



Microsoft



Directorate General of Training

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foundation

Module - 1

Computer Fundamentals

Disclaimer

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online/offline resources and used for
educational purpose only.



Chapters for Discussion

Chapter - 1	●	Safe Working Practices
Chapter - 2	●	Introduction to Computer Components
Chapter - 3	●	Introduction to Operating System
Chapter - 4	●	Introduction to MS Office

Chapter - 2

Introduction to Computer Components

Learning Objective

By the end of this course, students will be able to:

- Understand the components and functions of a computer system.
- Distinguish between personal computers, servers, embedded systems, and supercomputers.
- Explain the differences between system software and application software.
- Identify key hardware components like the CPU, storage, and network devices.
- Explain CPU architecture and performance metrics.
- Understand various storage devices and their functions.



Introduction to Computer System

What is a Computer System?

- A computer system is an integrated collection of hardware and software designed to process data and perform a variety of tasks.

Types of Computer system:

- **Personal Computers (PCs):** Desktops, laptops, tablets.
- **Servers:** Provide services and resources to other computers over a network.
- **Embedded Systems:** Specialized computer systems built into other devices.
- **Supercomputers:** Extremely powerful systems used for complex computations and simulations.



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Software

What is Software?

Software encompasses all programs, procedures, and routines essential for the operation of a computer system.

Types of Software:

System Software

0 1

Application Software

0 2



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System Software

- Controls internal operations and manages hardware resources
- Enables communication between hardware and other software for smooth operation

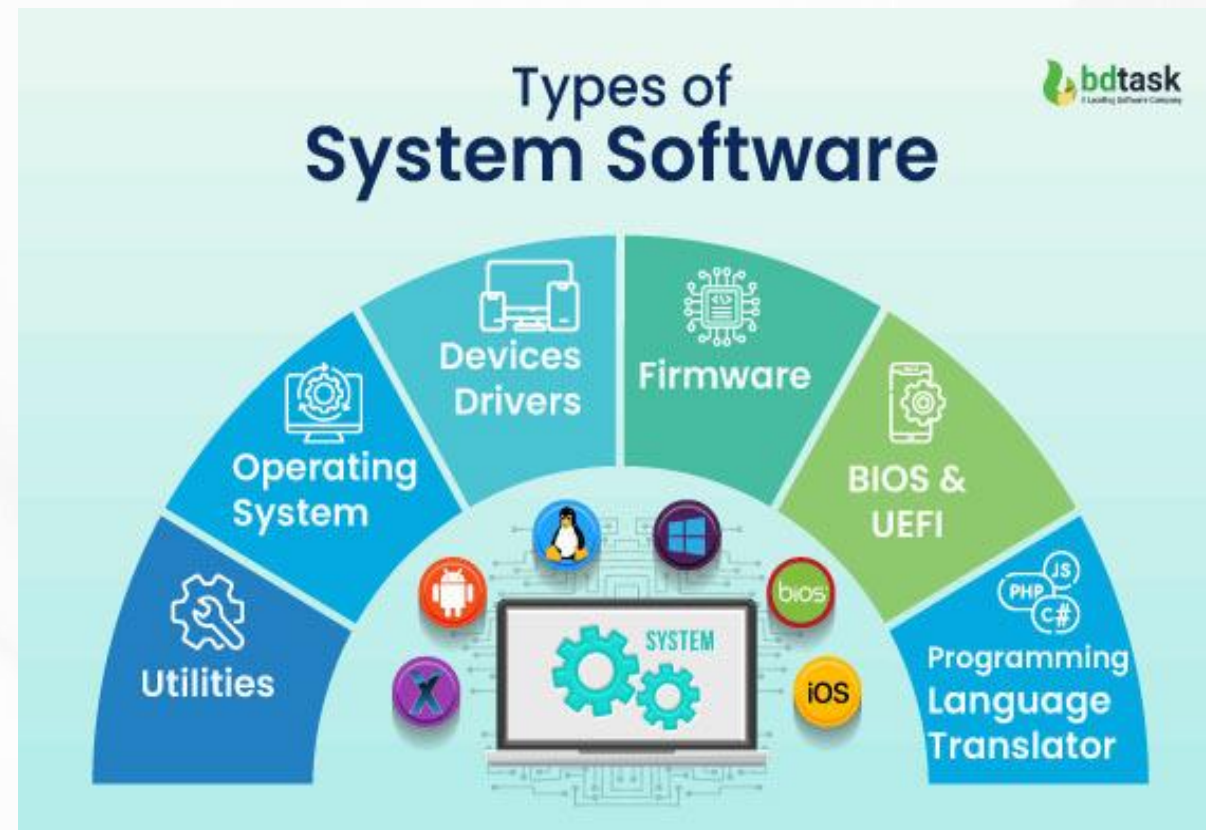
Examples:

Operating Systems

Microsoft Windows, iOS, Linux, Android, macOS X, BSD

Other

Device drivers, BIOS, machine language translators



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<https://www.bdtask.com/blog/difference-between-system-software-and-application-software>

Features of System Software

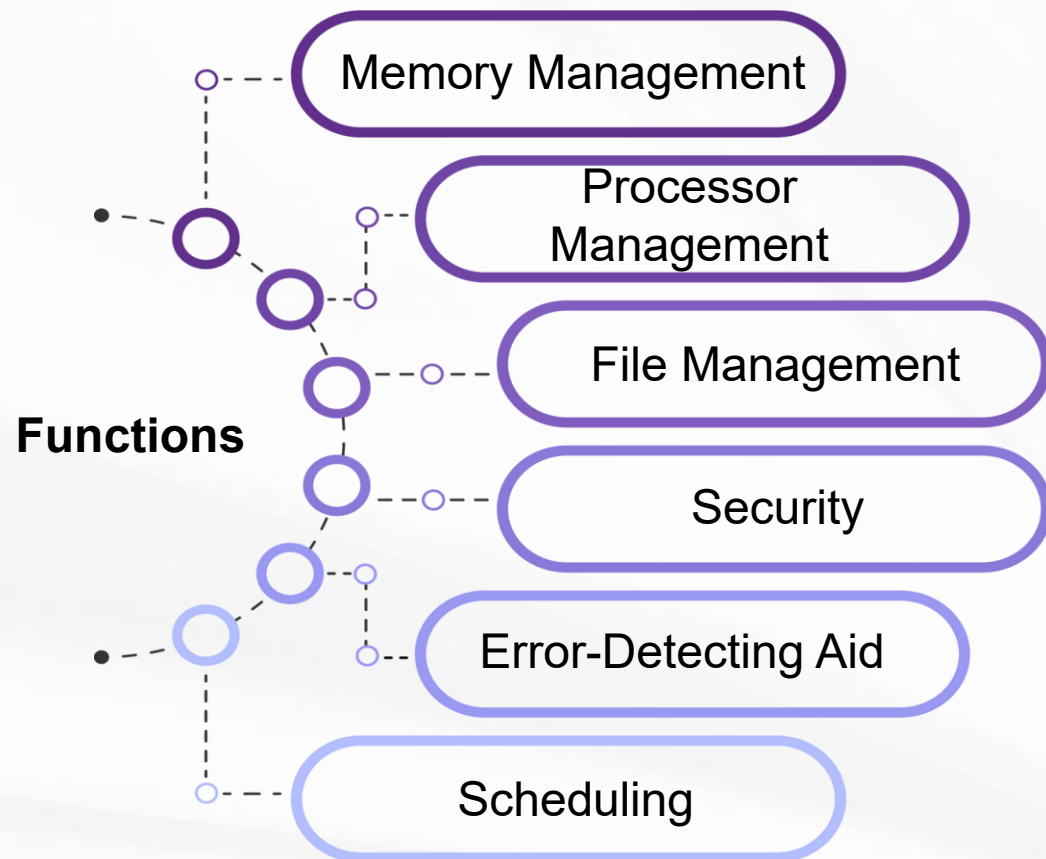
- Written in low-level language.
- Direct hardware control.
- Fast instruction execution, optimizing system performance.
- Complexity in design and comprehension due to low-level operations.
- Focuses on system operation and management and not on user interactivity.
- Bridges the gap between hardware and application software.
- Compact size, maximizing system resources.



