

# OPERATING SYSTEM

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## What is an Operating System?

- ▶ Operating System is a software, which makes a computer to actually work.
- ▶ It is the software that enables all the programs we use.
- ▶ The OS organizes and controls the hardware.
- ▶ OS acts as an interface between the application programs and the machine hardware.
- ▶ Examples: Windows, Linux, Unix and Mac OS, etc.

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## What OS does?

- ▶ Controlling and allocating memory
- ▶ Prioritizing system requests
- ▶ Controlling input and output devices
- ▶ Facilitating networking
- ▶ Managing file systems

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## Operating System Objectives

- ▶ **Convenience**
  - Makes the computer more convenient to use
- ▶ **Efficiency**
  - Allows computer system resources to be used in an efficient manner
- ▶ **Ability to Evolve**
  - Permit effective development, testing, and introduction of new system functions without interfering with service

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## Layers of Computer System

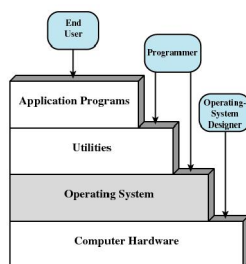


Figure 2.1 Layers and Views of a Computer System

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## Structure of Operating System

The structure of OS consists of 4 layers:

1. **Hardware**
  - Hardware consists of CPU, Main memory, I/O Devices, etc.
2. **Software (Operating System)**
  - Software includes process management routines, memory management routines, I/O control routines, file management routines.

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## Structure of Operating System

### 3. System programs

- This layer consists of compilers, Assemblers, linker etc.

### 4. Application programs

- This is dependent on users need.
- **E.g.:** Railway reservation system, Bank database management etc.

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## Functions of Operating System

- Process Management
- Memory Management
- File Management
- Device Management
- Command Interpretation
- Security

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## Types of Operating Systems

- Batch Operating System
- Multiprogramming
- Multiprocessing
- Timesharing / Multitasking
- Single User Operating System
- Multiuser Operating System
- Real Time Operating System

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## Batch Operating System

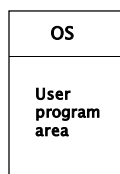
- In Batch processing, same type of jobs batch together and execute at a time.
- The OS was simple, its major task was to transfer control from one job to the next.
- The job was submitted to the computer operator in form of punch cards.
- The monitor is system software that is responsible for interpreting and carrying out the instructions in the batch jobs. When the monitor starts a job, the entire computer is dedicated to the job, which then controls the computer until it finishes.
- The OS was always resident in memory. Common Input devices were card readers and tape drives.

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## Batch Operating System

- Common output devices were line printers, tape drives, and card punches.
- Users did not interact directly with the computer systems, but he prepared a job (comprising of the program, the data & some control information).



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## Multiprogramming

- Multiprogramming is a technique to execute number of programs simultaneously by a single processor.
- In Multiprogramming, number of processes reside in main memory at a time.
- The OS picks and begins to execute one of the jobs in the main memory.
- If any I/O wait happened in a process, then CPU switches from that job to another job.
- Hence CPU is not idle at any time.

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## Multiprogramming

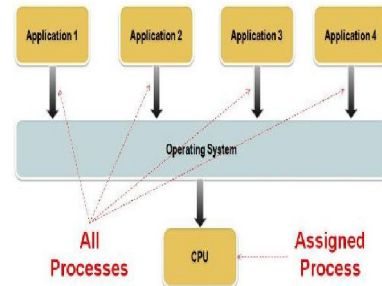
OS
Job 1
Job 2
Job 3
Job 4
Job 5

- Figure depicts the layout of multiprogramming system.
- The main memory consists of 5 jobs at a time, the CPU executes one by one.
- Advantages:
  - Efficient memory utilization
  - Throughput increases
  - CPU is never idle, so performance increases.

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## Multiprogramming



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## Timesharing

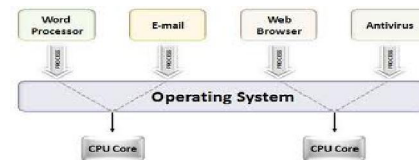
- Simultaneous interactive use of a computer system by many users in such a way that each one feels that he/she is the sole user of the system.
- Multiple jobs are executed by switching the CPU between them.
- In this, the CPU time is shared by different processes, so it is called as "Time sharing Systems".
- Time slice is defined by the OS, for sharing CPU time between processes. CPU is taken away from a running process when the allotted time slice expires.
- Examples: Multics, Unix, etc.

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## Advantages of Timesharing

- Reduces CPU Idle time.
- Provides advantages of quick response time.
- Offers good computing facility to small users.



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## Multiprocessing

- Multiprocessing** is the use of two or more central processing units (CPUs) within a single computer system.
- The term also refers to the ability of a system to support more than one processor and the ability to allocate tasks between them.
- An operating system capable of supporting and utilizing more than one computer processor.
- Below are some examples of multiprocessing operating systems.
  - Linux
  - Unix
  - Windows 2000

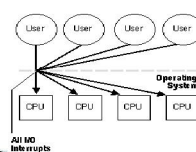
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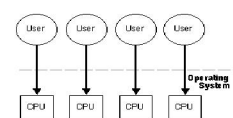
## Multiprocessing

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Asymmetric Multiprocessing:



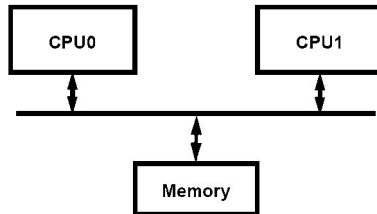
Symmetric Multiprocessing:



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## Multiprocessing



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## Single User Operating System

- Provides a platform for only one user at a time.
- **Single-User, Single Tasking**
  - As the name implies, this operating system is designed to manage the computer so that one user can effectively do one thing at a time.
  - The Palm OS for Palm handheld computers is a good example of a modern single-user, single-task operating system.
- **Single-User, Multi-Tasking**
  - This is the type of operating system most people use on their desktop and laptop computers today.
  - Example Microsoft's Windows, it's entirely possible for a Windows user to be writing a note in a word processor while downloading a file from the Internet while printing the text of an e-mail message.

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## Multi-User Operating System

- Provides regulated access for a number of users by maintaining a database of known users.
- Refers to computer systems that support two or more simultaneous users.
- Another term for *multi-user* is *time sharing*.
- E.g.: All mainframes are multi-user systems.

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## Real Time Operating System

- Real-time operating systems are used to control machinery, scientific instruments and industrial systems.
- A system is said to be **Real Time** if it is required to complete its work & deliver its services on time.
- Example – Food Processing System, Flight Control System
- All tasks in that system must execute on time.

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## Types of RTOS

### Soft Real Time System

- In Soft Real Time System, tasks are completed as fast as possible without having to be completed within a specified timeframe.

### Hard Real Time System

- In Hard Real Time System however, not only must tasks be completed within a specified timeframe, but they must also be completed correctly.

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## The Operating System: What It Does Task Management

	No. of Users	No. of Processors	Order of Processing
<b>Multi-tasking</b>	One	One	Concurrently
<b>Multiprogramming</b>	Multiple	One	Concurrently
<b>Timesharing</b>	Multiple	One	Round Robin
<b>Multiprocessing</b>	One or more	Two or more	Simultaneously

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