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。

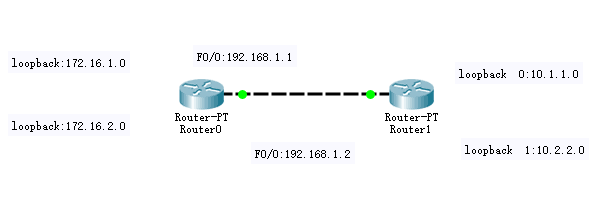
**【背景描述】**

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**

配置路由器Router0，将其命名为RouterA，fastEthernet 0/0的IP地址设置为 192.168.1.1，子网掩码为255.255.255.0；配置一个环回接口 loopback 0，其IP地址和子网掩码为172.16.1.1，255.255.255.0；配置一个环回接口 loopback 1，其IP地址和子网掩码为172.16.2.1，255.255.255.0。

配置路由器Router1，将其命名为RouterB，fastEthernet 0/0的IP地址设置为 192.168.1.2，子网掩码为255.255.255.0；配置一个环回接口 loopback 0，其IP地址和子网掩码为10.1.1.1，255.255.255.0；配置一个环回接口 loopback 1，其IP地址和子网掩码为10.2.2.1，255.255.255.0。

**第二步：在两台路由器上配置 RIP 路由协议**

RouterA(config)# #在RouterA上配置rip协议

RouterA(config-router)#network 192.168.1.0

RouterA(config-router)#network 172.16.1.0

RouterA(config-router)#exit

RouterB(config)# #在RouterB上配置rip协议

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