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Functions of System Software

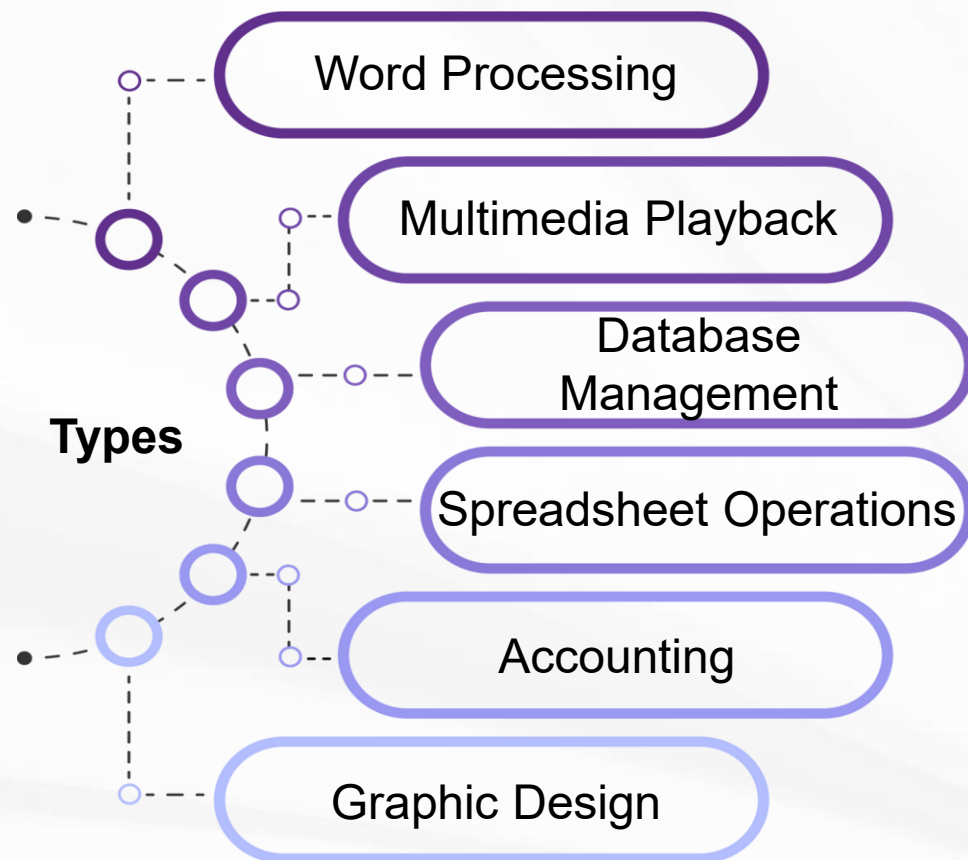
- System software plays crucial roles in managing system resources and ensuring optimal computer operation."



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Application Software

- **Function:** Executes tasks based on user commands within the system software platform
- **Goal:** Enhances user control and addresses specific needs



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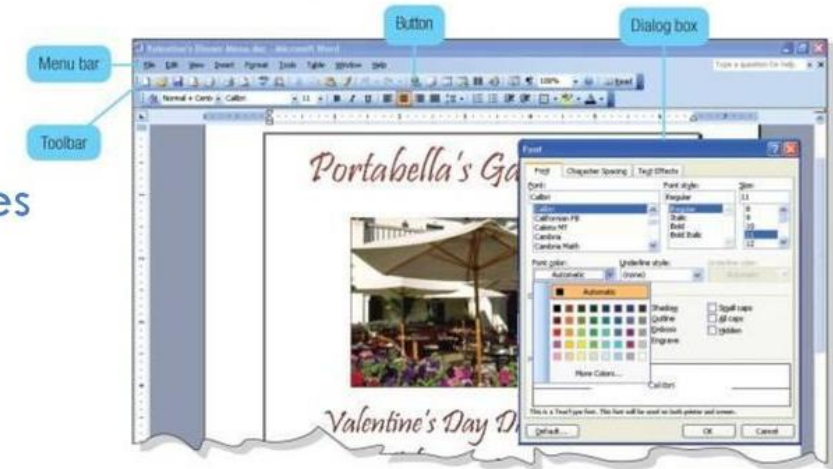
Features of Application Software

- Application software enhances user productivity and functionality with features tailored to specific tasks and user needs.

Features:

- Written in High-Level Programming Language
- Memory Intensive
- Ease of Development
- End-User Focus
- User Interaction Required
- Interface Creation
- Execution Speed

- Graphical User Interface (GUI)
- Menus
- Toolbars
- Dialog Boxes
- Icons
- Windows



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Functions of Application Software

- 01 Data Analysis and Information Storage
- 02 Document and Project Management
- 03 Communication Tools
- 04 Graphics, Animations, and Video Development
- 05 Business and Management Software



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<https://www.coderus.com/software-101-a-complete-guide-to-the-different-types-of-software/>

