

Linux Tutorial

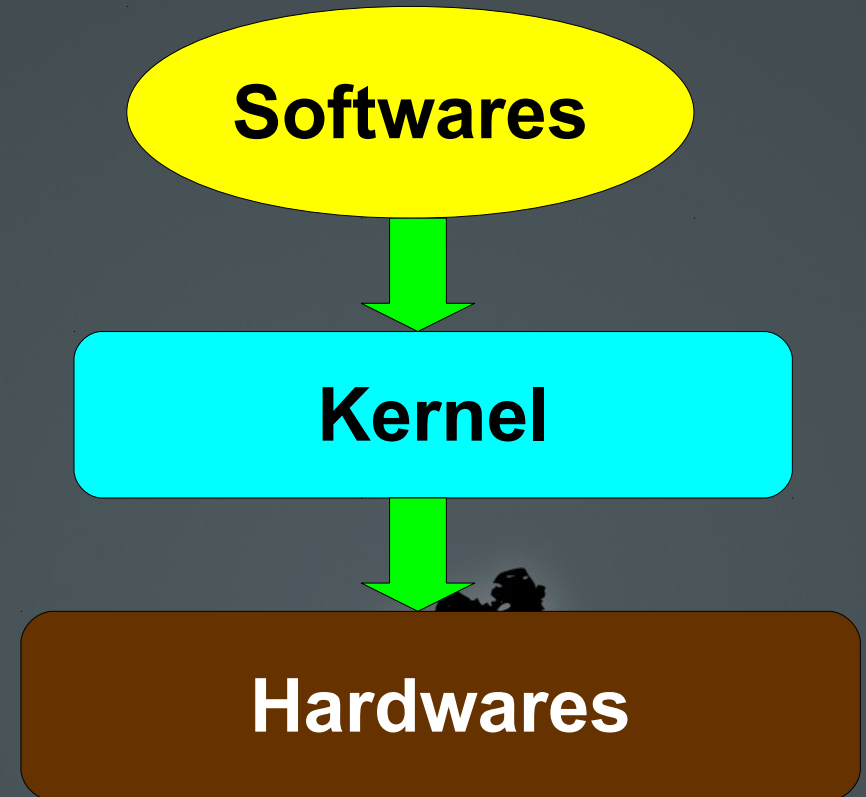
IUCAA summer school 2012

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What is Linux?

- Linux is a UNIX like operating system developed by Linus Torvalds in early 90s.
- The distinguishing feature is the **LINUX kernel**.
- There are several types of LINUX :
Debian based distros like Ubuntu, Mint.
Fedora, Red-hat types.
Open Suse type etc

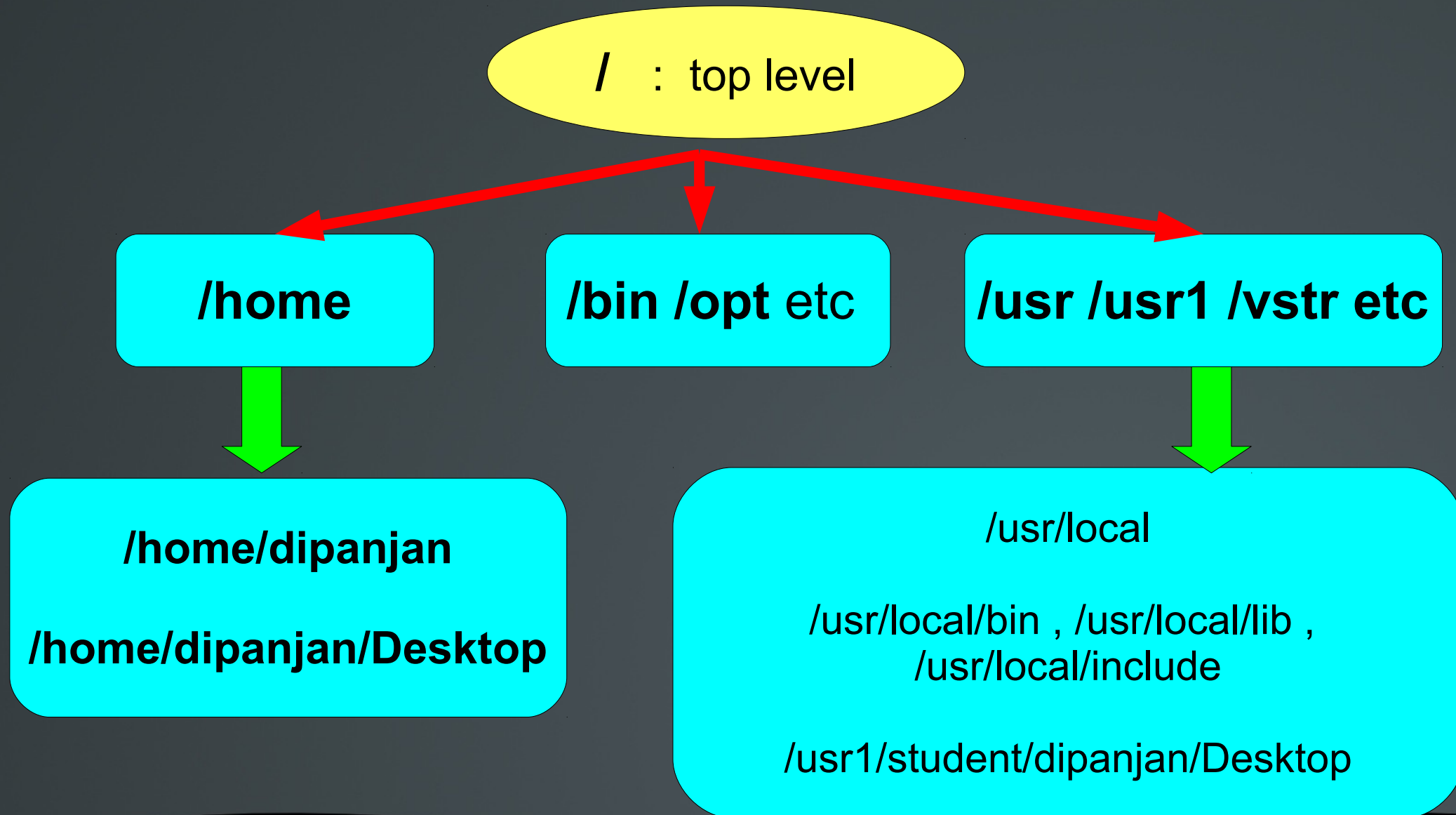


Some Jargons

- KDE and GNOME Desktop environments.
- GNU GRUB : Grand Unified Bootloader.
- EXT (Extended File system) as opposed to FAT 32 or NTFS. Currently used : ext4.
- SHELL : An user interface to the OS. e.g BASH, CSH, TCSH.



