History of Computing

Leen-Kiat Soh

JDE183H

Department of Computer Science and Engineering

University of Nebraska

Fall 2008

Who Invented Computer?

Computer History Year/Enter	Computer History Inventors/**Inventions**	Computer History Description of Event
1936	Konrad Zuse - **Z1 Computer**	First freely programmable computer.
1942	John Atanasoff & Clifford Berry **ABC Computer**	Who was first in the computing biz is not always as easy as ABC.
1944	Howard Aiken & Grace Hopper **Harvard Mark I Computer**	The Harvard Mark 1 computer.
1946	John Presper Eckert & John W. Mauchly **ENIAC 1 Computer**	20,000 vacuum tubes later...
1948	Frederic Williams & Tom Kilburn **Manchester Baby Computer & The Williams Tube**	Baby and the Williams Tube turn on the memories.
1947/48	John Bardeen, Walter Brattain & Wiliam Shockley **The Transistor**	No, a transistor is not a computer, but this invention greatly affected the history of computers.

Who Invented Computer?

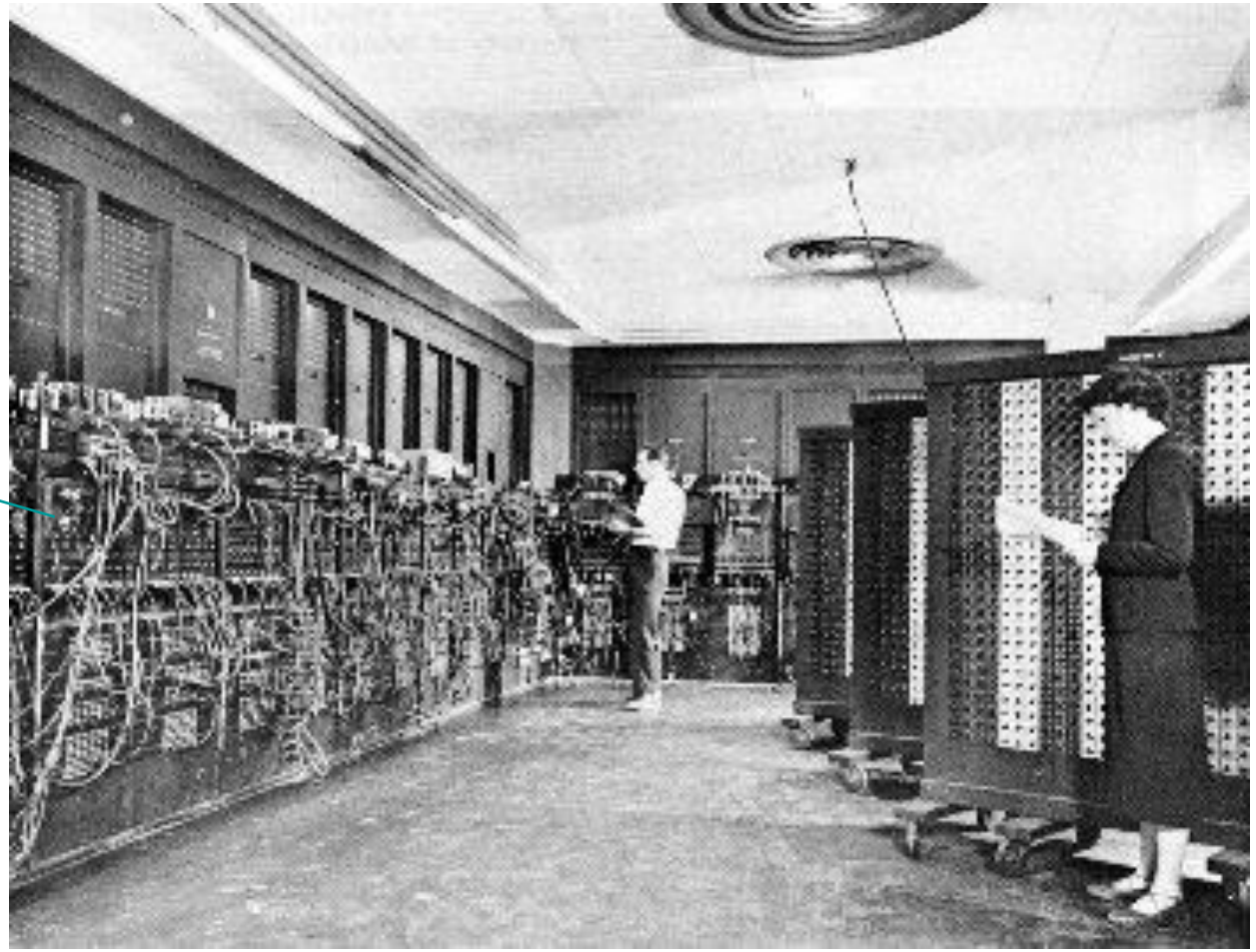
The ABC Computer

Who Invented Computer?

Harvard
Mark I

Who Invented Computer?

ENIAC



Who Invented Computer?

Computer History Year/Enter	Computer History Inventors/Inventions	Computer History Description of Event
1951	John Presper Eckert & John W. Mauchly **UNIVAC Computer**	First commercial computer & able to pick presidential winners.
1953	International Business Machines **IBM 701 EDPM Computer**	IBM enters into 'The History of Computers'.
1954	John Backus & IBM **FORTRAN Computer Programming Language**	The first successful high level programming language.
1955 (In Use 1959)	Stanford Research Institute, Bank of America, and General Electric **ERMA and MICR**	The first bank industry computer - also MICR (magnetic ink character recognition) for reading checks.
1958	Jack Kilby & Robert Noyce **The Integrated Circuit**	Otherwise known as 'The Chip'
1962	Steve Russell & MIT **Spacewar Computer Game**	The first computer game invented.

Who Invented Computer?

Computer History Year/Enter	Computer History Inventors/Inventions	Computer History Description of Event
1964	Douglas Engelbart **Computer Mouse & Windows**	Nicknamed the mouse because the tail came out the end.
1969	**ARPAnet**	The original Internet.
1970	**Intel 1103 Computer Memory**	The world's first available dynamic RAM chip.
1971	Faggin, Hoff & Mazor **Intel 4004 Computer Microprocessor**	The first microprocessor.
1971	Alan Shugart &IBM **The "Floppy" Disk**	Nicknamed the "Floppy" for its flexibility.
1973	Robert Metcalfe & Xerox **The Ethernet Computer Networking**	Networking.
1974/75	**Scelbi & Mark-8 Altair & IBM 5100 Computers**	The first consumer computers.

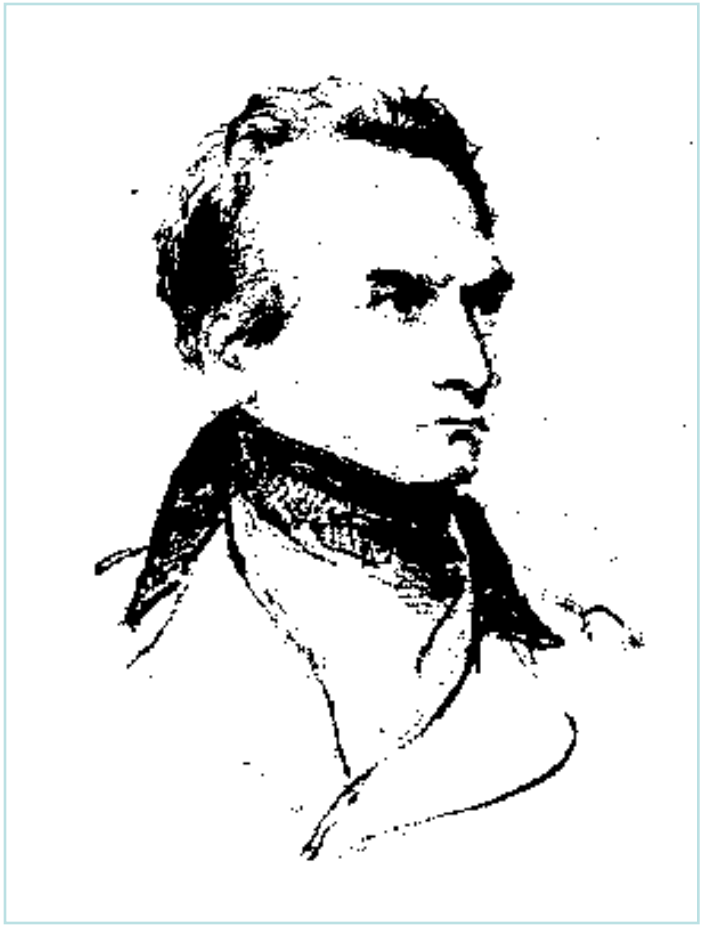
Who Invented Computer?

Computer History Year/Enter	Computer History Inventors/Inventions	Computer History Description of Event
1976/77	**Apple I, II & TRS-80 & Commodore Pet Computers**	More first consumer computers.
1978	Dan Bricklin & Bob Frankston **VisiCalc Spreadsheet Software**	Any product that pays for itself in two weeks is a surefire winner.
1979	Seymour Rubenstein & Rob Barnaby **WordStar Software**	Word Processors.
1981	IBM **The IBM PC - Home Computer**	From an "Acorn" grows a personal computer revolution
1981	Microsoft **MS-DOS Computer Operating System**	From "Quick And Dirty" comes the operating system of the century.

Who Invented Computer?

