# PAPER NO. 6

## Certified Public Accountants (CPA)

# INFORMATION COMMUNICATION TECHNOLOGY

## CPA
## FOUNDATION LEVEL

# STUDY TEXT

## GENERAL OBJECTIVE

This paper is intended to equip the candidate with knowledge, skills and attitudes that will enable him/her to apply fundamental information communication technology (ICT) skills in business

## LEARNING OUTCOMES

A candidate who passes this paper should be able to:

- Demonstrate knowledge of computer systems
- Select appropriate computer hardware and software
- Use various computer application packages
- Select various types of information systems
- Use computer networks and the Internet

## CONTENT

### 1. Introduction to ICT

- ICT overview
- Types of ICTs
- Information centres
- Uses of ICT in business
- Impact of ICT in society

### 2. Computer systems

- Overview of a computer system
- Evolution of computers
- Elements of a computer system

### 3. Computer hardware

- Overview
- Input devices
- Output devices
- Processing devices
- Storage devices
- Communication devices
- Factors that determine the processing power of a computer
- Selection and acquisition of computer hardware

### 4. Computer software

- Overview of computer software
- System software
- Application software
- Other utility software
- Computer programming languages
- Selection and acquisition of computer software

### 5. Introduction to operating systems

- Overview of an operating system

- Functions of an operating system
- Types of operating systems
- Computer booting
- Selection and acquisition of operating systems

**6. Computer files**

- Elements of a computer file
- Types of computer files
- Basic file design and storage
- File organisation
- File access methods

**7. An overview of application packages**

Word processing

- Features of word processor
- Formatting and editing text
- Creating and formatting tables

Spreadsheets

- Features of a spreadsheet program
- Formatting and editing spreadsheet
- Formulas and functions
- Charts and graphs

Presentation software

- Features of presentation program
- Typing and formatting text in slide
- Slide show
- Computerised accounting software
- Capturing data
- Features of accounting software

**8. Overview of information systems**

- Systems overview
- Information systems
- Components of an information system
- Role of information systems in an organisation
- Classification of information systems
- Types of information systems
- Overview of information systems security and controls

**9. Computer networks**

- Computer networks concepts
- Computer network hardware and software
- Data transmission media
- Types of computer networks
- Advantages and limitations of networking

**10. The Internet**

- Applications of Internet
  - Using search engines
  - E-mails
  - Electronic communication
- Introduction to the Internet
- Internet services - e -mails, WWW, instant messaging
- Searching for information on the Internet
- Internet service providers (ISPs)
- Applications of internet
- Impact of internet on society

**11. Emerging issues and trends**

**CONTENT** **PAGE**

**Topic 1:** Introduction to ICT……..... 5
**Topic 2:** Computer systems……..20.
**Topic 3:** Computer hardware……41
**Topic 4:** Computer software…….70
**Topic 5:** Introduction to operating systems……...……80
**Topic 6:** Computer files……106
**Topic 7:** An overview of application……119
**Topic 8:** Overview of information systems…….….150
**Topic 9:** Computer networks……168
**Topic 10:** The Internet……..190
**Topic 11:** Emerging issues and trends……...…219

# TOPIC 1

# INTRODUCTION TO ICT

## OVERVIEW OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

**Information and communications technology** (**ICT**) is often used as an extended synonym for information technology (IT). It is a more extensive term (i.e. more broad in scope) that stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals), computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information.

The term *ICT* is also used to refer to the convergence of audio-visual and telephone networks with computer networks through a single cabling or link system. There are large economic incentives (huge cost savings due to elimination of the telephone network) to merge the telephone network with the computer network system using a single unified system of cabling, signal distribution and management.

However, ICT has no universal definition, as "the concepts, methods and applications involved in ICT are constantly evolving on an almost daily basis."The broadness of ICT covers any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form, e.g. personal computers, digital television, email, robots.

### Information technology

**Information technology** (**IT**) is the application of computers and telecommunications equipment to store, retrieve, transmit and manipulate data, often in the context of a business or other enterprise.

The term is commonly used as a synonym for computers and computer networks, but it also encompasses other information distribution technologies such as television and telephones. Several industries are associated with information technology, including computer hardware, software, electronics, semiconductors, internet, telecom equipment, engineering, healthcare, e-commerce and computer services

## Components of ICT

Technological change is becoming a driving force in our society. Information technology is a generic term used for a group of technologies. James William (1982) has identified the following six major new technologies as most relevant in modern library and information system.

- Processor, memory and input/output channels,
- Micro. Mini and Large scale computers,
- Mass storage technologies,
- Data communication, networking and distributed processing,
- Data entry, display respond, and
- Software

These technologies can also be grouped into three major areas:

- Computer Technology,
- Communication Technology and
- Reprographic, Micrographic and Printing Technologies

### A. Computer Technology

The wide spread use of computer technology has made dramatic developments in the information transmission process in very field of human life. Highly sophisticated information services ranging from elaborate abstracting and indexing services to computerized data bases in almost all scientific disciplines are in wide use all over the world. The current developments in computer technology include mini computers, microcomputers, personnel computers, portable computers, super computers, speaking computer with IQS, microchip technology, artificial intelligence, software developments, C-ROM technology, machine-readable database, etc.

### B. Communication Technology

#### 1. Audio Technology

Due to tremendous improvements and inventions, older gramophone records are now dwindling and much sophisticated cassettes and tape records are emerging. The outmoded AM (Amplitude Modulated) radio receivers are being received by the modern FM (Frequency Modulation) receivers. Thus, the new audio technology can be used in libraries and information centers for a wide variety of, recreation, etc.

#### 2. Audio-Visual Technology

Motion pictures, Television, Videodisc are the main contributions of this technology.

Videodisc is a new medium containing prerecorded information, which allows the user to reproduce this information in the form of images on the screen of a television receiver at, will. Videodisc technology offers high quality storage, image stability and speed of recall.

**3. Facsimile Transmissions (Fax)**

Facsimile transmission has been boosted by the adoption of methods of data compression made possible by compact, reliable and inexpensive electronics. During the initial stages, the average speed of facsimile transmission was found to be 3.4 minutes per page. This technology was slow and it was replaced by micro facsimile. Satellite communication and fiber optics have increased the potential of facsimile transmission.

**4. Electronic Mail**

E-mail is the electronic transmission and receiving of messages, information, data files, letters or documents by means of point-to-point systems or computer-based messages system.

**C. Reprographic, Micrographic and Printing Technologies**

The technology of reprography made a big impact on the document delivery system. Most of the research libraries have reprographic machines and provide photocopy of any document on demand. Using reprographic and micrographic techniques, we can condense the bulky archives and newspapers and solve the storage problems. They also serve the purpose of preservation. They help in resource sharing and save the time of users.

**1. Micro Forms**

Microforms is a term for all type of micro-documents whether they are transparent or opaque or in roll or sheet form. The verities of microforms are microfilm, microfiche, ultra fiche, micro opaque, cards, computer about microfiche / micro film (COM).

**2. Roll-film (microfilm)**

It is a continuous strip of film with images arranged in sequence. It is available in 100 feet roll with 35mm width.

**3. Microfiche**

It is flat film having large number of images arranged in rows and columns. Standard sized microfiche of 4x6 inches accommodated 98 pages.

**4. Printing Technology**

Thousands of years ago, people recognized the necessity of keeping records of their daily activities. Paper was invented and the art of writing and record keeping came to be defined. At present, lasers and computers have entered the field of printing. Computer printers are three categories; line printers, dot matrix printer, and laser printers. Laser printers are popular today.

## ICT SYSTEM

An ICT system is a set-up consisting of hardware, software, data and the people who use them. It commonly includes communications technology, such as the Internet.

ICT and computers are **not** the same thing.

Computers are the hardware that is often part of an ICT system.

ICT Systems are used in a number of environments, such as:

- offices
- shops
- factories
- aircraft
- ships

They're also used in fields such as:

- communications
- medicine
- farming

ICT Systems are everyday and ordinary, yet extraordinary in how they can add extra power to what we do and want to do.

### The importance of ICT systems

By using ICT systems we are:

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

### Types of ICT system

The three main types of ICT system to be considered for GCSE are:

### Information systems

This type of ICT system is focused on managing data and information. Examples of these are a sports club membership system or a supermarket stock system.

**Control systems**

These ICT systems mainly control machines. They use input, process and output, but the output may be moving a robot arm to weld a car chassis rather than information.

**Communications systems**

The output of these ICT systems is the successful **transport of data** from one place to another.

**Input, output and system diagrams**

What comes out of an ICT system is largely dependant on what you put into the system to begin with.

ICT systems work by taking inputs (instructions and data), processing them and producing outputs that are stored or communicated in some way. The higher the quality and better thought-out the inputs, the more useful the outputs.

**Garbage In, Garbage Out (GIGO)**

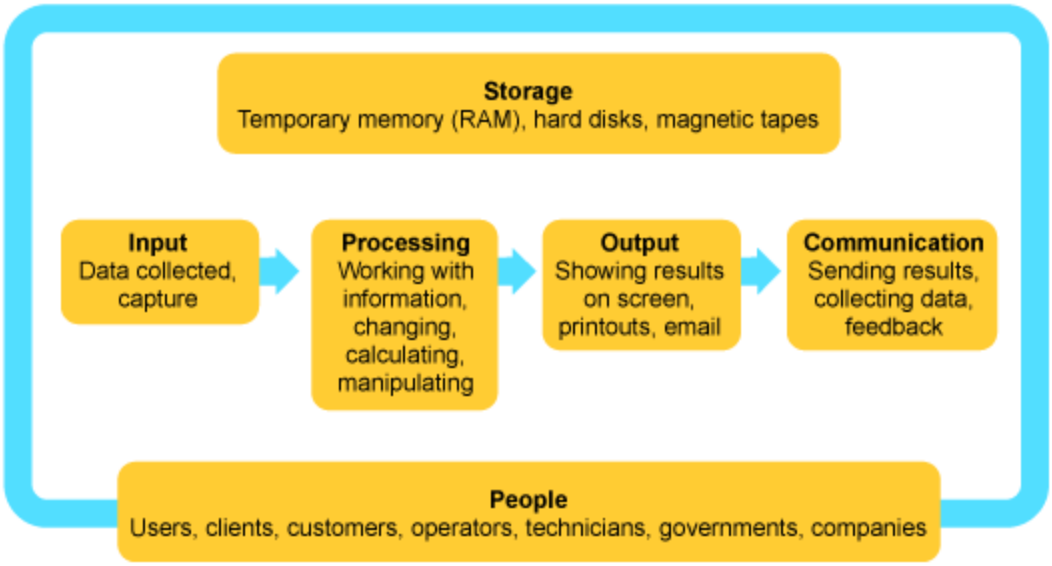
ICT systems cannot function properly if the inputs are inaccurate or faulty; they will either not be able to process the data at all, or will output data which is erroneous or useless.

**GIGO** is a useful term to remember in the exam - it can help explain many issues such as why validation is needed and why accurate data is valuable.

GIGO stands for Garbage In, Garbage Out

**An ICT system diagram**

A system is an assembly of parts that together make a whole. ICT systems are made up of some or all of the parts shown in the diagram. Various devices are used for input, processing, output, and communication.

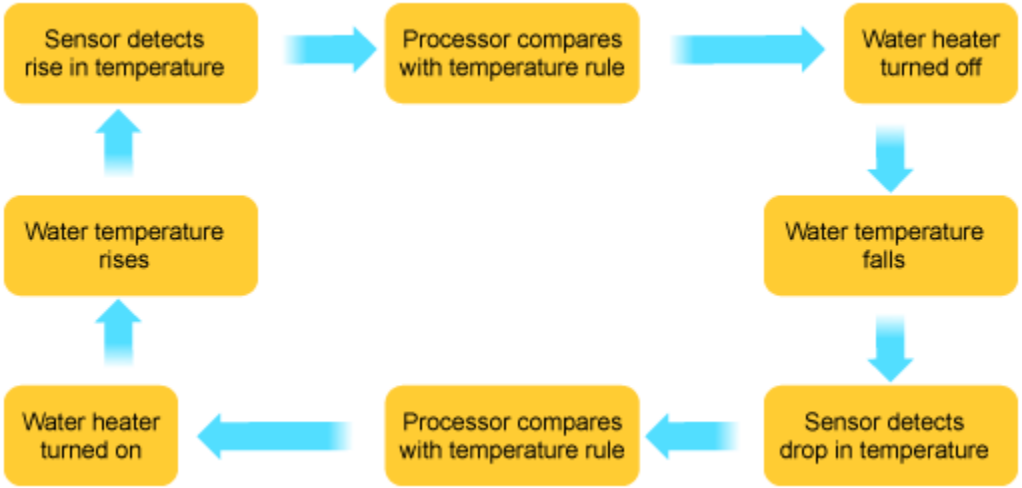



ICT systems can be made of some or all of the parts shown.

**Feedback**

It is sometimes good to have feedback in an ICT system. This is when the output from a system **feeds back** to influence the input and the process repeats itself.

A good example is a system set-up to control water temperature in a tropical fish tank. The temperature of the water is taken as an input from sensors. Processing takes place and the temperature of the water is compared against the pre-programmed parameters, eg maximum/minimum temperature. The outputs include the automatic decision to either turn on or off the heater to warm or let the water cool. The output, ie the change in the water's temperature, is then fed back by the sensors as an input and the process repeats itself.



A system that monitors the water temperature of a fishtank and reacts accordingly.

Feedback can occur in information-based systems as well. Often an output will have a result on further inputs. For example, the output of accepting an online booking for an air ticket will be to reduce the number of tickets available.

The Measurement and control section has more information about the feedback cycle.

## INFORMATION CENTRES

Information centre is a division within the IT department that supports end-user computing. It is responsible for training users in applications and solving related personal computer problems.

An information center is designed specifically for storing, processing, and retrieving information for dissemination at regular intervals, on demand or selectively, according to express needs of users.

## ROLE OF ICT IN THE MODERN ORGANIZATION

Information technology (IT) has become a vital and integral part of every business plan. From multi-national corporations who maintain mainframe systems and databases to small businesses that own a single computer, IT plays a role. The reasons for the omnipresent use of computer technology in business can best be determined by looking at how it is being used across the business world.

### Communication

For many companies, email is the principal means of communication between employees, suppliers and customers. Email was one of the early drivers of the Internet, providing a simple and inexpensive means to communicate. Over the years, a number of other communications tools have also evolved, allowing staff to communicate using live chat systems, online meeting tools and video-conferencing systems. Voice over internet protocol (VOIP) telephones and smart-phones offer even more high-tech ways for employees to communicate.

### Inventory Management

When it comes to managing inventory, organizations need to maintain enough stock to meet demand without investing in more than they require. Inventory management systems track the quantity of each item a company maintains, triggering an order of additional stock when the quantities fall below a pre-determined amount. These systems are best used when the inventory management system is connected to the point-of-sale (POS) system. The POS system ensures

that each time an item is sold, one of that item is removed from the inventory count, creating a closed information loop between all departments.

**Data Management**

The days of large file rooms, rows of filing cabinets and the mailing of documents is fading fast. Today, most companies store digital versions of documents on servers and storage devices. These documents become instantly available to everyone in the company, regardless of their geographical location. Companies are able to store and maintain a tremendous amount of historical data economically, and employees benefit from immediate access to the documents they need.

**Management Information Systems**

Storing data is only a benefit if that data can be used effectively. Progressive companies use that data as part of their strategic planning process as well as the tactical execution of that strategy. Management Information Systems (MIS) enable companies to track sales data, expenses and productivity levels. The information can be used to track profitability over time, maximize return on investment and identify areas of improvement. Managers can track sales on a daily basis, allowing them to immediately react to lower-than-expected numbers by boosting employee productivity or reducing the cost of an item.

**Customer Relationship Management**

Companies are using IT to improve the way they design and manage customer relationships. Customer Relationship Management (CRM) systems capture every interaction a company has with a customer, so that a more enriching experience is possible. If a customer calls a call center with an issue, the customer support representative will be able to see what the customer has purchased, view shipping information, call up the training manual for that item and effectively respond to the issue. The entire interaction is stored in the CRM system, ready to be recalled if the customer calls again. The customer has a better, more focused experience and the company benefits from improved productivity.

## USES OF ICT IN BUSINESS MANAGEMENT

Information technology is an essential partner in management of your business, regardless of the kind of enterprise you operate. Whether you need computers for storage, transfer, retrieval or transmission of information, you can manage your business with greater accuracy and efficiency with the assistance of information technology and computer applications. The U.S. Small Business Administration suggests it’s time to get connected.

## Storage

You may already use a computer for data storage for your business. Inventory, sales, receivables and payables stored in Excel, Open Office or a similar program keeps these figures at your fingertips. Accounting software stores your payroll information, tax records and specialized data for your business. Once you're acquainted with a program, you won't know how you functioned without it. You can eliminate much of the physical storage at the office by using information technology to scan and store old personnel and payroll files, tax files or client files. You may need less square footage with information technology.

## Marketing

Large and small businesses are on a level playing field on the Internet. You can have a Web presence, take orders, buy merchandise, sell excess or even operate some businesses entirely online. A marketing tool that uses information technology is the Quick Response or QR Code that looks like a bar code but is square. A scan advertises your website address and includes any text you choose. You can use your business management skills to direct employees or contractors to do your Internet marketing, or you can choose to learn a new set of skills in information technology.

## Information

Whether you learned business management by the book or by practical experience, you'll need updates all of your life. The Internet is a wealth of information to keep you current with trends, techniques, software and human resources. You can draw on online databases and websites to locate potential employees, compare insurance proposals, tackle employee issues or check out the competition. Managing your business with information gleaned from the Internet keeps you knowledgeable and on the cutting edge.

## Communication

Communication by email is faster and costs less than sending a paper letter in the mail. You can transform your business to the 21st century with the use of email for communication with clients or customers. Information technology allows you to organize email file folders by client or by type of communication, such as orders or billing. You can drag and drop your email files to closed folders as your company completes projects. Your communication files become closed files, placed in storage on CD or on a hard drive with a duplicate copy or backup automated by a program or service.

# BENEFITS OF ICT IN BUSINESS

Information technology, also known as IT, is a comprehensive term that includes all types of technology used to exchange, store, use or create information. Commonly used information technology equipment includes computers, servers, peripheral devices, Internet connectivity equipment and phone systems. From basic computer terminals to IP-based telephony systems, information technology is an integral part of most modern business operations.

## Communication

Rapid communications can help increase productivity, allow for better business decision-making and ease a company's expansion into new territories or countries. Email servers, routers, internal company billboards and chat services can serve as the backbone of a company's communications. These electronically based communication systems are used to disseminate routine and critical business information in a quick and efficient manner. IT equipment can be used to send business status reports to executives, to update employees on critical business projects and to connect with business partners and customers.

## Efficiency

Streamlined work flow systems, shared storage and collaborative work spaces can increase efficiency in a business and allow employees to process a greater level of work in a shorter period of time. Information technology systems can be used to automate routine tasks, to make data analysis easier and to store data in a manner that can easily be retrieved for future use. Technology can also be used to answer customer questions through email, in a real-time chat session or through a telephone routing system that connects a customer to an available customer service agent.

## Competitive Advantage

Adoption of information technology resources allows companies to maintain a competitive advantage over their rivals. Companies using a first-movers strategy can use information technology to create new products, distance their products from the existing market or enhance their customer services. Companies that follow a low-cost product strategy can look to information technology solutions to reduce their costs through increased productivity and reduced need for employee overhead. Businesses can also build-in information technology to their products that makes it difficult for customers to switch platforms or products.

## Economic Efficiencies

Companies can harness information technology resources to lower their costs. Using IT infrastructure, redundant tasks can be centralized at one location. For example, a large company could centralize their payroll function at one location to lower employee costs. Economic efficiencies can also be realized by migrating high-cost functions into an online environment. Companies can offer email support for customers that may have a lower cost than a live

customer support call. Cost savings could also be found through outsourcing opportunities, remote work options and lower-cost communication options.

## THE POSITIVE AND NEGATIVE IMPACTS OF ICT

As it is known from time immemorial that everything in life is like the two side of a coin, there is always a positive and negative side of every phenomenon. But whether the effect is positive or negative the effects of Information Communication Technology (ICT) is far reaching and cannot be overemphasized. The Effects of ICT lens looks at how our lives have been changed, for better and for worse, by the impact of ICT. It includes both positive effects and negative effects and looks at how individuals organisations and society are affected.

## POSITIVE IMPACTS OF ICT

## ICT CAN HAVE POSITIVE IMPACTS ON PEOPLE

- **Access to information:** Possibly the greatest effect of ICT on individuals is the huge increase in access to information and services that has accompanied the growth of the Internet. Some of the positive aspects of this increased access are better, and often cheaper, communications, such as VoIP phone and Instant Messaging. In addition, the use of ICT to access information has brought new opportunities for leisure and entertainment, the facility to make contacts and form relationships with people around the world, and the ability to obtain goods and services from a wider range of suppliers.
- **Improved access to education**, e.g. distance learning and on-line tutorials. New ways of learning, e.g. interactive multi-media and virtual reality. New job opportunities, e.g. flexible and mobile working, virtual offices and jobs in the communications industry.
- **New tools, new opportunities:** The second big effect of ICT is that it gives access to new tools that did not previously exist. A lot of these are tied into the access to information mentioned above, but there are many examples of stand-alone ICT systems as well:

**a)** ICT can be used for processes that had previously been out of the reach of most individuals, e.g. photography, where digital cameras, photo-editing software and high quality printers have enabled people to produce results that would previously required a photographic studio.

**b)** ICT can be used to help people overcome disabilities. e.g. screen magnification or screen reading software enables partially sighted or blind people to work with ordinary text rather than Braille.

## NEGATIVE IMPACTS OF ICT ON PEOPLE

- **Job loss:** One of the largest negative effects of ICT can be the loss of a person's job. This has both economic consequences, loss of income, and social consequences, loss of status and self esteem. Job losses may occur for several reasons, including: Manual operations being replaced by automation. e.g. robots replacing people on an assembly line.Job export. e.g. Data processing work being sent to other countries where operating costs are lower. Multiple workers being replaced by a smaller number who are able to do the same amount of work. e.g. A worker on a supermarket checkout can serve more customers per hour if a bar-code scanner linked to a computerized till is used to detect goods instead of the worker having to enter the item and price manually

- **Reduced personal interaction:** Being able to work from home is usually regarded as being a positive effect of using ICT, but there can be negative aspects as well. Most people need some form of social interaction in their daily lives and if they do not get the chance to meet and talk with other people they may feel isolated and unhappy.

- **Reduced physical activity:** A third negative effect of ICT is that users may adopt a more sedentary lifestyle. This can lead to health problems such as obesity, heart disease, and diabetes. Many countries have workplace regulations to prevent problems such as repetitive strain injury or eyestrain, but lack of physical exercise is rarely addressed as a specific health hazard.

## ICT CAN HAVE A POSITIVE EFFECT ON ORGANIZATIONS

There are three main areas in which organisations are affected by the use of ICT, communications, information management, and security. The three areas have considerable overlap.

- **Communication**: By using ICT has brought a number of benefits to organisations, such as: Cost savings by using e.g. VoIP instead of normal telephone, email / messaging instead of post, video conferencing instead of traveling to meetings, e-commerce web sites instead of sales catalogues. Access to larger, even worldwide, markets. Web sites can be seen from all parts of the world and orders can be taken wherever there is a compatible banking system to process payments, e.g. credit / debit card, Pay-Pal, bank transfer facility. Web sites also have 24 hour opening and are available every day of the year. Flexible response. Organisations with good communications can respond to changes quickly. This may mean better customer relations, an improved supply chain for goods and services, faster development of new products to meet a new opportunity, etc.

- **Information management:** Organisations can benefit from using ICT for information management. e.g. Data mining of customer information to produce lists for targeted advertising. Improved stock control, resulting in less wastage, better cash flow,

etc.Mangers are better informed and will have more reliable and up-to-date information on which to base their decisions.

- **Security:** Although the use of ICT can bring its own security issues, see next section, it can also solve or reduce some security problems, e.g. Encryption methods can keep data safe from unauthorized people, both while it is being stored or while it is being sent electronically. This is important for reasons such as data protection legislation or commercial secrecy. ICT enables physical security systems such as fingerprint, iris or facial recognition.

## NEGATIVE IMPACTS OF ICT ON ORGANIZATIONS

a) **Cost**: the cost of using ICT may cause a number of problems for organisations. A lot of ICT hardware and software is expensive, both to purchase and to maintain. An ICT system usually requires specialist staff to run it and there is also the challenge of keeping up with ever-changing technology. These extra costs should be offset by the poitive effects of using ICT, but if an organisation gets its cost-benefit analysis wrong it may lose money.

b) **Competition**: this is usually thought of as being a good thing, but for some organisations being exposed to greater competition can be a problem. If the organisation is competing for customers, donations, or other means of funding nationally or even internationally, they may lose out to other organisations that can offer the same service for less money.

c) **Security**: this is always a problem for any organisation that uses ICT. Data must be kept secure, Internet connections must be protected from attack, new viruses and other forms of malware are released nearly every day.

Organisations will usually have legal obligations to protect data such as customer information. Even if the organisation does not have to comply with a specific data protection law it will usually be in the organisation's interest to protect data from rivals.

## ICT CAN HAVE POSITIVE EFFECT ON THE SOCIETY

Probably the largest effect that ICT use has on society is allowing members of society to have greatly increased access to information. This can have numerous positive effects, such as:

a) Increasing opportunities for education
b) Improving communication
c) Allowing people to participate in a wider, even worldwide, society.

**The positive impact of ICT on education:** On the positive side, the use of ICT in education can provide opportunities that might not otherwise exist, such as:

i. Distance learning, where students can access teaching materials from all over the world,
ii. The ability to perform 'impossible' experiments' by using simulations,
iii. The possibility for students to have individual learning programs within a topic, rather than everybody having to do the same thing at the same time at the same pace. More able students can be given more challenging work, less able students can access remedial lessons.

**The negative impact of ICT on education:**

I. There are large costs involved and poorer students / educational establishments establishments can end up being disadvantaged. This is often referred to as being a factor in the **digital divide**
II. Students, and sometimes teachers, can get hooked on the technology aspect, rather than the subject content. Just because a topic can be taught via ICT, does not mean that it is taught most effectively via ICT.
Even if a subject can be taught effectively via ICT, and there is the money available, it does not always follow that there is any advantage to it. There have been a lot of studies / assessments carried out, looking to see if ICT usage improves learning. The results are mixed. Much simplified, it would appear that:

1. There is some initial impact of using ICT in that students get a wider range of resources and experience some extra motivation.
2. The motivation effect soon fades as using ICT becomes the new normal
3. The wider resource range remains a positive factor
4. There are some well documented positive effects in specific. e.g. simulation and modelling is effective in improving science standards, use of word processing and communication software is effective in developing language skills, but there is concern that large areas of the curriculum are not benefiting.

The manner in which the subject is taught probably has a larger effect than the mere use of ICT. i.e. if the teacher does not adapt their methods in order to make best use of ICT, the students do not gain from that use.

The attitude of the educational establishment also seems to have a greater effect. i.e. the people running them may not have the knowledge and experience, or often the money, to enable widespread and effective use of ICT in their schools.

The attitude of society / government can have a large impact of how ICT is perceived and thus how effectively it is used. Countries where the government encourages ICT usage and where the majority of the people use ICT on a daily basis are likely to make better use of ICT in education as well as in the larger society.

On the other hand, in countries where some uses of ICT are restricted because of e.g political or religious reasons, the use of ICT in education becomes less effective and may even be seen as a threat to those in power and thus actively discouraged

## NEGATIVE IMPACT OF ICT ON SOCIETY

Probably the largest effect that ICT use has on on society is allowing members of society to have greatly increased access to information. This can have numerous negative effects, such as: causing a digital divide between those who can access information and those who cannot, reducing levels of education and understanding due to the vast amount of incorrect and misleading information that is available causing moral and ethical problems due to the nature of some of the material available.

# TOPIC 2

# COMPUTER SYSTEMS

## OVERVIEW OF COMPUTER SYSTEMS

### Introduction

A computer is a device that can receive, process and store data. They are used as tools in every part of society together with the Internet. Computers nowadays are complex; there are a lot of different components inside them, and they all serve different purposes. They all need to work together for the computer to work; knowing how a computer works makes it easier to use a computer by being able to understand how a computer will respond.

A computer system is a *system* of interconnected *computers* that share a central storage *system* and various peripheral devices such as a printers, scanners, or routers. Each *computer* connected to the *system* can operate independently, but has the ability to communicate with other external devices and *computers*.

## COMPUTERISATION

It's the process of taking activities or tasks not previously done on the computer and shifting them to being done on the computer.

### Advantages of computerisation in an organisation

1. Response time is greatly reduced
2. Very large data are stored for information and decision-making
3. Accuracy of information is considerably improved, thereby improving the quality of the decision
4. Problems are handled more easily by using various operation research models
5. The cost involved in the decision-making process is reduced
6. More secrecy is observed as compared to manual file system

**Disadvantages of computerisation**

1. **Unemployment**
   Different tasks are performed automatically by using computers. It reduces the need of people and increases unemployment in society.
2. **Wastage of time and energy**
   Many people use computers without positive purpose. They play games and chat for a long period of time. It causes wastage of time and energy. Young generation is now spending a lot of time on the social media websites like Facebook, Twitter etc or texting their friends all night through smartphones which is bad for both studies and their health. And it also has adverse effects on the social life.
3. **Data Security**
   The data stored on a computer can be accessed by unauthorized persons through networks. It has created serious problems for the data security.
4. **Computer Crimes**
   People use the computer for negative activities. They hack the credit card numbers of the people and misuse them or they can steal important data from big organizations.
5. **Privacy violation**
   The computers are used to store personal data of the people. The privacy of a person can be violated if the personal and confidential records are not protected properly.
6. **Health risks**
   The improper and prolonged use of computer can results in injuries or disorders of hands, wrists, elbows, eyes, necks and back. The users can avoid health risks by using the computer in proper position. They must also take regular breaks while using the computer for longer period of time. It is recommended to take a couple of minutes break after 30 minutes of computer usage.
7. **Impact on Environment**
   The computer manufacturing processes and computer waste are polluting the environment. The wasted parts of computer can release dangerous toxic materials. Green computer is a method to reduce tire electricity consumed and environmental waste generated when using a computer. It includes recycling and regulating manufacturing processes. The used computers must be donated or disposed off properly.

## EVOLUTION OF COMPUTERS

### History of Computers

The first electronic computers were produced in the 1940s. Since then, many breakthroughs in electronics have occurred leading to great improvements in the capacity, processing speed and quality of computer resources.

The evolution of computerisation in business may be summarised as:

- **1870s:** Development of the typewriter allows speedier communication and less copying.

- **1920s:** Invention of the telephone enables both Wide Area Networks (WAN) and Local Area Networks (LAN) communication in real time. This marks the beginning of telecommunication.
- **1930s:** Use of scientific management is made available to analyse and rationalize data.
- **1940s**: Mathematical techniques developed in World War II (operations research) are applied to the decision making process.
- **1950s:** Introduction of copying facilitates cheap and faster document production, and the (limited) introduction of Electronic Data Processing (EDP) speeds up large scale transaction processing.
- **1960s:** Emergence of Management Information Systems (MIS) provides background within which office automation can develop.
- **1970s**: Setting up of telecommunication networks to allow for distant communication between computer systems. There is widespread use of word processors in text editing and formatting, advancement in personal computing - emergence of PCs. Use of spreadsheets.
- **1980s**: Development of office automation technologies that combine data, text, graphics and voice. Development of DSS, EIS and widespread use of personal productivity software.
- **1990s**: Advanced groupware; integrated packages, combining most of the office workclerical, operational as well as management.
- **2000s**: Wide spread use of Internet and related technology in many spheres of
- organisations including electronic commerce (e-commerce), e-learning, and e-health

**Computer Generations**

The classification of computers into generations is based on the fundamental technology employed. Each new generation is characterised by greater speed, larger memory capacity and smaller overall size than the previous one.

**i. First Generation Computers (1946 – 1957)**

- Used vacuum tubes to construct computers.
- These computers were large in size and writing programmes on them was difficult.
- The following are major drawbacks of First Generation computers.
    - The operating speed was quite slow.
    - Power consumption was very high.
    - It required large space for installation.
    - The programming capability was quite low.
    - Cumbersome to operate – switching between programmes, input and output

**ii. Second Generation Computers (1958 - 1964)**

- Replaced vacuum tubes with transistors
- The transistor was smaller, cheaper and dissipated less heat than a vacuum tube.

- The second generation also saw the introduction of more complex arithmetic and logic units, the use of high–level programming languages and the provision of system software with the computer.
- Transistors were smaller than electric tubes and had higher operating speed. They had no filament and required no heating. Manufacturing cost was also lower. Thus the size of the computer got reduced considerably
- It is in the second generation that the concept of Central Processing Unit (CPU), memory, programming language and input and output units were developed. The programming languages such as COBOL, FORTRAN were developed during this period.

**iii. Third Generation Computers (1965 - 1971)**

- Had an integrated circuit.
- Although the transistor technology was a major improvement over vacuum tubes, problems remained. The transistors were individually mounted in separate packages and interconnected on printed circuit boards by separate wires. This was a complex, time consuming and error-prone process.
- The early integrated circuits are referred to as small-scale integration (SSI).
- Computers of this generation were smaller in size, cost less, had larger memory while processing speed was much higher.

**iv. Fourth Generation Computers (1972 - Present)**

- Employ Large Scale Integrated (LSI) and Very Large Scale Integrated (VLSI) circuit technology to construct computers. Over 1,000 components can be placed on a single integrated-circuit chip.

**v. Fifth Generation Computers**

- These are computers of 1990s
- Use Very Large Scale Integrated (VLSI) circuit technology to build computers. Over 10,000 components can be incorporated on a single integrated chip.
- The speed is extremely high in fifth generation computer. Apart from this, it can perform *parallel processing*. The concept of *Artificial intelligence* has been introduced to allow the computer to make its own decision.

## CLASSIFICATION OF COMPUTERS

Computers can be classified in different ways as shown below:

### Classification by processing

This is based on how the computer represents and processes the data:

a) **Digital computers** are computers which process data that is represented in the form of discrete values by operating on it in steps. *Digital computers* process data represented in the form of discrete values like 0, 1, 2. They are used for both business data processing and scientific purposes since digital computation results in greater accuracy.

b) **Analog computers** are used for scientific, engineering, and process-controlled purposes. Outputs are represented in the form of graphs. *Analogue computers* process data represented by physical variables and output physical magnitudes in the form of smooth graphs.

c) **Hybrid computers** are computers that have the combined features of digital and analog computers. They offer an efficient and economical method of working out special problems in science and various areas of engineering.

### Classification by purpose

This is a classification based on the use to which the computer is put.

a) ***Special purpose*** computers are used for a certain specific function e.g. medicine, engineering and manufacturing.
b) ***General-purpose*** computers can be used for a wide variety of tasks e.g. accounting and word processing

### Classification by generation

This is a time-based classification coinciding with technological advances.
The computers are categorised as ***First generation*** through to ***Fifth generation.***

***a) First generation.*** These were computers of the early 1940s. They used a circuitry of wires and were vacuum tubes. Produced a lot of heat, took a lot of space, were very slow and expensive. Examples are LEO 1 and UNIVAC 1.

***b) Second generation***. These were computers of the early 1950s. Made use of transistorsand thus were smaller and faster. (200KHz). Examples include the IBM system 1000.

***c) Third generation.*** These were computers of the 1960s. They made use of IntegratedCircuits. They had speeds of up to 1MHz. Examples include the IBM system 360.

***d) Fourth generation.*** These were computers of the 1970s and 1980s. They used LargeScale Integration (LSI) technology. They had speeds of up to 10MHz. Examples include the IBM 4000 series.

***e) Fifth generation.*** These were computers of the 1990s. They used very Large Scale Integration (VLSI) technology and had speeds of up to 400MHz and above.

**Classification by power and size/ configuration**

***a) Supercomputers.*** These are the largest and most powerful. Used to process large amounts of data very quickly. Useful for meteorological or astronomical applications. Examples include Cray and Fujitsu.

***b) Mainframe computers.*** Large computers in terms of price, power and size. Require a carefully controlled environment and specialist staff to operate them. Used for centralised processing for large commercial organisations. Manufacturers include International Business Machine (IBM).

***Minicomputer***

Minicomputers are used by small businesses & firms. Minicomputers are also called as "Midrange Computers". These are small machines and can be accommodated on a disk with not as processing and data storage capabilities as super-computers & Mainframes. These computers are not designed for a single user. Individual departments of a large company or organizations use Mini-computers for specific purposes. For example, a production department can use Mini-computers for monitoring certain production process.

***Microcomputer***

Desktop computers, laptops, personal digital assistant (PDA), tablets & smartphones are all types of microcomputers. The micro-computers are widely used & the fastest growing computers. These computers are the cheapest among the other three types of computers. The Micro-computers are specially designed for general usage like entertainment, education and work purposes. Well known manufacturers of Micro-computer are Dell, Apple, Samsung, Sony & Toshiba.

Desktop computers, Gaming consoles, Sound & Navigation system of a car, Netbooks, Notebooks, PDA's, Tablet PC's, Smartphones, Calculators are all type of Microcomputers.

## DATA/INFORMATION REPRESENTATION IN COMPUTERS

### What is data?

Data can be defined as a representation of facts, concepts or instructions in a formalized manner which should be suitable for communication, interpretation, or processing by human or electronic machine.

Data is represented with the help of characters like alphabets (A-Z,a-z), digits (0-9) or special characters(+,-,/,*,<,>,= etc.).


### What is Information?

Information is organised or classified data which has some meaningful values for the receiver.

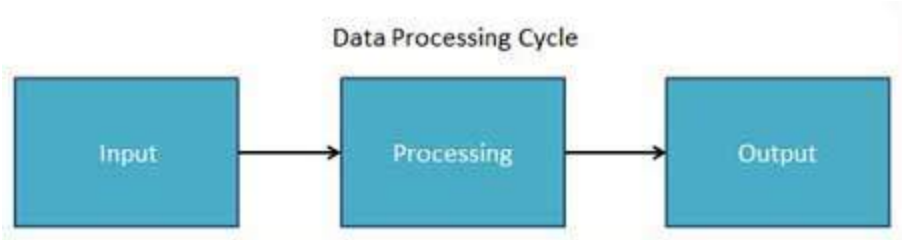
Information is the processed data on which decisions and actions are based.

For the decision to be meaningful, the processed data must qualify for the following characteristics:

- **Timely -** Information should be available when required.
- **Accuracy -** Information should be accurate.
- **Completeness -** Information should be complete.

### Daa Processing Cycle

Data processing is the re-structuring or re-ordering of data by people or machine to increase their usefulness and add values for particular purpose. Data processing consists of basic steps input, processing and output. These three steps constitute the data processing cycle.




- **Input -** In this step the input data is prepared in some convenient form for processing. The form will depend on the processing machine. For example, when electronic computers are used, the input data could be recorded on any one of several types of input medium, such as magnetic disks, tapes and so on.
- **Processing -** In this step input data is changed to produce data in a more useful form. For example, pay-checks may be calculated from the time cards, or a summary of sales for the month may be calculated from the sales orders.
- **Output -** Here the result of the proceeding processing step are collected. The particular form of the output data depends on the use of the data. For example, output data may be pay-checks for employees.

**Data Representation** refers to the methods used internally to represent information stored in a computer. Computers store lots of different types of information:

- text
- graphics of many varieties (stills, video, animation)
- sound
- numbers

At least, these all seem different to us. However, ALL types of information stored in a computer are stored internally in the same simple format: a sequence of 0's and 1's. *How can a sequence of 0's and 1's represent things as diverse as your photograph, your favorite song, a recent movie, and your term paper?*

It all depends on how we *interpret* the information. Computers use numeric codes to represent all the information they store. These codes are similar to those you may have used as a child to encrypt secret notes: let 1 stand for A, 2 stand for B, etc. With this code, any written message can be represented numerically. The codes used by computers are a bit more sophisticated, and they are based on the binary number system (base two) instead of the more familiar (for the moment, at least!) decimal system. Computers use a variety of different codes. Some are used for numbers, others for text, and still others for sound and graphics.

**Memory Structure in Computer**

- Memory consists of bits (0 or 1)
  - a single bit can represent two pieces of information
- bytes (=8 bits)
  - a single byte can represent 256 = 2x2x2x2x2x2x2x2 = $2^8$ pieces of information
- words (=2,4, or 8 bytes)

    - a 2 byte word can represent $256^2$ pieces of information (approximately 65 thousand).
- Byte addressable - each byte has its own address.

**Text**

Text can be represented easily by assigning a unique numeric value for each symbol used in the text. For example, the widely used ASCII code (American Standard Code for Information Interchange) defines 128 different symbols (all the characters found on a standard keyboard, plus a few extra), and assigns to each a unique numeric code between 0 and 127. In ASCII, an "A" is 65," B" is 66, "a" is 97, "b" is 98, and so forth. When you save a file as "plain text", it is stored using ASCII. ASCII format uses 1 byte per character 1 byte gives only 256 (128 standard and 128 non-standard) possible characters The code value for any character can be converted to base 2, so any written message made up of ASCII characters can be converted to a string of 0's and 1's.

**Graphics**

Graphics that are displayed on a computer screen consist of pixels: the tiny "dots" of color that collectively "paint" a graphic image on a computer screen. The pixels are organized into many rows on the screen. In one common configuration, each row is 640 pixels long, and there are 480 such rows. Another configuration (and the one used on the screens in the lab) is 800 pixels per row with 600 rows, which is referred to as a "resolution of 800x600." Each pixel has two properties: its location on the screen and its color.

A graphic image can be represented by a list of pixels. Imagine all the rows of pixels on the screen laid out end to end in one long row. This gives the pixel list, and a pixel's location in the list corresponds to its position on the screen. A pixel's color is represented by a binary code, and consists of a certain number of bits. In a monochrome (black and white) image, only 1 bit is needed per pixel: 0 for black, 1 for white, for example. A 16 color image requires 4 bits per pixel. Modern display hardware allows for 24 bits per pixel, which provides an astounding array of 16.7 million possible colors for each pixel!

**Compression**

Files today are so information-rich that they have become very large. This is particularly true of graphics files. With so many pixels in the list, and so many bits per pixel, a graphic file can easily take up over a megabyte of storage. Files containing large software applications can require 50 megabytes or more! This causes two problems: it becomes costly to store the files (requires many floppy disks or excessive room on a hard drive), and it becomes costly to transmit these files over networks and phone lines because the transmission takes a long time. In addition to studying how various types of data are represented, you will have the opportunity today to look at a technique known as data compression. The basic idea of compression is to make a file shorter by removing redundancies (repeated patterns of bits) from it. This shortened file must of course be de-compressed - have its redundancies put back in - in order to be used.

However, it can be stored or transmitted in its shorter compressed form, saving both time and money.

**Number System**

When we type some letters or words, the computer translates them in numbers as computers can understand only numbers. A computer can understand positional number system where there are only a few symbols called digits and these symbols represent different values depending on the position they occupy in the number.

A value of each digit in a number can be determined using

- The digit
- The position of the digit in the number
- The base of the number system (where base is defined as the total number of digits available in the number system).

**Decimal Number System**

The number system that we use in our day-to-day life is the decimal number system. Decimal number system has base 10 as it uses 10 digits from 0 to 9. In decimal number system, the successive positions to the left of the decimal point represent units, tens, hundreds, thousands and so on.

Each position represents a specific power of the base (10). For example, the decimal number 1234 consists of the digit 4 in the units position, 3 in the tens position, 2 in the hundreds position, and 1 in the thousands position, and its value can be written as

(1x1000)+ (2x100)+ (3x10)+ (4xl)
$(1x10^3)+ (2x10^2)+ (3x10^1)+ (4xl0^0)$
1000 + 200 + 30 + 41234

As a computer programmer or an IT professional, you should understand the following number systems which are frequently used in computers.

| S.N. | Number System and Description |
|---|---|
| 1 | **Binary Number System**<br>Base 2. Digits used : 0, 1 |
| 2 | **Octal Number System**<br>Base 8. Digits used : 0 to 7 |
| 3 | **Hexa Decimal Number System**<br>Base 16. Digits used : 0 to 9, Letters used : A- F |

**Binary Number System**

**Characteristics of binary number system are as follows:**

- Uses two digits, 0 and 1.
- Also called base 2 number system
- Each position in a binary number represents a 0 power of the base (2). Example $2^0$
- Last position in a binary number represents a x power of the base (2). Example $2^x$ where x represents the last position - 1.

**Example**

Binary Number : $10101_2$

Calculating Decimal Equivalent:

| Step | Binary Number | Decimal Number |
|---|---|---|
| Step 1 | $10101_2$ | $((1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0))_{10}$ |
| Step 2 | $10101_2$ | $(16 + 0 + 4 + 0 + 1)_{10}$ |
| Step 3 | $10101_2$ | $21_{10}$ |

**Note :** $10101_2$ is normally written as 10101.

**Octal Number System**

**Characteristics of octal number system are as follows:**

- Uses eight digits, 0,1,2,3,4,5,6,7.
- Also called base 8 number system
- Each position in an octal number represents a 0 power of the base (8). Example $8^0$
- Last position in an octal number represents a x power of the base (8). Example $8^x$ where x represents the last position - 1.

**Example**

Octal Number: $12570_8$

Calculating Decimal Equivalent:

| Step | Octal Number | Decimal Number |
|---|---|---|
| Step 1 | $12570_8$ | $((1 \times 8^4) + (2 \times 8^3) + (5 \times 8^2) + (7 \times 8^1) + (0 \times 8^0))_{10}$ |
| Step 2 | $12570_8$ | $(4096 + 1024 + 320 + 56 + 0)_{10}$ |
| Step 3 | $12570_8$ | $5496_{10}$ |

**Note :** $12570_8$ is normally written as 12570.

**Hexadecimal Number System**

**Characteristics of hexadecimal number system are as follows:**

- Uses 10 digits and 6 letters, 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F.
- Letters represents numbers starting from 10. A = 10. B = 11, C = 12, D = 13, E = 14, F = 15.
- Also called base 16 number system
- Each position in a hexadecimal number represents a 0 power of the base (16). Example $16^0$
- Last position in a hexadecimal number represents a x power of the base (16). Example $16^x$ where x represents the last position - 1.

