

1.1 Occupational Health and Safety (OH&S).

Whether you are stepping onto a construction site, working in a laboratory, or sitting at a desk, workplace safety is a shared responsibility. A strong OH&S framework protects not just the workers inside the building, but the surrounding community and environment as well.

Let's break down the four core pillars of OH&S policies and procedures.

1.1 Occupational Health and Safety Laws

OH&S laws form the legal backbone of workplace safety. They establish that every worker has the fundamental right to return home safely at the end of the day.

While specific regulations vary by country (such as OSHA in the United States, or DOLE OSH standards in the Philippines), they all share a common legal concept: the **Duty of Care**.

- **Employer Responsibilities:** Employers are legally required to provide a workplace free from recognized hazards. This includes providing proper training, maintaining safe equipment, and implementing emergency procedures.
- **Employee Rights:** Workers typically have the legal right to know about the hazards they face, the right to participate in safety programs, and crucially, the **right to refuse unsafe work** without fear of retaliation.
- **Compliance and Penalties:** Failing to adhere to these laws isn't just bad practice; it results in severe legal liabilities, massive fines, and even criminal charges for gross negligence.



1.2 Personal Safety

While employers must engineer a safe environment, personal safety focuses on the individual's role in the workplace. It is often considered the last line of defense against injury.

The most visible aspect of personal safety is **Personal Protective Equipment (PPE)**.



Personal safety protocols include:

1. **Proper Use of PPE:** Wearing the right gear for the job—whether that's a hard hat, steel-toed boots, respirator, or chemical-resistant gloves—and ensuring it fits correctly.
2. **Situational Awareness:** Staying alert to your surroundings, avoiding distractions (like using a phone while operating machinery), and never bypassing safety guards.
3. **Fitness for Duty:** Arriving at work rested, sober, and physically capable of performing the required tasks safely.

1.3 Workplace Hazards

A **hazard** is anything with the potential to cause harm, illness, or damage. Identifying these is the first step in risk management.



Hazards are generally grouped into five main categories:

Hazard Type	Description	Common Examples
Physical	Conditions or environments that can cause physical harm.	Slips/trips/falls, loud noises, exposed moving machinery parts, extreme temperatures.
Chemical	Exposure to harmful liquids, gases, solids, or fumes.	Cleaning solvents, battery acid, carbon monoxide, asbestos.
Biological	Exposure to living organisms or their byproducts that cause disease.	Bacteria, viruses, mold, bloodborne pathogens.
Ergonomic	Poor workplace design that strains the body over time.	Improper desk setup, heavy lifting, repetitive motions (typing, assembly line work).
Psychosocial	Factors that affect mental health and well-being.	Chronic stress, workplace bullying, harassment, severe fatigue.

1.4 Environment Laws

Workplaces do not exist in a vacuum. The processes happening inside a facility often have the potential to impact the outside world, which is where environmental laws intersect with OH&S.

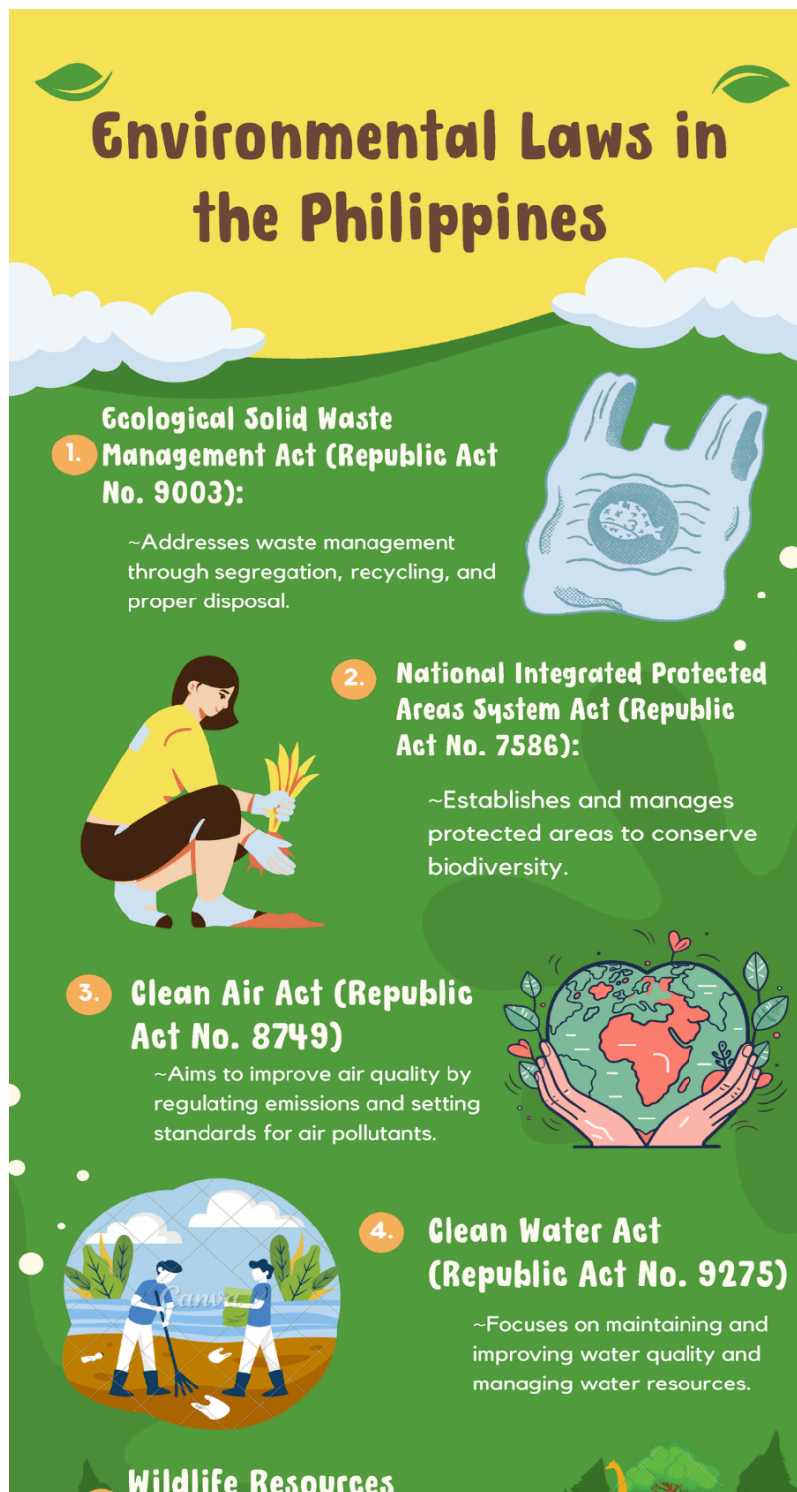
Environmental safety regulations ensure that a company's operations do not degrade the local ecosystem or endanger public health.

- ❑ **Hazardous Waste Disposal:** Laws dictate exactly how toxic chemicals, biomedical waste, and electronic waste must be stored, transported, and destroyed so they do not leach into soil or groundwater.
- ❑ **Air and Water Quality:** Facilities must monitor and limit their emissions. This includes scrubbing factory exhaust and properly treating wastewater before it enters municipal systems.
- ❑ **Spill Response and Reporting:** If a chemical spill occurs, environmental laws mandate immediate containment procedures and strict reporting to government agencies to mitigate ecological damage.

