

UNIT 1B

A Brief History Of Computing

Electronic Computing (1940's to the Present)

15110 Principles of Computing,
Carnegie Mellon University - CORTINA

1

Alan Turing



- Considered the “father” of modern computer science.
- Presented formalisms for the notions of computation and computability in the 1930's.
- Worked at Bletchley Park in Great Britain during WWII to develop Colossus to help break the German Enigma Code.
- Developed the notion in 1950 of a test for machine intelligence now called the Turing Test.
- The Turing Award, the highest award in computing, is named in honor of Alan Turing.

15-105 Principles of Computation,
Carnegie Mellon University - CORTINA

2

ENIAC

Electronic Numerical Integrator and Computer

- Collaboration between Moore School of Electrical Engineering at the University of Pennsylvania and the Ballistic Research Laboratory in Aberdeen, MD
 - Designed by John W. Mauchley and J. Presper Eckert
- In 1943, the Ordnance Dept. signs a contract for UPenn to develop an electronic computer to solve differential equations for ballistic trajectories
- Constructed completed in the fall of 1945 after WWII ends, and dedicated in February 1946.



from www.computer.org

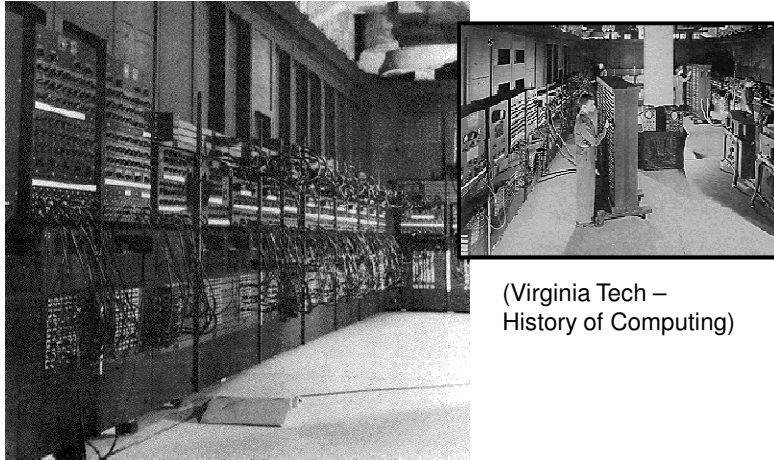
ENIAC

Electronic Numerical Integrator and Computer

- Filled an entire room
 - 42 panels, each 9' X 2' X 1', three on wheels
 - organized in a U shaped around the perimeter of a room with forced air cooling
- Weighed 30 tons
- Reportedly consumed 150-200 kW of power
- Contained a huge amount of parts:
 - approx. 19,000 vacuum tubes and 1,500 relays
 - over 100,000 resistors, capacitors and inductors
- Input and output via an IBM card reader and card punch

ENIAC

Electronic Numerical Integrator and Computer



(Virginia Tech –
History of Computing)

15-105 Principles of Computation,
Carnegie Mellon University - CORTINA

5

The first electronic computer?

- Patent filed for ENIAC in 1947 as first electronic computer
- In 1973, patent is ruled invalid
 - The inventor of the first electronic computer is John Atanasoff for the Atanasoff-Berry Computer
 - Outside of the U.S., Konrad Zuse of Germany is considered the inventor of the modern-day computer
 - Also designed the first programming language, Plankalkül (Plan Calculus) in 1945



15-105 Principles of Computation,
Carnegie Mellon University - CORTINA

6

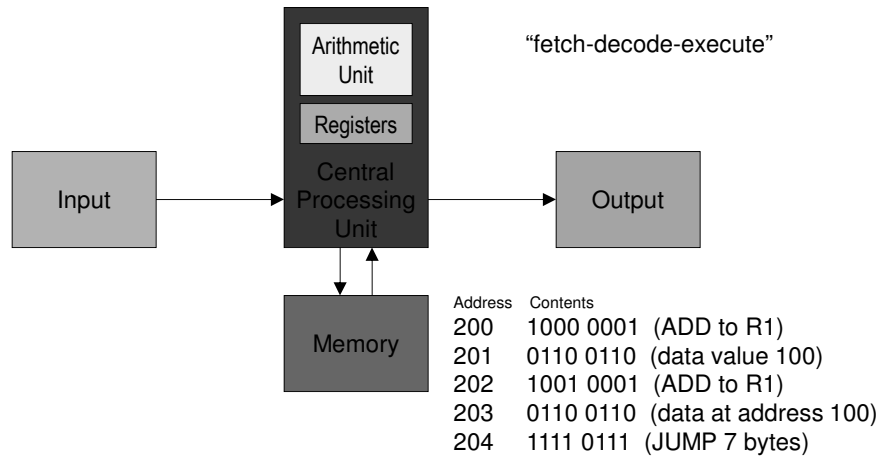
Stored Program Concept

- Stored-program concept is the fundamental principle of the ENIAC's successor, the EDVAC (Electronic Discrete Variable Automatic Computer)
- Instructions were stored in memory sequentially with their data
- Instructions were executed sequentially except where a conditional instruction would cause a jump to an instruction someplace other than the next instruction.

