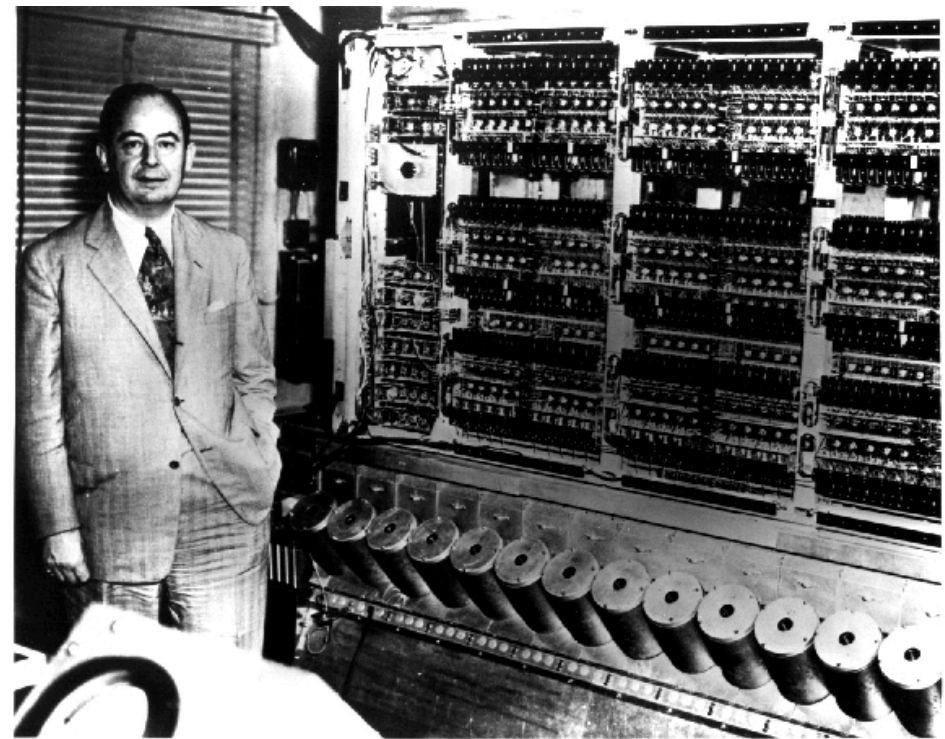


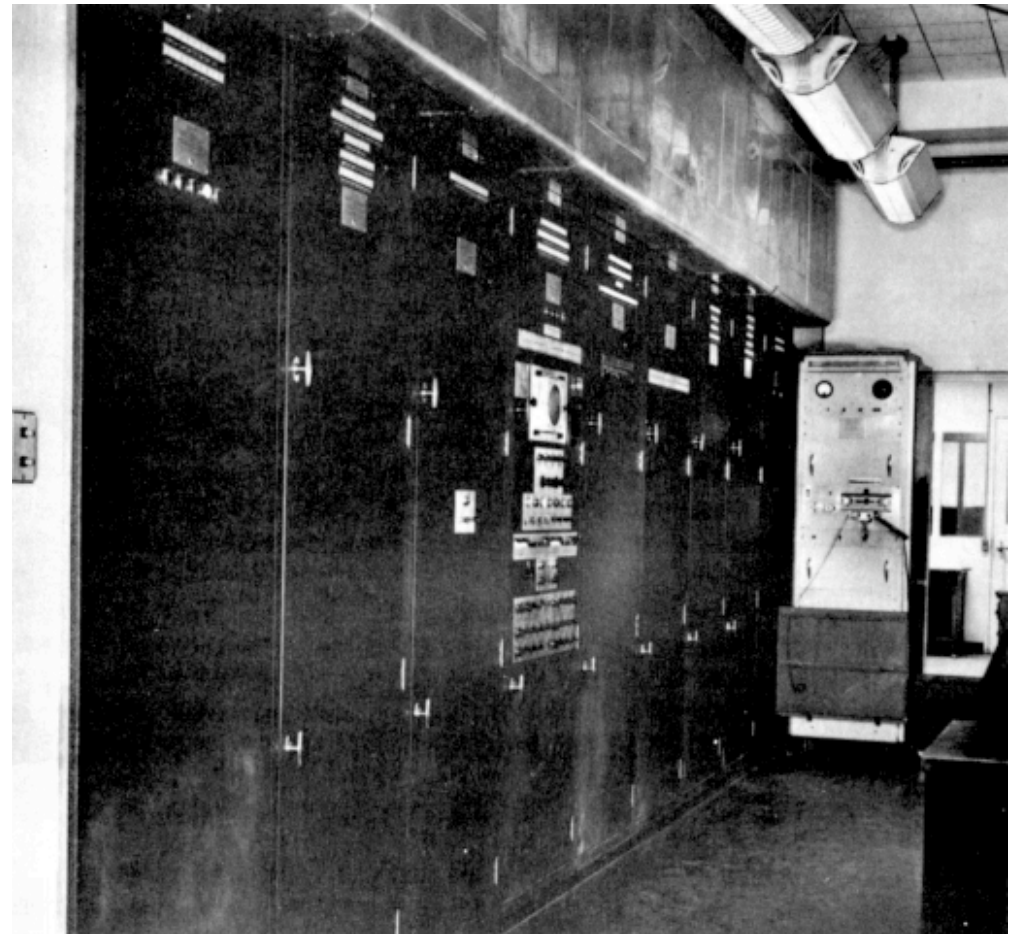
John von Neumann

- Hungarian mathematician, computer scientist, cyberneticist, all-around genius
- Worked on atomic bomb project in WW II
- Invented game theory and developed theory of self-replicating automata
- Originated key concept of **stored-program computer** in 1945
- Program instructions = data
- Easily reprogrammable
- **Von Neumann architecture** is still the universal standard



