FUTM-CPT 122: Introduction to Computer Hardware Systems and Maintenance

Module 2: Computer Hardware Components

Unit 1: Introduction to Different Parts of a Computer System

Module 2

Computer Hardware Components

Unit 1: **Introduction to Different Parts of a Computer System**

Unit 1

Introduction to Different Parts of a Computer System

Contents

1.0 Introduction

Having established a solid foundation in understanding the basics of computer systems and the types of software that drive them, we now turn our attention to the physical components that make up a computer. This unit, "Introduction to Different Parts of a Computer System," will delve into the hardware elements that are crucial for the functioning of a computer.

A computer is a complex machine composed of various parts, each serving a specific purpose and working in harmony to perform a wide range of tasks. Understanding these components is essential for anyone interested in computer hardware, troubleshooting, maintenance, or assembly.

2.0 Learning Outcomes

In this unit, you will explore the primary hardware components of a computer, including:

- Central Processing Unit (CPU): The brain of the computer
- Motherboard: The main circuit board that houses the CPU, memory, and other essential components.
- Memory (RAM and ROM): used for storing temporary and essential firmware and system instructions.
- Storage Devices: used for retaining data and applications.
- Power Supply Unit (PSU): Converts electrical power into a usable form for the computer.
- Input and Output Devices: allow users to interact with the computer and receive output.
- Expansion Cards: Additional cards that enhance the computer's capabilities.

By the end of this unit, you will have a comprehensive understanding of these hardware components, their functions, and how they interconnect to form a fully operational computer system. This knowledge is fundamental for anyone looking to build, upgrade, or maintain computer systems, ensuring they can diagnose issues and optimise performance effectively.

3.0 Learning Contents

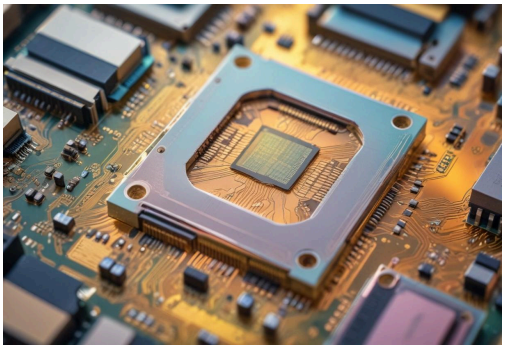
3.1 Overview of Internal and External Hardware Components

Understanding the various components that make up a computer system is essential for anyone interested in computer hardware, troubleshooting, or maintenance. Each part plays a crucial role in the computer's overall functionality, contributing to its performance and capabilities. In this unit, we will explore these fundamental hardware components, discussing their functions, characteristics, and importance in the seamless operation of a computer system.

Now, let's delve into the different parts of a computer system:

3.1.1 Central Processing Unit (CPU)

The Central Processing Unit (CPU), often referred to as the brain of the computer, is the primary component responsible for executing instructions and processing data. It performs the essential operations required to run programs and manage system tasks.



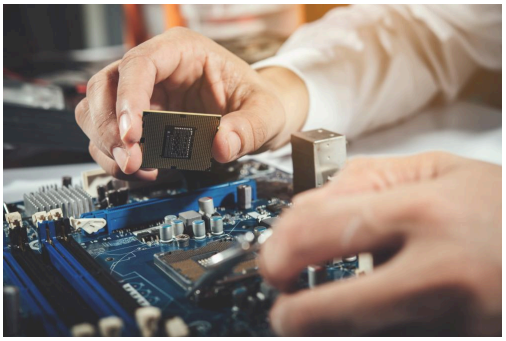


Figure 2.1: Central Processing Unit

3.1.1.1 Components of the CPU

1. **Control Unit (CU):** directs the operation of the processor. It tells the computer's memory, arithmetic/logic unit, and input and output devices how to respond to a program's instructions.
2. **Arithmetic Logic Unit (ALU):** Performs arithmetic and logical operations, such as addition, subtraction, and comparison.

