UNIVERSITY MAY 8, 1945 GUELMA
FACULTY OF MATHEMATICS, COMPUTER SCIENCES, PHYSICS AND CHEMISTRY
COMPUTER SCIENCE DEPARTMENT

FIRST YEAR COMPUTER ENGINEER
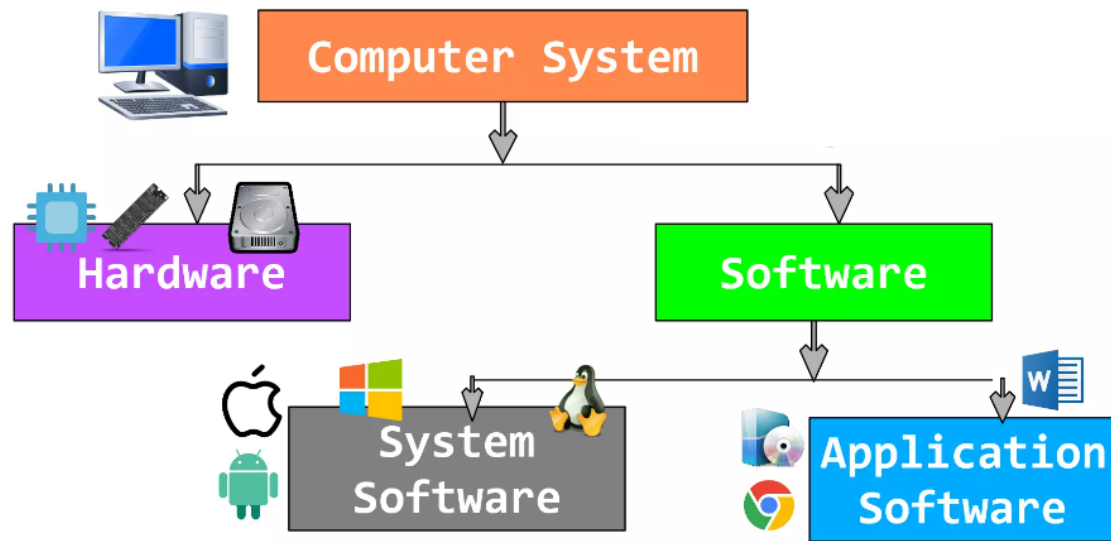**SEMESTER 1: INTRODUCTION TO OPERATING SYSTEMS 1**

CHAPTER 1
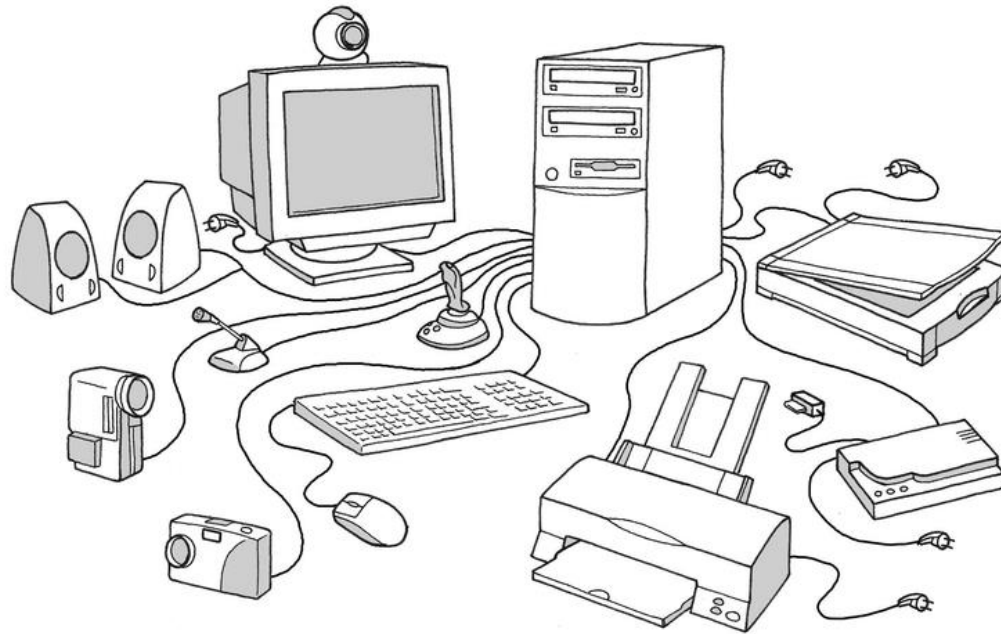# INTRODUCTION

DR FERKOUS CHOKRI

COMPUTER SYSTEM

- A computer system, often simply referred to as a computer, is a complex and integrated combination of hardware and software components designed to perform a wide range of computational, processing, storage, and communication tasks.

