



CIS 192 Linux Lab Exercise

Lab 2: Temporary Network Settings Configuration Spring 2010

Lab 2: Temporary Network Settings Configuration

The purpose of this lab is to configure the network settings of several Linux systems to join one or more networks. This includes setting the IP address, network mask, default gateway, and DNS settings for different distributions of Linux. Putty and SSH will be used to traverse through the various systems after the interfaces have been configured.

Supplies

- VMWare Server 1.08 or higher
- 192 VMs: Frodo, Elrond, and Fang
- Virtual networks: VMnet3

Preconfiguration

- Original versions of all VMs.
- You will need access to a DHCP server to assign addresses to the 172.30.4.0 /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 for help, post tips and any lessons learned when you have finished. Forum is at: <http://opus.cabrillo.edu/forum/viewforum.php?f=5>

Background

One way to configure network settings is to use the **ifconfig** and **route** commands. They are used to make immediate changes, however these changes are temporary and will only remain in effect till the next system reboot. The other way, which is permanent, is to edit network configuration files which are then used to configure network settings when the system is booted. We will be using the temporary method for this lab.

The NIC configuration can be static or dynamic. If static, an IP address is manually configured and care must be taken to avoid duplicate IP addresses. If dynamic, a DHCP server is required to provide an IP address.

To connect to the local network only the IP address and mask need be configured (with the **ifconfig** command). If we want to connect to hosts on a different network the routing table

must be updated with a route or default gateway (with the **route** command). If we want to use hostnames rather than IP addresses, then DNS name servers need to be configured in the **/etc/resolv.conf** file.

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

- **ifconfig**
- **dhclient**
- **ping**
- **route**
- **ssh**

It may be helpful to review these modules in Lesson 1:

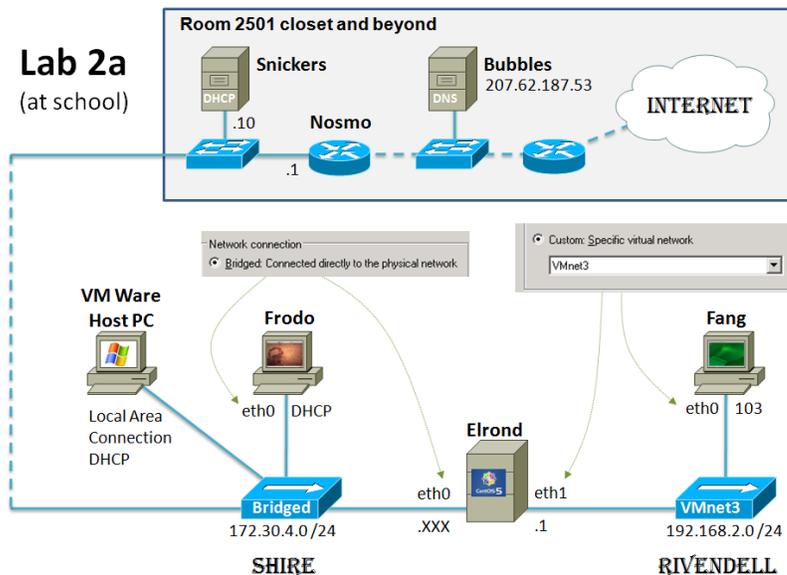
<http://simms-teach.com/docs/cis192/cis192lesson01.pdf>

- Configuring Static IP addresses (temporary)
- Configuring Gateway & DNS
- Configuring Dynamic IP address (dhcp)
- Testing
- SSH Hopping

Procedure

You will be cabling Frodo, Elrond and Fang according to the diagram below. Once cabled you will configure the network settings to join each VM to the network and then use ping to test connectivity.

Results will be recorded in a lab2.*logname* text file that gets submitted at the end of the lab.



Step 1 – Preparation

Revert the following VMs back to their snapshots:

- 192-Elrond
- 192-Fang
- 192-Frodo

There is a template available for writing up the results of this lab. If you don't want to use the template that's OK as long as you include the same information.

- Download the template from <http://simms-teach.com/docs/cis192/lab2.logname> and open it up with Notepad++.
- Save it as lab2.*logname* (using your Opus logname)
- Update the top header section with your own information.

Note the "TBA hours" should reflect the total amount of time you spent preparing for and doing this lab. The "Station number" is the CIS-Lab-*xx* identifier found on the front of the VMware station you use. To get CPU and RAM information for your station right-click on the CIS-Lab-*xx* "My Computer" icon on the desktop and select properties.