The Directory structure

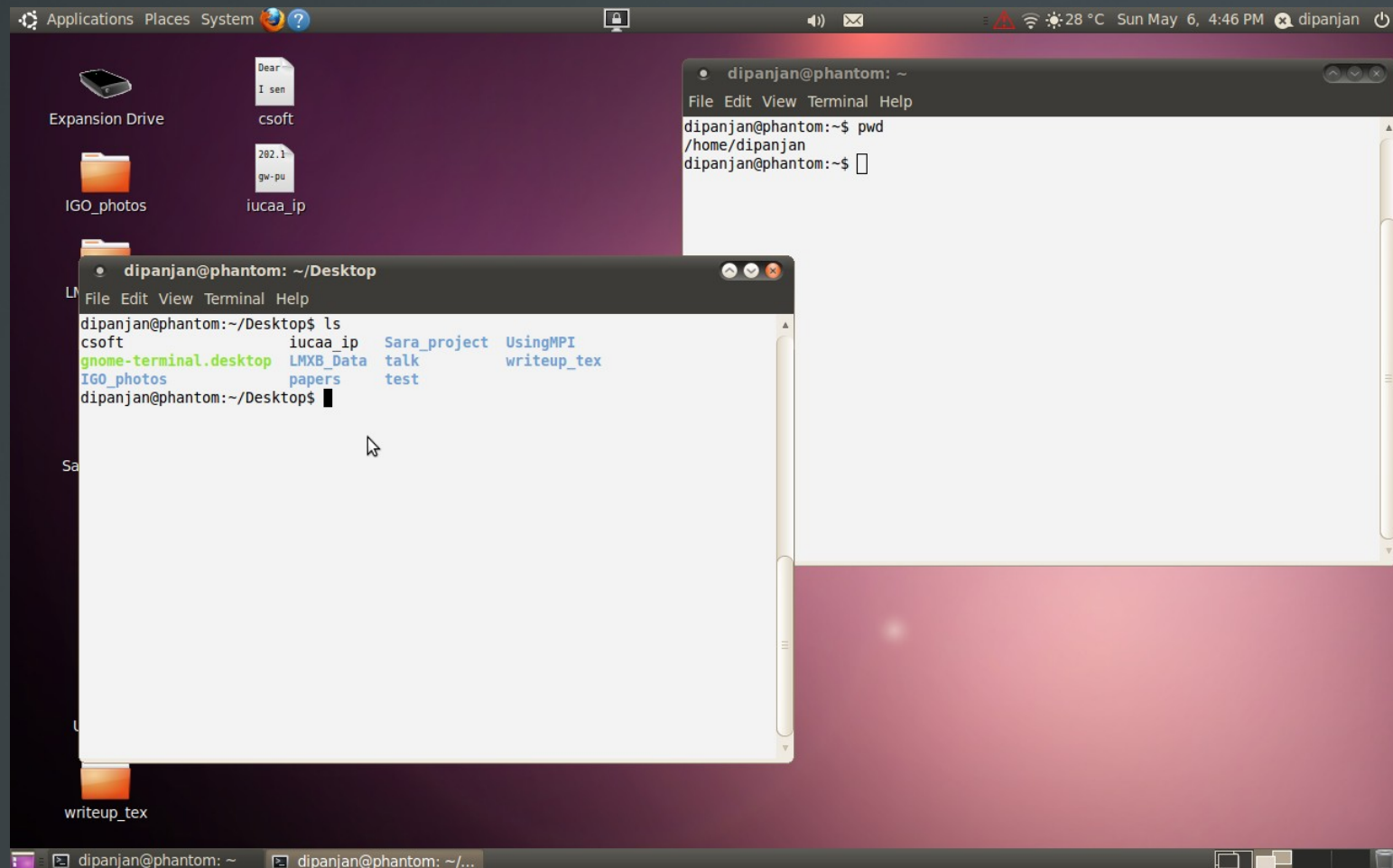


After Logging in

- **Nautilus** : graphical file manager, similar to windows. Folders in windows are called directories in LINUX world!
- **Workspace** : control which window is on your screen. Switch between workspaces by either mouse or :
ctrl+alt+left/right arrow key
- **Mozilla** web-browser.
- Switch between multiple objects in same workspace :
alt+tab
- Show Desktop : ctrl+alt+d
- Recycle bin is called Trash



- **The terminal** : used to enter shell commands and interact with the OS.



