

LINUX COMMAND LINE BASICS:

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2. **ls** - List. This command lists the contents of a directory.

```

File Edit View Terminal Help
( You have a reputation for being )
( thoroughly reliable and trustworthy. A )
( pity that it's totally undeserved. )
-----
o
o
  |o o|
  |: / |
 // \ \
(| |)
/\ \ /
 \ )=( /

ihaveapc@ihaveapc ~ $ pwd
/home/ihaveapc
ihaveapc@ihaveapc ~ $ ls
Desktop Downloads Music Public Videos
Documents FrostWire Pictures Templates
ihaveapc@ihaveapc ~ $

```

To view the directory contents in long format, issue the command:

ls -l

```

File Edit View Terminal Help
( Don't plan any hasty moves. You'll be )
( evicted soon anyway. )
-----
o
o
  {~..~}
  ( Y )
  ()~*~()
  ( )-( )

ihaveapc@ihaveapc ~ $ ls -l
total 36
drwxr-xr-x  2 ihaveapc ihaveapc 4096 2010-07-09 15:19 Desktop
drwxr-xr-x  5 ihaveapc ihaveapc 4096 2010-07-04 13:27 Documents
drwxr-xr-x  9 ihaveapc ihaveapc 4096 2010-07-09 11:30 Downloads
drwxr-xr-x  6 ihaveapc ihaveapc 4096 2010-07-03 02:33 FrostWire
drwxr-xr-x  2 ihaveapc ihaveapc 4096 2010-06-29 07:07 Music
drwxr-xr-x  3 ihaveapc ihaveapc 4096 2010-06-29 22:48 Pictures
drwxr-xr-x  2 ihaveapc ihaveapc 4096 2010-06-29 07:07 Public
drwxr-xr-x  2 ihaveapc ihaveapc 4096 2010-06-29 07:07 Templates
drwxr-xr-x 10 ihaveapc ihaveapc 4096 2010-07-09 11:29 Videos
ihaveapc@ihaveapc ~ $

```

In the above screenshot, you can see the output of list command in long format. The first column represents user permissions, which will learn about in the upcoming posts. Second column represents number of files/folders in that directory. Third column represents the owner. Fourth column represents the owner's group. Fifth column represents the size in bytes. Sixth and seventh columns represent the date and time modified respectively. Last column represents the file/folder name.

In Linux, a hidden file/directory name starts with a dot i.e. '.'. If you want to view the hidden files/directories then issue the following command:

ls -la

```

File Edit View Terminal Help
drwx----- 4 ihaveapc ihaveapc 4096 2010-06-29 07:20 .mozilla
lrwxrwxrwx 1 ihaveapc ihaveapc 27 2010-07-06 21:43 .mozilla-thunderbird ->
/home/ihaveapc/.thunderbird
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-07-05 09:05 .mplayer
-rw-r--r-- 1 ihaveapc ihaveapc 80 2010-06-29 23:11 .mtpaint
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-29 07:07 Music
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-29 07:08 .nautilus
drwxr-xr-x 3 ihaveapc ihaveapc 4096 2010-06-29 03:04 .openoffice.org
drwxr-xr-x 3 ihaveapc ihaveapc 4096 2010-06-29 22:48 Pictures
-rw-r--r-- 1 ihaveapc ihaveapc 675 2010-06-29 07:05 .profile
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-29 07:07 Public
drwx----- 2 ihaveapc ihaveapc 4096 2010-07-09 01:38 .pulse
-rw----- 1 ihaveapc ihaveapc 256 2010-06-29 07:08 .pulse-cookie
-rw----- 1 ihaveapc ihaveapc 1500 2010-07-09 15:22 .recently-used.xbel
-rw-r--r-- 1 ihaveapc ihaveapc 0 2010-06-29 07:27 .sudo_as_admin_successfu
l
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-29 07:07 Templates
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-29 02:26 .themes
drwx----- 5 ihaveapc ihaveapc 4096 2010-06-29 22:48 .thumbnails
drwx----- 3 ihaveapc ihaveapc 4096 2010-07-06 21:43 .thunderbird
drwxr-xr-x 10 ihaveapc ihaveapc 4096 2010-07-09 11:29 Videos
-rw----- 1 ihaveapc ihaveapc 162792 2010-07-09 15:21 .xsession-errors
-rw----- 1 ihaveapc ihaveapc 123568 2010-07-08 11:03 .xsession-errors.old
ihaveapc@ihaveapc ~ $

```

Also note that in the above screenshot, the colored entries are directories and black entries are files. Notice the second entry, which has '->' in its name. It is a link, which is similar to shortcut file in windows. In above case, '.mozilla-thunderbird' is a link to actual directory '/home/ihaveapc/.thunderbird'.

Also, note that the output has scrolled too fast for the user to read. To make the output readable, we will use two things- a pipe (|) and 'more'. Pipe will cascade output of one command as an input of the second command. Command 'more' will instruct the system to display output screen full at a time until space key is pressed. Hence, if we issue command:

ls -la | more

then, we will get the same output as above but screen full at time until user presses the space key to advance to the next screen.

```

File Edit View Terminal Help
total 496
drwxr-xr-x 41 ihaveapc ihaveapc 4096 2010-07-09 15:23 .
drwxr-xr-x 3 root root 4096 2010-06-29 07:05 ..
drwx----- 3 ihaveapc ihaveapc 4096 2010-06-29 02:05 .adobe
-rw----- 1 ihaveapc ihaveapc 2177 2010-07-09 15:21 .bash_history
-rw-r--r-- 1 ihaveapc ihaveapc 220 2010-06-29 07:05 .bash_logout
drwx----- 6 ihaveapc ihaveapc 4096 2010-07-09 01:38 .cache
drwx----- 3 ihaveapc ihaveapc 4096 2010-06-29 07:10 .compiz
drwxr-xr-x 14 ihaveapc ihaveapc 4096 2010-07-09 04:29 .config
drwx----- 3 ihaveapc ihaveapc 4096 2010-06-29 07:07 .dbus
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-07-09 15:22 Desktop
-rw-r--r-- 1 ihaveapc ihaveapc 36 2010-07-09 01:38 .dmrc
drwxr-xr-x 5 ihaveapc ihaveapc 4096 2010-07-04 13:27 Documents
drwxr-xr-x 9 ihaveapc ihaveapc 4096 2010-07-09 11:30 Downloads
-rw----- 1 ihaveapc ihaveapc 16 2010-06-29 07:08 .esd_auth
drwx----- 2 ihaveapc ihaveapc 4096 2010-07-05 22:49 .filezilla
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-07-05 22:16 .fontconfig
drwxr-xr-x 6 ihaveapc ihaveapc 4096 2010-07-03 02:33 FrostWire
drwxr-xr-x 7 ihaveapc ihaveapc 4096 2010-07-07 01:29 .frostwire4.18
drwx----- 5 ihaveapc ihaveapc 4096 2010-07-09 01:38 .gconf
drwx----- 2 ihaveapc ihaveapc 4096 2010-07-09 15:23 .gconfd
drwx----- 4 ihaveapc ihaveapc 4096 2010-06-29 01:59 .gegl-0.0
drwxr-xr-x 22 ihaveapc ihaveapc 4096 2010-07-05 22:17 .gimp-2.4
--More--

```

```

File Edit View Terminal Help
drwxr-xr-x 22 ihaveapc ihaveapc 4096 2010-07-05 23:04 .gimp-2.6
-rw-r----- 1 ihaveapc ihaveapc 0 2010-07-09 01:41 .gksu.lock
drwx----- 10 ihaveapc ihaveapc 4096 2010-07-08 11:03 .gnome2
drwx----- 2 ihaveapc ihaveapc 4096 2010-06-29 07:08 .gnome2_private
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-07-09 11:29 .gstreamer-0.10
-rw-r--r-- 1 ihaveapc ihaveapc 152 2010-07-09 01:38 .gtk-bookmarks
dr-x----- 2 ihaveapc ihaveapc 0 2010-07-09 01:38 .gvfs
-rw----- 1 ihaveapc ihaveapc 4564 2010-07-09 01:38 .ICEauthority
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-29 02:26 .icons
drwxr-xr-x 12 ihaveapc ihaveapc 4096 2010-07-08 00:42 .jdownloader
drwxr-xr-x 6 ihaveapc ihaveapc 4096 2010-06-29 12:43 .linuxmint
drwxr-xr-x 3 ihaveapc ihaveapc 4096 2010-06-29 07:05 .local
drwx----- 3 ihaveapc ihaveapc 4096 2010-06-29 02:05 .macromedia
drwx----- 4 ihaveapc ihaveapc 4096 2010-06-29 07:20 .mozilla
lrwxrwxrwx 1 ihaveapc ihaveapc 27 2010-07-06 21:43 .mozilla-thunderbird ->
/home/ihaveapc/.thunderbird
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-07-05 09:05 .mplayer
-rw-r--r-- 1 ihaveapc ihaveapc 80 2010-06-29 23:11 .mtpaint
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-29 07:07 Music
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-29 07:08 .nautilus
drwxr-xr-x 3 ihaveapc ihaveapc 4096 2010-06-29 03:04 .openoffice.org
drwxr-xr-x 3 ihaveapc ihaveapc 4096 2010-06-29 22:48 Pictures
-rw-r--r-- 1 ihaveapc ihaveapc 675 2010-06-29 07:05 .profile
--More--

```

3. **cd** – Change Directory. This command allows you to change the current working directory. Syntax is simple: 'cd <directory path>'. To go to the root directory, issue the following command:

cd /

```

File Edit View Terminal Help
-rw----- 1 ihaveapc ihaveapc 256 2010-06-29 07:08 .pulse-cookie
-rw----- 1 ihaveapc ihaveapc 1500 2010-07-09 15:23 .recently-used.xbel
-rw-r--r-- 1 ihaveapc ihaveapc 0 2010-06-29 07:27 .sudo_as_admin_successfu
l
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-29 07:07 Templates
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-29 02:26 .themes
drwx----- 5 ihaveapc ihaveapc 4096 2010-06-29 22:48 .thumbnails
drwx----- 3 ihaveapc ihaveapc 4096 2010-07-06 21:43 .thunderbird
drwxr-xr-x 10 ihaveapc ihaveapc 4096 2010-07-09 11:29 Videos
-rw----- 1 ihaveapc ihaveapc 162949 2010-07-09 15:22 .xsession-errors
-rw----- 1 ihaveapc ihaveapc 123568 2010-07-08 11:03 .xsession-errors.old
ihaveapc@ihaveapc ~ $ cd /
ihaveapc@ihaveapc / $ pwd
/
ihaveapc@ihaveapc / $ cd ~
ihaveapc@ihaveapc ~ $ pwd
/home/ihaveapc
ihaveapc@ihaveapc ~ $ cd -
/
ihaveapc@ihaveapc / $ cd /etc
ihaveapc@ihaveapc /etc $ cd /home/ihaveapc
ihaveapc@ihaveapc ~ $ pwd
/home/ihaveapc
ihaveapc@ihaveapc ~ $

```

After changing the directory, you can use 'pwd' command to check your current directory. You can issue command:

cd ~

from any directory to go back to your home directory.

You can issue command:

cd -

to switch back to previous directory in which you were working before issuing last 'cd' command.

Also, notice that when we changed to directory '/etc' by issuing command 'cd /etc', the directory path is displayed on the left side of the '\$' sign. When we changed to home directory by issuing command 'cd /home/ihaveapc', '~' is displayed on the left side of the '\$' sign. Recall that '~' represents home directory.

4. **cp** – Copy. The syntax is simple '**cp** <path to the file/folder to be copied> <path where the file/folder is to be copied>'

In below screenshot, we have changed to directory '/home/ihaveapc/Pictures' and we want to copy the file '10.jpg' to '/home/ihaveapc/Desktop'. Hence, we issue the following command:

cp 10.jpg /home/ihaveapc/Desktop

```

File Edit View Terminal Help
ihaveapc@ihaveapc ~ $ cd /
ihaveapc@ihaveapc / $ pwd
/
ihaveapc@ihaveapc / $ cd ~
ihaveapc@ihaveapc ~ $ pwd
/home/ihaveapc
ihaveapc@ihaveapc ~ $ cd -
/
ihaveapc@ihaveapc / $ cd /etc
ihaveapc@ihaveapc /etc $ cd /home/ihaveapc
ihaveapc@ihaveapc ~ $ pwd
/home/ihaveapc
ihaveapc@ihaveapc ~ $ ls
Desktop  Downloads  Music      Public     Videos
Documents FrostWire  Pictures   Templates
ihaveapc@ihaveapc ~ $ cd Pictures/
ihaveapc@ihaveapc ~/Pictures $ ls
10.jpg                                     9.jpg
17798469-743a-458b-8475-bea23f585b59.jpg  amateur_nonsense___-1440x900.jpg
7ea5eb31-1472-4bb8-a32c-af067d80194c.jpg Photos
ihaveapc@ihaveapc ~/Pictures $ cp 10.jpg /home/ihaveapc/Desktop/
ihaveapc@ihaveapc ~/Pictures $ cp -avr 10.jpg /home/ihaveapc/Desktop/
`10.jpg' -> `/home/ihaveapc/Desktop/10.jpg'
ihaveapc@ihaveapc ~/Pictures $

```

However, notice that we did not get any message on screen as the file was copied. Hence, we can issue the '-avr' option. 'a' means archive(preserve link and permissions), 'v' means verbose(show what is being done), 'r' means recursive(copy recursively). Hence, we issue the following command:

cp -avr 10.jpg /home/ihaveapc/Desktop

Note that the previously copied '10.jpg' in 'Desktop' directory was overwritten without confirmation. To avoid this we will use the option '-i'. 'i' means interactive(confirm before overwriting). Hence, the above command will be modified to:

cp -iavr 10.jpg /home/ihaveapc/Desktop

5. **mkdir** – Make Directory. Syntax is simple 'mkdir <directory name to be created>'

Now, we make a directory 'pics' in the 'Desktop' folder by issuing the following command:

mkdir pics

```

File Edit View Terminal Help
/home/ihaveapc
ihaveapc@ihaveapc ~ $ cd -
/
ihaveapc@ihaveapc / $ cd /etc
ihaveapc@ihaveapc /etc $ cd /home/ihaveapc
ihaveapc@ihaveapc ~ $ pwd
/home/ihaveapc
ihaveapc@ihaveapc ~ $ ls
Desktop  Downloads  Music      Public     Videos
Documents  FrostWire  Pictures  Templates
ihaveapc@ihaveapc ~ $ cd Pictures/
ihaveapc@ihaveapc ~/Pictures $ ls
10.jpg          9.jpg
17798469-743a-458b-8475-bea23f585b59.jpg  amateur_nonsense__-1440x900.jpg
7ea5eb31-1472-4bb8-a32c-af067d00194c.jpg  Photos
ihaveapc@ihaveapc ~/Pictures $ cp 10.jpg /home/ihaveapc/Desktop/
ihaveapc@ihaveapc ~/Pictures $ cp -avr 10.jpg /home/ihaveapc/Desktop/
`10.jpg' -> `/home/ihaveapc/Desktop/10.jpg'
ihaveapc@ihaveapc ~/Pictures $ cd /home/ihaveapc/Desktop/
ihaveapc@ihaveapc ~/Desktop $ mkdir pics
ihaveapc@ihaveapc ~/Desktop $ ls
001.jpeg  003.jpeg  005.jpeg  007.jpeg  10.jpg
002.jpeg  004.jpeg  006.jpeg  008.jpeg  pics
ihaveapc@ihaveapc ~/Desktop $

```

6. **mv** – Move. The syntax is simple 'mv <path to the file/folder to be moved> <path where the file/folder is to be moved>'

We need to move the file '10.jpg' from directory 'Desktop' to directory 'pics'. For this we will issue the following command:

mv 10.jpg /home/ihaveapc/Desktop/pics

```

File Edit View Terminal Help
ihaveapc@ihaveapc ~ $ ls
Desktop Downloads Music Public Videos
Documents FrostWire Pictures Templates
ihaveapc@ihaveapc ~ $ cd Pictures/
ihaveapc@ihaveapc ~/Pictures $ ls
10.jpg 9.jpg
17798469-743a-458b-8475-bea23f585b59.jpg amateur_nonsense__-1440x900.jpg
7ea5eb31-1472-4bb8-a32c-af067d80194c.jpg Photos
ihaveapc@ihaveapc ~/Pictures $ cp 10.jpg /home/ihaveapc/Desktop/
ihaveapc@ihaveapc ~/Pictures $ cp -avr 10.jpg /home/ihaveapc/Desktop/
`10.jpg' -> `/home/ihaveapc/Desktop/10.jpg'
ihaveapc@ihaveapc ~/Pictures $ cd /home/ihaveapc/Desktop/
ihaveapc@ihaveapc ~/Desktop $ mkdir pics
ihaveapc@ihaveapc ~/Desktop $ ls
001.jpeg 003.jpeg 005.jpeg 007.jpeg 10.jpg
002.jpeg 004.jpeg 006.jpeg 008.jpeg pics
ihaveapc@ihaveapc ~/Desktop $ mv 10.jpg /home/ihaveapc/Desktop/pics
ihaveapc@ihaveapc ~/Desktop $ ls
001.jpeg 003.jpeg 005.jpeg 007.jpeg 009.jpeg
002.jpeg 004.jpeg 006.jpeg 008.jpeg pics
ihaveapc@ihaveapc ~/Desktop $ cd pics/
ihaveapc@ihaveapc ~/Desktop/pics $ ls
10.jpg
ihaveapc@ihaveapc ~/Desktop/pics $ █

```

7. **rm** – Remove. This command deletes a file/directory. Syntax is 'rm <file/directory name to be deleted>'

We need to delete file '10.jpg' in directory 'pics'. Hence, we issue the following command:

```
rm 10.jpg
```

```

File Edit View Terminal Help
Documents FrostWire Pictures Templates
ihaveapc@ihaveapc ~ $ cd Pictures/
ihaveapc@ihaveapc ~/Pictures $ ls
10.jpg 9.jpg
17798469-743a-458b-8475-bea23f585b59.jpg amateur_nonsense___-1440x900.jpg
7ea5eb31-1472-4bb8-a32c-af067d80194c.jpg Photos
ihaveapc@ihaveapc ~/Pictures $ cp 10.jpg /home/ihaveapc/Desktop/
ihaveapc@ihaveapc ~/Pictures $ cp -avr 10.jpg /home/ihaveapc/Desktop/
`10.jpg' -> `/home/ihaveapc/Desktop/10.jpg'
ihaveapc@ihaveapc ~/Pictures $ cd /home/ihaveapc/Desktop/
ihaveapc@ihaveapc ~/Desktop $ mkdir pics
ihaveapc@ihaveapc ~/Desktop $ ls
001.jpeg 003.jpeg 005.jpeg 007.jpeg 10.jpg
002.jpeg 004.jpeg 006.jpeg 008.jpeg pics
ihaveapc@ihaveapc ~/Desktop $ mv 10.jpg /home/ihaveapc/Desktop/pics
ihaveapc@ihaveapc ~/Desktop $ ls
001.jpeg 003.jpeg 005.jpeg 007.jpeg 009.jpeg
002.jpeg 004.jpeg 006.jpeg 008.jpeg pics
ihaveapc@ihaveapc ~/Desktop $ cd pics/
ihaveapc@ihaveapc ~/Desktop/pics $ ls
10.jpg
ihaveapc@ihaveapc ~/Desktop/pics $ rm 10.jpg
ihaveapc@ihaveapc ~/Desktop/pics $ ls
ihaveapc@ihaveapc ~/Desktop/pics $

```

However, if we try to delete a directory which has files/folders in it, system will not delete it and will tell you that the directory is not empty. Hence, we can use '-rf' option in such cases. 'r' means recursive(delete recursively), 'f' means force(do not prompt about non-existent files). Hence, we issue the following command to delete 'pics' directory:

```
rm -rf pics
```

```

File Edit View Terminal Help
^10.jpg' -> ^/home/ihaveapc/Desktop/10.jpg'
ihaveapc@ihaveapc ~/Pictures $ cd /home/ihaveapc/Desktop/
ihaveapc@ihaveapc ~/Desktop $ mkdir pics
ihaveapc@ihaveapc ~/Desktop $ ls
001.jpeg 003.jpeg 005.jpeg 007.jpeg 10.jpg
002.jpeg 004.jpeg 006.jpeg 008.jpeg pics
ihaveapc@ihaveapc ~/Desktop $ mv 10.jpg /home/ihaveapc/Desktop/pics
ihaveapc@ihaveapc ~/Desktop $ ls
001.jpeg 003.jpeg 005.jpeg 007.jpeg 009.jpeg
002.jpeg 004.jpeg 006.jpeg 008.jpeg pics
ihaveapc@ihaveapc ~/Desktop $ cd pics/
ihaveapc@ihaveapc ~/Desktop/pics $ ls
10.jpg
ihaveapc@ihaveapc ~/Desktop/pics $ rm 10.jpg
ihaveapc@ihaveapc ~/Desktop/pics $ ls
ihaveapc@ihaveapc ~/Desktop/pics $ cd ..
ihaveapc@ihaveapc ~/Desktop $ ls
001.jpeg 003.jpeg 005.jpeg 007.jpeg 009.jpeg 011.jpeg
002.jpeg 004.jpeg 006.jpeg 008.jpeg 010.jpeg pics
ihaveapc@ihaveapc ~/Desktop $ rm -rf pics
ihaveapc@ihaveapc ~/Desktop $ ls
001.jpeg 003.jpeg 005.jpeg 007.jpeg 009.jpeg 011.jpeg
002.jpeg 004.jpeg 006.jpeg 008.jpeg 010.jpeg
ihaveapc@ihaveapc ~/Desktop $

```

[Be very careful while using the above command. Never run the above command on root directory as a root user.]

PART 2: Linux Directory Structure and Permissions

We will now continue with the Linux command line basics. We will go through the standard Linux directory structure before you explaining some concepts about Linux file permissions so that you will be in a better position to understand user/group management commands and the commands used to set file permissions in Linux.

Linux directory structure:

The Linux directory structure is like a tree. Standard Linux directory structure generally contains the following directories-

1. **/** – This is the highest level directory in the tree. It is called 'root' and all other folders and devices are its subdirectories. In Linux, everything is represented as a file or a folder (even hardware devices!). Since, you can set permissions on files and folders; you can secure access to these files and folders. This is the reason why Linux is secure by design.
2. **/bin** – This directory contains essential binary applications required by the system to operate.
3. **/usr/bin** – This directory contains the binary applications for the system's users.
4. **/sbin** – This directory contains the binary applications required for system administration by a super user. This folder contains critical binary applications that system must use even before other directories are mounted.
5. **/usr/sbin** – This directory contains the binary applications required for system administration by a super user but the applications are available only after booting is completed.
6. **/boot** – This is the directory where Linux kernel and boot loader files are kept.
7. **/dev** – This directory contains all the hardware devices available to the system represented as files. The system can read from and write to these files or both depending on the type of device.
8. **/etc** – This directory contains the configuration files for the OS, applications and the start up scripts.
9. **/home** – This is the directory which contains the user's home directories. In general, a normal user cannot write or make changes to the directories outside his home directory. This reduces the chances of user accidentally messing up the system. Only root user (administrator) or super users can write or make changes anywhere in the Linux directory structure.
10. **/lib** – This directory contains the shared libraries required for proper functioning of the system.

