

Practical No. 1

Aim: To study the installation of Red Hat Enterprise Linux.

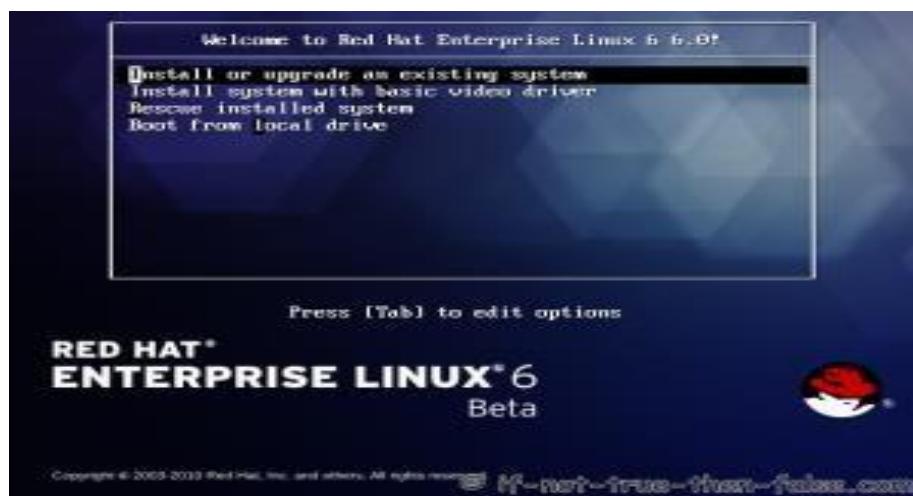
Step 1: Booting the Installation Program on your machine.

1. You can boot the installation program using
 - *Boot CD-ROM* — Your machine supports a bootable CD-ROM drive and you want to perform hard drive installation.
2. Insert the boot media and reboot the system. Your BIOS settings may need to be changed to allow you to boot from the CD-ROM or USB device.
3. To change your BIOS settings on an x86, AMD64, or Intel® 64 system, watch the instructions provided on your display when your computer first boots.
4. A line of text appears, telling you which key to press to enter the BIOS settings.
5. Once you have entered your BIOS setup program, find the section where the CD-ROM is first in your boot order.
6. This instructs the computer to first look at the CD-ROM drive for bootable media.
7. Press F10 to save your changes before exiting the BIOS.



Step 2: Welcome to Red Hat Enterprise Linux

1. The **Welcome** screen does not prompt you for any input.
2. Click on the **Next** button to continue.



Step 3: Language Selection

1. Using your mouse, select a language to use for the installation.
2. The language you select here will become the default language for the operating system once it is installed.
3. Selecting the appropriate language also helps target your time zone configuration later in the installation.
4. Once you select the appropriate language, click **Next** to continue.



Step 4: Keyboard Configuration

1. Using your mouse, select the correct layout type (for example, U.S. English) for the keyboard you would prefer to use for the installation and as the system default.
2. Once you have made your selection, click **Next** to continue.



Step 5: Enter the Installation Number

Choose to skip entering the installation number.



Step 6: Disk Partitioning Setup

1. Partitioning allows you to divide your hard drive into isolated sections, where each section behaves as its own hard drive.
2. Partitioning is particularly useful if you run multiple operating systems.
3. On this screen you can choose to create manual partition using the 'Create custom layout' option.
4. Once you have made your selection, click **Next** to continue.



Step 7: Deleting a Partition

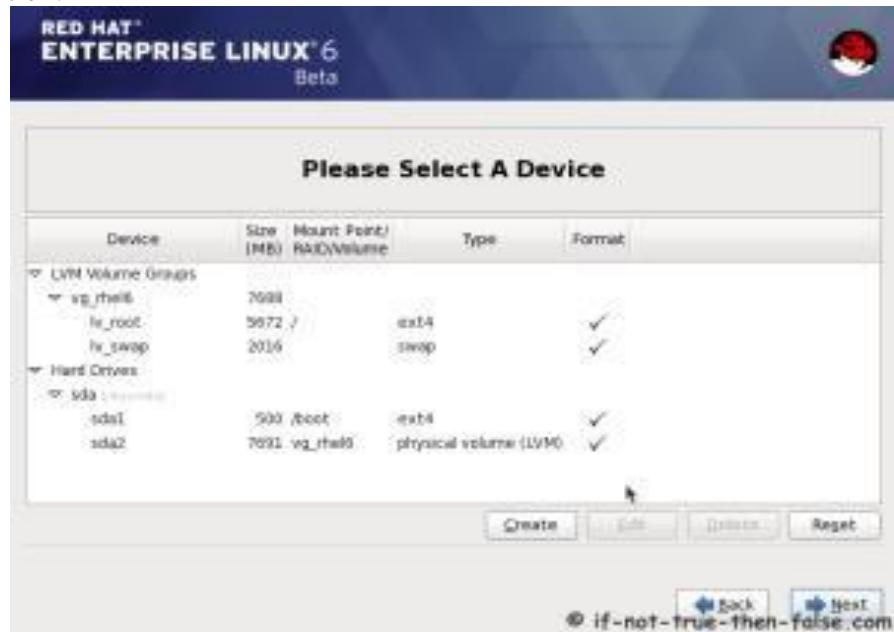
1. To delete a partition, highlight it in the **Partitions** section and click the **Delete** button.
2. Confirm the deletion when prompted.

Step 8: Editing Partitions

1. To edit a partition, select the **Edit** button or double-click on the existing partition.
2. If the partition already exists on your disk, you can only change the partition's mount point.
3. To make any other changes, you must delete the partition and recreate it.

Step 9: Adding Partitions

1. After deleting partitions, you can add new partitions to your system.
 2. A window appears that asks for mount point to be made for the partition.
 3. Here we have made two partitions: first on mount point —/with ext3 file system and for another do not select mount point , just select file system —swap|.
- a. **Mount Point:** Enter the partition's mount point. This partition should be the root partition.
 - b. **File System Type:** Using the pull-down menu, select the appropriate file system type for this partition. Select ext3.
ext3:
 - The ext3 file system is based on the ext2 file system and has one main advantage —journaling.
 - Using a journaling file system reduces time spent recovering a file system after a crash as there is no need to **fsck** the file system.
 - The ext3 file system is selected by default and is highly recommended.
 - c. **Size (MB):** Enter the size of the partition.
 - d. **swap**— Swap partitions are used to support virtual memory. Data is written to a swap partition when there is not enough RAM to store the data your system is processing.
 - e. **OK:** Select **OK** once you are satisfied with the settings and wish to create the partition.



Step 10: Boot Loader Configuration

1. To boot the system without boot media, you usually need to install a boot loader.
2. A boot loader is the first software program that runs when a computer starts.
3. It is responsible for loading and transferring control to the operating system kernel software.
4. The kernel, in turn, initializes the rest of the operating system.
5. GRUB (GRand Unified Bootloader), which is installed by default, is a very powerful boot loader.
6. GRUB can load a variety of free operating systems, as well as proprietary operating systems with chainloading.
7. Every bootable partition is listed, including partitions used by other operating systems.
8. Select **Default** beside the preferred boot partition to choose your default bootable OS.
9. You cannot move forward in the installation unless you choose a default boot image.



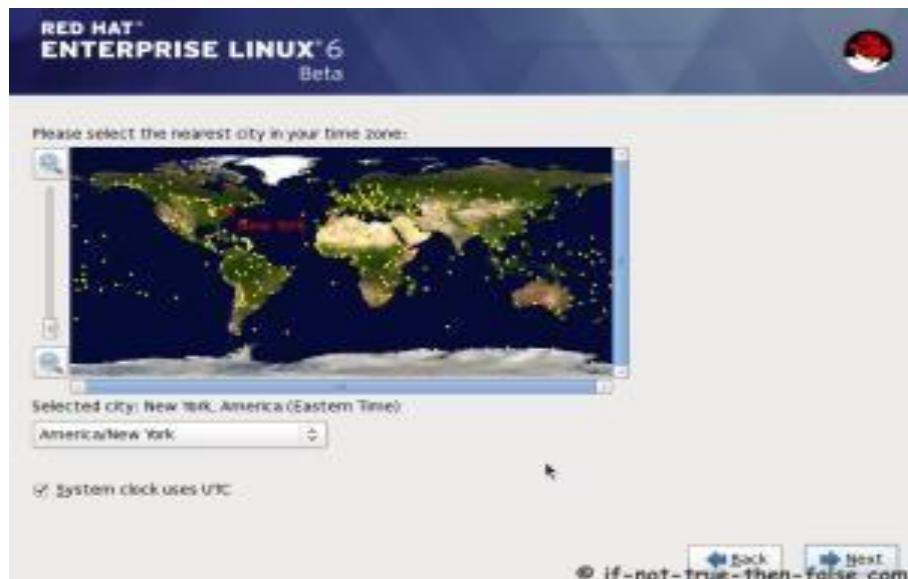
Step 11: Network Configuration

The installation program automatically detects any network devices you have and displays them in the **Network Devices** list. Here, eth0.



Step 12: Time Zone Configuration

1. Set your time zone by selecting the city closest to your computer's physical location.
Click on the map to zoom in to a particular geographical region of the world.
2. From here there are two ways for you to select your time zone:
 - a. Using your mouse, click on the interactive map to select a specific city (represented by a yellow dot). A red X appears indicating your selection.
 - b. You can also scroll through the list at the bottom of the screen to select your time zone. Using your mouse, click on a location to highlight your selection.



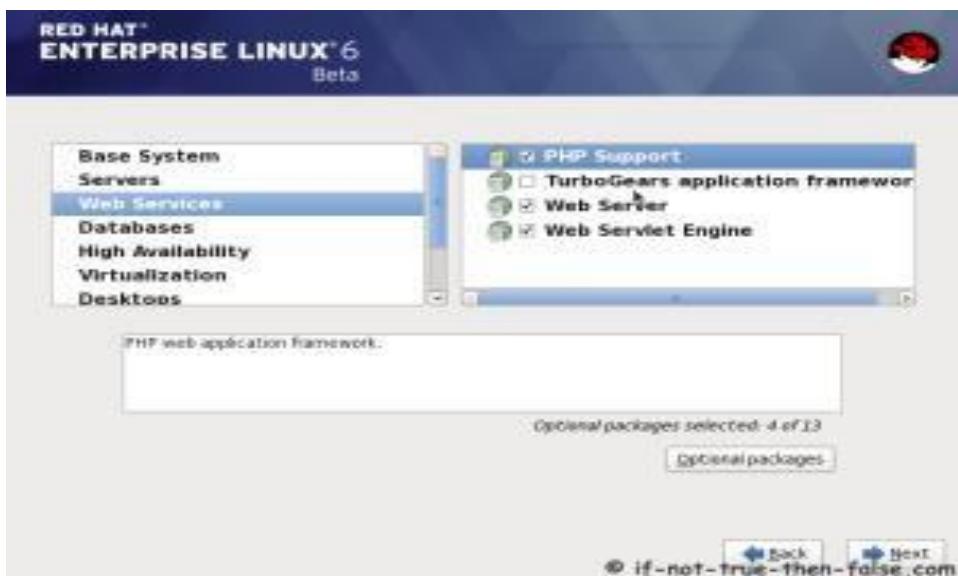
Step 13: Set Root Password

1. Setting up a root account and password is one of the most important steps during your installation.
2. The root account is used to install packages, and perform most system maintenance.
3. The root password must be at least six characters long; the password you type is not echoed to the screen.
4. You must enter the password twice; if the two passwords do not match, the installation program asks you to enter them again.



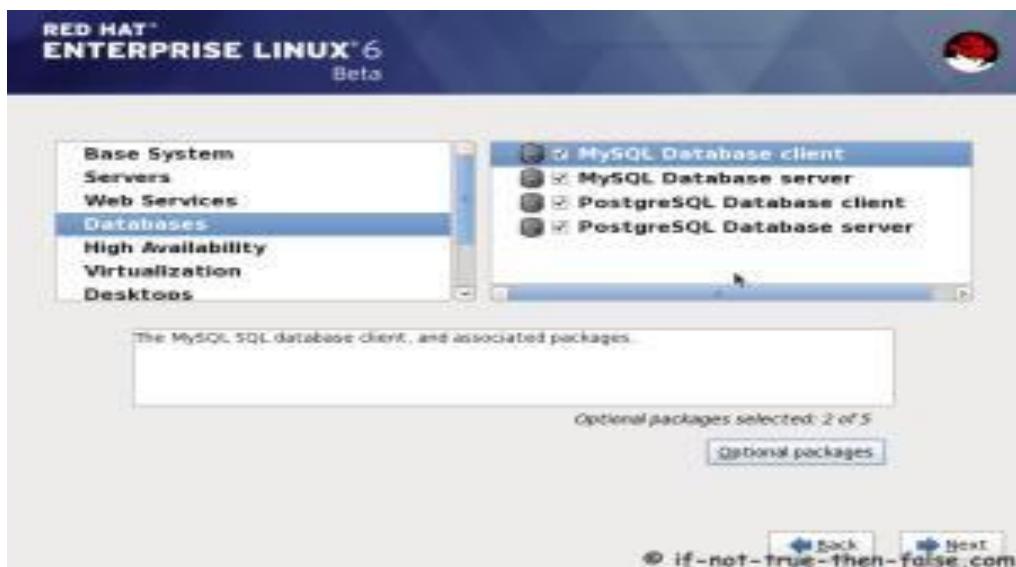
Step 14: Package Group Selection

1. The **Package Installation Defaults** screen appears and details the default package set for your Red Hat Enterprise Linux installation.
2. To customize your package set further, select the **Customize now** option on the screen.
3. Clicking **Next** takes you to the **Package Group Selection** screen.
4. You can select package groups, which group components together according to function (for example, **X Window System** and **Editors**), individual packages, or a combination of the two.



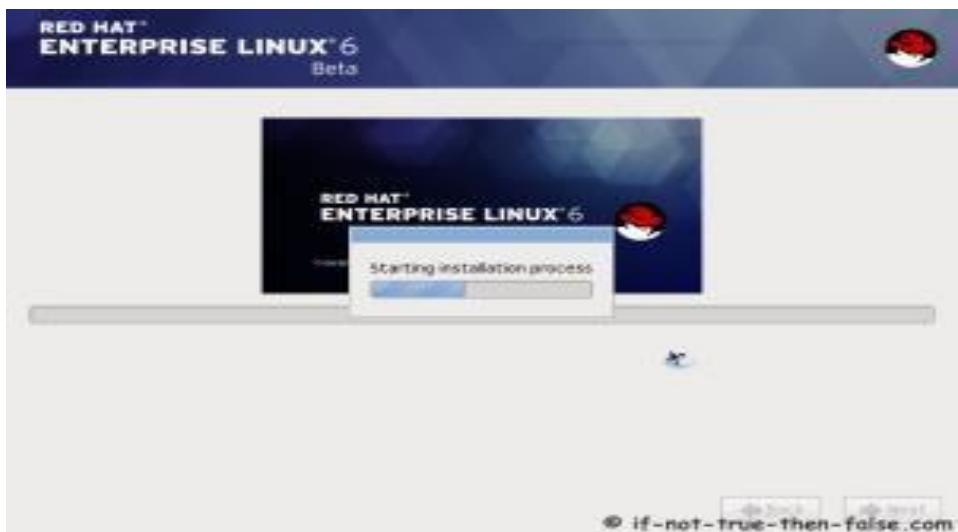
Step 15: Adding Optional Packages

Once a package group has been selected, if optional components are available you can click on **Optional packages** to view which packages are installed by default, and to add or remove optional packages from that group.



Step 16: Preparing to Install

A screen preparing you for the installation of Red Hat Enterprise Linux now appears.



Step 17: Installing Packages

At this point there is nothing left for you to do until all the packages have been installed. How quickly this happens depends on the number of packages you have selected and your computer's speed.



Step 18: Installation Complete

Your Red Hat Enterprise Linux installation is now complete!

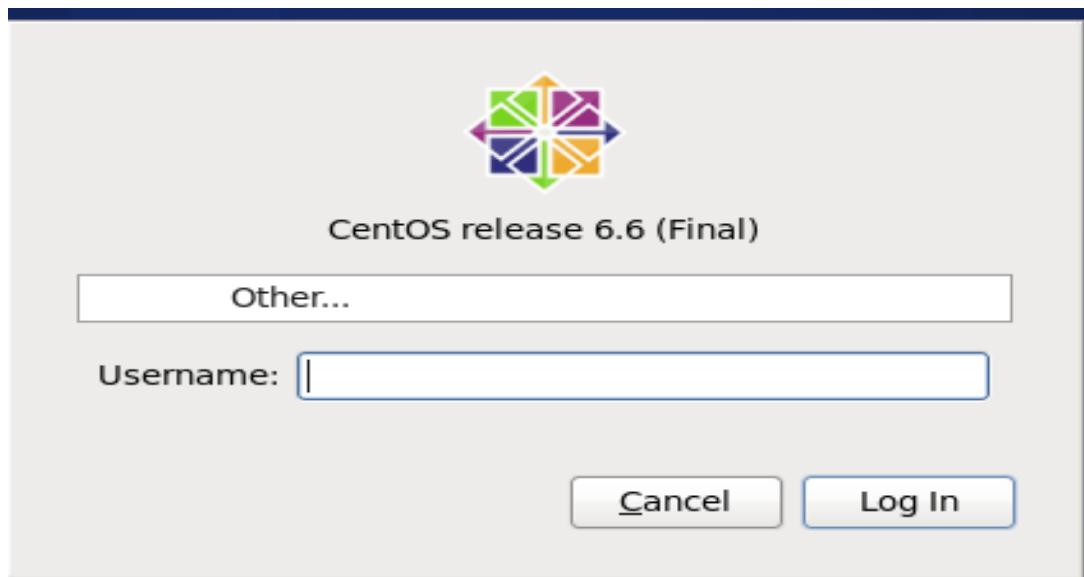


Practical No.: 2

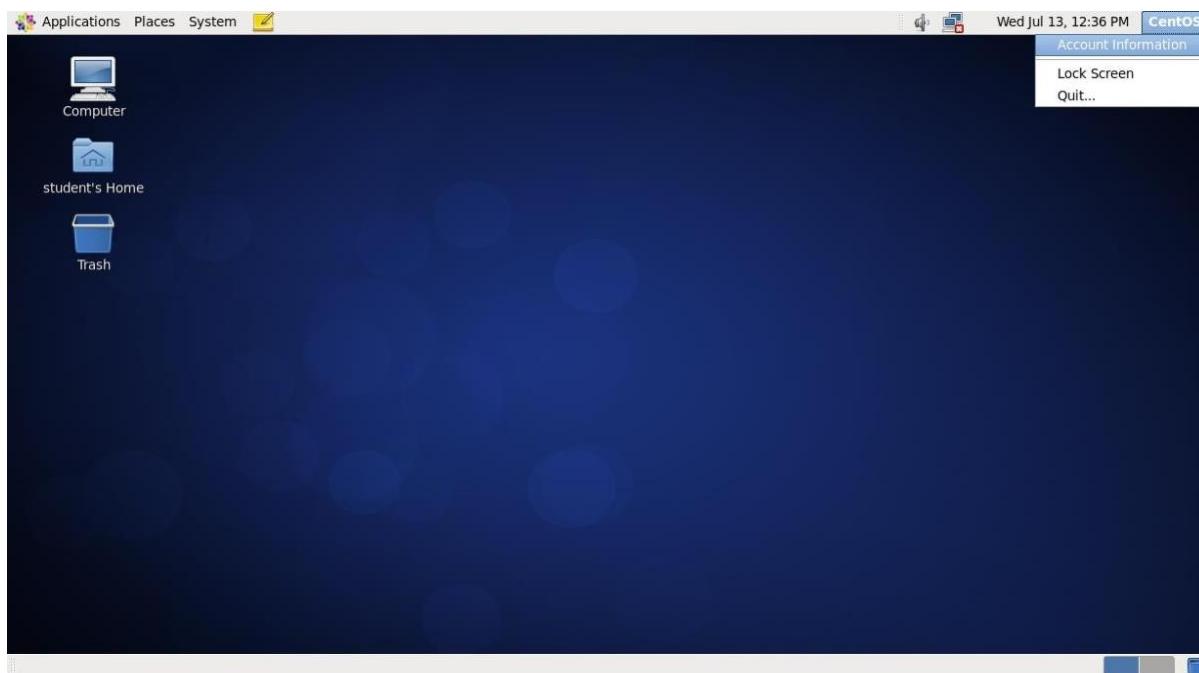
Aim: Graphical user Interface & command line interface

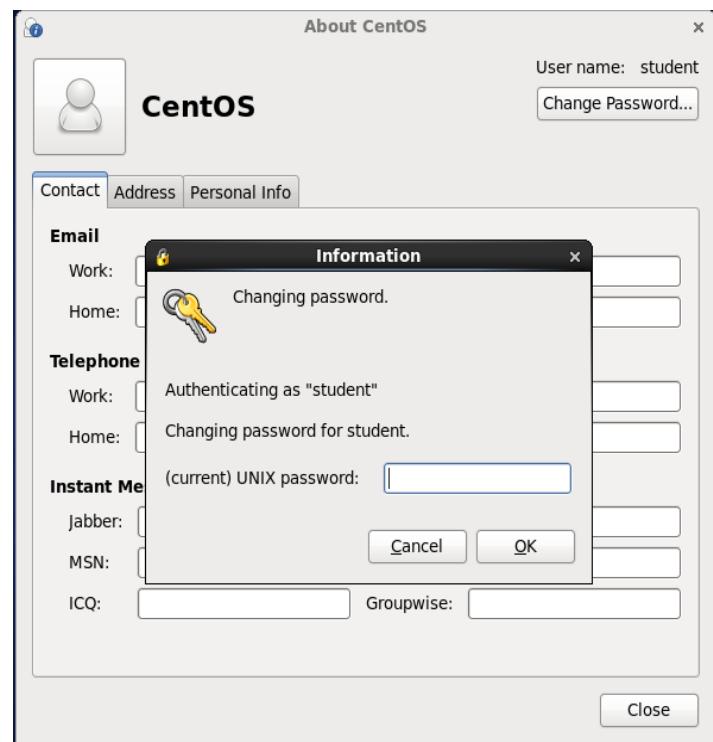
A. Exploring the graphical desktop:

1. In the login screen enter the login name —student and type the password.

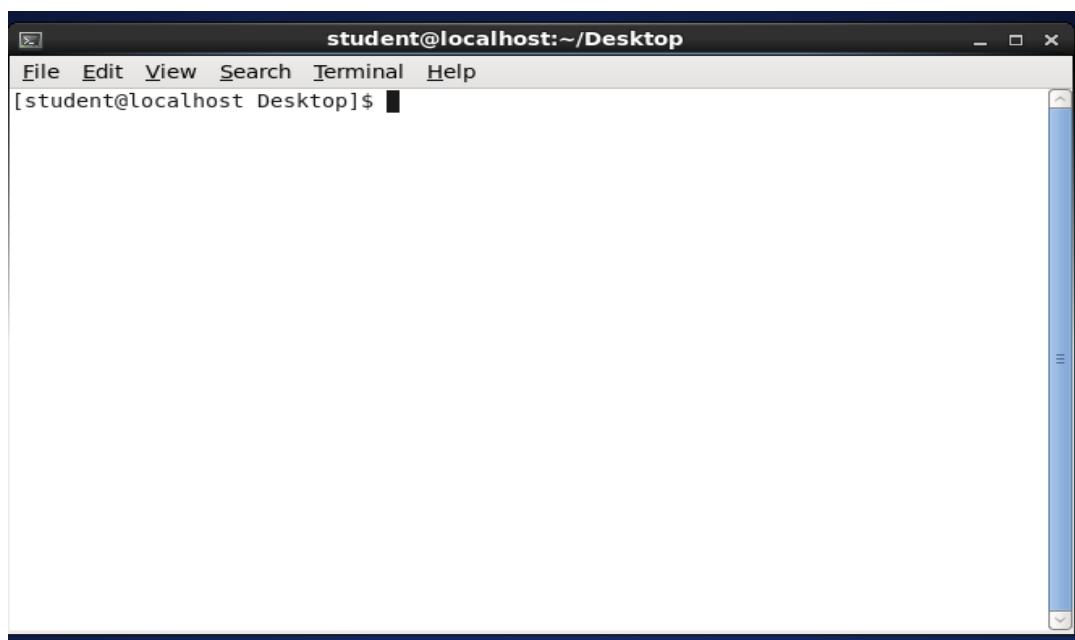
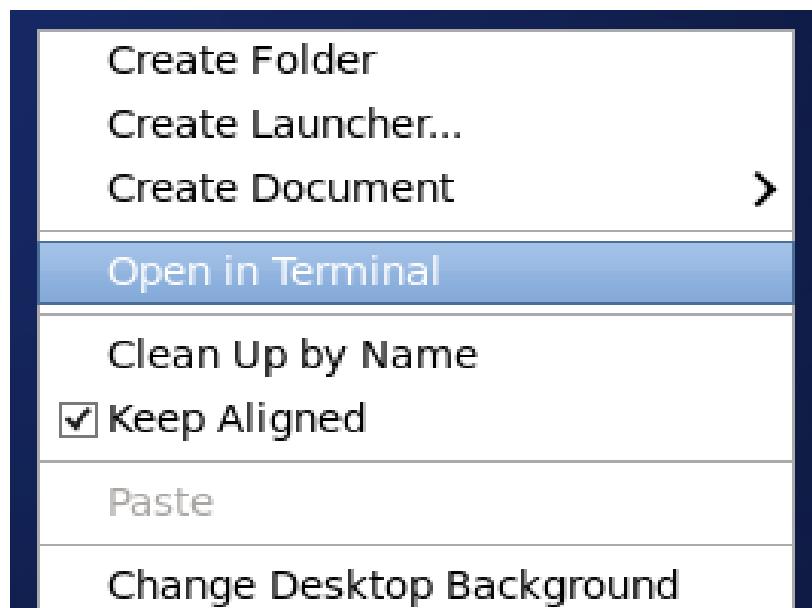


2. In the upper right corner you can see the name of the user who is currently logged in. Click this username to get access to different tools such as the tool that allows you to change the password.

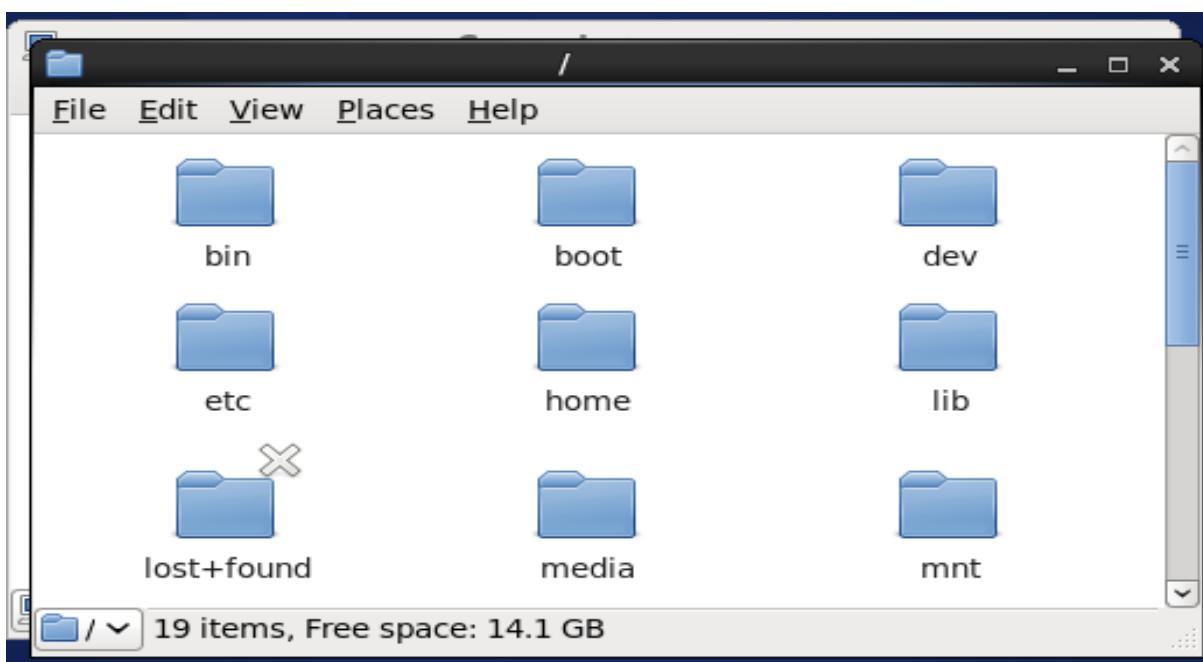
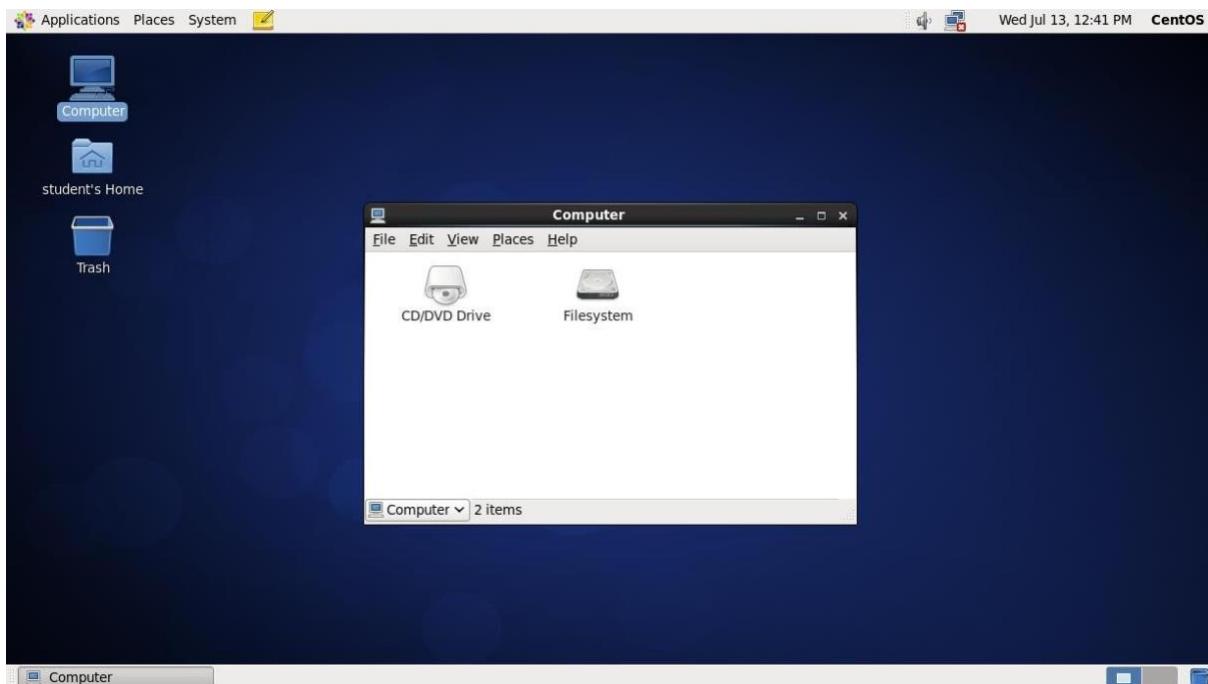


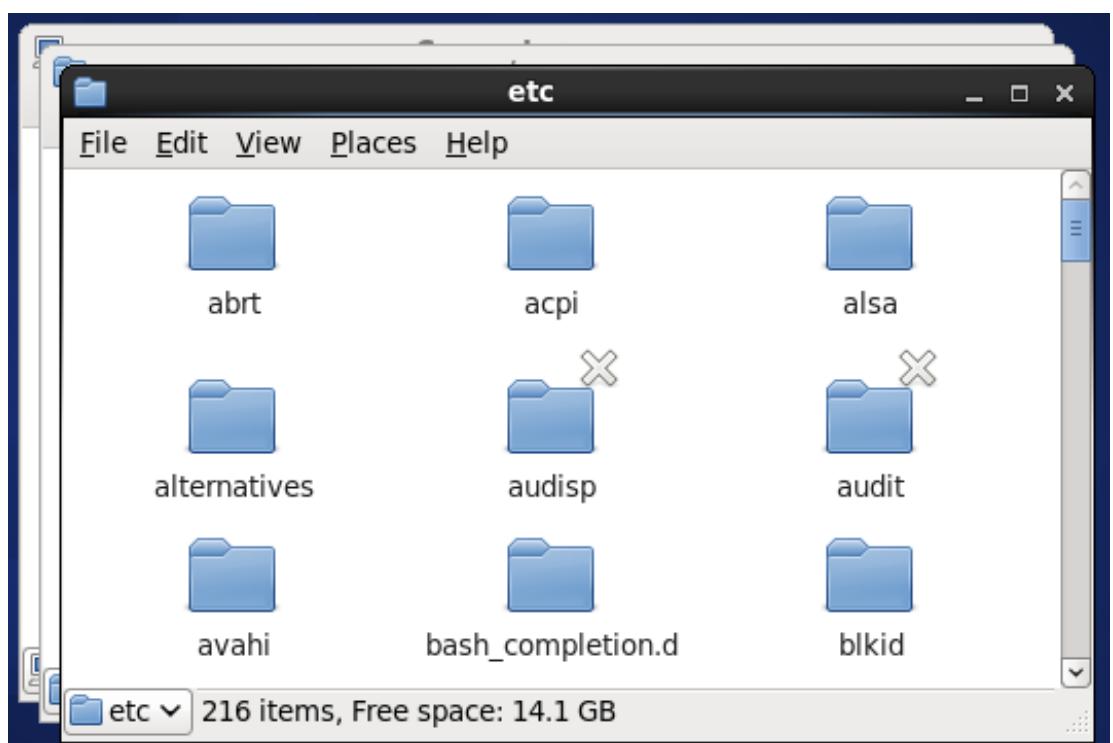


3. Right click the graphical desktop and select open in terminal next page type ls.

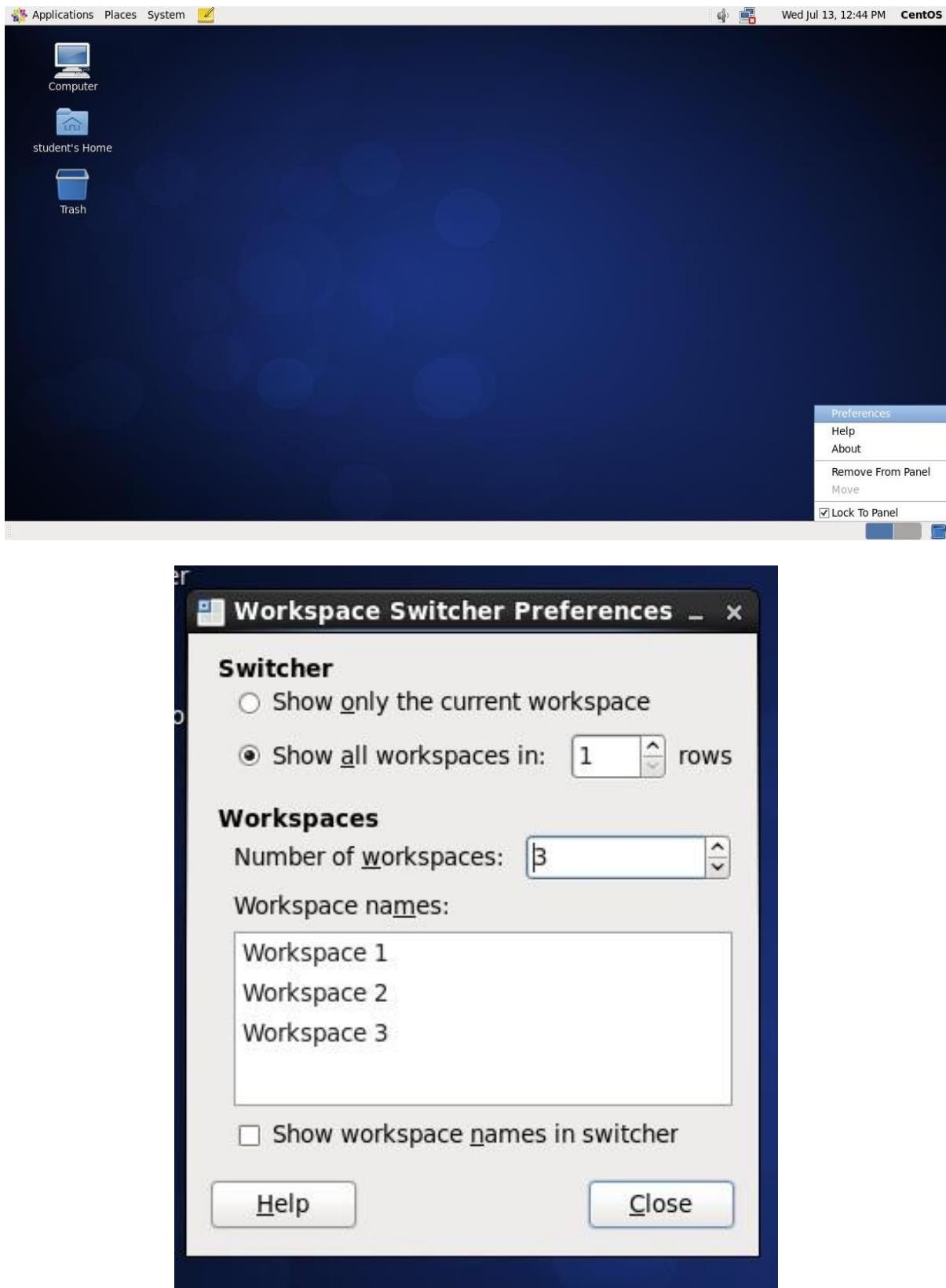


4. On the graphical desktop you will find an icon representing your home folder click on it navigate to /etc folder you will notice that as a normal user you have limited access to the folder.

