



Lab 1: Using the CIS Lab Resources

The purpose of this lab is to become familiar with some of CIS Lab resources and to start practicing some old and new Linux commands.

Resources

- The Opus server
- The CIS Student Forum
- CIS 192 VMs in the CIS VLab
- CIS 192 VMs on stations CIS-Lab-01 to CIS-Lab-10 in the CIS Lab

CIS 192 VMs

We will be using 7 Virtual Machines (VMs) for this course.

	CentOS	Ubuntu	Windows
VMs	Arwen	Frodo	William
	Celebrian	Sauron	
	Elrond		
	Legolas		

In the CIS Lab, VMware Workstation is used to operate these VMs. For the remotely accessed CIS VLab, the VMware vSphere Client is used to access the same VMs running on a VMware ESXi server.

Opus Server

The Opus server is available to students via an SSH connection. Opus is used as a repository for common files and submitting lab assignments.

CIS Student Forum

A phpBB forum, at <http://opus.cabrillo.edu/forum/viewforum.php?f=39>, has been set up for use by CIS students and instructors to collaborate, share information and help each other.

Procedure

For this lab you are going to create a file named lab01 in your home directory on Opus. As you complete each step below you will record information in this lab01 file. When finished submit your work by copying your lab01 file into the instructors *turnin* directory.

Please refer to the Logins sheet you filled out in the first class for your various user accounts and passwords.

VLab allows more than one student at a time to operate any of the VMs. You can use this feature to collaborate with other students and the instructor on lab assignments. Each student must still turn in their own work but working as a team is both allowed and encouraged.

In general, only use VMs not already in use (icons having a green triangle on them) and be sure to shut down VMs that are no longer in use so they are available for others.

Step 1 – [Login to Opus](#)

- If you are a Windows user and Putty is not installed, then see this [Howto](#) for how to install Putty. Run Putty and type opus.cabrillo.edu in the Host Name field, then click the Open button at the bottom to login.
 - If you are a Mac user, SSH is already installed. Mac users can refer to this [Howto](#) for additional information.
 - At this point you should be logged into Opus.
 - On Opus, copy the lab01 file found in /home/cis192/depot to your home directory.
 - Use **vi** to edit this file and add your own information.
 - Use the **who | grep \$LOGNAME** command to determine the hostname or IP address of the station you logged into Opus from. It's the portion at the end of the line surrounded by ().
- ❖ *Record this hostname or IP address in your lab01 file.*

Step 2 - [Enter VLab](#)

- Download the [CIS 192 RDP file](#) to the computer you are using to work this lab. If you have downloaded this file before you don't need to do it again.
 - Double-click the downloaded file and login to VLab. For more information on getting into VLab read the [Howto](#) or watch this [video](#).
 - In the vSphere client, go to the Inventory view and explore the various CIS 192 Pods on vmserver4. Clicking the + in front of a Pod will expand it. VMs that are already powered on will have a small green triangle on their mini-icon.
 - The Fang VM is running OpenSUSE. It has a spreadsheet on the cis192 user Desktop that will be the only way for now to schedule the use of the 192 VMs. Try it.
 - Select one of the Centos VMs (Arwen, Celebrian, Elrond or Legolas) and power it up. When prompted login as cis192, then become root using the **su** - command. Note, the CentOS VMs do not have a graphical desktop (GNOME).
 - Select one of the Ubuntu VMs (Frodo or Sauron) and power it up. These VMs have a graphical desktop (GNOME). Login as cis192, run a terminal, then use **sudo su** - to become root.
 - Observe the shell prompt strings on the Ubuntu and CentOS VMs. The prompt is the text string the shell outputs to prompt you for a command. How do these prompts compare to the prompt you get on Opus?
- ❖ *Record the shell prompt strings for both the CentOS and Ubuntu VMs in your lab01 file on Opus.*

Step 3 – [The CentOS VM network connection](#)

- On the CentOS VM try to ping google.com. The CentOS VMs are configured to boot up without any network configuration so you shouldn't be able to ping anything.
- Use **dhclient eth0** to obtain an IP address, a default gateway and DNS servers so our CentOS VM can join the local network.
- Now can you ping google.com? You should be able to now.
- Use **ifconfig eth0** to determine the IP address assigned to your CentOS VM's eth0 interface.
- Use **route -n** to show the gateway assigned.
- Use **cat /etc/resolv.conf** to show the DNS servers assigned.