3. **Registers and Cache:** Temporary storage areas that hold data and instructions the CPU needs during processing. The cache is a smaller, faster memory that stores copies of frequently accessed data from the main memory.

3.1.1.2 CPU Performance

1. **Clock Speed:** Measured in gigahertz (GHz), it indicates how many cycles per second the CPU can execute, affecting how quickly instructions are processed.
2. **Cores and Threads:** A core is an individual processing unit within the CPU. Modern CPUs often have multiple cores (dual-core, quad-core, etc.), enabling them to handle multiple tasks simultaneously. Threads are the smallest sequence of programmed instructions that can be managed independently by a scheduler.
3. **CPU Architecture:** refers to the design of the CPU, including the set of instructions it can execute. Common architectures include ARM (used in many mobile devices) and x86 (commonly used in PCs).

3.1.2 Motherboard

The motherboard is the main circuit board in a computer. It serves as the central hub that connects and allows communication between all other components and peripherals.

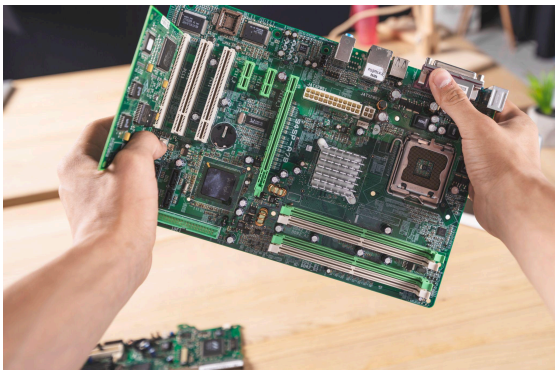


Figure 2.2: Motherboard

3.1.2.1 Key Components on the Motherboard

The key components on the motherboard include:

1. **Chipset:** The chipset is a silicon backbone that acts as the communication hub, facilitating data flow between different hardware components.
2. **BIOS/UEFI:** BIOS/UEFI is a firmware that initializes and tests hardware during the booting process and provides runtime services for the operating system. They define a new method by which OSes and platform firmware communicate, providing a lightweight BIOS alternative that uses only the information needed to launch the OS boot process.
3. **Slots:** Slots on the motherboard refer to the connectors where various expansion cards can be inserted to enhance or add functionality to the computer. Some slots include:
    a. **PCIe (Peripheral Component Interconnect Express):** Slots for adding expansion cards like GPUs, sound cards, and network cards.
    b. **RAM slots:** This slot acts as a connector for installing memory modules.

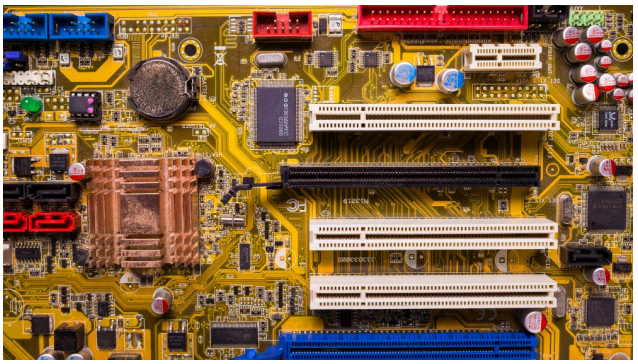


Figure 2.3: Slots on the motherboard

4. **Ports:** Ports are the inputs or connection points where components plug in, including the rear ports at the back of a computer. Some ports include;
    a. **USB (Universal Serial Bus):** For connecting peripherals like keyboards, mice, and storage devices.
    b. **HDMI (High-Definition Multimedia Interface):** This port is for connecting monitors and other display devices.
    c. **Ethernet:** This port is used for network connectivity.