Hierarchy of

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Controls

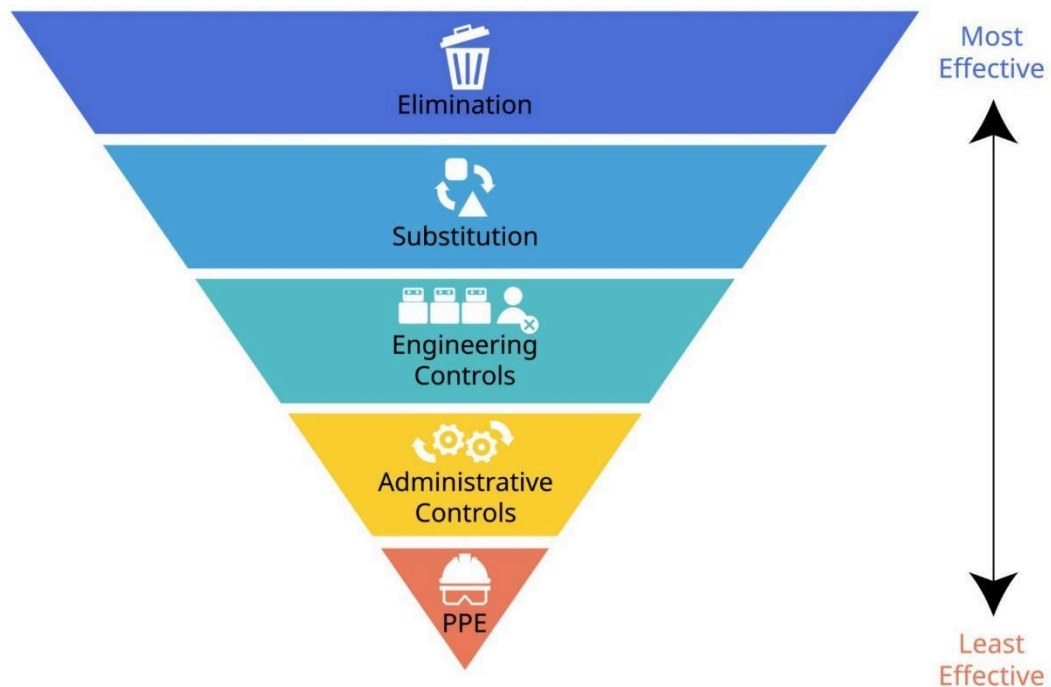
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framework

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Hierarchy of Controls



Here is a breakdown of each stage, from most to least effective:

1. Elimination

What it is: Physically removing the hazard entirely. This is the most effective control because the hazard no longer exists. **Example:** A maintenance worker needs to change a lightbulb on a 30-foot ceiling. Instead of using a wobbly ladder (putting them at risk of a fall), you install a lowering mechanism so the light fixture can be brought down to ground level to be serviced.

2. Substitution

What it is: Replacing a severe hazard with something that doesn't produce a hazard, or produces a much lesser one. **Example:** A manufacturing plant uses a highly toxic, flammable solvent to clean machine parts. They swap it out for a water-based, non-toxic detergent that cleans just as well without the chemical risks.

3. Engineering Controls

What it is: Isolating people from the hazard. You aren't removing the hazard, but you are creating a physical barrier or changing the workspace so the worker doesn't come into contact with it. **Example:** A woodshop has table saws that pose a severe amputation risk. Installing automatic blade guards that

snap into place over the spinning blade, or installing local exhaust ventilation to suck sawdust directly out of the air before it reaches the worker's lungs.

4. Administrative Controls

What it is: Changing the way people work. This relies on human behavior and compliance, which makes it less effective than the top three. It includes policies, training, and scheduling. **Example:** To prevent heat stroke in an outdoor lumber yard, management implements a policy requiring a 15-minute shaded water break every hour, puts up warning signs about heat exhaustion, and rotates workers so no one is in direct sun all day.

5. Personal Protective Equipment (PPE)

What it is: Protecting the worker with wearable equipment. This is the **last line of defense**. If the PPE fails, the worker is immediately exposed to the hazard. **Example:** Providing earplugs to workers in a noisy factory, or giving a respirator to a painter. The loud noise and toxic fumes are still there; you are just hoping the equipment doesn't break or slip.

1.2 Identifying Materials

Once your workspace is safe, it is time to inventory your materials. Never start building until you have verified that all necessary parts are present and match your established system requirements.

Component	What to Verify
Processor (CPU)	Matches the exact socket type of the motherboard.
Motherboard	Form factor (ATX, Micro-ATX) physically fits inside your chosen case.
Memory (RAM)	Speed and generation (e.g., DDR4 vs. DDR5) are supported by the motherboard.
Power Supply (PSU)	Provides enough wattage to comfortably run your CPU and Graphics Card.
Storage	NVMe SSD or SATA cables are present and compatible.

1.3 Tools, equipment and testing devices

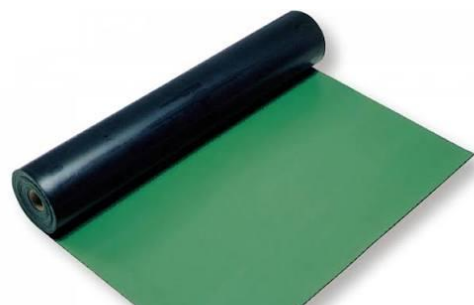
You can't fix a computer or troubleshoot a network without the right tools. More importantly, using the *wrong* tool often results in stripped screws, shattered motherboards, or personal injury.

Let's break down your toolkit into functional categories so you know exactly what to reach for when facing a repair.

1. Safety and Prevention (The Prerequisites)

Before you touch a single component, you must protect yourself and the hardware.

- **Protective eyewear:** A non-negotiable when soldering, cutting wires, or dealing with potentially shattering components.
- **Antistatic wrist strap:** Human bodies generate Electrostatic Discharge (ESD). A few volts of static—which you can't even feel—can permanently destroy a CPU or RAM module. The wrist strap grounds you, bleeding off that static safely.
- **Anti static mat:** An **anti-static mat** (or Electrostatic Discharge / ESD mat) protects sensitive electronic



components from damage by safely dissipating static electricity. It works by draining excess static charge from your body, tools, and components, allowing it to bleed away slowly to an earth ground rather than causing a rapid, destructive zap.

2. Hand Tools and Visibility (The Essentials)

These are your standard physical manipulation tools. Electronics use much smaller, more delicate fasteners than general construction, so precision is key.

Pliers (assorted): Needle-nose pliers are essential for holding tiny nuts, bending wire, or retrieving dropped screws from tight cases.



Screwdrivers (assorted): A precision set (Phillips, Flathead, Torx) is required. *Never* use a driver that is too big or small, or you will strip the screw head.



Allen wrench (0.05 – 0.25 inch): Used for hexagonal socket screws, occasionally found on custom PC cases or server racks.



Sharp pointed tweezers: Vital for picking up tiny jumpers, micro-screws, or guiding delicate ribbon cables into their slots.



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Mirror (inspection): Like a dentist's mirror, it helps you see the back of a motherboard or inside a crowded chassis without dismantling it.



Flashlight: Computer cases and server closets are notoriously dark. A headlamp or small LED flashlight is a must.



3. Diagnostics and Testing

When a device won't turn on or connect, you stop guessing and start measuring.



This is an example of Digital multi-meter

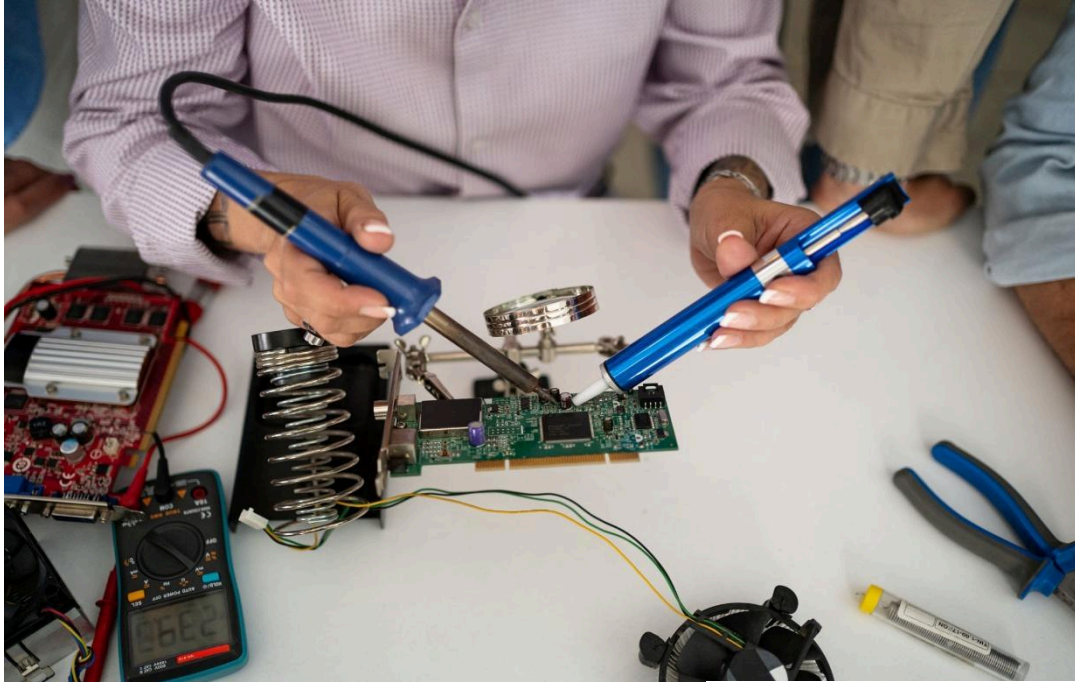
Digital multi-meter (DMM): Used to measure voltage, current, and resistance. It helps you verify if a power supply is outputting the correct voltage (e.g., 12V, 5V, 3.3V) or if a fuse is blown (continuity testing).

