

# **CTHASOPL**

## **Computer Hardware, Software and Peripheral Installation**

# Hardware & Software

## Hardware

All of the electronic and mechanical equipment in a computer is called the hardware. Examples include:

- **Motherboard**
- **Hard disk**
- **RAM**
- **Power supply**
- **Processor**
- **Case**
- **Monitor**
- **Keyboard**
- **Mouse**

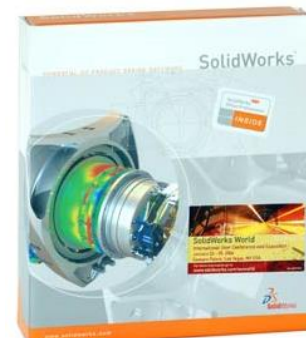
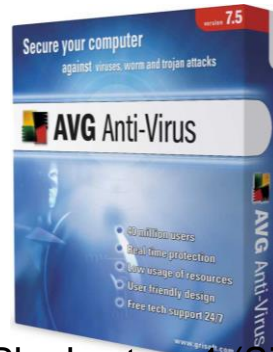
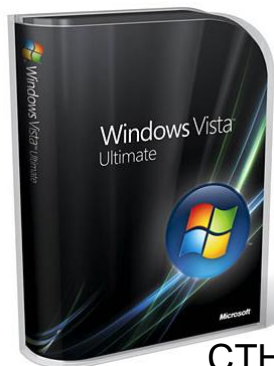


# Hardware & Software

## Software

The term software is used to describe computer programs that perform a task or tasks on a computer system. Software can be grouped as follows:

- System software - Operating System etc.
- Utility programs - Antivirus etc.
- Applications Software - Word, SolidWorks etc.



# PC Components

**Computer system** - collection of electronic and mechanical devices operating as a unit. The main parts are:

1. System unit
2. Monitor
3. Keyboard
4. Mouse
5. Speakers



# System Unit

The **system unit** is the main container for system devices. It protects the delicate electronic and mechanical devices from damage. Typical system unit devices include:

- Motherboard
- CPU (Processor)
- Memory
- Disk drives
- Ports - USB etc.
- Power supply
- Expansion cards - sound card, network card, graphics card etc.



# Peripherals

**Peripherals** are devices that connect to the system unit using cables or wireless technologies. Typical peripherals include:

- Monitor
- Keyboard
- Printer
- Plotter
- Scanner
- Speakers



**Plotter**

# System Devices

## Processor

An **integrated circuit** (IC) supplied on a single silicon chip. It's function is to control all the computers functions. The main processor manufacturers are:

- **AMD** - Athlon and Turion (mobile)
- **Intel** - Pentium and Centrino (mobile)



AMD  
Processor

# System Devices

**Computer program** - a series of instructions. When a program is run, the processor carries out these instructions in an orderly fashion. Typical instructions include:

- **Arithmetic** - addition, subtraction etc
- **Logical** - comparing data and acting according to the result
- **Move** - move data from place to place within the computer system - memory to the processor for addition - memory to a printer or disk drive etc.

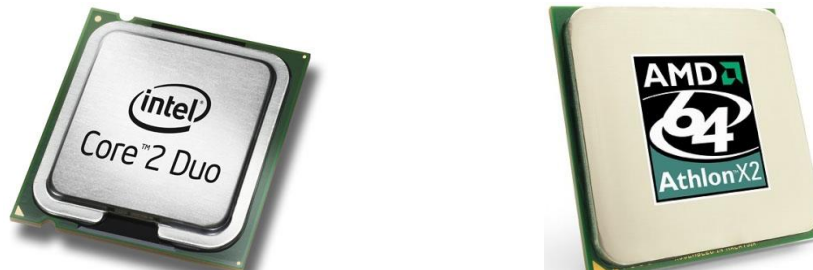


# System Devices

**Processor speed** - measured in megahertz (**MHz**) or Gigahertz (**GHz**) - the speed of the system clock (**clock speed**) within the processor and it controls how fast instructions are executed:

- 1 MHz - 1 **million** clock ticks every second
- 1 GHz - 1 **billion** clock ticks every second

**Latest trend** - **multi-core** processors can have two, three or four processor cores on a single chip.



# System Devices

## Random Access Memory (RAM)

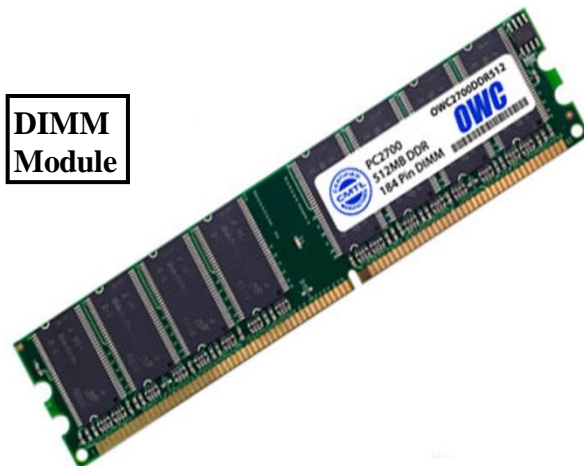
- **Primary storage** - main computer memory. Data, programs currently in use are held in RAM
- **Volatile** - contents of memory are lost if the computer is turned off
- **Module** - memory IC's on a circuit board



# System Devices

Memory is sold in modules:

- **DIMM's** (dual inline memory module) for desktop computers
- **SODIMM's** (small outline dual inline memory module) for notebook computers.



