

Computers 13825

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Only once in a lifetime will a new invention come about to touch every aspect of our lives. Such a device that changes the way we work, live, and play is a special one, indeed. A machine that has done all this and more now exists in nearly every business in the US and one out of every two households. This incredible invention is the computer. The electronic computer has been around for over a half-century, but its ancestors have been around for 2000 years. However, only in the last 40 years has it changed the American society. From the first wooden abacus to the latest high-speed microprocessor, the computer has changed nearly every aspect of people's lives for the better. The very earliest existence of the modern day computer's ancestor is the abacus. These date back to almost 2000 years ago. It is simply a wooden rack holding parallel wires on which beads are strung. When these beads are moved along the wire according to "programming" rules that the user must memorize, all ordinary arithmetic operations can be performed. The next innovation in computers took place in 1694 when Blaise Pascal invented the first "digital calculating machine". It could only add numbers and they had to be entered by turning dials. It was designed to help Pascal's father who was a tax collector. In the early 1800's, a mathematics professor named Charles Babbage designed an automatic calculation machine. It was steam powered and could store up to 1000 50-digit numbers. Built in to his machine were operations that included everything a modern general-purpose computer would need. It was programmed by--and stored data on--cards with holes punched in them, appropriately called "punchcards". His inventions were failures for the most part because of the lack of precision machining techniques used at the time and the lack of demand for such a device. After Babbage, people began to

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lose interest in computers. However, between 1850 and 1900 there were great advances in mathematics and physics that began to rekindle the interest. Many of these new advances involved complex calculations and formulas that were very time consuming for human calculation. The first major use for a computer in the US was during the 1890 census. Two men, Herman Hollerith and James Powers, developed a new punched-card system that could automatically read information on cards without human intervention. Since the population of the US was increasing so fast, the computer was an essential tool in tabulating the totals. These advantages were noted by commercial industries and soon led to the development of improved punch-card business-machine systems by International Business Machines (IBM), Remington-Rand, Burroughs, and other corporations. By modern standards the punched-card machines were slow, typically processing from 50 to 250 cards per minute, with each card holding up to 80 digits. At the time, however, punched cards were an enormous step forward; they provided a means of input, output, and memory storage on a massive scale. For more than 50 years following their first use, punched-card machines did the bulk of the world's business computing and a good portion of the computing work in science. By the late 1930s punched-card machine techniques had become so well established and reliable that Howard Hathaway Aiken, in collaboration with engineers at IBM, undertook construction of a large automatic digital computer based on standard IBM electromechanical parts. Aiken's machine, called the Harvard Mark I, handled 23-digit numbers and could perform all four arithmetic operations. Also, it had special built-in programs to handle logarithms and trigonometric functions. The Mark I was controlled from prepunched paper tape. Output

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was by card punch and electric typewriter. It was slow, requiring 3 to 5 seconds for a multiplication, but it was fully automatic and could complete long computations without human intervention. The outbreak of World War II produced a desperate need for computing capability, especially for the military. New weapons systems were produced which needed trajectory tables and other essential data. In 1942, John P. Eckert, John W. Mauchley, and their associates at the University of Pennsylvania decided to build a high-speed electronic computer to do the job. This machine became known as ENIAC, for "Electrical Numerical Integrator And Calculator". It could multiply two numbers at the rate of 300 products per second, by finding the value of each product from a multiplication table stored in its memory. ENIAC was thus about 1,000 times faster than the previous generation of computers. ENIAC used 18,000 standard vacuum tubes, occupied 1800 square feet of floor space, and used about 180,000 watts of electricity. It used punched-card input and output. The ENIAC was very difficult to program because one had to essentially re-wire it to perform whatever task he wanted the computer to do. It was, however, efficient in handling the particular programs for which it had been designed. ENIAC is generally accepted as the first successful high-speed electronic digital computer and was used in many applications from 1946 to 1955. Mathematician John von Neumann was very interested in the ENIAC. In 1945 he undertook a theoretical study of computation that demonstrated that a computer could have a very simple and yet be able to execute any kind of computation effectively by means of proper programmed control without the need for any changes in hardware. Von Neumann came up with incredible ideas for methods of building and organizing practical, fast computers. These ideas,