Difference between System software and Application Software

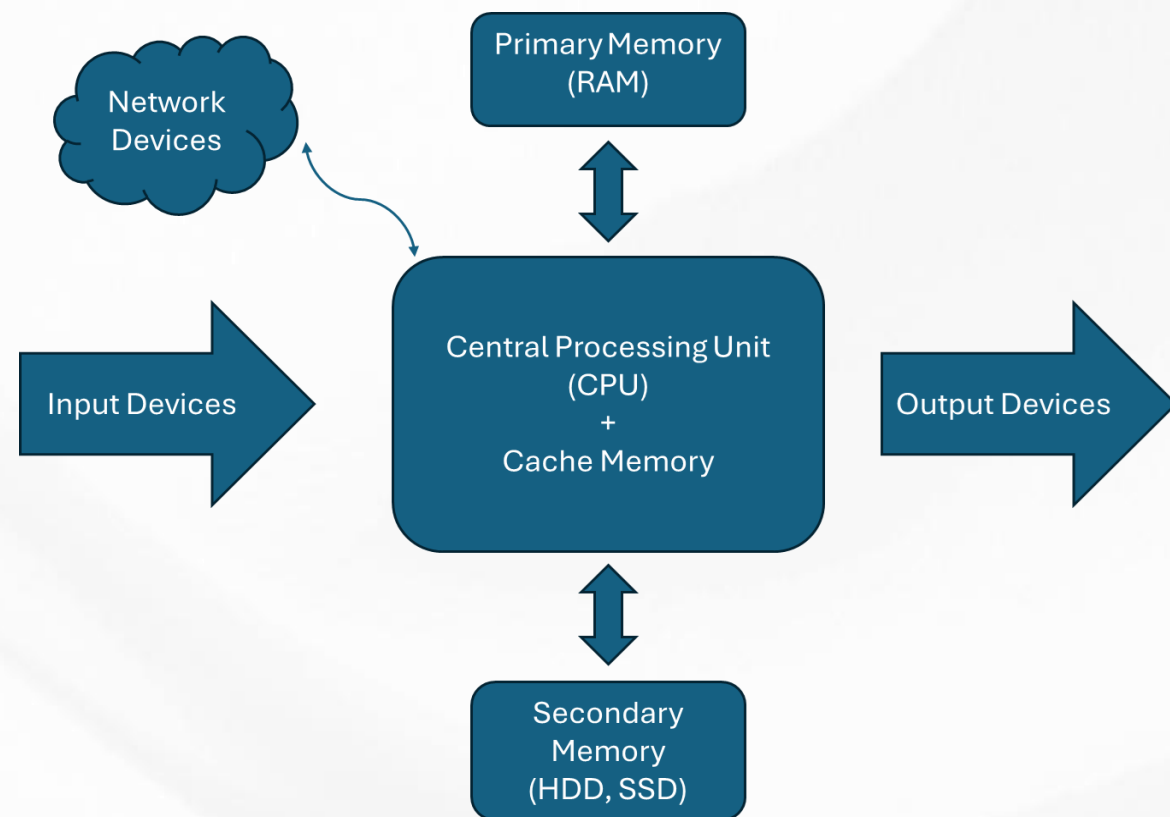
System Software	Application Software
System software is the interface between application software and system.	Application software is designed and developed for performing a specific task.
Users can't directly handle the system software.	Application software directly handled by the user.
System software installed when operating system setup.	Application software can install or uninstall after OS setup.
System software are independent, they don't need anything from application software.	Application software is dependent on System software.
System software is developed by machine or assembly language.	Maximum application software is developed with high level language.
A computer can't run without system software.	A computer can run without application software.
Some examples of system software are compiler, assembler, debugger, driver, etc.	Some examples of application software are word processor, web browser, media player, etc.

Hardware Components

The most critical hardware components of a computer system include:

- **Processor (CPU):** Executes instructions and processes data.
- **Storage devices:** Store data and software programs.
- **Networking devices:** Enable communication between computers.
- **Motherboard:** Connects and integrates all hardware components.
- **Input/output devices:** Allow user interaction and data exchange.

These elements work together to ensure the system's functionality and performance.



Hardware Components

Processor (CPU)

The central processing unit (CPU) of a computer, responsible for executing instructions from programs and performing calculations.

Key Aspects:

- **Clock Speed:** The speed at which the CPU processes instructions, measured in GHz (e.g., 3.5 GHz).
- **Cores:** Number of independent processing units within the CPU (e.g., dual-core, quad-core).
- **Threads:** Number of independent tasks the CPU can handle simultaneously (e.g., hyper-threading).
- **Architecture:** The design and structure of the CPU (e.g., x86, ARM).

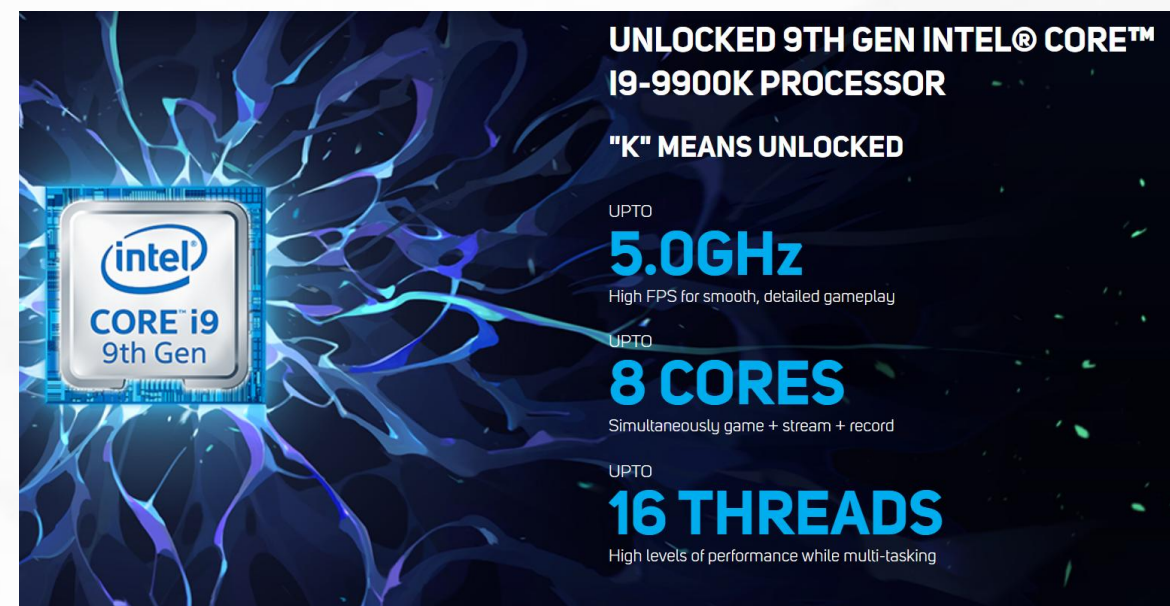


Hardware Components

Processor (CPU) (Contd...)

Key Aspects:

- **Cache:** Small, fast memory within the CPU to store frequently used data (e.g., L1, L2, L3 cache).
- **TDP (Thermal Design Power):** The amount of heat the CPU generates and how much cooling it requires, measured in watts.
- **Fabrication Process:** The size of the transistors used in the CPU, measured in nanometers (e.g., 7nm, 10nm).
- **Instruction Set:** The set of commands the CPU can execute (e.g., x86-64, ARMv8).
- **Integrated Graphics:** Built-in GPU within the CPU for handling graphics tasks without a dedicated graphics card.
- **Socket Compatibility:** The physical interface between the CPU and the motherboard (e.g., LGA1200, AM4).



Hardware Components

Processor (CPU) (Contd...)

Types of Processors based on Purpose:

- **Desktop Processors:** Designed for personal computers, balancing performance and power consumption.
- **Mobile Processors:** Used in laptops and mobile devices, optimized for energy efficiency and thermal management.
- **Server Processors:** High-performance CPUs for servers, offering multiple cores and threads for handling large workloads.
- **Embedded Processors:** Used in specialized devices like IoT devices, automotive systems, and industrial applications.



