CSE-556 Internetworking
Fall 2002

Laboratory Assignment 6

Objective

The objective of this Laboratory Assignment is to get familiar with the OSPF link state routing protocol, which is a dynamic routing protocol for TCP/IP internetworks. In addition, we will be performing route redistribution and route filtering and also doing further practice with IP addressing in this lab.

Theory

OSPF stands for Open Shortest Path First. The Open in the OSPF name refers to the fact that the protocol is an open standard (an Internet standard) and not a proprietary protocol. The SPF refers to the Djisktra's shortest path algorithm from graph theory, which is used by the link state routing protocol to develop its routing table from the topological database of the internetwork. The routers running a link state routing protocol such as OSPF flood the state of their links (cost & condition) to their neighbors. This is in contrast to the distance vector routing protocols such as RIP, which transmit their entire routing table to their neighbors. The Link state database (LSD) in all the Routers have to be the same. Synchronization ensures same Database. From the Synchronized Link State Database (LSD) of the Entire Area, Each Router builds a unique Shortest Path (SPF) Tree. From the SPF Tree, each Router then computes their different Routing Tables.

Routers can be configured to distribute routes learnt from one routing protocol into another. In addition, route filtering can be performed whereby internetwork administrators can control certain routing information from being propagated by the routers.

You would need the following pieces of equipment/hardware:

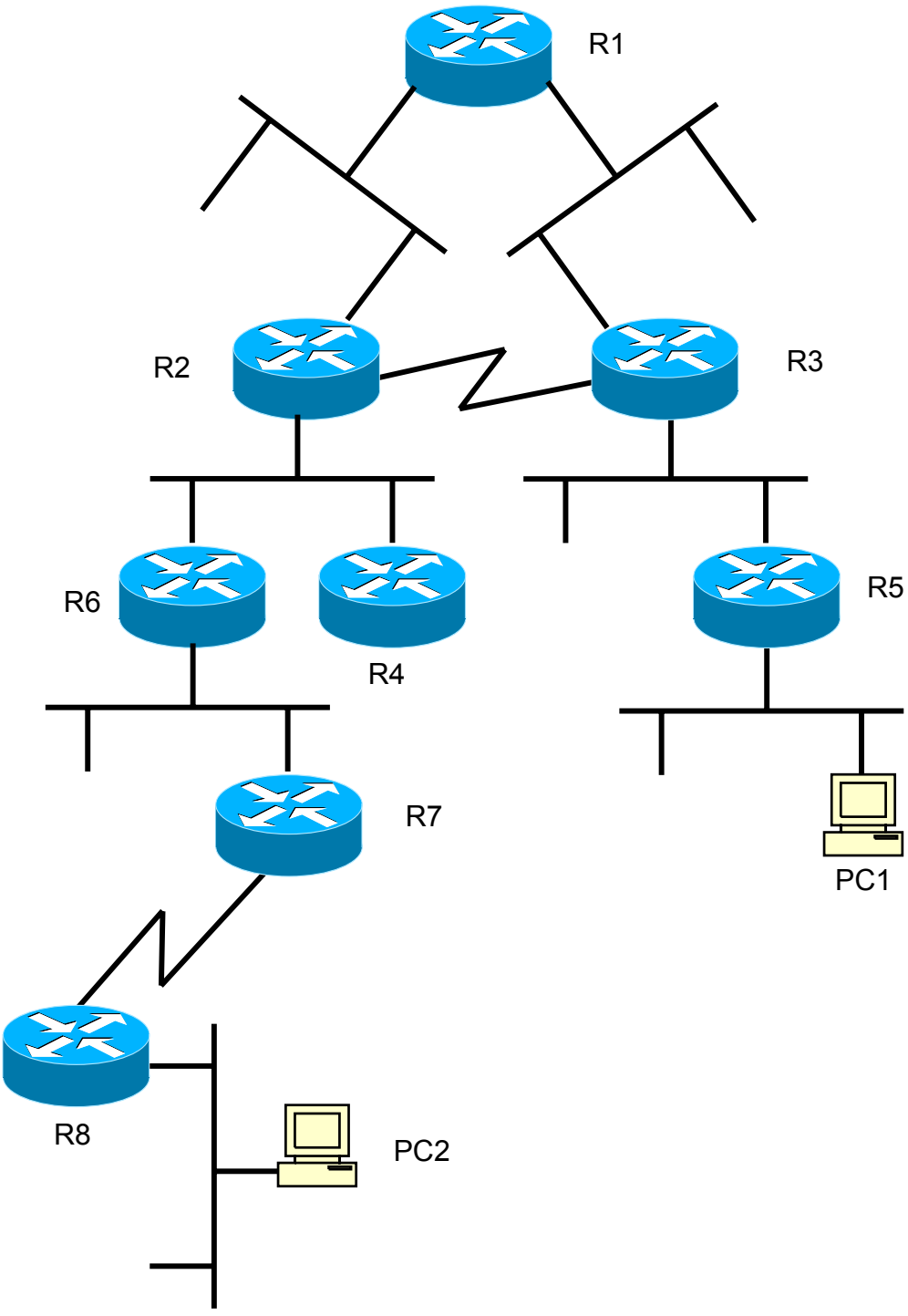
1. Seven Ethernet cross-over cables
2. Two Null Modem Serial cables
3. Four PCs equipped with two Ethernet NICs each and two PC equipped with a single Ethernet NIC each

