Lecture Notes
On
OPERATING SYSTEM
(Introduction)

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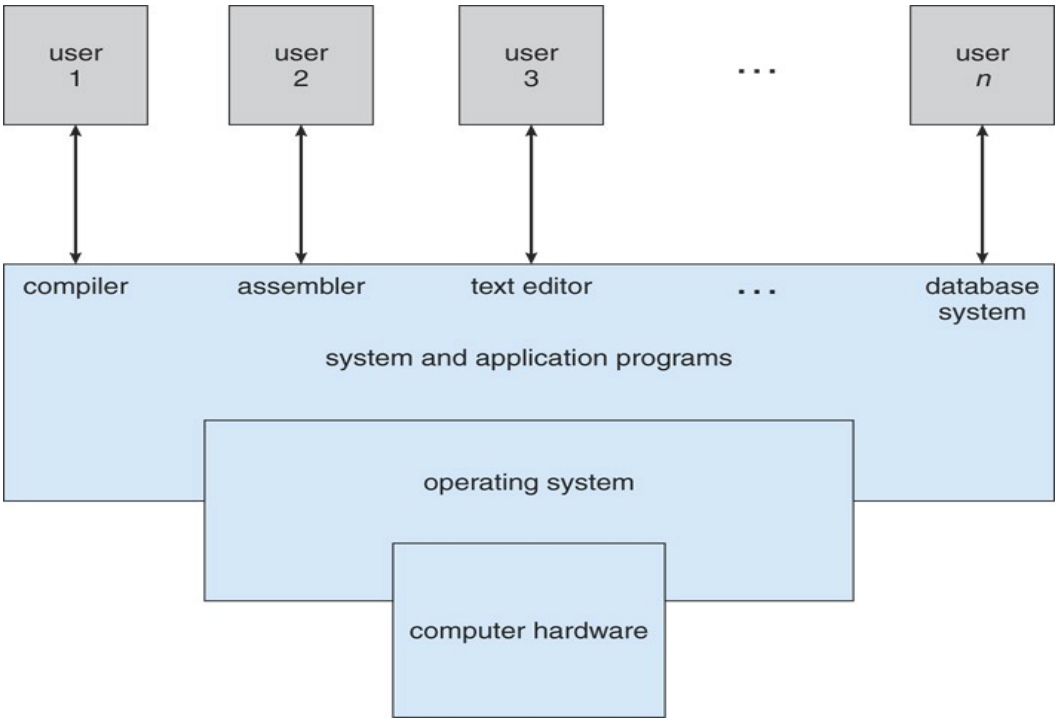
What is an operating system ?

An operating system, or "OS," is software that communicates with the hardware and allows other programs to run. It also interact between hardware and software.

Some examples of operating systems are MS-DOS, MS-Windows, Windows/NT, UNIX, LINUX, OS/2, MacOS.

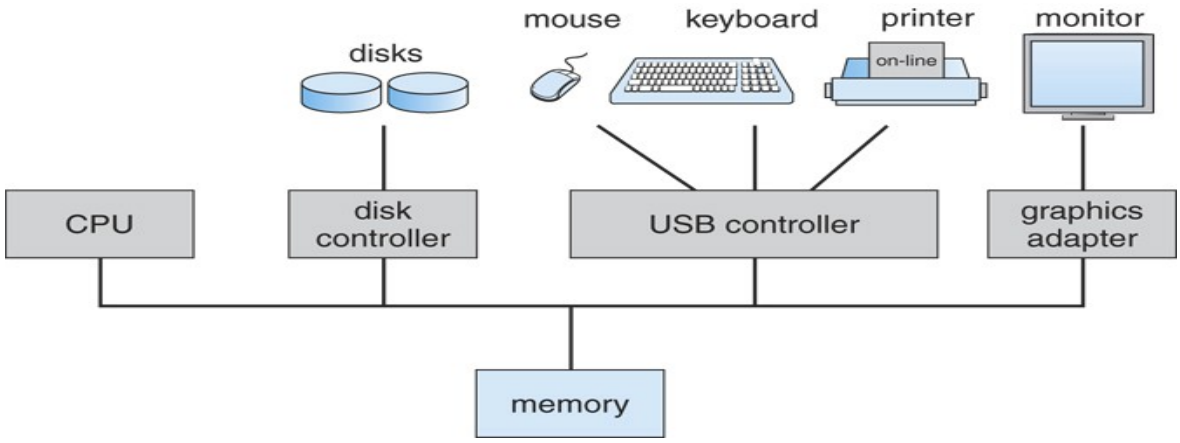
Operating system goals:
• Execute user programs and make solving user problems easier.
• Make the computer system convenient to use.
• Use the computer hardware in an efficient manner.



computer system can be divided into four components: the hardware, the operating system, the application programs,and the users.

