Types and Components of Computer Systems

Hardware:
Physical components that make up a computer system.
Eg: keyboard, mouse, monitor, printer, etc.

Internal hardware:
- Motherboard
    - printed circuit board
    - allows computer hardware to function and communicate – acts as kind of a hub
- Random access memory (RAM)
    - Internal chip where data is temporarily stored when running applications
    - Memory can be written to and read from
    - Contents are lost when power off – volatile/temporary memory
- Read-only memory (ROM)
    - Memory used to store information that needs to be permanent
    - Cannot be altered, only read from
    - Not lost when power off – non-volatile memory
- Central Processing Unit (CPU)
    - Electronic circuit board that can execute instructions from a computer program
    - Two main components:
        - Arithmetic and logical unit (ALU) where ALU operations are carried out
        - Control unit (CU) receives, decodes, and executes instructions
- Network interface card (NIC)
    - Component that allows a device to be connected to a network (can be wired or wireless)
    - Each is hard-coded with a unique MAC (media access control) address code
- Internal hard disk drive/solid-state drive
    - Magnetic in nature
    - One of the main methods for storing data and most of the system and application software
- Sound card
    - Integrated circuit board that provides the computer with the ability to produce sounds.
    - Also allow user to record sound input from a microphone and manipulate sound stored on a disk
- Graphics card
    - Allows computer to send graphical information to a video display device (monitor, television, etc)
    - Usually made up of a processing unit, a memory unit (usually RAM), a cooling mechanism, connections to a display unit

Software:
Programs that control the computer system and process data. Falls into two categories-application and system software

Application software:
Programs that allow the user to do a specific task
- Word processing
  - o Manipulates text documents
  - o Functions: Creating, editing, saving, manipulating text, copy and paste, spell check thesaurus, formatting, language translation
- Spreadsheet
  - o Organises and manipulates numerical data.
  - o Organised on a grid of lettered columns and numbered rows.
  - o Functions: Uses formulae to calculate, produces graphs, modelling
- Database
  - o Used to organise, analyse, and manipulate data.
  - o Consists of tables made up of rows and columns. Each row is called a 'record' and each column is called a field 'field'
  - o Functions: carry out queries on data and produce a report, add, delete, and modify data on a table
- Apps and Applets
  - o Applets: small applications that perform a single task on a device
  - o Apps: refer to software which can perform a substantial task such as video streaming, music streaming, social media, etc.
- Computer-aided design software (CAD)
  - o Creation, manipulation, modification and analysis of a drawing/design
  - o Used to produce 2D or 3D diagrams: can be rotated, full dimensions, estimate manufacturing cost of final product, predict structural problems
- Graphics editing software
  - o Allows bitmap and vector images to be changed.
  - o Manipulates lines, curves, text to alter the stored image
  - o type of editing software is chosen based on the format of the image
- Video editing software
  - o Allows a user the ability to manipulate videos to produce a new video
  - o Includes: Rearranging, adding, removing sections of video/audio clips, colour correction, filters, video enhancements, transitions between video footage
- Audio editing software
  - o Edits, manipulates, generate audio data on a computer
  - o Can alter: Length of track, start/stop time, conversion between file formats, volume, fading in and out, combining, noise reduction, another version of track
- Control and measurement software
  - o Designed to allow a computer or microprocessor to interface with sensors so it can: measure physical quantities, control applications (like chemical

processes) by comparing sensor stored data and sending out signals to alter process parameters

System software:
Programs that allow the hardware to run properly and to user to communicate with the computer
- Compiler
  - o A computer program that translates a program written in high level language (HLL) into machine code so it can be understood and used by a computer to perform a required task
  - o Original program is called a source code and after compilation, the object code
- Linker
  - o Computer program that takes one or more object files produced by a compiler and combines them into a single program that can be run on a computer
- Device driver
  - o Software that enables one or more hardware devices to communicate with the computer's operating system
- Operating systems (OS)
  - o Software running in the background of a computer system, manages basic functions
  - o Allow:
    - Input/output operations to communicate with computer
    - Error handling to take place
    - Users to communicate with computer
    - Loading and running of programs
    - Managing security
- Utilities
  - o Designed to carry out specific tasks on a computer
  - o Programs that help manage, maintain, control computer resources
    - Antivirus, anti-spyware, backup of files, disk repair, file management, security, screensavers, disk defragmenter

Analogue and digital data
Computers can only understand data in a binary format. Which is often referred to as digital data (it can only have discreet, discontinuous values)
Data in the real world is analogue – physical data that changes smoothly from one value to the next and not in discrete steps

Main components of a computer system
1. Central processing unit (CPU)
2. Internal hard disk driver or solid-state drive
3. Random access memory (RAM)
4. Read-only memory (ROM)

Central processing unit (CPU)

The part of the computer that interprets and executes the commands from the computer hardware and software, normally part of the motherboard. Made up of discrete components and small, integrated circuits; these were combined on one or more circuit boards. Now referred to as a microprocessor. The CPU/microprocessor is made up of a control unit, which controls the input and output devices, an arithmetic and logic unit (ALU) which carries out calculations and makes logical decisions, and small memory locations called registers.

Internal Memory

Random Access Memory (RAM)	Read-Only Memory (ROM)
Temporary memory device	Permanent memory device
Volatile memory	Non-volatile memory
Can be written to and read from	Data cannot be altered
Used to store data, files, programs, part of OS currently in use	Used to store BIOS and other data needed at startup.
Can be increased in size to improve operational speed of a computer	

Input and Output Devices

Input Devices	Output devices
An input device is any hardware device that allows a user to enter data or instructions into a computer directly	Any hardware device that takes the output data from a computer and puts it into a human-readable format or uses it to control another device
Can send data to another device but cannot receive data	Capable of receiving data from another device but cannot send data
Necessary for computers to receive commands from its users and data to process, under the control of the user or can be direct data entry	Needed for the computer to share the results of its processing with a human, they are under the control of the computer
Must ensure the user can interact with the computer correctly	Less complicated because they only must turn computer systems into an output

Backing Storage

Internal memory	Backing storage
RAM contents are lost when computer is powered down and ROM contents are readable only	Hold their own contents permanently, even when powered down
Smaller memories	Larger capacity to store data
Access time is very fast	Slower access time
Fixed inside computer	Can either be fixed or removable
Can be read directly by CPU	Must be moved to RAM first, therefore, not directly accessible by CPU

User interfaces
- Command line interface (CLI)
  - Requires users to type instructions to choose options from menus, open software, etc.
  - There are often a few commands that need to be typed in
  - The user has to learn the commands just to carry out basic operations
  - Used by those who need to have direct communication with a computer to develop new software, locate and remove errors, initiate memory dumps, etc (programmers, analysts, technicians)
- Graphical user interface (GUI)
  - Allows user to interact with a computer or device using pictures or icons rather than having to type in a number of commands
  - GUIs use various technologies and devices to provide the user interface one of the most common is WIMP (windows icons menu and pointing device)
  - Touch screens use post-WIMP interaction where fingers are in contact with the screen allowing actions like pinching and rotating
- Dialogue-based user interface
  - Use the human voice to give commands to a computer system
  - By speaking certain commands, the device will recognize its task
- Gesture based user interface
  - Rely on human interaction by moving of hands, head or feet
  - Uses computer vision and image processing

Interface	Advantage	Disadvantage

CLI	User is in direct communication with the computer	Needs to learn a number of commands to carry out basic operations
	User is not restricted to a number of predetermined options	All commands need to be typed in, which takes time and can be error-prone
	Possible to alter computer configuration settings	Each command must be typed in using the correct format, spelling, and so on
GUI	User does not need to learn any commands	Uses more memory than CLI
	More user friendly- icons are used to represent applications	User is limited to icons provided on the screen
	A pointing device used to click an application is much simpler than typing in commands	Needs a more complex OS to operate which can be slower to execute commands

Interface	Advantages	Disadvantages
Dialogue-based	No need for a driver to take their hands of the steering wheel	Unreliable – many commands not being recognizable or needing repetition
	Useful for people with disabilities	Can be complex to set up
	Possible to use as a security feature- voice recognition	User needs to know which commands can be used
Gesture-based	Replaces mechanical input devices	Possible for unintentional movement to be picked up
	No physical contact required	Only works fairly near the camera
	Natural interface for a human operator	May only accept a limited amount of movements
	No training needed to interface with the computer	

Types of computers:

Desktop computers:

A desktop computer usually refers to a general-purpose computer with a monitor, keyboard, mouse, and processor unit.

Advantages:
- desktop computers are cheaper and easier to upgrade and expand
- tend to have better specification, c) not too much power consumption
- less likely they will be damaged or stolen
- The internet connection is likely to be more stable since it usually has a wired connection.

Disadvantages:
- they are not portable
- more complicated.

Laptops:

A laptop is a type of computer where a monitor, keyboard, pointing device and processor are all together in one single unit.

Advantages:
- they are portable
- there are no trailing wires
- they take up less space.

Disadvantages
- they are easier to steal or get damaged
- they have a limited battery life
- keyboards and pointing devices might be hard to use
- they can't be upgraded a lot.

Smartphones:

Smartphones allow normal phone calls to be made but also give them an OS which allows them to run multiple computer applications.

Advantages:
- they are small and light
- they can use wifi
- they have apps
- they have a good battery life

Disadvantages:
- small screens
- trouble typing
- battery drainage
- small memory size
- incompatibility with certain websites.

Tablets:

Similar to smartphones, tablets have an OS that allows them to run multiple computer-like applications.

Advantages:
- *fast to use*

- *fully portable*
- *touch screen tech*
- *several apps can be used*
- *not much heat after long use*
- *long battery life.*

Disadvantages
- they can be expensive
- they have a limited memory
- they can use mobile networks
- the use of a touch screen can result in frequent error.