❖ **Record** your IP address, gateway and DNS servers of your CentOS VM in your lab01 file.

Step 4 – [The Ubuntu VM network connection](#)

- The Ubuntu VM is configured to automatically obtain IP information from a DHCP server when it boots up.
- Can you ping google.com? You should be able to.
- Use **ifconfig eth0** to determine the IP address assigned to your Ubuntu VM's eth0 interface.
- Use **route -n** to show the gateway assigned.
- Use **cat /etc/resolv.conf** to show the DNS servers assigned.

❖ **Record** your IP address, gateway and DNS servers of your Ubuntu VM in your lab01 file.

Step 5 – [Login to Opus via SSH from the VMs](#)

- On the CentOS VM, login to Opus again from the CentOS VM using the **ssh account@opus.cabrillo.edu** command. Be sure to specify your own account for this.
 - Notice how the prompt changes to indicate you are now connected to Opus.
 - On the Ubuntu VM, login to Opus again with the **ssh** command.
 - Notice how the prompt changes to indicate you are now connected to Opus.
 - You should now have three login sessions on Opus.
- ❖ **Record** the output from the **who** command showing your three Opus login sessions into your lab01 file. An easy way to do this would be to just redirect and append the output using **who | grep \$LOGNAME >> lab01** on Opus.
- Use **vi** again on Opus to tidy up your lab01 file as needed.

Step 6 – [Ping travel times](#)

- On the Ubuntu VM, use **exit** to logout of Opus. Notice how your prompt changes.
- Do the same for the CentOS VM.
- On your Ubuntu VM use **ping opus.cabrillo.edu** and observe how long (in milliseconds) it takes to ping Opus. Use Ctrl-C to stop pinging.

- On your Ubuntu VM, use **ping 172.30.4.XXX** (determine XXX from the IP address you recorded in Step 3) to ping your CentOS VM. Observe how long it takes each ping.
- Which ping trip was the shortest? The one from your Ubuntu VM to Opus or to the CentOS VM?

❖ *Record the fastest times for both trips in your lab01 file.*

Step 7 – [SSH hopping](#)

There is no limit to how far you can go using **ssh**. In this step we will start on the Ubuntu VM and login to the CentOS VM. From there we will login to Opus.

- On your Ubuntu VM use the **hostname** and **cat /etc/*-release** commands to observe the name of the computer and the name of the Linux distribution.
- On your Ubuntu VM, use **ssh cis192@172.30.4.XXX** (determine XXX from the IP address you recorded in Step 3) to login to your CentOS VM.
- Now use the **hostname** and **cat /etc/*-release** commands to observe the name of the computer and the name of the Linux distribution. It should have changed how that you have logged into the CentOS VM.
- From there, use **ssh account@opus.cabrillo.edu** to login to Opus.
- Now use the **hostname** and **cat /etc/*-release** commands to observe the name of the computer and the name of the Linux distribution. It should have changed again now that you are logged into Opus.
- Use **exit** to back out of Opus.
- Use **exit** to back out of your CentOS VM

❖ *Record the three different Linux distributions you observed in your lab01 file.*

Step 7.1 – Switching between virtual terminals

- On your Ubuntu VM, change to tty3 and login as cis192
- Now on your Ubuntu VM, change to tty5 and login as cis192
- Use **who** to see all logins on the Ubuntu VM.
- Then on your Ubuntu VM, change back to your graphical desktop (tty7)

- On your CentOS VM, change to tty3 and login as root
- Now on your CentOS VM, change to tty5 and login as root
- Use **who** to see all logins on the CentOS VM.
- Then on your CentOS VM, change back to tty1

Step 8 – [Shutting down the VMs and exiting VLab](#)

As root you can use the **init 0** command to rapidly shutdown a system. It's OK to do this with a VM where you are the only one logged in. Why would you not want to do **init 0** on a production system with multiple users logged in?

- Shutdown your Ubuntu VM
- Shutdown your CentOS VM

- Exit vSphere to end the VLab session.

