LAB NO.: 10 **Date:**

DISK MANAGEMENT

Objectives:

In this lab, students will be able to

- Understand find the details of underlying operating systems disk space and file system information

System calls related to disk

df command

The 'df' (Disk Free) command in an inbuilt utility to find the available and the disk usage space on Linux servers/storage.

The following table provides an overview of the options of df command in Linux.

Options	Description
-a	-all: includes real files and virtual files like pseudo,pro, sysfs. lxc
-h	lt prints the sizes in the human-readable format in power of 1024 (eg: 1K 1M 1G)
-H	--si : likewise '-h' but here in power of 1000
-i	-- inodes: correspondence the inode details
-k	--block-size=1K display the disk space
-l	--local display local file systems only
-m	--megabytes display the disk space
-t	--type=TYPE To filter a particular file system type
-T'	--print-type List the file system types
-x	--exclude-type=TYPE To exclude a particular file system type

1. **How to check the details of disk space used in each file system?**

```
# df
```

```
Output:

Filesystem     1K-blocks      Used Available Use% Mounted on
/dev/sda2      164962420 142892148  15301196  91% /
udev               10240         0     10240   0% /dev
tmpfs            3291620    329084   2962536  10% /run
tmpfs            8229048         0   8229048   0% /dev/shm
tmpfs               5120         0      5120   0% /run/lock
tmpfs            8229048         0   8229048   0% /sys/fs/cgroup
/dev/sda1          97167     76552     15598  84% /boot
tmpfs            1645812         0   1645812   0% /run/user/301703
tmpfs            1645812         0   1645812   0% /run/user/301677
tmpfs            1645812         0   1645812   0% /run/user/301483
```

Note: Using 'df' command without any option/parameter will display all the partitions and the usage information of the disk space. The result of the above command contains 6 columns which are explained here below:

Filesystem	-->	Mount Point Name
1K-blocks	-->	Available total space counted in 1kB (1000 bytes)
Used	-->	Used block size
Available	-->	Free blocks size
Use%	-->	Usage on percentage-wise
Mounted on	-->	Show the path of the mounted point

```
# df -k
```

Note: Even using the '-k' option also provides the same output as the default 'df' command. Both outputs provide the same data usage of file systems in block size which is measured in 1024 bytes.

2. How to check the disk space in Human-Readable format?

```
# df -h
```

```
Output:

Filesystem      Size  Used Avail Use% Mounted on
/dev/sda2       158G  137G   15G  91% /
udev             10M     0   10M   0% /dev
tmpfs           3.2G  322M  2.9G  10% /run
tmpfs           7.9G     0  7.9G   0% /dev/shm
tmpfs           5.0M     0  5.0M   0% /run/lock
tmpfs           7.9G     0  7.9G   0% /sys/fs/cgroup
/dev/sda1        95M   75M   16M  84% /boot
tmpfs           1.6G     0  1.6G   0% /run/user/301703
tmpfs           1.6G     0  1.6G   0% /run/user/301483
tmpfs           1.6G     0  1.6G   0% /run/user/301613
tmpfs           1.6G     0  1.6G   0% /run/user/301677
```

Note: Using the'-h' option will list all the output in "Human Readable Format" used the power of 1024

3. How to sum up the total of the disk space usage?

```
# df -h --total
```

```
Output:

Filesystem      Size  Used Avail Use% Mounted on
/dev/sda2       158G  137G   15G  91% /
udev             10M     0   10M   0% /dev
tmpfs           3.2G  322M  2.9G  11% /run
tmpfs           7.9G     0  7.9G   0% /dev/shm
tmpfs           5.0M     0  5.0M   0% /run/lock
tmpfs           7.9G     0  7.9G   0% /sys/fs/cgroup
/dev/sda1        95M   75M   16M  84% /boot
tmpfs           1.6G     0  1.6G   0% /run/user/301703
tmpfs           1.6G     0  1.6G   0% /run/user/301483
tmpfs           1.6G     0  1.6G   0% /run/user/301613
tmpfs           1.6G     0  1.6G   0% /run/user/301677
total           183G  137G   40G  78% -
```

Note: using '--total' along with '-h' will sum up the total disk usage of all the file systems.

