CISCO NETWORKING ACADEMY PROGRAM

Lab 1.5.2 Unequal-Cost Load Balancing with IGRP

Workstation
192.168.3.2

Fa0/0 192.168.3.1/24

Vista

S0/0 192.168.1.1/24   **S0/1** 192.168.2.1/24

Fractional T1:   **Fractional T1:**
128 Kbps   **384 Kbps**

S0/0 192.168.1.2/24   **S0/1** 192.168.2.2/24

Fa0/0 10.0.0.1/24

Fa0/0 10.0.0.2/24

SanJose1   **SanJose2**

IGRP 36
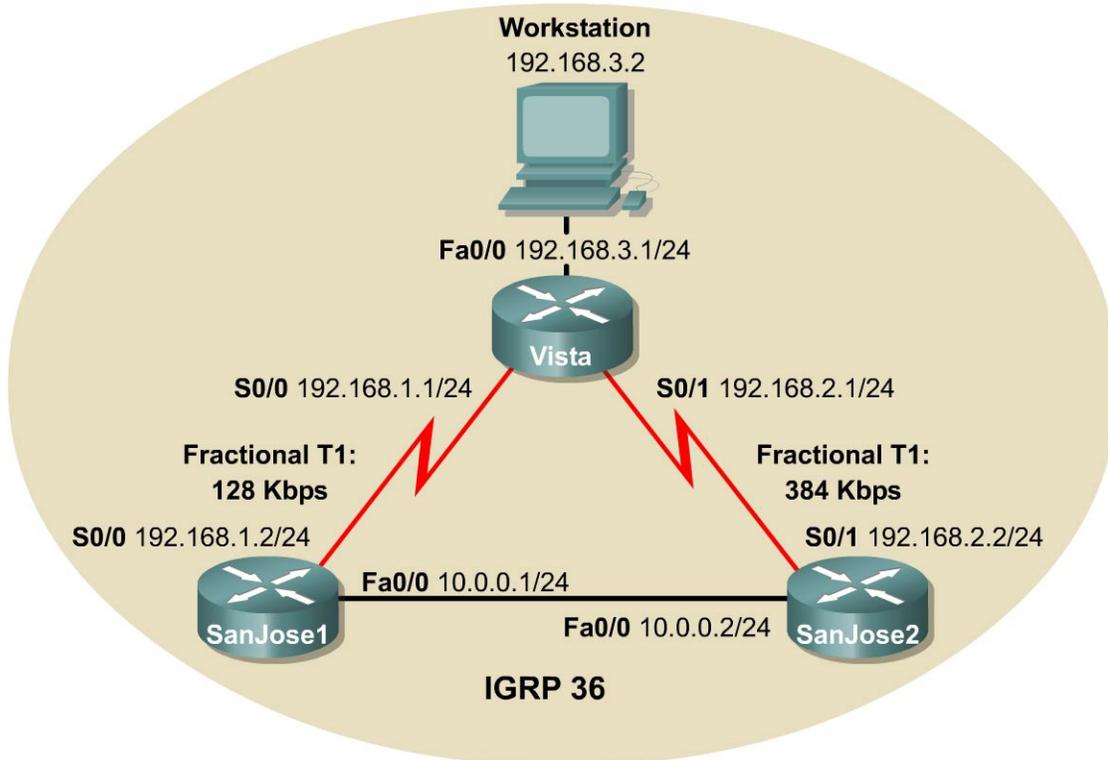
Objective

In this lab, the student will observe unequal-cost load balancing on an IGRP network by using advanced `debug` commands.

Scenario

Vista has two paths to network 10.0.0.0, but they have unequal IGRP metrics. Configure unequal-cost load balancing and use advanced `debug` features to verify the work.

Step 1

Build and configure the network according to the diagram. If continuing from the previous lab, remove the RIP process (and networks advertised by RIP) with the single command `no router rip`. Configure IGRP with an autonomous system number of 36, and enable updates on all active interfaces with `network` commands similar to the following:

```
SanJose2(config)#router igrp 36
SanJose2(config-router)#network 192.168.2.0
SanJose2(config-router)#network 10.0.0.0
```

Use `ping` to verify the configuration and test connectivity between all interfaces.