DIMM  
Module



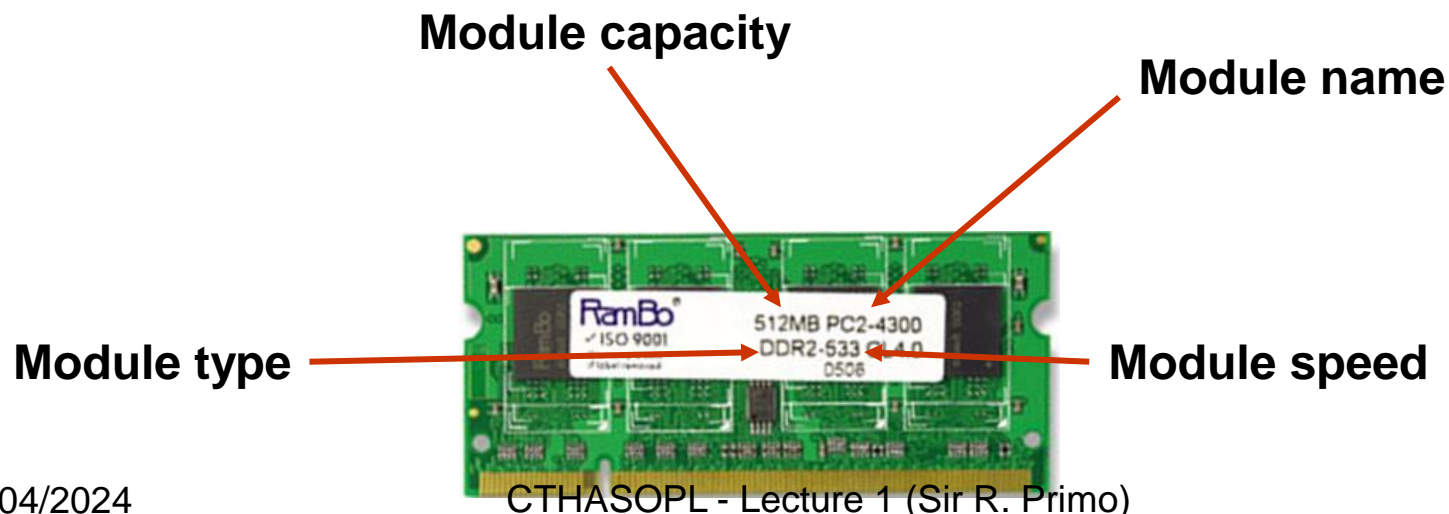
SODIMM  
Module

# System Devices

DIMM's and SODIMM's are available in modules of 256MB, 512MB, 1GB, 2GB

The current technology is called **DDR** (double data ram) and there are three types: DDR1, DDR2, DDR3

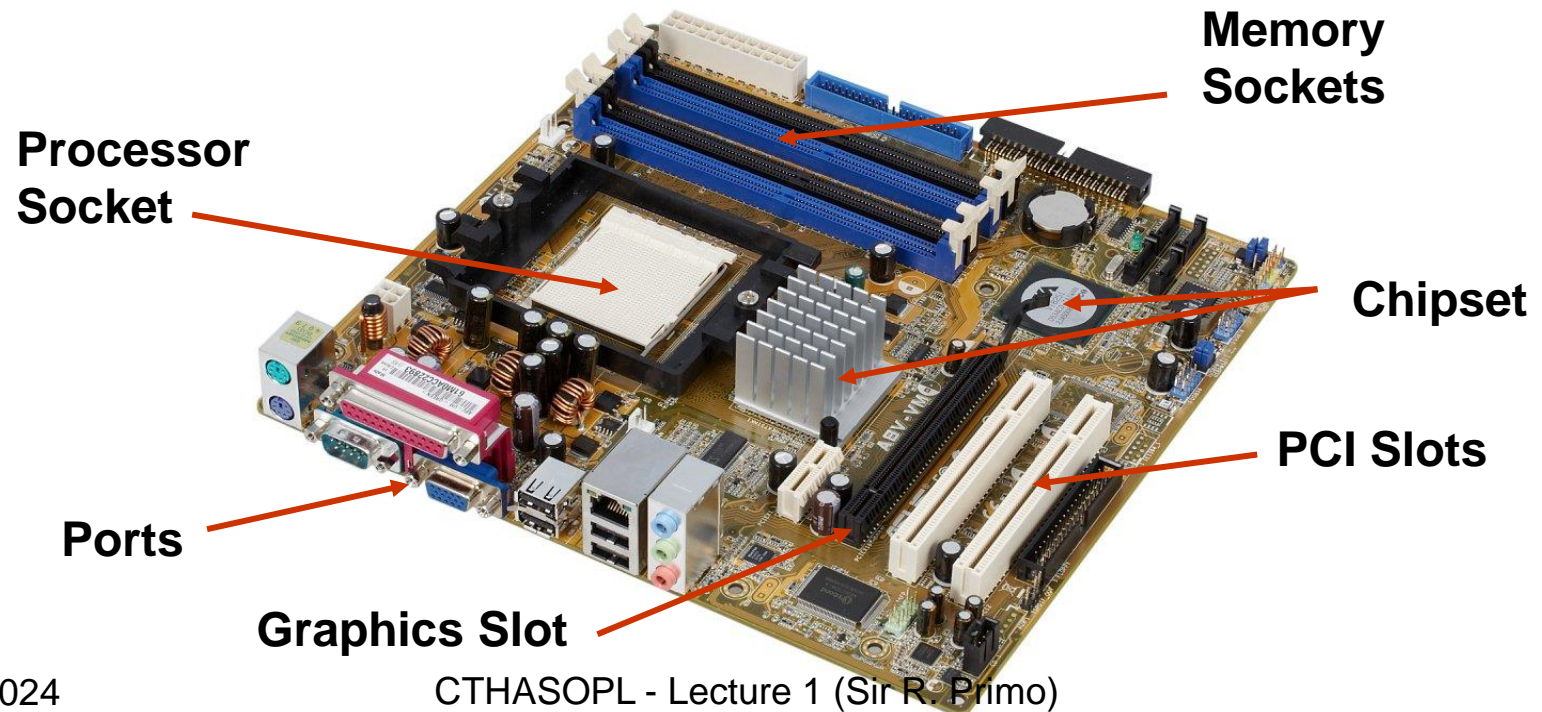
Any particular computer system is only compatible with one type.



