Linux

- Linux is an open-source clone of UNIX, the most secure and mature operating system.
- The major difference between Linux and UNIX is that UNIX is trademarked to The Open Group, while Linux is Open source.
- All command line tools work the same on both.
- Over 90% of the supercomputers in the world run Linux. And the 10 fastest run Linux.
- Linux is the leading operating system on Servers.

Benefits of Linux

- Low cost and very stable (some Linux servers are not rebooted for over a year, try that with Windows server!).
- Best multi-user, multitasking OS.
- Most secure OS. Hence, it's popularity as a server OS.
- Best computing power and inbuilt network support
- Fastest developing OS, with the greatest number of developers.

Linux Distributions

- A Linux distribution consists of the Linux kernel (actual OS) and a collection of applications.
    - Linux Kernel
    - X Window System
    - Graphical Desktops (GNOME, KDE…)
    - Applications

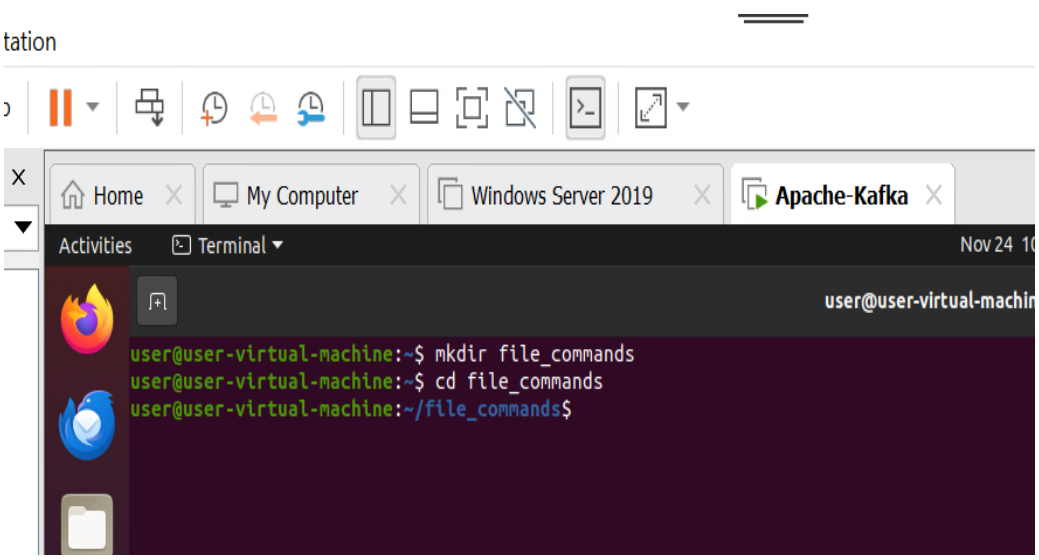
- GNU Software is at the heart of every Linux. Besides the Linux Kernel, GNU software/utilities come next.
- GNOME and KDE are the most popular graphical.

Linux Desktops

- The most common Desktops are GNOME and KDE (just cosmetic differences and default programs)
- Popular GNOME distros are Ubuntu & Fedora
- Popular KDE distros are Kubuntu & OpenSUSE
- Opening the Terminal Windows and 6 Virtual Consoles
- Navigating the Linux File System
- Linux Applications

File_commands:

- mkdir directory_name: to create a new directory.
- ls: list all files.
- ls –l: long list with details.
- ls –a: shows hidden files.
- ls –r: reverse order.
- ls –h: human readable.
- ls –t: sort by modification time.
- rm –r directory_name: remove directory.
- rm –rf directory_name: remove directory forcefully.



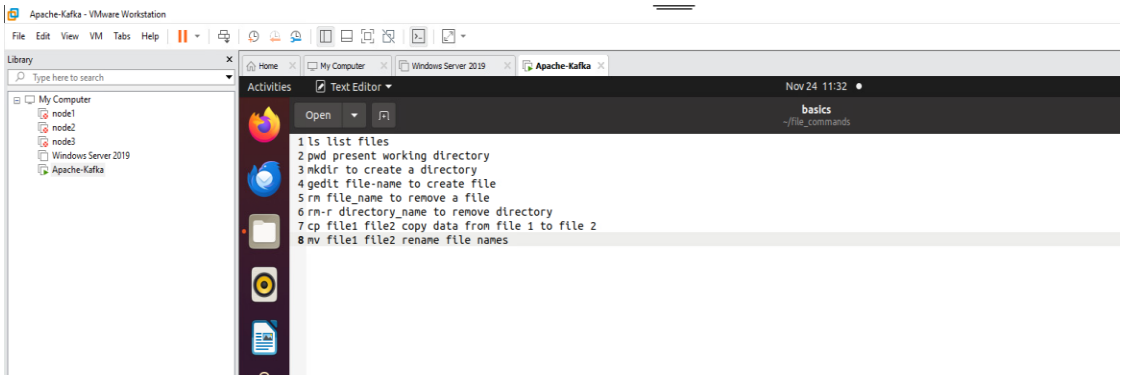
```
user@user-virtual-machine:~/nithin/file_commands$ ls
basics
user@user-virtual-machine:~/nithin/file_commands$ ls -l
total 4
-rw-rw-r-- 1 user user 249 Nov  1 00:42 basics
user@user-virtual-machine:~/nithin/file_commands$ ls -a
.  ..  basics
user@user-virtual-machine:~/nithin/file_commands$ ls -r
basics
user@user-virtual-machine:~/nithin/file_commands$ ls -h
basics
user@user-virtual-machine:~/nithin/file_commands$ ls -t
basics
user@user-virtual-machine:~/nithin/file_commands$
```

```
user@user-virtual-machine:~/nithin$ ls
disk_usage  file_commands  hardware  process_releated  systems  users
user@user-virtual-machine:~/nithin$ rm -r systems
user@user-virtual-machine:~/nithin$ ls
disk_usage  file_commands  hardware  process_releated  users
user@user-virtual-machine:~/nithin$ rm -rf users
user@user-virtual-machine:~/nithin$ ls
disk_usage  file_commands  hardware  process_releated
user@user-virtual-machine:~/nithin$
```

