Edexcel IGCSE

ICT

Revision Note

By

Shawon Notes

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Hardware

Software

Backing Storage

Networking

Impact of ICT

Types of ICT systems:

PCs:

A desktop PC usually has these basic components: a monitor, a keyboard, a system unit and a mouse.

Laptops:

A laptop computer is slightly larger and much heavier than an A4 file.

Notebook:

A notebook computer is a small laptop computer that is about as big as an oversized book. A notebook computer is likely to be half the size of a laptop and is lighter and easier to carry.

Netbook:

A netbook computer is a very small laptop that is optimized for Internet and email access. It is intended to be light and easy to carry and has a long battery life.

Hand-held:

A handheld computer or Personal Digital Assistant (PDA) or palmtop can fit in one hand or in your pocket, but it is too small for general work. A PDA usually has a touch sensitive screen. Although PDAs can be temporarily attached to a Keyboard, you cannot comfortably type a long document into a PDA.

Smartphone:

A smart phone is a mobile phone with the functions of a PDA. Hand-held computing devices can perform a range of activities such as personal record-keeping and satellite navigation.

Main frame:

A mainframe computer is a very large and expensive computercapable of supporting hundreds, or even thousands, of users simultaneously.

Super computers:

These are the fastest type of computers. Supercomputers are very expensive and are employed for specialized applicationsthat require immense amounts of mathematical calculations. For example, weather forecasting requires a supercomputer. Other uses of supercomputers include animated graphics, fluid dynamic calculations, nuclear energy research, and petroleum exploration.

Embedded computers:

An embedded computer is designed for and built into a specific application where it will perform a limited range of dedicatedfunctions. The size and functionality of an embedded computerdepends on the application. They may be very small devices built into a single microchip and may control.

Games consoles:

A games console is a PC that is designed specifically for playing games.

The importance of ICT systems

By using ICT systems we are:

- more productive - we can complete a greater number of tasks in the same time at reduced cost by using computers than we could prior to their invention
- able to deal with vast amounts of information and process it quickly
- able to transmit and receive information rapidly

IT applications play an important role in our daily life in terms of:

A. communicating applications
- newsletters
- websites
- multimedia presentations
- music scores
- cartoons
- flyers / posters
-

B. interactive communication applications
- blogs
- wikis
- social networking websites
-

C. data handling applications
- surveys
- address lists
- tuck shop records
- clubs and society records
- school reports
- school libraries
-

D. measurement applications
- scientific experiments
- electronic timing
- environmental monitoring
-

E. control applications
- turtle graphics
- control of lights, buzzers and motors
- automatic washing machines

- automatic cookers
- central heating controllers
- burglar alarms
- video recorders / players
- microwave ovens
- computer controlled greenhouse
-

F. modelling applications

- 3D modelling
- simulation (e.g. flight or driving)
- spreadsheets for personal finance
- spreadsheets for tuck shop finances

Input devices

1. Keyboard

The most widely used input device is a keyboard. This is a set of keys used to operate a PC. Numeric keyboards only have keys to input numbers and few special characters. A QWERTY keyboard may have a numeric keyboard built into the right hand side.

Advantages:
- Keyboards are almost always available as an input device. They are widely used at work.
- Many people know how to use a QWERTY keyboard, so help is usually available.

Disadvantages:
- To use a keyboard efficiently, you need to know the layout and be able to touch-type.

2. Mouse

The mouse is the most widely used pointing device. Some have the ball underneath that moves when you move the mouse, resulting in a similar movement of the pointer on the screen. A optical mouse detects movement using light instead of a ball.

3. Tracker ball

A tracker ball is like an upside-down mouse. The ball is on the top of the device and you move it with your thumb.

4. Joystick

A joystick is a lever that gives you similar control to a mouse but its behaviour is slightly different. Joystick can be used separately or can be built into a gamepad, where there are often two simple joysticks, one for each thumb.

5. Graphics tablet

Graphics tablet or a graphics pad is a flat rectangular pad between 6 and 20 inches wide. It works with a stylus which you move along the surface of the pad to produce drawings in the computer. There are several types of stylus. One, the puck, is small rounded device with cross-hairs for tracing lines accurately and with a number of buttons. The stylus can also be pen-shaped. A graphics tablet is used mainly for computer-aided design and drawing.

6. Scanner

A scanner reads printed data into the computer. A number of different devices are referred to as scanners:
- A hand-held scanner reads the image while being dragged over it.
- In the case of a flatbed scanner, the image is laid flat on the scanner's surface, and is captured in a similar manner to that of a photocopier.

- A sheet-fed scanner feeds the image in through rollers. The scanner reads the image as the paper goes through. The image must be printed on flexible sheet of paper.

Advantages:
- Scanners quickly convert printed images on paper to electronic form.

Disadvantages:
- The accuracy of the data input is unlikely to be verified.

7. Digital camera

Digital cameras store pictures on a memory card in a format suitable for saying and displaying on a computer. Pictures can be transferred from the camera to the computer where they can be edited and enhanced in graphics software or viewed on screen. The pictures can be transferred to a computer directly by connecting the camera to the computer, or the memory card can be removed and read using a memory card reader, which may be built into the computer or connected to it. Television sets can also have memory card readers built in or connected so that several people can view the pictures together on a large screen. The picture made by digital camera is formed by a quantity of very small dots of different colours, merging to form a picture. The picture quality is related to the density of the dots making the picture, the accurate placement of the dots and correctness of the colours being displayed. Thus an eight mega-pixel camera uses eight million dots to form a picture and so would produce better output than a two mega pixel camera. A digital video camera or camcorder has similar functions to a digital camera but records moving images with sound. Camcorders can save recordings on memory card but may also use DVD, miniDV tape or a built-in hard disk.

8. Webcam

A webcam is a type of digital video camera where the image captured is viewed using a computer. The computer connects to the webcam over the Web and the image is displayed on the computer screen. This has a variety of different uses:
- You could see if the weather is suitable for skiing by viewing the webcam in the mountains above Grindelwald in Switzerland.
- You could install a webcam at home for security and view this when you are out at work.
- You could attach a webcam to your computer and contact a friend who has a webcam so that you could both see each other while you are talking.
- You could set up a webcam in a classroom and listen to a teacher from another school. This might be useful if you were learning to speak English and could not find a teacher locally.

Advantages:
- Photos and videos can be recorded in a digital form that can be saved on computer. This makes backup easier, more reliable and more extensive.
- Digital photos and video can be displayed on a wide variety of devices,
- Digital phots and videos can be sent by email.
- Digital video can be broadcast over the Internet so that TV programmes can be available on demand. **Disadvantages of webcams:**
- Users tend to have more photos and longer videos and this creates a need for more backing storage.
- High-quality photos and videos can be in very large files. When these are sent by email or broadcast over the Internet, this uses bandwidth and slows down the network.

