

Science 1000: Part #2 (Wareham):

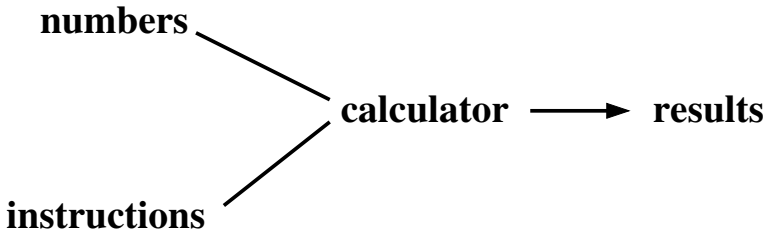
Getting Here: The Rise of the Machines (1940–1970)

THE DAWN OF ELECTRONIC COMPUTERS

MAINFRAMES AND MINICOMPUTERS

THE COMPUTER SOFTWARE CRISIS

What is a Computer? (Take II)



Overall speed of calculation can only increase if input, calculation, and output operations **all** undergo **same** increase in speed.

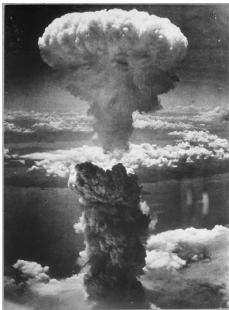
Computing in 1940: The State of the Art

- IBM tabulators (business)
- Human computers (business / scientific)
- Differential analyzer (scientific)
- Atanasoff-Berry electronic computer (experimental)

The Driving Forces Behind Electronic Computers



Adolf Hitler
(1889–1945)



Atomic Bomb
(August 6, 1945)



Joseph Stalin
(1878–1953)

Computing During World War II: Applications

- Weapons design and use:
 - Artillery tables
 - Automated firing control
 - Atomic bomb design
- Decrypting encoded military messages

Computing During World War II: Machines



Harvard Mark I
(Mechanical)



Colossus
(Electromechanical)

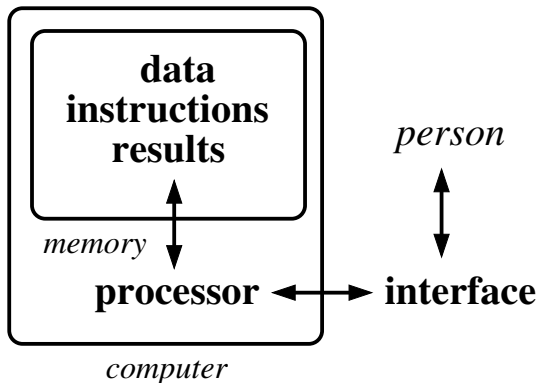


ENIAC
(Electronic)

Computing After World War II: Applications

- Weapons design and use:
 - Atomic and hydrogen bomb design
 - Bomber defense / offense systems
 - Missile guidance systems
- Government (recordkeeping / planning)
- Business (recordkeeping / planning)
- Science (numerical calculation)

What *is* a Computer? (Take III)

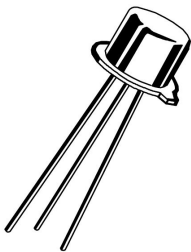


- Proposed by John von Neumann (1903–1957) and collaborators in 1945 as the stored program computer.

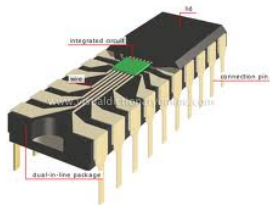
Computing Technology: Processor



Vacuum tube
(1904)



Transistor
(1947)



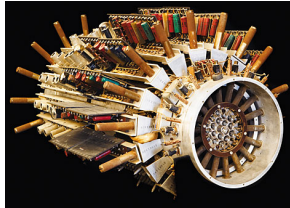
Silicon "chip"
(1959)

- Transistor invented by William Shockley (1910–1989); manufacture and miniaturization pioneered by Robert Noyce (1927-1990).

Computing Technology: Memory



Punch card / tape
(1940s)



Mercury delay line
(1940s)



Magnetic tape
(1951)

- Fast storage possible with transistors; however, still too expensive in 1960's for general memory usage.

Computing Technology: I/O Interface



Punch card / tape
(1940s)



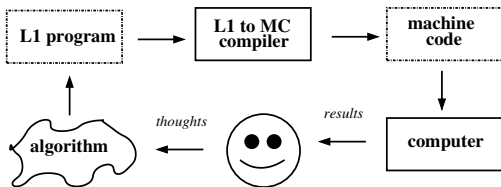
Teletype
(1940s)



CRT Display
(1940s)

Computing Technology: Software

- First programs written in binary machine code.
- A compiler is a program that translates a program in one language into an equivalent program in another language.



Grace Hopper
(1906–1992)

- First high-level computer languages (FORTRAN and COBOL) developed in late 1950's.

Computing Technology: Software (Cont'd)

- First programs loaded and run one at a time.
- An operating system is a computer program that co-ordinates all communications between memory, processors, other devices and human computer users.



- First operating systems developed in the 1950's.

The Computing Industry: Machines



UNIVAC



IBM



DEC

- Though UNIVAC first, IBM dominated mainframe market by end of 1950's; minicomputers emerged in 1960, led by Digital Equipment Corporation (DEC).

The Computing Industry: Software

- First computer programmers were women; the high pay associated with programming more complex systems in the early 1950's led to domination of the field by men.
- Software initially considered simple and was thrown in when computer purchased; as computers grew to handle more complex tasks, separate software development and maintenance companies emerged.
- Failure to develop various complex software systems in the 1960's (*e.g.*, IBM OS 360/370) led to 1968 conference at which software engineering was born.
- Many techniques proposed to engineer software (*e.g.*, structured / object-oriented programming); however, the problem of efficiently developing complex error-free software systems may always be with us.

The Computing Industry: End of an Era



Gertrud Blanch (1962)