UNIT-I

What is Data Communications and Networks? (1)

The distance over which data moves within a computer may vary from a few thousandths of an inch, as is the case within a single IC chip, to as much as several feet along the backplane of the main circuit board. Over such small distances, digital data may be transmitted as direct, two-level electrical signals over simple copper conductors. Generally, data must be sent beyond the local circuitry that constitutes a computer. In many cases, the distances involved may be enormous. Unfortunately, as the distance between the source of a message and its destination increases, accurate transmission becomes increasingly difficult. This result from the electrical distortion of signals travelling through long conductors, and from noise added to the signal as it propagates through a transmission medium. Although some precautions must be taken for data exchange within a computer, the biggest problems occur when data is transferred to devices outside the computer's circuitry.

Data communications concerns the transmission of digital messages to devices external to the message source. As a rule, the maximum permissible transmission rate of a message is directly proportional to signal power, and inversely proportional ~~to~~ to channel noise. It is the aim of any communications system to provide the highest possible transmission rate at the lowest possible power and with the least possible noise.

Digital And Analog Transmission

Data is transmitted from one point to another point by means of electrical signals that may be in digital and analog form. So one should know the fundamental difference between analog and digital signals. In analog signal the transmission power varies over a continuous range with respect to sound, light and radio waves.

On the other hand, a digital signal may assume only discrete set of values within a given range. Analog signal is measured in Volts and its frequency is in Hertz (Hz). A digital signal is a sequence of voltage represented in binary form. When digital data are to be sent over an analog form the digital signal must be converted to analog form. So the technique by which a digital signal is converted to analog form is known as modulation. And the reverse process, that is, the conversion of analog signal to its digital form, is known as demodulation. The device, which converts digital signals into analog, and the reverse, is known as modem.

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ASYNCHRONOUS And SYNCHRONOUS TRANSMISSION.

Data transmission through a medium can be either asynchronous or synchronous. In asynchronous transmission data is transmitted character by character as one go on typing on a keyboard. Hence there is an irregular gap between character. However, it is cheapter to implement, as one do not have to save the data before sending. In the synchronous mode the saved data is transmission block by block. Each block can contain many charchter. Schchonous transmission is well suited for remote communication between a computer and related device like card reader and printer.

Communication channels :=>

A Communication channel is a pathway over which information can be conveyed. It may be defined by a physical wire that connects communicating device, or by a radio laser, or other rediated energy source that has no obvious physical presence. Information sent through a communication channel has a source from which the information originates, and a destination to which the information is delivered. Although information originates from a single source, there may be more than one destination, depending upon how many receive stations are linked to the channel and how much energy the transmitted signal possesses.

There are mainly three types of modes by which data can be transmitted over the communication channel. These are ① Simplex ② Half duplex ③ Full duplex.

① Simplex :-

The message source is the transmitter, and the destination is the receiver. A channel whose direction of transmission is unchanging is referred to as a simplex channel.

② ~~Half~~ Half Duplex :-

A Half duplex channal is a single physical channel in which the direction may be reversed.

③ Full Duplex :→

A full duplex channal allows simultaneous message exchange in both direction. It really consists of two simplex channels, a forward channel and a reverse channel, linking the same points.

Commonly Used Communication Channels:-

Following are the major communication channal that are used frequently:-

1 Wire Pairs:-

Wire pairs are commonly used in local telephone communication and for short distance data communication. They are usually made up of copper and the pair of pair of wire is twisted together.

② Coaxial Cables:-

Coaxial cable is groups of specially wrapped and insulated wires that are able to transfer data at higher rate.

③ Microwave:-

microwave system uses very high frequency radio signals to transmit data through space. The transmitter and receiver of a microwave system should be in line of sight because the radio signal cannot bend.

Modulation:-

Modulation is a technique that is used to encode digital information in an analog wave.

1. Amplitude Modulation (AM)
2. Frequency modulation (FM)
3. Phase modulation (PM)

1. Amplitude modulation (AM):-

AM modifies the amplitude of the carrier to represent 1s or 0s. In the above example, a 1 is represented by the presence of the carrier for a predifined period of 3 cycles of carrier.

Advantage:-

1. It is simple to design.

Disadvantage:-

1. They makes noise.
2. The loss of connection is read as 0s.

Frequency modulation (FM)

Frequency modulation modifies the frequency of the carrier to represent the 1s or 0s. In example, a 0 is represent by the orginal carrier frequency and a 1 by a much higher frequency.

Advantage:-

(1) It is immune to noise on transmission medium.
(2) The loss of signal can be easily detected as signal is present always.

Disadvantage:

(1) It is requires 2 frequencies.
(2) It detection circuit needs to recognize both frequences when signal is lost.

Phase modulation (PM)

Phase modulation modifies the phase of the carrier to represent a 1 or 0. The carrier phase is swiched at every occurrence of a 1 bit but remains unaffected for a 0 bit.

Advantage:

1. Only 1 frequecy is used.
2. It is easy to detect loss of carrier.

Disadvantage:

1. The complex circuitry is required to generate and detect phase changes.

Unit I

INFORMATION

Information is the exchange of data with one another. Information is the processed data on which decisions are taken and subsequent actions are performed thereafter. For decisions to be meaningful and useful, the information must be accurate and relevant.

TECHNOLOGY

Technology is the making, usage, and knowledge of tools, machines, systems, techniques, or methods of organization in order to solve a problem or perform a specific function. It can also refer to the collection of such tools, machinery, and procedures. Some examples of technology are the electronic media such as video, computers, compact disks, audio tape, cell phones and satellite equipment that are used as tools to create, learn, explain, document, analyze, communicate or present information.

INFORMATION TECHNOLOGY (IT)

Information Technology is the technology (hardware and software) required for the processing of data and other information.

Information technology (IT) is concerned with technology to treat information. The acquisition, processing, storage and dissemination of vocal, pictorial, textual and numerical information by a microelectronics-based combination of computing and telecommunications are its main fields. The term in its modern sense first appeared in a 1958 article published in the *Harvard Business Review*, in which authors Leavitt and Whisler commented that "the new technology does not yet have a single established name. We shall call it information technology (IT)."

Different sources provide different definitions. A few of these definitions are described below...

The International Foundation for Information Technology (IF4IT) provides three definitions for Information Technology:

1. The technology used for the study, understanding, planning, design, construction, testing, distribution, support and operations of software, computers and computer related systems that exist for the purpose of Data, Information and Knowledge processing.

2. The industry that has evolved to include the study, science, and solution sets for all aspects of Data, Information and Knowledge management and/or processing.

3. The Organization in an enterprise or business that is held responsible and accountable for the technology used for planning, design, construction, testing, distribution, support and operations of software, computers and computer related systems that exist for the purpose of Data, Information and Knowledge management and/or processing.

The Information Technology Association of America (ITAA) defines Information Technology as:

1. "The study, design, development, implementation, support or management of computer-based information systems, particularly software applications and computer hardware." IT deals with the use of electronic computers and computer software to convert, store, protect, process, transmit, and securely retrieve information.

2. The combination of telecommunication and computer science for the capture, storage and transmission of information to every corner of the world is said to be IT.

COMPONENTS OF INFORMATION TECHNOLOGY

The components of IT include hardware, software, data and people. These components are essential for the proper functioning of a system in IT that are discussed below:

Hardware: Hardware consists of physical components that form a computer system or any other electronic gadget. To run a computer, both hardware and software are required. Hardware is the physical unit that stores and transmits information. Examples of hardware include monitor, keyboard, mouse. mobile phone and television, which are the popular inventions in the field of IT.

Software: Software is a set of instructions in the form of programs, which control the sequence of operations (tasks). Software runs along with the hardware on the digital systems. For example, the software present in mobile phones allows users to perform various functions like sending messages, recording a person's voice and taking photographs.

Data: Data are an unprocessed collection or representation of raw facts, concepts or instructions in a manner suitable for communication, interpretation and processing by humans or by automatic means. Data can be meaningful or meaningless. Data are gathered for the purpose of communication, interpretation or processing of tasks.

People: People play an important role in IT. They perform various functions with the help of hardware and software to produce the desired output using IT.

ROLE OF INFORMATION TECHNOLOGY

Even a single day without computers leaves us feeling paralytic. **Information Technology** has made us completely dependent for even the simplest day to day task. Internet being the simplest form of IT has a major role to play in our daily lives. IT has become the backbone of every organization as well as household. The various fields in which IT is used are:

1) **Telecommunication**

The progress of information technology has opened the doors to many new services in the field of telecommunications. The computer itself is connected to the telephone network to exchange communication through the channel of e-mail. Radio-TV transmission World Wide Web has also been made possible. Telephone and internet services are brought together in mobile internet.

Floppy disk, CDROM, etc...were used to transfer data from one computer to another computer. Nowadays the flash drive has dominated all those instruments in transferring as many times of data than instruments.

2) **Education**

The field of education has also been blessed with the benefits of IT. Online application to universities, checking results, study materials and much more has made the reach of education broader and easier. The computer can play a big role in the management of educational institutions. Preparation of timetables, organizing question banks, consolidation of details of each student, and preparation of salary details can be effectively done by the computer. With the help of computer ideas can be more easily explained to the student. In chemistry to do experiments with dangerous thing and that are too expensive, we can do by using computer.

3) **Entertainment**

Computer is now an important tool in film, television and advertisement. The computer allows you innumerable options to handle pictures.

4) **Medicine**

In many medical equipments like ECG machines, computer chips are used. Blood analysis and vision testing can be done through certain software's . when the health condition of a person is to be monitored round the clock, computer chips are connected to his/her body. This can collect the required responses and provide feedback to doctors through computer. Communication through internet also opened up more possibilities in medical care.

5) **Banking**

Banking is another sector that depends a lot on IT. From carrying out important transaction to storage of confidential data, IT has made several complicated and time consuming work a lot simpler and faster with considerable amount of safety. In fact, e-commerce has made online banking as well as online purchasing and selling of commodities and services much easier and faster adding to the convenience of the common man. By simply searching on the internet one can order anything with just a click of the mouse button.

6) **Travel and Tourism**

The travel and tourism sector all over the world has benefited a lot from the development of IT industry. One can avoid the crowd and lengthy procedures of booking air or railway

tickets. One can choose from the best deals and book tickets online from the comfort of their living room.

7) **Information Technology in Defense Services**

Today, military operators are restricted in their access to information. Most often, military operators use voice over radio or formatted text messages to communicate during crises. To help the military improve readiness and response, more flexible, timely and dependable access to information is needed. Key research areas in this field include dialogue management, context tracking, language generation, input language understanding, and hands-free and eyes-free interaction. New IT capability allows military personnel to literally converse with computers to create, access and manage information and solve problems. The presence of IT helps to gain relevant information in an organized and integrated manner that is readily usable by military personnel equipped with smart information devices. For example, pilotless warplanes have been developed to combat enemies at the time of war. This has been possible by gathering information and converting it into technology through means of research and development (R&D). Thus, the battlefield of the future will include weapons, unmanned combat vehicles and communication systems that can navigate, reconfigure and cooperate autonomously to accomplish time-critical military operations.

8) **Information Technology in Mobile Computing**

Mobile computing is a technology of wireless networking that uses common frequencies for transmission to permit networked devices move freely within the broadcast coverage area yet remain connected to the network. Mobile computing enables people to access network services anytime and anywhere and allows the transmission of data with the help of computers. This is done by integrating the cellular telephone technology with the portable computers having cabled network. Mobile voice communication has been established throughout the world and has seen an increase in the number of subscribers to the various cellular networks. An extension of this technology is the ability to send and receive data across the cellular networks, which is the principle of mobile computing. Similarly, mobile data communication has become Mobile computing is used in many fields such as in emergency services, stock information control, credit card verification and e-mail. Mobile computing relieves the users from working at a desk and provides them access to information they need. In addition, it provides a better lifestyle through improved communication and personal data management.

9) **Information Technology in Public Sector**

In recognition of the serious staffing and equipment situation in the public sector, there is currently a great deal of activity in outsourcing of information services. In countries where public sector is still developing, and is under the control of the government, there is a great requirement to automate services such as booking of railway tickets and payment of electricity bills. The IT sector has become a boon for public sector companies by helping them increase their output and efficiency. In addition, IT has enabled the

companies to have a greater quality control so that they are able to meet the laid standards. This has been possible as IT has been able to do the following:

*) Minimize duplication and sharing of scarce resources.

*) Promote and ensure that IT solutions are cost-effective, efficient and business-driven.

*) Promote transparency and accountability in public service by facilitating the availability, accessibility and sharing of information.

INFORMATION TECHNOLOGY PRESENT SCENARIO

Our society is being reshaped by rapid advances in IT, computers, telecommunications networks and other digital systems that have vastly increased our capacity to know, achieve and collaborate. These technologies allow people to transmit information quickly and widely, linking distant places and to create communities that just a decade ago were unimaginable. It is difficult to appreciate how quickly IT is evolving. Five decades ago ENIAC, one of the earliest computers, stood 10 feet tall and stretched 80 feet wide; while today, one can buy a musical greeting card with a silicon chip that is 100 times faster than ENIAC. This extraordinary pace of IT evolution is bringing people and cultures together and creating new social dynamics in the process. It is leading to the formation of closely bonded and widely dispersed communities of people united by their interest in doing business or in sharing experiences and intellectual pursuits. New forms of knowledge accumulation are developing, as are computer-based learning systems that open the way to innovative modes of instruction and learning. The rapid evolution of digital technologies is creating not only new opportunities for the society but also challenges. Corporations and governments are reorganizing their work culture to enhance productivity, improve quality and control costs. Entire industries have been restructured to better align themselves with the realities of the digital age. It is no exaggeration to say that IT is fundamentally changing the relationship between people and knowledge.

Information technology in India

The Indian Information Technology industry accounts for a 5.19% of the country's GDP (Gross domestic product) and export earnings as of 2009, while providing employment to a significant number of its tertiary sector workforce. However, only 2.5 million people are employed in the sector either directly or indirectly. In 2010-11, annual revenues from IT-BPO(Business Process Outsourcing) sector is estimated to have grown over $54.33 billion compared to China with $35.76 billion and Philippines with $8.85 billion. It is expected to touch at US$225 billion by 2020. The most prominent IT hubs are Bangalore and Hyderabad. The other emerging destinations are Chennai, Coimbatore, Kolkata, Trivandrum, Pune, Mumbai, Ahmadabad, NCR. Technically proficient immigrants from India sought jobs in the western world from the 1950s onwards as India's education system produced more workers than its industry could absorb and dearth of opportunities. India's growing stature in the Information Age enabled it to form close

ties with both the United States of America and the European Union. However, the recent global financial crises has deeply impacted the Indian IT companies as well as global companies. As a result hiring has dropped sharply, and employees are looking at different sectors like the financial service, telecommunications, and manufacturing industries, which have been growing phenomenally over the last few years. India's IT Services industry was born in Mumbai in 1967 with the establishment of Tata Group in partnership with Burroughs.

COMPUTER NETWORK

A computer network is a system in which computers are connected to share information and resources. The connection can be done as peer-to-peer or client/server. A computer network is a group of more computers connected to each electronically. This means that the computers can "talk" to each other and that every computer in the network can send information to the others. Some basic types of computer networks include:

- A local area network (often called a LAN) connects two or more computers, and may be called a corporate network in an office or business setting.
- An "internetwork", sometimes called a Wide Area Network (because of the **wide** distance between networks) connects two or more smaller networks together. The largest internetwork is called the Internet.

To set up a network an appropriate media is required. This can be wired or wireless. Twisted-pair, co-axial or fiber-optic are examples of cable and infra-red, blue-tooth, radio-wave, micro-wave etc. are wireless media used for networking. When you are working with a LAN, computers, media and peripherals are sufficient. But when you are working with a wider range you have use some additional devices like bridge, gateway or router to connect different small or large networks. And obviously a protocol must be maintained.

To set up a network you have to select an appropriate topology to arrange the hardware devices using the media. Topologies generally used are bus-topology, ring-topology, star-topology, tree-topology, object-oriented topology etc. Among these star-topology and tree-topology are most popular nowadays.

LAN - Local Area Network

A LAN connects network devices over a relatively short distance. An example of a local area network would be the network inside a particular company or the network at our home. It can have, for example, multiple floors but they would all be connected by a network medium in some way. It could also be multiple buildings and they could be interconnected in some way. We could have several buildings, like a campus for example. It's still a local area network because the geography separating the host is relatively small. This is called an internetwork, but it is still a local area network.

WAN - Wide Area Network

It's also possible to have a computer network where the networks and the hosts are very widely distributed geographically. In that case we are talking about a Wide Area Network or WAN. A wide area network is a group of interconnected LANs, Local Area Networks that are separated geographically. For example, a company can have offices at different cities. Sometimes, user from one city needs to access some data that is located on a server in another city. To make that possible we've connected them in some way so that these local area networks are inter-networked together, making a very large internetwork, or a wide area network.

MAN - Metropolitan Area Network

A network spanning a physical area larger than a LAN but smaller than a WAN, such as a city. A MAN is typically owned and operated by a single entity such as a government body or large corporation.

INTERNET

The Internet is a huge network of networks that link many different types of computers all over the world. It connects millions of computers together globally, forming a network in which any computer can communicate with any other computer as long as they are both connected to the Internet. It is a network that shares a common mechanism for addressing (or identifying) computer and a common set of communication protocols for communication between two computers on network. This is *the world-wide network* of computers accessible to anyone who knows their Internet Protocol (**IP**) address - the IP address is a unique set of numbers (such as 209.33.27.100) that defines the computer's location. The Internet is ideally suited for marketing, real-time commerce, delivery of technical support information, contact information and the posting of other "public" resources.

ADVANTAGES OF INTERNET

1. **Email** – Email is an essential communication tool in business. The advantage of email is that it is free and fast as compared to telephone, fax and postal services.
2. **Product Advertising** – Internet is used to advertise various products. With the help of internet one can find the specifications of products, its files, images and video clip in action.
3. **Entertainment** – Downloading games, visiting chat rooms or just surfing the web are some of the entertainment sources that people have discovered on internet. Music, news, hobbies and more can be found and shared on internet.
4. **Services** – Many services are now provided on internet such as online banking, job seeking, hotel reservation and purchasing tickets for your favorite movies etc.

5. **E-commerce** – It is the concept used for any type of commercial deals that involves transfer of information's across the globe via the internet. It has become a very effective way to buy and sell products all over the world.
6. **Information** – There is a huge amount of information available on the internet just about every subject known to men, ranging from government law and services, conferences, trade fairs, market information, new ideas etc. The search engine like Google, Yahoo is at our services on the internet. You can find any type of information on these sites.

DISADVANTAGES OF INTERNET

1. **Theft of personal information** – If you use internet, you may be facing grave danger as your personal information such as credit card number can be accessed by unknown people.
2. **Internet Addiction** – The internet have a huge addictive pull any many people surf the internet for up to 15 to 16 hours a day, doing chatting and other way of interactivity.
3. **Virus Threat** – The internet has also given birth to virus. Computers attached to the internet are more prone to virus attacks and they can end up into crashing your hard disk, causing a lot of problem.
4. **Spamming** – Spamming refers to sending unwanted emails in bulk, which provide no purpose and needlessly obstruct the entire system. Such illegal activities can be very frustrating to anyone.

