CSIS0234B Computer and Data Communication (Class B)
Tutorial 9
Experiencing dynamic routing

So far the routing tables of the computers are hand-built. This time we will try to let the system to figure out the routing table by itself. We will use all the computers of the lab as routers, and run a dynamic routing algorithm on it.

Your tasks

Form groups among yourselves, each group with three or four students, and operate on four computers. Three of them (A, B and C) are connected by a hub (or switch), and the fourth (D) is connected to C with a "cross cable", which you can treat as a hub plus two cables. There is also a network connecing A (of all groups) to the NAT router of the lab.

You are to configure zebra so that OSPF is used to find routes between all these networks. During the exercise, you can use `ethereal` to see the packets used to achieve routing. The detailed steps are as follows.

1. Find the IP addresses of the computers in your group (from the whiteboard). Use the addresses to write `/etc/zebra/zebra.conf` in all computers. Set a password for the control interface. Do not configure a default route.

2. Stop both interfaces of the computer (using `ifdown eth0` and `ifdown eth1`, and start zebra. Use `route -n` to check that the correct interfaces are up with the right IP addresses, and use ping to test connectivity with neighbours.

3. Type `telnet 127.0.0.1 zebra` to access the control interface. Type `?` to see the available commands, and use `show ip route` to see the current routing table. Try a few other commands as well. Note that `?` can be used at any time, and you can do command completion using the Tab key.

4. Exit the interface (by typing Control-D). Write `/etc/zebra/ospfd.conf` so that it runs on all networks connected. All of them should be in the backbone area. Again, setup the password for the control interface.

5. Use `ethereal` on the computer to monitor all traffic on one of the interfaces with OSPF enabled. (Hint: use the "update list of packets in real time" option when capturing, so that you can see the packets without finishing the capture.) Now start `ospfd`.

6. When more than one of the computers have ospfd running, monitor the routing table to confirm that new routes are installed. If the other groups have also reached this step, you should also see routes to their networks.

7. Check the packets captured, and see what packets are involved to enable the OSPF to exchange routing information, and read their application-level content.

8. Connect to the control interface of `ospfd`, by using the command `telnet 127.0.0.1 ospfd`. Use the `show ip ospfd` … commands to see the current state of OSPF.

9. At computer A, configure a static route to outside (using two networks 0.0.0.0 and 128.0.0.0 with a netmask length of 1), which should go through the NAT router. Restart both zebra and ospfd, and wait for a while until you see its routing table is filled with the routes of other networks.

10. Confirm that the other computers also obtains the default route. If you want to try connecting to the outside from these computers (e.g., browse the web), be sure to stop `ipchains` first (since the fire wallnormally blocks all transit packets). But you don't need to configure IP forwarding, since `zebra` does that for you. Connect to the `ospfd` control interface to see how these static routes (and the router providing them) are treated differently in `ospfd`. (Note: the mechanism for interacting with EGP is the same—the backbone router distribute the external route to all routers of all areas, although the routes are obtained from another routing protocol rather than configured manually.)

11. When the group opposite to you also reaches this step, add an extra cross cable between computer D's of the two groups. Note that now the network forms a cycle, and the best route is not always to go out to the network with the NAT router. Reconfigure zebra and ospfd in D to take advantage of this new link, and restart both `zebra` and `ospfd` of the computers with modified configuration. Check that the routing table of other computers are updated to get the shortest path.

12. Unplug the connection between A and the hub of one of the two groups (which causes link failure). See how long it takes for the other computers to fix the routing table so that all traffic pass through the cross-cable between D's. Plug the connection again and see how long it takes for the network to resume normal operations. Repeat by stopping and restarting OSPF running on one of the hosts (which causes host failure).