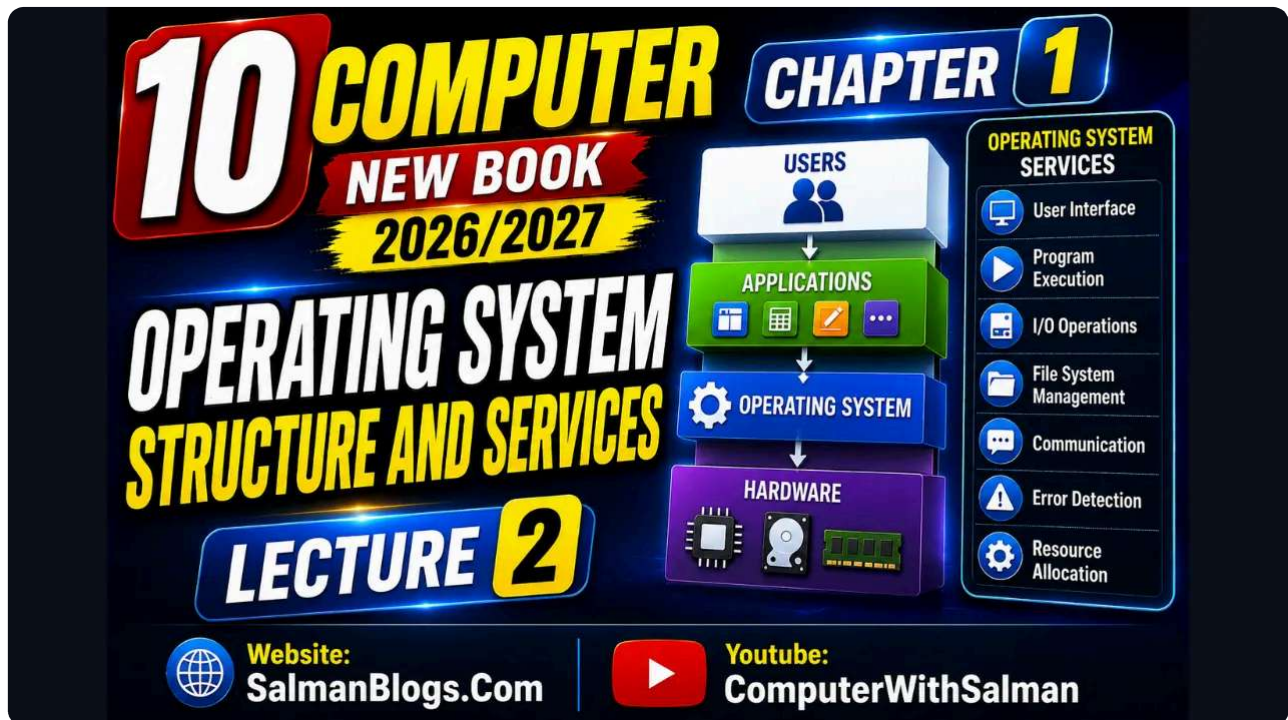


Operating System Structure and Services Lecture 2 Notes

Posted in 10 Computer Science



These lecture notes are prepared by **Salman Ahmad**, who is both a **teacher** and a **web developer**. The purpose of this material is to make the topic clear and useful for students of Class 10 Computer Science.

Table of Contents

Process Management in Operating System

Process in OS

Resource in OS

Process Life Cycle

Multitasking and Concurrency

Process Scheduling Concepts

Memory

Processes vs Threads

Thread

Multithreading

Benefits of Multithreading

System Calls

Types of System Calls

File System Structure and Management

Files

Folders

Metadata

File Systems

Types of Operating Systems

MCQs

MCQs for testing

FAQs

Process Management in Operating System

Process management means the OS controls these processes and gives them resources like CPU time and memory so they can run properly without disturbing each other.

Process in OS

An operating system (OS) manages all the programs running on a computer. When a program is running, it is called a process.

Resource in OS

A resource is anything required by a process to execute.