11. **/lost+found** – This directory contains the lost and found files from the root directory.
12. **/mnt** – This directory is the mount point for the mounted file systems in your computer.
13. **/media** – This directory is the mount point for the file systems of the removable devices.
14. **/opt** – This directory is a place for the optional applications that can be installed.
15. **/proc** – This is a virtual directory that contains entries corresponding to the processes and threads running in the system.
16. **/srv** – This directory acts as a temporary location for the data to be used by the servers.
17. **/sys** – This directory contains system-specific information to be used as a reference for other applications.
18. **/tmp** – This directory is used for temporary storage of files.
19. **/usr** – This directory contains files/folders that support applications that are available to all the users.
20. **/var** – This directory contains files that change while the system is running.

File / Folder permissions in Linux:

In Linux, there are 3 types of **file permissions**-

r (read) – Allows user to view the file – numerical value = 4

w (write) – Allows user to edit the file – numerical value = 2

x (execute) – Allows user to run the file as an executable – numerical value =1

```

File Edit View Terminal Help
( Don't plan any hasty moves. You'll be )
( evicted soon anyway. )
-----
o
o

{~.~.~}
( Y )
()~*~()
( )-( )
ihaveapc@ihaveapc ~ $ ls -l
total 36
drwxr-xr-x  2 ihaveapc ihaveapc 4096 2010-07-09 15:19 Desktop
drwxr-xr-x  5 ihaveapc ihaveapc 4096 2010-07-04 13:27 Documents
drwxr-xr-x  9 ihaveapc ihaveapc 4096 2010-07-09 11:30 Downloads
drwxr-xr-x  6 ihaveapc ihaveapc 4096 2010-07-03 02:33 FrostWire
drwxr-xr-x  2 ihaveapc ihaveapc 4096 2010-06-29 07:07 Music
drwxr-xr-x  3 ihaveapc ihaveapc 4096 2010-06-29 22:48 Pictures
drwxr-xr-x  2 ihaveapc ihaveapc 4096 2010-06-29 07:07 Public
drwxr-xr-x  2 ihaveapc ihaveapc 4096 2010-06-29 07:07 Templates
drwxr-xr-x 10 ihaveapc ihaveapc 4096 2010-07-09 11:29 Videos
ihaveapc@ihaveapc ~ $

```

While listing a directory in long format via ls -l command, you will notice the that the first column has the following format-

drwxrwxrwx

or

-rwxrwxrwx

This column represents the file / folder permissions. Let us see how-

- r w x r w x r w x

The first character from left represents the whether the listed entry is a file (represented by '-'), directory (represented by 'd') or a link (represented by 'l').

- r w x r w x r w x

The red characters represent the permissions provided to the owner of the file. Presence of a character (r, w or x) represents that the permission for that action (read, write or execute) is granted. Presence of a '-' instead of the character represents that the permission for that action (read, write or execute) is denied.

In above case the owner has permission to read, write and execute the file. Note that, $r+w+x = 4+2+1 = 7$.

- r w x r w x r w x

The green characters represent the permissions provided to the members of the owner's group for the file. In above case the group members have permission to read, write and execute the file. Note that, $r+w+x = 4+2+1 = 7$.

- r w x r w x r w x

The blue characters represent the permissions provided to all the other users for the file. In above case the other users have permission to read, write and execute the file. Note that, $r+w+x = 4+2+1 = 7$.

The numerical value of the above permission is represented as 777.

Here are few examples of the file permissions-

rwX----- : (4+2+1, 0+0+0, 0+0+0 = 700) Owner can read, write and execute the file. Group users and other users do not have any permission for the file.

rw-rw-rw- : (4+2+0, 4+2+0, 4+2+0 = 666) All users can read and write to the file.

rw-r--r-- : (4+2+0, 4+0+0, 4+0+0 = 644) Owner can read and write to the file. Group users and others can only read the file.

The **directory permissions** are calculated in similar manner with just the following differences-

r (read) – Allows user to list the files in the directory – numerical value = 4

w (write) – Allows user to create new files and delete the files in the directory – numerical value = 2

x (execute) – Allows user to change to the directory via cd command – numerical value = 1

Here are few examples of directory permissions-

rw-rw-rwx : (4+2+1, 4+2+1, 4+2+1 = 777) Allows owner, group members and others to list files in directory, create files in directory, delete files from the directory and to change to the directory.

rw-r-xr-x : (4+2+1, 4+0+1, 4+0+1 = 755) Allows owner to list files in directory, create files in directory, delete files from the directory and to change to the directory. Group members and others can change to the directory and list the files only.

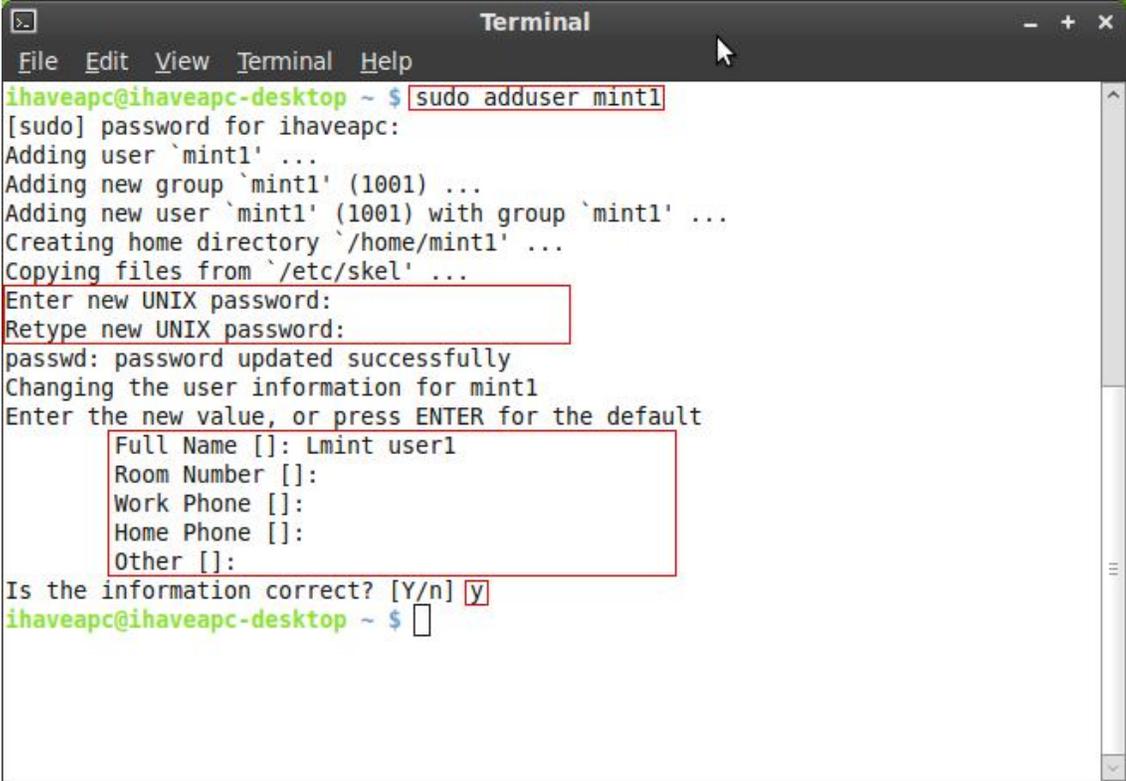
rw----- : (4+2+1, 0+0+0, 0+0+0 = 700) Allows owner to list files in directory, create files in directory, delete files from the directory and to change to the directory. Group members and others do not have any permission on the directory. This makes the directory private to the owner.

PART 3: Managing Users And Groups

We will learn how to manage users and groups.

1. **adduser** – Add user. Syntax is 'sudo adduser <user name>'. We need to use 'sudo' as root privileges are required to run this command. A root user can run the command without 'sudo'. To add a new user named 'mint1', issue the following command in the terminal:

sudo adduser mint1

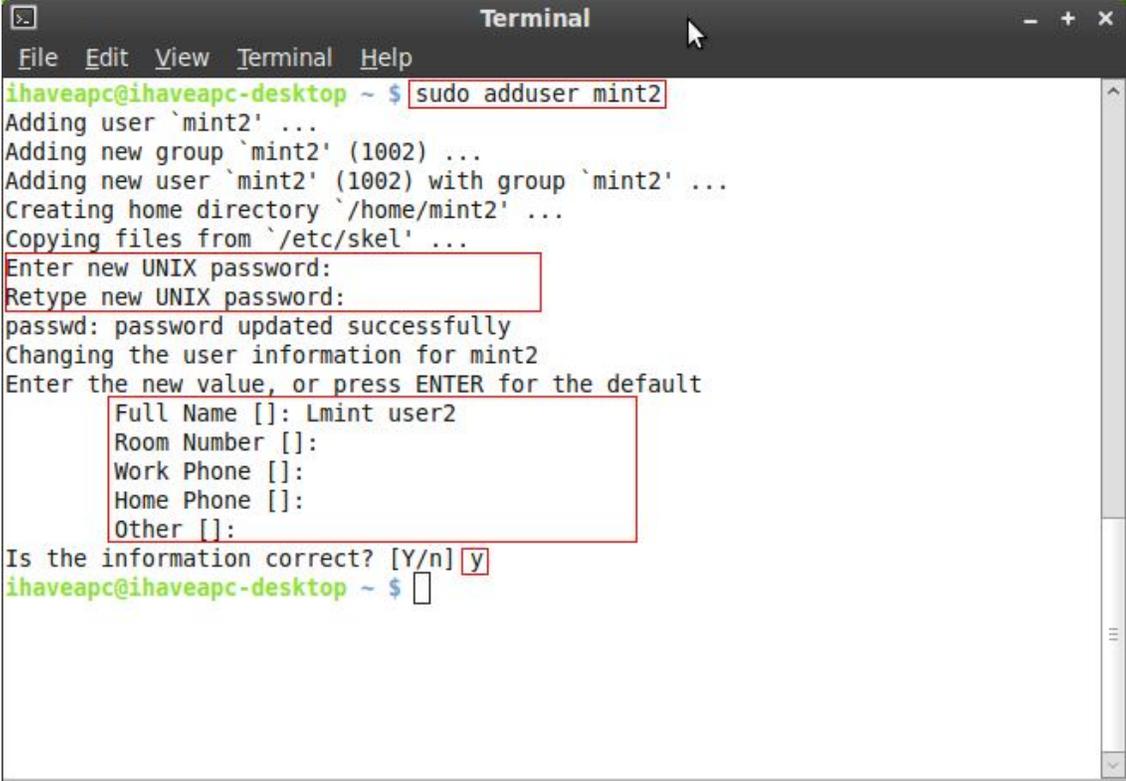


```
ihaveapc@ihaveapc-desktop ~ $ sudo adduser mint1
[sudo] password for ihaveapc:
Adding user `mint1' ...
Adding new group `mint1' (1001) ...
Adding new user `mint1' (1001) with group `mint1' ...
Creating home directory `/home/mint1' ...
Copying files from `/etc/skel' ...
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
Changing the user information for mint1
Enter the new value, or press ENTER for the default
Full Name []: Lmint user1
Room Number []:
Work Phone []:
Home Phone []:
Other []:
Is the information correct? [Y/n] y
ihaveapc@ihaveapc-desktop ~ $
```

Enter the user password when prompted. A new user called 'mint1' will be created. A home directory will be created for the new user in '/home' location. The name of new user's home directory will be same as his user name. [Note that the default structure of the home directory is defined in '/etc/skel' (skel=skeleton). Every time a home directory is to be created for a new user, files are copied from '/etc/skel']. The system will now ask you to create a password for this new user. Type the password and re-type it when prompted. Ask the user to change this password to a desired one by using 'passwd' command when the user logs in for the first time. You can also enter the full name and contact details of the new user when prompted. Type 'y' to confirm the information and hit enter.

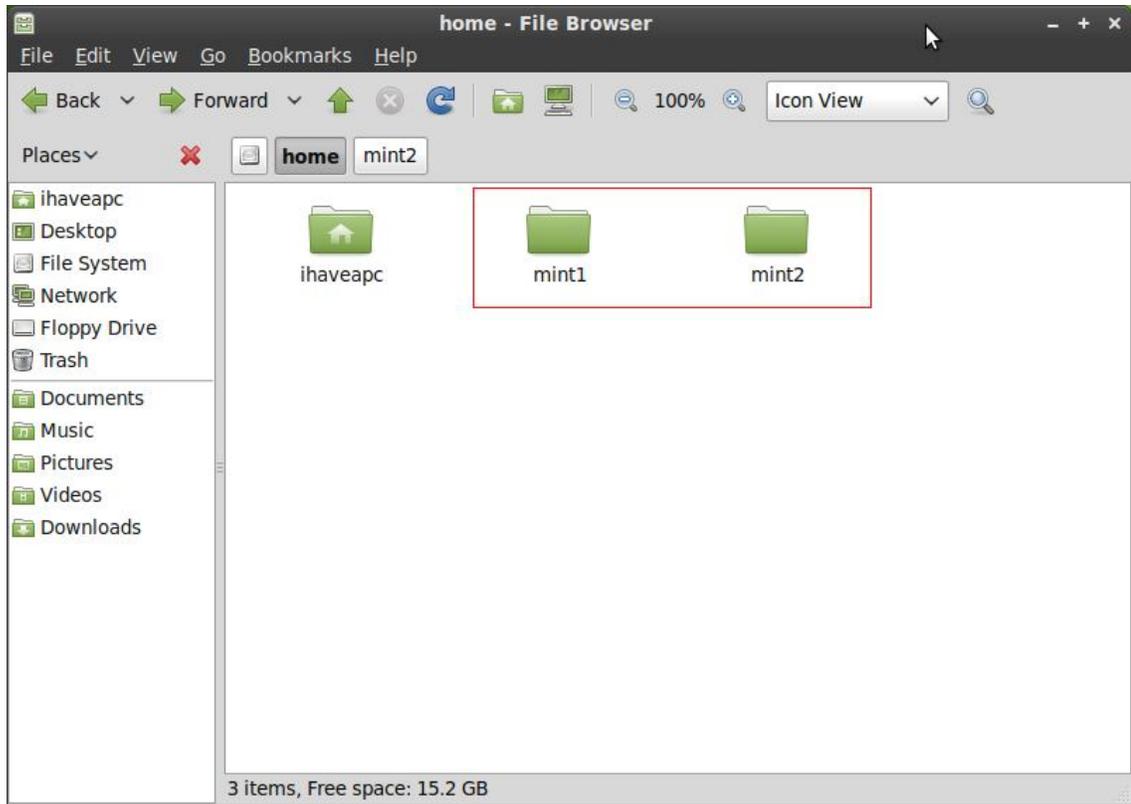
In similar manner, to add a new user named 'mint2', issue the following command in the terminal:

```
sudo adduser mint2
```



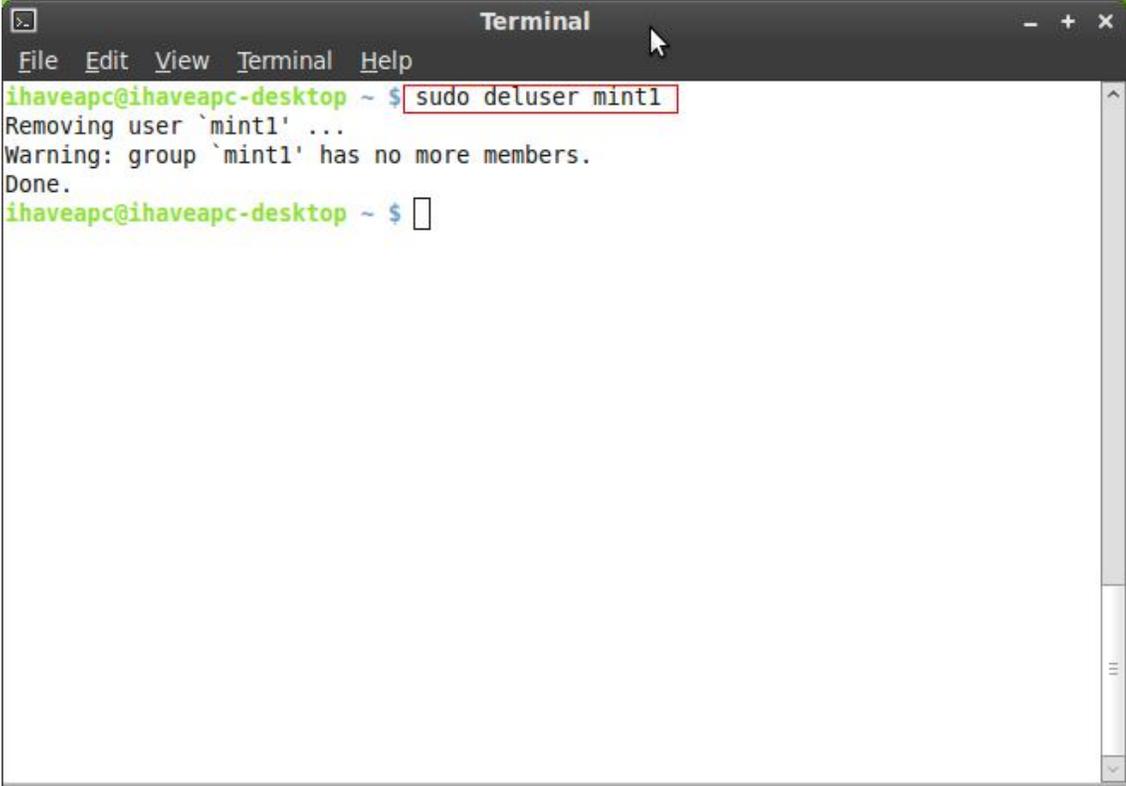
```
ihaveapc@ihaveapc-desktop ~ $ sudo adduser mint2
Adding user `mint2' ...
Adding new group `mint2' (1002) ...
Adding new user `mint2' (1002) with group `mint2' ...
Creating home directory `/home/mint2' ...
Copying files from `/etc/skel' ...
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
Changing the user information for mint2
Enter the new value, or press ENTER for the default
Full Name []: Lmint user2
Room Number []:
Work Phone []:
Home Phone []:
Other []:
Is the information correct? [Y/n] y
ihaveapc@ihaveapc-desktop ~ $
```

Note that two new home directories have been created for users 'mint1' and 'mint2' in '/home' location.



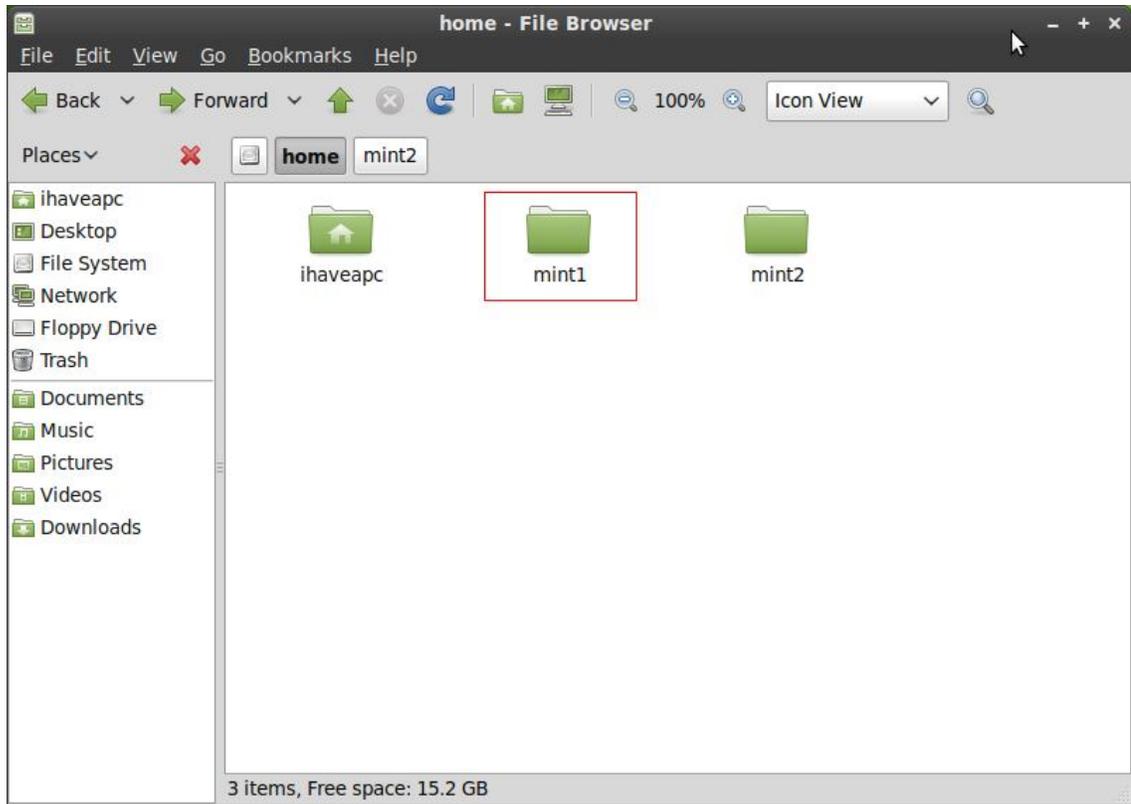
2. **deluser** – Delete user. Syntax is 'sudo deluser <user name>'. We need to use 'sudo' as root privileges are required to run this command. A root user can run the command without 'sudo'. To delete the user 'mint1' issue the following command at the terminal:

```
sudo deluser mint1
```

A terminal window titled "Terminal" with a menu bar containing "File", "Edit", "View", "Terminal", and "Help". The prompt is "ihaveapc@ihaveapc-desktop ~ \$". The command "sudo deluser mint1" is entered and highlighted with a red box. The output is: "Removing user `mint1' ...", "Warning: group `mint1' has no more members.", and "Done.". The prompt returns to "ihaveapc@ihaveapc-desktop ~ \$" with a cursor in the input field.

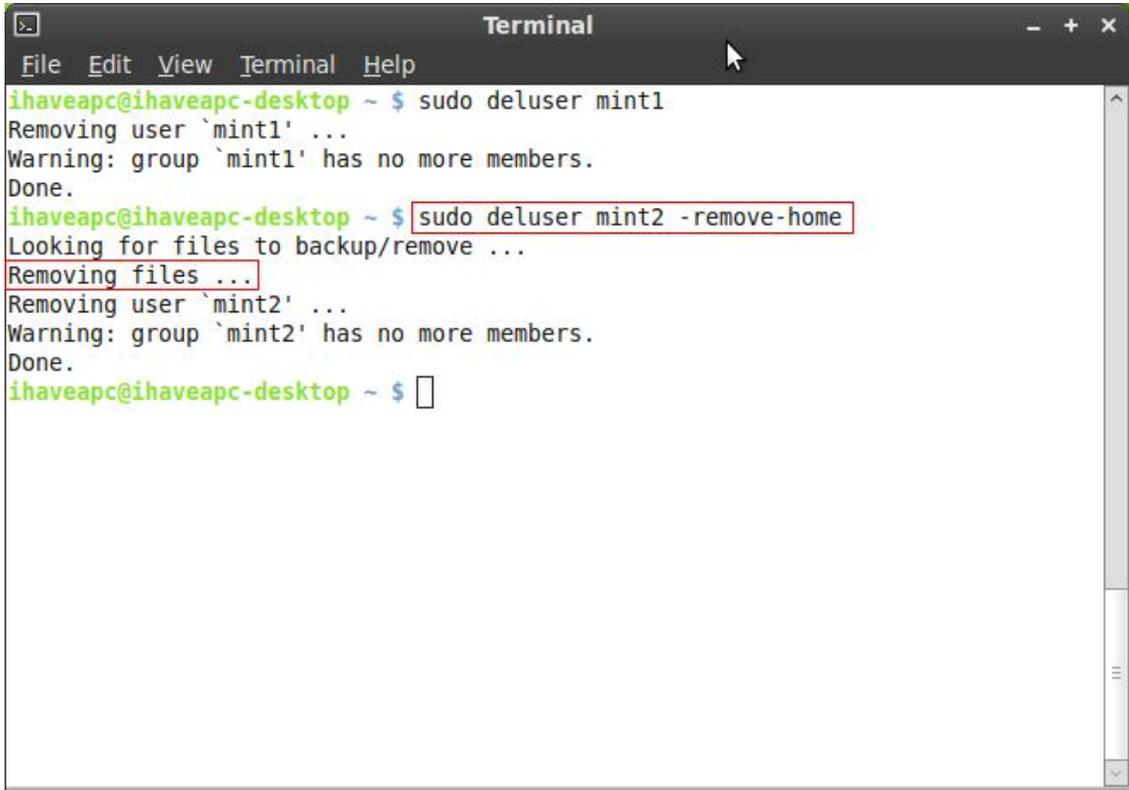
```
ihaveapc@ihaveapc-desktop ~ $ sudo deluser mint1
Removing user `mint1' ...
Warning: group `mint1' has no more members.
Done.
ihaveapc@ihaveapc-desktop ~ $
```

Note that the above command does not delete user's home directory. It is still present in '/home' location.



