

inexpensive price. It is very uncommon in schools, though the Mexican government has contracted to place the Linux operating system in all of its schools. It is very reliable though the various graphical user interfaces are somewhat less user friendly than either Windows or Mac OS, though that is changing rapidly. The most widely distributed packaged versions are by RedHat, Caldera, Corel and Mandrake.

them for its use. *Trial software* usually remains functional for only a given period of time, typically 30 days after which it ceases to function. *Demonstration software* or “demo” software is either severely limited in its functionality or simply demonstrates the use of the software without actually producing a real end-product. Software that is offered for free, without expiring, but is severely limited in its capability, is often called “cripple ware.” The most common form of crippling is the inability to save any work performed in the program or to send its results to any output other than the monitor.

Vaporware is a disparaging term used to refer to software that is announced by a company but never makes it to market or is very late in doing so.

PC Operating Systems

What is confusing to most people is the fact that all modern PC operating systems include not only the operating system, but an interface and numerous applications programs built-in.

When people think of an operating system, they generally think of the interface—what they see on the monitor screen and how they “do things” when using it.

Some characteristics of the most popular PC operating systems

Microsoft Windows: The most popular operating system, particularly among home and business users. In common usage, a computer that uses the windows operating system is known as a PC (as opposed to a Mac—see below). Windows is used on wide variety of relatively inexpensive computers manufactured by any number of computer hardware manufacturers. The operating system is relatively expensive, historically unreliable, very *user friendly* in the later versions, and is compatible with most hardware available today. Current versions include: Windows 98SE (Second Edition), Windows NT 4.0, Windows ME (Millennium Edition), Windows 2000, and Windows XP (both professional and home editions).

Apple Macintosh OS: Commonly referred to as “the Mac” (in contrast to the windows-based PC), the Apple Macintosh runs only on specific Apple hardware. The hardware is more expensive than the typical PC and, usually, of better quality (particularly in the consumer versions). Mac’s are most popular in education, in the music recording industry, and in video production. The operating system interface is very similar to windows—particularly in the latest version—and slightly more reliable. With a couple of glaring exceptions, the operating system is just as user-friendly as Windows. Current versions include: OS 9.2, OS X (ten).

Linux: A relative newcomer to the PC market, Linux is a modified version of UNIX first developed by Linus Torvalds (after whom it is named: Linus’ Unix). It operates on PC-based hardware, though does not support all hardware available. It is readily available in the free version, but is difficult to install and configure. Various packaged versions with user-friendly installation and support packages included are available at a relatively

system, by far, is the Microsoft Windows family. The Apple Macintosh and various Linux systems are a distant second, each with an approximately equal numbers of users.

Applications Programs

Applications programs are the most numerous type of software. While the typical computer only “runs” one operating system, it usually uses dozens, if not hundreds, of applications programs. Applications programs assist the human user in inputting the data and instructions necessary to perform the tasks for which people use computers. An application program typically performs a narrow range of related tasks.

Applications programs are categorized by the type of data manipulation they direct. The most common application program types are: *word-processing programs, spreadsheets, databases, games, tutoring programs, simulations, and multi-media authoring programs.*

Network Software

Network software enables computers to communicate over a physical network and humans to control the access to the network. Network software contains elements of both systems software and application software.

Language Software

Language software provides computer programmers with the tools to write programs for the computer and translates those programs into *machine language* that computers can understand. Language software is technically a special form of applications software, but is most often thought of as a separate category.

Software Distribution Methods

Packaged or commercial software is the type of software most users encounter. All modern operating systems include a number of applications programs that must be considered “commercial” because they require the purchase of a particular operating system to obtain them. These included software programs may have been written by the operating system manufacturer or *licensed* from a “third-party” software manufacturer. The salient identifying characteristic of commercial software is that it must be purchased to legally own.

Freeware and Public Domain Software are offered to the public at no cost. The two major sources of free or public domain software are associated with the Free Software Foundation, Inc and their GNU Public License (GPL) and the Open Source Initiative (originally at UC Berkeley) and its Berkeley Software Distribution license (BSD).

