配置 RIPv2 实现动态路由

难度（最高五星）：★★★　　　　建议学时：2学时

目录

实验说明

任务描述

RIP是Routing Information Protocol（路由信息协议）的简称，是一种较为简单的内部网关协议IGP（Interior Gateway Protocol）。RIP协议被设计用于使用同种技术的中小型网络。

RIP使用跳数（Hop Count）来衡量到达目的地址的距离，称为度量值。在RIP中，缺省情况下，路由设备到与它直接相连网络的跳数为0，通过一个路由设备可达的网络的跳数为1，其余依此类推。也就是说，度量值等于从本网络到达目的网络间的路由设备数量。为限制收敛时间，RIP规定度量值取0～15之间的整数，大于或等于16的跳数被定义为无穷大，即目的网络或主机不可达。由于这个限制，使得RIP不可能在大型网络中得到应用。

完成本任务后，学生会对RIP有一个清晰的了解，可以独立使用RIP组建和配置一个小型网络。

学习目标

完成本任务的学习后，你应当能：

1. 掌握 RIP 的配置方法
2. 掌握 RIP 被动接口的作用
3. 掌握 RIP 分布缺省路由的方法

任务准备

网络拓扑

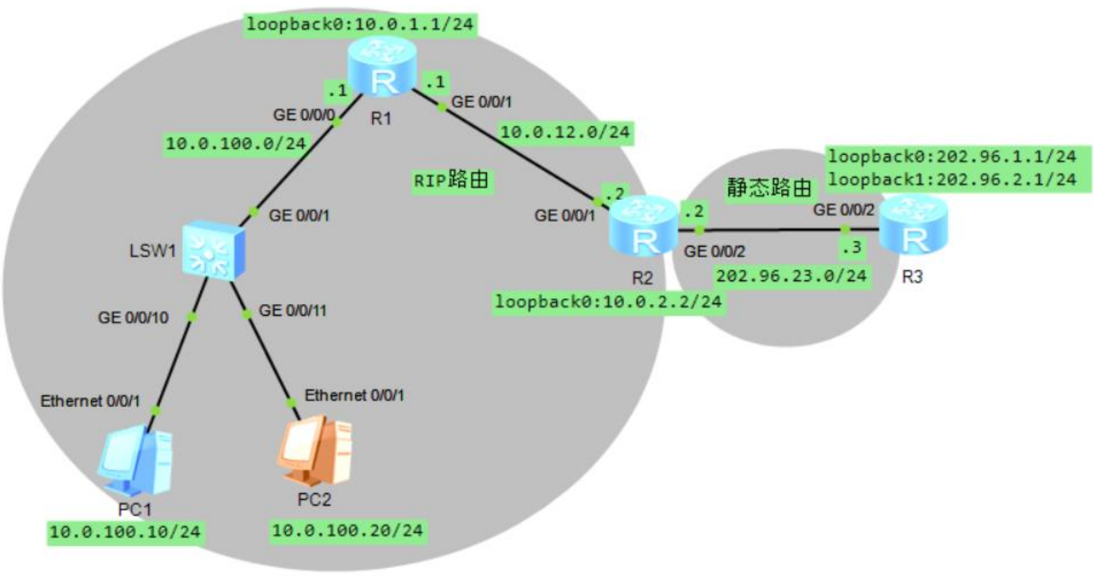

图1 使用RIPv2实现网络互通实验拓扑

初始配置

- R1的初始配置

```
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname R1
[R1]int loopback0
[R1-LoopBack0]ip address 10.0.1.1 24
[R1-LoopBack0]quit
[R1]int g0/0/0
[R1-GigabitEthernet0/0/0]ip address 10.0.100.1 24
[R1-GigabitEthernet0/0/0]quit
[R1]int g0/0/1
[R1-GigabitEthernet0/0/1]ip address 10.0.12.1 24
[R1-GigabitEthernet0/0/1]quit
[R1]
```

- R2的初始配置

```
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname R2
[R2]int loopback0
[R2-LoopBack0]ip address 10.0.2.2 24
[R2-LoopBack0]quit
[R2]int g0/0/1
[R2-GigabitEthernet0/0/1]ip address 10.0.12.2 24
[R2-GigabitEthernet0/0/1]quit
[R2]int g0/0/2
[R2-GigabitEthernet0/0/2]ip address 202.96.23.2 24
[R2-GigabitEthernet0/0/2]quit
[R2]
```