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which came to be referred to as the stored-program technique, became fundamental for future generations of high-speed digital computers and were universally adopted. The first wave of modern programmed electronic computers to take advantage of these improvements appeared in 1947. This group included computers using random access memory (RAM), which is a memory designed to give almost constant access to any particular piece of information. These machines had punched-card or punched-tape input and output devices and RAMs of 1000-word capacity. Physically, they were much more compact than ENIAC: some were about the size of a grand piano and required 2500 small electron tubes. This was quite an improvement over the earlier machines. The first-generation stored-program computers required considerable maintenance, usually attained 70% to 80% reliable operations, and were used for 8 to 12 years. Typically, they were programmed directly in machine language, although by the mid-1950s progress had been made in several aspects of advanced programming. This group of machines included EDVAC and UNIVAC, the first commercially available computers. John W. Mauchley and John Eckert, Jr. developed the UNIVAC in the 1950's. Together they had formed the Mauchley-Eckert Computer Corporation, America's first computer company in the 1940's. During the development of the UNIVAC, they began to run short on funds and sold their company to the larger Remington-Rand Corporation. Eventually they built a working UNIVAC computer. It was delivered to the US Census Bureau in 1951 where it was used to help tabulate the US population. Early in the 1950s two important engineering discoveries changed the electronic computer field. The first computers were made with vacuum tubes, but by the late 1950's computers were being made out of transistors, which were smaller, less expensive,

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more reliable, and more efficient. In 1959, Robert Noyce, a physicist at the Fairchild Semiconductor Corporation, invented the integrated circuit, a tiny chip of silicon that contained an entire electronic circuit. Gone was the bulky, unreliable, but fast machine; now computers began to become more compact, more reliable and have more capacity. These new technical discoveries rapidly found their way into new models of digital computers. Memory storage capacities increased 800% in commercially available machines by the early 1960s and speeds increased by an equally large margin. These machines were very expensive to purchase or to rent and were especially expensive to operate because of the cost of hiring programmers to perform the complex operations the computers ran. Such computers were typically found in large computer centers--operated by industry, government, and private laboratories--staffed with many programmers and support personnel. By 1956, 76 of IBM's large computer mainframes were in use, compared with only 46 UNIVAC's. In the 1960s efforts to design and develop the fastest possible computers with the greatest capacity reached a turning point with the completion of the LARC machine for Livermore Radiation Laboratories by the Sperry-Rand Corporation, and the Stretch computer by IBM. The LARC had a core memory of 98, 000 words and multiplied in 10 microseconds. Stretch was provided with several ranks of memory having slower access for the ranks of greater capacity, the fastest access time being less than 1 microseconds and the total capacity in the vicinity of 100 million words. During this time the major computer manufacturers began to offer a range of computer capabilities, as well as various computer-related equipment. These included input means such as consoles and card feeders; output means such as page printers,

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cathode-ray-tube displays, and graphing devices; and optional magnetic-tape and magnetic-disk file storage. These found wide use in business for such applications as accounting, payroll, inventory control, ordering supplies, and billing. Central processing units (CPUs) for such purposes did not need to be very fast arithmetically and were primarily used to access large amounts of records on file. The greatest number of computer systems were delivered for the larger applications, such as in hospitals for keeping track of patient records, medications, and treatments given. They were also used in automated library systems and in database systems such as the Chemical Abstracts system, where computer records now on file cover nearly all known chemical compounds. The trend during the 1970s was, to some extent, away from extremely powerful, centralized computational centers and toward a broader range of applications for less-costly computer systems. Most continuous-process manufacturing, such as petroleum refining and electrical-power distribution systems, began using computers of relatively modest capability for controlling and regulating their activities. In the 1960s the programming of applications problems was an obstacle to the self-sufficiency of moderate-sized on-site computer installations, but great advances in applications programming languages removed these obstacles. Applications languages became available for controlling a great range of manufacturing processes, for computer operation of machine tools, and for many other tasks. In 1971 Marcian E. Hoff, Jr., an engineer at the Intel Corporation, invented the microprocessor and another stage in the development of the computer began. A new revolution in computer hardware was now well under way, involving miniaturization of computer-logic circuitry and of component manufacture by what are called large-scale integration

