Department of Computer Science & Information Technology

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LINUX

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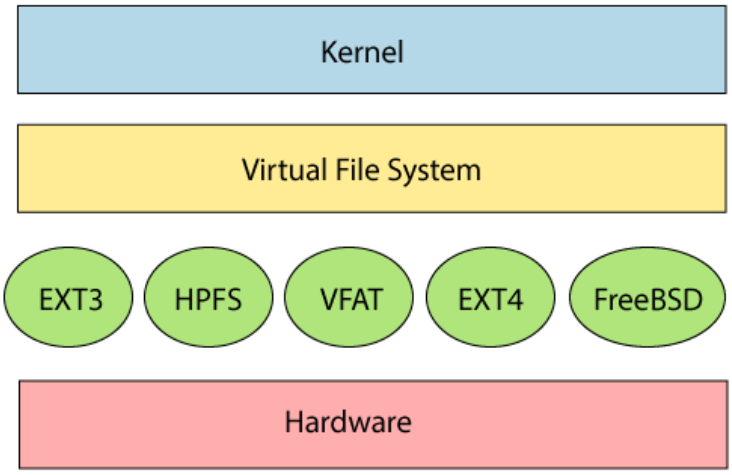
Experiment No - 4

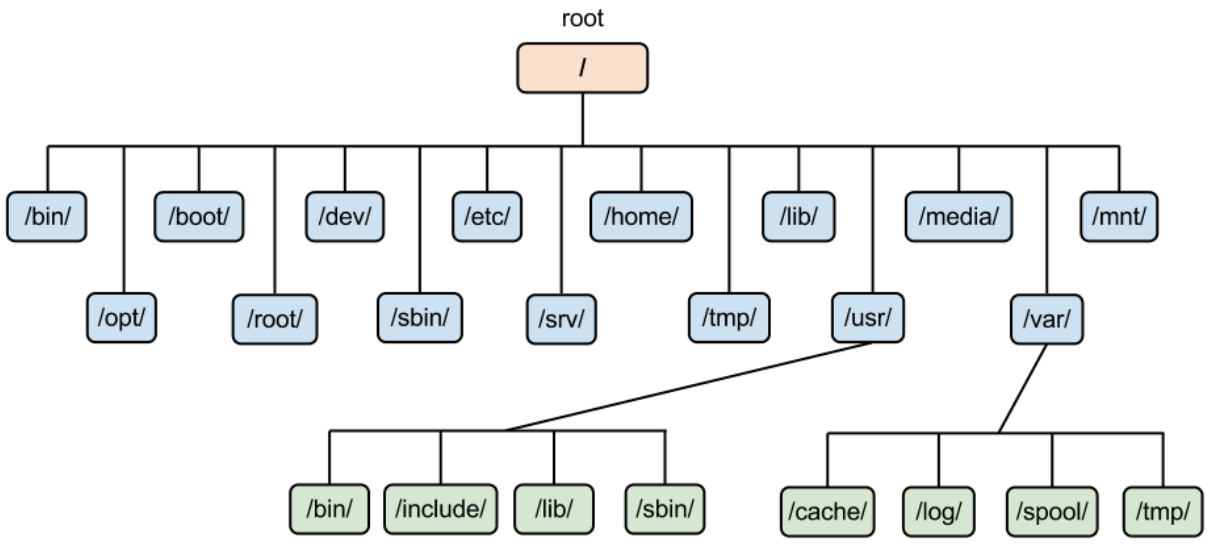
Introduction to Linux File System -

The Linux file system is a multifaceted structure comprised of three essential layers. At its foundation, the Logical File System serves as the interface between user applications and the file system, managing operations like opening, reading, and closing files. Above this, the Virtual File System facilitates the concurrent operation of multiple physical file systems, providing a standardized interface for compatibility. Finally, the Physical File System is responsible for the tangible management and storage of physical memory blocks on the disk, ensuring efficient data allocation and retrieval. Together, these layers form a cohesive architecture, orchestrating the organized and efficient handling of data in the Linux operating system.