- It is a versatile tool used in various fields, including business, education, research, entertainment, and personal use.

HARDWARE

- Hardware includes all the devices of a computer.
- A "device" is any electronic equipment that can be connected to a computer. here are some examples

INPUT DEVICES

- Input devices are hardware components or peripherals that allow users to interact with and provide data or instructions to a computer or electronic device.

- These devices are essential for sending information into a computer system for processing.

OUTPUT DEVICES

- Output devices are hardware components or peripherals that receive data from a computer or electronic device and present it to the user in a human-readable or perceivable form.

- These devices are essential for conveying processed information and results from the computer to the user.
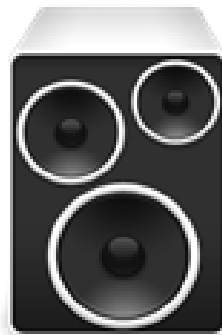
THE CENTRAL PROCESSING UNIT (CPU)

The Central Processing Unit (CPU) is the core component of a computer responsible for executing instructions and performing calculations. It processes data and manages the overall operation of the computer, including running software and managing hardware resources. CPUs come in various architectures and speeds, influencing a computer's performance.

The main manufacturers of microprocessors

- Intel, Advanced Micro Devices (AMD)
- Samsung
- STMicroelectronics
- Taiwan Semiconductor Manufacturing Company (TSMC)
- et United Microelectronics Corporation (UMC)

DATA STORAGE DEVICES

- Data storage devices are hardware components or devices used to store, manage, and retain digital data, files, and information for later retrieval and use.

- These devices play a crucial role in modern computing and data management, allowing users to store and access data efficiently.

- There are various types of data storage devices, each with its own characteristics and use cases.

  - **Hard Disk Drive (HDD)**
  - **Solid-State Drive (SSD):**
  - **USB Flash Drive, Memory Cards**
 - **Optical Discs:** Optical storage media, like CDs, DVDs
  - …

RANDOM ACCESS MEMORY (RAM)

- RAM, or Random Access Memory, is a type of computer memory that serves as the primary working memory for a computer or electronic device. It is a volatile memory, which means that it temporarily stores data that the computer is actively using or processing while the device is powered on. When the device is turned off or restarted, the data stored in RAM is erased, making it different from non-volatile storage devices like hard drives and SSDs.

VS
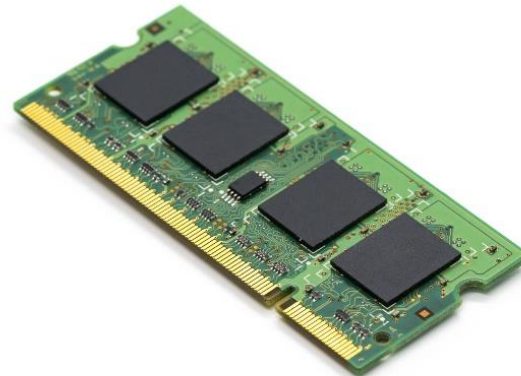
READ-ONLY MEMORY (ROM)

- ROM, or Read-Only Memory, is a type of computer memory that stores data permanently or semi-permanently.

- Unlike RAM (Random Access Memory), which is volatile and loses its data when the computer is powered off, ROM retains its data even when the power is turned off.

- ROM is used for storing essential firmware and instructions that are required for the proper operation of electronic devices, including computers, game consoles, smartphones, and embedded systems.

ROM vs RAM

GRAPHICAL CARD

- A graphical card, often referred to as a graphics card or GPU (Graphics Processing Unit), is a hardware component in a computer that is responsible for rendering and displaying graphics, images, and videos on a monitor or display device. It is a critical component for computers, especially those used for gaming, graphics design, video editing, and other graphics-intensive tasks.

- Common graphics card manufacturers include NVIDIA and AMD, both of which produce a wide range of GPUs catering to different performance levels and price points. Graphics cards are a critical component for modern computers, enabling them to handle graphics-intensive tasks and deliver high-quality visuals for various applications.

COMPUTER PORT

- In computer hardware, a port serves as an interface between the computer and other computers or peripheral devices.

- *Examples*:

  Serial

  Parallel

  Hdmi

  VGA

  USB

  RJ45

  PS2

SOFTWARE

- Software refers to a collection of computer programs and instructions that tell a computer how to perform specific tasks or functions.

  - It is a non-tangible component of a computer system and plays a critical role in enabling hardware components to perform various operations and tasks.