Figure 2.4: Ports on the motherboard

5. **Form Factors:** This is the physical size and shape of the motherboard, which determines the case size it fits into. The common form factors include:
    a. ATX (Advanced Technology eXtended)
    b. MicroATX
    c. Mini-ITX

Figure 2.5: CPU Case

3.1.3 Memory (RAM and ROM)

3.1.3.1 RAM (Random Access Memory)

RAM is utilized for temporary data storage during computer operation. It enables rapid reading and writing of data, supporting the seamless functioning of applications and system processes. Increased RAM capacity enhances multitasking abilities and

boosts performance, particularly in memory-intensive activities such as gaming and video editing. Various types of RAM are available, with DDR4 and DDR5 being the most prevalent, with DDR5 providing superior speeds and performance.

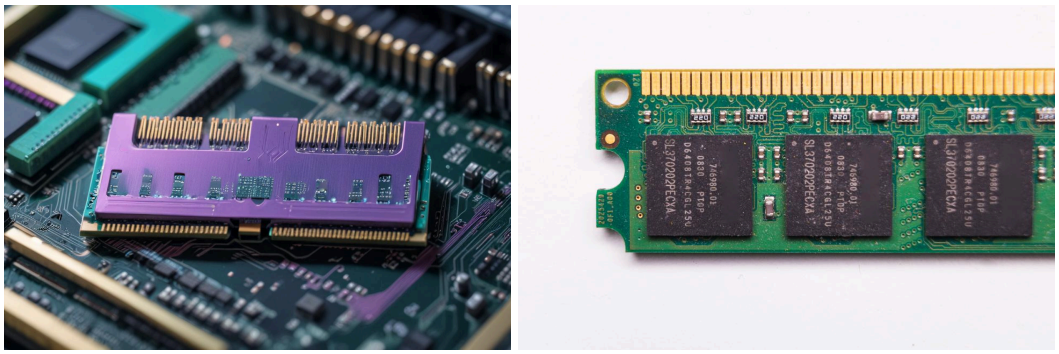


Figure 2.6: RAM

3.1.3.2 ROM (Read-Only Memory)

The ROM stores essential firmware and system instructions that are not lost when the computer is powered off. It is crucial for booting up the system. An example is the BIOS/UEFI firmware, which initialises hardware during startup and provides a runtime environment for the operating system.

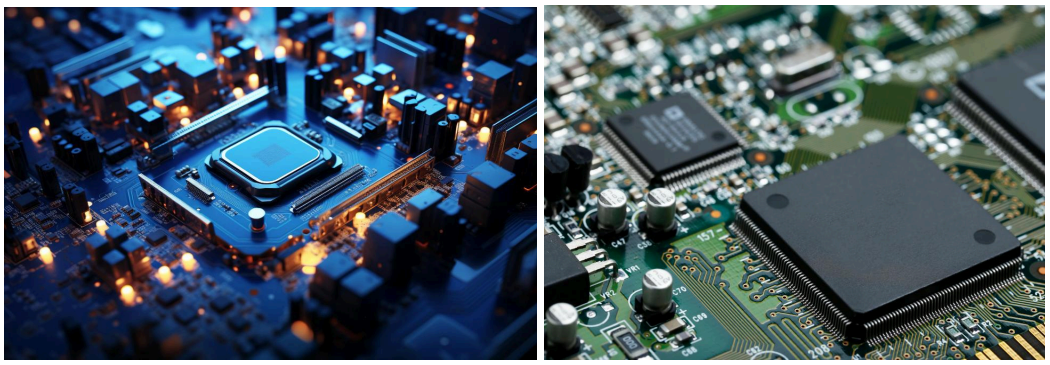


Figure 2.7: ROM

3.1.4 Storage Devices

Storage devices are used for the long-term storage of data. The types of storage devices include:

1. **Hard Disk Drives (HDD):** These are the traditional storage devices that use spinning disks to read/write data. They offer large storage capacities at lower costs.

