EXPERIMENT NO-1

Part A: Basic Linux Commands

Aim:

Explore usage of basic Linux Commands and system calls for file, directory and process management. For eg: (mkdir, chdir, cat, ls, chown, chmod, chgrp, ps etc. system calls: open, read, write, close, getpid, setpid, getuid, getgid, getegid, geteuid. sort, grep, awk, etc.)

Commands:

1. **pwd command (Print work directory):**
   We use the pwd command to find out the path of the current working directory (folder) you're in .The command will return a path of all the directories that starts with a forward slash (/).
   e.g. : -
   arshad@arshad-virtual-machine:~$ pwd
/home/arshad

2. **ls command (list):**
   We use ls command to view the contents of a directory. By default, this command will display the contents of your current working directory.
   e.g. : -
   arshad@arshad-virtual-machine:~$ ls
Documents Music Public Templates Videos
Desktop Downloads Pictures src twint
   ls command is showing the list in currently working directory
ls -R will list all the files in the sub-directories as well
ls -a will show the hidden files
ls -al will list the files and directories with detailed information like the permissions, size, owner, etc.

3. **cd command (change directory):**
   We use the cd command to navigate through the Linux files and directories, It requires either the full path or the name of the directory, depending on the current working directory that you're in.
   Suppose we are in one directory(home/username) and we want to navigate to other folder for example pictures
   we can either use cd /(full path) or we can just simply type cd Pi(tab) it will automatically navigate to pictures.
   e.g. :-
   arshad@arshad-virtual-machine:~$ cd Pictures/
arshad@arshad-virtual-machine:~/Pictures$
Now if we use ls command it will display all items over screen
e.g. :-
arshad@arshad-virtual-machine:~/Pictures$ ls
'Screenshot from 2020-08-07 12-13-59.png'
cd .. (with two dots) to move one directory up
cd to go straight to the home folder
cd- (with a hyphen) to move to your previous directory

4. **cat command(concatenate):**
   It is used to list the contents of a file on the standard output. To run this command, type cat followed by the file's name.
   e.g. :-
   arshad@arshad-virtual-machine:~/Documents/Example$ cat 20co24
I'm khan arshad and my roll no is 20co24
cat > filename creates a new file
cat filename1 filename2>filename3 joins two files (1 and 2) and stores the output of them in a new file (3)
to convert a file to upper or lower case use, cat filename | tr a-z A-Z >output.txt

5. **cp command(copy paste):**
   we use the cp command to copy files from the current directory to a different directory. We can use cp command by just typing cp <filename.ext> <filename.ext1> it will copy and paste the file
   e.g.:-
   arshad@arshad-virtual-machine:~/Pictures$ cp index.png index.png1
arshad@arshad-virtual-machine:~/Pictures$ ls
index.png
index.png1

6. **mkdir command(make directory):**
   mkdir is used to create a new directory under any directory.
   Its syntax is mkdir <directory name>
   (use sudo if the command is not working)
   e.g.:-
   arshad@arshad-virtual-machine:/home$ mkdir Arshad1
   arshad@arshad-virtual-machine:/home$ ls
Arshad1 arshad

7. **rmdir Command(remove directory):**
   The rmdir command is used to delete a directory.
Its syntax is redir<directory name>
(use sudo if the command is not working)
e.g.:-
arshad@arshad-virtual-machine:/home$ sudo rmdir Arshad
arshad@arshad-virtual-machine:/home$ ls
arshad
arshad@arshad-virtual-machine:/home$

8. **touch Command:**
   The touch command is used to create empty files. We can create multiple empty files by executing it once.
   Its syntax is touch <filename>
   e.g.:-
   arshad@arshad-virtual-machine:~$ touch newfile1.txt
arshad@arshad-virtual-machine:~$ ls
beef Documents Music Pictures src twint
Desktop Downloads newfile1.txt Public Templates Videos

9. **rm Command(remove):**

The rm command is used to remove a file.
Its syntax is rm <filename>
e.g.:-
arshad@arshad-virtual-machine:~$ rm newfile1.txt
arshad@arshad-virtual-machine:~$ ls
beef Documents Music Public Templates Videos
Desktop Downloads Pictures src twint
arshad@arshad-virtual-machine:~$

10. **mv Command(move):**

The mv command is used to move a file or a directory form one location to another location.
Its syntax is mv <file name> <directory path>
e.g.:-
list of pictures
arshad@arshad-virtual-machine:~/Pictures$ ls
index.png1
newimage
after using mv cmd
arshad@arshad-virtual-machine:~/Pictures$ mv newimage ~/Documents
arshad@arshad-virtual-machine:~/Pictures$ ls
index.png1
moved file to documents
arshad@arshad-virtual-machine:~/Documents$ ls
Example newimage 'Untitled 1.odt'

