

Introduction to Hardware

Computer Hardware

- "Those parts of the system that you can hit with a hammer (not advised) are called hardware"
- Modular

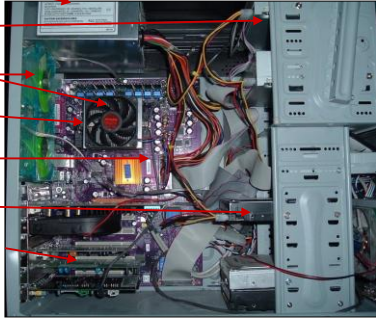
http://en.wikipedia.org/wiki/Computer_hardware

COMPSCI 111/111G - Hardware 3

Inside the System Unit

Modular Components

- Power Supply
- CD Drives
- Cooling Fans
- CPU
- Motherboard
- Hard Drives
- Expansion Cards



COMPSCI 111/111G - Hardware

4

Power Supply

Converts AC to lower DC voltage



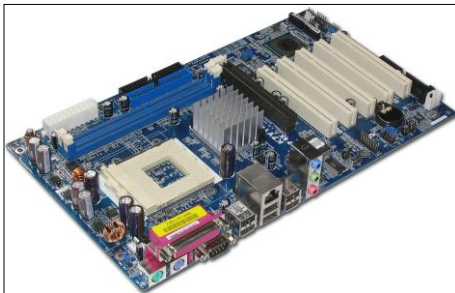
COMPSCI 111/111G - Hardware

5

Motherboard

Main circuit board for the computer

- Everything else connects to the motherboard



COMPSCI 111/111G - Hardware

6

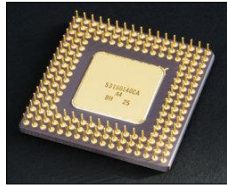
Central Processing Unit

CPU

- "Brain"
- Follows instructions

Speed

- Computation speed often measured in operations per second (OPS)
- Clock speed (Hz) is the speed with which electrical signals pass through the CPU
- The faster the better



Cooling

- Heat is one of the major limitations
- CPU must be kept cool
- Cooling fan, Heat sink, Water cooled



Clock Speed of a CPU

Speed

1 MHz
4 MHz
16 MHz
24 MHz
66-100 MHz
75 - 166 MHz
166 - 233 MHz
200 - 450 MHz
400 - 1 GHz
1GHz - 3.4 GHz

CPU

6052 (Commodore 64)
8088 (IBM XT)
80286 (IBM AT)
80386
80486
Intel Pentium / AMD K5
Intel Pentium MMX
Intel Pentium II / AMD K6
Intel Pentium III / AMD Athlon
Intel Pentium 4 / AMD Athlon XP

Moore's Law

Number of transistors on a single chip doubles every 18 months, while the price remains the same.

In 5 Years

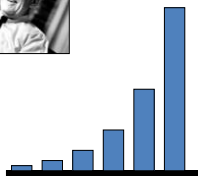
- 10 times as powerful

In 15 years

- 1,000 times as powerful
- 15 mins work in 1 second

In 30 years

- 1,000,000 times as powerful
- 11.5 days work done in 1 second
- 100 years work done in 50 minutes



Memory

Random Access Memory (RAM)

- Primary memory, main memory
- Data is lost when electricity switched off
- Size of the RAM is most important
- Speed also important (dependant on Motherboard)
- One memory access takes a couple of nanoseconds (one billionth sec.)



COMPSCI 111/111G - Hardware

10

Memory Capacity

Measured in Bytes

Plain Text (approx.)

1 byte	1 character
1 KB	200 words / 10 lines
1 MB	300 pages
1 GB	175 phone books

Music (approx.)

1 GB	2 hours
------	---------

DVD (approx.)

1 GB	20 minutes
------	------------

*"640K ought to be enough for anybody."
Bill Gates in 1981*

COMPSCI 111/111G - Hardware

11

Expansion Cards

Circuit board that provides additional functionality

- Sound Card
- Graphics Card
- Network Card
- Internal Modem
- RAID controller



Plugs into the Motherboard using standard slots

- ISA
- PCI
- AGP
- PCI-Express

http://en.wikipedia.org/wiki/Expansion_card

COMPSCI 111/111G - Hardware

12

Graphics Card

Converts the internal representation of an image into something that can be displayed using a computer monitor

- 2D Graphics Card
- 3D Graphics Card
 - Nvidia - GeForce
 - ATI - Radeon



COMPSCI 111/111G - Hardware

13

Secondary Storage

Mass Storage

- Long-term storage
- Persistent
- Much slower to access than RAM
- Much cheaper than RAM



Devices

- Hard Disk (HDD)
- Floppy Disk (FDD)
- Flash Memory
- Magnetic Tape



Optical Devices

- CD
- DVD

http://en.wikipedia.org/wiki/Hard_disk

COMPSCI 111/111G - Hardware

14

Size ambiguity



160 GB (decimal meaning)

OS reports size differently



149.05 GB (binary meaning)
= 160 GB (decimal meaning)

To avoid ambiguity,
use GB for decimal and GiB for binary
160 GB = 149.05 GiB

COMPSCI 111/111G - Hardware

15

CD / DVD Media

Different Media

- CD-ROM: read-only, 700 MB, manufactured by a press
- CD-R: recordable once, 700 MB
- CD-RW: rewritable, 700 MB
- DVD-ROM: read only, 4.7 GB, manufactured by a press
- DVD-R: recordable once, 4.7 GB
- DVD+R: recordable once, 4.7 GB
- DVD-RW: rewritable, 4.7 GB
- DVD+RW: rewritable, 4.7 GB
- DVD-RAM: rewritable, 4.7 GB
- DVD-R DL: dual layer record once, 8.5 GB
- DVD+R DL: dual layer record once, 8.5 GB
- DVD-RW DL: dual layer rewritable, 8.5 GB
- DVD+RW DL: dual layer rewritable, 8.5 GB



