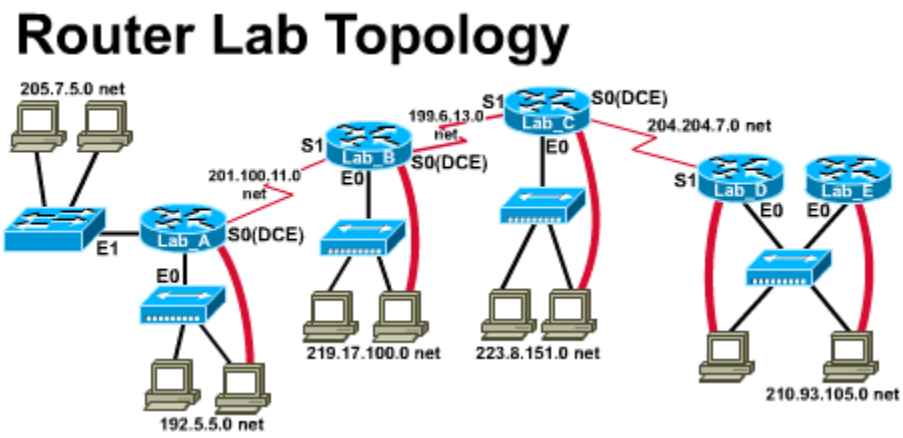
Lab 5.4.6.2 Multi-path IGRP - Overview



Router Name - Lab_A Router Type - 2514 E0 = 192.5.5.1 E1 = 205.7.5.1 S0 = 201.100.11.1 SM = 255.255.255.0	Router Name - Lab_C Router Type - 2501 E0 = 223.8.151.1 S0 = 204.204.7.1 S1 = 199.6.13.2 SM = 255.255.255.0	Router Name - Lab_E Router Type - 2501 E0 = 210.93.105.2 SM = 255.255.255.0
Router Name - Lab_B Router Type - 2501 E0 = 219.17.100.1 S0 = 199.6.13.1 S1 = 201.100.11.2 SM = 255.255.255.0	Router Name - Lab_D Router Type - 2501 E0 = 210.93.105.1 S1 = 204.204.7.2 SM = 255.255.255.0	

Estimated time: 60 min.

Objectives:

- Work with IGRP metrics used in path selection
- Understand the path that is selected to route data to a particular host.

Background:

In a previous lab, you saw how to set up the RIP routing protocol on Cisco routers. In this lab you will configure the routers to use IGRP and see how IGRP uses metrics to select the best path.

Initially, a router must refer to entries about networks or subnets that are directly connected to it. Each interface must be configured with an IP address and a subnet mask. The initial source of this information is from the user who types it into a configuration file. IGRP (Interior Gateway Routing Protocol) is a distance-vector routing protocol developed by Cisco to address problems associated with routing in large, heterogeneous networks.

RIP sends out routing updates every 30 seconds and uses only hop count to determine the best path. IGRP sends routing updates at 90 second intervals and uses a combination of variables in determining the best path to route packets. The

variables that make up this composite metric include bandwidth, delay, load, reliability and MTU (maximum transmission unit). Detailed information on how IGRP calculates the best path can be found at the 'Introduction to IGRP' site listed in the Web Site Resources section of this lab.

IGRP takes a more intelligent approach to determining the best route than RIP does. RIP only counts the number of routers (hops) from point A to point B, whereas IGRP looks at, among other factors, the speed of the various links before it determines the best path.

In this lab you will add a WAN link between Lab-A and Lab-E. This link will be configured for 56Kbps speed. The other WAN links are configured for 1,544 Kbps (T1 speed) by default. You will examine the routing tables and determine what path the data will take. Finally, you will take down one of the fast links between routers and force the data to be routed through the 56Kbps WAN link.

Tools / Preparation:

Prior to starting this lab you will need to have the equipment for the standard 5-router lab available. The routers and workstations should be pre-configured by the instructor or lab assistant with the correct IP settings prior to starting the lab. Work in teams of 3 or more. Before beginning this lab you may want to review Chapter 5 in the Cisco Networking Academy Second-Year Companion Guide and Semester 3 On-line Chapter 5.

Resources Required:

- (5) PC workstations (min.) with Windows operating system and HyperTerminal installed.
- (5) Cisco Routers (model 1600 series or 2500 series with IOS 12.0.9 or later)
- (4) Ethernet hubs (10BASE-T with 4 to 8 ports)
- (1) Ethernet switch (Cisco Catalyst 1900 or comparable).
- (5) serial console cables to connect workstation to router console port (with RJ-45 to DB9 converters).
- (4) Sets of V.35 WAN serial cables (DTE male/ DCE female) to connect from router to router.
- CAT5 Ethernet Cables wired straight through to connect routers and workstations to hubs and switches.
- AUI (DB15) to RJ-45 Ethernet transceivers (Quantity depends on the number of routers with AUI ports) to convert router AUI interfaces to 10BASE-T RJ-45

Web Resources:

Routing basics
General information on routers
2500 series routers
1600 series routers
Terms and acronyms
IP routing protocol IOS command summary
Introduction to IGRP

Step 1 - Connect router Lab-A to Lab-E .

Connect the DCE side of a V.35 WAN serial cable on port Serial 0 of **Lab-E**. Connect the other end of the cable (the DTE end) to port Serial 1 of **Lab-A**.

Step 2 - Configure the serial port on Lab-E.

