

Lab Assignment #1

Copyright©2004 by Bryan Brady and Ivan Kourtev
Copyright©2006 by Steven P. Levitan

University of Pittsburgh
Department of Electrical and Computer Engineering
September 1, 2006 (Friday, Week 1)

1 Objective

The objective of this handout is to help you get familiar with the UNIX environment that will be used throughout this course. Basic definitions and usage examples for most popular UNIX commands are demonstrated. Our version of UNIX is Solaris 7/8 running on Sun SPARC workstations.

2 Starters guide to UNIX

UNIX is a large, diverse and very rich operating system. UNIX is memory-efficient, easy to maintain and promotes efficient program development. Unfortunately, UNIX is not as user friendly as some other popular operating systems! Keeping this in mind, this tutorial is organized so that beginners can start with simple functions and progress learning about the UNIX system on their own.

Please try the examples at your workstation as you read through this text. The best way to learn about the UNIX system is by personally using it. Soon, you will be an experienced user in a general-purpose multi-user UNIX system!

2.1 Workstation Information

As you read this, you are hopefully sitting in front of a Sun Ultra-10 workstation which runs the Solaris 7/8 operating system (Solaris is the name of a UNIX version distributed and supported by Sun Microsystems). Solaris provides a graphical user interface for UNIX and is quite easy to use. Assuming one is familiar with Microsoft Windows, it should be relatively easy to get started using Solaris. Please look at the keyboard more carefully. You will notice that some of the functional keys are misplaced compared with a typical PC keyboard. We will not be using the dark colored keys on the left side (such as Stop, Again, Copy, and so on). Please avoid pressing these keys by mistake as this may cause unexpected action and confusion. Experienced PC users or fast typers may have a problem with the Control, Back Space, and Caps Lock keys (placed differently than on a typical PC keyboard). Getting used to these may take some time.

2.2 Before logging in

Click the left mouse button on the Options menu, keep it depressed and scroll down through the options. Point of interest in here is the Session option. The choices of interest are the Common Desktop Environment and the Open Windows and choosing on or the other affects the look and feel of the graphical interface. Most people like CDE better but you can achieve the exact same functionality while using Open Windows. Try both interfaces and feel free to choose one. Your chosen graphical interface will be stored and used by default in your following login sessions. One advantage of CDE over Open Windows is the multiple virtual windows feature of the window manager.

2.3 Logging in

You will use the ECE 1192/2192 user account which was given to you in class. If you have problems using it, consult your TA. Enter your user name and password, as it is done in the universal conventional way. Remember that UNIX is case-sensitive so make sure you are using correct letter-case. If this is your first time to log onto the UNIX machines, a window will pop up, asking you to specify your default desktop, please choose CDE, as the rest of the material is based on the CDE environment.

2.4 Getting introduced to Solaris

Welcome to the UNIX world! Solaris is pretty much similar to Windows OS as it has windows popping up for different utilities and tools. By default, in your first logging into the system, the Help viewer, Hot Java and File manager windows pop up. Opening, closing, resizing these windows is done as in Windows environment. Double clicking on the left topmost square will close the window. Rightmost square would extend the window to fit it to all screen, and the one left of it would minimize the window. Let's try these:

By clicking the upper rightmost square of Hot Java window, extend it and see it spread to your screen. Clicking the same square again would return the window to its original position. Or, you could try double-clicking the upper red bar. Try to do them both.

We wouldn't be needing the Hot Java window so close it, by either choosing File-Exit or double-clicking the upper-left button.

The 'Help viewer' contains extensive information about how to use CDE and applications, it is advisable to read them through some time, maybe at the end of this lab. For the time being close this window and proceed. Close all other windows, too, if any, expect for the long task bar at the bottom.

NOTICE: If you feel uncomfortable in working with windows, like resizing or moving them, or even using the mouse, scroll bars, etc., start reading through the Help viewer, or let your TA know.

Note the large task-bar at the bottom, which is called the Front Panel. In the middle of the Front panel, there are buttons with One-Two-Three-Four labels which are 4 predefined different Workspaces. Go click them all once to see the background change, notice that all are different workspaces, independent from each other. From user's perspective, we could think this like using four different monitors of single computer. Other icons on the front panel are Controls, which are shortcuts for some popular applications. Try clicking once on the leftmost icon, with HTML (or the globe) printed on it. You will see the default browser, popping up. Close it, don't spend too much time surfing right now, and try other icons, if you'd like.

NOTICE: Feel free to configure your Front Panel when you get experienced with Solaris, or desktop preferences. On top of control buttons on the Front Panel, you would notice small arrows, try clicking them once, and see the lists. These are the basic applications, tools that one can use in Solaris. To close these menus, double click the upper left button in the menu. Don't bother to click the items on the lists yet, as we won't be using most of them in the VLSI course.