# System Devices

## Motherboard

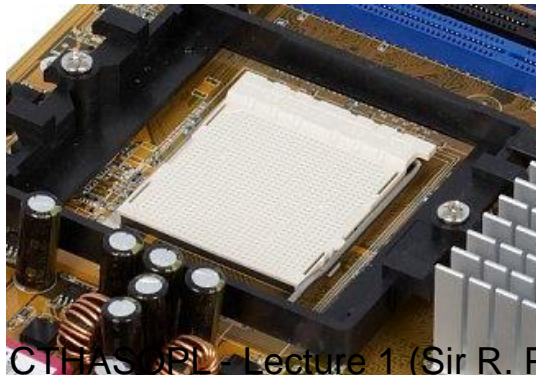
**Mainboard** or **system board** - the main circuit board for the computer system. All device in the computer system will either be part of the motherboard or connected to it.



# System Devices

**Processor socket** - different processors require different sockets and a motherboard must be chosen to suit the processor intended for use:

- **Socket 478** - Intel Pentium IV
- **Socket 775** - Intel Dual Core and Core Duo
- **Socket 754** - AMD Athlon
- **Socket 939** - AMD Athlon 64
- **Socket AM2** - AMD Athlon X2





# System Devices

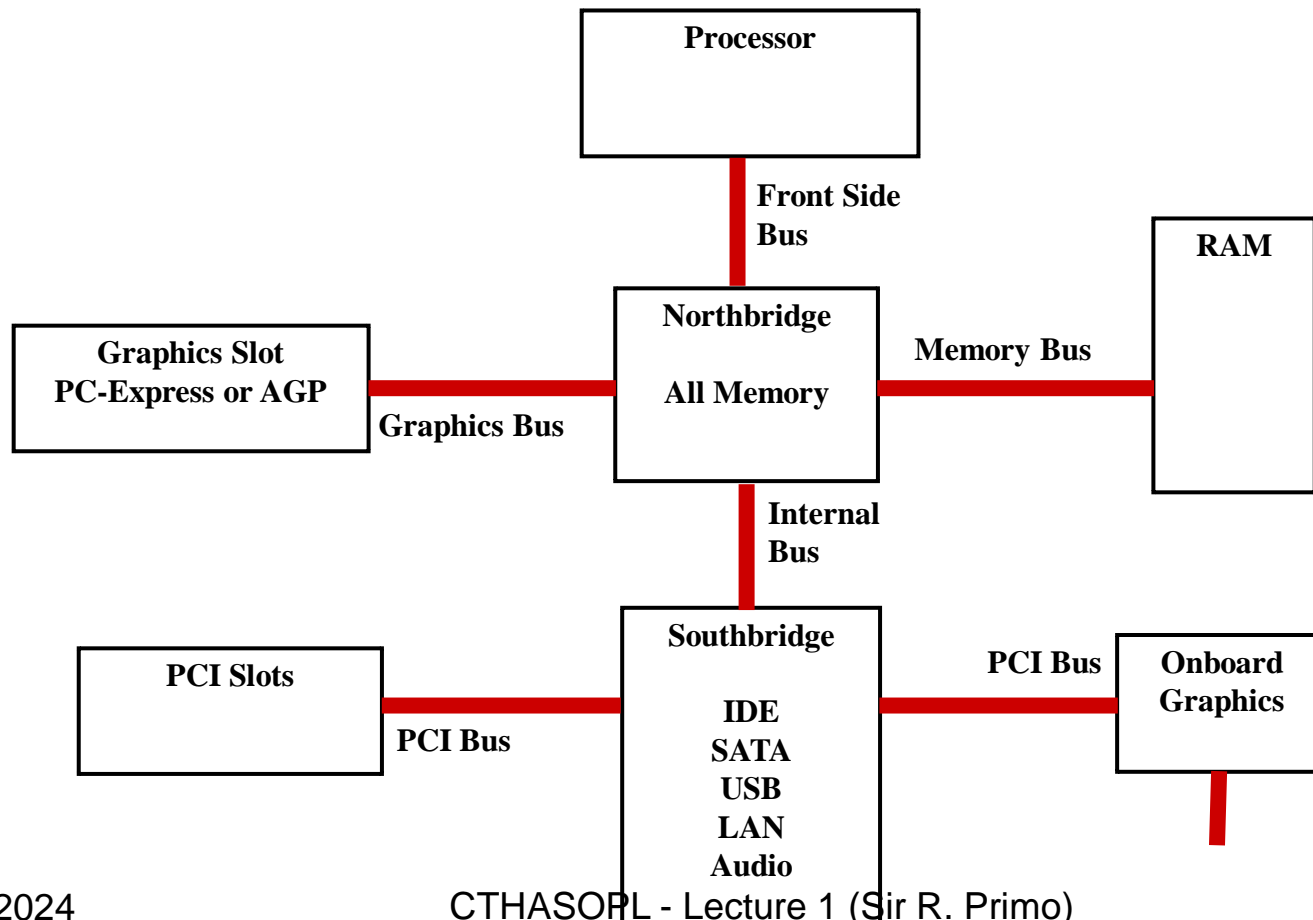
**Chipset** - controls data flow around the computer.  
It consists of two chips:

- **Northbridge** - data flow between memory and processor - data flow between the processor and the graphic's card
- **Southbridge** - controls data flow to the devices - USB, IDE, SATA, LAN and Audio - controls PCI slots and onboard graphics