9. Microphone

Microphone is a device used to record sound, to give voice commands and for voice communication over the Internet.

10. Touch screen
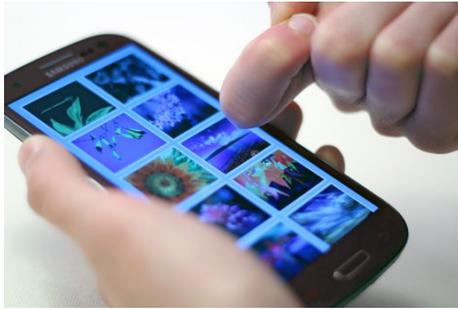
A touch screen is a two way user interface. It is both an input and output device. You can interact with the computer by touching pictures or words on the screen. Touch screens are widely used with tablet PCs, PDAs and smart phones.

## 11. Optical Mark Recognition (OMR)

OMR technology is used to interpret pencil marks on a piece of paper. An OMR reader can recognize the position of a mark or set of marks on paper, because the mark is darker than an unmarked area. The computer then records the mark's position and can analyse it to determine the meaning of the data. Marks made on this kind of form must be very clear or they may not be properly recognized.

Advantages:
- There is no requirement to type in the information written on the paper form. Because of this, input is faster and less expensive.
- The person who fills in the form is responsible for the accuracy of the information on it.
- **Disadvantages:**
- OMR forms must be printed very accurately because the position of the mark on the paper affects the accuracy of the input. Because of this, printing costs more.
- Verification checks on the input are unlikely to be carried out, so mistakes inputting the data are less likely to be detected.

12. Optical Character Recognition (OCR)
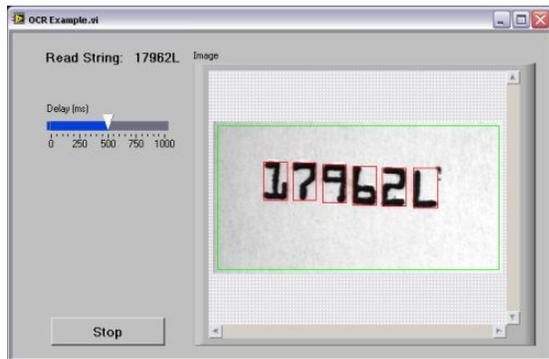
OCR is the identification of printed or written text characters by a computer. Printed text is scanned and input to the computer, which attempts to recognize the characters in it. These are then stored as text that can be word-processed. OCR can also be used to read handwriting. OCR software is often included when you purchase a scanner, so that any office with a scanner has OCR capabilities. A similar process of character recognition is used to interpret handwriting on the screen of a PDA or tablet computer. PDAs and tablet computers have touch-screen of a PDA or tablet computer. PDAs and tablet computers have touch-sensitive screens that accept handwriting as input and have character recognition software that can convert it to text characters that can be word processed. **Advantages:**

- Text printed on paper can be converted to electronic form and edited. This is especially useful for creating electronic versions of books printed before computers were available.
- **Disadvantages:**
- Character recognition is not always accurate and the electronic text has to be checked carefully.

13. Bar code scanner

A bar code scanner or bar code reader reads a pattern of bars representing the code number of the item on which it is printed. The bar code scanner usually passes a small laser beam over the pattern and reads in the pattern of reflected light. Bar code scanners may be hand-held, but some are built into the surface of a supermarket checkout counter.

14. Biometric scanner

A biometric scanner is a pattern recognition which makes a personal identification based on a person's unique physical characteristics. Biometric scanners can use face recognition, fingerprint matching, iris and retinal scans, voice recognition and hand geometry. Biometric scanners can be built into mobile phones, desktop and laptop computers, and smart cards. They can be used to control entry to buildings and can even replace keys in cars.

Advantages:
  ● There is no need to remember to carry personal identification.
  ● The person has to be present. This makes identification theft and fraud much less likely.

Disadvantages:
  ● Identification using biometric scanners is not yet sufficiently accurate. Permitted users will not be recognized at times, and blocked users will sometimes be permitted.

15. Magnetic stripe reader

A magnetic stripe card reader reads information from a magnetic strip on the surface of a plastic card when it is swiped through the reader. Magnetic stripe cards are also used as bank or credit cards. In addition to being able to read the magnetic stripe, some devices can also write information to it. The stripe can store a permanent value, such as an account number, or a value that could change, such as the amount of cash you are allowed to withdraw from a cash point.

Advantages:
- They are often used as a form of identification that is small and light and can be carried all the times.
- The data recorded on the magnetic stripe is in electronic form and can be input directly into a computer.
- **Disadvantages:**
- The data recorded on the magnetic stripe can be affected by electromagnetic radiation, such as that from televisions and computers.
- The data recorded on the magnetic stripe can be copied or deleted. This is an opportunity for determined criminals to commit identity theft and fraud.

16. Chip and pin

A smart card or Chip and PIN is similar to a magnetic stripe card but has a microprocessor chip embedded in it. The chip can do some processing, as well as storing information. Special devices can communicate with the chip to read and write information on the card. Security features can be programmed into the chip. Bank and credit cards used to be magnetic stripe cards but are now more usually smart cards. These cards can be used to withdraw cash at a cash point. Cash points are specialized computer terminals with a small screen numeric keyboard and smart card reader. The customer puts their card in the reader and is prompted to enter their four-digit PIN. If the pin entered on the keyboard matches the PIN read from the cards the customer can proceed: if not, the card is either confiscated or returned to the customer.

Advantages:
- Often used as form of identification that is small and light and can be carried at all times.
- The data recorded on the chip is in electronic form and can be input directly into a computer.
- The data recorded on the chip is more secure than data recorded on a magnetic stripe.
- The data recorded on the chip can be updated during transactions.

Disadvantages:
- The data recorded on the chip can be affected by electromagnetic radiation.

● The data recorded on the chip can be copied or edited by very determined criminals used for fraud.

17. Sensors

Sensors are used to input data about the environment into a computer. There are many types of sensors. They are available in many different shapes and sizes and they have a wide variety of uses. For example, sensors can be used to record light intensity, temperature and pressure. Sensors usually produce a low-voltage which must be converted to a digital signal for the computer using an analogue-to-digital converter (ADC).