Log in id and machine name

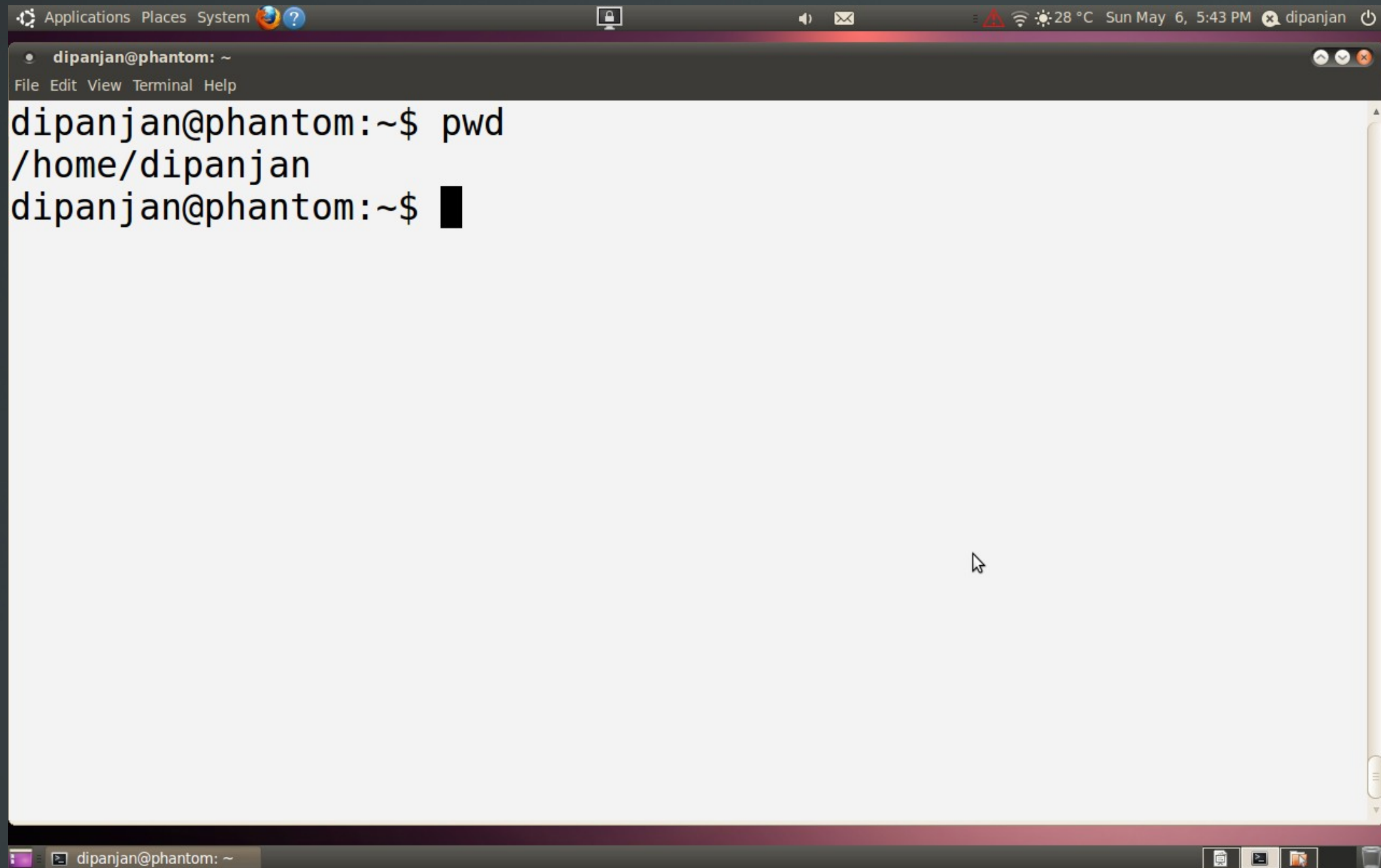
```
dipnjan@phantom: ~  
File Edit View Terminal Help  
dipnjan@phantom:~$ ping phantom  
PING phantom (127.0.1.1) 56(84) bytes of data.  
64 bytes from phantom (127.0.1.1): icmp_seq=1 ttl=64 time=0.046 ms  
64 bytes from phantom (127.0.1.1): icmp_seq=2 ttl=64 time=0.052 ms  
^C  
--- phantom ping statistics ---  
2 packets transmitted, 2 received, 0% packet loss, time 999ms  
rtt min/avg/max/mdev = 0.046/0.049/0.052/0.003 ms  
dipnjan@phantom:~$
```

IP Address

Username :
dipnjan

Machine name : phantom

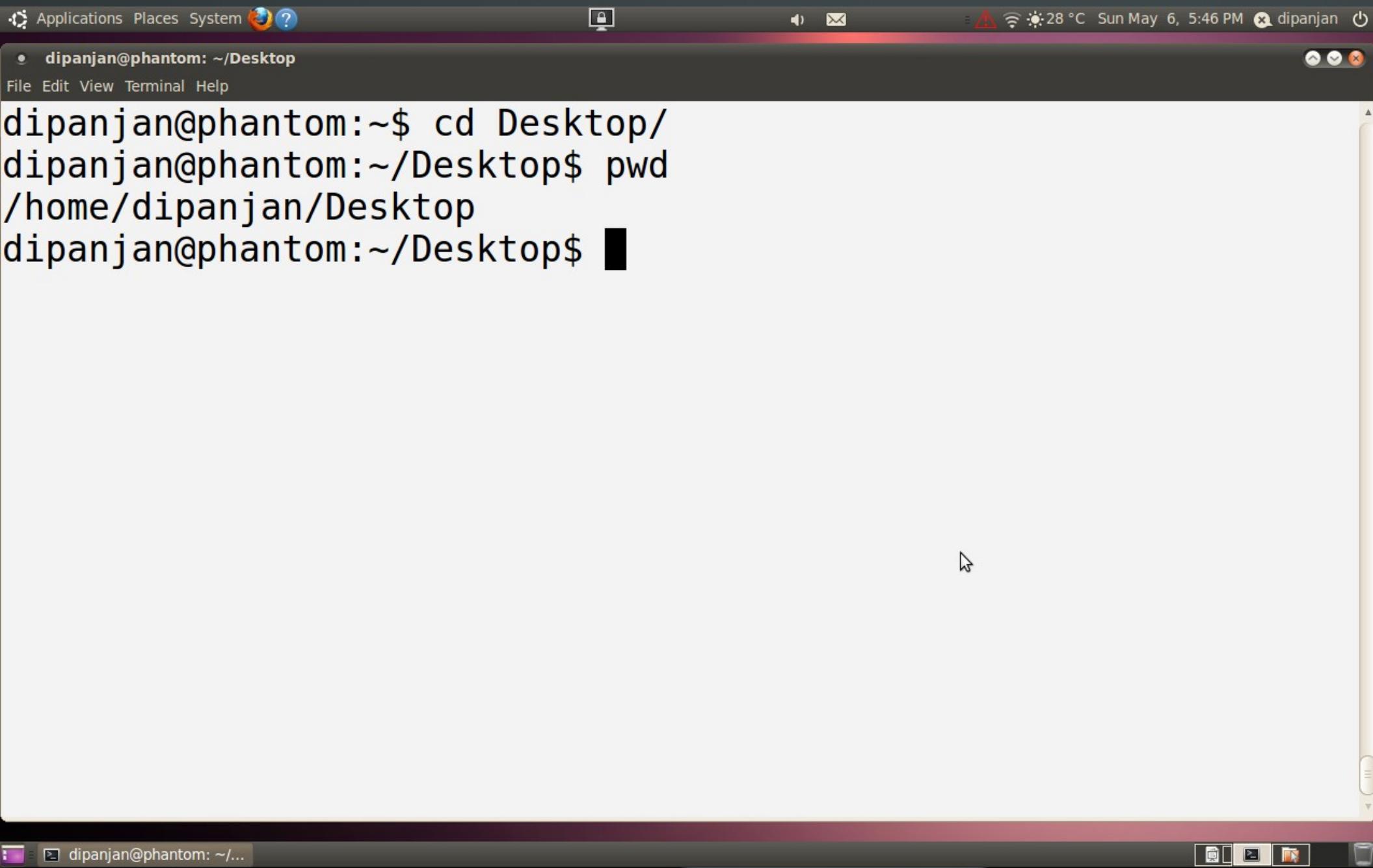
pwd : check current location



The image shows a screenshot of a Linux desktop environment. At the top, there is a system status bar with icons for Applications, Places, System, and a user profile. Below this is a terminal window titled "dipanjan@phantom: ~". The terminal has a menu bar with "File", "Edit", "View", "Terminal", and "Help". The terminal content shows the user typing the command "pwd" and receiving the output "/home/dipanjan". The prompt "dipanjan@phantom:~\$" is visible before and after the command. The desktop background is dark, and there are several icons in the bottom panel, including a file manager, a terminal, and a network icon.

```
dipanjan@phantom:~$ pwd
/home/dipanjan
dipanjan@phantom:~$
```


