

Computing

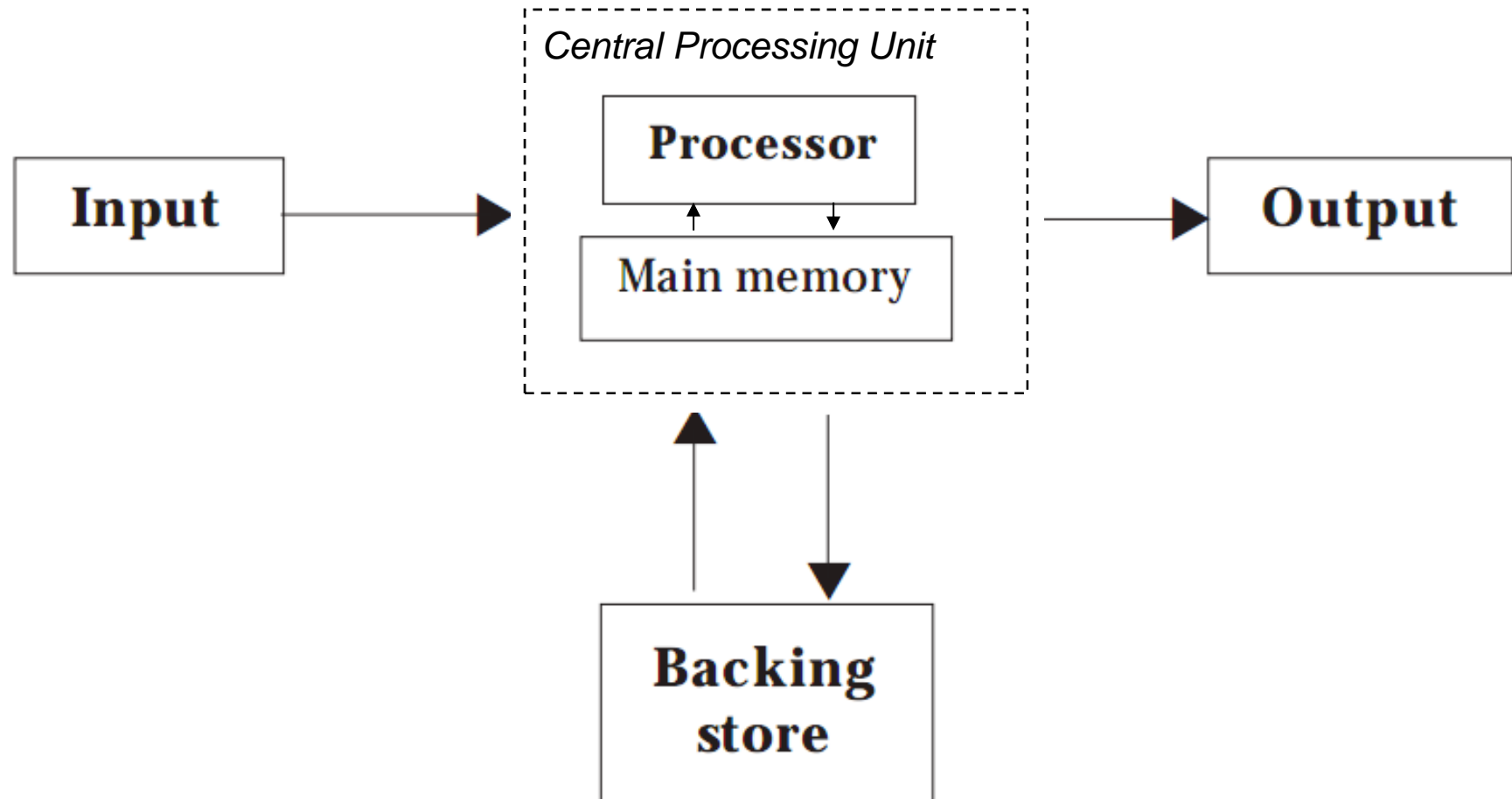
S3 Notes

Information system Design and Development

- Components of a computer
- Computers are data processing machines.
- Data is fed into them and, after processing, the output is useful information



The 5 Block Diagram



Peripherals

(Input, Output and Backing
Storage devices)

Input



Input

- Keyboard
- Mouse
- Microphone
- Digital camera
- Digital video camera
- Webcam
- Scanner
- Joystick
- Graphics tablet
- Whiteboard
- Touch sensitive screen

Storage



Backing Storage

- **Magnetic Media**

- Floppy disk
- Hard disk
- Magnetic tape

- USB Flash Drive

- **Optical Media**

- CD ROM
- DVD ROM
- CD-R
- CD-RW
- DVD-R
- DVD-RW

Output



Output

- Laser printer
- Inkjet printer
- Plotter
- Monitor
 - Liquid Crystal Display
 - Thin Film Transistor
- Speakers
- Headphones
- Data Projector



Types of system

Desktop



- Computer commonly used in homes or offices by one person at a time
- Has a powerful processor and large amount of memory
- Has keyboard, mouse and monitor
- Will use internal hard drive for storage
- May use other peripherals

Laptop



- A portable computer which can work from batteries
- Has built in LCD screen, keyboard and touchpad pointing device
- Has powerfull processor and large amount of RAM
- Used by one person at a time
- May use other peripherals

Tablet

Mainframe



- An enormous computer - may be the size of a room or more - used by many people at the same time, connected to the computer via terminals
- Has a very very powerful processor and vast amounts of RAM
- Will use multiple backup hard drives and may also use other backup devices such as magnetic tape

Embedded systems



- A computer system which performs a specific function within a device
- E.g.
- Anti lock braking system in a car
- Microwave oven controller
- Security system in a building

