

Part1 : Lecture note
part2 : practical guide

Computer Applications for Business and Management

(For BBA STUDENTS)



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Session 01

Introduction to ICT and ICT Skills

Related terminology

Before moving onto the topic of ICT Skills let us have a look at the different terms such as IT, ICT, and Computer Science related to this course unit and let us identify the differences among these terms.

1: IT (Information Technology)

The term **Information Technology** refers to an entire field that uses computers, networking, software, and other equipment to manage information electronically in a digital form. Consider an IT department in an organization. They are equipped with computers, database Management Systems, servers, and security mechanisms for storing, processing, retrieving, and protecting information available with the organization. You might have heard about the professionals working in such department of a company like system administrators, database administrators, programmers, IT managers, network engineers. If it is a business organization, they all work together to provide services such as providing information, providing tools to improve the productivity, automating the business processes, and providing means for connect with customers. Therefore, in the modern world, IT is an essential part of all of business operations.

ICT (Information and Communication Technology)

The term **Information and Communication Technology** can be considered as an extended version of the term IT as it involves a „C“ that represents the **communication** of data by electronic means, usually over some distance. Here, communication refers to the media broadcasting technologies, audio/video processing and transmission and telephony. Recently, the term ICT has been used to refer to the integrating telephone and audio/ visual networks with computer networks. This integration has provided large savings of costs due to the elimination of telephone networks. Simply, ICT can be seen as the integration of information technology with communication technology.

In contrast with IT according to the *Wikipedia*, Information and Communications Technology or (ICT), is often used as an extended synonym for information technology (IT). But it is a more specific term 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 more inclined and widely used in the educational sector. Some have simplified ICT as using audiovisual equipment for learning at school and the use of networks that help transmit information across schools.

CS (Computer Science)

In addition to the terms IT and ICT described above, you might have heard another terminology “Computer Science” which also sounds similar to the above two. **Computer Science** is the mother of all computational disciplines (Computer Engineering, Information Technology/Information Science, Software Engineering, ICT, etc). In simple words, Computer Science is all about computers. In contrast with IT, CS is the science of computing with in depth knowledge of working principles of computers whereas information technology is the science designed to make best use of information systems to make work easier in business environments. According to the *Wikipedia*, CS is the scientific and practical approach to computation and its applications. A computer scientist specializes in the theory of computation and the design of computational systems. So, a computer scientist is obviously thorough in Physics, Mathematics, electrical engineering, and forms of languages. CS is a field related to research work and thus it’s evolving with the innovations of the research outcomes. Now you may have some idea that the ones who can afford to be in touch with the information and communication technology can be updated with evolving knowledge while the ones who fail or have less chances may remain in the pre-knowledge stage.

Session 02

Introduction to Computers

What is a Computer?

A computer is a general purpose device which can be programmed to carry out a finite set of arithmetic or logical operations. Since a sequence of operations can be readily changed, the computer can solve more than one kind of problem.

- Wikipedia

A computer is, at its most basic, a machine which can take instructions, and perform computations based on those instructions.

- wiseGEEK

A computer is an electronic device which is capable of receiving the inputs (data from the user), storing it for a desired period of time, manipulating it according to the set of instructions (called program) and producing the output to the user in desired form. It performs a variety of operations in accordance to the set of instructions.

- <http://www.trivology.com>

The above three descriptions are some standard definitions extracted from different information resources available in the World Wide Web, including *Wikipedia*, the largest free encyclopedia. Meanwhile, a computer can be defined as follows in terms of basic usage of the computer which is more readable for a layman.

A computer is an electronic device that manipulates information, or "data". It has the ability to store, retrieve, and process data. You can use a computer to type documents, send email, and browse the internet. You can also use it to handle spreadsheets, accounting, database management, presentations, games, and more.

Data, with Information

Data: Facts and figures which relay something specific, but which are not organized in any way and which provide no further information regarding patterns, context, etc. So data means "unstructured facts and figures that have the least impact on the typical manager."

Information: For data to become information, it must be contextualized, categorized, calculated and condensed. Information thus paints a bigger picture; it is data with relevance and purpose. It may convey a trend in the environment, or perhaps indicate a pattern of sales for a given period of time. Essentially information is found "in answers to questions that begin with such words as who, what, where, when, and how many".

Different Types of Computers

When you hear the word "Computer" most of the time a **personal computer** like **desktop** or **laptop** will come to your mind as they are widely used by the people around us. However, these computers come in many sizes and shapes that perform different functions which is useful in our daily lives. You are using a type of computer even when you withdraw cash from an ATM (Automatic Teller Machine) or scan groceries at the shop, or use a calculator.

It is said that the ENIAC, which is considered as the first electronic general-purpose computer was of size of a large room (See Figure 2.1 and 2.2 below). However, with the advance of technologies the size of a today's computer has become smaller as of a small wrist watch. These computers have different processing powers as well.

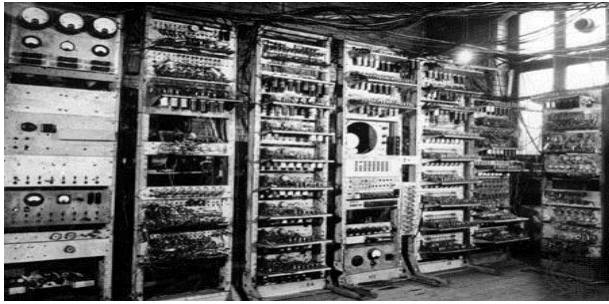


Figure 2.1: ENIAC



Figure 2.2: The ENIAC, taking up about 680 Square feet

The computers can be mainly classified into four categories as briefly described below. This classification is done based on the size and the data processing power.

1. **Microcomputers:** most common type of computers in the society. Can be used at your workplace, at school or on your study desk at home. Used by single user at a time. Small in size. Also called **Personal Computers (PCs)**.
2. **Minicomputers:** used by multi-users. In the middle when the computers are ranged from smallest to largest. Used in laboratories.
3. **Mainframes:** Largest in size. Capable of handling and processing very large amounts of data quickly.
4. **Super computers:** Used for performing complex scientific and numerical computations such as weather forecasting, fluid dynamics, nuclear simulations, theoretical astrophysics. Sometimes called as “**Workstations**”

Since the Personal Computers are the most common category of computers among the individuals let's talk more on PCs.

1.14 GENERATION OF COMPUTERS

The computer evolved as a result of man's search for a fast and accurate calculating device. Abacus was the first manual calculating device, which was invented in Asia many centuries ago. In 1617, John Napier, a Scottish mathematician invented a mechanical calculator called the 'Napier's bones'. Thereafter, many kinds of computers have been designed and built during the evolution of the modern digital computer. In order to provide a framework for the growth of computer industry, the computer era has been referred in terms of generations. Computers are classified into following s types based on their historical advancement and electronic components used.

First Generation Computers

The first generation of computers (1946-1954) was marked by the use of vacuum tubes or valves for their basic electronic component. Although these computers were faster than earlier mechanical devices, they had many disadvantages. First of all, they were very large in size. They consumed too much power and generated too much heat, when used for even short duration of time. They were very unreliable and broke down frequently.

transistors that can be used in place of vacuum tubes.

Examples:

- **ENIAC** (Electronic Numerical Integrator and Calculator) It was the first electronic

Second Generation Computers

The second generation of computers (1954-64) was marked by the use of transistors in place of vacuum tubes. Transistors had a number of advantages over the vacuum tubes. As transistors were made from pieces of silicon, they were more compact than vacuum tubes. The second generation computers, therefore, were smaller in size and less heat generated than first generation computers. Although they were slightly faster and more reliable than earlier computers, they also had many disadvantages

Third Generation Computers

The third generation of computers (1964-1980) was marked by the use of Integrated Circuits (ICs) in place of transistors. ICs were more compact than transistors, as hundreds of transistors could be put on a single small circuit. These computers removed many drawbacks of second generation computers. The third generation computers were even smaller in size which generated less heat and required very less power as compared to earlier two generations of computers. These computers required less human labor at the assembly stage. Although, third generation computers were faster and more reliable, they also had a few disadvantages. They still had less storage capacity, relatively slower performance and thus could not fulfil the requirements of the users and programmers. The third generation computers became outdated around the year 1978 when it was found that thousands of ICs could be integrated

Fourth Generation Computers

The fourth generation of computers (1978-till date) was marked by use of Large Scale Integrated (LSI) circuits in place of ICs. As thousands of ICs could be put onto a single circuit, so LSI circuits are still more compact than ICs. In 1978, it was found that millions of components could be packed onto a single circuit known as Very Large Scale Integration (VLSI). VLSI is the latest technology of computer that led to the development of the popular Personal Computers (PCs), also called as Microcomputers. All present day computers belong to the fourth generation of computers. These computers are very powerful having a high memory and a fast processing speed.

Fifth Generation Computers

The fifth generation computers (Tomorrow's computers) are still under research and development stage. These computers would have artificial intelligence. They will use ULSI (Ultra Large Scale Integration) chips in place of VLSI chips. One ULSI chip contains millions of components on a single IC. The most important feature of fifth generation computers is that they will use an intelligent software. This software will enable the user to tell computer 'What to do' and not 'How to do' by using intelligent programming and knowledge-based problem solving techniques. So, the programmers or users would not be required to give each and every instruction to the computer for solving a problem. These computers will also have user interface in form of speech in natural languages.

Example:

☐ Yet to develop but ROBOTS have few features of fifth generation computers.

Main parts of a computer system

You learned in the previous section that computers come in many varieties, from tiny computers to very large super computers. But no matters how complex it is or how big it is, every computer is part of a system. A complete computer system consists of four main parts as follows (see figure 2.10 below):

- Hardware
- Software
- Data

- User (Live ware)

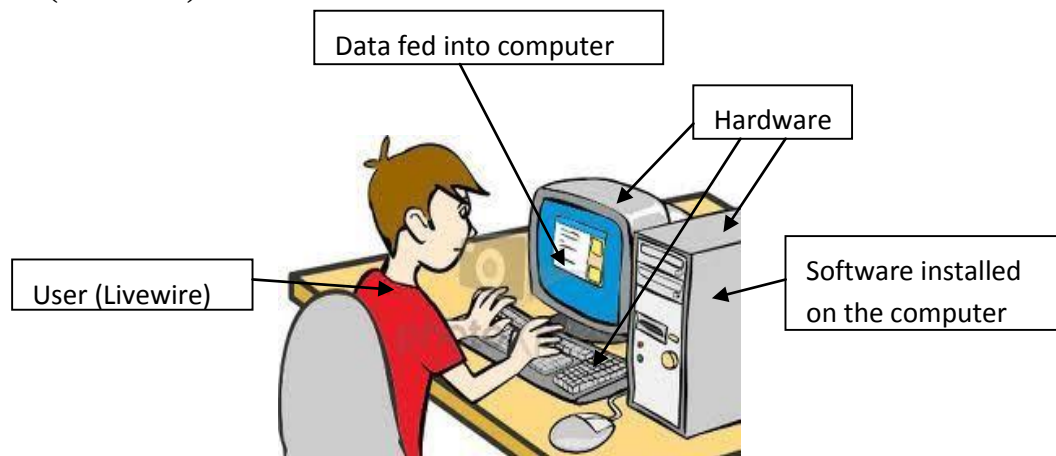


Figure 2.10: Parts of a Computer System Let

us have a look at each part of the computer system briefly.

