*T*o commemorate the 50th year of modern computing and the Computer Society, the timeline on the following pages traces the evolution of computing and computer technology.

Timeline research by Bob Carlson, Angela Burgess, and Christine Miller. Timeline design and production by Larry Bauer.

We thank our reviewers: Ted Biggerstaff, George Cybenko, Martin Campbell-Kelly, Alan Davis, Dan O'Leary, Edward Parrish, and Michael Williams.

In 2012 the timeline was augmented through 2010 by the Society's History Committee. Janice Hall did the update graphics.

Timeline of Computing History

4000-1200 B.C. *Inhabitants of the first known civilization in Sumer keep records of commercial transactions on clay tablets.*
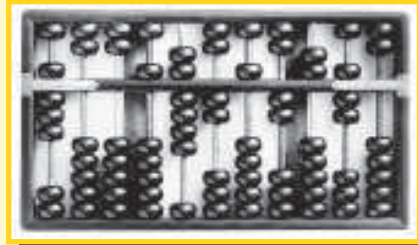
3000 B.C. *The abacus is invented in Babylonia.*

250-230 B.C. *The Sieve of Eratosthenes is used to determine prime numbers.*

About 79 A.D. *The "Antikythera Device," when set correctly according to latitude and day of the week, gives alternating 29- and 30-day lunar months.*

About 1300 *The more familiar wire-and-bead abacus replaces the Chinese calculating rods.*

4000 B.C. — 1300

1612-1614 **John Napier uses the printed decimal point, devises logarithms, and uses numbered sticks, or Napiers Bones, for calculating.**

The Computer Museum

1622 **William Oughtred invents the circular slide rule on the basis of Napier's logarithms.**

1623 **William (Wilhelm) Schickard designs a "calculating clock" with a gear-driven carry mechanism to aid in multiplication of multi-digit numbers.**

The Computer Museum

1642-1643 **Blaise Pascal creates a gear-driven adding machine called the "Pascalene," the first mechanical adding machine.**

1666 **In England, Samuel Morland produces a mechanical calculator that can add and subtract.**

1600s

IBM Archives

1674 *Gottfried Leibniz builds the "Stepped Reckoner," a calculator using a stepped cylindrical gear.*

1774 *Philipp-Matthaus Hahn builds and sells a small number of calculating machines precise to 12 digits.*

1777 *The third Earl of Stanhope invents a multiplying calculator.*

1786 *J.H. Mueller envisions a "difference engine" but cannot get the funds to build it.*

1801 *A linked sequence of punched cards controls the weaving of patterns in Joseph-Marie Jacquard's loom.*
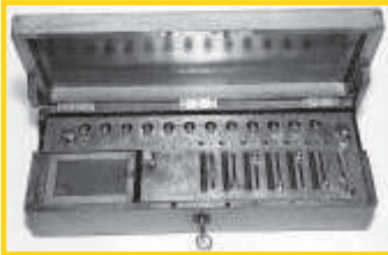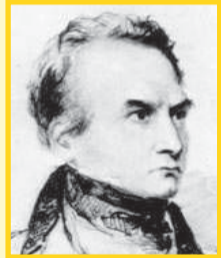

IBM Archives

1674 — 1801
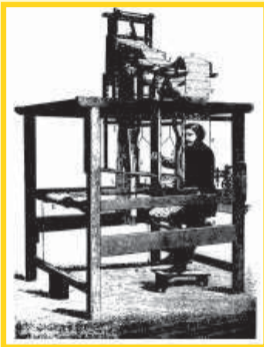
1811 Luddites destroy machinery that threatens to eliminate jobs.

1820 The Thomas Arithmometer, based on Leibniz' stepped-drum principle, is demonstrated to the French Academy of Science. It becomes the first mass-produced calculator and sells for many years.
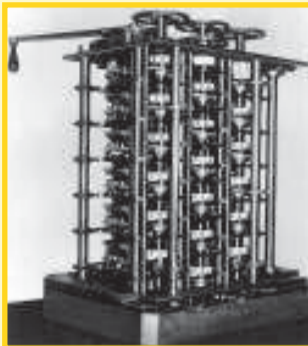
IBM Archives

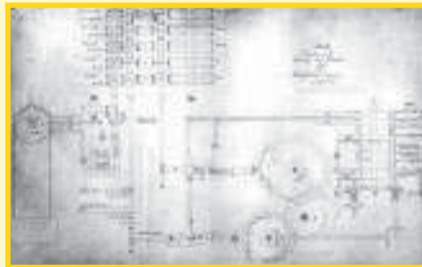*1822 Charles Babbage begins to design and build the Difference Engine.*

1811 — 1822

1832 Babbage and Joseph Clement produce a portion of the Difference Engine.

IBM Archives

1829 William Austin Burt patents an awkward but workable typewriter, the first writing machine in America.

1834-35 Babbage shifts his focus to designing the Analytical Engine.

IBM Archives

1838 In January Samuel Morse and Alfred Vail demonstrate elements of the telegraph system.

1829 — 1838

The Computer Museum

1842-1843 Augusta Ada, Countess of Lovelace, translates Luigi Menabrea's pamphlet on the Analytical Engine, adding her own commentary.

*1844 Samuel Morse sends a telegraph message from Washington to Baltimore.*

Smithsonian Institution Photo No. 89-22161

1847-1849 Babbage completes 21 drawings for the second version of the Difference Engine but does not complete construction.

1854 George Boole publishes "An Investigation of the Laws of Thought," describing a system for symbolic and logical reasoning that will become the basis for computer design.
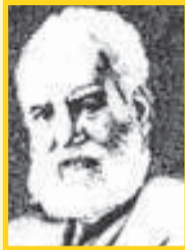

1842 — 1854

Smithsonian Institution Photo No.
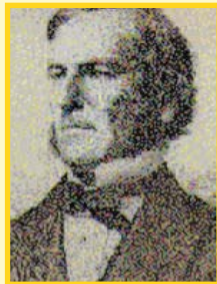
1858 A telegraph cable spans the Atlantic Ocean for the first time and provides service for a few days.

1861 A transcontinental telegraph line connects the Atlantic and Pacific coasts.

National Inventors Hall of Fame
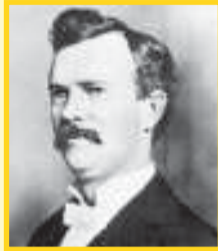
1876 Alexander Graham Bell invents and patents the telephone.

1876-1878 Baron Kelvin builds a harmonic analyzer and tide predictor.

Smithsonian Institution

Charles Babbage Institute, University of Minnesota, Minneapolis

1882 William S. Burroughs leaves his bank clerk's job determined to invent an adding machine.

1858 — 1882

The Computer Museum

1889 Herman Hollerith's Electric Tabulating System outperforms the competition and in the fall is selected for use in the 1890 census.