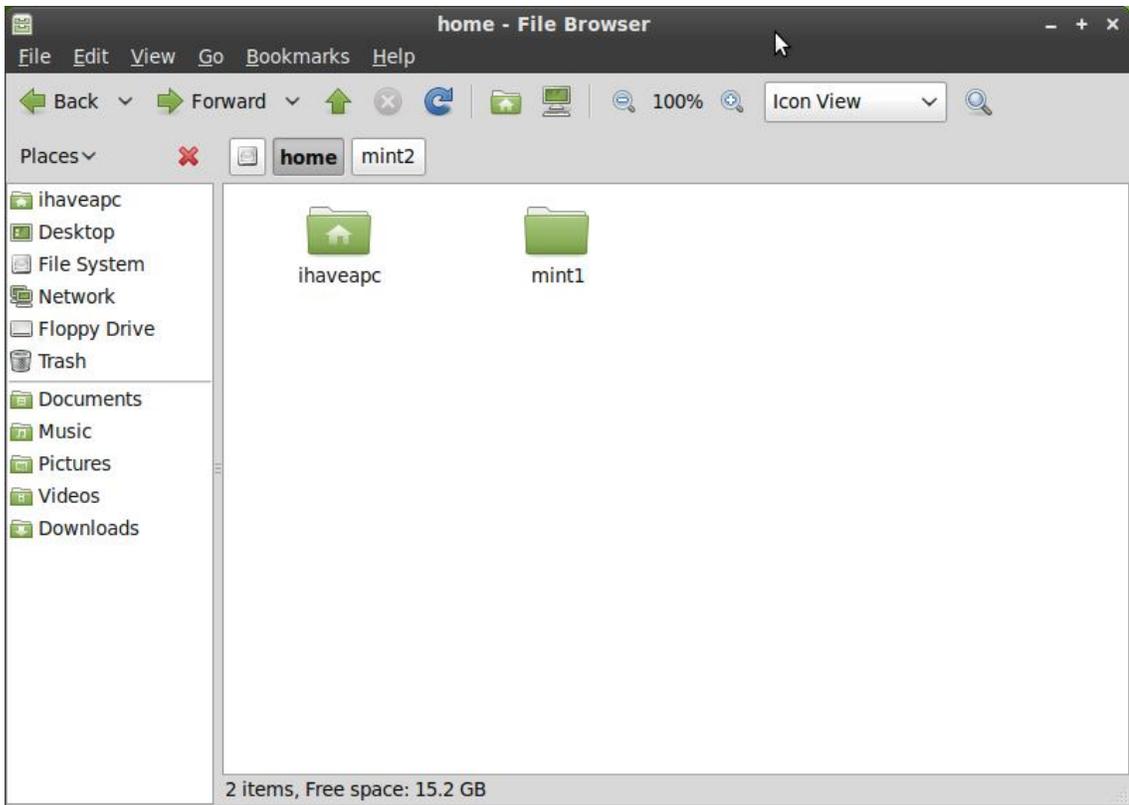
If you want to delete a user as well as his home directory, use the option '-remove-home'. In order to delete user 'mint2' as well as his home directory issue the following command at the terminal:

```
sudo deluser mint2 -remove-home
```



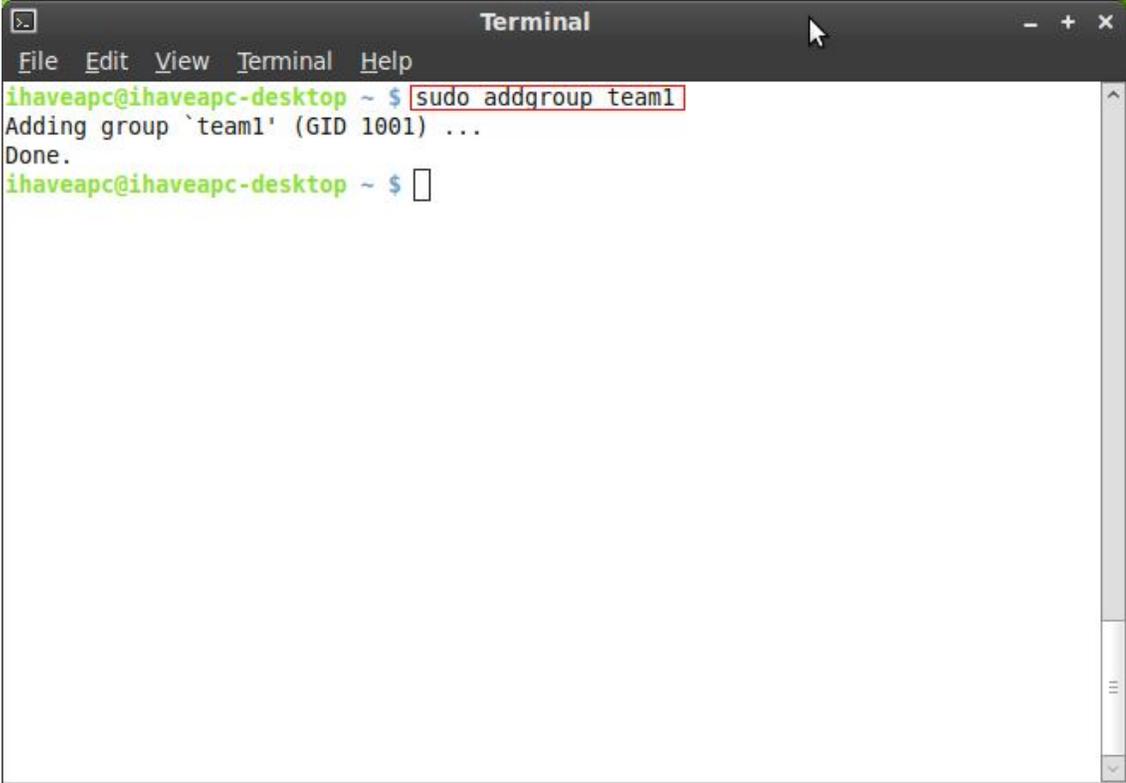
```
ihaveapc@ihaveapc-desktop ~ $ sudo deluser mint1
Removing user `mint1' ...
Warning: group `mint1' has no more members.
Done.
ihaveapc@ihaveapc-desktop ~ $ sudo deluser mint2 -remove-home
Looking for files to backup/remove ...
Removing files ...
Removing user `mint2' ...
Warning: group `mint2' has no more members.
Done.
ihaveapc@ihaveapc-desktop ~ $
```

Note that the user's directory has been deleted from the '/home' location.



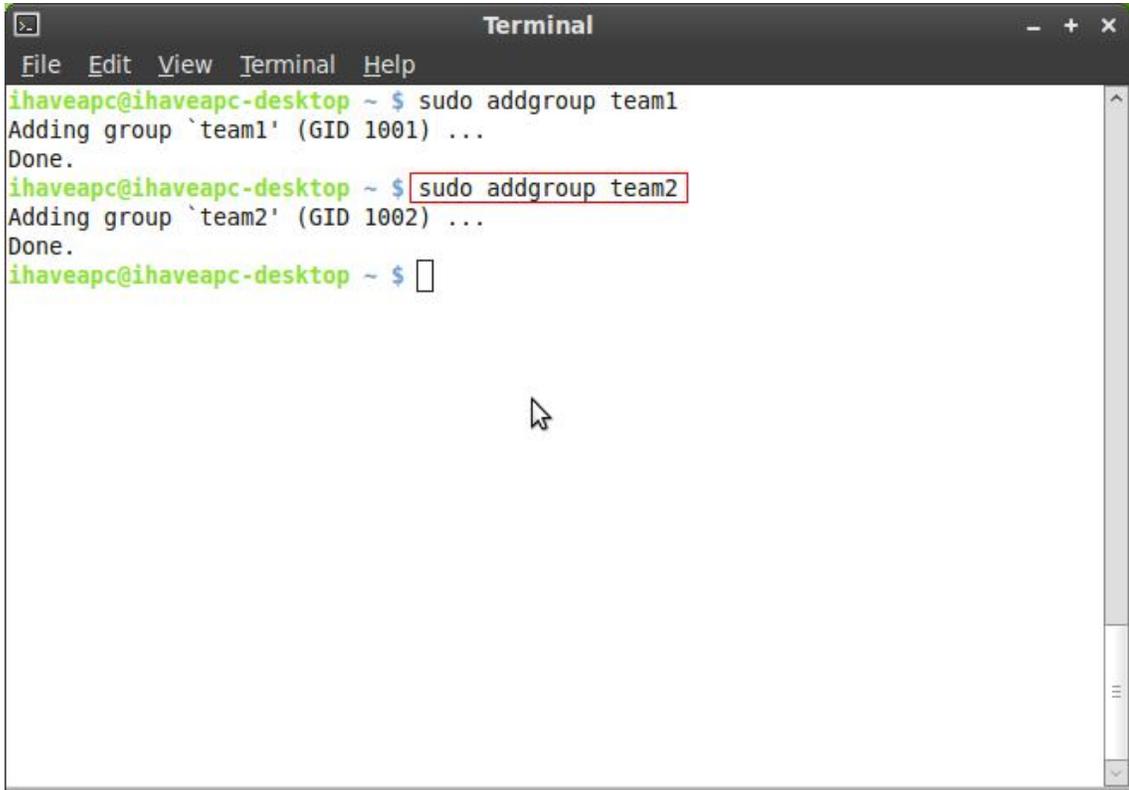
3. **addgroup** – Add group. Syntax is 'sudo addgroup <group name>'. We need to use 'sudo' as root privileges are required to run this command. A root user can run the command without 'sudo'. To add a group called 'team1', issue the following command at the terminal:

```
sudo addgroup team1
```

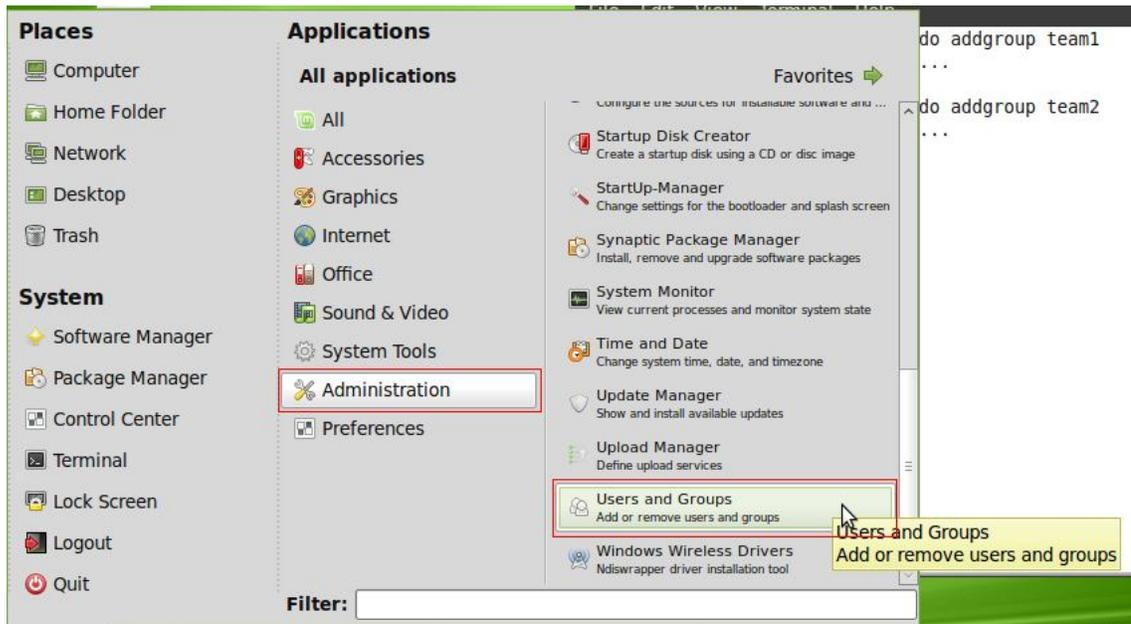
A screenshot of a Linux terminal window titled "Terminal". The window has a menu bar with "File", "Edit", "View", "Terminal", and "Help". The terminal content shows the user "ihaveapc@ihaveapc-desktop" at the prompt "~ \$". The command "sudo addgroup team1" is entered and highlighted with a red box. The output shows "Adding group 'team1' (GID 1001) ..." followed by "Done." on the next line. The prompt returns to "ihaveapc@ihaveapc-desktop ~ \$" with a cursor. The terminal window has standard window controls (minimize, maximize, close) in the top right corner and a scrollbar on the right side.

To add a group called 'team2', issue the following command at the terminal:

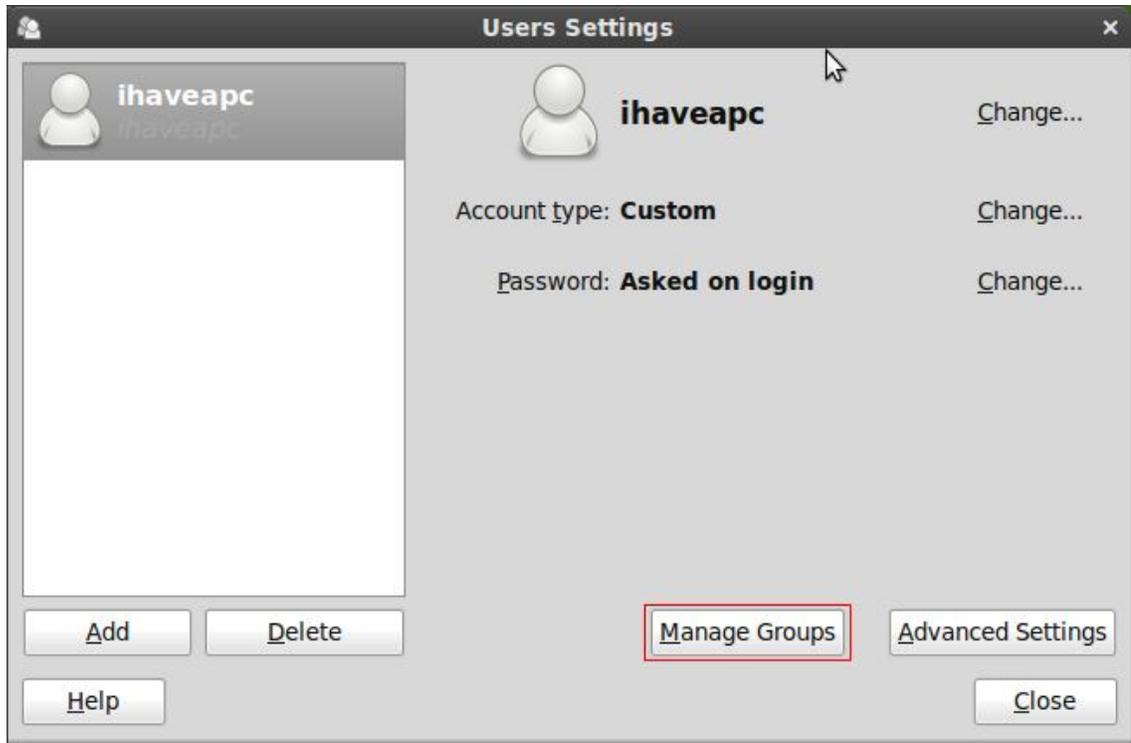
```
sudo addgroup team2
```



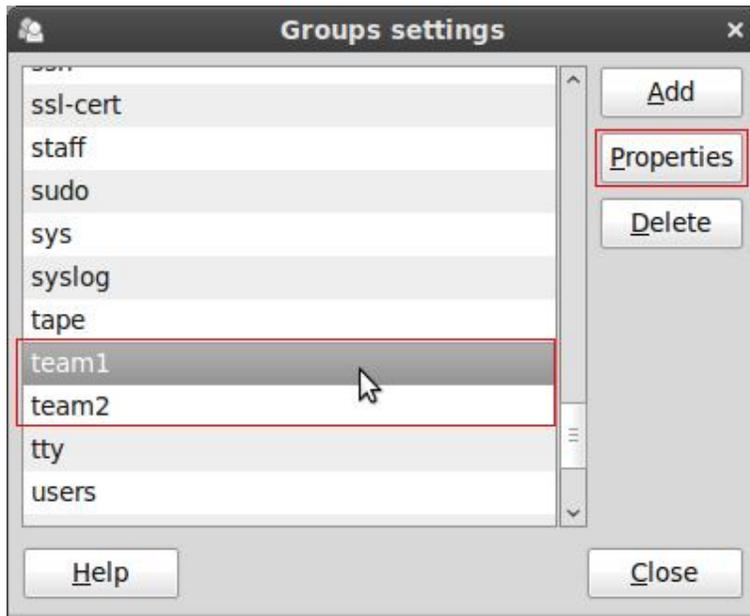
Now, click on 'Menu>Administration>Users and Groups'.



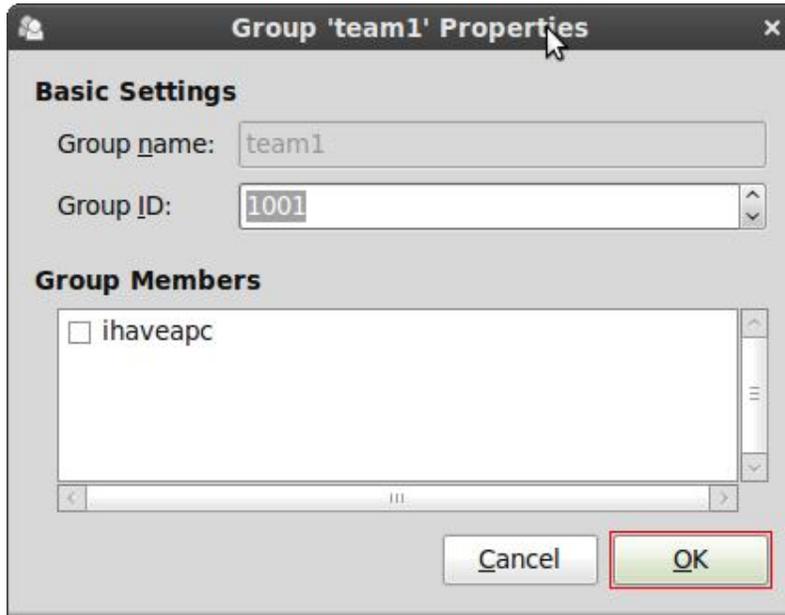
Click on 'Manage Groups'.



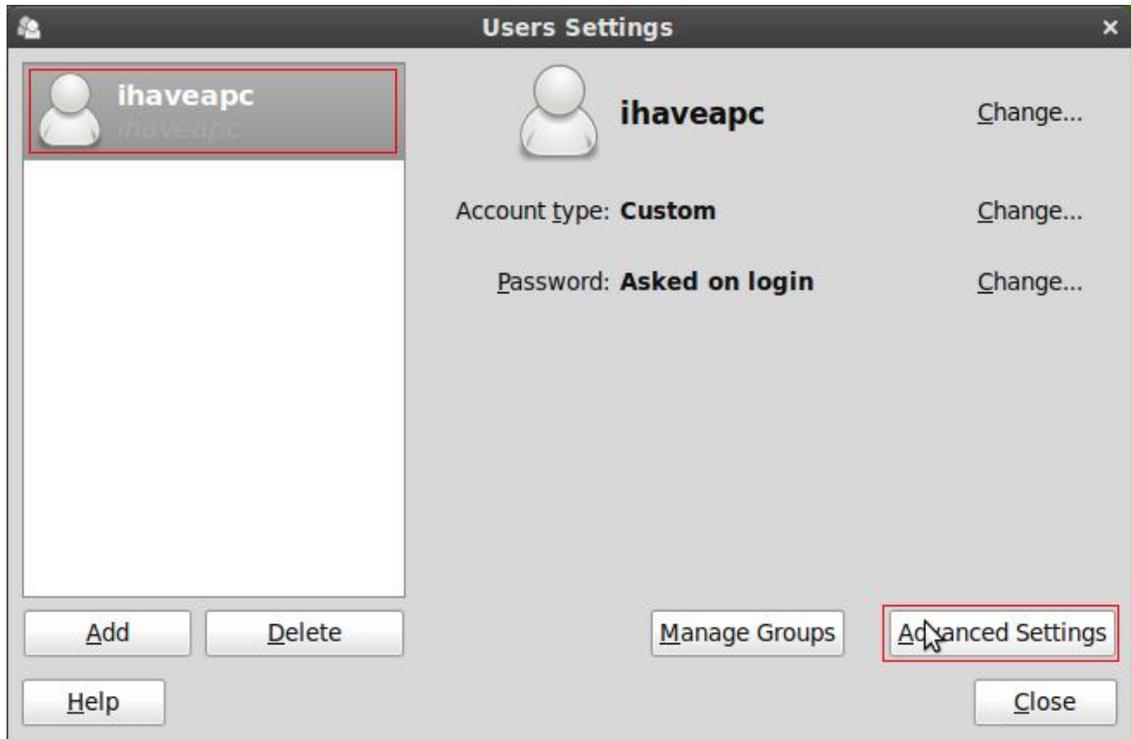
Notice that groups 'team1' and 'team2' have been added. Select 'team1' and click 'Properties'.



You can view the list of users who are members of this group. Click 'OK' to close the window.



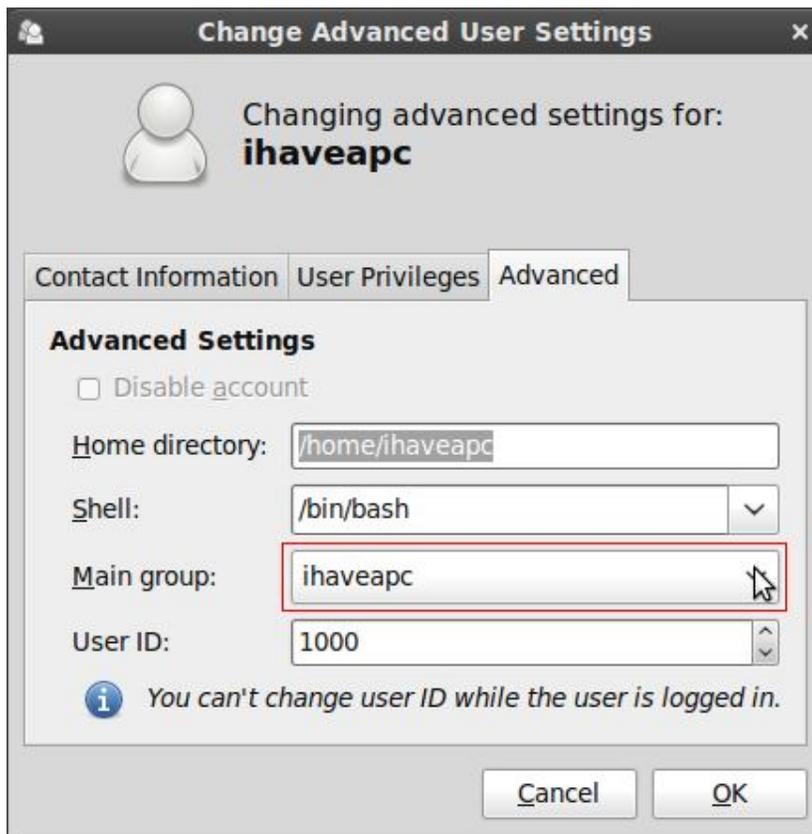
You can also select a user and click 'Advanced Settings'.