Desktop Processors



Mobile Processors



Server Processors



Embedded Processors

Hardware Components

Processor (CPU) (Contd...)

Types of Processors based on Purpose :

Workstation Processors

High-end CPUs for professional use, such as video editing, 3D rendering, and scientific computations.

Gaming Processors

Optimized for high performance in gaming applications, often with higher clock speeds and multiple cores.

Low-Power Processors

Designed for devices where battery life is critical, like smartphones and tablets.



Workstation Processors



Gaming Processors



Low-Power Processors

Hardware Components

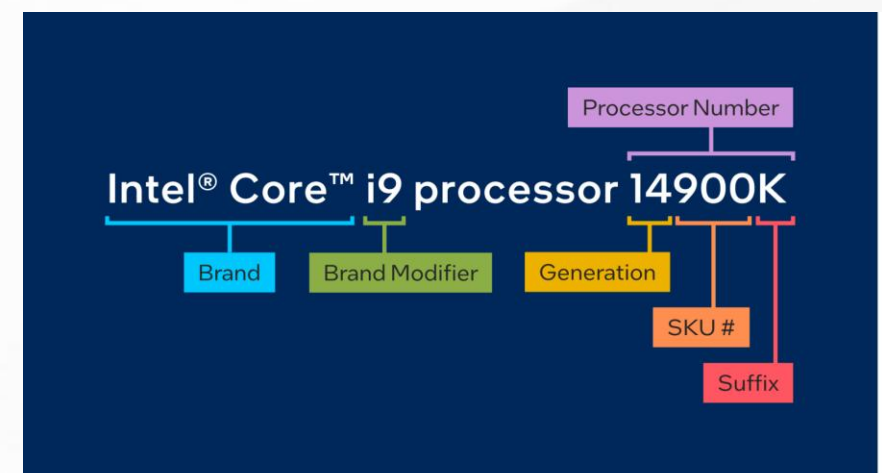
Processor (CPU) (Contd...)

Naming Convention of Processors:

Processor names typically include a combination of brand, product line, generation, and model number.

Intel Processors:

- **Brand:** Intel® Core™
- **Brand modifier:** i9
- **Processor number:** 14900
- **Suffix:** K
- The first digit or two in the processor number denotes the architectural generation.
- The digits following the generation number—900—comprise the SKU number.
- The letter following the SKU designates the processor as part of a series



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<https://www.intel.com/content/www/us/en/processors/processor-numbers.html>

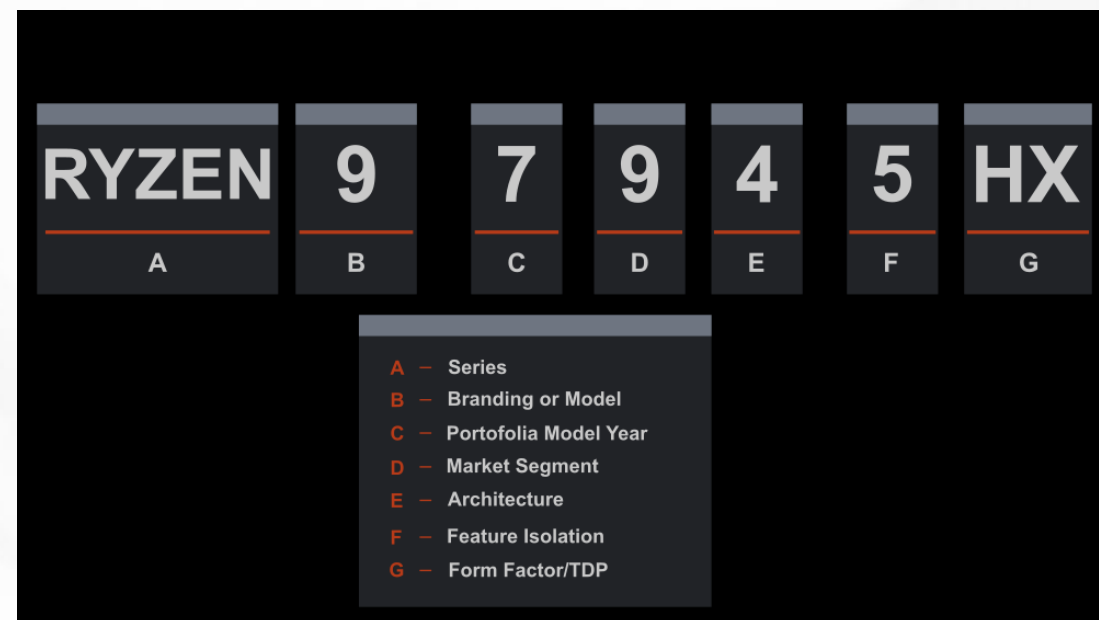
Hardware Components

Processor (CPU) (Contd...)

Naming Convention of Processors:

AMD Processors:

- **Model Year:** The first digit indicates the model year (e.g., 7 for 2023).
- **Market Segment:** The second digit shows performance level (e.g., 6 for high performance).
- **Architecture:** The third digit represents the architecture (e.g., 4 for Zen 4).
- **Feature Isolation:** The fourth digit differentiates similar architectures (e.g., 0 or 5).
- **Form Factor/TDP:** The suffix indicates the form factor and TDP (e.g., U for ultra-low power).



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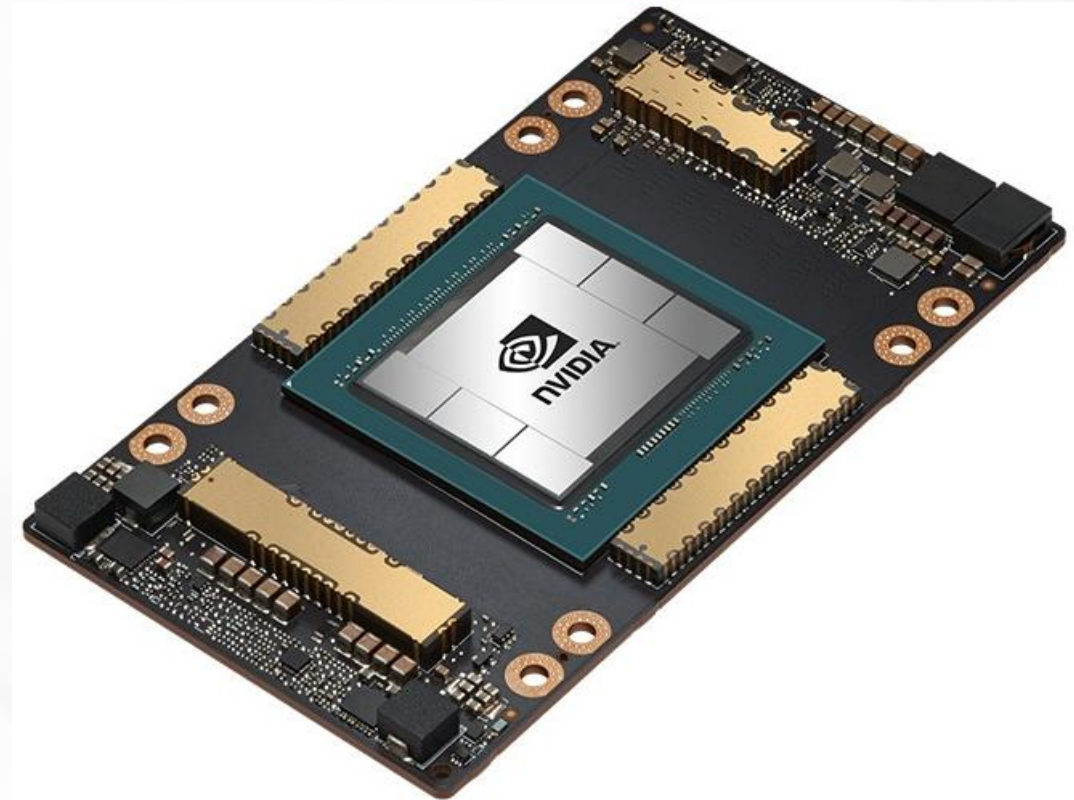
Hardware Components