1893 The first four-function calculator is invented.

1895 Guglielmo Marconi transmits a radio signal.

IBM Archives

1896 Hollerith establishes the Tabulating Machine Company.

1901 The keypunch appears and changes very little over the next half century.

1889 — 1901

1904 John A. Fleming patents the diode vacuum tube, setting the stage for better radio communication.

Smithsonian Institution Photo No. 351

1906 Lee de Forest adds a third valve to control current flow to Fleming's diode to create the three-electrode vacuum tube.

1907 Gramophone music constitutes the first regular radio broadcasts from New York.

1908 British scientist Campbell Swinton describes an electronic scanning method and foreshadows use of the cathode-ray tube for television.

1911 Hollerith's Tabulating Machines Co. and two other companies combine to form C-T-R—Calculating, Tabulating, and Recording Co.

1911 Dutch physicist Kamerlingh Onnes at Leiden University discovers superconductivity.

IBM Archives

1904 — 1911

1912 The Institute of Radio Engineers, which will eventually merge with other organizations to form the IEEE, is established.

1915 Use of microchips is foreshadowed as physicist Manson Benedicks discovers that the germanium crystal can be used to convert alternating current to direct current.

1919 Eccles and Jordan, US physicists, invent the flip-flop electronic switching circuit critical to high-speed electronic counting systems.

1920-1921 The word "robot" (derived from the Czech word for compulsory labor) is first used by Karel Câpek in his play RUR (Rossum's Universal Robots).

IBM Archives

1924 T.J. Watson renames CTR to IBM and popularizes the "Think" slogan he coined at National Cash Register.

IBM Archives

THINK
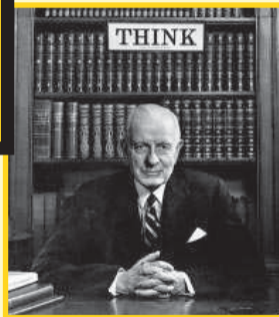
1912 — 1924

1927 **Herbert Hoover's face is seen on screen during the first demonstration of television in the US. Accompanying voice transmission uses telephone wires.**

1928 **The quartz crystal clock makes possible unprecedented time-keeping accuracy.**

*1929* **Color television signals are successfully transmitted.**

Center for the History of Electrical Engineering

1930 **The Differential Analyzer, devised by Vannevar Bush and colleagues at MIT, solves various differential equations.**

1931 **Reynold B. Johnson, a high school teacher in Michigan, devises a way to score multiple-choice tests by sensing conductive pencil marks on answer sheets. IBM later buys the technology.**

1934 **In Germany, Konrad Zuse seeks to build a better calculating machine than those currently available.**

1927 — 1934

IBM Archives
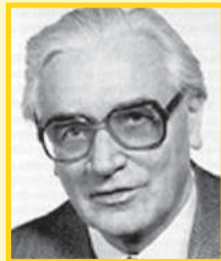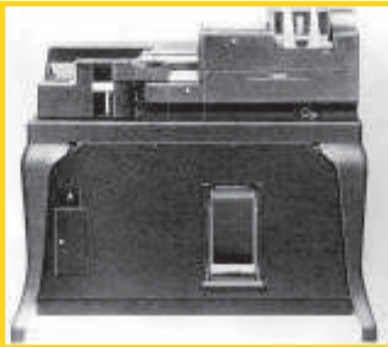
1935 IBM introduces not only the 601 multiplying punch-card machine but also an electric typewriter.

1936 Konrad Zuse realizes that programs composed of bit combinations can be stored, and he files a patent application in Germany for the automatic execution of calculations, including a "combination memory."

IBM Archives

1937 Howard Aiken submits to IBM a proposal for a digital calculating machine capable of performing the four fundamental operations of arithmetic and operating in a predetermined sequence.

1937 IClaude Shannon publishes the principles for an electric adder to the base two.

1937 George Stibitz develops a binary circuit based on Boolean algebra.

1935 — 1937

Iowa State University

1937 John Vincent Atanasoff spends the winter devising the principles for an electronic-digital computer.

1937 Alan Turing's paper "On Computable Numbers" presents the concept of the Turing machine.

HP Company Archives

1938 William Hewlett and David Packard form Hewlett-Packard in a garage in Palo Alto, California.

1939 Working from October through November, John Vincent Atanasoff, with help from graduate student Clifford E. Berry, builds a prototype electronic-digital computer that uses binary arithmetic.

1938 Zuse completes the Z1 electromechanical binary computer and refines the design with the Z2.

Iowa State University

1937 — 1939

1940 Konrad Zuse completes the Z2, which uses telephone relays instead of mechanical logical circuits.

1941 Zuse completes the Z3, the first fully functional program-controlled electromechanical digital computer.

1943 On May 31, 1943, construction begins on the ENIAC at the Moore School of Electrical Engineering in Philadelphia.

Bletchley Park Museum

1943 OIn December, Colossus, a British vacuum tube computer, becomes operational at Bletchley Park through the combined efforts of Alan Turing, Tommy Flowers, and M.H.A. Newman. It is considered the first all-electronic calculating device.

1944 The Harvard Mark I (a.k.a. IBM Automatic Sequence Controlled Calculator [ASCC]), produced by Howard Aiken, is dedicated at Harvard University on August 7, 1944.

IBM Archives

1940 — 1944

IEEE Annals of History of Computing

1945 J. Presper Eckert and John Mauchly sign a contract to build the EDVAC (Electronic Discrete Variable Automatic Computer).

1945 By spring of the year, ENIAC is up and running.

*1945 John von Neumann introduces the concept of a stored program in a June 30 draft report on the EDVAC design.*

1945 Zuse's Z4 survives World War II and helps launch postwar development of scientific computers in Germany.

1945 Working on a prototype of the Mark II, in the summer Grace Murray Hopper finds the first computer "bug," a moth that had caused a relay failure.

*1945 In July, Vannevar Bush's As We May Think is published in the Atlantic Monthly.*

1945
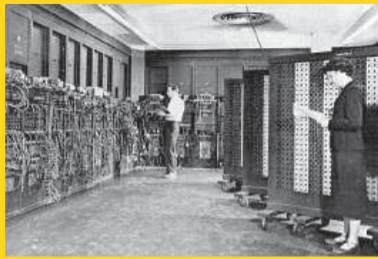
1946 ENIAC, designed by J. Presper Eckert and John Mauchly, is unveiled at the University of Pennsylvania on February 14.

1946 Arthur Burks, Herman Goldstine, and John von Neumann write "Preliminary Discussion of the Logical Design of an Electronic Computing Instrument."

1946 The American Institute of Electrical Engineers establishes a Subcommittee on Large-Scale Calculating Devices—the origin of today's IEEE Computer Society.
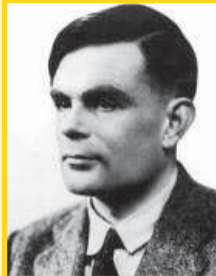
1946 Alan Turing publishes a report on his design for ACE (Automatic Computing Engine), featuring random extraction of information.

