

For this lab you will not be working with partners. Everyone is required to complete this assignment on their own.

Review and follow the general instructions included in the Lab 1 writeup.

READ ALL OF THIS ASSIGNMENT DOCUMENT AND LAB REPORT BEFORE STARTING.

ASK QUESTIONS ON PIAZZA!

In this lab, you will be getting hands on experience with Linux networking. You will be using virtual machines (VMs) in ONL. To use them you will need to be using an RLI that is version 8.5 or greater. Version 8.5 was released just recently. It can be found by following the “Get RLI” link on the ONL website.

You will be configuring a network of 7 VMs in ONL. Three of those VMs will be configured as routers. The other four VMs will be configured as end hosts.

VMs in ONL are different than physical end hosts in many ways.

1. Your ONL passwords are not used on the VMs. VMs are created each time you commit an experiment and a password is created for your VMs each time you commit. The same password is used on each VM. You find the password from the RLI *Topology* menu by selecting the *Show VM Password* menu item.
2. You will have root privileges via the *sudo* command. When you use *sudo* for the first time you will be asked to enter your password. This is the VM password. After you enter your password correctly you will be authorized to use *sudo* for about 15 minutes without entering your password each time. After that 15 minute period, when you try to use *sudo* again, it will ask for your password again.
3. The VM host names are different than the physical hostnames. For your experiment you will see host labels on your RLI topology of *VMsmall.1* through *VMsmall.7*. When you use the *source ~/.topology* command it will give you access to names of the form *VMsmall1* through *VMsmall7*. Note the missing ‘.’ in the latter names!!! So, if you are on *onlusr* and you want to log in to your *VMsmall.3* VM you would do this:

```
onlusr> source ~/.topology
onlusr> ssh $VMsmall3
jdd@vm12c02v01's password:
```

You are then prompted for the VM password. The *vm12c02v01* is the identification of the actual virtual machine you have been allocated.

4. Your home directories are NOT accessible on the VMs. Any work you do on the VMs that you want to save you will either have to use *sftp* (from onlusr to the VM) or do a text copy and paste.

If you wanted to sftp the file `cmd_results.txt` from your VM home directory on VMsmall.3 you would do this from onlusr:

```
onlusr> source ~/.topology
onlusr> sftp $VMsmall3
jdd@vm12c02v01's password:
connect to vm12c02v01.
sftp> get cmd_results.txt
sftp> quit
onlusr>
```

And the file would now be in your directory on onlusr.

Please remember that once you *Close* your experiment, your VMs are destroyed and anything you did on them can not be recovered.

In this lab you will utilize the following Linux commands:

`sudo`

`ifconfig`

`ip`

`route`

`arp`

`sysctl`

`iptables`

`ping`

`traceroute`

`apt-get`

For some uses you will be given all the command arguments you need and for others you will have to figure out the arguments. You are advised to read about each of these commands ahead of time so you are familiar with them. Using the *man* command on onlusr would be a good place to start. A search for "Ubuntu <cmd-name>" **might** provide any clarifications you may

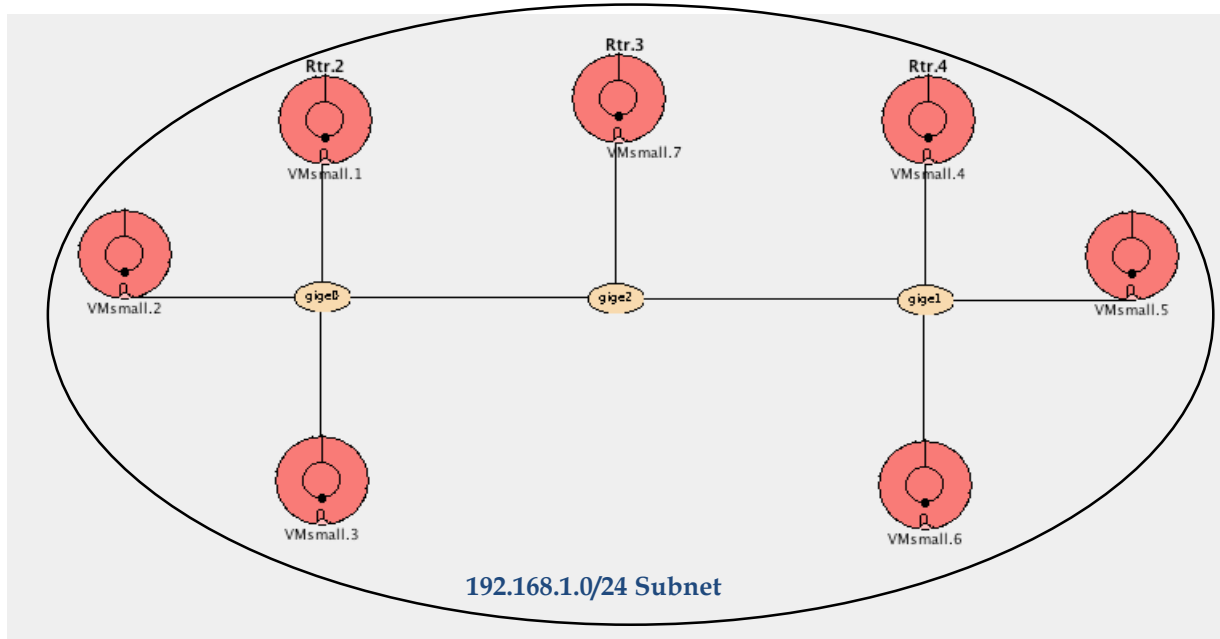
need, but you should always start with the *man* page for a command. For details on *sysctl* you will probably have to do some *google* searches to get the right arguments for the commands. But again, learn about the command with the *man* page first. For all the other commands, the *man* page for the command should have the information you need.