Advantages:
- Sensors can be placed in dangerous locations where people would be hurt.
- Sensors can continuously and reliably record data whereas to organize this using people could be much more unreliable and expensive.
- Sensors can record data that people do not sense or do not sense accurately, such as humidity.
- The data recorded by sensors can automatically record in a form that can be processed by a computer.
- Data can be collected by a central computer from sensors in remote locations. People do not need to travel and this saves time and allows data to be collected more frequently.

Disadvantages:
- Sensors cannot interpret the data.
- Sensors detect a very restricted range of the different types of data.

Processors

CPU

A processor or microprocessor is built into a microchip that has memory and other components built into it. The microchip itself is often referred to as the 'processor'. If there is more than one processor built into the microchip, then the microchip is referred to as the 'processor' and processors built into it are referred to as cores.

Graphics card

The graphics card which is also known as video card or display card is housed within the system unit, and controls the signals going to the monitor screen. Higher quality cards can produce very clear graphics very quickly. Some computer games demand advanced display cards and high-quality monitor screens.

Sound card

A sound card controls all input and output of audio. Audio input through a microphone and output through speakers are usually analogue and the sound card handles their conversion into digital signals processed by the computer. It also handles digital audio input, e.g: from multimedia applications.

Output Devices:

1. Monitor

Monitors are also known as visual display unit (VDUs). They come in different styles and quality levels. Screen colour quality, resolution and clarity are just some of the features that affect how desirable a particular monitor is to you.

Picture elements: Although the picture on a computer monitor may look sharp and clear, it is made up of many illuminated dots known as picture elements or pixels. The dots are usually so tiny that you would not normally notice them individually – you just see the whole picture. If you could actually see the picture elements, the picture would look jagged.

Advantages of monitor screens:
Enables the use of a graphical user interface.
Interactive, on-screen use of a computer is more natural and intuitive than programming.

Disadvantages of monitor screens:
Screen size can limit the extent and detail of what can be seen. For example, it is possible to refer to several printed pages at the same time. It could be much more difficult to arrange this on a monitor.
Screen displays can be difficult to read for people who have impaired sight.

2. Printer

Types of printer:
- An impact printer usually strikes through an inked ribbon, making marks on the paper. A non-impact printer uses a non-striking method to form the image on the paper.
- Inkjet printers use tiny dots of ink sprayed onto the paper, forming the shapes of characters and pictures. Inkjet printers are quiet and produce good quality output. They usually produce colour prints, and are very popular for home and small-office use.
- Laser printers use laser light to make patterns of ink on a drum. This drum then transfers the ink to the paper, and finally a heating process fuses the ink to the paper. Laser technology gives excellent quality and prints quickly. Laser printers are widely used but are more expensive than inkjet printers, and often only print in black and white.
- Thermal printers use heated wires to mark dots on the surface of a heat-sensitive paper.
- Thermal dye transfer printers use special coloured dyes heated into a gas. This process gives the best quality of colour printing, but is very expensive and requires special paper.
- Thermal wax transfer printers use molten wax, forming tiny dots of different colours on the paper. These coloured wax dots blend to produce tones.

Buffers and spooling: Printers are much slower than the computers and networks that send information to them to be printed. So that the computer does not have to wait for the printer to finish printing, most printers have a buffer built into them. A document sent to the printer will be quickly saved in the buffer so that the computer can do other tasks while the printer is printing the document.

A buffer will only hold a few short documents, and on large networks many users may be sharing the same printer. To avoid users having to wait, documents are first put into a queue on a server and then sent for printing in turn. This queuing process is known as spooling.

Print Quality: All these types of printers use very small dots to produce pictures. The smaller the dot, the better the quality of the picture. An important measure of print quality is the number

of dots per inch (dpi). The higher the dpi, the better the picture. In addition, for the best-quality output the dots must be accurately placed.

Printers and paper:
Printers can use different types of paper:-
- Many printers use sheets of A4 paper.
- Some printers have a long stream of continuous paper flowing through. Usually the paper is perforated, so that it can be torn easily to produce separate pages of output. There may be several sheets together, either impregnated with carbon or with carbon sheets between them, so that multiple copies produced at ones.
- In pre-printed stationery, certain information – for instance, the name of a company – has already been printed on the paper. This is usually the case with utility bills, which are printed with a high - volume single-coloured printed on forms that already have coloured logos and other symbols printed on them.

Photo-printers: Photo-printers are specially designed to print digital photographs. A memory card storing pictures taken by digital camera can sometimes be plugged directly into the printer, and the pictures printed. In other cases, the camera can be directly connected to the printer.

Advantages of printers:
- Printed output can be viewed without the need for a computer.
- Many people and organizations still use paper-based communications and similar legacy methods.

Disadvantages of printers:
- Printing is slow and expensive compared with electronic communications and storage.
- Paper is bulky and deteriorates in storage.
- Printed materials are more difficult to access and distribute. For example, printed photographs can be viewed by a limited number of people compared with digital photographs displayed on a TV screen, and it is more difficult and expensive to send copies to others.

Multi-function printers: Printers are now being built in combination with scanners, and sometimes with fax machines. Combining a printer with a scanner produces the effective functionality of a photocopying machine, as well as providing the separate functions of scanning and printing.

Advantages of multi-function devices:
- A multi-function device takes up much less space on the desktop than the individual devices it replaces.
- A multi-function device is usually less expensive to buy than all the individual devices it replaces.
- A multi-function device will be used more before it becomes obsolete.

- A multi-function device can be replaced more frequently, having provided good value, so that more modern technology is available for use.

Disadvantages of multi-function devices:
- If part of the device develops a fault, all the functions may be unavailable.
- Only one person at a time can use a multi function device.

3. Plotter

A plotter draws lines on paper using differently coloured pens. In a flatbed plotter, the paper is held still while the pen moves. Other plotters have the pen moving from left to right, while the paper goes forwards and backwards. Yet others use wires to draw charged patterns on special paper, then fuse toner onto the electrically charged patterns. An upright plotter can handle long sheets of paper, because of the way the paper flows, and can produce long continuous lines. Plotters are frequently used in computer-aided design.

Advantage of plotters:
Much larger and longer sheets are printed.

Disadvantage of plotters:
Printing is very slow
Plotters are usually more expensive than printers.

4. Data projector

A multimedia projector or data projector projects an image that would normally be displayed on a computer screen onto a larger, separate screen. This allows the image on the screen to be shared with an audience in a large room. Multimedia projectors are almost always used when giving computer-based presentation. Multimedia projectors are also used with home entertainment systems, enabling people to watch TV and DVDs and to play computer games.