INTRANET

This is a network that is not available to the world outside of the Intranet. An "intranet" is the generic term for a collection of private computer networks within an organization. Intranet functions much like the Internet except the content is not available to the public. Information such as company memos, employee handbooks and company databases may be made available on an intranet to those who have password access.

For example, consider an office with a few PCs and a few printers all networked together. The network would not be connected to the outside world. On one of the drives of one of the PCs there would be a directory of web pages that comprise the Intranet. Other PCs on the network could access this Intranet by pointing their browser (Netscape or Internet Explorer) to this directory - for example

U:\inet\index.htm.

From then onwards they would navigate around the Intranet in the same way as they would get around the Internet.

EXTRANET

An "extranet" is a computer network that allows controlled access from the outside for specific business or educational purposes. Extranets are similar to intranet except that the information is proprietary to a specific outside audience. For example, a company's dealers might have access to technical or pricing information which is not available to the general public. Allowing controlled access to an otherwise private company network enables business-to-business transactions and file sharing.

ADVANTAGES OF EXTRANET

1. Exchange large volume of data using EDI.
2. Share product catalogues exclusively with trade partners.
3. Collaborate with other companies on joint development efforts.
4. Jointly develop and use training programs with other companies.
5. Provide or access services provided by one company to a group of other companies such as an online banking application managed by one company on behalf of affiliated banks.

DISADVANTAGES OF EXTRANET

1. Extranet can be expensive to implement and maintain within an organization(e.g. hardware, software, employee training costs), if hosted internally rather than by an application service provider.
2. Security of extranet can be a concern when hosting valuable or proprietary information.

WWW (WORLD WIDE WEB)

WWW is a connection of hyper text documents and associated files linked together that spans the internet. It's popularity has increased because it is easy to use, attractive, colorful and right in content. Basically it is a series of interconnected documents stored on computer sites. On a trip through this web, you can visit colleges, companies, museums etc. You can read data on almost every imaginable topic; you can visit stores to buy things or transfer movies, pictures, games and other software to your computer. It is a tool that helps you to find and retrieve information using links to other pages. Web links are stored within the page itself and when you wish to jump to the page you select the hot spot or anchor. This technique is called hyper text. WWW is non-linear with no top or no bottom i.e. you do not have to follow a hierarchical path to information resources. So you can jump from one link to another or you can go directly to a resource if you know the URL, the address of the web page. Web page is created using HTML. Internet user request for information contained in web servers and is transported over the internet using protocol called HTTP. The WWW provides a network of interactive document and the software

E-MAIL

E-mail (electronic mail) can be defined as transmission of letters and menus from one computer to another. Email is a service for sending and receiving messages over the computer network. It is a store and forward service which is conceptually similar to the regular postal mail service that we all are used to. Email was originated in 1970s. At that time it was used for just sending the messages. The capability to send various items has rapidly become true. As the email users can now attach spreadsheets, business forms, lengthy documents, scanned images, computer graphics, sound, video and so on. When we send the mail it moves from one computer to another across the internet until it reaches the destination which is the recipient host computer. The mail is then stored in the recipient mail box which is a file that stores user's incoming messages and remains there until the user reads it, saves it and deletes it. Email is the most popular application over the internet. It is a fast, reliable, convenient service.

How It Works

The basic concept behind the working of email is similar to the regular postal mail service.

- Write the letter
- Put the recipient address on the letter
- Pay the postal charges
- Hand it over to postal department so that it can be delivered to the recipient

In email the similar steps are:

- Start the email program
- Type in the address where the email is to be sent
- Compose message using email program
- Execute the command to send the message

The email program running on user's computer is used to address and compose the message. Then it hands over the message over internet. SMTP (simple mail transfer protocol) transport or route the message across the internet until it reaches destination which is recipient's host computer. On reaching destination the message is stored in recipient's electronic mail box and remains there until user reads it, saves it in a file or deletes it. This process is done by POP (post office protocol) which is used to process the incoming messages. The user has the option to reply, forward or delete it.

ADVANTAGES OF EMAIL

1. It provides the cost effect communication medium. The cost of communicating with others as nothing to do with the distance and the size of the message.

2. It is a fast mail can be sent to anybody, anywhere in a matter of second.
3. It is non-intrusive medium that is like telephone, it does not ring in between the important meeting or at late night.
4. A unique property of email is its reusability. Since the mail resides on computer and in electronic form. It can be used again by importing or cut pasting into reports.
5. Text can be prepared in advance of transmission and incoming messages can be safe for later consideration. Thus providing offline working.
6. Blind copies can be sent automatically to many users at the same time where the principal recipient is not notified that others have received the same message.
7. **Radio Paging:** Your pager will beep when an urgent message is received in your mail box.
8. **Message Translation:** Message send or receive can be translated by the email service into the recipients native tongue.

DISADVANTAGE OF E – MAIL

1. It does not provide much security and privacy as your email can be read by people. You did not intend to send because it is very easy for other people to forward it on.
2. It does not tell about the emotions of the sender as it is an offline communication medium
3. The most serious drawback of email is that it is addictive in nature. Some net addicts are worried about checking their mails even when they are on vacations.

TELECOMMUNICATIONS

Telecommunications, also called telecommunication, is the exchange of information over significant distances by electronic means. A complete, single telecommunications circuit consists of two stations, each equipped with a transmitter and a receiver. The transmitter and receiver at any station may be combined into a single device called a transceiver. The medium of signal transmission can be electrical wire or cable (also known as "copper"), optical fiber or electromagnetic fields. The free-space transmission and reception of data by means of electromagnetic fields is called wireless.

The simplest form of telecommunications takes place between two stations. However, it is common for multiple transmitting and receiving stations to exchange data among themselves. Such an arrangement is called a telecommunications network.

A **telecommunications network** is a collection of terminals, links and nodes which connect to enable telecommunication between users of the terminals. Networks may use circuit switching or message switching. Each terminal in the network must have a unique address so messages or

connections can be routed to the correct recipients. The collection of addresses in the network is called the address space. The links connect the nodes together and are themselves built upon an underlying transmission network which physically pushes the message across the link.

Examples of telecommunications networks are computer networks, the Internet, the telephone network etc.

Components of telecommunication network

All telecommunication networks are made up of five basic components that are present in each network environment regardless of type or use. These basic components include terminals, telecommunications processors, telecommunications channels, computers, and telecommunications control software.

- **Terminals** are the starting and stopping points in any telecommunication network environment. Any input or output device that is used to transmit or receive data can be classified as a terminal component.

- **Telecommunications processors** support data transmission and reception between terminals and computers by providing a variety of control and support functions. (i.e. convert data from digital to analog and back)

- **Telecommunications channels** are the way by which data is transmitted and received. Telecommunication channels are created through a variety of media of which the most popular include copper wires and coaxial cables (structured cabling). Fiber-optic cables are increasingly used to bring faster and more robust connections to businesses and homes.

- In a telecommunication environment **computers** are connected through media to perform their communication assignments.

- **Telecommunications control software** is present on all networked computers and is responsible for controlling network activities and functionality.

COMMUNICATIONS SYSTEMS

A **communications system** is a collection of individual communications networks, transmission systems, relay stations, tributary stations, and data terminal equipment (DTE) usually capable of interconnection and interoperation to form an integrated whole. The components of a communications system serve a common purpose, are technically compatible, use common procedures, respond to controls, and operate in unison. Telecommunications is a method of communication (e.g., for sports broadcasting, mass media, journalism, etc.). A **communications subsystem** is a functional unit or operational assembly that is smaller than the larger assembly under consideration.

The communication system enables the successful transmission of idea or any other important information among individuals. The person from whom the thought originates carefully encodes his ideas into a sensible content which is now ready to be shared with everyone. He is commonly referred to as the sender and the other party who receives the information from him is called the receiver or the recipient. The free flow of information between the sender and the receiver takes place because of the communication system.

The flow of information can be between two individuals. The information can flow from the individual to a machine, from the machine to the individual and even between two machines. Machines coupled together through networks also provide signals for the individuals to respond, thus a type of communication system. In the above cases all the machines must work on similar lines and patterns, must be technically compatible and has to provide the same information, so that the individuals can decode the information well.

Types of communications system

1. **Optical Communication System**

   The word "Optical" stands for light. As the name itself suggests, optical communication system depends on light as the medium for communication. In an optical communication system the transmitter converts the information into an optical signal (signal in the form of light) and finally the signal then reaches the recipient. The recipient then decodes the signal and responds accordingly. In optical communication system, light helps in the transmission of information. The safe landing of helicopters and aeroplanes work on the above principle. The pilots receive light signals from the base and decide their next movements. On the roads, red light communicates the individual to immediately stop while the individual moves on seeing the green light.

   In this mode of communication light travels through the optical fibre.

2. **Radio Communication System**

   In the radio communication system the information flows with the help of a radio. Radio communication system works with the aid of a transmitter and a receiver both equipped with an antenna.

   The transmitter with the help of an antenna produces signals which are carried through radio carrier wave. The receiver also with the help of an antenna receives the signal. Some information is unwanted and must be discarded and hence the electronic filters help in the separation of radio signals from other unwanted signals which are further amplified to an optimum level Finally the signals are decoded in an information which can be easily understood by the individuals for them to respond accordingly.

3. **Duplex communications system**

In Duplex communications system two equipments can communicate with each other in both the directions simultaneously and hence the name Duplex. When you interact with your friend over the telephone, both of you can listen to each other at the same time. The sender sends the signals to the receiver who receives it then and there and also give his valuable feedback to the speaker for him to respond. Hence the communication actually takes place between the speaker and the receiver simultaneously.

In the Duplex communication system, two devices can communicate with each other at the same time.

A type of communication system involves the sender and the receiver where the sender is in charge of sending signals and the recipients only listen to it and respond accordingly. Such communication is also called Simplex communication system.

4. **Half Duplex Communication System**

In half Duplex communication system, both the two parties can't communicate simultaneously. The sender has to stop sending the signals to the recipient and then only the recipient can respond.

A walkie talkie works on the half duplex communication system. The military personnel while interacting has to say "Over" for the other person to respond. He needs to speak the security code correctly for the other person to speak. The other party will never communicate unless and until the code is correct and complete.

5. **Tactical Communication System**

Another mode of communication is the tactical mode of communication. In this mode of communication, communication varies according to the changes in the environmental conditions and other situations.

MOBILE COMMUNICATION

Mobile communication allows transmission of voice and multimedia data via a computer or a mobile device without having connected to any physical or fixed link. **Mobile communication** is the exchange of voice and data using a communication infrastructure at the same time regardless of any physical link.

There are so many types of mobile computers, such as laptops, PDAs, PDA phones and other mobility devices were introduced in the mid of 1990s including wearable technology as well. And to use these types of mobility equipments we need to use right technology to make it more secure and reliable infrastructure. If we talk about the mobile communication technologies we can count on many mobile technologies available today such as 2G, 3G, 4G, WiMAX, GPRS

and many others. Mobile communication technologies not only benefiting businesses to perform their operation faster and efficiently but also raising the standard of human lives.

Today's mobiles networks supports features likes SMS, GPRS, MMS, emailing facility on mobile, Bluetooth, WAP and many more depending upon how reputed and bigger mobile network company is, most of the networks worldwide provides these features as they have become the standard features in mobile communication between their customers and of course one cannot neglect how sophisticated mobiles phones are available now, these mobile phones carries many features which sometimes are not supported by mobile networks. Mobile phones of today's age are now equal to portable PCs. These mobile phones connect to their cellular networks and these cellular networks are connected to Public switching telephone network (PSTN).

Mobile Network Technology

Mobile Technology has groomed a lot in past few years, major reasons for rapid advancements in mobile network technology is requirements for being mobile or connectivity on move. Latest mobile handsets offers features which one had never thought off, ultimately it forces mobile network companies to bring these features in practice use to take commercial advantages.

Cellular companies use AMPS, D-AMPS, CMMA2000, UMTS, GSM, EVDO etc. AMPS however pretty much vanished from the scene, AMPS network system was based on analog communication technology, latest features were not supported by AMPS therefore all cellular networks worldwide have adopted above mentioned digital communication methodologies to meet the need of consumers. GSM remains the highly used mobile communication methodology worldwide. Cellular networks and mobile phones vary from geographical locations and providers to providers, but still standard communication methods are more or less same everywhere. Basic communication takes place using electromagnetic microwaves with cellular base stations. Cellular networks have huge antennas normally located in the middle of certain area to provide optimum signal broadcasting. These antennas are known as Base Transceiver Station (BTS). Mobile handsets have low powered transceivers which transmit voice data to the closed BTS which can usually be within 5 t 8 miles radius.

Transceivers: Transceivers are devices which have capability of transmitting and receive data at the same time. Mobile handset register itself at mobile network switch or exchange as soon as it starts transmitting, usually it means when handset is turn on, it tries to registered to the network of inserted SIM card. Mobile networks uniquely identify each and every registered mobile handset on the given BTS and sends notifications to those mobile handsets which have incoming calls. Handsets will always be registered to the most nearest BTS for communication, incase if user of the network is on move, mobile phones in this case will handoff to many closest BTS during the call and keep the connection alive with nearest base stations. In case of unavailability of BTS, handset will be disconnected from the network resulting in dropping of ongoing call.

BTS also operates on less power radio frequency transmission; they make their presence feel by broadcasting signals for receivers of mobile handsets. Communication between BTS and mobile

sets takes place in stream of digital data, which is digitized audio. Each mobile network operates on unique radio frequency.

Cellular technology is one of the fastest and ongoing growing telecommunication industries of the world; it may easily be one of those industries which may never suffer from economics of the world. Even today millions of users are subscribing to different mobile networks in the world.

There is numerous mobile communication technologies which makes growth of cellular industry to this extend one of the technology which is by far the best and most widely used in mobile communication is GSM, GSM stands for Global System for Mobile Communications.

Mobile Internet Communication Technologies

There are number of mobile communication technologies which have been developed ever since from analog days, every now and then new technology is released to cope with telephonic industry demands. Currently we have following mobile and internet communication technologies adopted by different mobile companies in different parts of the world.

- GSM
- CDMA
- GPRS

GSM (Global System for Mobile Communications) is the world's most widely used cell phone technology. GSM is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe technologies for second generation (2G) digital cellular networks. The GSM standard is more improved after the development of third generation (3G). GSM networks will evolve further as they begin to incorporate fourth generation (4G). "GSM" is a trademark owned by the GSM Association.

GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band.

CDMA stands for Code Division Multiple Access. Code Division Multiple Access, a generic term denoting a wireless interface based on advanced technology.

CDMA (Code-Division Multiple Access) refers to any of several protocols used in so-called second-generation (2G) and third-generation (3G) wireless communications. As the term implies, CDMA is a form of multiplexing, which allows numerous signals to occupy a single transmission channel, optimizing the use of available bandwidth.

General packet radio service (GPRS) is a packet oriented mobile data service on the 2G and 3G cellular communication system's global system for mobile communications (GSM). GPRS was originally standardized by European Telecommunications Standards Institute (ETSI). It is now maintained by the 3rd Generation Partnership Project (3GPP).

BLUETOOTH

Bluetooth is a specification for the use of low-power radio communications to wirelessly link phones, computers and other network devices over short distances. The name Bluetooth is borrowed from Harald Bluetooth, a king in Denmark more than 1,000 years ago.

Bluetooth technology was designed primarily to support simple wireless networking of personal consumer devices and peripherals, including cell phones, PDAs, and wireless headsets. Wireless signals transmitted with Bluetooth cover short distances, typically up to 30 feet (10 meters). Bluetooth devices generally communicate at less than 1 Mbps.

Bluetooth is a proprietary open wireless technology standard for exchanging data over short distances (using short wavelength radio transmissions in the ISM band from 2400-2480 MHz) from fixed and mobile devices, creating personal area networks (PANs) with high levels of security. Created by telecoms vendor Ericsson in 1994, it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization.

Bluetooth is managed by the Bluetooth Special Interest Group, which has more than 15,000 member companies in the areas of telecommunication, computing, networking, and consumer electronics.

Although the Bluetooth standard utilizes the same 2.4 Ghz range as 802.11b and 802.11g, Bluetooth technology is not a suitable Wi-Fi replacement. Compared to Wi-Fi, Bluetooth networking is much slower, a bit more limited in range, and supports many fewer devices.

As is true for Wi-Fi and other wireless technologies today, concerns with Bluetooth technology include security and interoperability with other networking standards. Bluetooth was ratified as **IEEE 802.15.1.**

Uses

Bluetooth is a standard wire-replacement communications protocol primarily designed for low power consumption, with a short range based on low-cost transceiver microchips in each device. Because the devices use a radio (broadcast) communications system, they do not have to be in visual line of sight of each other, however a quasi optical wireless path must be viable.

The effective range varies due to propagation conditions, material coverage, production sample variations, antenna configurations and battery conditions. In most cases the effective range of class 2 devices is extended if they connect to a class 1 transceiver, compared to a pure class 2

network. This is accomplished by the higher sensitivity and transmission power of Class 1 devices.

While the Bluetooth Core Specification does mandate minimums for range, the range of the technology is application specific and is not limited. Manufacturers may tune their implementations to the range needed to support individual use cases.

Bluetooth vs. Wi-Fi (IEEE 802.11)

Bluetooth and Wi-Fi (the brand name for products using IEEE 802.11 standards) have some similar applications: setting up networks, printing, or transferring files. Wi-Fi is intended as a replacement for cabling for general local area network access in work areas. This category of applications is sometimes called wireless local area networks (WLAN). Bluetooth was intended for portable equipment and its applications. The category of applications is outlined as the wireless personal area network (WPAN). Bluetooth is a replacement for cabling in a variety of personally carried applications in any setting and can also support fixed location applications such as smart energy functionality in the home (thermostats, etc.).

Wi-Fi is a wireless version of a common wired Ethernet network, and requires configuration to set up shared resources, transmit files, and to set up audio links (for example, headsets and hands-free devices). Wi-Fi uses the same radio frequencies as Bluetooth, but with higher power, resulting in higher bit rates and better range from the base station. The nearest equivalents in Bluetooth are the DUN profile, which allows devices to act as modem interfaces, and the PAN profile, which allows for ad hoc networking.

Bluetooth exists in many products, such as the iPod Touch, PlayStation 3, PSP Go, telephones, and some high definition headsets, modems, and watches. The technology is useful when transferring information between two or more devices that are near each other in low-bandwidth situations. Bluetooth is commonly used to transfer sound data with telephones (i.e., with a Bluetooth headset) or byte data with hand-held computers (transferring files).

Bluetooth protocols simplify the discovery and setup of services between devices. Bluetooth devices can advertise all of the services they provide. This makes using services easier because more of the security, network address and permission configuration can be automated than with many other network types.