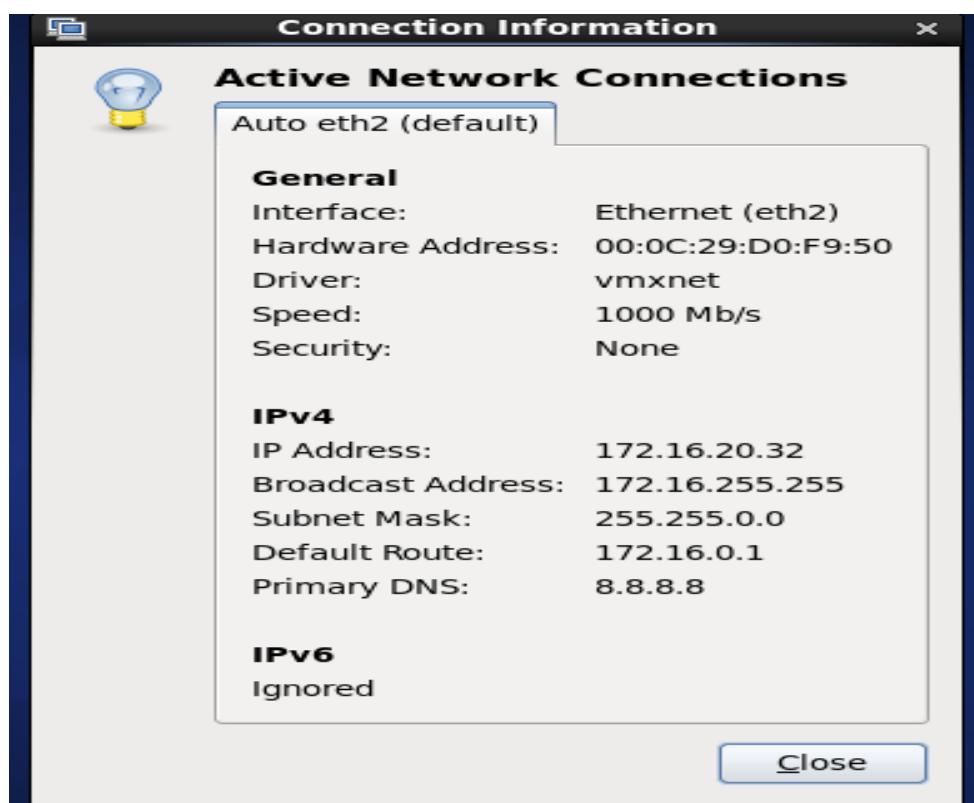
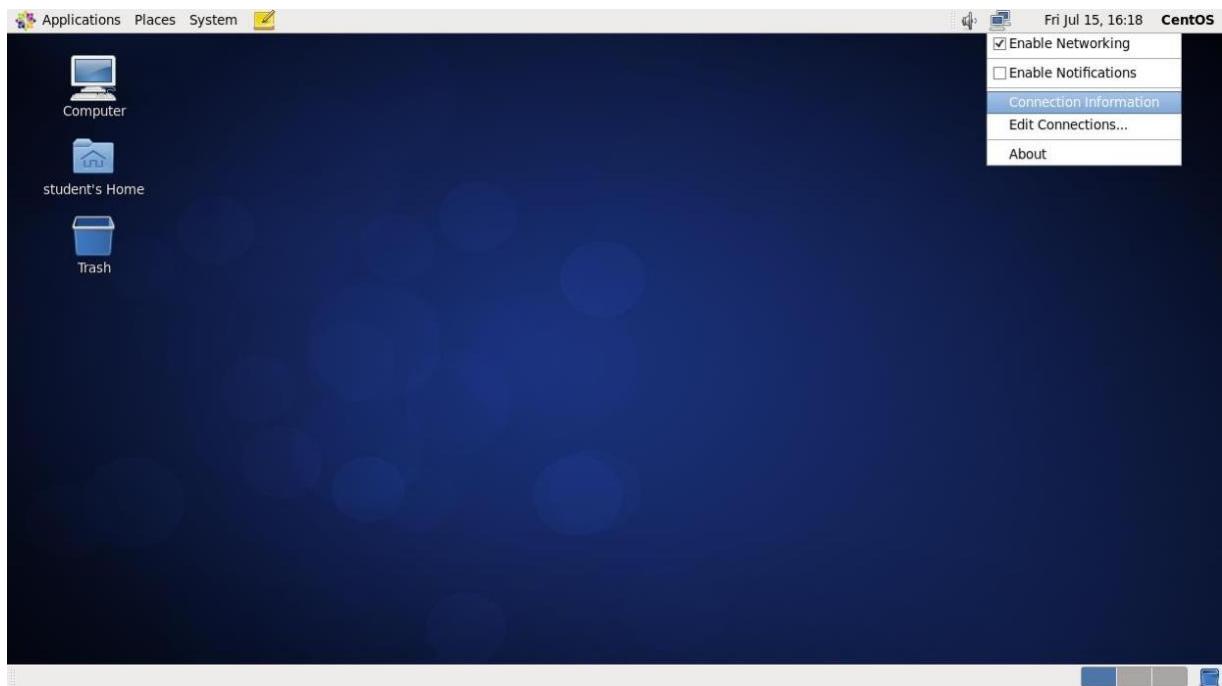




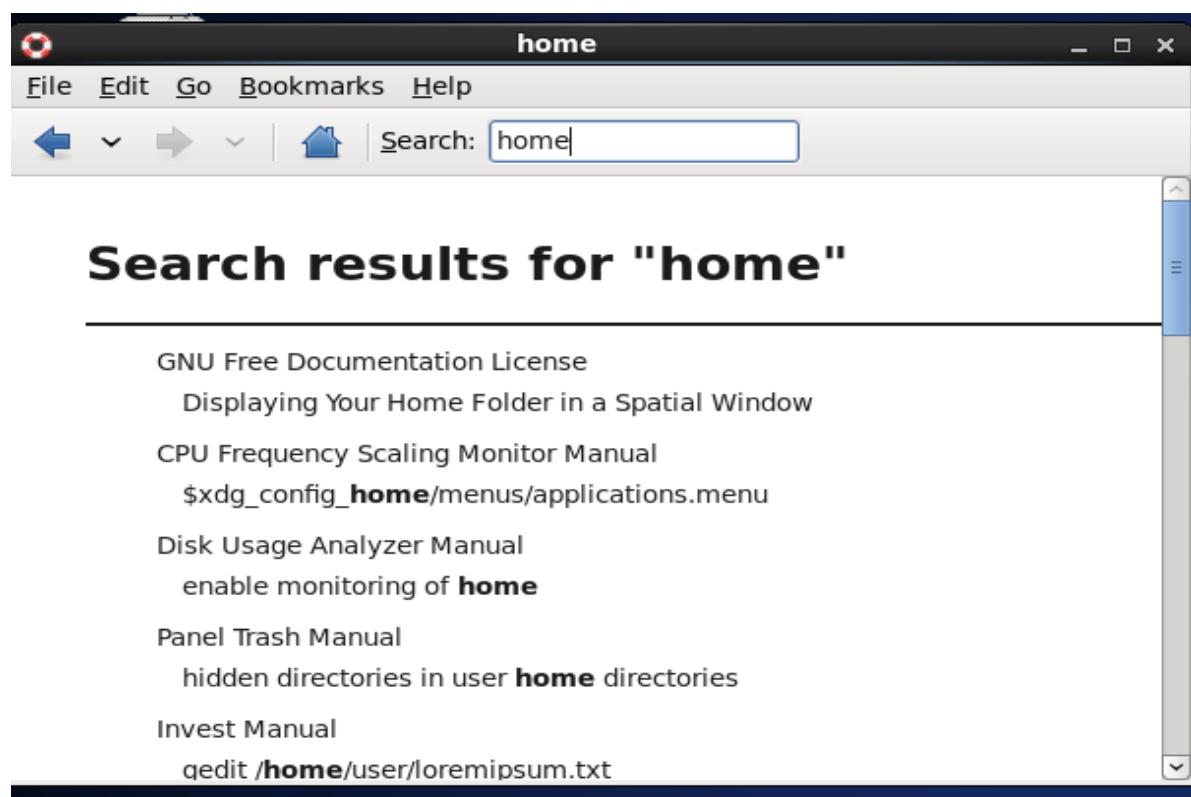
5. Right click a workspace icon and select the number of workspace you want to be displayed.



6. Right click the network manager icon in the upper right corner of desktop. Next click connection information to display information about current connection.

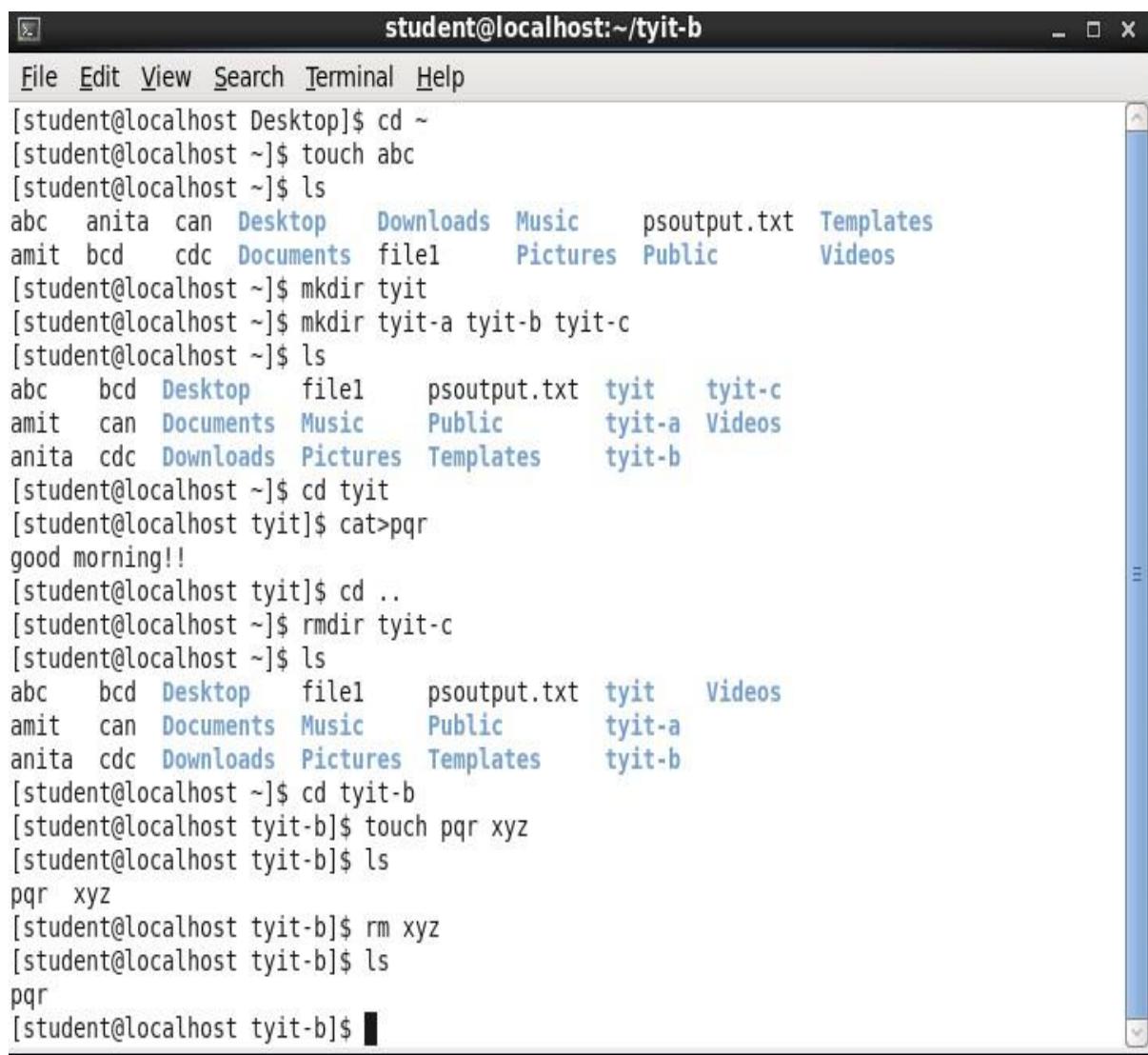


7. Press **F1** to show the help system type the keyboard you want to search for browse the results.



B. The Command line Interface.

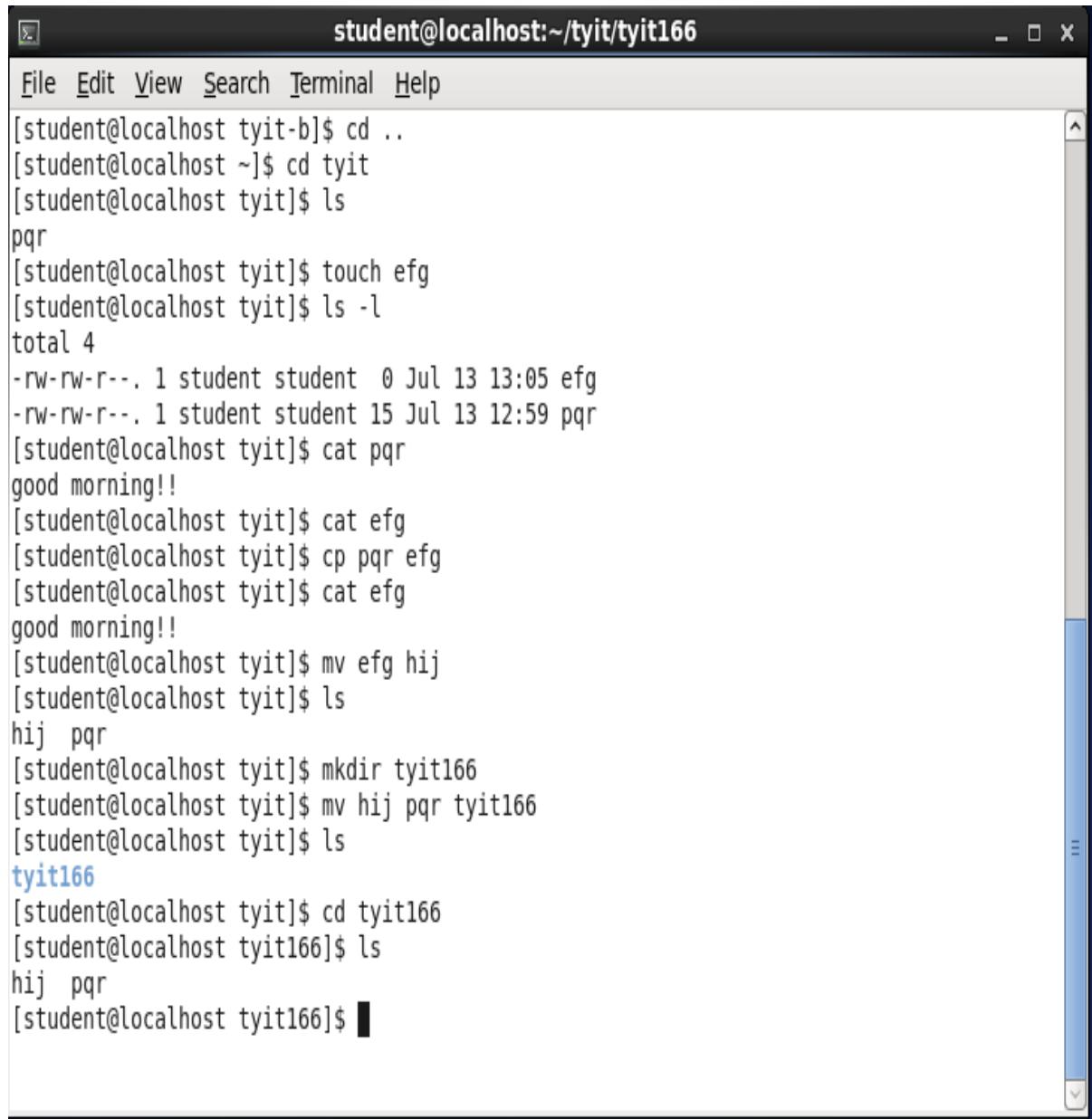
1. **cd**: cd command for the change directory it is an case sensitive.
2. **touch**: The touch command is the easiest way to create new, empty files, it is also used to change the timestamps.
3. **ls**: The ls command is command line utility for listing the contents of a directory or directories given to it via standard input, it writes results to standard output.
4. **mkdir**: The mkdir command in UNIX allow user to create directory or folders as they are referred to in same operating system.
5. **cat**: The cat command is one of the most frequently used command in linux, like operating system. Cat command allows to create single of multiple file
6. **rmdir**: This is important because once deleted, it is extremely difficult or impossible to recover deleted data on UNIX operating system.
7. **rm**: It is used to delete files from a file system. By default, it does not remove directories.



The screenshot shows a terminal window titled "student@localhost:~/tyit-b". The window contains the following command-line session:

```
[student@localhost Desktop]$ cd ~  
[student@localhost ~]$ touch abc  
[student@localhost ~]$ ls  
abc anita can Desktop Downloads Music psoutput.txt Templates  
amit bcd cdc Documents file1 Pictures Public Videos  
[student@localhost ~]$ mkdir tyit  
[student@localhost ~]$ mkdir tyit-a tyit-b tyit-c  
[student@localhost ~]$ ls  
abc bcd Desktop file1 psoutput.txt tyit tyit-c  
amit can Documents Music Public tyit-a Videos  
anita cdc Downloads Pictures Templates tyit-b  
[student@localhost ~]$ cd tyit  
[student@localhost tyit]$ cat>pqr  
good morning!!  
[student@localhost tyit]$ cd ..  
[student@localhost ~]$ rmdir tyit-c  
[student@localhost ~]$ ls  
abc bcd Desktop file1 psoutput.txt tyit Videos  
amit can Documents Music Public tyit-a  
anita cdc Downloads Pictures Templates tyit-b  
[student@localhost ~]$ cd tyit-b  
[student@localhost tyit-b]$ touch pqr xyz  
[student@localhost tyit-b]$ ls  
pqr xyz  
[student@localhost tyit-b]$ rm xyz  
[student@localhost tyit-b]$ ls  
pqr  
[student@localhost tyit-b]$
```

8. **cp**: cp command in linux which is stands for copy this command is used to copy files or group or files or group of files or directory.
9. **mv**: The mv command is a command line utility that moves file or directories from one place to another.



A screenshot of a terminal window titled "student@localhost:~/tyit/tyit166". The window has a standard title bar with icons for minimize, maximize, and close. Below the title bar is a menu bar with "File", "Edit", "View", "Search", "Terminal", and "Help". The main area of the terminal shows the following command-line session:

```
[student@localhost tyit-b]$ cd ..
[student@localhost ~]$ cd tyit
[student@localhost tyit]$ ls
pqr
[student@localhost tyit]$ touch efg
[student@localhost tyit]$ ls -l
total 4
-rw-rw-r--. 1 student student 0 Jul 13 13:05 efg
-rw-rw-r--. 1 student student 15 Jul 13 12:59 pqr
[student@localhost tyit]$ cat pqr
good morning!!
[student@localhost tyit]$ cat efg
[student@localhost tyit]$ cp pqr efg
[student@localhost tyit]$ cat efg
good morning!!
[student@localhost tyit]$ mv efg hij
[student@localhost tyit]$ ls
hij pqr
[student@localhost tyit]$ mkdir tyit166
[student@localhost tyit]$ mv hij pqr tyit166
[student@localhost tyit]$ ls
tyit166
[student@localhost tyit]$ cd tyit166
[student@localhost tyit166]$ ls
hij pqr
[student@localhost tyit166]$
```

10. **pwd**: pwd command (Present working directory) writes the full path name of the current working directory to the standard output.
11. **chmod**: The command name chmod stands for the [change mode] and it is used to define the way of file can be.

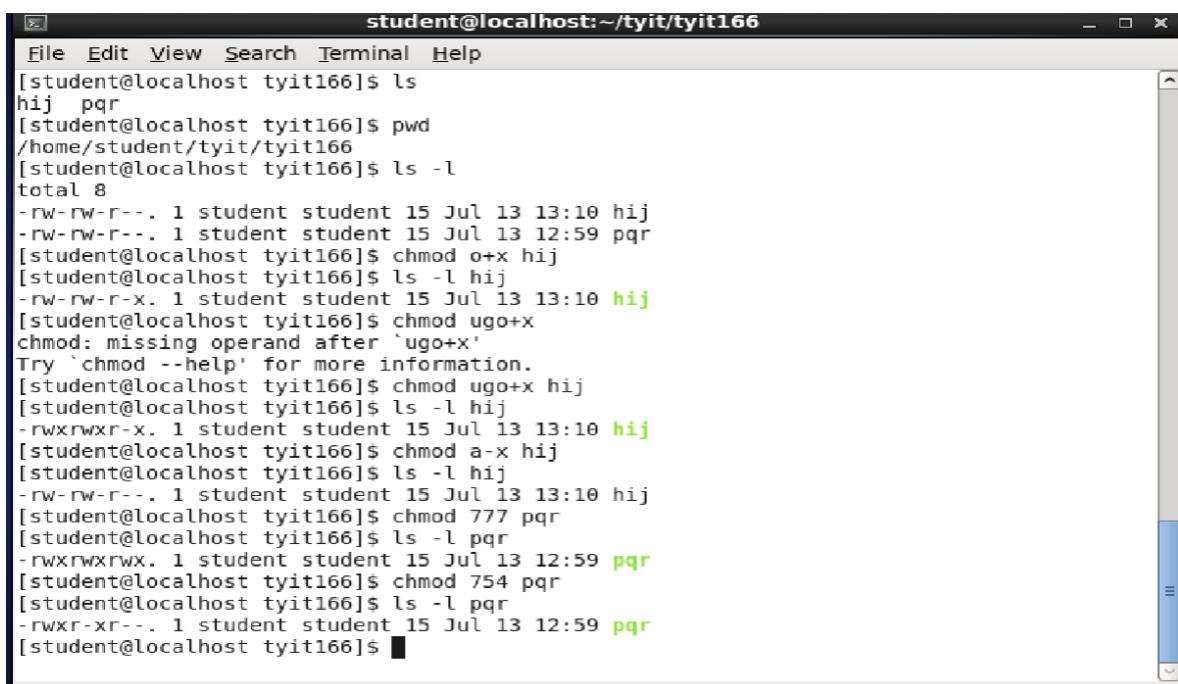
Two types of permissions:

- a) Absolute permissions: Use numbers to represent file permission (the method most commonly used to set permissions) when you change permission by using the absolute mode to represent permission for each triode by Oral number

Category	Permissions
u (user)	r (read)
g (group)	w (write)
o (other)	x (execute)

- b) Relative permission: Use a combination of letters of symbolic to add or remove permissions.

Octal	Permissions U.G.O	Significance
0	---	No permission
1	--x	Execute only
2	-w-	Write only
3	-wx	Write and Execute
4	r--	Read only
5	r-x	Read and Execute
6	r w-	Read and Write
7	rwx	All Permissions

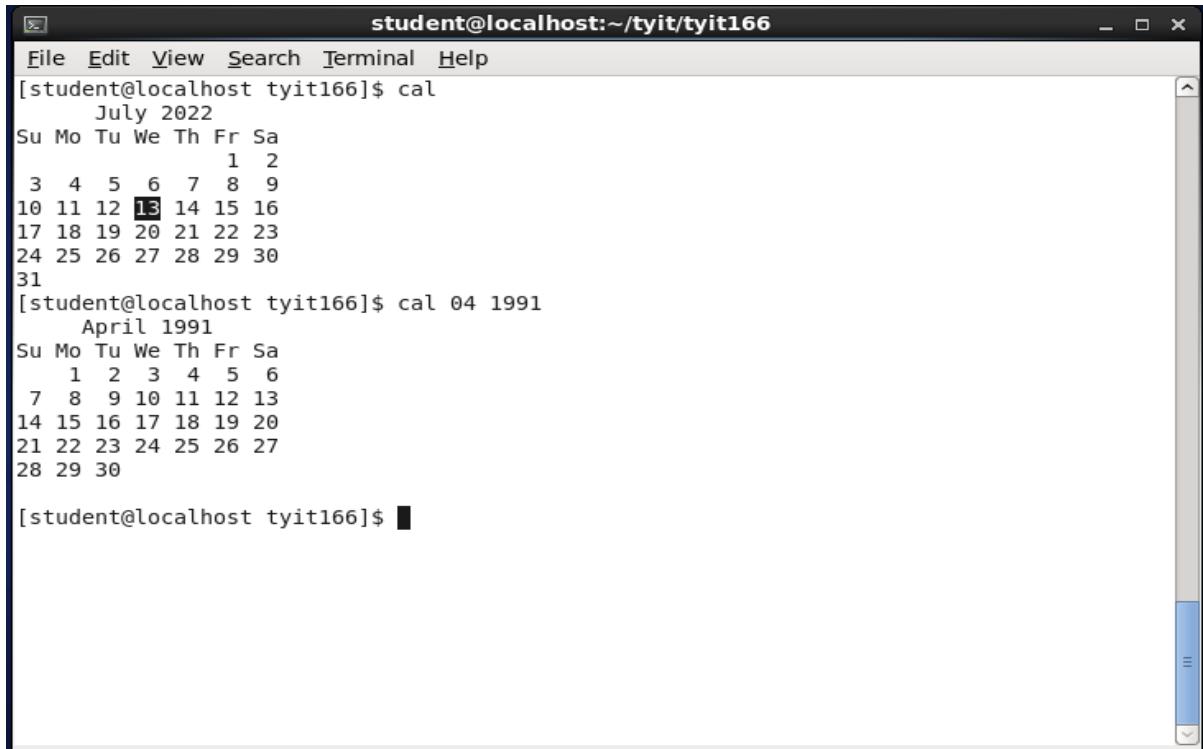


```

student@localhost:~/tyit/tyit166
File Edit View Search Terminal Help
[student@localhost tyit166]$ ls
hij pqr
[student@localhost tyit166]$ pwd
/home/student/tyit/tyit166
[student@localhost tyit166]$ ls -l
total 8
-rw-rw-r-- 1 student student 15 Jul 13 13:10 hij
-rw-rw-r-- 1 student student 15 Jul 13 12:59 pqr
[student@localhost tyit166]$ chmod o+x hij
[student@localhost tyit166]$ ls -l hij
-rw-rw-r-x. 1 student student 15 Jul 13 13:10 hij
[student@localhost tyit166]$ chmod ugo+x
chmod: missing operand after `ugo+x'
Try `chmod --help' for more information.
[student@localhost tyit166]$ chmod ugo+x hij
[student@localhost tyit166]$ ls -l hij
-rwxrwxr-x. 1 student student 15 Jul 13 13:10 hij
[student@localhost tyit166]$ chmod a-x hij
[student@localhost tyit166]$ ls -l hij
-rw-rw-r-- 1 student student 15 Jul 13 13:10 hij
[student@localhost tyit166]$ chmod 777 pqr
[student@localhost tyit166]$ ls -l pqr
-rwxrwxrwx. 1 student student 15 Jul 13 12:59 pqr
[student@localhost tyit166]$ chmod 754 pqr
[student@localhost tyit166]$ ls -l pqr
-rwxr-xr--- 1 student student 15 Jul 13 12:59 pqr
[student@localhost tyit166]$ 

```

12. **cal**: Calender on linux command line. Sometimes it shows that many excellent and convenient command line tools are forgotten when they are replaced by graphical tools.

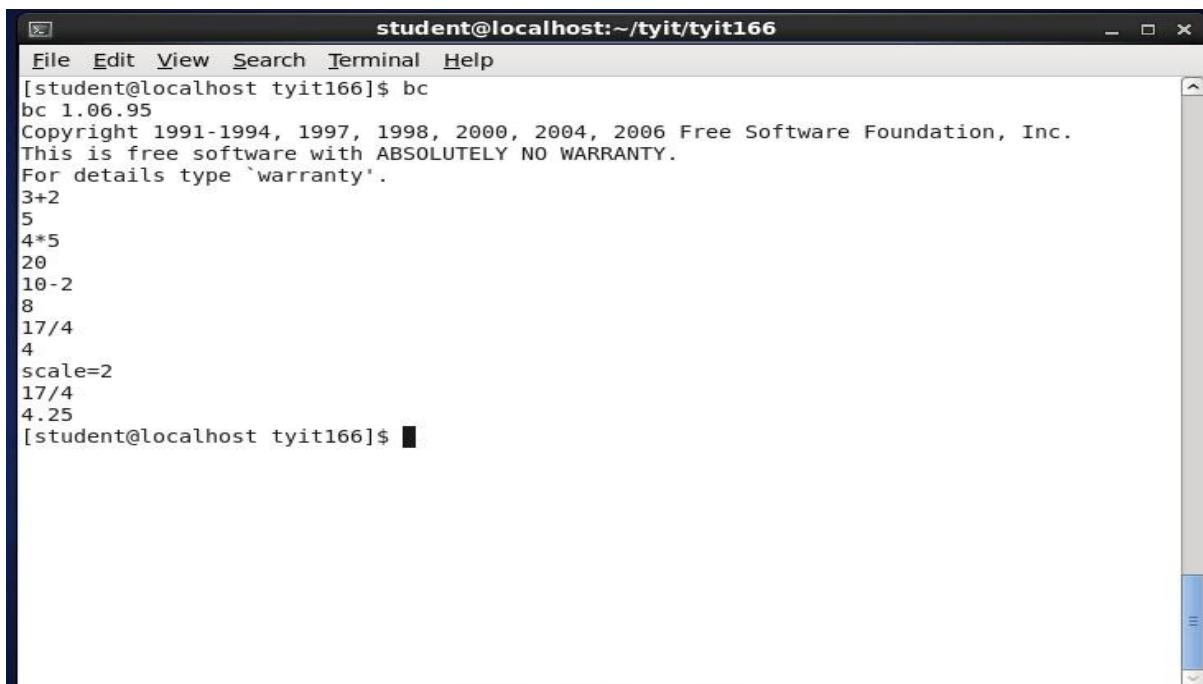


The screenshot shows a terminal window titled "student@localhost:~/tyit/tyit166". The user runs the command "cal" which displays the calendar for July 2022. The output shows the days of the week from Sunday to Saturday, with July 13th highlighted. Below this, the user runs "cal 04 1991" which shows the calendar for April 1991, also with the 13th highlighted.

```
student@localhost:~/tyit/tyit166$ cal
July 2022
Su Mo Tu We Th Fr Sa
      1  2
3  4  5  6  7  8  9
10 11 12 13 14 15 16
17 18 19 20 21 22 23
24 25 26 27 28 29 30
31
[student@localhost tyit166]$ cal 04 1991
April 1991
Su Mo Tu We Th Fr Sa
      1  2  3  4  5  6
7  8  9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30

[student@localhost tyit166]$
```

13. **bc** (The Calculator): It is used for a command line calculator which is similar to basic calculator, by using which we can do basic mathematical calculations. When you invoke bc without arguments, the cursor keeps on blinking and nothing seems to happen key in the following arithmetic and then use [**ctrl + d**] to quit bc.

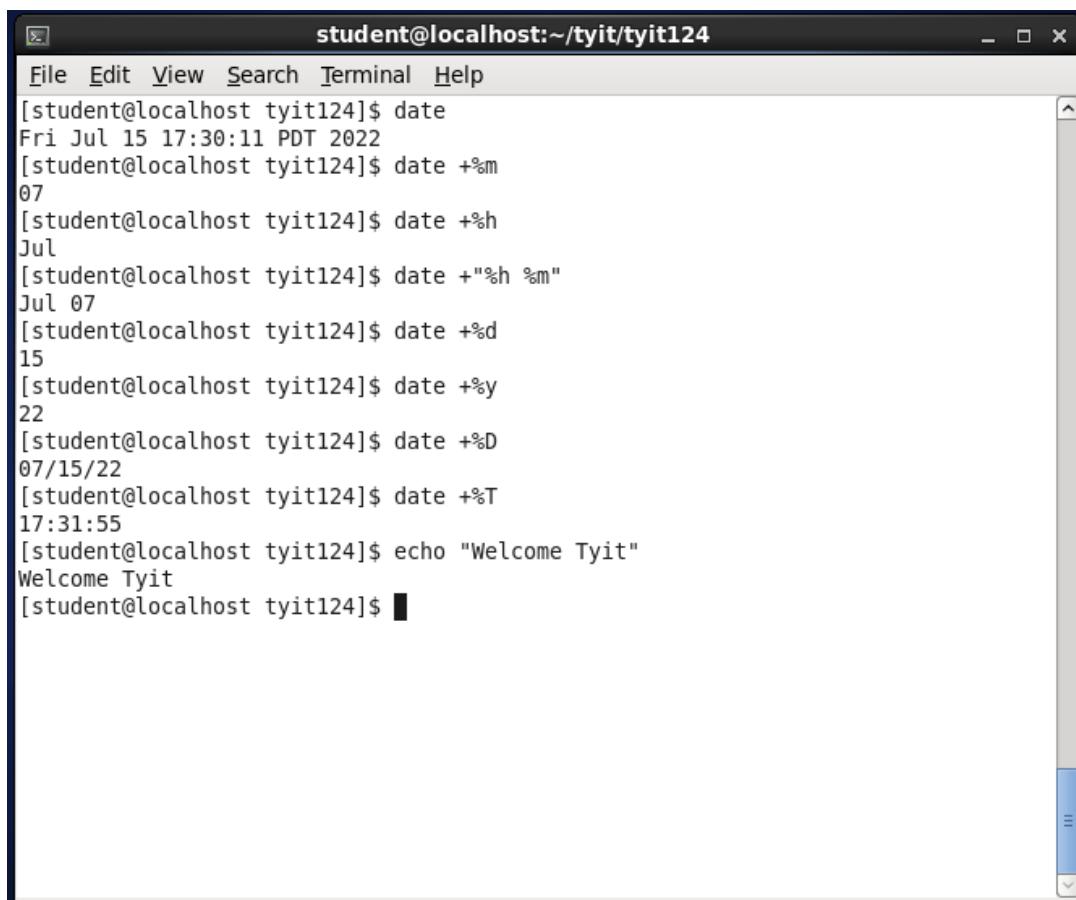


The screenshot shows a terminal window titled "student@localhost:~/tyit/tyit166". The user runs the command "bc" which starts a command-line calculator. They enter several arithmetic expressions: "3+2", "4*5", "20", "10-2", "8", "17/4", "4", "scale=2", "17/4", and "4.25". After each expression, the calculator prints the result or a prompt. The user then presses **ctrl + d** to quit the calculator.

```
student@localhost:~/tyit/tyit166$ bc
bc 1.06.95
Copyright 1991-1994, 1997, 1998, 2000, 2004, 2006 Free Software Foundation, Inc.
This is free software with ABSOLUTELY NO WARRANTY.
For details type `warranty'.
3+2
5
4*5
20
10-2
8
17/4
4
scale=2
17/4
4.25
[student@localhost tyit166]$
```

14. **date**: date command is also used to set the date & time of the system, by default the date command displays the date in the time zone on which UNIX.

date + %m: It shows the current month in number.
date + %M: It shows the minute's.
date + %h: It shows the month.
date + "%h %m": It shows a month in number also.
date + %d: It shows date.
date + %y: It shows current year.
date + %D: It shows full date.
date + %T: It shows current time.



A screenshot of a terminal window titled "student@localhost:~/tyit/tyit124". The window contains the following text:

```
student@localhost:~/tyit/tyit124
File Edit View Search Terminal Help
[student@localhost tyit124]$ date
Fri Jul 15 17:30:11 PDT 2022
[student@localhost tyit124]$ date +%m
07
[student@localhost tyit124]$ date +%h
Jul
[student@localhost tyit124]$ date +"%h %m"
Jul 07
[student@localhost tyit124]$ date +%d
15
[student@localhost tyit124]$ date +%y
22
[student@localhost tyit124]$ date +%D
07/15/22
[student@localhost tyit124]$ date +%T
17:31:55
[student@localhost tyit124]$ echo "Welcome Tyit"
Welcome Tyit
[student@localhost tyit124]$
```

15. **head**: Command is used for reads the first ten lines of any text given to it as an input and write them to standard output.
16. **tail**: The tail command line utility for outputting the last ten lines given to it as input and write them to standard output.
17. **tac**: tac command is partially the reverse version of cat command (also spelled backward)

The screenshot shows a terminal window titled "student@localhost:~/tyit/tyit166". The window contains the following text:

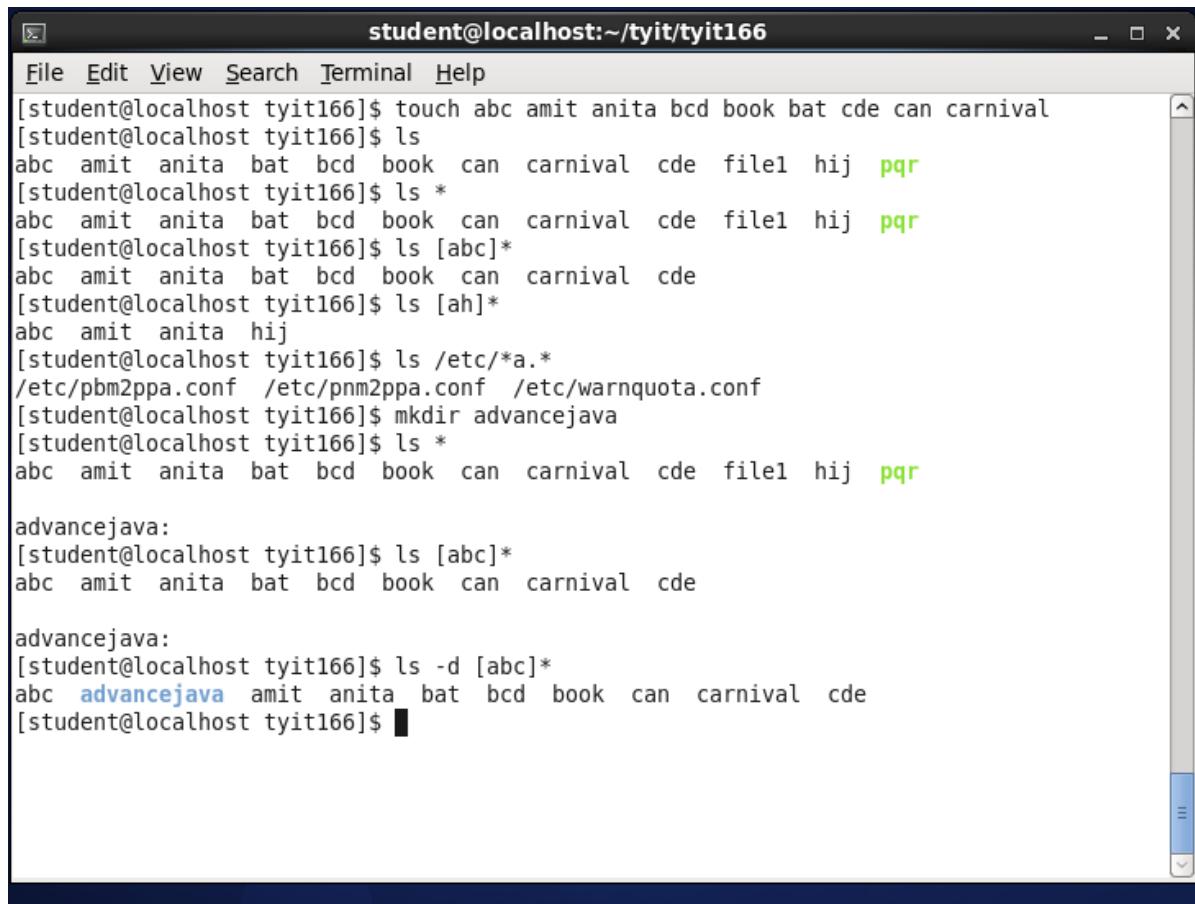
```
File Edit View Search Terminal Help
[student@localhost tyit166]$ cat>file1
Hello!!
My name is uddesh
I am currently pursuing in TY.Bsc.IT
I like to cycling
I want to become a web devloper
That's from my side
[student@localhost tyit166]$ head -n 2 file1
Hello!!
My name is uddesh
[student@localhost tyit166]$ tail -l 4 file1
tail: invalid option -- 'l'
Try `tail --help' for more information.
[student@localhost tyit166]$ tail -n 4 file1
I am currently pursuing in TY.Bsc.IT
I like to cycling
I want to become a web devloper
That's from my side
[student@localhost tyit166]$ tac file1
That's from my side
I want to become a web devloper
I like to cycling
I am currently pursuing in TY.Bsc.IT
My name is uddesh
Hello!!
[student@localhost tyit166]$
```

ls*: This command is used for listing all contents of a directory.

ls [abc]*: This command is used for showing all the directories that start from the a,b,c letters.

