Operating System

Lecture No 03

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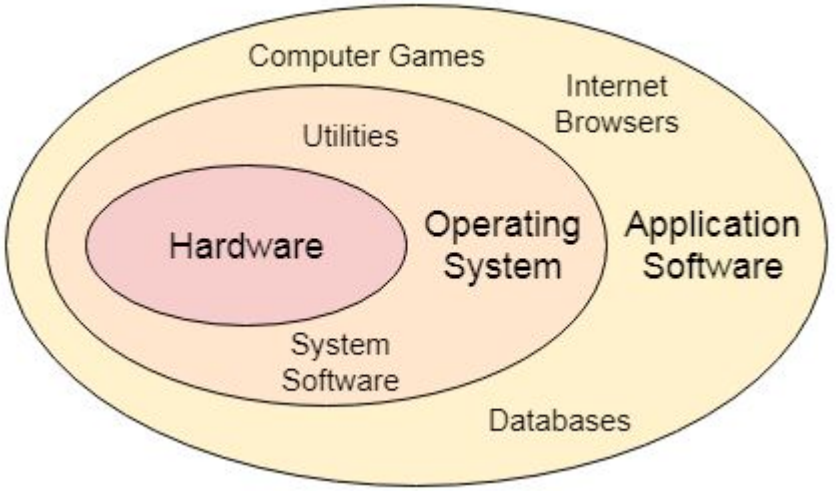
Operating System Definition and Function

- In the Computer System (comprises of Hardware and software), Hardware can only understand machine code (in the form of 0 and 1) which doesn't make any sense to a naive user.
- We need a system which can act as an intermediary and manage all the processes and resources present in the system.



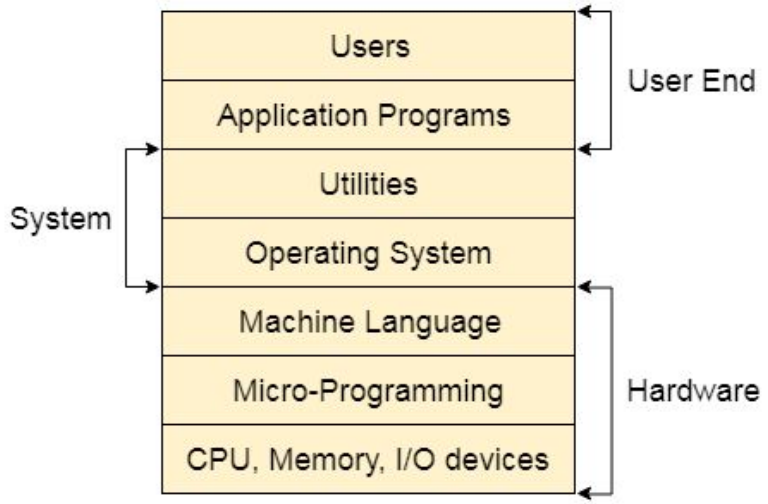
Operating System Definition and Function

- An **Operating System** can be defined as an **interface between user and hardware**. It is responsible for the execution of all the processes, Resource Allocation, CPU management, File Management and many other tasks.
- The purpose of an operating system is to provide an environment in which a user can execute programs in convenient and efficient manner.

Structure of a Computer System

A Computer System consists of:

1. Users (people who are using the computer)
2. Application Programs (Compilers, Databases, Games, Video player, Browsers, etc.)
3. System Programs (Shells, Editors, Compilers, etc.)
4. Operating System (A special program which acts as an interface between user and hardware)
5. Hardware (CPU, Disks, Memory, etc)



Structure of a Computer System

1. **Manages Hardware:** The OS controls and coordinates all the physical parts of your computer (like the CPU, memory, and storage).
2. **Runs Software:** It allows you to run programs and applications on your computer, like a word processor or a web browser.
3. **File Management:** The OS helps you store, organize, and access files on your computer, like documents, pictures, and videos.

