

INTRODUCTION TO SUBSIDIARY INFORMATION & COMMUNICATION  
TECHNOLOGY  
AND  
COMPUTER STUDIES.

THE BASIC ICT AND COMPUTER STUDY SKILLS FOR LEARNERS.

A complete guide to O'Level, A 'Level and Institution ICT scholars.

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## INTRODUCTION:

The goal of this study guide is to help you become computer literate. In becoming computer literate, you will need to be aware of the importance of computers and be able to use them to accomplish tasks every day.

### Definition of a computer:

A computer is an electronic device that stores, retrieves, processes data and present it in the form the user desires. A computer operates under the control of a set of instructions that is stored in its memory unit.

### Parts of a computer



Monitor

Helps you to view what is going on inside a computer.

Keyboard

Helps you to feed data into a computer

Mouse

Helps you to issue commands, point and select items on the computer screen.

System unit

This houses the internal components of a computer like the processor.

### Areas where computers are found

- Super markets
- Libraries
- Offices
- Banks
- Industries
- Hospitals
- Schools
- Vehicles, aero planes and ships
- Homes

## CHARACTERISTICS OF MODERN COMPUTERS

These include the following:

- ❖ **High Speed:** Computers are very fast in their operations and their speeds are measured in millions of instructions per second
- ❖ **Very Accurate:** Computers are so accurate that they hardly make mistakes. They can detect errors once made and correct them. However when wrong data is fed into them, wrong results will be output.

- ❖ **Large Storage:** Computers have storage space called the memory where data fed into the can be temporarily stored and later processed
- ❖ **Diligence:** Computers can perform the same task over and over along period of time without getting tired. For example industrial robots in the car assembly lines
- ❖ **Artificial Intelligence (AI):** Computers can respond to requirements given to them and also provide solutions through their programs.
- ❖ **Automation:** Computers do not need any supervision so as to perform programmed routines. For example traffic lights, digital watches.
- ❖ **Versatility:** Computers can be used for many different purposes and can change from one activity to another.

## HISTORY OF COMPUTERS

Historians divide the history of the modern computer into generations. Here is the history of the stops and starts that have given us this modern the computer.

This history is divided into Three Aras;

- The Mechanical era
- The Electro-mechanical era
- The electronic era

### Mechanical Computer Era 1623-1945

Mechanical computers are computers composed of mainly movable parts like wheels and axels.

The machines under this era had the following characteristics:

- Moving parts
- Mechanical gears

Machines under the mechanical era included the following:

### THE ABACUS 3000 B.C

- The ABACUS was the first computing machine.
- It was invented by the early Babylonians (The Greek) before the 17<sup>th</sup> Century
- It was used for small scale computing in china and Japan for thousands of years BC. The first aids of logarithms were introduced.
- The Abacus is listed as the first computational device.
- It consisted of columns of beads that could slide to and fro to represent numbers.

### NAPIER'S BONES

- It was invented by **john Napier** in the 17<sup>th</sup> century
- He set a multiplication table on ivory stacks that could slide back and forth to indicate a certain result.
- Napier's bones was rectangular rods with readings written on them that led users to do division and multiplication by adding number position bones.

### SLIDE RULE

- It was invented by William Oughtred in 1620
- In 1620, an English mathematician called William Oughtred invented
- It was the first analog device which was known as a slide rule.

### **Electro-Mechanical Era**

Electro-mechanical computers are computers that need electricity and have movable parts. The machines under this era had the following characteristics:

- Moving parts
- Mechanical gears
- Electro-mechanical relays
- Dials
- Used punched cards and tapes

#### **Pascal' Arithmetic Machine**

- In 1647, a French man Pascal Blaise was given credit for the first mechanical adding machine that used a system of gears and wheels.
- It had digits from one to nine arranged on a wheel similar to a speedometer.
- It used a counting-wheel design. Numbers for each digit were arranged on wheels so that a single revolution of one wheel would engage gears that turned the wheel one tenth of a revolution to its immediate left.

#### **Leibniz Calculator**

- In 1694, **William Leibniz** a German mathematician improved Pascal's design to create a calculator that would perform arithmetic operations of division, subtraction, addition and square root.

#### **Jacquard Weaving Loom-1801**

- **Jacquard** invented a machine to control the weaving process when making complex patterns.
- This system first stored programs using metal cards with holes of storing data, the machine could store programs or instructions using holes. Holes strategically punched in a card directed the movement of needles, tread and fabric creating the elaborate patterns still known as Jacquard weaves.
- It's considered the first significant use of binary automation.

#### **Babbage Analytical Engine**

- It was invented by Charles Babbage of England in 1832.
- It was the most outstanding developments in computing.
- The analytical engine was able to combine arithmetic process, division base on its own computer.
- It could add, subtract, multiply and divide in automatic sequence at a rate of 60 additions per second.

#### **HOLLERITH'S TABULATOR**

- Herman Hollerith (1860-1929) devised a punched-card tabulating machine.
- It was to be used to head count in the 1880 US census.

#### **Mark 1**

- Designed by Professor Howard Aiken In 1939
- Input was entered on punched cards and output on electric type writer.
- Professor Howard Aiken completed the Mark 1
- It was the first electromechanical computer.

## Electronic Era

### Early Electronic Computing Devices

- a) **Electronic numeric integrator and calculator (ENIAC)**
  - John P Eckert, J.W Mauchly, M.V Wilkes completed it in 1946.
  - It was the first electronic computer.
  - It used vacuum tubes for data processing.
  - It was used by the military for calculations relating to rockets
- b) **Electronic delay storage automatic computer (EDSAC)**
  - It was developed by 1949.
  - It was faster, more reliable and efficient than the ENIAC
- c) **Electronic discrete variable automatic computer (EDVAC)**
  - John Von Neumann developed it in 1946
  - It could store instructions and data in the memory
- d) **Universal automatic computer (UNIVAC)**
  - Mauchly and Eckert designed it in 1951
  - It was the first commercially available electronic computer
  - It could process both numeric and alphanumeric data

### COMPUTER GENERATIONS:

Computer generations refer to the advancement (evolution) and accumulation of computer technology over the years. It also refers to the state of improvement and different advancements of computer technology over time.

Each generation of computer is characterized by a major technological development that fundamentally changed the way computers operate, resulting in increasingly smaller, cheaper, and more powerful and more efficient and reliable devices.

Improvement was also in;

- Technology used to develop the computer
- Internal organization of the computer
- Software used
- Programming languages

### **First Generation 1946-1956**

Key characteristics include:

- These computers had limited primary memory hence were slow.
- Use of **vacuum tubes** for internal operations

- Used punched cards for input and output.
- Emitted a lot of heat
- Maximum memory size was approximately 2bytes
- Speed was limited only 10 kilo instructions per second
- The computers were short lived and required a standby technician
- Programming was done in **machine language and assembly language**
- The computers were very large Computers used magnetic drum memories for storage
- They were very expensive
- These computers included IBM 650, universal automatic computer, Lyons electronic office (LEO), ACE 1951, universal accounting company

### **Second Generation 1957-1963**

Key improvements/ characteristics include:

- ‘They used **transistors** for internal operations. A transistor is a semiconductor material made of a solid piece with at least three terminals for connection to an external circuit.
- They used **Magnetic core memory**, this “Computer memory” used small magnetic rings, the cores, through which wires are threaded to store data

### **Third Generation 1964-1979**

Key improvements/ characteristics include:

- They Used integrated circuits for internal operations
- They Used parallel processing
- Introduction of the operating system like **multics**. They used operating systems.
- used simpler programming languages like **BASIC**
- Lower cost, high reliability, small size. Low power consumption and these made computers more popular.
- Computers used **magnetic disks** for storage purposes
- There was introduction of **remote computing**
- There was production of the **first microcomputer in 1974**.
- Computers used large micro chips
- There was expanded range of input and output devices like monitors and keyboards; time-sharing and multi programming.
- Computer memory expanded to 2 mega bytes of Random access memory.
- Speed accelerated to 5 million instructions per second.
- Computers included: IBM 360, PDP 11, Honey Well that later developed into BUNCH, NCR, Burroughs, UNIVAC, CDC

### **Fourth Generation 1979-1989**

Key improvements/ characteristics include:

- Use of **large-scale integration** and very **large-scale integration**- both deal with the number of electronic components that can be placed on the computer chip.
- Development of the **microprocessor**

- Limited artificial intelligence and expert systems
- Development of micro computers
- Introduction of a wide range of software
- Computers became more powerful and cheap enough that schools and homes were able to purchase them.
- Computers included: 8088, 80286, 80486, Pentium, Apple, and Macintosh, Amdahl 580, IBM 308

### **Fifth Generation-(1990 to Present and Beyond)**

Key characteristics include:

- Computers use modern technology for example parallel architecture, three dimensional circuit and super conducting materials
- Development of very fast computers called super computers with speeds in the range of one Giga to one Tera instructions per second
- Development of computer networking
- Merging of the telecommunication and computing technology
- Highly sophisticated operating systems

### **Functions Of Computers**

#### **a. In Education**

- Used in computer based training (CBT)
- Used in stock control like in the library
- Used to carry out research in different subjects
- Used for managing students data
- used in presentation in teaching-learning process

#### **b. Business**

- Used in automated production (computer controlled robots)
- Used to design products using computer aided design (CAD)
- Stock control; keeps track of stock and automatically order replacement
- Maintain payroll and other large accounts
- Managing staff and client data using databases program such as Microsoft access
- Graphics programs such as Corel graphics is used to produce adverts
- Facilitates E-commerce
- Online banking is made possible
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#### **c. Home**

- Playing video game
- Communication
- Entertainment such as playing music
- Facilitates tele-working, where people can still work from home on connected computers
- Facilitates home security with the help of surveillance cameras

*Assignment; find out the various factors/ uses of computers in the following areas*

- a) Health
- b) Communication
- c) Security
- d) entertainment

### **MAJOR TASKS UNDER TAKEN BY A COMPUTER**

- Inputting data
- Processing data
- Storing data
- Outputting data and information

### **ADVANTAGES OF USING COMPUTERS**

- Produce accurate work; Computers are very accurate in performing any programmed routine
- They are flexible; Computers are flexible that they can perform a variety of programmed tasks
- They save time, The computer speed enables computers to handle tasks quickly even those with complicated procedures
- They are effective; Computers process huge volumes of data effectively
- They are diligent; Computers never get tired of doing programmed tasks
- They save space; Computers are space saving when it comes to document storage as they store large volumes of data.
- Less hectic; Computers are automatic and do not need supervision to complete programmed tasks
- Simplifies work; Computers simplify problem solving using programs designed for the purpose
- Good for information flow; Computers improve information flow in an organization
- They are entertaining; Use of computers has ushered in the era of games and music playing

### **DISADVANTAGES OF USING COMPUTERS**

- Computers are very costly. The initial cost of purchase and costs of maintenance of computers are very high
- Computer technology is full of changes so there is no guarantee that already bought machines will not be obsolete in the next few months
- The change from one system to the other often causes changes both in duty allocation and approach of doing work
- Installation of computers always causes training of staff and at times declaring some redundant
- Computers cannot think so what ever is fed to them whether correct or wrong is accepted.
- Once attacked by viruses, loss of data and software may occur.
- Incase there is no power; you can not deal with them.
- Computers like any other machine can break down and this may result into delay or stopping of data processing
- Computers have led to increase in unemployment of human labour
- Computers can not tackle all problems cost effective
- Computer systems can easily be cheated by knowledgeable persons
- Data and information can easily be lost due to power failure and disruptions, viruses

- When used for long periods, computers can cause body fatigue in hands, eyes and back
- Computers are difficult to program

### **THE COMPUTER LABORATORY**

This is a room that is specially designed and prepared to facilitate the installation of computers and to provide a safe conducive environment for teaching and learning of computer studies.

#### **Factors to consider when preparing a computer laboratory**

- Security of computers, programs and other resources
- Reliability of the power source
- The number of computers to be installed and the available floor space.
- The maximum number of users that the computer laboratory can accommodate.

Why must there be safety rules and precautions in the computer laboratory?

- To avoid accidental injuries to the users
- To avoid damage of computers
- To avoid lack of a conducive teaching-learning environment

### **COMPUTER CARE AND SECURITY PRECAUTIONS**

- There is need to follow the right procedures while starting and shutting down the computer therefore abrupt switching on and off the computer should be avoided since this can lead to damaging the computer.
- Do not open up the metallic covers of computers or peripherals without permission and particularly when the computer power is still on.
- Any connections to the computer should be done when the computer power has been switched off.
- The computer should be cleaned on a regular basis to remove dust from the keyboard, mouse and other parts.
- Floppy diskettes and CD should be removed from their drives before starting or shutting down the computer.
- Any repairs to the computer should be done by someone who has knowledge regarding computer repairs.
- Keep a regular record of computer servicing and repair to establish maintenance costs and common problems to your computer.
- Guard your computer against new users who might spoil the computer and data corruption by unauthorized parties
- Take up backup copies of your data to avoid accidental damage and if one copy develops a problem then you can use the other.
- Avoid using programs and commands you are not familiar with and always seek for help.
- Keep files and directories in an orderly way since duplicating similar file names leads to data corruption.
- Save your work frequently if you do not have an interruptible power supply to limit data loss when power fails.

- Keep the environment around your computer clean and avoiding piling documents on top of the monitor, keyboard and mouse.
- Computers should not share the same power line with other office machines to avoid overloading the power units.
- Scan for computer viruses and load up dated anti-virus software to detect viruses.
- Avoid carrying food and beverages to the computer room since they may fall into moving parts causing rusting or electrical faults.
- Avoid unnecessary movements because you may accidentally knock down peripheral devices.
- Avoid smoking and exposing computers to dust since they contain small abrasive particles that can damage computer components and cause wearing of moving parts.
- Have gaseous fire extinguishers like those filled with carbon dioxide. Water based or powder extinguishers should be avoided since they can cause damage to computer components.
- All power cables must be properly insulated and laid away from pathways in the room. Lay them along the walls in trunks. This prevents electric shock and power interruptions caused by stumbling on cables.
- Protect computers from being damaged due to power instabilities by having an interruptible power supply.
- Fit strong metallic grills and locks on doors, windows and roof incase the roofing is weak.
- Do not welcome strangers into the computer laboratory.
- Consider installing security alarms at strategic access points that would alert the security personnel incase of a break-in.
- Have good air circulation in the computer room since users and computers emit heat energy. This is possible through having enough ventilation points like windows, installing an air conditioning system; avoid overcrowding of machines and users. All the above prevent suffocation and over heating.
- Consider a location away from excessive dust and fit special curtains that would reduce entry of dust particles and always cover computers when not in use and after cooling.
- A computer laboratory must be well lit with appropriate wall paints to avoid eye strain, headaches, stress and fatigue. Always fit radiation filter screens to reduce light that reaches the eyes.

## **CLASSIFICATION OF COMPUTERS**

Computers are available in different shapes, sizes and weights, due to these different shapes and sizes they perform different sorts of jobs from one another.

A computer that is used in a home differs in size and shape from the computer being used in a hospital.

Computers are classified according to the following:

- Classification by process
- Classification by purpose
- Classification by size
- Classification by processor power

## **1. CLASSIFICATION BY PROCESS**

Under this computers are classified according to how data processed is presented and there are three categories:

- Digital computers
- Analog computers
- Hybrid computers

### **Digital Computers**

A digital computer is an electronic computing machine that uses the binary digits (bits) 0 and 1 to represent all forms of information internally in digital form.

They process data and present information in the form of discrete values for example: Digital watches, mathematical calculators. Discrete values are numbers that can be defined like 1, 2, and 3.

### **Analog Computers**

An analog computer is a form of computer that uses the continuously-changeable aspects of physical phenomena.

These computers process data that is in a continuous form and is in measurable quantities such as electrical, mechanical, or hydraulic quantities to model the problem being solved.

For example:

- Speedometer
- Petrol pump

### **Hybrid Computers**

These are computers that have combined features of both digital and analog computers.

The digital component normally serves as the controller and provides logical operations, while the analog component normally serves as a solver of differential equations.

## **2. CLASSIFICATION BY PURPOSE**

Under this computers are grouped into the following:

- Special purpose computers
- General purpose computers

### **Special Purpose Computers**

These are computers that are designed to handle only a particular task and their operations are limited in nature for example: Digital watches, Pocket calculators and Lifts

### **General Purpose Computers**

These are computers that are designed to solve a wide range of problems. They can:

- Perform calculations
- Keep time
- Word process

## **3. CLASSIFICATION BY SIZE**

Computers are classified according to the size of the machine and the main categories include:

### i. Super Computers

A supercomputer is an extremely fast computer that can perform hundreds of millions of instructions per second.

- They tend to be specialized for certain types of computation, usually numerical calculations, and perform poorly at more general computing tasks.
- They perform complex tasks requiring a lot of computational power
- They have multiple processors that split a single task among processors for faster execution and a single central processor controls all the processors
- They are the most powerful category of computers and are expensive
- They are operated in special rooms with special environment controls

They are used for:

- Weather forecasting
- Engineering design
- Space exploration
- Animated graphics
- Fluid dynamic calculations
- Nuclear energy research
- Petroleum exploration

Examples include:

- Cray T30
- NEC 5

### ii. **Main Frame Computers**

A mainframe computer is a powerful multi-user computer capable of supporting many hundreds or thousands of users simultaneously.

They are large general purpose computers with extended processing, storage, input and output capabilities

- They store large amounts of data and process tasks at a high rate.
- They can support between 500-1000 users at a time however each user has a separate keyboard and monitor but shares the same central processing unit with others.
- These computers are commonly used in big hospitals, airline reservations companies,

They are commonly used by:

- Multinational companies
- Government institutions
- Software houses

Examples of main frame computers include:

- IBM 4381
- ICL 39 series
- CDC Cyber series

*The main difference between a supercomputer and a mainframe is that a supercomputer channels all its power into executing a few programs as fast as possible, whereas a mainframe uses its power to execute many programs concurrently.*

### **iii. Mini Computers**

A minicomputer is a multi-user computer capable of supporting from 10 to hundreds of users simultaneously.

- These are small and have low user capacity
- Users can range from 50-100 at a time
- They are widely used by medium sized organizations

Examples of mini computers include:

- DECS VAX range
- IBM AS 400 range

### **iv. Micro Computers**

These are smaller than the above three categories and are single user capacity. One person can only use the key board, central processing unit and the monitor at a time

- They are also called personal computers(PCs) or micros
- However, although personal computers are designed as single-user systems, it is common to link them together to form a network. In terms of power, there is great variety.

Examples include:

- IBM PS/2PCs
- Apple Macintosh

Micro Computers Are Grouped Under The Following:

#### **Desktop Computers**

- Are computers designed to fit comfortably on top of a desk, typically with the monitor sitting on top of the computer.
- It is a personal computer (PC) in a form intended for regular use at a single location.
- These are stationed in one place and on top of a desk. They are commonly found in offices and homes. They are the standard personal computers

#### **Laptop**

- A laptop is a personal computer designed for mobile use and is small and light enough to sit on a person's lap while in use.
- A laptop integrates most of the typical components of a desktop computer, including a display, a keyboard, a pointing device, speakers, and often including a battery, into a single small and light unit.
- The rechargeable battery (if present) is charged from an AC adapter and typically stores enough energy to run the laptop for two to three hours in its initial state.
- They are designed for mobile computing and one can work on board for example a bus, air plane.

## Palm Tops

These are computers small enough to hold in one hand and operate with the other. Also called a "handtop," these ultra-small computers may have specialized keyboards or keypads for data entry applications or have small QWERTY keyboards.

## Pen Computers



These are computers that utilize an electronic pen (called a stylus) rather than a keyboard for input.

These are computers that allow the user to input and retrieve data by writing with a stylus (an electronic pen) directly on a display screen.

Pen computers generally require special operating systems that support handwriting recognition so that users can write on the screen or on a tablet instead of typing on a keyboard. Most pen computers are hand-held devices, which are too small for a full-size keyboard.

## Note Book Computers

These are portable computers that are smaller than a laptop model, often approximately the size of a sheet of A4 paper.

## Tower Computers

Refer to computers in which the power supply, motherboard, and mass storage devices are stacked on top of each other in a cabinet.

These are personal computers in an upright case.

The main advantage of tower models is that there are fewer space constraints, which makes installation of additional storage devices easier

## Work Station

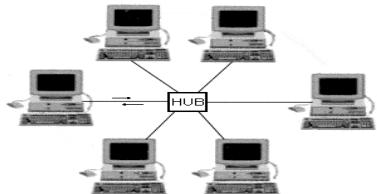
A workstation is a high-end microcomputer designed for technical or scientific applications. Intended primarily to be used by one person at a time, they are commonly connected to a local area network and run multi-user operating systems.

They are used for engineering applications (CAD/CAM), desktop publishing, software development, and other types of applications that require a moderate amount of computing power and relatively high quality graphics capabilities.

They are a powerful, single-user computers. A workstation is like a personal computer, but it has a more powerful microprocessor and a higher-quality monitor.

These are personal computers with powerful calculation and graphics capacity

## Network Computers



They are low cost computers designed to work only while connected to a network.

They have limited processing and storage capacities

## **Servers**

These are computers that reply to requests from other computers and they have the following characteristics:

- They are designed to be connected to one or more networks
- They have the most powerful processors available
- Have large memory capacity
- Have large disk storage capacity
- Have high speed internal and external communication

## **EMBEDDED SYSTEMS**

These are appliances that contain a microprocessor which is pre-programmed to perform a dedicated task.

Examples

- Rice cookers
- Washing machines
- Microwave ovens
- Video recorders
- Laser printers
- Calculators

## **4. CLASSIFICATION BY PROCESSOR POWER**

The first computers had a processor power of less than 0.4 million instructions per second but today 15 million instructions per second is the minimum



### **Types Of Processor Power**

Pentium 1	Intel 80X86 series
Pentium 11	Intel Pentium series
Pentium 111	Motorola 680X0 series
Pentium 1V	
IBM power pc	
DEC Alpha	

## **COMPUTER SYSTEM**

- This is a collection of components that work together to accomplish or solve problems using a computer.
- It is a complete set of components required to operate and use a computer. The computer system contains elements that make a computer work towards goal oriented behavior
- A computer system is a complete, working computer.

The computer system includes not only the computer, but also any software and peripheral devices that are necessary to make the computer function.

## **Components Of A Computer System**

These include the following:

- Hardware
- Software
- human ware

### **Hardware**

This refers to the physical parts of a computer that can be seen and touched. like disks, disk drives, display screens, keyboards, printers, boards, and chips.

### **Software**

This refers to a set of instructions or data that tell a computer what to do. Anything that can be stored electronically is software.

Software is untouchable and exists as ideas, concepts, and symbols, but it has no substance.

Software is divided into two general categories: **data software** and **programs software**.

Data: This refers to raw facts including words, figures, sounds, images fed into a computer to be processed into meaning results.

### **Human Ware/Live Ware**

Refers to people involved in designing, developing computer systems, operating computers, creating software.

People by far are the most important component of a computer system.

Live ware is a term used to denote people using (attached to) computers, and is based on the need for a human, or live ware, to operate the system using hardware and software.

## **COMPUTER HARDWARE COMPONENTS**

- Computer hardware refers to the physical parts of a computer that can be seen and felt.
- Computer hardware consists of the components that can be physically handled.

All computer hardware is divided into five broad categories according to their function on a computer. These categories include:

- |                   |                         |
|-------------------|-------------------------|
| • Input devices   | • Processing devices    |
| • Output devices  | • Communication devices |
| • Storage devices |                         |

**Peripherals:** this refers to any external device connected to the system unit.

### **COMPUTER INPUT DEVICES**

Input is any data or instructions you enter into the memory of a computer with a special writing device.

The two types of input are: DATA and COMMANDS

In-put devices are hardware components that allow a user to enter data and instructions into a computer

Input hardware consists of external devices—that is, components outside of the computer's CPU—that provide information and instructions to the computer.

The most common input devices found on computers include the following:

### KEY BOARD

The keyboard is the most common tool used for entering data and commands into a computer. It consists of a set of typewriter-like keys that enables you to enter data into a computer.

Computer keyboards are similar to electric-typewriter keyboards but contain additional keys. The keys on computer keyboards are often classified as follows:

- The standard layout of letters, numbers, and punctuation is known as a QWERTY keyboard because the first six keys on the top row of letters spell QWERTY.
- The QWERTY keyboard was designed in the 1800s for mechanical typewriters and was actually designed to slow typists down to avoid jamming the keys.
- Another keyboard design, which has letters positioned for speed typing, is the Dvorak keyboard.
- There is no standard computer keyboard, although many manufacturers imitate the keyboards of PCs.

There are actually three different PC keyboards: the original PC keyboard, with 84 keys; the AT keyboard, also with 84 keys; and the enhanced keyboard, with 101 keys.

The three differ somewhat in the placement of function keys, the Control key, the Return key, and the Shift keys.

The major divisions of the keyboard include:

- Typewriter area
- Function key area
- Numerical key part inclusive of the cursor control keys

#### Advantages of using a keyboard

- Keyboards are more reliable and produce fewer errors than other input methods
- Entering data and instructions with keyboards is generally faster than with pointing devices
- It is not necessary to buy additional equipment because most computer systems are normally supplied with keyboards

#### Disadvantages of using a keyboard

- It takes a lot of time to practice in order to type quickly and accurately
- Typing speeds are still very slow when compared with computer speeds

### MOUSE

- A mouse is a device that controls the movement of the cursor or pointer on a display screen.

- It is small object you can roll along a hard, flat surface.
- As you move the mouse, the pointer on the display screen moves in the same direction.
- Some newer mice also include a scroll wheel for scrolling through long documents.
- In particular, the mouse is important for graphical user interfaces because you can simply point to options and objects and click a mouse button.
- Such applications are often called point-and-click programs. The mouse is also useful for graphics programs that allow you to draw pictures by using the mouse like a pen, pencil, or paintbrush.

## **Types of computer mice**



### Mechanical mouse

This has a rubber or metal ball on its underside that can roll in all directions. Mechanical sensors within the mouse detect the direction the ball is rolling and move the screen pointer accordingly.



### Optical mouse

This uses a laser to detect the mouse's movement. You must move the mouse along a special mat with a grid so that the optical mechanism has a frame of reference. Optical mice have no mechanical moving parts. They respond more quickly and precisely than mechanical mice, but they are also more expensive.



### Cordless mouse

This is not physically connected at all. Instead it relies on infrared or radio waves to communicate with the computer. Cordless mice are more expensive than both serial and bus mice, but they do eliminate the cord, which can sometimes get in the way.

## **Advantages of using a computer mouse**

- It does not take time to master the techniques of using the mouse.
- Cursor movements across the screen are done quickly
- It can be used to draw shapes under graphics and drawing programs
- It fits comfortably below the palm and its wheel below fastens movements
- The mouse is easy to use even for beginners
- It can be operated by one hand

## **Disadvantages of using a computer mouse**

- Requires empty desk space to move it about
- You need to move a hand from the key board to move the pointer or execute a command given
- Its must be cleaned regularly to remove dust and dirt from the ball mechanism
- It is not easy and convenient to input text with a mouse
- Issuing commands by using a mouse is slower than by using a keyboard

- A mouse is not accurate enough when it comes to drawings that require high precision
- It needs some practice in order to control a mouse properly
- It needs a flat surface to operate

### **Major problems that often affect the proper functioning of the mouse**

- Dirt disrupts motion of the ball
- Nature of the surface-not too rough or too smooth
- Disconnection of the chord in case the mouse falls on humps
- Connecting the mouse to the system unit one must be very careful to follow the directions of the pins

### **Solutions to the problems**

- Cleaning the ball and rollers regularly
- Providing the correct roll surface or mouse pad
- Avoid mouse falling or hanging on the chord by tying twists on both the mouse and keyboard

## **TOUCH SCREEN**

This is a type of display screen that has a touch-sensitive transparent panel covering the screen. Instead of using a pointing device such as a mouse or light pen, you can use your finger to point directly to objects on the screen.

### **Touch screens are commonly used in:**

- Automated teller machines
- Directories conveying tourists' information in airports and hotels
- Fast food restaurants to display menus

### **Advantages**

- No extra peripherals are needed except the monitor
- Allows easy access to commands usually identified by words or symbols on the screen
- Touch screens also have assisted in recent changes in the PDA and Cell-Phone Industries, making these devices more usable.

### **Disadvantages**

- Are not suitable for inputting a large amount of data because they require a lot of arm movements
- Only items already on the screen can be selected
- Although touch screens provide a natural interface for computer novices, they are unsatisfactory for most applications because the finger is such a relatively large object.
- It is impossible to point accurately to small areas of the screen. In addition, most users find touch screens tiring to the arms after long use.

### **Joy Stick**

This is a lever that moves in all directions and controls the movement of a pointer or some other display symbol.

A joystick is similar to a mouse, except that with a mouse the cursor stops moving as soon as you stop moving the mouse.

With a joystick, the pointer continues moving in the direction the joystick is pointing.

Joysticks are used mostly for computer games, but they are also used occasionally for CAD/CAM systems and other applications.

### **Advantages**

It allows fast interactions required in most games

### **Disadvantages**

It is difficult to use a joystick to select objects accurately on the screen

## **LIGHT PEN**

This is an input device that utilizes a light-sensitive detector to select objects on a display screen.

A light pen is similar to a mouse, except that with a light pen you can move the pointer and select objects on the display screen by directly pointing to the objects with the pen

It allows the user to point to displayed objects, or draw on the screen, in a similar way to a touch screen but with greater positional accuracy.

### **Advantages**

Using a light pen is more direct and precise than using a mouse

It is convenient for applications with limited desktop space

### **Disadvantage**

Normally require a specially designed monitor to work with

## **DIGITAL CAMERAS**



A digital camera is an electronic device used to capture and store photographs electronically in a digital format, instead of using photographic film like conventional cameras, or recording images in an analog format to magnetic tape like many video cameras.

Modern compact digital cameras are typically multifunctional, with some devices capable of recording sound and/or video as well as photographs

They are largely used in desktop publishing to mix graphics with text.

### **Advantages of a digital camera**

- You can instantly see the picture you just took
- You can delete unwanted pictures
- You will not have to buy films again
- They have many advanced features in a small form factor
- You don't have to print every picture
- You have complete control of the final print after editing on the computer
- There is no risk of negatives getting lost or scratched
- They can store hundreds of pictures

- Photographic images can be digitized directly without using a scanner

### **Disadvantages of a digital camera**

- Generally higher cost per print although getting cheaper
- More sensitive to shocks and dropping
- Lower quality than film although the gap is closing
- Can be battery hogs
- Shutter delay is longer on low-end models
- Generally have poor low-light focusing ability
- Digital cameras are normally more expensive than ordinary film cameras

## **VOICE RECOGNITION EQUIPMENT**

These provide the computer with the capability to distinguish spoken words.

Note that; voice recognition implies only that the computer can take dictation, not that it understands what is being said.

### **Advantages**

- No typing of data is necessary
- The system can be used remotely by telephone or by people whose hands are occupied or disabled
- Are ideal for blind or visually impaired users

### **Disadvantages**

- Limitation on the size of the computer vocabulary
- Pronunciation differences among individuals
- Computer's inability to accept continuous speech
- Error rate is still high at the moment
- Recognition of words is slow
- The system is not suitable for use in noisy places
- The software must be trained to recognize specialist or technical words
- Many people find it difficult to speak in a "writing" style

## **MICROPHONE**



This is an input device that allows a user to speak to a computer to enter data and instructions into the computer.

Microphones use a sensor that converts sound into an electrical signal.

## **SCANNER**



This device converts images of text, drawings and photos into a digital form for processing.

It can read text or illustrations printed on paper and translate the information into a form the computer can use.

### **Advantage**

- A scanner with appropriate OCR software can work as an OCR system

### **Disadvantages**

- A scanner is not best for two dimensional objects only
- Scanned objects usually take up a lot of storage space

There are other scanning devices that may be used and they include:

#### Magnetic ink character recognition (MICR)

Magnetic Ink Character Recognition is a character recognition system that uses special ink and characters.

When a document that contains this ink needs to be read, it passes through a machine, which magnetizes the ink and then translates the magnetic information into characters.

MICR technology is used by banks.

Numbers and characters found on the bottom of checks (usually containing the cheque number, sort number, and account number) are printed using Magnetic Ink.

To print Magnetic Ink, you need a laser printer that accepts MICR toner.

MICR provides a secure, high-speed method of scanning and processing information.

### **Advantages**

- Magnetic ink character recognition is difficult to forge
- Documents can still be read when folded or written on

### **Disadvantages**

- Magnetic ink character recognition readers and encoders are very expensive
- The system can only accept a few different character sets

#### Optical character recognition (OCR)

These devices read special pre printed characters and convert them in a form which can be understood by the computer.

Examples of them are price tags and utility bills in super markets

### **Advantages**

- Written data and printed data can be read at the same time
- Hard copies of documents can be read directly into a computer without retyping
- The characters converted can later be edited by word processing software

### **Disadvantage**

- Optical character recognition readers often do not work well with handwritten characters or those in unusual fonts



### Bar code readers

These are photoelectric scanners that translate vertical zebra striped marks seen on most manufactured retail products into digital form before passing them into the computer for processing.

to capture and read information contained in a bar code

There are five basic kinds of barcode readers - pen wands, slot scanners, Charge-Couple Device scanners, image scanners, and laser scanners.

#### **Advantages**

- The process of data entry is fast and accurate
- Bar codes can be printed by normal printing methods
- No need to write down or key in the name of the item or its actual price

#### **Disadvantages**

- Only numbers can be coded
- Bar codes can not be read directly by people
  - A bar code reader may misread a bar code if there is any dirt or mark on the code

#### **TOUCH PAD**



This is a Data input device sensitive to pressure and motion.  
it is a device for pointing (controlling input positioning) on a computer display screen.

It is an alternative to the mouse.

Originally incorporated in laptop computers, touch pads are also being made for use with desktop computers.

#### **MIDI (Musical Instrument Digital Interface) DEVICE**

This is the electronic music industry's standard that defines how sounds are represented electronically by digital musical devices.



MIDI-Musical Instrument Digital Interface is a music industry standard that enables electronic musical instruments such as keyboard controllers, computers, and other electronic equipment to communicate, control, and coordinate with each other.

## WEBCAM

A webcam is a video camera attached to a computer that transmits images across the Internet.



A webcam, or web camera, is a camera that generates images that can be accessed by and displayed on the World Wide Web through a server.

A webcam is essentially just a camera that is connected to a computer, either directly or wirelessly, and gathers a series of images for remote display elsewhere.

Webcam technology is widely used by all sorts of people for all sorts of different reasons.

## SENSOR AND REMOTE SENSOR

This is an input device that can detect external changes in an environment

## TERMINAL

A terminal is a device that enables you to communicate with a computer.  
Generally, a terminal is a combination of keyboard and display screen.

Terminals are sometimes divided into three classes based on how much processing power they contain:

- Intelligent terminal: A stand-alone device that contains main memory and a Central Processing Unit.
- Smart terminal: Contains some processing power, but not as much as an intelligent terminal.
- Dumb terminal: This has no processing capabilities. It relies entirely on the computer's processor.

Examples of terminals include;

- An EPOS-electronic point of sale terminal is used to record purchases at the point where the consumer purchases the product or services.
- **EFTPOS**-electronic fund transfer point of sale terminals are able to transfer funds from a customer's bank account directly to a retain outlet's account after reading the customer's debit card.
- An **ATM**-automated teller machine is a self-service banking machine attached to a host computer through a telephone network.

## OUTPUT DEVICES

- The term 'output' refers to information out of a computer.
- Output can be meaningful information or gibberish, and it can appear in a variety of forms -as binary numbers, as characters, as pictures, and as printed pages.
- Output devices refer to any device capable of representing information from a computer. Out put devices are therefore hardware components responsible for translating information processed by a computer into a suitable form.

The two major forms of computer output are:

- Soft copy
- Hard copy

Soft copy: This refers to information/data displayed visually on the screen or is audio or voice form such as speech or music and this kind of output is not tangible.

Soft copy exists electronically and displays for a temporary period of time.

**Soft copy output devices:**

- Monitors
- Speakers

Hard copy: This refers to information/data that is in a permanent form that is in print out form and is tangible

Hard copy refers to a printout of data stored in a computer.

It is considered hard because it exists physically on paper, whereas a soft copy exists only electronically.

**Hard copy output devices:**

- Printers
- Plotters

Advantages of hardcopy over softcopy

- It cannot be easily changed without trace
- It can be read off line namely without a computer
- It is cheaper compared to softcopy which requires computer devices to be able to read the information
- Hardcopies last longer if stored in a safe place compared to softcopy which must be all the time changed with the technological developments taking place
- Hardcopies are universal as both rich and poor readers read them

The major output devices of a computer include the following:

## **PRINTERS**

A printer is an output device that produces text and graphics on a physical media like paper.

They produce a hard copy (permanent human-readable text and/or graphics) of documents stored in electronic form, usually on physical print media such as paper.

In other words, you will be able to view that information on paper (or other print media) instead of a computer monitor.

Printers come in many sizes and with numerous options however the major differences between printers are:

- |               |          |
|---------------|----------|
| • Reliability | • Output |
| • Speed       | • Costs  |

Printers are categorized by how images are formed that is whether or not the image is formed by physical contact of the print mechanism with paper.

There are two major categories:

- Impact printers
- Non-impact printers

The difference between impact printers and non-impact printers is that impact printers tend to be considerably noisier than nonimpact printers but are useful for multipart forms such as invoices.

### Impact Printers

Impact printers are a class of printers that work by banging a head or needle against an ink ribbon to make a mark on the paper. They use pins or hammers which hit a ribbon to transfer images to paper.

Print media could be:

- Paper
- Cloth
- Plastic transparencies

### Types of Impact Printers

They include the following:

- Character printers/serial printers
- Line printers/high speed printers
- Dot matrix printers

### **Character/serial printers**



These are low speed printers that copy the action of the type writers by printing one character at a time.

Characters are engraved on the print heads directly.

Character fonts cannot easily be modified.

Examples of character printers

#### Daisy's wheel

- The daisy wheel is a disk made of plastic or metal on which characters stand out in relief along the outer edge.
- To print a character, the printer rotates the disk until the desired letter is facing the paper.
- Then a hammer strikes the disk, forcing the character to hit an ink ribbon, leaving an impression of the character on the paper.
- This type of printer produces letter-quality type.



#### Thimble printers

These were earlier letter quality printers similar to a daisy wheel printer. Instead of a wheel, characters were formed facing out and around the rim of a thimble-shaped cup.

#### **Advantages**

- These printers have high quality output.
- They are the cheapest type of printers

#### **Disadvantages**

- They are very slow
- Are noisy

- Cannot print graphics
- Have limited type styles

### Line printers



These are high-speed printers capable of printing an entire line at one time. A fast line printer can print as many as 3,000 lines per minute. The disadvantages of line printers are that they cannot print graphics, the print quality is low, and they are very noisy.

Examples of line printers

- Chain printers
- Band printers
- Belt printers
- Drum printers

### Advantage of line printers

- They are speedy
- Disadvantages of line printers
- Poor quality output
- Lots of noise
- They are very expensive

### Dot matrix printers

- Dot-matrix printers are so far the most commonly used impact printers.
- A dot matrix printer works by striking an ink ribbon to print tiny and closely spaced dots onto paper to form certain characters and simple images.
- They produce characters and illustrations by striking pins against an ink ribbon to print closely spaced dots in the appropriate shape.
- Dot-matrix printers are relatively expensive and do not produce high-quality output.
- However, they can print to multi-page forms (carbon copies).
  - Examples of dot matrix printers
  - Epson LQ 1170
  - Epson LQ 2170
  - Epson FX 880

### Advantages

- They are faster than daisy' wheel printers
- They are least expensive printers
- Produce a variety of type face styles without changing the print mechanism
- They can withstand dusty environment, vibrations and extreme temperatures
- They can print on continuous paper or multipart documents
- They are the only printers which can use stencils
- They can print on a triplicate document because of the striking mechanism
- Low per page cost
- Energy efficient

## **Disadvantage**

- They do not offer high quality output.
- They are generally noisy because of the striking mechanism
- They are relatively slow
- They are not readily available on market
- They are not easily serviced because they are based on old technology
- Their colour print is limited to two (black and red)

## Advantages Of Impact Printers

- They are easier to maintain because their print heads require fewer periodic cleaning.
- They are reliable especially in commercial printing since print heads have longer life span.
- They are faster and can go over speeds of 160 characters per second hence increased productivity.
- They are flexible and cheap capable of printing various font styles and heavy graphics and can be used in place of plotters that are expensive.

## Disadvantages Of Impact Printers

- These printers are very noisy during operation though plastic covers are used on them to reduce the noise.
- They have low print resolution that is they are not good for high quality graphics
- Print heads over heat during long print out periods hence leading to low productivity.

## **NON-IMPACT PRINTERS**

Non-impact printers are printers that do not operate by striking a head against a ribbon. They use chemicals, lasers or heat to form the images on the paper.

The term nonimpact is important primarily in that it distinguishes quiet printers from noisy (impact) printers.

They include the following:

- Inkjet/Desktop printers
- Bubble jet printers
- Thermal printers
- Laser jet/page printers

## Inkjet Printers



Inkjet printers spray extremely tiny and precise ink droplets to create characters and graphics.

Based on color mixing principles, inkjet printers utilize several ink cartridges containing different colors to produce vivid color images, which is why inkjet printers are often applied for picture-intensive printing.

Examples of inkjet printers

- HP Deskjet 690C
- Epson stylus 640

### Advantages of inkjet printers

- Low levels of noise during operation
- Fairly high speed
- Ability to print in colour
- Very good quality output and ability to print graphics
- Small
- Energy efficient
- Many choices from which to choose

### Disadvantages of inkjet printers

- Nozzles can be blocked if unfiltered ink is used
- Very high costs of maintenance and buying
- Higher cost per page
- Slow
- Special paper is required for highest resolution output
- Limited to cut sheet media



### Bubble jet printers

These are a type of ink-jet printer developed by Canon.

The bubble-jet printers use special heating elements to prepare the ink.

Bubble-jet printers consist of a grid of ink-containing nozzles that forms an image when the ink is heated and expanded, forcing it out onto the page.

Examples include:    Canon BJC 200

### Advantages

- High quality output
- They are portable
- They are battery driven
- They are reasonably priced

### Disadvantage

Bubble-jet printers do not print as fast or sharply as a laser printer

### Thermal printers

- Thermal printers are printers that use heat to transfer an image onto a special paper.
- Thermal printers produce images by melting thermal ribbon to affix it upon paper or another material.
- There are two kinds of thermal printers: thermal wax transfer and direct thermal.

### Advantages of thermal printers

- Highest quality desktop colour printing
- Low noise level

### Disadvantages of thermal printers

- Are relatively slow

- Require special expensive paper that degrades with storage
- The paper is expensive

## Laser printer



this is A type of printer that utilizes a laser beam to produce an image on a drum. The light of the laser alters the electrical charge on the drum wherever it hits. The drum is then rolled through a reservoir of toner, which is picked up by the charged portions of the drum.

Finally, the toner is transferred to the paper through a combination of heat and pressure.

Because an entire page is transmitted to a drum before the toner is applied, laser printers are sometimes called page printers.

In addition to the standard monochrome laser printer, which uses a single toner, there also exist color laser printers that use four toners to print in full color.

Color laser printers tend to be about five to ten times as expensive as their monochrome siblings.

Laser printers produce very high-quality print and are capable of printing an almost unlimited variety of fonts.

In addition to text, laser printers are very adept at printing graphics. However, you need significant amounts of memory in the printer to print high-resolution graphics.

Because laser printers are nonimpact printers, they are much quieter. They are also relatively fast. The speed of laser printers ranges from about 4 to 20 pages of text per minute.

## **Examples of laser printers**

- HP LaserJet 1100 series
- HP Laser Jet 5M colour printer
- Epson EPL-N2000 PS printer

## **Advantages of laser printers**

- They produce high quality text and graphics
- Have very productive speed of between 5-50 copies per minute
- Low noise levels
- Excellent graphics capabilities
- Low maintenance requirements
- Large variety of type face sizes and styles
- Fast
- Many choices from which to choose
- Low cost per page
-

## **Disadvantage of laser printers**

- They are expensive especially the colour printers
- Limited to cut sheet media
- Slow for graphics output
- Advantages of non impact printers
- They are noiseless
- They consume very little power
- Produce clear images with high resolution
- Their print mechanisms are reliable with no paper jams, blocked nozzles thereby increasing productivity
- Disadvantages of non impact printers
- Require special paper for printing hence increasing the costs
- Paper are affected by age, sunlight, humidity and chemical vapour
- Papers have to be specially prepared hence inconvenient in commercial printing.
- Print heads can not be repaired even if a single dot heat fails the entire print head must be replaced
- Print speed is low due to the time given for the print heads to cool before the next print cycle
- Print heads have shorter life span
- 

## Common Problems Associated With The Use Of Printers

- Paper misfeeds
- Paper jams
- Clogged ink jets
- 
- Jammed ribbons
- Toner build up on rollers

## **Factors to consider before buying a printer**

- Pages per minute print out
- Memory of at least 2 mega bytes
- Price
- Availability of the toner or cartridge
- Purpose of the printer
- Printer drivers

Define the following terms

- a) **Near letter quality (NLQ):** Refers to the standard that compares printers' output of characters to the standard characters
- b) **Resolution:** This describes the clearness or sharpness of an image
- c) **Drops per inch (DPI):** Refers to the number of dots per inch on any print media

## **Advantages of printers**

- Information produced is permanent

## **Disadvantages of printers**

- The time to get the printout is slow when compared to display devices

- Paper is wasted for obtaining the output
- Printers are generally noisier than display devices

## **MONITOR / VISUAL DISPLAY UNIT/SCREEN**

A computer display monitor, usually called simply a monitor, is a piece of electrical equipment which displays viewable images generated by a computer without producing a permanent record.

