Diploma in Business Analytics

DBA-104

COMPUTER APPLICATIONS IN BUSINESS

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Contents

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INTRODUCTION TO COMPUTER

Structure

1.0   LEARNING OBJECTIVES

The main objective of this lesson is to introduce 'computer' to the students. After successful completion of the lesson the students will be able to:

- ✓ Understand the definition of computer
- ✓ Understand the characteristics computers
- ✓ Understand the capabilities as well as the limitations of computers.
- ✓ Understand about generations and classifications of computers

1.1   INTRODUCTION

Today, almost all of us in the world make use of computers in one way or the other. It finds applications in various fields of engineering, medicine, commercial, research and others. Not only in these sophisticated areas, but also in our daily lives, computers have become indispensable. They are present everywhere, in all the devices that we use daily like cars, games, washing machines, microwaves etc. and in day to day computations like banking, reservations, electronic m ails, internet and many more.

The word computer is derived from the word compute. Compute means to calculate. The computer was originally defined as a super-fast calculator. It had the capacity to solve complex arithmetic and scientific problems at very high speed. But nowadays in addition to handling complex arithmetic computations, computers perform many other tasks like accepting, sorting, selecting, moving, comparing various types of information. They also perform arithmetic and logical operations on alphabetic, numeric and other types of information. This information provided by the user to the computer is data. The information in one form which is presented to the computer is the input information or input data.

Information in another form is presented by the computer after performing a process on it. This information is the output information or output data.

The terms hardware and software are almost always used in connection with the computer.

- **The Hardware:**

The hardware is the machinery itself. It is made up of the physical parts or devices of the computer system like the electronic Integrated Circuits (ICs), magnetic storage media and other mechanical devices like input devices, output devices etc. All this various hardware is linked together to form an effective functional unit. The various types of hardware used in the computers, has evolved from vacuum tubes of the first generation to Ultra Large Scale Integrated Circuits of the present generation.

- **The Software**:

The computer hardware itself is not capable of doing anything on its own. It has to be given explicit instructions to perform the specific task. The computer program is the one which controls the processing activities of the computer. The computer thus functions according to the instructions written in the program. Software mainly consists of these computer programs, procedures and other documentation used in the operation of a computer system. Software is a collection of programs which utilize and enhance the capability of the hardware.

1.2 WHAT IS A COMPUTER?

The word "computer" comes from the word 'compute', which means to calculate. So a computer is normally considered to be a calculating device. **A computer is an electronic device that manipulates information, or data**. It has the ability to store, retrieve, and process data. In fact, the original objective for inventing the computer was to create a fast calculating machine. But more than 90% of the work done by computers today is of non-mathematical or non-numerical nature. Hence, to define a computer merely as calculating device is to ignore over 90% of its work.

More accurately, a computer may be defined as a device that operates upon information or data. Data can be anything like bio-data of various applicants when the computer is used for recruiting personnel, or the marks obtained by various students in various subjects when the computer is used to prepare results, or the details (name, age, sex etc.) of various passengers when the computer is employed for

making airline or railway reservations, or numbers of different types in case of application of computers for scientific research problems, etc. Thus Computer can be defined as an electronic device for processing data that takes data input from its user, stores, processes data and generates the required output as per the processing instructions given to it by the user.

The fact that computers process data is so fundamental that many people have started calling it a data processor. The name data processor is more inclusive because modern computers not only compute in the usual sense but also perform other functions with the data that flow to and from them. For example, data processor may

- gather data from various sources;
- merge (process of mixing or putting together) them all;
- sort (process of arranging in some sequence-ascending or descending) them; and
- Print them in desired format.

Thus computers not only can add, subtract, multiply and divide numbers but can also do certain logical operations; can remember (i.e. store and recall information); can communicate with operators; can direct themselves in a predetermined manner; can process a large volume of data effortlessly; can interpret massages from remote locations. Computers undertake repetitive and boring tasks, relieving us for more critical, creative activities. Computers offer unmatched speed, performance, and accuracy in data processing. Computers work at constant efficiency and perform tasks repeatedly without errors, avoiding the fatigue, that affect human beings. Computers can be used in almost every field and for almost every purpose. Computers allow society to undertake new activities in various fields and to function more efficiently. Computers are impartial.

They offer a mean of data processing unaffected by social, religious or cultural bias and prejudice. Computers offer effective and efficient data storage and retrieval, highest degree of integrity and reliability.
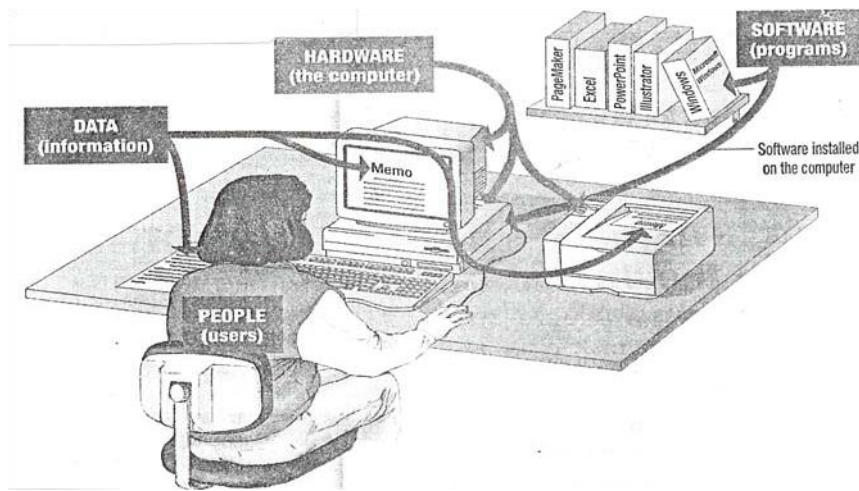
Computers come in many varieties, including the personal computer, tiny computers built into appliances and automobiles, and mainframe machines used by many people simultaneously to run a business. Despite their differences in size and use, all these computers are part of a system. A complete computer system consists of four parts: hardware, software, people, and data as shown in above figure.

1.2.1 EVOLUTION OF COMPUTERS

The computers of today are vastly different in appearance and performance as compared to the computers of earlier days. But where did this technology come from and Where is it heading? To fully understand the impact of computers on today's world and the promises they hold for the future, it is important to understand the evolution of computers.

1.2.1.1 The First Generation

The first generation computers made use of:

- Vacuum tube technology,
- Punched cards for data input,
- Punched cards and paper tape for output,
- Machine Language for writing programs,
- Magnetic tapes and drums for external storage.
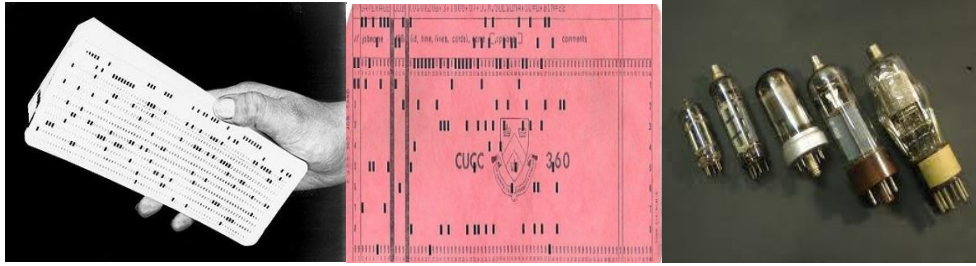
Punched cards   *Paper tape*   *Vacuum tube*

The first Generation Computer technology

The computers of the first generation were very bulky and emitted large amount of heat which required air conditioning. They were large in size and cumbersome to handle. They had to be manually assembled and had limited commercial use. The concept of operating systems was not known at that time. Each computer had a different binary coded program called a machine language that told it how to operate.
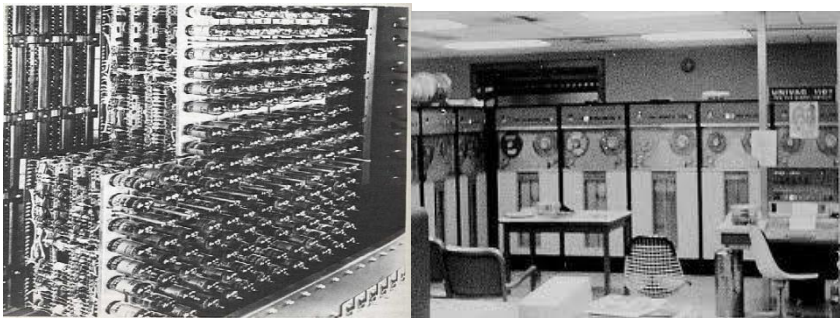
The Abacus, which emerged about 5000 years ago in Asia Minor and is still in use today, allows users to make computations using a system of sliding beads arranged on a rack. Early merchants used Abacus to keep trading transactions.

Abacus   *Pascaline*

The first Generation Computers

Blaise Pascal, a French mathematician invented the first mechanical machine, a rectangular brass box, called Pascaline which could perform addition and subtraction on whole numbers. This was in the seventeenth century. Colmar, a Frenchman invented a machine that could perform the four basic arithmetic functions of addition, subtraction, multiplication and division. Colmar's mechanical

calculator, "Arithmometer", presented a more practical approach to computing. With its enhanced versatility, the "Arithmometer" was widely used until the First World War, although later inventors refined Colmar's calculator, together with fellow inventors, Pascal and Leibniz, he helped define the age of mechanical computation.

Charles Babbage a British mathematician at Cambridge University invented the first analytical engine or difference engine. This machine could be programmed by instructions coded on punch cards and had mechanical memory to store the results. For his contributions in this field Charles Babbage is known as 'the father of modern digital computer.

Some of the early computers included:

Mark I –

This was the first fully automatic calculating machine. It was designed by Howard Aiken of Harvard University in collaboration with IBM. This machine was an electronic relay computer. Electromagnetic signals were used for the movement of mechanical parts. Mark I could perform the basic arithmetic and complex equations. Although this machine was extremely reliable, it was very slow (it took about 3-5 seconds per calculation) and was complex in design and large in size.

Fig.3 Mark-I Computer

Atanasoff-Berry Computer (ABC)

This computer dev eloped by John Atanasoff and Clifford Berry was the world's first general purpose electronic digital computer. It made use of vacuum tubes for internal logic and capacitors for storage.

The machine was, however, the first to implement three critical ideas that are still part of every modern computer:

- Using binary digits to represent all numbers and data
- Performing all calculations using electronics rather than wheels, ratchets, or mechanical switches
- Organizing a system in which computation and memory are separated.
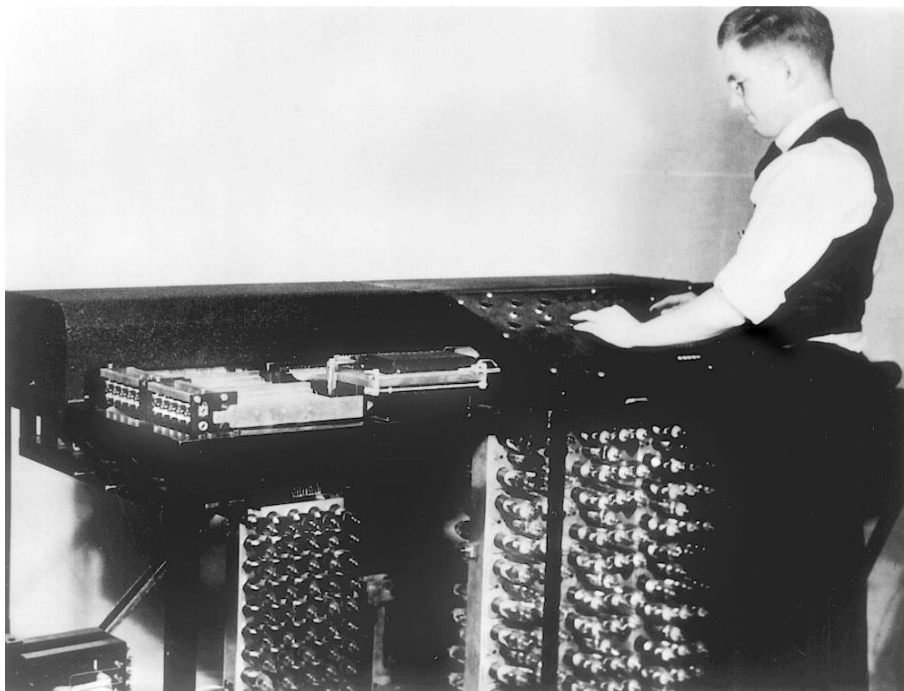
ABC Computer

The memory of the Atanasoff–Berry Computer was a system called regenerative capacitor memory, which consisted of a pair of drums, each containing 1600 capacitors that rotated on a common shaft once per second. The capacitors on each drum were organized into 32 "bands" of 50 (30 active bands and two spares in case a capacitor failed), giving the machine a speed of 30 additions/subtractions per

second. Data was represented as 50-bit binary fixed-point numbers. The electronics of the memory and arithmetic units could store and operate on 60 such numbers at a time (3000 bits).

ENIAC (Electronic Numeric Integrator and Calculator)

The first all-electronic computer was produced by a partnership between the US Government and the University of Pennsylvania. It was built using 18,000 vacuum tubes, 70,000 resistors and 1,500 relays and consumed 160 kilowatts of electrical power. The ENIAC computed at speed about thousand times faster than Mark I. However, it could store and manipulate only a limited amount of data. Program modifications and detecting errors were also difficult.

ENIAC was a modular computer, composed of individual panels to perform different functions. Twenty of these modules were accumulators that could not only add and subtract, but hold a ten-digit decimal number in memory. Numbers were passed between these units across several general-purpose buses (or trays, as they were called). In order to achieve its high speed, the panels had to send and receive numbers, compute, save the answer and trigger the next operation, all without any moving parts. Key to its versatility was the ability to branch; it could trigger different operations, depending on the sign of a computed result.
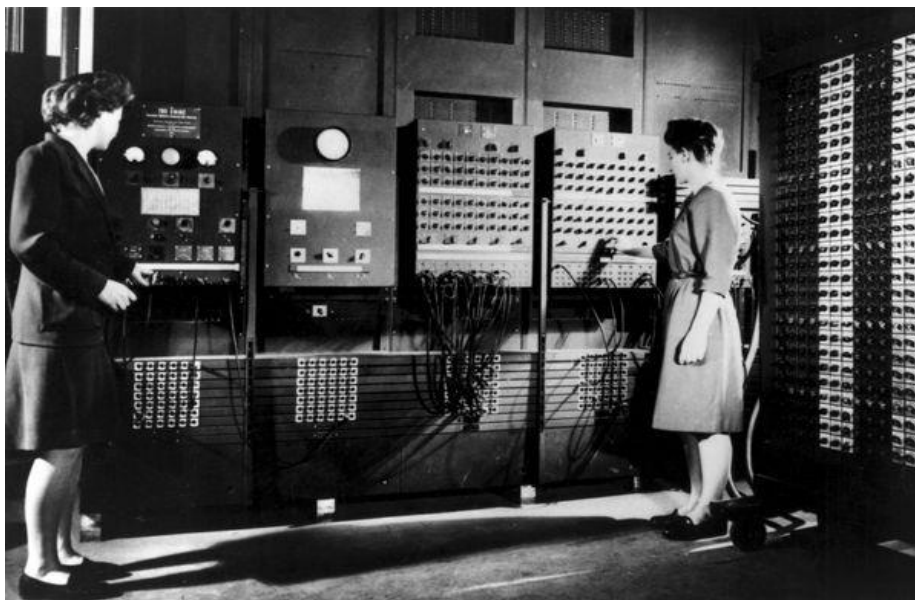
ENIAC Computer

EDVAC

In the mid 1940's Dr. John v on Neumann designed the Electronic Discrete Variable Automatic Computer with a memory to store both program and data. This was the first machine which used the stored program concept. It had five distinct units - arithmetic, central control, memory, input and output. The key element was the central control. All the functions of the computer were co-ordinate through this single source, the central control. The programming of the computers was done in machine language.

Functionally, EDVAC was a binary serial computer with automatic addition, subtraction, multiplication, programmed division and automatic checking with an ultrasonic serial memory capacity of 1,000 34-bit words. EDVAC's average addition time was 864 microseconds and its average multiplication time was 2,900 microseconds.
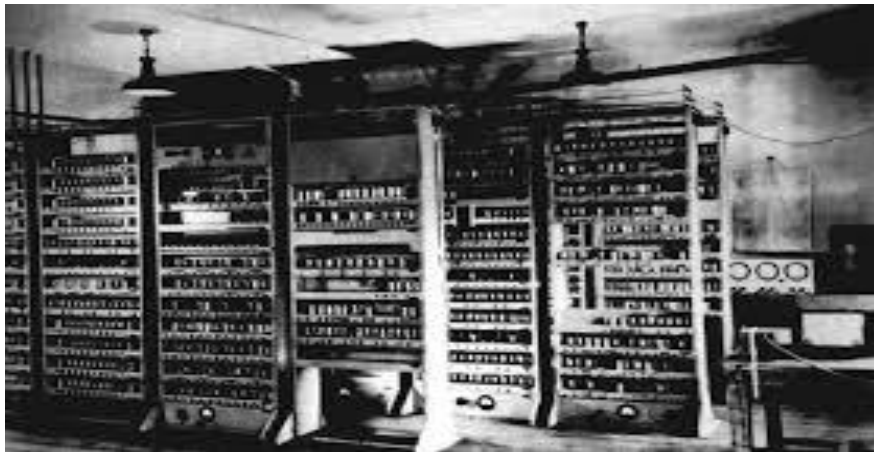
EDVAC Computer

UNIVAC

Remington Rand designed this computer specifically for business data processing applications. On June 14, 1951, the U.S. Census Bureau dedicates UNIVAC, the world's first commercially produced electronic digital computer. UNIVAC, which stood for Universal Automatic Computer, was developed by J. Presper Eckert and John Mauchly, makers of ENIAC, the first general-purpose electronic digital computer. These giant computers, which used thousands of vacuum tubes for computation, were the forerunners of today's digital computers. UNIVAC and other first-generation computers were replaced

by transistor computers of the late 1950s, which were smaller, used less power, and could perform nearly a thousand times more operations per second.

UNIVAC Computer

1.2.1.2 The Second Generation

In the second generation computers:

• Vacuum tube technology was replaced by transistorized technology,

• Size of the computers started reducing,

• Assembly language started being used in place of machine language,

• Concept of stored program emerged,

• High level languages were invented.

This was the generation of Transistorized Computers. Vacuum tubes were replaced by transistors. As a result, the size of the machines started shrinking. These computers were smaller, faster, more reliable and more energy efficient. The first transistorized computer was TX-0. The first large scale machines that took advantage of the transistor technology were the early supercomputers, Stretch by IBM and LARC by Sperry Rand. These machines were mainly developed for atomic energy laboratories. Typical computers of the second generation were the IBM 1400 and 7000 series, Honeywell 200 and General Electric.
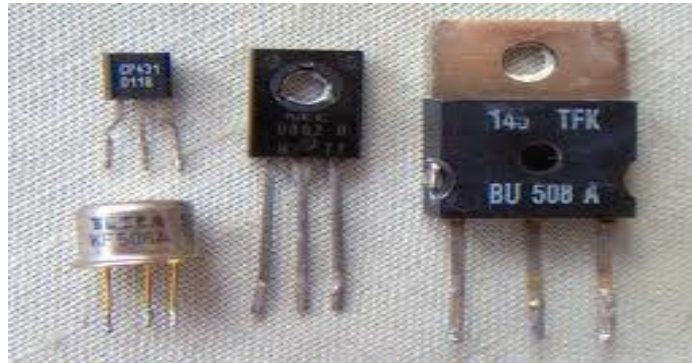
Transistors

IBM 1401 was universally accepted throughout the industry and most large businesses routinely processed financial information using second generation computers. The machine language was replaced by assembly language. Thus the long and difficult binary code was replaced with abbreviated programming code which was relatively easy to understand.

The stored program concept and programming languages gave the computers flexibility to finally be cost effective and productive for business use. The stored program concept implied that the instructions to run a computer f or a specific task were held inside the computer's memory and could quickly be modified or replaced by a different set of instructions for a different function. High level languages like COBOL, FORTRAN and AL- GOL were dev eloped. Computers started finding vast and varied applications. The entire software industry began with the second generation computers.

1.2.1.3. The Third Generation

The third generation computers were characterized by:

- Use of Integrated circuits,
- Phenomenal increase in computation speed,
- Substantial reduction in size and power consumption of the machines,
- Use of magnetic tapes and drums for external storage,
- Design-of Operating systems and new higher level languages,
- Commercial production of computers.

This generation was characterized by the invention of Integrated Circuits (ICs). The IC combined electronic components onto a small chip which was made from quartz.

Later, even more components were fitted onto a single chip, called a semiconductor. This reduced the size even further. The weight and power consumption of computers decreased and
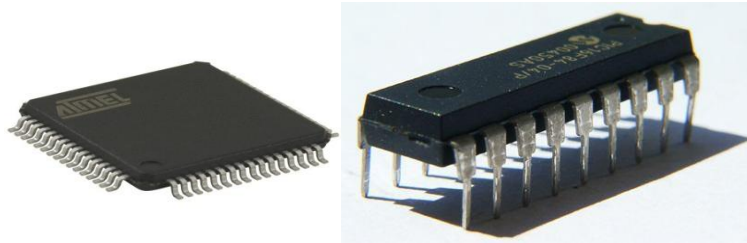
Fig. 1.9 Integrated Circuit

the speed increased tremendously. Heavy emphasis was given to the development of software. Operating systems were designed which allowed the machine to run many different programs at once. A central program monitored and co-ordinate the computer's memory. Multiprogramming was made possible, whereby the machine could perform several jobs at the same time. Computers achieved speeds of executing millions of instructions per second. Commercial production became easier and cheaper. Higher lev el languages like Pascal and Report Program Generator (RPG) were introduced and applications oriented languages like FORTRAN, COBOL, and PL/1 were developed.

1.2.1.4. The Fourth Generation

The general features of the fourth generation computers were:

• Use of Very Large Scale Integration,

• Invention of microcomputers,

• Introduction of Personal Computers,

• Networking,

• Fourth Generation Languages.

The third generation computers made use of 'Integrated Circuits that had 10- 20 components on each chip, this was Small Scale Integration (SSI).

The Fourth Generation realized Large Scale Integration (LSI) which could fit hundreds of components on one chip and Very Large Scale integration (VLSI) which squeezed thousands of components on one chip. The Intel 4004 chip, located all the components of a computer (central processing unit, memory,

input and output controls) on a single chip and microcomputers were introduced. Higher capacity storage media like magnetic disks were dev eloped. Fourth generation languages emerged and applications software's started becoming popular.

Fig. 1.10 VLSI

Computer production became inexpensive and the era of Personal Computers (PCs) commenced. In 1981, IBM introduced its personal computer for use in office, home and schools. In direct competition, the Macintosh was introduced by Apple in 1984. Shared interactive systems and user friendly environments were the features of these computers.

As the computers started becoming more and more powerful, they could be linked together or networked to share not only data but also memory space and software. The networks could reach enormous proportions with local area networks. A global web of computer circuitry, the Internet, links the computers worldwide into a single network of information.

1.2.1.5 The Fifth Generation

Defining the fifth generation computers is somewhat difficult because the field is still in its infancy. The computers of tomorrow would be characterized by Artificial Intelligence (At). An example of Al is

Expert Systems. Computers could be developed which could think and reason in much the same way as humans. Computers would be able to accept spoken words as input (voice recognition).

Many advances in the science of computer design and technology are coming together to enable the creation of fifth generation computers. Two such advances are parallel processing where many CPUs work as one and advance in superconductor technology which allows the flow of electricity with little or no resistance, greatly improving the speed of information flow.

1.2.2 CHARACTERISTICS OF A COMPUTER SYSTEM

Computers are not just adding machines; they are capable of doing complex activities and operations. They can be programmed to do complex, tedious and monotonous tasks. All computers have certain common characteristics irrespective of their type and size. The following are the important characteristics which took together, enable a computer to surpass its performance in some tasks in which the human beings cannot perform efficiently:

1. Speed: A computer is a very fast device capable of data processing at unbelievable speed. It can perform in a few seconds the amount of work that a human being may not be able to do in an entire year even if he works day and night and does nothing else. Computers can process millions of instructions per second thus carrying out even the complex tasks in fractions of seconds without any mistake.

While talking about the speed of a computer, we do not talk in terms of seconds or even milliseconds (10^{-3}). Our units of speed are the microseconds (10^{-6}), the nanoseconds (10^{-9}), and even the picoseconds (10^{-12}). A powerful computer is capable of performing about 3 to 4 million simple arithmetic operations per second.

2. Accuracy: In addition to speed, the computer has high accuracy in computing. The accuracy of a computer is consistently high and the degree of accuracy of a particular computer depends upon its design. But for a particular computer, each and every calculation is performed with the same accuracy. Errors can occur in a computer, but these are mainly due to human rather than technological weakness. The errors in computer are due to errors in programming and operation by human and due to inaccurate data.

3. Versatility: A computer is a very versatile machine. Versatility is one of the most wonderful features of the computer in the sense that they are not only capable of handling complex arithmetical problems, but can do equally well other number of jobs. They can perform activities ranging from simple calculations to performing complex CAD modeling and simulations to navigating missiles and satellites. In other words, computers can be programmed to perform any task that can be reduced to a series of logical steps. Computers can communicate with other computers and can receive and send data in various forms like text, sound, video, graphics, etc. We, now, live in a connected world and all this is because of computers and other related technologies.

4. Diligency: Unlike human beings, a computer is free from monotony, tiredness, lack of concentration etc. and hence can work for hours together without creating any error and without grumbling. Due to this property computer obviously score over human beings in doing routine type of jobs, which require greater accuracy. They will perform the tasks that are given to them - irrespective of whether it is interesting, creative, monotonous or boring; irrespective of whether it is the first time or the millionth time - with exactly the same accuracy and speed.

5. Storage Capability: Computers have their main memory and auxiliary memory systems. A computer can store a large amount of data. With more and more auxiliary storage devices, which are capable of storing huge amounts of data, the storage capacity of a computer is virtually unlimited. The factor that makes computer storage unique is not that it can store vast amount of data, but the fact that it can retrieve the information that the user wants in a few seconds. Every piece of information can be retained as long as desired by the user and can be recalled as and when required. Even after several years, the information recalled is as accurate as on the day when it was fed to computer. A computer forgets or loses certain information only when it is asked to do so. So it is entirely up to the user to make a computer retain or forget particular information.

6. Reliability: Reliability of the computers is indeed very high. Modern electronic components have long failure free lives. A microprocessor chip is said to have a life of 40 years even under adverse conditions and much before it fails, it will become obsolete. Computers are also designed in modular form so as to make maintenance easy; when a component fails, it can be replaced or repaired at a minimal cost.

7. Automation: The level of automation achieved in a computer is phenomenal. It is not a simple calculator where you have to punch in the numbers and press the equal to sign to get the result. Once a task is initiated, computers can proceed on its own till its completion. Computers can be programmed to perform a series of complex tasks involving multiple programs. Computers will perform these things flawlessly. They will execute the programs in the correct sequence, they will switch on/off the machines at the appropriate time, they will monitor the operational parameters, and they will send warning signals or take corrective actions if the parameters exceed the control level, and so on. Computers are capable of these levels of automation, provided they are programmed correctly.

1.2.3 CAPABILITIES OF COMPUTERS

Stepping down from the domains of technical people such as scientists and engineers; computer, today, is a very familiar household word. In 1950's computers were special purpose machines, which only huge institutions such as governments and universities could afford. In the 1960's modern computer began to revolutionize the business world and today it has become popular with all kinds of people from business to employees, from doctors to lawyers and from players to school going children. Today, computers are directly or indirectly influencing every aspect of our lives. Wherever human intellect and technology meet, we will find computers. Computers of all sizes and shapes are used for every purpose imaginable - from selling railway tickets to running washing machines; from stock market analysis to playing games; from publishing a new letter to designing a building… They can perform activities ranging from simple calculations to performing complex CAD modeling and simulations to navigating missiles and satellites. Computers can communicate with other computers and can receive and send data in various forms like text, sound, video, graphics, etc. This ability of computer to communicate to one another has led to the development of computer networks, Internet, WWW and so on. Today, we can send e-mail to people all around the world. We, now, live in a connected world and all this is because of computers and other related technologies.

Uses of Computers

Application Area	Use of Computers
Scientific Research	Used to resolve complex scientific problems accurately in a short time
Business	Used in banks, airports, share markets, hotels, export houses, Government offices and others for rising business applications like MIS, Payroll, Inventory, Financial Accounting *etc.*
Defense	Used to computerize warplanes, ships, radars and many advanced weapons
Space	Used to design computerized space satellites, rockets and related technology
Data Communication	Used to computerize geo-graphically separated offices through networking
Telecommunication	Used in ISDN, E-mail, Internet, Intranet, VSAT, Videoconferencing, Paging, Cellular phones *etc.*
Medicine	Used in hospitals and nursing homes/clinics for maintaining medical records, prescription writing, diagnostic applications and computerized scanning(CAT Scanning)
Education	Used in development of CBT (Computer Based Teaching)/ CAT (Computer Aided Teaching) programs for education
Law & Order	Used to records data of vehicles
Libraries	Used to develop Library Management Systems
Publishers	Used for Desk Top Publishing (DTP) for designing & printing of books
Engineering	Used CAD (Computer Aided Designing)/CAM (Computer Aided Manufacturing) by engineering companies
Emerging Technologies	Used in Artificial Intelligence (Expert Systems, Robotics *etc.*) and Virtual Reality

During the last four decades, computers have revolutionized almost all disciplines of our life. Computers have made possible many scientific, industrial and commercial advances that would have been impossible otherwise. Computers are being used in many areas of application viz. business,

industry, scientific research, defense, space, communications, medicine, education and so on. The utilization of computers in different fields is summarized in above Table.

1.2.3.1 COMPUTERS IN BUSINESS

Computers have completely altered the structure of business. They are reshaping the basics of business. Customer service, operations, product and marketing strategies, and distribution are heavily, or sometimes even entirely, dependent on computer-enabled applications. The computers that support these functions can be found on the desk, on the shop floor, in the store, even in briefcases. Computers have become an everyday part of business life.

Figure below, illustrates the fundamental roles of computers in business. Computer systems perform three vital roles in any type of organization:

- ➢ Support of Business Operations
- ➢ Support of Managerial Decision-Making
- ➢ Support of Strategic Competitive Advantage
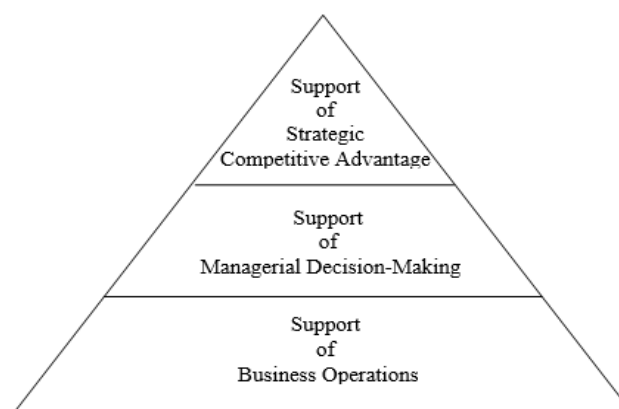
Three Major Roles of Computer-based Information Systems

Let's take a retail store as an example to illustrate these important roles. As a consumer, we have to deal regularly with the computer-based information systems that support business operations at many retail stores where we shop. For example, most retail stores now use computer-based information systems to help them record customer purchases, keep track of inventory, pay employees, buy new merchandise, and evaluate sales trends. Store operations would grind to a halt without the support of such information systems. See Figure below,
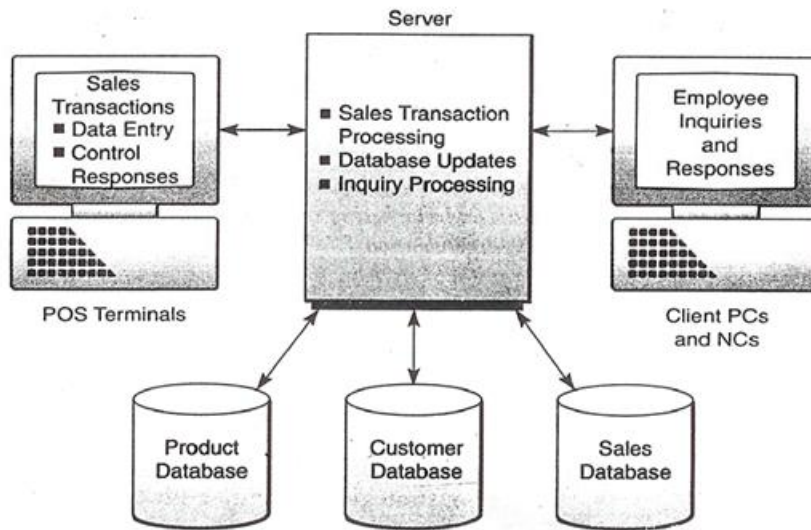
A Computer-based Sales Processing System that supports Sales Transaction Processing, Employee Inquiries and Responses, and the Access and Updating of Business Databases

Computer-based information systems also help store managers make better decisions and attempt to gain a strategic competitive advantage. For example, decisions on what lines of merchandise need to be added or discontinued, or on what kind of investment they require, are typically made after an analysis provided by computer-based information systems. This not only supports the decision making of store managers but also helps them look for ways to gain an advantage over other retailers in the competition for customers. Gaining a strategic advantage over competitors requires innovative use of computers and information technology. For example, store managers might make a decision to install computerized touch-screen catalog ordering systems in all of their stores, tied in with computer-based telephone ordering systems and an Internet-based computer shopping network. This might attract new customers and lure customers away from competing stores because of the ease of ordering provided by such innovative information systems. Thus, computer-based strategic information systems can help provide strategic products and services that give a business organization competitive advantage over its competitors.

1.2.4 LIMITATIONS OF COMPUTERS

There is no doubt that computers surpass human being in many aspects and can perform certain tasks better, faster and cheaper. But it cannot substitute man. The words of John F Kennedy are also 100% true *"Man is still the most extraordinary Computers of all".* The Computer, being an electronic device, has certain limitations, which can be summarized as follow:

1. **No IQ:** A computer is not a magical device. It can only perform tasks that a human being can. The difference is that it performs these tasks with unthinkable speed and accuracy. It possesses no intelligence of its own. Its IQ is zero, at least till today. Hence, only the user can determine what tasks a computer will perform. A computer cannot take its own decision in this regard. Unlike the human brain, a computer cannot think on its own, but has to be given very explicit, step-by-step instructions to make it perform a task.

2. **No Feelings:** Computers are devoid of emotions. They have no feelings and no instincts because they are machine. Although men have succeeded in building a memory for the computer, but no computer possesses the equivalent of human heart and soul. Based on our feelings, taste, knowledge, and experience, we often make certain judgments in our day-to-day life. But computers cannot make such judgments on their own. Their judgments are based on the instructions given to them in the form of programs that are written by us. They are only as good as man makes and uses them. They do not learn from experiences.

It is said for computers, "Garbage In Garbage Out (GIGO)". Many of the problems with computers occur because the computer can't tell the difference between doing something sensible versus something ridiculous. Erasing all its stored data is no different to a computer from adding two numbers. Computers operate logically, but they are incapable of acting prudently and rationally.

> *Thus a computer is not intelligent: it is a fast, rule-following idiot. Fast because it works at electronic speeds; rule-following because it needs to be given very detailed and complete instructions before it can do even the simplest task; and an idiot because it will unhesitatingly follow instructions even when to us it would be obvious that they were nonsense.*

1.2.5 CLASSIFICATION OF COMPUTERS

We can categorize computer by two ways:

- Data handling capabilities and
- Size

On the basis of data handling capabilities, the computer is of three types:

- Analogue Computer
- Digital Computer
- Hybrid Computer

1) Analogue Computer

Analogue computers are designed to process the analogue data. Analogue data is continuous data that changes continuously and cannot have discrete values such as speed, temperature, pressure and current. The analogue computers measure the continuous changes in physical quantity and generally render output as a reading on a dial or scale. Analogue computers directly accept the data from the measuring device without first converting it into numbers and codes.

Speedometer and mercury thermometer are examples of analogue computers.

2) Digital Computer

Digital computer is designed to perform calculations and logical operations at high speed. It accepts the raw data as digits or numbers and processes it with programs stored in its memory to produce output. All modern computers like laptops and desktops that we use at home or office are digital computers.

3) Hybrid Computer

Hybrid computer has features of both analogue and digital computers. It is fast like analogue computer and has memory and accuracy like digital computers. It can process both continuous and discrete data. So it is widely used in specialized applications where both analogue and digital data is processed. For example, a processor is used in petrol pumps that converts the measurements of fuel flow into quantity and price.

On the basis of size, the computer can be of five types:

- Supercomputer
- Mainframe Computer
- Miniframe Computer
- Workstation
- Microcomputer

1) Supercomputer

Supercomputers are the biggest and fastest computers. They are designed to process huge amount of data. A supercomputer can process trillions of instructions in a second. It has thousands of interconnected processors. Supercomputers are particularly used in scientific and engineering applications such as weather forecasting, scientific simulations and nuclear energy research. First supercomputer was developed by Roger Cray in 1976.

2) Mainframe computer

Mainframe computers are designed to support hundreds or thousands of users simultaneously. They can support multiple programs at the same time. It means they can execute different processes simultaneously. These features of mainframe computers make them ideal for big organizations like banking and telecom sectors, which need to manage and process high volume of data.

3) Miniframe computer

It is a midsize multiprocessing computer. It consists of two or more processors and can support 4 to 200 users at one time. Miniframe computers are used in institutes and departments for the tasks such as billing, accounting and inventory management.

4) Workstation

Workstation is a single user computer that is designed for technical or scientific applications. It has faster microprocessor, large amount of RAM and high speed graphic adapters. It generally performs a specific job with great expertise; accordingly, they are of different types such as graphics workstation, music workstation and engineering design workstation.

5) Microcomputer

Microcomputer is also known as personal computer. It is a general purpose computer that is designed for individual use. It has a microprocessor as a central processing unit, memory, storage area, input unit and output unit. Laptops and desktop computers are examples of microcomputers.

1.3 CARRIERS IN COMPUTER

Computers are growing in popularity very rapidly. Computers are running almost everything we can of think: from organizing records to directing traffic. The Information Technology (IT) industry is growing at an incredible rate. The impact of computers on our everyday lives is monumental, though taken for granted. Every time we make a bank deposit, purchase items on a credit card, pay an insurance premium or rent a video movie, innumerable computer operations are involved. Making all these operations happen, behind the scenes, is the work of a vast array of professionals: computer programmers, programmer analysts, systems analysts, hardware and software engineers, database managers, *etc.* As our society becomes more computerized and technologically sophisticated, the need for highly skilled computer professionals increases accordingly.

1.3.1 Career Options

The computer technology industry on the whole encompasses many fields of professional involvement and advancement. In broad terms, here are some of the career options that one can consider

1. Computer Science Jobs

Computer scientists are involved in designing computer systems and in researching ways to enhance the practical applications of such designs. Computer scientists address highly theoretical and complex problems associated with making new technology beneficial to all segments of society: academia, the military, civilian businesses, end-user consumers, *etc.* Included in this group of computer scientists are computer engineers, database administrators, computer support analysts, and other technically specialized professionals.

2. **Systems Development Jobs**

People working in this field analyze the informational needs within an organization and the ways by which various computer systems should properly relate to each other to enhance the overall operation of

the organization. Systems analysts ensure that the functional areas of the organization - accounting, marketing, sales *etc*.- communicate properly with each other. To accomplish this task, systems analysts study and modify the capabilities of the computer hardware and software to meet the changing demands of an evolving organization.

3. EDP Auditor Jobs

This is a challenging career option for professionals who have keen interests and skills in computers as well as in accounting and finance. The fundamental goal of EDP (Electronic Data Processing) auditing is to ensure the accuracy, efficiency, and integrity of a company's computer system, which is at the heart of all its business operations. EDP auditors are concerned, in part, with the accuracy of computer input and output as this accuracy relates to the possibility of financial impropriety, security leaks, or fraud. Along with knowledge of computer systems, programming languages, and various applications, EDP auditors need a good understanding of business and financial management. In fact, many EDP auditors hold MBA degrees and/or CA certification.

4. Consulting Jobs

One who aspires to become computer consultant can follow a number of career paths. Some computer consultants are motivated by strong entrepreneurial instincts. With several years of industry experience, they choose the route of freelance consulting, often as stepping-stones for starting their own companies to carve their niches in the computer market. Talented young professionals may also consider a career with combined-practice companies, such as the prestigious consulting firms, or with major hardware/ software suppliers, or with international consulting firms that offer computer consulting as part of turnkey business services. Other rewarding computer careers include sales/marketing support, technical writing and instruction, quality assurance, network engineering, management information systems, and so forth.

5. Teaching Jobs

One can make career in computer teaching at both under graduate and post graduate levels.

1.3.2 Computers in Non-IT Professions

Even if we are not interested in becoming a computer professional, it is a must that we have basic

knowledge of computers and the commonly used applications. It is imperative that we become a computer savvy professional-a person who can use computers with ease to perform routine tasks like composing a letter or memo, send and receive e-mail, surf the Internet, make computer presentations, *etc*. Because in today's information age- where computers hold the center stage - computer proficiency is a must for our survival and success.

The workers and professionals of the world will soon be divided into two distinct groups: those who will control computers and those who will be controlled by computers. It would be best for you to be in the former group.

1.4   CHECK YOUR PROGRESS

A.   **Fill in the blanks:**

1.   A computer is made up of two components- one is _____ and other is _____.

2.   _____computers incorporate the technology of both analog and digital computers.

3.   All physical components of computer are part of the_____.

4.   The smallest unit of data in computer is _____.

5.   The fastest and most expensive computers are_____

B.   **State whether the following statements are True or False:**

1.   A hybrid computer is the one having combined properties of analog and digital computer.

2.   Charles Babbage is the father of computer.

3.   Minicomputer works faster than micro-computers.

4.   UNIVAC is universal array computer.

5.   Fourth generation computers are based on VLSI.

1.5   SUMMARY

A computer is an electronic device that can perform a variety of operations according to the instructions given by the programmer/user and provides the desired information as an output. Computers are fast, accurate, diligent, having high memory, but no intelligence.

Computer are classified as general purpose or special purpose computers according to the purpose of their requirement. According to the technology used, computers are classified as analog which are used for scientific and engineering application, digital which are considered as general purpose computers or hybrid computers. Which incorporate the technology of both analog and digital computers. According to their size, computer can be classified as super computer, mainframe computer, minicomputer and microcomputer.

1.6   KEYWORDS

Computer: an electronic device for storing and processing data, typically in binary form, according to instructions given to it in a variable program.

Supercomputer: is a computer with a high level of performance as compared to a general-purpose computer. The performance of a supercomputer is commonly measured in floating-point operations per second (FLOPS) instead of million instructions per second (MIPS).

Minicomputer: Mini-Computer that is smaller, less expensive, and less powerful than a mainframe or supercomputer.

Mainframe computers or mainframes: are computers used primarily by large organizations for critical applications; bulk data processing, such as census, industry and consumer statistics, enterprise resource planning; and transaction processing.

PDA: Personal digital assistant, also known as a handheld PC, is a variety mobile device which functions as a personal information manager.

1.7   SELF-ASSESSMENT TEST

1   What are the motivating factors behind the development of computers?

2   Explain some of the important characteristics of computers.

3   Write a short note on "Capabilities of Computers". How the field of business is affected by the capabilities of computers?

4   Explain the limitations of computers.

5   What is a computer? Why is it known as data processor?

6   Explain the generations of computer.

7   Discuss the classification of computers.

1.8   ANSWERS TO CHECK YOUR PROGRESS

Check your Progress A

1. Software, Hardware
2. Hybrid
3. Hardware
4. Bit
5. Supercomputers

Check your Progress B

1. True
2. True
3. True
4. False
5. True

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Computer Components and Peripheral Devices

Structure

2.0   LEARNING OBJECTIVES

After studying this lesson, you should be able to understand:

- ✓ Components of a Computer System
- ✓ The basic concepts of input/output devices
- ✓ Functions of input/output devices
- ✓ Types of input/output devices
- ✓ Types of Ports

2.1   INTRODUCTION

In this lesson we shall discuss about components of a computer system and discuss something about input/output devices and their functions. Input/output devices constitute a major part of a computer system. These are also called peripheral devices. Without I/O devices, a user cannot communicate with the computer. They are required to enter data and instructions in a computer so that the computer can process that data and provide the result to the user through output devices. In computer, inputs are the signals and data received by the system and outputs are the signals and data which are generated from the system.

First we will discuss about components of a computer system in detail. Then input/output devices and then move on to the function and structure of input and output devices. And finally, we will discuss about recent trends in input devices such as digital camera, barcode reader, magnetic ink character recognition and magnetic stripe reader such as ATM machines and Electronic Point of Sale (EPOS).

2.1.1 COMPONENTS OF A COMPUTER SYSTEM

The capacity, size, cost and internal architectural design of computers differ from one model to another. However, the basic organization remains the same for all computer systems. A block diagram is shown in fig. below, which displays the basic building blocks or functional units, of a digital computer system. These units correspond to the basic operations performed by all computer systems. The function of each of these units is described below.

2.1.1.1   Input Unit

Data and instructions must enter the computer system before any computation can be performed on the supplied data. The input unit that links the external environment with the computer system performs this task. Data and instructions enter input units in forms that depend upon the particular device used. For example, data is entered from a keyboard in a manner similar to typing, and this differs from the way in which data is entered through a card reader which is another type of input device. However, regardless of the form in which they receive their inputs, all input devices must provide a computer with data that are transformed into the binary codes that the primary memory of a computer is designed to accept. This transformation is accomplished by units called input interfaces. Input interfaces are designed to match the unique physical or electrical characteristics of input devices to the requirements of the computer system.
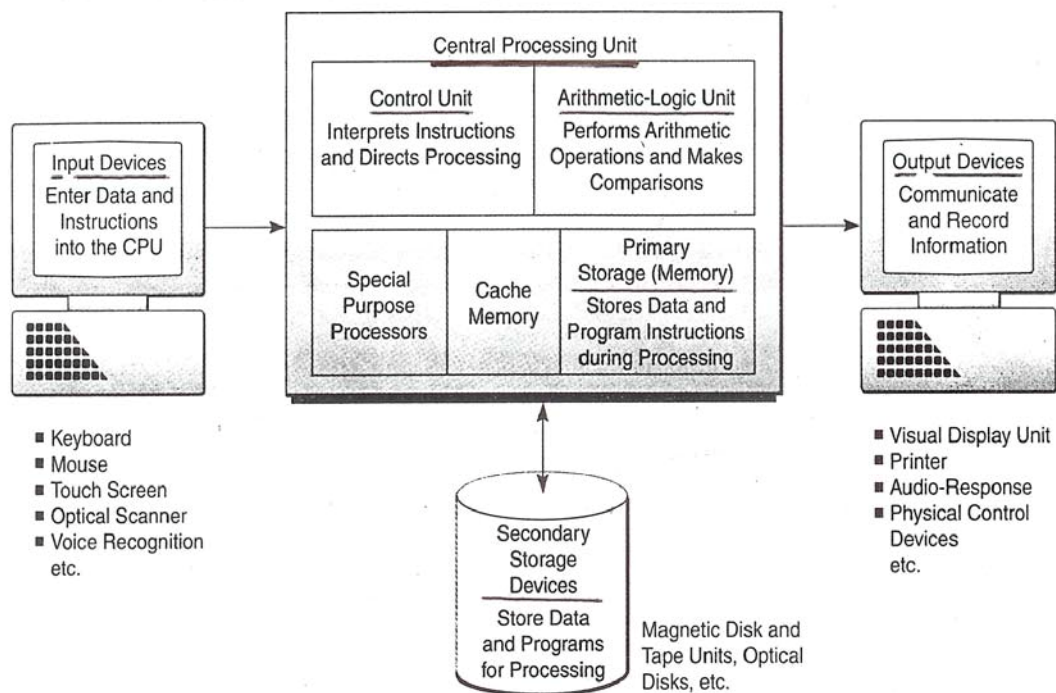
Components of a Computer System

In short, an input unit performs the following functions:

➢ It accepts (or reads) the list of instructions and data from the outside world.

➢ It converts these instructions and data in the computer acceptable form.

➢ It supplies the converted instructions and data to the complete system for further processing.

2.1.1.2 Output Unit

The job of an output unit is just the reverse of that of an input unit. It supplies information and results of computation to the outside world. Thus, it links the computer with the external environment. As computers work with binary code, the results produced are also in the binary form. Hence, before supplying the results to the outside world, it must be converted to human acceptable (readable) form. This task is accomplished by units call output interfaces. Output interfaces are designed to match the unique physical or electrical characteristics of output devices (terminals, printers, etc.) to the requirements of the external environmental.

In short, an output unit performs the following functions:

➢ It accepts the results produced by the computer, which are in coded form and hence cannot be easily understood by us.
➢ It converts these coded results to human acceptable (readable) form.
➢ It supplies the converted results to the outside world.

2.1.1.3 Storage Unit

The data and instructions that are entered into the computer system through input units have to be stored inside the computer before the actual processing starts. Similarly, the results produced by the computer after processing must also be kept somewhere inside the computer system before being passed on to the output units. Moreover, the intermediate results produced by the computer must also be preserved for ongoing processing.

The storage unit at the primary/main storage of a computer system is designed to cater to all these needs. It provides space for storing data and instructions; space for intermediate results; and also space for the final results.

In short the specific functions of the storage unit are to hold (store):

➢ All the data to be processed and the instructions required for processing (received from input devices).
➢ Intermediate results of processing.

> Final results of processing before these results are released to an output device.

Two Kinds of Memory

The main memory, housed inside the computer unit, is built from two different kinds of memory chip: the first kind, called ROM (read only memory), has permanently built into information and instructions the computer needs to know in order to operate properly; the second kind of memory, called RAM (random access memory), holds the program and other information typed in at the keyboard.

The RAM is a 'read and write' memory. This means we can store, or 'write', information into this memory and later recall it, or 'read' it out again. The ROM, on the other hand, can only be read; we cannot write information into it. This ensures that we do not destroy

the vital information held in ROM by over-writing it.

An important difference between the two types of memory is that RAM is 'volatile', i.e. it loses all the information stored when the power is switched off. ROM, on the other hand, is 'non-volatile'; its information is not lost when the power is switched off.

The secondary storage medium stores data, instructions and output for archival purpose so that whenever any data or instructions is required in the future it can be retrieved for reference or for further processing.

2.1.1.4 Central Processing Unit

The Arithmetic Logic Unit and the Control Unit of a computer system are jointly known as the Central Processing Unit (CPU). The CPU is the brain of any computer system. In a human body, the brain takes all major decisions and the other parts of the body function as directed by the brain. Similarly, in a computer system, all major calculations and comparisons are made inside the CPU and the CPU is also responsible for activating and controlling the operations of other units of a computer system.

2.1.1.5 Arithmetic Logic Unit

The Arithmetic Logic Unit (ALU) of a computer system is the place where the actual execution of the instructions takes place during the processing operation. To be more precise all calculations are performed and all comparisons (decisions) are made in the ALU. The data and instructions stored in the primary storage prior to processing, are transferred as and when needed to the ALU where processing

takes place. No processing is done in the primary storage unit. Intermediate results generated in the ALU are temporarily transferred back to the primary storage until needed at a later time. Data may, thus, move from primary storage to ALU and back again to storage many times before the processing is over. After the completion of processing the final results, which are stored in the storage unit, are released to an output device.

The type and number of arithmetic and logic operations that a computer can perform is determined by the engineering design of the ALU. However almost all ALU's are designed to perform the four basic arithmetic operations (add, subtract, multiply, divide) and logic operations or comparisons such as less than, equal to, or greater than.

2.1.1.6 Control Unit

How does the input device know that it is time for it to feed data into the storage unit? How does the ALU know what should be done with the data once they are received? And how is it that only the final results are sent to the output device and not the intermediate result? All this is possible because of the Control Unit of the computer system. By selecting, interpreting, and seeing to the execution of the program instructions, the Control Unit is able to maintain order and direct the operation of the entire system. Although, it does not perform any actual processing on the data, the Control Unit acts as a central nervous system for the other components of the computer. It manages and coordinates the entire computer system. It obtains instructions from the program stored in main memory, interprets the instructions, and issues signals that cause other units of the system to execute them.

2.1.2 INPUT/OUTPUT DEVICES

The computer will be of no use if it is not communicating with the external world. Thus, a computer must have a system to receive information from the outside world and must be able to communicate results to the external world. Thus, a computer consists of input/output devices. Input and output devices can also be written as I/O devices.

