Historically there have been two forces which have driven the development of the electronic computer. The first was the need for fast and accurate scientific computation. The second was the need for better "data processing" which coincided with the industrial revolution and the rise of government sponsored social programs.

Early Computing Devices

Abacus
Counting Boards
Indian Numbers (a.k.a. our modern positional notation)
Logarithms

Early Mechanical Computing Devices (Western Europe)

Wilhelm Schickard’s (1592-1635) - Calculating Clock
Blaise Pascal (1623-1662) – Pascaline
    addition & subtraction only!
Wilhelm Gottfried Leibniz (1646 – 1716) – Stepped Reckoner (Staffelwalze)
    multiplication & division using repeated addition & subtraction

Charles Babbage (1791 – 1871)

Difference Engine I (1822)
    used method of finite differences to compute functions
Analytic Engine (1837)
    used Jacquard loom type mechanism (punch card control) for programming
    had a “mill” to compute & “store” for memory
Difference Engine II (1847-1849)
    finally constructed in 1991 at London Science Museum - design worked!

The 1890 Census –> Hermann Hollerith (1860 – 1929) Tabulating Machines –> IBM

U.S. Constitution requires a census every 10 years to apportion representatives from each state to congress
Crisis of 1880 Census! Took 9 years to complete census! Too long!
Hollerith’s Tabulating Machines (punch cards) introduced for 1890 Census – saved time & effort!
1911: Tabulating Machine Company merges with 30 other companies to become Computing Tabulating Recording Company
1924: changes name to International Business Machines (IBM)

Alan Turing (1912 – 1954) - British

"On Computable Numbers, with an Application to the Entscheidungsproblem" (1936-37)
Introduces “Turing Machine” – theoretical model for computation
During WWII worked at Bletchley Park at GC&CS
Later published “Can Machines Think?” – proposed “Turing Test” for machine intelligence
    “Computing Machinery and Intelligence” – *Mind* 1950

The Early Machines

Konrad Zuse (1910 – 1995) – German
Z1 – Z4 machines (electro-mechanical, binary representation)
Howard Aiken (1900 – 1973) - US
ASCC (Automatic Sequence Controlled Calculator): Harvard Mark I (1944)
   electro-mechanical – built w/ support from IBM
decimal machine
constructed at Harvard Univ.
Mark II – IV (later models)
   1947 - Mark II famous for first “actual case of [a computer] bug being found”

John Atanasoff (1903 – 1995) and Clifford Berry - US
Atanasoff Berry Computer (1939-40) – Iowa State
binary representation – used to solve systems of equations

Colossus (1943-44) - British
constructed at Bletchley Park: Government Code and Cipher School (WW II Secret Project)
   Used to crack Lorenz SZ 40/42 Cipher (not the Enigma machine)
electronic & special purpose

decimal & electronic (17,000+ vacuum tubes!)
constructed at Moore School of Electrical Engineering at U Penn
designers were John Mauchly (1907 – 1980 & Presper Eckert (1919 – 1995)
John von-Neumann (1903 – 1957) became interested in project; subsequently influenced computer design
   later moved to Aberdeen Ballistic Research Labs and redesigned with a ROM for code

First Draft of a Report on the EDVAC (1945)
John von Neumann

Preliminary discussion of the logical design of an electronic computing device (1946)
Arthur Burks, Herman H. Goldstine, John von Neumann
Both papers laid out the logical design of a computer

The Early Stored Program Computers

The British:
SSEM (Small Scale Experimental Machine) – a.k.a. Manchester Mk I “Baby”
   June 21, 1948 – date that first stored program ran successfully
   used William’s storage tube memory
Cambridge EDSAC (1949)
   first “production” computer
   used acoustic delay line memory

The Americans
UNIVAC (1951)
   company formed by Mauchly & Eckert
   first commercial computer in US (US Census bureau was 1st client)
in 1952 correctly predicted US Presidential election (there is a story here)
   used acoustic delay line memory
IAS Machine (Institute for Advanced Study - Princeton) ~ 1951
   Von Neumann architecture – pattern for many subsequent machines
   used William’s tube memory
EDVAC (1952) – finally! – design from 1945 (see above)
   used acoustic delay line memory
Whirlwind Computer (1948 – 1951)
   real-time computing
IBM 701 (1952 – 53) – a late start but dominated mainframe market
Technology

Vacuum tubes to Transistors to IC’s (integrated circuits) to VLSIC’s

Memory Technology
- acoustic delay line
- CRT (cathode ray tube) memory; William’s storage tube memory
- ferrite core (first technology that really worked)
- semi-conductor – based on transistors – variants in use today

mid 1950’s – early 1970’s: Era of the big “mainframes”
- IBM and the Seven Dwarves: UNIVAC, Boroughs, NCR, Control Data Corporation, RCA, General Electric, Honeywell

Micro-computers – computer on a chip
- Intel 4004 (1971) – first CPU on a chip
- Intel 8080 - Altair 8800 (1975) – first commercial micro-computer (needed assembling)
- Apple II (1977), Apple IIe (1983)
- IBM PC (1981)

There after the computers on a chip got faster, more powerful and more omnipresent. And the rest you see today.

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