- R3的初始配置

```
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname R3
[R3]int loopback0
[R3-LoopBack0]ip address 202.96.1.1 24
```

```
[R3-LoopBack0]quit
[R3]int loopback1
[R3-LoopBack1]ip address 202.96.2.1 24
[R3-LoopBack1]quit
[R3]int g0/0/2
[R3-GigabitEthernet0/0/2]ip address 202.96.23.3 24
[R3-GigabitEthernet0/0/2]quit
[R3]
[R3]ip route-static 10.0.0.0 255.255.0.0 202.96.23.2
[R3]
```

- PC1和PC2的初始配置，如图2和图3所示。

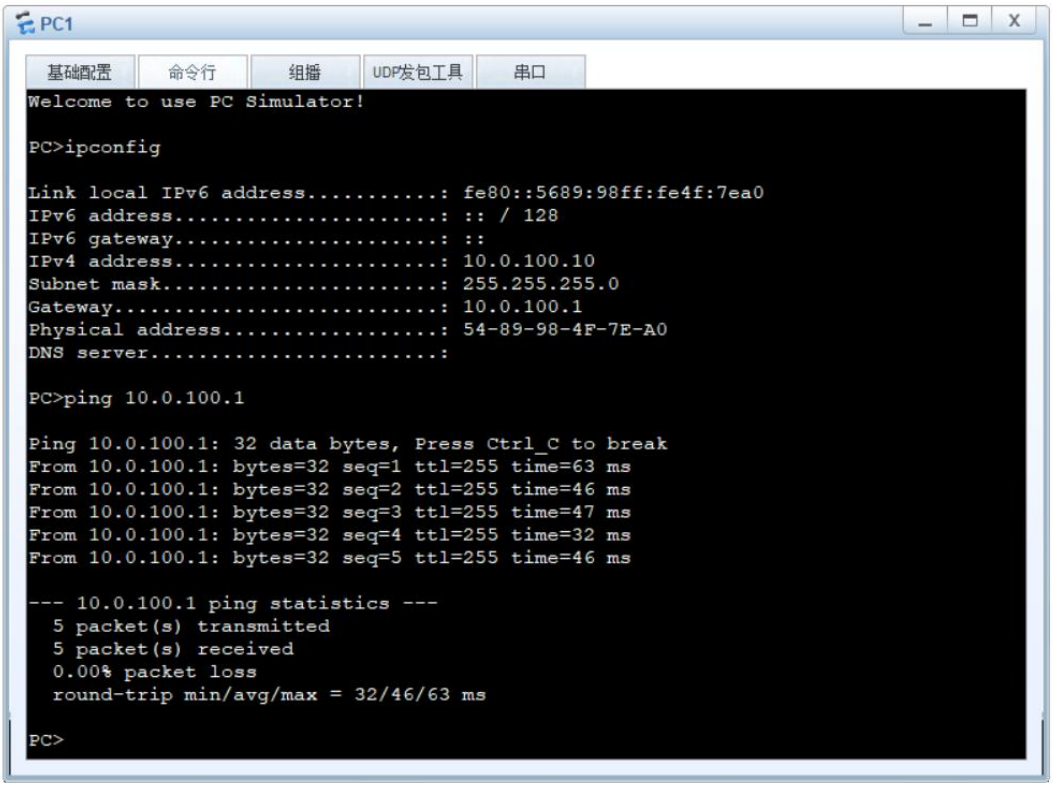

图2 PC1的IP地址

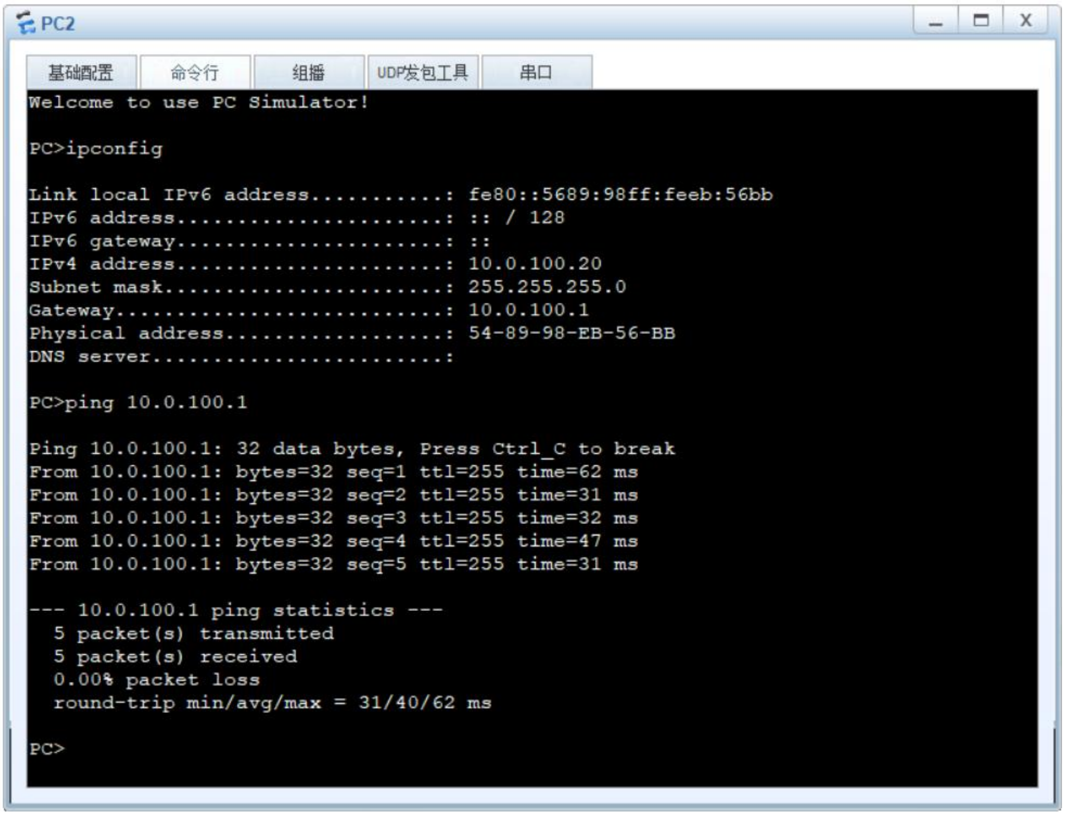

图3 PC2的IP地址

任务实施

1 查看基础配置

在R1、R2和R3上执行display ip interface brief命令，检查接口配置情况。

```
<R1>display ip int brief
*down: administratively down
^down: standby
(l): loopback
(s): spoofing
The number of interface that is UP in Physical is 4
The number of interface that is DOWN in Physical is 1
The number of interface that is UP in Protocol is 4
The number of interface that is DOWN in Protocol is 1

Interface                         IP Address/Mask      Physical   Protocol
GigabitEthernet0/0/0              10.0.100.1/24        up         up
GigabitEthernet0/0/1              10.0.12.1/24         up         up
GigabitEthernet0/0/2              unassigned           down       down
```

```
LoopBack0                   10.0.1.1/24          up          up(s)
NULL0                       unassigned           up          up(s)
<R1>

<R2>display ip int brief
*down: administratively down
^down: standby
(l): loopback