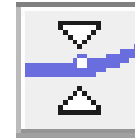
# System Devices

**Buses** - a path through which data can be sent to the different parts of the computer system. Main buses:





# System Devices



## Power Supply

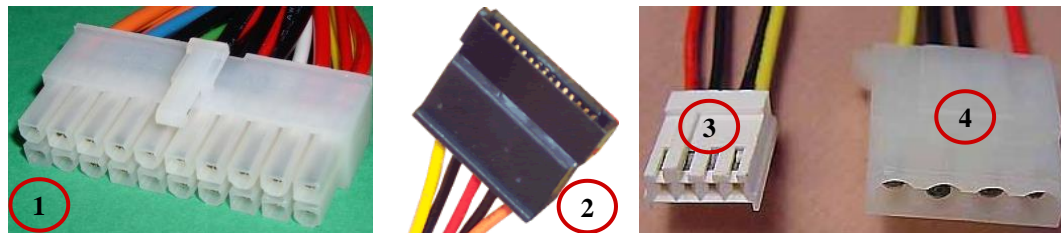
A computer power supply has a number of functions:

- Converts **Alternating current (AC)** **Direct current (DC)**
- Transforms mains voltage (240 Volts) to the voltages required by the computer. The main voltages are:
  - **12 volts** for the disk drives as they have motors
  - **3.3** and **5 volts** for the circuit boards in the computer



# System Devices

- Uses advances power management (**APM**) to allow the computer go into a standby mode
- Some have a switch to toggle between 240 volt supplies and 110 volt supplies.
- The main connections are:



1	Main connector	Connects to the motherboard and supplies the 3.3 and 5 volt supply for the board.
2	Molex connector	Connects IDE hard drives and optical drives.
3	Berg connector	Connects floppy disk drives
4	SATA connector	Connects SATA drives

# System Devices

## Ports

Computer ports are interfaces between peripheral devices and the computer. They are mainly found at the back of the computer but are often also built into the front of the computer chassis for easy access.

Ports at the rear of the computer



Ports at the front of the computer



# System Devices

- **Serial port** - a 9-pin port. Often called Com ports - Com1, Com2 etc. Mice and external modems were connected to these ports. They are **turquoise** in colour.



- **Parallel port** - a 25-pin port used to connect printers, scanners, external hard disks, zip drives etc. to the computer. **Burgundy** in colour, they are often called LPT ports - LPT1, LPT2 etc.

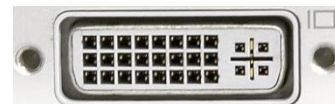


# System Devices

- **Video port** - used to connect a monitor to the computer system. There are two types:
- **VGA port** - This is a 15-pin port and is **blue** in colour. It is an analogue port and is being replaced by the DVI port.



- **DVI port** - **white** in colour, it is a digital port. This means that no conversion is necessary between the computer and the monitor and that means that images can be produced more quickly on the monitor



# System Devices

- **PS/2 port** - used to connect keyboards and mice to the computer. The keyboard port is **purple** and the mouse port is **green**



- **Modem port** - used to connect a modem to a telephone line. **RJ11** is the technical term for the port.



# System Devices

- **USB port** - intended to replace Serial, Parallel and PS/2 ports with a single standard. 127 devices can be connected to a single USB port.  
**Hot swappable** - devices can be connected and disconnected while the computer is on

There are different USB standards in use:

- **USB 1** - original standard - transfer data of **1.5MBps**.
- **USB 2** - current standard - transfer rate of **60MBps**.
- **USB3** - future standard (2009) transfer rate of **600MBps**.



# System Devices

- **FireWire port** - (IEEE 1394) is an Apple technology There are two versions available and a third is planned:
- **FW 400** - transfer rate of **50MBps**.
- **FW 800** - transfer rate of **100MBps**.
- **FW S3200** - transfer rate of **400MBps**.



- USB devices must be connected to a host computer while FireWire devices can be connected to each other without using a computer.



# System Devices

- **Ethernet port** - used to connect to a network. Known as **RJ45**, it is larger than a modem port.

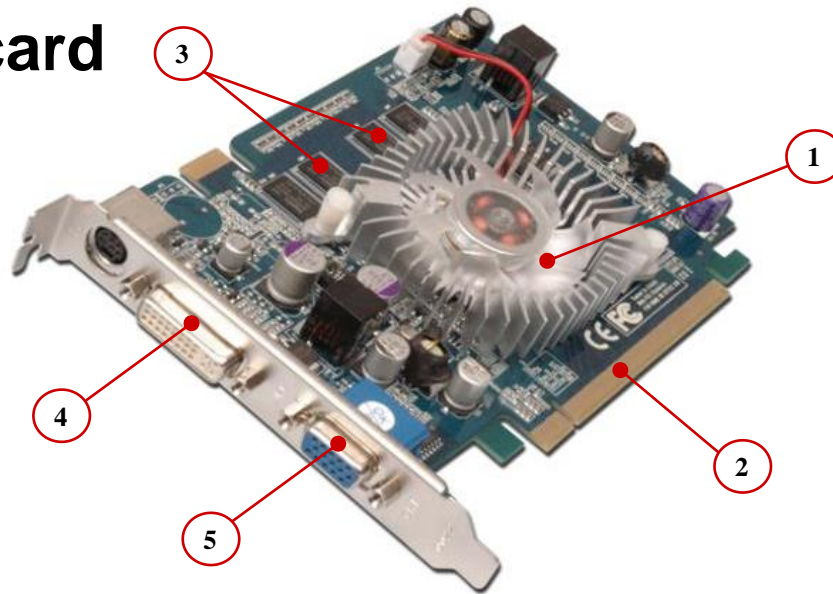


- **Audio ports** - used to input and output audio from the computer. Three mini jack ports but there may be more:
  - **Light blue** - Line in - connect external devices
  - **Lime** - Connect the speakers to this port.
  - **Pink** - Connect a microphone to this port.



# System Devices

## Graphics card



1	Processor and fan	Graphics card handles it's own processing making it almost independent of the processor.
2	Board connector	AGP or PCI-Express
3	Memory	Graphics card has it's own memory. This makes it much faster. Most new cards use DDR3 memory.
4	DVI connector	Digital output is supplied through this port.
5	VGA connector	Analogue output is provided through this port.

