1.What is a File system ? Explain the Linux file system with a diagram ?

ANSWER 1: [A file system is a method and data structure that the operating system uses to store and organize data on a storage device, such as a hard drive, an optical drive or a flash drive1](https://en.wikipedia.org/wiki/File_system). [A file system allows the user and the system to access and manage the data efficiently by separating the data into pieces and giving each piece a name, which are called files1](https://en.wikipedia.org/wiki/File_system). A file system also provides information about the files, such as their size, attributes, location and hierarchy, which are stored in the metadata[2](https://www.techtarget.com/searchstorage/definition/file-system). A file system also defines the rules for naming files and directories, and the syntax for specifying the path to a file[2](https://www.techtarget.com/searchstorage/definition/file-system).

The Linux file system is a type of file system that is used by Linux-based operating systems. [The Linux file system follows a hierarchical structure, where the root directory (/) is the top-level directory, and all other directories and files are subdirectories or files of the root directory3](https://www.pcmag.com/encyclopedia/term/file-system). The Linux file system supports multiple types of file systems, such as ext4, XFS, Btrfs, FAT32 and NTFS[3](https://www.pcmag.com/encyclopedia/term/file-system). The Linux file system also supports virtual file systems, such as procfs and sysfs, which provide information about processes and system resources[3](https://www.pcmag.com/encyclopedia/term/file-system).

Here is a diagram of the Linux file system structure:

/

├── bin

├── boot

├── dev

├── etc

├── home

├── lib

├── media

├── mnt

├── opt

├── proc

├── root

├── run

├── sbin

├── srv

├── sys

├── tmp

├── usr

└── var

Copy

The following table briefly explains the purpose of each directory:

| **Directory** | **Description** |
| --- | --- |
| /bin | Contains essential binary executables that are used by all users |
| /boot | Contains files required for booting the system |
| /dev | Contains device files that represent hardware devices |
| /etc | Contains configuration files for the system and applications |
| /home | Contains personal directories for each user |
| /lib | Contains shared libraries and kernel modules |
| /media | Contains mount points for removable media, such as CDs and USB drives |
| /mnt | Contains mount points for temporary mounts by the user |
| /opt | Contains optional or third-party software packages |
| /proc | Contains virtual files that provide information about processes and system status |
| /root | Contains home directory for the root user |
| /run | Contains runtime data for processes that are started since the last boot |
| /sbin | Contains binary executables that are used for system administration |
| /srv | Contains data for services provided by the system |
| /sys | Contains virtual files that provide information about system devices |
| /tmp | Contains temporary files that are deleted when the system is rebooted |
| /usr | Contains user-related programs, libraries, documentation and data |
| /var | Contains variable data, such as logs, caches and spools |

2.Explain the dual modes of an Operating system ?

ANSWER 2: [The dual modes of an operating system are user mode and kernel mode1](https://www.codingninjas.com/codestudio/library/dual-mode-in-os)[2](https://www.geeksforgeeks.org/dual-mode-operations-os/). [These modes are used to protect the operating system from illegal or harmful actions by user programs or processes1](https://www.codingninjas.com/codestudio/library/dual-mode-in-os)[2](https://www.geeksforgeeks.org/dual-mode-operations-os/).

* **User mode**: In this mode, the user programs or processes run with limited privileges and access to system resources, such as memory, CPU, I/O devices, etc. [User mode restricts the execution of privileged instructions, which are instructions that can affect the system state or configuration1](https://www.codingninjas.com/codestudio/library/dual-mode-in-os)[2](https://www.geeksforgeeks.org/dual-mode-operations-os/). [If a user program or process tries to execute a privileged instruction in user mode, it will cause a trap to the operating system, which will handle the request or terminate the program or process1](https://www.codingninjas.com/codestudio/library/dual-mode-in-os)[2](https://www.geeksforgeeks.org/dual-mode-operations-os/). User mode is also called non-privileged mode or normal mode[1](https://www.codingninjas.com/codestudio/library/dual-mode-in-os)[2](https://www.geeksforgeeks.org/dual-mode-operations-os/).
* **Kernel mode**: In this mode, the operating system runs with full privileges and access to system resources. Kernel mode allows the execution of privileged instructions, which are used to perform system-level operations, such as handling interrupts, managing memory, controlling I/O devices, etc[1](https://www.codingninjas.com/codestudio/library/dual-mode-in-os)[2](https://www.geeksforgeeks.org/dual-mode-operations-os/). Kernel mode is also called privileged mode or supervisor mode[1](https://www.codingninjas.com/codestudio/library/dual-mode-in-os)[2](https://www.geeksforgeeks.org/dual-mode-operations-os/).

The dual modes of an operating system are supported by hardware mechanisms that allow the system to switch between them. One such mechanism is the mode bit, which is a bit in the processor that indicates the current mode of operation. The mode bit is usually set to 0 for kernel mode and 1 for user mode[1](https://www.codingninjas.com/codestudio/library/dual-mode-in-os)[2](https://www.geeksforgeeks.org/dual-mode-operations-os/). Another mechanism is the interrupt mechanism, which is a signal that causes the processor to stop its current execution and switch to kernel mode to handle an event or request[1](https://www.codingninjas.com/codestudio/library/dual-mode-in-os)[2](https://www.geeksforgeeks.org/dual-mode-operations-os/).

