Lab 6: Dynamic Host Configuration Protocol
The purpose of this lab is to configure a DHCP server for several subnets. You will configure additional options along with an IP address and netmask, and you will configure a host reservation to guarantee that a particular host will always get a specific IP address. You will also configure a relay agent for relaying IP addresses from your server to clients in Mordor, the 192.168.2.0 network.
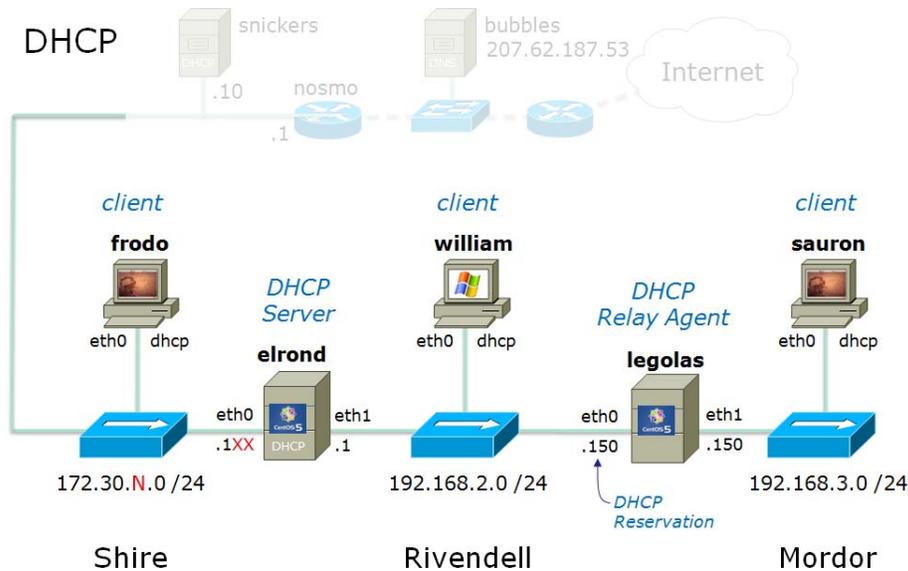
.1XX is based on your station number and the IP Table in the appendix
N=1 for the classroom and N=4 for the CIS lab or CTC

Supplies

- VMWare Server 1.08 or higher
- 192 VMs shown above

Preconfiguration

- Original versions of all VMs. Note, this will set the network configurations back to down or DHCP settings.
- You will need access to a DHCP server to assign addresses for the 172.30.N.0/24 network. This is already configured if the lab is done using the CIS VMware

Stations in the CIS Lab (room 2504) or the CTC. If you plan to do this lab at home see: http://simms-teach.com/howtos/202-working-at-home-nat.pdf

Forum

Use the forum to ask and answer questions, collaborate, and report any equipment issues. Post tips and any lessons learned when you have finished. Forum is at: http://opus.cabrillo.edu/forum/viewforum.php?f=5

Procedure

Read through the entire lab before proceeding with the individual steps so that you know what your objective is. You may decide which VMnets to use for this lab. Draw a picture of the network.

The new commands/daemons we will be using for this lab are:

- dhcpd
- dhclient
- dhcrelay

The configuration of the DHCP service will require root access.

Setup
1. Revert VMs back to the original state.
2. Permanently join Elrond to the Shire network using a static IP address based on your station number from the IP table in the appendix.
3. Install the dhcp package on Elrond with: **yum install dhcp**
4. Temporarily join Legolas to the Shire network and install dhcp as you did with Elrond.
5. After the DHCP service has been installed on Elrond and Legolas, cable the VMs according to the diagram above. Use any of the internal VMnets you wish for Rivendell and Mordor.
6. Configure Legolas eth0 for DHCP and eth1 as shown in the diagram.
7. Frodo, Sauron, and William should be configured for DHCP. You can power them back down for now. They will be used to test getting addresses from the DHCP server.