**Example**

Hexadecimal Number : $19FDE_{16}$

Calculating Decimal Equivalent:

| Step | Binary Number | Decimal Number |
|---|---|---|
| Step 1 | $19FDE_{16}$ | $((1 \times 16^4) + (9 \times 16^3) + (F \times 16^2) + (D \times 16^1) + (E \times 16^0))_{10}$ |
| Step 2 | $19FDE_{16}$ | $((1 \times 16^4) + (9 \times 16^3) + (15 \times 16^2) + (13 \times 16^1) + (14 \times 16^0))_{10}$ |
| Step 3 | $19FDE_{16}$ | $(65536 + 36864 + 3840 + 208 + 14)_{10}$ |
| Step 4 | $19FDE_{16}$ | $106462_{10}$ |

**Note :** $19FDE_{16}$ is normally written as 19FDE

**Number Conversion**

There are many methods or techniques which can be used to convert numbers from one base to another. We'll demonstrate here the following:

- Decimal to Other Base System
- Other Base System to Decimal
- Other Base System to Non-Decimal
- Shortcut method - Binary to Octal
- Shortcut method - Octal to Binary
- Shortcut method - Binary to Hexadecimal
- Shortcut method - Hexadecimal to Binary

**Decimal to Other Base System**

Steps

- **Step 1 -** Divide the decimal number to be converted by the value of the new base.
- **Step 2 -** Get the remainder from Step 1 as the rightmost digit (least significant digit) of new base number.
- **Step 3 -** Divide the quotient of the previous divide by the new base.
- **Step 4 -** Record the remainder from Step 3 as the next digit (to the left) of the new base number.

Repeat Steps 3 and 4, getting remainders from right to left, until the quotient becomes zero in Step 3.

The last remainder thus obtained will be the most significant digit (MSD) of the new base number.

**Example**

Decimal Number : $29_{10}$

Calculating Binary Equivalent:

| Step | Operation | Result | Remainder |
|---|---|---|---|
| Step 1 | 29 / 2 | 14 | 1 |
| Step 2 | 14 / 2 | 7 | 0 |
| Step 3 | 7 / 2 | 3 | 1 |
| Step 4 | 3 / 2 | 1 | 1 |
| Step 5 | 1 / 2 | 0 | 1 |

As mentioned in Steps 2 and 4, the remainders have to be arranged in the reverse order so that the first remainder becomes the least significant digit (LSD) and the last remainder becomes the most significant digit (MSD).

Decimal Number : $29_{10}$ = Binary Number : $11101_{2.}$

**Other base system to Decimal System**

Steps

- **Step 1 -** Determine the column (positional) value of each digit (this depends on the position of the digit and the base of the number system).

- **Step 2 -** Multiply the obtained column values (in Step 1) by the digits in the corresponding columns.
- **Step 3 -** Sum the products calculated in Step 2. The total is the equivalent value in decimal.

**Example**

Binary Number : $11101_2$

Calculating Decimal Equivalent:

| Step | Binary Number | Decimal Number |
|---|---|---|
| Step 1 | $11101_2$ | $((1 \times 2^4) + (1 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0))_{10}$ |
| Step 2 | $11101_2$ | $(16 + 8 + 4 + 0 + 1)_{10}$ |
| Step 3 | $11101_2$ | $29_{10}$ |

Binary Number : $11101_2$ = Decimal Number : $29_{10}$

**Other Base System to Non-Decimal System**

Steps

- **Step 1 -** Convert the original number to a decimal number (base 10).
- **Step 2 -** Convert the decimal number so obtained to the new base number.

**Example**

Octal Number : $25_8$

Calculating Binary Equivalent:

**Step 1 : Convert to Decimal**

| Step | Octal Number | Decimal Number |
|---|---|---|
| Step 1 | $25_8$ | $((2 \times 8^1) + (5 \times 8^0))_{10}$ |
| Step 2 | $25_8$ | $(16 + 5 )_{10}$ |
| Step 3 | $25_8$ | $21_{10}$ |

Octal Number : $25_8$ = Decimal Number : $21_{10}$

**Step 2 : Convert Decimal to Binary**

| Step | Operation | Result | Remainder |
|---|---|---|---|
| Step 1 | 21 / 2 | 10 | 1 |
| Step 2 | 10 / 2 | 5 | 0 |
| Step 3 | 5 / 2 | 2 | 1 |
| Step 4 | 2 / 2 | 1 | 0 |
| Step 5 | 1 / 2 | 0 | 1 |

Decimal Number : $21_{10}$ = Binary Number : $10101_2$

Octal Number : $25_8$ = Binary Number : $10101_2$

**Shortcut method - Binary to Octal**

Steps

- **Step 1 -** Divide the binary digits into groups of three (starting from the right).
- **Step 2 -** Convert each group of three binary digits to one octal digit.

**Example**

Binary Number : $10101_2$

Calculating Octal Equivalent:

| Step | Binary Number | Octal Number |
|---|---|---|
| Step 1 | $10101_2$ | 010 101 |
| Step 2 | $10101_2$ | $2_8$ $5_8$ |
| Step 3 | $10101_2$ | $25_8$ |

Binary Number : $10101_2$ = Octal Number : $25_8$

**Shortcut method - Octal to Binary**

Steps

- **Step 1 -** Convert each octal digit to a 3 digit binary number (the octal digits may be treated as decimal for this conversion).
- **Step 2 -** Combine all the resulting binary groups (of 3 digits each) into a single binary number.

**Example**

Octal Number : $25_8$

Calculating Binary Equivalent:

| Step | Octal Number | Binary Number |
|---|---|---|
| Step 1 | $25_8$ | $2_{10}\ 5_{10}$ |
| Step 2 | $25_8$ | $010_2\ 101_2$ |
| Step 3 | $25_8$ | $010101_2$ |

Octal Number : $25_8$ = Binary Number : $10101_2$

**Shortcut method - Binary to Hexadecimal**

Steps

- **Step 1 -** Divide the binary digits into groups of four (starting from the right).
- **Step 2 -** Convert each group of four binary digits to one hexadecimal symbol.

**Example**

Binary Number : $10101_2$

Calculating hexadecimal Equivalent:

| Step | Binary Number | Hexadecimal Number |
|---|---|---|
| Step 1 | $10101_2$ | 0001 0101 |
| Step 2 | $10101_2$ | $1_{10}\ 5_{10}$ |
| Step 3 | $10101_2$ | $15_{16}$ |

Binary Number : $10101_2$ = Hexadecimal Number : $15_{16}$

**Shortcut method - Hexadecimal to Binary**

Steps

- **Step 1 -** Convert each hexadecimal digit to a 4 digit binary number (the hexadecimal digits may be treated as decimal for this conversion).
- **Step 2 -** Combine all the resulting binary groups (of 4 digits each) into a single binary number.

**Example**

Hexadecimal Number : $15_{16}$

Calculating Binary Equivalent:

| Step | Hexadecimal Number | Binary Number |
|---|---|---|
| Step 1 | $15_{16}$ | $1_{10}\ 5_{10}$ |
| Step 2 | $15_{16}$ | $0001_2\ 0101_2$ |
| Step 3 | $15_{16}$ | $00010101_2$ |

Hexadecimal Number : $15_{16}$ = Binary Number : $10101_2$

**ELEMENTS OF A COMPUTER SYSTEM:**

**A computer system is a set of six elements viz.:**

i. Hardware,
ii. Software,
iii. People,
iv. Procedures,
v. Data and
vi. Connectivity.

***(i) Hardware:***

The physical components of a computer constitute its Hardware. These include keyboard, mouse, monitor and processor. Hardware consists of input devices and output devices that make a complete computer system.

Examples of input devices are keyboard, optical scanner, mouse and joystick which are used to feed data into the computer. Output devices such as monitor and printer are media to get the output from the computer.

***(ii) Software:***

A set of programs that form an interface between the hardware and the user of a computer system are referred to as Software.

**They are of six types:**

**(a) System software:**

A set of programs to control the internal operations such as reading data from input devices, giving results to output devices and ensuring proper functioning of components is called system software.

**(b) Application software:**

Programs designed by the user to perform a specific function, such as accounting software, payroll software etc.

**(c) Operating system:**

A set of tools and programs to manage the overall working of a computer using a defined set of hardware components is called an operating system. It is the interface between the user and the computer system.

**(d) Utility software:**

Certain special purpose programs that are designed to perform a specialized task, such as functions to copy, cut or paste files in a computer, formatting a disk etc.

**(e) Language processors:**

Special software to accept data and interpret it in the form of Machine /Assembly language understandable by a computer. It also ensures the correctness of language syntax and errors.

**(f) Connectivity software:**

A set of programs and instructions to connect the computer with the main server to enable sharing of resources and information with the server and other connected computers.

***(iii) People:***

The most important element of a computer system is its users. They are also called live-ware of the computer system.

**The following types of people interact with a computer system:**

**(a) System Analysts:**

People who design the operation and processing of the system.

**(b) System Programmers:**

People who write codes and programs to implement the working of the system

**(c) System Operators:**

People who operate the system and use it for different purposes. Also called the end users.

***(iv) Procedures:***

Procedure is a step by step series of instructions to perform a specific function and achieve desired output.

**In a computer system, there are three types of procedures:**

**(a) Hardware oriented procedure:**

It defines the working of a hardware component.

**(b) Software oriented procedure:**

It is a set of detailed instructions for using the software.

**(c) Internal procedure:**

It maintains the overall internal working of each part of a computer system by directing the flow of information.

***(v) Data:***

The facts and figures that are fed into a computer for further processing are called data. Data is raw until the computer system interprets it using machine language, stores it in memory, classifies it for processing and produces results in conformance with the instructions given to it. Processed and useful data is called information which is used for decision making.

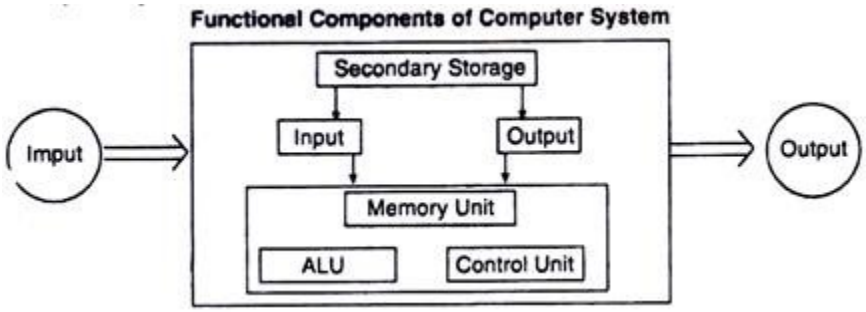
***(vi) Connectivity:***

When two or more computers are connected to each other, they can share information and resources such as sharing of files (data/music etc.), sharing of printer, sharing of facilities like the internet etc. This sharing is possible using wires, cables, satellite, infra-red, Bluetooth, microwave transmission etc.

**Components of A Computer System:**

A computer system mainly has three components viz. Input Unit, Central Processing Unit and Output Unit. These components are the building blocks of a computer and define its architecture.

**The relationship among these components is well established by the following diagram:**




***(i) Input Unit:***

Input unit is responsible for controlling the various input devices that are used to enter data into the computer. The commonly used input devices are mouse, keyboard, light pen, optical scanner etc. While some input devices are designed for special purposes such as Optical Character Recognition (OCR), Magnetic Ink Character Recognition (MICR) and Bar Code Reader etc, there are other devices that accept input by responding to physical touch and voice such as ATMs.

***(ii) Central Processing Unit (CPU):***

The CPU ensures the flow of data into the system by directing the data to enter the system, storing it into the memory and retrieving it when needed to produce the output.

**It has three parts:**

**(a) Arithmetic and Logic Unit (ALU):**

It performs all the arithmetical calculations and computations like addition, subtraction, multiplication and division. It is also responsible for logical calculations like comparisons among data items.

**(b) Memory Unit:**

The data has to be stored in the memory blocks of the computer before it is retrieved for actual processing.

**(c) Control Unit:**

As the name suggests, control unit controls and coordinates the activities of all the components of the computer system. It reads data from the memory, decodes the instructions, looks after its execution, and fetches the next instruction and so on.

***(iii) Output Unit:***

It controls various output devices like printer, graphic plotter, speech synthesizer, monitor (also known as Visual Display Unit or VDU) to produce the desired output and present it to the user. It ensures the convertibility of output into human readable form that is understandable by the user.

Examples include:

- Disk drive
- CD
- Ear phones
- Floppy Disk
- Pen drive
- Monitor
- Printers
- speakers

# TOPIC 3

# COMPUTER HARDWARE

Hardware represents the physical and tangible components of a computer i.e. the components that can be seen and touched.

Examples of Hardware are following:

- **Input devices --** keyboard, mouse etc.
- **Output devices --** printer, monitor etc.
- **Secondary storage devices --** Hard disk, CD, DVD etc.
- **Internal components --** CPU, motherboard, RAM etc.

**Components of a computer**

All types of computers follow a same basic logical structure and perform the following five basic operations for converting raw input data into information useful to their users.

| | Operation | Description |
|---|---|---|
| 1 | Take Input | The process of entering data and instructions into the computer system |
| 2 | Store Data | Saving data and instructions so that they are available for processing as and when required. |
| 3 | Processing Data | Performing arithmetic, and logical operations on data in order to convert them into useful information. |
| 4 | Output Information | The process of producing useful information or results for the user, such as a printed report or visual display. |
| 5 | Control the workflow | Directs the manner and sequence in which all of the above operations are performed. |

**INPUT DEVICES**

Following are few of the important input devices which are used in a computer:

- Keyboard
- Mouse
- Joy Stick
- Light pen
- Track Ball
- Scanner

- Graphic Tablet
- Microphone
- Magnetic Ink Card Reader(MICR)
- Optical Character Reader(OCR)
- Bar Code Reader
- Optical Mark Reader(OMR)

**Keyboard**

Keyboard is the most common and very popular input device which helps in inputting data to the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing additional functions.

Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet.

The keys on the keyboard are as follows:

| Sr.No | Keys | Description |
|---|---|---|
| 1 | Typing Keys | These keys include the letter keys (A-Z) and digit keys (0-9) which generally give same layout as that of typewriters. |
| 2 | Numeric Keypad | It is used to enter numeric data or cursor movement. Generally, it consists of a set of 17 keys that are laid out in the same configuration used by most adding machines and calculators. |
| 3 | Function Keys | The twelve function keys are present on the keyboard which are arranged in a row at the top of the keyboard. Each function key has unique meaning and is used for some specific purpose. |
| 4 | Control keys | These keys provide cursor and screen control. It includes four directional arrow keys. Control keys also include Home, End, Insert, Delete, Page Up, Page Down, Control(Ctrl), Alternate(Alt), Escape(Esc). |
| 5 | Special Purpose Keys | Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen. |

**Mouse**

Mouse is most popular pointing device. It is a very famous cursor-control device having a small palm size box with a round ball at its base which senses the movement of mouse and sends corresponding signals to CPU when the mouse buttons are pressed.

Generally it has two buttons called left and right button and a wheel is present between the buttons. Mouse can be used to control the position of cursor on screen, but it cannot be used to enter text into the computer.

**Advantages**

- Easy to use
- Not very expensive
- Moves the cursor faster than the arrow keys of keyboard.

**Joystick**

Joystick is also a pointing device which is used to move cursor position on a monitor screen. It is a stick having a spherical ball at its both lower and upper ends. The lower spherical ball moves in a socket. The joystick can be moved in all four directions.

The function of joystick is similar to that of a mouse. It is mainly used in Computer Aided Designing(CAD) and playing computer games.

**Light Pen**

Light pen is a pointing device which is similar to a pen. It is used to select a displayed menu item or draw pictures on the monitor screen. It consists of a photocell and an optical system placed in a small tube. When the tip of a light pen is moved over the monitor screen and pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU.

**Track Ball**

Track ball is an input device that is mostly used in notebook or laptop computer, instead of a mouse. This is a ball which is half inserted and by moving fingers on ball, pointer can be moved.

Since the whole device is not moved, a track ball requires less space than a mouse. A track ball comes in various shapes like a ball, a button and a square.

**Scanner**

Scanner is an input device which works more like a photocopy machine. It is used when some information is available on a paper and it is to be transferred to the hard disc of the computer for further manipulation. Scanner captures images from the source which are then converted into the digital form that can be stored on the disc. These images can be edited before they are printed.

**Digitizer**

Digitizer is an input device which converts analog information into digital form. Digitizer can convert a signal from the television or camera into a series of numbers that could be stored in a computer. They can be used by the computer to create a picture of whatever the camera had been pointed at. Digitizer is also known as Tablet or Graphics Tablet because it converts graphics and pictorial data into binary inputs. A graphic tablet as digitizer is used for doing fine works of drawing and image manipulation applications.

**Microphone**

Microphone is an input device to input sound that is then stored in digital form. The microphone is used for various applications like adding sound to a multimedia presentation or for mixing music.

**Magnetic Ink Card Reader(MICR)**

MICR input device is generally used in banks because of a large number of cheques to be processed every day. The bank's code number and cheque number are printed on the cheques with a special type of ink that contains particles of magnetic material that are machine readable. This reading process is called Magnetic Ink Character Recognition (MICR). The main advantages of MICR is that it is fast and less error prone.


**Optical Character Reader(OCR)**

OCR is an input device used to read a printed text. OCR scans text optically character by character, converts them into a machine readable code and stores the text on the system memory.

**Bar Code Readers**

Bar Code Reader is a device used for reading bar coded data (data in form of light and dark lines). Bar coded data is generally used in labelling goods, numbering the books etc. It may be a hand held scanner or may be embedded in a stationary scanner. Bar Code Reader scans a bar

code image, converts it into an alphanumeric value which is then fed to the computer to which bar code reader is connected.


**Optical Mark Reader(OMR)**

OMR is a special type of optical scanner used to recognize the type of mark made by pen or pencil. It is used where one out of a few alternatives is to be selected and marked. It is specially used for checking the answer sheets of examinations having multiple choice questions.


**PROCESSING DEVICES**

These are devices that transform inputs into outputs

**CPU(Central Processing Unit)**

CPU is considered as the brain of the computer. CPU performs all types of data processing operations. It stores data, intermediate results and instructions(program). It controls the operation of all parts of computer.

CPU itself has following three components

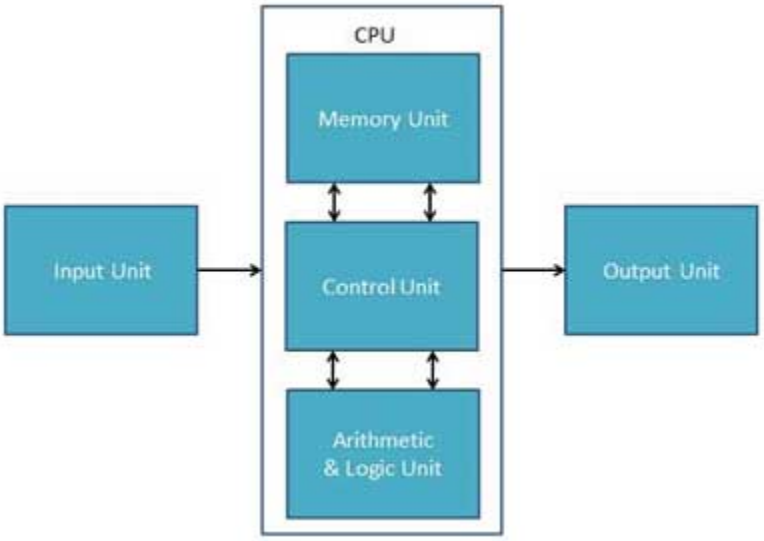
- ALU(Arithmetic Logic Unit)
- Memory Unit
- Control Unit

CPU consists of the following features:

- CPU is considered as the brain of the computer.
- CPU performs all types of data processing operations.
- It stores data, intermediate results and instructions(program).
- It controls the operation of all parts of computer.

CPU itself has following three components.

- Memory or Storage Unit
- Control Unit
- ALU(Arithmetic Logic Unit)



**Memory or Storage Unit**

This unit can store instructions, data and intermediate results. This unit supplies information to the other units of the computer when needed. It is also known as internal storage unit or main memory or primary storage or Random access memory(RAM).

Its size affects speed, power and capability. Primary memory and secondary memory are two types of memories in the computer. Functions of memory unit are:

- It stores all the data and the instructions required for processing.
- It stores intermediate results of processing.
- It stores final results of processing before these results are released to an output device.
- All inputs and outputs are transmitted through main memory.

**Control Unit**

This unit controls the operations of all parts of computer but does not carry out any actual data processing operations.

Functions of this unit are:

- It is responsible for controlling the transfer of data and instructions among other units of a computer.
- It manages and coordinates all the units of the computer.
- It obtains the instructions from the memory, interprets them, and directs the operation of the computer.
- It communicates with Input/Output devices for transfer of data or results from storage.
- It does not process or store data.

**ALU(Arithmetic Logic Unit)**

This unit consists of two subsections namely

- Arithmetic section
- Logic Section

**Arithmetic Section**

Function of arithmetic section is to perform arithmetic operations like addition, subtraction, multiplication and division. All complex operations are done by making repetitive use of above operations.

**Logic Section**

Function of logic section is to perform logic operations such as comparing, selecting, matching and merging of data.

## MEMORY

A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in computer where data is to be processed and instructions required for processing are stored. The memory is divided into large number of small parts called cells. Each location or cell has a unique address which varies from zero to memory size minus one. For example if computer has 64k words, then this memory unit has 64 * 1024=65536 memory locations. The address of these locations varies from 0 to 65535.

Memory is primarily of three types

- Cache Memory
- Primary Memory/Main Memory
- Secondary Memory

### Cache Memory

Cache memory is a very high speed semiconductor memory which can speed up CPU. It acts as a buffer between the CPU and main memory. It is used to hold those parts of data and program which are most frequently used by CPU. The parts of data and programs are transferred from disk to cache memory by operating system, from where CPU can access them.

### Advantages

The advantages of cache memory are as follows:

- Cache memory is faster than main memory.
- It consumes less access time as compared to main memory.
- It stores the program that can be executed within a short period of time.
- It stores data for temporary use.

### Disadvantages

The disadvantages of cache memory are as follows:

- Cache memory has limited capacity.
- It is very expensive.

**Primary Memory (Main Memory)**

Primary memory holds only those data and instructions on which computer is currently working. It has limited capacity and data is lost when power is switched off. It is generally made up of semiconductor device. These memories are not as fast as registers. The data and instruction required to be processed reside in main memory. It is divided into two subcategories RAM and ROM.

**Characteristics of Main Memory**

- These are semiconductor memories
- It is known as main memory.
- Usually volatile memory.
- Data is lost in case power is switched off.
- It is working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without primary memory.

**Secondary Memory**

This type of memory is also known as external memory or non-volatile. It is slower than main memory. These are used for storing data/Information permanently. CPU directly does not access these memories instead they are accessed via input-output routines. Contents of secondary memories are first transferred to main memory, and then CPU can access it. For example : disk, CD-ROM, DVD etc.

**Characteristic of Secondary Memory**

- These are magnetic and optical memories
- It is known as backup memory.
- It is non-volatile memory.
- Data is permanently stored even if power is switched off.
- It is used for storage of data in a computer.
- Computer may run without secondary memory.
- Slower than primary memories.


**Random access memory-RAM**

RAM(Random Access Memory) is the internal memory of the CPU for storing data, program and program result. It is read/write memory which stores data until the machine is working. As soon as the machine is switched off, data is erased.

Access time in RAM is independent of the address that is, each storage location inside the memory is as easy to reach as other locations and takes the same amount of time. Data in the RAM can be accessed randomly but it is very expensive.

RAM is volatile, i.e. data stored in it is lost when we switch off the computer or if there is a power failure. Hence a backup uninterruptible power system(UPS) is often used with computers. RAM is small, both in terms of its physical size and in the amount of data it can hold.

RAM is of two types

- Static RAM (SRAM)
- Dynamic RAM (DRAM)

**Static RAM (SRAM)**

The word **static** indicates that the memory retains its contents as long as power is being supplied. However, data is lost when the power gets down due to volatile nature. SRAM chips use a matrix of 6-transistors and no capacitors. Transistors do not require power to prevent leakage, so SRAM need not have to be refreshed on a regular basis.

Because of the extra space in the matrix, SRAM uses more chips than DRAM for the same amount of storage space, thus making the manufacturing costs higher. So SRAM is used as cache memory and has very fast access.

**Characteristic of the Static RAM**

- It has long life
- There is no need to refresh
- Faster
- Used as cache memory
- Large size
- Expensive
- High power consumption

**Dynamic RAM (DRAM)**

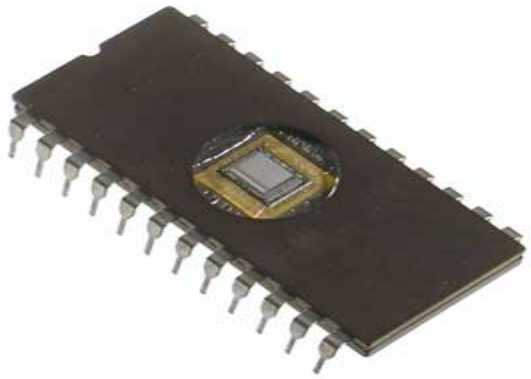
DRAM, unlike SRAM, must be continually **refreshed** in order to maintain the data. This is done by placing the memory on a refresh circuit that rewrites the data several hundred times per second. DRAM is used for most system memory because it is cheap and small. All DRAMs are made up of memory cells which are composed of one capacitor and one transistor.

**Characteristics of the Dynamic RAM**

- It has short data lifetime
- Need to be refreshed continuously
- Slower as compared to SRAM
- Used as RAM
- Lesser in size
- Less expensive
- Less power consumption

**Read Only Memory-ROM**

ROM stands for Read Only Memory. The memory from which we can only read but cannot write on it. This type of memory is non-volatile. The information is stored permanently in such memories during manufacture. A ROM, stores such instructions that are required to start a computer. This operation is referred to as bootstrap. ROM chips are not only used in the computer but also in other electronic items like washing machine and microwave oven.



Following are the various types of ROM

**MROM (Masked ROM)**

The very first ROMs were hard-wired devices that contained a pre-programmed set of data or instructions. These kind of ROMs are known as masked ROMs which are inexpensive.

**PROM (Programmable Read only Memory)**

PROM is read-only memory that can be modified only once by a user. The user buys a blank PROM and enters the desired contents using a PROM program. Inside the PROM chip there are small fuses which are burnt open during programming. It can be programmed only once and is not erasable.

**EPROM(Erasable and Programmable Read Only Memory)**

The EPROM can be erased by exposing it to ultra-violet light for a duration of up to 40 minutes. Usually, an EPROM eraser achieves this function. During programming, an electrical charge is trapped in an insulated gate region. The charge is retained for more than ten years because the charge has no leakage path. For erasing this charge, ultra-violet light is passed through a quartz crystal window(lid). This exposure to ultra-violet light dissipates the charge. During normal use the quartz lid is sealed with a sticker.

**EEPROM(Electrically Erasable and Programmable Read Only Memory)**

The EEPROM is programmed and erased electrically. It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 ms (milli second). In EEPROM, any location can be selectively erased and programmed. EEPROMs can be erased one byte at a time, rather than erasing the entire chip. Hence, the process of re-programming is flexible but slow.

**Advantages of ROM**

The advantages of ROM are as follows:

- Non-volatile in nature
- These cannot be accidentally changed
- Cheaper than RAMs
- Easy to test
- More reliable than RAMs
- These are static and do not require refreshing
- Its contents are always known and can be verified

**Motherboard**

The motherboard serves as a single platform to connect all of the parts of a computer together. A motherboard connects CPU, memory, hard drives, optical drives, video card, sound card, and other ports and expansion cards directly or via cables. It can be considered as the backbone of a computer.

**Features of Motherboard**

A motherboard comes with following features:

- Motherboard varies greatly in supporting various types of components.
- Normally a motherboard supports a single type of CPU and few types of memories.
- Video Cards, Hard disks, Sound Cards have to be compatible with motherboard to function properly
- Motherboards, cases and power supplies must be compatible to work properly together.

## Description of Motherboard

The motherboard is mounted inside the case and is securely attached via small screws through pre-drilled holes. Motherboard contains ports to connect all of the internal components. It provides a single socket for CPU whereas for memory, normally one or more slots are available. Motherboards provide ports to attach floppy drive, hard drive, and optical drives via ribbon cables. Motherboard carries fans and a special port designed for power supply.

There is a peripheral card slot in front of the motherboard using which video cards, sound cards and other expansion cards can be connected to motherboard.

On the left side, motherboards carry a number of ports to connect monitor, printer, mouse, keyboard, speaker, and network cables. Motherboards also provide USB ports which allow compatible devices to be connected in plug-in/plug-out fashion for example, pen drive, digital cameras etc.

## Memory Units

Memory unit is:

- the amount of data that can be stored in the storage unit.
- that in which storage capacity is expressed in terms of Bytes.

Following are the main memory storage units:

| Sr.No. | Unit | Description |
|---|---|---|
| 1 | Bit (Binary Digit) | A binary digit is logical 0 and 1 representing a passive or an active state of a component in an electric circuit. |
| 2 | Nibble | A group of 4 bits is called nibble. |
| 3 | Byte | A group of 8 bits is called byte. A byte is the smallest unit which can represent a data item or a character. |
| 4 | Word | A computer word, like a byte, is a group of fixed number of bits processed as a unit which varies from computer to computer but is fixed for each computer.<br><br>The length of a computer word is called word-size or word length and it may be as small as 8 bits or may be as long as 96 bits. A computer stores the information in the form of computer words. |

Few higher storage units are following

| Sr.No. | Unit | Description |
|---|---|---|
| 1 | Kilobyte (KB) | 1 KB = 1024 Bytes |
| 2 | Megabyte (MB) | 1 MB = 1024 KB |
| 3 | GigaByte (GB) | 1 GB = 1024 MB |
| 4 | TeraByte (TB | 1 TB = 1024 GB |
| 5 | PetaByte (PB) | 1 PB = 1024 TB |

**Ports**

**What is a Port?**

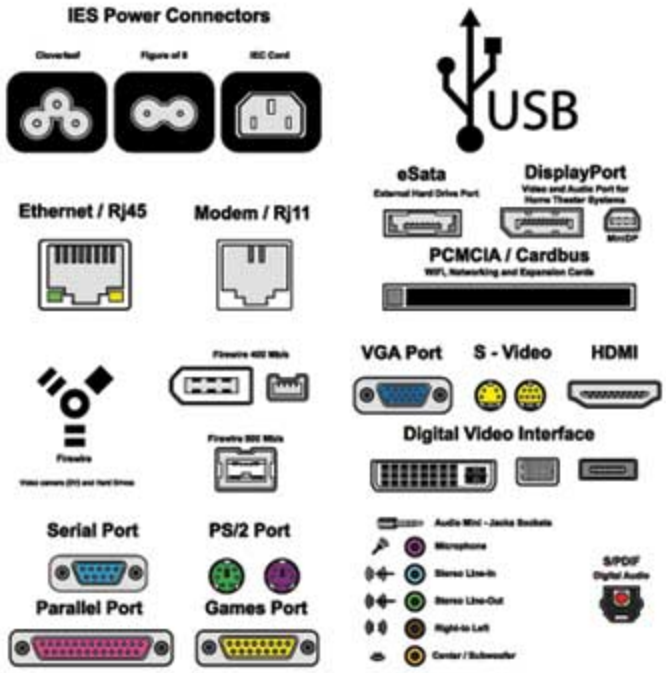
A port:

- is a physical docking point using which an external device can be connected to the computer.
- can also be programmatic docking point through which information flows from a program to computer or over the internet.

**Characteristics**

A port has the following characteristics:

- External devices are connected to a computer using cables and ports.
- Ports are slots on the motherboard into which a cable of external device is plugged in.
- Examples of external devices attached via ports are mouse, keyboard, monitor, microphone, speakers etc.




Following are few important types of ports:

**Serial Port**

- Used for external modems and older computer mouse
- Two versions : 9 pin, 25 pin model
- Data travels at 115 kilobits per second

**Parallel Port**

- Used for scanners and printers
- Also called printer port
- 25 pin model
- Also known as IEEE 1284-compliant Centronics port

**PS/2 Port**

- Used for old computer keyboard and mouse
- Also called mouse port
- Most of the old computers provide two PS/2 port, each for mouse and keyboard
- Also known as IEEE 1284-compliant Centronics port

**Universal Serial Bus (or USB) Port**

- It can connect all kinds of external USB devices such as external hard disk, printer, scanner, mouse, keyboard etc.

- It was introduced in 1997.
- Most of the computers provide two USB ports as minimum.
- Data travels at 12 megabits per seconds
- USB compliant devices can get power from a USB port

**VGA Port**

- Connects monitor to a computer's video card.
- Has 15 holes.
- Similar to serial port connector but serial port connector has pins, it has holes.

**Power Connector**

- Three-pronged plug
- Connects to the computer's power cable that plugs into a power bar or wall socket

**Firewire Port**

- Transfers large amount of data at very fast speed.
- Connects camcorders and video equipments to the computer
- Data travels at 400 to 800 megabits per seconds
- Invented by Apple
- Three variants : 4-Pin FireWire 400 connector, 6-Pin FireWire 400 connector and 9-Pin FireWire 800 connector

**Modem Port**

- Connects a PC's modem to the telephone network

**Ethernet Port**

- Connects to a network and high speed Internet.
- Connect network cable to a computer.
- This port resides on an Ethernet Card.
- Data travels at 10 megabits to 1000 megabits per seconds depending upon the network bandwidth.

**Game Port**

- Connect a joystick to a PC
- Now replaced by USB.

**Digital Video Interface, DVI port**

- Connects Flat panel LCD monitor to the computer's high end video graphic cards.
- Very popular among video card manufacturers.

**Sockets**

- Connect microphone, speakers to sound card of the computer

**Relationship between Hardware and Software**

- Hardware and software are mutually dependent on each other. Both of them must work together to make a computer produce a useful output.
- Software cannot be utilized without supporting hardware.
- Hardware without set of programs to operate upon cannot be utilized and is useless.
- To get a particular job done on the computer, relevant software should be loaded into the hardware
- Hardware is a one-time expense.
- Software development is very expensive and is a continuing expense.
- Different software applications can be loaded on a hardware to run different jobs.
- A software acts as an interface between the user and the hardware.
- If hardware is the 'heart' of a computer system, then software is its 'soul'. Both are complimentary to each other.

**OUTPUT DEVICES**

Following are few of the important output devices which are used in a computer.

- Monitors
- Printer
- Speakers

**Monitors**

Monitors, commonly called as Visual Display Unit (VDU), are the main output device of a computer. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of pixels.

There are two kinds of viewing screen used for monitors.

- Cathode-Ray Tube (CRT)
- Flat- Panel Display

**Cathode-Ray Tube (CRT) Monitor**

The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity, or resolution. It takes more than one illuminated pixel to form whole character, such as the letter ‘e’ in the word help.

A finite number of characters can be displayed on a screen at once. The screen can be divided into a series of character boxes - fixed location on the screen where a standard character can be placed. Most screens are capable of displaying 80 characters of data horizontally and 25 lines vertically. There are some disadvantages of CRT:

- Large in Size
- High power consumption

**Flat-Panel Display Monitor**

The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement in comparison to the CRT. You can hang them on walls or wear them on your wrists. Current uses of flat-panel displays include calculators, video games, monitors, laptop computer, graphics display.

The flat-panel display is divided into two categories:

- **Emissive Displays -** The emissive displays are devices that convert electrical energy into light. Example are plasma panel and LED(Light-Emitting Diodes).
- **Non-Emissive Displays -** The Non-emissive displays use optical effects to convert sunlight or light from some other source into graphics patterns. Example is LCD(Liquid-Crystal Device)

**Printers**

Printer is an output device, which is used to print information on paper.

There are two types of printers:

- Impact Printers

- Non-Impact Printers

**Impact Printers**

The impact printers print the characters by striking them on the ribbon which is then pressed on the paper.

Characteristics of Impact Printers are the following:

- Very low consumable costs
- Very noisy
- Useful for bulk printing due to low cost
- There is physical contact with the paper to produce an image

These printers are of two types

- Character printers
- Line printers

**Character Printers**

Character printers are the printers which print one character at a time.

These are further divided into two types:

- Dot Matrix Printer(DMP)
- Daisy Wheel

***Dot Matrix Printer***

In the market one of the most popular printers is Dot Matrix Printer. These printers are popular because of their ease of printing and economical price. Each character printed is in form of pattern of dots and head consists of a Matrix of Pins of size (5*7, 7*9, 9*7 or 9*9) which come out to form a character that is why it is called Dot Matrix Printer.

**Advantages**

- Inexpensive
- Widely Used
- Other language characters can be printed

**Disadvantages**

- Slow Speed
- Poor Quality

***Daisy Wheel***

Head is lying on a wheel and pins corresponding to characters are like petals of Daisy (flower name) that is why it is called Daisy Wheel Printer. These printers are generally used for word-processing in offices which require a few letters to be sent here and there with very nice quality.

**Advantages**

- More reliable than DMP
- Better quality
- The fonts of character can be easily changed

**Disadvantages**

- Slower than DMP
- Noisy
- More expensive than DMP

**Line Printers**

Line printers are the printers which print one line at a time.

These are of further two types

- Drum Printer
- Chain Printer

***Drum Printer***

This printer is like a drum in shape so it is called drum printer. The surface of drum is divided into number of tracks. Total tracks are equal to size of paper i.e. for a paper width of 132 characters, drum will have 132 tracks. A character set is embossed on track. The different character sets available in the market are 48 character set, 64 and 96 characters set. One rotation of drum prints one line. Drum printers are fast in speed and can print 300 to 2000 lines per minute.

**Advantages**

- Very high speed

**Disadvantages**

- Very expensive
- Characters fonts cannot be changed

***Chain Printer***

In this printer, chain of character sets are used so it is called Chain Printer. A standard character set may have 48, 64, or 96 characters.

**Advantages**

- Character fonts can easily be changed.
- Different languages can be used with the same printer.

**Disadvantages**

- Noisy

**Non-impact Printers**

Non-impact printers print the characters without using ribbon. These printers print a complete page at a time so they are also called as Page Printers.

These printers are of two types

- Laser Printers
- Inkjet Printers

**Characteristics of Non-impact Printers**

- Faster than impact printers.
- They are not noisy.
- High quality.
- Support many fonts and different character size.

**Laser Printers**

These are non-impact page printers. They use laser lights to produce the dots needed to form the characters to be printed on a page.

***Advantages***

- Very high speed
- Very high quality output
- Give good graphics quality
- Support many fonts and different character size

***Disadvantages***

- Expensive.
- Cannot be used to produce multiple copies of a document in a single printing.

**Inkjet Printers**

Inkjet printers are non-impact character printers based on a relatively new technology. They print characters by spraying small drops of ink onto paper. Inkjet printers produce high quality output with presentable features.

They make less noise because no hammering is done and these have many styles of printing modes available. Colour printing is also possible. Some models of Inkjet printers can produce multiple copies of printing also.

***Advantages***

- High quality printing
- More reliable

***Disadvantages***

- Expensive as cost per page is high
- Slow as compared to laser printer

**Speakers**

There are two types of speakers used in computers. Those that are inbuilt and external speakers

**COMMUNICATIONS DEVICE**

A communication device is piece of equipment or hardware designed to move information or data from one place to another, in other words, allowing one computer device to communicate with another. There are many examples of communication devices and we will look at a few below.

**Network interface card (NIC) or Network connector**

Computers on a network need to be able to communicate with the server and with other computers. In order to do this, a network interface card (NIC) is required or a built-in network chip is included on the motherboard, such as in the laptop opposite..

The hardware handles all the physical network signals.

The NIC allows data to be communicated to and from a networked computer.

**Wi-fi cards**

When you are using your computer on a wireless network, you need to be able to send data to and receive data from the server and other computers on the network. This may be done by a built-in wi-fi in your laptop or mobile device connected to a local network.

If your laptop needs to connect via a mobile wi-fi network whilst on the move, then you can also purchase a Wi-Fi 'dongle' that looks like a memory stick and is inserted into a USB port. It works in just the same way but is designed to work with a specific mobile internet network provider.

**Router**

This is a very important network communication device. It is responsible for sending network traffic to its correct destination. It works by reading the destination network address within each data packet and sends it along its way. There can be many routers on a large network.

**Modem**

A Modem is a device used to convert digital data to analogue data in order to transmit it over the telephone network (MODulation).

It will also convert the analogue data back into digital data when the computer is receiving data from the telephone network (DEModulation).

So together the device MODulates and DEModulates, hence MODEM

## FACTORS DETERMINING THE PROCESSING POWER OF A COMPUTER

There are many factors which affect how fast your computer can process data and instructions:

1. Registers
2. RAM
3. The System Clock
4. The Bus
5. Cache Memory

### 1. Registers

- The CPU contains of small memory areas: called registers, which store data and instructions while the CPU processes them.
- The size of the registers determines the amount of data with which the computer can work at a one time.
- Today most PC`s have 32-bit registers, mean the CPU can process four bytes data at one time. Register sizes are rapidly growing to 64 bits.

### 2. RAM

- The amount of RAM in a PC has a direct affect on the system`s speed.

- The more RAM a PC has. the more program instructions and data can be held in memory, which is faster than storage on disk.
- If a PC does not have enough memory to run a program, it must move data between RAM and the hard disk frequently. This process called swapping, can greatly slow a PC`s performance.

**3. The System Clock**

- The computer`s system clock sets the pace the CPU by using a vibrating quartz crystal.
- A single "tick" of the clock is the time required to turn a transistor off and back on.This is called a clock cycle.
- Clock cycles are measured in Hertz(Hz),a measure of cycles per second.If a computer has a clock speed of 300 MHz, then its system clock"ticks" 300 million times every seconds.
- The faster a PCs clock runs,the more instructions the PC can execute each second.

**4. The Bus**

- A bus is a path between the components of a computer.Data and instructions travel along these paths.
- The data bus width determines how many bits can be transmitted between the CPU and other devices.
- The address buss runs only between the CPU and RAM, and carries nothing but memory addresses for the CPU to use.
- Peripheral devices are connected to the CPU by an expansion bus.

**5. Cache Memory**

- Cache memory is high-speed memory that holds the most recent data and instructions that have been loaded by the CPU.
- Cache is located directly on the CPU or between the CPU and RAM,making it faster than normal RAM.
- CPU-resident cache is called Level-1 (L1)cache.External cache is called Level-2 (L2) cache.
- The amount of cache memory has a tremendous impact on the computer`s speed.

**Hardware Acquisition**

In acquiring hardware, organization needs to keep in mind that "Software" is the heart of the system, when selecting the system, those software to be used must efficiently and effectively satisfy organizaton's overall needs first, and the "Hardware" to be acquired must be able to support that selected software.

Hardware acquisition will normally involve those acquiring individuals or organizations in lots of learning about the new advancement in technology. The typical process will need to be well-organized, and it always requires buyers to conduct thorough analysis of the available equipment in order to ensure an appropriate selection that will perfectly satisfy their needs.

**Factors to consider in selection of computer hardware**

1. The volume of the data and the urgency of processing
2. Hardware availability and its cost of acquisition and maintenance
3. The cost of the mode
4. The computer response time
5. The required operating systems its cost and sustainability
6. The geographical separation between the terminal and the processors
7. Availability of required personnel including the cost of training them
8. The reliability efficiency, security of the mode

# TOPIC 4

# COMPUTER SOFTWARE

## OVERVIEW OF COMPUTER SOFTWARE

Software is detailed step-by-step sequence of instructions known as programme which guide computer hardware. A computer programme is a sequence of instructions that tell the computer hardware what to do. Programmes are written in (programming) languages, which consist of a set of symbols combined according to a given syntax.

A programme must be in main memory (RAM) to be executed. These invisible, intangible components of a computer that direct and control the operations of the hardware when processing data are referred to as software.

### Features of software

- An operating system is a program that acts as an interface between the software and the computer hardware.
- It is an integrated set of specialised programs that are used to manage overall resources and operations of the computer.
- It is specialised software that controls and monitors the execution of all other programs that reside in the computer, including application programs and other system software.

Software is classified into two major types: **System** and **Application** software.

## SYSTEM SOFTWARE

System software consists of programmes that coordinates the activities of hardware and other programs. System software is designed for a specific CPU and hardware class. The combination of a particular hardware configuration and operating system is called a computer platform. These programmes manage the ―behind the scenes‖ operation of the computer.