- Has a clear and well defined task which cannot be reprogrammed

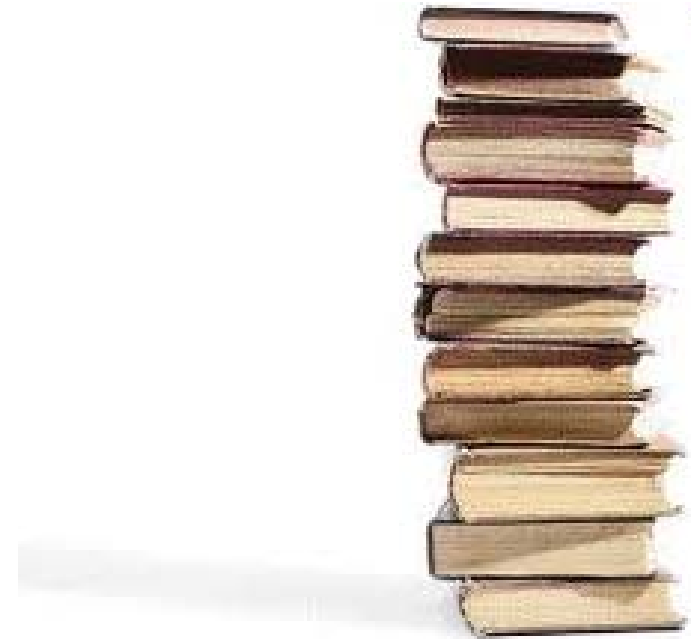
Embedded System



- Likely to be relatively simple processor
- Inputs may be from sensors
- Outputs may be alarm sounders, LED panels, or simply controlling the device
- Will have very little memory and very little or no backing storage



Storing Information



Storing Information

- The computer stores information using electricity

- Electricity **on** means 1



- Electricity **off** means 0



- Each one or zero is called a **binary digit** or a **bit**

Storage Capacities

- 1 Bit – either 1 or 0 = On or Off
 - 1 Byte = 8 Bits
 - 1 Kilobyte = 1024 Bytes
 - 1 Megabyte = 1024 Kilobytes
 - 1 Gigabyte = 1024 Megabytes
 - 1 Terabyte = 1024 Gigabytes
 - 1 Petabyte = 1024 Terabytes
-
- B B K M G T
 - Bad Boys Kiss Many Girls Terribly Passionately



Memory



- Two types of memory RAM and ROM
- RAM
 - Random Access Memory
 - Users' programs and data
 - Lost when power off
- ROM
 - Read Only Memory
 - Instructions to start up the computer
 - Cannot be changed
 - Kept when power off

Every “space” in memory has a Unique Address so the processor can find information

Units

- Clockspeed - measured in MHz and GHz
- RAM - measured in Kb, Mb, Gb
- Hard drives - measured in Mb, Gb, Tb



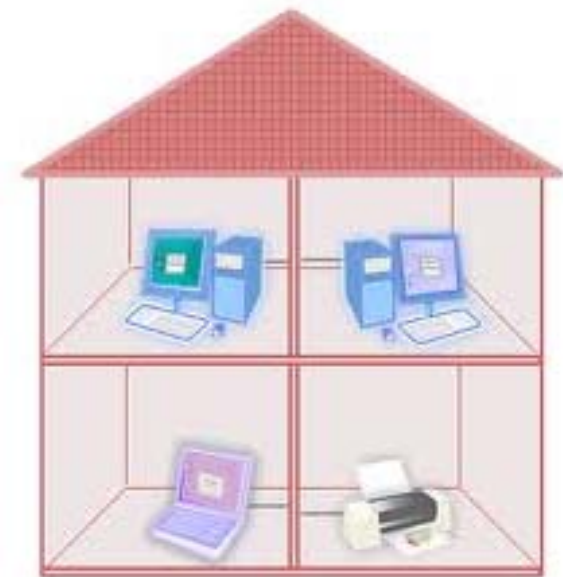
Networks

Networks

- A network is two or more computers or devices linked together
- Networked computers can communicate with each other and may be able to share files and/or other resources e.g. peripherals (scanners, printers).

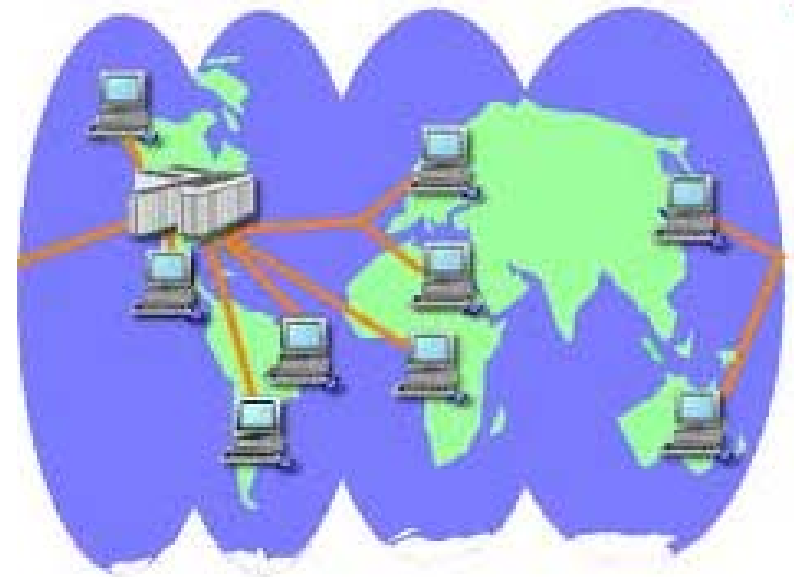
Local Area Network

- Small area - building or campus
- Share resources
 - Printer
 - Files
 - Applications
- Different levels of access
- Ease of backup



Wide Area Network

- Large area - may be worldwide
- Communications
 - eMail
 - Live chat
 - Video conferencing
 - Database access
 - eCommerce
 - Entertainment

