

## ESE-2025 Lab 2

Name: Shreya Mamadapur

Student ID: C0774035

Instructor: Takis Zourntos

### Introduction

This lab report is to get familiarised with the basic Linux commands to use in desktop as well as the BeagleBone Black.

Once we boot our BBB, we might want to add multiple users in the BBB or simply want to root privileges.

To switch between root and debian we can use the following commands:

`$whoami` #shows "debian"

`$su` - or `$sudo su` #gives superuser access

`$whoami` #now shows "root"

`$exit` #exit as root & get rid of responsibilities! (With great power comes great responsibilities)

Linux uses a data-structure called "inodes" to represent all the files and directories. These data-structures store information like permission-attributes, file size etc.

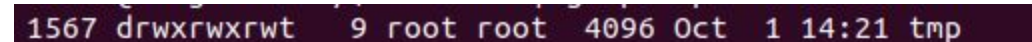
Inode-index is simply a reference number of the particular directory or file on the system.

To know stuff we can simply go to root directory and use the command

`$ls -ail`

where -i is to inode index

Now if we add any number of directory/files in this directory, the inode index remains the same. Please have a look at Appendix fig 2.



```
1567 drwxrwxrwt 9 root root 4096 Oct 1 14:21 tmp
```

1567 -- inode index

d -- stands for directory

rwx -- read/write/execute permissions for user, group and others respectively.

9 -- links

root -- file/directory owner username

root -- file/directory owner group name

4096 -- size of the directory

There are two types of links in Linux - soft links and hard links. Soft links are also called as symbolic links.

A soft link is a file that refers to the location of another file or directory whereas hard links directly to the inode index.

We can create a hard link using: `$ln /path/to/file.txt linkname`

We can create a soft link using: `$ln -s /path/to/file.txt linkname`

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Refer appendix for more clarity.

If we want to add new users and groups we can simply do it by `$adduser <name>` and `$groupadd <name>`.

To add a user a to group xyz we write `$adduser a xyz`

We can also reset our password by `$passwd <username>`

To change the ownership of the file we use `chown` and `chgrp` commands. To change the file permissions we use `chmod` commands

These can be very helpful for security, protection reasons. But, if we try to play around with files that are not accessible to us, Linux won't simply let us!

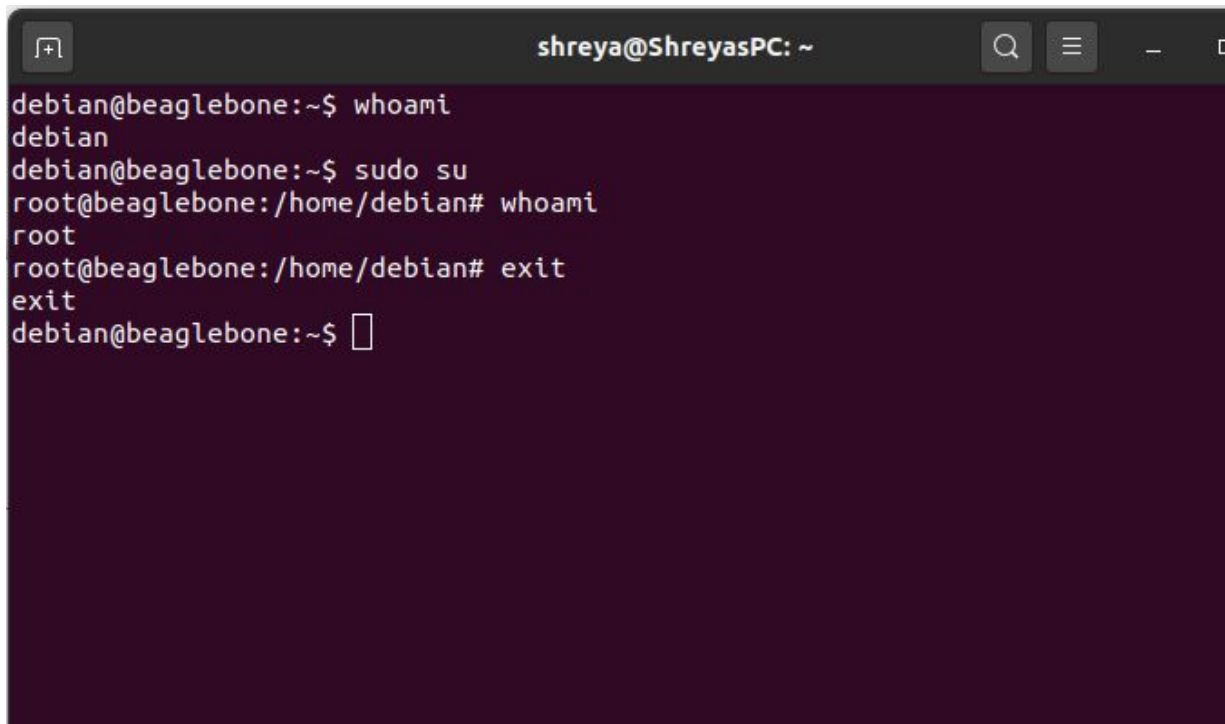
Linux says:

1. Respect the privacy of others
2. Think before you type
3. With great power comes great responsibility

### Conclusion

This report gives knowledge of some simple and useful commands. Linux can be quite easy and fun if we master the commands to control everything from the command terminal.

### Appendix:

A terminal window titled 'shreya@ShreyasPC: ~' with standard window controls. The terminal shows a sequence of commands and outputs: 'debian@beaglebone:~\$ whoami' returns 'debian'; 'debian@beaglebone:~\$ sudo su' returns 'root@beaglebone:/home/debian#'; 'root@beaglebone:/home/debian# whoami' returns 'root'; 'root@beaglebone:/home/debian# exit' returns 'exit'; and 'debian@beaglebone:~\$' followed by a cursor. The terminal has a dark purple background.

```
shreya@ShreyasPC: ~
debian@beaglebone:~$ whoami
debian
debian@beaglebone:~$ sudo su
root@beaglebone:/home/debian# whoami
root
root@beaglebone:/home/debian# exit
exit
debian@beaglebone:~$ █
```

Figure 1: debian and root switching

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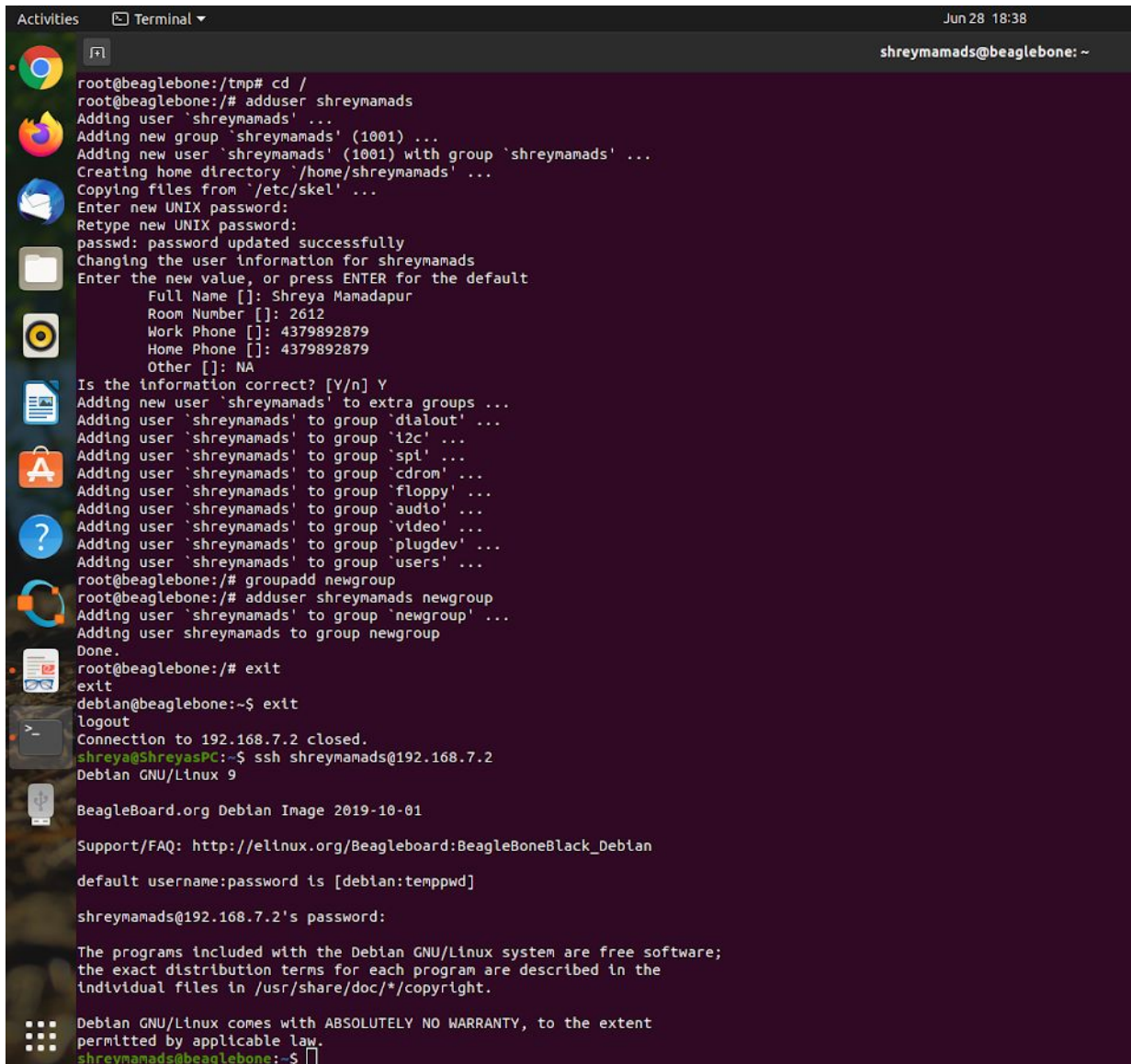
```
shreya@ShreyasPC: ~  
debian@beaglebone:~$ cd /  
debian@beaglebone:/$ ls -lia | grep tmp  
1567 drwxrwxrwt  9 root root 4096 Oct  1 14:21 tmp  
debian@beaglebone:/$ cd /tmp  
debian@beaglebone:/tmp$ touch check.txt  
debian@beaglebone:/tmp$ ls -ila  
total 36  
1567 drwxrwxrwt  9 root  root  4096 Oct  1 14:23 .  
2 drwxr-xr-x 21 root  root  4096 Oct  1 13:55 ..  
62961 -rw-r--r--  1 debian debian  0 Oct  1 14:23 check.txt  
63985 drwxrwxrwt  2 root  root  4096 Nov  3 2016 .font-unix  
63983 drwxrwxrwt  2 root  root  4096 Nov  3 2016 .ICE-unix  
63987 drwx----- 3 root  root  4096 Nov  3 2016 systemd-private-192fc9020aae  
4e90af170251a43b48e9-haveged.service-Qpct4M  
64030 drwx----- 3 root  root  4096 Nov  3 2016 systemd-private-192fc9020aae  