Analog multimeter: also known as a **VOM (Volt-Ohm-Milliammeter)**, is a classic electrical testing device that uses a physical needle moving across a printed scale to display measurements. While digital multimeters are more common today due to their direct numerical screens, analog multimeters remain highly valued by technicians because they instantly track fluctuating signals, consume less battery power, and are completely free of digital "ghost readings".



4. Board-Level Component Tools

If you are replacing a blown capacitor or fixing a broken port, you are doing board-level repair.



Soldering iron: Melts solder (a metal alloy) to join electronic components to a printed circuit board (PCB).



Desoldering tool: Also known as a "solder sucker." It uses a spring-loaded vacuum to suck away molten solder when you need to remove a broken component.



IC insertion/extraction tool: Integrated Circuits (microchips) have very fragile pins. This tool looks like specialized tongs, allowing you to pull a chip straight up out of its socket without bending the pins.



5. Networking and Connectors

These tools are specifically for building and troubleshooting communication cables.



Wire stripper with bolt cutter: Used to carefully remove the outer plastic jacket of a cable without cutting the copper wires inside.



Crimping tools: A heavy-duty press used to attach RJ45 connectors (the plastic clips) to the ends of an Ethernet cable, forcing the metal contacts to bite into the wires.



LAN Tester: A two-part device. You plug one end of your newly crimped cable into the master unit and the other into the remote unit. It lights up in sequence to verify all 8 internal wires are connected correctly.



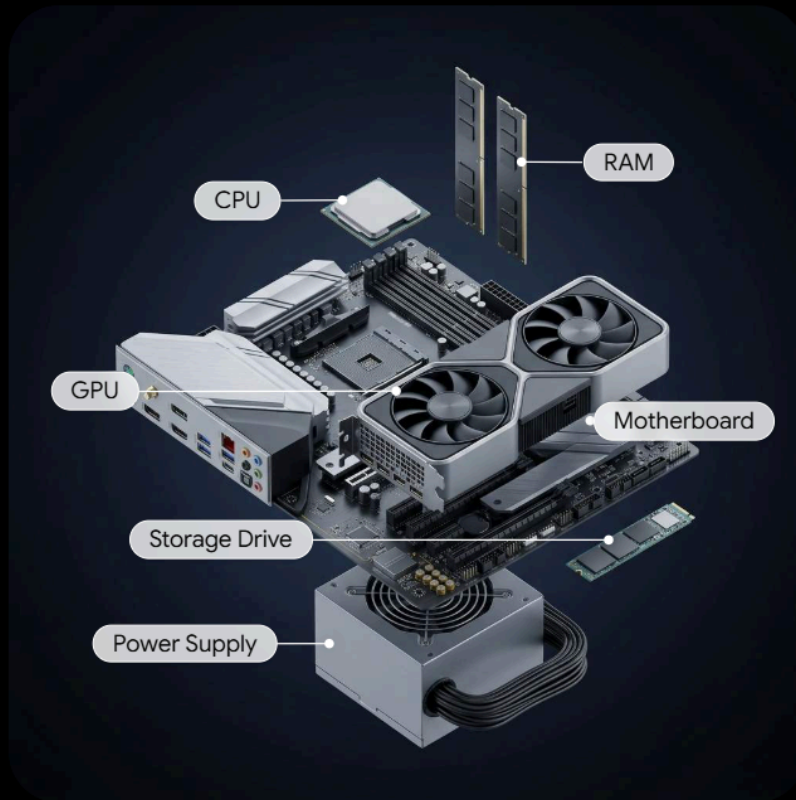
RS 232 pin insertion/extraction tool: A very specialized tool used to add or remove individual pins from a serial port (DB9 or DB25) connector, often used in older enterprise networking equipment.



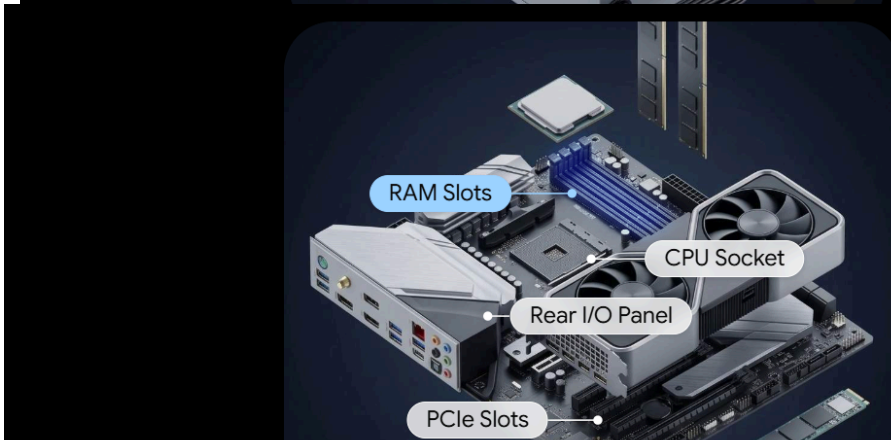
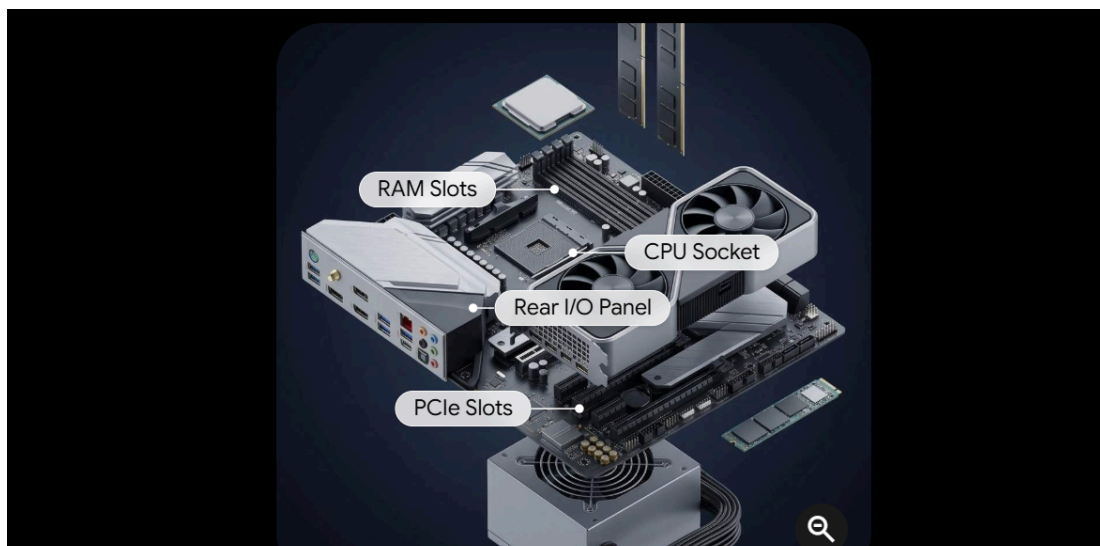
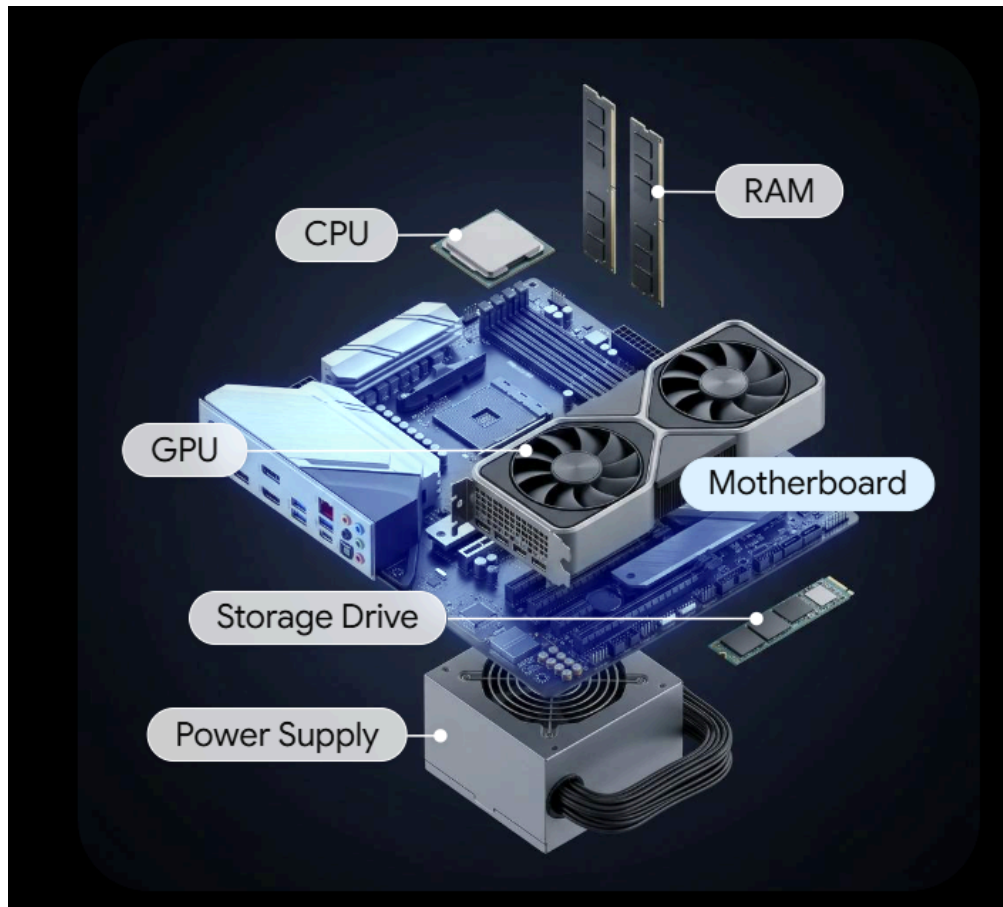
1.4 Computer Hardware