15-105 Principles of Computation,
Carnegie Mellon University - CORTINA

7

Stored Program Concept



15-105 Principles of Computation,
Carnegie Mellon University - CORTINA

8

Stored Program Concept

- Mauchly and Eckert are generally credited with the idea of the stored-program
- BUT: John von Neumann publishes a draft report that describes the concept and earns the recognition as the inventor of the concept
 - “von Neumann architecture”
 - *A First Draft of a Report of the EDVAC* published in 1945
 - <http://www.wps.com/projects/EDVAC/>



von Neumann,
Member of the Navy
Bureau of Ordinance
1941-1955

UNIVAC and the First Compiled Programming Language

- UNIVAC I
 - Built by Remington Rand to compute 1950 U.S. census but completed in 1951
 - Used to predict the winner of the 1952 U.S. Presidential Election based on ~3.4M votes
- A-0 is a programming language for the UNIVAC I or II, using three-address code instructions for solving mathematical problems.
 - Example: ADD R1, R2, R3
(Add the contents of R2 and R3 and put result in R1.)
- A-0 was the first language for which a compiler was developed, produced by a team led by Admiral Grace Hopper.



J. Presper Eckert and Walter Cronkite
next to the UNIVAC in 1952
(Center for the Study of Technology and Society)



Admiral Grace Hopper

The Integrated Circuit



- Robert Noyce and Jack Kilby are credited with the invention of the integrated circuit (IC) or microchip.
 - Kilby wins Nobel Prize in Physics in 2000.
 - Robert Noyce co-founded Intel in 1968.
- By the mid 1970s, ICs contained tens of thousands of transistors per chip.
 - In 1970, Intel created the 1103--the first generally available DRAM chip.
 - Today, you would need more than 65,000 of them to put 8 MB of memory into a PC.

Units of Memory

- Byte B 8 bits (8b)
- Kilobyte KB 1024 B = 2^{10} bytes $\approx 10^3$ bytes
- Megabyte MB 1024 KB = 2^{20} bytes $\approx 10^6$ bytes
- Gigabyte GB 1024 MB = 2^{30} bytes $\approx 10^9$ bytes
- Terabyte TB 1024 GB = 2^{40} bytes $\approx 10^{12}$ bytes
- Petabyte PB 1024 TB = 2^{50} bytes $\approx 10^{15}$ bytes
- How many bytes can be stored in a 4GB flash drive?
- How many bytes/second is a 16Mbps cable modem connection?

How Time Flies...



Commodore 64 (1982)
40cm X 22 cm X 8 cm
64KB of IC memory
\$595



Apple iShuffle (2008)
3cm X 3cm X 1cm
2GB of flash memory
\$49

15-105 Principles of Computation,
Carnegie Mellon University - CORTINA

13

Moore's Law

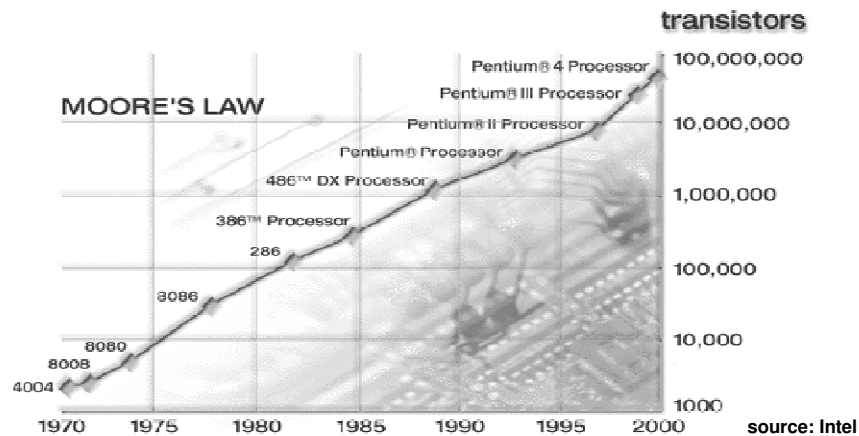


- Gordon Moore co-founded Intel Corporation in 1968.
- Famous for his prediction on the growth of the semiconductor industry: Moore's Law
 - <ftp://download.intel.com/research/silicon/moorespaper.pdf>
 - An empirical observation stating in effect that the complexity of integrated circuits doubles every 18 months. ("complexity" generally means number of transistors on a chip)

