COSMOGIC

LINUX

File System

File system are central and important part of any modern operating system and they are expected to be fast and reliable.

A File system provides support in creation , deletion and modification of files and helps in organizing the files into directories . It also supports control of access to files and directories while managing disk space accordingly to it.

The term file system can have two different meaning depending upon user and context
- First, is a entire hierarchy of directories (also known as directory tree) that is used to organize file on a computer system .
- Second, is a type of file system that is how the storage of data (files, folders, etc) is organized partition on computer disk (SSD, HDD, floppy disk , CDROM ,etc) or on a hard disk . Each type of file system has its own set of rules for controlling data about each file(talking about meta data) with that file such as it's name, location , permissions and creation date.

In Linux everything is configured as a file. This include not only text files , images and executable programs but also directories , partition and hard ware device drivers.

Each file system contain a control block, which holds information about the file system(the data)
The other block , which holds information about the file system are inodes , which contain information about individual files, and data blocks , which contain the information stored in the individual files.

* inode :— they are the data structure that stores various information about a file in Linux , such as the access mode ,ownership , file type , file size , group , number of links, etc . Each inode is identify by an integer number . An inode is assigned to a file when it is created.

There is a huge difference between the way user and kernel see the file system and the way the kernel actually stores the files . For user file system is an hierarchial arrangement of directories that contain files and other directories .

Types of Linux file System :

- ext
- ext2
- ext3
- ext4
- jfs
- ReiserFS
- XFS
- Btrfs

EXT:- EXT stands for extended file system . It was implemented in April 1992 as the first file system created for Linux kernel . It has metadata structure inspired by The UFS(unix file system) and it was designed by Remy Card to overcome the limitation of MINX file system

EXT2:- EXT2 stand for second extended file system .
Introduced in Jan 1993 designed for Linux kernel
developed by Remy Card to replace Extended file system
It's designed on same principal as the BSD(berkely fast
file system) it was first commercial-grade file system
for Linux .

EXT3:- EXT3 stands for third extended file system and
is a journaled file system commonly used by Linux kernel
. It is use to be default file system in many distro's .
Stephen Tweedie first revealed that he was working on
ext2 trying to add journaling in 1998.
The file system was merged with the mainline Linux
kernel in November 2001 . Its main advantage over
ext2 is journaling witch improves realiablity and
eliminates the need to check the file system after an
unclear shutdown.

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A Journaling file system is that keeps track of changes
not yet committed to the file system's main part by
recording the intentions of such changes in data
structure known as journal which is usually a circular log
It help to restore session with very less chance of
being corrupted in event of crash or power failure etc.
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EXT4:- Stands for fourth extended file system and is a journaling file system developed as successor to ext3.

JFS :- The Journaled File System (JFS) was developed by IBM for AIX UNIX which was used as an alternative to system ext. JFS is an alternative to ext4 currently and is used where stability is required with the use of very few resources. When CPU power is limited JFS comes handy.

ReiserFS:- It was introduced as an alternative to ext3 with improved performance and advanced features. There was a time when SuSE Linux's default file format was ReiserFS but later Reiser went out of business and SuSE had no option other than to return back to ext3.

XFS:-XFS was a high speed JFS which aimed at parallel I/O processing. NASA still usages this file system on their 300+ terabyte storage server.

Btrfs:-B-Tree File System (Btrfs) focus on fault tolerance, fun administration, repair System, large storage configuration and is still under development. Btrfs is not recommended for Production System.

The Filesystem Hierarchy Standard(FHS):-
```
T
|--root
|--bin
|--boot
|--cdrom
|--dev
|--etc
|--home
|--lib
|--lib32
|--lib64
|--libx32
|--media
|--mnt
|--opt
|--proc
|--run
|--sbin
|--snap
|--srv
|--sys
|--tmp
|--usr
|--var
⊥
```
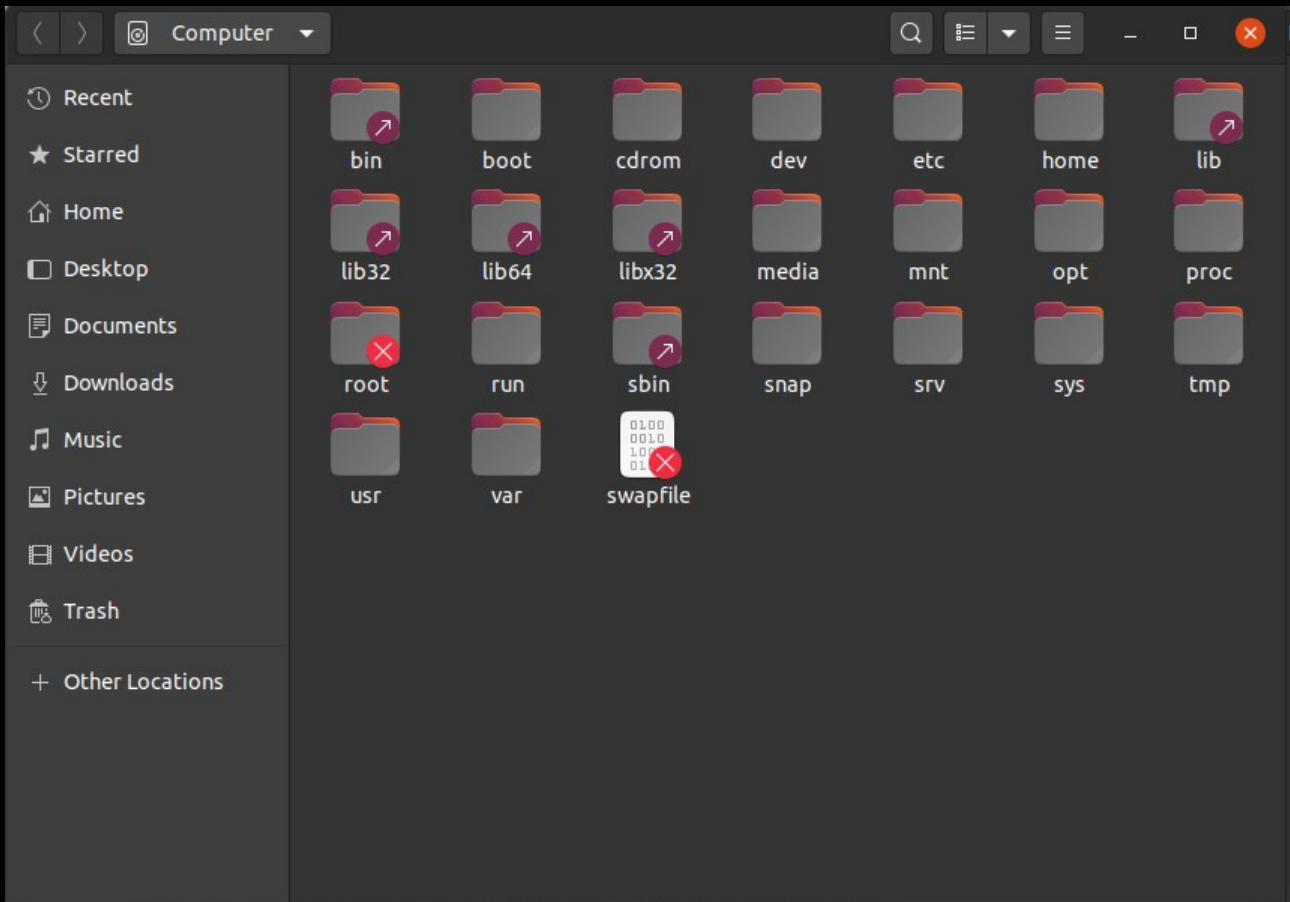
Filesystem Hierarchy Standard(FHS)
Ubuntu 20.04 LTS (Focal Fossa)