Enter user password when prompted and click 'Authenticate'.



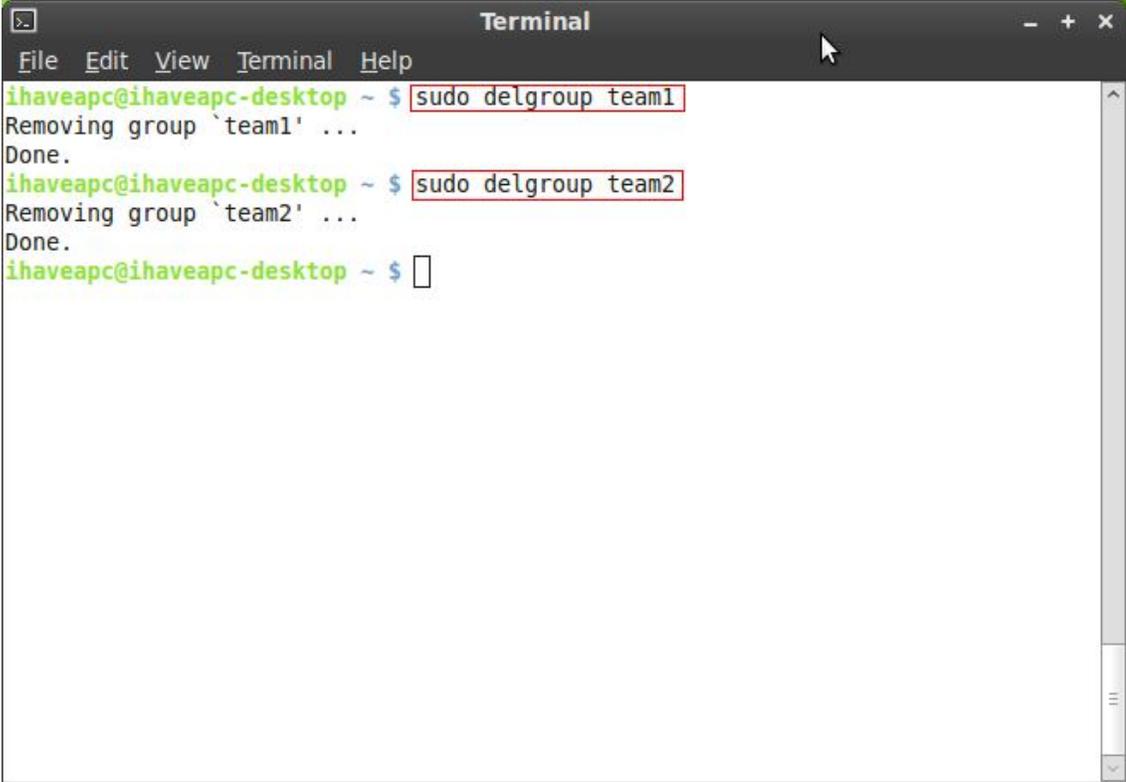
In the 'Change Advanced User Settings' window, you can modify user's main group, if required.



4. **delgroup** – Delete group. Syntax is 'sudo delgroup <group name>'. We need to use 'sudo' as root privileges are required to run this command. A root user can run the command without 'sudo'. In order to delete groups 'team1' and 'team2', issue the following commands at the terminal:

```
sudo delgroup team1
```

```
sudo delgroup team2
```

A screenshot of a Linux terminal window titled "Terminal". The window has a menu bar with "File", "Edit", "View", "Terminal", and "Help". The terminal output shows the user 'ihaveapc@ihaveapc-desktop' running the command 'sudo delgroup team1'. The output is 'Removing group `team1` ... Done.'. The user then runs 'sudo delgroup team2', and the output is 'Removing group `team2` ... Done.'. The prompt returns to 'ihaveapc@ihaveapc-desktop ~ \$' with a cursor. The commands and their outputs are highlighted with red boxes in the original image.

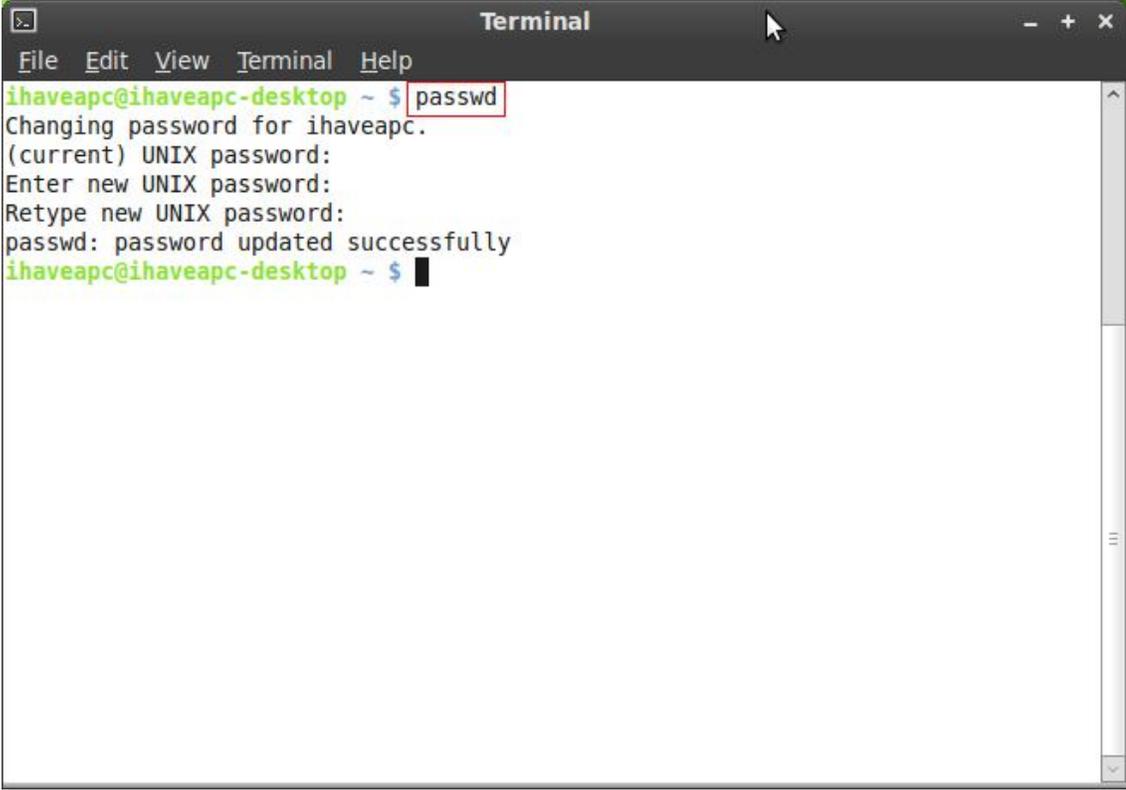
```
ihaveapc@ihaveapc-desktop ~ $ sudo delgroup team1
Removing group `team1` ...
Done.
ihaveapc@ihaveapc-desktop ~ $ sudo delgroup team2
Removing group `team2` ...
Done.
ihaveapc@ihaveapc-desktop ~ $
```

5. **passwd** – Change user password. Syntax is 'passwd <user name>'. You can change the password for the user whose name has been entered.

Simply issuing command 'passwd' enable you to change your own password. Issuing the command 'sudo passwd' will enable you to change root user's password.

To change your password, issue the following command at the terminal:

```
passwd
```

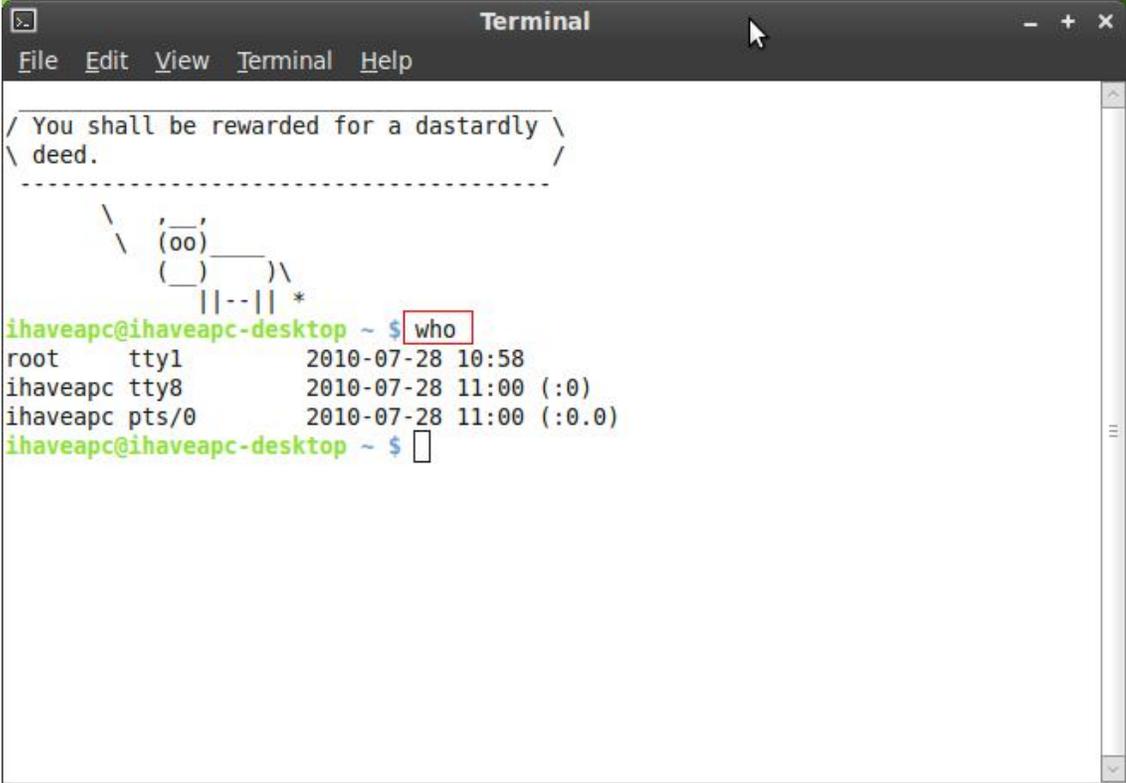


```
Terminal
File Edit View Terminal Help
ihaveapc@ihaveapc-desktop ~ $ passwd
Changing password for ihaveapc.
(current) UNIX password:
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
ihaveapc@ihaveapc-desktop ~ $
```

You need to enter your current password, new password and then re-type the new password.

6. **who** – Shows list of logged on users. To view the users which are logged on, issue the following command at the terminal:

who



```
Terminal
File Edit View Terminal Help

/ You shall be rewarded for a dastardly \
\ deed.
-----
      \
       (oo)
        ( )
         ||--|| *

ihaveapc@ihaveapc-desktop ~ $ who
root    tty1      2010-07-28 10:58
ihaveapc tty8      2010-07-28 11:00 (:0)
ihaveapc pts/0   2010-07-28 11:00 (:0.0)
ihaveapc@ihaveapc-desktop ~ $
```

Note that the users 'root' and 'ihaveapc' are logged in the system (entries 1 and 2). Entry 3 (pts/0) denotes the pseudo terminal slave session of user 'ihaveapc' (as we have opened a terminal in the GUI after logging in to the Gnome desktop, that session becomes the slave session of our current session in the GUI).

PART 4: Users, Groups And Permissions

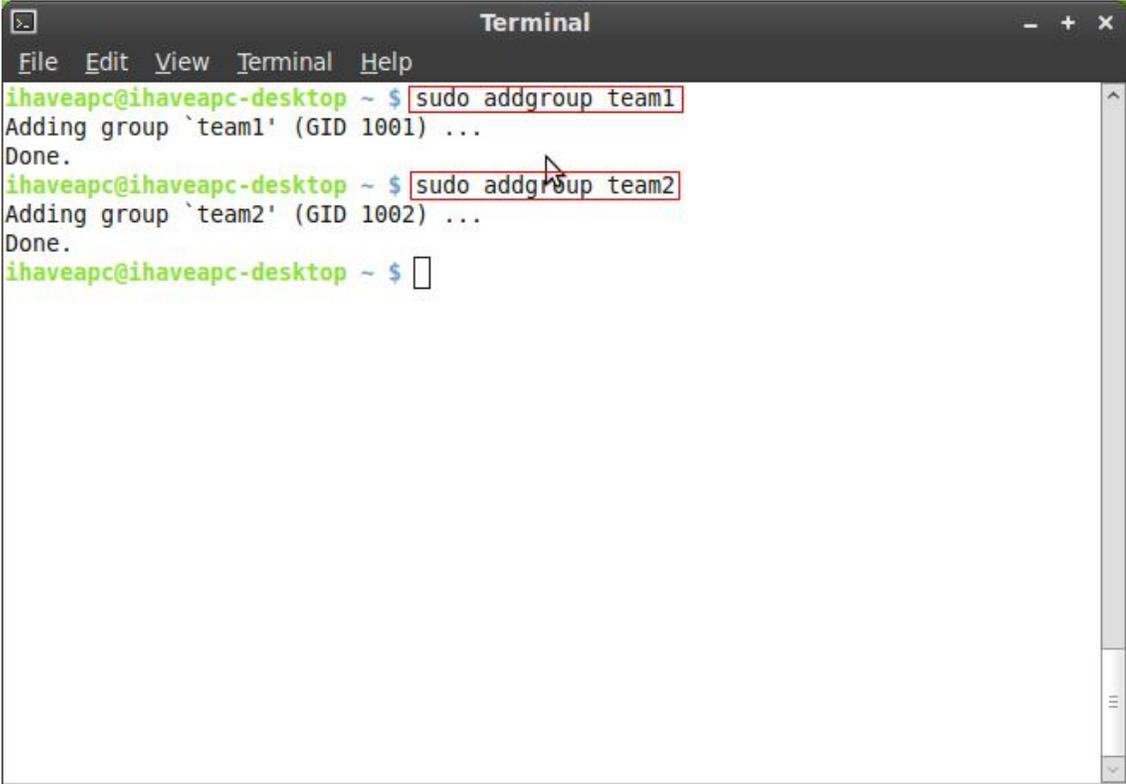
We'll now learn how to add users to groups via command line and how to modify file/folder permissions.

Let's create two groups in the system- 'team1' and 'team2'

Issue the following commands at the terminal:

```
sudo addgroup team1
```

```
sudo addgroup team2
```

A screenshot of a Linux terminal window titled "Terminal". The window has a menu bar with "File", "Edit", "View", "Terminal", and "Help". The terminal shows the following sequence of commands and output:

```
ihaveapc@ihaveapc-desktop ~ $ sudo addgroup team1
Adding group `team1' (GID 1001) ...
Done.
ihaveapc@ihaveapc-desktop ~ $ sudo addgroup team2
Adding group `team2' (GID 1002) ...
Done.
ihaveapc@ihaveapc-desktop ~ $
```

The commands and their corresponding output lines are highlighted with a red box in the original image.

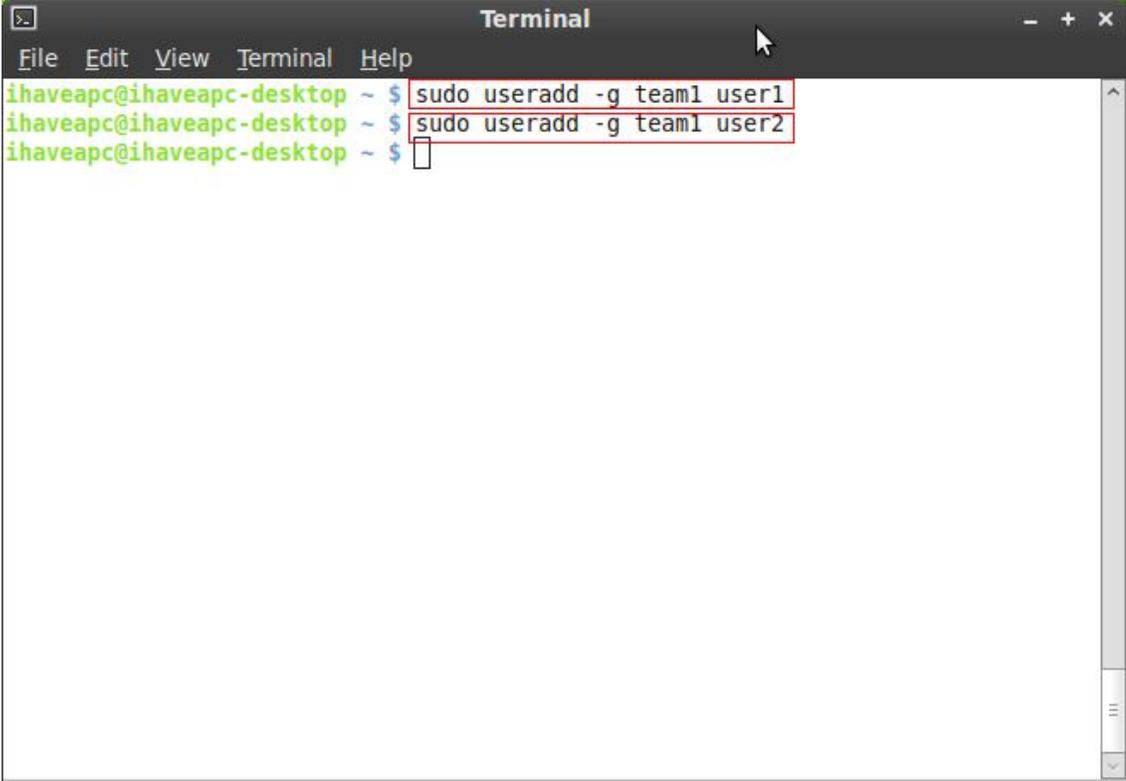
1. **useradd** – adds a new user to an existing group.

Syntax 1 – `sudo useradd -g <group-name> <user-name>`

The above command will add a new user to an existing group. The option '-g' will make the specified group new user's primary group. In order to add new users 'user1' and 'user2' with primary group 'team1', issue the following commands at the terminal:

```
sudo useradd -g team1 user1
```

```
sudo useradd -g team2 user2
```

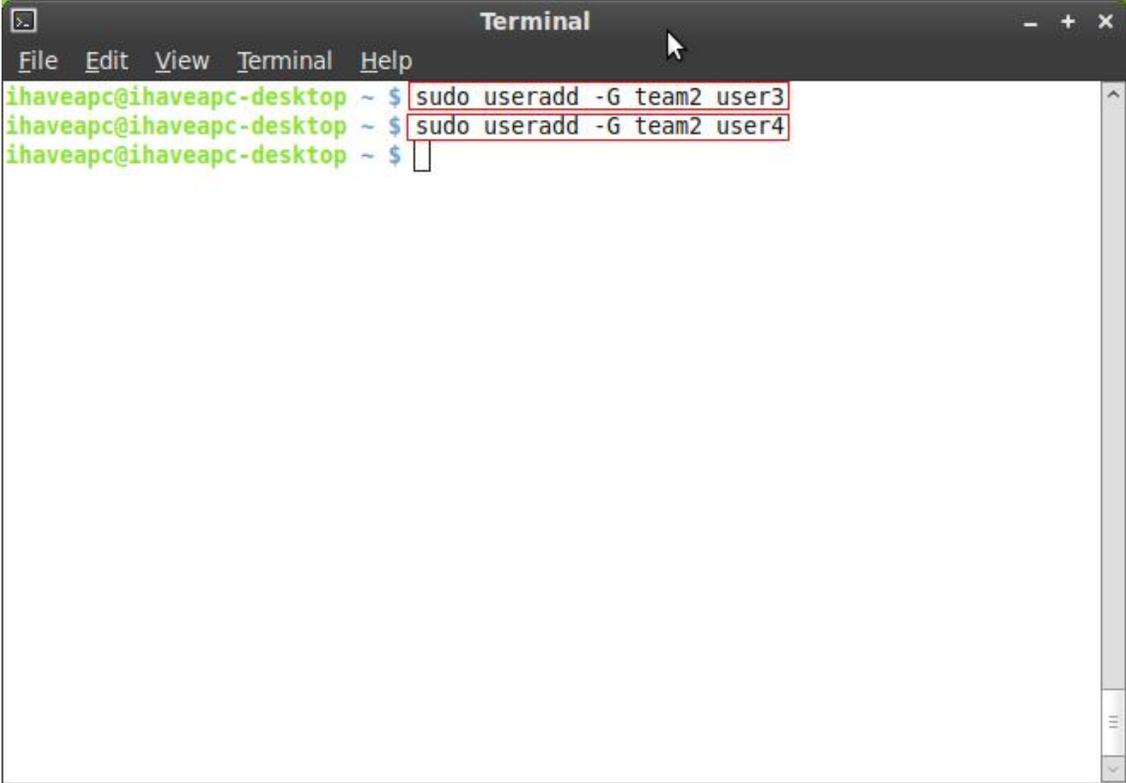
A screenshot of a Linux terminal window titled "Terminal". The window has a menu bar with "File", "Edit", "View", "Terminal", and "Help". The terminal shows three lines of text: the first line is "ihaveapc@ihaveapc-desktop ~ \$ sudo useradd -g team1 user1", the second line is "ihaveapc@ihaveapc-desktop ~ \$ sudo useradd -g team1 user2", and the third line is "ihaveapc@ihaveapc-desktop ~ \$" with a cursor. The two command lines are highlighted with a red rectangular box. The terminal also shows a vertical scrollbar on the right side.