Structure of a Computer System

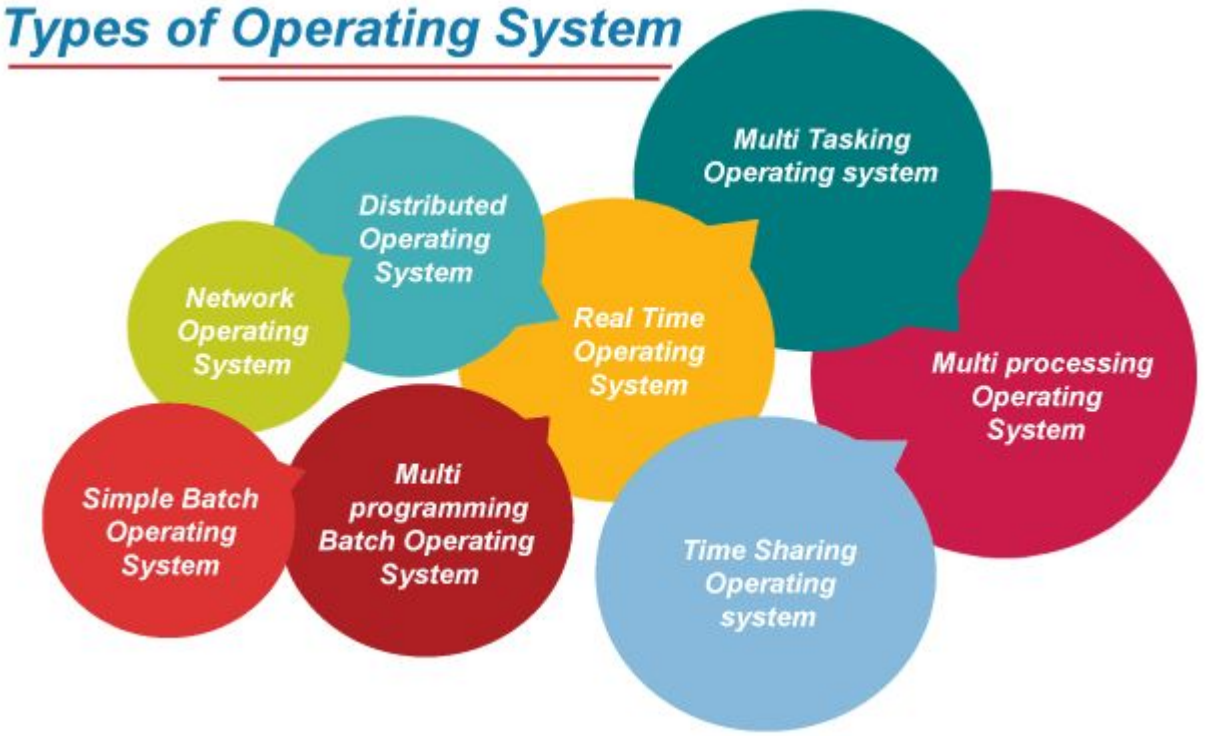
1. **Handles Tasks**: It manages different tasks or processes your computer is doing at the same time, ensuring they all run smoothly.
2. **User Interface**: The OS provides a way for you to interact with the computer, usually through a visual interface with icons, windows, and menus.

Structure of a Computer System

1. **Security:** It helps protect your computer from unauthorized access and manages user permissions.
2. **Device Communication:** The OS allows different devices (like printers, keyboards, and external drives) to communicate with your computer.
3. **Memory Management:** It efficiently uses your computer's memory (RAM) so that multiple programs can run without crashing.

Types of Operating Systems (OS)

- An operating system is a well-organized collection of programs that manages the computer hardware. It is a type of system software that is responsible for the smooth functioning of the computer system.

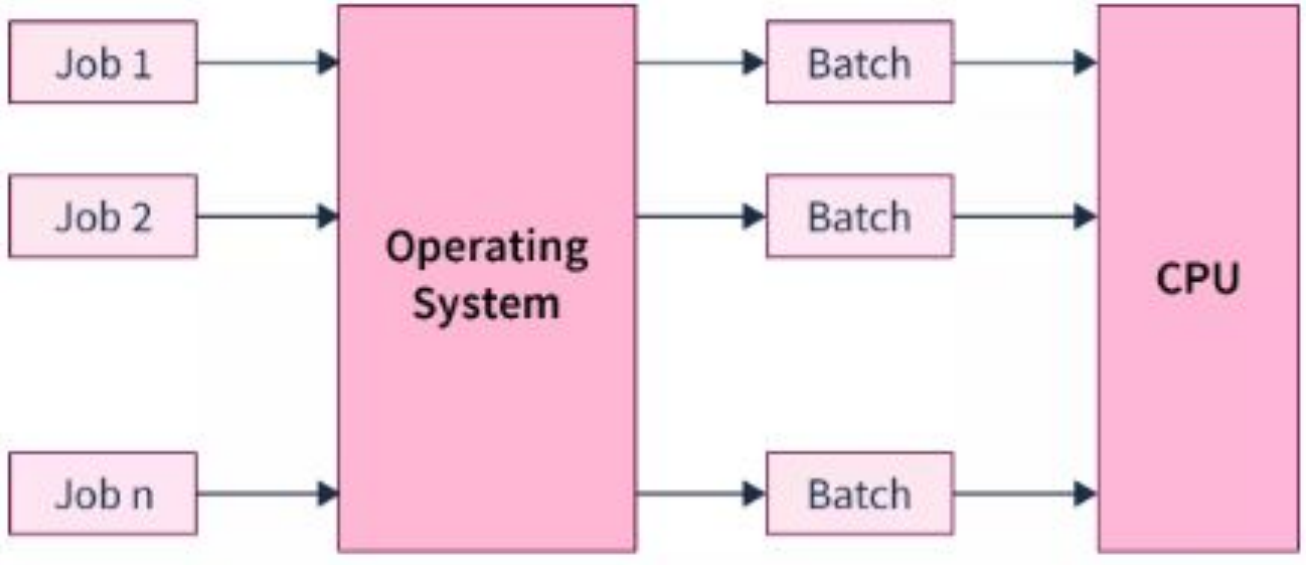


Batch Operating System?

- Imagine you have a big, old computer (called a mainframe) that many people share.
- In the 1970s, people didn’t have personal computers, so they would all use this one big computer to do their work.

How does it work

People would **submit their jobs** (tasks they wanted the computer to do) to the computer.
The computer would **collect all the jobs** and put them in a line (a queue).
The computer would then **process these jobs one by one** in the order they were submitted, like taking turns.



Real Life Example:

- Imagine you and your friends are at a printing shop, and you all want to print documents.
- You all give your documents to the shop owner (the computer), who puts them in a stack (the queue).
- The shop owner prints each document one by one, in the order they were given, and hands them back to you when done.

Why was it useful?