- Software can be categorized into two primary types:
 1. System Software
  2. Application Software
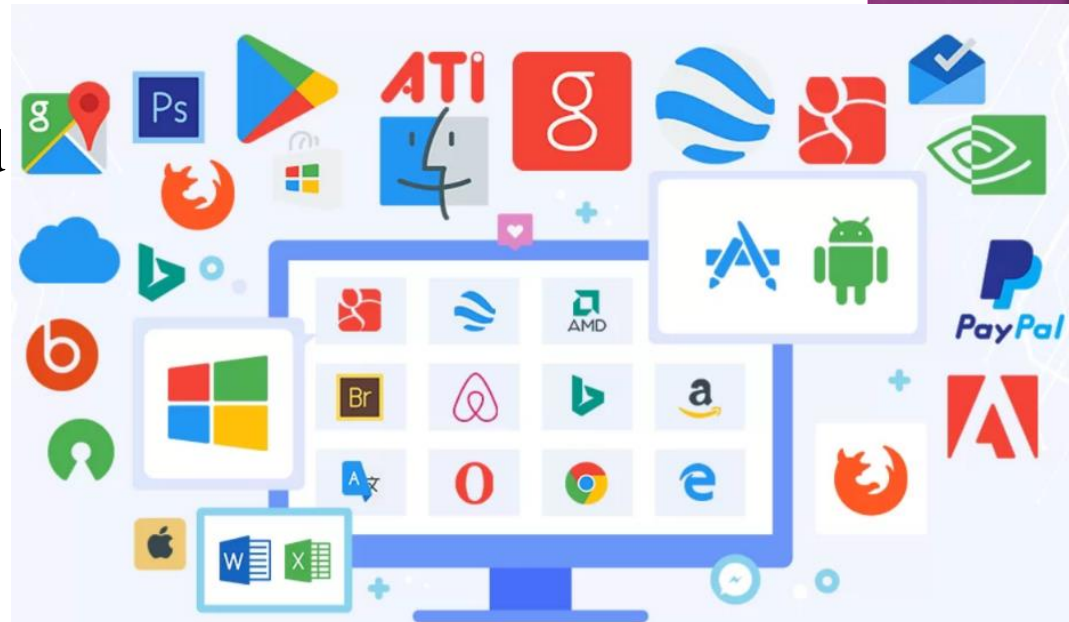
SYSTEM SOFTWARE

- **Operating System (OS)**: The operating system is a fundamental piece of system software that manages hardware resources, provides services to software applications, and serves as an interface between the user and the computer. Common operating systems include Windows, macOS, Linux, iOS, and Android.

- **Device Drivers:** Device drivers are software components that enable communication between the operating system and hardware devices, ensuring they work correctly. Examples include graphics card drivers, printer drivers, and sound card drivers.

- **Utilities:** System utilities are tools that assist in managing and maintaining a computer system. Examples include disk cleanup tools and system monitoring utilities.

APPLICATION SOFTWARE

Application software, often referred to simply as "applications" or "apps," are programs designed to perform specific tasks or functions for the user. This category includes a wide range of software, such as word processors, web browsers, spreadsheet programs, graphics editors, and video games.

HISTORY OF COMPUTERS

The ENIAC (Electronic Numerical Integrator and Computer) was the first electronic programmable computer built in the U.S.
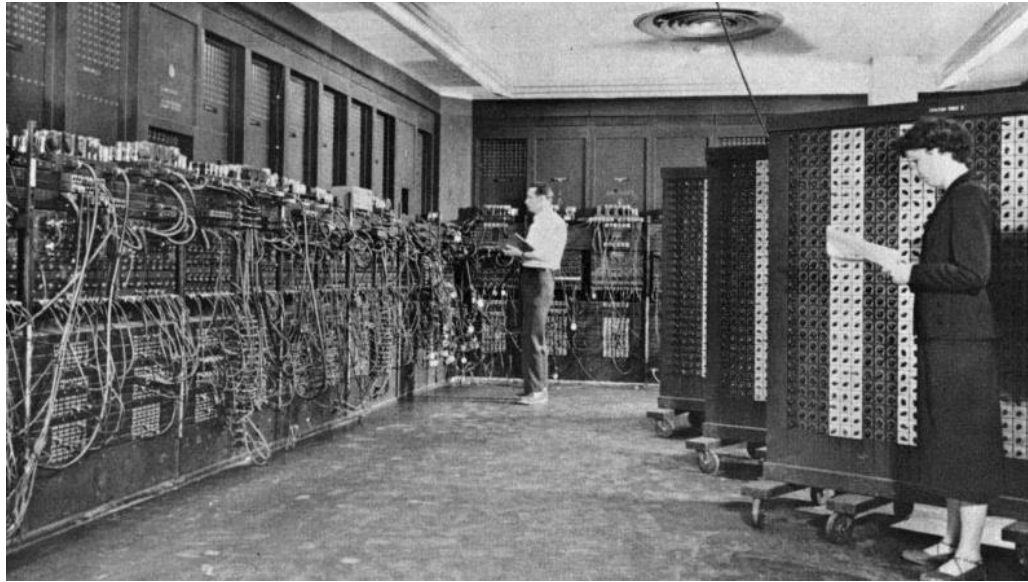
It combined the high speed of electronics with the ability to be programmed for many complex problems.