Some more basic commands in Linux:

- pwd: present working directory(displays present directory
- gedit file_name: create a file.
- touch file_name: create a file.
- rm file_name: removes a file.
- rm -f file_name: force full removes a file.
- rm –i file_name: asks for conformation.

```
user@user-virtual-machine:~/nithin/file_commands$ pwd
/home/user/nithin/file_commands
user@user-virtual-machine:~/nithin/file_commands$ pwd
/home/user/nithin/file_commands
user@user-virtual-machine:~/nithin/file_commands$ gedit basics
user@user-virtual-machine:~/nithin/file_commands$ ls
basics
user@user-virtual-machine:~/nithin/file_commands$ touch basics2
user@user-virtual-machine:~/nithin/file_commands$ ls
basics  basics2
user@user-virtual-machine:~/nithin/file_commands$ rm basics2
user@user-virtual-machine:~/nithin/file_commands$ ls
basics
user@user-virtual-machine:~/nithin/file_commands$
```



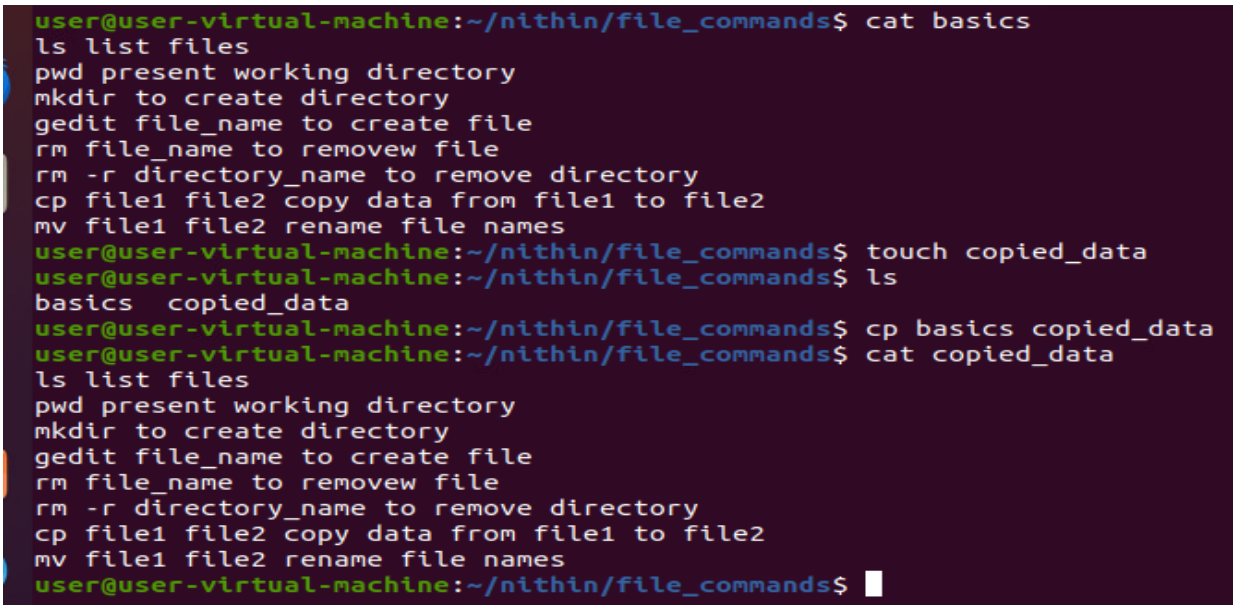

```
user@user-virtual-machine:~/nithin/file_commands$ touch file1
user@user-virtual-machine:~/nithin/file_commands$ touch file2
user@user-virtual-machine:~/nithin/file_commands$ touch file3
user@user-virtual-machine:~/nithin/file_commands$ ls
basics  file1  file2  file3
user@user-virtual-machine:~/nithin/file_commands$ rm file1
user@user-virtual-machine:~/nithin/file_commands$ ls
basics  file2  file3
user@user-virtual-machine:~/nithin/file_commands$ rm -f file2
user@user-virtual-machine:~/nithin/file_commands$ ls
basics  file3
user@user-virtual-machine:~/nithin/file_commands$ rm -i file2
rm: cannot remove 'file2': No such file or directory
user@user-virtual-machine:~/nithin/file_commands$ rm -i file3
rm: remove regular empty file 'file3'?
```