Syntax 2 – `sudo useradd -G <group-name> <user-name>`

The above command will add a new user to an existing group. The option '-G' will make the specified group new user's secondary group. In order to add new users 'user3' and 'user4' with secondary group 'team2', issue the following commands at the terminal:

```
sudo useradd -G team2 user3
```

```
sudo useradd -G team2 user4
```



```
Terminal
File Edit View Terminal Help
ihaveapc@ihaveapc-desktop ~ $ sudo useradd -G team2 user3
ihaveapc@ihaveapc-desktop ~ $ sudo useradd -G team2 user4
ihaveapc@ihaveapc-desktop ~ $
```

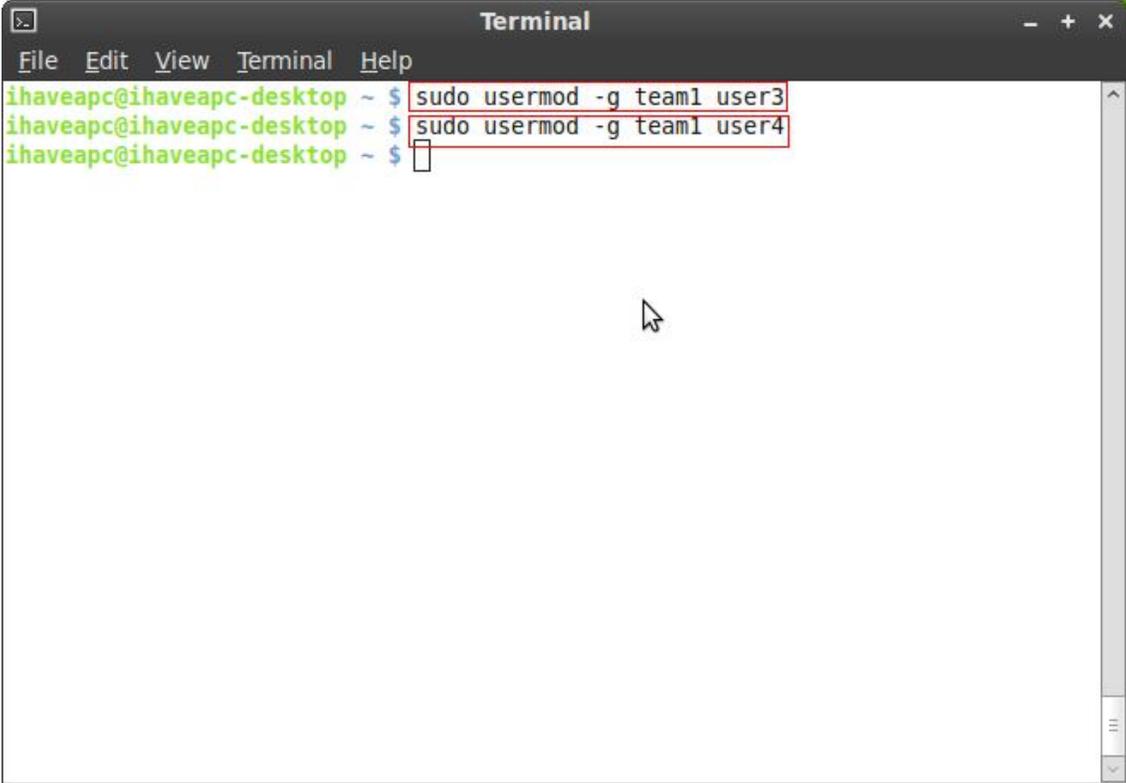
2. **usermod** – adds an existing user to an existing group.

Syntax 1 – `sudo usermod -g <group-name> <user-name>`

The above command will add an existing user to an existing group. The option '-g' will make the specified group existing user's primary group. In order to add existing users 'user3' and 'user4' with primary group 'team1', issue the following commands at the terminal:

```
sudo usermod -g team1 user3
```

```
sudo usermod -g team1 user4
```

A terminal window titled "Terminal" with a menu bar containing "File", "Edit", "View", "Terminal", and "Help". The terminal shows three lines of text: "ihaveapc@ihaveapc-desktop ~ \$ sudo usermod -g team1 user3", "ihaveapc@ihaveapc-desktop ~ \$ sudo usermod -g team1 user4", and "ihaveapc@ihaveapc-desktop ~ \$" followed by a cursor. The first two lines are highlighted with a red box. A mouse cursor is visible in the center of the terminal area.

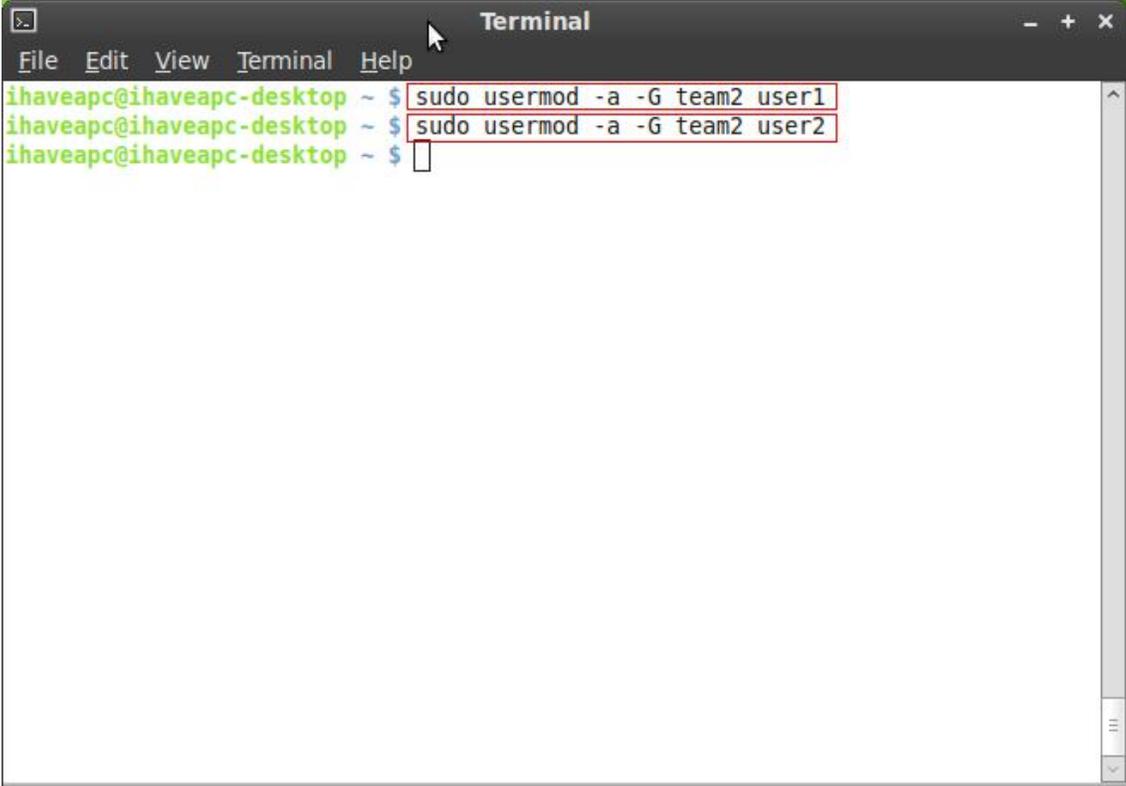
```
ihaveapc@ihaveapc-desktop ~ $ sudo usermod -g team1 user3
ihaveapc@ihaveapc-desktop ~ $ sudo usermod -g team1 user4
ihaveapc@ihaveapc-desktop ~ $
```

Syntax 2 – `sudo usermod -a -G <group-name> <user-name>`

The above command will add an existing user to an existing group. The options '-a' and '-G' will make the specified group existing user's secondary group. In order to add existing users 'user1' and 'user2' with secondary group 'team2', issue the following commands at the terminal:

```
sudo usermod -a -G team2 user1
```

```
sudo usermod -a -G team2 user2
```

A screenshot of a Linux terminal window titled "Terminal". The window has a menu bar with "File", "Edit", "View", "Terminal", and "Help". The terminal shows three lines of commands entered by the user "ihaveapc@ihaveapc-desktop". The first two lines are "sudo usermod -a -G team2 user1" and "sudo usermod -a -G team2 user2", both of which are highlighted with a red rectangular box. The third line is a prompt "~ \$" with a cursor. The terminal also shows a scroll bar on the right side.

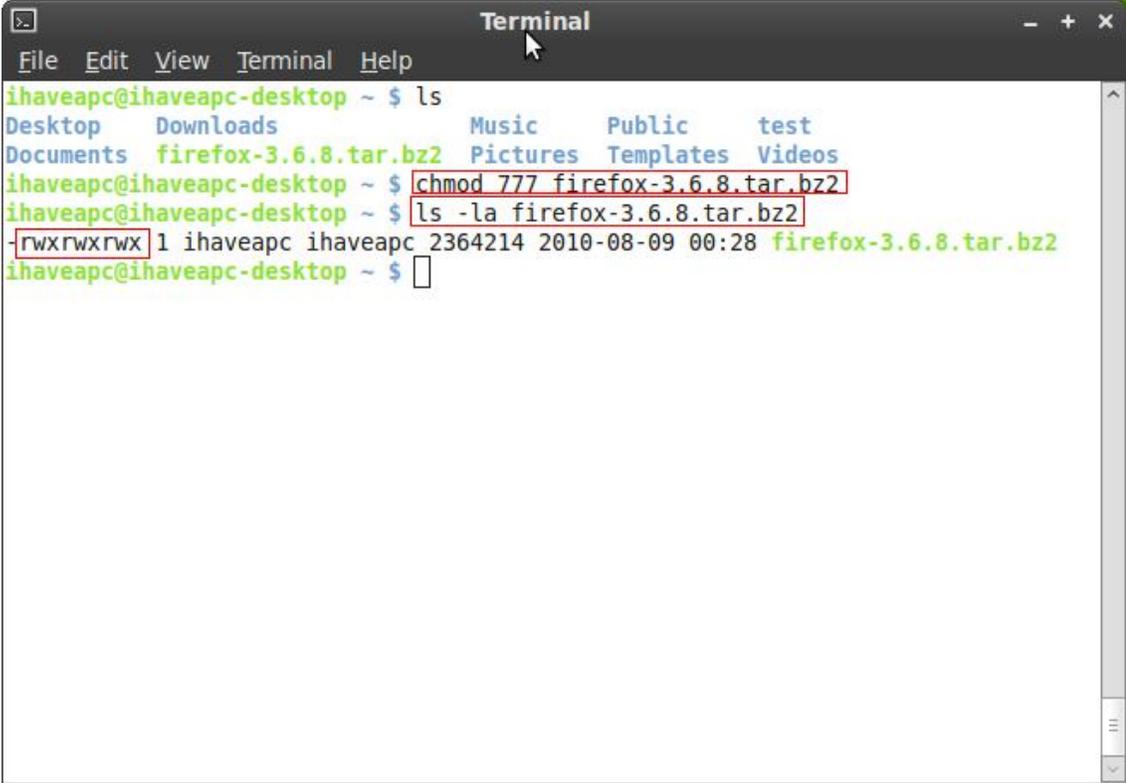
```
ihaveapc@ihaveapc-desktop ~ $ sudo usermod -a -G team2 user1
ihaveapc@ihaveapc-desktop ~ $ sudo usermod -a -G team2 user2
ihaveapc@ihaveapc-desktop ~ $
```

3. **chmod** – modifies file/folder permissions.

Syntax – `chmod <permission value> <file/folder name>`

Issue the following command at the terminal:

`chmod 777 firefox-3.6.8.tar.bz2`

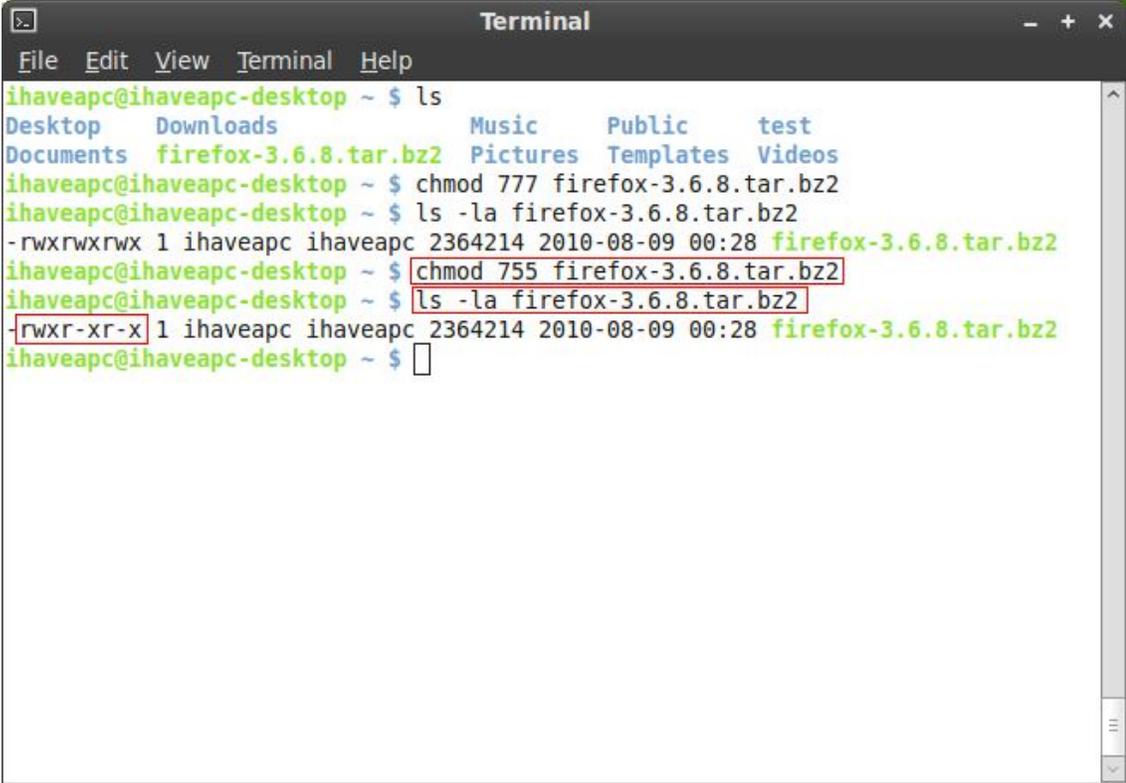


```
ihaveapc@ihaveapc-desktop ~ $ ls
Desktop  Downloads  Music  Public  test
Documents  firefox-3.6.8.tar.bz2  Pictures  Templates  Videos
ihaveapc@ihaveapc-desktop ~ $ chmod 777 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $ ls -la firefox-3.6.8.tar.bz2
-rwxrwxrwx 1 ihaveapc ihaveapc 2364214 2010-08-09 00:28 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $
```

The above command will allow everybody to read, write and execute the file.

Issue the following command at the terminal:

```
chmod 755 firefox-3.6.8.tar.bz2
```

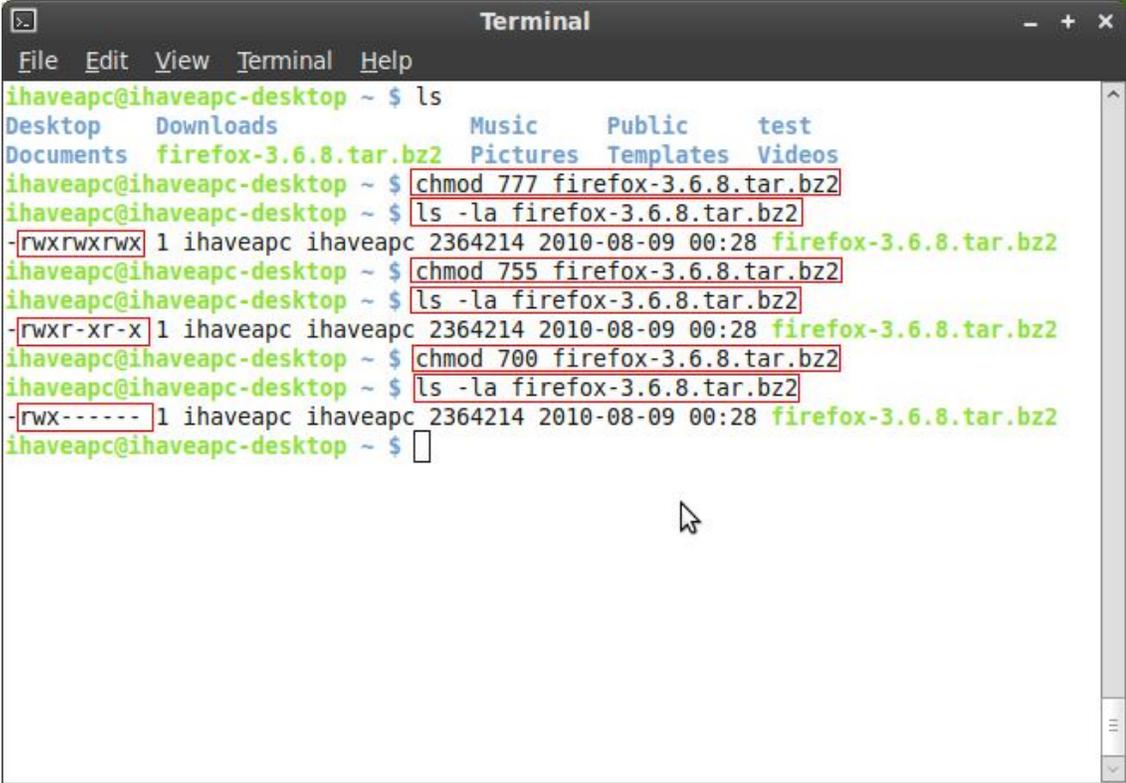
A terminal window titled "Terminal" with a menu bar (File, Edit, View, Terminal, Help) and window controls (-, +, X). The terminal shows a series of commands and their outputs. The user 'ihaveapc' is at the 'ihaveapc-desktop' prompt. The first command is 'ls', which lists several directories and files, including 'firefox-3.6.8.tar.bz2'. The second command is 'chmod 777 firefox-3.6.8.tar.bz2'. The third command is 'ls -la firefox-3.6.8.tar.bz2', which shows the file's permissions as '-rwxrwxrwx'. The fourth command is 'chmod 755 firefox-3.6.8.tar.bz2'. The fifth command is 'ls -la firefox-3.6.8.tar.bz2', which shows the file's permissions as '-rwxr-xr-x'. The terminal prompt is currently at the end of the last command.

```
ihaveapc@ihaveapc-desktop ~ $ ls
Desktop  Downloads  Music      Public     test
Documents  firefox-3.6.8.tar.bz2  Pictures  Templates  Videos
ihaveapc@ihaveapc-desktop ~ $ chmod 777 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $ ls -la firefox-3.6.8.tar.bz2
-rwxrwxrwx 1 ihaveapc ihaveapc 2364214 2010-08-09 00:28 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $ chmod 755 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $ ls -la firefox-3.6.8.tar.bz2
-rwxr-xr-x 1 ihaveapc ihaveapc 2364214 2010-08-09 00:28 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $
```

The above command will allow the file owner to read, write and execute the file. Group users can read and execute the file. Others can only execute the file.

Issue the following command at the terminal:

```
chmod 700 firefox-3.6.8.tar.bz2
```



```
ihaveapc@ihaveapc-desktop ~ $ ls
Desktop  Downloads  Music      Public     test
Documents  firefox-3.6.8.tar.bz2  Pictures  Templates  Videos
ihaveapc@ihaveapc-desktop ~ $ chmod 777 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $ ls -la firefox-3.6.8.tar.bz2
-rwxrwxrwx 1 ihaveapc ihaveapc 2364214 2010-08-09 00:28 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $ chmod 755 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $ ls -la firefox-3.6.8.tar.bz2
-rwxr-xr-x 1 ihaveapc ihaveapc 2364214 2010-08-09 00:28 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $ chmod 700 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $ ls -la firefox-3.6.8.tar.bz2
-rwx----- 1 ihaveapc ihaveapc 2364214 2010-08-09 00:28 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $
```

The above command will allow file owner to read, write and execute the file. Group users and others have no permissions on the file.

Now, let us look how 'chmod' is used to modify folder permissions.

Issue the following command at the terminal ('test' is folder in our home directory):

```
chmod 777 test
```

```

Terminal
File Edit View Terminal Help
ihaveapc@ihaveapc-desktop ~ $ ls
Desktop Downloads Music Public test
Documents firefox-3.6.8.tar.bz2 Pictures Templates Videos
ihaveapc@ihaveapc-desktop ~ $ chmod 777 test
ihaveapc@ihaveapc-desktop ~ $

```

```

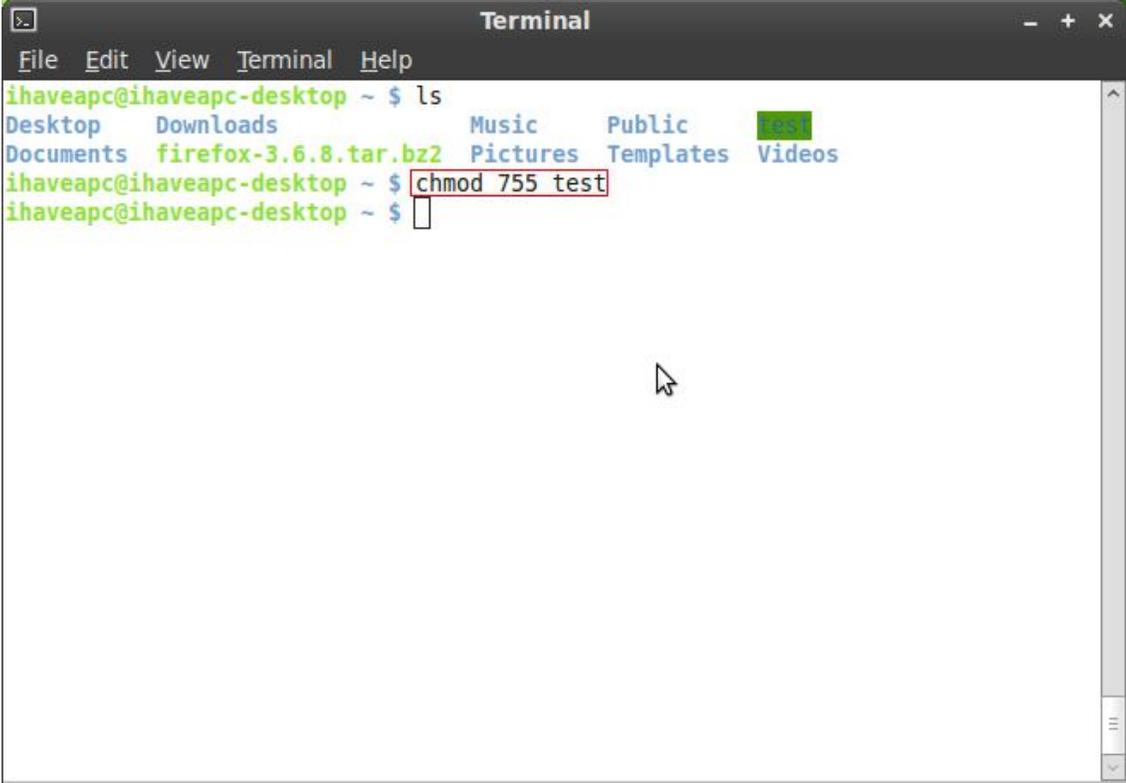
Terminal
File Edit View Terminal Help
-rw-r--r-- 1 ihaveapc ihaveapc 152 2010-08-16 12:00 .gtk-bookmarks
dr-x----- 2 ihaveapc ihaveapc 0 2010-08-16 12:00 .gvfs
-rw----- 1 ihaveapc ihaveapc 4654 2010-08-16 12:00 .ICEauthority
drwxr-xr-x 6 ihaveapc ihaveapc 4096 2010-06-26 13:45 .linuxmint
drwxr-xr-x 3 ihaveapc ihaveapc 4096 2010-06-26 12:12 .local
drwx----- 4 ihaveapc ihaveapc 4096 2010-08-09 00:26 .mozilla
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 Music
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 .nautilus
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 Pictures
-rw-r--r-- 1 ihaveapc ihaveapc 675 2010-06-26 12:12 .profile
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 Public
drwx----- 2 ihaveapc ihaveapc 4096 2010-08-16 12:00 .pulse
-rw----- 1 ihaveapc ihaveapc 256 2010-06-26 12:19 .pulse-cookie
-rw----- 1 ihaveapc ihaveapc 36347 2010-08-16 12:32 .recently-used.xbel
-rw-r--r-- 1 ihaveapc ihaveapc 0 2010-06-26 12:22 .sudo_as_admin_successf
ul
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 Templates
drwxrwxrwx 2 ihaveapc ihaveapc 4096 2010-08-16 12:25 test
drwx----- 3 ihaveapc ihaveapc 4096 2010-07-14 10:37 .thumbnails
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 Videos
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-07-14 10:41 .wcid
-rw----- 1 ihaveapc ihaveapc 3223 2010-08-16 12:03 .xsession-errors
-rw----- 1 ihaveapc ihaveapc 6675 2010-08-12 18:46 .xsession-errors.old
ihaveapc@ihaveapc-desktop ~ $

```

The output of 'ls -la' command shows that the above command allows owner, group members and others to list files in directory 'test', create files in directory 'test', delete files from the directory 'test' and to change to the directory 'test'.

