

CHAPTER ONE

Overview of operating systems

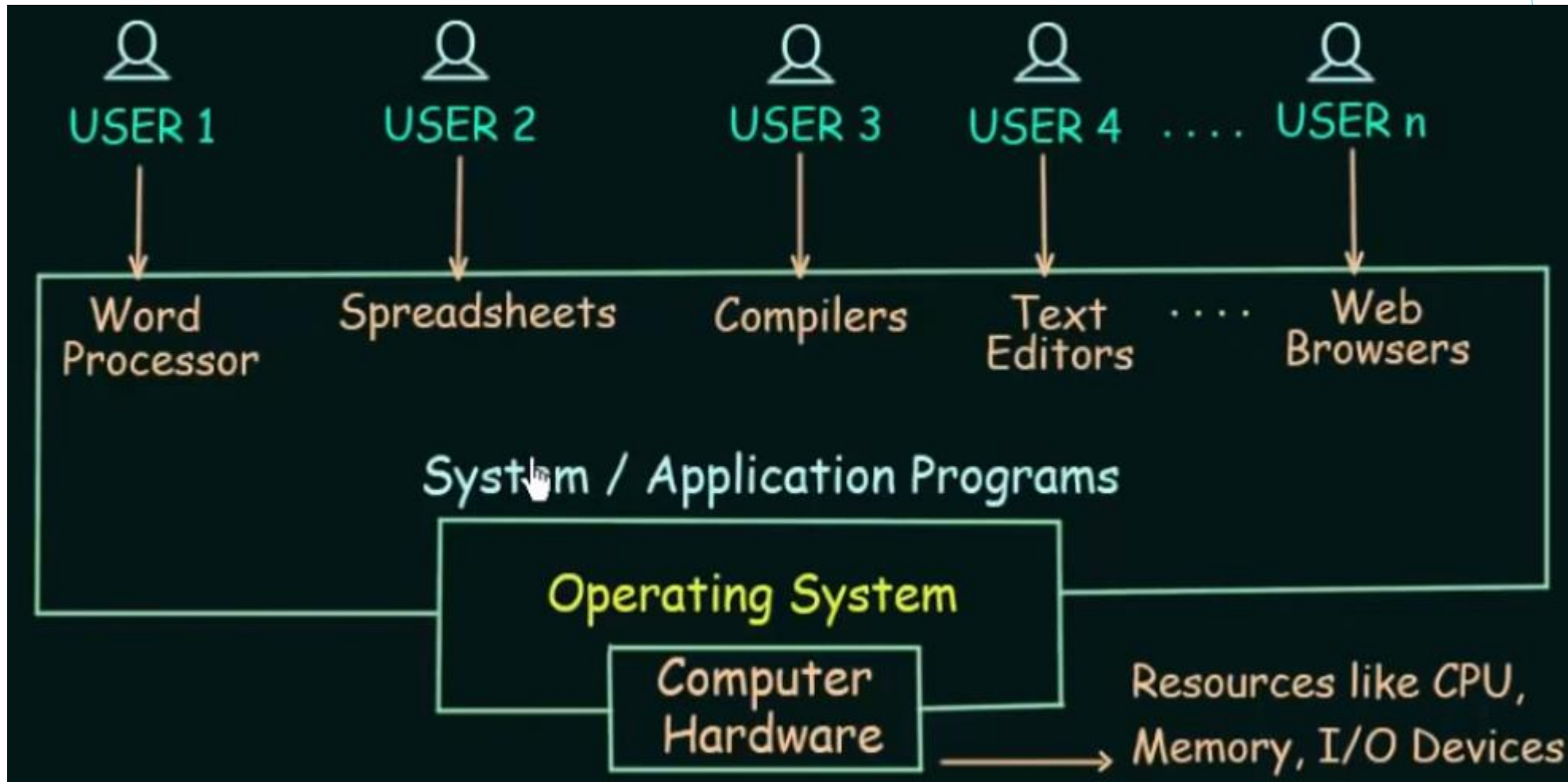
Outline of the Chapter

- ▶ Operating System
- ▶ OS and Computer system
- ▶ Classes of Operating system

Operating System

- ▶ An Operating System (OS) is an interface between computer user and computer hardware.
- ▶ Is a software that performs all basic tasks; like file management, memory management, process management, handling input and output, and controlling peripheral devices such as disk drives and printers.
- ▶ It also provides a basis for application programs and acts as an intermediary between the computer user and the computer hardware.
- ▶ Controls and coordinates use of hardware among various applications and users.