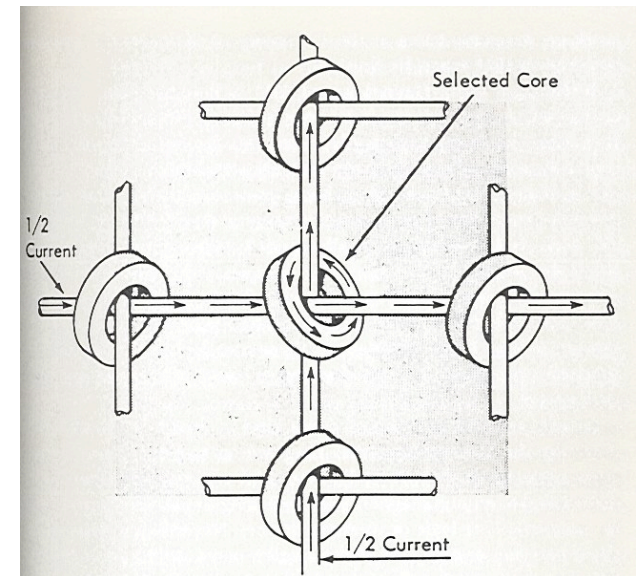
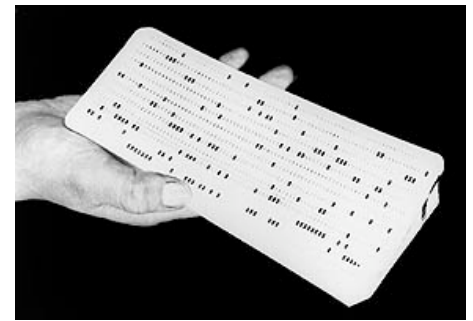
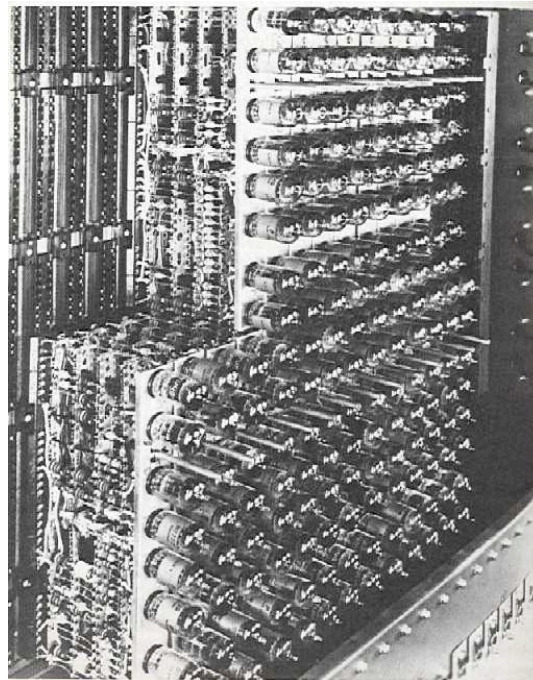
EDVAC

- **E**lectronic **D**iscrete **V**ariable **A**utomatic **C**omputer
- Designed by Mauchly, Eckert, and Von Neumann
- Stored-program design
- Used binary instead of decimal to represent information
- Version called UNIVAC I was the first commercially available computer system
- Sold to the U.S. Census Bureau in 1951