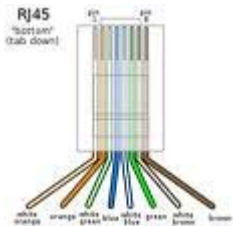


Connections

- **Local Area Network**
 - Twisted pair
 - Co-axial cable
 - Fibre Optic
 - Wireless
- **Wide Area Network**
 - Telephone network
 - Cable (Sky, Virgin)
 - Satellite

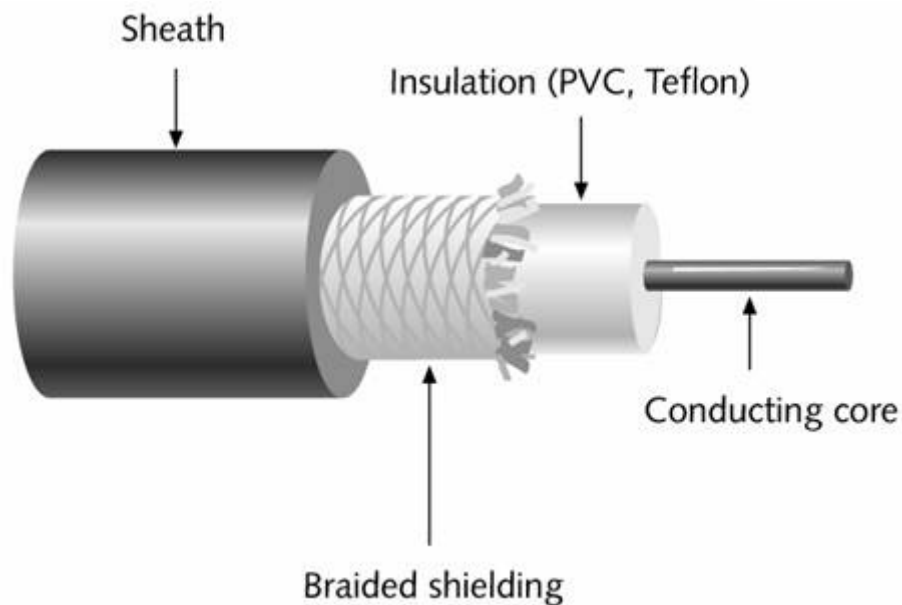


Copper Cables - Twisted Pair CAT5



- Four pairs of fine copper wires (8 wires in total)
- Pairs are twisted to reduce interference
- Data signals are sent as electrical signals along wires

Copper Cables - Co-axial



- Single solid cable in centre used to transmit data
- Fine wire sheathing helps reduce interference

Fibre Optic

- Data sent as light pulses along fine fibre-optic cables in centre
- Plastic sheathing to prevent damage to the fibre optic cables
- Unaffected by interference
- Expensive



Wireless

- Data is broadcast and received wirelessly
- Range can be limited
- Interference can be caused by buildings or other electrical equipment



Reasons for increased use

- the falling cost of telecommunication technologies and services
- shared access to expensive equipment
- the geographic spread of organisations
- demand for up-to-date information

Security Risks

- A **virus** is a **harmful program** written by a programmer which can cause **damage** to your computer system. It is a program that makes copies of itself and attaches itself to programs you have installed on your computer and then damages your system. **Viruses** can be **downloaded** by accident from the **World Wide Web** or through an **email** attachment. It is against the law to distribute a computer **virus** and if somebody was caught doing so, they could be imprisoned under the **Computer Misuse Act**.

Security Risks

- A **Worm** is similar to a virus, a worm is a program that makes copies of itself and then spreads through a network, damaging systems as it goes along. A worm keeps replicating until it fills up the piece of hardware that it is replicating on such as **RAM** or a **hard disk drive**. This will cause the computer to run programs very slowly or crash.
- A **Trojan** is a program that looks harmless and tricks you into running it on your computer. It then carries out its real task, for example, displaying adverts on the screen or installing unwanted toolbars. Trojans can also come in the form of RAT's (Remote Access Trojan's). A RAT gives control of your computer to a hacker.

Security Risks

- **Phishing** is an attempt to get your personal information such as your bank account details. The hacker will send out a fake email with a link that takes the user to a fake website that looks like your own banks. The hacker will use a key-logger to steal your username and password.
- A phishing e-mail often asks the users to “update” their information at the phisher's website. The sender is attempting to **trick** the recipient into **revealing account confidential information**.
- Spelling and grammar mistakes are common in phishing emails because most of them originate from foreign countries, particularly eastern Europe where the English language is less common. Grammar errors also make it a bit easier for these messages to bypass "junk mail" filters.

Security Risks

- **Spyware** programs gather information about you from your computer without your knowledge.
- This can be personal information, or information about which websites you have visited. Some spyware can also change your computer settings.
- Spyware does not necessarily spread in the same way as a virus or a worm because infected systems generally do not attempt to transmit or copy the software to other computers. Instead, spyware installs itself on a system by deceiving the user.
- When the user navigates to a Web page controlled by the spyware author, the page contains code which attacks the browser and forces the download and installation of spyware.
- A **key-logger** is a program designed to track and monitor user keystrokes, often used to steal passwords, credit card numbers, etc. Used often in phishing techniques.

Security Risks

- **Online Fraud** is the use of Internet services or software with Internet access to take advantage of users, for example by stealing personal information, which can often lead to identity theft. Internet fraud can occur in chat rooms, email, message boards, or on websites.
- **Identity Theft** is when people steal your personal details such as bank account details, Facebook profile details and pretend to be you.
- A **Denial of Service attack** (DoS attack) is an attempt to make a machine or network resource unavailable to its intended users. It generally consists of the efforts of one or more people to temporarily interrupt or suspend services of a server connected to the Internet.
- The hackers who carry out these DoS attacks typically target sites or services that rely on the Internet and their servers being up and running in order to do all of their business. Companies such as eBay and Amazon, Twitter and Facebook, etc.
- One common method of attack involves flooding the target machine with lots of communications requests, so much so that it cannot respond to the real traffic of its traffic customers. This causes the server computer to eventually crash.

