Al-Mustaqbal University
College Of Engineering Technology
Department Of Cyber Security Techniques Engineering
Class: 1st
Subject: **Software Engineering**

Lecturer: Dr. Zainab Abdullah Jasim
1st term – Lecture-4: - Introduction

1. Introduction to Software Engineering

➢ Definition of software

Software is a comprehensive set of instructions, programs, data, and related documentation that directs a computer system on how to operate and perform specific tasks. Unlike hardware, which consists of the physical components of a computer, software is intangible and provides the logical control that makes hardware useful.

Software manages and controls hardware resources such as the processor, memory, storage devices, and input/output devices. It also provides a platform for users to interact with the computer and for applications to run efficiently and securely. Software can range from low-level system software, **such as** operating systems that manage core system functions, to application software designed to help users perform tasks like word processing, data analysis, communication, and multimedia processing.

In modern computing, software plays a critical role in automation, decision-making, communication, and information management across personal computers, mobile devices, servers, and embedded systems.

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In short Software a set of instructions that used for controlling computer hardware. Software is such as Most operating systems are primarily written in **C and Assembly**, with some components written in **C++, Rust, or Java**, depending on design and requirements.

➢ Why Do We Need Software?

- Software controls and manages computer hardware resources.
- It allows users to perform tasks such as **writing**, **calculating**, and **browsing the internet**.
- Software provides user interfaces for **easy interaction** with **computers**.
- It helps store, process, and manage data efficiently.
- Software increases productivity by automating tasks.
- It enables communication and connectivity between users and systems.
- Software ensures system security, reliability, and proper operation.

In summary: Software makes computer hardware functional and useful in daily personal and professional activities.

➢ Relationship between hardware and software

Figure 1 computer system architecture, showing the interaction between the user, application software, system software, and hardware in a layered manner, where each layer depends on the one below it.

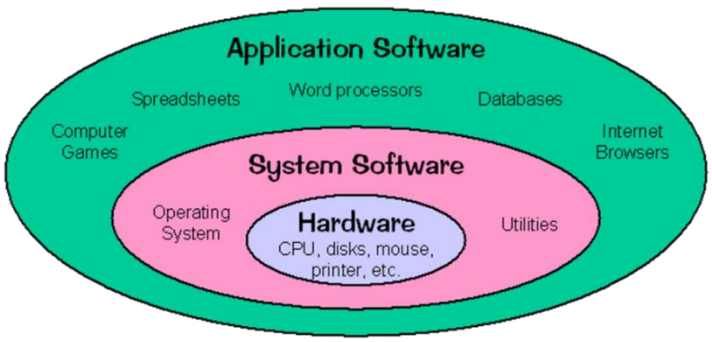

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Figure 1 computer system architecture

Application software: is a program that helps users in accomplishing specific tasks efficiently. Like (Word processors, spreadsheets, Photo Editing, Creating Web pages, Games, Instant messenger, Design, Accounting, Factory automation,....).

System software: is a program that is not directly intended to help achieving

the user‘s task but supports other application software. Helps **the computer perform essential operating tasks and enables the application software to run. Like:**

1. Operating systems (e.g. DOS, Windows, Unix, Mac, Linux, solaris),

2. System tools (e.g. Antivirus, archiving tools, disk defragmenter),

3. Software development tools (e.g. Compiler, debugger, integrated development

environment suite, Programming Languages, Database systems).

4. Drivers: Specific software programs that operates a specific piece of hardware.

This involves passing instructions from the application software, through the system software, to the hardware which ultimately receives the instruction as a machine code. Each instruction causes the computer to carry out an operation – to move data, carry out a computation, or alter the control flow of instructions. Figure 2 represent the **flow of Instructions in a Computer System**.

