# Module 4 - System Software

# System Software

End users also use system software. **System software** works with end users, application software, and computer hardware to handle the majority of technical details.

- For example, system software controls where a word processing program is stored in memory, how commands are converted so that the system unit can process them, and where a completed document or file is saved.
- system software is a not a single program. It is a collection or a system of programs that handle hundreds of technical details with little or no user intervention.

There are four types of programs:

- **Operating Systems**
  - Coordinate computer resources, provide an interface between users and the computer, and run applications.
- **Utilities**
  - Perform specific tasks related to managing computer resources.
- **Device Drivers**
  - Specialized programs that allow particular input or output devices to communicate with the rest of the computer system.
- **Language Translators**
  - Convert the programming instructions written by programmers into a language

    that computers understand and can process.

# Operating Systems

## Overview

- A collection of programs that handle technical details related to using a computer
- Most important type of computer program
- Essential for the functioning of a computer

## Importance

- Without a functioning operating system, a computer would be useless

# Functions of an Operating System

| Function | Description |
| --- | --- |
| Managing Resources | Operating systems coordinate all the computer's resources, including memory, processing, storage, and devices such as printers and monitors. They also monitor system performance, schedule tasks, provide security, and start up the computer. |
| Providing User Interface | Operating systems allow users to interact with application programs and computer hardware through a user interface. Most operating systems use a graphical user interface (GUI) or voice assist tools. |
| Running Applications | Operating systems load and run applications such as word processors and spreadsheets. Most operating systems support multitasking, or the ability to switch between different applications running in memory. |

# Features of an Operating System

- Warm and Cold Boot
    - **Warm boot:** Restarting the computer while it's already on
    - **Cold boot:** Starting the computer that has been turned off
- Graphical User Interface (GUI)
    - **Desktop:** A place that provides access to computer resources
    - **Icons:** Graphic representations for a program, type of file, or function
    - **Pointer:** Controlled by a mouse, trackpad, or touch screen, used to select items such as an icon
    - **Windows:** Rectangular areas for displaying information and running programs
    - **Menus:** List of options or commands that can be selected
    - **Tabs:** Divide menus into major activity areas
    - **Dialog boxes:** Provide information or request input
    - **Help:** Online assistance for operating system functions and procedures
    - **Gesture control:** Ability to control operations with finger movements such as swiping, sliding, and pinching
- Files & Folders
    - **Files:** Used to store data and programs.
    - **Folder:** Related files are stored within a folder, used for organizational purposes.

- Folders can contain other folders or subfolders.

# Categories of Operating Systems

There are three main categories of operating systems: embedded, stand-alone, and network.

1. **Embedded Operating Systems:** These operating systems are used in small electronic devices such as cell phones, tablets, video game systems, and others.
   - They are known as **real-time operating systems (RTOS)** and are designed to work exclusively with a particular device's hardware.
   - They are typically designed for a specific application and are essential for the evolution of IoT, where many everyday devices are able to communicate
     with each other.
   - For example, Watch OS was developed by Apple for the Apple Watch.
2. **Stand-Alone Operating Systems:** These operating systems are used in a single desktop or laptop computer.
   - Also called desktop operating systems, they are located on the computer's hard disk.
   - Desktop computers and laptops that are part of a network work with the network to share and coordinate resources.
   - Popular stand-alone operating systems include Apple's macOS and Microsoft's Windows.
3. **Network Operating Systems:** These operating systems are used to control and coordinate computers that are linked or networked together.
   - These networks can range in size from a few computers in an office to large
     networks that span an entire company or university.
   - A network operating system can be composed of several smaller networks and many types of computers.
   - The network operating system is typically located on one of the connected computers' hard disk, known as the network server, which coordinates all communication between the other computers.
   - Popular network
     operating systems include Linux, Windows Server, and UNIX.

The operating system is often referred to as the **software environment** or **software platform**.

- A computer's platform dictates what applications will ron that device.

# Mobile Operating Systems

**Mobile operating systems**, also known as **mobile OS**, are a type of embedded operating system.

- These mobile operating systems are less complicated and more specialized for wireless communication.

# Desktop Operating Systems

- The most widely used desktop operating systems are:
  - Windows
  - MacOS
  - UNIX
  - Linux

# Windows

Microsoft's Windows is the most widely used personal computer operating system.

- More application programs have been developed to run under Windows than any other operating system.

# MacOS

- First arrived with the introduction of the Macintosh personal computer in 1984.
- Designed to only run with Apple computers.
- Recognized as one of the most innovative operating systems.
- iOS and iPadOS mobile operating systems are based off the macOS.

# UNIX and Linux

- UNIX OS was originally designed in the late 1960s to run on minicomputers in network environments.
- Widely used by servers on the web, mainframe computers, and very powerful personal computers.
- Linux is an OS that extended one of the UNIX versions.
- Google's Chrome OS and Android are based on Linux.
  - Chrome OS integrates with web servers to run applications and to perform other
    traditional operating system functions. This capability has made Chrome OS a
    popular choice for inexpensive notebook computers that use cloud computing and cloud storage to do things that would normally require much more expensive hardware.
    - One limitation of these computers is that their efficiency is dependent
      upon the speed of their Internet connection.

# Virtualization

**Virtualization** can be used to support multiple operating systems on a single physical computer.

When a single computer runs a special program known as **virtualization software**, it operates as though it were two or more separate and independent computers, known as **virtual machines**.

- The operating system of the physical machine is known as the **host operating system**.
- The operating system for each virtual machine is known as the **guest operating system**.
- Two programs that can create and run virtual machines:
  - Parallels
  - VMware

# Utilities

Utilities are specialized programs designed to make computing easier, especially in cases where things happen such as files or apps go missing ,storage space fills up, or data is lost.

The most essential utility programs are:

- **Search Programs**
- **Storage Management Programs**
- **Backup Programs**
- **Antivirus Programs**
- **Troubleshooting** or **Diagnostic Programs**
- **Virtual Assistants**

# Operating System Utilities

Most operating systems have several common utility programs:

- A search program
- A storage management program
- A backup program

# Utility Suites

Utility suites coming several programs into one package. Some examples:

- Bitdefender
- Norton

# Careers in IT

**Computer support specialists** provide technical support to customers and other users.

- They may also be called technical support specialist or help-desk technicians.
- Computer support specialists manage the everyday technical problems faced by computer users.

- They resolve common networking problems and may use troubleshooting programs to diagnose problems.

# Autonomic Computing

Autonomic computing is a computing model that allows machines to run with little human intervention. It has the potential to revolutionize the way we interact with computers.

The Cloud and Autonomic Computer Center is the leading research group devoted to developing self-healing computers. This center includes:

- The National Science Foundation
- Leading universities (such as the University of Arizona and Texas Tech University)
- Industry leaders (such as Mitsubishi and Dell).

Their objective is to free businesses and individuals from time-consuming computer maintenance by developing systems that are self-maintaining and virtually invisible to the user.

- Autonomic processes in machines are modeled after human autonomic processes (such as the autonomic system that automatically controls our breathing)
- Autonomic computing systems are **not** artificial intelligence systems.
  - They are limited to reacting to their own systems, and have limited capability to learn from experience to correct errors.
  - Artificial intelligence is being used more and more with them.

Researchers at MIT are working on **neuromorphic computer chips** that compute using an architecture like a brain, with neurons and synapses.

- They intend to use resistive computing, a process that uses analog voltagers to store and computed data, instead of the digital method used today that is limited to binary values.
  - This also allows the chip to handle artificial intelligence tasks much more efficiently than today's hardware.