Emerging Technologies

Artificial intelligence:

A machine or application which carries out a task that requires some degree of intelligence.
- Duplicates human tasks which require decision-making and problem-solving skills which could lead to improvements in safety and quality of services and products

Eg: driverless cars, assist disabled people, dangerous tasks (bomb disposal, welding, etc)

Disadvantages:
- job losses in manufacturing, transportation and more.
- Dependency on technology could increase in the future
- Humans have been replaced by machines – loss of skills

Augmented Reality (AR):
- Allows user to experience the relationship between the digital and physical worlds
- The real world is enhanced with digital details
- Can experience AR world through special goggles or via smartphone/tablet/phablet
- Will impact:
  - Safety and rescue operations
  - Entertainment
  - Shopping and retail
  - Healthcare

Virtual reality (VR):
- Takes users out of a real-world environment and into a virtual(digital) environment.
- User is fully immersed in the stimulated digital world
- Must wear VR headset
- Will impact:
  - Military applications
  - Education
  - Health care
  - Entertainment
  - Fashion
  - Heritage
  - Business
  - Engineering

Input Devices

Hardware devices that allow data to be entered into a computer.

4 Main hardware components of a computer:
1. Input devices: get data into the computer
2. Processors: makes the data useful information
3. Output devices: show the results of the processing
4. Storage devices: holds the data in the system

Types of input devices:
1. Manual input devices: data is input into the computer by hand.
2. Direct input devices: data is directly planted into the computer by machine or device.

Manual input devices:
Keyboard:
- One of the most used manual input devices.
- Most keyboards use a QWERTY key layout.
- Ergonomic keyboards:
  - Have a more natural shape, designed to prevent health problems by reducing the stress on the wrist.
- Uses of a keyboard:
  - Used to input data (text and numbers) into an application.
  - Used to give commands to a computer.
- Advantages:
  - Enables fast entry of text.
  - Easy to use.
  - Inputs arrive instantly on the screen.
- Disadvantages:
  - Painful for people with hand and wrist problems.
  - Quite large and can take up desk space.
  - Entering data can be slow when compared to automatic methods.

Numeric keypads:
- Used for entering numbers into a system.
- Some allow you to enter simple text and symbols.
- Uses of a numeric keypad:
  - ATM's (entering information and withdrawing money).
  - Telephones.
  - Chip and pin devices.
- Advantages:
  - Faster than keyboards when entering numbers.
  - Small so they can fit on small things.
- Disadvantages:
  - People with large hands may find it difficult to use.
  - Difficult to enter text information.

Pointing devices:
- Used to control a cursor on a screen.
- Used with graphic user interfaces.
- Main types: Mouse, touchpad, tracker ball.

Mouse:
- Ball mouse: uses a ball under the mouse to detect movement.
- Optical mouse: uses reflected light to detect movement.
- Mice have two buttons and a scroll wheel.
    - The left button is used to select icons and click options.
    - The right button is used to call a drop-down menu of options.
    - Scroll wheel is moved up and down through a document.
- Mice are used for opening and closing files, maximizing, and minimizing programs and files, moving, grouping and deleting files, controlling a cursor, and editing images.
- Advantages: fast and easy to use, don't take up much space.
- Disadvantages: painful for people with hand and wrist issues, ball mice can pick up dirt (affecting the accuracy), need a flat surface to work properly.

Touchpad:
- Used as a replacement for mice in laptops.
- Users brush their finger over the touchpad to control a cursor.
- Have two buttons, left and right.
- Touchpads are used for opening and closing files, maximising and minimising programs and files, moving, grouping and deleting files, controlling a cursor, and editing images.
- Advantages: built into laptops (portable), can be used on any surface, won't get clogged with dirt.
- Disadvantages: more difficult to control, can be difficult to use with hand and wrist issues.

Trackball:
- Similar to mouse, except a ball is on the top or the side
- A pointer on the screen is controlled by rotating the ball
- Has two buttons, occasionally a third for double click
- Uses: can be a good alternative for mouse, in industrial control rooms, used in some luxury cars
- Advantages: does not need the same fine control as mouse, easier to use with wrist/hand problems, more robust, less desk space
- Disadvantages: not supplied with the computer standard, thus increased cost, user will need to be trained as it is not standard equipment

Remote control:
- Used to control other devices through infrared signals.
- Buttons on the remote can be used to perform functions:
    - Changing the channel on a TV
    - Changing the volume
- Can also be used to operate heavy/dangerous machinery.

- Advantages:
  - Devices can be operated from far away.
  - Can be used to operate devices in an unsafe environment.
- Disadvantages:
  - Can be difficult to use for those with limited hand movement.
  - The infrared signal can become blocked.

Joysticks:
- Control a cursor on a screen.
- The stick moves the cursor, and the buttons allow you to 'click.'
- Popular devices for gaming.
- They are also used in industrial machinery and simulators.
- Advantages:
  - Easy to use.
  - Good for gaming.
  - Can be used by disabled people.
- Disadvantages:
  - Not as easy to control as a mouse
  - People with hand/wrist issues can find it hard to use.
  - Difficult to enter text.

Touch Screens:
- Allows you to input commands into a computer by touching/pressing buttons and icons on the screen.
- Common uses include: mobile phones and PDA's.
- Public information systems.
- Advantages:
  - Easy to use
  - No training required
  - Fast entry
- Disadvantages:
  - Limited number of options available on the screen
  - Expensive
  - Screen can become dirty

Scanners:
- Used to enter information on hard copies into a computer.
- Convert hard copies into digital data which can be stored on a computer.
- Reflect the light of a hard copy to capture an analog image of the document and convert it into digital data.
- Advantages:
  - Very fast and easy
  - Damaged photos and documents can be repaired digitally
- Disadvantages:
  - Scanned images are of lesser quality
  - Take up a lot of disk space

Light Pens:

- Old technology that can be used as an alternative to mice, touch screens or graphic tablets.
- Used by directly drawing or selecting icons on a screen.
- They pick up light from a computer screen and signal to the computer where the light was picked up from, allowing the computer to "draw" on that part of the screen.
- Advantages:
  - More accurate than touch screens
  - Small
- Disadvantages:
  - Not as accurate as a graphics tablet
  - Can only be used with CRT (cathode ray tube) screens
  - Can be uncomfortable to use

Microphones:
- Used to input analog sounds into digital computers
- Uses:
  - to input sounds/speech for a range of applications, eg voice overs in movies.
  - voice recognition software.
  - hands-free mobile phones.
- Advantages:
  - Cheap
  - Dictation is faster than typing
  - Makes driving safer
- Disadvantages:
  - Take up a lot of storage space
  - Not as accurate as typing
  - Background noise can interfere with voice recognition

Digital Cameras:
- Store digital photos on a memory card which can be transferred onto a computer
- Most have a screen for allowing the previewing of an image
- The image quality is measured in megapixels
- Most can also capture video and sound
- Advantages:
  - No film to develop-faster process
  - Easy to make copies of pictures
  - No need to print pictures
  - Can store thousands of photos
  - Can be easily transferred
  - Can be improved and edited
- Disadvantages:
  - User must have basic computer skills
  - Not all images are as high quality
  - Images loose artistry effect

Web Cameras:
- ● Used to conduct video conferences
- ● Can capture image and video content
- ● Advantages:
  - ○ Reduces need for travel
  - ○ Long distance meetings can be conducted cheaper
  - ○ Can be left running
- ● Disadvantages:
  - ○ Poor image quality
  - ○ Does not have their own storage
  - ○ Usually in a fixed position

Direct Input Devices:

Magnetic Stripe Reader:
- ● Reads information from magnetic stripes found on cards
- ● The data is read by pulling the card through a magnetic stripe reader which then sends the information to the computer
- ● Uses:
  - ○ Processing bank cards
  - ○ Electronic transfer of money
  - ○ Hotel room keys
- ● Advantages:
  - ○ Fast entry of data
  - ○ Errors are impossible
  - ○ Not easily damaged
  - ○ Safe as data cannot be interpreted by humans
- ● Disadvantages:
  - ○ Can only hold a small amount of data
  - ○ Needs to be in contact with reader to be read
  - ○ If damaged, the data is lost
  - ○ Easily duplicated

Contactless debit card readers
- ● Advantages:
  - o Fast transactions
  - o Uses 128-bit encryption to protect the data
  - o Customers do not have to worry about typing errors
  - o Retailers no longer have access to the customer's credit/debit card info
- ● Disadvantages:
  - o More expensive than normal credit/debit cards
  - o Increased risk of thievery
  - o Transactions are usually limited to a smaller value

Pin and Chip Reader:
- Has a slot into which the card is placed and the chip is read
- Pin is entered using keypad
- Uses:
  - Card payments
- Advantages:
  - More secure than contactless payments
  - More robust than magnetic stripe readers
- Disadvantages:
  - Pin must be read by someone else while typing it in

Radio frequency identification (RFID) readers:
- Uses
  - livestock tracking
  - Retail
  - admission passes
  - libraries.
- Advantages
  - no line-of-sight contact is needed
  - very robust and very reliable
  - good speed
  - bulk detection is possible
- Disadvantages
  - tag collision
  - radio waves can be jammed or interrupted
  - easy to hack.

Optical mark recognition/reader (OMR):
OMRs read marks made by any form converts it into data.
- Uses:
  - multiple choice exams
  - Questionnaires
  - voting papers
- Advantages:
  - Fast
  - no typing errors
  - accurate.
- Disadvantages:
  - forms need to be carefully designed
  - margin for error.

Optical character recognition/reader (OCR):
OCRs convert text on hard copy documents into soft copies.
- Uses:
  - processing passports and ID cards
  - plate recognition in parks

- ○ digitise old documents to prevent further damage
- ● Advantages
  - ○ Fast
  - ○ fewer errors.
- ● Disadvantages
  - ○ difficulty reading certain handwriting
  - ○ not very accurate.

OMR	*OCR*
Information answered is limited to the multiple-choice option	Users can extend answers since it reads handwriting
Compared marks made on page with a template stored in memory	Read handwriting
Reads the position of marks made	Converts printed documents into editable electronic formats
Required complex and expensive forms to be completed but it is simpler than an OCR	Requires a complex recognition system
More instructions to understand how to use it	Fewer instructions on how to use it
More accurate	Accurate but high error rate

Barcode readers:
They are used to read information given as a barcode.
- ● uses:
  - ○ Supermarkets
  - ○ Libraries
  - ○ safety function in companies.
- ● Advantages:
  - ○ Fast
  - ○ can test for the safety of components
  - ○ allow automatic stock control
  - ○ tried and trusted technology.
- ● Disadvantages
  - ○ Expensive
  - ○ barcodes can be swapped around
  - ○ can be easily damaged.