4e90af170251a43b48e9-systemd-timesyncd.service-o1aqF9  
63986 drwxrwxrwt  2 root  root  4096 Nov  3 2016 .Test-unix  
63982 drwxrwxrwt  2 root  root  4096 Oct  1 13:56 .X11-unix  
63984 drwxrwxrwt  2 root  root  4096 Nov  3 2016 .XIM-unix  
debian@beaglebone:/tmp$
```

Figure 2: Inode index check

```
shreya@ShreyasPC: ~  
root@beaglebone:/tmp# touch test.txt  
root@beaglebone:/tmp# ln -s /tmp/test.txt softlink  
root@beaglebone:/tmp# ls  
shre1.txt  
softlink  
systemd-private-32d31ef607484b039d62a4979a2e55da-haveged.service-4AepOL  
systemd-private-32d31ef607484b039d62a4979a2e55da-systemd-timesyncd.service-MDoGHa  
test.txt  
root@beaglebone:/tmp# ln /tmp/test.txt hardlink  
root@beaglebone:/tmp# ls  
hardlink  
shre1.txt  
softlink  
systemd-private-32d31ef607484b039d62a4979a2e55da-haveged.service-4AepOL  
systemd-private-32d31ef607484b039d62a4979a2e55da-systemd-timesyncd.service-MDoGHa  
test.txt  
root@beaglebone:/tmp# ls -al  
total 36  
drwxrwxrwt  9 root root 4096 Oct  1 14:38 .  
drwxr-xr-x 21 root root 4096 Oct  1 13:55 ..  
drwxrwxrwt  2 root root 4096 Nov  3 2016 .font-unix  
-rw-r--r--  2 root root  0 Oct  1 14:37 hardlink  
drwxrwxrwt  2 root root 4096 Nov  3 2016 .ICE-unix  
-rw-r--r--  1 root root  0 Oct  1 14:20 shre1.txt  
lrwxrwxrwx  1 root root 13 Oct  1 14:37 softlink -> /tmp/test.txt  
drwx----- 3 root root 4096 Nov  3 2016 systemd-private-32d31ef607484b039d62a4979a2e55da-haveged.service-4AepOL  
drwx----- 3 root root 4096 Nov  3 2016 systemd-private-32d31ef607484b039d62a4979a2e55da-systemd-timesyncd.service-MDoGHa  
-rw-r--r--  2 root root  0 Oct  1 14:37 test.txt  
drwxrwxrwt  2 root root 4096 Nov  3 2016 .Test-unix  
drwxrwxrwt  2 root root 4096 Oct  1 13:56 .X11-unix  
drwxrwxrwt  2 root root 4096 Nov  3 2016 .XIM-unix  
root@beaglebone:/tmp#
```

