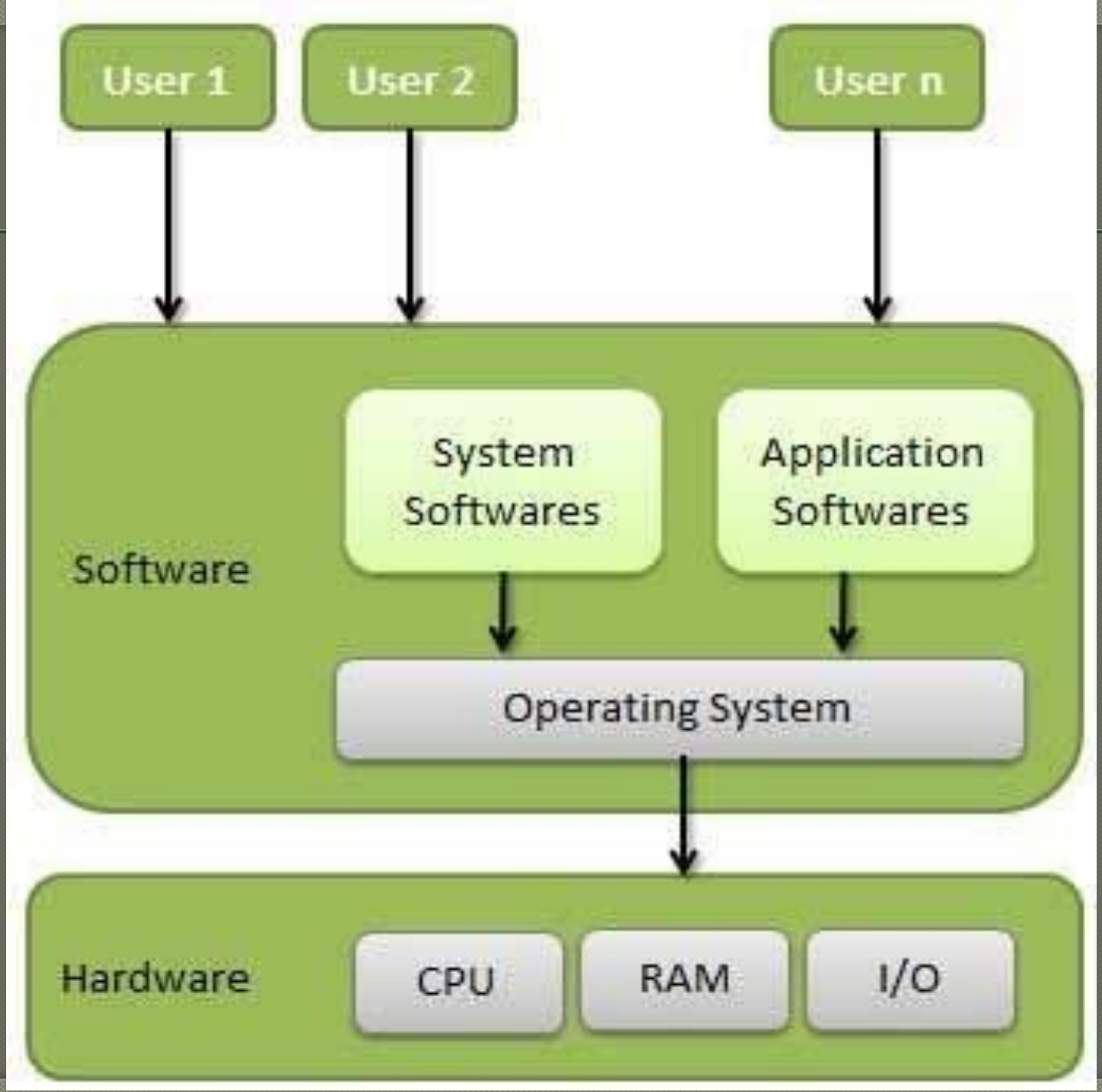
OPERATING SYSTEM

UNIT 1

INTRODUCTION

DEFINITION OF OPERATING SYSTEM

- An Operating System (OS) is an interface between a computer user and computer hardware. An operating system is a software which performs all the basic tasks like file management, memory management, process management, handling input and output, and controlling peripheral devices such as disk drives and printers.
- Some popular Operating Systems include Linux Operating System, Windows Operating System.