- It made sure that everyone's work got done in a fair order, and the big computer was always busy, making the most out of its time.

Key Point:

- The Batch Operating System processed jobs in batches, not all at once, but one after another, and everyone had to wait until all the jobs in the queue were completed to get their results.

Multiprogramming Operating System

It’s a way for a computer to work on many tasks at once, so it doesn’t waste time.

How does it work?

- Imagine the computer is like a person doing different chores.
- While waiting for one chore to finish (like waiting for the clothes to dry), the person starts another chore (like washing dishes).

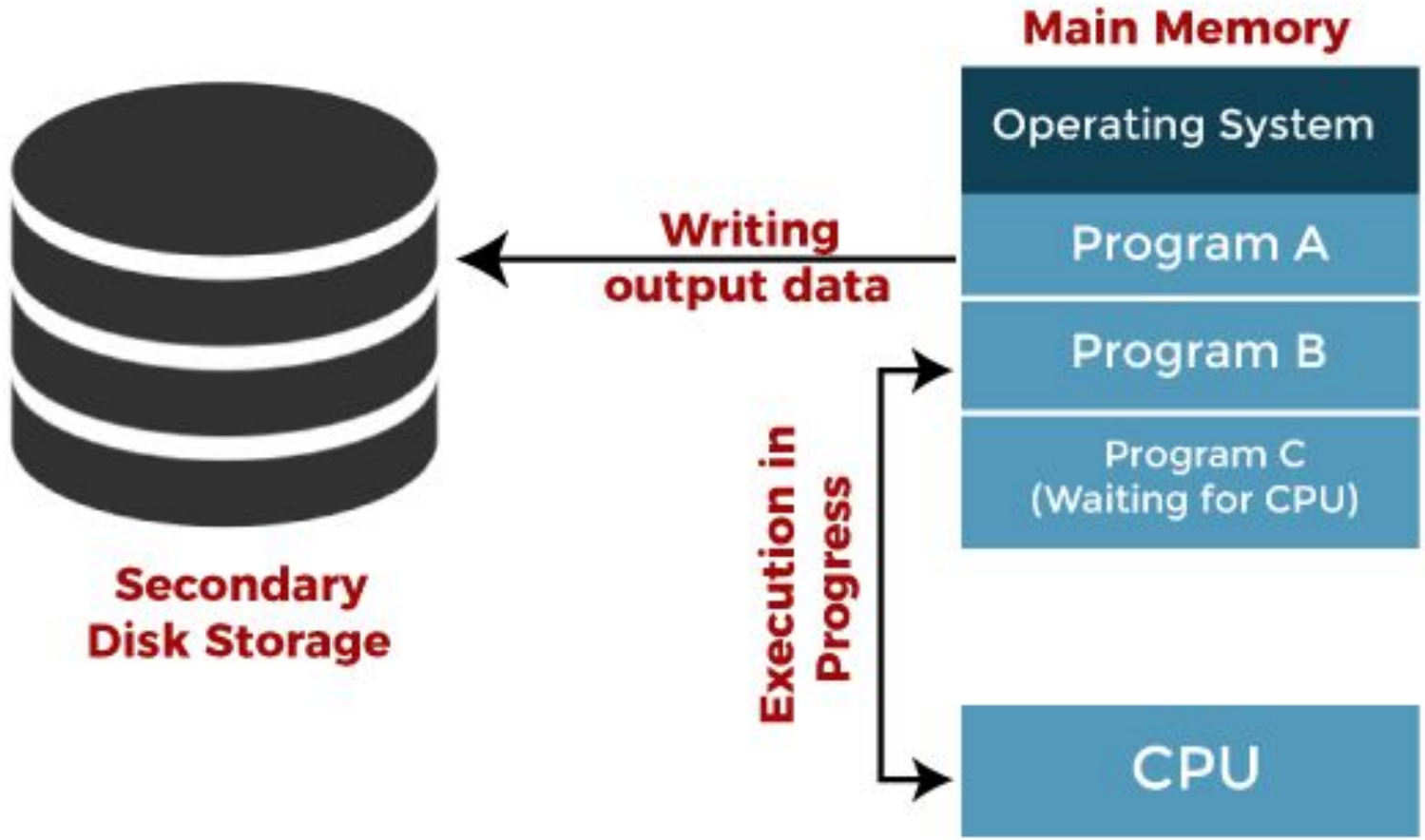
Example

Chore 1: Waiting for the laundry to dry (waiting time).
Chore 2: While waiting, the person starts cooking (working time).
Chore 3: When the cooking needs to simmer (waiting time), the person folds the dry laundry (working time).

- The person is always busy, switching between chores whenever one needs to wait.

Why is it useful?

- It makes sure the computer is always doing something productive, so it finishes tasks faster.
- **Key Point:**
- **Multiprogramming** helps the computer jump between tasks so it’s never just sitting idle, getting more things done efficiently.



Jobs in multiprogramming system

Multiprocessing Operating System

What is Multiprocessing?

- Multiprocessing means the computer has more than one brain (called processors).
- These processors can work on different tasks at the same time, which makes the computer faster.

How does it work?

Imagine you have two people (processors) in a kitchen.
One person is making a salad, while the other is baking a cake.
Both people are working at the same time, so the meal gets prepared faster.

Why is it useful?

