实验4-2 配置RIPv1和RIPv2

学习目标

* **理解RIP路由协议的防环机制**
* **掌握RIPv1的配置方法**
* **掌握在特定网络和接口上启用RIP的方法**
* **掌握使用display和debugging命令测试RIP的方法**
* **掌握测试RIP路由网络连通性的方法**
* **掌握RIPv2的配置方法**

拓扑图

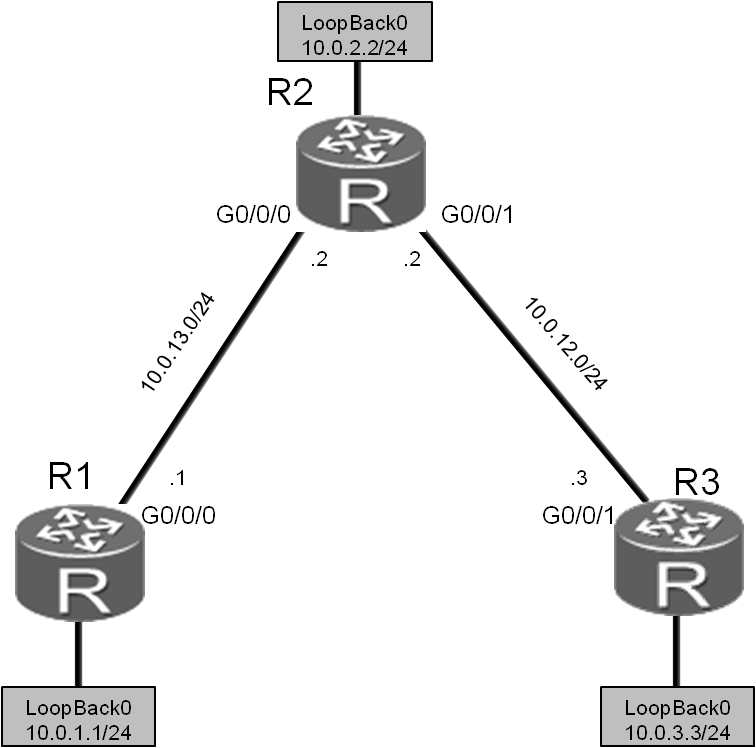


图4.2 配置RIPv1和RIPv2实验拓扑图

场景

您是公司的网络管理员。您所管理的小型网络中包含三台路由器，并规划了五个网络。您需要在网络中配置RIP路由协议来实现路由信息的相互传输。最初使用的是RIPv1，后来发现RIPv2更有优势，于是决定优化网络，使用RIPv2。

操作步骤

1. 实验环境准备

如果本任务中您使用的是空配置设备，需要从步骤1开始配置，然后跳过步骤2。如果使用的设备包含上一个实验的配置，请直接从步骤2开始配置。

<Huawei>system-view

Enter system view, return user view with Ctrl+Z.

[Huawei]sysname R1

[R1]interface GigabitEthernet 0/0/0

[R1-GigabitEthernet0/0/0]ip address 10.0.13.1 24

[R1-GigabitEthernet0/0/0]quit

[R1]interface LoopBack 0

[R1-LoopBack0]ip address 10.0.1.1 24

<Huawei>system-view

Enter system view, return user view with Ctrl+Z.

[Huawei]sysname R2

[R2]interface GigabitEthernet 0/0/1

[R2-GigabitEthernet0/0/1]ip address 10.0.12.2 24

[R2-GigabitEthernet0/0/1]quit

[R2]interface LoopBack 0

[R2-LoopBack0]ip address 10.0.2.2 24

<Huawei>system-view

Enter system view, return user view with Ctrl+Z.