Computer History Year/Enter	Computer History Inventors/Inventions	Computer History Description of Event
1983	**Apple Lisa Computer**	The first home computer with a GUI, graphical user interface.
1984	**Apple Macintosh Computer**	The more affordable home computer with a GUI.
1985	**Microsoft Windows**	Microsoft begins the friendly war with Apple.

People in Computers & Computing



Charles Babbage (1791-1871)

People in Computers & Computing

Charles Babbage (1791-1871)

•Born December 26, 1791 in Teignmouth, Devonshire UK, Died 1871, London

•Known to some as the "Father of Computing" for his contributions to the basic design of the computer through his Analytical machine

•His previous Difference Engine was a special purpose device intended for the production of tables

•1810: Entered Trinity College, Cambridge; 1814: graduated Peterhouse; 1817 received MA from Cambridge

People in Computers & Computing

Charles Babbage (1791-1871)

1820: founded the Analytical Society with Herschel and Peacock

1823: started work on the Difference Engine through funding from the British Government

1827: published a table of logarithms from 1 to 108000

1828: appointed to the Lucasian Chair of Mathematics at Cambridge (never presented a lecture)

1831: founded the British Association for the Advancement of Science

People in Computers & Computing

Charles Babbage (1791-1871)

1832: published "Economy of Manufactures and Machinery“

1833: began work on the Analytical Engine

1834: founded the Statistical Society of London

1864: published Passages from the Life of a Philosopher

People in Computers & Computing

Konrad Zuse (1910-??)

People in Computers & Computing

Konrad Zuse (1910-19??)

- Born June 22, 1910, Berlin-Wilmersdorf

- invented pre-war electromechanical binary computer designated Z1 which was destroyed without trace by wartime bombing

- developed two more machines before the end of the war but was unable to convince the Nazi government to support his work

- fled with the remains of Z3 to Zurich where he developed Z4

- developed a basic programming system known as "Plankalkül" with which he designed a chess playing program

People in Computers & Computing

Konrad Zuse (1910-19??)

•1927: enrolled at the Technical University in Berlin-Charlottenburg and began his working career as a design engineer (Statiker) in the aircraft industry (Henschel Flugzeugwerke)

•1935: completed a degree in civil engineering.

•remained in Berlin from the time he finished his degree until the end of the war in 1945, and it was during this time that he constructed his first digital computers.

•later formed his own company for the construction and marketing of his designs.

People in Computers & Computing

Konrad Zuse (1910-19??)

•During 1936 to 1938 Konrad Zuse developed and built the first binary digital computer in the world (Zl). A copy of this computer is on display in the Museum for Transport and Technology ("Museum fur Verkehr und Technik") (since 1989) in Berlin.

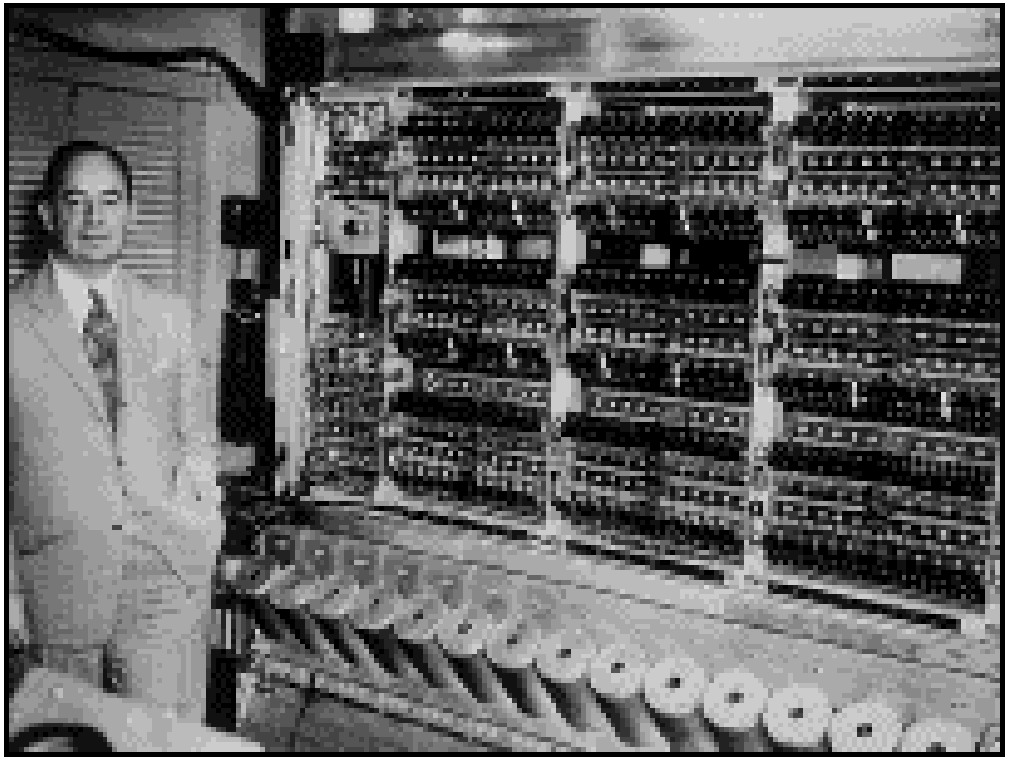
•The first fully functional program-controlled electromechanical digital computer in the world (the Z3) was completed by Zuse in 1941, but was destroyed in 1944 during the war. Because of its historical importance, a copy was made in 1960 and put on display in the German Museum ("Deutsches Museum") in Munich.

People in Computers & Computing

Konrad Zuse (1910-19??)

•Next came the more sophisticated Z4, which was the only Zuse Z-machine to survive the war. The Z4 was almost complete when, due to continued air raids, it was moved from Berlin to Gottingen where it was installed in the laboratory of the Aerodynamische Versuchanstalt (DVL/Experimental Aerodynamics Institute). It was only there for a few weeks before Gottingen was in danger of being captured and the machine was once again moved to a small village "Hinterstein" in the Allgau/Bavaria. Finally it was taken to Switzerland where it was installed in the ETH (Federal Polytechnical Institute/"Eidgenossisch Technische Hochschule") in Zurich in 1950. It was used in the Institute of Applied Mathematics at the ETH until 1955.

People in Computers & Computing



John Louis von Neumann (1903-1957)

People in Computers & Computing

John von Neumann (1903-1957)

•Born 28 December 1903, Budapest, Hungary; Died 8 February 1957, Washington DC

•1926: Doctorate, Mathematics (with minors in experimental physics and chemistry), University of Budapest

•1953: Medal of Freedom (Presidential Award)

•1956: Albert Einstein Commemorative Award, Enrico Fermi Award, Member, American Academy of Arts and Science …

People in Computers & Computing

John von Neumann (1903-1957)

•a child prodigy: When only six years old he could divide eight-digit numbers in his head.

•under the tutelage of M. Fekete, with whom he published his first paper at the age of 18.

•1921: Entered the University of Budapest in 1921, studied Chemistry, moving his base of studies to both Berlin and Zurich

•1925: received his diploma in Chemical Engineering

•1928: returned to his first love of mathematics in completing his doctoral degree

People in Computers & Computing

John von Neumann (1903-1957)

•1930: was invited to visit Princeton University

•1933: the Institute for Advanced Studies was founded at Princeton, appointed as one of the original six Professors of Mathematics, a position which he retained for the remainder of his life

•Von Neumann's interest in computers differed from that of his peers by his quickly perceiving the application of computers to applied mathematics for specific problems, rather than their mere application to the development of tables.

People in Computers & Computing

John von Neumann (1903-1957)

•During the war, von Neumann's expertise in hydrodynamics, ballistics, meteorology, game theory, and statistics, was put to good use in several projects.

•This work led him to consider the use of mechanical devices for computation

•He brought together the needs of the Los Alamos National Laboratory (and the Manhattan Project) with the capabilities of firstly the engineers at the Moore School of Electrical Engineering who were building the ENIAC, and later his own work on building the IAS machine. Several "supercomputers" were built by National Laboratories as copies of his machine.

People in Computers & Computing

John von Neumann (1903-1957)

•Postwar von Neumann concentrated on the development of the Institute for Advanced Studies (IAS) computer and its copies around the world. His work with the Los Alamos group continued and he continued to develop the synergism between computers capabilities and the needs for computational solutions to nuclear problems related to the hydrogen bomb

•There is no doubt that his insights into the organization of machines led to the infrastructure which is now known as the "von Neumann Architecture“

People in Computers & Computing

John von Neumann (1903-1957)

•recognized the need for parallelism in computers but equally well recognized the problems of construction and hence settled for a sequential system of implementation

•through the report entitled First Draft of a Report on the EDVAC [1945], authored solely by von Neumann, the basic elements of the stored program concept were introduced to the industry.

•In the 1950's von Neumann was employed as a consultant to IBM to review proposed and ongoing advanced technology projects.

People in Computers & Computing

Alan Turing (1912-1954)

People in Computers & Computing

Alan Turing (1912-1954)

•Born 23 June 1912, London; Died 7 June 1954, Manchester England

•Pioneer in developing computer logic as we know it today. One of the first to approach the topic of artificial intelligence.

•1931: Mathematics, Kings College, Cambridge; 1938: Ph.D., Princeton University

•1936: Smith's Prize, Cambridge University

•1946: Order of the British Empire (OBE)

•1951: Fellow, Royal Society

People in Computers & Computing

Alan Turing (1912-1954)

•Alan Mathison Turing was one of the great pioneers of the computer field. He inspired the now common terms of "The Turing Machine" and "Turing's Test."