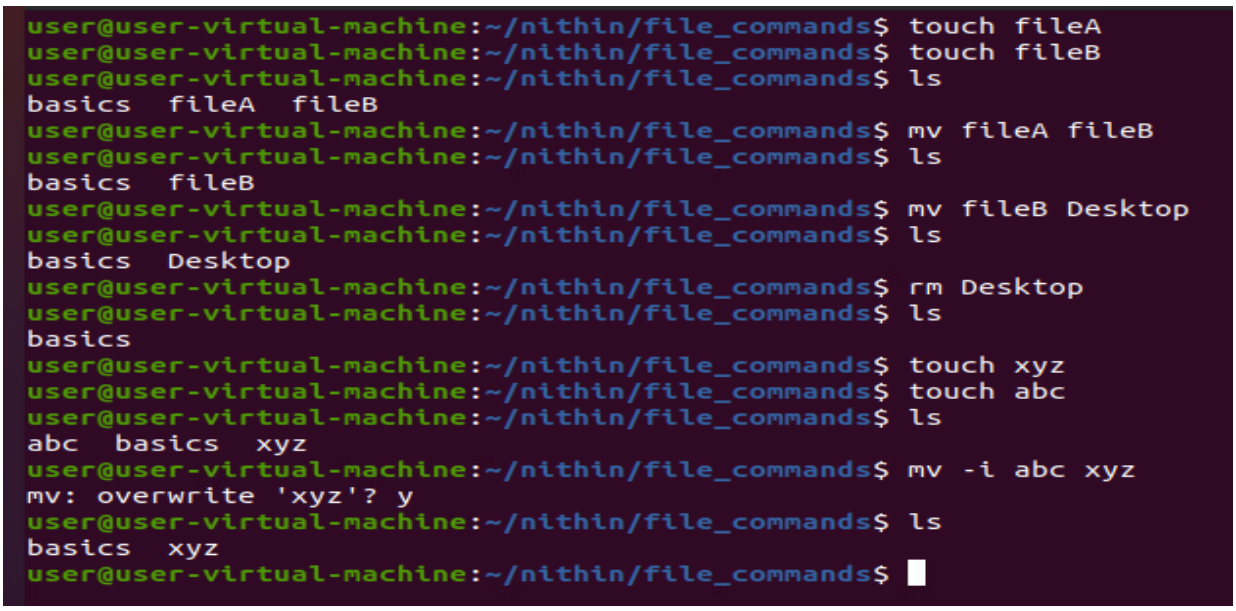
- Cat: cat file_name: displays the content in the file
- Display: head -1 file_name: display the first line in file
- Display: head -2 file_name: display the first two lines in file
- Display: tail -1 file_name: display last line in file
- Display: tail -2 file_name: display last two lines in file

```
user@user-virtual-machine:~/nithin/file_commands$ cat basics
ls list files
pwd present working directory
mkdir to create directory
gedit file_name to create file
rm file_name to removew file
rm -r directory_name to remove directory
cp file1 file2 copy data from file1 to file2
mv file1 file2 rename file names
user@user-virtual-machine:~/nithin/file_commands$ head -1 basics
ls list files
user@user-virtual-machine:~/nithin/file_commands$ head -2 basics
ls list files
pwd present working directory
user@user-virtual-machine:~/nithin/file_commands$ tail -1 basics
mv file1 file2 rename file names
user@user-virtual-machine:~/nithin/file_commands$ tail -2 basics
cp file1 file2 copy data from file1 to file2
mv file1 file2 rename file names
user@user-virtual-machine:~/nithin/file_commands$
```

Copy and move/rename File_commands:

- cp file1 file2: copy content from file1 to file2.
- cp – r file1 file2: copy the content recursively.
- cp –f file1 file2: copy content forcefully.
- cp –i: link file instead of copying
- mv file1 file2: moves the file location.
- mv –f file1 file2: moves the file forcefully.
- mv –i: asks for the conformation.





Compress files/create zip file:

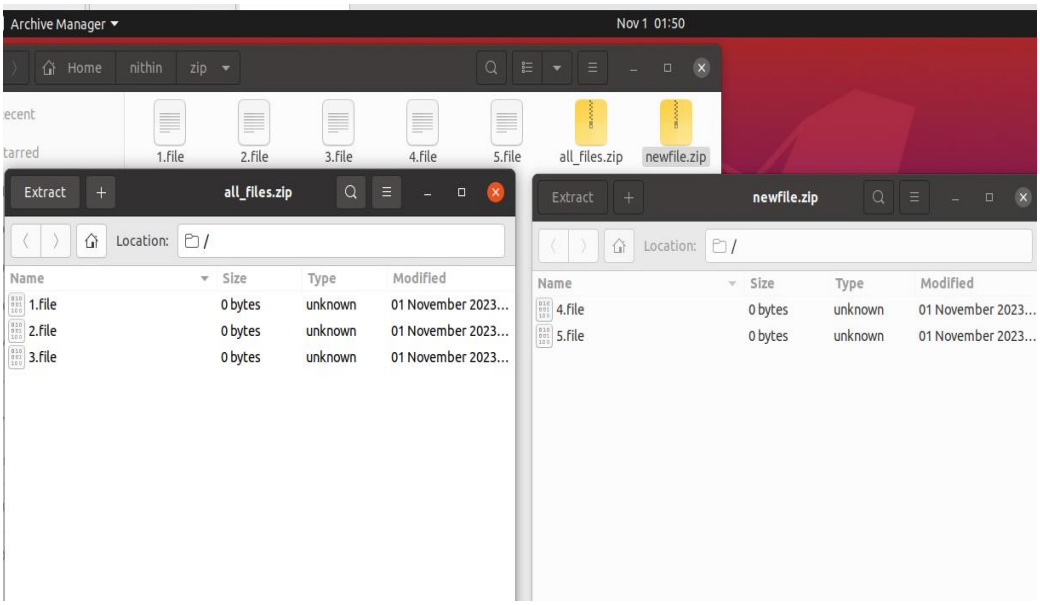
cd file_name: open file/directory

cd: go back to home.

