

History of Computer Science



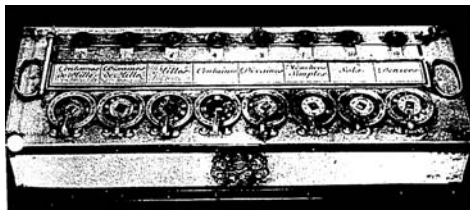
1870 MEMBERS OF THE BIRMINGHAM ACADEMY COMPANY
PHOTOGRAPH BY W. H. WOODS

Blaise Pascal (approx. 1650)

- ✂ built a machine with 8 gears called the Pascaline to assist French government in compiling tax reports



Pascaline



J.M. Jacquard (early 1800's)

- ✂ developed loom that used punched cards (the equivalent of stored programs)



Ketabton.com

Jacquard's Loom



Punched cards

- ✂ information coded on cards (forerunner of modern storage devices)
- ✂ cards could be linked in a series (forerunner of programs)
- ✂ Such programs can automate human tasks

Charles Babbage

- ⌘ British scientist and inventor, 1860's
- ⌘ known as 'the Father of the Computer'



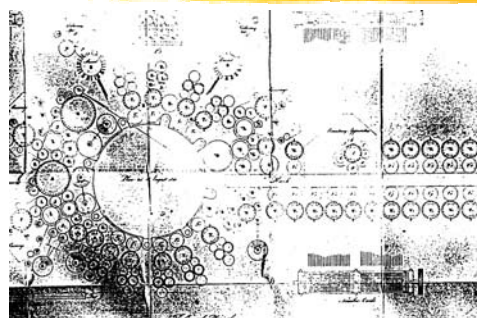
Babbage's computer

- ⌘ Difference Engine
- ⌘ could compute and print tables, but never got out of the 'working prototype' stage because of technological limits

Babbage's dream machine

- ⌘ The Analytical Engine
- ⌘ Steam powered calculating machine using programs on punched cards.
- ⌘ The analytical engine was never completed in his lifetime.

Analytical Engine plans



Analytical Engine, con't

- ⌘ Contained all the elements of modern computers including
 - ⊗ 'mill' (for calculating)
 - ⊗ 'store' (for holding instructions)
 - ⊗ 'operator' (for carrying out instructions)
 - ⊗ reading and writing device

Countess Ada Augusta Lovelace

- ⌘ Lord Byron's daughter
- ⌘ Mathematician
- ⌘ Devised way to use punched cards to give instructions to Babbage's machines
- ⌘ The 'first computer programmer'

Countess Ada Augusta Lovelace



Herman Hollerith (1890 census)

- ⌘ Invented a tabulating machine using punched cards (same size as ours today).
- ⌘ Founded forerunner of IBM

Hollerith's machine



Thomas Watson, Sr. (head of IBM in 1924)

- ⌘ Made his fortune in punched card tabulating equipment and office equipment
- ⌘ Never convinced that computing machines were worth the risk.
- ⌘ Turned over the company to his son in mid 1950's

Early Electronic Computers

- ⌘ Konrad Zuse
 - ☑ German engineering student, 1930's
 - ☑ Never allowed to complete his computer
- ⌘ ABC Computer
 - ☑ Atanasof and Berry
 - ☑ 1937
- ⌘ Mark I, Harvard, 1944
 - ☑ Automatic calculator used paper tapes

The ABC machine

1937
The first electronic
computer



Dr. John V. Atanasof



Clifford Berry

John von Neumann

⌘ invented the stored program concept (data and instructions stored in memory in binary form).

⌘ 1940's



Computer Science History

⌘ Alan Turing

☒ WW II

☒ Enigma

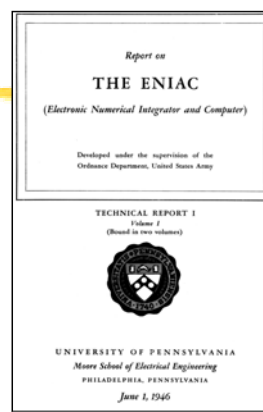
☒ "Computers"

⌘ John von Neumann

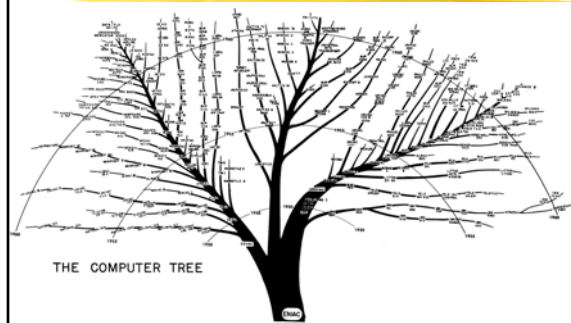
☒ Programs as data

⌘ ENIAC

ENIAC



Genesis of modern computing



Hardware "Generations"