•As a mathematician he applied the concept of the algorithm to digital computers.

•His research into the relationships between machines and nature created the field of artificial intelligence.

•**Turing helped pioneer the concept of the digital computer. The Turing Machine that he envisioned is essentially the same as today's multi-purpose computers.**

People in Computers & Computing

Alan Turing (1912-1954)

•He described a machine that would read a series of ones and zeros from a tape. These ones and zeros described the steps that needed to be done to solve a particular problem or perform a certain task. The Turing Machine would read each of the steps and perform them in sequence, resulting in the proper answer.

People in Computers & Computing

Alan Turing (1912-1954)

•This concept was revolutionary for the time. Most computers in the 1950's were designed for a particular purpose or a limited range of purposes. What Turing envisioned was a machine that could do anything, something that we take for granted today. The method of instructing the computer was very important in Turing's concept. He essentially described a machine which knew a few simple instructions. Making the computer perform a particular task was simply a matter of breaking the job down into a series of these simple instructions. This is identical to the process programmers go through today. He believed that an algorithm could be developed for most any problem. The hard part was determining what the simple steps were and how to break down the larger problems.

People in Computers & Computing

Alan Turing (1912-1954)

•During World War II, Turing used his mathematical skills to decipher the codes the Germans were using to communicate in the Department of Communications in Great Britain. This was an especially difficult task because the Germans had developed a type of computer called the Enigma. It was able to generate a constantly changing code that was impossible for the code breakers to decipher in a timely fashion.

•Turing and his fellow scientists worked with a device called COLOSSUS. The COLOSSUS quickly and efficiently deciphered the German codes created by the Enigma. COLOSSUS was essentially a bunch of servomotors and metal, but it was one of the first steps toward the digital computer.

People in Computers & Computing

Alan Turing (1912-1954)

•Turing went on to work for the National Physical Laboratory (NPL) and continued his research into digital computers. Here he worked on developing the Automatic Computing Engine (ACE), one of the first attempts at creating a true digital computer. It was during this time that he began to explore the relationship between computers and nature. He wrote a paper called "Intelligent Machinery" which was later published in 1969. This was one of the first times the concept of artificial intelligence was raised.

People in Computers & Computing

Alan Turing (1912-1954)

•Turing believed that machines could be created that would mimic the processes of the human brain. He discussed the possibility of such machines, acknowledging the difficulty people would have accepting a machine that would rival their own intelligence, a problem that still plagues artificial intelligence today. In his mind, there was nothing the brain could do that a well designed computer could not. As part of his argument, Turing described devices already in existence that worked like parts of the human body, such as television cameras and microphones.

People in Computers & Computing

Alan Turing (1912-1954)

•Turing believed that an intelligent machine could be created by following the blueprints of the human brain. He wrote a paper in 1950 describing what is now known as the "Turing Test." The test consisted of a person asking questions via keyboard to both a person and an intelligent machine. He believed that if the person could not tell the machine apart from the person after a reasonable amount of time, the machine was somewhat intelligent. This test has become the 'holy grail' of the artificial intelligence community. Turing's paper describing the test has been used in countless journals and papers relating to machine intelligence. The 1987 edition of the Oxford Companion to the Mind describes the Turing test as "the best test we have for confirming the presence of intelligence in a machine."

People in Computers & Computing

Alan Turing (1912-1954)

•Turing left the National Physical Laboratory before the completion of the Automatic Computing Engine and moved on to the University of Manchester. There he worked on the development of the Manchester Automatic Digital Machine (MADAM). He truly believed that machines would be created by the year 2000 that could replicate the human mind. Turing worked toward this end by creating algorithms and programs for the MADAM. He worked to create the operating manual for the MADAM and became one of the main users of MADAM to further his research.

People in Computers & Computing

Alan Turing (1912-1954)

•Turing died on June 7, 1954 from what the medical examiners described as, "self-administered potassium cyanide while in a moment of mental imbalance."

Timeline and History

350 Million Years BC The first tetrapods leave the oceans
30,000 BC to 20,000 BC Carving notches into bones
8500 BC Bone carved with prime numbers discovered
1900 BC to 1800 BC The first place-value number system
1000 BC to 500 BC The invention of the abacus
383 BC to 322 BC Aristotle and the Tree of Porphyry
300 BC to 600 AD The first use of zero and negative numbers
1285 AD to 1349 AD William of Ockham's logical transformations
1434 AD The first self-striking water clock
1500 AD Leonardo da Vinci's mechanical calculator
1600 AD John Napier and Napier's Bones
1621 AD The invention of the slide rule
1625 AD Wilhelm Schickard's mechanical calculator
1640 AD Blaise Pascal's Arithmetic Machine

Timeline and History

1658 AD Pascal creates a scandle
1670 AD Gottfried von Leibniz's Step Reckoner
1714 AD The first English typewriter patent
1761 AD Leonhard Euler's geometric system for problems in class logic
1800 AD Jacquard's punched cards
Circa 1800 AD Charles Stanhope invents the Stanhope Demonstrator
1822 AD Charles Babbage's Difference Engine
1829 AD The first American typewriter patent
1830 AD Charles Babbage's Analytical Engine
1834 AD Georg and Edward Scheutz's Difference Engine
1847 AD to 1854 AD George Boole invents Boolean Algebra
1857 AD Sir Charles Wheatstone uses paper tape to store data
1867 AD The first commercial typewriter
1869 AD William Stanley Jevons invents the Jevons' Logic Machine
Circa 1874 AD The Sholes keyboard
1876 AD George Barnard Grant's Difference Engine
1878 AD The first shift-key typewriter

Timeline and History

1881 AD Allan Marquand's rectangular logic diagrams
1881 AD Allan Marquand invents the Marquand Logic Machine
1886 AD Charles Pierce links Boolean algebra to circuits based on switches
1890 AD John Venn invents Venn Diagrams
1890 AD Herman Hollerith's tabulating machines
Circa 1900 AD John Ambrose Fleming invents the vacuum tube
1902 AD The first teleprinters
1906 AD Lee de Forest invents the Triode
1921 AD Karel Capek's R.U.R. (Rossum's Universal Robots)
1926 AD First patent for a semiconductor transistor
1927 AD Vannevar Bush's Differential Analyser
Circa 1936 AD The Dvorak keyboard
1936 AD Benjamin Burack constructs the first electrical logic machine
1937 AD George Robert Stibitz's Complex Number Calculator
1937 AD Alan Turing invents the Turing Machine
1939 AD John Vincent Atanasoff's special-purpose electronic digital computer
1939 AD to 1944 AD Howard Aiken's Harvard Mark I (the IBM ASCC)

Timeline and History

1940 AD The first example of remote computing
1941 AD Konrad Zuse and his Z1, Z3, and Z4
1943 AD Alan Turing and COLOSSUS
1943 AD to 1946 AD The first general-purpose electronic computer -- ENIAC
1944 AD to 1952 AD The first stored program computer -- EDVAC
1945 AD The "first" computer bug
1945 AD Johann (John) Von Neumann writes the "First Draft"
1947 AD First point-contact transistor
1948 AD to 1951 AD The first commercial computer -- UNIVAC
1949 AD EDSAC performs it's first calculation
1949 AD The first assembler -- "*Initial Orders*"
Circa 1950 AD Maurice Karnaugh invents Karnaugh Maps
1950 AD First bipolar junction transistor
1952 AD G.W.A. Dummer conceives integrated circuits
1957 AD IBM 610 Auto-Point Computer
1958 AD First integrated circuit
1962 AD First field-effect transistor

Timeline and History

1963 AD MIT's LINC Computer
1970 AD First static and dynamic RAMs
1971 AD CTC's Datapoint 2200 Computer
1971 AD The Kenbak-1 Computer
1971 AD The first microprocessor: the 4004
1972 AD The 8008 microprocessor
1973 AD The Xerox Alto Computer
1973 AD The Micral microcomputer
1973 AD The Scelbi-8H microcomputer
1974 AD The 8080 microprocessor
1974 AD The 6800 microprocessor
1974 AD The Mark-8 microcomputer
1975 AD The 6502 microprocessor
1975 AD The Altair 8800 microcomputer

Timeline and History

1975 AD Bill Gates and Paul Allen found Microsoft
1975 AD The KIM-1 microcomputer
1975 AD The Sphere 1 microcomputer
1976 AD The Z80 microprocessor
1976 AD The Apple I and Apple II microcomputers
1977 AD The Commodore PET microcomputer
1977 AD The TRS-80 microcomputer
1979 AD The VisiCalc spreadsheet program
1979 AD ADA programming language is named after Ada Lovelace"
1981 AD The first IBM PC
1982 AD The *TCP/IP* protocol is established, and the term "Internet" is used
1982 AD IBM launches double-sided 320K floppy disk drives
1984 AD The domain name server (DNS) is introduced to the Internet (~1,000 hosts)
1987 AD William Gibson coins the term "cyberspace" in his novel *Neuromancer*

