



## Home Linux Networking Lab (202)

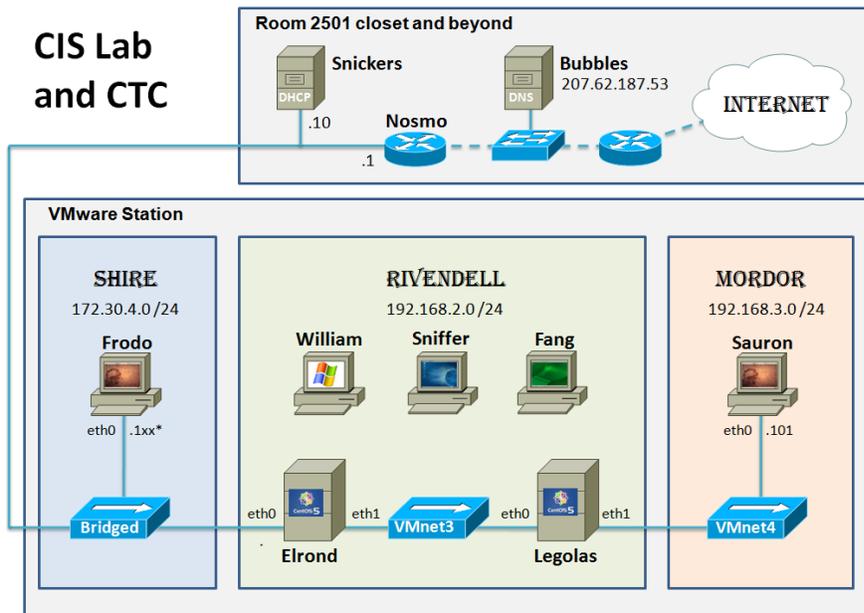
This Howto shows how to recreate the CIS Lab environment at home.

Supplies:

- A fast PC
  - 2 GB memory minimum
  - 50 GB free disk space minimum
- VMWare Server 1.08 or later  
<http://www.vmware.com/products/server/>
- VMs (available in the CIS Lab)
  - Treebeard, Celebrian, Arwen, Frodo, Elrond, Sniffer, Legolas, Sauron, Fang and Nosmo
- USB drive (to transport VMs from school to home)

## Overview

Here is the network environment used in the CIS Lab and CTC:



The network environment in the CIS Lab can be recreated at home. The lab assignments make use a number of systems running on virtual machines that can be "cabled" together in

a variety of way using virtual networks and virtual serial connections.

In the Lab assignments you will often be asked to ping the router at 172.30.4.1, use 207.62.187.53 as the DNS server, and power on Shire hosts that are using DHCP. To do this at home, there are some resources that need to be simulated so you can use the same network commands and configuration settings at home that you would use at school:

- A router at 172.30.4.1.
- Cabrillo's DNS server, bubbles.cabrillo.edu at 207.62.187.53
- The DHCP service on Snickers that assigns IP addresses on the Shire network in the range 172.30.4.150 to 172.30.4.199.