<http://en.wikipedia.org/wiki/CD>
<http://en.wikipedia.org/wiki/DVD>

CD / DVD Media

Different Media

- CD-ROM: read-only, 700 MB, manufactured by a press
- CD-R: recordable once, 700 MB
- CD-RW: rewritable, 700 MB
- DVD-ROM: read only, 4.7 GB, manufactured by a press
- DVD-R: recordable once, 4.7 GB
- DVD+R: recordable once, 4.7 GB
- DVD-RW: rewritable, 4.7 GB
- DVD+RW: rewritable, 4.7 GB
- DVD-RAM: rewritable, 4.7 GB
- DVD-R DL: dual layer record once, 8.5 GB
- DVD+R DL: dual layer record once, 8.5 GB
- DVD-RW DL: dual layer rewritable, 8.5 GB
- DVD+RW DL: dual layer rewritable, 8.5 GB
- Blu-ray, 25 GB
- Blu-ray DL, 50 GB
- Blu-ray 16 layer, 400GB



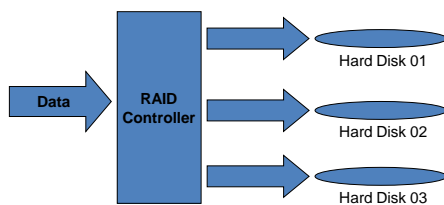
<http://en.wikipedia.org/wiki/CD>
<http://en.wikipedia.org/wiki/DVD>
http://en.wikipedia.org/wiki/Blu-ray_Disc

RAID

Bottleneck of performance on many systems is the secondary storage

Redundant Array of Independent Disks

- Read and write in parallel
- Write additional information to prevent lost data
- Fast, cheap and reliable



Input Devices

A machine that feeds data from a user into a computer

Keyboard

- Typewriter (QWERTY / DVORAK)
- Keypad



Pointing Device

- Mouse, Trackball, Touch Screen
- Digitizing Tablet, Digital Pen



Direct Entry

- Scanner
- Webcam, Microphone, Scanner
- Magnetic Stripe Reader



Output Devices

A machine that takes information processed by a computer and presents it in a form that a human can understand

Screen

- Cathode-Ray Tube
- Flat-Panel display (LCD, Plasma)
- Projector
- Head-mounted



Printer

- Inkjet, Laser



Speakers

"A printer consists of three main parts: the case, the jammed paper tray and the blinking red light"

Connectors

Universal Serial Bus (USB)

- Used for almost everything except monitors
- Version 1 is slow (~1.5MB/s)
- Version 2 is fast (~60 MB/s)



PS/2 connector

- Used for mouse & keyboard



Firewire

- Used for video cameras, HDS
- High-speed (~60-100MB/s)



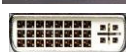
Video Graphics Array (VGA) connector

- Used only for monitors



Digital Visual Interface (DVI)

- Used for LCD monitors or projectors
- Transmits video data digitally (better quality)



Understanding Advertisements

Specifications

- CPU Type
- CPU Clock Speed
- Size of RAM
- Size of HDD
- Size/Type of Monitor
- Other drives (FDD, CD, DVD)

Intel® Pentium® D Processor 930 with Dual Core Processor 3GHz

- Genuine Windows® XP Home Edition
- 512MB DDR2 SDRAM at 533MHz
- 160GB SATA 3.0Gb with NCQ
- 16X Max DVD±/RW with Dual Layer Write Capabilities
- 19" LCD Flat Panel
- 256MB ATI® Radeon™ X600 HyperMemory™ Graphics
- Integrated 7.1 Audio

Buying a Computer

What do you want it for?

- Games - 3D Graphics Card, CPU, RAM
- Internet - Modem / Network Card
- Home / Office Applications

Desktop or Laptop

- Price
- Portability
- Ease of use

Laptop

- Battery capacity!!! How long can you use it without external power?
- Weight: how much do you want to carry around?
- Screen size: want to watch movies on your laptop?
- Internal speakers: usually very bad, sometimes surprisingly good

Buy cheap

- <http://www.pricespy.co.nz>

Some Advice

Spend a bit extra on the screen

- Interface between you and the machine
- Glare /non-glare

Buy more RAM

- More applications open at once
- Better performance
- 512MB - 2GB

Hard Drive Capacity

- Depends on use
- Digital Photos
- Music Storage

Processor

- Anything will be adequate

References

Simple Introduction to Hardware

- <http://www.coolnerds.com>
- <http://www.howstuffworks.com>

Images from:

- <http://www.regstevens.co.uk>
- <http://www.dansdata.com>
- <http://en.wikipedia.org>

The internet is an excellent resource for computer hardware