Timeline and History

1985 AD *Microsoft Windows* is launched
1987 AD The number of Internet hosts exceeds 10,000
1988 AD Laptops are developed
1988 AD The first optical chip is developed
1988 AD *Write Once Read Many times* (*WORM*) disks are marketed by IBM
1989 AD The "World Wide Web", invented by Tim Berners-Lee
1989 AD The Sound Blaster card is released
1990 AD The number of Internet hosts exceeds 300,000
1991 AD Linus Torvalds of Finland develops *Linux*,
a variant of the UNIX operating system
1992 AD *Gopher* servers are used to provide students with online information
1993 AD Commercial providers are allowed to sell Internet connections to individuals
1993 AD *Pentium* is released
1993 AD The first graphics-based web browser, *Mosaic*, becomes available
1993 AD The PDF (Portable Document Format) standard is introduced by Adobe
1997 AD AMD releases its Am486 microprocessor to compete with Intel's 80486

Timeline and History

1994 AD Object-oriented authoring systems such as *HyperCard*, *Hyperstudio*, and *Authorware* grow in popularity
1994 AD *Netscape 1.0 i*s written as an alternate browser to the *National Center for Supercomputing Applications* (*NCSA*) *Mosaic*
1994 AD First wireless technology standard (Bluetooth)
1994 AD Yahoo! Internet search service launched
1994 AD The World Wide Web comprises at least 2,000 Web servers
1995 AD *Windows 95* is released, as well as *Pentium Pro*
1995 AD Netscape announces *JavaScript*
1996 AD *Netscape Navigator 2.0* is released
1996 AD The number of Internet hosts approached 10,000,000
1996 AD Microsoft releases the first version of Internet Explorer

1997 AD Deep Blue by IBM defeats Kasporov

Timeline and History

1997-1998 AD The first Beboputer Virtual Computer
Intel releases the Pentium MMX for games and multimedia enhancement
Intel releases the Pentium II processor
Microsoft releases Windows 98
AMD releases the K-6 microprocessor
Palm Computing markets the first PDA (Personal Digital Assistant), the Palm Pilot
Internet-based computing starts on a large scale with
downloadable programs such as SETI@Home

1999 AD *Linux Kernel 2.2.0* is released
The number of people running *Linux* is estimated to be about 10 million
AMD releases *K6-III*, the 400MHz version
The 2000 (Y2K) compliance preparation
AMD releases its proprietary Athlon chip, which sets a new speed record of 1 GHz
outpacing all of the competing Pentium microprocessors offered by Intel

Timeline and History

2000 AD IBM releases a follow-up to *Deep Blue,* nicknamed *Blue Gene*:
it operates at 1 quadrillion ops per second (one peta flop) and
is 1,000 times faster than *Deep Blue*.
Blue Gene will be used for modelling human proteins

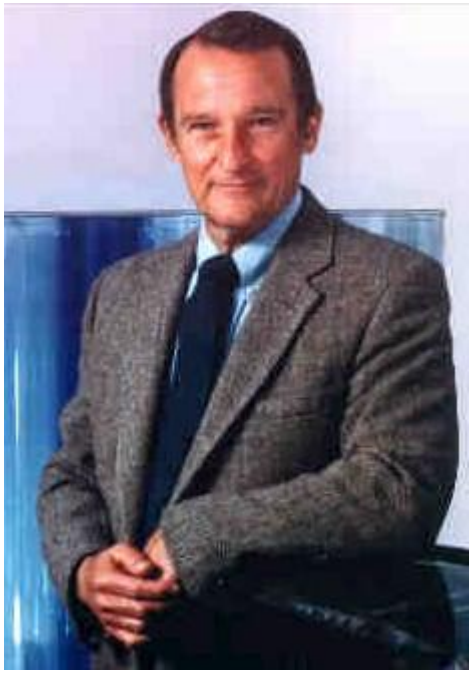
History of Supercomputers

Seymour Cray (1925-1996)

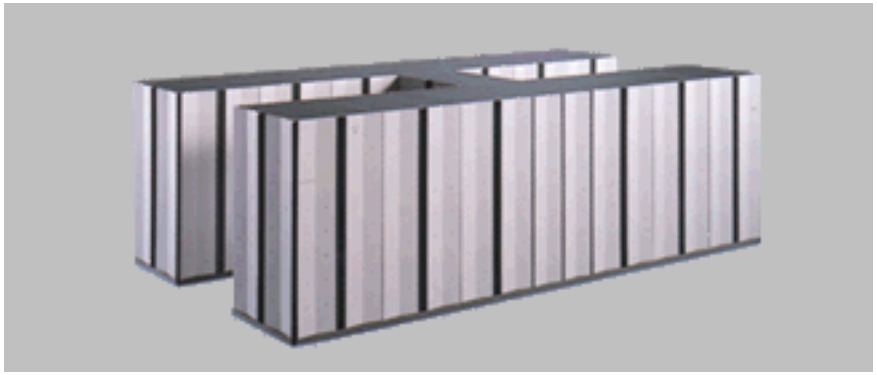
Education:
B.S. Electrical Engineering, University of Minnesota, 1950
M.S. Applied Mathematics, University of Minnesota, 1951

Professional Experience:
Engineering Research Associates, 1950-1957
Control Data Corp., 1957-1972
Cray Research Inc., 1972-1989
Cray Computer Corp., 1989-1995
SRC Computers Inc., 1996

Honors and Awards:
W.W. McDowell Award, American Foundation of Information Processing Societies, 1968
Harry H. Good Memorial Award, 1972



History of Supercomputers



Much of the early history of the supercomputer is the history of the father of the supercomputer, Seymour Cray (1925-96), and the various companies he founded; in particular, Cray Research, which was the U.S. leader in building the fastest supercomputers for many years.

- **1957:** Founded Control Data Corporation

- **1958:** Developed CDC 1604, first fully transistorized computer

History of Supercomputers

•**1958-1972**: Designed the CDC 6600, which used 60-bit words and parallel processing, demonstrated RISC design, and was forty times faster than its predecessor, followed by the CDC 7600 system

•**1972**: Founded Cray Research

•**1976**: Designed CRAY-1 (100 megaflops)

•**1985**: Designed CRAY-2 (1-2 gigaflops)

•**1989**: Founded Cray Computer Corporation, designed CRAY-3 (4-5 gigaflops).

•**19??**: Followed it with the CRAY-4, also based on gallium arsenide, which is twice as fast in per-node performance as the CRAY-3 and is smaller than the human brain.

History of Supercomputers

•**1980s-90s:** Advent of competition from Japanese companies such as Fujitsu Ltd., Hitachi Ltd., and NEC Corp.; and the rise in popularity of distributed computing based on large numbers of smaller microcomputers working together in a limited way all served to shrink the U.S. supercomputer industry

•**1995**: Cray Computer filed for bankruptcy

History of Supercomputers

•**1995**: Two University of Tokyo researchers broke the 1 teraflops (1.08 teraflops) barrier with their 1,692-processor **GRAPE-4** (GRAvity PipE number 4) special-purpose supercomputer costing less than two million U.S. dollars.

•**1996**: According to a November 11, 1996 announcement by Cray Research, a 2,048-processor **CRAY T3E-900** (TM) broke the world record for a general-purpose supercomputer with an incredible 1.8 teraflops peak performance.

•**1996**: Curiously, a December 16, 1996 announcement made by Intel Corporation, stated that their "**ultra**" computer, developed in a partnership with the U.S. Department of Energy, is the world's first supercomputer to break the 1 teraflops barrier.

•**ca. 1997**: A number of other companies have supercomputers operating in the 1 teraflops range, for example: NEC Corporation's **SX-4** has a peak performance of 1 teraflops, the Fujitsu (Siemens-Nixdorf) **VPP700** peaks at 0.5 teraflops, and the Hitachi **SR2201** High-end model peaks at 0.6 teraflops.

History of Supercomputers

•**Ongoing and Near Future**: A press release by Intel indicates that the completed "ultra" computer, also known as **ASCI Option Red** will incorporate over 9,000 Pentium Pro® processors, reach peak speeds of 1.8 teraflops, and cost $55 million.

•Part of the Accelerated Strategic Computing Initiative (ASCI), Option Red at the Sandia National Laboratory will be followed at the Lawrence Livermore National Laboratory by **ASCI Option Blue-Pacific**, a $93 million 4,096-processor supercomputer designed and built by IBM with an estimated peak performance of 3.2 teraflops.

History of Supercomputers

•**Future**: Over the next ten years, the ASCI program will sponsor the development and delivery of three more supercomputers to the Lawrence Livermore, Los Alamos, and Sandia national laboratories that will reach speeds of 10, 30, and finally 100 teraflops. Though they will be made available for other applications, the primary use of this tremendous amount of computing power will be to maintain the safety and reliability of the U.S.'s remaining stockpile of nuclear weapons.

•**Future**: If 100-teraflops computing seems to be a lofty goal, it should be noted that there is at least one petaflops (quadrillions of floating point operations per second) project in progress. The University of Tokyo's **GRAPE:TNG project** aims to have a petaflops-class computer by the year 2000. Also known as the **GRAPE-5**, it would have 10,000-20,000 higher-powered processors and cost around $10 million. More interesting, the new GRAPE system, though still special-purpose hardware, will be less specialized than before and will be able to perform a variety of astrophysical and cosmological simulations.

History of the Internet

(1957-1973)

•1957: The USSR launches **Sputnik**, the first artificial earth satellite. In response, the United States forms the Advanced Research Projects Agency (ARPA) within the Department of Defense (DoD) to establish US lead in science and technology applicable to the military.

Backbones: None - Hosts: None

•1962: RAND Paul Baran, of the RAND Corporation (a government agency), was commissioned by the U.S. Air Force to do a study on how it could maintain its command and control over its missiles and bombers, after a nuclear attack. This was to be a military research network that could survive a nuclear strike, decentralized so that if any locations (cities) in the U.S. were attacked, the military could still have control of nuclear arms for a counter-attack. His final proposal was a **packet switched network**.