Security Precautions

- **Anti-Virus software** will **scan** your machine when you want it to and check for signs of a **virus**. It will also **monitor RAM**. If a **virus** is identified, it will move it to a safe area of the disk where it can be deleted by the **user**.
- **Anti-virus software must be kept up-to-date.**
- **Firewall software** will **block** certain **incoming** and **outgoing connections** to your computer making it very difficult for a **hacker** to gain access to the **files** on your computer from another location.
- When a **firewall** is first used, the **user** needs to decide what **programs** they want to access the **Internet**.

Security Precautions

- A **password** is a secret word or collection of characters that is used for user authentication to prove identity, or for access approval to gain access to a resource.
- Passwords are used everywhere now and it should be kept secret
- from those not allowed access.
- A **strong** password will use a combination of letters and numbers with some letters being upper-case. If you want to make it **really strong** add a non-alphanumeric symbol such as (!@* <> , . % ? / ').

Security Precautions

- **Biometrics** (or biometric authentication) refers to the identification of humans by their characteristics or individual traits such as their fingerprint or retina scan. Biometrics is used in Computer Science as a form of identification and access control. It is also used to identify individuals in groups that are under surveillance.

Security Precautions

- A **security protocol** is sequence of operations that ensure protection of data.
- Used with a communications protocol, it provides secure delivery of data between two parties. The term generally refers to a suite of components that work in tandem.
- Examples include:
 - The 802.11i wireless standard provides security functions for wireless local area networks.
 - For the Web, HTTPS (Hyper Text Transfer Protocol Secure) is widely used to provide authentication and encryption in order to send sensitive data such as credit card numbers to a vendor.
 - The **encryption** of sensitive content over the Internet. Data can be encrypted using a special key. More about this is mentioned on the next slide.

Security Precautions

- **Encryption** is the process of **encoding** messages (or information) in such a way that eavesdroppers or hackers cannot read the contents, but that authorised users can.
- The message or information (referred to as **plaintext** or **clear text**) is **encrypted** using an encryption program which creates a **Public Key**, turning it into an unreadable **ciphertext**. It can then be sent across the network as an email and then **decrypted** at the other end using a program which creates a **Private Key**.

Security Precautions

- **Security Suite** is a collection of software utilities that protect a user's computer from viruses and other malware. They are managed by a single control panel interface that displays all the functions, antivirus and firewall are typically the primary elements.
- Other functions include antispam, parental controls, Web site authentication, password storage and protection against identity theft. Backup and computer tune-up may also be part of the collection. Since a security suite addresses a comprehensive range of security factors and manages the regular update and monitoring it require a security suite offers peace of mind amid a growing array of risks that increase exponentially as more PCs become accessible through the Internet.

Legal Implications

- **The Computer Misuse Act:** This Act was passed by Government in order to make it illegal to do the following on a computer over a **network**:
 - The spreading of computer **viruses**.
 - Access another computer without that computer **users** permission (**hacking**).
 - If a **user** is caught doing any of the above, they could be sent to prison.

Legal Implications

- **The Copyright, Designs and Patents Act:** This Act was passed by Government in order to make it illegal to do the following:
 - Copy and distribute **software** that they have not paid for.
 - Copy and distribute picture, **audio** and video **files** that they have not paid for.
 - Steal someone else's idea and pretend that it is theirs.
- If a **user** is caught doing any of the above, they could be sent to prison.

Legal Implications

- **The Data Protection Act:** This Act was passed by Government when companies started to hold more and more personal information on their customers. Companies must register with the **Data Protection Act** if there are keeping personal information such as names and addresses on their customers and must not distribute it amongst other companies without the customers permission.

Legal Implications

- **The Health and Safety (Display Screen Equipment):** This act came into force on 1st January 1993. The Health and Safety (Display Screen Equipment) (DSE) Regulations govern the safe use of computers used for work. The regulations set the standards for equipment, dealing with:
 - Adequate lighting, including adequate contrast with no glare or reflections
 - noise minimisation
 - Comfortable temperature and humidity
 - Reduction of radiation to negligible levels
 - Software which is appropriate to the task and user, provided feedback on system status
 - Adjustable, readable, glare/reflection free screen with no flicker
 - Usable, adjustable, detachable, legible keyboard - with space to support hands and wrists
 - Glare-free work surface with adequate space for all necessary arrangements
 - Adequate leg room and clearance under desk
- The regulations also recommend that employers provide education and training in the health and safety aspects of computer work.

Environmental Impact – Making and Using

- Making and running a computer uses up **a lot** of **resources**. These include:
 - Fossil fuels – Oil and Gas
 - Water
 - Chemicals
- A UN study demonstrated that making one computer uses more than **240kg** of fossil fuels. The weight of fossil fuel required to make one desktop computer amounts to **more than 10 times its weight**.
- Since burning fossil fuels adds to climate change and more and more computers are made each year, the production of computers has a **considerable** impact on the environment in terms of the energy resource needed alone.

Environmental Impact - Disposal

- Since computers are made up of different materials when they are discarded they can release toxins into the environment which have the potential to pollute drinking water as well as the air that we breathe. The following materials can be found in computers:
 - Plastics
 - Glass
 - Steel
 - Gold
 - Lead
 - Mercury
 - Cadmium
 - Fire retardant chemicals
 - Bromine
- All our devices are capable of emitting hazardous chemicals each of which can cause serious pollution on its own with combinations of chemicals often mixing to become more toxic.
- Burying such equipment underground means that the water table becomes heavily polluted. In fact a single computer complete with monitor, speakers, mouse and keyboard is capable of polluting 50,000 gallons of water.