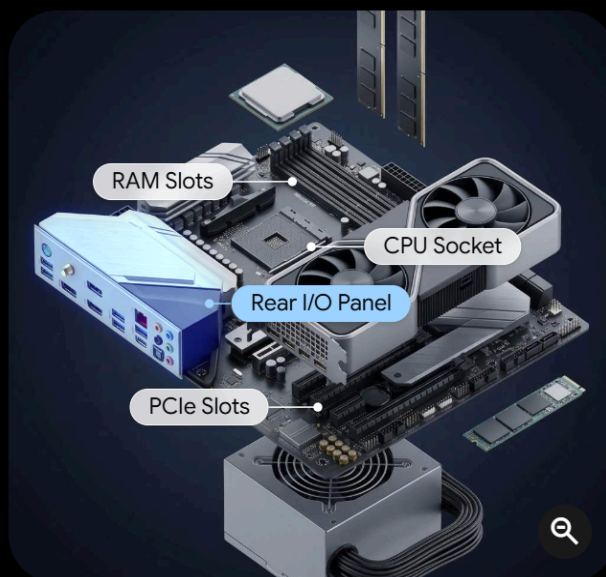
The Hardware Assembly Process

Before we put the pieces together, take a moment to explore how the major components interconnect inside the chassis using this interactive guide:



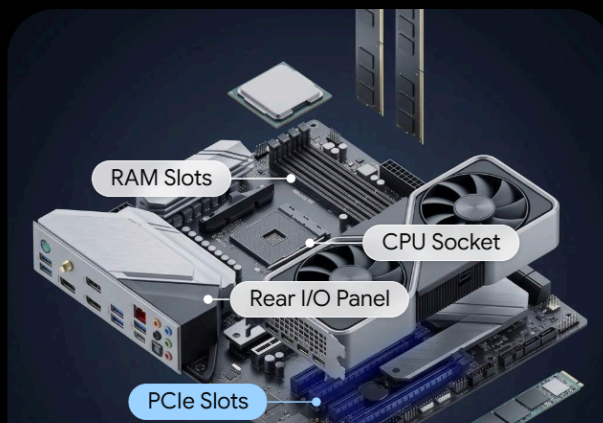
A Personal Computer (PC) is composed of several distinct hardware components working together to process, store, and display information. Tap on the floating components to explore the fundamental building blocks of a PC.

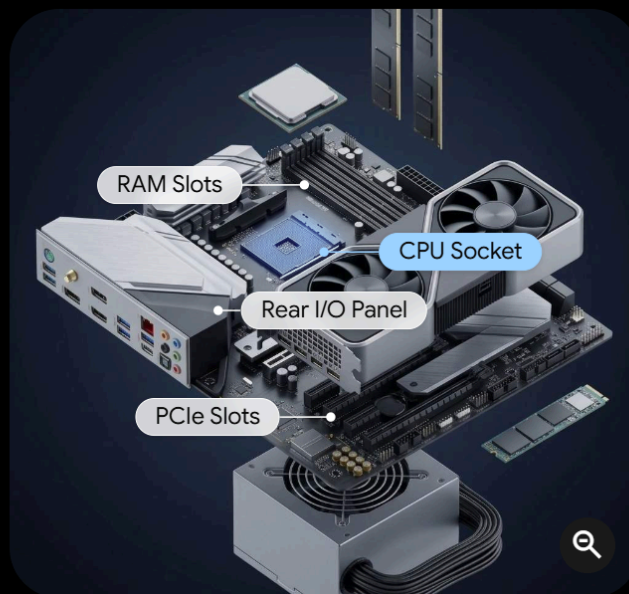




Rear I/O Panel

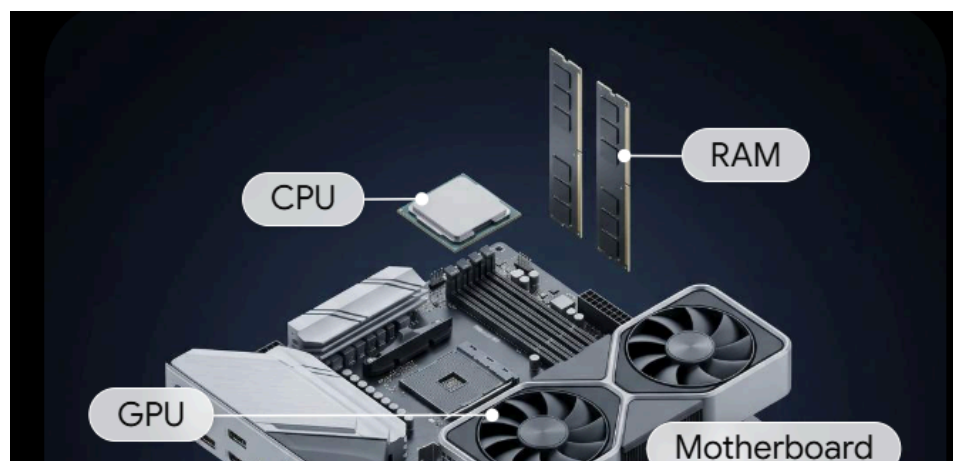
The Input/Output (I/O) panel is located at the back of the PC case and is physically soldered onto the motherboard. It provides the external connection points for all your peripherals, including USB ports for the mouse and keyboard, display outputs, network jacks, and audio connections.

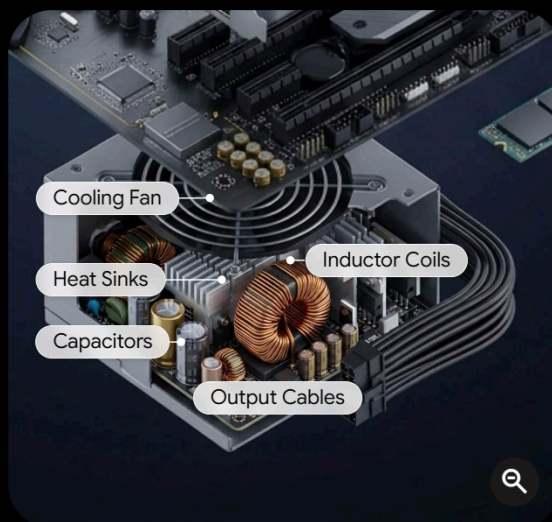




CPU Socket

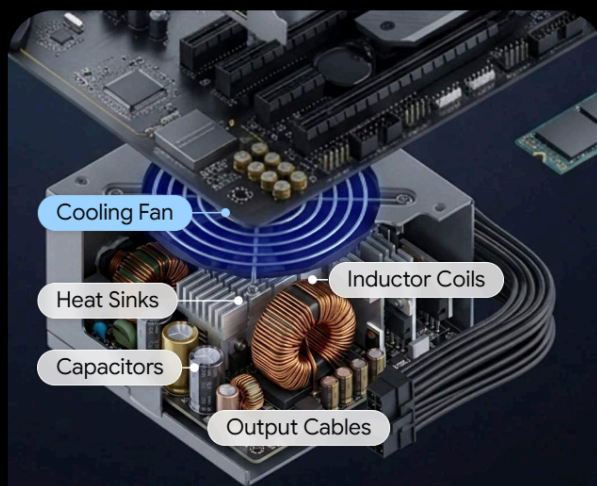
The CPU socket is the dedicated housing where the processor is installed. It contains an intricate grid of microscopic pins or contact pads that form the critical electrical connections between the processor and the rest of the computer.