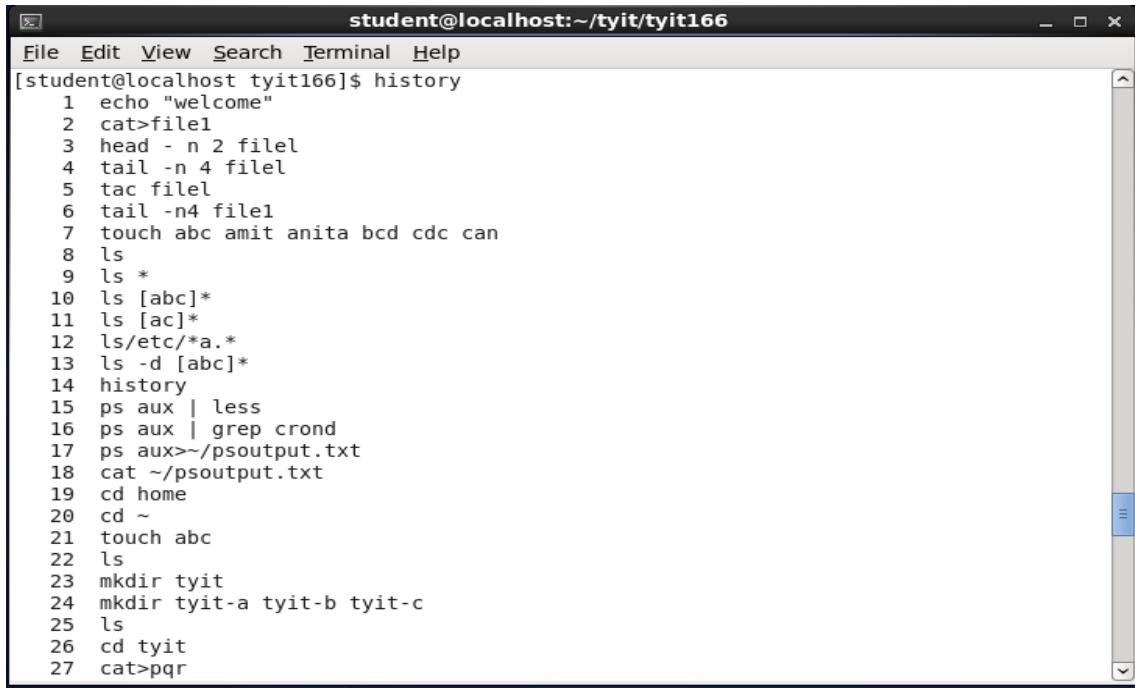
ls /etc/*.*: This command is used for the directory which can end with `_a` or after `_a` anything word or before `(.)` also.

ls -d: It can be used for displaying all the directories.



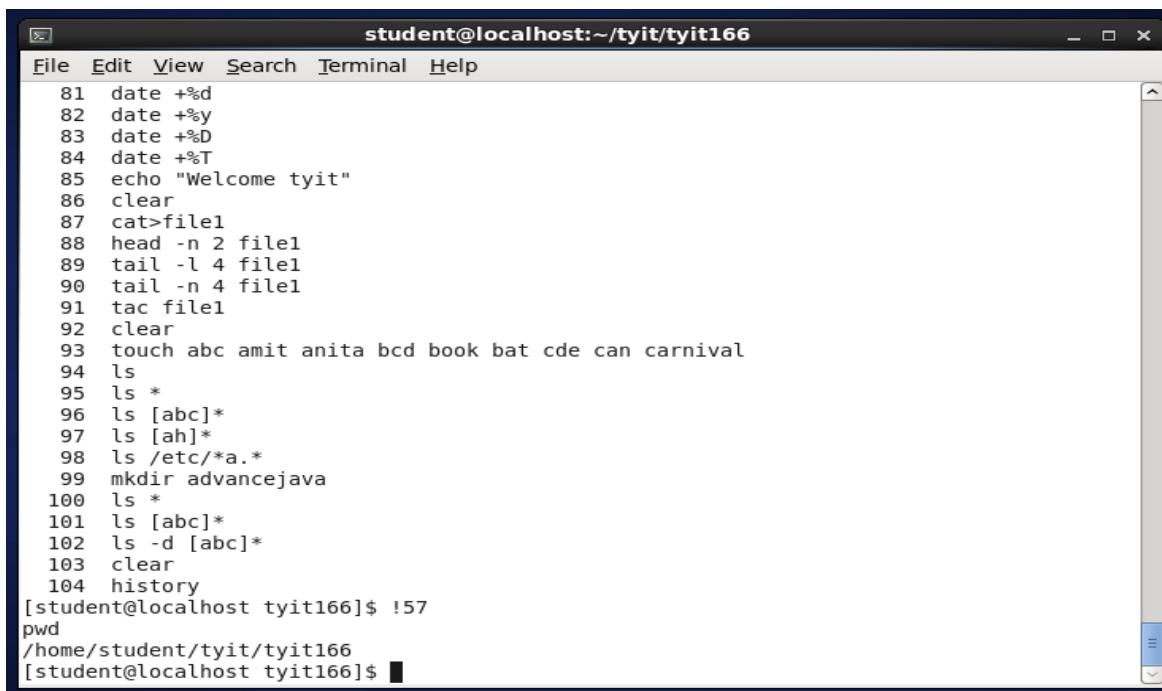
```
student@localhost:~/tyit/tyit166
File Edit View Search Terminal Help
[student@localhost tyit166]$ touch abc amit anita bcd book bat cde can carnival
[student@localhost tyit166]$ ls
abc amit anita bat bcd book can carnival cde file1 hij pqr
[student@localhost tyit166]$ ls *
abc amit anita bat bcd book can carnival cde file1 hij pqr
[student@localhost tyit166]$ ls [abc]*
abc amit anita bat bcd book can carnival cde
[student@localhost tyit166]$ ls [ah]*
abc amit anita hij
[student@localhost tyit166]$ ls /etc/*a.*
/etc/pbm2ppa.conf /etc/pnm2ppa.conf /etc/warnquota.conf
[student@localhost tyit166]$ mkdir advancejava
[student@localhost tyit166]$ ls *
abc amit anita bat bcd book can carnival cde file1 hij pqr
advancejava:
[student@localhost tyit166]$ ls [abc]*
abc amit anita bat bcd book can carnival cde
advancejava:
[student@localhost tyit166]$ ls -d [abc]*
abc advancejava amit anita bat bcd book can carnival cde
[student@localhost tyit166]$
```

18. **history**: This command is used for showing all the recent / last commands that have been 1000 commands of any user are rembered.



```
student@localhost:~/tyit/tyit166
File Edit View Search Terminal Help
[student@localhost tyit166]$ history
1 echo "welcome"
2 cat>file1
3 head - n 2 file1
4 tail -n 4 file1
5 tac file1
6 tail -n4 file1
7 touch abc amit anita bcd cdc can
8 ls
9 ls *
10 ls [abc]*
11 ls [ac]*
12 ls/etc/*a.-
13 ls -d [abc]*
14 history
15 ps aux | less
16 ps aux | grep crond
17 ps aux>/psoutput.txt
18 cat ~/psoutput.txt
19 cd home
20 cd ~
21 touch abc
22 ls
23 mkdir tyit
24 mkdir tyit-a tyit-b tyit-c
25 ls
26 cd tyit
27 cat>pqr
```

!: History command shows a list of all the recently used commands. From this list, a command can also be restarted. For ex: if you see command 35 in the list of commands, you can easily return this command by using it's number preceded by an exclamation mark (!) or !35 in this example



```
student@localhost:~/tyit/tyit166
File Edit View Search Terminal Help
81 date +%d
82 date +%y
83 date +%D
84 date +%T
85 echo "Welcome tyit"
86 clear
87 cat>file1
88 head -n 2 file1
89 tail -l 4 file1
90 tail -n 4 file1
91 tac file1
92 clear
93 touch abc amit anita bcd book bat cde can carnival
94 ls
95 ls *
96 ls [abc]*
97 ls [ah]*
98 ls /etc/*a.-
99 mkdir advancejava
100 ls *
101 ls [abc]*
102 ls -d [abc]*
103 clear
104 history
[student@localhost tyit166]$ !57
pwd
/home/student/tyit/tyit166
[student@localhost tyit166]$ █
```

Piping:

ps aux | less: This command provides a list of all the processes that are currently running on your computer. The `-t` option shows output as ten so that you can browse it page by page.

ps aux | grep crond: This command is used to detect only the lines that contain the text `crond`.

Redirection:

ps aux > ~/ps_output.txt: This command is used to detect only the lines that contain the text `crond`.

cat ~/output.txt: This command is used for viewing the output file of the above command i.e. `ps aux > ~/output.txt`

```
student@localhost:~/tyit/tyit166
File Edit View Search Terminal Help
[student@localhost tyit166]$ ps aux | less
[1]+ Stopped      ps aux | less
[student@localhost tyit166]$ ps aux | grep crond
root    1978  0.0  0.1  6036  1308 ?        Ss   12:20  0:00 crond
student 25431  0.0  0.0  4356   728 pts/0   S+   14:09  0:00 grep crond
[student@localhost tyit166]$ ps aux > ~/output.txt
[student@localhost tyit166]$ cat ~/output.txt
USER      PID %CPU %MEM    VSZ   RSS TTY      STAT START  TIME COMMAND
root        1  0.0  0.1   2896  1424 ?        Ss   12:20  0:01 /sbin/init
root        2  0.0  0.0     0     0 ?        S    12:20  0:00 [kthreadd]
root        3  0.0  0.0     0     0 ?        S    12:20  0:00 [migration/0]
root        4  0.0  0.0     0     0 ?        S    12:20  0:00 [ksoftirqd/0]
root        5  0.0  0.0     0     0 ?        S    12:20  0:00 [stopper/0]
root        6  0.0  0.0     0     0 ?        S    12:20  0:00 [watchdog/0]
root        7  0.0  0.0     0     0 ?        S    12:20  0:00 [events/0]
root        8  0.0  0.0     0     0 ?        S    12:20  0:00 [cgroup]
root        9  0.0  0.0     0     0 ?        S    12:20  0:00 [khelper]
root       10  0.0  0.0     0     0 ?        S    12:20  0:00 [netns]
root       11  0.0  0.0     0     0 ?        S    12:20  0:00 [async/mgr]
root       12  0.0  0.0     0     0 ?        S    12:20  0:00 [pm]
root       13  0.0  0.0     0     0 ?        S    12:20  0:00 [sync_supers]
root       14  0.0  0.0     0     0 ?        S    12:20  0:00 [bdi-default]
root       15  0.0  0.0     0     0 ?        S    12:20  0:00 [kintegrityd/0]
root       16  0.0  0.0     0     0 ?        S    12:20  0:00 [kblockd/0]
root       17  0.0  0.0     0     0 ?        S    12:20  0:00 [kacpid]
root       18  0.0  0.0     0     0 ?        S    12:20  0:00 [kacpi_notify]
root       19  0.0  0.0     0     0 ?        S    12:20  0:00 [kacpi_hotplug]
```

Practical 3

Aim: Working with Users, Groups & Permissions.

A. Creating users and groups:

Step 1: Open a root shell and use the command useradd user1 to create user & passwd user1 to give the password to user1.

```
[root@localhost Desktop]# cd /
[root@localhost /]# useradd user2
[root@localhost /]# passwd user2
Changing password for user user2.
New password:
BAD PASSWORD: it is based on a dictionary word
BAD PASSWORD: is too simple
Retype new password:
passwd: all authentication tokens updated successfully.
[root@localhost /]# useradd user3
[root@localhost /]# passwd user3
Changing password for user user3.
New password:
BAD PASSWORD: it is based on a dictionary word
BAD PASSWORD: is too simple
Retype new password:
passwd: all authentication tokens updated successfully.
[root@localhost /]# groupadd sales
[root@localhost /]# groupadd account
[root@localhost /]# id user2
uid=505(user2) gid=505(user2) groups=505(user2)
[root@localhost /]# usermod -aG sales user2
[root@localhost /]# id user2
uid=505(user2) gid=505(user2) groups=505(user2),507(sales)
[root@localhost /]# █
```

Step 2: Use the command useradd user2 to create user & passwd user2 to give the password to user2.

Step 3: Create two groups '_sales' & '_account' using groupadd command.

Step 4: Use userid user1 to use current group assessment for user1.

Step 5: Use usermod -aG sales user1 to add user to group sales as secondary group verify this by using id user1.

```
root@localhost:/
File Edit View Search Terminal Help
You have new mail in /var/spool/mail/root
[root@localhost /]# id user3
uid=506(user3) gid=506(user3) groups=506(user3)
[root@localhost /]# usermod -aG sales user3
[root@localhost /]# id user3
uid=506(user3) gid=506(user3) groups=506(user3),507(sales)
[root@localhost /]# usermod -aG account user3
You have new mail in /var/spool/mail/root
[root@localhost /]# usermod -aG account user2
[root@localhost /]# id user3
uid=506(user3) gid=506(user3) groups=506(user3),507(sales),508(account)
[root@localhost /]# id user2
uid=505(user2) gid=505(user2) groups=505(user2),507(sales),508(account)
[root@localhost /]# █
```

Step 6: Repeat the step 4 & step 5 for user 2.

Step 7: Repeat step 5 to add users user1 & user2 to the group account and verify by using id cmd.

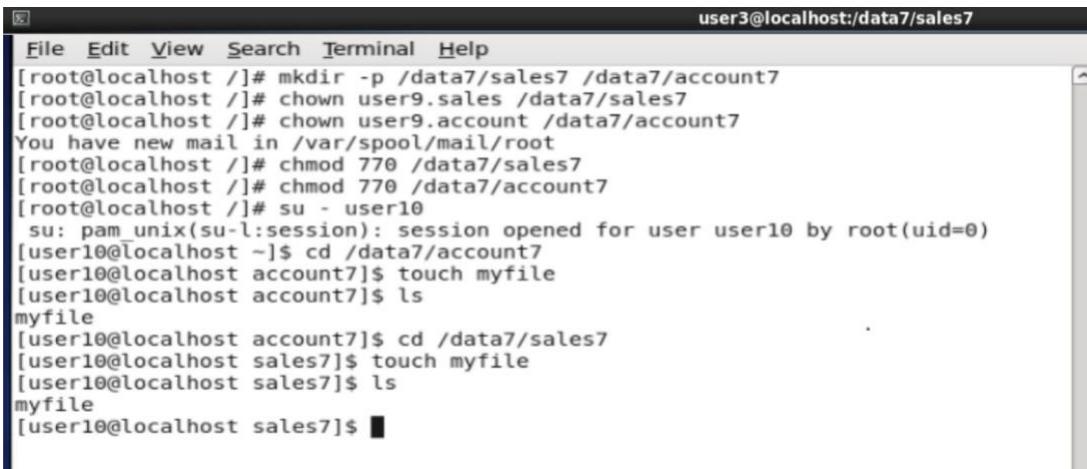
```
root@localhost:/
```

File Edit View Search Terminal Help

```
You have new mail in /var/spool/mail/root
[root@localhost /]# id user3
uid=506(user3) gid=506(user3) groups=506(user3)
[root@localhost /]# usermod -aG sales user3
[root@localhost /]# id user3
uid=506(user3) gid=506(user3) groups=506(user3),507(sales)
[root@localhost /]# usermod -aG account user3
You have new mail in /var/spool/mail/root
[root@localhost /]# usermod -aG account user2
[root@localhost /]# id user3
uid=506(user3) gid=506(user3) groups=506(user3),507(sales),508(account)
[root@localhost /]# id user2
uid=505(user2) gid=505(user2) groups=505(user2),507(sales),508(account)
[root@localhost /]# 
```

B. Setting Permissions for users & groups:

Step 1: From root shell, type mkdir -p /data/sales/data/account.



```
user3@localhost:/data7/sales7
File Edit View Search Terminal Help
[root@localhost /]# mkdir -p /data7/sales7 /data7/account7
[root@localhost /]# chown user9.sales /data7/sales7
[root@localhost /]# chown user9.account /data7/account7
You have new mail in /var/spool/mail/root
[root@localhost /]# chmod 770 /data7/sales7
[root@localhost /]# chmod 770 /data7/account7
[root@localhost /]# su - user10
su: pam_unix(su-l:session): session opened for user user10 by root(uid=0)
[user10@localhost ~]$ cd /data7/account7
[user10@localhost account7]$ touch myfile
[user10@localhost account7]$ ls
myfile
[user10@localhost account7]$ cd /data7/sales7
[user10@localhost sales7]$ touch myfile
[user10@localhost sales7]$ ls
myfile
[user10@localhost sales7]$
```

Step 2: Before setting the permissions, change the owner of directory using chown user1. sales/data/sales + chown user1 account/data/account.

Step 3: Set the permission to enable user & group owner to write file to this directory deny

all access for others chmod 770/data/sales chmod 770/data/sales

Step 4: Use su -user2 to become user2 and change directory to /data/account use touch emptyfile to create file in this directory.

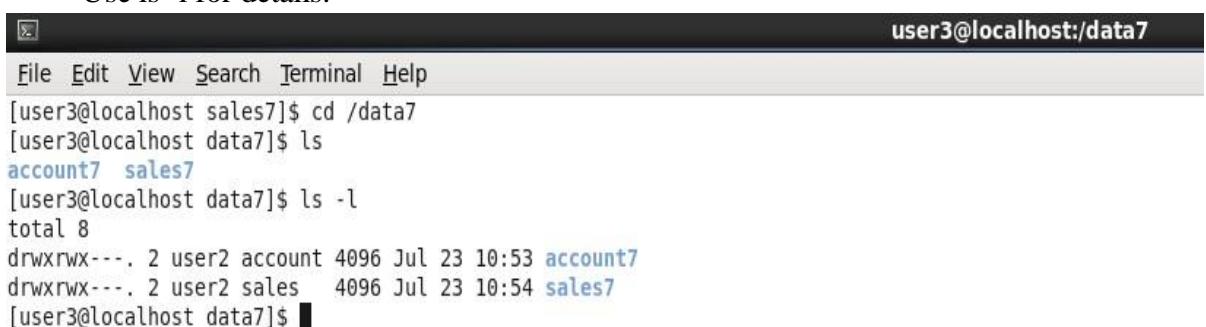
Step 5: Still as user2, we cd /data/sales & touch emptyfile to create a file in this directory.

Step 6: Open the file /etc/passwd using vi editor & check user1 & user2 are created having uid and gid.

Step 7: Open file /etc/group using vi editor and check groups sales & account are created and which users they belong to.

Step 8: Open a new terminal

- Use ls to check the directory data is created.
- Change directory to data & check it's content.
- Use ls -l for details.



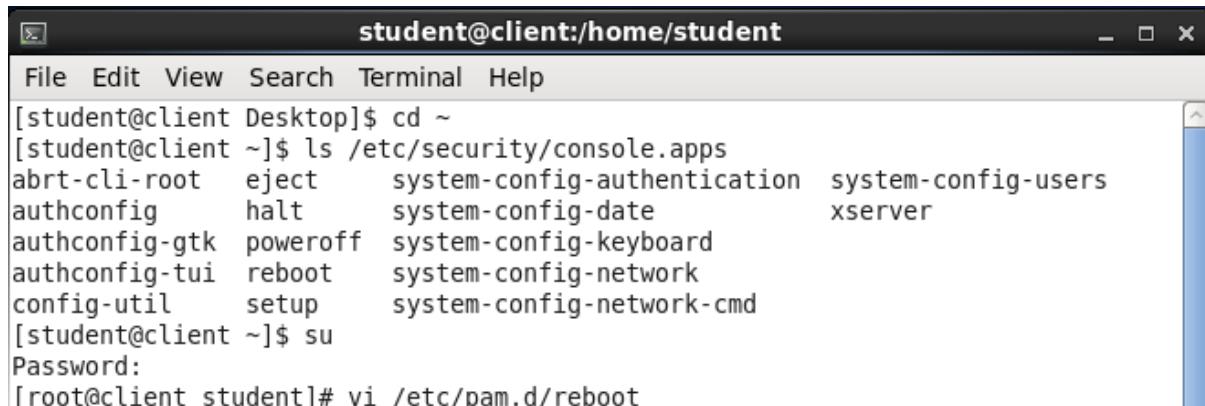
```
user3@localhost:/data7
File Edit View Search Terminal Help
[user3@localhost sales7]$ cd /data7
[user3@localhost data7]$ ls
account7 sales7
[user3@localhost data7]$ ls -l
total 8
drwxrwx---. 2 user2 account 4096 Jul 23 10:53 account7
drwxrwx---. 2 user2 sales 4096 Jul 23 10:54 sales7
[user3@localhost data7]$
```

Practical 4

Aim: Working with Console, RPM and YUM.

A. Working with Console

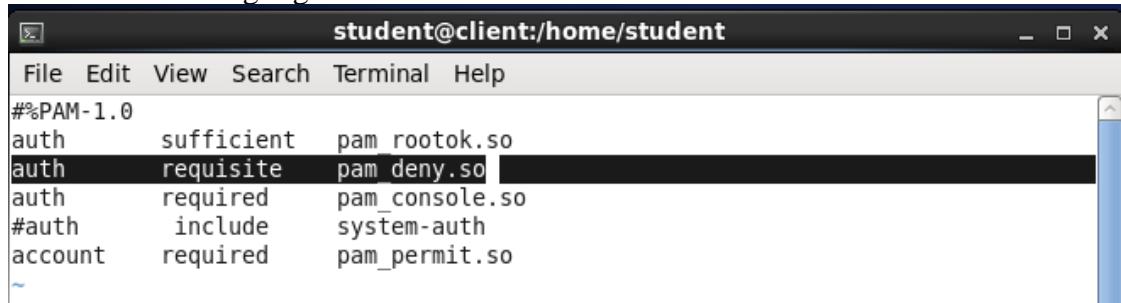
1. Console



student@client:~/home/student

```
[student@client Desktop]$ cd ~  
[student@client ~]$ ls /etc/security/console.apps  
abrt-cli-root  eject      system-config-authentication  system-config-users  
authconfig     halt       system-config-date          xserver  
authconfig-gtk poweroff   system-config-keyboard  
authconfig-tui reboot    system-config-network  
config-util    setup     system-config-network-cmd  
[student@client ~]$ su  
Password:  
[root@client student]# vi /etc/pam.d/reboot
```

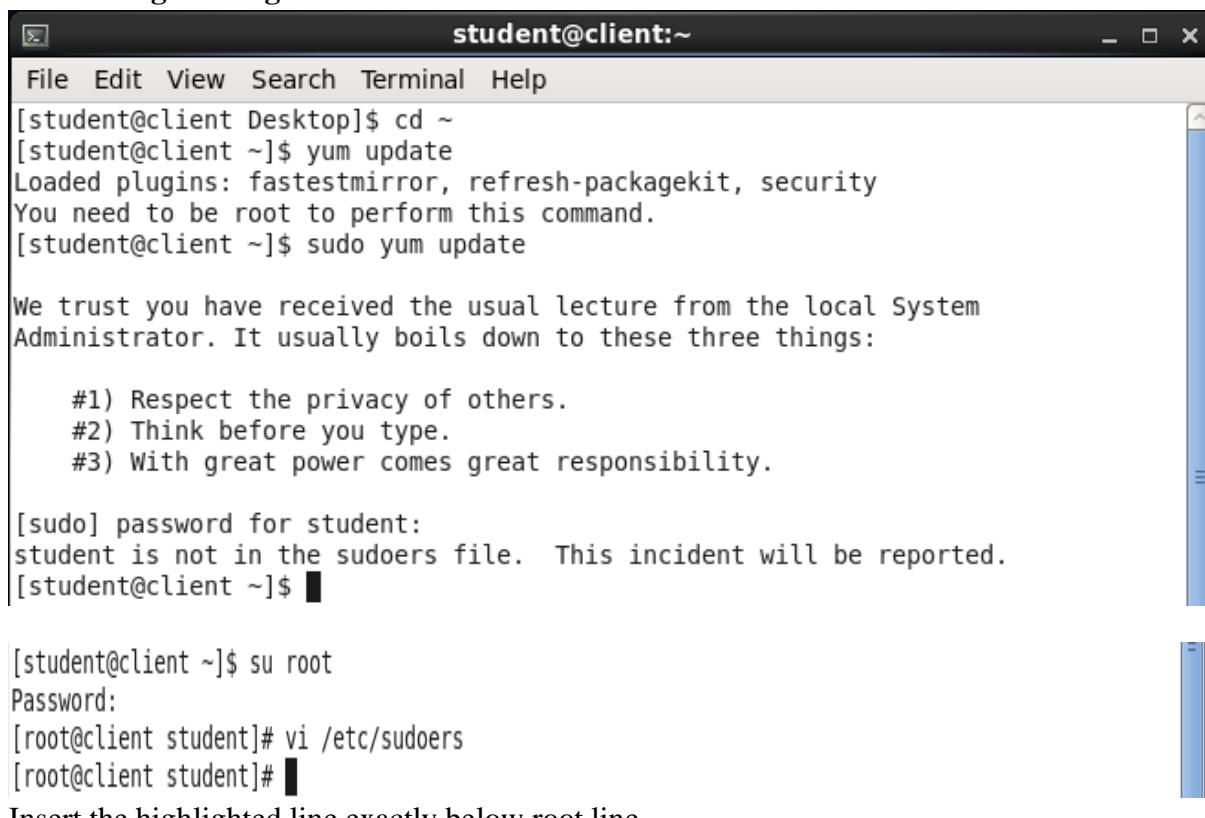
Enter the below highlighted line in the above file.



student@client:~/home/student

```
#%PAM-1.0  
auth      sufficient  pam_rootok.so  
auth      requisite   pam_deny.so [REDACTED]  
auth      required    pam_console.so  
#auth    include     system-auth  
account  required    pam_permit.so
```

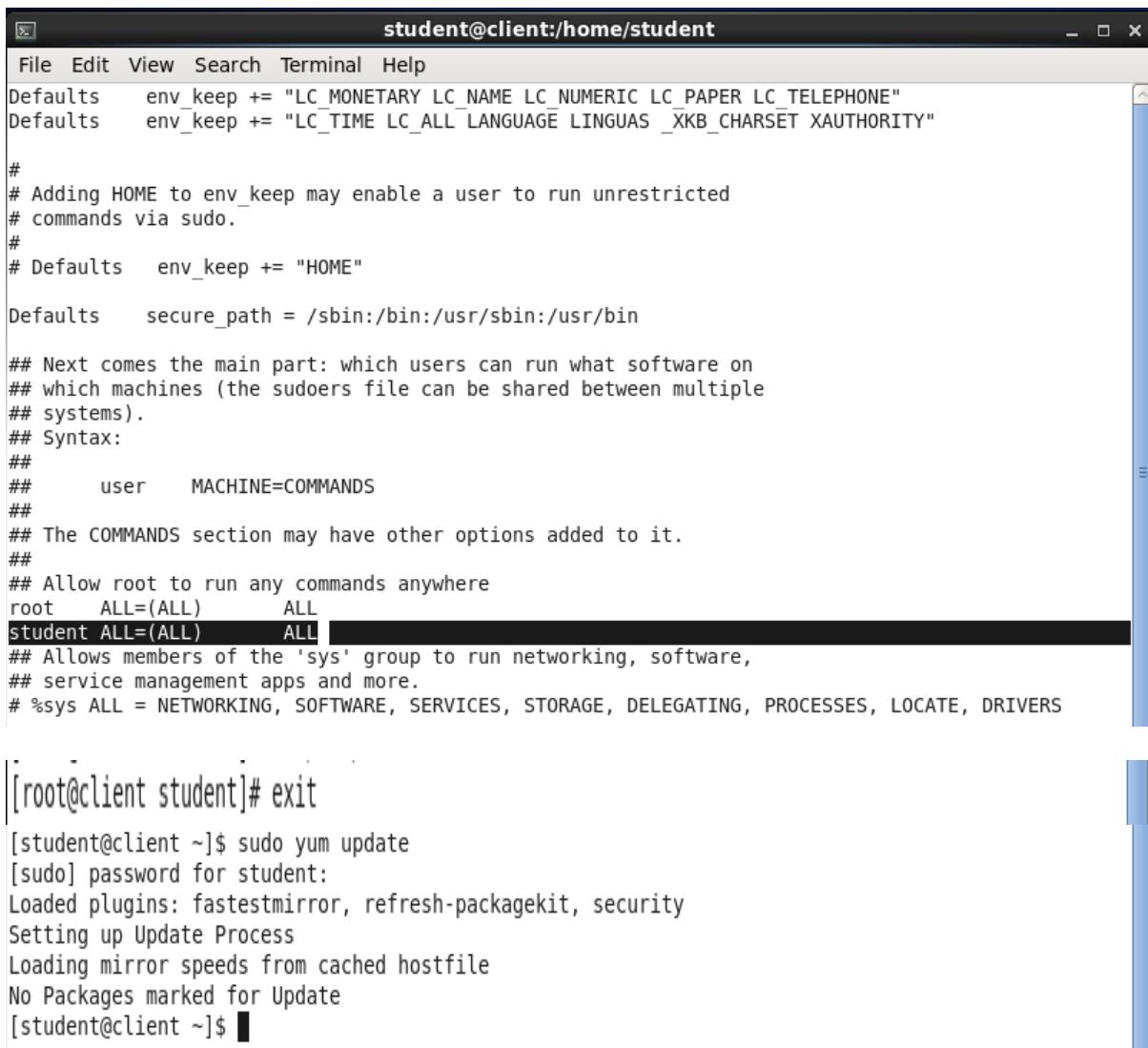
2. Gaining Privileges



student@client:~

```
[student@client Desktop]$ cd ~  
[student@client ~]$ yum update  
Loaded plugins: fastestmirror, refresh-packagekit, security  
You need to be root to perform this command.  
[student@client ~]$ sudo yum update  
  
We trust you have received the usual lecture from the local System  
Administrator. It usually boils down to these three things:  
  
#1) Respect the privacy of others.  
#2) Think before you type.  
#3) With great power comes great responsibility.  
  
[sudo] password for student:  
student is not in the sudoers file. This incident will be reported.  
[student@client ~]$ [REDACTED]  
  
[student@client ~]$ su root  
Password:  
[root@client student]# vi /etc/sudoers  
[root@client student]# [REDACTED]
```

Insert the highlighted line exactly below root line.



```

student@client:home/student
File Edit View Search Terminal Help
Defaults env_keep += "LC_MONETARY LC_NAME LC_NUMERIC LC_PAPER LC_TELEPHONE"
Defaults env_keep += "LC_TIME LC_ALL LANGUAGE LINGUAS _XKB_CHARSET XAUTHORITY"

#
# Adding HOME to env_keep may enable a user to run unrestricted
# commands via sudo.
#
# Defaults env_keep += "HOME"

Defaults secure_path = /sbin:/bin:/usr/sbin:/usr/bin

## Next comes the main part: which users can run what software on
## which machines (the sudoers file can be shared between multiple
## systems).
## Syntax:
##
##      user      MACHINE=COMMANDS
##
## The COMMANDS section may have other options added to it.
##
## Allow root to run any commands anywhere
root    ALL=(ALL)      ALL
student ALL=(ALL)      ALL [REDACTED]
## Allows members of the 'sys' group to run networking, software,
## service management apps and more.
# %sys ALL = NETWORKING, SOFTWARE, SERVICES, STORAGE, DELEGATING, PROCESSES, LOCATE, DRIVERS

```

[root@client student]# exit

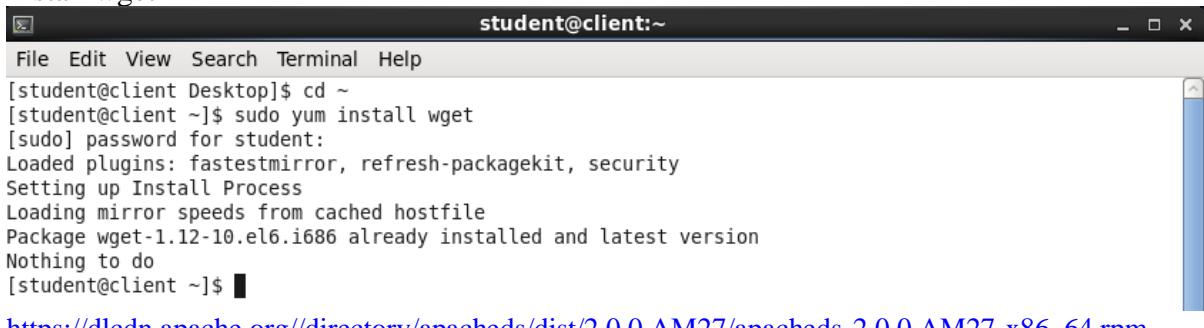
```

[student@client ~]$ sudo yum update
[sudo] password for student:
Loaded plugins: fastestmirror, refresh-packagekit, security
Setting up Update Process
Loading mirror speeds from cached hostfile
No Packages marked for Update
[student@client ~]$ 

```

B. RPM

Install wget



```

student@client:~
File Edit View Search Terminal Help
[student@client Desktop]$ cd ~
[student@client ~]$ sudo yum install wget
[sudo] password for student:
Loaded plugins: fastestmirror, refresh-packagekit, security
Setting up Install Process
Loading mirror speeds from cached hostfile
Package wget-1.12-10.el6.i686 already installed and latest version
Nothing to do
[student@client ~]$ 

```

https://dlcdn.apache.org//directory/apacheds/dist/2.0.0.AM27/apacheds-2.0.0.AM27-x86_64.rpm

download rpm file

```
[student@client ~]$ wget https://dlcdn.apache.org//directory/apacheds/dist/2.0.0.AM27/apacheds-2.0.0.AM27-x86_64.rpm
--2024-07-28 17:52:20-- https://dlcdn.apache.org//directory/apacheds/dist/2.0.0.AM27/apacheds-2.0.0.AM27-x86_64.rpm
Resolving dlcdn.apache.org... 151.101.2.132, 2a04:4e42::644
Connecting to dlcdn.apache.org|151.101.2.132|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 16244439 (15M) [application/x-redhat-package-manager]
Saving to: "apacheds-2.0.0.AM27-x86_64.rpm"

100%[=====] 16,244,439 3.39M/s in 4.2s
2024-07-28 17:52:26 (3.69 MB/s) - "apacheds-2.0.0.AM27-x86_64.rpm" saved [16244439/16244439]

[student@client ~]$
```

C. Yum

```
[root@client Desktop]# yum install mysql
Loaded plugins: fastestmirror, refresh-packagekit, security
Setting up Install Process
Loading mirror speeds from cached hostfile
Resolving Dependencies
--> Running transaction check
--> Package mysql.i686 0:5.1.73-8.el6_8 will be installed
--> Finished Dependency Resolution
```

Dependencies Resolved

```
=====
Package      Arch      Version       Repository      Size
=====
Installing:
mysql        i686      5.1.73-8.el6_8    base           904 k
```

Press y to continue

```
root@client:~/Desktop
File Edit View Search Terminal Help
[root@client Desktop]# yum install nmap
Loaded plugins: fastestmirror, refresh-packagekit, security
Setting up Install Process
Loading mirror speeds from cached hostfile
Resolving Dependencies
--> Running transaction check
--> Package nmap.i686 2:5.51-6.el6 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

=====
Package      Arch      Version       Repository      Size
=====
Installing:
nmap         i686      2:5.51-6.el6    base           2.7 M

Transaction Summary
=====
Install      1 Package(s)

Total download size: 2.7 M
Installed size: 9.7 M
Is this ok [y/N]:
```

```
root@client:~/Desktop
File Edit View Search Terminal Help
[root@client Desktop]# yum remove nmap
Loaded plugins: fastestmirror, refresh-packagekit, security
Setting up Remove Process
Resolving Dependencies
--> Running transaction check
--> Package nmap.i686 2:5.51-6.el6 will be erased
--> Finished Dependency Resolution

Dependencies Resolved

=====
Package      Arch      Version       Repository      Size
=====
Removing:
nmap        i686      2:5.51-6.el6    @base      9.7 M

Transaction Summary
=====
Remove      1 Package(s)

Installed size: 9.7 M
Is this ok [y/N]: y
Downloading Packages:
Running rpm_check_debug
Running Transaction Test
Transaction Test Succeeded
Running Transaction
  Erasing   : 2:nmap-5.51-6.el6.i686                  1/1
  Verifying  : 2:nmap-5.51-6.el6.i686                  1/1

Removed:
nmap.i686 2:5.51-6.el6

Complete!
[root@client Desktop]#
```

Practical 5

Aim : Working with storage, network and Infrastructure Services

A. Working with storage

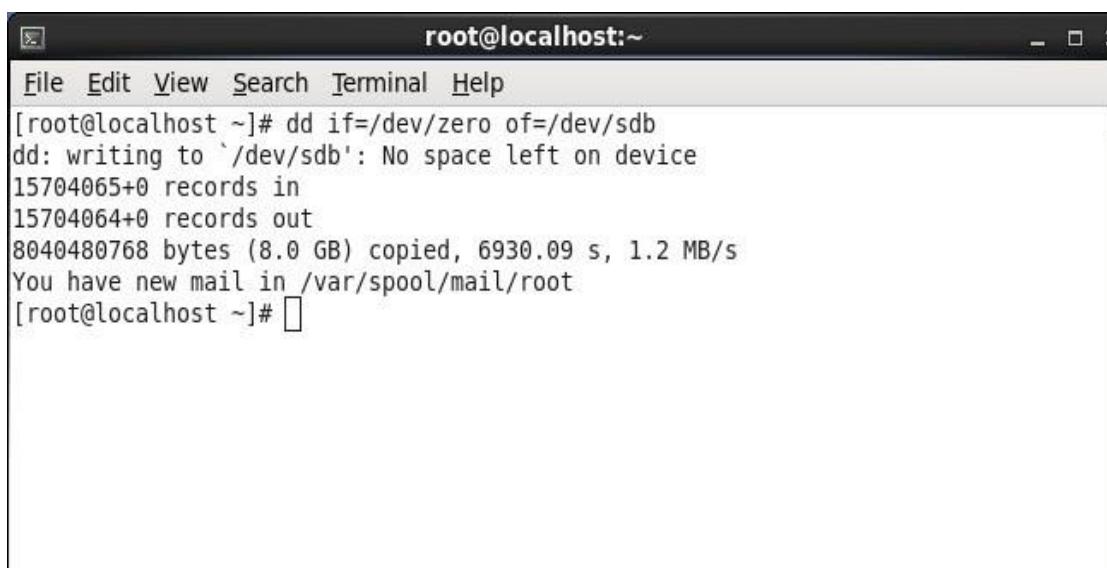
Create 4 partitions on /dev/sdb device that you work with also make sure that all currently existing partitions and volumes are wiped before you begin first partition have to be 500MB in size and created as primary partition use the first partition encrypted value with the name encrypt wall . Format this volume with and make sure it mounts automatically when your server reboots,use the 4 partitions in LVM setup.Create a logical volume with the name LOGVOL1 in the BG group, mount this as exit file system mounts automatically when you reboot your server.