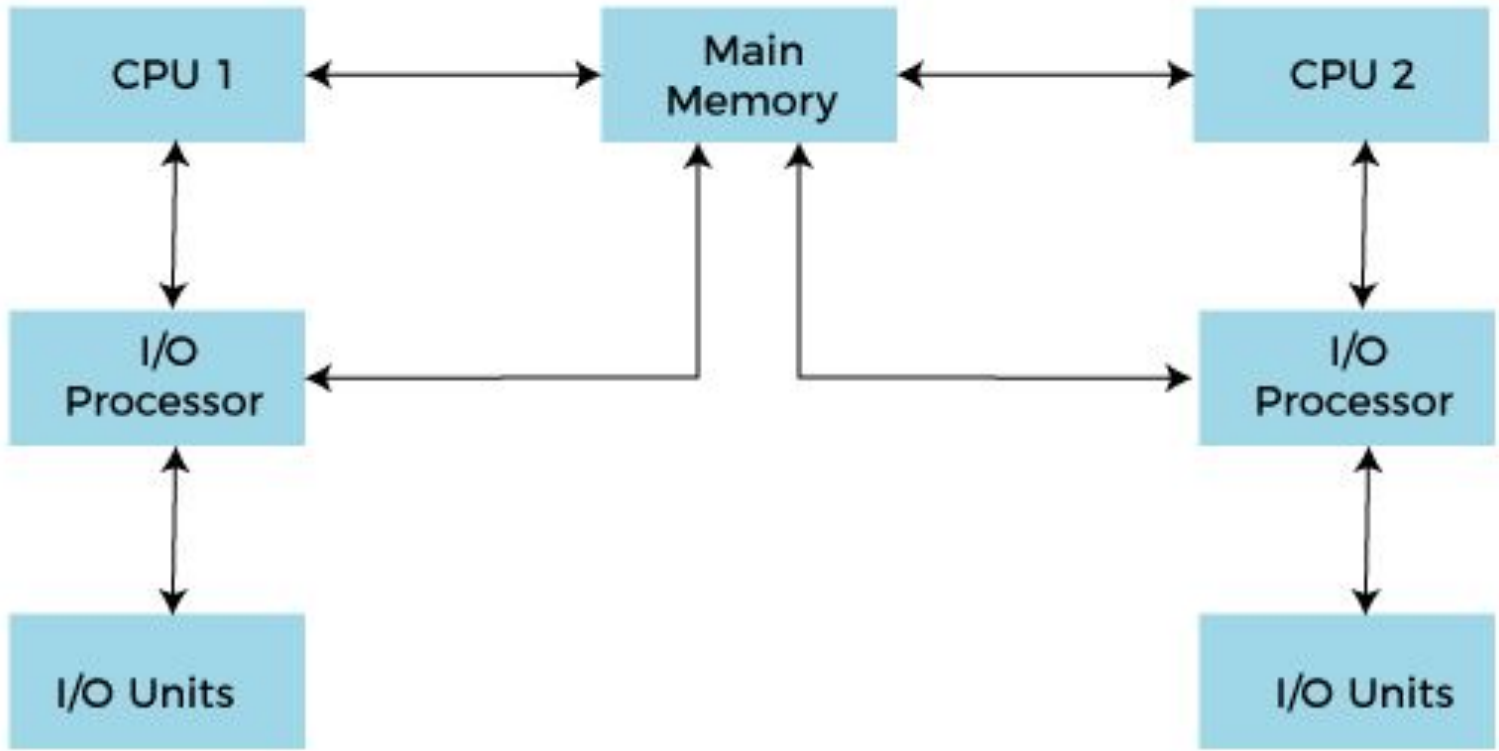
Since multiple processors are working on different tasks at the same time, the computer can get more work done quickly. This is called **parallel computing** because things happen in parallel (at the same time).

Example

- Think of a classroom where two teachers (processors) are teaching two different subjects at the same time.
- One teacher is teaching math, and the other is teaching science.
- The students learn both subjects faster because both teachers are working at the same time.

Key Point:

- **Multiprocessing** makes the computer more powerful and efficient by having multiple processors work on different tasks at the same time, speeding up the overall performance.