### Examples

- Operating systems
- Utility Programmes - Utility programmes often come installed in computer systems or packaged with operating systems. Utilities can also be purchased individually. Utility programmes perform useful tasks, such as virus detection, tracking computer jobs and compressing data.
- Language processors – Compilers and interpreters □

**Operating systems**

The functions of an operating system include:

1. Performing common hardware functions
2. Accepting input and store data on disks and send data to output devices
3. Providing a user interface
4. Providing hardware independence
5. Managing system memory
6. Managing processing
7. Controlling access to system resources
    - Protection against unauthorised access
    - Logins and passwords
8. Managing files- Physical storage location
    - File permissions
    - File access

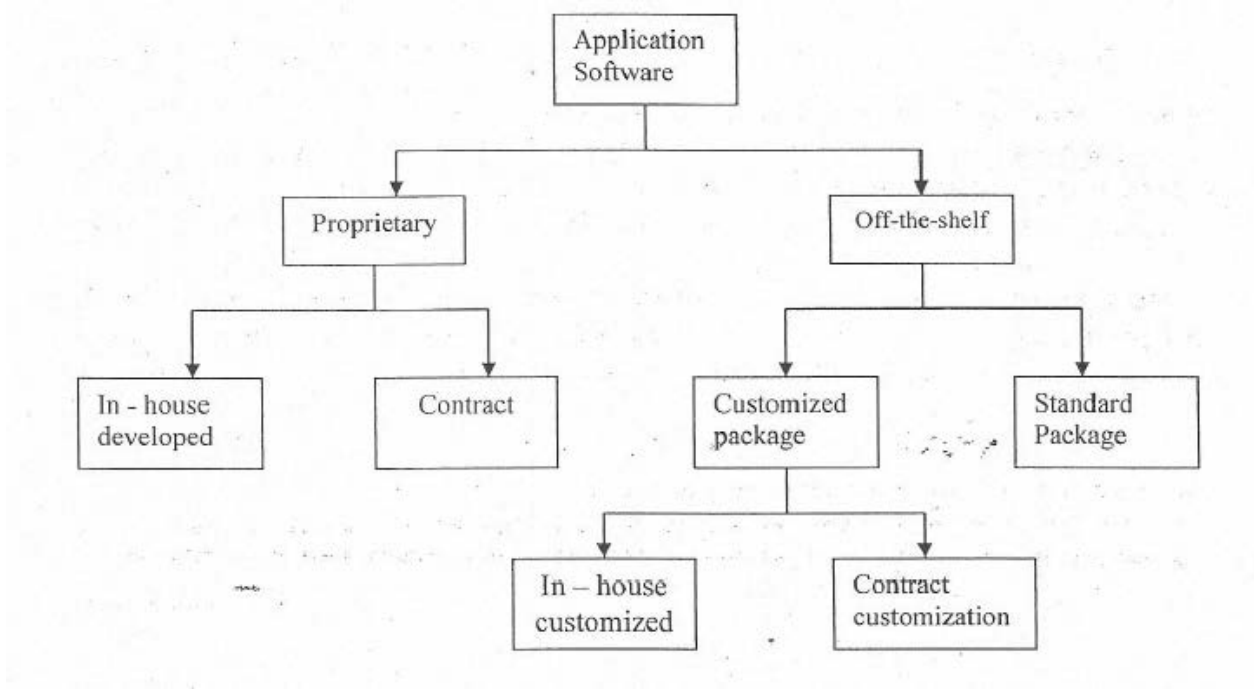
Examples of operating systems include: -

- DOS – Disk Operating System
- Windows XP, 7,8
- Linux, Unix, MAC OS, System/7

**APPLICATION SOFTWARE**

Applications software include programmes designed to help end users solve particular problems using the computer or to perform specific tasks.

**Sources of software**




**PROPRIETARY SOFTWARE**

Is a computer software which is legal property of one party. The terms of use for otherparties is defined by contracts or licensing agreements.

**Advantages of proprietary software**

- You can get exactly what you need in terms of reports, features etc.
- Being involved in development offers a further level in control over results. may be required to counteract a new initiative by a competitor or to meet new supplier or customer requirements. A merger with another firm or an acquisition will also necessitate software changes to meet new business needs.

**Disadvantages of proprietary software**

- It can take a long time and significant resources to develop required features.
- Inhouse system development staff may become hard pressed to provide the required level of ongoing support and maintenance because of pressure to get on to other new projects.
- There is more risk concerning the features and performance of the software that has yet to be developed.

**OFF-THE-SHELF SOFTWARE**

Off-the-shelf is a term for software or hardware, generally technology or computer products that are ready-made and available for sale, lease or license to the general public.

**Advantages of off-the-shelf software**

- The initial cost is lower since the software firm is able to spread the development costs over a large number of customers.
- There is lower risk that the software will fail to meet the basic business needs
- You can analyse existing features and performance of the package
- Package is likely to be of high quality since many customer firms have tested the software and helped identify many of its bugs.

**Disadvantages of off-the-shelf software**

- An organisation may have to pay for features that are not required or never used.
- The software may lack important features, thus requiring future modifications or customisation. This can be very expensive because users must adopt future releases of the software.
- Software may not match current work processes and data standards.

Application software is further classified into general-purpose software and applications which include:

- Word processing – Create, edit and print text documents, e.g. MS Word and Word Perfect. □
- Spreadsheets – Provide a wide range of built-in functions for statistical, logical, financial, database, graphics, data and time calculations, e.g. Lotus 1-2-3, Excel and Quattro Pro.
- Database management systems (DBMS) – Store, manipulate and retrieve data. e.g. Access, FoxPro and dBase.
- Online Information Services – Obtain a broad range of information from commercial services. e.g. America Online and CompuServe
- Communications - Ms Outlook for email
- Browsers e.g Internet Explorer and Eudora
- Graphics – Develop graphs, illustrations and drawings. e.g. PaintShop, FreeHand and Corel
- Project Management – Plan, schedule, allocate and control people and resources needed to complete a project according to schedule. e.g. Project for Windows andTime Line.
- Financial Management – Provide income and expense tracking and reporting to monitor and plan budgets, e.g. Quicken
- Desktop publishing - used to create high-quality printed output including text and graphics; various styles of pages can be laid out; art and text from other programmes can also be integrated into published pages, e.g. PageMaker and Publisher.
- Presentation packages like MS PowerPoint

## COMPUTER PROGRAMMING LANGUAGES

Programming languages are collections of commands, statements and words that are combined using a particular syntax, or rules, to write both systems and application software.
This results in meaningful instructions to the CPU.

## GENERATIONS OF PROGRAMMING LANGUAGES

### Machine Language (1st Generation Languages)

A machine language consists of binary digit, that is, zeroes (0) and ones (1). Instructions and addresses are written in binary (0,1) code. Binary is the only ―language‖ a CPU can understand. The CPU directly interprets and executes this language, therefore making its execution of instructions fast. Machine language programmes directly instructed the computer hardware, so they were not portable. That is, a programme written for computer model A could not be run on computer model B without being rewritten. All software in other languages must ultimately be translated down to machine language form. The translation process makes the other languages slower.

### Advantage

• The only advantage is that programmes of machine languages run very fast because no translation programme is required for the CPU.

### Disadvantages

- It is very difficult to programmes in machine language. The programmer has to know details of hardware to write the programme.
- The programmer has to remember a lot of codes to write a programme, which sometimes result in errors.
- It is difficult to debug a programme.

### Assembly Language (2nd Generation Languages)

Uses symbols and codes instead of binary digits to represent programme instructions. It is a symbolic language meaning that instructions and addresses are written using alphanumeric labels that are meaningful to the programmer.

The resulting programmes still directly instruct the computer hardware. For example, an assembly language instruction might move a piece of data stored at a particular location in RAM into a particular location on the CPU. Therefore, like their first generation counterparts, second generation programmes were not easily portable.

Assembly languages were designed to run in a small amount of RAM. Furthermore, they are low-level languages; that is the instructions directly manipulate the hardware. Therefore, programmes written in assembly language execute efficiently and quickly. As a result, more systems software is still written using assembly languages.

The language has a one-to-one mapping with machine instructions but has macros added to it. A macro is a group of multiple machine instructions, which are considered as one instruction in assembly language. A macro performs a specific task, for example adding and subtracting. A one-to-one mapping means that for every assembly instruction, there is corresponding single or multiple instructions in machine language.

An assembler is used to translate the assembly language statements into machine language.

**Advantages:**

- The symbolic programming of Assembly Language is easier to understand and saves a lot of time and effort of the programmer.
- It is easier to correct errors and modify programme instructions.
- Assembly Language has the same efficiency of execution as the machine level language. This is because this is a one-to-one translator between assembly language programme and its corresponding machine language programme.

**Disadvantages:**

- One of the major disadvantages is that assembly language is machine dependent. A programme written for one computer might not run in other computers with a different hardware configuration.

**High-level languages (3rd Generation Languages)**

Third generation languages are easier to learn and use than were earlier generations. Thus programmers are more productive when using third generation languages. For most applications, this increased productivity and compensates for the decrease in speed and efficiency of the resulting programmes. Furthermore, programmes written in third generation languages are portable, that is, a program written to run on a particular type of computer can be run with little or no modification on another type of computer. Portability is possible because third generation languages are ―high-level languages‖; that is, instructions do not directly manipulate the computer hardware.

Third generation languages are sometimes referred to as ―procedural‖ languages since programme instructions, must give the computer detailed instructions of how to reach the desired result.

High-level languages incorporated greater use of symbolic code. Its statements are more English– like, for example print, get and while. They are easier to learn but the resulting

programme is slower in execution. Examples include Basic, Cobol, C and Fortran. They have first to be compiled (translated into corresponding machine language statements) through the use of compilers.

**Advantages of High Level Languages**

- Higher level languages have a major advantage over machine and assembly languages since they high are easy to learn and use.
- Are portable

**Fourth Generation Languages (4GLs)**

Fourth generation languages are even easier to use, and more English-like, than are third generation languages. Fourth generation languages are sometimes referred to as ―non - procedural‖, since programmes tell the computer what it needs to accomplish, but do not provide detailed instructions as to how it should accomplish it. Since fourth generation languages concentrate on the output, not procedural details, they are more easily used by people who are not computer specialists, that is, by end users.

Many of the first fourth generation languages were connected with particular database management systems. These languages were called Query Languages since they allow people to retrieve information from databases. Structured query language, SQL, is a current fourth generation language used to access many databases. There are also some statistical fourth generation languages, such as SAS and SPSS.

Some fourth generation languages, such as Visual C++, Visual Basic, or PowerBuilder are targeted to more knowledgeable users, since they are more complex to use. Visual programming languages, such as visual basic, use windows, icons, and pull down menus to make programming easier and more intuitive.

**Object Oriented Programming**

First, second, third and fourth generation programming languages were used to construct programmes that contained procedures to perform operations, such as draw or display, on data elements defined in a file.

Object oriented programmes consist of objects, such as a time card, that include descriptions of the data relevant to the object, as well as the operations that can be done on that data. For example, included in the time card object, would be descriptions of such data such as employee name, hourly rate, start time and. The time card object would also contain descriptions of such operations as calculating total hours worked or calculating total pay.

***Object Oriented Programming has great advantages over other programming styles:***

- ***Code Reuse and Recycling***: Objects created for Object Oriented Programs can easily be reused in other programs.
- ***Encapsulation (part 1)***: Once an Object is created, knowledge of its implementation is not necessary for its use. In older programs, coders needed understand the details of a piece of code before using it (in this or another program).
- ***Encapsulation (part 2)***: Objects have the ability to hide certain parts of themselves from programmers. This prevents programmers from tampering with values they shouldn't. Additionally, the object controls how one interacts with it, preventing other kinds of errors. For example, a programmer (or another program) cannot set the width of a window to -400.
- ***Design Benefits***: Large programs are very difficult to write. Object Oriented Programs force designers to go through an extensive planning phase, which makes for better designs with less flaws. In addition, once a program reaches a certain size, Object Oriented Programs are actually *easier* to program than non-Object Oriented ones.
- ***Software Maintenance:*** Programs are not disposable. Legacy code must be dealt with on a daily basis, either to be improved upon (for a new version of an exist piece of software) or made to work with newer computers and software. An Object Oriented Program is much easier to modify and maintain than a non-Object Oriented Program. So although a lot of work is spent before the program is written, less work is needed to maintain it over time.

**Program Development Life Cycle**

The following are six steps in the Program Development Life Cycle:

1. **Analyze the problem**. The computer user must figure out the problem, and the best program to fix it.
2. **Design the program.** A flow chart is important to use during this step of the PDLC. This is a visual diagram of the flow containing the program. All in all, this step is breaking down the problem.
3. **Code the program.** This is using the language of programming to write the lines of code. The code is called the listing or the source code. The computer user will run an object code for this step.
4. **Debug the program**. The computer user must debug. This is the process of finding the "bugs" on the computer. The bugs are important to find because this is known as errors in a program.
5. **Formalize the solution.** One must run the program to make sure there are no syntax and logic errors. Syntax are grammatical errors and logic errors are incorrect results.
6. **Document and maintain the program.** This step is the final step of gathering everything together. Internal documentation is involved in this step because it explains the reasoning one might of made a change in the program or how to write a program.

**Language translators**
Although machine language is the only language the CPU understands, it is rarely used anymore since it is so difficult to use. Every programme that is not written in machine language must be translated into machine language before it can be executed. This is done by a category of system software called language translation software. These are programmes that convert the code originally written by the programmer, called source code, into its equivalent machine language programme, called object code.

There are two main types of language translators: interpreters and compilers.

**Interpreters**
While a programme is running, interpreters read, translate, and execute one statement of the programme at a time. The interpreter displays any errors immediately on the monitor. Interpreters are very useful for people learning how to programme or debugging a programme. However, the line-by-line translation adds significant overhead to the programme execution time leading to slow execution.

**Compilers**
A compiler uses a language translation programme that converts the entire source programme into object code, known as an object module, at one time. The object module is stored and it is the module that executes when the programme runs. The programme does not have to be compiled again until changes are made in the source code.

## SELECTION AND ACQUISITION OF COMPUTER SOFTWARE

Here are five things to consider when selecting a software solution as the plan is put in place.

1. **What the Software Needs to Do:**

Compile a list of the tasks. Ask everyone who will use the solution to make a list of their top 10 tasks. Be specific: Weekly Sales Reports by City, print invoices or e-mail receipts are specific features. It is also important to identify the information that needs to be stored or tracked such as customer names and addresses; vendors who send holiday gifts; past trip history; specific travel requirements; and more.

2. **Custom Designed or Pre-Written**

You will find that almost any type business has a choice of pre-written, off-the-shelf software solutions. These will include basic functions such as customer relations management (CRM), sales, accounting, vendor and product management and reporting, tailored for your specific industry or product. Pre-written solutions can save a great deal of time and money over custom solutions – they come pre-tested and ready to run. Custom solutions provide the best fit if your business is truly unique but time, money and the patience of Job will be required. My recommendation: a pre-written solution that allows a great deal of customization offers the best of both worlds.

### 3. Where the Solution Will Run

Your business solution will typically be shared by all or most of the computers on your office network. It can be hosted on a local computer or it can be hosted on a server somewhere on the Internet. The functions of your solution will determine the best method of hosting. Solutions or applications that are more specific or generic in function make good candidates for internet hosting. Internet applications are developed to be a “one-size-fits-all”, they are generally “rented” and they are not as customizable as an in-office solution. On the other hand, solutions that have a broader range of functionality or are more customized are better implemented on your local network. For your development dollar, generally you can get more features if the solution is designed to be hosted on your local network. Other considerations: security, backups, access to your data. If the solution and data are in your office, you have more control.

### 4. Budget

Set a realistic budget by speaking with other, similar companies who have recently implemented a solution. Trade groups are a good source for contacts. Don’t forget to consider required hardware upgrades, customization of the solution, training and support.

### 5. Demonstrations and References

One would assume that the salesperson can make the software look good but try to find one that has practical experience in your line of business. Ask about the developers or programmers, it’s a big plus if they have experience in your industry beyond the “programming”. Speak with actual users about their implementation experience, software’s performance, solution’s reliability, customer service team, scalability, and more.

When an integrated software solution is thoughtfully selected and systematically integrated into the office’s operation, the return on investment can be immediate and huge. Any office task you might think of can be completed more quickly with a well-designed, integrated solution. Rooming lists can be generated with a button click instead of editing or typing a document. Accounting reports can be automatically updated if a reservation changes, and invoices or receipts can be automatically queued and delivered. Tours or a series of tours can be “set up” in the system ready for booking with no more effort than creating the first one.

# TOPIC 5

# INTRODUCTION TO OPERATING SYSTEMS

## OVERVIEW OF OPERATING SYSTEMS

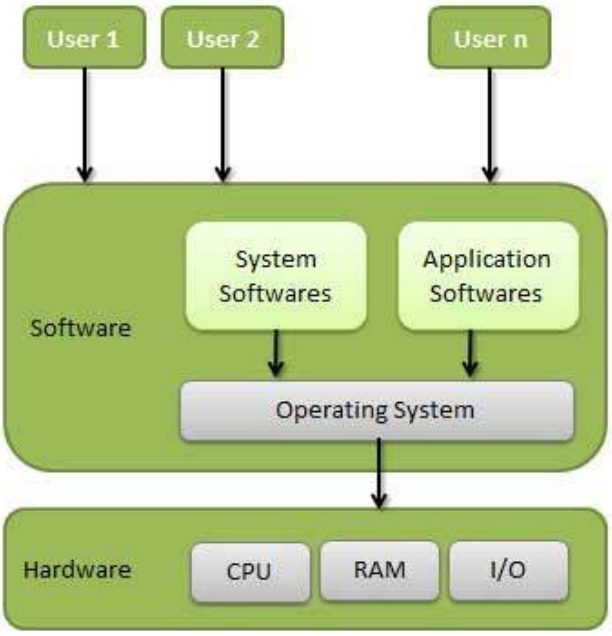
An operating system (OS) is a collection of software that manages computer hardware resources and provides common services for computer programs. The operating system is a vital component of the system software in a computer system.

An operating System (OS) is an intermediary between users and computer hardware. It provides users an environment in which a user can execute programs conveniently and efficiently.

In technical terms, It is a software which manages hardware. An operating System controls the allocation of resources and services such as memory, processors, devices and information.

### Definition

An operating system is a program that acts as an interface between the user and the computer hardware and controls the execution of all kinds of programs.



## FUNCTIONS OF AN OPERATING SYSTEM

## SERVICES

An Operating System provides services to both the users and to the programs.

- It provides programs, an environment to execute.
- It provides users, services to execute the programs in a convenient manner.

Following are few common services provided by operating systems.

- Program execution
- I/O operations
- File System manipulation
- Communication
- Error Detection
- Resource Allocation
- Protection

### Program execution

Operating system handles many kinds of activities from user programs to system programs like printer spooler, name servers, file server etc. Each of these activities is encapsulated as a process.

A process includes the complete execution context (code to execute, data to manipulate, registers, OS resources in use). Following are the major activities of an operating system with respect to program management.

- Loads a program into memory.
- Executes the program.
- Handles program's execution.
- Provides a mechanism for process synchronization.
- Provides a mechanism for process communication.
- Provides a mechanism for deadlock handling.

### I/O Operation

I/O subsystem comprised of I/O devices and their corresponding driver software. Drivers hides the peculiarities of specific hardware devices from the user as the device driver knows the peculiarities of the specific device.

Operating System manages the communication between user and device drivers. Following are the major activities of an operating system with respect to I/O Operation.

- I/O operation means read or write operation with any file or any specific I/O device.
- Program may require any I/O device while running.
- Operating system provides the access to the required I/O device when required.

**File system manipulation**

A file represents a collection of related information. Computer can store files on the disk (secondary storage), for long term storage purpose. Few examples of storage media are magnetic tape, magnetic disk and optical disk drives like CD, DVD. Each of these media has its own properties like speed, capacity, data transfer rate and data access methods.

A file system is normally organized into directories for easy navigation and usage. These directories may contain files and other directions. Following are the major activities of an operating system with respect to file management.

- Program needs to read a file or write a file.
- The operating system gives the permission to the program for operation on file.
- Permission varies from read-only, read-write, denied and so on.
- Operating System provides an interface to the user to create/delete files.
- Operating System provides an interface to the user to create/delete directories.
- Operating System provides an interface to create the backup of file system.

**Communication**

In case of distributed systems which are a collection of processors that do not share memory, peripheral devices, or a clock, operating system manages communications between processes. Multiple processes with one another through communication lines in the network.

OS handles routing and connection strategies, and the problems of contention and security. Following are the major activities of an operating system with respect to communication.

- Two processes often require data to be transferred between them.
- The both processes can be on the one computer or on different computer but are connected through computer network.
- Communication may be implemented by two methods either by Shared Memory or by Message Passing.

**Error handling**

Error can occur anytime and anywhere. Error may occur in CPU, in I/O devices or in the memory hardware. Following are the major activities of an operating system with respect to error handling.

- OS constantly remains aware of possible errors.
- OS takes the appropriate action to ensure correct and consistent computing.

**Resource Management**

In case of multi-user or multi-tasking environment, resources such as main memory, CPU cycles and files storage are to be allocated to each user or job. Following are the major activities of an operating system with respect to resource management.

- OS manages all kind of resources using schedulers.
- CPU scheduling algorithms are used for better utilization of CPU.

**Protection**

Considering a computer systems having multiple users the concurrent execution of multiple processes, then the various processes must be protected from each another's activities.

Protection refers to mechanism or a way to control the access of programs, processes, or users to the resources defined by a computer systems. Following are the major activities of an operating system with respect to protection.

- OS ensures that all access to system resources is controlled.
- OS ensures that external I/O devices are protected from invalid access attempts.
- OS provides authentication feature for each user by means of a password.

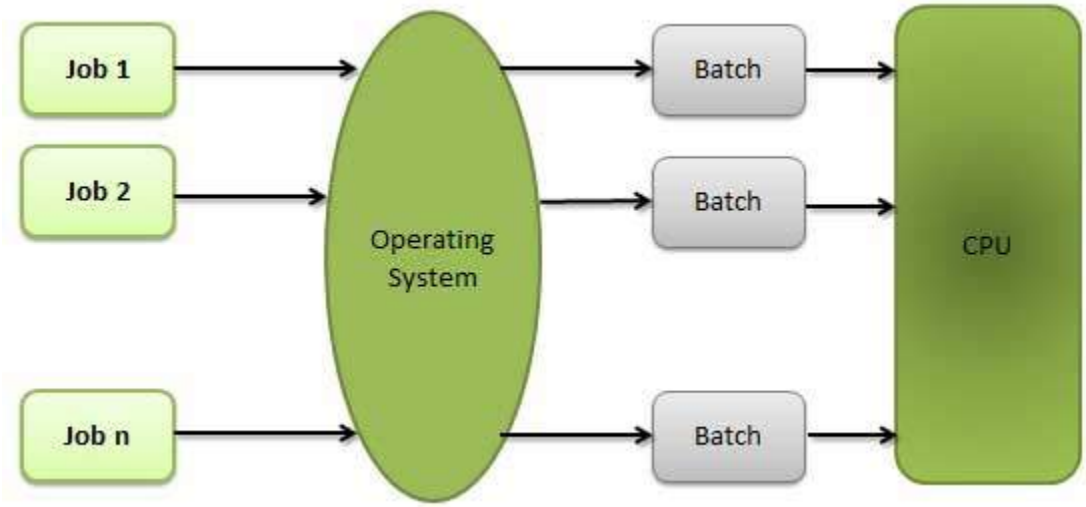
**Properties**

Following are few of very important tasks that Operating System handles

**Batch processing**

Batch processing is a technique in which Operating System collects one programs and data together in a batch before processing starts. Operating system does the following activities related to batch processing.

- OS defines a job which has predefined sequence of commands, programs and data as a single unit.
- OS keeps a number a jobs in memory and executes them without any manual information.
- Jobs are processed in the order of submission i.e first come first served fashion.
- When job completes its execution, its memory is released and the output for the job gets copied into an output spool for later printing or processing.




**Advantages**

- Batch processing takes much of the work of the operator to the computer.
- Increased performance as a new job get started as soon as the previous job finished without any manual intervention.

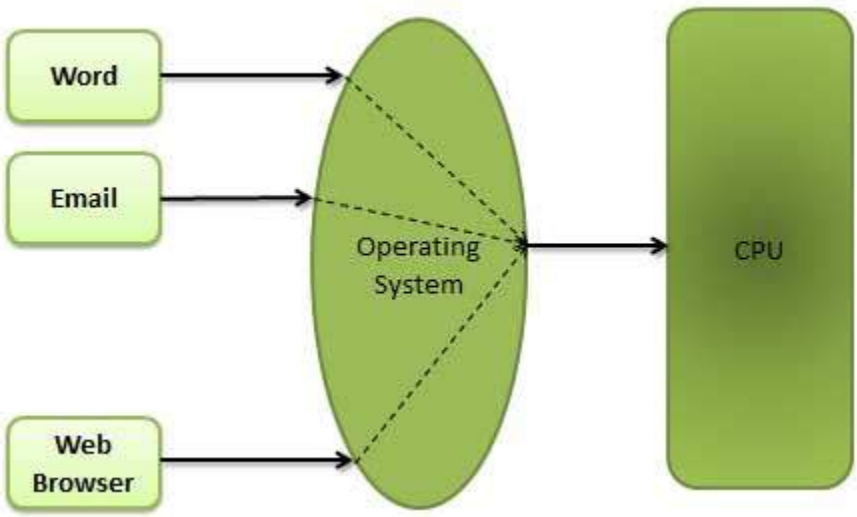
**Disadvantages**

- Difficult to debug program.
- A job could enter an infinite loop.
- Due to lack of protection scheme, one batch job can affect pending jobs.

**Multitasking**

Multitasking refers to term where multiple jobs are executed by the CPU simultaneously by switching between them.Switches occur so frequently that the users may interact with each program while it is running. Operating system does the following activities related to multitasking.

- The user gives instructions to the operating system or to a program directly, and receives an immediate response.
- Operating System handles multitasking in the way that it can handle multiple operations / executes multiple programs at a time.
- Multitasking Operating Systems are also known as Time-sharing systems.
- These Operating Systems were developed to provide interactive use of a computer system at a reasonable cost.
- A time-shared operating system uses concept of CPU scheduling and multiprogramming to provide each user with a small portion of a time-shared CPU.
- Each user has at least one separate program in memory.

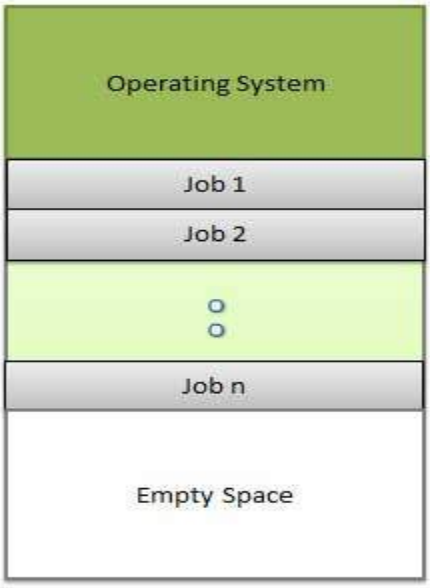



- A program that is loaded into memory and is executing is commonly referred to as a process.
- When a process executes, it typically executes for only a very short time before it either finishes or needs to perform I/O.
- Since interactive I/O typically runs at people speeds, it may take a long time to completed. During this time a CPU can be utilized by another process.
- Operating system allows the users to share the computer simultaneously. Since each action or command in a time-shared system tends to be short, only a little CPU time is needed for each user.
- As the system switches CPU rapidly from one user/program to the next, each user is given the impression that he/she has his/her own CPU, whereas actually one CPU is being shared among many users.

**Multiprogramming**

When two or more programs are residing in memory at the same time, then sharing the processor is referred to the multiprogramming. Multiprogramming assumes a single shared processor. Multiprogramming increases CPU utilization by organizing jobs so that the CPU always has one to execute.

Following figure shows the memory layout for a multiprogramming system.




Operating system does the following activities related to multiprogramming.

- The operating system keeps several jobs in memory at a time.
- This set of jobs is a subset of the jobs kept in the job pool.
- The operating system picks and begins to execute one of the job in the memory.
- Multiprogramming operating system monitors the state of all active programs and system resources using memory management programs to ensures that the CPU is never idle unless there are no jobs

**Advantages**

- High and efficient CPU utilization.
- User feels that many programs are allotted CPU almost simultaneously.

**Disadvantages**

- CPU scheduling is required.

- To accommodate many jobs in memory, memory management is required.

**Interactivity**

Interactivity refers that a User is capable to interact with computer system. Operating system does the following activities related to interactivity.

- OS provides user an interface to interact with system.
- OS managers input devices to take inputs from the user. For example, keyboard.
- OS manages output devices to show outputs to the user. For example, Monitor.
- OS Response time needs to be short since the user submits and waits for the result.

**Real Time System**

Real time systems represents are usually dedicated, embedded systems. Operating system does the following activities related to real time system activity.

- In such systems, Operating Systems typically read from and react to sensor data.
- The Operating system must guarantee response to events within fixed periods of time to ensure correct performance.

**Distributed Environment**

Distributed environment refers to multiple independent CPUs or processors in a computer system. Operating system does the following activities related to distributed environment.

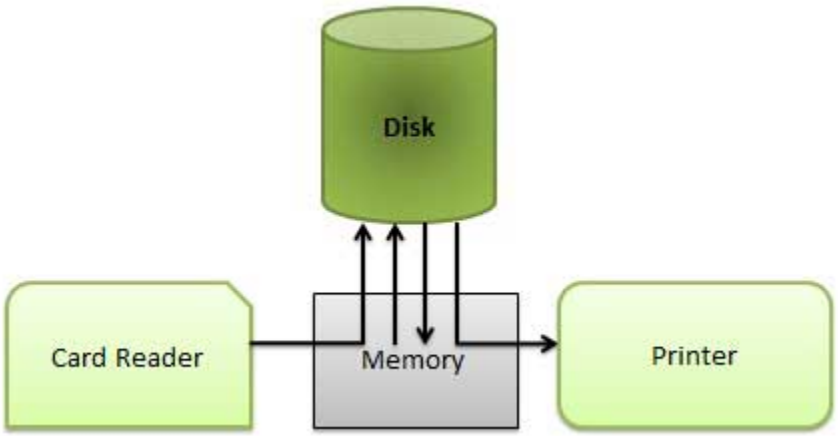
- OS Distributes computation logics among several physical processors.
- The processors do not share memory or a clock.
- Instead, each processor has its own local memory.
- OS manages the communications between the processors. They communicate with each other through various communication lines.

**Spooling**

Spooling is an acronym for simultaneous peripheral operations on line. Spooling refers to putting data of various I/O jobs in a buffer. This buffer is a special area in memory or hard disk which is accessible to I/O devices. Operating system does the following activites related to distributed environment.

- OS handles I/O device data spooling as devices have different data access rates.
- OS maintains the spooling buffer which provides a waiting station where data can rest while the slower device catches up.

- OS maintains parallel computation because of spooling process as a computer can perform I/O in parallel fashion. It becomes possible to have the computer read data from a tape, write data to disk and to write out to a tape printer while it is doing its computing task.




**Advantages**

- The spooling operation uses a disk as a very large buffer.
- Spooling is capable of overlapping I/O operation for one job with processor operations for another job.

**Processes**

A process is a program in execution. The execution of a process must progress in a sequential fashion. Definition of process is following.

- A process is defined as an entity which represents the basic unit of work to be implemented in the system.

Components of process are following.

| S.N. | Component & Description |
|---|---|
| 1 | **Object Program**<br>Code to be executed. |
| 2 | **Data**<br>Data to be used for executing the program. |
| 3 | **Resources**<br>While executing the program, it may require some resources. |

| | |
|---|---|
| 4 | **Status**<br>Verifies the status of the process execution.A process can run to completion only when all requested resources have been allocated to the process. Two or more processes could be executing the same program, each using their own data and resources. |

**Program**

A program by itself is not a process. It is a static entity made up of program statement while process is a dynamic entity. Program contains the instructions to be executed by processor.

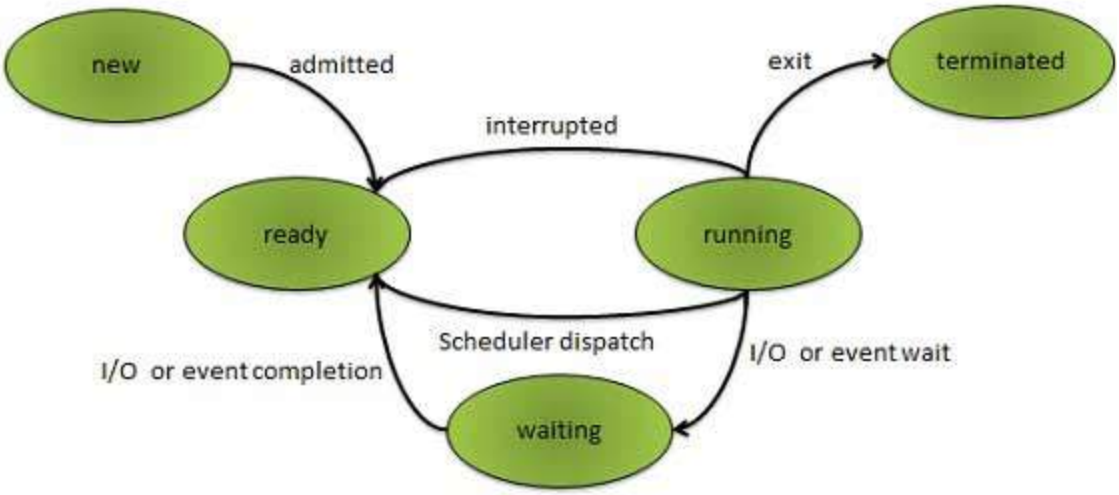
A program takes a space at single place in main memory and continues to stay there. A program does not perform any action by itself.

**Process States**

As a process executes, it changes state. The state of a process is defined as the current activity of the process.

Process can have one of the following five states at a time.

| S.N. | State & Description |
|---|---|
| 1 | **New**<br>The process is being created. |
| 2 | **Ready**<br>The process is waiting to be assigned to a processor. Ready processes are waiting to have the processor allocated to them by the operating system so that they can run. |
| 3 | **Running**<br>Process instructions are being executed (i.e. The process that is currently being executed). |
| 4 | **Waiting**<br>The process is waiting for some event to occur (such as the completion of an I/O operation). |
| 5 | **Terminated**<br>The process has finished execution. |




**Process Control Block, PCB**

Each process is represented in the operating system by a process control block (PCB) also called a task control block. PCB is the data structure used by the operating system. Operating system groups all information that needs about particular process.

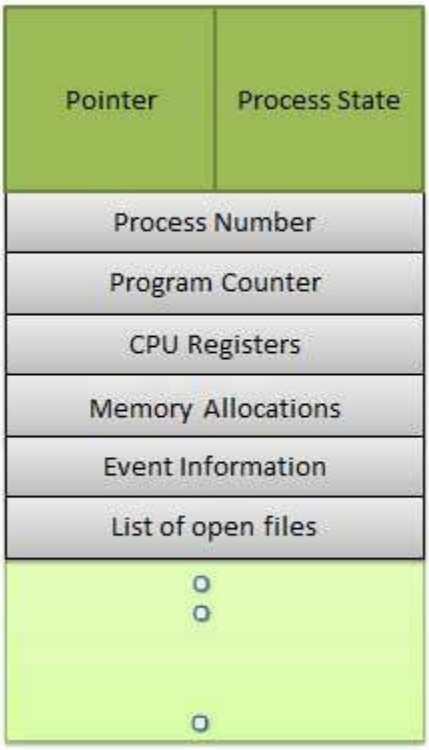
PCB contains many pieces of information associated with a specific process which are described below.

| S.N. | Information & Description |
|---|---|
| 1 | **Pointer**<br>Pointer points to another process control block. Pointer is used for maintaining the scheduling list. |
| 2 | **Process State**<br>Process state may be new, ready, running, waiting and so on. |
| 3 | **Program Counter**<br>Program Counter indicates the address of the next instruction to be executed for this process. |
| 4 | **CPU registers**<br>CPU registers include general purpose register, stack pointers, index registers and accumulators etc. number of register and type of register totally depends upon the computer architecture. |
| 5 | **Memory management information**<br>This information may include the value of base and limit registers, the page tables, or the segment tables depending on the memory system used by the operating system.This |

information is useful for deallocating the memory when the process terminates.

**Accounting information**

6 This information includes the amount of CPU and real time used, time limits, job or process numbers, account numbers etc.




Process control block includes CPU scheduling, I/O resource management, file management information etc.. The PCB serves as the repository for any information which can vary from process to process. Loader/linker sets flags and registers when a process is created. If that process get suspended, the contents of the registers are saved on a stack and the pointer to the particular stack frame is stored in the PCB. By this technique, the hardware state can be restored so that the process can be scheduled to run again.

**Process Scheduling**

**Definition**

The process scheduling is the activity of the process manager that handles the removal of the running process from the CPU and the selection of another process on the basis of a particular strategy.

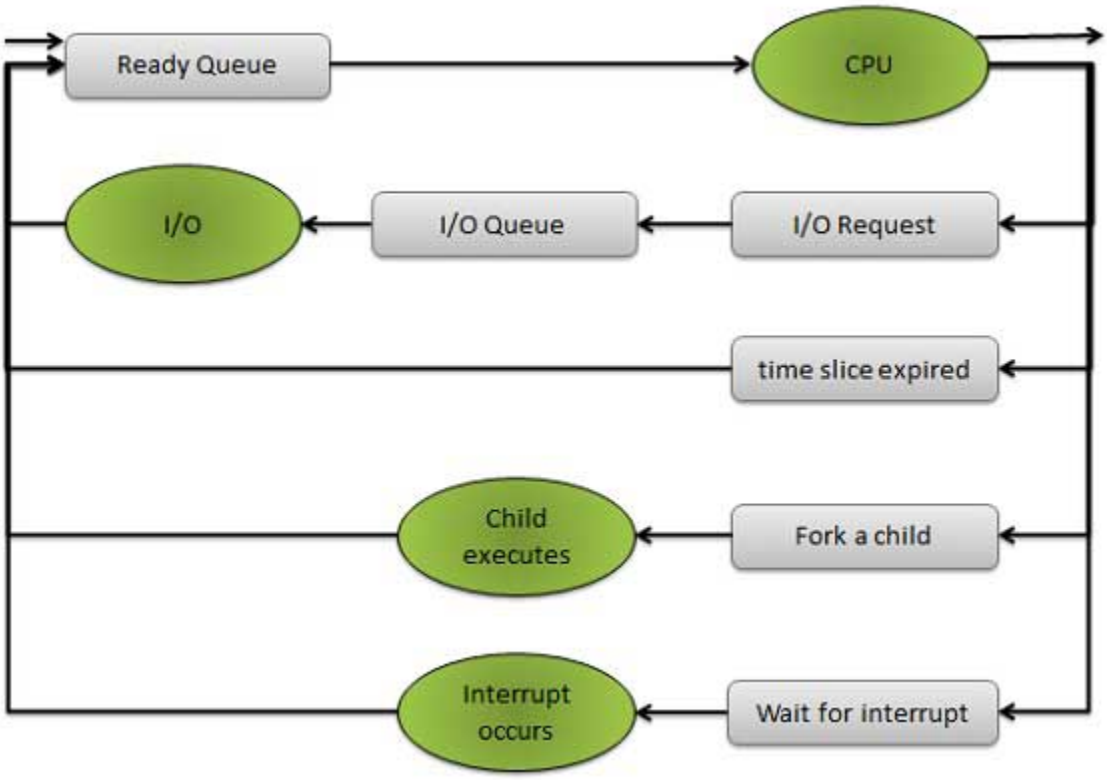
Process scheduling is an essential part of a Multiprogramming operating system. Such operating systems allow more than one process to be loaded into the executable memory at a time and loaded process shares the CPU using time multiplexing.

**Scheduling Queues**

Scheduling queues refers to queues of processes or devices. When the process enters into the system, then this process is put into a job queue. This queue consists of all processes in the system. The operating system also maintains other queues such as device queue. Device queue is a queue for which multiple processes are waiting for a particular I/O device. Each device has its own device queue.

This figure shows the queuing diagram of process scheduling.

- Queue is represented by rectangular box.
- The circles represent the resources that serve the queues.
- The arrows indicate the process flow in the system.




Queues are of two types

- Ready queue

- Device queue

A newly arrived process is put in the ready queue. Processes waits in ready queue for allocating the CPU. Once the CPU is assigned to a process, then that process will execute. While executing the process, any one of the following events can occur.

- The process could issue an I/O request and then it would be placed in an I/O queue.
- The process could create new sub process and will wait for its termination.
- The process could be removed forcibly from the CPU, as a result of interrupt and put back in the ready queue.

**Two State Process Model**

Two state process model refers to running and non-running states which are described below.

| S.N. | State & Description |
|---|---|
| 1 | **Running**<br>When new process is created by Operating System that process enters into the system as in the running state. |
| 2 | **Not Running**<br>Processes that are not running are kept in queue, waiting for their turn to execute. Each entry in the queue is a pointer to a particular process. Queue is implemented by using linked list. Use of dispatcher is as follows. When a process is interrupted, that process is transferred in the waiting queue. If the process has completed or aborted, the process is discarded. In either case, the dispatcher then selects a process from the queue to execute. |

**Schedulers**

Schedulers are special system softwares which handles process scheduling in various ways.Their main task is to select the jobs to be submitted into the system and to decide which process to run. Schedulers are of three types

- Long Term Scheduler
- Short Term Scheduler
- Medium Term Scheduler

**Long Term Scheduler**

It is also called job scheduler. Long term scheduler determines which programs are admitted to the system for processing. Job scheduler selects processes from the queue and loads them into memory for execution. Process loads into the memory for CPU scheduling. The primary

objective of the job scheduler is to provide a balanced mix of jobs, such as I/O bound and processor bound. It also controls the degree of multiprogramming. If the degree of multiprogramming is stable, then the average rate of process creation must be equal to the average departure rate of processes leaving the system.

On some systems, the long term scheduler may not be available or minimal. Time-sharing operating systems have no long term scheduler. When process changes the state from new to ready, then there is use of long term scheduler.

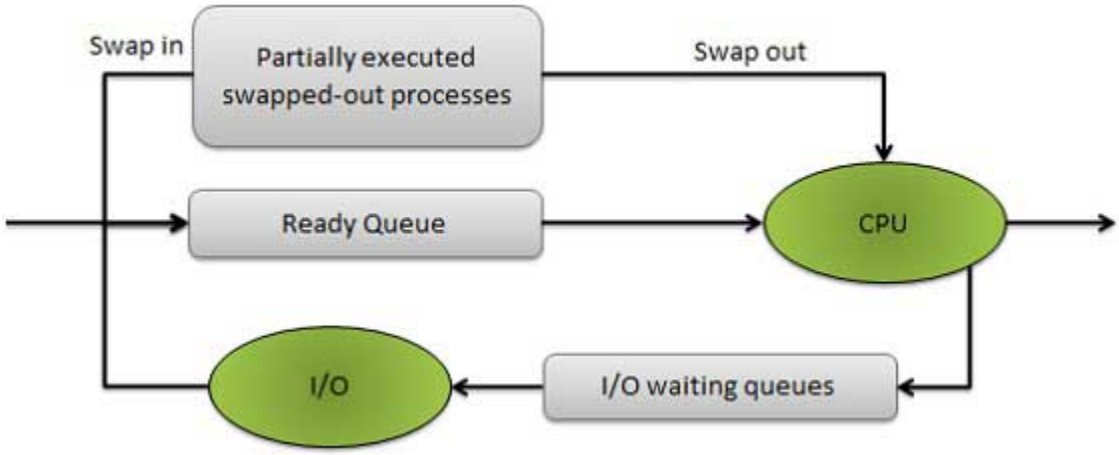
**Short Term Scheduler**

It is also called CPU scheduler. Main objective is increasing system performance in accordance with the chosen set of criteria. It is the change of ready state to running state of the process. CPU scheduler selects process among the processes that are ready to execute and allocates CPU to one of them.

Short term scheduler also known as dispatcher, execute most frequently and makes the fine grained decision of which process to execute next. Short term scheduler is faster than long term scheduler.

**Medium Term Scheduler**

Medium term scheduling is part of the swapping. It removes the processes from the memory. It reduces the degree of multiprogramming. The medium term scheduler is in-charge of handling the swapped out-processes.




Running process may become suspended if it makes an I/O request. Suspended processes cannot make any progress towards completion. In this condition, to remove the process from memory and make space for other process, the suspended process is moved to the secondary storage. This

process is called swapping, and the process is said to be swapped out or rolled out. Swapping may be necessary to improve the process mix.

**Comparison between Scheduler**

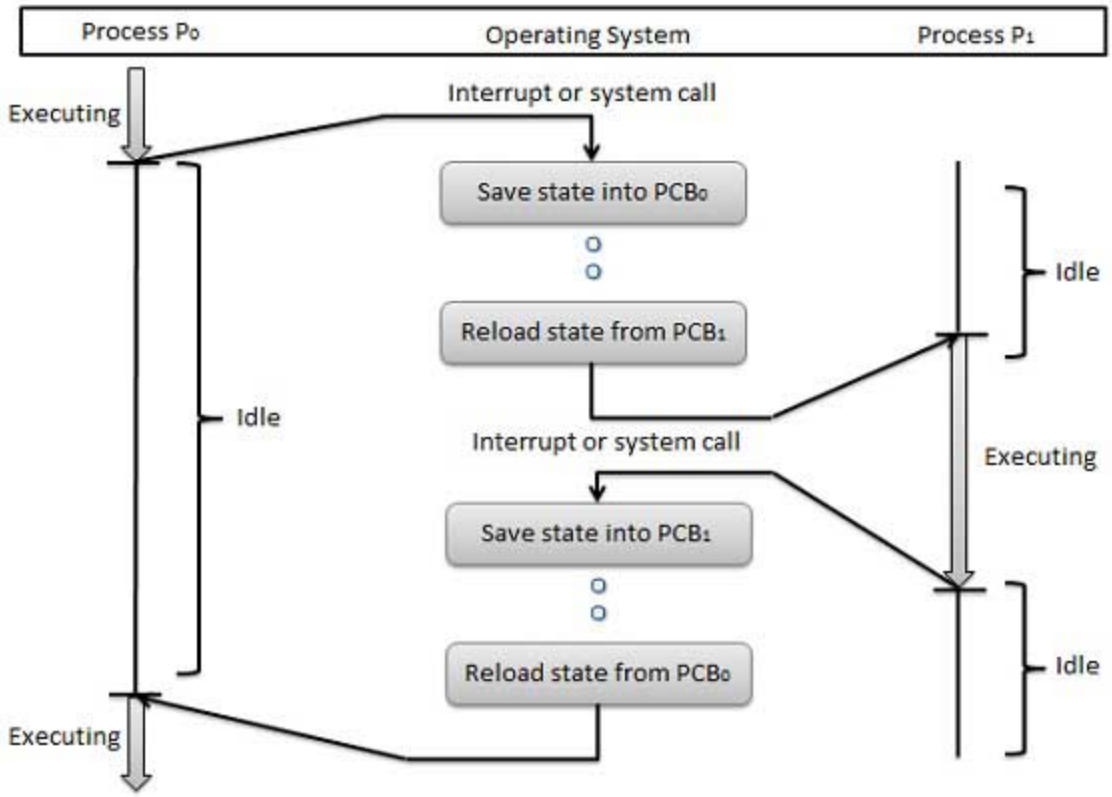
| S.N. | Long Term Scheduler | Short Term Scheduler | Medium Term Scheduler |
|---|---|---|---|
| 1 | It is a job scheduler | It is a CPU scheduler | It is a process swapping scheduler. |
| 2 | Speed is lesser than short term scheduler | Speed is fastest among other two | Speed is in between both short and long term scheduler. |
| 3 | It controls the degree of multiprogramming | It provides lesser control over degree of multiprogramming | It reduces the degree of multiprogramming. |
| 4 | It is almost absent or minimal in time sharing system | It is also minimal in time sharing system | It is a part of Time sharing systems. |
| 5 | It selects processes from pool and loads them into memory for execution | It selects those processes which are ready to execute | It can re-introduce the process into memory and execution can be continued. |

**Context Switch**

A context switch is the mechanism to store and restore the state or context of a CPU in Process Control block so that a process execution can be resumed from the same point at a later time. Using this technique a context switcher enables multiple processes to share a single CPU. Context switching is an essential part of a multitasking operating system features.