Please note the following:

1. Routers are running Red Hat Linux 7.2 with ZEBRA routing package
2. PC1 and PC2 can be running any desktop operating system (Windows 95/98/NT/2000/XP, Linux)
3. Bulk of this lab has been adapted from a Cisco Systems Bootcamp for Internetworking Engineers

Lab Assignment

1. Establish the network topology shown in the figure below:



2. Define IP addressing scheme for this internetwork using a class B networks available for use in private networks as per instructions in following points. Draw a labeled figure for your internetwork similar to the figure given in point 1 above.

3. Physically connect all devices.

    - The serial links from routers 1, 2, and 3 will run RIP and will be in one major net. The Ethernets between routers 3, 5, and PC1 will be in another major net, and will also run RIP. Router 2's Ethernet, router 4, router 6, router 7, and router 8 will run OSPF in a major net, different from the other two RIP nets mentioned earlier in this paragraph.

    Note: There will be a total of three major networks; two for RIP and one for OSPF.

4. Define an addressing scheme for the OSPF network using a single Class B address space.
5. Define a different address scheme for the RIP domain with Class B address space.
6. Configure the IP addresses and OSPF on routers 2, 4, 6, 7, and 8.
7. Configure each OSPF router with a loopback interface. Include the loopback interfaces under the OSPF process.
8. Configure the following in the OSPF areas:

    - OSPF Area 0: configure an Ethernet segment between router 6 and router 7
    - OSPF Area 1: configure an Ethernet segment between router 2, router 4, and router 6
    - OSPF Area 2: configure a serial link between router 7 and router 8
    - Make sure that each AS can see its connected routes. That is, make sure the RIP routers still see the RIP networks, and the OSPF routers see the OSPF networks.

9. Do a **show ip route** command on router 4.

    Question: What *inter-area* routes do you see?

    Question: What *intra-area* routes do you see?

10. Change the network statement on router 6 such that router 6's ethernet that connects to router 7 is included in area 1 now.

    Question: What *message do you see on the console*? Why?

11. Change the network statement on router 6 such that router 6's ethernet that connects to router 7 is included in area 0 now. Change the hello parameter of this interface to 9 second.
12. Do **debug ip ospf adjacency** command on router 6.

Question: What message do you see in the debug?

Question: Is it forming neighbors with router 7? Why not?

13. **Undebug all** and Change the hello parameter of router 6's ethernet back to 10 seconds
14. Do **show ip ospf database** command on router 4.

Question: Do you see the *intra-area* routes?

15. Do a **show ip ospf data router** command on router 4.

Question: Now do you see the *intra-area* routes?

16. Print and attach **show** command outputs to lab report.
17. Add another Ethernet or serial interface on router 4 in Area 1. Look at how this network appears in router 6 and router 7's routing table and database.

Question: Does this network show up one or more times in the database on each of these systems? If so, as what types of LSAs?

18. Print and bring output to the review session.
19. Do a **show ip ospf nei** command and a **show ip ospf int** command on router 2, router 4 and router 6.

Question: Who are the neighbors of routers 2, 4, and 6?

Question: Which router is the designated router (DR) on the router 4, 6, 7 network?

Why?

Question: Which neighbors have adjacencies with each other?

20. Do a **debug ip ospf events** command, and then shut down the interface of the DR on this Ethernet.

Question: What happens?

21. Bring the interface back up with debugs enabled.

Question: What happens?

22. Make router 6 the DR.
23. Make routers 2 and 4 ineligible to be the DR.

Question: Now which neighbors have adjacencies?

24. Print and attach **show** command outputs to lab report.
25. Make router 2 the point of redistribution from RIP to OSPF, and from OSPF to RIP.
26. Make sure all devices can ping each other.

Question: What does router 5's major net look like from router 2's perspective?

Question: What does router 5's major net look like from router 6's perspective?

27. Print and attach **show** command outputs to lab report.
28. Put filters on router 2 so that router 2 does not advertise router 5's major net into OSPF.

Question: How does the route look now on router 2?

29. Ensure that route is gone from router 7.

Question: Is the route from 2 to 5 still in router 7's OSPF database?

30. Print and attach **show** command outputs to lab report.
31. Configure a static route on router 8 that links router 8 with another major network. Redistribute this static route into OSPF.

Question: What does it the static route look like in router 6's routing table?

Question: What does it the static route look like in router 2's routing table?

Question: What does it the static route look like in router 5's routing table?

32. Put filters in so that this new major net with router 8 is blocked from RIP.

33. Verify that the new major net with router 8 is gone from router 5.

34. Print and attach **show** command outputs to lab report.