Southern Polytechnic State University

Electrical and Computer Engineering Technology Program

ECET 4820 Laboratory Exercise 4: Introduction to Linux

Objective:

The student will receive a general introduction to the Linux operating system. Such concepts as the boot menu, logon, GUI, the shell, network configuration, and various utilities will be covered.

Introduction:

Linus Torvalds created the operating system in 1990 at the University of Finland. Linux is a multi-user, multi-tasking operating system based on UNIX that runs on personal computers. It was originally designed with a command line interface, which is still very popular among users. It is extremely powerful, far more so than Microsoft's command-line interface operating system. The porting of a UNIX-based operating system over to a PC has resulted in tremendous growth in its popularity. Its open architecture has led to the development of numerous applications, some of which are covered here. Source code is available free of charge, but some companies have packaged Linux with graphical interfaces and applications, selling the composite software package as a commercial release.

Procedure:

Boot Up and Log On to Your Workstations

1. This section illustrates the operation of the boot loader that allows you to boot your workstation to any one of the operating systems on the workstation.
   a) Boot up your workstation.
   b) When the graphical boot loader appears, select **Ubuntu Linux**. *Do not* select the recovery mode if it is available.
   c) Linux may be configured to log you in automatically. Check with your instructor for the username and password. Otherwise, login with the user name and password given by your instructor.
   d) Set up your network protocol stack configuration.

Using the Shell

2. Once you are in the GUI, you will initiate a shell session, sometimes called a terminal window. The shell is similar to a Windows Command Prompt window and is essentially a command line interface to the Linux operating system. Once the shell starts, you will be located in your *home* directory, which has the same name as your user name. Many Linux functions can be executed using the user-friendly GUI. However, the shell command line interface adds more functionality in a less user-friendly format. Note that you must press **<Enter>** at the end of each command to execute it.
   a) At the top of the screen is the menu bar. Click **Applications→Accessories→Terminal**.

b) When the shell appears, place your mouse next to the prompt and left click. Now you are in the shell.

- Note that the prompt shows your user name and computer name followed by the directory your shell is pointing to at that time.

c) Your prompt will end with a "**$**" as a normal user If you are logged in as **root**, your prompt will end with a "**#**".

Note: When Ubuntu is installed the root account is disabled. It can be enabled if necessary, but root-level (administrative) commands can be executed using the **sudo** command.

Note: Your prompt will also have a "**~**" symbol in it if you are in the home directory for your username.

Note: Commands and filenames are case-sensitive.

3. You can use the **man** command to learn what other commands do. If you type **man** followed by the command you are interested in, the complete manual pages are displayed for that command.

- Note: If the manual text cannot be displayed in a single screen, pressing <Enter> will advance one line. Pressing the space bar will advance one screen. If you want to exit the manual page display, press **q**.
- Note: an alternative is to use the **info** command to learn about other commands. If you want to exit the info page display, press **ctrl-c**.

a) Use **man** to find the functions of the commands in the list below. These are classic commands with functionality that has in some cases been superseded by more user-friendly applications. For example, the archaic **vi** editor has been replaced by several others such as **gedit**. Write a short definition of the commands.

sed –
grep –
vim – (or vi)
more –
less –
mount –
tar –
zcat –
gcc –
cat –
chmod –
chown –
chgrp -
ps –
ls –
dir –
rm –

rmdir -
find –
cp –
kill –
shutdown –
touch -
reboot –
su –
sudo –
groups -

4. You will now move around the directory tree structure using the change directory (**cd**) command. You will display directory contents using the directory (**dir**) and list (**ls**) commands. Finally, you will create a subdirectory within your home directory.

   a) Change your directory to the root directory by typing **cd /**.

      - Note: starting your pathname with a "/" always references the path to the root directory. No matter where you are, typing **cd /** will always take you to the root.

   b) Display the contents of the root directory using the long format by typing **ls -l**.

      i) Each listing contains the following information as read from left to right.

         - The first character is the type of file (**d** for directory, **–** for an ordinary file)
         - The next three characters (characters 2, 3 and 4) are the access permissions for the *owner* of the file.

           Character 2 is the read permission. An **r** indicates that the owner can read the file and a **–** indicates they cannot.