Zip file_name file1 file2 file3: compress files in zip file.

```
user@user-virtual-machine:~/nithin$ ls
disk_usage  file_commands  hardware  process_releated  zip
user@user-virtual-machine:~/nithin$ cd zip
user@user-virtual-machine:~/nithin/zip$ touch 1.file 2.file 3.file
user@user-virtual-machine:~/nithin/zip$ zip all_files.zip 1.file 2.file
  adding: 1.file (stored 0%)
  adding: 2.file (stored 0%)
  adding: 3.file (stored 0%)
user@user-virtual-machine:~/nithin/zip$ touch 4.file 5.file
user@user-virtual-machine:~/nithin/zip$ zip newfile.zip

zip error: Nothing to do! (newfile.zip)
user@user-virtual-machine:~/nithin/zip$ zip newfile.zip 4.file 5.file
  adding: 4.file (stored 0%)
  adding: 5.file (stored 0%)
user@user-virtual-machine:~/nithin/zip$
```



Linux Basic Administration

- Linux has become extremely easy to administer, compared to its early days. And can be administered using GUI applications (like Windows OS) or using the Command line Interface (CLI)
- As a professional Linux administrator, you'll have to know how to administer the OS via the CLI
- Linux supports multi-tasking, several users using the OS simultaneously.
- By default, 7 users can work simultaneously (without anyone logging out). 6 Command line users and 1 GUI user. To switch use CTRL + ALT + F1 (F2,F3,F4,F5,F6,F7) . CTRL+ALT+F7 takes you to the GUI one

Linux – User Administration

- To show the Linux distro version: $ cat /proc/version.
- To see Linux kernel version: $ uname –r
- To add new user: #useradd michael
- To view the default useradd options: # useradd –D
- The options are:
    - -g Group
    - -m home directory
    - -f Inactive (to set password expiry date in days)
    - -e Expire (to disable the user after specified number of days)
    - -s Shell (user's default login shell, usually /bin/sh)
- To delete a user: # userdel –r michael

Some commands in administration:

uname: displays Linux system information.

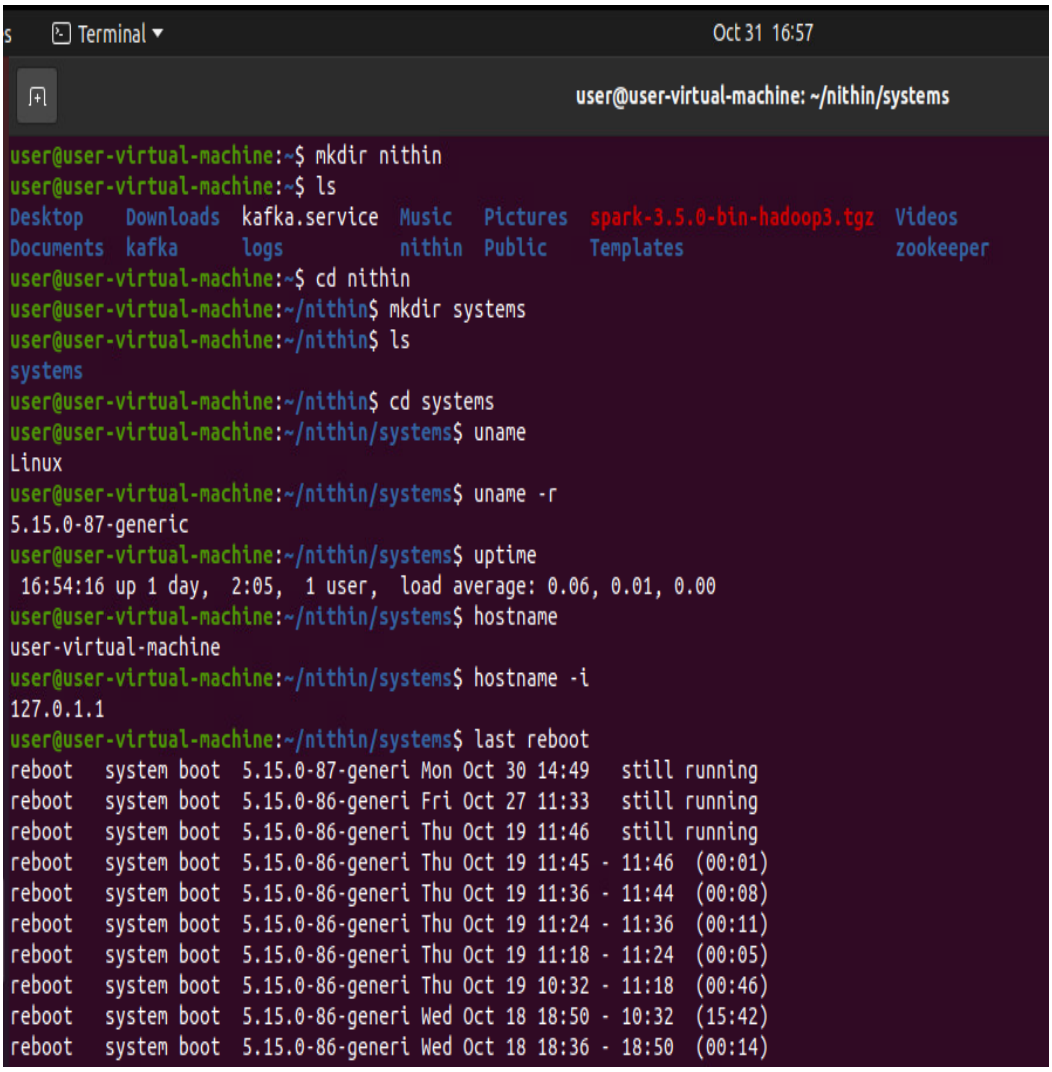
uname –r: displays kernel released information.