Interactive whiteboards are large touch sensitive panels used as screens for multimedia projectors. They are operated as touch screens. Some use capacitive or resistive technology but others use an optical curtain. Breaks in this curtain are detected and so the computer knows which part of the interactive whiteboard has been touched.

5. Speakers

Speakers are output unit of sound. This is sued to play music, to make telephone calls using VoIP, to listen to voicemail, to play video and DVDs for entertainment or education and to listen TV and radio.

Speakers are also needed for speech synthesis, where a computer reproduces human speech. The voice need not be recording and could be computer – generated. For instance, you can have text-reading program that takes a word-processed document in electronic form and reads it aloud.

Advantages of speakers:
They allow computer systems to be used for a wide range of multimedia applications. Interaction with a computer using voice recognition and speech synthesis is more natural and intuitive than programming.'

Disadvantages of speakers:
Applications that use speakers can be difficult to operate for people who have impaired hearing. Voice recognition systems can be difficult to set up and use.

6. Control devices

In control applications, computers make events happen using control devices or actuators. Examples of actuators are valves, heaters, coolers and motors. These can be powered by a range of different sources of energy, including electricity and compressed air. Actuators also include devices such as buzzers and alarms, which can warn us about various events: a burglar has entered through the window etc.

Advantages of control devices:
Actuators enable computer to perform physical tasks in the real world. For example, computers can control a central heating system or a mechanical digger.

Disadvantages of control devices:
Actuators perform physical operations when instructed by a computer. This can be dangerous for people if their presence is not known to computer.

Configuring ICT system to meet specified need

If a user selects an ICT system for business, he/she have to consider the following things:

- High speed processor
- Large amount of memory
- Large capacity of hard drive
- External storage devices for backup
- Type of printer
- An operating system with including office tools

If a user selects an ICT system for entertainment, he/she have to consider the following things:

- High speed processor
- Large amount of memory (video games usually need large RAM)
- Large capacity of hard drive which will contain user's movies, games and other files
- A graphics card to support all the games
- A high quality sound card to enjoy better sound
- Monitor with higher resolution
- Must have an operating system with apps to run videos, games, music etc

System software

Operating system: The operating system controls the computer. The operating system is software that runs between the hardware and application software. It enables application software to use the computer's hardware and other resources. The OS has many functions, including the following:

- Input and output control
- Error handling
- Resource allocation
- Providing a user interface
- Allowing users to give commands to the computer
- File handling

Applications software

Office productivity tools:

Office productivity software helps you work more efficiently when doing tasks in the office. This include:

- Word processing
- Desktop publishing
- Spreadsheet
- Database

Web authoring:

Web authoring software is used to create a website. A websiteis structed collection of web pages that is accessible via the Internet. Web pages usually include text and graphics and are written using HTML or software that generate HTML. Web authoring software like Adobe Dreamweaver gives you a more control over the webpage and may include facilities to manage your website.

Image and sound editing:

Image and sound editing software helps you prepare and edit pictures, photographs, video and music.

Presentation software:

Multimedia presentation software helps you prepare for and deliver a talk to an audience. The monitor display is projected onto a very large screen during the talk. A presentation will consist of a series of slides with mainly text and graphics, and notes for the speaker.

Project management software:

Project management software can be used to track and chartthe timelines of the individual tasks or events that have to be completed in order to complete a project. A project could be, for example, the construction of a large building.

Backing Storage

Data storage capacity terminology

- One kilobyte or KB is 1024 bytes
- One megabyte (MB) is 1024 KB or 1024 x 1024 = 1 048 576 bytes
- One gigabyte (GB) is 1024 MB
- One terabyte (TB) is 1024 GB

Main Memory

Memory

Memory is a device used to store programs temporarily or permanently.

Main Memory

Any data or instructions that are to be processed by the CPU must be placed into main memory (sometimes known as primary storage).

RAM
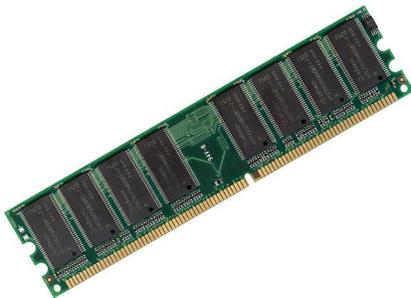
Random access memory can be written to, read from and edited. The data in it can be accessed in any order. Ram is volatile memory, which means that it is cleared when the computer is switched off.

ROM

Read only memory can also be accessed in random order, but the data in it cannot be changed. ROM is intended for permanent data, necessary for the operation of the computer system. ROM is non-volatile, which means that it retains what is stored in it when the computer is turned off.
Types of ROM:

- Programmable read-only memory (PROM) has no data locked onto it when first manufactured. But later, a company using PROM chips to make a computer can put in its own information. The data would then be locked in place, so the memory can no longer be changed.
- Erasable programmable read-only memory gets its original data in the same way PROM does. But, if necessary, the data can be erased using a special light shining on a window on the chip or by electric charge.

RAM vs ROM

RAM	ROM
Can be written to and read from.	Can only read from.
Holds program being run and data being processed.	Stores data and programs permanently.
Volatile: it is cleared when the computer is switched off.	Non-volatile: it retains what is stored when the computer is turned off.
RAM microchips are supplied as a module plugged into the motherboard.	ROM microchips are installed in the motherboard.

Storage Devices

1. Hard disks

A hard disk drive (HDD)[note 2] is a data storage device used for storing and retrieving digital information using rapidly rotating disks (platters) coated with magnetic material. On each individual disk, the data is stored in concentric tracks. For every track of data, there are corresponding tracks above and below it. The corresponding tracks form a cylinder. The number of cylinders is equal in number to the tracks on each surface of the disk. For each surface there is a read/write head, set on the tip of a small arm. These heads move in step with each other, traversing in and out over the spinning disk. The total storage space on a hard disk is given by the following formula:

number of readable sides x nnumber of cylinders x sector per track x bytes per sector

RAID(Redundant Array of Inexpensive Drives): this storage device essentially carries multiple copies of data, on different hard disk drives. If one falls, the data can still be recovered from the others.

External Hard Disks: External hard disks are built in a separate case and are robust, small and lightweight. They can be easily and safely carried around and can usually be connected to any computer with a USB socket.