Backbones: None - Hosts: None

History of the Internet

(1957-1973)

•1968: ARPA awarded the **ARPANET** contract to BBN. BBN had selected a Honeywell minicomputer as the base on which they would build the switch. The physical network was constructed in 1969, linking four nodes: University of California at Los Angeles, SRI (in Stanford), University of California at Santa Barbara, and University of Utah. The network was wired together via 50 Kbps circuits.

Backbones: 50Kbps ARPANET - Hosts: 4

•1972: The first **e-mail** program was created by Ray Tomlinson of BBN. The Advanced Research Projects Agency (ARPA) was renamed The Defense Advanced Research Projects Agency (or DARPA). ARPANET was currently using the **Network Control Protocol** or NCP to transfer data. This allowed communications between hosts running on the same network.

Backbones: 50Kbps ARPANET - Hosts: 23

History of the Internet

(1957-1973)

•1973: Development began on the protocol later to be called **TCP/IP**, it was developed by a group headed by Vinton Cerf from Stanford and Bob Kahn from DARPA. This new protocol was to allow diverse computer networks to interconnect and communicate with each other.

Backbones: 50Kbps ARPANET - Hosts: 23+

History of the Internet

(1974-1983)

•1974: First Use of term **Internet** by Vint Cerf and Bob Kahn in paper on **Transmission Control Protocol**.

Backbones: 50Kbps ARPANET - Hosts: 23+

•1976: Dr. Robert M. Metcalfe develops **Ethernet**, which allowed coaxial cable to move data extremely fast. This was a crucial component to the development of LANs. The packet satellite project went into practical use. **SATNET**, Atlantic packet Satellite network, was born. This network linked the United States with Europe. Surprisingly, it used **INTELSAT** satellites that were owned by a consortium of countries and not exclusively the United States government. **UUCP** (Unix-to-Unix CoPy) developed at AT&T Bell Labs and distributed with UNIX one year later. The Department of Defense began to experiment with the **TCP/IP** protocol and soon decided to require it for use on ARPANET.

Backbones: 50Kbps ARPANET, plus satellite and radio connections - Hosts: 111+

History of the Internet

(1974-1983)

•1979: **USENET** (the decentralized news group network) was created by Steve Bellovin, a graduate student at University of North Carolina, and programmers Tom Truscott and Jim Ellis. It was based on UUCP. The Creation of **BITNET**, by IBM, "Because its Time Network", introduced the "store and forward" network. It was used for **email** and **listservs**.

Backbones: 50Kbps ARPANET, plus satellite and radio connections - Hosts: 111+

•1981: National Science Foundation created backbone called **CSNET** 56 Kbps network for institutions without access to ARPANET. Vinton Cerf proposed a plan for an inter-network connection between CSNET and the ARPANET.

Backbones: 50Kbps ARPANET, 56Kbps CSNET, plus satellite and radio connections - Hosts: 213

History of the Internet

(1974-1983)

•1983: **Internet Activities Board** (IAB) was created in 1983.

On January 1st, every machine connected to ARPANET had to use TCP/IP. TCP/IP became the core Internet protocol and replaced NCP entirely.

The University of Wisconsin created **Domain Name System** (DNS). This allowed packets to be directed to a domain name, which would be translated by the server database into the corresponding IP number. This made it much easier for people to access other servers, because they no longer had to remember numbers.

Backbones: 50Kbps ARPANET, 56Kbps CSNET, plus satellite and radio connections - Hosts: 562

History of the Internet

(1984-1990)

•1984: The ARPANET was divided into two networks: **MILNET** and **ARPANET**. MILNET was to serve the needs of the military and ARPANET to support the advanced research component, Department of Defense continued to support both networks. Upgrade to CSNET was contracted to MCI. New network was to be called **NSFNET** (National Science Foundation Network), and old lines were to remain called CSNET.

Backbones: 50Kbps ARPANET, 56Kbps CSNET, plus satellite and radio connections - Hosts: 1024

•1985: The National Science Foundation began deploying its new T1 lines, which would be finished by 1988.

Backbones: 50Kbps ARPANET, 56Kbps CSNET, 1.544Mbps (T1) NSFNET, plus satellite and radio connections - Hosts: 1961

History of the Internet

(1984-1990)

•1986: The **Internet Engineering Task Force** or IETF was created to serve as a forum for technical coordination by contractors for DARPA working on ARPANET, US Defense Data Network (DDN), and the Internet core gateway system.

Backbones: 50Kbps ARPANET, 56Kbps CSNET, 1.544Mbps (T1) NSFNET, plus satellite and radio connections - Hosts: 2308

•1987: BITNET and CSNET merged to form the **Corporation for Research and Educational Networking** (CREN), another work of the National Science Foundation.

Backbones: 50Kbps ARPANET, 56Kbps CSNET, 1.544Mbps (T1) NSFNET, plus satellite and radio connections - Hosts: 28,174

History of the Internet

(1984-1990)

•1988: Soon after the completion of the **T1** NSFNET backbone, traffic increased so quickly that plans immediately began on upgrading the network.

Backbones: 50Kbps ARPANET, 56Kbps CSNET, 1.544Mbps (T1) NSFNET, plus satellite and radio connections - Hosts: 56,000

•1990: Merit, IBM and MCI formed a not for profit corporation called ANS, **Advanced Network & Services**, which was to conduct research into high speed networking. It soon came up with the concept of the **T3**, a 45 Mbps line. NSF quickly adopted the new network.

Tim Berners-Lee and CERN in Geneva implements a hypertext system to provide efficient information access to the members of the international high-energy physics community.

Backbones: 56Kbps CSNET, 1.544Mbps (T1) NSFNET, plus satellite and radio connections - Hosts: 313,000

History of the Internet

(1991-1995)

•1991: CSNET (which consisted of 56Kbps lines) was discontinued having fulfilled its important early role in the provision of academic networking service. The NSF established a new network, named **NREN**, the National Research and Education Network. The purpose of this network is to conduct high speed networking research. It was not to be used as a commercial network, nor was it to be used to send a lot of the data that the Internet now transfers.

Backbones: Partial 45Mbps (T3) NSFNET, a few private backbones, plus satellite and radio connections - Hosts: 617,0001992Internet Society is chartered.

World-Wide Web released by CERN.

NSFNET backbone upgraded to T3 (44.736Mbps)Backbones: 45Mbps (T3) NSFNET, private interconnected backbones consisting mainly of 56Kbps, 1.544Mbps, plus satellite and radio connections - Hosts: 1,136,000

History of the Internet

(1991-1995)

•1993: InterNIC created by NSF to provide specific Internet services: directory and database services (by AT&T), registration services (by Network Solutions Inc.), and information services (by General Atomics/CERFnet). Marc Andreessen and NCSA and the University of Illinois develops a graphical user interface to the WWW, called "**Mosaic for X**".

Backbones: 45Mbps (T3) NSFNET, private interconnected backbones consisting mainly of 56Kbps, 1.544Mbps, and 45Mpbs lines, plus satellite and radio connections - Hosts: 2,056,000

•1994: Growth!! Many new networks were added to the NSF backbone. **Hundreds of thousands of new hosts were added to the INTERNET during this time period**. **ATM** (Asynchronous Transmission Mode, 145Mbps) backbone is installed on NSFNET.

Backbones: 145Mbps (ATM) NSFNET, private interconnected backbones consisting mainly of 56Kbps, 1.544Mbps, and 45Mpbs lines, plus satellite and radio connections - Hosts: 3,864,000

History of the Internet

(1991-1995)

•1995: The National Science Foundation announced that as of April 30, 1995 it would no longer allow direct access to the NSF backbone. The National Science Foundation contracted with four companies that would be providers of access to the NSF backbone (Merit). These companies would then sell connections to groups, organizations, and companies.

$50 annual fee is imposed on domains, excluding .edu and .gov domains which are still funded by the National Science Foundation.

Backbones: 145Mbps (ATM) NSFNET (now private), private interconnected backbones consisting mainly of 56Kbps, 1.544Mbps, 45Mpbs, 155Mpbs lines in construction, plus satellite and radio connections - Hosts: 6,642,000

History of the Internet

(1996-present)

•1996-present: Most Internet traffic is carried by backbones of independent **ISP**s, including MCI, AT&T, Sprint, UUnet, BBN planet, ANS, and more.

Currently the Internet Society, the group that controls the INTERNET, is trying to figure out new TCP/IP to be able to have billions of addresses, rather than the limited system of today. The problem that has arisen is that it is not known how both the old and the new addressing systems will be able to work at the same time during a transition period.

Backbones: 145Mbps (ATM) NSFNET (now private), private interconnected backbones consisting mainly of 56Kbps, 1.544Mbps, 45Mpbs, and 155Mpbs lines, plus satellite and radio connections - Hosts: over **15,000,000**, and growing rapidly

Programming Languages

1940s, 1950s

•**ca. 1946**: **Konrad Zuse** develops Plankalkul. He applies the language to, among other things, chess.

•**1949**: **Short Code** , the first computer language actually used on an electronic computing device, appears. It is, however, a "hand-compiled" language.

•**1951**: **Grace Hopper**, working for Remington Rand, begins design work on the first widely known compiler, named A-0. When the language is released by Rand in 1957, it is called MATH-MATIC.

