History of the coputer 18386

Technology, Computer

COMPUTER

Generally, a computer is any device that can perform numerical Calculations --even an adding machine, an abacus, or a slide rule. Currently, however, the term usually refers to an electronic device that can use a list of instructions, called a program, to perform calculations or to store, manipulate, and retrieve information.

Today's computers are marvels of miniaturization. Machines that once weighed 30 tons and occupied warehouse-size rooms now may weigh as little as three pounds (1. 4 kilograms) and can be carried in a suit pocket. The heart of today's computers are integrated circuits (ICs), sometimes called microchips, or simply chips. These tiny silicon wafers can contain millions of microscopic electronic components and are designed for many specific operations: some control an entire computer (CPU, or central processing unit, chips); some perform millions of mathematical operations per second (math oprocessors); others can store more than 16 million characters of information at one time (memory chips).

In 1953 there were only about 100 computers in use in the entire world. Today hundreds of millions of computers form the core of electronic products, and more than 110 million programmable computers are being used in homes, businesses, government offices, and universities for almost every conceivable purpose.

Computers come in many sizes and shapes. Special-purpose, or dedicated, computers are designed to perform specific tasks. Their operations are limited to the programs built into their microchips. These computers are the

basis for electronic calculators and can be found in thousands of other electronic products, including digital watches (controlling timing, alarms, and displays), cameras (monitoring shutter speeds and aperture settings), and automobiles (controlling fuel injection, heating, and air conditioning and monitoring hundreds of electronic sensors).

General-purpose computers, such as personal computers and business computers, are much more versatile because they can accept new sets of instructions. Each new set of instructions, or program,

enables the same computer to perform a different type of operation. For example, one program lets the computer act like a word processor, another lets it manage inventories, and yet another transforms it into a video game.

Although some general-purpose computers are as small as pocket radios, the smallest class of fully functional, self-contained computers is the class called notebook computers. These usually consist of a CPU, data-storage devices called disk drives, a liquid-crystal display (LCD), and a full-size keyboard--all housed in a single unit small enough to fit into a briefcase.

Today's desktop personal computers, or PCs, are many times more powerful than the huge, million-dollar business computers of the 1960s and 1970s. Most PCs can perform from 16 to 66 million operations per second, and some can even perform more than 100 million. These computers are used not only for household management and personal entertainment, but also for most of the automated tasks required by small businesses, including word

processing, generating mailing lists, tracking inventory, and calculating accounting information.

Minicomputers are fast computers that have greater datamanipulating capabilities than personal computers and can be used simultaneously by many people. These machines are primarily used by larger businesses to handle extensive accounting, billing, and inventory records.

Mainframes are large, extremely fast, multi-user computers that often contain complex arrays of processors, each designed to perform a specific function. Because they can handle huge databases, can

simultaneously accommodate scores of users, and can perform complex mathematical operations, they are the mainstay of industry, research, and university computing centers.

The speed and power of supercomputers, the fastest class of computer, are almost beyond human comprehension, and their capabilities are continually being improved. The most sophisticated of

these machines can perform nearly 32 billion calculations per second, can store a billion characters in memory at one time, and can do in one hour what a desktop computer would take 40 years to do.

Supercomputers attain these speeds through the use of several advanced engineering techniques. For example, critical circuitry is supercooled to nearly absolute zero so that electrons can move at the

speed of light, and many processors are linked in such a way that they can all work on a single problem simultaneously. Because these computers can cost millions of dollars, they are used primarily by

government agencies and large research centers.

Computer development is rapidly progressing at both the high and the low ends of the computing spectrum. On the high end, by linking together networks of several small computers and programming them to use a language called Linda, scientists have been able to outperform the supercomputer. This technology is called parallel processing and helps avoid hours of idle computer time. A goal of this technology is the creation of a machine that could perform a trillion calculations per second, a measure known as a teraflop. On the other end of the spectrum, companies like Apple and Compaq are developing small, handheld personal digital assistants (PDAs). The Apple Newton, for example, lets people use a pen to input handwritten information through a touch-sensitive screen and to send mail and faxes to other computers. Researchers are currently developing microchips called digital signal

processors, or DSPs, to enable these PDAs to recognize and interpret human speech. This development, which will permit people in all professions to use a computer quickly and easily, promises to lead to a

revolution in the way humans communicate and transfer information.

