OPERATING SYSTEM

An operating system is system software that manages computer hardware and software resources and provides services for computer programs. The operating system acts as an intermediary between users and the computer hardware.

TYPES OF OPERATING SYSTEM

1 Desktop operating system. This operating system is designed for personal computers and workstations for example, windows, macOS, Linux.

Windows. This is developed by Microsoft; it is widely used on personal computers and it is known for its user interface and broad compatibility with application software and hardware.

MacOS. This is developed by apple Inc; it is used exclusively on Macintosh computers. Known for its sleek design, robust performance and integration with other apple products.

Linux.an opensource operating system that comes in various distribution such as fedora, ubuntu, Debian, known for its flexibility, security and strong community support.

2 server operating system. This is the type of OS optimized for managing network resources and providing services to other computers for example, windows server, Linux server distributions, UNIX

Windows server. Microsoft server operating system designed for managing network resources, providing services like file sharing, and handling enterprise applications.

Linux server distributions. Variants of Linux tailored or customized for server environments, offering stability, security, and scalability for web servers, databases, and, network services

3 Mobile operating system. This is the type of operating system that is designed for smartphones, tablets, and, other mobile devices for example android, IOS, harmony

Android OS. This is developed by google, it is the most widely used operating system, known for its flexibility, wide range of apps, and compatibility with various devices.

IOS. This is developed by apple Inc. for its mobile devices, including iPhone and iPad. Known for its smooth user experience, security features, and its integration with the apple ecosystem.

4 Network operating systems. This is operating system manages network resources and provides services to networked computers. for example, CISCO IOS, juniper Junos

CISCO IOS. this is used in cisco network devices like routers and switches. It provides networking functionalities including routing, switching, and, security features.

Juniper Junos. Used in juniper networking devices, known for its scalability, reliability and high-performance network management capabilities.

5 mainframe operating system. This is designed for large scale mainframe computers for example, IBM OS, IBMZ VM.

IBMZ OS. This is designed for IBM main frames, it supports high volume transaction processing, large scale data management and complex enterprise application.

6.Embeded operating systems. This is used in embedded systems and devices with specific functions for example, embedded Linux and real time operating system

Embedded Linux. This is a variant of Linux optimized for embedded system, used in devices like routers, smart televisions and industrial equipment. It offers customizability and low overhead.

FUNCTIONS OF AN OPERATING SYSTEM.

Process management. Handles the creatin, scheduling, and termination of processes. It ensures efficient execution of programs by managing CPU time and resources.

Memory management. The operating system oversees the allocation and deallocation of memory space to various programs and processes. It handles both physical and virtual memory.

Device management. Manages and controls peripheral devices like printers, keyboards and storage drives through device drivers. It facilitates communication between hardware and software.

Filesystem management. The operating system manages files and directories on storage devices. It handles file creation, deletion, reading, and, writing, as well as organizing and storing data.

Security and access controls. The operating system ensures system security by managing user permissions authentication, and, protection against unauthorized access and malware.

User interface. The operating system provides a user interface that is either graphical user interface or command line interface, allowing users to interact with the computer system and execute commands.

Computer networking. The operating system network connection and communication between, handling tasks like data transfer, network protocols, and connectivity.

Error detection and handling. Identifies and manages errors and faults in the system, ensuring stability and reliability through mechanisms for error reporting and recovery.

USER INTERFACE

A user interface is the means through which a user interacts with both computer software and hardware. The user interface includes the visual elements like buttons, menus, icons, and text that facilitate user interaction. The goal of UI is to make the user experience intuitive and efficient. The user interface is of two types and these include the graphical user interface where users interact with visual elements and command -line interface, where users input text commands.

TYPES OF USER INTERFACE

Graphical user interface GUI

Command-line interface CLI

GRAPHICAL USER INTERFACE

A graphical user interface is a type of user interface that allows users to interact with computers through graphical elements such as windows, icons, buttons, and, menus. Here users are able to perform tasks by simply interacting with visual elements as this is intuitive to humans and it is mostly used by those who are not familiar with the command-line interface

The GUI is most commonly used in operating systems like Microsoft windows, macOS, and, Linux and in applications like web browsers and office software.