Operating System Cont....



Operating System cont....

Examples of OS



Operating System and Computer system

- ▶ An operating system (OS) is system software that manages computer hardware and software resources and provides common services for computer programs.
- ▶ Nearly every computer program requires an operating system to function.
- ▶ OS are found on many devices that contain a computer – from cellular phones and video game consoles to web servers and supercomputers.
- ▶ **Mainframe OS** are designed primarily to optimize utilization of hardware.
- ▶ **Personal computer (PC) OS** support complex games, business applications, and everything in between.

Computer Hardware Review

The computer system is composed of multiple pieces of hardware and software.

Hardware: is the physical devices associated with a computer.

Example:

- ▶ Processors
- ▶ Memory (RAM)
- ▶ Disks
- ▶ Tapes
- ▶ Input Devices: keyboard, mouse, scanner, etc.
- ▶ Output Devices: printer, monitor, etc.
- ▶ Buses

Processors

- ▶ Processor also called central processing unit (CPU) include two main parts: Control unit (CU) and arithmetic logic unit (ALU).
- ▶ The primary function of a CPU is to execute the instructions stored in the main memory.
- ▶ An instruction tells the CPU to perform its basic operations.
- ▶ The CU is the one which interprets (decodes) the instruction to be executed and “tells” the other components what to do.

Buses

- ▶ Buses are communication path connecting two or more devices to communicate or share information among each other's.
- ▶ The buses are including the following parts which are controlled by the operating system.
 - ❖ The address buses
 - ❖ The data buses
 - ❖ The control buses and
 - ❖ There is also a power bus, and some architectures may also have a separate I/O bus.

Software

- ▶ Software is a set of programs, Which is designed to perform a well-defined function.
- ▶ A program is a sequence of instructions written to solve a particular problem. The software can be classified into two broad types:
 - ➔ **Application software** includes all the programs you apply to a task, such as a word processing, programs, spreadsheets—payroll and inventory programs, and games.
 - ➔ **System software** includes the programs you use to manage your computer, including operating systems such as Windows, Linux, or UNIX for larger computers, Google Android and Apple iOS for smartphones, etc.

Functions of Operating System

- ▶ **Processor Management:** Manages the processor's work by allocating various jobs to it and ensuring that each process receives enough time from the processor to function properly.
- ▶ **Memory Management:** it also manages the allocation and deallocation of the memory to various processes and ensures that the other process does not consume the memory allocated to one process.
- ▶ **Device Management:** An OS controls the working of input-output devices.
 - It receives the requests from these devices, performs a specific task, and communicates back to the requesting process.

Functions of Operating System...

- ▶ **File Management:** keeps track of information regarding the creation, deletion, transfer, copy, and storage of files
 - It also maintains the integrity of the data stored in these files, including the file directory structure, by protecting against unauthorized access.
- ▶ **Security:** provides various techniques which assure the integrity and confidentiality of user data.