# System Devices

**Graphic card** - screen images are made up of dots called **pixels** (picture elements). The graphics card must process each of these pixels to create the image.

The resolution of a screen is the number of pixels being displayed. Typical resolutions include:

- **800 x 600** - 480,000 pixels
- **1024 x 768** - 786,432 pixels
- **1280 x 1024:** - 1,310,720 pixels
- **1600 x 1200:** - 1,920,000 pixels



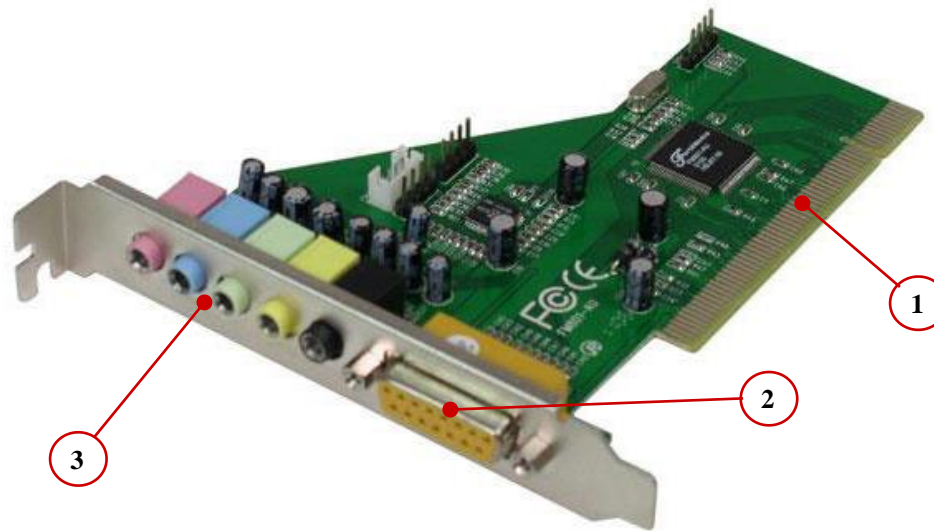
# System Devices

There are two types of graphic card available:

- **AGP** (accelerated graphics port) - the older technology but still available. It can output in analogue or digital or both.
- **PCI-Express** - the newer technology - faster than AGP. Allows for two graphics cards to improve the performance - called **Scalable Link Interface** (SLI). PCI-Express can also output in analogue or digital or both.
- These cards are mutually exclusive and the choice is made according to the graphics slot on the motherboard.

# System Devices

## Sound card



<b>1</b>	<b>PCI connector</b>	<b>Connects the sound card to a PCI slot</b>
<b>2</b>	<b>MIDI socket</b>	<b>Musical Instrument Digital Interface port is used to connect digital musical instruments to the computer.</b>
<b>3</b>	<b>Audio jacks</b>	<b>These are used to connect microphones, speakers, stereo systems etc to the computer.</b>

# System Devices

The main functions of a sound card are:

- To use a **DAC** (digital to analogue converter) to prepare audio for speakers etc.
- To use an **ADC** (analogue to digital converter) to convert the audio coming into the computer.

A sound card can be connected to the following:

- Analogue input devices - Microphone, Radio, Tape deck, Record player etc
- Headphones and speakers
- Output to tape etc.

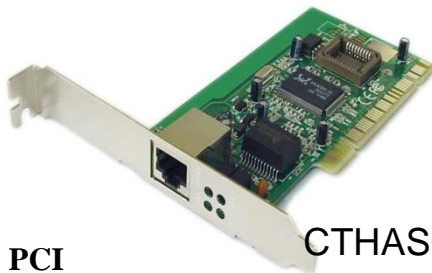
# System Devices

## Network card

- allows computers join a network. Can be wired or wireless. The standard used is called **Ethernet** - covers wired and wireless networks.

The wired standards include:

- **Fast Ethernet** - transmission speed of **100Mbps**.
- **Gigabyte Ethernet** - transmission speed of **1000Mbps**.



PCI



PC card



USB

# System Devices

The wireless standards include:

- **The B standard** - introduced in 1999, it has a transmission rate of **11Mbps** and a range of **30 Metres**.
- **The G standard** - introduced in 2003, it has a transmission rate of **54Mbps** and a range of **30 Metres**.
- **The N standard** - introduced in 2006, it has a transmission speed of **540Mbps** and a range of **50 metres**.





# System Devices

## Modem

- Internet access using a telephone line.
- Converts the digital computer data to analogue (**M**odulation) before transmission over the telephone line and converts the analogue data to digital (**DE**Modulation) before transmission to the computer. The device gets its name from these two terms.
- The standard transmission speed of a modem is **56Kbps**.