The monitor is used to view data that is input from the key board.

The monitors are categorized according to their shape and technology of operation. They include:

Cathode ray tube (CRT)



This is the most common and popular type of monitor used on desktop computers, work stations and dumb.

These monitors generate images using small dots on them called picture elements (pixels).

The smaller the pixels and the closer they are, the better the images clarity and sharpness. (Resolution)

### Advantages of cathode ray tubes

- High resolution
- Sharp contrast at large view angles

### Disadvantages of cathode ray tubes

- They are bulky
- Consume a lot of power
- They are expensive

## **Flat panel displays**



These are thin, weightless and low power consuming monitors used on portable computers.

The monitors available are of three types of flat panel displays:

- i. Liquid crystal display (LCD)

This is a type of display used in digital watches and many portable computers.

it displays utilize two sheets of polarizing material with a liquid crystal solution between them.

An electric current passed through the liquid causes the crystals to align so that light cannot pass through them.

Each crystal, therefore, is like a shutter, either allowing light to pass through or blocking the light.

Monochrome LCD images usually appear as blue or dark gray images on top of a grayish-white background.

Color LCD displays use two basic techniques for producing color: Passive matrix is the less expensive of the two technologies.

- ii. The other technology, called thin film transistor (TFT) or active-matrix, produces color images that are as sharp as traditional CRT displays, but the technology is expensive.

#### Advantages

Lower power consumption  
Low cost

Small size

#### Disadvantages

They do not emit light; as a result, the image has very little contrast  
The screen is very susceptible to glare, so the optimum viewing angle is very narrow.  
They have no colour capability  
The resolution is not as good as that of a cathode ray tube

Resolution is the clearness or sharpness of an image.

#### iii. Gas plasma

A type of thin display screen used in some older portable computers and is the oldest flat screen technology.  
A gas-plasma display works by sandwiching neon gas between two plates.

#### Advantages

- The images are much brighter than on a standard CRT
- The resolution is excellent
- Glare is not a significant problem
- The screen does not flicker like some CRTs

#### Disadvantages

- Only a single colour is available (reddish orange)
- The technology is expensive
- It uses a lot of power

#### Distinguish between cathode ray tubes and liquid crystal displays

- Cathode ray tubes work like standard televisions because they also contain a cathode ray tube.

- Liquid crystal displays create images on the screen and produce colour either passive matrix or active matrix technology.

### **Cathode ray tubes**

Consume more power  
Relatively cheap  
Common on desktops  
Use analog signals  
Not ideal due to their size  
Emit electro magnetic radiation

### **liquid crystal displays**

Consume less power  
More expensive  
Common with hand held devices  
Use digital signals  
Ideal for limited space  
Do not emit electro magnetic radiation

### **SPEAKERS**

These produce sound output and are common with today's multi media programs that have become so important and necessary.

Speakers are electro-acoustic transducers that convert electrical signals into sounds loud enough to be heard at a distance.

### **Advantages of audio output devices**

- Are ideal for visually impaired people

### **Disadvantages**

- Are not suitable for use in noisy environment
- Not suitable for use in very quiet environment where other people are working for example libraries
- No permanent copy is produced
- A computer can only repeat the same message exactly the same way therefore when the message is not understood the first time, it may not be understood the second time.

### **Data projectors**

These take images displayed on the computer screen and cast them so they can be clearly seen by a room full of people.

These are devices that launch computer output onto a white or silver fabric screen that is wall, ceiling or tripod mounted. They are widely used in classrooms and auditoriums for instruction and slide presentations.

### Facsimile machine(fax machines)

This is a machine that transmits and receives documents over telephone lines

This is a device that can send or receive pictures and text over a telephone line.

Fax machines work by digitizing an image -- dividing it into a grid of dots.

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### **Advantages**

- Saves paper
- Allows a user to store received faxes on the computer
- Received faxes can be e-mailed to others
- Hard copies are available

### **Disadvantages**

- Sending a big document can be slow
- Waste of paper when junk faxes are sent

### Multifunctional devices



These refer to a single piece of equipment that provides the functionality of a printer, scanner, copy machine and facsimile machine.

### **Advantages**

- Less space is needed
- Less costs for buying separate units

### **Disadvantage**

When it breaks down, the user loses all its functions

### Terminals

A computer terminal is an electronic or electromechanical hardware device that is used for entering data into, and displaying data from, a computer or a computing system.

The function of a terminal is confined to display and input of data; a device with significant local programmable data processing capability

An EPOS-electronic point of sale terminal is used to record purchases at the point where the consumer purchases the product or services.

EFTPOS-electronic fund transfer point of sale terminals are able to transfer funds from a customer's bank account directly to a retail outlet's account after reading the customer's debit card.

An ATM-automated teller machine is a self-service banking machine attached to a host computer through a telephone network.

## **STORAGE DEVICES**

Storage refers to the capacity of a device to hold and retain data.

A storage device records and retrieves items to and from a storage medium.

Storage devices act as input devices when they read and act as output devices when they write.

Reading is the process of transferring data, instructions and information from a storage medium into memory.

Writing is the process of transferring data, instructions and information from memory to a storage medium.

The speed of a storage device is defined by its access time which is the amount of time it takes to locate an item on a medium.

In a computer, storage is the place where data is held in an electromagnetic or optical form for access by a computer processor.

computer storage devices are hard ware components designed to retain data or instructions in a relatively permanent form. Computer storage devices are also called secondary storage or auxiliary storage.

Storage devices refer to devices capable of storing data. The term usually refers to mass storage devices, such as disk and tape drives.

Storage capacity is The amount of data a storage device such as a disk or tape can hold. Storage capacity is measured in kilobytes (KB), megabytes (MB), gigabytes (GB) and terabytes (TB).

Storage media: This refers to the physical material onto which data is engraved for example magnetic or optical material. It may also refer to the temporary device on to which data, instructions and information are kept for future use.

Computers have memory or primary storage and backing storage( secondary storage) or auxiliary storage.

Primary storage :This is the internal memory used to temporarily store the operating system instructions, application software instructions and data that are in use Primary storage, also known as main storage or memory, is the main area in a computer in which data is stored for quick access by the computer's processor.

Primary storage refers to temporary storage of information the computer is currently working on. Primary storage is fast because it is accessed electrically and no mechanical components are involved. Most memory except ROM, flash memory and CMOS is volatile and contents must be transferred to backing storage before the computer is turned off.

For example RAM and ROM

Secondary storage:This is the type of storage that provides long term storage for soft ware programs and data.

Backing storage is slow because of the mechanical components involved.

Backing storage is non-volatile and contents stored are relatively more permanent when compared to memory.

### Primary storage devices

These are devices used to temporarily store the operating system instructions, application software instructions and data that is in use for example RAM and ROM. They are devices that temporarily store information that the computer is currently working on.

### Secondary storage devices

These are devices that provide long-term storage for software programs and data.

#### **Advantages of backup storage over the computer memory**

- Backup storage provides large volume of information
- It is a reliable source of alternative information.
- Retains data for long time which is permanent

The main storage devices used on computers include the following:

#### **PUNCHED CARDS**

A punched card is a piece of stiff paper that contains digital information represented by the presence or absence of holes in predefined positions.

Early digital computers used punched cards as the primary medium for input of both computer programs and data, with offline data entry on key punch machines.

#### **MAGNETIC TAPES**



A Magnetic tape is a medium for magnetic recording generally consisting of a thin magnetisable coating on a long and narrow strip of plastic.

A magnetic tape is a magnetically coated ribbon of plastic capable of storing large amounts of data and information at a low cost.

Today magnetic tapes are mainly used for providing back up or duplicate storage.

Tapes are used for long term storage and backup.

#### **Advantages**

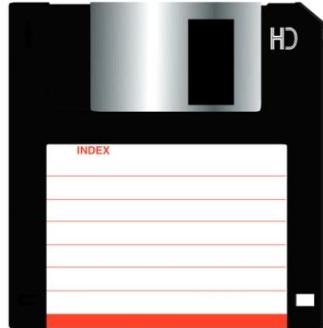
Storage capacity is much larger than a floppy disk

#### **Their disadvantages are:**

- They are bulky and require large storage space.
- The sequence mode of data access is so inconveniencing since it involves winding and unwinding to get the data that one needs leading to wastage of time.

- Winding and unwinding renders data life limited due to wearing down of the tape since the tapes can only be sequentially accessed.
- Humidity conditions may erase the magnetic particles.

## FLOPPY DISKETTES



A floppy diskette is a soft magnetic disk.

Floppy disks (often called floppies or diskettes) are portable, because you can remove them from a disk drive.

Disk drives for floppy disks are called floppy drives.

Floppy disks are slower to access and have less storage capacity, but they are much less expensive. And most importantly, they are portable.

A floppy disk is a thin, circular, flexible plastic disk with a magnetic coating enclosed in a square-shaped plastic shell.

**WRITE PROTECTION TAB:** This is a padlock system found on disks that is used to protect them when not in use.

Floppy diskettes need to be formatted before using them to prepare them for reading and writing.

Formatting is the process of preparing a floppy disk or hard disk for reading and writing by organizing the disk into storage locations called tracks and sectors.

For reading and writing purposes, sectors are grouped into clusters.

The formatting process may also erase the file location information and redefine the file allocation table (FAT) for these items of a formatted disk.

Note: A disk is a round plate on which data can be encoded. There are two basic types of disks: magnetic disks and optical disks.

### Advantages Of Using Floppy Diskettes

- Their mode of data access is random access and not winding and unwinding.
- They are portable and can fit in a shirt pocket and are the best so far since their size is acceptable.
- Since they are circular, data can be accessed from them at any sector in a short time.
- Their storage capacity is quite considerably bigger and can store up to 1.44 MB of data.
- Their rigid plastic cover provides protection for the data stored.
- They provide a reliable form of storage
- They can be used to transfer data from one computer to another
- They are convenient and inexpensive.

- Data on a floppy disk can be write-protected from being changed accidentally.

### DISADVANTAGES OF FLOPPY DISKETTES

- Harsh conditions of storage like temperature changes, moisture, bending can damage data stored on them.
- Data can easily be lost if the magnetic surface is exposed to a magnetic field so their data life is limited.
- Access time of a floppy is slow
- Storage capacity of a floppy disk is limited that is only 1.44MB.

### HARD DISKS

A hard disk is a magnetic disk on which you can store computer data.

A hard disk usually consists of several inflexible circular disks called platters on which data, instructions and information are stored electronically. It is also known as a hard disk drive. (HDD)

Hard disks are sealed tightly to keep out contaminants like dust and smoke which can lead to head crashes

#### Internal (fixed) disks



These are high speed and high storage capacity hard disks that can not be removed from the disk drives.

Each drive unit houses several non-removable platters with a number of read and write heads for reading and recording data on the disks.

It has a motor that rotates the drive at a high constant rate but because some fixed disks are larger than exchangeable disks the rotational speed may be slower than that of removable disk units.

Although not removable, or portable, this type of hard disk has greater storage capacity, access speed and is more reliable.

#### External (removable) hard disks



These are special types of hard disks that may be inserted in the computer when there is need for storage and then removed thereafter.

They are also called ‘magnetic disk packs’ or ‘hard zip disk cartridges’. Removable hard disk drives are placed in special drives connected to the

computer called ‘magnetic disk units’ which are responsible for recording or reading data on/from the disks.

These hard disks are largely used to back up data.

### **Advantages of hard disks**

- Provide far much larger storage capacity
- Provide faster and convenient data access time
- Hard disks are cheaper than floppy diskettes per megabyte.
- Since some reside inside the computer, they can not be stolen or misplaced.
- Data life of hard disks is long once in use
- Hard disks are reliable and have better protection against dust and dirt.

### **Disadvantages of hard disks**

- They are not portable especially those that reside inside the computer
- Hard disks are expensive
- Data becomes less secure if left on the hard disk
- May fail due to violent shaking
- Virus attacks render data life limited incase of unprotected systems
- Head crash may occur due to extreme shock or contaminants
- Disks are affected by magnetic fields since their storage media is made of the same material
- Since they are metallic, they expand and contract due changes in temperatures hence this may lead to data loss

Why a hard disk may fail to operate:

- Aging
- Violent shaking
- Power failures
- Virus attacks
- Excessive heat
- Excessive Humid conditions

## **COMPACT DISKS**



Compact disks are flat, round, portable storage medium that are store data using microscopic pits (indentation) and land (flat areas) that are in the middle layer of the disks.

A compact disk stores items in a single track which is also divided into evenly sizes sectors that spirals from the center of the disk to the edge of the disk.

**A track** is narrow recording band that forms a full circle on the surface of a disk.

**A sector** is a pie-shaped section on a track and is capable of holding data.

Any sector that can not be used due to a physical flaw on the disk is called a **bad** sector.

There are four major types of optical disks used on computers today:

**i. CD-ROM (compact disk read only memory)**

This is the common type of disk used on micro computers for storage of text, graphics and sound. They can not be written upon or erased by the user. The user can only access data imprinted by the disks' manufacturer but can not record on it or rub what has been recorded on it. Music, books, magazines, movies and games are some applications that may be found on compact disk read only memory.

**ii. CD-R (compact disks recordable)**

This is a specially manufactured compact disk format that allows you to write data on it, which data can then be read by a standard compact disk read only memory disk drive as well as compact disk recordable drive itself.

To record data on the compact disk recordable, special drives called compact disk writer drives are used.

**iii. WORM (write once read many) disks**

This is a type of optical disk designed to be recorded onto, just once and can not be erased; it can instead be read many times.

Data is written onto the disk by burning a permanent pattern into the surface of the disk by means of a high precision laser beam.

They are useful for storing data that needs to remain unchanged.

Recording is done in write once read many drives but reading is done in both write once read many and compact disk read only memory drives.

**iv. Erasable optical disks**

This is a re-writeable disk similar in appearance and size to other compact disks but enclosed in a casing which looks like that of a floppy disk.

These disks allow users to erase data so that the disk can be used over and over again.

Data can therefore be recorded and erased.

These are optical disks that can be erased and loaded with new data.

These four technologies are not **compatible** with one another; each requires a different type of disk drive and **disk**. Even within one category, there are many competing **formats**, although CD-ROMs are relatively standardized.

## CARE FOR OPTICAL DISKS

- Do not leave the disks in direct sunlight or in hot, humid conditions.
- Use a soft lint free cloth to remove spots, dust or finger prints and smears on the disk.
- Store the disks in protective cases
- Never stack disks on top of each other
- Never touch the underside of the compact disk
- Handle the disks only by the outer edges to prevent finger prints and smears on the disks

### Advantages of optical disks

- Are easy to store and are portable
- Have high storage capacity of over 700MB
- They are durable and can be stored for a long period of time and manufacturers guarantee that a properly cared for compact disk will last up to 50 years.
- Have high access speed and reduces access time
- Have a circular metallic plate with data grooved onto the disk that extends the data life of the disks.
- They can store text, graphics, video and sound as well as games.

The above advantages make optical disks the best convenient means of distributing today's huge software programs.

### **Disadvantages of optical disks**

- Breakage or a simple scratch may render the whole disk useless.
- They can be attacked by viruses
- Some kinds of compact disks are read only so their contents may not be changed like the compact disk read only memory.
- The average access time of a compact disk is slower than that of a hard disk.
- One problem with the compact disk re-writables is that they cannot be read by all compact disk read only memory drives.

### Photo CD

A Photo CD is a system designed by Kodak for digitizing and storing photos in a CD.

## DIGITAL VERSATILE DISKS/DIGITAL VIDEO DISKS (DVD-ROM)



DVD ("Digital Versatile Disk" or "Digital Video Disk") is an optical disk storage media format that can be used for data storage, including movies with high video and sound quality.

[com 0776222235/0702555411](http://com 0776222235/0702555411).

A digital versatile disc or digital video disc is a type of optical disk technology similar to the [CD-ROM](#).

A DVD holds a minimum of 4.7[GB](#) of data, enough for a full-length movie.

DVDs are commonly used as a medium for digital representation of movies and other multimedia presentations that combine sound with graphics.

The DVD specification supports disks with capacities of from 4.7GB to 17GB and access rates of 600KBps to 1.3 [MBps](#).

One of the best features of DVD drives is that they are backward-compatible with CD-ROMs, meaning they can play old CD-ROMs, CD-I disks, and video CDs, as well as new [DVD-ROMs](#). Newer DVD players can also read CD-R disks.

DVD uses [MPEG-2](#) to compress [video](#) data.

Other DVD types include:

#### DVD-RAM

This is a [DVD](#) format wherein DVD-RAM discs can be recorded and erased repeatedly but are only compatible with devices manufactured by the companies that support the DVD-RAM format. DVD-RAM discs are typically housed in cartridges.

#### DVD-R

Short for DVD-Recordable, a recordable [DVD](#) format similar to [CD-R](#). A DVD-R can only record data once and then the data becomes permanent on the disc.

The disc can not be recorded onto a second time. There also are two additional standards for DVD-R disks: DVD-RG for general use, and DVD-RA for authoring, which is used for mastering DVD video or data and is not typically available to the general public.

#### DVD-RW

Short for DVD-ReWritable, a re-recordable [DVD](#) format similar to [CD-RW](#)

#### Flash Memory



Flash memory is non-volatile computer memory that can be electrically erased and reprogrammed.

It is a technology that is primarily used for general storage and transfer of data between computers and other digital products.

#### Examples

- 1) USB Flash drives are flash memory modules that plug into a USB port, serving as small, long

lifetime, rapid access secondary storage. They serve as an efficient portable secondary storage devices.

2) Compact Flash is a new generation of high capacity secondary storage cards for digital cameras. The technology can provide sustained write speeds up to 750 Kbps. It also features an intelligent power management scheme to reduce power consumption up to 100 per cent as well as reduced standby current requirements.

3) Memory stick is a flash memory card from Sony designed for handheld digital appliances such as cameras and camcorders. Transfer to a PC is made via a PC Card adapter.

## Advantages

- 1) Flash memory is non-volatile, which means that no power is needed to maintain the information stored in the chip and better kinetic shock resistance than hard disks.
- 2) It is enormously durable, being able to withstand intense pressure, extremes of temperature, and even immersion in water.

## DRIVES

These are hardware components used to read and write on storage media.

Drive Type	Drive Letter
3.5" (floppy diskette)	A:
5.25" (now out of use)	B:
Hard disk	C:
CD-ROM	D:
Tape + Zip disk	E:
System disks (network drives)	F-Z:



## Eye strain

A sense of fatigue brought on by use of the eyes for prolonged close work or in persons who have uncorrected error of refraction.

**Eye strain** occurs when you over-use your **eye** muscles



Asthenopia or eye strain is an ophthalmologic condition that manifests itself through nonspecific symptoms such as fatigue, red eyes, eye strain.

### Symptoms of eye strain

#### Eye discomfort

Eye irritation/ dry itching or burning eyes.

Focusing problems

Blurring and double vision

Soreness of the eyes

Headaches

### Causes of eye strain



There are a small number of causes which can result in people suffering from Eye strain and sometimes accompanied by headaches.

These can differ from person to person and can be triggered differently from person to person.

Headache and eye strain triggers include:  
stress

tiredness

bad sitting posture

starring at a monitor for long hours

improper positioning of the monitor

failure to keep a proper distance from the screen

excessive lighting and reflection

reduced blinking time

poor lighting on the surrounding

stuffy work area

misuse of alcohol

reading when tired

screen flicker

poor legibility of input text

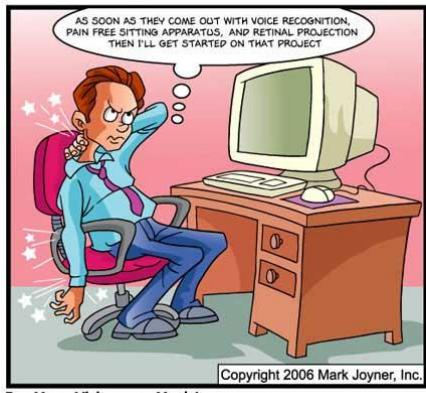
character size of fonts

poor setting of the screen display

Reducing eye strain  
 Minimize reflections  
 Control ambient light  
 Establish a suitable light environment  
 Establish a comfortable viewing distance  
 Regular eye examination  
 A variety in the type of work carried out  
 Regular rest periods  
 Improved sitting posture  
 Proper settings of the screen display

### Repetitive strain injury

A repetitive strain injury (RSI), also called repetitive stress injury, cumulative trauma disorder or occupational overuse syndrome, is any of a loose group of conditions from overuse of the computer, guitar, knife or similar motion or tool.



It is an occupational overuse syndrome affecting muscles, tendons and nerves in the arms and upper back; hence it is also known as work related upper limb disorder or WRULD.

The medically accepted condition in which it occurs is when muscles in these areas are kept tense for very long periods of time, due to poor posture and/or repetitive motions.

It is most common among assembly line and computer workers.

### Warning signs

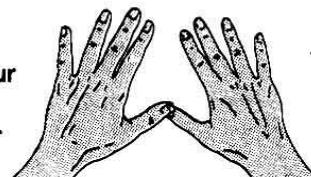
RSI conditions have many varied symptoms. following may indicate the onset of an RSI. Recurring pain or soreness in neck, shoulders, upper back, wrists or hands. Tingling, numbness, coldness or loss of sensation. Loss of grip strength, lack of endurance, weakness, fatigue. Muscles in the arms and shoulders feel hard when palpated. Pain or numbness while lying in bed. Often stage RSI sufferers mistakenly think they on their arms in an awkward position cutting circulation.

## Staying in shape

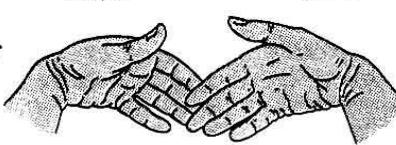
**By doing these exercises several times a day, you can give your hands a break from repetitive work and help to keep them flexible. Take a few minutes every hour or when your hands start to get tired to do these exercises. If you are being treated for hand problems, check with your doctor before starting these exercises.**

**1.**

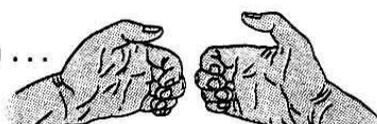
**A) Hands at your front, stretch your fingers . . .**



**B) . . . and rotate your hands . . .**



**C) . . . while closing them . . .**



**D) . . . into a tight fist.**

and wiry

early  
are lying  
off

Reducing repetitive strain injury

Good posture

Ergonomics

Limiting time in stressful working conditions.

Stretches, strengthening exercises

Massages

Biofeedback training to reduce neck and shoulder muscle tension can help heal existing disorders.

Ergonomics



Ergonomics is the scientific discipline concerned with designing according to the human needs, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.

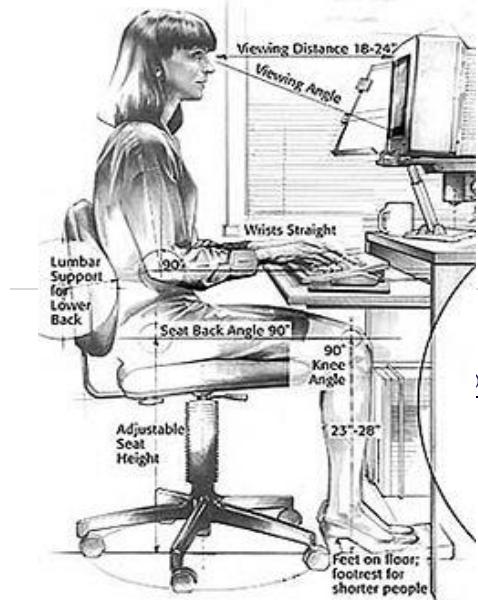
It also refers to incorporating comfort, efficiency and safety into the design of hardware in a work place.

It covers the relationship between people and their work environment.

Ergonomics is the science of designing the job, equipment, and workplace to fit the worker.

Proper ergonomic design is necessary to prevent repetitive strain injuries, which can develop over time and can lead to long-term disability.

### Five aspects of ergonomics



There are five aspects of ergonomics, safety, and comfort, ease of use, productivity/performance, and aesthetics. Based on these aspects of ergonomics, examples are given of how products or systems could benefit from redesign based on ergonomic principles.

Safety - Medicine bottles: The print on them could be larger so that a sick person who may have impaired vision (due to sinuses, etc.) can more easily see the dosages and label. Ergonomics could design the print style, color and size for optimal viewing.

Comfort - Alarm clock display: Some displays are harshly bright, drawing one's eye to the light when surroundings are dark. Ergonomic principles could redesign this based on contrast principles.

Ease of use - Street Signs: In a strange area, many times it is difficult to spot street signs. This could be addressed with the principles of visual detection in ergonomics.

Productivity/performance - HD TV: The sound on HD TV is much lower than regular TV. So when you switch from HD to regular, the volume increases dramatically. Ergonomics recognizes that this difference in decibel level creates a difference in loudness and hurts human ears and this could be solved by evening out the decibel levels. Voicemail instructions: It takes too long to have to listen to all of the obvious instructions. Ergonomics could address this by providing more options to the user, enabling them to easily and quickly skip the instructions.

Aesthetics - Signs in the workplace: Signage should be made consistent throughout the workplace to not only be aesthetically pleasing, but also so that information is easily accessible for all signs

#### Computer use ethics

These refer to moral guidelines that govern the use of computers and information systems.

Not to use a computer to harm other people.

Not to interfere with other people's computer work.

Not to snoop around in other people's files.

Not to use a computer to steal.

Not use a computer to bear false witness.

Not to use or copy software for which you have not paid.

Not to use other people's computer resources without authorization.

Not to appropriate other people's intellectual output.

Think about the social consequences of the program you write.

Use a computer in ways that show consideration and respect.

#### BOOTING A COMPUTER

Booting is the process of loading the operating system to primary memory and readying the computer system for use.

Booting refers to loading the first piece of software that starts a computer.

Because the operating system is essential for running all other programs, it is usually the first piece of software loaded during the boot process.

Booting is the process of starting-up of a computer, which involves loading the operating system and other basic software.

#### Boot sequence

This refers to the order of drives that a system's System follows when looking for the operating system (OS) to boot after the computer has performed Power-On Self Test.

A boot sequence is the initial set of operations that the computer performs when power is switched on

### **Boot devices**

A boot device is any device that must be initialized prior to loading the operating system.

In modern BIOS, the user can select one of several interfaces from which to boot. These include: hard disk, floppy, SCSI, CDROM, Zip, LS-120, a network interface card using PXE, or USB (USB-FDD, USB-ZIP, USB-CDROM, USB-HDD).

### **Types of booting**

#### 1. Cold booting

This happens when you turn on a computer after it has been powered off completely.

A cold boot is when you turn the computer on from an off position.

#### 2. Warm booting

This refers to restarting or resetting a computer that is already powered on.

The reset button, Control-Alt-Delete key combination was designed to allow a soft reboot for a quicker and more convenient.

A warm boot is when you reset a computer that is already on.

#### 3. Random reboot

Random reboot is a non-technical term referring to an unintended (and often undesired) reboot for which the cause is not immediately evident to the user.

Such reboots may occur due to a multitude of software and hardware problems, such as triple faults.

#### 4. Booting Down

Booting down is a phrase occasionally used to refer to shutting down a computer.

##### Errors

In Windows, when an error occurs in the boot process, a Blue Screen of Death or a Black Screen of Death may occur.

##### Effects of booting

Verification of hardware

Verify availability of software

Checking and correcting errors

### The boot process/stages of a computer

The boot process of a computer goes through stages and these include:

#### ✓ Power on reset (POR)

This is the first stage during the booting process where a computer checks the memory and microprocessor to find out if they are functioning normally. It happens as soon as a computer is switched on.

#### ✓ Power on self test (POST)

It is the second stage during the booting process where the computer checks all the devices connected to it in order to make sure that they are functioning well to enable the computer to execute the processing of data responsibly.

Incase there is a fault, a message will be displayed on a screen showing the faulty part; the end of this process is marked by a beep.

Incase several important devices are faulty the computer might stop at this stage.

#### ✓ Loading operating system

During this stage of booting, the computer begins to look for the operating system.

It does this starting with the floppy drive, once a computer finds no diskette in the floppy drive, it will proceed to start from the hard disk.

On getting the operating system, the computer will load it into the memory (RAM).

The name of the operating system will then be displayed on the screen at this stage and after a few seconds the computer will be ready for use.

Note the following:

When booting a computer, it is always advisable not to leave a floppy diskette in the floppy drive since the computer may think it has the operating system so it will not proceed to the hard disk and will display the message “non system disk replace the system disk and press any key”

## Cleaning computer peripherals

Cleaning your computer components and peripherals helps keep them in good working condition and helps the computer from spreading germs.

### General cleaning tips

- ✓ Never spray or squirt any type of liquid onto any computer component. Always use a clean cloth if a spray is to be used.
- ✓ Use a vacuum to suck up dirt, dust or hair around the computer on the outside case and keyboards.
- ✓ Turn off the computer or component before cleaning it.
- ✓ Never get any component inside the computer or any other circuit board damp or wet.
- ✓ Always use water or highly diluted solvents since some solvents may affect those individuals who are allergic to chemical reactions.
- ✓ When cleaning, be careful not to accidentally adjust any knobs or controls. At the back of a computer, if any control is plugged in, make sure not to disconnect any of the plugs.
- ✓ When cleaning fans inside the computers, hold the fan or place something in-between the fan blades to prevent it from spinning since this can cause damage and back voltage.
- ✓ Never eat or drink around the computer.
- ✓ Limit smoking around the computer.

### Cleaning tools

- ✓ Cloth or paper towels for rubbing down a component
- ✓ Water or rubbing spirit when moistening a cloth
- ✓ Portable vacuum for sucking the dust, dirt, hair, cigarettes particles
- ✓ Cotton swabs for wiping hard to reach areas in a keyboard and mouse.

Foam swabs

Cleaning the different components

Cleaning the case

Cleaning it helps to:

Keep the appearance of the computer look new

For its ventilation points help to steady airflow, cool components.

Procedure

Clean the plastic case using lint-free cloth that has been slightly dampened with water.

Rub a cloth over the holes and vents to make sure that they are hair and lint free.

Use a vacuum cleaner on the casing to remove dust particles.

### Cleaning the compact disks or other disk drives

A dirty compact disk drive or other disk drive can cause read errors and these cause software installation issues or issues while running the program.

#### Procedure

Use a compact disk ROM cleaner.

This eliminates dust, dirt and hair.

Use a cloth that is damp to clean the tray that ejects from the drive. Make sure that after cleaning the tray, it is completely dry before putting the tray back into the drive.

### Compact disks and digital video disks cleaning

Dirty compact disks can cause read errors or cause compact disks not to work at all.

#### Procedure

Use a cleaning kit or normal clean cotton cloth.

Wipe against the tracks starting from the middle of the compact disk and wiping towards the outer side.

Use a damp cloth and if the substance on the disk cannot be removed using water, pure alcohol can also be used.

### Floppy drive cleaning

Dirty read/write heads on the floppy drive can cause errors during the read and or writing process.

#### Procedure

Use a cleaning kit that is designed to clean the read/write heads on your floppy drive.

For experienced users, open the floppy drive casing and physically swap the read/write heads with a lint-free foam swab soaked in pure alcohol.

Be extremely careful when cleaning the heads to ensure that you do not lock them out of alignment causing the floppy drive not to work.

### Hard disk drive cleaning

While hard disks cannot be cleaned physically, they can be cleaned with various utilities on the computer to help them run fast and more efficient.

Utilizing these utilities will prevent the hard drive from slowing down.

### Headphones cleaning

Headphones that are used by multiple people may need to be cleaned frequently to help prevent the spreading of germs and head lice.

If the headphones being used are plastic or vinyl, moisten a cloth with warm water and rub the head and earpieces of the headphones.

Avoid using disinfectants or cleaning solvents since some users can have allergic reactions to some chemicals.

Headphones with cushions should have these cushions replaced to help keep them clean.

### Keyboard cleaning

Dirt, dust and hair can build up causing the keyboard not to work properly.

#### Procedure

Many people clean the keyboard by turning it upside down and shaking.

Use compressed air aimed between the keys to blow away all the debris and dust gathered there.

A vacuum cleaner can be used only if the keyboard has no loose “pop off” keys that could possibly be sucked up the vacuum.

Incase you spill anything into the keyboard, do the following:

Turn the computer off immediately.

Once the computer is off, flip the keyboard over quickly to prevent the substance from penetrating circuits.

While the keyboard is upside down, shake the keyboard over a surface you do not mind getting wet or that can be cleaned up later.

While still upside down, use a cloth to help clean out what can be reached.

After you have cleaned the keyboard to the best of your ability, leave the keyboard upside down for at least one night allowing it to dry.

If a keyboard does not work after trying it again later, it is recommended that it be replaced.

If some keys are sticky, or cannot be pressed in, you can attempt to do additional cleaning to resolve the issue.

#### Liquid crystal display cleaning

Dirt, dust and fingerprints can cause the computer screen to be difficult to read.

#### Procedure

Do not display any liquids onto the screen directly.

Do not use a paper towel as it may cause the screen to become scratched.

Use a soft cotton cloth and if a dry cloth can not clean the screen, then apply rubbing alcohol to the cloth and wipe the screen with the dump cloth.

#### Monitor cleaning

Dirt, dust and fingerprints can cause the computer screen to be difficult to read.

#### Procedure

The ordinary monitor can be cleaned with ordinary household glass cleaners.

Remove the power from the monitor and spray the cleaner onto a lint free cloth so the liquid does not leak into the electrical components inside the monitor.

Vacuum off any dust that has settled on top of the monitor and make sure no books or papers have been placed on the air vents since obstructed monitor vents can cause the monitor to overheat or even catch on fire.

#### Motherboard cleaning

Dust and especially particles of cigarette smoke can build up and corrode circuitry causing various problems like computer lockups.

When inside the computer, avoid unplugging any cables or other connections.

### **Procedure**

Use compressed air; hold it in upright position to avoid chemicals coming from the container from damaging or corroding the motherboard or other component within the computer.

Always blow the dust and dirt away from the motherboard or out of the case.

Use a portable battery powered vacuum to remove dust, dirt and hair from the motherboard completely and preventing it from getting trapped within the case.

Do not use a standard electricity powered vacuum as it can cause a lot of static electricity that can damage the computer.

It is vital that when using a vacuum to stay a couple of inches away from the motherboard and all other components to help prevent contact as well as to help prevent anything from being sucked into the vacuum.

Ensure that you do not remove any small components with the vacuum such as jumpers.

### **Mouse cleaning**

A dirty optical-mechanical mouse can cause the mouse to be difficult to move as well as cause strange mouse movements.

#### **Procedure**

To clean the rollers of the mouse, first remove the bottom cover of the mouse. Know the direction the mouse cover should be rotated. Place two fingers on the mouse cover and push in the correct direction of the cover.

Once the cover has rotated about an inch, rotate the mouse into its normal position, cover the bottom of the mouse with one hand and the bottom should fall off including the mouse ball. If this does not happen, attempt to shake the mouse gently.

Once the bottom cover and the ball are removed, you should be able to see three rollers located within the mouse.

Use a cotton swab, your finger and or fingernail and move in a horizontal direction of the rollers.

There will be a small line of hair and or dirt in the middle of the roller, remove this dirt and or hair as much as possible.

Once you have removed as much dirt and hair as possible, place the ball back within the mouse and place the cover back on.

If the mouse still has problems, repeat the same process and if repeated with no change, it is better to replace the mouse.

Cleaning your mouse pad with a dump cloth can also help improve a computer mouse movement.

Use a cloth moistened with rubbing alcohol, or warm water to rub the surface of the mouse and each of its buttons.

### **Printer cleaning**

Cleaning the outside of a printer can help keep the printer's appearance looking good and clean of germs.

#### **Procedure**

Turn off the printer before cleaning it.

Dampen a cloth with water or rubbing alcohol and wipe the case and each of the buttons or knobs on the printer.

Never spray any liquid directly onto the printer.

With some printers, it may be necessary to clean the inside of the printer to help keep the printer running smoothly.

#### Scanner cleaning

Flatbed Scanners commonly become dirty with dirt, dust, fingerprints and hair causing images to be distorted.

##### Procedure

Spray a window cleaner onto a paper towel or cotton cloth and wipe the glass until it is clean.

Never spray a liquid directly onto the component.

To clean the outside of the scanner, the same towel or cotton cloth can be used.

#### Super disk/LS120 cleaning

It is recommended that the super disk/LS120 drive be cleaned regularly to prevent drive heads from becoming dirty.

##### Procedure

Have the super disk cleaning kit available through Imation.

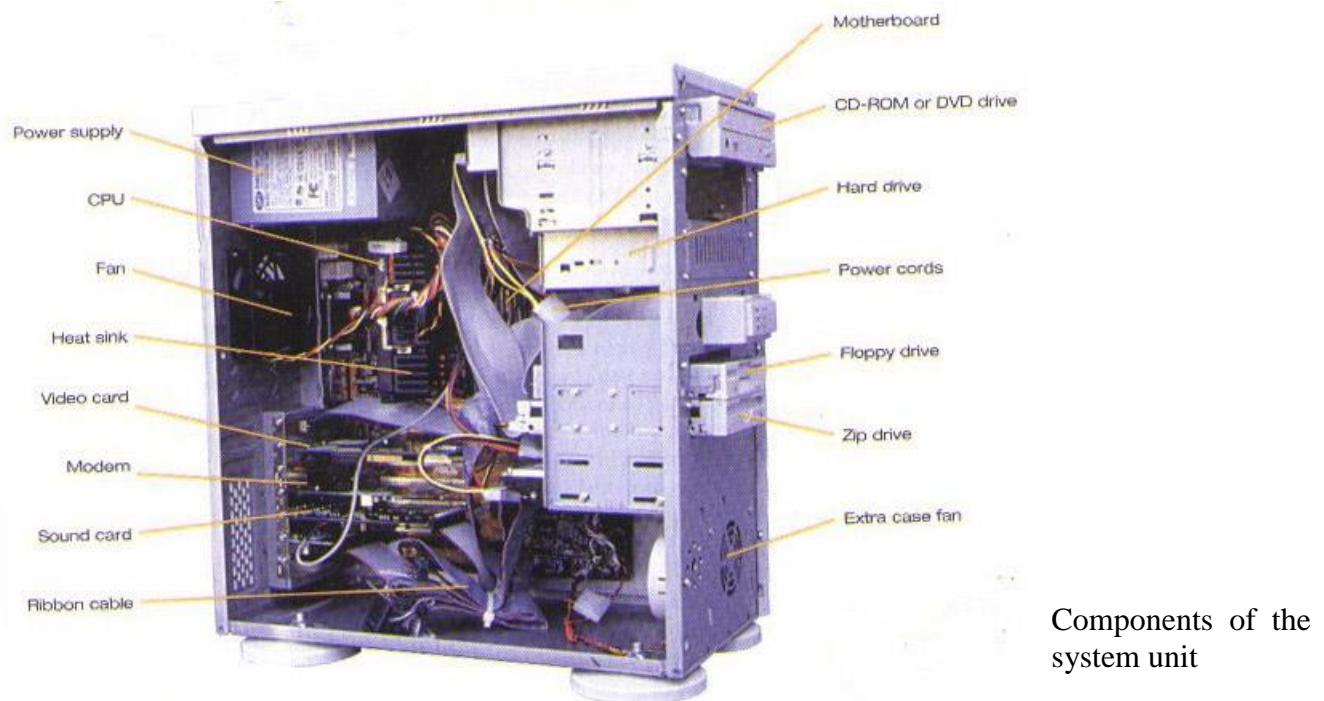
Using any other method will void the warranty on your drive.

## SYSTEM UNIT

This is a box like case that houses electronic components of the computer used to process data.

It is made up of metal or plastic and protects the internal components from damage.

The system unit includes the chassis, microprocessor, main memory, bus, and ports, but does not include the keyboard or monitor, or any peripheral devices.



### 1. Power supplies

These are used to convert wall outlet electricity to lower voltages used by a computer have fans that provide air flow inside the system unit to cool components

Power supplies are computer components that provide electricity to the system by converting AC (alternating current) from a wall outlet to DC (direct current) for the computer.

Power supplies are located at the rear of the computer case and usually contain one or more cooling fans. The back plate features a power cord receptacle and off/on switch. Most power supplies also have a rear voltage switch that can be changed for operating in different countries.

Power units-are connections in which power cables are put.

Computers have different voltages such as -5v, 5v,-12v and12v so the work of the power unit is to:



Convert AC to DC

Step down the incoming power to different voltages

Distribute power in the computer in different amounts

## Uninterruptible power supplies (UPS)



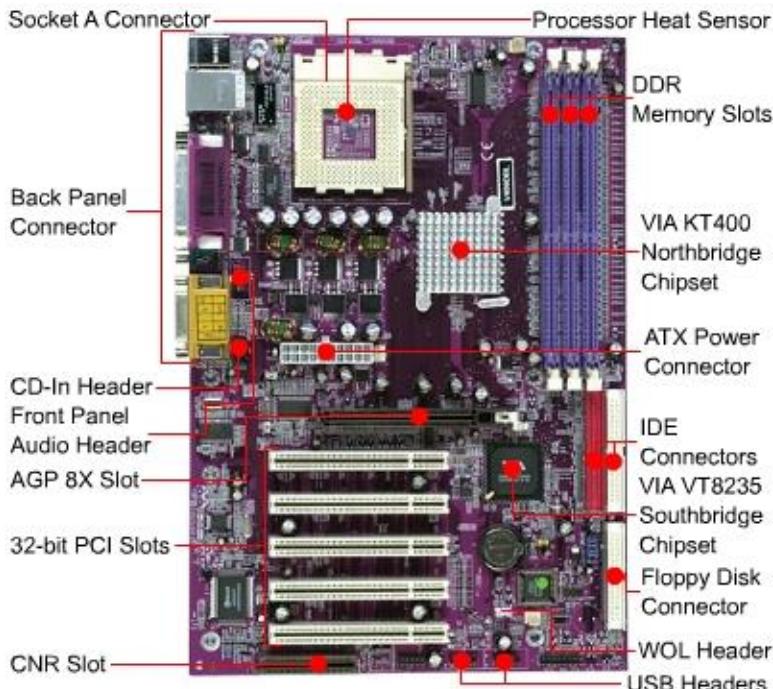
An uninterruptible power supply (UPS), uninterruptible power source or sometimes called a battery backup is a device which maintains a continuous supply of electric power to connected equipment by supplying power from a separate source when utility power is not available.

The uninterruptible power supply is a power supply that includes a battery to maintain power in the event of a power outage. Typically, a UPS keeps a computer running for several minutes after a power outage, enabling you to save data that is in RAM and shut down the computer gracefully. Many UPSs now offer a software component that enables you to automate backup and shut down procedures in case there's a power failure while you're away from the computer.

There are two basic types of UPS systems: standby power systems (SPSs) and on-line UPS systems. An SPS monitors the power line and switches to battery power as soon as it detects a problem. The switch to battery, however, can require several milliseconds, during which time the computer is not receiving any power. Standby Power Systems are sometimes called Line-interactive UPSes. An on-line UPS avoids these momentary power lapses by constantly providing power from its own inverter, even when the power line is functioning properly. In general, on-line UPSs are much more expensive than SPSs.

A UPS is inserted between the source of power and the load it is protecting. When a power failure or abnormality occurs, the UPS will effectively switch from utility power to its own power source almost instantaneously.

## 2. Mother board/system board/main board



A motherboard is the central printed circuit board (PCB) in many modern computers and holds many of the crucial components of the system, while providing connectors for other peripherals.

This is the main circuit board in the system unit.

Some motherboards contain empty sockets called upgrade sockets used to install more powerful central processing units or additional memory.

The motherboard is the main circuit board of a microcomputer. The motherboard contains the connectors for attaching additional boards.

Typically, the motherboard contains the CPU, BIOS, memory, mass storage interfaces, serial and parallel ports, expansion slots, and all the controllers required to control standard peripheral devices, such as the display screen, keyboard, and disk drive.

Collectively, all these chips that reside on the motherboard are known as the motherboard's chipset.