User 1
User 2
User n
System Softwares
Application Softwares
Software
Operating System
Hardware
CPU
RAM
I/O

Following are some of important functions of an operating System.

- Memory Management
- Process Management
- Device Management
- File Management
- Security
- Coordination between other software and users

HISTORY AND EVOLUTION OF OPERATING SYSTEM

- The first operating system was introduced in the early 1950's, it was called GMOS and was created by General Motors for IBM's machine.

- Operating systems in the 1950's were called single-stream batch processing systems because the data was submitted in groups. These new machines were called mainframes, and they were used by professional operators in large computer rooms.

- By the late 1960's operating systems designers were able to develop the system of multiprogramming in which a computer program will be able to perform multiple jobs at the same time.

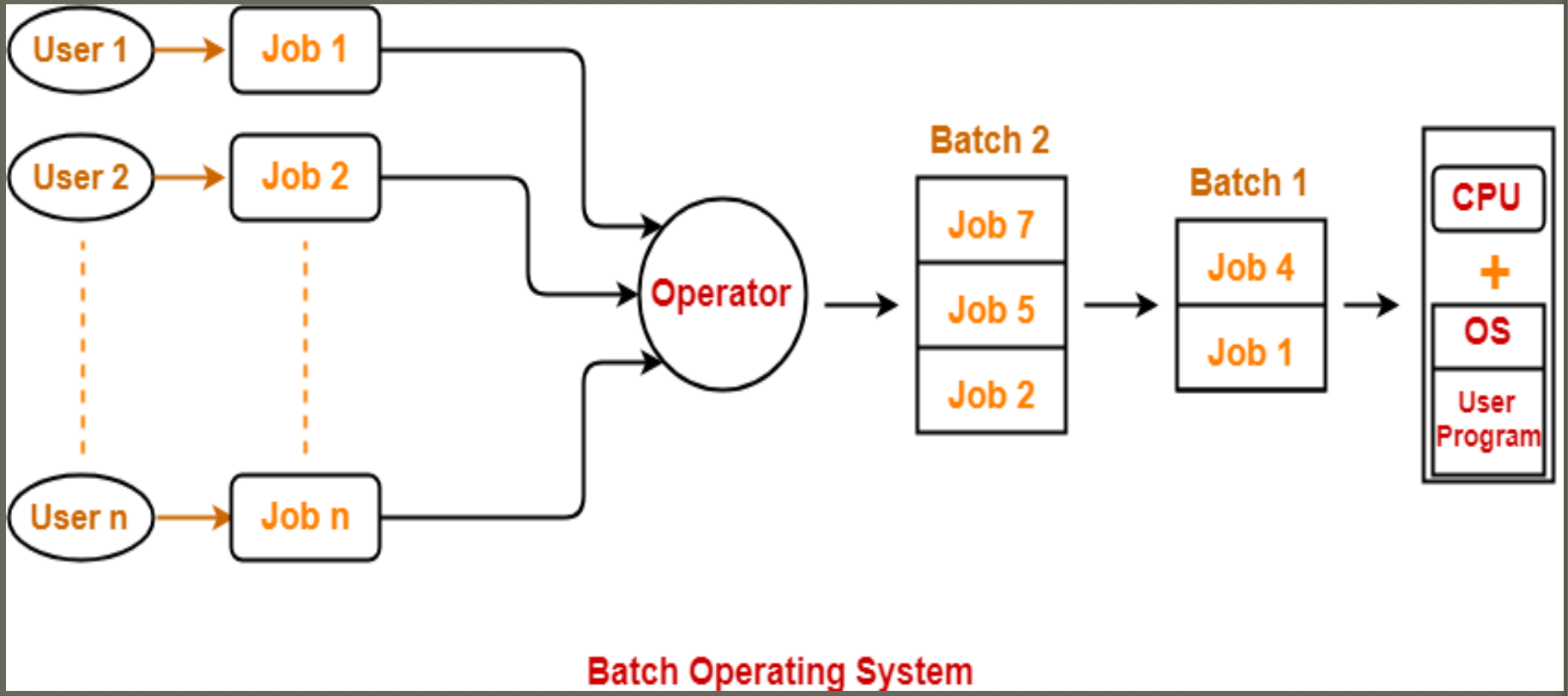
- The introduction of multiprogramming was a major part in the development of operating systems because it allows a CPU to be busy nearly 100 percent of the time that it was in operation.