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The root directory we see here and the root(/) both
are different . One is the directory which contain all
other directories and one is the root user and can
understand it as administrator of the system who have
every permission to modify any thing . We can relate it
with windows admin account
-----------------XXXXXXXXXXX-----------------

/

The root directory, where everything begins. It contain all other directory of the file system . Rest all directories begins with / .

/bin

this is where most of your binary files are stored, typically for the Linux terminal commands and core utilities, such as cd (change directory), pwd (print working directory), mv (move), and so on.

/boot

Contains the Linux kernel, initial RAM disk image (for drivers needed at boot time), and the boot loader.

/cdrom

This is the mounting point in our system of CD .

/dev

This is where your physical devices are mounted, such as your hard drives, USB drives, optical drives, and so on. We've already explored that typically, your system hard drive is mounted under /dev/sda, whereas your USB thumb drive might be mounted under /dev/sde. You may also have different partitions on your disk, so you'll see /dev/sda1, /dev/sda2, and so on.

/etc
The /etc directory contains all of the system-wide configuration files. It also contains a collection of shell scripts that start each of the system services at boot time.
Everything in this directory should be readable text.
Interesting files: While everything in /etc is interesting, here are some of my all-time favorites:
/etc/crontab, a file that defines when automated jobs will run
/etc/fstab, a table of storage devices and their associated mount points
/etc/passwd, a list of the user accounts

/home
This is where you'll spend the overwhelming majority of your time, as this is where all of your personal files are kept. The Desktop, Documents, Downloads, Photos, and Videos folders are all stored under the /home/username directory. You can also store files directly in your /home folder without going to a sub-folder, if you wish so. Typically, when you open a command-line terminal in Linux, the default location that the terminal points to is your /home/username folder, unless you've manually changed the default location to something else.

/lib

It contains the kernel modules and the shared library
required by out system .
We will notice that many times when installing Linux
software packages, additional libraries are also
automatically downloaded, and they almost always start
with lib-something (lib/python3). These are basically the
files needed for your programs on Linux to work.

/media

Another place where external devices such as optical
drives and USB drives can be mounted. This varies
between different Linux distros.

/mnt

This is basically a placeholder folder used for mounting
other folders or drives. Typically this is used for
Network locations, but you could really use it for
anything you want. We can use it as the mount point
for media server's hard drive (/mnt/server).

/opt

This directory is used to install "optional" software.
This is mainly used to hold commercial software
products that may be installed on your system.

/proc
This directory is special. It's not a real filesystem in the sense of files stored on your hard drive. Rather, it is a virtual filesystem maintained by the Linux kernel. The files content are peepholes into the kernel itself. The files are readable and will give you a picture of how the kernel sees your computer.

/root
This is the home directory for the root account

/run
This directory is the only clean solution for early-runtime-directory problem

/sbin
This directory contains "system" binaries. These are programs that perform vital system tasks that are generally reserved for the superuser.

/snap
This directory is use as by default location to store packages downloaded from snap store .

/srv
This directory use to store server specific and service
related files

/sys
Modern Linux distributions include a /sys directory as
a virtual file system, which stores and allows modification
of the devices connected to the system.

/tmp
This is where temporary files are stored, and they are
usually deleted upon shutdown, which saves you from
having to manually delete them like is required in
Windows

/usr
It contains all the programs and support files
used by regular users.

/var
The /var directory tree is
where data that is likely to change is stored. Various
databases, user mail, etc. are located here.

Searching more information is always a great idea ;)
Thank you
—1nv3nt0r