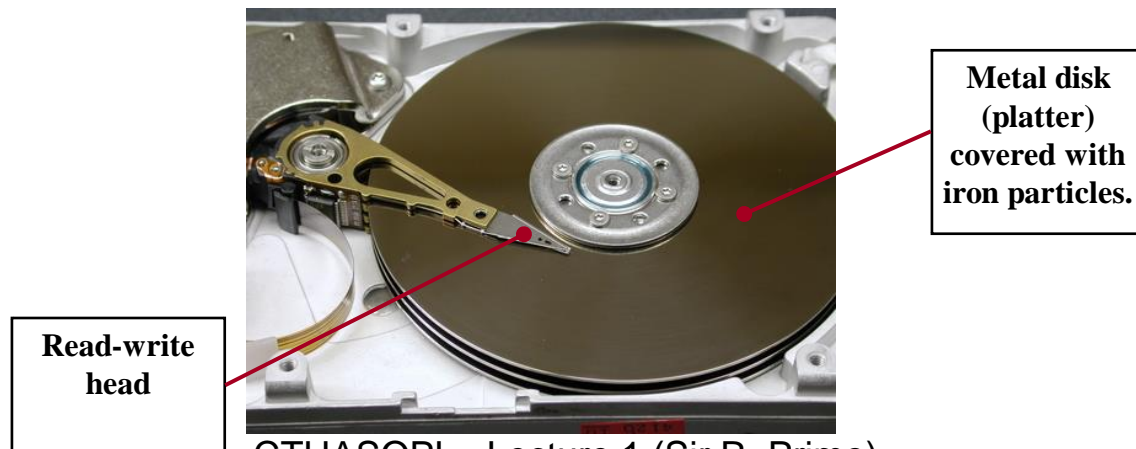
# System Devices

## Hard Disk

- **Primary storage** (memory) - volatile - contents lost when power is turned off.
- **Secondary storage** (disk drives) - non-volatile - can store files when power is turned off.
- In memory, voltages are used to store data as binary 1's and binary 0's. It was decided to mimic the situation for secondary storage using **magnetism** instead of electrical voltages to represent the binary data.

# System Devices

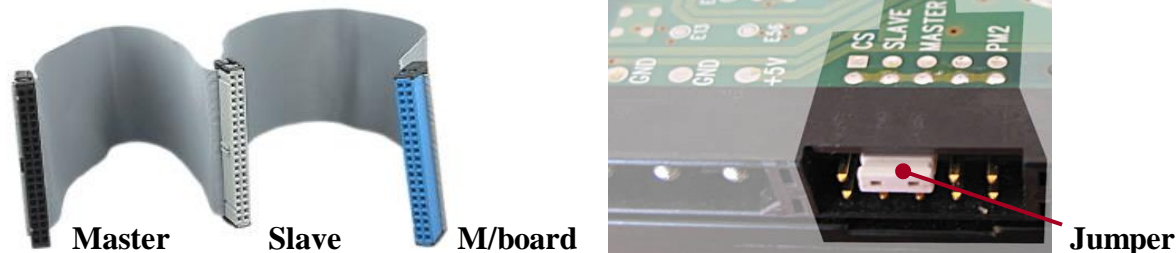
- A metal disk (**platter**) is coated with tiny iron particles which can be magnetised to **north** and **south** to represent the binary digits 0 and 1.
- A **read-write head** is used to magnetise the particles on the disk surface to represent the data held in RAM. The computer can now be switched off and a copy of the data is safe for later use.



# System Devices

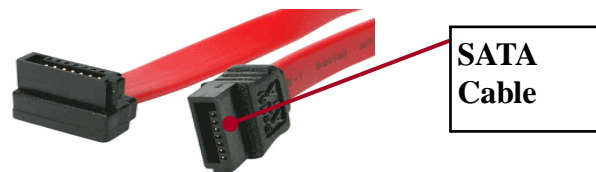
Hard disks can be **internal** or **external**. The internal standards are:

- **IDE** ( Integrated Drive Electronics). The disks connect to the motherboard using a ribbon cable. Each cable can hold two drives - **master** and **slave**. The drive is set as master or slave by positioning a **jumper** switch on the back of the drive. There are two IDE connectors and a total of four drives can be connected.

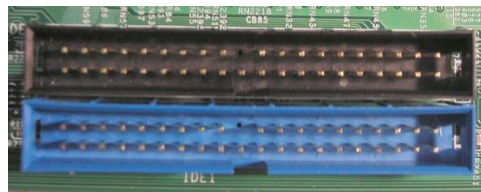


# System Devices

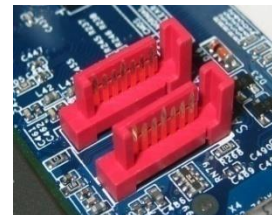
- **SATA** (Serial Advanced Technology Attachment) allow faster data transfer speeds than IDE. There is no master/slave arrangement with SATA and each drive has it's own cable. The cables are much smaller and allow better air circulation in the system unit.



## Motherboard connectors



IDE



SATA

# System Devices

**External hard disk drives** can be IDE or SATA and can be **mains powered** or **host powered**. Host powered drives receive their power from the USB port.



Mains  
Powered



Host  
Powered

Hard disk drives are also now found in video recorders, digital music players, digital camcorders, digital cameras and mobile phones.

2½ inch Notebook Drive



1 inch Microdrive



Microdrive



# System Devices

## Optical drives

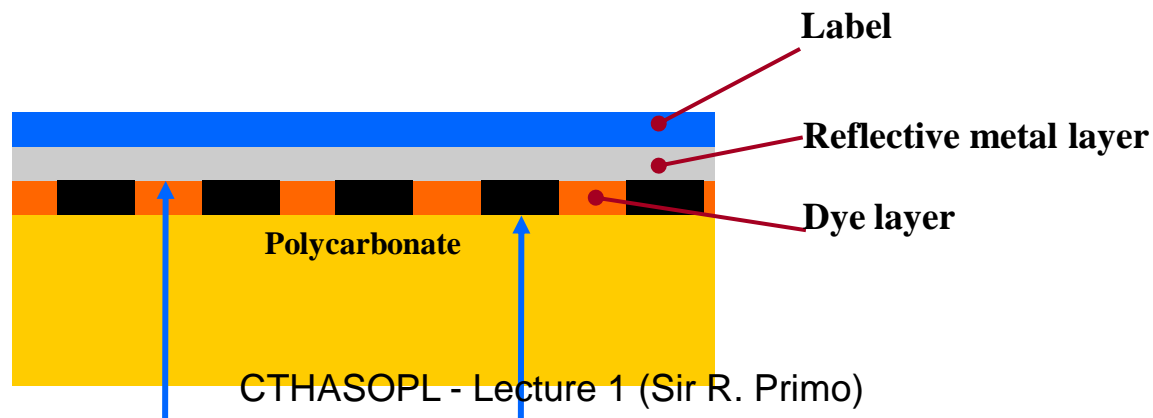
- Optical drives use lasers to sense **pits** and **lands** mechanically pressed into a polycarbonate disk. These pits and lands represent the binary 0's and 1's and so can store computer data.
- A thin layer of metal reflect the laser light. As the disk rotates, the laser senses the pits and lands and reads the data from the disk. The laser only operates at a **single intensity** as it only scans the surface of the disk to detect the pits and lands.



