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
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)
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)

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.
• 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.
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)