When the scheduler switches the CPU from executing one process to execute another, the context switcher saves the content of all processor registers for the process being removed from the CPU, in its process descriptor. The context of a process is represented in the process control block of a process.

Context switch time is pure overhead. Context switching can significantly affect performance as modern computers have a lot of general and status registers to be saved. Content switching times are highly dependent on hardware support. Context switch requires ( n + m ) bxK time units to save the state of the processor with n general registers, assuming b are the store operations are required to save n and m registers of two process control blocks and each store instruction requires K time units.




Some hardware systems employ two or more sets of processor registers to reduce the amount of context switching time. When the process is switched, the following information is stored.

- Program Counter
- Scheduling Information
- Base and limit register value
- Currently used register
- Changed State
- I/O State
- Accounting

## FUNCTIONS OF AN OPERATING SYSTEM

Following are some of important functions of an operating System.

- Memory Management
- Processor Management
- Device Management
- File Management
- Security
- Control over system performance
- Job accounting
- Error detecting aids
- Coordination between other software and users

### Memory Management

Memory management refers to management of Primary Memory or Main Memory. Main memory is a large array of words or bytes where each word or byte has its own address.

Main memory provides a fast storage that can be access directly by the CPU. So for a program to be executed, it must in the main memory. Operating System does the following activities for memory management.

- Keeps tracks of primary memory i.e. what part of it are in use by whom, what part are not in use.
- In multiprogramming, OS decides which process will get memory when and how much.
- Allocates the memory when the process requests it to do so.
- De-allocates the memory when the process no longer needs it or has been terminated.

### Processor Management

In multiprogramming environment, OS decides which process gets the processor when and how much time. This function is called process scheduling. Operating System does the following activities for processor management.

- Keeps tracks of processor and status of process. Program responsible for this task is known as traffic controller.
- Allocates the processor(CPU) to a process.
- De-allocates processor when processor is no longer required.

**Device Management**

OS manages device communication via their respective drivers. Operating System does the following activities for device management.

- Keeps tracks of all devices. Program responsible for this task is known as the I/O controller.
- Decides which process gets the device when and for how much time.
- Allocates the device in the efficient way.
- De-allocates devices.

**File Management**

A file system is normally organized into directories for easy navigation and usage. These directories may contain files and other directions. Operating System does the following activities for file management.

- Keeps track of information, location, uses, status etc. The collective facilities are often known as file system.
- Decides who gets the resources.
- Allocates the resources.
- De-allocates the resources.

**Other Important Activities**

Following are some of the important activities that Operating System does.

- **Security** -- By means of password and similar other techniques, preventing unauthorized access to programs and data.
- **Control over system performance** -- Recording delays between request for a service and response from the system.
- **Job accounting** -- Keeping track of time and resources used by various jobs and users.
- **Error detecting aids** -- Production of dumps, traces, error messages and other debugging and error detecting aids.
- **Coordination between other softwares and users** -- Coordination and assignment of compilers, interpreters, assemblers and other software to the various users of the computer systems.

## TYPES OF OPERATING SYSTEM

Operating systems are there from the very first computer generation. Operating systems keep evolving over the period of time. Following are few of the important types of operating system which are most commonly used.

### Batch operating system

The users of batch operating system do not interact with the computer directly. Each user prepares his job on an off-line device like punch cards and submits it to the computer operator. To speed up processing, jobs with similar needs are batched together and run as a group. Thus, the programmers left their programs with the operator. The operator then sorts programs into batches with similar requirements.

The problems with Batch Systems are following.

- Lack of interaction between the user and job.
- CPU is often idle, because the speeds of the mechanical I/O devices is slower than CPU.
- Difficult to provide the desired priority.

### Time-sharing operating systems

Time sharing is a technique which enables many people, located at various terminals, to use a particular computer system at the same time. Time-sharing or multitasking is a logical extension of multiprogramming. Processor's time which is shared among multiple users simultaneously is termed as time-sharing. The main difference between Multiprogrammed Batch Systems and Time-Sharing Systems is that in case of Multiprogrammed batch systems, objective is to maximize processor use, whereas in Time-Sharing Systems objective is to minimize response time.

Multiple jobs are executed by the CPU by switching between them, but the switches occur so frequently. Thus, the user can receives an immediate response. For example, in a transaction processing, processor execute each user program in a short burst or quantum of computation. That is if n users are present, each user can get time quantum. When the user submits the command, the response time is in few seconds at most.

Operating system uses CPU scheduling and multiprogramming to provide each user with a small portion of a time. Computer systems that were designed primarily as batch systems have been modified to time-sharing systems.

**Advantages of Timesharing operating systems are following**

- Provide advantage of quick response.
- Avoids duplication of software.
- Reduces CPU idle time.

**Disadvantages of Timesharing operating systems are following.**

- Problem of reliability.
- Question of security and integrity of user programs and data.
- Problem of data communication.

**Distributed operating System**

Distributed systems use multiple central processors to serve multiple real time application and multiple users. Data processing jobs are distributed among the processors accordingly to which one can perform each job most efficiently.

The processors communicate with one another through various communication lines (such as high-speed buses or telephone lines). These are referred as loosely coupled systems or distributed systems. Processors in a distributed system may vary in size and function. These processors are referred as sites, nodes, computers and so on.

**The advantages of distributed systems are following.**

- With resource sharing facility user at one site may be able to use the resources available at another.
- Speedup the exchange of data with one another via electronic mail.
- If one site fails in a distributed system, the remaining sites can potentially continue operating.
- Better service to the customers.
- Reduction of the load on the host computer.
- Reduction of delays in data processing.

**Network operating System**

Network Operating System runs on a server and and provides server the capability to manage data, users, groups, security, applications, and other networking functions. The primary purpose of the network operating system is to allow shared file and printer access among multiple computers in a network, typically a local area network (LAN), a private network or to other networks. Examples of network operating systems are Microsoft Windows Server 2003, Microsoft Windows Server 2008, UNIX, Linux, Mac OS X, Novell NetWare, and BSD.

**The advantages of network operating systems are following.**

- Centralized servers are highly stable.
- Security is server managed.
- Upgrades to new technologies and hardwares can be easily integrated into the system.
- Remote access to servers is possible from different locations and types of systems.

**The disadvantages of network operating systems are following.**

- High cost of buying and running a server.
- Dependency on a central location for most operations.
- Regular maintenance and updates are required.

**Real Time operating System**

Real time system is defines as a data processing system in which the time interval required to process and respond to inputs is so small that it controls the environment. Real time processing is always on line whereas on line system need not be real time. The time taken by the system to respond to an input and display of required updated information is termed as response time. So in this method response time is very less as compared to the online processing.

Real-time systems are used when there are rigid time requirements on the operation of a processor or the flow of data and real-time systems can be used as a control device in a dedicated application. Real-time operating system has well-defined, fixed time constraints otherwise system will fail. For example Scientific experiments, medical imaging systems, industrial control systems, weapon systems, robots, and home-appliance controllers, Air traffic control system etc.

**There are two types of real-time operating systems.**

**Hard real-time systems**

Hard real-time systems guarantee that critical tasks complete on time. In hard real-time systems secondary storage is limited or missing with data stored in ROM. In these systems virtual memory is almost never found.

**Soft real-time systems**

Soft real time systems are less restrictive. Critical real-time task gets priority over other tasks and retains the priority until it completes. Soft real-time systems have limited utility than hard real-time systems. For example, Multimedia, virtual reality, Advanced Scientific Projects like undersea exploration and planetary rovers etc.

## COMPUTER BOOTING

### How Computer Boots up?

Have you ever given it a thought that when you press the power button on your laptop or PC, what happens behind the logo of Windows XP/Vista/Seven or Linux? From the pressing of the power button to the appearance of the login screen there are more than hundred components/peripherals that are initialized and thousand lines of code is executed during the process of booting. But **what is booting**? We will look inside the machine, that actually what all happens. So let us start…

### What is Booting?

Booting is a process or set of operations that loads and hence starts the operating system, starting from the point when user switches on the power button.

### What is Booting Sequence?

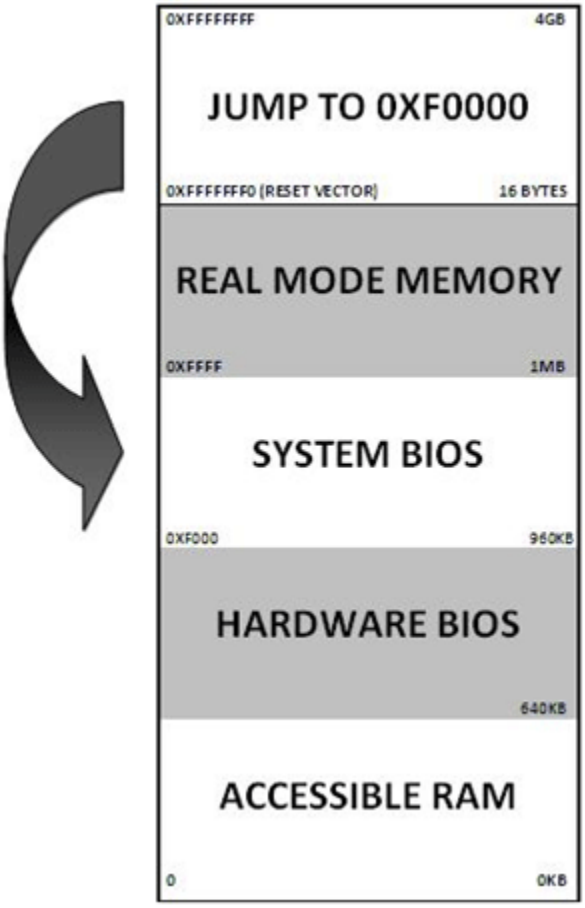
Basically documents related to booting are generally confusing as they are often related to some specific operating system that is Linux machine or Windows machine. But I will keep it as general as possible. ***General Booting sequence*** comprises of the following steps:

- Turn on the Power button.
- CPU pins are reset and registers are set to specific value.
- CPU jump to address of BIOS (0xFFFF0).
- BIOS run POST (Power-On Self Test) and other necessary checks.
- BIOS jumps to MBR(Master Boot Record).
- Primary Bootloader runs from MBR and jumps to Secondary Bootloader.

- Secondary Bootloaders loads Operating System.

These are the tasks that are carried during booting process. Now let us discuss them in detail.

As soon as we turn the power button, the reset signal is sent and the registers in the CPU are set to their pre defined value. The first and foremost is the reset vector as shown in the figure (example is taken of 4GB RAM). It should be noted that RAM contains the garbage value at this time, and the instructions/data stored at any memory location is due to the memory map of the chipset. Memory map maps the location (address) to flash memory containing values or instructions. It is ensured that the instruction stored at this reset vector location is jump to system BIOS, as BIOS takes up further process of powering up the system.




**BIOS-Basic Input Output System**

As we have seen that at power up CPU is reset and its registers are set to the default value, which is an address pointing or directing to the hardware containing BIOS. Generally the hardware is EEPROM containing the BIOS. The tasks performed by BIOS are categorized as follows:

- **POST**- Power on Self Test is the foremost routine which checks and tests the basic hardware. If it fails then it displays error.

- Initialization of the hardware devices by letting them run their individual BIOS( eg. video card have their own inbuilt BIOS code).
- Searching for the Master Boot Record and reading it.
- Copying the boot sector code to RAM and then switching the control to it.

**Boot Sectors**

A sector is a part of the hard disk having length of 512 bytes. A sector is termed as boot sector because of its location and because this sector is responsible for the further boot process of the system. This boot sector is generally called Master Boot Record. The MBR is a 512-byte sector, which is located in the first sector on the disk (sector 1 of cylinder 0, head 0). As soon as BIOS gets the boot sector, it tends to copy MBR to RAM and switches the execution authority to it.

- In the MBR the first 446 bytes are the primary boot loader, which is also referred as PBL.
- The next sixty-four bytes are the partition table, which has the record for each of the partitions.
- The MBR ends with two bytes that should be 0xAA55. These numbers act as validation that this sector is the boot sector or Master Boot Record.

**Choosing the Operating System**

Choosing an operating system may be a challenge without knowing what to look for. There are currently three major operating systems on the market: Microsoft Windows, Mac OS X, and Linux. When considering the importance an operating system plays on the entire computer, it is important to take care in choosing the right one. There are a few things one should evaluate before deciding on an operating system.

**What Will the Operating System Be Used For?**

Knowing what an operating system will be used for or where the computer will be used will help in determining which system to get. Certain operating systems are better for business use where others are better for home use.

***Business Use***

A computer that is going to be used for a business would need an operating system that can handle important business data with ease. This means that the computer won't be bogged down or slowed due to vast amounts of information being put into it.

### *Home Use*

If a computer is being used for home or school then the operating system should be designed to have gaming and a word processor. Of course, this depends on what the user wants to do with the computer at home.

Most new computers come with an operating system that is pre-installed on them. For instance, Apple computers come with Mac OS X where most PCs come with Windows XP. This means that when choosing a new computer, one must choose a computer with the operating system he or she wants.

## What Level of Security Does the Buyer Need?

Today, security is a big issue and one of the highest priorities for both home and business computers. Like securing a home, different operating systems come with different levels of security. Operating systems like Microsoft Windows and Linux are typically thought as the easiest operating systems for computer hackers to get into. On the other side, the Mac OS X is labeled as the most secure operating system available. The reason Microsoft Windows is considered by some to be safe is because the company consistently provides security updates; however hackers can still manage to get through.

## Evaluate the Operating System

Before making a final decision, the buyer should always do some research. Researching the different types of operating systems and how each one works will help the buyer in knowing which operating system meets his or her needs the best.

There are, currently, three main options when choosing an operating system: Windows, Linux, and Apple's OS X. The operating systems may serve the same purpose, but there are always differences between products.

# TOPIC 6

# COMPUTER FILES

## ELEMENTS OF COMPUTER FILES

Files stored on magnetic media can be organised in a number of ways, just as in a manual system. There are advantages and disadvantages to each type of file organisation, and the method chosen will depend on several factors such as:

i. How the file is to be used.
ii. How many records are processed each time the file is updated.
iii. Whether individual records need to be quickly aceessible.

A file is a collection of data, usually stored on disk. As a logical entity, a file enables you to divide your data into meaningful groups, for example, you can use one file to hold all of a company's product information and another to hold all of its personnel information. As a physical entity, a file should be considered in terms of its organization.

File organization refers to the logical relationships among the various records that constitute the file, particularly with respect to the means of identification and access to any specificIetord. File structure refers to the format of the label and data blocks and of any logical record control information. The organization of a given file may be sequential, relative, or indexed.

File organization is the methodology which is applied to structured computer files. Files contain computer records which can be documents or information which is stored in a certain way for later retrieval. File organization refers primarily to the logical arrangement of data (which can itself be organized in a system of records with correlation between the fields/columns) in a file system. It should not be confused with the physical storage of the file in some types of storage media. There are certain basic types of computer file, which can include files stored as blocks- of data and streams of data, where the information streams out of the file, while it is being read until the end of the file is encountered. A program that uses a file needs to know the structure of the file and needs to interpret its contents.

A file can be viewed in two common ways:

### 1. Logical file

This **view** is based on what data items, its record, contains and what proessing operations may be performed upon the file. References is made to the logical records or an entity and data items or the attributes of the entity.an entity is a person place, thing or event which we maintain information e.g. an item of stocks, an employee or a financial transactions. an order is a typical entity in a sales order. Each characteristics or quality describing a particular entity is called an attribute, e.g. order number, order date, order amount.

A logical !record is created for .each entity occurrence and the logical records contain one data item for each occurrence of the entities attributes.

**2. Physical file**

This is the view in terms 'of how data is stored in a storage device such as magnetic disk 'and how processing activities are made possible.

## Characteristics of File

Every file must have the following features:

1. Identifiers: the name a file can be addressed by.
2. Size: every file must have same size 'and= this can be known by the number 'of bytes it occupies.
3. Date of creation or modification:-refers to the age of the file.
4. Author/user:-the person who created the file or who file was created for.
5. Organisation:-this is the mode in which data can be retrieved from the file.
6. Type:-it can beamaster file ˛or a data file.
7. Size:-is the amount of data that is in the file, it may be expreskt1 in terms of number of records or character.
8. Growth:-files often grow in size as records are added or shrink as unwanted records are deleted. Growth must be allowed for when planning to store a file. The increase or decrease in the number of records that have been added or removed from the file or the percentage increase or decrease of records in relation to existing records are referred to as Growth.
9. Volatility:-is the frequency with which records are added or deleted from a file. If the frequency is high the file is said to be volatile, a file that is not altered is said to be static and if the frequency is low it is said to be semi-static.
10. Hit Rate

    Is the term use to describe the rate of producing master files in term of active record. it is a measure of file activity e.g. if in a day ,1000 transactions against a master file of 1000 records are affected then the heat rate is said to be 10

## Types of computer files

There are Many files which have their Owen Type and own names. When we Store a File in the System, then we must have to specify the Name and the Type of File. The Name of file will be any valid Name and Type means the application with the file has linked.

So that we can say that Every File also has Some Type Means Every File belongs to Special Type of Application software's. When we Provides a Name to a File then we also specify the Extension of the File because a System will retrieve the Contents of the File into that Application Software. For Example if there is a File Which Contains Some Paintings then this will Opened into the Paint Software.

1) Ordinary Files or Simple File:
   Ordinary File may belong to any type of Application for example notepad, paint, C Program, Songs etc. So all the Files those are created by a user are Ordinary Files. Ordinary Files are used for Storing the information about the user Programs. With the help of Ordinary Files we can store the information which contains text, database, any image or any other type of information.

2) Directory files. :
   The Files those are Stored into the a Particular Directory or Folder. Then these are the Directory Files. Because they belongs to a Directory and they are Stored into a Directory or Folder. For Example a Folder Name Songs which Contains Many Songs So that all the Files of Songs are known as Directory Files.

3) Special Files. :
4) The Special Files are those which are not created by the user. Or The Files those are necessary to run a System. The Files those are created by the System. Means all the Files of an Operating System or Window, are refers to Special Files. There are Many Types of Special Files, System Files, or windows Files, Input output Files. All the System Files are Stored into the System by using. sys Extension.

5) FIFO Files:

   The First in First Out Files are used by the System for Executing the Processes into Some Order. Means To Say the Files those are Come first, will be Executed First and the System Maintains a Order or Sequence Order. When a user Request for a Service from the System, then the Requests of the users are Arranged into Some Files and all the Requests of the System will be performed by the System by using Some Sequence Order in which they are Entered or we can say that all the files or Requests those are Received from the users will be Executed by using Some Order which is also called as First in First Out or FIFO order.

*Types of File Operations*

Files are not made for just reading the Contents, we can also Perform Some other operations on the Files those are Explained below As :-
1) Read Operation: Meant To Read the information which is Stored into the Files.
2) Write Operation: For inserting some new Contents into a File.
3) Rename or Change the Name of File.
4) Copy the File from one Location to another.
5) Sorting or Arrange the Contents of File.

6) Move or Cut the File from One Place to Another.
7) Delete a File
8) Execute Means to Run Means File Display Output.

We can Also Link a File with any other File. These are also called as the Symbolic Links, in the Symbolic Links all the files are linked by using Some Text or Some Alias.

When a User Clicks on the Special text or on the Alias then this will open that Linked File. So that we can say that the Files are linked With each other by using Some Names and by using Some Locations.

These are Also Called as the Symbolic Links and always remember that when we remove the Link from the System then this will not effect on the Actual file Means the Original File will be Kept Save into the Locations.

**Computer File Types by Extension**

| Extension | Associated Program |
|---|---|
| ABC | ABC Flowcharter |
| ASC | ASCII Text |
| ASF | Streaming Media |
| AVI | Animated Video |
| BAT | DOS Batch File |
| BMP | Bitmap Graphic |
| CAB | Compressed Archive |
| CH3 | Harvard Graphics |
| COM | Program |
| DAT | Data file |
| DLL | Dynamic Link Library |
| DOC | Microsoft Word Document |
| DOT | Microsoft Word Template |
| DGN | Microstation Drawing File |
| DWG | AutoAD Drawing File |
| EPS | Encapsulated PostScript |
| EXE | Program |
| FLA | Flash Movie |
| GIF | Image |

| | |
|---|---|
| HQX | Compressed Archive (MAC) |
| HTM | HTML Hyper Text Markup Language |
| ICO | Icon |
| INI | Windows Initialization |
| JPG | Image |
| LDB | Microsoft Access Lock File |
| LOG | Text Log |
| MAX | PaperPort Scanned Image |
| MDB | Microsoft Access Database |
| MID | MIDI |
| MOV | Quicktime Movie |
| MP3 | Audio |
| MPC | Microsoft Project Calendar |
| MPG | Media |
| MPP | Microsoft Project |
| MPV | Microsoft Project View |
| NSF | Lotus Notes Database |
| NTF | Lotus Notes DB Template |
| OCX | Microsoft Object Linking and Embedding |
| OST | Microsoft Outlook Offline folder |
| PAB | Microsoft Outlook Personal Address Book |
| PCX | Graphic |
| PDF | Adoble Acrobat Portable Document |
| PIC | Bitmap Graphic |
| PIF | Windows Program Information File |
| PM3 | PageMaker 3 |
| PM4 | PageMaker 4 |
| PM5 | PageMaker 5 |
| PNG | Graphic |
| PPD | Postscript Printer Description |
| PPS | Microsoft PowerPoint Slide Show |
| PPT | Microsoft PowerPoint |

| | |
|---|---|
| PST | Microsoft Outlook Personal folder |
| PT3 | PageMaker 3 Template |
| PT4 | PageMaker 4 Template |
| PT5 | PageMaker 5 Template |
| PWL | Password List |
| RAW | 24-bit Graphic |
| REG | Windows Registry Data |
| RM | Real Media |
| RTF | Rich Text Format |
| SAM | AmiPro Document |
| SAV | Backup File |
| SCR | Screen Saver |
| SVG | Scalable Vector Graphics |
| SWF | Flash Player Movie |
| SWP | Swap File |
| SYS | System Files |
| TIF | Image |
| TMP | Temporary File |
| TTF | Image |
| TXT | ASCII Text |
| VBS | Visual Basic Script |
| VSD | Visio Drawing |
| VXD | Virtual Device Driver |
| WAV | Audio File |
| WK1 | Lotus Spreadsheet |
| WK3 | Lotus Spreadsheet |
| WKS | Lotus Spreadsheet |
| WPD | WordPerfect Document |
| XLS | Microsoft Excel Spreadsheet |
| XLT | MIcrosoft Excel Template |
| XLW | Microsoft Excel Workspace |
| ZIP | Compressed Archive of Files |

## DATA PROCESSING

### *Definition*

Data processing is simply the conversion of raw data to meaningful information through a process. Data is manipulated to produce results that lead to a resolution of a problem or improvement of an existing situation. Similar to a production process, it follows a cycle where inputs (raw data) are fed to a process (computer systems, software, etc.) to produce output (information and insights).

Generally, organizations employ computer systems to carry out a series of operations on the data in order to present, interpret, or obtain information. The process includes activities like data entry, summary, calculation, storage, etc. Useful and informative output is presented in various appropriate forms such as diagrams, reports, graphics, etc.

### *Stages of the Data Processing Cycle*

**1) Collection** is the first stage of the cycle, and is very crucial, since the quality of data collected will impact heavily on the output. The collection process needs to ensure that the data gathered are both defined and accurate, so that subsequent decisions based on the findings are valid. This stage provides both the baseline from which to measure, and a target on what to improve.

Some types of data collection include census (data collection about everything in a group or statistical population), sample survey (collection method that includes only part of the total population), and administrative by-product (data collection is a byproduct of an organization's day-to-day operations).

**2) Preparation** is the manipulation of data into a form suitable for further analysis and processing. Raw data cannot be processed and must be checked for accuracy. Preparation is about constructing a dataset from one or more data sources to be used for further exploration and processing. Analyzing data that has not been carefully screened for problems can produce highly misleading results that are heavily dependent on the quality of data prepared.

**3) Input** is the task where verified data is coded or converted into machine readable form so that it can be processed through a computer. Data entry is done through the use of a keyboard, digitizer, scanner, or data entry from an existing source. This time-consuming process requires speed and accuracy. Most data need to follow a formal and strict syntax since a great deal of processing power is required to breakdown the complex data at this stage. Due to the costs, many businesses are resorting to outsource this stage.

**4) Processing** is when the data is subjected to various means and methods of manipulation, the point where a computer program is being executed, and it contains the program code and its

current activity. The process may be made up of multiple threads of execution that simultaneously execute instructions, depending on the operating system. While a computer program is a passive collection of instructions, a process is the actual execution of those instructions. Many software programs are available for processing large volumes of data within very short periods.

**5) Output and interpretation** is the stage where processed information is now transmitted to the user. Output is presented to users in various report formats like printed report, audio, video, or on monitor. Output need to be interpreted so that it can provide meaningful information that will guide future decisions of the company.

**6) Storage** is the last stage in the data processing cycle, where data, instruction and information are held for future use. The importance of this cycle is that it allows quick access and retrieval of the processed information, allowing it to be passed on to the next stage directly, when needed. Every computer uses storage to hold system and application software.

The Data Processing Cycle is a series of steps carried out to extract information from raw data. Although each step must be taken in order, the order is cyclic. The output and storage stage can lead to the repeat of the data collection stage, resulting in another cycle of data processing. The cycle provides a view on how the data travels and transforms from collection to interpretation, and ultimately, used in effective business decisions.

## METHODS AND DESIGN PARADIGM

It is a high-level design decision to specify a system of file organization for a computer software program or a computer system designed for a particular purpose. Performance is high on the list of priorities for this design process, depending on how the file is being used. The design of the file organization usually depends mainly on the system environment. For instance, factors such as whether the file is going to be used for transaction-oriented processes like OLTP or Data Warehousing, or whether the file is shared among various processes like those found in a typical distributed system or standalone. It must also be asked whether the file is on a network and used by a number of users and whether it may be accessed internally or remotely and how often it is accessed.

However, all things considered the most important considerations might be:

1. Rapid access to a record or a number of records which are related to each other.
2. The Adding, modification, or deletion of records.
3. Efficiency of storage and retrieval of records.
4. Redundancy, being the method of ensuring data integrity.

A file should be organized in such a way that the records are always available for processing with no delay. This should be done in line with the activity and volatility of the information.

## FILE ORGANISATION

Files need to be properly arranged and organised to facilitate easy access and retrieval of the information. Types of file organisation (physical method of storage) include:

- Serial
- Sequential
- Indexed-Sequential
- Random

All file organisation types apply to direct access storage media (disk, drum etc.) A file on a serial storage media (e.g. tape) can only be organised serially

### Serial Organisation

- Each record is placed in turn in the next available storage space
- A serial file must be accessed sequentially implying
    - good use of space
    - high access time
- Usually used for temporary files, e.g. transaction files, work files and spool files Note:
- The method of accessing the data on the file is different to its organisation
    - E.g. sequential access of a randomly organised file
    - E.g. direct access of a sequential file

### Sequential organization

- Records are organised in ascending sequence according to a certain key
- Sequential files are accessed sequentially, one record after the other
- Suitable:
    - for master files in a batch processing environment
    - where a large percentage of records (high hit-rate) are to be accessed
- Not suitable for online access that requires a fast response as file needs to be accessed sequentially

### Indexed-Sequential

- Most commonly used methods of file organisation
- File is organised sequentially and contains an index
- Used on direct access devices
- Used in applications that require sequential processing of large numbers of records but occasional direct access of individual records
- Increases processing overheads with maintenance of the indices

**Random organization**

- Records are stored in a specific location determined by a randomizing algorithm *o function (key) = record location (address)*☐
- Records can be accessed directly without regard to physical location ☐
- Used to provide fast access to any individual record e.g. airline reservations and online banking ☐

## FILE ACCESS METHODS

Information is kept in files. Files reside on secondary storage. When this information is to be used, it has to be accessed and brought into primary main memory. Information in files could be accessed in many ways. It is usually dependent on an application. There are three file access methods.

Information is kept in files. Files reside on secondary storage. When this information is to be used, it has to be accessed and brought into primary main memory. Information in files could be accessed in many ways. It is usually dependent on an application.

**Sequential Access:** A simple access method, information in a file is accessed sequentially one record after another. To process the with record all the 1-1 records previous to 1 must be accessed. Sequential access is based on the tape model that is inherently a sequential access device. Sequential access is best suited where most of the records in a file are to be processed. For example, transaction files.

**Direct Access:** Sometimes it is not necessary to process every record in a file. It may not be necessary to process records in the order in which they are present. Information present in a record of a file is to be accessed only if some key value in that record is known. In all such cases, direct access is used. Direct access is based on the disk that is a direct access device and allows random access of any file block. Since a file is a collection of physical blocks, any block and hence the records in that block are accessed. For example, master files. Databases are often of this type since they allow query processing that involves immediate access to large amounts of information. All reservation systems fall into this category. Not all operating systems support direct access files. Usually files are to be defined as sequential or direct at the time of creation and accessed accordingly later. Sequential access of a direct access file is possible but direct access of a sequential file is not.

**Indexed Sequential Access:** This access method is a slight modification of the direct access method. It is in fact a combination of both the sequential access as well as direct access. The main concept is to access a file direct first and then sequentially from that point onwards. This access method involves maintaining an index. The index is a pointer to a block. To access a record in a file, a direct access of the index is made. The information obtained from this access is used to access the file. For example, the direct access to a file will give the block address and

within the block the record is accessed sequentially. Sometimes indexes may be big. So hierarchies of indexes are built in which one direct access of an index leads to info to access another index directly and so on till the actual file is accessed sequentially for the particular record. The main advantage in this type of access is that both direct and sequential access of files is possible.

**Problems of traditional file- based approach**

Each function in an organisation develops specific applications in isolation from other divisions with each application using its own data files. This leads to the following problems:

1. Data redundancy
   - duplicate data in multiple data files
2. Redundancy leads to inconsistencies
   - in data representation e.g. refer to the same person as client or customer
   - values of data items across multiple files
3. Data isolation — multiple files and formats
4. Programme - data dependence
   - Tight relationship between data files and specific programs used to maintain files
5. Lack of flexibility
   - Need to write a new programme to carry out each new task
6. Lack of data sharing and availability
7. Integrity problems
   - Integrity constraints (e.g. account balance > 0) become part of programme code
   - Hard to add new constraints or change existing ones
8. Concurrent access by multiple users difficult
   - Concurrent access needed for performance
   - Uncontrolled concurrent access can lead to inconsistencies
   - E.g. two people reading a balance and updating it at the same time
9. Security problems

**Data files and databases**

A data file is a structured collection of data (information). The data are related in some manner. It is organised so that relationships within the data are revealed (revealable). A data file stores several (many) pieces of information about many data objects. The simplest and most efficient metaphor of how data is organised in a data file is as a table of rows and columns, like a spreadsheet but without the linkages between individual cells. A data file is made up of anumber of records; each row in a table is a separate record. Each record is made up of all the data about a particular entity in the file.

A record includes many data items, each of which is a separate cell in the table. Each columnin the table is a field; it is a set of values for a particular variable, and is made up of all the dataitems for that variable. Examples include phone book, library catalogue, hospital patient records and species information.

A database is an organised collection of (one or more) related data file(s). The way the database organises data depends on the type of database, called its data model, which, may be hierarchical, network and relational models.

**Benefits of the database approach**

1. Provide Data Independence
   - separating the physical (how) and logical (what) aspects of the system
2. Physical data independence
   - protects the application programmes from changes in the physical placement, of the files
   - the ability to modify the physical schema without changing the logical schema
3. Logical data independence
   - Modify logical schema without changing application programmes
4. Reduce redundancy
   - reduce duplicate data items
   - some redundancy may be necessary for business or technical reasons – DBA must ensure updates are propagated (a change to one is automatically applied to the other).
5. Avoid inconsistency (by reducing redundancy)
6. if it is necessary - propagate updates
   - Maintain integrity - i.e. ensure the data is accurate by:
   - Reducing redundancy
   - implementing integrity rules, e.g. through foreign keys

   T
7. Share data
   - among existing applications
   - used in new applications

8. Allow implementation of security restrictions
   - establish rules for different types of users for different types of update to database

   S
9. Enforce standards for
   - data representation - useful for migrating data between systems
   - data naming & documentation - aids data sharing and understandability
10. Balance conflicting requirements
    - structure the corporate data in a way that is best for the organisation

**Database Management Systems (DBMS)**

DBMSs are system software that aid in organising, controlling and using the data needed by application programmes. A DBMS provides the facility to create and maintain a well-organised database. It also provides functions such as normalisation to reduce data redundancy, decrease access time and establish basic security measures over sensitive data.

**DBMS can control user access at the following levels:**

- User and the database
- Programme and the database
- Transaction and the database
- Programme and data field
- User and transaction
- User and data field

**The following are some of the advantages of DBMS:**

- Data independence for application systems
- Ease of support and flexibility in meeting changing data requirements
- Transaction processing efficiency
- Reduction of data redundancy (similar data being held at more than one point – utilizes more resources) – have one copy of the data and avail it to all users and applications
- Maximises data consistency – users have same view of data even after an update
- Minimises maintenance costs through data sharing
- Opportunity to enforce data/programming standards
- Opportunity to enforce data security
- Availability of stored data integrity checks
- Facilitates terminal users ad hoc access to data, especially designed query languages/ application generators

Most DBMS have internal security features that interface with the operating system access control mechanism/package, unless it was implemented in a raw device. A combination of the DBMS security features and security package functions is often used to cover all required security functions. This dual security approach, however, introduces complexity and opportunity for security lapses.

# TOPIC 7

# AN OVERVIEW OF APPLICATION PACKAGES

## WORD PROCESSING

Word processing is an application program that allows you to create letters, reports, newsletters, tables, form letters, brochures, and Web pages. Using this application, program you can add pictures, tables, and charts to your documents. You can also check spelling and grammar.

Main features of word processing applications:

- Create professional documents fast, using built-in and custom templates
- Easily manage large documents using various features like the ability to create table of contents, index, and cross-references
- Work on multiple documents simultaneously
- With the help of mail merge, you can quickly create merge documents like mass mailings or mailing labels
- AutoCorrect and AutoFormat features catch typographical errors automatically and allow you to use predefined shortcuts and typing patterns to quickly format your documents.
- The print zoom facility scales a document on different paper sizes, and allows you to print out multiple pages on a single sheet of paper.
- The nested tables feature supports putting one table inside another table.
- Export and save your word documents in PDF and XPS file format.
- Batch mailings using form letter template and an address database (also called mail merging);
- Indices of keywords and their page numbers;
- Tables of contents with section titles and their page numbers;
- Tables of figures with caption titles and their page numbers;
- Cross-referencing with section or page numbers;
- Footnote numbering;
- New versions of a document using variables (e.g. model numbers, product names, etc.)

## ESSENTIAL WORD-PROCESSING FUNCTIONS

Essential word-processing functions can be grouped into the categories of input, manipulation, formatting, and output of text.

**Text Input**
Typically, text is entered into the word processor from a keyboard; other input methods include:

- Copying text from other applications (such as from hypertext markup language [HTML] documents, e-mail messages, or online encyclopedias) and pasting it into a word-processing document
- Scanning printed documents and using optical-character-recognition (OCR) software to convert the scanned documents into text characters
- Using voice-recognition software to convert spoken words into text characters

**Text Manipulation**

Text manipulation refers to the "processing" part of word processing. Word processors provide easy methods of deleting, inserting, copying, and moving individual characters, words, phrases, and paragraphs—even entire pages of information—with a few clicks of a mouse button or with such keyboard shortcuts as Ctrl-C to copy, Ctrl-X to cut, and Ctrl-V to paste or insert text. Text can be automatically checked for spelling and for conformance to basic grammatical principles as the text is entered and edited.

The find-and-replace feature in a word processor allows the user to search for every occurrence of a particular character, word, or phrase within a document and replace it with new text. Most word processors also include automatic correction and automatic formatting of common errors and mechanical conventions as text is entered from the keyboard. For example, commonly misspelled words can be automatically corrected as soon as the misspelled words are entered; two spaces entered after the end of a sentence can be changed automatically to one space; a lowercase letter beginning a new sentence can be capitalized automatically. Proper typographic quotation marks ("smart" or "curly" quote marks—" and ") and apostrophes (') can be inserted automatically instead of the straight typewriter-style quotation marks entered from the keyboard. Fractions and other symbols can be formatted automatically as their keyboard equivalents are entered. For example, when a fraction for one-half is entered as 1/2, it is changed to the symbol ½ two hyphens (—) are changed to a long dash (—); and (c) is changed to ©.

**Text Formatting**

Word-processing software typically includes "wizards" or "help" features to provide automated formatting of common business documents. For example, a letter wizard can assist the user to properly format a business letter, and a résumé wizard can help the user format a professional-looking résumé. Templates are another automated formatting feature. A template is a type of pre-formatted, fill-in-the-blank document that is useful for maintaining a specific format each time a document is created, especially when multiple word-processing operators are involved. A newsletter template, for example, allows a user to entered the text of newsletter articles, headlines, and graphics without having to re-create the newsletter layout for each issue of the newsletter.

The most-common formatting tasks are typically performed by the user as a document is created. Individual character and word formatting includes selection of type size, type style, and typeface. Size is measured in points, a unit of measure in which 72 points make up an inch. Typically, 11- or 12-point type is used for basic business documents. Newsletters, annual reports, and other such "designed" documents may use type as small as 8 or 9 points for the basic text and as large

as 24, 36, or 48 points (or more) for main titles. Type styles, such as *italics*, underline, and bold, are easily selected using keyboard shortcuts or by selecting them from the basic font menu. Typefaces (typeface refers to the look or design of the type) are available in thousands of varieties, including such commonly known faces as Times Roman, Arial, Helvetica, and Garamond.

Paragraph formatting includes line spacing, meaning the amount of blank space left between lines of type (single spacing and double spacing, for example); paragraph spacing (the amount of blank space that precedes or follows each paragraph); justification (all lines of type made even at both margins, or left uneven or ragged at the right margin); and indentation (such as a first-line indentation at the beginning of each paragraph).

Page and overall-document formatting includes setting margins (typically 1-inch margins are used on the top, bottom, and both sides of such basic business documents as letters, reports, and memos), creating columns like those used in a newspaper or newsletter, and creating headers and footers (information such as the page number or a chapter title that is repeated at the top or bottom of each page of a document). Most word processors also provide special layout features for formatting outlines, tables, envelopes, and mailing labels.

### Text Output

Once text has been created, edited, and formatted into a finished electronic document, it must be put into some tangible form or lasting electronic form to be of practical benefit. That output process usually starts with the saving of the document on the computer's hard drive, a floppy disk, a CD, or a memory device such as a flash drive. Saving the document, in fact, is an activity that should take place frequently during the creation and editing processes to guard against loss due to problems such as electrical-power failure, computer malfunctions, and operator error.

Printing a document on paper is the most common output method; other output methods include faxing a document directly from the word processor by use of a computer modem, sending the document to another person by e-mail, and converting the word-processing document to various other electronic formats for online viewing or for eventual printing from other applications. For example, word-processing documents are frequently converted to HTML for use as Web pages, to portable document format (PDF) files, and to rich text format (RTF) files for use in other computer programs (particularly other word-processing programs).

## ADVANCED WORD-PROCESSING FEATURES

Although most word-processing users tend to learn and use primarily the basic word-processing features, numerous more-advanced features are available in most word processors to make word processing much easier to complete in less time. Taking the time to learn some advanced word-processing features and functions usually has a high payoff in terms of productivity and professionalism.

Some of the more-common advanced word-processing features and functions are described briefly below:

**Styles**

Styles are user-created formatting commands that allow great control over repetitive formatting structures within a document. For example, using a "style" for each type of heading in a report will ensure consistent formatting of the headings and will eliminate the need for a user to manually format each heading as it is created.

**Macros and Merging**

Macros are stored keystrokes, or sets of editing and formatting commands, that can be replayed whenever needed. Macros can boost productivity and take much of the tedium out of repetitive word-processing tasks. Merging is the process of using lists of such information as names, addresses, phone numbers, product descriptions or model numbers, and so on to fill in designated fields or blanks in documents to create mass mailings, address labels, directories, and catalogs.

**Version Control**

Version-control features allow a user to track the various stages of editing that a document may pass through, including versions created by multiple users involved in the creation and editing of a document. Related features such as the ability to track changes made in a document enable multiple users to review suggested document changes and to accept or reject proposed changes.

**Automatic References and Indexes**

Documents that include tables of contents, cross-references, indexes, footnotes, endnotes, and captions will benefit from the capability of a word processor to automatically generate and format these items.

**Desktop-Publishing Capabilities**

Professional-looking documents such as newsletters, advertisements, annual reports, brochures, and business cards can be designed with most modern word-processing software.

Graphical images from clip-art collections, digital photographs, and scanned images, and drawings created with graphics programs, can be integrated easily into word-processing documents. Pages and paragraphs can be enclosed with decorative borders. Background images and colors can be added to pages within a document. Graphical elements such as lines, boxes, arrows, and artistic textual headings can be created quickly and easily within most word-processing programs.

Although word processors are generally not as sophisticated as desktop-publishing software or page-layout programs in their capabilities for setting type and for working with graphical elements, they can be used to create attractive, professional-looking documents that go beyond

the basic layout and formatting of letters, memos, and reports. Using a word-processing program to create designed documents is often preferable to using a high- end desktop-publishing program, however, because word-processing users are not required to become proficient in using another program and because documents within an organization or department are created and maintained using the same application.

## CREATING AND FORMATING TABLES

Creating tables in Microsoft Word used to be so annoying that most people just did it in Excel, then imported it into Word. It's worth giving Word 2013's table tools a try, though, because the process is easier, and there are some new graphical options.

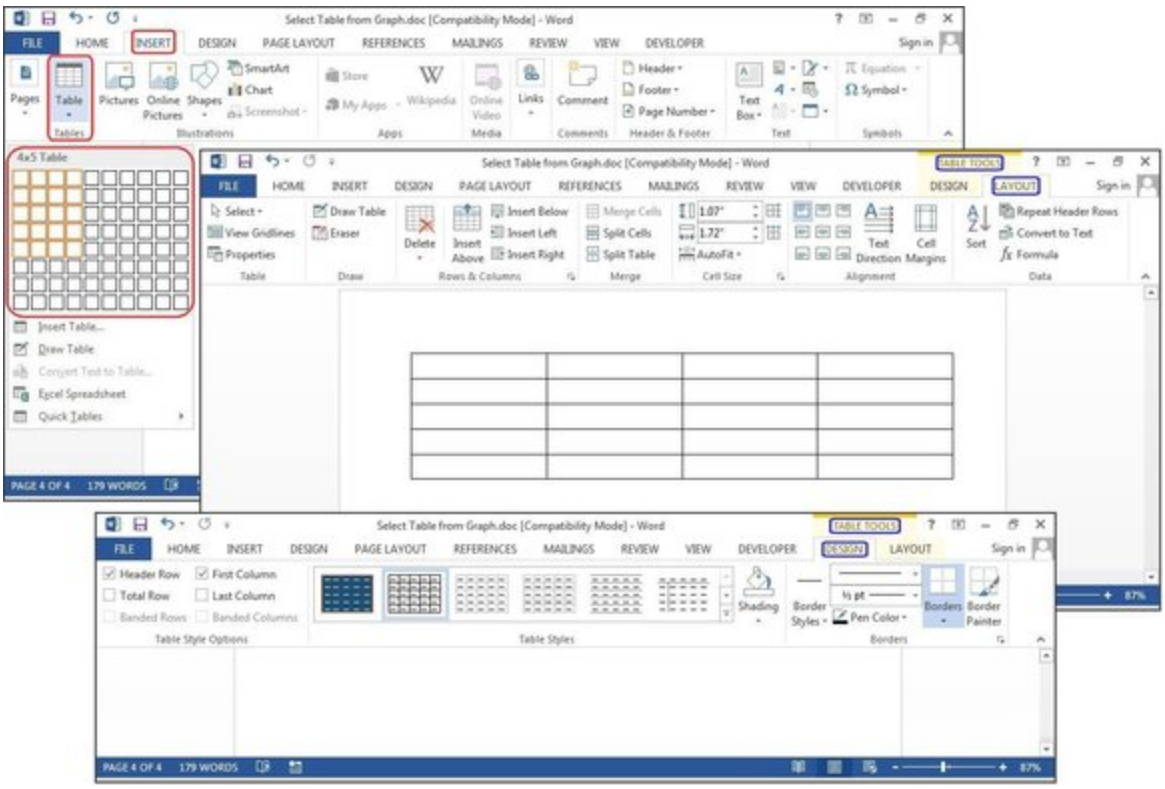
### Seven ways to create tables

Microsoft now provides five different methods for creating tables: the Graphic Grid, Insert Table, Draw Table, insert a new or existing Excel Spreadsheet table, and Quick Tables, plus an option for converting existing text into a table. To start, open a blank Word document from the Home/New page. Position your cursor in the document where you want the table inserted.