Input and output devices of a computer system are the devices that connect you to computer. Input devices let you to transfer data and user command into the computer system. I/O devices are used to interact with the computer system. For example, you can type in data by using a keyboard, or you can input data in picture form by using a scanner in computer system.

On the other hand, output devices display the result of input data or signals after processing it. Examples of these could be your computer's monitor, which displays all the programs which are running on the computer, as well as the printer, which will print out a hard copy of the information which is saved in your computer.

Input and output devices allow the computer system to interact with the outside world by moving data into and out of the computer system.

Examples of some input devices are:

- Keyboard
- Mouse
- Joystick
- Bar code reader
- Graphics tablet
- Pen drive
- CD/DVD
- Digital Camera

An output device is used to send data out of the system. The user sees the result after processing of data by the computer through output devices. Examples of some output devices are:

- Monitor
- Printer
- Plotter
- Speaker

Input and output devices are also called I/O devices. They are directly connected to an electronic module called I/O module or device controller. For example, the speakers of a multimedia computer system are directly connected to a device controller called an audio card, which in turn is connected to the rest of the system. Input and output devices are similar in operation but perform opposite functions. It is through the use of these devices that the computer is able to communicate with the outside world.

Input data for the computer system could be in any of the following forms:

➢ Manual inputs from a keyboard or console.

➢ Analog inputs from instruments or sensors.

➢ Inputs from a storage device, such as pen-drive, CD's and Floppy Drives.

The speed of a processor is far more than the input devices, such as the keyboard of computer system. Computer systems can process hundreds or thousands of computer words or characters per second. Thus, a study of the first method, i.e. manual input reflects the inability of human-operated keyboards or keypunches to supply data at a speed that matches the speed of digital computers.

2.1.3 WHAT IS PORT?

Port is a connecting socket, outside the system into which different types of cables are plugged. It is a specific place from which other devices can be physically connected. I/O ports are the interfaces through which computers communicate with external devices such as printers, modems, joysticks and terminals. There are many types of ports used in computer system. Some of them are given as follows.

2.1.3.1 Parallel Port

Various peripherals can be connected through parallel port, which is a parallel communication physical interface. A parallel port transmits 8 bits of a byte of data in parallel. It is used for transmitting fast data over short distances. It is used to connect a printer to a computer. Since a parallel port transmits an entire byte at a time, it operatesI/O devices at a relatively high speed. A Parallel port is primarily used to connect printers to a computer and hence it is often called a printer port.

Parallel Port

2.1.3.2 Serial Port

Serial port transmits one bit of a byte, one at a time as a single stream of bits. It is meant for transmitting slow data over long distances. Communication over a phone is an example of serial communication. It is a serial communication physical interface which transmits one bit at a time. Dial-

up modems and serial mice use serial ports.

Serial Port

2.1.3.3   Universal Serial Bus (USB)

A USB Port can connect up to 127 peripheral devices such as a digital camera, digital speakers, scanners, speakers etc. It permits Plug and Play – configuring of expansion cards and peripheral devices as and when they are installed.

USB

2.1.3.4   Small Computer System Interface (SCSI) Port

SCSI-Small Computer System Interface Port allows data to be transmitted in a daisy chain to up to 7 devices at a speed higher (32 bits at a time) than those possible with serial and parallel ports. It is a fast data transmitting device and is used to connect HDD, CD ROM drives and scanners with the computer system.

2.2   INPUT DEVICES

In this section we will discuss various types of input devices used for entering data into the computer system. These are:

2.2.1 Keyboard

It is the most common input device used for entering data and information into the computer system. This is the standard input device attached to all computers. The keyboard is a primary device for inputting text by pressing a set of keys. All the keys are neatly mounted in a keyboard connected to the computer system. Keyboard devices can be classified into two types   general purpose keyboards   and special purpose keyboards. General purpose keyboard are standard keyboards used with most computer system. They are called general purpose because that have enough keys to make them useful for any type of application. The layout of keyboard is just like the traditional typewriter of the type QWERTY. It also contains some extra command keys and function keys. It contains a total of 101 to 104 keys. You have to press a correct combination of keys to input data. The computer can recognize the electrical signals corresponding to the correct key combination and processing is done accordingly.

The User can enter data into the computer by pressing a set of keys on the keyboard. In a keyboard letters are printed on the keys.   The first keyboard was developed in the 18th century and was named as a QWERTY keyboard.   A Computer keyboard includes control circuitry which converts the key pressed by the user into key codes so that the computer can understand it.   Now-a-days wireless keyboards are also being used which increase user freedom. The wireless feature is achieved by infrared signals or by radio frequency.

In general, a computer keyboard has following keys:

1. Alphanumeric Keys: It includes letters and numbers.

2. Punctuation Keys: These include comma, period, semicolon etc. and

3. Special Keys: These can be function keys, control keys, arrow keys and Caps lock keys etc.

All the modern keyboards of computer are classified as:

   (a) Original PC keyboard having 84 keys;

   (b) Advance Technology (AT) Keyboard having 101-104 keys; and

   (c) Multimedia Keyboard having 120 – 140 keys.

2.2.2 Mouse

A Mouse is a handy device which can be moved on a smooth surface to cause the movement of a cursor on the screen. It is a pointing device which is used to input data and information into the computer system by pointing on it. Physically, a mouse contains a small case, held under one of the user's hands with one or more buttons. For GUI-based systems a mouse is an essential pointing-device. The cursor of the mouse moves in the same direction in which the mouse ball rolls.

Its name is derived from its shape, which looks a bit like a mouse, with its connecting wire that one can imagine to be the mouse's tail. A Mouse rolls on a small ball and has two or three buttons on the top. When you roll the mouse across a flat surface on the screen, sensors sense the mouse in the direction of mouse movement. The cursor moves very fast with a mouse giving you more freedom to work in any direction. It is easier and faster to move through a mouse compared to movement using keys.

Types of Mouse

Mouse could be mechanical, optical or cordless types. Further information regarding these types are as follows:

Mechanical Mouse: Mechanical Mouse uses ball for the movement of cursor on the computer screen. When the ball is rolled in any direction, a sensor of the mouse detects it and also moves the mouse pointer in the same direction.

Optical Mouse: Optical Mouse uses Laser rays for the movement of cursor on the computer screen. It is an advanced pointing device. Movement is detected by sensing changes in the reflected light rather than the motion of a rolling sphere.

Cord-Less Mouse: Cord-Less Mouse is battery driven and does not need any wire for the physical connection with the motherboard. It transmits data through infrared or radio signal.

Computer mice are very useful in designing pictures and graphs and computer and video games by multimedia designers. A Mouse pad is required to move the mouse because it provides a smooth surface. However, an optical or laser mouse doesn't require a mouse pad.

2.2.3 Digitizing (Graphic) Tablet

Digitizing or Graphics' tablet is a computer input device that allows one to hand-draw images and graphics, similar to the way one draws images with a pencil and paper. These tablets may also be used to capture data of handwritten signatures.   Some tablets are intended as a general replacement for a mouse as the primary pointing and navigation device for desktop computers. These are used by architects, engineers and designers in Computer Aided Design (CAD) for designing purposes, such as buildings, cars, mechanical parts, robots etc. These are also used in Geographical Information System (GPS) for digitizing of maps.

Graphics Tablet

Graphics tablet is most suited for artists and those who want the natural feel of a pen-like object to manipulate the cursor on their screen. Wacom is the most well-known manufacturer of graphics tablets, and is incredibly well respected.

2.2.4 Trackball

Trackball is a moveable ball mounted on a stationary device, which can be rotated manually by using fingers. It is also a pointing device. In a trackball, the ball is placed on the top along with buttons which can be rolled with the fingers. These are used in playing video games. Mouse and mobile phones are equipped with trackballs to navigate addresses as well as play games.

2.2.5 Joystick

Joystick is a remote control device for a computer which is used for playing video games to indicate the position. It has a stick that pivots on a base and is used for controlling the action in video games. The User moves a spherical ball with the help of a stick in the joystick as opposed to the trackball where fingers are used for moving the ball. Joysticks are also used for controlling machines such as cranes, trucks, underwater unmanned vehicles, flight simulators, industrial robots etc. The Joystick shown in figure has a base and a handle for controlling the movement of the cursor on the screen.

2.2.6   Pick Devices

Pick devices are used to select an object on the screen. The selected object can be text or graphics. Examples of pick devices are light pens and touch screens.

2.2.6.1 Light Pens

A Light pen is a pen like light-sensitive device. It is connected by a wire to the computer terminal to detect the CRT beam when pointed towards the screen and generate a narrow electrical pulse that can be fed to the computer as an input signal.

It is used to draw on the screen or to point to the displayed objects. It operates by detecting the light emitted by the screen phosphors.A light pen can work with any CRT monitor but not with LCD monitors. It is used by architects and engineers for CAD applications and editing.

Light Pen

2.2.6.2   Touch Screens

Touch screens are monitors / electronic visual display screens which detect where they are being touched. The user makes selections by directly touching the screen, rather than moving a cursor to the point on the screen with a mouse or joystick

Now days touch screens are being used in ATM machines for making it user friendly and

Kiosk machines are used for guiding the travelers about their travel plans. Touch screens are also used in many of the modern cell phones.

Touch Screen

2.2.7   Source Data Entry Devices

Entry of data into a computer system directly from the source, without transcription is called source data entry. Source data entry devices have a lower probability of error in input data than standard keyboard entry.

Some of the common source data entry devices are discussed below:

2.2.7.1 Digital Camera

A Digital camera is an electronic device which takes video or still photographs or both, digitally by recording images via an electronic image sensor. Digital cameras can do things which film cameras can't, for example displaying images on screen immediately after they are recorded. Images recorded on a digital camera can be cropped for editing, deleted and various types of special effects can be created by using Photoshop software.

Digital cameras look like ordinary cameras but have sufficient memory in the form of chips to store thousands of images, rather than using photographic films.

Digital camera

Most digital cameras allow users to choose the resolution needed for a picture. Most of those can connect directly to a computer to transfer data. A USB port is generally used for this purpose. A Wireless connection can also be used for connecting to a computer via Bluetooth.

These cameras use memory cards with flash memory to store images. The joint photographing expert's group standard (JPEG) is the most common file format used for storing data in a camera. Other formats include raw image format, DNG format etc.

2.2.7.2 Scanners

A Scanner is an input device and is used to input data into the computer system in the form of pictures. It optically scans images, printed text, handwriting, or an object, and converts it to a digital image. Examples of scanners are a desktop or flatbed scanner.

In scanners the document is placed on a glass window for scanning. Mechanically driven scanners that move the document are typically used for large-formatted volume of documents.Another type of scanner is a planetary scanner. This scanner takes photographs of books and documents. Three dimensional scanners are used for producing three-dimensional models of objects.
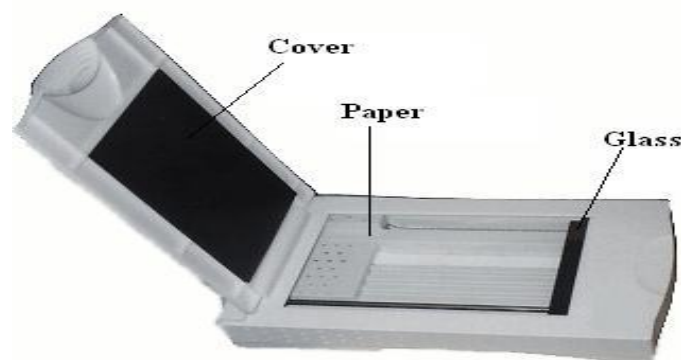
Optical Scanner

2.2.7.3 Optical Mark Recognition (OMR)

OMR is the scanning of paper to detect the presence or absence of a mark in a predetermined position. Now days, it is used as an input device for source data entry purposes.   Universities and colleges often use OMR for the evaluation of OMR sheets for competitive exams. OMR sheets consist of multiple

choice question papers and students are required to make a mark to indicate their answers. OMR is used in the evaluation of questionnaires, surveys and university exam OMR sheets.

Optical Mark Recognition

2.2.7.4 Magnetic Ink Character Recognition (MICR)

Magnetic Ink Character Recognition is a character recognition system that uses special ink and characters. When a document that contains this ink needs to be read, it passes through a machine, which magnetizes the ink and then translates the magnetic information into characters.

MICR technology is used by banks for faster processing of large volumes of cheques. Numbers and characters found on the bottom of checks (usually containing the check number, sort number, and account number) are printed using Magnetic Ink. To print Magnetic Ink codes, we need a laser printer that accepts MICR toner.

MICR provides a secure, high-speed method of scanning and processing information. This technology is used for processing large volume of data. It speeds up data input for the bank because cheques can be directly fed into the input device as it also ensures accuracy of data entry. The most commonly used character set by MICR devices are known as E13B font which consists of the numerals 0 to 9, and four special characters.

2.2.7.5 Bar Code Reader

A barcode reader is an electronic device which is used to read printed barcodes. Barcodes represent alphanumeric data which is a combination of vertical lines (bars) that vary in width and length. It is a fast and effective way to input data. A Barcode reader uses a laser beam to read the series of thick and thin lines which represent the bar code number.

Bar Codes   **Bar Code Reader**

The bar code is 13 digits long and it has four main divisions. The First two digits of a bar code represent the country, the second part represents the manufacturer's code (five digits) the third part represents the product code (five digits) and the last digit is a check digit.

2.2.7.6   Magnetic Stripe Reader

A magnetic reader is a hardware device which is used to read the information encoded in the magnetic stripe located at the back of a credit/debit card. A bank card holds data about the owner of the card, bank account number and code of the bank branch, where the account is held.

Magnetic Stripe Reader   **ATM Machine with Card**

Magnetic stripe readers are often used at supermarkets and in many different types of shops. In these machines data is read electronically and the point of sale is called Electronic Point of Sale (EPOS).

There are several other pick devices such as microphones and speakers. These have been discussed in length under the section Out Put Devices section of this unit.

2.3   OUTPUT DEVICES

One of the most important output devices in computer system is its screen commonly called monitor. It is an output device and displays all the programs and applications which are running on the computer

system. A Monitor is the visual display unit of the computer system. It displays images generated from the video output. It displays images without keeping a permanent record.

A Graphic display is made up of a series of dots called 'pixels' (picture elements) whose pattern produces images in computer system. Each dot on the screen is defined as a separate unit which can be addressed separately. Since each dot on the screen can be controlled separately it gives greater flexibility in drawing pictures. The Number of dots per inch (dpi) is called the resolution of the screen and represents the quality of the computer system.

2.3.1 Cathode Ray Tube Monitors (CRT)

Monitors display what is going on in your computer. They can run at various resolutions. It is the part of computer which looks like a TV set. After typing the characters from the keyboard, we can see them on the monitor. The main components of a CRT monitors are the electron gun, the electron beam controlled by an electromagnetic field and phosphor coated display screen. These older monitors are bulky and require a lot of space for installation.

In CRT monitors, the image is projected on the screen by directing the electron beam onto the computer screen. To precisely direct the electron beams, copper steering coils are used to create a magnetic field inside the tube. By applying varying voltages to the copper coils a beam can be positioned at any point on the screen.

2.3.2 Liquid Crystal Displays (LCD)

First introduced in watches and clocks in the1970's, LCDs are now used to display images in monitors. A newer technology in computer screens is TFT LCD monitors. These are light weight monitors and are used in laptop computers. Active matrix structure is used by most of the modern LCD monitors and

television sets. In this technology, a matrix of thin-film transistors (TFT) is added to the polarizing and color filters. It enhances the display to make it look brighter and sharper. It can also produce much better images and have quicker response times.

These monitors are portable, reliable and consume less electricity. Images produced by these monitors are of better quality than that of old CRT monitors. The LCD monitors have very high resolution and emit less radiation than CRT monitors. The screen is also flicker free.

2.3.3 Thin Film Transistor Liquid Crystal Display (TFT LCD)

It is type of monitor which used thin film transistor technology to enhance the image quality of LCD Monitors. These are used as monitor in television set, desktop computer, laptop computer and mobile phones etc.

2.3.4 Light Emitting Diodes Monitors (LED)

Light Emitting Diodes (LED) is the latest technology which is being used now a day for making high definition TV screens and monitors. It is a semi-conductor light source. In this technology diodes are used to light up the screen instead of liquid crystal Diodes.

LED is known as light emitting diode. It is an electronic device that lights up when electricity is passed through it. LEDs are usually red. They are good for displaying images because they can be relatively small, and they do not burn out. However, they require more power than LCD monitors. LED is light weight monitors and is used in laptop computers and in TV.

The Life of LED monitors is three times than that of LCD monitors and they have less warm up time than that of CRT or LCD monitors. These monitors require less space on the desk, less power consumption and have flicker free screen.

2.3.5 Projection Displays

These are normally used for large group presentations. These systems can be connected to a computer and whatever appears on the computer terminal gets enlarged and projected on a large screen. Video projector receives video signals and projects the corresponding image on a projection screen. It uses a lens system for this projection.

LCD Overhead Projector

These are popularly used for seminars, class room lectures, marketing presentations and conference room presentations etc.

2.3.6 Printers

Printers are used for producing output on paper. There are a large variety of printers and printing devices which can be classified according to the print quality and printing speed.

These varieties of printers are:

Printing Technology – impact printers vs. non-impact printers

Impact printers use variations of the standard typewriter printing mechanism where a hammer strikes paper through an inked ribbon.

A non-Impact printer uses chemical, heat or electrical signals to produce symbols on paper. Some of these require special coated or treated paper to print characters on them.

2.3.7 Plotters

A Plotter is a device that draws pictures on a page as output, after receiving a print command from the computer. It is also called a graph plotter. In plotters pens are used to draw lines on the paper, which is placed in the plotter.

Plotter

Plotters produce high quality diagrams on the paper and their output quality is good. Engineers, architects and planners use plotters to generate high quality, high-precision graphic output of different sizes. For several design applications such as design of layout of an aircraft, car, and architectural design of a building and in other computer-aided design applications plotter are very useful.

Plotter is of two types:

- Drum Plotter
- Flat-Bed Plotter

The drum plotters are generally smaller than flatbed plotters and they have lower resolutions than flatbed plotters. HP, Canon and Epson are the popular companies which manufacture good quality of platters.

2.3.8 Speaker

Computer speakers, or multimedia speakers, are external speakers, commonly equipped with a low-power internal amplifier which produces sound as output. External speakers are connected with a computer by using a plug and socket.

Computer speakers range widely in quality and in price. Laptop computers have inbuilt speakers.

2.4   CHECK YOUR PROGRESS

A.   Fill in the blanks:

1. The _____ pen is a small input device used to select and display objects on a screen.

2. _____ keys are present on the top row of the keyboard.

3. The OCR recognises the _____ of the characters with the help of light source.

4. The most common method of entering text and numerical data into a computer system is through the use of a _____.

5. Information that comes from an external source and is fed into computer software is called _____.

B.   State whether the following statements are True or False:

1. Scanner is used to print documents.
2. Printer is used to display pictures.
3. Pick devices are used to pick objects on the monitor.
4. Graphic tablets are used for designing purposes.
5. Speaker is an output device.

2.5   SUMMARY

Input/output devices are the devices that connect you to your computer. Input devices let you input data and other information into your computer and they also let you give your computer special instructions so that it will know what to do. For example, you can type in data by using a keyboard, or you can input data in picture form by using a scanner.

On the other hand, output devices display the results of your computer's computations. Examples of these would be your computer's monitor, which displays all of the programs you're running, as well as the printer, which will print out a hard copy of the information. Source data entry devices are those devices which automatically capture data and images at its source, record it in small chips and produces images immediately.

2.6 KEYWORDS

Input Unit: This unit contains devices with the help of which we enter data into the computer. This unit creates a link between the user and the computer.

CPU: Central Processing Unitis considered as the brain of the computer. CPU performs all types of data processing operations.

Output Unit: The output unit consists of devices with the help of which we get the information from the computer. This unit is a link between the computer and the users.

Input Devices: In computing, an input device is a piece of computer hardware equipment used to provide data and control signals to an information processing system such as a computer.

Output Devices: An output device is any piece of computer hardware equipment which converts information into human-readable form. It can be text, graphics, tactile, audio, and video.

2.7 SELF-ASSESSMENT TEST

1. Explain the various components of a computer system.
2. What do you mean by a port? Discuss various types of port associated with computer.
3. What do you mean by peak devices? Discuss various types of pick devices.
4. Write a short note on:
    a. CPU
    b. ALU
5. Define input devices. Describe various types of input devices.
6. Define output devices. Describe various types of output devices.

2.8 ANSWERS TO CHECK YOUR PROGRESS

Check your Progress A

1. Light
2. Function
3. Shape
4. Keyboard

5. Input

Check Your Progress B

1. False
2. False
3. True
4. True
5. True

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| Course: DBA-104 | Author: Mr. Sawtantar Singh |
| Lesson: 3 | Updated By: Mr. Balwant |

Computer Memory

Structure

3.0   LEARNING OBJECTIVES

After studying this lesson, you should be able to understand:

- ✓ The basics of computer memory and its types
- ✓ What is RAM and its types
- ✓ ROM and its types
- ✓ Mass storage devices and its types
- ✓ Brief idea of modern processor

3.1   INTRODUCTION

Charles Babbage, the famous 19th century English mathematician and polymath, once said that for a machine to perform the functions of a human computer it must possess three things: a unit capable of performing the operations of arithmetic, a built-in power of judgment and a store.

The latter - a store - would retain the numbers and instructions required to define the successive stages in computation. Of course, in the 21st century we'd recognize this as 'computer memory', but in the 19th century this really was a groundbreaking idea.

Let's first define, in modern terms, what we mean by a store, or the memory of a computational machine:

"The memory of a computer is where the program and data are stored before the calculations begin. During a computer run, the control section may store partial answers in the memory; similar to the way we use paper to record our work. The memory is therefore one of the most active parts of a computer, storing not only the program and data but processed data as well. The memory is equivalent to thousands of registers, each storing a binary word."

In this lesson we discuss register memory, cache memory, primary memory and secondary memory.

3.2 COMPUTER MEMORY

The computer memory holds the data and instructions needed to process raw data and produce output. The computer memory is divided into large number of small parts known as cells. Each cell has a unique address which varies from 0 to memory size minus one.

Computer memory is of two types: Volatile (RAM) and Non-volatile (ROM). The secondary memory (hard disk) is referred as storage not memory.

But, if we categorize memory on behalf of space or location, it is of four types:

1. Register memory
2. Cache memory
3. Primary memory
4. Secondary memory

3.2.1 REGISTER MEMORY

Register memory is the smallest and fastest memory in a computer. It is not a part of the main memory and is located in the CPU in the form of registers, which are the smallest data holding elements. A register temporarily holds frequently used data, instructions, and memory address that are to be used by CPU. They hold instructions that are currently processed by the CPU. All data is required to pass through registers before it can be processed. So, they are used by CPU to process the data entered by the users.

Registers hold a small amount of data around 32 bits to 64 bits. The speed of a CPU depends on the number and size (no. of bits) of registers that are built into the CPU. Registers can be of different types based on their uses. Some of the widely used Registers include Accumulator or AC, Data Register or DR, the Address Register or AR, Program Counter (PC), I/O Address Register, and more.

3.2.1.1 Types and Functions of Computer Registers

Data Register: It is a 16-bit register, which is used to store operands (variables) to be operated by the processor. It temporarily stores data, which is being transmitted to or received from a peripheral device.

Program Counter (PC): It holds the address of the memory location of the next instruction, which is to be fetched after the current instruction, is completed. So, it is used to maintain the path of execution of the different programs and thus executes the programs one by one, when the previous instruction gets completed.

Instructor Register: It is a 16-bit register. It stores the instruction which is fetched from the main memory. So, it is used to hold instruction codes, which are to be executed. The Control Unit takes instruction from Instructor Register, then decodes and executes it.

Accumulator Register: It is a 16-bit register, which is used to store the results produced by the system. For example, the results generated by CPU after the processing are stored in the AC register.

Address Register: It is a 12-bit register that stores the address of a memory location where instructions or data is stored in the memory.

I/O Address Register: Its job is to specify the address of a particular I/O device.

I/O Buffer Register: Its job is to exchange the data between an I/O module and the CPU.

3.2.2 CACHE MEMORY

Cache memory is a high-speed memory, which is small in size but faster than the main memory (RAM). The CPU can access it more quickly than the primary memory. So, it is used to synchronize with high-speed CPU and to improve its performance. Cache memory can only be accessed by CPU. It can be a reserved part of the main memory or a storage device outside the CPU. It holds the data and programs which are frequently used by the CPU. So, it makes sure that the data is instantly available for CPU whenever the CPU needs this data. In other words, if the CPU finds the required data or instructions in the cache memory, it doesn't need to access the primary memory (RAM). Thus, by acting as a buffer between RAM and CPU, it speeds up the system performance.

3.2.2.1 Types of Cache Memory

L1: It is the first level of cache memory, which is called Level 1 cache or L1 cache. In this type of cache memory, a small amount of memory is present inside the CPU itself. If a CPU has four cores (quad core CPU), then each core will have its own level 1 cache. As this memory is present in the CPU, it can work at the same speed as of the CPU. The size of this memory ranges from 2KB to 64 KB. The

L1 cache further has two types of caches: Instruction cache, which stores instructions required by the CPU, and the data cache that stores the data required by the CPU.
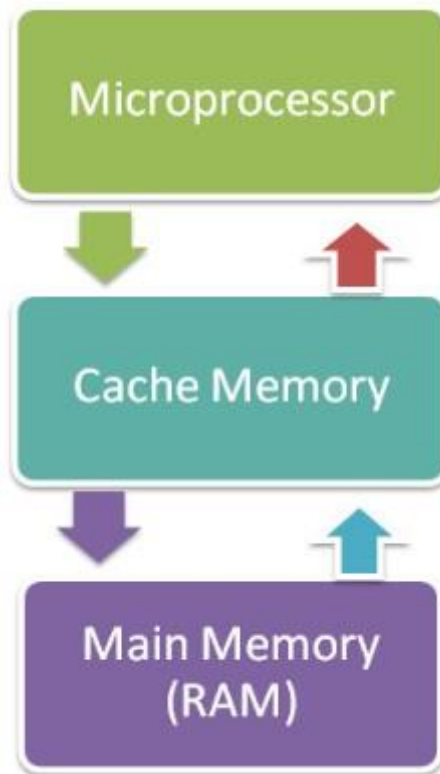
L2: This cache is known as Level 2 cache or L2 cache. This level 2 cache may be inside the CPU or outside the CPU. All the cores of a CPU can have their own separate level 2 cache, or they can share one L2 cache among themselves. In case it is outside the CPU, it is connected with the CPU with a very high-speed bus. The memory size of this cache is in the range of 256 KB to the 512 KB. In terms of speed, they are slower than the L1 cache.

L3: It is known as Level 3 cache or L3 cache. This cache is not present in all the processors; some high-end processors may have this type of cache. This cache is used to enhance the performance of Level 1 and Level 2 cache. It is located outside the CPU and is shared by all the cores of a CPU. Its memory size ranges from 1 MB to 8 MB. Although it is slower than L1 and L2 cache, it is faster than Random Access Memory (RAM).

3.2.2.2 How does cache memory work with CPU?

When CPU needs the data, first of all, it looks inside the L1 cache. If it does not find anything in L1, it looks inside the L2 cache. If again, it does not find the data in L2 cache, it looks into the L3 cache. If data is found in the cache memory, then it is known as a cache hit. On the contrary, if data is not found inside the cache, it is called a cache miss.

If data is not available in any of the cache memories, it looks inside the Random Access Memory (RAM). If RAM also does not have the data, then it will get that data from the Hard Disk Drive.

So, when a computer is started for the first time, or an application is opened for the first time, data is not available in cache memory or in RAM. In this case, the CPU gets the data directly from the hard disk drive. Thereafter, when you start your computer or open an application, CPU can get that data from cache memory or RAM.

3.2.3 PRIMARY MEMORY

Primary Memory is of two types: RAM and ROM.

RAM (Volatile Memory)

It is a volatile memory. It means it does not store data or instructions permanently. When you switch on the computer the data and instructions from the hard disk are stored in RAM. CPU utilizes this data to perform the required tasks. As soon as you shut down the computer the RAM loses all the data.

ROM (Non-volatile Memory)

It is a non-volatile memory. It means it does not lose its data or programs that are written on it at the time of manufacture. So it is a permanent memory that contains all important data and instructions needed to perform important tasks like the boot process.

3.2.3.1 What is RAM?

RAM, which stands for Random Access Memory, is a hardware device generally located on the motherboard of a computer and acts as an internal memory of the CPU. It allows CPU store data, program, and program results when you switch on the computer. It is the read and writes memory of a computer, which means the information can be written to it as well as read from it.
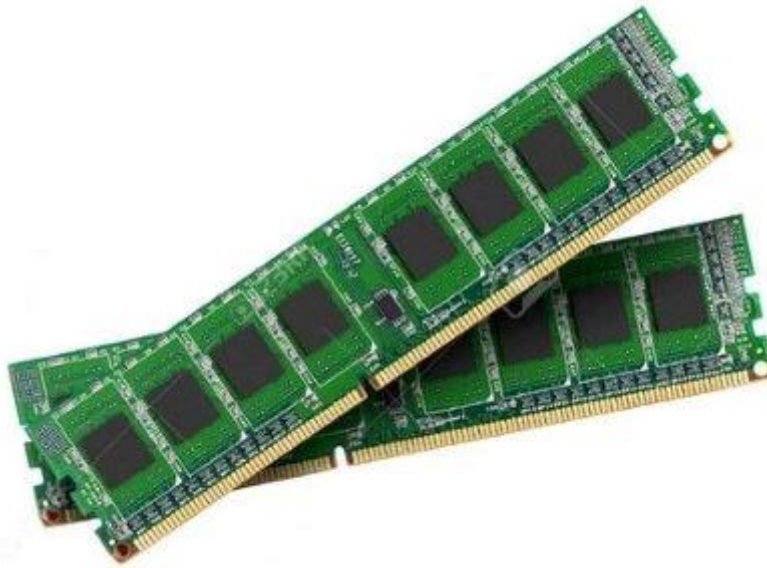
RAM is a volatile memory, which means it does not store data or instructions permanently. When you switch on the computer the data and instructions from the hard disk are stored in the RAM, e.g., when the computer is rebooted, and when you open a program, the operating system (OS), and the program are loaded into RAM, generally from an HDD or SSD. CPU utilizes this data to perform the required tasks. As soon as you shut down the computer, the RAM loses the data. So, the data remains in the RAM as long as the computer is on and lost when the computer is turned off. The benefit of loading data into RAM is that reading data from the RAM is much faster than reading from the hard drive.

In simple words, we can say that RAM is like a person's short term memory, and hard drive storage is like a person's long term memory. Short term memory remembers the things for a short duration, whereas long term memory remembers for a long duration. Short term memory can be refreshed with information stored in the brains long term memory. A computer also works like this; when the RAM fills up, the processor goes to the hard disk to overlay the old data in Ram with new data. It is like a reusable scratch paper on which you can write notes, numbers, etc., with a pencil. If you run out of space on the paper, you may erase what you no longer need; RAM also behaves like this, the unnecessary data on the RAM is deleted when it fills up, and it is replaced with new data from the hard disk which is required for the current operations.

RAM comes in the form of a chip that is individually mounted on the motherboard or in the form of several chips on a small board connected to the motherboard. It is the main memory of a computer. It is

faster to write to and read from as compared to other memories such as a hard disk drive (HDD), solid-state drive (SSD), optical drive, etc.

A computer's performance mainly depends on the size or storage capacity of the RAM. If it does not have sufficient RAM (random access memory) to run the OS and software programs, it will result in slower performance. So, the more RAM a computer has, the faster it will work. Information stored in RAM is accessed randomly, not in a sequence as on a CD or hard drive. So, its access time is much faster.

3.2.3.1.1   History of RAM:

- The first type of RAM was introduced in 1947 with the Williams tube. It was used in CRT (cathode ray tube), and the data was stored as electrically charged spots on the face.
- The second type of RAM was a magnetic-core memory, invented in 1947. It was made of tiny metal rings and wires connecting to each ring. A ring stored one bit of data, and it can be accessed at any time.
- The RAM which we know today, as solid-state memory, was invented by Robert Dennard in 1968 at IBM Thomas J Watson Research Centre. It is specifically known as dynamic random access memory (DRAM) and has transistors to store bits of data. A constant supply of power was required to maintain the state of each transistor.
- In October 1969, Intel introduced its first DRAM, the Intel 1103. It was its first commercially available DRAM.
- In 1993, Samsung introduced the KM48SL2000 synchronous DRAM (SDRAM).
- In 1996, DDR SDRAM was commercially available.
- In 1999, RDRAM was available for computers.
- In 2003, DDR2 SDRAM began being sold.
- In June 2007, DDR3 SDRAM started being sold.
- In September 2014, DDR4 became available in the market.

3.2.3.1.2   Types of RAM:

Integrated RAM chips can be of two types:

- Static RAM (SRAM):

- Dynamic RAM (DRAM):

Both types of RAM are volatile, as both lose their content when the power is turned off.

1) Static RAM:

Static RAM (SRAM) Cell
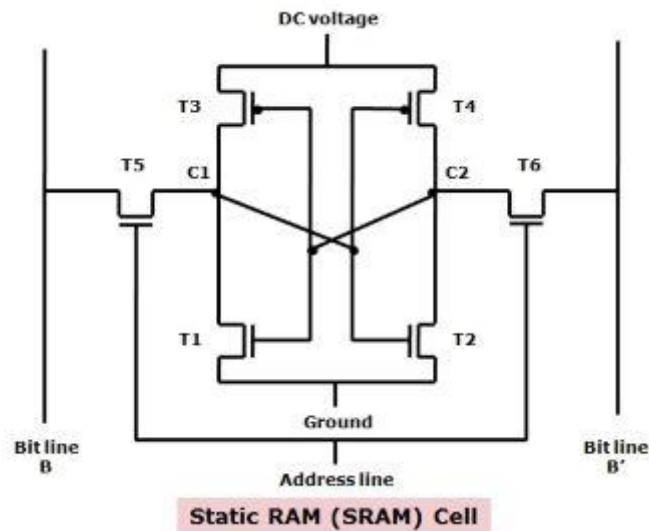
Static RAM (SRAM) is a type of random access memory that retains its state for data bits or holds data as long as it receives the power. It is made up of memory cells and is called a static RAM as it does not need to be refreshed on a regular basis because it does not need the power to prevent leakage, unlike dynamic RAM. So, it is faster than DRAM.

It has a special arrangement of transistors that makes a flip-flop, a type of memory cell. One memory cell stores one bit of data. Most of the modern SRAM memory cells are made of six CMOS transistors, but lack capacitors. The access time in SRAM chips can be as low as 10 nanoseconds. Whereas, the access time in DRAM usually remains above 50 nanoseconds.

Furthermore, its cycle time is much shorter than that of DRAM as it does not pause between accesses. Due to these advantages associated with the use of SRAM, It is primarily used for system cache memory, and high-speed registers, and small memory banks such as a frame buffer on graphics cards.

The Static RAM is fast because the six-transistor configuration of its circuit maintains the flow of current in one direction or the other (0 or 1). The 0 or 1 state can be written and read instantly without waiting for the capacitor to fill up or drain. The early asynchronous static RAM chips performed read

and write operations sequentially, but the modern synchronous static RAM chips overlap read and write operations.

The drawback with Static RAM is that its memory cells occupy more space on a chip than the DRAM memory cells for the same amount of storage space (memory) as it has more parts than a DRAM. So, it offers less memory per chip.

2) Dynamic RAM:

Dynamic RAM (DRAM) Cell
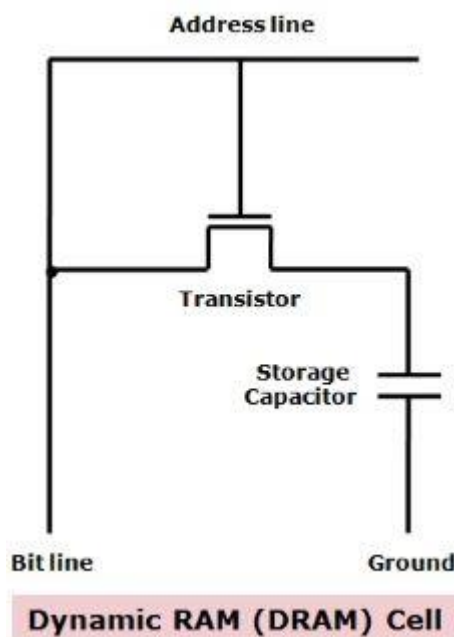
Dynamic Ram (DRAM) is also made up of memory cells. It is an integrated circuit (IC) made of millions of transistors and capacitors which are extremely small in size and each transistor is lined up with a capacitor to create a very compact memory cell so that millions of them can fit on a single memory chip. So, a memory cell of a DRAM has one transistor and one capacitor and each cell represents or stores a single bit of data in its capacitor within an integrated circuit.

The capacitor holds this bit of information or data, either as 0 or as 1. The transistor, which is also present in the cell, acts as a switch that allows the electric circuit on the memory chip to read the capacitor and change its state.

The capacitor needs to be refreshed after regular intervals to maintain the charge in the capacitor. This is the reason it is called dynamic RAM as it needs to be refreshed continuously to maintain its data or it

would forget what it is holding. This is achieved by placing the memory on a refresh circuit that rewrites the data several hundred times per second. The access time in DRAM is around 60 nanoseconds.

We can say that a capacitor is like a box that stores electrons. To store a ?1? in the memory cell, the box is filled with electrons. Whereas, to store a ?0?, it is emptied. The drawback is that the box has a leak. In just a few milliseconds the full box becomes empty. So, to make dynamic memory work, the CPU or Memory controller has to recharge all the capacitors before they discharge. To achieve this, the memory controller reads the memory and then writes it right back. This is called refreshing the memory and this process continues automatically thousands of times per second. So, this type of RAM needs to be dynamically refreshed all the time.

Types of DRAM:

i) Asynchronous DRAM:
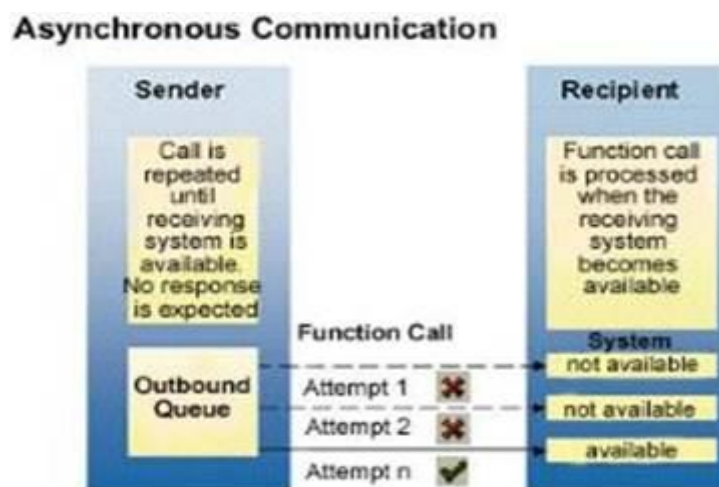
This type of DRAM is not synchronized with the CPU clock. So, the drawback with this RAM is that CPU could not know the exact timing at which the data would be available from the RAM on the input-output bus. This limitation was overcome by the next generation of RAM, which is known as the synchronous DRAM.

ii) Synchronous DRAM:
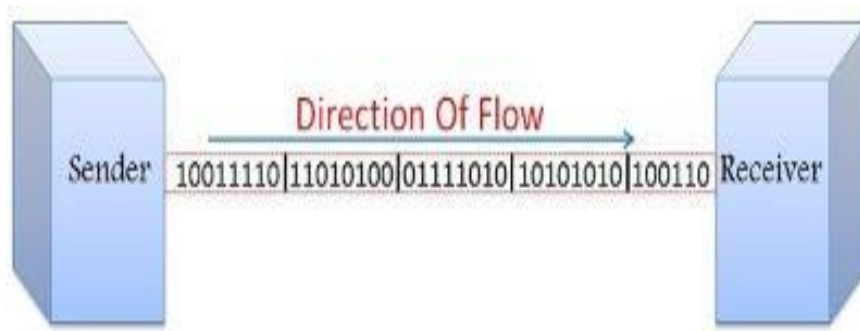
SDRAM (Synchronous DRAM) began to appear in late 1996. In SDRAM, the RAM was synchronized with the CPU clock. It allowed the CPU or to be precise the memory controller to know the exact clock cycle or timing or the number of cycles after which the data will be available on the bus. So, the CPU does not need for the memory accesses and thus the memory read and writes speed can be increased. The SDRAM is also known as the single data rate SDRAM (SDR SDRAM) as data is transferred only at each rising edge of the clock cycle. See the image in the following description.

iii) DDR SDRAM:
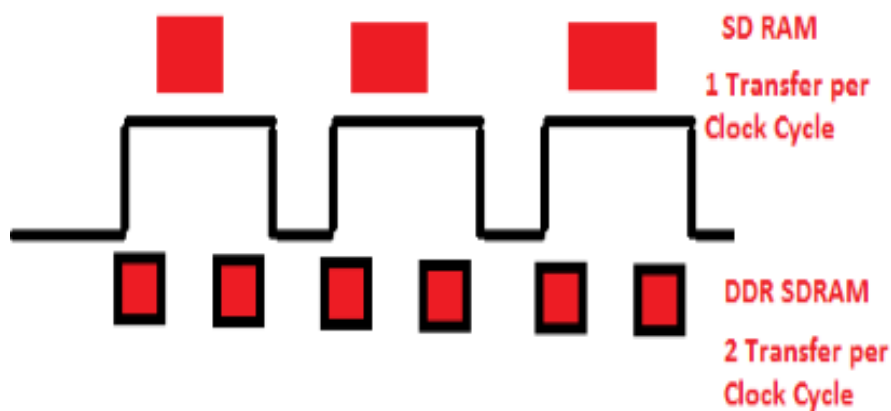
The next generation of the synchronous DRAM is known as the DDR RAM. It was developed to overcome the limitations of SDRAM and was used in PC memory at the beginning of the year 2000. In DDR SDRAM (DDR RAM), the data is transferred twice during each clock cycle; during the positive edge (rising edge) and the negative edge (falling edge) of the cycle. So, it is known as the double data rate SDRAM.

There are different generations of DDR SDRAM which include DDR1, DDR2, DDR3, and DDR4. Today, the memory that we use inside the desktop, laptop, mobile, etc., is mostly either DDR3 or DDR4 RAM. Types of DDR SDRAM:

a) DDR1 SDRAM:
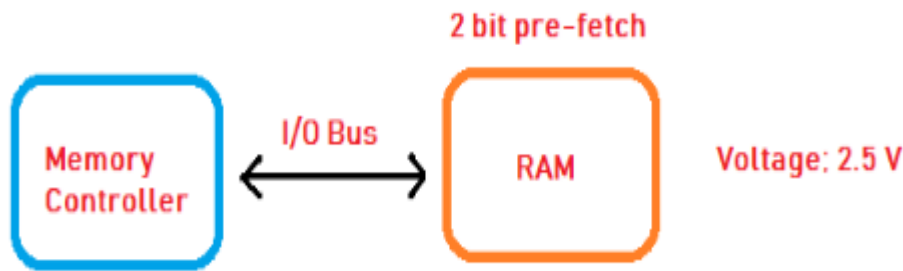
DDR1 SDRAM is the first advanced version of SDRAM. In this RAM, the voltage was reduced from 3.3 V to 2.5 V. The data is transferred during both the rising as well as the falling edge of the clock cycle. So, in each clock cycle, instead of 1 bit, 2 bits are being pre-fetched which is commonly known as the 2-bit pre-fetch. It is mostly operated in the range of 133 MHz to the 200 MHz.

Furthermore, the data rate at the input-output bus is double the clock frequency because the data is transferred during both the rising as well as falling edge. So, if a DDR1 RAM is operating at 133 MHz, the data rate would be double, 266 Mega transfer per second.

b) DDR2 SDRAM:
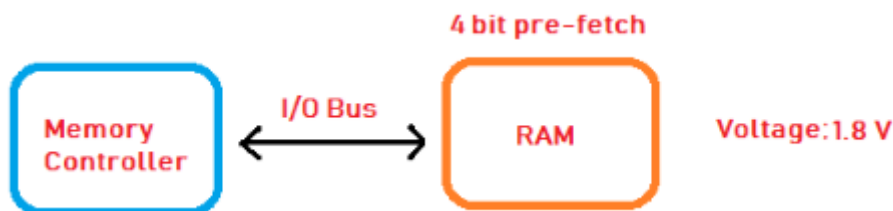
It is an advanced version of DDR1. It operates at 1.8 V instead of 2.5V. Its data rate is double the data rate of the previous generation due to the increase in the number of bits that are pre-fetched during each cycle; 4 bits are pre-fetched instead of 2 bits. The internal bus width of this RAM has been doubled. For example, if the input-output bus is 64 bits wide, the internal bus width of it will be equal to 128 bits. So, a single cycle can handle double the amount of data.

c) DDR3 SDRAM:
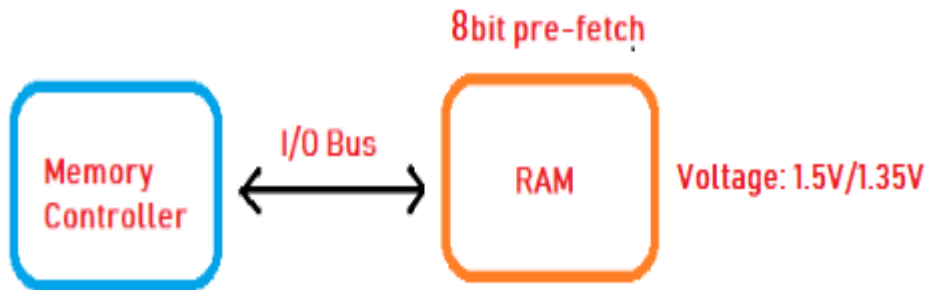
In this version, the voltage is further reduced from 1.8 V to the 1.5 V. The data rate has been doubled than the previous generation RAM as the number of bits that are pre-fetched has been increased from 4 bits to the 8 bits. We can say that the internal data bus width of RAM has been increased 2 times than that of the last generation.

d) DDR4 SDRAM:
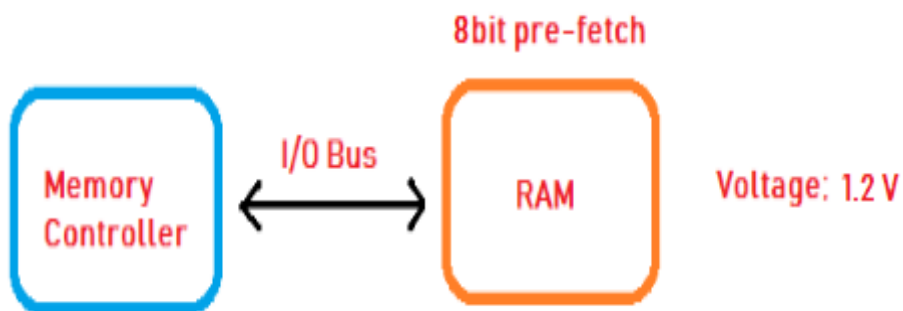
In this version, the operating voltage is further reduced from 1.5 V to 1.2 V, but the number of bits that can be pre-fetched is same as the previous generation; 8 bits per cycle. The Internal clock frequency of the RAM is double of the previous version. If you are operating at 400 MHz the clock frequency of the input-output bus would be four times, 1600 MHz and the transfer rate would be equal to 3200 Mega transfer per second.

Difference between Static RAM and Dynamic RAM:

SRAM	DRAM
SRAM stands for Static Random Access Memory.	DRAM stands for Dynamic Random Access Memory.
SRAM stores information with the help of transistors.	DRAM stores data using capacitors.
In SRAM, capacitors are not used which means refresh is not needed.	In DRAM, contents of a capacitor need to be refreshed periodically.
SRAM provides faster speed of data read/write.	DRAM provides slower speed of data read/write.
SRAM consumes more power.	DRAM consumes less power.
SRAM has long data life.	DRAM has short data life.
SRAM are expensive.	DRAM are less expensive.
SRAM is a low density device.	DRAM is a high density device.
SRAMs are used as cache memory in computer and other computing devices.	DRAMs are used as main memory in computer systems.

3.2.3.2 What is ROM?

ROM, which stands for read only memory, is a memory device or storage medium that stores information permanently. It is also the primary memory unit of a computer along with the random access memory (RAM). It is called read only memory as we can only read the programs and data stored on it but cannot write on it. It is restricted to reading words that are permanently stored within the unit.

The manufacturer of ROM fills the programs into the ROM at the time of manufacturing the ROM. After this, the content of the ROM can't be altered, which means you can't reprogram, rewrite, or erase its content later. However, there are some types of ROM where you can modify the data.

ROM contains special internal electronic fuses that can be programmed for a specific interconnection pattern (information). The binary information stored in the chip is specified by the designer and then embedded in the unit at the time of manufacturing to form the required interconnection pattern (information). Once the pattern (information) is established, it stays within the unit even when the power is turned off. So, it is a non-volatile memory as it holds the information even when the power is turned off, or you shut down your computer.

The information is added to a RAM in the form of bits by a process known as programming the ROM as bits are stored in the hardware configuration of the device. So, ROM is a Programmable Logic Device (PLD).

A simple example of ROM is the cartridge used in video game consoles that allows the system to run many games. The data which is stored permanently on personal computers and other electronic devices like Smartphone's, tablets, TV, AC, etc. is also an example of ROM.

For example, when you start your computer, the screen does not appear instantly. It takes time to appear as there are startup instructions stored in ROM which are required to start the computer during the booting process. The work of the booting process is to start the computer. It loads the operating system into the main memory (RAM) installed on your computer. The BIOS program, which is also present in the computer memory (ROM) is used by the microprocessor of the computer to start the computer during the booting process. It allows you to open the computer and connects the computer with the operating system.

ROM is also used to store Firmware, which is a software program which remains attached to the hardware or programmed on a hardware device like a keyboard, hard drive, video cards, etc. It is stored in the flash ROM of a hardware device. It provides instructions to the device to communicate and interact with other devices.

Block Diagram of ROM:
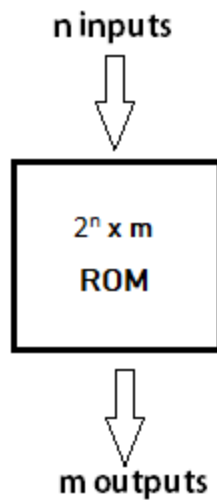
The block of ROM has 'n' input lines and 'm' output lines. Each bit combination of the input variables is known as an address. Each bit combination that comes out through output lines is called a word. The number of bits per word is equal to the number of output lines, m.

The address of a binary number refers to one of the addresses of n variables. So, the number of possible addresses with 'n' input variables is 2n. An output word has a unique address, and as there are 2n distinct addresses in a ROM, there are 2n separate words in the ROM. The words on the output lines at a given time depends on the address value applied to the input lines.

3.2.3.2.1   Internal Structure of ROM:

The internal structure comprises two basic components: decoder and OR gates. A decoder is a circuit that decodes an encoded form (such as binary coded decimal, BCD) to a decimal form. So, the input is in binary form, and the output is its decimal equivalent. All the OR gates present in the ROM will have outputs of the decoder as their output. Let us take an example of 64 x 4 ROM. The structure is shown in the following image.

Internal construction of 64x4 ROM
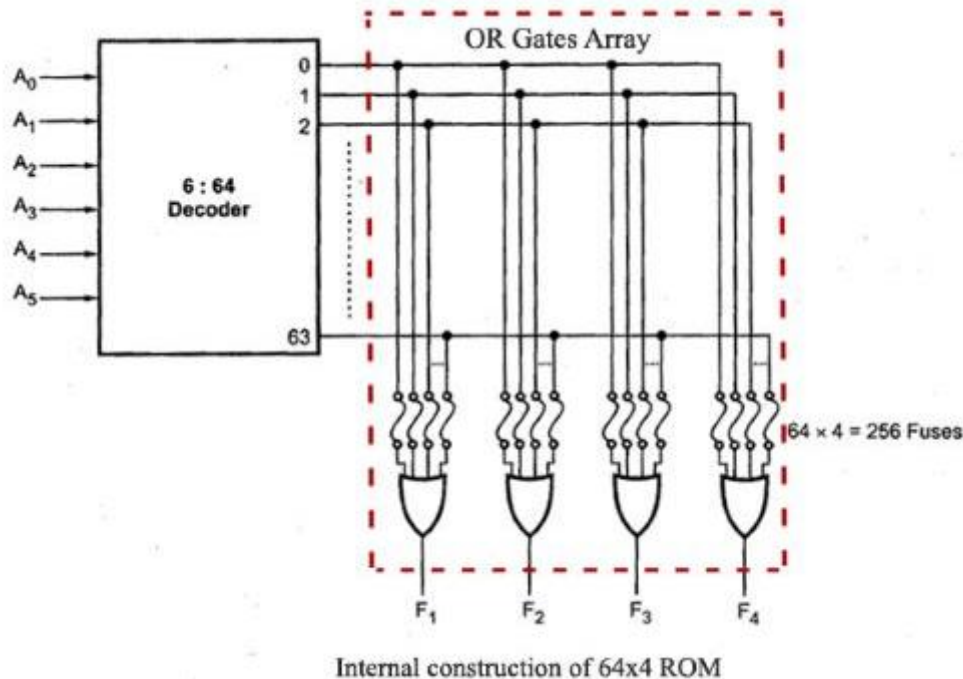
This Read Only Memory consists of 64 words of 4 bits each. So, there would be four output lines, and one of the 64 words available on the output lines is determined from the six input lines as we have only six inputs because in this ROM we have 26 = 64, so we can specify 64 addresses or minterms. For each address input, there is a unique selected word. For example, if the input address is 000000, word number 0 will be selected and applied to the output lines. If the input address is 111111, word number 63 is selected and applied to the output lines.