Hardware

The tangible parts that make up the computer are called „Hardware“. The physical parts such as monitor, key board, processor, and speakers can be identified as hardware. We can use the generic term **device** to refer any piece of hardware. You will learn deeply about computer hardware in Session 03 of this course material.

Software

Computer software is a set of instructions that tells computer hardware what to do. The computer will work according to the instructions given to it. We can use the generic term **computer program** to refer any piece of software. Some software are specially designed for the primary functions of the computer to manage its operations while some software are designed for the users to get their work done, ex. to prepare a letter. However, software can be categorized into different categories and you will learn deeply about software in Session 04 of this course material.

Data

Any individual fact or piece of information in a form suitable for use with a computer is known as „data“. This information may be in the form of text, documents, images, audio clips or software program. The primary use of the computer is to convert these data into useful information to the user. The computer accepts data from some sources or from the user to produce useful information. Thus the raw data fed into the computer may not make much sense to the users until it is processed.

User/ Live ware

Though the computers automate most functions we cannot say that it is fully automatic, as the intervention of a human being or an operator is often needed. You may think whether a user is essential as you might have seen some performs their job without a person sitting in front of the computer. But you should not forget that the people design and build the programs running on it. The people do repairs to computer systems when needed. Therefore, „User“ is an essential part of a computer system. Further, you will learn about the applica/tions that you can run in „Personal computers“ within this course material.

Session 03

Computer Hardware

3.1 What is Computer Hardware?

You are already aware that a computer system is made up of several different components. Those that can be seen and touched are referred to as the **Computer Hardware** (or simply „hardware“). In other words, the physical equipment's that are involved in the function of the computer are called its hardware. The computer hardware is typically divided into four main categories: **Processing Devices, Memory Devices, Input/ Output Devices, and Storage Devices.**

The following diagram (Figure 3.1) summarizes the classification of the computer hardware.

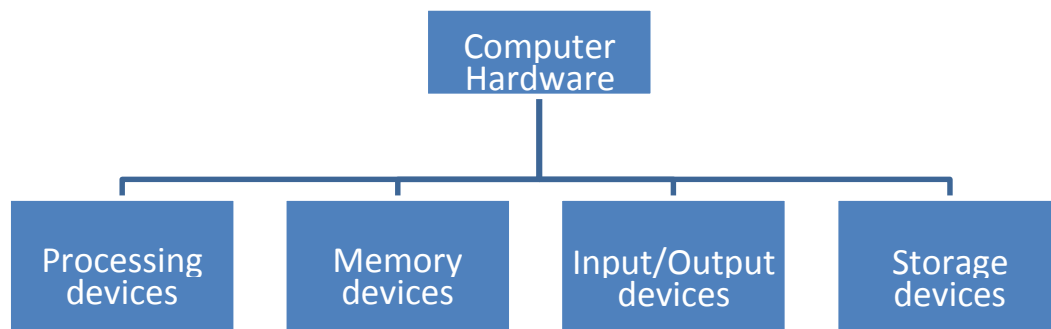


Figure 3.1: Classification of Computer Hardware

Following Figure 3.2 shows the basic computer architecture and the organization .

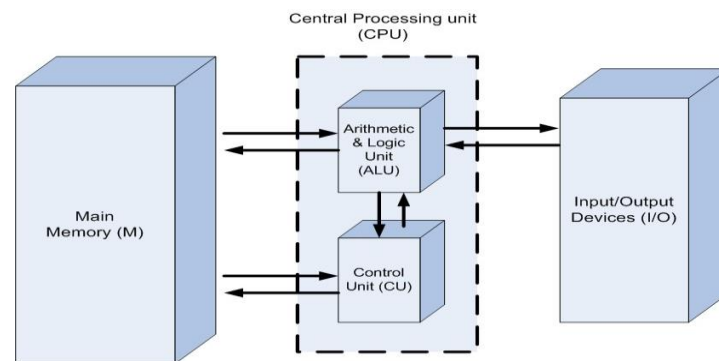


Figure 3.2: Basic computer architecture and the organization

Let us discuss on each type of hardware in the next sections with reference to the above Figure 3.1 and 3.2.

Processing Devices

Central Processing Unit

Central Processing Unit (CPU) is the main component or "brain" of a computer, which performs all the processing of input data. Its function is to fetch, examine and then execute the instructions stored in main memory of computer. In microcomputers, the CPU is built on a single chip or Integrated Circuit (IC) and is called as Microprocessor. The CPU consists of following distinct parts:

1. Arithmetic Logic Unit (ALU)

The arithmetic and logic unit of CPU is responsible for all arithmetic operations like addition, subtraction, multiplication and division as well as logical operations such as less than, equal to and greater than. Actually, all calculations and comparisons are performed in the arithmetic logic unit.

2. Control Unit (CU)

The control unit is responsible for controlling the transfer of data and instructions among other units of computer. It is considered as a "Central Nervous System" of computer, as it manages and coordinates all the units of computer. It obtains the instructions from the memory, interprets them and directs the operation of the computer. It also performs the physical data transfer between memory and the peripheral device.

Memory Devices

Computer Memory

A character is stored in the computer as a group of 0s and 1s, called a **Byte**. The size of the memory is measured by the number of bites available. The following equalities give the measuring units of the memory.

8 Bits	= 1 Byte
1024 Bytes	= 1 Kilobyte (1KB)
1024KB	= 1 Megabyte (1MB)
1024 MB	= 1 Gigabyte (1 GB)
1024 GB	= 1 Terabyte (1 TB)

While performing a processing operation, a processor needs a place to temporarily store instructions to be executed and the data to be used with those instructions. The data and the instructions needed by the CPU are temporarily stored in the Memory. Therefore, the memory acts as the internal storage of a computer. The programs that are stored in external storages are loaded into the memory before they start running. The memory of a computer may be either **volatile** or **non-volatile**. If the data will be lost as soon as the power is turned off the computer, then this type of memory is said to be Volatile. Such memory needs a continuous steady power/electricity to remain its content.

3.3.2 Random Access Memory (RAM)

The **Random Access Memory (RAM)** is a volatile form of a computer memory. This small memory is capable of memorizing temporarily. It can be read and written. That is, you can both write data into RAM and read data from RAM. Together with the CPU, RAM determines the computer's speed. A computer with a large RAM and a CPU can actually run faster than a computer with a powerful CPU but with a low RAM.

Read Only Memory (ROM)

As RAM is volatile, the computers need a non-volatile memory to read larger programs. This is known as the **Read Only Memory (ROM)**. The programs which are needed to start up your computer (Ex: to boot the computer) are stored in ROM.

Figure 3.3 and 3.4 show RAM and ROM memory chips respectively.



Figure 3.3: Random Access Memory (RAM) Figure 3.4: Read Only Memory (ROM) Chips

Input Devices

A computer executes instructions and processes data into information and stores the information for future use. Input devices are used to enter instructions and data into the computer.

What is Input?

Input is any data or instructions you enter to the memory of a computer. Once input is in memory, the CPU can access it and process the input into output. There are four types of input namely: data, programs, commands, and user responses.

Data

Data is a collection of unorganized facts that can include words, numbers, pictures, sounds, and videos. A computer manipulates and processes data into information, which is useful. .

Command

A Command is an instruction given to a computer program. Commands can be issued by typing keywords or pressing special keys on the keyboard. A **keyword** is a specific word, phrase, or code that a program understands as an instruction. Some keyboards include keys that send a command to a program when you press them. Instead of requiring you to remember keywords or special keys, many programs allow you to issue commands by selecting menu choices or graphical objects. For examples, programs that are **menu driven** provide menus as a means of providing commands. Today, most programs have a **graphical user interface (GUI)** that uses icons, buttons, and other graphical objects to issue commands. However, GUI is the most user friendly way to issue commands.

Input Devices

An **Input Device** is any hardware component that allows you to enter data, programs, commands, and user responses into a computer. Some of the commonly used input devices are listed below.

- Keyboard
- Pointing devices
 - Mouse
 - Trackball
 - Joystick
 - Touchpad
 - Light Pen
- Scanners
- Voice input systems
- Web Cam

Output Devices

What is output?

Output is data that has been processed into a useful form called information. A computer processes input into output. Computers generate several types of output, depending on the hardware and software being used and the requirements of the user. You may choose to display or view this output on a monitor, print it on a paper using a printer, or listen to it through speakers or a headset. Accordingly, the four common types of output are text, graphics, audio, and video. A brief description on some of output type is given below.

Text

Text consists of characters that are used to create words, sentences and paragraphs. A **character** can be a letter, number, punctuation mark, or any other symbol that requires one bite of computer storage space.

Audio

Audio is Music, speech, or any other sound. You might have learnt at school that sound waves, such as the human voice or music are **analog**. To store such sounds, a computer converts the sounds 0from a continuous analog signal into a digital **format**. Most output devices require that the computer converts the digital format back into analog signals.

An output device is any computer component capable of conveying information to a user. Some commonly used output devices are listed below.

- Display devices
- Printers
- Audio Devices
 - Speakers
 - Headphones

Storage Devices

Storage refers to the media on which data, instructions, and information are kept, as well as the devices that record and retrieve these items. In this section we will discuss about the storage media and storage devices.

Memory versus Storage

It is important to understand the difference between the memory what we discussed under section 3.3 and the Storage. Memory holds data and instructions temporarily while they are being processed by the CPU. Storage, also called Secondary, Auxiliary storage, or Mass storage, holds items such as data, instruction, and information for **future use**.

Think of storage as a filing cabinet used to hold file folders, and memory as the top of your desk. When you need to work with a file, you remove it from the filing cabinet (storage) and place it on your desk (memory). When you are finished with the file, you return it to the filing cabinet. time of memory devices are measured in milliseconds.