Environmental Impact – Carbon Footprint

- The global computing industry is starting to rival aviation (airplanes, etc) in its contribution to global warming. Currently, Information Systems contribute to 2% of global carbon emissions and thus global warming and this is growing fast. The computing sector has been criticised over energy consumption and the carbon emissions of huge data centers which provide cloud computing.
- The computing sector will increase its carbon emissions by 6% a year, because of demand by consumers for computing hardware, software and services. Personal computer ownership will quadruple to four billion devices by 2020, with emissions doubling, according to a 2008 report by The Climate Group.
- Digital waste has grown as storage of data, such as e-mails, pictures, audio and video files have shifted to the online sphere (cloud computing). The advent of web services that allow users to upload files has made it possible to leave behind (most likely in landfills) tapes and discs and instead throw all of our recorded information into one big digital cloud of computers.

Internet & World Wide Web

- World wide network of connected networks
- Internet : Hardware - the many interconnected servers
- World Wide Web : the software, web pages, games available on the Internet



World Wide Web



The Internet

- The Internet is made up of many computers connected together around the world.
- The World Wide Web is the collection of all the web pages which are available to view via the Internet.



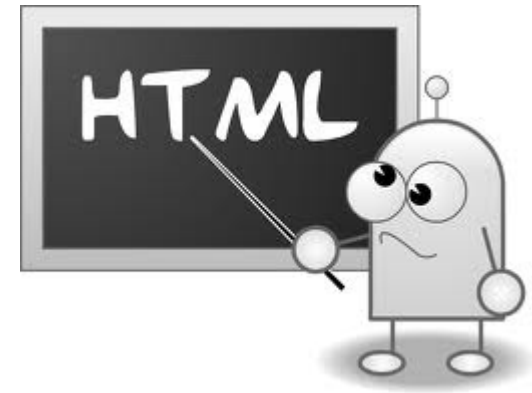
Web pages



- Web pages are just files of text.
- You can write a web page using a simple text editor such as notepad.
- You can also use special web editing programs such as Taco, DreamWeaver, FrontPage



Web Pages



- Web pages contain the **information** that will be displayed.
- And **instructions** about HOW the information should be displayed.
- They are written in **HTML**
(Hyper Text Markup Language)

Web Pages

- A web **Browser** program such as Firefox, Safari, Internet Explorer or Chrome displays the information on screen and uses the instructions to format it.

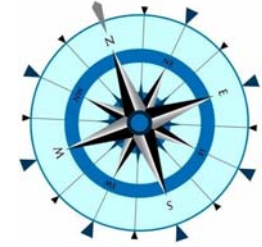


Web Pages

- Every web page has a Unique Address called a URL (Uniform Resource Locator)
- E.g. <http://www.jghs.edin.sch.uk>
- http is the *protocol* used to read the URL
- www.jghs.edin.sch.uk is the *Domain*
- .uk is the *Top Level Domain*



Navigating



- Users can move from one website URL to another by
 - Typing the URL into the browser address bar
 - Clicking on a hyperlink
 - Use browser forward and back buttons
 - Bookmarks
 - History

Web Pages

- The instructions are called TAGs and each tag is written inside angle brackets < >

<head>

<title>

<body>



Most tags also have a closing tag e.g.

</head>

Tags

- `<p />` new paragraph
- `
` new line
- `<table>` table
- `<tr>` table row
- `<td>` table data
- `</td>` `</tr>` `</table>`

Tags

- `<h1>` This is a main heading `</h1>`
- `<h2>` This is a sub heading `</h2>`
- `<h4>` This is a minor heading `</h4>`
- `<h7>` This is the smallest heading `</h7>`

Styles

- We can define Styles which will control how parts of the page look and are coloured
- The `<style>` tag goes inside the `<head>` area

Styles

- `Body {background-color: FFFF00;}`
 - Sets the background colour of your page
- `H1 { color: 00FF00;
text-align: center;
font-style: bold;
font-family: Helvetica;}`
 - Sets up how your main heading will look

Linking pages

- If you have one page called Index.html and another one called S3.html you can create a link from Index to the S3 page

- `< a href = " S3.html " > S3 page < / a >`

- The file it links to

- The text that will appear underlined

Images

- You must save your image file as a JPG or GIF in the same folder as your html web page file
- `< img src = " mypicture.gif " >`
- Or, you can keep things tidy with an image folder for all your images, then use
- `< img src = "images / mypicture.gif " >`

Images

- You can adjust the size of your image
- ``

Web pages

- *Carry on with your web page work from the TACO book*
- *If you have finished the entire book, create a series of linked web pages on a topic of your choice.*

