

Hitchhiker's Guide

to

Linux

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The VLSI design tools at Harvey Mudd College are hosted on a Linux server named *tera*. This document introduces you to connecting with the server, getting around Linux, and starting the tools.

Connecting to *tera*

The usual way to connect to *tera* is from your Windows, Mac, or Linux-based computer using the X11 display protocol. From Windows, you will need a program such as Cygwin or PuTTY with Xming, to open an X terminal. Cygwin is installed on the ECF computers and you can download it for free onto your personal computer using the directions on *X11 for Windows*. Cygwin is heavy install so PuTTY is much lighter alternative.

If you have a Mac or Linux, the X Windows software is already built in.

If you are on Windows, choose Start • Programs • Cygwin-X • XWin Server or you can open a Cygwin terminal, type `xlaunch &` and accept all the settings. If you are on Mac, run `/Applications/Utilities/X11.app`. If you are on Linux, open a new terminal.

IMPORTANT: If you are using Cygwin-X on an Engineering department lab computer, be sure to exit Cygwin when you are done. Simply logging out and closing the window doesn't suffice. Instead, you must right-click on the X icon in the Windows taskbar notification area (in the lower right corner of the screen) and choose Exit... Unfortunately, if you don't exit properly, you'll leave a lock file that will prevent others from using Cygwin on that computer until it is rebooted. If rebooting doesn't fix the problem, please notify the Engineering Systems Administrator.

IMPORTANT: If you are using Cygwin for the first time on your personal computer or on a lab computer, it may be necessary to follow the directions in the additional help section *X11 for Windows*.

At the terminal, type `ssh -Y username@tera.eng.hmc.edu`, where you supply your [username \(usually first initial and last name, such as bkeller for Ben Keller\)](#). Tera will prompt you for your password.

The first time you log in, you'll be prompted for your year. A link to your Charlie account will be automatically set up based on that information. Change your password the first time you log in, by typing `passwd` and following the prompt.

You will need some files for the various labs. They are located in `/courses/e158/15`

Getting around Linux

Tera runs Linux CentOS 6.6, which is the old, stable, and preferred release for the CAD tools. If you aren't already familiar with Linux, follow this tutorial to learn your way around.

You can create, view, and manipulate files by typing commands into the terminal. Type

```
ls
```

to **list** the contents of your directory. You'll initially see "charlie" as the only entry. We'll return to this special entry later. To create a new subdirectory, type

```
mkdir IC_CAD
```

when you `ls` again, you'll see

```
charlie          IC_CAD To
```

create a new file, type

```
gedit foo
```

The GNOME text editor opens up. Type "Hello" into the text editor, then save and quit. Now,

Typing

```
ls -l
```

gives you a longer listing showing more information about the files:

```
drwxr-xr-x  2 bkeller users 4096 Jan 29  2009 charlie
-rw-rw----  1 bkeller users    6 Jan 17 12:54 foo drwxr-
xr-x  2 bkeller users 4096 Jan 17 12:44 IC_CAD
```

The owner is **bkeller**, who is part of the group **users** (you should see your user name instead) The `d` indicates that both files are directories. It is followed by three triples of letters. The first `wxr` means that the user can **w**rite, **r**ead, and **e**xecute the file (for directories, execute means to enter the directory). The second means that members of the same group can read and execute but not write the file. The third means that others not in the same group can also read and execute but not write. The file size is 4096 bytes, which is standard for a directory. The `IC_CAD` directory was created on January 17 of this year at 12:44. `foo` is not a directory and is only 6 bytes long (five characters plus the carriage return at the end). It is readable and writable only by `bkeller` and other group members. In Linux, file names beginning with a dot are normally not displayed when you type `ls`. Usually, configuration files are named this way so they don't clutter things up. To display everything including the dot files, type

```
ls -al
```

Some dot files have already been created in your directory. For example, `.bash_profile` is a configuration file invoked on log-in that sets up the paths to find various programs.

To **print** your current **working directory**, type

```
pwd
```

and you'll see

```
/home/bkeller
```

To **change directory** into the new directory you created, type

```
cd IC_CAD
```

Now if you type `pwd`, you'll see

```
/home/bkeller/IC_CAD
```

To go back up to your home directory (`/home/bkeller`), type

```
cd ..
```

Where `..` indicates the directory above where you currently are. (Note that `.` refers to the directory where you currently are.) Alternatively, you could have typed

```
cd /home/bkeller
```

or

```
cd /home  
cd bkeller
```

or

```
cd ~bkeller
```

where `~bkeller` is a shortcut for the home directory of that user (i.e. `/home/bkeller`)

or just

```
cd
```

because `cd` returns you to your home directory from wherever you are.