cd : change directory . Use tab to autofill commands

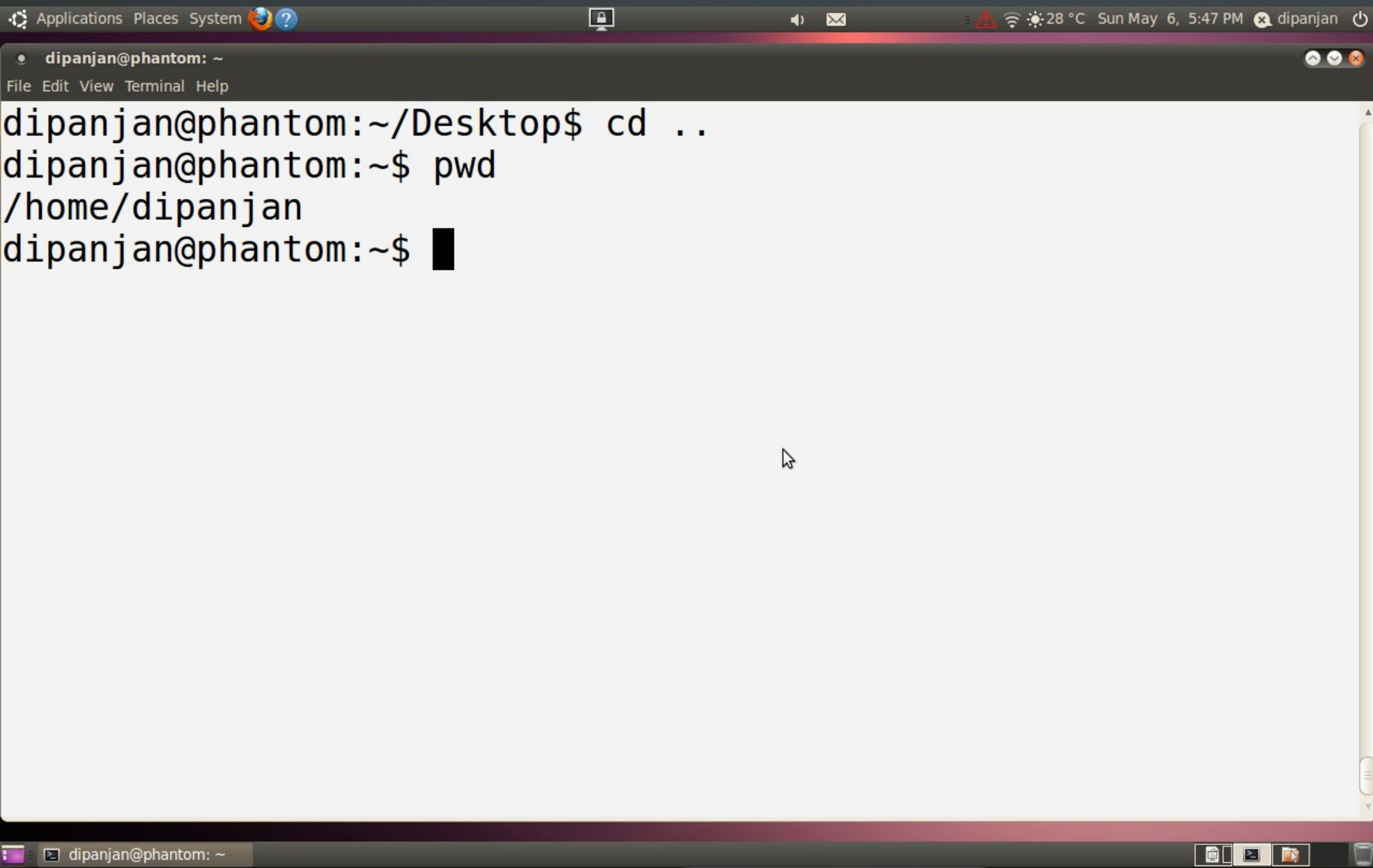


The image shows a Linux desktop environment with a terminal window open. The terminal window has a title bar that reads "dipanjan@phantom: ~/Desktop". The terminal content shows the following sequence of commands and output:

```
dipanjan@phantom:~$ cd Desktop/  
dipanjan@phantom:~/Desktop$ pwd  
/home/dipanjan/Desktop  
dipanjan@phantom:~/Desktop$
```

The terminal window is titled "dipanjan@phantom: ~/Desktop". The desktop background is dark. The top panel shows system status icons including Applications, Places, System, and a clock showing "Sun May 6, 5:46 PM". The bottom panel shows a taskbar with icons for the terminal, a file manager, and other applications.

cd .. : go one level backwards



A screenshot of a Linux terminal window. The window title is "dipanjan@phantom: ~". The menu bar includes "File", "Edit", "View", "Terminal", and "Help". The terminal shows the following commands and output:

```
dipanjan@phantom:~/Desktop$ cd ..  
dipanjan@phantom:~$ pwd  
/home/dipanjan  
dipanjan@phantom:~$
```

The terminal window is part of a desktop environment. The top panel shows system status: "Applications", "Places", "System", and a notification area with icons for a lock, speaker, mail, and weather (28 °C). The bottom panel shows a taskbar with icons for a file manager, terminal, and other applications.

dipanjan@phantom: ~

File Edit View Terminal Help

```
dipanjan@phantom:~$ cd ../../
```

```
dipanjan@phantom:/$ pwd
```

```
/
```

```
dipanjan@phantom:/$ cd
```