•**1952**: **Alick E. Glennie** , in his spare time at the University of Manchester, devises a programming system called AUTOCODE, a rudimentary compiler.

Programming Languages

1940s, 1950s

•**1957**: **FORTRAN** --mathematical FORmula TRANslating system-- appears. Heading the team is John Backus, who goes on to contribute to the development of ALGOL and the well-known syntax-specification system known as BNF.

•**1958**: **FORTRAN II** appears, able to handle subroutines and links to assembly language. John McCarthy at M.I.T. begins work on LISP-- LISt Processing. **The original specification for ALGOL** appears. The specification does not describe how data will be input or output; that is left to the individual implementations.

•**1959**: **LISP 1.5** appears. **COBOL** is created by the Conference on Data Systems and Languages (CODASYL).

Programming Languages

1960s

•**1960: ALGOL 60 ,** the first block-structured language, appears. This is the root of the family tree that will ultimately produce the likes of Pascal. ALGOL goes on to become the most popular language in Europe in the mid- to late-1960s.

•**Sometime in the early 1960s ,** Kenneth Iverson begins work on the language that will become APL--A Programming Language. It uses a specialized character set that, for proper use, requires APL-compatible I/O devices.

•**1962: APL** is documented in Iverson's book, *A Programming Language* . **FORTRAN IV** appears. **Work begins** on the sure-fire winner of the "clever acronym" award, SNOBOL--StriNg-Oriented symBOlic Language.

Programming Languages

1960s

•**1963**: **ALGOL 60** is revised. **Work begins on PL/1.**

•**1964**: **APL\360** is implemented. **At Dartmouth University**, Professors John G. Kemeny and Thomas E. Kurtz invent BASIC. The first implementation is a compiler. The first BASIC program runs at about 4:00 a.m. on May 1, 1964. **PL/1** is released.

•**1965**: **SNOBOL3** appears.

•**1966**: **FORTRAN 66** appears. **LISP 2** appears. **Work begins on LOGO** at Bolt, Beranek, & Newman. The team is headed by Wally Fuerzeig and includes Seymour Papert. LOGO is best known for its "turtle graphics."

Programming Languages

1960s

•**1967**: **SNOBOL4**, a much-enhanced SNOBOL, appears.

•**1968**: **ALGOL 68**, a monster compared to ALGOL 60, appears. Some members of the specifications committee--including C.A.R. Hoare and Niklaus Wirth--protest its approval. ALGOL 68 proves difficult to implement. **ALTRAN** , a FORTRAN variant, appears. **COBOL** is officially defined by ANSI. **Niklaus Wirth** begins work on Pascal.

•**1969**: **500 people** attend an APL conference at IBM's headquarters in Armonk, New York. The demands for APL's distribution are so great that the event is later referred to as "The March on Armonk."

Programming Languages

1970s

•**1970: Sometime in the early 1970s** , Charles Moore writes the first significant programs in his new language, **Forth**. **Work on Prolog** begins about this time. **Also sometime in the early 1970s**, work on **Smalltalk** begins at Xerox PARC, led by Alan Kay. Early versions will include Smalltalk-72, Smalltalk-74, and Smalltalk-76. **An implementation of Pascal** appears on a CDC 6000-series computer. **Icon**, a descendant of SNOBOL4, appears.

•**1972: The manuscript** for Konrad Zuse's Plankalkul (see 1946) is finally published. **Dennis Ritchie** produces **C**. The definitive reference manual for it will not appear until 1974. **The first implementation of Prolog** -- by Alain Colmerauer and Phillip Roussel -- appears.

Programming Languages

1970s

•**1974: Another ANSI** specification for **COBOL** appears.

•**1975: Tiny BASIC** by Bob Albrecht and Dennis Allison (implementation by Dick Whipple and John Arnold) runs on a microcomputer in 2 KB of RAM. A 4-KB machine is sizable, which left 2 KB available for the program. **Bill Gates and Paul Allen** write a version of **BASIC** that they sell to MITS (Micro Instrumentation and Telemetry Systems) on a per-copy royalty basis. MITS is producing the Altair, an 8080-based microcomputer. **Scheme**, a LISP dialect by G.L. Steele and G.J. Sussman, appears. ***Pascal User Manual and Report***, by Jensen and Wirth, is published. Still considered by many to be the definitive reference on **Pascal**. **B.W. Kerninghan** describes **RATFOR**--RATional FORTRAN. It is a preprocessor that allows C-like control structures in FORTRAN.

Programming Languages

1970s

1976: **Design System Language**, considered to be a forerunner of **PostScript**, appears.

1977: **The ANSI standard for MUMPS** -- Massachusetts General Hospital Utility Multi-Programming System -- appears. Used originally to handle medical records, MUMPS recognizes only a string data-type. Later renamed **M**. **The design competition that will produce Ada** begins. Honeywell Bull's team, led by Jean Ichbiah, will win the competition. **Kim Harris** and others set up FIG, the FORTH interest group. They develop FIG-FORTH, which they sell for around $20. **Sometime in the late 1970s** , Kenneth Bowles produces **UCSD Pascal**, which makes Pascal available on PDP-11 and Z80-based computers. **Niklaus Wirth** begins work on **Modula**, forerunner of **Modula-2** and successor to Pascal.

Programming Languages

1970s

•**1978: AWK** -- a text-processing language named after the designers, Aho, Weinberger, and Kernighan -- appears. **The ANSI standard** for **FORTRAN 77** appears.

Programming Languages

1980s

•**1980**: **Smalltalk-80** appears. **Modula-2** appears. **Franz LISP** appears. **Bjarne Stroustrup, of Bell Labs,** develops a set of languages -- collectively referred to as "C With Classes" -- that serve as the breeding ground for **C++**.

•**1981**: **Effort begins** on a common dialect of LISP, referred to as **Common LISP**. **Japan begins** the Fifth Generation Computer System project. The primary language is **Prolog**.

•**1982**: **ISO Pascal** appears. **PostScript** appears.

Programming Languages

1980s

•**1983**: ***Smalltalk-80: The Language and Its Implementation*** by Goldberg et al is published. **Ada appears** . Its name comes from Lady Augusta Ada Byron, Countess of Lovelace and daughter of the English poet Byron. She has been called the first computer programmer because of her work on Charles Babbage's analytical engine. In 1983, the Department of Defense directs that all new "mission-critical" applications be written in Ada.
In late 1983 and early 1984, Microsoft and Digital Research both release the first C compilers for microcomputers.
In July, the first implementation of **C++** appears. The name is coined by Rick Mascitti.
In November, Borland's **Turbo Pascal** hits the scene like a nuclear blast, thanks to an advertisement in BYTE magazine.

Programming Languages

1980s

•**1984**: **A reference manual** for **APL2** appears. APL2 is an extension of APL that permits nested arrays.

•**1985**: **Forth** controls the submersible sled that locates the wreck of the Titanic. **Vanilla SNOBOL4** for microcomputers is released. **Methods**, a line-oriented Smalltalk for PCs, is introduced.

•**1986**: **Smalltalk/V** appears--the first widely av ailable version of Smalltalk for microcomputers. **Apple releases Object Pascal** for the Mac. **Borland** releases Turbo Prolog. **Charles Duff** releases **Actor**, an object-oriented language for developing Microsoft Windows applications. **Eiffel**, another object-oriented language, appears. **C++** appears.

Programming Languages

1980s

•**1987: Turbo Pascal** version 4.0 is released.

•**1988: The specification for CLOS** -- Common LISP Object System -- is published. **Niklaus Wirth** finishes **Oberon**, his follow-up to Modula-2.

•**1989: The ANSI C** specification is published. **C++ 2.0** arrives in the form of a draft reference manual. The 2.0 version adds features such as multiple inheritance and pointers to members.

Programming Languages

1990s

•**1990**: **C++ 2.1**, detailed in *Annotated C++ Reference Manual* by B. Stroustrup et al, is published. This adds *templates* and *exception-handling* features. **FORTRAN 90** includes such new elements as case statements and derived types. Kenneth Iverson and Roger Hui present **J** at the APL90 conference.

•**1991**: **Visual Basic** wins BYTE's Best of Show award at Spring COMDEX.

•**1992**: **Dylan** -- named for Dylan Thomas -- an object-oriented language resembling Scheme, is released by Apple.

Programming Languages

1990s

•**1993**: ANSI releases the X3J4.1 technical report -- the first-draft proposal for object-oriented COBOL. The standard is expected to be finalized in 1997.

•**1994**: Microsoft incorporates **Visual Basic** for Applications into Excel.

•**1995**: In February, ISO accepts the 1995 revision of the Ada language. Called **Ada 95**, it includes OOP features and support for real-time systems. Sun releases **Java** and **HotJava**.

•**1996**: **ANSI C++ standard** is released.

•**1997, 1998**: Microsoft **J++** is released. (Support ended in 2004)

Programming Languages

2000s

- **2000**: Microsoft **C#**, for .NET, aimed for Internet applications.

Tidbits

What is this?

Who is this?

Tidbits

•**1939 AD:** John Vincent Atanasoff's Special-Purpose Electronic Digital Computer

A lecturer at Iowa State College (now Iowa State University), Atanasoff was disgruntled with the cumbersome and time-consuming process of solving complex equations by hand. Working alongside one of his graduate students (the brilliant Clifford Berry), Atanasoff commenced work on an electronic computer in early 1939, and had a prototype machine by the autumn of that year.