1946

1947 *In July, Howard Aiken and his team complete the Harvard Mark II.*

IEEE Annals of History of Computing

1947-1948 *The magnetic drum memory is introduced as a data storage device for computers.*

Bell Laboratories

1947 *On December 23, Bell Labs management is informed by John Bardeen and Walter Brattain that along with William Shockley they have developed the first transistor.*

The Computer Museum

1947 — 1948

1948 Claude Shannon publishes "A Mathematical Theory of Communication," formulating the modern understanding of the communication process.

Bell Laboratories

The Computer Museum

1948 On June 21, the Manchester Mark I, or "baby" machine, becomes the first operational stored-program digital computer. It used vacuum tube, or valve, circuits.

1948 Richard Hamming devises a way to find and correct errors in blocks of data. The Hamming code is subsequently used in computer and telephone switching systems.

Bell Laboratories

1948

1948 The SSEC (Selective Sequence Electronic Calculator), using both electronics and relays, is dedicated on January 24.

IBM Archives

The Computer Museum

1949 The Whirlwind computer, constructed under the leadership of Jay Forrester at MIT to be the first real-time computer, is placed in service during the third quarter. It contained 5,000 vacuum tubes.

1949 EDSAC (Electronic Delayed Storage Automatic Computer), a stored-program computer built by Maurice Wilkes at Cambridge University, England, performs its first calculation on May 6.

1949 Short Order Code, developed by John Mauchly, is thought to be the first high-level programming language.

*1950 The Pilot ACE is completed at England's National Physical Laboratory and runs its first program on May 10.*

1948 — 1950

1950 Remington Rand buys the Eckert-Mauchly Computer Corporation.

1950 The Standards Western Automatic Computer (SWAC), built under Harry Huskey's leadership, is dedicated at UCLA on August 17.
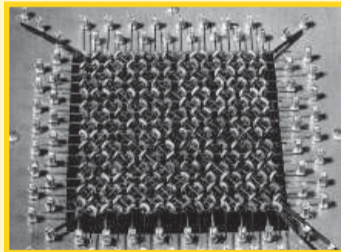
1950 Alan Turing publishes an article in the journal Mind establishing the criteria for the Turing Test of machine intelligence.
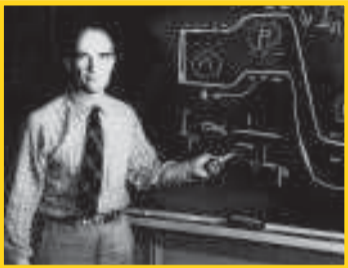
Smithsonian 0Institution
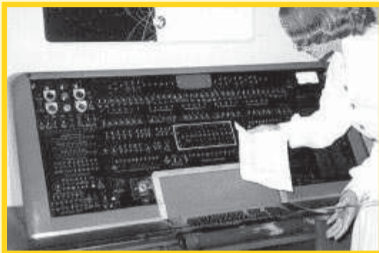
1951 The first Univac I is delivered to the US Census Bureau in March.

1951 Jay Forrester files a patent application for the matrix core memory on May 11.

Center for the History of Electrical Engineering

1950 — 1951

Bell Laboratories

1951 William Shockley invents the junction transistor.

1951 David Wheeler, Maurice Wilkes, and Stanley Gill introduce sub-programs and the "Wheeler jump" as a means to implement them.

1951 Betty Holberton creates a sort-merge generator, a predecessor of the compiler.

1951 Maurice Wilkes originates the concept of micro-programming, a technique providing an orderly approach to designing a computer system's control section.

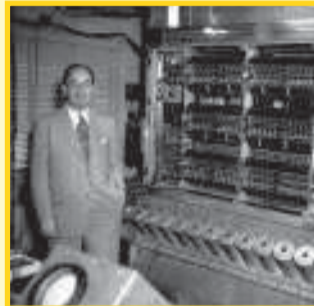**1951-1952** Grace Murray Hopper develops A-0, the first compiler.

1952 The EDVAC runs its first production program on January 28.

1952 Illiac I is built at the University of Illinois, Urbana-Champaign; Ordvac is built by the US Army. Both use von Neumann architecture.

1952 John von Neumann's IAS bit-parallel machine is completed in June for the Institute of Advanced Studies at Princeton, New Jersey.

1952

1952 Thomas Watson Jr. becomes president of IBM.

IBM Archives

1952 The Institute of Radio Engineers initiates the Transactions of the I.R.E. Electronics Group on Electronic Computers, a predecessor to the IEEE Transactions on Computers.

1952 On television, a Univac I predicts the outcome of the presidential election and expands the public consciousness regarding computers.

1952 The IBM 701—the Defense Calculator—is introduced in December.

IBM Archives

1952

1953 **After several years of development, LEO, a commercial version of EDSAC built by the Lyons Company in the UK, goes into service.**

1953 **The IBM 650, known as the Magnetic Drum Calculator, debuts and becomes the first mass-produced computer.**

1953 **Kenneth Olsen uses Jay Forrester's ferrite-core memory to build the Memory Test computer.**

1954 **Earl Masterson's Uniprinter, or line printer, developed for computers, executes 600 lines per minute.**

1954 **Texas Instruments introduces the silicon transistor, pointing the way to lower manufacturing costs.**

1953 — 1954

1954 The Univac 1103A becomes the first commercial machine with a ferrite-core memory.

IBM Archives

1956-1957 IBM introduces and begins installing the RAMAC (random-access method of accounting and control) for hard disk data storage.

1956 John McCarthy and Marvin Minsky chair a meeting at Dartmouth College at which the concept of artificial intelligence is developed.

1956 Fuji Photo Film Co. in Japan develops a 1,700-vacuum-tube computer for lens design calculations.

1956 A Univac with transistors and designed for commercial use is introduced.

1957 John Backus and colleagues at IBM deliver the first Fortran (formula translator) compiler to Westinghouse.

http://www.latec.edu/~acm/HelloWorld.shtml

```
c
c   Hello, world.
c
      Program Hello

      implicit none
      logical  DONE

      DO while (.NOT. DONE)
       write(*,10)
      END DO
 10   format('Hello, world.')
      END
```

1954 — 1957

1957 The Atlas Guidance Computer from Burroughs, one of the first computers using transistors, helps control the launch of the Atlas missile.

1957-1958 Gordon Moore, Robert Noyce, and others found Fairchild Semiconductor.

1957 Japan's Electrotechnical Laboratory develops a transistor computer, the ETL Mark III, that uses 130 transistors and 1,700 diodes.


1957 John McCarthy forms MIT's Artificial Intelligence Department.

1957 Control Data is incorporated on July 8.

1957 Russia launches Sputnik I into orbit on October 4, and the "space race" begins.

1957 Nippon Telegraph and Telephone Corp. develops the Musasino-1, the first parametron computer. It uses 519 vacuum tubes and 5,400 parametrons—logic elements based on the principle of parametric excitation and invented by Eiji Goto in 1954.