<head><style>

body {color: blue; background-color: FFFF00;}

H1 {color: FF0000; text-align: center;} </style>

</head> <body>

 new line <p /> new paragraph

<h1> Page heading </h1>

 Image

 Link to a page

</body>

Graphics

Vector - Drawing

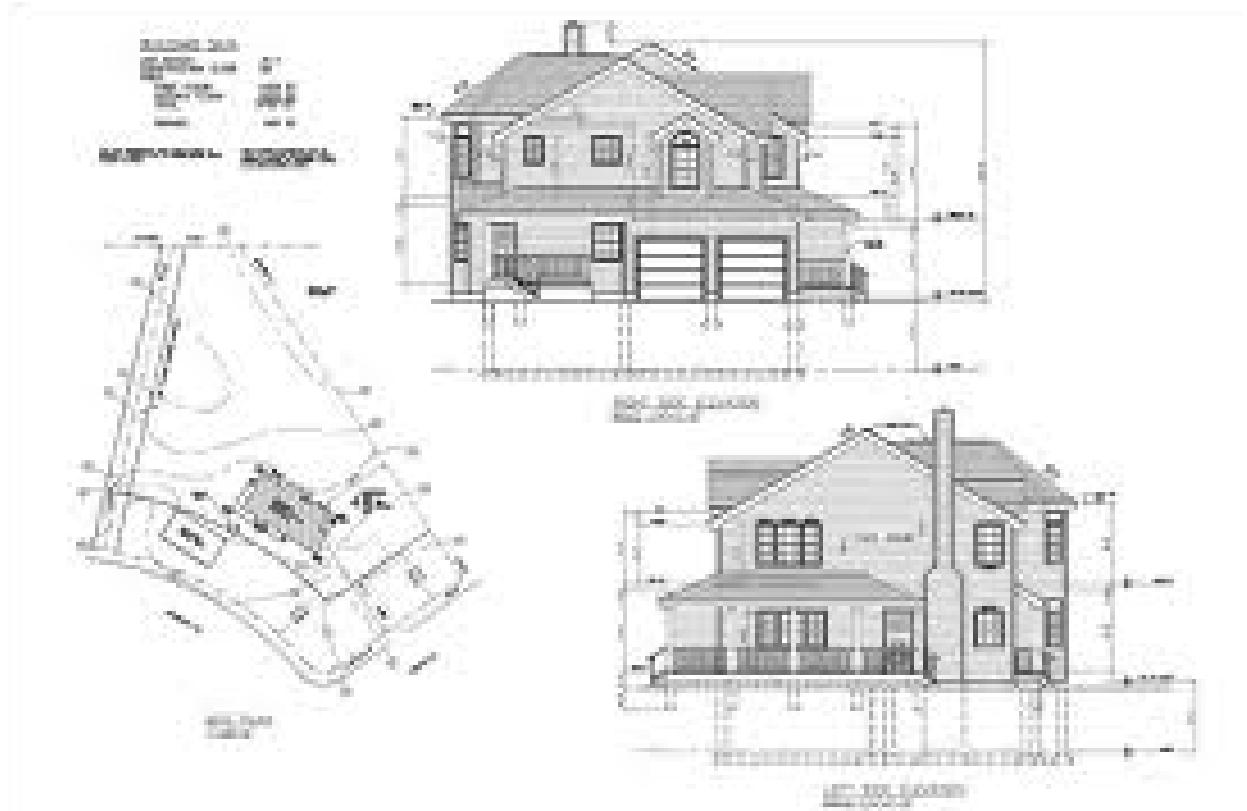
- Image is made up of shapes
- Each shape is stored as a start position, size, line colour, line thickness, fill colour, fill pattern, order (object in front of others)
- Editing the image means changing some of these numbers e.g. changing the line colour, changing the start position

Vector - Drawing

- Each shape is therefore stored as just a few numbers
- File size increases as more shapes are added
- But each shape takes only a few numbers so file size is generally very small

Vector - Drawing

- Used for drawing
 - Plans
 - Diagrams



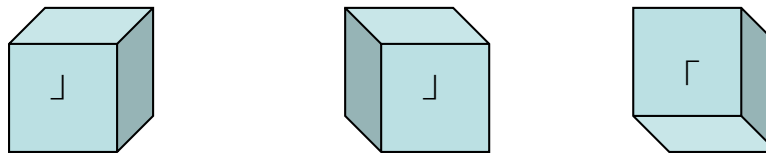
Vector - Drawing

- You can also
 - Group objects together
(This lets you move them all at once)

– Rotate



– Flip





Bitmapped Graphics (painting)

Jotters out please

Bit Mapped Graphics

- Also known as Painting
- In painting the image is made up of **PIXELS** (short for Picture Elements)
- In a black and white image
 - A white pixel is stored as 0 (off)
 - A black pixel is stored as 1 (on)

Screen



Memory

1	0	1	0	0	1	0	1
0	1	0	1	1	0	1	0

Bitmap - Painting

- Image is made up of many tiny dots called pixels
- Editing the image means changing the colour of pixels
- File size is determined by the size of the image - usually large files

Bitmap - Painting

- Digital photographs are bitmap images
- You can make small corrections e.g. remove red eye on a photo



Graphics Compression

GIF

- Lossless compression – no information about the image is lost
- Limited to 256 colours
- Colours can be set as transparent
- Used for cartoons and line drawings
- Can be animated



JPEG

- Lossy Compression
- Some information is lost e.g. shades of colour
- This is not noticeable at low rates of compression
- Used for photographs
- and paintings



Audio Files

Capturing Sound

- Microphone
- Sound card
- Sound card converts analogue signal from microphone to digital audio data.



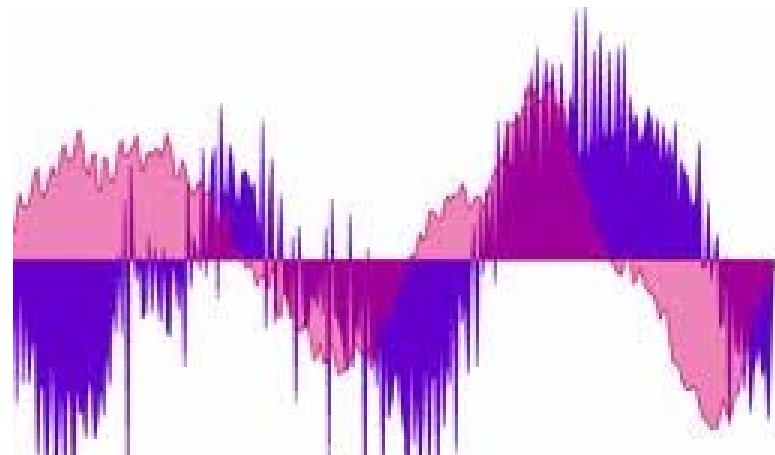
Uncompressed Sound

- RAW
 - Uncompressed samples of sound waves have very large file sizes
 - 1 minute may take up to 10 Mb
- RIFF
 - Resources Interchange File Format for multimedia
 - Can contain bit-mapped graphics, animation, digital audio



