

Routing II

1 Introduction

We have seen why dynamic routing protocols are beneficial for reliable routing. The usefulness of the RIP protocol was tested between a router and a host system, but the limitations of RIP were discussed for use between one router and another. This lab will explore more advanced routing between Routers.

2 Dynamic Routing Configuration

2.1 Routing Information Protocol

The Routing Information Protocol (RIP) is one of the simplest and oldest dynamic internet routing protocol. RIP is limited to modern local networks because of its broadcast nature and small maximum number (15) of routers that can be announced in a single path. The following sections help configure RIP receiving and sending on the host station and router respectively.

2.2 Switch Setup

The switch should already be setup with 3 separate VLANs, if not, set them up for this lab. VLAN1 should have the Vista Host and Router1 connected. A port on VLAN2 should be cabled to the FastEthernet Port of Router2. (See Figure 1.) The ETH0 interfaces of the router could be hooked directly between the routers, but cable them to VLAN3 ports for a later experiment. (You may need a cross-over cable into the ETH0 interfaces of the router). The Linux Host should hook to VLAN2 and have a default route, like set in Lab 1.

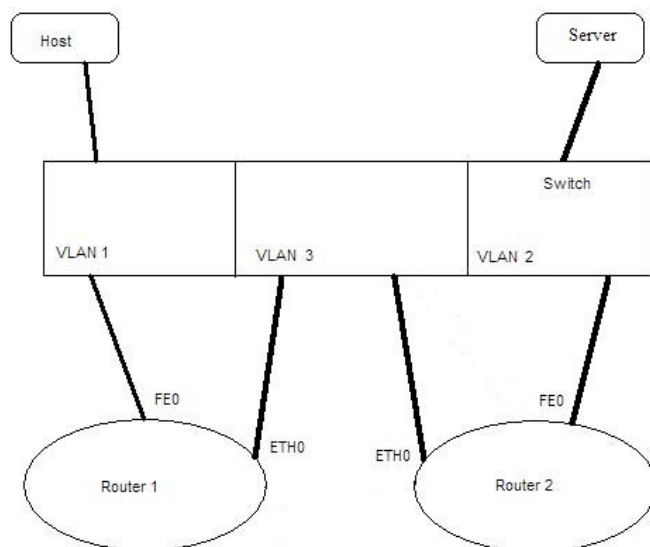


Figure 1

2.3 Host Station Configuration

The Vista host stations are usually just configured with a “default” route, either manually or through a startup protocol like DHCP. Recent Windows versions allow a more flexible setup by enabling the OS to listen to and use RIP data if it’s present on the local network. Use the procedure below to enable your RIP on your station. **(Note: Make sure that any manual default gateways are removed before starting this procedure)**

Verify that the RIP listener is enabled on your Vista Host using the following procedure:

1. Click Start -> Control Panel
2. Open “Programs and Features” in Classic view
3. Open “Turn Windows Features on or off” in the Tasks sidebar
4. Verify that the checkbox next to RIP listener is selected

Verify that the RIP listener is enabled on your Linux Host using the following procedure:

1. Open a Local Terminal on the Linux Host
2. Type “sudo /usr/sbin/routed”

2.4 Router Configuration

Open a HyperTerminal connection to Router1 and Router2 for CLI configuration of RIP. Before you begin configuration, check that IP connectivity is active between the Vista host and the Router1, if not make sure you setup the routers with basic IP settings. You may want to monitor the network traffic on your host station with the Wireshark program, to see if/when RIP packets from the router begin to appear on the network. Configure IP on both interfaces on each of the routers, according to the lab addressing policy posted at your station. The following information is from the Cisco IOS documentation for RIP.

Configuring Routing Information Protocol

This chapter describes how to configure Routing Information Protocol (RIP). For a complete description of the RIP commands that appear in this chapter, refer to the “RIP Commands” chapter of the Cisco IOS IP Command Reference, Volume 2 of 3: Routing Protocols. To locate documentation of other commands that appear in this chapter, use the command reference master index, or search online.

RIP is a relatively old but still commonly used interior gateway protocol created for use in small, homogeneous networks. It is a classical distance-vector routing protocol. RIP is documented in RFC 1058.

RIP uses broadcast User Datagram Protocol (UDP) data packets to exchange routing information. Cisco IOS software sends routing information updates every 30 seconds, which is termed advertising. If a router does not receive an update from another router for 180 seconds or more, it marks the routes served by the nonupdating router as being unusable. If there is still no update after 240 seconds, the router removes all routing table entries for the nonupdating router.

The metric that RIP uses to rate the value of different routes is hop count. The hop count is the number of routers that can be traversed in a route. A directly connected network has a metric of zero; an unreachable network has a metric of 16. This small range of metrics makes RIP an unsuitable routing protocol for large networks.

A router that is running RIP can receive a default network via an update from another router that is running RIP, or the router can source (generate) the default network itself with RIP. In both cases, the default network is advertised through RIP to other RIP neighbors.