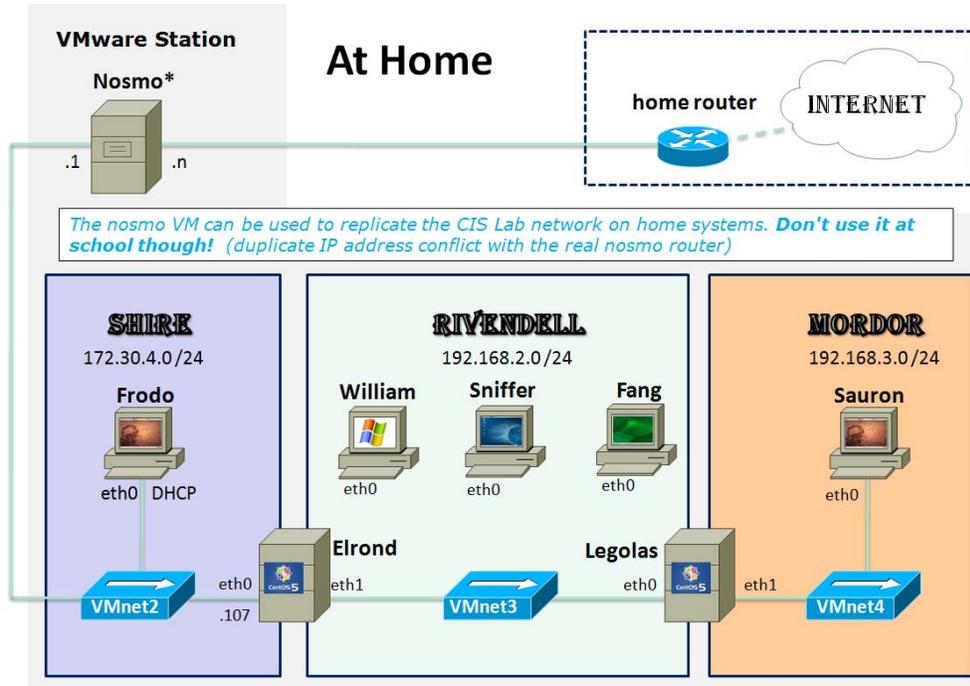
The Nosmo VM uses good old Red Hat 9. Nosmo is named after the Cisco router we use in the 2500 building. The Nosmo VM has two interfaces and forwards packets between them. On one side is your regular home network. On the other side is the 172.30.4.0 /24 Shire network which uses VMnet2.

You cannot use Bubbles, the Cabrillo DNS server, from home. Nosmo uses iptables to translate any DNS packets for Bubbles at 207.62.187.53 to your home router (or whatever DNS address you normally use at home).

Nosmo uses iptables to provide a NAT service (using masquerade) so VM's can access the Internet and your home LAN. Unlike the real Nosmo at school, static routes have been configured to direct packets to the Rivendell and Mordor networks used in the labs.

Nosmo provides a DHCP service to assign IP addresses (172.30.4.150 to 199) for hosts in the Shire network. At school this is done by the Snickers server.

The Nosmo VM **will need some modifications to properly work with your home networking environment**. Specifically it's eth0 interface will need to join your home network and requests to the Cabrillo DNS server need to be modified to go to your DNS service at home.



### Step 1 – Setup VMware at Home

You will need to obtain and install the free VMware Server product on either a Windows or Linux PC. Make sure you meet the minimum hardware requirements noted above.

### Step 2 – Obtain the Linux Networking VMs

At the time of writing this document the VMs above take about 45 GB. Using USB drives of sufficient size or quantity is the best way to transport these VM's home. You may have to make multiple trips.

1. Get pristine versions of the VM's at school. Use Revert to snapshot or get fresh copies from the NAS server at \\172.30.4.12\depot
2. When you run the school VMs at home for the first time, VMware will prompt you to either "create" or "move" the VM. Choose "Create" so you will have unique MAC addresses on your interfaces.
3. It's a good idea to run the /root/bin/init-network script on each VM. This will undo any changes VMware made to the network setting and remove any persistent links to previous MAC addresses.
4. It's also a good idea to make a fresh snapshot of your VMs. Remove the lock on the current snapshot (in Virtual Machine Settings) then take a new snapshot.

### Step 3 – Configure Nosmo VM with a static IP address on your home network

Without any modification, the Nosmo eth0 interface will be configured with a static IP address of 192.168.0.2, a network mask of 255.255.255.0 and a default gateway of 192.168.0.1. To change this you will need to edit the following file and change the information in red to an available address on your home network.

```
[root@nosmo root]# cat /etc/sysconfig/network-scripts/ifcfg-eth0
DEVICE=eth0
BOOTPROTO=static
BROADCAST=192.168.0.255
IPADDR=192.168.0.2
NETMASK=255.255.255.0
NETWORK=192.168.0.0
ONBOOT=yes
[root@nosmo root]#
```