3.2.3.2.2   Types of ROM:

1) Masked Read Only Memory (MROM):

It is the oldest type of read only memory (ROM). It has become obsolete so it is not used anywhere in today's world. It is a hardware memory device in which programs and instructions are stored at the time of manufacturing by the manufacturer. So it is programmed during the manufacturing process and can't be modified, reprogrammed, or erased later.

The MROM chips are made of integrated circuits. Chips send a current through a particular input-output pathway determined by the location of fuses among the rows and columns on the chip. The current has

to pass along a fuse-enabled path, so it can return only via the output the manufacturer chooses. This is the reason the rewriting and any other modification is not impossible in this memory.

2) Programmable Read Only Memory (PROM):

PROM is a blank version of ROM. It is manufactured as blank memory and programmed after manufacturing. We can say that it is kept blank at the time of manufacturing. You can purchase and then program it once using a special tool called a programmer.

In the chip, the current travels through all possible pathways. The programmer can choose one particular path for the current by burning unwanted fuses by sending a high voltage through them. The user has the opportunity to program it or to add data and instructions as per his requirement. Due to this reason, it is also known as the user-programmed ROM as a user can program it.

To write data onto a PROM chip; a device called PROM programmer or PROM burner is used. The process or programming a PROM is known as burning the PROM. Once it is programmed, the data cannot be modified later, so it is also called as one-time programmable device.

Uses: It is used in cell phones, video game consoles, medical devices, RFID tags, and more.

3) Erasable and Programmable Read Only Memory (EPROM):

EPROM is a type of ROM that can be reprogrammed and erased many times. The method to erase the data is very different; it comes with a quartz window through which a specific frequency of ultraviolet light is passed for around 40 minutes to erase the data. So, it retains its content until it is exposed to the ultraviolet light. You need a special device called a PROM programmer or PROM burner to reprogram the EPROM.

Uses: It is used in some micro-controllers to store program, e.g., some versions of Intel 8048 and the Freescale 68HC11.

4) Electrically Erasable and Programmable Read Only Memory (EEPROM):

ROM is a type of read only memory that can be erased and reprogrammed repeatedly, up to 10000 times. It is also known as Flash EEPROM as it is similar to flash memory. It is erased and reprogrammed electrically without using ultraviolet light. Access time is between 45 and 200 nanoseconds.

The data in this memory is written or erased one byte at a time; byte per byte, whereas, in flash memory data is written and erased in blocks. So, it is faster than EEPROM. It is used for storing a small amount of data in computer and electronic systems and devices such as circuit boards.

Uses: The BIOS of a computer is stored in this memory.

5) FLASH ROM:

It is an advanced version of EEPROM. It stores information in an arrangement or array of memory cells made from floating-gate transistors. The advantage of using this memory is that you can delete or write blocks of data around 512 bytes at a particular time. Whereas, in EEPROM, you can delete or write only 1 byte of data at a time. So, this memory is faster than EEPROM.

It can be reprogrammed without removing it from the computer. Its access time is very high, around 45 to 90 nanoseconds. It is also highly durable as it can bear high temperature and intense pressure.

Uses: It is used for storage and transferring data between a personal computer and digital devices. It is used in USB flash drives, MP3 players, digital cameras, modems and solid-state drives (SSDs). The BIOS of many modern computers are stored on a flash memory chip, called flash BIOS.

3.2.4 SECONDARY MEMORY

The secondary storage devices which are built into the computer or connected to the computer are known as a secondary memory of the computer. It is also known as external memory or auxiliary storage.

The secondary memory is accessed indirectly via input/output operations. It is non-volatile, so permanently stores the data even when the computer is turned off or until this data is overwritten or deleted. The CPU can't directly access the secondary memory. First, the secondary memory data is transferred to primary memory then the CPU can access it.

Some of the secondary memory or storage devices are described below:

3.2.4.1 Hard Disk:

It is a rigid magnetic disc that is used to store data. It permanently stores data and is located within a drive unit.

The hard disk is also known as a hard drive. It is a rigid magnetic disc that stores data permanently, as it is a non-volatile storage device. The hard disk is located within a drive unit on the computer's motherboard and comprises one or more platters packed in an air-sealed casing. The data is written on the platters by moving a magnetic head over the platters as they spin. The data stored on a computer's hard drive generally includes the operating system, installed software, and the user's files and programs, including pictures, music, videos, text documents, etc.

Components of Hard Drive:

The main components of a hard drive include a head actuator, read/write actuator arm, read/write head, platter, and spindle. A circuit board, which is called the disk controller or interface board, is present on the back of a hard drive. It allows the hard drive to communicate with the computer.

3.2.4.2 Solid-state Drive:

SSD (Solid State Drive) is also a non-volatile storage medium that is used to hold and access data. Unlike a hard drive, it does not have moving components, so it offers many advantages over SSD, such as faster access time, noiseless operation, less power consumption, and more.

As the cost of SSD has come down, it has become an ideal replacement for a standard hard drive in desktop and laptop computers. It is also suitable for notebooks, and tablets that don't require lots of storage.

3.2.4.3 Pen drive:

Pen drive is a compact secondary storage device. It is also known as a USB flash drive, thumb drive or a jump drive. It connects to a computer via a USB port. It is commonly used to store and transfer data between computers. For example, you can write a report using a computer and then copy or transfer it in the pen drive. Later, you can connect this pen drive to a computer to see or edit your report. You can also store your important documents and pictures, music, videos in the pen drive and keep it at a safe place.

Pen drive does not have movable parts; it comprises an integrated circuit memory chip that stores the data. This chip is housed inside a plastic or aluminum casing. The data storage capacity of the pen drive generally ranges from 2 GB to 128 GB. Furthermore, it is a plug and play device as you don't need additional drives, software, or hardware to use it.

3.2.4.4 SD Card:

SD Card stands for Secure Digital Card. It is most often used in portable and mobile devices such as smartphones and digital cameras. You can remove it from your device and see the things stored in it using a computer with a card reader.

There are many memory chips inside the SD card that store the data; it does not have moving parts. SD cards are not created equal, so they may differ from each other in terms of speed, physical sizes, and capacity. For example, standard SD cards, mini SD cards, and micro SD cards.

3.2.4.5 Compact Disk (CD):

Compact Disk is a portable secondary storage device in the shape of a round medium disk. It is made of polycarbonate plastic. The concept of CD was co-developed by Philips and Sony in 1982. The first CD was created on 17 August 1982 at the workshop of Philips in Germany.

In the beginning, it was used for storing and playing sound recordings, later it was used for various purposes such as for storing documents, audio files, videos, and other data like software programs in a CD.

Physical characteristics of a CD/ Structure of CD:

A standard CD is around 5 inches in diameter and 0.05 inches in thickness. It is made of a clear polycarbonate plastic substrate, a reflective metallic layer, and a clear coating of acrylic plastic. These thin circular layers are attached one on top of another as described below:

- A polycarbonate disc layer at the bottom has the data encoded by creating lands and pits.
- The polycarbonate disc layer is coated with a thin aluminium layer that reflects the laser.
- The reflective aluminium layer is coated with a lacquer layer to prevent oxidation in order to protect the below layers. It is generally spin coated directly on the top of the reflective layer.

- The label print is applied on the lacquer layer, or artwork is screen printed on the top of the disc on the lacquer layer by offset printing or screen printing.

How Does a CD Work?

The data or information is stored or recorded or encoded in CD digitally using a laser beam that etches tiny indentations or bumps on its surface. The bump is called a pit, which represents the number 0. Space, where the bump is not created, is called land, and it represents the number 1. Thus, the data is encoded into a compact disc by creating pits (0) and lands (1). The CD players use laser technology to read the optically recorded data.

3.2.4.6 DVD:

DVD is short for digital versatile disc or digital video disc. It is a type of optical media used for storing optical data. Although it has the same size as a CD, its storage capacity is much more than a CD. So, it is widely used for storing and viewing movies and to distribute software programs as they are too large to fit on a CD. DVD was co-developed by Sony, Panasonic, Philips, and Toshiba in 1995.

Types of DVDs:

DVDs can be divided into three main categories which are as follows:

DVD-ROM (Read-Only): These types of DVDs come with media already recorded on them, such as movie dvds. As the name suggests, data on these discs cannot be erased or added, so these discs are known as a read-only or non-writable DVD.

DVD-R (Writable): It allows you to record or write information to the DVD. However, you can write information only once as it becomes a read-only DVD once it is full.

DVD-RW (Rewritable or Erasable): This type of discs can be erased, written, or recorded multiple times.

3.3   MEMORY UNITS

Memory units are used to measure and represent data. Some of the commonly used memory units are:

1) **Bit**: The computer memory units start from bit. A bit is the smallest memory unit to measure data stored in main memory and storage devices. A bit can have only one binary value out of 0 and 1.

2) **Byte**: It is the fundamental unit to measure data. It contains 8 bits or is equal to 8 bits. Thus a byte can represent 2*8 or 256 values.

3) **Kilobyte**: A kilobyte contains 1024 bytes.

4) **Megabyte:** A megabyte contains 1024 kilobytes.

5) **Gigabyte:** A gigabyte contains 1024 megabyte.

6) **Terabyte**: A terabyte contains 1024 gigabytes.

3.4   INTRODUCTION TO MODERN CPU and PROCESSOR

A processor, or "microprocessor," is a small chip that resides in computers and other electronic devices. Its basic job is to receive input and provide the appropriate output. While this may seem like a simple task, modern processors can handle trillions of calculations per second.

The central processor of a computer is also known as the CPU, or "central processing unit." This processor handles all the basic system instructions, such as processing mouse and keyboard input and running applications. Most desktop computers contain a CPU developed by either Intel or AMD, both of which use the x86 processor architecture. Mobile devices, such as laptops and tablets may use Intel and AMD CPUs, but can also use specific mobile processors developed by companies like ARM or Apple.

Modern CPUs often include multiple processing cores, which work together to process instructions. While these "cores" are contained in one physical unit, they are actually individual processors. In fact, if you view your computer's performance with a system monitoring utility like Windows Task Manager (Windows) or Activity Monitor (Mac OS X), you will see separate graphs for each processor. Processors that include two cores are called dual-core processors, while those with four cores are called quad-core processors. Some high-end workstations contain multiple CPUs with multiple cores, allowing a single machine to have eight, twelve, or even more processing cores.

Besides the central processing unit, most desktop and laptop computers also include a GPU. This processor is specifically designed for rendering graphics that are output on a monitor. Desktop computers often have a video card that contains the GPU, while mobile devices usually contain a graphics chip that is integrated into the motherboard. By using separate processors for system and graphics processing, computers are able to handle graphic-intensive applications more efficiently.

3.5   CHECK YOUR PROGRESS

A.   Fill in the blanks:

1. Storage which stores or retains data after power off is called _____.
2. _____ memories must be refreshed many times per second.
3. Magnetic tape is not practical for applications where data must be quickly recalled because tape is _____.
4. Main memory works in conjunction with _____.
5. SRAM stands for _____.

B.   State whether the following statements are True or False:

1. Magnetic Tape used random access method.
2. Cache memory is placed in between the CPU and ROM.
3. Primary memory is usually referred to as RAM.
4. A group of 8 bits is called a byte.
5. ROM is a volatile memory

3.6   SUMMARY

The basic computer model works on stored program concept. The computer architecture has been developed to be able to store data, instructions and storage space for temporary variables. This storage space is supplemented by internal (primary storage devices) and external (secondary storage devices). Variety of storage devices have been developed depending upon the need and suitability of the application. This lesson discussed the different types of primary and secondary storage devices.

3.7   KEYWORDS

Computer memory: is any physical device capable of storing information.

Register memory is the smallest and fastest memory in a computer. It is not a part of the main memory and is located in the CPU in the form of registers.

Cache memory is an extremely fast memory type that acts as a buffer between RAM and the CPU.

Primary memory is computer memory that is accessed directly by the CPU.

Secondary memory is where programs and data are kept on a long-term basis. Common secondary storage devices are the hard disk and optical disks.

3.8   SELF-ASSESSMENT TEST

1.   Define computer memory? Why we need memory?

2.   Describe the register memory. Discuss various types of registers.

3.   What do you mean by cache memory? How cache memory works with CPU?

4.   Discuss different types of Cache memory.

5.   What do you mean by primary memory? Explain different types of primary memory.

6.   What do you mean by secondary memory? Explain different types of secondary memory.

7.   Differentiate between SRAM and DRAM.

8.   Discuss the various types of ROM in detail.

9.   Discuss the different types of RAM in detail.

3.9   ANSWERS TO CHECK YOUR PROGRESS

Check your Progress A

1. Non-volatile memory

2. Dynamic RAM

3. A sequential-access medium

4. CPU

5. Static Random-Access Memory

Check Your Progress B

1. False

2. False

3. True

4. True

5. False

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Lesson: 4	Updated By: Mr. Balwant

INTRODUCTION TO COMPUTER SOFTWARE AND PROGRAMMING LANGUAGE

Structure

4.0   LEARNING OBJECTIVES

The computer, as a machine, can do nothing for you without the software. Software is required for the functioning of computer. Software programs instruct computer about the actions to be performed, so as to get the desired output. The purpose of this chapter is to introduce you to the different categories of software.

In this lesson you will learn about

- ✓   Computer software and its types
- ✓   System software

     o   For management and functionality of computer—Operating system, device drivers, and system utilities

     o   For development of application software—Programming languages, translator

- ✓   software, loader, and linker
- ✓   Operating system
- ✓   Device drivers
- ✓   System utility software—Anti-virus, data compression, cryptographic, disk compression,
- ✓   disk partitioning, disk cleaner, backup, system profiling, and network manager
- ✓   Programming language—Machine language, assembly language, high-level language, and different generations of programming languages
- ✓   Translator software—Assembler, compiler, and interpreter
- ✓   Linker, and loader software
- ✓   Application software—Word processing software, image processing software, accounting
- ✓   software, spreadsheet software, presentation software, CAD/CAM software, and web browser software

4.1   INTRODUCTION

Computer software, or simply software, is a collection of data or computer instructions that tell the computer how to work. This is in contrast to physical hardware, from which the system is built and actually performs the work. Computer software includes computer programs, libraries and related non-executable data, such as online documentation or digital media. Computer hardware and software require each other and neither can be realistically used on its own.

At the lowest programming level, executable code consists of machine language instructions supported by an individual processor—typically a central processing unit (CPU) or a graphics processing unit (GPU). A machine language consists of groups of binary values signifying processor instructions that change the state of the computer from its preceding state. For example, an instruction may change the value stored in a particular storage location in the computer—an effect that is not directly observable to the user. An instruction may also invoke one of many input or output operations, for example displaying some text on a computer screen; causing state changes which should be visible to the user. The processor executes the instructions in the order they are provided, unless it is instructed to "jump" to a different instruction, or is interrupted by the operating system. As of 2015, most personal computers, Smartphone devices and servers have processors with multiple execution units or multiple processors performing computation together, and computing has become a much more concurrent activity than in the past.

The majority of software is written in high-level programming languages. They are easier and more efficient for programmers because they are closer to natural languages than machine languages. High-level languages are translated into machine language using a compiler or an interpreter or a combination of the two. Software may also be written in a low-level assembly language, which has strong correspondence to the computer's machine language instructions and is translated into machine language using an assembler. In this lesson, we will discuss the different categories of computer software.

4.1.1 TYPES OF SOFTWARE

On virtually all computer platforms, software can be grouped into a few broad categories.

Based on the goal, computer software can be divided into:

4.1.1.1 System Software

Which is software for managing computer hardware behavior, as to provide basic functionalities that are required by users, or for other software to run properly, if at all? System software provides basic functionality to the computer. System software is required for the working of computer itself. The user of computer does not need to be aware about the functioning of system software, while using the computer. For example, when you buy a computer, the system software would also include different device drivers. When you request for using any of the devices, the corresponding device driver software interacts with the hardware device to perform the specified request. If the appropriate device driver for any device, say a particular model of a printer, is installed on the computer, the user does not need to know about the device driver, while printing on this printer.

It only runs in the background of your device, at the most basic level while you use other application software. This is why system software is also called **"low-level software"**.
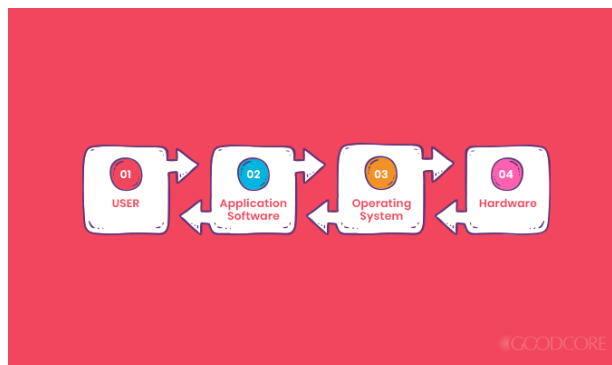
Example of System Software

The purposes of the system software are:

o   To provide basic functionality to computer,

o   To control computer hardware, and

o   To act as an interface between user, application software and computer hardware.

On the basis of their functionality, system software may be broadly divided into two categories:

➢ System software for the management and functionality of computer relates to the functioning of different components of the computer, like, processor, input and output devices etc. System software is required for managing the operations performed by the components of computer and the devices attached to the computer. It provides support for various services, as requested by the application software. Operating system, device drivers, and system utilities constitute the system software for management of computer and its resources.

➢ System software for the development of application software provides services required for the development and execution of application software. System software provides the software tools required for the development of application software. The programming language software, translator software, loader, and linker are also categorized as system software, and are required for the application software development.

Features of a system software

- Close to the system

- Fast in speed

- Difficult to design

- Difficult to understand

- Less interactive

- Smaller in size

- Difficult to manipulate

- Generally written in low-level language
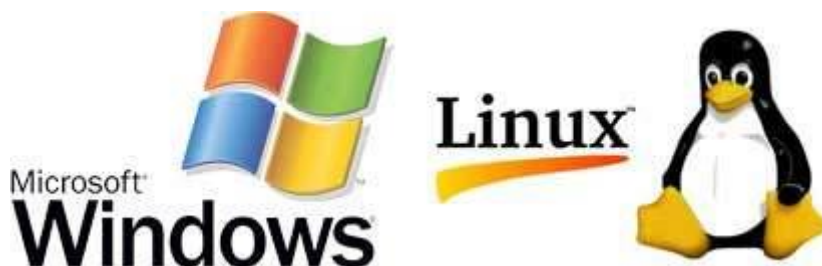
System software is also designed for providing a platform for running application software, and it includes the following:

Operating system

Which are essential collections of software that manage resources and provide common services for other software that runs "on top" of them. Supervisory programs, boot loaders, shells and window systems are core parts of operating systems.

All of your computer-like devices run on an operating system, including your desktop, laptop, Smartphone, and tablet, etc. Here is a list of examples of an operating system. Let's take a look and you might spot some familiar names of system software:

For desktop computers, laptops and tablets:

- Microsoft Windows

- Mac (for Apple devices)

- Linux

For Smartphone's:

- Apple's iOS

- Google's Android

- Windows Phone OS

In practice, an operating system comes bundled with additional software (including application software) so that a user can potentially do some work with a computer that only has one operating system.

➢ It controls the execution of different programs to prevent occurrence of   error.

➢ It provides a convenient interface to the user in the form of commands and

  graphical interface, which facilitates the use of computer.

➢ Some available operating systems are Microsoft Disk Operating System (MS-DOS), Windows 7, Windows XP, Linux, UNIX, and Mac OS X Snow Leopard

Device drivers

Which operate or control a particular type of device that is attached to a computer. Each device needs at least one corresponding device driver; because a computer typically has at minimum at least one input device and at least one output device, a computer typically needs more than one device driver.

➢   Driver software is often classified as one of the types of system software.

➢   They operate and control devices and peripherals plugged into a computer.

➢   Drivers are important because they enable the devices to perform their designated tasks. They do this by translating commands of an Operating System for the Hardware or devices, assigning duties.

➢   Therefore, each device connected with your computer requires at least one device driver to function.
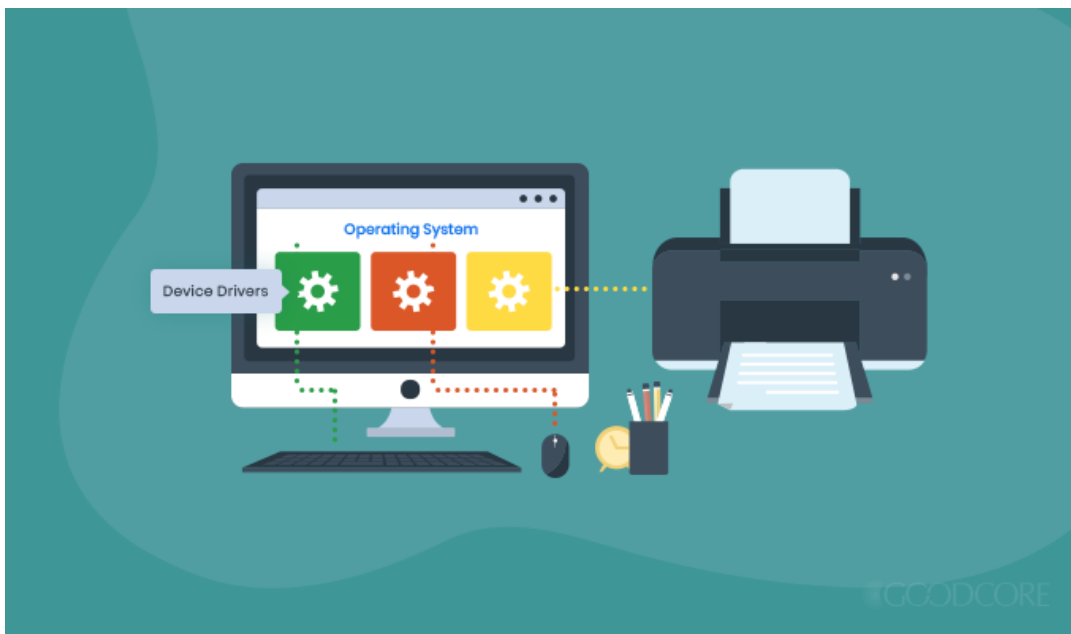
Driver Software

➢   Since there are thousands of types of devices, drivers make the job of your system software easier by allowing it to communicate through a standardized language.

➢   Some examples of driver software that you may be familiar with are:

•   Printer Driver

-         Mouse Driver

-         Network Card

Usually, the operating system comes built-in with drivers for mouse, keyboard, and printers by default. They often do not require third-party installations. But for some advanced devices, you may need to install the driver externally. Moreover, if you use multiple operating systems like Linux, Windows, and Mac, then each of these supports different variants of drivers. For them, separate drivers need to be maintained for each.

Utilities

Which are computer programs designed to assist users in the maintenance and care of their computers. Some features of utility software include:

- Antivirus and security software

- File compressor

- Disk cleaner

- Disk defragmentation software

- Data backup software

➢   Backup Utility to make a copy of all information stored on the disk. It also restores the backed up contents in case of disk failure.

➢   System Profiling Utility provides detailed information about the software installed on the computer and the hardware attached to it.

➢   Network Managers to check the computer network and to log events.

The system utilities on a computer working on Windows XP OS can be viewed by clicking **<Start><All Programs><Accessories><System Tools>**

Malicious Software

which is software that is developed to harm and disrupt computers. As such, malware is undesirable. Malware is closely associated with computer-related crimes.

Programming tools

Programming tools are also software in the form of programs or applications that software developers (also known as *programmers, coders, hackers* or *software engineers*) use to create, debug, maintain (i.e. improve or fix), or otherwise support software.

4.1.1.2 APPLICATION SOFTWARE

Which is software that uses the computer system to perform special functions or provide entertainment functions beyond the basic operation of the computer itself? There are many different types of application software, because the range of tasks that can be performed with a modern computer is so large.

As a user of technology, Application Software or 'Apps' are what you engage with the most. These types of computer software are productive end-user programs that help you perform tasks. Following are some examples of application software that allow you to do specific work:

- **Word Processing Software:** For writing letter, reports, documents etc. (e.g. MS-WORD).

- **Image Processing Software:** For assisting in drawing and manipulating graphics (e.g. Adobe Photoshop).

- **Accounting Software:** For assisting in accounting information, salary, tax returns (Tally software).

- **MS Excel:** It is spreadsheet software that you can use for presenting and analyzing data.

- **Photoshop:** It is a photo editing application software by Adobe. You can use it to visually enhance, catalog and share your pictures.

- **Skype:** It is an online communication app that you can use for video chat, voice calling and instant messaging.

- **Spreadsheet Software:** Used for creating budget, tables etc. (e.g. MS-Excel).
- **Presentation Software:** To make presentations, slide shows (e.g. MS-PowerPoint)
- **Suite of Software having Word Processor, Spreadsheet and Presentation Software:** Some examples are MS-Office, Google Docs, Sun Open office, Apple i work.
- **CAD/CAM Software:** To assist in architectural design. (e.g. AutoCAD, Autodesk)

- **Geographic Information Systems:** It captures, stores, analyzes, manages, and presents data, images and maps that are linked to different locations. (e.g. ArcGIS)

- **Web Browser Software:** To access the World Wide Web to search documents, sounds, images etc. (e.g. Internet Explorer, Netscape Communicator, Chrome)

Application Software

Examples of Application software are the following −

- Payroll Software

- Student Record Software

- Inventory Management Software

- Income Tax Software

- Railways Reservation Software

- Microsoft Office Suite Software

- Microsoft Word

- Microsoft Excel

- Microsoft PowerPoint

Features of application software are as follows −

- Close to the user

- Easy to design

- More interactive

- Slow in speed

- Generally written in high-level language

- Easy to understand

Software applications are also referred to as non-essential software. They are installed and operated on a computer-based on the user's requirement. There are plenty of application software that you can use to perform different tasks. The number of such apps keeps increasing with technological advances and the evolving needs of the users. You can categorize these software types into different groups, as shown in the following table:

Application Software Type	Examples
Word processing software: Tools that are used to create word sheets and type documents etc.	Microsoft Word, WordPad, AppleWorks and Notepad

Application Software Type	Examples
Spreadsheet software: Software used to compute quantitative data.	Apple Numbers, Microsoft Excel and Quattro Pro
Database software: Used to store data and sort information.	Oracle, MS Access and FileMaker Pro
Application Suites: A collection of related programs sold as a package.	Open Office, Microsoft Office
Multimedia software: Tools used for a mixture of audio, video, image and text content.	Real Player, Media Player
Communication Software: Tools that connect systems and allow text, audio, and video-based communication.	MS NetMeeting, IRC, ICQ
Internet Browsers: Used to access and view websites.	Netscape Navigator, MS Internet Explorer, and Google Chrome
Email Programs: Software used for emailing.	Microsoft Outlook, Gmail, Apple Mail

4.1.2 SOFTWARE ACQUISITION

Different kinds of software are made available for use to users in different ways. The user may have to purchase the software, can download for free from the Internet, or can get it bundled along with the hardware. Nowadays with the advent of Cloud computing, many application software are also available

on the cloud for use through the Internet, e.g. Google Docs. The different ways in which the software are made available to users are:

Retail Software is off-the-shelf software sold in retail stores. It comes with printed manuals and installation instructions. For example, Microsoft Windows operating system.

OEM Software stands for "Original Equipment Manufacturer" software. It refers to software which is sold, and bundled with hardware. Microsoft sells its operating system as OEM software to hardware dealers. OEM software is sold at reduced price, without the manuals, packaging and installation instructions. For example, Dell computers are sold with the "Windows 7" OS pre-loaded on them.

Demo Software is designed to demonstrate what a purchased version of the software is capable of doing and provides a restricted set of features. To use the software, the user must buy a fully- functional version.

Shareware on the other hand, are software applications that are paid programs, but are made available for free for a limited period of time known as 'trial period'. You can use the software without any charges for the trial period but you will be asked to purchase it for use after the trial ends. Shareware allows you to test drive the software before you actually invest in purchasing it. Some examples of Shareware that you must be familiar with are:

- Adobe Photoshop

- Adobe Illustrator

- Netflix App

- Matlab

- McAfee Antivirus

Freeware is software that is free for personal use. It is downloadable from the Internet. The commercial use of this software may require a paid license. The author of the freeware software is the owner of the software, though others may use it for free. The users abide by the license terms, where the user cannot make changes to it, or sell it to someone else.

Some well-known examples of freeware are:

- Google Chrome

- Skype

- Instagram

- Snap chat

- Adobe reader

Although they all fall under the category of Application or end-user software, they can further be categorized as freeware because they are free for you to use.

Public Domain Software is free software. Unlike freeware, public domain software does not have a copyright owner or license restrictions. The source code is publicly available for anyone to use. Public domain software can be modified by the user.

Open-Source Software

 is software whose source code is available and can be customized and altered within the specified guidelines laid down by the creator. Unlike public domain software, open-source software has restrictions on their use and modification, redistribution limitations, and copyrights are some examples of open-source software.

Common examples of open source software used by programmers are:

- LibreOffice

- PHP

- GNU Image Manipulation Program (GIMP)

- Linux

- Apache

- Firefox

- Open Office

Closed Source Software

These are the types of software that are non-free for the programmers. For this software, the source code is the intellectual property of software publishers It is also called **'proprietary software'** since only the original authors can copy, modify and share the software. Following are some of the most common examples of closed-source software:

- .Net

- Java

- Android

- Microsoft Office

- Adobe Photoshop

4.1.3 INTRODUCTION OF PROGRAMMING LANGUAGES

Software is written in one or more programming languages; there are many programming languages in existence, and each has at least one implementation, each of which consists of its own set of programming tools. These tools may be relatively self-contained programs such as compilers, debuggers, interpreters, linkers, and text editors, that can be combined together to accomplish a task; or they may form an integrated development environment (IDE), which combines much or all of the functionality of such self-contained tools.

A programming language is a vocabulary and set of grammatical rules for instructing a computer or computing device to perform specific tasks. The term *programming language* usually refers to high-level languages, such as BASIC, C, C++, COBOL, JAVA, FORTRAN, Ada, and Pascal. Each programming language has a unique set of keywords (words that it understands) and a special syntax for organizing program instructions.
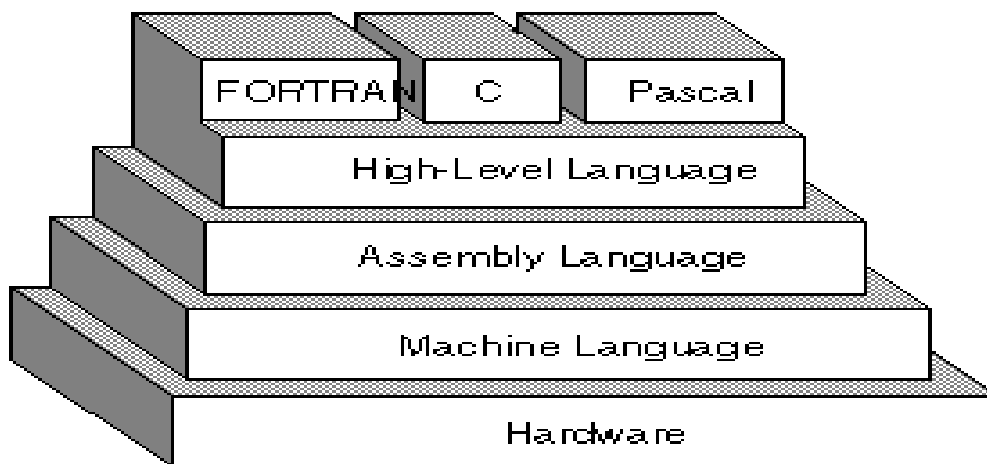
Computer Program

➢   **A program is a set of instructions following the rules of the chosen language.**

➢   **Without programs, computers are useless.**

➢   **A program is like a recipe. It contains a list of ingredients (called variables) and a list of directions (called statements) that tell the computer what to do with the variables.**

4.1.3.1 TYPES OF PROGRAMMING LANGUAGE

There are three types of programming language: –

➢   Machine language (Low-level language)

➢   Assembly language (Low-level language)

➢   High-level language

 Low-level languages are closer to the language used by a computer, while high-level languages are closer to human languages.

4.1.3.1.1 Machine Language

➢   Machine language is a collection of binary digits or bits that the computer reads and interprets. Machine languages are the only languages understood by computers.

➢   While easily understood by computers, machine languages are almost impossible for humans to use because they consist entirely of numbers.

Machine Language

169 1 160 0 153 0 128 153 0 129 153 130 153 0 131 200 208 241 96

High level language

FOR I=1 TO 1000: PRINT "A"; NEXT I

➢   Machine Language Example:

o   Let us say that an electric toothbrush has a processor and main memory.

o   The processor can rotate the bristles left and right, and can check the on/off switch.

4.1.3.1.2 Assembly Language

A program written in assembly language consists of a series of instructions mnemonics that correspond to a stream of executable instructions, when translated by an assembler that can be loaded into memory and executed.

➢   Assembly languages use keywords and symbols, much like English, to form a programming language but at the same time introduce a new problem.

➢   The problem is that the computer doesn't understand the assembly code, so we need a way to convert it to machine code, which the computer does understand.

➢   Assembly language programs are translated into machine language by a program called an assembler.

➢   Example: – Machine language: 10110000 01100001

      Assembly language: mov a1, #061h

      Meaning: Move the hexadecimal value 61 (97 decimal) into the processor register named "a1".

4.1.3.1.3 High Level Language

High-level languages allow us to write computer code using instructions resembling everyday spoken language (for example: print, if, while) which are then translated into machine language to be executed.

➢   Programs written in a high-level language need to be translated into machine language before they can be executed.

➢   Some programming languages use a compiler to perform this translation and others use an interpreter

➢   Examples of High-level Language:

  1.   ADA
  2.   C
  3.   C++
  4.   JAVA
  5.   BASIC
  6.   COBOL
  7.   PASCAL
  8.   PHYTON

4.2   CONVERTING TO MACHINE LANGUAGE

Regardless of what language you use, you eventually need to convert your program into machine language so that the computer can understand it. There are two ways to do this:

1)   Compile the program.

2)   *Interpret* the program.

Compile is to transform a program written in a high-level programming language from source code into object code.

➢   This can be done by using a tool called compiler.

➢   A compiler reads the whole source code and translates it into a complete machine code program to perform the required tasks which is output as a new file.

Interpreter is a program that executes instructions written in a high-level language.

➢   An interpreter reads the source code one instruction or line at a time, converts this line into machine code and executes it.

Computer programming is the process of writing, testing, debugging/troubleshooting, and maintaining the source code of computer programs.

The question of which language is best is one that consumes a lot of time and energy among computer professionals. Every language has its strengths and weaknesses. For example, FORTRAN is a particularly good language for processing numerical data, but it does not lend itself very well to organizing large programs. Pascal is very good for writing well-structured and readable programs, but it is not as flexible as the C programming language. C++ embodies powerful object-oriented features, but it is complex and difficult to learn.

Programs are easier to write, read or understand in high-level languages than in machine language or assembly language. For example, a program written in C++ is easier to understand than a machine language program.

➢ Programs written in high-level languages is the source code which is converted into the object code (machine code) using translator software like interpreter or compiler.

➢ A line of code in high-level program may correspond to more than one line of machine code.

➢ Programs written in high-level languages are easily portable from one computer to another.

4.3 DIFFERENT GENERATIONS OF PROGRAMMING LANGUAGES

In addition to the categorization of programming languages into machine language, assembly language, and high-level language, programming languages are also classified in terms of generations in which they have evolved.

❖ **First Generation Languages**, or 1GL, are low-level languages that are machine language.

❖ **Second Generation Languages**, or 2GL, are also low-level languages that generally consist of assembly languages.

❖ **Third Generation Languages**, or 3GL, are high-level languages such as C.

❖ **Fourth Generation Languages**, or 4GL, are languages that consist of statements similar to statements in a human language. Fourth generation languages are commonly used in database programming and scripts.

❖ **Fifth Generation Languages**, or 5GL, are programming languages that contain visual tools to help develop a program. A good example of a fifth generation language is Visual Basic.

4.4 CHOOSING A PROGRAMMING LANGUAGE

Before you decide on what language to use, you should consider the following:

➢   your server platform

➢   the server software you run

➢   your budget

➢   previous experience in programming

➢   the database you have chosen for your backend

4.5 CHECK YOUR PROGRESS

A.   Fill in the blanks:

1.   --------------------is a program that translates mnemonic statements into executable instructions.

2.   A set of instructions is called ------------.

3.   The instructions that tell a computer how to carry out the processing tasks are referred to as computer.........

4.   The only language which the computer understands is _____.

5.   The software designed to perform a specific task is _____.

B.   State whether the following statements are True or False:

1.   Word processing software is a type of application software.

2.   Binary code comprises of digits from 0 to 9.

3.   Word processor is an example of system software?

4.   Software Package is a group of programs that solve a multiple problem.

5.   Interpreter is a program that reads each of the instructions in mnemonic form and translates it into the machine-language equivalent.

4.6 SUMMARY

In conclusion, there can be multiple ways to classify different types of computer software. The software can be categorized based on the function they perform such as Application software, System software, Programming Software, and Driver software. They can also be classified based on different features such as the nature of source code, accessibility, and cost of usage.

After reading this chapter, I am hopeful you will now be able to clearly identify the types of software around you. A clear understanding of them will help you choose and use the software efficiently.

4.7   KEYWORDS

Freeware: Freeware is software, most often proprietary, that is distributed at no monetary cost to the end user.

Program: A computer program is a collection of instructions that can be executed by a computer to perform a specific task.

Anti-virus utility: Antivirus software is a type of utility used for scanning and removing viruses from your computer.

Application software: Application software is a program or group of programs designed for end users.

Programming languages: A programming language is a formal language comprising a set of instructions that produce various kinds of output.

Assembler: program for converting instructions written in low-level symbolic code into machine code.

High-level language: high-level language is any programming language that enables development of a program in a much more user-friendly programming

Assembly language: programming language that consists of instructions that are mnemonic codes for corresponding machine language

Shareware: software that is available free of charge and often distributed informally for evaluation, after which a fee may be requested for continued use.

Software: Computer software, or simply software, is a collection of data or computer instructions that tell the computer how to work

Interpreter: an interpreter is a computer program that directly executes instructions written in a programming or scripting language, without requiring them previously to have been compiled into a machine language program.

CAD/CAM software: CAD/CAM software is used to design and manufacture prototypes, finished products and production runs.

Linker: a program used with a compiler or assembler to provide links to the libraries needed for an executable program.

Source code: *source code* is any collection of *code*, possibly with comments, written using a human-readable programming language, usually as plain text.

Compiler: A compiler is a computer program that translates computer code written in one programming language into another language

Low-level language: A *low-level language* is a type of *programming language* that contains basic instructions recognized by a computer.

System software: System software is software designed to provide a platform for other software

System utility: *Utility* software is software designed to help to analyze, configure, optimize or maintain a computer

Object code: object code is a sequence of statements or instructions in a computer language, usually a machine code language or an intermediate language

4.8 SELF-ASSESSMENT TEST

1.   What is the purpose of a device driver? What are the uses of system utilities?

2.   Why are programming languages used?

3.   What is the need for programming languages?

4.   Name the three categories of programming languages.

5.   What are low-level languages?

6.   Define source code?

7.   Define object code?

8.   Machine language is hardware dependent—True or False.

9.   List the key features of machine language.

10.   List the key features of assembly language.

11.   List the key features of high-level languages

12.   Why is it difficult to write a program in machine language?

13.   State three features of the program written in machine language?

4.9 ANSWERS TO CHECK YOUR PROGRESS

Check your Progress A

1. Assembler

2. Program

3. Program

4. Binary

5. Application software

Check Your Progress B

1. True

2. False

3. False

4. False

5. False

4.10 REFERENCES/SUGGESTED READINGS

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Course: DBA-104	Author: Mr. Sawtantar Singh
Lesson: 5: IT and Business: Concepts of Data, Information Technology and Effect of IT on Business	**Updated By: Mr. Balwant**

LESSON STRUCTURE

5.0   Learning Objective

5.1   Introduction

5.2   Meaning of Data and its Characteristics

5.3   Meaning of Information and its Characteristics

    5.3.1   Information Needs at Various Levels of Management

    5.3.2   Factors Affecting Information Needs

    5.3.3   Knowledge

    5.3.4   Information Technology

    5.3.5   Effect of IT on Business

5.4   Check Your Progress

5.5   Summary

5.6   Keywords

5.7   Self-Assessment Test

5.8   Answers to Check Your Progress

5.9   References/Suggested Readings

5.0 Learning Objectives

In this chapter you will learn about

- ➢ Definition of data and its characteristics
- ➢ Definition of information and its characteristics

- ➢ Types of information and features of information
- ➢ Need of information at various levels of management
- ➢ Definition of information technology
- ➢ Need of information technology
- ➢ Role of IT in business
- ➢ Benefits of information technology
- ➢ Issues and challenges in information technology
- ➢ Effect of IT on business

5.1   Introduction

We live in the information age. In the same way that the development of industry created the industrial age, the development of information technology systems, and especially the internet, has created the information age. It has been a long-held belief by many philosophers that knowledge is power and that knowledge stems from understanding of information; information, in turn, is the assigning of meaning to data. In the following sections data and information is defined according to three types of views:

- • Objective view
- • Subjective view
- • Inter-subjective view

The objective view tends to assume that all data processing will be automated. The subjective view is very different in that it emphasizes that if data are processed using a computer, the output is still only more highly structured or reformatted data. The inter-subjective view allows for the possibility that data may be processed either by computer or directly by a person.

To develop learners' understanding of information technology, we start by defining these three related concepts. The topics are hierarchical in that:
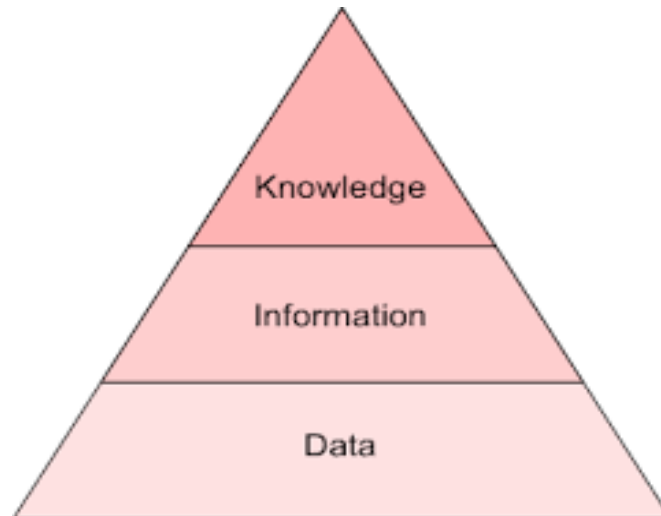
5.2   MEANING OF DATA AND ITS CHARACTERISTICS

5.2.1 Data in Noun form means

- Facts and figures collected together for reference or analysis.

- The quantities, characters, or symbols on which operations are performed by a computer, being stored and transmitted in the form of Information.

Example

- 3, 6, 9, 12

- cat, dog, gerbil, rabbit, cockatoo

- 161.2, 175.3,166.4, 164.7,169.3

These are meaningless so f data. They could be the first four answers in the3x table, a list of household depts. and theheightsof15-year-oldstudentsbut without a context we don't know.

The concept of data as it is used in the syllabus is commonly referred to as 'raw' data – a collection of text, numbers and symbols with no meaning. Data therefore has to be processed, or provided with a context, before it can have meaning.

5.2.2 The objective point of view of data

The objective view makes the following assumptions about data.

- They are factual, resulting from recording of measurable events, or objects.

- They record particular instances of reality.

- Introna [1992: 2.42] takes a purely objective view of data, proclaiming them to be *"Aperspectual, ahistorical, acontextual"*.

- They are explicit as they are in a fixed, recorded form.

- Hence, they can be communicated digitally.

- Modern society generates enormous amounts of data that record details of individual events and objects.

- This objective point of view accepts that the data are validated in the sense that they must be measured and recorded accurately. Certain logic checks as to the reasonableness of the data can be done to try to determine whether the data capturing instruments or processes have failed. Data can be shown to be true if they correspond to reality.

The definitions that follow are examples of those that refer only to the objective characteristics of data:

"Data represent unstructured facts." (Avison and Fitzgerald [1995: 12] quoted by Checkland and Holwell [1998])

"Data: Facts collected from observations or recordings about events, objects or people." (Clare and Loucopoulos [1987: 2] quoted by Checkland and Holwell [1998])

"Data: The raw material of organizational life; it consists of disconnected numbers, words, symbols and syllables relating to the events and processes of the business." (Martin and Powell [1992: 10] quoted by Checkland and Holwell [1998])

5.2.3 The subjective point of view of data

On the other hand the subjective view makes the following assumptions about data.

- The data are not necessarily true or accurate as not all errors can be detected automatically and not everyone will necessarily agree that they are a true representation of a particular fact.

- Some data record subjective opinion, not facts. If data can represent opinions and concepts, they are not truly objective.

- Data represent information and are the only way we can make information explicit.

- Nothing but data can be communicated digitally or in any other way. Only data are transmitted, be it by means of a telecommunications medium, in printed form, or directly without using any technology.

- Data have absolutely no meaning. They acquire meaning only when appropriated by a human recipient.

The definitions that follow are examples of those that include subjective aspects. These definitions include characteristics which have been highlighted as being objective or inter subjective as well.

"*Data: Natural language: facts given, from which others may be deduced, inferred. Info. Processing and computer science: signs or symbols, especially for transmission in communication systems and for processing in computer systems, usually but not always representing information, agreed facts or assumed knowledge; and represented using agreed characters, codes, syntax and structure.*" (Maddison [1989: 168] quoted by Checkland and Holwell [1998])

"*By themselves, data are meaningless; they must be changed into a usable form and placed in a context to have value. Data becomes information when they are transformed to communicate meaning or knowledge, ideas or conclusions.*" (Senn [1982: 62] quoted by Introna [1992])

5.2.4 The inter-subjective point of view

- The purpose of data is to permit communication.

- Information exists before data. Some version of that information can be retrieved from the data.

- Data must be recorded in a formalised structure and knowledge of this structure must be shared as prior shared meaning. They cannot be totally unstructured or no-one would ever be able to process them, but they can be reorganised into more complex structures during subsequent processing. The structure will result from language syntax and semantics if the data are in the form of text, or in the case of numeric or symbolic data, will depend on the predesigned layout of database records, forms or even the position of the data on a physical object. (We know something about what a number plate denotes from its position on a car even if the format is unfamiliar.)

- They are represented using agreed characters, codes, syntax and structure. A predetermined, agreed way of coding and decoding must be associated with this representation. A stream of bits is not data unless someone has the key by means of which it can be decoded.

- The fact that data are both recorded and have some structure makes them potentially useful - they are in a form suitable for subsequent interpretation and processing. Other information can be inferred and deduced from them and they can be associated with other data. They have potential meaning.

- They have an implied context and history. If the data have been captured or a procedure exists to capture them, a purpose has already been recognised.

Example definitions:

"*Data: Facts, concepts or derivatives in a form that can be communicated and interpreted.*" (Galland, [1982: 57] quoted by Checkland and Holwell [1998])

"*Data are formalized representations of information, making it possible to process or communicate that information.*" [Dahlbom&Mathiassen, 1995]

5.2.5 Data characteristics

- Data means Facts, statistics used for reference or analysis.
- Data comprises Numbers, characters, symbols, images etc., which can be processed by a computer.
- Data must be interpreted, by a human or machine, to derive meaning.
- Data is a representation of information.

- Data is derived from Latin word 'datum' which means "that which is given".

5.3   MEANING OF INFORMATION AND ITS CHARACTERISTICS

It is important that students learn the concept of what 'information' is as used in information technology. Information is the result of processing data, usually by computer. This results in facts, which enables the processed data to be used in context and have meaning.

Information is Facts provided or learned about something or someone. It can be defined as data that:

- Has been verified to be accurate and timely
- Is specific and organized for a purpose
- Is presented within a context that gives it meaning and relevance, and
- That can lead to an increase in understanding and decrease in uncertainty.

In simple words it means processed data that has some meaning. Data alone are insufficient unless they are processed. Once converted in to information becomes directly applicable. The value of information lies solely in its ability to affect a behavior, decision, or outcome. A piece of information is considered valueless if, after receiving it, things remain unchanged.

The objective point of view

- Information is output from a computer program.
- The systems analyst decides what output will be useful. This output remains useful and meaningful regardless who the recipient is.
- The processing which produces the information includes summarising in order to reduce the volume of data.
- Data may be associated with other data, which may be obtained from different sources, to produce the information.
- The processing (classifying, linking, summarising, sorting, presentation) adds value in the form of potential meaning. The less structured data are less useful and less meaningful than the more structured information.

In the definition that follows "**a** meaning" seems to imply that the meaning is fixed and not open to interpretation and, therefore, this definition refers only to the objective characteristics of information:

"*Information has a meaning ... (it) comes from selecting data, summarizing it and presenting it in such a way that it is useful to the recipient.*" (Avison and Fitzgerald [1995] quoted by Check land and Howell [1998])

The subjective point of view

- Data become information only once they have been appropriated by the human recipient. Hence, the output from any computer program is still data.
- The added value of information (compared with data) results from the recipient appropriating the new data, interpreting them and placing them in context by combining them with existing personal information.
- Some authors consider data to be information only if they are used by the recipient in making a decision.
- Data become information only if they include something previously unknown to the recipient.
- Introna considers information to be historical, contextual and perceptual [Introna, 1992]. It is moulded by the life experience (erlebnis) to provide understanding.

The definitions that follow are examples of those that include subjective aspects. These definitions also include some characteristics which are considered to be objective or inter-subjective.

"*Information usually implies data that is organized and meaningful to the person receiving it. Data is therefore raw material that is transformed into information by data processing. Information can be defined in terms of its surprise value. It tells the recipient something he did not know.*" (Davis et al [1985] quoted by Introna [1992])

"*Information: (1) Data that has been transformed into a meaningful and useful form for specific human beings. (2) The meaning that a human assigns to data by means of the known conventions used in its representations.*" [Lay et al, 1993]

"Information is that which results when some human mental activity (observation, analysis) is successfully applied to data to reveal its meaning or significance." (Galland [1982] quoted by Check land and Holwell [1998])

"Information is the particular instances of reality as experience, perceived or understood by an individual in a specific context." [Introna, 1992]

"... Information comes into being as the receiver appropriates the data and gives it meaning" [Introna, 1992]

The inter-subjective point of view

- Aspects of shared meaning and discourse (validity claims [Braaten, 1991]) are characteristic of this point of view.

- The recipient has participated in the systems analysis and hence has influenced the process and has said what output was likely to be meaningful to him and others using the system.

- More advanced, database-oriented, systems allow the user to formulate queries and interact directly with the data in the database. Hence, there is a more dynamic process where the user's judgement is combined with the power of the technology.

- Information "has meaning" which can be communicated versus "is meaning" in the objective point of view.

Information must be put into some context *"... in order to understand something, we already need a preliminary understanding of it"* [Dahlbom & Mathiassen, 1995]. This Preliminary understanding must be shared in order for a new shared understanding to result.

preconceptions plus information = interpretation => knowledge

"To produce information we have to interpret what we experience and make explicit what we know." [Dahlbom&Mathiassen, 1995]

Characteristics of Information

- Information is the useful knowledge derived from the data

- Information is knowledge derived from study, experience (by the senses), or instruction.

- Information is any kind of knowledge that is exchangeable amongst people, about things, facts, concepts, etc.,

- In some context "Information is interpreted data".

When does data become information?

