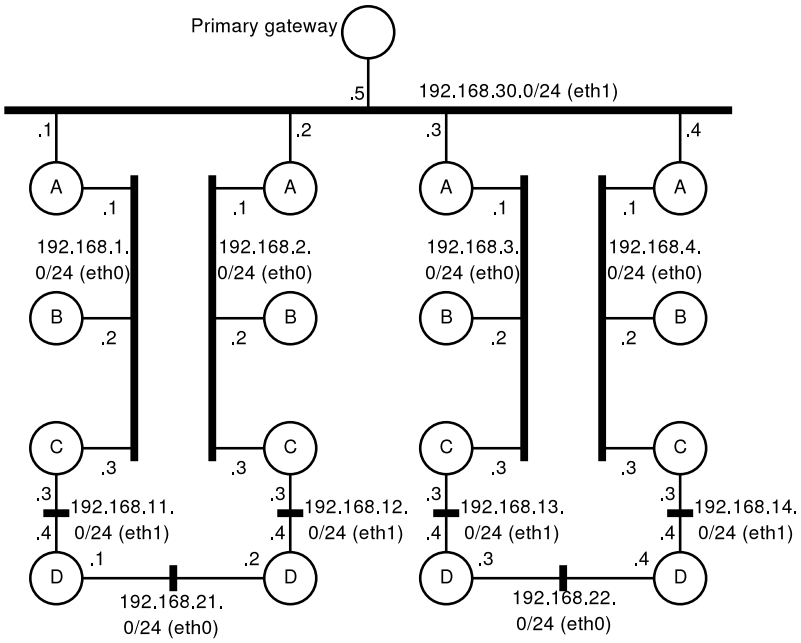
CSIS0234B Computer and Communication Networks (Class B)
Tutorial 9
Experiencing dynamic routing

In this tutorial, we work in groups of 3 to 4, to setup a network so complex that we don't want to configure manually. We will use the computers as routers, and run OSPF on it using `zebra`.

Your tasks

Each group works on four computers. One of them, A, is connected to a primary gateway (interface `eth1`). Two of them, B and C, are connected to A with a hub or switch (interface `eth0`), and the fourth (D) is connected to C with a "cross cable" (interface `eth1`), which you can treat as a hub plus two cables. Computer D of adjacent groups are also connected with a cross cable (interface `eth0`). The configuration, as well as the IP addresses to use for each of the computer and network, is shown below.



You will configure zebra to find routes among these networks. During the exercise, you can use `ethereal` to see the packets used to achieve routing. The detailed steps are as follows.

1. Login as `root` in **virtual console 1** (Control-Alt-F1) to bring down the `eth0` interface, using `ifdown`. Switch back to GUI login (Control-Alt-F7), login as `root` again.

2. Since we will treat our computers as routers, **stop the firewall** with `service iptables stop`. You don't need to configure IP forwarding, since `zebra` does that for you.

3. Use the IP addresses in the diagram above to **write** `/etc/zebra/zebra.conf` **in each computer**. Set a password for the control interface. Do not configure a default route. For computer D, do not configure the inter-group interface yet.

4. At computer A, **configure a default route** to outside, which should go through the NAT router. Other computers do not need a default route. (It will be obtained by the routing protocol.)

5. **Start zebra**. Use `ifconfig` to check that each interface has the right IP address, and use ping to test connectivity with neighbours. If you find that the IP address is not correct, stop

`zebra`, and use `ifconfig eth0 0.0.0.0 down` and `ifconfig eth1 0.0.0.0 down` to erase the IP addresses in the interface **before** starting `zebra` again (otherwise the wrong IP addresses will still be binded to the interface).

6. Use `telnet 127.0.0.1 zebra` to access the **control interface**, using the password you set. Type `?` to see the available commands, and use `show ip route` to see the current routing table. Note that `?` can be used at any time, and you can do command completion using the Tab key. Take advantage of these help to try a few other commands. At the end, exit by typing Control-D.

7. **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.

8. In computer A, add a line `default-information originate` in `ospfd.conf`, which allows the default route to be redistributed to other routers. (By default it is not redistributed.)

9. 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`.

10. 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. Confirm that you can ping to the primary gateway. You should also be able to connect to the outside from these computers (e.g., browse the web).

11. **Check the packets captured**. Find the packets used to exchange routing information, and read their application-level content to find the "LSAs" (Link State Advertisements) being flooded across the network.

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

13. From the `ospfd` control interface, see the OSPF neighbours and routes (using `show ip ospf` …) to see how the **default route**, and the router providing them, are **treated differently** from other routers.

14. When the group opposite to you also reaches this step, **configure the 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 two D's. Check that the routing table of other computers are updated to get the shortest path.

15. **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 passes 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 routers (which causes router failure).