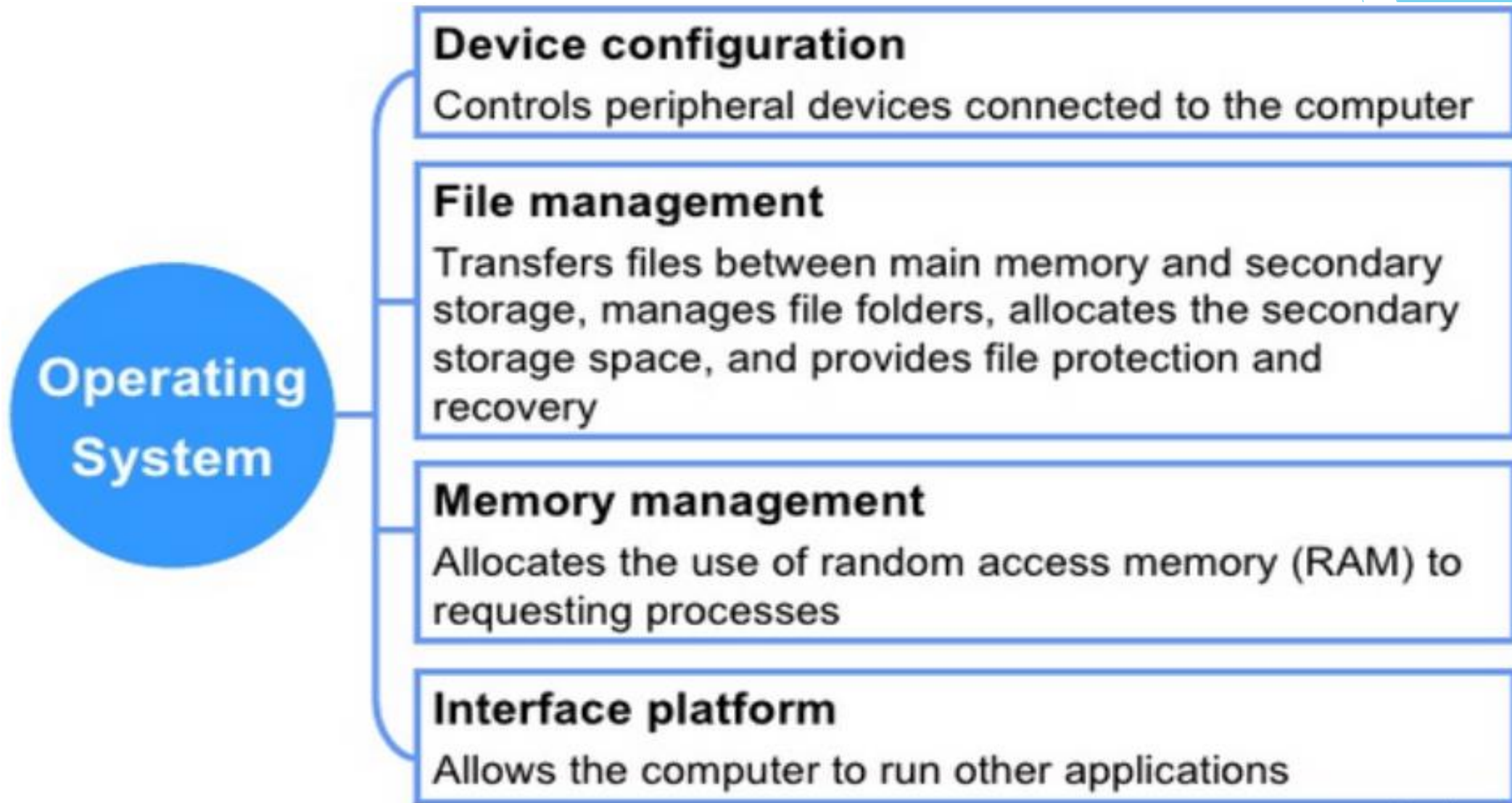
Following security measures are used to protect user data:

- ✓ Protection against unauthorized access through login.
- ✓ Protection against intrusion by keeping Firewall active.
- ✓ Protecting the system memory against malicious access.
- ✓ Displaying messages related to system vulnerabilities.

Functions of Operating System...

- ▶ **Error Detection:** From time to time, the OS checks the system for any external threat or malicious software activity.
 - It also checks the hardware for any type of damage.
 - This process displays several alerts to the user so that the appropriate action can be taken against any damage caused to the system.
- ▶ **Job Scheduling:** In a multitasking OS where multiple programs run simultaneously, OS determines which applications should run in which order and how much time should be allocated to each application.