Data on its own has no meaning. It only takes on meaning and becomes information when it is interpreted. Data consists of raw facts and figures. When that data is processed into sets according to context, it provides information.

Example

Looking at the examples given for data:

- 3, 6, 9, 12

- cat, dog, gerbil, rabbit, cockatoo

- 161.2, 175.3,166.4, 164.7,169.3

Only when we assign a context or meaning does the data become information. It all becomes meaningful when we are told:

- 3, 6, 9 and 12 are the first four answers in the 3 x table
- cat, dog, gerbil, rabbit, cockatoo is a list of household pets
- 161.2, 175.3, 166.4, 164.7, 169.3 are the heights of 15-year-old students.

Data refers to raw input that when processed or arranged makes meaningful output. Information is usually the processed outcome of data. When data is processed into information, it becomes interpretable and gains significance.

In IT, symbols, characters, images, or numbers are data. These are the inputs an IT system needs to process in order to produce a meaningful interpretation. In other words, data in a meaningful form becomes information. Information can be about facts, things, concepts, or anything relevant to the topic concerned. It may provide answers to questions like who, which, when, why, what, and how.

If we put Information into an equation it would look like this:

Data + Meaning = Information

Difference between Data and Information

	Data	Information
Meaning	Data is raw, unorganized facts that need to be processed. Data can be something simple and seemingly random and useless until it is organized.	When data is processed, organized, structured or presented in a given context so as to make it useful, it is called information.
Example	Each student's test score is one piece of data.	The average score of a class or of the entire school is information that can be derived from the given data.
Etymology	"Data" comes from a singular Latin word, datum, which originally meant "something given." Its early usage dates back to the 1600s. Over time "data" has become the plural of datum.	"Information" is an older word that dates back to the 1300s and has Old French and Middle English origins. It has always referred to "the act of informing," usually in regard to education, instruction, or other knowledge communication.

How does a computer process data into information?

A computer uses hardware and software in the following four functions to allow it to process data.

Input

Before a computer can process anything, data must receive input. For example, typing on a keyboard can enter input into the computer.

Process

After a computer has received input data, a program is used to process that information. A typical program may calculate, manipulate, or organize the data to create information that is understandable and presentable to the user.

Output

After the data is processed into information, it is displayed as output to the user. For example, the program displays the information on your monitor when you use the Windows Calculator.

Storage

Finally, the computer can store the created information for later use.

A real-life example of how data is processed

As a real-life example of data being processed into information, imagine the following scenario. You open a spread sheet program on your computer and enter the data "1.25" into the first cell. Initially, the computer understands this data only as the floating point number 1.25. But, using the spread sheet program, you can specify the data to be formatted as currency, so the computer understands it as "$1.25" (one dollar and twenty-five cents).

You could input the data ".75" to another cell, and again format it as currency ("$0.75"). Then, you could input a formula in a third cell that adds the values of the information in the first two cells. This formula would return the new information "$2.00." Or, the formula could convert the amount to another currency unit. For instance, if one dollar is worth .89 euros, the formula could convert "$2.00" to the new information "€1.77."

After all of the data is processed, the spread sheet program can save (store) the file, allowing it to be opened again in the future to add additional data.

Features and qualities of information

1. Relevancy: The information so generated should be relevant to the context for which it is collated. Too much irrelevant information may confuse the intended user so it is necessary o generate only relevant information. No information should be generated only because it can be generated by Information System. A good way of ensuring relevance is to closely define the objectives of any information reports. Another way to improve relevance is to produce information that focuses on "exceptions" - e.g. problems, high or low values, where limits have been exceeded.

2. Up-to-date: Information needs to be timely if it is to be auctioned upon. For example, a professional need updated information about applicable laws so that he may give relevant advice to his clients. To improve the speed with which information is produced, businesses usually need to look at upgrading or replacing their information systems.

3. Accurate: As far as possible, information should be free from errors (e.g. the figures add up; data is allocated to the correct categories). The users of information should be informed whenever assumptions or estimates have been used.

4. Meet the needs of the User: Since different users have different information needs The managing director doesn't have time to trawl through thick printouts of each week's production or sales listings - he or she wants a summary of the key facts while the quality control supervisor will want detailed information about quality testing results rather than a brief one-line summary of how things are going. It is a good idea to encourage users to help develop the style and format of information reporting that they require.

5. Concise and User Friendly: Information should be clearly presented (e.g. use summaries, charts) and not too long. It also needs to be communicated using an appropriate medium (e.g. email, printed report, presentation. Businesses should also consider developing "templates" which are used consistently throughout the organization

- So that users get used to seeing information in a similar style.

6. Worth the cost: Often forgotten. Information costs money. Data is costly to collect, analyse and report. Information takes time to read and assimilate. All users should question whether the information they receive/ have requested is worthwhile.

7. Reliable: Information should come from authoritative sources. It is good practice to quote the source used - whether it is internal or external sources. If estimates or assumptions have been applied, these should be clearly stated and explained.

Types of information

There may be different types of information classifications such as:

- ➢ Factual vs. Analytical
- ➢ Objective vs. Subjective
- ➢ Primary vs. Secondary

Factual Information: These are just the facts. This information is very objective and real. Something that actually exists, reality, truth is a factual information. Examples of factual information are like; Temperature in a city, winner of academy award etc.

Analytical Information: Interpretations, Analysis, Criticism constitute analytical information. To examine critically, so as to bring out the essential elements or give the essence of something, analysis is required. Examples include; Increase of drug use in the 2013, growth in crime rate etc.

Objective Information: Without Bias Non-judgmental "not influenced by personal feelings, interpretations, or prejudices; based on facts". It is to the point, clear cut without any personal projection. Examples of objective information needs: Chronology of the Feminist movement, the eight stages of development according to Erik Erikson

Subjective Information: It includes **o**pinions, personal viewpoints, and evaluations existing in the mind. Examples of subjective information needs include; Criticism of O'Neill's play, Evaluation of a course based on class comments. Book review or movie reviews etc.

Primary Information: Information in its original form, not translated by anyone else, has not been published elsewhere, is termed as primary. Examples of primary information needs: Explanation or instructions from an employer or teacher, an eyewitness account of a house fire, etc.

Secondary Information: It is repackaged examination, restatement or interpretation of primary information already collected by someone. Examples of secondary information needs: Notes borrowed from a classmate for a missed class, a bibliography on the letters of Ernest Hemingway and so on.

Based on it is meant for information may be Personal Information, or Business Information. There can be other classifications as well like, formal vs informal, confirmed vs tentative etc.

Process of generating information

The goal of information generation is to generating information which is reliable, timely, user friendly and meeting the intended user objectives. If it fails to meet the stated objectives it is considered poor in quality. Therefore information generation requires careful steps so that it serves it purpose. The process basically involves the following steps.

- Understanding the user need in general
- Create framework for generating intended information
- Collecting the data.
- Process or analyze data.
- Collate the result from data, interpret, evaluate.
- Communicate the result of interpretation, evaluation of data in form of Information to intended user.

Value and cost of information

Information is of value to decision makers if it is accurate, timely, complete, and relevant. If it is poor on any o these criteria, it will be less useful hence may not have that value. These four criteria are used to distinguish valuable information from information that is of less value.

Accurate information provides a reliable and valid representation of reality. The cost of inaccurate or distorted information can be extremely high.

Consider the demise of the multimillion dollar Mars Climate Orbiter launched by NASA in 1998. The tragic outcome of this mission was blamed on the failure of one scientific team to recognize and correct an error in information from another team. Findings indicate that one team used English units (e.g., inches, feet and pounds) while the other used metric units for key spacecraft operations affecting navigation. This oversight caused the orbiter to burn up in Mars atmosphere before it could deploy to the surface. Oops.

Timely information is information that is available when it is needed. When information is needed almost always depends on the situation. In the fast-paced world of air travel, commercial airlines need virtually daily updates on what other commercial airlines are doing with their ticket prices. If one airline reduces its airfares from Mumbai Airport to New Delhi Airport, other airlines flying the same route would find out quickly about it and respond in a similar manner.

Complete information tends to be comprehensive in covering the issue or topic of interest. Complete information tells a complete story. Without complete information, a decision maker will get a distorted view of reality. Incomplete market information can lead businesses to introduce products and services that customers don't want.

Information is relevant if it has significance or can be applied to a specific situation, problem, or issue of interest. Here are some examples of relevant information. Human resource managers need information on hiring and employee turnover; operations managers need information on costs and productivity; marketing managers need information on sales projections and advertising rates; top executives need information on the strategic actions of their competitors. In contrast, product inventory information is not very relevant to a computer programmer.

Information as a corporate resource

Generally human, financial, physical and knowledge factors that provide a corporate the means to perform its business processes are considered as corporate resources.

Information can be considered as the raw material used in producing each and every decision taken in an organization. Organizations need to decide regularly on what objectives to be achieved, what actions to be taken to achieve these objectives, how and when these actions are to be taken, and the resources to

be used for all these activities. These decisions are taken by all the people in the organization who work at different level of organizational hierarchy and handle different aspect of the organizational work.

The exact decision that in individual takes varies from person to person and from time to time, depending on nature of organizational tasks being performed. Also some people need to do more of decision making as compared to implementing the decisions. But everyone in the organization needs has to takes some decisions for which availability of adequate information is critical.

Information is also required to convey decisions taken to the people responsible for implementing the decisions taken, and for monitoring the actual results achieved as the work progresses. In want of information many decisions cannot be taken and in some cases it results into poor decisions. Therefore information is acting as a resource, which should be managed, so that needy people may get it in time when required. In this way information plays a role of corporate resource in every organization. Like any other resource it need to be formalized, must have some identified and systematize way of generation and dissemination.

5.3.1 INFORMATION NEEDS AT VARIOUS LEVELS OF MANAGEMENT

Information is needed for decision making at all levels of management. Managers at different organizational levels make different types of decisions, control different types of processes, and have different information needs.

Three classical levels of management include

- Top Management or Strategic Management
- Middle Management or tactical management
- Low Level Management or Operational Management

Strategic Management includes directors/owner that make decisions which affect the entire organization, or large parts of it, and leave an impact in the long run. The decision making at this level is highly unstructured. By this we mean, there may not be a proper format for decision making. It requires lot of inputs in terms of information, but there is no fixed way of mixing those inputs.

Middle, or tactical, management receive strategic decisions from strategic management as general directives. Using those directives as guidelines, they develop tactics to meet those strategic directives. The decision making at this level is semi structured. Some pieces of information can be mixed to get some conclusion but some amount of ambiguity is always there.

Operational managers are responsible for daily operations. They make decisions concerning a narrow time span about the deployment of small groups of clerical and/or shop floor workers. Generally the decisions at this level are structured in nature.

People in different management levels have different information needs. Most of the information that managers require is used to make decisions. The decision making process of middle managers and above is less structured than that of operational managers; In general, strategic decisions have no proven methods for selecting a course of action that guarantees a predicted outcome.

(a) Information needs of top or Strategic Management

Strategic management or TOP management of a company comprises the owners/managing director of a company. They are responsible for taking strategic decisions for a company which has long term bearing on company policies and perspectives. Strategic management is responsible for making strategic plan which is necessary to take the company on growth path. To prepare strategic Plan, Top management is not concerned about day to day information of company operations. They do the macro analysis and their decisions are based on macro analysis. Generally the Strategic Management information needs comprises

- Information about market trend- Macro analysis.
- Information about Government Policies.
- Information about Competitors policies and tactics
- Information about Major exceptions in implementing the company policy at tactical/operation level.
- Analysis about major happening/event which may have a long term bearing on the strategic decisions of the company

The information need of TOP management is generally unstructured and it not easily defined.

(b) Information needs of Middle Level Management/Tactical Management

Tactical management/Middle Management comprises those who are responsible for preparing annual business plan to achieve the strategic Plan objectives of a company. Tactical Managers prepare Annual Business Plan on the basis of directs received from TOP management. The Information need of middle management comprises

- Information about Strategic Decisions/Plan of the organization for which they have been working.

- Information about Latest Technologies in the area they have been working.

- Information about problems faced by operational management in getting the things implemented.

- Information about best practices adopted by different organization in the same industries or different industries.

The information need of Middle level management is structured in comparison to TOP management and it can be developed in form of template in some cases.

(c) Information needs of Low Level or Operational Management

Operation management is responsible for implementing the policies framed by tactical management to achieve the business plan of the organization. They are generally responsible for the operational part of the organization. The information need of Operational management is limited but very structured in nature. The information need of Operation management needs to be very accurate and it can be easily developed in the form of template

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5.3.2 FACTORS AFFECTING INFORMATION NEEDS

There are various factors which affected the information need of him. Some of them are explained as below

1.   **Management Hierarchy:** Management Hierarchy plays an important role in deciding the information need of a user. Information need of TOP management will be entirely different from the information needs of Operational Management.

2. **Purpose of seeking information:** The information needs will be depend on the purpose of seeking information. If a person wants to investment in a company, he/she will be interested about the financial statement of the company. He/she will have no interest in knowing about the past directors of the company.

3. **Role in the Organization:** Information need of a person also depend on the role of the concerned user.

The information needs of different stakeholder in the organization will be different. For example, an employee of the organization will be interested in knowing about the company wage policy. They will have no interest in knowing company policy on market segmentation.

5.3.3 KNOWLEDGE

(a) What is knowledge?

When someone memorizes information this is often referred to as 'rote-learning' or 'learning by heart'. We can then say that they have acquired some knowledge. Another form of knowledge is produced as a result of understanding information that has been given to us, and using that information to gain knowledge of how to solve problems.

Knowledge can therefore be:

- acquiring and remembering a set of facts, or
- The use of information to solve problems.

The first type is often called explicit knowledge. This is knowledge that can be easily passed on to others. Most forms of explicit knowledge can be stored in certain media. The information contained in encyclopedias and textbooks are good examples of explicit knowledge.

Example

Looking at the examplesgivenfor data:

- 3, 6, 9, 12

- cat, dog,gerbil, rabbit, cockatoo

- 161.2, 175.3,166.4, 164.7,169.3

Only when we assign a context or meaning does the data become information. It all becomes meaningful when we are told:

• 3, 6, 9 and 12 are the first four answers in the 3 x table

• cat, dog, gerbil, rabbit, cockatoo is a list of household pets

• 161.2, 175.3, 166.4, 164.7, 169.3 are the heights of 15-year-old students.

If we now apply this information to gain further knowledge we could say that:

- 4, 8, 12 and 16 are the first four answers in the 4 x table (because the 3 x table starts at three and goes up in threes the 4 x table must start at four and go up in fours)

- A lion is not a household pet as it is not in the list and it lives in the wild.

- The tallest student is 175.3cm.

The second type is called tacit knowledge. It is the kind of knowledge that is difficult to pass on to another person just by writing it down. For example, saying that Paris is the capital of France is explicit knowledge that can be written down, passed on, and understood by someone else. However, the ability to speak a foreign language, bake bread, program a computer or use complicated machinery requires additional pieces of knowledge (such as that gained through experience) that are not always known explicitly and are difficult to pass on to other users.

(b) How are data, information and knowledge linked?

If we put Knowledge into an equation it would look like this:

Information

+ application or use = Knowledge

5.3.4 INFORMATION TECHNOLOGY

Information is a resource which has no value until it is extracted, processed and utilized. Information technology deals with information system, data storage, access, retrieval, analysis and intelligent decision making. Information technology refers to the creation, gathering, processing, storage, presentation and dissemination of information and also the processes and devices that enable all this to be done.

It can be extremely beneficial for all business owners to have some basic level of awareness about information technology. The advent of information technologies based on computers has enabled business models to understand that they may function as subsets of information technology. Information technology is a study of the design, implementation, development, management, and support of computer-based information systems that assist with supporting business operational needs within an industry.

(a)   IT in the Past

The term information technology was first coined by Thomas L. Whisler and Harold J. Leavitt in a 1958 article published in the Harvard Business Review. At that time, the term IT was used only to describe the process of storing information.

At the time, there was no such thing as a degree or certificate in information technology and businesses had no need for large IT departments. There were no interconnected networks, server farms, or complex computer systems. Phone, fax, and regular mail were the main communication media.

(b)   Modern Use of Information Systems

These days, the vast majority of businesses wouldn't survive without the use of information systems. They are sending internal emails, marketing via the web, managing e-commerce web sites, and storing and tracking data online. From the big conglomerates to the smallest home businesses, there's no doubt that companies all over the world rely heavily on information.

(c) **The Necessity of Information Technology**

Information technology is a broad field. It is concerned with all aspects of managing and processing electronic information, especially in the business world, where computers are vital for data management. In today's competitive environment, almost every company's business strategy relies on the use of information systems in order to succeed and grow into the future. For this reason, IT professionals are valued members of the organizations they're involved in, and the need for certified IT experts continues to increase.

(d) **More Specifically Information Technology Means**

- Managing a network of computers.
- Creating original web pages.
- Producing videos digitally.
- Designing computer systems as a consultant.
- Vendors selling products on the internet.
- Designing 3D artwork.
- Administering a company's database.
- Coding software.
- Providing technical support.
- Managing projects and budgets.
- Writing technical documentation.

(e) **Examples of Information Technology Are**

- Telephone and radio equipment and switches used for voice communications.
- Traditional computer applications that include data storage and programs to input process and output the data.
- Software and support for office automation systems such as word processing and spread sheets, as well as the computer to run them.
- User, PCs & software.

- Data networks and all associated communications equipment such as servers, bridges, routers, hubs & wiring.

- Peripherals directly connected to computer information systems used to collect or transmit audio, video or graphic information, such as scanners and digitizers.

- Voice response systems that interact with a computer database or application.

- Video conferencing equipment.

- The state radio communications network.

- Computers and network systems used by teachers, trainers and students for educational purpose.

- "Open" computer systems that monitor or automate mechanical or chemical processes and also store information used by computer applications for analysis and decision making.

- All operating costs, equipment and staff time associated with supporting the technology infrastructure of the agency, possibly including items excluded above, such as video equipment used for technology training that is included in the information systems costs center for the agency.

(f)   Role of IT in businesses

Information technology covers many different areas, including software solutions and hardware that allow organizations and companies to organize, gather, and evaluate data. Ultimately, the analysis of this data helps companies achieve their goals. This also includes workflow processes that can expand an organization's capacity to grow revenue. The bottom line for many business owners is that revenue growth and profit margins are key drivers for performance and efficiency. There are four primary elements for information technology as a whole: information security, database and network management, computer technical support, and business software development.

Some businesses may be under the impression that information technology is only a minor part of running the company and achieving goals. This can be a big mistake. The IT industry is always evolving with new software and hardware applications. For many companies, information technology is most present in their concern for network security. Network security is vital for preventing system breaches. Many various data breaches for companies large and small have made headlines in recent years, and yet a surprising number of companies still have not adapted their own systems and procedures to prevent these attacks.

Another reason that today's business world must be aware of information technology has to do with data overloads. Many businesses are processing high volumes of data every single day, and without appropriate processing capability, this can overload a system easily. IT professionals play a key role in helping business owners address problems immediately in front of the company, as well as achieving goals down the road. Teamwork and clear communication skills are at the top of the list in a desirable information technology professional. The IT professional of the day helps to translate complicated concepts in the information technology world to meaningful results for those using the technology in their daily working lives. As such, businesses have to remain aware of the basics behind IT.

Reduce Operating Costs

Small business owners can use technology to reduce business costs. Basic enterprise software enables a firm to automate back office functions, such as record keeping, accounting and payroll. Mobile technology allows home offices to interact in real time.

Securing Sensitive Information

Business owners can also use technology to create secure environments for maintaining sensitive business or consumer information. Many types of business technology or software programs are user-friendly and allow business owners with only minor backgrounds in information technology to make the most of their tools and features.

Improved Communication Processes

Business technology helps small businesses improve their communication processes. Emails, texting, websites and apps, for example, facilitate improved communication with consumers. Using several types of information technology communication methods enable companies to saturate the economic market with their message. Companies may also receive more consumer feedback through these electronic communication methods.

Technology also improves inter-office communication as well. For example, social intranet software gives employees a centralized portal to access and update internal documents and contracts and relay relevant data to other departments instantly. These methods also help companies reach consumers through mobile devices in a real-time format.

Increased Employee Productivity

Small businesses can increase their employee's productivity through the use of technology. Computer programs and business software usually allow employees to process more information than manual methods. Business owners can also implement business technology to reduce the amount of human labor in business functions. This allows small businesses to avoid paying labor costs along with employee benefits.

Business owners may also choose to expand operations using technology rather than employees if the technology will provide better production output.

Broaden Customer Bases

Technology allows small businesses to reach new economic markets. Rather than just selling consumer goods or services in the local market, small businesses can reach regional, national and international markets. Retail websites are the most common way small businesses sell products in several different economic markets.

Collaboration and Outsourcing

Business technology allows companies to outsource business functions to other businesses in the national and international business environment. Outsourcing can help companies' lower costs and focus on completing the business function they do best. Technical support and customer service are two common function companies outsource.

Small business owners may consider outsourcing some operations if they do not have the proper facilities or available manpower.

Issues and Challenges in Information Technology

- As computing systems and capabilities continue expanding worldwide, "data overload" has become an increasingly critical issue for many IT professionals. Efficiently processing huge amounts of data to produce useful business intelligence requires large amounts of processing power, sophisticated software, and human analytic skills.

- Teamwork and communication skills have also become essential for most businesses to manage the complexity of IT systems. Many IT professionals are responsible for providing service to business users who are not trained in computer networking or other information technologies but who are instead interested in simply using IT as a tool to get their work done efficiently.

- System and network security issues are a primary concern for many business executives, as any security incident can potentially damage a company's reputation and cost large sums of money.

5.3.5 EFFECT OF IT ON BUSINESS

The rise of information technology has paved the way for various innovations. With the digitization of information, more and more businesses are increasingly leveraging the benefits of digital tools to improve their prospects. Information technology has been crucial in turning this process into a complete success.

Information technology has dramatically transformed the lives of individuals. It provides businesses the scope to analyses data and plan business strategies accordingly. Utilizing information technology means that the data analysis is accurate, thus optimizing profits.

Information technology has had a major impact on various aspects of businesses. Let's take a look at some of these here.

1. Cloud Computing

The concept of cloud computing is immensely popular among businesses owing to the efficiency in business operations that it provides. Cloud computing utilizes information technology to capitalize on its ability to provide improved agility and time and resource management for businesses. Increasingly, businesses are shifting to the cloud to leverage its many benefits. It has been predicted that more than $1 trillion will be impacted in IT spending by the transition of businesses to cloud computing by 2020.

2. Automation of Business Processes

The movement towards increased automation of business processes improves efficiency and increases workflow considerably.

Information technology helps in developing automated processes for businesses. This not only helps in reducing the cost of operation but also saves time. The time saved can be utilized to focus on other tasks, thus speeding up business processes significantly.

Processes like billing, tracking metrics, collecting customer data, monitoring certain processes etc. can be automated easily. There are various automation software that can be utilized for this purpose.

3. Working Remotely

Implementation of information technology provides the ability to remotely access your company's network. As a result, it equips employees with the ability to get the work done even if they are not physically present at the workplace. Therefore, it has gained massive popularity.

4. Mobile Technology

Mobile technology takes business communication to a whole new level. A mobile team can improve the workplace productivity considerably. There are numerous ways to integrate mobile technology in the workplace.

5. Protecting Information

Every organization has database comprising various information related to business transactions, client details and so on. Such information is extremely valuable to a business and can cause a legal issue if it is lost. This is where information technology becomes relevant. It provides the right resources to store the information in a way that ensures maximum protection.

Therefore, information technology helps in upholding business integrity.

6. Providing Customer Satisfaction

Customer experience and satisfaction are crucial aspects of all businesses. The key to customer satisfaction is a strong customer support team and its availability to cater to the requirements of the customers. Information technology provides the best tools for communicating with customers and solving their problems in real time. It has unlocked the facilities like Email, social media and other messaging platforms for this purpose.

7. Management of Resources

A business has a variety of resources. These may include financial resources, human resources and so on. For large organizations, managing resources becomes quite difficult. Information technology plays a vital role in managing these resources effortlessly by introducing a wide range of feasible solutions.

For example, the integration of Enterprise Resource Planning (ERP) has improved the efficiency of various business processes. ERP is business management software that enables an organization to use a series of integrated applications that can manage and automate various business operations.

8. Open Source Software

Information technology has paved the way for various open source software that allow free usage of certain tools for various organizations. The primary benefit of open source software is its flexible license. This allows modifications to the source code. This means that you have the facility to customize its functions according to your requirements.

5.4 CHECK YOUR PROGRESS

1. The hardware, software and media used to store, organize, retrieve and communicate information is known as _____.
2. _____ is a generic term that refers to a variety of devices that allow people to access data and information from wherever they are.
3. _____ is the useful knowledge derived from the data
4. Information in its original form, not translated by anyone else, has not been published elsewhere, is termed as _____.
5. Data + _____ = Information

5.5 SUMMARY

Information is a resource which has no value until it is extracted, processed and utilized. Information technology deals with information system, data storage, access, retrieval, analysis and intelligent decision making. It can be extremely beneficial for all business owners to have some basic level of awareness about information technology. Information technology is a study of the design, implementation, development, management, and support of computer-based information systems that assist with supporting business operational needs within an industry. Information technology covers many different areas, including software solutions and hardware that allow organizations and companies to organize, gather, and evaluate data. Ultimately, the analysis of this data helps companies achieve their goals. This also includes workflow processes that can expand an organization's capacity to grow revenue. Utilizing information technology means that the data analysis is accurate, thus optimizing profits.

5.6 KEYWORDS

Data: The quantities, characters, or symbols on which operations are performed by a computer, being stored and transmitted in the form of Information.

Information: Information is the useful knowledge derived from the data.

Information Technology: The study or use of systems (especially computers and telecommunications) for storing, retrieving, and sending information.

Knowledge: Facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject.

Cloud Computing: The practice of using a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or a personal computer.

Mobile Computing: Mobile computing is a generic term that refers to a variety of devices that allow people to access data and information from wherever they are. Mobile computing transports data, voice, and video over a network via a mobile device.

5.7 SELF-ASSESSMENT TEST

1. What is data and explain its characteristics.

2. What is information? What are the differences between Data and Information?

3. Explain the needs of information for different levels of managements, in detail.

4. Discuss the various factors affecting the information needs.

5. What is knowledge? How is knowledge different than information?

6. What is information technology (IT)? What are the various advantages of IT?

7. Discuss the effects of IT on Business.

8. Discuss the various challenges for IT in detail.

9. Explain the role of IT in business.

10. Discuss the factors affecting the information needs.

5.8   ANSWERS TO CHECK YOUR PROGRESS

1. Information technology

2. Mobile computing

3. Information

4. Primary

5. Meaning

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LESSON STRUCTURE

6.0 Learning Objectives

The value of information is directly linked to how it helps decision makers achieve the organization's goals. In this chapter you will learn about-

- Definition of information and types of information.

- Relation between information, knowledge and intelligence.

- Organizational levels and their required information.

- Functions of an information system

- Types of information system

- Use of information system in business

- Causes of information system failure

- Transaction Processing System

- Management Information System

6.1 Introduction

It is often observed that term information system and information technology are used interchangeably. In a literal sense, information technology is a subset of information systems. Information systems consist of people, processes, machines and information technology. The great advancement in information systems is due to development in information technology and introduction of computers. Section 6.2.1 explains some basic concepts of information system. This section defines information, various types of information, a variety of methods for collecting information (such as interview, focus group, observation, surveys) and system along with its components. Section 6.3 introduces information system with its needs. After that structure of an organization along with their corresponding information needs is represented by a pyramid diagram. Section 6.5 explains various functions of information system and section 6.6 describe types of information system i.e. Transaction Processing system, Management Information System, Decision Support System, Executive Support System, Office Automation System, Business Expert System. Section 6.7 explains use of information system and 6.8 describe cause of information system. Section 6.9 explains Transaction Processing System with its processing cycle and various types of transactions. Section 6.10 explains Management Information System and comparative study of manual information system and MIS, components of MIS, Characteristics of MIS, advantages and disadvantages.

6.1.1 Basic concepts

Information-Collection of facts organized in such a way that they have additional value beyond the value of the facts themselves.

According to Davis and Olson: "Information is a data that has been processed into a form that is meaningful to recipient and is of real or perceived value in the current or the prospective action or decision of recipient."

Information can only be considered to be 'real' Info if it meets certain criteria i.e.

1. It must be communicated to the recipient

2. It must be in a language that is understood

3. It must be in a suitable form

4. It must be relevant for achieving some purpose

6.1.2 Types of information- Information could be classified on the basis of the purpose for which it is utilized, into three main categories:

- **Strategic information**-it is required by the managers at the strategic level of management for the formulation of organizational strategies.

- **Tactical information**-information in this category is used in short term planning and is of use at management control level.

- **Operational information**-it applies to short periods which may vary from an hour to a few days.

6.1.3 Information Collection Techniques

In order to determine the requirements of a system, information must be gathered from the customer. Ideally, the information obtained will enable a well-defined, accurate, and complete description of how the business functions as well as the people, functions and data involved. However, this is not always the case, and information is often misinterpreted or omitted entirely. There are many techniques that can be employed when gathering information. The type of information you are trying to obtain, as well as the people providing the information, will determine which techniques you should use.

- ✓ **Focus group**
  - o Used to explore a topic in depth with key stakeholders to learn what the common understanding is on various issues.

- ✓ **Case Studies**
  - o A case study is a thorough description of a process, structure, or experience at one organization. Case studies use surveys, statistics about usage, and qualitative data collection techniques. While performing a research quantitative data is gathered first and then the qualitative strategies are used.

✓ **Observation**

o Observation is a data collection technique that is performed by monitoring or viewing the subject.

o Sometimes observations are performed continuously or in a set of time periods. There can be different types of observations like structured, unstructured, and semi-structured.

o The limitation of observations is that it consumes time and it affects the behavior of the participants.

✓ **Interviews**

o An interview is another data collection technique.

o For collecting the data through this technique, interviews are performed in groups or on a one-on-one basis. During interviews, the data can be collected using stenography, video recordings, audio recordings, or written notes.

✓ **Surveys**

o Surveys are performed through questionnaires. A standard set of questions are used for performing the survey of any specific topic.

6.1.4 System

In a system, network of components work towards a single objective, if there is lack of co-ordination among components, it leads to counterproductive results.

PARTS OF A SYSTEM
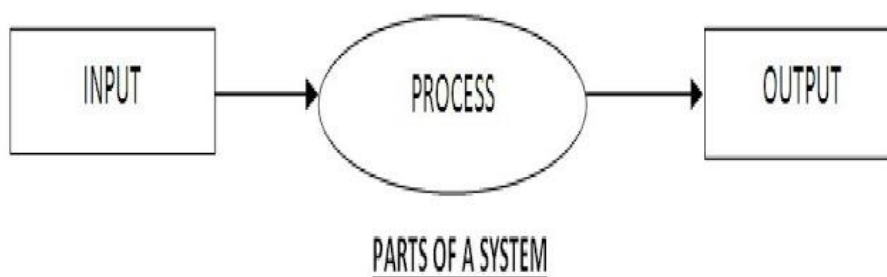
A system may have following features:

✓ **Adaptability:** some systems are adaptive to the exterior environment, while some systems are non-adaptive to the external environment. For example, anti-lock braking system in car reacts

depending on the road conditions, whereas the music system in the car is independent of other happening with the car.

✓   **Limitation:** every system has pre-defined limits or boundaries within which it operates. This limits or boundaries can be defined by law or current state of technology.

6.2 INFORMATION SYSTEM

Information system **is** an <u>integrated</u> set of components for collecting, storing and processing data and for providing <u>information</u>, 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.

(a) Need of information system

Information systems gain their importance by processing the data from company inputs to generate information that is useful for managing your operations. To increase the information system's effectiveness, you can either add more data to make the information more accurate or use the information in new ways.

Business Communication Systems

Part of management is gathering and distributing information, and information systems can make this process more efficient by allowing managers to communicate rapidly. Email is quick and effective, but managers can 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.

Business Operations Management

How you manage your company's operations depends on the information you have. Information systems can offer more complete and more recent information, allowing you to operate your company more efficiently. You can use information systems to gain a cost advantage over competitors or to

differentiate yourself by offering better customer service. Sales data give you insights about what customers are buying and let you stock or produce items that are selling well. With guidance from the information system, you can streamline your operations.

Company Decision-Making

The company information system can help you make better decisions by delivering all the information you need and by modeling the results of your decisions. A decision involves choosing a course of action from several alternatives and carrying out the corresponding tasks. When you have accurate, up-to-date information, you can make the choice with confidence.

If more than one choice looks appealing, you 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 help you determine which alternative gives the most beneficial result.

Company Record-Keeping

Your company 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. You can use such information to prepare cost estimates and forecasts and to analyze how your actions affected the key company indicators.

6.2.1 PYRAMID DIAGRAM OF ORGANIZATIONAL LEVELS AND INFORMATION REQUIREMENTS

Understanding the various levels of an organization is essential to understand the information required by the users who operate at their respective levels.

(a) **Operational management level**

- The operational level is concerned with performing day to day business transactions of the organization.

- Examples of users at this level of management include cashiers at a point of sale, bank tellers, nurses in a hospital, customer care staff, etc.

- Users at this level use make structured decisions. This means that they have defined rules that guide them while making decisions.

The following diagram illustrates the various levels of a typical organization.
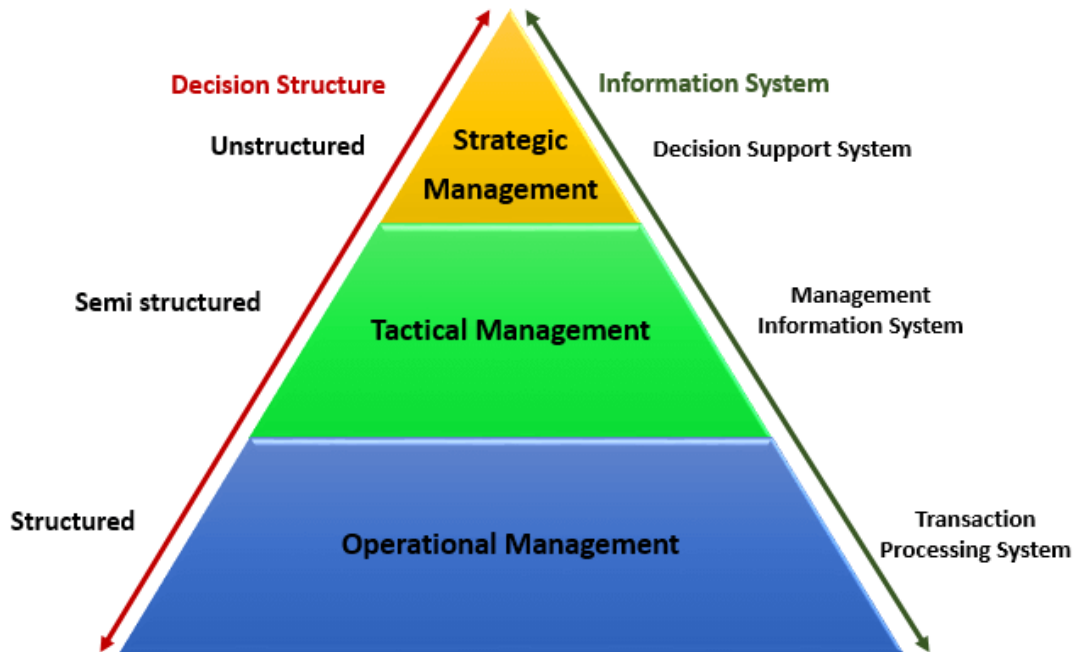
(b) Tactical Management Level

- This organization level is dominated by middle-level managers, heads of departments, supervisors, etc. The users at this level usually oversee the activities of the users at the operational management level.

- Tactical users make semi-structured decisions. The decisions are partly based on set guidelines and judgmental calls. As an example, a tactical manager can check the credit limit and payments history of a customer and decide to make an exception to raise the credit limit for a particular customer. The decision is partly structured in the sense that the tactical manager has to use existing information to identify a payments history that benefits the organization and an allowed increase percentage.

(c) Strategic Management Level

- This is the most senior level in an organization.

- The users at this level make unstructured decisions.

- Senior level managers are concerned with the long-term planning of the organization. They use information from tactical managers and external data to guide them when making unstructured decisions.

6.2.2 FUNCTIONS OF INFORMATION SYSTEM

One of the mostly widely used bases for organizing activities in almost every organization is the business function. Business activities are grouped around functions such as production, marketing, finance and personnel etc. resulting in the respective department or an area of the business organization. These departments or functional areas are commonly known as the functional areas of business.

There is no standard classification of such sub-system in an organization, but a typical set of functions in a manufacturing organization includes:

- Production
- Marketing
- Finance and accounting
- Materials and
- Personnel systems

Production:
➢　planning and control
➢　Engineering standards
➢　Quality control
➢　R & D etc

Marketing:
➢　Sales order
➢　Forecasting
➢　Sales analysis
➢　Billing
➢　Distribution
➢　Stock availability

- Sales quota control
- Pricing
- Product promotion.

Finance and accounting:

- Financial planning
- Budgeting
- Cost accounting
- Asset accounting
- Accounts receivable
- Payroll Accounts
- Payable, etc...

Materials:

- Material planning
- Bill of material
- Cost estimate
- Warehousing planning etc...

Personnel:

- Employee recruitment
- Employee selection
- Employee development
- Employee transfers
- Employee retirements etc.

3.2.3 TYPES OF INFORMATION SYSTEM

The classifications of information system are-

(a) Transaction processing system.

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. Other details of TPS are given later in this chapter

(b) Management information 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.

(c) Decision support system.

The Decision support system (DSS) is an information system application that assist decision making. Decision support systems tend to be designed primarily to serve management control level and strategic planning level managers. The data in the database typically is a combination of master files (internal corporate data) and from external sources.

Features of DSS

- **Adaptability and flexibility**
- **High levels of Interactivity** DSS are computer-based systems designed for interactive use by decision makers or staff users who control the sequence of interaction and the operations performed.
- **Ease of use**
- **Efficiency and effectiveness** DSS are intended to improve the accuracy, timeliness, quality and overall effectiveness of a specific decision or a set of related decisions. It provides a single platform that allows all users to access the same information and access the same version of truth, while providing autonomy to individual users and development groups to design reporting content locally.

DSSs are intended to improve the accuracy, timeliness, quality and overall effectiveness of a specific decision or a set of related decisions.

- **Complete control by decision-makers** they are not intended to replace decision makers, instead a DSS can support decision makers at any level in an organization.

- **Ease of development** As a standalone, integrated, and Web-based systems, a DSS delivers an interactive, scalable platform for rapidly developing and deploying projects. Multiple projects can be created within a single shared meta-data. Within each project, development teams create a wide variety of re-usable meta-data objects. Most DSSs will allow for extendibility ,support for modeling and analysis and support for data access

Benefits of DSS

- Improves efficiency and speed of decision-making activities.
- Increases the control, competitiveness and capability of futuristic decision-making of the organization.
- Facilitates interpersonal communication.
- Encourages learning or training.
- Since it is mostly used in non-programmed decisions, it reveals new approaches and sets up new evidences for an unusual decision.
- Helps automate managerial processes.

Disadvantages of Decision Support Systems

- **Information Overload:** A computerized decision making system may sometimes result in information overload. Since it analyzes all aspects of a problem, it leaves a user in a dilemma what to consider and what not to consider. Not each bite of information is necessary in decision making. But when it's present, a decision maker finds it difficult to ignore information that is not a priority.

- **Too much Dependence on DSS:** It is true that decision support systems are integrated into businesses to make everyday decisions faster and more easily. Some decision makers develop a tendency to depend too much on computerized decision making and don't want to apply their own

brains. Clearly, there is a shift in focus and decision makers may not hone their skills further because of excessive dependence on DSS.

- **Devaluation of Subjectivity:** A decision support system promotes rational decision making by suggesting alternatives basis the objectivity. While bounded rationality or restricted irrationality plays a critical role in decision making, subjectivity cannot and should not be rejected. A DSS promotes objectivity and relegates subjectivity, which can have serious impact on a business.

- **Overemphasis on Decision Making:** Clearly the focus of computerized decision making is on considering all aspects of a problem all the time, which may not be required in many of the situations. It is essentially important to train the users to ensure effective and optimal use of DSS.

- **Cost of Development:** The cost of decision making decreases once a decision support system is installed. But development and implementation of a DSS requires a huge monetary investment. Customization may attract higher cost. If you're on a tight budget, you might not get a customized DSS specific to your needs.

(d) Executive support system

Executive support system (ESS) is an extension of the management information system which is a special kind of DSS. An ESS is specially tailored for the use of chief executive of an organization to support his decision making. An ESS is designed to cater to the information needs of a chief executive keeping in view not only his requirements but also taking into account his personality and style of functioning etc.

Characteristics of ESS

❖ **Informational characteristics**

1. Flexibility and simple use.
2. Provides the timely info with the short reaction time and additionally with the short retrieval.
3. Produces the proper info.
4. Produces the relevant info.
5. Produces the valid info.

❖ **User interface/orientation characteristics**

1. Consists of the subtle self-facilitate.
2. Contains the user friendly interfaces consisting of the graphic user.

3. Will be used from several places.

4. Offers secure reliable, confidential access in conjunction with the access procedure.

5. Suites the management forms of the individual executives.

❖ **Social control / Govt characteristics**

1. Supports the overall vision, mission and also the strategy.

2. Provides the support for the strategic management.

3. Typically helps to manage the things that have a high degree of risk.

4. Is coupled to the worth accessorial business processes.

5. Supports the need/ access for/ to the external data/ databases.

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

- Filters data for management

- Improves to 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

   (e) Office automation system

Office automation refers to the application of computer and communication technology to office functions. Office automation systems are meant to improve the productivity of managers at various level of management by providing secretarial assistance and better communication facilities. Office automation systems are the combination of hardware, software and people in information systems, that process office transactions and support office activities at all levels of the organization. These systems include a wide range of support facilities, which include word processing, electronic filing, electronic mail, message switching, data storage, data and voice communication etc.

Characteristics

- Sophisticated process that consists of electronic equipment and communication systems.
- Involves and integrates people, procedure, and technology.
- Involves the use of computers, in conjunction with other electronic equipment.
- Consists of word processors and other essential documenting and presentation designing software connected to one another through means of a local area network or cloud drive.
- Designed as a multi-function information system to provide executives some decision support tools.
- Supports a large number of software packages working by integrating with each other.

Advantages and Disadvantages of Office Automation

Office automation today is much more than just document producing, storage and retrieval. Electronic and digital information is the crux of modern office automation. It may include strictly internal computers, high-end management software, a worldwide digital network through the internet or off-site cloud storage. Implementing the new office automation system in your office comes with its own set of advantages and disadvantages.

The Advantages are:

- **Values Time and Company Resources:** Your company's most valuable assets are time and its resources. The good performance of your company starts with using these two effects. Office automation allows you to communicate with people via emails, chats, fax, etc., and send text, image, audio, and video files digitally to anyone inside the office or outside in any part of the world. This way you can also save your resources that otherwise would have been spent on travel to meet people for information or file sharing.

- **Reduces Direct Involvement in Regular Works:** It reduces your workload on regular office tasks such as creating reports and organizing all sorts of data. Spread sheets allow you to enter, compile, and store bulk data for future reference. Spread sheets also help reduce the workload and keep your office in order.

- **Faster, and You Can Rely on Its Accuracy:** Everything from creation, editing, and sharing of documents and all sorts of data is way faster with office automation. Also, machines and software combined together give results that are highly accurate. For example, you can add up numbers in spread sheets and create budgets and it will always come up with accurate balance.

- **Reduces Cost of Operation with Lesser Workforce:** From ledger work to a more extensive task like managing company's facilities inside or outside the office, office automation allows you to hire only a selected number of people to manage all sorts of work through its digital dashboards. It helps by lowering the cost of operation and increased dependency on manpower for even the pettiest of works.

Like any other system in the world, office automation system too has some issues however; they seem to be not-so-worrying to anyone who is using it. Let's have a look on the issues that exist with office automation.

- **Chances of System Failure, But No Data Loss:** Minor glitches are common, not in frequency but in the form of errors that are usually reported. A complete system failure is a rare phenomenon. Office automation technology isn't new. It has already been through the time and testing for so long. By keeping up with the updates, and software and hardware meltdowns, you can easily avoid a shutdown. Also, even if a shutdown couldn't be avoided, you still don't need to worry about your company data. If you have installed a cloud-based technology, your data will be safe which you can re-access right after the system restart.

- **First Time Installation Is Expensive:** Obviously, if you are installing everything afresh, it has to cost you dearly. A professional office suite and machines, their installation, training for use, and fixing of the initial issues, are the areas where you have to dig your pocket. You should think about the long-term benefits your company will be drawing out from automation after this one-time expense.

(f) Business expert system

Business expert system (BES) is a knowledge based information system that uses its knowledge about a specific, complex application area to act as an expert. This system is one of the knowledge based information system. Expert system provides decision support to managers in the form of advice from an expert in a specific problem area. Expert systems find application in diverse areas, ranging from medical, engineering and business.

Characteristics of an expert system:

- Human experts are perishable but an expert system is permanent.
- It helps to distribute the expertise of a human.
- One expert system may contain knowledge from more than one human experts thus making the solutions more efficient.
- It decreases the cost of consulting an expert for various domains such as medical diagnosis.
- They use a knowledge base and inference engine.
- Expert systems can solve complex problems by deducing new facts through existing facts of knowledge, represented mostly as if-then rules rather than through conventional procedural code.
- Expert systems were among the first truly successful forms of artificial intelligence (AI) software.

Limitations:

- Don't have human-like decision making power.
- Can't possess human capabilities.
- Can't produce correct result from less amount of knowledge.
- Requires excessive training.

Advantages:

- Low accessibility cost.
- Fast response.
- Not affected by emotions unlike humans.
- Low error rate.
- Capable of explaining how they reached a solution.

Disadvantages:

- Expert systems have no emotions.
- Common sense is the main issue of the expert system.

- It is developed for a specific domain.
- It needs to be updated manually. It does not learn itself.
- Not capable to explain the logic behind the decision.

6.2.4 WHY BUSINESSES USE INFORMATION SYSTEM

Many businesses today do not make use of internet which is very important in this day. Upgrading the computer information system is not an option in this technology-driven era, it is essential. The follow are reasons why businesses need to use information systems.

1. **Operational excellence:**

    In order for a business to achieve high levels of profitability, they need to improve the efficiency of their operations. Information systems are a tool that is used in order to achieve high levels of efficiency and productivity in business operations.

2. **New Products, Services and Business Models:**

    Information systems can be used to create new products and services and also an entirely new business model. A business model describes how a company produces, delivers and how they sell a product or service to create wealth.

3. **Customer/Supplier Intimacy:**

    When a business provides a good product or service customers tend to return and purchase more frequently which raises revenue and profits. The more a business engages with its suppliers, the better the supplier can provide vital inputs which can lower costs.

4. **Improved Decision-Making:**

    Many managers in an information bank may never have the right information at the right time to make an informed decision. This can raise costs and lose customers. However, information systems allow the managers to use real-time data from the marketplace when making decision.

5. **Competitive Advantage:**

    When a firm achieved one or more of these business objectives (operational excellence, new products, services and business models, customer/supplier intimacy and improved decision-making), they may have a competitive advantage. By performing better than competitors, charging less for superior goods and responding to customers and suppliers, higher sales and profits can be made.

6. Day To Day Survival:

Businesses must invest in information systems and technology as they are essential to doing business. Information system enables companies to react, respond, cater, store, retrieve, disseminate and control their new valuable asset that is information. In the future, a good information system in a business will no longer be an option; it will become a compulsory in determining success.

6.2.5 CAUSE OF INFORMATION SYSTEM FAILURE

The British Computer Society defines information systems as "software that has been written to support human activity within an organization". So at what point can we say that an information system has failed? Well an information system has failed when it:

- Goes way over budget

- Is not operational at a specific time

- Does not do what it was intended to do

- Does not fit in the organizational structure or work processes

Information system failure is not caused by just technological difficulties but also human resource issues and the functionality within a business.

Organizations need to be aware of the causes of information system failure because unfortunately failure rates are very high, much higher than success rate. The harsh reality is most projects are destined to fail before they even begin.

(a)   Here are some causes of Information system failure in

- Requirements do not represent the actual needs of the customer.

- Improper planning

- Lack of and poor communication

- Requirements are incomplete or conflicting. have problems understanding and communicating with each other.

- Both a lack of proper leadership and poor leadership

- Unrealistic expectations

- Inability to keep within the budget

6.2.6 TRANSACTION PROCESSING SYSTEM

An information system that processes data arising from the occurrence of business transactions is known as transaction processing system.

➢ Transaction processing systems (TPS) are aimed at improving the routine business activities on which all organizations depend.

➢ A transaction is any event or activity that affects the organization which occur as part of doing business, such as sales, purchases, deposit, withdrawals, refunds and payments.

➢ Common transactions include placing orders, billing customers, hiring employees, and depositing cheques.

➢ The types of transactions that occur vary from organization to organization.

➢ Transaction processing, the set of procedures for handling the transactions, often includes the activities like calculation, storage and retrieval, classification, summarization, sorting.

➢ Transaction processing procedures are often called standard operating procedures.

When you purchase a book from an online bookstore, you exchange money (in the form of credit) for a book. If your credit is good, a series of related operations ensures that you get the book and the bookstore gets your money. However, if a single operation in the series fails during the exchange, the entire exchange fails. You do not get the book and the bookstore does not get your money.

The technology responsible for making the exchange balanced and predictable is called transaction processing. Transactions ensure that data-oriented resources are not permanently updated unless all operations within the transactional unit complete successfully. By combining a set of related operations into a unit that either completely succeeds or completely fails, you can simplify error recovery and make your application more reliable.

Transaction processing systems consist of computer hardware and software hosting a transaction-oriented application that performs the routine transactions necessary to conduct business. Examples include systems that manage sales order entry, airline reservations, payroll, employee records, manufacturing, and shipping.

(a)   **Types of Transactions**

Note that the transactions can be internal or external. When a department orders office supplies from the purchasing department, an **internal transaction** occurs, when a customer places an order for a product, an **external transaction** occurs.

Internal Transactions: Those transactions, which are internal to the company and are related with the internal working of any organization. For example Recruitment Policy, promotion Policy, production policy etc.

External Transactions: Those transactions, which are external to the organization and are related with the external sources, are regarded as External Transaction. For example sales, purchase etc.

(b) Transaction Processing cycle

Transaction processing systems capture and process data describing business transactions. Then they update organizational files and databases and produce a variety of information products for internal and external use.

Transaction processing systems generally go through a five-stage cycle of

1. Data Entry: - The input activity in transaction processing systems involves a data entry process. In this process, data is captured, or collected by recording, coding, and editing activities. Then the data may be converted to a form that can be entered into a computer system. Data entry activities have always been a bottleneck in the use of computers for transaction processing.

2. Transaction Processing: - Transaction processing systems process data in two ways.

a) Batch processing - In a batch processing system, transaction data is accumulated over a period of time and processed periodically. For example paying by cheque.

Advantages of Batch Processing

➢ Control over time of processing

➢ Standardization

➢ Reduce setup and processing cost

Disadvantages of Batch Processing

➢ Time delay in gathering data , storing and bulk processing

➢ Operation cost may increase

➢ Only identical is processed in one batch

➢ Errors are corrected after processing the data

b) Real-time processing- real time processing is where all details of transactions are recorded and changed at the time as it occurs. For example- ATM.

Advantages of Real Time Processing

➢ Error correction can be immediate

➢ Data is processed as demand

➢ No time delay

Disadvantages of Real Time Processing

➢ Standardization may not exist or may be more difficult

➢ Processing needs make control difficult

➢ System hardware and software is expensive

➢ Security is critical

3. File and database processing-

An organizations database must be updated by its transaction processing system so that they are always correct and up-to-date. Therefore, Transaction processing system serve to assist in maintaining the corporate database of an organization to reflect changes resulting from day-to-day business transaction.

4. Document and report generation-

Transaction processing system generates a number of documents and reports.Eg of transaction documents are purchase order, sales receipt, customer statement.

Transaction reports might take the form of a transaction listing such as a payroll register, edit reports that describe errors detected during processing.

5. Enquiry Processing-

Many transaction processing system allow you to use internet, extranet, intranet and web browser or database management query languages to make enquiry and receive responses concerning the result of transaction processing activity. Typically responses are displayed in a variety of formats.

Examples of transaction processing systems include;

• **Point of Sale Systems** – records daily sales

• **Payroll systems** – processing employee's salary, loans management, etc.