WAV

- Use the RIFF format to store data
- A quarter the size of RAW data
- Use 4 bit numbers to store data instead of 16 bit
- No loss of sound quality



MP3

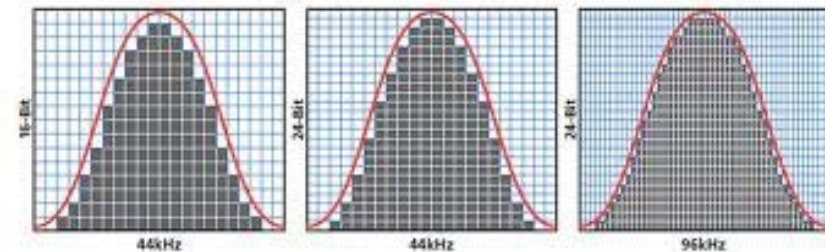
- Reduces file size by removing some data that a human cannot hear
- Lossy compression without noticeable loss of quality
- Less than one tenth the size of original RAW file
- Suitable for use on
- World Wide Web



File Size vs Quality

- Sampling Depth

- The more bits used to store each sound sample, the greater the range that can be stored so the better the sound quality



As bit depth and sample rate increase, more information is captured—resulting in higher-quality audio

- Sampling Frequency

- The higher the sampling frequency, the better the sound quality
- The more data is stored, the bigger the file size

Video and Multimedia



Capturing Video

- Digital video camera
- Web cam with video capture (low quality)
- Graphics card
- Sound card



Video Files



- Video files need to store both
- the images and the sound track

- Uncompressed video files can therefore result in very very large files

- 1 second of uncompressed wide-screen video can take up to 53 Megabytes of storage

Video File Types

- AVI - Audio Visual Interleave
 - Uncompressed video format
- MPEG
 - Lossy compression
 - Stores initial image
 - Thereafter, stores only the DIFFERENCES between frames and cuts out the unchanged parts of the video clip
 - Does not affect the visibly quality of the video



Video Quality and File Size

- Colour depth
 - Increasing colour depth improves quality but the file size increases
- Resolution
 - Increasing resolution improves quality and increases file size



Video Quality and File Size

- Frame rate
 - Measured in frames per second fps
 - 30 fps is the usual rate for a video clip
 - Increasing frame rate increases file size
 - Lower frame rates reduce file size but makes the video clip 'jerky'



Video Quality and File Size

- Video time
 - Increasing or reducing the time a video clip lasts also changes the file size
 - Quality of the display of the clip is not affected



Video Editing

- Editing can only be performed on uncompressed video
- Cropping: cutting unwanted data from the beginning and end of a clip
- Add effects, titles, sound tracks



Standard File Formats

Text Files

- Text is used in many different types of document
- In some programs, text may be formatted using fonts, styles (bold, underline) and layout (alignment, margins).



Standard File Formats

- When a file is saved, you expect that you will be able to open it again using the same program used to create it.
- Using Standard File Formats, you may also be able to open it in other programs.



Standard Text File Formats

- Standard Text file formats include
- .TXT
 - The text is saved but no formatting information or pictures
 - Can be opened by almost program
 - Very small file size



Standard Text File Formats

- .RTF
 - The text is saved with basic formatting information but no pictures
 - Can be opened by almost program
 - Small file size



Standard Text File Formats

- Proprietary formats for specific programs
- .CWK .DOC
 - The text is saved with all formatting information and pictures
 - Can be opened by the original program
 - Rival programs may attempt to open the file but may lose some information such as pictures or some formatting
 - Larger file size



Databases

Data and Information

- **DATA** is raw facts and figures
 - 090113
 - SK13CAR
 - 50

Data and Information

- **INFORMATION** is data that has been processed and given context and meaning.
 - Today's date is 09/01/13
 - Car Registration
 - The price of a cake

SK13 CAR

50p



Databases

- Databases store **DATA** in an organised and structured way
- Database is stored in a database **FILE**
- The database file is made up of many **RECORDS**

Databases

- Each **RECORD** stores the data about one person or thing
- Each **RECORD** is made up of many **FIELDS**
- Each **FIELD** stores a single item of data about the person or thing e.g. their Name, Date of birth, Colour, Price...

Databases

- You can ADD a RECORD when you need to store information about a new person or thing.
- You can DELETE a RECORD e.g. from a Class List database if that person leaves the class
- You can AMEND a RECORD if the information has changed
- You can ADD a FIELD when you need to store a new item of information about a person or thing already in the database.

Databases

- Each field has a **DATA TYPE** which may be
 - Text
 - Number
 - Date
 - Time
 - Picture / Multimedia / Container
 - Computed / Calculation
 - Link
 - Boolean

Databases

- TEXT fields may contain digits and punctuation symbols as well as letters
- This can be useful for storing e.g. Phone numbers
 - If you use a NUMBER field then any leading Zeros would not be stored
 - You can space out the number e.g.
0123 456 0987

Databases

- Computed fields use a formula to work out an answer
- Computed fields use values from other fields
 - e.g. if a record held the marks a pupils scored in three separate tests then it could add up the marks to give a total.
 - If a record held the price of an item then it could work out that price plus VAT

Databases

- Calculations can also be done using dates
- E.g the database might **store** someone's Date of Birth and it might **calculate** their age by subtracting this from the current date.

Databases

- Databases can be **SEARCHED** so that only the records you are interested in are shown
- E.g. you could search your address book for SURNAME = Smith

Databases

- You can **SEARCH** more than one field
- This is called a **COMPLEX** search
- E.g. you could search your address book for SURNAME = Smith **AND**
FIRST NAME = Sam
- Only records for Sam Smith would be shown

Databases

- You can **SORT** a database into order
- The default is to sort into **ASCENDING** order i.e. A to Z or 0 to 9
- Sometimes you may use **DESCENDING** order e.g. to sort a class so the **HIGHEST** mark is at the start of the list

Key Fields

- Every record must be able to be uniquely identified.
- The field which is the unique identifier is called the **Primary Key**.
- This might be something like a “Customer Code” which is assigned when the details are added to the database.