Storage Devices

Some of the commonly used storage devices are described below with their images. However, you may already have some idea about them.

Fixed hard disks

A hard disk drive is the device used to store large amounts of digital information in computers and related equipment like iPods and games consoles such as the Xbox 360 and PS3. Hard disk drives are used to store operating systems, software and working data.

These are suitable for any application which requires very fast access to data for both reading and writing to. However, Hard disk drives may not be suitable for applications which need portability. Almost all computers used a fixed hard disc. Used for on-line and real time processes requiring direct access. Used in file servers for Computer networks to store large amount of data.



Hard Disk drive which is often referred to as **Hard Disk** or **Hard Drive** is a device to store and retrieve data in a computer. The hard drive can store important system files like the operating system, program files and other data. Though HDDs were originally designed to be used with computers nowadays the applications for HDDs have expanded beyond computers to include digital video recorders, digital audio players, personal digital assistants, digital cameras and video game consoles. HDD is a non-volatile storage device that stores digitally encoded data. It is an electromagnetically charged surface or set of disks that record data in concentric circles known as tracks. HDDs record data by magnetizing ferromagnetic material directionally, to

represent either a 0 or a 1 binary digit. They read the data back by detecting the magnetization of the material. A typical HDD design consists of a spindle which holds one or more flat circular disks called platters, onto which the data is recorded. The platters are made from a non-magnetic material, usually aluminum alloy or glass, and are coated with a thin layer of magnetic material. Figure 3.27 and 3.28 show some images of Hard Disk Drives.

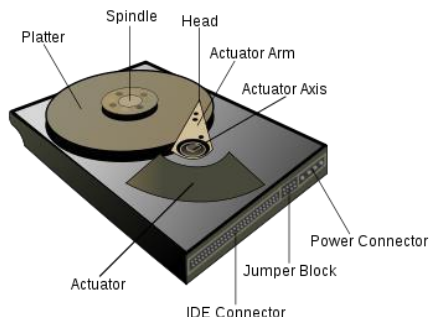


Figure 3.27: Parts of Hard Disk Drive



Figure 3.28: Outer view of a Hard Disk Drive

Portable Hard Disks

Portable hard disk is an interesting and useful device because you can carry data about all over the place and transfer information, programs, pictures, etc. between computers. Modern portable hard disks have a massive capacity like 500GB.



The System Unit

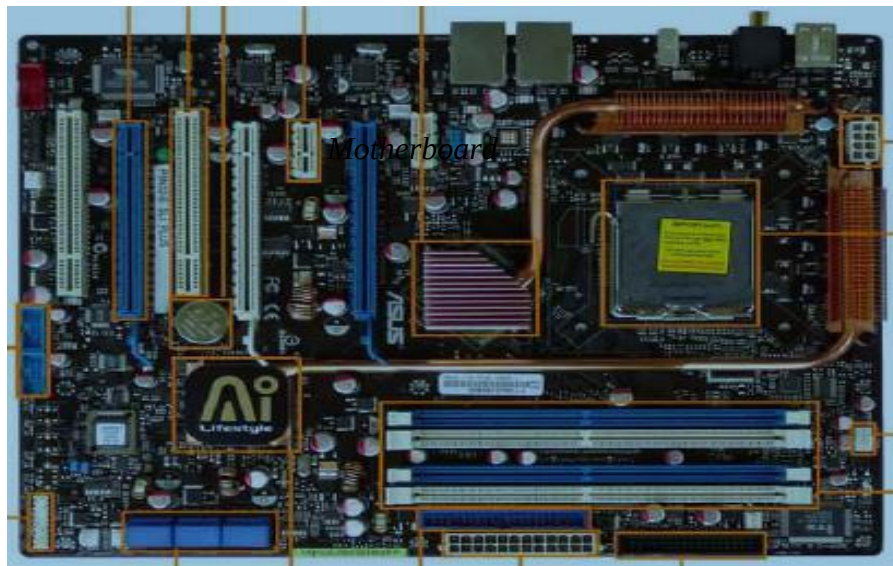
With reference to Figure 2.3 above, the System Unit of the computer is the box-like casing which contains the major electronic components that are responsible for the main functions of the computer. It should be mentioned here that many people use to refer to this as the CPU incorrectly. This erroneous reference may be due to CPU: *The brain of the commuter* being that significant. However, the electronic devices such as **CPU**, **memory**, **hard disk drive** are located inside the System Unit. In addition to the above parts, **Motherboard**, **Floppy Disk Drive**, **Power Supply unit**, and **CD-ROM Drive** are the other major components that you can find within the system unit. A brief description of each above component is given next.

Note: *The system unit is also called the housing, case, computer chassis, or cabinet.*

Motherboard

The motherboard is sometimes called the **system board**, **planner board** or **main board**. It is the **main circuit board** of a computer. The motherboard contains several **connectors** for attaching additional boards. Usually, the motherboard contains the CPU, BIOS, memory, mass storage interfaces, serial/parallel ports, expansion slots, and all the controllers required to control standard peripheral devices, such as the display screen, keyboard, and disk drive. All of the basic circuitry and components required for a computer to function are onboard the motherboard or are connected with a cable. The most important component on a motherboard is the chipset. It often consists of two components or chips known as the **Northbridge** and **Southbridge**, though

they may also be integrated into a single component. These **chips** determine, to an extent, the features and capabilities of the motherboard.



Power Supply Unit

Power Supply Unit (PSU) is another very important unit found in the system unit. Usually we connect the power code of the computer to the domestic mains supply. Therefore, PSU converts Alternating Current (AC) from mains supply to Direct Current (DC) with the required different voltages needed to power different components of the computer. Power supplies have a certain power output specified in Watts, a standard power supply would typically be able to deliver around 350 Watts. The more components like HDD, CD/DVD drives, and cooling fans, are connected to your computer the greater the power required from the power supply. See Figure 3.35 for an image of a typical power supply unit.



Figure 3.35: Power Supply Unit

Session 04

Computer Software

What is Software?

Software, also called a **computer program** or simply a **program**, is a series of instructions that tells the hardware of a computer what to do. For example, some instructions direct the computer to allow you to input data from the keyboard and store it in memory. Other instructions cause data stored in memory to be used in calculations such as adding a series of numbers to obtain a total.

Before a computer can perform or execute a program, the instructions in the program must be loaded into the memory of the computer. Usually, they are loaded into memory from storage like hard disk.

When you purchase a program, you will receive one or more CD-ROMs or a single DVD-ROM on which the software is stored. To use the software, you often need to **install** the software on the computer's hard disk. Sometimes, a program can be loaded in memory directly from a CDROM or a DVD-ROM so that you do not have to install it on the hard disk to use it.

When you buy a computer, it usually has some software already installed in its hard disk. Thus you can use the computer as soon as you receive it. Software is the key to productive use of computers. With the correct software, a computer can become a valuable tool.

CLASSIFICATION OF SOFTWARE

Software are broadly classified into following two types. The following diagram (Figure 4.1) shows the basic categories of software. This section will give you a description on each category of software together with some examples.

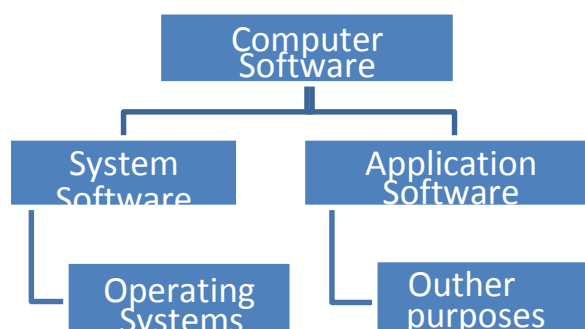


Figure 4.1: Classification of Computer Software

System Software

Software, which are required to control the working of hardware and aid in effective execution of a general user's applications are called system software. This software's perform a variety of functions like file editing, storage management, resource accounting, I/O management, database management, etc.

Types of System Software

System software can be further categorized into following three types:

(i) System Management Software

(Operating Systems, DBMS, Operating Environments)

(ii) System Development Software

(Language Translators, Application Generators, CASE Tools)

(iii) System Software Utilities

Operating Systems (OS)

The Operating System contains instructions that co-ordinate all of the activities of hardware devices of your computer. It also contains instructions that allow you to run any applications software. One may define the Operating system as an interface between a user and all computer resources.

When you start a computer, the operating system is loaded or copied into memory from the computer hard disk. It remains in memory while the computer is running and allows you to communicate with the computer and other software. A computer cannot function without an operating system. It is an important component of the computer system, because it sets the standards for the application programs that run on it. All programs must “talk to” the OS.

There are two main types of Operating Systems:

Single-user OS: A type of OS which allows only one user at a time. There can be single-user OS either as **single-user single-task** or **single-user multi-task**. The Single-user single-task OS has to deal with only one person at a time running only one application at a time. MS DOS is an example for a single user single task OS.

Think of the OS of your Personal Computer. It is designed mainly with one user (i.e. you) in mind but that only user: you can deal with many applications running at the same time. You may word process a document with a word processing application like MS Word while listening to music played in the windows media player in parallel. Or you might be answering the school assignment while searching more facts on the internet while a suitable video is being downloaded. This type of OSs is of **single-user multi-task** OS. An example of such OS is Windows 95.

Multi-user OS: In some situations, we need to share the single computer among few users. So the OS should be a multi-user where more than one user is logged on to the computer and uses it at the same time. These multi users may work with remote desktop connections. Further, these different users may need to run different applications at the same time. So the OS must support multi-task facility as well. Obviously the computer should be a powerful one. Each user draws on a big power of the computer in a shared way. This type of Multi –user multi-task OSs have to manage some tasks as listed below:

- Each user logged on to the system, their workspace and so on.
- Allocate resources to the jobs they want to run.
- Keep logs of how much processing time and resources they use
- Work out the most efficient use of computer processing cycles - Maintain security

Following are some examples of such OS:

- Windows XP, 7, 8 etc.
- Unix
- Linux (Ubuntu, Centos, Fedora etc.)

Desktop OS vs. Server OS

The OS can also be categorized as Desktop OS and Server OS depending on whether the OS is to be installed in a desktop computer or a server. For example, the latest versions of the Windows OS family can be categorized as follows:

Desktop OS: windows XP, windows 7, Windows 8

Server OS: Windows 2000Server, Windows 2005Server, Windows 2008Server /

Application Software

Software which are required for general and special purpose applications like database management, word processing, accounting etc. are called as application software. Some of

the examples of application software are , Word Star, Tally etc. Application software are developed using system software by Application Programmers.