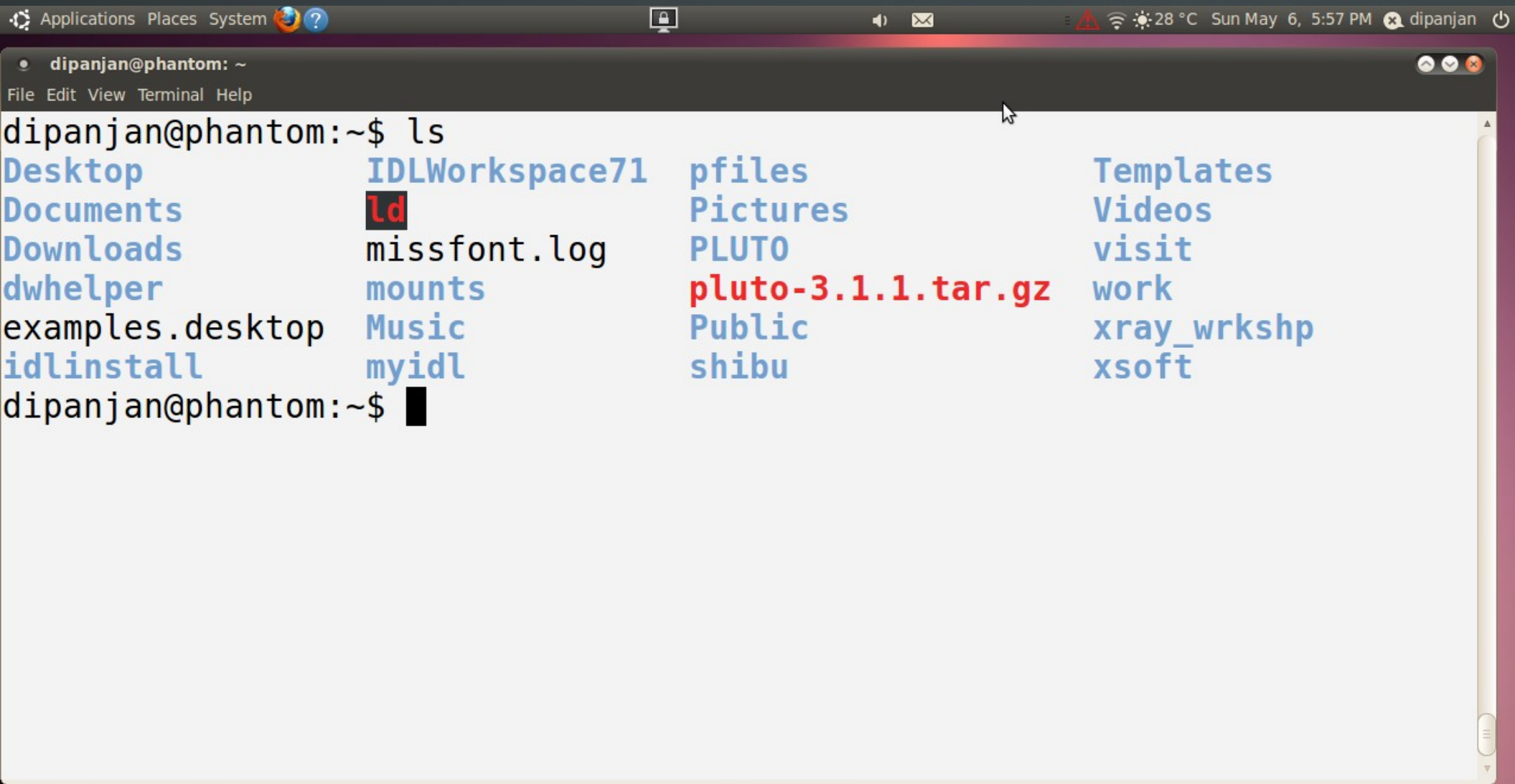
```
dipanjan@phantom:~$ pwd
```

```
/home/dipanjan
```

```
dipanjan@phantom:~$
```

dipanjan@phantom: ~


ls : list files.



A terminal window titled "dipanjan@phantom: ~" with a menu bar (File, Edit, View, Terminal, Help). The terminal shows the command "ls" and its output, which lists files and directories in a multi-column format. The files are color-coded: directories are blue, executables are red, and regular files are black. The output is as follows:

```
dipanjan@phantom:~$ ls
Desktop          IDLWorkspace71  pfiles          Templates
Documents        ld              Pictures        Videos
Downloads        missfont.log    PLUTO           visit
dwhelper         mounts          pluto-3.1.1.tar.gz work
examples.desktop Music           Public          xray_wrkshp
idlinstall       myidl          shibu           xsoft
dipanjan@phantom:~$
```

UsingMPI


writeup_tex

ls -ltr .

Permission settings :

r – read

w – write

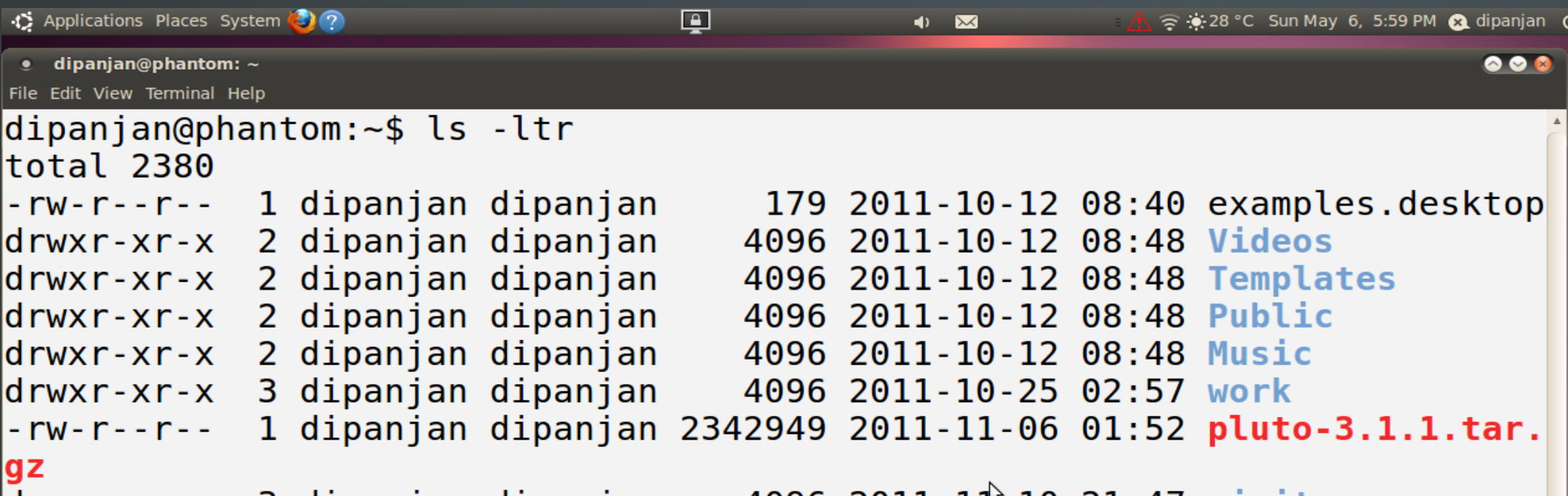
x – execute

e.g. xr – read and execute only. rw - read and write only. rwxr – read, write and execute.

