**DISK MANAGEMENT**

1. **Disk Management**
2. **disk types**
3. **disk partitions**
4. **disk permissions**
5. **commands to check size, free, delete**
6. **How booting process happens in Linux**

**Types of drivers:**

1. Monolithic: cannot be removed or changed ex: android, predefined apps.

2. Modular: can be added/removed

**Types of files:**

1. Regular files/Ordinary files/ASCII text

2. Directory files.

3. Device files

Block Special Files => storage files ex. Harddisk, floppy, usb, dvd

Character special files => I/O files- ex: mouse, keyboard, monitor, printer, scanner.

4. Linked files

Softlink files and Hardlink files

5. Socket files

6. Binary executable files

7. Empty files

8. tar files

9. Zip files

UNIX file structure is in inverted tree structure, where root on the top and branch in the bottom.

Architecture of windows, Architecture of Unix or Components

**Partitions and Filesystems**

A **partition** is a physically contiguous(connecting) section of a disk, or what appears to be so in some advanced setups.

A **filesystem** is a method of storing/finding files on a hard disk (usually in a partition).

One can think of a partition as a container in which a filesystem resides, although in some circumstances, a filesystem can span more than one partition if one uses symbolic links, which we will discuss much later.

A comparison between filesystems in Windows and Linux is given in the accompanying table:

**Partition**  Disk1 **/dev/sda1**

**Filesystem Type** NTFS/VFAT EXT3/EXT4/XFS/BTRFS...

**Mounting Parameters**  DriveLetter Mountpoint

**Base Folder (where OS is stored)** C:\ /

All Linux filesystem names are case-sensitive, so **/boot**, **/Boot**, and **/BOOT** represent three different directories (or folders). Many distributions distinguish between core utilities needed for proper system operation and other programs, and place the latter in directories under **/usr** (think user). To get a sense for how the other programs are organized, find the **/usr** directory in the diagram from the previous page and compare the subdirectories with those that exist directly under the system root directory (**/**).

A file system is made up of data files indexed in a way that allows the perception of a directory-based organization.

A disk partition is the logical division of a physical storage device that can be made to work exactly like a standalone device. Partitions are common organizational tools for all modern operating systems.

**Summary:**

* + 1. A partition is a logical part of the disk.
    2. A filesystem is a method of storing/finding files on a hard disk.
    3. By dividing the hard disk into partitions, data can be grouped and separated as needed. When a failure or mistake occurs, only the data in the affected partition will be damaged, while the data on the other partitions will likely survive.
    4. The boot process has multiple steps, starting with BIOS, which triggers the boot loader to start up the Linux kernel. From there, the **initramfs** filesystem is invoked, which triggers the init program to complete the startup process.
    5. Determining the appropriate distribution to deploy requires that you match your specific system needs to the capabilities of the different distributions.

File wc grep echo cat tail more less sort tr sed grep Find command

**Partitions and Filesystems**

**Identify Linux File System**

**- Conventional file systems: ext3, ext4, XFS, Btrfs, JFS, NTFS, vfat, exfat, etc...**

**- Flash storage filesystem: ubifs, jffs2, yaffs etc...**

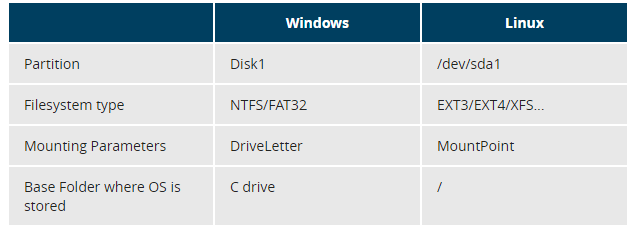
**- Database File Systems**

**- Special purpose filesystems: procfs, sysfs, tmpfs, squashfs, debugfs, fuse...**

**Differences between partitions and Filesystems**

**- Partition is a physically contagious section of a disk (it's a logical partition)**

**- A filesystem is a method of storing/finding files on the Harddisk**



**Disk Management:**

The tools to create the physical and logical partitions:

Logical partitions:

1. fdisk

2. sfdisk

3. parted

The limitations of fdisk tool:

1. cannot resize. The partition without data loss

2. Reboot the server when the file system is created or modified of deleted.

No limitations for sfdisk and parted

The type of file system that linux supports:

Ext2 - extended 2 – native file system in linux.