On most PCs, it is possible to add memory chips directly to the motherboard. You may also be able to upgrade to a faster PC by replacing the CPU chip.

To add additional core features, you may need to replace the motherboard entirely.

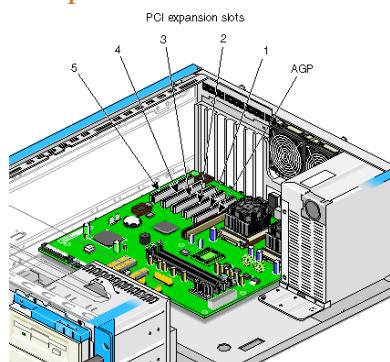
#### Uses of the motherboard

It provides a convenient method of inter board connection

It reduces hand wiring and possibilities of errors

It provides superior electrical performance

### 3. Expansion slots



These are empty slots left for the purpose of installing units such as speakers, modems and printers.

They may also be referred to as sockets designed to hold the circuit boards of other devices like tape drives and sound cards.

Expansion boards/expansion cards/controller cards/adapter cards/interface cards are circuit boards for the add-on devices.

A special type of expansion slot is PCMCIA that supports:  
Additional memory, Storage and Communications

An expansion slot is an opening in a computer where a circuit board can be inserted to add new capabilities to the computer. Nearly all personal computers except portables contain expansion slots for adding more memory, graphics capabilities, and support for special devices. The boards inserted into the expansion slots are called expansion boards, expansion cards , cards , add-ins , and add-ons.

#### Expansion card

It is a circuit board that adds devices or capabilities to the computer for example sound card, modem card, video card

A circuit board is a printed circuit that can be inserted into expansion slots in a computer to increase the computer's capabilities.

#### 4. Ports and connectors

The various connectors and ports on the computer allow it to communicate with the many different devices and peripherals attached.

Because there are so many cables and cords attached to the back of the computer, and so many different types of connectors, it often seems a little intimidating to the newer user.

Although there are some devices which may use the same connector or port, the individual devices and their cords can only physically attach to one certain type of connector; so don't feel nervous about hooking your system together.

##### Ports



These refer to the point of attachment to the system unit

They are also sockets used to connect the system unit to peripheral devices for example printer, modems, mice, and keyboards

A port is an interface on a computer to which you can connect a device.

Ports are either:

Parallel ports

Serial ports

##### Parallel ports

These are used to connect devices that send or receive large amounts of data for example printers, disk drives, tape drives.

A parallel port is parallel interface for connecting an external device such as a printer. Most personal computers have both a parallel port and at least one serial port.

On PCs, the parallel port uses a 25-pin connector (type DB-25) and is used to connect printers, computers and other devices that need relatively high bandwidth.

It is often called a Centronics interface after the company that designed the original standard for parallel communication between a computer and printer. (The modern parallel interface is based on a design by Epson.)

A newer type of parallel port, which supports the same connectors as the Centronics interface, is the EPP (Enhanced Parallel Port) or ECP (Extended Capabilities Port).

Both of these parallel ports support bi-directional communication and transfer rates ten times as fast as the Centronics port.

Macintoshes have a SCSI port, which is parallel, but more flexible.

### Serial ports

These are used to transmit data one bit at a time and are used to connect the mouse, keyboard and communication devices like modems.

A serial port, or interface, is a port that can be used for serial communication, in which only 1 bit is transmitted at a time.

Most serial ports on personal computers conform to the RS-232C or RS-422 standards. A serial port is a general-purpose interface that can be used for almost any type of device, including modems, mice, and printers (although most printers are connected to a parallel port).

### Universal serial bus (USB) ports



These are a new standard serial interface that is set to replace the conventional parallel and serial cables and ports.

Although they transmit one bit at a time, they provide very high speed and quality data transmission over distances of approximately five meters.

They support a wide range of peripheral devices ranging from external storage drives to digital cameras.

If a computer has no USB port, it can be bought and fitted on the motherboard.

Universal Serial Bus is an external bus standard that supports data transfer rates of 12 Mbps.

A single USB port can be used to connect up to 127 peripheral devices, such as mice, modems, and keyboards. USB also supports Plug-and-Play installation and hot plugging.

Starting in 1996, a few computer manufacturers started including USB support in their new machines.

It wasn't until the release of the best-selling iMac in 1998 that USB became widespread. It is expected to completely replace serial and parallel ports.

### Small computer systems interface (SCSI) cables and ports



These ports and interface cables transmit data in parallel but are faster than the parallel ports.

Small computer system interface is a parallel interface standard used by Apple Macintosh computers, PCs, and many UNIX systems for attaching peripheral devices to computers. Nearly all Apple Macintosh computers, excluding only the earliest Macs and the recent iMac, come with a SCSI port for attaching devices such as disk drives and printers.

SCSI interfaces provide for faster data transmission rates (up to 80 megabytes per second) than standard serial and parallel ports. In addition, you can attach many devices to a single SCSI port, so that SCSI is really an I/O bus rather than simply an interface.

Although SCSI is an ANSI standard, there are many variations of it, so two SCSI interfaces may be incompatible. For example, SCSI supports several types of connectors.

While SCSI has been the standard interface for Macintoshes, the iMac comes with IDE, a less expensive interface, in which the controller is integrated into the disk or CD-ROM drive.

Other interfaces supported by PCs include enhanced IDE and ESDI for mass storage devices and Centronics for printers. You can, however, attach SCSI devices to a PC by inserting a SCSI board in one of the expansion slots. Many high-end new PCs come with SCSI built in. Note, however, that the lack of a single SCSI standard means that some devices may not work with some SCSI boards.

The following varieties of SCSI are currently implemented:

**SCSI-1:** Uses an 8-bit bus, and supports data rates of 4 MBps

**SCSI-2:** Same as SCSI-1, but uses a 50-pin connector instead of a 25-pin connector, and supports multiple devices. This is what most people mean when they refer to plain SCSI.

**Wide SCSI:** Uses a wider cable (168 cable lines to 68 pins) to support 16-bit transfers.

**Fast SCSI:** Uses an 8-bit bus, but doubles the clock rate to support data rates of 10 MBps.

**Fast Wide SCSI:** Uses a 16-bit bus and supports data rates of 20 MBps.

**Ultra SCSI:** Uses an 8-bit bus, and supports data rates of 20 MBps.

**SCSI-3:** Uses a 16-bit bus and supports data rates of 40 MBps. Also called Ultra Wide SCSI.

**Ultra2 SCSI:** Uses an 8-bit bus and supports data rates of 40 MBps.

**Wide Ultra2 SCSI:** Uses a 16-bit bus and supports data rates of 80 MBps.

### Summary

Personal computers have various types of ports. Internally, there are several ports for connecting disk drives, display screens, and keyboards. Externally, personal computers have ports for connecting modems, printers, mice, and other peripheral devices.

Almost all personal computers come with a serial RS-232C port or RS-422 port for connecting a modem or mouse and a parallel port for connecting a printer. On PCs, the parallel port is a Centronics interface that uses a 25-pin connector. SCSI (Small Computer System Interface) ports support higher transmission speeds than do conventional ports and enable you to attach up to seven devices to the same port.

### Connectors

These are used to attach cables to peripheral devices

#### Female connectors

These are plugs or sockets that contain receptacles.



#### Male connectors

These are connectors that have pins.



connect a keyboard to the motherboard.

Other ports and connectors include:  
5-pin DIN and 6-in (PS/2) ports  
Originally, computers used the 5-pin DIN to

The 6-pin mini DIN also called PS/2 interface port has almost replaced this technology.

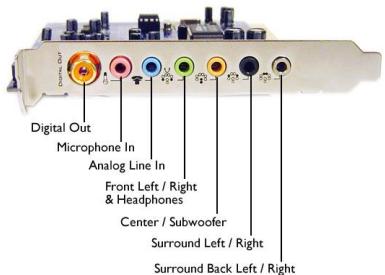
Currently most computers use the PS/2 connector as the new standard to connect PS/2 mice and keyboards.

### Monitor ports



The two common connectors used for monitors are the 9-pin D and the 15-pin Hi-D connector. They are called D-ports because they resemble letter D.

Audio connectors



These are jack plugs found on a sound interface adapter used to connect speakers, microphones and other portable audio equipment.

## 5. Central processing unit or processor chip

The CPU is the brains of the computer. Sometimes referred to simply as the central processor, but more commonly called processor, the CPU is where most calculations take place.

In terms of computing power, the CPU is the most important element of a computer system.

On large machines, CPUs require one or more printed circuit boards. On personal computers and small workstations, the CPU is housed in a single chip called a microprocessor.

The CPU itself is an internal component of the computer. Modern CPUs are small and square and contain multiple metallic connectors or pins on the underside.

The CPU is inserted directly into a CPU socket, pin side down, on the motherboard. Each motherboard will support only a specific type or range of CPU so you must check the motherboard manufacturer's specifications before attempting to replace or upgrade a CPU.

Modern CPUs also have an attached heat sink and small fan that go directly on top of the CPU to help dissipate heat.

## 6. RAM chips



RAM is a type of computer memory that can be accessed randomly; that is, any byte of memory can be accessed without touching the preceding bytes.

RAM is the most common type of memory found in computers and other devices, such as printers.

## 7. ROM chips



extensively in calculators and peripheral devices such as laser printers, whose fonts are often stored in ROMs.

### **8. PC (PCMCIA) slots and cards**

Personal Computer Memory Card International Association, and pronounced as separate letters, PCMCIA is an organization consisting of some 500 companies that has developed a standard for small, credit card-sized devices, called PC Cards.

Originally designed for adding memory to portable computers, the PCMCIA standard has been expanded several times and is now suitable for many types of devices. There are in fact three types of PCMCIA cards.

All three have the same rectangular size (85.6 by 54 millimeters), but different widths

Type I cards can be up to 3.3 mm thick, and are used primarily for adding additional ROM or RAM to a computer.

Type II cards can be up to 5.5 mm thick. These cards are often used for modem and fax modem cards.

Type III cards can be up to 10.5 mm thick, which is sufficiently large for portable disk drives.

As with the cards, PCMCIA **slots** also come in three sizes:

A Type I slot can hold one Type I card

A Type II slot can hold one Type II card or one Type I card

A Type III slot can hold one Type III card or any combination of two Type I or II cards.

In general, you can exchange PC Cards on the fly, without rebooting your computer. For example, you can slip in a fax modem card when you want to send a fax and then, when you're done, replace the fax modem card with a memory card.

### **9. Computer bus**

Is computer memory on which data has been pre-recorded. Once data has been written onto a ROM chip, it cannot be removed and can only be read.

ROM retains its contents even when the computer is turned off. ROM is referred to as being nonvolatile, whereas RAM is volatile.

Most personal computers contain a small amount of ROM that stores critical programs such as the program that boots the computer. In addition, ROMs are used

This consists of a number of wires connecting a processor to another device to enable elements to communicate to each other.

### Types of computer bus

#### Data buses

These are high ways in which data passes in the computer.

There are many categories of data buses:

They are bi-directional buses that carry information and data to and from the micro processor.

The categories of data buses are:

Address lines

Data lines

Circuit lines

#### Address buses

They have the memory locations or devices to be acted on by the micro processor.

They are usually unidirectional.

#### Control buses

They are unidirectional and carry command signals from the microprocessor.

#### Expansion bus

This carries data to and from the expansion slots

#### Local bus

This is an expansion bus that connects directly to the central processing unit.

#### Bay

This is an open area in the system unit in which you can install additional equipment like disk drives, tape drives

#### Sound components

The system has a small speaker housed in it and this can generate a variety of sounds for example music and voice.

Some computers have built in microphones used to record voice messages and other sounds.

Before carrying out any set up activity, note the following

Discharge any static electricity that might have built up on the hands by touching an earthed metallic object.

Never work alone because you may need help incase of an emergence.

Do not work on any peripheral without the guidance of the teacher.

Disconnect all devices from power sources before staring to work on them.

#### Device drivers and control circuits

These are devices that work as an interface between the computer and other devices connected to it for example a data cable connected to the computer from a printer.

They may also refer to a small program that enables a specific piece of hardware and software to communicate with operating system.

#### Plug and play

This refers to the ability of a computer system to automatically configure expansion boards and other devices.

### MICRO COMPUTER PROCESSING DEVICES

These are hardware components of a computer that serve the function of retrieving and executing (interpreting and processing) instructions and data into information in a computer.

They are responsible for the actual processing within the computer.

Processing may consist of performing calculations or logical activities.

#### Function of internal memory

Acts as a buffer between the CPU and the rest of the computer system components

The main processing hardware includes:

Central processing unit (CPU)

Main memory

Central processing unit (CPU) micro processor/micro chip



This is the brain of a computer responsible for performing all the processing within the computer.

It reads and interprets software and coordinates the processing activities that must take place.

The design of the central processing unit affects the processing power and the speed of the computer as well as the amount of main memory it can use effectively.

The more powerful the CPU, the faster the computer and the bigger the memory required.  
The CPU follows the instructions of the software to manipulate data into information.

The faster the clock, the more instructions the CPU executes per second.

The clock speed is stated in mega hertz and giga hertz.

Each tick is a clock cycle.

Clock speed/clock rate is the speed at which a processor executes instructions.

A hertz is one cycle per second.

Mega-million

Giga-billion

933MHZ is equal to 933 million ticks of the system clock.

Pronounced as separate letters it is the abbreviation for central processing unit. The CPU is the brains of the computer. Sometimes referred to simply as the central processor, but more commonly called processor, the CPU is where most calculations take place. In terms of computing power, the CPU is the most important element of a computer system.

On large machines, CPUs require one or more printed circuit boards. On personal computers and small workstations, the CPU is housed in a single chip called a microprocessor. Since the 1970's the microprocessor class of CPUs has almost completely overtaken all other CPU implementations.

The CPU itself is an internal component of the computer. Modern CPUs are small and square and contain multiple metallic connectors or pins on the underside. The CPU is inserted directly into a CPU socket, pin side down, on the motherboard. Each motherboard will support only a specific type or range of CPU so you must check the motherboard manufacturer's specifications before attempting to replace or upgrade a CPU. Modern CPUs also have an attached heat sink and small fan that go directly on top of the CPU to help dissipate heat.

Two typical components of a CPU are the following:

The arithmetic logic unit (ALU), which performs arithmetic and logical operations.

The control unit (CU), which extracts instructions from memory and decodes and executes them, calling on the ALU when necessary.

A silicon chip that contains a CPU. In the world of personal computers, the terms microprocessor and CPU are used interchangeably. At the heart of all personal computers and most workstations sits a microprocessor. Microprocessors also control the logic of almost all digital devices, from clock radios to fuel-injection systems for automobiles.

Three basic characteristics differentiate microprocessors:

- Instruction set:** The set of instructions that the microprocessor can execute.
- bandwidth :** The number of bits processed in a single instruction.
- clock speed :** Given in megahertz (MHz), the clock speed determines how many instructions per second the processor can execute.

In both cases, the higher the value, the more powerful the CPU. For example, a 32-bit microprocessor that runs at 50MHz is more powerful than a 16-bit microprocessor that runs at 25MHz.

In addition to bandwidth and clock speed, microprocessors are classified as being either RISC (reduced instruction set computer) or CISC (complex instruction set computer).

An instruction set refers to the set of instructions available for the central processing unit to execute.

Instruction set

Also called a command set, the basic set of commands, or instructions, that a microprocessor understands.

RISC-reduced instruction set computer

Is a type of microprocessor that recognizes a relatively limited number of instructions.

One advantage of reduced instruction set computers is that they can execute their instructions very fast because the instructions are so simple.

Another, perhaps more important advantage, is that RISC chips require fewer transistors, which makes them cheaper to design and produce.

There is still considerable controversy among experts about the ultimate value of RISC architectures. Its proponents argue that RISC machines are both cheaper and faster, and are therefore the machines of the future.

Skeptics note that by making the hardware simpler, RISC architectures put a greater burden on the software.

They argue that this is not worth the trouble because conventional microprocessors are becoming increasingly fast and cheap anyway.

To some extent, the argument is becoming moot because CISC and RISC implementations are becoming more and more alike. Many of today's RISC chips support as many instructions as yesterday's CISC chips. And today's CISC chips use many techniques formerly associated with RISC chips.

CISC-Complex instruction set computer.

Most personal computers, use a CISC architecture, in which the CPU supports as many as two hundred instructions.

The main components of the central processing unit are:

Main memory

Control unit

## Arithmetic logic unit

The central processing unit is composed of two logical parts connected together.

### Control unit

It directs all the operations that take place within the computer that is it tells the rest of the computer system how to carry out a program's instructions.

It gets instructions from the memory and then interpret them to determine what is to be done and direct the part responsible to carry out the task in doing the task, the control unit will open or close the circuits, will start or stop input or output devices and control the flow of information within the computer.

A key component common to all CPUs is the program counter, a special memory cell (a register) that keeps track of which location in memory the next instruction is to be read from.

#### Uses of the control unit

It controls the entire operations of the microprocessor system

It generates synchronization signals that is a process of transferring information between a hand held computer and desktop computer so that the same information is available on both computers.

It manages commands exchanged between the arithmetic logic unit and input/output devices and the memory.

Fetches, decodes and executes instructions

#### Fetching

Is the process of obtaining a program instruction or data item from the memory.

#### Decoding

Is the process of translating the instructions into commands a computer can execute.

#### Executing

Is the process of carrying out commands

#### Storing

Is the process of writing the results to the memory.

## Arithmetic and logic unit (ALU)

This is the part that performs arithmetic operations and logical operations and controls the speed of those operations.

The ALU is capable of performing two classes of operations: arithmetic and logic.

The set of arithmetic operations that a particular ALU supports may be limited to adding and subtracting or might include multiplying or dividing, trigonometry functions (sine, cosine, etc) and square roots.

Some can only operate on whole numbers (integers) whilst others use floating point to represent real numbers—albeit with limited precision.

Arithmetic operations include:

Addition  
Subtraction  
Division  
Multiplication

Logical operations are comparisons that the ALU compares two pieces of data to see whether one is:

Equal to	(=)
Greater than	(>)
Less than	(<)
Greater than or equal to	(>=)
Less than or equal to	(<=)
AND	
OR	
NOT	

These comparisons make it possible for the computer to sort data into alphabetic or numeric order.

It simply compares each item with every other item.

## THE MAIN MEMORY

Also called primary storage, internal memory or main memory is the part of processing hardware that is used to temporarily store data and instructions about to be processed by the computer.

It also stores information processed by a computer.

Computer memory is the temporary storage space for data, programs, commands and instructions.

Data in the memory is represented as electronic voltage in space called memory addresses.

A computer's memory can be viewed as a list of cells into which numbers can be placed or read.

Each cell has a numbered "address" and can store a single number.

In almost all modern computers, each memory cell is set up to store binary numbers in groups of eight bits (called a byte).

Why is the binary number system used for computers?

Because the computer (CPU) understands only binary every character is represented in binary form

The three basic items stored in the memory include:

Operating system and system software

Application programs

Data being processed

The role of the computer memory in storing both data and instructions is called the stored program concept.

## TYPES OF COMPUTER MEMORY

RAM and ROM are the two different types of memory found in the computer.

ROM is used to store software and configurations used in booting a computer.

RAM is used to store programs apparently used by the user when the computer is working.

Computers use two basic types of internal memory:

Read only memory (ROM)

Random access memory (RAM)

## Differences between RAM and ROM

RAM

Volatile

Read and write

Temporal

Can be increased

ROM

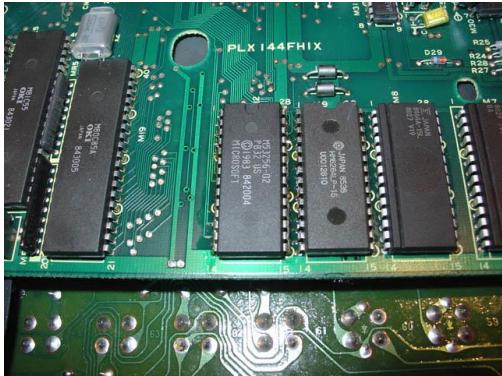
Non volatile

Read only

Permanent

Normally not increaseable

## READ ONLY MEMORY (ROM)



Contents of the read only memory are collectively called firm ware that is set during manufacture and can not be altered.

It has BIOS (basic input/output system)-this refers to firm ware that contains the computer's start up instructions.

Firm ware contains permanently written data, instructions or information.

It's the smallest in size and contains programs that are built in during manufacture.

Because it can not be written upon or erased it's also called firm ware.

Read-only memory, computer memory on which data has been prerecorded. Once data has been written onto a ROM chip, it cannot be removed and can only be read.

Unlike RAM, ROM retains its contents even when the computer is turned off. ROM is referred to as being nonvolatile, whereas RAM is volatile.

Most personal computers contain a small amount of ROM that stores critical programs such as the program that boots the computer. In addition, ROMs are used extensively in calculators and peripheral devices such as laser printers, whose fonts are often stored in ROMs.

## TYPES OF READ ONLY MEMORY

### PROM-programmable read only memory

Programmable read-only memory, a memory chip on which data can be written only once. Once a program has been written onto a PROM, it remains there forever. PROMs retain their contents when the computer is turned off.

The difference between a PROM and a ROM (read-only memory) is that a PROM is manufactured as blank memory, whereas a ROM is programmed during the manufacturing process.

To write data onto a PROM chip, you need a special device called a PROM programmer or PROM burner. The process of programming a PROM is sometimes called burning the PROM.

### EPROM- erasable programmable read only memory

Erasable programmable read-only memory, EPROM is a special type of memory that retains its contents until it is exposed to ultraviolet light. The ultraviolet light clears its contents, making it possible to reprogram the memory. To write to and erase an EPROM, you need a special device called a PROM programmer or PROM burner.

An EPROM differs from a PROM in that a PROM can be written to only once and cannot be erased. EPROMs are used widely in personal computers because they enable the manufacturer to change the contents of the PROM before the computer is actually shipped. This means that bugs can be removed and new versions installed shortly before delivery.

## EEPROM-electronically erasable programmable read only memory

EEPROM is a special type of PROM that can be erased by exposing it to an electrical charge. Like other types of PROM, EEPROM retains its contents even when the power is turned off. Also like other types of ROM, EEPROM is not as fast as RAM.

EEPROM is similar to flash memory (sometimes called flash EEPROM). The principal difference is that EEPROM requires data to be written or erased one byte at a time whereas flash memory allows data to be written or erased in blocks. This makes flash memory faster.

Instructions can be put in this memory as many times as one may like. The memory contains instructions up to when one decides to alter them. The instructions will remain in the memory unreduced.

## Uses of ROM

It stores data and programs that must be kept permanent at all time

It stores system files that enable a computer to operate

It stores BIOS that enables a computer to start

## RANDOM ACCESS MEMORY



This is the working area of a computer where data entered by the computer user and instructions are temporarily stored while the computer works on them.

So it stores data before, during and after processing.

It's a volatile memory because it can only retain its contents when the power is on.

Random access memory, a type of computer memory that can be accessed randomly; that is, any byte of memory can be accessed without touching the preceding bytes. RAM is the most common type of memory found in computers and other devices, such as printers.

In common usage, the term RAM is synonymous with main memory, the memory available to programs. For example, a computer with 8MB RAM has approximately 8 million bytes of memory that programs can use. In contrast, ROM (read-only memory) refers to special memory used to store programs that boot the computer and perform diagnostics. Most personal computers have a small amount of ROM (a few thousand bytes). In fact, both types of memory (ROM and RAM) allow random access. To be precise, therefore, RAM should be referred to as read/write RAM and ROM as read-only RAM.

It's also bigger in size compared to ROM

It determines the total size of programs and data files the computer can work on at any given moment depending on its size.

The bigger the RAM the faster the computer operates and the better your software performs.

The greater your machine's memory capacity the better because:

- It can create and use much larger programs
- It can hold copies of more than one program
- It can operate faster and more efficiently
- It will be able to use new, supplicated software
- RAM forms a major portion of main storage.
- It is in constant use for temporarily storage.

There are two different types of RAM: DRAM (Dynamic Random Access Memory) and SRAM (Static Random Access Memory). The two types differ in the technology they use to hold data, with DRAM being the more common type. In terms of speed, SRAM is faster. DRAM needs to be refreshed thousands of times per second while SRAM does not need to be refreshed, which is what makes it faster than DRAM. DRAM supports access times of about 60 nanoseconds, SRAM can give access times as low as 10 nanoseconds. Despite SRAM being faster, it's not as commonly used as DRAM because it's so much more expensive. Both types of RAM are volatile, meaning that they lose their contents when the power is turned off.

#### TYPES OF RAM

##### Conventional memory

This occupies the first 640KB of computer memory.

It is used by all MS-DOS computers

##### Upper memory

It occupies 384KB of memory and is found above the 640KB of the conventional memory.

It is used by computer hardware such as monitors and its used parts are called upper memory blocks.

It can also be used for running deice drivers and memory resident programs

##### High memory area

It is found in the first 64KB of extended memory for computers with extended memory.

MS DOS uses it to conserve conventional memory

Extended memory

This is beyond the first megabyte of memory on all 80286 or high computers.

This type of memory may require an extended memory manager like HIMEM

Expanded memory

It is an addition to conventional memory.

It comes on expanded memory boards with its own memory managers.

It is always slow.

Cache memory

It is an extra high speed memory that stores data that is frequently accessed.

It provides space for temporary storage of frequently accessed data.

It is more expensive than any other memory but once contained in a computer, it makes it more powerful.

All data in the cache memory is frequently replaced with new one due to its limited capacity.

Uses of RAM

Provides storage of a copy of the main software program.

Provides temporary storage of a copy of an application program

Provides temporary storage of a copy of data items input from the key board and mouse.

Silicon chips used for RAM

DRAM-dynamic random access memory

It is commonly used in personal computers since it is small and cheap.

SRAM-static random access memory

SRAM is a type of memory that is faster and more reliable than the more common DRAM (dynamic RAM). The term static is derived from the fact that it doesn't need to be refreshed like dynamic RAM.

Due to its high cost, SRAM is often used only as a memory cache.

It has faster access time but requires additional power usually supplied by a battery and is used in small portable computers.

FRAM-Ferro electric random access memory

Ferroelectric Random Access Memory, a type of non-volatile memory. FRAM combines the access speed of DRAM and SRAM with the non-volatility of ROM. Because of its high speed, it is replacing EEPROM in many devices.

## MEMORY MEASUREMENT, PARITY BITS, BINARY CODES

Data is represented electronically by storage cells that are either charged or discharged.

In RAM, the cells can be charged (on) or discharged (off) as one may wish.

In ROM, the cells are either charged or discharged permanently.

Mathematically, it is represented as either 0 or 1 in binary system.

## BINARY DIGITS

Computers are based on the binary numbering system, which consists of just two unique numbers, 0 and 1.

All operations that are possible in the decimal system (addition, subtraction, multiplication, division) are equally possible in the binary system.

For the computer, the binary system is more natural because of its electrical nature (charged versus uncharged).

Computers use the binary system as a basis of working with 0 and 1

The term binary is used to refer to two distinct states; on or off, yes or no, present or absent, 1 or 0.

Data is converted into the simplest form that can be processed magnetically or electronically.

A binary digit (bit) is either the character 1 (on) or the character 0 (off).

Computer memory is measured in terms of binary digits (bits) that are the lowest units of measurement and the computer use the binary number system because they only understand binary.

One character in a word has 8 bits.

One character = 8 bits and this is a byte, therefore 8 bits = 1 byte.

A bit is the basic unit of information in a computer

A byte is the basic storage unit in the computer

A byte is eight bits grouped together.

A byte is made up of eight bits. A bit is a single state, usually represented by a 0 or a 1. Using binary code, eight bits can be used to represent characters numbers and other items.

A bit is a single numeric value, either '1' or '0', that encodes a single unit of digital information. A byte is a sequence of bits; usually eight bits equal one byte.

An address is a unique number that identifies the location of the byte in the memory

CMOS (Complementary metal–oxide–semiconductor) stores configuration information about the computer like the type of disk, drives, key board.

Personal computers also contain a small amount of battery-powered CMOS memory to hold the date, time, and system setup parameters.

Measurement	Equivalence in bytes	Actual bytes
1 binary digit 0 or 1	1 bit	
1 character or 8 bits	1 byte	20
1 kilobyte (KB)	1,000 bytes	1024(210)
1 megabyte (MB)	1,000,000 bytes	1084576(220)
1 gigabyte (GB)	1,000,000,000 bytes	(230)
1 terabyte (TB)	1,000,000,000,000 bytes	(240)
1 Petabyte	1,000,000,000,000,000bytes	

## BINARY CODES

A binary code is a scheme for encoding data using a series of binary digits.

A code is a set of symbols for representing something. For example, most computers use ASCII codes to represent characters or may refer to written computer instructions.

Various groups of binary codes have been developed to represent the letters of the alphabet and special keys in accordance to specific standards and codes.

In computer technology, encoding is the process of putting a sequence of characters into a special format for transmission or storage purposes.

### American Standard Code for Information Interchange (ASCII)

ASCII is a code for representing English characters as numbers, with each letter assigned a number from 0 to 127. For example, the ASCII code for uppercase M is 77. Most computers use ASCII codes to represent text, which makes it possible to transfer data from one computer to another.

Text files stored in ASCII format are sometimes called ASCII files. Text editors and word processors are usually capable of storing data in ASCII format, although ASCII format is not always the default storage format. Most data files, particularly if they contain numeric data, are not stored in ASCII format. Executable programs are never stored in ASCII format.

The standard ASCII character set uses just 7 bits for each character. There are several larger character sets that use 8 bits, which gives them 128 additional characters.

The extra characters are used to represent non-English characters, graphics symbols, and mathematical symbols. Several companies and organizations have proposed extensions for these 128 characters.

The DOS operating system uses a superset of ASCII called extended ASCII or high ASCII. A more universal standard is the ISO Latin 1 set of characters, which is used by many operating systems, as well as Web browsers.

It controls the system bell and printing.

### Extended Binary Coded Decimal Interchange Code (EBCDI Code)

EBCDIC is an IBM code for representing characters as numbers. Although it is widely used on large IBM computers, most other computers, including PCs and Macintoshes, use ASCII codes.

It was used in large computers

It employed the 8-bit character emulation and was at times referred to as the 8-bit American code for information interchange.

### Binary Coded Decimal Code (BCD Code)

It is the least used code and is almost extinct.

It employs the 6 bit code and characters can be represented by 6 bits.

Binary-coded decimal is a format for representing decimal numbers (integers) in which each digit is represented by four bits (a nibble). For example, the number 375 would be represented as:

0011 0111 0101

One advantage of BCD over binary representations is that there is no limit to the size of a number.

To add another digit, you just need to add a new 4-bit sequence. In contrast, numbers represented in binary format are generally limited to the largest number that can be represented by 8, 16, 32 or 64 bits

Character	ASCII code	EBCDI code	BCD code
A	01000001	110000011	110001
B	01000010	11000010	110010
C	01000011	11000011	110011
G	01000111	11000111	110111
E	01000101	11000101	110101
S	01010011	11100010	010010
Z	01011010	11101001	011001

## PARITY BITS

These are bits added to data by a computer to ensure its accuracy.

Data may be stored in 8 bit, 16 bit, 64 bit groups but if you have a parity memory, an extra bit is added to have; 9 bit, 17 bit, 65 bit groups.

The computer checks the number of bits and the data during data processing to ensure that no bit is lost during the process and this is called performing a parity check.

This is done before, during and after data transmission.

When a computer detects an error or mismatch in bits, then it will ‘hang’.

Alternatively it will respond with a message “this application has performed an illegal operation and will be shut down” and the application is immediately closed to allow data application to start again.

The parity chip holds the parity bit or check bit that is used for error detection.

Parity checking refers to the use of parity bits to check that data has been transmitted accurately.

The parity bit is added to every data unit (typically seven or eight bits) that are transmitted.

The parity bit for each unit is set so that all bytes have either an odd number or an even number of set bits.

Assume, for example, that two devices are communicating with even parity (the most common form of parity checking). As the transmitting device sends data, it counts the number of set bits in each group of seven bits.

If the number of set bits is even, it sets the parity bit to 0; if the number of set bits is odd, it sets the parity bit to 1.

In this way, every byte has an even number of set bits. On the receiving side, the device checks each byte to make sure that it has an even number of set bits.

If it finds an odd number of set bits, the receiver knows there was an error during transmission.

The sender and receiver must both agree to use parity checking and to agree on whether parity is to be odd or even.

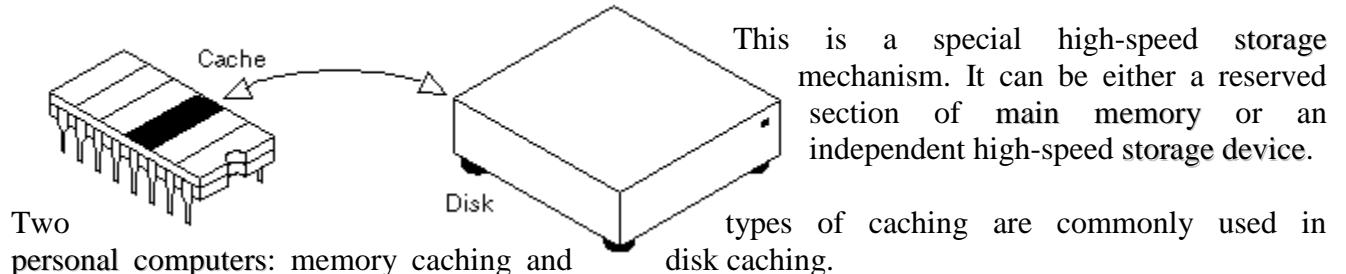
If the two sides are not configured with the same parity sense, communication will be impossible.

Parity checking is the most basic form of error detection in communications.

Although it detects many errors, it is not foolproof, because it cannot detect situations in which an even number of bits in the same data unit are changed due to electrical noise.

Parity checking is used not only in communications but also to test memory storage devices. Many PCs, for example, perform a parity check on memory every time a byte of data is read.

#### Memory cache



A memory cache, sometimes called a cache store or RAM cache, is a portion of memory made of high-speed static RAM (SRAM) instead of the slower and cheaper dynamic RAM (DRAM) used for main memory.

Memory caching is effective because most programs access the same data or instructions over and over.

By keeping as much of this information as possible in SRAM, the computer avoids accessing the slower DRAM.

Some memory caches are built into the architecture of microprocessors. The Intel 80486 microprocessor, for example, contains an 8K memory cache, and the Pentium has a 16K cache.

Such internal caches are often called Level 1 (L1) caches. Most modern PCs also come with external cache memory, called Level 2 (L2) caches.

These caches sit between the CPU and the DRAM. Like L1 caches, L2 caches are composed of SRAM but they are much larger.

Disk caching works under the same principle as memory caching, but instead of using high-speed SRAM, a disk cache uses conventional main memory.

The most recently accessed data from the disk (as well as adjacent sectors) is stored in a memory buffer.

When a program needs to access data from the disk, it first checks the disk cache to see if the data is there.

Disk caching can dramatically improve the performance of applications, because accessing a byte of data in RAM can be thousands of times faster than accessing a byte on a hard disk.

When data is found in the cache, it is called a cache hit, and the effectiveness of a cache is judged by its hit rate.

Many cache systems use a technique known as smart caching, in which the system can recognize certain types of frequently used data.

The strategies for determining which information should be kept in the cache constitute some of the more interesting problems in computer science.

## COMMUNICATION HARDWARE

These are hardware parts of a computer that facilitate connection between computers and between groups of interconnected computers.

The commonly used communication hardware components are the modem, multiplexers, cables and the fax modem.

### DIAL UP MODEMS



A modem is a device that allows one computer to communicate with another over a telephone line.

It changes from digital to analog from a computer to a telephone line.

It also changes from analog to digital from a telephone line to the computer.

The word modem comes from:

### MODULATION

This is the process of converting digital signals from a computer to analog signals including data to be sent over a telephone line.

## DEMODULATION

This is the process of converting analog signals sent over a telephone line to digital signals to be processed by the receiving computer.

A modem can be external or internal

An external modem is a stand alone device that attaches to a serial port on a computer with a cable and to a telephone outlet with a standard telephone cord.

An internal modem is an expansion card that can be inserted into an expansion slot on a computer's motherboard and the modem then attaches to a telephone outlet with standard telephone cord.

## FAX MODEM

This is a special type of modem with fax capabilities that enable you to send signals directly from your computer to some one else's fax machine or computer fax modem.

## ISDL and DSL MODEMS

Integrated services digital network is a set of standards for digital transmission of data over standard copper telephone lines.

Advantages of ISDL lines

Provide faster transfer rates than dial up lines

Faster web downloads and clearer video conferencing

Produce very clear voice conversation

Digital subscriber lines provide high-speed connections to the internet over a regular copper telephone line.

ADSL-asymmetric digital subscriber line is a type of DSL that supports faster transfer rates when receiving data than when sending data.

Cable modems

A cable modem sends and receives data over the cable television network.

They transmit data at speeds much faster than dial-up modems.

Network interface cards

These are expansion cards that enable a computer or device to connect to a network.

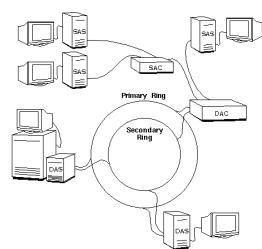
## MULTIPLEXERS, CONCENTRATORS AND CONTROLLERS

### MULTIPLEXERS



These are communication devices that combine two or more input signals from several devices into a single stream of data and transmit over a communication channel.

### CONCENTRATORS



A concentrator also allows many devices to share a single communication line but is more 'intelligent' than a multiplexer because it can store and forward transmissions.

### CONTROLLERS

A controller also supports a group of devices (terminals and printers) connected to a computer.

### FRONT END PROCESSORS



Is a small computer that relieves the larger one of many data traffic management and communication functions

It allows the main computer to concentrate on processing and improving the responsiveness of the system to the user.

Applications that rely on communication technology

#### Instant messaging-IM

This is a real-time communications service that notifies a user when one or more people are online and then allows the user to exchange messages or files with them.

#### Electronic mail

This refers to transmission of messages from one computer to another on the same network or separate networks.

### Voice mail

This may be considered verbal electronic mail made possible by the latest computerized telephone systems; voice mail reduces the problem of telephone tags where two people trying to reach each other end up leaving a series of messages to please call back.

### Video conferencing

This refers to the use of computers, television cameras and communications software and equipment to conduct electronic meetings with participants at different locations.

### Groupware

This is software that helps multiple users collaborate on projects and share information.

### Fax

Facsimile or fax equipment is used to transmit a reproduced image of a document over phone lines. The document can contain text, graphics or can be hand written.

### Advantage

Hard copies are available

### Disadvantages

Sending a big document can be slow

Waste of paper when junk faxes are sent

### Telecommuting

This refers to the capability of individuals to work at home and communicate with their offices by using personal computers and communication channels.

### Advantages

Reduces the time and expenses for travelling to and from work

Eliminates travelling during unsafe weather conditions

Allows a flexible work schedule for employees

Provides a convenient, comfortable work environment for disabled employees or those recovering from injury or illness

Reduces air pollution caused by vehicles driven to and from work

Employers reduce costs due to less office space and furniture required

### Disadvantages

Data security may be problematic

Leisure time at home may be replaced by work

Work has to stop if any component of the communications system fails to work

Reduced human face-to-face interactions among working staff

### **Electronic data interchange (EDI)**

This is the capability to electronically transfer documents from one business to another.

#### **Advantages**

Lower transaction costs

Reduced time to transmit documents

Reduced data entry errors

Reduced paper flow

### **Global positioning systems (GPS)**

These use satellites to determine the geographical location of earth-based global positioning equipment

#### **Uses**

Create a map

Monitor movement of a person or object

Ascertain the best route between two points

Locate a person or an object

Cars and ships use the GPS to provide directions to a destination and weather information

Chat rooms

A chat room is a location on an internet server that permits users to chat with each other by typing lines of text on the computer.

### **Bulletin board system (BBS)**

These allow users to communicate with one another and share information.

### **Online services**

They are sometimes called information services and they make information and services available to paying subscribers.

### **The internet and World Wide Web**

Both are one of the more exciting uses of communications today.

# **COMPUTER SPECIFICATIONS**

These include amongst others the following:

## **COMPUTER TYPE**

There are two basic choices:

IBM compatible and the Apple Macintosh

These support add on boards used in many IBM computers, servicing and accessories.

## **PROCESSOR POWER**

286, 386, Pentium I, Pentium II, Pentium III, Pentium IV and the cache memory is also useful

The mother board should support the memory 256K, 512K.

For graphics 512K in the 486PCs is better.

## **SYSTEM RAM**

This enhances the system performance.

4MB is currently the minimum for Windows 3x since 8MB is recommended for Windows 95.

16MB is the standard level.

For heavy graphics for example computer aided designs in auto card, multimedia games, 64MB is good.

For windows 2000, 128MB should be the bear minimum.

The more memory the better performance.

## **HARD DISK**

There is need for adequate hard disk space for storage.

1GB of hard disk space is appropriate.

620MB would be the lowest end.

Pentium power of 2GB and 16GB of hard disk space may be recommended.

## **MONITORS**

14" size of resolution 640X640 is also available on monitors.

The choice of the monitors depends on the purpose of the machine.

For graphics designing resolution of 1280X8100, 1600X8100 rates of 76MHZ is good.

14", 17", 19", 21" for desktop and laptop computers is also good

Monitor such as SVGA, VGA, EGA, CGA are absolute.

## **DISKETTE DRIVES**

The most common diskette drives for PCs are the 3.5" HD DD and CD ROM drives. Originally 5.25" was the standard on 286 and 386 PCs.

## **EXPANSION SLOTS**

These are found on desktop computers

They provide space for expansion cards that may be needed

Cards may be internal modems, VGA, network cards, SCSI controllers.

Expansion slots make a computer future proof.

## **LAPTOP SLOTS**

The laptops use PCMCIA cards or PC cards

They look like typical credit cards or telephone cards.

Laptop cards are for type II slots but the bulky ones like HDD are type III cards

## **VIDEO CARDS**

These provide output from the mother board to the monitor.

For heavy graphics and screen display, require faster and powerful video graphics accelerators cards.

The convenient averages are the 256K cards

For graphics 1MB is good though some are expanded to 2MB

## **SOUND CARDS**

These deal with multi media packages especially sound.

Most cards have tinny speakers on them and can produce PC sounds.

## **MODEMS**

These are used to connect to the internet and computer communications to transmit data to and from the computers.

They have video/fax facilities incorporated.

They are categorised according to the speed of transmission for example 14400bps, 33600bps, and 48000bps

Slower modems take long to download data

## **KEY BOARD AND MICE**

These are supplied with the PC and standards are similar everywhere.

102/03 enhanced keyboard is the standard.

Some mice have two buttons and the two mouse button is the best choice

## **BUNDLED SOFTWARE**

This includes operating system like DOS and windows 3.1 or windows 95/98 installed on them may also include useful packages like MS office or lotus a smart suite and a host of shareware games or software.

## DOCUMENTATION AND SUPPORT

This includes user annuals and guides including program diskettes or CDs.

This may contain a license agreement that you may need to use.

It may contain a number code or procedures for support from manufacturers when things go wrong.

## MS-DOS-Microsoft Disk Operating System

Is an operating system commercialized by Microsoft.

It was the most commonly used member of the DOS family of operating systems and was the dominant operating system for the PC compatible platform during the 1980s.

It has gradually been replaced on consumer desktop computers by various generations of the Windows operating system.

MS-DOS was originally released in 1981 and had eight major versions released before Microsoft stopped development in 2000.

It was the key product in Microsoft's growth from a programming languages company to a diverse software development firm, providing the company with essential revenue and marketing resources.

### Features

#### User interface

MS-DOS employs a command line interface and a batch scripting facility via its command interpreter, COMMAND.COM.

MS-DOS was designed so users could easily substitute a different command line interpreter, for example 4DOS.

Beginning with version 4.0, MS-DOS included DOS Shell, a file manager program with a quasi-graphical text user interface (TUI) that featured menus, split windows, color themes, mouse support and program shortcuts using character mode graphics.

#### Multitasking

MS-DOS was not designed to be a multi-user or multitasking operating system, but many attempts were made to add these capabilities.

## THE ROLE OF MS DOS

It has a set of programs that enable one work effectively, manage the information on the external storage devices and carry out house keeping routines on the computer.

The categories of work include:

## MANAGING DEVICES

Managing the different auxiliary devices like printers, key boards, monitors and disks

Managing the flow of information between the memory and storage devices

Managing the files by performing sorts, deletes, copying, backups and keeping the time and date.

### **COMMAND PROCESSING**

A command is an instruction for DOS to run a program. A command may be internal or external.

### **CONTROL PROGRAMS**

External commands are copied from the disk to the computer and then set up a framework of how it will run. It is done in addition to providing various services of an operating system to the program.

Managing system resources

Other functions of DOS include the following.

Keeping track of previously used commands.

