Chapter 1

Computer System

1.1 Computer definition

- A computer is a device that receives **input**, processes that input, and then produces the **output**.
- A computer consists of two main components: **hardware** and **software**.

1.2 Hardware and Software

Hardware

Definition:

- The physical components that make up a computer system.
- Hardware can be **External** or **Internal**.

External Hardware

Definition:

Devices that are external and normally visible to the user.

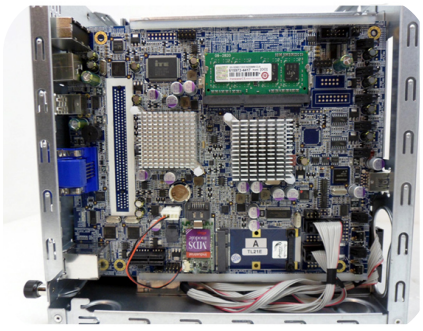
Examples:

Mouse, keyboard, monitor, printer, scanner, etc.

Internal Hardware

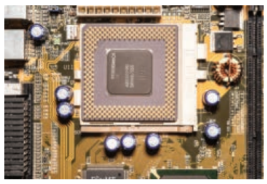
Definition:

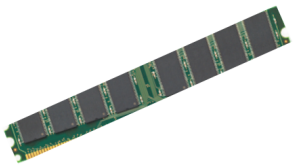
Devices that exist inside the computer and are not normally visible to the user.



Examples:

- CPU/Processor
- Motherboard
- RAM
- ROM
- Graphics Card
- Sound Card
- Internal HDD/Internal SSD

Motherboard: 

RAM: 

ROM: 

Graphics card: 

Sound card: 

SSD: 

HDD: 

Motherboard allows the processor and other computer hardware to communicate with each other.

Software

Definition:

- **Programs** for:
  - Controlling the operation of a computer system
  - Processing of electronic data
- There are two types: **Applications** and **System**.

Applications Software

Definition and Main Purpose:

Programs that provide the services that the **user** requires to solve a task.

Examples:

- Word processor
- Spreadsheet
- Database management system
- Graphics editing
- Video editing
- Audio editing
- Apps and applets

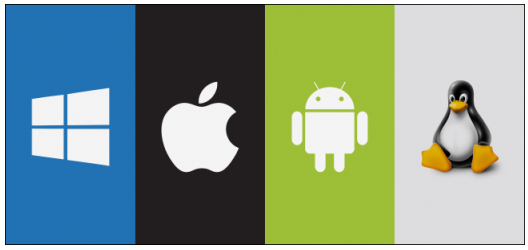
Apps refer to programs that run on **smartphones** or **tablets**.

System Software

Definition and Main Purpose:

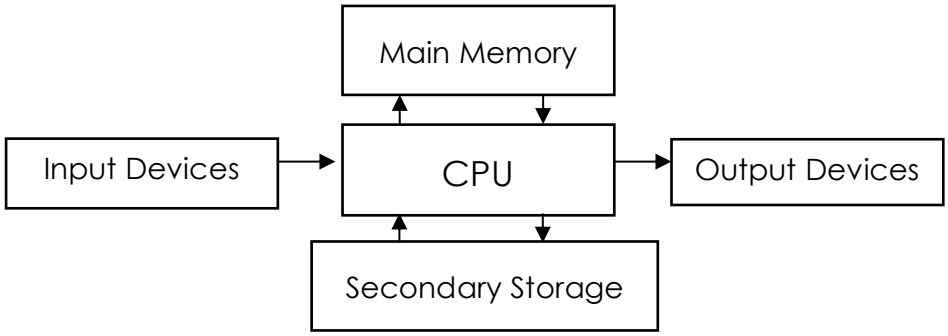
Programs that provide the services that a **computer** requires to run properly.

Examples:



- Operating System (OS)
- Device Driver
- Compiler
- Linkers
- Utilities (for example, Anti-virus)

1.3 Computer's main hardware components



Central Processing Unit (CPU)

Definition and Main Purpose:

Hardware that processes instructions to produce an output.