2. Optical discs
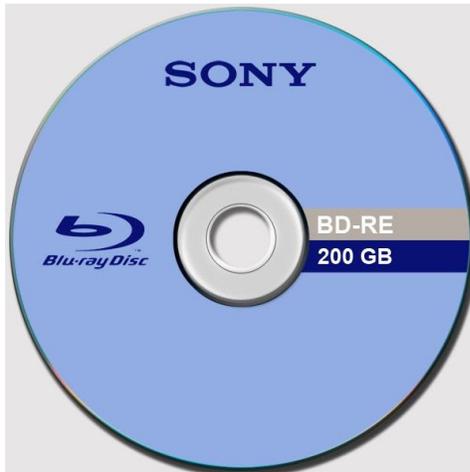
Compact disks (CDs): A typical CD stores around 700 MB of data on one side of the disc. Access time is slower than a hard disk. A CD is a piece of plastic, about 4/100 of an inch or 1.2 mm thick. During manufacture, a pattern is etched onto the lower polycarbonate plastic layer. This pattern is a single, continuous, extremely long spiral track of data. This lower layer is covered with a thin, reflective aluminium layer. Then a thin acrylic layer is sprayed over the aluminium to protect it. The CD's label is then printed onto the acrylic. CD drive has a laser beam in the read/write head, which can read the information on the disc.

Digital Versatile discs (DVDs): A digital versatile disc looks much the same as a CD. A single-sided layer DVD can hold up to 4.7GB on one side. In contrast, a dual-layer DVD can carry two layers of data on each of its two sides: this means it can hold up to 18 GB of video, audio or other information. Types of CD and DVD:

- CD-R and DVD-R allow data to be written to them on one occasion only: after this, the data on them can only be read. This enable you to create your own music CDs and record TV programmes on DVD, CD-R and DVD-R are useful for backing up the hard disk on a computer, because once the data has been written it cannot be deleted or changed.
- CD-RW and DVD-RW can be written to repeatedly up to around 1000 times and can be used for continuously backing up data or archiving. Data recorded on them can be deleted or replaced by more up-to-date data.
- DVD-RAM may be sealed inside a cartridge and can be rewritten more than 100000 times. Data written to DVD-RAM is expected to last at least 30 years. DVD-RAM drives are used in video recorders, camcorders and computers.
- HD DVD is an optical disk format for storing digital information, similar to DVD but with sufficient capacity for high definition video and movies. Its development was supported by a group of manufacturers led by Toshiba. HD DVD was created to succeed DVD but found competition in Blu-ray, which is a rival format. In 2008, HD DVD marketing and development ceased.
- Blu-ray is a high definition DVD format supported by a group of manufacturers led by Sony. It is intended as a replaced for the current range of DVDs and is used for

distributing HD material such as movies. A dual-layer Blu-ray can store 50 GB almost 10 times the capacity of a single-sided, single-layer DVD. It is the same size as a CD.

3. Flash memory

Flash memory is a type of EPROM. The memory can be reset quickly and easily so that it can be written to, read from and edited. It retains what has been stored without a power source. A common use of Flash memory is for the basic input/ output system (BIOS) of your computer. On vitually every PC available, the BIOS makes sure the computer starts up as it should and that all the parts of the computer work together.

Memory cards are removable and are used in video games consoles, digital cameras, mobile phones, PDAs and other portable devices. PCs often have card slots. Memory cards can store up to 32 GB of data. There are many types of memory card, including Compact Flash (CF), Secure Digital (SD), mini and micro SD, xD Cards, Smart media and Multimedia cards. Flash pen devices or memory sticks plug into the USB port on a computer. They are lightweight and fit easily into your pocket s they are a convenient way of moving data from one computer to another. They have a storage capacity of up to 32GB. They are used by teachers and lecturers to store presentations and other files, because they can be easily moved from one classroom to another. They are robust and not easily damaged, and are a relatively inexpensive medium.

4. Magnetic tape

A magnetic tape is wrapped onto a reel and provides a large amount of surface area. This abundance of surface means that a great quantity of information can be stored on a tape. But tape storage offers only serial access. So if you want to access data at the middle of the tape you must start at the beginning, and forward through the tape to reach the part you want. For this reason, accessing the data on a tape can be very slow, and so magnetic tape is mostly used for backing up data not for quick regular access.

Networking

Types of Network

Local area networks (LANs):

A **LAN** consists of a collection of computers that can share peripherals, share information and communicate with each other over a network. These are likely to be in the same room, building, department, school or workplace. Each computer that forms part of the network can function both as an independent personal computer running its own software and as a workstation on the network accessing information from the network server.
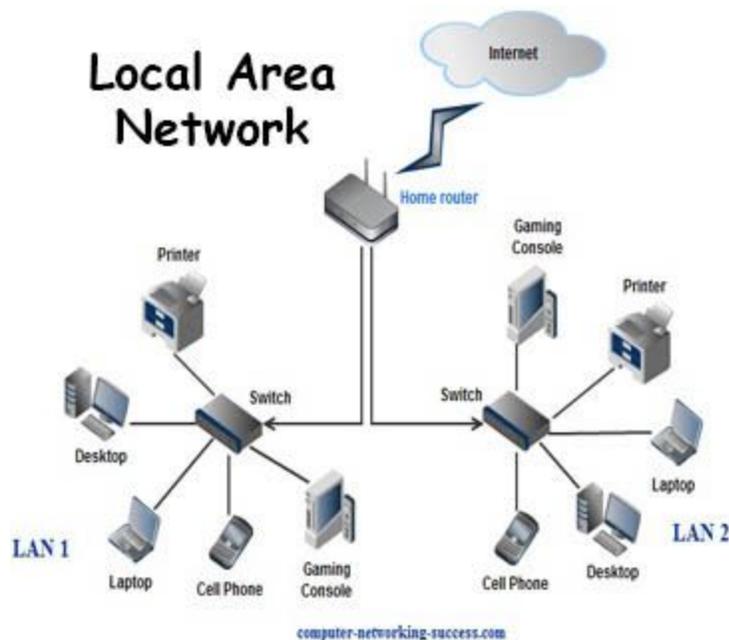
Advantages of LAN:

- Software and data files can be shared by many users.
- Users can work together on a single shared document.
- Users can communicate using instant messaging.
- Users can stream media.
- Users can access the network from any computer or other device that can be attached to the network.

- It is usually cheaper to buy one copy of a software application and pay the license fee for several computers, than to buy individual licenses for each computer.
- Users can share hardware devices.
- Users can share an Internet connection.
- User's access rights can be controlled centrally.
- Computers attached to the network can be maintained either centrally or from any network station.

Disadvantages of LAN:

- Set-up of server and network cabling costs high.
- Data can get corrupt easily.
- There is a risk from viruses as they can spread easily between the computers.