Cisco IOS software will source the default network with RIP if one of the following conditions is met:

- The ip default-network command is configured.
- The default-information originate command is configured.
- The default route is learned via another routing protocol or static route and then redistributed into RIP.

RIP sends updates to the interfaces in the specified networks. If the network of an interface network is not specified, it will not be advertised in any RIP update.

RIP Configuration Task List

To configure RIP, perform the tasks described in the following sections. The tasks in the first two sections are required; the tasks in the remaining sections are optional.

- Enabling RIP (Required)
- Specifying a RIP Version (Optional)

Enabling RIP

To enable RIP, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	<code>Router(config)# router rip</code>	Enables a RIP routing process, which places you in router configuration mode.
Step 2	<code>Router(config-router)# network ip-address</code>	Associates a network with a RIP routing process.

Specifying a RIP Version

The Cisco implementation of RIP Version 2 supports authentication, key management, route summarization, CIDR, and VLSMs. Key management and VLSM are described in the chapter "Configuring IP Routing Protocol-Independent Features."

By default, the software receives RIP Version 1 and Version 2 packets, but sends only Version 1 packets. You can configure the software to receive and send only Version 1 packets. Alternatively, you can configure the software to receive and send only Version 2 packets. To configure the software to send and receive packets from only one version, use the following command in router configuration mode:

	Command	Purpose
Step 1	<code>Router(config-router)# version {1 2}</code>	Configures the software to receive and send only RIP Version 1 or only RIP Version 2 packets.

The preceding task controls the default behavior of RIP. You can override that behavior by configuring a particular interface to behave differently. To control which RIP version an interface sends, use the following commands in interface configuration mode, as needed:

	Command	Purpose
Step 1	Router(config-if)# ip rip send version 1	Configures an interface to send only RIP Version 1 packets.
Step 2	Router(config-if)# ip rip send version 2	Configures an interface to send only RIP Version 2 packets.
Step 3	Router(config-if)# ip rip send version 1 2	Configures an interface to send RIP Version 1 and Version 2 packets.

Similarly, to control how packets received from an interface are processed, use the following commands in interface configuration mode, as needed:

	Command	Purpose
Step 1	Router(config-if)# ip rip receive version 1	Configures an interface to accept only RIP Version 1 packets.
Step 2	Router(config-if)# ip rip receive version 2	Configures an interface to accept only RIP Version 2 packets.
Step 3	Router(config-if)# ip rip receive version 1 2	Configures an interface to accept either RIP Version 1 or 2 packets.

default-information originate

To generate a default route into Routing Information Protocol (RIP), use the **default-information originate** router configuration command. To disable this feature, use the **no** form of this command.

```
default-information originate
```

3 Experiment

Additional information on RIP and information on OSPF and BGP is available in the RoutingProtocolsConfig.pdf document located in the User Manuals folder on the desktop of the Linux Host. Configure Router1 to start RIP on both interfaces. Extend the functionality by having the router supply a default route and send and receive both versions of RIP. Once RIP is enabled and verified running on the router1, configure RIP on router2, but don't include the default-information command on router2. Verify that routing info is being successfully seen and used by the Vista host. Configure the interfaces connecting the two routers, so they exchange RIP. The Host should be able to route to the

FastEthernet interface of Router2 and the Linux Host, if everything goes correct. Use the “show ip route” and “show ip protocol” to help you determine the status of the router configuration. See the 1760Router.pdf document located in the User Manuals folder on the Desktop of the Linux host for Cisco IOS Routing documentation.

Router1 (Additional RIP configuration commands)

```
ip routing
router rip
  network 10.0.0.0
  version 1
  default-information originate
interface fastethernet0/0
  ip rip send version 1 2
  ip rip receive version 1
interface ethernet0/0
  ip rip send version 1 2
  ip rip receive version 1
```

Router2 (Additional RIP configuration commands)

```
ip routing
router rip
  network 10.0.0.0
  version 1
interface fastethernet0/0
  ip rip send version 1 2
  ip rip receive version 1
interface ethernet0/0
  ip rip send version 1 2
  ip rip receive version 1
```

3.1 OSPF

Develop IOS configurations that setup an OSPF area between Router1 and Router2. Have the FastEthernet subnets announced in the OSPF area and setup MD5 authentication between routers. **Disable RIP (passive interface) between the routers (leave it running on the FastEthernet Interfaces),** and redistribute OSPF routes into the RIP process and vice-versa. Observe the routing table (show ip route) on both routers to verify that OSPF routes are being successfully exchanged. Verify that the Vista host can still see routes from Router2 and what happens when the FastEthernet interface of Router2 is uncabled from the VLAN switch. A minimum OSPF configuration should have the `router`, `network`, and `redistribute` commands properly configured on both Routers as in the below (incomplete) example.

