Lecture 1

Where do Computers Come From?

What is a Computer?

Consists of two things:
1. A set of interconnected switches
   - switching some of the switches causes other switches to switch
2. A way of setting some of those switches off (in a useful order)

Example - Early Computing

- Jacquard Loom (18th century)
  A French weaver, Joseph Jacquard developed a loom that wove complex patterns using punch cards.

Hardware
Software

the hardware
the software (punched into the cards)
Early Computing

- The Hardware: Difference Engine (18th-19th century)
  - Designed by Charles Babbage to solve certain mathematical problems (complex polynomial equalities to a high degree of precision)

- The Software: Ada Lovelace
  - Regarded as the first ever “programmer”

The First iPod?

- Pianola (piano player)
  - 1898

The First “Computer!”

Computer Hardware

- Back to “where do computers come from?”
- The 6 great moments in computer hardware...
1. The Thermionic Valve

- A non-mechanical “automated” switch!
  - output of one switch can switch another
- Suddenly many things were possible...

Automated Switches

- Automated switches can do a lot of cool things
  - implement logic gates
  - from logic gates you can create multiplexors, decoders, storage devices (flip flops), adders, multipliers
  - they can do stuff like maths really fast
  - even send people to the moon!

- If you collect a lot of switches together you get...

2. Mainframe Computers

- The birth of modern computers

Mainframe Computers

- ENIAC - Electronic Numerical Integrator And Computer (1945)
  - developed by John Mauchly and J. Presper Eckert.
  - The first successful operational, general purpose, electronic digital computer.
Mainframe Computers

- Manchester Mark 1 (1949) – the first true stored program computer. Turing was involved.
- EDVAC (1951) – Completely binary in internal operations, floating point operations. Stored program computer. Von Neumann design.
- UNIVAC (1951) – First commercial computer in the US

Some even dreamed of a “Home Computer”!

3. The Transistor (another switch)

- A small, very fast, automated switch
- First patented 1925, developed late 1940s
- The greatest invention ever?

The Transistor

- Which got smaller... and smaller...

and smaller... until it became...
4. The Integrated Circuit

- Which was still just a lot of switches, but a LOT!
- which enabled...

5. The Minicomputer!

- Starring...
- 1960 - 1980s: DEC PDP series
  - 1960: PDP-1: 18-bit machine
    Birth of hacker culture, first computer video game - Space War!
  - 1965: PDP-8: 12-bit
    Wildly successful, first "personal computer" or minicomputer.
    Purchased by universities, research labs, etc
- 1960: PDP-1: 18-bit machine
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The Minicomputer

- Made computing accessible to institutions
- PDP-11: The archetypal minicomputer
  Widely regarded as the best 16-bit instruction set ever created. Influenced later CPUs such as Motorola 68000.
  (See CSSE lobby!)
- VAX: 32-bit architecture
  Regarded as the quintessential CISC processing architecture.
  1M instructions per second!
Aside - Computing in WA

- First computer brought to West Australia in 1962 when the West Australian Regional Computing Centre (WARCC) was established at UWA with a single IBM 1620.
- In 1965 WARCC purchased a DEC PDP 6, a multi-access, time-sharing computer, and became the first organisation in the world to lease time on a computer.
- By 1972 WARCC had also acquired a DEC PDP 10 and a CDC Cyber 72 and was a semi-autonomous organisation used by the University of Western Australia and by other research institutions.


Aside - Computing in WA

- The “DEC 10” (PDP-10)

6. Birth of the Personal Computer

- 1970s: First “personal computers”
  - 1975: Altair 8800
    Microcomputer based on Intel 8080A CPU
    Sparked personal computer revolution
  - 1976: Apple I
    Original PCs came in kit form for enthusiasts
Personal Computers

• Radio Shack (Tandy) TRS-80
  Integrated units.
  Notice tape recorder for
  program/data storage!

• 1980: Dick Smith System 80
  Australia’s answer!

• 1981: IBM PC
  The “green screen”
  computers
  4.77 MHz Intel 8088 16KB

• 1983: Apple IIe
  Motorolla 68000 CPU
  Graphics!

• 1984: Apple Macintosh
  MC68000, 8MHz, 16-bit,
  128kB RAM, 3.5” floppy

  Hey, is that a window!?  

• And the rest, as they say, is history...

Computer Software

• 6 great moments in software storage...
1. Punch Cards

- Herman Hollerith (1860-1926)
- Developed “An Electric Tabulating System” or tabulator to do statistics
- A founder of the Computing-Tabulating-Recording Company (CTR) that became International Business Machines Corporation (IBM) in 1924.
- Allowed persistent storage of programs and data!

2. Magnetic Tape

- IBM 701 - the first magnetic tape drive for computer data storage, 1949
- 8mm tape and drive, 1987
- Compact (electrically based) storage media - far more data in much smaller space

3. The Hard Disk Drive

- Introduced by IBM in 1956
- Fast, compact and reliable, but most of all...
- Provided random access!

4. The Floppy Drive

- Invented by IBM, 1971
- Provided reliable removable/transportable form of persistent storage
- Primary removable media in 70’s, 80’s, up to 90’s
5. Optical Storage

- CDs and DVDs
  - late 1970s, mid 90s
  - lower capacity than magnetic storage, but..
  - less volatile
  - *much harder wearing and resilient, long lasting*

6. Flash Memory

- Invented in 1980s
- A type of Electrically Erasable Programmable Read-Only Memory
- Initially too small for wide use but growing rapidly
- *No moving parts!*

Further Reading

- Switches:
  Tanenbaum, Chapter 3 up to Section 3.1.1
- Computer Milestones:
  Tanenbaum, Section 1.2 - 1.4.1