           Character 3 is the write permission. A **w** indicates that the owner can write to the file and a **–** indicates they cannot.

           Character 4 is the execute permission. An **x** indicates that the owner can write to the file and a **–** indicates they cannot.

         - The next three characters (5, 6, and 7) are the read, write, and execute permissions for the *group*.
         - The last three characters (8, 9, and 10) are the read, write and execute permissions for everyone else.
         - Following the file permissions, the next field to the right is the number of links to the file.
         - The next field is the name of the file owner (creator).
         - The next is the name of the group that has access to the file.
         - The next field is the file size in bytes (not Kbytes).
         - The next fields are the date and time the file was created.

- Finally, the last field is the filename.

- Can you tell whether the names listed are directory names or file names?
- Who are the owners of the directories?

c) Display the contents of the root directory by typing **ls**.

- What is the difference between this display and the one in part b)?

d) Display the contents of the root directory by typing **ls –a**.

- What is the difference between this display and the one in part b)?

e) Try displaying the directory contents using **dir –l**, **dir**, and **dir –a**.

- Note: because so many Linux users are familiar with Microsoft commands, an *alias* for the **ls** command was created called **dir** that maps the **dir** keyword to the **ls** command.

f) Change your directory to the top-level, directory. Now change to the home directory of the user whose logon name is "**student**". You can use either of the commands **cd /home/username** or **cd home/username**, where username is your login username.

- Why do both of these commands work? Question 2 at the end of the lab exercise is related to this one.

g) Once in your personal user home directory, use the **ls** and **ls –a** commands.

- Do you see more files/directories using one of the commands?
- What is the common characteristic of the hidden file/directory names?

h) Use both the **–l** and **–a** attributes at the same time with the **ls** command.

- What happened?

i) The command **cd ..** will move you up one level to the **/home** directory. Type this command and verify that you are in **/home** using **ls**.

j) Return to the **student** user home directory. **If you are logged on as root, *do not* go to the /root directory.**

k) Create a new subdirectory called "**testdir**" in the **student** home directory using the make directory command by typing **mkdir testdir**. Verify that it was created using **ls**.

l) Now remove the subdirectory by typing **rmdir testdir**. Verify that it was removed using **ls**.

5. You will create a text file and add content to it using the **vi** editor. This editor is primitive and several more advanced editors are available through the GUI. Make sure you are in your personal user home directory before proceeding.

a) Create a file using **touch**. Type **touch myfile**.

b) Use **ls –l** to determine whether the file was created.

- What is the file size?

c) At the prompt, type **vi myfile**.

d) Within the editor type **i** to enter the insert mode, then type **Howdy folks!**

e) Save your file by typing **Esc** followed by **:** followed by **wq!** Be sure to include the "**!**". Then press **return**.

f) Once out of **vi**, type **more myfile** at the prompt.

- What happened?

g) Create a second file called **myfile1** and place the text **Goodbye folks!** in it using **vi**. This time however, just type **vi myfile1** to create the file and start **vi**.

h) Use the concatenate (**cat**) command to combine both files and display the output on the screen. Type **cat myfile myfile1**.

- What happened?

i) Now use the ">" to redirect the cat output. Instead of going to the screen, you will make it go to the file **myfile2**. Type **cat myfile myfile1 > myfile2**. Type **more myfile2**.

- What happened?

6. You will now test file permissions using the **more** command.

a) Print the contents of the file **/etc/sudoers** to the screen using **more**.

- What happened?
- **Prove to your instructor that you know why the results of this command occurred.**

7. You will use the copy (**cp**) command to copy a file to another location.

a) Create a new subdirectory in the **student** home directory called **testdir2**. **Do not do this in the /root** directory**.**

b) Copy **myfile** to this directory. **Have your instructor verify that you did this**.

Remove Your Files and Directories

8. Remove your copy of **myfile** from the **testdir2** directory and also remove the directory. Then remove any other directories and files you created**. Have your instructor verify that you have done this**.