Graphical Processing Unit (GPU)

A GPU accelerates rendering of images, animations, and video, excelling in parallel processing for gaming, graphics, and computational tasks.

Functions:

- **Rendering Graphics:** Generates real-time images and effects.
- **Parallel Processing:** Handles thousands of threads simultaneously.
- **Graphics Pipeline:** Stages include vertex, geometry, rasterization, and fragment processing.
- **Video Processing:** Enhances video playback and streaming.
- **GPGPU:** Used for scientific simulations, machine learning, and data analysis.

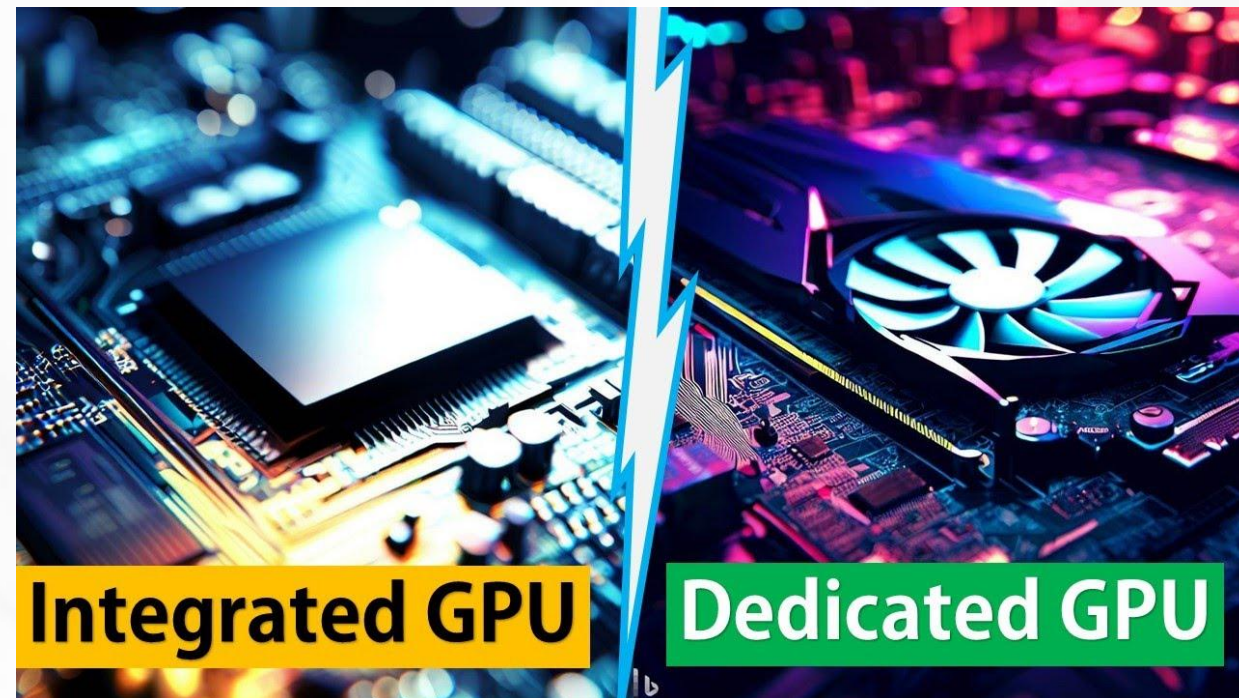


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Hardware Components

Types of GPU (Contd ...)

- **Integrated GPUs:** Built into the CPU, for basic tasks.
 - Examples: Intel HD Graphics, AMD Radeon Vega.
- **Dedicated GPUs:** Separate, with dedicated memory (VRAM), for demanding tasks.
 - Examples: NVIDIA GeForce, AMD Radeon.
- **Workstation GPUs:** For professional, high-precision applications.
 - Examples: NVIDIA Quadro, AMD Radeon Pro.



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Hardware Components

Specifications of a GPU

1. Architecture:

- **Design:** Influences efficiency and performance (e.g., NVIDIA Ampere, AMD RDNA2).

2. Core Count:

- **CUDA Cores (NVIDIA):** More cores = better parallel processing.
- **Stream Processors (AMD):** Similar to CUDA cores.

3. Clock Speed:

- **Base Clock:** Minimum operating frequency.
- **Boost Clock:** Maximum frequency under load.

4. Memory:

- **VRAM:** Dedicated memory for graphical data; more VRAM = better handling of large datasets.
- **Memory Type:** GDDR6, GDDR6X, HBM2.
- **Memory Bus Width:** Wider bus = more simultaneous data transfer.
- **Memory Bandwidth:** Higher bandwidth = better performance.

Hardware Components

Specifications of a GPU

5. Performance Metrics:

- **TeraFLOPS:** Measure of computational power.
- **Ray Tracing Cores:** For realistic lighting and shadows.
- **Tensor Cores:** For AI and machine learning tasks.

6. Cooling and Power:

- **TDP:** Indicates heat and power consumption.
- **Cooling Solutions:** Air, liquid, or hybrid cooling.