1957

The Computer Museum
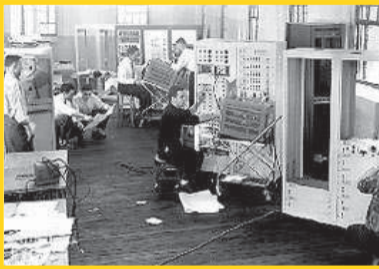
1958 Digital Equipment Corp. is founded.

1958 At Texas Instruments, Jack Kilby develops a prototype semiconductor IC while Robert Noyce works separately on ICs at Fairchild Semiconductor.

Texas Instruments Incorporated

1958 The Whirlwind project is extended to produce an air traffic control system.

Bell Laboratories

1958 Bell's development of the modem data phone enables telephone lines to transmit binary data.

1958

```
000100 IDENTIFICATION DIVISION.
000200 PROGRAM-ID.  HELLOWORLD.
000300 DATE-WRITTEN.02/05/96  21:04.
000400*     AUTHOR JOHN JONES
000500 ENVIRONMENT DIVISION.
000600 CONFIGURATION SECTION.
000700 SOURCE-COMPUTER. RM-COBOL.
000800 OBJECT-COMPUTER. RM-COBOL.
000900
001000 DATA DIVISION.
001100 FILE SECTION.
001200
100000 PROCEDURE DIVISION.
100100
100200 MAIN-LOGIC SECTION.
100300 BEGIN.
100400     DISPLAY " " LINE 1 POSITION 1 ERASE EOS.
100500     DISPLAY "HELLO, WORLD." LINE 15 POSITION 10.
100600     STOP RUN.
100700 MAIN-LOGIC-EXIT.
100800     EXIT.
```

The Computer Museum

1959 The Committee on Data Systems Languages (Codasyl) is formed to create Cobol (Common Business Oriented Language).

```
; LISP
(DEFUN HELLO-WORLD ()
            (PRINT (LIST 'HELLO 'WORLD)))
```

1959 John McCarthy develops Lisp (list processing) for artificial intelligence applications.

1959 In June, Japan's first commercial transistor computer, NEC Corp.'s NEAC 2201, is demonstrated at an exhibition in Paris.

1959 Xerox introduces the first commercial copy machine.

1959

1959 Jack Kilby at Texas Instruments designs a flip-flop IC.

1959 On July 30, Robert Noyce and Gordon Moore file a patent application for integrated circuit technology on behalf of the Fairchild Semiconductor Corp.

1959 UNESCO sponsors the first major international computer conference.

1959 General Electric produces the GE ERMA to process checks in a banking application via magnetic ink character recognition.

1959

Rand Corp.

1960 Working at Rand Corp., Paul Baran develops the packet-switching principle for data communications.

```
BEGIN
FILE F (KIND=REMOTE);
EBCDIC ARRAY E [0:11];
REPLACE E BY "HELLO WORLD!";
WHILE TRUE DO
  BEGIN
  WRITE (F, *, E);
  END;
END.
```

http://www.latec.edu/~acm/HelloWorld.shtml

1960 Standards for Algol 60 are established jointly by American and European computer scientists.

1960 The Livermore Advance Research Computer (LARC) by Remington Rand is designed for scientific work and uses 60,000 transistors.

1960 At Cornell University, Frank Rosenblatt builds a computer—the Perceptron—that can learn by trial and error through a neural network.

1960 In November, DEC introduces the PDP-1, the first commercial computer with a monitor and keyboard input.

Digital Equipment Corporation

1960

The Computer Museum

1961 Georg C. Devol patents a robotic device, which Unimation soon markets as the first industrial robot. It is first used to automate the manufacture of TV picture tubes.

1961 IBM's 7030, or Stretch, computer is completed and runs about 30 times faster than the 704, leading to further exploration of supercomputing.

IBM Archives

1961 Fernando Corbató at MIT develops a way for multiple users to share computer time.

1961

1962 **Max V. Mathews leads a Bell Labs team in developing software that can design, store, and edit synthesized music.**

1962 **Stanford and Purdue Universities establish the first departments of computer science.**

1962 **H. Ross Perot founds Electronic Data Systems, which will become the world's largest computer service bureau.**

1962 **The first video game is invented by MIT graduate student Steve Russell. It is soon played in computer labs all over the US.**

The Computer Museum

1962 **The Telstar communications satellite is launched on July 10 and relays the first transatlantic television pictures.**

1962 **Atlas, considered the world's most powerful computer, is inaugurated in England on December 7. Its advances include virtual memory and pipelined operations.**

1963 **On the basis of an idea of Alan Turing's, Joseph Weizenbaum at MIT develops a "mechanical psychiatrist" called Eliza that appears to possess intelligence.**

1962 — 1963

1963 **In January, Ivan Sutherland introduces Sketchpad, leading to the consolidation of computer graphics.**

A	1	0	0	0	0	0	1
B	1	0	0	0	0	1	0
C	1	0	0	0	0	1	1
D	1	0	0	0	1	0	0
E	1	0	0	0	1	0	1
F	1	0	0	0	1	1	0
G	1	0	0	0	1	1	1
H	1	0	0	1	0	0	0
I	1	0	0	1	0	0	1
J	1	0	0	1	0	1	0
K	1	0	0	1	0	1	1
L	1	0	0	1	1	0	0
M	1	0	0	1	1	0	1

1963 **The American National Standards Institute accepts ASCII 7-bit code for information exchange.**

Gold vectors   Gold bore

Blue Enamel
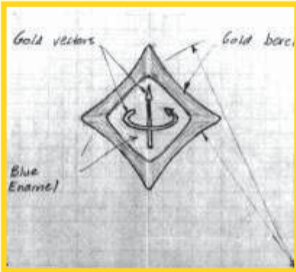
1963 **The Institute of Radio Engineers and the American Institute of Electrical Engineers merge to form the IEEE.**

1963 **The SAGE system for military defense is fully deployed at a total project cost of about $8 billion. Many of its technological advances prove beneficial to the entire computer industry.**

*1963* **At the University of California, Berkeley, Lotfi Zadeh begins work on fuzzy logic.**

1963

1964 *Basic (Beginner's All-Purpose Symbolic Instruction Code) is developed at Dartmouth by John Kemeny and Thomas Kurtz. It spawns many variations.*

```
10 print "Hello World!"
20 goto 10
```

1964 *IBM's seven-year-long Sabre project, allowing travel agents anywhere to make airline reservations, is fully implemented.*

IBM Archives

1964 *IBM announces the System/360 "third-generation" line of computers.*

IBM Archives

1964

University of Virginia
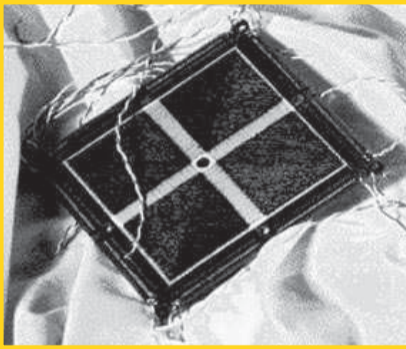
1964 *With a speed of 9 megaflops, Control Data Corp.'s CDC 6600, designed by Seymour Cray, claims the title of first commercially successful supercomputer.*

1964 *IBM develops a computer-aided design system.*

1964 *Doug Engelbart invents the mouse.*

Bootstrap Institute

1964

1965 J.A. Robinson develops unification, the underpinning of logic programming and important to many of today's programming technologies.