- (i) General Purpose Application Software
(Database Management Packages, Word Processors, Spreadsheets, Office Automation Packages)
- (ii) Special Purpose Application Software
(Desktop Publishing, Multimedia, Business Applications)

Session 05

What is a Computer Network?

Two or more independent computers connected together through a communication media form a computer network. The computers are connected in a network to exchange information and data. The computers connected in a network can also use resources of other computers such as software packages and peripherals like modems, printers, backup drives, or CD-ROM drives. Networks are built with a mix of computer hardware and computer software. Further, you do not need the same software package installed on your machine, if your network has that software installed on one of the machines on the network. In this sense, computer networks are clear means for sharing resources. This makes the use of computer technology cost effective. Following Figure 5.1 shows a typical network with four computers.

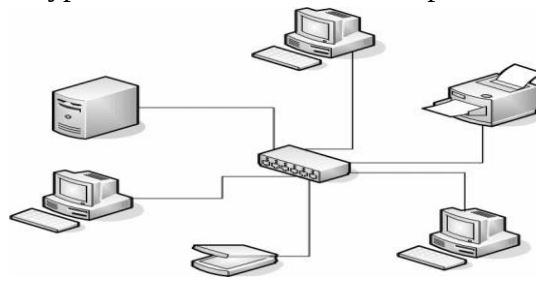


Figure 5.1: Typical computer network

Basic hardware and terminology in networks

If you explore more on computer networks, you will come across with a huge list of terminology associated with networks. Let us look at the basic terminology used in the subject of computer networks in brief. It is worth to note here that all networks are made up of basic hardware building blocks to interconnect network nodes.

Node

Any device attached to the network capable of communicating with other network devices is called a **Node**. A node can be a computer or some other device, such as a printer. Every node has a unique network address, sometimes called a Data Link Control (DLC) address or Media Access Control (MAC) address.

Client

A device or application that uses the services provided by a server is called a **Client** in the network. A client may be a PC or a workstation on a network using services provided from the network file server, or it may be that part of an application program that runs on the workstation supported by additional software running on the server. One of the most familiar clients is the Web browser.

Server

Any computer that makes access to files, printing, communications, and other services available to users of the network is called a **Server** in the network. In large networks, a dedicated server runs a special network operating system; in smaller installations, a non-dedicated server may run a personal computer operating system with peer-to-peer networking software running on top.

A server typically has a more advanced processor, more memory, a larger cache, and more disk storage than a single-user workstation. A server may also have several processors rather than just one and may be dedicated to a specific support function such as printing, e-mail, or communications. Many servers also have large power supplies, UPS (uninterruptible power

supply) support, and fault-tolerant features, such as RAID technology. On the Internet, a server responds to requests from a client, usually a Web browser.

Following Figure 5.2 shows the client and server in a network.

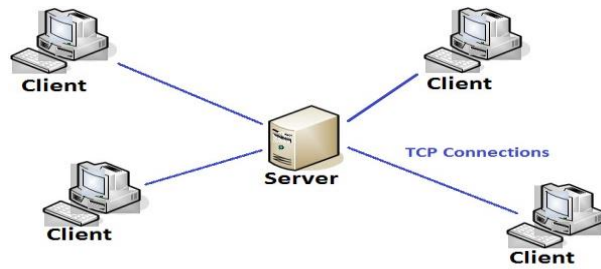


Figure 5.2: Client and Server

Hub

A device used to extend a network so that additional workstations can be attached. In some star networks, a hub is the central controlling device. Hubs typically provide from 4 to 24 connections, allowing anything from 2 to 24 devices to communicate with one another. Following Figure 5.3 shows the use of a hub in a Star network (You will learn what a star network is in the latter part of this session) while the Figure shows an enlarged view of an 8-port hub.

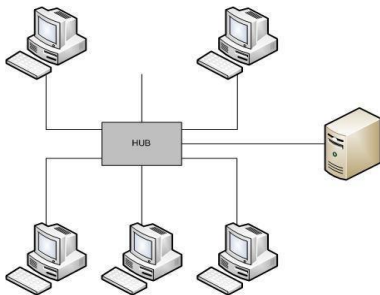


Figure 5.3: Hub in a Star network



Figure 5.4: 8-port Hub

IP Address

An Internet Protocol (IP) address is a numerical identification (logical address) that is assigned to devices participating in a computer network utilizing the Internet Protocol for communication between its nodes. Although IP addresses are stored as binary numbers, they are often displayed in more human-readable notations, such as 192.168.100.1(for IPv4). The role of the IP address has been characterized as follows: "A name indicates what we seek. An address indicates where it is. A route indicates how to get there."

Switches

A network switch is a computer networking device that links network segments or network devices. The term commonly refers to a multi-port network bridge that processes and routes data at the data link layer (layer 2) of the OSI model. Switches that additionally process data at the network layer (layer 3) and above are often called *layer-3 switches* or *multilayer switches*.



Figure 5.6: Switch

Routers

A router is a networking device that forwards packets between networks using information in protocol headers and forwarding tables to determine the best next router for each packet. Routers work at the Network Layer of the OSI model and the Internet Layer of TCP/IP.



Figure 5.7: Router

Classifications of Computer Networks

Classification of computer networks by scale

According to the Table 5.1 above, the networks can be classified into six classes abbreviated as PAN, LAN, MAN and GAN.

Local Area Network (LAN)

A local area network (LAN) is a computer network covering a small geographic area, like a home, office, or group of buildings. Ex: a school (See Figure 5.10 below). The defining characteristics of LANs, in contrast to Wide Area Networks (WANs), include their much higher data transfer rates, smaller geographic range, and lack of a need for leased telecommunication lines. LANs can be small, linking as few as three computers, but often link hundreds of computers used by thousands of people. The development of standard networking protocols and media has resulted in worldwide propagation of LANs throughout business and educational organizations. The Figure 5.9 below shows a LAN consisting of six computers/work stations.

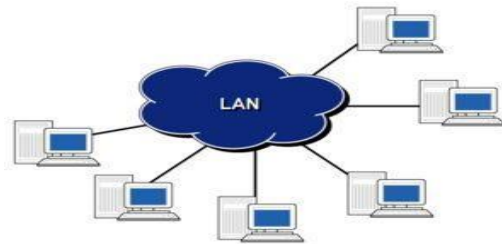


Figure 5.9: Local Area Network (LAN)

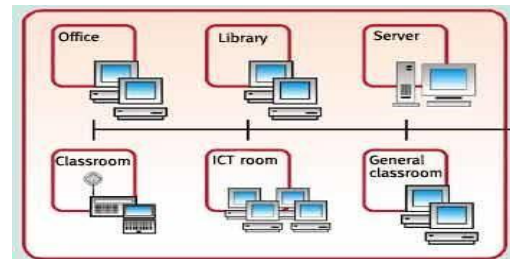


Figure 5.10: LAN in a School

Wide Area Network (WAN)

Wide Area Network is defined as a group of computers and network devices connected across large physical areas such as states or countries. Computers connected to a Wide Area Network are often connected through the telephone system. They can also be connected through leased lines or satellites. One may define a WAN as a collection of several LANs as depicted in Figure 5.11 below.

The largest WAN in existence is the Internet. (You will learn about Internet in a coming section).

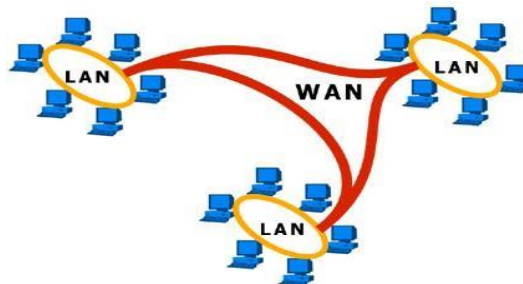


Figure 5.11: Wide Area Network

Metropolitan Area Network (MAN)

MAN is a network that interconnects users with computer resources in a geographic area or region larger than that covered by a local area network (LAN) but smaller than the area covered by wide area network (WAN). Further a MAN is a network that connects two or more Local Area Networks or Campus Area Networks together but does not extend beyond the boundaries of the immediate town, city, or metropolitan area. See Figure 5.12 below for a typical set up of a MAN.

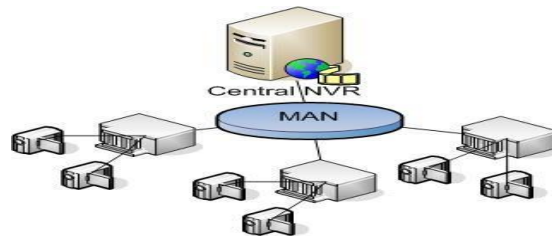


Figure 5.12: Metropolitan Area Network (MAN)

Classifications of networks based on the topology

Network Topology is the schematic description how the arrangement of the network is including the nodes, connecting lines, and other devices. As per the above Table 5.1, the main network topologies are listed below.

- Bus
- Star
- Ring
- Mesh
- Tree/Hierarchical

Deep discussions on the topologies are beyond the level of this course unit. However, brief descriptions on each topology and images of them are given below.

Bus Topology

Bus networks (not to be confused with the system bus of a computer) use a common backbone to connect all devices. A single cable, the backbone, functions as a shared communication medium that devices attach or tap into with an interface connector. A device wanting to communicate with another device on the network sends a broadcast message onto the wire that all other devices see, but only the intended recipient actually accepts and processes the message.

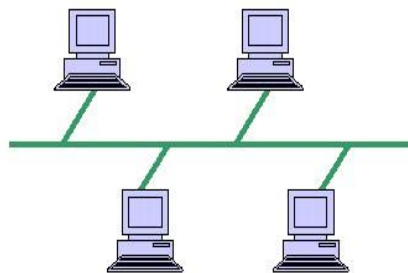


Figure 5.14: Bus topology

Star Topology

Many home networks use the star topology. A star network features a central connection point called a "hub node" that may be a network hub, switch or router. Devices typically connect to the hub with Unshielded Twisted Pair (UTP) Ethernet.

Compared to the bus topology, a star network generally requires more cable, but a failure in any star network cable will only take down one computer's network access and not the entire LAN. (If the hub fails, however the entire network also fails.)