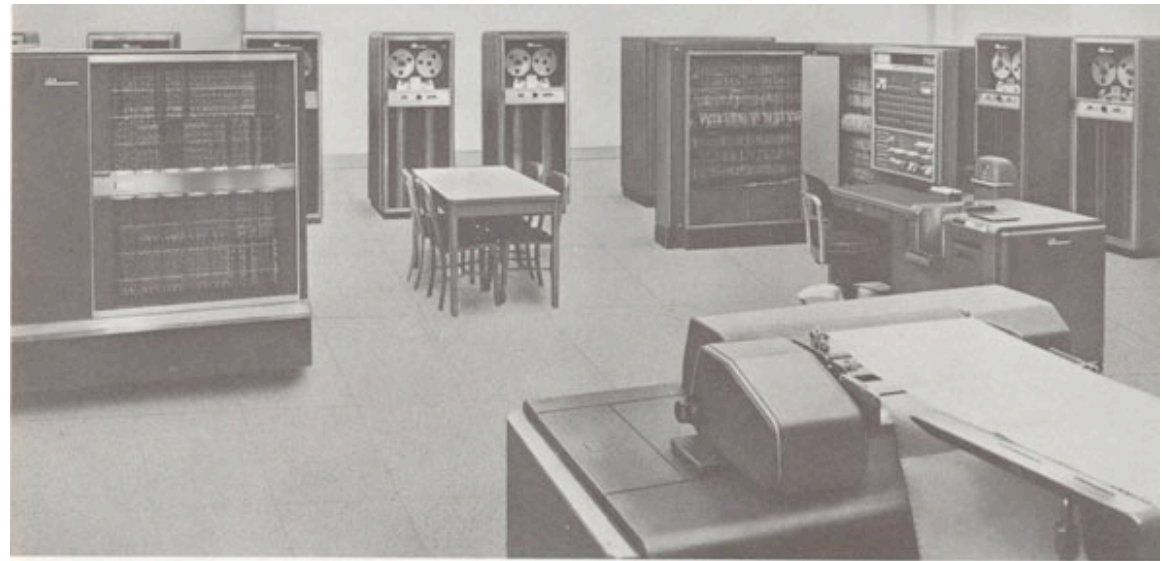
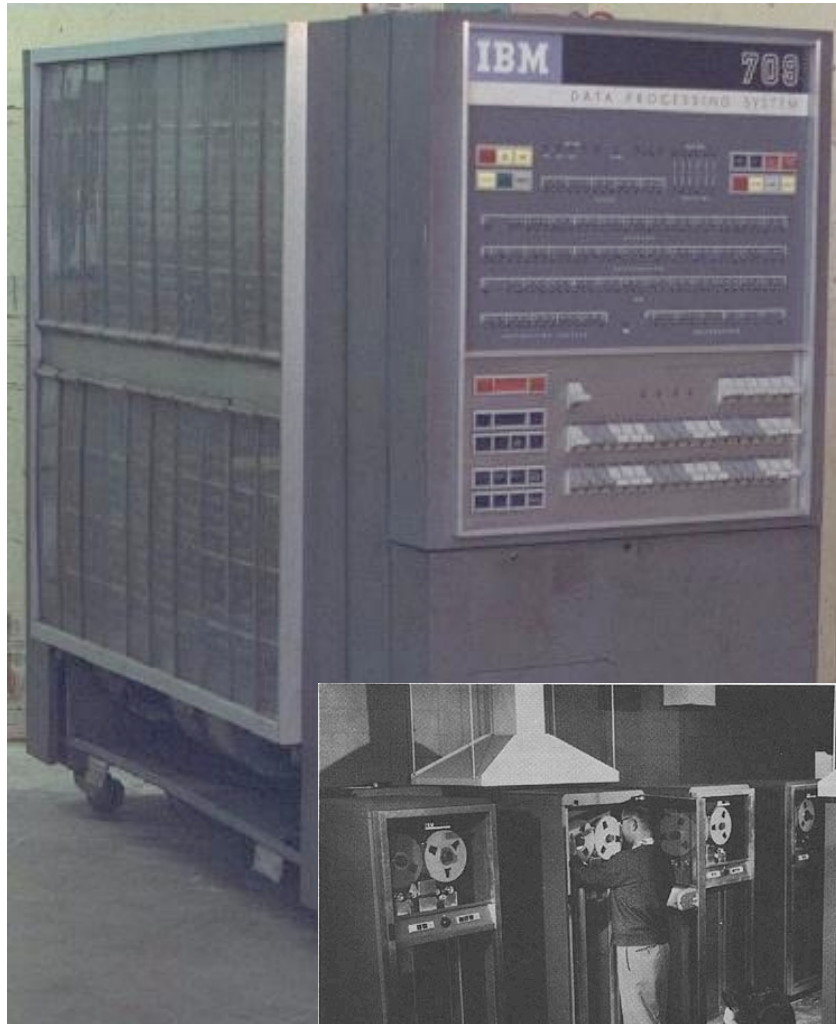


First Generation Computers

- Mid 1940s to late 1950s
- Stored-program design with ~ 1000 words of RAM
- Used vacuum tubes, but required less space than ENIAC
- Punched cards for input and output
- Vacuum tube or magnetic core memory for data storage
- Programmed directly in binary machine language
- Included EDVAC and UNIVAC



First Generation Computers



A large-scale data processing system made up of inter-connected units. It can perform up to 42,000 additions or subtractions, or 5,000 multiplications or divisions, each second.

STORAGE:

The 709's magnetic core storage has a capacity of over 327,000 decimal digits. A Data Synchronizer which permits the system to read, write, and calculate simultaneously also is incorporated.

The 709's tape units permit information being written on magnetic tape to be automatically checked for accuracy during the writing process.

USE:

Commercial, scientific, engineering problems.

PRICES (Average):

Monthly rental — \$55,200 and up.