Computers at Work--Applications

Communication. Computers make all modern communication possible. They operate telephone switching systems, coordinate satellite launches and operations, help generate special effects for movies, and control the equipment in all phases of television and radio broadcasts. Local-area networks (LANs) link the computers in separate departments of businesses or universities, and larger networks, such as the Internet, permit modems--telecommunication devices that transmit data through telephone lines--to link individual computers to other computers anywhere in the world. Journalists and writers now use word processors to write books and articles, which they then submit to publishers on magnetic disks or through telephone lines. The data may then be sent directly to computer-controlled typesetters, some of which actually design the layout of printed pages on computer screens.

Science and research. Computers are used by scientists and researchers in many ways to collect, store, manipulate, and analyze data. Running simulations is one of the most important applications.

Data representing a real-life system is entered into the computer, and the computer manipulates the data in order to show how the natural system is likely to behave under a variety of conditions. In this way scientists can test new theories and designs or can examine a problem that does not lend itself to direct experimentation. Computer-aided design, or CAD, programs enable engineers and architects to design three-dimensional models on a computer screen. Chemists may use computer simulation to design and test molecular models of new drugs. Some simulation programs can generate models of

weather conditions to help meteorologists make predictions. Flight simulators are valuable training tools for pilots.

Industry. Computers have opened a new era in manufacturing and consumer-product development. In the factory, computer-assisted manufacturing, or CAM, programs help people plan complex production

schedules, keep track of inventories and accounts, run automated assembly lines, and control robots. Dedicated computers are routinely used in thousands of products ranging from calculators to airplanes.

Government. Government agencies are the largest users of mainframes and supercomputers. The United States Department of Defense uses computers for hundreds of tasks, including research,

breaking codes, interpreting data from spy satellites, and targeting missiles. The Internal Revenue Service uses computers to keep track of tens of millions of tax returns. Computers are also essential for

taking the census, maintaining criminal records, and other tasks.

Education. Computers have proved to be valuable educational tools. Computer-assisted instruction, or CAI, uses computerized lessons that range from simple drills and practice sessions to complex

interactive tutorials. These programs have become essential teaching tools in medical schools and military training centers, where the topics are complex and the cost of human teachers is extremely high.

Educational aids, such as some encyclopedias and other major reference works, are available to personal-computer users--either on magnetic disks or optical discs or through various Telecommunication networks.

Arts and Entertainment. Video games are one of the most popular applications of personal computers. The constantly improving graphics and sound capabilities of personal computers have made them

popular tools for artists and musicians. Personal computers can display millions of colors, can produce images far clearer than those of a television set, and can connect to various musical instruments and

synthesizers. Painting and drawing programs enable artists to create realistic images and animated displays much more easily than they could with more traditional tools. " Morphing" programs allow

photographers and filmmakers to transform photographic images into any size and shape they can imagine. High-speed supercomputers can insert lifelike animated images into frames of a film so seamlessly that movie-goers cannot distinguish real actors from computer-generated

images. Musicians can use computers to create multiple-voice compositions and to play back music with hundreds of variations.

Types of Computers

There are two fundamentally different types of computers--analog and digital. (Hybrid computers combine elements of both types.) Analog computers solve problems by using continuously changing data (such as

pressure or voltage) rather than by manipulating discrete binary digits (1s and 0s) as a digital computer does. In current usage, the term computer usually refers to digital computers. Digital computers are generally more effective than analog computers for four principal reasons: they are faster; they are not as susceptible to signal interference; they can convey data with more precision; and their coded binary data are easier to store and transfer than are analog signals.

Analog computers. Analog computers work by translating constantly changing physical conditions (such as temperature, pressure, or voltage) into corresponding mechanical or electrical quantities. They

offer continuous solutions to the problems on which they are operating. For example, an automobile speedometer is a mechanical analog computer that measures the rotations per minute of the drive shaft and translates that measurement into a display of miles per hour. Electronic analog computers in chemical plants monitor temperatures, pressures, and flow rates and send corresponding voltages to various control devices, which, in turn, adjust the chemical processing conditions to their proper levels.

