Redundancy and OSPF

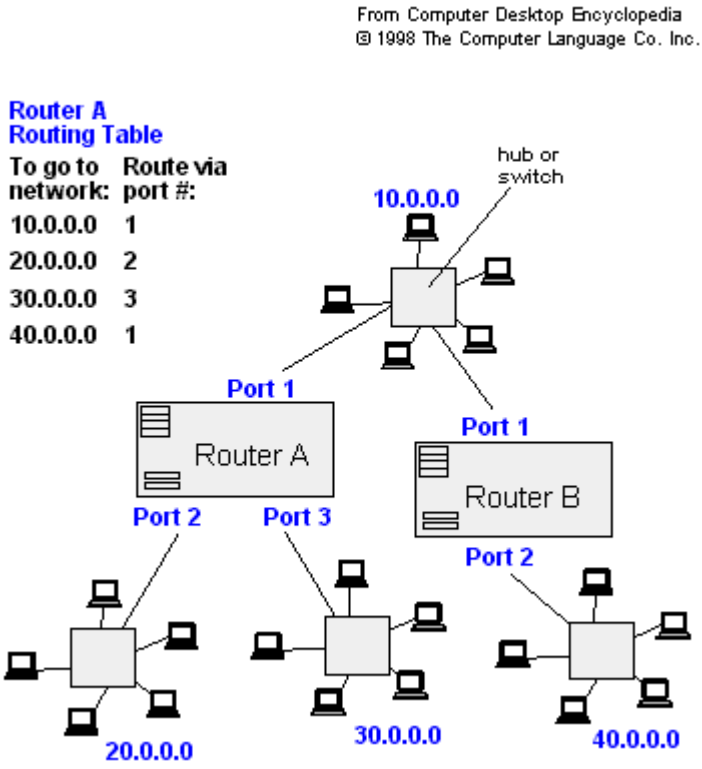
Objective:

1. Learn how to connect the routers and switches in a redundant design.
2. Learn how to configure OSPF(Open Shortest Path First) routing.
3. Test to determine whether or not redundant configuration is functioning as designed.

Background:

1. Introduction to OSPF:

Routing protocol: Routing protocol is a formula used by routers to determine the appropriate path onto which data should be forwarded. The routing protocol also specifies how routers report changes and share information with the other routers in the



network that they can reach. A routing protocol allows the network to adjust to changing conditions dynamically, otherwise all routing decisions have to be predetermined and remain static. This is a simple example of a routing table, showing how packets are directed out the appropriate port.

RIP is a simple routing protocol that is part of the TCP/IP protocol suite. It determines a route based on the smallest hop count between source and destination. RIP is a distance vector protocol that routinely broadcasts routing information to its neighboring routers and is known to waste bandwidth. AppleTalk, DECnet, TCP/IP, NetWare and VINES all use incompatible versions of RIP.

OSPF is a routing protocol that determines the best path for routing IP traffic over a TCP/IP network. OSPF is an interior gateway protocol (IGP), which is designed to work within an autonomous system. It is also a link state protocol that causes less router-to-router update traffic than the RIP protocol (distance vector protocol) that it was designed to replace.

2. Based on class material or information available at:
http://www.cisco.com/warp/public/104/1.html
answer the following questions:

1. Which algorithm does OSPF use?

2. What are Area and Border Routers?

3. What's the RID(Router ID)?

4. What is a virtual-link?

3. Study the topology demonstrated by the diagram.

Procedure:

1. First, find out what's your computer's IP address, and check the following table to know which router you are connected to, and record the result.

IP ADDR	ROUTER
10.0.10.10	router2
10.0.20.10	router3
10.0.20.20	router4
10.0.30.10	router5
10.0.30.20	router6

What's your computer's IP address? _____

What's the name of the router your computer connected to? _____

Note: See the reference 1 about how to check a machine's IP address.

2. On each computer, execute following command, and record the feed back on the worksheet.

```
ping  10.0.100.100
```

5. What's the feed back of ping program?

_____

3. We define area number for every subnet in out lab as following:

SUBNETS	AREA NUM.
10.0.100.0	0
10.5.2.0	1
10.5.3.0	2
10.5.4.0	3
10.6.2.0	4
10.6.3.0	5
10.6.4.0	6
10.0.20.0	7
10.0.30.0	8

Note: All the subnet masks = 255.255.255.0

Study the diagram, try to find how many interfaces in use in your router and which subnets they belong to and what are the subnets' area numbers. Record this information.

SUBNETS	AREA NUM.
_____	_____
_____	_____
_____	_____
_____	_____

5. Connect to your router using Tip/HyperTerminal. According to the table in step 4, enable OSPF in your router, and define areas.