CPU 1
Main Memory
CPU 2
I/O Processor
I/O Processor
I/O Units
I/O Units

Multitasking Operating System

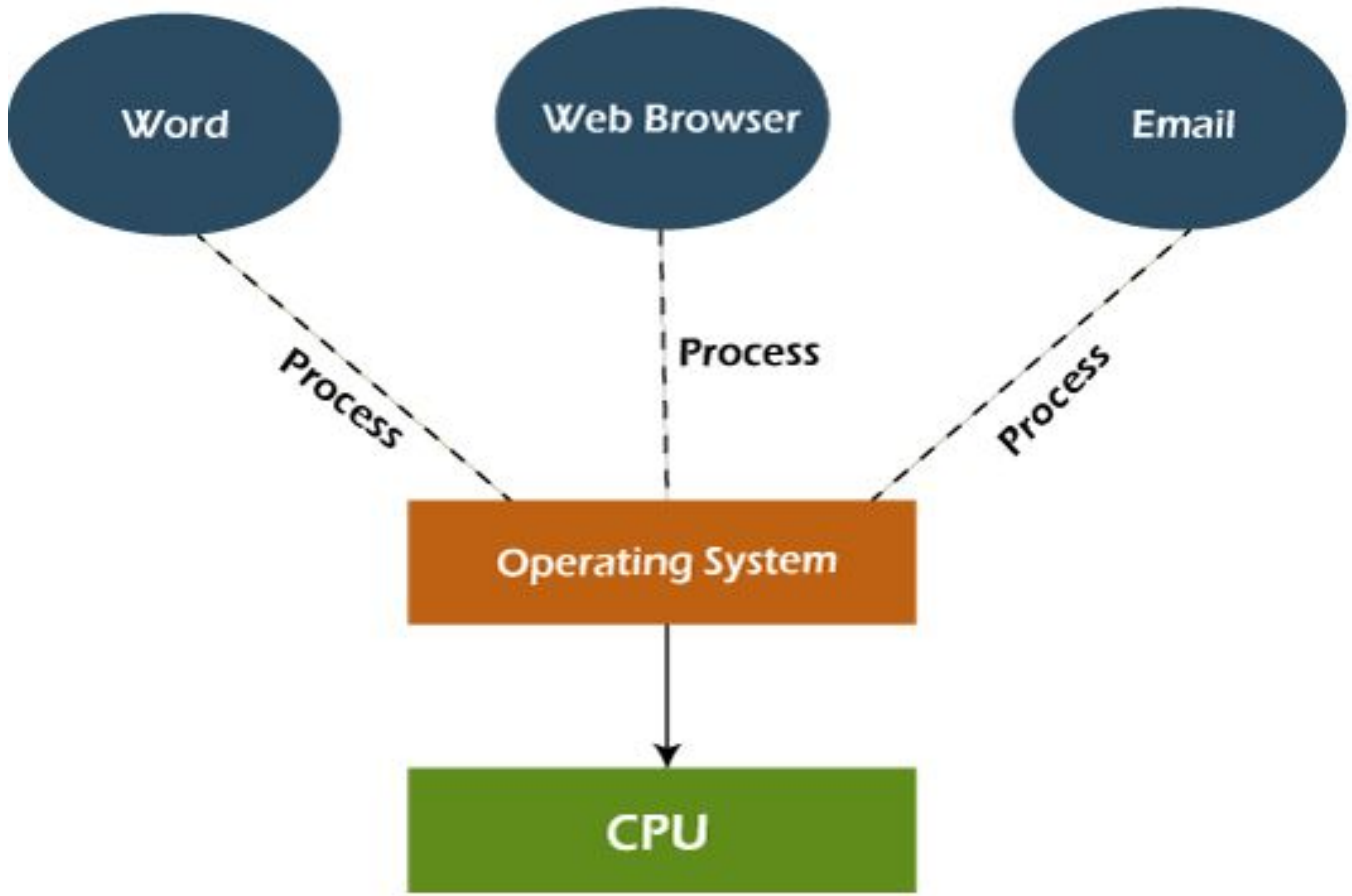
What is a Multitasking Operating System?
It’s a system that lets you do more than one thing on your computer at the same time.
How does it work?
The computer quickly switches between different tasks so fast that it seems like everything is happening at once.

Example:

Imagine you’re watching a movie on your computer, and at the same time, you’re writing a document and chatting with a friend online.
Even though you’re doing all these things at once, the computer is rapidly switching between these tasks so smoothly that you don’t notice the switching.

Why is it useful?

- It allows you to use your time better because you can do many things at once, like listening to music while browsing the web.
- **Key Point:**
- **Multitasking** makes it feel like your computer is doing many tasks at the same time, even though it’s quickly switching between them to keep everything running smoothly.