Basic function of operating systems



History of Operating Systems

► First generation 1945 - 1955

- All programming was done in absolute machine language, often by wiring up plug boards to control the machine's basic functions.
- During this generation computers were generally used to solve simple math calculations.
- Technology used is vacuum tubes and plugboards

► Second generation 1955 - 1965

- Technology: transistors
- Programming language used is FORTRAN and assembly language.
- Batch system was introduced

History of Operating Systems...

- Focused on **cost** effectiveness
- Computers were expensive
 - ▶ IBM 7094: **\$200,000**
- ▶ Two widely adopted improvements
 - Computer operators: **humans hired** to facilitate machine operation
 - Concept of **job scheduling**: group together programs with similar requirements
- ▶ **Expensive time** lags between **CPU** and **I/O** devices

History of Operating Systems...

▶ Third generation 1965 – 1980

- Faster CPUs
- Technology: ICs
- Multiprogramming was introduced.
 - Allowed loading many programs at one time
- Program scheduling
 - Initiated with second-generation systems

Major achievements of third generation:

- ▶ Multiprogramming
- ▶ Timesharing

History of Operating Systems...

- ▶ Fourth generation 1980 – present
 - ▶ Technology: VLSI
 - ▶ Programming: high level
 - ▶ Programming language: C/C++, Java, ...
 - ▶ Computer: PC
 - ▶ OS: Windows, MacOS, Linux ...