In the process of creating the device, Atanasoff and Berry evolved a number of ingenious and unique features. For example, one of the biggest problems for computer designers of the time was to be able to store numbers for use in the machine's calculations. Atanasoff's design utilized capacitors to store electrical charge that could represent numbers in the form of *logic 0s* and *logic 1s*. The capacitors were mounted in rotating bakelite cylinders, which had metal bands on their outer surface. These cylinders, each approximately 12 inches tall and 8 inches in diameter, could store thirty binary numbers, which could be read off the metal bands as the cylinders rotated.

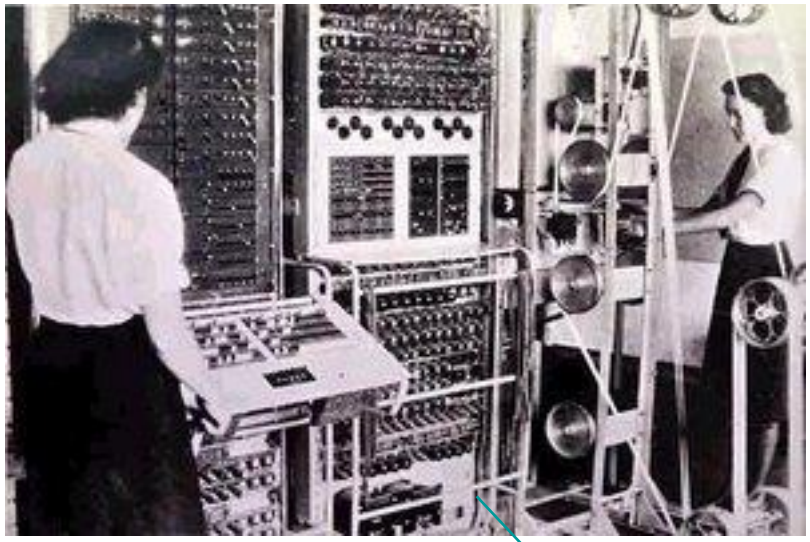
Tidbits

•**1939 AD:** John Vincent Atanasoff's Special-Purpose Electronic Digital Computer, Cont'd

Input data was presented to the machine in the form of punched cards, while intermediate results could be stored on other cards. Once again, Atanasoff's solution to storing intermediate results was quite interesting -- he used sparks to burn small spots onto the cards. The presence or absence of these spots could be automatically determined by the machine later, because the electrical resistance of a carbonized spot varied from that of the blank card.

Tidbits

What is this?



What is this?

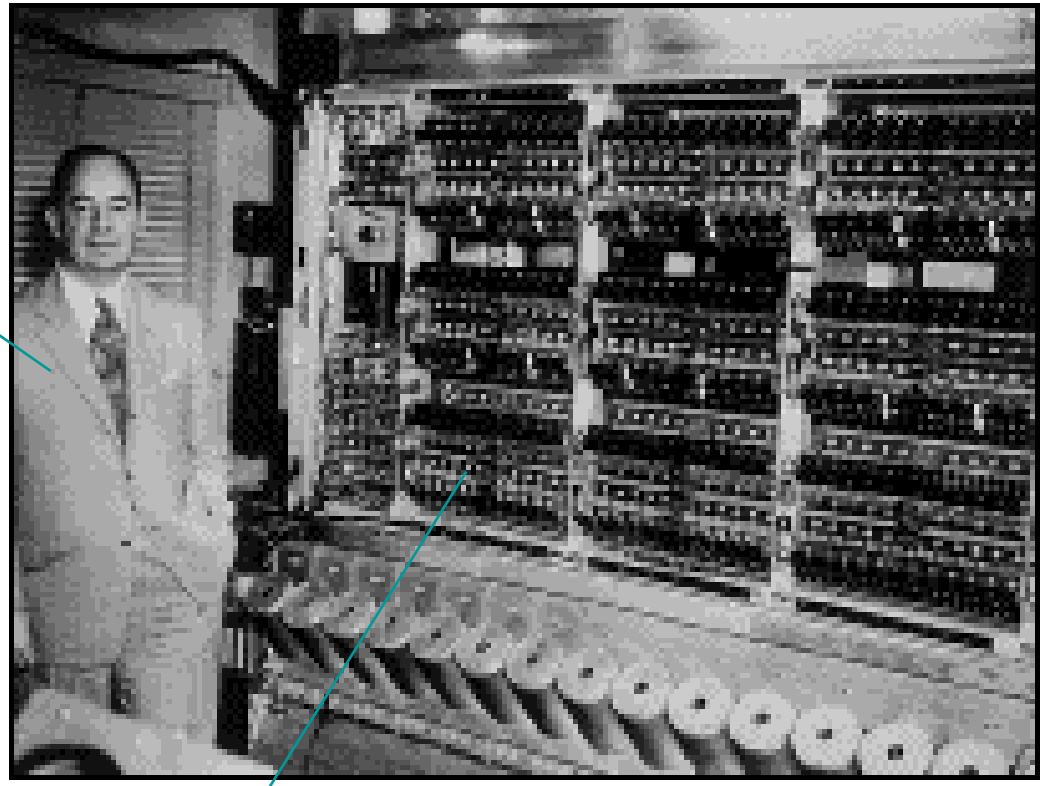
Tidbits

- **1943 AD**: Alan Turing and COLOSSUS

By any standards **COLOSSUS** was one of the world's *earliest working programmable electronic digital computers*. But it was a special-purpose machine that was really only suited to a narrow range of tasks (for example, it was not capable of performing decimal multiplications). Having said this, although COLOSSUS was built as a special-purpose computer, it did prove flexible enough to be programmed to execute a variety of different routines.

Tidbits

Who is this?



What is this?

Tidbits

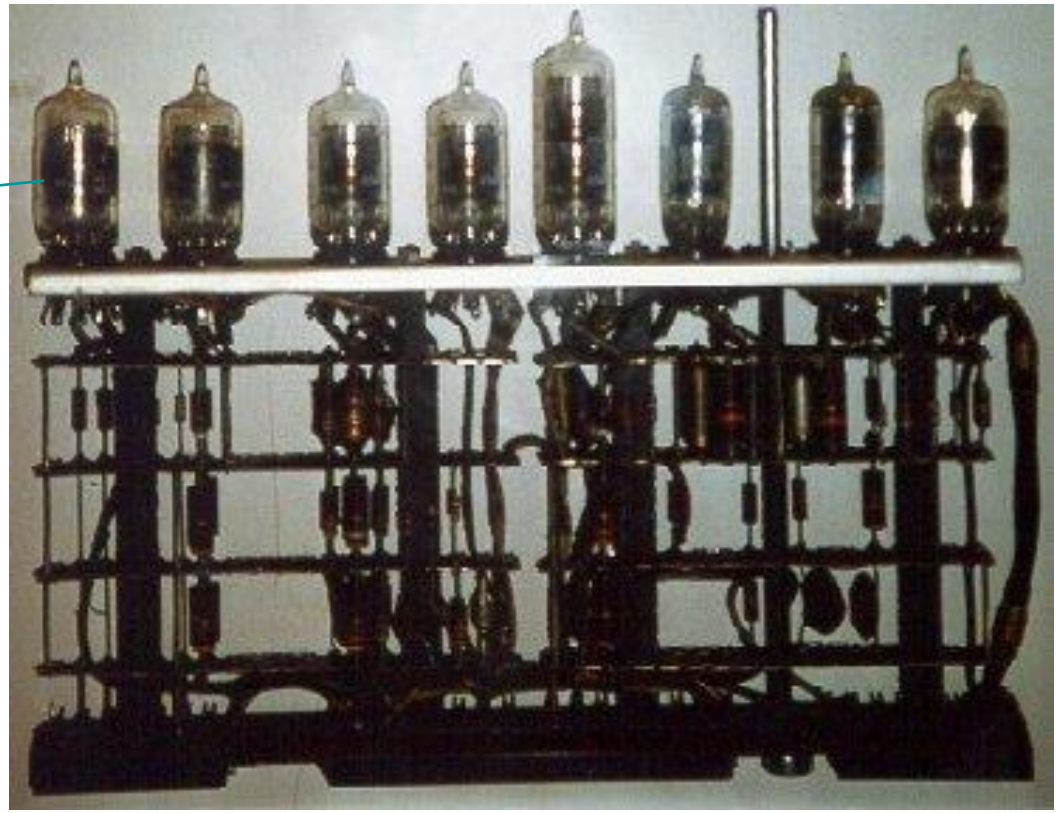
- **1944 AD to 1952 AD:** The First Stored Program Computer -- EDVAC

This concept was subsequently documented by Johann (John) von Neumann in his paper which is now known as the **First Draft**.

In August 1944, Mauchly and Eckert proposed the building of a new machine called the *electronic discrete variable automatic computer (EDVAC)*. Unfortunately, although the conceptual design for EDVAC was completed by 1946, several key members left the project to pursue their own careers, and the machine did not become fully operational until 1952. When it was finally completed, EDVAC contained approximately 4,000 vacuum tubes and 10,000 crystal diodes. A 1956 report shows that EDVAC's average error-free up-time was approximately 8 hours.

