# Lab 5 - OSPF

Introduction

In this lab you will configure a simple network of three routers to use OSPF. You will use Wireshark to show Hello and Link State Update packets. By changing the interface bandwidths, and thus the link costs, you will force the routers to recompute their routing tables. You will use traceroute to check the changes to the routing tables.

The network below will let us demonstrate basic OSPF operation.
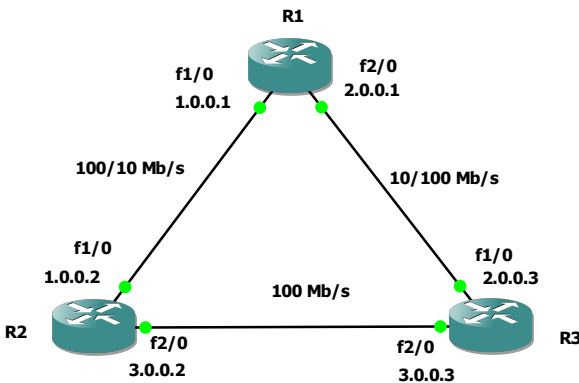
Packets from R1 must be routed through either R2 or R3 to reach network 3.0.0.0/8. The links from R1 to R2 and from R1 to R3 will be set to different data rates so that one route is preferred.

If the R1-R2 link is faster, the shortest (lowest cost) path from R1 to 3.0.0.0/8 will be through R2. But if the R1-R3 link is faster then the lowest-cost path from R1 to 3.0.0.0/8 should be through R3.

To verify that the OSPF algorithm is working we will look at the OSPF protocol messages with Wireshark, display the OSPF database and the routing tables on R1 and use the traceroute utility.

Procedure

Check Working Directories

If the software was installed by someone else you may need to change some working directory settings.

Check that the following working directory settings are set to a folder you can access (e.g. the GNS3 installation folder):

- under Edit -> Preferences -> Dynamips check the "Working directory for Dynamips".
- under Edit -> Preferences -> Capture check the "Working directory for capture files".

Configure Network

Set up the network topology shown above using c7200 routers as in the previous lab.

Each router should be configured with two Fast Ethernet (PA-FE-TX) adapters on each of Slots 1 and 2. Do not use a PA-2FE-TX card – it is not supported by the version of IOS that we have.

Configure the IP addresses shown in the diagram with /8 netmasks. You may find it easier to use the Device -> Startup-config menu command and copy and paste configuration commands into the startup config file. You can then load the startup configuration commands with the command: `copy start run`.

Start a Wireshark capture on the R1-R2 interface.

Configure and Enable OSPF

To enable OSPF processing on a router use the IOS config-mode command:

```
router ospf 1
```

where 1 is an arbitrary "process number" which allows one router to have multiple OSPF routing databases. We will only use one. This will change the prompt to `(config-router)#`.

To specify that all interfaces should be in OSPF area 0, use the command:

```
network  0.0.0.0  0.0.0.0  area 0
```

followed by `ex` to return to config mode. Give these commands on each router. Again, you may want to modify the startup config files instead of entering the commands manually.

Change Bandwidth Settings

The Ethernet interfaces auto-negotiate link speeds (10 or 100 Mb/s) and cannot be reconfigured with IOS commands. However, we can change an interface's bandwidth parameter, normally set to the interface speed, to force OSPF to calculate a different link cost.

Use the command `sh in f2/0` to show the configuration of the interface between R1 and R3. Note the bandwidth (BW) value is set to 100000 Kbit (100Mb/s). Change this by entering interface f2/0 configuration mode (see previous lab) and set the bandwidth to 10 Mb/s using the command `bandwidth 10000`. This will set the bandwidth to be used in cost calculations to 10 Mb/s.

Return to exec mode and check that the bandwidth setting for R1-R2 is faster than the bandwidth for R1-R3 although both interfaces are still running at 100 Mb/s.

Check the OSPF database on R1 using the commands:

- `show ip ospf` will show configuration and statistics for the OSPF process
- `show ip ospf neigh` will show the OSPF neighbours (from Hello packets)
- `show ip ospf database` will show a summary of the contents of the link state database

Use the `sh ip route` to look at the routing table.

Use the command `traceroute 3.0.0.3` to verify the route from R1 to the 3.0.0.0/8 network.

Take a screen capture showing the routing table and the output of the traceroute command.

Reverse Bandwidth Settings

Reverse the bandwidth settings so that the bandwidth setting on the R1 to R3 link is faster than from R1 to R2.

Check to see if the link metrics (costs) in the routing database and the routes in the routing table have changed. Run the same traceroute command to verify the updated routing.

Take a screen capture showing the new routing table and the output of the second traceroute command.

Stop Wireshark and save the Wireshark capture to submit with your report (File->Save As).

You may want to save your GNS3 project (File->Save project as...) in case you need to repeat some part of the lab.

Report

Include the following in your report:

- a screen capture of your topology (use View -> Show hostnames and View -> Show interface labels to make sure the router names and interface names are shown).
- the two sets of `show ip route` and `traceroute` results
- Wireshark capture of a Hello packet from R1 to R2
- Wireshark capture of an link state update packet from R1 showing the Router-LSA information including costs (metrics).

To find relevant packets you can use Wireshark filter expressions such as `ospf.msg.hello` or `ospf.msg.lsupdate`.

Answer the following questions based on the captured OSPF packets sent between R1 and R2 of type Hello:

- what are the router priorities?
- what other routers has R1 received Hello packets from? R2?
- which router was elected the DR? why?

Answer the following questions based on the captured OSPF packets sent by R1 of type LS update and their Router-LSA link state type information:

- what are the source and destination IP addresses?
- how many link metrics are included?
- what are the Router IDs and metrics? (Note: the Data: value is the router's interface IP address, the ID: value is the ID of the other end of the link.)

You can add conditions to the Wireshark filter using the and (`&&`) operator. For example, use `ip.src == 1.0.0.1` to select a specific source address and `ospf.lsa.router` to select packets with Router-LSA data.

Submit your report to the dropbox on the course web site along with your Wireshark capture file.