Step 9 – Using the CIS Forum

Browse to the forum at <http://opus.cabrillo.edu/forum/viewforum.php?f=39> and read the current posts. Be sure to register if you haven't already. When you register, be sure to select a username that is your first and last name separated by a space to get credit for your posts.

Make a post on the forum. You can post anything you like but if you are having trouble picking a topic here are some suggestions:

- A post introducing yourself
- or a question about this lab that you would like someone to respond to
- or share a tip on how to do this lab that might save others time and effort
- or reply to an existing post

Step 10 – VMware Stations in the [CIS Lab](#) (optional step)

In addition to the VMs remotely available in VLab, the same VMs are available on each CIS Lab workstation in the CIS Lab. The CIS Lab is located in the CTC (Building 1400) on the Aptos campus. These stations are labeled CIS-Lab-XX and are along the walls adjacent to the entrance.

- Select any of these stations and log in as CIS192.
- Run VMware Workstation
- Select one of the Centos VMs (Arwen, Celebrian, Elrond or Legolas), power it up.
- Login as cis192 and **su** – to become root.
- Use **dhclient eth0** to get an IP address.
- Verify you got an IP address with **ifconfig eth0**
- ping** the lab router at 172.30.4.1
- Shutdown with **init 0**
- Exit VMware Workstation
- Logon the VMware station

To turn in

When finished with this lab, record the end date and how long it took to do it. This should reflect the total number of hours you spent preparing for and getting this lab done. Be sure and clean up your lab01 file so it looks professional before submitting.

To submit your work:

```
cp lab01 /home/rsimms/turnin/lab01.$LOGNAME
```

Submit as many times as you like up to the deadline. Each new submittal will overwrite the previous one.

Remember, **late work is not accepted**, so please start early, plan ahead for things to go wrong and use the forum to collaborate.

Grading rubric (30 points)

- 3 points for a complete submittal, with professional appearance and quality
- 3 points for including the amount of time you spent on this lab
- 3 points for recording the hostname or IP address requested in Step 1
- 3 points for recording the prompt strings requested in Step 2
- 3 points for recording the IP address, gateway and DNS servers requested in Step 3
- 3 points for recording the IP address, gateway and DNS servers requested in Step 4
- 3 points for recording the who output on Opus requested in Step 5
- 3 points for recording the fastest ping times requested in Step 6
- 3 points for recording the distributions requested in Step 7
- 3 points for doing a forum post in Step 9

Extra Credit (1 point each)

- 1) Use Google and see if you can figure out how to do a broadcast ping and record multiple ping responses from 2 or more VMs. Hint: You will need to use the b option on ping, the broadcast address (from **ifconfig**) and enable some of the VMs to not ignore ping broadcasts. Record your ping output in your lab01 file. Hint: use copy and paste between multiple graphical terminals or use the scp command to send redirected command output to your Opus account.
- 2) See if you can find the vendor name and model of the NICs on any of the CentOS VMs. Record this information in your lab01 file.
- 3) What command would you use to list all the loaded kernel modules, including the NIC drivers? What is the name of the NIC driver used on the CentOS VMs? Record this driver name in your lab01 file.
- 4) What command would you use to unload the NIC driver on the Centos VMs? Would you still be able to ping another system after unloading this driver? Record your answers in your lab01 file.
- 5) If the NIC driver on the Centos VMs had been unloaded what command would you use to load it again? What steps would be necessary so that you could ping another computer after reloading the driver? Record your answers in your lab01 file.

Appendix

General Linux commands	
su -	To become root (superuser). The - is very important as it provides root's shell environment.
sudo su - or sudo -i	To become root on the Ubuntu VMs.
cp source destination	Linux command to copy file(s) from the source pathname to the destination pathname. Example:

	cp /home/cis192/depot/lab01 . will copy the file named lab01 in the /home/cis192/depot directory to your current directory.
vi pathname	Run the vi text editor on the specified file. Example: vi lab01
who	Show logged in users and the IP address or hostnames they logged in from.
echo \$PATH	Shows your path. The shell uses the path to locate any commands entered. Entering a command that is not located on the path will result in a "command not found" error.
cat /etc/*-release	Shows the name of the Linux distribution being run.
> filename	<i>filename</i> is created if it does not exist and emptied. Example: > output would empty the file named output or create it if it did not exist already.
command > filename	<i>filename</i> is emptied, then the output of the command is redirected into <i>filename</i> . Example: ifconfig > output would save the output of the ifconfig command in a file named output.
command >> filename	Output of the command is appended to the end of <i>filename</i> . Example: route -n >> output would append the routing table to the end of the file named output.
ssh account@hostname ssh account@ip-address	Login to a remote Linux computer on the network. Example: ssh cis192@172.30.4.153
ssh account@hostname 'command'	Run a command on a remote system. Example: ssh root@172.30.4.164 'ifconfig' would run the ifconfig command on the remote system and show the output of the command on the local system.
scp pathname account@host:pathname scp account@host:pathname pathname	Copy files from one system to another. Example: scp output

	simben192@opus.cabrillo.edu: (above all on one line) would copy the local file named output to the user simben192's home directory on Opus.
hostname	Shows the hostname of the system being used.
tty	Shows the current terminal being used.
exit	End a terminal login session
init 0	A fast way to gracefully shutdown a VM. You must be the root user to perform this command. Note: no warning is given to users that the system will be shut down.
yum provides <i>command</i>	Find the package containing the command or program to install
yum install <i>package</i>	Download and install the software package. Just specify the name of the package to get the correct version for your distribution. Examples: yum install traceroute yum install mtr
VMware commands and operations	
On PC Keyboard: While holding down the Ctrl-Alt keys, tap spacebar then tap f1, f2, ... or f7. On Mac keyboard: Hold down Control and Option keys, tap the spacebar , hold down fn key (in addition to Control and Option keys) and tap f1, f2, ... or f7.	Change to a different virtual terminal on the VM. F7 is graphics mode for the Ubuntu VMs. The Centos VMs do not have a graphics mode (init level 3 only) Note: the spacebar does not need to be tapped on a physical (non-VM) system. This is just required for changing virtual terminals on VMware VMs.
Linux network or network-related commands	
dhclient eth0	Obtain an IP address for the eth0 interface from a DHCP server.
dhclient -r	Release the IP address previously obtained.
ifconfig or /sbin/ifconfig	Show the interface configurations. The full absolute pathname may be required if user is not logged in as root and /sbin is not in the user's path.
route -n	Shows the routing table which includes the default gateway if configured.
cat /etc/resolv.conf	Show the DNS servers to use for resolving hostnames to IP addresses.

<p>ping <i>hostname</i> ping <i>IP-address</i></p>	<p>Test connectivity with another computer on the network. Use Ctrl-C to stop pinging.</p> <p>The c option can be used to limit the number of pings.</p> <p>The b option can be used to ping a broadcast address.</p> <p>Example ping -c3 google.com will ping Google three times then stop.</p>
<p>Linux Guru commands</p>	
<p>echo 0 > /proc/sys/net/ipv4/icmp_echo_ignore_broadcasts</p>	<p>Enables Linux system to respond to broadcast pings.</p>
<p>lspci or /sbin/lspci</p>	<p>Shows PCI devices including what NIC or NICs (Network Interface Controllers) are being used to physically connect the system to the network.</p> <p>The full absolute pathname may be required if user is not logged in as root and /sbin is not in the user's path.</p>
<p>lsmod or /sbin/lsmod</p>	<p>Shows the kernel modules that are currently loaded. Example NIC drivers (implemented as kernel modules) are e100 (Intel), e1000 (Intel), pcnet32 (AMD) and vmxnet (VMware).</p> <p>The full absolute pathname may be required if user is not logged in as root and /sbin is not in the user's path.</p>
<p>rmmod <i>module</i></p>	<p>Use to unload (remove) a running kernel module (e.g. a NIC driver).</p> <p>Example: rmmod e1000 would unload the Intel gigabit NIC driver if it was loaded.</p>
<p>modprobe <i>module</i></p>	<p>Use to load a kernel module (e.g. NIC driver).</p> <p>Example: modprobe e1000 would load the Intel gigabit NIC driver if not loaded already.</p>