⌘ Hardware

☒ vacuum tubes

☒ transistors

☒ printed circuits

☒ integrated circuits

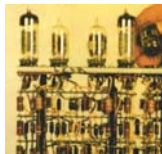
⌘ Moore's law

☒ Circuit capacity doubles every 18 months

☒ True from 1972 to the present day

The First Generation of Computers

- ⌘ 1951-1958
- ⌘ Vacuum tubes for internal operations
- ⌘ Magnetic drums for memory
- ⌘ Limited memory
- ⌘ Heat and maintenance problems



ENIAC (19,000 vacuum tubes)



Replacing a bad tube meant checking among ENIAC's 19,000 possibilities.

ENIAC Modular programming?



Age of the dinosaurs



1st Generation (con't)

- ⌘ Punched cards for input and output
- ⌘ Slow input, processing and output
- ⌘ Low-level symbolic languages for programming

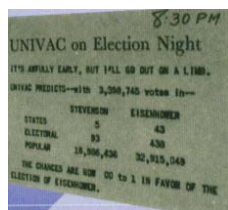
UNIVAC

- ⌘ UNIVAC I (1951)
- ⌘ developed by Mauchley and Eckert for Remington Rand
- ⌘ replaced IBM tabulating machines at the Census Bureau

UNIVAC



J. Presper Eckert and Walter Cronkite and the UNIVAC I on election night 1952



Machine language

- ⌘ Machine language: 0's and 1's, the only language a computer can directly execute.

Assembly language

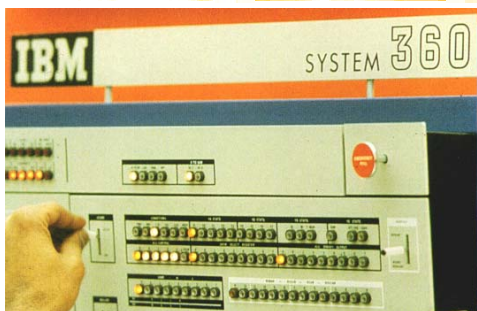
- ⌘ Made programming easier.
- ⌘ Uses abbreviations instead of binary code i.e., LD for load.
- ⌘ Machine-dependent (not portable)

The Second Generation of Computers

- ⌘ 1959-1964
- ⌘ Transistors for internal operations
- ⌘ Magnetic cores for memory
- ⌘ Increased memory capacity



IBM 360



Second Generation (con't)

- ⌘ Magnetic tapes and disks for storage
- ⌘ Reductions in size and heat generation
- ⌘ Increase in processing speed and reliability
- ⌘ Increased use of high-level languages

High-level languages

- ⌘ The first high-level programming languages were
 - ☒ FORTRAN (1954)
 - ☒ COBOL (1956)
 - ☒ LISP (1961)
 - ☒ BASIC (1964)

Admiral Grace Hopper



1952
She introduces the new concept that computers could be programmed using symbols on paper (languages).

Later writes the COBOL language.

The Third Generation of Computers

- ⌘ 1965-1970
- ⌘ Integrated circuits on silicon chips for internal operations (IC's)
- ⌘ Increased memory capacity
- ⌘ Common use of minicomputers



Third generation (con't)

- ⌘ Emergence of the software industry
- ⌘ Reduction in size and cost
- ⌘ Increase in speed and reliability
- ⌘ Introduction of families of computers

Key term: LSI

- ⌘ LSI (Large Scale Integration) - method by which circuits containing
- ⌘ thousands of components are packed on a single chip

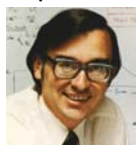
Third generation (con't)

- ⌘ Compatibility problems (languages, I/O devices, etc. were informally standardized)
- ⌘ Minicomputers popular in offices.



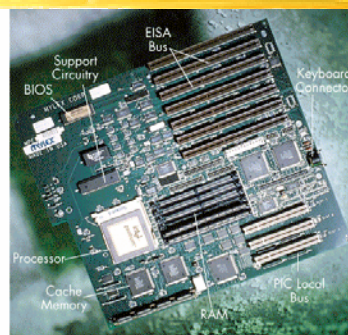
The Fourth Generation of Computers

- ⌘ 1971-today
- ⌘ VLSI (100,000's of components/chip)
- ⌘ Development of the microprocessor
- ⌘ Microcomputers and supercomputers