SMARTCARD

A smart card is a plastic card about the size of a credit card, with an embedded microchip that can be loaded with data, used for telephone calling, electronic cash payments, and other applications, and then periodically refreshed for additional use. Currently or soon, you may be able to use a smart card to:

- Dial a connection on a mobile telephone and be charged on a per-call basis
- Establish your identity when logging on to an Internet access provider or to an online bank
- Pay for parking at parking meters or to get on subways, trains, or buses
- Give hospitals or doctors personal data without filling out a form

A smart card may have the following generic characteristics:

- Dimensions similar to those of a credit card. ID-1 of the ISO/IEC 7810 standard defines cards as nominally 85.60 by 53.98 millimetres (3.370 × 2.125 in). Another popular size is ID-000 which is nominally 25 by 15 millimetres (0.984 × 0.591 in) (commonly used in SIM cards). Both are 0.76 millimetres (0.030 in) thick.
- Contains a tamper-resistant security system (for example a secure cryptoprocessor and a secure file system) and provides security services (e.g., protects in-memory information).
- Managed by an administration system which securely interchanges information and configuration settings with the card, controlling card blacklisting and application-data updates.
- Communicates with external services via card-reading devices, such as ticket readers, ATMs, etc.

Benefits

Smart cards can provide identification, authentication, data storage and application processing.

The benefits of smart cards are directly related to the volume of information and applications that are programmed for use on a card. A single contact/contactless smart card can be programmed with multiple banking credentials, medical entitlement, driver's license/public transport entitlement, loyalty programs and club memberships to name just a few. Multi-factor and proximity authentication can and has been embedded into smart cards to increase the security of all services on the card. For example, a smart card can be programmed to only allow a contactless transaction if it is also within range of another device like a uniquely paired mobile phone. This can significantly increase the security of the smart card.

Governments gain a significant enhancement to the provision of publicly funded services through the increased security offered by smart cards. These savings are passed onto society through a reduction in the necessary funding or enhanced public services.

Individuals gain increased security and convenience when using smart cards designed for interoperability between services. For example, consumers only need to replace one card if their wallet is lost or stolen. Additionally, the data storage available on a card could contain medical information that is critical in an emergency should the card holder allow access to this.

How Smart Cards Work

A smart card contains more information than a magnetic stripe card and it can be programmed for different applications. Some cards can contain programming and data to support multiple applications and some can be updated to add new applications after they are issued. Smart cards can be designed to be inserted into a slot and read by a special reader or to be read at a distance, such as at a toll booth. Cards can be disposable (as at a trade-show) or reloadable (for most applications).

An industry standard interface between programming and PC hardware in a smart card has been defined by the PC/SC Working Group, representing Microsoft, IBM, Bull, Schlumberger, and other interested companies. Another standard is called OpenCard. There are two leading smart card operating systems: JavaCard and MULTOS.

GLOBAL POSITIONING SYSTEM

The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS.

The **Global Positioning System (GPS)** is a space-based satellite navigation system that provides location and time information in all weather, anywhere on or near the Earth, where there is an unobstructed line of sight to four or more GPS satellites. It is maintained by the United States government and is freely accessible by anyone with a GPS receiver. The system imposes some technical limitations which are only removed for authorized users.

The GPS program provides critical capabilities to military, civil and commercial users around the world. In addition, GPS is the backbone for modernizing the global air traffic system.

The GPS project was developed in 1973 to overcome the limitations of previous navigation systems, integrating ideas from several predecessors, including a number of classified engineering design studies from the 1960s. GPS was created and realized by the U.S. Department of Defense (DoD) and was originally run with 24 satellites. It became fully operational in 1994.

Advances in technology and new demands on the existing system have now led to efforts to modernize the GPS system and implement the next generation of GPS III satellites and Next Generation Operational Control System (OCX). Announcements from the Vice President and the White House in 1998 initiated these changes. In 2000, U.S. Congress authorized the modernization effort, referred to as GPS III.

APPLICATIONS

While originally a military project, GPS is considered a dual-use technology, meaning it has significant military and civilian applications.

GPS has become a widely deployed and useful tool for commerce, scientific uses, tracking, and surveillance. GPS's accurate time facilitates everyday activities such as banking, mobile phone operations, and even the control of power grids by allowing well synchronized hand-off switching.

HOW IT WORKS

GPS satellites circle the earth twice a day in a very precise orbit and transmit signal information to earth. GPS receivers take this information and use triangulation to calculate the user's exact location. Essentially, the GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is Now, with distance measurements from a few more satellites, the receiver can determine the user's position and display it on the unit's electronic map.

A GPS receiver must be locked on to the signal of at least three satellites to calculate a 2D position (latitude and longitude) and track movement. With four or more satellites in view, the receiver can determine the user's 3D position (latitude, longitude and altitude). Once the user's position has been determined, the GPS unit can calculate other information, such as speed, bearing, track, trip distance, distance to destination, sunrise and sunset time and more.

THE GPS SATELLITE SYSTEM

The 24 satellites that make up the GPS space segment are orbiting the earth about 12,000 miles above us. They are constantly moving, making two complete orbits in less than 24 hours. These satellites are travelling at speeds of roughly 7,000 miles an hour.

GPS satellites are powered by solar energy. They have backup batteries onboard to keep them running in the event of a solar eclipse, when there's no solar power. Small rocket boosters on each satellite keep them flying in the correct path.

Here are some other interesting facts about the GPS satellites (also called NAVSTAR, the official U.S. Department of Defense name for GPS):

- The first GPS satellite was launched in 1978.
- A full constellation of 24 satellites was achieved in 1994.
- Each satellite is built to last about 10 years. Replacements are constantly being built and launched into orbit.
- A GPS satellite weighs approximately 2,000 pounds and is about 17 feet across with the solar panels extended.
- Transmitter power is only 50 watts or less.

UNIT II

WHITEBOARDS

A **whiteboard** (also known by the terms **markerboard**, **dry-erase** board, **dry-wipe** board, **pen-board**, and the misnomer **greaseboard**) is a name for any glossy, usually white surface for nonpermanent markings. Whiteboards are analogous to chalkboards, allowing rapid marking and erasing of markings on their surface. The popularity of whiteboards increased rapidly in the mid-1990s and they have become a fixture in many offices, meeting rooms, school classrooms, and other work environments. The whiteboard was invented by Ian Ewing, a photographer and Korean war veteran.

WHITEBOARD PEN

The whiteboard pen (also called a whiteboard marker or dry erasable marker) was invented by Jerry Woolf from Techform Laboratories and later patented by Pilot Pen in the early 1960s. It's a non-permanent marker and uses an erasable ink—an ink that adheres to the writing surface without binding or being absorbed by it—for temporary writing with overhead projectors, whiteboards, and the like. They may also be used by children when adults want to be able to clean up after them. The erasable ink does not contain the toxic chemical compounds xylene and/or toluene, unlike permanent markers.

SURFACE MATERIALS

There are four types of materials commonly used for whiteboard surfaces:

MELAMINE

A resin-infused paper which is typically used over a substrate that can range from particle board to MDF (medium density fiberboard). Melamine boards range in quality primarily due to the amount of resin deposited on the base material. Some melamine boards will remain clean (no ghosting) for a long time and others will fail prematurely. Generally these least expensive type of whiteboard are most commonly found in use in non-institutional applications. They are available in any office supply stores. It is not possible to quantify how well this type of board will perform due to the wide range of quality. The major brands are generally a good bargain, but institutional (schools, hospitals) and heavily used commercial applications are not a good application for melamine boards

PAINTED STEEL OR ALUMINUM

Painted steel and aluminum dry erase also have a wide range of quality. Painted surfaces tend to be smoother, which leads to better methods of erasing. The painted surface is generally a multiple layer of coatings made up of a base coat in color (most commonly white) and a clear performance coating that is the dry erase component. Paint varies from electron beam cured coatings to UV and other coating systems. Good commercial grade painted steel or aluminum has excellent dry erase properties and many will able to have permanent marker cleaned from the

surface. Any coated surface is susceptible to scratching. Painted steel surfaces are magnetic and allow the use of magnets. Painted aluminum surfaces are rarely used as a base for whiteboards as they are not magnetic and are more expensive than steel. Painted steel whiteboards are most commonly used for custom printed whiteboards. These products are used as tracking boards, patient information boards and tournament and training boards.

HARDCOAT LAMINATE

Every laminate manufacturer makes a dry erase board or laminate. Here again the performance varies over a wide range depending on the amount of resin used in the manufacturer. Basically this category primarily uses melamine as its dry erase performance coat and therefore falls into the melamine universe. Depending on the manufacturer (and the price) these laminate often are less porous and highly resistant to staining. Less common than other whiteboard surfaces, because they usually are used in combination with something else (a cabinet, doors or table tops for example). (this statement applies to Porcelain steel which is the only lifetime warranty available on the market)

Porcelain, enamel-on-steel

Ceramic (glass) fired onto a steel surface in a kiln. They are the most durable surfaces and most carry a lifetime warranty. They are very common in high traffic industrial settings. Highly scratch-resistant, although materials harder than glass (like diamond) can scratch them. They do not absorb dry erase or permanent marker ink. They allow the use of magnets. Since it is glass, the porcelain surface can be cleaned with any non-abrasive cleaner, which must then be rinsed off with water to prevent smearing. Permanent marker can be removed by writing over it with a dry-erase marker and erasing it. Some porcelain surfaces provide LEED credit in new construction.

ADVANTAGES

- Whiteboard ink markings are less susceptible to external factors, such as water, because the ink adheres in a different manner than does chalk to a chalkboard. Using markers does not generate the dust that comes from using and erasing chalk, allowing their use in areas containing dust-sensitive equipment. Some who are allergic to chalk or are asthmatic use whiteboards as an alternative.
- A whiteboard can be used as the projecting medium for an overhead or video projector. This allows the person giving the presentation to fill in blanks, edit, underline and make comments by writing directly onto the whiteboard, which in turn shows through the projected image. Proper dry wipe boards are high gloss to enable the dry marker ink to be wiped off easily and high gloss surfaces will reflect the projector light, creating a so called "hot spot", a glare back from the board, which can cause people to be unable to read the board from certain angles. Semi-matte whiteboards are better suited for projection but more difficult to dry wipe clean.

- A whiteboard pen is easier than chalk to hold and write with. This can benefit persons with limited mobility in their hands, such as those affected by diseases such as arthritis or systemic lupus erythematosus. In addition, marking on a whiteboard takes less time, effort, and pressure than marking on a chalkboard.
- Like chalkboards, whiteboards help to save paper.
- When compared to a chalkboard a whiteboard can have significantly more colors because markers have a greater range of color than chalk (sidewalk chalk).

DISADVANTAGES

- Only special whiteboard markers are suitable for use on whiteboards. Using other markers that resemble whiteboard markers but contain the wrong kind of ink creates markings that are hard or impossible to remove, depending on the surface type (see *surface materials* above). However, some techniques have been developed, which include filling over them using a marker with the right type of removable ink and then erasing the ink; wiping the marks with acetone or alcohol; or by using board cleaning sprays or pre packaged wipes commercially available from the whiteboard manufacturers.
- The white background can cause contrast problems for people with vision impairment.
- Markers on whiteboards are generally less pressure sensitive than chalk, making it harder to draw heavier/lighter lines
- Whiteboard markers are often sealed in opaque plastics and difficult to determine the amount of ink remaining, only fading in color intensity with use. Like other contemporary markers, they can dry out with if the writing tip is uncapped for long periods of time.
- Whiteboard markers often have a pungent and strong odor (depending on brand and color) whereas chalk has a mild smell mainly from the chalk dust.
- Whiteboard markers, once dry, are disposed of and are generally non-biodegradable, having a increased impact on the environment.
- When writing on a vertical surface, most people incline markers upwards, however this impedes the flow of ink which is dependent on gravity.

MOBILE NEWSPAPER

This is a service launched by BSNL, Vodafone and Nokia.

BSNL's Mobile Newspaper

This is a new value added service under cellular services (both prepaid and postpaid GPRS subscribers) in the name of "MOBILE NEWSPAPER" (mPaper) the WAP portal of BSNL "Cell One Safari".
The various features of the mPaper service are as follows :-
a. Auto image and text resizing.
b. All newspaper sections, except classifieds.
c. Search on the newspaper contents.

d. My store (for saving particular articles for future reference)
e. Sharing/sending of news through MMS.

Vodafone's Mobile Newspaper

Leading cellular service provider Vodafone today launched its mobile newspaper - Newswrap - for its customers in the city. Vodafone launched mobile newspaper in Hyderabad.

Users subscribing to this service can read the news as an MMS and be updated with the latest happenings around the world. In addition to regular morning and evening alerts, all breaking news will be available at the subscribers' fingertips.

Newswrap provides the reader with a brief synopsis of the news bulletin along with pictures and makes the reading experience more informative.

It covers national, international, business, sports and entertainment-related stories, release added.

Nokia's Mobile Newspaper

In an industry first, Nokia, in association with leading news publication, Malyalam Manorama, has announced the launch of a "vernacular news portal", what the company calls a 'mobile newspaper'.

Courtesy this portal, users of Nokia GPRS-enabled handsets in Kerala will be able to get both national and international news in their native language and across categories such as sports, travel, music, astrology, and movies.

"Currently Internet penetration is very low, especially in smaller cities & rural areas. Services such as the 'Mobile Newspaper' will ride on the larger penetration of mobile phones, and bring the Internet Revolution to the masses."

In addition to the launch of this 'vernacular news portal', Nokia said it has partnered with various media houses in the country to bring value added services in 10 languages including Hindi, Punjabi, Bengali, Oriya, Assamese, Marathi, Gujarati, Tamil, Telugu and Kannada in association with leading media houses across India.

Users of Nokia GPRS-enabled handsets such as Nokia 2626, 6233, 6300, 6131, N72, N80, and N95 can download the vernacular news portal icon on their phones. All they need to do is send 'MM' as SMS to 5555. They will subsequently receive a URL on their handsets, clicking upon which will help them download the news portal icon onto their phones.

MOBILE COMPUTING

"Mobile computing is the ability to use computing capability without a pre-defined location and/or connection to a network to publish and/or subscribe to information."

Mobile computing is a form of human–computer interaction by which a computer is expected to be transported during normal usage. Mobile computing has three aspects: mobile communication, mobile hardware, and mobile software. The first aspect **mobile communication** allows transmission of voice and multimedia data via a computer or a mobile device without having connected to any physical or fixed link. Mobile communication is the exchange of voice and data using a communication infrastructure at the same time regardless of any physical link. The second aspect is on the hardware, e.g., mobile devices or device components. A **mobile device** is a small, hand-held computing device, typically having a display screen with touch input and/or a miniature keyboard and weighting less than 2 pounds (0.91 kg). For example smart phones, tablet computers, personal digital assistants (PDAs), enterprise digital assistants etc. The third aspect **mobile software** deals with the characteristics and requirements of mobile applications. (for example connectivity, security etc.)

BENEFITS

1) Locational Flexibility:

You no longer need to stay plugged in (literally!) to a specific location for performing computing activities. Mobile computing allows you unprecedented flexibility to move about and perform computing activities at the same time! This is, indeed, the chief among all other advantages of mobile computing. Traveling abroad for work and missing family and friends? Mobile computing enables you to connect with near and dear ones while you're in transit.

2) Improved decision making:

Mobile Computing lets you conduct business at the point of activity. The ability to collect, access and evaluate critical business information quickly and accurately means better decision making that can have a far-reaching effect on your company's ability to compete successfully

3) Increased productivity and reduced costs:

Mobile computing can lead to increased individual productivity, increased sales per sales person, more service calls per repair person, less time spent by professionals on administrative work, and much more--all of which ultimately translates into higher sales at lower cost. And, on-the-spot invoice production in service vehicles can lead to shorter payment cycles and better cash flow.

4) Improved customer relations:

The success of a business can often be measured by its ability to satisfy customers. Mobile computers gives your field worker the ability to answer customer questions, check order status and provide other services anytime their customers need them from wherever they happen to be.

5) Ease of Research: Mobile computing and the flexibility offered by it enable students as well as professionals to conduct in-depth research on just about any topic or subject even when on the go!

6) **Entertainment:** As discussed previously, nowadays, with the advent and advance of mobile computing technology, no time is wasted time anymore! Getting bored is so last-decade now what with zillions of entertainment options available on mobile computing devices these days - games, movies, music, videos, you name it!

LIMITATIONS

- **Insufficient bandwidth**: Mobile Internet access is generally slower than direct cable connections, using technologies such as GPRS. These networks are usually available within range of commercial cell phone towers. Higher speed wireless LANs are inexpensive but have very limited range.
- **Security standards**: When working mobile, one is dependent on public networks, requiring careful use of VPN. Security is a major concern while concerning the mobile computing standards on the fleet. One can easily attack the VPN through a huge number of networks interconnected through the line.
- **Power consumption**: When a power outlet or portable generator is not available, mobile computers must rely entirely on battery power. Combined with the compact size of many mobile devices, this often means unusually expensive batteries must be used to obtain the necessary battery life.
- **Transmission interferences**: Weather, terrain, and the range from the nearest signal point can all interfere with signal reception. Reception in tunnels, some buildings, and rural areas is often poor.
- **Potential health hazards**: People who use mobile devices while driving are often distracted from driving and are thus assumed more likely to be involved in traffic accidents. (While this may seem obvious, there is considerable discussion about whether banning mobile device use while driving reduces accidents or not.) Cell phones may interfere with sensitive medical devices. There are allegations that cell phone signals may cause health problems.
- **Human interface with device**: Screens and keyboards tend to be small, which may make them hard to use. Alternate input methods such as speech or handwriting recognition require training.

ONLINE ADVERTISING

Online advertising is a form of promotion that uses the Internet and World Wide Web to deliver marketing messages to attract customers. Examples of online advertising include contextual ads on search engine results pages, banner ads, blogs, Rich Media Ads, Social network advertising, online classified advertising, advertising networks and e-mail marketing, including e-mail spam. Many of these types of ads are delivered by an Ad server.

TYPES OF ONLINE ADVERTISEMENT

- **Floating ad:** An ad which moves across the user's screen or floats above the content.

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- **Expanding ad:** An ad which changes size and which may alter the contents of the webpage.
- **Polite ad:** A method by which a large ad will be downloaded in smaller pieces to minimize the disruption of the content being viewed
- **Wallpaper ad:** An ad which changes the background of the page being viewed.
- **Trick banner:** A banner ad that looks like a dialog box with buttons. It simulates an error message or an alert.
- **Pop-up:** A new window which opens in front of the current one, displaying an advertisement, or entire webpage.
- **Pop-under:** Similar to a Pop-Up except that the window is loaded or sent behind the current window so that the user does not see it until they close one or more active windows.
- **Video ad:** similar to a banner ad, except that instead of a static or animated image, actual moving video clips are displayed. This is the kind of advertising most prominent in television, and many advertisers will use the same clips for both television and online advertising.
- **Map ad:** text or graphics linked from, and appearing in or over, a location on an electronic map such as on Google Maps.
- **Mobile ad:** an SMS text or multi-media message sent to a cell phone.