Using the Substitute User (su) and (sudo) Commands

9. The substitute user command, or **su** command is used by a user that also happens to be the root in order to perform tasks that only root can do. This is convenient, as you do not have to log out and log in twice to perform your task. In Ubuntu, since the root account is disabled by default, the sudo command can be used to execute a root command. Therefore, the steps a) through e) will not work on a standard Ubuntu installation. In this case, start with step f)

a) While logged in as the student user, navigate to the directory **/root**, which is the home directory of the root user. List its contents using *ls*.

- What happened?

b) Now type **su**. You will be asked for the root password. Enter the password given to you by your instructor. Notice that your prompt changes from "**$**" to "**#**".

c) Now list the contents of the **/root** directory.

d) Repeat step (6) above.

- **Have your instructor verify your results.**

e) Exit the **su** mode by typing **exit**.

f) Type **sudo more /etc/sudoers** and enter the password if prompted to. Was the result different than in step 6 a) above?

- **Have your instructor verify your results.**

Processes

10. When programs are executed in Linux, they are assigned process numbers. This includes shells and other operating system functions that you start up. You will display the processes running on your workstation and selectively "kill" one of them.

a) At the shell prompt type **firefox&.** This will start the Firefox web browser.

- Can you tell what the **&** does? If you cannot, open another shell window and enter the command without the **&** to see what the difference is.

b) After Firefox starts, left click at the prompt in the shell window ant type **<Enter>.**

c) Type **ps –ax**.

- What does this do?

d) Find the number of your Firefox process in the left column.

e) At the prompt type **kill id#**, where **id#** is Firefox's process number or numbers.

- What happened?

The Linux Kernel Source Code

11. It is useful to know the Linux kernel version and where the source code is. Ambitious users can compile the kernel themselves to customize the operating system.

a) Navigate to the **/usr/src** directory.

b) Type the **ls –l** command and determine the kernel version.

Kernel version:_____

Checking Network Configuration

12. You will check the TCP/IP configuration of your workstation. You will need to be **root** to check the network so either log in as **root** or use the **su** command.

Note: If you are not logged in as root, you can use the \sbin\ifconfig command.

a) At the shell prompt type **ifconfig**. Determine the IPv4 address, subnet mask, and MTU size for your Ethernet interface.

Interface name:_____

IP address:_____

Subnet mask:_____

MTU size:_____

- Do you also see the configuration of the loopback interface?

Configuring Network Configuration

13. You will use the Ubuntu graphical interface to configure your Ethernet card.

a) At the top Ubuntu menu, click **System→Preferences→Network Connections**.

b) **Select Network Devices→Network Card.**

c) In the **Network Connections** box, select **Auto eth0** followed by **Edit**.

d) Select the IPv4 Settings tab.

e) In the **Editing Auto eth0** box, select **Manual** from the **Method** drop down menu.

f) Then next to the **Addresses** area, select **Add**. Enter the IP address, subnet mask, and default gateway specified by your instructor. Then enter the DNS server specified by your instructor.

- Note: you must use the <Enter> key after the default gateway is added to make sure it is properly entered.

g) Click **Apply** and if prompted, enter the password. You must restart the computer for the changes to take effect

h) At the shell prompt, test your TCP/IP stack by typing **ping localhost**.

- Note: To stop the pings, press **Ctrl-c**.

i) Type **ping ip_address**, where **ip_address** is your workstation's IP address.

j) Now type **ping www.spsu.edu**.

- What happened in each of your ping scenarios?

k) Use **man** to find out how to ping a site only three times. What is that command?

GUI Text Editor

14. A number of simple text editors are available, such as Emacs, KEdit, and gedit.

a) Start gedit by clicking **Applications→Accessories→gedit Text Editor.** Create a text file and save it in the **/home/student/Documents** folder using the filename **text1.**

b) **Have your instructor verify that you did this and then delete the file.**

Setting Up a Network Printer Using the GUI (Optional)

15. You will set up a network printer. The printer must be turned on and on the same IP network

a) Select **System→Administration→Printing**.

b) In the **Printing Localhost** box click **Add** and select **Network Printer**. After a short time, a list will appear that should include the printer, indicating its IP address.

c) When the printer is found, click on it and then click Forward. The **Searching for Drivers** box should appear. When a driver is found, the New Printer box should appear. Select **Apply**.

d) When prompted to print a test page, select no.