Managing system memory

Managing errors: When an invalid command is entered, DOS will respond by making sound through the computer bell or displaying an error message like Bad command or file name.

### **LOADING DOS**

The booting process of an MS DOS based computer follows the following procedure

Post Routine

When power is switched on a PC, the POST (power on self test) inbuilt within the ROM BIOS runs. It checks all peripherals like memory, processor, monitor, keyboard, printer and any other hardware installed in the expansion slots. The boot record is then sought.

### **BOOT RECORD**

The ROM BIOS determines which devices to boot from by checking the boot record. The boot record can be on a floppy diskette or local hard disk. ROM BIOS then loads a short program from the boot record to determine how the disk stores and the directories.

### **SYSTEM FILES**

Using information in the boot record, the ROM BIOS then loads the command. COM file, a command processor and the system files including the hidden files like 10.sys and DO.SYS

### **DOS FILES**

When the system file 10 is loaded it checks for a configuration system file CONFIG.SYS and this contains files that load device drivers, set parameters for initial environment. If the CONFIG.SYS does not exist, DOS assigns the default values.

When command.com is loaded:

Checks for a batch file called Auto exec. Bat and executes it.

Contains programs, utilities, virus guards and DOS commands to be executed before the computer is ready for use.

May contain additional batch files to be executed before the command prompt is displayed to indicate that the PC is now ready for use.

It loads most of the TSR programs.

Under windows 9x, windows have to load before the computer is ready.

Configuration is the setting up of your computer so that hardware and application work the way you want them to.

### COMMAND PROMPT

When the computer is powered on, text first scrolls up the screen and the following text is seen either on the first line or the last line of the screen.

C:\>-

This command is the command prompt and signifies the end of the boot process. The computer is ready to accept valid commands.

### THE CURSOR

This is the blinking under-score at the command prompt. It indicates where the next character will appear when typed.

### MS DOS COMMANDS

At the command prompt, any command can be issued for execution. Commands include:

Internal commands

External commands

### INTERNAL COMMANDS

They reside inside a file COMMAND.COM

Are the most frequently used commands.

Are loaded together with the operating system during boot process.

Are stored in the main memory for fast access.

Are most important because they are used to start up the machine.

### EXAMPLES OF INTERNAL COMMANDS

DIR

RD

COPY

ERASE

REN

DATE

MK DIR

TIME

Note the following:

Main memory-internal commands  
Secondary storage-external commands

### **EXTERNAL COMMANDS**

Are computer files with their own compiled codes or set of instructions.

Are not commonly used and not loaded in main memory at boot.

Are files with extensions.

BAT for batch files (text files).

.COM for command files (compiled source)

.EXE for executed file complied source and linked

.TXT for text files

.DOC for document files

Back up, disk copy and format

### **COMMAND EXECUTION**

When a command is issued at the command prompt, the computer searches for it in this folder, searches the memory to verify whether it is an internal command. If it is not in the memory, the computer searches for any file in the current directory on the drive for a file either the same file specifications as the command issued. It begins with a file that has the file name but with the .COM extensions and then searches for the file with the same file name but with .Exe extension and finally the .Bat extension. If none of these is found, then it will return the “Bad command or file name” expression.

Note:

The DOS command line is where users type and enter commands.

Files are stored in physical trucks on a computer disk.

Command language is a set of commands you use to interact with the computer. Are difficult since they require exact spelling, grammar, and punctuation

### **BASIC MS DOS COMMANDS**

Command name	:	VERSION
Command type	:	internal
Command use	:	displays version number of MS DOS currently running.
Syntax	:	VER {press enter}
Example	:	VER {enter}
Command results	:	MS DOS 6.22
Command name	:	DATE
Command type	:	internal
Command use	:	returns the current system date.

Syntax	:	date {press enter}
Example	:	date {enter}
Command results	:	current date is Wed 03 04 1999 Enter new date (mm-dd-yr)
Command name	:	TIME
Command type	:	internal
Command use	:	returns current system time.
Syntax	:	time {press enter}
Example	:	time {enter}
Command results	:	the current time is 09: 30: 21:05 pm Enter new time:-
Command name	:	DIR
Command type	:	internal
Command use	:	displays a list of files and sub directories in current directory
Syntax	:	DIR {press enter} parameter /P, /W, /S
Example	:	:
Command results	:	:
Command name	:	CLS
Command type	:	internal
Command use	:	clears the screen and repositions the command prompt on top of the screen.
Syntax	:	CLS {press enter}
Example	:	CLS {enter}
Command results:	:	C:>-
Command name	:	SORT
Command type	:	external
Command use	:	rearranges a list of variables in chronological order
Syntax	:	Sort {press enter} for each variable. F6
Example	:	:
Command results	:	:

## COMMAND NAME AND DESCRIPTION

Command .com	DOS command processor
Disk copy .com	copies an entire diskette
Format .com	formats diskettes
Backup .com	copies files from a fixed disk to a diskette

## MANAGING DIRECTORIES

A directory is an area on a computer disk that a user creates to store related files forming a tree like arrangement with single route directories branching out to multiple sub directories.

Organized set of topics such as arts, reference, sports and subtopics  
A list of files arranged in a chronological order.

## **TYPES OF DIRECTORIES/FOLDERS**

These include the following:

### **ROOT DIRECTORY**

Is always the upper level directory in a computer file structure. It is always indicated as the current drive letter on a particular drive. It is only created when a disk is first formatted or initialized. Once a root directory has been created, it cannot be removed, unless you want to alter all files and directories on the drive. It can be indicated as:

A:\ on drive A and C:\ on drive C

### **MAIN DIRECTORY**

Is the first level directory on a drive or on the root directory. Is the second level directory in a computer's file structure. Can be created and or deleted. Many contain other directories called sub directories.

### **SUB DIRECTORIES**

Are sub level directories other than the first level directory. They stem from the first level directory and or sub directories. Can also be created and or deleted.

## **CREATING DIRECTORIES**

Command used: MK DIR (MD)  
Command type : internal  
Command use : used to create main or sub directories  
Syntax MD {directory name} {enter}

## **CHANGING INTO SUB DIRECTORIE**

Command used: CDDIR (CD)  
Command type : internal  
Command use : used to change from one directory to another  
Syntax : CD {directory name} {enter}

## **CHANGING OUT OF A DIRECTORY**

Command used: CDDIR (CD) (CD)\  
Command type : internal  
Command use : used to remove or delete directories  
Syntax: CD {enter} to move out of a directory step by step

CD\ {enter} to move of a directory and go straight back to the root directory

## REMOVING DIRECTORIES

Command used:      RDDIR (RD)  
Command type        :           internal  
Command use        :           used to remove or delete directories  
Syntax:              RD {directory name} {enter}

## THE PATH CONCEPT

A path is a route taken to a particular directory or a file.

A path's statement may include a drive letter, the main directory and any sub directory.

E.g. a path to file called MOSES on a floppy could be

A:\MOSES

### Summary

Creating a directory	: type	MD (paths to the directory) (enter)
Changing to a directory	:type	CD (paths to the directory) (enter)
Removing a directory	:type	RD (paths to the directory) (enter)

### MANAGING FILES

This embraces file names and extensions.

Major definitions under this sub topic include the following:

#### File

It is a collection of information initially created in memory then stored on a secondary storage device with a name.

In MS DOS-edit or copy commands can be to create or edit text files.

Files are named and stored on any of the storage media under a directory.

#### File extension

These are used to group files into types.

When naming files some names are not used e.g. AUX, CLOCK, COM, CON, KEY, BB, APT, and PRN

#### File name

Refer to the reference given to files when they are saved.

#### Types of files

### **Command files**

These contain program executable codes for instructions to perform a task.

### **Data files**

These are stored for data processing.

#### **Types**

##### **Master files**

These contain permanent data against which translocations are processes and contain reference data and dynamic data.

##### **Transaction files**

These hold temporary incoming and outgoing data. They update dynamic data on master files

#### **Folders**

These are fundamental devices for organizing files.

Is special kind of file that contains a list of other files

#### **File specifications**

These to drive specifies placed before the file name.

They are used to tell DOS where the file is stored.

## **SOME BASIC RULES TO CONSIDER WHEN NAMING FILES**

No file can have the file specification under the same directory.

File specification has two parts that is file name and file extension.

A file can have any number of characters between 1 and 8 characters inclusive.

The file extension may have up to three characters.

In a file specification a file name may be separated from the file extension by a (.) or full stop.

Some special characters like +, =," ", comma, [ , ], /, <,>, \,-,? And \* may not be accepted in a file specification.

## **CREATING A FILE**

Command use	:	edit
Command type	:	external
Command use	:	used to create text documents
Syntax	:	edit {file name. TXT}
Example	:	EDIT Demo.Txt press enter or copy com Demo.Txt press enter

## USING THE DOS EDITOR PROCEDURE

The text editor starts and opens a file called DEMO.TEXT.Type in your information while pressing the enter key to go to the next line.

To save the file and exit the text editor press ALT+F press X.

A dialogue box pops up to conform together to save currently loaded file.

Press enter or Y: the file is concurrently saved while the text editor exists to display the command prompt again.

## RENAMING A FILE

Command used      RENAME

Command type      : internal

Command use      : assign a different name to a particular file

Syntax:            RENAME {old file specification} {enter}

E.g. TYPE DEMO .TXT {enter}

## DISPLAYING CONTENTS A FILE

Command used      : TYPE

Command type      : external

Command use      : to display the contents of a specified file

Syntax            : TYPE (file specification) (press enter)

E.g. TYPE DEMO. TXT (Press enter)

## COPYING A FILE

Command used      : COPY

Command type      : copy a file or files from one directory to another

Syntax            : COPY sd: \path\file specifications dd :\ path (press enter)

Where:          sd: source drive

Paths: source paths

dd: destination drive

Path d: destination paths

## DELETING FILES

Command used:    DELETE OR ERASE

Command type      : internal

Command use      : remove files in a directory

Syntax:            DELETE {file specification} {enter}

E.g. erase exercise. DOC press enter

## PRINTING A FILE

Command used      : PRINT

Command type      : external

Command use      : send contents of a file to a printer

Syntax : PRINT {file specification} {enter}  
TYPE PRINT DEMO.TXT

#### Batch files

These are normal text files containing a series of commands executed whenever you type the name of the batch file

Auto exec. Bat file is a special batch program that runs every time the computer starts

Displays DOS prompt in a given format

Specifies the paths

Displays screen messages

Starts programs like virus guards and device drivers

## COMPUTER HUMAN INTERFACES

A user interface is a combination of hardware and software that you use to communicate with and control the computer.

Through the user interface you are able to make selections on the computer, request information from the computer and respond to messages displayed by the computer.

Thus the user interface provides the means for dialogue between you and the computer.

The user interface controls how you enter data and instructions and how information displays on the screen.

#### User friendliness

A user friendly interface is one that the end user finds helpful, easy to learn and easy to use.

The goal of an effective user interface is to be user friendly which means the software can be used easily by individuals with limited training.

#### What makes a computer human interface user friendly?

The system should behave in a logical and consistent manner enabling the user to reason and apply what has been learnt.

The user should be made to feel in control of what is going on.

The user should be insulated from unexpected or spurious system action that is it should be robust and reliable.

Minimal effort and information should be required to get the system to complete required tasks.

The system should be self contained that the user is not forced to access manuals.

It should be relatively easy for the user to try to start using the system.

Types of computer human interfaces

Command driven interface

Under this, commands help users to quickly and simply instruct a computer on what to do.

The end user should have some knowledge so as the commands to be user friendly.

Simple and consistent set of rules should be available for more complex commands or variations on a single command.

A user types keywords or presses special keys on the keyboard to enter data and instructions.

Provided with a virtually empty screen with a blinking cursor where commands are keyed and the computer executes them on pressing the enter key.

Examples include

DOS-disk operating system

UNIX

LINUX

Advantages

Takes up little memory and normally does not require a very fast processor

Operation is very fast since commands can be entered directly through the keyboard

Many commands can be grouped together to automate repetitive tasks

Disadvantages

Command language has to be learnt and memorised

Menu driven interfaces

These provide users with a number of options and simple means of selecting between them.

The user has a choice hence needs no remembrance of the commands.

They are suitable for beginners and infrequent users.

Direct manipulation interface

Users are made at all times visibly aware of the options available.

They are provided with immediate visual responses on the screen to any action taken.

Such interfaces require bit mapped screens and input devices like mice together with keyboards.

Some software products using it include Apple Macintosh hyper card system.

Under this icons represent options.

The cursor may change its shape for example pointer, vertical bar, pointing brush, pointing hand.

User interface management system

These are aimed at creating a means by which a consistent interface with the same “look” and “feel” can be provided for any number of different applications with the same system.

Every user will have the desired properties.

Examples include systems used on Apple Macintosh computers: OS F/MOTIF-open systems foundation, “open look” systems developed by the Sun for AT&T.

Special purpose computer human interface

Under this, special hardware and software may use the general-purpose computer for example computers in industrial processes have video monitors.

A computer could be embedded inside some special purpose instrument and controlled by an interface that is specific to that purpose for example digital watch interface.

Graphical user interface (GUI)

This combines text with graphics to make software easier to use.

This allows a user to use menus and visual images such as icons, buttons and other graphical objects to issue commands.

You are provided with a coloured screen with icons each representing a program. A mouse may be used.

Examples include:

Windows (3.1, 95, 98, 2000, XP, Vista)

Susie Linux

Novel Netware

The graphical user interface displays graphics in addition to text when it communicates with the user.

Windows XP graphical user interface was designed carefully to be easier to set up, simpler to learn, faster, more powerful and better integrated with the internet than previous versions of windows.

It includes features like:

#### Windows

This refers to the rectangular area of the screen used to present information. It is called so since you see into another part of a program.

#### Icons

Refer to pictures or symbols used to represent processing options.  
They may also refer to the graphical representation of programs.

#### Menus

These include a list of options from which the user can choose.

They also contain a list of commands, instructions that cause the computer software to perform a specific action.

#### Buttons

These are icons that cause a specific action to take place.

It is easier to feed commands and different applications look and behave alike so it is easier to learn them.

Graphical user interfaces accept input via devices such as keyboard, mouse and provide articulated graphical output on the computer.

#### Advantages of a graphical user interface

Is user friendly because it is easy to learn and work with  
There is no need to type or memorise commands  
The interface is similar for any application

#### Disadvantages

Requires more memory and a faster processor  
Occupies more disk space  
Is difficult to automate functions for expert users

## COMPUTER SOFTWARE

This refers to a series of computer language coded instructions that tell a computer how to perform tasks.

Software consists of step-by-step instructions that tell a computer how to do a task.

Computer software can be broadly divided into three categories:

System software

Application software

Programming languages

## SYSTEM SOFTWARE

This is a set of programs software which manages the operation of the computer itself.

The purpose of systems software is to insulate the applications programmer as much as possible from the details of the particular computer complex being used, especially memory and other hardware features, and such accessory devices as communications, printers, readers, displays, keyboards

System software capabilities

Multitasking

This refers to the ability to execute more than one task or program at a time.

A copy of each program to be executed is placed in a reserve portion of internal memory called a partition.

Multiprocessing

This involves managing the simultaneous execution of programs with two or more CPUs. It entails processing instructions from different programs or different instructions from the same program.

Timesharing

A timesharing computer system supports many user stations or terminals simultaneously that is users share time on the computer.

Virtual memory/virtual storage

Is an operating system element that enables the computer to process as if it contained an almost unlimited supply of internal memory.

Virtual memory enables a program to be broken into modules or small sections that can be loaded into internal memory when needed.

## FUNCTIONS OF SYSTEM SOFTWARE

Starting up a computer

Transferring data between input and output devices

Executing and storing application programs

Storing and retrieving files

Formatting disks

Translating program instructions into machine language

Sorting data files

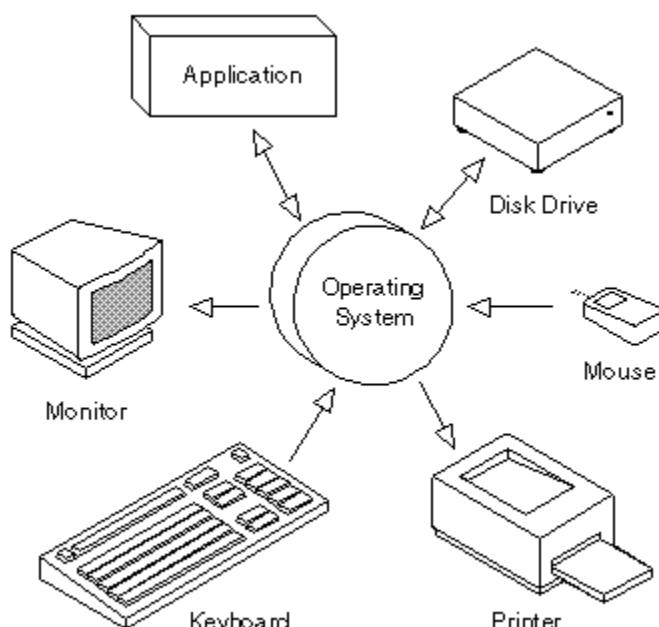
System software is divided into three categories:

Operating system

Utility software/system utilities/utilities

Language translators

## OPERATING SYSTEM



This is a set of programs that coordinate the operation of all hardware and application software components of a computer.

It consists of a master system of programs that manage the basic operations of a computer.

It is one or more programs that control the allocation and usage of hardware resources.

It is a set of programs containing instructions that coordinate all the activities among computer hardware resources.

An operating system is a set of computer instructions that controls the allocation of computer hardware and provides the capability for you to communicate with the computer.

The most important program that runs on a computer. Every general-purpose computer must have an operating system to run other programs. Operating systems perform basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers.

For large systems, the operating system has even greater responsibilities and powers. It is like a traffic cop -- it makes sure that different programs and users running at the same time do not interfere with each other. The operating system is also responsible for security, ensuring that unauthorized users do not access the system.

Operating systems can be classified as follows:

**Multi-user** : Allows two or more users to run programs at the same time. Some operating systems permit hundreds or even thousands of concurrent users.

**Multiprocessing** : Supports running a program on more than one CPU.

**Multitasking** : Allows more than one program to run concurrently.

**Multithreading** : Allows different parts of a single program to run concurrently.

**Real time**: Responds to input instantly. General-purpose operating systems, such as DOS and UNIX, are not real-time.

Operating systems provide a software platform on top of which other programs, called application programs, can run. The application programs must be written to run on top of a particular operating system. Your choice of operating system, therefore, determines to a great extent the applications you can run. For PCs, the most popular operating systems are DOS, OS/2, and Windows, but others are available, such as Linux.

As a user, you normally interact with the operating system through a set of commands. For example, the DOS operating system contains commands such as COPY and RENAME for copying files and changing the names of files, respectively. The commands are accepted and executed by a part of the operating system called the command processor or command line interpreter. Graphical user interfaces allow you to enter commands by pointing and clicking at objects that appear on the screen.

#### Device driver

This is a small program that tells the operating system how to communicate with a device.

### FUNCTIONS OF AN OPERATING SYSTEM

Loading of programs and data files from the secondary storage to the memory when required.

Control of hardware resources of a computer by allocating the use of peripheral devices for example input, output, storage and processing devices.

Protects hardware, software and data from improper use.

Controls and interprets keyboard, mouse and other inputs.

Controls the computer systems security for example by monitoring the use of passwords.

It provides a computer user with an interface that enables him or her to easily manage, control and operate a computer.

It checks whether hardware is working properly, equipment malfunctioning and displays error handling and correct messages.

Keeping track and furnishing a complete record of all that happens during the processing.

Responsible for starting a computer

Provides a means to establish web connections and some include a web browser and e-mail program.

Responsible for administering security where administrators establish user accounts that require a user name and password to access a computer system.

Responsible for managing and monitoring directories and files stored and the disks.

### TYPES OF OPERATING SYSTEMS

The basic categories of computer operating systems are:

Stand alone operating system

Network operating system

Embedded operating system

Stand alone operating system/desktop operating system

This is a complete set of operating system that works on desktop or notebook computers.

Examples of stand alone operating system include:

1) DOS versions for example PC DOS and MS DOS

These used the command line interface and are not widely used today since:

2) Windows operating system

Examples of windows include:

Windows 3.x

This refers to three earlier versions of MS Windows that is Windows 3.0, Windows 3.1 and Windows 3.11.

Windows 95

This is a true, multitasking operating system developed by Microsoft and does not require DOS to run.

Windows NT work station

This is a client operating system that could connect to Windows NT server and had a Windows 95 interface and often used by most businesses.

Windows 98

An upgrade to Windows 95 operating system

Included MS internet explorer

Provided faster system start up and shut down, better file management and support for multimedia technology for example DVD and web T.V, universal serial bus (USB) could add and remove devices on your computer.

Windows 2000 professional

An upgrade to Windows NT workstation

Complete multitasking operating system with a graphical user interface.

It is a reliable operating system for desktop and laptop business computers.

Windows millennium edition (Windows ME)

An upgrade to Windows 98 operating system

Windows XP

Windows XP is a line of operating systems produced by Microsoft for use on personal computers running x86 and IA-64 processors, including home and business desktops, notebook computers, and media centers. The name "XP" is short for "experience". Windows XP is the successor to both Windows 2000 Professional and Windows Me.

#### Windows Vista

Windows Vista is a line of operating systems developed by Microsoft for use on personal computers, including home and business desktops, laptops, Tablet PCs, and media center PCs. Prior to its announcement on July 22, 2005, Windows Vista was known by its codename "Longhorn.

#### 3) Mac operating system (Macintosh operating system)

Graphical user interface multitasking client operating system that supports, Networking, Internet, Java, Speech recognition

### NETWORK OPERATING SYSTEM

This was designed to be used on several computers that exist on a network.  
It can be installed on stand alone computers as well.

It includes the following:

#### 4) Novell's NetWare

It is a widely used network operating system designed for client server networks.

It boosts of NetWare directly on service.

It maintains a directory of network resources.

It limits access to authorized users only.

It is useful in areas which are interconnected thereafter applications and services can be offered on per group, per individual, per client basis.

#### 5) Operating system 2 (O/S 2)

This is designed for all sizes of businesses.

#### 6) UNIX

Multitasking, multi user, time sharing operating system developed in early 1970s at AT&T Bell laboratories for mini and main frame computers.

Some other versions of UNIX like SOC Unix can be found on larger personal computers.

It has a command line interface.

Many of its commands are difficult to remember and use.

It has both stand alone and network operating systems.

#### 7) Linux

Is one of the fastest growing operating systems

It is a popular, free, multitasking UNIX type operating system and includes many programming languages all free.

It is open source software so its code is available to the public.

It encompasses free software especially GNU software from the free software foundation.

It is used as a back end server.

It is an industrial straight operating system supported by Bell and IBM.

### 8) Solaris

It is a version of UNIX developed by sun micro systems.

It is a network operating system developed specially for e-commerce applications and can manage high traffic accounts and has incorporated security for web transactions.

### c) PERSONAL DIGITAL ASSISTANTS (PDA)/EMBEDDED OPERATING SYSTEM

It is common on hand held computer that are pen driven and or touch sensitive systems and small devices.

It resides on the ROM chip.

It includes the following:

Windows compact edition (CE)

This is a scaled down operating system designed for use on wireless communication devices and smaller computers for example hand held computers, in vehicle devices.

It supports colour, sound, multitasking, e-mail and internet.

### 9) Pocket PC operating system

It is a scaled down operating system that works on specific type of hand held computers.

### 10) Palm operating system

It is used by palm computers from palm inc. and visor hand held computers from hand spring.

Other operating systems are those designed for particular computers by their manufacturers and they include:

Mac operating system 8.5 for Macintosh computers

Arcon Risc operating system for machines that use Arcon Risc processors

VMS for DEC's micro computers

VME for ICL's mini computers

System 7 for Macs computers

## UTILITY PROGRAMS/UTILITIES

They are also called service programs.

These are programs which improve the performance of the operating system

These are used to generally enhance, support and expand the existing programs on a computer system.

They are a type of operating system software that performs a specific task usually related to managing a computer, its devices and its programs.

Utilities include the following:

File viewer

This allows you to display and copy contents of a file.

Examples include windows explorer

File compression

This shrinks the size of a file and frees up room on storage media.

Examples include: PKZIP, WINZIP

Diagnostic utility

This compiles technical information about hardware and system software programs and prepares a report outlining and identifying problems for example Dr. Watson

Uninstaller

This removes an application as well as associated entries in the system files for example McAfee's uninstaller.

Disk scanner

This detects and corrects both physical and logical problems on hard disks and floppy diskettes and also searches and removes unnecessary files.

The file allocation table is a table of information that the operating system uses to locate files on a disk.

Disk defragmenter

This reorganizes files and unused space on a computer's hard disk to access data more quickly and programs to run faster.

Backup utility

This allows you to copy selected files or your entire hard disk onto another disk or tape.

It is also a program that will make duplicate copies of information from one storage device to another.

It is helpful to avoid loss of sensitive data incase the storage media crashes.

#### Screen saver

This is a utility that causes a monitor's screen to display a moving image or blank screen if no keyboard or mouse activity occurs for a specified time period.

It is a moving pattern or bitmap that appears on your computer screen after the computer has not been used for a specified time period.

#### Uses of a screen saver

Reduces wear and tear of the screen

Provides security for your system when you are away

Business for example advertising

Entertainment by use of digital photos moving

Prevents ghosting that involves images permanently being etched on a monitor.

#### Anti virus utility

It is a utility that prevents, detects and removes viruses from a computer system.

#### Sorting utility

This is a program designed to arrange records into a pre-determined sequence.

Such programs are often used to sort files or data in a specific order to ease their access and update.

#### Data recovery

It is a utility program used to delete a file or information that has been accidentally deleted from a computer.

The data you are trying to recover may be on a hard disk or diskette.

#### Software monitors

These are utility programs designed to check the activity of specific aspect of a computer system to ascertain where the bottleneck exists and try to fix them for example software related problems which usually occur when there is a physical defect on storage media.

Other utilities include:

Editors for word processing

Resource usage logging in networks

Merging utility

**Debugger**

A special program used to find errors (bugs) in other programs. A debugger allows a programmer to stop a program at any point and examine and change the values of variables.

**Bug**

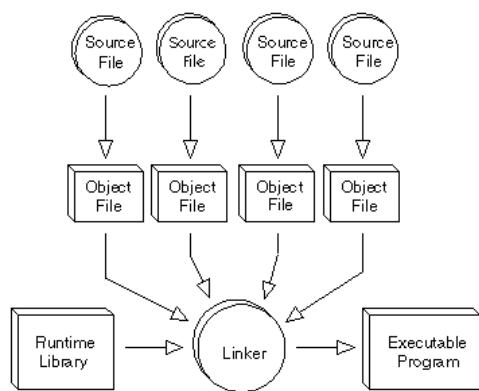
An error or defect in software or hardware that causes a program to malfunction. Often a bug is caused by conflicts in software when applications try to run in tandem.

## LANGUAGE PROCESSORS/TRANSLATORS

These are used mainly with high level programming languages to work backward to the processor.

Language processors include the following:

### COMPILER



A compiler is a program that translates source code (Program instructions in their original form) into object code (The code produced by a compiler).

The advantage of interpreters is that they can execute a program immediately.

Compilers require some time before an executable program emerges.

However, programs produced by compilers run much faster than the same programs executed by an interpreter.

### ASSEMBLER

An assembler is a program that translates programs from assembly language to machine language.

### INTERPRETERS

These translate a source program line by line while the program is running.

It is done each time the program is running.

## LINKERS

These combine compiled programs and determine where the program will be located in the memory.

A linker is a program that takes one or more objects generated by compilers and assembles them into a single executable program.

## APPLICATION SOFTWARE/SOFTWARE APPLICATION/APPLICATION

These are problem-oriented programs written by the user or professional software houses to solve specific problems.

These are programs and their associated documentation designed to solve specific user problems.

They are designed to solve practical problems experienced in life.

Application software refers to related programs designed to perform a specific task to solve a particular problem for the user.

### Application package

This is a user software program designed to accomplish a given task.

### Characteristics

Targeted to wide range of users

Easy to use-user friendly

Designed for power and flexibility

Machine independent

### Cross platform application

This is one that runs identically on multiple operating systems.

### Software suite

This refers to the collection of individual applications sold as a single package.

The common software suites include:

Microsoft office

Lotus smart suite

Corel word perfect suite

### Advantages of software suites

Cost significantly less than purchasing a single program  
Ease of use since applications inside use and share common features

Uses of application software  
Create graphics and multimedia projects  
Productive tool/business tool  
Support personal activities, business and education  
Facilitate communication

Features of application software include:

Cursors  
Scrolling  
Menus  
Help screens  
Dialog boxes  
Special purpose and function keys  
Macros  
Tutorials and documentation

Categories of application software

Application software is divided into two main groups and these include:

Off the shelf software/packaged software/software package/pre written software/general software

These are software programs that are ready to run when purchased and installed on computers.

They may also be referred to as software programs that are ready-made.

They are of general nature and solve needs, which are common in nature for example word processing.

This is commercial software which is copyrighted and designed to meet needs of a wide variety of users.

Advantages of off the shelf software

They are usually provided with extensive documentation to help the user.  
They are easy to use and are suitable for people with little or no computing knowledge.  
They are appropriate for a large variety of applications  
They are relatively low priced since they are sold in large numbers.  
They are readily available  
They can be customized  
They have less errors

## Disadvantages of off the shelf software

The package may allow only clumsy solution to the task at hand.

Some packages need developing for example databases so require thorough knowledge that is quite expensive.

The user has to provide documentation for the particular application created

It is easy to forget commands to use the package especially if it is not used frequently.

Examples of off the shelf software include:

## WORD PROCESSING SOFTWARE

This allows a user to create and manipulate documents that contain text and graphics.

Text editors are the simplest word processors used to type without any special formatting and they include:

Line editors

Screen editors

Word processing software refers to programs that allow a computer to be used to create, edit, revise, store and print documents.

They enable users to easily insert, delete, and move text and dress up documents with variable margins, type, sizes and styles.

Powerful word processors enable users to integrate or combine graphics and text on a professional looking page.

Examples of word processing software include the following:

Microsoft word

Word pad

AmiPro

PC Write

Mac Write

Lotus word Pro

Notepad

Word star

Corel word perfect

Microsoft

pocket word

Word processors are used to create the following:

Letters  
Newsletters  
Reports  
Websites  
Mailing labels

Advantages of word processors

Can easily change what has been done  
Efficient way of storing documents  
Stored documents can be shared among users of a network

## SPREAD SHEET SOFTWARE

This is used to manipulate figures.

They are general purpose calculation programs that allow entry and manipulation of data in rows and columns arranged as a grid on a display screen.

They provide features such as arithmetic, mathematical and statistical functions, data functions and user defined formulae that can easily be reproduced.

Examples of spread sheet software include:

Microsoft excel  
Corel Quattro pro  
Lotus 123  
Microsoft pocket excel  
Visi calc  
Super  
calc

Spread sheets are used to create:

Charts  
Financial statements  
Statistical reports

## DATABASE SOFTWARE

This is used to store large volumes of related data that can be retrieved easily for use.

They are programs designed for storing, cross-indexing, retrieving, organizing and manipulating large amounts of data.

One can compile huge amounts of data and manipulate, store and retrieve it later.

Data base software includes:

Microsoft access

Claris file marker pro

D-base

Fox pro

Paradox

Sybase

SQL server

Progress

Ingress

Informix

Oracle

## DESKTOP PUBLISHING SOFTWARE

These are specialized programs that combine text with pictures to produce higher quality documents. They enable professional designers to design and produce sophisticated documents that contain text, graphics and brilliant colours.

Examples of desktop publishing software include:

Adobe in design

Adobe page maker

Corel Ventura

Quark X press

Aldus page maker

Microsoft publisher

Broderbund

Print

Shop

pro

Desktop publishing software is used to create the following:

Text books

Corporate news letters

Marketing literature

Product catalogues

Annual reports

Business cards

Calendars

Flyers

Features of desktop publishing software include:

Ability to create master pages

Large paper sizes

Paper grids for aligning text and graphics

Ability to stack and overlap multiple objects on a page

Ability to trap objects to eliminate white space between colours in a printed document.

Advantages of desktop publishing software

Is specially designed to support page layout that involves arranging text and graphics in a document on a page-by-page basis.

Includes colour libraries to ensure that colours will print exactly as specified.

Supports colour separation for producing the master copies used in the final presswork.

Very high quality print with a lot of creativity needed for example in printery, graphic designers and the press.

They have several standard templates which are ready for use

## GRAPHICS PROCESSING SOFTWARE

These are programs that enable users to create drawings and artworks that can be exported to other programs.

They enable one to draw charts, graphs and other pictorial data using built in objects, free hand drawing and clip art, symbols.

You can also add text to scanned images/photographs and edit them or transform them from one format to another.

Examples of graphics packages include:

Corel drawing

MS photo draw

Adobe photo shop

Page maker

Ventura

## PRESENTATION SOFTWARE

This enables users to create computer based slide shows using graphics and animations to enhance images.

They help users convey information to others.

One can combine text, pictures, charts, graphs, sounds and movies when conveying information.

Examples of presentation software include:

Microsoft power point

Corel presentations

Lotus freelance graphics  
Word perfect  
Harvard graphics

### PERSONAL INFORMATION MANAGERS (PIM)

These are programs used to organize personal information like calendars.

Examples include:

Microsoft outlook  
Corel CENTRAL  
Lotus organizer  
Palm desktop

### PROJECT MANAGEMENT SOFTWARE

These are programs that allow a user to plan, schedule and analyse the events, resources and costs of a project.

Examples include:  
Corel catalyst  
Microsoft project  
Primavera sure track project manager

### MULTIMEDIA SOFTWARE

These are programs that allow you to combine text, graphics, audio, video and animation into interactive presentations.

Examples include:  
Click2learn.com tool Book  
Macromedia author ware  
Macromedia director  
Macromedia flash

### COMPUTER AIDED DESIGN (CAD) SOFTWARE

These are programs that assist professional users to create engineering, architectural and scientific, building structural plans, floor plans, molecular structure designs.

This reduces labourious manual drafting and plans are viewed immediately.

Examples of computer aided design software include:

Auto CAD

Microsoft Visio technical

#### PAINT/IMAGE EDITING SOFTWARE

These are programs that allow users to create and modify graphics, images.

Examples of image editing software include:

Adobe illustrator

Adobe photo shop

Corel draw

Macromedia free hand

#### VIDEO AND AUDIO EDITING SOFTWARE

These are programs that help users to modify a segment of a video or audio clip.

Examples include:

Adone premiere

Unlead systems media studio pro

#### WEB PAGE AUTHORIZING SOFTWARE

These are programs that enable users to create fascinating web pages that include graphic images, video, audio animation.

Examples include:

Fire works

Adobe Go live

Adobe pageMill

Macromedia dream weaver

Macromedia flash

Microsoft front page

#### COMMUNICATION SOFTWARE

These are programs designed to access information and data on one computer and transmit it to another computer across a network or data link.

These programs work in conjunction with relevant hardware to perform their work.

Examples include:

Web browsers (internet explorer and Netscape navigator)

E-mail software (Microsoft outlook)

Chat rooms

Newsgroups

Video conferencing

Education software

Educational software is computer software, the primary purpose of which is teaching or self-learning.

Examples

Encarta,

Mavis Beacon Teaches Typing

Personal finance software

Is a simplified accounting program that helps a user to pay bills, balance the cheque book, track personal income and expenditure

Examples

Microsoft money

Inuit

Reference software

This provides valuable and thorough information for reference purposes. (Encyclopedias, dictionaries, health and medical guides)

Examples

Microsoft Encarta

Mosby's medical encyclopedia

Webster's dictionary and thesaurus

Entertainment software

This includes interactive games, videos and other programs designed to support a hobby or provide amusement and enjoyment.

Software that is both educational and entertaining is called edutainment software.

Examples of entertainment software

Windows and Nero media player,

Power DVD

Customized software/custom made software/tailored software/bespoke software

These are user specified software programs written by users or independent software professionals to meet the user's specifications.

These are applications designed and developed at a user's request to satisfy personal data processing needs.

They are application programs designed to meet a client's particular needs.

They are also called in-house developed software and are designed by following the user's directives to produce a program that solves a given individual's or organisation's requirements.

They are very expensive but can always be modified to suit the user's particular interest.

They are mainly developed by large companies to handle specific tasks in that organization.

Examples include:

Accounting packages like sage, sand systems, pastel, tally, point of sale

Stock control packages

Library software systems

Statistical analysis (statistical presentation software systems) (SPSS)

School management system

Banking system

Insurance system

Payroll systems

## DEVELOPMENT SOFTWARE

These are all those application packages that can be used to tailor other packages or applications.

Examples include:

Visual basics

Java

Visual C++

Note the following:

Share ware

This refers to copyrighted software distributed free for a trial period and payment is required for continued use after the trial period. For example antivirus software such as McAfee, Kaspersky. Motorbikes, computer car racing simulation

Freeware software

Refers to copyrighted software provided at no cost to the user by an individual or company. For example games like Dave, solitaire and antivirus software.

Public domain software

This is free software donated for public use with no copyright restrictions. For example parliament news, news papers

Software package

This refers to specific software product like Microsoft word.

Integrated software packages

These are programs that combine tools such as word processing, outlining, spreadsheets, graphics, databases, charting, presentations and communication in a single program.

Its major objective is to allow the user to perform a variety of tasks without having to switch software programs and learn different commands and procedures to run each one.

Examples include:

Claris works

Symphony for lotus development corporation

## PROGRAMMING LANGUAGES

These are a special type of software that is used to write other types of software using words and symbols that conform to a set of predetermined rules.

A programming language is a vocabulary and set of grammatical rules for instructing a computer to perform specific tasks.

Each language has a unique set of keywords (words that it understands) and a special syntax for organizing program instructions.

Syntax refers to the spelling and grammar of a programming language.

Computers are inflexible machines that understand what you type only if you type it in the exact form that the computer expects.

The expected form is called the syntax

A prominent purpose of programming languages is to provide instructions to a computer.

## CLASSIFICATION OF PROGRAMMING LANGUAGES

Programming languages can be grouped into two categories:

Low level languages

Low-level languages are closer to the hardware.

These are programming languages used to write programs that directly control the central processing unit of a computer.

Classification of low level languages

Low level languages are divided into the following:

Machine language

Machine languages are the only languages understood by computers.

While easily understood by computers, machine languages are almost impossible for humans to use because they consist entirely of numbers.

Advantages of machine code languages

Are highly efficient

They allow direct control of each operation

Disadvantages of machine code languages

They are difficult to read and learn since programmers write computer programs using 0s and 1s.

They are very unfamiliar to humans

They are not user friendly at all.

Programming in machine code is tedious; time consuming hence chances of errors are high.

They are designed for a specific machine and specific micro processor.

Assembly language

Assembly languages have the same structure and set of commands as machine languages, but they enable a programmer to use names instead of numbers.

Each type of CPU has its own machine language and assembly language, so an assembly language program written for one type of CPU won't run on another.

Words like add, sum, and could be used in programs.

Advantages of assembly language

This language was more understood and remembered by human beings.

It has closer control over the computer hardware and executed very efficiently.

It is useful for writing operating systems and game programs which require faster and efficient use of the central processing unit.

### Disadvantages of assembly language

It depends on registers and memory locations in a computer so can not be transferred from computer to computer.

### High level languages

These are programming languages that are easier to write and understand than low level languages because they are closer to English but have to be converted into machine code before being run.

A high-level programming language may be more abstract, easier to use, or more portable across platforms.

There are over 500 high level programming languages

### COBOL-common business oriented languages

This was designed with business and commercial data processing in consideration. It is one of the oldest programming languages still in active use. It is a third generation programming language.

#### Advantages

The language is widely used

It is machine independent

Its English-like statements are easy to understand

It can handle many files

It has a pool of skilled programmers

It can easily handle input/output operations

It is portable

#### Disadvantages

Its structure makes even simple programs long

Since it is readable, it is wordy

It cannot handle mathematical processing

### FORTRAN-formula translator

It was developed to provide an easier way of writing scientific mathematical and engineering applications.

#### Advantages

It is widely used

It is the best for processing numeric data

It has a standard therefore is portable even to other computer types

It can handle complex mathematical and logical expressions  
Its statements are relatively short and simple

#### Disadvantages

It is not suited for business applications  
It does not effectively handle input/output operations to storage devices  
It is not easy to read and understand as some other high level languages

BASIC-beginners all purpose symbolic instruction code  
It was designed to provide access for non-science students to computers.

#### Advantages

It can do almost all computer processing tasks  
There are many dialects of the language  
It is easy to use

#### Disadvantages

It has low processing speed  
It has no standard  
It has limited facilities in terms of structured programming and meaningful variable names

#### PASCAL

It was designed and developed as a tool for teaching programming.

#### Advantages

It is the most widely used language for teaching programming  
It has strict variable typing and declaration  
It uses procedures and functions that allow a top down approach to solving problems  
It is easy to learn  
It has extensive capabilities for graphics programming  
It is excellent for scientific handling

#### Disadvantages

It is poor on data file handling  
It has limited input/output programming capabilities so limits its business applications  
C  
“C” is the entire name for the language.  
It works well for micro computers and is portable among computers

#### Advantages

It is a powerful language that permits direct control over hardware  
It has powerful commands that permit rapid development of programs  
It is an ideal tool for system programming

It works well with micro computers  
It has a high degree of portability  
It is fast and efficient  
It enables the program to manipulate individual bits in main memory

#### Disadvantages

It is difficult to read and write  
Because of its conciseness, the code can be difficult to follow  
It is not suited to applications that require a lot of report formatting  
Ada  
It was considered originally to be a standard language for weapons systems but has been used for commercial applications.

#### Advantages

It is a structured language with a modular design  
It has more input/output capabilities  
It has features that permit the compiler to check for errors before the program can run

#### Disadvantages

The amount of memory required hinders its use on micro computers  
It has a high level of complexity and difficulty  
Business users are not motivated to use it since they have invested so much in COBOL

#### LISP-delivered from list processing

It was used principally to construct artificial intelligent programs.  
It is used to write expert systems and natural language programs.

#### Advantages

It is a pre-eminent language used in artificial intelligence  
Both programs and data are structures as lists

#### Disadvantages

It is not suitable for commercial data processing and interactive programming.

#### PROLOG-programming in logic

It is a logic programming language and is often associated with artificial intelligence and computational linguistics.

#### Advantages

It was designed and developed for use with expert systems and artificial intelligence  
It can solve problems that involve objects and relationship between objects

#### Disadvantages

It is not suitable for commercial data processing  
It is not widely available or known by many programmers

#### LOGO

It was designed for educational use in which children can explore and develop concepts through programming the movement of a turtle or pen.  
It teaches children problem solving and programming skills

#### PL/1-programming language 1

It is one of the most feature-rich programming languages and one of the very first in the highly-feature-rich category.

#### RPG-report program generator

It is a programming language for business applications  
It is designed to process both business and scientific applications

#### APL-A programming language

Is an extremely powerful, expensive and concise programming language

#### FORTH-for processing data quickly

It is designed for real time control tasks as well as business and graphics applications.

#### MODULAR-2

Is designed for writing system software

#### dBASE

This is a database management system and a programming language  
It controls access to data and structure of a database

#### Object oriented languages (OOLs)

These are the current state of art in programming technology. They use objects that combine data and behaviour.

#### Advantages

Enable rapid program development  
Every object has properties that can be set for example colour, size and data source  
Every object has events associated with it hence trigger certain actions

Examples include:

Visual basic  
Visual C++  
Object COBOL  
Smalltalk

Turbo Pascal  
Hyper talk

Fifth generation languages  
They are used in intelligent knowledge based systems (IKBS) such as robots  
These manipulate various facts and rules to reach a conclusion  
They were used in projects like the recent mars exploration

Hypertext markup language (HTML)  
These are used to create web pages  
They allow programmers to compose text, pictures, sound, animations and video for screen display.

**JAVA**  
This is an object oriented programming language that resembles a simplified form of C++  
Java programs are converted into an architecture-neutral-byte-code-format.

## DIGITAL COMMUNICATION AND COMPUTER NETWORKING

Originally information interchange was by drums and long distance runners but now all you need are two computers with modems located anywhere but with a telecommunication link between them.

Data communication refers to one computer transferring data, instructions and information to another computer or some other computers.

Computer communication  
This refers to the sending and receiving of electronic messages.

Networking  
This refers to linking of two or more computers to each other in order to share resources.

The basic model for data communications consists of:  
Sending device  
Communications device that converts the data to be transmitted  
Communications channel  
Communications device that receives the signals  
Receiving device  
Communications software

Uses of data communication	
Voicemail	E-mail
Fax	Bulletin board systems

Instant messaging	Videoconferencing
Chat rooms	Groupware
Newsgroups	Telecommuting
Internet telephony	Global positioning systems

#### Factors affecting data transmission

- Serial versus parallel transmission
- Transmission rate (frequency and band width)
- Directions of transmission (simplex, half duplex and full duplex)
- Transmission mode (asynchronous and synchronous)
- Line of configuration (point to point or multi point)
- Packet switching
- Protocols

#### Types of data transmission

##### Serial transmission

Bits are sent over a single wire individually.