• **Stock Control systems** – keeping track of inventory levels

- **Airline booking systems** – flights booking management

6.3   MANAGEMENT INFORMATION SYSTEM (MIS)

The MIS is an idea which is associated with man, machine, marketing and methods for collecting information's from the internal and external source and processing this information for the purpose of facilitating the process of decision-making of the business.

MIS is not new, only the computerization is new before computers MIS techniques existed to supply managers with the information that would permit them to plan and control business operations. The computer has added on more dimensions such as speed, accuracy and increased volume of data that permit the consideration of more alternatives in the decision-making process. The scope and purpose of MIS is better understood if each part of them is defined individually, thus

Management: Management has been defining in processor activities that describe what managers do in the operation for their organization plan, organize, initiate and control operations. They plan by setting strategies and goals and selecting the best course of action to achieve the goals. They organize the necessary tasks for the operational plan, set these tasks up into homogenous groups and assign authority delegation; they control the performance standards and avoiding deviation from the standard.

The decision-making is a fundamental prerequisite of each of the foregoing process, the job of MIS is facilitating decisions necessary for planning, organizing and controlling the work and functions of the business so that specified goals of the business are achieved.

Information: Data must be distinguished from information and the distinction is clear and important for the present purpose. Data are facts and figures that are not currently being used in a decision-making process and usually are taken from the historical records that are recorded and filled without immediate intent to retrieve for decision-making.

Information consists of data that have been retrieved, processed or otherwise used for information or interference purpose, argument or as a basis forecasting or decision-making regarding any business unit. Information is the knowledge that one derives from facts for the effective functioning of systems placed in the right context with the purpose of reducing uncertainty regarding the alternative courses of action as they are based on description and measurement of attributes of various entities associated with the enterprise.

System: The system can be described as a set of elements joined together for a common objective. A subsystem is a part of a larger system with which one is concerned. All systems for our purpose the organization is the system and the parts (divisions, departments, functions, unit, etc) are the subsystems. The system concept of MIS is, therefore one of optimizing the output of the organization by connecting the operating subsystems through the medium of information exchange. The Management information system (MIS) is a concept of the last two decade or two. It has been understood and described in a number of ways. It is also known as the Information System, the Information and Decision System, the computer-based Decision System.

Information is the lifeblood of an organization, particularly in the case of system approach management. The MIS or Information system can be defined as the knowledge communicated by others or obtained from investigation or study. It is a system providing needed information to each manager at the right time in the right form and relevant one which aids understanding and stimulates the action. MIS is an organized method of providing past, present and projection information relating to internal operations and externals intelligence. It supports the planning, control and operational functions of an organization by furnishing uniform information in the proper time frame to help the process of decision-making.

Management Information System is generally defined as an integrated user-machine system for providing information to support operations, management and decision-making functions in an organization. The system utilizes computer hardware and software, manual procedure, models for analysis. Information is viewed as a resource much like land, labor, and capital. It must be obtained processed, stored, manipulated and analyzed, distributed, etc. An organization with a well-defined information system will generally have a competitive advantage over an organization with poor MIS and no MIS.

The MIS has more than one definition, some of which are given below:

1. The MIS is defined as a system which provides information support for decision-making in   the organization.

2. The MIS is defined as an integrated system of man and machine for providing the information to support the operations, the management and the decision-making function in the organization.

3. The MIS is defined as a system based on the database of the organization evolved for the purpose of providing information to the people in the organization.

4. The MIS is defined as a computer-based information system.

Though there are a number of definitions all of them converge on a single point, i.e. the MIS is a system that supports the decision-making function of the organization. The difference lies in defining the elements of MIS. However, in today's world, the MIS is a computerized business processing system generating information for the people in the organization to meet the information needs for decision-making to achieve the corporate objective of the organization.

✓ MIS is a computer-based system that provides flexible and speedy access to accurate data. The organizational information system which in general relates to the planning, operation and control of an enterprise is the most important among them. MIS refers primarily to such an organizational system which is generally large, sophisticated, structured and dynamically evolving and of immense commercial values. A large number of programs and system analysts are employed by many organizations to build a variety of MIS. Thus, the education of programmers and system analysts as well as general manager, the subject of MIS, has occupied a key position.

✓ Thus, MIS is a set of computer-based system and procedures implemented to help managers in their routine job of decision-making and planning, expansion and development.

✓ The objective of MIS is to provide information for a decision support process of management. It should help in such a way that the business goals are achieved in the most efficient manner. Since the decision-making is not restricted to a particular level, the MIS is expected to support all the levels of the management in conducting the business operations. Unless the MIS becomes a management aid, it is not useful to the organization.

✓ Modern management system relies on MIS, the complexity of business management and the competitive nature of business requires handling of business operations with skill and foresight to avert the crisis. The management process is executed through a variety of decisions taken at each step of planning, organizing, staffing, directing, coordinating and controlling. If the management is able to spell out the decision required to be taken, then the MIS is designed suitably.

✓ The actual MIS process relates to:

     A.   Collection

     B.   Organization

     C.   Distribution

       D.   Storage of wide information

       E.   Managerial control and analysis of data

✓ Management Information Systems (MIS) are used by tactical managers to monitor the organization's current performance status. The output from a transaction processing system is used as input to a management information system.

(a)   **Why MIS?**

A manager has to take decisions with two main challenges:

First, a manager has to take quick decisions, or else there's a chance of the business being taken over by his competitors. The liberalization and globalization, in which organizations are required to compete globally, has further enhanced the necessity for such a system.

Second, information is doubling up every two or three years, a manager has to process a large voluminous data; failing which he may end up taking a strong decision that may prove to be very costly to the company.

Hence, Management Information System has proved to be the one of the most important in today's business environment.

(b)   **Manual Information Systems VS Computerized Information Systems (MIS)**

Data is the bloodstream of any business entity. Everyone in an organization needs information to make decisions. An information system is an organized way of recording, storing data, and retrieving information.

In this section, we will look at manual information systems vs. computerized information systems.

Manual Information System

A manual information system does not use any computerized devices. The recording, storing and retrieving of data is done manually by the people, who are responsible for the information system.

The following are the major components of a manual information system

- **People –**people are the recipients of information system

- **Business Procedures –**these are measures put in place that define the rules for processing data, storing it, analyzing it and producing information

- **Data –**these are the recorded day to day transactions

- **Filing system –** this is an organized way of storing information
- **Reports –**the reports are generated after manually analyzing the data from the filing system and compiling it.

Advantages and Dis-advantages of a manual information system

Advantages:

The following are the advantages of manual information systems

- **Cost effective –** it is cheaper compared to a computerized system because there is no need to purchase expensive equipment such as servers, workstations, printers, etc.
- **Flexible –**evolving business requirements can easily be implemented into the business procedures and implemented immediately

Disadvantages:

The following are some of the disadvantages of a manual information system.

- **Time consuming –**all data entries need to be verified before filing, this is a time consuming task when done by humans. Retrieving data from the filing system also takes a considerable amount of time
- **Prone to error –** the accuracy of the data when verified and validated by human beings is more prone to errors compared to verification and validation done by computerized systems.
- **Lack of security –** the security of manual systems is implemented by restricting access to the file room. Experience shows unauthorized people can easily gain access to the filing room
- **Duplication of data –**most departments in an organization need to have access to the same data. In a manual system, it is common to duplicate this data to make it easy to accessible to all authorized users. The challenge comes in when the same data needs to be updated
- **Data inconsistency –** due to the duplication of data, it is very common to update data in one file and not update the other files. This leads to data inconsistency
- **Lack of backups –** if the file get lost or mishandled, the chances of recovering the data are almost zero.

Computerized information system

Computerized systems were developed to address the challenges of manual information systems. The major difference between a manual and computerized information system is a computerized system uses a combination of software and hardware to record, store, analyze and retrieve information.

(c)   Examples of management information systems include;

1)   **Sales management systems** – they get input from the point of sale system

2)   **Budgeting systems** – gives an overview of how much money is spent within the organization for the short and long terms.

3)   **Human resource management system** – overall welfare of the employees, staff turnover, etc.

(d)   Important roles of the MIS:

- MIS satisfies the diverse needs through a variety of systems such as Query System, Analysis System, Modeling System and Decision Support System.

- It helps in strategic planning, management control, operational control and transaction processing.

- It helps in the clerical transaction processing.

- It answers the queries on the data pertaining to the transaction, the status of a particular record and reference on a variety of documents.

- MIS for Junior Management: Providing the operational data for planning, scheduling and control, and helps them further in decision-making at the operation level to correct an out of control situation.

- MIS for Middle Management: In short-term planning, target setting and controlling the business functions which is supported by the use of the management tools of planning and control.

- MIS for Top- Level Management: in goal setting, strategic planning and evolving the business plans and their implementation.

- It plays the role of information generation, communication, problem identification and helps in the process of decision-making.

In conclusion, organizations today just cannot survive and grow without properly planned, implemented and maintained MIS.

(e)   Competitive advantage of information and MIS

Competitive advantage is a position that makes a business more profitable than its competitors. For example, producing products at a lower cost than your competitors makes you more profitable. Information systems have the capacity to help an organization into such a position. They do so in the following ways:

Operational excellence – operational excellence seeks to improve the operations of the business. Let's take an example of a retail store. A retail store can use information systems to automatically place an order with a supplier once the inventory level reaches the re-order limit. This ensures that the retail store never runs out of inventory and customers can always count on it to find what they need.

New business models, products, and services – let's continue with the example of a retail store. The retail store can develop a web based order system or smart phone application that clients can use to buy items from the comfort of their homes or wherever they are. The order system can be linked to a delivery business and have support for online payments. This is a new business model compared to customers walking in to make purchases vs doing it from web based or smart phone apps.

Improved supplier and customer relations – historical data is used to understand the needs of the customers and suppliers. This data is then used to create services and products that address the needs. This leads to long-term relationships with customers and business which puts an organization in a more profitable position.

Improved decision making – information is critical when making decisions. Information systems if designed and operated efficiently then outputs information that has all the characteristic of good information that described in the above section. This enables an organization to make decisions that will profit the organizations.

(f) Components of MIS and their relationship

A management information system is made up of five major components namely people, business processes, data, hardware, and software. All of these components must work together to achieve business objects.

People – these are the users who use the information system to record the day to day business transactions. The users are usually qualified professionals such as accountants, human resource

managers, etc. The ICT department usually has the support staff that ensures that the system is running properly.

Business Procedures – these are agreed upon best practices that guide the users and all other components on how to work efficiently. Business procedures are developed by the people i.e. users, consultants, etc.

Data – the recorded day to day business transactions. For a bank, data is collected from activities such as deposits, withdrawals, etc.

Hardware – hardware is made up of the computers, printers, networking devices, etc. The hardware provides the computing power for processing data. It also provides networking and printing capabilities. The hardware speeds up the processing of data into information.

Software – these are programs that run on the hardware. The software is broken down into two major categories namely system software and applications software. System software refers to the operating system i.e. Windows, Mac OS, and Ubuntu, etc. Applications software refers to specialized software for accomplishing business tasks such as a Payroll program, banking system, point of sale system, etc.

(g) Following are the key characteristics of MIS:

1. **System approach:** MIS follows the system approach, which implies a step by step approach to the study of system and its performance in the light of the objective for which it has been constituted. It means taking an inclusive view at sub-systems to operate within an organization.

2. **Management-oriented:** The management-oriented characteristic of MIS implies that top-down approach needs to be followed for designing MIS. A top-down method says the initiation of system development determines management requirements as well as business goals. MIS implies the management dynamically to the system development towards the completion of management decision.

3. **As per requirements:** The design and development of MIS should be as per the information required by the managers. The required design and development information is at different levels, viz., strategic planning, management control and operational control. It means MIS should cater to the specific needs of managers in the hierarchy of an organization.

4. **Future-oriented:** The design and development of MIS should also be future purpose so that the system is not restricted to provide only the past information.

5.   **Integrated:** A complete MIS is a combination of its multiple sub-components to provide the relevant information to take out a useful decision. An integrated system, which blends information from several operational areas, is a necessary characteristic of MIS.

6.   **Common data flows:** This concept supports numerous basic views of system analysis such as avoiding duplication, combining similar functions and simplifying operations. The expansion of common data flow is a cost-effectively and logical concept.

7.   **Long-term planning:** MIS should always develop as a long term planning because it involves logical planning to get success of an organization. While developing MIS, the analyst should keep future oriented analysis and needs of the company in mind.

8.   **Relevant connection of sub-system planning:** The MIS development should be decomposing into its related sub-systems. These sub-systems must be meaningful with proper planning.

9.   **Central database:** it contains data in tabular form. The data base is responsible to operations like insertion, deletion, updating of records. This database covers information related to inventory, personnel, vendors, customers, etc. the data stored in the database.

(h)   Advantages:

The following are the advantages of computerized information systems

- **Fast data processing and information retrieval** – this is one of the biggest advantages of a computerized information system. It processes data and retrieves information at a faster rate. This leads to improved client/customer service

- **Improved data accuracy** – easy to implement data validation and verification checks in a computerized system compared to a manual system.

- **Improved security** – in addition to restricting access to the database server, the computerized information system can implement other security controls such as user's authentication, biometric authentication systems, access rights control, etc.

- **Reduced data duplication** – database systems are designed in such a way that minimized duplication of data. This means updating data in one department automatically makes it available to the other departments

- **Improved backup systems** – with modern day technology, backups can be stored in the cloud which makes it easy to recover the data if something happened to the hardware and software used to store the data

- **Easy access to information** – most business executives need to travel and still be able to make a decision based on the information. The web and Mobile technologies make accessing data from anywhere possible.

(i)   Disadvantages:

- **It is expensive to set up and configure** – the organization has to buy hardware and the required software to run the information system. In addition to that, business procedures will need to be revised, and the staff will need to be trained on how to use the computerized information system.

- **Heavy reliance on technology** – if something happens to the hardware or software that makes it stop functioning, then the information cannot be accessed until the required hardware or software has been replaced.

- **Risk of fraud** – if proper controls and checks are not in place, an intruder can post unauthorized transactions such as an invoice for goods that were never delivered, etc.

6.4   CHECK YOUR PROGRESS

1. _____ is required by the managers at the strategic level of management for the formulation of organizational strategies.

2. An information system that processes data arising from the occurrence of business transactions is known as _____.

3. _____ are used by top level managers, and they help top level managers to make unstructured decisions.

4. _____ is a collection of people, procedures, data, and information technology that aids managers to make informed decisions.

5. _____ are by operational staff to record day to day business transactions, and they are used to make structured decisions.

6.5 SUMMARY

MIS is the acronym for Management Information System. It is a collection of people, procedures, data, and information technology that aids managers to make informed decisions. Computerized information systems are more efficient compared to manual information systems. Manual information systems are cheaper compared to computerized information systems. Transaction processing systems (TPS) are used by operational staff to record day to day business transactions, and they are used to make structured decisions. Management Information Systems (MIS) are used by middle-level managers to make semi-structured decisions. Decision Support Systems are used by top level managers, and they help top level managers to make unstructured decisions.

6.6 KEYWORDS

Information System: An information system is the information and communication technology (ICT) that an organization uses, and also the way in which people interact with this technology in support of business processes.

Transaction processing system: An information system that processes data arising from the occurrence of business transactions is known as transaction processing system.

Management information system: A management information system (MIS) is a computer system consisting of hardware and software that serves as the backbone of an organization's operations. An MIS gathers data from multiple online systems, analyses the information, and reports data to aid in management decision-making.

Decision support system: A decision support system (DSS) is a computerized program used to support determinations, judgments, and courses of action in an organization or a business.

6.7 Self-assessment Test

1. What do you mean by information system, explain in detail?
2. Explain the Transaction processing system.
3. Write short note on Management information system. Discuss various advantages and disadvantages of MIS.

4. Discuss the various features of decision support system.

5. What are the various characteristics of Executive support system?

6. What is Business expert system? Explain its characteristics.

7. Discuss "why do we require an information system for our business?"

8. Explain the various causes of information system failure.

9. Discuss the key characteristics of MIS.

10. Discuss the competitive advantages of information and MIS.

6.8 Answers to Check Your Progress

1. Strategic information

2. Transaction processing system

3. Decision Support Systems

4. Management information system

5. Transaction processing systems

6.9 References/Suggested Readings

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Subject: Computer Applications in Business	
Course Code: DBA-104	Author: Mr. Balwant Kumar
Lesson 7: E-Commerce: Concept, WWW and Application Services	Vetter: Prof. Dhramender Kumar

LESSON STRUCTURE

7.0 Learning Objectives

➢ How the term E-commerce has been defined,

➢ What are the goals and scope of E-commerce

➢ What are the different methods to use E-commerce?

➢ About the scope of E-commerce.

➢ Application of www for E-commerce.

➢ About World Wide Web

➤ The benefits of getting your business into using e-commerce at one or more levels

➤ Which technical and economical challenges have to be faced when doing business electronically?

7.1 Introduction to E-Commerce

This chapter introduces you about the paperless exchange of business information- known as "E-Commerce". The World Trade Organization defines e-commerce as, "e-commerce is the production, distribution, marketing, sales or delivery of goods and services by electronic means." E-Commerce is commonly referred as electronic commerce. It is also known as "Internet Commerce". It refers to the buying and selling of goods or services using the internet, and the transfer of money and data to execute these transactions.

Michael Aldrich in 1979 invented online shopping to enable online transaction processing between consumers and businesses, or between one business and another, a technique known later as e-commerce.

In traditional commerce, communication/transactions are done in synchronous way. Manual intervention is required for each communication or transaction. Now with e-commerce, communication or transactions can be done in asynchronous way. The whole process is completely automated.

It takes place between companies, between companies and their customers, or between companies and public administrations. Section (a) states basic concepts about E-commerce. Section (b) states objectives of E-commerce in our daily life. In addition to usage of e-Commerce specified in section (c), there are some benefits provided to organization, society, and customers are also specified in section (d) of this chapter. Section 7.1.3 states about **WWW**. A broader definition comes from the World Wide Web Consortium (W3C): "The World Wide Web is the universe of network-accessible information, an embodiment of human knowledge."

(a) E- Commerce

E-commerce is a business model or a larger business model that allows companies or individuals through the electronic network.

Electronic commerce is subdivided into three categories: business to business in B2B, business to consumer or B2C and consumer to consumer or C2C. What is B2B (Business To Business)? B2B is a

type of between manufacturers and wholesalers or wholesalers and retailers. Business to business refers to the business between the company rather than the company and personal consumption. What is B2C (Business to Customer)? B2C is also the trading between consumers. What is C2C (Customer to Customer)? C2C is the promotion and interaction between benefit and customer. Customer to customer is to provide location and talk to people, exchange and trading with other people.

(b) Goals of E-Commerce-

- Reduce cost
- Reduce product cycle time
- Faster customer response
- Improve service quality
- Attract more customer

(c) Usage of Electronic Commerce:

1. Send letters, documents, orders, or advertising material around the world, almost instantaneously and low cost;

2. Create a store-front on the Internet so that people around the world can find and access your business · Buy or sell around the world via the Internet - do business with anyone, anywhere in the world at any time;

3. Provide better information and services to businesses and consumers;

4. Streamline your business processes and reduce costs.

It is also called a '**Virtual Market Place'**.

(d) Benefits of E-Commerce-

1. Benefits to Organization-

- E-Commerce decreases the cost of creating, Processing, distributing, storing and retrieving paper based information.
- E-Commerce reduces the time.
- Improved customer service.
- Improved image.

2. Benefits to Consumer-

- Customer can perform a transaction 24 hours per day.

- It provides customers with more choices

- It allows quick delivery

- Customer can communicate with each other through electronic communication

- It provides customer with less expensive products

3. Benefits to Society-

- It reduce the time of travelling for shopping

- Its facilitates people in rural areas to enjoy product and services

- It facilitates delivery of public services

(e) Methods of using of E-Commerce

E-commerce can be used in following ways

- **Electronic Data Interchange (EDI)-** Electronic data interchange (EDI) is the most commonly used B2B e-commerce technology today. It is the computer-to-computer exchange of business documents, such as purchase orders and invoices, in a standard electronic format between business partners.

- **Electronic Mail (e-mail)-** Electronic mail (also called email or e-mail) is the transmission of messages over communications networks. Most email systems include an editor for composing messages and then you send the message by specifying the recipient's email address.

- **Electronic Bulletin Boards**-Electronic bulletin boards (also known as message boards or   as computer forums) are online communication systems where one can share, request, or discuss information on just about any subject.

- **Electronic Fund Transfer (EFT)**-*Electronic funds transfer* (*EFT*) are *electronic   transfer* of money from one bank account to another, either within a single financial institution or across multiple institutions, via computer-based systems, without the direct intervention of bank staff.

- Other Network-based technologies

(f) Scope of E-commerce

- Marketing, sales and sales promotion.

- Pre-sales, subcontracts, supply.

- Financing and insurance.

- Commercial transactions – ordering, delivery, payment.

- Product service and maintenance.

- Co-operative product development.

- Distributed co-operative working.

- Use of public and private services.

- Business-to-administrations

- Transport and logistics.

- Public procurement.

- Automatic trading of digital goods like games, learning material, songs and music etc.

- Accounting and financial management.

- Legal advice

7.1.1 TYPES OF E-COMMERCE

Electronic commerce can be classified into following main categories. The basis for this simple classification is the parties that are involved in the transactions. So the six basic electronic commerce models are as follows,

- Business-to-Business (B2B)
- Business-to-Consumer (B2C)
- Consumer-to-Consumer (C2C)
- Consumer-to-Business (C2B)
- Business-to-Administration (B2A)
- Consumer-to-Administration (C2A)

Business-to-Business (B2B): This kind of E-commerce consists of all the electronic transactions and dealings related to the goods and services. These basically are conducted between companies and include conventional wholesalers and producers dealing with retailers.

Business-to-Consumer (B2C): The Business-to-Consumer E-commerce is related to the transactions and relationship between businesses and the end customers. This is mainly to do with the retail E-commerce trade that takes place online. With the inception of the internet, B2C E-commerce has evolved to a great extent. Today, we find scores of electronic shopping sites and virtual stores on the web, that sell myriad products, ranging from computers, fashion items to even necessities.

In this case, the customer has more info about the products in the form of informative content and there is also a chance to buy products at cheaper rates. Most times, quick delivery of the order is also maintained.

Steps in B2C E-commerce

1. Customer uses a browser and locates vendor or he has vendor's webpage address

2. Sees Vendor's web page listing of items available, prices etc

3. Customer selects item and places order. Order may include credit card details or may be cash on delivery

4. Vendor checks with credit card company customer's credit

5. Credit card company OKs transaction

6. Vendor acknowledges Customer's order and gives details of delivery date, mode of transport, cost etc

7. Vendor orders with distributor who ships item to vendor's warehouse from where item supplied to customer

8. Customer's credit card company debits his account, credits vendor's account and sends bill to customer for payment.

Consumer-to-Consumer (C2C): This consists of electronic transactions of products and services between two customers. These are mainly conducted through a third party that provides an online platform for these transactions. Sites, where old items are bought and sold, are examples of C2C E-commerce.

Consumer-to-Business (C2B): In this, a complete reversal of the selling and buying process takes place. This is very relevant for crowd sourcing projects. In this case, individuals make their items or services and sell them to companies. Some examples are proposals for company site or logo, royalty free photographs, design elements and so on.

Business-to-Administration (B2A): In this kind of E-commerce transaction, there are dealings between companies and public administration. It encompasses different services, such as social security, fiscal measures, legal documents, employment and so on.

Consumer-to-Administration (C2A): In this E-commerce model, electronic transactions are carried between individuals and public administration. Some examples are distance learning, information sharing, electronic tax filing, and so on.

The main objective of both the B2A and C2A types of E-commerce is to increase flexibility, efficiency, and transparency in public administration.

7.1.2 E-COMMERCE ARCHITECTURE

- E-commerce is based on the client-server architecture.

- A client can be an application, which uses a Graphical User Interface (GUI) that sends request to a server for certain services.

- The server is the provider of the services requested by the client.

- In E-commerce, a client refers to a customer who requests for certain services and the server refers to the business application through which the services are provided.

- The business application that provides services is deployed on a Web' server.

- The E - Commerce Web server is a computer program that provides services to "other computer programs and serves requested Hyper Text Mark-up Language (HTML) pages or files.

- In client-server architecture, a machine can be both a client as well as a server.

There are two types of client server architecture that E-commerce follows: two-tier and three-tier.

I.   **E- Commerce System Architecture: Two-tier architecture:**

In two-tier client-server architecture the user interface runs on the client and the database is stored on the server. The business application logic can either run on the client or the server. The user application logic can either run on the client or the server. It allows the client processes to run separately from the server processes on different computers.

The client processes provide an interface for the customer that gather and present the data on the computer of the customer. This part of the application is known as presentation layer. The server processes provide an interface with the data store of the business.

This part of the application is known as data layer. The business logic, which validates data, monitors security and permissions and performs other business rules, can be kept either on the client or the server. The following Figure shows the e commerce system two-tier architecture diagram.
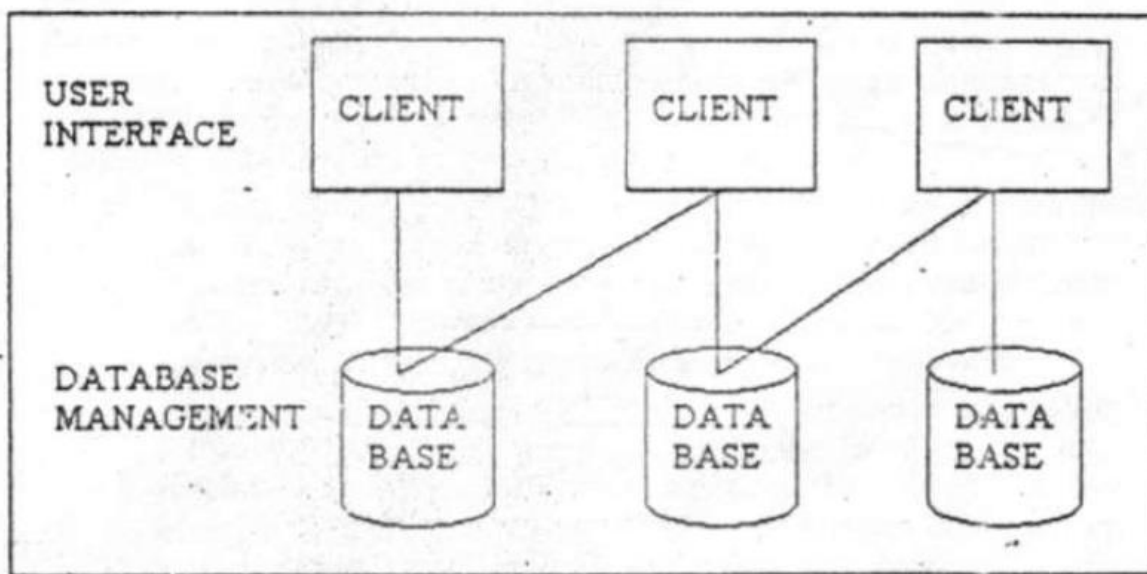
II.   E-Commerce System Architecture: Three tier architecture

The three-tier architecture emerged in the 1990s to overcome the limitations of the two-tier architecture. In three-tier architecture, the user interface and the business application logic, also known as business rules and data storage and access, are developed and maintained as independent modules.

The three-tier architecture includes three tiers:

- ✓ Top tier,

✓ Middle tier and

✓ Third tier.

The **top tier** includes a user interface where user services such as session, text input, and dialog and display management reside.

The **middle tier** provides process management services such as process development, process monitoring and process resourcing that are shared by the multiple applications.

The **third tier** provides database management functionality. The data management component ensures that the data is consistent throughout the distributed environment, the centralized process logic in this architecture, which makes administration easier by localizing the system functionality, is placed on the middle tier.
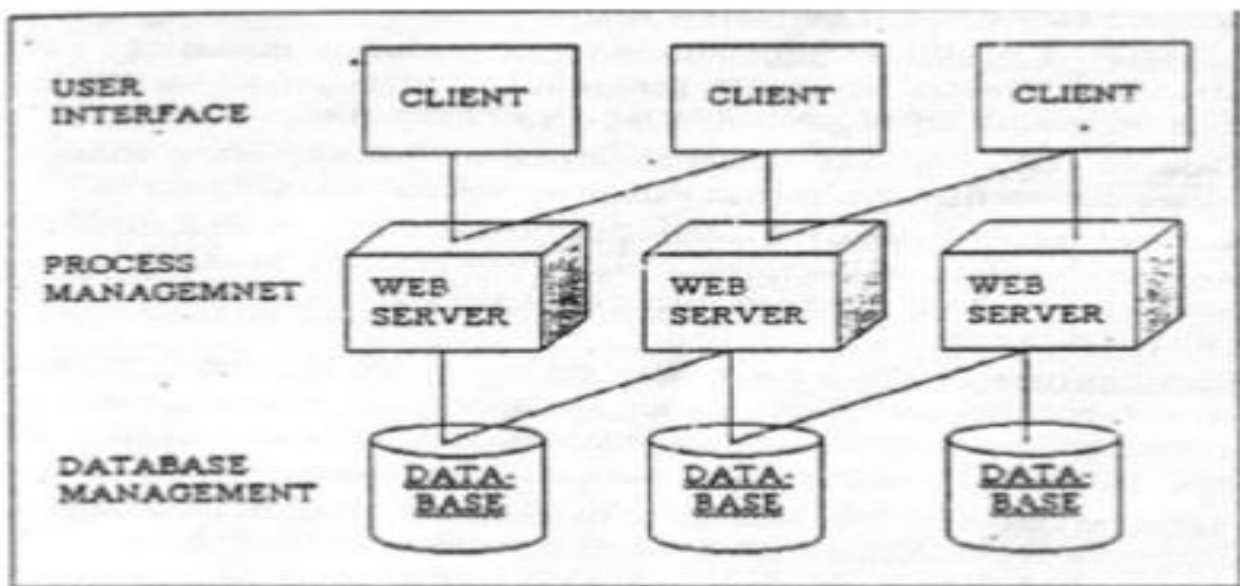
The figure above shows the outline of the e commerce system three - tier architecture diagram.

III.   Advantages of Client –Server model:

➢ The client-server architecture provides standardized, abstract interfaces to establish communication between multiple modules. When these modules are combined, they become an integrated business application. Each module is a shareable and reusable object that can be included in another business application.

➢ In the client-server architecture, the functions of a business application are isolated within the smaller business application objects and so application logic can be modified easily.6

➢ In "the client-server architecture, each business application object works with its own encapsulated data structures that correspond to a specific database. When business application objects communicate, they send the data parameters as specified in the abstract interface rather than the entire database records.

➢ This reduces the network traffic. In the client-server architecture, a programmer can develop presentation components without knowing the business application logic.

➢ This architecture also helps a database analyst in accessing the data from the database without being concerned how the data is presented to an end user.

7.1.3 WWW

The **World Wide Web** is the universe of network-accessible information. The development of the World Wide Web was begun in 1989 by Tim Berners-Lee and his colleagues at CERN, an international scientific organization based in Geneva, Switzerland. The Web gives users access to a vast array of documents that are connected to each other by means of hypertext or hypermedia links— i.e., hyperlinks, electronic connections that link related pieces of information in order to allow a user easy access to them. Hypertext allows the user to select a word or phrase from text and thereby access other documents that contain additional information pertaining to that word or phrase; hypermedia documents feature links to images, sounds, animations, and movies. Browser software allows users to view the retrieved documents. A hypertext document with its corresponding text and hyperlinks is written in Hyper Text Markup Language (HTML) and is assigned an online address called a Uniform Resource Locator (URL).

I. Difference between World Wide Web and Internet

Some people use the terms 'internet' and 'World Wide Web' interchangeably. They think they are the same thing, but it is not so. Internet is entirely different from WWW. It is a worldwide network of devices like computers, laptops, tablets, etc. It enables users to send emails to other users and chat with them online. For example, when you send an email or chatting with someone online, you are using the internet.

II. World Wide Web and E-Commerce

This invention became the launching point of the growth of the Internet as a way for businesses to share information about them. As web browsers and Internet connections became the norm, companies rushed to grab domain names and create websites. The year 1994 saw the establishment of both eBay and Amazon.com, two true pioneers in the use of the new digital marketplace.

Companies are utilizing the WWW today for purposes of:

(1) Promoting greater awareness of their companies and products;

(2) Providing customer support for their products

(3) Offering sales of products or services directly or indirectly either exclusively through the web or to supplement existing marketing channels

(4) Selling advertising space on Web sites to other companies

(5) Offering electronic information services.

Clearly, WWW applications for electronic commerce have accelerated so quickly in the past years that little attention has been paid to understanding WWW usage at a higher level.

7.1.4 APPLICATIONS OF E-COMMERCE

The applications of E-commerce are used in various business areas such as retail and wholesale and manufacturing. The most common E-commerce applications are as follows:

1. Online marketing and purchasing
2. Retail and wholesale
3. Finance
4. Manufacturing
5. Online Auction
6. E-Banking
7. Online publishing
8. Online booking
9. **Electronic Newspapers**
10. **Internet Bookshops**

I. Online marketing and purchasing

Data collection about customer behavior, preferences, needs and buying patterns is possible through Web and E-commerce. This helps marketing activities such as price fixation, negotiation, product feature enhancement and relationship with the customer.

II. Retail and wholesale

E-commerce has a number of applications in retail and wholesale. E-retailing or on-line retailing is the selling of goods from Business-to-Consumer through electronic stores that are designed using the electronic catalog and shopping cart model. Cybermall is a single Website that offers different products and services at one Internet location.

III. Finance

Financial companies are using E-commerce to a large extent. Customers can use E-commerce for following purposes-

- Check the balances of their savings and loan accounts
- Transfer money to their other account
- Pay their bill through on-line banking or E-banking.

Another application of E-commerce is on-line stock trading. Many Websites provide access to news, charts, information about company profile and analyst rating on the stocks.

IV. Manufacturing

E-commerce is also used in the supply chain operations of a company. Some companies form an electronic exchange by providing together buy and sell goods, trade market information and run back office information such as inventory control. This speeds up the flow of raw material and finished goods among the members of the business community. Various issues related to the strategic and competitive issues limit the implementation of the business models. Companies may not trust their competitors and may fear that they will lose trade secrets if they participate in mass electronic exchanges.

V. Auctions

Customer-to-Customer E-commerce is direct selling of goods and services among customers. It also includes electronic auctions that involve bidding. Bidding is a special type of auction that allows prospective buyers to bid for an item. For example, airline companies give the customer an opportunity to quote the price for a seat on a specific route on the specified date and time.

VI. E-Banking

Online banking or E- banking is an electronic payment system that enables customers of a financial institution to conduct financial transactions on a website operated by the institution, Online banking is also referred as internet banking, e-banking, virtual banking and by other terms. Some sites related to Internet banking are as follows:

- www.indianbank.net.in
- www.icicibank.com

You cannot use the services provided by the online banks till you are not the customer.

VII. Online Publishing

Electronic publishing (also referred to as e-publishing or digital publishing) includes the digital publication of e-books, digital magazines, and the development of digital libraries and catalogs.

VIII. Online Booking

An Internet Booking Engine (IBE) is an application which helps the travel and tourism industry support reservation through the Internet. It helps consumers to book flights, hotels, holiday packages, insurance and other services online.

IX. Electronic Newspapers

One of the hot areas on the Internet is the electronic newspaper. Electronic newspaper has advantages over both, the printed newspapers and the broadcast news on radio and televisions. In comparison to printed newspaper, the e-newspaper can give up-to-date news similar to broadcast news. Further, the browser could be set to select the news of interest of the reader and to leave out the rest. This is not possible with the broadcast news.

Despite the said advantages, the electronic newspapers are not being very popular due to the following reasons:

- Radio and television news are often consumed while people are doing other things like eating their foods or driving a car.
- Printed newspapers may be read on the train or in the park and then may be shared with someone else.
- The printed newspapers give the reader the chance to be selective (the selection depends on the moods and time of the reader).

There are a number of online newspapers and most of them are web versions of existing newspapers. For example:

- www.timesofindia.com
- www.dainikjagran.com

X. Internet Bookshops

It is one of the first applications of e-commerce on Internet. Books as an item have the following significant advantages:

- Books can be described well on the Internet. Moreover, it is not an item, which is required to be checked physically.
- Normally, the books have nominal prices and not too much risk is involved in the online payments.
- Books are small items and can be delivered in the customer's letterbox. The customer does not need to be at home.
- A large database of books. The details available for display include a picture of the cover, description of the book including page numbers, price of the book and reviews of other customers also if possible.
- The book can be searched with the help of search engines. The search can be made on the author's name, title of the book or the subject etc.
- There may be software on the site that may record the interest of the particular customer and can inform the customer on the new arrivals on that subject.

Some large online bookshop sites are:

- www.amazon.com
- www.infibeam.com
- books.rediff.com

7.2 ADVANTAGES

I. Speed up the buying process and save time for customers

It literally speeds up the buying process because when someone thinks of buying one specific product from the physical store, which is very far and not easily available. Here how the E-commerce helps the customer to avail the specific product easily and speedily.

For example – Sometimes customer are not able to find a particular product from the store and even by visiting other chained stores, this is where E-commerce come into a scene with a quick response over the requirement by even helping to purchase the particular product without wasting time.

E-commerce helps the one to choose from a wide range of online accessed products easily and get it delivered too; it helps you to access online global market standards.

Such type of buying process can help you to reduce the traveling time and helps you with choosing plenty of options which you might be looking forward to getting your own one.

II. Personalize the store as per the customer expectation

One of the online business benefit which will enhance your <u>online shopping</u> experience. It is because every purchase which is made online will be referred as per location and recommended as per customers advanced searches.

It is one kind of personalize store where every customer has a different front page because of their location and previous purchases. Even customers are eligible sometime to get extra services because of previous history and loyalty towards the services. Such kind of store helps the customer to fulfill their expectations.

III. Reduce recurring cost while hiring virtual support resources.

One of the factors which can benefit in E-commerce is that by hiring employees is affordable. It is like you can choose to outsource your task and work to your virtual assistants in different countries. It will make your presence of the company in a different location at the same time always. In this case, you will not need many employees in an E-commerce business as compared retail locations.

IV. Easily retarget your customers.

There are many ways to retarget the customer and sell the product nicely. Below are some of the techniques which you can use to retarget customers:-

- Share a coupon when customers leave the checkout page.

- Even by sending emails which are pitching upsell and cross-sell.
- Can be done through Google paid and organic search results.
- It can be done through the customer's number of visits to a specific page with a certain period of time.

V. Easier to encourage an impulse buy

Impulse buying is one of the techniques where it works as a common behavior of customer's perception towards a particular product. It is related to the control of human psychological behavior which is like some people possess personality traits that can be said as impulse buying tendencies.

This is what can be used on an E-commerce platform too by making the product more attractive with images, other color options and even by showing a video of the product. So the customer can get the same aura of buying the product from the store.

VI. Reviews Available

It has so many positive recommendations which can give more values to your E-commerce website and help customers to build more trust over a particular product. It can help you to be clear and more visible about the product that helps you with more product selection too.

All of the reviews are valuable to customers, which can really help a lot to built trust over the products and services

VII. Able to provide detailed information to the customer.

Every customer looks for more details over the products so that it can help them to take a wise decision over their purchases. It is one kind of description which really helps a lot and expresses about any particular product.

It is in short one kind of information which is been shared clearly on the description about the product, that helps the user to take a final decision on the requirements. The flow which is been shared below the product in detail makes the customer to understand it in more details and that makes them to put them on a cart for their final check out with making them aware of all the features and functions of the product.

VIII. Best Quality of services in reasonably low operation cost

It is one of the benefits which plays a very vital role over an E-commerce platform. In most of the case, physical retail stores have to pay a lot to maintain their presence in the market by paying rent or even if it's own. There are several upfront costs which affect the store which is physically owned.

E-commerce store will help you cut off more than 60% of the price which has been run through a physical store. When you talk about operation cost it is very high as compared to the online store. One has to pay their staff, location charges, inventory, store design etc, which affects a lot.

IX. Quick and affordable marketing

You will not have to spend many bucks to market your e-commerce biz. There are many ways to pull your E-commerce business into this online world through various ways of online marketing which are quick and affordable.

Here are some of the unique ways which can just make you understand and help you with improvising marketing techniques.

- Always go with great content this is what helps you to be more visible in the market through creative content marketing.
- You can even go for creative marketing video which expresses about the product and services.
- Social networking helps you to make your presence everywhere because there is no one who is currently not into socializing.
- Even there are DIY info graphics which helps you to express about presence, you can say contrary that it works as browser.
- It helps you to enlighten the life to old data too.
- Every customer can be reached through digital market just have to focus on the techniques to approach them.

This what makes all things affordable because when you try to same on offline marketing it is expensive and time consuming a lot.

X. Provide flexibility to the customer to buy product 24/7

It has more flexibility over the regular store because the services are available 24/7 and though helps to serve you the services at anytime and anyplace.

There is a lot of change in the online markets recently which are providing you services helping you with the recommendation, sales support, chat support and even helps you find similar products. E-commerce is one of the platform which available for consumers 24/7 and globally.

XI. less store setup cost and quick ROI (Return of investments)

When you talk about E-commerce it has less amount of investment as compared to the offline store, it takes a huge amount of investment to set up an offline store which affects your business a lot by lacking on the return of investments.

This happens all because all investment which is been done over maintaining the store, on the contrary, it takes less amount of investment to make an online one.

Even after investing a lot of money over stock, labor, services, maintenance, electricity bill, rent (if any) etc, these will never help you out to gain profits over your investments. **E-commerce stores** are affordable and though if you see nicely than you will find that there is not much of investment as compared to the offline store and has more benefits too.

XII. No Geographical limitation, tap the global market form the day one.

It is like the customer will have access to the online store from anywhere in the world, which can globally be accessed. This is what every customer is looking forward to having as their service because sometimes customers are not able to find a particular product which not available at the store location but though online store works like a magic to provide them with multiple options. So, they can avail the services easily.

That is the main reason why E-commerce store helps you to be visible over the global market, where you will be fully available to everyone across the globe from the day one itself.

XIII. Reduce Resource hiring and training cost

In E-commerce you will not have to hire many employees as compared to the store, it is because when you open an online store your half of the work is been done through approaching customers directly by providing detailed information and visibility of the products.

You will not have to hire a seller to express everything about the product or have to train them. This is what makes E-commerce more effective in cost deduction of hiring and training employees.

XIV. Avoid human error while dealing with customers.

In the path of e-commerce, you will never face the issue of human error because every product is updated with details on the site, so that makes easy for the customer to have more visibility over the products.

This is what makes the customer feel comfortable to buy online as compared to the store. The stores are way more difficult sometimes because due to lack of options, comparison and descriptions.

When you visit a store you will always find that the seller tries to express with things which are not much convincing but though still, you will have to hear it till the end. This is what makes the customer more confusing to buy or not? It is like getting pitched again and again for the same on what you are not looking for to get checked out.

XV. Environment – Friendly

You can say the E-commerce is totally eco-friendly as compared to the store. It is because when we visit a store at a time of purchase, we receive a bill, receipts, coupons etc.

These harms our environment a lot and that is the reason why E-commerce bought such services which are much eco-friendly and easy to maintain.

XVI. Compare product and price

In the world of E-commerce, you can compare the products easily which shares a detailed description over it. The most beneficial part of E-commerce is that you can avail and understand the product clearly but though this happens totally opposite when you visit a store.

In store you might not be able to find the product and will not be able to compare it, even you might have to visit multiple shops to know the differences.

This is what saves time for the customers when we look into the world of E-commerce. Every service which are been provided through E-commerce are made to serve customers to have easy access with more details and less time-consuming.

7.3   DISADVANTAGES OF E-COMMERCE

Security

Online portals have been in the news a lot because of hacks by cybercriminals and hackers. It is a very serious issue as your account might be hacked because of negligence and wiped out clean of the existing cash.

This is a harsh reality of e-commerce sites and a website cannot give this assurance that the financial information cannot be compromised on its portal. The website owner needs to take important steps to change its password so as to stop any data breaches.

- Training and maintenance-
- Hardware and Software problems
- Online Security problem

Legal issues

Several cyber laws have been implemented to protect the rights of both seller and buyer. If you are looking to create a website it is important that you go through the local laws as well as cyber laws so that you do not have to face any problems later on. A serious disadvantage of e-commerce portals is that people either take care of local laws or cyber laws and fail to realize that you need to pay attention to both of them if you want to make a success of your business.

Huge technological cost

E-commerce requires advanced platforms to better their performance. If it faces disturbances in the form of software, network or domain issue it will not be able to offer seamless transactions.

The apt technical infrastructure is costly and needs huge investment. It also needs to be upgraded periodically to stay with changing times. Huge technological cost for a successful venture is a disadvantage of the e-commerce portal.

Fear

People fear the unknown. E-commerce transactions are mostly faceless and paperless without any due proof. Most of the organizations do not have a physical existence and customers are hesitant to make card payments beforehand.

They fear that if the desired product does not arrive then they will lose their money. If this happens then how are they going to trace the online outlet and recover their hard-earned money? One of the disadvantages of e-commerce is the absence of the physical existence of the store.

High labour cost

High labour cost is a serious disadvantage of the e-commerce platform. You need to hire technically sound, trained and qualified workforce for your website who are talented and capable of handling them in an efficient manner.

You need to shed a large chunk of money to hire and retain a talented pool of workers that will prove an immense help in handling all transactions.

Credit card fraud

Online transactions are mostly made by debit card, credit card, and internet banking and in very few cases with cash on delivery option. Yes, the website owners try to take every available precaution to protect the card details but what if the site is hacked by cybercriminals.

It is a growing concern as we hear news of data hacks regularly. The websites need to place proper blockers in place because the customers will lose faith and will stop making online payments. Stop it before it starts proving a serious disadvantage for e-commerce sites.

Dependency on the website

An e-commerce site is heavily dependent on its website. If it is not properly projected or the software is not implemented the site can face technology hiccups. It then comes under the serious radar.

Customers tend to lose faith very easily and shift their loyalties to other portals that they find convenient. The portal will suffer substantial loss because of this action.

Do not keep all the eggs in one basket as the dependency on the website can prove a disadvantage of e-commerce in times of crises.

Shipping problems

E-commerce stores run successfully because it can ship its products from anywhere to everywhere with ease. It has a strong network that helps it in its endeavor. In a physical store, a buyer chooses a product, purchases it and leaves the store with the item.

This is not so on an online store where the customer has to choose and buy and then wait for the product to arrive at his doorstep within the stipulated time frame. Shipping is an integral part of commerce and if you do not have appropriate infrastructure then it can cause serious issues and become a disadvantage of e-commerce.

Some products are difficult to buy online

If you think that you can buy everything online then it is your misconception. There are products for instance eatables like ice cream, spectacles, and metals like gold and silver that you do not want to buy online even if you have the option of doing so.

You cannot trust yourself to make a purchase without visibly touching, trying, testing them and this can prove a disadvantage for an e-commerce site. All the images and assurances cannot tempt you to buy some items, for example, you need to buy a gold and diamond bracelet.

Do you trust the online store to meet your expectations or will you make the effort and travel to a physical store to verify and then make a purchase.

late delivery

Late delivery is one of the common disadvantages of e-commerce platforms. While ordering a product the customer is assured that it will reach him in maximum seven days or a particular time period. In most cases that do not happen and you are kept waiting for it.

Ultimately when the information reaches you that the product will be delivered on this day the portal is not specific about the timings. There are several instances when a person who is going to collect the parcel had to wait for hours for the delivery.

His whole day is wasted and he could not go outside as per his original schedule. Such a situation makes the customer angry as he feels unnecessarily harassed.

7.4 CHECK YOUR PROGRESS

1. _____ is the electronic interchange of business information using a standardized format.

2. _____ refers to the buying and selling of goods or services using the internet.

3. The dimension of e-commerce that enables commerce across national boundaries is called _____.

4. A _____ is the set of planned activities designed to result in a profit in a marketplace.

5. The _____ is the universe of network-accessible information.

7.5 SUMMARY

E-commerce is the production, distribution, marketing, sales or delivery of goods and services by electronic means. E-Commerce is commonly referred as electronic commerce. It is also known as "Internet Commerce". It refers to the buying and selling of goods or services using the internet, and the transfer of money and data to execute these transactions. E-Commerce creates a virtual market place for customer over internet. In traditional commerce, communication/transactions are done in synchronous way. Manual intervention is required for each communication or transaction. Now with e-commerce, communication or transactions can be done in asynchronous way. The whole process is completely automated. E-Commerce can be implemented in one of the following ways- EDI, E-mail, electronic bulletin board, electronic fund transfer.

7.6 KEYWORDS

VMP (Virtual Marketplace): A nonphysical and borderless spatial dimension that exists in the digital domain, in which exchange relations and transactions take place at different levels through digital interactions supported by communication technologies.

EDI: Electronic Data Interchange (EDI) is the electronic interchange of business information using a standardized format; a process which allows one company to send information to another company electronically rather than with paper. Business entities conducting business electronically are called trading partners.

EFT: Electronic funds transfer (EFT) are electronic transfer of money from one bank account to another, either within a single financial institution or across multiple institutions, via computer-based systems, without the direct intervention of bank staff.

E- Commerce: Ecommerce, also known as electronic commerce or internet commerce, refers to the buying and selling of goods or services using the internet, and the transfer of money and data to execute these transactions.

E-Banking: Electronic banking is a form of banking in which funds are transferred through an exchange of electronic signals rather than through an exchange of cash, checks, or other types of paper documents.

E-Newspaper: An electronic newspaper is a self-contained, reusable, and refreshable version of a traditional newspaper that acquires and holds information electronically.

4.7 Self-assessment Test

1. What is E-commerce and why it is needed?
2. How to use E-commerce in our daily life?
3. Explain how application of WWW plays a vital role in implementation of E-Commerce?
4. What kind of advantages does business gets using E-commerce?
5. Which technical and economical limitations are faced by a business using E-commerce?
6. Discuss the advantages of E-commerce.
7. Explain the various disadvantages of E-commerce.
8. Discuss the applications of E-Commerce.
9. Explain WWW and differentiate between WWW and Internet.
10. Discuss E-commerce system architecture.

4.8 Answers to Check Your Progress

1. Electronic Data Interchange
2. E-Commerce
3. Global reach
4. Business model
5. World Wide Web

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Lesson 8: Models of E-Commerce	Vetter: Prof. Dhramender Kumar

LESSON STRUCTURE

8.0 Learning Objective

8.1 Introduction

8.2 Types of E-Commerce Business Models

    8.2.1 Business-to-Business (B2B)

    8.2.2 Business-to-Consumer (B2C)

    8.2.3 Consumer-to-Business (C2B)

    8.2.4 Consumer-to-Consumer (C2C)

    8.2.5 Business-to-Government (B2G)

    8.2.6 Consumer-to-Government (C2G)

8.3 Check Your Progress

8.4 Summary

8.5 Keywords

8.7 Self-Assessment Test

8.7 Answers to Check Your Progress

8.8 References/Suggested Readings

8.0 Learning Objectives

The objective of this chapter is to get the students acquainted with the basic concepts of E-commerce business models. This chapter highlights the different types of E-commerce models.

After reading this chapter, you will be able to:

✓ Describe the various types of E-commerce models

✓ Give examples of different types of E-commerce models

✓ Define pros and cons of different types of E-commerce models

8.1　Introduction

In this chapter, we dive into the types of E-commerce business models and afterward, discuss the pros and cons of running an E-commerce venture using any of them. Before we get to that, let's define **what a business model is**?

A business model refers to a plan for the successful operation of a business and how it relates to existing products or services in the industry. It also encompasses the revenue sources as well as the potential customer base. A **business model** is a set of planned activities (sometimes referred to as *business processes*) designed to result in a profit in a marketplace. A business model is not always the same as a business strategy, although in some cases they are very close insofar as the business model explicitly takes into account the competitive environment. The business model is at the centre of the business plan. A **business plan is** a document that describes a firm's business model. A business plan always takes into account the competitive environment. An **e-commerce business model** aims to use and leverage the unique qualities of the Internet, the Web, and the mobile platform.