Quick response (QR) code scanners (readers):
They are used to read information given as a QR code.

- Uses:
    - Advertising
    - to deliver augmented reality
    - establish virtual online stores.
- Advantages
    - they hold more data than a barcode
    - fewer errors, c) easier to read
    - easier to transmit QR codes as images or text messages
    - possible to encrypt QR codes.
- Disadvantages
    - more that one QR format is available
    - can be used to transmit malicious codes.

Output Devices

Monitors (screens)
Devices that usually show the result of a computer processing in a format that can be understood by a human.
CRT Monitors
- Cathode ray tube monitor (CRT) are becoming increasingly rare
- Come in various sizes and make use of an electron gun firing against a phosphor screen. The picture is made up of tiny dots which are coloured red, green or blue
- Uses:
    - Only in specialist areas such as CAD
- Advantages:
    - Screen can be seen at a wider range of viewing angles than a LCD monitor
    - Allow the use of light pens
- Disadvantages:
    - Heavy
    - Can run very hot
    - Consume more power than LCD
    - Can flicker

LED and LCD Screens
- Led screen is made up of light emitting diodes, each one is either red, green or blue
- Used for large outdoor displays due to the brilliance of colour produced
- Uses:
    - Main output device for most modern computers
    - Many offer touch screen input
    - Mobile phones, tablets, laptops all used LCD screens
- Advantages:
    - Efficient, low power consumption
    - Lightweight
    - Do not suffer from screen image burn-in

- o Screens can be made in a variation of sizes
- o No flickering images
- o Sharp image resolution
- o Produces low electromagnetic fields
- o Reaches maximum brightness almost immediately
- o Last almost indefinitely
- o Thinner screens
- · Disadvantages:
  - o Colour and contrast from various viewing angles can be inconsistent
  - o Motion blur
  - o Lower contrast than CRT
  - o Weak or stuck pixels

Touch screen
- · Uses:
  - o Smartphones, tablets – allow interaction with apps
  - o ATMs
  - o Ticket collection
- · Advantages:
  - o Fast entry of data / options
  - o User-friendly
  - o Each method for choosing options
  - o Option to expand the size if necessary
- · Disadvantages:
  - o Limited number of options available
  - o Not good for large amounts of data being inputted
  - o Screen can get very dirty
  - o Easier for a third party to track user interactions

Multimedia Projectors
- · An image from a source is magnified and put onto a large screen
- · Uses:
  - o Presentations, home cinema systems
- · Advantages:
  - o Enables many people to see a presentation rather than crowding around a small computer screen
  - o Avoids the need for several networked computers
- · Disadvantages
  - o Images can be fuzzy
  - o Expensive
  - o Setting up can be hard

Printers
Laser printer:

- · They produce high quality hard copy output.
- · Advantages
  - o Fast
  - o can handle large print jobs
  - o high quality images
  - o cartridges last long
- · Disadvantages
  - o expensive to buy and run
  - o can be health hazards.

Inkjet printer
- · They produce good quality hard copy output.
- · produced using two different technologies: the thermal bubble and the piezoelectric.
- · Advantages
  - o high quality output
  - o cheaper to buy
- · Disadvantages
  - o low output
  - o can't handle large print jobs
  - o smudges easily
  - o can be expensive if used a lot since cartridges are expensive

Dot matrix printers
- · They are impact printers
- · Advantages
  - o can be used in dirty/moist environments
  - o carbon copies can be produced
  - o cheap to buy and run
- · Disadvantages
  - o they are very noisy
  - o cost more than inkjets to buy
  - o they are slow and poorer quality.

Graph plotters:
- · an output device that uses pens, pencils or markers to draw continuous lines
- · Advantages
  - o high quality
  - o high accuracy
  - o can produce in high numbers
  - o can print on many materials
- · Disadvantages
  - o Slow
  - o expensive equipment

  - o large physical footprint.

3D printers:
They are primarily used in CAD applications and are based on inkjet and laser printer technology
- · they produce solid 3d objects that can properly function
- · Advantages
  - o easier to manufacture items
  - o can produce items quickly
  - o less costly than labour costs for developing the same products
  - o helpful in medicine
  - o can produce parts for machinery
- · Disadvantages
  - o can make counterfeit items
  - o can lead to dangerous or illegal activities
  - o jobs are lost.

Speakers:
- · They are output devices that produce sound.
- · Advantages
  - o amplified sound
  - o helps visually impaired people
  - o simple technology
- · Disadvantages
  - o can be disturbing
  - o good quality ones can be expensive
  - o take up space.

Actuators:
When a computer is used to control devices, such as a conveyer belt or a valve, it is usually necessary to use an actuator to, for example, start/stop the conveyer belt or open/close the valve.
- · Advantages
  - o allow remote control
  - o inexpensive
- · Disadvantages
  - o additional devices
  - o analogue devices that need DAC

Storage Devices - Chapter 3

Magnetic tape drives
- · Uses:
  - o Applications where batch processing is used
  - o Backup media where vast amounts of data need to be stored
  - o Long term archiving of data
- · Advantages:
  - o Less expensive per byte than HDD
  - o Very robust
  - o Huge storage capacity
  - o Data transfer rate is fast
- · Disadvantages:
  - o Very slow data access time
  - o While updating, another tape is required to store the final version
  - o Affected by magnetic fields

Hard disk drives
- · Uses
  - o Stores operating system, system software and working data/files
  - o Stores application software
  - o Used in real-time systems
  - o File servers for computer networks
- · Advantages
  - o Fast data transfer and access rate
  - o Large memory capacities
- · Disadvantages
  - o Easily damaged
  - o Many moving parts affects overall reliability
  - o Read/write operation can be noisy

Portable hard disk drives
- · Uses
  - o Backup system prevent loss of data
  - o Transfer data, files, software between computers
- · Advantages
  - o Fast data transfer and access rate
  - o Large memory capacities
- · Disadvantages
  - o Can be easily damaged
  - o *Transfer* rate is not as fast as hard drives

Optical Media and Optical Storage Devices
CD/DVD Optical Disks

- CD-R and DVD-R
  - Uses: home recordings – music, film & stores data to be kept or transferred
  - Advantages
    - Cheaper than RW, once burned-behaves like a ROM
  - Disadvantages
    - Recorded once
    - Not all players can read
- CD-RW/DVD-RW
  - Uses: backup device, CCTV systems, rerecording of television programs
  - Advantages
    - Written over many times
    - Can use different file formats
      - Not as wasteful as R
  - Disadvantages
    - Expensive
    - Possible to overwrite
- CD-ROM/DVD-ROM
  - Uses: permanent method of data storage
  - Advantages- Less expensive than HDD
  - Disadvantages- Data transfer/access rate is slower than HDD

Comparison between CD and Blu-ray discs
- Blu-ray discs
  - have more storage
  - can record high-definition TV programs
  - can skip ahead to any part
  - creates playlists
  - edit or reorder programs
  - access websites and download subtitles and other features
  - searches for empty space to avoid over-recording
- Advantages
  - Large storage capacity
  - Fast data transfer rate
  - Access speed fast
  - Secure encryption system
- Disadvantages
  - Relatively expensive
  - Encryption problems when storing video
  - High-definition DVD players reduce Blu-ray

Storage state media and storage state storage devices
Solid state drives

- · Advantages
  - o More reliable
  - o Lighter
  - o Do not have a 'get up speed' before proper function
  - o Low power consumption
  - o Run cooler than HDDs
  - o Thin – no moving parts
  - o Faster access time
  - o Faster access speed
- · Disadvantages
  - o Durability, endurance – lack of longevity of the technology
  - o Is being actively improved

Pen drives
- · Uses
  - o Transporting files between computers
  - o Security device to prevent software piracy
- · Advantages
  - o Compact and portable
  - o Robust
  - o No additional software required
  - o Not affected by magnetic fields
- · Disadvantages
  - o Read-only
  - o Easy to lose
  - o User needs to be careful when removing the pen drive

Memory cards
- · Uses
  - o Storing photos on digital cameras
  - o Mobile phone memory cards
  - o Backing storage in hand-held computer devices
- · Advantages
  - o Compact
  - o Durable
  - o Large storage capacity
  - o Can be read by digital devices
- · Disadvantages
  - o Expensive per GB of memory
  - o Lower storage capacity than hard dicks
  - o Finite life
  - o Small – can be lost/stolen
  - o Not all computers have memory cards built in

Chapter 4 – Networks and the Effects of Using Them

Common network terms:

Network interface card (NIC)

·   Needed to allow a device to connect to a network

·   Turns binary data into an electrical signal that allows access to networks

·   Given a unique hardwired or hard-coded MAC address at the manufacturing stage

·   Wireless NICs (WNICs) use an antenna to communicate with networks via microwaves

Media access control (MAC) address

·   A number which uniquely identifies a device when its connected to a network

·   Made up of 48 bits which are shown as six groups of hexadecimal digits

      o First three digits refer to the manufacturer and the second three are unique to the device

Internet protocol (IP) address

·   Given whenever a computer connects to the internet

·   Usually assigned by the internet service provider (ISP)

·   Essentially identifies the location of a device on a network

Data packet

·   Data is moved around in networks through data packets

·   Usually has a header containing:

      o Senders and receivers IP addresses, sequence/identity number of the packet, packet size, and number of packets making up the message

Hubs

·   Hardware devices that can have a number of devices connected to them

·   Primarily used to connect devices to form a local area network (LAN)

·   Takes a data packet received at one of its ports and broadcast it to every device connected to it

·   Therefore:

      o Hubs are not very secure – every device receives every data packet

      o Unnecessary traffic on the network – results in reduced bandwidth

Switches

·   'intelligent hubs' – connect a number of devices to form a LAN but stores the MAC addresses of all the devices on the network. Each port on the switch connected to a device has a matching MAC address called a lookup table