Ext3 – ext2+journal – introduced in ver3.0

Ext4 – ext3+journal – introduced in ver6.0

Xfs – extended file system – introduced version 7.0

**Features of ext3:**

1. ext3 is essentially an ext2 file system.

2. ext3 journal can be done on ext2 file system

3. ext3 can easily migrate from ext2 file system.

# df -h => lists all the mouted file system.

# Fdisk -l => list all the disk and all the file system.

# fdisk /dev/sda => list the system only in 1st disk.

**Creation file system after installation:**

#fdisk /dev/sda => sda stands first disk => creates a file system in 1st disk.

p => partion table

n => create new file system

after n , the first ,starting cylinders: last cylinder, + cylinders or + size{k,m,g}

(1685 -2611, default 2611): + 1G

K- KB M-MB G -GM

Command (m for help) : p

To see changes p for print.

Command (m for help): wq

Save and quit

# cat /proc/partitions => to check the kernel is updated.

To check the kernel without rebooting

# partx -d /dev/sda => 2 times

# partx -a /dev/sa

New version:

# partprobe /dev/sda

#cat /proc/partitions

# mkfs /dev/sda6 =>format

**Commands to format file system:**

Mkfs => to format the file system under ext2 or ext3 or ext4 or xfs

Mkfs.ext2 => To format only with ext2

Mkfs . ext3 => To format only with ext3

Mkfs.ext4 => to format only with ext4

Mke2fs => to format with ext2 or ext3 or ext4 or xfs.

**To format the file system under ext2:**

Mkfs /dev/sda7

Mkfs /dev/sda7

Mkfs.ext2 /dev/sda7

**To format the file system under ext3/**

# mkfs -t ext3 /dev/sda7

# mkfs -j /dev/sda7

# mkfs –t /dev/sda7

# mkdezfs -j /dev/sda7

**To format the file system under ext4/**

# mkfs -t ext4 /dev/sda7

# mkezfs -t ext4 //dev/sda7

# mkfs.ext4 /dev/sda7

**To format the file system under xfs/**

# mkfs -t xfs /dev/sda7

# mke2fs -t xfs /dev/sda7

# mkfs .xfs /dev/sda7

# mkfs /dev/sda6

**Default**

**In 6.0 => ext4**

**In 7.0 => xfs**

**To see the file system type:**

# blkid

# mkfs /dev/sda6

#df -h

Sda => first disk and it’s a file .

# mkdir /oradb

# mount /dev/sda6/oradb

# df -h => to see all mounted file system

/dev/sda6 /oradb

# cd /oradb

**To unmount the file system:**

# umount /oradb

Note: mountpoint is logical, sda is physical .

Note: Every mountpoint is a directory , not every directory is a mountpoint .

**# df -h**

**Disk management**

Before going to partition any disk, we will check the space in the Harddisk.

**# Fdisk -l**

**To create a new partition command is:**

# fdisk /dev/sda

Command prompt is displayed: p

Command (m for help): n

First cylinder number is: 1557

Size +100M

Command: p

Command: n

First cylinder number is: 1571 size +100M

The above partion shows an error, run the below command to show the partitions.

# Partx -a /dev/sda/ => new partitions created

First-time it won’t show partitions, run the command again.

# Partx -a /dev/sda/

It will show you partitions,

Ext3 is old version, and ext4 is new version. First, we will format with ext3 and move to ext4.