Whilst only one bit is sent at a time, high transfer rates are possible.

This can be used over longer distances as a check digit or Parity bit can be sent along it easily.

This is a form of transmission in which bits are sent sequentially, one at a time, over a single line.

##### Parallel transmission

Multiple wires are used and transmit bits simultaneously and is much faster than Serial transmission as one byte can be sent rather than one bit.

This method is used internally within the computer, for example the internal buses, and sometimes externally for such things as printers, however this method of transmission is only available over short distances as the signal will degrade and become unreadable, as there is more interference between many wires than between one.

This is a transmission mode that sends a number of bits simultaneously over separate lines.

This is a form of transmission in which groups of bits typically the 8 bits forming 1 byte are sent at the same time over multiple wires.

## Channels of data transmission

### Channel

A channel is a link between one station and another and it is used to transmit data from one station to another.

### Bandwidth

This refers to the rate of speed of data through a channel and is expressed in bit per second.

The bandwidth is the difference between the lowest and highest frequencies transmitted.

This is the amount of data that can be transmitted via a given communications channel (for example between a hard drive and the host PC) in a given unit of time.

This refers to the volume of information per unit of time that a transmission media can handle at a time.

This refers to the amount of information or data that can be sent over a network connection in a given period of time.

It refers to quantity of data transmitted by a media in a given time.

NB: Bandwidth is usually stated in bits per second (bps), kilobits per second (kbps), or megabits per second (mps).

NB: The higher the bandwidth, the greater the amount of information that can be transmitted.

### Ranges of frequencies

The band width is the difference between the lowest and highest frequencies transmitted.

### Baud

The number of signaling elements that occur each second

### Baud rate

A measure of the speed of data transmission between computers and other devices, measured in bits per second.

This refers to the speed at which a signal changes.

The rate of data transmission based on the number of signal elements or symbols transmitted per second.

Baud refers to the measure of signal changes per second.

A measure of speed of electronic transmission; the higher the baud rate, the faster the signal can be sent.

Data transfer rate

Is the rate of transfer of data and it is measured in baud or bits per second (bps)

Base band media

This refers to transmission of a digital or analog signal signaling at its original frequencies. The signal is in its original form, not changed by modulation.

This is a network in which the entire bandwidth of the transmission medium is used by a single digital signal. No modulation techniques are used.

This is a transmission scheme in which the entire bandwidth, or data-carrying capacity, of a medium (such as coaxial cable) is used to carry a single digital pulse, or signal, between multiple users. Because digital signals are not modulated, only one kind of data can be transmitted at a time.

A type of channel where data transmission is carried across only one communications channel, supporting only one signal transmission at a time.

The telephone systems frequency-division multiplexing hierarchy, is usually treated as a base band

Broad band media

Broadband refers to data transmission in which a single medium or wire can carry several channels at once.

Refers to data transmission where multiple pieces of data are sent simultaneously to increase the effective rate of transmission, regardless of actual data rate.

Various forms of Digital Subscriber Line (DSL) services are broadband in the sense that digital information is sent over one channel and voice over another channel sharing a single pair of wires.

Analog modems operating at speeds greater than 600 bit/s are technically broadband.

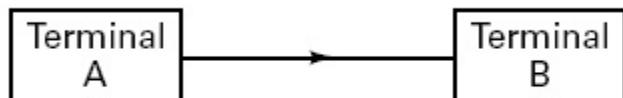
Cable TV is a good example of a system that uses broadband transmission.

This can transmit multiple signals over a single communication line.

## DIRECTIONS OF TRANSMISSION

These include the following:

### SIMPLEX TRANSMISSION



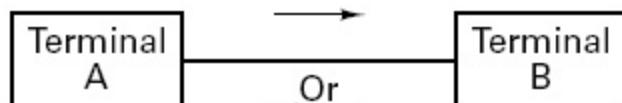
Transmission in only one direction

This is where transmission is in only one direction that is you can receive messages but you can not send.

It is commonly used under:

Pagers  
Temperature sensors

### HALF DUPLEX TRANSMISSION

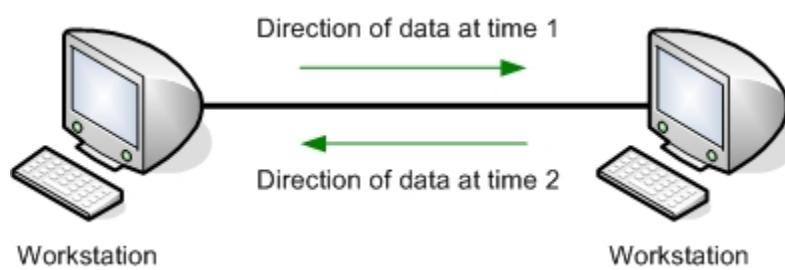


Transmission in either direction,  
but not simultaneously

Data can be transmitted in both directions but not at the same time.

until it is finished then the other can flow in the opposite direction.

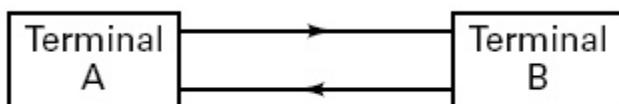
Data flows from one end to the other



It is commonly used under:

Radio calls used by the army

### FULL DUPLEX TRANSMISSION



**Transmission in both directions simultaneously**  
telephone system

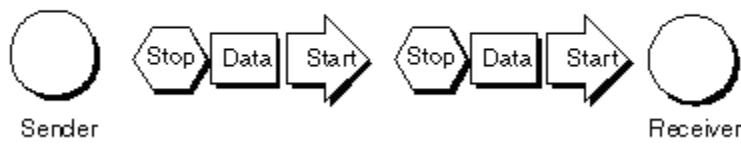
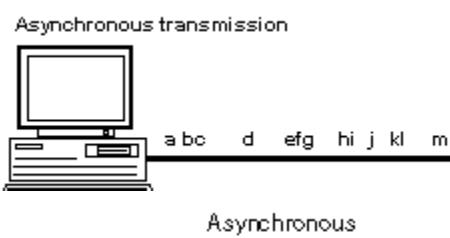
Data can be transmitted in both directions simultaneously (at the same time).

It is commonly used under the telephone system

## TRANSMISSION MODES

These include:

### ASYNCHRONOUS TRANSMISSION



Asynchronous transmission uses start and stop bits to signify the beginning and end of a transmission.

This method of transmission is used when data is sent intermittently as opposed to in a solid stream

Data can be transmitted at irregular intervals of time singly at will.

It is more common with low baud rates

Not synchronized; that is, not occurring at predetermined or regular intervals. The term asynchronous is usually used to describe communications in which data can be transmitted intermittently rather than in a steady stream. For example, a telephone conversation is asynchronous because both parties can talk whenever they like. If the communication were synchronous, each party would be required to wait a specified interval before speaking.

The difficulty with asynchronous communications is that the receiver must have a way to distinguish between valid data and noise. In computer communications, this is usually accomplished through a special start bit and stop bit at the beginning and end of each piece of data. For this reason, asynchronous communication is sometimes called start-stop transmission.

It is commonly used for:

Telephone system  
Satellites

Most communications between computers and devices are asynchronous.

## SYNCHRONOUS TRANSMISSION



Synchronous transmission uses no start and stop bits but instead synchronizes transmission speeds at both the receiving and sending end of the transmission using clock signals built into each component.

continual stream of data is then sent between the two nodes.

This is done for large quantities of data transmission at a fixed rate.

It is more common with high baud rates and Communication within a computer



## PACKET SWITCHING

This combines individual packets of data from various users and transmits them together over a high-speed channel.

Packet switching is a network communications method that groups all transmitted data, irrespective of content, type, or structure into suitably-sized blocks, called packets.

The network over which packets are transmitted is a shared network which routes each packet independently from all others and allocates transmission resources as needed.

The principal goals of packet switching are to optimize utilization of available link capacity and to increase the robustness of communication.

This is where messages are divided into packets before they are sent. Each packet is then transmitted individually and can even follow different routes to its destination. Once all the packets forming a message arrive at the destination, they are recompiled into the original message.

## TRANSMISSION MEDIA

These are the materials/means used to establish a communication channel.

Describes the type of physical system or means used to carry a communication signal from one system to another

Transmission media enable computers to send and receive messages but do not guarantee that the messages will be understood.

The wireless or unguided media include:

In networking terminology, wireless is the term used to describe any computer network where there is no physical wired connection between sender and receiver, but rather the network is connected by radio waves and/or microwaves to maintain communications

These send communication signals through the air or space using radio waves, microwaves and infrared signals.

The extraordinary convenience of wireless communications has placed an increased emphasis on wireless networks in recent years. Technology is expanding rapidly and will continue to expand into the near future, offering more and better options for wireless networks.

Wireless networks are especially useful for the following situations:

Spaces where cabling would be impossible or inconvenient. These include open lobbies, inaccessible parts of buildings, older buildings, historical buildings where renovation is prohibited, and outdoor installations.

People who move around a lot within their work environment. Network administrators, for instance, must troubleshoot a large office network. Nurses and doctors need to make rounds at a hospital.

Temporary installations. These situations include any temporary department set up for a specific purpose that soon will be torn down or relocated.

People who travel outside of the work environment and need instantaneous access to network resources.

## MICRO WAVES

Microwave transmission is line of sight transmission. The transmit station must be in visible contact with the receive station. This sets a limit on the distance between stations depending on the local geography. Typically the line of sight due to the Earth's curvature is only 50 km to the horizon. Repeater stations must be placed so the data signal can hop, skip and jump across the country.



Microwaves operate at high operating frequencies of 3 to 10 GHz. This allows them to carry large quantities of data due to their large bandwidth.

They provide a high-speed transmission of both voice communication and data signals.

They are usually located on the tops of buildings, towers or mountains to avoid possible obstruction.

#### Advantages of microwaves

Provide high-speed communication transmission

No need to install cables

Lower installation and maintenance costs

They require no right of way acquisition between towers.

They can carry high quantities of information due to their high operating frequencies.

High frequency/short wavelength signals require small antennae.

#### Disadvantages of microwaves

Limited to line of sight transmission

May be affected by temporary atmospheric disturbances

Attenuation by solid objects: birds, rain, snow and fog.

Reflected from flat surfaces like water and metal.

Diffracted (split) around solid objects.

#### RADIO WAVES

Radio is the wireless transmission of signals, by modulation of electromagnetic waves with frequencies below those of visible light.

Electromagnetic radiation travels by means of oscillating electromagnetic fields that pass through the air and the vacuum of space.

It does not require a medium of transport. Information is carried by systematically changing (modulating) some property of the radiated waves, such as their amplitude radiated waves or their frequency.

#### INFRARED LIGHT

IR, infrared is a wave of light that in the area beyond the visible part of the color spectrum. While it is invisible to human eye infrared is often used to enhance visibility when using night vision devices.

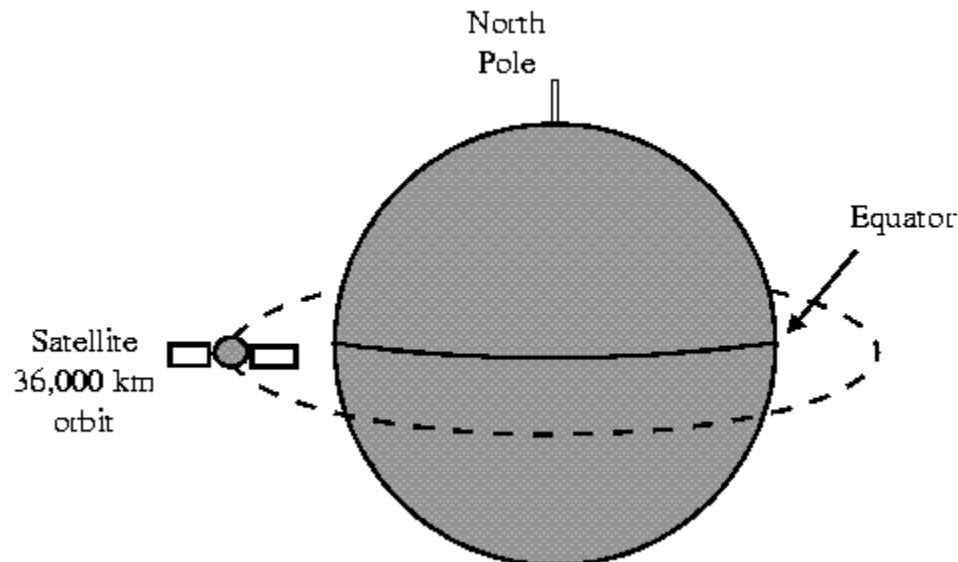
The name means "below red" (from the Latin infra, "below"), red being the color of visible light with the longest wavelength.

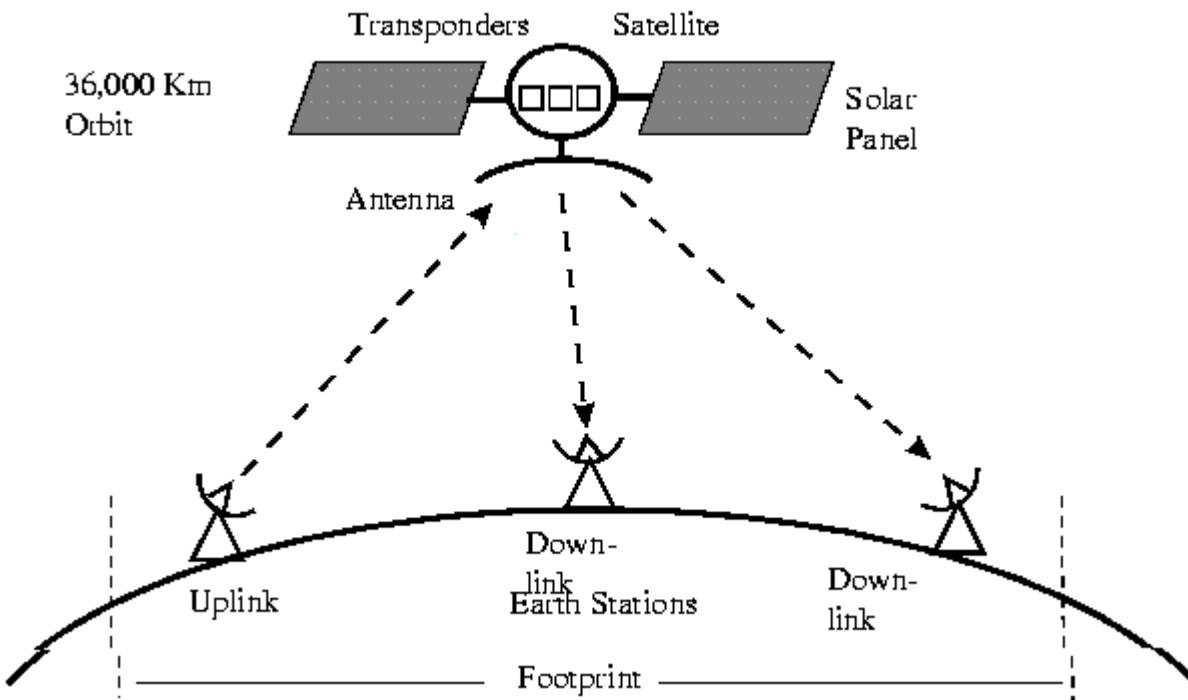
The uses of infrared include military, such as: target acquisition, surveillance, homing and tracking and non-military, such as thermal efficiency analysis, remote temperature sensing, short-ranged wireless communication, spectroscopy, and weather forecasting.

Infrared astronomy uses sensor-equipped telescopes to penetrate dusty regions of space, such as molecular clouds; detect cool objects such as planets, and to view highly red-shifted objects from the early days of the universe.

#### SATELLITE TRANSMISSION

Satellites are transponders (units that receive on one frequency and retransmit on another) that are set in geostationary orbits directly over the equator. These geostationary orbits are 36,000 km from the Earth's surface. At this point, the gravitational pull of the Earth and the centrifugal force of Earth's rotation are balanced and cancel each other out. Centrifugal force is the rotational force placed on the satellite that wants to fling it out into space.





The uplink is the transmitter of data to the satellite. The downlink is the receiver of data. Uplinks and downlinks are also called Earth stations because they are located on the Earth. The footprint is the "shadow" that the satellite can transmit to, the shadow being the area that can receive the satellite's transmitted signal.

A communication satellite is used to link ground stations

Operates on a number of frequency bands, called **transponder** channels

Receives transmissions on one frequency band (uplink), and transmits on another frequency (downlink).

This uses a solar powered electronic device that has up to 25 small-specialized types of radios called transponders that receive, amplify and retransmit signals.

The satellite works as a relay station from microwave stations on the ground.

It is costly to set up a satellite system

Satellite communication has become the most popular and cost effective method for moving large quantities of data over long distances.

Applications of communication satellites include:  
Television broadcasts

Radio broadcasts  
Video conferencing  
Paging  
Global positioning systems

Advantages of communication satellites  
Lots of data can be sent simultaneously  
Allow high quality broadband communication across continents  
Cover a large geographical area for data transmission

Disadvantages of communication satellites  
The fee to launch a satellite is extremely expensive  
The infrastructure needed to access satellite communication is also expensive

## BROADCAST RADIO

This is a wireless transmission medium that distributes radio signals through the air.  
A transmitter is needed to send the broadcast signal and a receiver is needed to accept the signal.  
Some networks use a transceiver which both sends and receives signals from wireless devices.

## BLUETOOTH

This is a kind of short range broadcast radio communications which can transmit data at a rate of 1Mbps among Bluetooth-enabled devices such as notebook computers, handheld computers, internet appliances, cellular telephones and printers

A short-range radio technology aimed at simplifying communications among Internet devices and between devices and the Internet. It also aims to simplify data synchronization between Internet devices and other computers.

## CELLULAR RADIO

This is a form of broadcast radio that is used widely for mobile communications specifically cellular telephones.

## PERSONAL COMMUNICATIONS SERVICES (PCS)

Is a set of technologies used for completely digital cellular devices such as handheld computers, cellular phones, pagers and fax machines

CDMA (code division multiple access)  
Is the most popular PCS technology because of its fast transmission speed and lower cost

Code-Division Multiple Access is a digital cellular technology that uses spread-spectrum techniques.

CDMA does not assign a specific frequency to each user. Instead, every channel uses the full available spectrum. Individual conversations are encoded with a pseudo-random digital sequence.

CDMA consistently provides better capacity for voice and data communications than other commercial mobile technologies, allowing more subscribers to connect at any given time, and it is the common platform on which 3G technologies are built.

### 3G

Is newer technology that provides even faster transfer rates so that users can display multimedia, watch TV

3G is a family of standards for wireless communications

Services include wide-area wireless voice telephone, video calls, and wireless data, all in a mobile environment.

3G allows simultaneous use of speech and data services and higher data rates

Thus, 3G networks enable network operators to offer users a wider range of more advanced services while achieving greater network capacity through improved spectral efficiency.

The physical or the guided cabling media include the following:

These use wires, cables and other physical materials to send communication signals.

### TWISTED PAIR CABLE



This is a type of cable that consists of two independently insulated wires twisted around one another.

The use of two wires twisted together helps to reduce crosstalk and electromagnetic induction.

While twisted-pair cable is used by older telephone networks and is the least expensive type of local-area network (LAN) cable, most networks contain some twisted-pair cabling at some point along the network.

The twisted pair cables are commonly used for:

Telephone lines

Data communication between computers

Infra building communication.

### Advantages

Inexpensive

Easy to install

It is a thin, flexible cable that is easy to string between walls.

Because UTP is small, it does not quickly fill up wiring ducts.

Data cannot be easily distorted due to reduced noise interference.

They are used in transmission of both data and voice

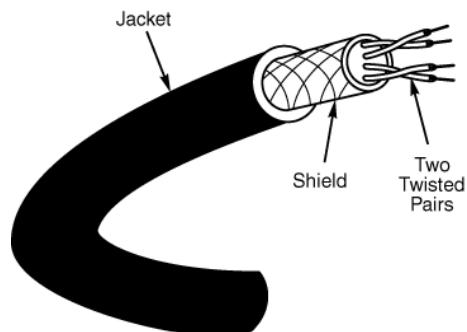
#### Disadvantages

Twisted pair's susceptibility to the electromagnetic interference greatly depends on the pair twisting schemes staying intact during the installation

Its unrepeated length limit is 100 meters that is limited to short distances.

Slow transmission of data between devices.

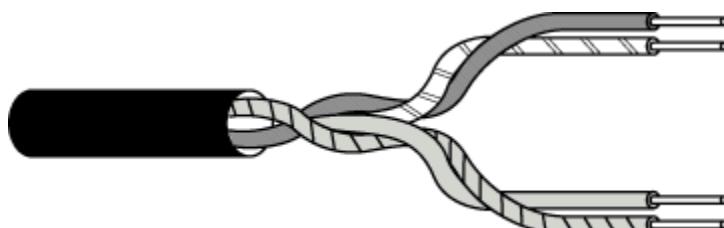
#### Shielded twisted pair (STP)



STP cabling includes metal shielding over each individual pair of copper wires.

This type of shielding protects cables from external EMI (electromagnetic interferences).

#### Unshielded twisted pair (UTP)



UTP cables are not shielded.

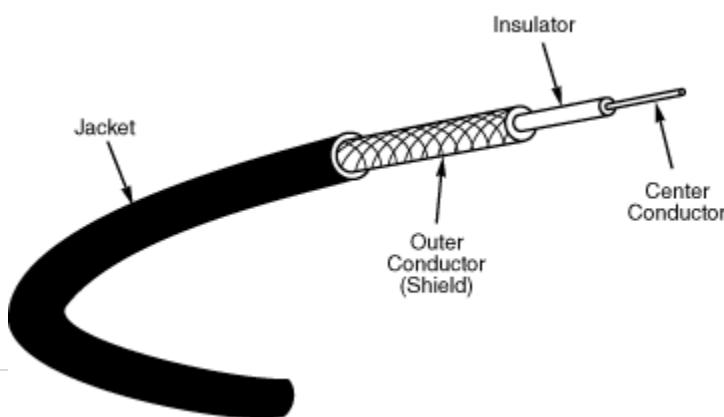
This lack of shielding results in a high degree of flexibility as well as rugged durability.

UTP cables are found in many Ethernet networks and telephone systems.

#### COAXIAL CABLE



A type of wire that consists of a center wire surrounded by insulation and then a grounded shield of braided wire. The shield minimizes



electrical and radio frequency interference.

Coaxial cabling is the primary type of cabling used by the cable television industry and is also widely used for computer networks, such as Ethernet. Although more expensive than standard telephone wire, it is much less susceptible to interference and can carry much more data.

It is commonly used for:

Telecommunication systems

Local area networks

Cable television

Advantages

Heavily insulated that reduces electro magnetic interference

Transmits data faster over long distances

Can transmit much data at a time

Disadvantages

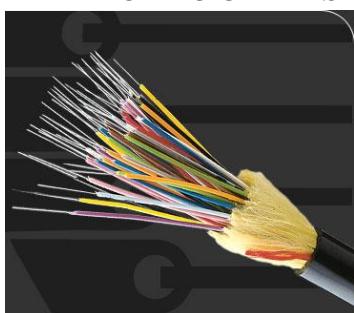
More expensive than twisted pair cables

Not easy to install

Need boosters to transmit data

They are bulky

## FIBRE OPTIC CABLES



This is technology that uses glass (or plastic) threads (fibers) to transmit data. A fiber optic cable consists of a bundle of glass threads, each of which is capable of transmitting messages in light form

They are commonly used for:

Cable televisions

Computer networking

New voice and data installations

Advantages

Offer high band width that is carry significantly more signals

Low signal loss

Faster or increased speed of data transmission

Secure data transmission at a significant cost.

Substantial weight and size saving

Data can be transmitted digitally (the natural form for computer data) rather than analogically.

Disadvantages

More expensive

Difficult to install and modify

More fragile than other wire based communication channels.

## FACTORS AFFECTING TRANSMISSION MEDIA

Soils

Topography

Band width

Cross talk-A disturbance, caused by electromagnetic interference, along a circuit or a cable pair. A telecommunication signal disrupts a signal in an adjacent circuit and can cause the signals to become confused and cross over each other

EMI-Electromagnetic interference, naturally occurring phenomena when the electromagnetic field of one device disrupts, impedes or degrades the electromagnetic field of another device by coming into proximity with it.

In computer technology, computer devices are susceptible to EMI because electromagnetic fields are a byproduct of passing electricity through a wire. Data lines that have not been properly shielded are susceptible to data corruption by EMI.

Note the following

A packet

A packet is the unit of data that is routed between an origin and a destination on the Internet or any other packet-switched network.

A piece of a message transmitted over a packet-switching network.

"Packet" and "datagram" are similar in meaning.

A packet is the smallest unit of data transmitted across a network.

A signal

A signal is an electric current or electromagnetic field used to convey data from one place to another

Analog signal

A signal that is capable of being continuously varied.

Consist of continuous electronic waves.

An analog or analogue signal is any variable signal continuous in both time and amplitude for example human speech.

Digital signals

Consist of individual electronic pulses that represent bits grouped together into bytes.

An analog signal differs from a digital signal in that small fluctuations in the signal are meaningful.

For analog signals, bandwidth is expressed in hertz (Hz) or cycles per second (cps) whereas for digital signals, bandwidth is expressed in bits per second (bps)

A device is called digital if data in it is represented as electrical off and on signals that correspond to the binary digits 0 and 1.

Data is represented as a succession of 1s and 0s

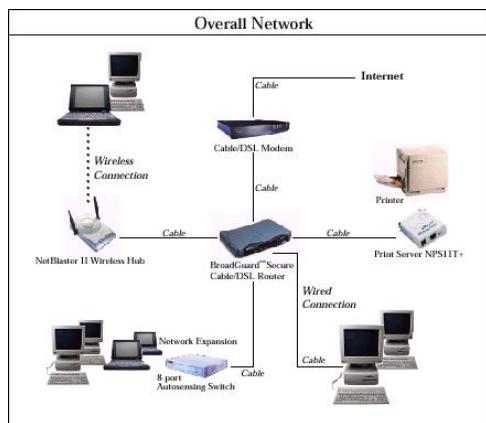
A digital device is more accurate because it only needs to sense the difference between two clearly distinguishable states: off and on.

Advantages of digital signals

They can be copied exactly without any loss of quality

They can be further processed by a computer

## COMPUTER NETWORKS



These are interconnected collections of independent computers with ability to communicate with each other.

These refer to stand alone computers and other devices like printers, plotters interconnected to one another with the ability of sharing data and or other resources.

A computer network is composed of multiple computers connected together using a telecommunication system for the purpose of sharing data, resources and communication.

### FACTORS AFFECTING DESIGN OF A NETWORK

Cost

Security

Ability to fulfill required functions

Expansion potential

Compatibility of components

### ADVANTAGES OF NETWORKS

Facilitate communications because people can communicate efficiently and easily via e-mail, instant messaging, chat rooms, telephony and video conferencing.

Enable sharing of hardware thereby reducing costs

Enable sharing of data and information

Enable sharing of software

Allow tight control over who has access to what data

### DISADVANTAGES OF NETWORKS

The hardware, software and expertise required to set up a network can be expensive

Networks are vulnerable to security problems

If the server fails to work, the complete network may also fail to work

### USES OF A COMPUTER NETWORK

Encourages and promotes group work

Shared risks and motivational support

Faster and economic communication facilities  
Easy distribution of work processing loads  
Provision of local resources without loss of control  
Sharing of resources and information  
Messaging which improves communication, productivity.

Factors affecting transmission rate of a network  
Transfer rate-speed of transmitting data  
Bandwidth-amount of data a transmission media can handle  
Network topology-arrangement of devices on the network  
Capacity of hardware such as hubs, switches  
The server  
Location of files and software

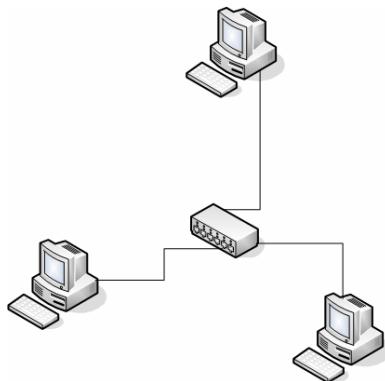
## NETWORK COMMUNICATION SOFTWARE

Novel Netware  
Apple talk  
Digi card  
Econet for acorn computers  
UNIX  
Windows for work groups

## CATEGORIES OF NETWORKS

The following are the categories of computer networks:

Peer-to peer-networks



Under this, several personal computers are connected together each being able to access the resources of other computers.

All the computers are equal and no single machine is designed as the main computer or central point or controller.

All computers are considered equal; they all have the same abilities to use the resources available on the network. They are designed primarily for small to medium local area networks.

Apple share and windows for workgroups are examples of programs that can function as peer to peer network operating systems.

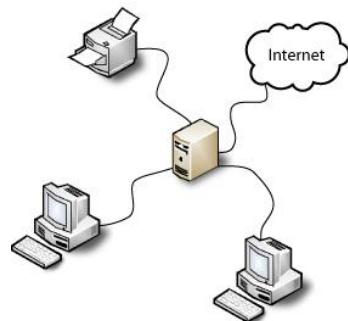
Advantages

Less initial expense since there is no need for a dedicated server  
Setup-an operating system such as windows already in place may only need to be reconfigured for peer to peer operations.

#### Disadvantages

Decentralized-no central repository for files and applications  
Security-does not provide the security available on a client/server network

#### Client server network



Under this several computers are connected to a single central computer or server that controls all the resources.

Individual workstations have access to the resources available on the server.

The server becomes the heart of the system providing access to resources and providing security.

Novell Netware and windows 200 server are examples of client/server operating systems.

#### Advantages

Flexibility-new technology can be easily integrated into the system  
Interoperability-all components (client/network/server) work together  
Accessibility- server can be accessed remotely and across multiple platforms

#### Disadvantages

Expense-requires initial investment in dedicated server  
Maintenance- large networks will require a staff to ensure efficient operation  
Dependence-when the server goes down, operations will cease across the network

Note the following:

A workstation is a computer connected to the server.

A server is a computer that controls access to the hardware and software on a network and provides a centralized storage area for programs, data and information.

Communication point to point

This is commonly used to establish a direct connection between two networking nodes

The network contains numerous cables or leased telephone lines each one connecting a pair of computers.

The message is received at each intermediate computer and it is entirely stored there until the required output line forced and then forwarded.

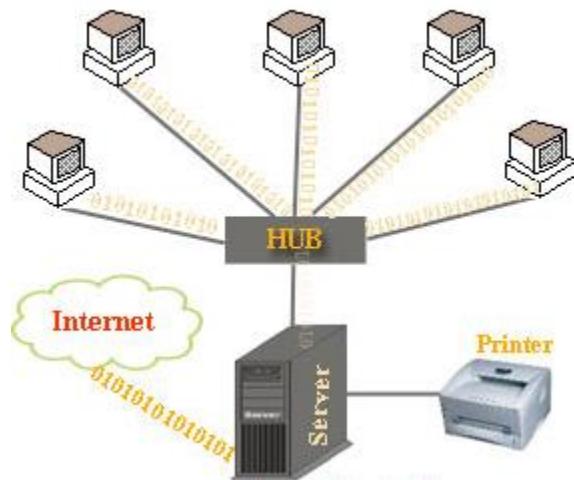
## Broadcasting

There is a single communication channel shared by all computers.

All computers receive messages sent by any computer and all local area networks use the broadcasting communication schemes.

## TYPES OF COMPUTER NETWORKS

### LOCAL AREA NETWORK (LAN)



A local area network is a computer network covering a small geographic area, like a home, office, or group of buildings.

Each node or computer in the LAN has its own computing power but it can also access other devices on the LAN subject to the permissions it has been allowed.

These could include data, processing power, and the ability to communicate or chat with other users in the network.

A local area network allows the following:

Those on the network to use a centralized database to keep all information up to date

Contains a communications channel that connects a series of computer terminals to the central computer.

Provides a convenient means of communication and information transfer

Sharing of expensive equipment like printers

Software resource sharing

Data sharing

### COMPONENTS OF A LOCAL AREA NETWORK

The major components of a local area network are:

### **File servers/host computers**

These are computers with high hard disk capacities than other computers on the network. They enable data and resources to be shared on the network.

### **Client workstations**

These are personal computers attached to the network on which network users do their work. They have their own operating systems and files and are always many.

### **Network operating system**

It enables all resources on a network to be shared.

Such resources include:

Files

Disk space

Network printers

Computer processing power

Communication ports

### **Network interface card (NIC)/local area network adapter**

It enables each computer on the network to be connected to the network cable.

It is usually installed in the expansion slots on the server and network stations.

Each card must have network card driver software loaded in the computer that provides the communication between the card and the network operating system.

Cables

### **Peripheral devices**

Apart from the client personal computers connected to the network, other computing equipment such as printers, plotters and modems can also be connected to the network.

### **Network accessories**

These refer to the various kinds of connections used for connecting cables together.

Requirements needed to setup a local area network

Hub or switch, routers

Computers with network interface cards

Network operating system software

Power to run the system

Communication media

## **FACTORS AFFECTING LOCAL AREA NETWORK PERFORMANCE**

### **Server processing power**

This determines how fast the server can process a network request

### **Hard disk**

This contains the network operating system and the database so the size, seek time and data transfer rate are important

### **Network interface card**

Its bandwidth affects the speed at which it responds to request so the wider the bandwidth, the better performance.

### **Cable speed**

The bandwidth of the network determines the maximum number of requests that can be serviced concurrently and the speed of data transfer.

### **Note the following**

#### **Network neighborhood**

A Windows 95 folder that lists computers, printers and other resources connected to your local-area network (LAN).

By default, a Network Neighborhood icon appears on your desktop, and the folder is also accessible from within the Windows 95 Explorer.

The Network Neighborhood is designed to replace the drive mapping older system, which associates a letter with each shared disk drive. Many programs, however, still require drive mapping.

The Network Neighborhood serves no purpose if your computer is not connected to a LAN, except that it is required to link two computers using Windows 95's Direct Cable Connection (DCC) feature.

#### **NetBEUI network**

This refers to a local area network made up of windows PCs. NetBeui was the transport protocol natively supported by all versions of windows until TCP/IP became the standard in the late 1990s.

### **WIDE AREA NETWORK (WAN)**

This is a computer network that spans a relatively large geographical area.

Typically, a WAN consists of two or more local-area networks (LANs).

Computers connected to a wide-area network are often connected through public networks, such as the telephone system. They can also be connected through leased lines or satellites. The largest WAN in existence is the Internet.

Is a computer network that covers a broad area (i.e., any network whose communications links cross metropolitan, regional, or national boundaries)

This is formed when computers are connected over a long distance.

They are characterized by:

- Unlimited geographical distance
- Low data transmission rates
- High transmission link costs
- Long distance transmission
- High degree of vendor independence

Telephone networks work for long distances, and the transmission system in the telephone network could be:

A cable for short distances

Very high frequency (VHF) or ultra high frequency (UHF) radio for moderately long distances

Microwave radios for haul distances

Satellite communication for international communication

WANs are used to connect LANs and other types of networks together, so that users and computers in one location can communicate with users and computers in other locations.

### **METROPOLITAN AREA NETWORKS (MAN)**

Metropolitan Area Network is a data network designed for a town or city.

In terms of geographic breadth, MANs are larger than local-area networks (LANs), but smaller than wide-area networks (WANs).

MANs are usually characterized by very high-speed connections using fiber optical cable or other digital media.

These cover medium size areas for example an entire city with a radius of approximately 10KM and data rates of 100MBPS and are more expensive than the LANs.

Metropolitan area networks, or MANs, are large computer networks usually spanning a city. They typically use wireless infrastructure or Optical fiber connections to link their sites.

They will often provide means for inter-networking of local networks

## **INTRANET**

A network based on TCP/IP protocols belonging to an organization, accessible only by the organization's members, employees, or others with authorization.

An intranet's Web sites look and act just like any other Web sites, but the firewall surrounding an intranet fends off unauthorized access.

Intranets are used to share information. Secure intranets are now the fastest-growing segment of the Internet because they are much less expensive to build and manage than private networks based on proprietary protocols.

An intranet is a private computer network that uses Internet protocols, network connectivity to securely share part of an organization's information or operations with its employees.

The intranet generally makes the company information accessible to employees and facilitates working in groups.

### **Advantages**

#### **Workforce productivity**

Intranets can help users to locate and view information faster and use applications relevant to their roles and responsibilities.

#### **Time**

With intranets, organizations can make more information available since employees can link to relevant information at a time which suits them rather than being deluged indiscriminately by emails.

#### **Communication**

Intranets can serve as powerful tools for communicating strategic initiatives that have a global reach throughout the organization.

#### **Web publishing**

Because each business unit can update the online copy of a document, the most recent version is always available to employees using the intranet.

#### **Business operations and management**

Intranets are also being used as a platform for developing and deploying applications to support business operations and decisions across the internet worked enterprise.

#### **Cost-effective**

Users can view information and data via web-browser rather than maintaining physical documents such as procedure manuals, internal phone list and requisition forms.

#### **Promote common corporate culture**

Every user is viewing the same information within the Intranet.

#### Enhance Collaboration

With information easily accessible by all authorized users, teamwork is enabled.

#### Cross-platform Capability

Web browsers that support Java under Windows, Mac, and UNIX are supported.

#### Disadvantages

##### Inappropriate or incorrect information

This can be posted on an intranet which can reduce its credibility and effectiveness. In a devolved and highly interactive intranet there is freedom to post abusive and possibly illegal materials.

##### Training

This is required to educate people of what intranet can do.

#### Need expertise

Under this, in the field to administer and develop Intranet information within the organization, security of the intranet becomes an issue. Other users may post sensitive information which may appear to another user.

#### Information overload

As information can be posted by any user, information overload may occur during the cause if it is not controlled well.

## EXTRANET

An extranet refers to a network that is partially accessible to authorized outsiders.

An extranet provides various levels of accessibility to outsiders. You can access an extranet only if you have a valid username and password, and your identity determines which parts of the extranet you can view.

Extranets are becoming a very popular means for business partners to exchange information.

An extranet is a private network that uses Internet protocols, network connectivity, and possibly the public telecommunication system to securely share part of an organization's information or operations with suppliers, vendors, partners, customers or other businesses.

#### Advantages

Extranets can improve organization productivity by automating processes that were previously done manually (e.g.: reordering of inventory from suppliers).

Extranets allow organization or project information to be viewed at times convenient for business partners, customers, employees, suppliers and other stake-holders. This cuts down on meeting times and is an advantage when doing business with partners in different time zones.

Information on an extranet can be updated, edited and changed instantly. All authorized users therefore have immediate access to the most up-to-date information.

Extranets can improve relationships with key customers, providing them with accurate and updated information.

#### Disadvantages

Extranets can be expensive to implement and maintain within an organization (e.g.: hardware, software, employee training costs)

Security of extranets can be a big concern when dealing with valuable information. System access needs to be carefully controlled to avoid sensitive information falling into the wrong hands.

Extranets can reduce personal contact (face-to-face meetings) with customers and business partners. This could cause a lack of connections made between people and a company, which hurts the business when it comes to loyalty of its business partners and customers.

## INTERNET

This is a global network connecting millions of computers.

## CONNECTING NETWORKS

The following devices are used to connect computer networks

### REPEATERS



These are used to extend the geographical coverage of a local area network by locally connecting two or more local area networks.

They retime, amplify and repeat all electrical signals carried by the networks.

A repeater is an electronic device that receives a weak or low-level signal and retransmits it at a higher level or higher power, so that the signal can cover longer distances without degradation.

Repeaters are often used in trans-continental and trans-oceanic cables, because the attenuation (signal loss) over such distances would be completely unacceptable without them.

Repeaters are used in both copper-wire cables carrying electrical signals, and in fibre optics carrying light

Repeaters are used in radio communication services.

Radio repeaters often transmit and receive on different frequencies.

Repeaters are also used extensively in broadcasting, where they are known as translators or boosters.

## BRIDGES



These are a combination of hardware and software that is used to connect similar networks over wide area communication links.

### Advantages of network bridges

Self configuring

Primitive bridges are often inexpensive

Reduce size of collision domain

Transparent to protocols above the MAC layer

Allows the introduction of management - performance information and access control

LANs interconnected are separate and physical constraints such as number of stations, repeaters and segment length don't apply

### Disadvantages of network bridges

Do not limit the scope of broadcasts

Do not scale to extremely large networks

Buffering introduces store and forward delays - on average traffic destined for bridge will be related to the number of stations on the rest of the LAN

Bridging of different MAC protocols introduces errors

Because bridges do more than repeaters by viewing MAC addresses, the extra processing makes them slower than repeaters

Bridges are more expensive than repeaters

## ROUTERS



These are used when several networks are connected together and send communication traffic directly to the appropriate network.

They are generally used to link physically similar local area networks for large networks with heavy traffic and where cost is not primarily in consideration.

A router is a device that determines the proper path for data to travel between different networks.

They connect networks together; a LAN to a WAN for example, to access the Internet.

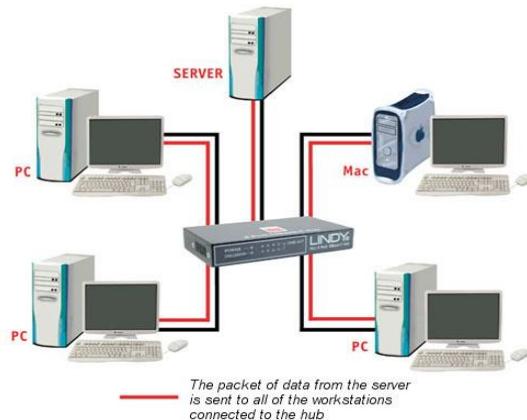
They connect networks that are not directly connected to each other.

## GATEWAYS

These are a combination of hardware and software that tell users on the network to access resources on a different type of network.

They allow terminals to connect to any computer on the network.

## HUBS



These allow devices to be

connected to the server.

It acts as a central point that connects several devices on a network.

## SWITCHES



These are used to store the address of every device down each cable connected to it.

A network switch is a computer networking device that connects network segments.

Network switches appear nearly identical to network hubs, but a switch generally contains more "intelligence" (and a slightly higher price tag) than a network hub.

Network switches are capable of inspecting data packets as they are received, determining the source and destination device of that packet, and forwarding it appropriately.

By delivering each message only to the connected device it was intended for, a network switch conserves network bandwidth and offers generally better performance than a hub.

#### NODE

A node is a device that is connected as part of a computer network. For example, a node may be a computer, personal digital assistant, cell phone, router, switch, or hub.

### PROTOCOLS FOR NETWORKS

These refer to the rules governing the exchange of information between devices on a data link.

Protocols refer to the description of the rules computers must follow to communicate with each other.

These include the following:

#### Ethernet

This is a local area network protocol that allows personal computers to contend for access to the network. It uses coaxial cable that carries radio frequency signals between computers at a rate of 10 megabytes per second.

Ethernet uses the CSMA/CD access method to handle simultaneous demands. It is one of the most widely implemented LAN standards.

#### Carrier sense multiple access/collision detect (CSMA/CD)

This is a protocol for carrier transmission in Ethernet networks.

On Ethernet, any device can try to send a frame at any time. Each device senses whether the line is idle and therefore available to be used.

If it is, the device begins to transmit its first frame. If another device has tried to send at the same time, a collision is said to occur and the frames are discarded.

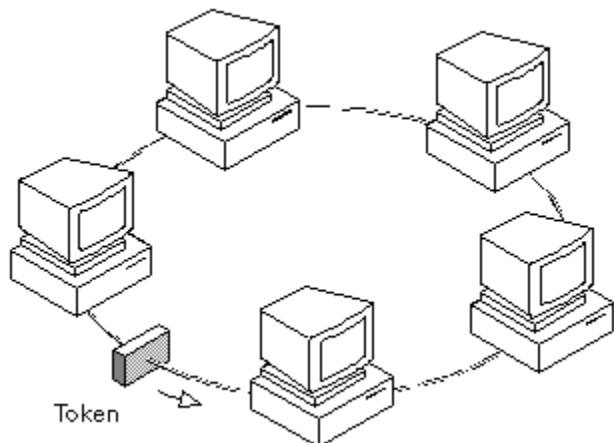
Each device then waits a random amount of time and retries until successful in getting its frame transmitted.

This is a local-area network (LAN) architecture developed by Xerox Corporation in cooperation with DEC and Intel in 1976. Ethernet uses a bus or star topology and supports data transfer rates of 10

Mbps. The Ethernet specification served as the basis for the IEEE 802.3 standard, which specifies the physical and lower software layers.

A newer version of Ethernet, called 100Base-T (or Fast Ethernet), supports data transfer rates of 100 Mbps. And the newest version, Gigabit Ethernet supports data rates of 1 gigabit (1,000 megabits) per second.