(s): spoofing
The number of interface that is UP in Physical is 4
The number of interface that is DOWN in Physical is 1
The number of interface that is UP in Protocol is 4
The number of interface that is DOWN in Protocol is 1

Interface                   IP Address/Mask      Physical    Protocol
GigabitEthernet0/0/0        unassigned           down        down
GigabitEthernet0/0/1        10.0.12.2/24         up          up
GigabitEthernet0/0/2        202.96.23.2/24       up          up
LoopBack0                   10.0.2.2/24          up          up(s)
NULL0                       unassigned           up          up(s)
<R2>

<R3>display ip int brief
*down: administratively down
^down: standby
(l): loopback
(s): spoofing
The number of interface that is UP in Physical is 4
The number of interface that is DOWN in Physical is 2
The number of interface that is UP in Protocol is 4
The number of interface that is DOWN in Protocol is 2

Interface                   IP Address/Mask      Physical    Protocol
GigabitEthernet0/0/0        unassigned           down        down
GigabitEthernet0/0/1        unassigned           down        down
GigabitEthernet0/0/2        202.96.23.3/24       up          up
LoopBack0                   202.96.1.1/24        up          up(s)
LoopBack1                   202.96.2.1/24        up          up(s)
NULL0                       unassigned           up          up(s)
```

```
<R3>
```

