

Hardware and Software

Hardware refers to the physical parts of a computer; things that can be actually seen and held. **Software**, on the other hand, refers to the intangible parts. Software programs tell the hardware what to do.

When buying, building, or upgrading a computer, there are a few key factors to keep in mind:

- Compatibility: ensure that the components you choose are compatible with each other and with the operating system you want to install.
- Power supply: choose a power supply that can provide enough power for all the components you plan to use.
- Cooling: make sure the components are adequately cooled to avoid overheating and reduce the risk of damage.
- Assembly: follow the instructions carefully and take precautions to avoid static electricity and physical damage to the components.

[PCPartPicker](#) is a great resource for researching and comparing parts. If you choose not to build your own computer, there are still some hardware and software tips that can help keep your system running smoothly:

- Keep your software up to date, including your operating system, drivers, and applications.
- Install and regularly update anti-virus and anti-malware software to protect against threats.
- Keep your system clean and dust-free to avoid overheating and reduce the risk of damage.
- Regularly backup important data to prevent loss in case of hardware failure or other issues.
- Use surge protectors or an **uninterruptible power supply** (pictured below) to protect your system from power fluctuations and outages.



Hardware

● Base Unit

The main part of a computer, also called the **system unit** or the **tower**. Made up of many different components housed inside of a case. Does not include peripheral devices such as the monitor, keyboard, or mouse, which are connected to it.



○ CPU

The **central processing unit** (or just **processor**) is like the brain of a computer. It manages all of the other hardware and processes by performing calculations and sending/receiving electrical signals.



Clock speed: The speed of a CPU is measured in GHz (gigahertz) and determines how fast it can perform instructions. Higher GHz means faster processing speeds, though it also requires more power and more cooling.

Core count: The CPU can have one or more processing units, known as cores. More cores mean the CPU can perform more tasks simultaneously, which can improve overall system performance.

Cooling: The CPU generates a lot of heat as it operates, so it needs to be properly cooled to prevent overheating. This is typically done using a heatsink and a fan, which are attached to the CPU with thermal paste.

○ Motherboard

If the CPU is the brain of a computer, then the motherboard is the central nervous system. It's the main circuit board that allows for the other components to connect and communicate with each other.



Form Factor: Motherboards come in different sizes, known as form factors. The most common form factor for desktop computers is ATX, while smaller form factors like Micro-ATX and Mini-ITX are used for more compact builds.

Expansion Slots: The motherboard has slots for expansion cards, such as graphics cards, sound cards, or Wi-Fi cards, which allow for extra functionality.

BIOS: The Basic Input/Output System is a chip on the motherboard that initializes the hardware components and allows you to configure basic settings.

○ **Memory (RAM Stick)**

RAM is short for **random access memory**.

It's also referred to as system memory or primary storage. A RAM module or RAM stick handles a computer's short-term memory. Your computer can access the information instantly, but it's volatile storage, meaning it relies on a power supply and is lost once the computer shuts off. More RAM generally means more speed and better multitasking. For basic tasks like web browsing and email, 4GB of RAM may be enough. More demanding tasks like video editing or gaming might require 16-32GB.



○ **Storage (HDD / SSD)**

Secondary storage is **non-volatile** meaning the data is stored permanently, even after the computer is powered off. This is where your files go when you save them. **Hard disk drives** (HDDs) use spinning magnetic disks and a mechanical arm to read and write data.

They're relatively cheap and are used for mass storage.

Solid state drives (SSDs) use flash memory to store data and can access data much faster than HDDs. SSDs are more expensive per-gigabyte than HDDs but they are getting cheaper, and they've become increasingly popular because they're fast and reliable.



▶ **SSDs Die, RAM Doesn't. Why?**

○ Graphics Card

A graphics card (or video card) is an expansion board that contains a **graphics processing unit (GPU)** and its main purpose is to handle the rendering of images, videos, and 3D graphics. If you plan to only use your computer for basic tasks like web browsing and word processing, then **integrated graphics** (built into the CPU) are sufficient. But if your computer's CPU does not come with integrated graphics, or if you plan on using your computer for things like gaming or video editing, you'll need a discrete graphics card. The most important factors to consider when choosing a graphics card are the amount of Video RAM (VRAM) it has, and the processing power of the GPU. More VRAM and higher processing power will result in better performance.



○ Power Supply

A power supply converts the AC (alternating current) power from your wall outlet into DC (direct current) power that your computer can use. It's important to choose one that's powerful enough to support your system's wattage requirements.