Purpose and roles:

- Controls all computer operations
- Controls the input and output devices
- Controls the movement of data within the computer
- Executes instructions sent from the hardware and software
- Carries out calculations
- Makes logical decisions

CPU contains **Control Unit** and **Arithmetic Logic Unit (ALU)**

Control Unit

Part of the CPU that controls the interactions between the different parts of the CPU.

Arithmetic Logic Unit (ALU)

Part of the CPU that performs calculations and logical decisions.

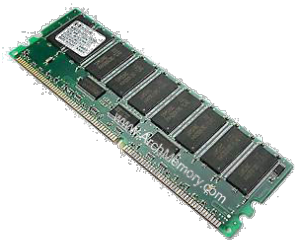
Main Memory

Definition/Main Feature/Main Characteristic:

Internal memory that is **directly accessible by the CPU**.

> **Main Memory** can be referred to as **Primary Memory** and **Internal Memory.**

Random Access Memory (RAM)



Definition and characteristics/features:

- **Volatile** memory
- Temporary storage
- Can read from and written to

Purpose:

Used to store:

- Instructions that are **currently in use**
- Software **currently in use**
- Data that is **currently in use**
- Parts of the operating system that are **currently in use**

> **Volatile** means that if the computer's power is turned off, the contents of RAM are lost.

Read Only Memory (ROM)

Definition and characteristics/features:

- **Non-volatile** memory
- Permanent storage
- Can only be read from but not written to

Purpose:

Used to **permanently** store **start-up instructions** when the computer is first switched on (for example, BIOS).

> **BIOS (Basic Input/Output System)** is a program that carries out a hardware check to find out if all the devices are present and whether they are functional.

The following table summarizes the differences between RAM and ROM:

RAM	ROM
Volatile memory	Non-volatile memory
Temporary storage	Permanent storage
Can be written to and read from	Can only be read from but not written to
Used to store data, software, instructions or parts of the operating system that are **currently in use**	Stores **permanently** the **start-up instructions** when the computer is first switched on
Tends to have greater storage capacity	

Backing storage

Definition and characteristics/features:

- **Non-volatile** storage
- Stores data permanently
- Not directly accessed by the CPU, **so it's slower to access than the main memory**

Purpose:

- For **permanent** storage of files and software
- To store data that is **not currently required by the CPU**
- To store data to transfer it to another computer

Input devices

Definition and characteristics/features:

- A device that sends data to a computer for processing
- The devices are under the control of the user
- Their design is more complex than output devices

Purpose:

- Sends data to a computer for processing
- Turn input into a form the computer can understand

Output devices

Definition and characteristics/features:

- A device that receives data from the computer
- Devices are under the control of the computer
- Their design is less complex than input devices

Purpose:

Displays the results of processed data.

The following table summarizes the differences between Input and Output devices:

Input Devices	Output Devices
An input device sends data to a computer for processing	An output device receives data from the compute
Used to turn input into a form the computer can understand	Devices used to display the results of processed data
Input devices are under the control of the user	Output devices are under the control of the computer
Design is more complex	Design is less complex

1.4 Operating systems

Definition and Main Purpose:

A piece of system software that allows the user to communicate with the computer hardware and perform many basic tasks.

Functions of the operating system:

- Provides a **user interface**
- Manages user accounts
- Managing peripherals
- Memory management
- Provides system security

User interfaces

Command Line Interface (CLI)

Definition:

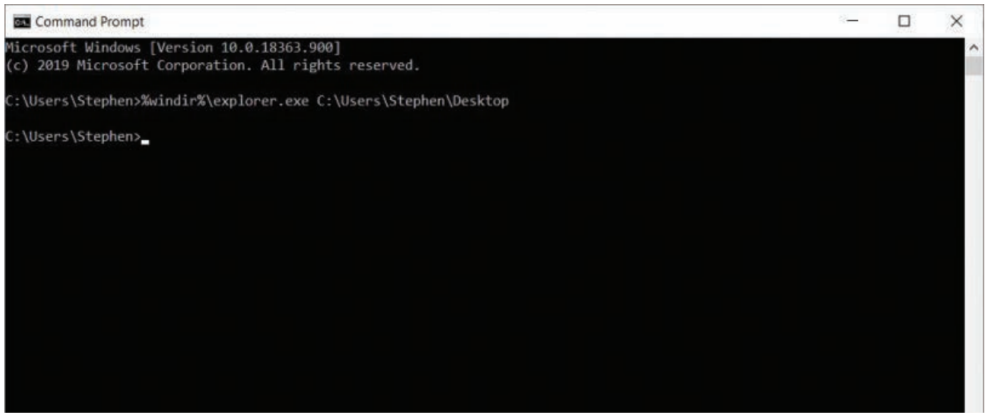
An interface in which the user would have to type **commands** to interact with the computer.