➢ It could add or subtract 5000 times a second, a thousand times faster than any other machine.

➢ It also had modules to multiply, divide, and square root. High speed memory was limited to 20 words (about 80 bytes).

HISTORY OF OPERATING SYSTEM

The arrival of transistors and punched cards in the 1960s marked the beginning of operating systems, allowing better computer management and much more computing flexibility.

➢ Historically, the first computer managed by an operating system (OS) was marketed in 1951

➢ The first generation of modern operating system was UNIX. It was developed in 1969 by Ken Thompson and Dennis Ritchie at AT&T Bell Labs.

➢ Unix was developed as a multi-user, multi-tasking operating system and has been widely used in science and research.

➢ We cite also Apple-DOS 3.1 (1978),MSDOS (1981).

HISTORY OF FREE OPERATING SYSTEM

- The GNU project was launched in September 1983 by Richard M. Stallman to create a complete operating system which is Free Software.

- Software development work started the following January.

Today we have several Free Software operating systems which respect the users' freedom by giving everybody the right to use, study, share, and improve the software for any purpose.

HISTORY OF FREE OPERATING SYSTEM

The Free Software Foundation (FSF) is a non-profit organization founded by Richard Stallman on October 4, 1985, to support the free software movement,

From its founding until the mid-1990s, FSF's funds were mostly used to employ software developers to write free software for the GNU Project.

FSF FREE SOFTWARE FOUNDATION

HISTORY OF FREE OPERATING SYSTEM

Minix is born: In the early 1980s, computer science professor Andrew S. Tanenbaum created a small Unix-like operating system called Minix. Minix was developed as an educational tool and the source code was made available to students.

Linux is born: In 1991, a 21-year-old student named Linus Torvalds began working on a new operating system he named Linux. Linus used the code of Minix as a starting point for his own projects. He also drew heavily on Unix design principles.

Release of Linux 0.01: In September 1991, Linus released the first version of his Linux called Linux 0.01.
It was a command-line operating system and was freely distributed.
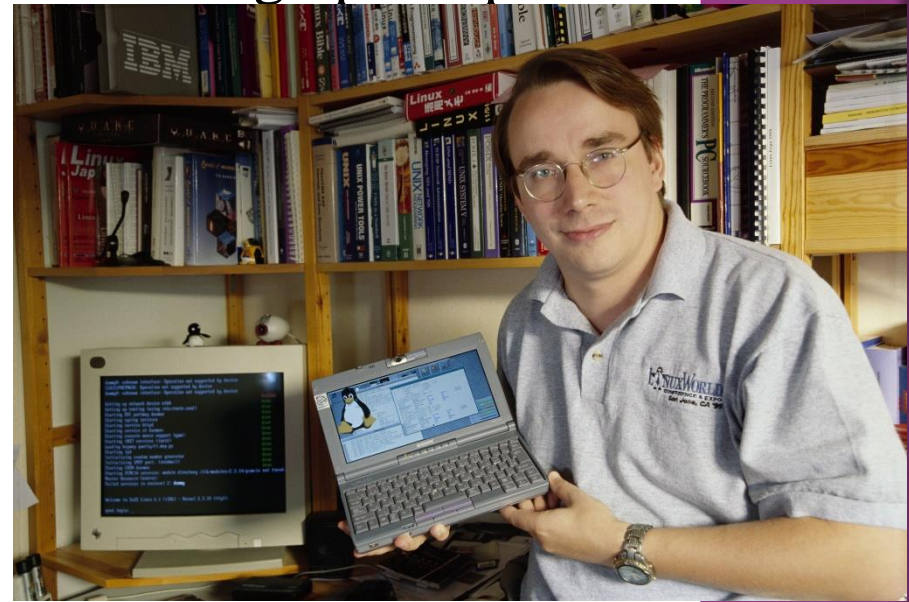
HISTORY OF FREE OPERATING SYSTEM

Linux community development: In the years that followed, Linux quickly gained popularity among programmers and enthusiasts. A community of developers began to form around Linux, contributing to the development of the operating system by writing code, filing bug reports, and providing feedback.