Issue the following command at the terminal:

`chmod 755 test`



```
Terminal
File Edit View Terminal Help
ihaveapc@ihaveapc-desktop ~ $ ls
Desktop Downloads Music Public test
Documents firefox-3.6.8.tar.bz2 Pictures Templates Videos
ihaveapc@ihaveapc-desktop ~ $ chmod 755 test
ihaveapc@ihaveapc-desktop ~ $
```

```

Terminal
File Edit View Terminal Help
-rw-r--r-- 1 ihaveapc ihaveapc 152 2010-08-16 12:00 .gtk-bookmarks
dr-x----- 2 ihaveapc ihaveapc 0 2010-08-16 12:00 .gvfs
-rw----- 1 ihaveapc ihaveapc 4654 2010-08-16 12:00 .ICEauthority
drwxr-xr-x 6 ihaveapc ihaveapc 4096 2010-06-26 13:45 .linuxmint
drwxr-xr-x 3 ihaveapc ihaveapc 4096 2010-06-26 12:12 .local
drwx----- 4 ihaveapc ihaveapc 4096 2010-08-09 00:26 .mozilla
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 Music
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 .nautilus
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 Pictures
-rw-r--r-- 1 ihaveapc ihaveapc 675 2010-06-26 12:12 .profile
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 Public
drwx----- 2 ihaveapc ihaveapc 4096 2010-08-16 12:00 .pulse
-rw----- 1 ihaveapc ihaveapc 256 2010-06-26 12:19 .pulse-cookie
-rw----- 1 ihaveapc ihaveapc 39283 2010-08-16 12:36 .recently-used.xbel
-rw-r--r-- 1 ihaveapc ihaveapc 0 2010-06-26 12:22 .sudo_as_admin_successf
ul
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 Templates
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-08-16 12:25 test
drwx----- 3 ihaveapc ihaveapc 4096 2010-07-14 10:37 .thumbnails
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 Videos
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-07-14 10:41 .wicd
-rw----- 1 ihaveapc ihaveapc 3223 2010-08-16 12:03 .xsession-errors
-rw----- 1 ihaveapc ihaveapc 6675 2010-08-12 18:46 .xsession-errors.old
ihaveapc@ihaveapc-desktop ~ $

```

The output of 'ls -la' command shows that the above command allows owner to list files in directory 'test', create files in directory 'test', delete files from the directory 'test' and to change to the directory 'test'. Group members and others can change to the directory 'test' and list the files only.

Issue the following command at the terminal:

```
chmod 700 test
```

```

Terminal
File Edit View Terminal Help
ihaveapc@ihaveapc-desktop ~ $ ls
Desktop  Downloads  Music  Public  test
Documents  firefox-3.6.8.tar.bz2  Pictures  Templates  Videos
ihaveapc@ihaveapc-desktop ~ $ chmod 700 test
ihaveapc@ihaveapc-desktop ~ $

```

```

Terminal
File Edit View Terminal Help
-rw-r--r-- 1 ihaveapc ihaveapc 152 2010-08-16 12:00 .gtk-bookmarks
dr-x----- 2 ihaveapc ihaveapc 0 2010-08-16 12:00 .gvfs
-rw----- 1 ihaveapc ihaveapc 4654 2010-08-16 12:00 .ICEauthority
drwxr-xr-x 6 ihaveapc ihaveapc 4096 2010-06-26 13:45 .linuxmint
drwxr-xr-x 3 ihaveapc ihaveapc 4096 2010-06-26 12:12 .local
drwx----- 4 ihaveapc ihaveapc 4096 2010-08-09 00:26 .mozilla
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 Music
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 .nautilus
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 Pictures
-rw-r--r-- 1 ihaveapc ihaveapc 675 2010-06-26 12:12 .profile
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 Public
drwx----- 2 ihaveapc ihaveapc 4096 2010-08-16 12:00 .pulse
-rw----- 1 ihaveapc ihaveapc 256 2010-06-26 12:19 .pulse-cookie
-rw----- 1 ihaveapc ihaveapc 40475 2010-08-16 12:37 .recently-used.xbel
-rw-r--r-- 1 ihaveapc ihaveapc 0 2010-06-26 12:22 .sudo_as_admin_successf
ul
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 Templates
drwx----- 2 ihaveapc ihaveapc 4096 2010-08-16 12:25 test
drwx----- 3 ihaveapc ihaveapc 4096 2010-07-14 10:37 .thumbnails
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-06-26 12:19 Videos
drwxr-xr-x 2 ihaveapc ihaveapc 4096 2010-07-14 10:41 .wicd
-rw----- 1 ihaveapc ihaveapc 3223 2010-08-16 12:03 .xsession-errors
-rw----- 1 ihaveapc ihaveapc 6675 2010-08-12 18:46 .xsession-errors.old
ihaveapc@ihaveapc-desktop ~ $

```

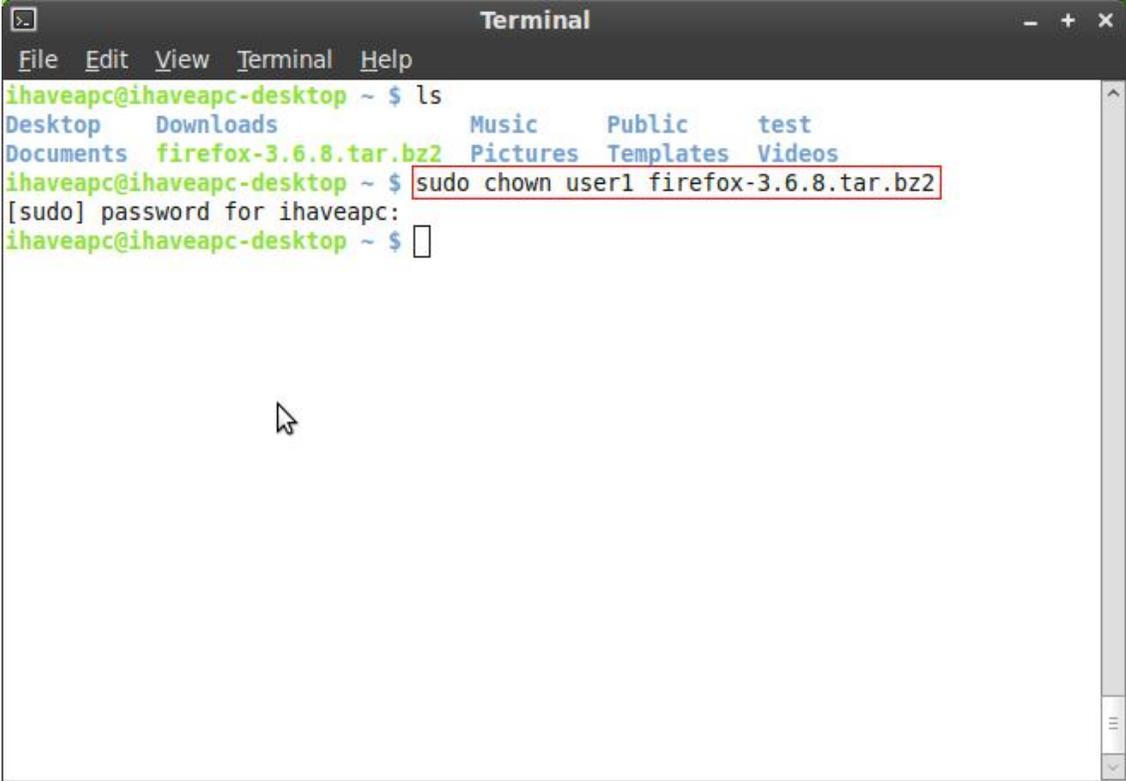
The output of 'ls -la' command shows that the above command allows owner to list files in directory 'test', create files in directory 'test', delete files from the directory 'test' and to change to the directory 'test'. Group members and others do not have any permission on the directory 'test'.

4. **chown** – changes file ownership.

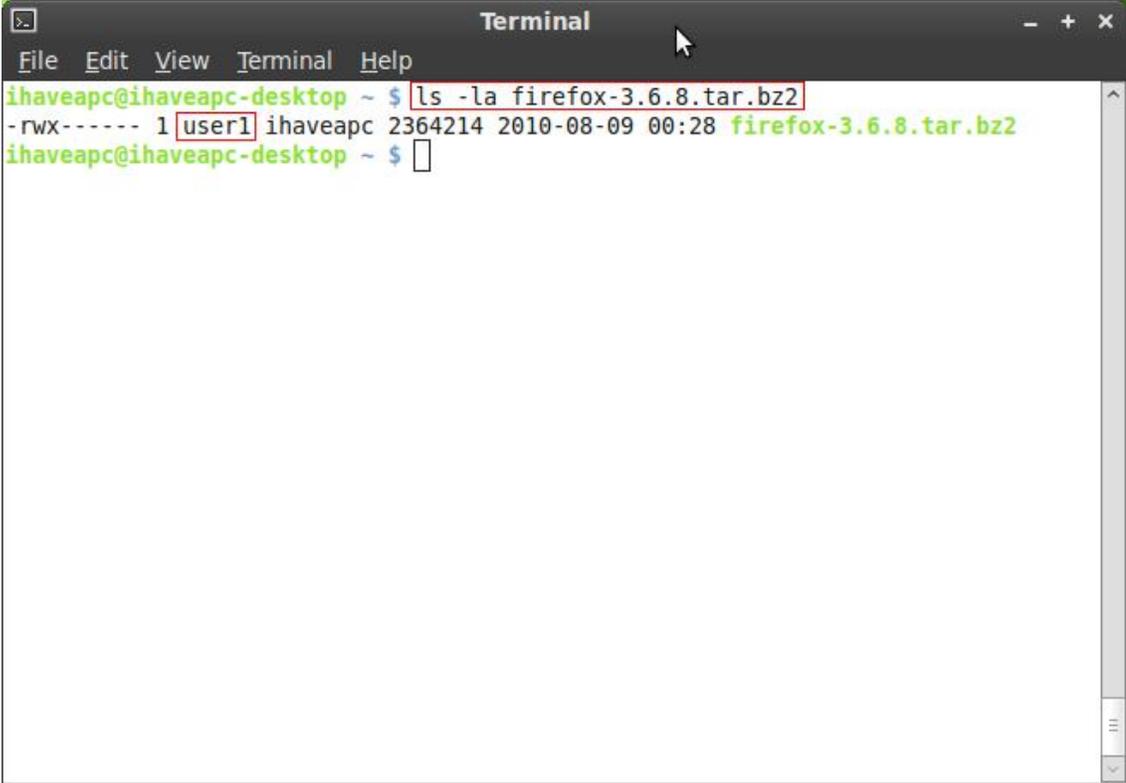
Syntax – `sudo chown <user-name(of new owner)> <file-name>`

Issue the following command at the terminal:

`sudo chown user1 firefox-3.6.8.tar.bz2`



```
ihaveapc@ihaveapc-desktop ~ $ ls
Desktop  Downloads  Music  Public  test
Documents  firefox-3.6.8.tar.bz2  Pictures  Templates  Videos
ihaveapc@ihaveapc-desktop ~ $ sudo chown user1 firefox-3.6.8.tar.bz2
[sudo] password for ihaveapc:
ihaveapc@ihaveapc-desktop ~ $
```



```
Terminal
File Edit View Terminal Help
ihaveapc@ihaveapc-desktop ~ $ ls -la firefox-3.6.8.tar.bz2
-rwx----- 1 user1 ihaveapc 2364214 2010-08-09 00:28 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $
```

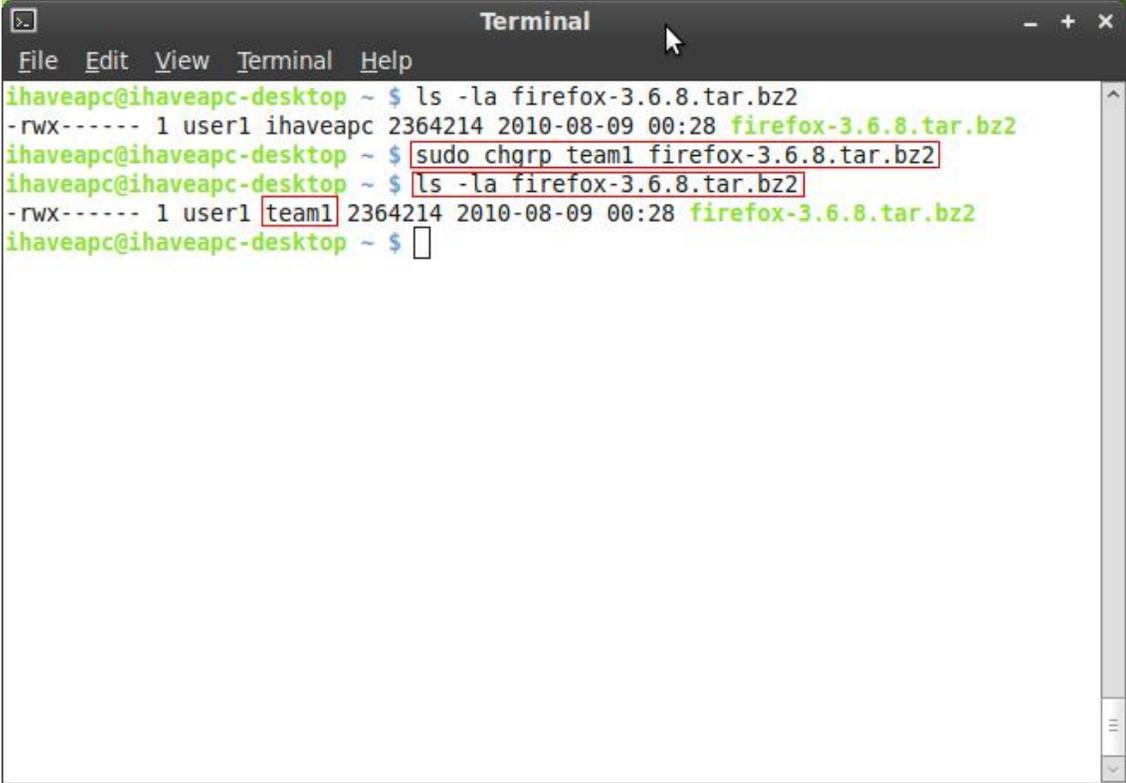
The output of command 'ls -la firefox-3.6.8.tar.bz2' shows that 'user1' is the new owner of the file.

5. **chgrp** – changes file's group ownership

Syntax – sudo chgrp <group-name(of new owner group)> <file-name>

Issue the following command at the terminal:

```
sudo chgrp team1 firefox-3.6.8.tar.bz2
```

A terminal window titled "Terminal" with a menu bar containing "File", "Edit", "View", "Terminal", and "Help". The terminal shows a series of commands and their outputs. The first command is `ls -la firefox-3.6.8.tar.bz2`, which outputs `-rwx----- 1 user1 ihaveapc 2364214 2010-08-09 00:28 firefox-3.6.8.tar.bz2`. The second command is `sudo chgrp team1 firefox-3.6.8.tar.bz2`. The third command is `ls -la firefox-3.6.8.tar.bz2`, which outputs `-rwx----- 1 user1 team1 2364214 2010-08-09 00:28 firefox-3.6.8.tar.bz2`. The terminal prompt is `ihaveapc@ihaveapc-desktop ~ $`.

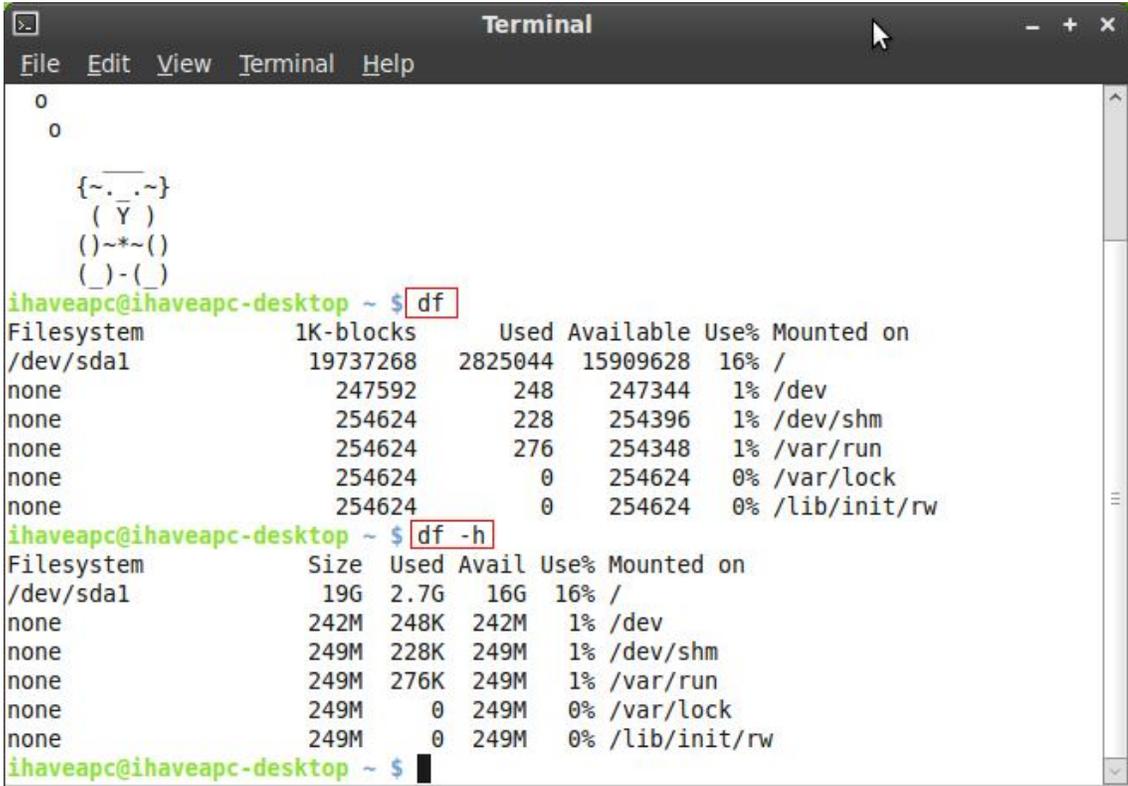
```
ihaveapc@ihaveapc-desktop ~ $ ls -la firefox-3.6.8.tar.bz2
-rwx----- 1 user1 ihaveapc 2364214 2010-08-09 00:28 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $ sudo chgrp team1 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $ ls -la firefox-3.6.8.tar.bz2
-rwx----- 1 user1 team1 2364214 2010-08-09 00:28 firefox-3.6.8.tar.bz2
ihaveapc@ihaveapc-desktop ~ $
```

The output of the command `'ls -la firefox-3.6.8.tar.bz2'` shows that the file's group ownership has changed to `'team1'`.

PART 5: System Information Commands

Now we'll learn a few Linux system information commands:

1. **df** – disk free. This command displays file system and disk space usage for all partitions. If option '-h' (human-readable) is used with the command, it will generate the report using KB/MB/GB units instead of number of blocks which are displayed when the command is used without any options.



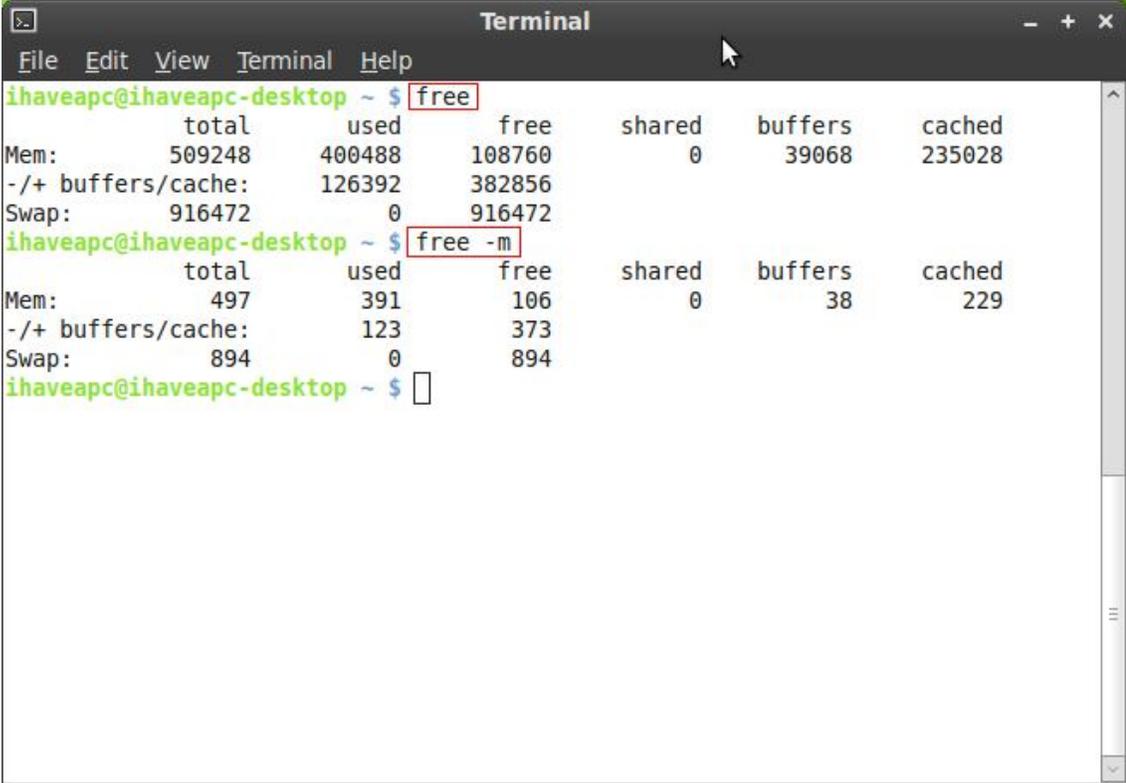
```

ihaveapc@ihaveapc-desktop ~ $ df
Filesystem            1K-blocks      Used Available Use% Mounted on
/dev/sda1              19737268    2825044  15909628  16% /
none                  247592         248    247344   1% /dev
none                  254624         228    254396   1% /dev/shm
none                  254624         276    254348   1% /var/run
none                  254624          0    254624   0% /var/lock
none                  254624          0    254624   0% /lib/init/rw

ihaveapc@ihaveapc-desktop ~ $ df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/sda1             19G  2.7G  16G  16% /
none                 242M  248K  242M   1% /dev
none                 249M  228K  249M   1% /dev/shm
none                 249M  276K  249M   1% /var/run
none                 249M     0  249M   0% /var/lock
none                 249M     0  249M   0% /lib/init/rw

```

2. **free** – This command displays information about the amount of used and free system memory. If option '-m' is used with the command, report is generated using MB unit.



```
ihaveapc@ihaveapc-desktop ~ $ free
              total        used         free       shared    buffers     cached
Mem:           509248      400488      108760           0         39068      235028
-/+ buffers/cache:  126392      382856
Swap:          916472           0       916472

ihaveapc@ihaveapc-desktop ~ $ free -m
              total        used         free       shared    buffers     cached
Mem:              497          391          106           0           38          229
-/+ buffers/cache:   123           373
Swap:              894           0           894

ihaveapc@ihaveapc-desktop ~ $
```

3. **top** – This command provides a real-time information about Linux system uptime, number of users, system load, number of tasks, and utilization of system resources such as cpu, memory and swap partition. You can press 'Ctrl' + 'Z' keys to quit the program at any time.

```

Terminal
File Edit View Terminal Help
ihaveapc@ihaveapc-desktop ~ $ top