Word
Web Browser
Email
Process
Process
Process
Operating System
CPU

Network Operating System

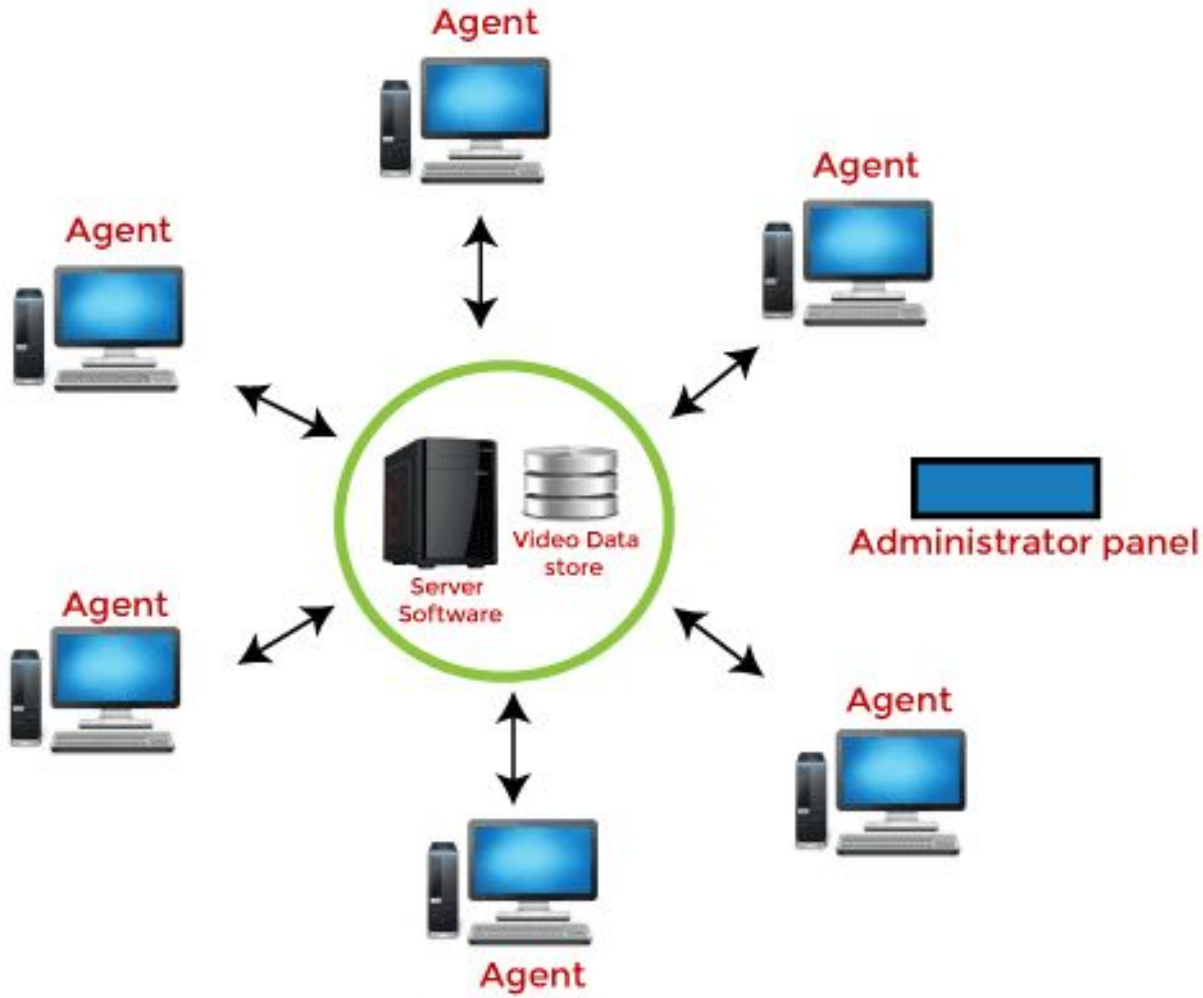
- **What is a Network Operating System?**
- It's a special type of operating system that helps computers connect and talk to each other over a network.
- **How does it work?**
- It includes software and rules (called protocols) that make it easy and affordable for computers to share files, printers, and other resources through a network.

Example:

- Imagine you have a group of friends, and you all want to share photos with each other.
- A **Network Operating System** is like a team leader who helps everyone share and access each other's photos easily and quickly, using agreed-upon methods.

Why is it useful?

- It lets computers in different places work together as if they're in the same room, sharing resources like files and printers without needing a lot of extra equipment.
- **Key Point:**
- A **Network Operating System** helps computers communicate and share resources over a network in a simple and cost-effective way.



Network Operating Systems

Real Time Operating System

What is a Real-Time System?

It’s a type of system where tasks must be completed within a specific time limit, or else there could be serious problems.

•How does it work?

- Each task (or job) has a deadline, and the system has to finish that task before the deadline to be useful.

Example:

Imagine you’re baking a cake, and you have to take it out of the oven after exactly 30 minutes.

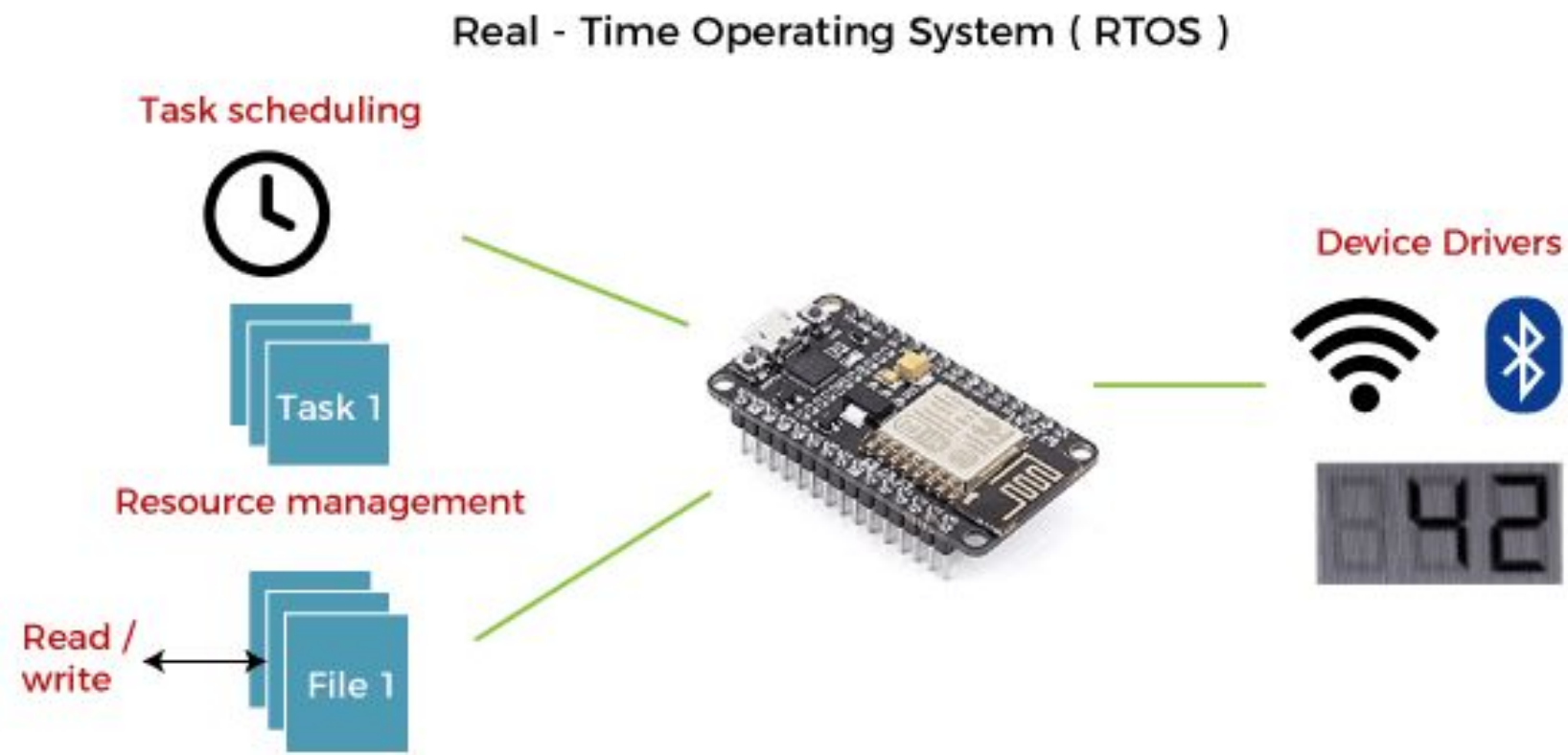
- If you take it out too late, the cake will burn and be ruined. Even if you take it out after 31 minutes, it’s still too late—the cake is already bad.
- In a **Real-Time System**, missing the deadline is like burning the cake: even if you finish the task later, it’s no good anymore.