TYPES OF OPERATING SYSTEM

1. Batch Processing Operating System
2. Multiprogramming Operating System
3. Multitasking(Time Sharing) Operating System
4. Real Time Operating System
5. Multiprocessor Operating System

BATCH PROCESSING

- The users of a batch operating system do not interact with the computer directly. Each user prepares his job on an off-line device like punch cards and submits it to the computer operator.
- To speed up processing, jobs with similar needs are batched together and run as a group. The programmers leave their programs with the operator and the operator then sorts the programs with similar requirements into batches.



Batch Operating System

- Advantages

1. Batch processing takes much of the work of the operator to the computer.
2. Increased performance as a new job get started as soon as the previous job is finished, without any manual intervention.

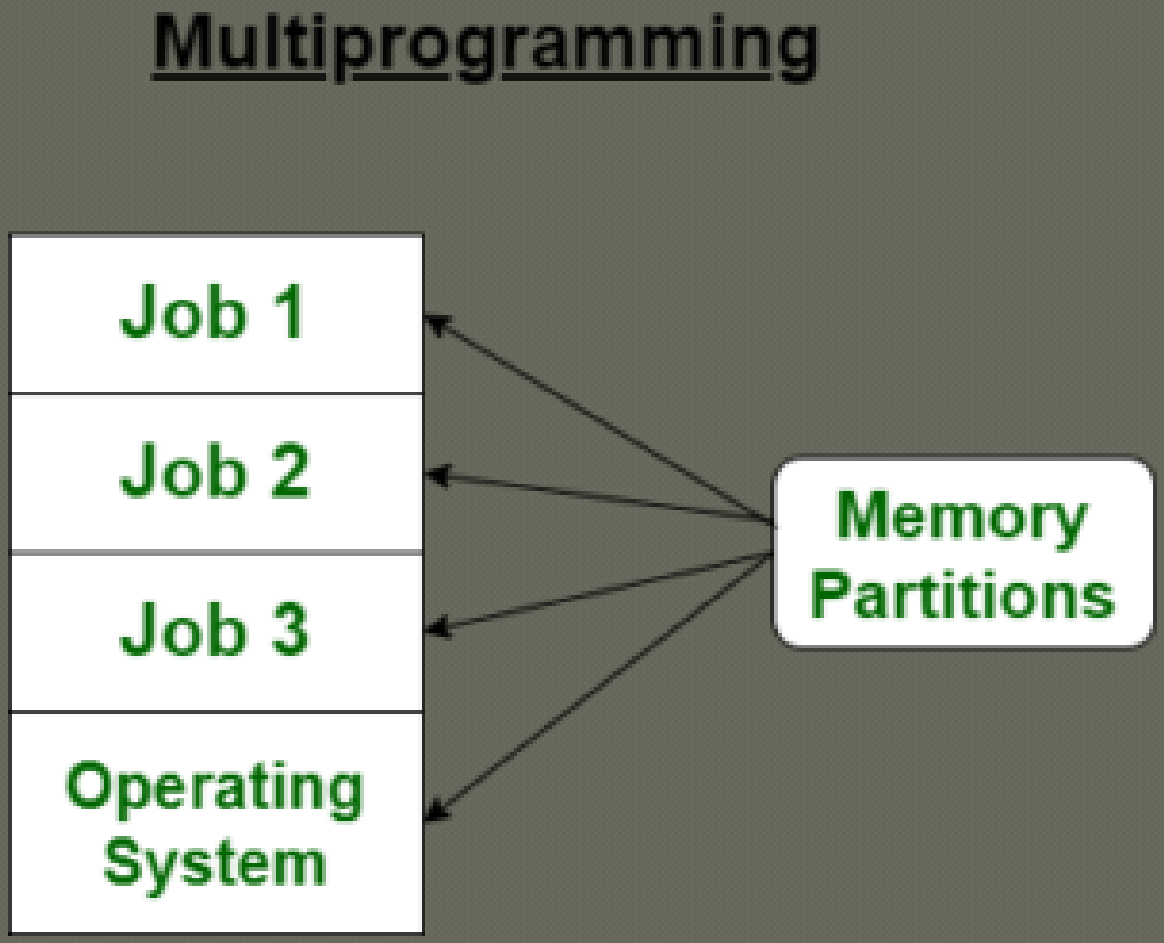
Disadvantages

1. Lack of interaction between the user and the job.
2. CPU is often idle, because the speed of the mechanical I/O devices is slower than the CPU.