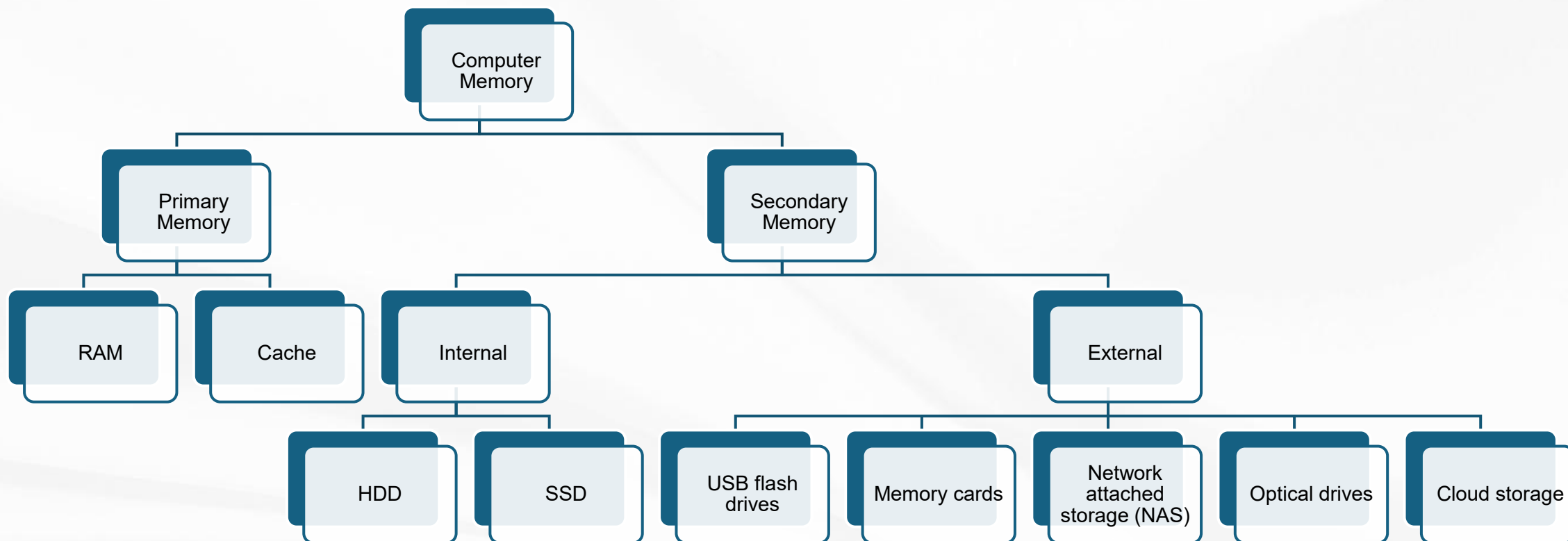
7. Interface and Compatibility:

- **PCI Express:** Connects GPU to motherboard (e.g., PCIe 4.0).
- **Multi-GPU Support:** For configurations like NVIDIA SLI, AMD CrossFire.

Hardware Components

Storage Devices

- Storage devices are essential for recording, retaining, and retrieving data.
- They ensure long-term data retention and are crucial for data management, backup, and retrieval.



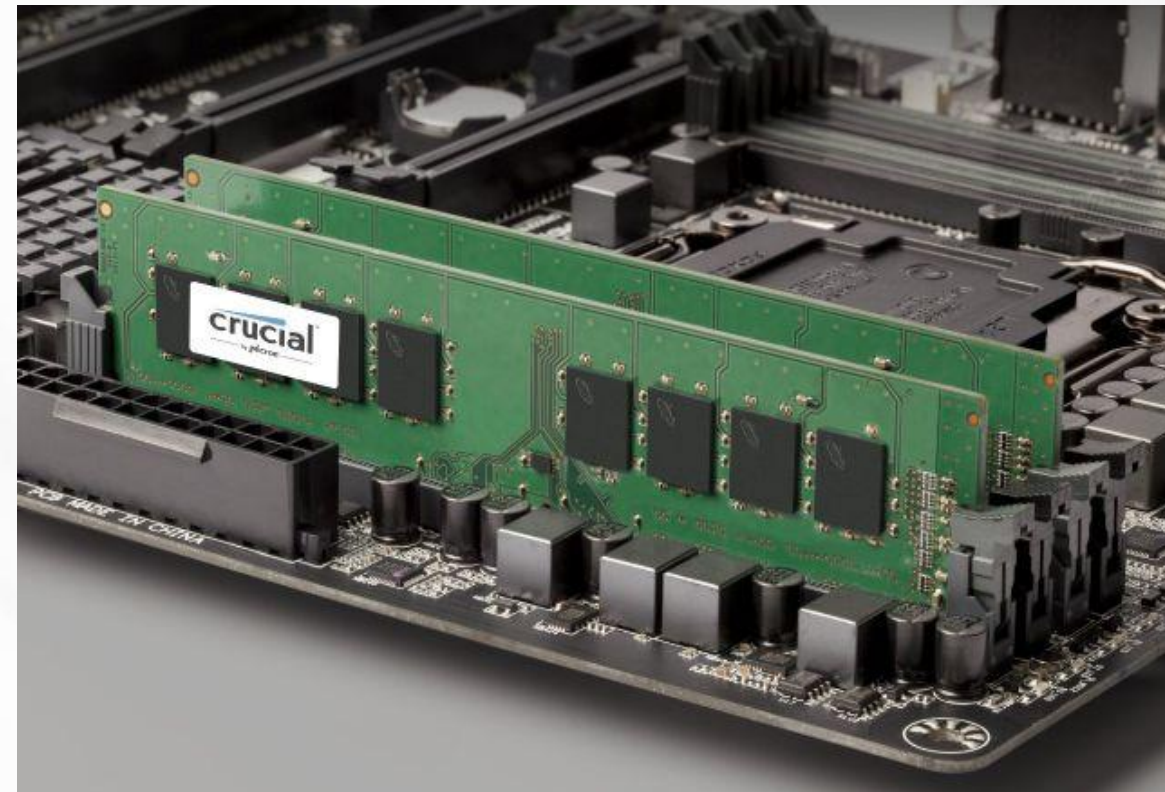
Hardware Components

Primary Storage - RAM

- RAM is a type of volatile memory that provides fast read and write access to a computer's processor.
- It temporarily stores data and instructions that the CPU needs while performing tasks.

Key Aspects:

- **Capacity:** The amount of memory available, measured in gigabytes (GB) (e.g., 8 GB, 16 GB).
- **Speed:** The rate at which data can be read from or written to RAM, measured in megahertz (MHz) or gigahertz (GHz) (e.g., 3200 MHz).
- **Type:** The specific kind of RAM (e.g., DDR4, DDR5).



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<https://www.crucial.in/articles/about-memory/is-my-ram-compatible-with-my-motherboard>

Hardware Components

Primary Storage - RAM

Key Aspects:

Latency

The delay time for memory operations, measured in nanoseconds (ns) (e.g., CL16).

Channels

The number of channels used for data transfer (e.g., single-channel, dual-channel, quad-channel).

Form Factor

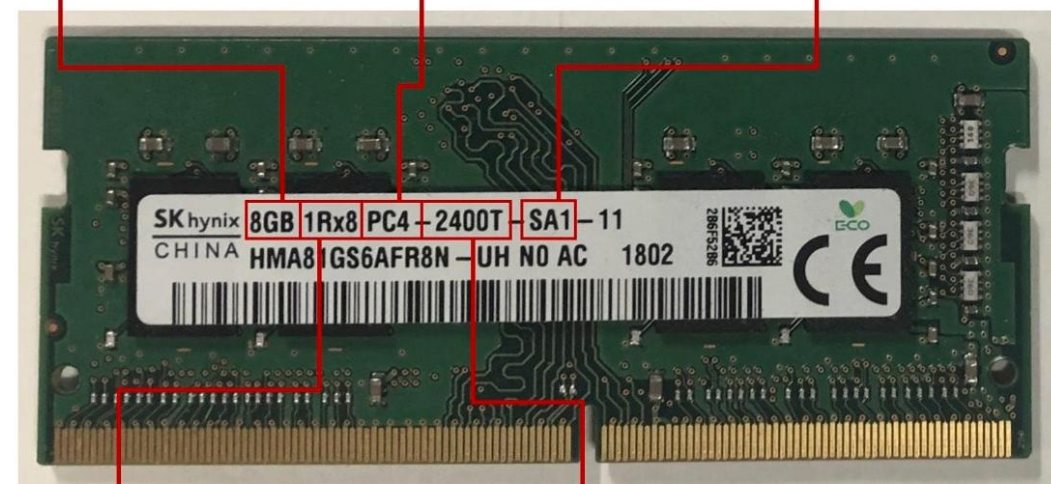
Physical size and shape of the RAM module (e.g., DIMM for desktops, SO-DIMM for laptops).