COMMAND-LINE INTERFACE

A command-line interface is a text – based interface used to interact with a computer by typing commands. The CLI requires users to input specific text commands to perform tasks, this system provides powerful control over the computer system, often used for advanced configuration, automation and programing tasks. Examples include the windows command prompt, macOS terminal, Linux shell environments like bash. CLI can be more efficient for experienced users but may have a steeper learning curve for beginners.

There are also other user interfaces that have been developed to enhance user interaction with the computer and these include

Voice user interface VUI. this is where a user interacts with a computer through spoken commands and responses that is to say users speak commands or queries and receive spoken feedback for example, virtual assistants like Bixby of Samsung, Siri of apple, google assistant, Alexa of amazon.

Natural language user interface NUI. In this user interface there is interaction using natural language processing NLP, here users can communicate using everyday language and the system interprets and responds examples include chatbots, advanced AI systems in customer service.

Touch user interface TUI. Interaction through touch gestures like tapping, swiping, and pinching. and this is primarily used in mobile devices and touch enabled screens.

Examples include smartphones, tablets and interactive kiosks

FILE SYSTEMS

A file system is a method and data structure that an operating system uses to manage and organize files on a storage device, such as HDD, SSD, OR a flash drive. It determines how data is stored, retrieved, and organized on a disk, including how files and directories are named, managed, and accessed. Each file system has its own way of handling data and file permissions

TYPES OF FILE SYSTEMS

There are several types of file systems, each designed to suit different needs and operating systems. And these are.

NTFS new technology file system. This is used by windows operating systems.it supports large file size, advanced permissions, encryptions, and journaling.

FAT32file allocation table 32. An older file system used by many operating systems, it is widely compatible but has limitations on file size and partition size for example, maxmum file size is 4GB.

ExFAT Extended file allocation table. Designed as a bridge between FAT32 and NTFS, offering better support for larger for larger files and partitions without the limitations of FAT32.

ext4 fourth extended fie system. Commonly used by Linux distributions. It supports large files and volumes, journaling, and extended attributes.

APFS apple file system. This is used by macOS and iOS devices it features strong encryption, space sharing, and efficient file system operations.

HFS hierarchical file system plus. Previously used by macOS before APFS it supports journaling and metadata but has been largely replaced by APFS.

XFS. A high-performance file system used by some Linux distributions, known for its scalability and reliability.

Btrfs B-tree file system. A modern file system for Linux with advanced features like snapshots, dynamic inode allocation, and integrated volume management.

ReFS resilient file system. Designed by Microsoft for windows server, focusing on data integrity, resilience t corruption, and scalability.

NOTE. Each file system has its own strengths and weakness, and the choice of file system often depends on the operating system, the requirement of specific application, and the type of storage being used.

IMPORTANCE OF FILE SYSTEMS

Data organization. They manage how data is stored and organized on storage devices, allowing for efficient retrieval and management of files and directories.

Data integrity. File systems include mechanisms that protect data from corruption and loss. Features like journaling and checksums help ensure data integrity and recovery in case of system failures.

Access control. They enforce file permissions and access controls which help protect data from unauthorized access and ensure that users have the appropriate level access.

Performance. Different file systems are optimized for various types of operations, such as large file handling, high speed access, or minimal overhead, affecting the overall performance of the system.

Compatibility. File system determine how files can be shared and accessed across different systems and devices. Choosing the right file system ensures compatibility with other systems and devices.

File management. They provide mechanisms for organizing files into directories, meaning files, and managing file metadata, which are essential for effective file management and navigation.

Fault tolerance. Some file systems include features for fault tolerance and recovery, helping to safeguard data against hardware failures and other issues.

APPLICATIONS OF FILE SYSTEM

Data storage and retrieval. File systems organize and manage how data is stored on hard drives, SSDs and other storage media, making it possible to efficiently save, access, and retrieve files.

Operating systems. Each operating system relies on file system to handle file management. For instance, windows use NTFS, Linux uses ext4 or Btrfs, and macOS uses APFS.