On Lab-E, enter the privileged EXEC mode by entering the command `router (config)#` **`class`** . Enter global configuration mode by entering the command **`configure terminal`** (abbreviated **`config t`**). Enter the interface configuration mode for port Serial 0 by entering the command **`interface Serial 0`** (abbreviated **`int s 0`**). Assign the IP address of 220.68.33.1 to the serial port by entering the command **`ip address 220.68.33.1 255.255.255.0`** . This WAN link will be a 56 Kbps circuit, so enter the command **`bandwidth 56`** . Assign the clock rate of 56000 bits per second by entering the command clock rate 56000. Bring the interface up by entering the command **`no shutdown`** . Type the key sequence Control+Z to return to the command line interface.

Step 3 - Configure the serial port on Lab-A .

On Lab-A, enter the privileged EXEC mode by entering the command enable. If prompted, enter the password **class**. Enter global configuration mode by entering the command **`configure terminal`** (abbreviated**`config t`**). Enter the interface configuration mode for port Serial 1 by entering the command interface Serial 1 (abbreviated **`int s 1`**). Assign the IP address of 220.68.33.2 to the serial port by entering the command **`ip address 220.68.33.2 255.255.255.0`** . This WAN link will be a 56 Kbps circuit, so enter the command **`bandwidth 56`** . Bring the interface up by entering the command **`no shutdown`** . Type the key sequence Control+Z to return to the command line interface.

Step 4 - Document the change to the network topology.

To successfully complete this lab, you will be referring to the topology diagram at the start of this lab. Draw a WAN link (indicated by a lightening bolt-style line) between Lab-A and Lab-E. Indicate the network number **220.68.33.0**above this link. Indicate the point at which the line connects to Lab-E as S0 (DCE), with the IP address of **220.68.33.1**. Indicate the point at which the line connects to Lab-A as S1 with an IP address of **220.68.33.2**.

Step 5 - Configure IGRP routing on each router.

Each router in the lab needs to be configured with IGRP and the same autonomous system number. For purposes of this lab, use the number **10**. On each router, enter privileged EXEC mode by entering the command `router (config)#` **`class`** . Enter global configuration mode by entering the command **`configure terminal`** (abbreviated **`config t`**). To ensure that RIP routing is not in use on the lab routers, enter the command no router rip. To start to configure

IGRP enter the command **router igrp 10** (where 10 is the autonomous system number you are assigned).

1. What does the prompt change to?

IGRP requires the router administrator to enter the network number of all networks that are physically connected to it. The command to do this is network xxx.xxx.xxx.xxx (where xxx.xxx.xxx.xxx is the IP address of the network connected to the interface, not the IP address of the interface itself). Refer to the network topology diagram at the start of this lab for these numbers. Be sure to include the IP address of the networks on the Ethernet ports as well as those on the serial ports (see example below). Type the key sequence Control+Z to return to the command line interface. Save the router configuration to NVRAM by entering the command **copy running-config startup-config** (abbreviated **copy run start**).

Example for Lab-A:

```
Lab-A(config)# router igrp 10
Lab-A(config-router)# network 205.7.5.0
Lab-A(config-router)# network 192.5.5.0
Lab-A(config-router)# network 201.100.11.0
Lab-A(config-router)# network 220.68.33.0
```

Step 6 - Examine a routing table.

Log onto the Lab-C router and issue the command **show ip route** .

2. Record the results below:

You will note that a "**C**" in the first column indicates that the network is directly

connected to the router. An "I" in the first column indicates that the network was learned via IGRP. The first number in the square brackets indicate the calculated distance to the particular router. The second number indicates the calculated metric to the particular router.

Step 7 - Examine the path that data travels.

From Lab-C, follow the path that data travels to reach interface S0 on Lab-E. Issue the command **`traceroute 220.68.33.1`** (abbreviated **`tr 220.68.33.1`**).

3. What path does the data travel?

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Step 8 - Examine the path that data travels between two different routers.

Log onto Lab-E. Trace from Lab-E to the Ethernet 1 interface of the Lab-A router by entering the command **`traceroute 192.5.5.1`** (abbreviated **`tr 192.5.5.1`**).

4. What path did the traceroute command follow?

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5. Why didn't the path travel from Lab-E to Lab-A?

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Step 9 - Shutdown one of the fast links between routers.

Since the network of routers has more than one path to route data, you have some redundancy in your system. If one of the links between routers goes down, data will be able to be routed via the alternate path. This routing will occur once the network has converged.

From Lab-E, issue the command show ip route.

6. Record the results below.

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Disconnect the cable from Lab-E's Ethernet 0 interface. The output of the show ip route command (above) indicated that all traffic from Lab-E was being routed through the Ethernet 0 interface.

Entering the command **traceroute** 192.5.5.1(abbreviated **tr 192.5.5.1**).

7. What path does the traceroute command now follow?

8. Record the results below.

Note that the IGRP metric (the second number in the square brackets) on each route has increased significantly from the results you recorded in question 6. This indicates that the 56Kbps WAN link, between Lab-E and Lab-A, is slower. Even though it is slower, this is the only way to route traffic out of Lab-E.

Step 10 - Examine the routing of traffic from another router.

Log onto Lab-C. Note that it takes time for the network to converge between steps 9 and 10. Enter the command **clear ip route *** to force the router to clear all routing table information and obtain new information from the other routers, via a

broadcast. Issue the command **show ip route** , and compare the results to those you recorded in question 2.

9. Have any of the routes changed?

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10. What interface does this route now use?

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Examine the path data now takes to go to interface Serial 0 on Lab-E. Enter the command **traceroute** 220.68.33.1(abbreviated tr 220.68.33.1).

11. What path does the traceroute command now follow?

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