# System Devices

CD-R (blank CD's) use a dye layer to mimic the lands and pits created mechanically on commercial disks.

- The laser used has **two intensities**.
- At the **high setting**, it burns spots on the dye layer changing it from transparent to opaque. This allows data to be written as spots of transparency and opacity.
- At the low setting, it reads these differences





# System Devices

The CD-RW (re-writable) disk is similar but the laser has **three intensities**. The third and highest is needed to turn the burned areas of the dye layer back to their original condition. The dye layer can now be re-burned to hold new data.

The three laser intensities are:

- **Intensity 1** - Read data
- **Intensity 2** - Burn data
- **Intensity 3** - Erase data

The CD-R disk has a capacity of 650MB to 800MB.

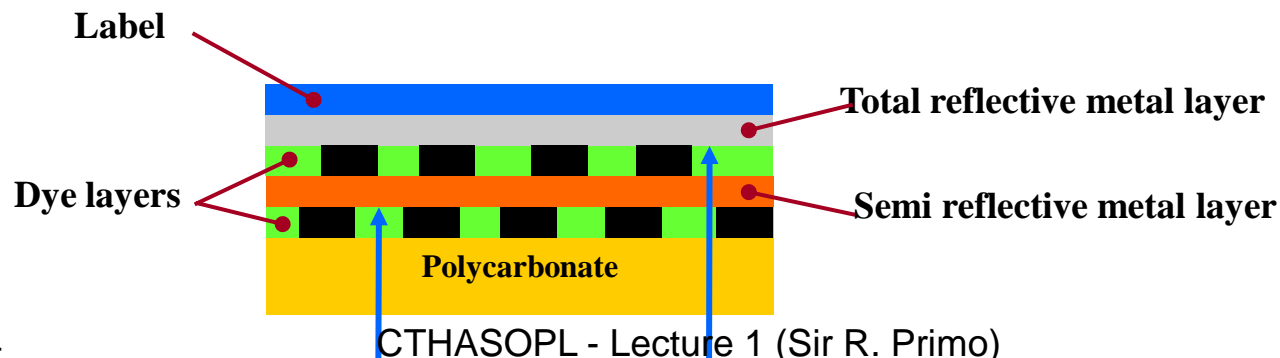
# System Devices

DVD's hold a lot more data than CD's. They can have several layers, each holding **4.7GB** of data.

The possibilities are:

Number of sides	1	1	2	2
Number of layers	1	2	1	2
Disk capacity	4.7GB	8.5GB	9.4GB	17GB

Dual layer disks have two reflective layers, one which can be penetrated at a certain intensity



# System Devices

## DVD Formats

1	<b>DVD-ROM</b>	Read only. Mechanically stamped and manufactured as single or double layer and as single sided or double sided.
2	<b>DVD-R</b>	Single or dual layer disks and can be single or double sided. They can be written to only once.
3	<b>DVD-RW</b>	Same as DVD-R but can be written to several times.
4	<b>DVD+R</b>	These are single or dual layer disks and can be single or double sided. They can be written to only once.
5	<b>DVD+RW</b>	These are the same as DVD+R only that they can be written to several times.

DVD-R and DVD+R are incompatible with each other. Manufacturers have produced **DVD±R** drives capable of reading and writing to both standards.

# System Devices

A number of new high capacity formats have come onto the market.

These are:

1	<b>HD-DVD</b>	Uses a new laser technology resulting in layer of 15GB instead of the 4.7GB on standard DVD. This gives a total capacity of a double sided - double layered disk as 60GB.
2	<b>Blu-Ray</b>	Higher capacity than HD-DVD - 25GB of data/layer. A dual layer disk can hold 50GB. Technically, a double sided and double layered disk can hold 100GB of data.



**Blu-Ray**



**HD-DVD**

# System Devices

## Card readers

Replaces floppy drives in new computers. They can read media cards from most digital cameras:

- **Microdrive:**
- **Smartmedia:**
- **SD memory card:**
- **Memory stick/Duo/Pro:**
- **xD picture card:**



Card reader drive



# System Devices

## Monitors

A computer monitor displays images generated by the graphics card.

Monitors are almost exclusively **LCD** (Liquid Crystal Display). **CRT** (Cathode Ray Tube) monitors are rare and are now as expensive as LCD monitors.



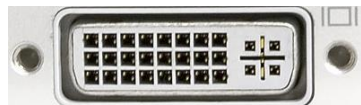
19 inch Widescreen LCD

# System Devices

The **aspect ratio** of a computer monitor is the ratio between the width and height of the screen. The aspect ratios are:

- **Standard monitor** - 4:3
- **Widescreen monitor** - 16:9

Most LCD monitors offer a **VGA** and a **DVI** connection. The VGA connector is used for analogue signals and the DVI connector is used for digital. As the computer is a digital machine, it is best if no conversion is required and so the best option is the DVI connection.



DVI



VGA

# System Devices

## Resolution

### Standard monitor

- **XGA** (Extended Graphics Array) - **1024 x 768**
- **SXGA** (Super Extended Graphics Array) - **1280 x 1024**
- **UXGA** (Ultra Extended Graphics Array) - **1600 x 1200**
- **QXGA** (Quad Extended Graphics Array) - **2048 x 1536**

### Widescreen

- **WXGA** (Wide XGA) - **1280 x 800**
- **WSXGA** (Wide SXGA) - **1680 x 1050**
- **WUXGA** (Wide UXGA) - **1920 x 1200**

LCD monitors - **native resolution** at which the image is crisp.  
Other resolutions are possible but the image quality decreases.