Digital computers. For all their apparent complexity, digital computers are basically simple machines. Every operation they perform, from navigating a spacecraft to playing a game of chess, is based on one key operation--determining whether certain switches, called gates, are open or closed. The real power of a computer lies in the speed with which it checks these switches--anywhere from 1

million to 4 billion times, or cycles, per second.

A computer can recognize only two states in each of its millions of circuit switches--on or off, or high voltage or low voltage. By assigning binary numbers to these states--1 for on and 0 for off, for example-and linking many switches together, a computer can represent any type of data--from numbers to letters to musical notes. This process is called digitization.

Imagine that a computer is checking only one switch at a time. If the switch is on, it symbolizes one operation, letter, or number; if the switch is off it represents another. When switches are linked together as a unit, the computer can recognize more data in each cycle. For example, if a computer checks two switches at once it can recognize any of four pieces of data--one represented by the combination off-off; one by off-on; one by on-off; and one by on-on. The more switches a computer checks in each cycle, the more data it can recognize at one time and the faster it can operate. Below are some common groupings of switches (each switch is called a binary digit, or bit) and the number of discrete units of data that they can symbolize:

4 bits= a nibble (16 pieces of data);

8 bits= a byte (256 pieces of data);

16 bits= a word (65, 536 pieces of data).

32 bits= a double word (4, 294, 967, 296 pieces of data).

A byte is the basic unit of data storage because all characters, numbers, and symbols on a keyboard can be symbolized by using a combination of only eight 0s and 1s.

Each combination of ons and offs represents a different instruction, part of an instruction, or type of data (number, letter, or symbol). For example, depending on its context in a program, a byte with a pattern of 01000001 may symbolize the number 65, the capital letter A, or an instruction to the computer to move data from one place to another.

Hardware

The central processing unit, or CPU, is the heart of a computer. In addition to performing arithmetic and logic operations on data, it times and controls the rest of the system. Mainframe CPUs sometimes consist of several linked microchips, each performing a separate task, but most other computers require only a single microprocessor as a CPU.

Most CPU chips and microprocessors have four functional sections:

(1) the arithmetic/logic unit, which performs arithmetic operations

(such as addition and subtraction) and logic operations (such as testing

a value to see if it is true or false);

(2) temporary storage locations, called registers, which hold data,

instructions, or the results of calculations;

(3) the control section, which times and regulates all elements of the computer system and also translates patterns in the registers into computer activities (such as instructions to add, move, or compare data); and

(4) the internal bus, a network of communication lines that links internal CPU elements and offers several different data paths for input from and output to other elements of the computer system.

Input devices let users enter commands, data, or programs for processing by the CPU. Computer keyboards, which are much like typewriter keyboards, are the most common input devices. Information typed at the keyboard is translated into a series of binary numbers that the CPU can manipulate. Another common input device, the mouse, is a mechanical or optomechanical device with buttons on the top and a rolling ball in its base. To move the cursor on the display screen, the user moves the mouse around on a flat surface. The user selects operations, activates commands, or creates or changes images on the screen by pressing buttons on the mouse. Other input devices include joysticks and trackballs. Light pens can be used to draw or to point to items or areas on the display screen. A sensitized digitizer pad translates images drawn on it with an electronic stylus or pen into a

corresponding image on the display screen. Touch-sensitive display screens allow users to point to items or areas on the screen and to activate commands. Optical scanners " read" characters on a printed

page and translate them into binary numbers that the CPU can use. Voice-recognition circuitry digitizes spoken words and enters them into the computer.

Memory-storage devices. Most digital computers store data both internally, in what is called main memory, and externally, on auxiliary storage units. As a computer processes data and instructions,

it temporarily stores information internally, usually on silicon random-access memory, or RAM, chips--often called semiconductor memory. Usually mounted on the main circuit board inside the computer or on peripheral cards that plug into the board, each RAM chip may consist of as many as 16 million switches, called flip-flop switches, that respond to changes in electric current. Each switch can hold one bit of data: high voltage applied to a switch causes it to hold a 1; low voltage causes it to hold a 0. This kind of internal memory is also called read/write memory.

Another type of internal memory consists of a series of read-only memory, or ROM, chips. The switches of ROM chips are set when they are manufactured and are unchangeable. The patterns on these chips correspond to commands and programs that the computer needs in order to boot up, or ready itself for operation, and to carry out basic operations. Because read-only memory is

actually a combination of hardware (microchips) and software (programs), it is often referred to as firmware.