### Token ring



This is a type of computer network in which all the computers are arranged in a circle.

A token, which is a special bit pattern, travels around the circle. To send a message, a computer catches the token, attaches a message to it, and then lets it continue to travel around the network.

The Token Ring protocol is the second most widely used protocol on local area networks after Ethernet.

### Transmission control protocol (TCP)

This is a protocol used along with the Internet protocol to send data between computers over the Internet.

It specifies the how computers communicate with each other on the Internet.

The Internet protocol handles actual delivery of data where as the transmission control protocol keeps track of the packets being delivered.

The protocol guarantees reliable and in-order delivery of data from sender to receiver.

Whereas the IP protocol deals only with packets, TCP enables two hosts to establish a connection and exchange streams of data. TCP guarantees delivery of data and also guarantees that packets will be delivered in the same order in which they were sent.

All other protocols are built on top of the transmission control protocol.

### File transfer protocol (FTP)

This is a protocol that makes it possible to send data contained in files between computers on a data link.

FTP is most commonly used to download a file from a server using the Internet or to upload a file to a server

#### Hypertext transfer protocol (HTTP)

This is the World Wide Web protocol that performs the request and retrieval functions of the server.

It defines how web documents are requested for and delivered over the internet.

The underlying protocol used by the World Wide Web. HTTP defines how messages are formatted and transmitted, and what actions Web servers and browsers should take in response to various commands.

For example, when you enter a URL in your browser, this actually sends an HTTP command to the Web server directing it to fetch and transmit the requested Web page.

#### Gopher

Gopher is a distributed document search and retrieval network protocol designed for the Internet.

The Gopher protocol offers some features not natively supported by the Web and imposes a much stronger hierarchy on information stored on it.

Its text menu interface is well-suited to computing environments that rely heavily on remote computer terminals, common in universities at the time of its creation.

Some consider it to be the superior protocol for storing and searching large repositories of information

This is a system that pre-dates the World Wide Web for organizing and displaying files on Internet servers. A Gopher server presents its contents as a hierarchically structured list of files. With the ascendancy of the Web, many gopher databases were converted to Web sites which can be more easily accessed via Web search engines

#### Telnet

It enables you to log on remotely to other computers on the network.

A terminal emulation program for TCP/IP networks such as the Internet. The Telnet program runs on your computer and connects your PC to a server on the network.

You can then enter commands through the Telnet program and they will be executed as if you were entering them directly on the server console. This enables you to control the server and communicate with other servers on the network.

To start a Telnet session, you must log in to a server by entering a valid username and password. Telnet is a common way to remotely control Web servers.

### IPX (Internetwork Packet Exchange)

IPX is a datagram protocol used for connectionless communications

This is a datagram or packet protocol for example regular voice phone call.

### SPX (sequenced packet exchange)

This is a networking protocol for handling packet sequencing in Novell NetWare network.

It provides connection-oriented services between two nodes on the network. SPX is used primarily by client/server applications.

It prepares the sequence of packets that the message is divided into and manages the reassembling of received packets.

Whereas the IPX protocol is similar to IP, SPX is similar to TCP. Together, therefore, IPX/SPX provides connection services similar to TCP/IP.

### ATM (asynchronous transfer mode)

Is a network technology based on transferring data in cells or packets of a fixed size. The cell used with ATM is relatively small compared to units used with older technologies. The small, constant cell size allows ATM equipment to transmit video, audio, and computer data over the same network, and assure that no single type of data hogs the line.

Some people think that ATM holds the answer to the Internet bandwidth problem, but others are skeptical. ATM creates a fixed channel, or route, between two points whenever data transfer begins. This differs from TCP/IP, in which messages are divided into packets and each packet can take a different route from source to destination. This difference makes it easier to track and bill data usage across an ATM network, but it makes it less adaptable to sudden surges in network traffic.

Note the following

#### Handshaking

This is the process by which two devices initiate communications.

Handshaking begins when one device sends a message to another device indicating that it wants to establish a communications channel.

The two devices then send several messages back and forth that enable them to agree on a communications protocol.

Handshaking must occur before data transmission as it allows the protocol to be agreed.

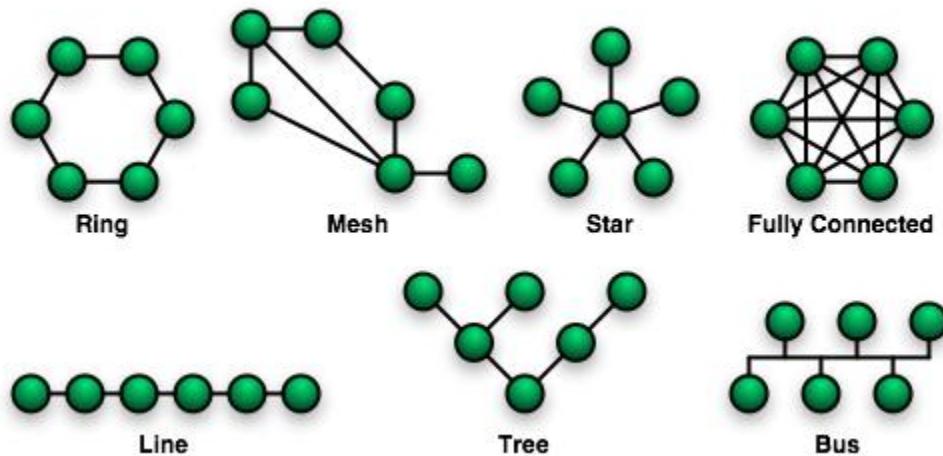
### NetBIOS

Short for Network Basic Input Output System, an API that augments the DOS BIOS by adding special functions for local-area networks (LANs). Almost all Windows-based LANs for PCs are based on the NetBIOS. Some LAN manufacturers have even extended it, adding additional network capabilities.

This was the original networking protocol for DOS and windows PCs. NetBIOS packets did not contain a network address and were not easily routable between networks. As a result, the interface to NetBIOS and the transport part of NetBIOS were later separated so that NetBIOS applications could use routable protocols such as TCP/IP and SPX/IPX.

The programming interface retained the NetBIOS name while the transport protocol was named NetBEUI.

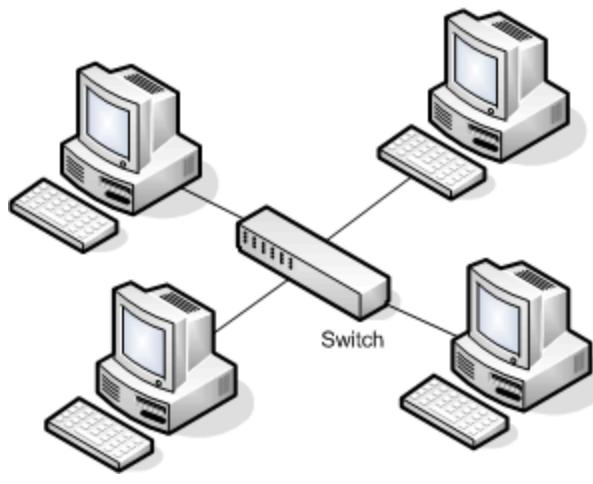
## TYPES OF NETWORK TOPOLOGIES



Topology refers to the specific physical or virtual arrangement of the elements of a network.

Network topologies refer to the configuration or physical arrangement of the devices in a communication network.

## STAR NETWORK TOPOLOGY



Star networks are one of the most common computer network topologies.

In its simplest form, a star network consists of one central switch, hub or computer which acts as a conduit to transmit messages.

The star topology reduces the chance of network failure by connecting all of the systems to a central node.

All peripheral nodes may thus communicate with all others by transmitting to, and receiving from, the central node only.

The failure of a transmission line linking any peripheral node to the central node will result in the isolation of that peripheral node from all others, but the rest of the systems will be unaffected.

#### Advantages

Good performance.

Flexibility in adding and deleting devices

Well understood techniques with standard hardware and software

Relatively efficient

Simplicity of control over data processed on the network

Scalable, Easy to set up and to expand.

Any non-centralized failure will have very little effect on the network, whereas on a ring network it would all fail with one fault.

Easy to detect faults

Data Packets are sent quickly as they do not have to travel through any unnecessary nodes.

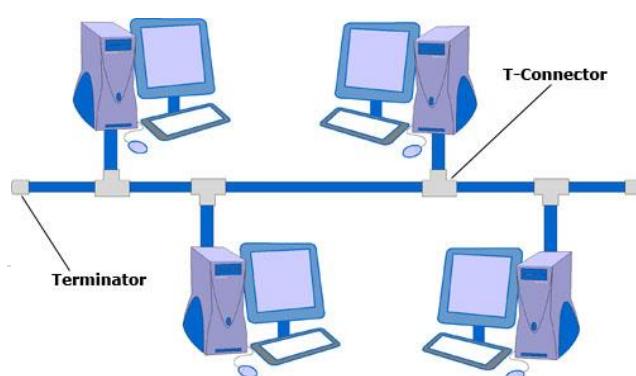
#### Disadvantages

Expensive to install

Extra hardware required

If the hub/switch, central computer fail the entire system is affected.

## BUS/DAISY/MULTI DROP/CHAIN TOPOLOGY



Is a network architecture in which a set of clients is connected via a shared communication line called a bus.

### Advantages

Allows its components to communicate independently of each other  
Failure of one station does not affect operations on the bus  
Data is transmitted in both directions  
Devices may be attached or detached from the network at any point without disrupting the rest of the network  
Requires less cable length than a star network topology  
Easy to implement and extend  
Well suited for temporary or small networks not requiring high speeds  
Cheaper than other topologies to install

### Disadvantages

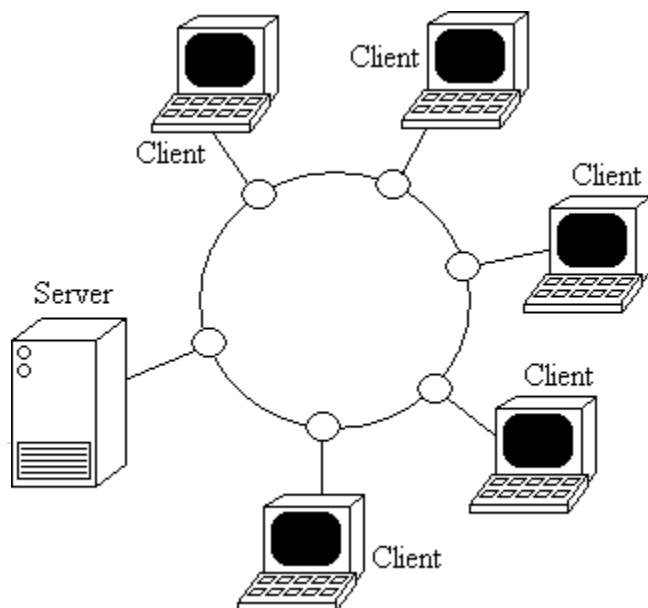
Difficult to administer/troubleshoot  
Limited cable length and number of stations  
If there is a problem with the cable, the entire network goes down  
Maintenance costs may be higher in the long run  
Performance degrades as additional computers are added or in case of heavy traffic  
Low security since all computers on the bus can see all data transmitted  
Proper termination is required (loop must be in closed path)  
Significant capacitive load (each bus transaction must be able to stretch to most distant link)

### Trouble shoot

To isolate the source of a problem and fix it, typically through a process of elimination whereby possible sources of the problem are investigated and eliminated beginning with the most obvious or easiest problem to fix.

Usage Note: In the case of computer systems, the term troubleshoot is usually used when the problem is suspected to be hardware-related. If the problem is known to be in software, the term debug is more commonly used.

## RING NETWORK TOPOLOGY



All data that is transmitted between nodes in the network travels from one node to the next node in a circular manner and the data generally flows in a single direction only.

A ring network is a network topology where each node is connected to two other nodes, so as to create a ring.

Ring networks tend to be inefficient when compared to Star networks because data must

travel through more points before reaching its destination.

#### Advantages

Data is quickly transferred without a ‘bottle neck’

The transmission of data is relatively simple as packets travel in one direction only

It prevents network collisions because of the media access method or architecture required

Adding additional nodes has very little impact on bandwidth

Fewer cables are used so network cabling costs are low.

#### Disadvantages

Data packets must pass through every computer between the sender and recipient Therefore this makes it slower

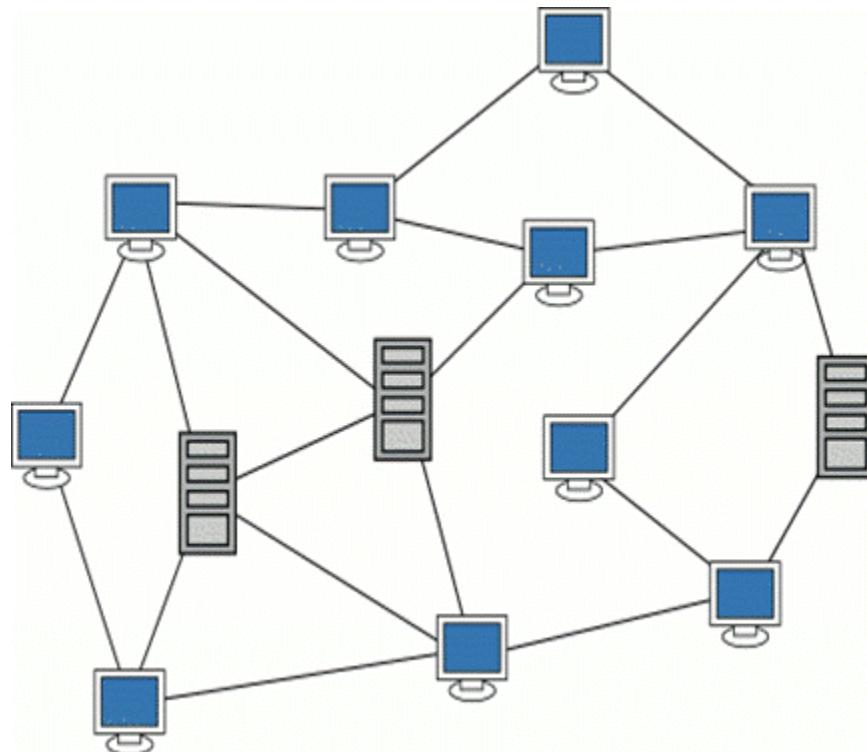
If any of the nodes fail then the ring is broken and data cannot be transmitted successfully

Because all stations are wired together, to add a station you must shut down the network temporarily.

It is difficult to troubleshoot the ring

If a cable fails, the whole network goes down.

## MESH NETWORK TOPOLOGY



The type of network topology in which each of the nodes of the network is connected to each of the other nodes in the network with a point-to-point link – this makes it possible for data to be simultaneously transmitted from any single node to all of the other nodes.

#### Advantages

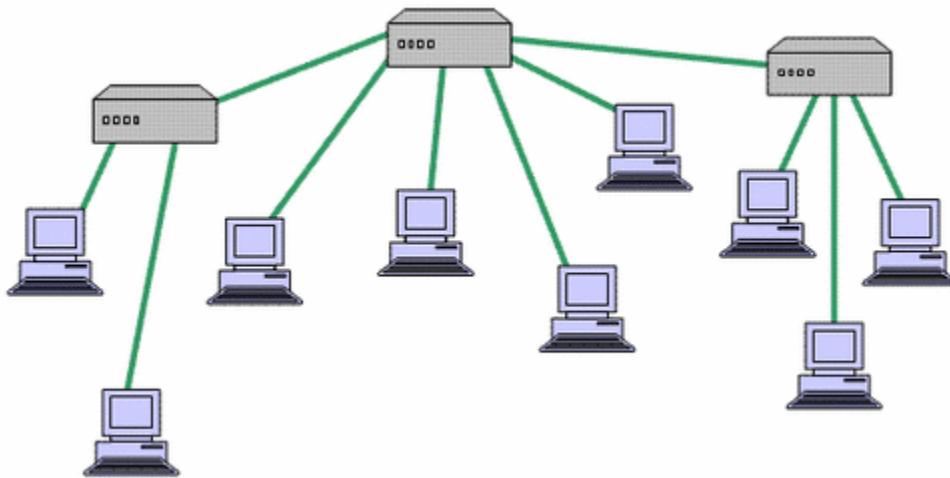
The topology is used when there are only a small number of nodes to be interconnected.

#### Disadvantages

Generally too costly for a physical fully connected mesh

Complex for practical networks

## TREE NETWORK TOPOLOGY (Hierarchical)



The type of network topology in which a central 'root' node (the top level of the hierarchy) is connected to one or more other nodes that are one level lower in the hierarchy (i.e., the second level) with a point-to-point link between each of the second level nodes.

### INTERCONNECTED NETWORK TOPOLOGY

This is common with peer to peer and server to client links and it is used in situations where the two types of link are supposed to exist and the connecting point is the server.

### HYBRID NETWORKS

These are a combination of star, ring and bus networks.

### THE INTERNET AND THE WORLD WIDE WEB

This is a bunch of computers connected together so that people can quickly and inexpensively share information.

It is a large world wide network of computers with ability to receive and send files from one computer to another.

This is a global network connecting millions of computers.

#### History of the Internet:

The Internet was conceived during early 1960 as a solution to a pending cold war problem.

The essence was how the US government would communicate after a major attack.

Any communication network controlled by a central facility would be useless because these were the primary targets in any major attack.

A communication network without a centralized authority or control was the solution because the network could operate after parts of it were damaged or destroyed.

The major principle put across was to have a network where any computer connection on the network would be able to receive and send messages from one destination to another without relying on any of the other computers so even without other connection could not hinder messages reaching their destinations so long as the destinations were not destroyed or missing.

In 1968, the first test network was set up in Great Britain and shortly after, a USA project sponsored by the Pentagon Advanced Research Agency (ARPA) was started.

It used four high-speed computers/super computers using high-speed transmission lines to transfer data on its network then called ARPANET.

In early 1970s, Arpanet's network control protocol (NCP) standard used by then developed into a more sophisticated standard known as transmission control protocol (TCP/IP).

This standard transmission enabled messages to be broken down into smaller 'packets' sent across the network and when it reached the destination it was reassembled into the original message before it could be opened.

The Internet protocol part of this standard was responsible for all the addressing of the messages. It enabled messages to be transmitted across various networks using multiple standards.

Originally ARPANET was designed to enable scientists and the researchers to enjoy long distance computing but as time went on they started using it for sending and receiving personal e-mails and news articles.

By then they had started owning personal user accounts and addresses for the e-mails thus the start of the electronic post office.

With the turn of years, computers became more and more powerful yet less expensive. Various organizations acquired suitable computers and eventually linked their networks to the ARPANET.

As more and more organizations connected to the ARPANET, they dominated the network so much that ARPANET was just a small part of the various network connections. Eventually this collection of inter-worked networks became known as the Internet.

Who uses the Internet?

Business organizations for advertising goods  
Scientific researchers and academicians  
Governments for policy implementation  
Individuals for killing boredom and education.

ISP- Internet Service Providers

These are organizations/companies that avail Internet services to those who need them and are willing to pay for them.

These are organisations that provide access to the internet. Their customers can be individuals or organisations.

#### Examples of Internet service providers

Local service providers- MTN, UTL and Zain

AOL and MSN-online service providers

AT&T world net

Comp serve interactive

Microsoft network

Prodigy Internet

#### Uses of Internet service providers

Provide their users with a mail box which stores their e-mails on a special server called a mail server  
They provide an address that points to a specific resource on the web for example addressing schemes used to link resources on the web.

They operate local area networks connected to the world wide web

They connect organisations and individuals to the web

They also provide technical support

They provide local telephone numbers

They also provide the connection media such as modems

#### Factors to consider when choosing an Internet service provider

##### Bandwidth

The higher the bandwidth the more the data it carries and the faster the data transfer. So one needs an ISP who would provide a higher bandwidth.

##### Past experience

An ISP with years of experience may provide you with better internet connections than newly established ISP.

##### Administrative support/budget

Getting an ISP depends on the amount one is willing to invest in internet connection. This fee should be reasonable in exchange for better services.

##### Consultancy from technical specialists in that field

When choosing an ISP, it is recommended that you do some research before signing up with your chosen ISP in order to use their experience to ensure you get the best ISP

### **Services provided**

Before choosing an ISP, you select the services that you need so you should find out whether your would-be ISP supports such services.

### **Cost for Internet access**

One needs to know the charges for internet access depending on the services accessed, amount of time spent on the internet, standard fee for a month so as to calculate the total amount to be paid for internet access.

### **The type of connections offered**

This refers to the modes by which your computer connects to the ISP for internet access. Always choose a mode that will offer good connections and it is good to know whether or not the mode you need is available with your would be ISP.

### **Technical support**

This is required incase of a problem or difficulties for example installing software, dialing into the ISP's system so one should know how to contact the ISP and the charge if any.

### **Security**

It is always important to protect your activities and computer system from illegal access to them so the ISPs should mention how they manage security or whether they support any kind of encryption, fire wall virus guards.

### **Software**

You need to know the type of software the would-be ISP supports because some software may not be either available or supported by some ISP.

### **Location**

Consider the location of your chosen ISP, you may want to choose a local company as you have to call up the number to check email and so on.

### **Stability**

You want to choose an internet service provider that will meet your needs for years to come. Many internet service providers disappeared in the dot com crash of the last few years. Many others were built just to make a quick buck. You should choose a company that is built to last for the long run. The long run is a foreign concept to many-start up internet providers.

### **Modem ratio**

### **Free Website Hosting**

Your internet service provider should provide free website hosting for your personal website. Five to ten megabytes is plenty. This space is great for personal sites, but is not the best place to put your business website.

## **Reliability**

A fast, cheap connection is no good if you get disconnected every 10 minutes. Your internet service provider should keep you connected.

## **Ways of connecting to the Internet**

There are several ways of connecting to the Internet and these include the following:

### **Dial-up modems**

A dial-up is temporary connection that uses one or more analog telephone lines for communications

#### **Advantages**

They are cheap and easy to install

They have a wide technical base because they have been in use for many years

They are cheap to maintain

#### **Disadvantages**

They have limited speed

Modems use up the whole telephone line that is it is not possible to use a modem and a phone line at the same time.

### **Advantages of using telephone for communications**

Immediate contact is made

Tone of the voice helps communications

#### **Disadvantages**

Time zone problems between different countries

Call is successful only when the person to contact is present

It may take time to get some one on the phone

### **Cable modems**

These offer a means of connecting the computer to the Internet through a coaxial television cable instead of a telephone line.

This means they offer high speed for Internet connection and are suitable for home and business use.

#### **Advantages**

They are very fast

They do not use up the entire phone line.

Suitable for home and business use

#### **Disadvantages**

They are expensive to buy and install.

They need extra hardware, which is an additional cost.

Digital subscriber link (DSL)

This uses standard copper phone lines to transmit data in a digital form at a very high speed.

Advantages

This method is good for private homes and small businesses as well.

It uses a standard formula

It does not use up the entire phone line so it can allow Internet connection and phone calling at the same line.

Disadvantages

Requires extra hardware

Not available with all Internet service providers

Integrated services digital network (ISDN)

This is an Internet connection that uses a special telephone line running directly from the hub to the users' house or business.

Advantages

This computer connection is widely supported

It is faster

Can support more than one computer

Does not hold up the entire phone line

Produces clear voice conversations

Disadvantages

It is expensive to set up and maintain

It requires extra hardware

T-1 LINE (leased line)

This is a high-speed digital connection that avails a large line and is good for small to medium sized companies.

Advantages

It is very fast

Offers a broad technical base

Disadvantages

It is very expensive

Requires extra hardware and services from a telephone company

### **Advantages of using the Internet**

It allows greater communication between all people throughout the world and breaks down geographical and cultural boundaries.

The internet provides entertainment and information for millions of people through online music and movies.

It allows people who are otherwise isolated from the society for whatever reason to interact with the society.

It provides educational, health and commercial services to people anywhere in the world.

The internet is changing the work place environment by allowing people to work from home and remote locations.

It provides people with membership to a world wide library and resource center.

The internet offers a wide variety of software applications that can be downloaded for use for example games software, device drivers.

**Cost Effective and Enduring Marketing Strategies.** The Internet has become the information superhighway for the buying public. Most persons prefer the hassle free transactions that Internet shopping can offer. As a result, the Internet has become the most powerful selling tool. Internet Promotion offers cost effective ways for small businesses to enhance their product or service distribution networks. Internet Promotion presents the advantage of reduced budget and storage costs, when compared with printing brochures, producing television or radio advertisements or managing a call centre. It presents a fast and cost effective option for penetrating new markets

It is a source of employment for those with skills such as researchers, web site designers and webmasters.

### **Disadvantages of using the internet**

The internet is a big source of pornography and this has led to moral decay.

Because knowledge is power, the internet extends division between the privileged and the underprivileged.

The security of data belonging to individuals, businesses and governments may be jeopardized or at risk from unauthorized access.

The internet enables opportunities for fraud for example illegal money transfer.

The internet promotes the spread of computer viruses through junk mails and computer games.

There is no controlling body that verifies the validity of information or restricts illicit materials.

The Internet can isolate people from direct social interaction as well as erode the socio aspect of work.

Spamming which involves sending of unsolicited electronic mails in bulk that serve no purpose and unnecessarily clog up the entire system.

Computer crimes such as hacking, piracy and information theft and all these bring more invasion of privacy of individuals.

Unemployment as more and more less skilled people get retrenched and their roles taken up by more efficient IT experts

Increased instability in man being all the time insecure for his future and is compelled to learn new things every now and then

Isolation of the old being hard for them to cope with the many IT changes  
IT related health problems like eye strain, repetitive strain injury  
Computer addiction by young people like playing games and over surfing.  
Increased installation and maintenance costs

Hard ware and software requirements for internet use  
Computer  
Modem  
Telephone line connection  
Communication software  
An account with an internet service provider.

#### How the internet is changing the world?

The internet offers avenues for communication with people around the world through electronic mails, chat room and discussion.

The internet offers news of all types. One can access a web for information news and research communications.

Education, teaching and learning are being changed by the internet being a source of educational materials for example one can access online libraries, attend a lesson over the internet.

The internet is changing the world through entertainment and television that is one can watch television over the internet and also download, listen to music and watch videos.

The internet is changing the world through personal enrichment for example one can obtain information, photographs and audio clips regarding a given topic.

The internet is changing the world by merging telecommunication with computer technology such that one can send or exchange data files over the internet and make a phone call using a computer and telephone line.

The internet is changing the world through business; advertising and online shopping for example one can buy goods, bank money over the internet.

The internet is changing the world through electronic publishing for example news papers, magazines are published electronically over the internet and they provide a good source of information.

#### Uses of the Internet

Transfer of research papers, ideas and mails  
Easiest way of availing product information  
Advertising and providing customer support internationally  
Access a wealth of information, news and research information  
Communicate with people around the world  
Bank and invest  
Shop for goods and services  
Download and listen to music and watch videos  
Access educational materials  
Access entertainment sources  
Access other computers and exchange files

Provide information, photographs and audio clips.

## WEB BROWSERS

Browser, short for Web browser, is a software application used to locate and display Web pages.

These are programs used to interface between the web and computer users.

These are computer program software that accesses web pages and displays them on the computer screen.

They are also client programs that read files from a web server.

Web browsers interpret, find pictures and display them, accept text, sounds and movies.

They also refer to software that enables you to use your computer to surf the web and download text, pictures and sounds to your computer.

Web browsers can display graphics as well as text. In addition, most modern browsers can present multimedia information, including sound and video, though they require plug-ins for some formats.

Examples of web browsers

Internet Explorer (IE)

Flock

Netscape navigator

Safari

Mozilla Fire fox

Lynx

Mosaic

Opera

## PARTS OF A WEB BROWSER

Title bar

This displays the title of the web page.

Menu bar

This offers different options on the pull down menus.

Tool bar and tool bar buttons

These offer the tools needed to explore the web.

Back

This returns you to view again the last page you saw.

### **Forward**

This allows you to view again the pages you passed when using the back button.

### **Home**

This returns you to the page first displayed when you access the web.

### **Reload/refresh**

This is used for pages that seem incomplete on the screen or obtain the latest version of a page that is continually updated.

### **Print**

This allows you to print the page currently displayed on the screen.

### **Find/search**

This takes you to the browser's built in search engine.

### **Stop**

This cancels or ends the loading of a web page.

### **Favourites/ Bookmark**

This allows you to keep a collection of web pages for quick access.

It is a feature that allows users to click and store the Internet addresses of favourite websites so that the uniform resource locator does not need to be memorized.

### **Location/address window**

This displays the uniform resource locator of the current page.

### **Status bar**

This displays information about data transfer.

### **Scroll bar and scroll button**

This allows you to move up and down or left and right to view the entire page.

### **SEARCH ENGINE**

This is a program that searches documents for specified keywords and returns a list of the documents where the keywords were found.

A search engine is a tool that searches web pages, indices them, identifies web pages related to key words and topics that you ask for.

A search engine is an information retrieval system designed to help find information stored on a computer system, such as on the World Wide Web

Typically, a search engine works by sending out a spider to fetch as many documents as possible. Another program, called an indexer, then reads these documents and creates an index based on the words contained in each document. Each search engine uses a proprietary algorithm to create its indices such that, ideally, only meaningful results are returned for each query.

Uses of search engines

Dealing with the quantity of information problem

Filtering out some of the poor quality web pages

Organising and bringing structure to the internet and in particular the web's vast resources.

#### Search engines and sites

Alta vista

Excite

Lycos

Google

Meta crawler

Yahoo

#### About

The Argus clearing house

Internet public library

Look smart

Magellan

Common problems associated with the use of search engines

Response time

Advanced searching capabilities

Relevancy and amount of information returned

Ranking and/or sorting by system

Getting information on the world wide web-client server computing

The World Wide Web is a network designed around client server architecture.

When we are surfing the internet using a web browser, we are a client, the computers that have the information are the servers called web servers.

The client and server can send and receive web pages using a language called hypertext transfer protocol and it is for this reason that most web documents' addresses begin with http.

All documents and web sites on the internet have unique internet addresses associated with them.

Some of the documents have links pointing to other documents.

Hyperlinks contain the internet addresses to other documents.

Internet addresses are referred to as uniform resource locators therefore to access any site on the internet you must know its uniform resource locator.

Servers and clients

Server

This is a computer that responds to requests for information for example an e-mail server responds to requests to send and receive e-mail messages.

It is a computer that manages resources on the network and provides a centralised storage area for resources for example programs and data.

Client

This is a computer that requests for information from a server.

Client-server computing refers to the manner in which computers exchange information by sending it as servers and receiving it as clients.

Computers devoted to serving web pages are called web servers.

When a computer/server requests for additional information to answer given requests, then it becomes a client.

URL-uniform resource locator

This is the address of a resource on the Internet.

The Uniform Resource Locator is the address of a resource available on the Internet for example <http://www.lib.latrobe.edu.au>

This is an address that specifies the location of a file on the Internet (e.g. <http://library.wur.nl/>).

This is the standard way to give the address of any resource on the Internet that is part of the World Wide Web (WWW). A URL looks like this: <http://www.yahoo.com/>

Uniform Resource Locator, an HTTP address used by the World Wide Web to specify a certain site.

A Uniform Resource Locator is the global address of documents and other resources on the World Wide Web.

The first part of the address is called a protocol identifier and it indicates what protocol to use and the second part is called a resource name and it specifies the IP address or the domain name where the resource is located. The protocol identifier and the resource name are separated by a colon and two forward slashes.

For example, the two URLs below point to two different files at the domain pcwebopedia.com. The first specifies an executable file that should be fetched using the FTP protocol; the second specifies a Web page that should be fetched using the HTTP protocol:

ftp://www.pcwebopedia.com/stuff.exe

http://www.pcwebopedia.com

Resources could be:

Text

Animations

Graphics

Application software

Sounds

Movies

They also bring up news groups, chat rooms, search engines, real time, audio and video streams.

Once you enter the URL "http://www.webopedia.com/browser.html" into your address line, the browser breaks that Web address down into three distinct parts.

The Protocol: "http"

The server name: "www.webopedia.com"

The file name, which follows the server name: "browser.html"

Parts of a uniform resource locator

The uniform resource locator has three parts.

Protocol

Server name/site name

Path and file name

Protocol

This is the method of access being used. It could be http, ftp, news or gopher.

It is a kind of link to be made.

It is a set of rules that allows you to communicate with other computers on the web.

Server name/site name

This is the Internet address of the computer or file server on which the resource resides.

It normally ends with a designation like .com, .edu, .gov, and .mil

Path/directory path

This identifies the route through the site to the specific page.

File name

This takes you to the specific file or page that you are looking for.

#### Domain/host name

This identifies the owner of the site that is the network to which a computer is connected.

A name that identifies a computer or computers on the internet. These names appear as a component of a Web site's URL, e.g. wikipedia.org. This type of domain name is also called a hostname.

#### Port number (optional)

It rarely appears because all files are on default port of the web that is port 80.

#### Anchor (optional)

This is a named bookmark within a hypertext markup language.

Note the following:

##### Internet protocol address (IP address)

This is a number that uniquely identifies each computer or device connected to the computer network.

An IP address (Internet Protocol address) is a unique address that certain electronic devices use in order to identify and communicate with each other on a computer network utilizing the Internet Protocol standard (IP)—in simpler terms, a computer address.

This is an identifier for a computer or device on a TCP/IP network. Networks using the TCP/IP protocol route messages based on the IP address of the destination. Each number can be zero to 255. For example, 1.160.10.240 could be an IP address.

#### Domain name

It is the text version of an internet protocol address.

#### Domain name system (DNS)

This is a system that permits use of alphabetic characters instead of numbers for easy remembrance of the Internet protocol address.

It is a system that translates a uniform resource locator address that you type into a series of numbers.

The computer uses the numbers to find websites you want to reach.

This is an Internet service that translates domain names into IP addresses.

Because domain names are alphabetic, they're easier to remember. The Internet however, is really based on IP addresses. Every time you use a domain name, therefore, a DNS service must translate the name into the corresponding IP address.

For example, the domain name www.example.com might translate to 198.105.232.4.

The DNS system is, in fact, its own network. If one DNS server doesn't know how to translate a particular domain name, it asks another one, and so on, until the correct IP address is returned.

## Uses

The most basic use of DNS is to translate hostnames to IP addresses. It is in very simple terms like a phone book. For example, if you want to know the internet address of en.wikipedia.org, the Domain Name System can be used to tell you it is 66.230.200.100.

Typical uniform resource locators include:

<http://www.cnn.com>

<http://www.yahoo.com>

<http://www.microsoft.com>

<ftp://eds.ipi.arizona.com>

Additional parts of these names refer to the path name about the location of files or documents requested for.

To access a particular site, the site's URL must be entered on a single line with no spaces in between.

This must be entered in the address box labeled "address" on the location bar of the web browser being used.

## Illustrations

[www.louvre.fr](http://www.louvre.fr)

Where:

WWW is the host name: indicates this computer as louvre's World Wide Web server.

Louvre is the sub domain and it indicates that the server is on a network called louvre.

Fr is the top domain and it indicates that the server is in France.

<http://www.glencoe.com/sec/languageart/index.html>

Where:

Http is the Internet protocol

[www.glencoe.com](http://www.glencoe.com) is the domain

/sec/language art is the file name

/index.html is the file name

Within the domain name is the suffix, or top-level domain that tells the type of the site

Suffix	Type of site
--------	--------------

.com	commercial
------	------------

.edu	educational
------	-------------

.gov	government
------	------------

.mil	military
.net	network
.org	organization

The suffix is the final part of a domain name that is preceded by a period and identifies the type of site.

## INTERNET SERVICES/COMPONENTS/ELEMENTS/FEATURES

Internet services are broadly categorized into the following:

Retrieval services

FTP-File Transfer Protocol

File Transfer Protocol makes it possible to send data contained in files between computers.

Gopher

A hierarchical system for finding and retrieving information from the Internet or and intranet

Is a menu-based system for exploring the Internet. Users locate resources by selecting resources from menus.

Is a play on the words "go for." Is a text menu-based browsing service on the Internet. The user selects an item on the menu and is led to either a file or another menu.

A system allowing users to search for files via menus or directory structures.

Is a menu-driven information system that transparently connects users to other Internet sites.

Communication services

E-Mail (electronic mail)

Is a communications protocol whereby a computer user can exchange messages with other computer users (or groups of users) via a communications network.

Is a protocol for the transmission of messages over communications networks. The messages can be notes entered from the keyboard or electronic files stored on disk.

Telnet

Is a protocol used to logon to a remote computer.

Is a protocol for logging onto remote computers from anywhere on the network or data link.

A protocol that allows users to log on to remote hosts and allows users of one type of computer hardware and software to access other computers that use different hardware and software.

Usenet

This is a worldwide bulletin board system (an electronic message center) that can be accessed through the Internet or through many online services.

Usenet is a world-wide network of discussion groups (or news groups).

User's Network-Messages are posted and responded to by readers either as public or private emails.

Discussion groups that are continuous as people sharing like interests post, read, and reply to messages from each other.

IRC- Internet Relay Chats

This is an internet service that allows you to have real time conversations with other people over your computer.

It is the Internet's version of phone calls except that the conversation is typed.

IRC has become very popular as more people get connected to the Internet because it enables people connected anywhere on the Internet to join in live discussions.

Multimedia services

WWW (World Wide Web)

A network of servers linked together by a common protocol, allowing access to millions of hypertext resources. It is also known as W3, the Web and the World Wide Web.

A very popular Internet service that organizes information using a hypertext and hypermedia system of linking documents, FTP sites, gopher sites, WAIS, and telnet.

A system of Internet servers that support specially formatted documents.

The documents are formatted in a markup language called HTML (Hypertext Markup Language) that supports links to other documents, as well as graphics, audio, and video files.

This means you can jump from one document to another simply by clicking on hot spots (An area of a graphics object, or a section of text, that activates a function when selected). Hot spots are particularly common in multimedia applications, where selecting a hot spot can make the application display a picture, run a video, or open a new window of information). Not all Internet servers are part of the World Wide Web.

A hotspot is a specific geographic location in which an access point provides public wireless broadband network services to mobile visitors through a WLAN. Hotspots are often located in heavily populated places such as airports, train stations, libraries, marinas, conventions centers and hotels. Hotspots typically have a short range of access.

WWW-world wide web

It refers to data and information that is made available on the global network.

It is an information system using the Internet to access hypertext documents.

The web got its name because it is interconnected like a spider web so that you move around it in many directions.

The web enables you to follow links to documents and resources all over the world.

It is the most popular service on the internet because of the following reasons:

It is simple to navigate

It contains millions of documents that contain several media like graphics, sound, video and pictures.

It presents a wealth of vibrant and interesting information on a variety of useful, entertaining and useless topics in any attractive way.

## The Difference between the Internet and the World Wide Web

Many people use the terms Internet and World Wide Web interchangeably, but in fact the two terms are not synonymous. The Internet and the Web are two separate but related things.

The Internet is a massive network of networks, a networking infrastructure. It connects millions of computers together globally, forming a network in which any computer can communicate with any other computer as long as they are both connected to the Internet. Information that travels over the Internet does so via a variety of languages known as protocols.

The World Wide Web, or simply Web, is a way of accessing information over the medium of the Internet. It is an information-sharing model that is built on top of the Internet. The Web uses the HTTP protocol, only one of the languages spoken over the Internet, to transmit data. Web services, which use HTTP to allow applications to communicate in order to exchange business logic, use the Web to share information. The Web also utilizes browsers, such as Internet Explorer or Fire fox, to

access Web documents called Web pages that are linked to each other via hyperlinks. Web documents also contain graphics, sounds, text and video.

The Web is just one of the ways that information can be disseminated over the Internet. The Internet, not the Web, is also used for e-mail, which relies on SMTP, Usenet news groups, instant messaging and FTP. So the Web is just a portion of the Internet, albeit a large portion, but the two terms are not synonymous and should not be confused.

## Search services

### WAIS- Wide Area Information Server

This is a program for finding documents on the Internet. WAIS is rather primitive in its search capabilities.

Wide Area Information Server, an index and retrieval system; when you enter a keyword, a search is performed on indexed documents, which can then be retrieved

An internet search service that locates documents containing a keyword or phrase.

Is a set of full-text databases containing information on hundreds of topics.

### Veronica- Very Easy Rodent Oriented Net-wide Index to Computerized Archives

This is an Internet tool that allows you to search by keyword through gopher titles and directories.

This is a search utility that helps find information on gopher servers. Veronica allows users to enter keywords to locate the gopher site holding the desired information.

This is a search engine for Gopher sites. While Archie is to FTP sites, Veronica is to Gopher sites.

Veronica uses a spider to create an index of the files on all Gopher servers. You can then enter search keywords into the Veronica system to search all Gopher sites at once.

### Archie

A tool used for searching FTP sites for various program files.

Derived from the word archive, Archie is a Net-based service that allows you to locate files that can be downloaded via FTP.

This is a program that enables you to search for files anywhere on the Internet by filename.

## Protocols

These refer to a uniform set of rules that enable two devices to connect and transmit data to one another.

Protocols determine how data are transmitted between computing devices and over networks. They define issues such as error control and data compression methods.

Examples of protocols

IP- Internet Protocol.

Is a packet-based protocol for delivering data across networks.

Is a network and transport protocol used for exchanging data over the Internet.

Is the most important of the Internet data transfer protocols. It enables a data packet to travel multiple networks on the way to its final destination.

Is the protocol that is used to route a data packet from its source to its destination over a data link or network and specifies the format of packets, also called data grams, and the addressing scheme.

TCP-transmission control protocol

A protocol used along with the Internet Protocol (IP) to send data in the form of individual units (called packets) between computers over the Internet.

Whereas IP handles the actual delivery of the data, TCP keeps track of the packets that a message is divided into for efficient routing through the Internet.

TCP enables two hosts to establish a connection and exchange streams of data.

TCP guarantees delivery of data and also guarantees that packets will be delivered in the same

Transmission Control Protocol works with IP to ensure that packets travel safely on the Internet. This is the method by which most Internet activity takes place.

Is a connection-based protocol, responsible for breaking data into packets, which the IP protocol sends over the network. This protocol provides a reliable, sequenced communication stream of internet work communication.

HTTP-hypertext transfer protocol

Hyper Text Transfer Protocol (HTTP), the actual communications protocol that enables Web browsing.

Is the set of rules for exchanging files (text, graphic images, sound, video, and other multimedia files) on the World Wide Web

The World Wide Web protocol that performs the request and retrieve functions of a server. Commonly seen as the first part of a website address.

Is the Internet protocol that is used by the server and your computer to transfer the data between them.

## TELNET

Is a protocol used to logon to a Remote computer. The method provides a remote console allowing resident commands to be implemented.

## IPX- Inter-networked Packet Exchange

Inter-networked Packet Exchange (IPX) is a networking protocol from Novell that interconnects networks that use Novell's NetWare clients and servers.

LAN communications protocol used to move data between server and/or workstation programs running on different network nodes.

## SPX- Sequenced packet exchange protocol.

This protocol provides a method for two workstations or applications to communicate across the network.

SPX works with IPX to deliver the messages. However, SPX guarantees the delivery of the messages and maintains the order of messages on the packet stream.

## Asynchronous Transfer Mode (ATM)

Is a cell relay, packet switching network and data link layer protocol which encodes data traffic into small fixed-sized cells.

ATM is a connection-oriented technology, in which a logical connection is established between the two endpoints before the actual data exchange begins.

## Language of the web (hypertext markup language) HTML

Hypertext Markup Language is the authoring software language used on the Internet's World Wide Web. HTML is used for creating World Wide Web pages.

Hypertext Markup Language (html) is a language in which web pages are written.

## Markup

These are special codes that describe how parts of a document are to be processed by a particular software application

These are codes in some (text formatting) description language that determine how text will look when printed.

#### Tags/marks

These are special codes that specify how the text and other elements display in a browser and where links lead.

They specify the links to other documents.

#### Hypertext

Is textual data that is "linked" across multiple documents or locations.

Is text with links to other text. Documents written as hypertext contain text that when "clicked on" by the user with a mouse, links to other documents.

#### Hyperlink

Is a link in a document to information within that document or another document.

These links are usually represented by highlighted words or images. When a reader selects a hyperlink, the computer display switches to the document or portion of the document referenced by the hyperlink.

Is a graphic or text string which, when clicked, opens a new web page or jumps to a new location in the current page.

#### Identifying hyper links

Having description text like a navigator bar or by formatting the hyper link in a certain way.

By changing the mouse pointer to a pointing finger or hand.

#### Relative hyperlinks

These move from one document to another on the same Internet.

#### Target hyperlinks

These move from one location in a document to another location in the same document.

#### Absolute hyperlinks

These move to another document on a different Internet computer.

#### Link

This is a spot when selected triggers the object of the link.

It is a built in connection to another web page or part of a web page.