·   Under the table, the switch matches the MAC address of the incoming packet and directs it to the right device

·   More secure than hubs and do not waste bandwidth

Bridges

·   Devices that connect one LAN to another LAN that uses the same protocol (communication rules)

·   Cannot communicate with other external networks

Routers

· Used to route data packets from one network to another based on IP addresses. Each router has its own IP address.
· Used to join a LAN to the internet

Router	Bridge
Main objective is to connect various types of networks together	Main objective is to connect LANs together
Scan a device's IP address	Scan a device's MAC address
Data sent out using data packets	Data sent out using data packets
Connected networks will use different protocols	Will connect networks using the same protocols
Routing table is used to direct data packets to the correct device	Do not use routing tables
Has more than 2 parts	Has only 2 parts

Wi-Fi and Bluetooth
· Offer wireless communication between devices
· Use electromagnetic radiation as the carrier of data transmission
· They send and receive radio waves in different frequencies
· Wi-Fi is better suited to operating full-scale networks
   o Has faster data transfer rates
   o Has better range and security
· Uses of Bluetooth:
   o When transferring data between devices within a 30 metre distance
   o When the speed of data transmission is not critical
   o For low-bandwidth applications (sending music files from a phone to a headset)

Cloud Computing
· Method of data storage where the data is stored on remote servers
· Three common cloud storage systems
   o Public cloud
   o Private cloud
   o Hybrid cloud
· Advantages
   o Data can be accessed at any time, from any device, and any place as long as internet access is available

- o No need to carry an external storage device
- o Provides remote backup
- o Allows for recovery of data if failure of hard disk or backup device
- o Offers almost unlimited storage (at a price)
- · Disadvantages
  - o Security concerns – data can be hacked
  - o Needs internet connection
  - o Can be expensive if a high storage capacity/large data transfer is required
  - o Potential failure of cloud storage company is possible – could result in loss of data

Network types

- · Local Area Network (LAN)
  - o Usually within one building or geographically near each other
  - o Consists of a number of computers and devices connected to hubs and switches
  - o One of the hubs/switches will be connected to a router to allow for internet access
  - o Advantages:
    - ● Allow the sharing of resources like hardware and software
    - ● Permit easy communication between users
    - ● Use a network administrator that ensures security and use of the LAN is constantly monitored
  - o Disadvantages:
    - ● Easier to spread viruses throughout the network
    - ● Queues for shared resources
    - ● Slower access to external networks
    - ● Increased security risk as compared to stand-alone computers
    - ● If the main server breaks down, in many network structures, the network will not function properly

- · Wireless Local Area Network (WLAN)
  - o Similar to LANs but there are no wires or cables
  - o Provide wireless network communication over fairly short distances

Wireless Networking	*Wired Networking*
Easier to expand networks + not necessary to connect devices using cables	More reliable/stable network
Devices have increased mobility	Data transfer rates are faster + no dead spots

Safety improvement + increased flexibility	Cheaper overall
Increased chance of interference from external sources	Lose mobility
Data is less secure – easier to intercept radio and microwaves than cables	Tripping hazards, overheating connections (fire risk), disconnection of cables
Data transmission rate is slower	
Possible for signals to be stopped by thick walls	

- · Wide Area Network (WAN)
    - o Used where computers or networks are situated a long distance from each other
    - o A number of LANs joined together by a router can form a WAN
    - o WANs usually make use of some public communication networks (phone lines/satellites) but can also use leased communication lines, which can be less expensive and less prone to hacking

Network issues and communication

Authentication Methods
Passwords
- · Used when accessing email account, carrying out online banking, accessing social networking sites
- · Protecting passwords:
    - o Run anti-spyware software
    - o Change on a regular basis
    - o Should not be easy to crack
    - o Strong passwords contain:
        - At least one capital letter
        - At least one numerical value
        - At least one other keyboard character

Zero login and biometrics
- · Relies on a device being smart enough to recognise a user based on biometrics or behavioural patterns
- · Builds up a complex user profile to log into devices instead of passwords
- · Advantages:
    - o Enhanced security

- o Easier and quicker
  - · Disadvantages:
    - o How do users know if they're being monitored?
    - o How do users if and when they have been logged out?
    - o How well protected is it in reality?

Magnetic stripe cards
- · Advantages
  - o Easy to use
  - o Not expensive
  - o Can be remotely deactivated
  - o Can be multi-purpose
- · Disadvantages
  - o Less secure than biometrics – no encryption
  - o Wear out with lot of use
  - o Often fail to read the cards on the first attempt

Smart cards – contactless version – made by entering a tag (chip and antenna)

Physical tokens
- · A form of identification in the form of a physical object
- · Contain internal clocks and when a pin/other authentication methods are entered, an OTP is generated
- · Example: online banking
- · Electronic tokens are the same but on a smartphone

Anti-malware software
- · Checks software/files before they're loaded onto a computer
- · Compares possible virus against a database of known viruses
- · Carry out heuristic checking – checking of software to indicate behaviours of possible viruses
- · Any possibly infected files or software are put into quarantine – allows the virus to be automatically deleted or allows user to make decision about deletion

Electronic conferencing
Video conferencing
- · Communication method that uses both video and sound
- · Basic hardware:
  - o Webcams
  - o Large monitors
  - o Microphones
  - o Speakers
- · Software

- Webcam and microphone software drivers
    - § Ensures that all webcams and microphones transmit their images and sound to other delegates
- CODEC
    - § Used to encode/decode the digital data stream to allow data to be transmitted and played back
    - § Used to compress data before transmission and then decompress
- Echo cancellation
    - § Removed echoes created by microphones
- Items to consider
    - Agree on a time and date
    - All delegates must log in to the system
    - Needs to be set-up and checked before the meeting is live
    - Webcams should be positioned so all delegates can be seen
    - Microphone should be placed centrally so all delegates can be heard
- Advantages
    - Easier to access documents or bring in experts – people are in their own building
    - Possible to hold conferences at short notices
    - Not travelling for meetings – reduced travel costs, reduced venue/hotel costs, people are not taken away from the office for a few days
    - No need to travel to potentially unsafe places
    - Better for the environment
- Disadvantages
    - Potential lag time in responses
    - Images can jerk
    - Can be expensive to set up
    - Time zones in different countries
    - Training people to use the system – costly + time consuming
    - Demotivation for stuff who enjoy international travel
    - System relies on good network connection – if the network connection breaks down it won't work

Audio conferencing
- Meetings held between people using audio equipment
- Hardware
    - Telephone OR
    - Computer
    - External microphone + speakers
    - Internet phone
    - Standard phone
- VoIP – voice over internet protocol

- Allows communication between multiple parties using voice, IM or video
- Drawbacks – quality of sound

Web conferencing
- Uses the internet to permit conferencing to take place
- Requires only a computer and high-speed internet + stable connection and the required application (user can also log in from a website)
- Main features
    - Slide presentations and documents can be posted on the conference website in advance
    - Host's computer screen can be shared for live presentations
    - Possible for any delegate to draw or write on a 'whiteboard'
    - Possible to transmit images or videos using a webcam throughout the conference
    - Possible to chat verbally and over instant messaging

Chapter 5 - The Effects of ICT
Internet of things (IoT)

Microprocessor Controlled Devices

Using microprocessor controlled devices can have both positive and negative effects on our lifestyle, leisure time, physical fitness, data security and social interaction.

Labour Saving Devices
Any device that takes the load off physical work
- Coffee machine
- Washing machine / dryer
- Vacuum cleaner
- Sprinkler
- microwave/oven/toaster - all kitchen appliances

Non Labour Saving Devices
- Television
- AC/Heater
- Fridge
- Smartwatches
- Bluetooth speaker

Smart Devices In Transport
- Self-driving cars
- Planes - autopilot
- Things it helps with:
  - GPS - helps with direction
  - Speed limit in current zone
  - Chooses the best route for you
  - Proximity sensors
  - Seat belts

Microprocessors (labour saving devices)
- Benefits
  - No longer have to do manual tasks at home
  - Gives time for more activities such hobbies, leisure time, shopping, socialising
  - No longer a need to stay home when food is cooking or clothes are washing
  - Automated burglar alarms give people a sense of security and well-being as they give a very sophisticated level of intruder warning at all times
  - Can share data with other devices
  - Compact
  - Tasks can be done remotely
  - Smart fridges/freezers can lead to a more healthy lifestyle

- Disadvantages:
    - Can lead to laziness
    - Unhealthy lifestyle - exercise is reduced
    - Cybersecurity threats - less security

General advantages and disadvantages:
- Advantages
    - Save energy as they are far more efficient
    - Easier to program the devices to perform tasks than manually perform them
- Disadvantages
    - Lead to a more wasteful society - once a circuit board is fails they are usually not replaced, just discarded
    - Can be more complex to operate for those who are not good with technology
    - Devices on standby is wasteful of electricity

Data and security issues
Having a microprocessor-controlled device connected to the internet can lead to cybersecurity issues. If you are able to communicate remotely with devices in your home, then so can a hacker. Any household device which can be remotely-controlled could allow a hacker to gain personal data about you. These devices are often set with a default (or no) password, making it easy for cybercriminals to obtain personal details.