To view the contents of a text file, you can open it in an editor such as `gedit`. However, for short files, it is often more convenient to use the `more` command.

```
more foo
```

To **move** or rename a file, type

```
mv foo foobar
```

To **copy** a file, type

```
cp foobar fooseball To
```

remove a file, type `rm`

```
foobar
```

Then type `ls` to see

```
charlie fooseball IC_CAD
```

Linux supports symbolic **links**, in which one file is really just a pointer to a second. If you change the second file, the first will change. For example

```
ln -s fooseball foolink
```

Then when you `ls -l`, you'll see what `foolink` links to. If you were to use `gedit` to change `fooseball` to say "Goodbye", then typed `more foolink`, you'd see Goodbye. Thus, symbolic links are better than copying when you want two files to remain the same.

To **change** the permissions on a file, use `chmod`. `Chmod` takes three octal numbers, indicating the permissions for the user, the group, and for others. Each number should be the sum of three bit fields: 4 for read, 2 for write, and 1 for execute. For example,

```
chmod 644 fooseball
```

changes the file to be readable and writable by the user and read-only for everyone else. Then

you could move `fooseball` into `IC_CAD` and rename it back to `foo`

```
mv fooseball IC_CAD/foo
```

To get rid of the entire `IC_CAD` folder and its contents, use the recursive option on `rm`:

```
rm -r IC_CAD
```

Use this command with care! Open

```
gedit
```

again by typing `gedit`

While it is running, the terminal is tied up and can't be used. To fix this, press `ctrl-Z` in the terminal to put `gedit` to sleep. Now `gedit` becomes unresponsive. Then type

```
bg
```

in the terminal to run `gedit` in the **background**. Now, you can use both `gedit` and the terminal. To find out what **processes** you have running, type

```
ps
```

And you'll see something like

PID	TTY	TIME	CMD
29382	pts/1	00:00:00	bash
29905	pts/1	00:00:00	gedit
29949	pts/1	00:00:00	ps

`bash` is the “**B**ourne-**A**gain **S**hell,” part of the terminal that interprets the commands you have been typing. `Gedit` is running in the background. `ps` is the command you just invoked. Notice that each command has a process ID (PID). If a program locks up, you can kill it based on its PID. For example

```
kill 29905
```

kills the `gedit` session. You would lose any unsaved work, so don't use this unless you have to.

Instead of putting `gedit` to sleep and restarting it in the background with separate commands, you could have typed

```
gedit &
```

to invoke it in the background in the first place.

Your `tera` account should be automatically linked to your `tera` account. To access your account, change into that subdirectory. You can then copy files between the systems.

This is particularly helpful to copy over images from `tera` for a report that you are writing on your PC.

```
cd ~/charlie
```

In the `Charlie` folder is a `README` file. To read it and learn about changing your password, type

more README

Another way to move files between your computer and terra is through an **file transport protocol (FTP)** client. WinSCP is a good FTP program for Windows. To get more information about a command, use `man`:

`man rm`

Moving to the Next Level

The commands so far are adequate to get you started. However, Linux is full of other commands that you will find useful as you become more sophisticated and work with a greater assortment of files.

`!!`: repeat the last command

`!word`: repeat the last command that started with word

`*`: matches any file name

Ex: `rm *.txt` removes all files ending with the suffix `.txt` (dangerous!)

`grep`: global regular expression print

Ex: `grep Hello *` prints the lines of all files that contain the word "Hello"

`|`: pipe the output of one command to another

Ex: `grep Hello * | more` displays the results of the `grep` with `more`

Other commands

`gpdf &`: read a PDF file

`ps2pdf`: convert a Postscript (`.ps` or `.eps`) file to PDF

`xterm &`: create another terminal window

`exit`: closes a terminal

`top`: display a list of the processes using the most resources

A longer list of commands is located at <http://www.ss64.com/bash/>

Running Linux and Windows Together

If you find you like Linux and want to install it on your computer but still need access to Windows-based software, you might want to run it alongside Windows on your PC. You can configure your computer as dual-boot and select the option of running either one at startup, but this is a pain because you have to reboot to switch. If your computer has plenty of disk and RAM, a better option is to use virtualization to run Linux and Windows side-by-side. You can do this by installing the free Microsoft Virtual PC software, then installing Linux on the virtual PC. For more information, see

http://www.preview.co.uk/articles/Windows/Run_Linux_in_Windows/