Step 1 : Insert the USB Flash drive that you used with your server if the window opens showing you the contents of USB Flash drive close it.

Step 2 : Open the root shell and type the command dmesg to get the device name.

Step 3 : Use the following command to wipe of it's content quickly.

```
dd if=/dev/zero of=/dev/sda
```

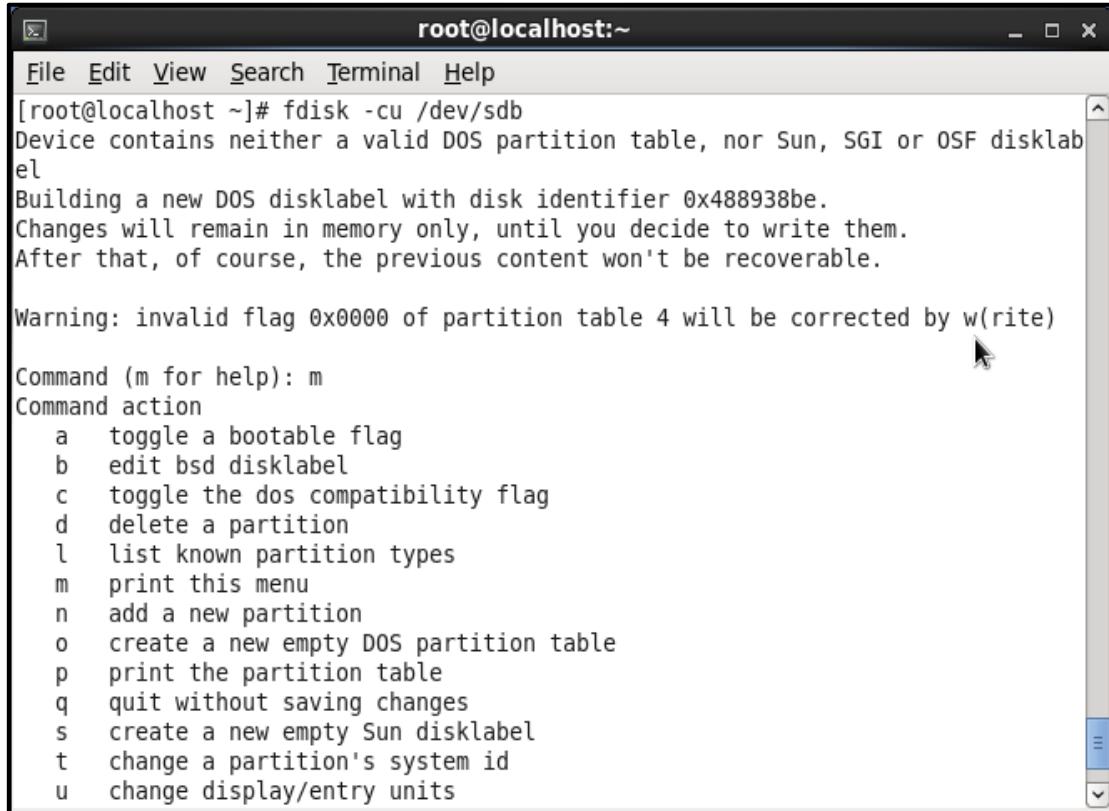


The screenshot shows a terminal window titled "root@localhost:~". The window has a standard Linux terminal interface with a menu bar (File, Edit, View, Search, Terminal, Help) and a title bar. The command "dd if=/dev/zero of=/dev/sdb" is being run in the terminal. The output of the command is displayed below the command line. The output shows the progress of the write operation, indicating that 8.0 GB of data was copied at a rate of 1.2 MB/s. It also mentions that there is no space left on the device and that new mail is available in the root's mailbox.

```
[root@localhost ~]# dd if=/dev/zero of=/dev/sdb
dd: writing to '/dev/sdb': No space left on device
15704065+0 records in
15704064+0 records out
8040480768 bytes (8.0 GB) copied, 6930.09 s, 1.2 MB/s
You have new mail in /var/spool/mail/root
[root@localhost ~]#
```

Step 4 : Use fdisk -cu /dev/sda to open the fdisk on the device and create new partition on it.

Step 5 : Enter m to overview all the commands.



The screenshot shows a terminal window titled "root@localhost:~". The command entered is "fdisk -cu /dev/sdb". The output indicates that the device contains neither a valid DOS partition table, nor Sun, SGI or OSF disklabel. It then proceeds to build a new DOS disklabel with disk identifier 0x488938be. It states that changes will remain in memory only, until you decide to write them. After that, of course, the previous content won't be recoverable. A warning message follows, stating that invalid flag 0x0000 of partition table 4 will be corrected by w(rite). The user then enters the command "m" to view the menu. The menu lists various options: a (toggle a bootable flag), b (edit bsd disklabel), c (toggle the dos compatibility flag), d (delete a partition), l (list known partition types), m (print this menu), n (add a new partition), o (create a new empty DOS partition table), p (print the partition table), q (quit without saving changes), s (create a new empty Sun disklabel), t (change a partition's system id), and u (change display/entry units).

```
[root@localhost ~]# fdisk -cu /dev/sdb
Device contains neither a valid DOS partition table, nor Sun, SGI or OSF disklabel
Building a new DOS disklabel with disk identifier 0x488938be.
Changes will remain in memory only, until you decide to write them.
After that, of course, the previous content won't be recoverable.

Warning: invalid flag 0x0000 of partition table 4 will be corrected by w(rite)

Command (m for help): m
Command action
  a  toggle a bootable flag
  b  edit bsd disklabel
  c  toggle the dos compatibility flag
  d  delete a partition
  l  list known partition types
  m  print this menu
  n  add a new partition
  o  create a new empty DOS partition table
  p  print the partition table
  q  quit without saving changes
  s  create a new empty Sun disklabel
  t  change a partition's system id
  u  change display/entry units
```

Step 6 : Type n for new partition.

Step 7 : Type p for primary partitions.

Step 8 : Enter partition 1 for 1st sector of partition it will take the default value of 208

Step 9 : For the last sector enter the value +500 and enter.

Step 10 : Type p to list the point of current partitions.

Step 11 : Again press N to create new partitions.

Step 12 : Type e for extended partitions.

Step 13 : Enter partition No. 2 for the first sector of partition it will take the default value.

Step 14 : For the last sector enter it will take the value.

```
root@localhost:~
```

File Edit View Search Terminal Help

```
Command (m for help): n
Command action
  e  extended
  p  primary partition (1-4)
p
Partition number (1-4): 1
First sector (2048-15704063, default 2048):
Using default value 2048
Last sector, +sectors or +size{K,M,G} (2048-15704063, default 15704063): +500M

Command (m for help): p

Disk /dev/sdb: 8040 MB, 8040480768 bytes
248 heads, 62 sectors/track, 1021 cylinders, total 15704064 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x488938be

  Device Boot      Start        End      Blocks   Id  System
/dev/sdb1          2048     1026047      512000   83  Linux

Command (m for help): 
```

Step 15 : Again press n to create new partitions.

Step 16 : Type L for logical partitions.

Step 17 : For the first sector of partitions it will take default value.

Step 18 : For last sector +500MB and enter.

Step 19 : Type p to print the list of current partition.

Step 20 : Type w to write new partition to disk.

Step 21 : Type fdisk -cu /dev/sda to open the fdisk interface.

Step 22 : Type n to create new partitions and choose L for logical partition.

Step 23 : Next press enter to select the default starting sector for this partition.

Step 24 : Type +500MB to make this a 500MB partition.

Step 25 : Type t to change the partition type.

Step 26 : Enter partition number 6 and partition type 8E.

Step 27 : Type w to write new partition to disk and exit.

```
root@localhost:~
```

File Edit View Search Terminal Help

```
Command (m for help): n
Command action
  l  logical (5 or over)
  p  primary partition (1-4)
l
First sector (1028096-15704063, default 1028096):
Using default value 1028096
Last sector, +sectors or +size{K,M,G} (1028096-15704063, default 15704063): +500M

Command (m for help): p

Disk /dev/sdb: 8040 MB, 8040480768 bytes
248 heads, 62 sectors/track, 1021 cylinders, total 15704064 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x488938be

  Device Boot      Start        End      Blocks   Id  System
/dev/sdb1          2048     1026047      512000   83  Linux
/dev/sdb2          1026048     15704063     7339008    5  Extended
/dev/sdb5          1028096     2052095      512000   83  Linux

Command (m for help): 
```

```
root@localhost:~  
File Edit View Search Terminal Help  
Command (m for help): w  
The partition table has been altered!  
  
Calling ioctl() to re-read partition table.  
Syncing disks.  
[root@localhost ~]# fdisk -cu /dev/sdb  
  
Command (m for help): n  
Command action  
    l    logical (5 or over)  
    p    primary partition (1-4)  
l  
First sector (2054144-15704063, default 2054144):  
Using default value 2054144  
Last sector, +sectors or +size{M,G} (2054144-15704063, default 15704063): +500M  
  
Command (m for help): t  
Partition number (1-6): 6  
Hex code (type L to list codes): 8e  
Changed system type of partition 6 to 8e (Linux LVM)  
  
Command (m for help): w  
The partition table has been altered!  
  
Calling ioctl() to re-read partition table.  
Syncing disks.  
[root@localhost ~]#
```

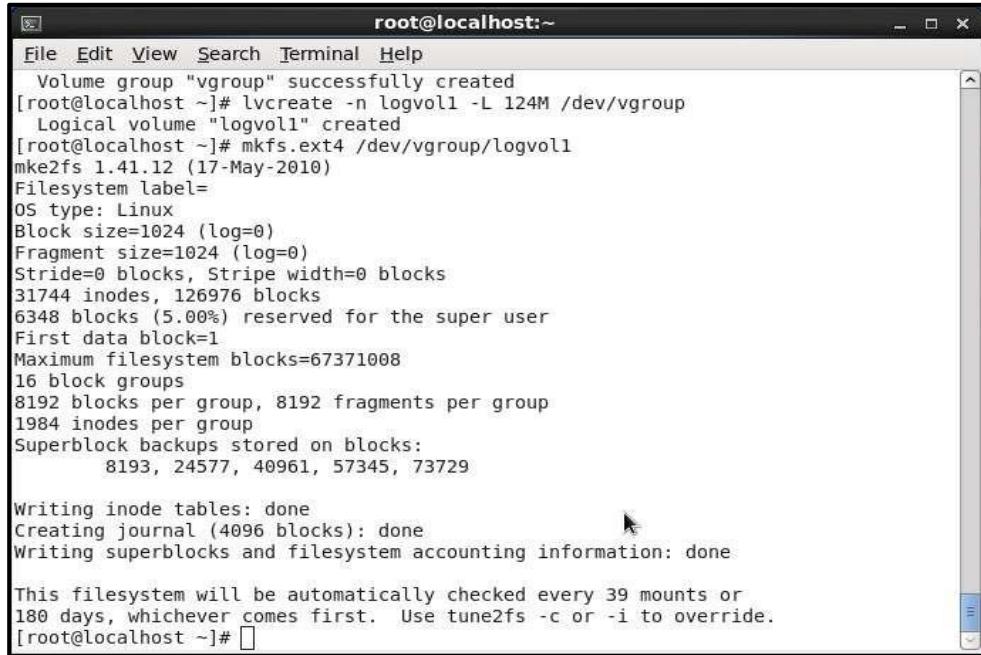
Step 28 : User fdisk -cul /dev/sdb to see the current partition on the disk.

```
root@localhost:~  
File Edit View Search Terminal Help  
[root@localhost ~]# fdisk -cul /dev/sdb  
  
Disk /dev/sdb: 8040 MB, 8040480768 bytes  
248 heads, 62 sectors/track, 1021 cylinders, total 15704064 sectors  
Units = sectors of 1 * 512 = 512 bytes  
Sector size (logical/physical): 512 bytes / 512 bytes  
I/O size (minimum/optimal): 512 bytes / 512 bytes  
Disk identifier: 0x488938be  
  
      Device Boot      Start        End     Blocks   Id  System  
/dev/sdb1          2048     1026047      512000   83  Linux  
/dev/sdb2         1026048     15704063     7339008    5  Extended  
  /dev/sdb5         1028096     2052095      512000   83  Linux  
  /dev/sdb6         2054144     3078143      512000   8e  Linux LVM  
[root@localhost ~]# pvcreate /dev/sdb6  
  Physical volume "/dev/sdb6" successfully created  
[root@localhost ~]# vgcreate vgroup /dev/sdb6  
  Volume group "vgroup" successfully created  
[root@localhost ~]# lvcreate -n logvol1 -L 124M /dev/vgroup  
  Logical volume "logvol1" created  
[root@localhost ~]# mkfs.ext4 /dev/vgroup/logvol1  
mke2fs 1.41.12 (17-May-2010)  
Filesystem label=  
OS type: Linux  
Block size=1024 (log=0)  
Fragment size=1024 (log=0)  
Stride=0 blocks, Stripe width=0 blocks
```

Step 29 : Use pv create /dev/sdb6 to convert it into LVM physical volume.

Step 30 : Use bg create vgroup /dev/sda6 to create a volume group with the name vgroup and to put the logical volume /dev/sdb in it.

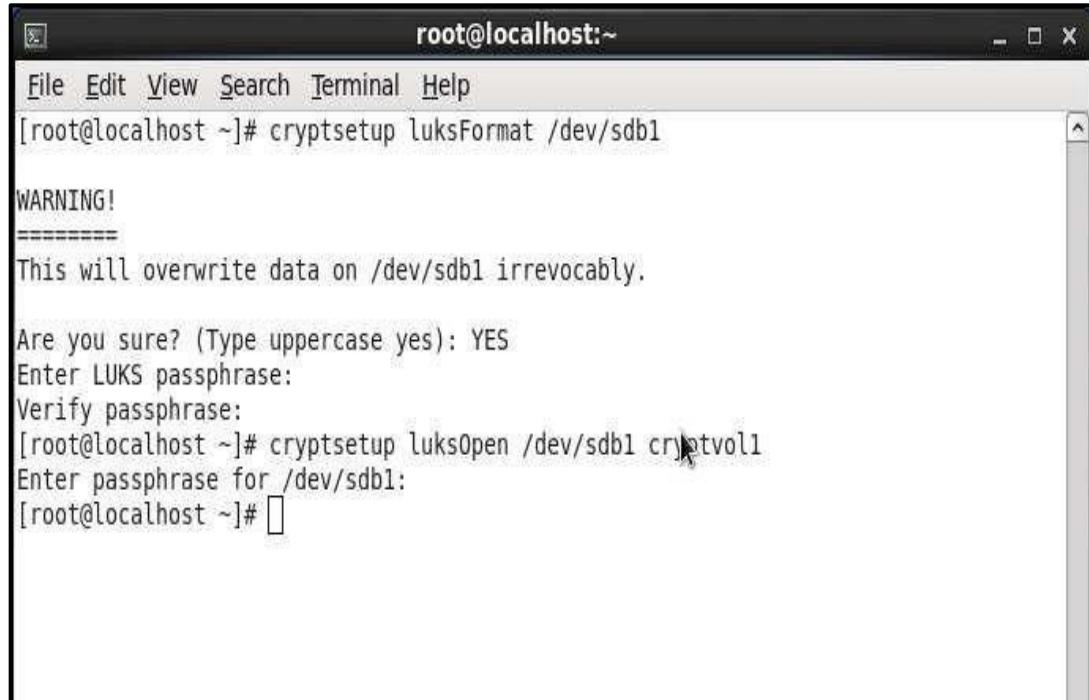
Step 31 : Use lv create -n logvol1 -L 124M /dev/vgroup to create a logical volume in volume group.



```
root@localhost:~  
File Edit View Search Terminal Help  
Volume group "vgroup" successfully created  
[root@localhost ~]# lvcreate -n logvol1 -L 124M /dev/vgroup  
Logical volume "logvol1" created  
[root@localhost ~]# mkfs.ext4 /dev/vgroup/logvol1  
mke2fs 1.41.12 (17-May-2010)  
Filesystem label=  
OS type: Linux  
Block size=1024 (log=0)  
Fragment size=1024 (log=0)  
Stride=0 blocks, Stripe width=0 blocks  
31744 inodes, 126976 blocks  
6348 blocks (5.00%) reserved for the super user  
First data block=1  
Maximum filesystem blocks=67371008  
16 block groups  
8192 blocks per group, 8192 fragments per group  
1984 inodes per group  
Superblock backups stored on blocks:  
    8193, 24577, 40961, 57345, 73729  
  
Writing inode tables: done  
Creating journal (4096 blocks): done  
Writing superblocks and filesystem accounting information: done  
  
This filesystem will be automatically checked every 39 mounts or  
180 days, whichever comes first.  Use tune2fs -c or -i to override.  
[root@localhost ~]#
```

Step 32 : Use the mkfs ext4 /dev/vgroup/logvol1 to format the volume with exit file system.

Step 33 : Use crypt setup look format /dev/sda1 to format the 1st partition as encrypted once when if you really want to do this type YES in all the uppercase. Enter the password you are going to use.



```
root@localhost:~  
File Edit View Search Terminal Help  
[root@localhost ~]# cryptsetup luksFormat /dev/sdb1  
  
WARNING!  
=====  
This will overwrite data on /dev/sdb1 irrevocably.  
  
Are you sure? (Type uppercase yes): YES  
Enter LUKS passphrase:  
Verify passphrase:  
[root@localhost ~]# cryptsetup luksOpen /dev/sdb1 cryptvol1  
Enter passphrase for /dev/sdb1:  
[root@localhost ~]#
```

Step 34 : Type cryptsetup luksOpen /dev/sdb1 cryptvol to open the encrypted volume and make it accessible as a device /dev/mapper/cryptvol.



```
[root@localhost ~]# cryptsetup luksOpen /dev/sdb1 cryptvol1
Enter passphrase for /dev/sdb1:
[root@localhost ~]# mkfs.ext4 /dev/mapper/cryptvol1
mke2fs 1.41.12 (17-May-2010)
Filesystem label=
OS type: Linux
Block size=1024 (log=0)
Fragment size=1024 (log=0)
Stride=0 blocks, Stripe width=0 blocks
127512 inodes, 509952 blocks
25497 blocks (5.00%) reserved for the super user
First data block=1
Maximum filesystem blocks=67633152
63 block groups
8192 blocks per group, 8192 fragments per group
2024 inodes per group
Superblock backups stored on blocks:
    8193, 24577, 40961, 57345, 73729, 204801, 221185, 401409

Writing inode tables: done
Creating journal (8192 blocks): done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 26 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
[root@localhost ~]#
```

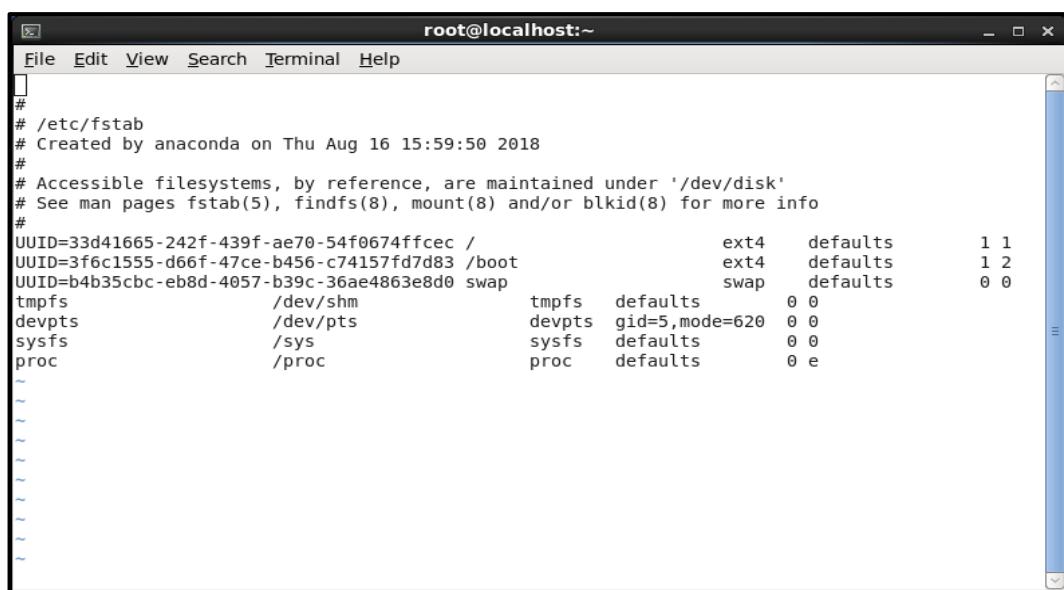
Step 35 : Now use mkfs.ext4 /dev/maper/cryptvol to put a file system on encrypted device you have just open.

Step 36 : Use vi /etc/crypttab to open the file /etc/crypttab put following line in it crypttab
/dev/sdb1



```
cryptvol1 /dev/sdb1
```

Step 37 : Use vi /etc/fs tab and put the following line in it
/dev/mapper/cryptvol/dev/vgroup.logvol



```
# /etc/fstab
# Created by anaconda on Thu Aug 16 15:59:50 2018
#
# Accessible filesystems, by reference, are maintained under '/dev/disk'
# See man pages fstab(5), findfs(8), mount(8) and/or blkid(8) for more info
#
UUID=33d41665-242f-439f-ae70-54f0674ffcec /          ext4      defaults        1 1
UUID=3f6c1555-d66f-47ce-b456-c74157fd7d83 /boot       ext4      defaults        1 2
UUID=b4b35cbc-eb8d-4057-b39c-36ae4863e8d0 swap       swap      defaults        0 0
tmpfs           /dev/shm          tmpfs   defaults        0 0
devpts          /dev/pts          devpts  gid=5,mode=620  0 0
sysfs          /sys              sysfs   defaults        0 0
proc            /proc             proc    defaults        0 e
```

B. Working with Networking

Step 1: Use IP address show to know the IP address of our system.

Step 2: Use IP route to know the route path

Step 3: Open the file /etc/resolv.conf using cat to get the address of the main server.

Step 4: Add a new IP address to the device eth1.

Step 5: Open the file IFCFG-Auto-eth0 present in /etc/sysconfig/network-scripts

Step 6: Query DNS to find out which DNS service is authoritative for www.sanderbanbugt.com

```
root@localhost:~/Desktop
File Edit View Search Terminal Help
[root@localhost Desktop]# ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN
    link/loopback 00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        inet6 ::1/128 scope host
            valid_lft forever preferred_lft forever
2: eth2: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP qlen 1000
    link/ether 00:0c:29:11:6a:89 brd ff:ff:ff:ff:ff:ff
    inet 172.16.20.31/16 brd 172.16.255.255 scope global eth2
        inet6 fe80::20c:29ff:fe11:6a89/64 scope link
            valid_lft forever preferred_lft forever
[root@localhost Desktop]# ip route show
172.16.0.0/16 dev eth2 proto kernel scope link src 172.16.20.31 metric 1
default via 172.16.0.1 dev eth2 proto static
[root@localhost Desktop]# cat /etc/resolv.conf
# Generated by NetworkManager
nameserver 8.8.8.8
[root@localhost Desktop]#
```

```
root@localhost:~/Desktop
File Edit View Search Terminal Help
[root@localhost Desktop]# ip addr add dev eth2 10.0.0.111/24
You have new mail in /var/spool/mail/root
[root@localhost Desktop]# ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN
    link/loopback 00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        inet6 ::1/128 scope host
            valid_lft forever preferred_lft forever
2: eth2: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP qlen 1000
    link/ether 00:0c:29:11:6a:89 brd ff:ff:ff:ff:ff:ff
    inet 172.16.20.31/16 brd 172.16.255.255 scope global eth2
        inet 10.0.0.111/24 scope global eth2
        inet6 fe80::20c:29ff:fe11:6a89/64 scope link
            valid_lft forever preferred_lft forever
[root@localhost Desktop]#
```

```
root@localhost:~$ cd /etc/sysconfig/network-scripts
root@localhost network-scripts]$ ls
ifcfg-Auto_eth2  ifdown-post  ifup-ippv   ifup-tunnel
ifcfg-eth0        ifdown-ppp   ifup-ip6    ifup-wireless
ifcfg-lo          ifdown-routes ifup-isdn  init.ipv6-global
ifdown            ifdown-sit   ifup-plip  net.hotplug
ifdown-bnep       ifdown-tunnel ifup-plusb network-functions
ifdown-eth        ifup        ifup-post  network-functions-ipv6
ifdown-ippv      ifup-aliases ifup-ppp
ifdown-ip6        ifup-bnep   ifup-routes
ifdown-isdn       ifup-eth   ifup-sit
[root@localhost network-scripts]$ cat ^C
[root@localhost network-scripts]$ cat ifcfg-Auto_eth2
HWADDR=00:0C:29:11:6A:89
TYPE=Ethernet
BOOTPROTO=none
IPADDR=172.16.20.31
PREFIX=16
GATEWAY=172.16.0.1
DNS1=8.8.8.8
DEFROUTE=yes
IPV4_FAILURE_FATAL=yes
IPV6INIT=no
NAME="Auto eth2"
UUID=4e78378a-dfa1-4699-97de-5bf6401f4135
ONBOOT=yes
LAST_CONNECT=1658324269
[root@localhost network-scripts]#
```

```
root@localhost:~$ dig www.sandervanvugt.com

; <>> DiG 9.8.2rc1-RedHat-9.8.2-0.30.rc1.el6 <>> www.sandervanvugt.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 38180
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;www.sandervanvugt.com.           IN      A

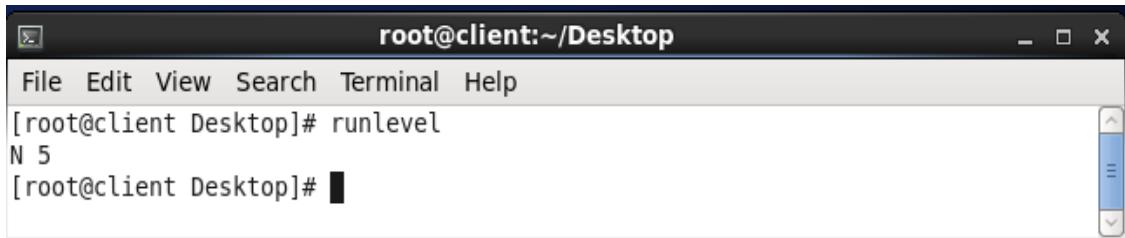
;; ANSWER SECTION:
www.sandervanvugt.com. 21600  IN      CNAME   www.sandervanvugt.com.cdn.cloudflare.net.
www.sandervanvugt.com.cdn.cloudflare.net. 300 IN A 104.21.84.139
www.sandervanvugt.com.cdn.cloudflare.net. 300 IN A 172.67.193.204

;; Query time: 65 msec
;; SERVER: 8.8.8.8#53(8.8.8.8)
;; WHEN: Wed Jul 20 08:49:36 2022
;; MSG SIZE rcvd: 125

[root@localhost network-scripts]#
```

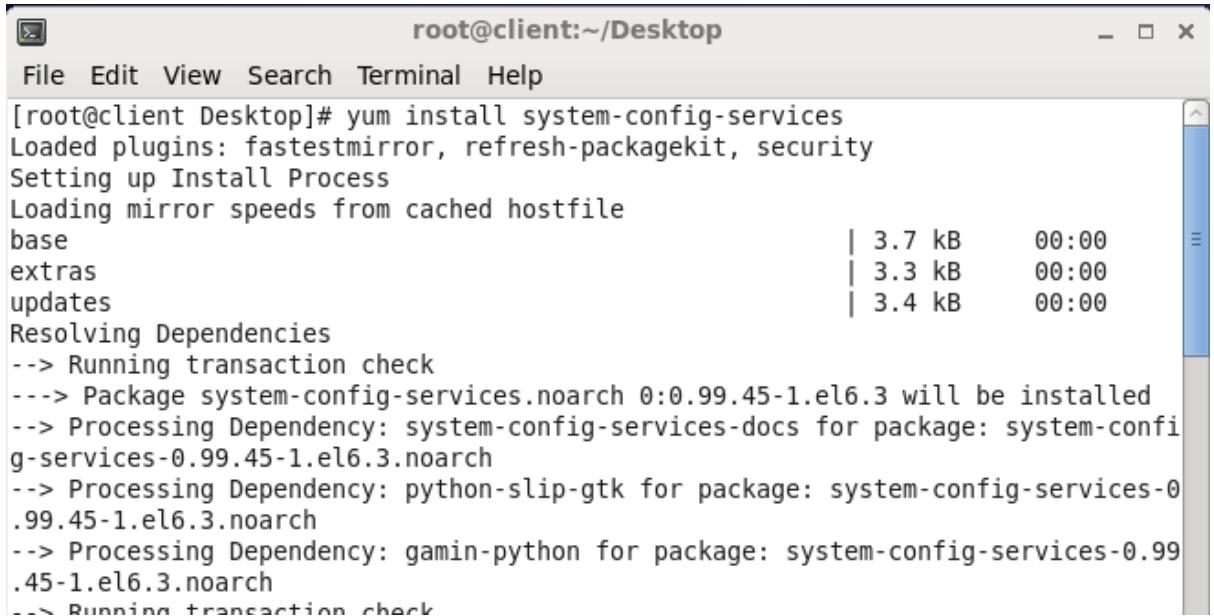
C. Configuring and enabling infrastructure services

1. Checking runlevels.



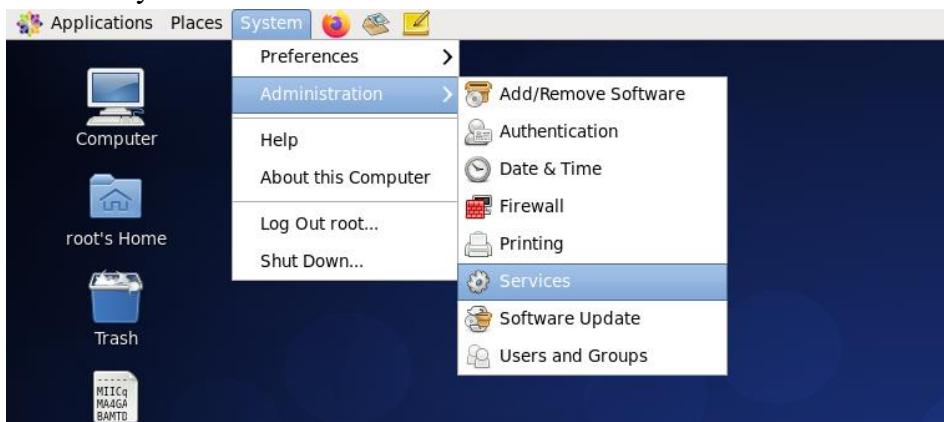
```
root@client:~/Desktop
File Edit View Search Terminal Help
[root@client Desktop]# runlevel
N 5
[root@client Desktop]#
```

2. Installing services. Press y when asked to download dependencies.

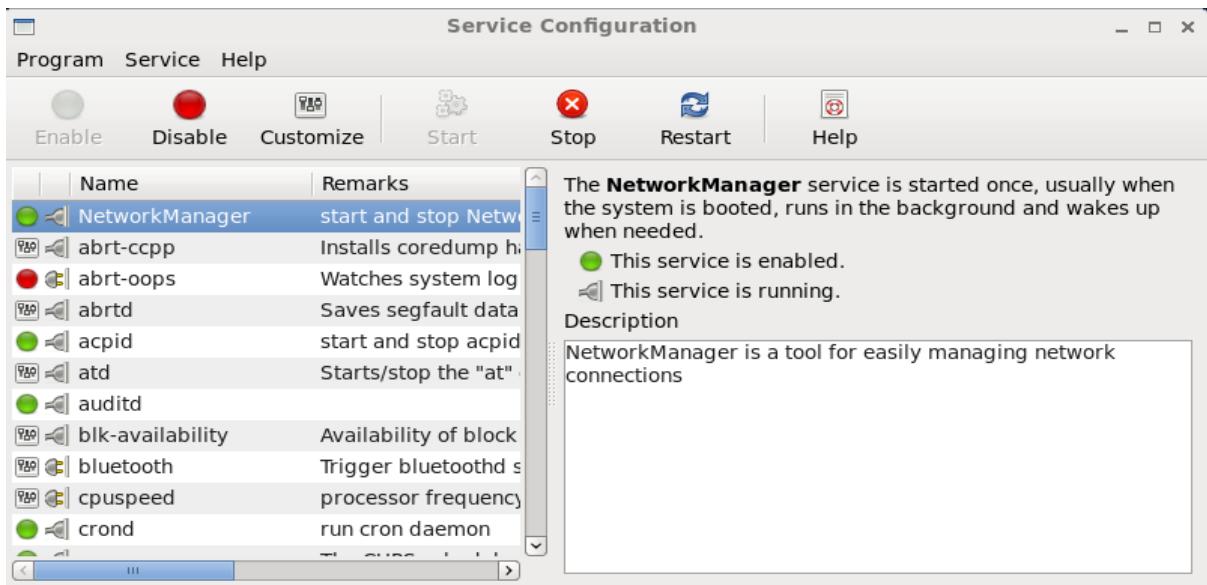


```
root@client:~/Desktop
File Edit View Search Terminal Help
[root@client Desktop]# yum install system-config-services
Loaded plugins: fastestmirror, refresh-packagekit, security
Setting up Install Process
Loading mirror speeds from cached hostfile
base | 3.7 kB     00:00
extras | 3.3 kB     00:00
updates | 3.4 kB     00:00
Resolving Dependencies
--> Running transaction check
--> Package system-config-services.noarch 0:0.99.45-1.el6.3 will be installed
--> Processing Dependency: system-config-services-docs for package: system-config-services-0.99.45-1.el6.3.noarch
--> Processing Dependency: python-slip-gtk for package: system-config-services-0.99.45-1.el6.3.noarch
--> Processing Dependency: gamin-python for package: system-config-services-0.99.45-1.el6.3.noarch
--> Running transaction check
```

3. Go to System → Administration → Services.



4. A Service Configuration window appears from where services can be started, stopped, checked the status. It can be checked whether service is enabled or disabled.



5. To display list of system services.

```
root@client:~/Desktop
File Edit View Search Terminal Help
[root@client Desktop]# chkconfig --list
NetworkManager 0:off 1:off 2:on 3:on 4:on 5:on 6:off
abrt-ccpp 0:off 1:off 2:off 3:on 4:off 5:on 6:off
abrt-oops 0:off 1:off 2:off 3:on 4:off 5:on 6:off
abrttd 0:off 1:off 2:off 3:on 4:off 5:on 6:off
acpid 0:off 1:off 2:on 3:on 4:on 5:on 6:off
atd 0:off 1:off 2:off 3:on 4:on 5:on 6:off
auditd 0:off 1:off 2:on 3:on 4:on 5:on 6:off
blk-availability 0:off 1:on 2:on 3:on 4:on 5:on 6:off
bluetooth 0:off 1:off 2:off 3:on 4:on 5:on 6:off
cpuspeed 0:off 1:on 2:on 3:on 4:on 5:on 6:off
```

6. To check a service starting at which runlevel, to on a service on runlevels 2,3,4 and 5 and check its status.

```
root@client:~/Desktop
File Edit View Search Terminal Help
[root@client Desktop]# chkconfig --list sshd
sshd 0:off 1:off 2:on 3:on 4:on 5:on 6:off
[root@client Desktop]# chkconfig httpd on
[root@client Desktop]# chkconfig --list httpd
httpd 0:off 1:off 2:on 3:on 4:on 5:on 6:off
[root@client Desktop]# chkconfig httpd off
[root@client Desktop]# chkconfig --list httpd
httpd 0:off 1:off 2:off 3:off 4:off 5:off 6:off
[root@client Desktop]#
```

7. To start, restart, stop or check status of a service.

```
root@client:~/Desktop
File Edit View Search Terminal Help
[root@client Desktop]# service httpd start
Starting httpd: [ OK ]
[root@client Desktop]# service httpd status
httpd (pid 4079) is running...
[root@client Desktop]# service httpd restart
Stopping httpd: [ OK ]
Starting httpd: [ OK ]
[root@client Desktop]# service httpd stop
Stopping httpd: [ OK ]
[root@client Desktop]#
```

D. Configuring OpenSSH

Perform on CentOS Server

Login as root user

Enabling and Testing the SSH Server

1. From a terminal with root permissions, check whether ssh client and server are installed on the device.
2. If not, use **yum install openssh-server** to install the ssh server package.
3. Use the **chkconfig sshd on** command to enable the SSH service, and add it to your server's runlevels.
4. Create a user lsa-it and assign a password to the same.
5. Open the ssh configuration file /etc/ssh/sshd_config
6. Modify the below line to no and add the highlighted line as shown.

```
#PermitRootLogin no
```

```
#AllowUsers lsa-it
#AllowAgentForwarding yes
#AllowTcpForwarding yes
#GatewayPorts no
#X11Forwarding no
```

7. Save and exit the file.
8. Restart the sshd service.

```
[root@server Desktop]# rpm -q openssh-clients
openssh-clients-5.3p1-124.el6_10.i686
[root@server Desktop]# rpm -q openssh-server
openssh-server-5.3p1-124.el6_10.i686
[root@server Desktop]# service sshd start
[root@server Desktop]# chkconfig sshd on
[root@server Desktop]# chkconfig --list sshd
sshd      0:off  1:off  2:on   3:on    4:on    5:on    6:off
[root@server Desktop]# useradd lsa-it
[root@server Desktop]# passwd lsa-it
Changing password for user lsa-it.
New password:
BAD PASSWORD: it is based on a dictionary word
BAD PASSWORD: is too simple
Retype new password:
passwd: all authentication tokens updated successfully.
[root@server Desktop]# vi /etc/ssh/sshd_config
[root@server Desktop]# service sshd restart
Stopping sshd: [OK]
Starting sshd: [OK]
[root@server Desktop]#
```

9. Open the command prompt on windows and login through ssh followed by `username@ipaddressoflinuxserver` machine. It will ask for password of the user.
10. After entering password, the ssh connection is open.

```
C:\> lsa-it@server:~
Microsoft Windows [Version 10.0.19045.4651]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Binita>ssh lsa-it@192.168.0.106
lsa-it@192.168.0.106's password:
[lsa-it@server ~]$
```

11. On linux system, login through ssh followed by `username@ipaddressoflinuxserver` machine. It will ask for password of the user.

