Robots play Soccer

"By 2050 our aim is to beat the winners of the World Cup..." - Shu Ishiguro, head of Robot Lab in Osaka, Japan

Origins of Digital Computers

- earliest computing devices designed to aid numeric computation
- abacus, first developed in Babylonia over 5,000 years ago

Slide Rule of 1622

- 1614 John Napier discovered Logarithms.
- 1622 Edmond Gunter put scales on two pieces of wood.
- Multiply, divide, squares, cubes, logarithms, trig

Early Calculating Machines

- Blaise Pascal (1623–1662); addition and subtraction using on 8 sprocket gear for each digit.
- Sold 10-15 machines.

Leibniz Machine—late 1600’s

- G. W. F. Leibniz (1646–1716), “Stepped Reckoner” full-featured calculator, Add, Subt. Mul, Div 5-12 digits
- Long time to set up for each operation
Charles Babbage (1791-1871)

• Mathematics Prof at Cambridge University
• first true pioneer of modern digital computing machines
• built two prototype calculating machines
• Difference Engine
• Analytical Engine

Difference Engine - 1812

• Add, Subtract, Multiply & Divide
• Created math tables containing up to 26 digits
• designed a larger model, but hardware technology insufficient to build the machine
• 1990 London Museum of Science built it from original design

Analytical Engine - 1840

• Used punched cards
• Calculations to 20 digits of accuracy
• Ada Lovlace, daughter of Lord Byron. Assisted Babbage as his Programmer*, for free

Jacquard Loom - early 1800's

• Used series of wooden cards with holes
• Rods entered holes, moved appropriate strings for bobbin to pass through
• Method seen by Babbage and applied to his machines

Card Tabulator -1890

• Data coded into punched cards.
• Cards and Tabulator used in the census of 1890
• as cards were "read", dials kept count.

Herman Hollerith Tabulating Machine Company
Herman Hollerith
International Business Machine

- 1924 renamed IBM by new President Thomas Watson
- By 1952 world was using 16 Billion cards/year

Konrad Zuse
Germany, 1939

"I was too lazy to calculate and so I invented the computer."

First General Purpose, programmable digital computer
built with electric relays and eventually vacuum tubes.
Developed first programming language “PlanKalkul”

John Atanasoff
USA, 1939

First electronic digital computer
Built at Iowa State University with his student Clifford Berry
called ABC Computer
- special-purpose: only to solve simultaneous equations

Bill Hewlett and Dave Packard
USA, 1939

Began HP company in Garage in Palo Alto, CA
40 years later in a Garage in same town, Apple computer was begun
Did not work with computers until years later

Howard Aiken - Mark I
USA, 1944

At Harvard, the Mark I was the largest electromechanical calculator ever built.
- 5 Tons, 55ft long
- Used electromechanical relays
- Instructions were punched in paper tape.
- Took 3-5 sec/calculation
- Data stored in 3000 mechanical wheels

He said WHAT?

- Howard Aiken was quoted in 1947 as saying
- "Only six electronic digital computers would be required to satisfy the computing needs of the entire United States"
Grace Murray Hopper (1906–1992)  
USA, 1944
Retired at 79 as a Rear Admiral in the Navy
Worked on Mark I, II, III and UNIVAC
Primary designer of COBOL

John Mauchly and Presper Eckert 1945
ENIAC - Electronic Numerical Integrator and Computer
• First general purpose electronic computer
• Operational in 1946
• 18,000 vacuum tubes
• Weighed 30 tons
• 140,000 watts of power
• 3000 blinking lights
• 5000 additions/sec
Compiled a trajectory table in two days.

ENIAC
Programmed by setting 6000 Switches

ENIAC
Transferred data with connecting wires
Took two days to set up a program that might run a few seconds

Von Neumann Architecture
• Early 1950’s developed the “stored program” concept
• Basic computer architecture of today’s computers
• Binary encoding
• I/O, CPU-Memory organization
• “Fetch-decode-execute” instruction cycle

Alan M. Turing (1912–1954)
• Led the WWII research group that designed a machine similar to ENIAC called Colossus.
• Proposed a simple abstract universal machine model for defining computability

More Info
Colossus vs Enigma

- In England in 1943, Colossus was used to break the German's coded messages created by their Enigma machine.

UNIVAC I

- First commercial general-purpose computer system
- Successor to Mauchly-Eckert BINAC
- Delivered in 1951
- Used to forecast the 1952 presidential election (Eisenhower)

Evolution and Acceleration

First Generation
1930's-1940's
Vacuum tubes

Second Generation
1950's - mid 1960's
Transistors

Third Generation
Late 60's
Integrated circuits

Fourth Generation
70's to present
Microprocessors

Integrated Circuits

- More reliable
- Smaller
  - Millions on one silicon chip
- Faster
- More Efficient
  - Less power needed, less heat
- Cost less
  - Mass produced

CORE MEMORY

- Small donut shaped magnets
- Oriented in one of two directions
- Some wires used for determining location
- Others for specifying magnetic orientation
- Nonvolatile

Today's MEMORY

- SIMM: Single In-line Memory Module
- DIMM: Dual In-line Memory Module
- EDO, SRAM, VRAM, WRAM, SDRAM, RDRAM
- Access speeds: 60, 45, 12, 6, 2 nanoseconds
First Microcomputer were Kits for Hobbyists

- Alan Kay
- Developed one of the first microcomputers in the late 1960s
- Coined the term “Personal Computer”
- His Alto computer was not a commercial success

First Commercial Desktop computer

- Steve Jobs and Steven Wozniak
- Jobs sold VW Van to Form Apple Computer in 1976
- HP did not think it was a worthwhile project

Types of Computers

Computers for Individuals

- Desktop – PC, iMac
- Notebook – Laptop
- All-in-One
- Personal Digital Assistant
- Internet Appliance
- Workstation

Computers for Organizations

- Servers are not designed for individuals. They make programs available for network users
- Minicomputers handle the computing for small corporations
- Mainframes handle gigantic processing jobs for large corporations or agencies
- Supercomputers are ultra-fast and handle huge amounts of scientific data using hundreds of microprocessor chips running in parallel
Special-Purpose Computers

- Special-Purpose
  - often attached to sensors to measure and/or control the environment
  - programs etched in silicon so they can’t be altered (firmware)
- Embedded
  - enhance consumer goods
  - control a variety of hardware devices, including robots

Software

- A 16 year old Bill Gates in partnership with his friend Paul Allen created a DOS (Disk operating system) that would eventually dominate the world’s operating system markets.

Bill Gates/Microsoft Corp.

- In 2004 his Windows Operating Systems were on more than 96% of the world’s desktop computers.
- Apple OS on 2.8%
- Linux OS on 1%

What’s he worth today?

Software Applications

- Word processing and desktop publishing
- Spreadsheets and databases
- Computer graphics, multimedia
- Telecommunication and networking
- Artificial intelligence
- General problem-solving
- Programming languages

The Internet Explosion

- A network of networks
- World Wide Web for usability
- Electronic mail
- Multimedia content
- Self-publishing
- On-line transactions
- Intranets
- Network computers

That’s all folks!