8.2　TYPES OF E-COMMERCE BUSINESS MODELS

There are primarily six e-Commerce business models:

➢ Business-to-Business (B2B)

➢ Business-to-Consumer (B2C)

➢ Consumer-to-Business (C2B)

➢ Consumer-to-Consumer (C2C)

➢ Business-to-Government (B2G)

➢ Consumer-to-Government (C2G)

8.2.1 BUSINESS-TO-BUSINESS (B2B)

Business to business, known as B2B model, is the largest e-commerce model that is based on revenue which involves trillions of dollars. In this both the buyers and sellers are business entities. B2B

describes commerce transactions between businesses, such as between a manufacturer and a wholesaler, or between a wholesaler and a retailer. The volume of B2B transactions is much higher than the volume of B2C transactions and any other transaction. The primary reason for this is that in a typical supply chain there will be many B2B transactions involving sub components or raw materials, and only one B2C transaction, specifically sale of the finished product to the end customer.
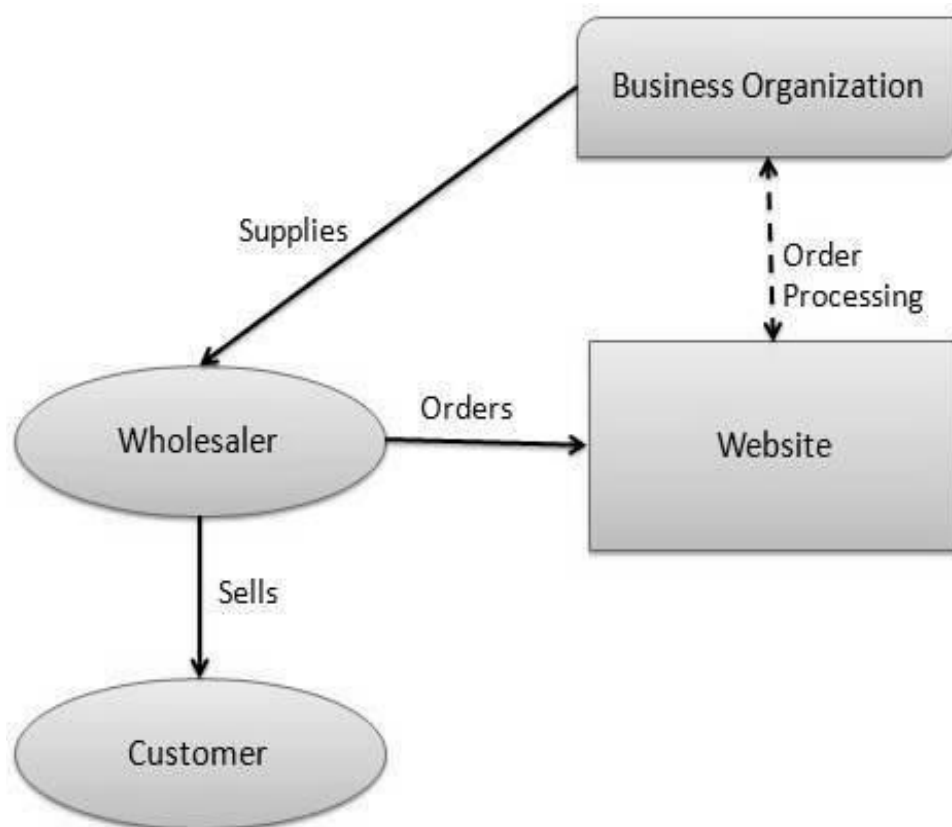
A website following the B2B business model sells its products to an intermediate buyer who then sells the product to the final customer. As an example, a wholesaler places an order from a company's website and after receiving the consignment, sells the end product to the final customer who comes to buy the product at one of its retail outlets.

I.   B2B EXAMPLES

Do you want to know the details about such companies in India? Followings are the some examples:

- AmazonBusiness.in

Amazon, the US-based ecommerce giant started its B2B online platform in 2015 to fulfill the demand of business customers who were looking for the seamless 'Amazon buying experience' while procuring supplies for their work.

Currently available in two cities, Bangalore and Mangalore with plans to expand in other cities, you can become a part of this members-only site if you have a valid business license.

Payments can be made through NEFT/RTGS transfer, Credit/Debit Card and Net-banking and cash-on-delivery service is available for Bangalore-based buyers. The marketplace also offers free credit service (up to 48 days) in association with HDFC Bank and ICICI Bank.

Its main USPs are the brand name 'Amazon' and ease of buying.

Primary Categories: Health & Personal Care, Home Medical Supplies, Beauty, Food & Beverages, Cleaning & Laundry, Mobile & Accessories, Office & IT Peripherals, Home, Kitchen & Dining products at wholesale prices and in bulk quantities.

- Power2SME.com

Founded by R. Narayanan in 2012, Power2SME calls itself the first 'Buying Club' for SMEs. The company was formed with an aim to empower SMEs by making it easy & affordable for them to procure raw materials.

In 2014, the company raised Rs. 42 crores in Series C round of funding from Accel Partners, Inventus Capital and Kalaari Capital. In January 2016, Chairman of UIDAI Nandan Nilekani along with the existing three investors poured more capital into Power2SME during Series D round of funding.

In April 2016, the B2B firm's revenue was $10 million and the average order value was Rs.25 lakh! This is why the company is confident about breaking even by next year.

Register for free or fill up the Request for Quote (RFQ) form with your business requirement. The company's sales representative then gets in touch with buyers with proposed rates. SMEs can avail loan facility on request.

Its main USPs are strong investors and high-quality suppliers like LG, Essar, and Indian Oil.

Primary Categories: Abrasives, Adhesives, Safety, Power tools, Plumbing, Handtools, Power Transmission, Security, Machining, Office Supplies, Motors & Pumps, Medical Supplies, Electricals, Hardware and a lot more.

- IndustryBuying.com

Established in 2013 by Swati Gupta and Rahul Gupta, Industry Buying is a B2B marketplace for industrial good and supplies. Regular buyers are offered credit and the purchasing process is quite straightforward.

The startup has grown tremendously with its seller base increasing from 1000 in 2015 to 4,500 in May 2016. Buyer base increased from 40 enterprises and 25,000 SMEs in 2015 to 150 enterprises and 75,000 SMEs in May 2016. Customer visits too multiplied by four times.

The company has raised Rs 87 crores from investors such as Kalaari Capital, Saif Partners and BEENext so far.

Its main USPs are impressive growth & traction and innovative product solutions like ProcMan.

*Primary Categories***:** Lab supplies, LED & lights, Electronics & Robotics, Cleaning, Dimension Measurement, Industrial Automation, Furniture & Hospitality, Lubricants & Oils, Powder & Coatings, and Welding are just 10 of the 40+ categories.

- Bizongo.in

This B2B marketplace focuses on bulk buying and selling of 'Packaging' materials. Started by Aniket Deb, Sachin Agrawal and Ankit Tomar (IIT Bombay and IIT Delhi graduates) in 2014, the startup found an investor in Accel Partners.

It initially started as a platform for plastic and chemical product categories, but as of now, there are only packaging products listed on the website.

Last heard news about Bizongo's funding was in October 2015, when Accel invested an undisclosed amount in the startup.

Its main USPs are knowledgeable team and ability to adapt with changing business environment.

*Primary Categories***:** Food packaging, Bottles, rigid and protective packaging, Crates, Pallets, Drums, Dustbins, Packaging Bags & Boxes, Flexible films, Pouches and Bubblewraps.

- Tolexo.com

It's an IndiaMart subsidiary launched in June 2014 for SMEs. With more than 1,000,000+ products from over 28 categories, 7000 sellers, and 8000 brands, Tolexo's product portfolio, seller & buyer base is probably the widest and biggest out of all players.

The B2B marketplace offers last mile deliveries with guaranteed dispatch within 24 hours, which is a great service for business clients.

IndiaMart had invested Rs. 100 crores in Tolexo in FY15-16.

Its main USP is its association with IndiaMart, which is one of the biggest players in the Indian B2B industry.

*Primary Categories***:** Safety, Plumbing, Adhesives, Fasteners, Electricals, Abrasives, Car & Bike Accessories, Lubrication, Handtools, Hardware, Office Supplies, Lab supplies, and much more.

- JustByLive.com

The newest one on the block, Just By Live is already creating waves by multiplying its network and raising funds in less than a year. The startup is an app-based e-distributor that connects traditional manufacturers to retailers. Thus, by eliminating regular distributors, manufacturers get better margins and retailers get a wide range of products at one glance.

The firm raised around Rs 136 crore ($20 million) in Series A funding from Alpha Capital in January 2016. Just by Live aims to restructure the age-old retail distribution system by modernizing it to fit the current fast-pace ecommerce industry.

Buyers/retailers can access the listed products through Just Buy Live's app, talk to brand teams and get order delivered at doorstep after downloading the app and registering their business. Buyers can also make use of credit facility 'Udhaar by Just Pay' by uploading required documents. If you are a brand owner, then write to brands@justbuylive.com to list your label on the B2B platform.

Its main USPs are unique concept and focussed approach backed by thorough research and experienced team.

Primary Categories: Grocery, Ayurveda, Dairy, Water, Chocolates & Sweets, Home care, Personal care, Fashion & Beauty, Auto, Appliances and many more.

The B2B ecommerce space comes with its own set of complex challenges that has forced startups like Omnikart to shut shop.

But such startups with the help of technology, new-age thinking, compassion and ecommerce have empowered SMEs to a great extent. Many business buyers have stopped haggling with local distributors and now prefer to buy from B2B ecommerce portals like the ones mentioned above.

Faster delivery, wide range of products, competitive prices, organised buying process, professional service, secure payment process, legal credit facility, low commission rates and buying assistance are few of the many reasons why industry buyers rely on such companies.

Investors too are keen on investing/buying stake in B2B start-ups as the business model doesn't allow or demand to spend funds on mindless-discounting, year-round deals, marketing & promotional activities and heavy returns like it is the case in B2C ecommerce space.

Sellers, have you tried any of these B2B marketplaces? Do you buy or sell from any such platform? Any feedback or recommendations you would like to share? Please do leave your valuable comments and help the seller community.

II.   PROS

- The B2B market is predictable as well as stable.
- There is greater customer loyalty than in other models of e-Commerce
- B2B features lower operating costs after the initial setup since most processes are automated and valid for a long time.
- You can generate a sustainable and reasonably high-profit margin from repeat clients.

III.   CONS

- B2B e-Commerce often requires substantial capital to set up. Costs include business registration, branding and setting up a physical or virtual office.
- There is a smaller pool of customers when compared to other models.
- Since B2B marketing targets businesses, sales are a little hard to come by because firms take a longer time to make decisions. Where firms ask for huge discounts because of their bulk purchase, it could eat into the profit of the seller.

8.2.2 BUSINESS-TO-CONSUMER (B2C)

Business-to-consumer (B2C) is among the most popular and widely known of sales models. The idea of B2C was first utilized by Michael Aldrich in 1979, who used television as the primary medium to reach out to consumers.

B2C traditionally referred to mall shopping, eating out at restaurants, pay-per-view movies, and infomercials. However, the rise of the Internet created a whole new B2C business channel in the form of e-commerce or selling of goods and services over the Internet.

B2C, the acronym for "business-to-consumer", is a business model based on transactions between a company, that sells products or services, and individual customers who are the end-users of these products. B2C ecommerce definition suggests the commerce transaction through a company website featured with online catalog.

Most Internet users are familiar with the B2C ecommerce model. Consumers appreciate the convenience of online shopping where they now can purchase clothes, electronics, media subscriptions and services via Internet.

Any business that relies on B2C sales must maintain good relations with their customers to ensure they return. Unlike business-to-business (B2B), whose marketing campaigns are geared to demonstrate the value of a product or service, companies that rely on B2C must elicit an emotional response to their marketing in their customers.
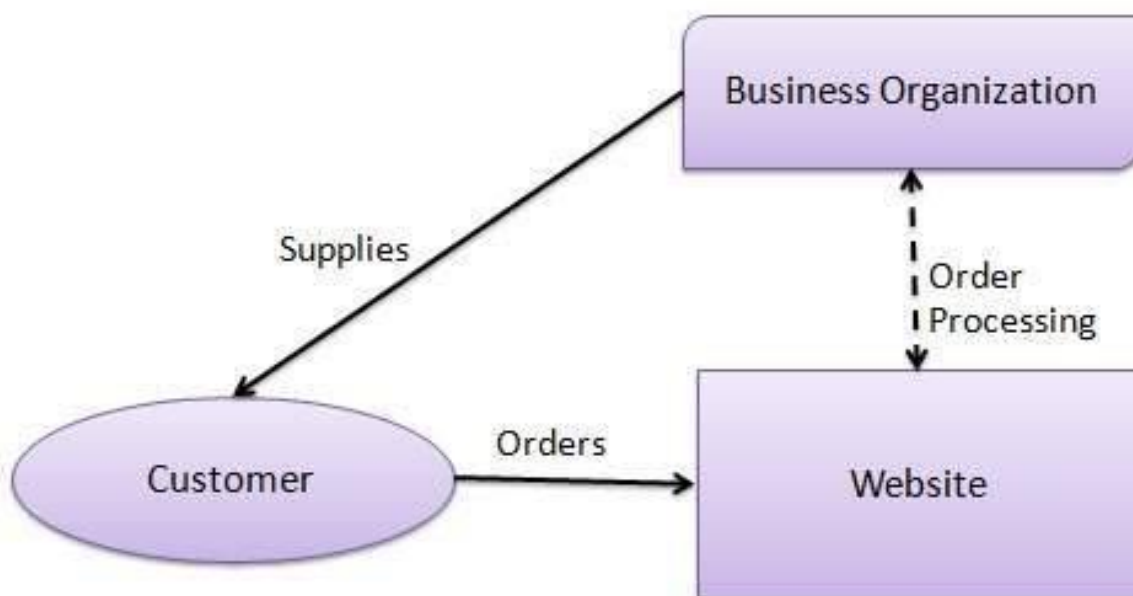
Following are the key features of the B2C model

- ➢ Heavy advertising required to attract customers.
- ➢ High investments in terms of hardware/software.
- ➢ Support or good customer care service.

Consumer Shopping Procedure

Following are the steps used in B2C e-commerce:

A consumer −

- ➢ Determines the requirement.
- ➢ Searches available items on the website meeting the requirement.
- ➢ Compares similar items for price, delivery date or any other terms.
- ➢ Places the order.
- ➢ Pays the bill.
- ➢ Receives the delivered item and review/inspect them.
- ➢ Consults the vendor to get after service support or returns the product if not satisfied with the delivered product.

I.   **B2C Business Models in the Digital World**

There are typically five types of online B2C business models that most companies use online to target consumers.

1. Direct sellers. This is the most common model, in which people buy goods from online retailers. These may include manufacturers or small businesses, or simply online versions of department stores that sell products from different manufacturers.

2. Online intermediaries. These are liaisons or go-betweens who don't actually own products or services that put buyers and sellers together. Sites like Expedia, Trivago, and Etsy fall into this category.

3. Advertising-based B2C. This model uses free content to get visitors to a website. Those visitors, in turn, come across digital or online ads. Basically, large volumes of web traffic are used to sell advertising, which sells goods and services. Media sites like the Huffington Post, a high-traffic site that mixes in advertising with its native content is one example.

4. Community-based. Sites like Facebook, which builds online communities based on shared interests, help marketers and advertisers promote their products directly to consumers. Websites will target ads based on users' demographics and geographical location.

5. Fee-based. Direct-to-consumer sites like Netflix charge a fee so consumers can access their content. The site may also offer free, but limited, content while charging for most of it. The New York Times and other large newspapers often use a fee-based B2C business model.

II. B2C Examples

➢ All major online retail stores like Amazon and payment processors like PayPal.

➢ A traveling agency that provides ticket and travel insurance policies to clients.

➢ A digital education website such as Code Academy that lets users learn basic computer programming for free.

III. PROS

➢ It requires a reasonably low startup capital when compared to other e-Commerce models. For instance, drop shipping allows selling products without you having to manage an inventory or delivery.

➢ Anyone with a basic knowledge of the internet can set up and manage a B2C e-Commerce store under little supervision.

➢ It is also easy to scale a B2C e-Commerce venture.

➢ It involves selling to a wide range of audience with already known purchase patterns and behavior.

➢ It allows for flexibility since the platform is the channel for efficiently collating market demand in real-time.

➢ It is easier to encourage B2C e-Commerce shoppers to practice impulse buying since you can run ads targeted towards customers that are not even searching for what to buy.

➢ The retailer is in charge of discounts and giveaways as opposed to the B2B model.

IV. CONS

➢ The B2C space is highly competitive with most firms already boasting a majority of the market share.

➢ Shipping products across borders can be a massive challenge if you mistakenly land the wrong shipping company.

➢ Many buyers still prefer making purchases in-store rather than online.

➢ There is little difficulty in sourcing for hot and cheap products to list on your e-Commerce store throughout the year.

➢ The market is continually evolving and requires upgrades more frequently than in other models.

V.   DIFFERENCE BETWEEN B2B AND B2C

The point given below clarifies the difference between B2B and B2C:

1. B2B is a business model where business is done between companies. B2C is another business model, where a company sells goods directly to the final consumer.

2. In B2B, the customer is business entities while in B2C, the customer is a consumer.

3. B2B focus on the relationship with the business entities, but B2C's primary focus is on the product.

4. In B2B, the buying and selling cycle is very lengthy as compared to B2C.

5. In B2B the business relationships last for long periods but in B2C, the relationship between buyer and seller lasts for a short duration.

6. In B2B, the decision making is fully planned and logical whereas in B2C the decision making is emotional.

7. The volume of merchandise sold in B2B is large. Conversely, in B2C small quantities of merchandise are sold.

8. Brand value is created on the basis of trust and personal relationship of business entities. In contrast to, B2C where advertising and promotion create brand value.

BASIS FOR COMPARISON	B2B	B2C
Meaning	The selling of goods and services between two business entities is known as Business to Business or B2B.	The transaction in which business sells the goods and services to the consumer is called Business to Consumer or B2C.
Customer	Company	End user
Focus on	Relationship	Product
Quantity of merchandise	Large	Small
Relationship	Supplier - Manufacturer Manufacturer - Wholesaler Wholesaler - Retailer	Retailer - Consumer

Relationship horizon	Long term	Short term
Buying and Selling cycle	Lengthy	Short
Buying Decision	Planned and Logical, based on needs.	Emotional, based on want and desire.
Creation of Brand Value	Trust and Mutual Relationship	Advertising and Promotion

8.2.3 CONSUMER-TO-BUSINESS (C2B)

C2B is a business model in which consumers (individuals) offer products and services to companies and the companies pay them. This business model is a complete reversal of traditional business model where companies offer goods and services to consumers.

This kind of economic relationship is qualified as an inverted business model. The advent of the C2B scheme is due to major changes:

➢ Connecting a large group of people to a bidirectional network has made this sort of commercial relationship possible. The large traditional media outlets are one direction relationship whereas the internet is bidirectional one.

➢ Decreased cost of technology : Individuals now have access to technologies that were once only available to large companies (digital printing and acquisition technology, high performance computer, powerful software)

Consumer-to-Business model is based on 3 players: a consumer acting as seller, a business acting as buyer and an intermediary dealing with the connection between sellers and buyers.

Consumer

A consumer in the C2B business model can be any individual who has something to offer either a service or a good. The individual is paid for the work provided to the companies. Depending on the model, the "consumer" can be:

➢ A webmaster/ blogger offering advertising service (through Google Adsense program for example or amazon.com affiliation program)

➢ A photographer or a designer offering stock images to companies by selling his artwork through Fotolia or istockphoto for example

➢ Any individual answering a poll through a survey site

➢ Any individual with connections offering job hiring service by referring someone through <u>referral hiring sites</u> like <u>jobster.com</u> or <u>h3.com</u>

Business

Business in the C2B business model represents any companies buying goods or services to individual through intermediaries. Here are some examples of potential companies which can be such clients:

➢ Any company which wants to fill a job (through <u>referral hiring sites</u>)

➢ Any company needing to advertise online (through <u>Google Adwords</u> program for example)

➢ Any advertising agency which needs to buy a stock photo (through microstock sites)

Intermediary

The Intermediary is the crucial element since it creates the connection between business which needs a service or a good and a mass of individuals. Intermediary is usually a portal both for buyers (businesses) and seller (individuals).

The intermediary plays two roles:

➢ It promotes goods and services offered by individuals by proposing a distribution channel. It offers what individuals can't do themselves : large promotion, logistic and financial support, technical expertise

➢ It offers buyers a contact to a mass of individuals and takes care of money transactions and legal aspects

We can notice that some intermediaries prefer creating two different accesses one for buyers and one for sellers (Google Adwords for advertiser - Google Adsense for web publisher) whereas other companies like Fotolia have only one access because buyers and sellers can be the same.

We can differentiate two kinds of intermediaries:

➢ Extern intermediary : they act as a extern agent within the relation between companies and individual (ex : referral hiring site)

➢ Intern intermediary: they play the role both of business and intermediary. For example, it is the case of amazon.com through its affiliation program. Amazon pays individual to promote its own products.

PROS

➢ C2B provides a channel for companies to source and hire a variety of service talents and products from around the globe.

➢ It also provides an opportunity for companies to prioritize hiring from regions where the standard of living is low, thus, reducing what figure goes on the paycheck.

➢ It also allows service providers to gain work experience across multiple projects and get paid well for doing so.

➢ Freelancers also enjoy relative freedom and flexibility in terms of working hours.

CONS

➢ A high level of communication skills is required to convey project ideas.

➢ Companies that hire freelancers could face a challenge in sending payment to freelancers in some parts of the world.

The possibility of outsourcing means the freelancer paid for the job may not even be the one doing it. This situation could put the

➢ Employer at a disadvantage as he gets a substandard service than what he originally paid.

8.2.4 CONSUMER-TO-CONSUMER (C2C)

A website following the C2C business model helps consumers to sell their assets like residential property, cars, motorcycles, etc., or rent a room by publishing their information on the website. Website may or may not charge the consumer for its services. Another consumer may opt to buy the product of the first customer by viewing the post/advertisement on the website.
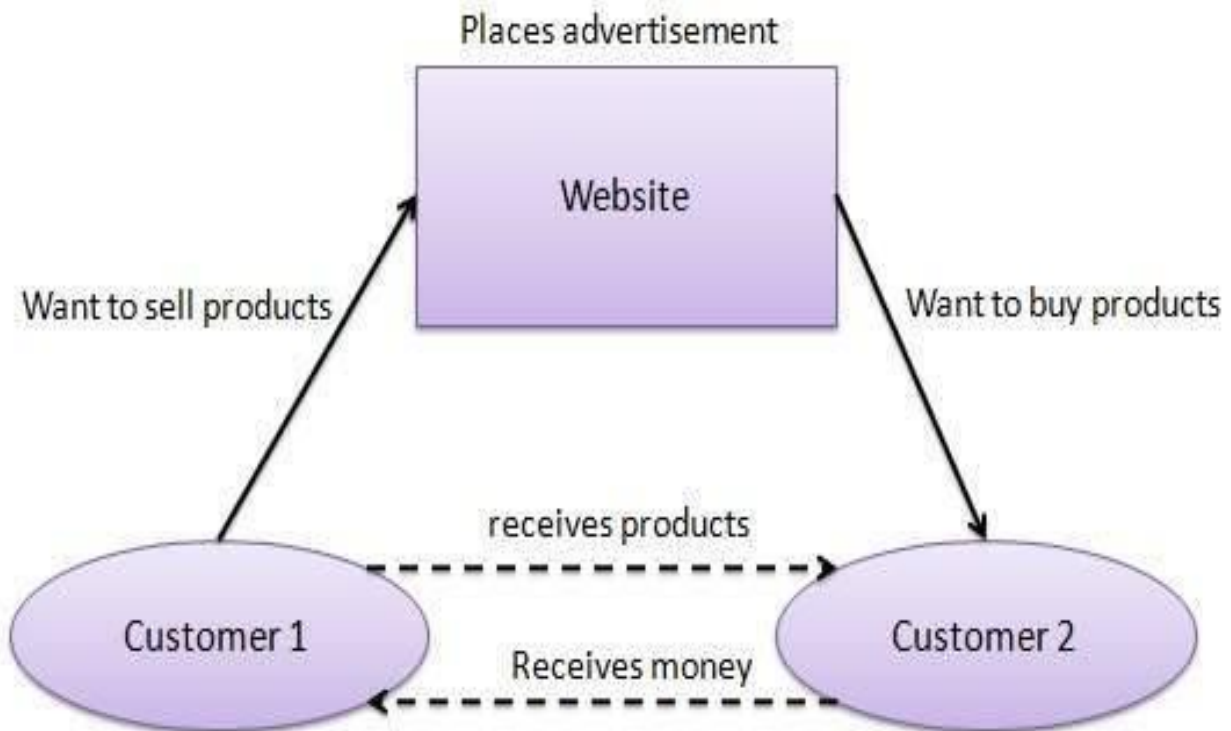
C2C Examples

➤ The foremost example of C2C via a third-party website would be an auction platform like eBay which brings seller and buyers together. eBay charges a fee for facilitating each sale while the other parties to the transaction are responsible for settling other matters such as product quality, packaging, shipping, and refunds.

➤ Cryptocurrency exchanges that offer over-the-counter trades to users. Under such circumstance, the exchange charges a fee for the transaction while it allows the users to transact cryptocurrencies with one another.

➤ It is important to note that most businesses operate the B2C and C2C models simultaneously even though they may decide to start up with one. In most cases, though, the B2C comes first while the C2C follows shortly as an extension and additional revenue source.

➤ If you plan to go down this path, you may need to do more extensive research to find out what buyer behavior is prevalent in the market before deciding which model to employ first.

PROS

➢ There are usually no upfront costs to get product listed on a third-party C2C website.

➢ With C2C, the products gallery is unlimited since different customers are on board and selling various items scattered across different niches.

➢ C2C facilitates the sale of used items as opposed to B2C where a majority of the products are new.

➢ C2C often serves as a black market for businesses to purchase items without going through the primary market.

➢ Any online platform that allows interaction between two or more people can facilitate a C2C trade.

CONS

➢ The cost charged for each sale using the C2C ecommerce model on a third-party site like eBay may eat into the profit of the merchant.

➢ C2C poses a high level of risk in terms of product quality than other ecommerce business models. Under C2C, most transactions require that both parties trust it each other.

➢ For auction sites, users may end up buying goods at inflated prices which is not a good economic decision.

8.2.5 BUSINESS-TO-GOVERNMENT (B2G)

It is the exchange of information, services and products between business organisations and government agencies on-line. It refers to the use of the Internet for public procurement, licensing procedures, and other government-related operations. In most case, businesses under this umbrella have these government or public administrative offices as their only clients and receive contracts on a long-term basis. Such a situation makes it possible for them to easily calculate profits and manage funds effectively while delivering their solution to a wide audience. Sadly, though, their business could also be negatively affected if there is a change in government and the new authority refuses to honor the already existing contract.

Consider this scenario:

An online marketing agency or influencer is contracted by a sitting government to manage its political campaign by broadcasting promotional material to the masses across social media and other digital channels.

If by any chance, the ruling government fails to win at the election, the new authority may likely opt for another online marketing agency or influencer to do the job of previously held by a different entity. In this situation, one B2G firm gains while the other loses out.

Other Examples of B2G

➢ A government using virtual workspace software designed by a creative agency.

➢ The situation in Ohio where the State's tax department hired the service of a third-party to collect and convert tax payments in crypto currencies to fiat.

PROS

➢ It features a high-profit margin and longevity than most other ecommerce business models.

➢ B2G businesses can enjoy tax benefits not common to other ecommerce merchants.

➢ It increases flexibility and efficiency in public administration.

CONS

➢ A change in government could adversely affect a B2G product or service provider

➢ It often requires huge capital to set up.

➢ It could also confine a business to operate within a specific geographical location, thus removing the primary purpose of ecommerce transactions which is borderless product and service delivery.

8.2.6 CONSUMER-TO-GOVERNMENT (C2G)

C2G is just the opposite of the last ecommerce business model albeit a little difference; this time it is the consumers or members of the public that offer value to the government or public administrative agencies.

However, it is still the public administration or government that initiates the transactions, often as a way to ease its operations and relieve the citizenry of some burdens.

The public does not bear any responsibility whatsoever if the platform conducting the C2G transactions goes offline or fails to deliver.

Examples of C2G

➢ A State's tax agency deciding to ditch paper tax filing and instead introduce an electronic tax filing portal.

➢ A State creating an information sharing platform to allow citizens to get the latest information possibly because of a suspected natural disaster.

➢ An electronic voting app for citizens to participate in an election without having to visit the polling unit or filing paperwork.

➢ Other forms of transactions between citizens and the government either facilitated by the government directly or via a third-party

Note that the government could decide to terminate C2G transactions if it doesn't realize its purpose of creating such a platform or wants to try a new approach.

PROS

➢ It makes public administration more flexible and efficient.

➢ It encourages public knowledge of internet-based technology.

➢ There is enormous profit potential for third parties contracted to handle C2G transactions.

CONS

➢ A lack of internet service in some regions could restrict the performance of C2G ecommerce.

➢ Public awareness and education programmes may be needed to introduce the populace to such systems.

5.3   Check Your Progress

1. _____ type of e-commerce focuses on consumers dealing with each other.

2. _____ refers to business that is conducted between companies.

3. All major online retail stores like Amazon belongs to _____ model.

4. A _____ is a document that describes a firm's business model.

5. _____ is a business model that refers to businesses selling products, services or information to governments or government agencies.

5.4   Summary

A business model refers to a plan for the successful operation of a business and how it relates to existing products or services in the industry. It also encompasses the revenue sources as well as the potential customer base. The business model is at the center of the business plan. A **business plan is** a document

that describes a firm's business model. A business plan always takes into account the competitive environment. An **e-commerce business model** aims to use and leverage the unique qualities of the Internet, the Web, and the mobile platform. We discussed six types of business models in this chapter. Each model has its own pros and cons.

5.5   KEYWORDS

B2B: Business to business refers to business that is conducted between companies, rather than between a company and individual consumers

B2C: The term business-to-consumer (B2C) refers to the process of selling products and services directly between consumers who are the end-users of its products or services.

C2B: Consumer-to-business (C2B) is a business model where an end user or consumer makes a product or service that an organization uses to complete a business process or gain competitive advantage.

C2C: Consumer to consumer, or C2C, is the business model that facilitates commerce between private individuals. Whether it's for goods or services, this category of e-commerce connects people to do business with one another.

B2G: Business-to-government (B2G) is a business model that refers to businesses selling products, services or information to governments or government agencies.

8.6 Self-assessment Test

1. What are the different E-commerce business models?
2. Explain the B2C business model briefly?
3. Explain the B2B business model briefly?
4. Explain the C2B business model briefly?
5. Explain the C2C business model briefly?
6. Explain the B2G business model briefly?
7. Explain the C2G business model briefly?
8. Discuss the various advantages and disadvantages of different E-commerce models.
9. Differentiate between B2B and B2C model.

10. Differentiate between C2B and C2C model.

8.7   Answers to Check Your Progress

1. C2C

2. Business to business

3. B2C

4. Business plan

5. Business-to-government

8.8   References/Suggested Readings

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LESSON STRUCTURE

9.0 Learning Objectives

In this chapter you will learn about

➢   M-Commerce and Wireless communication technology

➢   Scope of mobile--commerce

➢   Principles of mobile commerce

➢   Benefits of mobile commerce

➢   Limitations of mobile commerce

➢   Mobile commerce framework

➢   Mobile commerce business models

➢   M-commerce applications

➢   E-government and E-governance

➢   Stages of E-governance

➢   Importance of E-government

➢   National E-governance Plan

➢   Need of E-governance

➢   E-governance experiences in India

9.1 Introduction

This chapter introduces the M-commerce and E-governance. Mobile Commerce, also known as m-commerce, is defined as the process of performing business transactions using handheld mobile devices which are connected through wireless networks. E-Governance is defined as the use of information and communication technologies, and particularly the internet, as a tool to achieve better government. Section 9.3 to 9.12 discusses about the M-commerce and section 9.13 to 9.21 discusses about E-governance.

9.2 M-COMMERCE

Mobile Commerce, also known as m-commerce, is defined as the process of performing business transactions using handheld mobile devices which are connected through wireless networks. The business transactions may range from buying and selling goods, making mobile payments,

downloading audio/video contents, playing online games, using numerous software applications or getting mobile tickets. The mobile devices include cellular phones, handheld computers such as palmtops or laptops, pagers, smartphones and Personal Digital Assistants (PDA). The mobile users can access internet through these devices without any wired connection or a computer. Powered with the emerging technology based on Wireless Application Protocol (WAP), m- commerce employs web ready micro browsers in these mobile devices to surf through the internet anytime, anywhere on earth. WAP-enabled smartphones equipped with Bluetooth technology offer fax, e-mail and phone capabilities to the user to facilitate business transactions while in transit. Such smartphones are becoming so popular that most business houses have adopted m-commerce as the more efficient method of reaching to the customers or communicating with other business partners. The content delivery over wireless mobile devices has become much faster, safer as well as cheaper. The reservation of air/rail/bus tickets through mobile devices saves time and offers peace of mind to numerous passengers. Such services are gradually making m-commerce as the method of choice for performing digital business transactions. For these reasons, m-commerce is sometimes referred to as next generation e-commerce.

9.2.1 WIRELESS COMMUNICATION TECHNOLOGY

Mobile commerce is based on wireless communication technology. The wireless communication technology has emerged as the new choice of modern corporate world. The wireless networking has some distinct advantages over traditional wired networking that employs co-axial, twisted pair or fibre optic cables for physical connection between two or more computing devices. In wireless networking, the data transfer between computers is facilitated by microwaves, radio waves or infrared waves. It eliminates the cumbersome cabling process involving bulky cables with a significant reduction in labour and material cost as well as development time. The wireless networking technology together with wireless application protocol provides the backbone of mobile commerce applications. In various vertical markets, such as retail, health care, manufacturing and warehousing, mobile commerce gained acceptance and provided increased productivity through the usage of mobile devices. The mobile handheld devices are used to transmit data in real time to centralized hosts through wireless networks.

The mobile commerce that employs wireless technology, offers some extra advantage over the internet based e-commerce. In e-commerce, the internet provides information anytime of the day, while in m-commerce; the information is available anytime, anywhere. In e-commerce, the information is available as long as the user is connected with the internet, i.e. connected with the wired network. If the user is involved with some other activities, i.e. travelling or doing some offline job, which forces him/her to become disconnected from the internet, the information becomes unavailable. M-commerce removes such uncertainties. Wireless networking allows the user to be connected with the wireless internet even if he/she is on the move. Thus, in m- commerce, it is possible to stay online anywhere on earth and anytime of the day. The user can access information instantly even if he/she is engaged in some other activities, such as travelling or shopping, with the help of the mobile device and the wireless network or internet. This helps the employees to make spot decisions, the customers to ask questions spontaneously and business owners to perform transactions anytime regardless of their geo-graphical positions.

9.2.2 SCOPE OF MOBILE COMMERCE

Mobile commerce provides instant connectivity between mobile users irrespective of their geographical location and time of the day. With enormous growth of wireless and mobile technology and rapid penetration of mobile phones in developing countries worldwide, the scope of m-commerce has increased manifold. With the advent of super-fast 3G access technology that' ensures high speed data transfer rates of the order of 20 Mbps, m-commerce is opening up new vistas of digital media applications. 3G technology, equipped with WiMax and UMTS standards for high speed mobile broadband internet connectivity, supports mobile multimedia application delivery at far greater bandwidths. So, it is now possible for mobile users to watch their favourite TV programmes or download and view famous movies in their mobile devices while travelling.

The scope of mobile commerce is all pervasive, and is gradually engulfing all aspects of lives of modern day citizens. Ranging from mobile banking, mobile browsing and mobile ticketing up to mobile marketing, mobile advertising and mobile computing, mobile commerce is gradually becoming an integral part of both corporate world and common people. With the prices of mobile phone decreasing exponentially and the number of different mobile applications increasing enormously, more and more people will indulge in m-commerce applications and soon it will become the preferred choice of the digital business world.
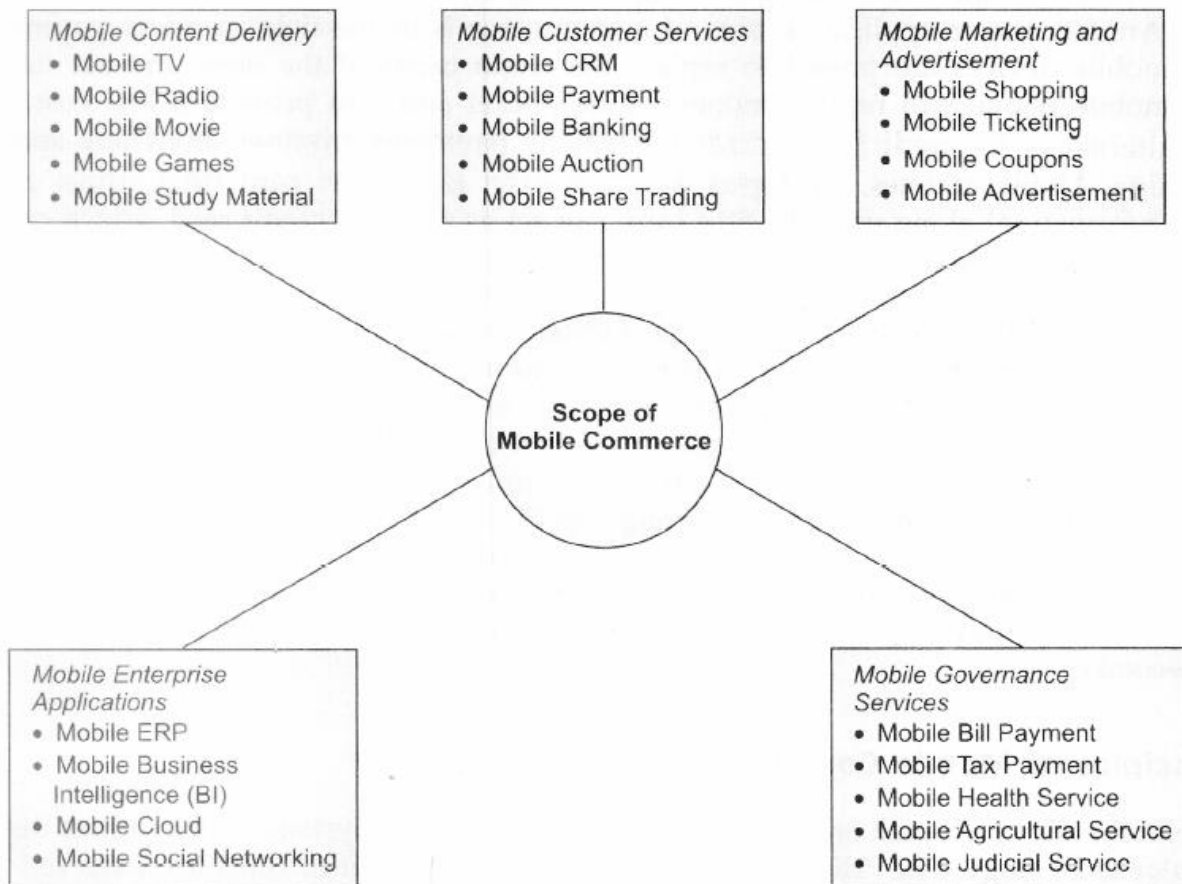
Fig.1 : Scope of Mobile Commerce.

9.2.3 PRINCIPLES OF MOBILE COMMERCE

Mobile commerce is based on wireless mobile communication system, which utilizes digital cellular technology. The cellular network consists of a number of cell sites. Each cell site consists of a stationary base station (a radio frequency transceiver), an adjacent tower antenna (for transmission and reception of signals) and a surrounding cell (a hexagonal shaped geographical area). Each cell is allotted a band of radio frequencies and provides coverage to any portable mobile device that comes within the geographical range of the cell. Whenever a mobile device such as a mobile phone or a pager, etc., comes inside a cell, it starts communicating with the base station using one of the cell frequencies. The· base station receives the signal from the mobile device and transmits using the tower antenna to a distant base station for call delivery. To distinguish signals received from different

mobile devices at the same base station, different access technologies such as Frequency Division Multiple Access (FDMA), Code Division Multiple Access (COMA) or Time Division Multiple Access (TDMA) are used. Whenever a mobile user tends to move away from one cell to another adjacent cell, the cell frequency switching occurs, whereby the old cell frequency is dropped and the mobile device is automatically allotted a new frequency corresponding to the adjacent base station. The mobile device switches from previous base station frequency to current base station frequency and the communication with the new base station continues without interruption. This is known as cell handover. There are a number of different digital cellular technologies which are used in various mobile phone networks worldwide. These are: Global System for Mobile (GSM) Communication, General Packet Radio Service (GPRS), and Enhanced Data Rates for GSM Evolution (EDGE), Digital Enhanced Cordless Telecommunications (DECT), etc.

The geographical location of a base station is fixed, i.e. stationary and the frequency band and location of each base station are registered in the database of a centralized Mobile Telecommunication Switching Office (MTSO). So, whenever a mobile device changes position from one cell site to another, its geographical location can be easily tracked from MTSO. Utilizing this fact, mobile commerce offers a number of location-based services, such as tracking and monitoring of people/vehicles, identifying or discovering nearest ATM machines/banks/hospitals/restaurants and local weather/traffic reports. People tracking can help in criminal investigation where the mobile phone used by a criminal can be tracked and its location is identified. The vehicle tracking is utilized in finding out the actual position of the goods to be delivered and helps in supply chain operation management. The local traffic and weather report can be generated in a local office and delivered to the mobile phone of a user on request. The local bank/ ATM/ hospital/restaurant info can also be delivered to a mobile user at a minimal cost.

9.2.4 BENEFITS OF MOBILE COMMERCE

The main advantage of mobile commerce is that it provides instant connectivity to the mobile user, irrespective of his/her geographical location and time of the day. The mobile user can stay connected with his/her business network and gather information even if he/she is in transit and remotely located away from the business installation. The same light weight mobile device can be used for making business transactions or making online payments round-the-clock in a cost- effective way. Highly

personalized information can be delivered in the mobile device in an efficient manner to satisfy numerous needs of a large number of customers. The major benefits of mobile commerce are as follows:

Anytime Anywhere

Mobile commerce together with wireless communication technology and wireless broadband internet access, keeps the mobile user connected with the internet while travelling across the globe. The business information is available to the mobile user any time of the day and anywhere around the globe. This anytime/anywhere internet access makes business transactions more flexible and customer communications more efficient, which in turn improves the productivity of the company and increases customer satisfaction. The valuable market information, stock/share prices, inventory position, delivery schedule, etc. are instantly available at the fingertips. Handheld devices, such as Blackberry, etc. work on internet mode and allow users to continuously send/receive electronic mail, download news alerts, stock prices and receive weather updates. The round the clock (24 x 7) internet availability benefits many users to conduct business transactions from their homes or from any other place while on the move and at any convenient time. Thus m-commerce offers greater mobility and flexibility to mobile users in performing business transactions using their handheld mobile devices.

Cost-effective

The costs of transactions using mobile devices are relatively low. The time-critical business data, such as reports, photographs, etc. can be captured and transmitted easily from the mobile devices without involving any bulky expensive equipment. The customer queries can be attended and support provided instantly from the mobile device, thus making customer support more comprehensive. The SMS-based micro payments facilitate bank account transfer within a few seconds and at the cost of an SMS. Contact less smartcard based mobile payments provide a low cost alternative for toll tax payments in mass transit systems. In case of mobile billing, users can pay for electricity bills, telephone bills, petrol, grocery, etc. through their mobile phones. The payments made in the mobile phones for such items will appear as part of their mobile phone bills, thus eliminating the need' for a third party payment mechanism such as, credit cards. This reduces the cost of payment to a large extent.

Personalized Service

Mobile commerce offers a number of personalized services to the mobile users depending on their

various requirements and purposes. The digital cellular technology can monitor the location of user performing mobile transactions. Knowledge of the user's location may be used to deliver timely and useful contents such as product availability and discount information to the potential customer. Timely information, such as flight schedules and flight availability can be delivered to the user at the last minute. Delivery of time critical as well as emergency information, SMS- based notifications and alerts can be easily made if the location of the user is tracked. The location tracking is also utilized in offering customized services to the user, such as delivery of discount coupons that can be cashed in and around of the location of the customer. Delivery of regional maps, driving directions and online directories are also possible if the location of the mobile user is known. Another major advantage-of location tracking is that, in criminal investigation, the location of the mobile user can be monitored and recorded as part of the investigation process.

9.2.5 LIMITATIONS OF MOBILE COMMERCE

Although mobile commerce has some distinctive advantages, such as instant connectivity and location and time independence over electronic commerce and offers low cost personalized services to the mobile users, it suffers from some serious limitations which restrict its use in mainstream business world. The mobile device limitations, such as small screen size, small memory capacity and lower processor speed makes it unsuitable for high quality internet graphics applications. The limited availability of bandwidth to various mobile operators imposes a limitation on the speed of operation of different mobile commerce applications. The wireless networks used in mobile commerce are more vulnerable to external hacker attacks compared to wired networks and stringent security arrangements in the form of encryption and authentication should be adopted to prevent unwanted intrusions. The main disadvantages of mobile commerce are explained in detail below.

(1) Mobile Device Limitations

1. Small screen size: Mobile devices have smaller screen size (of the order of 2 by 3 inches) and poor resolution which makes them inconvenient for browsing applications. Data entry can be quite difficult using small combinational keypad that comes with most of the mobile handheld devices. The wide and high resolution screens in conventional desktops or laptops used in e- commerce applications offer ease of use in data entry operations as well as viewing web pages. These larger screens support 1920 x 1080 resolution and 3D graphics display. Although mobile devices offer greater mobility and flexibility in

accessing information, the smaller screen size restricts the amount of information that could be presented and offers a less convenient user interface in the form of menu-based scroll-and-click mode of data entry.

2. Low speed processor: Most mobile devices come with low-powered processors with much lower processing speed compared to sophisticated processors (i.e. core 2 duo or i-core series) used in desktops or laptops. Such low speed processors restrict the download speed in most mobile commerce applications. The applications requiring too much processing power should be avoided as they may become irritably slow due to low speed processors. Also, keeping the low processor speed in mind, the mobile websites must be optimized to ensure customer satisfaction. Unnecessary plug-ins, flash images and animations should be removed to ensure speed of delivery.

3. Small memory capacity: The mobile devices do not have large storage space. The memory capacity in mobile devices is in the order of 5 GB to 10 GB compared to 2 TB or higher used in desktops/laptops. So, it is difficult to store large video files in mobile devices for future use. The mobile application developers must be concerned about the size of their applications during the development phase.

4. Low power backup: Mobile devices use batteries as their power supply. Normally, power for a mobile device lasts up to 2-3 days, depending on the size of the device. After this period, the battery should be recharged again, and it adds an additional burden to the user who has to remember every now and then to recharge it.

(2) Wireless Network Limitations

Mobile commerce depends on wireless networks which are usually of lower speed compared to wired networks. In many cases, wireless networks offer one-fourth speed of standard wired network. Also, most wireless networks are more common in urban areas and some of the rural areas might not have wireless communication facilities. So online mobile services may become unavailable in some rural areas, and thus the popularity of mobile services may be suffered. Unless the mobile device is 2.SG or 3G technologies compatible, the applications will become sluggish and unreliable compared to wired network applications. Atmospheric interference and fading of signals transmitted through wireless networks sometimes cause severe data errors and may even lead to disconnections.

(3) Bandwidth Restrictions

A major disadvantage of mobile commerce is the bandwidth limitation, which imposes a limitation on speed of operation in various m-commerce applications. Wireless networks use frequency spectrum to transmit information across the network. Regulatory bodies control the use of available frequency spectrum and allocate the spectrum to various mobile operators. In India, the frequency spectrum were initially allocated and regulated by Department of Telecommunication (DoT). Later, the Telecom Regulatory Authority of India (TRAI) was set up to control the usage of frequency spectrum. The limited availability of bandwidth to various mobile operators in turn restricts the data rate in mobile commerce applications. The GSM technology offers the data rate of the order of 10 Kbps and 3G technology can go up to 10 Mbps.

(4) Security Issues

Another concern that is often raised in connection with mobile commerce is the security issue. Mobile devices are more vulnerable to theft, loss and mishandling. Special care must be taken to ensure that the security and privacy of the mobile customer are not compromised at the event of loss of a mobile device. This includes not storing sensitive information in the mobile devices and changing/locking of PIN (password fast and simple at the time of need.

Mobile commerce employs public wireless networks for transmission of signals which can be easily intercepted by hackers for capturing/ altering stream of data travelling through the wireless medium. In wired networks, in order to gain access, the intruder has to gain physical access to the wired infrastructure. In wireless networks, anyone with the ability to receive signal in a mobile device can gain access to the network. In order to protect the wireless network from unwanted users, various encryption and authentication techniques should be employed. As the handheld devices have limited computing power and storage capacity, it is difficult to employ 256 bit encryption technique that requires enough computing power. However, the SIM cards inside a cell phone can include the digital signatures of PKI system. Thus, the PKI system of digital signatures can be integrated in a mobile device that adds to the security of the mobile application.

Authentication of mobile devices prior to carrying out any financial transaction is another important issue. The Subscriber Identity Module (SIM) stores the subscriber identity in the form of cryptographic keys. The authentication server of the wireless network stores the matching keys and verifies the user identity prior to any transaction. Though it is far easier to intercept signals over wireless networks, the

encryption and authentication mechanism makes it harder to decipher by the unwanted user.

9.2.6 MOBILE COMMERCE FRAMEWORK

Despite of the described limitations, numbers of people performing m-commerce transactions are growing exponentially. As in-commerce provides mobility to busy professionals, more and more people tend to access internet through their mobile phones. People find it more convenient to shift from e-commerce to m-commerce. And the projected global revenue from m-commerce is expected to cross 400 billion USD, during 2015. The day-to-day functioning of individuals as well as corporations is being transformed to mobile applications and is embedded in mobile devices. The mobile network operators have started providing value-added services that supports the new concepts of anytime anywhere computing. Accordingly, a new mobile business model has emerged, which is based on shared revenue distribution through sales in respective channels. For example, in mobile retail, a diverse range of mobile applications are developed to enable the multi-channel retailer to perform the key functions, such as mobile promotions, mobile payment, product information display, order management, catalogue management, create and display shopping list, loyalty programmes and other value-added services. Similarly, in travel industry, location-based tourism, mobile ticketing, navigational guidance and local weather/and traffic information delivery results in new revenue generating opportunities.

In order to make these value-added services work efficiently, and in a cost-effective manner, perfect collaboration between various network providers, technology providers and application developers is required. In order to integrate different mobile services, applications and technologies in a well-coordinated and controlled architecture, a mobile commerce framework needs to be developed. The purpose of the framework is to develop a structured integration of mobile services, applications and technology resources so that it will be able to deliver diverse range of value-added services in different industry sectors, and at the same time aim to reduce operating cost and improve efficiency to attract the end user population. The mobile commerce framework consists of the four basic building blocks as follows:

Content Management

This component deals with the creation, distribution and management of diverse range of media rich

digital contents that can be browsed through the small screens of the mobile devices. The digital contents are used in performing various business transactions such as buying and selling of goods, making online payments, product promos and providing on line customer support. An important part of content management is the ability to track different content providers and maintain and manage the relationships among them. The security and authenticity of the contents must be guaranteed and the access control mechanism must be provided to prevent unwanted users from misusing the document. The content distribution, rights management and clearing financial settlements, all come under the purview of content management module.

Technology Infrastructure

This component deals with the distribution of digital contents and transaction details over wireless communication networks to customer locations or other business installations. The wireless network infrastructure provides the very foundation of mobile commerce framework as it fulfils the basic requirements of data transmission between various business partners while performing any business transaction. The technology infrastructure includes wireless communication technology, Wireless Application Protocol (WAP) and mobile security technology. These technologies need to support digital content distribution, mobile application development and distribution and also provide a secure technological platform for mobile billing and prepaid services through the use of mobile Virtual Private Networks (VPN). Figure 2 depicts the Mobile Commerce Framework.

Application Development

The application development component of mobile commerce framework deals with the diverse range of mobile commerce applications. The main purpose of these mobile applications is to provide the product information to the end users, and also to enable them in performing the mobile business transactions. There are four major categories of mobile applications namely the information applications, communication applications, entertainment applications and commerce applications. Several mobile applications, such as mobile ticketing, mobile banking, mobile advertising, mobile office applications, etc. Fall under these categories. These applications support key business functionalities in respective verticals and are meant to achieve higher revenue generation as well as cost reduction. Sometimes, more than one application are combined together to deliver an aggregated service, which leads to further cost reduction. With the rapid development in various

emerging mobile technologies, the application development is going through an evolutional stage. In order to meet the requirements of today's rapidly evolving markets, the mobile applications must be developed in an innovative manner so that it allows the service provider to quickly address the growing demands of the market and also at the same time offer more profitability and greater cost reduction.

Business Service Infrastructure

The business service infrastructure provides the backbone to the mobile commerce framework. It supports the back office functionalities, such as payment services, location and search facilities and security arrangements of the mobile commerce systems. Production and fulfilment of these services are beyond the scope of traditional telecom service providers. These services are managed and delivered by some outside vendors, who have the ability and experience to provide such functionalities. They maintain the required infrastructure for supporting secured financial transactions in mobile commerce environments and also provide back-end support for searching and other facilities.