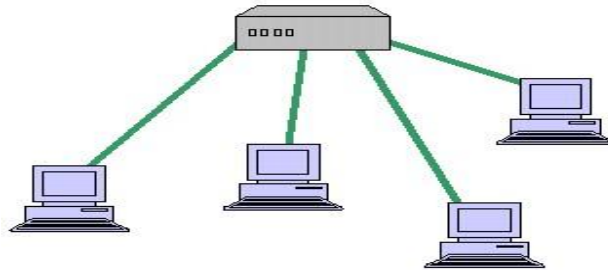


Figure 5.15: Star topology

Ring Topology

In a ring network, every device has exactly two neighbors for communication purposes. All messages travel through a ring in the same direction (either "clockwise" or "counterclockwise"). A failure in any cable or device breaks the loop and can take down the entire network.

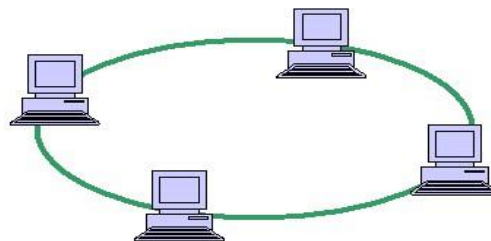


Figure 5.16: Ring topology

Mesh Topology

Mesh topologies involve the concept of routes. Unlike each of the previous topologies, messages sent on a mesh network can take any of several possible paths from source to destination. (Recall that even in a ring, although two cable paths exist, messages can only travel in one direction.) Some WANs, most notably the Internet, employ mesh routing

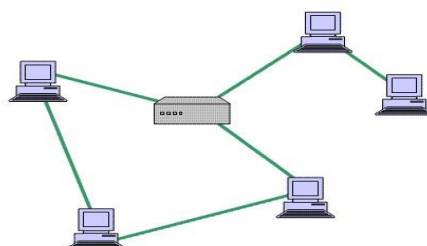


Figure 5.17: Mesh topology

Tree Topology

Tree topologies integrate multiple star topologies together onto a bus. In its simplest form, only hub devices connect directly to the tree bus and each hub functions as the root of a tree of devices. This bus/star hybrid approach supports future expandability of the network much better than a bus (limited in the number of devices due to the broadcast traffic it generates) or a star (limited by the number of hub connection points) alone.

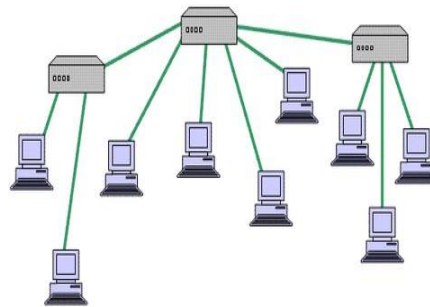


Figure 5.18: Tree topology

Session 06

internet

INTRODUCTION

In the present age of information Technology, use of Internet is becoming quite popular for accessing information on any topic of your interest. It also provides tremendous opportunities to students, researchers and professionals for getting information on matters related to academic and professional topics and lot more. In the present world, most of the people who have computers around themselves use Internet to access information from the World Wide Web, exchange messages & documents and e-services.

WHAT IS INTERNET?

The Internet or simply the Net is a worldwide network of computer networks. It is an interconnection of large and small networks around the globe.

APPLICATIONS OF INTERNET

With the help of Internet, you can:

- l Exchange messages using e-mail (Electronic mail).
- l Transfer files as well as software.
- l Browse through information on any topic on web.
- l Communicate in real time (chat) with others connected to the Internet.
- l Search databases of government, individuals and organizations.
- l Read news available from leading news groups.
- l Send or receive animation and picture files from distant places.
- l Set up a site with information about your company's products and services.

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Types of Internet Connections

(a) Dial-up

This is the most common basic type of connection available from ISPs (Internet Service Providers). In Dial-up connection, you use your computer, dial a phone number (provided by ISP) to get connected to server at Providers end through which you access Internet. It means you are not directly connected to Internet; you access the Internet through an Internet Service Provider.

(b) ISDN (Integrated Services Digital Network)

The process of connecting to server to access Internet is almost same as Dial-up, but it offers connectivity through the use of digital phone lines instead of Analog. It offers Internet connectivity at speeds of up to 128 Kbps, allows the user to receive or make calls simultaneously on the same line. ISDN comes through a regular telephone wire from the telephone pole on the street. The line combines two 64 Kbps channels to offer 128 Kbps bandwidth broken into three bands: One band for the ringing signal of your phone, one band for your telephone conversation, and one band for data transfer.

(c) Leased Line Connection (Direct Internet Access)

A "permanent connection" between a computer system (single CPU or LAN, and the Internet). It is generally used by larger institutions, corporate and government agencies. It involves establishing your own Internet gateway (connection) and payment to have a direct full time line with the network. Your computers, in effect, become part of the Net. The main advantage of this connection is that: it is on

line – 24 hrs. a day, seven days a week, (24x7) and provides faster access. Dedicated links are established through an internet service provider who places a computer-controlled router (message director) at your site. A router is used to connect your local network to the Internet, allow all the members of network to have complete access to Internet.

(d) DSL (Digital Subscriber Line or Dedicated Service Line)

Broadband Connection

DSL, an “always-on” data connection is becoming widely available these days. It can provide an excellent Internet connection. It connects your home or office to the Internet through the same telephone wire that comes from telephone pole on the street. Like ISDN, with DSL, user can make and receive telephone calls while connected to the Internet. The difference between DSL and dialup ISDN is that a DSL Internet connection uses a high-speed dedicated circuit filtering out standard phone calls and Internet signals.

HOW DOES INTERNET WORK?

The thing that characterizes the Internet is how data are transferred from one computer to another. Did you ever wonder what magical things go on behind the scenes that results in a web page being displayed on your screen seconds after you request it? How does the data move from one side of the world to the other?

Fig. 10.2

Here is what happens to a piece of data (e.g. a Web page) when is transferred over the Internet:

- l It is broken into a lot of same-sized pieces (called packets).

- l A header is added to each packet that explains where it came from, where it should end up and how it fits in with the rest of the packets’ Each packet is sent from computer to computer until it finds its way to its destination. Each computer along the way decides where next to send the packet. This could depend on things like how busy the other computers are when the packet was received. The packets may not all take the same route. At the destination, the packets are examined. If there is any packet missing or damaged, a message is sent asking for that packet to be resent. This continues until all the packets have been received intact. The packets are reassembled into their original form.

Each computer connected up to the Internet has a software called TCP/IP (Transmission Control Protocol/Internet Protocol), which is responsible for receiving, sending and checking packets. TCP/IP is the ‘glue’ of the Internet.

FREQUENTLY USED TERMS IN INTERNET

In this section we will discuss common internet terms to help you understand the relationship of various Internet technologies.

World Wide Web (WWW): The World Wide Web (“WWW” or simply the “web”) is a collection of electronic documents (called web pages) that are linked together like a spider web. These documents are stored on computers called servers located around the world. **Web Server:** A Web Server is a computer that stores web pages. It is responsible for accepting request(s) from users and serves them with web pages. Two important web server programs are: IIS (Internet Information server) and Apache, etc. Web servers are connected to the Internet 24 hours a day, seven days a week.

Hyperlink: It is an element in an electronic document that links to another place in the same document or to an entirely different document or other resource. Hyperlinks usually appear as underlined text and in a different color, but they may also appear as graphics, such as buttons to click. Hyperlinks may be used to link another place in the same page, or another page, to play an audio or

video file, to download a file, to set up a message to an e-mail address, and to link to other Internet resources.

HTML (Hypertext Markup Language): It is a language that consists of certain key words called 'Tags', used for writing the documents on the web. **Web Page:** A web page (such as the one you are looking at now) is an electronic document written in a computer language called HTML (Hypertext Markup Language). Web pages can contain text, graphics, video, animation, and sound, as well as interactive features, such as data entry forms. Each page has a unique address known as a UR (Uniform Resource Locator) that identifies its location on the server. Web pages usually contain hyperlinks to other web pages. **Website:** A website (often shortened to just site) is one or more web pages, belonging to a particular company, institute, government or an individual. The first page is called the home page, which acts like an index, indicating the content on the site.

By default the home page is named as index.htm. From the home page, you can click hyperlinks to access other web pages. **URL (Uniform Resource Locator):** Every page on the web has a unique address, called Uniform Resource Locator, URL. A URL indicates where the web page is stored on the Internet. A sample URL might look like the following:

Fig. 10.3

IP (Internet Protocol) Address: Computers do not understand letters or symbols that humans use to communicate effectively. Computers understand numbers-specifically, 1s and 0s. Thus every host (a computer linked to the Internet) on the Internet has a unique host number. This number is called the Internet Protocol address, or IP address. The IP address is a unique address, generally written in the format xxx.xxx.xxx.xxx, where xxx represents a 3 digit number that varies between 0 and 255. For Example: 192.100.8.56

DNS (Domain Name System): Every host (computer linked to Internet) has a unique host number called IP address. You can connect to any host through IP address only, but it is difficult to remember the 4-digit number of hosts. To resolve this, domain name is the only solution. Domain name, a unique name of the individual host computer on the Internet. Every computer on the Internet now have both a domain name and an IP address. To connect to any host through domain name requires some mechanism that will convert the domain name IP address. DNS, Domain Name System is the standard for resolving names to addresses. It is used mostly to translate between domain names and IP addresses.

Session 07

Mobile Communication and Modern Wireless Communication Systems

Introduction

Communication is one of the integral parts of science that has always been a focus point for exchanging information among parties at locations physically apart. After its discovery, telephones have replaced the telegrams and letters. Similarly, the term 'mobile' has completely revolutionized the communication by opening up innovative applications that are limited to one's imagination. Today, mobile communication has become the backbone of the society. All the mobile system technologies have improved the way of living. Its main plus point is that it has privileged a common mass of society. In this chapter, the evolution as well as the fundamental techniques of the mobile communication is discussed.