Social interactions:
While some devices leave people with more time to do things outside their home, other devices encourage people to stay at home. Devices, such as smartphones, smart televisions or tablets allow people to communicate from home using VoIP, or chat rooms.
Positive aspects:
- Easier to make new friends in chat rooms
- Easier to find people with similar interests
- Less expensive to keep in touch

Negative aspects:
- People do not meet face-face as much
- People might get more anxious in real-life interactions
- People behave differently when interacting online

Monitoring and controlling transport
Control of smart road systems and smart signs
- Many modern motorways are now called smart motorways as the monitoring and control of the traffic and/or the information displayed on the motorway signs is controlled by a central computer system.
- Can control traffic lights and signs to avoid traffic or accidents
- However, if hacked, it could lead to many safety implications

Rail and airline network control systems

- Coordinate planes and trains leaving and arriving at airports and stations
- Advantages
  - Constantly adapt to conditions - saving time
  - More efficient
  - Traffic offences can be automatically penalised using ANPR
  - Minimises human error - decreases chance of accidents
- Disadvantages
  - If hacked could cause disruption
  - If fails the whole system could be brought to a standstill
  - Could compromise safety if poorly designed
  - Innocent people's movement could be tracked as well

Autonomous vehicles in transport
- Cars
  - use sensors, cameras, actuators and microprocessors to carry out their actions safely. Sensors (radar and ultrasonics) and cameras allow the control systems in cars to perform critical functions by sensing the dynamic conditions on a road.
  - Advantages:
    - Human error removed - safer
    - Operate more efficiently - better for environment
    - Reduced traffic congestion
    - Increased lane capacity
    - Reduced travel times
    - Stress free parking for motorists
  - Disadvantages
    - Expensive to set up
    - Stress of hacking
    - Security and safety issues in case of glitches
    - System needs to be well maintained at all times
    - Reluctance at new technology
    - Reduction in need for taxis - unemployment
- Trains
  - makes use of a system called LiDaR (Light Detection and Ranging); LiDaR uses lasers which build up a 3D image of the surroundings. Other sensors are all used for various purposes to help control the train and maintain safety. Also uses global positioning satellite technology, which allows accurate changes in speed and direction to be calculated.
  - Advantages
    - Improves punctuality
    - Reduced running costs - fewer staff required
    - Improved safety
    - Minimises energy consumption
    - Can increase the frequency of trains
    - Easier to change train scheduling

- ○ Disadvantages
    - ■ Fear of hacking
    - ■ Does not work well with busy services
    - ■ Initially high capital and building costs
    - ■ Ensuring passenger behaviour is acceptable
    - ■ No need for CCTV to monitor railways - no drivers
- ● Planes
    - ○ main features of a control system on a pilotless aeroplane would include: sensors to detect turbulence to ensure smooth flights, an increase in self-testing of all circuits and systems, sensors that would automatically detect depressurisation in the cabin, therefore allowing for quick stabilisation of the aeroplane, use of GPS for navigation and speed calculations, use of actuators to control, for example, throttle, flaps (on the wings) and the rudder.
    - ○ Advantages
        - ■ Improvement in passenger comfort
        - ■ Reduced running costs
        - ■ Improved safety
        - ■ Improved aerodynamics in front of the plane as a cockpit would no longer be necessary
    - ○ Disadvantages
        - ■ Security threats if no pilots on board
        - ■ Flight may be difficult to deal with in emergency situations
        - ■ Hacking threats
        - ■ Passenger reluctance to accept new technology
        - ■ Threat of software glitches

Potential Health Risks Related To Prolonged Use of IT Equipment

Health Risk	Cause	Elimination
Back and neck strain	Sitting in front of a computer screen for long periods of time	Use adjustable chairs, footrests, tiltable screens
Repetitive strain injury (RSI)	Damage to wrist/fingers due to continuous use of keyboard/mouse	Maintain correct posture, use correct wrist positioning, take regular breaks, ergonomic keyboards, voice activated software
Eyestrain	Caused by staring at a screen for too long or having incorrect lighting causing reflections	Use LCD screens, take regular breaks, anti-glare screens, have eyes tested on a regular basis
Headaches	Caused by incorrect lighting,	Anti-glare screens, regular

	screen reflections, flickering screens, etc	breaks, have eyes tested on a regular basis
Ozone irritation	Laser printers in offices	Proper ventilation, housed in a designated printer room, change to inkjet

Robots in Industries
- Benefits
  - Robots work 24 hours/7 days a week - cost per unit would be cheaper
  - No labour costs
  - More precision in work
  - Do not require holidays/sick leave
  - Works faster than humans - increased production rate
  - Can do tasks that are hazardous for humans
  - Less liability for injury
  - Allow humans to do other skilled work
- Drawbacks
  - Expensive to maintain/purchase
  - Deskilling of labour
  - Leads to unemployment

Chapter 6 - ICT Applications

Communication
Newsletters and posters
How they are created
Using spell checkers
- Language used could have different spellings for example, British and American English
- Names and proper nouns could be highlighted
- Similar sounding words will be be picked up from the checker
- Correct highlighted word may not exist in the dictionary

Advantages and disadvantages
Attractive newsletter

Posters
Include the following information
- What the event is
- Date, time, place
- Contact details
- Admission fee
- Any other information
- Release date
- Details of genre/story

Advantages and disadvantages

Websites
advantages and disadvantages

Multimedia presentations

Mobile communication
Text messaging
Phone calls
Video calling

Modelling
Represents a real world situation/system in a virtual form
Personal finance, bridge and building design, flood water management, traffic management, weather forecasting
Advantages
- Less expensive than having to build the real thing
- Safer to use on many occasions, some real situations are hazardous - chemical processes
- Allows you to try various different scenarios in advance

- Nearly impossible to try out some tasks in real life because of the high risk involved or the remoteness
- Faster - some real applications would take tears before finding out the real result when measuring against population growth or climate changeCan find unexpected problems
- Able to explore "what if"
- can speed things up/slow things down

Disadvantages
- Only as good as the data entered or the programming
- Sometimes a costly option as well
- People may not always trust the simulation

What data is to be collected

Robots
Advantages
- Work in environments harmful to humans
- Work non-stop 24-7
- Less expensive long term - no need for wages
- Higher productivity - no holidays, no breaks
- Provide consistency
- Do boring repetitive tasks, humans are free to do more skilled work
- Carry out different tasks by fitting with different end-effectors attachments

disadvantages
- Difficult to do unusual or one-off tasks
- Cause higher unemployment
- Risk of skills being lost
- Initial set up and maintenance can be expensive
- Not easily replaceable if robot stops working

When robots are used

School management systems
Registration and attendance record
Magnetic ID card
Biometrics
Advantages
Disadvantages
Student performance
Computer Aided Learning (CAL)
Advantages
- Students can learn at their own pace when they want to
- Allows VR to be used - full immersion
- Student can stop and continue at any point
- Possible to retake tests until the student reaches the required level
- More interactive
- Makes use of multimedia

Disadvantages
- Cannot give the experience of handling laboratory equipment
- Expensive and time consuming to integrate properly
- Easily distracted while online
- Can lead to isolation
- Cannot answer unusual questions

Booking systems
Travel industry, concerts, cinema tickets, sporting events
Advantages
Disadvantages

Banking Systems and Applications
ATMs:
- Uses:
    - Withdrawing cash
    - Deposit cash and cheques
    - Check balance of account and mini bank statements
    - Money transfers and paying bills
- What atms can't do:
- How they work:
    - Insert card in machine
    - Contact is made with banks computer
    - Type in pin (unique and entered through keypad)
    - Some options are shown
    - Amount is chosen
        - Checks to see if customer has sufficient funds
    - Receipt and return
    - Money given
- Advantages
    - Can withdraw cash anytime
    - Can access account from anywhere in the world
    - Many banking services are available without going to the bank itself
- Disadvantages
    - Often in places where theft is common
    - Threat of shoulder surfing
    - Threat of card cloning
    - Cash teller jobs lost

Electronic Funds Transfer (EFT):
- Money can be transferred without physical contact / without relying on paper money
- Advantages
    - Quick
    - Secure

- - Less expensive than using cheques
  - Disadvantages
    - Cannot be reversed
    - Customer needs to have funds available
    - Cannot guarantee it gets to the correct recipient (fake ids, etc)

Transactions of credit and debit cards
- Differences between credit and debit cards
  - Credit cards
    - Customer protection if something doesn't arrive

Cheques
- Advantages
  - Convenient and safer than cash
  - Possible to stop payments if needed
  - Can be drawn anytime
  - Can be post dated
  - Can be traced if lost
- Disadvantages
  - Slow method
  - Easier for fraudsters
  - Relatively expensive
  - Can be refused
  - Not legal tender
- Centralised clearing of cheques

Online shopping and banking
- Advantages
- Disadvantages
  - May lead to social isolation
  - Many health risks caused by excessive use of tech
  - Possible security risks
  - Possible to unknowingly use fraudulent websites
  - Access to computer and internet connection is necessary
  - Return process can be complicated
- Effects on companies

Medicine
Patient and pharmacy records
Use of 3D printers
- Surgical and diagnostic aid
- Prosthetics
- Tissue engineering
- Artificial blood vessels

- Customised medicines

Expert systems
Advantages
Disadvantages
Made up of:
- User interface
- Explanation system
- Inference engine
- Knowledge base
- Rules base

Setting up
Uses

Computers in retail
Point of sale (POS) terminals
Electronic funds transfer
- Chip and pin
- Contactless cards
- Tokenisation

Online shopping
- Advantages
- Disadvantages
- Effects on companies

Recognition systems
OMR
Barcode readers
QR code readers
OCR
ANPR systems
RFID
Contactless credit/debit cards
Near field communication (NFC)
Biometric recognition systems

Satellite systems
GPS
GIS

Chapter 7 - The System's Life Cycle

Reasons for system change:
- The existing computer equipment is obsolete (cannot be repaired)
- Changes to law or taxes requiring complete overhaul of software
- More suitable hardware/software is available to improve reliability and efficiency
- Need to expand the company

Stages in a systems life cycle:
1. Analysis
2. Design
3. Development/Testing
4. Implementation
5. Documentation
6. Evaluation

Stage 1: Analysis
Step 1: Research the current system
Step 2: Identity input and output, processing and problems with the system
Step 3: User requirements for the new system
Step 4: information requirements for new system
Step 5: Identify hardware and software for new system

Research Methods
- Interviews
  - a one- to-one question-and-answer session between the analyst and the user. It is a good method if the analyst wants to probe deeply into one specific aspect of the existing system.
  - Advantages
    - Interviewee is motivated to give detailed and honest answers
    - Analyst can probe for more feedback - ask follow up questions
    - Possible to modify questions as interview proceeds (specific to interviewee)
    - Analyst can watch body language and facial expressions
  - Disadvantages
    - Time consuming
    - Expensive - many analysts required
    - Interviewee cannot be anonymous
    - Interviewees can give answers they think the interviewer wants to here
    - Interviewees may not be available when the interviewer is
- Questionnaires/surveys
  - distributing questionnaires to the workforce, clients or system users to find out their views of the existing system and to find out how some of the key tasks are carried out