ls -al : lists all files, including hidden files : .bashrc

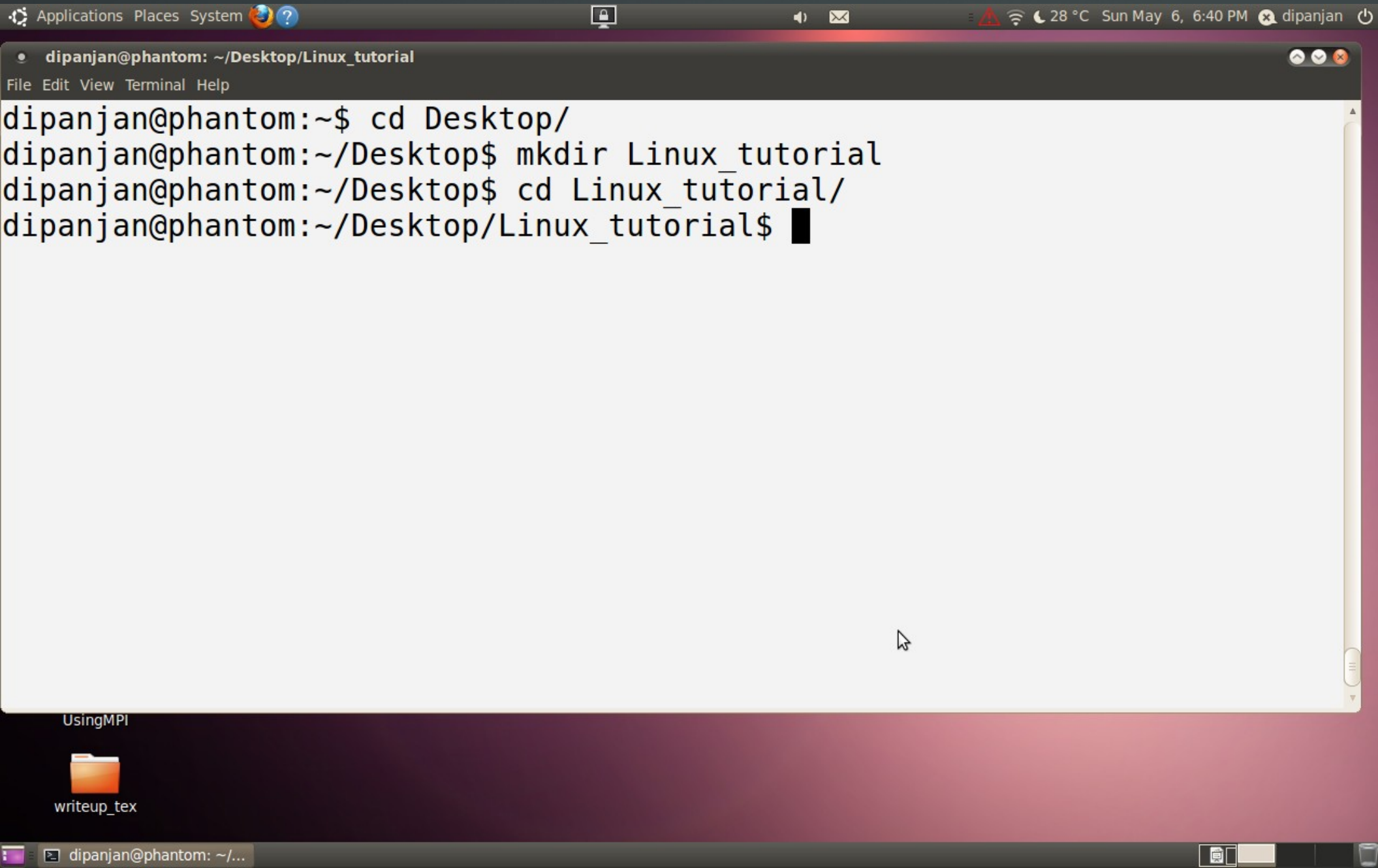
\$clear : to clean screen.

\$man ls : manual page for commands. Exit by pressing q



```
dipanjan@phantom: ~$ ls -ltr
total 2380
-rw-r--r--  1 dipanjan dipanjan    179 2011-10-12 08:40 examples.desktop
drwxr-xr-x  2 dipanjan dipanjan   4096 2011-10-12 08:48 Videos
drwxr-xr-x  2 dipanjan dipanjan   4096 2011-10-12 08:48 Templates
drwxr-xr-x  2 dipanjan dipanjan   4096 2011-10-12 08:48 Public
drwxr-xr-x  2 dipanjan dipanjan   4096 2011-10-12 08:48 Music
drwxr-xr-x  3 dipanjan dipanjan   4096 2011-10-25 02:57 work
-rw-r--r--  1 dipanjan dipanjan 2342949 2011-11-06 01:52 pluto-3.1.1.tar.
gz
```


mkdir : make directory



The screenshot shows a Linux desktop environment. At the top, there is a system menu bar with icons for Applications, Places, System, and a help icon. The system status bar on the right shows the temperature as 28 °C, the date and time as Sun May 6, 6:40 PM, and the username as dipanjan. A terminal window is open, titled 'dipanjan@phantom: ~/Desktop/Linux_tutorial'. The terminal shows the following commands and output:

```
dipanjan@phantom:~$ cd Desktop/  
dipanjan@phantom:~/Desktop$ mkdir Linux_tutorial  
dipanjan@phantom:~/Desktop$ cd Linux_tutorial/  
dipanjan@phantom:~/Desktop/Linux_tutorial$
```

On the desktop, there is a folder icon labeled 'UsingMPI' and a file icon labeled 'writeup_tex'. The bottom of the screen shows a taskbar with a terminal icon and the text 'dipanjan@phantom: ~/...'.

