168.1.1
routesrc=192.168.1.1
Aug 8 21:06:08 RouterB %7: [RIP] [172.16.0.0/16] RIP route refresh!
Aug 8 21:06:08 RouterB %7: [RIP] [172.16.0.0/16] RIP distance apply from
192.168.1.1!
Aug 8 21:06:08 RouterB %7: [RIP] [172.16.0.0/16] ready to refresh kernel...
Aug 8 21:06:08 RouterB %7: [RIP] NSM refresh: IPv4 RIP Route 172.16.0.0/16 distance=120 metric=1 nexthop_num=1 distance=120 nexhop=192.168.1.1 ifindex=1
Aug 8 21:06:08 RouterB %7: [RIP] [172.16.0.0/16] cancel route timer
Aug 8 21:06:08 RouterB %7: [RIP] [172.16.0.0/16] route timer schedule...
Aug 8 21:06:23 RouterB %7: [RIP] Output timer expired to send reponse

Aug 8 21:06:23 RouterB %7: [RIP] Prepare to send BROADCAST response...
Aug 8 21:06:23 RouterB %7: [RIP] Building update entries on FastEthernet 0/0
Aug 8 21:06:23 RouterB %7: network 10.0.0.0 metric 1
Aug 8 21:06:23 RouterB %7: [RIP] **Send packet to 192.168.1.255 Port 520 on FastEthernet 0/0**
Aug 8 21:06:23 RouterB %7: [RIP] Prepare to send BROADCAST response...
Aug 8 21:06:23 RouterB %7: [RIP] Building update entries on Loopback 0
Aug 8 21:06:23 RouterB %7: network 10.2.2.0 metric 1
Aug 8 21:06:23 RouterB %7: network 172.16.0.0 metric 2
Aug 8 21:06:23 RouterB %7: network 192.168.1.0 metric 1
Aug 8 21:06:23 RouterB %7: [RIP] **Send packet to 10.1.1.255 Port 520 on Loopback 0**
Aug 8 21:06:23 RouterB %7: [RIP] Prepare to send BROADCAST response... **Aug 8 21:06:23 RouterB %7: [RIP] Building update entries on Loopback 1**
Aug 8 21:06:23 RouterB %7: network 10.1.1.0 metric 1
Aug 8 21:06:23 RouterB %7: network 172.16.0.0 metric 2
Aug 8 21:06:23 RouterB %7: network 192.168.1.0 metric 1
Aug 8 21:06:23 RouterB %7: [RIP] **Send packet to 10.2.2.255 Port 520 on Loopback 1**
Aug 8 21:06:23 RouterB %7: [RIP] Schedule response send timer

【注意事项】

1、配置 RIP 的 Network 命令时只支持 A、B、C 的主网络号，如果写入子网则自动转为主网络号。

2、No auto-summary 功能只有在 RIPv2 支持。

【参考配置】

RouterA#show running-config
Building configuration...
Current configuration : 612 bytes
!
version RGNOS 10.1.00(4), Release(18443)(Tue Jul 17 20:50:30 CST 2007 -ubu1server)
hostname RouterA
!
interface FastEthernet 0/0
ip address 192.168.1.1 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet 0/1
duplex auto
speed auto
!
interface Loopback 0
ip address 172.16.1.1 255.255.255.0

!
interface Loopback 1
ip address 172.16.2.1 255.255.255.0
!
router rip
network 172.16.0.0
network 192.168.1.0
!
line con 0 line aux 0
line vty 0 4
login
!
end

RouterB#show running-config

Building configuration...
Current configuration : 606 bytes
!
version RGNOS 10.1.00(4), Release(18443)(Tue Jul 17 20:50:30 CST 2007
-ubu1server)
hostname RouterB
!
interface FastEthernet 0/0
ip address 192.168.1.2 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet 0/1
duplex auto
speed auto
!
interface Loopback 0
ip address 10.1.1.1 255.255.255.0
!
interface Loopback 1
ip address 10.2.2.1 255.255.255.0
!
router rip
network 10.0.0.0
network 192.168.1.0
!
line con 0
line aux 0
line vty 0 4
login

!
end