

4. Inside the box

Building blocks of a PC

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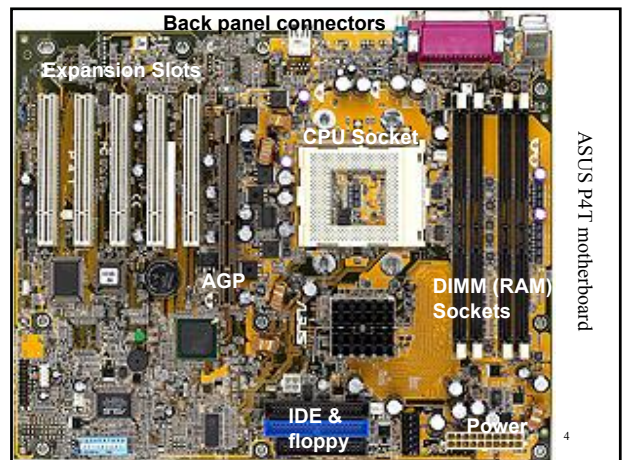
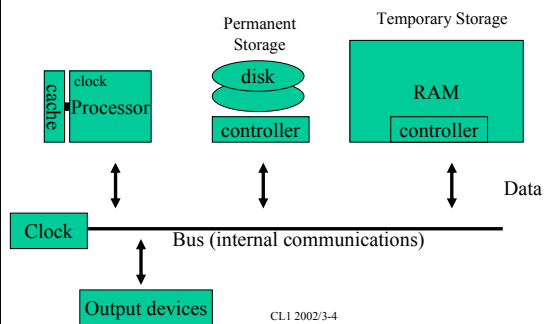
A computer comprises ... 1

- A cabinet
- Power Supply, Fan(s)
- Cables, indicators, switches
- Serviced bays for additional units
- A motherboard



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Basic Computer Architecture



Motherboard

- Processor (hot; usually has heat sink (fins) & fan)
- Semiconductor ('chip') memory (RAM) & controller
- Basic *serial* input/output: Keyboard, mouse, *USB*, *RS232*
- Basic output: Support for graphics system, maybe sound
- *IDE* interface for hard disk and DVD/CD-ROM
- Floppy disk interface
- Expansion slots
 - Accelerated graphics (AGP), sound, network
 - *SCSI*: disk, tape e.g. *DAT*. Use for scanners etc replaced by *USB*.
- (old-style) *parallel* interface: printer
- Circuitry to glue it all together. Clock crystal for timing

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The Motherboard

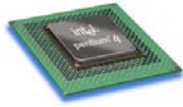
- Summary:
 1. Some large chips that do leg-work for the processor – the *chipset*
 2. Basic circuitry to join everything together, principally the *Bus* – a highway for data traffic within the PC; not nearly as fast as processor (20% typical)
 3. Basic interfaces and connectors to floppy disk, hard disk(s), CD-ROM etc., keyboard, mouse ...
 4. Slots for the processor, RAM and expansion cards



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The Processor



- Performs most but not all computation and control (Graphics chips are also complex)
- Much faster than other components
- Clever design needed to achieve speed
 - *Cache* is a small store of ultra-fast memory within the chip, a sort of scratch-pad
 - *Parallelism* – doing many operations simultaneously
 - *Pipeline* – fetch data or perform calculations that might be needed later, discarding them if not.

RAM memory



- “256 Megabytes of Random Access Memory
- Semiconductor; SIMMs, DIMMs etc.
- Computer’s ‘notepad’: *volatile* - contents lost when switched off
- Unless you are doing heavy number crunching or serious graphics, adding memory will improve performance more than anything else
- Also occurs as *video RAM* and *cache*

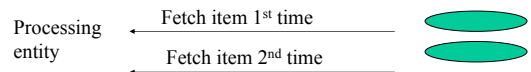
Cacheing (real world)

- You have to phone a list of people from a mobile phone
- In each case, 1st time you have to look up number from Directory Enquiries
- If you need to redial you use ‘recent dialled’ number in phone memory (or quickly learn to write numbers down for later use)
- This is a *cache*

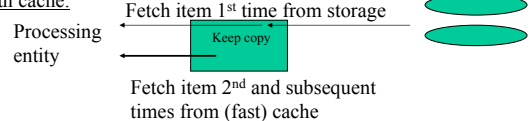
Cacheing on read

Slow storage

No cache:



With cache:

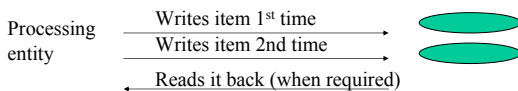


Processors cache instructions and data; Operating system caches disk pages; Web browsers cache bits of Web pages.

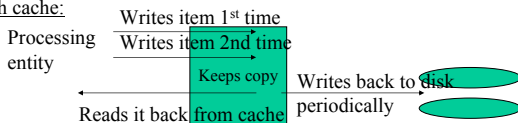
Cacheing on write

Slow storage

No cache:



With cache:



(Disk caching) Cache may not be written back to disk immediately. This is why you don’t want to just switch off a PC - disk may not be consistent.