Enterprise Adoption: In the late 1990s and early 2000s, the open-source nature of Linux made it more flexible, cost-effective, and more secure than proprietary operating systems such as Windows, making it a popular choice for enterprises and businesses. started being hired by companies. This increased acceptance led to the development of commercial support and services for Linux.
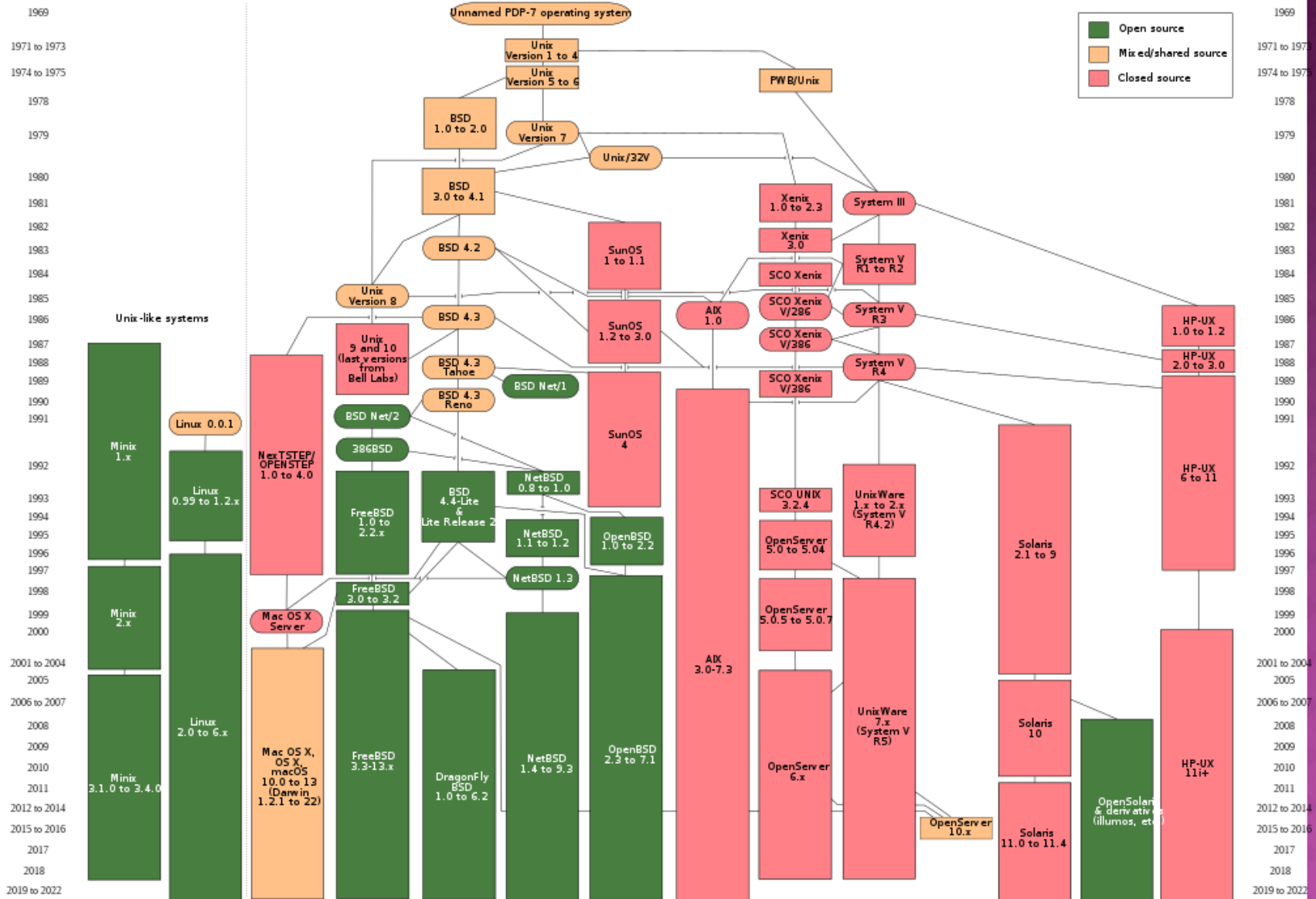
HISTORY OF FREE OPERATING SYSTEM

Linux Distribution Growth: As Linux became more popular, various groups of developers began creating their own versions of the operating system, called distributions. Some of the most popular distributions are Red Hat, Debian, and Ubuntu. These distros contain the Linux kernel and a number of his packages of easy-to-use tools and software that make using his Linux easy for both developers and end users.

Linux in the Enterprise: With the growth of cloud computing, Linux continues to gain traction in the enterprise. Linux is now widely used as an operating system for servers, mainframes, and supercomputers. It's also used in embedded systems, mobile devices...

Linux in the Consumer Market: Linux has also entered the consumer market with the advent of Linux-based mobile devices, smart TVs, and other consumer electronics.