[Huawei]sysname R3

[R3]interface LoopBack 0

[R3-LoopBack0]ip address 10.0.3.3 24

1. 清除设备上原有的配置

清除上一个实验中的静态路由配置并关闭无关的接口。

[R1]interface GigabitEthernet0/0/1

[R1-GigabitEthernet0/0/1]shutdown

[R1-GigabitEthernet0/0/1]quit

[R1]interface GigabitEthernet0/0/0

[R1-GigabitEthernet0/0/0]undo shutdown

[R1-GigabitEthernet0/0/0]quit

[R1]undo ip route-static 0.0.0.0 0.0.0.0

[R1]undo ip route-static 10.0.3.0 255.255.255.0

[R1]undo ip route-static 10.0.12.0 255.255.255.0

[R2]interface GigabitEthernet 0/0/2

[R2-GigabitEthernet0/0/2]shutdown

[R2-GigabitEthernet0/0/2]quit

[R2]undo ip route-static 10.0.3.0 255.255.255.0

[R2]undo ip route-static 10.0.13.0 255.255.255.0

[R3]interface GigabitEthernet 0/0/2

[R3-GigabitEthernet0/0/2]shutdown

[R3-GigabitEthernet0/0/2]quit

[R3]undo ip route-static 10.0.12.0 255.255.255.0

1. 配置IP地址

为R2和R3配置如下IP地址。

[R2]interface GigabitEthernet 0/0/0

[R2-GigabitEthernet0/0/0]ip address 10.0.13.2 24

[R3]interface GigabitEthernet0/0/1

[R3-GigabitEthernet0/0/1]ip address 10.0.12.3 24

测试R1与R2间的连通性。

<R1>ping 10.0.13.2

PING 10.0.13.2: 56 data bytes, press CTRL\_C to break

Reply from 10.0.13.2: bytes=56 Sequence=1 ttl=255 time=30 ms

Reply from 10.0.13.2: bytes=56 Sequence=2 ttl=255 time=30 ms

Reply from 10.0.13.2: bytes=56 Sequence=3 ttl=255 time=30 ms

Reply from 10.0.13.2: bytes=56 Sequence=4 ttl=255 time=30 ms

Reply from 10.0.13.2: bytes=56 Sequence=5 ttl=255 time=30 ms

--- 10.0.13.2 ping statistics ---

5 packet(s) transmitted

5 packet(s) received

0.00% packet loss

round-trip min/avg/max = 30/30/30 ms

测试R2与R3间的连通性。

<R2>ping 10.0.12.3

PING 10.0.12.2: 56 data bytes, press CTRL\_C to break

Reply from 10.0.12.3: bytes=56 Sequence=1 ttl=255 time=31 ms

Reply from 10.0.12.3: bytes=56 Sequence=2 ttl=255 time=31 ms

Reply from 10.0.12.3: bytes=56 Sequence=3 ttl=255 time=41 ms

Reply from 10.0.12.3: bytes=56 Sequence=4 ttl=255 time=31 ms

Reply from 10.0.12.3: bytes=56 Sequence=5 ttl=255 time=41 ms

--- 10.0.12.3 ping statistics ---

5 packet(s) transmitted

5 packet(s) received

0.00% packet loss

round-trip min/avg/max = 31/35/41 ms

1. 配置RIPv1协议

在R1上启动RIP协议，并将10.0.0.0网段发布到RIP协议中。

[R1]rip 1

[R1-rip-1]network 10.0.0.0

在R2上启动RIP协议，并将10.0.0.0网段发布到RIP协议中。

[R2]rip 1

[R2-rip-1]network 10.0.0.0

在R3上启动RIP协议，并将10.0.0.0网段发布到RIP协议中。

[R3]rip 1

[R3-rip-1]network 10.0.0.0

1. 验证RIPv1路由

查看R1、R2和R3的路由表。确保路由器已经学习到了如下显示信息中灰色阴影标注的RIP路由。

<R1>display ip routing-table

Route Flags: R - relay, D - download to fib

-------------------------------------------------------------------------

Routing Tables: Public

Destinations : 13 Routes : 13

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 10.0.13.2 GigabitEthernet0/0/0

10.0.3.0/24 RIP 100 2 D 10.0.13.2 GigabitEthernet0/0/0

10.0.12.0/24 RIP 100 1 D 10.0.13.2 GigabitEthernet0/0/0

10.0.13.0/24 Direct 0 0 D 10.0.13.1 GigabitEthernet0/0/0

10.0.13.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.13.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

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 10.0.13.1 GigabitEthernet0/0/0

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

10.0.3.0/24 RIP 100 1 D 10.0.12.3 GigabitEthernet0/0/1

10.0.12.0/24 Direct 0 0 D 10.0.12.2 GigabitEthernet0/0/1

10.0.12.2/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1

10.0.12.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1

10.0.13.0/24 Direct 0 0 D 10.0.13.2 GigabitEthernet0/0/0

10.0.13.2/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.13.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