Other devices that are sometimes used for main memory are magnetic-core memory and magnetic-bubble memory. Unlike semiconductor memories, these do not lose their contents if the power

supply is cut off. Long used in mainframe computers, magnetic-core memories are being supplanted by the faster and more compact semiconductor memories in mainframes designed for high-speed applications. Magnetic-bubble memory is used more often for auxiliary storage than for main memory.

Auxiliary storage units supplement the main memory by holding parts of programs that are too large to fit into the random-access memory at one time. They also offer a more permanent and secure method for storing programs and data.

Four auxiliary storage devices--floppy disks, hard disks, magnetic tape, and magnetic drums--store data by magnetically rearranging metal particles on disks, tape, or drums. Particles oriented in one direction

represent 1s, and particles oriented in another direction represent 0s. Floppy-disk drives (which " write" data on removable magnetic disks) can store from 140, 000 to 2. 8 million bytes of data on one disk and are used primarily in laptop and personal computers. Hard disk drives contain nonremovable magnetic media and are used with all types of computers. They access data very quickly and can store from 10 million bytes (10

megabytes) of data to a few gigabytes (billion bytes). Magnetic-tape storage devices are usually used together with hard disk drives on large computer systems that handle high volumes of

constantly changing data. The tape drives, which access data very slowly, regularly back up, or duplicate, the data in the hard disk drives to protect the system against loss of data during power failures or computer malfunctions.

magnetic-drum memories store data in the form of magnetized spots in adjacent circular tracks on the surface of a rotating metal cylinder. They are relatively slow and are rarely used today. Optical discs are nonmagnetic auxiliary storage devices that developed from compact-audio-disc technology. Data is encoded on a disc as a series of pits and flat spaces, called lands, the lengths of

which correspond to different patterns of 0s and 1s. One removable 43/4-inch (12-centimeter) disc contains a spiral track more than 3 miles (4. 8 kilometers) long, on which can be stored nearly a billion bytes (gigabyte) of information. All of the text in this encyclopedia, for example, would fill only one fifth of one disc. Read-only optical discs, whose data can be read but not changed, are called CD- ROMs

(Compact disc-read-only memory).

Recordable CD-ROM drives, called WORM (write-once/read-many) drives, are used by many businesses and universities to periodically back up changing databases and to conveniently distribute massive amounts of information to customers or users.

Video display terminal

Output devices let the user see the results of the computer's data processing. The most common output device is the video display terminal (VDT), or monitor, which uses a cathode-ray tube (CRT) to display characters and graphics on a television-like screen. Modems (modulator-demodulators) are input-output devices that allow computers to transfer data between each other. A modem on one

computer translates digital pulses into analog signals (sound) and then transmits the signals through a telephone line or a communication network to another computer. A modem on the computer at the other end of the line reverses the process.

Printers generate hard copy--a printed version of information stored in one of the computer's memory systems. The three principal types of printers are daisy-wheel, dot-matrix, and laser. Other types of printers include ink-jet printers and thermal printers.

Software

A computer's operating system is the software that allows all of the dissimilar hardware and software systems to work together. It is often stored in a computer's ROM memory. An operating system consists of programs and routines that coordinate operations and processes, translate the data from different input and output devices, regulate data storage in memory, allocate tasks to different processors, and provide functions that help programmers write software.

Computers that use disk memory-storage systems are said to have disk operating systems (DOS). MS-DOS is the most popular microcomputer operating system. UNIX, a powerful operating system for larger computers, allows many users and many different programs to gain access to a computer's processor at the same time. Visual operating systems called GUIs (graphical user interfaces) were

designed to be easy to use, yet to give UNIX-like power and flexibility to home and small-business users. Future operating systems will enable users to control all aspects of the computer's hardware and software simply by moving and manipulating their corresponding " objects," or graphical icons displayed on the screen. Sometimes programs other than the operating system are built into

the hardware, as is the case in dedicated computers or ROM chips. Most often, however, programs exist independently of the computer. When such software is loaded into a general-purpose computer, it

automatically programs the computer to perform a specific task--such as word processing, managing accounts and inventories, or displaying an arcade game.