Advantages of using CLI:

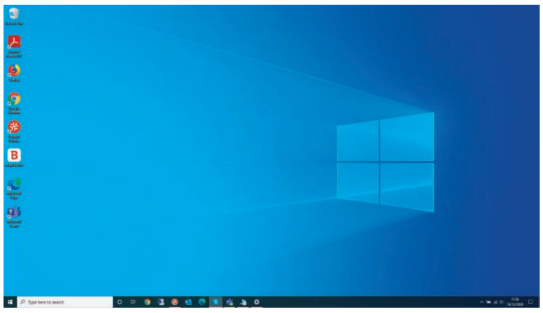
- Uses less memory than the GUI
- Requires less processing power than GUI
- The user is not limited to pre-determined options as with the GUI

Disadvantages of using CLI:

- Commands must be learned and memorized by the user
- Commands must be typed in exactly
- More prone to errors in data entry
- Commands must be typed, which takes time



Graphic User Interface (GUI)



Definition:

- Interface built around graphical items
- It uses a **WIMP system (windows, icons, menus, and pointer)**

Features of GUI:

- **Windows:** Regions of the screen used to display data
- **Icons:** Small pictures that are used to represent folders, software, etc.
- **Menus:** Lists of options the user can select from
- **Pointer:** An arrow used to navigate the screen and select things on the screen

Advantages of using GUI:

- No need to memorize any commands
- More user-friendly than CLI (can be used by non-experts)
- No need to type in commands, so fewer errors are made
- It uses a WIMP system
- The use of pointer and icons is quicker and simpler than typing in commands

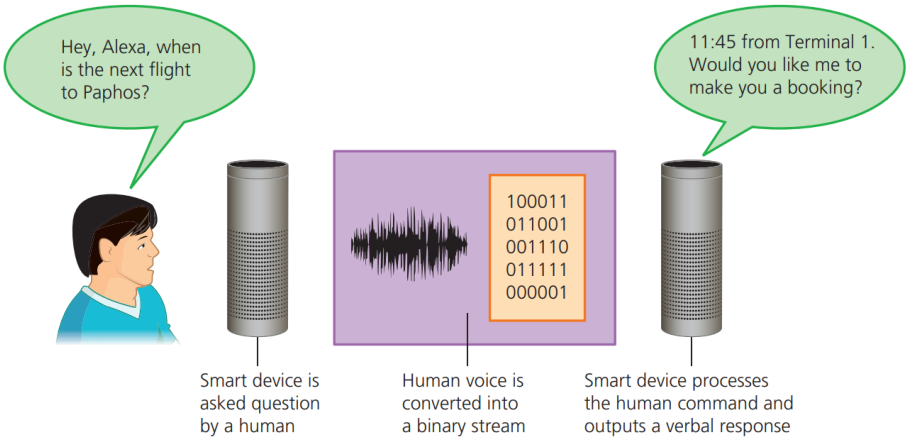
Disadvantages of using GUI:

- GUI consumes more memory than CLI (due to graphics)
- GUI requires more processing power than CLI (due to graphics)
- The user is limited to the icons and set menus provided on the screen
- Computer settings are protected from the user

Dialogue-based interface

Definition:

- Software that interacts through speech recognition
- Uses spoken words to carry out actions



Advantages:

- No need for a driver to take their hands off the steering wheel
- Safer than using a standard interface
- In a home, it is very useful for people with disabilities
- Can be used as a security feature, as voice recognition could be used to identify a person

Disadvantages:

- Can be complex to set up
- Expensive to develop
- The user needs to know which commands can be used
- Unreliable as many commands are not being recognized or need to be repeated several times
- Can be distracting if the commands are not understood
- Limited access due to the number of commands stored
- Need to be 'trained' by the user

Gesture-based interface

Definition:

- Where the human body interacts with the device
- Where a human gives a command …
- … without using a keyboard/mouse/pointing device

Advantages:

- Replaces mechanical input devices
- No physical contact required
- Very natural interface for a human operator
- No training is needed to interface with the computer

Disadvantages:

- User can unintentionally activate the device by moving their arms/fingers
- Not as accurate as other interfaces
- Only works near the camera or sensor
- May only accept a limited number of movements
- Must remember the gestures
- Must learn the gestures accurately otherwise, they may not be identified
- Users with physical disabilities may not be able to make the gestures

1.5 Types of Computers

Desktop computers

Advantages of using desktop computers:

- Less chance of being stolen compared to mobile computers
- Tends to have better specifications for a given price than mobile computers
- Easier to upgrade compared to mobile computers

Disadvantages of desktop computers:

- Not very portable
- Larger **footprint** than other types of computers
- They need a constant power supply so they can't be used in case of a power cut

> **Footprint** refers to the physical space that a device consumes.

Uses of desktop computers:

- Office and business work
- Educational use
- Used as a gaming device
- General entertainment

Mobile computers

Definition:

A group of computers that are **more portable** than desktop computers.

Examples:

- Laptop computers
- Tablets
- Smartphones
- Phablets

Main uses of mobile computers:

- Communication
- Office and business work
- Educational use
- Used as a gaming device
- General entertainment
- Used to control devices remotely

Examples of uses of mobile devices for communication:

- Make/receive phone calls
- Text messaging
- Instant messaging
- Video calls
- Surfing the internet
- Sending and receiving emails
- Streaming of music/videos

Laptop computers

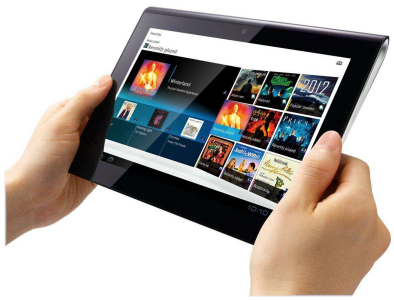
Advantages of laptops:

- Lightweight to aid portability
- Smaller footprint compared to desktop computers
- Low power consumption
- Low heat generation
- Has a built-in battery, so it can be used if there's a power cut

Disadvantages of laptops:

- As they are more portable, they are easier to lose/steal compared to desktop computers
- It is not always possible to upgrade them

Tablets



Advantages of tablets:

- Very fast to switch on
- Lightweight to aid portability (more than laptops)
- Small footprint (less than laptops)
- Uses touchscreen technology, which is **simple to use**
- Has a built-in battery, so it can be used if there's a power cut
- Low power consumption (less than laptops)
- Low heat generation (less than laptops)

Disadvantages of tablets compared to laptops:

- Tends to have less storage capacity than laptops and desktop computers
- Easier to lose than laptops and desktop computers
- Typing on a touchscreen can be slower and harder compared to a standard keyboard
- Supports fewer types of file formats than laptops and desktop computers

Smartphones

Advantages of smartphones:

- Lightweight to aid portability (more than laptops and tablets)
- Small footprint (less than laptops and tablets)
- Easier to use while on the move (more than laptops and tablets)
- Can make use of 3G/4G/5G communication links
- Has a built-in battery, so it can be used if there's a power cut
- People are more likely to have a smartphone with them than other types of computers

Disadvantages of smartphones:

- It is much easier to lose a smartphone than other types of computers
- Tends to have less storage capacity compared to laptops and desktop computers
- Small keyboards make typing slower and more difficult compared to laptops and desktop computers

Phablet

Definition:

- A computer that is a hybrid between a tablet and a smartphone
- A tablet that functions as a smartphone
- The device size is between a smartphone and a tablet

Phablets have all the features of a typical smartphone and a tablet!

Characteristics of computers are their advantages and disadvantages.