Evolution of Mobile Radio Communications

The first wireline telephone system was introduced in the year 1877. Mobile communication systems as early as 1934 were based on Amplitude Modulation (AM) schemes and only certain public organizations maintained such systems. With the demand for newer and better mobile radio communication systems during the World War II and the development of Frequency Modulation (FM) technique by Edwin Armstrong, the mobile radio communication systems began to witness many new changes. Mobile telephone was introduced in the year 1946. However, during its initial three and a half decades it found very less market penetration owing to high

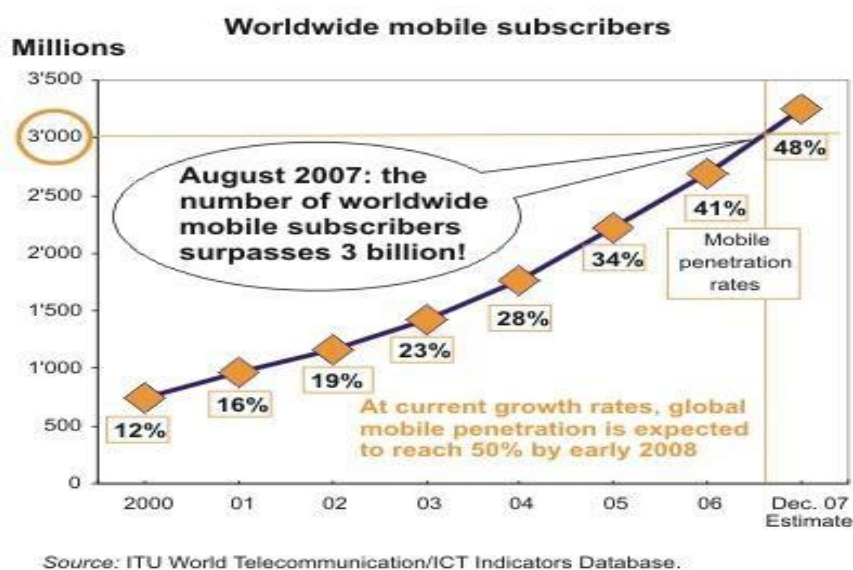


Figure 1.1: The worldwide mobile subscriber chart

costs and numerous technological drawbacks. But with the development of the cellular concept in the 1960s at the Bell Laboratories, mobile communications began to be a promising field of expanse which could serve wider populations. Initially, mobile communication was restricted to certain official users and the cellular concept was never even dreamt of being made commercially available. Moreover, even the growth

in the cellular networks was very slow. However, with the development of newer and better technologies starting from the 1970s and with the mobile users now connected to the Public Switched Telephone Network (PSTN), there has been an astronomical growth in the cellular radio and the personal communication systems. Advanced Mobile Phone System (AMPS) was the first U.S. cellular telephone system and it was deployed in 1983. Wireless services have since then been experiencing a 50% per year growth rate. The number of cellular telephone users grew from 25000 in 1984 to around 3 billion in the year 2007 and the demand rate is increasing day by day. A schematic of the subscribers is shown in Fig. 1.1.

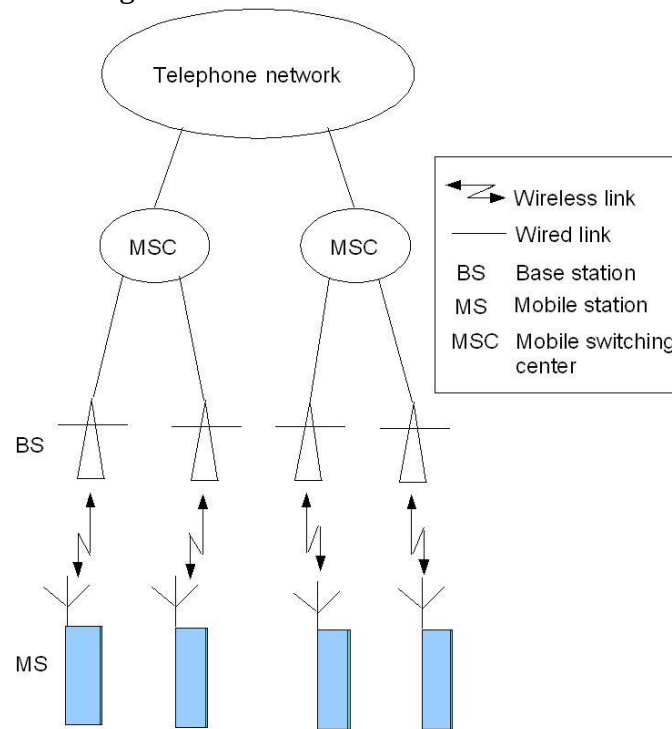


Figure 1.2: Basic mobile communication structure.

Present Day Mobile Communication

Since the time of wireless telegraphy, radio communication has been used extensively. Our society has been looking for acquiring mobility in communication since then. Initially the mobile communication was limited between one pair of users on single channel pair. The range of mobility was defined by the transmitter power, type of antenna used and the frequency of operation. With the increase in the number of users, accommodating them within the limited available frequency spectrum became a major problem. To resolve this problem, the concept of cellular communication was evolved. The present day cellular communication uses a basic unit called cell. Each cell consists of small hexagonal area with a base station located at the center of the cell which communicates with the user. To accommodate multiple users Time Division multiple Access (TDMA), Code Division Multiple Access (CDMA), Frequency Division Multiple Access (FDMA) and their hybrids are used. Numerous mobile radio standards have been deployed at various places such as AMPS, PACS,

Radio Transmission Techniques

Based on the type of channels being utilized, mobile radio transmission systems may be classified as the following three categories which is also shown in Fig. 1.3:

_ **Simplex System:** Simplex systems utilize simplex channels i.e., the communication is unidirectional. The first user can communicate with the second user. However, the second user cannot communicate with the first user. One example of such a system is a pager.

_ **Half Duplex System:** Half duplex radio systems that use half duplex radio channels allow for non-simultaneous bidirectional communication. The first user can communicate with the second user but the second user can communicate to the first user only after the First user has finished his conversation. At a time, the user can only transmit or receive information. A walkie-talkie is an example of a half-duplex system which uses 'push to talk' and 'release to listen' type of switches.

_ **Full Duplex System:** Full duplex systems allow two way simultaneous communications. Both the users can communicate to each other simultaneously. This can be done by providing two simultaneous but separate channels to both the users. This is possible by one of the two following methods

Frequency Division Duplexing (FDD): FDD supports two-way radio communication by using two distinct radio channels. One frequency channel is transmitted downstream from the BS to the MS (forward channel).

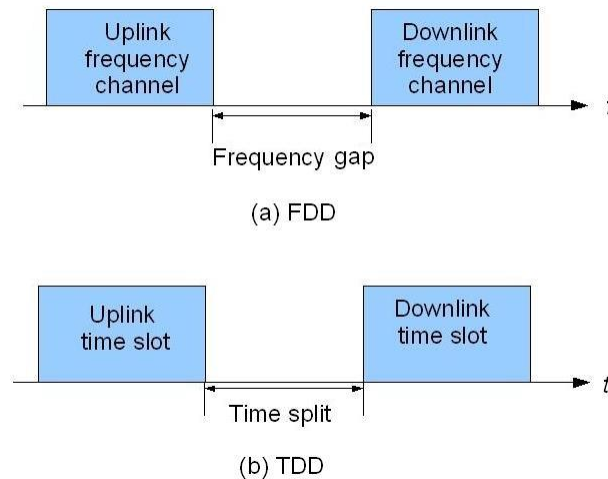


Figure 1.4: (a) Frequency division duplexing and (b) time division duplexing.

A second frequency is used in the upstream direction and supports transmission from the MS to the BS (reverse channel). Because of the pairing of frequencies, simultaneous transmission in both directions is possible. To mitigate self-interference between upstream and downstream transmissions, a minimum amount of frequency separation must be maintained between the frequency pair, as shown in Fig. 1.4.

Time Division Duplexing (TDD): TDD uses a single frequency band to transmit signals in both the downstream and upstream directions. TDD operates by toggling transmission directions over a time interval. This toggling takes place very rapidly and is imperceptible to the user.

Session 08

Usage of ICT& Environment for Computers

6.2 Usage of ICT in different sectors

We looked at the usage of computers in a typical office in the previous section. It was quite difficult to list of uses as it is vast. However, it can be clearly identify the sectors where ICT is now used in the Sri Lanka and in the world, in general as listed below.

6.2.1 Potential Sectors with ICT usage

ICT can be potentially used in the following sectors. Note that the following list is given in general but not specific to our country. Some of the sectors may be already familiar to you in your everyday life.

- Education
- Heals care/medicine
- Agriculture
- Banking
- Business/trade and commerce
- Transport
- Manufacturing
- Travel and Tourism
- Environment
- Gender
- Culture

ICT in Business/Trade and Commerce

1.1 Electronic Commerce:

Electronic commerce, commonly known as E-commerce is trading in products or services using computer networks, such as the Internet.

Electronic commerce draws on technologies such as mobile commerce, electronic funds transfer, supply chain management, Internet marketing, online transaction processing, electronic data interchange (EDI), inventory management systems, and automated data collection systems. Modern electronic commerce typically uses the World Wide Web for at least one part of the transaction's life cycle, although it may also use other technologies such as e-mail.

Definition of E-commerce: Sharing business information, maintaining business relationships and conducting business transactions using computers connected to telecommunication network is called E-Commerce.

1.2 E-Commerce Categories:

1.Electronic Markets Present a range of offerings available in a market segment so that the purchaser can compare the prices of the offerings and make a purchase decision.

Example: Airline Booking System

2. Electronic Data Interchange (EDI) • It provides a standardized system • Coding trade transactions • Communicated from one computer to another without the need for printed orders and invoices & delays & errors in paper handling • It is used by organizations that a make a large no. of regular transactions Example: EDI is used in the large market chains for transactions with their suppliers

3. Internet Commerce • It is use to advertise & make sales of wide range of goods & services. • This application is for both businesses to business & business to consumer transactions.

Example: The purchase of goods that are then delivered by post or the booking of tickets that can be picked up by the clients when they arrive at the event.