### Graphic Grid/Select Table from Graph

Under the Insert tab, click the *Table* button. The Insert Table dialog box will open, showing a basic grid pattern as well as traditional menu options below it. Place your cursor on the first cell in the grid and slide it down and over until you highlight (for this example) four columns and five rows, then click once.

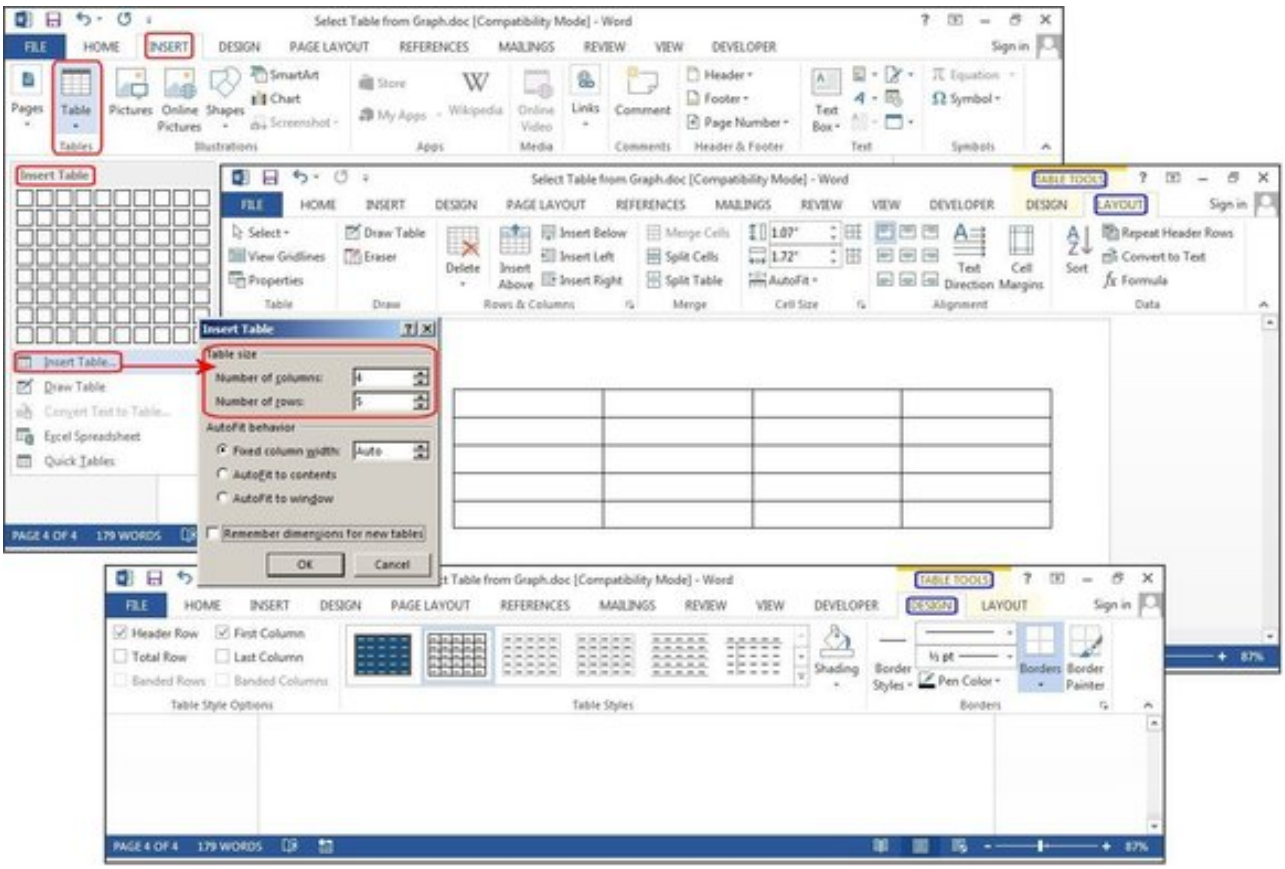
Notice that once the table is created, a new option called Table Tools appears on the Ribbon bar with two new tabs: Design and Layout. See the Layout and Design section below for details regarding these options.




Create a new table using the graphical grid.

**Insert Table**

Click *Insert* > *Tables* > *Insert Table* from the dropdown menu. In the Insert Table dialog box, enter the number of columns and rows you want in this table (four columns and five rows). In the AutoFit Behavior panel, select *Auto*, or click the down arrow to choose a specific size. You can also choose AutoFit to Contents (produces narrow columns that expand as you add data) or AutoFit to Window (expands the table to fit the document size). Check the *Remember Dimensions for New Tables* box if you want the sizes you're entering now to become your defaults for future tables.



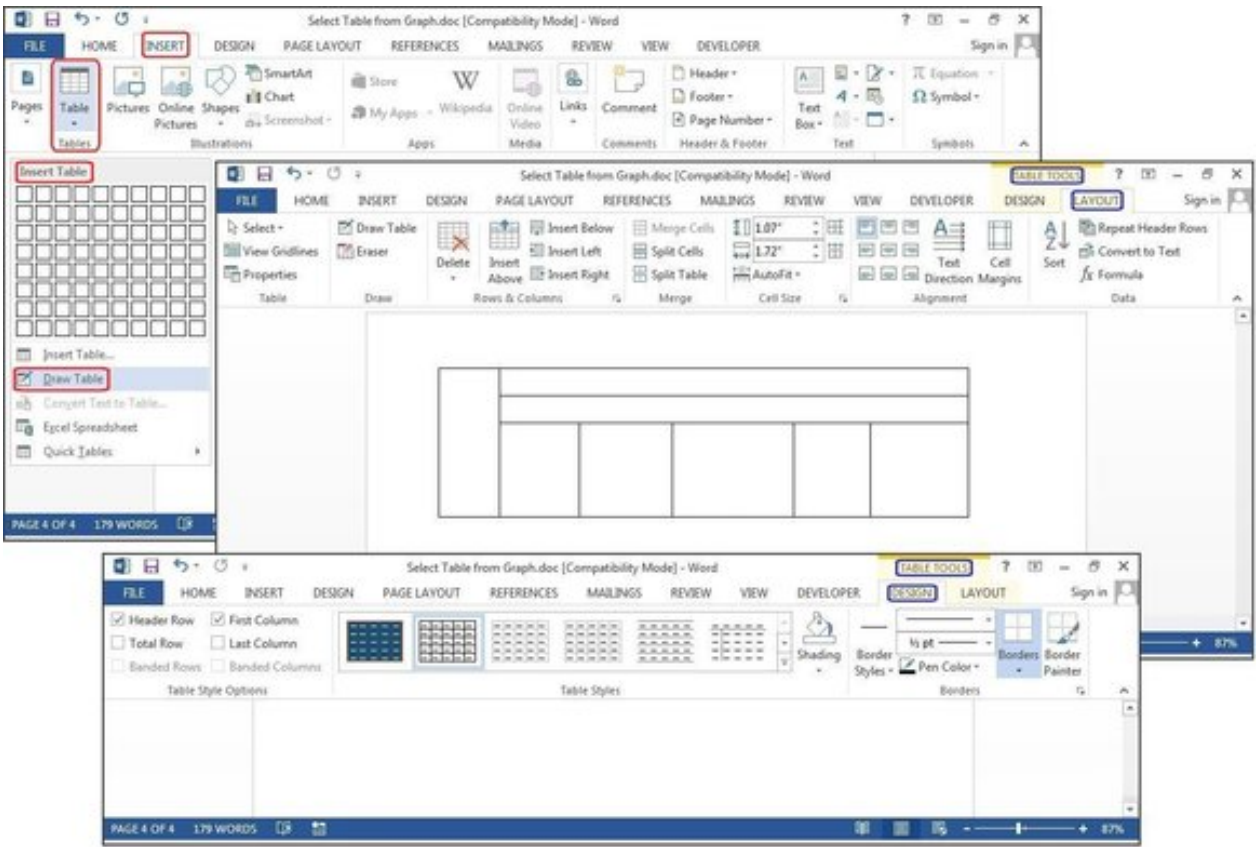

Create a new table using Insert Table.

**Draw Table**

Click *Insert> Tables > Draw Table*. The cursor turns into a pencil, which you drag down and across to draw a box. Don't worry about the exact dimensions; you can modify it any time.

Once the box is created, position the cursor inside the box and draw lines over and down for the columns and rows (one at a time). Don't worry about crooked lines, either—Word straightens them as you draw.

To add or remove columns and/or rows later, click anywhere inside the table, then select the Design tab under Table Tools. Click the *Draw Table* button to add or continue drawing lines with your pencil cursor, or click the *Eraser* button to remove lines with the eraser cursor. To remove a line, just touch the line with the eraser cursor, and the line disappears.



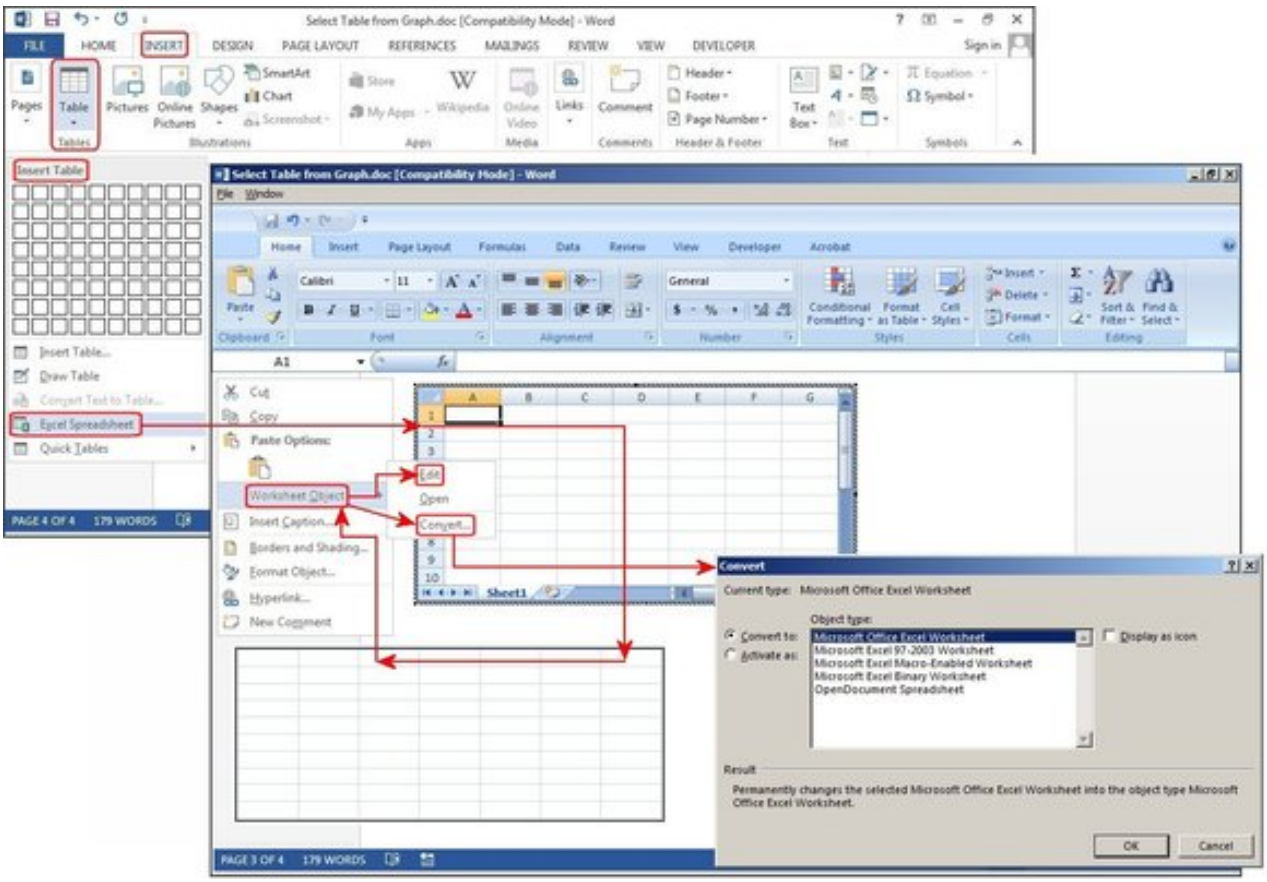

Create a new table using Draw Table.

**Excel Spreadsheet (create In Word)**

Click *Insert* > *Tables* > *Excel Spreadsheet*. An Excel spreadsheet inserts at your cursor location. You can continue using Excel and its menus and commands, but after you enter your data it converts to a non-editable graphic.

If you want to add, delete, or modify the spreadsheet, right-click anywhere inside the worksheet graphic, select *Worksheet Object* from the dropdown menu, then click *Edit*. The original spreadsheet reappears for editing. Notice the top menu has changed to an Excel menu for edits.

Also from the Worksheet Object dropdown menu, you can click *Open* to open the spreadsheet in Excel, so you can manipulate it in that program. Or click *Convert* to view a Windows dialog box that lists file-conversion options.




Create a new table using Excel Spreadsheet.

**SPREADSHEETS**

Spreadsheet software is one of the most-used technologies for collecting, computing, and displaying data. Spreadsheets contain a rectangular array of cells in rows and columns that can hold data. Users can create business models, graphs and charts, and reports for financial, statistical, or other data. Most spreadsheet software allows a user to access real-time data from Web sites and to collaborate across teams and workgroups.

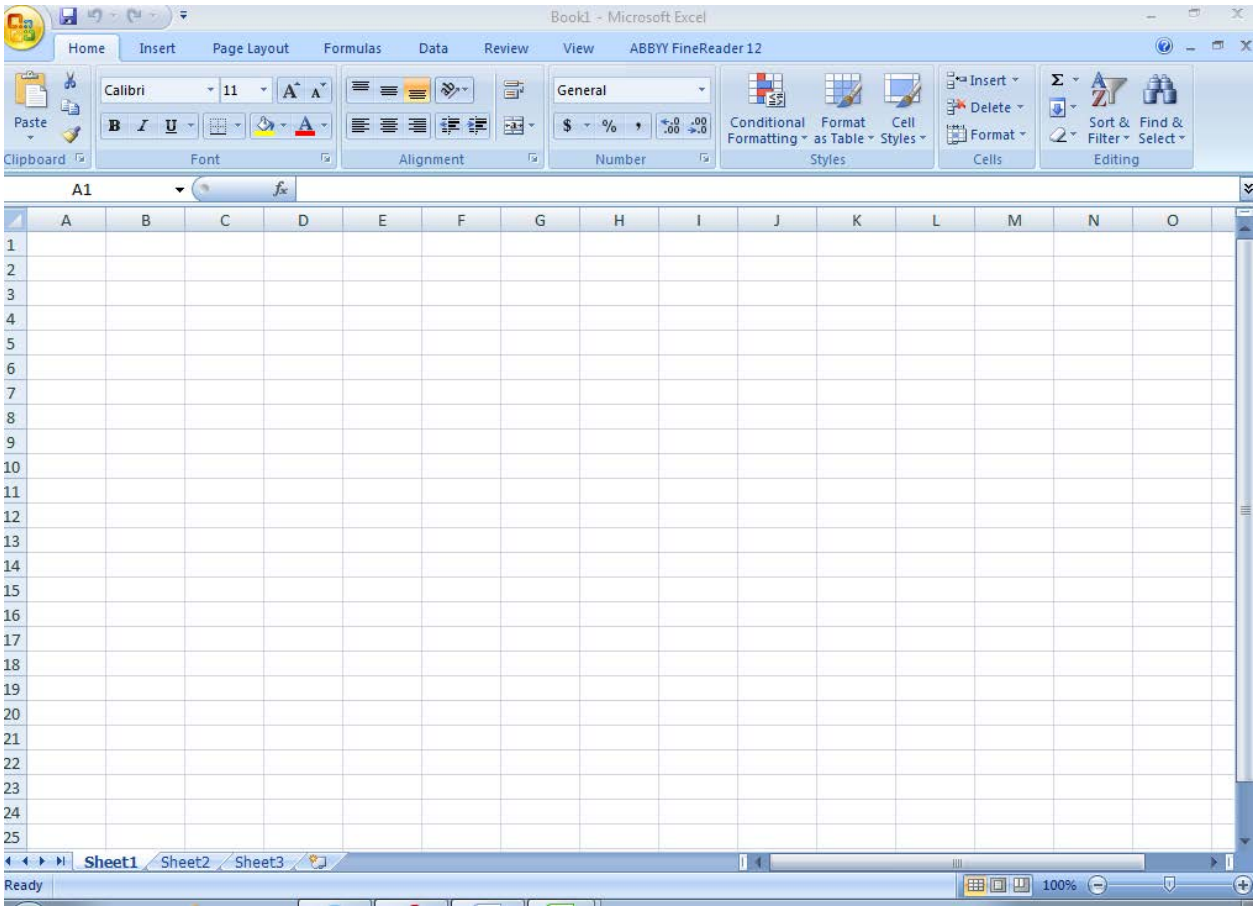



**Figure showing Excel in Microsoft office 2007**

## SPREADSHEET PACKAGES

Spreadsheet packages are available for various operating systems, such as Windows, Macintosh, UNIX, Java, Linux, and VMS. Spreadsheet capabilities are included in financial management packages and integrated software packages. The best-known spreadsheet software packages are Microsoft Excel, Lotus 1-2-3 from IBM Corporation, and Corel's Quattro Pro. These three packages are included as parts of office suites from Microsoft, IBM, and Corel.

In addition, dozens of other spreadsheet packages are available. Many of these offer users an opportunity to try the product for a limited period and then pay a fee for permission to use the package beyond the evaluation period. Many spreadsheets are listed on the Internet by their developers, either as shareware or for purchase, and some are available for downloading.

**Characteristics of spreadsheet applications**

'Features' explained in the previous page are the fundamental things that make a spreadsheet a good choice for financial modeling 'Characteristics' are the fine details of a particular spreadsheet package that make life easier for you.

## FEATURES OF SPREEDSHEET PROGRAM

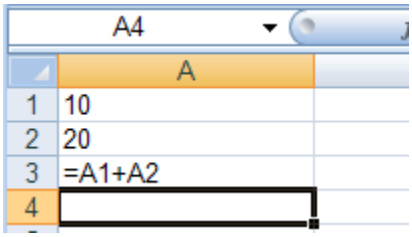
- **Can sort data**: good for making it easier to find individual data
- **Absolute and relative referencing**: makes setting up formulas easier
- **Can protect certain cells from change**: Handy to make the model more robust
- **User interface forms** : Excellent to load input values into the model
- **Macro language support**: Allows complicated subroutines and functions to be written
- **Automatic re-calculation** : Makes the model respond very quickly
- **Conditional formatting** : Highlight certain numbers of interest such as a profit / loss
- **Import / Export support** : Easy to load input values in one go and save output values
- **Searching and filtering** : Very good when looking for specific data in the model
- **Lookup tables** : Used extensively in modelling to store values
- **Pivot tables** : Very powerful tool to summarise a huge amount of data into one table
- **Pivot charts** : Very powerful way of seeing the effect of running 'what if' questions
- **Replication** : Easy to create a list of values by simply dragging down in a certain way
- **Database lookup** : Can connect to external databases to get values
- **Worksheets supported** : Very good for splitting up parts of the model
- **Graphing** : Pie-charts, Bar charts etc each good for presenting data in a different way

You can expect any spreadsheet software package to include the 'Features' but it is the characteristics of each package that helps you choose which one to use / buy.

## FORMATTING AND EDITING FUNCTIONS

### Introduction

The most basic way of using a a spreadsheet is to use it as a glorified calculator, where you simply enter some values then apply a formula to work out the answer.



For instance you have a set of numbers you want to add up.

So you enter them into a worksheet and simply add them up using a formula (as in cell A3)

Most people can quickly master the use of basic formulae and can use spreadsheets to add together lists of things, multiply a few items and come up with a grand total.

However, there are literally hundreds of different formulae and functions already built into spreadsheets. They allow you to use a spreadsheet not just for basic calculations but also for statistical analysis, as a database and for modelling different scenarios.

Over the next few pages we will take a look at formulae and functions and also discuss the difference between relative and absolute cell addresses

**Variables**

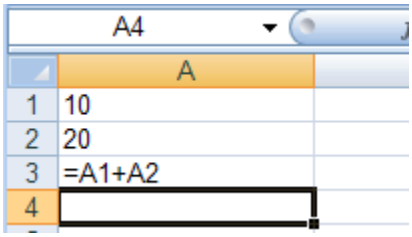
**DEFINITION:**

A variable holds values which can change.

In order to set up a model, you need to be able to change parts of it in order to see what effect that has on the overall result.

This is what a variable can do for you - a variable allows you to change the model that then re-calculates the result.

The simplest kind of variable is a single cell containing a number

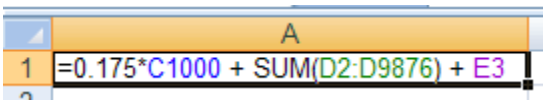



Cell A1 and A2 are 'variables', because if you change their values, the result in A3 will change. So the simplest kind of variable is a single cell reference.

**Named variables**

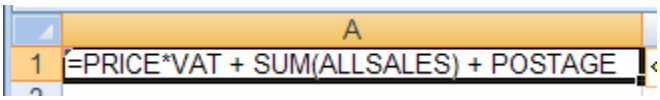
***=A1+A2***

The formula shown above is so simple that it is easy to understand what it is doing. But things can get (and do) become far more complicated. For instance, consider a formula like this:




It is much more difficult to understand the purpose of this formula. You can see that is seems to be adding up a range of cells and also multiplying a cell value but why?

Now lets set up the same formula in a slightly different way



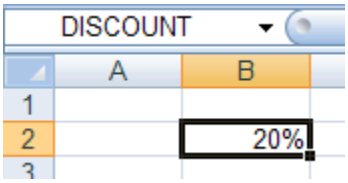

It is still a little complicated but now it is much more clear as to what it is doing. In this case it is taking the price variable and VAT variable to work out the VAT on an item, then adds the postage costs. It then adds these to the total sales.

This can be done in a spreadsheet because it supports the idea of a 'Named variable'.

*A named variable substitutes text for referencing a cell or range of cells.*

***Creating a Named variable***

This is quite straight forward as it can be done right on screen.




Select the cell you want to use (B2)

In the top left box enter the name you want to use (DISCOUNT) and press enter.

That's it. You can now use DISCOUNT instead of cell B2 in a formula.

**Formulae**

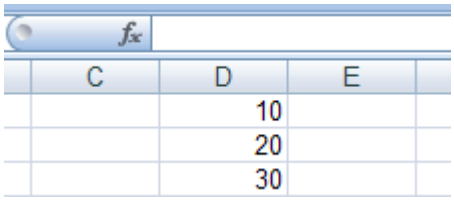
**DEFINITION:**

A formula performs calculations using numbers, addresses of cells and mathematical operators

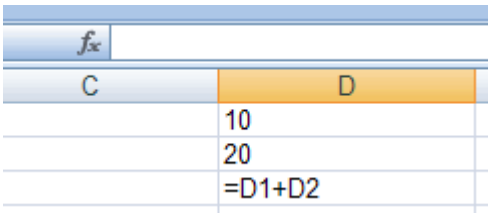
Formulas are the bread and butter of spreadsheets. Without formulas, a spreadsheet would only contain a static never-changing set of numbers. Not exactly useful.

A formula takes a set of values, usually from other cells, and carries out some maths on them. The result is displayed in the same cell containing the formula.

Normally formulas are not visible when just viewing a spreadsheet



| C | D | E |
|---|---|---|
| | 10 | |
| | 20 | |
| | 30 | |

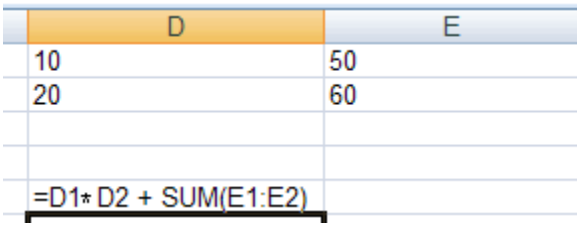


| C | D |
|---|---|
| | 10 |
| | 20 |
| | =D1+D2 |

The image on the left is what you would normally see in a spreadsheet. But if you set the spreadsheet software to make formulas visible, then you see the image on the right. Just how you make formulas visible depends on the package, so check with the help menu.

A spreadsheet formula must start with an equals sign (=). It is the trigger to tell the spreadsheet that a calculation is needed.

Formulas can also contain functions which are explained in a later page. Like this.



| D | E |
|---|---|
| 10 | 50 |
| 20 | 60 |
| | |
| | |
| =D1* D2 + SUM(E1:E2) | |

Do you know how to write basic formulae?

Make sure that you know how to write a formula to add, subtract, multiply and divide

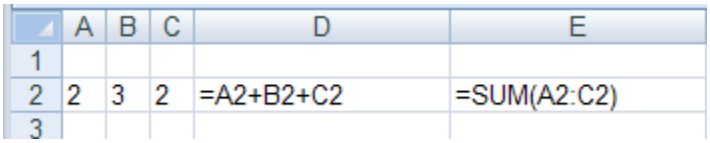
**Functions**

**DEFINITION:**

A function is a standard routine used to perform common tasks. It represents a complex formula that uses reserved words e.g. VLOOKUP, IF.

A function performs a specific set of operations on its input values to produce a single output value. The main spreadsheet applications available today have hundreds of ready-made functions that you can use.

For instance, one way to add up a list of items is to add them up one by one like this



| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | 2 | 3 | 2 | =A2+B2+C2 | =SUM(A2:C2) |
| 3 | | | | | |

The formula in cell D2 can add up the three numbers in cells A2, B2, B3 but the function called SUM can also do the same thing. Creating a formula by hand to add up three numbers is very simple - but what if you had to add up 30,000 numbers? By far the easiest thing to do is to use the built-in function called SUM and provide it with the range of numbers to be added up.

This is the power of functions - they can carry out complicated operations on a set of numbers very easily. Other very common functions are

- VLOOKUP (looks up a value in a table)
- AVERAGE (works out the average of a set of numbers)
- COUNTIF (adds up numbers meeting a certain criteria)
- STDEV ( statistical function called standard deviation)
- DSUM (powerful way of summing values meeting a given criteria)
- WEEKNUM (finds the week number in the year that the input date falls within)

Functions can also be combined in a formula to make even more complicated operations. For example

=SUM(A1:A4) * AVERAGE(C2:C5) + VLOOKUP(A1,PRICE_LIST,2,FALSE)

This formula sums a range of values, multiplies the result by the average of another range of numbers then finally adds another number obtained from a look-up table.

People can be very creative in combining functions to work out complicated problems.

**Differences between formulae and functions**

| FORMULA | FUNCTION |
|---|---|
| A formula is typed directly into the formula bar | A function is built into the software.; it is a special type of formula |
| Unable to nest a formula | Can nest functions |
| Formula are simple calculations | Functions are used to simplify complicated maths |
| Formulas do not have built-in wizards | A function often has a built-in wizard to help you complete them e.g. VLOOKUP |

## PRESENTATION SOFTWARE

Presentation software is used to create presentations, quizzes, e-learning packages, information points and many other multimedia products.

Most presentation software packages allow you to create your multimedia product using a series of slides. Text, images, video, animations, links and sound can be combined on each slide to create a sophisticated final product.

Presentation software programs include -

- **PowerPoint** (many versions) - The most widely used presentation software it is the leader on the Windows platform, and is created by *Microsoft*. PowerPoint can be bought separately or is included in the Microsoft Office suite of programs
- **OpenOffice.org Impress** - created by *Sun Microsystems Inc.* OpenOffice Impress (as it is more commonly known), is part of a suite of programs offered as a free download. The suite also contains a word processor, a spreadsheet program and a drawing program.
- **Windows Movie Maker** - a desktop video program, created by *Microsoft* installed on every Windows computer. Windows Movie Maker allows you to create and edit movies to use to accompany your presentation, although you can also add still photos or graphics and create a slide show, just as in PowerPoint and OpenOffice Impress.
- **Keynote** - created by *Apple Computer* is the leader in presentation software on a Mac platform. It was created for their OS X operating system. It is part of a suite of programs called iWork.

### Common features of presentation software

- Slides that can contain any mixture of text, images, video, animations, links and sound.
- Animation effects that allow the various elements on each slide to appear after a certain amount of time or when a presenter presses a button.
- **Slide master** – this allows the style (font, font size, background etc) to be set once and then used throughout the presentation.
- **Transitions** – this is how the presentation software "moves" the display of one slide to another. Transitions usually include dissolving from one slide to the next or the current slide being moved in some way to show the next slide as though it was underneath.
- **Slide notes** – when these are used the presenter will see the current slide and any notes associated with it on his/her display and the audience will see just the slide on another screen or from a projector.

### Slide Presentation

A PowerPoint has two methods for creating a slide presentation:

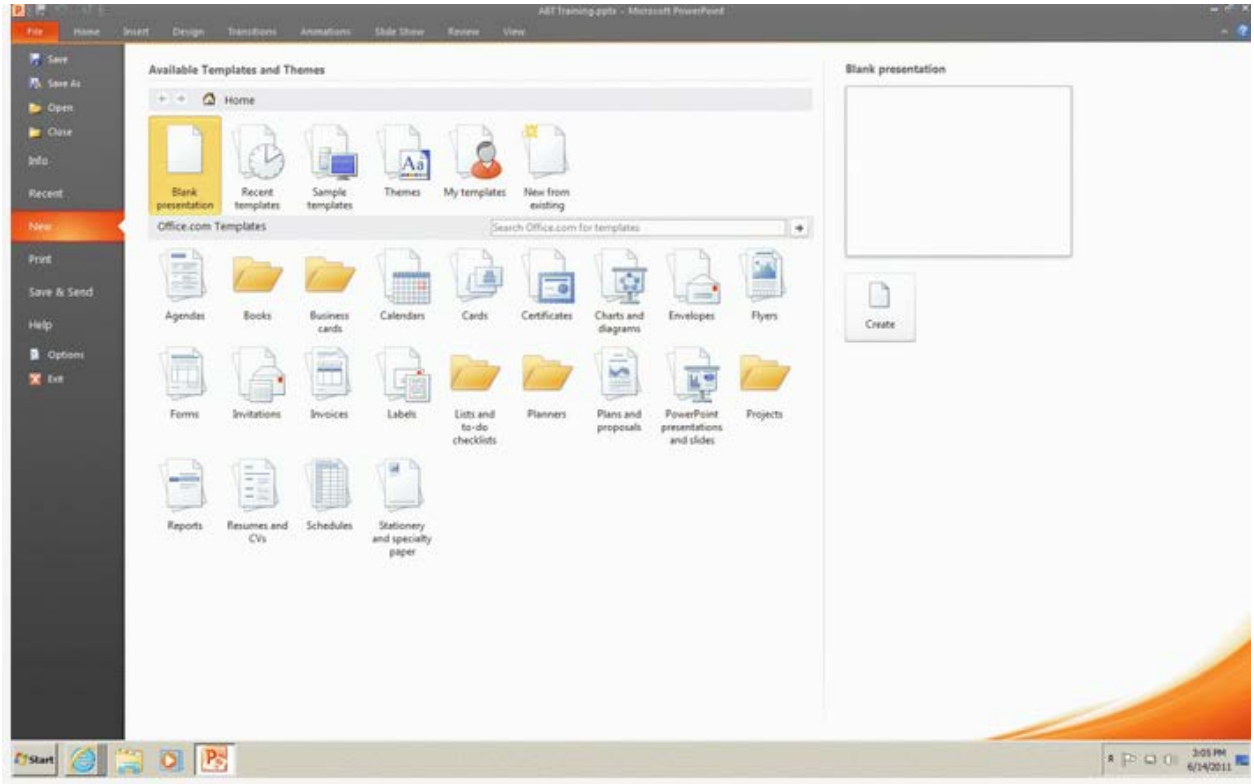
- *Choose a theme template*

- *Create a blank presentation (this method is covered in Unit 3)*

PowerPoint software has built in and free online pre-designed templates that contain various color schemes and pre-arranged elements in a slide, eg. text and graphics. Select a template and PowerPoint will format the entire presentation according to that template.

*Steps to choosing a theme template:*

1. Open PowerPoint.
2. At the PowerPoint window, click the File tab, then click New.
3. The Available Templates and Themes screen will appear, click on an available template or download a free template from the office.com online templates.




4. Once you have selected the desired template, it will be displayed in normal view. New slides can be added as needed.

***Tips & Tricks***

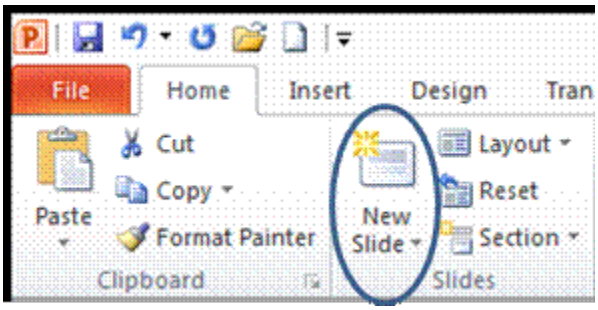
A theme template can be added to a presentation before, during or after you have added the presentation content.

To apply various templates to a presentation, click the Design tab, then click on the desired template in the themes group.


***Create a New Slide***

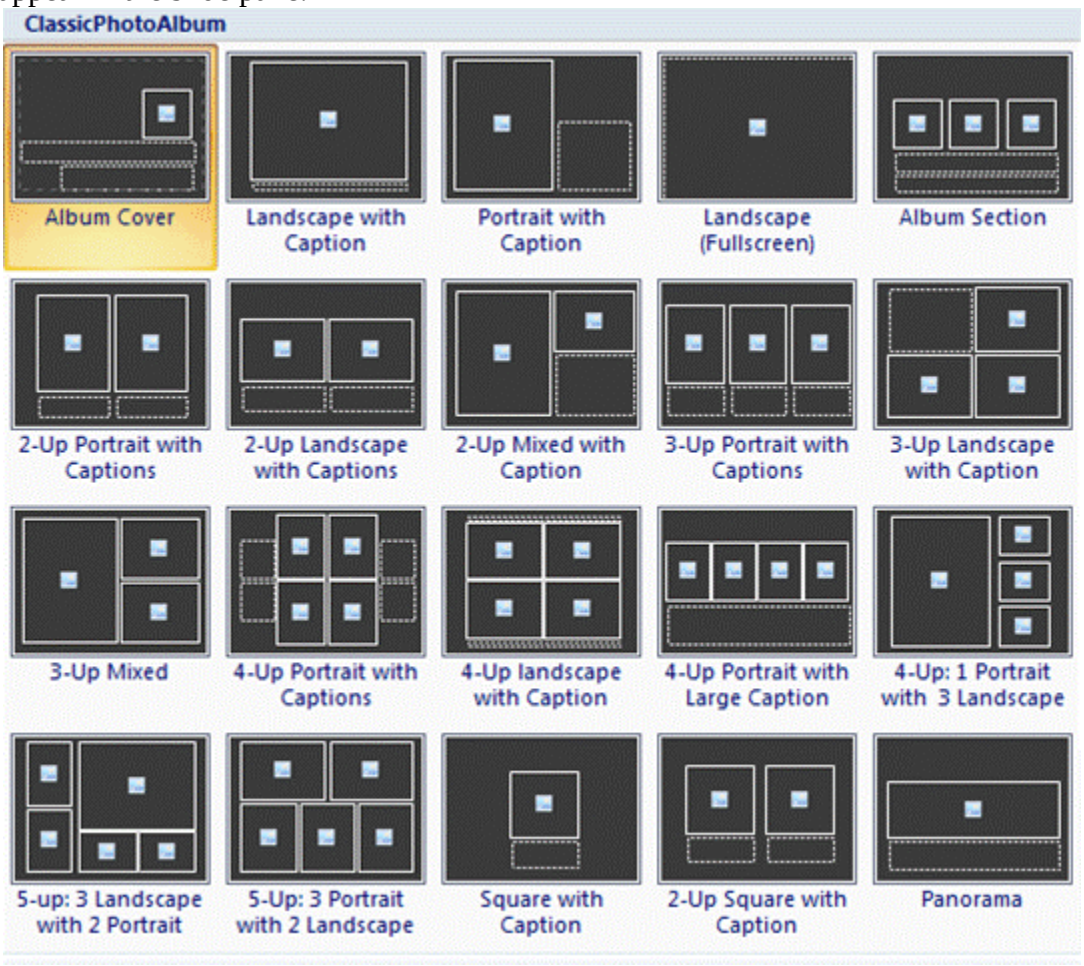
Whether you are using a pre-made theme template or working from your own design, it is very easy to insert a new slide.

1. In the slide pane click on the slide where you would like the new slide to appear below.
2. Click on the **New Slide** button located on the **Home** tab in the **Slides** group.




3. The new slide should appear below the selected slide. If you want to add a new slide between two, select the first of the two slides and click **New Slide**.
4. Notice the New Slide button contains a New Slide button arrow. Click on the arrow to view different slide layouts. Another way to change the slide layout is by clicking on the **Layout** button located in the **Slides** group. The slide layout option determines the position of the objects on a slide. Simply click on the layout you want to use and it will

appear in the slide pane.




***Create Slide Content***

Entering text and images into your presentation slide is easy and fun. When using the theme template the first slide to appear in Normal view is called the **Title Slide**.

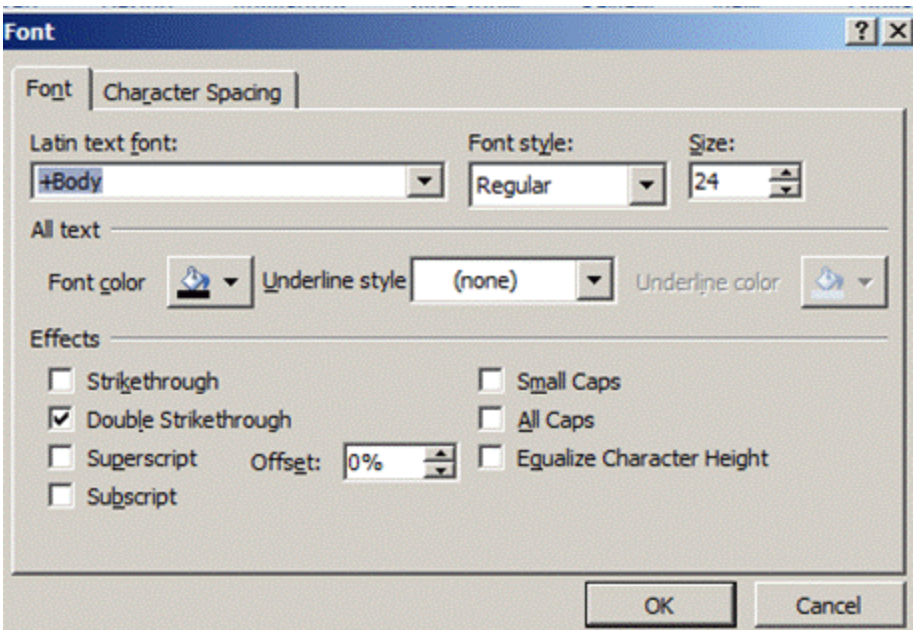
The title slide is the slide that is used to introduce the presentation to the audience. It has two text placeholders for text: title text placeholder and sub-title text placeholder. Placeholders are the building blocks for a PowerPoint slide.


To insert text in a placeholder, left click inside of the textbox and begin typing. Once you have entered text, click outside the text box to see how your text looks. The placeholder then becomes an object. An **object** is any item on a slide that can be manipulated. Objects are the building blocks that make up a slide. A text object can moved around and repositioned on a slide.

A object is selected when there is a gray, bold outline around the object, and when the cursor turns into a cross. Around the selected object are small white circles that are called sizing handles. You can drag the handles to position the object.

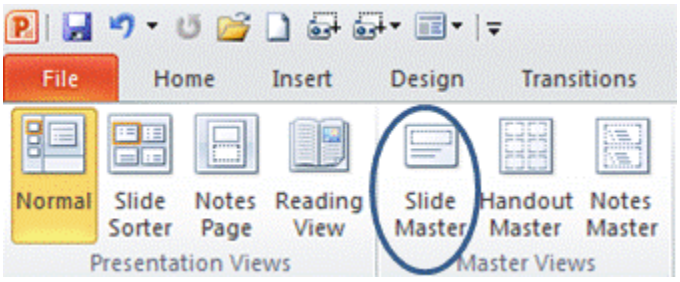
To apply formatting to text inside an object, select the text with your cursor, then click on the **Home** tab and in the **Font** group add text attributes such as bold, underline, and italics. The **Paragraph** group, located next to the Font group, contains commands that allow you to change the alignment of text, insert numbers or bullets to lists, and indent text.

You can also edit your text by accessing the Font dialogue box by clicking the **Font** group dialogue box launcher. (The dialogue box launcher is the small button containing a diagonal arrow that displays in the lower right corner of the group.) The Font dialogue box includes special effects such as: double strikethrough, superscript and subscript.

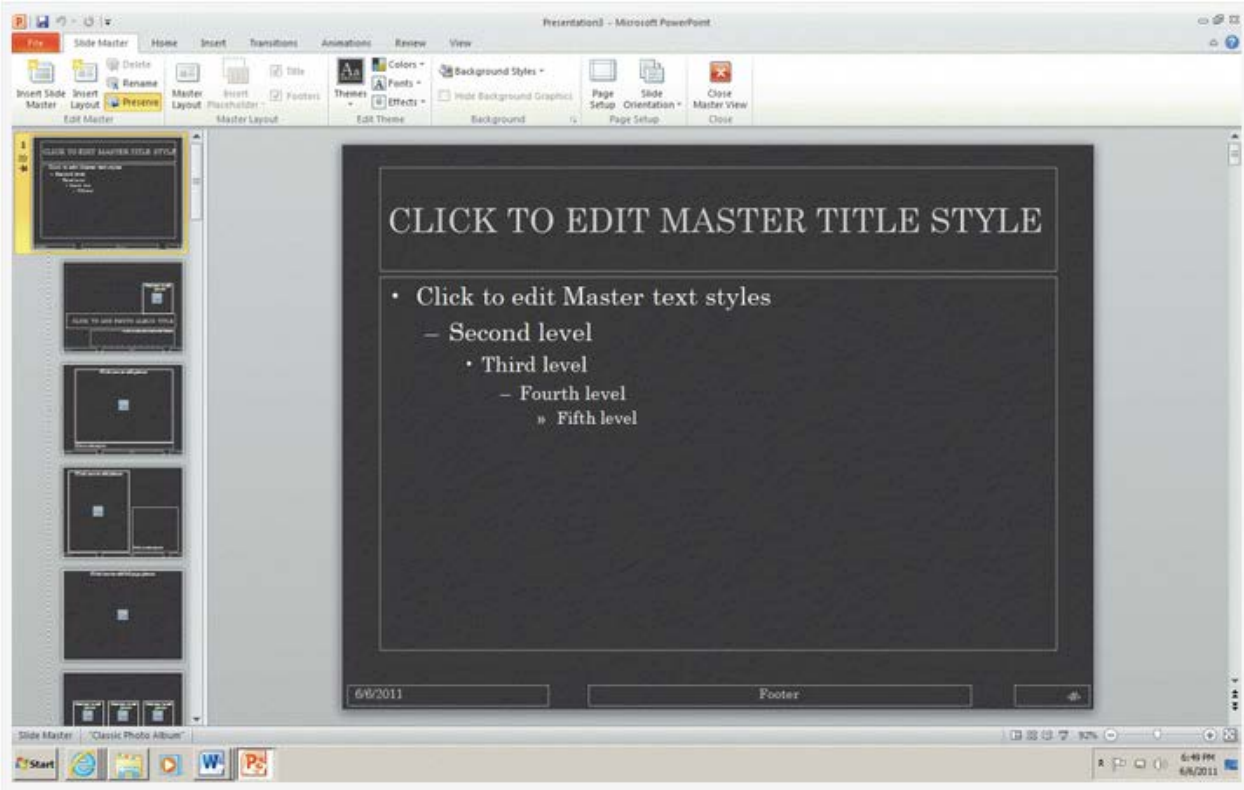



Another quick and easy way to format slides is by using a slide master. A **Slide Master** will reduce the steps needed to format all the slides in a presentation. Any changes made in the slide master will affect all slides in the presentation. This allows for consistency in any presentation.

When you choose a theme template PowerPoint automatically adds a Slide master. To format the slide master click the **View** tab and then choose **Slide Master** located in the **Presentation View** group.



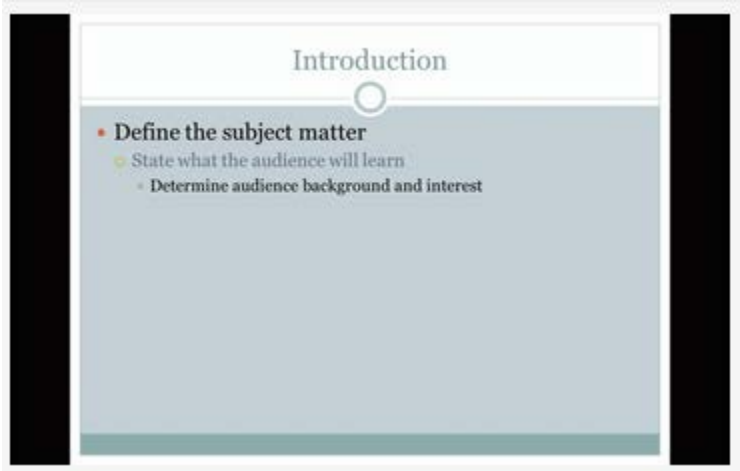

A slide master appears in the slide pane and in the Outline/Slide pane. The largest thumbnail in the pane is the slide master and the other thumbnails represent associated layouts.Click on the master slide or a specific layout to apply formatting or themes. Once formatting changes have been made click on **Close Master View** to return to the normal view.