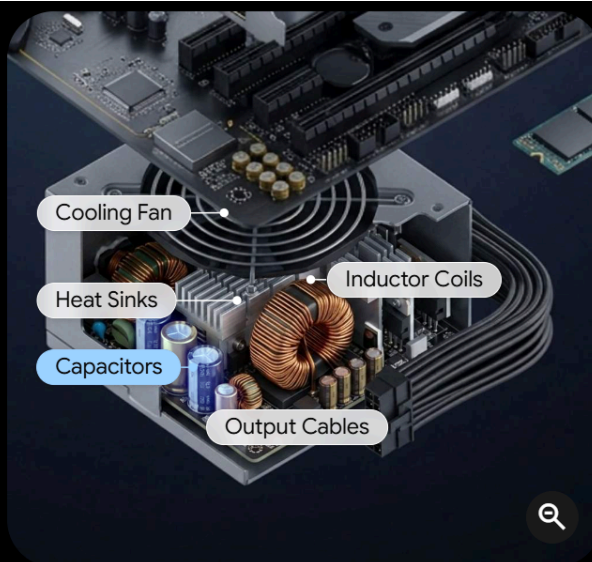




Power Supply Unit (PSU)

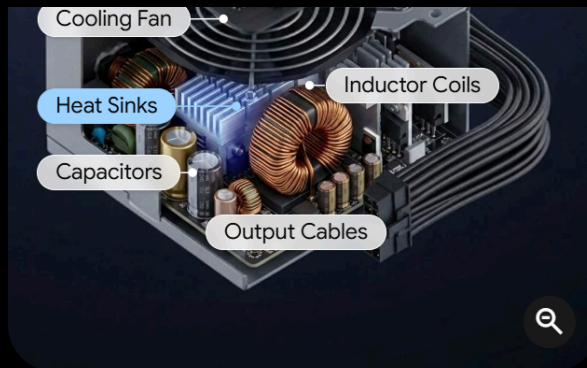
The PSU converts the alternating current (AC) from your wall outlet into the stable direct current (DC) needed by the PC's delicate electronics. It distributes specific voltages to the motherboard, GPU, and storage drives via its thick cable bundles.





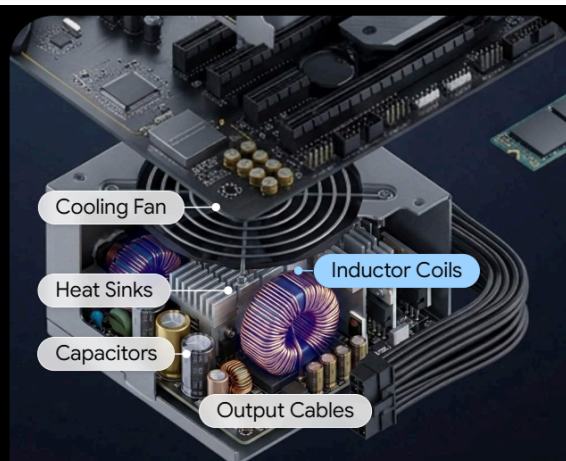
Capacitors

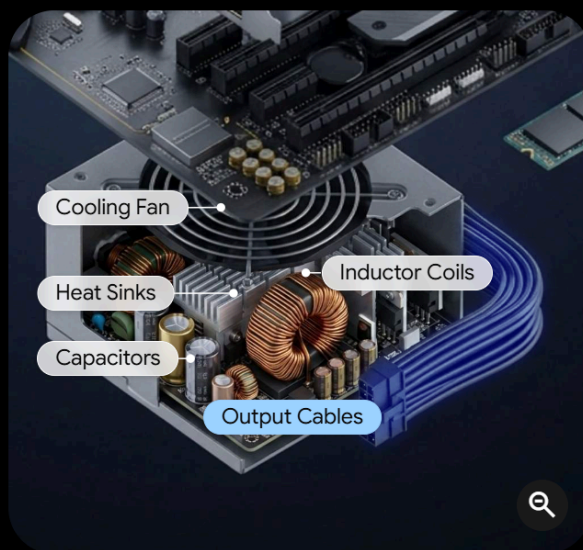
Capacitors act like temporary, lightning-fast energy reservoirs that absorb excess voltage and instantly fill in any gaps in the electrical flow. This rigorous smoothing process ensures the delicate microchips in the PC receive a perfectly steady and clean supply of power.



Heat Sinks

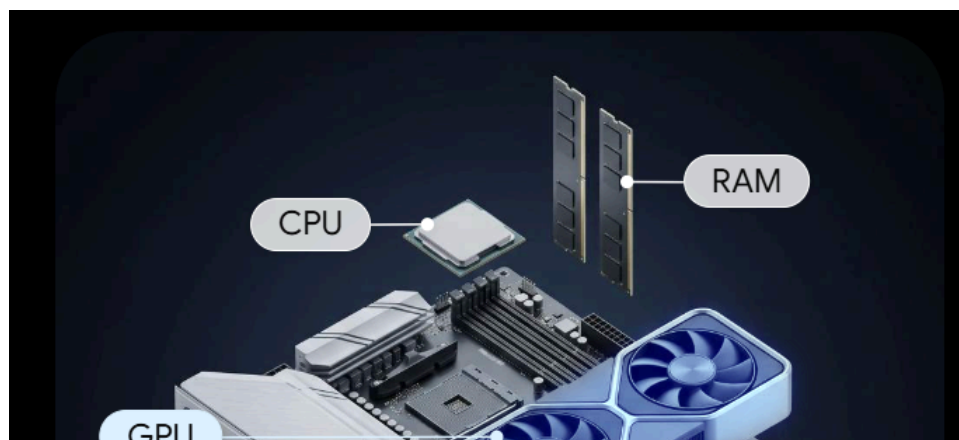
Certain active components, such as transistors and diodes, get extremely hot during the power conversion process. These aluminum heat sinks are physically attached to those hot parts; their large, finned surface area rapidly absorbs the heat and transfers it into the air flow generated by the cooling fan.

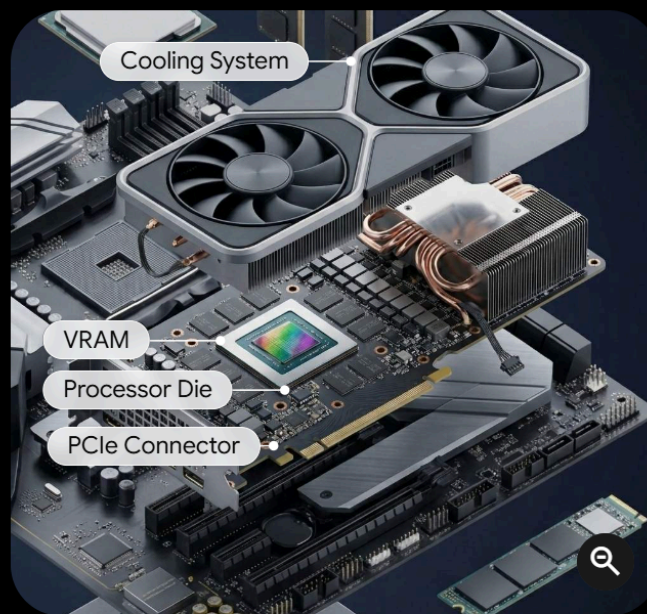




Output Cables

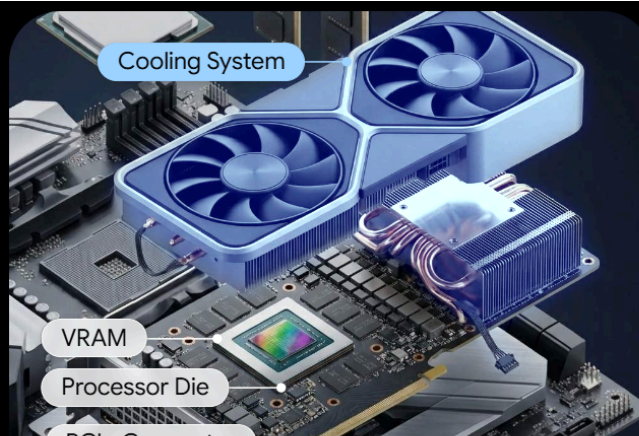
Once the power is converted and perfectly stabilized, it is sent out through these heavy-duty insulated cable bundles. The large multi-pin block connector shown here typically plugs directly into the motherboard, delivering the main primary power required to run the entire system.