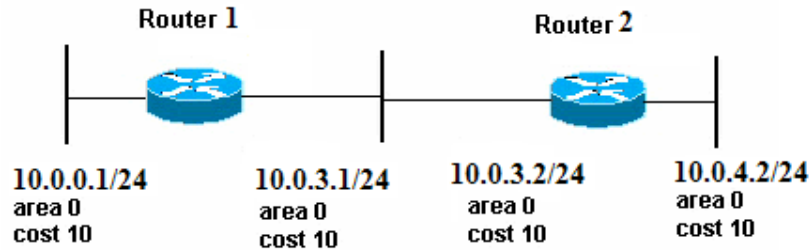


Figure 2: Network Diagram

Router 1 Example Configuration

```
hostname router1
interface FastEthernet0/0
  ip address 10.0.0.1 255.255.255.0
interface Ethernet0/0
  ip address 10.0.3.1 255.255.255.0
  ip ospf authentication-key abcdefgh
router ospf 1
  network 10.0.0.0 0.0.0.255 area 0
  network 10.0.3.0 0.0.0.255 area 0
  area 0 authentication
  redistribute rip
router rip
  passive interface ethernet0/0
  redistribute ospf 1
  default metric 10
```

Router 2 Example Configuration

```
hostname router2
interface FastEthernet0/0
  ip address 10.0.4.2 255.255.255.0
interface Ethernet0/0
  ip address 10.0.3.2 255.255.255.0
  ip ospf authentication-key abcdefgh
router ospf 2
  network 10.0.3.0 0.0.0.255 area 0
  network 10.0.4.0 0.0.0.255 area 0
  area 0 authentication
  redistribute rip
router rip
  passive interface ethernet0/0
  redistribute ospf 2
  default metric 10
```

After successfully testing the path between Vista Host and Linux Host, setup the Vista Host switch port to be a MONITOR (SPAN) port, and setup to monitor all VLAN3 traffic. Run Wireshark on the Vista Host and watch for OSPF exchanges between the Routers when disconnecting one or both Fastethernet cables of the Routers.

This example shows how to set up a SPAN session, session 1, for monitoring source port traffic to a destination port. First, any existing SPAN configuration for session 1 is cleared, and then bidirectional traffic is mirrored from source ports 1 through 4, to destination port 10.

```
Switch(config)# no monitor session 1
Switch(config)# monitor session 1 source interface fastethernet0/1 ,
fastethernet0/2, fastethernet0/3, ...
Switch(config)# monitor session 1 destination interface fastethernet0/10
Switch(config)# end
```

After the test, remove the monitor session so the Host can again work normally with the VLAN1.

This example shows how to remove port 10 as a monitor destination:

```
Switch(config)# no monitor session 1 destination interface fastEthernet0/10
Switch(config)# end
```

3.2 BGP

Develop IOS configurations that setup a BGP session between Router1 and Router2. Each router should have a unique Autonomous Systems number. Have the FastEthernet subnets announced in the BGP sessions. Observe the routing table (`show ip route`) on both routers to verify that BGP routes are being successfully exchanged. Leave RIP disabled between the routers (leave it running on the FastEthernet Interfaces), and also disable OSPF commands from Section 3.1 above. Redistribute BGP routes into the RIP process, noting that this may require the `clear ip bgp` command to restart the bgp process. Verify that the Vista host can still see routes from Router2 and what happens when the FastEthernet interface of Router2 is uncabled from the VLAN switch. A minimum BGP configuration should have the `router`, `network`, `neighbor` and `redistribute` commands properly configured on both Routers.

Router 1 (Autonomous System number 109) Example configuration:

```
hostname router1
interface FastEthernet0/0
  ip address 10.0.0.1 255.255.255.0
interface Ethernet0/0
  ip address 10.0.3.1 255.255.255.0
router bgp 109
  network 10.0.0.0
  neighbor 10.0.3.2 remote-as 110
  redistribute rip
router rip
  passive interface ethernet0/0
  redistribute bgp 110
  default metric 11
```

Router 2 Example configuration:

```
hostname router2
interface FastEthernet0/0
  ip address 10.0.4.2 255.255.255.0
interface Ethernet0/0
  ip address 10.0.3.2 255.255.255.0
  ip ospf authentication-key abcdefgh
router bgp 110
  network 10.0.0.0
```

```
neighbor 10.0.3.1 remote-as 109
redistribute rip
router rip
passive interface ethernet0/0
redistribute bgp 109
default metric 11
```

After successfully testing the path between Vista Host and Linux host, setup the Vista Host switch port to be a MONITOR (SPAN) port, and setup to monitor all VLAN3 traffic. Run Wireshark on the Host and watch for BGP exchanges between the Routers when disconnecting one or both Fastethernet cables of the Routers.

4 Extensions

The 3 dynamic routing protocols examined here each has unique features that make them preferred in certain network situations. Describe and include your configurations and what each of the commands in each protocol means in the context of that protocol. Discuss some of the various topologies which would benefit or require certain protocols. With the plethora of options for OSPF and BGP, choose 2 of more esoteric options for each and explain and summarize their usage in a representative network setting.