uptime: displays how long the system is running including load average.

hostname: shows the system host name.

hostname –i: displays the IP address of the system.

last reboot: shows system reboot information.


Terminal
Oct 31 16:57
user@user-virtual-machine: ~/nithin/systems
user@user-virtual-machine:~$ mkdir nithin
user@user-virtual-machine:~$ ls
Desktop Downloads kafka.service Music Pictures spark-3.5.0-bin-hadoop3.tgz Videos
Documents kafka logs nithin Public Templates zookeeper
user@user-virtual-machine:~$ cd nithin
user@user-virtual-machine:~/nithin$ mkdir systems
user@user-virtual-machine:~/nithin$ ls
systems
user@user-virtual-machine:~/nithin$ cd systems
user@user-virtual-machine:~/nithin/systems$ uname
Linux
user@user-virtual-machine:~/nithin/systems$ uname -r
5.15.0-87-generic
user@user-virtual-machine:~/nithin/systems$ uptime
16:54:16 up 1 day, 2:05, 1 user, load average: 0.06, 0.01, 0.00
user@user-virtual-machine:~/nithin/systems$ hostname
user-virtual-machine
user@user-virtual-machine:~/nithin/systems$ hostname -i
127.0.1.1
user@user-virtual-machine:~/nithin/systems$ last reboot
reboot system boot 5.15.0-87-generi Mon Oct 30 14:49 still running
reboot system boot 5.15.0-86-generi Fri Oct 27 11:33 still running
reboot system boot 5.15.0-86-generi Thu Oct 19 11:46 still running
reboot system boot 5.15.0-86-generi Thu Oct 19 11:45 - 11:46 (00:01)
reboot system boot 5.15.0-86-generi Thu Oct 19 11:36 - 11:44 (00:08)
reboot system boot 5.15.0-86-generi Thu Oct 19 11:24 - 11:36 (00:11)
reboot system boot 5.15.0-86-generi Thu Oct 19 11:18 - 11:24 (00:05)
reboot system boot 5.15.0-86-generi Thu Oct 19 10:32 - 11:18 (00:46)
reboot system boot 5.15.0-86-generi Wed Oct 18 18:50 - 10:32 (15:42)
reboot system boot 5.15.0-86-generi Wed Oct 18 18:36 - 18:50 (00:14)