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

<R3>display ip routing-table

Route Flags: R - relay, D - download to fib

-------------------------------------------------------------------------

Routing Tables: Public

Destinations : 13 Routes : 13

Destination/Mask Proto Pre Cost Flags NextHop Interface

10.0.1.0/24 RIP 100 2 D 10.0.12.2 GigabitEthernet0/0/1

10.0.2.0/24 RIP 100 1 D 10.0.12.2 GigabitEthernet0/0/1

10.0.3.0/24 Direct 0 0 D 10.0.3.3 LoopBack0

10.0.3.3/32 Direct 0 0 D 127.0.0.1 LoopBack0

10.0.3.255/32 Direct 0 0 D 127.0.0.1 LoopBack0

10.0.12.0/24 Direct 0 0 D 10.0.12.3 GigabitEthernet0/0/1

10.0.12.3/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1

10.0.12.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1

10.0.13.0/24 RIP 100 1 D 10.0.12.2 GigabitEthernet0/0/1

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

255.255.255.255/32 Direct 0 0 D 127.0.0.1 InLoopBack0

检测R1到IP地址10.0.12.3的连通性。如下所示R1和R3能够互通。

[R1]ping 10.0.12.3

PING 10.0.12.3: 56 data bytes, press CTRL\_C to break

Reply from 10.0.12.3: bytes=56 Sequence=1 ttl=254 time=70 ms

Reply from 10.0.12.3: bytes=56 Sequence=2 ttl=254 time=65 ms

Reply from 10.0.12.3: bytes=56 Sequence=3 ttl=254 time=65 ms

Reply from 10.0.12.3: bytes=56 Sequence=4 ttl=254 time=65 ms

Reply from 10.0.12.3: bytes=56 Sequence=5 ttl=254 time=65 ms

--- 10.0.12.3 ping statistics ---

5 packet(s) transmitted

5 packet(s) received

0.00% packet loss

round-trip min/avg/max = 65/66/70 ms

执行**debugging**命令，查看RIPv1协议的定期更新情况。

执行**debugging**命令开启RIP调测功能。注意只能在用户视图下执行**debugging**命令。执行**display debugging**命令，查看当前的调测信息。执行**terminal debugging**命令，开启**debug**信息在终端屏幕上显示的功能。

路由器间的RIP交互信息显示如下：

<R1>debugging rip 1

<R1>display debugging

RIP Process id: 1

Debugs ON: SEND, RECEIVE, PACKET, TIMER, EVENT, BRIEF,

JOB, ROUTE-PROCESSING, ERROR,

REPLAY-PROTECT, GR

<R1>terminal debugging

Info: Current terminal debugging is on.

<R1>

Mar29 2016 09:45:07.860.1+00:00 R1 RIP/7/DBG: 6: 12734: RIP 1: Receiving v1 response on GigabitEthernet0/0/0 from 10.0.13.2 with 3 RTEs

<R1>

Mar 29 2016 09:45:07.860.2+00:00 R1 RIP/7/DBG: 6: 12785: RIP 1: Receive response from 10.0.13.2 on GigabitEthernet0/0/0

<R1>

Mar 29 2016 09:45:07.860.3+00:00 R1 RIP/7/DBG: 6: 12796: Packet: Version 1, Cmd response, Length 64

<R1>

Mar 29 2016 09:45:07.860.4+00:00 R1 RIP/7/DBG: 6: 12845: Dest 10.0.2.0, Cost 1

<R1>

Mar 29 2016 09:45:07.860.5+00:00 R1 RIP/7/DBG: 6: 12845: Dest 10.0.3.0, Cost 2

<R1>

Mar 29 2016 09:45:07.860.6+00:00 R1 RIP/7/DBG: 6: 12845: Dest 10.0.12.0, Cost 1

<R1>

Mar 29 2016 09:45:09.370.1+00:00 R1 RIP/7/DBG: 25: 5071: RIP 1: Periodic timer expired for interface GigabitEthernet0/0/1