- ○ Advantages
  - ■ Questionnaires can be answered fairly quickly and in their own time
  - ■ Relatively inexpensive
  - ■ Individuals may remain anonymous - can be more truthful
  - ■ Allows for quick analysis
  - ■ Many people can take part
- ○ Disadvantages
  - ■ Number of returned questionnaires can be low
  - ■ Questions are rigid and generic, not possible to ask follow up questions
  - ■ No immediate way to clarify a vague answer
  - ■ Users tend to exaggerate responses when anonymous
  - ■ Interviewees may not take it seriously if anonymous
- ● Observations
  - ○ involves watching personnel using the existing system to find out exactly how it works.
  - ○ Advantages
    - ■ reliable data obtained
    - ■ Possible to get a good overall view of system
    - ■ Relatively inexpensive as only requires the observer
    - ■ All inputs and outputs are clearly seen
  - ○ Disadvantages
    - ■ People are generally uncomfortable being watched and might perform in a different way
    - ■ If workers are performing tasks that contravene standard procedure they may not do so when watched
- ● Look at existing documents
  - ○ allows the analyst to see how existing files are kept, look at operating instructions and training manuals, check the accounts, etc. This allows the analyst to get some idea of the scale of the problem
  - ○ Advantages
    - ■ Allows information to be obtained that is not available from other methods
    - ■ Analyst can see for themselves how the current system works
  - ○ Disadvantages
    - ■ Can be time consuming
    - ■ Expensive as it is time consuming

Inputs, outputs, processing and current problems
- ● Data flow diagrams
  - ○ Can understand:
    - ■ what inputs take place
    - ■ What outputs are produced
    - ■ What processing is done
    - ■ What storage may be needed
  - ○ The analyst can understand:

- - - Any problems that could occur
    - User and information requirements
  - User requirements
    - User requirements are written by the analyst as developers and business managers (the clients) don't understand the user requirements
    - written in natural language with very few technical details
    - Their purpose is to allow the customers to check that what the analyst proposes, following the investigations, is exactly what they originally specified
    - describe what the analyst thinks the customer does with their system.
  - Information requirements
    - information needed to support the business requirements are made up of:
      - what? (that is, the data)
      - when? (that is, the timing)
  - A systems analyst turns the information and user requirements into a functional requirements specification. The requirements are typically defined as a list of:
    - who the customers are and how they interface with the system
    - who the vendors are and how they interface with the system
    - who the employees are and how they interface with the system.

Identify and justify hardware and software requirements
- Barcode readers
- Scanners
- Touch screens
- 3D printer
- Larger monitor
- Speakers
- Software
  - Applications software
  - Size of storage
  - Type of storage

Stage 2: Design
Step 1. Verification
Step 2. File and data structures
Step 3. Input formats (data capture forms)
Step 4. Output formats (screen and report layouts)
Step 5. Validation checks

Verification - to check that the data shifted is correct
Visual verification - a method of inputting data through looking at the original document and check to ensure the data entered is the same while inputting it
Double entry - two people enter the data and the computer compares the two to ensure its the same
- Advantages: faster, more reliable

- Disadvantages: more people required, more expensive

File and Data Structures
File: made up of a number of records, which are divided into fields. The primary key allows each record to be uniquely identified
Each field must be defined with: field name, field length, data type, (if) code used, primary key

Data types:
- Alphanumeric
- Character
- Text
- Boolean
- Numeric
    - Integer
    - decimal/real
    - Currency
    - date/time

Data Validation - to check that the data meets the specified criteria set
- Range - checks to see if data lies between an acceptable upper and lower value
- type/character - checks to see if data entered if of the correct type
- Length - checks to see if data contains only the required number of characters
- Presence - checks that data has been entered in a field and its not empty
- Format - checks if data is in the correct format
- Check digit - extra digit added to a number calculated from the other digits
    - Two digits have been transposed
    - Incorrect digit entered
    - Digit missed/extra digit added

Input formats - data capture forms

Output formats - screen and report layouts
- Important as it is a part of any user interface
- Size of output field should be correct
- instructions/descriptions are clear
- Full screen is utilised
- Fonts and colours make it clear
- Reports should clearly show all the fields, colours, headers and footers should be well-planned

Stage 3: Development and testing
The system is designed in modules which are combined so they can be tested
Why testing
- File structures must be finalised

- - What type of data stored in each field, length of each field, which field will be the key field, how they will be linked
    - Tested to make sure it is robust for when the system goes live
  - Ensure the data in the files is of the right type
    - Verification and validation routines to trap unwanted data and move the original data accurately
  - How the hardware will be used in the final system
    - Testing for user-friendliness and to ensure the correct output is associated with the inputs

Test designs
- Data structure - tests to see if all data is in the correct format or stored correctly
- File structure - tests to see if file structures function correctly (eg. data can be easily retrieved)
- Input formats - tests that all data can be entered into the system correctly
- Output formats - screen outputs and reports are in correct format (output is clear, complete and matches input data)
- Validation routines - determines what data is needed to see if all the validation rules work (checks to see if system rejects incorrect data)

Test strategies
- Software is often developed in modular form which allows it to be broken down into smaller parts called modules. Each module is developed separately
- Each module is tested separately and any resulting problems are modified and its tested again
- The modules are put together to test for data clashes, incompatibility, memory issues, etc
- If necessary, input and output methods are improved and then the whole system is tested again before it uses live data

Test plan for modules
- List all tests that need to be performed
- What data is to be used in testing
- What type of testing the data is designed to check
- What live data should be used
- What expected outcomes from testing are
- actual outcomes match expected?

test data
- Normal data - acceptable data with a known outcome
- Extreme data - data at the limits of acceptability
- Abnormal data - data outside the limits of acceptability and should be rejected/cause an error message

Stage 4: Implementation
Transfer of files from old to new system
- Scan in documents
- Key in data
- Download files to new database

Changeover to new system
- Direct changeover
    - Old system stopped overnight and new system introduced immediately
        - Advantages: benefits are immediate, costs are reduced
        - disadvantages: can be disastrous if new system fails as old system is unavailable
- Parallel running
    - Two systems run side by side for a while before new system takes over
    - Advantages: Best method for a large organisation - giving employees time to adjust to a new system, lowest risk
    - Disadvantages: Most expensive, more time consuming than direct
- Pilot implementation
    - New system is introduced into one branch of the company and its performance is assessed before its introduced elsewhere
    - Advantages: if new system fails only one part is affected, possible to train staff in only one area (less costly, faster), only one part of the system is used - cost less
- Phased implementation
    - Only part of the new system is introduced and when it works satisfactorily, the next part is introduced until the whole system is replaced
    - Advantages: failure not disastrous, possible to ensure system works properly before expanding
    - Disadvantages: expensive - evaluation for each stage, time consuming

Stage 5: Technical documentation
Needed for:
- Modifying the system at a later stage
- End user

Technical documentation
designed to help programmers/analysts to make improvements to the system or repair/maintain the system, consists of:
- program listing/coding
- programming language used
- program flowcharts/algorithms
- system flowcharts
- purpose of the system/program/software
- limitations of the system
- input formats

- hardware requirements
- software requirements
- minimum memory requirements
- known 'bugs' in the system
- list of variables used (and their meaning/description)
- file structures
- sample runs (with results and actual test data used)
- output formats
- validation rules
- meaning of error messages

User documentation
designed to help users to learn how to use the software or system. Consists of:
- how to load/install/run the software
- how to save files
- how to do a search
- how to sort data
- how to print out
- how to add, delete or amend records
- the purpose of the system/program/software package
- limitations of the system
- screen layouts (input format)
- print layouts (output format)
- hardware requirements
- software requirements
- sample runs (with results and actual test data used)
- error handling/meaning of errors
- troubleshooting guide/helplines/FAQs (frequently asked questions)
- how to log in/log out
- tutorials
- error messages/meaning of error messages
- glossary of terms

Stage 6: Evaluation
- Compare the final solution with the original task requirements.
- Identify any limitations of the system.
- Identify any necessary improvements that need to be made.
- Evaluate the users' responses to using the new system.
- Compare test results from the new system with results from the old system.
- Compare performance of the new system with performance of the old system.
- Observe users performing set tasks (compare old with new).
- Measure the time taken to complete tasks (compare old with new).
- Interview users to gather responses about how well the new system works

- Give out questionnaires to gather responses about the ease of use

Results
- Update on software
  - feedback from end-users
  - changes to the company structure or how the company works that may require modifications to the software
  - changes in legislation that may require modifications to the software.
- Update on hardware
  - feedback from end-users
  - new hardware comes on the market, necessitating change
  - changes within the company require new devices to be added or updated.