● Input devices

○ Keyboard

A **peripheral** (an auxiliary device; i.e. devices that can be easily removed and plugged into a computer system) input device allowing the user to enter text and perform useful keyboard shortcuts.



- **Mouse**

A peripheral input device that controls the **cursor**, allowing for smooth control of the **graphical user interface (GUI)** of a computer. Mice also feature buttons and scroll wheels which allow for additional control and dimensional input. Laptops often include touchpads in place of a mouse.



- **Webcam**

A peripheral input device capable of streaming and/or recording audio and video. Any device that captures sound or images and sends it to the computer is considered an input device, including your phone's camera and microphone.



- **Output devices**

- **Monitor (Display)**

The output device that displays visual information, which it receives from the CPU (for basic text) and GPU (for image and video rendering.)

Size: The size of a monitor is usually measured diagonally in inches.



Resolution: Refers to the number of pixels on the screen. A higher resolution provides sharper and more detailed images. Common resolutions are HD (720p), Full HD (1080p), Quad HD (1440p), and Ultra HD (4K).

Refresh rate: The refresh rate of a monitor refers to how many times per second the screen is updated. This is measured in Hertz (Hz); a 60 Hz monitor updates 60 times per seconds. A higher refresh rate can provide smoother and more fluid motion, which is important for tasks such as gaming or video editing.

Panel type: The panel type of a monitor determines the quality of the display. Common types include TN (twisted nematic), IPS (in-plane switching), and VA (vertical alignment). IPS panels typically offer the best color reproduction and viewing angles, while TN panels are often used for gaming due to their fast response times.

Connectivity: The monitor should have ports that can be used to connect to your computer, such as HDMI, DisplayPort, or VGA. When shopping for a monitor, be sure that it's actually compatible with your computer.

- **Speakers / Headset**

Some monitors come with dedicated speakers, but otherwise your computer will require external speakers or a headset.



- **Printer**

A printer is a computer peripheral device that produces a hard copy of digital documents, images, or other content stored on a computer or mobile device. Some printers also have scanning, copying, and faxing capabilities.



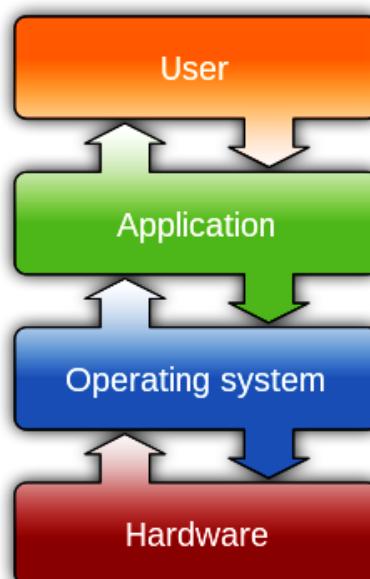
Software

• Operating Systems (System Software)

An **operating system** (OS) is software that manages all the hardware and software resources of a computer. It serves as the interface between the user and the computer, and also acts as a middleman between hardware and software. It's responsible for tasks such as managing memory, running applications, managing files and folders, and controlling peripheral devices such as printers and scanners. It also provides a graphical user interface (GUI) that allows users to interact with the computer using icons, menus, and windows.

An OS allows different programs to work with a wide range of hardware, without requiring knowledge of how each specific hardware component works. For example, when you print a document from Microsoft Word, the program itself doesn't need to know how to use your printer. It just communicates with the OS, which in turn communicates with the printer. Similarly, the OS provides information to programs about input from peripheral devices. When you move your mouse or type with a keyboard, those devices talk to the OS and the OS tells your computer to move the cursor or enter text.

Operating systems include Windows, macOS, and Linux for PC, and Android and iOS for phones. Operating systems are loaded into RAM when the computer powers on, and they have access to the hard drive.