执行ping命令，检测R1与其它设备间的连通性。

```
<R1>ping 10.0.100.10
  PING 10.0.100.10: 56  data bytes, press CTRL_C to break
    Reply from 10.0.100.10: bytes=56 Sequence=1 ttl=128 time=80 ms
    Reply from 10.0.100.10: bytes=56 Sequence=2 ttl=128 time=90 ms
    Reply from 10.0.100.10: bytes=56 Sequence=3 ttl=128 time=100 ms
    Reply from 10.0.100.10: bytes=56 Sequence=4 ttl=128 time=90 ms
    Reply from 10.0.100.10: bytes=56 Sequence=5 ttl=128 time=80 ms

  --- 10.0.100.10 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 80/88/100 ms

<R1>ping 10.0.12.2
  PING 10.0.12.2: 56  data bytes, press CTRL_C to break
    Reply from 10.0.12.2: bytes=56 Sequence=1 ttl=255 time=100 ms
    Reply from 10.0.12.2: bytes=56 Sequence=2 ttl=255 time=80 ms
    Reply from 10.0.12.2: bytes=56 Sequence=3 ttl=255 time=70 ms
    Reply from 10.0.12.2: bytes=56 Sequence=4 ttl=255 time=70 ms
    Reply from 10.0.12.2: bytes=56 Sequence=5 ttl=255 time=30 ms

  --- 10.0.12.2 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 30/70/100 ms
<R1>
```

执行ping命令，检测R2与其它设备间的连通性。

```
<R2>ping 202.96.23.3
  PING 202.96.23.3: 56  data bytes, press CTRL_C to break
    Reply from 202.96.23.3: bytes=56 Sequence=1 ttl=255 time=50 ms
    Reply from 202.96.23.3: bytes=56 Sequence=2 ttl=255 time=20 ms
    Reply from 202.96.23.3: bytes=56 Sequence=3 ttl=255 time=30 ms
    Reply from 202.96.23.3: bytes=56 Sequence=4 ttl=255 time=20 ms
    Reply from 202.96.23.3: bytes=56 Sequence=5 ttl=255 time=30 ms
```

```
 --- 202.96.23.3 ping statistics ---
   5 packet(s) transmitted
   5 packet(s) received
   0.00% packet loss
   round-trip min/avg/max = 20/30/50 ms

<R2>
```

执行display ip routing-table命令，检测R3上配置的静态路由。

```
<R3>display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 14       Routes : 14

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

       10.0.0.0/16  Static  60   0           RD   202.96.23.2 GigabitEthernet 0/0/2
      127.0.0.0/8   Direct  0    0           D   127.0.0.1       InLoopBack0
      127.0.0.1/32  Direct  0    0           D   127.0.0.1       InLoopBack0
127.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0
     202.96.1.0/24  Direct  0    0           D   202.96.1.1      LoopBack0
     202.96.1.1/32  Direct  0    0           D   127.0.0.1       LoopBack0
   202.96.1.255/32  Direct  0    0           D   127.0.0.1       LoopBack0
     202.96.2.0/24  Direct  0    0           D   202.96.2.1      LoopBack1
     202.96.2.1/32  Direct  0    0           D   127.0.0.1       LoopBack1
   202.96.2.255/32  Direct  0    0           D   127.0.0.1       LoopBack1
    202.96.23.0/24  Direct  0    0           D   202.96.23.3  GigabitEthernet 0/0/2
    202.96.23.3/32  Direct  0    0           D   127.0.0.1    GigabitEthernet 0/0/2
  202.96.23.255/32  Direct  0    0           D   127.0.0.1    GigabitEthernet 0/0/2
255.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0

<R3>
```

2 R1 上配置 RIP

RIP只在指定网段上的接口上运行。对于不在指定网段上的接口，RIP不会在它上面接收、发送和转发路由。

```
[R1]rip
[R1-rip-1]version 2
[R1-rip-1]network 10.0.0.0
[R1-rip-1]quit
[R1]
```