Types of LAN:

- On a **client/server** network, one or more computers are designated as the servers. Client computers are those computers available for you to use. Clients communicate with each other and externally through the server. The server will have a faster processor, more RAM and a lot more backing storage space than the client computers. A large LAN may have several servers to perform different tasks. For instance, a file server may look after the organization of the files on the network, while a print server coordinates printing on the network. Each server will also have software that manages the services it provides: email and Internet access, shared peripherals and the security of the system. Any computer that gives a user access to any type of network, including a connection to a mainframe computer, can be called a terminal.
- A **peer-to-peer network** allows every computer to communicate directly with very other computer in the network. A user can access data from any computer on the network. They are used mainly in small business and departments.

Cabled LAN: In a cabled LAN, all the computers and other peripheral devices on the network are attached o cables that are used to transmit data between them. A computer must be connected to a cabled LAN using a network interface (NIC). The network cable is plugged into the NIC.

Wireless LAN (WLAN): A wireless LAN differs from a cabled LAN in that computers can use wireless link to connect to the network instead of being attached using a cable. The wireless connection is made possible by three sets of components: wireless access points; wireless network interface cards (NICs) and routers.
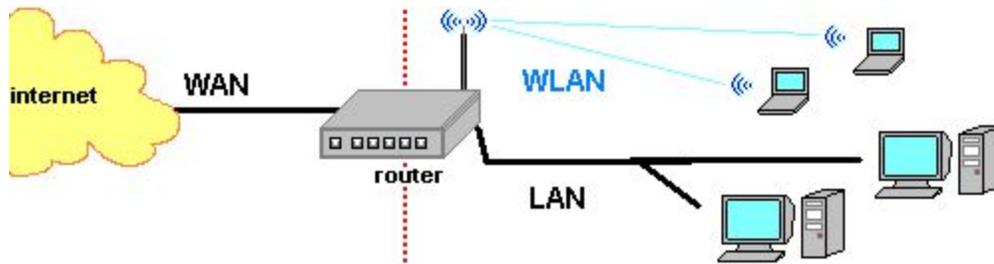
A **wireless access point** contains a radio receiver, encryption and communications software so that it can broadcast and receive wireless communications. It translates computer signals into wireless signals, so that it can broadcast to and receive signals from wireless network interface cards (NICs) on the network. NICs equipped for wireless communications have a fixed or detachable radio antenna instead of usual coaxial cable. Routers enable several computers to communicate through a wireless access point at the same time.

Bluetooth: Bluetooth is a form of wireless communication designed to enable PDAs, mobile phones, computers and similar devices to share information and to synchronise data. Bluetooth requires a transceiver chip in each device. The data transfer rate is 720 kbps with a 10 metre range.

Wide area networks (WANs):

A WAM can connect networks across a large geographical area, such as a city or a country or even internationally. Information can be transmitted in many ways: for example using high-speed telephone lines, fibre optic cables, microwave links and satellite links, or a combination of these. WANs are used mainly by universities, large companies and banks with branches in different countries, to share information and processing loads.

IP address:

Each computer on the Internet has a unique address that identifies it. This unique address is a number called IP address (Internet Protocol address), which is a 32-bit address consisting of four sets of up to three digits each, separated by full stops. The IP address could be static or dynamic. To connect to a computer on the Internet, your computer needs to know its IP address.

Benefits of establishing a network

By establishing a network we can:
- Share peripherals from hundreds of computers.
- Share data between people continuously
- Communicate easily
- Access to Internet simultaneously
- Stream media
- Distribute software

Network Security

Threat	Protection
Hacking is **unauthorised access** to your computer or files and to your personal information, e.g. email and bank accounts.	Use **a username and password**. Don't give these to anyone and don't write them down.
	Use a **firewall**. This is a combination of hardware and software that controls network traffic between a secure computer or network and the Internet.
	Use **WEP** (Wired Equivalent Privacy) or WPA (Wi-Fi Protected Access) codes which prevent unauthorised connection to a wireless network.
	Encrypt data. Encrypted data cannot be understood by someone without the encryption key. This prevents hackers understanding data on the ICT systems they access.
	Use a transaction log to track use of the system. This can show hackers' activities and help identify them.

	Hacking is often by authorised users accessing ICT systems they should not. Restrict users' file access rights to prevent this.
Spam is unsolicited email. There is so much spam that it can swamp legitimate email.	Use a **spam filter** to scan incoming email and remove unwanted email messages.
A **virus** is malicious software installed on a computer without the user's consent. Viruses can be attached to emails and downloaded with software.	Use **antivirus** software which checks for viruses and removes them, e.g. McAfee VirusScan. Treat files from unknown sources with caution.
Phishing is an attempt to find out personal information in order to carry out identity theft and fraud, e.g. you receive an email asking you to access your online bank by clicking on a hyperlink in the email. However, the link takes you to a fraudulent website where you enter your username and password. These are stolen and used to take money from your bank account.	Look for spelling and grammar errors, which are unlikely in an email from a bank. Suspect a phishing attack when you receive an email claiming to be from a bank, as they do not usually send unsolicited emails. Check that you have an account with the bank. If you are worried your bank is really trying to contact you, break the connection with the email then contact the bank directly. Remember that you are unlikely to win a competition you haven't entered!
Pharming is an attempt to collect personal information when users connect to legitimate websites. **Spyware** installed on a user's computer logs their personal information as they enter it.	Detect and destroy spyware using antivirussoftware and specialised programs, e.g. Spybot Search & Destroy.
Adware is unsolicited advertising which often generates **pop-up** adverts.	Block adware and pop-ups in a browser or using antivirus software and specialised programs, e.g. Spybot Search & Destroy.

Access to inappropriate information, e.g. children accessing pornography.	Use **parental control (or filter) software** to restrict children's access to inappropriate information, e.g. CYBERsitter. Features are: Access to some web addresses, searches on some keywords and sending some personal information are blocked. The URLs visited are recorded. Parents are notified by email that blocking is occurring. Parents are able to change filter settings over the Internet.
Cookies are saved on your hard disk by websites and contain personal information that can be accessed by the website.	Use a **cookie manager** to block cookies or remove them using a browser.

Requirements for connecting to the internet

Hardware:

Modem   Router   Gateway

i. **Modem**: Modem is a device that connects one computer to another using a telephone line so that data can be sent.
ii. **Router**: Routers enable several computers to communicate through a wireless access point at the same time.
iii. **Gateway**: Gateway is a router that connect two computer networks with different protocols.