One of the complications we will run into in this lab is that the underlying network is a fully connected subnet and ARP will undermine what we are trying to achieve. So we are going to bypass the automatic things that ARP normally does for us by doing what we want manually.

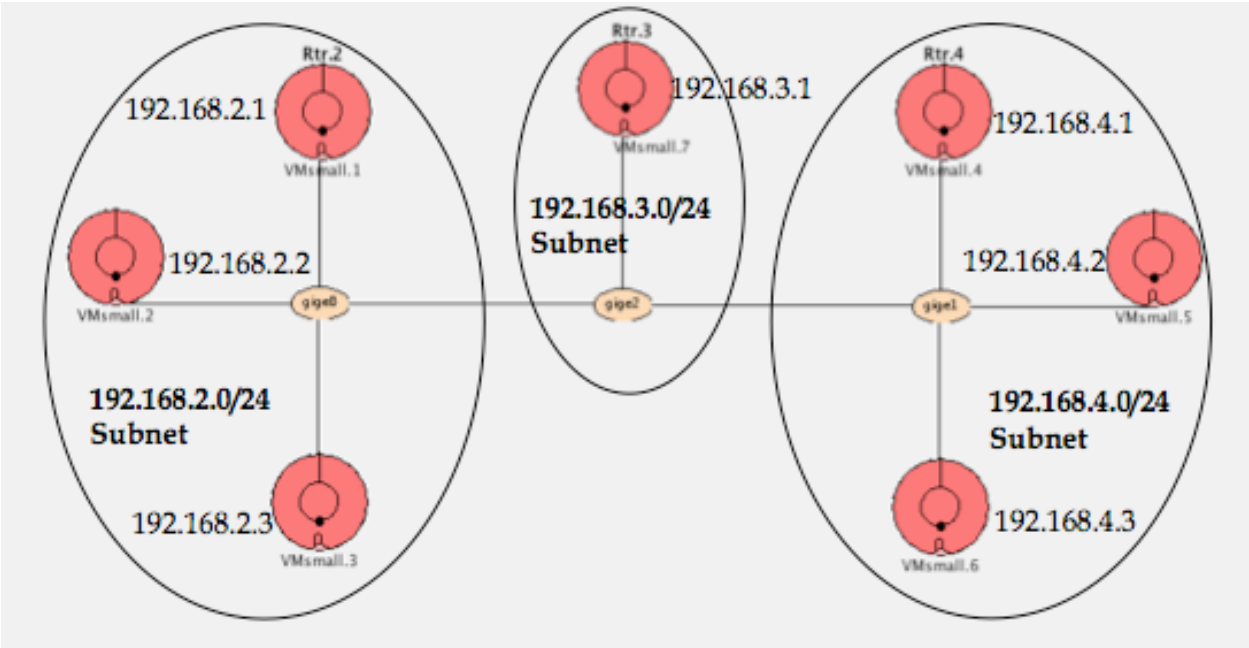
A second complication has to do with ICMP redirects. If a router receives a packet to be forwarded and it finds that it needs to forward it out the same interface that it came in on, it will typically issue an ICMP REDIRECT to tell the sending host that it could take a simpler path to get to its destination. We want to turn off this feature. If we don't then our routers will end up with no work to do! Normally routers have many interfaces. For this lab we are going to operate with routers that have just one interface.

When you first commit your topology the seven VMs will be configured into one subnet. Each will have an address in the 192.168.1.0/24 address space and they will each be able to communicate directly with each other. There are no routers in this original configuration.

You will be taking this configuration:



and turning it into this configuration:



Note the labeling of Rtr.2, Rtr.3 and Rtr.4.

Once you have reconfigured your networks, you will be performing experiments and observing packet routing via Wireshark.

The provided lab report template contains additional instructions and a number of questions for you to answer.

Start early and read all the material before your start.