Part I
Choose Elrond as your Rivendell-Shire router and DHCP server.
1. Configure Elrond to forward packets between the Shire and Rivendell networks.
2. Choose Legolas as your reservation client. This client will be configured as the router/relay agent into Mordor in Part III.
3. Now, use the **ifconfig** command to obtain Legolas' eth0 hardware (MAC) address. Record this address for use in a DHCP reservation.
8. On Elrond, verify that the dhcp package is installed:
   rpm -qi dhcp
   You should see that dhcp-3.0.5-13.el5 or later is installed.
9. Now copy the file /usr/share/doc/dhcp*/dhcpd.conf.sample to the /etc directory renaming it to dhcpd.conf
10. You will now edit this configuration file; be careful not to lose any of the terminating semicolons.
11. You will create two subnet scopes: one for Rivendell and one for the Shire.

12. Update the following fields in these scopes:
    - the subnets you are working on are 192.168.2.0/24 and 172.30.N.0/24
    - default gateway (option routers) = 172.30.4.1 for the Shire and 192.168.2.1 for Rivendell.
    - the option domain-name = Shire and Rivendell
    - the option domain-name-servers = 207.62.187.53
    - Update the option time-offset to reflect Pacific Standard Time (-28800 seconds) or Daylight Savings Time (-25200 seconds). One hour = 3600 seconds.
    - For Rivendell, make the range of IP addresses from 50 to 99.
    - For Shire, make the range of IP addresses **using the DHCP IP allocation pools table in the Appendix so conflicting IP addresses are not assigned**.
    - Comment out or remove unused options.
    - Edit the reservation in the Rivendell subnet of the /etc/dhcpd.conf file:

      ```
      host legolas {
              hardware ethernet 00:0C:29:XX:XX:XX;
              fixed-address    192.168.2.150;
      }
      ```

13. Save the above changes to /etc/dhcpd.conf.
14. Check for the existence of the DHCP Server's database dhcpd.leases file in the /var/lib/dhcpd directory. If not present, create it with:
    touch /var/lib/dhcpd/dhcpd.leases
15. Open port 67 on Elrond's default CentOS firewall with:
    iptables -I RH-Firewall-1-INPUT 6 -p udp -m udp --dport 67 -j ACCEPT
16. Review your firewall with **iptables –L -n**

Part II
You are now ready to start your DHCP server.

1. Start the DHCP service with
   /etc/init.d/dhcpd start
   or **service dhcpd start**
2. If this command FAILS, then review the /var/log/messages file. You must re-edit /etc/dhcpd.conf, fix any mistakes, and try again.
3. If the DHCP daemon starts up successfully, you are ready to test the service.
4. Power on Frodo, what IP address did you get? Note: there is another DHCP server on the 172.30.4.0 subnet, so Frodo may obtain an address from the other DHCP server. How will you know? (Hint: the other DHCP server's pool of addresses is from 150 - 199).
5. On Frodo, release the current DHCP address with **dhclient –r**, then request again with **dhclient**.
6. On Frodo, use **ifconfig, route –n** and **cat /etc/resolv.conf** to verify IP settings, default gateway and DNS have been set up properly.
7. Power on William, use **ipconfig /all** to see the IP address you got. Use **ipconfig /release** and **ipconfig /renew** to release and then request a new DHCP address.
8. On William, use **ipconfig /all** to verify IP settings, default gateway and DNS have been set up properly.
9. On Legolas, do a service network restart. Does Legolas get it's reserved IP address?

10. On Legolas, do a **dhclient –r eth0** followed by a **ifconfig eth0** to release then request a new DHCP address.
11. On Legolas, use **ifconfig**, **route –n** and **cat /etc/resolv.conf** to verify IP settings, default gateway and DNS have been set up properly.
12. On the clients, the lease and reservation will be recorded in the client database file:
    Frodo (Ubuntu 9.10): /var/lib/dhcp3/dhclient.leases
    Legolas (CentOS 5.4) /var/lib/dhclient/dhclient.leases
    Note that this information records the address of the DHCP server that handed them out.
13. You should also look at the DHCP Server's database file, /var/lib/dhcpd/dhcpd.leases, for a recording of the leases and their expiration dates. Note the comment about UTC and Greenwich Mean Time.

Part III
Add a third subnet to your DHCP Server and configure Legolas as a DHCP Relay agent allowing the clients on the Mordor network to obtain IP addresses from your DHCP Server.
Note: a Relay agent is a router service and cannot also be the DHCP server.