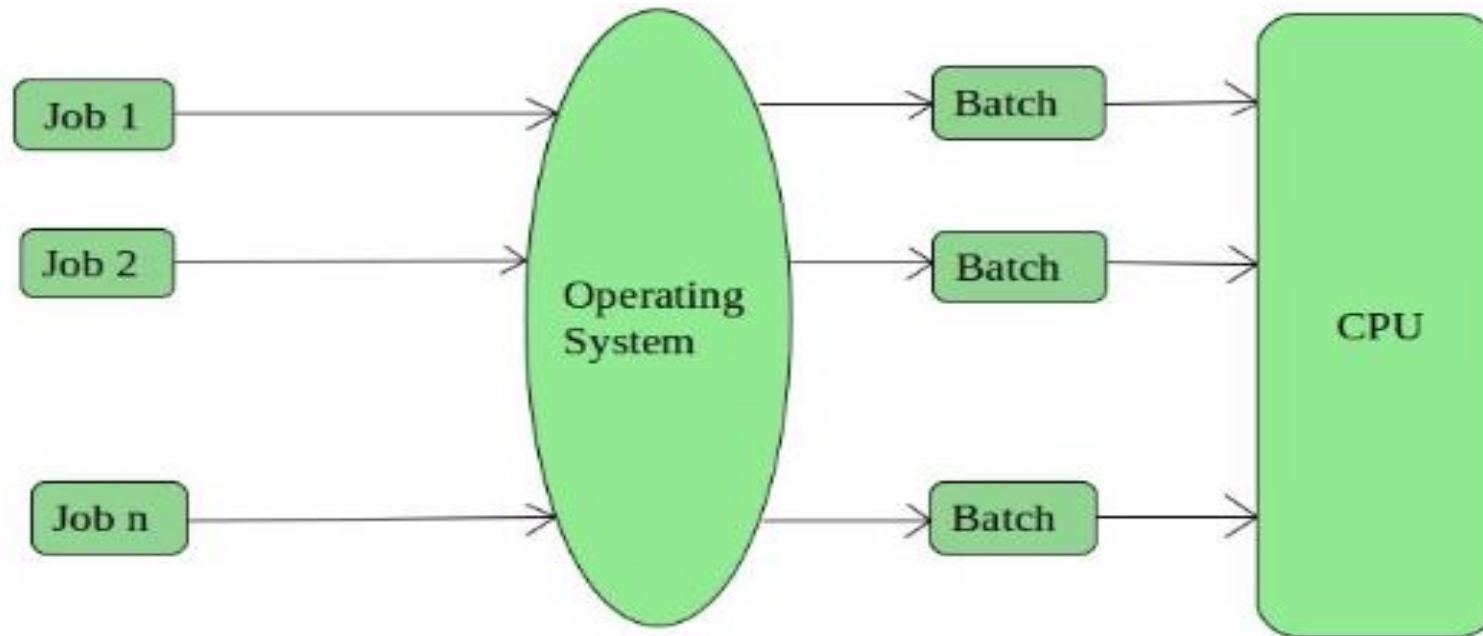
Classes of Operating system

The important types of operating system which are most commonly used are:

- ▶ Batch operating system
- ▶ Time-sharing operating systems
- ▶ Real-Time Operating System
- ▶ Network Operating System
- ▶ Distributed operating System

Batch operating system

- ▶ This type of operating system does not interact with the computer directly.
- ▶ There is an operator which takes similar jobs having the same requirement and group them into batches.
- ▶ It is the responsibility of the operator to sort jobs with similar needs.



Batch operating system...

Advantages of Batch Operating System:

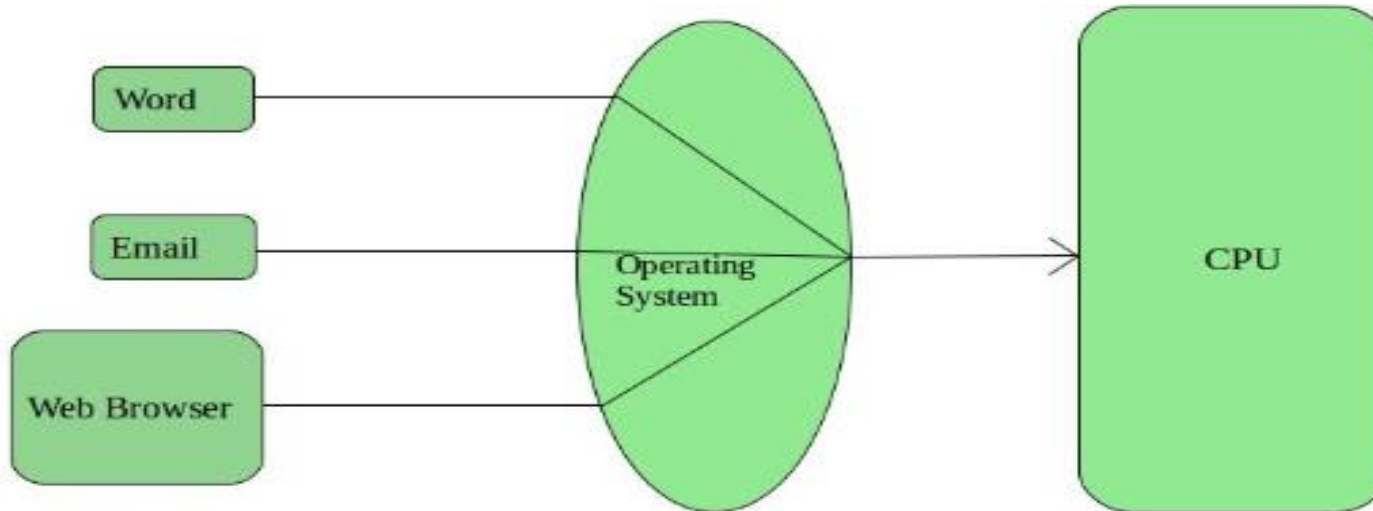
- ▶ Multiple users can share the batch systems
- ▶ The idle time for the batch system is very less
- ▶ It is easy to manage large work repeatedly in batch systems

Disadvantages of Batch Operating System:

- ▶ The computer operators should be well known with batch systems
- ▶ Batch systems are hard to debug
- ▶ It is sometimes costly
- ▶ The other jobs will have to wait for an unknown time if any job fails

Time-sharing operating systems

- ▶ Each task is given some time to execute so that all the tasks work smoothly.
- ▶ Each user gets the time of CPU as they use a single system.
- ▶ These systems are also known as Multitasking Systems.
- ▶ The time that each task gets to execute is called **quantum**.
- ▶ After this time interval is over OS switches over to the next task.