Advertising is the branch of marketing that deals with communicating to customers about products, brands, services and companies. The Internet, as a global communications medium, provides advertisers with unique and often cost-effective ways of reaching advertising audiences. As with all media, however, advertising on the Internet has unique advantages and disadvantages.

ADVANTAGES OF ONLINE ADVERTISING

Reach More Customers

Web advertising can expand awareness of your company and encompass an entirely new set of potential customers. Individuals who never set foot in your retail location may be avid online shoppers who would enjoy shopping on your website. You can offer online discount coupons to encourage your in-store customers to visit your website, resulting in additional sales. Using an effective pay per click campaign or organic search methods, your company website can draw visitors from around the globe -- or you can keep it local if you prefer.

Cost Effectiveness

If your business has a limited marketing budget, web advertising offers several free or low-cost means of marketing. Pay per click advertising with search engines, for example, can be relatively inexpensive. You can establish a pre-set limit and you only pay when someone clicks on your ad. For search engine advertising to be effective, however, you will need a compelling landing page that gets the results you want, whether your goal is for visitors to make a purchase, call you, or sign up for your newsletter. If you need help, you can search online for a web designer and writer to help you create attractive and interesting web pages. Look for free online classified

advertising sites and online business directories in which you can place a listing. Email advertising can also be relatively inexpensive depending on how many subscribers you want to reach. Some email advertising services offer a free or low-cost trial.

Personal Touch

Although the internet can sometimes seem like a very impersonal place, it can also afford opportunities for developing a more personal relationship with your current and potential customers. When buyers go online to research a purchase they are considering, your website can tell them a great deal about your company. Use testimonials from satisfied customers and create an About Us page that allows visitors to get to know a little about the people behind your company. You can also use your website or email newsletter to educate buyers about your products and services. Photos of your products and videos of your company's services in action can be very effective. Giving your visitors interesting and helpful content can help build confidence in your company.

Update ads

Unlike TV commercials, which must be periodically updated, your Internet ads could go for some time without change. If they need updating, the amendment of the site or your ad is usually a very simple matter that can be done quickly and easily.

DISADVANTAGES

One disadvantage of advertising on the Internet is that your marketing materials are automatically available for anyone in the world to copy, regardless of the legal ramifications. Logos, images and trademarks can be copied and used for commercial purposes, or even to slander or mock your company. This is not the case with television and magazine advertising, wherein images must be replicated rather than simply copied electronically. Another disadvantage is the fact that the Internet-advertising gold rush has begun to introduce ad clutter to the Web. Web users are so inundated with banner ads and spam email that they have begun to ignore internet advertising just as much as ads on traditional media.

DATABASE

A database is a collection of information that is organized so that it can easily be accessed, managed, and updated. A database is an organized collection of data for one or more purposes, *usually in digital form. The data are typically organized to model relevant aspects of reality* (for example, the availability of rooms in hotels), in a way that supports processes requiring this information (for example, finding a hotel with vacancies). This definition is very general, and is independent of the technology used.

RELATIONAL DATABASE

A RelationalDatabase is a database constituting a set of **relations** (usually erroneously referred to as "tables"). A relation is a set of **tuples** (a.k.a. "records"), a tuple being a set of attribute values, each attribute being identified by its name (and not by any ordinal position).

The relational database was invented by E. F. Codd at IBM in 1970.

A relational database is a set of tables containing data fitted into predefined categories. Each table (which is sometimes called a *relation*) contains one or more data categories in columns. Each row contains a unique instance of data for the categories defined by the columns. For example, a typical business order entry database would include a table that described a customer with columns for name, address, phone number, and so forth. Another table would describe an order: product, customer, date, sales price, and so forth. A user of the database could obtain a *view* of the database that fitted the user's needs. For example, a branch office manager might like a view or report on all customers that had bought products after a certain date. A financial services manager in the same company could, from the same tables, obtain a report on accounts that needed to be paid.

When creating a relational database, you can define the *domain* of possible values in a data column and further *constraints* that may apply to that data value. For example, a domain of possible customers could allow up to ten possible customer names but be constrained in one table to allowing only three of these customer names to be specifiable.

The standard user and application program interface to a relational database is the *structured query language* (SQL). SQL statements are used both for interactive queries for information from a relational database and for gathering data for reports.

ADVANTAGES OF RELATIONAL DATABASE

1. Ease of use: The revision of any information as tables consisting 0f rows and columns is quite natural and therefore even first time users find it attractive.

2. Flexibility: Different tables from which information has to be linked and extracted can be easily manipulated by operators such as project and join to give information in the form in which it is desired.

3. Precision: The usage of relational algebra and relational calculus in the manipulation of he relations between the tables ensures that there is no ambiguity, which may otherwise arise in establishing the linkages in a complicated network type database.

4. Security: Security control and authorization can also be implemented more easily by moving *sensitive attributes in a given table into a separate relation with its own authorization controls. If* authorization requirement permits, a particular attribute could be joined back with others to enable full information retrieval.

5. Data Independence: Data independence is achieved more easily with normalization structure used in a relational database than in the more complicated tree or network structure.

6. Data Manipulation Language: The possibility of responding to ad-hoc query by means of a language based on relational algebra and relational calculus is easy in the relational database approach. For data organized in other structure the query language either becomes complex or extremely limited in its capabilities.

DISADVANTAGES

A major constraint and therefore disadvantage in the use of relational database system is machine performance. If the number of tables between which relationships to be established are large and the tables themselves are voluminous, the performance in responding to queries is definitely degraded. While the relational database approach is a logically attractive, commercially feasible approach, but if the data is for example naturally organized in a hierarchical manner and stored as such, the hierarchical approach may give better results.

OBJECT ORIENTED DATABASE

Object oriented databases are also called Object Database Management Systems (ODBMS). Object databases store objects rather than data such as integers, strings or real numbers. Objects are used in object oriented languages such as Smalltalk, C++, Java, and others. Objects basically consist of the following:

- Attributes - Attributes are data which defines the characteristics of an object. This data may be simple such as integers, strings, and real numbers or it may be a reference to a complex object.
- Methods - Methods define the behavior of an object and are what was formally called procedures or functions.

Classes are used in object oriented programming to define the data and methods the object will contain. The class is like a template to the object. The class does not itself contain data or methods but defines the data and methods contained in the object. The class is used to create (instantiate) the object. Classes may be used in object databases to recreate parts of the object that may not actually be stored in the database. Methods may not be stored in the database and may be recreated by using a class.

When to Use Object Databases

Object databases should be used when there is complex data and/or complex data relationships. This includes a many to many object relationship. Object databases should not be used when there would be few join tables and there are large volumes of simple transactional data.

Object databases work well with:

- CAS Applications (CASE-computer aided software engineering, CAD-computer aided design, CAM-computer aided manufacture)
- Multimedia Applications

- Object projects that change over time.
- Commerce

FEATURES OF OBJECT ORIENTED DATABASE

The following list of features are capabilities that object databases may support. Object database features include:

- Support of the object oriented language you want to use.
- Support of Object Oriented Concepts.
  - Aggregation - Objects that are composed of other objects.
  - Encapsulation - Data with method storage. Not all databases support the methods but rely upon the classes defined in the schema to reconstruct the object with its methods.
  - Inheritance - Objects inherit attributes from parent objects.
  - Polymorphism - Allows two methods to use the same name but have different behavior. Methods for one object can be defined, then the operation specification can be shared with other objects.
- Distributed Architecture - Object are sharing in a distributed environment or the entire database may be replicated on multiple computers.
- Heterogeneous environment - Cross Platform support - The database may be able to run on various builds of computers and with various operating systems.
- • Object relationships - Object relationships define association with other objects, and whether objects can detect each other in one direction or two directions. Two way object relationships may allow for garbage collection. The best option is two way relationships.
- • Database Garbage Collection - Requires bi-directional object relationships. Determines if the database performs garbage collection on objects that are no longer referenced by the database. This keeps external programs from having to track the use of object pointers.

Object Database Advantages over RDBMS

- Objects don't require assembly and disassembly saving coding time and execution time to assemble or disassemble objects.
- Reduced paging
- Easier navigation
- Better concurrency control - A hierarchy of objects may be locked.
- Data model is based on the real world.
- Works well for distributed architectures.
- Less code required when applications are object oriented.

Object Database Disadvantages compared to RDBMS

- Lower efficiency when data is simple and relationships are simple.

- Relational tables are simpler.
- Late binding may slow access speed.
- More user tools exist for RDBMS.
- Standards for RDBMS are more stable.
- Support for RDBMS is more certain and change is less likely to be required.

ACTIVE DATABASE

An active database is a database with the event monitoring scheme for detecting when certain data is INSERTED, DELETED, UPDATED, or SELECTED, and automatically executing the actions in response when certain events happen and particular conditions are met.

An active database is a database that includes an event-driven architecture which can respond to conditions both inside and outside the database. Possible uses include security monitoring, alerting, statistics gathering and authorization.

Other Definitions

Sara Comai, Letizia Tanca

An active database system is a database management system endowed with active rules, i.e. stored procedures activated by the system when specific events occur. Typically an active rule consists of three parts: event, condition, and action, normally written as: WHEN event IF condition THEN action. "Event" specifies a list of events, "Condition" is a query on the database, "action" generally consists of one or more updates or queries on the database.

Martin Sjolin

A general definition of an active database is a database where a pattern of data in database invokes an action (rule). The actual execution of the rule can take part either in the database manager itself or in the application.

An "active" database emits spontaneous information (indirectly requested by the applications) to the applications; it takes an active part within the system. To indicate this we name it an active database.

Active database systems enhance traditional database functionality with powerful rule-processing capabilities, providing a uniform and efficient mechanism for many database system applications. Among these applications are integrity constraints, views, authorization, statistics gathering, monitoring and alerting, knowledge-based systems, expert systems, and workflow management. This significant collection focuses on the most prominent research projects in active database systems. The project leaders for each prototype system provide detailed discussions of their projects and the relevance of their results to the future of active database systems.

* A broad overview of current active database systems and how they can be extended and improved
* A comprehensive introduction to the core topics of the field, including its motivation and history
* Coverage of active database (trigger) capabilities in commercial products
* Discussion of forthcoming standards

ADVANTAGES

- More secure
- Delegation easy
- Robust
- Easy manageability
- Easy administration and control
- All regions have same data
- Can manage millions of objects
- Search easy
- Increases the productivity of users
- Reduces the burden of IT administration
- Increase Fault Tolerance to minimize Downtime
- It improves security

DISADVANTAGE

- Cost of infrastructure
- Good planning is must
- Complex structure for user

DISTRIBUTED DATABASE

A **distributed database** is a database in which storage devices are not all attached to a common CPU. It may be stored in multiple computers located in the same physical location, or may be dispersed over a network of interconnected computers.

Collections of data (e.g. in a database) can be distributed across multiple physical locations. A distributed database can reside on network servers on the Internet, on corporate intranets or extranets, or on other company networks. The replication and distribution of databases improves database performance at end-user worksites.

Examples are databases of local work-groups and departments at regional offices, branch offices, manufacturing plants and other work sites. These databases can include both segments shared by multiple sites, and segments specific to one site and used only locally in that site.

To ensure that the distributive databases are up to date and current, there are two processes: replication and duplication. Replication involves using specialized software that looks for changes in the distributive database. Once the changes have been identified, the replication process makes all the databases look the same. The replication process can be very complex and time consuming depending on the size and number of the distributive databases. This process can also require a lot of time and computer resources. Duplication on the other hand is not as complicated. It basically identifies one database as a master and then duplicates that database. The duplication process is normally done at a set time after hours. This is to ensure that each distributed location has the same data. In the duplication process, changes to the master database only are allowed. This is to ensure that local data will not be overwritten. Both of the processes can keep the data current in all distributive locations.

Besides distributed database replication and fragmentation, there are many other distributed database design technologies. For example, local autonomy, synchronous and asynchronous distributed database technologies. These technologies' implementation can and does depend on the needs of the business and the sensitivity/confidentiality of the data to be stored in the database, and hence the price the business is willing to spend on ensuring data security, consistency and integrity.

ADVANTAGES

- Management of distributed data with different levels of transparency like fragmentation transparency, replication transparency, etc.
- Increase reliability and availability.
- Easier expansion.
- Reflects organizational structure — database fragments are located in the departments they relate to.
- Local autonomy or site autonomy — a department can control the data about them (as they are the ones familiar with it.)
- Protection of valuable data — if there were ever a catastrophic event such as a fire, all of the data would not be in one place, but distributed in multiple locations.
- Improved performance — data is located near the site of greatest demand, and the database systems themselves are parallelized, allowing load on the databases to be balanced among servers. (A high load on one module of the database won't affect other modules of the database in a distributed database.)
- Economics — it costs less to create a network of smaller computers with the power of a single large computer.
- Modularity — systems can be modified, added and removed from the distributed database without affecting other modules (systems).
- Reliable transactions - Due to replication of database.
- Hardware, Operating System, Network, Fragmentation, DBMS, Replication and Location Independence.

- Continuous operation.
- Distributed Query processing.
- Distributed Transaction management.

Single site failure does not affect performance of system. All transactions follow A.C.I.D. property: a-atomicity, the transaction takes place as whole or not at all; c-consistency, maps one consistent DB state to another; i-isolation, each transaction sees a consistent DB; d-durability, the results of a transaction must survive system failures.

DISADVANTAGES

- Complexity — extra work must be done by the DBAs to ensure that the distributed nature of the system is transparent. Extra work must also be done to maintain multiple disparate systems, instead of one big one. Extra database design work must also be done to account for the disconnected nature of the database — for example, joins become prohibitively expensive when performed across multiple systems.
- Economics — increased complexity and a more extensive infrastructure means extra labour costs.
- Security — remote database fragments must be secured, and they are not centralized so the remote sites must be secured as well. The infrastructure must also be secured (e.g., by encrypting the network links between remote sites).
- Difficult to maintain integrity — but in a distributed database, enforcing integrity over a network may require too much of the network's resources to be feasible.,
- Inexperience — distributed databases are difficult to work with, and as a young field there is not much readily available experience on proper practice.
- Lack of standards — there are no tools or methodologies yet to help users convert a centralized DBMS into a distributed DBMS.
- Database design more complex — besides of the normal difficulties, the design of a distributed database has to consider fragmentation of data, allocation of fragments to specific sites and data replication.
- Additional software is required.
- Operating System should support distributed environment.
- Concurrency control: it is a major issue. It can be solved by locking and time stamping.

PARALLEL DATABASE

A **parallel database**, run by a parallel DBMS, seeks to improve performance through parallelization for tasks such as loading data, building indexes and evaluating queries. Parallel databases improve processing and input/output speeds by using multiple central processing units (CPUs) (including multi-core processors) and storage in parallel. In parallel processing, many operations are performed simultaneously, as opposed to serial, sequential processing, where operations are performed with no time overlap.

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The major parallel DBMS architectures (which are induced by the underlying hardware architecture are:

- **Shared memory architecture**, where multiple processors share the main memory space, as well as other data storage.
- **Shared disk architecture**, where each processing unit (typically consisting of multiple processors) has its own main memory, but all units share the other storage.
- **Shared nothing architecture**, where each processing unit has its own main memory and other storage.

ADVANTAGES

Higher performance

With more CPUs available to an application, higher speed up and scale up can be attained. The improvement in performance depends on the degree of inter-node locking and synchronization activities. Each lock operation is processor and message intensive; there can be a lot of latency. The volume of lock operations and database contention, as well as the throughput and performance of the IDLM, ultimately determine the scalability of the system.

Higher availability

Nodes are isolated from each other, so a failure at one node does not bring the whole system down. The remaining nodes can recover the failed node and continue to provide data access to users. This means that data is much more available than it would be with a single node upon node failure, and amounts to significantly higher availability of the database.

Greater flexibility

An Oracle Parallel Server environment is extremely flexible. Instances can be allocated or deallocated as necessary. When there is high demand for the database, more instances can be temporarily allocated. The instances can be deallocated and used for other purposes once they are no longer necessary.

More users

Parallel database technology can make it possible to overcome memory limits, enabling a single system to serve thousands of users.

DISADVANTAGES

1) Cost is increased considerably

2) Huge Number of resources are required to support parallelism

3) Managing such system simultaneously becomes difficult

DEDUCTIVE DATABASE

A **Deductive database** is a database system that can make deductions (i.e.: conclude additional facts) based on rules and facts stored in the (deductive) database. Datalog is the language typically used to specify facts, rules and queries in deductive databases. Deductive databases have grown out of the desire to combine logic programming with relational databases to construct systems that support a powerful formalism and are still fast and able to deal with very large datasets. Deductive databases are more expressive than relational databases but less expressive than logic programming systems. Deductive databases have not found widespread adoptions outside academia, but some of their concepts are used in today's relational databases to support the advanced features of more recent SQL standards.

Deductive databases and logic programming

Deductive databases reuse a large number of concepts from logic programming; rules and facts specified in the deductive database language Datalog look very similar to those in Prolog. However, there are a number of important differences between deductive databases and logic programming:

- Order sensitivity and procedurality: in Prolog, program execution depends on the order of rules in the program and on the order of parts of rules; these properties are used by programmers to build efficient programs. In database languages (like SQL or Datalog), however, program execution is independent of the order of rules and facts.
- Special predicates: In Prolog, programmers can directly influence the procedural evaluation of the program with special predicates such as the cut, this has no correspondence in deductive databases.
- Function symbols: Logic Programming languages allow function symbols to build up complex symbols. This is not allowed in deductive databases.
- Tuple oriented processing: Deductive databases use set-oriented processing while logic programming languages concentrate on one tuple at a time.

MULTIDIMENSIONAL DATABASE (MDB)

Multidimensional structure is defined as "a variation of the relational model that uses multidimensional structures to organize data and express the relationships between data". The structure is broken into cubes and the cubes are able to store and access data within the confines of each cube. "Each cell within a multidimensional structure contains aggregated data related to elements along each of its dimensions". Even when data is manipulated it remains easy to access and continues to constitute a compact database format. The data still remains interrelated. Multidimensional structure is quite popular for analytical databases that use online analytical processing (OLAP) applications. Analytical databases use these databases because of their ability

to deliver answers to complex business queries swiftly. Data can be viewed from different angles, which gives a broader perspective of a problem unlike other models.

A multidimensional database (MDB) is a type of database that is optimized for data warehouse and online analytical processing (OLAP) applications. Multidimensional databases are frequently created using input from existing relational databases. Whereas a relational database is typically accessed using a Structured Query Language (SQL). An OLAP application that accesses data from a multidimensional database is known as a MOLAP (multidimensional OLAP) application.

A multidimensional database - or a multidimensional database management system (MDDBMS) - implies the ability to rapidly process the data in the database so that answers can be generated quickly. A number of vendors provide products that use multidimensional databases. Approaches to how data is stored and the user interface vary.