1.3 Advantages of E-commerce:

- ☐ Buying/selling a variety of goods and services from one's home or business
- ☐ Anywhere, anytime transaction
- ☐ Can look for lowest cost for specific goods or service
- ☐ Businesses can reach out to worldwide clients - can establish business partnerships
- ☐ Order processing cost reduced
- ☐ Electronic funds transfer faster
- ☐ Supply chain management is simpler, faster, and cheaper using ecommerce
- Can order from several vendors and monitor supplies.
- Production schedule and inventory of an organization can be inspected by cooperating supplier who can in-turn schedule their work

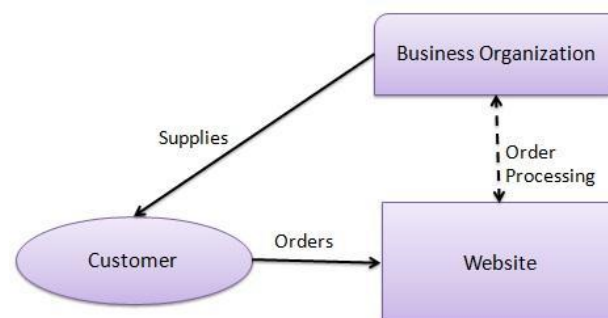
1.4 Disadvantages of E-commerce:

- ☐ Electronic data interchange using EDI is expensive for small businesses
- ☐ Security of internet is not very good - viruses, hacker attacks can paradise e-commerce

1.7 Business models of e-commerce: There are mainly 4 types of business models based on transaction party.

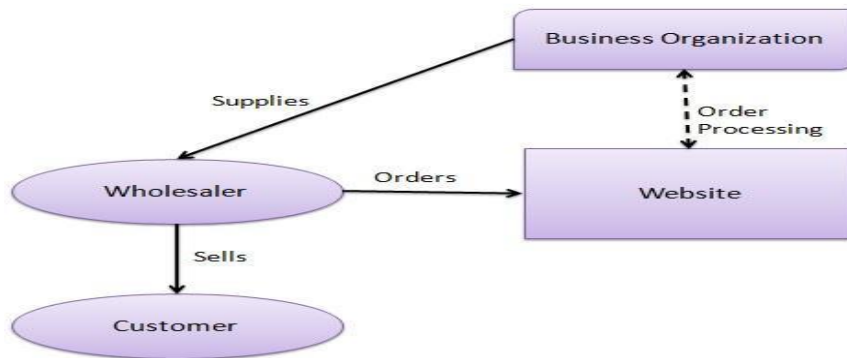
Business-to-Consumer (B2C)

In a Business-to-Consumer E-commerce environment, companies sell their online goods to consumers who are the end users of their products or services. Usually, B2C E-commerce web shops have an open access for any visitor, meaning that there is no need for a person to login in order to make any product related inquiry.



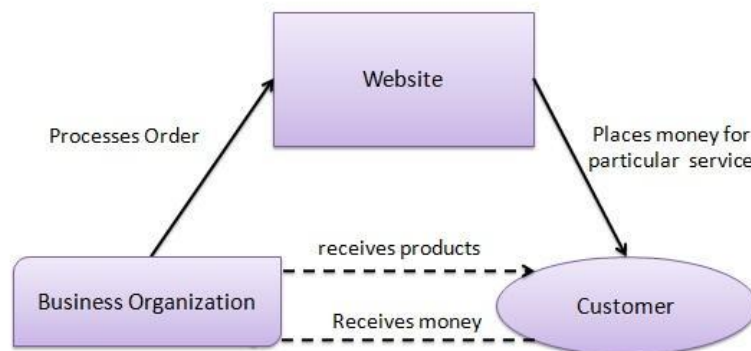
Business-to-Business (B2B)

In a Business-to-Business E-commerce environment, companies sell their online goods to other companies without being engaged in sales to consumers. In most B2B E-commerce environments entering the web shop will require a log in. B2B web shop usually contains customer-specific pricing, customer-specific assortments and customer-specific discounts.



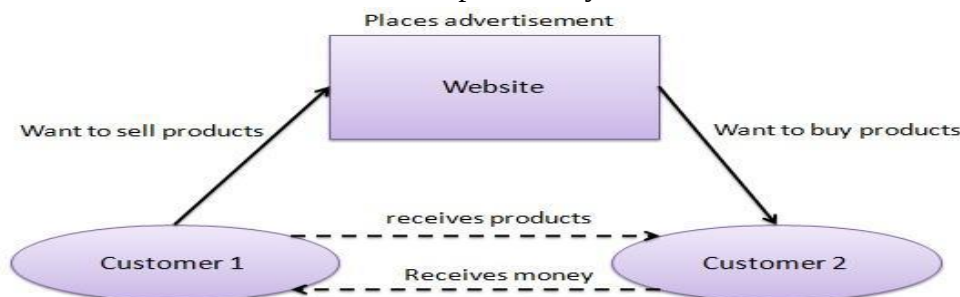
Consumer-to-Business (C2B)

In a Consumer-to-Business E-commerce environment, consumers usually post their products or services online on which companies can post their bids. A consumer reviews the bids and selects the company that meets his price expectations.



Consumer-to-Consumer (C2C)

In a Consumer-to-Consumer E-commerce environment consumers sell their online goods to other consumers. A well-known example is eBay.

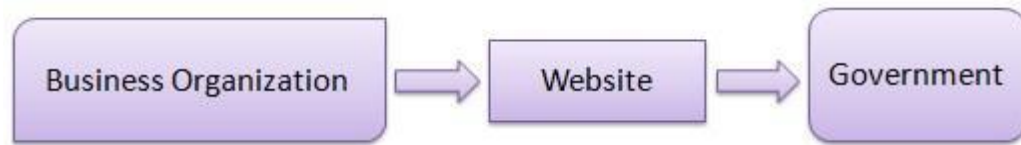


1.8 E-Governance: E-governance is the application of information and communication technology (ICT) for delivering government services, exchange of information communication transactions, integration of various stand-alone systems and services between government-to-customer (G2C), government-to-business (G2B), government-to-government (G2G) as well as back office processes and interactions within the entire government framework.

Through e-governance, government services will be made available to citizens in a convenient, efficient and transparent manner. The three main target groups that can be distinguished in e-governance concepts are government, citizens and businesses/inter groups. In e-governance there are no distinct boundaries.

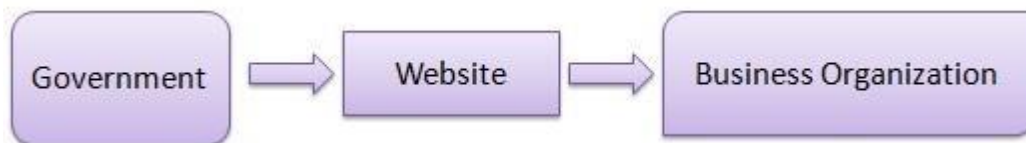
Business - to - Government (B2G)

B2G model is a variant of B2B model. Such websites are used by government to trade and exchange information with various business organizations. Such websites are accredited by the government and provide a medium to businesses to submit application forms to the government.



Government - to - Business (G2B)

Government uses B2G model website to approach business organizations. Such websites support auctions, tenders and application submission functionalities.



Government - to - Citizen (G2C)

Government uses G2C model website to approach citizen in general. Such websites support auctions of vehicles, machinery or any other material. Such website also provides services like registration for birth, marriage or death certificates. Main objectives of G2C website are to reduce average time for fulfilling people requests for various government services.



Session 09

19.1 Introduction to Databases

A database is a structured collection of records or data. A computer database is a kind of software to organize the storage of data. Databases help you organize this related information in a logical fashion for easy access and retrieval. To develop a database, there are several models used such as Hierarchical model, Network model, Relational model, Object-Oriented model etc. Though discussing about these models in details is beyond the level of this course unit, for the sake of completion, some models are briefed below.

19.2 Database Management System

A Database Management System (DBMS) is computer software designed for the purpose of managing databases based on a variety of data models. A DBMS is a complex set of software programs that controls the organization, storage, management, and retrieval of data in a database. DBMS are categorized according to their data structures or types; sometime DBMS is also known as a *Database Manager*. Data management tasks fall into one of four general categories as given below:

- Entering data into the database.
- Housekeeping tasks such as updating data, deleting obsolete records, and backing up the database.
- Sorting the data: arranging or re-arranging the database's records. □ Obtaining subsets of data.

There are several advantages in DBMS such as reduced data redundancy and inconsistency, enhanced data integrity, improved security etc.

19.3 Basic terminology in Databases

These terms are used often in Database Management Systems, so you need to become familiar with them before using the database management system,

19.3.1 Database

A database is an organized collection of the related information.

19.3.2 Object

An object is a component in the database such as a table, query, form, report, or macro, etc.

19.3.3 Table

A table is a group of related data organized in fields (columns) and records (rows) on a datasheet. By using a common field in two tables, the data can be combined. Many tables can be stored in a single database.

19.3.4 Field

A field is a column on a datasheet and defines a data type for a set of values in a table. For a mailing list table might include fields for first name, last name, address, city, and telephone number.

19.3.5 Record

A record is a row on a datasheet and do fields define a set of values. In a mailing list table, each record would contain the data for one person as specified by the intersecting fields.

Let's see some of the above items in the following table.

Table/Entity name: **Employee**

<u>Employee ID</u>	<u>Name</u>	<u>Sex</u>	<u>Address</u>	<u>Joined Date</u>
001	Mala Perera	Female	Colombo	05-04-00
002	Kamal Perera	Male	Colombo	04-01-05
003	Sanath Mahawela	Male	Matara	07-07-99
004	Gayan Weerahewa	Male	Galle	04-09-00
005	Leela Wijetunga	Female	Ambilipitiya	16-04-08
006	Kolitha Gallege	Male	Galle	09-09-10
007	Sarani Perera	Female	Matara	08-04-08
008	Gayan Peris	Male	Panadura	04-04-06
009	Gunapala Desilva	Male	Panadura	07-07-01
010	Kamal Perera	Male	Meegama	11-03-09

Figure 19.3: Table 'Employee'

19.3.6 Primary key

A primary key is used to uniquely identify each row in a table. It can either be a part of the actual record itself, or it can be an artificial field (one that has nothing to do with the actual record). A primary key can consist of one or more fields on a table. When multiple fields are used as a primary key, they are called as a composite key.

19.3.7 Foreign key

A foreign key is a field (or fields) that points to the primary key of another table. The purpose of the foreign key is to ensure referential integrity of the data.

19.3.8 Relationships

Two tables/entities in a database may relate to each other using one or more common attribute. There are three types of relationships among tables namely, One-to-one, one-to-many, many-to-many.

19.4 Different Database Management Applications

There are several different database management applications which are not only meant for entering and retrieving information but also they facilitate simultaneous updates and queries from multiple users.

Some of the database management applications are listed below:

1. Oracle
2. MySQL/ SQL Server
3. Microsoft Access
4. IBM DB2
5. Sybase

Session 10

MIS (Management Information System)

INTRODUCTION TO MIS

Definition of MIS

A system that collects, process, stores the data and distributes information to help in decision making for managerial function. It is also defined as the integrated user machine system for providing information to supports the decision making operations & achieving organizational goal.

According to **Jerome** “A system that aids management in making, carrying out and controlling decisions”.

According to **Kelley**, “A combination of human and computer based resources which results in collection, storage, retrieval, communication and use of efficient management of operations and for business planning”.

Management: - Management covers the planning, control and administration of the operations of a concern.

Information: - Information, in MIS, means the processed data that helps the management in planning, controlling and operations.