12. After entering password, the ssh connection is open.
13. Type **exit** to close the SSH sessions on both windows and linux machine.

The image shows two terminal windows side-by-side. The left window is titled "root@server:~/Desktop" and is running on a Linux system. It displays the command "ssh lsa-it@192.168.0.106", the password prompt for "lsa-it@192.168.0.106", the last login information ("Last login: Wed Jul 31 21:10:00 2024 from 192.168.0.107"), the command "[lsa-it@server ~]\$ exit", the "logout" message, and the confirmation "Connection to 192.168.0.106 closed." followed by the prompt "[root@server Desktop]#". The right window is titled "Select Command Prompt" and is running on a Windows system. It shows the command "C:\Users\Binita>ssh lsa-it@192.168.0.106", the password prompt for "lsa-it@192.168.0.106", the command "[lsa-it@server ~]\$ exit", the "logout" message, and the confirmation "Connection to 192.168.0.106 closed." followed by the prompt "C:\Users\Binita>". Both windows have standard window controls (minimize, maximize, close) at the top right.

```
[root@server Desktop]# ssh lsa-it@192.168.0.106
lsa-it@192.168.0.106's password:
Last login: Wed Jul 31 21:10:00 2024 from 192.168.0.107
[lsa-it@server ~]$ exit
logout
Connection to 192.168.0.106 closed.
[root@server Desktop]# 

C:\Users\Binita>ssh lsa-it@192.168.0.106
lsa-it@192.168.0.106's password:
[lsa-it@server ~]$ exit
logout
Connection to 192.168.0.106 closed.

C:\Users\Binita>
```

Practical 6

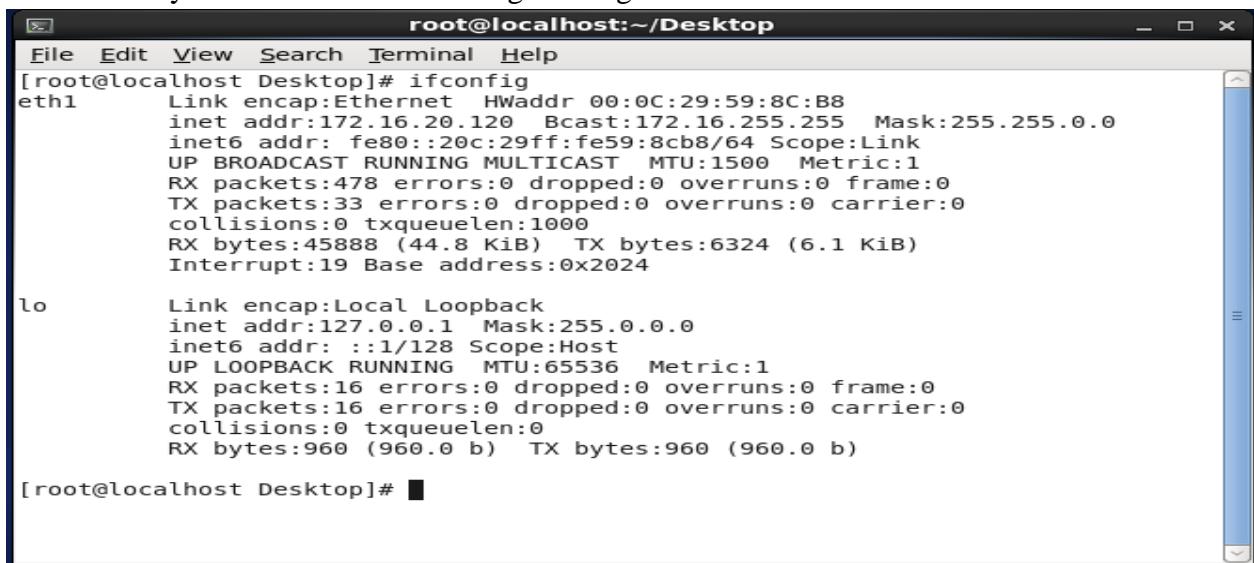
Aim: Configuring Server for File Sharing

A. Configuring NFS Server

Perform on CentOS Server

Login as root user

1. Login as root user.
2. Verify IP address of server using ifconfig command.



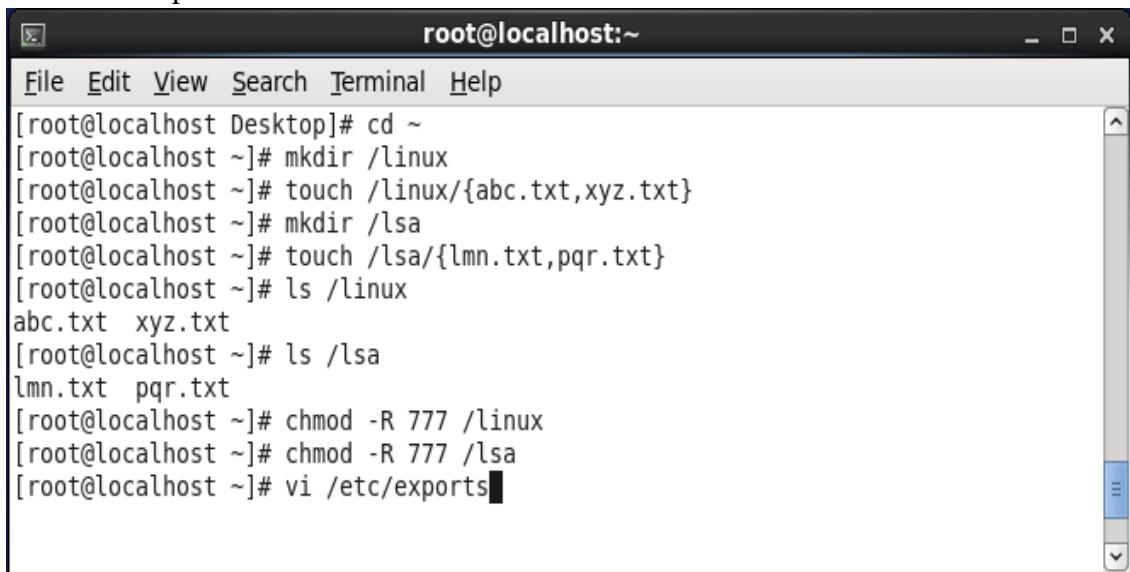
root@localhost:~/Desktop

```
File Edit View Search Terminal Help
[root@localhost Desktop]# ifconfig
eth1      Link encap:Ethernet HWaddr 00:0C:29:59:8C:B8
          inet addr:172.16.20.120 Bcast:172.16.255.255 Mask:255.255.0.0
          inet6 addr: fe80::20c:29ff:fe59:8cb8/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:478 errors:0 dropped:0 overruns:0 frame:0
          TX packets:33 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:45888 (44.8 KiB) TX bytes:6324 (6.1 KiB)
          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:65536 Metric:1
          RX packets:16 errors:0 dropped:0 overruns:0 frame:0
          TX packets:16 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:960 (960.0 b) TX bytes:960 (960.0 b)

[root@localhost Desktop]#
```

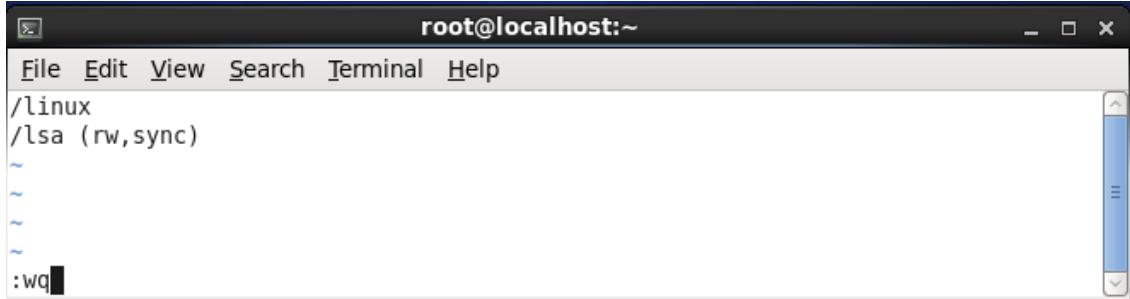
3. Install NFS using yum install nfs-utils
4. Create directory /linux and two file abc.txt and xyz.txt within it to be exported.
5. Create directory /lsa and two file lmn.txt and pqr.txt within it to be exported.
6. Check whether created or not.
7. Give permissions to the created directories.



root@localhost:~

```
File Edit View Search Terminal Help
[root@localhost Desktop]# cd ~
[root@localhost ~]# mkdir /linux
[root@localhost ~]# touch /linux/{abc.txt,xyz.txt}
[root@localhost ~]# mkdir /lsa
[root@localhost ~]# touch /lsa/{lmn.txt,pqr.txt}
[root@localhost ~]# ls /linux
abc.txt xyz.txt
[root@localhost ~]# ls /lsa
lmn.txt pqr.txt
[root@localhost ~]# chmod -R 777 /linux
[root@localhost ~]# chmod -R 777 /lsa
[root@localhost ~]# vi /etc/exports
```

8. Open configuration file /etc/exports using vi and enter the following:
/linux is read only by default.
/lsa is read write with root squash. Hence root user of client will be considered as anonymous user on nfs server and will be identified as nfsnobody user.

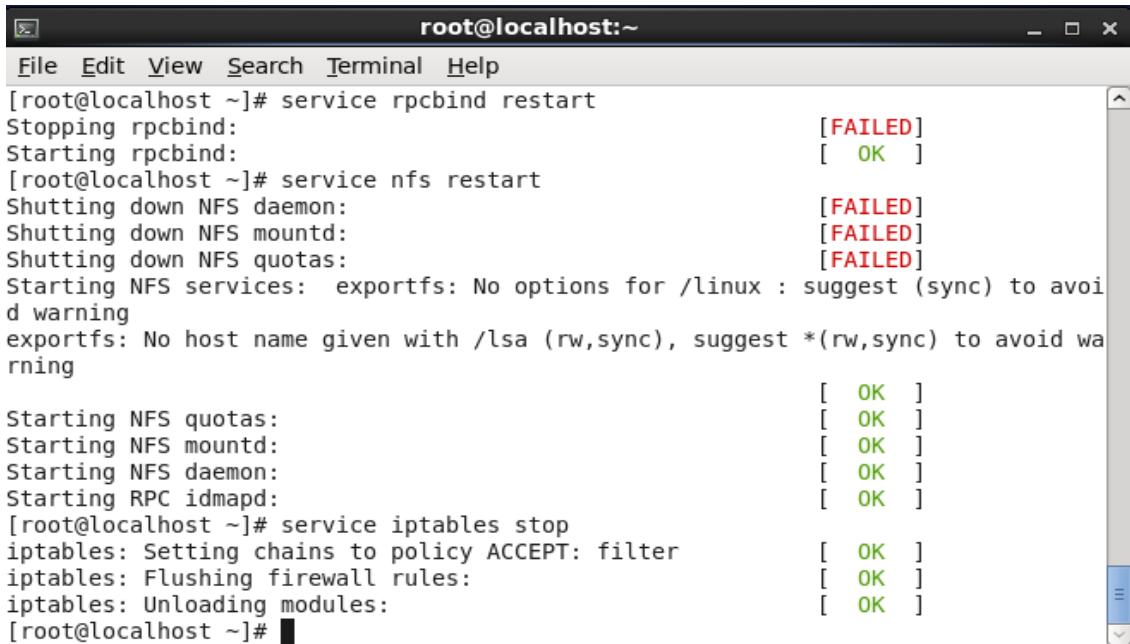


A screenshot of a terminal window titled "root@localhost:~". The window has a menu bar with File, Edit, View, Search, Terminal, and Help. The main area contains the following text:

```
/linux
/lsa (rw,sync)
~
```

At the bottom of the window, there is a command prompt with the text ":wq" followed by a cursor.

9. Restart rpcbind and nfs service. Stop firewall.



A screenshot of a terminal window titled "root@localhost:~". The window has a menu bar with File, Edit, View, Search, Terminal, and Help. The main area contains the following text:

```
[root@localhost ~]# service rpcbind restart
Stopping rpcbind: [FAILED]
Starting rpcbind: [OK]
[root@localhost ~]# service nfs restart
Shutting down NFS daemon: [FAILED]
Shutting down NFS mountd: [FAILED]
Shutting down NFS quotas: [FAILED]
Starting NFS services: exportfs: No options for /linux : suggest (sync) to avoid warning
exportfs: No host name given with /lsa (rw,sync), suggest *(rw,sync) to avoid warning
Starting NFS quotas: [OK]
Starting NFS mountd: [OK]
Starting NFS daemon: [OK]
Starting RPC idmapd: [OK]
[root@localhost ~]# service iptables stop
iptables: Setting chains to policy ACCEPT: filter [OK]
iptables: Flushing firewall rules: [OK]
iptables: Unloading modules: [OK]
[root@localhost ~]#
```

Perform on CentOS Client

1. Login as root user.
2. Verify IP address of server using ifconfig command.
3. Install NFS using yum install nfs-utils

```

root@localhost:~/Desktop
File Edit View Search Terminal Help
[root@localhost Desktop]# ifconfig
eth1      Link encap:Ethernet HWaddr 00:0C:29:A9:9D:74
          inet addr:172.16.20.152 Bcast:172.16.255.255 Mask:255.255.0.0
          inet6 addr: fe80::20c:29ff:fea9:9d74/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:2748 errors:0 dropped:0 overruns:0 frame:0
          TX packets:16 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:248665 (242.8 KiB) TX bytes:4432 (4.3 KiB)
          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:65536 Metric:1
          RX packets:16 errors:0 dropped:0 overruns:0 frame:0
          TX packets:16 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:960 (960.0 b) TX bytes:960 (960.0 b)

[root@localhost Desktop]# yum install nfs-utils

```

4. On client, showmount command shows all shared directories created on server.
5. Create two local directories on client named tyit and syit .
6. Mount server exported directory on it.
7. On listing it shows up the content of server export directory.
8. We have mounted read only directory /linux on tyit. Hence client is not able to create a file in it.
9. /lsa is read write directory which is mounted on syit, hence client is able to create files. Create a new file uvw.txt on client. You can check on server.

```

root@localhost:~/syit
File Edit View Search Terminal Help
[root@localhost Desktop]# cd ~
[root@localhost ~]# showmount -e 172.16.20.120
Export list for 172.16.20.120:
/lsa   *
/linux *
[root@localhost ~]# mkdir tyit
[root@localhost ~]# mkdir syit
[root@localhost ~]# mount -t nfs 172.16.20.120:/linux tyit
[root@localhost ~]# mount -t nfs 172.16.20.120:/lsa syit
[root@localhost ~]# cd tyit
[root@localhost tyit]# ls
abc.txt xyz.txt
[root@localhost tyit]# touch hij.txt
touch: cannot touch `hij.txt': Read-only file system
[root@localhost tyit]# cd ..
[root@localhost ~]# cd syit
[root@localhost syit]# ls
lmn.txt pqr.txt
[root@localhost syit]# touch uvw.txt
[root@localhost syit]# ls
lmn.txt pqr.txt uvw.txt
[root@localhost syit]#

```

On Server

- Because of root squash, client user is anonymous user `nfsnobody` for nfs server.

```
root@localhost:~# ls -lh /lsa
total 0
-rwxrwxrwx. 1 root      root      0 Aug 21 02:23 lmn.txt
-rwxrwxrwx. 1 root      root      0 Aug 21 02:23 pqr.txt
-rw-r--r--. 1 nfsnobody nfsnobody 0 Aug 21 02:28 uvw.txt
[root@server ~]# vi /etc/exports
[root@server ~]# service rpcbind restart
Stopping rpcbind: [ OK ]
Starting rpcbind: [ OK ]
[root@server ~]# service nfs restart
Shutting down NFS daemon: [ OK ]
Shutting down NFS mountd: [ OK ]
Shutting down NFS quotas: [ OK ]
exportfs: No host name given with /linux (ro,sync,wdelay,hide,nocrossmnt,secure,
root_squash,no_all_squash,no_subtree_check,secure_locks,acl,anongid=65534,anongid=65534,sec=sys,ro,root_squash,no_all_squash), suggest *(ro,sync,wdelay,hide,nocrossmnt,secure,root_squash,no_all_squash,no_subtree_check,secure_locks,acl,anongid=65534,anongid=65534,sec=sys,ro,root_squash,no_all_squash) to avoid warning
Shutting down NFS services: [ OK ]
Shutting down RPC idmapd: [ OK ]
Starting NFS services:
Starting NFS quotas: [ OK ]
Starting NFS mountd: [ OK ]
Starting NFS daemon: [ OK ]
Starting RPC idmapd: [ OK ]
[root@server ~]# service iptables stop
[root@server ~]#
```

- Open configuration file and make following changes:

```
root@localhost:~# vi /etc/exports
/linux *(ro,sync)
/lsa *(rw,sync,no_root_squash)
~
~
~
~
:wq
```

On Client

- Create a new file in syit.

```
root@localhost:~/syit
File Edit View Search Terminal Help
[root@localhost syit]#
[root@localhost syit]# touch efg.txt
[root@localhost syit]# ls
efg.txt lmn.txt pqr.txt uvw.txt
```

On Server

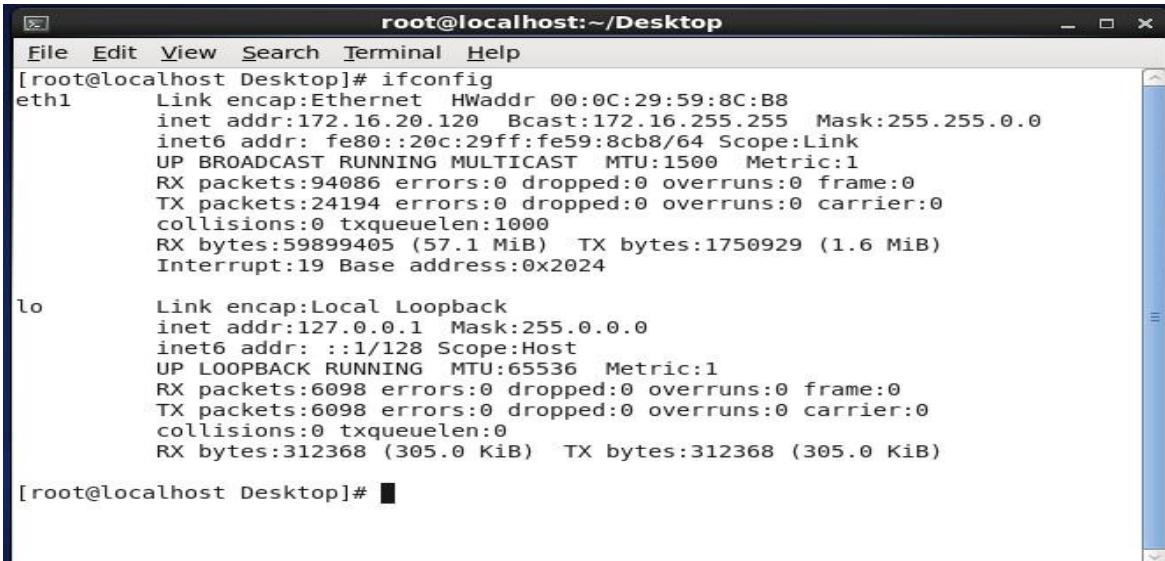
Because of no root squash, client root user is identified as root user on nfs server.

```
root@localhost:~# ls -lh /lsa
total 0
-rw-r--r--. 1 root      root      0 Aug 21 02:31 efg.txt
-rwxrwxrwx. 1 root      root      0 Aug 21 02:23 lmn.txt
-rwxrwxrwx. 1 root      root      0 Aug 21 02:23 pqr.txt
-rw-r--r--. 1 nfsnobody nfsnobody 0 Aug 21 02:28 uvw.txt
[root@server ~]#
```

B. Configuring FTPServer

Perform on CentOS Server

1. Login as root user.
2. Verify IP address of server using ifconfig command.



A terminal window titled "root@localhost:~/Desktop". The window shows the output of the "ifconfig" command. It lists two interfaces: "eth1" and "lo". The "eth1" interface has an IP address of 172.16.20.120 and a MAC address of 00:0C:29:59:8C:B8. The "lo" interface is a loopback interface with an IP address of 127.0.0.1. Both interfaces are up and running.

```
root@localhost Desktop]# ifconfig
eth1      Link encap:Ethernet HWaddr 00:0C:29:59:8C:B8
          inet addr:172.16.20.120 Bcast:172.16.255.255 Mask:255.255.0.0
          inet6 addr: fe80::20c:29ff:fe59:8cb8/64 Scope:Link
             UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
             RX packets:94086 errors:0 dropped:0 overruns:0 frame:0
             TX packets:24194 errors:0 dropped:0 overruns:0 carrier:0
             collisions:0 txqueuelen:1000
             RX bytes:59899405 (57.1 MiB) TX bytes:1750929 (1.6 MiB)
             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:65536 Metric:1
             RX packets:6098 errors:0 dropped:0 overruns:0 frame:0
             TX packets:6098 errors:0 dropped:0 overruns:0 carrier:0
             collisions:0 txqueuelen:0
             RX bytes:312368 (305.0 KiB) TX bytes:312368 (305.0 KiB)

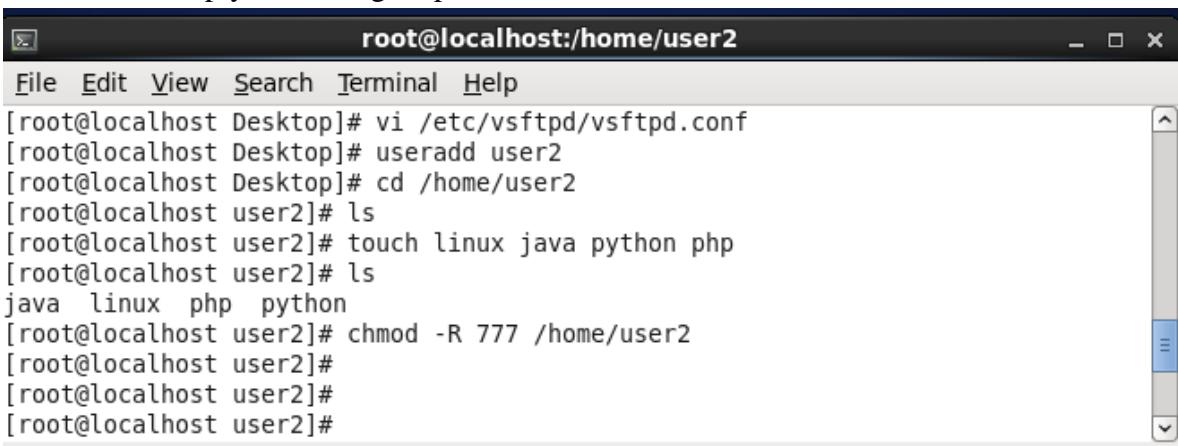
[root@localhost Desktop]#
```

3. Install ftp using yum install vsftpd* command.
4. Edit the configuration file /etc/vsftpd/vsftpd.conf using vi.

```
anonymous_enable = NO
local_enable = YES
xferlog_file = /var/log/vsftpd.log
listen = YES
userlist_enable = YES
```

Press Esc :wq to save and exit.

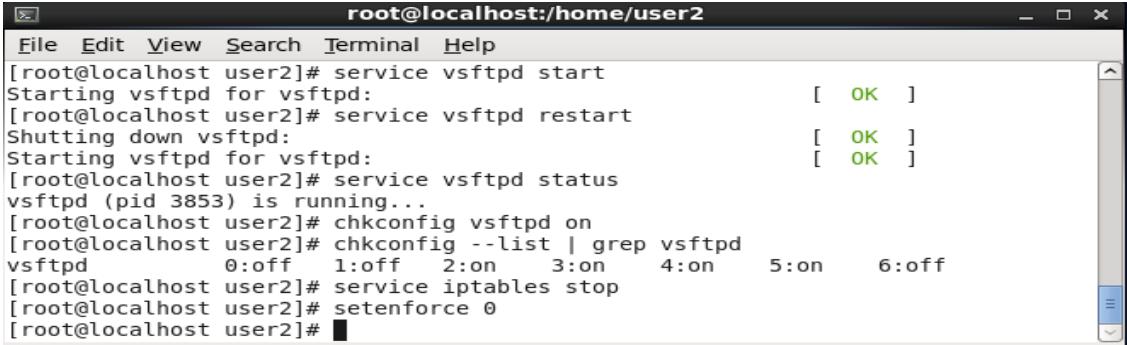
5. Create a user "user2". Also give password using passwd command.
6. Change directory to /home/user2
7. Create 4 empty files and give permissions.



A terminal window titled "root@localhost:/home/user2". The window shows the root user performing several commands:
1. Using vi to edit the vsftpd configuration file.
2. Creating a new user "user2" using useradd.
3. Changing to the "/home/user2" directory.
4. Creating four empty files: "linux", "java", "python", and "php".
5. Giving all files the same permissions (chmod -R 777).
6. Logging out of the user2 session.

```
root@localhost Desktop]# vi /etc/vsftpd/vsftpd.conf
root@localhost Desktop]# useradd user2
root@localhost Desktop]# cd /home/user2
root@localhost user2]# ls
root@localhost user2]# touch linux java python php
root@localhost user2]# ls
java linux php python
root@localhost user2]# chmod -R 777 /home/user2
root@localhost user2]#
root@localhost user2]#
root@localhost user2]#
```

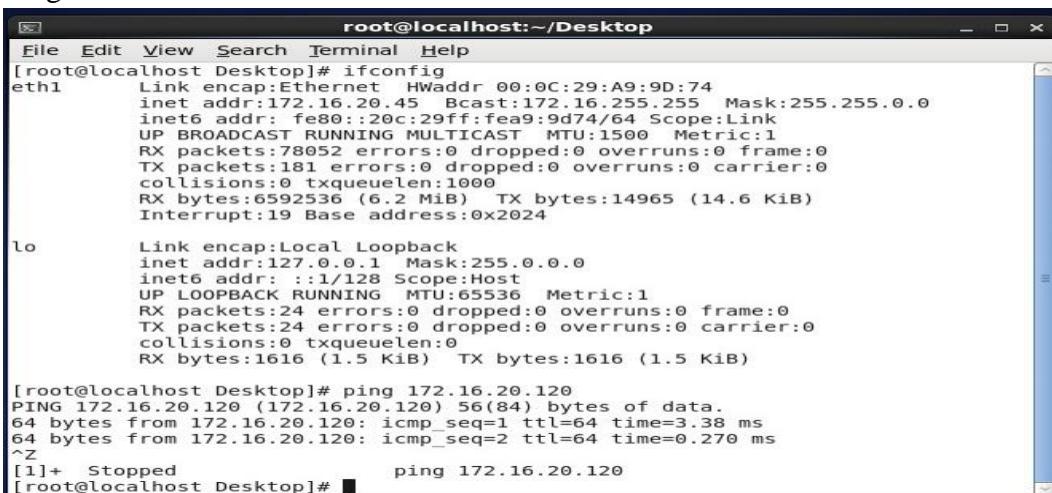
8. Start the service.



```
root@localhost:~/home/user2
File Edit View Search Terminal Help
[root@localhost user2]# service vsftpd start
Starting vsftpd for vsftpd: [ OK ]
[root@localhost user2]# service vsftpd restart
Shutting down vsftpd: [ OK ]
Starting vsftpd for vsftpd: [ OK ]
[root@localhost user2]# service vsftpd status
vsftpd (pid 3853) is running...
[root@localhost user2]# chkconfig vsftpd on
[root@localhost user2]# chkconfig --list | grep vsftpd
vsftpd      0:off 1:off 2:on 3:on 4:on 5:on   6:off
[root@localhost user2]# service iptables stop
[root@localhost user2]# setenforce 0
[root@localhost user2]#
```

Perform on CentOS Client

1. Login as root user.
2. Verify IP address using ifconfig command.
3. Ping to server. It should work.

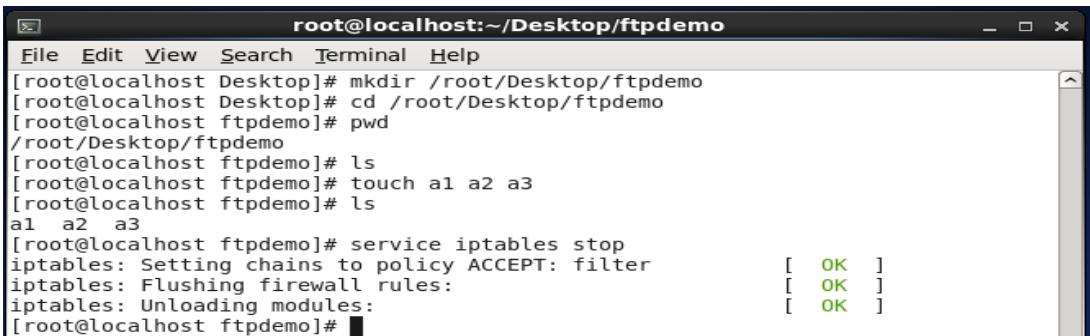


```
root@localhost:~/Desktop
File Edit View Search Terminal Help
[root@localhost Desktop]# ifconfig
eth0      Link encap:Ethernet HWaddr 00:0C:29:A9:9D:74
          inet addr:172.16.20.45  Bcast:172.16.255.255  Mask:255.255.0.0
          inet6 addr: fe80::20c:29ff:fea9:9d74/64 Scope:Link
             UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
             RX packets:78052 errors:0 dropped:0 overruns:0 frame:0
             TX packets:181 errors:0 dropped:0 overruns:0 carrier:0
             collisions:0 txqueuelen:1000
             RX bytes:6592536 (6.2 MiB)  TX bytes:14965 (14.6 KiB)
             Interrupt:19 Base address:0x02024

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:65536  Metric:1
             RX packets:24 errors:0 dropped:0 overruns:0 frame:0
             TX packets:24 errors:0 dropped:0 overruns:0 carrier:0
             collisions:0 txqueuelen:0
             RX bytes:1616 (1.5 KiB)  TX bytes:1616 (1.5 KiB)

[root@localhost Desktop]# ping 172.16.20.120
PING 172.16.20.120 (172.16.20.120) 56(84) bytes of data.
64 bytes from 172.16.20.120: icmp_seq=1 ttl=64 time=3.38 ms
64 bytes from 172.16.20.120: icmp_seq=2 ttl=64 time=0.270 ms
^Z
[1]+  Stopped                  ping 172.16.20.120
[root@localhost Desktop]#
```

4. Install ftp on client using yum install ftp command.
5. Create directory ftpdemo.
6. Change directory to ftpdemo.
7. Check present working directory.
8. Create 3 empty files.
9. Stop service for firewalls.



```
root@localhost:~/Desktop/ftpdemo
File Edit View Search Terminal Help
[root@localhost Desktop]# mkdir /root/Desktop/ftpdemo
[root@localhost Desktop]# cd /root/Desktop/ftpdemo
[root@localhost ftpdemo]# pwd
/root/Desktop/ftpdemo
[root@localhost ftpdemo]# ls
[root@localhost ftpdemo]# touch a1 a2 a3
[root@localhost ftpdemo]# ls
a1 a2 a3
[root@localhost ftpdemo]# service iptables stop
iptables: Setting chains to policy ACCEPT: filter [ OK ]
iptables: Flushing firewall rules: [ OK ]
iptables: Unloading modules: [ OK ]
[root@localhost ftpdemo]#
```

10. Login as ftp using ftp command with ip address of server. It will ask you for username. Enter user2. When asked for password enter its password.

11. Use ls to see files on server.

```
root@localhost:~/Desktop/ftpdemo
File Edit View Search Terminal Help
[root@localhost ftpdemo]# pwd
/root/Desktop/ftpdemo
[root@localhost ftpdemo]# ls
a1 a2 a3
[root@localhost ftpdemo]# ftp
ftp> bye
[root@localhost ftpdemo]# ftp 172.16.20.120
Connected to 172.16.20.120 (172.16.20.120).
220 (vsFTPd 2.2.2)
Name (172.16.20.120:root): user2
331 Please specify the password.
Password:
230 Login successful.
Remote system type is UNIX.
Using binary mode to transfer files.
ftp> ls
227 Entering Passive Mode (172,16,20,120,46,76).
150 Here comes the directory listing.
-rwxrwxrwx 1 0 0 0 Aug 28 08:40 java
-rwxrwxrwx 1 0 0 0 Aug 28 08:40 linux
-rwxrwxrwx 1 0 0 0 Aug 28 08:40 php
-rwxrwxrwx 1 0 0 0 Aug 28 08:40 python
226 Directory send OK.
ftp> 
```

12. Download the file on client from server using get command.

13. Upload the file from client to server using put command.

14. To end ftp connection use bye command.

15. Use ls to check changes.

```
root@localhost:~/Desktop/ftpdemo
File Edit View Search Terminal Help
ftp> get linux
local: linux remote: linux
227 Entering Passive Mode (172,16,20,120,101,118).
150 Opening BINARY mode data connection for linux (0 bytes).
226 Transfer complete.
ftp> get php
local: php remote: php
227 Entering Passive Mode (172,16,20,120,227,171).
150 Opening BINARY mode data connection for php (0 bytes).
226 Transfer complete.
ftp> put a1
local: a1 remote: a1
227 Entering Passive Mode (172,16,20,120,38,219).
150 Ok to send data.
226 Transfer complete.
ftp> put a2
local: a2 remote: a2
227 Entering Passive Mode (172,16,20,120,99,65).
150 Ok to send data.
226 Transfer complete.
ftp> bye
221 Goodbye.
[root@localhost ftpdemo]# ls
a1 a2 a3 linux php
[root@localhost ftpdemo]# 
```

On CentOS Server

1. Change directory to user2 and use ls to check files uploaded by client.

```
root@localhost:~/home/user2
File Edit View Search Terminal Help
[root@localhost user2]# pwd
/home/user2
[root@localhost user2]# ls
a1 a2 java linux php python
[root@localhost user2]# 
```

Practical 7

Aim: Configuring DHCP Server, Web Server and Mail Server.

A. Configuring DHCP Server

Perform on CentOS Server

To change the hostname of server:

1. Login as root user and check the IP address of server.
2. Change the hostname of server:

- Open /etc/sysconfig/network

Modify HOSTNAME= server.viva.edu save n exit

- Open /etc/hosts

Add line 172.16.20.120 server.viva.edu save n exit

- Now hostname server.viva.edu

- Now run hostname

```
root@localhost:~/Desktop
File Edit View Search Terminal Help
[root@localhost Desktop]# ifconfig
eth1      Link encap:Ethernet HWaddr 00:0C:29:59:8C:B8
          inet addr:172.16.20.120 Bcast:172.16.255.255 Mask:255.255.0.0
          inet6 addr: fe80::20c:29ff:fe59:8cb8/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:1009 errors:0 dropped:0 overruns:0 frame:0
          TX packets:35 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:93665 (91.4 KiB) TX bytes:3178 (3.1 KiB)
          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:65536 Metric:1
          RX packets:16 errors:0 dropped:0 overruns:0 frame:0
          TX packets:16 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:960 (960.0 b) TX bytes:960 (960.0 b)

[root@localhost Desktop]# vi /etc/sysconfig/networks
[root@localhost Desktop]# vi /etc/sysconfig/network
[root@localhost Desktop]# hostname
localhost.localdomain
[root@localhost Desktop]# hostname server.viva.edu
[root@localhost Desktop]# hostname
server.viva.edu
[root@localhost Desktop]#
```

3. Install dhcp using `yum install dhcp*` command.
4. Edit configuration file `/etc/dhcp/dhcpd.conf`. Initially when opened its empty.
5. Copy content of `/usr/share/doc/dhcp-4.1.1/dhcpd.conf.sample` to `/etc/dhcp/dhcpd.conf`. When asked whether to overwrite, type yes and enter.