Such back office systems are meant to be flexible enough and also are capable of rapid deployment of new services. They have a direct impact on end user experience, and have the greatest influence on the success or failure of the service provider. With the help of such back office infrastructures, mobile service providers can avoid upfront capital IT expenditure, and also these managed services offer the service providers the ability to quickly upgrade to the newer technological environment without any significant investment.
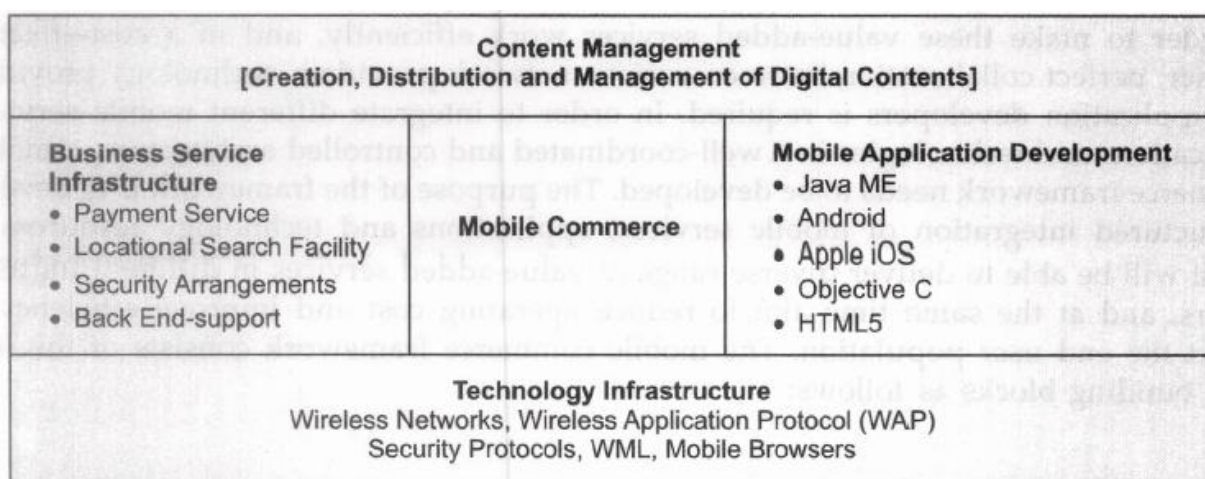

Fig 2 : Mobile Commerce Framework.

Above four components are the four pillars of mobile commerce framework and all m-commerce activities revolve around them. Whenever a mobile user tends to download MP3 music or a latest movie in his/her mobile device, sends an SMS requesting online payment to a bank, submits online order form requesting purchase in a mobile browser or books a mobile airline ticket, he/she is indulging in either or all four of the above mobile commerce framework components. In order to cope with the dynamic .nature of the modern day lifestyle, people are demanding more mobility in accessing their business applications. A properly integrated and well- coordinated mobile commerce framework needs to be developed in order to provide easy-to-use and secure mobile services to end customers. The main purpose of a structured and balanced mobile commerce framework is to enable the organizations to rapidly adapt to the latest mobile technologies and to ensure customer loyalty by providing them improved and enhanced services in sync with the growing market demands.

9.2.7 MOBILE COMMERCE BUSINESS MODELS

A business model determines the path or process through which a business organization can realize some profit. It shows the way by which an organization can make some investment, add some value to the investment, get a finished product or service and generate some revenue through sales of the product or service. The revenue generated through sales must exceed the operating cost, so that the company gets some profit. Business models specify the mechanism for generating profit margins and to sustain in the value chain. Thus, business models help managers in strategic planning and formulating overall business strategy of the organization. Electronic commerce has some traditional business models that are widely followed by all major e- commerce vendors worldwide.

These include Merchant model, Broker model, Service Provider model, Advertiser model, etc. Mobile commerce business models differ from those of electronic commerce due to their intrinsic difference in operations and technology. As mobile commerce imparts extra mobility to the users, the business models also reflect the mobility in their nature. The four major services offered by mobile commerce are the payment services, mobile advertisements, mobile shopping and mobile entertainment. Accordingly, mobile commerce business models also revolve around these four applications. The four major mobile commerce business models are described below:

(1) Payment Model

In this model, mobile payment service providers offer mobile payment services that allow users to make cashless payment transactions including banking transactions, share trading, tax/bill payments and ticket or other retail purchases using credit/debit card or bank PIN. The payment service providers have collaboration with banks (or other financial institutions) and/ or mobile network operators, and accordingly get bank-controlled mobile payment model or operator controlled mobile payment model. The payment service provider charges a certain percentage fee for each payment transaction made through the payment application. Alternatively, the user can pay a nominal monthly subscription fee to the payment service provider and can use the service as and when required

(2) Advertiser Model

This model is an extension of traditional e-commerce advertiser model and provides mobile websites which can be viewed by mobile users in their handheld mobile devices. Advertising companies can display their advertising messages in the website and pay a rental fee to the hosting website for displaying their messages. These mobile advertising websites usually offer some basic services such as email service, search engines, news service or social networking service to the users and post advertising messages in these sites to enjoy greater coverage. The advertisements often come with purchase buttons that allow users to purchase the product directly from their mobile devices. The mobile payment service is also provided to facilitate mobile purchase directly from the advertising websites. The advertiser companies pay a fixed fee to the advertising website for displaying their advertising messages. Additional revenue is generated for each purchase transaction made by the user through the website.

(3) Shopping Model

This model is similar to e-commerce merchant model where retailers create mobile websites to display their range of products to the mobile devices of the customers. The mobile users can browse the mobile websites in their WAP enabled mobile screens and select and purchase any product of their choice. Mobile payment option is also provided in the website so that the users can make mobile payment for the purchased product and complete the deal even while in transit or far away from the actual store location. Thus, shopping model allows retailers to generate additional revenues through mobile shopping and can improve their profit margins.

(4) Content Provider Model

In this model, mobile service providers offer a host of entertainment contents, such as breaking news, weather forecast, traffic updates, music, mobile games, TV shows, video content, movies, etc. that could be downloaded to user mobile devices. Network operators have tie-ups with various content providers and offer both subscription-based services as well as pay-per-use services to mobile customers. Location-based services, such as map-based navigational services, discount coupons offered in local retail stores or restaurants, news of local events, etc. are also delivered in customer mobile devices. The revenue is generated through subscription fees (for news, traffic/weather updates, movies, and games), usage fees (TV shows, videos, games etc.) or data download fees (for e-mails, e-books, etc.). Various media houses, press agencies or content aggregators follow this model for generating extra revenue through mobile channel.

9.2.8 M-COMMERCE APPLICATIONS

The main advantage of mobile commerce is that it offers instant connectivity to mobile users even if they are travelling in remote areas and want to communicate in the wee hours of the day. With the help of digital cellular technology and wireless broadband internet access, the mobile user can browse through websites on the screens of their mobile devices and perform business transactions anytime and from anywhere. Customers can place orders as well as pay their bills through their mobile devices while in transit. As the price of mobile phones are decreasing rapidly, number of mobile phone users are increasing in millions and more and more people resort to m-commerce activities.

With the increased use of mobile devices, mobile marketing and advertising have become an effective tool and all big corporations have started their product campaign through mobile devices. In financial sector, mobile banking allows customers to access their bank accounts and pay their bills from their mobile handheld devices. The same handheld device can be used for viewing the latest stock prices and also for conducting share trading. The service plan details of any mobile service, such as mobile phone service can be accessed, mobile bill payment can be achieved and account updates can be viewed through the mobile devices easily and effectively. In information services, delivery of financial news, sports events, weather reports and traffic updates, all can be achieved with a minimal cost and time. In retail industry, customers can place orders for goods/services from their mobile devices on-the-fly. All these applications (see Figure 3) come as the direct consequences of the instant connectivity feature of

mobile commerce. The four major products of mobile commerce are as follows:

(1) Mobile Banking

Mobile banking is the process of performing banking transactions such as balance checking, account transfer, bill payments, credit card-based payments, etc. through a mobile device, such as a mobile phone or a Personal Digital Assistant (PDA). Such transactions could be performed from any remote locations and at any time of the day irrespective of the normal working hours of the bank. In order to avail the mobile banking facility, the customer must have an account in the bank, the mobile phone number must be preregistered in the bank and also the network service provider (for the mobile device of the customer) must have a tie-up with the bank. When the customer wants to perform a mobile banking transaction, the transaction request from the customer first goes to the premises of the mobile service provider, and from there it is finally routed to the bank. Depending on the type of transaction, two types of mobile banking are available, namely SMS-banking and WAP-based mobile banking. SMS banking is usually used for non-financial transactions, such as viewing of balance statement, requesting for a cheque book, status checking or stopping a check payment although some banks permit financial transactions also through SMS banking. In SMS banking, an SMS code requesting a transaction is sent to a particular number (as directed by the bank) from the mobile device of the customer. As soon as the bank receives the SMS, the required transaction is performed; the information is retrieved (in case of non-financial transaction) and sent back to the customer mobile phone in the form of another SMS. The entire transaction takes only a few seconds and the cost of the transaction is only that of an SMS. For different types of transactions different SMS codes are used.

In WAP-based mobile banking, the customers are provided with a mobile Personal Identification Number (PIN) by the bank. At the time of performing the transaction, the customer logs on to the WAP website of the bank from the WAP-enabled mobile device. In the bank website, the customer enters the PIN to gain access to the various financial/non-financial transactions of the bank. After the successful verification of the PIN by the bank, the customer is allowed to perform various financial/non-financial transactions, such as transfer of funds from one account to other, payment of bills, credit card-based payments, fixed deposit enquiry, etc. Another facility available in mobile banking is mobile banking alerts. The customers are provided regular alerts whenever a special type of transaction occurs. For example, the customers are alerted whenever credit/ debit crosses a threshold or a check is

returned.
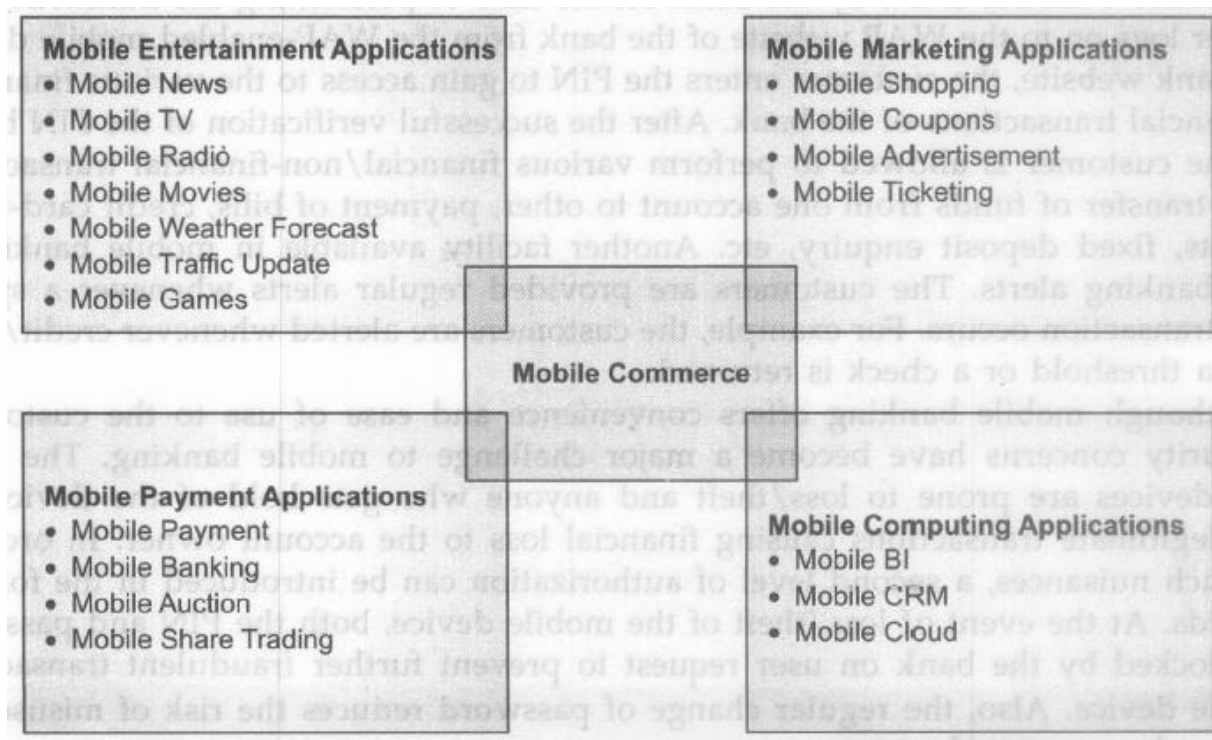
Fig 3: Mobile Commerce Applications.

Although mobile banking offers convenience and ease of use to the customers, the security concerns have become a major challenge to mobile banking. The small mobile devices are prone to loss/theft and anyone who gets hold of the device can make illegitimate transactions causing financial loss to the account owner. In order to avoid such nuisances, a second level of authorization can be introduced in the form of passwords. At the event of loss/theft of the mobile device, both the PIN and password can be locked by the bank on user request to prevent further fraudulent transactions using the device. Also, the regular change of password reduces the risk of misuse and tampering by unwanted users.

(2) Mobile Payments

Mobile payment is an alternative payment system where the mobile user makes payment using the mobile device for a wide range of services or goods. Depending on the mode of payments, mobile payments can be broadly classified in the following categories:

Mobile Phone Based Payments:

In this mode, the customer makes payment using the mobile device. In SMS-based payment, the

payment is made by sending an SMS to the retailer. Both the customer and the retailer must have a regular credit! Debit account in a partner bank. After selecting an item for purchase, the customer sends an SMS 'from his/her mobile device to the retailer requesting the purchase. The retailer responds by sending a payment request through SMS to the customer. The customer keys in the bank PIN number to approve the payment. The bank verifies the PIN and the ~mount is automatically debited from the customer bank account to the retailer's account. Both the retailer and the customer get SMS from the bank indicating the details of the transaction and the entire process takes only 10-15 seconds.

In SIM card based payment, the customer uses the mobile phone for purchase of digitized items such as mobile ringtones, MP3 music, video games, wallpapers, etc. that can be' downloaded in the mobile device itself. The purchase amount is added to the monthly mobile bill of the customer. This offers an alternate cashless payment option that does not require use of credit! debit cards or any other online payment service provider, such as PayPal and thus bypass bank and credit card companies altogether. The payment is either debited from the subscriber's pre- paid account or added to the standard post-paid invoice of the subscriber as the case may be.

Card based Mobile Payments

In credit card based mobile payments, the mobile handset is used as a credit card for making payments. The credit card issuing bank gives a PIN number to the mobile handset user. At the time of making payments, the mobile user initiates the transaction by entering the PIN from his/her mobile handset. The issuing bank verifies the PIN and authorizes the payment. Next, the customer enters the amount to be paid and the transaction is completed. The amount is automatically deducted from the credit card account of the mobile user and credited to the bank account of the payee business partner, such as the shop owner.

In smartcard based mobile payments, the SIM (Subscriber Identity Module) card of a mobile handset are equipped with smart card capabilities. Smart cards are plastic cards with embedded integrated circuits. Containing microprocessor and memory to store personal data such as credit card number, PIN, driving license number, etc. The information stored in a smartcard can be read by a card reader in either contact or contact less mode. The SIM card of a mobile device is also a processor card containing programmable memory to store user information for authentication purpose. If the smartcard capabilities are combined with the SIM card of a mobile device, it can be used as a contact less

.smartcard, and can be used effectively in making mobile payments.

Mobile phones equipped with contact less smartcards employ Near Field Communication (NFC) technology to exchange data between the mobile device and the nearby smartcard .readers. It combines the smartcard interface as well as the reader interface in the mobile device so that the mobile device can communicate with the card readers and other NFC devices/mobile phones, At the time of making payments, the mobile phone user waves his/her mobile phone (equipped with contact less smartcard) near a reader module installed in a store or in a public transport system. In order to make the transaction more secure, a PIN is used for authentication purpose, which is automatically supplied by the smartcard. After successful verification of the PIN, the transaction is completed and the payment is automatically deducted from the pre-paid account of the mobile user or charged to the bank account of the user directly. Such NFC-based contact less mobile payment finds wide application in transportation services, toll-tax collection, transit fare collection in mass transit networks, parking fee collection and other unattended POS terminals, where the users can pay with their smartcard enabled mobile phones sitting inside the car while driving.

Mobile Web Payments through WAP

In this mode of mobile payment, the payment is made through the web pages displayed in the micro browser of the mobile phone. The web page is displayed following Wireless Application Protocol (WAP) and associated technology. At the time of making a purchase, the mobile user types the URL of the website of a merchant in the mobile device. The website containing product information is displayed in the micro browser of the mobile handset. The user selects a product that he/she intends to buy and places order for the product through the website. The merchant then sends an invoice to the user. If the user intends to pay through a credit card, he/she enters the credit card number, which is transmitted to the partner bank through a secured channel that employs encryption. The partner bank verifies the credit card number, and if found OK, informs the acquirer bank for making the payment. Alternatively, if the user wants to pay directly from the partner bank in the form of account transfer, he/she enters the PIN number, which is sent to the partner bank for verification. After successful verification of the PIN, the partner bank debits the amount from the user's account and credits to the merchant's account. In either case, an SMS is sent to both the user and the merchant confirming the payment. The entire payment process is simple, quick and user-friendly as they have a similarity to the familiar online payment

systems.

Above mobile payment systems are emerging as a potential payment mechanism that ensures fast, smooth and transparent micro payment solutions to mobile users. The mobile phones tend to replace the pocket money and provide a low cost alternative to credit/debit cards for cashless payments anytime, anywhere and for anything. However, like all other online payment systems, special care should be taken to secure such mobile payments. Stringent security arrangements in the form of encryption and/or password authentication should be adopted to ensure that the financial transaction performed through the mobile device cannot be duplicated, re-used or counterfeited.

(3) Mobile Ticketing

Mobile ticketing is a special application of m-commerce which allows users to purchase tickets for air/rail/bus travel or for any sports/ entertainment events from any location and at any time using mobile phones or any mobile device. The users can avoid tedious and time consuming process of getting paper tickets after waiting in a long line and the organizations can reduce production, distribution and infrastructural cost by providing simpler ways to purchase tickets anytime/anywhere. Mobile tickets are available for a number of cases, such as mass transit tickets, airline check-in, movie/theatre shows, sporting events, consumer voucher distribution, and so on. There are a variety of options by which a user can purchase mobile tickets, such as online purchase from merchant website, from WAP page in the mobile handset, purchase via SMS from the mobile handset, over the phone from a voice call or through a secure mobile ticketing application. Due to the convenience it offers to the customers and cost savings it offers to the companies, mobile ticketing is gaining momentum and more and more people are opting for mobile ticketing. Around 6 million mobile tickets were sold during 2012 worldwide, and the number is expected to increase manifold to cope with the ever increasing demand of the mobile users. At the time of purchasing a mobile ticket, the mobile handset owner logs on to the website of the organization (providing the mobile ticket) and choose "Mobile Ticketing" as the delivery option. Alternatively, the user can log on to WAP page of the organization in the mobile handset. Next, the cell phone number, mobile carrier and cell phone model is entered in the website. In another variation, the request for mobile ticket can be sent through an SMS from the mobile handset to the designated organization. After making online/mobile payment for the ticket, the user receives the mobile ticket in the form of a text message in the phone. The text message includes an image (MMS) with a barcode. At

the venue of the event/airport/railway station, the text message with the barcode is produced at the gate. The gate is usually equipped with a barcode reader which after successful verification allows the user to pass through. Alternatively, the alphanumeric number in the barcode can be manually entered in a computer at the gate for verification.

With affordable internet services, decline in handset prices, rapid evolution of secured and easy- to-use mobile applications and convenience of mobile usage, more and more people have started purchasing travel tickets through mobile devices. Realizing the potential of mobile ticketing, almost all major travel portals have launched their mobile ticketing applications for booking purpose. People at the time of making last minute changes to their travel plans find mobile ticketing the only option giving surety and security. In India, Indian Railways (website irctc.com), makemytrip.com, cleartrip.com, yatra.com and many more offer mobile ticketing in their travel offerings. Apart from ticket booking, such travel portals also allow other customer support features, such as cancellation of tickets, tracking refunds on cancelled tickets, and so on. In order to maintain security and integrity of service, special validation techniques have been adopted to avoid reuse of mobile tickets. Such systems employ encryption of barcode data of the mobile ticket, which is decoded at the venue and validated at the centralized server containing ticket database. The mobile ticket once scanned by the barcode reader can never be reused again, thus preventing the fraudulent practice of duplicate tickets.

(4) Mobile Computing

Mobile computing is a technology that allows users to perform normal computing operations, such as internet surfing, document preparation, spread sheeting, preparing PowerPoint presentations, send/receive e-mails or download MP3 audio files using portable computing devices while in transit. The portable computing devices include smart phones, personal digital assistants, laptops, ultra mobile PC or wearable computers. Some of these portable computers have bigger screens compared to mobile phones and hence overcome the small screen limitations. For example, Apple iPad comes with an 8" x 10" screen, which is suitable for reading e-books as well as viewing websites.

In order to communicate with the external world, mobile computing employs wireless communication technology. For wireless internet access, Wi-Fi or Wi-Max technology is used that utilizes radio waves to broadcast internet signal from a wireless router to the surrounding area. Alternatively, digital cellular technology can be employed that utilizes cellular modem in the form of a

data card that connects to nearby cell towers for high speed broadband internet access. The data card fits into the PC card slot of the laptop or the notebook computer. Broadband internet access is also provided to cell phones and PDAs using cellular broadband technology.

Mobile computing uses specially developed software that allows users to perform all the functions that are possible in standard desktop PCs connected under LAN environment. Such software are designed for small-power handheld devices such as Personal Digital Assistants (PDA), enterprise digital assistants or smart phones, and are either pre-loaded in these devices or downloaded by customers from internet. Usually, mobile software is developed by transforming existing software used by computers into software which can be used in any mobile device. Sometimes, new mobile applications are developed for different mobile platforms and programming languages based on the type of mobile device. Different mobile devices use different hardware components, and therefore, the corresponding mobile software needs to be developed using different software architectures and operating systems. Well-known mobile software platforms include Java ME, Symbian OS, Android, Windows mobile, and BREW & Palm OS. Each of these platforms supports a development environment that provides tools to allow software developers write numerous mobile applications in these mobile platforms. Apart from normal e-commerce and m-commerce operations, mobile computing finds wide application in transportation industry, manufacturing and mining industry and distribution industry. In transportation industry, mobile computing is used in exact delivery time tracking, consignment tracking, fleet management information gathering and real-time traffic reporting. Mobile networks are employed. to provide' two-way communication between fleet drivers and their dispatch centres. Real-time passenger information can be obtained from kiosks/bus stops/road signs. In mining industries, portable computers are used in mines for in-process monitoring. In manufacturing industry, portable computers fitted in shop floors help in real time asset management, instant purchase verification, delivery confirmation and order tracking. In hospitality industry, guest check-in can be done using handheld devices, such as PDAs, Blackberry and cellular phones. Portable computers can be employed in sales force automation and mobile POS (Point of Sale) applications. Another service associated with mobile computing is cloud computing that allows mobile users to access application software, databases and shared computing resources, such as server spaces through internet from a mobile computer, The application software such as Microsoft Office, databases etc. reside on a remote server and user can access and use the resource through internet as and when required and pay

for .exactly what they use. Thus, the company field representatives can utilize company resources, such as, databases or application software from remote locations through internet accessed in their mobile computers, rather than carrying the company resources with themselves in bulky machines. Mobile computing also provides access to company's Virtual Private Network (VPN) by tunnelling through the internet. Mobile computing has become an integral part of corporate world. From Gmail to Twitter, Skype to LinkedIn, cloud computing to VPN, it is virtually impossible to do without it just like it is without electricity.

9.2.9 E-COMMERCE vs. M-COMMERCE

Electronic Commerce (E-Commerce) is the process of conducting business transactions through internet using personal computers or laptops. It employs wired Local Area Networks and cable internet to perform an array of operations, such as online purchase, online payment, online banking, online share trading or online marketing and advertising. People get the freedom of conducting business from their home or making online payments from their offices without travelling to the shop location. However, in order to perform e-commerce transactions, wired internet connectivity as well as personal computers or laptops having internet facility is essential. Thus, in remote areas with limited or no internet facility as well as areas without electricity, e- commerce becomes completely ineffective.

Mobile commerce, on the other hand, allows mobile users to conduct business transactions through their internet enabled mobile devices, such as smartphones, tablets, digital assistants or PDAs. It employs high frequency radio waves for providing wireless internet connectivity and allows mobile users to perform mobile shopping, mobile payments, mobile auctions or mobile ticketing through their mobile devices even when they are out in the field or are travelling. Thus, mobile commerce offers freedom from wired internet connectivity, and supports critical business transactions under completely mobile environment. People can perform share transactions, make tax or bill payments or perform fund transfers through mobile banking, even if they are travelling in remote areas far from their home or office. In other words, mobile commerce aptly fits into the extremely mobile lifestyle of modern day business executives and has become an integral part of daily lives of billions of mobile users.

Table 1: Comparison of E-commerce and M-commerce

Factors	E-commerce	M-commerce
Mobility	E-commerce employs wired networks for internet connectivity and hence is restricted inside a building. It offers anytime connectivity.	M-commerce employs high frequency wireless networks for providing wireless internet and is completely ubiquitous in nature. It offers anytime anywhere connectivity.
Reliability	Wired networks are more reliable and suffer less interference and noise. Quality of data transmitted is better as there is little or no cross-talk.	Wireless networks suffer from interference from adjacent channel frequencies or reflected waves that tend to reduce the intensity and quality of transmission. Special error detection techniques are employed to eliminate errors in transmission and improve signal quality.
Speed	The transmission speed of wired networks are much higher (of the order of 1000 Mbps)	The transmission speed of modern wireless networks are usually of the order of 100 Mbps.
Security	E-commerce transactions are more secured as the networks remain well-protected inside campus buildings. Firewalls and proxy servers are used to keep confidential business data secured in the central server.	M-commerce transactions through wireless networks are more vulnerable to hacker and other security attacks and require stringent security arrangements in the form of encryption and firewalls to prevent damage or misuse of private data during transmission.
Cost	The initial network set-up cost is high and periodic maintenance is mandatory.	The initial set-up cost is much lower and maintenance cost is minimal.
Usability	E-commerce is performed through personal computers or laptops having larger screens, which are more convenient and user-friendly.	M-commerce is performed through handheld mobile devices having smaller screens and lower battery life. Also, the small devices have higher chance of getting lost or stolen, thus resulting to data loss.

Difference between E-commerce and M-commerce

The fundamental difference of e-commerce and in-commerce lies on the fact that the former uses wired

networks and the latter uses wireless networks for internet connectivity. Although wired networks require cumbersome cabling and switching operations to provide connectivity to each and every computer and other peripheral devices, they offer better performance and better speed as compared to the wireless networks. A wired network can offer data rate of the order of 1000 Mbps, whereas a wireless network usually offers data rate of the order of 100 Mbps. A wired network is much more secure than wireless networks, as it is much more difficult to gain access to the internal wired network inside a protected building without breaking in. On the other hand, it is much easier to break the security barrier of a wireless network and gain access to private and confidential data stored (or in transit) inside the wireless network. Proper security arrangements in the form of encryption are employed in order to make wireless networks as secure as their wired counterparts. The comparison between e-commerce and m-commerce is given in Table 1.

In spite of above disadvantages, mobile commerce is fast becoming the preferred choice of numerous mobile users for making online transactions during travel or while outside the range of conventional wired networks in their home or office buildings. They prefer to watch their favourite TV shows, play online games, connect with friends through mobile social networking sites or purchase train/bus/event tickets, while travelling inside a bus or while waiting inside an airport. The ubiquitous nature of mobile devices adds extra mobility to the mobile users worldwide, and as a result there is an exponential growth in the mobile online transactions across all industry sectors and verticals.

9.3   E-GOVERNANCE

The terms government and governance have been widely disputed. Saxena (2005) draws a key distinction between 'government' and 'governance'. He identifies the government as an institution, whereas governance may be seen as a wider concept illustrating forms of governance that can be undertaken not only by government authority but by private firms, non-governmental organization or associations of firms.

Governments are specific institutions that donate to governance. In other words, it is suggested that governance focuses on the approach in which decisions are made, while government focuses on the approach in which these decisions are carried out.

The Government of India views E-Governance as a strategic tool for transforming Governance and improving the quality of services provided by the government to its people. India's experience in E-Governance has demonstrated significant success in improving accessibility, cutting down costs, reducing corruption, extending help and increased access to un-served groups. In this phase of experimentation, many e-initiatives have reached millions of people belonging to these sections of society. Improved access to information and services has provided economic and social development opportunities, facilitated participation and communication in policy and decision-making processes and empowerment of the weakest groups. This has led to fostering a sense of ownership and building of social capital, which in turn, constitute a basis for local revitalization.

The Government of India, in various forums, has indicatedits commitment to provide efficient and transparent government to all strata of society. E-Governance is now mainly seen as a key element of the country's governance and administrative reform agenda. The Government of India aspires to provide:

• Governance that is easily understood by and accountable to the citizens, open to democratic involvement and scrutiny (an open and transparent government)

• Citizen-centric governance that will cover all of its services and respect everyone as individuals by providing personalized services.

• An effective government that delivers maximum value for taxpayers' money (quick and efficient services)

9.3.1 E-GOVERNMENT

E-Government is not simply a matter of giving government officials computers or automating old practices. Neither the use of computers nor the automation of complex procedures can bring about greater effectiveness in government or promote civic participation. Focusing solely on technological solutions will not change the mentality of bureaucrats who view the citizen as neither a customer of government nor a participant in decision-making.

Understood correctly, e-Government utilizes technology to accomplish reform by fostering transparency, eliminating distance and other divides, and empowering people to participate in the political processes that affect their lives.

Governments have different strategies to build e-government. Some have created comprehensive long-term plans. Others have opted to identify just a few key areas as the focus of early projects. In all cases, however, the countries identified as most successful have begun with smaller projects in phases on which to build a structure.

To assist policymakers in devising their own plans and initiatives, this handbook divides the process of e- government implementation into three phases. These phases are not dependent on each other, nor need one phase be completed before another can begin, but conceptually they offer three ways to think about the goals of e-government. The three phases are Publish, Interact and Transact.

Government to SMART Government

The one line translation of SMART Governance is in fact is very true in meaning. I want to illustrate every word in my thoughts as under:

Simple: When hierarchy of governing people is simple and is fit in the eyes of people for whom result of governance is meant, than only it is meaningful.

Moral: Governing people should be high in moral values. It is only inner moral value that inspire individual to do a justified job, which is essential for people looking towards them for justice.

Accountable: As per management principle accountability is more with more authority/power. Hence people sitting on every stage concerned with governance should give direction with feeling of accountability towards the result of action.

Responsive: People appointed for governing others have to responsive in action. Their action should be immediate and at the time of need, because something denied at the time of need is useless, if later given. It wipes the faith of people.

Transparency: Transparency is like a mirror in administration which always shows other the good and bad point, needs to be clarified or appreciated which are otherwise hidden in nature.

In continuation to above one more thing I would like to add is that it should be innovative in nature of good to very good and very good to outstanding and outstanding to super.

9.3.2 E-GOVERNANCE: DEFINITION

'E-Government' or e-Governance is defined as 'The utilization of the Internet and the world-wide-web for delivering government information and services to the citizens.' (United Nations, 2006; AOEMA, 2005),

'Electronic Governance' essentially refers to the approach 'How government utilized IT, ICT, and other web-based telecommunication technologies to improve and/or enhance on the efficiency and effectiveness of service delivery in the public sector.' Like when you are using ATM facility of a Bank to collect cash anytime from anywhere or you are using on line fund transfer facility of an Indian bank is an application of e-Governance.

One more definition of e-Governance is "the use of information and communication technologies, and particularly the internet, as a tool to achieve better government". In this description, the internet is defined as a requirement and a possible medium for e-Governance.

9.3.3 FOUR STAGES OF E-GOVERNMENT

E-Government is a relatively new term that has emerged over the past several years. As governments all over the country have been making the commitment to E-Government, certain patterns have developed that reflect the stages of evolution:

Phase 1: Presence

This first stage of E-Government development is characterized by the existence of a presence on the Internet. During this first phase, the Internet sites are rather static in nature and are only meant to provide general information.

Phase 2: Interaction

This second stage of e-Government development is characterized by Internet sites that provide search capabilities, host forms to download, and provide links to other relevant sites. In most instances, this stage enables the public to access critical information online, but requires a visit to a government office in order to complete the task.

Phase 3: Transaction

This third stage of e-Government development is characterized by empowering the public to conduct and complete entire tasks online. The focus of this stage is to build self-service applications for the public to access online. This is the stage where Oakland County is currently.

Phase 4: Transformation

The fourth stage of e-Government development is characterized by redefining the delivery of governmental information and services. This phase relies on robust customer relationship management (CRM) tools, wireless access devices and new methods of alternative service delivery capabilities that reshape relationships between citizens, businesses, employees and governments.

9.3.4 IMPORTANCE OF E-GOVERNMENT

The importance of e-government is closely inter-related with importance of good government in country. We can see that good government as in exercise of administrative, political and economic authority to manage affair and transaction of country in each and every level. The main importance of e-government is to support and simplify e-governance for all parties, government, citizen and business. Following are some points which make clearer about E-government objective and importance.

- Better delivery of government services to citizens

- Improved interactions with businesses, industries, and citizen empowerment through access of information and Communication Technology.

- Supporting economic growth and poverty reduction through improved access to ICTs.

- Strengthening tenets of good governance – efficiency, transparency, accountability, and inclusiveness

- 365 days * 24 Hours fulfilling changed expectations of citizens –They expect the service from government as they get from private business.

- 365 days * 24 Hours Generating information and knowledge in line with socio-economic dynamism.

- 365 days * 24 Hours Ensuring citizen centricity (also extended to include businesses) and service orientation (amidst changing level of expectations at par with private sector entities)

9.3.5 NATIONAL E-GOVERNANCE PLAN

The National E-Governance Plan of Indian Government seeks to lay the foundation and provide the impetus for long-term growth of e-Governance within the country. The plan seeks to create the right governance and institutional mechanisms, set up the core infrastructure and policies and implements a

number of Mission Mode Projects at the centre, state and integrated service levels to create a citizen-centric and business-centric environment for governance.

The National e-Governance Plan (NeGP), takes a holistic view of e-Governance initiatives across the country, integrating them into a collective vision, a shared cause. Around this idea, a massive countrywide infrastructure reaching down to the remotest of villages is evolving, and large-scale digitization of records is taking place to enable easy, reliable access over the internet. The ultimate objective is to bring public services closer home to citizens, as articulated in the Vision Statement of NeGP.

"Make all Government services accessible to the common man in his locality, through common service delivery outlets, and ensure efficiency, transparency, and reliability of such services at affordable costs to realise the basic needs of the common man"

The Government approved the National e-Governance Plan (NeGP), comprising of 27 Mission Mode Projects (MMPs) and 8 components, on May 18, 2006. The Government has accorded approval to the vision, approach, strategy, key components, implementation methodology, and management structure for NeGP. However, the approval of NeGP does not constitute financial approval(s) for all the Mission Mode Projects (MMPs) and components under it. The existing or on-going projects in the MMP category, being implemented by various Central Ministries, States, and State Departments would be suitably augmented and enhanced to align with the objectives of NeGP.

9.3.6 MISSION MODE PROJECTS AND THEIR IMPLEMENTATION STATUS

NeGP comprises of 27 Mission Mode Projects (MMPs) encompassing 10 Central MMPs, 10 State MMPs and 7 Integrated MMPs spanning multiple Ministries/ Departments. "Mission Mode" implies that the objective and the scope of the project are clearly defined, that the project has measurable outcomes and service-levels, and the project has well-defined milestones and timelines for implementation.

MMPs are owned and spearheaded by various Line Ministries concerned for Central, State, and Integrated MMPs. The concerned Ministry/ Department is entirely responsible for all decisions related to their MMPs. However, decisions impacting NeGP as a whole are taken in consultation with DIT. Additionally, wherever required by the concerned Ministries/ Departments, DIT provides necessary support for project formulation and development.

Every State has the flexibility of identifying up to 5 additional State-specific MMPs (relevant for economic development within the State). In cases where Central Assistance is required, such inclusions are considered on the advice of the concerned Line Ministries/ Departments.

Central MMPs

- Banking
- Central Excise & Customs
- Income Tax (IT)
- Insurance
- MCA21
- National Citizen Database
- Passport
- Immigration, Visa and Foreigners Registration& Tracking
- Pension
- E-Office

State MMPs

- Agriculture
- Commercial Taxes
- e−District
- Employment Exchange
- Land Records
- Municipalities
- Gram Panchayats
- Police
- Road Transport
- Treasuries

Integrated MMPs

- CSC
- E-Biz
- E-Courts

- E-Procurement
- EDI For e-Trade
- National e-governance Service Delivery Gateway
- India Portal

Central MMPs

Banking

Evolution of core banking technology in India has brought in the convenience of "anytime, anywhere banking" to Indian customers. There is now a movement towards integration of core banking solutions of various banks, which is expected to bring in operational efficiency and reduce the time and effort involved in handling and settling transactions, thereby improving customer service and facilitating regulatory compliance.

The Banking MMP covers the following services:
- Electronic Central Registry under Sarfaesi Act, 2002
- One India One Account-for Public Sector Banks
- Electronic Mass Payment System

Central Excise & Customs

The Central Board for Excise and Customs (CBEC) is implementing this MMP with a view to facilitate trade and industry by streamlining and simplifying customs and excise processes, and to create a climate for voluntary compliance.

The project aims to network 20,000 users in 245 cities using wide area network, and equip taxpayers with up-to-date information relating to Customs, Central Excise, Service Tax Laws, etc. over the internet.

Some of the services proposed to be covered in this MMP are:
- Simplification of registration, returns, revenue reconciliation and exports procedures
- Movement towards integration of goods and service taxation
- e-Registration for excise and service tax
- e-Filing of returns and refunds
- Integration of e-filing with system driven, risk-based scrutiny
- Export facilitation through linkages between Excise and Customs

- Improved dispute resolution mechanism

- Monitoring of arrears and their recovery

- Central Excise Revenue reconciliation

Income Tax (IT)

The Income Tax Department of India is implementing a plan for setting up a comprehensive service that enables citizens to transact all businesses with the Department on an anywhere, anytime basis.

Some of the services proposed to be covered under the Income Tax MMP are:

- Allocation of Permanent Account Number (PAN)

- Tax accounting

- Taxpayer grievance redressal

- Taxpayer correspondence

- Tax compliance

- Online submission of returns

- Processing of tax return

- Processing of tax-deducted-at-source (TDS) return

Insurance

This MMP has been conceived with a view improve services for customers in the General Insurance sector. The MMP aims to:

- Facilitate customer service through education, information, speedy processing of claims and online issuance of policies on web

- Provide automated grievance reporting and redressal facility to customers

- Create and enlarge business opportunities

- Create holistic database of insurance users

- Integrate insurance database(s) with other government database(s) to analyse social security aspects and facilitate service delivery

The project is proposed to be implemented through the four PSU Insurance companies.

MCA21

The Ministry of Corporate Affairs (MCA), Government of India, has initiated the MCA21 project, which enables easy and secure access to MCA services in an assisted manner for corporate entities, professionals, and general public. The MCA21project is designed to fully automate all processes related to enforcement and compliance of the legal requirements under the Companies Act, 1956. The project further seeks to achieve inter-operability with the National e-Governance Services Delivery Gateway (NSDG), which will help extend MCA services to businesses via multiple front-end delivery channels, and which will also help provide other value-added services over and above the base services offered by MCA21.

National Citizen Database

Project UID, a Planning Commission initiative, proposes to

- Create a central database of residents, initially of those above the age of 18 years
- Generate a unique identification number (UID) for all such residents

The UID is intended to provide a robust basis for efficient delivery of various social and welfare services to persons below the poverty line (BPL). It can also be used as the basis for identifying and authenticating a person's entitlement to government services and benefits through a single system rather than all government departments individually and independently investing in creating infrastructure, systems and procedures for verifying entitlement of residents under various schemes of the Government. To this end, the project envisages provision of linking of existing databases, as well as providing for future additions, by the user agencies.

Passport

The Passport Seva Project was launched by the Ministry of External Affairs with the objective of delivering Passport Services to the citizens in a comfortable environment with wider accessibility and reliability. The project envisages setting up of 77 Passport Seva Kendras (PSKs) across the country, a Data Centre and Disaster Recovery Centre, Call centre operating 18x7 in 17 languages, and a centralized nationwide computerized system for issuance of passports. The entire operation will function in a "less paper" environment with an attempt being made to deliver passports within 3 working days to categories not requiring police verification.

Immigration, Visa and Foreigner's Registration & Tracking (IVFRT)

In order to Modernize and upgrade the Immigration services, "Immigration, Visa and Foreigners Registration & Tracking (IVFRT)" has been identified and included as one of the MMPs to be undertaken by the Ministry of Home Affairs under the National e-Governance Plan (NeGP). The core objective of this Project is to develop and implement a secure and integrated service delivery framework that facilitates legitimate travellers while strengthening security. The scope of the project includes 169 Missions, 77 ICPs (Immigration Check Posts), 5 FRROs (Foreigners Regional Registration Offices), and FROs (Foreigners Registration Offices) in the State/District Headquarters.

The implementation of this MMP will enable authentication of traveller's identity at the Missions, Immigration Check Posts (ICPs) and Foreigners Registration Offices (FROs) through use of intelligent document scanners and biometrics, updation of foreigner's details at entry and exit points, improved tracking of foreigner's through sharing of information captured during visa issuance at Missions, during immigration check at ICPs, and during registration at FRRO/ FROs.

Pension

Under this MMP, a Pensioner's Portal http://pensionersportal.gov.in has been set up with the following components:

- Non-interactive component to provide updated information on pension issues
- Interactive component to monitor grievance redressal at three interlinked levels, as follows:
    o Central-level in Department of Pensions &Pensioners' Welfare (nodal point)
    o Central Ministries/ Department-level
    o Pensioners' Associations-level (field level)

Pensioners registering grievances on the portal get unique access codes, which helps them monitor progress of their cases. The designated nodal officer at the level of Department of Pension & Pensioners' Welfare and at the level of Central Ministry/ Department can also monitor the progress of such registered cases.

E-Office

The Government of India, in recognition of the long-felt need for efficiency in government processes and service delivery mechanisms, has included e-Office as a core mission mode project (MMP) under the National e-Governance Plan (NeGP). It is estimated that this MMP has the potential of targeting over 2 lakh users.

This MMP aims at significantly improving the operational efficiency of the Government by transitioning to a "Less Paper Office".

The objectives of the MMP are:

- To improve efficiency, consistency and effectiveness of government responses
- To reduce turnaround time and to meet the demands of the citizens charter
- To provide for effective resource management to improve the quality of administration
- To reduce processing delays
- To establish transparency and accountability

State MMPs

Agriculture

There have been several initiatives by State and Central Governments to meet the various challenges facing the agriculture sector in the country. The Agriculture MMP has been included in NeGP in an effort to consolidate the various learning from the past, integrate all the diverse and disparate efforts currently underway, and upscale them to cover the entire country.

The MMP is to be operationalized by Department of Agriculture and Cooperation (DAC), and aims to provide services, such as:

- Information to farmers on seeds, fertilizers, pesticides
- Information to farmers on Govt. Schemes
- Information to farmers on Soil recommendations
- Information on crop management
- Information on weather and marketing of agriculture produce

Commercial Taxes

There has been a strong demand for streamlining VAT administration through citizen-centric, service-oriented processes, and establishing a certain degree of standardization with respect to Commercial Tax (CT) administration. Since the CT departments mainly interface with businesses and often account for $60-70$ per cent of the total revenue of the States and Union Territories (UTs), their functioning can directly affect the attractiveness of a State or UT as a business destination. It is against this backdrop that the Commercial Taxes MMP was conceived. The initiative is spearheaded by the Department of

Revenue (DoR), Ministry of Finance, with strategic consultancy provided by the National Institute for Smart Government (NISG) and Ernst & Young (E &Y).

Under this MMP, various recommendations have been made to facilitate simplification of administrative procedures and reduction of processing timelines. Some of the key recommendations are noted below:

- Electronic filing of returns
- Electronic clearance of refunds
- Electronic payment of tax
- Online dealer ledger
- Online issuance of CST statutory forms through Tax Information Exchange System (TINXSYS)
- Facility to dealer to obtain various online information services

E-District

Districts are the de facto front-end of government where most Government-to-Consumer or G2C interaction takes place. The e-District project was conceptualized to improve this experience and enhance the efficiencies of the various Departments at the district-level to enable seamless service delivery to the citizen.

Front-ends under the scheme, in the form of citizen facilitation centers, are envisioned to be built at District-, Tehsil-, Sub-division- and Block- levels. Village-level front-ends would be established through Common Services Centres (CSCs) for delivery of services.Indicative services planned to be delivered through this MMP include:

- Certificates: Creation and distribution of certificates for income, domicile, caste, Birth, Death etc.
- Licences: Arms Licenses etc.
- Public Distribution System (PDS): Issue of Ration Card, etc.
- Social Welfare Schemes: Disbursement of old-age pensions, family pensions, widow pensions, etc.
- Complaints: Related to unfair prices, absentee teachers, non-availability of doctor, etc.
- RTI: Online filing and receipt of information relating to the Right to Information Act

- Linking with other e government projects: Registration, Land Records, and Driving Licences, etc.

- Information Dissemination: About government schemes, entitlements, etc.

- Assessment of taxes: Property tax, and other government taxes.

- Utility Payment: Payments relating to electricity, water bills property taxes etc.

Employment Exchange

Ministry of Labour & Employment is in the process of conceptualizing this MMP. It is expected that the MMP will help match the requirements of employers against employee database. It is also expected that the MMP will have mechanisms to provide valuable guidance and career counselling to the unemployed, and facilitate online registration of vacancies by employers.

Land Records

Maintenance of land records and the availability of easily accessible land information is one of the most important issues facing governance today. "Land Records" itself is a generic expression and can include records such as, the register of lands, Records of Rights (RoRs), tenancy and crop inspection register, mutation register, disputed cases register, etc. It can also include geological information regarding the shape, size, soil-type of the land; and economic information related to irrigation and crops

The Land Records MMP, being implemented by Ministry of Rural Development (MoRD), seeks to accomplish the following across States:

- Completion of all data entry related to digitization of land records

- Provision of legal sanctity to computerized Records-of-Rights (RoRs)

- Stopping further issue of manual RORs

- Setting up computer centers at Tehsils

- Enabling Web access

The main objectives of the MMP are:

- To facilitate easy maintenance and updates in land databases

- To provide for comprehensive scrutiny to make land records tamper-proof (in an effort to reduce the menace of litigation and social conflicts associated with land disputes)

- To provide the required support for implementation of development programmes for which data about distribution of land holdings is vital

- To facilitate detailed planning for infrastructural as well as environment development

- To facilitate preparation of an annual set of records in the mechanised process, thereby producing accurate documents for recording details such as collection of land revenue, cropping pattern, etc.

- To facilitate a variety of standard and ad-hoc queries on land data

- To provide database for agricultural census

Core Services offered under the Land Records MMP are:

- Issue of copies of RoRs

- Crop, irrigation and soil details

- Filing and tracking of status of mutation cases

- Availability and submission of forms

Municipalities

The Municipalities MMP aims to leverage ICT for sustained improvement in efficiency and effectiveness of delivery of municipal service to citizens. The key objectives of the MMP are:

- To provide single window services to citizens on anytime, anywhere basis

- To increase the efficiency and productivity of Urban Local Bodies (ULBs)

- To develop a single, integrated view of ULB information system across all ULBs in the State

- To provide timely and reliable management information relating to municipal administration for effective decision-making

- To adopt a standards-based approach to enable integration with other related applications

- This MMP is one with significant citizen interaction, given that municipalities provide a large number of basic services for millions of citizen living in urban centres across the Nation.

Panchayats

The Panchayat represents the first-level of Government interaction for over 60 per cent of the Indian populace, and provides a large number of basic services for millions of citizens living in rural locations across the Nation. It is against this backdrop that the Panchayat MMP has been included in NeGP. The

MMP aims to address and overcome the typical challenges faced in the villages, such as lack of reliable communication infrastructure, delay in delivery of services to citizens, low revenue mobilization for implementing schemes at the Gram Panchayat level, and lack of monitoring mechanisms for schemes.

The MMP envisages implementation of various modules across the services and management functions within Gram Panchayat, such as the following:

- Issue of trade licences and NoC
- House-related services
- Issue of certificates of Birth and Death, Income and Solvency
- Dissemination of internal process of Panchayat agenda, voting, and resolution
- Copy of proceedings of Gram Sabha and Action Taken Report (ATR)
- Receipt of funds / progress report
- Dissemination of BPL data

Police

This MMP has been included in NeGP in light of the ever-increasing threats of terror attacks and of continually ascending crime graphs. It includes aspects such as creation of- and sharing of- crime-related databases across departments, effective personal management, and efficient inventory control.

Given the large variations in these functions across States, the MMP professes a phased approach towards implementation. The first phase broadly targets those functions that are common across States and which are driven by the Criminal Procedure Code (CrPC).

Road Transport

The Road Transport MMP was included in NeGP with a view to create a unified data schema which could be used by all States and Union Territories to computerize their respective transport offices (for faster and better-managed issue of vehicle registration certificates and driving licences). This MMP is being implemented as part of the Horizontal Transfer Programme of DIT.

Treasuries

Due to non-computerization or part-computerization of State Treasuries, most of the operational information continues to be exchanged in paper form. A Core Group on Computerization of Treasuries in State has been constituted to formulate a draft scheme on the Treasuries MMP under NeGP. The detailed concept note is being worked out by the Department of Expenditure.

Integrated MMPs

Common Services Centers

The CSC is a strategic cornerstone of the National e-Governance Plan (NeGP), as part of its commitment in the National Common Minimum Programme to introduce e-governance on a massive scale. The CSCs would provide high quality and cost-effective video, voice and data content and services, in the areas of e-governance, education, health, telemedicine, entertainment as well as other private services. A highlight of the CSCs is that it will offer web-enabled e-governance services in rural areas, including application forms, certificates, and utility payments such as electricity, telephone and water bills.

The Scheme creates a conducive environment for the private sector and NGOs to play an active role in implementation of the CSC Scheme, thereby becoming a partner of the government in the development of rural India. The PPP model of the CSC scheme envisages a 3-tier structure consisting of the CSC operator (called Village Level Entrepreneur or VLE) the Service Centre Agency (SCA), that will be responsible for a division of 500-1000 CSCs and a State Designated Agency (SDA) identified by the State Government responsible for managing the implementation over the entire State.

The CSC Scheme has been approved by Government in September 2006 with an outlay of Rs. 5742 Crores over a period of 4 years. It is expected that 100% CSCs would be rolled by March 2011.

E-BIZ

The eBiz initiative, being piloted by the Department of Industrial Policy and Promotion, seeks to provide comprehensive Government-to-Business (G2B) services to business entities with transparency, speed, and certainty. It aims at reducing the points of contact between business entities and Government agencies, standardizing "requirement information", establishing single-window services, and reducing the burden of compliance, thereby benefitting stakeholders such as entrepreneurs, industries and businesses, industry associations, regulatory agencies, industrial promotional agencies, banks and financial institutions, and taxation authorities.

E-Courts

The Indian judiciary comprises of nearly 15,000 courts situated in approximately 2,500 court complexes throughout the country. Under the e-Courts MMP, it is proposed to implement ICT in Indian judiciary in 3 phases over a period of 5 years. The MMP aims to develop, deliver, install, and implement

automated decision-making and decision-support systems in 700 courts across Delhi, Bombay, Kolkata and Chennai; 900 courts across 29 State/ Union Territory capitals; and 13,000 district and subordinate courts across the Nation.

The objectives of the project are:

- To help judicial administration in streamlining their day-to-day activities
- To assist judicial administration in reducing the pendency of cases
- To provide transparency of information to the litigants
- To provide judges with easy access to legal and judicial databases

E-Procurement

This MMP aims at making government procurement simplified, transparent, and result-oriented. It is being implemented through the Directorate General of Supplies & Disposals (DGS&D), a central purchasing organization under the Ministry of Commerce and Industry, which has core competency in procurement of goods and services.