Step 2 – Cabling

- Cable up (using VM Settings) Frodo, Elrond and Fang to insure they match the diagram above. Frodo's only and Elrond's first interface are on the Shire network. Fang's first and Elrond's second interface are on the Rivendell network.

Step 3 – Verify Frodo's connection to the network

In this step we examine the network settings on an Ubuntu VM that gets configured by a DHCP service. The pristine version of Frodo has been preconfigured to connect to the network using DHCP. Snickers, a Windows server in the 2501 closet, provides a DHCP service for room 2501, 2504 and the CIS area in the CTC. The network settings (IP address, mask, gateway and name server) get configured automatically during system startup.

- Power up Frodo, which is an Ubuntu VM. The Ubuntu distribution is based on Debian. Ubuntu is working hard to produce an easy-to-use Linux for widespread use on desktop and notebook computers.
- Login as cis192 and then **su -** to root.
- Use **ping -c 3 google.com** to verify we have an IP address, subnet mask and name server configured.
- Let's examine the NIC hardware and driver on Frodo:
 - a. Use **lspci** to show the NIC hardware (AMD 79C970).
 - b. Use **lsmod | grep pcnet32** to see the loaded NIC driver kernel module (pcnet32).
- Lets view the interfaces and check that we have an IP address and subnet mask:
 - a. Issue the **ifconfig** command and check that eth0 and lo are up and running.
 - b. lo is the loopback interface to access local services without having to go out on the network.
 - c. For eth0, note the MAC address (HWaddr), IP address (inet addr), subnet mask (Mask) and broadcast address (Bcast).
- Check the connection to the Shire network:
 - a. Use **ping 172.30.4.1** to ping the router. You must hit Ctrl-C to stop the pinging.
 - b. Alternatively you can use the **-c** option to set the ping count. Try **ping -c 5 172.30.4.1** to test this. Note the success or failure of the ping.

- c. Use **ping 172.30.4.1xx** where **xx** is your CIS-Lab-xx station number.
- d. Note if this fails you may be experiencing the GAH! problem. See <http://simms-teach.com/docs/wanted.pdf> to troubleshoot.
- Verify you have a default gateway set:
 - a. Use **route -n** and look for an entry with 172.30.4.1 under the Gateway column and a "G" under the Flags column.
- Verify you have some DNS name servers configured to resolve hostnames to IP addresses:
 - a. Use **cat /etc/resolv.conf** and look for the 207.62.187.53 and/or 207.62.187.54 name servers.

Step 4 – Frodo Troubleshooting

Now let's break some things and see what happens. Don't do this from your Putty session because your connection will be broken. We will be using the ping command and observing the error messages we get after breaking things. Knowing what these error messages mean will help you troubleshoot future labs. If you break things so badly that you can't get them to work again then restart the network service on Frodo using **/etc/init.d/networking restart**

- Shut down the interface eth0
 - a. Shut down the eth0 interface with **ifconfig eth0 down** and verify it is down with the **ifconfig** command (should no longer see the eth0 interface).
 - b. Try to ping the router again which should now fail. Record the error message in your lab report.
 - c. Bring the interface back up again with **ifconfig eth0 up** and use ifconfig to see if you still have the same IP address.
 - d. Make sure you can ping the router again.
- Release the IP address:
 - a. Release your current IP address with **dhclient -r**
 - b. Ping the router and record the error message in your lab report.
 - c. Get a new IP address with **dhclient eth0**
 - d. Make sure you can ping the router again.
- Delete the default gateway:
 - a. Ping Opus using **ping 207.62.186.9** which should succeed.
 - b. Delete your default gateway using **route del default gw 172.30.4.1**
 - c. Use **route -n** to check it has been removed.
 - d. Ping Opus again and record the error message in your lab report.
 - e. Restore the route with **route add default gw 172.30.4.1**
 - f. Check the routing table with **route -n** and make sure you can ping Opus again.
- Delete your DNS name servers:
 - a. Use **ping opus.cabrillo.edu** to ping Opus
 - b. Remove the name servers with **> /etc/resolv.conf**
 - c. Use **cat /etc/resolv.conf** to make sure file is now empty.
 - d. Use **ping opus.cabrillo.edu** again and record the error message in your lab report.
 - e. Try pinging Opus using its IP address with **ping 207.62.186.9**
 - f. Why does that work?
 - g. Use **echo nameserver 207.62.187.53 > /etc/resolv.conf** to restore one of the name servers.
 - h. Use **ping opus.cabrillo.edu** to make sure all is well again.
- Disconnect Frodo from the Shire network

- a. Use VM Settings and for the Ethernet device, under Device status remove the check in front of “Connected”



- b. Ping the router with **ping 172.30.4.1** and record the error message in your lab report.
- c. Reconnect by using VM Settings putting a check back in front of “Connected”.
- d. Make sure you can ping the router again.