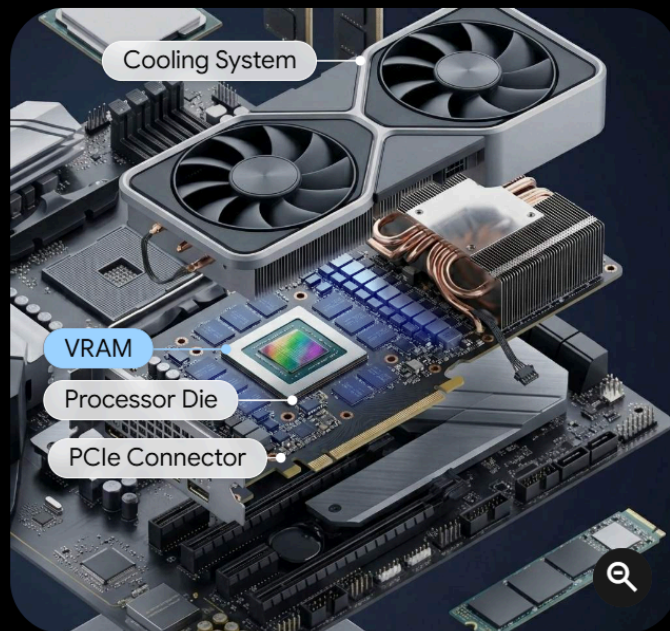




GPU (Graphics Card)

The GPU specializes in rendering images, video, and 3D graphics to output to your monitor. Because graphics require processing thousands of pixels simultaneously, GPUs have thousands of smaller cores designed for parallel processing.

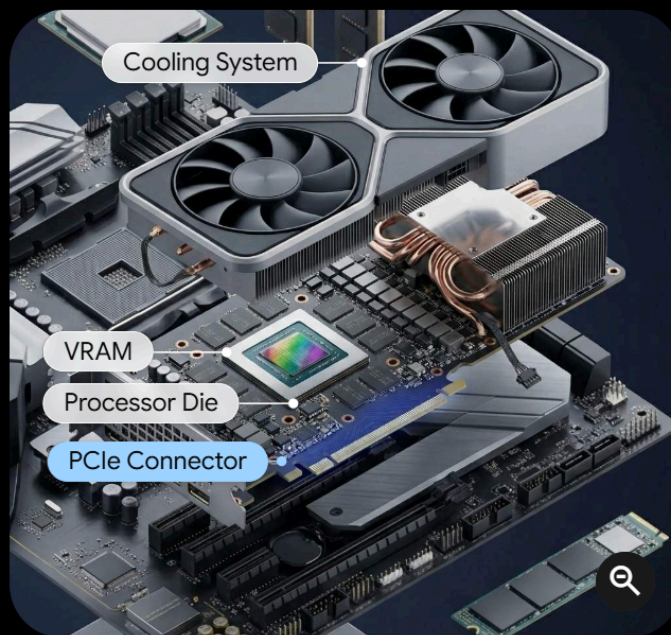




VRAM (Video RAM)

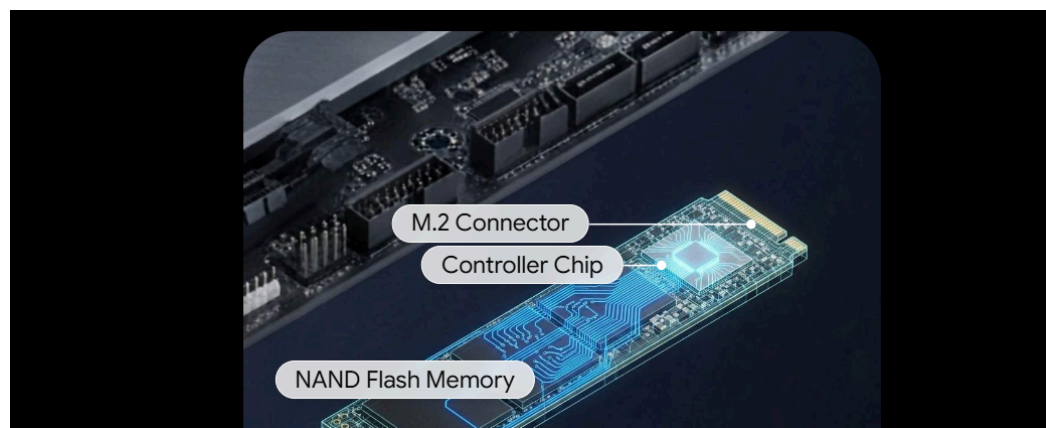
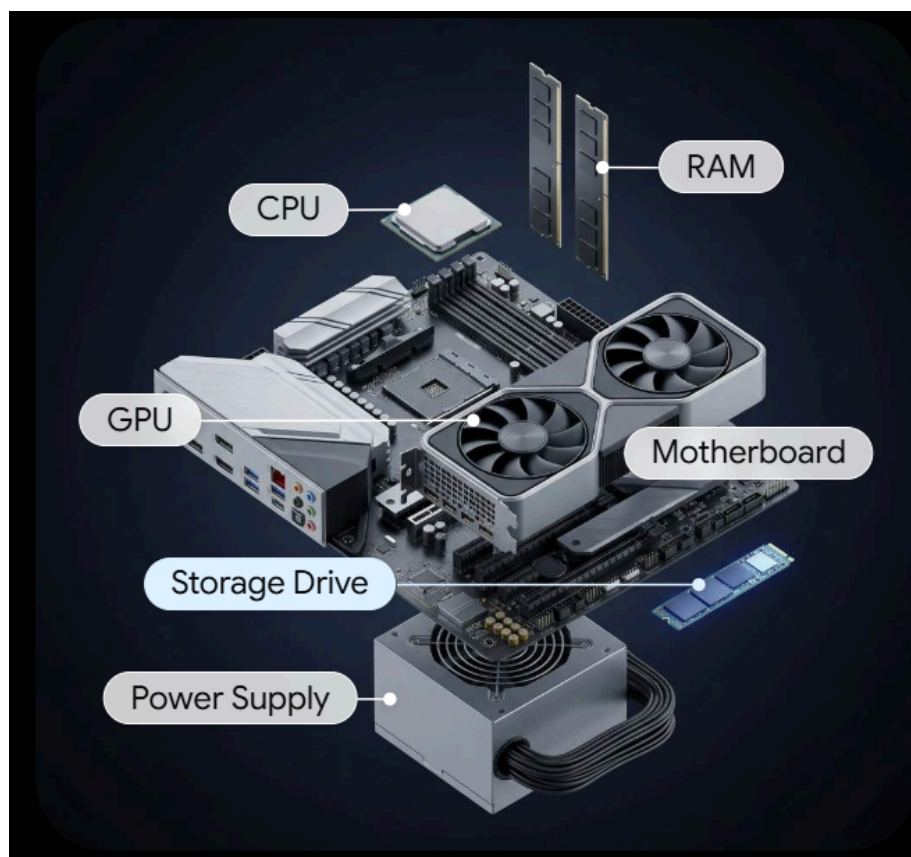
Video RAM stores the image data, textures, and assets the GPU needs to access instantly while rendering frames. Having sufficient and fast VRAM is essential for high-resolution gaming and heavy creative workloads.