HISTORIQUE

HISTORY OF OPERATING SYSTEM

- We will also note the Android OS, based on the Linux kernel. It was initially intended for digital cameras but was immediately offered free of charge to mobile phone manufacturers, who were free to add an overlay to the Android OS.

- Today, therefore, we reference four main OS / Linux, Microsoft Windows, Apple IOS and Google Android. But there are hundreds of them.

COMPUTER SYSTEM ARCHITECTURE
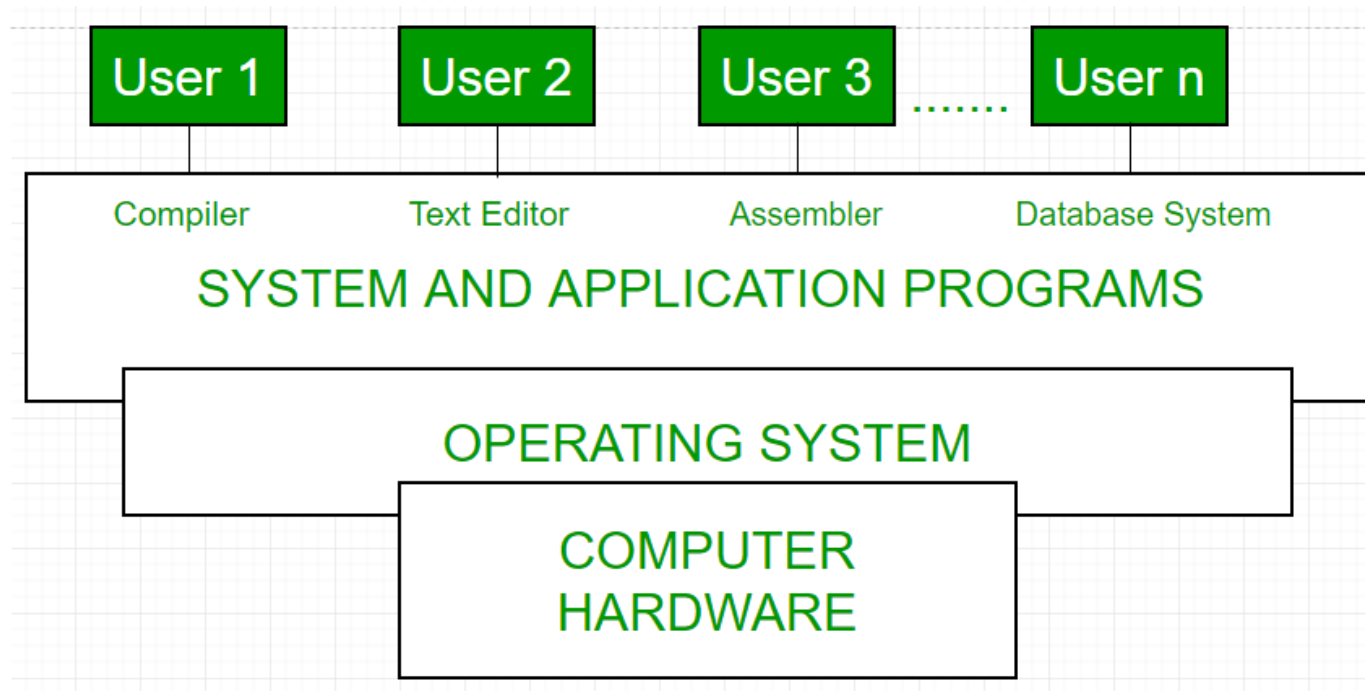
An operating system or OS is system software that works as an interface between hardware components and end-user. It enables other programs to run. Each computer system, whether it is desktop, laptop, tablet, or smartphone, all must have an OS to provide basic functionalities for the device.

OPERATION SYSTEM (OS)

An operating system consists of:

1. A kernel: Kernel is a computer program that is a core or heart of an operating system.

- Kernel is the core part of an OS; hence it has full control over everything in the system. Each operation of hardware and software is managed and administrated by the kernel.

- It acts as a bridge between applications and data processing done at the hardware level. It is the central component of an OS.

- It is the part of the OS that always resides in computer memory and enables the communication between software and hardware components.