**Note, the red text above must be customized to your home LAN settings!**

#### Step 4 – Translate DNS requests to Cabrillo’s DNS server to your DNS server

Without any modification, the Nosmo VM will redirect any packets sent to the Cabrillo DNS server (207.62.187.53) to 192.168.0.1. If you use a different DNS address for your home systems then you must modify the firewall (iptables) on Nosmo. You can do this by editing this file:

```
[root@nosmo root]# cat /etc/sysconfig/iptables
# Generated by iptables-save v1.2.7a on Mon Jan 11 12:14:00 2010
*filter
:INPUT ACCEPT [4229:434875]
:FORWARD ACCEPT [1481:444016]
:OUTPUT ACCEPT [3340:350240]
COMMIT
# Completed on Mon Jan 11 12:14:00 2010
# Generated by iptables-save v1.2.7a on Mon Jan 11 12:14:00 2010
*nat
:PREROUTING ACCEPT [8414:1265541]
:POSTROUTING ACCEPT [226:15381]
:OUTPUT ACCEPT [95:7826]
-A PREROUTING -d 207.62.187.53 -j DNAT --to-destination 192.168.0.1
-A POSTROUTING -o eth0 -j MASQUERADE
COMMIT
# Completed on Mon Jan 11 12:14:00 2010
[root@nosmo root]#
```

**Note, the red text above must be customized to your home LAN settings! Set this IP address to your normal DNS server IP address setting.**

Restart the service to have the change take effect:

```
service iptables restart
```

#### Step 5 – Configure Nosmo’s DNS server

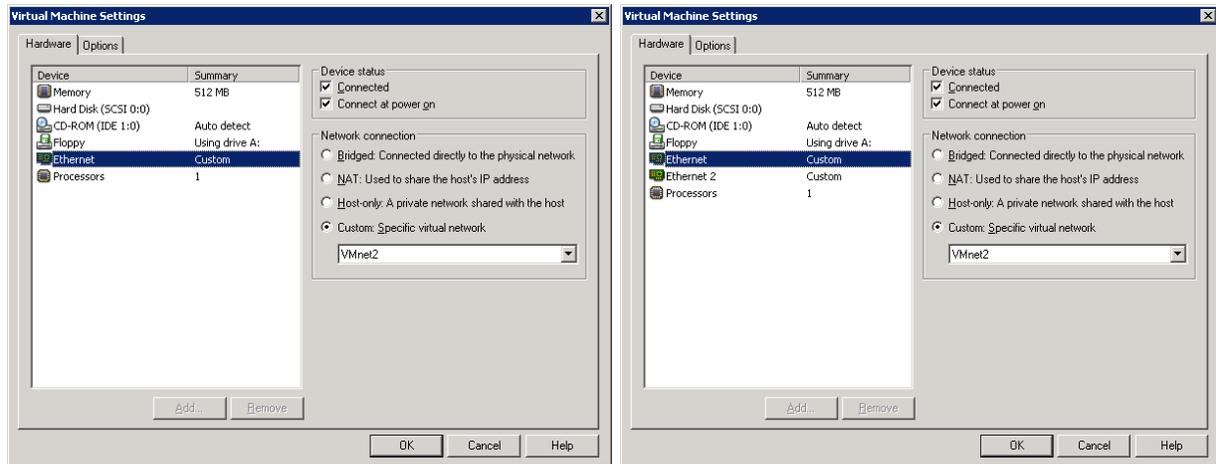
Without any modification, the Nosmo VM will use 192.168.0.1 as its DNS server. If you use a different DNS address for your home systems then you must modify the /etc/resolv.conf on Nosmo. You can do this with the following command and change the red 192.168.0.1 to the DNS address you use at home:

```
echo nameserver 192.168.0.1 > /etc/resolv.conf
```

Note, the red text above must be customized to your home LAN settings!

## Step 6 – “Recable” bridged VM’s to use VMnet2

In the CTC and the CIS Lab, the Frodo and Elrond VMs have their Ethernet device configured to be bridged (to use the physical Shire network). At home the Shire network is virtual, so you must reconfigure these devices to use VMnet2 instead as follows:



Frodo

Elrond

This recabling to VMnet2 must be done in general for any VM’s that are required to be bridged to the Shire network for a lab assignment.