6. Now edit configuration file /etc/dhcp/dhcpd.conf.

```
option domain-name —viva.edu;
option domain-name servers —server.viva.edu;
authoritative;
#subnet (comment the subnet line preceding by #)
subnet 172.16.0.0 netmask 255.255.0.0 {
range 172.16.20.40 172.16.21.60
#option routers (comment the subnet line preceding by #)
}
```

Press Esc and save and exit the file.

```
# option definitions common to all supported networks...
option domain-name "viva.edu";
option domain-name-servers server.viva.edu;

default-lease-time 600;
max-lease-time 7200;

# Use this to enable / disable dynamic dns updates globally.
#ddns-update-style none;

# If this DHCP server is the official DHCP server for the local
# network, the authoritative directive should be uncommented.
authoritative;
subnet 10.152.187.0 netmask 255.255.255.0 {
#}

# This is a very basic subnet declaration.

subnet 172.16.0.0 netmask 255.255.0.0 {
range 172.16.20.40 172.16.21.60
# option routers rtr-239-0-1.example.org, rtr-239-0-2.example.org;
}
```

7. Start the dhcpcd service.

8. Stop the firewall service.



The screenshot shows a terminal window titled "root@localhost:~/Desktop (on localhost.localdomain)". The terminal output is as follows:

```
[root@localhost Desktop]# cp /usr/share/doc/dhcp-4.1.1/dhcpd.conf.sample /etc/dh
cp: overwrite `/etc/dhcp/dhcpd.conf'? yes
[root@localhost Desktop]# vi /etc/dhcp/dhcpd.conf
[root@localhost Desktop]# service dhcpcd start
Starting dhcpcd: [ OK ]
[root@localhost Desktop]# service dhcpcd restart
Shutting down dhcpcd: [ OK ]
Starting dhcpcd: [ OK ]
[root@localhost Desktop]# chkconfig dhcpcd on
[root@localhost Desktop]# chkconfig --list | grep dhcpcd
dhcpcd      0:off  1:off  2:on   3:on   4:on    5:on    6:off
dhcpcd6     0:off  1:off  2:off  3:off  4:off   5:off   6:off
[root@localhost Desktop]# service iptables stop
iptables: Setting chains to policy ACCEPT: filter [ OK ]
iptables: Flushing firewall rules: [ OK ]
iptables: Unloading modules: [ OK ]
[root@localhost Desktop]# setenforce 0
[root@localhost Desktop]#
```

9. After completing configuration on server, start the client system and login as root user.

10. Check the IP address on it by using ifconfig command.

11. You will see that the address is one from the range specified on server.

B. Configuring Web Server

Step 1: Ping to check the connectivity

Step 2: Change the directory to /etc/httpd.check if conf.d file is present

Step 3: Change directory to /var/www/html and create a file index.html

```
<html>
<head>
<title>My page</title>
</head>
<body>
<h1>This is apache server</h1>
</body>
</html>
```

Step 4: Start the httpd service

Step 5: Open the browser and type localhost



C. Configuring Mail Server

Perform on CentOS Server

To change the hostname of server:

- Open /etc/sysconfig/network
 - Modify HOSTNAME= server.viva.edu save n exit
- Open /etc/hosts
 - Add line 172.16.20.120 server.viva.edu save n exit
- Now hostname server.viva.edu
- Now run hostname

```
root@localhost:~/Desktop
File Edit View Search Terminal Help
[root@localhost Desktop]# clear
[root@localhost Desktop]# vi /etc/hosts
[root@localhost Desktop]# vi /etc/sysconfig/network
[root@localhost Desktop]# hostname
localhost.localdomain
[root@localhost Desktop]# vi /etc/hosts
[root@localhost Desktop]# hostname server.viva.edu
[root@localhost Desktop]# hostname
server.viva.edu
[root@localhost Desktop]#
[root@localhost Desktop]#
```

1. Login as root user.
2. Verify IP address and hostname of server using ifconfig and hostname command.

```
root@localhost:~/Desktop
File Edit View Search Terminal Help
[root@localhost Desktop]# ifconfig
eth1      Link encap:Ethernet HWaddr 00:0C:29:59:8C:B8
          inet addr:172.16.20.120 Bcast:172.16.255.255 Mask:255.255.0.0
          inet6 addr: fe80::20c:29ff:fe59:8cb8/64 Scope:Link
            UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
            RX packets:117289 errors:0 dropped:0 overruns:0 frame:0
            TX packets:27676 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1000
            RX bytes:66973984 (63.8 MiB) TX bytes:2148792 (2.0 MiB)
            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:65536 Metric:1
            RX packets:20343 errors:0 dropped:0 overruns:0 frame:0
            TX packets:20343 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:0
            RX bytes:1026726 (1002.6 KiB) TX bytes:1026726 (1002.6 KiB)

[root@localhost Desktop]# hostname
server.viva.edu
[root@localhost Desktop]#
```

3. Install mail server using yum install postfix.
4. Edit the configuration file /etc/postfix/main.cf

myhostname = server.viva.edu

mydomain = viva.edu

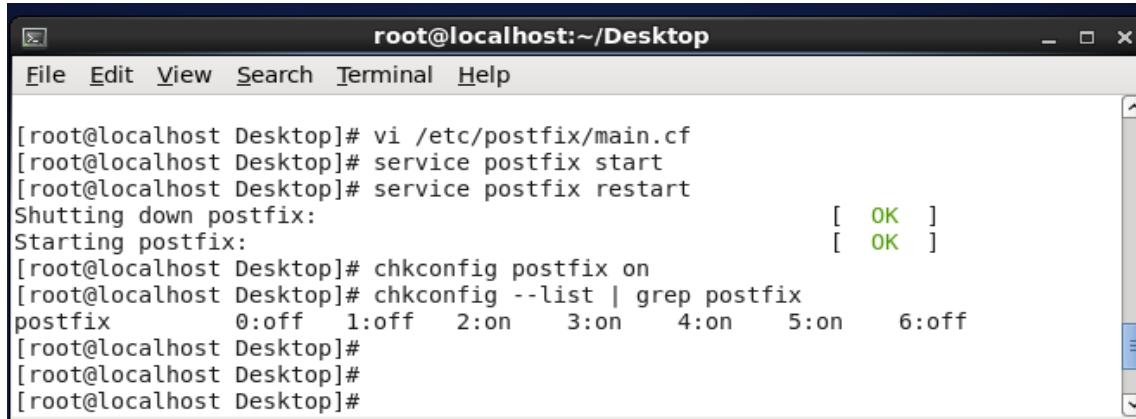
myorigin = \$mydomain

mydestination = \$myhostname, localhost.\$mydomain, localhost

mynetworks = 172.16.0.0/16

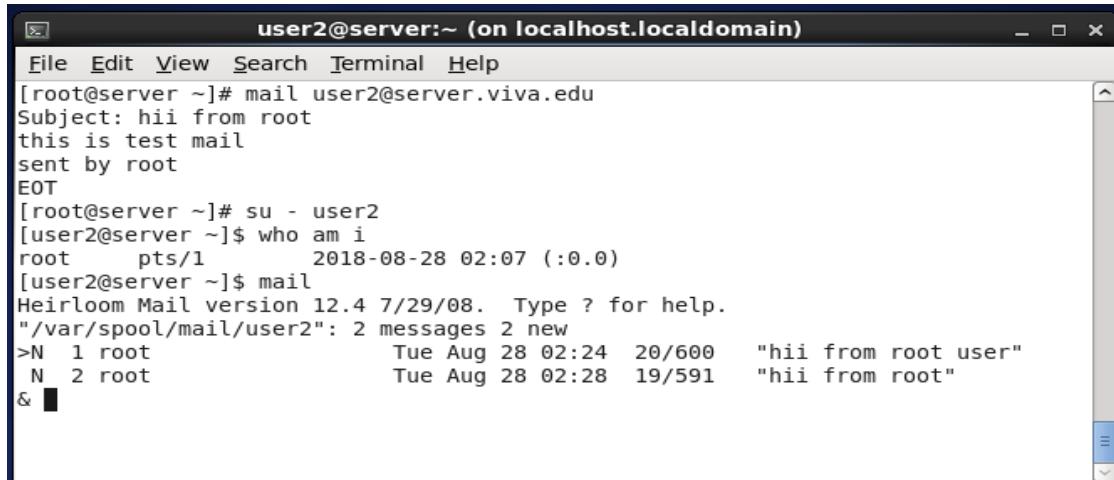
Press Esc :wq to save and exit.

5. Start the service.



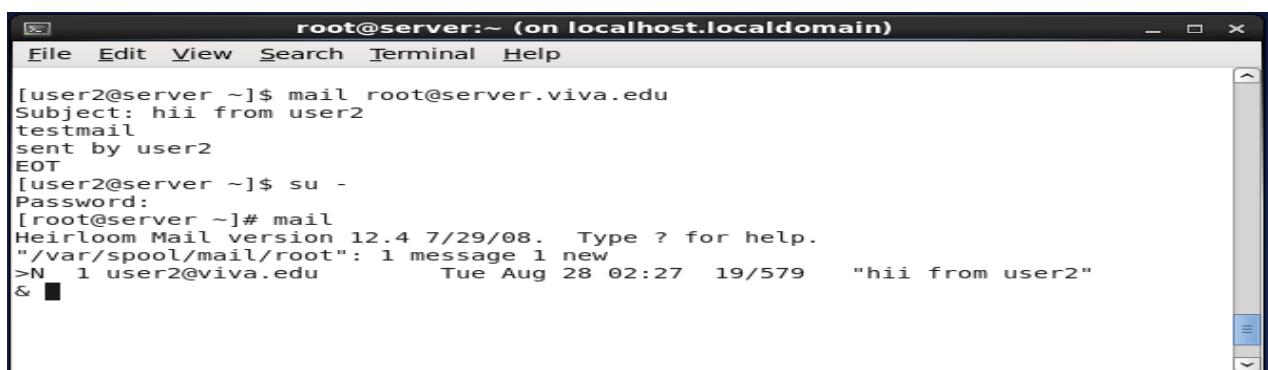
```
[root@localhost Desktop]# vi /etc/postfix/main.cf
[root@localhost Desktop]# service postfix start
[root@localhost Desktop]# service postfix restart
Shutting down postfix: [ OK ]
Starting postfix: [ OK ]
[root@localhost Desktop]# chkconfig postfix on
[root@localhost Desktop]# chkconfig --list | grep postfix
postfix      0:off  1:off  2:on   3:on   4:on   5:on   6:off
[root@localhost Desktop]#
[root@localhost Desktop]#
[root@localhost Desktop]#
```

6. Now root sends mail to user2 using mail command. Enter the subject and data you want to send and press Ctrl+d to end the file.
7. Login as user2 to check the mail.



```
user2@server:~ (on localhost.localdomain)
File Edit View Search Terminal Help
[root@server ~]# mail user2@server.viva.edu
Subject: hii from root
this is test mail
sent by root
EOT
[root@server ~]# su - user2
[user2@server ~]$ who am i
root pts/1 2018-08-28 02:07 (:0.0)
[user2@server ~]$ mail
Heirloom Mail version 12.4 7/29/08. Type ? for help.
"/var/spool/mail/user2": 2 messages 2 new
>N 1 root Tue Aug 28 02:24 20/600 "hii from root user"
N 2 root Tue Aug 28 02:28 19/591 "hii from root"
& [
```

8. Now user2 sends mail to root using mail command. Enter the subject and data you want to send and press Ctrl+d to end the file.
9. Login as root to check the mail.



```
root@server:~ (on localhost.localdomain)
File Edit View Search Terminal Help
[user2@server ~]$ mail root@server.viva.edu
Subject: hii from user2
testmail
sent by user2
EOT
[user2@server ~]$ su -
Password:
[root@server ~]# mail
Heirloom Mail version 12.4 7/29/08. Type ? for help.
"/var/spool/mail/root": 1 message 1 new
>N 1 user2@viva.edu Tue Aug 28 02:27 19/579 "hii from user2"
& [
```

Practical 8

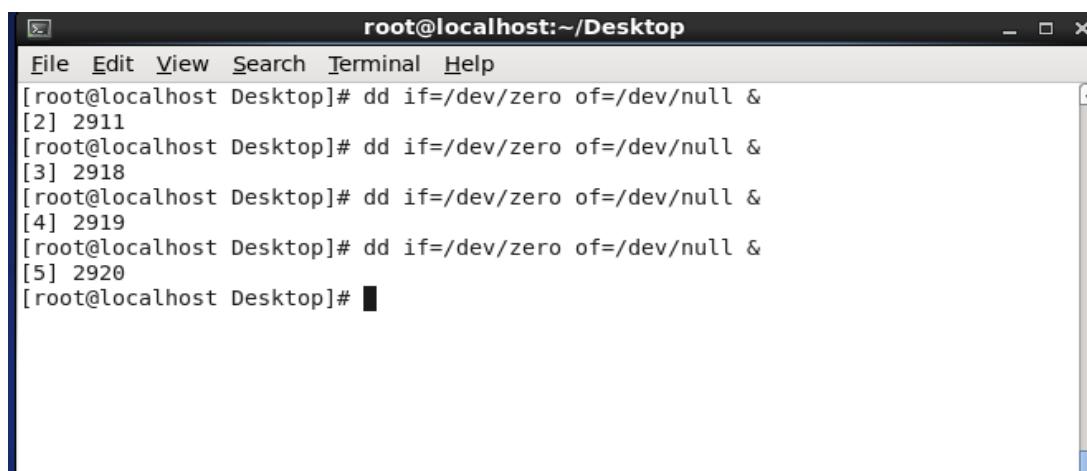
Aim: Configuring Monitoring and Automation Tasks

A. Configuring System Monitoring Tools

i. Using nice to Change Process Priority:

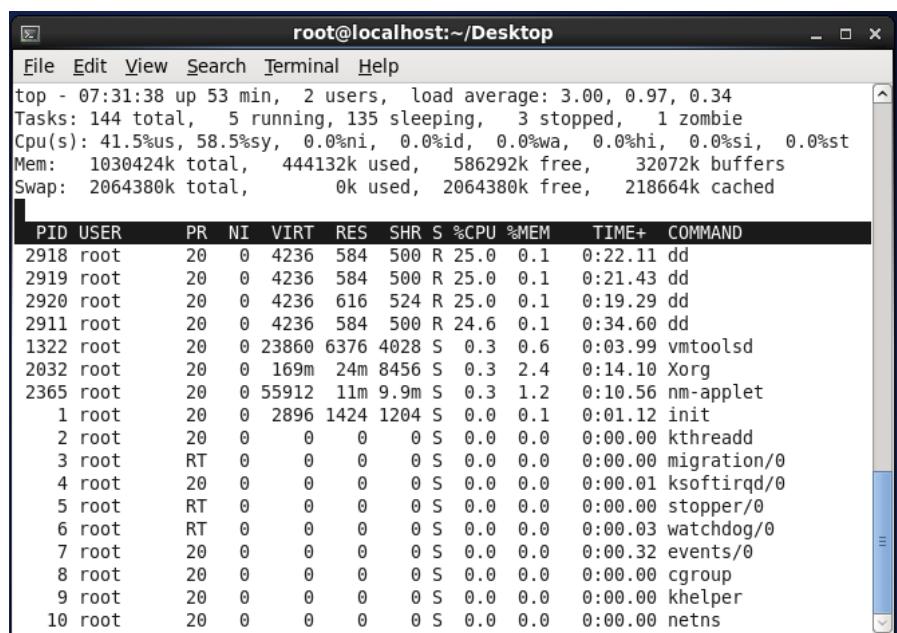
In this exercise, you'll start four dd processes, which, by default, will go on forever. You'll see that all of them are started with the same priority and receive about the same amount of CPU time and capacity. Next you'll adjust the niceness of two of these processes from within top, which immediately shows the effect of using nice on these commands.

1. Open a terminal window, and use su - to escalate to a root shell
2. Type the command dd if=/dev/zero of=/dev/null &, and repeat this four times.



```
root@localhost:~/Desktop
File Edit View Search Terminal Help
[root@localhost Desktop]# dd if=/dev/zero of=/dev/null &
[2] 2911
[root@localhost Desktop]# dd if=/dev/zero of=/dev/null &
[3] 2918
[root@localhost Desktop]# dd if=/dev/zero of=/dev/null &
[4] 2919
[root@localhost Desktop]# dd if=/dev/zero of=/dev/null &
[5] 2920
[root@localhost Desktop]#
```

3. Now start top. You'll see the four dd commands listed at the top. In the PR column, you can see that the priority of all of these processes is set to 20. The NI column, which shows the actual process niceness, indicates a value of 0 for all of the dd processes, and, in the TIME column, you can see that all of the processes use about the same amount of processor time.



```
root@localhost:~/Desktop
File Edit View Search Terminal Help
top - 07:31:38 up 53 min, 2 users, load average: 3.00, 0.97, 0.34
Tasks: 144 total, 5 running, 135 sleeping, 3 stopped, 1 zombie
Cpu(s): 41.5%us, 58.5%sy, 0.0%ni, 0.0%id, 0.0%wa, 0.0%hi, 0.0%si, 0.0%st
Mem: 1030424k total, 444132k used, 586292k free, 32072k buffers
Swap: 2064380k total, 0k used, 2064380k free, 218664k cached

      PID USER      PR  NI    VIRT    RES    SHR S %CPU %MEM     TIME+ COMMAND
2918 root      20   0  4236   584   500 R 25.0  0.1  0:22.11 dd
2919 root      20   0  4236   584   500 R 25.0  0.1  0:21.43 dd
2920 root      20   0  4236   616   524 R 25.0  0.1  0:19.29 dd
2911 root      20   0  4236   584   500 R 24.6  0.1  0:34.60 dd
1322 root      20   0 23860 6376 4028 S  0.3  0.6  0:03.99 vmtoolsd
2032 root      20   0 169m  24m 8456 S  0.3  2.4  0:14.10 Xorg
2365 root      20   0 55912 11m 9.9m S  0.3  1.2  0:10.56 nm-applet
  1 root      20   0  2896 1424 1204 S  0.0  0.1  0:01.12 init
  2 root      20   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  0:00.01 ksoftirqd/0
  5 root      RT   0      0    0    0 S  0.0  0.0  0:00.00 stopper/0
  6 root      RT   0      0    0    0 S  0.0  0.0  0:00.03 watchdog/0
  7 root      20   0      0    0    0 S  0.0  0.0  0:00.32 events/0
  8 root      20   0      0    0    0 S  0.0  0.0  0:00.00 cgroup
  9 root      20   0      0    0    0 S  0.0  0.0  0:00.00 khelper
10 root      20   0      0    0    0 S  0.0  0.0  0:00.00 netns
```

4. Now, from within the top interface, press r. On the PID to renice prompt, type the PID of one of the four dd processes, and press Enter. When asked Renice PID 3309 to value:, type 5, and press Enter.

```
root@localhost:~/Desktop
File Edit View Search Terminal Help
top - 07:32:38 up 54 min, 2 users, load average: 3.63, 1.52, 0.57
Tasks: 144 total, 6 running, 134 sleeping, 3 stopped, 1 zombie
Cpu(s): 43.0%us, 57.0%sy, 0.0%ni, 0.0%id, 0.0%wa, 0.0%hi, 0.0%si, 0.0%st
Mem: 1030424k total, 444256k used, 586168k free, 32128k buffers
Swap: 2064380k total, 0k used, 2064380k free, 218668k cached
PID to renice: 2911

```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
2911	root	20	0	4236	584	500	R	25.0	0.1	0:49.53	dd
2920	root	20	0	4236	616	524	R	25.0	0.1	0:34.20	dd
2918	root	20	0	4236	584	500	R	24.6	0.1	0:37.03	dd
2919	root	20	0	4236	584	500	R	24.6	0.1	0:36.35	dd
1	root	20	0	2896	1424	1204	S	0.0	0.1	0:01.12	init
2	root	20	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	0:00.01	ksoftirqd/0
5	root	RT	0	0	0	0	S	0.0	0.0	0:00.00	stopper/0
6	root	RT	0	0	0	0	S	0.0	0.0	0:00.03	watchdog/0
7	root	20	0	0	0	0	S	0.0	0.0	0:00.32	events/0
8	root	20	0	0	0	0	S	0.0	0.0	0:00.00	cgroup
9	root	20	0	0	0	0	S	0.0	0.0	0:00.00	khelper
10	root	20	0	0	0	0	S	0.0	0.0	0:00.00	netns
11	root	20	0	0	0	0	S	0.0	0.0	0:00.00	async/mgr
12	root	20	0	0	0	0	S	0.0	0.0	0:00.00	pm
13	root	20	0	0	0	0	S	0.0	0.0	0:00.01	sync_supers

```
root@localhost:~/Desktop
File Edit View Search Terminal Help
top - 07:32:38 up 54 min, 2 users, load average: 3.63, 1.52, 0.57
Tasks: 144 total, 6 running, 134 sleeping, 3 stopped, 1 zombie
Cpu(s): 43.0%us, 57.0%sy, 0.0%ni, 0.0%id, 0.0%wa, 0.0%hi, 0.0%si, 0.0%st
Mem: 1030424k total, 444256k used, 586168k free, 32128k buffers
Swap: 2064380k total, 0k used, 2064380k free, 218668k cached
Renice PID 2911 to value: 5

```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
2911	root	20	0	4236	584	500	R	25.0	0.1	0:49.53	dd
2920	root	20	0	4236	616	524	R	25.0	0.1	0:34.20	dd
2918	root	20	0	4236	584	500	R	24.6	0.1	0:37.03	dd
2919	root	20	0	4236	584	500	R	24.6	0.1	0:36.35	dd
1	root	20	0	2896	1424	1204	S	0.0	0.1	0:01.12	init
2	root	20	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	0:00.01	ksoftirqd/0
5	root	RT	0	0	0	0	S	0.0	0.0	0:00.00	stopper/0
6	root	RT	0	0	0	0	S	0.0	0.0	0:00.03	watchdog/0
7	root	20	0	0	0	0	S	0.0	0.0	0:00.32	events/0
8	root	20	0	0	0	0	S	0.0	0.0	0:00.00	cgroup
9	root	20	0	0	0	0	S	0.0	0.0	0:00.00	khelper
10	root	20	0	0	0	0	S	0.0	0.0	0:00.00	netns
11	root	20	0	0	0	0	S	0.0	0.0	0:00.00	async/mgr
12	root	20	0	0	0	0	S	0.0	0.0	0:00.00	pm
13	root	20	0	0	0	0	S	0.0	0.0	0:00.01	sync_supers

5. With the previous action, you lowered the priority of one of the dd commands. You should immediately start seeing the result in top, because one of the dd processes will receive a significantly lower amount of CPU time.

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
2918	root	20	0	4236	584	500	R	30.0	0.1	1:44.28	dd
2919	root	20	0	4236	584	500	R	30.0	0.1	1:43.60	dd
2920	root	20	0	4236	616	524	R	30.0	0.1	1:41.45	dd
2911	root	25	5	4236	584	500	R	10.0	0.1	1:22.80	dd
1	root	20	0	2896	1424	1204	S	0.0	0.1	0:01.12	init
2	root	20	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	0:00.02	ksoftirqd/0
5	root	RT	0	0	0	0	S	0.0	0.0	0:00.00	stopper/0
6	root	RT	0	0	0	0	S	0.0	0.0	0:00.03	watchdog/0
7	root	20	0	0	0	0	S	0.0	0.0	0:00.33	events/0
8	root	20	0	0	0	0	S	0.0	0.0	0:00.00	cgroup
9	root	20	0	0	0	0	S	0.0	0.0	0:00.00	khelper
10	root	20	0	0	0	0	S	0.0	0.0	0:00.00	netns
11	root	20	0	0	0	0	S	0.0	0.0	0:00.00	async/mgr
12	root	20	0	0	0	0	S	0.0	0.0	0:00.00	pm
13	root	20	0	0	0	0	S	0.0	0.0	0:00.01	sync_supers

6. Repeat the procedure to adjust the niceness of one of the other dd processes. Now use a niceness value of -15. You will notice that this process now tends to consume all of the available resources on your computer. Thus, you should avoid the extremes when working with nice.

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
2918	root	20	0	4236	584	500	R	30.3	0.1	1:46.99	dd
2919	root	20	0	4236	584	500	R	29.9	0.1	1:46.30	dd
2920	root	20	0	4236	616	524	R	29.9	0.1	1:44.15	dd
2911	root	25	5	4236	584	500	R	10.0	0.1	1:23.68	dd
1	root	20	0	2896	1424	1204	S	0.0	0.1	0:01.12	init
2	root	20	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	0:00.02	ksoftirqd/0
5	root	RT	0	0	0	0	S	0.0	0.0	0:00.00	stopper/0
6	root	RT	0	0	0	0	S	0.0	0.0	0:00.03	watchdog/0
7	root	20	0	0	0	0	S	0.0	0.0	0:00.33	events/0
8	root	20	0	0	0	0	S	0.0	0.0	0:00.00	cgroup
9	root	20	0	0	0	0	S	0.0	0.0	0:00.00	khelper
10	root	20	0	0	0	0	S	0.0	0.0	0:00.00	netns
11	root	20	0	0	0	0	S	0.0	0.0	0:00.00	async/mgr
12	root	20	0	0	0	0	S	0.0	0.0	0:00.00	pm
13	root	20	0	0	0	0	S	0.0	0.0	0:00.01	sync_supers

```
root@localhost:~/Desktop
File Edit View Search Terminal Help
top - 07:36:43 up 59 min, 2 users, load average: 3.99, 2.90, 1.35
Tasks: 143 total, 5 running, 134 sleeping, 3 stopped, 1 zombie
Cpu(s): 38.0%us, 58.0%sy, 4.0%ni, 0.0%id, 0.0%wa, 0.0%hi, 0.0%si, 0.0%st
Mem: 1030424k total, 444132k used, 586292k free, 32256k buffers
Swap: 2064380k total, 0k used, 2064380k free, 218668k cached
Renice PID 2920 to value: -15
PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND
2918 root 20 0 4236 584 500 R 30.3 0.1 1:46.99 dd
2919 root 20 0 4236 584 500 R 29.9 0.1 1:46.30 dd
2920 root 20 0 4236 616 524 R 29.9 0.1 1:44.15 dd
2911 root 25 5 4236 584 500 R 10.0 0.1 1:23.68 dd
1 root 20 0 2896 1424 1204 S 0.0 0.1 0:01.12 init
2 root 20 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 0:00.02 ksoftirqd/0
5 root RT 0 0 0 0 S 0.0 0.0 0:00.00 stopper/0
6 root RT 0 0 0 0 S 0.0 0.0 0:00.03 watchdog/0
7 root 20 0 0 0 0 S 0.0 0.0 0:00.33 events/0
8 root 20 0 0 0 0 S 0.0 0.0 0:00.00 cgroup
9 root 20 0 0 0 0 S 0.0 0.0 0:00.00 khelper
10 root 20 0 0 0 0 S 0.0 0.0 0:00.00 netns
11 root 20 0 0 0 0 S 0.0 0.0 0:00.00 async/mgr
12 root 20 0 0 0 0 S 0.0 0.0 0:00.00 pm
13 root 20 0 0 0 0 S 0.0 0.0 0:00.01 sync_supers
```

```
root@localhost:~/Desktop
File Edit View Search Terminal Help
top - 07:37:35 up 59 min, 2 users, load average: 3.99, 3.08, 1.50
Tasks: 143 total, 5 running, 134 sleeping, 3 stopped, 1 zombie
Cpu(s): 42.2%us, 57.5%sy, 0.3%ni, 0.0%id, 0.0%wa, 0.0%hi, 0.0%si, 0.0%st
Mem: 1030424k total, 444124k used, 586300k free, 32272k buffers
Swap: 2064380k total, 0k used, 2064380k free, 218668k cached
PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND
2920 root 5 -15 4236 616 524 R 92.0 0.1 2:09.20 dd
2918 root 20 0 4236 584 500 R 3.3 0.1 1:58.66 dd
2919 root 20 0 4236 584 500 R 3.0 0.1 1:57.97 dd
2911 root 25 5 4236 584 500 R 1.0 0.1 1:27.50 dd
2284 root 20 0 46356 12m 10m S 0.3 1.3 0:00.34 gnome-panel
2923 root 20 0 2700 1132 884 R 0.3 0.1 0:00.19 top
1 root 20 0 2896 1424 1204 S 0.0 0.1 0:01.12 init
2 root 20 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 0:00.02 ksoftirqd/0
5 root RT 0 0 0 0 S 0.0 0.0 0:00.00 stopper/0
6 root RT 0 0 0 0 S 0.0 0.0 0:00.03 watchdog/0
7 root 20 0 0 0 0 S 0.0 0.0 0:00.33 events/0
8 root 20 0 0 0 0 S 0.0 0.0 0:00.00 cgroup
9 root 20 0 0 0 0 S 0.0 0.0 0:00.00 khelper
10 root 20 0 0 0 0 S 0.0 0.0 0:00.00 netns
11 root 20 0 0 0 0 S 0.0 0.0 0:00.00 async/mgr
```

7. Use the k command from the top interface to stop all processes where you adjusted the niceness.

```

root@localhost:~/Desktop
File Edit View Search Terminal Help
top - 07:37:56 up 1:00, 2 users, load average: 3.99, 3.14, 1.55
Tasks: 143 total, 5 running, 134 sleeping, 3 stopped, 1 zombie
Cpu(s): 42.0%us, 57.3%sy, 0.3%ni, 0.0%id, 0.0%wa, 0.3%hi, 0.0%si, 0.0%st
Mem: 1030424k total, 444124k used, 586300k free, 32280k buffers
Swap: 2064380k total, 0k used, 2064380k free, 218668k cached
PID to kill: 2918
  PID USER      PR  NI    VIRT    RES   SHR S %CPU %MEM     TIME+   COMMAND
2920 root      5 -15   4236   616  524 R 91.8  0.1  2:28.60 dd
2918 root      20   0   4236   584  500 R  3.3  0.1  1:59.34 dd
2919 root      20   0   4236   584  500 R  3.3  0.1  1:58.66 dd
2911 root      25   5   4236   584  500 R  1.0  0.1  1:27.72 dd
2032 root      20   0 169m  24m  8456 S  0.3  2.4  0:14.47 Xorg
2308 root      20   0  6380   824  600 S  0.3  0.1  0:00.89 udisks-daemon
2923 root      20   0 2700 1132  884 R  0.3  0.1  0:00.20 top
  1 root      20   0 2896 1424 1204 S  0.0  0.1  0:01.12 init
  2 root      20   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  0:00.02 ksoftirqd/0
  5 root      RT   0   0     0   0 S  0.0  0.0  0:00.00 stopper/0
  6 root      RT   0   0     0   0 S  0.0  0.0  0:00.03 watchdog/0
  7 root      20   0   0     0   0 S  0.0  0.0  0:00.33 events/0
  8 root      20   0   0     0   0 S  0.0  0.0  0:00.00 cgroup
  9 root      20   0   0     0   0 S  0.0  0.0  0:00.00 khelper
 10 root     20   0   0     0   0 S  0.0  0.0  0:00.00 netns

```

```

root@localhost:~/Desktop
File Edit View Search Terminal Help
top - 07:37:56 up 1:00, 2 users, load average: 3.99, 3.14, 1.55
Tasks: 143 total, 5 running, 134 sleeping, 3 stopped, 1 zombie
Cpu(s): 42.0%us, 57.3%sy, 0.3%ni, 0.0%id, 0.0%wa, 0.3%hi, 0.0%si, 0.0%st
Mem: 1030424k total, 444124k used, 586300k free, 32280k buffers
Swap: 2064380k total, 0k used, 2064380k free, 218668k cached
Kill PID 2918 with signal [15]: y
  PID USER      PR  NI    VIRT    RES   SHR S %CPU %MEM     TIME+   COMMAND
2920 root      5 -15   4236   616  524 R 91.8  0.1  2:28.60 dd
2918 root      20   0   4236   584  500 R  3.3  0.1  1:59.34 dd
2919 root      20   0   4236   584  500 R  3.3  0.1  1:58.66 dd
2911 root      25   5   4236   584  500 R  1.0  0.1  1:27.72 dd
2032 root      20   0 169m  24m  8456 S  0.3  2.4  0:14.47 Xorg
2308 root      20   0  6380   824  600 S  0.3  0.1  0:00.89 udisks-daemon
2923 root      20   0 2700 1132  884 R  0.3  0.1  0:00.20 top
  1 root      20   0 2896 1424 1204 S  0.0  0.1  0:01.12 init
  2 root      20   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  0:00.02 ksoftirqd/0
  5 root      RT   0   0     0   0 S  0.0  0.0  0:00.00 stopper/0
  6 root      RT   0   0     0   0 S  0.0  0.0  0:00.03 watchdog/0
  7 root      20   0   0     0   0 S  0.0  0.0  0:00.33 events/0
  8 root      20   0   0     0   0 S  0.0  0.0  0:00.00 cgroup
  9 root      20   0   0     0   0 S  0.0  0.0  0:00.00 khelper
 10 root     20   0   0     0   0 S  0.0  0.0  0:00.00 netns

```

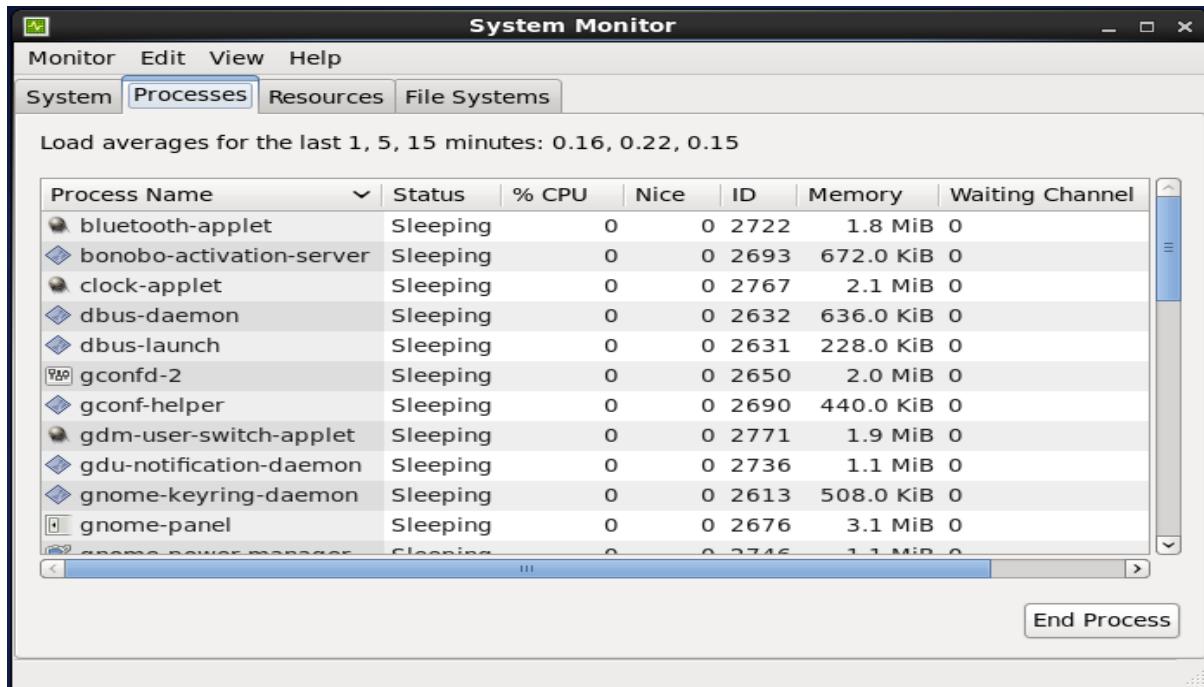
root@localhost:~/Desktop

```
File Edit View Search Terminal Help
top - 07:38:39 up 1:00, 2 users, load average: 3.91, 3.24, 1.66
Tasks: 142 total, 4 running, 134 sleeping, 3 stopped, 1 zombie
Cpu(s): 47.7%us, 51.7%sy, 0.7%ni, 0.0%id, 0.0%wa, 0.0%hi, 0.0%si, 0.0%st
Mem: 1030424k total, 443992k used, 586432k free, 32288k buffers
Swap: 2064380k total, 0k used, 2064380k free, 218668k cached
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
2920	root	5	-15	4236	616	524	R	95.2	0.1	3:08.22	dd
2919	root	20	0	4236	584	500	R	3.3	0.1	2:00.05	dd
2911	root	25	5	4236	584	500	R	1.0	0.1	1:28.18	dd
2032	root	20	0	169m	24m	8456	S	0.3	2.4	0:14.51	Xorg
1	root	20	0	2896	1424	1204	S	0.0	0.1	0:01.12	init
2	root	20	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	0:00.02	ksoftirqd/0
5	root	RT	0	0	0	0	S	0.0	0.0	0:00.00	stopper/0
6	root	RT	0	0	0	0	S	0.0	0.0	0:00.03	watchdog/0
7	root	20	0	0	0	0	S	0.0	0.0	0:00.33	events/0
8	root	20	0	0	0	0	S	0.0	0.0	0:00.00	cgroup
9	root	20	0	0	0	0	S	0.0	0.0	0:00.00	khelper
10	root	20	0	0	0	0	S	0.0	0.0	0:00.00	netns
11	root	20	0	0	0	0	S	0.0	0.0	0:00.00	async/mgr
12	root	20	0	0	0	0	S	0.0	0.0	0:00.00	pm
13	root	20	0	0	0	0	S	0.0	0.0	0:00.01	sync_supers

ii. System monitor tool





iii. free command

To check used and free memory in kb and mb

```
student@client:~$ free
              total        used        free      shared  buffers   cached
Mem:       1030100      500468      529632      3808     24980    284852
-/+ buffers/cache:  190636     839464
Swap:      2064380          0     2064380
[student@client ~]$ 
[student@client ~]$ 
[student@client ~]$ free -m
              total        used        free      shared  buffers   cached
Mem:         1005         488         517          3         24        278
-/+ buffers/cache:  186         819
Swap:        2015          0        2015
[student@client ~]$ 
```

iv. lsblk

To check list of available block devices in tree structure and ordinary structure.

```
student@client:~$ lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sr0  11:0    1 1024M  0 rom
sda   8:0    0  20G  0 disk
└─sda1  8:1    0 300M  0 part /boot
└─sda2  8:2    0 17.8G 0 part /
└─sda3  8:3    0   2G  0 part [SWAP]
[student@client ~]$ lsblk -l
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sr0  11:0    1 1024M  0 rom
sda   8:0    0  20G  0 disk
sda1  8:1    0 300M  0 part /boot
sda2  8:2    0 17.8G 0 part /
sda3  8:3    0   2G  0 part [SWAP]
[student@client ~]$ 
```

v. blkid

To display information about available block devices.

```
student@client:~$ blkid
/dev/sda1: UUID="6fbfb9704-88b0-41b5-878c-602c7e81a97d" TYPE="ext4"
/dev/sda2: UUID="35a5b030-838c-4cff-a28b-19672132b5bc" TYPE="ext4"
/dev/sda3: UUID="bbe53e68-50e6-408a-a708-43dd1e6cf083" TYPE="swap"
[student@client ~]$
[student@client ~]$
[student@client ~]$ blkid /dev/sda1
/dev/sda1: UUID="6fbfb9704-88b0-41b5-878c-602c7e81a97d" TYPE="ext4"
[student@client ~]$
```

vi. findmnt

To display currently mounted file system

```
student@client:~$ findmnt
TARGET           SOURCE      FSTYPE    OPTIONS
/                  /dev/sda2    ext4      rw,relatime,seclabel,barrier=1
└─/proc          proc        proc      rw,relatime
└─/proc/bus/usb  /proc/bus/usb  usbfs    rw,relatime
    └─/proc/sys/fs/binfmt_misc binfmt_m  rw,relatime
└─/sys           sysfs      sysfs    rw,relatime,seclabel
└─/selinux       selinux     selinuxf rw,relatime
└─/dev           devtmpfs   devtmpfs  rw,relatime,seclabel,size=5042
    └─/dev
        └─/dev/pts    devpts     devpts   rw,relatime,seclabel,gid=5,mode=620
        └─/dev/shm    tmpfs     tmpfs   rw,relatime,seclabel
└─/boot          /dev/sda1    ext4      rw,relatime,seclabel,barrier=1
└─/var/run/vmblock-fuse  vmware-vmblock fuse.vmw  rw,nosuid,nodev,relatime,user_
[student@client ~]$
[student@client ~]$
[student@client ~]$ findmnt -l
TARGET           SOURCE      FSTYPE    OPTIONS
/proc            proc        proc      rw,relatime
/sys             sysfs      sysfs    rw,relatime,seclabel
/dev             devtmpfs   devtmpfs  rw,relatime,seclabel,size=504276k,nr_inod
/dev/pts         devpts     devpts   rw,relatime,seclabel,gid=5,mode=620,ptmxm
/dev/shm         tmpfs     tmpfs   rw,relatime,seclabel
/                /dev/sda2    ext4      rw,relatime,seclabel,barrier=1,data=order
└─/selinux       selinuxfs  selinuxfs rw,relatime
└─/dev           devtmpfs   devtmpfs  rw,relatime,seclabel,size=504276k,nr_inod
└─/proc/bus/usb  /proc/bus/usb  usbfs    rw,relatime
└─/boot          /dev/sda1    ext4      rw,relatime,seclabel,barrier=1,data=order
└─/proc/sys/fs/binfmt_misc binfmt_mi  rw,relatime
└─/var/run/vmblock-fuse  vmware-vmblock fuse.vmwa  rw,nosuid,nodev,relatime,user_id=0,group_
[student@client ~]$
```

vii. df

To display detailed report on system's disk space usage.