System Utilities | Libraries | GUI

Kernel

Operating system

Hardware
CPU(s), Memories, devices...
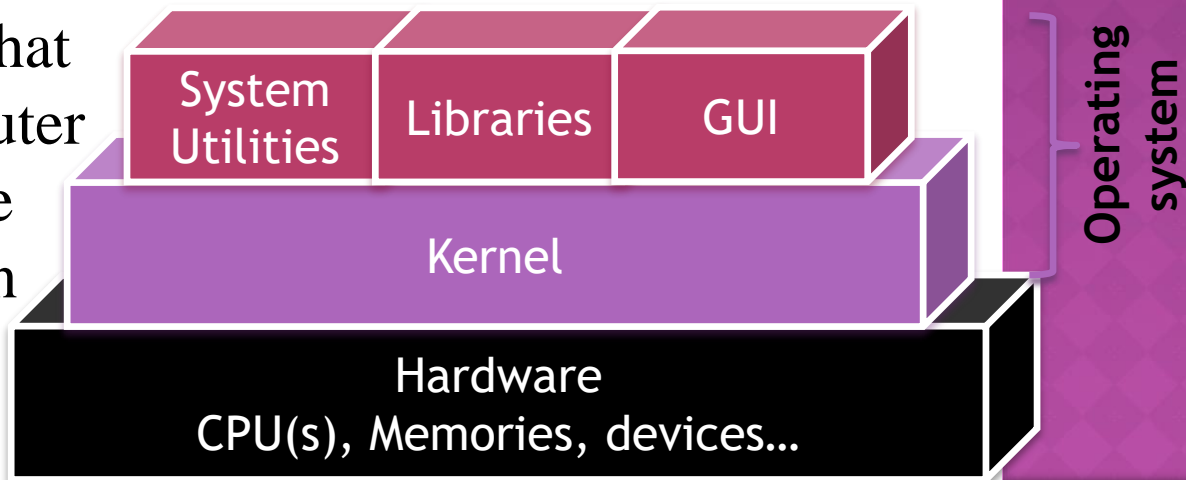
OPERATION SYSTEM (OS)

- It is the computer program that first loaded on start-up the system (After the bootloader). Once it is loaded, it manages the remaining start-ups. It also manages memory, peripheral, and I/O requests from software. Moreover, it translates all I/O requests into data processing instructions for the CPU. It manages other tasks also such **as memory management, task management, and disk management**.

- A kernel is kept and usually loaded into separate memory space, known as protected Kernel space. It is protected from being accessed by application programs or less important parts of OS.
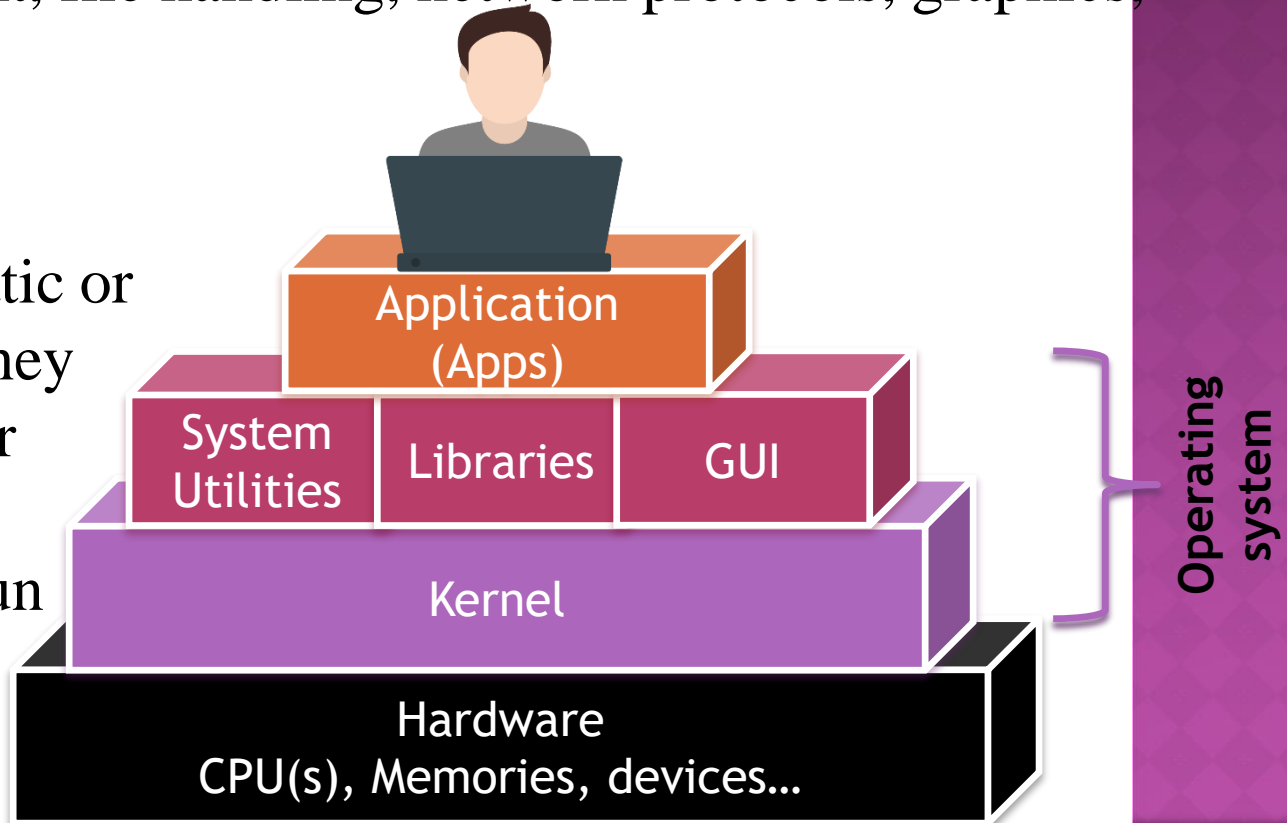
System Utilities	Libraries	GUI
Kernel		
Hardware CPU(s), Memories, devices…		