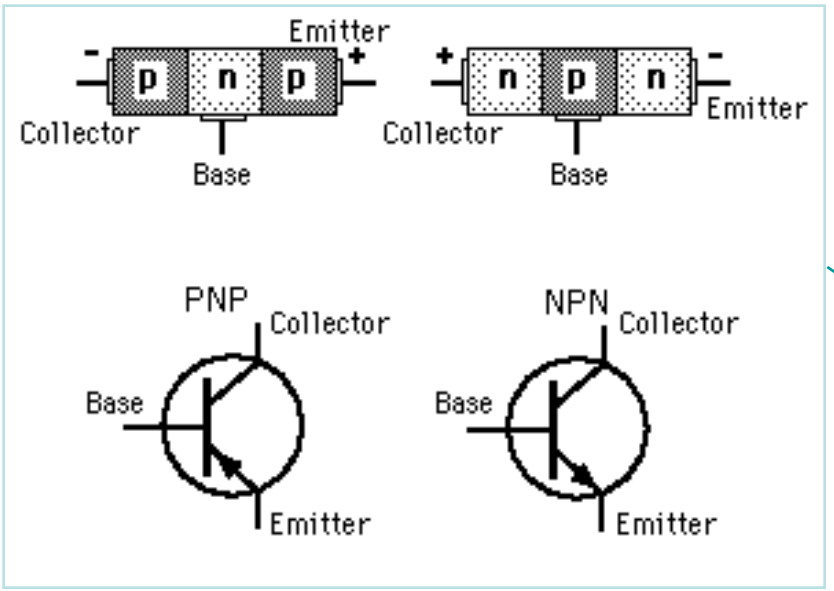
Tidbits

What are these?



What is this?

Tidbits



What are these?

Tidbits

- **1926 AD to 1962 AD:** The First Transistors

At that time it was recognized that devices formed from semiconductors had potential as amplifiers and switches, and could therefore be used to replace the prevailing technology of vacuum tubes, but that they would be much smaller, lighter, and would require less power.

Bell Laboratories in the United States began research into semiconductors in 1945, and physicists William Shockley, Walter Brattain and John Bardeen succeeded in creating the first *point- contact germanium transistor* on the 23rd December, 1947 (they took a break for the Christmas holidays before publishing their achievement, which is why some reference books state that the first transistor was created in 1948).

Tidbits

What is this?

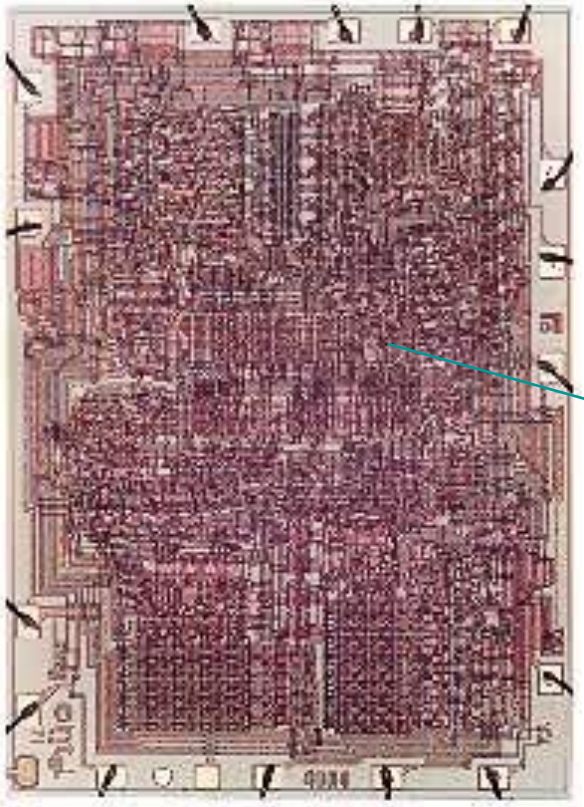
Tidbits

- **1952 AD to 1970 AD:** The First Integrated Circuits

Individually packaged transistors were much smaller than their vacuum tube predecessors, but designers desired still smaller electronic switches. To a large extent the demand for miniaturization was driven by the demands of the American space program. For some time people had been thinking that it would be a good idea to be able to fabricate entire circuits on a single piece of semiconductor.

By 1961, Fairchild and Texas Instruments had announced the availability of the first commercial planar integrated circuits comprising simple logic functions. This announcement marked the beginning of the mass production of integrated circuits. In 1963, Fairchild produced a device called the 907 containing two logic gates, each of which consisted of four bipolar transistors and four resistors. The 907 also made use of isolation layers and buried layers, both of which were to become common features in modern integrated circuits.

Tidbits



What is this?

Tidbits

- **1971 AD to 1976 AD:** The First Microprocessors

The end result was that the (potential) future of the (hypothetical) microprocessor looked somewhat bleak, but fortunately other forces were afoot. Although computers were somewhat scarce in the 1960s, there was a large and growing market for electronic desktop calculators. In 1970, the Japanese calculator company Busicom approached Intel with a request to design a set of twelve integrated circuits for use in a new calculator.

The task was presented to one Marcian "Ted" Hoff, a man who could foresee a somewhat bleak and never-ending role for himself designing sets of special-purpose integrated circuits for one-of-a-kind tasks. However, during his early ruminations on the project, Hoff realized that rather than design the special-purpose devices requested by Busicom, he could create a single integrated circuit with the attributes of a simple-minded, stripped-down, general-purpose computer processor.

Tidbits

- **1971 AD to 1976 AD:** The First Microprocessors, Cont'd

The result of Hoff's inspiration was the world's first microprocessor, the **4004**, where the '4's were used to indicate that the device had a 4-bit data path. The 4004 was part of a four-chip system which also consisted of a 256-byte ROM, a 32-bit RAM, and a 10-bit shift register. The 4004 itself contained approximately 2,300 transistors and could execute 60,000 operations per second. The advantage (as far as Hoff was concerned) was that by simply changing the external program, the same device could be used for a multitude of future projects.

Tidbits

What is this?

Tidbits

- **1945 AD:** The "First" Computer Bug

The term "**bug**" is now universally accepted by computer users as meaning an error or flaw -- either in the machine itself or, perhaps more commonly, in a program.

The first official record of the use of the word "bug" in the context of computing is associated with a relay-based Harvard Mark II computer, which was in service at the Naval Weapons Center in Dahlgren, Virginia. On September 9th, 1945, a moth flew into one of the relays and jammed it. The offending moth was taped into the log book alongside the official report, which stated: "*First actual case of a bug being found*."

Tidbits

- **1962 AD:** The "Worst" Computer Bug (Arguably)

On 28th July, 1962, the Mariner I space probe was launched from Cape Canaveral on the beginning of its long voyage to Venus.

The flight plan stated that after thirteen minutes a booster engine would accelerate the probe to 25,820 mph; after eighty days the probe's on-board computer would make any final course corrections; and after one hundred days, Mariner 1 would be in orbit around Venus taking radar pictures of the planet's surface through its thick cloud cover.

However, only four minutes into the flight, Mariner I did an abrupt U-turn and plunged into the Atlantic ocean. The investigating team found that a **logical negation operator** had been accidentally omitted from the computer program in charge of controlling the rocket's engines. On the basis that the launch, including the probe, cost in the region of $10,000,000, this has to rank as one of the more expensive (and visible) bugs in the history of computing.

Tidbits

- **1973 AD to 1981 AD:** The First Personal Computers (PCs)

As is true of many facets in computing, the phrase "*Personal Computer*" can be something of a slippery customer. For example, the IBM 610 **Auto-Point Computer** (1957) was described as being "*IBM's first personal computer*" on the premise that it was intended for use by a single operator, but this machine was not based on the stored program concept and it cost $55,000! Other contenders include MIT's **LINC** (1963), CTC's **Datapoint 2200** (1971), the **Kenbak-1** (1971), and the Xerox **Alto** (1973), but all of these machines were either cripplingly expensive, relatively unusable, or only intended as experimental projects. So, we will understand "Personal Computer" to refer to an affordable, general-purpose, microprocessor-based computer intended for the consumer market.

In 1975, an IBM mainframe computer that could perform 10,000,000 instructions per second cost around $10,000,000. In 1995 (only twenty years later), a computer video game capable of performing 500,000,000 million instructions per second was available for approximately $500!

Quotes

"Computers in the future may weigh no more than one-and-a-half tonnes."

— *Popular Mechanics,* 1949

"I think there is a world market for maybe five computers."

— Thomas Watson, Chairman of IBM, 1943

"I can assure you that data processing is a fad that won't last the year."

— Chief Business Editor, Prentice Hall, 1957

"There is no reason anyone in the right state of mind will want a computer in their home."

— Ken Olson, President of Digital Equipment Corp, 1977

"640k is enough for anyone, and by the way, what's a network?"

— William Gates III, President of Microsoft Corporation, 1984

Quotes

“If people do not believe that mathematics is simple, it is only because they do not realize how complicated life is.”

— John von Neumann

References

Who Invented Computers?
http://inventors.about.com/library/blcoindex.htm?once=true&Inventors

People in Computers & Computing
http://ei.cs.vt.edu/~history

Alan Turing
By John M. Kowalik 1995

Timeline and History
http://www.maxmon.com/history.htm
http://www.statcan.ca/english/edu/power/ch4/history/computers.htm

Programming Languages
http://www.byte.com/art/9509/sec7/art19.htm

History of Java http://www.ils.unc.edu/blaze/java/javahist.html

Supercomputers
By Dan Calle

References

Tidbits
http://www.maxmon.com/history.htm

Famous Quotes in Computers
http://http://www.lexcie.zetnet.co.uk/compquotes.htm

Internet
http://www.davesite.com/webstation/net-history.shtml