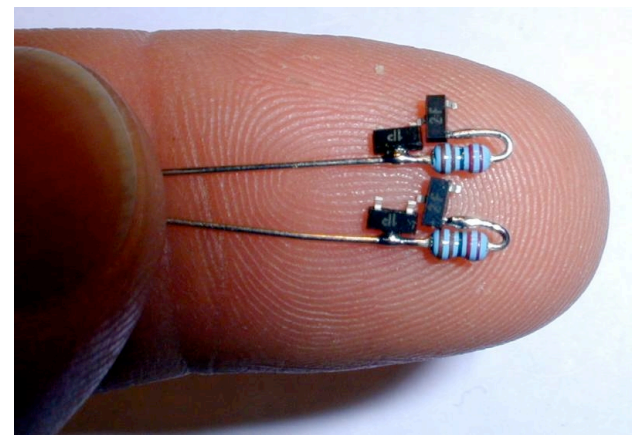
Purchase price — \$2,630,000 and up.



Transistors

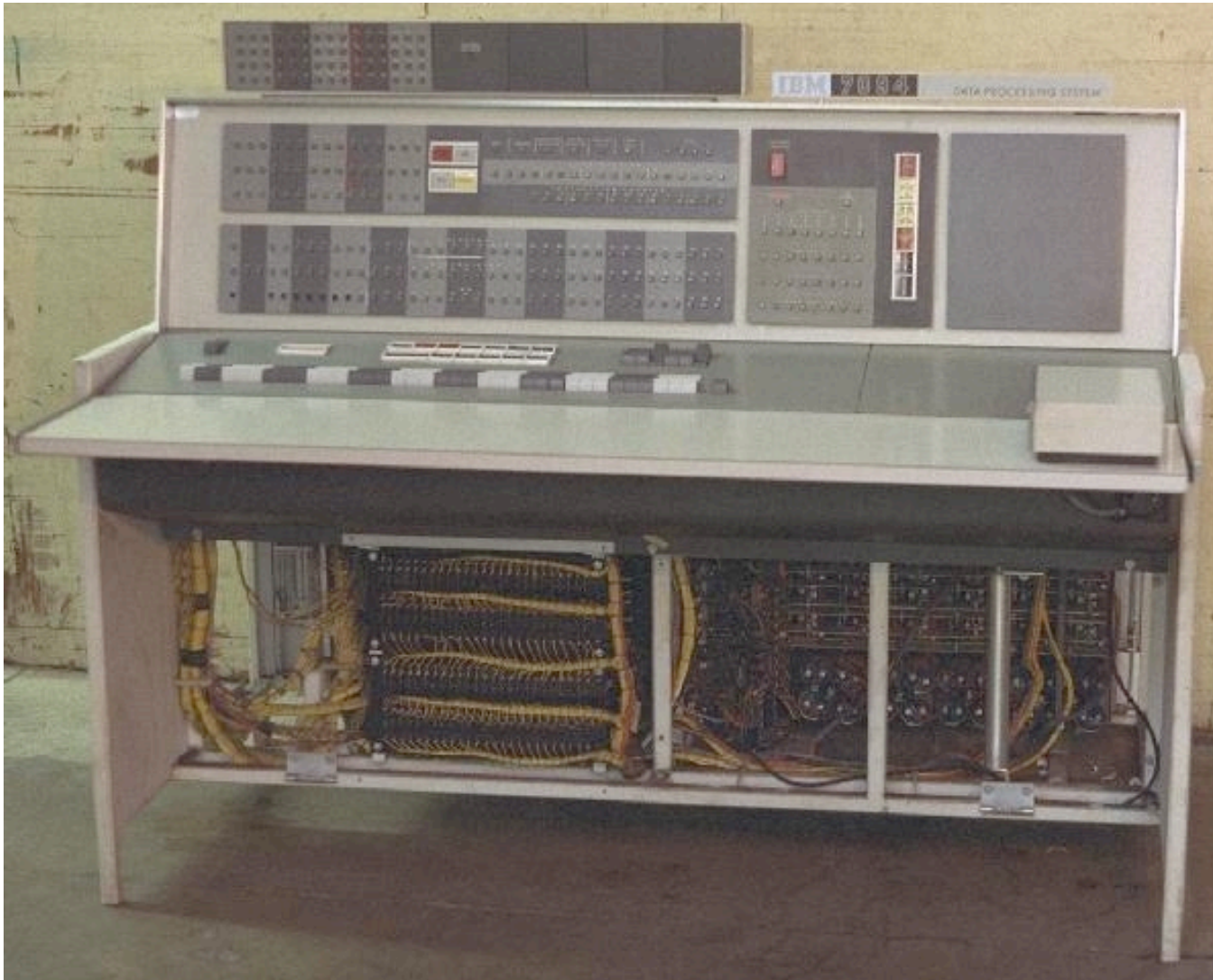


- Invented at Bell Labs in 1947 by William Shockley, John Bardeen, and Walter Brattain
- Generated far less heat than vacuum tubes
- Required far less power
- Much faster, smaller, cheaper, and more reliable