Now, pop-up a text editor in Workspace One, click and hold the right mouse button, choose Applications → Text Editor. Once the text editor is running, write something in it (don't save yet). Click workspace 'Two' on Front Panel and see the text editor doesn't show up in here! Try 3rd and 4th workspaces, too. We have four independent workspaces on your workstation, we can make use of them if desired. Go back to Workspace One and click the upper-left button of the text-editor window. Choose 'Occupy Workspace', click on Two and 'OK'. See the text editor has disappeared. Choose 'Two' as the workspace from the Front Panel, and see your text editor placed there. This way you could change your workspace. Try, but not now, other options for workspace occupying choices, like occupy all workspaces, etc. Coming back to the Front Panel, we will mostly be using:

- Browser (default as Netscape),
- File manager,
- Text editor.

Try launching these applications.

Now move the pointer over some empty space on the desktop, and press right button, and keep it depressed (not the middle one). We will see the Workspace menu. Check out the applications, don't take your time to execute them right now. We will be using Snapshot (to capture simulations, schematics, etc. as image files), Image viewer, calculator and text editor, more frequently.

From tools menu, start up a terminal. Here we meet a UNIX shell at last. This is analogous to popping up a MSDOS prompt in WINDOWS.

Before going into the 'core' UNIX world, we should learn to logout from the workstation. Remembering that a user should *NEVER* power on/off a workstation by pressing the buttons on the station, we should log out for the sake of security and your own privacy. To logout, click on the 'Exit' button to the right of the workspace buttons in the Front Panel. Choose OK from the upcoming window. Once you are out of the system, look at the login screen and find out the name of your workstation. It is written as 'Welcome to Jupiter', on workstation named as Jupiter. Now log into the system again, and get ready to try some basic UNIX commands.

Last note on Solaris: I would like to remind you that there is a quite well oriented and basic online manual for Solaris, which is the Help Viewer. Feel free to read through it any time and discover about it. This is no big deal but could make you feel comfortable while working.

2.5 UNIX

An operating system, abbreviated as OS, is a collection of programs that coordinates the operation of hardware and software. UNIX is one kind of an OS, which is basically broken down into three components: Scheduler, file system and shell. You will only interact with the shell so let's start running some basic UNIX commands now. To execute the shell click and hold the right mouse button, choose Tools → Terminal.

2.6 Some Basic UNIX Commands

You have previously popped up an x-term (or terminal/console) window, if you don't have one, open it. There should be a line starting with '>', this is the command prompt. This is where you will enter commands.

2.6.1 The ls command

Type ls in prompt line, this command displays the contents of the current working directory. For example:

```
> ls
README routes
>
```

All commands in UNIX can get arguments. Try `ls -alF`. `-a` is an option that shows all files, even files that are hidden. `-l` is an option type argument, which provides much more information about a file than the simple version. `-F` is an option that marks directories with a trailing slash (/). Example:

```
> ls -alF
-rw-rw-rw- 1 steve other 138 Apr 5 19:34 README
drwxr-xr-x 1 steve other 512 Apr 2 19:33 routes/
drwxrwxr-x 1 steve steve 4096 Apr 2 19:31 ./
drwxrwxr-x 1 steve steve 4096 Apr 2 19:30 ../
-rw-rw-r-- 1 steve steve 5132 Apr 1 17:40 .cshrc
```

This listing displays several types of information regarding your files. The first entry on the left refers to the permissions on the file, steve is owner, other is the group, succeeding number is the file size, date, and file names. The last three entrees shown above appear only by using `-a` option because these are

otherwise hidden. Don't worry if you don't understand what all of these mean, and proceed, but at least note to see the name and the size of files.

2.6.2 The pwd command

Type `pwd`, this command displays your current working directory.

Unix has a file system where files are stored on storage devices such as disks, and file directories are organized in a logical and structured fashion. Directories could have files, programs and subdirectories in them, like in all usual file systems. Every user has his/her own home directory, where no one but the user can access. In your current working directory, you could create other directories, store or delete files. Note that our space is limited, so be neat in allocating space for storing your studies.

2.6.3 The cat command

`cat` (concatenate) command is generally used to create and display a text file. Type

```
> cat > sample.txt
Just trying...
Ctrl-d (Control and d keys pressed simultaneously)
>
```

We have just created the `sample.txt` file in our working directory. Type `ls` to see the file. To display the file, type `cat sample.txt`.

To display longer files, you could try `page` command, too, or other text editors. Try `page sample.txt`.

2.6.4 The mkdir command

The `mkdir` command is used to create a directory into your current working.

```
> mkdir sampledir
> ls
```

A directory named “sampledir” is created in your current working directory, in the hierarchical structure.

2.6.5 The cd command

This command used to change the working directory. Type `pwd` to see your working directory. Now type `cd sampledir`. Use `pwd` again to see the new working directory.

In general, `cd <directoryname>` is used to change to another directory and `cd ..` to pop out of a directory.

NOTE: you do NOT need the angle brackets around the directory name.

Type `cd ..` (note the space between `cd` and `..`). We are back in our home directory, check typing `pwd`. If you are in a different directory and you want to come back to your home directory, type `cd` or type `cd ~`.

2.6.6 The cp command

This is used in order to make a copy of a file. Type

```
> cp sample.txt sample_2.txt
>
```

The first argument is the name of the file to be copied (source file) and the second argument is the place to copy the save into (destination file). Type `ls` to see `sample_2.txt` file. Full path names could be used as source and destination files.