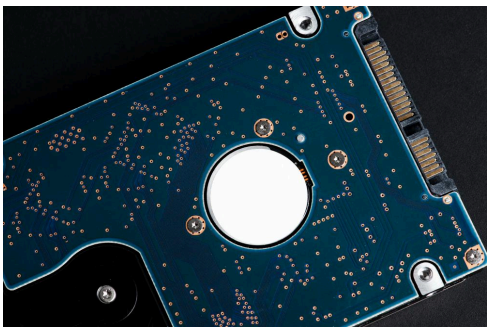


Figure 2.8: Hard Disk Drives

2. **Solid-State Drives (SSD):** These are the modern storage devices that use flash memory to store data, providing faster read/write speeds and better performance than HDDs.

Figure 2.9: Solid-State Drives (SSD)

3. **Hybrid Drives (SSHD):** These combine the large storage capacity of HDDs with the speed of SSDs by using a small amount of solid-state storage to cache frequently accessed data.

Figure 2.10: Hybrid Drives (SSHD)

These storage devices need to connect to and interface with the computer. These storage interfaces include;

1. **SATA (Serial ATA):** This is the common interface for connecting HDDs and SSDs to the motherboard.
2. **NVMe (Non-Volatile Memory Express):** This is an advanced interface for SSDs that offers higher data transfer speeds by connecting directly to the PCIe bus.
3. **M.2:** This is a form factor for SSDs that can use either SATA or NVMe interfaces.

3.1.5 Power Supply Unit (PSU)

The Power Supply Unit (PSU) converts electrical power from an outlet into usable power for the computer's components. It distributes this power to the motherboard, CPU, GPU, and other hardware. For a simple conversion of eclectic power, some key specifications include;

1. **Wattage:** Indicates the total power output available. Higher wattage is needed for systems with more powerful components.
2. **Efficiency Ratings:** Indicate how effectively the PSU converts power. Ratings include 80 Plus Bronze, Silver, Gold, Platinum, and Titanium, with higher ratings being more efficient.

Figure 2.11: Power Supply Unit (PSU)

3.1.6 Input and Output Devices

3.1.6.1 Input Devices

These are devices that allow users to provide data and commands to the computer. Some examples include:

1. **Keyboard:** Used for typing text and commands.
2. **Mouse:** used for pointing, clicking, and navigating the user interface.
3. **Scanner:** used for digitising physical documents.
4. **Webcam:** used for capturing video and images.

3.1.6.2 Output Devices

These are devices that convey information from the computer to the user. Some examples include:

1. **Monitor:** used to display visual output from the computer.
2. **Printer:** used to produce physical copies of digital documents.
3. **Speakers:** used to output sound from the computer.

3.1.6.3 Combination Devices

These are devices that serve both input and output functions. Some examples include:

1. **Touchscreens:** Allow users to interact directly with the display.
2. **Multifunction Printers:** Combine printing, scanning, copying, and faxing functions.

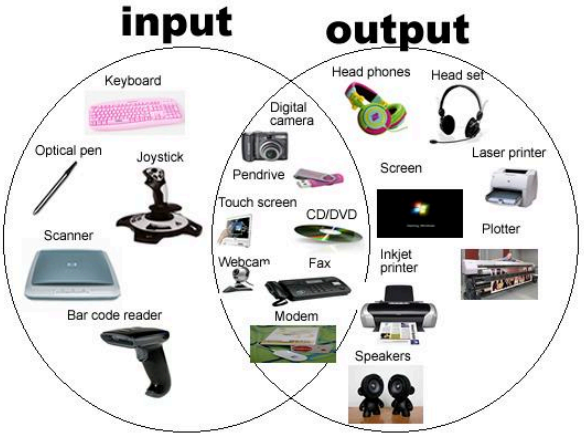


Figure 2.12: Input and Output Devices

3.1.7 Expansion Cards

Expansion cards enhance or add capabilities to a computer system, providing additional functionality that may not be available on the motherboard. Installing expansion cards involves inserting them into the appropriate PCIe slots on the motherboard. It is important to ensure compatibility with the motherboard and a sufficient power supply. Some types of expansion cards include:

1. **Graphics Cards (GPUs):** Enhance the computer's ability to render graphics, essential for gaming, video editing, and 3D rendering.
2. **Sound Cards:** Improve audio output quality and add advanced audio processing capabilities.
3. **Network Interface Cards (NICs):** Provide wired or wireless network connectivity.
4. **USB Expansion Cards:** Add additional USB ports to the computer.

Figure 2.13: Expansion Cards (black Sapphire Graphic Card)

4.0 Conclusion

In this unit, we have looked at the different hardware parts that make up a computer system.

5.0 Summary

In this unit, we explored the various hardware components that constitute a computer system. Understanding these components is fundamental for anyone

interested in computer hardware, maintenance, and troubleshooting. Here are some take homes;

1. **Central Processing Unit (CPU):** Known as the brain of the computer, the CPU executes instructions and processes data. It consists of the Control Unit (CU), Arithmetic Logic Unit (ALU), and registers and cache. CPU performance is influenced by factors such as clock speed, cores, and threads, as well as the architecture (e.g., ARM vs. x86).
2. **Motherboard:** The main circuit board, the motherboard, connects all computer components and peripherals. Key components include the chipset, BIOS/UEFI, various slots (PCIe, RAM), and ports (USB, HDMI, and Ethernet). The physical size and shape of the motherboard, known as its form factor, determine its compatibility with the computer case and other hardware.
3. **Memory (RAM and ROM):** RAM (Random Access Memory) is used for temporary data storage, enabling quick read/write operations necessary for smooth application performance. ROM (Read-Only Memory) stores essential firmware and system instructions that are retained even when the computer is powered off.
4. **Storage Devices:** We examined different types of storage devices, including Hard Disk Drives (HDDs), Solid-State Drives (SSDs), and Hybrid Drives (SSHDs). Storage interfaces like SATA and NVMe impact the speed and efficiency of data transfers. Storage capacity and performance are crucial for overall system efficiency.
5. **Power Supply Unit (PSU):** The PSU converts electrical power from an outlet into usable power for the computer's components. Key specifications include wattage and efficiency ratings (e.g., 80 Plus Bronze, Gold).
6. **Input and Output Devices:** Input devices (e.g., keyboard, mouse, scanner) allow users to provide data and commands to the computer, while output devices (e.g., monitor, printer, speakers) convey information from the computer to the user. Combination devices like touchscreens and multifunction printers serve both input and output functions.
7. **Expansion Cards:** These enhance or add capabilities to a computer system. Common types include graphics cards (GPUs), sound cards, network interface cards (NICs), and USB expansion cards. Proper installation and compatibility with the motherboard are essential for optimal performance.

By understanding these components, their functions, and how they interconnect, students are equipped with the foundational knowledge needed for further exploration of computer hardware systems and maintenance. This knowledge is essential for diagnosing issues, performing upgrades, and ensuring the efficient operation of computer systems.

6.0 Tutor-Marked Assignment (TMA)

Question 1: Define the Central Processing Unit (CPU) and explain its main components. Describe how each component contributes to the overall functioning of the CPU.

Question 2: Describe the role of the motherboard in a computer system. Identify and explain the function of at least three key components or connectors found on the motherboard.

Question 3: Compare and contrast Random Access Memory (RAM) and Read-Only Memory (ROM). Discuss their roles in a computer system and explain how they impact performance and functionality.

Question 4: Explain the differences between Hard Disk Drives (HDDs), Solid-State Drives (SSDs), and Hybrid Drives (SSHDs). Discuss the advantages and disadvantages of each type of storage device in terms of speed, capacity, and cost.