1965 DEC debuts the first minicomputer, the PDP-8, which used transistor circuitry modules.

1965 Project MAC, a large collaborative time-sharing project, leads to the Multics operating system.

1965 Maurice Wilkes proposes the use of a cache memory on the basis of an idea by Gordon Scarott.

1965 At the University of Belgrade, Rajko Tomovic makes one of the earliest attempts to develop an artificial limb with a sense of touch.

1965

```
Begin
    while l = 1 do begin
            outtext ("Hello World!");
            outimage;
    end;
End;
```

1967 Ole-Johan Dahl and Kristen Nygaard at the Norwegian Computing Centre complete a general-purpose version of the language Simula, the first object-oriented language.

1967 Fairchild introduces its 3800 8-bit ALU chip.

1967 At Texas Instruments, Jack Kilby, Jerry Merryman, and James Van Tassel invent a four-function handheld calculator.

1967 Donald Knuth writes about algorithms and data structures as entities separate from the programs they are used in.

1968 A conference sponsored by the NATO Science Committee addresses the "software crisis" and introduces the term "software engineering."
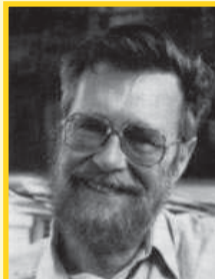
1968 Edsger Dijkstra writes about the harmful effects of the goto statement, and interest in structured programming burgeons.

1967 — 1968

1968 The first computers to incorporate integrated circuits—the B2500 and B3500—are introduced by Burroughs.

1968 A Federal Information Processing Standard encourages use of the six-digit data format (YYMMDD) for information interchange, sowing the seeds of the "Year 2000 Crisis."
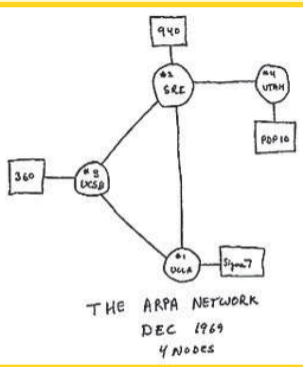
1968 The Seymour Cray-designed CDC 7600 supercomputer achieves 40-megaflops performance.

1968 The Rand Corp. presents a decentralized communications network concept to ARPA.

Intel Corporation

1968 Robert Noyce, Andy Grove, and Gordon Moore establish Intel, which is incorporated on July 18.

1969

1969 The RS-232-C standard is introduced to facilitate data exchange between computers and peripherals.

1969 The US Department of Defense commissions Arpanet for research networking, and the first four nodes become operational at UCLA, UC Santa Barbara, SRI, and the University of Utah using BBN-developed packet switches.

1970 Shakey, developed at SRI International, is the first robot to use artificial intelligence to navigate.

1970 Winston Royce publishes "Managing the Development of Large Software Systems," which outlines the waterfall development method.

1969 — 1970

Bell Laboratories

1970 Unix is developed at Bell Labs by Dennis Ritchie and Kenneth Thomson.

1970 The Computer Group News becomes Computer, a monthly magazine for all Computer Society members.

1970 RCA's MOS (metal-oxide semiconductor) technology promises cheaper and smaller ICs.

1970 Xerox establishes the Palo Alto Research Center at Stanford University for computer research.

1970 E.F. Codd describes the relational model.

IBM Archives

1970 The floppy disk and the daisywheel printer make their debut.

1970

1971 The team of Ted Hoff, S. Mazor, and F. Faggin develops the Intel 4004 microprocessor—a "computer on a chip."

1971 Don Hoefler writes a series of articles for Electronic News called "Silicon Valley USA," using in print the name that had been adopted to describe the area.

1971 David Parnas describes the principle of information hiding.

1971 Ray Tomlinson of Bolt Beranek and Newman sends the first network e-mail message.

http://www.latec.edu/~acm/HelloWorld.shtml

```
Program Hello (Input, Output);

Begin
  Writeln ('Hello World!');
End.
```

1971 Niklaus Wirth develops Pascal, a predecessor to Modula-2.

1971 The IEEE Computer Group becomes the IEEE Computer Society.

1971

HP Company Archives

1972 Hand-held calculators become popular, making the slide rule obsolete.

1972 Intel's 8008, the first 8-bit microprocessor, appears but is soon replaced by the 8080.

1972 Nolan Bushnell's Pong video game is so successful that he founds Atari.

```
#include

main()
{
  for(;;)
      {
         printf ("Hello World!\n");
      }
}
```

1972 Dennis Ritchie develops C at Bell Labs, so named because its predecessor was named B.

```
Transcript show: 'Hello World';cr
```

1972 Smalltalk is developed by Xerox PARC's Learning Research Group, based largely on the ideas of Alan Kay.

1972

1972 Alain Colmerauer at the University of Marseille develops Prolog, which popularizes key logic programming concepts.

```
% HELLO WORLD  Works with Sbp (prolog)

hello :-
printstring ("HELLO WORLD!!!!")

printstring ([])
printstring ([H|T]) :- put (H), printstring (T).
```

1972 Wang, VYDEC, and Lexitron all introduce word processing systems.

1972 In Wimbledon, England, an experimental computerized axial tomography imager finds a brain tumor in a patient.

The Computer Museum

1972 DEC's PDP 11/45 is introduced, its circuitry encased in chips.

1972 Analytic complexity theory develops the idea of NP-completeness, showing that a large class of computing problems, such as the "traveling salesman problem," may be computationally intractable.

1972

The Computer Museum
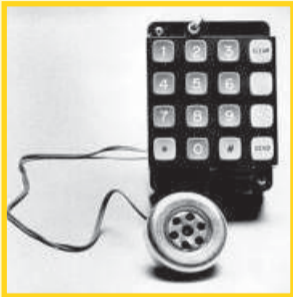
1972 **Steve Wozniak builds a "blue box" tone generator to make free phone calls and sells them in the dorm at UC Berkeley.**

1973 **Researchers at Xerox PARC develop an experimental PC called Alto that uses a mouse, Ethernet, and a graphical user interface.**

1973 **Work begins on the Transmission Control Protocol at a Stanford University laboratory headed by Vinton Cerf.**

1973 **Alan Kay develops a forerunner of the PC. His "office computer," based on Smalltalk, employs icons, graphics, and a mouse.**

Xerox PARC

1972 — 1973
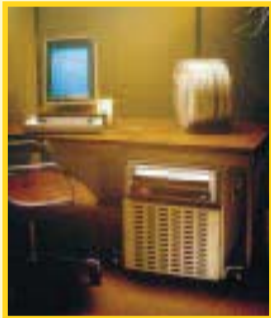
1973 Through a technique called large-scale integration, 10,000 components are placed on a 1-sq-cm chip.