Shareware is software that is free to try and priced to buy. Shareware is distinct from trial or demonstration software in that shareware is a fully-working, non-time limited product. The distributors of the software rely upon the honesty of the user to compensate

Another type of device that has become an integral part of the modern computer is the *network interface*. The network interface connects 2 or more CPU's—each forming an integral computer—together to create a *network*. While essentially an input/output device, it is qualitatively different from other input/output devices in three respects: Both input and outputs take place within one device, the input/output takes place between two computers, and no “translation” of information takes place.

Anything that connects two dissimilar parties together is known as an interface. An interface usually exhibits the following characteristics: It provides a physical connection between the two parties and acts as an interpreter between them.

All input-output devices may be differentiated according to the source and direction of the communication it fosters: Input devices involve a *human-to-computer* interface; output devices a *computer-to-human* interface, and network interfaces physically connect *computer-to-computer* (We will ignore human-to-human interfaces for now).

The network interface has two components: a hardware component and a software component. The hardware component allows a physical connection to be made over which data can travel. The software component formats the data into a mutually agreed-upon form and regulates its transmittal.

SOFTWARE

There are four types of software (computer programs): *Systems software*, *Application software*, *network software*, and *language software*. Software is also often categorized according to the method by which it is distributed. This includes *packaged* (commercial) *programs*, *freeware* and *public domain software*, *shareware*, and *vaporware*. As with hardware, any given piece of software has both attributes.

Systems software

Systems software controls the working of the computer, including the hardware and the interactions between them. The most basic system software is the BIOS (Basic Input-Output System) that starts the operating system (“boots” the computer) and carries out the transfer of data between the system components. The BIOS is largely invisible to the user who interacts with the computer through the *operating system* (OS).

The Operating System controls the use of the hardware in the computing system (the control programs are collectively called the *kernel*). Operating systems include an interface that allows the human user to direct the various functions of the system hardware. Modern interfaces are typically *Graphical User Interfaces* (GUI) rather than *command-line* interfaces.

The most popular current operating systems are *Microsoft Windows*, *Apple MacOS*, various “flavors” of UNIX and various “flavors” of *Linux*. UNIX is rarely used on desktop PC's and will not be treated further in this paper. The most popular PC operating

TABLE 1: Types and Classification of Storage Media

<u>Storage Media</u>	<u>Volatile</u>	<u>Non-volatile</u>	<u>Fixed</u>	<u>Removable</u>
Fixed Disk (Hard Drive)	X		X	
Floppy Disk	X			X
BIOS/System ROM		X*	X	
CD-ROM (includes CD-R)		X		X
DVD-ROM (includes DVD-R)		X		X
CD-RW	X			X
DVD-RW	X			X
Tape (in any configuration)	X			X
USB Micro-vault/thumb drive	X			X
Video Cache	X		X	
RAM	X		X	

*Note: “Flash ROM” can be updated and thus may be considered a type of volatile memory, however it is usually viewed as non-volatile memory.

Input and Output

The computer communicates with the “outside world” via various input and output devices:

Input devices allow the human user to communicate with the CPU (actually, to put data and instructions into the CPU).

Output devices allow the CPU to communicate to the human user. The exchange of information and the manipulation of the data in between is what constitutes computing. Various common types of input and output devices are shown in TABLE 2 below.

TABLE 2: Common Input and Output Devices

<u>Input Devices</u>	<u>Output Devices</u>
Keyboards	Monitor/video cards
Pointing Devices: Mouse/trackball	Printers/plotters
Touchpad (trackpad)/Joystick	LCD projector
scanner	Speakers/sound cards
Microphone or other sound transducer	Midi musical instruments
digital cameras(still and video)	Video cameras/recorders
Drawing tablet	

The CPU

The modern CPU microprocessor is an integrated circuit composed of millions of electronic components microscopically implanted on a silicon “chip” (common name for an integrated circuit). The processing power of a CPU is determined by a number of factors, not the least of which is its *processor speed*.