Figure 3: Softlinks and Hardlinks

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The terminal window shows the following commands and output:

```
root@beaglebone:/tmp# cd /
root@beaglebone:/# adduser shreymamads
Adding user 'shreymamads' ...
Adding new group 'shreymamads' (1001) ...
Adding new user 'shreymamads' (1001) with group 'shreymamads' ...
Creating home directory '/home/shreymamads' ...
Copying files from '/etc/skel' ...
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
Changing the user information for shreymamads
Enter the new value, or press ENTER for the default
Full Name []: Shreya Mamadapur
Room Number []: 2612
Work Phone []: 4379892879
Home Phone []: 4379892879
Other []: NA
Is the information correct? [Y/n] Y
Adding new user 'shreymamads' to extra groups ...
Adding user 'shreymamads' to group 'dialout' ...
Adding user 'shreymamads' to group 'i2c' ...
Adding user 'shreymamads' to group 'spi' ...
Adding user 'shreymamads' to group 'cdrom' ...
Adding user 'shreymamads' to group 'floppy' ...
Adding user 'shreymamads' to group 'audio' ...
Adding user 'shreymamads' to group 'video' ...
Adding user 'shreymamads' to group 'plugdev' ...
Adding user 'shreymamads' to group 'users' ...
root@beaglebone:/# groupadd newgroup
root@beaglebone:/# adduser shreymamads newgroup
Adding user 'shreymamads' to group 'newgroup' ...
Adding user shreymamads to group newgroup
Done.
root@beaglebone:/# exit
exit
debian@beaglebone:~$ exit
logout
Connection to 192.168.7.2 closed.
shreya@ShreyasPC:~$ ssh shreymamads@192.168.7.2
Debian GNU/Linux 9

BeagleBoard.org Debian Image 2019-10-01

Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack\_Debian

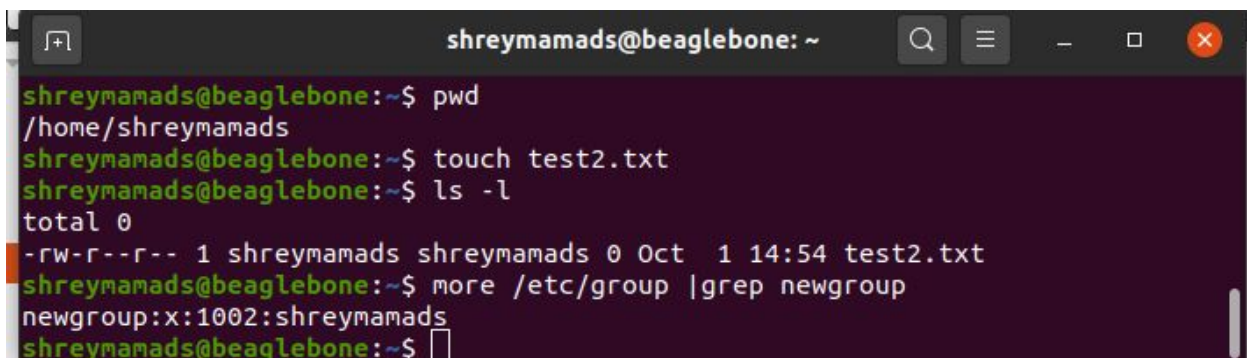
default username:password is [debian:tempwd]

shreymamads@192.168.7.2's password:

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
shreymamads@beaglebone:~$
```