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Advantages of Timesharing operating systems are:

- ▶ Each task gets an equal opportunity
- ▶ Avoids duplication of software.
- ▶ Reduces CPU idle time.

Disadvantages of Timesharing operating systems.

- ▶ Problem of reliability.
- ▶ Question of security and integrity of user programs and data.
- ▶ Problem of data communication.

Real-Time Operating System

- ▶ In this type of operating system, the job has to be completed within the set time limit; otherwise, the job gets lost or loses its meaning.
- ▶ Real-time systems are used when there are rigid time requirements on the operation
- ▶ Real-time operating system has well-defined, fixed time constraints otherwise system will fail.
- ▶ For example, Scientific experiments, medical imaging systems, industrial control systems, weapon systems (or missile systems), robots, and home-appliance controllers, Air traffic control system etc.
- ▶ In these types of OS the time interval required to process and respond to inputs is very small. This time interval is called **response time**.

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- ▶ **Real-time systems** are used when there are time requirements that are very strict like missile systems, air traffic control systems, robots, etc.

There are two types of real-time operating systems.

- **Hard real-time systems:** These OSs are meant for applications where time constraints are very strict and even the shortest possible delay is not acceptable.

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- These systems are built for saving life like automatic parachutes or airbags which are required to be readily available in case of any accident.
- Virtual memory is rarely found in these systems.
- **Soft real-time systems:** These OSs are for applications where for time-constraint is less strict.
- ▶ 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.

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- ▶ For example, Multimedia, virtual reality, Advanced Scientific Projects like undersea exploration and planetary rovers etc.

Advantages of RTOS:

- ▶ **Maximum Consumption:** Maximum utilization of devices and system, thus more output from all the resources
- ▶ **Task Shifting:** The time assigned for shifting tasks in these systems are very less. For example, in older systems, it takes about 10 microseconds in shifting one task to another, and in the latest systems, it takes 3 microseconds.

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- ▶ **Focus on Application:** Focus on running applications and less importance to applications which are in the queue.

Disadvantages of RTOS:

- ▶ **Limited Tasks:** Very few tasks run at the same time and their concentration is very less on few applications to avoid errors.
- ▶ **Use heavy system resources:** Sometimes the system resources are not so good and they are expensive as well.
- ▶ **Complex Algorithms:** The algorithms are very complex and difficult for the designer to write on.
- ▶ **Thread Priority:** It is not good to set thread priority as these systems are very less prone to switching tasks.

Network Operating System

- ▶ These systems run on a server and provide the capability to manage data, users, groups, security, applications, and other networking functions.
- ▶ These types of operating systems allow shared access of files, printers, security, applications, and other networking functions over a small private network.
- ▶ One more important aspect of Network Operating Systems is that all the users are well aware of the underlying configuration, of all other users within the network, their individual connections, etc. and that's why these computers are popularly known as **tightly coupled systems**.

Distributed operating System

- ▶ Various autonomous interconnected computers communicate with each other using a shared communication network.
- ▶ Independent systems possess their own memory unit and CPU so it is referred to as **loosely coupled systems** or distributed systems.
- ▶ These system's processors differ in size and function.
- ▶ The major benefit of working with these types of the operating system is that it is always possible that one user can access the files or software which are not actually present on his system but some other system connected within this network i.e., remote access is enabled within the devices connected in that network.

Distributed operating System...

- ▶ Processors in a distributed system may vary in size and function.
- ▶ These processors are referred as sites, nodes, and computers and so on.
- ▶ A distributed operating system manages a group of independent computers and makes them appear to be a single computer.

THE END OF CHAPTER ONE
QUESTION?