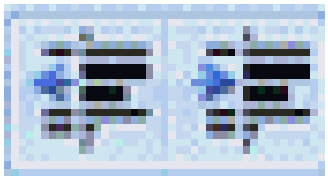

For more information on Slide Masters take this link to Microsoft Tips for using Slide Masters.

***Multi Level Bulleted Lists***

PowerPoint allows information to be displayed as multilevel bulleted lists. Bulleted lists are used in PowerPoint to display levels of importance within the presentation. Various slide layouts in the Slide Layout task pane contain bullets. To add multi levels to a bulleted list you need to choose the appropriate layout.

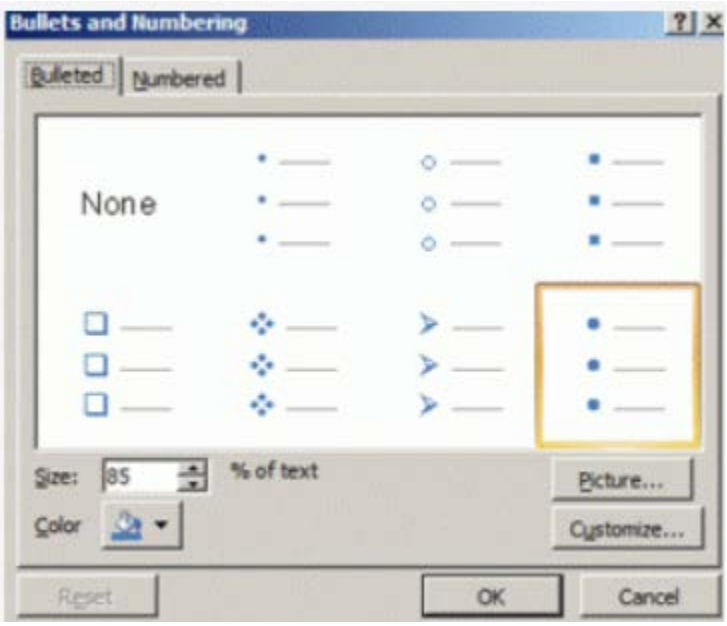


The first-level bullet will be displayed under the title placeholder. Once you have typed your text next to the first-level bullet press **Enter** on your keyboard. The new first-level bullet automatically appears. Press **Tab** on your keyboard and the first-level bullet becomes a second level bullet. Press **Shift + Tab** this will decrease the indent and bring the bullet back to first level.



Another method to add levels to your presentation is by clicking the decrease list level or increase list level buttons on the **Paragraph** group in the **Home** tab.

You can customize the bullets in your presentation by selecting the Bullets and Numbering dialogue box from **Paragraph** group located in the **Home** tab. Select the bullet text, click on the drop down arrow next to Bullets or Numbering, click on **Bullets and Numbering**, then choose the from the pre-designed bullets.




Now that you are able to create a presentation let us move on to view and save presentations.

## SLIDE SHOW

### Create a self-running presentation

By using a self-running presentation created in Microsoft PowerPoint 2010, you can communicate your information without a presenter. For example, you can set up a presentation to run unattended in a booth or kiosk at a trade show or convention, or you can send a CD with a self-running presentation to a client.

You can make most controls unavailable, so that your audience cannot make changes to your self-running presentation. Self-running presentations restart after they are finished and when they have been idle on a manually advanced slide for longer than five minutes.

This article covers considerations and suggestions for creating and producing a self-running presentation. Other articles cover many of the ways to distribute a self-running presentation, including package a presentation for CD or turn your presentation into a video.

### Set up a self-running presentation

To set up a PowerPoint presentation to run automatically, do the following:

1. On the **Slide Show** tab, in the **Set Up** group, click **Set Up Slide Show**.
2. In the Set Up Show box, under **Show type**, do one of the following:
3. For a presentation to be viewed by users click **Browsed at a kiosk (full screen)**.

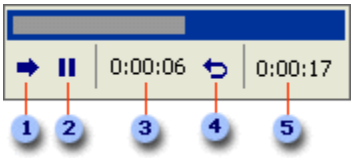
**Important** If you set up a presentation to run at a kiosk, remember to also set slide timing options, or use navigation hyperlinks to other documents or Internet sites, or action buttons such as graphics users can click to go forward or back in the presentation. Otherwise, your self-running presentation will not advance beyond the first slide.

### Rehearse and record slide timings

**Note** Be prepared to begin timing your presentation immediately after you perform the first step in this procedure.

1. On the **Slide Show** tab, in the **Set Up** group, click **Rehearse Timings**.

   The **Rehearsal** toolbar appears and the **Slide Time** box begins timing the presentation.




The Rehearsal toolbar

1. Next (advance to next slide)
2. Pause
3. Slide Time
4. Repeat

5. Total presentation time

5.

2. While timing your presentation, do one or more of the following on the **Rehearsal** toolbar:
    - To move to the next slide, click **Next**.
    - To temporarily stop recording the time, click **Pause**.
    - To restart recording the time after pausing, click **Pause**.
    - To set an exact length of time for a slide to appear, type the length of time in the **Slide Time** box.
    - To restart recording the time for the current slide, click **Repeat**.
3. After you set the time for the last slide, a message box displays the total time for the presentation and prompts you to do one of the following:
    - To keep the recorded slide timings, click **Yes**.
    - To discard the recorded slide timings, click **No**.

    Slide Sorter view appears and displays the time of each slide in your presentation.

## COMPUTERIZED ACCOUNTING SOFTWARE

'**Accounting Software**' is a Computer programs that assist bookkeepers and accountants in recording and reporting on a firm's financial transactions. The functionality of accounting software differs from product to product.

Usage of Accounting Software:

The computerized accounting uses the concept of databases. For this purpose an accounting software is used to implement a computerized accounting system. It does away the necessity to create and maintain journals, ledgers, etc. Some of the commonly used accounting software is Tally, Cash Manager, Best Books, etc.

Accounting software is basic software, which allows access to the data contained in the data base. It is a system to manage collection of data insuring at the same time that it remains reliable and confidential.

**Typical computerized accounting software will offer a number of different facilities, such as follows:**

1. On-screen input and print out of sales invoices

2. Automatic updating of customer accounts in the sales ledger
3. Recording of suppliers' invoice
4. Automatic updating of suppliers' accounts in the purchase ledger
5. Recording of bank receipts
6. Making payments to suppliers and for expenses
7. Automatic updating of general ledger
8. Automatic adjustment of stock records
9. Integration of database with the accounting program
10. Automatic calculation of pay rolls and associated entries
11. Computerized accounting programs can provide instant reports for management, for example: Aged debtors summary – a summary of customer accounts showing overdue amounts, Trial Balance, Trading and Profit and Loss Account and Balance Sheet, Stock Valuation, Sales Analysis, Budget Analysis, Variance Analysis, GST/VAT Returns, and Pay Roll Analysis.

When using computerized accounting system on the computer, the input screens have been designed for ease of use. The main advantage is that each transaction needs to be inputted only once, unlike a manual double entry system where two or three entries are required.

**While selecting accounting software the following points need to be taken into consideration:**

The requirements of the particular business should match with the available solutions. The software that fulfills the maximum requirement should be selected.

1. Costs of the various packages should be considered before final selection.
2. It should very simple and easy to use.
3. Vendor's credentials should also be verified. A vendor who is prepared to supply updates has to be preferred.

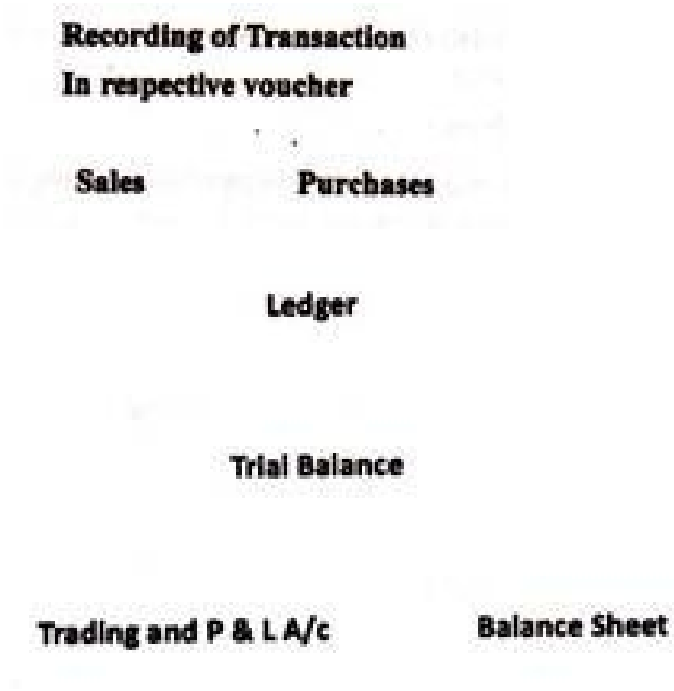
**Components of Computerized Accounting Software:**

***Preparation of Accounting Documents:***

Computer helps in preparing accounting documents like Cash Memo, Bills, and Invoices, etc., and preparing accounting vouchers.

***Recording of Transactions:***

Every day business transactions are recorded with the help of computer software. Logical scheme is implied for codification of account and transaction. Every account and transaction is assigned a unique code. The grouping of accounts is done from the first page. This process simplifies the work of recording the transactions.




***Preparation of Trial Balance and Financial Statements:***

After recording the transaction, the data is automatically transferred into ledger account by the computer. The Computer prepares the Trial Balance to check the accuracy of the records. With the help of trial balance, the computer can be programmed to prepare the Trading account, Profit and Loss account, and Balance Sheet.

**Stages of Computerized Accounting System:**

***Transaction Processing System [TPS]:***

It is the first stage of computerized accounting system. Its purpose is to record, process, validate and store transactions that occur in various functional areas of a business for subsequent retrieval and usage.

The following steps are involved in processing a transaction: Data Entry, Data Validation, Processing, and Revalidation, Storage, Information and Reporting. TPS is one of transaction processing systems, which is concerned with financial transactions only.

When a system contains only human resources, it is called manual system. When it uses computer resources, it is called computerized system. When both computer and human resources are used, it is called computer-based system.

These steps may be explained with an example making use of Automatic Teller Machine [ATM] facility by a Bank – Customer.

***Data Entry:***

Processing presumes data entry. A bank customer operates an ATM facility to make a withdrawal. The actions taken by the customer constitute the data, which is processed after validation by the computerized personal banking system.

***Data Validation:***

It ensures the accuracy and reliability of input data by comparing the same with some predefined standards or known data. 'Error Detection' or Error Correction' procedures do this validation.

Error detection control mechanism ensures to detect errors by comparing the actual data with the predetermined norm. And the Error correction mechanism makes suggestions for entering correct data input.

The Personal Identification Number [PIN] of the customer is validated with known data. If the PIN is wrong, a suggestion is made to indicate the PIN is invalid. Once the PIN is validated, the amount of withdrawal being made is also checked to ensure that it does not exceed a pre-specified limit of withdrawal.

***Processing and Revalidation:***

The processing of data occurs almost instantaneously in case of Online Transaction Processing [OLTP] provided a valid data has been fed to the system. This is called check input validity.

Revalidation occurs to ensure that the transaction in terms of delivery of money by ATM has been duly completed. This is called check output validity.

***Storage:***

Processed actions, as described above, result into financial transaction data. That is, withdrawal money by a particular customer is stored in transaction database of computerized personal banking system.

This ensures that only valid transactions are stored in the database. The stored data is processed making use of the Query facility to produce the desired information.

***Reporting:***

Reports can be prepared on the basis of the required information content according to the decision usefulness of the report.

**Customized Accounting Software:**

Customized software is one, which is developed on the basis of the requirement specifications provided by the business unit. A feasibility study is done in order to ascertain the requirements of the unit.

Based on these requirements, a requirement specification report is prepared for submission to the top management for approval. After approval, the designing process starts. After testing, it is implemented.

**Advantages:**

1. It covers all functional areas as per requirement,
2. For ease of data entry, the input screens would be tailor-made to match input documents,
3. The reports would be as per the specifications of the business unit,
4. Bar-code scanners can be used as input devices suitable for its specific needs.

**Disadvantages:**

a) If requirement specification or documentation is incomplete or control measures are inadequate, the system may work defectively,
b) Inadequate testing may result in bugs in the software,
c) Vendor may not give full support for the operation of the software.

The introduction of computerized accounting systems provide major advantages such as speed and accuracy of operation, and, perhaps most importantly, the ability to see the real-time state of the company's financial position. In my experience I have never seen a business that has upgraded to a computerized accounting system return to paper based accounting systems. A typical computerized accounting package will offer a number of different facilities. These include:

- On-screen input and printout of sales invoices
- Automatic updating of customer accounts in the sales ledger
- Recording of suppliers' invoices
- Automatic updating of suppliers' accounts in the purchases ledger Recording of bank receipts
- Making payments to suppliers and for expenses
- Automatic updating of the general ledger
- Automatic adjustment of stock records
- Integration of a business database with the accounting program
- Automatic calculation of payroll and associated entries

Computerized accounting programs can provide instant reports for management, for example:

- Aged debtors' summary – a summary of customer accounts showing overdue amounts
- Trial balance, trading and profit and loss account and balance sheet
- Stock valuation
- Sales analysis
- Budget analysis and variance analysis
- GST/VAT returns
- Payroll analysis

When using a computerized accounting system the on computer, input screens have been designed for ease of use. The main advantage is that each transaction needs only to be inputed once, unlike a manual double entry system where two or three entries are required. The computerized ledger system is fully integrated. This means that when a business transaction is inputed on the computer it is recorded in a number of different accounting records at the same time.

**The main advantages of a computerized accounting system are listed below:**

**Speed –** data entry onto the computer with its formatted screens and built-in databases of customers and supplier details and stock records can be carried out far more quickly than any manual processing.

**Automatic document production –** fast and accurate invoices, credit notes, purchase orders, printing statements and payroll documents are all done automatically.

**Accuracy –** there is less room for errors as only one accounting entry is needed for each transaction rather than two (or three) for a manual system.

**Up-to-date information –** the accounting records are automatically updated and so account balances (e.g. customer accounts) will always be up-to-date.

**Availability of information** – the data is instantly available and can be made available to different users in different locations at the same time.

**Management information –** reports can be produced which will help management monitor and control the business, for example the aged debtors analysis will show which customer accounts are overdue, trial balance, trading and profit and loss account and balance sheet.

**GST/VAT return –** the automatic creation of figures for the regular GST/VAT returns.

**Legibility -–** the onscreen and printed data should always be legible and so will avoid errors caused by poor figures.

**Efficiency –** better use is made of resources and time; cash flow should improve through better debt collection and inventory control.

**Staff motivation –** the system will require staff to be trained to use new skills, which can make them feel more motivated. Further to this with many 'off-the-shelf' packages like MYOB the training can be outsourced and thus making a particular staff member less critical of business operations.

**Cost savings –** computerized accounting programs reduce staff time doing accounts and reduce audit expenses as records are neat, up-to-date and accurate.

**Reduce frustration –** management can be on top of their accounts and thus reduce stress levels associated with what is not known.

**The ability to deal in multiple currencies easily** – many computerized accounting packages now allow a business to trade in multiple currencies with ease. Problems associated with exchange rate changes are minimized.

# TOPIC 8

# OVERVIEW OF INFORMATION SYSTEMS

## SYSTEMS OVERVIEW

A system is a set of related components, which can process input to produce a certain output. Every system requires a form of data input. For example, an ATM machine accepts data when you enter the PIN number. A washing machine accepts data when you select the start buttons. They process the inputs and produce their respective output

## INFORMATION SYSTEM

**Information system,** an integrated set of components for collecting, storing, and processing data and for delivering information, knowledge, and digital products. Business firms and other organizations rely on information systems to carry out and manage their operations, interact with their customers and suppliers, and compete in the marketplace. For instance, corporations use information systems to reach their potential customers with targeted messages over the Web, to process financial accounts, and to manage their human resources.

Governments deploy information systems to provide services cost-effectively to citizens. Digital goods, such as electronic books and software, and online services, such as auctions and social networking, are delivered with information systems. Individuals rely on information systems, generally Internet-based, for conducting much of their personal lives: for socializing, study, shopping, banking, and entertainment.

## COMPONENTS OF INFORMATION SYSTEMS

The six components that must come together in order to produce an information system are:

1. **Hardware:** The term hardware refers to machinery. This category includes the computer itself, which is often referred to as the central processing unit (CPU), and all of its support equipments. Among the support equipments are input and output devices, storage devices and communications devices.
2. **Software:** The term software refers to computer programs and the manuals (if any) that support them. Computer programs are machine-readable instructions that direct the circuitry within the hardware parts of the system to function in ways that produce useful information from data. Programs are generally stored on some input / output medium, often a disk or tape.

3. **Data:** Data are facts that are used by programs to produce useful information. Like programs, data are generally stored in machine-readable form on disk or tape until the computer needs them.
4. **Procedures:** Procedures are the policies that govern the operation of a computer system. "Procedures are to people what software is to hardware" is a common analogy that is used to illustrate the role of procedures in a system.
5. **People:** Every system needs people if it is to be useful. Often the most over-looked element of the system are the people, probably the component that most influence the success or failure of information systems. This includes "not only the users, but those who operate and service the computers, those who maintain the data, and those who support the network of computers
6. **Feedback**: it is another component of the IS, that defines that an IS may be provided with a feedback (Although this component isn't necessary to function).

Data is the bridge between hardware and people. This means that the data we collect is only data, until we involve people. At that point, data is now information.

## ROLE OF INFORMATION SYSTEMS IN AN ORGANIZATION

### Communication

Part of management is gathers and distributes information, and information systems makes this process more efficient by allowing managers to communicate rapidly. Email is quick and effective, but managers use information systems even more efficiently by storing documents in folders that they share with the employees who need the information. This type of communication lets employees collaborate in a systematic way. Each employee can communicate additional information by making changes that the system tracks. The manager collects the inputs and sends the newly revised document to his target audience.

### Operations

Management of an organisation's operations depends on the information it has. Information systems can offers more complete and more recent information, allows an organisation to operate more efficiently. it can use information systems to gain a cost advantage over competitors or to differentiate itself by offering better customer service. Sales data gives it insights about what customers are buying and lets it stock or produce items that are selling well. With guidance from the information system, it can streamline its operations.

### Decisions

The organisation information system can help it make better decisions by delivering all the information it needs and by modeling the results of its decisions. A decision involves choosing a

course of action from several alternatives and carrying out the corresponding tasks. When it has accurate, up-to-date information, it can make the choice with confidence. If more than one choice looks appealing, its can use the information system to run different scenarios. For each possibility, the system can calculate key indicators such as sales, costs and profits to helps it determine which alternative gives the most beneficial result.

**Records**

Organisation needs records of its activities for financial and regulatory purposes as well as for finding the causes of problems and taking corrective action. The information system stores documents and revision histories, communication records and operational data. The trick to exploiting this recording capability is organizing the data and using the system to process and present it as useful historical information. It can use such information to prepare cost estimates and forecasts and to analyze how its actions affected the key company indicators.

## CLASSIFICATION OF INFORMATION SYSTEM

In any given organization information system can be classified based on the usage of the information. Therefore, an information system in an organization can be divided into operations support system and management support system.

- **Operations support system**

  In an organization, data input is done by the end user which is processed to generate information products i.e. reports, which are utilized by internal and or external users. Such a system is called operation support system.

  The purpose of the operation support system is to facilitate business transaction, control production, support internal as well as external communication and update organization central database. The operation support system is further divided into a transaction-processing system, processing control system and enterprise collaboration system.

- **Transaction Processing System (TPS)**

  In manufacturing organization, there are several types of transaction across department. Typical organizational departments are Sales, Account, Finance, Plant, Engineering, Human Resource and Marketing. Across which following transaction may occur sales order, sales return, cash receipts, credit sales; credit slips, material accounting, inventory management, depreciation accounting, etc.

  These transactions can be categorized into batch transaction processing, single transaction processing and real time transaction processing.

- **Process Control System**

  In a manufacturing organization, certain decisions are made by a computer system without any manual intervention. In this type of system, critical information is fed to the system on a real-time basis thereby enabling process control. This kind of systems is referred as process control systems.

- **Enterprise Collaboration System**

  In recent times, there is more stress on team effort or collaboration across different functional teams. A system which enables collaborative effort by improving communication and sharing of data is referred to as an enterprise collaboration system.

- **Management Support System**

  Managers require precise information in a specific format to undertake an organizational decision. A system which facilitates an efficient decision making process for managers is called management support system.

  Management support systems are essentially categorized as management information system, decision support system, expert system and accounting information system.

Management information system provides information to manager facilitating the routine decision-making process. Decision support system provides information to manager facilitating specific issue related solution.

## TYPES OF INFORMATION SYSTEMS

Major types of systems include:

1. Transaction Processing Systems (TPS)
2. Management Information Systems (MIS)
3. Decision Support Systems (DSS)
4. Executive Support Systems (ESS)
5. Expert Systems

### 1. Transaction Processing System (TPS)

A transaction is any business related exchange, such as a sale to a client or a payment to a vendor. Transaction processing systems process and record transactions as well as update records. They automate the handling of data about business activities and transactions. They

record daily routine transactions such as sales orders from customers, or bank deposits and withdrawals. Although they are the oldest type of business information system around and handle routine tasks, they are critical to business organisation. For example, what would happen if a bank‘s system that records deposits and withdrawals and maintain accounts balances disappears?

TPS are vital for the organisation, as they gather all the input necessary for other types of systems. Think of how one could generate a monthly sales report for middle management or critical marketing information to senior managers without TPS. TPS provide the basic input to the company‘s database. A failure in TPS often means disaster for the organisation. Imagine what happens when an airline reservation system fails: all operations stop and no transaction can be carried out until the system is up and running again. Long queues form in front of ATMs and tellers when a bank‘s TPS crashes.

Transaction processing systems were created to maintain records and do simple calculations faster, more accurately and more cheaply than people could do the tasks.

**Characteristics of TPS:**

- TPS are large and complex in terms of the number of system interfaces with the various users and databases and usually developed by MIS experts.
- TPS‘s control collection of specific data in specific formats and in accordance with rules, policies, and goals of organisation- standard format
- They accumulate information from internal operations o the business.
- They are general in nature—applied across organisations.
- They are continuously evolving.

The goal of TPS is to improve transaction handling by:

- Speeding it up
- Using fewer people
- Improving efficiency and accuracy
- Integrating with other organisational information systems
- Providing information that was not available previously

Examples—Airline reservation systems, ATMs, order processing systems, registration systems, payroll systems and point of sale systems.

## 2. Management Reporting System (MRS)

Management Reporting Systems (MRS) formerly called Management Information Systems (MIS) provide routine information to decision makers to make structured, recurring and routine

decisions, such as restocking decisions or bonus awards. They focus on operational efficiency and provide summaries of data. An MRS takes the relatively raw data available through a TPS and converts it into meaningful aggregated form that managers need to conduct their responsibilities. They generate information for monitoring performance (e.g. productivity information) and maintaining coordination (e.g. between purchasing and accounts payable).

The main input to an MRS is data collected and stored by transaction processing systems. An MRS further processes transaction data to produce information useful for specific purposes. Generally, all MIS output have been pre-programmed by information systems personnel.

**Outputs include:**

**a) Scheduled Reports –** These were originally the only reports provided by early management information systems. Scheduled reports are produced periodically, such as hourly, daily, weekly or monthly. An example might be a weekly sales report that a store manager gets each Monday showing total weekly sales for each department compared to sales this week last year or planned sales.

**b) Demand Reports –** These provide specific information upon request. For instance, if the store manager wanted to know how weekly sales were going on Friday, and not wait until the scheduled report on Monday, she could request the same report using figures for the part of the week already elapsed.

**c) Exception Reports** – These are produced to describe unusual circumstances. For example, the store manager might receive a report for the week if any department‘s sales were more than 10% below planned sales.

**Characteristics of MRS**

- MIS professionals usually design MRS rather than end users - using life cycle oriented development methodologies.
- They are large and complex in terms of the number of system interfaces with the various users and databases.
- MRS are built for situations in which information requirements are reasonably well known and are expected to remain relatively stable. This limits the informational flexibility of MRS but ensures that a stable informational environment exists.
- They do not directly support the decision-making process in a search for alternative solutions to problems. Information gained through MRS is used in the decision –making process.
- They are oriented towards reporting on the past and the present, rather than projecting the future. Can be manipulated to do predictive reporting.
- MRS have limited analytical capabilities. They are not built around elaborate models, but rather rely on summarisation and extraction from the databases according to the given criteria.

**3. Decision Support System (DSS)**

Decision support systems provide problem-specific support for non-routine, dynamic and often complex decisions or problems. DSS users interact directly with the information systems, helping to model the problem interactively. DSS basically provide support for non-routine decisions or problems and an interactive environment in which decision makers can quickly manipulate data and models of business operations. A DSS might be used, for example, to help a management team decide where to locate a new distribution facility. This is a non-routine, dynamic problem. Each time a new facility must be built, the competitive, environmental, or internal contexts are most likely different. New competitors or government regulations may need to be considered, or the facility may be needed due to a new product line or business venture.

When the structure of a problem or decision changes, or the information required to address it is different each time the decision is made, then the needed information cannot be supplied by an MIS, but must be interactively modelled using a DSS. DSS provide support for analytical work in semi-structured or unstructured situations. They enable mangers to answer _What if‘ questions by providing powerful modelling tools (with simulation and optimisation capabilities) and to evaluate alternatives e.g. evaluating alternative marketing plans.

DSS have less structure and predictable use. They are user-friendly and highly interactive. Although they use data from the TPS and MIS, they also allow the inclusion of new data, often from external sources such as current share prices or prices of competitors.

**DSS components include:**

i. Database (usually extracted from MIS or TPS)
ii. Model Base
iii. User Dialogue/Dialogue Module

**Advantages of Decision Support System**

**(1) Time savings.** For all categories of decision support systems, research has demonstrated and substantiated reduced decision cycle time, increased employee productivity and more timely information for decision making. The time savings that have been documented from using computerized decision support are often substantial. Researchers, however, have not always demonstrated that decision quality remained the same or actually improved.

**(2) Enhance effectiveness.** A second category of advantage that has been widely discussed and examined is improved decision making effectiveness and better decisions. Decision quality and decision making effectiveness are however hard to document and measure. Most researches have examined soft measures like perceived decision quality rather than objective measures. Advocates of building data warehouses identify the

possibility of more and better analysis that can improve decision making.

**(3) Improve interpersonal communication.** DSS can improve communication and collaboration among decision makers. In appropriate circumstances, communications-driven and group DSS have had this impact. Model-driven DSS provides a means for sharing facts and assumptions. Data-driven DSS make "one version of the truth" about company operations available to managers and hence can encourage fact-based decision making. Improved data accessibility is often a major motivation for building a data-driven DSS. This advantage has not been adequately demonstrated for most types of DSS.

**(4) Competitive advantage.** Vendors frequently cite this advantage for business intelligence systems, performance management systems, and web-based DSS. Although it is possible to gain a competitive advantage from computerized decision support, this is not a likely outcome. Vendors routinely sell the same product to competitors and even help with the installation. Organizations are most likely to gain this advantage from novel, high risk, enterprise-wide, inward facing decision support systems. Measuring this is and will continue to be difficult.

**(5) Cost reduction.** Some researches and especially case studies have documented DSS cost saving from labor savings in making decisions and from lower infrastructure or technology costs. This is not always a goal of building DSS.

**(6) Increase decision maker satisfaction.** The novelty of using computers has and may continue to confound analysis of this outcome. DSS may reduce frustrations of decision makers, create perceptions that better information is being used and/or creates perceptions that the individual is a "better" decision maker. Satisfaction is a complex measure and researchers often measure satisfaction with the DSS rather than satisfaction with using a DSS in decision making. Some studies have compared satisfaction with and without computerized decision aids. Those studies suggest the complexity and "love/hate" tension of using computers for decision support.

**(7) Promote learning.** Learning can occur as a by-product of initial and ongoing use of a DSS. Two types of learning seem to occur: learning of new concepts and the development of a better factual understanding of the business and decision making environment. Some DSS serve as "de facto" training tools for new employees. This potential advantage has not been adequately examined.

**(8) Increase organizational control.** Data-driven DSS often make business transaction data available for performance monitoring and ad hoc querying. Such systems can enhance management understanding of business operations and managers perceive that this is useful. What is not always evident is the financial benefit from increasingly detailed data.

**Disadvantages of Decision Support System**

**Decision Support System** can create advantages for organizations and can have positive benefits, however building and using Decision Support System can create negative outcomes in some situations.

**(1) Monetary cost.** The decision support system requires investing in information system to collect data from many sources and analyze them to support the decision making. Some analysis for Decision Support System needs the advance of data analysis, statistics, econometrics and information system, so it is the high cost to hire the specialists to set up the system.

**(2) Overemphasize decision making.** Clearly the focus of those of us interested in computerized decision support is on decisions and decision making. Implementing Decision Support System may reinforce the rational perspective and overemphasize decision processes and decision making. It is important to educate managers about the broader context of decision making and the social, political and emotional factors that impact organizational success. It is especially important to continue examining when and under what circumstances Decision Support System should be built and used. We must continue asking if the decision situation is appropriate for using any type of Decision Support System and if a specific Decision Support System is or remains appropriate to use for making or informing a specific decision.

**(3) Assumption of relevance.** According to Wino grad and Flores (1986), "Once a computer system has been installed it is difficult to avoid the assumption that the things it can deal with are the most relevant things for the manager's concern." The danger is that once Decision Support System become common in organizations, that managers will use them inappropriately. There is limited evidence that this occurs. Again training is the only way to avoid this potential problem.

**(4) Transfer of power.** Building Decision Support System, especially knowledge-driven Decision Support System, may be perceived as transferring decision authority to a software program. This is more a concern with decision automation systems than with Decision Support System. We advocate building computerized decision support systems because we want to improve decision making while keeping a human decision maker in the "decision loop". In general, we value the "need for human discretion and innovation" in the decision making process.

(**5) Unanticipated effects.** Implementing decision support technologies may have unanticipated consequences. It is conceivable and it has been demonstrated that some Decision Support System reduce the skill needed to perform a decision task. Some Decision Support System overload decision makers with information and actually reduce decision making effectiveness. We are sure that other such unintended consequences have been documented. Nevertheless, most of the examples seem correctable, avoidable or subject to remedy if and when they occur.

**(6) Obscuring responsibility.** The computer does not make a "bad" decision, people do. Unfortunately some people may deflect personal responsibility to a Decision Support System. Managers need to be continually reminded that the computerized decision support system is an intermediary between the people who built the system and the people who use the system. The

entire responsibility associated with making a decision using a Decision Support System resides with people who built and use the system.

**(7) False belief in objectivity.** Managers who use Decision Support System may or may not be more objective in their decision making. Computer software can encourage more rational action, but managers can also use decision support technologies to rationalize their actions. It is an overstatement to suggest that people using a Decision Support System are more objective and rational than managers who are not using computerized decision support.

**(8) Status reduction.** Some managers argue using a Decision Support System will diminish their status and force them to do clerical work. This perceptual problem can be a disadvantage of implementing a Decision Support System. Managers and IS staff who advocate building and using computerized decision support need to deal with any status issues that may arise. This perception may or should be less common now that computer usage is common and accepted in organizations.

**(9) Information overload.** Too much information is a major problem for people and many Decision Support System increase the information load. Although this can be a problem, Decision Support System can help managers organize and use information. Decision Support System can actually reduce and manage the information load of a user. Decision Support System developers need to try to measure the information load created by the system and Decision Support System users need to monitor their perceptions of how much information they are receiving. The increasing ubiquity of handheld, wireless computing devices may exacerbate this problem and disadvantage.

## 4. Executive Information System (EIS) / Executive Support Systems (ESS)

EIS provide a generalized computing and communication environment to senior managers to support strategic decisions. They draw data from the MIS and allow communication with external sources of information. But unlike DSS, they are not designed to use analytical models for specific problem solving. EIS are designed to facilitate senior managers‘ access to information quickly and effectively.

ESS has menu-driven user-friendly interfaces, interactive graphics to help visualisation of the situation and communication capabilities that link the senior executives to the external databases he requires.

Top executives need ESS because they are busy and want information quickly and in an easy to read form. They want to have direct access to information and want their computer set-up to directly communicate with others. They want structured forms for viewing and want summaries rather than details.

**Advantages and disadvantages**

**Advantages of EIS**

- Easy for upper-level executives to use, extensive computer experience is not required in operations
- Provides timely delivery of company summary information
- Information that is provided is better understood
- EIS provides timely delivery of information. Management can make decisions promptly.
- Improves tracking information
- Offers efficiency to decision makers

**Disadvantages of EIS**

- System dependent
- Limited functionality, by design
- Information overload for some managers
- Benefits hard to quantify
- High implementation costs
- System may become slow, large, and hard to manage
- Need good internal processes for data management
- May lead to less reliable and less secure data

**5. Expert System (ES)**

It is an advanced DSS that provides expert advice by asking users a sequence of questions dependent on prior answers that lead to a conclusion or recommendation. It is made of a knowledge base (database of decision rules and outcomes), inference engine (search algorithm), and a user interface.
ES use artificial intelligence technology. It attempts to codify and manipulate knowledge rather than information. ES may expand the capabilities of a DSS in support of the initial phase of the decision making process. It can assist the second (design) phase of the decision making process by suggesting alternative scenarios for "what if" evaluation.
It assists a human in the selection of an appropriate model for the decision problem. This is an avenue for an automatic model management; the user of such a system would need less knowledge about models.
ES can simplify model-building in particular simulation models lends itself to this approach.
ES can provide an explanation of the result obtained with a DSS. This would be a new and important DSS capability.
ES can act as tutors. In addition ES capabilities may be employed during DSS development; their general potential in software engineering has been recognised.

**Advantages**

Expert systems use information technology to gain and use human expertise. Obviously, this can be very beneficial to organizations. Expert Systems can:

1. Provide answers for decisions, processes and tasks that are repetitive
2. Hold huge amounts of information
3. Minimize employee training costs
4. Centralize the decision making process
5. Make things more efficient by reducing the time needed to solve problems
6. Combine various human expert intelligences
7. Reduce the number of human errors
8. Provide strategic and comparative advantages that may create problems for competitors
9. Look over transactions that human experts may not think of

**Disadvantages**

However, there are also disadvantages to expert systems, such as:

1. No common sense used in making decisions
2. Lack of creative responses that human experts are capable of
3. Not capable of explaining the logic and reasoning behind a decision
4. It is not easy to automate complex processes
5. There is no flexibility and ability to adapt to changing environments
6. Not able to recognize when there is no answer

**Other Information Systems**

These are special purpose information systems. They are more recent types of information systems that cannot be characterised as one of the types discussed above.

**1. Office Automation Systems (OAS)**

Office automation systems support general office work for handling and managing documents and facilitating communication. Text and image processing systems evolved as from word processors to desktop publishing, enabling the creation of professional documents with graphics and special layout features. Spreadsheets, presentation packages like PowerPoint, personal database systems and note-taking systems (appointment book, notepad, card file) are part of OAS.

In addition OAS include communication systems for transmitting messages and documents (e-mail) and teleconferencing capabilities.

## 2. Artificial Intelligence Systems

Artificial intelligence is a broad field of research that focuses on developing computer systems that simulate human behaviour, that is, systems with human characteristics. These characteristics include, vision, reasoning, learning and natural language processing.

Examples: Expert systems, Neural Networks, Robotics.

## 3. Knowledge-Based Systems/ Knowledge Work Systems (KWS)

Knowledge Work Systems support highly skilled knowledge workers in the creation and integration of new knowledge in the company. Computer Aided Design (CAD) systems used by product designers not only allow them to easily make modifications without having to redraw the entire object (just like word processors for documents), but also enable them to test the product without having to build physical prototypes.

Architects use CAD software to create, modify, evaluate and test their designs; such systems can generate photo-realistic pictures, simulating the lighting in rooms at different times of the day, perform calculations, for instance on the amount of paint required. Surgeons use sophisticated CAD systems to design operations. Financial institutions use knowledge work systems to support trading and portfolio management with powerful high-end PCs. These allow managers to get instantaneously analysed results on huge amounts of financial data and provide access to external databases.

Workflow systems are rule-based programmes - (IF _this happens‘ THEN _take this action‘) - that coordinate and monitor the performance of a set of interrelated tasks in a business process.

## 4. Geographic Information Systems (GIS)

Geographic information systems include digital mapping technology used to store and manipulate data relative to locations on the earth. An example is a marketing GIS database. A GIS is different from a Global Positioning System (GPS). The latter is a satellite-based system that allows accurate location determination.

## 5. Virtual Reality Systems

Virtual reality systems include 3-dimensional simulation software, where often the user is immersed in a simulated environment using special hardware (such as gloves, data suits or head

mounted displays). Sample applications include flight simulators, interior design or surgical training using a virtual patient.

**6. E-Commerce/E-Business Systems**

E-Commerce involves business transactions executed electronically between parties. Parties can be companies, consumers, public sector organisations or governments.

**7. Enterprise Resource Planning (ERP) systems**

ERP systems are a set of integrated programmes that handle most or all organisations‘ key business processes at all its locations in a unified manner. Different ERP packages have different scopes. They often coordinate planning, inventory control, production and ordering. Most include finance and manufacturing functions, but many are now including customer relationship management, distribution, human resource as well as supply chain management. ERP systems are integrated around a common database. Some well known ERP vendors are ORACLE, SAP and PeopleSoft.

For instance a manufacturing company may prepare a demand forecast for an item for the next month. The ERP system would then check existing items inventory to see if there is enough on hand to meet the demand. If not, the ERP system schedules production of the shortfall, ordering additional raw material and shipping materials if necessary.

**8. Electronic Funds Transfer (EFT)**

EFT is the exchange of money via telecommunications without currency actually changing hands.

EFT refers to any financial transaction that transfers a sum of money from one account to another electronically. Usually, transactions originate at a computer at one institution (location) and are transmitted to a computer at another institution (location) with the monetary amount recorded in the respective organisation‘s accounts. Because of the potential high volume of money being exchanged, these systems may be in an extremely high-risk category. Therefore, access security and authorisation of processing are important controls.

Security in an EFT environment is extremely important. Security includes methods used by the customer to gain access to the system, the communications network and the host or application-processing site. Individual customer access to the EFT system is generally controlled by a plastic card and a personal identification number (PIN). Both items are required to initiate a transaction.

### 9. Automated Teller Machine (ATM)

An ATM is a specialised form of point of sale terminal designed for the unattended use by a customer of a financial institution. These customarily allow a range of banking and debit operations, especially financial deposits and cash withdrawals. ATMs are usually located in uncontrolled areas and utilise unprotected telecommunications lines for data transmissions. Therefore, the system must provide high levels of logical and physical security for both the customer and the machinery.

Recommended internal control guidelines for ATMs include the following:

- Review measures to establish proper customer identification and maintenance of their confidentiality
- Review file maintenance and retention system to trace transactions
- Review and maintain exception reports to provide an audit trail
- Review daily reconciliation of ATM machine transactions.

## INFORMATION SYSTEMS SECURITY AND CONTROL

With the opening of information systems to the global Internet and with their thorough infusion into the operation and management of business and government organizations and into the infrastructure of daily life across the world, security issues have moved to the forefront of concerns about global well-being.

## INFORMATION SYSTEMS SECURITY

Information systems security is responsible for the integrity and safety of system resources and activities. Most organizations in developed countries are dependent on the secure operation of their information systems. In fact, the very fabric of societies often depends on this security. Information systems are at the heart of intensive care units and air traffic control systems. Financial institutions could not survive a total failure of their information systems for longer than a day or two. Electronic funds transfer systems (EFTS) handle immense amounts of money that exist only as electronic signals sent over the networks or as magnetized spots on storage disks. Information systems are vulnerable to a number of threats, which require strict controls such as countermeasures and regular audits to ensure that the system remains secure. (The relationship among security measures is shown in the figure.)

Although instances of computer crime and abuse receive extensive media attention, human error is estimated to cause greater losses in information systems operation. Disasters such as earthquakes, floods, and fires are the particular concern of disaster recovery planning, which is a

part of a corporate business continuity plan. A contingency scheme is also necessary to cover the failure of servers, telecommunications networks, or software.

## Computer crime and abuse

Computer crime—illegal acts in which computers are the primary tool—costs the world economy billions of dollars annually. Computer abuse does not rise to the level of crime, yet it involves unethical use of a computer. The objectives of the so-called hacking of information systems include vandalism, theft of consumer information, governmental and commercial espionage, sabotage, and cyberwar. Some of the more widespread means of computer crime include phishing and planting of malware, such as computer viruses and worms, Trojan horses, and logic bombs.

**Phishing -**involves obtaining a legitimate user's login and other information by subterfuge with messages fraudulently claiming to originate with a legitimate entity, such as a bank or government office. A successful phishing raid to obtain a user's information may be followed by identity theft, an impersonation of the user to gain access to the user's resources.

**Computer viruses -** are a particularly common form of attack. These are program instructions that are able not only to perform malicious acts but also to insert copies of themselves into other programs and thus spread to other computer systems. Similar to viruses, worms are complete computer programs that replicate through telecommunications networks. Because of their ability to spread rapidly and widely, viruses and worms can inflict immense damage. The damage can be in the form of tampering with system operation, theft of large volumes of data (e.g., credit card numbers), or denial of service by overloading systems with a barrage of spurious requests.

In a Trojan horse attack, the malefactor conceals unauthorized instructions within an authorized program. A logic bomb consists of hidden instructions, often introduced with the Trojan horse technique, that stay dormant until a specific event occurs, at which time the instructions are activated. In one well-known case, in 1985 a programmer at an insurance company in Fort Worth, Texas, placed a logic bomb in his company's human resources system; when he was fired and his name was deleted from the company's employee database, the entire database was erased.

Once a system connected to the Internet is invaded, it may be used to take over many others and organize them into so-called botnets that can launch massive attacks against other systems to steal information or sabotage their operation.

## INFORMATION SYSTEMS CONTROLS

To ensure secure and efficient operation of information systems, an organization institutes a set of procedures and technological measures called controls. Information systems are safeguarded through a combination of general and application controls.

General controls apply to information system activities throughout an organization. The most important general controls are the measures that control access to computer systems and the information stored there or transmitted over telecommunications networks. General controls include administrative measures that restrict employees' access to only those processes directly relevant to their duties. As a result, these controls limit the damage that any individual employee or employee impersonator can do. Fault-tolerant computer systems installed in critical environments, such as in hospital information systems or securities marketplaces, are designed to control and isolate problems so that the system can continue to function.

Application controls are specific to a given application and include such measures as validating input data, logging the accesses to the system, regularly archiving copies of various databases, and ensuring that information is disseminated only to authorized users.

### Securing information

Controlling access to information systems became profoundly more difficult with the spread of wide area networks (WANs) and, in particular, the Internet. Users, as well as interlopers, may access systems from any unattended computer within an organization or from virtually anywhere over the Internet. As a security measure, each legitimate user has a unique name and a regularly changed password. Another security measure is to require some form of physical authentication, such as an object (a physical token or a smart card) or a personal characteristic (fingerprint, retinal pattern, hand geometry, or signature). Many systems combine these types of measures—such as automatic teller machines, which rely on a combination of a personal identification number (PIN) and an identification card. Security measures placed between an organization's internal networks and the Internet are known as firewalls.

A different way to prohibit access to information is via data encryption, which has gained particular importance in electronic commerce. Public key encryption is used widely in such commerce. To ensure confidentiality, only the intended addressee has the private key needed to decrypt messages that have been encrypted with the addressee's public key. Furthermore, authentication of both parties in an electronic transaction is possible through the digital certificates issued to both parties by a trusted third party and the use of digital signatures—an additional code attached to the message to verify its origin. A type of antitampering code can also be attached to a message to detect corruption. Similar means are available to ensure that parties to an electronic transaction cannot later repudiate their participation. Some messages require additional attributes. For example, electronic cash is a type of message, with encryption used to ensure the purchaser's anonymity, that acts like physical cash.

To continually monitor information systems, intrusion detection systems are used. They detect anomalous events and log the information necessary to produce reports and to establish the source and the nature of the possible intrusion. More active systems also attempt to prevent the intrusion upon detection.

**Information systems audit**

The effectiveness of an information system's controls is evaluated through an information systems audit. An audit aims to establish whether information systems are safeguarding corporate assets, maintaining the integrity of stored and communicated data, supporting corporate objectives effectively, and operating efficiently. It is a part of a more general financial audit that verifies an organization's accounting records and financial statements. Information systems are designed so that every financial transaction can be traced. In other words, an audit trail must exist that can establish where each transaction originated and how it was processed. Aside from financial audits, operational audits are used to evaluate the effectiveness and efficiency of information systems operations, and technological audits verify that information technologies are appropriately chosen, configured, and implemented.

# TOPIC 9

# COMPUTER NETWORKS

## COMPUTER NETWORK CONCEPTS

A computer network is a communications system connecting two or more computers that work to exchange information and share resources (hardware, software and data). A network may consist of microcomputers or it may integrate microcomputers or other devices with larger computers. Networks may be controlled by all nodes working together equally or by specialized nodes coordinating and supplying all resources. Networks may be simple or complex, self - contained or dispersed over a large geographical area.

Network architecture is a description of how a computer is set-up (configured) and what strategies are used in the design. The interconnection of PCs over a network is becoming more important, especially as more hardware is accessed remotely and PCs intercommunicate with one another.