Transistors

- Incorporated into Second Generation computers in the late 1950s and early 1960s

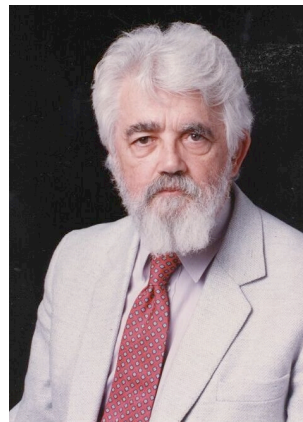


Origins of AI

- 1956 Summer Dartmouth Conference
 - Organized by John McCarthy, who coined the term “artificial intelligence”

- Participants:

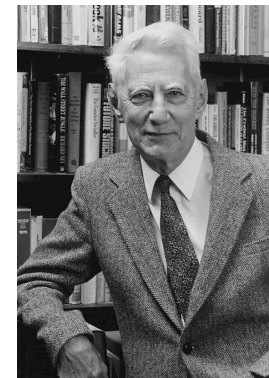
- John McCarthy
- Marvin Minsky
- Claude Shannon
- Nathaniel Rochester
- Allen Newell
- Herbert Simon
- Oliver Selfridge
- Trenchant More
- Arthur Samuel
- Ray Solomonoff



McCarthy



Minsky



Shannon



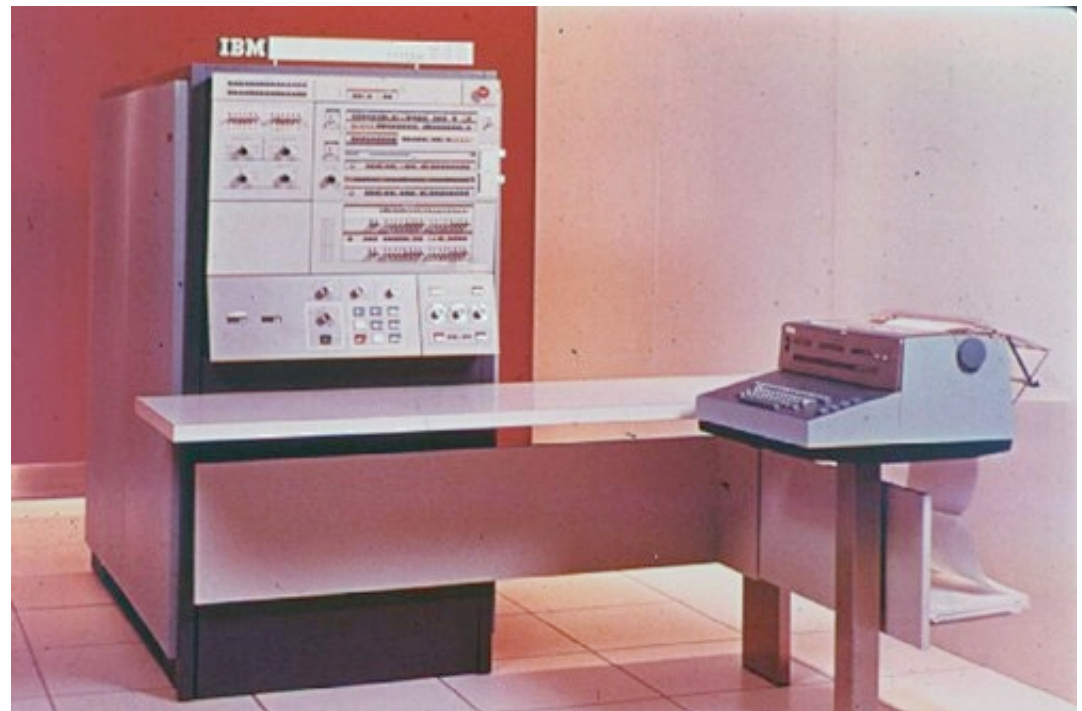
Simon and Newell



Samuel (standing)

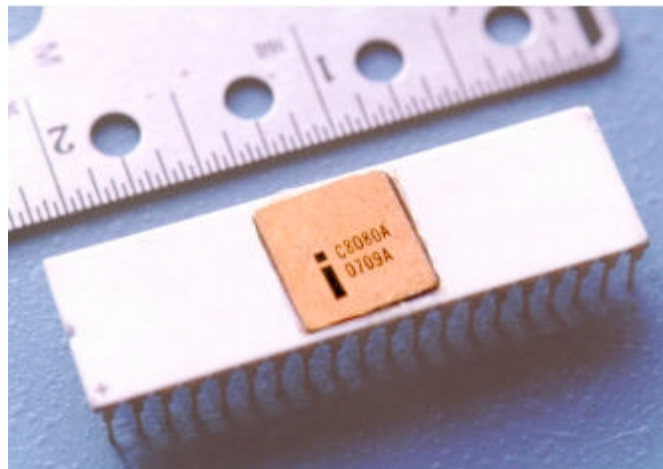
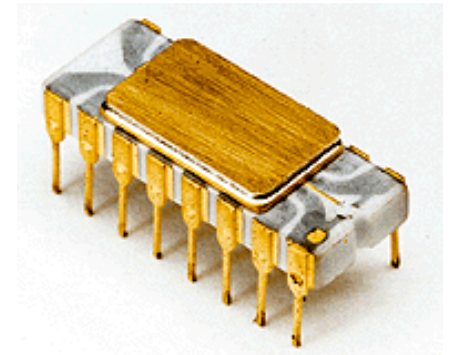
Integrated Circuits