3. Difficult to provide the desired priority.
4. Less throughput.

MULTIPROGRAMMING

- When two or more programs reside in memory at the same time, is referred to as **multiprogramming**. Multiprogramming assumes a single shared processor. Multiprogramming increases CPU utilization by organizing jobs so that the CPU always has one to execute.

The following figure shows the memory layout for a multiprogramming system



An OS does the following activities related to multiprogramming.

1. The operating system keeps several jobs in memory at a time.
2. This set of jobs is a subset of the jobs kept in the job pool.
3. The operating system picks and begins to execute one of the jobs in the memory.
4. Multiprogramming operating systems monitor the state of all active programs and system resources using memory management programs to ensures that the CPU is never idle, unless there are no jobs to process.

Advantages

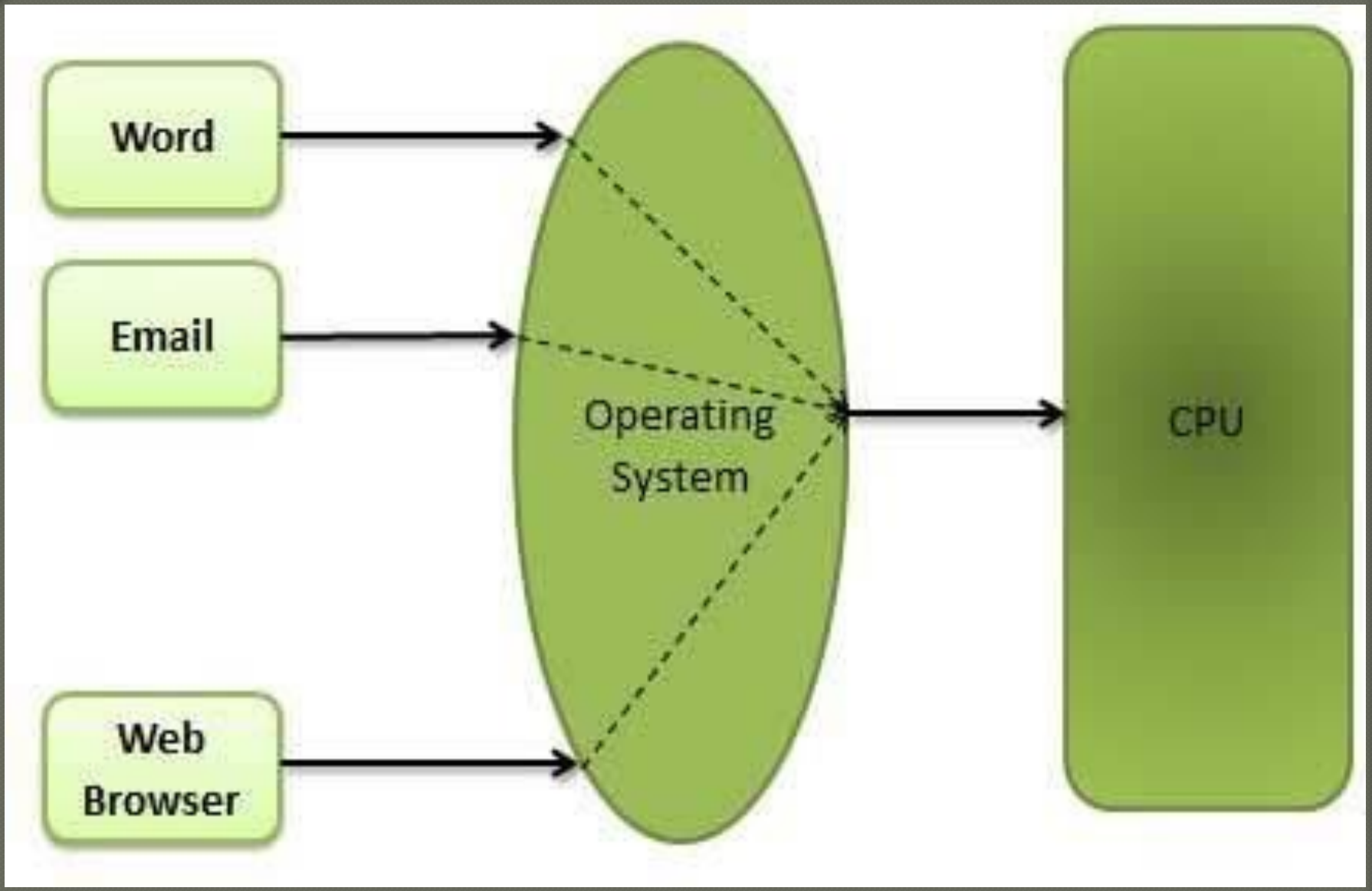
1. High and efficient CPU utilization.
2. User feels that many programs are allotted CPU almost simultaneously.