Input Validation

- Database systems can check that the data entered into the system meets certain criteria.
- **Unique** - the same value cannot be used in more than one record - often used to ensure the Primary Key is unique



Input Validation



- **Required** - the field may not be left blank
- In a **range**
 - A test grade might be in the range A-D
 - A test mark might be in the range 1-100
- In a **list** set up in the database
 - A regi class must be one of 1K1, 1K2... 6R4

Databases

- There are two types of computerised databases
 - Flat file
 - Relational
(contains linked tables)



Databases

- **Flat file** – there is a single file with one table containing all the records
- The problem with flat file databases is that they can contain the same data several times – this is called **repeating data**.

Relational Databases

- We can solve the problem of repeating data through a process called **Normalisation**
- In normalisation, we remove the repeating data into a separate table, and include the primary key of the original table in each records to provide a link between the tables. This is the **Foreign Key**.

Normalisation

Worked Example

Sandy's Bakery

Shop ID	Shop Name	Address	Tel No	Owner Name	Order Number	Date of Delivery	Sandwich Filling	Bread Type	No Needed	Sandwich Cost
5001	Barries	1 Union St, Aberdeen	7823 45	Mr Barrie	101	12/9/00	Tuna	White	6	1.20
					101	12/9/00	Chicken	Brown	4	1.30
					101	12/9/00	Cheese	White	5	1.20
5002	Duncan s	3 Royal Terrace Aberdeen	7823 92	Mr Duncan	102	12/9/00	Cheese	White	12	1.20
					102	12/9/00	BLT	White	6	1.50

Sandy's Bakery UNF

- ORDER

(Shop ID

Shop Name

Address

Tel No

Owner Name

Order Number

Date of Delivery

Sandwich Filling

Bread type

No needed

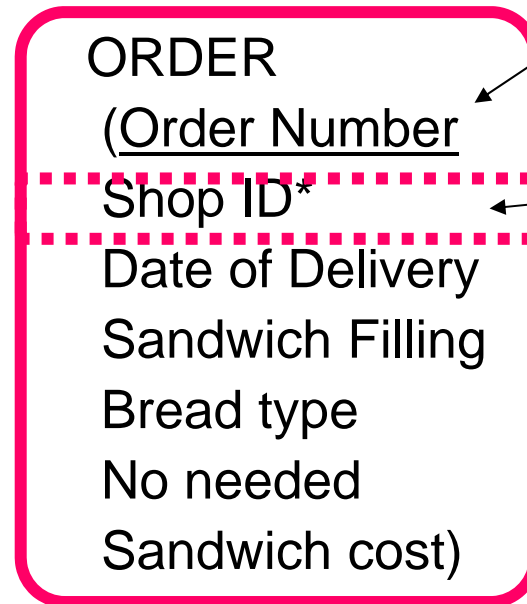
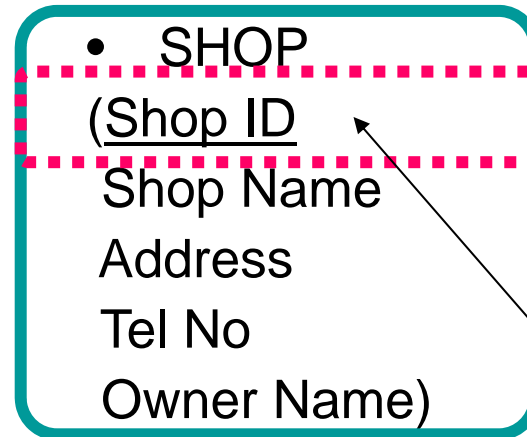
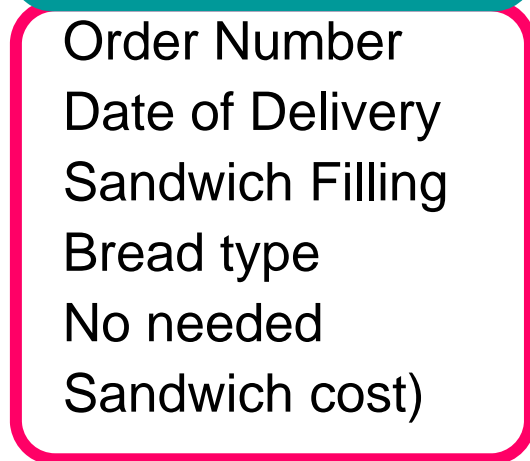
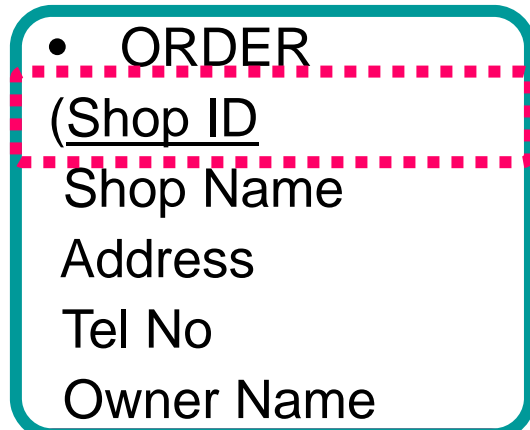
Sandwich cost)

Sandy's Bakery

Shop ID	Shop Name	Address	Tel No	Owner Name	Order Number	Date of Delivery	Sandwich Filling	Bread Type	No Needed	Sandwich Cost
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					102	12/9/00	BLT	White	6	1.50

Repeating data

Sandy's Bakery 1NF



Two separate tables.

Primary Keys

Foreign Key to provide the link