Also, because the metric for IGRP includes bandwidth in its calculation, manually configure the bandwidth of serial interfaces in order to ensure accuracy. For the purposes of this lab, Vista alternative paths to network 10.0.0.0 are not of unequal-cost until the appropriate bandwidths are set. Use the following commands to further configure Vista for the correct bandwidth and process switching:

```
Vista(config)#interface s0/0
Vista(config-if)#bandwidth 128
Vista(config-if)#no ip route-cache
Vista(config-if)#interface s0/1
Vista(config-if)#bandwidth 384
Vista(config-if)#no ip route-cache
```

Use the `show interface` command output to verify the correct bandwidth settings and the `show ip interface` command to ensure that fast switching is disabled.

1. Can you set the bandwidth of Ethernet interfaces manually?

_____

Note: The `bandwidth` command can be entered in interface configuration mode, but it only effects metric computations; in this case, it only affects routing protocols that use bandwidth in their metric computations.

2. Can an Ethernet interface be placed in fast switching mode?

_____

Step 2

Check the routing table on Vista by using the `show ip route` command. Vista should have only one route to network 10.0.0.0 in its table. Troubleshoot if necessary.

Step 3

The variance value determines whether IGRP will accept unequal-cost routes. An IGRP router will only accept routes equal to the local best metric for the destination multiplied by the variance value. So, if a router using IGRP has a local best metric for Network A is 10476, and the variance is three, the router will accept unequal-cost routes with any metric up to 31428 or 10,476 x 3. This is as long as the advertising router is closer to the destination. An IGRP router accepts only up to four paths to the same network.

Note: An alternate route is added to the route table only if the next hop router in that path is closer to the destination by having a lower metric value than the current route.

By default, the variance of IGRP is set to one (1), which means that only routes that are exactly one (1) times the local best metric are installed. Therefore, a variance of one (1) disables unequal-cost load balancing.

Configure Vista to enable unequal-cost load balancing using the following commands:

```
Vista(config)#router igrp 36
Vista(config-router)#variance 10
```

3. According to the help feature, what is the maximum variance multiplier value?

_____

Step 4

Check Vista routing table again. Vista should have two routes to network 10.0.0.0 with unequal metrics.

4. What is the IGRP metric for the route to 10.0.0.0 via SanJose1?

_____

5. What is the IGRP metric for the route to 10.0.0.0 via SanJose2?

_____

Step 5

Now test unequal-cost load balancing by sending a **ping** packet to network 10.0.0.0 from Vista while debugging. Remove any existing access lists on Vista. First, configure an access list to restrict **debug** output to the **ping** requests from Vista to network 10.0.0.0:

```
Vista(config)#access-list 101 permit icmp any 10.0.0.0 0.255.255.255
```

Then, enable **debug** using the access list to filter output:

```
Vista#debug ip packet 101
```

Finally, execute the command **ping –t 10.0.0.1**. This continuous ping can be stopped by typing **Ctrl-C**.

6. Are the packets load balanced per destination or per packet?

_____

7. How is unequal-cost load balancing different from equal-cost load balancing?

_____

Note: If using a named ACL, any line can be selectively deleted from the access list. In a numbered ACL, lines cannot be selectively deleted, but lines can be added to the end of the list. In a named ACL, lines can be added after the list has already been created, but their appearance in the list cannot be controlled (interestingly, they are not always appended to the end). Therefore, with either a named or numbered ACL, making changes that require adding lines to middle of a list should only be done by deleting the entire ACL and reconstructing it. Cisco recommends using a TFTP server (or a cut-and-paste) so that edited ACLs can be implemented with ease. In this case, the first line of the edited ACL should begin with a line that explicitly deletes the existing ACL (if applicable). Otherwise, the downloaded ACL is appended to the existing ACL.