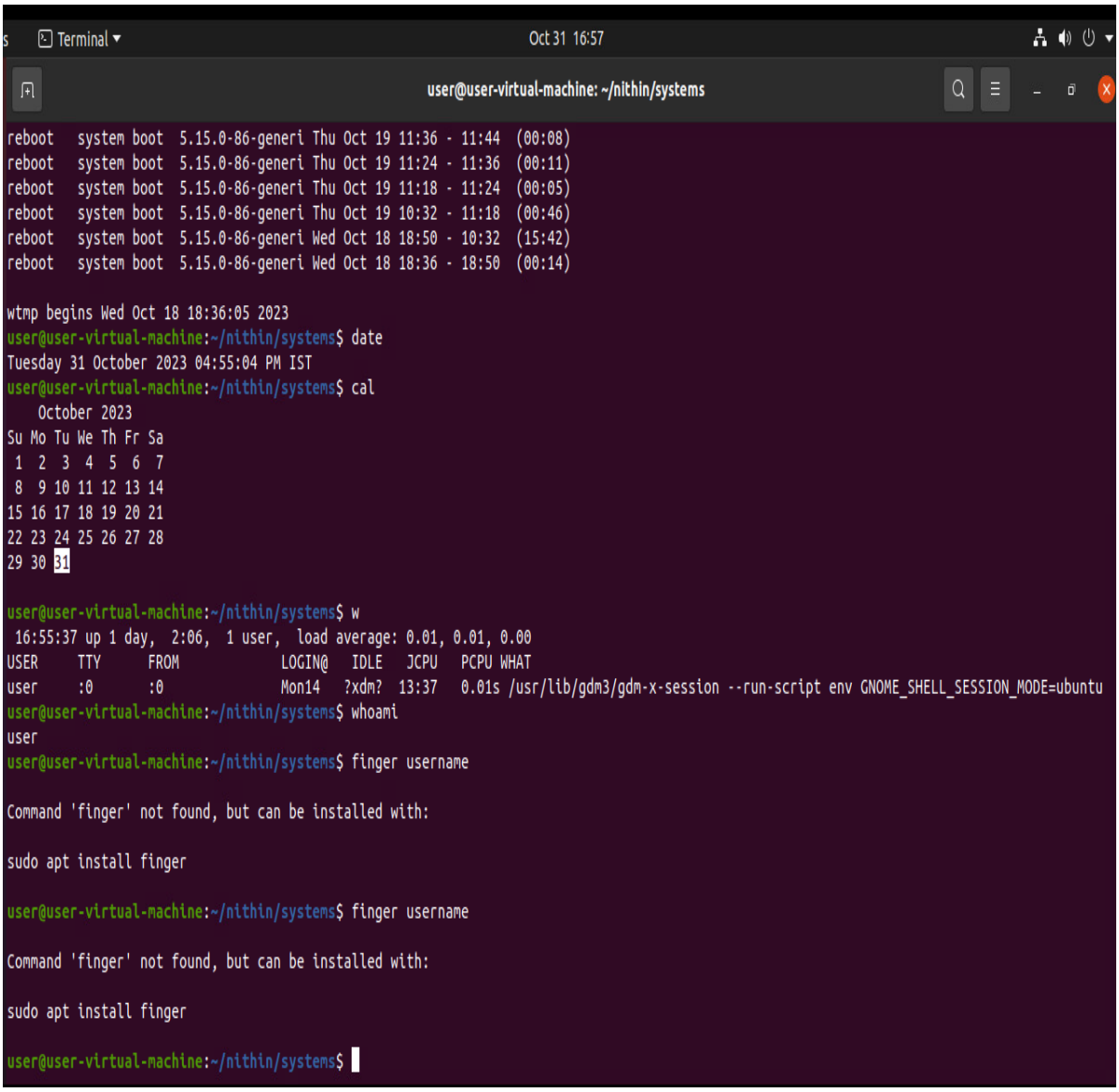
SYSTEM_RELATED:

date: displays current date.

cal: displays current month and date in calendar.

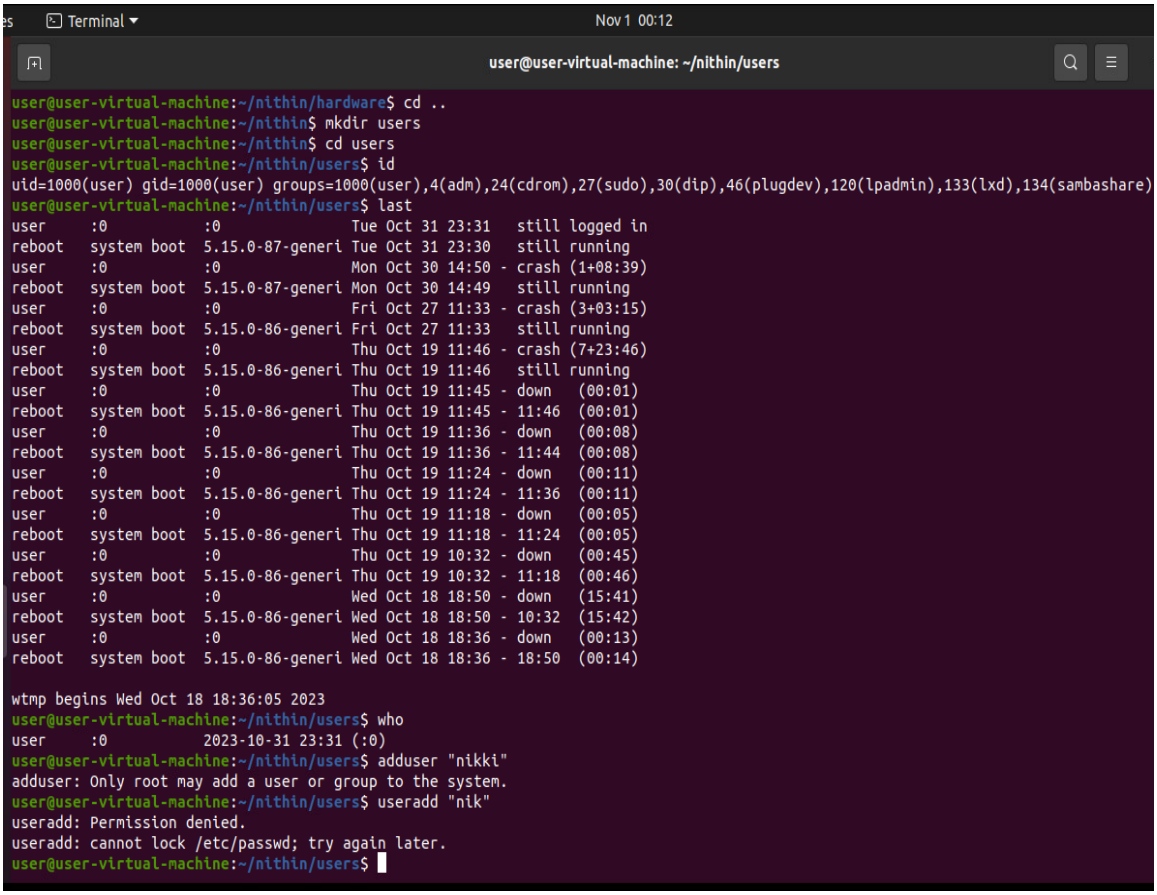
w: displays current logged in user in system.

whoami: displays who you are logged in as



User_related:

- id: displays the details of the active user.
- last: shows last login in the system.
- who: shows who login in the system.
- groupadd “admin”: adds the group admin.
- userdel: used to delete the user.
- usermod: used for modifying or change user information.