## Step 7 – Verify your changes.

Make sure that the Nosmo VM is up and running. Select the Frodo VM and revert it to its snapshot. Finally start up Frodo and check the following:

- Use **ipconfig eth0** to check it was assigned an IP address between 172.30.4.150 to 172.30.4.199.
- Make sure you can ping the lab router now at 172.30.4.1.
- Check DNS by pinging an Internet host like google.com.
- Check you can Putty into Nosmo and from there to Frodo from your physical host PC or any other system on your home network.
- Likewise, check you can connect Filezilla on a system on your home network to Frodo.

## Appendix

The configurations shown below are for a home network of 192.168.0.0/24 with the home router at 192.168.0.1 and Nosmo eth0 interface set to 192.168.0.2.

Providing a “fake” Bubbles DNS server and NAT service:

```
[root@nosmo root]# cat /etc/sysconfig/iptables
# Generated by iptables-save v1.2.7a on Mon Jan 11 12:14:00 2010
```

```
*filter
:INPUT ACCEPT [4229:434875]
:FORWARD ACCEPT [1481:444016]
:OUTPUT ACCEPT [3340:350240]
COMMIT
# Completed on Mon Jan 11 12:14:00 2010
# Generated by iptables-save v1.2.7a on Mon Jan 11 12:14:00 2010
*nat
:PREROUTING ACCEPT [8414:1265541]
:POSTROUTING ACCEPT [226:15381]
:OUTPUT ACCEPT [95:7826]
-A PREROUTING -d 207.62.187.53 -j DNAT --to-destination 192.168.0.1
-A POSTROUTING -o eth0 -j MASQUERADE
COMMIT
# Completed on Mon Jan 11 12:14:00 2010
[root@nosmo root]#
```

#### NIC configuration:

```
[root@nosmo root]# cat /etc/sysconfig/network-scripts/ifcfg-eth0
DEVICE=eth0
BOOTPROTO=static
BROADCAST=192.168.0.255
IPADDR=192.168.0.2
NETMASK=255.255.255.0
NETWORK=192.168.0.0
ONBOOT=yes
[root@nosmo root]#
```

```
[root@nosmo root]# cat /etc/sysconfig/network-scripts/ifcfg-eth1
DEVICE=eth1
BOOTPROTO=static
BROADCAST=172.30.4.255
IPADDR=172.30.4.1
NETMASK=255.255.255.0
NETWORK=172.30.4.0
ONBOOT=yes
[root@nosmo root]#
```

```
[root@nosmo root]# cat /etc/sysconfig/network
NETWORKING=yes
HOSTNAME=nosmo
GATEWAY=192.168.0.1
[root@nosmo root]#
```

#### Static Routes (to networks used in labs):

```
[root@nosmo root]# cat /etc/sysconfig/network-scripts/route-eth1
192.168.2.0/24 via 172.30.4.107
192.168.3.0/24 via 172.30.4.107
10.0.0.0/8 via 172.30.4.107
[root@nosmo root]#
```

#### Forwarding:

```
[root@nosmo root]# cat /etc/sysctl.conf
# Kernel sysctl configuration file for Red Hat Linux
#
# For binary values, 0 is disabled, 1 is enabled.  See sysctl(8) and
# sysctl.conf(5) for more details.

# Controls IP packet forwarding
net.ipv4.ip_forward = 1

# Controls source route verification
net.ipv4.conf.default.rp_filter = 1

# Controls the System Request debugging functionality of the kernel
kernel.sysrq = 0

# Controls whether core dumps will append the PID to the core
# filename.
# Useful for debugging multi-threaded applications.
kernel.core_uses_pid = 1
[root@nosmo root]#
```

#### DHCP server:

```
[root@nosmo root]# cat /etc/dhcpd.conf
ddns-update-style interim;
ignore client-updates;
option time-offset                -25200; #PDT
#
# Shire
#
subnet 172.30.4.0 netmask 255.255.255.0 {
option routers                    172.30.4.1;
option subnet-mask                255.255.255.0;
option domain-name                "Shire";
option domain-name-servers        207.62.187.53;

range dynamic-bootp              172.30.4.150 172.30.4.199;
default-lease-time                21600;
max-lease-time                    43200;
}
[root@nosmo root]#
```