Linux File System Structure -

Linux file system has a hierarchical file structure as it contains a root directory and its subdirectories. All other directories can be accessed from the root directory. A partition usually has only one file system, but it may have more than one file system.A file system is designed in a way so that it can manage and provide space for non-volatile storage data. All file systems required a namespace that is a naming and organizational methodology. The namespace defines the naming process, length of the file name, or a subset of characters that can be used for the file name. It also defines the logical structure of files on a memory segment, such as the use of directories for organizing the specific files. Once a namespace is described, a Metadata description must be defined for that particular file.The data structure needs to support a hierarchical directory structure; this structure is used to describe the available and used disk space for a particular block. It also has the other details about the files such as file size, date & time of creation, update, and last modified.Also, it stores advanced information about the section of the disk, such as partitions and volumes.



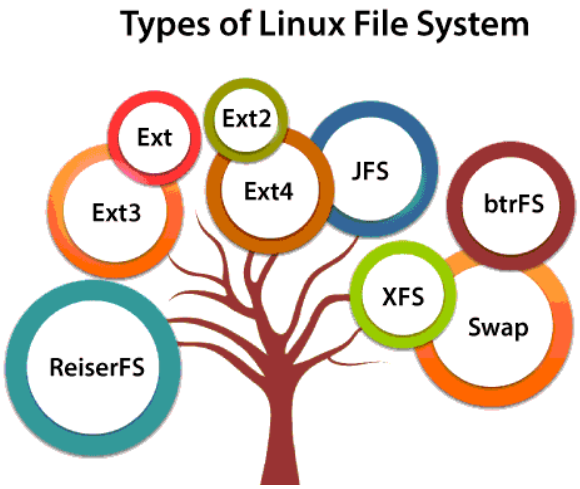


#Characteristics of a File System -

- Space Management: how the data is stored on a storage device. Pertaining to the memory blocks and fragmentation practices applied in it.
- Filename: a file system may have certain restrictions to file names such as the name length, the use of special characters, and case sensitive-ness.
- Directory: the directories/folders may store files in a linear or hierarchical manner while maintaining an index table of all the files contained in that directory or subdirectory.
- Metadata: for each file stored, the file system stores various information about that file's existence such as its data length, its access permissions, device type, modified date-time, and other attributes. This is called metadata.
- Utilities: file systems provide features for initializing, deleting, renaming, moving, copying, backup, recovery, and control access of files and folders.
- Design: due to their implementations, file systems have limitations on the amount of data they can store.

Types of Linux File System -

When we install the Linux operating system, Linux offers many file systems such as Ext, Ext2, Ext3, Ext4, JFS, ReiserFS, XFS, btrfs, and swap.



1) Ext, Ext2, Ext3 and Ext4 file system -

The file system Ext stands for Extended File System. It was primarily developed for MINIX OS. The Ext file system is an older version, and is no longer used due to some limitations.
Ext2 is the first Linux file system that allows managing two terabytes of data. Ext3 is developed through Ext2; it is an upgraded version of Ext2 and contains backward compatibility. The major drawback of Ext3 is that it does not support servers because this file system does not support file recovery and disk snapshot.
Ext4 file system is the fastest file system among all the Ext file systems. It is a very compatible option for the SSD (solid-state drive) disks, and it is the default file system in Linux distribution.

2) JFS File System -

JFS stands for Journaled File System, and it is developed by IBM for AIX Unix. It is an alternative to the Ext file system. It can also be used in place of Ext4, where stability is needed with few resources. It is a handy file system when CPU power is limited.

3) ReiserFS File System -

ReiserFS is an alternative to the Ext3 file system. It has improved performance and advanced features. In the earlier time, the ReiserFS was used as the default file system in SUSE Linux, but later it changed some policies, so SUSE returned to Ext3. This file system dynamically supports the file extension, but it has some drawbacks in performance.

4) XFS File System -

XFS file system was considered as high-speed JFS, which is developed for parallel I/O processing. NASA is still using this file system with its high storage server (300+ Terabyte server).

5) Btrfs File System -

Btrfs stands for the B tree file system. It is used for fault tolerance, repair system, fun administration, extensive storage configuration, and more. It is not a good suit for the production system.

6) Swap File System -

The swap file system is used for memory paging in Linux operating system during the system hibernation. A system that never goes in hibernate state is required to have swap space equal to its RAM size.