Disadvantages

1. CPU scheduling is required.
2. To accommodate many jobs in memory, memory management is required.

MULTITASKING(TIME SHARING SYSTEM)

- In Multitasking OS multiple jobs are executed by the CPU simultaneously by switching between them. Switches occur so frequently that the users may interact with each program while it is running.
- Multitasking Operating Systems are also known as Time-sharing systems.


Word
Email
Web Browser
Operating System
CPU

An OS does the following activities related to multitasking –

1. The user gives instructions to the operating system or to a program directly, and receives an immediate response.
2. The OS handles multitasking in the way that it can handle multiple operations/executes multiple programs at a time.

- These Operating Systems were developed to provide interactive use of a computer system at a reasonable cost.
- A time-shared operating system uses the concept of CPU scheduling and multiprogramming to provide each user with a small portion of a time-shared CPU.
- Each user has at least one separate program in memory.

Advantage

1. Since interactive I/O typically runs at slower speeds, it may take a long time to complete. During this time, a CPU can be utilized by another process.

2. The operating system allows the users to share the computer simultaneously. Since each action or command in a time-shared system tends to be short, only a little CPU time is needed for each user.

3. As the system switches CPU rapidly from one user/program to the next, each user is given the impression that he/she has his/her own CPU, whereas actually one CPU is being shared among many users.

Disadvantages

1. Problem of reliability.
2. Question of security and integrity of user programs and data.

Real Time operating System

Real-time systems are used when there are rigid time requirements on the operation of a processor or the flow of data and real-time systems can be used as a control device in a dedicated application. A real-time operating system must have well-defined, fixed time constraints, otherwise the system will fail. For example, Scientific experiments, medical imaging systems, industrial control systems, weapon systems, robots, air traffic control systems, etc.

There are two types of real-time operating systems.

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1. Hard real-time systems

   Hard real-time systems guarantee that critical tasks complete on time..