For example, in router 4, execute following commands:

```
config terminal
router ospf 100
network 10.5.4.0   0.0.0.255 area 3
network 10.0.30.0  0.0.0.255 area 8
network 10.6.4.0   0.0.0.255 area 6
```

```
exit
exit
write
```

In RSM, we have defined area 0 like this:

```
router ospf 100
network 10.0.100.0 0.0.0.255 area 0
```

6. Now we should set some virtual links between areas that make all the areas can access area 0. But before we do anything about virtual link, we must understand the concept of RID.

The RID is the router-id. The OSPF router-id is usually the highest IP address on the box, or the highest loopback address if one exists. For example, there are three IP addresses in router2: 10.0.20.2, 10.5.2.2, 10.6.2.2. The highest address is 10.6.2.2, so the RID of router2 is 10.6.2.2.

Study the diagram, find RIDs for all the routers and record them.

ROUTER	RID
router2	_____
router3	_____
router4	_____
router5	_____
router6	_____

7. Every area that not physically connected to area 0 must have a virtual link to connect to area 0. And note that virtual links must appear in pair, i.e., if there is a virtual link from router A to router B, it requires that there must be a virtual link from router B to router A as well. Study diagram, find out if your router need some virtual links to connect to area 0, or need some virtual links to let some areas not in your router can access to area 0. For more facts of virtual-link, go to
http://www.exit109.com/~jeremy/news/providers/traceroute.html

And see section of virtual link.

For example, router4 belongs to three areas: area 3(10.5.4.2), area 6(10.6.4.2) and area 8(10.0.30.4). Area 3 and area 6 connect to area 0 physically, in router5 and router6, respectively. But area 8 does not connect area 0 directly. So in router4, area 8 can set two virtual links to access area 0. One is through area 3, the other is through area 6. The commands are like following:

```
config terminal
router ospf 100
area 3 virtual-link 10.5.4.1
area 6 virtual-link 10.6.4.1
```

```
exit
exit
write
```

Because there is a virtual link from router4 to router5 and router6, router5 and router6 must has a corresponding virtual link pointing back to router4.
In router5, there will be a virtual link:

area 3 virtual-link 10.6.4.2

In router6, there will be a virtual link:

area 6 virtual-link 10.6.4.2

Router2 and Router3 are in the same manner.

Find out which virtual links your router need and execute the similar commands like above to set them in your router, and write your commands.

_____
_____
_____
_____
_____
_____
_____
_____
_____

8. To take benefits of our lab's redundant connection, we must set more than one default routers for our computer. Study the diagram, find out which routers are connected to your computer through a LAN switch, and write them below(workstation 10.0.10.10 does not need to do this):

_____
_____

All these routers should be your default routers.
In SUN Solaris system, open a new terminal window, and execute the following command using root privilege(ask instructor to do this):

route add default <default router1>
route add default <default router2>

Then you can use following command to display the routing table in your workstation:

netstat –rn

In Windows system, you can not use two default routers at the same time. Anyway, you can open the properties window of the TCP/IP protocol, and change the default gateway.

9. Now we have set the ospf for our network. **On your computer**, open a termial or dos prompt window, try the traceroute program to see what's the route from your computer to rsm. For how to use traceroute program, see reference 3).

In Solaris:

```
traceroute 10.0.100.100
```

In Windows:

```
tracert 10.0.100.100
```

6. What's the feed back of traceroute program?

_____should success_____
_____
_____
_____
_____

10. Now shut down one of router2,3,4, and try traceroute program again.

In Solaris:

```
traceroute 10.0.100.100
```

In Windows:

```
tracert 10.0.100.100
```

7. What's the feed back this time?
_____should success_____
_____
_____
_____
_____

12. Now shut down one of router5,6, and try traceroute program one more time.

In Solaris:

```
traceroute 10.0.100.100
```

In Windows:

```
tracert 10.0.100.100
```

8. What's the feed back now?
___should success_____
_____
_____

_____
_____

References and Useful Information:

1. How to know a computer's IP address?
On SUN workstation, execute the command:
    ifconfig hme0
The feedback will include the IP address of the interface hme0.
On Windows 2000 PC, open a dos prompt window, and execute the command:
    ipconfig
The feedback will include the IP address of this computer.

2. How to connect routers via serial links?
Before this lab, the instructor should connect the serial line between your computer and your router. All you need to do is using some tools to communicate the router.

On Windows 2000 PC, You can start HyperTerminal by clicking **Start**, pointing to **Programs**, pointing to **Accessories**, pointing to **Communications**, clicking **HyperTerminal**.

For information about how to use HyperTerminal, click the **Help** menu in HyperTerminal

On SUN Solaris system, you can use the tip program. Just type the following command:

```
tip hardware
```

When you after doing the work, use "~." to exit tip.

3. How to use traceroute program?
Here is a useful link: http://www.exit109.com/~jeremy/news/providers/traceroute.html

4. The diagram for lab6's topology(see the next page).

Redundant Network Design