- Invented in the late 1950s by Jack Kilby of Texas Instruments
- Many transistors etched on a single silicon chip as a single electronic circuit
- Faster due to decreased distance between transistors
Incorporated into Third Generation computers in the mid 1960s to early 1970s



VLSI Technology

- **V**ery **L**arge **S**cale **I**ntegration
- Thousands or millions of transistors per chip
- First microprocessor chip: Intel 4004 (1971)
- Designed by Ted Hoff for Japanese calculator company
- Followed by Intel 8008 and 4040 (1972) and 8080 (1974)
- Entire computer packaged as single integrated circuit chip
- Like having an Analytical Engine the size of a shirt button



VLSI Technology

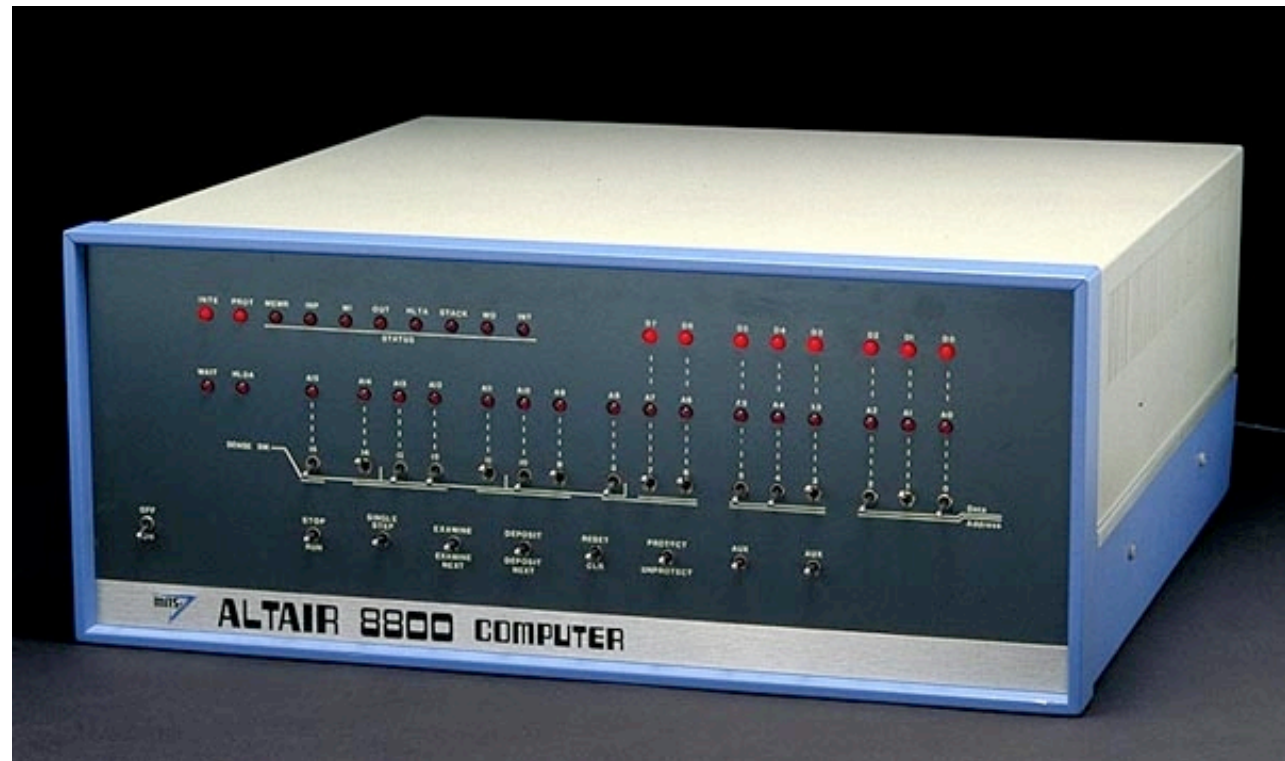
- Incorporated into Fourth Generation computers from the mid 1970s to the present



VAX minicomputer from Digital Equipment Corporation (early 1980s)

MIT'S Altair 8800 (1975)

- First popular and affordable **microcomputer** (\$375)
- Based on Intel 8080 chip
- 256 bytes of RAM (that's *bytes*, not kilobytes or megabytes)
- Programmed by manually flipping switches on front panel
- Output in the form of blinking lights
- No software available
- MIT'S couldn't sell them fast enough!