**Key terms**

- Node – any device connected to a network such as a computer, printer or data storage device.
- Client – a node that requests and uses resources available from other nodes. Typically a microcomputer.
- Server – a node that shares resources with other nodes. May be called a file server, printer server, communication server, web server or database server.
- Network Operating System (NOS) – the operating system of the network that controls and coordinates the activities between computers on a network, such as electronic communication and sharing of information and resources.
- Distributed processing – computing power is located and shared at different locations. Common in decentralised organisations (each office has its own computer system but is networked to the main computer).
- Host computer – a large centralised computer, usually a minicomputer or mainframe.

## COMPUTER NETWORK HARDWARE AND SOFTWARE

Networking hardware may also be known as network equipment, computer networking devices. Units which are the last receiver or generate data are called hosts or data terminal equipment. All these terms refer to devices facilitating the use of a computer network. .

Network software is a general phrase for software that, is designed to -help set up, manage, and/or monitor computer networks: Networking software applications are available to manage

and monitor networks of all sizes; from the smallest home networks to the largest enterprise networks.

**Hub:-**unintelligent network device. that sends one signal to all of the stations connected to it. computers/devices are competing for attention because it takes the data that comes into a port and sends it out all the other ports in the hub. Traditionally, hubs are used for star topology networks, but they are .often used with other configurations to make it easy to add and remove computers without bringing down the network. Resides on Layer 1 of the OSI model

**Switch:-**Split large rietWorks. into segments, decreasing the nuinber of users sharing the same network resources and bandwidth. 'Understands when two devices want to talk to each other, and gives them a switched connection Helps prevent data collisions and reduces network congestion, increasing network *performance. Most home users. get very little, if any advantage from switches, even when sharing a broadband connection. ReSideS on Layer 2 of the OSI model.

**Bridge:-**Connects two LANs and forwards or filters data packets between them. Creates an extended network in which any two workstations on the linked LANs can share data. Transparent to' protocols and to higher level devices like routers. Forward data depending on the Hardware (MAC) address, not the Network address (IP).Resides on Layer 2 of the OSI model

**Repeaten-**Used to boost the signal between two cable segments or wireless access points. Cannot connect different network architecture. Does not simply amplify the signal, it regenerates the packets and retimes them. Resides on Layer l of the OSI model.

**Router:-**A device that connects any number of LANs. Uses standardized protocols to move packets efficiently to their, destination. More sophisticated than bridges, connecting networks of different types (for example, star and token ring) Forwards data depending on the Network 'address (IP), not the Hardware (MAC) address. Routers are the only one of these four devices that will allow you to share a single IP address among multiple network clients. Resides on Layer 3 of the OSI model.

**Additional Network Hardware Devices**

**Network Interface Cards (NICs):-**Puts the data into packets and transmits packet onto the network. May be wired or wireless.

**Gateway:-**Connects networks with different protocols like TCP/IP network and IPX/SPX networks. Routers and Gateways often refer to the same device.

**Proxy server:-**Isolates internal network computers from the internet. The user first accesses the proxy server and the proxy server accesses the internet and retrieves the requested web page or document. The user then gets a copy of that page from the proxy server.

## TYPES OF COMPUTER NETWORKS

Different communication channels allow different types of networks to be formed. Telephone lines may connect communications equipment within the same building. Coaxial cable or fibreoptic cable can be installed on building walls to form communication networks. You can also create your own network in your home or apartment. Communication networks also differ in geographical size.

Three important networks according to geographical size are LANs, MANs and WANs.

### Local Area Network (LAN)

A LAN is a computer network in which computers and peripheral devices are in close physical proximity. It is a collection of computers within a single office or building that connect to a common electronic connection – commonly known as a network backbone. This type of network typically uses microcomputers in a busy organisation linked with telephone, coaxial or fibre-optic cable.

A LAN allows all users to share hardware, software and data on the network. Minicomputers, mainframes or optical disk storage devices can be added to the network. A network bridge device may be used to link a LAN to other networks with the same configuration. A network gateway device may be used to link a LAN to other networks, even if their configurations are different.

### Metropolitan Area Network (MAN)

A MAN is a computer network that may be citywide. This type of network may be used as a link between office buildings in a city. The use of cellular phone systems expands the flexibility of a MAN network by linking car phones and portable phones to the network.

### Wide Area Networks (WAN)

A WAN is a computer network that may be countrywide or worldwide. It normally connects networks over a large physical area, such as in different buildings, towns or even countries. A modem connects a LAN to a WAN when the WAN connection is an analogue line.
For a digital connection, a gateway connects one type of LAN to another LAN or WAN, and a bridge connects a LAN to similar types of LAN. This type of network typically uses microwave relays and satellites to reach users over long distances. The widest of all WANs is the Internet, which spans the entire globe.

**WAN technologies**

How you get from one computer to the other across the Internet.

(i) Circuit switching
- A dedicated path between machines is established.
- All resources are guaranteed.
- Has limitation of set-up delay but has fast transmission.

(ii) Packet switching
- Nodes in the network _routers' decide where to send data next.
- No resources are guaranteed —best effort‖.
- Little set-up, transmission delay at each router.
- Computer-computer communication.

(iii) Frame relay
- Like packet switching
- Low level error correction removed to yield higher data rates.

(iv) Cell relay – ATM (Asynchronous Transmission Mode)
- Frame relay with uniformly sized packets (cells).
- Dedicated circuit paths.

(v) ISDN (Integrated Services Digital Network)
- Transmits voice and data traffic.
- Specialised circuit switching.
- Uses frame relay (narrowband) and ATM (broadband).

**DATA COMMUNICATION**

Data communication systems are the electronic systems that transmit data over communication lines from one location to another. End users need to know the essential parts of communication technology, including connections, channels, transmission, network architectures and network types. Communication allows microcomputer users to transmit and receive data and gain access to electronic resources.

- Source – creates the data, could be a computer or a telephone
- Transmitter – encodes the information e.g. modem, network card
- Transmission system – transfers the information e.g. wire or complex network
- Receiver – decodes the information for the destination e.g. modem, network card
- Destination – accepts and uses the incoming information, could be a computer or telephone

**Communication channels**

The transmission media used in communication are called communication channels. Two ways of connecting microcomputers for communication with each other and with other equipment is through cable and air. There are five kinds of communication channels used for cable or air connections:

- Telephone lines
- Coaxial cable
- Fibre-optic cable
- Microwave
- Satellite

**1. Telephone lines (Twisted Pair)**

Telephone line cables made up of copper wires called twisted pair. A single twisted pair culminates in a wall jack where you plug your phone. Telephone lines have been the standard communication channel for both voice and data. More technically advanced and reliable transmission media are now replacing it.

**2. Coaxial cable**

This is a high-frequency transmission cable that replaces the multiple wires of telephone lines with a single solid copper core. It has over 80 times the transmission capacity of twisted pair. It is often used to link parts of a computer system in one building.

**3. Fibre-optic cable**

Fibre-optic cable transmits data as pulses of light through tubes of glass. It has over 26,000 times the transmission capacity of twisted pair. A fibre-optic tube can be half the diameter of human hair. Fibre-optic cables are immune to electronic interference and more secure and reliable. Fibre-optic cable is rapidly replacing twisted-pair telephone lines.

**4. Microwave**

Microwaves transmit data as high-frequency radio waves that travel in straight lines through air. Microwaves cannot bend with the curvature of the earth. They can only be transmitted over short distances. Microwaves are good medium for sending data between buildings in a city or on a large college campus. Microwave transmission over longer distances is relayed by means of _dishes‘ or antennas installed on towers, high buildings or mountaintops.

**5. Satellite**

Satellites are used to amplify and relay microwave signals from one transmitter on the ground to another. They orbit about 22,000 miles above the earth. They rotate at a precise point and speed

and can be used to send large volumes of data. Bad weather can sometimes interrupt the flow of data from a satellite transmission. INTELSAT (INternational TELecommunication SATellite consortium), owned by 114 governments forming a worldwide communications system, offers many satellites that can be used as microwave relay stations.

**Data transmission: analog versus digital**

Information is available in an analogue or in a digital form. Computer-generated data can easily be stored in a digital format, but analogue signals, such as speech and video, must first be sampled at regular intervals and then converted into a digital form.

This process is known as digitisation and has the following advantages:

i. Digital data is less affected by noise
ii. Extra information can be added to digital signals so that errors can either be detected or corrected.
iii. Digital data tends not to degrade over time.
iv. Processing of digital information is relatively easy, either in real-time or non real-time.
v. A single type of media can be used to store many different types of information (such as video, speech, audio and computer data can be stored on tape, hard-disk or CD-ROM).
vi. A digital system has a more dependable response, whereas an analogue system‘s accuracy depends on parameters such as component tolerance, temperature, power supply variations, and so on. Analogue systems thus produce a variable response and no two analogue systems are identical.
vii. Digital systems are more adaptable and can be reprogrammed with software. Analogue systems normally require a change of hardware for any functional changes (although programmable analogue devices are now available).

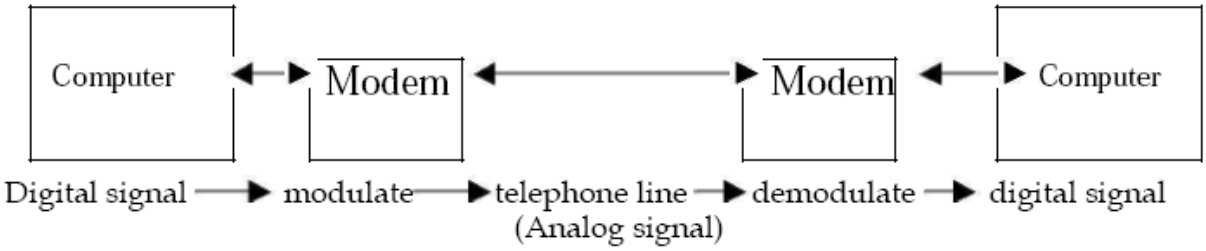
The main disadvantage with digital conversion is:

- Digital samples must be quantised to given levels: this adds an error called quantisation error. The larger the number of bits used to represent each sample, the smaller the quantisation error.

**Modem**

A modem is a hardware device that converts computer signals (digital signals) to telephone signals (analog signals) and vice versa.

The process of converting digital signals to analog is called modulation while the process of converting analog signals to digital is called demodulation.




**Modem transmission speed**

The speed with which modems transmit data varies. Communications speed is typically measured in bits per second (bps). The most popular speeds for conventional modems are 36.6 kbps (36,600 bps) and 56kbps (56,000 bps). The higher the speed, the faster you can send and receive data.

**Types of modems**

**a) External modem**

An external modem stands apart from the computer. It is connected by a cable to the computer‘s serial port. Another cable is used to connect the modem to the telephone wall jack.

**b) Internal modem**

An internal modem is a plug-in circuit board inside the system unit. A telephone cable connects this type of modem to the telephone wall jack.

**c) Wireless modem**

A wireless modem is similar to an external modem. It connects to the computer‘s serial port, but does not connect to telephone lines. It uses new technology that receives data through the air.

**Principles of data communication and networks**

1. **Destiny**

- The system should transmit the message to the correct intended destination. The destination can be another user or another computer

2. **Reliability**

- The system should deliver the data faithfully. Any unwanted signals/noise added along with the original data may play havoc

3. **Fast**

- The system should transmit the data as fast as possible within the technological constraints. In case of audio and video data they must be received in the same order as they are produced without adding any significant delay

**Data transmission**

Technical matters that affect data transmission include:

- Bandwidth
- Type of transmission
- Direction of data flow
- Mode of transmitting data
- Protocols

**Bandwidth**

Bandwidth is the bits-per-second (bps) transmission capability of a communication channel.

There are three types of bandwidth:

- Voice band – bandwidth of standard telephone lines (9.6 to56 kbps)
- Medium band – bandwidth of special leased lines used (56 to 264,000 kbps)
- Broadband – bandwidth of microwave, satellite, coaxial cable and fiber optic (56 to 30,000,000 kbps).

**Types of transmission – serial or parallel**

a. **Serial data transmission**

In serial transmission, bits flow in a continuous stream. It is the way most data is sent over telephone lines. It is used by external modems typically connected to a microcomputer through a serial port. The technical names for such serial ports are RS-232C connector or asynchronous communications port.

b. **Parallel data transmission**

In parallel transmission, bits flow through separate lines simultaneously (at the same time). Parallel transmission is typically limited to communications over short distances (not telephone lines). It is the standard method of sending data from a computer‘s CPU to a printer.

**Direction of data transmission**

There are three directions or modes of data flow in a data communication system.

- Simplex communication – data travels in one-direction only e.g. point-of-sale terminals.
- Half-duplex communication – data flows in both directions, but not simultaneously. E.g. electronic bulletin board
- Full-duplex communication – data is transmitted back and forth at the same time e.g. mainframe communications.

**Mode of data transmission**

Data may be sent over communication channels in either asynchronous or synchronous mode.

a) Asynchronous transmission – data is sent and received one byte at a time. Used with microcomputers and terminals with slow speeds.
b) Synchronous transmission – data is sent and received several bytes (blocks) at a time. It requires a synchronised clock to enable transmission at timed intervals.

**Protocols**

These are sets of communication rules for exchange of information. Protocols define speeds and modes for connecting one computer with another. Network protocols can become very complex and therefore must adhere to certain standards. The first set of protocol standards was IBM Systems Network Architecture (SNA), which only works for IBM‘s own equipment.

The Open Systems Interconnection (OSI) is a set of communication protocols defined by International Standards Organisation. The OSI is used to identify functions provided by any network and separates each network‘s functions into seven _layers‘ of communication rules.

**OSI layers**

The main concept of OSI is that the process of communication between two endpoints in a telecommunication network can be divided into seven distinct groups of related functions, or layers. Each communicating user or program is at a computer that can provide those seven layers of function. So in a given message between users, there will be a flow of data down through the layers in the source computer, across the network and then up through the layers in the receiving computer. The seven layers of function are provided by a combination of applications, operating systems, network card device drivers and networking hardware that enable a system to put a signal on a network cable or out over Wi-Fi or other wireless protocol).

**The seven Open Systems Interconnection layers are:**

The Open Systems Interconnect (OSI) model has seven layers. This article describes and explains them, beginning with the 'lowest' in the hierarchy (the physical) and proceeding to the 'highest' (the application). The layers are stacked this way:

- Application
- Presentation
- Session
- Transport
- Network
- Data Link
- Physical

**PHYSICAL LAYER**

The physical layer, the lowest layer of the OSI model, is concerned with the transmission and reception of the unstructured raw bit stream over a physical medium. It describes the electrical/optical, mechanical, and functional interfaces to the physical medium, and carries the signals for all of the higher layers. It provides:

- Data encoding: modifies the simple digital signal pattern (1s and 0s) used by the PC to better accommodate the characteristics of the physical medium, and to aid in bit and frame synchronization. It determines:
    - What signal state represents a binary 1
    - How the receiving station knows when a "bit-time" starts
    - How the receiving station delimits a frame
- Physical medium attachment, accommodating various possibilities in the medium:

    - Will an external transceiver (MAU) be used to connect to the medium?
    - How many pins do the connectors have and what is each pin used for?
- Transmission technique: determines whether the encoded bits will be transmitted by baseband (digital) or broadband (analog) signaling.
- Physical medium transmission: transmits bits as electrical or optical signals appropriate for the physical medium, and determines:

    - What physical medium options can be used
    - How many volts/db should be used to represent a given signal state, using a given physical medium

**DATA LINK LAYER**

The data link layer provides error-free transfer of data frames from one node to another over the physical layer, allowing layers above it to assume virtually error-free transmission over the link. To do this, the data link layer provides:

- Link establishment and termination: establishes and terminates the logical link between two nodes.
- Frame traffic control: tells the transmitting node to "back-off" when no frame buffers are available.
- Frame sequencing: transmits/receives frames sequentially.
- Frame acknowledgment: provides/expects frame acknowledgments. Detects and recovers from errors that occur in the physical layer by retransmitting non-acknowledged frames and handling duplicate frame receipt.
- Frame delimiting: creates and recognizes frame boundaries.
- Frame error checking: checks received frames for integrity.
- Media access management: determines when the node "has the right" to use the physical medium.

**NETWORK LAYER**

The network layer controls the operation of the subnet, deciding which physical path the data should take based on network conditions, priority of service, and other factors. It provides:

- Routing: routes frames among networks.
- Subnet traffic control: routers (network layer intermediate systems) can instruct a sending station to "throttle back" its frame transmission when the router's buffer fills up.
- Frame fragmentation: if it determines that a downstream router's maximum transmission unit (MTU) size is less than the frame size, a router can fragment a frame for transmission and re-assembly at the destination station.
- Logical-physical address mapping: translates logical addresses, or names, into physical addresses.
- Subnet usage accounting: has accounting functions to keep track of frames forwarded by subnet intermediate systems, to produce billing information.

***Communications Subnet***

The network layer software must build headers so that the network layer software residing in the subnet intermediate systems can recognize them and use them to route data to the destination address.

This layer relieves the upper layers of the need to know anything about the data transmission and intermediate switching technologies used to connect systems. It establishes, maintains and terminates connections across the intervening communications facility (one or several intermediate systems in the communication subnet).

In the network layer and the layers below, peer protocols exist between a node and its immediate neighbor, but the neighbor may be a node through which data is routed, not the destination station. The source and destination stations may be separated by many intermediate systems.

**TRANSPORT LAYER**

The transport layer ensures that messages are delivered error-free, in sequence, and with no losses or duplications. It relieves the higher layer protocols from any concern with the transfer of data between them and their peers.

The size and complexity of a transport protocol depends on the type of service it can get from the network layer. For a reliable network layer with virtual circuit capability, a minimal transport layer is required. If the network layer is unreliable and/or only supports datagrams, the transport protocol should include extensive error detection and recovery.

The transport layer provides:

- Message segmentation: accepts a message from the (session) layer above it, splits the message into smaller units (if not already small enough), and passes the smaller units down to the network layer. The transport layer at the destination station reassembles the message.
- Message acknowledgment: provides reliable end-to-end message delivery with acknowledgments.
- Message traffic control: tells the transmitting station to "back-off" when no message buffers are available.
- Session multiplexing: multiplexes several message streams, or sessions onto one logical link and keeps track of which messages belong to which sessions (see session layer).

Typically, the transport layer can accept relatively large messages, but there are strict message size limits imposed by the network (or lower) layer. Consequently, the transport layer must break up the messages into smaller units, or frames, prepending a header to each frame.

The transport layer header information must then include control information, such as message start and message end flags, to enable the transport layer on the other end to recognize message boundaries. In addition, if the lower layers do not maintain sequence, the transport header must

contain sequence information to enable the transport layer on the receiving end to get the pieces back together in the right order before handing the received message up to the layer above.

***End-to-end layers***

Unlike the lower "subnet" layers whose protocol is between immediately adjacent nodes, the transport layer and the layers above are true "source to destination" or end-to-end layers, and are not concerned with the details of the underlying communications facility. Transport layer software (and software above it) on the source station carries on a conversation with similar software on the destination station by using message headers and control messages.

**SESSION LAYER**

The session layer allows session establishment between processes running on different stations. It provides:

- Session establishment, maintenance and termination: allows two application processes on different machines to establish, use and terminate a connection, called a session.
- Session support: performs the functions that allow these processes to communicate over the network, performing security, name recognition, logging, and so on.

**PRESENTATION LAYER**

The presentation layer formats the data to be presented to the application layer. It can be viewed as the translator for the network. This layer may translate data from a format used by the application layer into a common format at the sending station, then translate the common format to a format known to the application layer at the receiving station.

The presentation layer provides:

- Character code translation: for example, ASCII to EBCDIC.
- Data conversion: bit order, CR-CR/LF, integer-floating point, and so on.
- Data compression: reduces the number of bits that need to be transmitted on the network.
- Data encryption: encrypt data for security purposes. For example, password encryption.

**APPLICATION LAYER**

The application layer serves as the window for users and application processes to access network services. This layer contains a variety of commonly needed functions:

- Resource sharing and device redirection
- Remote file access
- Remote printer access
- Inter-process communication
- Network management
- Directory services
- Electronic messaging (such as mail)
- Network virtual terminals

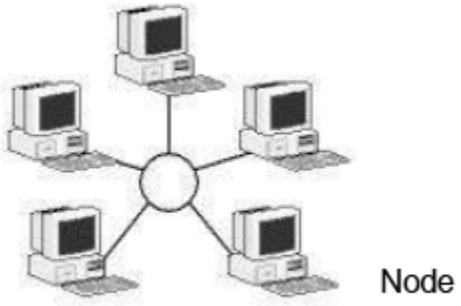
## NETWORK TOPOLOGIES

Network topology is also called computer network configuration. The topology is the method of arranging and connecting the nodes of a network. There are four principal network topologies:

a) Star
b) Bus
c) Ring
d) Hierarchical (hybrid)
e) Completely connected (mesh)

### Star network

In a star network there are a number of small computers or peripheral devices linked to a central unit called a main hub. The central unit may be a host computer or a file server. All communications pass through the central unit and control is maintained by polling. This type of network can be used to provide a time-sharing system and is common for linking microcomputers to a mainframe.




### Advantages of star topology

- Centralized management of the network, through the use of the central computer, hub, or switch.
- Easy to add another computer to the network.
- If one computer on the network fails, the rest of the network continues to function normally.

### Disadvantages of star topology

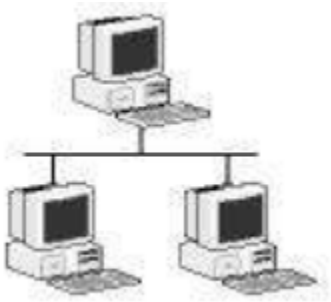
- Can have a higher cost to implement, especially when using a switch or router as the central network device.
- The central network device determines the performance and number of nodes the network can handle.

- If the central computer, hub, or switch fails, the entire network goes down and all computers are disconnected from the network.

**Bus network**

In a bus network each device handles its communications control. There is no host computer; however there may be a file server. All communications travel along a common connecting cable called a bus. It is a common arrangement for sharing data stored on different microcomputers.

It is not as efficient as star network for sharing common resources, but is less expensive. The distinguishing feature is that all devices (nodes) are linked along one communication line - with endpoints - called the bus or backbone.



**Advantages:**

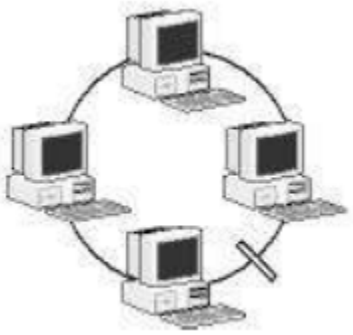
- Reliable in very small networks as well as easy to use and understand
- Requires the least amount of cable to connect the computers together and therefore is less expensive than other cabling arrangements.
- Is easy to extend. Two cables can be easily joined with a connector, making a longer cable for more computers to join the network
- A repeater can also be used to extend a bus configuration

**Disadvantages:**

- Heavy network traffic can also slow down a bus considerably. Because any computer can transmit at any time, bus networks do not coordinate when information is sent.
- Computers interrupting each other can use a lot of bandwidth. Each connection between two cables weakens the electrical signal.
- The bus configuration can be difficult to troubleshoot. A cable break or malfunctioning computer can be difficult to find and can cause the whole network to stop functioning.

**Ring network**

In a ring network, each device is connected to two other devices, forming a ring. There is no central file server or computer. Messages are passed around the ring until they reach their destination. Often used to link mainframes, especially over wide geographical areas. It is useful in a decentralised organisation called a distributed data processing system.



**Advantages:**

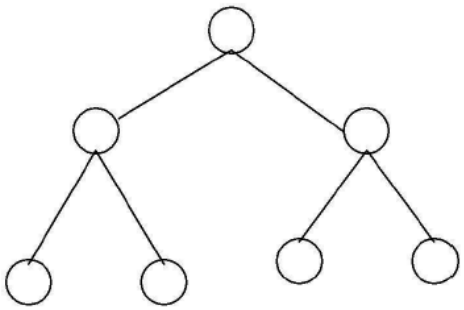
- Ring networks offer high performance for a small number of workstations or for larger networks where each station has a similar work load.
- Ring networks can span longer distances than other types of networks.
- Ring networks are easily extendable.

**Disadvantages**

- Relatively expensive and difficult to install.
- Failure of one component on the network can affect the whole network.
- It is difficult to troubleshoot a ring network.
- Adding or removing computers can disrupt the network.

**Hierarchical (hybrid) network**

A hierarchical network consists of several computers linked to a central host computer. It is similar to a star. Other computers are also hosts to other, smaller computers or to peripheral devices in this type of network. It allows various computers to share databases, process power and different output devices. It is useful in centralised organisations.



**Advantages:**

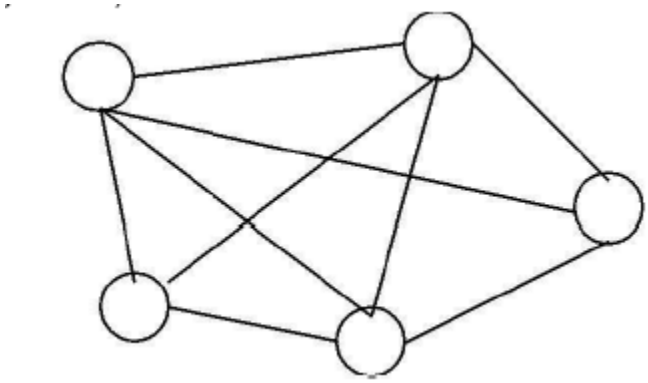
- Improves sharing of data and programmes across the network.
- Offers reliable communication between nodes.

**Disadvantages:**

- Difficult and costly to install and maintain.
- Difficult to troubleshoot network problems.

**Completely connected (mesh) configuration**

Is a network topology in which devices are connected with many redundant interconnections between network nodes.



**Advantages:**

- Yields the greatest amount of redundancy (multiple connections between same nodes) in the event that one of the nodes fails where network traffic can be redirected to another node.
- Network problems are easier to diagnose.

**Disadvantages**

- The cost of installation and maintenance is high (more cable is required than any other configuration)

## CLOUD COMPUTING

**Cloud computing** is a term used to describe services provided over a network by a collection of remote servers. This abstract "cloud" of computers provides massive, distributed storage and processing power, which can be accessed by any Internet-connected device running a web browser.

Because the term cloud computing is a broad term, it is likely if you have spent any time on the Internet or use devices connected to the Internet that you have used some cloud computing. Below are some common examples of cloud computing you have likely heard of or used.

**Examples of cloud services**

- **Amazon Web Services (AWS)** and **Amazon EC2** - Amazon.com provides a variety of different cloud computing services
- **Dashlane** - Online password service to synchronize and manage passwords between all devices.
- **Google App Engine** - A service that provides users the ability to create scalable web services that use Google's resources.
- **Google Calendar** - A way to organize your schedule, synchronize, and share events with your friends.
- **Google Docs** - A fantastic free solution from Google that allows you to open Microsoft Office documents as well as share them with other users with Internet access.

- **Online backup** - There are dozens of online backup services to store your important information offsite in the cloud. For example, Mozy and Dropbox are two good examples of **cloud storage** and **online storage** backup solutions that store information in the cloud.
- **Windows Azure** - A cloud computing solution by Microsoft that allows companies to develop and run services from their cloud.
- **Websites** - Many popular social networking sites such as Facebook, Picasa, and YouTube are also often considered parts of cloud computing.

## Software as a service (SaaS)

- Cloud-based applications—or software as a service—run on distant computers "in the cloud" that are owned and operated by others and that connect to users' computers via the Internet and, usually, a web browser

The benefits of saas

- You can sign up and rapidly start using innovative business apps
- Apps and data are accessible from any connected computer
- No data is lost if your computer breaks, as data is in the cloud
- The service is able to dynamically scale to usage needs

## Platform as a service (PaaS)

- Platform as a service provides a cloud-based environment with everything required to support the complete lifecycle of building and delivering web-based (cloud) applications—without the cost and complexity of buying and managing the underlying hardware, software, provisioning and hosting.

The benefits of paas

- Develop applications and get to market faster
- Deploy new web applications to the cloud in minutes
- Reduce complexity with middleware as a service

## Infrastructure as a service (IaaS)

- Infrastructure as a service provides companies with computing resources including servers, networking, storage and data center space on a pay-per-use basis.

The benefits of iaas

- No need to invest in your own hardware
- Infrastructure scales on demand to support dynamic workloads
- Flexible, innovative services available on demand

## Public cloud

- Public clouds are owned and operated by companies that offer rapid access over a public network to affordable computing resources. With public cloud services, users don't need to purchase hardware, software or supporting infrastructure, which is owned and managed by providers.

Key aspects of public cloud

- Innovative SaaS business apps for applications ranging from customer resource management (CRM) to transaction management and data analytics
- Flexible, scalable IaaS for storage and compute services on a moment's notice
- Powerful PaaS for cloud-based application development and deployment environments

## Private cloud

- A private cloud is infrastructure operated solely for a single organization, whether managed internally or by a third party, and hosted either internally or externally. Private clouds can take advantage of cloud's efficiencies, while providing more control of resources and steering clear of multi-tenancy.

Key aspects of private cloud

- A self-service interface controls services, allowing IT staff to quickly provision, allocate and deliver on-demand IT resources
- Highly automated management of resource pools for everything from compute capability to storage, analytics and middleware
- Sophisticated security and governance designed for a company's specific requirements

The additional level of security you want with the benefits of cloud.

## Hybrid cloud

- A hybrid cloud uses a private cloud foundation combined with the strategic integration and use of public cloud services. The reality is a private cloud can't exist in isolation from the rest of a company's IT resources and the public cloud. Most companies with private clouds will evolve to manage workloads across data centers, private clouds and public clouds—thereby creating hybrid clouds.

Key aspects of hybrid cloud

- Allows companies to keep the critical applications and sensitive data in a traditional data center environment or private cloud
- Enables taking advantage of public cloud resources like SaaS, for the latest applications, and IaaS, for elastic virtual resources
- Facilitates portability of data, apps and services and more choices for deployment models

## MOBILE COMPUTING

**Mobile computing** is human–computer interaction by which a computer is expected to be transported during normal usage. Mobile computing involves mobile communication, mobile hardware, and mobile software. Communication issues include ad hoc and infrastructure networks as well as communication properties, protocols, data formats and concrete technologies. Hardware includes mobile devices or device components. Mobile software deals with the characteristics and requirements of mobile applications.

### Definitions

Mobile Computing

Technology that allows transmission of data, voice and video via a computer or any other wireless enabled device without having to be connected to a fixed physical link. The main concept involves:

- Mobile communication
- Mobile hardware

### Devices

Some of the most common forms of mobile computing devices are as follows.

- portable computers, compacted lightweight units including a full character set keyboard and primarily intended as hosts for software that may be parametrized, as laptops, notebooks, notepads, etc.
- *mobile phones* including a restricted key set primarily intended but not restricted to for vocal communications, as cell phones, smart phones, phonepads, etc.
- Smart cards that can run multiple applications but typically payment, travel and secure area access
- *wearable computers*, mostly limited to functional keys and primarily intended as incorporation of software agents, as watches, wristbands, necklaces, keyless implants, etc.

The existence of these classes is expected to be long lasting, and complementary in personal usage, none replacing one the other in all features of convenience.

Other types of mobile computers have been introduced since the 1990s including the:

- Portable computer (discontinued)
- Personal digital assistant/Enterprise digital assistant (discontinued)
- Ultra-Mobile PC (discontinued)
- Laptop
- Smartphone
- Robots
- Tablet computer
- Wearable computer
- Carputer
- Application-specific computer

**Limitations**

- **Range & Bandwidth**: Mobile Internet access is generally slower than direct cable connections, using technologies such as GPRS and EDGE, and more recently HSDPA and HSUPA 3G and 4G networks and also upcoming 5G network. These networks are usually available within range of commercial cell phone towers. High speed network wireless LANs are inexpensive but have very limited range.
- **Security standards**: When working mobile, one is dependent on public networks, requiring careful use of VPN. Security is a major concern while concerning the mobile computing standards on the fleet. One can easily attack the VPN through a huge number of networks interconnected through the line.
- **Power consumption**: When a power outlet or portable generator is not available, mobile computers must rely entirely on battery power. Combined with the compact size of many mobile devices, this often means unusually expensive batteries must be used to obtain the necessary battery life.
- **Transmission interferences**: Weather, terrain, and the range from the nearest signal point can all interfere with signal reception. Reception in tunnels, some buildings, and rural areas is often poor.
- **Potential health hazards**: People who use mobile devices while driving are often distracted from driving and are thus assumed more likely to be involved in traffic accidents. (While this may seem obvious, there is considerable discussion about whether banning mobile device use while driving reduces accidents or not.) Cell phones may interfere with sensitive medical devices. Questions concerning mobile phone radiation and health have been raised.
- **Human interface with device**: Screens and keyboards tend to be small, which may make them hard to use. Alternate input methods such as speech or handwriting recognition require training.

# TOPIC 10

# THE INTERNET

## APPLICATION OF INTERNET

- **USING SEARCH ENGINE**

**Using search engines (text guides)**
On the internet, you can find information on just about any topic you can think of.

If you're looking for information, or if you want to visit a website and you don't know the website address, you can use a search engine to help you find what you're looking for.

Search engines are websites that search the internet for you and give you a list of search results.

Search engines can search for more than just written information.

Depending on the search engine you're using, you might also be able to search for other online content like images, video content, books and news, as well as products and services.

You can also search for online maps and directions to help plan your travel from one place to another.

**Accessing a search engine**

You can use a search engine on most internet-connected devices.

Once the device is connected to the internet and you have opened your internet browser software, enter the website address for the search engine into the address field.

There are lots of different search engines you could use.

Some of the commonly-used search engines include Google, Bing and Yahoo.

Google's website address is www.google.com. If you'd like to use the Kenyan version of Google, the website address is www.google.co.ke

**Doing a search**

All search engines will have a search field where you enter your search terms.

Some devices, like tablets and smartphones, might already have a search field installed on the device to make searching quicker and easier.

Search terms are the keywords a search engine will use to try to find the most relevant search results.

If you're looking for general information, just enter the name of the topic you're interested in into the search field.

So, if you're looking for cake recipes, you can use the search terms 'cake' and 'recipes'.

The search engine will return you a list of web pages that include the words 'cake' and 'recipes'.

If you're looking for more specific information, you can narrow your search results by using more specific search terms.

So, if you wanted chocolate cake recipes that are suitable for someone with diabetes, you could use the search terms: 'chocolate', 'cake', 'recipes' and 'diabetic'.

Once you've entered your search terms and selected the search or go button, the search engine will provide you with a list of search results.

Depending on your search, you could get thousands or even millions of search results. This is because search engines will usually list every single web page on the internet that used those search terms somewhere on a web page.

**Advanced searches**

If you've tried a few different search engines, and a few different search terms, and you haven't found exactly what you're looking for, you might try using a search engine that has advanced search features.

With an advanced search, you can limit results to a specific type of website

- **E-MAILS**

**Introduction**

**Advantages of email**

1. Fast and cheap
2. Ideal way to reach persons who are difficult to get on the phone (e.g. most physicians!)
3. Because it is written, you can compose and review your message before sending
4. Ideal for international communications (expense, problems reaching colleagues, differences in time zones)
5. Convenient and non-intrusive: I typically review and answer emails late at night after the kids have gone to bed

6. You can check your email from any computer in the world; e.g., while visiting, from a hotel room, in your car, etc.
7. You can easily include all or part of previous messages, or the message you are responding to, including point by point responses to questions, etc.
8. Ability to send same message to predefined groups of people
9. Ability to include attached files, documents, pictures, datasets
10. Messages easily archivable and storable in a database; search by sender, date, subject, or put into separate mailboxes
11. Ability to paste from other applications directly into email document (e.g., a review of a paper found on a website)

**Disadvantages of email**

1. You don't always know when/if your message has been read (some email programs notify sender when email has been read)
2. Privacy issues
    - Interception: By company, hospital, university administration, or by unauthorized snoops on the Web (email can be encrypted)
    - Difficult to delete: Emails are stored in a variety of places on computer disks. Difficult to completely erase and destroy.
    - Masquerade: Someone can masquerade as you; send emails in your name. No unique signature.
    - Forwarding function: A recipient can remail a sender's message to a large number of people; e.g., you criticize the boss, and your colleague forwards your critical letter to all the employees in the company
3. Easy to get swamped (but you can filter and sort messages)
4. A hazard for emotionally "fiery" people; you get mad, you fire off an email, the recipient forwards it to 10 other people, including the target of your anger, and you pay the consequences for many months to come.

**Email connections**

- University connection
- Paid connection provider: America On-line, CompuServe, or Microsoft Network, Prodigy, Genie, etc. ($$)
- Dial-up free email providers: Physicians On-Line, Juno
- Web-based free email providers: Hotmail
- Local internet service providers (ISP)

**Email Addresses**

**Structure**
Most often take the form of *loginID@domain-name*; e.g., jjbinksr@uic.edu. No spaces, no parentheses, and no commas in the address! Some email addresses include the computer (machine) name, e.g., *jjbinks@tigger.uic.edu*. Others begin with *INTERNET:loginID@domain-name*. Compuserve users replace the comma in their numerical ID with a period. America On-Line users remove spaces from their login name and add @aol.com. When an email address is followed by < *name* >, the text between the lesser and greater signs is optional; e.g. jjbinks@uic.edu < Dr. John T. Daugirdas >

1) **Difference between Cc: and Bcc:** Cc: stands for "carbon copy", and is to send copies to other people: the recipient will know to whom copies have been sent. Bcc: stands for blind carbon copy: The recipient will NOT know that a blind carbon copy was sent.

2) Difference between **From:** and **Reply to:** Typically in mailing lists such as NEPHROL, **Reply to:** is to everyone on the list, and **From** will go just to the person who sent the message to the list. Be careful not to mix these up! 3) **CTRL-G will give you HELP:** When replying to a message there are a host of useful keyboard strokes for editing: CTRL-Y scrolls up, CTRL-V (or spacebar) scrolls down, CTRL-K deletes the current line. CTRL-E goes to end of line, etc.

4) **Address book with nicknames:** It's a pain to fill out, but very useful. When composing a message, if you forgot the nickname, use CTRL-T in any one of the header fields to take you right to the addressbook.

4)**Uploading/sending outside files with your email:**
a) **Method 1: (Text files only)**
Save your document as an MS-DOS text file on your PC (or Mac) using your File Save As command. Then FTP the file to your UNIX machine in your home directory. Open pine. Use COMPOSE to start a message. Then use CTRL-R to input the text file into the body of your document. If you can't remember the filename you can use CTRL-R and CTRL-T to scroll through the files on your UNIX home directory. In this method your file will be INSIDE your email and will not really be attached.

b)**Method 2: (Text files only)**
If your telnet program supports the Edit toolbar, first copy the text from your PC application by highlighting it and saving it to the Windows notepad using Edit Copy. Once in telnet, after

you've opened pine and your message, at your cursor, use Edit Paste to paste in the text. This is also useful for taking things off the Web and putting them into email.

b)**Method 3: (Any file)**
Upload your file from PC to UNIX machine using FTP. Type in the filename in the attached field of the header, or else use CTRL-J.

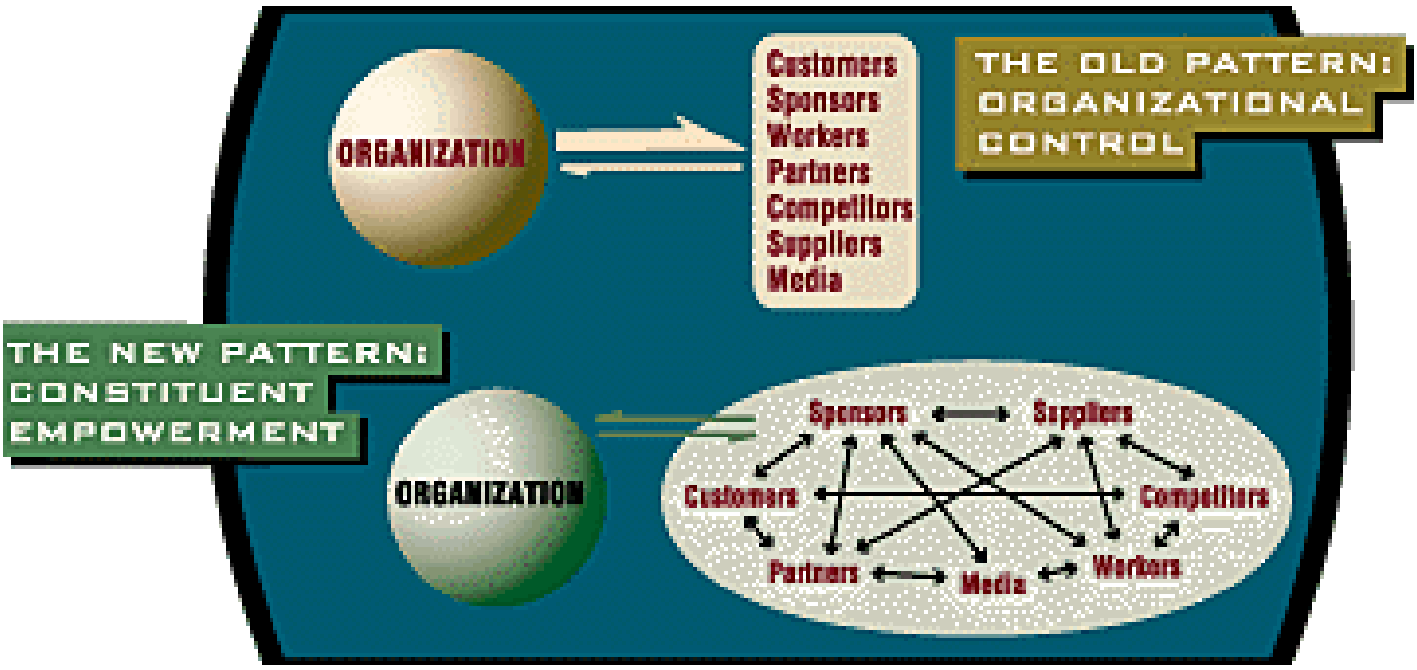
5) **Reading/downloading attached files:**
If you want to save the text of your message, press E for export and give a filename. Then use FTP go transport it back to your PC. For short text, if your telnet program supports cut and paste, you can just highlight the text and save it to the Windows notepad with Edit Copy. Then Edit Paste to a document on your PC or Mac. If you get a message with an attached file, if it is encoded using BinHex or UUENCODE, this is too bad! Get help to unencode it. It should be encoded using MIME. Then just press V to save it to a textfile on your UNIX machine, and FTP it down to your PC.

6) **.signature file and .vacation.msg file**
You can create these in your home directory using the UNIX text editor pico. The .signature file will be added to all of your outgoing emails (but not forwarded messages). The vacation message can be activated by typing in a UNIX command: vacation -i, and an appropriate .forward file. Ask your system administrator for help.

- **ELECTRONIC COMMUNICATION**

Why Use Electronic Communications?

The Internet and electronic communications (also called computer mediated communications, or CMC) doesn't just mean new tools for communication; it means new ways to communicate. Today your organization interacts with its various constituents differently - employees, board members, customers, partners and others - depending upon the nature of the message, the goals you are trying to achieve and the strengths (and weaknesses) of the available media - telephones, voice mail, fax machines, print, etc.




Electronic communications adds a powerful new channel that not only will change how you use this mix of options, but it will create entirely new ways to interact. For example:

Electronic communications lets you combine numerous media - text, graphics sound, video, etc. - into a single message. That can result in far more meaningful communications tailored to the nature of your particular audience. In contrast to broadcasting, narrowcasting reflects the ability to develop numerous communications for subsets of your market or constituencies.

Electronic communications is interactive. It engages audiences in active, two-way communications. That requires a new way of thinking about advertising copy and the handling of public relations. The pay-off, however, is a self-selected audience, engaged and actively participating in the communications process.

Two-way communication is nothing new. But electronic communications creates a new form of many-to-many communications that lets geographically distributed groups communicate interactively and simultaneously through text, sound and video. You can hold inexpensive video conferences or press conferences from your desk, or conference with people at several desks located across the world. One of the burgeoning phenomena of the Internet is businesses and organizations sponsoring, supporting and moderating discussion groups about issues, products, strategies - anything of interest to the organization and its constituents. Sponsorships are also solicited for popular resources, such as indexes and other Internet search tools, and these provide a further communications and marketing opportunity.

Many organizations are using electronic communications facilities, such as the World Wide Web, as internal communications tools to enhance team work. Many individuals at different locations can work on the same documents, hold meetings and integrate research findings.

Electronic communications removes the power of communications gatekeepers to both positive and negative effects. Most organizations are used to controlling the messages that go out to its constituents through managers, spokespeople and others. But with the Internet, constituents begin to talk among themselves, requiring new approaches and a new emphasis on listening and reacting, not just talking.

With the Internet you have the ability to transmit and receive large amounts of information quickly to and from individuals and workgroups around the world. This changes the way activists, for example, can galvanize communities, inform legislators and change public opinion. It changes the sources and depth of your constituents' knowledge levels. It also lets those constituents reach you with new kinds of communications they may never have attempted before.

And these are only some of the changes we are seeing now. There will be unanticipated and ripple effects we can't imagine. For example, will electronic mail become a buffer to avoid communications or confrontations that might be better resolved in person? Will managers find themselves traveling more in order to gain the personal touch with members of distributed workgroups? How will organizations prepare themselves for this increased level of participatory constituent interaction?

## INTRODUCTION TO INTERNET

By definition the Internet is a worldwide, publicly accessible series of interconnected computer networks that transmit data by packet switching using the standard Internet Protocol. But, how did it come to be this technology that is so popular and so widely used around the world? Was it always so large and extensive, filled with information about just about anything you could possibly think of accessible from almost anywhere, anytime? The answer is no and its important to understand where it all came from to understand how to utilize it to its fullest potential now.