```

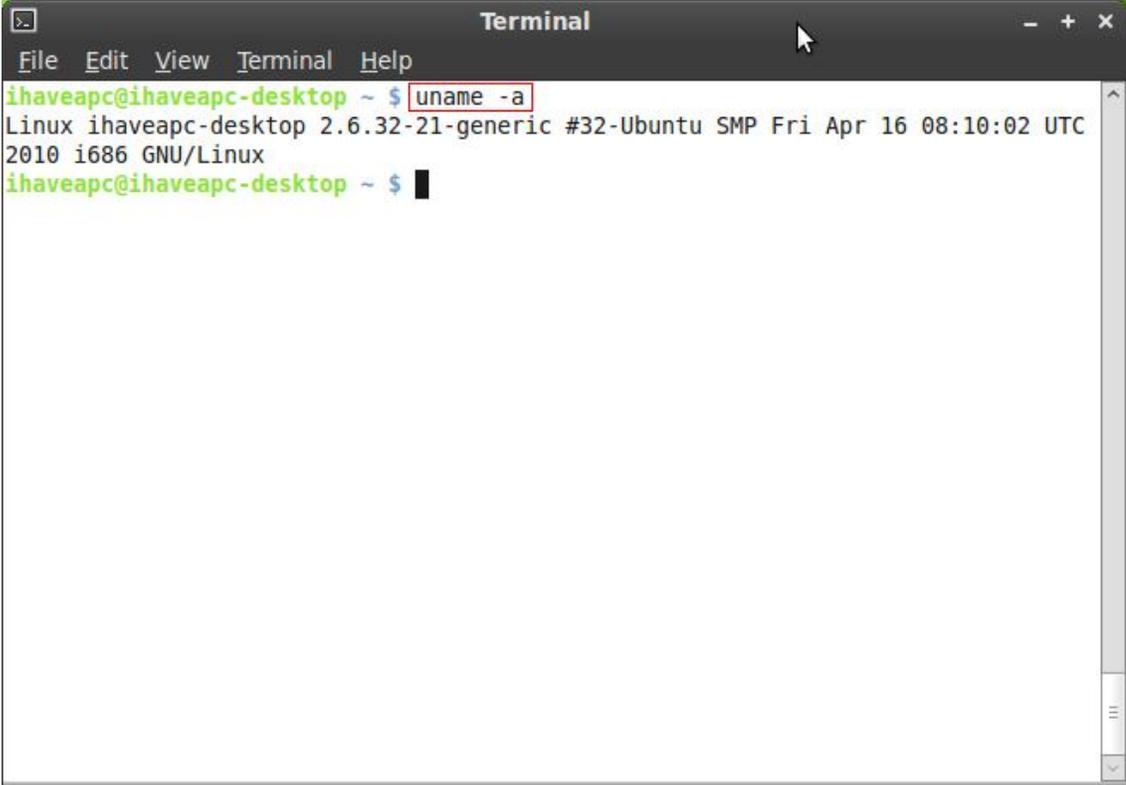
```

Terminal
File Edit View Terminal Help
top - 10:05:52 up 18 min, 2 users, load average: 0.39, 0.27, 0.17
Tasks: 132 total, 1 running, 129 sleeping, 1 stopped, 1 zombie
Cpu(s): 5.0%us, 4.0%sy, 0.0%ni, 91.0%id, 0.0%wa, 0.0%hi, 0.0%si, 0.0%st
Mem: 509248k total, 401948k used, 107300k free, 39192k buffers
Swap: 916472k total, 0k used, 916472k free, 235352k cached

  PID USER      PR  NI  VIRT  RES  SHR  S  %CPU  %MEM    TIME+  COMMAND
 895 root        20   0 44048  18m 9340  S   6.6   3.8   0:11.07 Xorg
1542 root        20   0 24296  6732 1984  S   0.7   1.3   0:02.13 wicd
2194 ihaveapc    20   0 46568  11m 9388  S   0.7   2.4   0:00.69 gnome-terminal
2138 ihaveapc    20   0 40252  11m 9656  S   0.3   2.4   0:00.31 wnck-applet
2297 ihaveapc    20   0  2544  1216  928  R   0.3   0.2   0:00.04 top
   1 root         0   0  2800  1672 1224  S   0.0   0.3   0:01.20 init
   2 root         0   0     0     0     0  S   0.0   0.0   0:00.00 kthreadd
   3 root        RT   0     0     0     0  S   0.0   0.0   0:00.00 migration/0
   4 root        20   0     0     0     0  S   0.0   0.0   0:00.00 ksoftirqd/0
   5 root        RT   0     0     0     0  S   0.0   0.0   0:00.00 watchdog/0
   6 root        20   0     0     0     0  S   0.0   0.0   0:00.06 events/0
   7 root        20   0     0     0     0  S   0.0   0.0   0:00.00 cpuset
   8 root        20   0     0     0     0  S   0.0   0.0   0:00.00 khelper
   9 root        20   0     0     0     0  S   0.0   0.0   0:00.00 netns
  10 root        20   0     0     0     0  S   0.0   0.0   0:00.00 async/mgr
  11 root        20   0     0     0     0  S   0.0   0.0   0:00.00 pm
  12 root        20   0     0     0     0  S   0.0   0.0   0:00.00 sync_supers

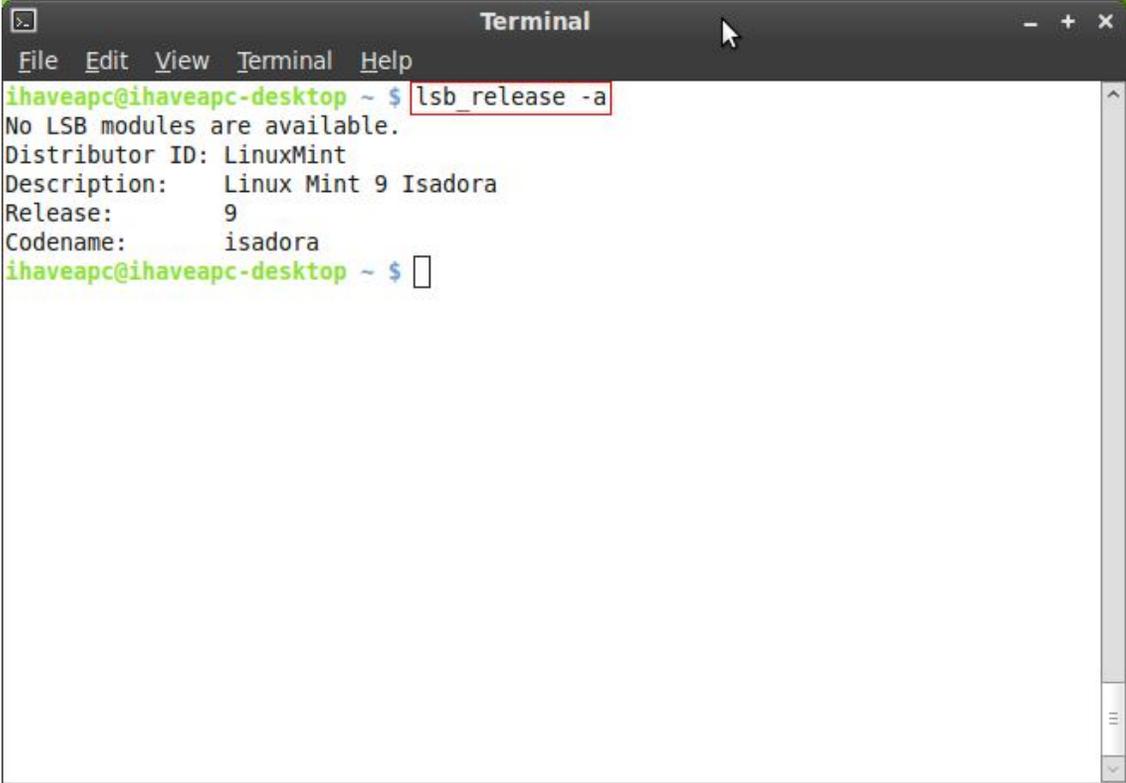
```

4. **uname** – unix name. This command provides the name, kernel version and other system architecture details about the current system and the Linux OS running on it. If option '-a' is used with the command, it will print machine type, network node host name, processor type, OS release and OS version.

A screenshot of a Linux terminal window titled "Terminal". The window has a menu bar with "File", "Edit", "View", "Terminal", and "Help". The prompt is "ihaveapc@ihaveapc-desktop ~ \$". The command "uname -a" is entered and highlighted with a red box. The output is "Linux ihaveapc-desktop 2.6.32-21-generic #32-Ubuntu SMP Fri Apr 16 08:10:02 UTC 2010 i686 GNU/Linux". The prompt "ihaveapc@ihaveapc-desktop ~ \$" is shown again with a cursor.

```
ihaveapc@ihaveapc-desktop ~ $ uname -a
Linux ihaveapc-desktop 2.6.32-21-generic #32-Ubuntu SMP Fri Apr 16 08:10:02 UTC
2010 i686 GNU/Linux
ihaveapc@ihaveapc-desktop ~ $ █
```

5. **lsb_release** – This command provides Linux Standard Base and the distribution information. When '-a' option is used with the command, it will print LSB version, distributor ID, description of distribution, release number and codename of the distribution.

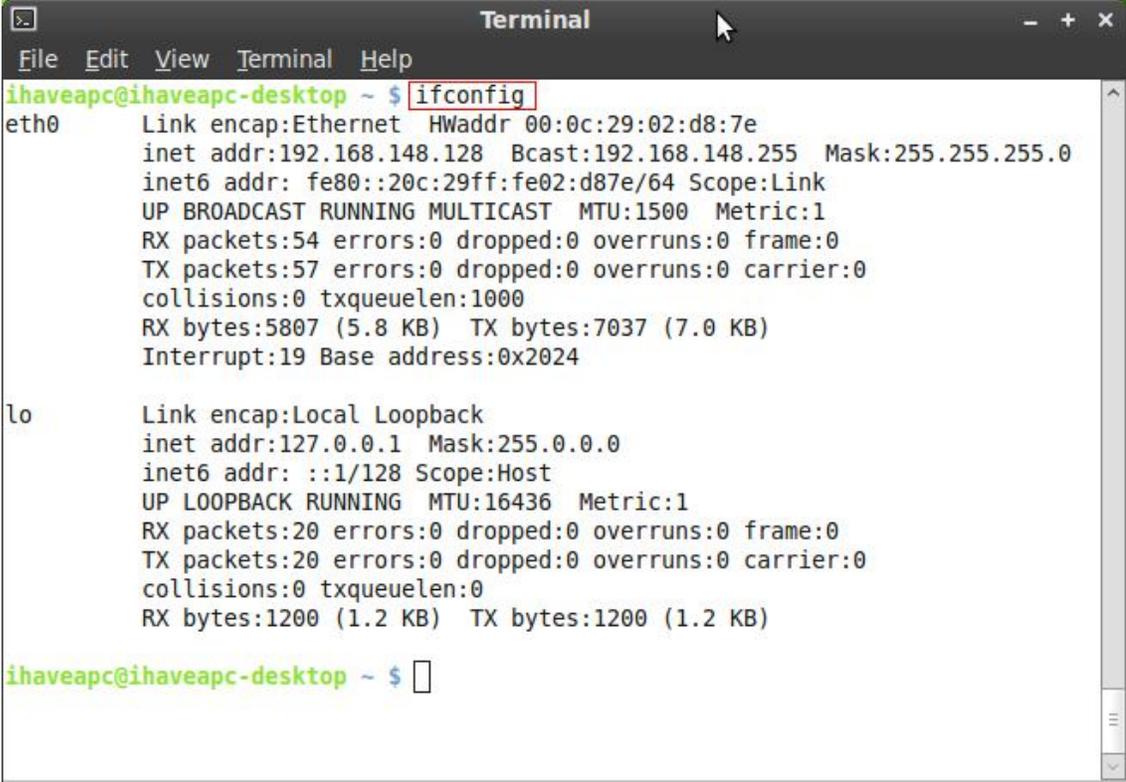


```
Terminal
File Edit View Terminal Help
ihaveapc@ihaveapc-desktop ~ $ lsb_release -a
No LSB modules are available.
Distributor ID: LinuxMint
Description:    Linux Mint 9 Isadora
Release:       9
Codename:      isadora
ihaveapc@ihaveapc-desktop ~ $
```

PART 6: More System Information Commands

Let us learn a few more Linux system information commands.

1. **ifconfig** – interface configuration. This command displays information about the network interfaces in a system.

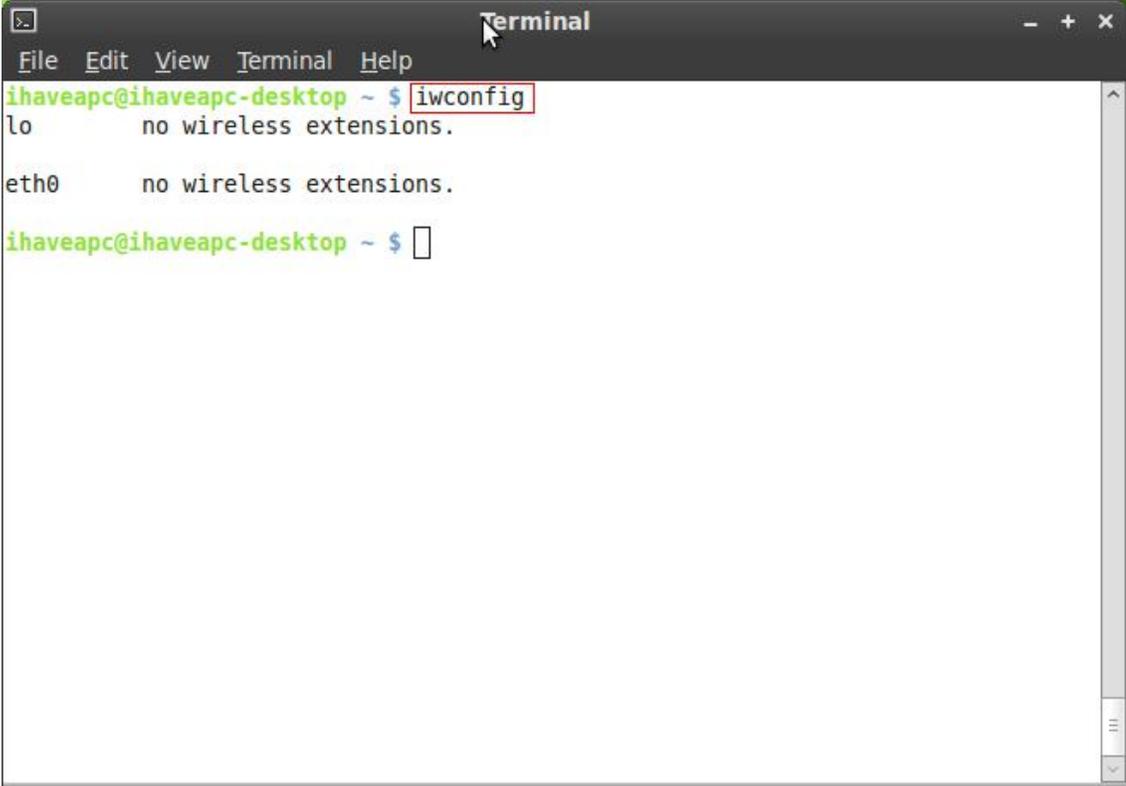
A terminal window titled "Terminal" with a menu bar (File, Edit, View, Terminal, Help) and window controls. The prompt is "ihaveapc@ihaveapc-desktop ~ \$". The command "ifconfig" is entered and highlighted with a red box. The output shows details for the "eth0" and "lo" interfaces. The "eth0" interface is an Ethernet card with IP 192.168.148.128. The "lo" interface is a local loopback with IP 127.0.0.1.

```
ihaveapc@ihaveapc-desktop ~ $ ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0c:29:02:d8:7e
          inet addr:192.168.148.128  Bcast:192.168.148.255  Mask:255.255.255.0
          inet6 addr: fe80::20c:29ff:fe02:d87e/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:54 errors:0 dropped:0 overruns:0 frame:0
          TX packets:57 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:5807 (5.8 KB)  TX bytes:7037 (7.0 KB)
          Interrupt:19 Base address:0x2024

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:20 errors:0 dropped:0 overruns:0 frame:0
          TX packets:20 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:1200 (1.2 KB)  TX bytes:1200 (1.2 KB)

ihaveapc@ihaveapc-desktop ~ $
```

2. **iwconfig** – This command is similar to 'ifconfig' command but it only displays information about the wireless network interfaces. (You won't see any wireless network interface in the screenshot as it has been taken inside a virtual machine.)

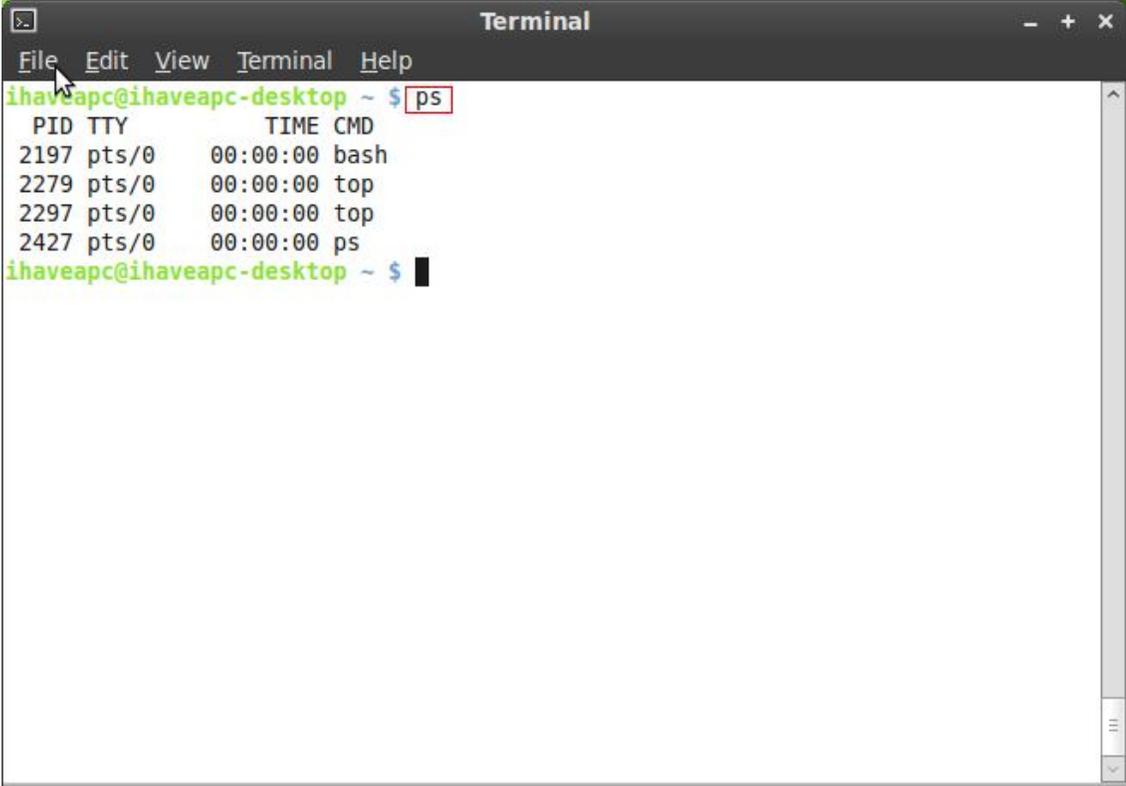


```
ihaveapc@ihaveapc-desktop ~ $ iwconfig
lo          no wireless extensions.

eth0       no wireless extensions.

ihaveapc@ihaveapc-desktop ~ $
```

3. **ps** – process status. This command shows you all the processes running in the system.



A terminal window titled "Terminal" with a menu bar containing "File", "Edit", "View", "Terminal", and "Help". The prompt is "ihaveapc@ihaveapc-desktop ~ \$". The command "ps" has been entered and is highlighted with a red box. The output is a table of running processes:

PID	TTY	TIME	CMD
2197	pts/0	00:00:00	bash
2279	pts/0	00:00:00	top
2297	pts/0	00:00:00	top
2427	pts/0	00:00:00	ps

The prompt "ihaveapc@ihaveapc-desktop ~ \$" is shown again at the bottom of the terminal.