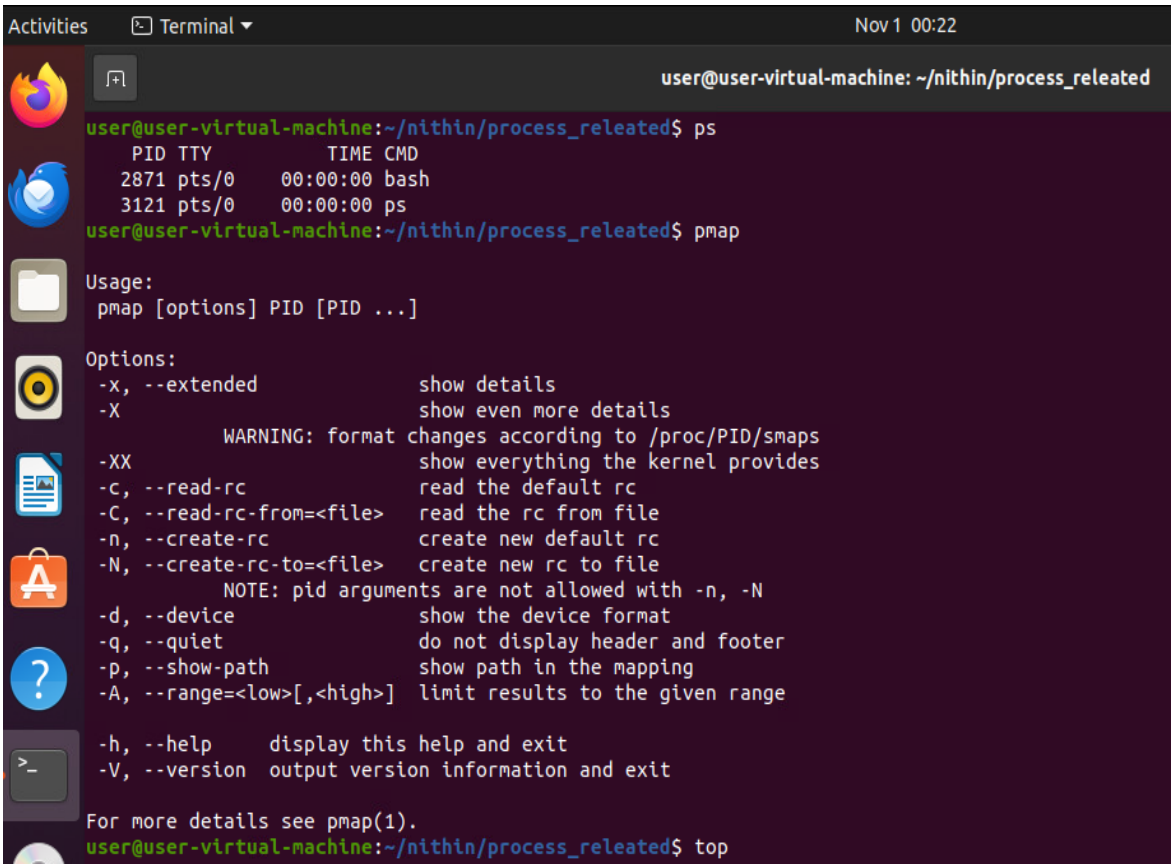


Process_related:

ps: displays current active process.

pmap: displays memory map of process.

top: displays all running process.



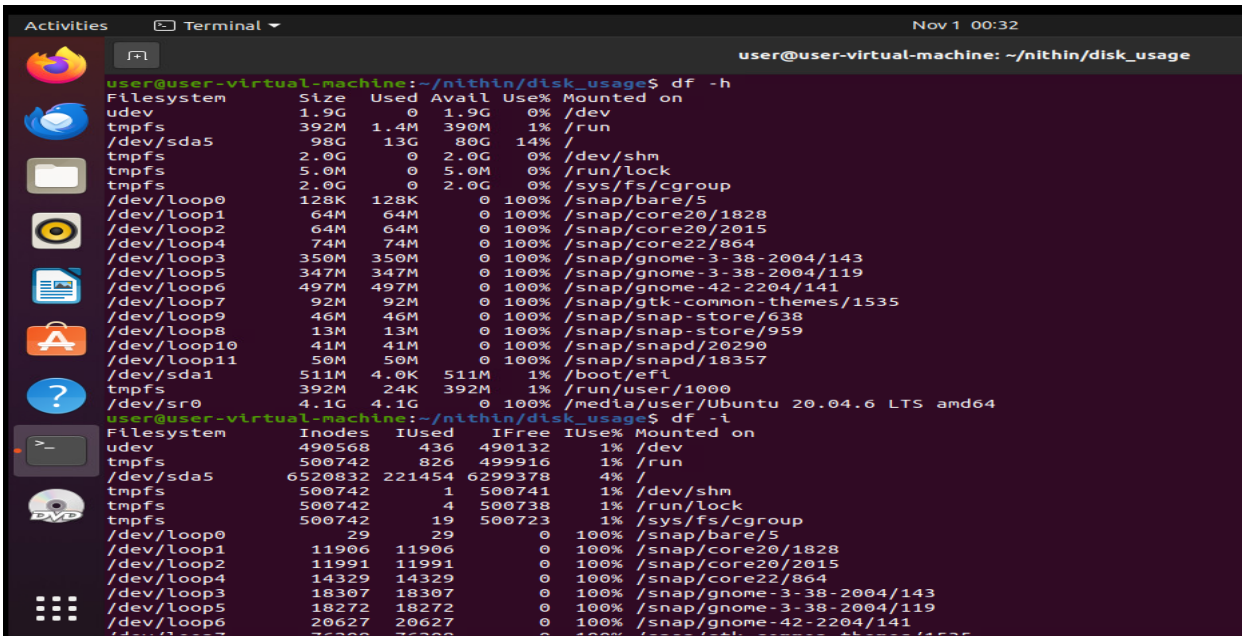
Disk_usage:

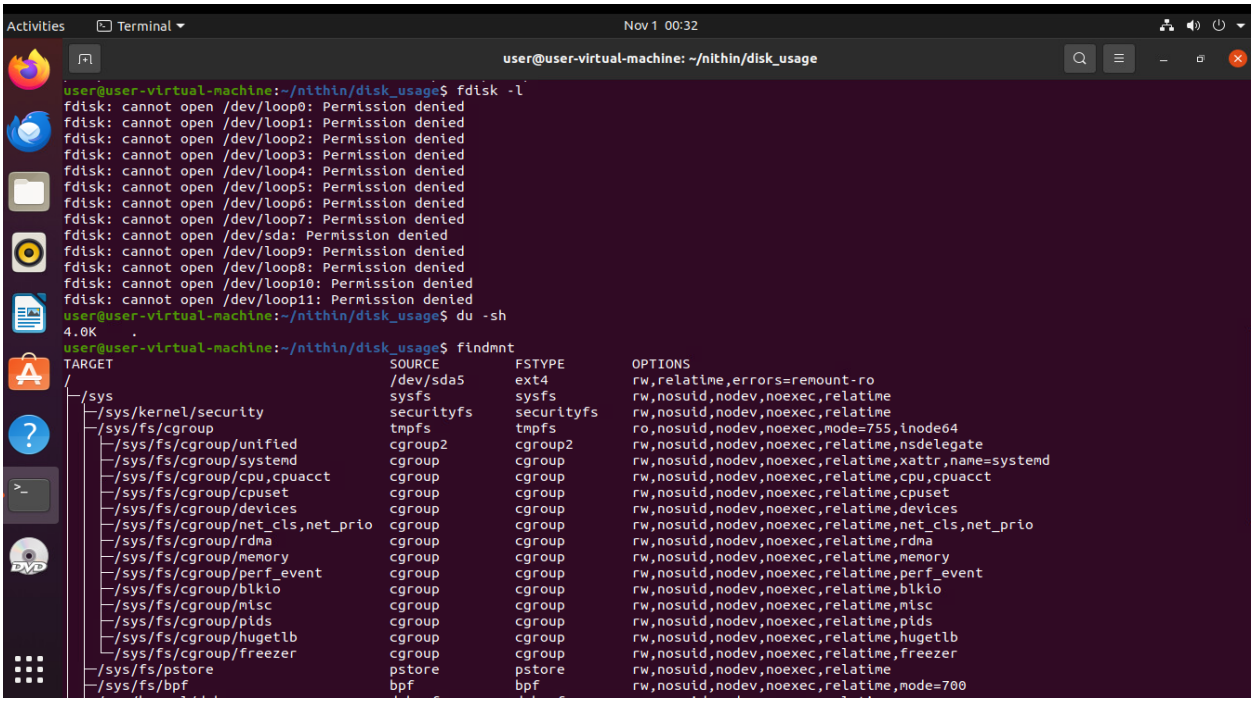
df –h: displays free space on mounted system.

df –i: displays free inodes on filesystem.

fdisk –l: shows disk partition, size, types.

du –sh: displays disk usage in the current directory.





Basic security principles:

User Permissions: Assign appropriate permissions to users and groups to control access to files and directories.

Firewalls: Configure and enable firewalls (like iptables) to control incoming and outgoing network traffic.

Regular Updates: Keep the system and software up to date with the latest security patches to fix vulnerabilities.

Password Policies: Enforce strong password policies, including regular password changes and avoiding default passwords.

Limited Root Access: Minimize the use of the root account; use sudo for administrative tasks to limit the potential impact of security breaches.

Audit Logs: Enable and regularly review system logs to detect and respond to security incidents.

File System Encryption: Use encryption for sensitive data, either at the file level or for the entire file system.

Secure Shell (SSH): Configure SSH securely, including key-based authentication and disabling root login.

Network Security: Disable unnecessary services and secure network services by binding them to specific IP addresses or using secure protocols.

Application Whitelisting: Only install and run necessary applications; avoid unnecessary software that could introduce security risks.