- CPU time
- Main memory (RAM)
- Cache memory
- Secondary storage (HDD, SSD)
- Input devices (keyboard, mouse, scanner)
- Output devices (monitor, printer, speakers)

Process Life Cycle

A process has 3 main stages:

1. Creation

A process starts when you open a program. The OS loads it into memory and gives it resources.

Example: When you open MS Word or Chrome, the process starts.

2. Execution

The process is working and doing its job.

Example: Chrome loads websites, plays videos, and responds when you click.

3. Termination

The process ends when you close the program. The OS removes it from memory and frees resources.

Example: When you close Chrome, it stops and memory is cleared.

Full Example (Chrome)

- **Creation:** Click Chrome icon → OS opens it
- **Execution:** Browse websites
- **Termination:** Close Chrome → OS stops it

Multitasking and Concurrency

Modern computers are designed to handle multiple tasks at the same time. This helps users work smoothly without waiting for one task to finish before starting another.

Multitasking

Multitasking means using more than one program at the same time.

Examples:

- Listening to music 🎵 while browsing the internet 🌐
- Writing a document 📄 while downloading a file ⬇️
- Watching a video 🎬 while chatting on WhatsApp 💬
- Playing a game 🎮 while music is running in background 🎧

All feel like they are running together.

Concurrency

Concurrency means the CPU does not do everything at once. It quickly switches between tasks, so all tasks keep moving forward.

Examples:

Chef Example:

- cooks rice for a short time
- then checks curry
- then prepares salad
- keeps switching quickly

Computer Example:

- CPU runs Chrome for a short time
- then switches to music player
- then switches to file download
- keeps rotating very fast

Phone Example:

- WhatsApp running in background 🗨️
- Music playing 🎵
- Instagram loading posts 📱
- System switches between them quickly

So it looks like all tasks are running at the same time.

Process Scheduling Concepts

The CPU cannot run all processes at once, so the OS decides:

- Which process goes first
- How long each process runs

This is called scheduling.

FCFS (First Come, First Served)

The first process that arrives is done first. Others wait their turn.

Example:

Like a line in a shop:

- First person in line is served first
- Then second, third, and so on

Advantages:

- Very simple
- Easy to understand
- No process is skipped

Disadvantages:

- Small tasks may wait too long if big tasks are ahead
- This is called the convoy effect
- If one process takes too long, overall system performance feels slow

Memory

Memory is where the computer stores data and instructions so the CPU can work fast.

Primary Memory (RAM)

RAM is the main working memory of a computer. It is very fast but temporary. Data is lost when power is off.

Example:

When you open a Word file, it is loaded into RAM so you can work on it quickly.

Virtual Memory

When RAM becomes full, the computer uses storage (HDD/SSD) as extra memory. This is called virtual memory.

But:

- It is slower than RAM

Simple idea:

Virtual memory = backup space for RAM

Example:

- You open many apps at once
- RAM gets full
- The system moves less used apps to storage
- This frees RAM for active apps

But those moved apps may become slower when you open them again.

Processes vs Threads

A process is a running program on a computer. Processes are independent, so one process crashing usually does not affect others.

Simple idea:

A process = a separate application running on your computer.

Example:

- Google Chrome
- MS Word
- A game

All of these are separate processes.

Thread

A thread is a small part of a process.

A process can have many threads.

Threads share the same memory.

Each thread does a different job.

Simple idea:

Thread = a small worker inside a program.

Example (Web Browser)

One browser (process) has many threads:

- One thread loads web pages 🌐
- One thread plays videos 🎬
- One thread downloads files ⬇️

So you can do many things at the same time without waiting.

Multithreading

Multithreading means one program uses multiple threads to do many tasks at the same time.

Each thread works independently but shares memory.

Simple idea:

One program → many small tasks running together.

Benefits of Multithreading

1. ⚡ Enhanced Performance

Multithreading improves system performance by running multiple threads at the same time, which reduces the time needed to complete tasks.

Example:

A video editing software processes audio and video at the same time, making the final output faster.

2. 🎯 Improved Responsiveness

Definition: It keeps applications responsive by running background tasks without stopping the main program.

Example:

In a web browser, you can scroll and use websites while a file is downloading in the background.