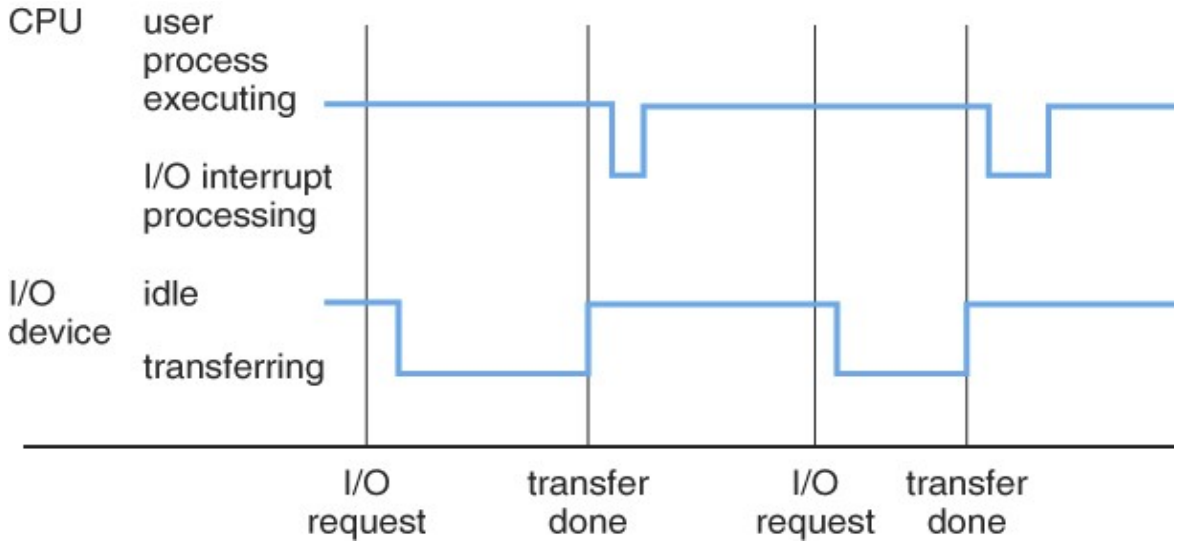
1. **Hardware** – provides basic computing resources (CPU, memory, I/O devices).
2. **Operating system** – controls and coordinates the use of the hardware among the various application programs for the various users.
3. **Applications programs** – Define the ways in which the system resources are used to solve the computing problems of the users (compilers, database systems, video games, business programs).
4. **Users** (people, machines, other computers).

Computer-System Organization



Computer-System Operation

- Bootstrap program
- Shared memory between CPU and I/O cards
- Time slicing for multi-process operation
- Interrupt handling - clock, HW, SW
- Implementation of system calls



Storage Structure

Main memory (RAM)

- Programs must be loaded into RAM to run.
- Instructions and data fetched from RAM into registers.
- RAM is volatile
- Medium size and speed

Other electronic (volatile) memory is faster, smaller, and more expensive per bit:

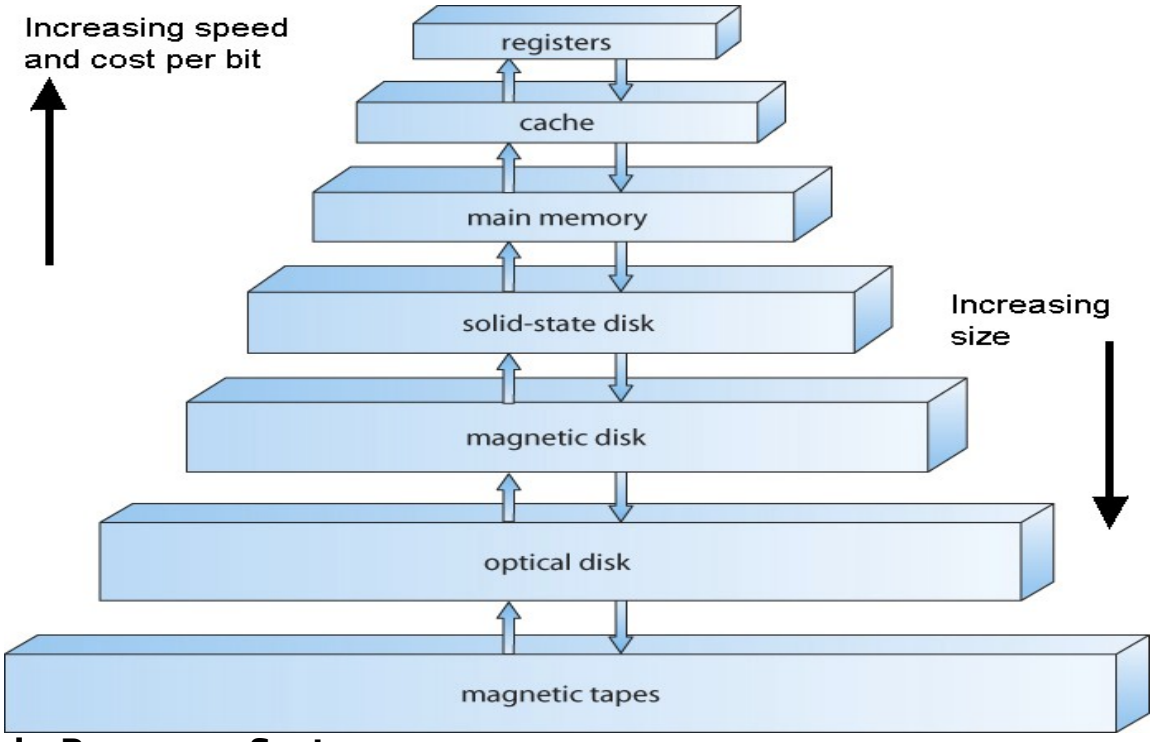
- Registers
- CPU Cache

Non-volatile memory ("permanent" storage) is slower, larger, and less expensive per bit:

- Electronic disks
- Magnetic disks
- Optical disks
- Magnetic Tapes

Ideally, we want the programs and data to reside in main memory permanently. This arrangement usually is not possible for the following two reasons:

1. Main memory is usually too small to store all needed programs and data permanently.
2. Main memory is a volatile storage device that loses its contents when power is turned off or otherwise lost.



Single-Processor Systems :

On a single-processor system, there is one main CPU capable of executing a general-purpose instruction set, including instructions from user processes.

Multiprocessor Systems :
Multiprocessor systems (also known as parallel systems or multicore systems) have begun to dominate of computing. Such systems have two or more processors in close communication, sharing the computer bus and sometimes the clock, memory, and peripheral devices, tablet computers.

Multiprocessor systems have three main advantages:
1. **Increased throughput**. By increasing the number of processors, we expect to get more work done in less time. The speed-up ratio with N processors is not N , however; rather, it is less than N . When multiple processors cooperate on a task, a certain amount of overhead is incurred in keeping all the parts working correctly. This overhead, plus contention for shared resources, lowers the expected gain from additional processors. Similarly, N programmers working closely together do not produce N times the amount of work a single programmer would produce.
2. **Economy of scale**. Multiprocessor systems can cost less than equivalent multiple single-processor systems, because they can share peripherals, mass storage, and power supplies. lf several programs operate on the same set of data, it is cheaper to store those data on one disk and to have all the processors share them than to have many computers with local disks and many copies of the data.
3. **Increased reliability.** If functions can be distributed properly among several processors, then the failure of one processor will not halt the system, only slow it down. If we have ten processors and one fails, then each of the remaining nine processors can pick up a share of the work of the failed processor. Thus, the entire system runs only 10 percent slower, rather than failing altogether.