Step 5 – Configure Elrond with a static IP address

In this step you will be configuring both of Elrond’s interfaces with Static IP addresses to match the diagram above.

- Power up Elrond which is running the CentOS Linux distribution.
 - a. CentOS is a replica distribution of Red Hat Enterprise Server.
 - b. Elrond has two NICs so it can be configured as a router in later labs.
 - c. Note that Elrond is configured to boot up to run level 3 (no graphics).
 - d. Log in as `cis192`, then `su -` to root.
- Check the two NICs and driver
 - a. Use `lspci` to check there are two NICs, both AMD 79C970’s.
 - b. Use `lsmod | grep pcnet32` to see the loaded NIC driver kernel module (`pcnet32`).
- Check that the interfaces are down:
 - a. The pristine (reverted back to snapshot) version of Elrond is preconfigured with both `eth0` and `eth1` down. That means there will be no network connectivity without some manual NIC configuration.
 - b. Issue the `ifconfig` command and check that only the `lo` (loopback) interface is up and running.
 - c. Try `ping 172.30.4.1` which should fail because the interface is down.
- Configure `eth0` with a **non-duplicate** static IP address:
 - a. Open <http://simms-teach.com/docs/static-ip-addr.pdf> and look at the table on page 2 titled “Static IP addresses for CIS Lab and CTC VM’s page”.
 - b. Determine *your* static IP address using this table for *your* station. Use the address in the Static 1 column. For example, if you are using CIS-Lab-02 then your static IP address would be 172.30.4.123.
 - c. Use `ifconfig eth0 172.30.4.1xx netmask 255.255.255.0` to configure your particular static IP address.
 - d. Note, if you don’t use this table, and perhaps use the static IP address used by the person sitting next to you your connectivity tests will not be reliable.
- Check local network connectivity:
 - a. Use `ifconfig` to check `eth0` is up and note the MAC address (HWaddr), IP address (inet addr), subnet mask (Mask) and broadcast address (Bcast).
 - b. Use `ping 172.30.4.1` to ping the router. It should work now.
- Check Internet connectivity:
 - a. Next `ping 207.62.186.9` and `ping opus.cabrillo.edu`. Opus is on the Internet and both pings should fail. What errors do you get?
 - b. Set the default gateway with `route add default gw 172.30.4.1` and use `route -n` to verify. Try pinging 207.62.186.9 again. It should succeed now as we have a route out and back.

- c. Can you **ping opus.cabrillo.edu** now? What error message did you get? Without a name server configured the ping command cannot resolve the hostname to an IP address.
- d. Set the primary DNS server address with **echo nameserver 207.62.187.53 > /etc/resolv.conf** and retry pinging opus.cabrillo.edu. This should succeed now that the DNS server has been configured and the hostnames can be resolved to IP addresses.
- Configure Elrond's second interface.
 - a. Look at the diagram above and determine what IP address **xxx.xxx.xxx.xxx** should be set on eth1.
 - b. Use **ifconfig eth1 xxx.xxx.xxx.xxx netmask 255.255.255.0** to set it.
 - c. Use **ifconfig** to check eth1 is up and note the MAC address (HWaddr), IP address (inet addr), subnet mask (Mask) and broadcast address (Bcast).

Step 6 – Configure Fang's eth0 interface

In this step you will be configuring Fang's network settings to match the diagram above.