2.6.7 The mv command

This is used to move a file between directories and/or renaming a file/directory.

To rename, type:

```
> mv sample_2.txt sample_3.txt
>
```

Check the results. Now type

```
> mv sample_3.txt ./sampledir/any_name
>
```

Switch to `sampledir` and see the file renamed under `sampledir`. You could leave `any_name` place empty, and just carry the file into the directory, leaving the name same. Now rename the `sampledir` as `enoughdir` by typing:

```
> mv sampledir enoughdir
>
```

Up to now we have covered choosing our working directory, listing the files in it, creating & copying new files and making new directories.

2.6.8 The rm command

This command is used to remove files. Type `ls` to see `sample.txt` in working directory. Type

```
> rm sample.txt
>
```

Now try removing `sampledir`, type:

```
> rm enoughdir
.....
```

You get an error message!

The way to delete a directory, recursively with the files and subdirectories under it in the hierarchical structure is to use `rm` command with `-r` option.

```
> rm -r enoughdir
```

2.6.9 The chmod command

This command is used to change the permissions over a file that you own. Type `ls -l` to see the permissions of the files stored in your current directory. The leftmost column indicates whether the file is a file(-), directory(d) or a link(l). 'b' and 'c' can also appear in this position, if the file is a special file used to control a hardware device. This is not our point of interest. The rest nine characters in the first strings shows the permissions or mode of the file.

A file can have three set of permissions: user, group, other, abbreviated as u,g,o respectively. Each of these three groups has three parts: read access, write access and execute access. Read means the subject (u,g or o) can read the file, write means the subject can edit the file and execute means execute the file as a command.

For a directory the meanings are slightly different: read access means that the subject is allowed to look at the contents of the directory (with ls for example), write access means that the user can create a file in the directory, and execute means the user can go through the directory searching through the subdirectories.

The UNIX system provides the chmod command to change the permissions of a file that you own. The syntax for chmod is user class(u,g, or o), followed by the action to take (- or +), followed by the permission to change (r,w,or x).

Now create a file and a directory, using cat and mkdir commands and see their default permission status by using `ls -la <created_file_name>`.

```
> chmod o+x <created_file_name>
```

Now others have permissions to execute your file after using the above command and you can type `ls -la <created_file_name>` to see the new permissions.

```
> chmod o-rx <created_file_name>
```

The above command will remove the read and execute permissions for others.

2.6.10 The ps command

This is used to give information on the running processes. Type:

```
> ps -al
```

In the command arguments, -a means all, -l denotes long listing. After running the above command, you will see PID (Process ID number) for all the processes as one of the options.

2.6.11 The kill command

If a process is stuck, for instance the netscape browser, you can identify that application from the ps list, and stop that execution by using the kill command.

```
> kill <PID of the running application>
```

Don't try to experiment this command right now, but remember that there is such a command to stop running programs.

2.6.12 The man command

This command is the help command for UNIX environment. For example, type:

```
> man ls
```

This formats and displays a page (actually lots of pages) concerning the usage of ls command and its arguments. Try to find out what an `ls -al` command does.

The man command provides an extensively useful online tutorial for UNIX. If you are interested, you could take your time to go through some popular commands, but it might take too long. Remember you could even type `man man` to get information on the usage of man command.

2.7 Password and Home Directory

After logging in, you can change your password by typing "`passwd`" command. You will be required to enter your old password and twice enter the new password.

Your home directory would be:

```
/classes/ece1192/fall106/<username>
```

NOTE: you do NOT need the angle brackets around your username. Type `pwd` to see your home (current directory) directory.

2.8 Snapshots

After completing the assignments, you will definitely need to hand in some simulation results and schematics/layout drawings. It would sometimes be a problem to use CAD tools' built-in print commands, so we could use the snapshot function of Solaris. On a CDE desktop, Click-hold right mouse button, choose Applications → Snapshot.

2.9

Print outs

The built in 'Print' commands of many applications may fail, as they would individually require printer path definitions or captures. To take a printout from Solaris workstations, prepare your file and save it with a predefined, known suffix, like `.ps`, `.doc`, `.txt`, etc. Then use the terminal window and `lpr` command to take printouts. For example to print `h1.ps` file, type:

```
> lp h1.ps
>
```

This will send the request (`h1.ps` file) to the printer across the room.

When you complete your work, don't forget to logout.

3 Class Account Setup

Before you are able to use the tools which we will use in class, you must first setup your account. This can be done by 'sourcing' a configuration file. To do this, type the following command in the Terminal:

```
> source ../CLASS/dot_cshrc
>
```

The source command reads through the specified file and sets variables and other options which you will need. This must be done every time you login. However, you can modify your `.cshrc` file so that it is no longer necessary to execute the command each time you login. To do this, open your `.cshrc` file in your favorite text editor (if you don't have a favorite text editor, `dtpad` will work). Add the following line to your file, then save it. *Note:* you will need to logout and log back in for your changes to take effect.

```
source ../CLASS/dot_cshrc
```