1973 John Vincent Atanasoff is recognized as the creator of the modern computer when a federal judge invalidates Eckert and Mauchly's ENIAC patent.

Robert Metcalfe
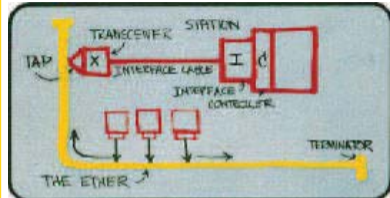
1973 Robert Metcalfe writes a memo on "Ether Acquisition," which describes the Ethernet as a modified Alohanet.

1974 An article in Radio Electronics describes how to build a "personal minicomputer," the Mark-8.

1974 At Xexoc PARC, Charles Simonyi writes the first WYSIWYG application, Bravo.

1974 A 4-Kbit D-RAM chip becomes commercially available.

1974 In Stockholm, chess-playing computers engage in their first tournament.

1973 — 1974

The Computer Museum

1975 *The first PC, an Altair 8800, available as a kit, appears on the cover of Popular Electronics in January.*

1975 *Michael Jackson describes a method to treat a program's structure as a reflection of a problem's structure, a precursor to the Jackson System Development method.*

1975 *John Cocke works on the 801 project at IBM to develop a minicomputer with the yet-unnamed RISC architecture.*

1975 *IBM introduces the laser printer.*

The George C. Page Museum, © LACMNH

1975 *Frederick Brooks writes The Mythical Man-Month, which describes software development as "the mortal struggle of great beasts in the tar pits" and advises that adding more people to a late project only makes it later.*

1975

The Computer Museum

1976 The Cray-1 from Cray Research is the first supercomputer with a vectorial architecture.

1976 Gary Kildall develops the CP/M operating system for 8-bit PCs.

1976 OnTyme, the first commercial e-mail service, finds a limited market because the installed base of potential users is too small.

1976 IBM develops the ink-jet printer.

The Computer Museum

1976 Steve Jobs and Steve Wozniak design and build the Apple I , which consists mostly of a circuit board.

1976

Apple Computer, Inc.

1977 Steve Jobs and Steve Wozniak incorporate Apple Computer on January 3.

1977 The Apple II is announced in the spring and establishes the benchmark for personal computers.

1977 Several companies begin experimenting with fiber-optic cable.

1977 Bill Gates and Paul Allen found Microsoft, setting up shop first in Albuquerque, New Mexico.

Microsoft Archives

1977

The Computer Museum

1977 PCs from Tandy and Commodore come with built-in monitors and thus require no television hookup.

The Computer Museum

Digital Equipment Corporation
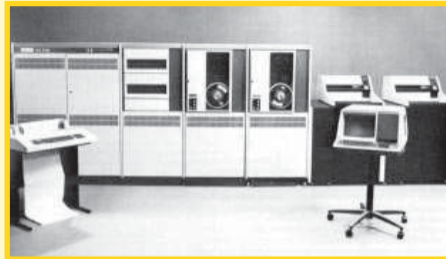
1978 DEC introduces the VAX 11/780, a 32-bit computer that becomes popular for technical and scientific applications.

Wow, It's WordStar!

1978 Wordstar is introduced and goes on to become a widely used word processor with CP/M systems and later on DOS computers.

1978 Tom DeMarco's Structured Analysis and System Specification popularizes structured analysis.

1978 Ron Rivest, Adi Shamir, and Leonard Adelman propose the RSA cipher as a public-key cryptosystem for enciphering digital transmissions.

1978 Intel's first 16-bit processor, the 8086, debuts.
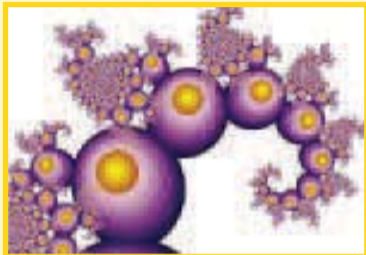
pjcarlsn@ix.netcom.com

1979 Benoit Mandelbrot continues his research into fractals by generating a Mandelbrot set, derived from $z(n + 1) = z(n) * z(n) - (0)$.

1978 — 1979

The Computer Museum

1979 The first electronic spreadsheet program, Don Bricklin's and Bob Franston's VisiCalc, is unveiled on May 11 and proves to be the "killer app" for early PCs.

1979 Motorola introduces the 68000 chip, which will later support the Macintosh.

1979 Digital videodisks appear through the efforts of Sony and Philips.

© 1996 Motorola Museum of Electronics

1979 Cellular telephones are tested in Japan and Chicago.

1979

1980 IBM selects PC-DOS from upstart Microsoft as the operating system for its new PC.

1980 After a long development period, the Ada language emerges. Developed by the US Department of Defense, it is designed for process control and embedded applications.

```
with i_o; use i_o;
procdure hello is
begin
   put ("Hello World!");
end Hello;
```

1980 Wayne Ratliff develops dBase II, the first version of a PC database program. It goes on to enjoy wide market success.

1980 The Osborne 1 "portable" computer weighs 24 pounds and is the size of a small suitcase.

1980

1980 David A. Patterson at UC Berkeley begins using the term "reduced-instruction set" and, with John Hennessy at Stanford, develops the concept.

1981 Barry Boehm devises Cocomo (Constructive Cost Model), a software cost-estimation model.

1981 Japan grabs a big piece of the chip market by producing chips with 64 Kbits of memory.

1981 Xerox introduces a commercial version of the Alto called the Xerox Star.

IBM Archives

1981 The open-architecture IBM PC is launched in August, signaling to corporate America that desktop computing is going mainstream.

1980 — 1981

1982 Columbia Data Products produces the first IBM PC "clone." Compaq soon follows with its own version.

1982 Autodesk is founded and ships the first version of AutoCAD later that year.

Adobe Systems, Inc.

1982 John Warnock develops the PostScript page-description language and with Charles Geschke founds Adobe Systems.

1982 Time magazine names the computer as its "Man of the Year."

Cray Research

1982 The Cray X-MP (two Cray-1 computers linked in parallel) proves three times faster than a Cray-1.

1982

1982 Japan launches its "fifth generation" computer project, focusing on artificial intelligence.

1982 Commercial e-mail service begins among 25 cities.

1982 In November, Compaq unveils an IBM-compatible portable PC.

Lotus

1983 By including graphics such as pie charts and bar graphs, Lotus 1-2-3 does for the IBM PC what VisiCalc did for the Apple II.

1983 A Josephson junction is developed on the basis of Brian Josephson's 1962 prediction, bringing higher speed and lower power dissipation to ICs.