Conceptually, a multidimensional database uses the idea of a data cube to represent the dimensions of data available to a user. For example, "sales" could be viewed in the dimensions of product model, geography, time, or some additional dimension. In this case, "sales" is known as the *measure attribute* of the data cube and the other dimensions are seen as *feature attributes*. Additionally, a database creator can define hierarchies and levels within a dimension (for example, state and city levels within a regional hierarchy).

TEMPORAL DATABASE

A **temporal database** is a database with built-in time aspects, for example a temporal data model and a temporal version of Structured Query Language (SQL).

More specifically the temporal aspects usually include valid-time and transaction-time. These attributes go together to form bitemporal data.

- Valid time denotes the time period during which a fact is true with respect to the real world.
- Transaction time is the time period during which a fact is stored in the database.
- Bitemporal data combines both Valid and Transaction Time.

These two time periods do not have to be the same for a single fact. Imagine that we come up with a temporal database storing data about the 18th century. The valid time of these facts is somewhere between 1701 and 1800, whereas the transaction time starts when we insert the facts into the database, for example, January 21, 1998.

It is possible to have timelines other than Valid Time and Transaction Time, such as Decision Time, in the database. In that case the database would be called a multitemporal database as opposed to a bitemporal database. However, this approach introduces additional complexities such as dealing with the validity of (foreign) keys.

Temporal database stores data relating to time instances. It offers temporal data types

and stores information relating to past, present and future time, for example, the history of the stock market or the movement of employees within an organisation. Thus, a temporal database stores a collection of time related data.

The Main Goal of Temporal Database:

- Identification of an appropriate data type for time
- Prevent fragmentation of an object description
- Provide query algebra to deal with temporal data
- Compatiable with old database without temporal data

DIFFERENT FORMS OF TEMPORAL DATABASES

Time can be interpreted as valid time (when data occurred or is true in reality) or transaction time (when data was entered into the database).
A *historical database* stores data with respect to valid time.
A *rollback database* stores data with respect to transaction time.
A *bitemporal database* stores data with respect to both valid and transaction time – they store the history of data with respect to valid time and transaction time.

APPLICATION DOMAINS OF TEMPORAL DATA

Examples of application domains dealing with temporal data are:
- Financial Applications – e.g. history of stock markets; share prices
- Reservation Systems – e.g. when was a flight booked
- Medical Systems – e.g. patient records
- Computer Applications – e.g. history of file back ups
- Archive Management Systems – e.g. sporting events, publications and journals etc.

SPATIAL DATABASE

A **spatial database** is a database that is optimized to store and query data that is related to objects in space, including points, lines and polygons. While typical databases can understand various numeric and character types of data, additional functionality needs to be added for databases to process spatial data types. These are typically called *geometry* or *feature*. The Open Geospatial Consortium created the Simple Features specification and sets standards for adding spatial functionality to database systems.

FEATURES OF SPATIAL DATABASES

Database systems use indexes to quickly look up values and the way that most databases index data is not optimal for spatial queries. Instead, spatial databases use a spatial index to speed up database operations.

In addition to typical SQL queries such as SELECT statements, spatial databases can perform a wide variety of spatial operations. The following query types and many more are supported by the Open Geospatial Consortium:

- Spatial Measurements: Finds the distance between points, polygon area, etc.
- Spatial Functions: Modify existing features to create new ones, for example by providing a buffer around them, intersecting features, etc.
- Spatial Predicates: Allows true/false queries such as 'is there a residence located within a mile of the area we are planning to build the landfill?'
- Constructor Functions: Creates new features with an SQL query specifying the vertices (points of nodes) which can make up lines. If the first and last vertex of a line are identical the feature can also be of the type polygon (a closed line).
- Observer Functions: Queries which return specific information about a feature such as the location of the center of a circle

MULTIMEDIA DATABASE

A multimedia database is a database that hosts one or more primary media file types such as .txt (documents), .jpg (images), .swf (videos), .mp3 (audio), etc. And loosely fall into three main categories:

- Static media (time-independent, i.e. images and handwriting)
- Dynamic media (time-dependent, i.e. video and sound bytes)
- Dimensional media (i.e. 3D games or computer-aided drafting programs- CAD)

All primary media files are stored in binary strings of zeros and ones, and are encoded according to file type.

The applications include digital libraries, manufacturing and retailing, art and entertainment, journalism and so on. MMDBs are supposed to provide almost all the functionalities, a traditional database provides. Apart from those, a MMDB has to provide some new and enhanced functionalities and features. MMDBs are required to provide unified frameworks for storing, processing, retrieving, transmitting and presenting a variety of media data types in a wide variety of formats.

CONTENTS OF MMDB

An MMDB needs to manage several different types of information pertaining to the actual multimedia data. They are:

- **Media data** - This is the actual data representing images, audio, video that is captured, digitized, processes, compressed and stored.

- **Media format data** - This contains information pertaining to the format of the media data after it goes through the acquisition, processing, and encoding phases. For instance, this consists of information such as the sampling rate, resolution, frame rate, encoding scheme etc.
- **Media keyword data** - This contains the keyword descriptions, usually relating to the generation of the media data. For example, for a video, this might include the date, time, and place of recording , the person who recorded, the scene that is recorded, etc This is also called as content descriptive data.
- **Media feature data** - This contains the features derived from the media data. A feature characterizes the media contents. For example, this could contain information about the distribution of colors, the kinds of textures and the different shapes present in an image. This is also referred to as content dependent data.

The last three types are called meta data as they describe several different aspects of the media data. The media keyword data and media feature data are used as indices for searching purpose. The media format data is used to present the retrieved information.

BENEFITS OF USING MULTIMEDIA DATABASE

The incorporation of multimedia database systems will improve the quantity and quality of information manipulated by computer users in all fields, computer aided design, and information retrieval. The area of intelligent multimedia content analysis and retrieval techniques is an emerging discipline. Techniques for representing and extracting semantic information from media such as speech, images, and video are required.

When a multimedia application lacks a database, the data structure is buried in the script, where all of its value is lost. This omission also makes the script more complicated and less flexible. Using a multimedia database makes the data structure logic available to other multimedia applications and simplifies the script so that many scripts can share the same multimedia metadata. In addition, when a multimedia or abstract data database is organized and annotated for one application, other applications can use those annotations without going through the same time-consuming process. This capability adds great value to the data through reuse and controlled redundancy.

When multimedia application content is controlled by the multimedia database, multimedia content can be added, deleted, or modified without modifying the application script. For example, interactive kiosks that display, describe, and demonstrate products can be updated automatically without reprogramming the application script. Furthermore, a multimedia application such as a multimedia textbook can actually control the operation of book topics that have the same look and feel. This control lets the script perform as a template: An entire series of math textbooks (algebra, calculus, trigonometry, and geometry), including text and video, can use the same multimedia application because all data is physically

separate.

Search and retrieval operations are critical in interactive multimedia applications; they must be equally efficient and powerful. Search and retrieval of multimedia and abstract data is challenging, but multimedia databases make it feasible through internal storage format flexibility and efficient operation. The DBMS should have significant knowledge about the data and its structure to enable powerful semantic optimizations and intelligent searches. Search and retrieval operations also give the application access to media components so that they can be dynamically and seamlessly processed when necessary.

WEB DATABASE

An online (or web based) database is one that resides on a server and is accessed via a web browser. You can access the database from anywhere in the world via a standard internet connected PC.

A web database is a wide term for managing data online. A web database is an organized listing of web pages. It's like the card catalog that you might find in the library. The database holds a "surrogate" (or selected pieces like the title, the headings, etc.) for each web page. The creation of these surrogates is called "indexing", and each web database does it in a different way. Web databases hold surrogates for anywhere from 1 million to several billion web pages. The program also has a search interface, which is the box you type words into (like in Alta Vista or Google) or the lists of directories you pick from (like in Yahoo). Thus, each web database has a different indexing method and a different search interface.

METHODS OF INDEXING

There are two important methods of indexing used in web database creation - full-text and human.

Full-Text Indexing

As its name implies, full-text indexing is where every word on the page is put into a database for searching. Alta Vista and Google are examples of full-text databases. Full-text indexing will help you find every examples of a reference to a specific name or terminology. However, a general topic search will not be very useful in these database, and you will have to dig through a lot of "false drops" (or returned pages that have nothing to do with your search).

Human Indexing

Yahoo and some of Magellan are two of the few examples of human indexing. In the above two indexing, all of the work was done by a computer program called a "spider" or a "robot". In human indexing, a person examines the page and determines a very few key phrases that

describe it. This allows for the user to find a good start of works on a topic - assuming that the topic was picked by the human as something that describes the page. This is how the directory-based web databases are developed.

ADVANTAGES OF WEB DATABASE

The advantages are:

- No special hardware requirements, any computer with a web browser can access the database
- Database can be run on a web server so you can access it from any computer connected to the internet
- Development cost is typically lower than stand alone software
- Development time is typically shorter than stand alone software

DISADVANTAGES OF WEB DATABASE

- You may need a reasonably decent server if you want to run the database in-house
- Stand alone software can perform more complex tasks more easily then web based databases
- Running from a web server may incur ongoing hosting costs
- Web based databases are more exposed to hacking and security theats.

DATA WAREHOUSING

A data warehouse is a database designed to support a broad range of decision tasks in a specific organization. It is usually batch updated and structured for rapid online queries and managerial summaries. Data warehouses contain large amounts of historical data. The term data warehousing is often used to describe the process of creating, managing and using a data warehouse.

A data warehouse is a database used for reporting and analysis. The data stored in the warehouse is uploaded from the operational systems. The data may pass through an operational data store for additional operations before it is used in the DW for reporting.

The typical data warehouse uses staging, integration, and access layers to house its key functions. The staging layer stores raw data, the integration layer integrates the data and moves it into hierarchal groups, and the access layer helps users retrieve data.

Data warehouses can be subdivided into data marts. Data marts store subsets of data from a warehouse.

This definition of the data warehouse focuses on data storage. The main source of the data is cleaned, transformed, catalogued and made available for use by managers and other business professionals for data mining, online analytical processing, market research and decision support. However, the means to retrieve and analyze data, to extract, transform and load data, and to

manage the data dictionary are also considered essential components of a data warehousing system. Many references to data warehousing use this broader context. Thus, an expanded definition for data warehousing includes business intelligence tools, tools to extract, transform and load data into the repository, and tools to manage and retrieve metadata.

A common way of introducing data warehousing is to refer to the characteristics of a data warehouse as set forth by William Inmon:

- Subject Oriented
- Integrated
- Nonvolatile
- Time Variant

Subject oriented

Data warehouses are designed to help you analyze data. For example, to learn more about your company's sales data, you can build a warehouse that concentrates on sales. Using this warehouse, you can answer questions like "Who was our best customer for this item last year?" This ability to define a data warehouse by subject matter, sales in this case, makes the data warehouse subject oriented.

Integrated

Integration is closely related to subject orientation. Data warehouses must put data from disparate sources into a consistent format. They must resolve such problems as naming conflicts and inconsistencies among units of measure. When they achieve this, they are said to be integrated.

Nonvolatile

Nonvolatile means that, once entered into the warehouse, data should not change. This is logical because the purpose of a warehouse is to enable you to analyze what has occurred.

Time variant

In order to discover trends in business, analysts need large amounts of data. This is very much in contrast to **online transaction processing (OLTP)** systems, where performance requirements demand that historical data be moved to an archive. A data warehouse's focus on change over time is what is meant by the term time variant.

APPLICATIONS

Some of the applications data warehousing can be used for are:

- Decision support
- Trend analysis

- Financial forecasting
- Insurance fraud analysis
- Call record analysis
- Logistics and Inventory management
- Agriculture

BENEFITS OF A DATA WAREHOUSE

Some of the potential benefits of putting data into a data warehouse include:
1. improving turnaround time for data access and reporting;
2. standardizing data across the organization so there will be one view of the "truth";
3. merging data from various source systems to create a more comprehensive information source;
4. lowering costs to create and distribute information and reports;
5. sharing data and allowing others to access and analyze the data; and
6. encouraging and improving fact-based decision making.

DISADVANTAGES

There are also disadvantages to using a data warehouse. Some of them are:

• Data warehouses are not the optimal environment for unstructured data.

• Because data must be extracted, transformed and loaded into the warehouse, there is an element of latency in data warehouse data.

• Over their life, data warehouses can have high costs.

• Data warehouses can get outdated relatively quickly. There is a cost of delivering suboptimal information to the organization.

• There is often a fine line between data warehouses and operational systems. Duplicate, expensive functionality may be developed. Or, functionality may be developed in the data warehouse that, in retrospect, should have been developed in the operational systems.

DATA MINING

Data mining (sometimes called data or knowledge discovery) is the process of analyzing data from different perspectives and summarizing it into useful information - information that can be used to increase revenue, cuts costs, or both. Data mining software is one of a number of analytical tools for analyzing data. It allows users to analyze data from many different dimensions or angles, categorize it, and summarize the relationships identified. Technically, data mining is the process of finding correlations or patterns among dozens of fields in large relational databases.

Data mining consists of five major elements:

- Extract, transform, and load transaction data onto the data warehouse system.
- Store and manage the data in a multidimensional database system.
- Provide data access to business analysts and information technology professionals.
- Analyze the data by application software.
- Present the data in a useful format, such as a graph or table.

Different levels of analysis are available:

- **Artificial neural networks**: Non-linear predictive models that learn through training and resemble biological neural networks in structure.
- ***Genetic algorithms***: *Optimization techniques that use processes such as genetic* combination, mutation, and natural selection in a design based on the concepts of natural evolution.
- **Decision trees**: Tree-shaped structures that represent sets of decisions. These decisions generate rules for the classification of a dataset. Specific decision tree methods include Classification and Regression Trees (CART) and Chi Square Automatic Interaction Detection (CHAID) . CART and CHAID are decision tree techniques used for classification of a dataset. They provide a set of rules that you can apply to a new (unclassified) dataset to predict which records will have a given outcome. CART segments a dataset by creating 2-way splits while CHAID segments using chi square tests to create multi-way splits. CART typically requires less data preparation than CHAID.
- **Nearest neighbor method**: A technique that classifies each record in a dataset based on a combination of the classes of the *k* record(s) most similar to it in a historical dataset (where *k* 1). Sometimes called the *k*-nearest neighbor technique.
- **Rule induction**: The extraction of useful if-then rules from data based on statistical significance.
- **Data visualization**: The visual interpretation of complex relationships in multidimensional data. Graphics tools are used to illustrate data relationships.

How does data mining work?

While large-scale information technology has been evolving separate transaction and analytical systems, data mining provides the link between the two. Data mining software analyzes relationships and patterns in stored transaction data based on open-ended user queries. Several

types of analytical software are available: statistical, machine learning, and neural networks. Generally, any of four types of relationships are sought:

- **Classes**: Stored data is used to locate data in predetermined groups. For example, a restaurant chain could mine customer purchase data to determine when customers visit and what they typically order. This information could be used to increase traffic by having daily specials.

- **Clusters**: Data items are grouped according to logical relationships or consumer preferences. For example, data can be mined to identify market segments or consumer affinities.

- **Associations**: Data can be mined to identify associations. The beer-diaper example is an example of associative mining.

- **Sequential patterns**: Data is mined to anticipate behavior patterns and trends. For example, an outdoor equipment retailer could predict the likelihood of a backpack being purchased based on a consumer's purchase of sleeping bags and hiking shoes.

PROFITABLE APPLICATIONS

A wide range of companies have deployed successful applications of data mining. While early adopters of this technology have tended to be in information-intensive industries such as financial services and direct mail marketing, the technology is applicable to any company looking to leverage a large data warehouse to better manage their customer relationships. Two critical factors for success with data mining are: a large, well-integrated data warehouse and a well-defined understanding of the business process within which data mining is to be applied (such as customer prospecting, retention, campaign management, and so on).

Some successful application areas include:

- A pharmaceutical company can analyze its recent sales force activity and their results to improve targeting of high-value physicians and determine which marketing activities will have the greatest impact in the next few months. The data needs to include competitor market activity as well as information about the local health care systems. The results can be distributed to the sales force via a wide-area network that enables the representatives to review the recommendations from the perspective of the key attributes in the decision process. The ongoing, dynamic analysis of the data warehouse allows best practices from throughout the organization to be applied in specific sales situations.
- A credit card company can leverage its vast warehouse of customer transaction data to identify customers most likely to be interested in a new credit product. Using a small test mailing, the attributes of customers with an affinity for the product can be identified. Recent projects have indicated more than a 20-fold decrease in costs for targeted mailing campaigns over conventional approaches.
- A diversified transportation company with a large direct sales force can apply data mining to identify the best prospects for its services. Using data mining to analyze its

own customer experience, this company can build a unique segmentation identifying the attributes of high-value prospects. Applying this segmentation to a general business database such as those provided by Dun & Bradstreet can yield a prioritized list of prospects by region.

- A large consumer package goods company can apply data mining to improve its sales process to retailers. Data from consumer panels, shipments, and competitor activity can be applied to understand the reasons for brand and store switching. Through this analysis, the manufacturer can select promotional strategies that best reach their target customer segments.

ADVANTAGES OF DATA MINING

Marketing / retail

Data mining helps marketing companies to build models based on historical data to predict who will respond to new marketing campaign such as direct mail, online marketing campaign and etc. Through this prediction, marketers can have appropriate approach to sell profitable products to targeted customers with high satisfaction.

Data mining brings a lot of benefit s to retail company in the same way as marketing. Through market basket analysis, the store can have an appropriate production arrangement in the way that customers can buy frequent buying products together with pleasant. In addition, it also help the retail company offers a certain discount for particular products what will attract customers.

Banking/Crediting

Data mining can assist financial institutions in areas such as credit reporting and loan information. For example, by examining previous customers with similar attributes, a bank can estimated the level of risk associated with each given loan. In addition, data mining can also assist credit card issuers in detecting potentially fraudulent credit card transaction. Although the data mining technique is not a 100% accurate in its prediction about fraudulent charges, it does help the credit card issuers reduce their losses.

Law enforcement

Data mining can aid law enforcers in identifying criminal suspects as well as apprehending these criminals by examining trends in location, crime type, habit, and other patterns of behaviors.

Researchers

Data mining can assist researchers by speeding up their data analyzing process; thus, allowing them more time to work on other projects.

Manufacturing

By applying data mining in operational engineering data, manufacturers can detect faulty equipments and determine optimal control parameters. For example semi-conductor manufacturers had a challenge that even the conditions of manufacturing environments at different wafer production plants are similar, the quality of wafer are lot the same and some for unknown reasons even contain defects. Data mining has been applied to determine the ranges of control parameters that lead to the production of golden wafer. Then those optimal control parameters are used to manufacture wafers with desired quality.

Governments

Data mining helps government agency by digging and analyzing records of financial transaction to build patterns that can detect money laundering or criminal activity.