The objectives of the MMP are:

- To establish a one stop-shop for all services related to government procurement
- To reduce cycle time and cost of procurement
- To enhance transparency in government procurement
- To enhance efficiency of procurement
- To bring about procurement reform across the government

The e-Procurement MMP will cover all aspects of procurement from indent of tender to tender preparation, bidding, bid evaluation and award of contract. In light of the CVC mandate that all Departments publish their tenders on the internet, the MMP will deploy extensive security features for encryption and decryption of bids, and digital signatures.

NSDG

The National e-Governance Plan (NeGP) of the Govt. of India aims to cooperate, collaborate and integrate information across different departments in the Centre, States and Local Government. Government systems are characterized by islands of legacy systems using heterogeneous platforms and

technologies and spread across diverse geographical locations, in varying state of automation, make this task very challenging.

The National e-Governance Service Delivery Gateway (NSDG), an integrated MMP under the National e- Governance Plan (NeGP), can simplify the above task by acting as a standards-based messaging switch and providing seamless interoperability and exchange of data across the departments. NSDG acting as a nerve centre, would handle large number of transactions and would help in tracking and time stamping all transactions of the Government.

9.3.7 NEED OF E-GOVERNANCE

The strategic need of e-Governance is to support and simplify governance for all parties' government, citizens and businesses. The use of ICTs can connect all three parties and support processes and activities. In other words, in e-Governance uses electronic means to support and stimulate good governance. Therefore the objectives of   e-Governance are similar to the objectives of good governance. Good governance can be seen as an exercise of economic, political, and administrative authority to better manage affairs of a country at all levels, national and local.

It is useful here to present objectives for e-democracy and e-government. The two main objectives of e-democracy are:

- To provide citizens access to information and knowledge about the political process, about services and about choices available

- To make possible the transition from passive information access to active citizen participation by:
  - Informing the citizen
  - Representing the citizen
  - Encouraging the citizen to vote
  - Consulting the citizen
  - Involving the citizen

Regarding e-government, the distinction is made between the objectives for internally focused processes (operations) and objectives for externally focused services.

External strategic objectives

The external objective of e -Governance is to satisfactorily fulfill the public's needs and expectations on the front office side, by simplifying their interaction with various online services. The use of ICTs in

government operations facilitates speedy, transparent, accountable, efficient and effective interaction with the public, citizens, business and other agencies.

Internal strategic objectives

In the back-office, the objective of e-Governance in government operations is to facilitate a speedy, transparent, accountable, efficient and effective process for performing government administration activities. Significant cost savings (per transaction) in government operations can be the result. It can be concluded that e-Governance is more than just a Government website on the Internet. Political, social, economic and technological aspects determine e- Governance.

9.3.8 E-GOVERNANCE EXPERIENCES IN INDIA

Recognizing that e-Governance shall be a major part of e-initiatives and shall play an increasingly important role in modern Governance, various agencies of the Government and civil society organizations have taken a large number of e-initiatives across the country. Indicated below are some of the key e- initiatives taken in the country across some of the important citizen/business related departments:

Customs and Excise (Government of India)

- 98% of export and 90-95% of import documentation computerized

- Electronic filing through ICEGATE at 3 locations (Mumbai, Delhi, Chennai)

- 80% of Service Tax returns electronically processed

- Anywhere to Anywhere reservation from Anywhere

- Electronic Booking of tickets on select sectors

- Online Information on Railway reservation on Internet

Postal Department (Government of India)

- Direct e-credit of Monthly Income Scheme returns into the investors accounts

- Dematerialization of Savings Certificate (NSC) and Vikas Patras (KVP), offering full portability

Passport / Visa (Government of India)

- 100% passport information computerized

- All 33 Regional Passport Offices covered

- Machine readable passports at some locations

AP Online (State Government of Andhra Pradesh)

An Integrated Citizen Services Portal providing citizen centric services such as: Birth/Death Certificates, Property Registration, Driver's License, Govt. Applications & Forms, Payment of taxes / utility bills etc.

Bhoomi

Automation of Land Records (State Government of Karnataka) it provides computerized Record of Rights Tenancy & Crops (RTC) - needed by farmer to obtain bank loans, settle land disputes etc. It has also ensured increased transparency and reliability, significant reduction in corruption, exploitation and oppression of farmers. This project has benefited 20 million rural land records covering 6.7 million farmers.

CARD – Registration Project (State Government of Andhra Pradesh)

Computerization Administration of Registration Department (CARD) impacting 10 million citizens over a period of 3 years. It has completed registration of 2.8 million titles with title searches made in 1.4 million cases. The system ensures transparency in valuation of   property and efficient document management system. The estimated saving of 70 million man-hours of citizen time valued at US$ 35 mil (investment in CARD - US$ 6million). Similar initiatives in other states like SARITA (State Government of Maharashtra) STAR (State Government of Tamil Nadu), etc. have further built upon this initiative.

Gyandoot: Intranet in Tribal District of Dhar (State Government of Madhya Pradesh)

This project offers e-Governance services including online registration of applications, rural e-mail facility, village auction site etc. It also provides services such as Information on Mandi (farm products market) rates, On-line public grievance redressal, caste & income certificates and Rural Market (Gaon ka Bazaar).

LOKMITRA (State Government of Himachal Pradesh)

- Offers e-Governance services:
- Online registration of applications,
- Rural e-mail facility, village auction site etc.
- Key services provided to citizens

- Information on Mandi (farm products market) rates

- On-line public grievance redressal

- Sending and receiving information regarding land records, income certificates, caste certificates and other official documents.

- Market rates of vegetables, fruits and other items

e-Mitra - Integrated Citizen Services Center (State Government of Rajasthan)

- Implemented using a PPP (Public Private Partnership) model

- Private partner paid by the government department / agency

- G2C services like:
  o Payment of electricity, water, telephone bills o Payment of taxes
  o Ticket Reservations
  o Filing of Passport applications o Registration of birth/death
  o Payment by cash/cheque/ credit card

The above cases of e-initiatives are only illustrative. Many of the State Governments have successfully implemented several such e-initiatives. This has positively impacted the quality of life of citizens. Hence e- Governance as a major e-initiative affords an excellent opportunity for India to radically improve the quality of governance and thereby:

- Allow for two-way communication between government and citizens not only for service delivery but also to receive opinions of citizens on policies and government performance

- Provide greater access to excluded groups, who have few opportunities to interact with government and benefit from its services and schemes

- Include all sections of the society in the mainstream of development

- Enabling rural and traditionally marginalized segments of the population to gain fast and convenient access to services in their own neighbourhoods.

9.4 CHECK YOUR PROGRESS

1. _____ is the buying and selling of goods and services through wireless handheld devices such as smartphones and tablets.

2. _____ is a communications protocol that is used for wireless data access through most mobile wireless networks.

3. A _____ is a technology that creates a safe and encrypted connection over a less secure network, such as the internet.

4. The _____ is an initiative of the Government of India to make all government services available to the citizens of India via electronic media.

5. The utilization of the Internet and the world-wide-web for delivering government information and services to the citizens is known as _____.

9.5 SUMMARY

M-Commerce is the process of performing business transactions using handheld mobile devices which are connected through wireless networks. The business transactions may range from buying and selling goods, making mobile payments, downloading audio/video contents, playing online games, using numerous software applications or getting mobile tickets. The mobile devices include cellular phones, handheld computers such as palmtops or laptops, pagers, smartphones and Personal Digital Assistants (PDA). Mobile commerce provides instant connectivity between mobile users irrespective of their geographical location and time of the day. With enormous growth of wireless and mobile technology and rapid penetration of mobile phones in developing countries worldwide, the scope of m-commerce has increased manifold.

9.6 KEYWORDS

M-Commerce: M-commerce (mobile commerce) is the buying and selling of goods and services through wireless handheld devices such as smartphones and tablets.

PDA: A Personal Digital Assistant (PDA) is a small device that can include computing, telephone/fax, paging, networking, and other features. It is typically used as a personal organizer.

WAP: Wireless application protocol (WAP) is a communications protocol that is used for wireless data access through most mobile wireless networks

VPN: A virtual private network (VPN) is a technology that creates a safe and encrypted connection over a less secure network, such as the internet.

E-Government: E-government (short for electronic government) is the use of technological communications devices, such as computers and the Internet to provide public services to citizens and other persons in a country or region.

NeGP: The National e-Governance Plan (NeGP) is an initiative of the Government of India to make all government services available to the citizens of India via electronic media. MMPs- Mission Mode Projects

MCA: The Ministry of Corporate Affairs is an Indian government ministry. It is primarily concerned with administration of the Companies Act 2013, the Companies Act 1956, the Limited Liability Partnership Act, 2008 & other allied Acts and rules & regulations framed there-under mainly for regulating the functioning of the corporate sector in accordance with law

9.7 SELF-ASSESSMENT TEST

1. Define mobile commerce. Describe how business transactions are performed through mobile devices.
2. What is mobile payment? Describe SMS-based transactional payment.
3. What is a cell site in a cellular network? What are the components of a cell site?
4. What are the benefits of mobile commerce? Describe in detail.
5. Describe the limitations of mobile commerce and suggest possible remedies.
6. Describe the features of mobile banking. What are the security challenges of mobile banking?
7. What are the various categories of mobile payment? Describe card-based mobile payment.
8. Describe mobile ticketing process. What are the challenges faced by mobile ticketing?
9. Define the term e-Governance and its applications for a normal user.
10. Do you think e-Governance will help the citizen to collect and contact with government services in future is yes then write your views?
11. What are the basic requirements to start with e-Governance?
12. For a normal user what will be the difficulties to access e-Governance services?

13. Study National e-Governance Plan from NEGP website and write about some pilot projects of e- Governance

14. Find our 10 Mission mode projects websites and write a note about them.

15. Explain the benefits of e-Governance for a common man also describe the barriers to avail those services.

9.8   ANSWERS TO CHECK YOUR PROGRESS

1. M-commerce

2. Wireless application protocol

3. virtual private network

4. National e-Governance Plan

5. E-Government

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SUBJECT: COMPUTER APPLICATIONS IN BUSINESS	
COURSE CODE: DBA-104	AUTHOR: Ms. Kapila Devi
LESSON NO. 10	VETTER: Prof. Dharminder Kumar
ONLINE PAYMENT SYSTEM	

STRUCTURE

10.1   LEARNING OBJECTIVES

- Description of online Payment System(OPS)

- Describe the different Phases of OPS

- Learn various methods of e-payment of OPS

- Know the different components of OPS

- Describe advantages and disadvantages of OPS

10.2 INTRODUCTION

People exchange commodities and services for cash on a daily basis. The primary medium of exchange is now money. Later, various payment systems were created in response to the demand to support the expansion of trade and economic development. The methods for exchanging value are highly diverse, spanning through the use of straightforward payment methods like cash towards the usage of intricate systems. The most common and conventional mode of payment used by customers to make purchases of merchandise and services is tangible currency. The amount of money grows along with the number and variety of transactions. It is neither realistic nor economical to conduct each significant transaction in cash. When there are significant currency dealings involved, there are privacy and logistics issues.

In such circumstances, banks would assist by providing alternative payment options. The idea of a cashless society has long been debated. Cash and checks could not suddenly disappear. Despite the fact that old habits rarely change, people are open to embracing new ideas. Payment systems are lifeline of every economy as they provide financial stability and way to reach the economic benefit to the lower level of the economy. Rapid growth of payment system resulted into the safe secure, cheap, handy, convenient and effective state-of-the-art digital payment system. Digital payment or electronic payment system are widely used payment system in our country. Electronic payment system provides a way to make online payment for any good or service without using cash or check in a secure environment. It is also called E-payment or online payment system (OPS).

10.3 ONLINE PAYMENT SYSTEM (OPS)

A business mechanism known as an electronic payment method includes an intermediary to enable the transmission of funds among a seller as well as a buyer. It is also known by the names liquidation, clearing system, and clearing service occasionally. It is crucial to contemporary financial systems and enables the transfer of value from one aspect of the economy to another.

Modern payment methods can be either physical or electronic, and each has its own protocols and processes that direct the financial institution's use of payment mechanisms and legal frameworks. Certain of these systems have expanded internationally thanks to standardisation. A payment that is

made electronically between two bank accounts, avoiding the direct involvement of bank workers, is referred to as an electronic payment.

- The financial operations of a corporation depend heavily on the payment system. But when numerous payment mechanisms are employed, it gets complicated. The ongoing use of newer payment methods like paytm, UPI, bitcoin, and numerous mobile payment solutions presents further difficulties. Because of this, there are lots of payment methods in use worldwide. The transfer of money using digital or electronic means is what is meant by "electronic payments."

- Various e-payment options are available, including bank cards, net banking, mobile wallets, mobile banking etc.

- E-payments are rapid and easy, and the money is often transferred immediately.

- E-payments are a secure, fast and effective method of sending money, and the funds are often transferred promptly.

- E-payments do away with the necessity for cash transactions by transferring money straight into customer's accounts or mobile wallets that are connected to a mobile number.

Credit and debit cards, mobile wallets, UPI, internet and mobile banking, and many other options are among the several kinds of e-payment. To use e-payment solutions and pay for different goods and services, all you need is a bank account and a device that can connect to the internet.

10.4   PHASES OF ONLINE PAYMENT SYSTEM

The following steps are commonly involved in an electronic payment:

Registration: During this stage, the payer and payee must register with the issuer and acquirer, respectively. The majority of electronic payment systems need payers and payees to register with their respective banks so that there is a connection between their identities and the bank accounts they hold.

Invoicing: In this stage, the payee receives an invoice to be paid. When making purchases via the internet, this is done either by browsing and choosing the things you want to buy from the payee's website, or by requesting an electronic invoice through another electronic communication channel, such as email. This stage is often skipped over when designing payment procedures and is

carried out in an unsafe environment. This stage is crucial because it determines which data variables are required to be part of a payment protocol and which are optional.

Payment selection and processing: Depending on the sort of payment, the payer chooses a payment method in this phase like card-based, electronic cash, electronic check, etc. Given the choice, the payer provides the payee the pertinent payment information, including the account number and other unique identifiers of the payer, together with the acceptable payment amount determined by the invoice. Before delivering the payment details to the payee, the payer may also be required by some protocols to get a preauthorized token (such as bank draughts) from the issuer.

Payment authorisation and confirmation: Upon receiving payment information from the payee, the acquirer authorises the payment and gives a receipt to the payee that indicates whether the payment was successful or unsuccessful. The payee may also give the payer a receipt for payment depending on the message.

10.5   COMPONENTS OF ONLINE PAYMENT SYSTEM

The online payment system includes the following components:

Banks and other financial institutions: they include building societies, mortgage financing firms, foreign exchange bureaus, and post office savings banks.

Customers: it consists people and businesses as well as organisations and governments.

Systems for payments and settlements: it comprises the numerous procedures and avenues used to carry out the value exchange between the parties for a transaction.

Payment Apparatus: Cash, checks, postal and money orders, point of sale, debit and credit cards, smart cards, electronic funds transfers, and vouchers are among the payment instruments and streams.

Clearing Apparatus: it includes cheques, Electronic Funds Transfers (EFTs), as well as direct credits and debits, are clearing apparatus.

Rules, Regulations, and Agreements: The rights, obligations, and responsibilities of the system's members are governed by the legal and statutory framework and the Rules, Regulations, and Agreements.

Providers of access to payment related services: it includes Information Technology Solution Providers, Society for Worldwide Interbank Financial Telecommunications, etc. **Infrastructure:** These are system-level operations and processes. They are made up of telecommunication, power, and transportation networks which support the operation of payment systems.

10.6 METHODS OF ONLINE PAYMENT SYSTEM

Online payment system has different type of methods for payment which are discussed below:

E-Banking:

Electronic banking usually includes fund transfer by electronic means despite of a check or cash from one account to another account. This method of money transfer is very secure and easy. You can use electronic funds transfer to:

- You can withdraw money at your convenience, day or night, by using ATM and a personal identification number (PIN).
- You can instruct bank to deduct your payments or charges such as your auto loan or mortgage, from your account automatically.
- You can request transfer money from your account to mutual fund or fixed deposit account automatically every month.
- You can request a direct deposit of your tax refund or social security benefits into your checking account.
- Use a check card at the point of sale to pay for groceries, gas, and other items rather than cash, a credit card, or a personal check.
- Use a smart card with a pre-loaded amount of money instead of cash at pay phones, toll booths on motorways, bookstores on college campuses, and copier machines in libraries.
- Organize your entire personal financial management process using your computer and personal finance software, integrating information and tasks related to your income, spending, saving, investing, record-keeping, bill-paying, and taxes, as well as performing basic financial analysis and making decisions.

Internet Banking:

Internet banking, also known as online banking or e-banking, refers to the practice of conducting banking activities and financial transactions over the internet. It enables customers to access their bank accounts, manage finances, and perform various banking tasks without the need to visit a physical branch.

The computer system of the bank is integrated with the Internet banking system so that customers who use remote banking can access other automated services provided by the bank. The stages in the invention's method include entering a customer's banking request at a remote personnel computer from a menu of banking requests; transferring the customer banking requests over a network to the host computer, receiving the requests there, and determining the kind of customer banking requests that were received; Automatically logging the service request, comparing it to a table of request types that has been stored, each of which has an attribute that indicates whether it can be handled by a customer service agent or by an automated system, and, based on the attribute, routing the request to either a queue for handling by a customer service agent or to a queue for processing by an automated system. The following is a list of different types of online banking:

National Electronic Funds Transfer (NEFT)

National Electronic Funds Transfer (NEFT) is an electronic payment system in India that facilitates interbank fund transfers on a deferred net settlement basis. It was introduced by the Reserve Bank of India (RBI) as a safe, secure, and efficient way to transfer money between different banks across the country. NEFT is commonly used for various purposes, such as fund transfers to individuals, vendor payments, bill payments, and other non-time-sensitive transactions. For time-sensitive and high-value transactions, the Real-Time Gross Settlement (RTGS) system is more suitable, as it provides instantaneous and irrevocable settlement.

Key features of the NEFT system include:

1. Deferred Net Settlement: NEFT operates on a deferred net settlement basis, which means that transactions are not processed individually in real-time like RTGS (Real-Time Gross Settlement). Instead, all the transactions initiated during specific time slots are batched together and settled at regular intervals throughout the day.

2. Settlement Batches: NEFT transactions are processed in batches, with multiple settlement windows on weekdays (Monday to Friday) and a reduced number on Saturdays. This allows for multiple settlement cycles during the day, providing reasonable speed and flexibility for fund transfers.

3. Timings: As of my last update in September 2021, NEFT transactions can be initiated during the working hours of the bank, subject to the bank's specific timings. However, please note that the RBI may have made changes to the NEFT operating hours beyond my last update, so it's best to check with the respective bank for the latest information.

4. Lower Transaction Threshold: NEFT is typically used for lower-value transactions, making it suitable for individuals and businesses with relatively smaller fund transfer requirements.

5. Wide Reach: NEFT allows fund transfers between almost all banks in India, making it one of the most widely accessible electronic payment systems in the country.

6. Online and Offline Initiation: NEFT transactions can be initiated through various channels, including internet banking, mobile banking, and bank branches. In addition, some banks also allow NEFT transactions to be initiated via SMS.

7. Transaction Charges: Banks may charge a nominal fee for processing NEFT transactions. The charges may vary based on the transaction amount and the bank's policies.

Real Time Gross Settlement (RTGS)

Real-time gross settlement (RTGS) is a financial transaction processing system used to transfer funds between banks or financial institutions in real-time. It enables instantaneous and irrevocable settlement of individual transactions on a "gross" basis, meaning each transaction is processed individually and not bundled with others. RTGS is particularly useful when time sensitivity and immediate settlement are crucial, such as in financial markets, large interbank transfers, and critical business transactions. It contrasts with systems like Automated Clearing House (ACH) that may offer batch processing and take longer to settle transactions. The availability and functionality of RTGS can vary by country, and some countries may have multiple RTGS systems to accommodate different currencies or types of transactions.

Key features of RTGS include:

1. Real-Time Processing: RTGS systems process transactions immediately upon receipt, providing instantaneous settlement. As soon as a payment instruction is initiated, the funds are transferred in real-time to the recipient's account.

2. Irrevocable Settlement: Once a transaction is processed through RTGS, it is considered final and cannot be reversed. This ensures a high level of security and certainty in financial transactions.

3. High-Value Transactions: RTGS is primarily used for large-value and time-sensitive transactions, such as interbank transfers, large business payments, and high-value customer payments.

4. Centralized Clearing: Many countries have a central bank-operated RTGS system that acts as a clearinghouse for the settlement of large-value transactions among banks and financial institutions.

5. Payment Finality: RTGS provides immediate and definitive payment finality, meaning that once the payment is completed, the recipient can be certain that the funds are available and the payment is successful.

6. Continuous Operation: RTGS systems often operate continuously throughout the business day, allowing banks to settle transactions in real-time at any time during the working hours.

7. Cost Efficiency: While RTGS may involve higher transaction fees compared to other payment systems, it reduces settlement risk and the need for manual intervention, making it more efficient for high-value transactions.

Immediate Payment Service (IMPS)

Immediate Payment Service (IMPS) is an instant interbank electronic fund transfer service offered by banks in India. It allows customers to transfer funds in real-time, 24/7, throughout the year, including weekends and holidays. IMPS was introduced by the National Payments Corporation of India (NPCI) to facilitate quick and convenient money transfers using mobile phones, internet banking, or ATMs. IMPS has become popular in India due to its speed and accessibility, especially for small and time-sensitive

transactions. It complements other electronic payment systems like NEFT (National Electronic Funds Transfer) and RTGS (Real-Time Gross Settlement), which may have different processing times and are usually restricted to specific banking hours.

Key features of IMPS include:

1. Real-Time Transfers: IMPS enables immediate and instant transfer of funds between banks, ensuring that the recipient receives the money in a matter of seconds.

2. Available 24/7: IMPS operates round-the-clock, allowing customers to initiate transactions at any time, even outside of regular banking hours.

3. Multiple Channels: IMPS transactions can be initiated through various channels, including mobile banking apps, internet banking platforms, ATMs, and bank branches.

4. Mobile Number and MMID: One of the unique features of IMPS is the ability to transfer funds using the recipient's mobile number and Mobile Money Identifier (MMID). The sender only needs to know the recipient's registered mobile number and MMID to initiate the transfer.

5. Account Number and IFSC: Alternatively, IMPS transfers can also be made using the recipient's bank account number and Indian Financial System Code (IFSC).

6. Immediate Payment Confirmation: After the successful completion of an IMPS transaction, both the sender and the recipient receive instant confirmation of the payment via SMS or notification.

7. Payment Services in India: IMPS can be used for various purposes, such as person-to-person (P2P) transfers, person-to-merchant (P2M) payments, utility bill payments, and online shopping payments.

Automated Teller Machines (ATM)

Automated Teller Machines (ATMs) are electronic self-service machines that provide a range of banking services to customers without the need for human interaction. ATMs are typically located in public places, such as bank branches, shopping malls, airports, and convenience stores, making banking services more accessible and convenient for customers. ATMs have revolutionized the banking industry, providing customers with increased flexibility and convenience to access their funds and

perform essential banking tasks outside of traditional banking hours. The widespread availability of ATMs has significantly reduced the need for customers to visit brick-and-mortar bank branches for routine transactions, making banking services more efficient and accessible.

Key features and functions of ATMs include:

1. Cash Withdrawals: The primary function of ATMs is to allow customers to withdraw cash from their bank accounts. Customers can use their debit or ATM cards, along with a personal identification number (PIN), to access their accounts and withdraw cash in various denominations.

2. Balance Inquiry: ATMs enable customers to check their account balances, allowing them to see how much money they have in their accounts before making any transactions.

3. Fund Transfers: Many ATMs provide the option for customers to transfer funds between their own accounts within the same bank or to other accounts within the bank's network.

4. Bill Payments: Some ATMs offer bill payment services, allowing customers to pay utility bills, credit card bills, or other bills directly from their bank accounts.

5. Mini Statements: ATMs can generate mini statements that display the recent transactions made on the account, providing a quick overview of the account's activity.

6. PIN Change: Customers can change their ATM PINs at the ATM for enhanced security.

7. Check Deposits: Some advanced ATMs accept check deposits, allowing customers to deposit checks without visiting a bank branch.

8. Card-less Transactions: In some regions, ATMs offer card-less transactions, allowing customers to initiate transactions using their mobile phones and receiving a secure code to use at the ATM.

9. Accessibility Features: Many modern ATMs are equipped with accessibility features, such as Braille keypads and text-to-speech capabilities, to cater to customers with visual impairments.

E-Cheque

An e-Cheque, also known as an electronic cheque or digital cheque, is an electronic version of a traditional paper cheque. Like a paper cheque, an e-Cheque is used to make payments from one bank account to another, but instead of being physically written on paper, it is created and processed electronically.

Key features of e-Cheques include:

1. Digital Format: E-Cheques are created and stored in a digital format, typically in a secure electronic document. They contain all the necessary information, such as the payer's account details, payee's information, the payment amount, date, and signature (often represented with a digital signature or other authentication methods).

2. Electronic Transmission: E-Cheques are transmitted electronically between banks or financial institutions, using secure communication channels like the internet or private networks.

3. Processing and Clearing: The processing and clearing of e-Cheques are similar to traditional paper cheques. The cheque information is sent to the payer's bank, which validates the details and deducts the payment amount from the payer's account. Then, the cheque is sent to the payee's bank for verification and crediting the amount to the payee's account.

4. Digital Signatures: E-Cheques often use digital signatures or other authentication mechanisms to ensure the authenticity and integrity of the cheque. This helps prevent fraud and unauthorized alterations.

5. Convenience and Efficiency: E-Cheques offer greater convenience and efficiency compared to paper cheques. They can be created and sent electronically, saving time and effort for both the payer and payee.

6. Security Measures: To ensure the security of e-Cheques, robust encryption and secure communication protocols are employed during transmission. Additionally, digital signatures and authentication methods add another layer of security.

7. Payment Gateway Integration: Some e-Cheque systems are integrated with payment gateways, allowing businesses to accept e-Cheque payments for online purchases or transactions.

Card based Payment methods:

Cards are more safe and secure methods that provide convenience, and control to consumers besides other form of payment. A lot of freedom is also provided by the large range of cards that are accessible, including credit, debit, and prepaid cards. These cards offer two-ways authentication for safe transactions, such as secure PIN and OTP, as follows:

Credit Card

A credit card is a plastic payment card issued by financial institutions, typically banks or credit unions, that allows cardholders to borrow money up to a certain credit limit to make purchases or withdraw cash. Unlike debit cards that use the money from a linked bank account, credit cards provide a line of credit that cardholders can use to pay for goods and services, with the understanding that they will repay the borrowed amount, usually on a monthly basis.

Key features of credit cards include:

1. Credit Limit: Each credit card has a predefined credit limit, which is the maximum amount of money a cardholder can borrow at any given time. The credit limit is determined by the card issuer based on factors such as the individual's creditworthiness, income, and repayment history.

2. Purchases: Cardholders can use their credit cards to make purchases at various merchants, both in-person and online. When making a purchase, the cardholder is essentially borrowing money from the card issuer to pay for the transaction.

3. Repayment Options: Credit cardholders have the flexibility to repay the borrowed amount in full by the due date, avoiding interest charges, or they can choose to pay a minimum amount and carry forward the remaining balance to the next billing cycle. However, carrying forward a balance typically incurs interest charges, making it important to manage credit card debt responsibly.

4. Interest Charges: If the cardholder does not pay the full outstanding balance by the due date, the card issuer will charge interest on the remaining amount. The interest rate, also known as the

Annual Percentage Rate (APR), varies from one credit card to another and can be relatively high, so it's crucial to be aware of the interest rates when using a credit card.

5. Rewards and Benefits: Many credit cards offer reward programs and benefits, such as cashback, travel rewards, points, or discounts on specific purchases. These perks are designed to incentivize card usage and offer additional value to the cardholder.

6. Security Features: Credit cards come with security features like EMV chips and PINs to protect against fraud. Additionally, cardholders are usually protected against unauthorized transactions through zero-liability policies.

7. International Usage: Credit cards can be used internationally, making them a convenient payment option for travellers. However, foreign transactions may incur additional fees or foreign exchange charges.

8. Building Credit History: Proper use of a credit card and timely repayments can help individuals build a positive credit history, which is essential for obtaining loans or other credit products in the future.

Debit Card

A debit card is a plastic payment card issued by a bank or credit union that allows cardholders to access funds directly from their bank account to make purchases or withdraw cash. Unlike credit cards that offer a line of credit, debit cards draw money directly from the available balance in the linked bank account, making them a convenient and straightforward payment method.

Key features of debit cards include:

1. Linked Bank Account: A debit card is linked to a specific bank account held by the cardholder. When a transaction is made using the debit card, the purchase amount is immediately deducted from the available balance in the account.

2. PIN or Signature: Debit card transactions can be authorized using either a Personal Identification Number (PIN) or a signature. For most in-person transactions, the cardholder enters a PIN to

validate the transaction's authenticity. For some transactions, especially in certain countries, a signature may be required instead of a PIN.

3. No Borrowing: Unlike credit cards, where the cardholder borrows money from the card issuer, a debit card only allows access to the funds already available in the linked bank account. It does not provide a credit line, so there are no interest charges or debt accumulation.

4. ATM Withdrawals: Debit cards can be used at Automated Teller Machines (ATMs) to withdraw cash from the linked bank account. Cardholders can access cash conveniently at ATMs around the clock.

5. Point-of-Sale Purchases: Debit cards can be used to make purchases at various merchants, including retail stores, restaurants, and online shops. The card is swiped or inserted into a card reader, and the transaction is authorized with a PIN or signature.

6. Safety and Security: Debit cards come with security features, such as EMV chips and PINs, to protect against fraudulent transactions. Cardholders can report lost or stolen cards to their bank to prevent unauthorized use.

7. Budgeting: Since debit cards access the funds directly from the linked account, they can help individuals stay within their budget, as they can only spend what they have available in the account.

8. No Interest Charges: Since debit cards do not involve borrowing, there are no interest charges associated with their use. However, some banks may charge nominal fees for certain debit card transactions or account maintenance.

Smart Card

A smart card, also known as an integrated circuit card or chip card, is a pocket-sized plastic card that contains an embedded microprocessor or integrated circuit chip. Smart cards are used to securely store and process data, making them suitable for various applications and industries.

Key features and uses of smart cards include:

1. Secure Data Storage: The embedded microprocessor in a smart card enables secure storage of data, including personal information, financial data, and authentication credentials.

2. Authentication and Identification: Smart cards are commonly used for user authentication and identification purposes. They can store digital certificates and biometric data, making them suitable for secure access to computer networks, buildings, and online services.

3. Payment Applications: Smart cards are widely used in payment systems, both for contact-based and contactless transactions. Chip and PIN credit cards and contactless payment cards are examples of smart card-based payment applications.

4. Public Transport: Many cities use smart cards in their public transportation systems. Commuters can load the card with credit and use it to pay for bus, subway, or train fares, making public transit more convenient and efficient.

5. Health Care: Smart cards are utilized in healthcare systems to store patient data, medical records, and health insurance information securely. This can streamline administrative processes and improve patient care.

6. Loyalty and Membership Cards: Smart cards are used as loyalty cards or membership cards for various businesses. Customers can earn rewards points or access exclusive benefits through these cards.

7. SIM Cards: Subscriber Identity Module (SIM) cards used in mobile phones are a type of smart card. They contain the user's mobile phone number, contacts, and other subscriber-related information.

8. Secure Transactions: Smart cards offer enhanced security for transactions and data exchange. The embedded chip enables encryption and authentication, reducing the risk of fraud and unauthorized access.

9. Contact and Contactless Cards: Smart cards can be either contact-based (requiring physical contact with a card reader) or contactless (using radio frequency technology for communication).

Aadhaar Enabled Payment System

The Aadhaar Enabled Payment System (AePS) is a financial inclusion initiative launched by the Government of India. It is an innovative payment platform that leverages the Aadhaar biometric data to facilitate transactions. Aadhaar is a 12-digit unique identification number issued by the Unique Identification Authority of India (UIDAI) to residents of India, based on their biometric and demographic data. AePS allows individuals to perform basic banking transactions through Aadhaar authentication at Micro-ATMs (AEPS-enabled devices) operated by banks or business correspondents. These transactions can be carried out using biometric authentication (fingerprint or iris scan) or a one-time password (OTP) received on the registered mobile number linked with Aadhaar.

Unified Payments Interface (UPI)

Unified Payments Interface (UPI) is a real-time payment system and a popular digital payment platform in India. It was launched by the National Payments Corporation of India (NPCI) to facilitate instant and secure fund transfers between banks and enable seamless peer-to-peer (P2P) and peer-to-merchant (P2M) transactions.

Key features and characteristics of Unified Payments Interface (UPI) include:

1. Real-Time Transactions: UPI allows for instant fund transfers between bank accounts, enabling users to send and receive money in real-time, 24/7, throughout the year.

2. Interoperability: UPI is interoperable across different banks and financial institutions, meaning that users can send money to accounts held in any participating bank through a single UPI app or platform.

3. Mobile-Based Platform: UPI transactions are primarily carried out through mobile apps. Users need to download and register on a UPI-enabled app provided by their respective banks.

4. Virtual Payment Address (VPA): UPI simplifies fund transfers by using Virtual Payment Addresses (VPAs) instead of traditional bank account numbers and IFSC codes. A VPA is a unique identifier assigned to the user and looks like "yourname@bankname."

5. Single Click Authentication: UPI transactions are secured using two-factor authentication, usually through a combination of a VPA and a mobile PIN (MPIN) or biometric authentication.

6. Multiple Payment Options: UPI supports various payment options, including person-to-person (P2P) transfers, merchant payments, bill payments, and online shopping.

7. Immediate Payment Service (IMPS): UPI leverages IMPS to enable real-time settlement and secure transactions.

8. Scan and Pay: UPI also offers the option to make payments by scanning QR codes at merchants' establishments, facilitating easy and cashless transactions.

9. Linking Multiple Bank Accounts: Users can link multiple bank accounts to a single UPI app, providing greater flexibility in managing finances.

Mobile Wallet

A mobile wallet, also known as a digital wallet or e-wallet, is a virtual wallet or application that allows users to store and manage their payment card information, loyalty cards, and other payment-related data on their mobile devices. Mobile wallets enable users to make electronic transactions, both in-store and online, by securely storing and using their payment credentials without the need to carry physical cards or cash.

Key features and functionalities of mobile wallets include:

1. Payment Cards Storage: Mobile wallets allow users to add and store various payment cards, such as credit cards, debit cards, and prepaid cards, within the app.

2. Secure Transactions: Mobile wallets employ various security measures like encryption and tokenization to protect users' payment information, making transactions secure and reducing the risk of card fraud.

3. Contactless Payments: Many mobile wallets support contactless payment methods, allowing users to make payments by tapping their mobile devices on NFC-enabled payment terminals at the point of sale (POS).

4. Online Shopping: Mobile wallets facilitate easy and secure payments for online shopping. Users can select their mobile wallet as a payment method during the checkout process on e-commerce websites or mobile apps.

5. Loyalty Cards and Coupons: Some mobile wallets also enable users to store and manage loyalty cards, rewards programs, and digital coupons, streamlining the redemption process at participating merchants.

6. Peer-to-Peer (P2P) Transfers: Many mobile wallets offer P2P transfer capabilities, allowing users to send money to friends, family, or contacts using their mobile phone numbers or email addresses.

7. Bill Payments: Users can use mobile wallets to pay utility bills, mobile phone bills, and other recurring payments, streamlining the payment process.

8. Integration with Digital Services: Mobile wallets may integrate with other digital services, such as ride-sharing apps or food delivery platforms, to offer seamless and quick payments within the app.

9. Mobile Banking Features: Some mobile wallets provide basic mobile banking features, such as checking account balances and transaction history.

10.7   DIGITAL SIGNATURE

A digital signature is a cryptographic technique used to verify the authenticity and integrity of a digital document, message, or data. It provides a way to ensure that the information has not been tampered with and that it originated from a specific sender. Here's how digital signatures work:

1. **Key Generation**: The signer generates a pair of cryptographic keys—a private key and a corresponding public key. The private key is kept secure and known only to the signer, while the public key can be freely shared.

2. **Signing Process**: To sign a digital document, the signer applies a mathematical algorithm (typically using their private key) to create a unique digital signature. The signature is computed based on the content of the document and is specific to that document.

3. **Verification Process**: To verify the digital signature, the recipient of the document uses the signer's public key to perform a mathematical calculation on the signature and the document. If the resulting value matches the original value generated by the signer, the signature is considered valid. This verifies the integrity of the document and confirms that it was signed by the person possessing the private key.

1. **Cryptographic Keys**:

   - **Private Key**: A digital signature is created using a signer's private key. This key is kept secret and known only to the signer. It should be securely stored and protected from unauthorized access.

   - **Public Key**: The corresponding public key is derived from the private key and can be freely distributed. The public key is used by recipients to verify the digital signature. It is important to note that the private key cannot be calculated or derived from the public key.

2. **Signing Process**:

   - **Hashing**: The digital signature process begins with creating a unique representation of the document, known as a hash value or message digest. A cryptographic hash function, such as SHA-256 (Secure Hash Algorithm 256-bit), is commonly used for this purpose. The hash function takes the document's content as input and generates a fixed-length string of characters unique to that content.

   - **Signing**: The signer's private key is then used to encrypt the hash value. This encryption process is typically performed using a digital signature algorithm, such as RSA (Rivest-Shamir-Adleman) or ECDSA (Elliptic Curve Digital Signature Algorithm). The output of this encryption is the digital signature.

3. **Verification Process**:

- **Hashing**: The recipient of the digitally signed document performs the same hash function on the received document to generate a hash value.

- **Decryption**: The recipient uses the signer's public key to decrypt the digital signature. This process yields the original hash value generated by the signer.

- **Comparison**: The generated hash value from the received document is compared to the decrypted hash value from the digital signature. If the two values match, it confirms the document's integrity and authenticity.

4. **Properties and Benefits:**

- **Integrity**: Any modification or tampering of the document, no matter how small, will result in a different hash value. Thus, when verifying the digital signature, any mismatch between the computed hash value and the decrypted hash value indicates that the document has been altered.

- **Authentication**: The use of the signer's private key ensures that the document came from the claimed sender. The recipient can verify the public key against a trusted source to validate the signer's identity.

- **Non-repudiation**: Digital signatures provide evidence that the signer cannot deny their involvement in signing the document. Since the private key is unique to the signer, they cannot refute their responsibility for the signature.

- **Efficiency**: Digital signatures are computationally efficient, allowing for quick verification even for large documents.

- **Security**: Asymmetric cryptography, which employs the use of private and public keys, provides a strong level of security, making it extremely difficult for unauthorized individuals to forge a valid digital signature.

5. **Certificate Authorities (CAs):**

- Certificate Authorities play a crucial role in the digital signature infrastructure. They issue digital certificates that bind a person's identity to their public key. These certificates

are used to verify the authenticity of the public key during the verification process. CAs use their own private key to sign the digital certificates, creating a chain of trust.

Digital signatures have widespread applications across industries and sectors. They ensure the integrity, authenticity, and non-repudiation of digitally transmitted information, promoting secure communication, document signing, and online transactions. They are commonly used in various scenarios, such as:

- Secure email communication: Digital signatures can ensure that emails are sent by the claimed sender and that the content hasn't been altered during transmission.

- Software distribution: Digital signatures are used to verify the authenticity and integrity of software updates or downloads to ensure they haven't been tampered with by malicious actors.

- Legal and business documents: Digital signatures are utilized to sign contracts, agreements, and other legal documents electronically, providing a secure and legally binding method.

- Financial transactions: Digital signatures play a crucial role in secure online transactions, ensuring the authenticity of digital certificates, payment requests, and other financial documents.

10.8   DIGITAL CERTIFICATE

A digital certificate, also known as an SSL/TLS certificate or an X.509 certificate, is a digital document that verifies the authenticity of a website or server and enables secure communication over the internet. It is issued by a trusted third-party organization called a Certificate Authority (CA).

Digital certificates are used to establish the identity of an entity (such as a website, server, or individual) and provide a mechanism for encrypting communication between the entity and the users. They play a crucial role in ensuring the security and integrity of online transactions, data transfer, and communication.

Here are some key points about digital certificates:

1. **Authentication**: Digital certificates contain information about the identity of the certificate holder, such as their name, organization, and public key. This information is validated and

verified by the CA before issuing the certificate, establishing trust in the identity of the certificate holder.

2. **Encryption**: Digital certificates are used in conjunction with encryption protocols (such as SSL/TLS) to secure communication. When a user visits a website protected by an SSL certificate, their browser establishes an encrypted connection with the server, ensuring that sensitive data transmitted between the user and the server remains confidential and cannot be intercepted or tampered with by unauthorized parties.

3. **Trust hierarchy**: Digital certificates operate within a hierarchical structure of trust. Certificate Authorities are trusted entities that issue and manage digital certificates. They are responsible for verifying the identity of certificate applicants and vouching for their authenticity. Web browsers and operating systems come pre-installed with a list of trusted CAs, allowing them to validate and trust certificates issued by those authorities.

4. **Certificate revocation**: Sometimes, certificates need to be revoked before their expiration date due to various reasons, such as compromise or change in the entity's status. Certificate Revocation Lists (CRLs) and Online Certificate Status Protocol (OCSP) are used to check the validity of digital certificates and ensure they have not been revoked.

5. **Types of digital certificates**: There are different types of digital certificates, including:

   - Domain Validation (DV) certificates: Verify ownership of a domain.

   - Organization Validation (OV) certificates: Verify the legal existence of an organization.

   - Extended Validation (EV) certificates: Provide the highest level of validation, displaying the organization's name in the browser address bar.

   - Code Signing certificates: Verify the authenticity of software and digital code.

   - Client certificates: Used for client authentication in some systems.

DIGITAL CERTIFICATES PROCESS

Digital certificates play a crucial role in securing online communication, establishing trust, and protecting sensitive information. They are essential for enabling secure e-commerce, online banking, secure email communication, and other applications that require encryption and authentication.

Certificate Structure:

A digital certificate is an electronic file that contains specific information about the identity of an entity, along with a digital signature from a trusted Certificate Authority (CA). The certificate follows the X.509 standard, which defines the format for public key certificates. It consists of several components:

- Subject: This field contains information about the entity or individual to whom the certificate is issued, such as their common name (CN), organization, country, etc.
- Public Key: The certificate includes the public key corresponding to the private key held by the entity. This public key is used for encryption and verifying digital signatures.
- Issuer: This field specifies the CA that issued the certificate. It identifies the CA by its name, digital signature, and public key.
- Validity Period: The certificate has a validity period indicating the start and end dates during which it is considered valid.

Digital Signature: To ensure the integrity and authenticity of the certificate, it is digitally signed by the CA using their private key. The digital signature is generated by applying a cryptographic hash function to the certificate data and encrypting the hash value with the CA's private key.

Extensions: Additional information and attributes can be included in the certificate through extensions. For example, extensions may specify the intended usage of the certificate, alternative subject names, or policy information.

Certificate Issuance Process:

The process of issuing a digital certificate involves several steps:

Certificate Request: The entity or individual requesting the certificate (referred to as the subscriber) generates a certificate signing request (CSR). The CSR includes their public key and relevant identity information.

Identity Verification: The CA verifies the identity of the subscriber through a validation process. The level of verification depends on the type of certificate (DV, OV, EV). This process may involve verifying domain ownership, organization legal existence, and other checks to establish trust.

Certificate Issuance: Once the identity verification is completed, the CA generates a digital certificate for the subscriber. The certificate is created by combining the subscriber's public key, identity information, validity period, and the CA's digital signature.

Certificate Distribution: The CA sends the issued certificate to the subscriber, who can then install it on their server or device. The certificate can also be made available for download from the CA's website.

Certificate Validation and Trust:

To establish trust in a digital certificate, it needs to be validated by relying parties (such as web browsers) who interact with the entity presenting the certificate. The validation process involves several checks:

Trust Chain: The relying party verifies the digital signature on the certificate using the CA's public key. The CA's public key is obtained from a trusted source, such as the operating system or browser's pre-installed list of trusted CAs. If the signature is valid, the relying party trusts the CA's assertion that the certificate is genuine.

Certificate Revocation: The relying party checks if the certificate has been revoked before its expiration date. This is done by consulting Certificate Revocation Lists (CRLs) or by using the Online Certificate Status Protocol (OCSP). Revoked certificates are no longer considered trustworthy and should not be used.

Certificate Status: The relying party verifies the validity period of the certificate to ensure it has not expired.

Name Matching: The relying party checks if the entity's identity information (such as domain name) matches the information in the certificate.

Types of Digital Certificates:

Domain Validation (DV) certificates: These certificates validate domain ownership, making them the easiest and quickest to obtain. They are typically used to secure websites with basic encryption and do not provide extensive identity verification.

Organization Validation (OV) certificates: OV certificates verify the legal existence and identity of an organization, in addition to domain ownership. They provide a higher level of assurance than DV certificates and are often used by businesses and organizations.

Extended Validation (EV) certificates: EV certificates offer the highest level of validation and are commonly used by financial institutions and e-commerce websites. They undergo a rigorous validation process, including verifying legal existence, physical location, and legal authority.

Code Signing certificates: These certificates are used to digitally sign software and code to ensure its integrity and authenticity. They enable users to verify that the code has not been tampered with and comes from a trusted source.

Client certificates: Client certificates are used for client authentication in certain systems. They allow clients (users or devices) to authenticate themselves to servers, establishing a secure connection.

10.9   Advantages of online payments

There are several advantages of online payments, which have contributed to their increasing popularity and widespread adoption. Here are some key advantages:

1. **Convenience:** Online payments offer unparalleled convenience. Users can make payments from anywhere and at any time, as long as they have internet access. This eliminates the need to physically visit a store or bank to make a payment.

2. **Time-saving:** Online payments are significantly faster compared to traditional payment methods. With just a few clicks, users can complete a transaction within seconds, avoiding the time-consuming process of writing checks, waiting in line, or manually entering payment details.

3. **24/7 Accessibility:** Online payment systems operate round-the-clock, enabling users to make payments at any time, including weekends and holidays. This is particularly beneficial for international transactions across different time zones.

4. **Efficiency and Automation:** Online payments streamline the payment process, automating various steps. Users can set up recurring payments or schedule future payments, eliminating the need to manually initiate transactions each time. This improves efficiency and helps avoid late payment penalties.

5. **Enhanced Security:** Online payment platforms employ robust security measures to protect users' financial information. Encryption, tokenization, and multi-factor authentication techniques are used to safeguard sensitive data and prevent unauthorized access or fraud.

6. **Record-keeping and Tracking:** Online payments provide a digital trail of transactions, making it easier to track and manage financial records. Users can access their payment history, receipts, and statements electronically, simplifying financial management and reconciliation.

7. **Cashless Transactions:** Online payments reduce the need for physical cash, promoting a cashless society. This eliminates the risk associated with carrying and handling cash, such as theft or loss.

8. **Increased Financial Visibility:** Online payment platforms often provide detailed transaction information, including the merchant name, date, and amount. This enhances financial visibility, helping users track their spending patterns and make informed financial decisions.

9. **Global Accessibility:** Online payments enable cross-border transactions, making it convenient for businesses and individuals to engage in international commerce. This has opened up new opportunities and expanded markets for businesses around the world.

10. **Environmental Sustainability:** By reducing the reliance on paper checks and receipts, online payments contribute to environmental sustainability by minimizing paper usage and waste.

10.10   DISADVANTAGES OF ONLINE PAYMENTS

While online payments offer numerous benefits, there are also some potential disadvantages to consider:

1. **Security Concerns:** One of the most significant disadvantages of online payments is the risk of security breaches and fraud. Despite robust security measures, hackers and cybercriminals may still attempt to steal sensitive financial information, leading to unauthorized transactions and potential financial losses.

2. **Technical Glitches and Downtime:** Online payment systems can experience technical issues, such as server outages or connectivity problems. Such downtime can disrupt transactions and cause inconvenience to users.

3. **Lack of Privacy:** Online payments involve sharing personal and financial information, which may lead to privacy concerns. Users need to trust that the payment platform or service provider will handle their data securely and responsibly.

4. **Hidden Fees:** Some online payment platforms or merchants may impose hidden fees or additional charges, impacting the actual cost of the transaction. Users need to carefully review the terms and conditions to avoid unexpected costs.

5. **Limited Acceptance:** While online payments have become more widespread, some merchants or businesses may still not accept online payment methods, especially in remote or cash-based economies.

6. **Dependency on Technology:** Online payments rely on internet connectivity and digital devices. If there are technical issues or an internet outage, users may face difficulties in making payments.

7. **Chargebacks and Disputes:** Online transactions can lead to disputes between buyers and sellers, resulting in chargebacks or refunds. Resolving such issues can be time-consuming and may involve additional administrative efforts.

8. **Impulse Spending:** The ease of online payments can lead to impulsive purchases, as users may be more tempted to buy items without giving it sufficient thought, potentially leading to financial mismanagement.

9. **Inaccessible to Some Users:** Not everyone may have access to online payment options or be familiar with digital technology, especially in rural or less technologically advanced regions.

10. **Over-reliance on Electronic Transactions:** Over-reliance on online payments may leave individuals vulnerable if there are disruptions in the digital payment infrastructure or if they lack access to physical cash for emergencies.

10.11 CHECK YOUR PROGRESS

1. **An electronic check is one form of what?**
    A. e-commerce
    B. online banking
    C. e-cash
    D. check

2. **When hackers flood a Web site with useless traffic to overwhelm the network, it is called _____.**
    A. phishing
    B. pharming
    C. a Denial of Service (DoS) attack
    D. spoofing

3. **If you need to transfer money to another person via the internet, which of the following methods could you use?**
    A. financial cybermediary
    B. electronic check
    C. electronic bill presentment and payment

D. all of the above

4. **Which of the following is not a dimension of e-commerce security provided by encryption?**

    A. availability

    B. message integrity

    C. nonrepudiation

    D. confidentiality

5. **Which of the following permits the transmission of a bill, along with payment of that bill, to be conducted over the Internet?**

    A. financial cybermediary

    B. electronic check

    C. electronic bill presentment and payment

    D. all of the above

10.12 SUMMARY

In this chapter we understand about online payment system. An online payment system includes an intermediary to enable the transmission of funds among a seller as well as a buyer. It is also known by the names liquidation, clearing system, and clearing service occasionally. It is crucial to contemporary financial systems and enables the transfer of value from one aspect of the economy to another. Then we read about the phases of online payment system. There are four phases in online payment system: Registration, Invoicing, Payment selection and processing, and Payment authorisation and confirmation. Online payment system also has different component. These are Banks and other financial institutions, Customers, Systems for payments and settlements, Payment instruments and streams, clearing instruments, Rules, Regulations, and Agreements, Providers of access to payment related services, and Infrastructure. Finally, we determine the method of online system. The methods are e-banking, automated teller machines, card based payment methods, adhar enabled payment system, and mobile wallet.

10.13 KEYWORDS

Cards: Banks give plastic cards to customers to facilitate cashless payments at the Point of sale, on an e-commerce website, or via a mobile app. Cards are usually administered by card networks and might be debit, credit, or prepaid. A card number, which is unique to each card, is found on a typical card. It also includes a security code used in conjunction with other data (such as the card's expiration date and the cardholder's name) to verify card-not-present transactions.

Cryptocurrency: Bitcoin is a digital currency created, distributed, and tracked using block chain technology and cryptography.

Electronic Fund Transfer: The electronic transfer of money between two bank accounts, rather than via paper procedures. This includes Payroll, ACH, wire transfers, and any other electronic fund transmission.

Gateway: An organisation or a system that initiates transactions between merchants and acquiring firms. Often provides identity, reporting features, additional fraud, and transaction processing equipment and software. Integrate gateway with website and mobile app.

Payment Methods: This enables merchants to accept in-app payments and e-commerce payments without cards. Bank transfers, direct debit, e-wallets, mobile payments, and other means are among them.

Point of Sale: A shopper can make a cashless in-person payment in a merchant's shop or another physical location using a point-of-sale service. Cards, NFC wallets (like Apple Pay), QR code wallets, and prepaid and gift cards are all used to make this payment.

10.14 SELF-ASSESSMENT TEST

1. Define electronic payment system
2. Explain the concept of e-wallet
3. What are Payment cards?
4. Define micro electronic payment and its role in E-Commerce.
5. Explain briefly Anatomy of a credit card
6. What is the role of Electronic payment system?
7. List some popular macro on-line payment systems.
8. What is credit card? Explain the key players of a credit card payment system and bring out the merits of it.

9.   Write a note on

   a. Internet banking

   b. Mobile banking

10.   What is cryptocurrency? Explain the same.

11.   Explain the advantages of UPI?

10.15 ANSWER TO CHECK YOUR PROGRESS

1.   **b**
2.   **c**
3.   **d**
4.   **a**
5.   **c**

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