Common problems encountered on the Internet  
Failure to connect with the Internet service provider  
Incomplete web pages  
Slow loading web pages  
Junk electronic mails  
Computer viruses  
Error messages  
Staggering volume of available information  
Varying quality and reliability of the information.

Factors affecting communication speed over the internet

Slow transmission time

When the dial up networking is slow, obtaining documents that include sounds, videos and audio clips takes long.

Malfunctioning web servers

This is usually caused by being too busy to respond to requests or temporarily shut down for regular maintenance or may simply have permanently disappeared.

Messed up connection properties

These usually disturb cable modems and digital subscriber line modems hence accessing web browsers becomes difficult.

Bad uniform resource locators

This comes about when the uniform resource locator is entered incorrectly that the pages can not be located.

Bad connections

These come about if you can not display a new web page you have not viewed.

Traffic on the internet at any time

This is usually caused by news events or popularity of a web site hence increasing the visitor traffic that the web site is not equipped to accommodate.

Band width

Band width is the volume of information/data per unit of time that a transmission media can handle. The wider the band width, the higher the rate of communication whereas the lower the band width, the lower the rate of communication.

Speed of the internet service provider's server

If the speed of the internet service provider's server is high, the rate of retrieval of data required is high and if the speed is low then the rate of data retrieval is also low.

Computer processing speed

When the computer has a high processing speed, then the rate at which requests and retrievals are made is high and when the speed is low then requests and retrievals are made at low rates.

Capacity of hardware

Hubs, switches and network interface cards have their own maximum speeds.

Location of software and files

Storing software on the workstation hard disks reduces network traffic and speed of performance

Network topology

Since data travels in both directions in a bus network, if data collides, then it has to be sent again and slow the network down. On the other hand, star networks have fewer collisions and usually run faster.

Types of information shared on the internet

Electronic letters

Web pages

Web sites

Discussions

Files

Chatting

Information sharing methods

Sharing of different types of information by the internet can be undertaken through a variety of methods called protocols.

A protocol is a process or set of rules by which computers send or receive data to and from one another.

These include the following:

FTP-file transfer protocol

This is a protocol that makes it possible to send data contained in files between computers.

HTTP-hypertext transfer protocol

This is a protocol that allows you to view and even upload web pages from your computer.

It is a communications standard that enables pages to be transferred on the web.

**HTTPS-hypertext transfer protocol secure**

It is a secure protocol that allows you to send and receive sensitive information on the web for example credit card numbers or passwords.

**IMAP-internet message access protocol**

This is a protocol that is used to receive electronic mail messages over the Internet.

**LDAP-light weight directory access protocol**

This allows you to search for electronic mail addresses and other contact information on the Internet.

**POP3-post office protocol version 3**

This is used to receive electronic mail messages over the Internet.

**NNTP-network news transfer protocol**

This lets you receive more news group messages to and from news servers.

**SMTP-simple mail transfer protocol**

This allows you to send electronic mails over the Internet.

**PPP-point to point tunneling protocol**

This enables Internet users to connect to private networks.

**VoIP**

Voice over Internet Protocol, also called VoIP, IP Telephony, Internet telephony, **Broadband** telephony, Broadband Phone and Voice over Broadband is the routing of voice conversations over the Internet or through any other IP-based network.

Sending and receiving electronic mails

Electronic mails involve transmission of electronic messages and files via a computer network or data link.

It is a program that enables you to send, receive electronic mail like you do in ordinary post office environment.

It is also a personal connection to the Internet and can be used to send and receive electronic messages.

You can also attach files created from other programs with the help of the multipurpose Internet mail extension (MIME).

Electronic mail systems can be created over a local area network or the Internet or any data link and one requires an electronic address.

Electronic mail systems can be configured to use any of the following protocols:

SMTP-simple mail transfer protocol

This allows you to send electronic mails over the Internet.

IMAP-internet message access protocol

This is a protocol that is used to receive electronic mail messages over the Internet.

POP3-post office protocol version 3

This is used to receive electronic mail messages over the Internet.

Electronic mail systems use some standardized application packages like:

Lotus domino

Lotus CC: mail server

Eudora pro

Quick mail office

Microsoft outlook

Pegasus

Turnpike

Creating a new electronic mail message

The main components of an electronic mail message are:

Address

Subject

Body

Sender's name and address

Cc-carbon copy

Bcc-blank carbon copy

The address

Actual electronic mail messages are needed for people outside your organization or school network.

The mail must be addressed to the person who is to receive it.

An accurate address is a necessity for each person who is to receive the message.

An example of an electronic mail address is **biilbrown@bigpound.com**

The subject

The subject should let the receiver know what the message is about.

## The message/body

This is where the actual message is entered. You can generally enter as much text as you need here.  
CC carbon copy

This enables one to forward a copy of your message to the user you include.

## BCC blank carbon copy

This allows one to send a copy of a message to some one else without the original recipient knowing.

## Electronic message etiquette

While messages are a form of letter writing, business mail messages are not usually as formal as an actual letter. Even so, confidentiality and privacy rules should apply to electronic mails.

Do not access or disclose other people's e-mail without prior consent.

Always read the message before sending to check for spelling and grammar errors.

Do not use all capitals when typing since it is difficult to read and is sometimes termed as shouting.

Keep your message brief for easy reading and understanding by your recipients.

Avoid long paragraphs and use white space to make the message easier to read.

Have an appropriate subject as this encourages the recipient to open and read the message and also make it easier to find again.

Limit your topics to one subject per electronic mail.

Do not Spam that is mass electronic mailing for the purpose of advertising.

Do not forward angry messages

Do not repeat the entire message to which you are responding.

Read your mails on a daily basis so as to respond to your recipients when it is still appropriate.

## Replying to a message

Messages you receive are listed in your inbox. Replying to a person who sent you an electronic message is very easy. Instead of creating a new message from scratch, simply open or highlight the message in the list of messages in your inbox then click on the reply button.

## Attachments

Files are attached to electronic messages very easily. A paper clip icon is commonly used in most electronic mail programs.

An attachment therefore is a file sent along with an electronic mail message.

Dealing with unwanted electronic mails

Just delete them

Send a reply to show your displeasure

Use mail filters to always block mail from electronic addresses that you forbid.

The benefits of electronic mails in the classroom include the following:

Students write messages for a purpose and to a real audience.

It avails students with increased communication

It increases focus on literacy

It provides increased motivation

It also provides research skills.

Advantages of electronic mails

One can send any size of messages just at the cost of a local call.

They can be sent at any time and the results are almost simultaneous because the messages reach their destinations after a short time.

Electronic mails are highly efficient.

They save a lot of time for example you can present a report at a conference by going to it and downloading it from the conference.

saves time, paper, and money compared to the telephone or written letters

The recipient may read the message anytime

Allows you to communicate easily with many people at once

Allows you to thoughtfully compose what you would like to say

Ability to send to multiple recipients at the same time.

It is very easy to send a reply to an e-mail as soon as it is received by using a reply button.

Large files such as spreadsheets and graphics can be sent as attachments

Can be used for advertisements

Assurance of whether the mail has been delivered is given

No use of stamps

Convenient when retrieving and delivering

Disadvantages

They cannot be accessed from anywhere especially when there is no Internet or network connection.

Emotion or complete meaning may be lost without verbal or visual clues

Cannot be canceled once it has been sent

Unsolicited or unwanted messages (Spam) may flood your mailbox

Keeps a semi-permanent record of the message

Electronic mail addresses or accounts

An electronic mail address is a combination of a user name and address name that identifies a user to receive Internet electronic mail.

An account enables you to log on to the computer that hosts your electronic mail server.

The computer that hosts your account is called the electronic mail host computer.

The software program that you use to read your electronic mail is called electronic mail client.

For example:

Netscape messenger

Microsoft outlook express

Username/ID

This is a unique combination of characters that identifies you.

Electronic mail addresses may consist of simple names or words while others may consist of complicated phrases of words, it depends on the system requirements.

Normally electronic mail accounts take up the general form of:

username@servername.country initials

For example alubanga@yahoo.com this indicates that a user name alubanga is at a server known as yahoo that is a company.

The @ symbol separates the user name from the domain name.

There are common sites that currently offer free electronic mail addresses.

Yahoo

Hotmail

Google

Internet etiquette/netiquette

This refers to rules and ethics for responsible use of the Internet.

It also refers to the code of conduct to follow while on the Internet.

Some of the rules include:

Think about the social consequences of the program you are writing or the system you are designing.  
Remember that any one on the Internet can read your posting.

Be forging

Do not hide your identity

Avoid entering into stupid arguments over stupid ideas.

Do not forward chain letters

Never send unsolicited junk mails

Respond to your recipients and do not waste people's time for long private messages.

Respect your audience and do not waste people's time with idle nonsense.

Being online does not mean or turn you less than what you are.

Never do any thing online that you could not do in real life.

Keep messages and postings, remarks short and relevant to the current subject

#### Internet/E-mail language

Among the most interesting features of the Internet are the chat rooms where users send and receive messages to and from. Since they do not see each other, emoticons (emotion icons) and acronyms are used to express one's emotions as well as reduce on the typing work.

Below is a list of some of these:

Emoticon	meaning
😢	Crying
😊	Smiling
Emoticon	meaning
bbiaf	be back in a flash
brb	be right back
bchnu	be seeing you
ftf	face to face
foaf	friend of a friend

When one types a message in upper case, this is called shouting. It is done to imply emphasis on that word.

Bold words imply shouting out loud the bolded word with anger.

Lower case letters may imply normal talking like in a conversation. It is the most recommended way of writing over the Internet.

#### Electronic commerce/electronic business

Electronic Commerce (also referred to as EC, e-commerce eCommerce or ecommerce) consists primarily of the distributing, buying, selling, marketing and servicing of products or services over electronic systems such as the Internet and other computer networks.

#### Advantages of electronic commerce

Access to the global market 24 hours a day.

Access to many people

Consumers conduct price comparisons easily.

Feedback can be immediate  
Changing information can be available quickly  
FAQ pages can provide easy access to consumer support.  
Ability to gather customer information, analyze and react.  
New approaches to generating revenue.  
Manufacturers buy and sell directly hence avoiding cost of middlemen  
Reduced costs for distributing information.  
Options to creating a paperless environment.

### **Problems**

Failure to understand customers, why they buy and how they buy. Even a product with a sound value proposition can fail if producers and retailers do not understand customer habits, expectations, and motivations.

Failure to consider the competitive situation. One may have the will to construct a viable book e-tailing business model, but lack the capability to compete with Amazon.com.

Inability to predict environmental reaction. What will competitors do? Will they introduce competitive brands or competitive web sites? Will they supplement their service offerings?

Over-estimation of resource competence. Can staff, hardware, software, and processes handle the proposed strategy? Have e-tailers failed to develop employee and management skills? These issues may call for thorough resource planning and employee training.

Failure to coordinate. If existing reporting and control relationships do not suffice, one can move towards a flat, accountable, and flexible organizational structure, which may or may not aid coordination.

Failure to obtain senior management commitment. This often results in a failure to gain sufficient corporate resources to accomplish a task. It may help to get top management involved right from the start.

Failure to obtain employee commitment. If planners do not explain their strategy well to employees, or fail to give employees the whole picture, then training and setting up incentives for workers to embrace the strategy may assist.

Under-estimation of time requirements. Setting up an e-commerce venture can take considerable time and money, and failure to understand the timing and sequencing of tasks can lead to significant cost overruns.

Failure to follow a plan. Poor follow-through after the initial planning, and insufficient tracking of progress against a plan can result in problems. One may mitigate such problems with standard tools: benchmarking, milestones, variance tracking, and penalties and rewards for variances.

Becoming the victim of organized crime. Many syndicates have caught on to the potential of the Internet as a new revenue stream. Two main methods are as follows: (1) Using identity theft techniques like phishing to order expensive goods and bill them to some innocent person, then liquidating the goods for quick cash; (2) Extortion by using a network of compromised "zombie" computers to engage in distributed denial of service attacks against the target Web site until it starts paying protection money.

Failure to expect the unexpected. Too often new businesses do not take into account the amount of time, money or resources needed to complete a project and often find themselves without the necessary components to become successful.

Undesirable behaviours involving the internet

Spam

Electronic junk mail or junk newsgroup postings. Some people define spam even more generally as any unsolicited e-mail.

Real spam is generally e-mail advertising for some product sent to a mailing list or newsgroup.

In addition to wasting people's time with unwanted e-mail, spam also eats up a lot of network bandwidth.

Pirating

Watching immoral websites before you are of age

Illicit material

Abusive and threatening messages

Hacking and cracking

Impersonation

Information processing circle

This refers to the Input, process, output and storage activities

Information is the product of data processing which involves manipulating data into a useful form for decision making.

Information technology (IT) is the combination of computer and communication technologies to process data into information.

Computerization is the use of computers to control systems and operations

Computer literacy is the state of knowing how to use a computer.

Global village

The new electronic interdependence recreates the world in the image of a global village. Computers and people are linked within companies and between countries.

The global village is an outgrowth of the computer network. Computers are electronically linked to one another to share resources and information.

We can communicate with people on the other side of the world as easily as we might have a conversation with a neighbour.

### Information processing stages

#### Collecting data

This involves capturing data from their sources and recording it onto some media for example paper.

#### Preparing data

This involves copying, grouping or arranging data in a more convenient way for input. At this stage checking and verifying data is done.

Data verification is the checking for mistakes when data is copied from one place to another.

Data validation is the checking of input data for errors before processing.

#### Input of data

This involves entering the data or sending the stored data into the processing system.

#### Processing data

This involves calculating or manipulating the input data and even storing the results for future use.

#### Output of information

This involves giving out the processed results in a readable form.

#### Common data collecting and processing devices

Computers

Typewriters

Fax machines

E-mails and internet

Telephones

#### Information processing systems

These include the following:

#### Time-sharing system

This is a system that allows multiple users to share time on a single computer. The computer works so fast that each user seems to be the sole user of the computer.

#### Multi-user system

This is a system that allows different users to independently run different programs at a time.

#### Multi-tasking system

This is a system that can handle a number of different jobs at the same time. For example running spreadsheets and listening to music.

#### Interactive processing system

This is a system that involves communications between the user and the computer during processing.

#### Batch processing system

This involves data being collected together in a batch before processing starts.

##### Advantages

Jobs can be scheduled for a time when the computer is not busy

The computer is used only for a certain period of time for the batch job

Once the data is submitted for processing, the computer may be left running without human interaction

##### Disadvantages

Involves an expensive computer and a large number of trained staff

There is always a delay before work is processed and returned

#### Real-time processing

This processes data without significant delay.

##### Advantages

Output from the computer may be used to adjust and improve the input

Information is always up-to-date

There is no significant delay for response

##### Disadvantages

The computer must be continually online

A computer must be dedicated solely to the task

What are the advantages and disadvantages of using manual system for processing?

##### Advantages

They are cheap

Power failures do not affect the system

They are simple to understand

##### Disadvantages

Paper files take huge space to store and are quite expensive

Information is normally kept in a predefined order and may not be transformed to another form easily  
It takes a lot of time to find a particular record hence are always slow

What are the advantages and disadvantages of using computers for information processing?

#### Advantages

The management can observe new information and new trends more quickly  
Customer services can be improved due to more efficient management and operation  
Overall security can be raised due to less human intervention  
Running costs become lower in the long run  
Tasks can be completed with little human intervention  
Increased productivity and efficiency  
Computers can store enormous amounts of data for future use  
The high reliability of components inside modern computers enables computers to produce consistent results  
Tasks can be completed faster because computers work at high speeds  
Provided the data entered is correct, computers process large amounts of data and generate error free results.  
Computers with communication capability can share data and information with other computers

#### Disadvantages

Some staff has to be trained or retrained  
Some jobs may be lost due to use of computers and this can lower the morale of staff members  
Extra costs are needed to employ specialized staff and design data processing systems  
Initial investment costs can be high  
Face-to-face interaction among staff may be reduced  
Easier transmission of computer viruses through the internet and other computer networks  
Security has to be provided to protect personnel and staff from an authorized access  
Failure of computer components may lead to a delay or halt in operations  
Individual privacy may be abused incases of confidential data on the computers

#### Applications of information technology today

##### Health care

Use of computer aided surgery for training prior to performing surgery on live human beings  
Maintain patients records in hospitals and clinics  
Telemedicine through computers with video conferencing capabilities.  
Telemedicine is a rapidly developing application of clinical medicine where medical information is transferred through the phone or the Internet and sometimes other networks for the purpose of consulting, and sometimes remote medical procedures or examinations.

Telemedicine may be as simple as two health professionals discussing a case over the telephone. Telemedicine generally refers to the use of communications and information technologies for the delivery of clinical care.

Monitor patients' vital signs in hospital rooms and at home

Computer assisted medical tests

Research and diagnose medical conditions

Implant computerized devices that allow patients to live longer

Use computer controlled devices during operations that require great precision for example laser eye surgery and heart surgery

## Homes

Pay bills through the payment by phone services (PPS)

Budgeting and personal financial management for example balance a cheque book, buy and sell stocks online, prepare taxes, manage investments and family budgets

Entertainment for example through listening to music, watching movies and videos, playing games.

Research and education for example help youngsters to read, write, count and spell, learn to speak a foreign language, produce assignments and report, take lessons online

Personal and business communication for example organize names and addresses, communicate with others

## School

Computer-based training

This includes:

Computer assisted instruction (CAI)

Under this teachers can use computers and other IT equipment to present teaching materials in a more interesting way.

Computer assisted learning (CAL)

Under this students can use computers and appropriate software to learn at their own pace.

Computer assisted assessment (CAA)

This reduces the time and labour to mark the answer scripts

Distance learning

This is possible through computer-based training and web based training

Simulations of experiments or real-life situations that may be hazardous

Electronic library system for searching, borrowing and returning books

The school administration and management system (SAMS) for keeping records of students and producing report cards or other related documents

#### Edutainment

This is a type of education software that combines education with entertainment

What are the advantages and disadvantages of using IT in learning and teaching?

#### Advantages

Advanced instructions may be given to students in areas where the teacher may not be qualified.  
CAI and CAL packages that usually contain multimedia effects make learning more interesting and interactive

Teachers can show experiments that are difficult to perform or dangerous in nature with multimedia

Students can learn by themselves when the teacher is not available

Students can learn and proceed at their own pace

Teachers can present subject matter and explain abstract concepts more clearly with multimedia

Students can usually get their results immediately after they have answered the question or taken an action

There are rich educational resources on CD-ROMs and the internet

#### Disadvantages

Students can only follow what the CAL packages are predefined to offer

Face-to-face interaction between students and teachers may be reduced

#### Offices

Creating memos, letters and reports

Create websites to provide selected information and advertise goods

Use of document processing system to facilitate data entry

Calculate payroll, prepare income statements and balance sheets

Track inventory and generate invoices and receipts

Use of telecommunicating so that employees can work away from a company's standard workplace

Use of facsimile, electronic mail, electronic bulletin and video conferencing

Present projects and ideas by means of presentation graphics software

#### Banks

##### Automated teller machine (ATM)

This is a self-service banking machine attached to a host computer through a telephone network.

It is used for making deposits, withdrawing money, transfer money, applying for bank documents and obtain account balances.

##### Online banking

This is used to transfer money electronically, apply for loans and credit cards, obtain credit card statements, account balances and download monthly transaction information

#### Electronic commerce (EC)

It refers to a financial business transaction that occurs over an electronic network.

It involves online shopping and banking

Entertainment

Plan a vacation

Read a book or magazine online

Retouch a photograph

Compose and edit a video

Watch a video or a movie

Listen to music

Play computer games

Industries

Data sensing and logging

Robots. These are computer controlled devices that can move and react to feedback from the outside world.

Computer aided design (CAD) software is mainly used for creating engineering, architectural and scientific drawings.

Security

Computer aided cameras for domestic and business premises security

Location of enemy positions/targets

Flying and directing fighter/combat planes

Manning of gates on business premises

Directing missiles and ammunition

Detecting weapons

Information technology (IT) is the combination of computer and communication technologies to process data into information.

Information and Communication Technology - (ICT) The study of the technology used to handle information and aid communication.

1) Computer trainer

Train people on how to use a computer and the various application programs

Developing training reference materials

Guiding learners on how to acquire knowledge through carrying out research

Advising the learners on the best career opportunities in ICT

## Preparing learners for ICT examinations

### 2) Webmaster

Developing and testing websites

Maintaining, updating and modifying information on websites

Monitoring access and use of the internet connection

Downloading information needed by the organization from internet websites

### 3) Computer operator

Entering data into a computer for processing

Keeping up-to-date records of all information processing activities

### 4) Computer technician

Troubleshooting computer hardware and software related problems

Assembling and upgrading computers and their components

Ensuring that computer accessories like printers are in good condition

Help engineers to develop some computer components such as motherboards

### 5) System analyst

This is a person who is responsible for analyzing company needs or problems then designs and develops a computer based information system. Has:

Good problem solving skills

Good communication skills

Business knowledge

Does the following:

Reviews the current manual system

Works with programmers to construct and test the system

Coordinating training for the new system

### 6) Computer programmer

Writes in house applications or system programs

Customize commercial application package to suite the needs

Test, debug, install and maintain programs developed

### 7) Software engineer

This is a person skilled in software development and technical operation of computer hardware.

Developing system and application software

Developing user and technical documentations for the new software

Maintaining and updating the software to meet day to day requirements while overcoming challenges.

### 8) Computer engineer

Design and develop computer components like storage devices

Determine the electrical power requirements of each computer component

Re-engineer computer components to enhance their functionality and efficiency  
Design and develop engineering and manufacturing computer controlled devices.

9) Information system manager

Controls, plans, staffs, schedules and monitors all the activities of the ICT department.

Making sure that all tasks in the ICT department are done correctly

Preparing budgets for the department

Keeping the department inventory records up-to-date

Managing the human resource within the department

10) Database administrator

Designs and develops database applications for the organization

Sets up security measures needed to control access to data and information

Keeps the database up-to-date by adding new records, modifying or deleting unnecessary records

# Data security, Ethical Issues & Emerging technologies.

Data security is the means of ensuring that data is kept safe from corruption and that access to it is suitably controlled.

This refers to controls to ensure that data files on either disks or tapes are not subject to unauthorized access, change or destruction.

Data corruption

This refers to errors in computer data that occur during transmission or retrieval, introducing unintended changes to the original data.

Data corruption during transmission has a variety of causes.

Interruption of data transmission causes information loss.

Environmental conditions can interfere with data transmission, especially when dealing with wireless transmission methods.

Heavy clouds can block satellite transmissions.

Wireless networks are susceptible to interference from devices such as microwave ovens.

Data loss during storage has two broad causes:

Hardware failure -Head crashes and general wear and tear of media

Software failure- typically occurs due to bugs in the code

Data privacy

Data privacy refers to the changing relationship between technology and the legal right to, or public expectation of privacy in the collection and sharing of data.

Privacy concerns exist wherever uniquely identifiable data relating to a person or persons are collected and stored, in digital form or otherwise.

Improper or non-existent disclosure control can be the root cause for privacy issues.

The most common sources of data privacy issues are:

Health information

Criminal justice

Financial information

Genetic information

Location information

Computer crimes

Due to the creativity and inquisitive nature of some computer specialists, a number of computer crimes have emerged.

These include:

a) Unauthorized use

This is the use of a computer or its data for unapproved or possibly illegal activities.

Examples include:

An employee using a company computer to send personal e-mail

Some one gaining access to bank computers and performing unauthorized transfers

b) Unauthorized access

This is the use of a computer or network without permission.

Such is intended to commit fraud, steal and destroy or corrupt the data.

Forms of unauthorized access

Eavesdropping

This is the tapping into communication channels to get information. This is common for those who want to obtain numbers of credit cards.

#### Surveillance/monitoring

One keeps a profile of all computer activities done by another person or people. The information gathered may be used for one reason or the other for example sabotage. Many websites keep track of your activities using special programs called cookies.

#### Industrial espionage

This involves spying on your competitor to get information that you can use to counter or finish the competitor.

It is done to get ideas on how to counter by developing similar approach or sabotage.

Also unauthorized access can be as follows

An employee who is not supposed to view or see sensitive data by mistake or design gets it  
Network access incase the computers are networked and connected to the external world

Forced entry into computer rooms through weak access points

Strangers who may stray into the computer room when no body is using the computers

Control measures against unauthorized access

Keep the computer room closed when no body is using it

Reinforce weak access points like doors and windows with metallic grills and burglar alarms

Enforce network security measures

Encrypt the data and information during transmission

Another way to prevent unauthorized access and use of computer is to utilize access controls

An access control is a security measure that defines who can access a computer, when the user can access a computer and what actions the users can take while accessing the computer.

Access control is normally implemented using a two phase process:

Identification verifies whether the user is a valid one

Authentication verifies that the user is really the one he or she claims to be

Four methods of identification and authentication exist and they include:

User names and passwords

Possessed objects

Biometric devices

Callback system

A password is a combination of characters associated with a user name that allow a user to access a computer or a network.

A possessed object is any item that a user must carry to gain access to a computer or computer facility.

A personal identification number (PIN) is a numeric password either assigned by a company or selected by a user.

A biometric device authenticates a person's identity by verifying personal characteristics for example finger prints.

It translates a personal characteristic into a digital code that is compared with a digital code stored in the computer.

Examples of biometric devices include:

A finger print scanner which captures curves and identifications of a finger print

A hand geometry system which can measure the shape and size of a person's hand

A call back system connects a user to a computer only after the computer calls the user back at a previously established telephone number.

To initiate the call back system:

The user calls the computer and then enters the correct username and password

The computer instructs the user to hang up and then calls the user back.

c) Hardware theft

This refers to the act of stealing computer equipment.

Hardware vandalism is the act of defacing or destroying computer equipment

Security measures to control hardware theft

Employ guards to keep watch over data and information centers and backups.

Apply burglar proof for the computer laboratory.

Reinforce weak access points like windows, doors, roofing with metal grills and having strong padlocks.

Create backups in locations way from the main computer centers.

Do not leave hardware in open areas like cars seats and open offices.

Set up alarms to alert you incase of break-ins.

Use system locks to make it difficult to access internal components like hard disks and memory sticks.

Use visual deterrents for example stop security plates that are hard to remove since these kill the resale value.

Encode hardware components with digitally authenticated handshake between systems and computer at power up.

Use cables to lock the equipment to desk, cabinet or floor.

Backup all the files stored on the computer regularly

Backup is a duplicate of a file, program or disk that can be used if the original is lost, damaged or destroyed.

Computer errors and accidental access

Some people print sensitive reports and unsuspectingly give them to unauthorized people

Sometimes, end users have too much privilege that allows them to change or access sensitive files on the computer.

Errors and accidental access to data may be as a result of people experimenting with features they are not familiar with

Control measures

Set up a comprehensive error recovery strategy in the organization

Give various file access privileges and roles to the end users and technical staff in the organization

d) Software theft

Theft of programs and data is a real threat.

Two forms of software theft are:

Physically stealing media for example floppy disk, CD-ROM that contains software

Software piracy which is the most common form of software theft

Information theft refers to someone stealing personal or confidential information from others.

Control against theft

Create backups in locations away from the main computing center

Burglar proof the computer room

Reinforce weak access points like windows, doors and roofing

Employ guards to keep watch over data and information centers and backups

Reasons for information theft include:

A company wants to learn about a competitor

An individual steals credit card numbers to make fraudulent purchases

Information privacy refers to the right of individuals or organizations to deny or restrict the collection and use of information about them.

e) Computer viruses

A computer virus is a computer program that can copy itself and infect a computer without permission or knowledge of the user.

A computer virus is a program specifically designed to damage other programs or cause irregular behaviour.

A virus is a mischievous program designed to damage other programs.

Computer program designed to copy itself into other programs, with the intention of causing mischief or damage.

Virus definitions

These refer to databases for viruses that the anti virus software scans for.

Why people create computer viruses

Viruses have been written as research projects

Vandalism

To attack products of specific companies

To distribute political messages

Gain financially from identity theft, spy ware

Some virus writers consider their creations to be works of art and see virus writing as a creative hobby

Some viruses were intended as good viruses though such are rare and may still affect system resources

The viruses carry out two tasks:

Replicate themselves from one computer system to another

Locate themselves in the computer system and later destroy programs and data files by interfering with normal processes of the processing system.

There are three basic ways of activating viruses:

Running an infected program

Booting a computer with an infected floppy disk in the disk drive.

Opening an infected file.

How viruses are spread

Use of infected diskettes

Through electronic mails or Internet

Use of infected hard disks

Through some downloads

Through freeware and shareware

## **Types of viruses**

There are many types of viruses:

### **Droppers**

These are programs written to perform useful tasks like compressing files, previewing video clips thereafter introducing the virus.

### **Viruses**

These damage other programs.

### **Worms**

These copy themselves repeatedly in memory or on disk drive until no memory or disk space remains which makes the computer to stop working.

### **Trojan horses**

These do not replicate themselves.

They are small program codes hidden within legitimate software and can be triggered off immediately.

### **Time Bombs**

These are program codes activated in conjunction with some predetermined events for example valentine, fools day.

### **Failed Viruses**

These are viruses that have not meant their would-be goals due to poor programming.

### **Packagers**

These hide the existence of a virus fro virus guards by making some codes around actual software programs.

### **Trojans**

These do irritating actions like flickering of the screen, cursor disappearance

### **Jokes**

These are harmless programs that do amusing things on the screen for example your computer is about to explode in five minutes. Please run away.

### **Text Viruses**

These are text files written to test some virus guard software.

They are not harmful but are for learning purposes only.

### **Hoax viruses**

These come as e-mail with an attractive subject and launch themselves when the e-mail is opened.

#### Backdoors

These may be a Trojan or a worm that allows hidden access to a computer system.

#### Boot sector viruses

These execute when the computer starts up because they reside in the boot sector of a floppy disk or the master boot record of a hard disk.

#### File virus

It attaches itself to a program file and is loaded into memory when the infected program is run.

#### Macro virus

This uses the macro language of an application for example word processor or spreadsheet to hide the virus code.

#### Logic bomb

This virus activates when it detects a certain condition.

#### Polymorphic viruses

These modify their program code each time they attach themselves to another program so that even an anti virus utility has difficulty in detecting it.

### SOURCES OF COMPUTER VIRUSES

Viruses can be introduced into computers through the following sources:

#### Fake games

Since many people enjoy playing games, some virus programs pose as games software and spread very fast.

Some games are irresistible like hot sex.exe, jack pot.com

#### Contact with contaminated system

Any diskettes used on a contaminated system could become contaminated.

If the same diskette is used on another system, then the virus will spread.

#### Pirated software

Such could have contaminated virus codes or amended to perform some other destructive function that may affect your computer.

#### Infected proprietary software

Virus programs can be introduced through contaminating software under development in laboratories and then being installed on dikes.

#### Freeware and shareware

These are available from bulletin board systems and require no license to use them so may be infected with virus codes.

#### Update of legitimate software

Software distributed via networks is fairly obvious target for virus programmers as they provide a built in method for wide spread and anonymous propagation.

#### Symptoms of computer viruses

These include the following

Changes to disk volume identification.

Executable files changing size for no obvious reasons.

Programs/files mysteriously disappearing

Access lights turning on for non referenced devices

Less memory available than usual

Unusual error messages occurring more frequently

Disk accesses seeming excessive for simple tasks

Programs taking longer than usual to load

Unfamiliar graphics or quizzical messages appearing on the screen.

Failure to do print jobs

Computers may not start at all

Computers may freeze or hang

#### Protecting computers from viruses

Some of the suggestions below may keep viruses out of computer systems.

Be careful when downloading anything from the internet since this is the main source of transmitting computer viruses.

Never start up a computer with a floppy disk in the floppy drive.

Set the security level for macros in an application so that the user can choose whether or not to run potentially unsafe macros.

Always have back up copies of all programs and data files kept safely such that incase of any catastrophe on the computers there is a clean copy of the vital software.

Isolate any media or computers suspected of having any virus attack, disinfect them and investigate how it may have got the virus.

Do not use any media like diskettes, backup tapes, CDs from unknown sources especially if you are not sure whether they contain viruses or not.

Write protect the recovery disk before using it.

Scan all foreign media for viruses before using them with your computer and this includes installation disks of purchased software.

Have a routine check/scan for viruses on all computers including the media

Used to store data for example backup tapes, zip disks, diskettes once every month.

That there is a policy to ensure the usage of computers and their protection and regulations.

Install updated antivirus guards/software to detect, alert and remove viruses.

They may include:  
Norton anti virus  
Dr. Solomon anti virus  
Avira  
McAfee virus guard  
AVG

Inoculate  
Penicillin  
Thunder byte  
Kaspersky internet security  
Internet security  
F-Secure

Steps taken incase of virus attacks/suspicion

Identify and isolate personal computers and disks that could be affected.  
Seek advice of a specialist to perform the following: identify the virus code, remove the codes, and evaluate security procedures.  
Determine how the virus was introduced to the system  
If the matter affects the public image, management must address the matter  
If it is out of a floppy, computer users should be advised to retrieve them.

Type of destruction	Symptoms
Mass destruction	Attacks the formats of disks whereby any program or damage will be unrecoverable
Partial destruction	Erase and modify a specific portion of disk affecting any files stored in that location
Selective destruction	Erase and modify specific files or file groups
Random havoc	Randomly changing data in memory during normal program execution or changing key stroke values
Network saturation	Systematically using up memory or space to impede performance or cause the system to crash

f) Tress pass

This involves the illegal physical entry to restricted places where computer hardware, software and backed up data are kept.

Tress pass is not allowed at all and should be discouraged.

g) Piracy

It involves making illegal copies of copyrighted software, information or data.

## Copyright

The legal right granted to an author, composer, playwright, publisher, or distributor to exclusive publication, production, sale, or distribution of a literary, musical, dramatic, or artistic work. Abbreviated as (c) or ©.

Copyright is the exclusive legal right that prohibits copying of ones' (the author or creator) original property without his/her permission.

## Need for the copyright law in the modern computer era

Protection of consumers against fake computer products

Granting of ownership

Prohibiting of unfair profiting from other people's work/efforts

Encouragement of authorship

Discouragement of piracy or unauthorized copying of copyrighted software

Encouragement of creativity by ensuring that creative people receive the financial benefits of their work

Prevention of plagiarism that is expropriation of other authors texts and findings to present them as ones own

Ensuring good international relations and image. A country without copyright protection is viewed as one which encourages stealing

Ensuring quality products as producers try to guard their copyrights jealously

To allow payment of damages to the copyright owner

## Reducing piracy

Set installation passwords that deter illegal installation of software

Use licenses and certificates to identify originals

Enact laws that protect the owners of data and information against piracy

Make software cheap enough to increase affordability

## h) Tapping

This involves sending an intelligent program on a host computer that sends on information from the computer.

It also involves spying on a networked computer using special programs that are able to intercept messages being sent and received by the unsuspecting computer.

## i) Hacking

A hacker intelligently breaks codes and passwords to gain unauthorized entry to a computer system data and information files.

## j) Cracking

It involves the use of guesswork over and over again by a person until he/she finally discovers a weakness in the security policies or codes of software.

k) Sabotage

It is illegal destruction of data and information with the aim of crippling service delivery or causing great loss to an organization.

l) Alteration

It is the illegal changing of data and information without permission with the aim of gaining or misinforming the authorized users.

To reduce this:

Do not give data editing to anybody without vetting

The person altering data compromises the qualities of good data like readability, relevance and integrity.

m) Computer fraud

It involves the use of computers to conceal information or cheat other people with the intention of gaining money or information.

Fraud may involve production or use of fake documents.

Detection and protection against computer crimes

Firewalls

A firewall is a device or software system that filters the data and information exchange between different networks by enforcing the host networks access control policy.

A firewall monitors and controls access to and from protected system.

A firewall is software designed to prevent unauthorized data transfer between different but physically connected computers.

It protects the system through disk locking programs and anti virus programs.

Audit trail

It involves a careful study of an information system by experts in order to establish or find out all the weaknesses in the system that could lead to security threats and weak access points for crimes.

An audit trail is a record kept by a computer system of who carried out what operation on what files and when they occurred.

Data encrypting

It involves transforming the standard codes into unreadable code using a special number called a key.

### **Log files**

These are special system files that keep a record of events on the use of the computers and resources of the information system.

### **Physical barriers**

Involve putting equipment in rooms accessed by only employees and doors are kept locked

Electronic locking mechanism with keys, swipe cards, finger print recognition

These two may not be possible due to the following:

Computers behind counters of organizations that deal directly with the public; such organizations require communication with other organizations in other geographical areas.

Some keyboard locks and fitting disk locks can be applied.

### **Software barriers**

Involve user name and password

A user name is a code given to users of a networked computer system so that the system recognizes them when they seek to gain access.

Passwords are secret codes known only to holders used by a networked computer system to determine if some one attempting to gain access is legitimate.

Passwords may not be secure because of the following

You may tell those close to you the password

You may write the passwords on the terminals

You may choose those that are easily determined

### **Safe passwords**

Have at least six characters

Have a mixture of digits

Have uppercase and lowercase letters

Change your passwords at regular intervals

The user may or may not be allowed to repeat a password

### **Monitoring logins**

Logging in and logging out is the process of keying in the user name and password.

Login is the process of gaining entry to a networked computer system usually by supplying a username and password.

Usernames monitor attempted break-ins by:

Tracking unsuccessful attempts to log in

Locking a user out after a set number of failed attempts

### **Access restrictions**

Access rights are rights given to computer network users that describe what kind of access they have to any given file or process in the system.

Other detection technologies to prevent computer crimes include:

Video surveillance

Data surveillance

Virus detectors

Minimizing data loss

Have backup

Online data copying

Uninterruptible power supply

To protect data, consider the following:

Cost of recovery

Probability of loss occurring

Importance of data

Why is data stolen?

Gain competitive advantage over another organization

Facilitate some other crime

Locating people who do not wish to be located

In order to protect data, one must know the threats to data and these include:

Loss of data

Damage to data

Stealing of data

Individually leaving data open to the public through paper lying on the floor, screens left open, disposing off poorly and disk formatting.

Data can be lost through the following:

Power failure

Component failure

Media failure

Virus attacks

Data can be stolen by tapping into transmission lines

Principles of holding personal data on computers

Data must be obtained fairly and lawfully

Data users should have appropriate security against unauthorized access

Any data object must be allowed to see the data held on it in readable and legible form  
Data must not be held longer than it is necessary  
Data must be accurate and up to date  
Data must not be disclosed to unauthorized parties  
Data must be adequate, relevant and excessive for the purpose of it being held  
Data can only be used for specific purpose set out in the original submission to the register.

### Firewall

A system designed to prevent unauthorized access to or from a private network.

Firewalls can be implemented in both hardware and software, or a combination of both.

Firewalls are frequently used to prevent unauthorized Internet users from accessing private networks connected to the Internet, especially *intranets*.

All messages entering or leaving the intranet pass through the firewall, which examines each message and blocks those that do not meet the specified security criteria.

There are several types of firewall techniques:

Packet filter: Looks at each packet entering or leaving the network and accepts or rejects it based on user-defined rules. Packet filtering is fairly effective and transparent to users, but it is difficult to configure. In addition, it is susceptible to IP spoofing.

Application gateway: Applies security mechanisms to specific applications, such as FTP and Telnet servers. This is very effective, but can impose a performance degradation.

Circuit-level gateway: Applies security mechanisms when a TCP or UDP(*User Datagram Protocol*) connection is established. Once the connection has been made, packets can flow between the hosts without further checking.

Proxy server: Intercepts all messages entering and leaving the network. The proxy server effectively hides the true network addresses.

In practice, many firewalls use two or more of these techniques in concert.

A firewall is considered a first line of defense in protecting private information. For greater security, data can be encrypted.

### Audit trail

A record showing who has accessed a computer system and what operations he or she has performed during a given period of time.

Audit trails are useful both for maintaining security and for recovering lost transactions.

Most accounting systems and database management systems include an audit trail component.

In addition, there are separate audit trail software products that enable network administrators to monitor use of network resources.

### Data encryption

The translation of data into a secret code.

Encryption is the most effective way to achieve data security.

To read an encrypted file, you must have access to a secret key or password that enables you to *decrypt* it.

Unencrypted data is called *plain text*; encrypted data is referred to as *cipher text*.

There are two main types of encryption:

Asymmetric encryption (public-key encryption)

Type of encryption in which an encryption key (the public key) is used to encrypt a message, and another encryption key (the private key) is used to decrypt the message.

#### Symmetric encryption (conventional encryption)

This is any encryption system where the same key is used for both encryption and decryption. This requires that the key must be securely transmitted between the encryptor and decryptor

#### Log file

A file that lists actions that have occurred.

For example, Web servers maintain log files listing every request made to the server.

With log file analysis tools, it's possible to get a good idea of where visitors are coming from, how often they return, and how they navigate through a site.

Using cookies enables Webmasters to log even more detailed information about how individual users are accessing a site.

#### Password

A secret series of characters that enables a user to access a file, computer, or program. On multi-user systems, each user must enter his or her password before the computer will respond to commands. The password helps ensure that unauthorized users do not access the computer. In addition, data files and programs may require a password.

Ideally, the password should be something that nobody could guess. In practice, most people choose a password that is easy to remember, such as their name or their initials. This is one reason it is relatively easy to break into most computer systems.

## Computer Security and Privacy

### Introduction

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Like any other electronic device, your computer is at risk from damages caused by accident or by intention. Some of these damages can be permanent. You can prevent your computer hardware, software, and the data stored on it from a number of damages by taking certain preventive measures.



This module helps you to identify the various threats to your computer and the data stored on it. You will explore how to protect your computer from these threats by taking some preventive measures. Finally, the module explains the ethical and legal issues related to Internet usage.

Your computer is a very valuable and important device and you might depend on it for many things that you do throughout the day. Also, you might use computers for storing personal or official information, which you cannot afford to lose. However, your computer and the data stored on it are vulnerable to damage and destruction. Therefore, it is essential that you take some protective measures to keep your computer secure and updated.

You store your important documents, such as your tax papers, securely so that they are not damaged or lost. You also ensure that no one has access to them without your permission.

If you use computers regularly, you may have a lot of information stored on the computer. This information may be in form of tax details, personal letters, or business correspondence. You need to ensure that this information is not viewed by other people without your permission. You also need to protect this information from getting damaged.

### Introduction to Computer Security and Privacy

Any factor that can damage your computer or the data on it is a computer threat. There are different types of computer threats. Natural events such as earthquakes or hurricanes can cause widespread physical damage. It is possible that you or someone else accidentally deletes some important files causing the computer to malfunction. When your computer is connected to a network, the computer becomes even more vulnerable to computer threats. For example, another user may use the network to gain unauthorized access to your computer.

There are various measures that you can use to reduce these threats and reduce the likelihood of loss due to damage. For example, you can restrict the access to your computer and create backups of important data, which you can use if the data is deleted or tampered with. By following basic guidelines, you can minimize the risks of damage to your computer and ensure its security and privacy.

These are some of the common threats to your computer and how you can safeguard your computer and the data stored on it from these threats.

### Introducing Computer Threats and Solutions

There are various threats to your computers and the data stored on it. For example, someone may try to steal your computer hardware. Some components of your computer can get damaged due to excessive heat or cold. You can categorize these threats into three main categories: environmental or natural threats, malicious human threats, and non-malicious human threats. The following table lists the various threats to computer security and privacy. It also explains the measures that you can take to protect your data and computer from these threats.

Some of the major natural and environmental threats to computers are as follows:

Natural disasters such as floods, earthquakes, and hurricanes: These disasters have the potential to cause massive destruction. The computers in the affected area can suffer major physical damage, which generally includes a complete loss of data.

Fire: Fire can damage your computer beyond repair. Even if the computer does not directly catch fire, the heat caused is enough to melt the delicate components inside the computer. Moreover, smoke can damage a computer, especially the hard disk because smoke contains tiny particles that do the damage.

Extreme heat or cold: Most of the components inside a computer are designed to operate within a specific temperature range. In case of excessive heat or cold, some components of your computer may start to malfunction, and you may need to replace them. If your computer has been outdoors and exposed to extreme temperatures, let it return to room temperature before you start it.

Voltage problems – surges/spikes: A surge or spike is a sudden increase in the supply voltage, which can permanently damage some components of your computer. For example, a sudden increase in voltage can destroy the motherboard of your computer. A surge can also occur due to lightning that strikes with a huge amount of electrical charge. This charge travels through power or phone lines into your computer and damages the components inside the computer.

Following are some examples of malicious human threats:

**Discontented Employees:** A discontented employee in your office can deliberately try to tamper with or destroy the data on your computer.

**Hackers:** A hacker is a person who tries to illegally access your computer when you connect it to the Internet. After accessing your computer, a hacker can steal or damage the data stored on the computer.

**Physical Theft:** Anyone can steal your computer or its components, if they have access to it. With the popularity of portable computers, such as laptops, physical theft of computers has become very common.