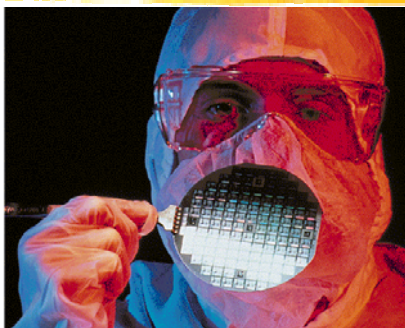


Ted Hoff, Intel
Designer of first microprocessor

4th generation design



VLSI (each wafer has 100-400 IC's with millions of transistors on each one)



Fourth Generation (con't)

- ⌘ Greater software versatility
- ⌘ Increase in speed, power and storage capacity
- ⌘ Parallel processing
- ⌘ Artificial intelligence and expert systems
- ⌘ Robotics

Graphic User Interfaces (GUI)



Lisa, 1983



Macintosh, 1984



Sun, 1988

Key term: Microprocessor

- ⌘ Microprocessor: programmable unit on a single silicon chip, containing all essential CPU components (ALU, controller)

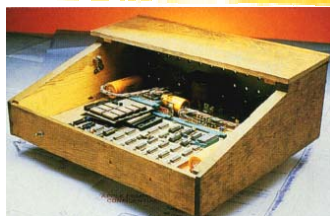
Modern microprocessor



Key term: Microcomputer

⌘ Microcomputer: small, low-priced, personal computer.

Early microcomputers

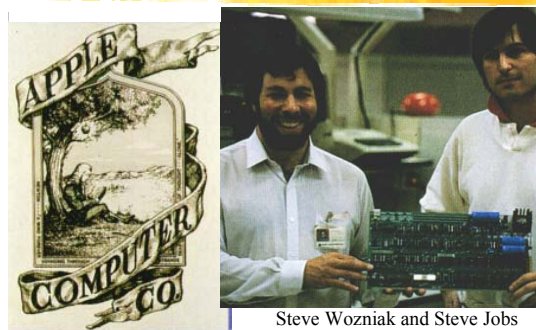


Apple I, 1976



Apple II, 1977

Apple computer company



Steve Wozniak and Steve Jobs

Early IBM microcomputers

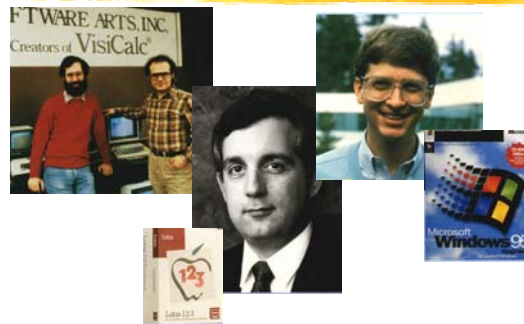


IBM PC, 1981



IBM XT, 1983
w/10M Hard drive

Software giants



Programming language giants



BASIC, 1964
David Kennedy,
Dartmouth U



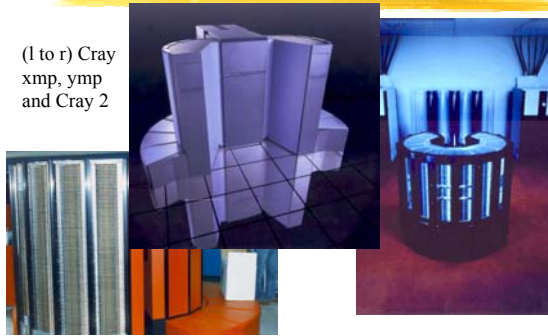
Niklaus Wirth
Pascal, 1972

Key term: Supercomputer

- ⌘ Supercomputer: perform millions of operations per second and process enormous amounts of data
- ⌘ enormous amounts of data
- ⌘ Costs in tens of millions of dollars

Supercomputers

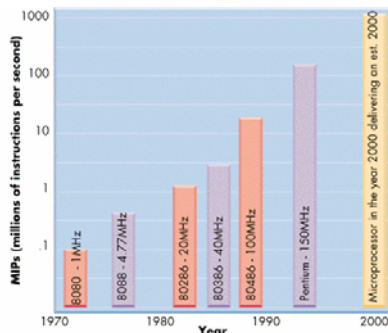
(l to r) Cray xmp, ymp and Cray 2



Cray T90, 40gigaflops



Processor speed growth



Environment "Generations"

- ⌘ Environments
 - ⊗ single process
 - ⊗ batch process
 - ⊗ time-shared
 - ⊗ one powerful computer serving multiple users
 - ⊗ personal computer
 - ⊗ multiple individual computers
 - ⊗ client/server
 - ⊗ individual computers (clients) interacting with powerful computer providing services to multiple users (server)

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