```
student@client:~$ df
Filesystem  1K-blocks  Used  Available Use% Mounted on
/dev/sda2      18175756 3289040  13956772  20% /
tmpfs          515048    228    514820   1% /dev/shm
/dev/sda1      289293   53979    219954  20% /boot
[student@client ~]$
[student@client ~]$
[student@client ~]$ df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda2      18G   3.2G   14G  20% /
tmpfs          503M  228K  503M   1% /dev/shm
/dev/sda1      283M   53M  215M  20% /boot
[student@client ~]$
```

viii. du

To display amount of space that is being used by files in a directory.

The image shows three separate terminal windows side-by-side. Each window has a title bar 'student@client:~' and a menu bar 'File Edit View Search Terminal Help'. The first window displays the command 'du' without options, showing file sizes from 16 to 40. The second window displays 'du -h', which includes human-readable units (K, M, G). The third window displays 'du -sh', which shows the total size of the current directory.

```
[student@client ~]$ du
16      ./cache
4       ./Videos
8       ./gconf/apps/nm-applet
8       ./gconf/apps/nautilus/desktop-metadata/directory
8       ./gconf/apps/nautilus/desktop-metadata/home
8       ./gconf/apps/nautilus/desktop-metadata/trash
8       ./gconf/apps/nautilus/desktop-metadata/computer
36      ./gconf/apps/nautilus/desktop-metadata
40      ./gconf/apps/nautilus

[student@client ~]$ du -h
16K     ./cache
4.0K    ./Videos
8.0K   ./gconf/apps/nm-applet
8.0K   ./gconf/apps/nautilus/desktop-metadata/directory
8.0K   ./gconf/apps/nautilus/desktop-metadata/home
8.0K   ./gconf/apps/nautilus/desktop-metadata/trash
8.0K   ./gconf/apps/nautilus/desktop-metadata/computer
36K    ./gconf/apps/nautilus/desktop-metadata
40K    ./gconf/apps/nautilus

[student@client ~]$ du -sh
33M   .
[student@client ~]$
```

ix. lspci

To display information about PCI buses and devices attached to them.

The image shows two terminal windows. The top window displays the standard output of the 'lspci' command, listing various PCI devices and their details. The bottom window displays the output of 'lspci -v' for the same devices, providing more detailed information such as subsystems, flags, and kernel drivers.

```
[student@client ~]$ 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 (rev 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 10)
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)

[student@client ~]$ lspci -v
00:00.0 Host bridge: Intel Corporation 440BX/ZX/DX - 82443BX/ZX/DX Host bridge (rev 01)
          Subsystem: VMware Virtual Machine Chipset
          Flags: bus master, medium devsel, latency 0
          Kernel driver in use: agpgart-intel

00:01.0 PCI bridge: Intel Corporation 440BX/ZX/DX - 82443BX/ZX/DX AGP bridge (rev 01) (prog-if 00 [Normal decode])
          Flags: bus master, 66MHz, medium devsel, latency 0
          Bus: primary=00, secondary=01, subordinate=01, sec-latency=64
```

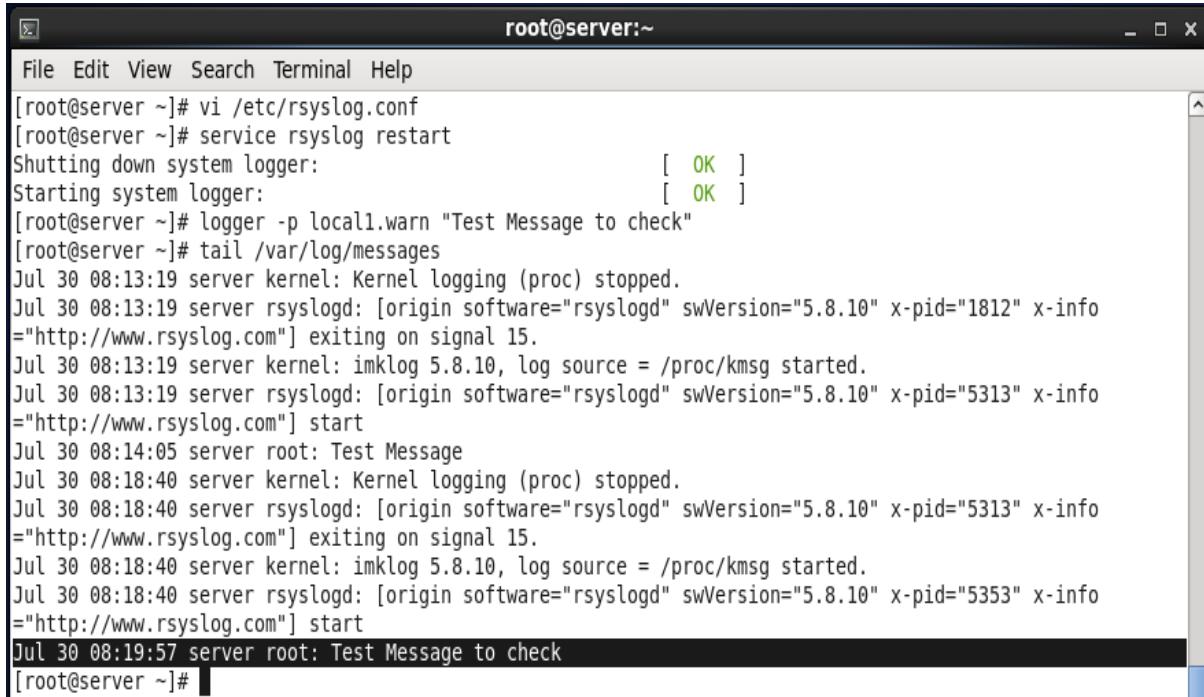
x. lsusb

To display information about USB buses and devices attached to them.

```
student@client:~  
File Edit View Search Terminal Help  
[student@client ~]$ lsusb  
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub  
Bus 002 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub  
Bus 002 Device 002: ID 0e0f:0003 VMware, Inc. Virtual Mouse  
Bus 002 Device 003: ID 0e0f:0002 VMware, Inc. Virtual USB Hub  
Bus 002 Device 004: ID 0e0f:0008 VMware, Inc.  
[student@client ~]$ lsusb -v  
  
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub  
Couldn't open device, some information will be missing  
Device Descriptor:  
    bLength          18  
    bDescriptorType   1  
    bcdUSB         2.00  
    bDeviceClass      9 Hub  
    bDeviceSubClass    0 Unused  
    bDeviceProtocol     0 Full speed (or root) hub
```

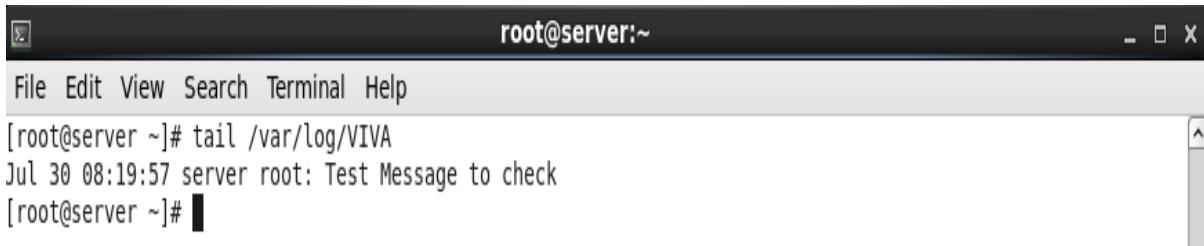
B. Configuring rsyslog

1. Login as a root user on server.
2. Open the file /etc/rsyslog.conf
3. Enter the following line below the line *.info;mail.none;authpriv.none;cron.none
Local1.info /var/log/VIVA
Save the file using :wq
4. Restart the rsyslog service
5. Use command logger -p local1.warn “Test Message to check” to see from where the message is coming.
6. Use tail command to check log messages in default file.



```
root@server:~ File Edit View Search Terminal Help [root@server ~]# vi /etc/rsyslog.conf [root@server ~]# service rsyslog restart Shutting down system logger: [ OK ] Starting system logger: [ OK ] [root@server ~]# logger -p local1.warn "Test Message to check" [root@server ~]# tail /var/log/messages Jul 30 08:13:19 server kernel: Kernel logging (proc) stopped. Jul 30 08:13:19 server rsyslogd: [origin software="rsyslogd" swVersion="5.8.10" x-pid="1812" x-info ="http://www.rsyslog.com"] exiting on signal 15. Jul 30 08:13:19 server kernel: imklog 5.8.10, log source = /proc/kmsg started. Jul 30 08:13:19 server rsyslogd: [origin software="rsyslogd" swVersion="5.8.10" x-pid="5313" x-info ="http://www.rsyslog.com"] start Jul 30 08:14:05 server root: Test Message Jul 30 08:18:40 server kernel: Kernel logging (proc) stopped. Jul 30 08:18:40 server rsyslogd: [origin software="rsyslogd" swVersion="5.8.10" x-pid="5313" x-info ="http://www.rsyslog.com"] exiting on signal 15. Jul 30 08:18:40 server kernel: imklog 5.8.10, log source = /proc/kmsg started. Jul 30 08:18:40 server rsyslogd: [origin software="rsyslogd" swVersion="5.8.10" x-pid="5353" x-info ="http://www.rsyslog.com"] start Jul 30 08:19:57 server root: Test Message to check [root@server ~]#
```

7. To check message in the created file.



```
root@server:~ File Edit View Search Terminal Help [root@server ~]# tail /var/log/VIVA Jul 30 08:19:57 server root: Test Message to check [root@server ~]#
```

C. Configuring cron, anacron, at and batch

i. Configuring cron

1. Open a terminal, and make sure you are logged in with your normal user account.
 2. Type crontab -e to open the crontab editor.
 3. Type the following line, which will send an email message every five minutes:
*/5 * * * * mail -s "hello root" root <
 4. Use the vi command :wq! to close the crontab editor and save your changes.
 5. Wait five minutes. Then, in a root terminal, type mail to start the command-line mail program. You should see a message with the subject hello root that was sent by your normal user account. Type q to quit the mail interface.
 6. Go back to the terminal where you are logged in with the normal user account, and type crontab -r. This deletes the current crontab file for your user account.

```
student@localhost:~/Desktop
File Edit View Search Terminal Help
[student@localhost Desktop]$ crontab -e
no crontab for student - using an empty one
crontab: installing new crontab
[student@localhost Desktop]$ █
```

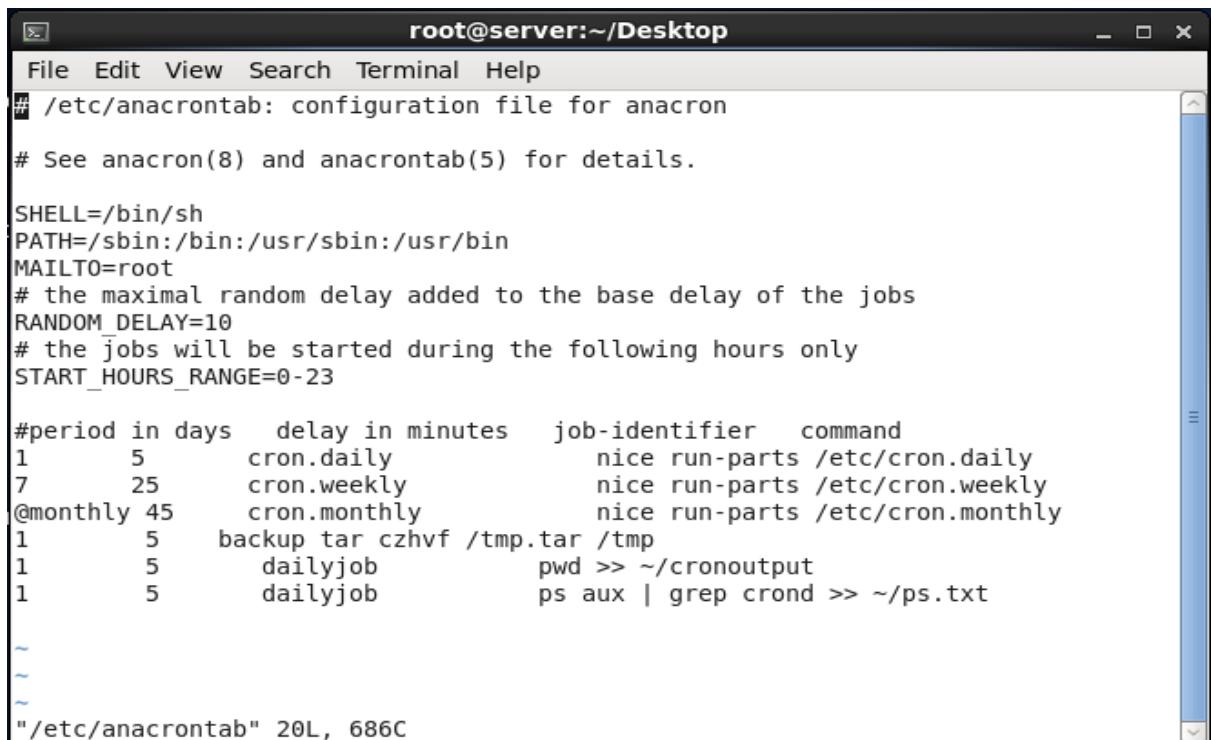
```
student@localhost:~/Desktop
File Edit View Search Terminal Help
[student@localhost Desktop]$ mail
Heirloom Mail version 12.4 7/29/08. Type ? for help.
"/var/spool/mail/student": 5 messages 5 new
>N 1 Cron Daemon      Fri Jul 27 03:35  22/873  "Cron <student@localho"
N 2 Cron Daemon      Fri Jul 27 03:40  22/873  "Cron <student@localho"
N 3 Cron Daemon      Fri Jul 27 03:45  22/873  "Cron <student@localho"
N 4 Cron Daemon      Fri Jul 27 03:50  22/873  "Cron <student@localho"
N 5 Cron Daemon      Fri Jul 27 03:55  22/873  "Cron <student@localho"
& q
Held 5 messages in /var/spool/mail/student
[student@localhost Desktop]$
```

ii. Configuring Anacron

1. Login as root user.
 2. Open file /etc/ancrontab using vi.
 3. Add following lines at the end of file

```
1    5    backup      tar czhfv /tmp.tar /tmp
1    5    dailyjob    pwd >> ~/cronoutput
1    5    dailyjob    ps aux | grep crond >> ~ps.txt
```
 4. Save and exit the file.
 5. Restart the crond service using service crond restart command.

```
[root@server Desktop]# vi /etc/anacrontab  
[root@server Desktop]# service crond restart  
Stopping crond: [ OK ]  
Starting crond: [ OK ]  
[root@server Desktop]# █
```



```

root@server:~/Desktop
File Edit View Search Terminal Help
# /etc/anacrontab: configuration file for anacron
# See anacron(8) and anacrontab(5) for details.

SHELL=/bin/sh
PATH=/sbin:/bin:/usr/sbin:/usr/bin
MAILTO=root
# the maximal random delay added to the base delay of the jobs
RANDOM_DELAY=10
# the jobs will be started during the following hours only
START_HOURS_RANGE=0-23

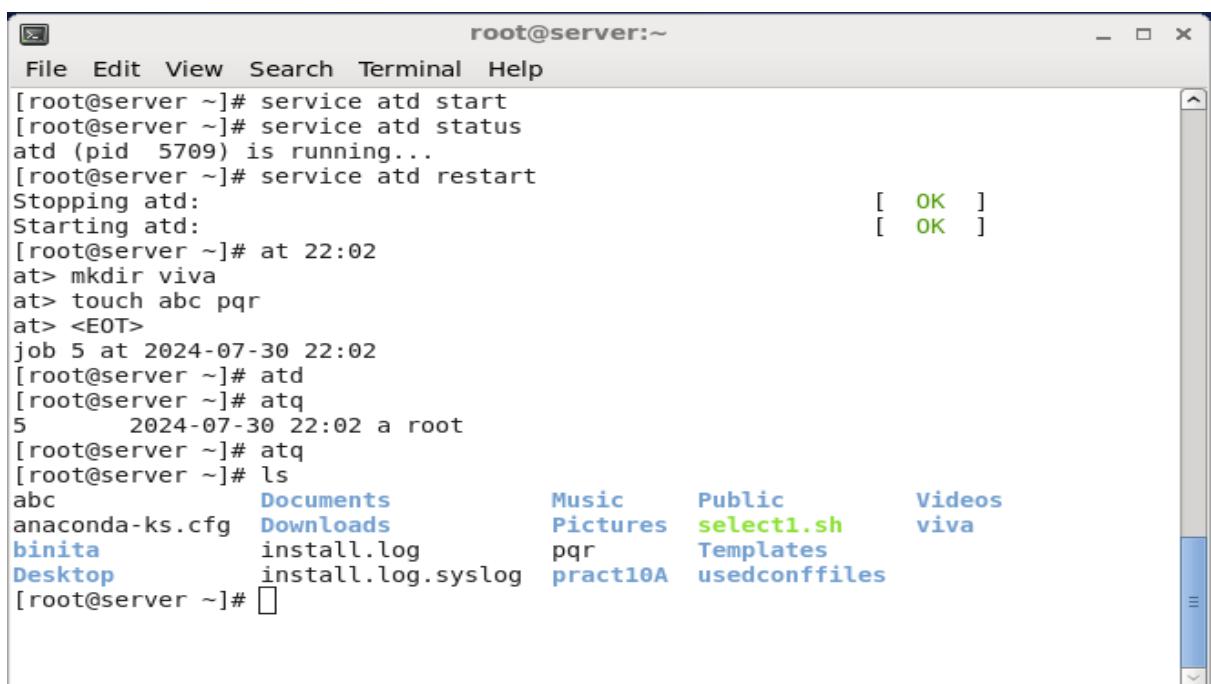
#period in days    delay in minutes    job-identifier    command
1      5      cron.daily           nice run-parts /etc/cron.daily
7      25     cron.weekly          nice run-parts /etc/cron.weekly
@monthly 45   cron.monthly         nice run-parts /etc/cron.monthly
1      5      backup tar czhvf /tmp.tar /tmp
1      5      dailyjob            pwd >> ~/cronoutput
1      5      dailyjob            ps aux | grep crond >> ~/ps.txt

~
~
~
"/etc/anacrontab" 20L, 686C

```

iii. Configuring At

1. Start the service at.
2. Check the status and restart it.
3. Use command at followed by a time.
4. In at> prompt, mention commands to be executed by that time period.
5. Close the prompt with Ctrl+D.
6. Check the pending jobs atq.
7. Run ls to see the command given in at.



```

root@server:~
File Edit View Search Terminal Help
[root@server ~]# service atd start
[root@server ~]# service atd status
atd (pid 5709) is running...
[root@server ~]# service atd restart
Stopping atd:                                     [ OK ]
Starting atd:                                     [ OK ]
[root@server ~]# at 22:02
at> mkdir viva
at> touch abc pqr
at> <EOT>
job 5 at 2024-07-30 22:02
[root@server ~]# atd
[root@server ~]# atq
5      2024-07-30 22:02 a root
[root@server ~]# atq
[root@server ~]# ls
abc      Documents      Music      Public      Videos
anaconda-ks.cfg Downloads      Pictures    select1.sh  viva
binita    install.log    pqr       Templates
Desktop   install.log.syslog pract10A usedconffiles
[root@server ~]#

```

iv. Configuring batch

1. Enter command batch.
2. In at> prompt enter commands to be executed.
3. Close the prompt with Ctlr+D.
4. Check the pending jobs atq.
5. Run ls to see the command given in batch.

The screenshot shows a terminal window titled "root@server:~". The window has a menu bar with "File", "Edit", "View", "Search", "Terminal", and "Help". The main area displays the following terminal session:

```
[root@server ~]# batch
at> mkdir binita
at> touch tyit1 tyit2
at> <EOT>
job 6 at 2024-07-30 22:09
[root@server ~]# atq
[root@server ~]# ls
abc                Documents          Music      Public    tyit2
anaconda-ks.cfg   Downloads          Pictures   select1.sh usedconffiles
binita             install.log       pqr        Templates  Videos
Desktop            install.log.syslog pract10A  tyit1     viva
[root@server ~]#
```

Practical 9

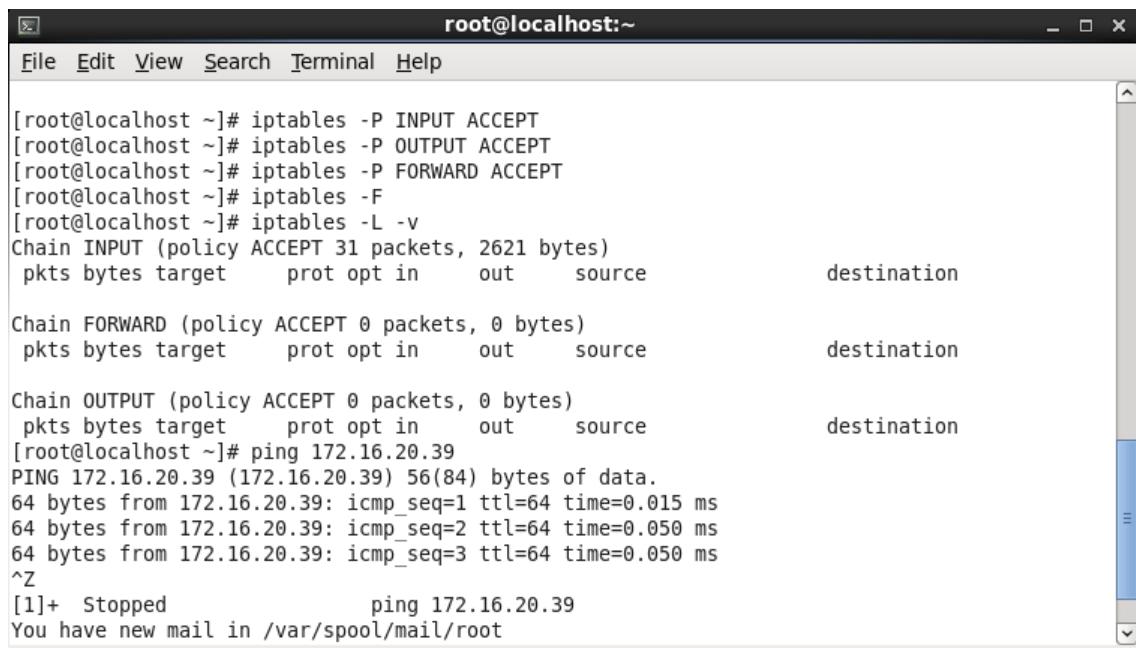
Aim: Firewall and Cryptographic Services

A. Securing Server with iptables

Step 1 : Type iptables -L -V to display current configuration

Step 2: Type the following commands :iptables -P INPUT ACCEPT iptables -P OUTPUT

ACCEPT iptables -P FORWARD ACCEPT, iptables -F.

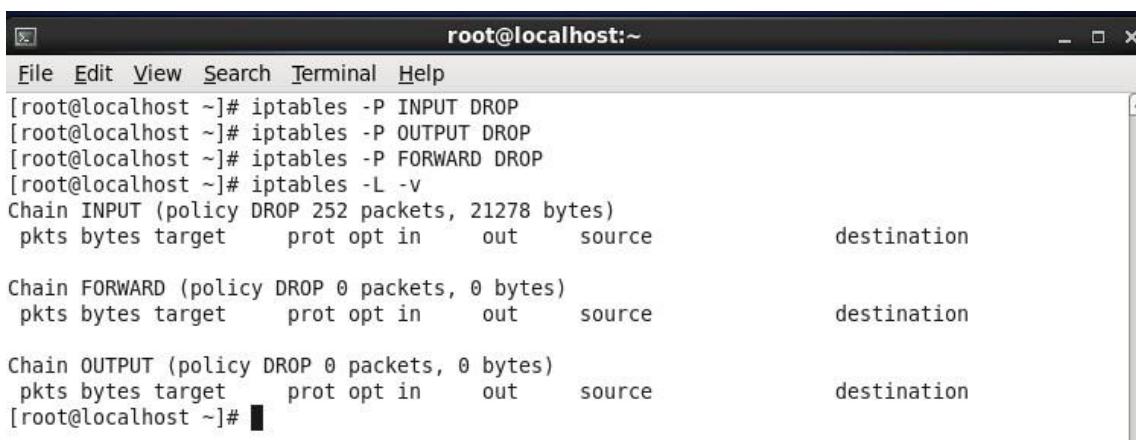


```
root@localhost:~ [root@localhost ~]# iptables -P INPUT ACCEPT
[root@localhost ~]# iptables -P OUTPUT ACCEPT
[root@localhost ~]# iptables -P FORWARD ACCEPT
[root@localhost ~]# iptables -F
[root@localhost ~]# iptables -L -v
Chain INPUT (policy ACCEPT 31 packets, 2621 bytes)
 pkts bytes target     prot opt in     out     source          destination
Chain FORWARD (policy ACCEPT 0 packets, 0 bytes)
 pkts bytes target     prot opt in     out     source          destination
Chain OUTPUT (policy ACCEPT 0 packets, 0 bytes)
 pkts bytes target     prot opt in     out     source          destination
[root@localhost ~]# ping 172.16.20.39
PING 172.16.20.39 (172.16.20.39) 56(84) bytes of data.
64 bytes from 172.16.20.39: icmp_seq=1 ttl=64 time=0.015 ms
64 bytes from 172.16.20.39: icmp_seq=2 ttl=64 time=0.050 ms
64 bytes from 172.16.20.39: icmp_seq=3 ttl=64 time=0.050 ms
^Z
[1]+  Stopped                  ping 172.16.20.39
You have new mail in /var/spool/mail/root
```

Step 3: Use iptables -L -V to verify that the policy is set for all three chains in filter tables.

Step 4: Use ping to check the connectivity.

Step 5: Set a policy for 3 chains type the following iptables -P INPUT DROP, iptables -P OUTPUT DROP, iptables -P FORWARD DROP.



```
root@localhost:~ [root@localhost ~]# iptables -P INPUT DROP
[root@localhost ~]# iptables -P OUTPUT DROP
[root@localhost ~]# iptables -P FORWARD DROP
[root@localhost ~]# iptables -L -v
Chain INPUT (policy DROP 252 packets, 21278 bytes)
 pkts bytes target     prot opt in     out     source          destination
Chain FORWARD (policy DROP 0 packets, 0 bytes)
 pkts bytes target     prot opt in     out     source          destination
Chain OUTPUT (policy DROP 0 packets, 0 bytes)
 pkts bytes target     prot opt in     out     source          destination
[root@localhost ~]#
```

Step 6: Open loopback interface first the put ssh, ptp on their port numbers.

```
root@localhost:~
```

```
File Edit View Search Terminal Help
You have new mail in /var/spool/mail/root
[root@localhost ~]# iptables -A INPUT -p tcp --dport 22 -j ACCEPT
[root@localhost ~]# iptables -A OUTPUT -M state --state ESTABLISHED,RELATED -j ACCEPT
iptables v1.4.7: unknown option '--state'
Try `iptables -h` or `iptables --help` for more information.
[root@localhost ~]# iptables -A OUTPUT -m state --state ESTABLISHED,RELATED -j ACCEPT
[root@localhost ~]# iptables -A INPUT -p tcp --dport 80 -j ACCEPT
[root@localhost ~]# iptables -L -v
Chain INPUT (policy DROP 302 packets, 24813 bytes)
 pkts bytes target     prot opt in      out      source          destination
    0    0 ACCEPT     all  --  to      any     anywhere        anywhere
    0    0 ACCEPT     tcp  --  any     any     anywhere        anywhere
    0    0 ACCEPT     tcp  --  any     any     anywhere        anywhere
Chain FORWARD (policy DROP 0 packets, 0 bytes)
 pkts bytes target     prot opt in      out      source          destination
Chain OUTPUT (policy DROP 0 packets, 0 bytes)
 pkts bytes target     prot opt in      out      source          destination
    0    0 ACCEPT     all  --  any     to      anywhere        anywhere
    0    0 ACCEPT     all  --  any     any     anywhere        anywhere
e RELATED,ESTABLISHED
[root@localhost ~]#
```

Step 7: Save the current configuration by service iptables save command to add an exception

```
root@localhost:~
```

```
File Edit View Search Terminal Help
You have new mail in /var/spool/mail/root
[root@localhost ~]# iptables -A INPUT -m multiport -p tcp --port 20,21 -j ACCEPT
[root@localhost ~]# iptables -L -v
Chain INPUT (policy DROP 187 packets, 17603 bytes)
 pkts bytes target     prot opt in      out      source          destination
    0    0 ACCEPT     all  --  to      any     anywhere        anywhere
    0    0 ACCEPT     tcp  --  any     any     anywhere        anywhere
    0    0 ACCEPT     tcp  --  any     any     anywhere        anywhere
Chain FORWARD (policy DROP 0 packets, 0 bytes)
 pkts bytes target     prot opt in      out      source          destination
Chain OUTPUT (policy DROP 6 packets, 396 bytes)
 pkts bytes target     prot opt in      out      source          destination
    0    0 ACCEPT     all  --  any     to      anywhere        anywhere
    0    0 ACCEPT     all  --  any     any     anywhere        anywhere
e RELATED,ESTABLISHED
[root@localhost ~]# service iptables save
iptables: Saving firewall rules to /etc/sysconfig/iptables:[ OK ]
[root@localhost ~]#
```

ie allow one specific ip address to access any service usp iptables.

-L, -V –line –number

Step 8: Create the exception before.

```
root@localhost:~ Maximize
File Edit View Search Terminal Help
[root@localhost ~]# iptables -L -v --line-numbers
Chain INPUT (policy DROP 959 packets, 93065 bytes)
num pkts bytes target prot opt in     out      source          destination
1     0     0 ACCEPT   all  --  to      any    anywhere        anywhere
2     0     0 ACCEPT   tcp   --  any    any    anywhere        anywhere
tcp dpt:ssh
3     0     0 ACCEPT   tcp   --  any    any    anywhere        anywhere
tcp dpt:http
4     0     0 ACCEPT   tcp   --  any    any    anywhere        anywhere
multiport ports ftp-data,ftp

Chain FORWARD (policy DROP 0 packets, 0 bytes)
num pkts bytes target prot opt in     out      source          destination

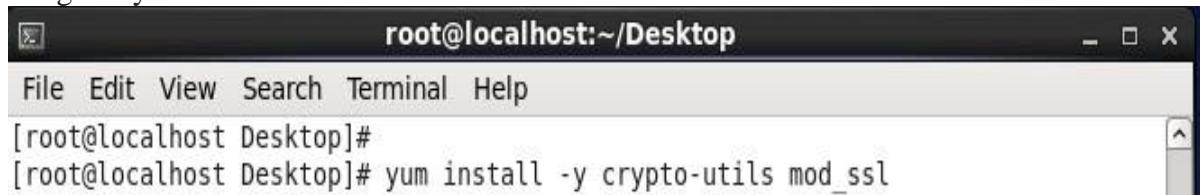
Chain OUTPUT (policy DROP 6 packets, 396 bytes)
num pkts bytes target prot opt in     out      source          destination
1     0     0 ACCEPT   all  --  any    to      anywhere        anywhere
2     0     0 ACCEPT   all  --  any    any    anywhere        anywhere
state RELATED,ESTABLISHED
[root@localhost ~]# iptables -I INPUT 2 -s 192.168.168.1/24 -j ACCEPT
[root@localhost ~]# service iptables save
iptables: Saving firewall rules to /etc/sysconfig/iptables:[  OK  ]
[root@localhost ~]#
```

B. Setting up Cryptographic Services

Perform on CentOS Server

Login as root user

- a. Use `yum install -y crypto-utils mod_ssl` to install the RPM package that contains the genkey command.



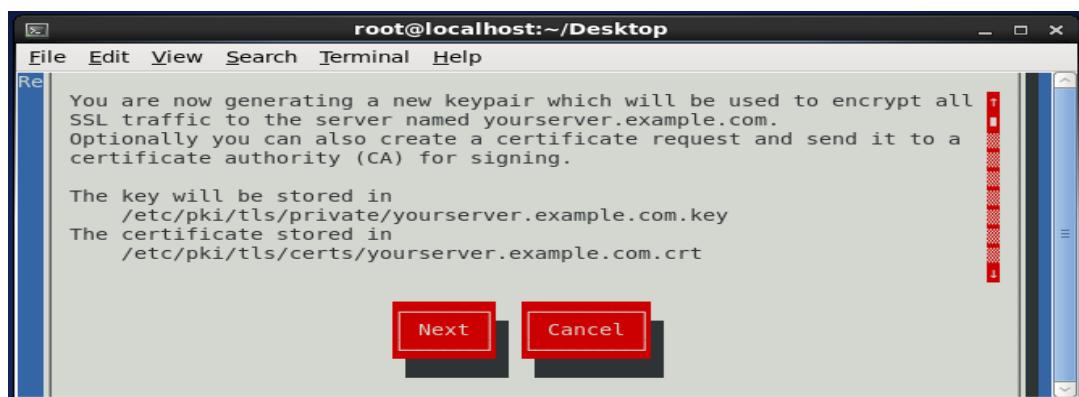
```
root@localhost:~/Desktop
File Edit View Search Terminal Help
[root@localhost Desktop]#
[root@localhost Desktop]# yum install -y crypto-utils mod_ssl
```

- B. Use `genkey --days 365 yourserver.example.com` command to generate keys.

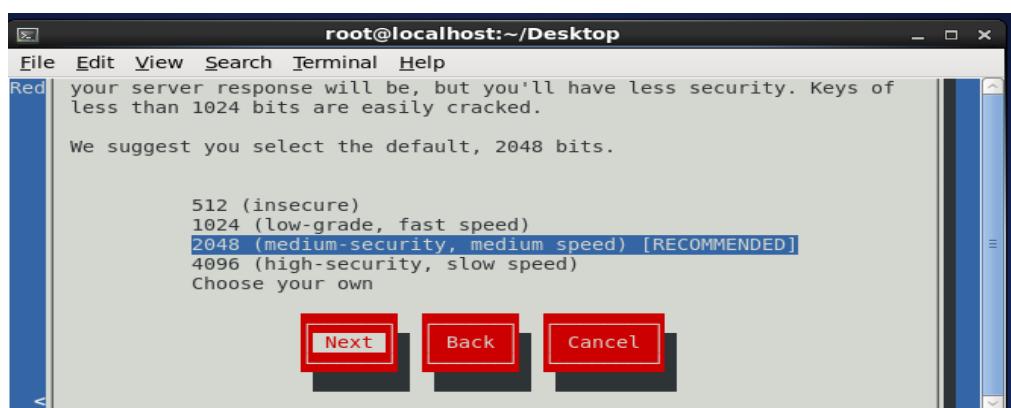