The Processor

- “Intel Pentium 4, 2.4 GHz”
- Two major PC processor manufacturers left: Intel (Pentium ...) vs AMD (Athlon ...)
- Also G3, G4 (IBM, Mac); SPARC (Sun)
- The last 20% of clock speed doubles the cost of the processor and gets you 4-5 months *future-proofing* (i.e. before the technology is overtaken)
- Processor development and manufacture costs \$billions

The big con

- PC clock speed (e.g. 2.53 GHz) is always quoted but is an **incomplete** indication of performance
- Performance depends on a chain of factors and on how the computer is used
- Performance depends on Processor speed + amount of Cache + speed of motherboard + Memory speed + Disk speed + graphics speed
- Processor spends most of its time idle.
- Processor activity governed by ticks of a very fast clock
- MHz, GHz: MegaHertz, GigaHertz – measures of (clock) frequency

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Hard disc



- “80 Gb 7200 RPM SCSI drive”
- 80 Gb (Gigabytes) is the disk capacity
- 7200 RPM indicates the rotational speed of the disk; more is better. Seek time is a measure of how fast the disk head can move across the disk; short time is better.
- SCSI is the Small Computer Systems Interface used in many computer disks; alternative is IDE (PCs, Macs)

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CD/DVD

- “12x DVD; 40r16w12rw DVD/CD-ROM”
- Drive can read CDs and DVDs and write CD-R (write once) and CD-RW (rewritable) disks. Speeds refer.
- DVD is taking over from CD; 12x is an indication of speed; more is better
- CD-ROM media have a capacity of around 650 Mb
- DVD media capacity depends on no. of layers
 - 1 layer, 1 side: 4.7 Gb
 - 2 layer, 2 side: 17 Gb

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Graphics

- “32Mb AGP 4x accelerated graphics”
- If you’re a gamer the graphics card may be the most important aspect of the PC (research it); if not it probably doesn’t matter much.
- (4x is an indication of speed; more is better). 32Mb is a measure of video RAM and is an indication of the maximum possible resolution times number of colours that can be displayed. It is also used for storing textures and fonts for fast display.

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Monitor



- “17” FST monitor, 0.28 mm, 1280*1024”
- 17” is the diagonal size of the tube; visible part is usually rather less. FST = Flatter Squarer Tube
- (0.28 mm is the dot pitch; smaller is better)
- 1280*1024 is the screen resolution in pixels
 - About 4:3 aspect ratio (like a TV)
- LCD screens: big laptop screens with backlight
 - Nice, expensive, some widescreen

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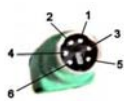
Hardware options

- Sound card, microphone
- Network Card
- Accelerated graphics
- Video capture card
- High performance disk interface (e.g. SCSI)
- TV tuner? Etc. etc.
- Trend is to put intelligence in peripherals attached via fast interfaces such as USB


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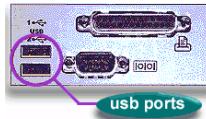
Connectors




PS/2 mouse, keyboard




USB (General purpose)

usb ports




RJ45 (Ethernet)




S-VGA (Monitor)

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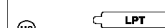
Connectors - diagrams




PS/2 mouse, keyboard



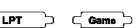
USB




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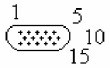
COM



VGA







RS-232



S-VGA

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Systems in a nutshell







- Operating system is the software you need to run your *applications* (Office, Web browser) ...
- Windows utterly dominates business world
- Windows (3.1 ... 98.. Me) / XP-home: home
- Windows NT / 2000 / XP-Pro: corporate, specialist
- Mac – Specialist, especially multimedia, collaboration, art, design, architecture. More user friendly, stylish. Now Unix-based

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Unix, Linux



- First there was Unix (1970s)
- Solaris, HP-UX, AIX: proprietary versions of Unix
- Linux (Linus Torvalds), Richard Stallman: version of Unix
 - Software ‘Source’ free (distributions at low cost)
 - Free Software Foundation - GNU
 - Many thousands of people producing Linux software
 - Secure, reliable but user interface ‘clunkier’
 - Some ‘killer apps’ missing (Office, Photoshop)
- Windows: for ‘vanilla’ office desktop IT
- Unix for ‘back office’, infrastructure, anything home-grown or specialised.
- All this *IMHO*. Beware religious wars

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A computer is like a Banana

- It is perishable – write-down 2-3 years
- So is this kind of information
- To keep up to date read PC magazines, manufacturer catalogues & web pages, trade papers etc.
- From CL1 point of view, terms here are illustrations of principles

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Key Points

- Major units of a small computer and how they work together
- Design tricks for performance
 - Cache, pipeline, parallelism
- PC raw speed is not the whole story
- Characteristics of the principal operating systems
- A few things to consider when buying a PC

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