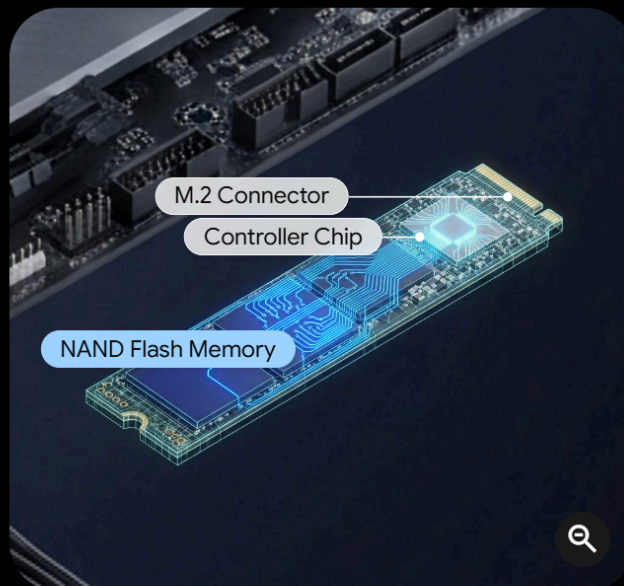




PCIe Connector

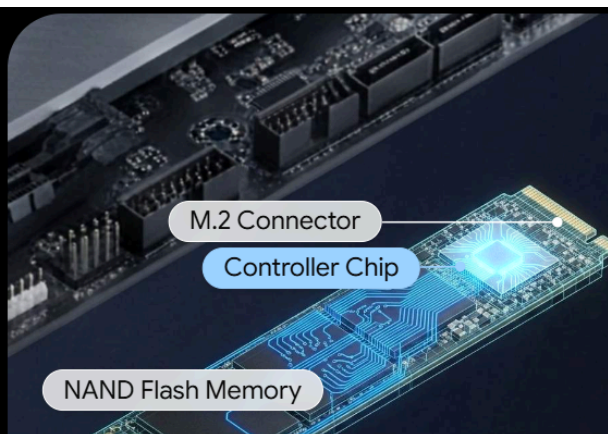
This edge connector plugs directly into the motherboard's PCIe expansion slot. It provides a high-speed data connection between the GPU and the rest of the computer, ensuring minimal latency when sending rendering instructions.

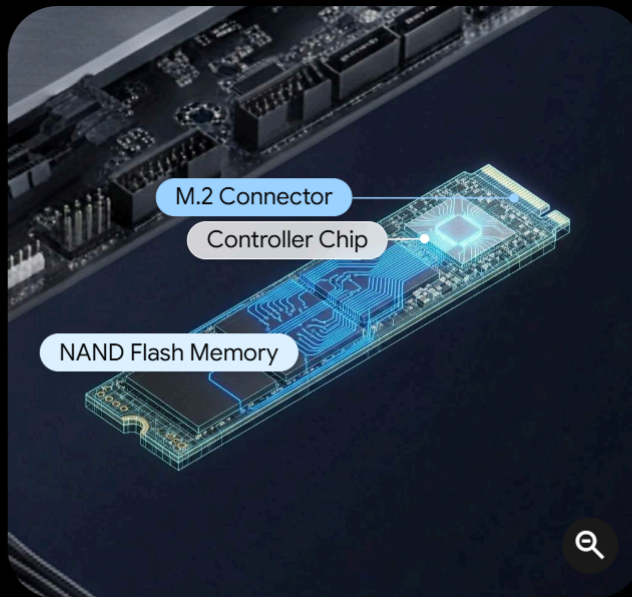




NAND Flash Memory

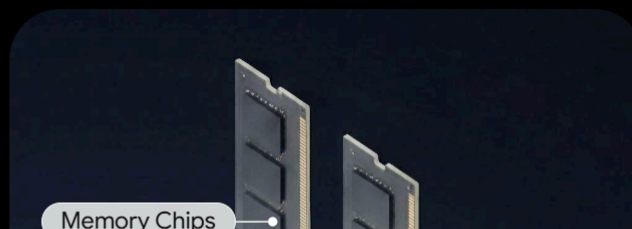
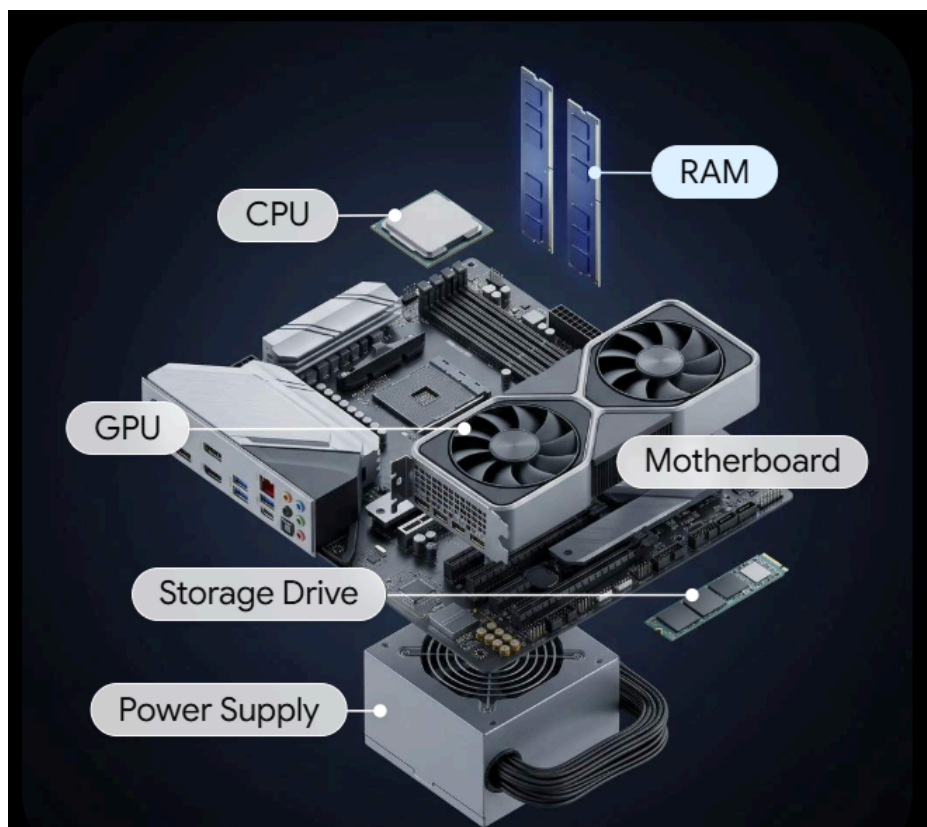
These chips store your digital files permanently, even when the power to the computer is completely turned off. They work by trapping billions of electrons inside microscopic grids (floating-gate transistors), representing the 1s and 0s of your data.