techniques. In the 1950s it was realized that "scaling down" the size of electronic digital computer circuits and parts would increase speed and efficiency and improve performance. However, at that time the manufacturing methods were not good enough to accomplish such a task. About 1960-photo printing of conductive circuit boards to eliminate wiring became highly developed. Then it became possible to build resistors and capacitors into the circuitry by photographic means (Rogers, 142). In the 1970s entire assemblies, such as adders, shifting registers, and counters, became available on tiny chips of silicon. In the 1980s very large scale integration (VLSI), in which hundreds of thousands of transistors are placed on a single chip, became increasingly common. Many companies, some new to the computer field, introduced in the 1970s programmable minicomputers supplied with software packages. The size-reduction trend continued with the introduction of personal computers, which are programmable machines small enough and inexpensive enough to be purchased and used by individuals. One of the firsts of such machines was introduced in January 1975. Popular Electronics magazine provided plans that would allow any electronics wizard to build his own small, programmable computer for about \$380 (Rose, 32). The computer was called the "Altair 88000. Its programming involved pushing buttons and flipping switches on the front of the box. It didn't include a monitor or keyboard, and its applications were very limited (Jacobs, 53). Even though, many orders came in for it and several famous owners of computer and software manufacturing companies got their start in computing through the Altair. For example, Steve Jobs and Steve Wozniak, founders of Apple Computer, built a much cheaper, yet more productive version of the Altair and turned their hobby into a business. After

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the introduction of the Altair 8800, the personal computer industry became a fierce battleground of competition. IBM had been the computer industry standard for well over a half-century. They held their position as the standard when they introduced their first personal computer, the IBM Model 60 in 1975. However, the newly formed Apple Computer company was releasing its own personal computer, the Apple II (The Apple I was the first computer designed by Jobs and Wozniak in Wozniak's garage, which was not produced on a wide scale). Software was needed to run the computers as well. Microsoft developed a Disk Operating System (MS-DOS) for the IBM computer while Apple developed its own software system. Because Microsoft had now set the software standard for IBMs, every software manufacturer had to make their software compatible with Microsoft's. This would lead to huge profits for Microsoft. The main goal of the computer manufacturers was to make the computer as affordable as possible while increasing speed, reliability, and capacity. Nearly every computer manufacturer accomplished this and computers popped up everywhere. Computers were in businesses keeping track of inventories. Computers were in colleges aiding students in research. Computers were in laboratories making complex calculations at high speeds for scientists and physicists. The computer had made its mark everywhere in society and built up a huge industry. The future is promising for the computer industry and its technology. The speed of processors is expected to double every year and a half in the coming years. As manufacturing techniques are further perfected the prices of computer systems are expected to steadily fall. However, since the microprocessor technology will be increasing, its higher costs will offset the drop in price of older processors. In other words, the price of a new computer will stay about

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the same from year to year, but technology will steadily increase. Since the end of World War II, the computer industry has grown from a standing start into one of the biggest and most profitable industries in the United States. It now comprises thousands of companies, making everything from multi-million dollar high-speed super computers to printout paper and floppy disks. It employs millions of people and generates tens of billions of dollars in sales each year. Surely, the computer has impacted every aspect of people's lives. It has affected the way people work and play. It has made everyone's life easier by doing difficult work for people. The computer truly is one of the most incredible inventions in history.