执行**undo debugging rip** <*process-id*> or **undo debugging all**命令，关闭调测功能。

<R1>undo debugging rip 1

也可以使用带更多参数的命令查看某类型的调试信息，如**debug rip 1 event**查看路由器发出和收到的定期更新事件。其它参数可以使用“？”获取帮助。

<R1>debugging rip 1 event

<R1>

Mar 29 2016 10:00:04.880.1+00:00 R1 RIP/7/DBG: 25: 5719: RIP 1: Periodic timer expired for interface GigabitEthernet0/0/0 (10.0.13.1) and its added to periodic update queue

<R1>

Mar 29 2016 10:00:04.890.1+00:00 R1 RIP/7/DBG: 25: 6048: RIP 1: Interface GigabitEthernet0/0/0 (10.0.13.1) is deleted from the periodic update queue

<R1>undo debugging all

Info: All possible debugging has been turned off

警告：开启过多的调测功能将消耗路由器的大量资源，甚至可能导致宕机。因而，请慎重使用开启批量**debug**功能的命令，如**debug all**。

1. 配置RIPv2协议

基于前面的配置，只需在RIP子视图模式下配置version 2即可。

[R1]rip 1

[R1-rip-1]version 2

[R2]rip 1

[R2-rip-1]version 2

[R3]rip 1

[R3-rip-1]version 2

1. 验证RIPv2路由

查看R1、R2和R3上的路由表。

执行**display ip routing-table**命令，查看R1、R2和R3上的路由表。注意比较灰色标注部分路由条目与之前RIPv1路由条目的不同之处。

<R1>display ip routing-table

Route Flags: R - relay, D - download to fib

-------------------------------------------------------------------------

Routing Tables: Public

Destinations : 13 Routes : 13

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 10.0.13.2 GigabitEthernet0/0/0

10.0.3.0/24 RIP 100 2 D 10.0.13.2 GigabitEthernet0/0/0

10.0.12.0/24 RIP 100 1 D 10.0.13.2 GigabitEthernet0/0/0

10.0.13.0/24 Direct 0 0 D 10.0.13.1 GigabitEthernet0/0/0

10.0.13.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.13.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

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 10.0.13.1 GigabitEthernet0/0/0

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

10.0.3.0/24 RIP 100 1 D 10.0.12.3 GigabitEthernet0/0/1

10.0.12.0/24 Direct 0 0 D 10.0.12.2 GigabitEthernet0/0/1

10.0.12.2/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1

10.0.12.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1

10.0.13.0/24 Direct 0 0 D 10.0.13.2 GigabitEthernet0/0/0

10.0.13.2/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.13.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

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

<R3>display ip routing-table

Route Flags: R - relay, D - download to fib

-------------------------------------------------------------------------

Routing Tables: Public

Destinations : 13 Routes : 13

Destination/Mask Proto Pre Cost Flags NextHop Interface

10.0.1.0/24 RIP 100 2 D 10.0.12.2 GigabitEthernet0/0/1

10.0.2.0/24 RIP 100 1 D 10.0.12.2 GigabitEthernet0/0/1

10.0.3.0/24 Direct 0 0 D 10.0.3.3 LoopBack0

10.0.3.3/32 Direct 0 0 D 127.0.0.1 LoopBack0

10.0.3.255/32 Direct 0 0 D 127.0.0.1 LoopBack0

10.0.12.0/24 Direct 0 0 D 10.0.12.3 GigabitEthernet0/0/1

10.0.12.3/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1

10.0.12.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1

10.0.13.0/24 RIP 100 1 D 10.0.12.2 GigabitEthernet0/0/1

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

255.255.255.255/32 Direct 0 0 D 127.0.0.1 InLoopBack0

检测R1到R3的G0/0/1接口（IP地址为10.0.12.3）的连通性。

<R1>ping 10.0.12.3

PING 10.0.12.3: 56 data bytes, press CTRL\_C to break

Reply from 10.0.12.3: bytes=56 Sequence=1 ttl=254 time=74 ms

Reply from 10.0.12.3: bytes=56 Sequence=2 ttl=254 time=75 ms

Reply from 10.0.12.3: bytes=56 Sequence=3 ttl=254 time=75 ms

Reply from 10.0.12.3: bytes=56 Sequence=4 ttl=254 time=75 ms

Reply from 10.0.12.3: bytes=56 Sequence=5 ttl=254 time=75 ms

--- 10.0.12.3 ping statistics ---

5 packet(s) transmitted

5 packet(s) received

0.00% packet loss

round-trip min/avg/max = 74/74/75 ms

执行**debugging**命令，查看RIPv2协议定期更新情况。

<R1>terminal debugging

Info: Current terminal debugging is on.