Processor speed is currently measured in megahertz (millions of cycles per second) or gigahertz (billions of cycles per second). The larger the number, the faster and—presumably—more powerful a processor is. The steady increase in the speed and power of processors is often referred to as *Moore’s law*.

Storage or Memory

Storage or memory is measured in *kilobytes* (1,024 bytes—abbreviated Kb), *megabytes* (1,024 kilobytes—abbreviated Mb), *gigabytes* (1,024 megabytes—abbreviated Gb) and *terabytes* (1,024 gigabytes—abbreviated Tb). A *byte* is 8 bits. A *bit* (Binary Term) is one binary digit (either 1 or 0) representing a condition of current on or off. A byte defines one character (such as a letter or a number).

Memory is classified as either *volatile* or *non-volatile*—that is, changeable or non-changeable. Certain types of volatile memory are used for temporary “in-out” storage (swap or cache). Other types of volatile memory are used for long-term storage and retrieval.

Memory devices are either *fixed* or *removable*—that is, permanently connected to the CPU or used in conjunction with some type of *storage media* to store data separate from the computer hardware itself.

A distinction is sometimes made between storage and memory in that storage is said to refer to non-volatile memory while memory refers to volatile memory.

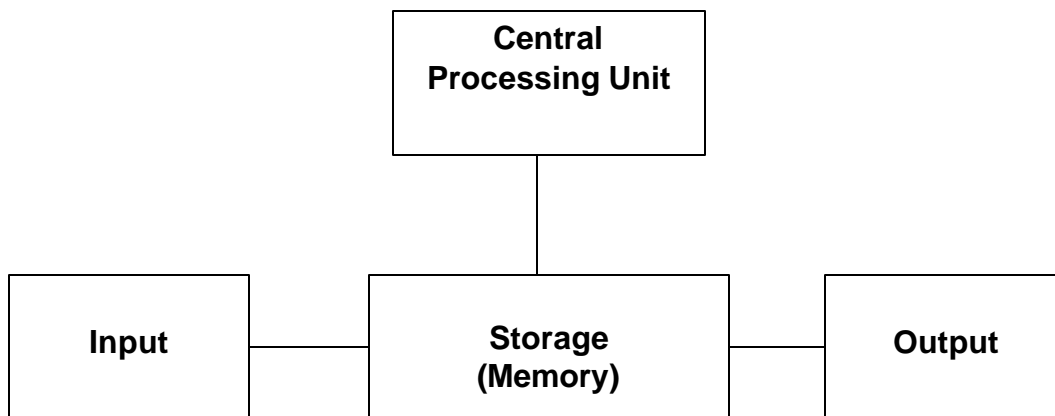
In popular usage—though not always technically correct—volatile memory is usually called RAM (Random Access Memory) and non-volatile memory is called ROM (Read Only Memory).

Storage media can be either volatile or non-volatile and fixed or removable and are often used in conjunction with memory devices. Thus, storage media can be volatile and either fixed or removable or non-volatile and either fixed or removable.

Some examples of storage media and their classifications are shown below in Table 1:

The Computer

Block Diagram of a computing system



The above diagram illustrates *the flow of data* within a computer. It also helps differentiate the various hardware systems that comprise a computing system.

Hardware refers to the physical components of the computing system.

Software refers to computer programs—the set of instructions that direct the processing of data within a computing system.

HARDWARE

Central Processing Unit (CPU): The device that interprets data, executes instructions, and transfers the results to one or more output devices. In a *personal computer (PC)* it is typically called a “microprocessor.”

Storage/Memory: Locations within the computing system where information is stored before, during and after being processed by the CPU. Together, the CPU and the Memory are often called the computer’s *brain* (first popularized by John von Neumann).

Input: Information entered into a computer or similar data-processing device. Input includes both data and instructions.

Output: The results of processing.