**Virtual Theft:** You can become a victim of virtual theft, which is again more common in cases of computers connected to the Internet. One example of virtual theft is identity theft, in which a hacker can steal your personal information to assume your identity. Using this false identity, the hacker can gain access to your finances or perform an illegal activity. Another example of virtual theft is software piracy, which refers to the theft of a computer design or program. It can also mean unauthorized distribution and use of a computer program.

Following are some examples of human threats that are unintentional and non-malicious:

**Human Errors:** Many times, damage to a computer is due to unintentional human error. For example, you may accidentally delete an important file, causing the computer to malfunction.

**Hardware Damage:** Computer components, being delicate, run the risk of getting damaged due to carelessness. For example, if you accidentally drop your laptop computer, this might result in damage to the hardware components, such as motherboard or CD ROM. As a result you lose the data stored on the computer.

## Solutions

Computers require optimum environmental conditions to operate smoothly. Here are some measures that you can take to protect your computer from natural and environmental threats, and also minimize the damages caused by these threats:

**Backing up data:** Backing up data involves creating multiple copies of your data. Events like floods and earthquakes can strike without warning. Your data is always unique and cannot be replaced. Creating a backup helps you to recover your data in case of any data loss. To provide better recoverability, try to keep a copy of your important data in a physically separate location, such as in another building or city.

**Installing computers in secure locations:** Install your computer in a place where it is not likely to get damaged due to environmental factors. For example, avoid installing computers in rooms that are exposed to excessive dust or moisture.

**Controlling operating environment:** You should maintain an optimum temperature and humidity level to ensure the smooth functioning of your computer. You can do this by installing devices such as air conditioners and humidity controllers.

**Surge protection and line conditioning:** Use devices such as surge protectors and line conditioning devices, which connect the computer with the power source. This connection provides protection against spikes and surges on the power line. However, in case of a strong surge, the risk of damage remains and it is therefore important to keep backups of important data. In the event of a major storm, you should turn off the computer and unplug it from the power to avoid damage due to lightning.

**Uninterruptible Power Supply (UPS):** Install devices such as a UPS that can provide an uninterrupted power supply to the computer. A UPS provides battery backup in case of a power outage. This

prevents software damage caused by abrupt shutting down of your computer. A UPS also provides built-in surge protection and line-conditioning features.

Following are some measures that you can take in order to minimize the risks associated with malicious human threats:

**Data Storage in Safe Locations:** Keep your data in safe and secure locations that have limited access to others. This minimizes the possibility of theft or tampering of the data. Windows XP Service Pack 2 provides you with folder-level encryption. Encryption of the folders results in encoding of the data in the folders. This can help prevent unauthorized access of the data.

**Virus and Spyware Protection:** There are some basic steps that you can take to reduce the threat of viruses and spyware. You must open an e-mail attachment or install any software from a Web site with caution. Built-in features in e-mail software, such as Microsoft® Office Outlook® 2003, allow you to block junk e-mail messages and provide features to check for viruses and worms. The most reliable way is to install antivirus and anti-spyware software from a reputable vendor. These software programs have the ability to check for viruses and spyware present in the computer's memory and also prevent new ones from entering. It is also necessary to regularly update antivirus and anti-spyware software so that they are able to recognize new viruses and spyware. Most antivirus and anti-spyware software offer the automatic updates feature that automatically installs the updated version of the software on your computer.

**Firewall:** Installing a firewall is another effective step that you can take to protect against malicious threats. A firewall enables you to filter the Internet traffic before it reaches your computer or a private network. It provides additional protection against threats such as hackers and viruses. A firewall also helps to ensure computer privacy by restricting external access to your computer by any unauthorized user.

**Protecting hardware from accidental and environmental damages:** You can take various measures to avoid any unintentional damage to your computer. Keep the computer in an area that is dust-free, free from vibration, and out of the way of possible impact. The place where you keep your computer should be well-ventilated to prevent any damage due to heat. Keep the computer away from any magnetic substance, water, or static discharge. For example, do not put the computer on the floor or on a rug. Use a surge suppressor to prevent electrical damage. Avoid eating and drinking near the keyboard and use a keyboard cover to protect against any spillage. The table or shelf housing the computer should be steady and stable to keep the computer from falling, even if the computer is bumped.

**Backing up Data:** Regularly back up important computer data. Creating multiple copies of data provides protection against loss of data due to accidental erasure or destruction of data.

### Protecting Your Computer and Your Data



You need to provide your identification to access your bank locker or your safe deposit box. This identification is to ensure that no one else is able to access your items.

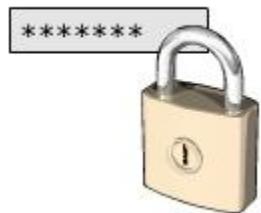
Similarly, you can implement various security measures to minimize the threat to your computer and the data on it. This lesson introduces you to some

common best practices that will help you to protect your operating system, software, and data on your computer.

### Securing Online and Network Transactions

Connecting your computer to the Internet introduces it to a world of information and entertainment. However, it also leaves your computer vulnerable to many online threats. For example, it becomes easier for viruses to transfer from an infected computer to your computer. You can reduce the risks to your computer from these online threats by using a combination of best practices such as creating strong passwords, encrypting data, and using antivirus software.

#### Use strong passwords



A strong password is a complex password, which cannot be guessed easily. The password should consist of a combination of uppercase and lowercase letters, numbers, and special characters such as ampersand and number sign, and should not contain complete words or names.

A strong password is your primary defense against security and privacy threats. Strong passwords must be created for:

Local access to standalone computers

Access to networks

Access to Web sites that have sensitive information, such as personal or financial details

Access to any valuable data

Personal data stored on your computer

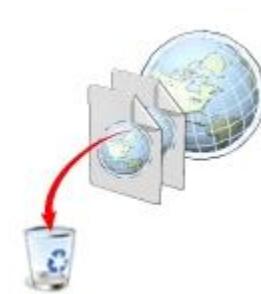
#### Protect against hacking and spyware



While you are browsing the Internet, it is possible that a software program installed on your computer is transmitting your personal information to a hacker in another country. Such software programs are examples of spyware. These programs generally get installed on your computer without your knowledge and secretly transfers confidential data from your computer to the hackers. Sometimes, employers deliberately install spyware on the computers used by the employees to track the computing activities of the employees.

You can install software programs, such as Microsoft Defender, on your computer to help prevent spyware from getting secretly installed on the computer. You also need to install antivirus software and firewall on your computer to protect it from viruses and hackers.

#### Clear history and cache periodically



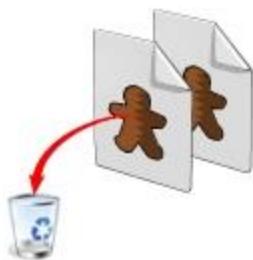
The Web sites and Web pages that you visit while browsing the Internet are saved in your browser's History. Also, while you browse the Internet, a number of files are stored in the temporary memory of your computer.

This temporary memory is known as cache memory. The files stored in the cache memory record information about the Web pages you visit.

However, some of these temporary Internet files may contain your personal information, such as your username and password, which can be accessed by hackers.

To prevent hackers from accessing your personal information, regularly delete the contents present in the browser history and in the cache memory.

#### Delete cookies periodically



While visiting a Web site, you may notice that it displays your name. This is made possible through the use of cookies.

Cookies are small files that are created on your computer by previously visited Web sites to identify and track your preferences. Their purpose is to provide a more personal experience while visiting a Web site.

However, cookies can also be a threat to computer privacy because they contain your personal information. For example, the cookies might contain your credit card details that you have used while shopping online. For these reasons, it is a good practice to periodically delete cookies to prevent your personal information from being misused.

#### Avoid sharing personal information



information.

Some Web sites require you to fill out forms containing personal information such as your name, gender, and age. In case of e-commerce sites, you might even need to share your bank account details or credit card number.

But, remember that hackers can access and misuse this information. Some companies may also use this information to send you unwanted commercial e-mail messages.

Therefore, before you share any personal information on a Web site, ensure that it is a secured Web site and there is a specific need to provide the

#### Ensure online transactions are performed on secure sites



While shopping online, you usually need to provide sensitive information such as your bank account number or credit card details. Therefore, it is important to ensure that you carry out online transactions only on secure Web sites.

A Web site is secure if its name has the prefix https. The prefix indicates that the Web site implements the Secure Sockets Layer (SSL) protocol. SSL is an Internet security protocol that ensures secure data communication by encrypting the information transmitted. The SSL protocol certifies that the

Web site is genuine and ensures that the data you provide to the site is not misused. When you enter a secure Web site, most of the Web browsers display a message to confirm that you have entered a secure Web site. The locked padlock icon at the lower right of the browser screen also helps you identify a secure Web site. You can also check the security certificate of a Web site before performing any online transaction on that site.

### **Configure security components using Windows Security Center**



Windows Security Center is a feature in Windows XP Service Pack 2, which provides you a convenient utility to check the status of essential security settings and track the antivirus software installed on your computer. You can open Security Center from Control Panel. The Security Center has three broad components:

Windows Firewall: You should enable the firewall before connecting to the Internet. The firewall helps prevent malicious content, such as viruses and worms, from entering your computer. It also helps prevent hackers from

gaining access to your computer.

**Automatic Updates:** This feature checks for relevant security-related updates available on the Microsoft Windows Update Web site. It then automatically downloads and installs the updates on your computer. Enabling this feature ensures that your computer remains updated and protected against the newest security threats on the Internet.

**Internet Options:** In the Security Center, you can configure the Internet options for your computer. By using Internet options, you can set the security level to low, medium, or high. Changing the security level affects the way your browser handles various Internet files such as cookies and active content. You can also restrict the type of content that reaches your computer through the Internet.

**Disable active content**



Active content refers to small programs that get installed on your computer while you are browsing the Internet. Their basic function is to provide you with an interactive Internet experience through videos and toolbars.

However, in some cases, these programs can be used to damage the data stored on your computer or install malicious software without your consent. By using your browser settings, you can disable active content to prevent damage to your computer.

#### **Make use of security help from your ISP**

Make use of Internet service provider (ISP) support for online security. The support can be in the form of antivirus and anti-spyware software.



Some ISPs even provide firewall protection, e-mail virus screening, and spam protection.

#### **Ensuring E-Mail and Instant Messaging Security**

E-mail and Instant Messaging (IM) are widely used for business and personal communication. However, hackers, online predators, and the people who create worms and viruses use e-mail and IM for malicious purposes. For example, these people can send e-mail attachments containing harmful software. These people can also use e-mail to solicit sensitive information or to lure you into fake offers. It is therefore important for you to take certain measures to ensure e-mail and IM security.

To ensure e-mail security, avoid opening e-mail with attachments, do not respond to junk mail, do not respond to unsolicited commercial mail, and protect yourself from phishing. To ensure IM security, chat with known people only and do not open attachments received over IM. The following table explains the actions to ensure e-mail and IM security.

#### **Avoid opening e-mail with attachments**

You can send e-mail attachments to share files with your friends. You might receive a photograph or a music file as an attachment in an e-mail message.

However, you need to be cautious while opening any mail containing an attachment because it is the most common pathway for the spread of viruses.

### **Do not respond to junk mail**

You may receive a number of irrelevant or unwanted e-mail messages from unknown senders. These messages are known as junk mail or spam.

It is advisable not to reply to the senders of such e-mail messages. Junk mail is often malicious in nature and can include content that is harmful for your computer. E-mail programs, such as Microsoft Outlook, include a junk mail folder in which the suspected junk mail may be directed.

### **Do not respond to unsolicited commercial mail**

You may receive a number of unsolicited e-mail messages from companies that are advertising their products or services. These messages may also be in the form of online surveys that require you to fill up personal information.

However, these commercial messages carry the potential of identity theft, and you might accidentally share some sensitive information while responding to them. It is therefore advisable to not respond to these unsolicited messages. You may also delete these messages whenever you receive them.

### **Protect yourself from phishing**

Phishing is a common activity used to extract personal information from computer users and then use the information for malicious purposes.

For example, someone sends e-mail messages to you, pretending to be from a bank or any other trustworthy organization, and asks for sensitive information, such as credit card number or password. This information is either sold further or used to cause financial loss to you. Therefore, you must verify the authenticity of such e-mail messages before responding with any personal information.

### **Chat with known people only**

You should limit your chat activity only to the people whom you know. Developing communication with new and unknown individuals makes you more vulnerable to threats such as online predators and scams.

### **Do not open attachments received over IM**

Instant messaging is a common pathway for malicious attachments. You must avoid opening any attachments that you receive in an instant message, unless you are absolutely sure about its origin. An instant messaging attachment might contain a virus or spyware, which can harm your computer.

## **Protecting the Operating Environment and the Data on Your Computer**

Imagine that you have saved a confidential project report on your computer. You have been working for weeks to prepare this report and now you want to share the project report with your supervisor.

You have a single copy of this report on your computer and it is important to secure the report from being tampered with or deleted. However, another employee uses your computer in your absence and deletes the project report from your computer. To avoid such situations, you can take measures to secure the data on your computer.

### **Implement user identification**

One way to achieve this is by setting up accounts for authorized users of the computer, on the basis of which each user gets an appropriate level of access.

For example, in Microsoft® Windows® XP Service Pack 2, you can set up user accounts for each member of your family or other users.

You can decide to give yourself more privileges, or in the case of a child's account, you can restrict the account's capabilities.

### **Set a username and password**

You can also increase security and limit unauthorized access to your computer by setting up a username and password. In most offices, each employee has a unique username and password. The employees must provide the correct username and password to access their computers. You can set up users and passwords in Microsoft Windows.

### **Keep passwords secure**

Your password acts like a key to your computer. Anyone who knows your password can access your computer and tamper with data.

You must keep your password secure. Be careful while typing your password to prevent anyone else from seeing it. Do not share your password with others.

Do not write the password and leave it on your computer or desk. If you think that the password has been compromised, change it immediately, before anyone else is able to misuse it.

### **Lock your computer**

When you leave your computer on and unattended, someone can tamper with your computer software or data. You can prevent this by temporarily locking your computer while you are away.

When a computer is locked, it immediately hides the content of the screen and does not allow any operation until the computer is unlocked with the correct username and password combination.

The exact steps to lock your computer depend on the operating system you are using. For example, in Windows XP Service Pack 2, you can lock your computer by pressing CTRL+ALT+DEL, and then clicking the Lock Computer button in the Windows Security box.

Note that this feature of locking the computers is not available in all operating systems.

### **Install protective software**

You need to continuously guard your computer against threats such as viruses and spyware. At times, the damage due to a virus is considerable and you may lose important data or need to reinstall the operating system and other software. You can protect your computer from viruses and spyware by installing antivirus and anti-spyware software.

These protective software programs help you detect and remove viruses and spyware present in your computer. They also prevent new ones from infecting your computer.

It is a good practice to install a firewall, which filters out the content that reaches your computer. Installing a firewall also protects against hackers by restricting access by other online users.

### **Encrypt data**

Converting your data to an unreadable form to protect it from unauthorized access is called encryption. An authorized user can reconvert the encrypted data into a readable and usable form. This is called decryption.

Various software products today include a way to encrypt data. In Windows XP Service Pack 2, encryption is transparent to the user who encrypts the file. That is, you do not have to manually decrypt the encrypted file before you can use it. You can open and change the file as you usually do.

### **Back up data**

You can also help protect your files from loss or damage by making copies of important files and storing them on a different storage media, such as CDs, DVDs, or floppy disks.

This process is known as backing up data. You should keep the backups in secure locations, so that you can use the backup data in case the original data is damaged or deleted.

### **Keep your computer updated**

As newer threats keep appearing, software companies regularly create updates that you can install on your computer.

These updates make additions to the installed software or operating system in your computer to make it less vulnerable to security threats.

Ensure that you regularly update the antivirus software so that it can detect the newest viruses.

## **Protecting Yourself and Your Family from Security Threats**



Computers are not only used at schools, colleges, and offices, but are also commonly used in homes. You use computers for various purposes such as to keep household accounts, exchange e-mail messages with family and friends,

browse the Internet, and play games and music. Every member of your family can find some use for the computer.

With increase in the use of computers at home and at work, it is important that you and your family understand the various threats associated with the use of computers and the Internet. In this lesson, you will learn about the various measures that can help protect your computer from these threats.

## Online Predators



The Internet is a popular medium of communication for people all over the world. You can get acquainted with someone while actually knowing very little about the identity and intentions of the individual. This aspect of the Internet communication can be misused by people to lure young individuals into inappropriate or dangerous relationships. The people who engage in such activities are known as online predators.

Online predators generally target children, especially adolescents. It is during adolescence that children gradually move out of parental control and look for new relationships. Online predators attempt to establish a relationship of trust and intimacy with these children.

The predators try to gain the attention of their targets, such as children, for the purpose of establishing inappropriate relationships. However, children are not the only ones who are targeted by these predators. Online predators can also target adults with the objective of financial exploitation.

Online predators trap their victims by developing contact through chat rooms, instant messaging, e-mail, or discussion boards. Among the various tools, chat rooms are the ones most commonly used by these predators. Online predators often assume a fake identity as a member of a specific chat room. For example, if the chat room belongs only to children, an online predator can easily assume the identity of a child in order to participate in that chat room.

### Guidelines to Protect Yourself and Your Family from Online Predators

You and your family members can become the target of online predators. These predators may try to establish contact with you or your family members to exploit you financially. The predators may also try to involve you and your family members in inappropriate relationships.

The following table lists some guidelines that you can follow to protect yourself and your family from on-line predators.

Guidelines	Description
Know how predators behave	Online predators have some predictable behaviors, which can help you identify them easily. Online predators tend to get intimate very quickly. They often express a great deal of interest and affection toward their targets. You need to ensure that you and your family members can detect such behavior to avoid contact with potential online predators.
Be suspicious	Online predators usually lure their targets with gifts or other

about gifts offered over the Internet	tempting offers. You should be cautious about such gifts or offers. Also, educate your family members to be suspicious about gifts offered over the Internet.
Educate your family about online safety measures	Educate your family members on appropriate chat room behavior to avoid being targeted by online predators. Tell them to use non-suggestive and neutral screen names. The screen names must not give away their actual name, age, gender, or contact information because this information can be misused.
Tell your family not to give out personal information	Some Web sites try to extract information under the pretext of feedback or surveys. Tell your family not to reveal any personal information to these Web sites without your permission. Also, ensure that your family does not give out any personal details, such as name, last name, address, and phone number, in chat rooms and bulletin boards. Your family members must not share their username and password with anyone, including friends.

It is advisable that you follow some additional guidelines to protect your children from online predators. The following table lists these additional guidelines.

Guidelines	Description
Guide children when they visit Web sites	As parents, restrict young children from visiting Web sites that are inappropriate for them, or those Web sites that bring them in contact with potential online predators. It is recommended that parents guide their young children when the children visit any Web site.
Be aware of the Web sites that your children visit	It is important for parents to regularly check the type of Web sites their children visit. You can track the previously visited Web sites by viewing the browser history or by using software that help you track the online activity of a computer.
Block access to inappropriate Web sites	You can enable your browser's Content Advisor feature to control the type of Web sites that your family members can visit while browsing the Internet. By using this feature, you can restrict children from visiting Web sites that contain adult content. You can also install certain software programs that help you block specific Web sites.
Monitor chat activities on your computer	Specialized software can monitor chat activities and flag inappropriate information exchange on your computer. You can install these software to track the chat activities of your children.

Instruct children to leave unpleasant Web sites	As a parent, instruct your children to leave a Web site if it makes them uncomfortable or if the site contains any unpleasant content. Also, educate your children to leave a Web site that asks for excessive personal information.
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## Protecting Privacy



With the growing popularity of computers and the Internet, there are multiple ways in which your privacy is compromised. You and your family members need to prevent these threats to privacy. You can take the following simple measures to safeguard yourself and your family members against invasion of privacy.

### Shield Your Identity

Avoid sharing your personal information with anyone, unless you know the person. This is the golden rule of protecting privacy. While exchanging e-mail messages or chatting through instant messenger, ensure that you do not reveal personal details about you or others known to you. Also, use strong passwords for access to your computer and e-mail connections.

### Make Regular Backups of Your Computer and Important Data

It is a good practice to back up all types of the important and sensitive data on your computer. Important data might be documents, databases, or contact information. You can use various storage media such as compact disc or another hard disk to back up your data. If you regularly back up the data stored on your computer, you can recover the data in case the original data is damaged or deleted. Also, it is advisable to store the backup data in a secure place and restrict access to it by using passwords and encryption.

### Check Current Security of Your System Regularly

Check the current security level of your computer regularly. Modern operating systems have built-in features that help you track the ability of your computer to safeguard against various threats to security and privacy. For example, Windows Security Center is a component in Windows XP Service Pack 2, which helps you to maintain firewall settings, set up schedules for software updates, and check the validity of the antivirus software installed on your computer.

### Run Virus Scans Daily

Each day when you access the Internet, there is a chance that your computer is infected by viruses. Therefore, it is important that you run a virus scan on your computer everyday. You also need to keep the antivirus software on your computer up-to-date to protect your computer from new viruses.

### Use Anti-spyware

Spyware programs can secretly enter your computer and transmit personal information about you and your family. Use anti-spyware software to keep a check upon these malicious programs, and keep the software up-to-date.

### Perform Online Transactions on Secure Web Sites with Reputable Vendors

When you perform an online transaction, you need to provide your personal information, such as your credit card details or bank account details, to the Web site. This information, if disclosed to others, can be misused for financial fraud. Therefore, it is important that you carry out online transactions only on secure Web sites.

## **Report Abuse to the ISP**

Most reputable ISPs have a set of terms and conditions that does not allow its users to follow any unethical or illegal practices. You should report to the ISP whenever someone attempts to invade your online privacy by sending you spam or attempts to hack your computer. This allows the ISP to take action against such individuals.

## **Filter E-mail Messages from Unknown/Anonymous Senders**

You may receive a number of e-mail messages from individuals unknown to you. Such e-mail messages, referred to as spam or junk mail, can often be carriers of viruses or spyware. Hackers attempting to retrieve your personal information can also send you junk mail. Therefore, it is important to be careful while dealing with them. With e-mail software programs, you can create e-mail filters that help you block the junk mail. You must also ensure never to respond to junk mail because it can lead to an increase in unwanted messages and accidental sharing of personal information.

## **Encrypt Sensitive E-mail Messages, If Possible**

Using encryption is a simple and effective way to ensure that your e-mail communication remains confidential. Encryption is the process of encoding the e-mail message in such a manner that it appears unreadable to everyone except the intended reader. Most e-mail software, such as Outlook, provides this e-mail encryption feature.

## **Keeping Your Computer Secure and Updated**

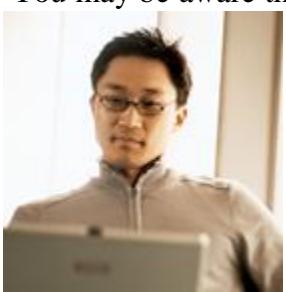
### **Introduction**

When you connect your computer to the Internet, your computer software and data are accessible to the rest of the world. Connecting to the Internet increases the threat to your computer from viruses, spyware, and hackers. However, you can minimize these security threats by configuring the security settings on your computer and keeping security-related software up-to-date.

In this module, you will learn how to maximize the security of your computer by configuring the security settings on your operating system. The module also explains how to configure your computer to automatically update its security software.

### **Keeping the Computer Up-to-Date**

You may be aware that new medicines are continuously invented to counter new diseases. Similarly, the computer industry keeps updating the versions of antivirus software and similar products to counter new viruses, worms, and spyware. You need to keep your computer up-to-date with updated versions of security software to ensure better protection of your computer.



The Microsoft Windows Update Web site provides you with security updates that are necessary to protect your computer's operating system. You can download these security updates from this Web site and install them on your computer. If you find it difficult to keep track of the security software that you

need to update, you can automate this updating process by configuring your computer.

### **Configuring the Computer Security Settings**

Over the Internet, the biggest security threats to your computer come from hackers and viruses. Most of the time, these threats occur because the security settings on your computer are not set properly or the security software is either missing or obsolete. Security settings are configured on your computer

when you install the operating system. However, you can modify these security settings according to your requirements.

For example, in Windows XP Service Pack 2, you can view and modify the security settings by using the Windows Security Center. In the Security Center, you can:

Use the Internet security options to specify the privacy and security levels for the Web sites that you visit.

Modify the firewall settings to help protect your computer from unauthorized access through the Internet.

Configure your computer to automatically download and install updated security software to provide better protection from new viruses.

## Computer Ethics

### Introduction

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On the Internet, you can find a wide range of information that includes news, articles, pictures, songs, movies, and software. Searching the Internet is often the fastest and easiest way to gather information, at any time. For example, you can use the Internet to search for information for your school assignments, or ideas to include in an office presentation. You can also download songs and movies from various Web sites.

You do not have to pay money to download information from most of the Web sites. But, these free downloads may not actually be free. The information in a Web site is legally owned by the author who created it or by the Web site which published it. Therefore, you may need the permission of the author or the owner of the Web site to use the contents. You need to be aware of the rights or permissions you have on the contents available in a Web site before downloading them.

This module explains the meaning of intellectual property in the field of computing, and how unauthorized use of intellectual property can lead to copyright violation. In this module, you will also learn about the various legal concerns associated with information exchange.

### About Intellectual Property



Any information available on the Internet is an intellectual property, which is legally owned by the person who created it. For example, when you publish an article on a Web site, the article is your intellectual property. As the owner of an intellectual property, you have the exclusive rights to control the use of the material to:

Copy, reproduce, or distribute the property.

Share or sell the rights to the property.

Give away the rights to the property for free.

You do not have the right to use intellectual property without the permission of its owner. There are laws to protect the rights of a person to an intellectual property. These laws are called copyright laws. Violation of these laws may lead to legal problems.

### Copyright Violation and Prevention

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When you use copyrighted intellectual property without the owner's consent, it leads to copyright violation. The reasons for copyright violation and the measures that you can take to avoid it are explained as follows.

### Plagiarism

When you copy someone's work and use it as if it is your own work, without mentioning the source, it is known as plagiarism. Suppose you create an exact copy of a graphic displayed on a Web site. You then post this graphic to another Web site as your own creation, but do not mention about the Web site from where you copied it. This results in plagiarism.

In many countries, paraphrasing an existing work and passing it off as an original work is also considered as plagiarism.

### Misuse of Copyrighted Material

The following explains some of the common misuses of copyrighted material that you need to be aware of and avoid.

#### **Copying music**



There are many Web sites that allow you to download and share songs. However, some of these Web sites may not have the legal authority to offer the songs for free download. When you download songs from these Web sites, it is misuse of copyrighted music.

You misuse copyrighted music when you take any of the following actions:  
You download copyrighted music from a Web site without the owner's permission or without paying a copyright fee.

You download copyrighted music from a Web site and create CDs or DVDs containing the downloaded music.

You create copies of copyrighted CDs or DVDs and share the copies with others.

You share copyrighted songs on the Internet through Web sites that facilitate sharing of songs.

### Legal Concerns with Information Exchange

With the extensive use of the Internet, there is potential for you to get involved in illegal and unethical activities, such as gambling and defamation. You need to be aware and cautious of these illegal and unethical issues. Also, remember that these issues vary from country to country, and even within parts of a country.

The following explains some unethical and illegal uses of information exchange.

#### **Defaming someone's reputation**

When you communicate with others by using e-mail, chat, or online public forums, be careful not to make any statements that may result in defamation of someone. Defamation means making false statements about a person that can negatively affect the person's reputation. For example, suppose you post a message on an online forum falsely stating that your neighbor, who is a celebrity, owns illegal property. This can be considered as defamation because you are spreading false information that may harm your neighbor's credibility.

Note

A false statement can be considered defamatory, even if it is not derogatory. Sometimes, even true statements can be considered as defamatory if the statements harm someone's reputation.

*Libel* and *slander* are two forms of defamation. Libel means written defamation which has been published, whereas slander means verbal defamation.

The legal system of most countries considers both libel and slander as punishable offenses. You may face criminal or civil penalties according to the legal system of your country. The punishment may range from monetary penalty to severe punishment like jail terms. Sometimes, the severity of the offense depends on the situation. For example, in some countries, any insult to the President is a criminal offense. However, in some other countries, public officials have less protection than the average citizen. Therefore, be aware of the local laws before making any defamatory statements.

### **Visiting inappropriate Web sites**

Internet provides you free access to all types of Web sites, some of which might promote illegal activities. Some Web sites offer services that carry out activities that are restricted by the legal system of your state or country. It is possible to access these sites over the Internet because there are no boundaries and policing over the Internet. For example, you can access a gambling site even if the law of your country bans gambling. But, this may cause legal troubles for you.

You also need to be aware that the legal system is different in different states and countries. For example, the products that you can legally buy or sell in one country may be an illegal purchase or sale in another country. So, though a Web site may not restrict you from buying an item that is illegal in your country, you may face legal charges for buying the item.

### **May 2006: Step-by-Step Guide to Proper PC Maintenance**

Computers are one of the valuable assets in which companies and individuals invest a lot of money. This investment is in anticipation for high value output in processing and storing data, sending and receiving emails, accessing the Internet etc. However sometimes these expectations fall short, when computers crash losing all the vital data or malfunction in the middle of an urgent assignment. Many of these crashes and malfunctions could be avoided, or their impact reduced.

#### **Preventative Maintenance Tips for Your PC**

The average PC user doesn't think much about problems that can arise with a computer until a problem actually occurs in the system. Once a failure happens, repairs can be both costly and time-

consuming. The good news is that there are some preventive measures that you can take to decrease the likelihood of running into problems with the computer's smooth and efficient operation and also to lessen any damage that does occur despite best efforts to avoid failures.

#### Possible Reasons for PC Failure:

According to webopedia.com, an online dictionary of computer science, computer failures occur for a variety of reasons, sometimes because of human error and sometimes because of factors in the environment that cause a computer to malfunction (or a combination of human and environmental factors). Adopted from the site at:

[http://www.webopedia.com/DidYouKnow/Hardware\\_Software/2003/PreventiveMaintenancePC.asp](http://www.webopedia.com/DidYouKnow/Hardware_Software/2003/PreventiveMaintenancePC.asp)

These factors can include: excessive buildups of dust, heat or magnetism; viruses picked up from the Internet or from storage media shared between different computers; static electricity shocks or power surges; carelessness (such as spilling liquids into a computer or bumping or dropping the hard drive casing); software that has not been configured correctly or a PC's setup that has been handled incorrectly; and incorrect handling of upgrades.

#### The Following Tips Will Help Lessen a Likelihood of PC Failure:

Do not place a PC directly near a heating or cooling source, such as heating vents or air conditioners. Both excessive heat and cold can damage a PC.

Do not connect power sources directly into wall outlets but rather connect them first to some form of surge protector. Surge protectors prevent electrical surges from destroying hard drives and erasing data.

Use of dust covers, blinders, constant dusting will reduce dust levels into the computer area. An efficient way to clean dust from the inside of a computer is with compressed air, blowing dust away from the motherboard and other components. (Note Use some one knowledgeable if you are not conversant with the inside of a computer.)

Be extremely careful when moving a PC from one location to another. Even small jolts can dislodge chips and expansion boards.

Keep the root directory organized. Only keep your system's startup and software initialization files in the root directory. Application files and their data belong in a separate directory from the root directory.

Do not store data files in the same directory that you store the software. This will eliminate the possibility of accidentally erasing or overwriting a software file.

Keep a set of backup rescue disks for the operating system.

Keep a backup copy of original software, either on CD or floppy disk. This type of software copying is perfectly legal.

Keep meticulous records of default settings, any changes you make in a system's CMOS setup that differ from the default settings, and any maintenance you perform on the system. You can often use this record to backtrack when you are troubleshooting a problem and will become valuable if you decide to upgrade any of the system's components. It is also possible for the CMOS to lose settings and you will want a record of the setup to reconstruct it.

Keep meticulous records of any expansion cards you install and the procedures you follow to install them.

Save all documentation that comes with your PC and its components. You may need to refer to the documentation if something goes wrong.

Do not compress your hard drive. Compressed hard drives are more likely to become corrupted than those that have not been compressed.

Keep backup copies of any important data on a removable medium. Hard drives can fail and having important data on more than one medium can save a lot of stress and headaches.

Install a virus scan program that automatically scans for viruses when the system boots. Do not download any files from the Internet unless you are certain the source is not transmitting a virus to you. Do not use any storage media that has been used in another computer unless you are certain the other computer is free of viruses and will not pass the virus on to your system.

Getting into the habit of maintaining the health and integrity of your system will save you money and time in the long run. For more information on PC Maintenance you may visit the following sites.

About.com's site on PC Maintenance: <http://pcsupport.about.com/cs/pcmaintenance/>

A PC Troubleshooting Guide from Everything Computers:  
<http://www.everythingcomputers.com/troubleg.htm>

PC World Magazine: <http://www.pcworld.com/>

Computerhope.com - Free computer help for everyone: <http://www.computerhope.com/>

Microsoft Support Pages: <http://support.microsoft.com/>

## **June 2007: Five Steps to Extend Your Computer's Life: A maintenance schedule for your hardware**

### **1. Verify Your Physical Setup**

It's difficult to keep a computer functioning well if it's in a poor environment. There are three factors to consider: temperature, air quality, and electricity. For most computers, room temperature should be between 15.5 to 29.5 degrees Celsius.

Air quality is important because computers require air circulation to prevent overheating. There are two rules: The vents on the monitor, case, and printer need a good three to four inches of space (roughly the width of your hand from thumb to small finger) to get good air flow. Move them away from any cables or cubicle walls blocking them.

Electricity is a key factor in determining the longevity of your computer. So-called "dirty" electricity (blackouts and fluctuations etc) will damage your computer, and your files, far more effectively than any virus. A good protection for this is using a stabilizer and an uninterruptible power supply or UPS.

### **2. Verify Your Electronic Setup**

Automation is the name of the game when it comes to preventive computer maintenance for a busy organisation. There are three items that you must automate: virus protection, critical software updates, and computer firewalls that are either part of the operating systems (such as Windows XP's firewall) or part of your antivirus software.

### **3. Monthly Preventative Maintenance**

Once a month, perform two tasks: Clean your temporary files and empty your trash or recycle bin (you can do this with the "Disk Cleanup" utility in Windows XP) and defragment your computer (you can do this by running the Disk Defragmenter utility in Windows XP).

### **4. Annual Computer Maintenance**

There are two aspects to this process: electronic and physical.

The electronic tune-up consists of the regular monthly maintenance plus a disk scan of your hard drives and a manual check of all software for updates. In Windows XP, utilize the Check Disk utility check both boxes to fix file-system errors and scan for bad sectors.

The physical tune-up, while short (it takes five to ten minutes from start to finish), might seem intimidating at first. Don't let it scare you, though. There are only five simple steps: unplug, unplug, look, lift, and dust. However, I recommend that this be done by someone with at least basic technical skills.

First, turn off and unplug your computer and your monitor. Next, unplug the rest of the cables from the computer case, including the network cable, the printer cable, and so on. Inspect the cabling for any broken or frayed bits. If you have a laptop, take out the battery. For desktop computers, unscrew the case (generally in the back) and lift it off (some computers, like Dell and HP, have flip cases that you open by pressing a plastic button). Now, with the hose and bristle-sweep attachment of your vacuum, clean off the air vents on the outside of the computer case, the monitor, and the keyboard (and the docking station if you have a laptop). Then, gently vacuum out the dust from inside the case. This is not a detailed spring cleaning; go lightly and quickly (it should take you less than 30 seconds).

## 5. Independent "Health Check"

At least once every 18 months, if not yearly, ask someone you trust, or who comes recommended, to do a "health check" of your systems and processes. You want this done by an IT professional who is a generalist, skilled in both software and hardware issues. You want personalized advice focused on your technology, organisation and environment.

### Final Thoughts

If your organisation has more than 30 computers, you may find it challenging to consistently take time away from your mission to devote to this maintenance routine. If this is the case, consider asking for help from a local technology service provider or an independent IT contractor. Likewise, if you are uncomfortable handling this maintenance, seek help from a professional.

This Tech Tip was compiled by the WOUGNET Technical Support Team. Extracted from an article by John Avellanet <<http://www.techsoup.org/learningcenter/hardware/page6006.cfm>>

### **Simple guide to setup of a computer**

In this month's tip we cover the setup of a computer including monitor, keyboard, mouse and so on. A number of organizations have got second-hand/refurbished computers without the set up instructions, so we hope this will be helpful. When available, always read the installation instructions to be sure that you are following the correct installation method.

### **1) Installing the Keyboard**



Installing a keyboard is very straightforward and easy to do, but first you need to determine if the keyboard uses a PS/2 or USB connector. The PS/2 connector for keyboards is round and typically colored purple to match the connection on your computer although not all connectors are color coordinated. If your keyboard has a USB connector, the connector will be flat and rectangular in shape.

### **2) Installing the Mouse**



Installing a mouse is very similar to installing a keyboard. You will still find mice with either USB or PS/2 connectivity. To complete the installation, simply plug the mouse into the proper port, (typically colored green for the PS/2).

### **3) Installing the Monitor**



Installing a monitor (also known as a “display”) requires a free power outlet and identifying the connection port you will use to connect the monitor to your CPU (Computer). On the CPU, this port is typically colored blue.

#### **4) Installing the Printer**



Most printers on the market today will also use a USB connection; however, parallel port printers are still fairly common. You can also set up a printer over the network if you have another computer on a local area network (LAN) with a printer attached and shared. This method is beyond the scope of this tech tip.

Typically, you will either be connecting your printer via USB or parallel line printer (LPT) ports (usually colored red). Printer installation typically requires that you install the drivers (printer operating software) first then plug the printer in via USB or parallel port. The OS (operating system) will finish up the install for you after that.

#### **5) Installing a Scanner**



Installing a scanner is almost identical to installing your printer. Again, you will simply need to install the drivers and then plug the USB cable in.

Remember, when available, read the installation instructions to be sure that you are following the correct installation method.

## 6. Installing a Webcam

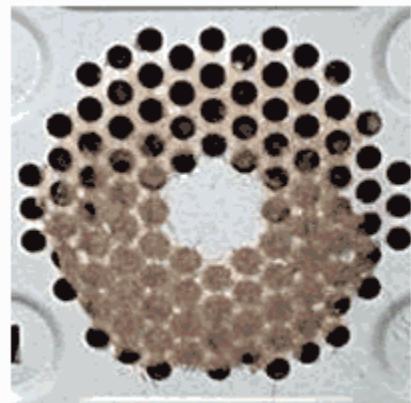


Most webcams are USB-powered and simply require that you plug them in and install their drivers. However, some cams require that the drivers be installed first, so be sure to read the instructions that came with your webcam to avoid any problems. If you bought a FireWire (a form of connection that is often faster than USB connections) webcam, ensure that your computer has a FireWire port because they are not yet all that common.

This Tech Tip was compiled by the WOUGNET Technical Support Team. Adopted from an article by Shane McGlaun: <http://www.geeks.com/techtips/2006/techtips-24aug06.htm>

### Tech Tip 38 - Canned Air Computer Maintenance

Many people don't think of their computer when doing a bit of cleaning around the home, but perhaps they should. We're talking about an effort far less unpleasant than doing windows or cleaning the bathroom, and the use of a can of compressed air can take care of a bulk of the work for you.



Cleaning your system on a somewhat regular basis can easily help extend the life of components, increase system stability, and reduce noise. This Tech Tip will take a look at a few areas to focus on, and all you really need to do is open your case and pull the trigger!

#### Case Fans

A well-designed computer case will have at least two (sometimes many more) case fans in order to exchange air with the room in

order to cool the internal components. With the typical home computer being installed in, well, the typical home, it is reasonable to expect things like dust, hair, pet fur, and so on to be drawn into these fans.



The blades of the fan, as well as the walls of the fan's frame, can grab hold of this debris which creates a thin film that can eventually grow in thickness. As it does, the cooling performance of the fan will decrease and more than likely the noise produced by the fan will increase. In addition, as the fan motor has to work harder to overcome the extra load and resistance created by the debris, the life of the fan can be expected to be cut short. A healthy blast of canned air will knock a good deal of this dust and debris away, and if the fans are running while the blast is administered, they will hopefully eject all the dust out of the case. If not, it should settle to the bottom of the case, and a cloth can be used to wipe it clean.

In addition to gunking up the fans, dust can also cover the fan grills, or other types of guards, intended to protect fingers from the spinning blades. Keeping these clear will allow the maximum airflow for efficiently cooling the components, as well as cutting down on noise created by the air trying to flow past a restricted opening.

Some case manufacturers now include removable filters in front of their case fans in order to make maintenance easier. These filters can then be removed and blown clean, while the fans and case

internals remain relatively dust free. For those without such a thoughtful feature included in their case, fan filters are available in standard sizes to be added to just about any fan.

## Heat Sinks



Heat sinks are necessary for cooling the heat-generating chips inside your computer, and keeping them clean will help them keep your machine running smoothly. Whether we're talking about a CPU heat sink, or something like a VGA heat sink, dust and debris can not only cling to the blades/walls of the fan, but can also become trapped between the narrow fins of the heat sink body.

As with case fans, a dirty heat sink fan will suffer a drop in cooling efficiency, create more noise, and perhaps have its life shortened. The heat sink body, generally constructed of aluminum or copper, is the means by which the heat from the chip is transferred to the air. A layer of dust will act as a blanket and insulate the heat sink, thus preventing it from freely exchanging heat with the air.

## Keyboard



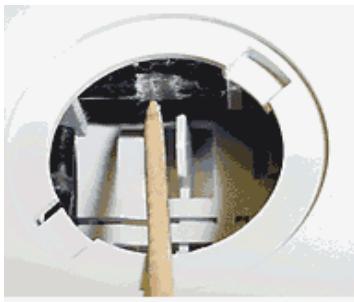
Keyboards seem to suffer most when it comes to accumulating the debris of every day usage. Not only do they gather dust and hair like most of the other components discussed, but they seem to be magnets for crumbs of food, cigarette ashes, and just about anything else that can slip down between the cracks. Eventually a keyboard may look too gross to actually want to use, and you may even find that

the key action is less responsive or even blocked by items under the keys.

A sweeping blast of canned air will work wonders to eliminate the debris, and for best results hold the keyboard upside down while doing so. It might not hurt to give the keyboard a good shake while it is upside down, but be prepared as you never know what might fall out.

### Mice

Optical mice may be more immune from dust than the old roller ball mice, but both styles are still prone to diminished performance caused by dust. Roller ball mice require fairly frequent cleanings in the socket around the ball, as it can sweep just about anything you roll over up into its mechanism. Optical (and laser) mice have a smooth bottom surface that may not have anywhere for dust to gather, but there are still places for it to settle elsewhere.



The buttons on either type of mice are generally not sealed, and junk can get into the small cracks around the edges, potentially interfering with the click action of the device. In addition, the area around scroll wheels can easily become gunked up with dust and debris, which a blast of canned air can alleviate.

### Power Supply



Power supplies are much like heat sinks with respect to keeping them clean. The housing of a power supply features a fan (or two) used to cool aluminum heat sinks found inside, and the same issues that

impacted the performance of a chip's heat sink and fan will be found in a power supply.

Overheating power supplies can be a major cause of system instability and failure, but it seems like they receive the least attention when it comes to preventive system maintenance. A good blast of air through each of the fan openings and vents on the side can help keep these critical components operating well.

The components of a power supply run hot due to the resistance in the process of converting the 120V AC power to the various DC voltages needed inside the computer. Power supplies with better efficiencies are now available which reduce the heat generated, but keeping the fans and heat sinks free of dust will help keep them doing so for a much longer time.

### Laptops

Laptop computers can benefit equally from a cleansing blast of air. For example, the integrated keyboard and pointing device can get the same crud behind them as a desktop version and inverting the laptop and giving a blast can set this debris free.

The processor in a laptop computer may not be as readily accessible as in a desktop, but there are vents in the housing that lead to it. One set of vents allow a cooling fan to draw air in, and another set of vents allow the heated air from the processor to be expelled. Giving these vents a puff of canned air will help ensure that the pathway doesn't become restricted and that the processor's heat sink doesn't become insulated by a layer of dust.

### Final Words

A can of air won't take care of all of your computer maintenance needs, but one can really make keeping key components functioning at their best a breeze. Available at most consumer electronics and office supply stores, the (low) price of a can of air is well worth it to help maintain the large investment you have in your computer.

### Addendum :

The use of canned air products comes with a responsibility to use these products as directed and limit their access to children and teenagers. We feel that the safety of our children and young people is of

the utmost importance in our society. Thanks to all of our Tech Tip readers who wrote and asked us to point out the potential dangers of canned air and similar products.

### Troubleshooting Guide

Trying to track down and resolve technical problems on your computer is, undeniably, one of life's most frustrating experiences. To help you through the process, I've written some articles that explain the critical issues you need to understand to do effective troubleshooting on PCs or Macs. In addition, the articles address common questions and common problems I'm often asked about on the "[O'Donnell on Computers](#)" radio show. These articles (at least the PC versions) also form the basis of some of the more extensive troubleshooting advice you'll find in my book, "[Personal Computer Secrets](#)." I hope you find them useful.