3 R2 上配置 RIP

```
[R2]rip
[R2-rip-1]version 2
[R2-rip-1]network 10.0.0.0
[R2-rip-1]quit
[R2]
```

4 验证 RIP 路由

在R1和R2的路由表中，查看当前的RIP路由。

```
[R1]display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 14        Routes : 14

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

       10.0.1.0/24  Direct  0    0           D   10.0.1.1        LoopBack0
       10.0.1.1/32  Direct  0    0           D   127.0.0.1       LoopBack0
     10.0.1.255/32  Direct  0    0           D   127.0.0.1       LoopBack0
       10.0.2.0/24  RIP     100  1           D   10.0.12.2     GigabitEthernet0/0/1
      10.0.12.0/24  Direct  0    0           D   10.0.12.1     GigabitEthernet 0/0/1
      10.0.12.1/32  Direct  0    0           D   127.0.0.1     GigabitEthernet 0/0/1
    10.0.12.255/32  Direct  0    0           D   127.0.0.1     GigabitEthernet 0/0/1
     10.0.100.0/24  Direct  0    0           D   10.0.100.1    GigabitEthernet 0/0/0
     10.0.100.1/32  Direct  0    0           D   127.0.0.1     GigabitEthernet 0/0/0
   10.0.100.255/32  Direct  0    0           D   127.0.0.1     GigabitEthernet 0/0/0
      127.0.0.0/8   Direct  0    0           D   127.0.0.1       InLoopBack0
      127.0.0.1/32  Direct  0    0           D   127.0.0.1       InLoopBack0
127.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0
```

```
255.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0

[R2]display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 15       Routes : 15

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

       10.0.1.0/24  RIP     100  1           D   10.0.12.1     GigabitEthernet 0/0/1
       10.0.2.0/24  Direct  0    0           D   10.0.2.2        LoopBack0
       10.0.2.2/32  Direct  0    0           D   127.0.0.1       LoopBack0
     10.0.2.255/32  Direct  0    0           D   127.0.0.1       LoopBack0
      10.0.12.0/24  Direct  0    0           D   10.0.12.2     GigabitEthernet 0/0/1
      10.0.12.2/32  Direct  0    0           D   127.0.0.1     GigabitEthernet 0/0/1
    10.0.12.255/32  Direct  0    0           D   127.0.0.1     GigabitEthernet 0/0/1
     10.0.100.0/24  RIP     100  1           D   10.0.12.1     GigabitEthernet 0/0/1
      127.0.0.0/8   Direct  0    0           D   127.0.0.1       InLoopBack0
      127.0.0.1/32  Direct  0    0           D   127.0.0.1       InLoopBack0
127.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0
    202.96.23.0/24  Direct  0    0           D   202.96.23.2   GigabitEthernet 0/0/2
    202.96.23.2/32  Direct  0    0           D   127.0.0.1     GigabitEthernet 0/0/2
  202.96.23.255/32  Direct  0    0           D   127.0.0.1     GigabitEthernet 0/0/2
255.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0

[R2]
```

R1和R2路由表中各包含一条RIP路由。其中，Protocol字段的值是RIP，表明该路由是RIP路由。

5 验证网络连通性

在PC1上pingR2的loopback0接口，IP地址为10.0.2.2。

```
PC>ping 10.0.2.2

Ping 10.0.2.2: 32 data bytes, Press Ctrl_C to break
From 10.0.2.2: bytes=32 seq=1 ttl=254 time=62 ms
From 10.0.2.2: bytes=32 seq=2 ttl=254 time=31 ms
```

```
From 10.0.2.2: bytes=32 seq=3 ttl=254 time=47 ms
From 10.0.2.2: bytes=32 seq=4 ttl=254 time=47 ms
From 10.0.2.2: bytes=32 seq=5 ttl=254 time=47 ms

--- 10.0.2.2 ping statistics ---
  5 packet(s) transmitted
  5 packet(s) received
  0.00% packet loss
  round-trip min/avg/max = 31/46/62 ms

PC>
```

执行tracert命令，可以查看数据的传输路径。

```
PC>tracert 10.0.2.2

traceroute to 10.0.2.2, 8 hops max
(ICMP), press Ctrl+C to stop
 1  10.0.100.1   32 ms  46 ms  47 ms
 2  10.0.2.2   47 ms  47 ms  31 ms

PC>
```

6 RIP 被动接口

RIP被动接口用来抑制接口，使其只接收报文，用来更新自己的路由表，而不发送RIP报文。R1的G0/0/0接口连接的终端，因此可以将R1的G0/0/0设置为被动接口，使用该接口不会像终端网络发送RIP消息。

```
[R1]rip
[R1-rip-1]silent-interface g0/0/0
[R1-rip-1]
[R1-rip-1]display this

[V200R003C00]
#
rip 1
 version 2
 network 10.0.0.0
 silent-interface GigabitEthernet0/0/0
#
return
```

```
[R1-rip-1]quit
[R1]
```