Figure 4a: adding user and group



The terminal window shows the following commands and output:

```
shreymamads@beaglebone:~$ pwd
/home/shreymamads
shreymamads@beaglebone:~$ touch test2.txt
shreymamads@beaglebone:~$ ls -l
total 0
-rw-r--r-- 1 shreymamads shreymamads 0 Oct  1 14:54 test2.txt
shreymamads@beaglebone:~$ more /etc/group |grep newgroup
newgroup:x:1002:shreymamads
shreymamads@beaglebone:~$
```

Figure 4b



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```
debian@beaglebone:~$ cd /tmp/
debian@beaglebone:/tmp$ ls -l
total 8
-rw-r--r-- 1 shreymamads shreymamads  0 Oct  1 16:05 check2.txt
-rw-r--r-- 1 debian     debian        0 Oct  1 14:23 check.txt
drwx----- 3 root      root          4096 Nov  3  2016 systemd-private-192fc9020
aae4e90af170251a43b48e9-haveged.service-Qpct4M
drwx----- 3 root      root          4096 Nov  3  2016 systemd-private-192fc9020
aae4e90af170251a43b48e9-systemd-timesyncd.service-o1aqF9
debian@beaglebone:/tmp$ chown shreymamads check.txt
chown: changing ownership of 'check.txt': Operation not permitted
debian@beaglebone:/tmp$ sudo chown shreymamads check.txt
[sudo] password for debian:
debian@beaglebone:/tmp$ ls -l
total 8
-rw-r--r-- 1 shreymamads shreymamads  0 Oct  1 16:05 check2.txt
-rw-r--r-- 1 shreymamads debian        0 Oct  1 14:23 check.txt
drwx----- 3 root      root          4096 Nov  3  2016 systemd-private-192fc9020
aae4e90af170251a43b48e9-haveged.service-Qpct4M
drwx----- 3 root      root          4096 Nov  3  2016 systemd-private-192fc9020
aae4e90af170251a43b48e9-systemd-timesyncd.service-o1aqF9
debian@beaglebone:/tmp$
```

Figure 5a: changing ownership of check.txt from debian to shreymamads

```
debian@beaglebone:/tmp$ sudo chgrp shreymamads check.txt
debian@beaglebone:/tmp$ ls -l
total 8
-rw-r--r-- 1 shreymamads shreymamads  0 Oct  1 16:05 check2.txt
-rw-r--r-- 1 shreymamads shreymamads  0 Oct  1 14:23 check.txt
drwx----- 3 root      root          4096 Nov  3  2016 systemd-private-192fc9020
aae4e90af170251a43b48e9-haveged.service-Qpct4M
drwx----- 3 root      root          4096 Nov  3  2016 systemd-private-192fc9020
aae4e90af170251a43b48e9-systemd-timesyncd.service-o1aqF9
debian@beaglebone:/tmp$
```

Figure 5b: changing group ownership of check.txt

```
shreymamads@beaglebone:/tmp$ ls -l
total 8
-rw-r--r-- 1 shreymamads shreymamads  0 Oct  1 16:05 check2.txt
-rw-r--r-- 1 shreymamads shreymamads  0 Oct  1 14:23 check.txt
drwx----- 3 root      root          4096 Nov  3  2016 systemd-private-192fc9020a
ae4e90af170251a43b48e9-haveged.service-Qpct4M
drwx----- 3 root      root          4096 Nov  3  2016 systemd-private-192fc9020a
ae4e90af170251a43b48e9-systemd-timesyncd.service-o1aqF9
shreymamads@beaglebone:/tmp$ chmod 774 check.txt
shreymamads@beaglebone:/tmp$ ls -l
total 8
-rw-r--r-- 1 shreymamads shreymamads  0 Oct  1 16:05 check2.txt
-rwxrwxr-- 1 shreymamads shreymamads  0 Oct  1 14:23 check.txt
drwx----- 3 root      root          4096 Nov  3  2016 systemd-private-192fc9020a
ae4e90af170251a43b48e9-haveged.service-Qpct4M
drwx----- 3 root      root          4096 Nov  3  2016 systemd-private-192fc9020a
ae4e90af170251a43b48e9-systemd-timesyncd.service-o1aqF9
shreymamads@beaglebone:/tmp$
```

Figure 5c: Changing file permissions of check.txt