Handling text files. Editors : gedit, vi, gvim, emacs.

Open a text file with gedit : **\$gedit testfile.txt**

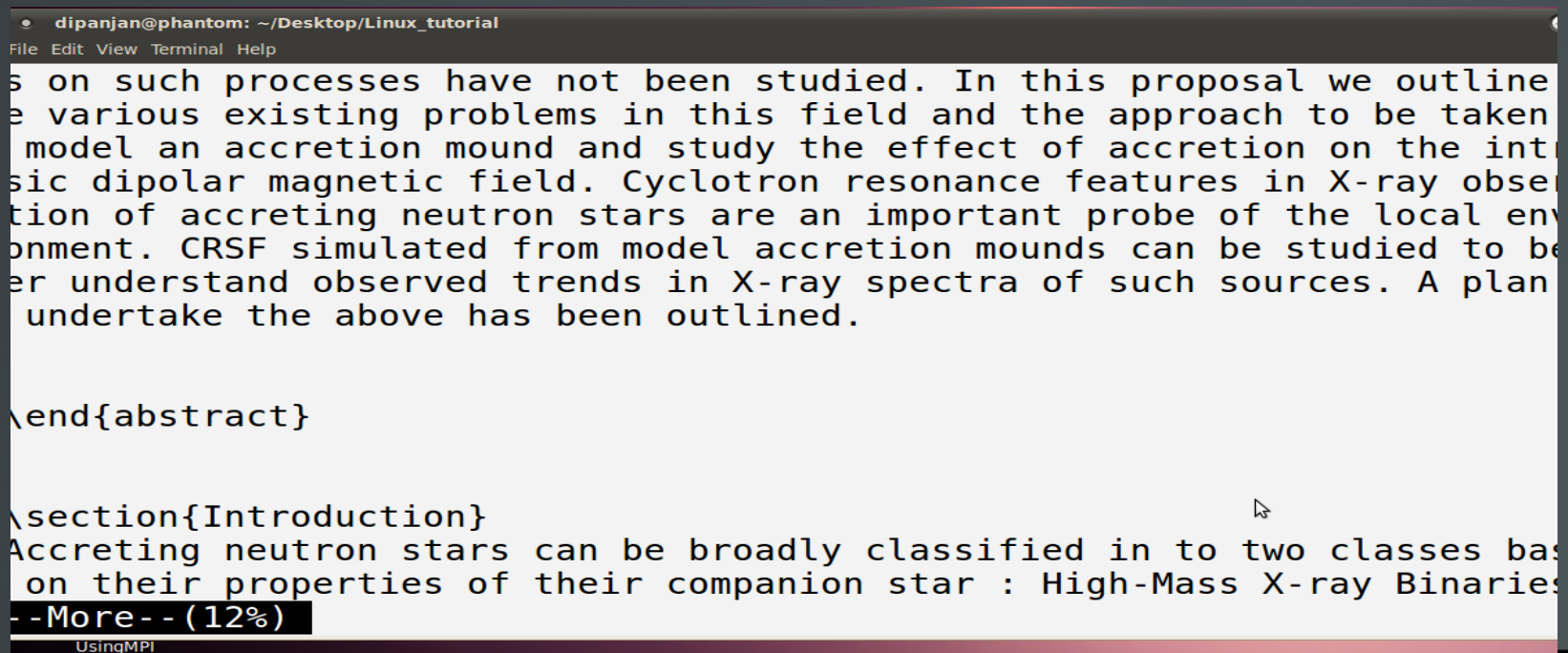
Write some text. Close the text file. You can also close by : **ctrl+c** from the terminal. ctrl+c terminates a process opened through the terminal.

To check contents of a file :

\$more testfile.txt

\$cat testfile.txt

\$less testfile.txt



```
dipanjan@phantom: ~/Desktop/Linux_tutorial
File Edit View Terminal Help
s on such processes have not been studied. In this proposal we outline
e various existing problems in this field and the approach to be taken
model an accretion mound and study the effect of accretion on the int
sic dipolar magnetic field. Cyclotron resonance features in X-ray obser
tion of accreting neutron stars are an important probe of the local env
onment. CRSF simulated from model accretion mounds can be studied to be
er understand observed trends in X-ray spectra of such sources. A plan
undertake the above has been outlined.

\end{abstract}

\section{Introduction}
Accreting neutron stars can be broadly classified in to two classes bas
on their properties of their companion star : High-Mass X-ray Binaries
--More-- (12%)
UsingMPI
```

Copying files : cp filename destination

```
dipanjan@phantom: ~/Desktop/Linux_tutorial
File Edit View Terminal Help
dipanjan@phantom:~/Desktop/Linux_tutorial$ mkdir dir_test
dipanjan@phantom:~/Desktop/Linux_tutorial$ cp testfile.txt copy_test.txt
dipanjan@phantom:~/Desktop/Linux_tutorial$ ls
copy_test.txt  dir_test  testfile.txt
dipanjan@phantom:~/Desktop/Linux_tutorial$ cp testfile.txt dir_test/
```

Copying directories : cp -r directory destination

```
dipanjan@phantom:~/Desktop/Linux_tutorial$ cp -r dir_test another_dir
dipanjan@phantom:~/Desktop/Linux_tutorial$ ls
another_dir  copy_test.txt  dir_test  testfile.txt
```



Renaming files/directories : `mv filename newname`

```
dipanjan@phantom:~/Desktop/Linux_tutorial$ mv copy_test.txt renamed.txt
dipanjan@phantom:~/Desktop/Linux_tutorial$ ls
another_dir  dir_test  renamed.txt  testfile.txt
```

Moving files/directories : `mv directory or file destination`

```
dipanjan@phantom:~/Desktop/Linux_tutorial$ mv renamed.txt another_dir/
dipanjan@phantom:~/Desktop/Linux_tutorial$ ls
another_dir  dir_test  testfile.txt
dipanjan@phantom:~/Desktop/Linux_tutorial$ █
```



Removing files : `rm filename`

```
dipanjana@phantom:~/Desktop/Linux_tutorial$ ls
another_dir  dir_test  testfile.txt
dipanjana@phantom:~/Desktop/Linux_tutorial$ rm testfile.txt
dipanjana@phantom:~/Desktop/Linux_tutorial$ ls
another_dir  dir_test
```

Removing directories : `rm -r directories`

```
dipanjana@phantom:~/Desktop/Linux_tutorial$ rm -r another_dir/
dipanjana@phantom:~/Desktop/Linux_tutorial$ ls
dir_test
```

Removing Everything : `rm -rf *` -> one of the most Dangerous commands. Take care not to delete important files.