Browse and Share Files on a Windows Network

16. To browse Windows networks, Samba must be installed and running. Once installed, it will automatically start when the workstation boots.

    a) Check to see if Samba is installed by opening a terminal window and typing **ps –ax** to see the running processes.

    b) If you see processes with names **nmbd** and **smbd**, Samba is running. If it is, go to step 17. If not, follow the steps below to install Samba.

    c) In a terminal window, enter the command

    sudo apt-get install samba samba-common

    Answer with Y if asked. This will install Samba. Note that apt-get is Ubuntu's Advanced Packaging Tool.

    d) Install the GUI share configuration utility. In a terminal window, enter the command:

    sudo apt-get install system-config-samba

    e) Restart Ubuntu to start the Samba services.

17. You will share your Ubuntu user Documents folder on the Windows network

    a) Open the Samba configuration utility. For Ubuntu 11.04 use **System > Administration > Samba**. For Ubuntu 11.04 with Unity desktop Launcher click **Applications**. Then search for **System Settings**. A **Control Center** window will open. Click **Samba**.

    b) Enter your user password when asked.

    c) Click **File > Add Share**. Browse to your **/home/<username>** folder and click on **Documents**. Then click **OK**. Check **Writable** and **Visible**. Under **Access**, choose **Allow access to everyone**. Click **OK** when you are done.

18. You will now browse the Windows network.

    a) Click **Places** > **Network > Windows Network** or on Unity click **Home Folder > Network > Windows Network**.

    b) Double click on an icon, folder, or network icon to access the shares or computers with shares. Locate a running Windows workstation and click on its icon. Enter the local Windows computer administrator username and password when prompted. Then click on a shared folder to display its contents.

    Note: Linux can access MS Windows shared folders because it has a utility that can interact with the workstation using the Windows SMB (Session Message Block) network sharing protocol.

Note: Linux can see the c:\ drive administrative share on the Windows computers even though it is not shared to other Windows computers. It also displays Windows hidden folders.

Note: The MS Windows shares are controlled by the security settings on the Windows host.

Logout and Shutdown

19. Click the **"power"** button in the top right of the **Ubuntu** menu bar. Then select **Shut Down**.

- **Note:** from the Shell prompt, you can use the **sudo shutdown –h now** command to turn off the computer or the **reboot** command to reboot to the GRUB boot loader.

Questions

1. What were the differences between the files and directories displayed using **ls** and those displayed using **dir**?
2. The /home subdirectory is one level below the root. Your personal user home subdirectory is one level below that. If you are in the /home subdirectory, what are two cd commands that will take you to your personal user home subdirectory?
3. Investigate the SAMBA Linux utility and describe its purpose.
4. Investigate the APACHE Linux utility and describe its purpose.
5. Find a utility that can run on a Linux machine and emulates a Windows operating system, permitting you to run Windows programs on a Linux computer. Record its name, whether it is open-source, and the WWW URL where it is found.
6. Ubuntu is based on another Linux distribution. What is it?

Report

Analyze your data and prepare a brief, concise report. Answer all questions and make meaningful conclusions about what you learned.

- The 10/12 update changed details in the Windows network folder sharing/browsing and includes how to install Samba.
- In the section on testing file permissions, the student attempts to print the output of the **/etc/sudoers** file to the screen. This will fail because only root has read permissions. The students must use **ls –l** to show that this is the case.
- May want to show students how to scroll through the command history using up and down arrows.
- May want to introduce whereis and whoami commands.
- When trying out the firefox command, "firefox&" allows firefox to be a background process. If you type only "firefox", the process will be a foreground-only process. In foreground only, if you were to click on the shell window, your text entry would not be acted on until after firefox ended.
- Note: this did not seem to work for some.
- In some cases, you may have to use the kill 9 command to kill firefox's process.

Answers to Questions

1. There is no difference between the **dir** and **ls** commands because **dir** is an alias for **ls**.
2. The commands **cd /home/username** or cd **username** would work.
3. Student should research the subject.
4. Student should research the subject.
5. One utility is Wine. There are others.
6. Ubuntu is based on Debian Linux