8GB Laptop RAM Module

RAM volume. This is a 8GB module.

This is the RAM generation. 'PC4' corresponds to DDR4. This RAM module could not be installed in a system that runs DDR3 generation RAM.

The 'S' refers to SODIMM RAM – which is fewer pins and specifically designed for laptops.



This is the RAM ranking. '1R' means Single Rank. Tip: if you are maxing out the RAM on a system, you want to make sure your rankings match between the modules.

The RAM speed. In this case, it is listing in MHz, this module's speed is 2400 mHz.

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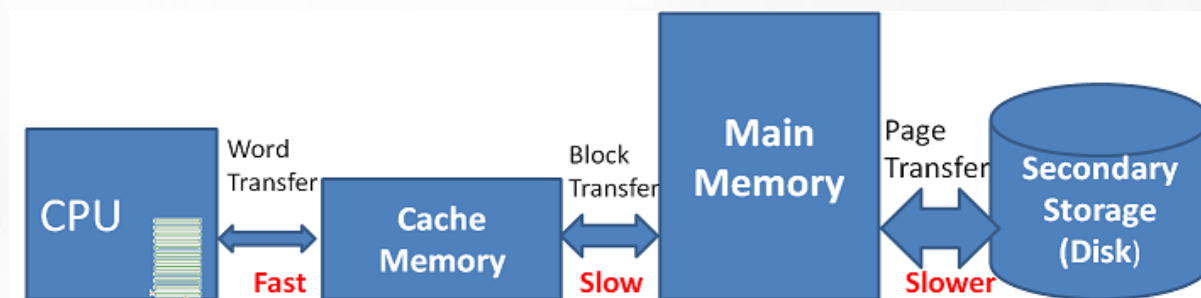
Hardware Components

Primary Storage - Cache Memory

- High-speed storage area
- Store copies of frequently accessed data and instructions from the main memory
- Enhances overall processing speed and efficiency

Levels of Cache Memory:

- Level 1 Cache (L1): Integrated directly into the CPU core.
- Level 2 Cache (L2): Located on the CPU or close to it on the motherboard.
- Level 3 Cache (L3): Shared among multiple CPU cores, usually on the motherboard.
- Level 4 Cache: Not commonly used in many systems



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Hardware Components

Secondary Storage - Internal Memory

HDD - Hard Disk Drive

- Non-volatile storage device
- Uses magnetic storage to store and retrieve digital information.

Key specifications:

- **Storage Capacity:** Total amount of data the HDD can store.
- **Rotational Speed:** How fast the drive spins, measured in revolutions per minute (RPM).
- **Cache Size:** Memory that stores frequently accessed data for quicker access.
- **Interface:** How the HDD connects to the computer.
- **Form Factor:** Specifies the drive's dimensions and mounting characteristics.



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Hardware Components

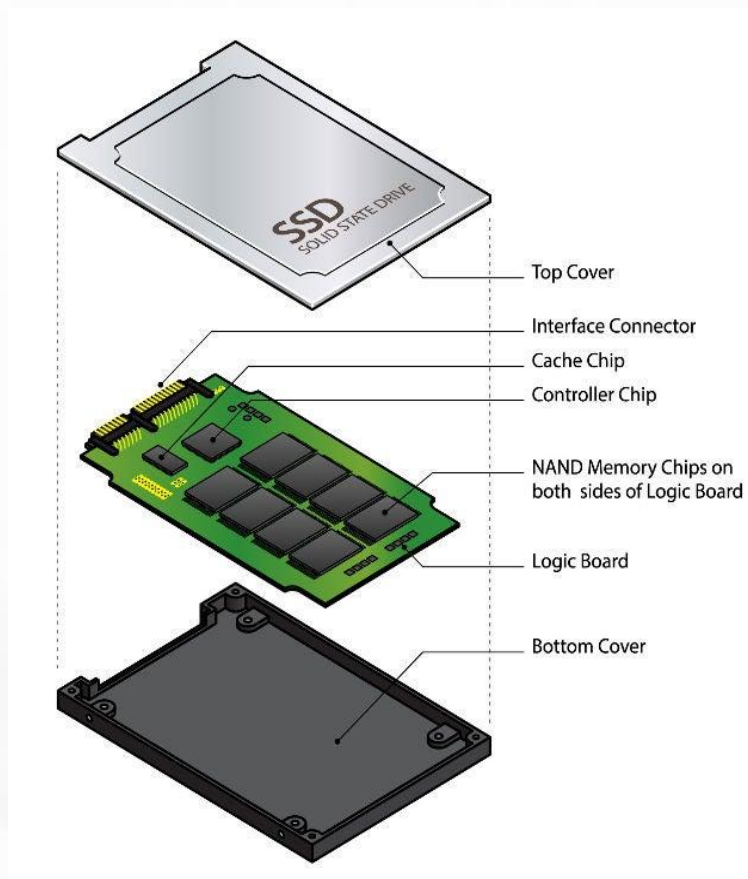
Secondary Storage - Internal Memory

SSD - Solid State Drive

- Non-volatile storage device that uses flash memory to store and retrieve.
- SSDs have no moving parts, making them faster, more reliable, and more durable.

Key Specifications

- **Storage Capacity:** How much data the SSD can store.
- **Read/Write Speed:** Speed at which data is read from or written to the SSD.
- **Interface:** How the HDD connects to the computer.
- **Form Factor:** Specifies the drive's dimensions and mounting characteristics.



Source

Hardware Components

Secondary Storage - External Memory

- **External Hard Disk Drives (HDDs):** Large storage drives in a case for backups and big files.
- **External Solid-State Drives (SSDs):** Fast storage drives in a case for quick data access.
- **USB Flash Drives:** Small, portable drives that plug into USB ports.
- **Memory Cards:** Small cards used in cameras and phones for extra storage.
- **Network Attached Storage (NAS):** A storage device connected to a network for sharing files.
- **External Optical Drives:** Drives that read and write CDs and DVDs, connected via USB.
- **Cloud Storage:** Online services (like Google Drive) that store files on the internet.



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Hardware Components

Power Supply Unit (PSU)

- The Power Supply Unit (PSU) converts AC power from an outlet into DC power for a computer's components.
- It is crucial for ensuring stable and reliable operation.