# System Devices

## Keyboard

Primary input device - divided into sections:

- **Typing keys** - contains the letter and number keys, shift keys, spacebar, return key etc.
- **Numeric keypad** - These keys are arranged as on a calculator.
- **Function keys** - programmable keys used by software for special functions. E.g. - F1 - Help.
- **Control keys** - screen and cursor control.

# System Devices

- Most common arrangement is called **QWERTY** after the first six keys.
- Other arrangements are available including **Dvorak**, **ABCDEF**, **AZERTY** etc.



**QWERTY**



**Dvorak**

# System Devices

Keyboards are available wired or wireless:

- **Wired** - These are either **PS/2** or **USB**.
- **Wireless** - The keyboard uses batteries.



**Rubber keyboard** - useful for use with notebook computers. Leaves users less prone to **RSI** (Repetitive Strain Injury)



# System Devices

## Mouse

Input device - uses point and click technology

There are two main types:

- **Ball mouse** - uses a ball to roll across the surface and move rollers attached to sensors inside the mouse - reflecting the ball movement as cursor movement.
- **Optical mouse** - camera takes thousands of images per second and sends them for digital processing. The red LED lights up the surface for the camera.



Optical  
mouse



Ball mouse

# System Devices

## Printers

Output devices - produce a **hardcopy** ( permanent and readable) of computer data. The can print onto paper, transparency, photographic paper, card etc.

There are two main technologies involved:

- **Inkjet (Bubble-jet)**
- **Laser**

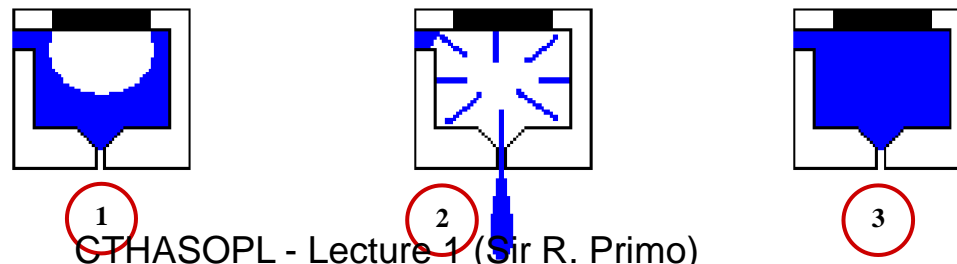


# System Devices

- **Inkjet** - uses an electric charge to vibrate a membrane. When the membrane flexes downwards, it ejects an ink droplet through the nozzle (1). When it flexes upwards, it draws more ink into the reservoir (2).



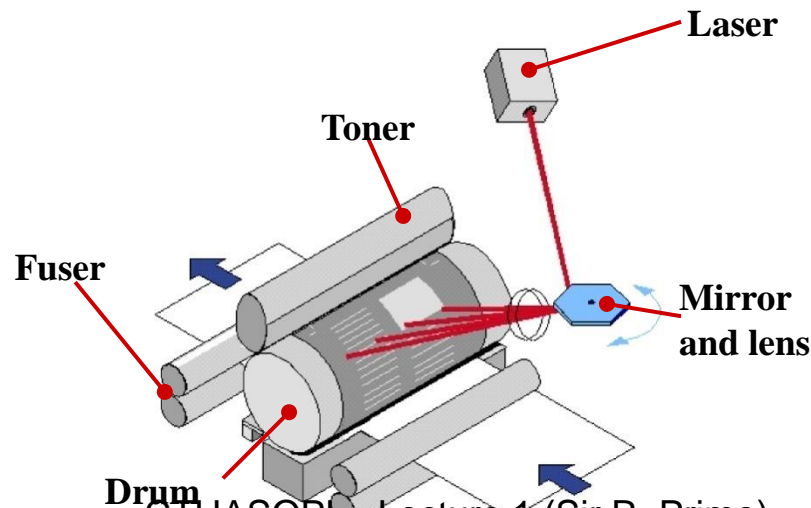
- **Bubblejet** - a heating element locally heats ink to form a bubble (1). As the bubble expands, it forces ink through the nozzle (2). When it bursts, it causes a vacuum which draws ink into the reservoir (3).



# System Devices

Laser printers use **toner** (powdered ink) instead of liquid ink as in inkjet printers.

- Laser printers produce images using dots. The image is created using a **laser beam** and a **mirror -lens** arrangement on a **drum** coated with magnetically charged **toner** and then transferred from the drum to the paper. The paper is then fed through a heated **fuser** which fuses the toner to the paper as ink.



# System Devices

Printers are available as **A4**, **A3** and even **A2**, but if larger drawings and images are required, a plotter is more suitable.

**Plotters** use inkjet technology and are available in **A3**, **A2**, **A1** and **A0**. They take up much less space than an equivalent inkjet or laser, but are more expensive.





# System Devices

## Computer Specification

- Intel Core Duo Processor - 2.66MHz 64-Bit CPU, 128 KB L1 cache, 4MB L2 Cache, 1333MHz FSB
- Windows Vista Business
- 4GB DDR2 Memory - 667MHz
- 500GB SATA HDD 10,000rpm
- 256MB DDR2 NVIDIA PCI-Express Graphics
- 19" Widescreen LCD - 0.22mm Dot Pitch, Res -1490 x 900
- 7:1 Surround Sound Inc. Woofer
- PCI-E Mainboard - nForce SLI, Micro ATX
- 6 x USB2 Ports - 2 Front
- 2 x 1394 Ports - 1 Front
- Broadcom GB LAN Network Connection
- Multi Card Reader
- 18X SATA Dual Format Dual Layer DVDRW Drive
- 550W Power Supply
- Logitech Wireless Internet Keyboard and Wireless Optical Mouse