<R1>debugging rip 1 event

<R1>

Mar 29 2016 10:41:04.490.1+00:00 R1 RIP/7/DBG: 25: 5719: RIP 1: Periodic timer expired for interface GigabitEthernet0/0/0 (10.0.13.1) and its added to periodic update queue

<R1>

Mar 29 2016 10:41:04.500.1+00:00 R1 RIP/7/DBG: 25: 6048: RIP 1: Interface GigabitEthernet0/0/0 (10.0.13.1) is deleted from the periodic update queue

<R1>undo debugging rip 1

<R1>debugging rip 1 packet

<R1>

Mar 29 2016 10:43:07.770.1+00:00 R1 RIP/7/DBG: 6: 12776: RIP 1: Sending response on interface GigabitEthernet0/0/0 from 10.0.13.1 to 224.0.0.9

<R1>

Mar 29 2016 10:43:07.770.2+00:00 R1 RIP/7/DBG: 6: 12796: Packet: Version 2, Cmd response, Length 24

<R1>

Mar 29 2016 10:43:07.770.3+00:00 R1 RIP/7/DBG: 6: 12864: Dest 10.0.1.0/24, Nexthop 0.0.0.0, Cost 1, Tag 0

<R1>undo debugging rip 1

附加练习：分析并验证

思考一下，在使用RIPv1时，一台路由器向它的邻居路由器发送路由更新时，仅发送网络号码信息，不发送掩码。这样接收路由更新的路由器可以依据哪些条件进行处理，生成对应的掩码信息？

RIPv1和RIPv2分别有哪些优缺点？

配置文件

<R1>display current-configuration

[V200R007C00SPC600]

#

sysname R1

#

interface GigabitEthernet0/0/0

ip address 10.0.13.1 255.255.255.0

#

interface GigabitEthernet0/0/1

shutdown

ip address 10.0.12.1 255.255.255.0

#

interface LoopBack0

ip address 10.0.1.1 255.255.255.0

#

rip 1

version 2

network 10.0.0.0

#

user-interface con 0

authentication-mode password

set authentication password cipher %$%$+L'YR&IZt'4,)>-\*#lH",}%K-oJ\_M9+'lOU~bD (\WTqB}%N,%$%$

user-interface vty 0 4

#

return

<R2>display current-configuration

[V200R007C00SPC600]

#

sysname R2

#

interface GigabitEthernet0/0/0

ip address 10.0.13.2 255.255.255.0

#

interface GigabitEthernet0/0/1

ip address 10.0.12.2 255.255.255.0

#

interface GigabitEthernet0/0/2

shutdown

ip address 10.0.23.2 255.255.255.0

#

interface LoopBack0

ip address 10.0.2.2 255.255.255.0

#

rip 1

version 2

network 10.0.0.0

#

user-interface con 0

authentication-mode password

set authentication password cipher %$%$1=cd%b%/O%Id-8X:by1N,+s}'4wD6TvO<I|/pd# #44C@+s#,%$%$

user-interface vty 0 4

#

return

<R3>display current-configuration

[V200R007C00SPC600]

#

sysname R3

#

interface GigabitEthernet0/0/0

shutdown

ip address 10.0.13.3 255.255.255.0

#

interface GigabitEthernet0/0/1

ip address 10.0.12.3 255.255.255.0

#

interface GigabitEthernet0/0/2

shutdown

ip address 10.0.23.3 255.255.255.0

#

interface LoopBack0

ip address 10.0.3.3 255.255.255.0

#

rip 1

version 2

network 10.0.0.0

#

user-interface con 0

authentication-mode password

set authentication password cipher %$%$ksXDMg7Ry6yUU:63:DQ),#/sQg"@\*S\U#.s.bHW xQ,y%#/v,%$%$

user-interface vty 0 4

#

return