- Power up the Fang which is running the openSUSE Linux distribution. SUSE is a distribution popular in Europe.
- Login as cis192 and use **su -** to become root.
- Check the NIC and driver:
 - a. Use **lspci** to check the NIC hardware (AMD 79C970). Fang should have only one NIC.
 - b. Use **lsmod | grep pcnet32** to see the loaded NIC driver kernel module (pcnet32).
- Issue the **ifconfig** command and check the interfaces. Fang's interface has been preconfigured to use DHCP. Since there is no DHCP server on the 192.168.2.0/24 Rivendell network the interface may up but it will not have an IPv4 address.
- Use **ifconfig eth0 192.168.2.103 netmask 255.255.255.0** to manually configure the eth0 interface.
- Use **ifconfig** to check eth0 is configured and note the MAC address (HWaddr), IP address (inet addr), subnet mask (Mask) and broadcast address (Bcast).
- Use the **ping 192.168.2.1** command to ping Elrond's eth1 interface. This should work.
- Use the **ping 172.30.4.1** command to ping the router. This should fail. Use **route -n** to see why. There are no routes to anywhere except the local network 192.168.2.0 /24 and the loopback (127.0.0.0 /8).
- Don't worry about setting up the default gateway or the DNS name server. Until we learn how to configure routing on Elrond, Fang will not be able to get out to the Internet. We will learn how to do that in the next lab!

Step 7 – Traversing the VM's using Putty and SSH

Even though we don't have routes set up between the Shire and Rivendell networks we can still use Putty/SSH to traverse from system to system. Starting with Putty on your Windows system you can Putty to Frodo, from Frodo SSH to Elrond, from Elrond SSH to Fang. You can also Putty directly into Elrond as well.

- On the Windows desktop, use Putty to login into Frodo. Note you will need the IP address you noted earlier for Frodo to do this.
- Still in Putty, from Frodo, use **ssh 172.30.4.1xx** to login to Elrond. Use Elrond's eth0 IP address you noted earlier.

- ❑ Still in Putty, from Elrond, use **ssh 192.168.2.103** to login to Fang.
- ❑ Use **exit** to log off Fang.
- ❑ Use **exit** to log off Elrond.
- ❑ Use **exit** to log off Frodo.

Tip: Use Putty to enable a reliable way to use copy and paste between Windows and the Linux VMs. You can SSH to the VM of choice and then copy command output from the Putty window and paste it into your windows document. Likewise you can copy commands from a Windows document and paste them into the command line of a VM.

Note, **Putty uses a non-Windows method of doing copy and paste.** To copy data from putty **just select it.** Any highlighted text in Putty is automatically put on the Windows clipboard. To paste text or commands from the Windows clipboard into the Putty session, just **click the right mouse button.** Be careful using right mouse click in Putty as this will do an immediate paste whether you wanted to or not.

Step 8 – Record the following information on the VMs

On Frodo, record output from the following commands:

- NICs: **lspci | grep AMD**
- NIC driver: **lsmod | grep pcnet32**
- Interfaces: **ifconfig**
- Routing table: **route -n**
- Name servers: **cat /etc/resolv.conf**
- Internet connectivity test: **ping -c 3 opus.cabrillo.edu**

On Elrond, record output from the following commands:

- NICs: **lspci | grep AMD**
- NIC driver: **lsmod | grep pcnet32**
- Interfaces: **ifconfig**
- Routing table: **route -n**
- Name servers: **cat /etc/resolv.conf**
- Internet connectivity test: **ping -c 3 google.com**
- Rivendell connectivity test: **ping -c 3 192.168.2.103**

On Fang, record output from the following commands:

- NICs: **lspci | grep AMD**
- NIC driver: **lsmod | grep pcnet32**
- Interfaces: **ifconfig**
- Rivendell connectivity test: **ping -c 3 192.168.2.1**

Step 9 – Record Linux commands for your own future use

The **man** command is useful for documenting commands, options and arguments. However it is almost guaranteed that there will be no examples for a command you can't get to work.

Add example commands and key information to the "COMMAND/CONFIGURATON SUMMARY" section. Make this something you will find useful in the future after this course is long over. Think of it as a crib sheet you wish you had with you the next time you are in an igloo on the North Pole and your life depends on getting a Linux server connected to the network.

To turn in

When finished with this lab, update your total "TBA hours" in your lab2.*logname* file. This should reflect the total number of hours you spent preparing for and getting this lab done.

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.

scp lab2.*logname* cis192@opus.cabrillo.edu:lab2.*logname*

(Note: use pscp, rather than scp, if uploading from Windows)

Grading rubric (30 points)

- 5 points for complete submittal, professional appearance and quality
- 5 points for correct Frodo troubleshooting messages
- 5 points for correct Frodo configuration
- 5 points for correct Elrond configuration
- 5 points for correct Fang configuration
- 5 points for complete and concise command summary