15-105 Principles of Computation,
Carnegie Mellon University - CORTINA

14

Moore's Law



15-105 Principles of Computation,
Carnegie Mellon University - CORTINA

15

The GUI

Graphical User Interface

- Concept born at SRI in the early 1960s
- Major development at Xerox PARC in late 70s
- Apple Macintosh, founded by Steve Jobs and his friend Steve Wozniak, introduced in 1984 with full GUI operating system
- Microsoft is founded by Bill Gates and Paul G. Allen with sales of Microsoft BASIC
 - develops its own window-based operating system soon afterwards based on Apple's design... many lawsuits follow
- Even IBM jumps into the fray with OS/2

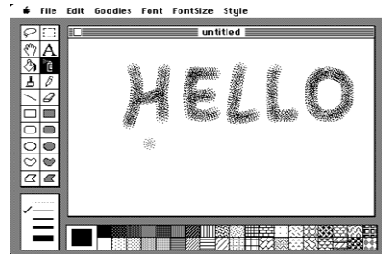


15-105 Principles of Computation,
Carnegie Mellon University - CORTINA

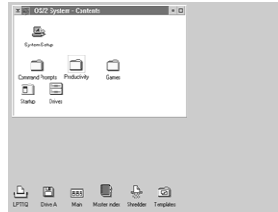
16

The GUI

Graphical User Interface



Macintosh OS



IBM OS/2



Microsoft Windows 1.0

Input Devices

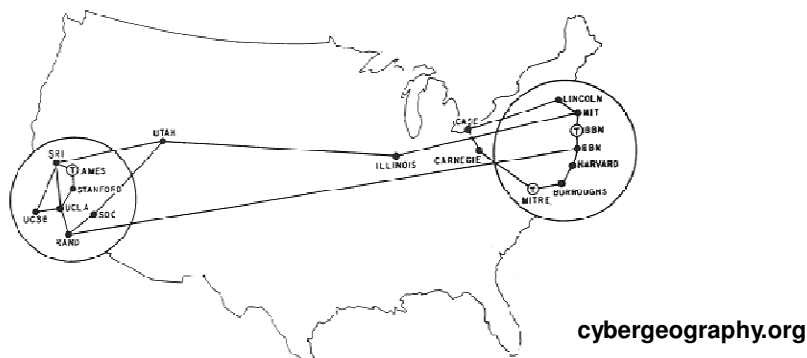
- The mouse was invented by Douglas Engelbart of Stanford Research Institute in 1963 after extensive usability testing.
 - He received a patent in Nov. 1970 for the "X-Y Position Indicator For A Display System".
 - He was the recipient of the 1997 ACM Turing Award. (<http://www.acm.org/awards/taward.html>)
- Ethernet was originally developed as one of the many pioneering projects at Xerox PARC.
 - Invented between 1973-1976 by Robert Metcalfe and David Boggs



The Birth of the Internet

- The earliest ideas of a global computer network were formulated by J.C.R. Licklider at MIT in 1962 in a series of memos discussing the "Galactic Network" concept.
- The Advanced Research Projects Agency Network (ARPANET) of the U.S. DoD was the world's first operational packet switching network.
 - Much of the work in computer development in the 1960s was spurred by the Space Race and the Cold War.
- In 1971, Ray Tomlinson of Bolt, Beranek, and Newman (BBN) wrote the first email program
- By the late 1980s, the DoD transferred operation of the network to NSF, and what is known as the "Internet" emerges.

ARPANET 1971



MAP 4 September 1971

The World Wide Web

- Developed by Tim Berners-Lee of CERN (European Organization for Nuclear Research) - 1990
 - Used hypertext to mark up text documents so they could be searched and displayed by other users on the Internet
- Mosaic (1993): First Internet browser developed by a team at the National Center for Supercomputing Applications at the University of Illinois at Urbana-Champaign (NCSA-UIUC)
- Google (1998): World's most popular search engine company on the web launches from a pair of graduate students at Stanford University (Larry Page and Sergey Brin)
- Wikipedia (2001), Facebook (2004), YouTube (2005), Twitter (2006)



Really?

- In 1981, Bill Gates is supposedly quoted as saying that how much computer memory “ought to be enough for anyone”?