Copying/moving all files : `cp * destination`

Copying/moving same type of files : `cp *.txt* destination`

Editing with vi

- Open file with vi
\$vi testfile.txt
- To enter text press i
- Write text.
- Press escape to exit write mode.
- To save file enter :w (type the colon then w)
- To undo what you did last enter :u
- To exit :q
- To save and exit :wq
- To exit without saving :q!



Changing file permissions

Chmod 755 filename

7 -> full permission : read + write + execute

5 -> read+write

4 -> read only

1st place : owner's permission (user)

2nd place : group

3rd place : others

Chmod 777 -> full permission to all

Chmod 755 -> full permission to user read/write to others

Chmod 744 -> full permission to user, read only to others



Miscellaneous commands

- **\$ top** : lists current processes
- **\$ kill process id**
- Alternatively kill process from System-> Administration ->System Monitor
- Check file size **\$ du -h testfile.txt**
du -sh gives total size of current directory without listing contents.
- Find file type with **\$file name**
- To search for a file **\$ find . *.txt** searches all text file in current directory. To search in a known directory give **\$ find path *.txt**
- **Open pdf/ps** with **\$ gv file.pdf** or **\$ evince file.pdf** or **\$ acroread file.pdf**
- **Open jpg or png** image files with **\$ display file.jpg** or **\$ eog file.jpg**
- To make a **tarball** (similar to zip) :
\$ tar cvfz name.tar.gz file1 file2 file3 dir1 dir2
- To untar : **\$ tar xvfz name.tar.gz**



Miscellaneous commands

- Redirect output to a text file :
\$ du -ah > size.txt or \$ du -ah >> size.txt (appends)
- Check end of text file \$ tail filename or \$ tail -f filename
- Count number of words/lines ; \$ wc -w file or \$ wc -l file
- Pipe output of one as input of another
\$ du -h testfile.txt | wc -w
- \$ grep text * searches the pattern text inside all files in current directory.
- \$ diff file1 file2 : lists differences in two files line by line. \$gvimdiff also works.
- \$ date : prints system time and date
- Calculator on terminal!! : \$ bc set scale variable for decimal place; scale=3 gives results till 3rd decimal place.



Shell

- A program that talks to the Kernel/OS.
- Types : Bourne shell (sh), Korn shell (ksh), C shell (csh), tcsh shell and Bourne Again shell (bash).
- csh and tcsh are syntactically similar. bash and sh are again similar to each other.

- Find your shell type using :

\$ echo \$SHELL

```
dipanjana@phantom:~$ echo $SHELL  
/bin/bash  
dipanjana@phantom:~$
```

- For tcsh or csh shell, a startup script file is run called cshrc. For bash it is bashrc. For some others it is .profile. Open cshrc using :

\$ gvim ~/.cshrc . If you edit .cshrc, run .cshrc for that session once :

\$ source ~/.cshrc



Shell

- **Setting variables** in C shell :

\$ set var1=2.0 For bash shells it is : **\$ var1=2.0** without using set.

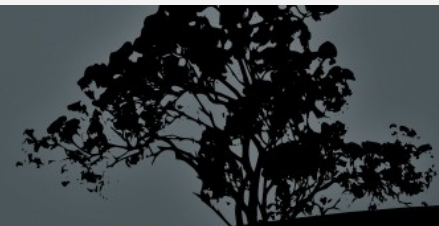
```
File Edit View Terminal Help
phantom:~> set string=/home/dipanjan/Desktop
phantom:~> cd $string
phantom:~/Desktop> █
```

- **Setting environment variables** in C shell :

```
phantom:~/Desktop/Linux_tutorial> pwd
/home/dipanjan/Desktop/Linux_tutorial
phantom:~/Desktop/Linux_tutorial> setenv workdir /home/dipanjan/Desktop/Linux_tutorial
phantom:~/Desktop/Linux_tutorial> echo $workdir
/home/dipanjan/Desktop/Linux_tutorial
phantom:~/Desktop/Linux_tutorial> █
```

- **Export variables** in bash shell :

```
phantom:~/Desktop/Linux_tutorial> bash
dipanjan@phantom:~/Desktop/Linux_tutorial$ export workdir="/home/dipanjan/Desktop/Linux_tutorial"
dipanjan@phantom:~/Desktop/Linux_tutorial$ echo $workdir
/home/dipanjan/Desktop/Linux_tutorial
█
```



Shell

- **Aliasing commands** in C shell

```
phantom:~> cd
phantom:~> alias work 'cd $workdir'
phantom:~> work
phantom:~/Desktop/Linux_tutorial> pwd
/home/dipanjan/Desktop/Linux_tutorial
phantom:~/Desktop/Linux_tutorial> █
```

- **Aliasing** in Bash

```
dipanjan@phantom:~$ alias work='cd $workdir'
dipanjan@phantom:~$ work
```

- **Arithmetic** in C shell :

```
phantom:~/Desktop/Linux_tutorial> set var1=2
phantom:~/Desktop/Linux_tutorial> set var2=3
phantom:~/Desktop/Linux_tutorial> @ a = $var1 * $var2
phantom:~/Desktop/Linux_tutorial> @ a = $var1 * $var2; echo $a
6
phantom:~/Desktop/Linux_tutorial> @ a = $var1 + $var2 ; echo $a
5
```


A simple SHELL script

```
dipanjan@phantom:~/Desktop/Linux_tutorial$ more test.sh
#!/bin/bash
count=0
theta=0
rm -f outfile.dat
touch outfile.dat

while (( $count <= 200 )); do

# ----Fermat spiral-----
#theta=$(echo "scale=10;$count/200*8*6.28318" | bc)
#r=$(echo "scale=10;0.1*$theta*$theta" | bc -l)

#-----Hyperbolic spiral-----
theta=$(echo "scale=15;1.0+$count/200*8.0*6.28318" | bc)
r=$(echo "scale=15;2.0/$theta" | bc -l)
echo $theta $r >>outfile.dat
count=$(( $count + 1 ))

done
dipanjan@phantom:~/Desktop/Linux_tutorial$ chmod 755 test.sh
dipanjan@phantom:~/Desktop/Linux_tutorial$ ./test.sh
```

Plot using GNUPLOT :
\$ gnuplot

```
gnuplot> set polar
```

```
dummy variable is t for curves
gnuplot> plot "outfile.dat" with lines
```




Fin

Thats all Folks!