Why is it important?

- Some tasks are so important that if they aren't done on time, they could cause big problems. For example, in air traffic control, if instructions are delayed, it could lead to accidents.

Key Point:

In **Real-Time Systems**, completing tasks on time is crucial because missing the deadline can make the results useless or cause serious issues.


Real - Time Operating System (RTOS)
Task scheduling
Task 1
Resource management
Read / write
File 1
Device Drivers
42

Time-Sharing Operating System:

What is a Time Sharing Operating System?

- It's a system that allows many people to use the same computer at the same time by sharing its resources.

How does it work?

- The computer's CPU switches between different programs from different users very quickly, giving each user a little bit of time one after the other.
- This makes it seem like everyone is using the computer at the same time.

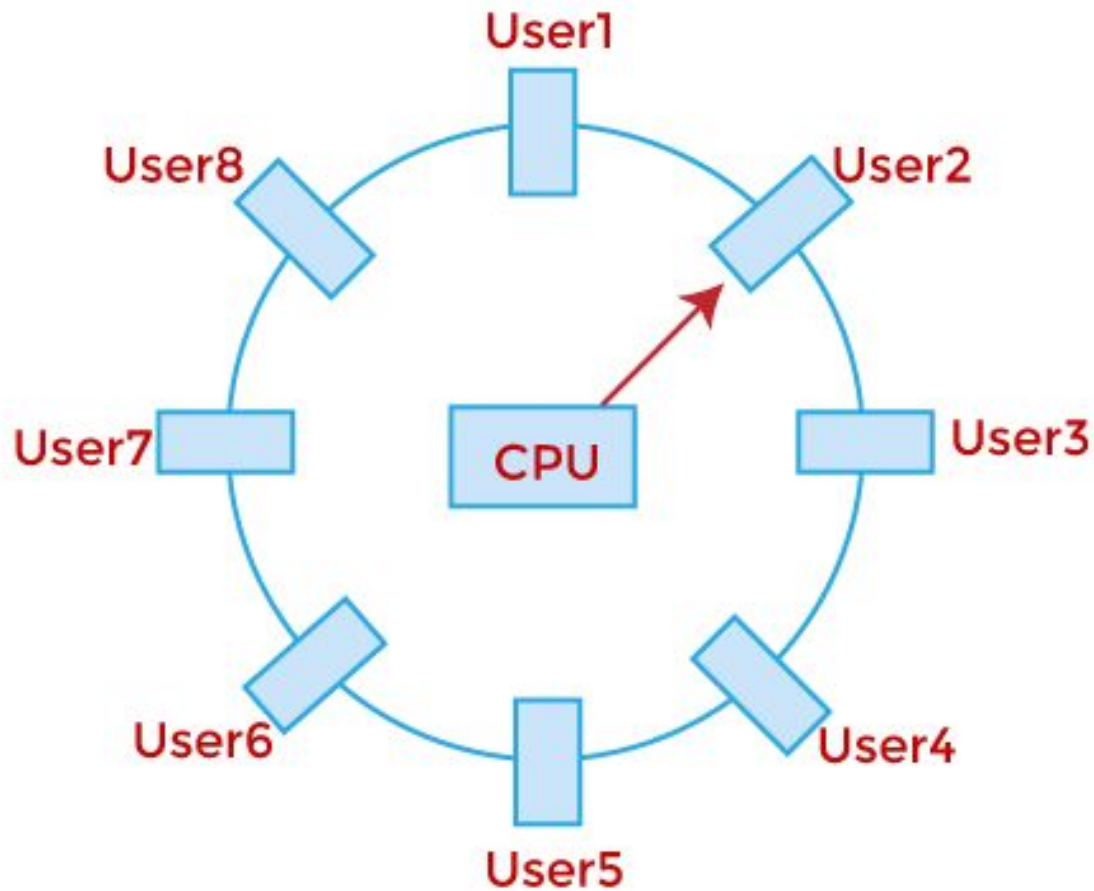
Time-Sharing Operating System:

Example:

- Imagine you're in a classroom with one teacher (the computer) and several students (the users).
- The teacher spends a few seconds helping each student in turn, moving quickly from one student to the next.
- Because the teacher moves so fast, it feels like everyone is getting help at the same time.