The dual modes of an operating system provide several benefits, such as:

* **Protection**: By separating user programs or processes from the operating system, dual modes prevent unauthorized or malicious access to critical system resources or data. [User programs or processes cannot modify or interfere with the operating system or other programs or processes running in kernel mode1](https://www.codingninjas.com/codestudio/library/dual-mode-in-os)[2](https://www.geeksforgeeks.org/dual-mode-operations-os/).
* **Stability**: By restricting user programs or processes from performing privileged instructions, dual modes prevent errors or crashes that could affect the system performance or functionality. [User programs or processes cannot cause system failures or deadlocks by executing invalid or harmful instructions1](https://www.codingninjas.com/codestudio/library/dual-mode-in-os)[2](https://www.geeksforgeeks.org/dual-mode-operations-os/).
* **Flexibility**: By providing a well-defined interface between user programs or processes and the operating system, dual modes allow for easier development and deployment of applications and hardware devices. User programs or processes can request services from the operating system using system calls, which are handled by the operating system in kernel mode[1](https://www.codingninjas.com/codestudio/library/dual-mode-in-os)[2](https://www.geeksforgeeks.org/dual-mode-operations-os/).
* **Debugging**: By switching between user mode and kernel mode, developers can identify and fix problems with user programs or processes and the operating system more quickly and easily. [User programs or processes can be traced and monitored by the operating system in kernel mode](https://www.codingninjas.com/codestudio/library/dual-mode-in-os)

3.What are system program ? Highlight few characteristics of it.

ANSWER 3: [A system program is a program that controls some aspect of the operation of a computer, such as an operating system, a compiler, a utility program, a device driver, etc1](https://www.tutorialspoint.com/what-is-a-system-program)[2](https://www.dictionary.com/browse/system-program). [A system program is different from an application program, which is a program that performs a specific task for the user, such as a word processor, a web browser, a game, etc1](https://www.tutorialspoint.com/what-is-a-system-program)[2](https://www.dictionary.com/browse/system-program).

Some characteristics of system programs are:

* [They run in kernel mode, which means they have full access to the hardware and system resources1](https://www.tutorialspoint.com/what-is-a-system-program)[2](https://www.dictionary.com/browse/system-program).
* [They provide services and interfaces for application programs and user programs to interact with the system1](https://www.tutorialspoint.com/what-is-a-system-program)[2](https://www.dictionary.com/browse/system-program).
* They are usually written in low-level languages, such as assembly or C, to optimize performance and efficiency[1](https://www.tutorialspoint.com/what-is-a-system-program)[2](https://www.dictionary.com/browse/system-program).
* They are usually loaded into memory at boot time and remain resident until the system is shut down[1](https://www.tutorialspoint.com/what-is-a-system-program)[2](https://www.dictionary.com/browse/system-program).
* [They are usually distributed with the operating system or the hardware device they control](https://www.tutorialspoint.com/what-is-a-system-program)

4.How are server systems classified? What is asymmetric clustering?

Server systems are computer systems that provide services to other systems or devices, called clients, over a network. Server systems can be classified based on different criteria, such as:

* **Form factor**: This refers to the physical shape and size of the server hardware. Common form factors include tower servers, rack servers and blade servers[1](https://www.indeed.com/career-advice/career-development/types-of-servers). Tower servers are standalone units that resemble desktop PCs. Rack servers are designed to be mounted on metal frames called racks. Blade servers are thin modules that fit into a chassis that provides power and cooling[1](https://www.indeed.com/career-advice/career-development/types-of-servers).
* **Function**: This refers to the type of service or workload that the server system performs. Common functions include web servers, proxy servers, file servers, database servers, mail servers, application servers, etc[2](https://www.techtarget.com/searchdatacenter/Server-hardware-guide-to-architecture-products-and-management). Web servers host websites and web applications. Proxy servers act as intermediaries between clients and other servers. File servers store and share files over a network. Database servers store and manage data in databases. Mail servers handle email communication. Application servers run business logic or software applications[2](https://www.techtarget.com/searchdatacenter/Server-hardware-guide-to-architecture-products-and-management).
* **Architecture**: This refers to the way that the server system is organized and connected with other components. Common architectures include two-tier, three-tier and n-tier[3](https://www.techtarget.com/searchdatacenter/feature/Learn-the-major-types-of-server-hardware-and-their-pros-and-cons). Two-tier architecture consists of a client layer and a server layer. Three-tier architecture consists of a client layer, an application layer and a data layer. N-tier architecture consists of multiple layers that can be distributed across different servers[3](https://www.techtarget.com/searchdatacenter/feature/Learn-the-major-types-of-server-hardware-and-their-pros-and-cons).

[Asymmetric clustering is a type of clustering technique that involves two or more server systems working together to provide high availability and load balancing for a service or application4](https://www.scribd.com/document/430032061/Classification-of-Client-Server-System). [In asymmetric clustering, one server system acts as the primary or active server, while the other server system acts as the secondary or passive server4](https://www.scribd.com/document/430032061/Classification-of-Client-Server-System). The primary server handles all the requests from the clients, while the secondary server remains idle until the primary server fails or becomes overloaded[4](https://www.scribd.com/document/430032061/Classification-of-Client-Server-System). In that case, the secondary server takes over the role of the primary server and handles the requests from the clients[4](https://www.scribd.com/document/430032061/Classification-of-Client-Server-System). [Asymmetric clustering can improve reliability and performance, but it can also introduce complexity and overhead in managing the cluster state and switching between servers](https://www.scribd.com/document/430032061/Classification-of-Client-Server-System)