PCs and other Revolutions

By the mid-1970s, microchips and microprocessors had drastically reduced the cost of the thousands of electronic components required in a computer. The first affordable desktop computer designed specifically for personal use was called the Altair 8800 and was sold by Micro Telemetry Systems in 1974.

In 1977 Tandy Corporation became the first major electronics firm to produce a personal computer. They added a keyboard and CRT to their computer and offered a means of storing programs on a cassette recorder. Soon afterward, a small company named Apple Computer, founded by engineer Stephen Wozniak and entrepreneur Steven Jobs, began producing a superior computer.

IBM introduced its Personal Computer, or PC, in 1981. As a result of competition from the makers of clones (computers that worked exactly like an IBM-PC), the price of personal computers fell drastically. Today's personal computer is 400 times faster than ENIAC, 3, 000 times lighter, and several million dollars cheaper. In rapid succession computers have shrunk from tabletop to lap-top and finally to palm size. With some personal computers, called pen-pads, people can even write directly on an etched-glass, liquid-crystal screen using a small electronic stylus , and words will appear on the screen in clean typescript.

Multimedia

In the early 1990s, manufacturers began producing inexpensive CD-ROM drives that could access more than 650 megabytes of data form a single disc. This development started a multimedia revolution

that may continue for decades. The term multimedia encompasses the computer's ability to merge sounds, video, text, music, animations, charts, maps, etc., into colorful, interactive presentations, a business advertising campaign, or even a space-war arcade game.

Faster computers and the rapid proliferation of multimedia programs will probably forever change the way people get information. The computer's ability to instantly retrieve a tiny piece of information from the midst of a huge mass of data has always been one of its most important uses. Since video and audio clips can be stored alongside text on a single CD-ROM disc, a whole new way of exploring a subject is possible . By using hyperlinks--a programming method by which related terms, articles, pictures, and sounds are internally hooked together--material can be presented to people so that they can peruse it in a typically human manner, by association. For example, if you are reading about Abraham Lincoln's Gettysburg Address and you want to read about the battle of Gettysburg, you need only click on the highlighted hyperlink " battle of Gettysburg." Instantly, the appropriate text, photos, and maps appear on the monitor. " Pennsylvania" is another click away, and so on. Encyclopedias, almanacs, collections of reference books, interactive games using movie footage, educational programs, and even motion pictures with accompanying screenplay, actor biographies, director's notes, and reviews make multimedia one of the computer world's most exciting and creative fields.

The Information Superhighway

A computer network is the interconnection of many individual computers, much as a road is the link between the homes and the buildings of a city. Having many separate computers linked on a network provides many advantages to organizations such as businesses and universities. People may quickly and easily share files; modify databases; send memos called E-mail,

or electronic mail; run programs on remote mainframes; and get access to information in databases that are too massive to fit on a small computer's hard drive. Networks provide an essential tool for the routing, managing, and storing of huge amounts of rapidly changing data.

The Internet is a network of networks: the international linking of tens of thousands of businesses, universities, and research organizations with millions of individual users. It is what United States President Al Gore first publicly referred to as the information superhighway. What is now known as the Internet was originally formed in 1970 as a military network called ARPAnet (Advanced Research Projects Agency network) as part of the Department of Defense. The network opened to non-military users in the 1970s, when universities and companies doing defense-related research were given access, and flourished in the late 1980s as most universities and many businesses around the world online. In 1993, when commercial providers were first permitted to sell Internet connections to individuals, usage of the network exploded. Millions of new users came on within months, and a new era of computer communications began. Most networks on the Internet make certain files available to other. These common files can be databases, programs, or E-mail from the individuals on the network. With hundreds of thousands of international sites each providing thousands of pieces of data, it's easy to imagine the mass of raw data available to users.

The Internet is by no means the only way in which computer users

can communicate with others. Several commercial online services

provide connections to members who pay a monthly connect-time fee. CompuServe, America OnLine, Prodigy, Genie, and several others provide a tremendous range of information and services, including online conferencing, electronic mail transfer, program downloading, current weather and stock market information, travel and entertainment information, access to encyclopedias and other reference works, and electronic forums for specific users' groups such as PC us

Word Count: 4317