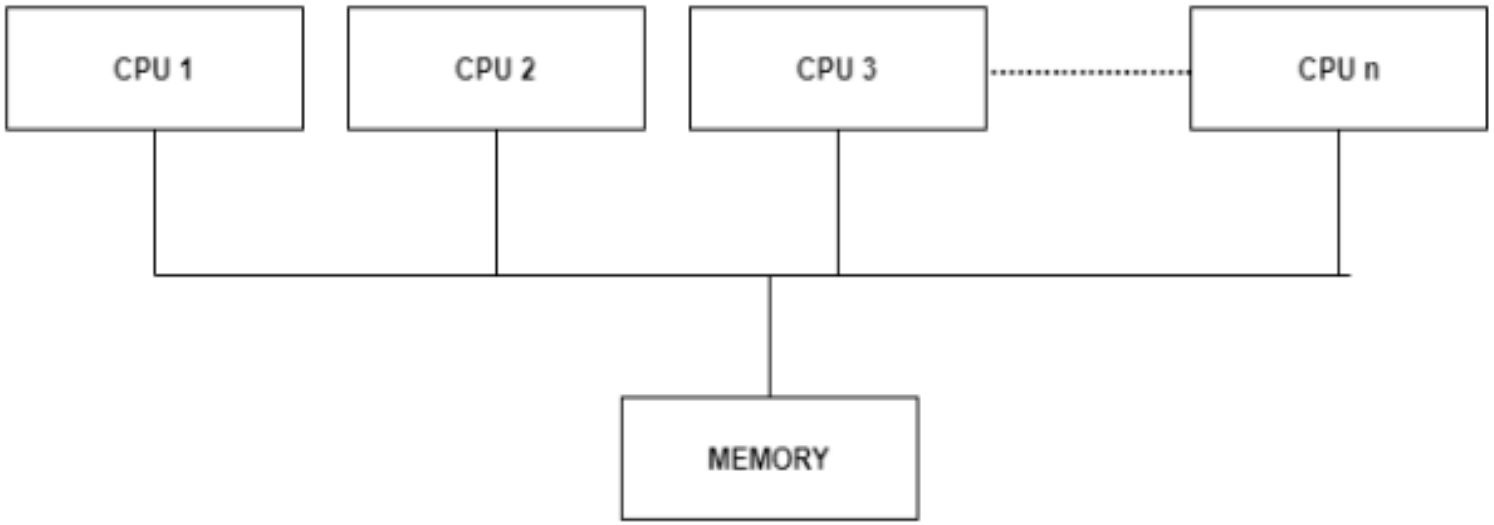
2. Soft real-time systems

   Soft real-time systems are less restrictive. A critical real-time task gets priority over other tasks and retains the priority until it completes. Soft real-time systems have limited utility than hard real-time systems. For example, multimedia, virtual reality.

MULTIPROCESSOR OPERATING SYSTEM

- Most computer systems are single processor systems i.e. they only have one processor. However, multiprocessor or parallel systems have multiple processors working in parallel that share the computer clock, memory, bus, peripheral devices etc.

An image demonstrating the multiprocessor architecture is –



Multiprocessing Architecture

Types of Multiprocessors

- There are mainly two types of multiprocessors

1. symmetric
2. asymmetric multiprocessors.

1. **Symmetric Multiprocessors**

In these types of systems, each processor contains a similar copy of the operating system and they all communicate with each other. All the processors are in a peer to peer relationship i.e. no master - slave relationship exists between them.

2. Asymmetric Multiprocessors

In asymmetric systems, each processor is given a predefined task. There is a master processor that gives instruction to all the other processors. Asymmetric multiprocessor system contains a master slave relationship..

Advantage

- Reliable
- Enhanced throughput

Disadvantage

- Increased Expense
- Complicated Operating System Required
- Large Main Memory Required