1. Add a subnet for the 192.168.3.0 addresses to your DHCP server's dhcpd.conf file.
   - Use the range: 192.168.3.50 to 192.168.3.99
   - The domain-name option should be Mordor
   - The router option should be: 192.168.3.150
   - You do not need to specify a reservation for this subnet.
2. Before restarting your DHCP server, add a static route for the Mordor network to Elrond's routing table. Your relay agent will be your gateway into Mordor.
3. Restart your DHCP server.
4. Setup Legolas to be the Rivendell-Mordor router. Use 192.168.3.150 as its eth1 address to Mordor. (It already has its reservation for eth0.)
   Don't forget to turn on IP forwarding.
5. Before starting your dhcrelay server, you will need to edit the dhcrelay configuration file:
   /etc/sysconfig/dhcrelay
   assign the two shell variables in this file:
   INTERFACES="eth0 eth1"
   DHCPSERVERS=192.168.2.1
   The DHCRelay agent needs to listen on the interface with which it will talk to the DHCP server as well as the interface on which it will listen for client requests.
6. Open port 67 on Elrond's default CentOS firewall with:
   iptables -I RH-Firewall-1-INPUT 6 -p udp -m udp --dport 67 -j ACCEPT
7. Review your firewall with **iptables –L -n**
8. Start the dhcrelay service:
   service dhcrelay start
9. Power on the Mordor client Sauron and verify it got a correct address.

To turn in

Your *lab06* **text** file should contain the following sections.

- Standard boilerplate information:
  – CIS 192 Lab *XX*
  – *Name*

- *Date*
- TBA hours: *X.X*
- Station number: CIS-Lab-*XX*

- From Elrond: /etc/dhcpd.conf and /var/lib/dhcpd/dhcpd.leases
- From Legolas: /etc/sysconfig/dhcrelay and /var/lib/dhclient/dhclient.leases
- From Frodo: /var/lib/dhcp3/dhclient.leases
- From Sauron: /var/lib/dhcp3/dhclient.leases
- From William: output from ipconfig /all
- Command summary (your cheat sheet for future reference)

Having done the lab, can you answer the following questions?

1. Is a reservation the same as a lease, that is, does it expire?
   (Hint: check the DHCP server's database file, *dhcpd.leases* for the reservation.
2. Why did you have to add the static route to Mordor in the DHCP server's routing table?

Check your work for completeness then submit as many times as you wish up until the due date deadline. Remember, **late work is not accepted**, so start early, plan ahead for things to go wrong and use the forum to ask questions.

[p]scp lab06 cis192@opus.cabrillo.edu:lab06.*lastname*

Grading rubric (30 points)

3 points for complete submittal, professional appearance and quality
8 points for correctly configuring the DHCP server
8 points for correctly configuring the DHCP relay agent
8 points for Frodo, William and Sauron getting correct settings
3 points for concise and useful command summary

Extra Credit (5 points)

Modify the default CentOS firewall/nat rules on Elrond and Legolas so all Rivendell clients have Internet access without adding any additional static routes.

Hint: one rule needs to be added to Elrond's POSTROUTING chain, one rule needs to be deleted on Elrond's FORWARD chain, and one rule needs to be deleted on Legolas' FORWARD chain.

- From Elrond: show **iptables -L –n -t nat** output
- From Elrond: show **iptables –L –n** output
- From Legolas: show **iptables –L –n** output
- On Sauron: show **ping –c1 google.com** output

Appendix

IP Address Assignments for Lab PCs (CIS Lab and CTC)

		Static		DHCP Pool	
Station	**Station IP**	**Static 1**	**Static 2**	**Start**	**End**
CIS-Lab-	**172.30.4.**	**172.30.4.**	**172.30.4.**	**172.30.4.**	**172.30.4.**
1	101	121	122	50	54
2	102	123	124	55	59
3	103	125	126	60	64
4	104	127	128	65	69
5	105	129	130	70	74
6	106	131	132	75	79
7	107	133	134	80	84
8	108	135	136	85	89
9	109	137	138	90	94
10	110	139	140	95	99
11	111	141	142	200	204
12	112	143	144	205	209
13	113	145	146	210	214
14	114	147	148	215	219
15	115	149	150	220	224
16	116	151	152	225	229