1983 The IBM PC-XT heads for market success, while the PC Junior faces quick extinction.

1983 Completion of the TCP/IP switchover marks the creation of the global Internet.

1982 — 1983

1983 Though not destined for commercial success, Apple's Lisa, launched in May, shows what can be done with a mouse, icons, and pulldown menus.

1983 Thinking Machines Corp. and Ncube are founded, providing a boost to parallel processing.

```
#include

int main()
{
  char *s1, *s2;
  par {
    s1 = "hello, ";
    s2 = "world\n";
  }
  cout << s1 << s2 << endl;
  return(0);
}
```

1983 At AT&T Bell Labs, Bjarne Stroustrup continues work on C++, an OO extension to C.

1983

Apple Computer, Inc.

1984 *In January, the Macintosh is unveiled with a publicity campaign that includes an Orwellian-themed ad during the Super Bowl.*

Apple Computer, Inc.
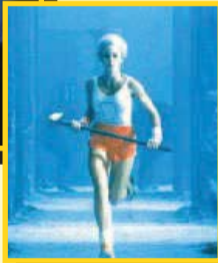
1984 *Apple gives computer graphics a boost with its MacPaint program.*

1984 *MIDI (Musical Instrument Digital Interface) standards are developed for interfacing computers and digital music synthesizers.*

Smithsonian Institution Photo No.

1984 *The CD-ROM, introduced by Sony and Philips, provides significantly greater storage capacity for digital data.*

1984

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1984 Motorola introduces the MC68020 with 250,000 transistors.

1984 A motion picture, The Last Starfighter, uses extensive supercomputer-generated graphics.

1984 NEC manufactures a 256-Kbit chip, and IBM introduces a 1-Mbit RAM chip.

1984 In Neuromancer, novelist William Gibson coins the term "cyberspace."

1984 Beginning in August, Intel's 16-bit 80286 chip, installed in IBM's new PC AT, expands desktop computer capabilities.

Intel Corporation

1984

1985 *Supercomputer speeds reach 1 billion operations per second with the release of the Cray 2 and Thinking Machines' parallel-processor Connection Machine.*

1985 *Inmos introduces transputers, featuring concurrent processing architecture.*

1985 *The National Science Foundation establishes four national supercomputing centers.*

The Computer Museum

1985 *With the development of Windows 1.0, Microsoft brings Macintosh-like features to DOS-compatible computers.*

1985 *The Omnibot 2000 from Tony Kyogo can move, talk, and carry objects.*

1985

1985 Paul Brainard's PageMaker becomes the first PC desktop publishing program and is widely used, first on the Macintosh and later on IBM compatibles.
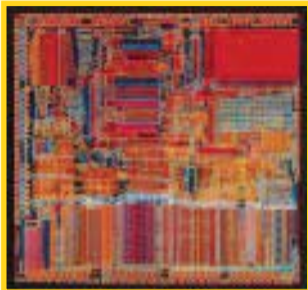
1985 In October, Intel introduces the 80386 chip with 32-bit processing and on-chip memory management.

1985
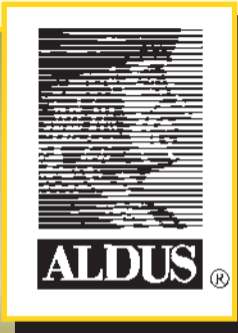
1986 **An article in the Wall Street Journal helps to popularize the concept and term CASE, for computer-aided software engineering.**

1987 **Experimental 4-and 16-Mbit chips are introduced.**

PROCESS EVOLUTION

OPTIMIZING

PROCESS CONTROL

MANAGED

PROCESS MEASUREMENT

DEFINED

PROCESS DEFINITION

REPEATABLE

BASIC MANAGEMENT CONTROL

INITIAL

1986 **The four-processor Cray XP performs 713 million floating-point operations per second.**

1987 **Watts Humphrey (pictured) and William Sweet, of the Software Engineering Institute, publish a "process maturity framework," which becomes the Capability Maturity Model, designed to help predict a developer's ability to produce reliable software.**
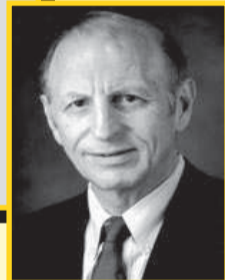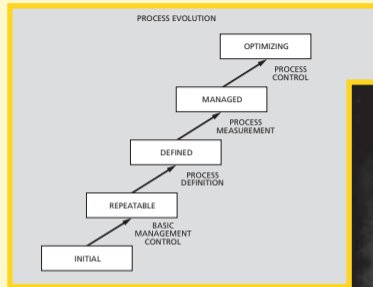
1986 — 1987
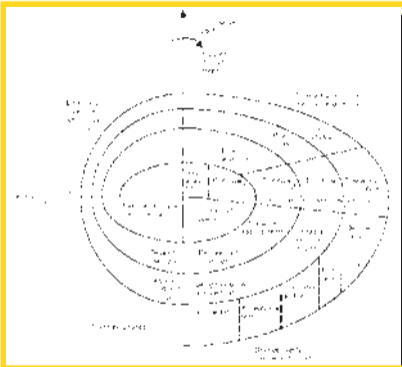
1988 Motorola's 32-bit 88000 series of RISC microprocessors offer processing speeds of up to 17 million instructions per second.

1988 Graduate student Robert Morris Jr. reveals the need for greater network security by releasing a worm program into the Internet on November 2.

1988 Barry Boehm publishes a description of the spiral model of software development, which recognizes the need to incrementally build systems.

1988 Steve Jobs' Next computer debuts but, despite advanced features, attracts too few buyers to compete in the market.

Next Software

1988

Massachusetts Institute of Technology

1989 **Tim Berners-Lee proposes the World Wide Web project to CERN (European Council for Nuclear Research).**

1989 **The first set of SPEC benchmarks is released, facilitating machine performance comparisons for scientific computation tasks.**

1989 **Intel's 80486 chip with 1.2 million transistors is introduced in April.**

Microsoft Archives

1990 **Microsoft introduces Windows 3.0 in May, intensifying its legal dispute with Apple over the software's "look and feel" resemblance to the Macintosh operating system.**

1989 **Seymour Cray founds Cray Computer Corp. and begins developing the Cray 3 using gallium arsenide chips.**

1989 — 1990
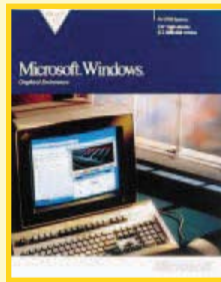
1990 Scientists at Bell Labs demonstrate the first all-optical processor on January 29.

1990 Hewlett-Packard and IBM both announce RISC-based computers.

1990 Intel's i486 and iPSC/860, and Motorola's 68040 become available.

1990 Berners-Lee writes the initial prototype for the World Wide Web, which uses his other creations: URLs, HTML, and HTTP.

1990 Arpanet is officially decommissioned.

1991 The Japanese Ministry of Trade and Industry abandons its program to build a fifth-generation computer and plans instead for a sixth-generation computer to be based on neural networks.