11. **rename command:**

The rename command is used to rename files. It is useful for renaming a large group of files.
Its synatx is rename ‘s/<filename>/<filename>/’ *.txt
e.g.:-
arshad@arshad-virtual-machine:~/Documents$ ls
Example newimage.png 'Untitled 1.odt'
arshad@arshad-virtual-machine:~/Documents$ rename 's/newimage/oldimage/' *.png
arshad@arshad-virtual-machine:~/Documents$ ls
Example oldimage.png 'Untitled 1.odt'
arshad@arshad-virtual-machine:~/Documents$

12. **head Command:**

The head command is used to display the content of a file. It displays the first 10 lines of a file.
It will print only up to 10 lines
Its syntax is head <file name>
e.g.:-arshad@arshad-virtual-machine:~/Documents/Example$ head 20co24
1
2
3
5
4
8
95

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746
54
22

13. tail Command:

The tail command is similar to the head command. The difference between both commands is that it displays the last ten lines of the file content. It is useful for reading the error message.
Its Syntax is tail <file name>
e.g.:-
arshad@arshad-virtual-machine:~/Documents/Example$ tail 20co24
4
78
95
746
54
22
2579
148

14. tac Command:

The tac command is the reverse of cat command, as its name specified. It displays the file content in reverse order (from the last line).
Its Syntax is tac <file name>
e.g.:-
arshad@arshad-virtual-machine:~/Documents/Example$ tac 20co24
148
2579
22

15. more command:

The more command is quite similar to the cat command, as it is used to display the file content in the same way that the cat command does. The only difference between both commands is that, in case of larger files, the more command displays screenful output at a time.
Enter key: To scroll down page by line.
Space bar: To move to the next page.
b key: To move to the previous page.
/ key: To search the string.

16. less Command

The less command is similar to the more command. It also includes some extra features such as 'adjustment in width and height of the terminal.' Comparatively, the more command cuts the output in the width of the terminal.

Its syntax is less <file name>

17. id Command:

The id command is used to display the user ID (UID) and group ID (GID).
Its syntax is id
e.g.:-
arshad@arshad-virtual-machine:~$ id

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uid=1000(arshad) gid=1000(arshad)
groups=1000(arshad),4(adm),24(cdrom),27(sudo),30(dip),46(plugdev),120(lpadmin),131(lxd),132(sambashare)

18. host Command:

The host command is used to display the IP address for a given domain name and vice versa. It performs the DNS lookups for the DNS Query.
Its syntax is host <domain name> or <ip address>
e.g.:-
arshad@arshad-virtual-machine:/$ host arshad-virtual-machine
arshad-virtual-machine.localdomain has address <ip add>

19. ping Command:

The ping command is used to check the connectivity between two nodes, that is whether the server is connected. It is a short form of "Packet Internet Groper."
its syntax is ping <destination>

20. mail Command:

The mail command is used to send emails from the command line.
its syntax is mail -s "Subject" <recipient address>

21. ssh Command:

Linux ssh command is used to create a remote connection through the ssh protocol.
Its Syntax is ssh user_name@host(IP/Domain_name)</p>

22. ip Command:

Linux ip command is an updated version of the ipconfig command. It is used to assign an IP address, initialize an interface, disable an interface.
Its Syntax is ip a or ip addr
e.g.:-

```
arshad@arshad-virtual-machine:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
   inet6 ::1/128 scope host
      valid_lft forever preferred_lft forever
2: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:28:2b:20:bf brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 193.168.94.129/24 brd 193.168.94.255 scope global dynamic noprefixroute ens33
       valid_lft 1092sec preferred_lft 1092sec
   inet6 fe80::5c46:cbfb:34ac:1a52/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
arshad@arshad-virtual-machine:~$
```

23. clear Command:

Linux clear command is used to clear the terminal screen.
Syntax is clear
and it will clear the terminal

24. exit Command:

Linux exit command is used to exit from the current shell. It takes a parameter as a number and exits the shell with a return of status number.
Syntax is exit
it will exit or close the terminal

25. df Command:

The df command is used to display the disk space used in the file system. It displays the output as in the number of used blocks, available blocks, and the mounted directory.
Its syntax is df
e.g.:-

```
arshad@arshad-virtual-machine:~$ df
Filesystem     1K-blocks     Used Available Use% Mounted on
udev             1959948        0   1959948   0% /dev
tmpfs             398672     1860    396812   1% /run
/dev/sda5       19992176 10283160   8670424  55% /
tmpfs            1993360        0   1993360   0% /dev/shm
tmpfs               5120        4      5116   1% /run/lock
tmpfs            1993360        0   1993360   0% /sys/fs/cgroup
/dev/loop3           128      128         0 100% /snap/bare/5
/dev/loop0         56960    56960         0 100% /snap/core18/2284
/dev/loop4        224256   224256         0 100% /snap/gnome-3-34-1804/66
/dev/loop2         63488    63488         0 100% /snap/core20/1328
/dev/loop1         56832    56832         0 100% /snap/core18/1997
/dev/loop5        224256   224256         0 100% /snap/gnome-3-34-1804/77
/dev/loop6        253952   253952         0 100% /snap/gnome-3-38-2004/87
/dev/loop9         55552    55552         0 100% /snap/snap-store/558
/dev/loop8         66816    66816         0 100% /snap/gtk-common-themes/1519
/dev/loop7         66688    66688         0 100% /snap/gtk-common-themes/1515
/dev/loop12        32896    32896         0 100% /snap/snapd/11841
/dev/loop11        44544    44544         0 100% /snap/snapd/14549
/dev/loop10        52352    52352         0 100% /snap/snap-store/518
/dev/sda1         523248        4    523244   1% /boot/efi
tmpfs             398672       40    398632   1% /run/user/1000
arshad@arshad-virtual-machine:~$
```

26. zcat Command:

The zcat command is used to display the compressed files.
Syntax is zcat <file name>
e.g.:-

```
arshad@arshad-virtual-machine:~/Documents/Example$ ls
20co24  20co24.zip
arshad@arshad-virtual-machine:~/Documents/Example$ zcat 20co24.zip
1
2
3
5
4
78
95
```

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746
54
22
2579
148

27. sleep Command:

The sleep command is used to hold the terminal by the specified amount of time. By default, it takes time in seconds.
Syntax is sleep <time>
e.g.:-
arshad@arshad-virtual-machine:~/Documents/Example$ sleep 7
now the terminal will not accept any command for 7 seconds after 7 seconds terminal will accept comands and this line will pop
arshad@arshad-virtual-machine:~/Documents/Example$

28. cal Command:

The cal command is used to display the current month's calendar with the current date highlighted.
Syntax is cal
e.g.:-
arshad@arshad-virtual-machine:~$ cal
February 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

arshad@arshad-virtual-machine:~$

29. date Command:

The date command is used to display date, time, time zone, and more.
Syntax is date
arshad@arshad-virtual-machine:~$ date
Monday 07 February 2022 01:19:38 PM IST

30. wc Command:

The wc command is used to count the lines, words, and characters in a file.
Syntax is wc <file name>
e.g.:-
arshad@arshad-virtual-machine:~/Documents$ wc largetextfile.odt
94 562 28217 largetextfile.odt

Part B: System Call

What is a System Call? A system call is a method for a computer program to request a service from the kernel of the operating system. A system call is a method of interacting with the operating system via programs. A system call is a request from computer software to an operating system's kernel .A system call is a way for a user program to interface with the operating system. The program requests several services, and the OS responds by invoking a series of system calls to satisfy the request. A system call can be written in assembly language or a high-level language like

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C or C++ API(Application Program Interface) connects the operating system's functions to user programs .It acts as a link between the operating system and a process

Need of system calls:

1. Network connections require the system calls to sending and receiving data packets.
2. If you want to read or write a file, you need to system calls.
3. If you want to access hardware devices, including a printer, scanner, you need a system call.
4. System calls are used to create and manage new processes.
5. It is must require when a file system wants to create or delete a file.

System Calls can be grouped into major 5 categories:

Process Control:
Process control is the system call that is used to direct the processes. Some process control examples include creating, load, abort, end, execute, process, terminate the process, etc.

File Management:
File management is a system call that is used to handle the files. Some file management examples include creating files, delete files, open, close, read, write, etc.

Device Management:
Device management is a system call that is used to deal with devices. Some examples of device management include read, device, write, get device attributes, release device, etc.

Information Maintenance:
Information maintenance is a system call that is used to maintain information. There are some examples of information maintenance, including getting system data, set time or date, get time or date, set system data, etc.

Communication:
Communication is a system call that is used for communication. There are some examples of communication, including create, delete communication connections, send, receive messages, etc.

Process	Windows	Unix
Process Control	CreateProcess()	Fork()
	ExitProcess()	Exit()
	WaitForSingleObject()	Wait()
File Manipulation	CreateFile()	Open()
	ReadFile()	Read()
	WriteFile()	Write()
	CloseHandle()	Close()
Device Management	SetConsoleMode()	Ioctl()
	ReadConsole()	Read()
	WriteConsole()	Write()

Information Maintenance	GetCurrentProcessID()	Getpid()
	SetTimer()	Alarm()
	Sleep()	Sleep()
Communication	CreatePipe()	Pipe()
	CreateFileMapping()	Shmget()
	MapViewOfFile()	Mmap()
Protection	SetFileSecurity()	Chmod()
	InitializeSecurityDescriptor()	Umask()
	SetSecurityDescriptorgroup()	Chown(