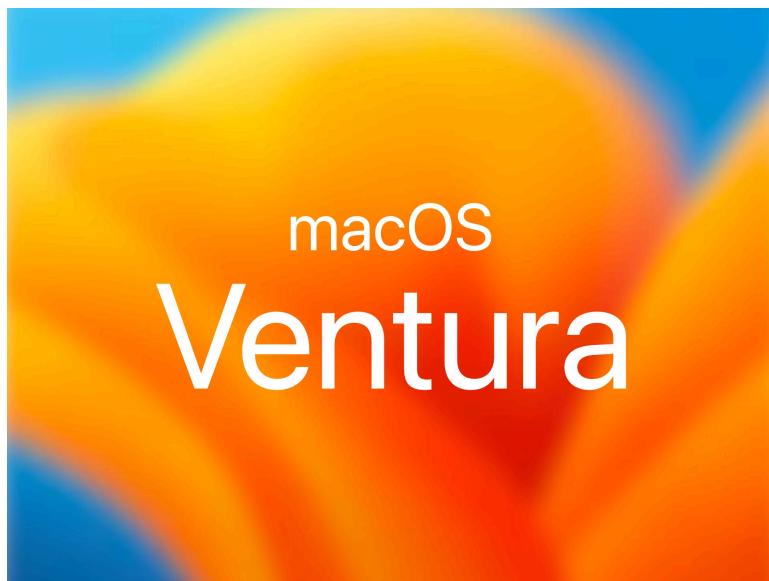
- **Windows**

Developed by Microsoft, Windows' goal is to be as accessible and user-friendly as possible. Their primary target customer is the general user, with less emphasis placed on customization, security, or performance. Because Windows is the most common OS, most **malware** is designed to attack Windows. However, with good online safety habits, the majority of users will remain safe from viruses.



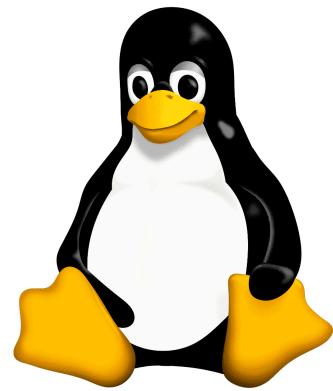
- **macOS**

macOS is what runs on Apple desktops and laptops. Like Windows, it has a graphical interface and supports a wide range of software. Compared to Windows, macOS is known for its elegance and stability. It's often considered more secure than Windows, with fewer viruses and malware designed to attack it. However, macOS has a smaller user base, which means it may not be compatible with certain software and can be more expensive. Apple produces both hardware and software, and Apple's software typically only runs on their own machines. While Windows is designed to be user-friendly, many find that macOS has a steeper learning curve and may take more time to become familiar with (though this is all subjective).



- **Linux**

Technically not an OS itself, Linux is a **kernel** that serves as the foundation for many operating systems, called **distributions** or "distros," such as **Ubuntu** and **Debian**. It's open-source, meaning it's free and can be modified and redistributed by developers. Linux is widely used for servers and is popular among programmers. However, it can be intimidating for new users, and not all programs are compatible with it. In particular, gaming has traditionally been more difficult compared to Windows, though this is improving.



- **iOS**

iOS is the operating system developed by Apple exclusively for iPhones and iPads, and offers similar advantages and disadvantages to macOS. iOS is known for its sleek design and user-friendly interface and is generally considered to have better security and privacy features than Android.



- **Android**

By far the most widely-used mobile phone OS, Android is based on Linux and more closely resembles a PC than iOS does. Android is developed by Google and runs on a variety of devices from different manufacturers. It's known for its customization options and flexibility and offers more variety in terms of device options and price points. Overall, both operating systems have their strengths and weaknesses, and the choice between them often comes down to personal preference and the specific needs of the user.



● Utility Software

Utility software, also called system support software, is a type of computer program that helps your computer work correctly. Utility software does things in the background that you may not see, like keeping your computer safe from viruses, managing your copy-pasting, and checking to make sure your computer is working properly. Some utility software is already installed on your computer when you buy it, while others you can download separately. Some examples of utility software are antivirus software, which helps protect your computer from viruses, and diagnostic programs, which help figure out if there is something wrong with your computer.

Using Ctrl + Alt + Del on Windows, you'll be able to access the **Task Manager**. Similarly, on macOS you can use Cmd + Spacebar to search for **Activity Monitor**. These will show you all the processes running on your computer, which will include utility software as well as applications that may be running.



● Applications

This category encompasses basically everything else; programs that are not essential for running the computer but are designed to perform a specific task for the user. Examples include word processors, web browsers, video games, and many more. These programs are typically designed to be user-friendly and to provide a specific set of features or functionality.



Firmware

Firmware is a special type of software specifically designed to work with the hardware of a particular device, like a smart TV or a printer. Unlike regular software, firmware is built into the hardware of a device, and it controls basic functions such as turning on, connecting to the internet, and communicating with other devices. Firmware can be updated or "flashed" to fix bugs, improve performance, or add new features.

