

Introduction to Computer Hardware

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Designed as a quick-reference guide for beginners.

1. What Is Computer Hardware?

- **Definition:** The physical components that make up a computer system and enable it to process, store, and communicate information.
 - **Contrast with Software:** Hardware = tangible parts; Software = instructions that run on those parts.
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2. Core Hardware Categories

Category	Primary Function	Typical Examples
Processing	Executes instructions, performs calculations	CPU (Central Processing Unit), GPU (Graphics Processing Unit), TPU (Tensor Processing Unit)
Memory & Storage	Holds data temporarily (fast) or permanently (large capacity)	RAM (Random Access Memory), Cache, SSD (Solid State Drive), HDD (Hard Disk Drive), NVMe drives
Input	Captures user or external data	Keyboard, Mouse, Touchscreen, Microphone, Scanner, Sensors
Output	Presents results to the user or other systems	Monitor, Printer, Speakers, LEDs, Haptic devices
Communication	Transfers data inside/outside the computer	Motherboard chipset, Network cards (Ethernet/Wi-Fi), USB, Bluetooth, Thunderbolt
Power & Cooling	Supplies and regulates electricity; removes excess heat	Power Supply Unit (PSU), Batteries, Fans, Heat sinks, Liquid cooling loops

3. The Central Processing Unit (CPU)

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Aspect	Details
Architecture	x86?64 (Intel/AMD), ARM, RISC?V, etc.
Key Specs	Clock speed (GHz), core count, threads, cache size (L1/L2/L3)
Roles	- Fetch, decode, execute instructions - Manage system tasks via the scheduler
Placement	Sits in a CPU socket on the motherboard; often paired with a cooler .

4. Memory (RAM)

- **Volatile:** Data is lost when power is removed.
 - **Types:** DDR4, DDR5 (desktop/laptop), LPDDR (mobile).
 - **Capacity & Speed:** Measured in GB and MHz; more capacity ? better multitasking; higher speed ? faster data access.
 - **Dual/Quad?Channel:** Using matched sticks in pairs/triples can double the data bandwidth.
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5. Storage Devices

Device	Technology	Typical Use
HDD	Magnetic platters, moving read/write heads	Large, inexpensive archives
SSD	NAND flash, no moving parts	Fast OS & application loading
NVMe SSD	PCIe interface, direct to CPU	Highest performance (e.g., gaming, video editing)
Hybrid (SSHD)	Small SSD cache + HDD storage	Balance of speed & capacity

Key metrics: Capacity (GB/TB), Sequential read/write speed (MB/s), Random IOPS.

6. Motherboard (Mainboard)

- **Function:** Central hub that interconnects all components.
- **Key Sections:**

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- **CPU socket** – holds the processor.
- **DIMM slots** – RAM modules.
- **PCIe slots** – graphics cards, NVMe SSDs, expansion cards.
- **SATA ports** – HDD/SSD connections.
- **Power connectors** – 24-pin ATX, 8-pin CPU.
- **Chipset** – determines supported CPU generations, I/O options