4. How to list the Inodes information of all file systems?

```
# df -i
```

```
 Output:

Filesystem       Inodes   IUsed   IFree IUse% Mounted on
/dev/sda2      10240000 2491518 7748482   25% /
udev            2054985     305 2054680    1% /dev
tmpfs           2057262     767 2056495    1% /run
tmpfs           2057262       1 2057261    1% /dev/shm
tmpfs           2057262      11 2057251    1% /run/lock
tmpfs           2057262      13 2057249    1% /sys/fs/cgroup
/dev/sda1         25168     336   24832    2% /boot
tmpfs           2057262       4 2057258    1% /run/user/301703
tmpfs           2057262       4 2057258    1% /run/user/301483
tmpfs           2057262       4 2057258    1% /run/user/301613
tmpfs           2057262       4 2057258    1% /run/user/301677
```

Note: Using '-i' will list the information about the Inodes of all the filesystem.

5. How to list the file system usage in MB (MegaByte)?

```
# df -m
```

```
 Output:

Filesystem     1M-blocks   Used Available Use% Mounted on
/dev/sda2         161097 139711     14776  91% /
udev                 10      0        10   0% /dev
tmpfs              3215    322      2894  10% /run
tmpfs              8037      0      8037   0% /dev/shm
tmpfs                 5      0         5   0% /run/lock
tmpfs              8037      0      8037   0% /sys/fs/cgroup
/dev/sda1            95     75        16  84% /boot
tmpfs              1608      0      1608   0% /run/user/301703
tmpfs              1608      0      1608   0% /run/user/301483
tmpfs              1608      0      1608   0% /run/user/301613
```

Note: Using the '-m' option we can get the output of all the file systems disk space usage in MB (megabytes).

6. How to check the file system type?

```
# df -T
```

```
 Output:

Filesystem     Type     1K-blocks      Used Available Use% Mounted on
/dev/sda2      ext4     164962420 143084916  15108428  91% /
udev           devtmpfs     10240         0     10240   0% /dev
tmpfs          tmpfs      3291620    329144   2962476  10% /run
tmpfs          tmpfs      8229048         0   8229048   0% /dev/shm
tmpfs          tmpfs         5120         0      5120   0% /run/lock
tmpfs          tmpfs      8229048         0   8229048   0% /sys/fs/cgroup
/dev/sda1      ext2         97167     76552     15598  84% /boot
tmpfs          tmpfs      1645812         0   1645812   0% /run/user/301703
tmpfs          tmpfs      1645812         0   1645812   0% /run/uscr/301483
tmpfs          tmpfs      1645812         0   1645812   0% /run/user/301613
tmpfs          tmpfs      1645812         0   1645812   0% /run/user/301677
```

Note: Using the'-T' option we can get the list of file system types. As you can see types of file systems in the above example's 2nd column "TYPE" as "ext4, tmpfs, ext2".

7. How to check the disk space details of a specific file system type?

```
# df -t ext4
```

```
 Output:

Filesystem     1K-blocks      Used Available Use% Mounted on
/dev/sda2      164962420 143225180  14968164  91% /
```

Note: Using the'-t' option we can filter the output of a specific file system. In this example, I have used the "ext4" file system. You can check it accordingly.

8. How to customize the output with certain columns?

```
# df -h / --output=size,used
 Output:
 Size Used
158G 137G
```

Note: Using '--output[=FIELD_LIST]'with df command you can customize your output with certain fields/columns. Check the example I used here.

```
# df --help or man help
```

Sample Program:

Read sectors from a disk

```
#include<stdio.h>
int main()
{
        int numSecteur=10;
        char secteur[1024];
        FILE* disqueF=fopen("/dev/sda6","r");
        fseek(disqueF, numSecteur*512,SEEK_SET);
        fread(secteur, 1024, 1, disqueF);
```

```
        //printf("%s",se
        for (int i = 0; i < sizeof(secteur); i++) {
           printf ("%x ", secteur[i]);
           if ((i + 1) % 16 == 0)
              printf ("\n");
        }
        fclose(disqueF);
        return 0;
}
```

Lab Exercises:

1. Identify the number of hard disks connected to the system.
2. Write a program to read a sector from the pen drive?
3. Identify the number of partitions and other details with the pen drive.
4. Write a program to write to a particular sector of a flash drive and SSD?

Additional Exercises:

1. Identify the available memory in the system.
2. Display the list of devices connected to your system including the physical names and its instance number.