Key Aspects:

- **Wattage:** Power output in watts (e.g., 500W, 750W).
- **Efficiency Rating:** Effectiveness of power conversion, rated by 80 PLUS (e.g., Bronze, Gold).
- **Form Factor:** Size and shape (e.g., ATX, SFX).
- **Modularity:** Cable design (e.g., modular or non-modular).
- **Connectors:** Types and number of connections (e.g., 24-pin, PCIe).
- **Cooling:** Cooling method (e.g., fan-based, fanless).
- **Protection Features:** Safety features (e.g., over-voltage, short-circuit protection).



Load	Efficiency					
	80 plus basic	Bronze	Silver	Gold	Platinum	Titanium
10%	-	-	-	-	-	90.00%
20%	80.00%	81.00%	85.00%	88.00%	90.00%	94.00%
50%	80.00%	85.00%	89.00%	92.00%	94.00%	96.00%
100%	80.00%	81.00%	85.00%	88.00%	91.00%	91.00%

Hardware Components

Types of Power Supply Units (PSUs):

- **ATX (Advanced Technology eXtended):** Common for desktop PCs.
- **SFX (Small Form Factor):** Compact size for small cases.
- **TFX (Thin Form Factor):** Slim design for thin systems.
- **Modular:** Detachable cables for cleaner builds.
- **Non-Modular:** Fixed cables.
- **Fanless:** Silent operation.



ATX PSU



SFX PSU



SFX PSU



Modular PSU



Fanless PSU

Hardware Components

Network Devices

- Hardware component used to connect, manage, and facilitate communication between computers and other devices within a network.

Router:

- Network device that directs data between different networks and devices

Key Functions of a Router

- **Data Routing:** Chooses the best path for data to travel.
- **Network Segmentation:** Creates separate network sections for different devices.
- **Internet Sharing:** Connects multiple devices to one internet connection.
- **Network Security:** Protects the network with firewalls and encryption.
- **Wireless Connectivity:** Provides Wi-Fi for wireless device connections



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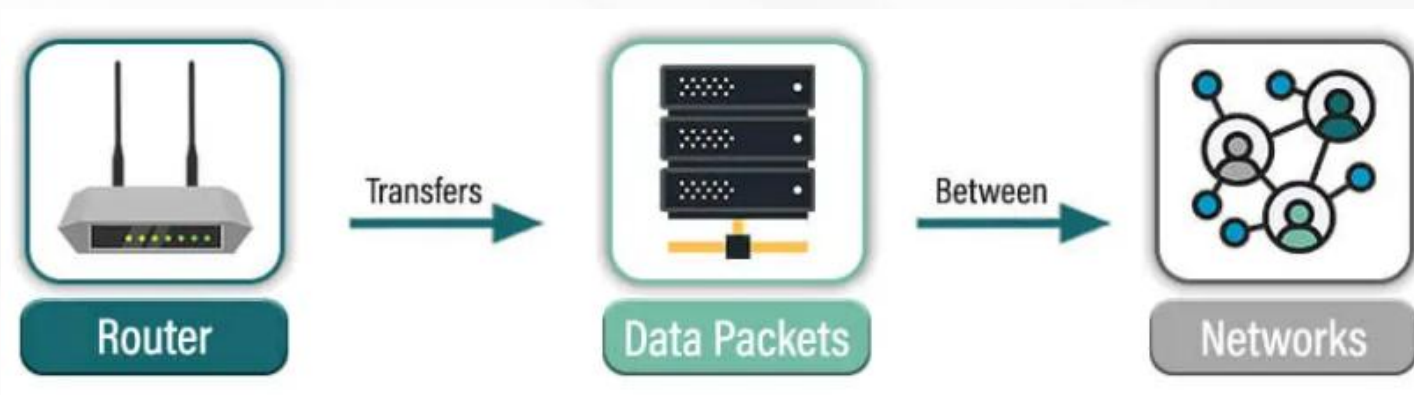
<https://www.indiamart.com/proddetail/network-router-19691440373.html>

Hardware Components

Network Devices - Router:

Key aspects of a Router

- **Ports** : Physical connectors on a router where you plug in cables.
- **Speed** : The rate at which data is transmitted by the router.
- **Security**: Protect network from unauthorized access and threats.
- **Wi-Fi Standards**: Determine the capabilities and performance of the router's wireless connection.
- **Frequency Bands**: Radio ranges used by the router for wireless communication.



Source

Hardware Components

Types of Router:

- **Broadband Routers** : Handle both network management and internet access.
- **Wireless Routers** : Wireless routers provide Wi-Fi access.
- **Wired Routers** : Connect multiple devices using Ethernet cables.
- **Portable Routers** : Designed to create a private Wi-Fi network on the go.



Broadband Router



Wireless Router



Wired Router



Portable Router

Source

Hardware Components

Network device - Modem

- Modulator-demodulator
- Enables a computer or network to connect to the internet

Key Aspects of Modems

- **Speed:** Rate at which data is transmitted through the modem.
- **Interface:** Type of connection used to link the modem to other devices.
- **Compatibility:** Ability to work with various internet service providers (ISPs) and network technologies.



Source

<https://www.taylorworks.com/blog/tech-term-modems-and-routers-defined>

Hardware Components

Types of Modem

- **DSL Modems:** Telephone lines for moderate-speed internet.
- **Cable Modems:** Coaxial cables for high-speed internet.
- **Fiber Optic Modems (ONTs):** Fiber optic cables for very high-speed internet.
- **Satellite Modems:** Satellite technology for internet in remote areas.



DSL Modem



Cable Modem



Fiber Optic Modem



Satellite Modems

Summary

Students will have:

- Gained an understanding of what constitutes a computer system and its key components.
- Identified and differentiated between various types of computer systems such as PCs, servers, embedded systems, and supercomputers.
- Learned the distinctions between system software and application software, including their roles and examples.
- Recognized the major hardware components of a computer, including the CPU, storage devices, and network devices.
- Acquired knowledge about CPU architecture, including performance metrics and types of processors.
- Understood different storage devices, including their functions and specifications.





Quiz

1. Which internal component of a computer system is responsible for temporarily storing data and instructions that the CPU needs to access quickly?

- a) Motherboard
- b) Storage Devices
- c) Random Access Memory (RAM)
- d) Central Processing Unit (CPU)



Answer: c
Random Access Memory

Quiz

2. What type of software is Microsoft Word an example of?

- a) System software
- b) Utility software
- c) Application software
- d) Firmware



Answer: c
Application software

Quiz

3. What is the primary function of system software?

- a) Perform specific user tasks
- b) Manage computer hardware and provide a platform for applications
- c) Create documents and spreadsheets
- d) Design graphics and multimedia



Answer: b

Manage computer hardware and provide a platform for applications

Quiz

4. What is the role of the CPU (Central Processing Unit) in a computer system?

- a) Manages memory and storage devices
- b) Displays output on the monitor
- c) Executes instructions and processes data
- d) Provides power to the computer



Answer: c

Executes instructions and processes data

Quiz

5. Which component is responsible for temporarily storing data and instructions that the CPU needs while processing information?

- a) RAM (Random Access Memory)
- b) Hard drive
- c) Motherboard
- d) Operating system



Answer: a

RAM (Random Access Memory)

Reference

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- <https://www.nwkings.com/routers-and-switches-in-networking>
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