3. 🔄 Support for Concurrent/Parallel Operations

Definition: Multithreading allows multiple tasks to run at the same time within a program.

Example:

- Video plays 🎥
- Comments load 💬
- Recommendations update 🔄

4. ⚙️ Efficient Use of Resources

Definition: Multithreading uses CPU and memory in a better way by sharing resources between threads.

Example:

In a music app, you can play a song 🎵 and browse songs at the same time without opening two separate apps.

System Calls

A system call is a request made by a program to the operating system to perform a task that the program cannot directly do itself.

Simple idea:

A program asks the OS for help when it needs to use hardware.

Example:

When you save a file, the application uses a system call to ask the OS to write data to the hard drive or SSD.

Types of System Calls

1. open

Used to open a file for reading or writing.

Example: Opening a music file to play it 🎵

2. read

Used to read data from a file or input device.

Example: Opening and reading a text document 📄

3. write

Used to write or save data into a file or output device.

Example: Saving a photo or document on the computer 🖼️

4. fork

Used to create a new process by cloning an existing one.

Example: When you duplicate a browser tab, the system uses a fork to instantly copy the exact state of your current tab into a new process. 🌐

File System Structure and Management

The operating system not only runs programs but also manages how data is stored and organized on storage devices.

A file system provides a proper structure so that files can be stored, located, and managed easily. It ensures data remains organized even when there are thousands of files.

Files

A file is a collection of related data stored on a computer. It is the basic unit of storage.

Files can contain:

- text documents
- images
- audio
- video
- program instructions

Example:

A PDF document, a photo, or a song are all files.

Folders

A folder (or directory) is used to organize files in a structured way.

It helps users group related files together so they are easier to find and manage.

Example:

A “School Work” folder may contain assignments, notes, and projects.

Metadata

Metadata is information about a file or folder. It does not contain the actual content, but describes the file.

It includes:

- file name
- file size
- file type
- creation date
- last modified date

Example:

A photo file might show: Name: img.jpg, Size: 3 MB, Created: 1 June

File Systems

A file system is a method used by an operating system to store, organize, and manage files on storage devices such as HDD, SSD, or USB drives.

It decides where each file is stored and keeps track of its location so the file can be easily accessed when needed.



Common File Systems (with full forms)

FAT32 → File Allocation Table (32-bit)

Used in USB flash drives and memory cards due to its wide compatibility.

NTFS → New Technology File System

Used in Windows operating systems for better performance, security, and support for large files.

APFS → Apple File System

Used in modern macOS devices for fast and efficient storage, especially on SSDs.

EXT4 → Fourth Extended File System

Commonly used in Linux systems for its stability and performance.

Types of Operating Systems

Operating systems are designed based on the type of device and its purpose. Each type is optimized for specific tasks.

Real-Time Operating System (RTOS)

A Real-Time Operating System is designed to respond immediately to inputs within a strict time limit (deadline). Even a small delay can cause serious problems in such systems.

Key Feature: Very fast response with no delay in processing important tasks.

Used In:

- Air traffic control systems ✈️
- Heart monitoring devices ❤️
- Industrial robots 🤖

Embedded Operating System (EOS)

An Embedded OS is a small operating system designed for a specific device or function. It is not for general use but is optimized for one main task.

Key Feature: Uses very low memory, power, and resources.

Used In:

- Washing machines
- Microwaves
- Smart TVs
- Printers
- ATMs

Network Operating System (NOS)

A Network Operating System is used to manage multiple computers connected in a network. It allows users to share resources like files, printers, and internet connections.

Key Feature: Focuses on communication and sharing between computers.

Example: In a school computer lab, all computers are connected, students can save files on one central server, and all can use the same printer.

Mobile Operating System

A Mobile Operating System is designed for smartphones and tablets. It is optimized for touch screens, mobile apps, battery saving, and wireless communication.

Key Features:

- Supports apps
- Uses touch interface
- Manages battery efficiently
- Supports camera, GPS, and sensors

Used In:

- Smartphones 📱
- Tablets
- Smartwatches ⌚