# mkfs .ext3 /dev/sda6

#mkdir /oracle

# mkdir /dev/sda6 /oracle

# df -h

# 10 Commands to Check Disk Partitions and Disk Space on Linux

In this post we are taking a look at some commands that can be used to check up the partitions on your system.

The commands would check what partitions there are on each disk and other details like the total size, used up space and file system etc.

### 1. fdisk

Fdisk is the most commonly used command to check the partitions on a disk. The fdisk command can display the partitions and details like file system type. However it does not report the size of each partitions.

Each device is reported separately with details about size, seconds, id and individual partitions.

### 2. sfdisk

Sfdisk is another utility with a purpose similar to fdisk, but with more features. It can display the size of each partition in MB.

### 3. cfdisk

Cfdisk is a linux partition editor with an interactive user interface based on ncurses. It can be used to list out the existing partitions as well as create or modify them.

Here is an example of how to use cfdisk to list the partitions.

Cfdisk works with one partition at a time. So if you need to see the details of a particular disk, then pass the device name to cfdisk.

**$ sudo cfdisk /dev/sdb**

### 4. parted

Parted is yet another command line utility to list out partitions and modify them if needed.  
Here is an example that lists out the partition details.

### 5. df -h

Df is not a partitioning utility, but prints out details about only mounted file systems. The list generated by df even includes file systems that are not real disk partitions.

Here is a simple example

**$ df -h**

**Filesystem Size Used Avail Use% Mounted on**

**/dev/sda6 97G 43G 49G 48% /**

**none 4.0K 0 4.0K 0% /sys/fs/cgroup**

**udev 3.9G 8.0K 3.9G 1% /dev**

**tmpfs 799M 1.7M 797M 1% /run**

**none 5.0M 0 5.0M 0% /run/lock**

**none 3.9G 12M 3.9G 1% /run/shm**

**none 100M 20K 100M 1% /run/user**

**/dev/sda8 196G 154G 33G 83% /media/13f35f59-f023-4d98-b06f-9dfaebefd6c1**

**/dev/sda5 98G 37G 62G 38% /media/4668484A68483B47**

Only the file systems that start with a /dev are actual devices or partitions.  
Use grep to filter out real hard disk partitions/file systems.

**$ df -h | grep ^/dev**

**/dev/sda6 97G 43G 49G 48% /**

**/dev/sda8 196G 154G 33G 83% /media/13f35f59-f023-4d98-b06f-9dfaebefd6c1**

**/dev/sda5 98G 37G 62G 38% /media/4668484A68483B47**

To display only real disk partitions along with partition type, use df like this

**$ df -h --output=source,fstype,size,used,avail,pcent,target -x tmpfs -x devtmpfs**

**Filesystem Type Size Used Avail Use% Mounted on**

**/dev/sda6 ext4 97G 43G 49G 48% /**

**/dev/sda8 ext4 196G 154G 33G 83% /media/13f35f59-f023-4d98-b06f-9dfaebefd6c1**

**/dev/sda5 fuseblk 98G 37G 62G 38% /media/4668484A68483B47**

### 6. pydf

Improved version of df, written in python. Prints out all the hard disk partitions in a easy to read manner.

**$ pydf**

**Filesystem Size Used Avail Use% Mounted on**

**/dev/sda6 96G 43G 48G 44.7 [####.....] /**

**/dev/sda8 195G 153G 32G 78.4 [#######..] /media/13f35f59-f023-4d98-b06f-9dfaebefd6c1**

**/dev/sda5 98G 36G 61G 37.1 [###......] /media/4668484A68483B47**

Again, pydf is limited to showing only the mounted file systems.

### 7. lsblk

Lists out all the storage blocks, which includes disk partitions and optical drives. Details include the total size of the partition/block and the mount point if any.  
Does not report the used/free disk space on the partitions.