Software:
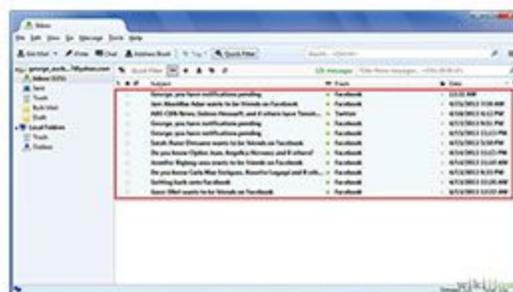
Web browser: Chrome   Email client: Thunderbird

i.   **Web Browser**: A web browser is software that lets you access the information available on the Web. Popular browsers include Microsoft Internet Explorer and Mozilla Firefox. All web browsers operate in a very similar manner and have similar features.
ii. **Email client**: An email client is used to send email.

Type of Connection:

i.   **Broadband**: Broadband is usually available over telephone land lines or cable. This refers to data transmission using ADSL and cable. ADSL is a means of transmitting digital signals using telephone lines. Coaxial cables, fibre optic cables, microwave links and communication satellites are commonly used to provide broadband. Microwave signals are very high-frequency radio signals that can be transmitted through space. A communications satellite accepts signals beamed to it from a point on Earth and then reflects the signals to another point. Communication satellites can transmit data that includes text, voice, pictures and video.

ii. **Dial-up**: Dial up is when your computer dials up a phone number to connect you to your ISP using telephone line. This is a legacy method used by individual home users to access the Internet. Dial up connections are very slow but inexpensive if you do not access the Internet very often.

iii. **Wi-Fi**: A Wi-Fi sends data wirelessly i.e. using radio waves instead of cables.

iv. **VPN**: A VPN is private network that runs within public networks. Conceptually it is similar to an extranet but network traffic will be encrypted and Internet protocols such as TCP/IP might not be used. It can be thought of as a separate 'pipe' inside the Internet. Network traffic inside the pipe is inaccessible to those outside the pipe.

Features of common internet services

Source of Services:

To access the Internet you need to subscribe to an Internet Service Provider (ISP). This is a company that is directly connected to the Internet and gives you access to it, usually for a fee.

Uses:

- View hundreds of millions web pages, all over the world.
- Use a search engine such as Google to find the page you want.
- Send and receive email.
- Use online shopping and e-commerce – you can buy goods, pay for them online and have them delivered o your door.
- Do your banking.
- Access customer support – many commercial organizations support the sale and maintenance of their products by putting information about their features and how to maintain them on the Web. Company websites often have help and FAQs which support customers using their products.
- Software distribution – for example, you can download free software or purchase it online, and download printer drivers.
- Access and discuss information – mailing lists, bulletin boards and newsgroups provide you with the information you need.
- Join discussion groups and chat online.
- Participate in conferences – you can even use a sound card, speakers and a microphone to talk to other users.
- Browse web rings.
- Receive web broadcasting.
- Advertise your business by setting up your own website or purchasing adverts on other websites.
- Build your own website and upload it to the Web.
- Upload and download digital media, such as music, images and video and publish these on the Web so that they can be shared with friends and family.
- Publish an online personal diary with narrative, pictures and hyperlinks.
- Describe and define particular topics in collaboration with other web users, using a wiki. An online encyclopedia could be a wiki, and you would find articles about

history, science and many other topics that have been written by many different contributors.
- Use social networking sites to communicate with a closed circle of friends who can see the information about yourself that you upload.

Intranet

An intranet is a local version of the Internet within a company or organization. It offers many of the same features as the global Internet, but in a localized environment such as a factory site or an office. Many companies make large volumes of information – such as notice boards, staff directories, training manuals, company reports, job adverts and newsletters – available to their employees on an intranet. An intranet allows information about organizational procedures to be centralized, leading to more consistent operations and the distribution of the forms used for record keeping from a centralized repository.

Authorised users within a company can use the company's intranet to find information easily and quickly. An intranet uses the same browsers, TCP/IP and other software as used for the Internet. If a company has an intranet and allows limited, secure access to it by people working off site, for example at home, the intranet is referred to as an **extranet**.

Impact of ICT

Impact of ICT on individuals, organisations and society

Positive effects:

- Easy ways are found to pay the employees in a company using payroll
- Fast and flexible access to airline booking system from internet
- Large supermarket stock control are done by ICT, which is difficult to do physically
- Easy means of banking
- Large amount of cash can be carried using credit or debit card and cash can be withdrawed using ATM
- Computer-aided design are used in designing for engineering
- Faster production of products
- Weather can be forecasted
- Robots perform complex industrial or manufacturing physical tasks
- Education system is developed
- Law enforcement became stronger
- Expert medical systems are build
- Wider range of entertainment and leisure opportunities

To read details of each points [visit here](#).

Negative effects:

Areas of Increased Unemployment
Some jobs have been lost as a result of computers being used to do the same work that people used to do.
Some examples of areas have suffered job losses:
Manufacturing
Many factories now have fully automated production lines. Instead of using people to build things, computer-controlled robots are used.

Robots can run day and night, never needing a break, and don't need to be paid! (Although the robots cost a lot to purchase, in the long-term the factory saves money.)

Secretarial Work

Offices used to employee many secretaries to produce the documents required for the business to run.

Now people have personal computers, they tend to type and print their own documents.

Accounting Clerks

Companies once had large departments full of people whose job it was to do calculations(e.g. profit, loss, billing, etc.)

A personal computer running a spreadsheet can now do the same work.

Newspaper Printing

It used to take a team of highly skilled printers to typeset (layout) a newspaper page and to then print thousands of newspapers.

The same task can now be performed far more quickly using computers with DTP software and computer-controlled printing presses.

Legal issues relating to use/misuse of ICT and the constraints placed on individuals

Computer crime

Computer crime – that is, crime is only possible because of the widespread use of ICT systems and networks – has increased in variety and extent.

Software piracy

Software piracy is the unauthorized copying using or selling of software without an appropriate license. It includes copying CDs with software or music on them, and downloading software or music without paying for it. These activities are effectively software theft.

Copyright violation

Using the Web you can download music, pictures, animated graphics, videos and books, as well as software. The copyright to some of this material is restricted to its owners. They may sell you the right to copy it, but if you copy it without permission this is effectively theft. The profitability of the music industry has been badly affected by music being freely copied and downloaded over the Web.

Legal constraints on the use of information

Legal issues about what you may do with personal data

Fortunately, for the IGCSE ICT course, the directive can be reduced to 8 principles. Briefly, these are:

1. A person must be told when their data is collected.
2. Data must only be used for the purpose given when it was collected.
3. Data must not be disclosed without the consent of the person concerned.
4. Data must be kept secure.
5. A person whose data is being collected must be told who is collecting it.
6. A person must be allowed to access their data and make corrections if it is not accurate
7. Data must not be transferred to another country that has weaker data protection laws
8. There must be a method by which people can check that data holders are complying with the principles.

