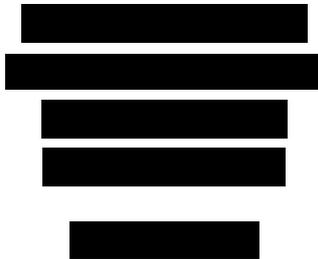


# CY3520: Practical Network Operations

## NPS Summer 2014

### Lab 1: Intro to Linux and Building a Router



## **Intro**

### **Motivation**

The purpose of this lab assignment is to get you more acquainted with working in Linux, especially as it comes to the command line, and to utilize the command line skills you develop to build a router. Keep those goals in mind as you work through the tasks below.

### **Prerequisites**

For doing this lab you will need your Ubuntu server machine installed and upgraded. Please review the July 7<sup>th</sup> lab recording for how to set this up.

For all other inquiries, post in the discussion forum, e-mail or call me, or see the Lab Resources folder in the Resources section of Sakai.

### **What to Turn In**

For the remainder of the lab you will encounter a set of instructions on what to do. These instructions will guide you through what is required of

you for the lab. At times you will be required to do research on your own to figure out what exactly to do, but I encourage you to ask for help at any point if the instructions are not clear or you start to get stuck. Ask lots of questions.

Along the way you will encounter a set of questions. As a deliverable you are required to submit a PDF of your typed answers to the Assignments section of the course's Sakai page. Please make sure to submit a PDF—no other file format will be accepted. Also, make sure you include the questions above your answers and that your answers are precise and complete.<sup>1</sup> Finally, in your write-up, include the heading title that each question appears under. For example, if three questions appear under the heading title *Heading 1*, then your answers to those questions should appear below the same heading title in your answers document.

## Doing Some Shell Work

For learning how to work with the shell go to the following web-site<sup>23</sup>

[http://linuxcommand.org/lc3\\_learning\\_the\\_shell.php](http://linuxcommand.org/lc3_learning_the_shell.php)

For the next part your assignment I want you to work through the following sections on that site:

- Everything in the *Learning the Shell* section.
- Sections 1–2 in the *Writing Shell Scripts* section.

As you work through those parts, answer the following questions (questions are under the section that they go with):

## Looking Around

1. From the section entitled *A Closer Look At Long Format*, describe what the permission bits mean for the files *web\_page* and *web\_site.tar*.
2. Research the *chmod* and *chown* commands (*Hint*: Use the man page for each command). Describe what each does. For each, choose two options you can pass to it on the command line and describe what they do.

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<sup>1</sup>You do not need to be verbose, you just need to be correct.

<sup>2</sup>If you already know all of this, I apologize. Bear with me and we will get into material new to you soon enough.

<sup>3</sup>The author of this web-site has released a free book with the contents of this site that you can obtain from the site.

## A Guided Tour

When you get to this portion of the tutorial, please visit <http://www.pathname.com/fhs/pub/fhs-2.3.html> and read through the whole thing. It will give you a better sense of how the file system is laid out in Linux distros compliant with the filesystem hierarchy.

As you read through this standard, answer these questions:

3. What's special about the `/proc` directory? Do some quick research online about it. What sorts of information about your system can you find out in `/proc`?
4. Where in `/proc` can you find out the absolute file path/file name for your kernel? What version of the kernel do you have?
5. What types of files are found in the `/bin` directory? Using a pipe and the `ls` and `wc` commands, how would you find out how many files are in the `/bin` directory?
6. What command would you use to find out how many files in `/etc/` end with `.conf`?
7. What is located in the file `/etc/passwd`? How about `/etc/shadow`? You can use Google, or use the `man` command, e.g., `man 5 passwd` to find out.
8. What is the `/var` directory used for? Browse into your `/var/log` directory. What types of entries do you see in `auth.log`? How about in `kern.log`? What command would you use to find out how many lines are contained in each of those files (provide the full command)?

## Manipulating Files

9. What does the command `rm -rf /` do?
10. If you do not specify an absolute path name to the `mv` or `cp` command, where are the file(s) moved or copied? For example, if you issue the command `cp /etc/passwd copiedPasswd` where would the file `copied-Passwd` end up?