**$ lsblk**

**NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINT**

**sda 8:0 0 465.8G 0 disk**

**├─sda1 8:1 0 70G 0 part**

**├─sda2 8:2 0 1K 0 part**

**├─sda5 8:5 0 97.7G 0 part /media/4668484A68483B47**

**├─sda6 8:6 0 97.7G 0 part /**

**├─sda7 8:7 0 1.9G 0 part [SWAP]**

**└─sda8 8:8 0 198.5G 0 part /media/13f35f59-f023-4d98-b06f-9dfaebefd6c1**

**sdb 8:16 1 3.8G 0 disk**

**└─sdb1 8:17 1 3.8G 0 part**

**sr0 11:0 1 1024M 0 rom**

If there is no MOUNTPOINT, then it means that the file system is not yet mounted. For cd/dvd this means that there is no disk.

Lsblk is capbale of displaying more information about each device like the label and model. Check out the man page for more information

**Display UUID and Model of device**

The "-o" option can be used to specify the columns to display. The following example shows the UUID and model name column along with other columns.

**$ lsblk -o PATH,SIZE,RO,TYPE,MOUNTPOINT,UUID,MODEL**

**PATH SIZE RO TYPE MOUNTPOINT UUID MODEL**

**/dev/loop0 96.5M 1 loop /snap/core/9436**

**/dev/loop1 229.6M 1 loop /snap/atom/257**

**/dev/loop2 55M 1 loop /snap/core18/1880**

**/dev/loop3 54.8M 1 loop /snap/gtk-common-themes/1502**

**/dev/loop4 156.2M 1 loop /snap/chromium/1213**

**/dev/loop5 55M 1 loop /snap/core18/1754**

**/dev/loop6 62.1M 1 loop /snap/gtk-common-themes/1506**

**/dev/loop7 230.6M 1 loop /snap/atom/258**

**/dev/loop8 158.4M 1 loop /snap/chromium/1229**

**/dev/loop9 97M 1 loop /snap/core/9665**

**/dev/sda 465.8G 0 disk Samsung\_Portable\_SSD\_T5**

**/dev/sda1 420G 0 part 757dcceb-3e17-4ca8-9ba1-b0cf68fb0134**

**/dev/sdb 111.8G 0 disk Samsung\_SSD\_840\_EVO\_120GB**

**/dev/sdb1 95.4G 0 part / 19d84ceb-8046-4f8d-a85a-cda49515d92c**

**/dev/sdc 111.8G 0 disk Samsung\_SSD\_850\_EVO\_120GB**

**/dev/sdc1 95.8G 0 part f41b21a7-e8be-48ac-b10d-cad641bf709b**

**$**

The above output has all the necessary information about all the storage devices present on the system or connected via usb. You can see the device name, size, mount point, uuid, model name etc.

This is the best command to see all information about storage devices together in one place.

### 8. blkid

Prints the block device (partitions and storage media) attributes like uuid and file system type. Does not report the space on the partitions.

**$ sudo blkid**

### 9. hwinfo

The hwinfo is a general purpose hardware information tool and can be used to print out the disk and partition list.

The output however does not print details about each partition like the above commands.

**$ hwinfo --block --short**

### 10. Inxi

Inxi is a very useful command line program that can display information about various hardware components present on the system. To display information about the disk drives and storage devices use the "-D" option with inxi.

**$ inxi -D -xx**

The "-x" option prints extra available information.  
The output from inxi does not contains details like UUID and mount directory.

### Summary

The output of parted is concise and complete to get an overview of different partitions, file system on them and the total space. Pydf and df are limited to showing only mounted file systems and the same on them.

Fdisk and Sfdisk show a whole lot of information that can take sometime to interpret whereas, Cfdisk is an interactive partitioning tool that display a single device at a time.

So try them out, and do not forget to comment below.

[Useful Linux commands for disk management | InetServices Knowledge Base](https://www.inetservices.com/knowledgebase/useful-linux-commands-for-disk-management/)