DISADVANTAGES OF DATA MINING

Privacy Issues

The concerns about the personal privacy have been increasing enormously recently especially when internet is booming with social networks, e-commerce, forums, blogs…. Because of privacy issues, people are afraid of their personal information is collected and used in unethical way that potentially causing them a lot of trouble. Businesses collect information about their customers in many ways for understanding their purchasing behaviors trends. However businesses don't last forever, some days they may be acquired by other or gone. At this time the personal information they own probably is sold to other or leak.

Security issues

Security is a big issue. Businesses owns information about their employee and customers including social security number, birthday, payroll and etc. However how properly this information is taken is still in questions. There have been a lot of cases that hackers were accesses and stole big data of customers from big corporation such as Ford Motor Credit Company, Sony… with so much personal and financial information available, the credit card stolen and identity theft become a big problem.

Misuse of information/inaccurate information

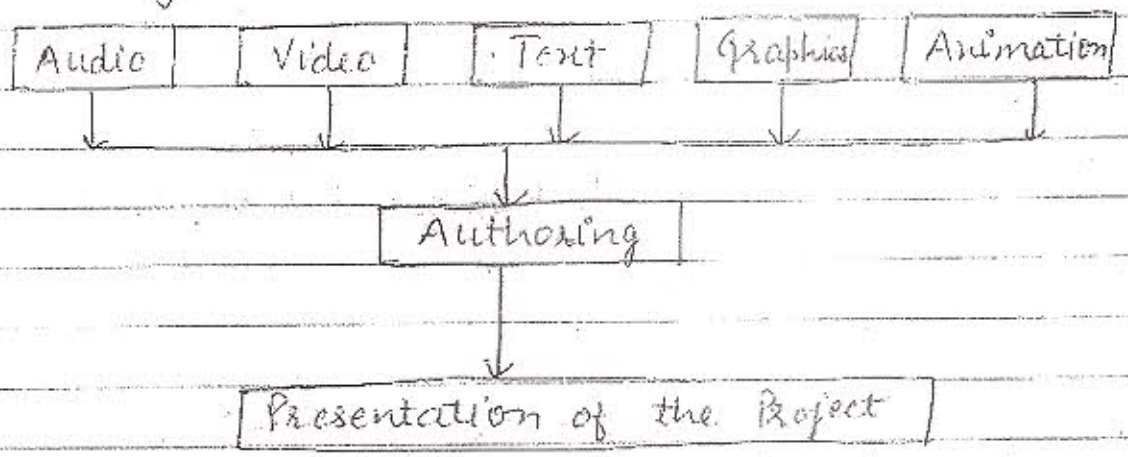
Information collected through data mining intended for marketing or ethical purposes can be misused. This information is exploited by unethical people or business to take benefit of vulnerable people or discriminate against a group of people.

In addition, data mining technique is not perfectly accurate therefore if inaccurate information is used for decision-making will cause serious consequence.

Q5:- What do you understand by authoring? Explain its various steps in detail with an example. Also describe authoring tools briefly.

Ans:- Authoring can be defined as the process of joining all the independent media elements such as graphics, text, animation, audio and video to produce an interactive frame-work. Authoring integrates all media elements/contents developed for the presentation of the project.

In other words, authoring is importing of audio and its integration with video and providing the capability of interactivity is called authoring.



Thus, when all the related media elements are created and digitized according to specifications then comes the final stage of production process called authoring, so m/m authoring is the final stage of m/m project production.

With m/m authoring s/w, we can make video productions, animations, games, interactive

Time based and presentation tools

In this authoring system, elements and events are organized along a well-defined time line or with respect to time axis with resolutions as high as 1/30 second. These time based tools are popular m/m authoring tools.

These tools are best to use when there is a message / inform^{n} flow with a beginning and an end like the movies. As the time advances, from zero seconds (starting point of the project) the events begin to occur, one after another.

These tools take the help of a few timer. The events happen one after another following this timer. The speed of the transition of inform^{n} can also be accurately controlled. Since main aim in m/m is presentation, therefore, for effectiveness, the sequence must be kept in view i.e. what actions / events should happen / occur / run for what time.

"Macromedia's Director" is an example of m/m authoring system that makes use of this methodology.

Because time-based authoring tools work by displaying a series of frames, they are especially good for creating animations.

Advantages of Authoring Tools :-

1) Helps in creating high-quality audio & video app^{n}s

2) Enables a developer to enrich his app^n by incorporating m/m content in all forms as appropriate
3) Less need for programming expertise
4) Easy to use
5) The use of video, sound and animation can bring a concept to life and make it highly memorable
6) Significant long-term cost savings in corporate training and educational app^{n}s can be achieved
7) Provides facilities for organizing & editing basic elements
8) One can structure the Inform^n as seen fit, skip certain areas and carefully study other areas as needed

Disadvantages :- 1) Poor data handling
2) Slow Execution

Q6:- What do you understand by Intelligent M/M system? What are its salient features? Illustrate.

Ans:- Intelligent m/m system is an environment in which a human being can interact with the m/m system and the m/m system can act as an expert to enhance the capabilities in selecting, accessing and manipulating m/m inform^n.

Under simple m/m environment the user can of course interact but after interaction the computer has to do little bit of processing. But in this system some deep processing are involved after each user interaction. In this type of

app's, Simulations, interactive training, prototypes and technical visualizations, presentations, demo disks and interactive guided tours.

M/M authoring is the most imp. phase of m/m project design & development because the output of this phase will be the finally rendered title that will be replicated and introduced in the market.

Step involved in authoring are :-

1) The first step of authoring is to bring all the independent media elements used in m/m projects, as each them are developed using various graphics, audio, video and animation tools.

2) Once all graphics, text, animation and digital video are combined together, different relationships and actions with each of the media element can be worked out by adding interactive control.

3) When m/m program is executed, the interpreter part of the authoring program takes all necessary commands and relationships that has been defined for each media elements and converts them into binary code or m/c code that computer operating system can understand.

4) The converted program is then executed by the CPU of the computer system which sends out instruction to the system to play the music or audio, display the text, video and

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Animation.

Authoring Tools / Authoring Methodologies :-

M/M authoring tools allows to develop all the m/m building blocks like text, graphics, sound, video and animation and then integrate these elements and make an interactive appⁿ.

M/M authoring tools may vary from appⁿ to appⁿ. It is the responsibility of the m/m team to select best possible tool depending upon the appⁿ.

Based on the fundamental methodologies, various authoring tools are arranged into following groups :-

1) Card or page-based authoring tools
2) Icon based event driven authoring tools
3) Time based and presentation tools

Card or page based authoring tools :-

In this authoring system / methodology, element or contents of m/m are arranged as individual pages or cards, and the project is developed as a 'Book' or a stack of cards.

Thousands of pages or cards may be available in the book or stack. Every page of the book may contain many media elements including sound, videos and animations. This system lets the user to link these pages or cards into organized sequence. The user can jump, on command, to any desired page in the structured navigation pattern.

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This type of authoring methodology is best suited where the major part of a program consists of a elements allowing individual viewing like turning of pages of a book and the contents of the project can be arranged as individual sequences, one independent of another, as far as possible. Among the card and page based authorings tools are Apple's HyperCard and Allegiant's Supercard.

HyperCard is one of the first m/m authoring tools / programs, which ran on Apple computers.

Advantages of using card or page based authoring:-

The advantages of using card or page based authoring tools are -

1) It is easy to understand the straight forward relationship b/w what is displayed on any particular screen and what is created on a card or page.
2) It is easy to use and provide templates that can significantly reduce development time.

Disadvantages of :-

1) some programs run on only one platform like Windows.
2) Some of their features like animation and paint tools are not as powerful as those in other programs.

Icon based Event Driven tools :-

These tools allow each and every element and interactive event of a particular m/m project, to be arranged sequentially in the form of icons.

These tools provide the m/m developes with a visual programming approach to organizing and presenting events in the m/m appn. These icons are driven from one phase to another by means of events. The use of these tools in projecting is rather simple for their visual approach. These event driven tools simplify the orgn of the m/m project. These tools typically display flow diagrams of activities of the program by linking up icon symbolizing events, tasks and decisions.

Macromedia's Authorware is an authoring tool that uses the icon-based event driven tool for building m/m presentation.

Advantages of icon-based event driven tools :-

The advantage of icon-based event driven tools is that one can easily see how a title is structured i.e/ the flow of a program & the branching. This makes it easy to edit and update the program by merely adding or deleting icons representing content or events.

Disadvantages :-

Disadvantage of icon-based event driven tools is that they are difficult to learn.

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ACCOUNTING INFORMATION SYSTEM 2-

An **accounting information system (AIS)** is a system of collection, storage and processing of financial and accounting data that is used by decision makers. An accounting information system is generally a computer-based method for tracking accounting activity in conjunction with information technology resources. The resulting statistical reports can be used internally by management or externally by other interested parties including investors, creditors and tax authorities. Accounting Information Systems (AISs) combine the study and practice of accounting with the design, implementation, and monitoring of information systems. Such systems use modern information technology resources together with traditional accounting controls and methods to provide users the financial information necessary to manage their organizations.

Accounting information systems are composed of six main components:

1. **People:** users who operate on the systems
2. **Procedures and instructions:** methods for retrieving and processing data.
3. **Data:** data that is related to the organization and its business processes
4. **Software:** application that processes the data
5. **Information technology infrastructure:** the actual physical devices and systems that allows the AIS to operate and perform its functions
6. **Internal controls and security measures:** security measures to protect sensitive data.

CHARACTERISTICS OF ACCOUNTING INFORMATION SYSTEM

1) Timely Information

Your accounting information system should provide you and other users with timely information. This information helps users and business owners with strategic planning, budgets and other valuable sales information. Payroll, bank reconciliations and creating spreadsheets are some of the tasks your accounting information system should be capable of handling.

2) Easy to Use

Raw data such as vendor names, sales dates and amounts and purchases are entered into the system. Point of sale devices offer another means for data to be input directly into your accounting information system. That's pretty much the extent of the labor involved with your accounting information system. Once the data is input, the system processes any calculations, reports, and reconciliations. For popular accounting information systems such as QuickBooks, reconciling bank and credit accounts is as simple as clicking your mouse to match accounts with one another.

3) Internal Controls

Your accounting information system makes it easier for you to establish internal controls. These internal controls include various inventory decisions resulting from sales data. A good accounting information system helps detect fraud, theft and other mismanagement.

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4) **Decision Making**

Data recorded and processed in your accounting information system yields reports that aid managers and owners in the decision making process. These business decisions include how much inventory should be carried and how much money should be spent. Most accounting information systems can yield statistics that indicate performance of products or services. This information can further be analyzed to make decisions regarding sales, cost of goods sold and efficiency.

5) **External Financial Reporting**

One of the most important characteristics of your accounting information system is its ability to produce information that helps you generate year-ending financial statements. From your accounting information system you should be able to create your company's balance sheet, income statement, shareholder or owner's equity and statement of cash flows. Many accounting information systems have the ability to create your financial statements within the software itself.

The accounting information system is divided into following sub-systems.

1) **Cash sub-system**

It deals with the receipt and payment of cash both physical cash and electronic fund transfer. Electronic fund transfer takes place without having the physical cash entry or exit by using the credit cards or electronic banking.

2) **Sales and accounts receivable sub-system**

It deals with recording of sales, maintaining of sales ledger and receivables. It generates periodic reports about sales, collections made, overdue accounts and receivables positions as also ageing schedule of receivables/debtors.

3) **Inventory sub-system**

It deals with the recording of different items purchased and issued specifying the price, quantity and date. It generates the inventory positions and valuations reports.

4) **Accounts payable sub-system**

It deals with the purchase and payments to creditors. It provides for ordering of goods, sorting of purchase expenses and payment to creditors. It also generates periodic reports about the performance of suppliers, payments schedule and position of creditors.

5) **Payroll accounting sub-system**

It deals with payment of wages and salary to employees. A typical wage report details information about basic pay, dearness pay, dearness allowance, other allowances and bonus and deductions from salary and wages on account of provident fund, loans, advances, taxes and other charges. The system generates reports about wage bill, overtime payment and payment on account of leave encashment, etc.

6) Fixed assets accounting sub-system

It deals with the recording of purchase, addition, deletion, usage of fixed assets such as land and building, machinery and equipment, etc. It also generates reports about the cost, depreciation book value of different assets.

7) Costing sub-system

It deals with the ascertainment of cost of goods produced. It has linkages with other accounting sub-systems for obtaining the necessary information about cost of material, labor and other expenses. This system generates information about the changes in the cost that take place during the period under review.

8) Budget sub-system

It deals with the preparation of budget for the coming financial year as well as comparison with the current budget of the actual performances.

ADVANTAGES OF ACCOUNTING INFORMATION SYSTEM

1) Efficiency

Computerized financial information systems are faster and more efficient in processing data. The use of hardware such as scanners automatically generates accounting information without much ado. The information is available almost immediately. The cost of hardware such as computers is low and the availability of cheaper and user-friendly accounting software makes accounting information systems affordable. Computerized financial systems enable users to access it promptly by the click of a mouse. Unlike manual, which by the way is still very much in existence as some companies want to keep both electronic and manual accounting information systems, the user does not have to go through a pile of paper work in order to locate the information he needs.

2) Cost Effectiveness

Accounting information system makes the maintenance of a bloated financial department irrelevant. The software does most of the work that would otherwise require several employees. The accounting software can journal and prepare documents such as the trial

balance. Journals and ledgers are recorded in the computer data bases. There is also software that can perform functions such as billing budgeting and preparing payroll. Accounting information systems help cuts the payroll for accounting staff substantially.

DISADVANTAGES OF ACCOUNTING INFORMATION SYSTEM

1) Learning the System

Learning an accounting information system can often be difficult and time-consuming. Individuals must be trained on a system, and this can cause a disadvantage to companies in terms of time and manpower. An accounting information system is made up of many different components, and almost all systems are computerized. Because of their complexity, some people may find them hard to use. It can take weeks or months for a person to understand an accounting system, and usually the individual still does not understand completely what the system is capable of. If the employee quits working at the organization, it can take weeks or months, once again, to train another employee.

2) Loss of Information

Accounting information systems are usually computerized. Because of this, there is always a risk of losing information through power outages or system crashes. When this happens, there is a chance that all the information in the system could be lost. Companies take precautions for this problem by backing up their files regularly and performing standard maintenance on all computer systems. They also install anti-virus software as another precaution. Still, none of these steps eliminates the potential problem that may occur. Accounting information systems store a company's financial information for years. If a system crash occurs, it causes a major disadvantage to the company. All, or some, information is lost, and there's a chance it may never be recovered.

3) Re-evaluation

Companies often change their way of doing business to keep up with the latest trends. To keep up in a demanding business world, these changes may impact an accounting system. An accounting information system is difficult to set up because every company is unique in its own way. In order to keep up with changes, accounting information systems must be re-evaluated often. Changes often need to be made in a system in order to process information efficiently. This can be a disadvantage to companies because it takes time for the re-evaluation, and it costs money.

MANAGEMENT INFORMATION SYSTEM

MIS is an integrated man machine system that provides information to support the planning and control function of manager in an organization.

CHARACTERISTICS

ERP (Enterprise Resource Planning) systems typically include the following characteristics:

- An integrated system that operates in real time (or next to real time), without relying on periodic updates.
- A common database, which supports all applications.
- A consistent look and feel throughout each module.
- Installation of the system without elaborate application/data integration by the Information Technology (IT) department.

ADVANTAGES

Advantages of ERP (Enterprise Resource Planning) System:

1. Complete **visibility** into all the important processes across various departments of an organization (especially for senior management personnel).

2. Automatic and coherent **work-flow** from one department / function to another to ensure smooth transition/ completion of processes.

3. A unified and single **reporting** system to analyze the statistics/ numbers/ status etc in real time, across all the functions / departments.

4. Since **same software** is used across all departments – this can avoid individual departments having to buy and maintain their own software systems.

5. Certain ERP vendors can extend their ERP systems to provide **Business Intelligence** functionalities as well.

6. Advanced **e-commerce integration** is possible with ERP systems that can handle web based order tracking/ processing.

7. There are **various modules** in an ERP system like Finance/ Accounts, Human Resource Management, Manufacturing, Marketing / Sales, Supply Chain / Warehouse Management, CRM, Project Management, etc.

8. Since ERP is a **modular software** system, it's possible to implement either a few modules (or) many modules based on the requirements of an organization. If more modules implemented, the integration between various departments might be better.

9. Single Database is implemented on the back-end to store all the information required by the ERP system and that enables **centralized storage** / back-up of all enterprise data.

10. ERP systems are more **secure** as centralized security policies can be applied to them and all the transactions happening via the ERP systems can be tracked.

11. ERP systems provide visibility and hence enable better/ faster **collaboration** across all the departments.

12. It is possible to integrate other systems (like bar-code reader, for example) to the ERP system through an **API** (Application Programing Interface).

13. ERP systems make it **easier** for order tracking, inventory tracking, revenue tracking, sales forecasting and related activities.

14. ERP systems are a boon for managing **globally dispersed** enterprise companies.

Disadvantages of ERP (Enterprise Resource Planning) Systems:

1. The **cost** of ERP Software, planning, customization, configuration, testing, implementation, etc is too high.

2. ERP deployments take **1-3 years** to get completed and fully functional.

3. Too little **customization** may not integrate the ERP system with the business process & too much customization may slow down the project and make it difficult to upgrade.

4. The **cost savings/ payback** may not be realized immediately after the ERP implementation & it is quite difficult to measure the same.

5. The **participation** of users is very important for successful implementation of ERP projects – So, exhaustive user training and simple user interface might be critical. But ERP systems are generally difficult to use (and learn).

6. There may be additional **indirect costs** like new IT infrastructure, upgrading the WAN links, etc.

7. **Migration** of existing data to the new ERP systems is always difficult to achieve as with integrating ERP systems with other stand alone software systems.

8. ERP implementations are difficult to achieve in **decentralized organizations** with disparate business processes and systems.

9. Once an ERP systems is implemented it becomes a **single vendor lock-in** for further upgrades, customizations etc.

MIS can also be defined as the combination of human and computer based resources that result in the collection storage, retrieval communication and use of data for efficient management operation.

MIS refers broadly to a computer-based system that provides managers with the tools for organizing, evaluating and efficiently running their departments. In order to provide past, present and prediction information, an MIS can include software that helps in decision making, data resources such as databases, the hardware resources of a system, decision support systems, people management and project management applications, and any computerized processes that enable the department to run efficiently. A management information system (MIS) provides information which is needed to manage organizations efficiently and effectively.

The scope and purpose of MIS is better understood if each part of MIS is explain separately:
Management, Information and System- together bring out the focus clearly & effectively.
Management focusing on the ultimate use of such information systems for managerial decision making; management is the art of getting thing done through computer in an organized way.
Information can be defined as data which is organized so that the decision maker may take necessary action when we process the data & convert it into a form that is useful and meaningful to the decision maker then it becomes information. Information stressing on processed data in the context in which it is used by end users;
System means an organized relationship among functional units or components. A system exists because it is designed to achieve one or more common objectives. System emphasizing a fair degree of integration and a holistic view;

NEED FOR MIS

MIS tries to handle the organization information system through a computer. It offers vital information to the managers so that they can carry out operational control, mgt. control and strategic planning successfully.