MIT'S Altair 8800 (1975)

- Some assembly required



MITS Altair 8800 (1975)

- Some assembly required
- **Bill Gates** and **Paul Allen** promised MITS a BASIC interpreter for the Altair, leading to the creation of **Microsoft** in 1975



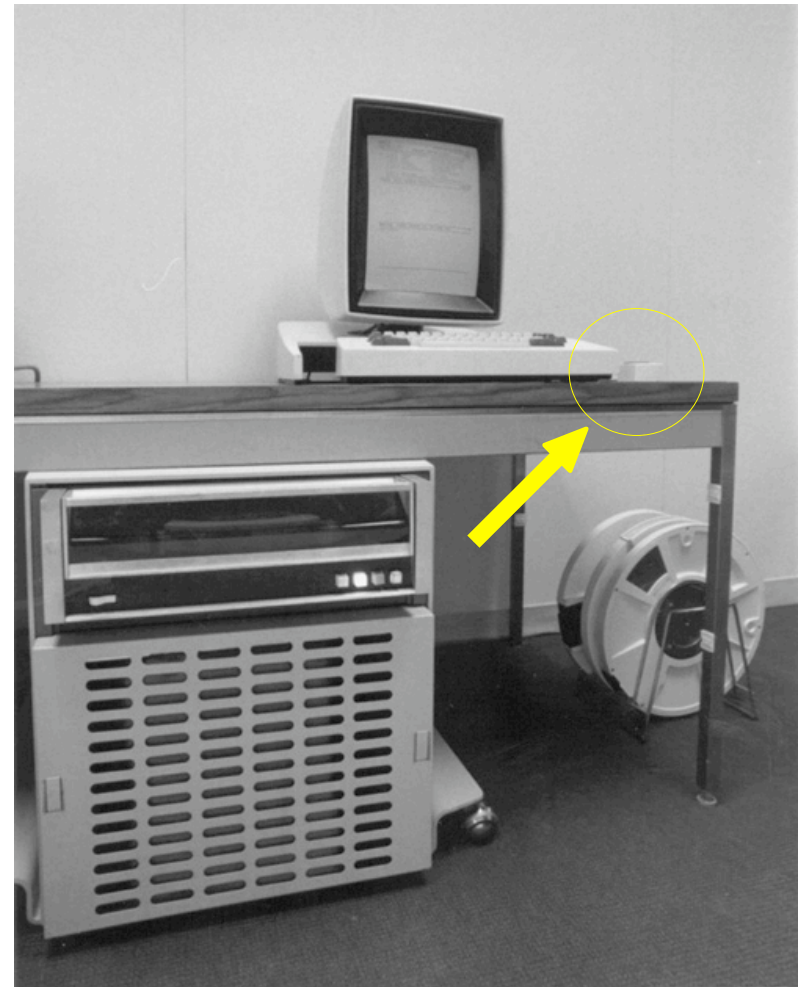
Ha, ha, I'm richer than you!



Other Early Developments



- IMSAI 8080 microcomputer was similar to the Altair 8800
- Doug Engelbart invented the **mouse** at SRI in 1964
- Xerox PARC Alto computer (1974) used mouse, graphics, menus, and icons



Apple Computer, Inc.

Steve Jobs and Steve Wozniak



The original Apple I



Apple II (1977)

- color graphics
- BASIC, 4K RAM
- cassette tape data storage
- \$1300
- VisiCalc released in 1979

Apple Computer, Inc.

- Sales went from \$2.5 million to \$583 million in six years
- Fortune 500 by 1982
- Steve Jobs visits Xerox PARC in 1979
- **Apple Macintosh** introduced in 1984
- First widely available microcomputer with GUI



The Personal Computing Era is Born

Radio Shack
TRS-80 Model I

affectionately
known as the
"Trash 80"



Commodore PET
(1977)



TRS-80 Model II



IBM PC (1981)

reverse-engineered
by Compaq in 1985

The Internet and the World Wide Web

- ARPANET created in 1969 by connecting together 4 computers at UCSB, UCLA, Utah, and SRI
- World Wide Web conceived at CERN in Switzerland in late 1980s by **Tim Berners-Lee**
- First Web browser written in 1990 by Tim Berners-Lee using a NeXT computer

