LEC-4: Components of OS

hardware ka access kernel ke paas rahta

1. **Kernel:** A **kernel** is that part of the operating system which interacts directly with the hardware andperforms the most crucial tasks.
    a. Heart of OS/Core component
    b. Very first part of OS to load on start-up.

apps run here
no hardware access,
provide only environment

2. **User space:** Where application software runs, apps don't have privileged access to the underlying hardware. It interacts with kernel.
    a. GUI graphical user interface
    b. CLI command line interface

A **shell**, also known as a command interpreter, is that part of the operating system that receives commands from the users and gets them executed.

user connected with hardware ,, through kernel
kernel direct hardware se interact krta hai

Functions of Kernel:

1. **Process management:**
    a. Scheduling processes and threads on the CPUs.
    b. Creating & deleting both user and system process.
    c. Suspending and resuming processes
    d. Providing mechanisms for process synchronization or process communication.
2. **Memory management:**
    a. Allocating and deallocating memory space as per need.
    b. Keeping track of which part of memory are currently being used and by which process.
3. **File management:**
    a. Creating and deleting files.
    b. Creating and deleting directories to organize files.
    c. Mapping files into secondary storage.
    d. Backup support onto a stable storage media.
4. **I/O management:** to manage and control I/O operations and I/O devices
    a. Buffering (data copy between two devices), caching and spooling.
        i. Spooling
            1. Within differing speed two jobs.
            2. Eg. Print spooling and mail spooling.
        ii. Buffering
            1. Within one job.
            2. Eg. Youtube video buffering
        iii. Caching
            1. Memory caching, Web caching etc.

software interrupt (user mode and kernel mei switch krata)

Types of Kernels:

charo kaam (function vaale)kernel manage

1. Monolithic kernel
    a. All functions are in kernel itself.
    b. Bulky in size.
    c. Memory required to run is high.
    d. Less reliable, one module crashes -> whole kernel is down.
    e. High performance as communication is fast. (Less user mode, kernel mode overheads)
    f. Eg. Linux, Unix, MS-DOS.

2. Micro Kernel
    a. Only major functions are in kernel.
        i. Memory mgmt.
        ii. Process mgmt.
    b. File mgmt. and IO mgmt. are in User-space.
    c. smaller in size.
    d. More Reliable
    e. More stable
    f. Performance is slow.
    g. Overhead switching b/w user mode and kernel mode.
    h. Eg. L4 Linux, Symbian OS, MINIX etc.

overhead switching =baar baar switching

3. Hybrid Kernel:
    a. Advantages of both worlds. (File mgmt. in User space and rest in Kernel space.)
    b. Combined approach.
    c. Speed and design of mono.
    d. Modularity and stability of micro.
    e. Eg. MacOS, Windows NT/7/10
    f. IPC also happens but lesser overheads

4. Nano/Exo kernels…

Q. How will communication happen between user mode and kernel mode?

Ans. Inter process communication (**IPC**). OR System Calls

1. Two processes executing independently, having independent memory space (Memory protection), But some may need to communicate to work.

2. Done by shared memory and message passing.

Exo Kernel –
It is the type of kernel which follows end-to-end principle. It has fewest hardware abstractions as possible. It allocates physical resources to applications.

Nano Kernel –
It is the type of kernel that offers hardware abstraction but without system services. Micro Kernel also does not have system services therefore the Micro Kernel and Nano Kernel have become analogous.