System: - data is processed into information with the help of a system. **Need of MIS** MIS helps the management at various levels and it is mean of communication where data are collected, processed, stored and retrieved for making decisions regarding planning, operation and control of an organization.

Characteristics of MIS

Management Oriented

Management Directed

Integrated System

Avoid Redundancy

Common Data Flow

Heavy Planning Element

Subsystem Concept

Common Database

Flexibility

Computerization

Components of MIS

Management information system refers to the data, hardware and the computer programs that are used to develop information for managerial use.

People – it is the only living component of MIS which operates, controls the other components of MIS.

Procedure – procedure explain people how to operate the computer hardware.

Data – Data provide interface between the user and computer.

Hardware – It is the machine part of the system which executes the instruction in programs.

Programs – The program is the set of instruction written in logical order for performing specific task related to information production.

Role of MIS

- 1 MIS ensure that appropriate and relevant data is collected from various sources, processed and is sent further to the needy destination.
- 2 It fulfills the need of individual, workgroup and management.
3. MIS satisfies the diverse need of various systems like query, Analysis, Modeling, DSS
- 4 MIS helps in strategic planning, management control, operational control and transaction processing level.
- 5 MIS play important role in information generation, communication, problem identification and decision making administration.
- 6 With good MIS support marketing, finance, production, and personal functions increases efficiently. 7 MIS helps in streamlining of the operations.
- 8 MIS creates structured database and therefore saves the time.
- 9 MIS bring clarity in communication and understanding this help in bringing high degree of professionalism.
- 10 MIS helps in systemization of business operation through tools and techniques of the computer, which makes task simpler, accurate and faster.

Process of MIS

The process of MIS starts by knowing MIS objectives. The objectives of MIS should be compatible with the company's objectives.

Management comprises process or activities they are as follows: -

1. Recognition of a problem and an opportunity
2. Define problem or opportunity
3. Develop alternative course of action
4. Decision
5. Implementation of plan
6. Control performance against plan

Processing

Development of MIS within the Organization

If MIS is to assist managerial decision making at all level of company, then low organization level information systems must be integrated in MIS. Next stage is planning & control. Next stage of MIS development is integration of subsystems. Management plans to integrate existing sub system to unified system. The management focuses attention to database administration. Next stage is MIS maturity. This is to state when MIS department is agreed up to plan future needs for organization.

Management Process

Management comprises process or activities via planning, organizing, controlling, directing and initiating operation of an organization. For its smooth functioning and achieving of its predetermined goals through optimal utilization of its resources like men, money, material and machines.

Concept of Data & Information

Data – Data is a set of characters or symbols like numeric, alphabetic or alphanumeric, audio, video, images or any combination of these. Raw facts & figure are known as data. **Information** –Processed data is known as information.

System – System is set of components which interact with each other to accomplish a specific goal.

- 1 Human body and its subsystem could be nervous system, digestive system and cardiac system etc
- 2 Computer system and it has various subsystem like ALU, CU, Memory, Input unit and Output unit etc.

Characteristics of system

Every system has a purpose.

Every system is made up of components like input process output, feedback and control etc.
System is made up of subsystem, whose goals are referred to as sub goals.
Goal of a system is more important than subsystem goal.

Types of System

There is several way of classifying systems that emphasizes the differences. Classification of system is as follows-

Open & Closed Systems –

An open system interfaces and interacts with other system. An open system needs to receive feedback to change and continue to exist in its environment. Example – A marketing system is an open system. A closed system does not exchange the information with its environment. It does not have any connection to the other system. Example – Research & development of

Session 11

INFORMATION SECURITY

security problem in computing

1.1 The meaning of computer security

The meaning of the term computer security has evolved in recent years. Before the problem of data security became widely publicized in the media, most people's idea of computer security focused on the physical machine. Traditionally, computer facilities have been physically protected for three reasons:

- To prevent theft of or damage to the hardware
- To prevent theft of or damage to the information
- To prevent disruption of service

Computer security is security applied to computing devices such as computers and smartphones, as well as computer networks such as private and public networks, including the whole Internet. The field covers all the processes and mechanisms by which digital equipment, information and services are protected from unintended or unauthorized access, change or destruction, and are of growing importance in line with the increasing reliance on computer systems of most societies worldwide. It includes physical security to prevent theft of equipment, and information security to protect the data on that equipment. It is sometimes referred to as "cyber security" or "IT security", though these terms generally do not refer to physical security (locks and such).

Some important terms used in computer security are:

Vulnerability

Vulnerability is a weakness which allows an attacker to reduce a system's information assurance. Vulnerability is the intersection of three elements: a system susceptibility or flaw, attacker access to the flaw, and attacker capability to exploit the flaw. To exploit vulnerability, an attacker must have at least one applicable tool or technique that can connect to a system weakness. In this frame, vulnerability is also known as the attack surface.

Vulnerability management is the cyclical practice of identifying, classifying, remediating, and mitigating vulnerabilities. This practice generally refers to software vulnerabilities in computing systems.

Backdoors

A backdoor in a computer system, is a method of bypassing normal authentication, securing remote access to a computer, obtaining access to plaintext, and so on, while attempting to remain undetected. The backdoor may take the form of an installed program (e.g., Back Orifice), or could be a modification to an existing program or hardware device. It may also fake information about disk and memory usage.

Denial-of-service attack

Unlike other exploits, denials of service attacks are not used to gain unauthorized access or control of a system. They are instead designed to render it unusable. Attackers can deny service to individual victims, such as by deliberately entering a wrong password enough consecutive times to cause the victim account to be locked, or they may overload the capabilities of a machine or network and block all users at once. These types of attack are, in practice, very hard to prevent, because the behavior of

whole networks needs to be analyzed, not only the behavior of small pieces of code. Distributed denial of service (DDoS) attacks are common, where a large number of compromised hosts (commonly referred to as "zombie computers", used as part of a botnet with, for example; a worm, Trojan horse, or backdoor exploit to control them) are used to flood a target system with network requests, thus attempting to render it unusable through resource exhaustion.

Direct-access attacks

An unauthorized user gaining physical access to a computer (or part thereof) can perform many functions, install different types of devices to compromise security, including operating system modifications, software worms, key loggers, and covert listening devices. The attacker can also easily download large quantities of data onto backup media, for instance CD-R/DVD-R, tape; or portable devices such as key drives, digital cameras or digital audio players. Another common technique is to boot an operating system contained on a CD-ROM or other bootable media and read the data from the hard drive(s) this way. The only way to defeat this is to encrypt the storage media and store the key separate from the system. Direct-access attacks are the only type of threat to Standalone computers (never connect to internet), in most cases.

Eavesdropping

Eavesdropping is the act of surreptitiously listening to a private conversation, typically between hosts on a network. For instance, programs such as Carnivore and NarusInsight have been used by the FBI and NSA to eavesdrop on the systems of internet service providers.

Spoofing

Spoofing of user identity describes a situation in which one person or program successfully masquerades as another by falsifying data and thereby gaining an illegitimate advantage.

Tampering

Tampering describes an intentional modification of products in a way that would make them harmful to the consumer.

Repudiation

Repudiation describes a situation where the authenticity of a signature is being challenged.

Information disclosure

Information Disclosure (Privacy breach or Data leak) describes a situation where information, thought as secure, is released in an untrusted environment.

Elevation of privilege

Elevation of Privilege describes a situation where a person or a program want to gain elevated privileges or access to resources that are normally restricted to him/it.

Exploits

An exploit is a piece of software, a chunk of data, or sequence of commands that takes advantage of a software "bug" or "glitch" in order to cause unintended or unanticipated behavior to occur on computer software, hardware, or something electronic (usually computerized). This frequently includes such things as gaining control of a computer system or allowing privilege escalation or a denial of service attack. The term "exploit" generally refers to small programs designed to take advantage of a software flaw that has been discovered, either remote or local. The code from the exploit program is frequently reused in Trojan horses and computer viruses.

Indirect attacks

An indirect attack is an attack launched by a third-party computer. By using someone else's computer to launch an attack, it becomes far more difficult to track down the actual attacker. There have also been cases where attackers took advantage of public anonymizing systems, such as the tor onion router system.

Computer crime: Computer crime refers to any crime that involves a computer and a network.

Top 10 Cyber Crime Prevention Tips

1. **Use Strong Passwords** Use different user ID / password combinations for different accounts and avoid writing them down. Make the passwords more complicated by combining letters, numbers, special characters (minimum 10 characters in total) and change them on a regular basis.
2. **Secure your computer**
 - o **Activate your firewall** Firewalls are the first line of cyber defence; they block connections to unknown or bogus sites and will keep out some types of viruses and hackers.
 - o **Use anti-virus/malware software** Prevent viruses from infecting your computer by installing and regularly updating anti-virus software.
 - o **Block spyware attacks** Prevent spyware from infiltrating your computer by installing and updating anti-spyware software.
3. **Be Social-Media Savvy** Make sure your social networking profiles (e.g. Facebook, Twitter, YouTube, MSN, etc.) are set to private. Check your security settings. Be careful what information you post online. Once it is on the Internet, it is there forever!
4. **Secure your Mobile Devices** Be aware that your mobile device is vulnerable to viruses and hackers. Download applications from trusted sources.
5. **Install the latest operating system updates** Keep your applications and operating system (e.g. Windows, Mac, Linux) current with the latest system updates. Turn on automatic updates to prevent potential attacks on older software.
6. **Protect your Data** Use encryption for your most sensitive files such as tax returns or financial records, make regular back-ups of all your important data, and store it in another location.
7. **Secure your wireless network** Wi-Fi (wireless) networks at home are vulnerable to intrusion if they are not properly secured. Review and modify default settings. Public Wi-Fi, a.k.a. “Hot Spots”, are also vulnerable. Avoid conducting financial or corporate transactions on these networks.
8. **Protect your e-identity** Be cautious when giving out personal information such as your name, address, phone number or financial information on the Internet. Make sure that websites are secure (e.g. when making online purchases) or that you’ve enabled privacy settings (e.g. when accessing/using social networking sites).
9. **Avoid being scammed** Always think before you click on a link or file of unknown origin. Don’t feel pressured by any emails. Check the source of the message. When in doubt, verify the source. Never reply to emails that ask you to verify your information or confirm your user ID or password.
10. **Call the right person for help** Don’t panic! If you are a victim, if you encounter illegal Internet content (e.g. child exploitation) or if you suspect a computer crime, identity theft or a commercial scam, report this to your local police. If you need help with maintenance or software installation on your computer, consult with your service provider or a certified computer technician.

The end of part 1