Data integrity and recovery. File systems implement features like journaling in eaxt4 and NFTS or snapshots in Btrfs to protect data integrity and aid in recovery in case of crashes or power failures.

Access control. They enforce file permissions and access controls, managing who can read, write, or execute file, which is crucial for security and privacy.

Cross- platform compatibility. File systems like exFAT are used for external drives and memory cards to ensure compatibility between different operating systems for example windows, macOS.

Backup and archiving. Some file systems support advanced features for backing up and archiving data, such as versioning and snapshot capabilities.

High-performance environments. Specialized file systems, like XFS or ZFS, are used in environments requiring high performance and scalability, such as large database or large databases or enterprise storage systems.

Embedded system. Light weight systems like FAT or ext2 are often used in embedded systems and device with limited resources, such as smartphones and IoT devices.

WINDOWS BOOTING PROCESS

The windows booting process involves several key steps, from powering on the computer to loading the operating system. Here is a general overview.

Power-on self-test POST. when you power on the computer, the BIOS or UEFI firmware performs a POST to check the hardware components like the CPU, RAM, and storage devices for basic functionality. if everything is in order, it proceeds to the next step.

BIOS UEFI INTIALIZATION. the BIOS or UEFI firmware initializes hardware components and then looks for a boot device based on its boot order settings. It locates the bootloader, typically stored on a hard drive or SSD.

Bootloader execution. For windows, the bootloader is the windows boot manager or bootmgr. It is responsible for loading the windows operating system. The boot loader is located in the system partition.

Windows boot manager or bootmgr. The bootmgr reads the boot configuration data BCD to determine which version of windows to load and which bootloader to use. It then loads the windows OS loader winload.exe

Windows OS loader winload.exe. winload. exe is responsible for loading the core operating system files, including the kernel Ntkrnlmp.exe. and essential drivers, into memory.

Kernel initialization. the windows kernel initializes system services and hardware abstraction layers. It starts essential system processes and prepares the system for user logon.

Session managers Smss.exe. the session manager process is responsible for setting up the windows environment, including loading system drivers and starting the windows subsystem.

Winlogon.exe. this process manages user logon and logoff. It displays the login screen where users can enter their credentials.

User session. Once a user logs in, the userinit.exe process starts the user profile and launches the windows explorer. Explorer.exe. to provide the graphical interface and desktop environment.

System service and startup programs. Windows continues by starting up system services and user-defined startup programs, completing the boot process and providing a fully functional operating system.

INSTALLATION OF WINDOWS OPERATING SYSTEM

1 Prepare installation media. download windows ISO. Go to the Microsoft website to download the windows ISO file**. Create bootable media**. Use a tool like RUFUS or the windows media creation tool to create a bootable USB drive or DVD from the ISO file.

2 Prepare your computer. Backup data. Ensure that any important data is backed up, as the installation process may erase existing data**. Adjust BIOS UEFI settings**. usually by pressing F2, F12, De1, or Esc during startup. Set you're your computer to boot from the USB drive or DVD you created.

3 Start installation. **insert installation media**. Insert the bootable USB drive or DVD into your computer. **Boot from media**. Restart the computer and boot from the installation media**. Select language and preferences**. Choose your language, time, and, keyboard preferences, then click next **Install now**. click the install now button to start the installation process.

4 Activation and installation. **Enter product key**. If prompted, enter your windows product key. If you don't have one, you can choose I don't have a product key to proceed with a trail**. Select installation type**. choose custom install windows only, if you are doing a fresh installation. if upgrading choose upgrade. **Select drive**. Choose the drive or partition where you want to install windows. If needed, Format or create partitions here.

5 Complete installations. Follow prompts. Windows will copy files and install. Your computer may restart several times. **Set up windows**. After installation, follow the on-screen prompts to set up your privacy settings, and preferences.

6 Install drivers and updates. **Install drivers**. Ensure you install the necessary drivers for your hardware, which can be downloaded from the manufacturer's websites**. Update windows**. Go to settings> update and security> windows update to download and install the latest update.