CHARACTERISTICS OF MIS:

To function effectively as an interacting, interrelated, and interdependent feedback tool for management and staff, MIS must be "useable." The five elements of a useable MIS system are: timeliness, accuracy, consistency, completeness, and relevance.

1) Timeliness

To simplify prompt decision making, an institution's MIS should be capable of providing and distributing *current* information to appropriate users. Information systems should be designed to expedite reporting of information. The system should be able to quickly collect and edit data, summarize results, and be able to adjust and correct errors promptly.

2) Accuracy

A sound system of automated and manual internal controls must exist throughout all information systems processing activities. Information should receive appropriate editing, balancing, and internal control checks. A comprehensive internal and external audit program should be employed to ensure the adequacy of internal controls.

3) **Consistency**

To be reliable, data should be processed and compiled consistently and uniformly. Variations in how data is collected and reported can distort information and trend analysis. In addition, because data collection and reporting processes will change over time, management must establish sound procedures to allow for systems changes. These procedures should be well defined and documented, clearly communicated to appropriate employees, and should include an effective monitoring system.

4) **Completeness**

Decision makers need complete and pertinent information in a summarized form. Reports should be designed to eliminate clutter and voluminous detail, thereby avoiding "information overload."
Relevance Information provided to management must be relevant. Information that is inappropriate, unnecessary, or too detailed for effective decision making has no value. MIS must be appropriate to support the management level using it. The relevance and level of detail provided through MIS systems directly correlate to what is needed by the board of directors, executive management, departmental or area mid-level managers, etc. in the performance of their jobs.

COMPONENTS OF MANAGEMENT INFORMATION SYSTEM

Hardware
Input and output devices constitute the hardware components of MIS.

Software
The programs and applications that convert data into machine-readable language are known as software.

Procedures
Procedures are sets of rules or guidelines, which an organization establishes for the use of a computer-based information system.

Personnel
The computer experts, managers, users, analysts, programmers, database managers, and many other computer professionals who utilize the computer-based information systems are the personnel in a management information system.

ADVANTAGES

An MIS provides the following advantages.

1. **It Facilitates planning**

   MIS improves the quality of plants by providing relevant information for sound decision - making. Due to increase in the size and complexity of organizations, managers have lost personal contact with the scene of operations.

2. **In Minimizes information overload**

   MIS change the larger amount of data in to summarized form and there by avoids the confusion which may arise when managers are flooded with detailed facts.

3. **MIS Encourages Decentralization**

   Decentralization of authority is possibly when there is a system for monitoring operations at lower levels. MIS is successfully used for measuring performance and making necessary change in the organizational plans and procedures.

4. **It brings Co ordination**

   MIS facilitates integration of specialized activities by keeping each department aware of the problem and requirements of other departments. It connects all decision centers in the organization.

5. **It makes control easier**

   MIS serves as a link between managerial planning and control. It improves the ability of management to evaluate and improve performance. The used computers has increased the data processing and storage capabilities and reduced the cost.

6. MIS assembles, process, stores, retrieves, evaluates and disseminates the information.

DISADVANTAGES

1. Highly sensitive requires constant monitoring.
2. Budgeting of MIS extremely difficult.
3. Quality of outputs governed by quality of inputs.
4. Lack of flexibility to update itself.
5. Effectiveness decreases due to frequent changes in top management

6. Takes into account only qualitative factors and ignores non-qualitative factors like morale of worker, attitude of worker etc...

DECISION SUPPORT SYSTEM

A **decision support system (DSS)** is a computer-based information system that supports business or organizational decision-making activities. DSS is an interactive computerized system that gathers and presents data from a wide range of sources, typically for business purposes. DSSs serve the management, operations, and planning levels of an organization and help to make decisions, which may be rapidly changing and not easily specified in advance.

DSSs include knowledge-based systems. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, personal knowledge, or business models to identify and solve problems and make decisions.

For example: a national on-line book seller wants to begin selling its products internationally but first needs to determine if that will be a wise business decision. The vendor can use a DSS to gather information from its own resources (using a tool such as OLAP) to determine if the company has the ability or potential ability to expand its business and also from external resources, such as industry data, to determine if there is indeed a demand to meet. The DSS will collect and analyze the data and then present it in a way that can be interpreted by humans. Some decision support systems come very close to acting as artificial intelligence agents.

COMPONENTS OF A DSS

1. DSS Generator

It is a s/w that consist of a program that helps in the development of a DSS and also helpful in the processing of its task. The very common DSS generator is Lotus-123.

2. DBMS(Database Management Systems)

The database management system or DBMS controls the information gathered from both the internal and external sources of the company. The data in the DSS database are managed by DBMS which helps in the compilation of data, manipulation of data, data generation, data updating, data maintenance and data reconfiguration (like sorting).

3. MBMS(Model Based Management System)

The model based management system is concerned with in-depth analysis of sophisticated data and their proper interpretation. It provides various models for the purpose of assessing and interpreting that will help in forming decisions.

4. **Dialogue Management System**

It involves user intervention i.e. user can work in a GUI environment such as windows based on pull down menus for giving interactive output.

CHARACTERISTICS OF DSS

1. **Facilitation**. DSS facilitate and support specific decision-making activities and/or decision processes.

2. **Interaction**. 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.

3. **Ancillary**. DSS can support decision makers at any level in an organization. They are NOT intended to replace decision makers.

4. **Repeated Use**. DSS are intended for repeated use. A specific DSS may be used routinely or used as needed for ad hoc decision support tasks.

5. **Task-oriented**. DSS provide specific capabilities that support one or more tasks related to decision-making, including: intelligence and data analysis; identification and design of alternatives; choice among alternatives; and decision implementation.

6. **Identifiable**. DSS may be independent systems that collect or replicate data from other information systems OR subsystems of a larger, more integrated information system.

7. **Decision Impact**. DSS are intended to improve the accuracy, timeliness, quality and overall effectiveness of a specific decision or a set of related decisions.

ADVANTAGES OF DECISION SUPPORT SYSTEM

1) Time savings

For all categories of decision support systems, research has demonstrated and substantiated reduced decision cycle time, increased employee productivity and more timely information for decision making. The time savings that have been documented from using computerized decision support are often substantial. Researchers have not however always demonstrated that decision quality remained the same or actually improved.

2) Enhance effectiveness

A second category of advantage that has been widely discussed and examined is improved decision making effectiveness and better decisions. Decision quality and decision making effectiveness are however hard to document and measure. Most research has examined soft measures like perceived decision quality rather than objective measures. Advocates of building data warehouses identify the possibility of more and better analyses that can improve decision making.

3) Improve interpersonal communication

DSS can improve communication and collaboration among decision makers. In appropriate circumstances, communications-driven and group DSS have had this impact. Model-driven DSS provide a means for sharing facts and assumptions. Data-driven DSS make "one version of the truth" about company operations available to managers and hence can encourage fact-based decision making. Improved data accessibility is often a major motivation for building a data-driven DSS. This advantage has not been adequately demonstrated for most types of DSS.

4) Competitive advantage

Vendors frequently cite this advantage for business intelligence systems, performance management systems, and web-based DSS. Although it is possible to gain a competitive advantage from computerized decision support, this is not a likely outcome. Vendors routinely sell the same product to competitors and even help with the installation. Organizations are most likely to gain this advantage from novel, high risk, enterprise-wide, inward facing decision support systems.

5) Cost reduction

Some research and especially case studies have documented DSS cost saving from labor savings in making decisions and from lower infrastructure or technology costs. This is not always a goal of building DSS.

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6) Increase decision maker satisfaction

The novelty of using computers has and may continue to confound analysis of this outcome. DSS may reduce frustrations of decision makers, create perceptions that better information is being used and/or create perceptions that the individual is a "better" decision maker. Satisfaction is a complex measure and often researchers measure satisfaction with the DSS rather than satisfaction with using a DSS in decision making. Some studies have compared satisfaction with and without computerized decision aids. Those studies suggest the complexity and "love/hate" tension of using computers for decision support.

7) Promote learning

Learning can occur as a by-product of initial and ongoing use of a DSS. Two types of learning seem to occur: learning of new concepts and the development of a better factual understanding of the business and decision making environment. Some DSS serve as "de facto" training tools for new employees.

8) Increase organizational control

Data-driven DSS often make business transaction data available for performance monitoring and ad hoc querying. Such systems can enhance management understanding of business operations and managers perceive that this is useful. What is not always evident is the financial benefit from increasingly detailed data. Regulations like Sarbanes-Oxley often dictate reporting requirements and hence heavily influence the control information that is made available to managers. On a more ominous note, some DSS provide summary data about decisions made, usage of the systems, and recommendations of the system. Managers need to be very careful about how decision-related information is collected and then used for organizational control purposes.

DISADVANTAGES OF DECISION SUPPORT SYSTEM

Decision Support System can create advantages for organizations and can have positive benefits, however building and using Decision Support System can create negative outcomes in some situations.

(1) Monetary cost

The decision support system requires investing in information system to collect data from many sources and analyze them to support the decision making. Some analysis for Decision Support System needs the advance of data analysis, statistics, econometrics and information system, so it is the high cost to hire the specialists to set up the system.

(2) Overemphasize decision making

Clearly the focus of those of us interested in computerized decision support is on decisions and decision making. Implementing Decision Support System may reinforce the rational perspective and overemphasize decision processes and decision making. It is important to educate managers about the broader context of decision making and the social, political and emotional factors that impact organizational success. It is especially important to continue examining when and under what circumstances Decision Support System should be built and used. We must continue asking if the decision situation is appropriate for using any type of Decision Support System and if a specific Decision Support System is or remains appropriate to use for making or informing a specific decision.

(3) Assumption of relevance

According to Wino grad and Flores (1986), "Once a computer system has been installed it is difficult to avoid the assumption that the things it can deal with are the most relevant things for the manager's concern." The danger is that once Decision Support System become common in organizations, that managers will use them inappropriately. There is limited evidence that this occurs. Again training is the only way to avoid this potential problem.

(4) Transfer of power

Building Decision Support System, especially knowledge-driven Decision Support System, may be perceived as transferring decision authority to a software program. This is more a concern with decision automation systems than with Decision Support System. We advocate building computerized decision support systems because we want to improve decision making while keeping a human decision maker in the "decision loop". In general, we value the "need for human discretion and innovation" in the decision making process.

(5) Unanticipated effects

Implementing decision support technologies may have unanticipated consequences. It is conceivable and it has been demonstrated that some Decision Support System reduce the skill needed to perform a decision task. Some Decision Support System overload decision makers with information and actually reduce decision making effectiveness. We are sure that other such unintended consequences have been documented. Nevertheless, most of the examples seem correctable, avoidable or subject to remedy if and when they occur.

(6) Obscuring responsibility

The computer does not make a "bad" decision, people do. Unfortunately some people may deflect personal responsibility to a Decision Support System. Managers need to be continually reminded that the computerized decision support system is an intermediary between the people who built the system and the people who use the system. The entire responsibility associated with making a decision using a Decision Support System resides with people who built and use the system.

(7) False belief in objectivity

Managers who use Decision Support System may or may not be more objective in their decision making. Computer software can encourage more rational action, but managers can also use decision support technologies to rationalize their actions. It is an overstatement to suggest that people using a Decision Support System are more objective and rational than managers who are not using computerized decision support.

(8) Status reduction

Some managers argue using a Decision Support System will diminish their status and force them to do clerical work. This perceptual problem can be a disadvantage of implementing a Decision Support System. Managers and IS staff who advocate building and using computerized decision support need to deal with any status issues that may arise. This perception may or should be less common now that computer usage is common and accepted in organizations.

(9) Information overload

Too much information is a major problem for people and many Decision Support System increase the information load. Although this can be a problem, Decision Support System can help managers organize and use information. Decision Support System can actually reduce and manage the information load of a user. Decision Support System developers need to try to measure the information load created by the system and Decision Support System users need to monitor their perceptions of how much information they are receiving. The increasing ubiquity of handheld, wireless computing devices may exacerbate this problem and disadvantage.

OFFICE AUTOMATION SYSTEM

Office automation system is a computer-based information system that collects, process, store and transmit electronic message, document and other form of communication among individual, work group and organizations. Office automation refers to the varied computer machinery and software used to digitally create, collect, store, manipulate, and relay office information needed for accomplishing basic tasks. In its basic form, information exists as letters, memos, graphs, records, messages, and so on. When that information is electronically transferred, raw data is exchanged between two or more office employees, either at the same or different locations. Office Automation system collects, processes, stores and transmits data and information in the form of electronic office communication. Raw data storage, electronic transfer, and the management of electronic business information comprise the basic activities of an office automation system. Office automation helps in optimizing or automating existing office procedures.

The backbone of office automation is a LAN, which allows users to transmit data, mail and even voice across the network. All office functions, including dictation, typing, filing, copying, fax, Telex, microfilm and records management, telephone and telephone switchboard operations, fall into this category.

Examples- word processing, electronic mail, desktop publishing, telecommunication and document image processing.

THE BASICS OF OFFICE AUTOMATION

Generally, there are three basic activities of an office automation system: storage of raw data, data exchange, and data management.

Data Storage and Manipulation

Data storage usually includes office records and other primary office forms and documents. Data applications involve the capture and editing of a file, image, or spreadsheet. Word processing and desktop presentation packages accommodate raw textual and graphical data, while spreadsheet applications enable the easy manipulation and output of numbers. Image applications allow the capture and editing of visual images.

Text-handling software and systems cover the whole field of word processing and desktop publishing. Word processing is the inputting (usually via keyboard) and manipulation of text on a computer. Word processing is frequently the most basic and common office automation activity. Popular commercial word processing applications include Word Perfect (Corel) and Word (Microsoft). Each provides the office user with a sophisticated set of commands to format, edit, and print text documents. One of the most popular features of word processing packages are their preformatted document templates. Templates automatically set up such things as font size, paragraph styles, headers and footers, and page numbers so that the user does not have to reset document characteristics every time they create a new record.

Desktop publishing adds another dimension to text manipulation. By packaging the features of a word processor with advanced page design and layout features, desktop publishing packages easily create documents with text and images, such as newsletters or brochures.

Image-handling software and systems are another aspect of office automation. Images, or digital pictures, are representations of visual information. Visual information is an important complement to textual information. Examples of visual information include pictures of documents, photographs, and graphics such as tables and charts. These images are converted into digital files, which cannot be edited the same way that text files can. In a word processor or desktop publishing application, each word or character is treated individually. In an imaging system, the entire picture or document is treated as one whole object. One of the most popular uses of computerized images is in corporate presentations or speeches. Presentation software packages simplify the creation of multimedia presentations that use computer video, images, sound, and text in an integrated information package.

Spreadsheet programs allow the manipulation of numeric data. Early popular spreadsheets like VisiCalc and Lotus 1-2-3 greatly simplified common financial record keeping. Particularly useful among the many spreadsheet options is the ability to use variables in pro forma statements. The pro forma option allows the user to change a variable and have a

complex formula automatically recalculated based on the new numbers. Many businesses use spreadsheets for financial management, financial projection, and accounting.

Data Exchange

The exchange of stored and manipulated information is an equally important component of an office automation system. Electronic transfer is a general application area that highlights the exchange of information between more than one user or participant. Electronic mail, voice mail, and facsimile are examples of electronic transfer applications. Systems that allow instantaneous or "real time" transfer of information (i.e. online conversations via computer or audio exchange with video capture) are considered electronic sharing systems. Electronic sharing software illustrates the collaborative nature of many office automation systems. The distinction between electronic transfer and electronic sharing is subtle but recognizable.

Electronic transfer software and systems allow for electronic, voice, and facsimile transmission of office information. Electronic mail uses computer based storage and a common set of network communication standards to forward electronic messages from one user to another. It is usually possible to relay electronic mail to more than one recipient. Additionally, many electronic mail systems provide security features, automatic messaging, and mail management systems like electronic folders or notebooks. Voice mail offers essentially the same applications, but for telephones rather than computers. Facsimile transmissions are limited to image relay and have suffered in popularity with the increase in the use of the personal computer. One popular alternative, for example, is to send and receive faxes by modem.

Electronic sharing systems offset the limitations of a store-and-forward electronic mail system. Office automation systems that include the ability to electronically share information between more than one user simultaneously are often called groupware. One type of groupware is an electronic meeting system, which allows geographically dispersed participants to exchange information in real time. Participants may be within the same office or building or thousands of miles apart. Long-distance electronic sharing systems usually use a telephone line connection to transfer data; while sharing in a localized area often involves just a local area network of computers (no outside phone line is needed). An interesting byproduct of the electronic sharing functions of an office automation system is telecommuting. A telecommuter works for a business from another location (often home) using a computer and a connection to the office automation system. Telecommuting is an increasingly popular style of work for many office workers and companies.

Data Management

The last major component of an office automation system offers planning and strategic advantages by simplifying the management of stored information. Task management, tickler systems or reminder systems, and scheduling programs monitor and control various projects and activities within the office. Electronic management systems monitor and control office activities and tasks through timelines, resource equations, and electronic scheduling. As in data exchange, groupware is gaining in popularity for data management. Each member of the

work group or larger group may share access to necessary information via the automated office system and groupware.

CHARACTERISTICS OF OFFICE AUTOMATION SYSTEM

Office automation is a widely used term today. It generally means the application of computer and communication technology to improve the productivity of "knowledge works".

1. Office automation refers to the use of sophisticated electronic equipment and communication systems to carry out the "electronic tasks" the tasks include

- Text processing,
- Data processing
- Information storage,
- Information retrieval and updating,
- Message distribution,
- Document transmission and reproduction,
- Teleconferencing.

2. Office automation is a process that involves people, procedure and technology. Office automation technology include word processor, telecommunication, reprographics, e-mail, e-filing, facsimile transmission, micro-graphics and voice technologies.

3. Office automation involves the use of computers, in conjunction with other electronic-equipment to automate the basic secretarial and clerical tasks of office.

4. Basic office automation consists of word processors connected to one another to means of a local area network.

5. Office automation should be designed as a multifunction information system to provide executives decision support tools such as:

- On-line access to databases,
- Model building and forecasting,
- Risk analysis,
- Sophisticated graphics,
- Integration of data and text,
- Data communication.

6. Some office automation systems go far beyond the function of providing word processing on networks. PCs or workstations are connected to a network.

7. Office automation support a large number of software packages that could be used as decision support tools. Important ones are:

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- Word processor, database management systems,
- Electronic spreadsheets,
- Graphics packages,
- Electronic mail systems.

ADVANTAGES OF OFFICE AUTOMATION SYSTEM

Office automation can get many tasks accomplished faster, eliminating the need for a larger staff. Less storage space is required for data, and copies can be easily transferred off-site for safekeeping in case of fire or other emergency. Multiple people can be updated simultaneously in the event of schedule changes.

