



Central Processing Unit (CPU)

CPU Basics

<b>Function:</b> The “brain” of the computer, executing instructions and performing calculations.
<b>Key Specs:</b> <ul style="list-style-type: none"><li>• <b>Clock Speed (GHz):</b> How many instructions the CPU can execute per second.</li><li>• <b>Cores:</b> Number of independent processing units.</li><li>• <b>Threads:</b> Virtual cores that improve multitasking (Hyper-Threading).</li><li>• <b>Cache (L1, L2, L3):</b> Fast memory for frequently accessed data.</li><li>• <b>TDP (Thermal Design Power):</b> Maximum heat the CPU will generate (Watts).</li></ul>
<b>Manufacturers:</b> Intel, AMD
<b>Socket Type:</b> Physical interface on the motherboard (e.g., LGA 1700, AM5).

CPU Architecture

<b>Cores</b>	Independent processing units. More cores generally improve multitasking and performance in multi-threaded applications.
<b>Threads</b>	Virtual cores (Hyper-Threading in Intel CPUs, SMT in AMD CPUs). Allow a single physical core to handle two independent sets of instructions concurrently.
<b>Cache Memory</b>	Small, fast memory used to store frequently accessed data. L1 cache is the fastest and smallest, followed by L2 and L3.

Common CPU Issues

<ul style="list-style-type: none"><li>• <b>Overheating:</b> Can cause performance throttling or system instability. Ensure proper cooling (heatsink, cooler, liquid cooling).</li><li>• <b>Incompatible Socket:</b> CPU must match the motherboard’s socket.</li><li>• <b>Driver Issues:</b> Outdated or corrupted drivers can cause problems.</li></ul>
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Random Access Memory (RAM)

RAM Fundamentals

<b>Function:</b> Temporary storage for data and instructions that the CPU is actively using.
<b>Key Specs:</b> <ul style="list-style-type: none"><li>• <b>Capacity (GB):</b> Total amount of RAM.</li><li>• <b>Speed (MHz):</b> Data transfer rate.</li><li>• <b>Type:</b> DDR4, DDR5 (Different generations, not interchangeable).</li><li>• <b>Latency (CAS Latency):</b> Delay in clock cycles between requesting data and receiving it.</li></ul>
<b>Form Factors:</b> DIMM (desktop), SO-DIMM (laptop)
<b>Dual/Quad Channel:</b> Improves memory bandwidth by using multiple memory channels.

RAM Configurations

<b>Single Channel</b>	RAM operates in a single pathway to the CPU. Least efficient configuration.
<b>Dual Channel</b>	RAM operates in two pathways, doubling the bandwidth. Requires two identical RAM sticks in matching slots.
<b>Quad Channel</b>	RAM operates in four pathways, quadrupling the bandwidth. Requires four identical RAM sticks in matching slots. Commonly found in high-end desktop and server platforms.

Common RAM Issues

<ul style="list-style-type: none"><li>• <b>Incompatibility:</b> RAM must be compatible with the motherboard (DDR type, speed).</li><li>• <b>Insufficient Capacity:</b> Can lead to slow performance and frequent disk access (paging).</li><li>• <b>Faulty RAM:</b> Can cause system crashes and data corruption. Memtest86+ can be used to diagnose RAM issues.</li></ul>
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Storage Devices

Storage Types

<b>Hard Disk Drive (HDD):</b> Traditional mechanical storage with spinning platters and read/write heads.
<b>Solid State Drive (SSD):</b> Flash-based storage with no moving parts, offering significantly faster performance.
<b>NVMe SSD:</b> High-performance SSDs that connect directly to the PCIe bus, offering even faster speeds than SATA SSDs.

Key Storage Specs

<b>Capacity (TB/GB)</b>	Total storage space.
<b>Interface</b>	SATA (HDDs and some SSDs), NVMe (high-performance SSDs).
<b>Read/Write Speeds</b>	Measured in MB/s (megabytes per second) for SATA drives, and GB/s (gigabytes per second) for NVMe drives. Higher speeds result in faster boot times, application loading, and file transfers.
<b>RPM (for HDDs)</b>	Revolutions per minute. Higher RPMs generally result in faster data access times.

Common Storage Issues

<ul style="list-style-type: none"><li>• <b>Slow Performance:</b> Can be caused by a fragmented HDD, a failing drive, or a full drive.</li><li>• <b>Drive Failure:</b> HDDs are more prone to mechanical failure than SSDs. Regular backups are essential.</li><li>• <b>Driver Issues:</b> Outdated or corrupted storage drivers can cause problems.</li></ul>
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# Graphics Processing Unit (GPU)

## GPU Fundamentals

<b>Function:</b> Renders images, videos, and other visual content. Crucial for gaming, video editing, and other graphics-intensive tasks.
<b>Key Specs:</b> <ul style="list-style-type: none"><li><b>VRAM (Video RAM):</b> Memory dedicated to storing textures, frame buffers, and other graphics data.</li><li><b>Clock Speed (MHz):</b> Speed of the GPU core.</li><li><b>CUDA Cores/Stream Processors:</b> Parallel processing units used for calculations.</li><li><b>Memory Interface Width (bits):</b> Bandwidth between the GPU and VRAM.</li><li><b>TDP (Thermal Design Power):</b> Maximum heat the GPU will generate (Watts).</li></ul>
<b>Manufacturers:</b> NVIDIA, AMD, Intel (integrated graphics)
<b>Discrete vs. Integrated:</b> Discrete GPUs are separate cards, while integrated GPUs are built into the CPU or motherboard.

## GPU Architectures

<b>NVIDIA</b>	Uses CUDA cores for parallel processing. Features like ray tracing and DLSS (Deep Learning Super Sampling) are prominent in newer NVIDIA GPUs.
<b>AMD</b>	Uses Stream Processors for parallel processing. Features like FidelityFX Super Resolution (FSR) compete with NVIDIA's DLSS.
<b>Intel (Integrated)</b>	Integrated GPUs share system memory. Suitable for basic graphics tasks and light gaming.

## Common GPU Issues

<ul style="list-style-type: none"><li><b>Overheating:</b> Can lead to performance throttling and artifacts. Ensure proper cooling.</li><li><b>Driver Issues:</b> Outdated or corrupted drivers can cause graphical glitches and crashes.</li><li><b>Insufficient VRAM:</b> Can cause stuttering and low frame rates in games.</li></ul>
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