```
[root@localhost Desktop]# genkey --days 365 yourserver.example.com
```

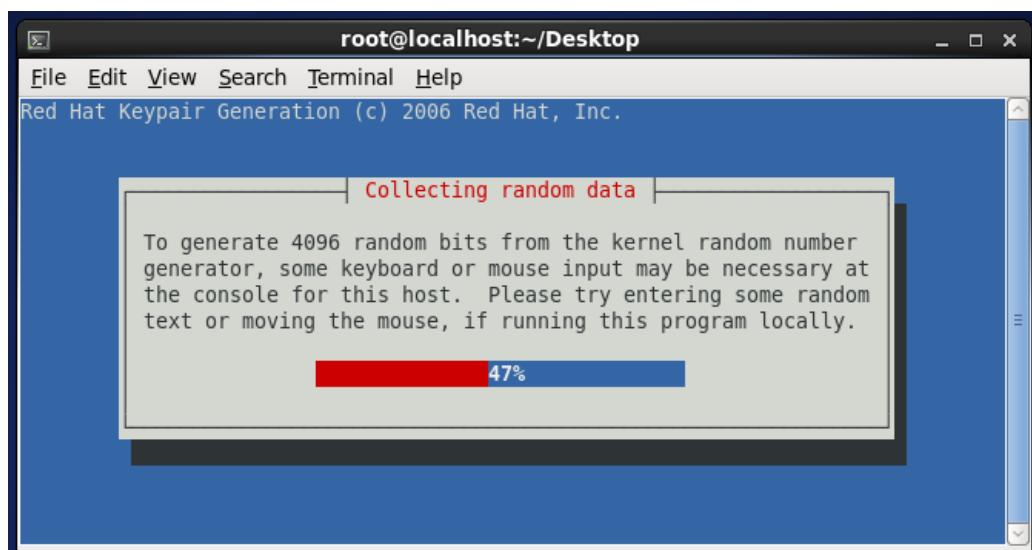
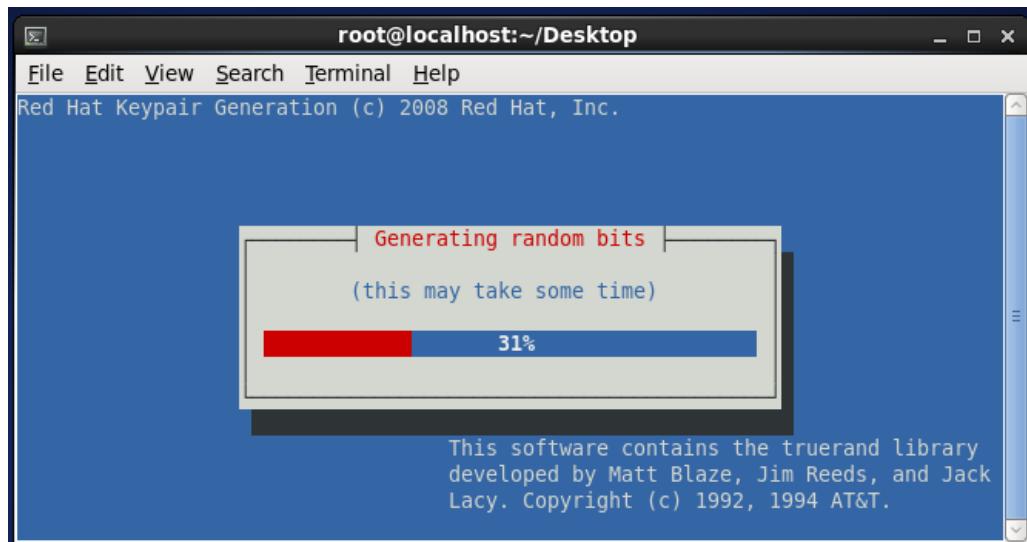
It will specify the location of keys and certificate, press Next.



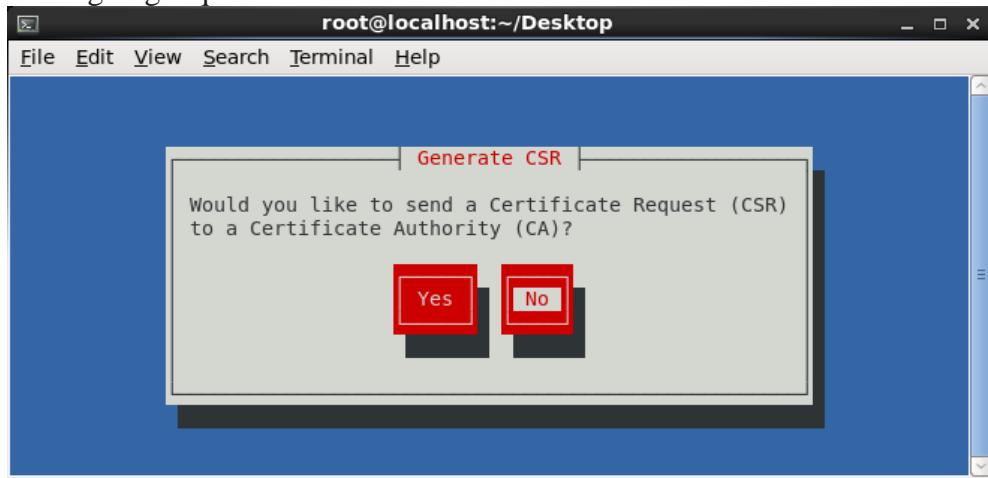
- b. Select the key size you want to use. Select the recommended one.



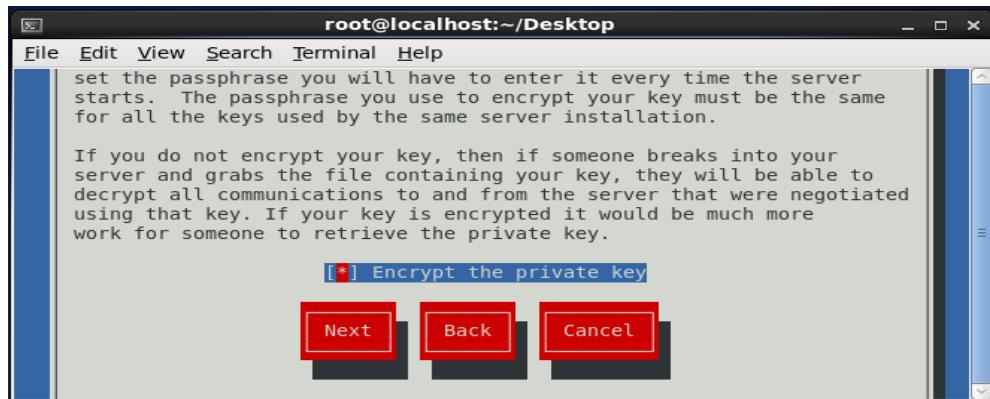
- c. The system will generate some random bits that are necessary to produce the key.



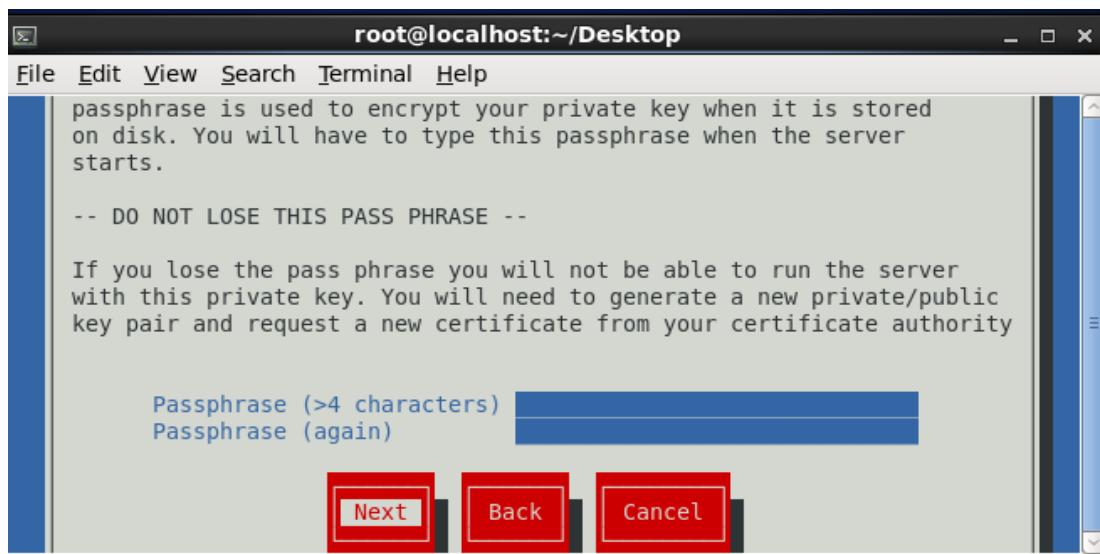
- d. Once the key has been generated, genkey asks whether you want to create a certificate signing request. Select No.



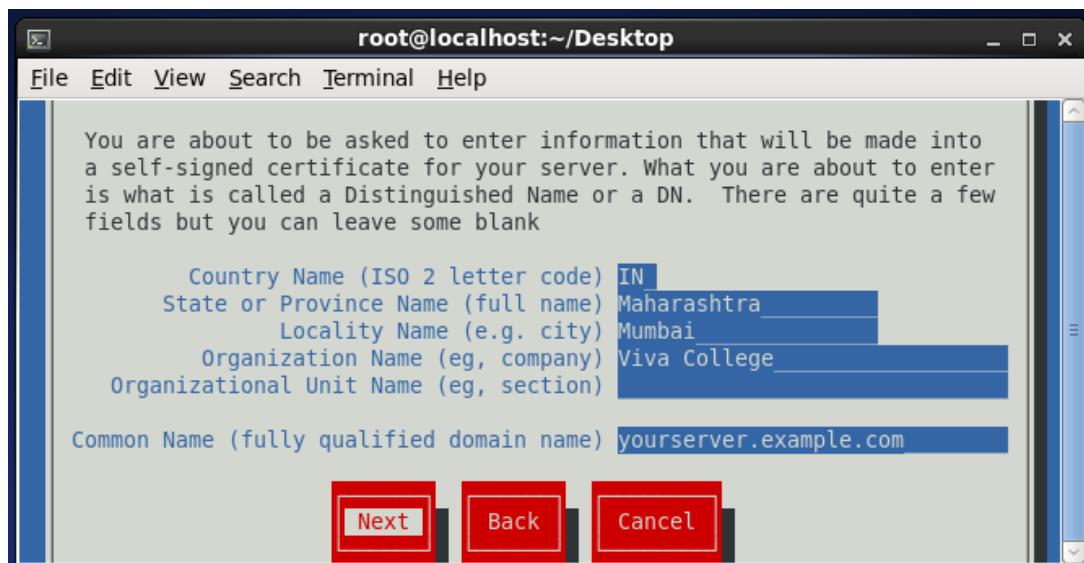
- e. Enter the passphrase for private key. Give space bar here * appears and enter.



Enter a long passphrase.



- f. Now enter the appropriate information to identify your server.



- g. After you enter the appropriate identification, the public and private keys are written to the appropriate directories and are ready for use.

```

root@localhost:~/Desktop
File Edit View Search Terminal Help
random seed from /etc/pki/tls/.rand.23459
key encryption password = *****
output will be written to /etc/pki/tls/certs/yourserver.example.com.crt
output key written to /etc/pki/tls/private/yourserver.example.com.key

Generating key. This may take a few moments...

Made a key
Opened tmprequest for writing
/usr/bin/keyutil Copying the cert pointer
Created a certificate
Wrote 1818 bytes of encoded data to /etc/pki/tls/private/yourserver.example.com.key
Wrote the key to:
/etc/pki/tls/private/yourserver.example.com.key
[root@localhost Desktop]#

```

- h. Open the certificate using following command.

```

root@localhost:~/Desktop
File Edit View Search Terminal Help
[root@localhost Desktop]# openssl x509 -text < /etc/pki/tls/certs/yourserver.example.com.crt
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number: 2975969090 (0xb161af42)
        Signature Algorithm: sha256WithRSAEncryption
        Issuer: C=IN, ST=Maharashtra, L=Mumbai, O=Viva College, CN=yourserver.example.com
        Validity
            Not Before: Jun 11 14:54:42 2019 GMT
            Not After : Jun 11 14:54:42 2020 GMT
        Subject: C=IN, ST=Maharashtra, L=Mumbai, O=Viva College, CN=yourserver.example.com
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
            Public-Key: (2048 bit)
                Modulus:
                    00:02:81:1b:d7:2d:db:82:dd:ac:58:e7:46:a4:c3:
                    55:50:38:52:4d:c1:08:bb:19:10:63:ba:13:e2:03:
                    58:43:4e:3a:9c:d1:84:9f:bc:8d:93:6d:49:b2:c8:
                    a7:ac:88:8f:61:9b:ce:e9:6d:b5:1a:db:78:80:e0:
                    8c:ef:f3:cb:da:fc:45:67:ad:78:45:32:84:7c:36:
                    c0:ee:e2:b5:e0:0e:57:72:41:fd:12:ab:27:eb:dc:
                    6a:86:d7:23:80:2c:8c:c5:6d:1d:6e:bd:e6:5e:f5:
                    2e:b7:b2:44:28:07:34:d4:8d:f5:03:a8:7e:30:02:
                    5e:fb:84:9b:cd:21:2b:c5:03:a0:4a:60:38:3e:d6:
                    8f:57:0e:cd:fd:75:1a:43:7c:e3:c7:54:b7:ce:3c:
                Exponent:
                    65537 (0x10001)
        Signature Algorithm: sha256WithRSAEncryption
    
```

```

root@localhost:~/Desktop
File Edit View Search Terminal Help
ca:b6:8b:71:a5:3e:bc:aa:28:2c:d4:b0:c4:96:4c:
fd:93:db:e1:8e:df:de:bd:a5:4d:f8:c3:c8:8c:f1:
bf:c8:65:81:9e:c5:e2:5a:8c:4a:95:7d:bd:c1:f8:
d2:67:61:e5:47:49:70:fe:ab:4c:96:18:e9:a7:22:
8f:59:49:97:e8:e8:a7:74:83:60:74:a1:98:81:99:
cb:41:73:dd:6e:bd:07:4a:b4:c1:e6:28:5c:1c:2e:
c9:52:32:93:60:6f:c3:af:96:10:aa:7e:b7:93:9f:
3c:2b:
Exponent: 65537 (0x10001)
Signature Algorithm: sha256WithRSAEncryption
    
```

```

root@localhost:~/Desktop
File Edit View Search Terminal Help
-----BEGIN CERTIFICATE-----
MIIDVTCCAjBgAwIBAgIFALFhr0IwDQYJKoZIhvqNAQELBQAwbDELMKA1UEBHMC
SU4xFDASBgNVBAgTC01haGFyIXNodHjhMQ8wD0YDVQHewZndw1iYWkxFTATBqNV
BAoTDFZpdmEg029sbVnZTEFB0GA1UEAxMWeW91cnNlc1zLc15leGftcGxLmNv
bTAeW0xTA2MTExNDU0NDJaFw0yMDA2MTExNDU0NDJaMgwxczaJBgNVBAYTAKLo
MRQwEgYDVQOIEvtNYwhmcFzaHRYTEPMa0GA1UEBXMGTXVYimFpMRUwEwYDVQOK
EwxWaXzhIENvbGxzZUUhZAdBgNVBAMTFn1vdXJzzXJ2ZXIuZXhhbXBsZS5jb29w
ggE1MA0GCSQGSlb3DQEBAQUAA4IBdAwggEKAoIBAQdq1gvRxlduc3axY50kw1Q
OFJNzw17GRBluiPhA1hb1lqc345tv1Z1b0myykes19m87pbb0a231A41zvPLIK
/EVnrXhFMor8Nsdu4rXgbdyqfqsqrfr3GqG1yoAL1zFBRuvZe9563skqod2TU
jfUDHwA177chjvNISV46p0dp4t69XDp24881pRxDfOPHMv4fMq2s61PryqKCzu
sMSITTTttG039o0c4w8imB817z0n1c1eqfbz-NjYvVPSX0y0yG0m
ID9ZSZf6k0c0B0c18mctBc91uv0dktHmKfcb1LShpNgby2v1hcqf4TzYyr
AgHBAAEwD0YJKoZIhvqNAQELB0AdggEBAMHHMYBj5gb+6PDjaEi44ABvJ0C4VvKB
h1F9842rst5In2Al2fCz1tVvY+GLMX4kNcoKtthozP5EH0a5Fv-PjIqPn9Gen5a0
n85pwT1zNWAPjyL7Hemt1ADLohk06AheHmjci8DZRBM8+2reV5Jgsj1hsdo+Kbg0
U0fYKFwxxRbozNPZKAQ9VxBj0+tm0+l87VNviDNgsfTU6w8ghKFc4lQxh01K208
LokyFAwfHvmsqx3g0j9dC+wGBV5XHKFxgrNP60sN/anhmpvOV9Vxjuzx0YPPWXA
5Kdg/GsqTtl6pxn2zbjzqoNBet08sQu/b/eZThPyglu/APb4nnTZ124=
-----END CERTIFICATE-----
[root@localhost Desktop]#

```

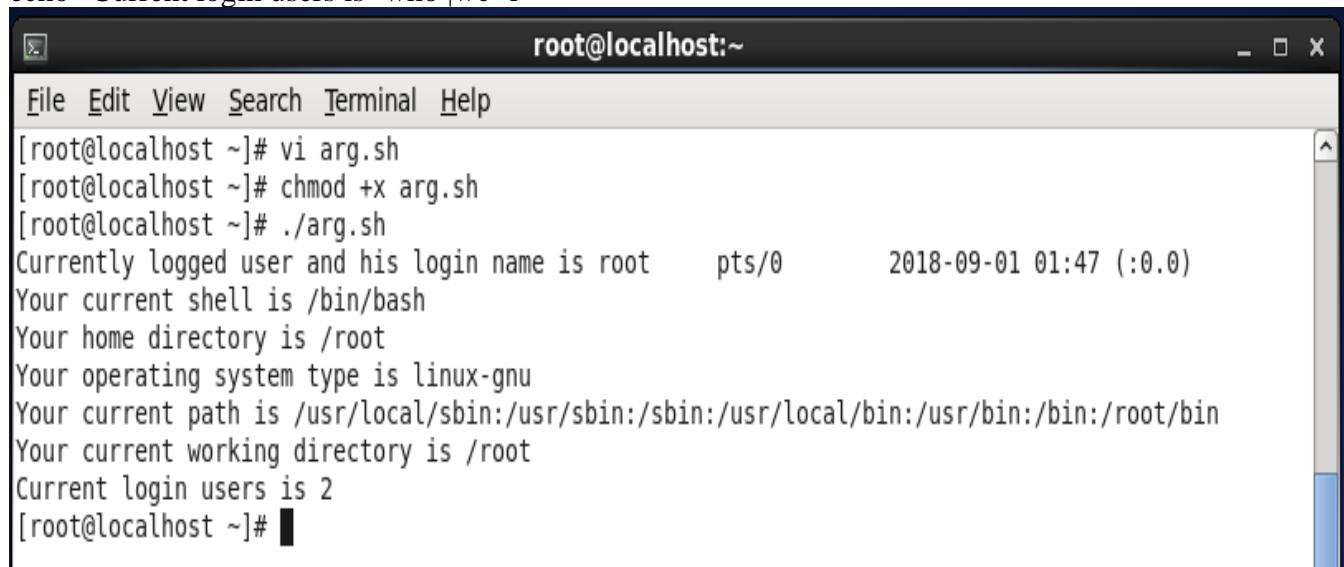
Practical 10

Aim: Write the program for following

A. Programs on Shell Scripts

- 1. Write a shell script to show various system configurations like:**
 - a. Currently logged user and his login name.**
 - b. Your current shell.**
 - c. Your home directory**
 - d. Your operating system type.**
 - e. Your current path.**
 - f. Your current working directory.**
 - g. Currently number of users logged in.**

```
if [ $# -ne 0 ]
then
echo "Please do not use arguments"
exit
fi
echo "Currently logged user and his login name is `who am i`"
echo "Your current shell is $SHELL"
echo "Your home directory is $HOME"
echo "Your operating system type is $OSTYPE"
echo "Your current path is $PATH"
echo "Your current working directory is $PWD"
echo "Current login users is `who |wc -l`"
```

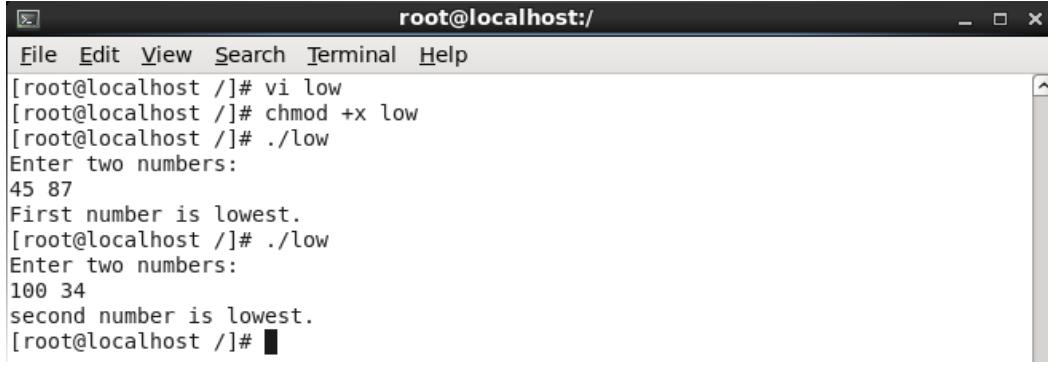


The screenshot shows a terminal window titled "root@localhost:~". The window contains the following text:

```
[root@localhost ~]# vi arg.sh
[root@localhost ~]# chmod +x arg.sh
[root@localhost ~]# ./arg.sh
Currently logged user and his login name is root      pts/0      2018-09-01 01:47 (:0.0)
Your current shell is /bin/bash
Your home directory is /root
Your operating system type is linux-gnu
Your current path is /usr/local/sbin:/usr/sbin:/sbin:/usr/local/bin:/usr/bin:/bin:/root/bin
Your current working directory is /root
Current login users is 2
[root@localhost ~]#
```

2. Write a shell script to find lowest of two numbers.

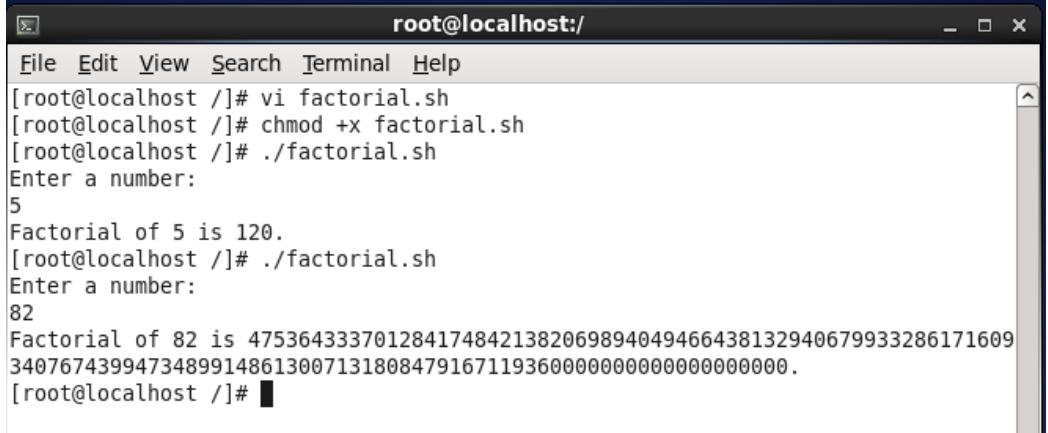
```
echo Enter two numbers:
read n1 n2
if [ $n1 -lt $n2 ]
then
    echo "First number is lowest."
else
    echo "second number is lowest."
fi
```



```
[root@localhost ~]# vi low
[root@localhost ~]# chmod +x low
[root@localhost ~]# ./low
Enter two numbers:
45 87
First number is lowest.
[root@localhost ~]# ./low
Enter two numbers:
100 34
second number is lowest.
[root@localhost ~]#
```

3. Write a shell script to find factorial of a number.

```
#!/bin/bash
fact=1
echo -e "Enter a number:"
read n
if [ $n -gt 0 ] ; then
for ((i=$n;i>=1;i--))
do
    fact=`expr $fact \* $i`
done
fi
echo "Factorial of $n is $fact."
```



```
[root@localhost ~]# vi factorial.sh
[root@localhost ~]# chmod +x factorial.sh
[root@localhost ~]# ./factorial.sh
Enter a number:
5
Factorial of 5 is 120.
[root@localhost ~]# ./factorial.sh
Enter a number:
82
Factorial of 82 is 4753643337012841748421382069894049466438132940679933286171609
34076743994734899148613007131808479167119360000000000000000000000000000000.
[root@localhost ~]#
```

4. Write a shell script to check if the number is even or odd.

```
echo "Enter a number:"
read n
if [ $(($n % 2)) -eq 0 ]
then
    echo "The number is even."
else
    echo "The number is odd."
fi
```

```
root@localhost:~# vi evenodd.sh
[root@localhost ~]# chmod +x evenodd.sh
[root@localhost ~]# ./evenodd.sh
Enter a number:
5
The number is odd.
[root@localhost ~]# ./evenodd.sh
Enter a number:
8
The number is even.
[root@localhost ~]#
```

5. Write a shell script to check whether number is armstrong.

```
echo "Enter the number:"
read c
x=$c
sum=0
r=0
n=0
while [ $x -gt 0 ]
do
    r=`expr $x % 10`
    n=`expr $r \* $r \* $r`
    sum=`expr $sum + $n`
    x=`expr $x / 10`
done
if [ $sum -eq $c ]
then
    echo "Number is armstrong."
else
    echo "Number is not armstrong."
fi
```

```
root@localhost:~# vi armstrong
[root@localhost ~]# chmod +x armstrong
[root@localhost ~]# ./armstrong
Enter the number:
153
Number is armstrong.
[root@localhost ~]# ./armstrong
Enter the number:
78
Number is not armstrong.
[root@localhost ~]#
```

B. Shell script to automate or monitor tasks/process

Monitoring activity of httpd process

Write the program using vi editor.

```
root@localhost:~/Desktop
File Edit View Search Terminal Help
#!/bin/bash
COUNTER=0
while ps aux | grep httpd | grep -v grep > /dev/null
do
    COUNTER=$((COUNTER+1))
    sleep 1
    echo COUNTER IS $COUNTER
done
service httpd start
```

Practical No. 11

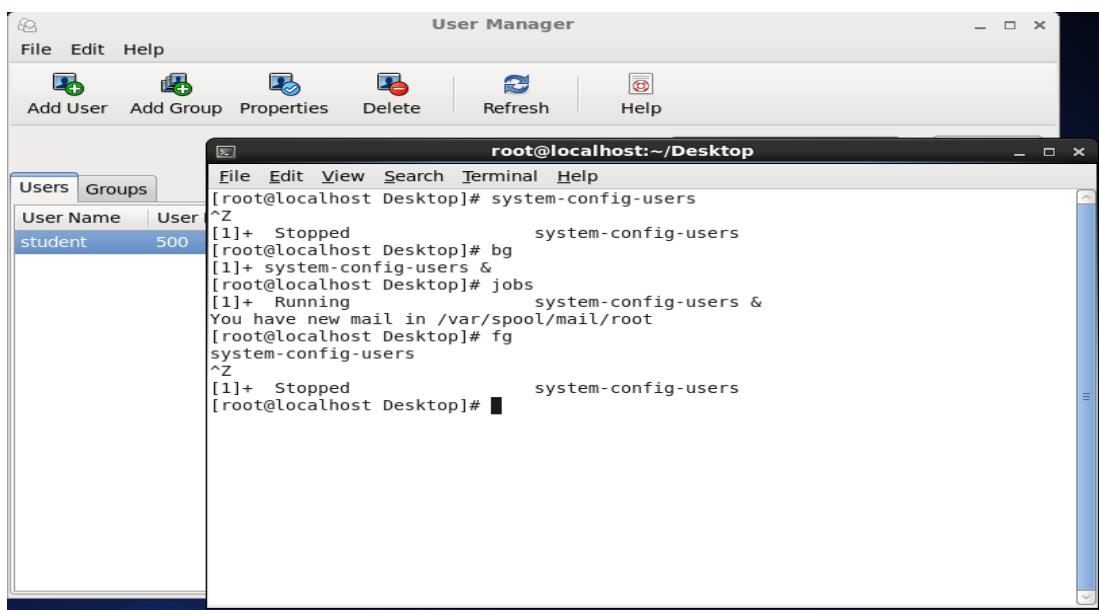
Aim: Perform daily system administration task

A. Managing Processes

Different ways to manage your jobs is shown in the below steps:

1. From a graphical user interface, open a terminal, and from that terminal, start the system-config-users program. You will see that the terminal is now occupied by the graphical program you've just started and that you cannot start any other programs.
2. Click in the terminal where you started system-config-users, and use the Ctrl+Z key sequence. This temporarily stops the graphical program and returns the prompt on your terminal.
3. Use the bg command to move the job you started by entering the system-configusers command to the background. You can now continue using the graphical user interface and, at the same time, have access to the terminal where you can start other jobs by entering new commands.
4. From the terminal window, type the jobs command. This shows a list of all jobs that are started from this terminal. You should see just the system-config-users command. Every job has a unique job number in the list displayed by the jobs command. If you have just one job, it will always be job 1.
5. To put a background job back into the foreground, use the fg command.

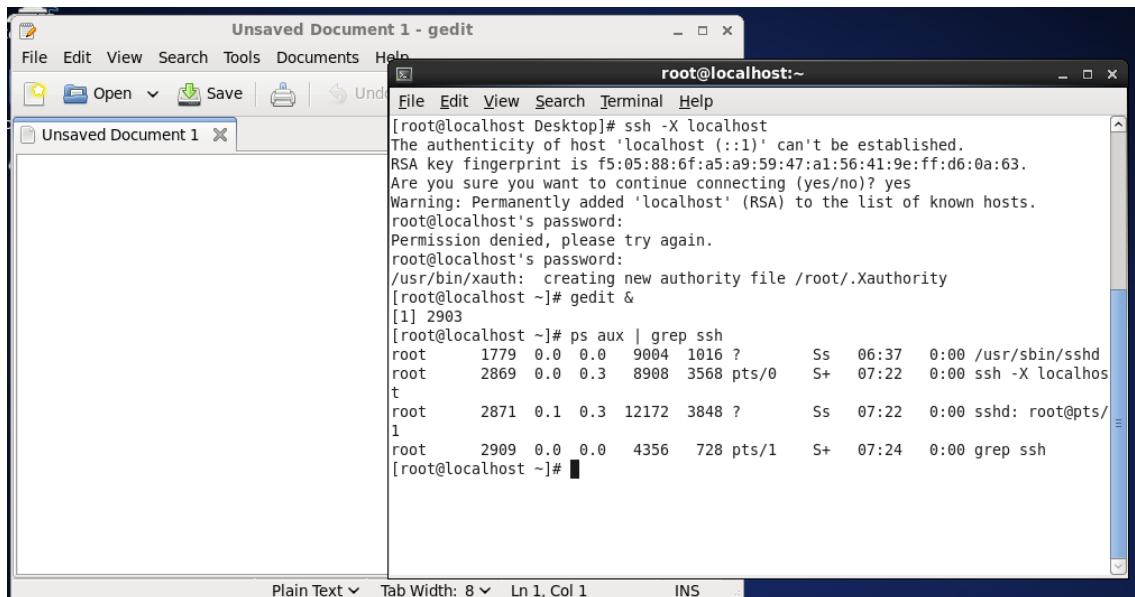
By default, this command will put the last command you started in the background into the foreground. If you want to put another background job into the foreground, use fg followed by the job number of the job you want to manage



Managing Process with ps & kill:

In this exercise, you will start a few processes to make the parent-child relationship between these processes visible. Then you will kill the parent process, and you will see that all related child processes also disappear.

1. Open a terminal window (right-click the graphical desktop, and select Open In Terminal).
2. Use the bash command to start Bash as a subshell in the current terminal window.
3. Use ssh -X localhost to start ssh as a subshell in the Bash shell you just opened. When asked if you want to permanently add localhost to the list of known hosts, enter yes. Next enter the password of the user root.
4. Type gedit & to start gedit as a background job.
5. Type ps aux to show a listing of all current processes, including the parent-child relationship between the commands you just entered.
6. Find the PID of the SSH shell you just started. If you can't find it, use ps aux | grep ssh. One of the output lines shows the ssh -X localhost command you just entered. Note the PID that you see in that output line.
7. Use kill followed by the PID number you just found to close the ssh shell. Because the ssh environment is the parent of the gedit command, killing ssh will also kill the gedit window.



The screenshot shows two windows side-by-side. The left window is a gedit text editor titled 'Unsaved Document 1 - gedit'. It contains a single line of text: 'root@localhost ~]#'. The right window is a terminal window titled 'root@localhost:~'. It displays the following terminal session:

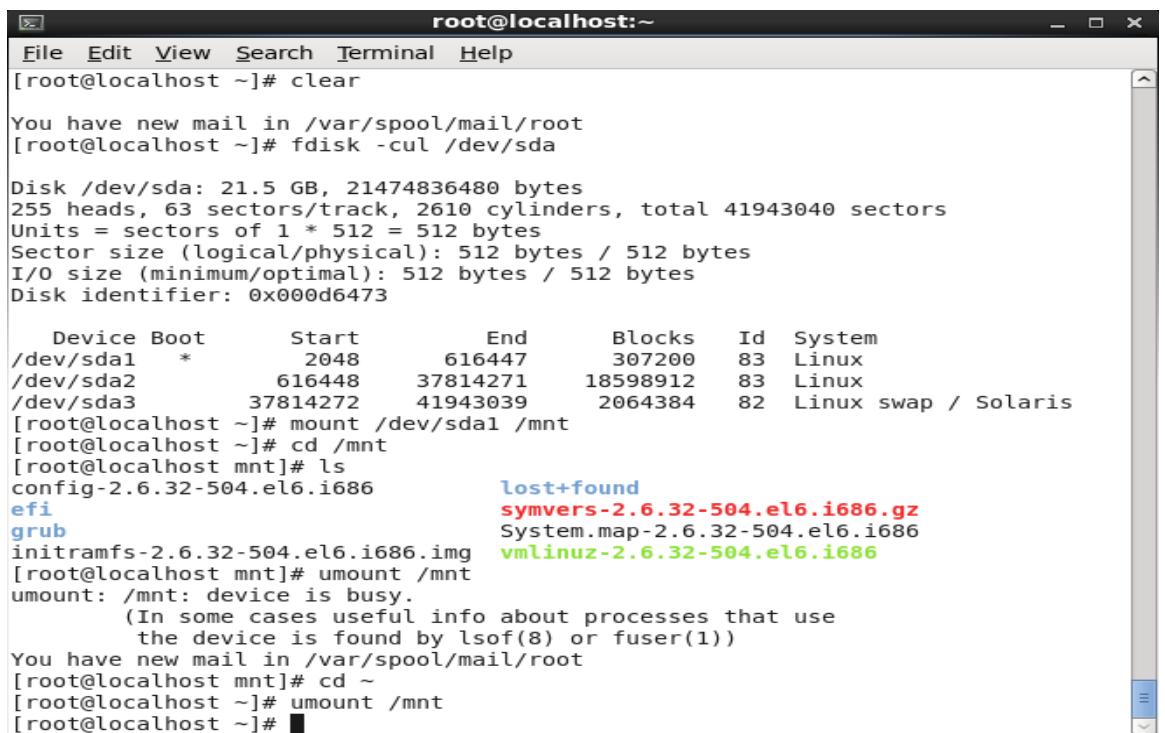
```
[root@localhost Desktop]# ssh -X localhost
The authenticity of host 'localhost (::1)' can't be established.
RSA key fingerprint is f5:05:88:6f:a5:a9:59:47:a1:56:41:9e:ff:d6:0a:63.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'localhost' (RSA) to the list of known hosts.
root@localhost's password:
Permission denied, please try again.
root@localhost's password:
/usr/bin/xauth: creating new authority file /root/.Xauthority
[root@localhost ~]# gedit &
[1] 2903
[root@localhost ~]# ps aux | grep ssh
root      1779  0.0  0.0   9004  1016 ?        Ss   06:37  0:00 /usr/sbin/sshd
root     2869  0.0  0.3   8908  3568 pts/0    S+   07:22  0:00 ssh -X localhost
root     2871  0.1  0.3  12172  3848 ?        Ss   07:22  0:00 sshd: root@pts/1
root     2909  0.0  0.0   4356    728 pts/1    S+   07:24  0:00 grep ssh
[root@localhost ~]#
```

The terminal window has a status bar at the bottom showing 'Plain Text' and 'Tab Width: 8'.

```
root@localhost:~/Desktop
File Edit View Search Terminal Help
[root@localhost Desktop]# ssh -X localhost
The authenticity of host 'localhost (::1)' can't be established.
RSA key fingerprint is f5:05:88:6f:a5:a9:59:47:a1:56:41:9e:ff:d6:0a:63.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'localhost' (RSA) to the list of known hosts.
root@localhost's password:
Permission denied, please try again.
root@localhost's password:
/usr/bin/xauth: creating new authority file /root/.Xauthority
[root@localhost ~]# gedit &
[1] 2903
[root@localhost ~]# ps aux | grep ssh
root      1779  0.0  0.0  9004  1016 ?        Ss   06:37  0:00 /usr/sbin/sshd
root      2869  0.0  0.3  8908  3568 pts/0    S+   07:22  0:00 ssh -X localhost
root      2871  0.1  0.3  12172  3848 ?        Ss   07:22  0:00 sshd: root@pts/1
root      2909  0.0  0.0  4356   728 pts/1    S+   07:24  0:00 grep ssh
[root@localhost ~]# kill 2869Killed by signal 15.
[root@localhost Desktop]#
```

B. Mounting a USB flash drive:

1. Open a terminal, and make sure you have root privileges.
2. Insert a USB flash drive in the USB port of your computer.
3. Use dmesg to find the device name of the USB flash drive.
4. Use fdisk -cul /dev/sdb to find current partitions on the USB flash drive.
5. Use mount /dev/sdb1 /mnt to mount the USB flash drive on the /mnt directory.
6. Use cd /mnt to go into the /mnt directory.
7. Type ls to verify that you see the contents of the USB flash drive.
8. Now use umount /dev/sdb1 to try to dismount the USB flash drive.
This won't work because you still are in the /mnt directory.
You'll see the "device is busy" error message.
9. Use cd without any arguments. This takes your current shell out of the /mnt directory and back to your home directory.
10. At this point, you'll be able to dismount the USB flash drive successfully using umount /dev/sdb1.



The screenshot shows a terminal window titled "root@localhost:~". The terminal session is as follows:

```
root@localhost ~]# clear
You have new mail in /var/spool/mail/root
[root@localhost ~]# fdisk -cul /dev/sda
Disk /dev/sda: 21.5 GB, 21474836480 bytes
255 heads, 63 sectors/track, 2610 cylinders, total 41943040 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x0000d6473

Device Boot Start End Blocks Id System
/dev/sda1 * 2048 616447 307200 83 Linux
/dev/sda2 616448 37814271 18598912 83 Linux
/dev/sda3 37814272 41943039 2064384 82 Linux swap / Solaris
[root@localhost ~]# mount /dev/sda1 /mnt
[root@localhost ~]# cd /mnt
[root@localhost mnt]# ls
config-2.6.32-504.el6.i686      lost+found
efi                               symvers-2.6.32-504.el6.i686.gz
grub                             System.map-2.6.32-504.el6.i686
initramfs-2.6.32-504.el6.i686.img vmlinuz-2.6.32-504.el6.i686
[root@localhost mnt]# umount /mnt
umount: /mnt: device is busy.
(In some cases useful info about processes that use
the device is found by lsof(8) or fuser(1))
You have new mail in /var/spool/mail/root
[root@localhost mnt]# cd ~
[root@localhost ~]# umount /mnt
[root@localhost ~]#
```

C. Creating Links

1. Open a terminal, and make sure you have root permissions.
2. Use the command `ln -s /etc/hosts ~/symhosts`. This creates a symbolic link with the name `symhosts` in your home directory.
3. Use the command `ln /etc/hosts ~/hardhosts`. This creates a hard link with the name `hardhosts` in your home directory.
4. Use the command `echo 10.0.0.10 dummyhost >> /etc/hosts`. Verify that you can see this addition in all three files: `/etc/hosts`, `~/symhosts`, and `~/hardhosts`.
5. Use the command `ls -il /etc/hosts ~/symhosts ~/hardhosts`. The option `-I` shows the inode number. You can see that it is the same for `/etc/hosts` and `~/hardhosts`, like all other properties of the file.
6. Use `rm /etc/hosts`. Try to read the contents of `~/symhosts`. What happens? Now try to access the contents of `~/hardhosts`. Do you see the difference?
7. Restore the original situation by re-creating the `/etc/hosts` file. You can do that easily by making a new hard link using `ln ~/hardhosts /etc/hosts`.

```
student@localhost:/home/student/Desktop
File Edit View Search Terminal Help
[student@localhost Desktop]$ su
Password:
[student@localhost Desktop]# ln -s /etc/hosts ~/symhosts
You have new mail in /var/spool/mail/student
[student@localhost Desktop]# ln /etc/hosts ~/hardhosts
[student@localhost Desktop]# echo 10.0.0.10 dummyhosts >> /etc/hosts
[student@localhost Desktop]# ls
abhinav abhinav~
[student@localhost Desktop]# ls
abhinav~
[student@localhost Desktop]# ls -il /etc/hosts ~/symhosts ~/hardhosts
917542 -rw-r--r--. 2 root root 179 Jul 16 15:52 /etc/hosts
917542 -rw-r--r--. 2 root root 179 Jul 16 15:52 /root/hardhosts
136392 lrwxrwxrwx. 1 root root 10 Jul 16 15:50 /root/symhosts -> /etc/hosts
[student@localhost Desktop]# rm /etc/hosts
rm: remove regular file `/etc/hosts'? y
You have new mail in /var/spool/mail/student
[student@localhost Desktop]# ls
abhinav~
[student@localhost Desktop]# cat ~symhosts
cat: ~symhosts: No such file or directory
[student@localhost Desktop]# cat ~/symhosts
cat: /root/symhosts: No such file or directory
[student@localhost Desktop]# cat ~/hardhosts
127.0.0.1 localhost localhost.localdomain localhost4 localhost4.localdomain4
::1 localhost localhost.localdomain localhost6 localhost6.localdomain6
10.0.0.10 dummyhosts
[student@localhost Desktop]# cat /etc/hosts
cat: /etc/hosts: No such file or directory
[student@localhost Desktop]# ln ~/hardhosts /etc/hosts
[student@localhost Desktop]# cat /etc/hosts
127.0.0.1 localhost localhost.localdomain localhost4 localhost4.localdomain4
::1 localhost localhost.localdomain localhost6 localhost6.localdomain6
10.0.0.10 dummyhosts
[student@localhost Desktop]#
```