## I/O Redirection

11. What is the difference between the `>` and the `<` operator?
12. What is the difference between `cat > [filename]` and `cat >> [filename]`?
13. Using `man` or a similar method of obtaining help, what does the `uniq` command do? What must be true about the input to `uniq` so it functions properly?<sup>4</sup>

## Expansion

14. What is the special meaning of `$` to the shell?
15. When are double quotes useful on the command line?
16. What's the difference between double and single quotes in the shell?
17. Do some quick research and discover what enclosing a command in back-ticks does?<sup>5</sup>

## Permissions

Some extra reading material about the `sudo` command is found [here](#). It is not required but might help with the following questions.

18. Where is the configuration file for the `sudo` command located? What command is used to modify it?
19. Ubuntu-based distros don't come with a root account enabled. Do some research on the `passwd` command. What does this command do? What arguments to `passwd` can be used to re-enable the root account?

## Lesson 2: Editing the scripts you already have

20. It was mentioned in lecture that the `rm` command can be quite damaging to a system. On other OSes there is often a trash can or recycle bin to prevent any deletion mishaps from happening. Using the `alias` command you can mimic the behavior of a recycle bin. First, using the `mkdir` command, and next using an alias, create an alias for `rm`

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<sup>4</sup>*Hint:* Read the full `uniq` man-page.

<sup>5</sup>*Hint:* Experiment yourself by typing a command like: `file `which ls``

that makes it act like a recycle bin/trash function. Provide the line you used for your alias.<sup>6</sup>

## Getting A Bit More Linux Information

Finally, for your own information, and so you have a better idea about what's going on when Linux boots up<sup>7</sup> please read the following web-sites:

<http://www.ibm.com/developerworks/linux/library/l-linuxboot/>  
[http://www.pathbreak.com/blog/  
ubuntu-startup-init-scripts-runlevels-upstart-jobs-explained](http://www.pathbreak.com/blog/ubuntu-startup-init-scripts-runlevels-upstart-jobs-explained)

After you finish with that, answer the following questions:

21. What types of files are located in `/etc/init.d/`? *Hint:* Read the man page for service.
22. Briefly described what a runlevel is.
23. Which runlevel does your VM boot into? What's associated with that runlevel?

## Setting Up a Router

Finally you are at the point where you feel somewhat comfortable working on the command line. Now, surprisingly, setting up a router is simple. It involves these steps:

- Make sure you have two NICs on your machine. One NIC should have the Routing Network Label and the other NIC should have your personal VLAN's Network Label.
- Set up a static IP address on the router's NICs. Make sure to do this so that the IP addresses persist between boots.
- Enable IP forwarding in the kernel. Again, make sure to do this so that this setting persists between boots.

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<sup>6</sup>*Hint:* Create a new directory called Recycle and look into what the `-t` option for the `mv` command does. An alias can contain several commands separated by semi-colons.

<sup>7</sup>We'll get more into this later—it's very important to understand—at least at a basic level—when we get around to setting up monitoring tools and looking into logging.

- Set up static routes so that the router knows where different subnets are located.<sup>8</sup> Make sure these static routes persist between boots.
- Make sure no firewall rules prevent forwarding of traffic from taking place.

## Static IP addresses

Use Google to find out how to set a static IP address on Ubuntu. After finding the correct web-page, answer these questions:

24. What configuration file did you need to edit to set a static IP address?

## IP Forwarding

Research how to enable IP forwarding in the kernel and answer these questions:

25. What configuration file was needed for this task?
26. What else does this configuration file control, i.e., what other tasks can you accomplish by editing this configuration file?

## Static Routes

Research how to set static routes in Ubuntu and answer these questions:

27. What configuration file was needed for this task?
28. In our configuration is it necessary to set a default gateway? Why or why not?
29. If we used a dynamic routing protocol, which one would be the most appropriate here? Why?

## Conclusion

Take a deep breath: you are now done with the first lab assignment and have completed the first step in linking your soon to be built network with the rest of the class. Submit your answers as a PDF to the Assignments section of the course's Sakai page.

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<sup>8</sup>Of course, outside of our environment these routes would be set up dynamically through the use of a routing protocol.