1991 Cray Research unveils the Cray Y-MP C90 with 16 processors and a speed of 16 Gflops.

University of Virginia
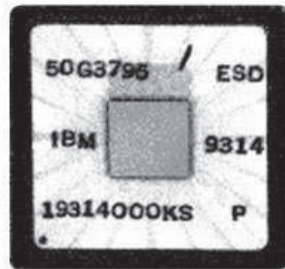
1991 IBM, Motorola, and Apple's PowerPC alliance is announced on July 30.

1990 — 1991

1992 After generating great concern in early March, the Michelangelo virus results in little actual damage.

1992 In March, the first M-bone audio multicast is transmitted on the Net.

Digital Equipment Corporation
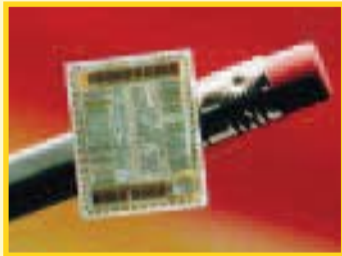
1992 DEC introduces the first chip to implement its 64-bit RISC Alpha architecture.

Apple Computer, Inc./John Lund

1993 Apple releases the Newton, the first popular personal digital assistant. It uses a stylus pen, and the first generation suffers from poor handwriting recognition.

1992 — 1993
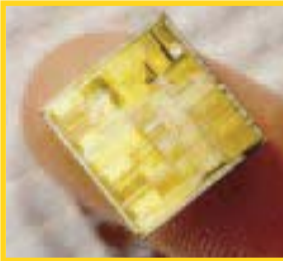
1993 Intel's Pentium is introduced in March.

1993 Students and staff at the University of Illinois' National Center for Supercomputing Applications create a graphical user interface for Internet navigation called NCSA Mosaic.

1994 In April, Jim Clark and Marc Andreesen found Netscape Communications (originally Mosaic Communications).

1994 Leonard Adleman of the University of Southern California demonstrates that DNA can be used as a computing medium.

1994 Netscape's first browser becomes available in September and creates a rapidly growing body of Web surfers.

1993 — 1994

JavaSoft

JavaSoft
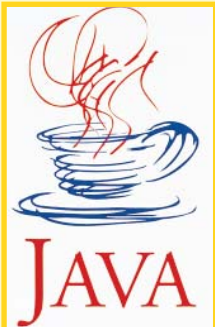
1995 Toy Story is the first full-length feature movie completely computer generated.

1995 The Java programming language, unveiled in May, enables platform-independent application development. "Duke" is the first applet.

Microsoft Archives

1995 Amazon.com went online.

1996 The Intel Pentium Pro is announced.
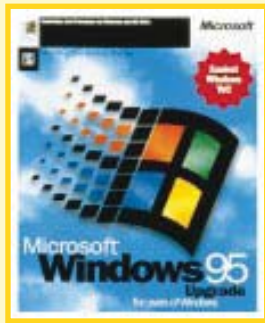
1995 Windows 95 is launched on August 24 with great fanfare.

1995 — 1996

1997 IBM Deep Blue computer beats world champion Gary Kasparov in a chess match.

1997 distributed.net launched as a worldwide distributed computing effort attempting to solve large scale problems using otherwise idle computers.

1998 Google incorporated.

1998 Intel achieves 45 million transistors in a CPU chip, a 100 MHz Pentium using photography with 180-nanometer line widths.

1997 — 1998

1999 Napster launched, demonstrating the potential for peer-to-peer computing.

1999 SETI@home launched as the second large-scale distributed computing project.

2000 C# programming language announced with Anders Hejlsberg being primary designer.

2000 The Y2K problem comes and goes.

2000 First USB flash drives sold.

1999 — 2000

2001 *Wikipedia founded, with content from tens of thousands of volunteers and substantially replacing pre-digital-age encyclopedias.*

2001 *iPod introduced, becoming a "game changer" for the world of portable music players.*

2002 *Earth Simulator highly parallel vector supercomputer system developed by the Japanese government for running global climate models.*

2002 *One billion PCs have been sold (according to a Gartner study).*

2002 *Indian computer scientists Manindra Agrawal, Neeraj Kayal, and Nitin Saxena discover the "Agrawal-Kayal-Saxena class" of algorithms for finding primes in polynomial time.*

2002 *MIT OpenCourseware introduced.*

2001 — 2002

2003 Skype introduced as an inexpensive, easy-to-use way to make video and voice "phone calls" over the Internet.

2003 iTunes store launched, bringing the recording industry into the Internet age with billions of singles sold.

2003 Mozilla Foundation formed, a spin-out from Netscape.

2004 Mark Zuckerberg's creation Facebook is incorporated and over time gains more than a billion users, becoming the communication and sharing approach for young people of the early 21st century.
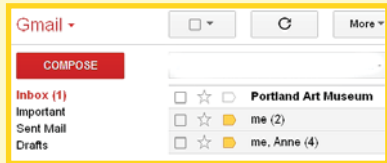
2004 Gmail introduced.

2003 — 2004

2005 IBM sells it PC business to Lenovo, maintaining only a minority share in the technology and business it originally created.

2005 European Parliament rejects the proposed "directive on the patentability of computer-implemented inventions."

2005 YouTube incorporated, providing a way for anyone to publish videos to a potential worldwide audience.
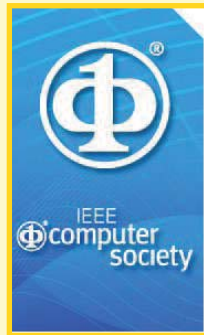
2006 60th anniversary of the IEEE Computer Society.

2006 Twitter introduced, allowing people to share their thoughts minute by minute.

2005 — 2006

2007 Amazon Kindle ebook reader introduced, contributing to significant changes in the publishing industry.

2007 802.11-2007 consolidation of 802.11 in support of continued spread of wireless communications.

2007 60th anniversary of the ACM.

2007 iPhone introduced, bringing technological and competitive upheaval to the smart phone industry.

2007 Estonia conducts a general election allowing voting via the Internet.

2008 Hulu launched, a significant instance of integration of computing and television, supporting a variety of devices for "TV" viewing.

2007 — 2008

2009 30th anniversary of the Annals of the History of Computing.
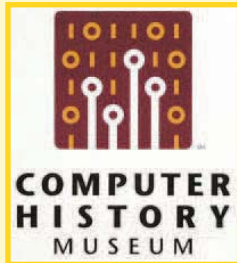
2010 Computer History Museum exhibits "Revolution: The First 2000 Years of Computing."

2010 2^5 anniversary of the revolutionary TEX typesetting and font design system.
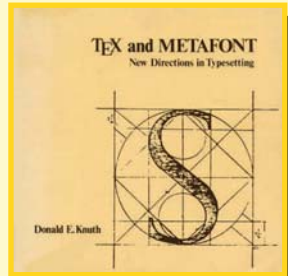
2010 iPad introduced, invigorating the tablet computer market.

Credits