7 配置缺省路由实现网络的互通

配置R2访问R3的缺省路由。

```
[R2]ip route-static 0.0.0.0 0.0.0.0 202.96.23.3
[R2]
```

8 验证网络连通性

验证从R2到R3的Loopback0接口网络的连通性。

```
[R2]ping 202.96.1.1
  PING 202.96.1.1: 56  data bytes, press CTRL_C to break
    Reply from 202.96.1.1: bytes=56 Sequence=1 ttl=255 time=30 ms
    Reply from 202.96.1.1: bytes=56 Sequence=2 ttl=255 time=40 ms
    Reply from 202.96.1.1: bytes=56 Sequence=3 ttl=255 time=20 ms
    Reply from 202.96.1.1: bytes=56 Sequence=4 ttl=255 time=20 ms
    Reply from 202.96.1.1: bytes=56 Sequence=5 ttl=255 time=20 ms

  --- 202.96.1.1 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 20/26/40 ms
```

因为R2上已经配置了缺省路由，而且R3上也配置了静态路由，所以R2报文可以Ping通R3。

验证从R1到R3的Loopback0接口网络的连通性。

```
<R1>ping 202.96.1.1
  PING 202.96.1.1: 56  data bytes, press CTRL_C to break
    Request time out
    Request time out
    Request time out
    Request time out
    Request time out

  --- 202.96.1.1 ping statistics ---
    5 packet(s) transmitted
    0 packet(s) received
    100.00% packet loss
```

可以看到，R1上无法ping 通R3的loopback0接口，因为R1没有到达该接口的路由。

9 RIP 发布缺省路由

缺省情况下，RIP不向其邻居发布缺省路由。在实际组网中，可以根据网络部署配置RIP协议发布缺省路由，达到控制路由信息的目的，更好地为网络服务。

在R2的RIP进程下发布缺省路由。

```
[R2]rip
[R2-rip-1]default-route originate cost 2
[R2-rip-1]quit
[R2]
```

查看R1上的RIP路由条目。

```
[R1]display ip routing-table protocol rip
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Public routing table : RIP
         Destinations : 2        Routes : 2

RIP routing table status : <Active>
         Destinations : 2        Routes : 2

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

        0.0.0.0/0   RIP     100  3           D   10.0.12.2    GigabitEthernet 0/0/1
       10.0.2.0/24  RIP     100  1           D   10.0.12.2    GigabitEthernet 0/0/1

RIP routing table status : <Inactive>
         Destinations : 0        Routes : 0

[R1]
```

可以看到，R1的路由表中有一条RIP的默认路由。

10 验证全网连通性

在R1再次ping R3的loopback接口IP地址202.96.1.1。

```
[R1]ping 202.96.1.1
  PING 202.96.1.1: 56  data bytes, press CTRL_C to break
    Reply from 202.96.1.1: bytes=56 Sequence=1 ttl=254 time=20 ms
    Reply from 202.96.1.1: bytes=56 Sequence=2 ttl=254 time=30 ms
```

```
    Reply from 202.96.1.1: bytes=56 Sequence=3 ttl=254 time=30 ms
    Reply from 202.96.1.1: bytes=56 Sequence=4 ttl=254 time=30 ms
    Reply from 202.96.1.1: bytes=56 Sequence=5 ttl=254 time=30 ms

  --- 202.96.1.1 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 20/28/30 ms

[R1]
```

在PC1终端上ping R3的loopback接口IP地址202.96.1.1。

```
PC>ping 202.96.1.1

Ping 202.96.1.1: 32 data bytes, Press Ctrl_C to break
From 202.96.1.1: bytes=32 seq=1 ttl=253 time=63 ms
From 202.96.1.1: bytes=32 seq=2 ttl=253 time=46 ms
From 202.96.1.1: bytes=32 seq=3 ttl=253 time=32 ms
From 202.96.1.1: bytes=32 seq=4 ttl=253 time=31 ms
From 202.96.1.1: bytes=32 seq=5 ttl=253 time=47 ms

--- 202.96.1.1 ping statistics ---
  5 packet(s) transmitted
  5 packet(s) received
  0.00% packet loss
  round-trip min/avg/max = 31/43/63 ms

PC>
```

在PC1上执行tracert命令，查看数据包的转发路径。

```
PC>tracert 202.96.1.1

traceroute to 202.96.1.1, 8 hops max
(ICMP), press Ctrl+C to stop
 1  10.0.100.1   31 ms  47 ms  47 ms
 2  10.0.12.2   31 ms  47 ms  47 ms
 3  202.96.1.1   47 ms  62 ms  63 ms

PC>
```

结果显示报文通过网关R1（10.0.100.1）转发到R2（10.0.12.2），最后到达R3（202.96.1.1）。

结果验证

实验过程中已验证。