Legal issues when obtaining information

Rules while downloading content from internet:

1. The Internet is international. What may be legal to upload and download in one country, may be breaching copyright or some other law if it is downloaded in another country.
2. Licences and permissions come in many forms. What may be free to download for e.g. a student in full time education, may need to be paid for by anyone else.
3. Different types of download may be covered by different laws. Most material has to comply with copyright law, but an item such as a computer programme, or part of one, may be protected by a patent as well.

Safety

Effect on user's health

As employees spend more time at work using ICT, there is a greater likelihood that this will affect their health. Ergonomics is important in reducing injury to people using computers. This includes:

- The design and arrangement of the seating and the computer system, especially the keyboard and monitor.
- Arrangements to support someone using the computer; that is, foot and wrist supports.
- Rules governing the user's behaviour when using the computer; for example, how often to take breaks.

The health risks associated with intense and prolonged computer use are:

- Repetitive strain injury (RSI) to the hands and arms. RSI is a painful condition that occurs because of damage to tendons, nerves, muscles and soft body tissue, and can be caused by the repetitive use of keyboard and a mouse. It can be avoided and its effect reduced by taking regular breaks using a specially adapted ergonomic keyboard and a wrist support.
- Eye problems such as soreness, lack of focus and eye dryness can arise from staring at a monitor all day. Potential problems can be avoided by taking regular breaks, having regular eye examinations by an optician and using antistatic and other screen filters. Monitors should be positioned to avoid light reflecting on the screen, and a interio lighting should be shaded and directed to avoid reflections. Using a larger screen can also help.
- Backache and similar problems. These can arise through sitting in an inappropriate posture for long periods of time. The solution is to use a purpose-designed operator's chair with adjustable height and backrest, and a footrest, and to take regular breaks.
- Fatigue and headaches.
- Trip hazards. These are associated with trailing cables and should be reduced by putting cabling in trunking or where it is not likely to interfere with the user's movement.
- Electric shock. This can be minimized by the use of a RCD on the main power supply to the computer. This is designed to turn off the power if the user receives an electric shock.

Computer Crime

Software piracy

Software piracy is copying, downloading, using or selling software without an appropriate license.

Copyright Violation

It occurs when, e.g. music or pictures, are copied or downloaded without an appropriate license.

Hacking

Hacking means gaining unauthorized access to an ICT system, and an individual who does this is referred to as a hacker. Many hackers break into ICT systems just for the challenge or as a prank. This might seem harmless, but it can cause considerable damage and is illegal in many countries.

The reasons why criminally minded hackers gain unauthorized access to ICT systems include:

- To steal data – this may have a security classification or could be commerciallysensitive.
- To alter data or destroy data, by deletion or by installing a virus to destroy or corrupt it. This may be done in order to disrupt legitimate commercial or governmental activities.
- To steal money by transferring it from one account to another using EFT.

Identity theft

When you are connected to the Web, spyware may be installed on your computer without your knowledge. This could send information about your computer to others who may have malicious intent.

Phishing

A phishing attack is when you receive an unsolicited email inviting you to a response that involves you entering your username, password and other personal details.

Securing Data and Personal Information

Physical safeguards

Physical safeguards deal with the protection of hardware and software from accidental or malicious damage or destruction. For example:

- Access control to ICT rooms using locks that are opened using entry codes, swipe cards or biometrics such as fingerprints and retinal scans. Security guards can ensure that those entering using entry codes and swipe cards are actually those who are allowed entry.
- Access monitoring using CCTV cameras so that those entering and leaving ICT rooms can be recorded.
- Data security can be ensured by taking regular backups and storing these in a fireproof safe in another location.
- Protect hardware from fire, floods, theft and malicious damage by locating it in buildings and areas where such problems can be reduced, for example, in a concrete underground bunker on top of a hill that is accessible only through a well guarded and narrow passage. Or more usually, not on the ground floor of a building where hardware is accessible to thieves.
- Further precautions to protect hardware from theft involve clamping individual computers to desks or securing them to wall; installing burglar alarms attached to individual computers in addition to those already used for the building and using CCTV cameras in ICT rooms to discourage inappropriate use of computer equipment and to allow any such use to be traced and the culprits identified.
- Make detailed contingency plans and disaster recovery arrangements so that ICT systems continue operating with a minimum of disruption and recovery is swift. For example, make arrangements with an organization with similar ICT facilities that is located at a distance so that their ICT facilities can be used should your own be destroyed.

Software safeguards

Software safeguards can protect data from theft or damage by hackers and other unauthorized persons accessing the software to steal or damage it. For example:

- Use of ICT systems and networks in restricted to those who have valid usernames and passwords.

- Access permissions that allow access to the data to the minimum number of people who need it. Others are blocked from accessing the data.
- File-level passwords that restrict access to individual files to those who have appropriate access permissions and passwords.
- Use a virus scanner to prevent viruses entering your system. The intention of some viruses is to damage software recorded on the ICT system or steal it by copying it and emailing it to unauthorized persons.
- Use a firewall. This is a program or hardware device or combination of both that filters the information coming through the Internet connection into a computer or network, to prevent unauthorized users from gaining access. Some firewalls also block cookies, pop-up adverts and spam. Popular firewall software packages are BlackICE Defender, ZoneAlarm, and Freedom.
- Data encryption is used so that if data is access by unauthorized persons it cannot be understood. Encrypted data is scrambled during storage and transmission so that it cannot be understood by someone without the encryption key to unscramble it. Wireless networks can be encrypted using WEP (Wired Equivalent Privacy) and WPA (Wi-Fi Protected Access)
- Establish transaction logs to automatically track alterations to ICT systems. Including the identity of those who access data and all the changes made.

Personal Responsibility on the Internet

The ways each individual uses the Internet and the Web can have a considerable social impact as this is aggregated and its impact emphasised by the use of networks. It is important to behave sensibly to protect yourself and others because the openness and freedom of the Internet can be abused by criminals.

- Be very cautious who you share personal data with. Don't publish your personal data on web pages that anyone can access.
- Don't publish anyone else's personal data anywhere unless you have their permissions.
- Make sure you know who stores your personal data and that it is correct.
- Don't copy someone else's work and write it as your own. This is plagiarism.
- Don't download software or music unless it is not copyrighted.
- Do not involve in activities such as hacking.
- Don't believe everything you see or hear over the internet.
- Be polite and reasonable in all your online interactions. If you feel you are the victim of cyber bullying seek help. Don't bully others.