4. **lspci** – This command lists all PCI buses and devices connected to them.

```

Terminal
File Edit View Terminal Help
ihaveapc@ihaveapc-desktop ~ $ lspci
00:00.0 Host bridge: Intel Corporation 440BX/ZX/DX - 82443BX/ZX/DX Host bridge (
rev 01)
00:01.0 PCI bridge: Intel Corporation 440BX/ZX/DX - 82443BX/ZX/DX AGP bridge (re
v 01)
00:07.0 ISA bridge: Intel Corporation 82371AB/EB/MB PIIX4 ISA (rev 08)
00:07.1 IDE interface: Intel Corporation 82371AB/EB/MB PIIX4 IDE (rev 01)
00:07.3 Bridge: Intel Corporation 82371AB/EB/MB PIIX4 ACPI (rev 08)
00:07.7 System peripheral: VMware Virtual Machine Communication Interface (rev 1
0)
00:0f.0 VGA compatible controller: VMware SVGA II Adapter
00:10.0 SCSI storage controller: LSI Logic / Symbios Logic 53c1030 PCI-X Fusion-
MPT Dual Ultra320 SCSI (rev 01)
00:11.0 PCI bridge: VMware PCI bridge (rev 02)
00:15.0 PCI bridge: VMware PCI Express Root Port (rev 01)
00:15.1 PCI bridge: VMware PCI Express Root Port (rev 01)
00:15.2 PCI bridge: VMware PCI Express Root Port (rev 01)
00:15.3 PCI bridge: VMware PCI Express Root Port (rev 01)
00:15.4 PCI bridge: VMware PCI Express Root Port (rev 01)
00:15.5 PCI bridge: VMware PCI Express Root Port (rev 01)
00:15.6 PCI bridge: VMware PCI Express Root Port (rev 01)
00:15.7 PCI bridge: VMware PCI Express Root Port (rev 01)
00:16.0 PCI bridge: VMware PCI Express Root Port (rev 01)
00:16.1 PCI bridge: VMware PCI Express Root Port (rev 01)

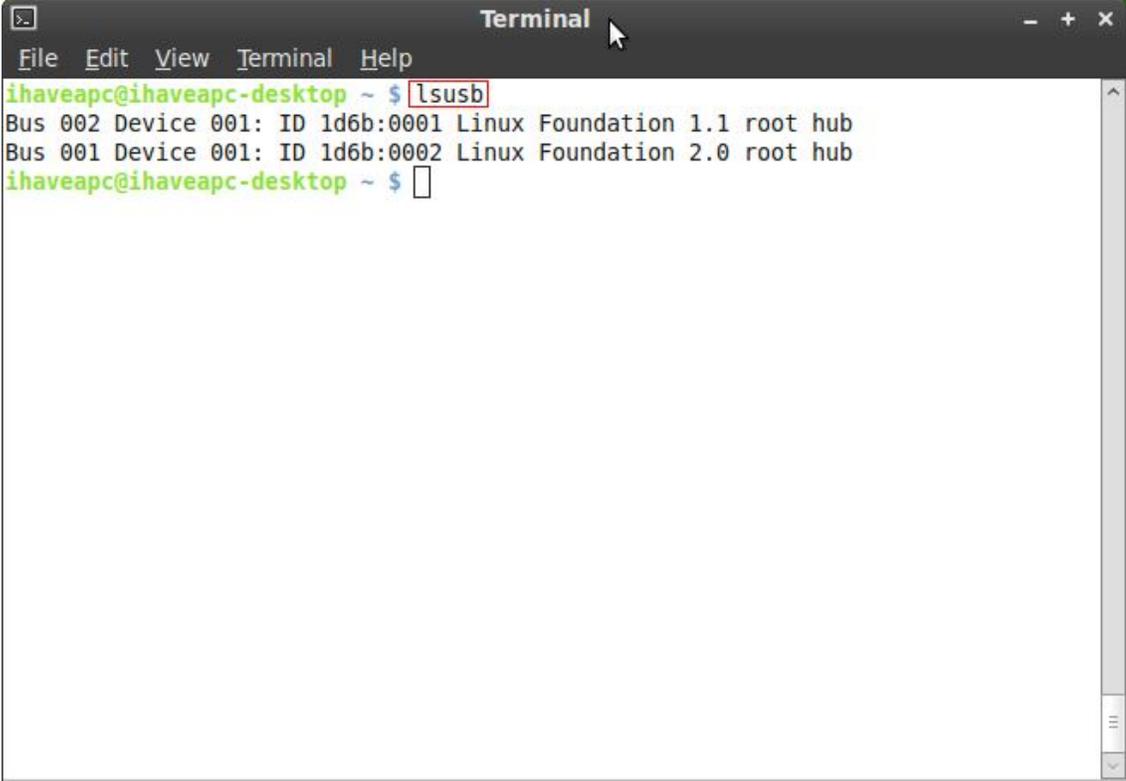
```

```

Terminal
File Edit View Terminal Help
00:16.6 PCI bridge: VMware PCI Express Root Port (rev 01)
00:16.7 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.0 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.1 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.2 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.3 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.4 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.5 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.6 PCI bridge: VMware PCI Express Root Port (rev 01)
00:17.7 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.0 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.1 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.2 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.3 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.4 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.5 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.6 PCI bridge: VMware PCI Express Root Port (rev 01)
00:18.7 PCI bridge: VMware PCI Express Root Port (rev 01)
02:00.0 USB Controller: Intel Corporation 82371AB/EB/MB PIIX4 USB
02:01.0 Ethernet controller: Advanced Micro Devices [AMD] 79c970 [PCnet32 LANCE]
(rev 10)
02:02.0 Multimedia audio controller: Ensoniq ES1371 [AudioPCI-97] (rev 02)
02:03.0 USB Controller: VMware USB2 EHCI Controller
ihaveapc@ihaveapc-desktop ~ $

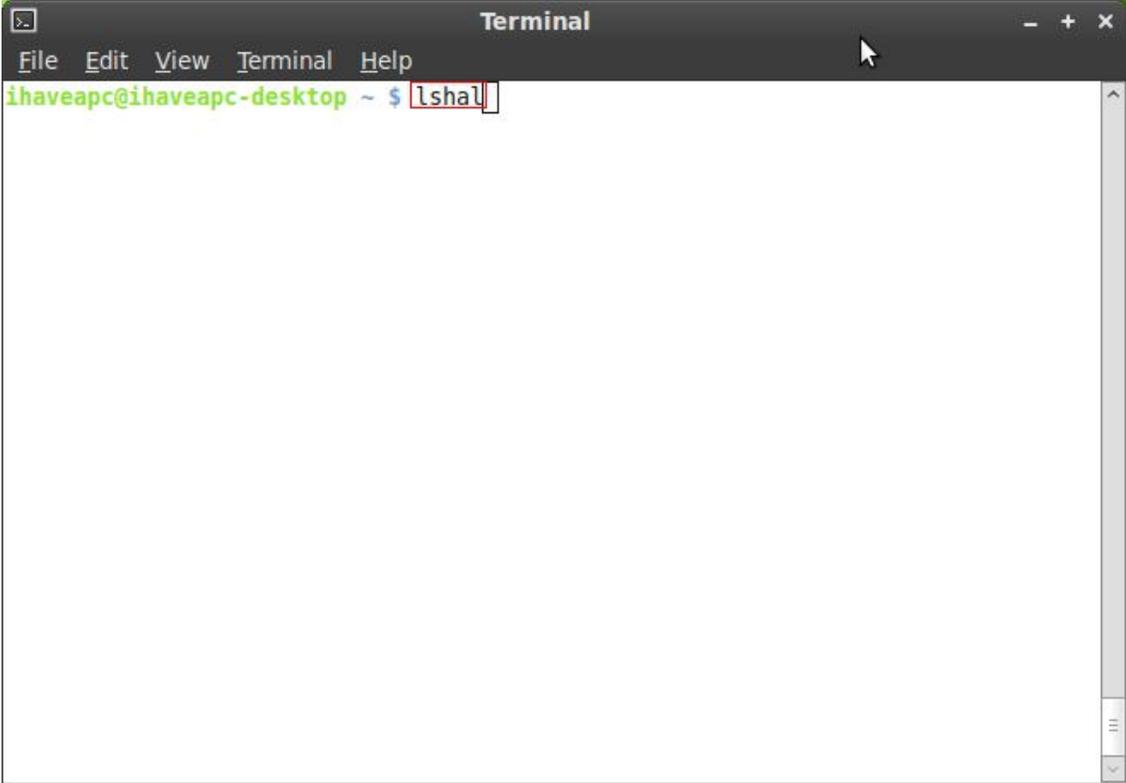
```

5. **lsusb** – This command lists all USB buses and devices connected to them.

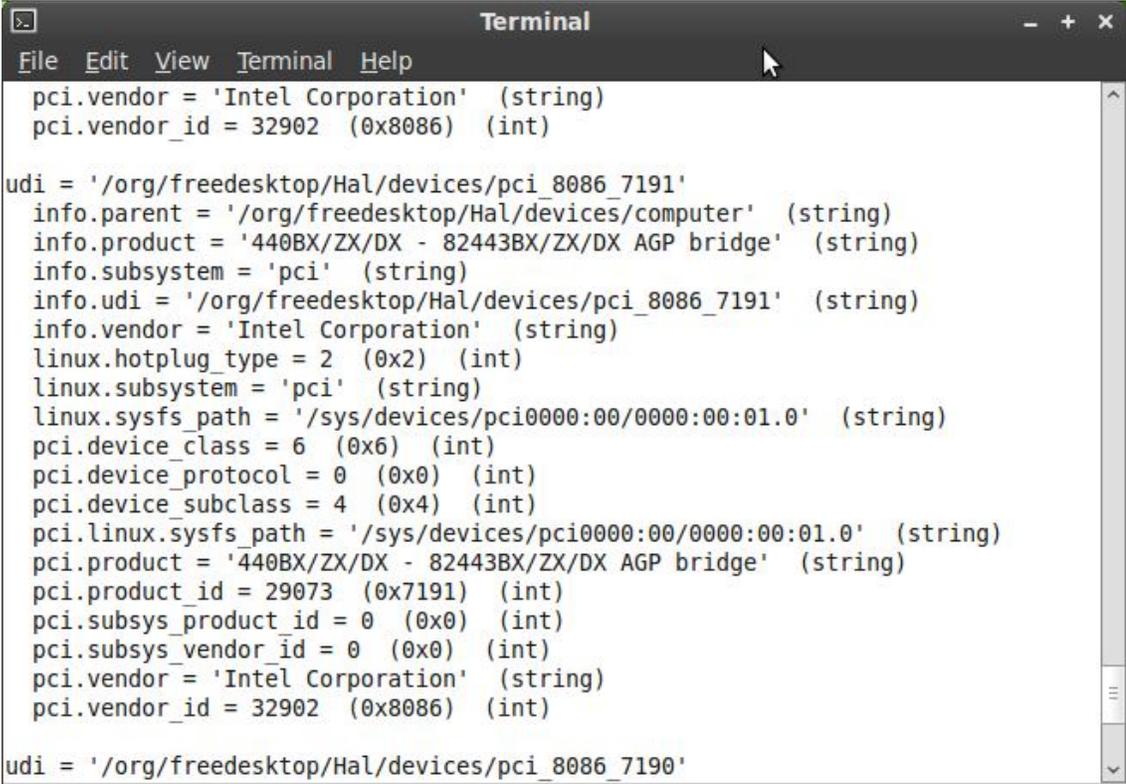


```
ihaveapc@ihaveapc-desktop ~ $ lsusb
Bus 002 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
ihaveapc@ihaveapc-desktop ~ $
```

6. **lshal** – This command lists all the devices that HAL(Hardware Abstraction Layer) is aware about i.e. most of the hardware connected to your system.



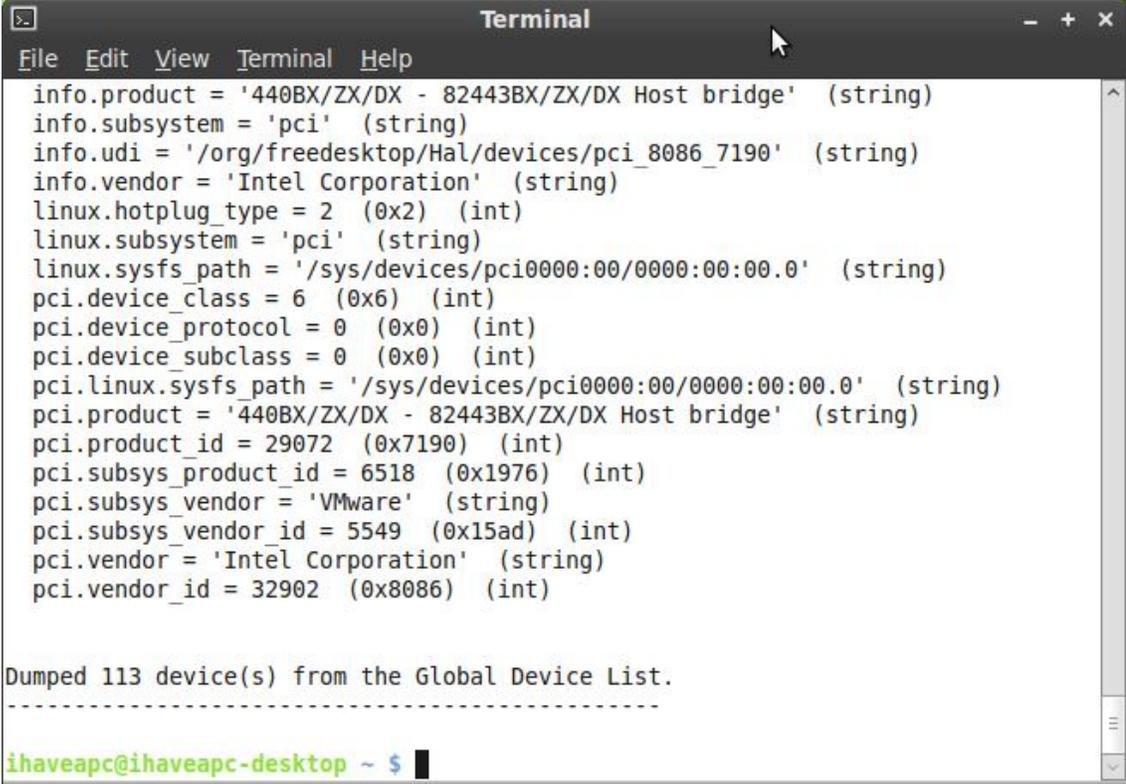
```
Terminal
File Edit View Terminal Help
ihaveapc@ihaveapc-desktop ~ $ lshal
```



```
Terminal
File Edit View Terminal Help
pci.vendor = 'Intel Corporation' (string)
pci.vendor_id = 32902 (0x8086) (int)

udi = '/org/freedesktop/Hal/devices/pci_8086_7191'
  info.parent = '/org/freedesktop/Hal/devices/computer' (string)
  info.product = '440BX/ZX/DX - 82443BX/ZX/DX AGP bridge' (string)
  info.subsystem = 'pci' (string)
  info.udi = '/org/freedesktop/Hal/devices/pci_8086_7191' (string)
  info.vendor = 'Intel Corporation' (string)
  linux.hotplug_type = 2 (0x2) (int)
  linux.subsystem = 'pci' (string)
  linux.sysfs_path = '/sys/devices/pci0000:00/0000:00:01.0' (string)
  pci.device_class = 6 (0x6) (int)
  pci.device_protocol = 0 (0x0) (int)
  pci.device_subclass = 4 (0x4) (int)
  pci.linux.sysfs_path = '/sys/devices/pci0000:00/0000:00:01.0' (string)
  pci.product = '440BX/ZX/DX - 82443BX/ZX/DX AGP bridge' (string)
  pci.product_id = 29073 (0x7191) (int)
  pci.subsys_product_id = 0 (0x0) (int)
  pci.subsys_vendor_id = 0 (0x0) (int)
  pci.vendor = 'Intel Corporation' (string)
  pci.vendor_id = 32902 (0x8086) (int)

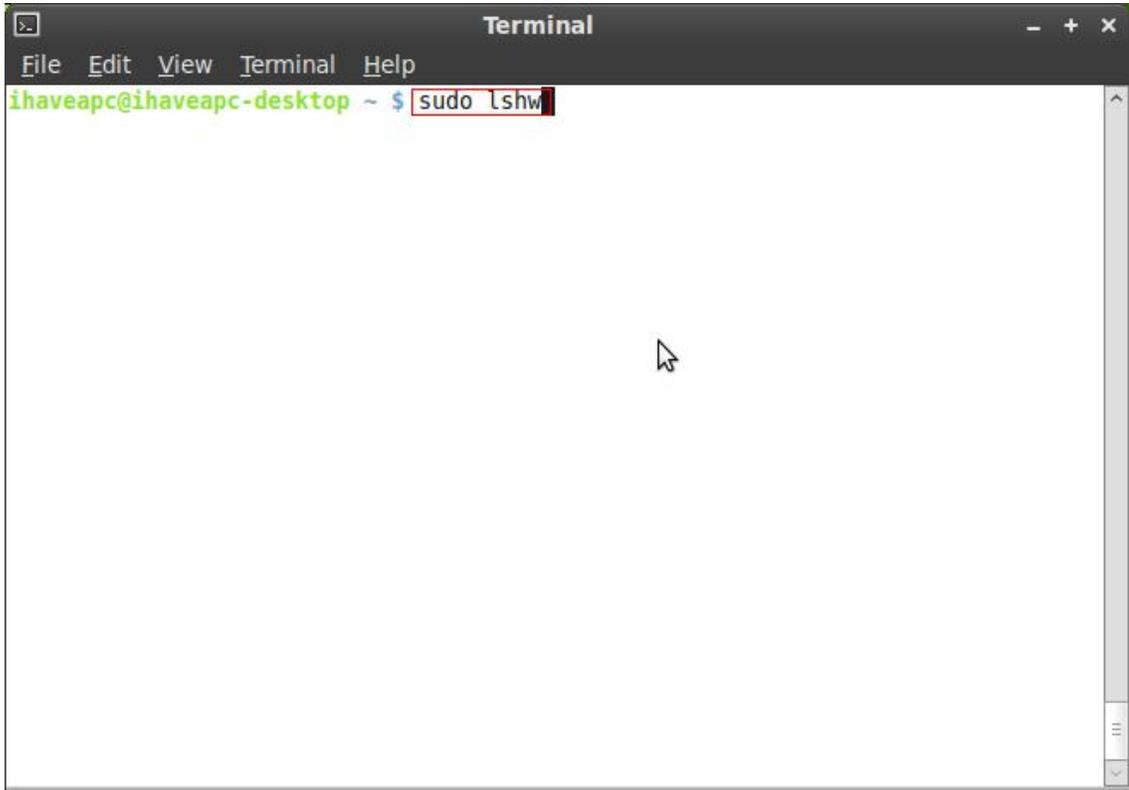
udi = '/org/freedesktop/Hal/devices/pci_8086_7190'
```



```
Terminal
File Edit View Terminal Help
info.product = '440BX/ZX/DX - 82443BX/ZX/DX Host bridge' (string)
info.subsystem = 'pci' (string)
info.udi = '/org/freedesktop/Hal/devices/pci_8086_7190' (string)
info.vendor = 'Intel Corporation' (string)
linux.hotplug_type = 2 (0x2) (int)
linux.subsystem = 'pci' (string)
linux.sysfs_path = '/sys/devices/pci0000:00/0000:00:00.0' (string)
pci.device_class = 6 (0x6) (int)
pci.device_protocol = 0 (0x0) (int)
pci.device_subclass = 0 (0x0) (int)
pci.linux.sysfs_path = '/sys/devices/pci0000:00/0000:00:00.0' (string)
pci.product = '440BX/ZX/DX - 82443BX/ZX/DX Host bridge' (string)
pci.product_id = 29072 (0x7190) (int)
pci.subsys_product_id = 6518 (0x1976) (int)
pci.subsys_vendor = 'VMware' (string)
pci.subsys_vendor_id = 5549 (0x15ad) (int)
pci.vendor = 'Intel Corporation' (string)
pci.vendor_id = 32902 (0x8086) (int)

Dumped 113 device(s) from the Global Device List.
-----
ihaveapc@ihaveapc-desktop ~ $
```

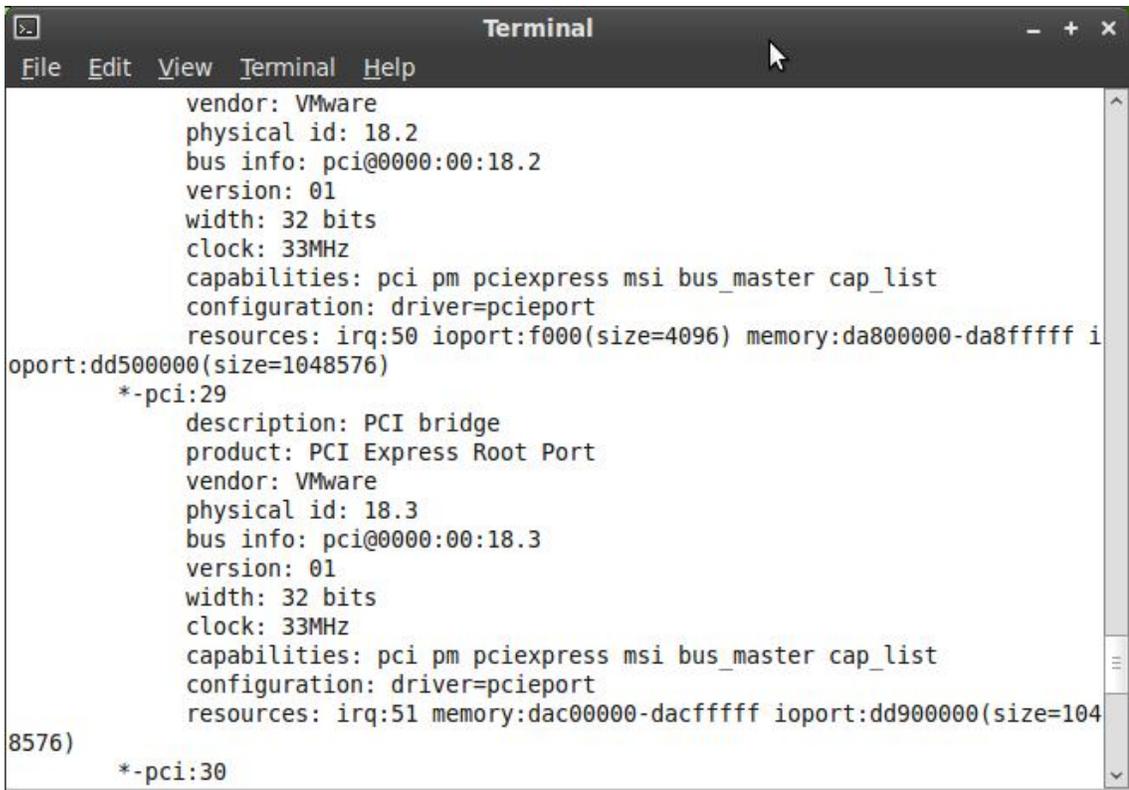
7. **lshw** – This command lists hardware present in the system including information about manufacturer, device type and where it is connected.



```

Terminal
File Edit View Terminal Help
ihaveapc@ihaveapc-desktop ~ $ sudo lshw

```



```

Terminal
File Edit View Terminal Help
vendor: VMware
physical id: 18.2
bus info: pci@0000:00:18.2
version: 01
width: 32 bits
clock: 33MHz
capabilities: pci pm pciexpress msi bus_master cap_list
configuration: driver=pcieport
resources: irq:50 ioport:f000(size=4096) memory:da800000-da8fffff i
oport:dd500000(size=1048576)
*-pci:29
description: PCI bridge
product: PCI Express Root Port
vendor: VMware
physical id: 18.3
bus info: pci@0000:00:18.3
version: 01
width: 32 bits
clock: 33MHz
capabilities: pci pm pciexpress msi bus_master cap_list
configuration: driver=pcieport
resources: irq:51 memory:dac00000-dacfffff ioport:dd900000(size=104
8576)
*-pci:30

```

```
Terminal
File Edit View Terminal Help
width: 32 bits
clock: 33MHz
capabilities: pci pm pciexpress msi bus_master cap_list
configuration: driver=pcieport
resources: irq:54 memory:db800000-db8fffff ioport:de500000(size=104
8576)
*-pci:33
description: PCI bridge
product: PCI Express Root Port
vendor: VMware
physical id: 18.7
bus info: pci@0000:00:18.7
version: 01
width: 32 bits
clock: 33MHz
capabilities: pci pm pciexpress msi bus_master cap_list
configuration: driver=pcieport
resources: irq:55 memory:dbc00000-dbcfffff ioport:de900000(size=104
8576)
*-remoteaccess UNCLAIMED
vendor: Intel
physical id: 1
capabilities: inbound
ihaveapc@ihaveapc-desktop ~ $
```

PART 7: vi Cheat Sheet



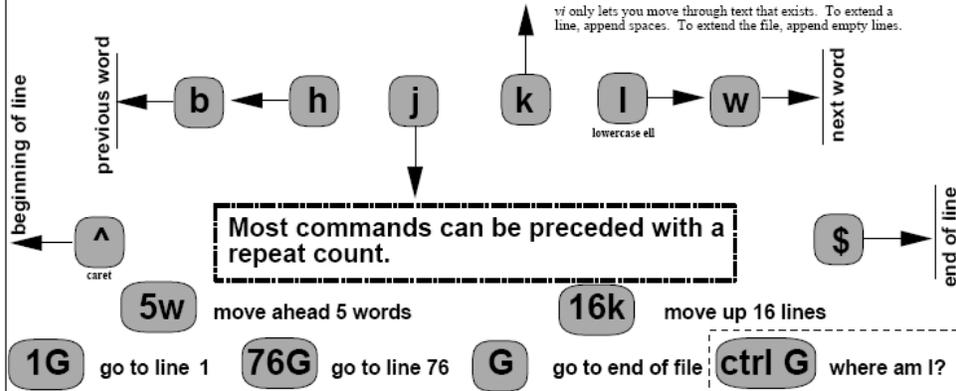
Cheat Sheet

You're in command mode when you start *vi*.

Pressing **ESC** always takes you back to command mode.

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Need a fresh copy?
<http://www.kcomputing.com/vi.html>
Contact us at info@kcomputing.com
+1 512 858 0380

Cursor Movement Commands



Exiting *vi*...be in command mode! Press **Enter** to end these commands.
 :wq write file then quit
 :q! quit, forget changes
 :q quit unless save needed

Changing Commands...can include any cursor movement command

c\$ change to end of line **d5w** delete 5 words **dG** delete to end of file
dd delete current line **X** delete this character **u** undo last change **U** restore line

Add-text Commands...press **ESC when you're done**

a append here **A** append at end of line **i** insert here **I** insert at start of line
capital i **R** overstrike