Operating system
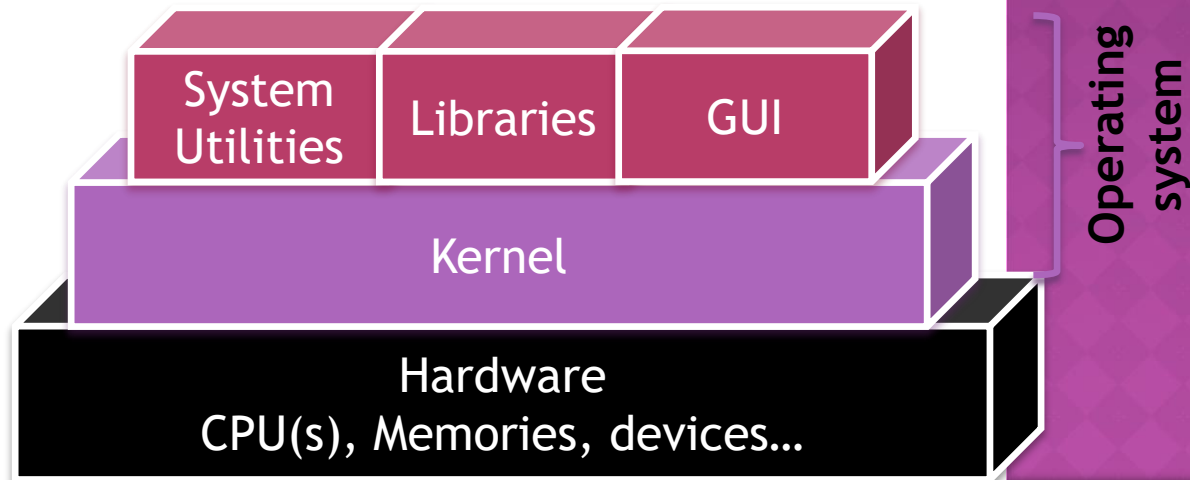
2. System tools, libraries and Graphical user interface (GUI): part allowing the user to take advantage of the OS, manage peripherals, configure them, etc.

Libraries are collections of reusable code that provide common functions and features for your operating system, such as memory management, file handling, network protocols, graphics, and so on.

Libraries can be static or dynamic, meaning they can be linked to your operating system at compile time or at run time.

Application (Apps)

System Utilities | Libraries | GUI

Kernel

Hardware
CPU(s), Memories, devices...

Operating system

FUNCTIONS OF A KERNEL

- A kernel of an OS is responsible for performing various functions and has control over the system. Some main responsibilities of Kernel are given below:

Device Management

To perform various actions, processes require access to peripheral devices such as a mouse, keyboard, etc., that are connected to the computer. A kernel is responsible for controlling these devices using device drivers.

Here, a **device driver** is a computer program that helps or enables the OS to communicate with any hardware device.

A kernel maintains a list of all the available devices, and this list may be already known, configured by the user, or detected by OS at runtime.

FUNCTIONS OF A KERNEL

- **Memory Management**
  The kernel has full control for accessing the computer's memory. Each process requires some memory to work, and the kernel enables the processes to safely access the memory.

- **Resource Management**
  One of the important functionalities of Kernel is to share the resources between various processes. It must share the resources in a way that each process uniformly accesses the resource.

FUNCTIONS OF A KERNEL

- **Accessing Computer Resources**
  A kernel is responsible for accessing computer resources such as RAM and I/O devices. RAM is used to contain both data and instructions. Each program needs to access the memory to execute and mostly wants more memory than the available. For such a case, Kernel plays its role and decides which memory each process will use and what to do if the required memory is not available.

- The kernel also allocates the request from applications to use I/O devices such as keyboards, microphones, printers, etc.

END OF CHAPTER 1