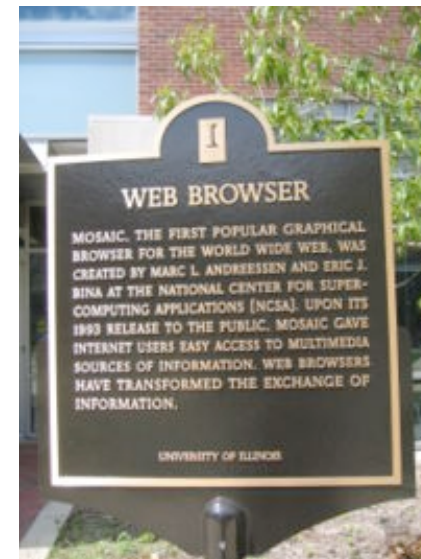
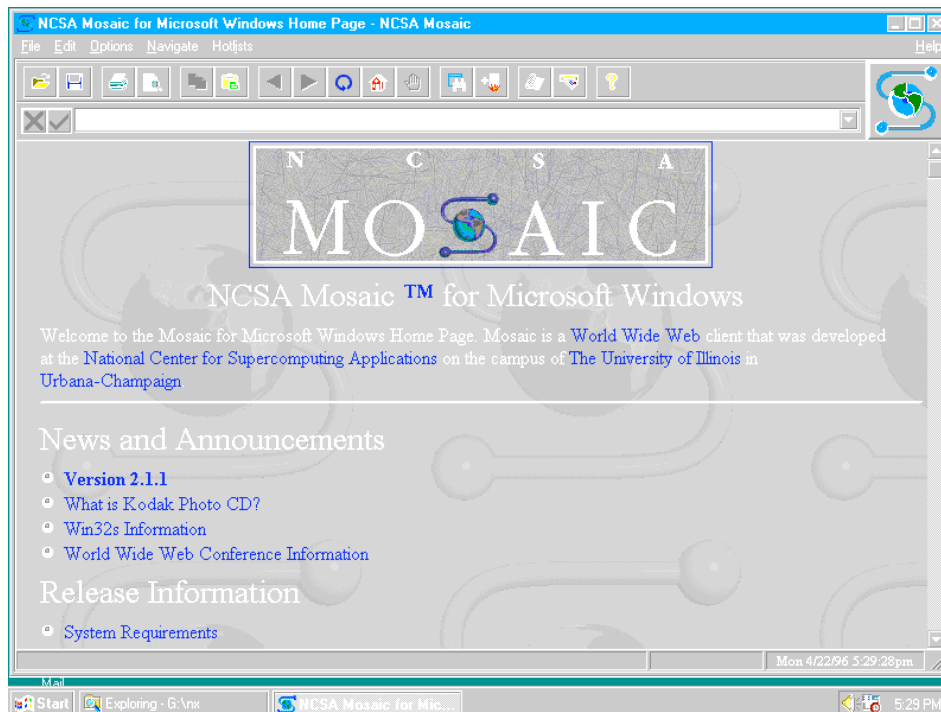


The Internet and the World Wide Web

- Marc Andreessen and Eric Bina at the University of Illinois develop **Mosaic Web browser**
- Marc Andreessen and Jim Clark found Netscape Communications, Inc. in 1994
- Netscape goes public on August 9, 1995 and is worth \$3 billion by the end of the day



Marc Andreessen



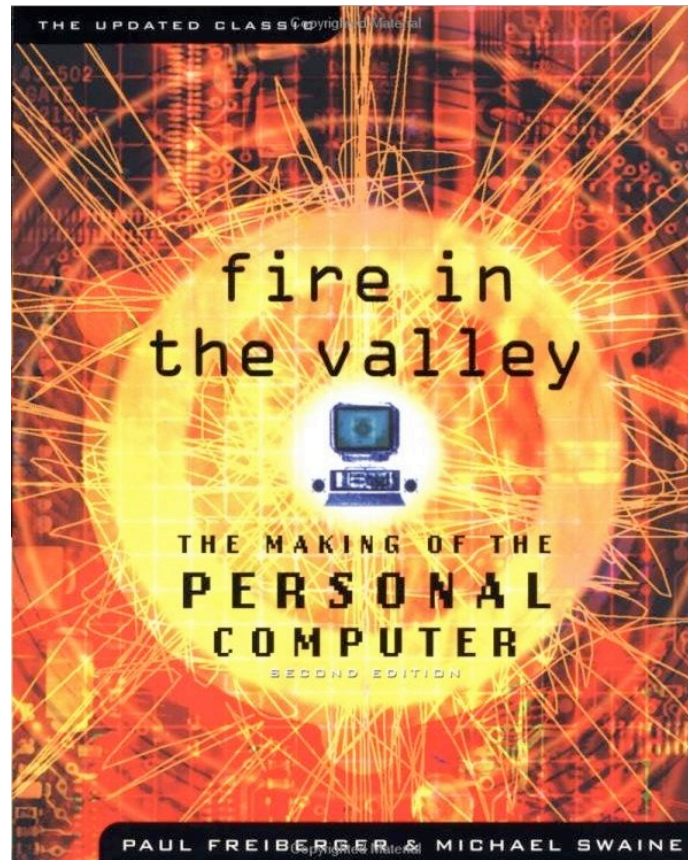
The Future . . . ?

- *"I think there is a world market for maybe five computers"*
—Thomas J. Watson
Chairman of IBM, 1943
- *"If automotive technology had progressed as fast as computer technology between 1960 and today, the car today would have an engine less than a tenth of an inch across, would get 120,000 miles per gallon, have a top speed of 240,000 miles per hour, and would cost \$4"*

—Rick Decker and Stuart Hirshfield
The Analytical Engine
- Other predictions, anyone?

For Further Reading

One of the best available histories of the personal computer revolution is



Fire in the Valley: the Making of the Personal Computer
by Paul Freiberger and Michael Swaine