Chapter 8 – Safety and Security

Physical Safety

Safety Risk	*Cause*	*Prevention*
Electrocution	Spilling liquids on electrical equipment, exposed wires, damaged insulation, unsafe electrical equipment, unsafe electrics	Do not allow drinks near the computer, check all wires on a regular basis, ensure all equipment is checked by a qualified electrician, make use of an RCB
Fire hazard	Overloaded wall sockets, overheating of computer equipment, exposed wires	Increase number of wall sockets, do not cover cooling vents, clean out dust accumulation, use low-voltage equipment, ensure there is good ventilation, have fully tested fire extinguishers
Tripping hazard	Trailing wires on the floor, damaged carpets/flooring	Use cable ducts, cover exposed wires, use wireless connectivity
Personal injury	Heavy equipment falling from desks, desks collapsing	Use strong desks, ensure computers are not too close to the edge

E-Safety

Data Protection
- · Countries have some form of a data protection act (DPA)
- · Designed to protect individuals and prevent incorrect or inaccurate data from being stored
- · Failure to abide by the rules can lead to a heavy fine and even imprisonment
- · Methods of data protection:
  - o Do not leave personal information lying unattended
  - o Use passwords and user IDs which should be kept secure
  - o Do not email any sensitive information

Personal Data
- · *Examples of personal data:* name, address, email, ID card number, passport number, IP address, cookie ID, advertising identifier on a phone, date of birth, banking details, photographs of an individual

- *Examples of sensitive data:* ethnicity or race, political views, membership of a political party, membership of a trade union, religion, sexual orientation, criminal record, medical history, genetic data, biometric data

E-Safety
- The safe and responsible use of technology
- When using the internet:
  - Make sure that websites being used can be trusted look for websites including https and the padlock symbol
  - Only purchase items from websites offering secure, encrypted connections
  - Use search engines when the device settings are set to 'safe search' and the highest possible level of security
  - Only use websites recommended by teachers, parents, or trusted sources
  - Be careful about what you download
  - Log out of websites when you're done using them + remember cookies are used every time you log in
- Sending and receiving emails
  - Only open emails/attachments from known sources
  - Make sure your internet service provider (ISP) has an effective email filtering feature to ensure unknown emails are put in your spam folder
  - Only reply to an email if you know the sender
  - Check that email or website addresses are pertaining from a genuine company
  - Never include any personal/sensitive data in an email
  - Avoid sending photos of yourself
  - Beware of phishing and pharming scams
  - Use secure passwords for your account
  - Take care when forwarding emails
  - Manually type email addresses you may not spot typing errors or clues that it's not genuine
  - The unsubscribe link at the bottom of the email could be fraudulent
  - Always use BCC rather than CC or To
- Social Media
  - Do not post personal/sensitive data to people you don't know could lead to identity theft/house theft
  - Do not send photos of yourself to people you don't know could lead to identity theft
  - Use the privacy settings on social media apps so you can control who sees your account
  - Ensure none of the photos you post link you to a place
  - Ensure you don't post photos in school uniform
  - Maintain privacy settings to prevent 'non-friends' from contacting you
  - Avoid using, or forwarding messages containing inappropriate language
  - Be vigilant when using social networking sites, IMs, or chat rooms:
    - Block anyone who acts suspicious or uses inappropriate language

- Use a nickname and keep personal data secret
- Be careful with the language used
- Do not enter private chat rooms
- Never arrange to meet anyone on your own, tell an adult and meet in a public place
- Avoid the misuse of images, including forwarding images from others
- Respect people's confidentiality

· Online gaming risks
  o Predators – those who prey on others who they see as vulnerable
  o Cyberbullying
  o Use of webcams
  o Voice masking technology
  o Source of cyber-attacks – viruses, phishing, spyware
  o Violence within the game – could lead to violence in reality

Security of Data

Hacking

· The act of gaining unauthorized/illegal access to a computer system
· Effect
  o Can lead to identity theft or the misuse of personal information
  o Data can be deleted, changed, or corrupted on a user's computer
· Methods of prevention
  o Use of firewalls
  o Use of strong passwords and user IDs
  o Use of anti-hacking software

Phishing, Vishing, Smishing

· The creator sends legitimate-looking emails to target users with a link attached. When the recipient clicks the link, they are sent to a fake website where they are fooled into giving personal information
· Often look legitimate by copying large companies, such as online stores, banks etc
· Effects
  o The creator of the email can gain personal data, such as bank account data or credit card numbers
  o Can lead to fraud or identity theft
· Methods of prevention
  o Many ISPs or web browsers filter out phishing emails
  o Users should always be cautious when opening emails/attachments
  o Don't click on executable attachments that end in .exe, .bat, .com, .php
· Smishing SMS phishing
  o Fake text message containing a URL or a telephone number
· Vishing voicemail phishing
  o Voicemail message to trick the user into calling the number

Malware

· One of the biggest risks to the integrity and security of data on a computer system. There are many forms.

· Viruses
  o A program code or software that can replicate itself with the intention of deleting or corrupting files on a computer
  o Often sent as email attachments and reside on infected websites or software downloaded on the recipient's computer
  o Effects
    ● Can cause the computer to 'crash' – stop functioning normally or become unresponsive
    ● The software can delete files or data
    Can corrupt files, making the computer run slowly
  o Methods of prevention
    ● Install anti-virus software and update it regularly
    ● Don't use software from unknown sources
    ● Be careful when opening emails or attachments from unknown senders
    ● Run an up-to-date virus scanner

· Worms
  o Type of stand-alone virus that can self-replicate
  o Spread viruses to whole computer networks and frequently arrive as message attachments
  o Do not need an active host program to do damage – remain inside applications which allows them to move through the network
  o Replicate without targeting specific files – rely on security failures

· Trojan Horse
  o Malicious program disguised as a legitimate software but contains malicious instructions embedded within it – replaces all or part of the legitimate software to do harm to the user's computer
  o Usually arrive as an email attachment or download from an infected website
  o Once installed, it gives cyber criminals access to personal information; spyware and ransomware are often installed

· Key logging software
  o A form of spyware that gathers information by monitoring a user's keyboard activities
  o The stored keystrokes are emailed to the cybercriminal and its designed to capture web browsing and personal data
  o Can be detected and removed by anti-spyware software

· Adware
  o Floods the end-user with unwanted advertising
  o Not necessarily harmful but
    ● Can highlight weaknesses in a user's security defenses

- ● Difficult to remove – defeat most anti-malware software
- ● Hijack a browser and create its own default search requests
- · Ransomware
  - o Programs that encrypt data on a user's computer and hold the data hostage
  - o The cybercriminal waits till the money is paid and then a decryption key is usually sent

Card Fraud
- · The illegal use of a credit/debit card
- · Shoulder Surfing
  - o Someone watching you key in data, such as your pin
  - o Someone listening while you give card details over the phone
  - o Use of tiny digital cameras
  - o Prevention:
    - ● Use a hand to shield entering your pin
    - ● Never key in data on your phone in a public place
    - ● Make sure no security cameras can catch you entering personal data
- · Card cloning
  - o a skimmer captures data stored in the magnetic stripe of a card, can be placed in ATM slots and then copied onto a magnetic strip of a fake card
  - o newer cards use shimmers. Prevented by regular checks of unusual activity
- · Key logging
  - o used to detect key presses - credit card number, cvv (security code), PIN

Protection of Data
Biometrics
- · Relies on certain unique characteristics of human beings

Biometric technique	Advantages	Disadvantages
Fingerprint scans	High accuracy, easy to use, one of the most developed, relatively small storage requirements	Can be intrusive – still related to criminal identification, can make mistakes if skin is dirty/damaged
Signature recognition	Non-intrusive, not time consuming, relatively low cost	Consistent signature is required, error rate
Retina scans	Very high accuracy, no known way to replicate a person's retina pattern	Very intrusive, can be relatively slow, can be expensive

Iris recognition	Very high accuracy, verification time is less	Very intrusive, uses a lot of memory, very expensive
Face recognition	Non-intrusive, relatively inexpensive	Affected by changes in lighting, person's hair, age, spectacles
Voice recognition	Non-intrusive, verification takes less time, relatively inexpensive	Person's voice can be easily recorded, low accuracy, illness can change the voice

Digital certificates
- A pair of files stored into a computer that ensures the security of the data sent over the internet
- Divided into a public key and a private key
- Consists of: sender's email, name of certificate owner, serial number, expiry date, public key, digital signature of certificate authority

Secure sockets layer (SSL)
- Type of protocol tool that allows data to be sent and received securely over the internet
- When a user logs onto a website, SSL encrypts the data, so only the user's computer and the web server can understand what's transmitted.
- SSL is being applied when you see the https or the padlock symbol
- SSL certificates are small data files that digitally bind an encryption key to an organization's details
- Examples: online banking, online shopping, cloud storage, emailing, instant messaging

Encryption
- Used primarily to protect data incase it's been hacked or accessed illegally
- Does not prevent hacking but makes the data meaningless
- Uses a secret key that changes the characters in a message, making it unreadable unless the recipient has the same key

Firewalls
- Can be software installed on a computer or hardware and usually sits between a computer and an external network
- Keeps potentially destructive forces away from a user's computer by filtering incoming and outgoing traffic, the criteria for allowing or denying access to a computer can be set by the user
- tasks include: examine traffic between user computer and external networks, check whether incoming, outgoing data meets a set of criteria, can block traffic if checks fail and give the user a warning there may be a security issue, can log all traffic, prevent viruses and hackers from entering the network

Chapter 9 - Audiences

Key factors when creating a presentation:
- Language used
    - Use of technical term - experienced audience
- Need for multimedia
    - Do not overdo - too many distractions
    - Better for young audience and complicated descriptions - graphics or animations
- Length of presentation
    - Only work if interesting and very young audiences can get bored
- Need for audience participation
    - Asking questions and asking the audience but not everyone wants to participate
- Examples used to illustrate certain points
    - Be understanding - eg don't refer to meat products when presenting to vegetarians

What to consider:
- Age group
- Experiences of the audience
- Expectation of the audience - appeal to the likes of the audience
- Knowledge of the audience

How to find the characteristics of the audience:
- Interview cross section of the target group
- Find out how to engage the audience
    - Major ict solution - techniques from chapter 7
- Questionnaires and online surveys
- Analyse data - draw conclusions

Examples of factors in a presentation
- small/big font size
- Formal font style
- Formal content
- Pastel shade colours - easier to read
- Bright colours - engaging
- Use of both upper and lower case characters - easy to read
- technical/appropriate language
- Fewer images and more text or vice versa depending on audiences
- Use of colour/not
- Plain and simple backgrounds
- Appropriate/simple images

Audience characteristics:
- Age
    - Young - animation, bright colours, large font size, sound
    - Older - more content, simple attractive colour scheme, easy to navigate
- Income levels

- - ○ Consider target audience to choose what will be included
  - Interests
  - Disability and impairments

Why consider the needs of the audience:
- Necessary to hold the attention of the user so they continue to use the website
- Attractive designs - attract more users
- Keeping interfaces clear and easy to use keeps people engaged
- Lots of typing can be frustrating
- If another reason is needed, just give an example from above