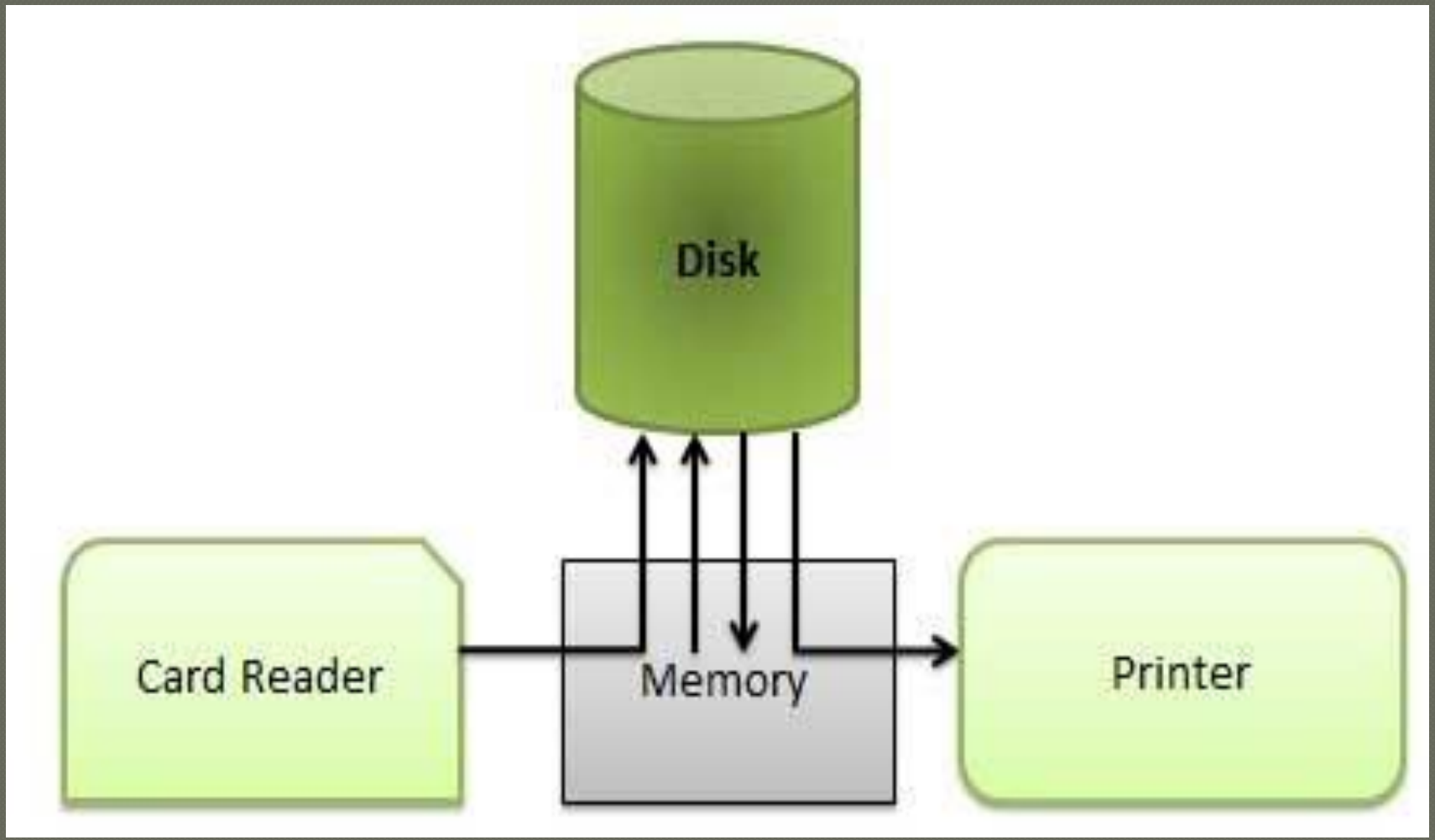
Spooling

- Spooling is an acronym for simultaneous peripheral operations on line.

- Spooling refers to putting data of various I/O jobs in a buffer. This buffer is a special area in memory or hard disk which is accessible to I/O devices.

- Spooling works like a typical request queue or spool where data, instructions and processes from multiple sources are accumulated for execution later on. Generally, the spool is maintained on the computer's physical memory, buffers or the I/O device-specific interrupts. The spool is processed in ascending order, working on the basis of a FIFO (first in, first out) algorithm.

- The most common implementation of spooling can be found in typical input/output devices such as the keyboard, mouse and printer.
- For example, in printer spooling, the documents/files that are sent to the printer are first stored in the memory or printer spooler. Once the printer is ready, it fetches the data from that spool and prints it.


Disk
Card Reader
Memory
Printer

Advantages

- The spooling operation uses a disk as a very large buffer.
- Spooling is capable of overlapping I/O operation for one job with processor operations for another job.

GOALS OF OPERATING SYSTEM

- CONVENIENCE(EASE OF USE): From the user's point of view operating system should provide an environment where user can easily learn and perform its task. OS should maximize the work that user performs.
- EFFICIENT RESOURCE UTILIZATION: From the system's point of view OS is a resource allocator. It efficiently allocates resources(h/w and s/w)so that performance of system will be increased.