### History of the Internet

The Internet origin comes from a military project. The Semi Automatic Ground Environment (SAGE) program consisted of networked country-wide radar systems together for the first time. This was created around 1958 as part of an attempt to regain the lead in technology from the Soviet Union who had recently launched Sputnik. J.C.R. Licklider was selected to head the committee which controlled the SAGE project. He envisioned universal networking as a unifying human revolution.

Licklider recruited Lawrence Roberts to head a project which implemented a network. Roberts had worked with the U.S. Air Force on a packet switching system as opposed to a circuit switching system. On October 29, 1969, Licklider and Roberts interconnected the first two nodes between UCLA and SRI International at Menlo Park, California. This was the beginning of the Advanced Research Projects Agency Network (ARPANET) which was one of the key networks which our Internet today was based off of. Soon after the first international packet-switched network service was created between U.S. and U.K.

Vinton Cerf and Robert Kahn developed the first description of the TCP protocols (covered more deeply in the Introduction to Networking lesson) in 1973. The term “Internet” was first used in 1974 to describe a single global TCP/IP network detailed in the first full specification of TCP written by Cerf and his colleagues. The first TCP/IP-wide area network was created on January 1, 1983 when all hosts on the ARPANET were switched over from the older protocols to TCP/IP.

In 1984, the United States National Sciencce Foundation (NSF) commissioned the construction of a 1.5 megabit/second network which became known as NSFNET. In 1989 the US Federal Networking Council approved the interconnection of the NSFNET to the commercial MCI Mail system. Soon after, other commercial e-mail services were soon connected such as OnTyme, Telemail, and Compuserve. Three Internet Service Providers (ISPs) were also created: UUNET, PSINET, and CERFNET. More and more seperate networks were created that eventually interconnected with this large, growing network. The ability of TCP/IP to work over virtually any pre-existing communication networks allowed for a great ease of growth, although the rapid growth of the Internet was due primarily to the availability of commercial routers from companies such as Cisco Systems, proteon and Juniper, the availability of commercial Ethernet equipment for local-area networking and the widespread implementation of TCP/IP on the UNIX operating system.

**Growth**

Although the basic applications and guidelines that make the Internet possible had existed for almost a decade, the network did not gain public face until the 1990s. On August 6, 1991, CERN, which straddles the border between France and Switzerland, publicized the new World Wide Web project. The web was invented by English scientist Tim Berners-Lee in 1989.

An early popular web browser was ViolaWWW. It was eventually replaced in popularity by the Mosaic web browser. By 1996 usage of the word “Internet” had become commonplace, and consequently, so had its use as a reference to the World Wide Web. Over the course of the decade, the Internet successfully accommodated the majority of previously existing public computer networks (although some networks have remained seperate).

**Today’s Internet**

Aside from the complex physical connections that make up its infrastructure, the Internet is facilitated by bi- or multi-lateral commercial contrracts and technical specifications or protocols that describe how to exchange data over the network. Indeed, the Internet has severely matured

since its birth many years ago. Today almost 1.5 billion people use the Internet. That's almost a quarter of the entire world (a lot of people).

The Internet Corporation for Assigned Names and Numbers (ICANN) is the authority that coordinates the assignment of unique identifiers on the Internet, including domain names, Internet Protocol (IP) addresses, and protocol port and parameter numbers. A globally unified namespace is essential for the Internet to function. Because the Internet is a distributed network comprising many volunatirly interconnected networks, the Internet, as such, has no governing body.

One of the most common uses people have for the Internet is the World Wide Web. Whenever you say you are "on the Internet" you are using the World Wide Web. When you are surfing the Internet through different pages you are moving through the World Wide Web. However, that is not the only use for the Internet. E-mail is another very popular use for the Internet. Internet e-mail may travel and be stored unencrypted on many other networks and machines out of both the sender's and the recipient's control. Remote access is another very common use for the Internet. The Internet allows computer users to connect to other computers and information stores easily, wherever they may be across the world. File sharing is also popular. It allows people to send files through e-mail, FTP, peer-to-peer networks, etc.

**INTERNET SERVISES**

**1. Communication:**

Email is an important communications service available on the Internet. Pictures, documents and other files are sent as email attachments. Emails can be cc-ed to multiple email addresses

Internet telephony is another common communications service made possible by the creation of the Internet. VoIP stands for Voice-over-Internet Protocol, referring to the protocol that underlies all Internet communication.

**2. Data Transfer:**

File sharing is an example of transferring large amounts of data across the Internet. A computer file can be emailed to customers, colleagues and friends as an attachment. It can be uploaded to a website or FTP server for easy download by others. Some of the example of file sharing are:-

- FTP
- TELNET( Remote Computing)

Telnet or remote computing is telecommunication utility software, which uses available telecommunication facility and allows you become a user on a remote computer. Once you gain access to remote computer, you can use it for the intended purpose. The TELNET works in a very step by step procedure. The commands typed on the client computer are sent to the local Internet Service Provider (ISP), and then from the ISP to the remote computer that you have gained access. Most of the ISP provides facility to

TELENET into your own account from another city and check your e-mail while you are traveling or away on business.

The following steps are required for a TELNET session

• Start up the TELNET program

• Give the TELNET program an address to connect (some really nifty TELNET packages allow you to combine steps 1 and 2 into one simple step)

• Make a note of what the “escape character” is

• Log in to the remote computer,

• Set the “terminal emulation”

• Play around on the remote computer, and

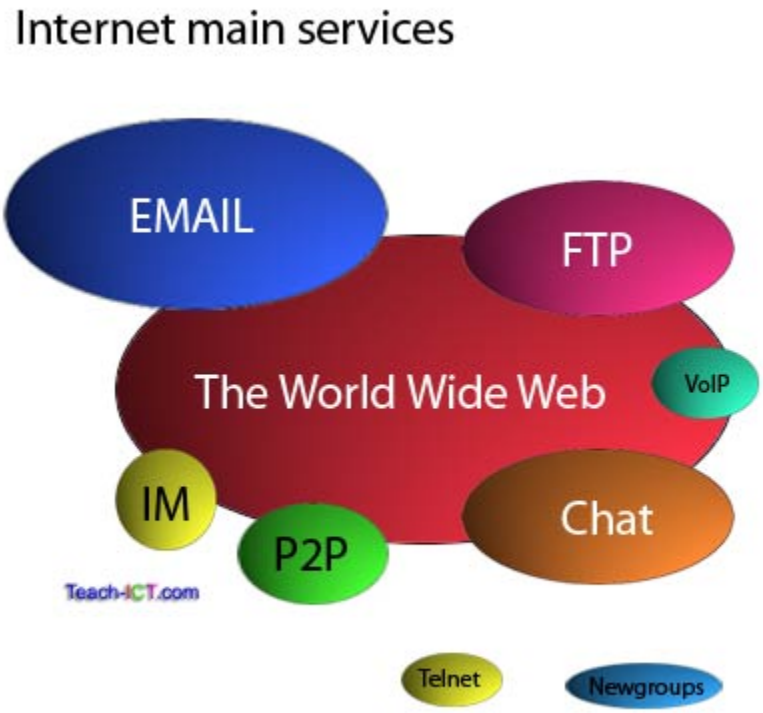
• Quit.

**3. Information:**

Many people use the terms Internet and World Wide Web, or just the Web, interchangeably, but the two terms are not synonymous. The World Wide Web is a global set of documents, images and other resources, logically interrelated by hyperlinks and referenced with Uniform Resource Identifiers (URIs). Hypertext Transfer Protocol (HTTP) is the main access protocol of the World Wide Web, but it is only one of the hundreds of communication protocols used on the Internet. Internet is interconnection of large number of heterogeneous computer networks all over the world that can share information back and forth. These interconnected network exchange information by using same standards and protocols.

**THE WORLD WIDE WEB (WWW)**

It is important to understand that the Internet is not the same as the World Wide Web.




The Internet is to the World Wide Web as Europe is to France. One is the container, the other is an item within the container.

The world wide web (WWW or just 'the web') is part of the Internet but is much younger. The Internet is about 40 years old whilst the WWW is merely 25 years old.

It was developed at CERN, the world famous underground physics laboratory in Switzerland, by Tim Berners-Lee around 1990.

The complete web is organised as millions of 'web sites'. Each web site is made up of one or more 'web pages'. Each page is made up of text, images or multimedia such as video and sound.

So the World Wide Web is actually made up of millions upon millions of individual web pages.

**INTRANETS AND EXTRANETS**

The Internet is a world wide system which offers web pages, email, forums, instant messaging and so on.

Because of its use as a communications tool many companies and organisations want their own local version to support their employees or members. To enable this to happen, **intranets** were developed.

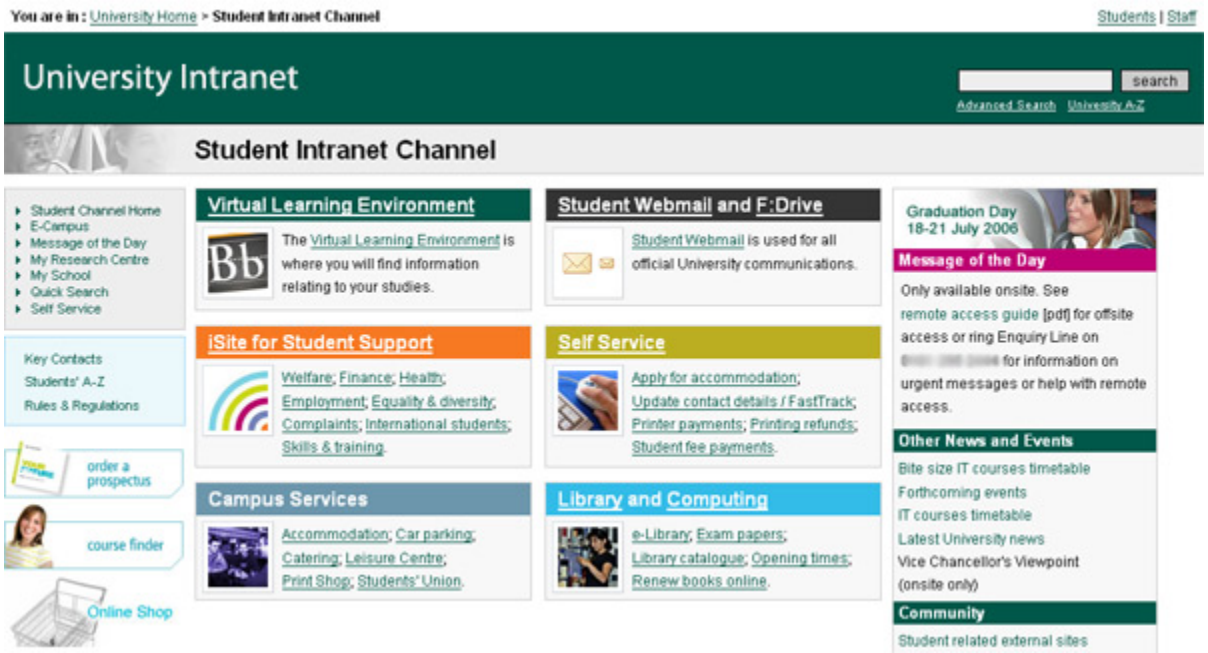
Sometimes a company will want to allow specific customers to access their intranet. This is known as an extranet.

**Intranet**

An intranet has almost the same services as the wider Internet, but it is a private system. It is only accessible to authorised people within the organisation.

An intranet can over a local area network (LAN) where only staff in the same building or locality can use it. Or it can run over a wide area network (WAN) where staff from around the world can log in.

An example intranet is shown below:




This intranet for a university is offering many services that are only available to their students. No one on the web can access or use this page because they require the login details.

Commercial companies offer their own particular services for their employees. For example, an intranet for a building society might have a section explaining the different types of savings

products. Staff can refer to these pages as a reference guide. There might be a page with links to important documents or templates. There might be another section which lists all of the internal telephone numbers and email addresses of every member of staff. And there might be an area that publishes details of social events e.g. the staff Christmas party.

**Intranet services**

These are virtually the same as the Internet, but for internal use only.

Some of the services include:

- Email
- File transfer
- Real time chat
- Web pages
- Video and Audio streaming services

Each service requires at least one server to provide the service e.g. Web server and Email servers.

Although it is unlikely that the video and audio services are there for entertainment (unlike the Internet). They can be used to stream business multimedia - for instance video training packages streamed to the students' computer.

The internet itself can usually be accessed through the organisation's firewall. This is quite often restricted though in order to reduce employee 'time-wasting' and to reduce bandwidth costs. For instance many companies block access to social networking sites and sports sites.

The point of an intranet is make people more effective at their work rather as a means of entertainment or socialising.

**Advantages of an Intranet**

In theory every employee could use the Internet to get the same services. But an Intranet has the following advantages:

- Commercial or confidential data is kept secure within the organisation
- Emails remain private and may also be encrypted
- High bandwidth. No connection limits unlike the Internet
- Reliable. The company will have dedicated IT personnel to keep things running smoothly
- Information specificly tailored to the organisation or staff's needs can be published

## Extranet

An Extranet is one where people from outside the organisation can connect to the internal Intranet.

For example, external suppliers may have been set up to allow them to communicate via the company Intranet.

Remote business offices may be set up to use an intranet.

Employees on business travel may use an Extranet.

They are not connected directly to the LAN or WAN but instead are able to establish a connection with the correct equipment and authorisation.

### *Method 1: Mobile phone*

A sales person on the road wants to connect to the company Intranet. They use the mobile phone network to contact the company's secure server.

### *Method 2: Virtual Private Network*

With this method, connection to the company's secure server is made through the normal Internet. But now the secure server and the laptop will exchange secret keys which they use to encrypt all communication between the two. No one can eavesdrop on the data being exchanged. This is a 'virtual private network'.

Many teleworkers use a VPN to connect to their company Intranet.

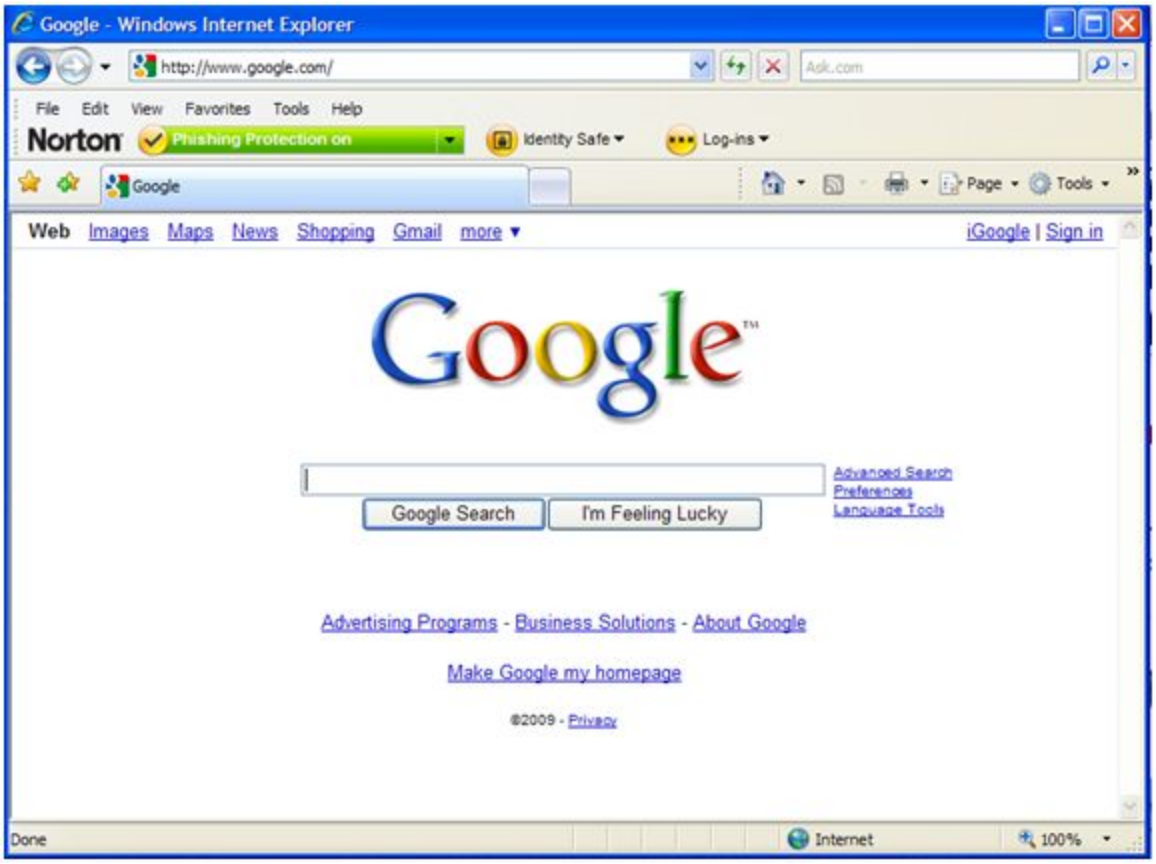
## SEARCHING FOR INFORMATION ON INTERNET

### Introduction

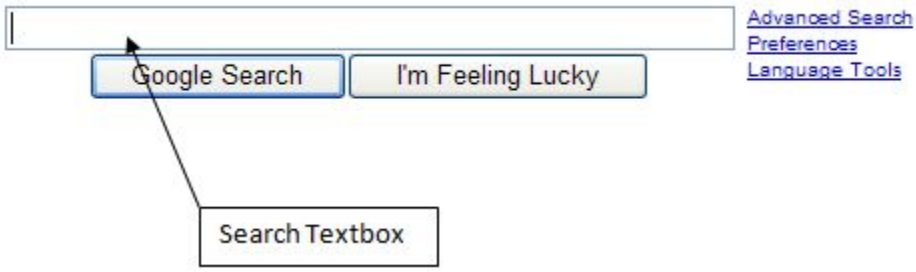
You do not always have to know a website’s address in order to use the Internet. It is important to know how to search for information. One of the best methods to search is to use a search engine. A search engine is a software system on the Internet that will conduct a search of its own database of websites based on terms you have entered. As a result, you will be shown a list of web addresses that contain the term you were looking to find. An example of a popular search engine is www.google.com.

### How to Use Google

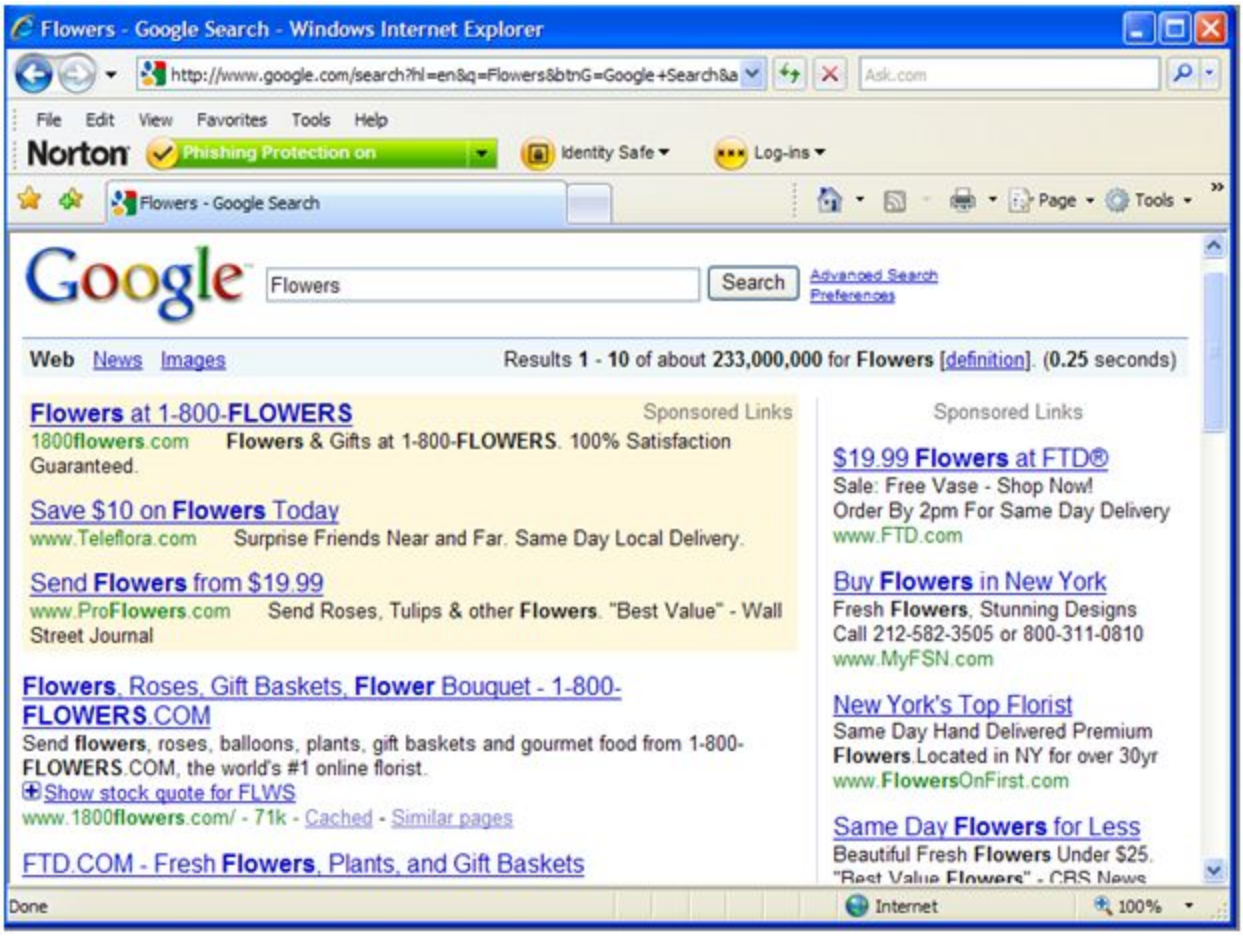
First you will need to open **Internet Explorer** then enter **www.google.com** in the address bar. Here is what **www.google.com** looks like:




To conduct the search, point and click your mouse in the **search textbox**. Type in the textbox the words or words you would like to search. Then point and click your mouse on the **Google Search** button below the search textbox.



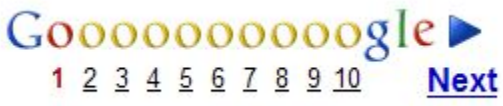

As an example, the word ‘flowers’ was entered into the Google textbox and after clicking on the Google Search button these are the results:




Every phrase in either blue with an underline may be clicked on to visit that particular site. These are hyperlinks to websites. The websites deemed most fitting for the search are found at the near the top of the list. There are also paid sponsors found at the top (shaded) and to the right of the screen that you may visit if you wish. You can see actual web addresses in green text.

In addition, notice the results area:


These results are found on the top right of the page. 233,000,000 would be impossible to go through therefore you will need to learn ways to reduce the amount of results. To continue reviewing the search results pages, scroll to the bottom of the Google webpage until you see:



Click on the number 2 or on the blue arrow to the right to continue through the search results.

**Important!**

You may not always get the results you are looking for so you will need to play with searchable terms. Using more words in combination, and especially more specific words will help. Be aware that not all websites that are found in the results are appropriate to your search. Read the blurb under the result name on the list before you click. In addition, do not click on anything that seems inappropriate, too good to be true, or dangerous. Use your gut instinct before you click. There are many websites out there on the Internet that will mislead and try to take advantage of beginners. Use caution.

**Interesting Tidbit**

1. The more specific your query is, the more success you're likely to have.
2. Use more than one search engine.
    - www.yahoo.com/
    - www.ask.com/
    - www.alltheweb.com/
    - search.aol.com/
    - www.hotbot.com/
3. The longer you spend time searching for something, the more frustrated you can get!
4. Use quotation marks around the terms when searching for a specific phrase.

**Vocabulary and Glossary**

Address Bar

> A horizontal area at the top of the browser window where you enter the web address of the website that you would like to visit.

Browser

> A browser is a software program used to access and navigate the Internet. It is used to enable users to view web pages.

Search Engine

> A software system on the Internet that will conduct a search of its own database of websites based on terms you have entered.

Hyperlink

> A word, button, and/or image that when clicked will go to another webpage either within the same website or to another web address.

Internet

The Internet is an information system connecting computers globally. It is an electronic communications pathway. It includes all the physical telephones lines and other cables that link computer s to computers.

***Four Tips to Help Make the Most of a Search***

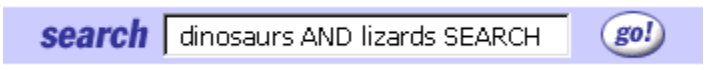
1. **Make your keywords as precise as possible.** If you're looking for information on Tyrannosaurus rex, don't type in "dinosaurs." You'll get too much general information about dinosaurs and not enough specific hits about T-rex.
2. **Use two or more keywords in your search.** But put the most important keywords first. For example, if you wanted information about what the T-rex ate, you might use the following keywords in this order: Tyrannosaurus rex diet. The search engine will look for Web pages that contain all these words.
3. **Make sure you spell the keywords correctly.** If you typed "dinasour" as a keyword, your search would turn up empty. If you're not sure of a word's correct spelling, use a dictionary.
4. **Always try more than one search engine.** Each search engine doesn't look through every site on the Web. Instead, most search engines check Web site pages every once in a while to create their own databases. So when you use a search engine, you're actually looking at one small slice of sites. Different search engines will usually come up with different results. So it makes sense to use more than one.

***Three Tips for Getting More Precise Hits***

1. Use **AND**

   Sometimes you may need to use more than one keyword when searching, without making a phrase. You usually need to let the search engine know whether you want to see sites that contain all the keywords or whether it should find those in which just one of the words appears. If you want to get results with all the keywords you type, then you should use "AND" to let the search engine know. Make sure you use capital letters when typing "AND."

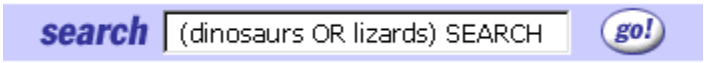
   Example: If you were searching for Web pages about dinosaurs and lizards, you would type:

   The search engine will list sites that contain both words. Some search engines require a plus sign (+) instead of the word AND. Then you would add a plus sign before any keyword that must appear in your results:

2. Use **OR**

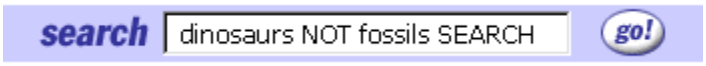
Let's say you perform a search using two keywords. What can you do if you actually want to find Web sites in which either one word or the other appears? You can use the word "OR." This will let the search engine know you want Web sites that contain any of the keywords you type in. For the best results, you should always enclose OR searches in parentheses:



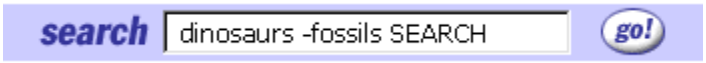

The search engine will list Web sites that contain either keyword.

3. Use **NOT**

Sometimes by typing one keyword, you'll get many results that have nothing to do with your topic. For example, if you wanted to find Web sites about dinosaurs, but not dinosaur fossils, you could type this into the search box:




The search engine will look for Web pages that contain the word "dinosaur." But if the page contains the word "fossil," the search engine will not list it. Some search engines require you to use a minus sign (-) in place of the word NOT. You would then add a minus sign in front of any word that you didn't want to appear in your results.




These types of searches are known as Boolean searches. AND (+), OR, and NOT (-) are known as Boolean operators. They are named after the British mathematician George Boole, who developed a system of logic in the 1800s.

## INTERNET SERVICE PROVIDERS (ISPs)

### What does ISP mean?

ISP literally means ***Internet service provider*** or ***provider***. It is a service (most of the time paid for) which allows you to connect to the Internet.

### Why use an ISP?

Unless you have a specialized line (other than a telephone line), you cannot connect directly to the internet using your telephone line. Indeed, the telephone line was not designed for this:

- it was originally designed to transport "voice", i.e. a frequency modulation in the range of the voice tone
- telephone servers only know how to start a conversation from a telephone number
- unless you resort to a special service, generally it is not possible to have communication between more than two points...

So, the internet service provider is an intermediary (connected to the internet by specialized lines) which gives you access to the Internet, using a number which you enter using your modem, and which enables a connection to be established.

**How does the ISP connect you to the Internet?**

When you are connected to the Internet through your service provider, communication between you and the ISP is established using a simple protocol: PPP (*Point to Point Protocol*), a protocol making it possible for two remote computers to communicate without having an IP address.
In fact your computer does not have an IP address. However an IP address is necessary to be able to go onto the Internet because the protocol used on the Internet is the TCP/IP protocol which makes it possible for a very large number of computers which are located by these addresses to communicate.

So, communication between you and the service provider is established according to the PPP protocol which is characterised by:

- a telephone call
- initialization of communication
- verification of the user name (login or userid)
- verification of the password

Once you are "connected", the internet service provider lends you an IP address which you keep for the whole duration that you are connected to the internet. However, this address is not fixed because at the time of the next connection the service provider gives you one of its free addresses (therefore different because depending on its capacity, it may have several hundreds of thousand addresses.).
Your connection is therefore a proxy connection because it is your service provider who sends all the requests you make and the service provider who receives all the pages that you request and who returns them to you.

It is for these reasons for example that when you have Internet access via an ISP, you must pick up your email on each connection because generally it is the service provider that receives your email (it is stored on one of its servers).

**Differences between ISPs**

Selecting an ISP depends on many criteria including the number of services offered and the quality of these services. So what are these criteria?

- Cover: some ISPs only offer cover in large towns, other offers national coverage, i.e. a number which is charged as a local call wherever you are calling from
- Bandwidth: this is the total speed that the ISP offers. This bandwidth is shared between the number of subscribers, so the more the number of subscribers increases the smaller this becomes (the bandwidth allocated to each subscriber must be greater than his transmission capacity in order to provide him with a quality service).
- Price: this depends on the ISP and the type of package chosen. Some ISPs now offer free access
- Access: unlimited: some ISPs offer a package where your connection time is taken into account, i.e. you cannot exceed a number of hours of connection per month, in which case the call charge is subject to a price increase (additional minutes are very expensive). Some providers even offer tariffs without subscription, i.e. only the communication is paid for (but obviously is more expensive than a local call!)
- Technical service: this is a team responsible for responding to your technical problems (also called a hotline or even customer service). ISPs generally charge for this type of service (sometimes 1.35€ for the call then 0.34€/min)
- Supplementary services:
    - Number of email addresses
    - Space made available for the creation of a personal page (HTML)
    - ...

**Making sense of the different packages on offer**

Internet service providers (ISP) offer increasing subscription and package types for accessing the Internet...
Free Internet, Internet without subscription which is all very tempting but how do they offer these types of free services?

- **Paid subscription with unlimited access**
  This is the traditional package. It consists of paying a fixed amount each month (around 10 to 30€). With this package Internet access is unlimited, i.e. you can connect as much as you want during the month... you only pay the call charges (at the cost of a local call). This type of package generally offers one (or more) email address as well as space to create a personal page
- **Paid subscription with limited access**
  This type of package has the same characteristics as the previous one with the difference that the subscription is cheaper but the amount of connection time is limited. Beyond this limit, the cost is increased per additional period.
- **Internet access without subscription**
  Warning! This service is not free of charge... It only allows you to be able to connect occasionally by paying for access with a higher per minute cost for the call. It is only suitable for people who rarely connect to the internet (very few hours a month), and does not include benefits such as space for a personal page (however free hosting is available other than with ISPs).

- **Free internet service providers**
  How do these companies offer free access?
  It is advertising which enables these companies to offer such packages. In fact, from the moment you connect you will see several advertising banners displayed.
  Here you are gaining. Furthermore, the inconvenience caused by this type of advertising is minimal

## TYPES OF INTERNET CONNECTIONS

There are various type of connectivity to get hook on to Internet. They all can be broadly classified into following category.

i. Gateway Access
ii. Dial-up Connection
iii. Leased Connection
iv. DSL
v. Cable Modem Connection
vi. VSAT

### Gateway Access

Gateway Access is also known as Level-One connection. It is the access to the Internet from a network, which is not on the Internet. The gateway allows the two different types of networks to "talk" to each other. But the users of the Gateway Internet have limited access to the Internet. They might not be able to use all the tools available on Internet. The local Internet Service Provider (ISP) normally defines this limitation. Good example of network with Level One connectivity within India is that of VSNL (Videsh Sanchar Nigam Limited). All access to Internet from India are through VSNL gateway.

### Dial-up Connection

'Dial-up' connection is also known as Level Two connection. This provides connection to Internet through a dial-up terminal connection. The computer, which provides Internet access is known as 'Host' and the computer that receives the access, is 'Client' or 'Terminal'. The client computer uses modem to access a "host" and acts as if it is a terminal directly connected to that host. 56K modem access is now widely available and supported by most ISPs. It allows user to surf the Web at 56 Kbps with graphics. So this type of connection is also known as 'Remote Modem Access' connection. And the host to which the client gets connected is actually connected to the Internet by a full time connection (See Leased Connection).

In dial-up connection to Internet, Host carries all the command that are typed on a client machine and forward them to Internet. It also receives the data or information from the Internet on behalf of the 'Client' and passes it to them. The client computer acts as a 'dumb' terminal connected to remote host.

This type of connection can further be divided into three categories.

**Shell Connection:**

In this type of Internet Connection, the user will get only textual matter of a Web Page. This connection does not support Graphics display.Shell Accounts were the only type of Internet access available for many years before the Internet entered in to the world of graphics and became more users friendly.

**TCP/IP Connection:**

Today's graphical World Wide Web browsers provide easier access with multimedia sound and pictures. The major difference between Shell and TCP/IP account is that, Shell account can only display text and does not support graphics display, whereas TCP/IP can display both.

**ISDN:**

ISDN (Integrated Services Digital Network) offers Internet connectivity at speeds of up to 128 Kbps through the use of digital phone lines. ISDN is a dial-up service that has been provided by telephone companies for many years.

To access any of these dial-up accounts you need the followings;

- Computer
- Modem
- Telephone Connection
- Shell or TCP/IP/ISDN account from the ISP
- Internet client software such as Internet browser

**Leased Connection**

Leased connection is also known as direct Internet access or Level Three connection. It is the secure, dedicated and most expensive, level of Internet connection. With leased connection, your computer is dedicatedly and directly connected to the Internet using highspeed transmission lines. It is on-line twenty-four hours a day, seven days a week.

**DSL connection**

Digital Subscriber Line (DSL) is a family of technologies that provides digital data transmission over the wires of a local telephone network. DSL originally stood for digital subscriber loop. In telecommunications marketing, the term DSL is widely understood to mean Asymmetric Digital Subscriber Line (ADSL), the most commonly installed DSL technology. DSL service is delivered simultaneously with wired telephone service on the same telephone line. This is possible because DSL uses higher frequency bands for data separated by filtering. On the

customer premises, a DSL filter on each outlet removes the high frequency interference, to enable simultaneous use of the telephone and data.

The data bit rate of consumer DSL services typically ranges from 256 kbit/s to 40 Mbit/s in the direction to the customer (downstream), depending on DSL technology, line conditions, and service-level implementation. In ADSL, the data throughput in the upstream direction, (the direction to the service provider) is lower, hence the designation of asymmetric service. In Symmetric Digital Subscriber Line (SDSL) services, the downstream and upstream data rates are equal.

**Advantages:**

- Security: Unlike cable modems, each subscriber can be configured so that it will not be on the same network. In some cable modem networks, other computers on the cable modem network are left visibly vulnerable and are easily susceptible to break in as well as data destruction.
- Integration: DSL will easily interface with ATM and WAN technology.
- High bandwidth
- Cheap line charges from the phone company.
- Good for “bursty” traffic patterns

**Disadvantages**

- No current standardization: A person moving from one area to another might find that their DSL modem is just another paperweight. Customers may have to buy new equipment to simply change ISPs.
- Expensive: Most customers are not willing to spend more than $20 to $25 per month for Internet access. Current installation costs, including the modem, can be as high as $750. Prices should come down within 1-3 years. As with all computer technology, being first usually means an emptier wallet.
- Distance Dependence: The farther you live from the DSLAM (DSL Access Multiplexer), the lower the data rate. The longest run lengths are 18,000 feet, or a little over 3 miles.

**Cable Modem Connection**

A cable modem is a type of Network Bridge and modem that provides bi-directional data communication via radio frequency channels on a HFC and RFoG infrastructure. Cable modems are primarily used to deliver broadband Internet access in the form of cable Internet, taking

advantage of the high bandwidth of a HFC and RFoG network. They are commonly deployed in Australia, Europe, Asia and Americas.

**Cable Modem Connection**

Above figure shows the most common network connection topologies when using cable modems. The cable TV company runs a coaxial cable into the building to deliver their Internet service. Although fed from the same coax that provides cable TV service, most companies place a splitter outside of the building and runs two cables in, rather than using a splitter at the set-top box. The coax terminates at the cable modem.

The cable modem itself attaches to the SOHO computing equipment via its 10BASE-T port. In most circumstances, the cable modem attaches directly to a user's computer. If a LAN is present on the premises (something many cable companies frown upon), some sort of router can be connected to the cable modem.

**Advantages**

- Always Connected: A cable modem connection is always connected to the Internet. This is advantageous because you do not have to wait for your computer to "log on" to the Internet; however, this also has the disadvantage of making your computer more vulnerable to hackers. Broadband: Cable modems transmit and receive data as digital packets, meaning they provide high-speed Internet access. This makes cable modem connections much faster than traditional dial-up connections.
- Bandwidth: Cable modems have the potential to receive data from their cable provider at speeds greater than 30 megabits per second; unfortunately, this speed is rarely ever realized. Cable lines are shared by all of the cable modem users in a given area; thus, the connection speed varies depending upon the number of other people using the Internet and the amount of data they are receiving or transmitting.
- File Transfer Capabilities: Downloads may be faster, but uploads are typically slower. Since the same lines are used to transmit data to and from the modem, priority is often given to data traveling in one direction.
- Signal Integrity: Cable Internet can be transmitted long distances with little signal degradation. This means the quality of the Internet signal is not significantly decreased by the distance of the modem from the cable provider.
- Routing: Cable routers allow multiple computers to be hooked up to one cable modem, allowing several devices to be directly connected through a single modem. Wireless routers can also be attached to your cable modem.
- Rely on Existing Connections: Cable modems connect directly to preinstalled cable lines. This is advantageous because you do not need to have other services, such as telephone or Internet, in order to receive Internet through your cable modem. The disadvantage is that you cannot have cable internet in areas where there are no cable lines.

**Disadvantages**

• Cable internet technology excels at maintaining signal strength over distance. Once it is delivered to a region, however, such as a neighborhood, it is split among that regions subscribers. While increased capacity has diminished the effect somewhat, it is still possible that users will see significantly lower speeds at peak times when more people are using the shared connection.

• Bandwidth equals money, so cable's advantage in throughput comes with a price. Even in plans of similar speeds compared with DSL, customers spend more per Mb with cable than they do with DSL.

• It's hard to imagine, but there are still pockets of the United States without adequate cable television service. There are far fewer such pockets without residential land-line service meaning cable internet is on balance less accessible in remote areas.

**VSAT**

Short for very small aperture terminal, an earthbound station used in satellite communications of data, voice and video signals, excluding broadcast television. A VSAT consists of two parts, a transceiver that is placed outdoors in direct line of sight to the satellite and a device that is placed indoors to interface the transceiver with the end user's communications device, such as a PC. The transceiver receives or sends a signal to a satellite transponder in the sky. The satellite sends and receives signals from a ground station computer that acts as a hub for the system. Each end user is interconnected with the hub station via the satellite, forming a star topology. The hub controls the entire operation of the network. For one end user to communicate with another, each transmission has to first go to the hub station that then retransmits it via the satellite to the other end user's VSAT.

**Advantages**

Satellite communication systems have some advantages that can be exploited for the provision of connectivity. These are:

• Costs Insensitive to Distance

• Single Platform service delivery (one-stop-shop)

• Flexibility

• Upgradeable

• Low incremental costs per unit

**Disadvantages**

However like all systems there are disadvantages also. Some of these are

• High start-up costs (hubs and basic elements must be in place before the services can be provided)

• Higher than normal risk profiles

• Severe regulatory restrictions imposed by countries that prevent VSAT networks and solutions from reaching critical mass and therefore profitability

• Some service quality limitations such the high signal delays (latency)

• Natural availability limits that cannot be mitigated against

• Lack of skills required in the developing world to design, install and maintain satellite communication systems adequately

**APPLICATION OF INTERNET**

We can roughly separate internet applications into the following types: media, information search, communications,communities, entertainment, e-business, finance and other applications.

The internet is treated as one of the biggest invention. It has a large number of uses..

1. Communication
2. Job searches
3. Finding books and study material
4. Health and medicine
5. Travel
6. Entertainment
7. Shopping
8. Stock market updates
9. Research
10. Business use of internet: There are different ways by which intenet can be used for business are:

    - Information about the product can be provided online to the the customer .
    - Provide market information to the business eg Stock Market
    - It help business to recruit talented people.
    - Help in locating suppliers of the product
    - Feedback and reviews about companies product
    - Eliminate middle men and have a direct contact with customer .
    - Providing information to the investor by providing companies back ground and financial information on web site.

## IMPACT OF INTERNET ON SOCIETY

### Advantages of Internet:

- **E-mail:** Email is an essential communication tools in todays world. With e-mail one can send and receive instant electronic messages, which works like writing letters. Messages are delivered instantly to people anywhere in the world, unlike traditional mail that takes a lot of time. Email is free, fast and very cheap when compared to telephone, fax and postal services.
- **24 hours a day** - 7 days a week: Internet is available, 24x7 days for usage.
- '**Information:** There is a huge amount of information available on the internet for just about every subject, ranging from government law and services, trade fairs and conferences, market information, new ideas and technical support. One can find any type of data on almost any kind of subject by using search engines like google, yahoo, msn, etc.
- **Online Chat:** Chat facility can be used to meet new people, make new friends, as well as to stay in touch with friends. Commonly used chat messangers are MSN, gmail and yahoo websites.
- **Services:** Many services are provided on the internet like net banking, job searching, purchasing tickets, hotel reservations, guidance services on array of topics engulfing the every aspect of life.
- **Communities:** Communities of all types have sprung up on the internet. Its a great way to meet up with people of similar interest and discuss common issues.
- **Shopping:** There are many online stores and sites that can be used to look for products as well as buy them using credit card. Through internet all shopping could be done sitting conveniently at your home.
- **Entertainment:** Internet provides facility to access wide range of Audio/Video songs, plays films. Many of which can be downloaded. One such popular website is YouTube.
- **Software Downloads:** You can freely download innumerable, softwares like utilities, games, music, videos, movies, etc from the Internet.

### Limitations of Internet

- **Theft of Personal information:** With the use of Internet there are chances that personal information such as name, address, credit card, bank details and other information can be accessed by unauthorized persons. If you use a credit card or internet banking for online shopping, then your details can also be ‘stolen’.
- Most parents do not realize the dangers involved when their children log onto the Internet. When children talk to others online, they do not realize they could actually be talking to a harmful person. Moreover, pornography is also a very serious issue concerning the Internet, especially when it comes to young children.
- **Virus threat:** Virus is a program created to disrupts the normal functioning of computer systems. Computers attached to internet are more prone to virus attacks and they can end up into crashing your whole hard disk.

- **Spamming:** It is often viewed as the act of sending unsolicited email. This multiple or vast emailing is often compared to mass junk mailings.
- **Phishing :** Phishing attack refers to sending a convincing mail to targetted user with an embedded url in the same. When the user clicks the url it directs the user to the phishing website. And when the person enters there personal details , the same is utilized by phisher to transfer money.

# TOPIC 11

# EMERGING TRENDS IN INFORMATION COMMUNICATION TECHNOLOGY

**Introduction**

21st century has been defined by application of and advancement in information technology. Information technology has become an integral part of our daily life. According to Information Technology Association of America, information technology is defined as "the study, design, development, application, implementation, support or management of computer-based information systems."

Information technology has served as a big change agent in different aspect of business and society. It has proven game changer in resolving economic and social issues.

Advancement and application of information technology are ever changing. Some of the trends in the information technology are as follows:

1. **Cloud Computing**

   One of the most talked about concept in information technology is the cloud computing. Clouding computing is defined as utilization of computing services, i.e. software as well as hardware as a service over a network. Typically, this network is the internet.

   Cloud computing offers 3 types of broad services mainly Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS).

   Some of the benefit of cloud computing is as follows:

   - Cloud computing reduces IT infrastructure cost of the company.
   - Cloud computing promotes the concept of virtualization, which enables server and storage device to be utilized across organization.
   - Cloud computing makes maintenance of software and hardware easier as installation is not required on each end user's computer.

   Some issues concerning cloud computing are privacy, compliance, security, legal, abuse, IT governance, etc.

2. **Mobile Application**

   Another emerging trend within information technology is mobile applications (software application on Smart phone, tablet, etc.)

   Mobile application or mobile app has become a success since its introduction. They are designed to run on Smartphone, tablets and other mobile devices. They are available as a download from various mobile operating systems like Apple, Blackberry, Nokia, etc. Some of the mobile app are available free where as some involve download cost. The revenue collected is shared between app distributor and app developer.

3. **User Interfaces**

   User interface has undergone a revolution since introduction of touch screen. The touch screen capability has revolutionized way end users interact with application. Touch screen enables the user to directly interact with what is displayed and also removes any intermediate hand-held device like the mouse.

   Touch screen capability is utilized in smart phones, tablet, information kiosks and other information appliances.

4. **Analytics**

   The field of analytics has grown many folds in recent years. Analytics is a process which helps in discovering the informational patterns with data. The field of analytics is a combination of statistics, computer programming and operations research.

   The field of analytics has shown growth in the field of data analytics, predictive analytics and social analytics.

   Data analytics is tool used to support decision-making process. It converts raw data into meaningful information.

   Predictive analytics is tool used to predict future events based on current and historical information.

   Social media analytics is tool used by companies to understand and accommodate customer needs.

The every changing field of information technology has seen great advancement and changes in the last decade. And from the emerging trend, it can be concluded that its influence on business is ever growing, and it will help companies to serve customers better.