Copyright - The right to copy or reproduce
It is illegal to:
- Make a copy of the software and then give it away to a friend or colleague
- Use a software on a network or multiple computers unless a licence is acquired to do so
- Use coding or code from a copyright software in your own software and pass this on or sell it as your own without permission from the copyright holders
- Rent out a software package without permission from the publishers
- Use the name of the copyrighted software on your own software and sell this as your own without an agreement to do so

Software piracy - illegal copying of software
- Big issue of software companies
- Take many measures to prevent it

How to protect software and preventing piracy
- Making the installer agree to certain terms and conditions
- Methods which require the original software present for it to work
- User is asked in to key a unique reference number or product key which was supplied with the original copy of the software
- Hard copy - sticker comes informing it is illegal to make copies. Label is in the form of a hologram, indicating it's a genuine copy
- Some will only run if the CD, DVD, or memory stick is already in the drive which prevents the use of software across multiple computers/network
- Some only work if a dongle is plugged into a usb port
  - Dongle used to allow wireless communication with devices such as keyboards

Why copyright is important
- Someone else cannot copy your work without permission
- Can be sold, traded or inherited by others
- You legally own the content published
- It's your decision whether to let other people use it or not
- Supports the original producers

Moral implications when creating an ICT Solution
- What may be immoral in some cultures might be acceptable in others
- Something immoral might not be illegal
- The solution can cause distress or be offensive
- It is immortal if the person gains from their actions

Chapter 10 - Communication

Communication through Email:

Email Laws

- ○ Require opt-in permission before email is sent out
- ○ Company or individual must have a clear way to opt out
- ○ Must provide subscribers with a clear way to unsubscribe from listings
- ○ Companies and organisations must make their privacy policies very clear to subscribers
- ○ Don't allow organisations to harvest email addresses
- ○ Valid postal address must accompany emails from organisations
- ○ Not sent out with false or misleading subject lines

Unacceptable Language

- ● Obscene images
- ● Languages that are regarded as abusive, profane, inflammatory, cohesive, blasphemous
- ● Racist, exploitative or violent messages
- ● Use of illegal materials or messages

Employee Guidelines

- ● Any company must publish guidelines for electronic communication
- ● Must indicate how they ensure how their staff follows the rules
    - ○ employees can use a company's email system for business use - companies to decide if personal emails should be permitted
    - ○ may specify which company devices are allowed to be used for sending and receiving emails
    - ○ acceptable style and tone of emails
    - ○ It must be made clear what email content is not permitted
    - ○ only use their own accounts when sending emails and these accounts should be password protected
    - ○ clear rules regarding confidentiality of information and that all staff must be aware of their contractual obligations
    - ○ method and duration of storing emails
    - ○ Incoming emails should only be read by the recipient; they can only be read by another member of staff if so nominated
    - ○ company policy on how to deal with and prevent viruses (and other security threats)
    - ○ Monitoring of emails may be carried out and staff must be aware that the company has the right to read all emails

Security and password protection

- ● Using strong passwords
- ● Changing passwords on regular basis
- ● Using spam filters to remove certain suspicious emails to a junk folder
- ● Running antivirus and antispam software

Netiquette

- ● Do not be abusive - do not threaten people or use personal violence

- Do not send spam
- Be clear and succinct
- Check spelling and grammar
- Respect privacy
- No capital letters or highlighted comments
- Do not plagiarise
- Do not use too many emoticons

Email groups
- Easier to send out multiple emails if the addresses are grouped together
- Companies can group for marketing purposes - according to age, hobbies, etc to target specific audiences
- Spammers create email groups by buying addresses of people from companies or software 'raids' of address books - several thousands can be spammed
- Used to set up meetings to ensure everyone is invited to attend and no one is forgotten

Other email operations
- Carbon copies (cc) - those on the "to" list are main recipients and the "cc" list are interested parties
- Blind carbon copies (bcc) - address details are invisible to everyone except the bcc recipient
- Forward - should be done with care as some ISPs do not recognise the true source of emails so forwarded emails could reach spam. Some ISPs have filters based on email volumes with just one address, this could lead to your email being blacklisted
- Attachments - treat with caution spam, phishing scams which might contain malware that can affect your computer. Emails are not meant to withstand big attachments, so use a zipped file, or upload the files and then create a link.

Characteristics and effects of spam
- Uses up people's time
- Annoys people
- Uses up valuable bandwidth on the internet, slowing it down
- Can have viruses attached or be part of a phishing scam
- Can clog up inboxes

Constraints in sending an email
- Abide by the laws within the country that affect the general use of emails
- Use acceptable language
- Abide by copyright
- Follow local guidelines set by the employer
- Use appropriate security
- Follow netiquette
- Respect privacy
- Be aware of need for password protection
- Be aware that email accounts can be illegally accessed

Effective Use of the Internet
Difference between the internet and the World Wide Web

Internet	World Wide Web (WWW)
Users can send and receive emails	Collection of multimedia web pages and other information on websites
Allows online chatting - text, video, audio	Uses https protocols to send HTML documents
Uses transmission protocols (TCP) and internet protocols (IP)	Uniform resource locators (URL) are used to specify location of web pages
Worldwide collection of interconnected networks and devices	Web resources accessed by web browsers
	Uses the internet to access information from web pages

Intranets
A computer network based on internet technology but designed to meet the internal needs for sharing information within a single organisation.
● Reside behind a firewall and are only accessed by members of the company (internally) or external people given various levels of access
Why the intranet over the internet
● Safer - less chance of external hacking and viruses
● Easier to prevent external links (eg certain websites)
● Ensure that all information is specific to audience needs
● Sensitive messages will remain within the company
● Offer better bandwidth than internet - fewer connection limits
Extranets allow intranets to be extended outside the organisation but with the same advantages

Comparison between internet and intranet
● Similarities:
    ○ Both are networks
    ○ Both are used to share data through the network
    ○ Both use standard internet protocols for connection (IP, HTTP, TCP)
● Differences:
    ○ Intranet used to give local information relevant to the company or organisation whereas internet covers everything
    ○ Possible to block out certain websites in the intranet which is difficult through the internet
    ○ Intranet often requires a password and user ID, and can only be accessed by authorised computers, people while the internet can be accessed by anyone
    ○ Intranet is behind a firewall which provides security against hackers/viruses while the internet is not as safe
    ○ Information on the intranet is usually stored on local servers

Features of the internet
- Blogs
  - Personal internet journal where the writer types their observations about a topic
  - Updated regularly, organised in reversed chronological, public usually, single author usually, cannot be changed by others
  - Microblogs allow short frequent posts - personal profiles on social media
- Wikis
  - Allow any user to create and edit their web pages using any browser - supports hyperlinks and uses a simple syntax called a wiki markup to create pages
  - Anyone can edit, many authors involved, possible to organise in any way, shows document history, easily edited, allows many large documents to be seen by many
- Social networking sites
  - Focus on building online communities of users with similar interests
  - Each member provided with free space, can build private and public profiles, can have photos and videos, can have text messages, possible to write on others walls, free instant messaging and video chatting, invite people, members have access control
- Forums
  - Moderated forums - online discussion forum, posts are controlled or monitored by an administrator, those who break the rules are banned, filters out inappropriate posts, rules and policies
  - Unmoderated forum - online discussion forums, no administrator, posts are not monitored, relies on voluntary code from users, people write what they want, no rules

Functionality of the internet
- Internet Service Provider (ISP)
  - Company that provides users with internet access - has the equipment and telecommunication lines required
- Web addresses, uRLs, hyperlinks and web browsers
  - A software that allows a user to display a web page on their computer screen, they interpret HTML from websites and show the result
  - Home page, store favourite sites, history, navigate through many sites, hyperlinks-naviagte web pages
  - Use URL - uniform resource locator to access websites, files, etc they are text addresses used to access website
  - protocol://website address/path/filename

Opening websites
- from a URL
- From a search engine
- Use a web address
- Type what you need in search bar

Using the internet to find information
- Advantages
  - Up to date - quicker and easier to amend web pages
  - Vast, almost limitless amounts of information
  - Fast to access information
  - Information increases all the time
  - Communication over long distances is possible/like minded people can find each other
  - Easy for most to use
  - Allows social networking
  - Searching for information using a search engine is fast and easy
  - Can look for information from home - no need for travel
  - Essentially free of charge
  - Pages can have multimedia elements that make learning more interesting and understanding easier
- Disadvantages
  - Not regulated - anything may be biassed or incorrect whiles books usually undergo some form of review before publishing
  - Always the risk of accessing inappropriate websites
  - Too easy to be distracted
  - Information overload if user lacks expertise with using search engines
  - Huge temptation to plagiarise
  - Research skills are lost
- Why it's not always fast
  - Information overload - without specific criteria it can take a while to obtain relevant information
  - Search results may not be what the user is looking for
- How to evaluate information found
  - Reliable source
  - Grammatically correct and free of spelling errors
  - Objectivity
  - Information dated - when it was last updated and by whom
  - Arguments supported by evidence
  - Does the website look legitimate

Internet Protocols
Sets of rules agreed by the sender and receiver when data is being transferred within devices
- Http - hypertext transfer protocol - a set of rules that must be obeyed when transmitting website data over the internet
  - When some form of SSL or such certificate is used its changed to https
- Ftp - file transfer protocol - network protocol used to transfer files from one computer to the other over the internet
  - Similar to http but specific to transfer of files

- SSL - secure socket layer - protocol that allows data to be sent and received securely over the internet
  - Designed to work with communication protocols like http and ftp
  - When used with http a user logs onto a website as normal but the ssl encrypts the data and only the users computer and the web server can be sense of whats transmitted
  - Padlock or https

Internet control

PRO

- Prevent illegal material being posted on websites as people would find it easier to find information such as how to be a hacker
- Prevent children and vulnerable groups being subjected to undesirable websites
- Stop incorrect information from being published

CON

- Material on websites is available from other sources
- Expensive to police all websites
- Difficult to enforce on global scale as different countries have different laws
- Goes against freedom of speech
- Some laws already exist to deal with offenders
- Who is to decide what is illegal and offensive? Different things are offensive to different people