Time-Sharing Operating System:

- **Why is it useful?**
- It allows multiple people to use the computer's power at once, making it very efficient, especially when many users need to work on the same computer.
- **Key Point:**
- **Time Sharing** means the computer's resources are divided among many users, with the CPU switching between their programs quickly so everyone can work simultaneously.



Timesharing in case of 8 users

Distributed Operating System:

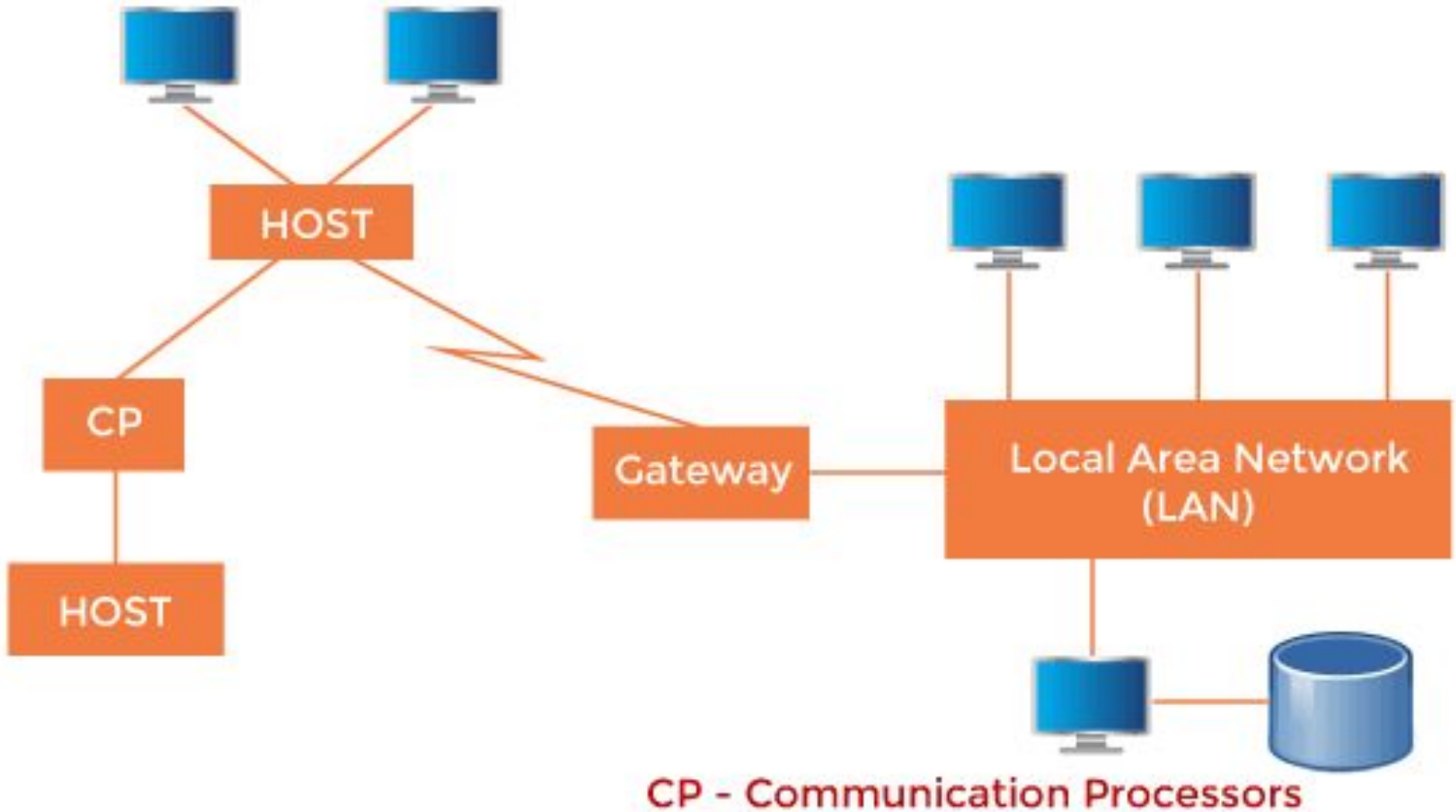
- **What is a Distributed Operating System?**
- It's an operating system that is spread across multiple computers, rather than being installed on just one.
- **How does it work?**
- Each computer in the network has a part of the operating system installed on it.
- These parts work together, allowing the computers to share resources and communicate as if they were one big system.

Distributed Operating System:

Imagine you have a group of friends who each have a piece of a big puzzle.
Each friend (computer) has a different section of the puzzle (part of the operating system).
By working together and fitting their pieces correctly, they complete the whole puzzle (distributed system).

Distributed Operating System:

- **Why is it useful?**
- It allows many computers to work together as a unified system, handling more complex tasks and sharing resources more efficiently.
- **Key Point:**
- A **Distributed Operating System** divides its functions across multiple computers to work together as one system, making it more complex but allowing for more powerful and coordinated computing



A Typical View of a Distributed System