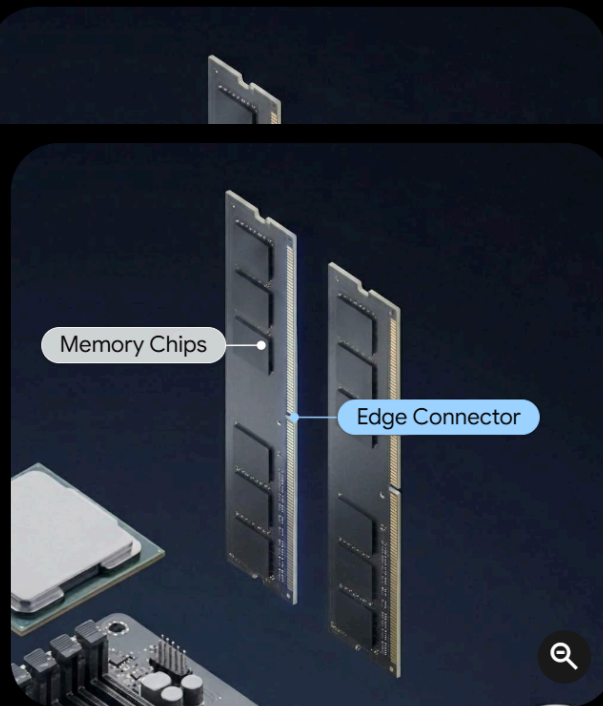




M.2 Connector

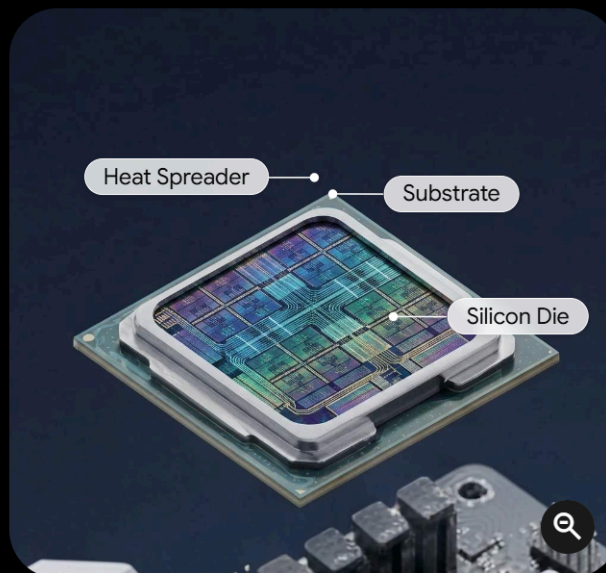
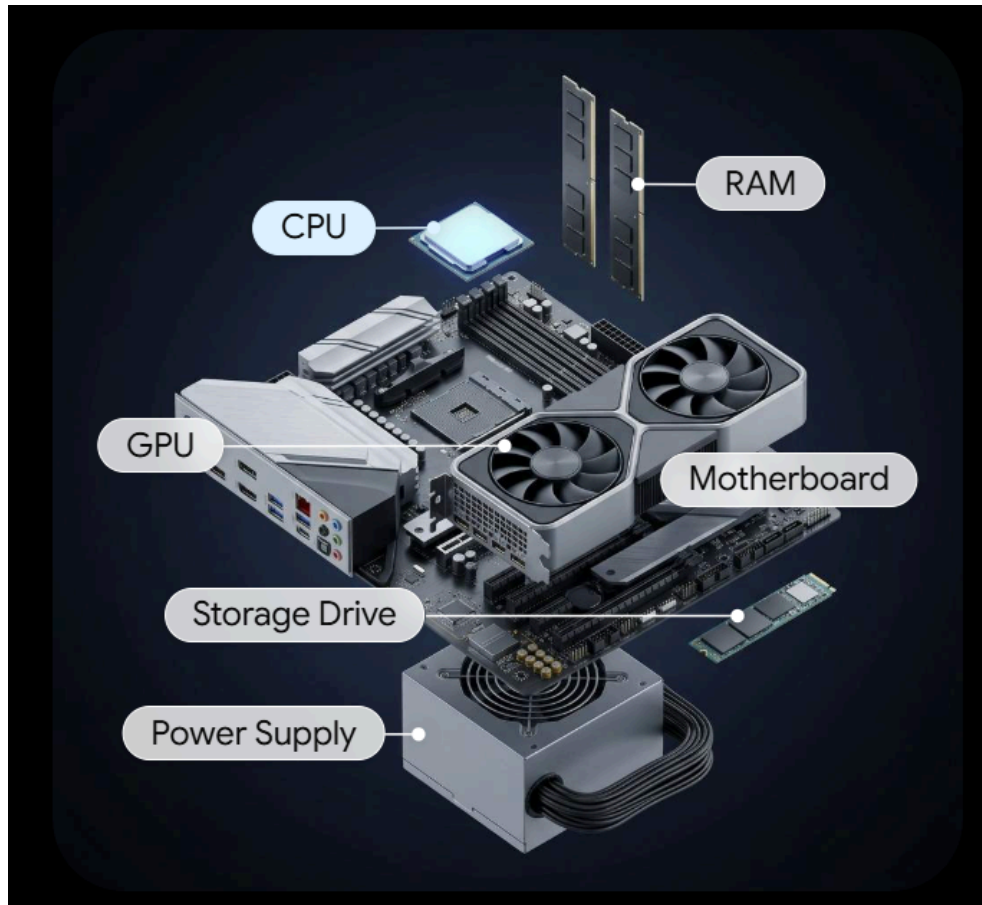
These gold pins plug directly into a dedicated M.2 slot on the PC's motherboard. They provide a high-bandwidth connection (often using the PCIe interface) that allows data to travel back and forth at speeds many times faster than older SATA cables.





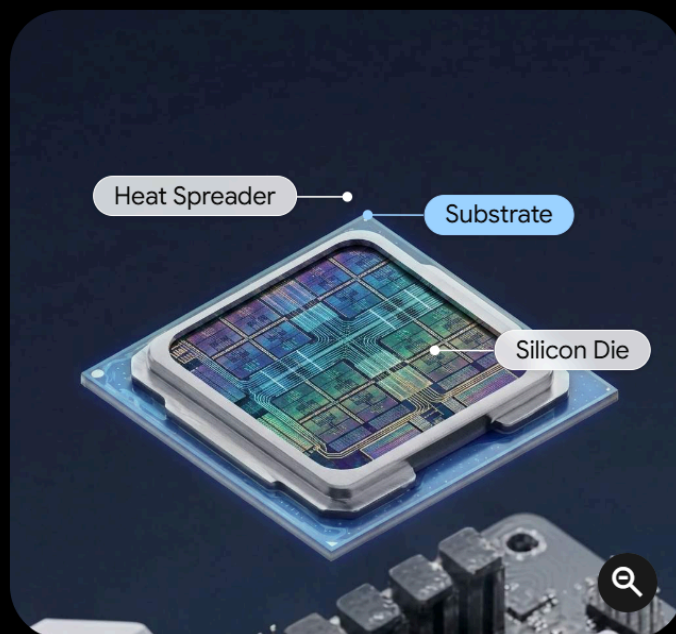
Edge Connector

This row of gold-plated pins forms the edge connector, which slots directly into the memory banks on the motherboard. It provides the physical and electrical interface required for high-speed data transfer between the RAM and the CPU.



CPU (Central Processing Unit)

Known as the 'brain' of the computer, the CPU executes instructions and performs complex calculations. Its speed is measured in Gigahertz (GHz), indicating it can process billions of cycles every single second.



Substrate

The substrate is the small printed circuit board (PCB) that acts as the physical foundation of the CPU. It is responsible for routing electrical signals between the microscopic connections on the silicon die and the motherboard.

When you are ready to build, the sequence in which you install components matters heavily. Doing things out of order can block your hands from reaching tight corners.

1.Prepare the Motherboard Outside the Case: Do this on top of the motherboard's cardboard box.

It is much easier to install the core components before the motherboard is screwed into the cramped case. Unlatch the CPU socket, gently drop the CPU in (aligning the golden triangles), and lock it down. Next, click your RAM sticks into their slots, and screw down your M.2 NVMe storage drives.

2.Install the I/O Shield and Motherboard:

Snap the metal I/O shield into the rectangular hole at the back of the computer case (if your motherboard doesn't have a pre-installed one). Then, gently lower the motherboard into the case and secure it to the stand-off screws.

3. Mount the Power Supply (PSU): Ensure the PSU fan points toward a ventilation grate.

Slide the power supply into the bottom or rear of the case and screw it into the chassis. Route the main heavy cables through the back panel of the case.

4. Install the Graphics Card (GPU):

Remove the expansion slot covers on the back of the case. Press the GPU into the top PCIe slot on the motherboard until the retention clip clicks, then screw the metal bracket into the case to support its weight.

5. Connect All Cables: Take your time to ensure secure connections.

Plug in the 24-pin main motherboard power, the CPU power at the top left, and the PCIe power for your graphics card. Finally, plug in the tiny, fragile front-panel cables (power button, reset switch, USB headers) by following the map in your motherboard manual.

1.5 Basic-input-output-system (BIOS)

BIOS Configuration

Once assembly is complete, plug the PC into the wall, connect your monitor and keyboard, and press the power button.

If everything was assembled correctly, the system will POST (Power-On Self-Test) and take you to the UEFI/BIOS (Basic Input/Output System). This is the motherboard's built-in firmware.



You must configure the BIOS to ensure the hardware runs properly before installing Windows or Linux:

1. **Verify Hardware Detection:** Check the main screen to ensure your CPU model, total RAM capacity, and storage drives are correctly identified. If a stick of RAM is missing, you need to power down and re-seat it.
2. **Enable RAM Profiles (XMP/EXPO):** By default, high-speed RAM runs at a slow, basic speed. You must click the button to enable XMP (Intel) or EXPO (AMD) so your RAM runs at the speed you actually paid for.
3. **Adjust Fan Curves:** Ensure your CPU and case fans are spinning. You can set them to "Quiet" or "Performance" depending on your thermal needs.
4. **Set the Boot Order:** Tell the BIOS to look for a bootable USB drive first (which will contain your Operating System installer) and your blank SSD second.
5. **Save and Exit:** Usually done by pressing F10. The system will restart, and you are ready to install your operating system!