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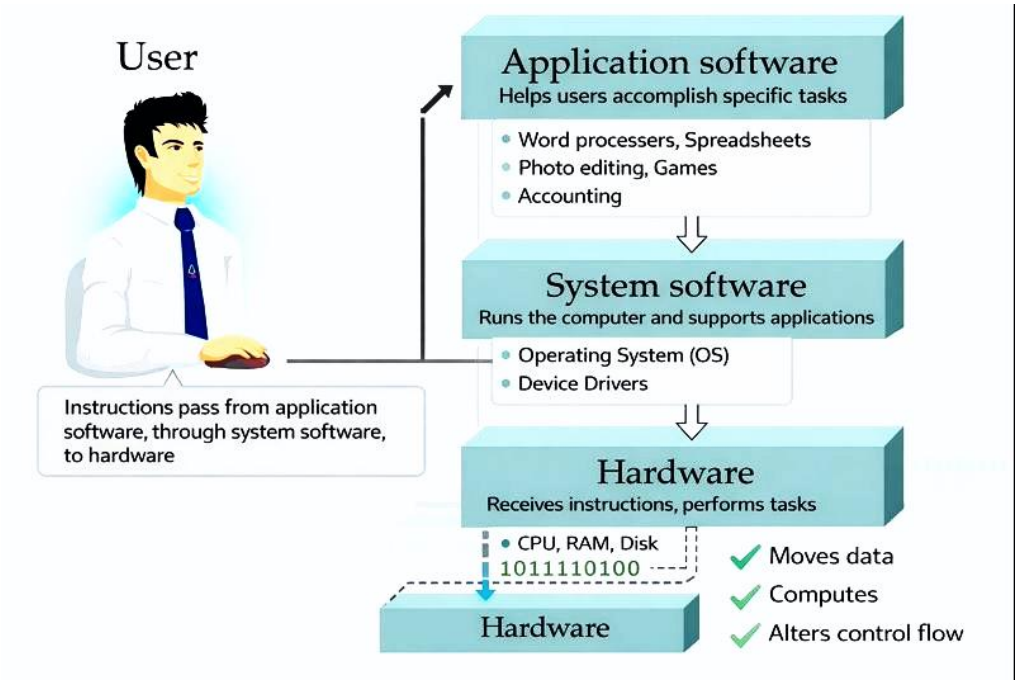

Figure 2 Flow of Instructions in a Computer System

- **Data** is typically moved from one place in the memory to another. Sometimes it involves moving data between memory and registers which enables high-speed data access in the CPU.
- **Instructions** may be performed sequentially, conditionally, or iteratively.
- **Sequential instructions** are those operations that are performed one after another.
- **Conditional instructions** They are performed in such a way that different sets of instructions are executed depending on the value(s) of some data. In some languages this is known as an "if statement".
- **Iterative instructions** They are performed repetitively and may depend on some data value. This is sometimes **called a "loop."** Often, one instruction may "call" another set of instructions that are defined in some other program

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or module. When more than one computer processor is used, instructions may be executed simultaneously.

➢ Types of Software

1-System Software:- It includes the Operating System and all the utilities that enable the computer to function.

It refers to any computer software which manages and controls the hardware so that application software can perform a task.

Example: Operating Systems, Compiler, Loader, Linker, Interpreter

Table 1 represent different function or for Roles of System Software Components.

Table 1 Roles of System Software Components

Component	Purpose	How It Works	Output
Operating System (OS)	Manages hardware and software resources	Acts as an interface between user, applications, and hardware	Running system
Compiler	Translates high-level code to machine code	Translates the entire program at once	Executable / object code
Interpreter	Executes high-level code	Translates and executes line by line	No separate executable
Linker	Combines object files	Links libraries and object files together	Single executable file
Loader	Loads program into memory	Loads executable from disk to RAM	Program ready to run

In Short

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- **Compiler vs Interpreter:** Compiler translates all at once; Interpreter works line by line.
- **Linker and Loader:** Work after compilation to prepare and run the program.
- **Operating System:** Controls everything and makes execution possible**.**

2-Application Software:- Application software is a type of software designed to help users perform specific tasks or activities. It runs on top of system software and allows users to interact with the computer to complete practical work such as writing documents, analyzing data, designing graphics, communicating, or entertainment.

Examples:

- **Word processors** (Microsoft Word) Used to create, edit, format, and print text documents such as letters, reports, and assignments.
- **Spreadsheets (Excel)** Used to organize data in tables, perform calculations, analyze data, and create charts.
- **Web browsers** Used to access, navigate, and view websites and online content on the internet.
- **Photo and video editing software** Used to edit images and videos by enhancing quality, adding effects, and creating multimedia content**.**
- **Accounting and design applications** Accounting software manages financial records, budgeting, and payroll, while design software is used for graphic, architectural, or engineering design, like graphics, CAD drawings, or 3D models.
- **Games and messaging application** Games provide performing and interactive experiences, while messaging applications enable real-time communication through text, voice, and video, **Email software , Social media apps**

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