Office automation is a great way to save money and time while protecting your important business information. People no longer want to store paper records or hand write order forms and other information needed to do business. Project management software, electronic invoicing, scheduling software and credit card payments make it much easier to run your business without the need for so much paper.

DISADVANTAGES OF OFFICE AUTOMATION SYSTEM

The main disadvantage is that fewer employees are then needed. (This leads to reduced manpower - in communities, states, and the nation, as a whole, increasing the unemployment rate). Older staff members may have a harder time adjusting to the new technology and be unable to use it efficiently. Also, if something is "misfiled," it can be a lot harder to find. Other disadvantages include the amount of money required to implement and the cost of maintenance of certain equipment.

MARKETING INFORMATION SYSTEM

A marketing information system (MIS) is a set of procedures and methods designed to generate, analyze, disseminate, and store anticipated marketing decision information on a regular, continuous basis. A marketing information system can be used operationally, managerially, and strategically for several aspects of marketing.

A system that analyzes and assesses marketing information, gathered continuously from sources inside and outside an organization. Timely marketing information provides basis for decisions such as product development or improvement, pricing, packaging, distribution, media selection, and promotion.

Jobber (2007) defines it as a "system in which marketing data is formally gathered, stored, analyzed and distributed to managers in accordance with their informational needs on a regular basis."

Kotler, et al. (2006) define it more broadly as "people, equipment, and procedures to gather, sort, analyze, evaluate, and distribute needed, timely, and accurate information to marketing decision makers."

The information needed by marketing managers comes from three main sources:

1) Internal company information – E.g. sales, orders, customer profiles, stocks, customer service reports etc

2) Marketing intelligence – This can be information gathered from many sources, including suppliers, customers, and distributors. Marketing intelligence is a catchall term to include all the everyday information about developments in the market that helps a business prepare and adjust its marketing plans. It is possible to buy intelligence information from outside suppliers (e.g. IDC, ORG, MARG) who set up data gathering systems to support commercial intelligence products that can be profitably sold to all players in a market.

(3) Market research – Management cannot always wait for information to arrive in bits and pieces from internal sources. Also, sources of market intelligence cannot always be relied upon to provide relevant or up-to-date information (particularly for smaller or niche market segments). In such circumstances, businesses often need to undertake specific studies to support their marketing strategy – this is market research.

FEATURES OF MARKETING INFORMATION SYSTEM

The features of marketing information system are:

a) Inter related components: Marketing information system is a set of inter-related components. They consist of people, equipment, and procedures. Computer hardware, software, and information communication technology is used to design and deliver it.

b) Processing: Marketing information system collects, processes, analysis, stores, retrieves, and disseminates information for decision marketing and control. Its output consists of various reports.

c) Timeliness: Marketing information system provides right information to right people at right time. Information if received late has no use.

d) Accuracy: Marketing information system provides accurate and reliable information. Past and present information are more accurate than future forecasts. It also provides complete

information.

c) Consistency: Market information system provides consistent information. All data is based on same definition, assumptions, and time period.

f) Accessibility: Market information system is easily accessible. The information is properly secured. But it is easily available to authorized persons. Information communication technology has facilitated accessibility. It also avoids information overload.

COMPONENTS OF A MARKETING INFORMATION SYSTEM

"A marketing information system is a continuing and interacting structure of people, equipment and procedures to gather, sort, analyze, evaluate, and distribute pertinent, timely and accurate information for use by marketing decision makers to improve their marketing planning, implementation, and control".

A marketing information system has four components: the internal reporting system, the marketing research systems, the marketing intelligence system and marketing models. Internal reports include orders received, inventory records and sales invoices. Marketing research takes the form of purposeful studies either *ad hoc* or continuous. By contrast, marketing intelligence is less specific in its purposes, is chiefly carried out in an informal manner and by managers themselves rather than by professional marketing researchers.

Internal Reporting Systems:

All enterprises which have been in operation for any period of time have a wealth of information. However, this information often remains under-utilized because it is compartmentalized, either in the form of an individual entrepreneur or in the functional departments of larger businesses. That is, information is usually categorized according to its nature so that there are, for example, financial, production, manpower, marketing, stockholding and logistical data. Often the entrepreneurs, or various personnel working in the functional departments holding these pieces of data, do not see how it could help decision makers in other functional areas. Similarly, decision makers can fail to appreciate how information from other functional areas might help them and therefore do not request it.

The internal records that are of immediate value to marketing decisions are: orders received, stockholdings and sales invoices. These are but a few of the internal records that can be used by marketing managers, but even this small set of records is capable of generating a great deal of information. Below, is a list of some of the information that can be derived from sales invoices.

- ☐ Product type, size and pack type by territory
- ☐ Product type, size and pack type by type of account
- ☐ Product type, size and pack type by industry
- ☐ Product type, size and pack type by customer
- ☐ Average value and/or volume of sale by territory
- ☐ Average value and/or volume of sale by type of account
- ☐ Average value and/or volume of sale by industry
- ☐ Average value and/or volume of sale by sales person

By comparing orders received with invoices an enterprise can establish the extent to which it is providing an acceptable level of customer service. In the same way, comparing stockholding records with orders received helps an enterprise ascertain whether its stocks are in line with current demand patterns.

Marketing research systems: The general topic of marketing research has been the prime subject of the textbook and only a little more needs to be added here. Marketing research is a proactive search for information. That is, the enterprise which commissions these studies does so to solve a perceived marketing problem. In many cases, data is collected in a purposeful way to address a well-defined problem (or a problem which can be defined and solved within the course of the study). The other form of marketing research centers not around a specific marketing problem but is an attempt to continuously monitor the marketing environment. These monitoring or tracking exercises are continuous marketing research studies, often involving panels of farmers, consumers or distributors from which the same data is collected at regular intervals. Whilst the *ad hoc* study and continuous marketing research differs in the orientation, yet they are both proactive.

Marketing intelligence systems: Whereas marketing research is focused, market intelligence is not. A marketing intelligence system is a set of procedures and data sources used by marketing managers to sift information from the environment that they can use in their decision making. This scanning of the economic and business environment can be undertaken in a variety of ways, including

Unfocused scanning	The manager, by virtue of what he/she reads, hears and watches exposes him/herself to information that may prove useful. Whilst the behaviour is unfocused and the manager has no specific purpose in mind, it is not unintentional
Semi-focused scanning	Again, the manager is not in search of particular pieces of information that he/she is actively searching but does narrow the range of media that is scanned. For instance, the manager may focus more on economic and business publications, broadcasts etc. and pay less attention to political, scientific or technological media.
Informal search	This describes the situation where a fairly limited and unstructured attempt is made to obtain information for a specific purpose. For example, the marketing manager of a firm considering entering the business of importing

	frozen fish from a neighbouring country may make informal inquiries as to prices and demand levels of frozen and fresh fish. There would be little structure to this search with the manager making inquiries with traders he/she happens to encounter as well as with other *ad hoc* contacts in ministries, international aid agencies, with trade associations, importers/exporters etc.
Formal search	This is a purposeful search after information in some systematic way. The information will be required to address a specific issue. Whilst this sort of activity may seem to share the characteristics of marketing research it is carried out by the manager him/herself rather than a professional researcher. Moreover, the scope of the search is likely to be narrow in scope and far less intensive than marketing research

Marketing intelligence is the province of entrepreneurs and senior managers within an agribusiness. It involves them in scanning newspaper trade magazines, business journals and reports, economic forecasts and other media. In addition it involves management in talking to producers, suppliers and customers, as well as to competitors. Nonetheless, it is a largely informal process of observing and conversing.

Some enterprises will approach marketing intelligence gathering in a more deliberate fashion and will train its sales force, after-sales personnel and district/area managers to take cognizance of competitors' actions, customer complaints and requests and distributor problems. Enterprises with vision will also encourage intermediaries, such as collectors, retailers, traders and other middlemen to be proactive in conveying market intelligence back to them.

Marketing models: Within the MIS there has to be the means of interpreting information in order to give direction to decision. These models may be computerized or may not. Typical tools are:

- Time series sales modes
- Brand switching models
- Linear programming
- Elasticity models (price, incomes, demand, supply, etc.)
- Regression and correlation models
- Analysis of Variance (ANOVA) models
- Sensitivity analysis
- Discounted cash flow
- Spreadsheet 'what if models

These and similar mathematical, statistical, econometric and financial models are the analytical subsystem of the MIS. A relatively modest investment in a desktop computer is enough to allow an enterprise to automate the analysis of its data. Some of the models used are stochastic, i.e. those containing a probabilistic element whereas others are deterministic

models where chance plays no part. Brand switching models are stochastic since these express brand choices in probabilities whereas linear programming is deterministic in that the relationships between variables are expressed in exact mathematical terms.

ADVANTAGES OF MARKETING INFORMATION SYSTEM

1) **Organized Data collection** – Lots of data can be collected from the market. But the main word here is "Organized". Organizing data is very important else the data is meaningless. Thus MIS helps you to organize your database thereby improving productivity.

2) **A broad perspective** – With a proper MIS in place, the complete organization can be tracked which can be used to analyse independent processes. This helps in establishing a broader perspective which helps us know which steps can be taken to facilitate improvement.

3) **Storage of Important Data** – Several times in pharmaceuticals, when one drug is being produced they may need data of another drug which was produced years back. Similarly in Media, photographs are stored in archives. This storage of important data plays a crucial role in execution and thus proves again that MIS is not important only for information but also for execution.

4) **Avoidance of Crisis** – The best way to analyse a stock (share market) is to see its past performance. Top websites like moneycontrol thrive on MIS. Similarly MIS helps you keep tracks of margins and profits. With an amazing information system established, you can know where your organization is moving and probably avert a crisis long before it has taken place. Ignoring hints received from MIS reports is foolhardy.

5) **Co-ordination** – Consumer durables and FMCG companies have huge number of processes which needs to be co-ordinated. These companies depend completely on MIS for the proper running of the organization. There are dedicated people for marketing information systems in such organizations. This is mainly because of the speed required to access information and implement it.

7) **Analysis and Planning** – MIS is critical for planning. You cannot do planning without information. For planning, the first thing which is needed is the organizations capabilities, then the business environment and finally competitor analysis. In a proper MIS, all these are present by default and are continuously updated. Thus MIS is very important for planning and analysis.

8) **Control** – Just like MIS can help in a crisis, in normal times it provides control as you have information of the various processes going on and what is happening across the company. Thus it provides you with a sense of control.

Disadvantages – The disadvantages of Marketing information system are high initial time and labour cost, maintenance, complexity of setting up a MIS are one of the major hindrances to Marketing information systems. Marketers often complain that they lack enough marketing information or the right kind, or have too much of the wrong kind.

Furthermore, wrong information being fed in MIS can become cumbersome and appropriate filters need to be established.

FINANCIAL INFORMATION SYSTEM

Generally, Information is the lifeblood of financial markets, but they rely on a flow of news and market information to function. Moreover, *financial information systems* deliver huge amounts of details to financial professionals around the world about counter markets, price endorsers, research services and news-providers.

A financial information system (FIS) is a business software system used to input and track financial and accounting data. The system generates reports and alerts that assist managers in effectively running the business.

PRIMARY FUNCTIONS OF FIS

The primary functions of FIS include: Recording all financial transactions in general ledger accounts producing fiscal reports to meet up administration and statutory requirements controlling overall spending through budgetary controls embedded in the system producing business fiscal statements.

NEED OF FINANCIAL INFORMATION

Financial professionals have access to a wide range of data from breaking news and immediate prices, price-histories, historic news, stats, agent research, corporation fundamental data and estimates. However, the most demanding users of financial information are traders and sales people. They require high-speed and high execution systems because seconds can add up in their fast paced environment. Some needs the most advanced systems that offer real time reporting of all fiscal asset classes merchandised worldwide. Others who have a narrow focal point, who do business in domestic or regional fiscal instruments, may search for the systems that provide smaller set of details adapted to their exact needs. Those working outside the trading environment i.e. in asset management, wealth management and in investigate and consultative business has dissimilar requirements.

Although they also desire access to the news and market information they do not require pursuing market actions as strictly as traders. They need systems that supply other content together with company s basic data, forecast data, broker investigating and details on managed resources. Financial professionals look for information systems which also supply analysis and communicating tools. They require tools which allow them to investigate the markets, identify the trading and investment chances, and evaluate the perils linked with their strategies. In addition, they need the ability to speak quickly and simply with other market-participants and with their co-workers & ; clients. Increasingly, financial professionals on the purchase-side want to trade directly and try to find access to feasible prices and merchandising tools in their fiscal information systems.

FEATURES OF FINANCIAL INFORMATION SYSTEM

Some of the features of Financial Information Systems are:

- **Payroll:** Handles all the recurring and non-recurring payments and deductions for employees. All recurring transactions can be automatically generated each payroll period with non-recurring transactions such as overtime added to the payroll upon approval. It is also possible to maintain employee pay rates, entitlements, full salary movements and payroll histories.
- **Patient Accounting:** This concentrates on financial transactions generated during a patient's visit to the hospital. These include inpatient and outpatient charges, doctors' fees generated across the hospital, the cost of procedures, operations and medications.
- **Accounts Payable:** Handles the processing of invoices and payments within the hospital.
- Accounts Receivable: This provides support for and the maintenance of the records of all clients, invoices and payments.
- **General Ledger:** This handles the collection, processing and reporting of financial data generated by all transactions, enabling a current, accurate and instant view of the financial status of the hospital at any point in time.
- **Fixed Asset Management:** This deals with asset data retention and depreciation forecasting. The transfer of fixed assets between locations, cost centres or departments; reclassification of assets and reassessments of asset values can functions that can be done by the Financial Information System.
- **Claims Management:** Manages all claims that are made to insurance companies
- **Contract Management:** Keeps track of all ongoing contracts.

COMPONENTS OF FIS

FIS is comprised of three components. This section focuses on how they work individually and how they relate to each other. The three components are:

Financial Accounting

Financial Accounting is used to record the entire financial transactions in general ledger accounts for the assets that is A/R, liabilities that is A/P, revenues and expenses. Financial Accounting is considered to be central part of the *Financial Information System*. It is the only factor which tracks other than revenue and expense activity, balance sheet kind of activity for example assets, liabilities and maintained earnings. Additionally, for divisional or

departmental purposes the Financial Accounting offers the account-codes to be used in recording the revenue, disbursement, accounts-receivable and accounts-payable activity.

Funds Management

Funds Management is used to recognize the funding source and control the overall expenses. Funds Management will prevent the posting of a transaction for which there are insufficient budget dollars. Funds Management has a unique feature, which is not present anywhere else in FIS. It will stop a business deal from being posted if there are not enough funds to cover the transaction. This feature is called Funds Availability Control. The funding sources are categorized as follows:

Operating Funds: These funds are used to cover the general operating costs for example educational and administrative salaries and the benefits, utilities, supplies, etc. The funding sources that would typically be included in this group are revenues yielded through departmental enterprising-nesses and the yearly working grants from Federal and or provincial governments.

Ancillary Operations: The funding sources that would typically be built-in this grouping are the revenues yielded from the sale-of dwelling or parking spaces, food and beverage. The expenses incurred in running the ancillary operations such as salaries & benefits, cost of goods sold, interest on mortgage etc compensate these revenues.

Restricted Funds: The funding sources that would typically be integrated in this type are research granting agencies, confidential donors and patronizing companies. Usually these finances have certain limitations or conditions attached to how the money can be spent.

Capital Funds: Capital funds are used to cover up the costs of construction or most important overhauls of buildings. The funding sources can incorporates government agencies, donors and other departments contributing part-of their operating finances, etc.

Controlling

Controliing is used to track the revenues and expenses based on particular reporting necessities, i.e. by department or specific activity or project. Each revenue or expense transaction practiced within *Financial Information System* will incorporate a code furnished from each of these components. Controlling permits the system-user to report on intended spending and evaluate it to the real postings of taxations and operating expense for a particular department, program/activity at the general ledger level in detail. The departments and projects are identified in Controlling by utilizing various codes, namely Cost Centers and Internal Orders.

BENEFITS & LIMITATIONS OF FINANCIAL INFORMATION SYSTEM

A financial information system is not suitable for everyone. Due to its complexity and cost, it is better suited for medium- and large-sized organizations.

TRANSACTION PROCESSING SYSTEM

A Transaction Processing System (TPS) is a type of information system that collects, stores, modifies and retrieves the data transactions of an enterprise. TPS supports the processing of the organization transactions which are routine business events and that affect the financial health of an organization. Examples of TPS are payroll processing, order entry system, inventory system, invoicing system, accounts receivable system, accounts payable system, purchasing system, general ledger system etc. A transaction processing system collects and stores data about transactions and sometimes be using a credit card, making a reservation or making cash withdrawal at an ATM. Transaction processing is a type of computer processing that takes place in the presence of a computer user. It allows for an immediate response to a user request (or transaction). Examples of such systems would be Airline Reservation Systems, Banking Systems, or the Accounting System of almost any large company.

There are two types of transaction processing:

Batch transaction processing: this is information that is gathered and stored but not processed immediately i.e. the processing of an invoice or cheques in a banking system.

Real time transaction processing: this is a transaction which is processed immediately and the operator has access to on-line database i.e. withdrawal from a bank account, Library loans.

FUNCTION OF TRANSACTION PROCESSING SYSTEM (TPS):

a. Book keeping:

Book keeping involves keeping accurate records of firm's business transactions. Every organization is involved with day-to-day business transactions between groups such as customers and suppliers, because these transactions establish linkage among them and are so important as bread & butter for human. For example, banks typically both human tellers and automatic teller machines to record deposits & withdrawals of account holders. Colleges and universities record student registrations and fees paid by students. All of these tasks involve keeping accurate records of the firm's business transactions.

b. Issuance:

Issuance refers to the production of such documents as pay cheque, invoices, monthly telephone and credit card bills, and payment reminders. The creation of these documents is absolutely necessary to the effective operation of the company i.e. these documents are not discretionary.

c. Control Reporting:

It involves reports on transactions for controlling the whole process.

FEATURES OF TRANSACTION PROCESSING SYSTEMS

The success of commercial enterprises depends on the reliable processing of transactions to ensure that customer orders are met on time, and that partners and suppliers are paid and can make payment. The field of transaction processing, therefore, has become a vital part of effective business management, led by such organizations as the Association for Work Process Improvement and the Transaction Processing Performance Council.

Transaction processing systems offer enterprises the means to rapidly process transactions to ensure the smooth flow of data and the progression of processes throughout the enterprise. Typically, a TPS will exhibit the following characteristics:

Rapid Processing

The rapid processing of transactions is vital to the success of any enterprise – now more than ever, in the face of advancing technology and customer demand for immediate action. TPS systems are designed to process transactions virtually instantly to ensure that customer data is available to the processes that require it.

Reliability

Many organizations rely heavily on their TPS; a breakdown will disrupt operations or even stop the business. For a TPS to be effective its failure rate must be very low. If a TPS does fail, then quick and accurate recovery must be possible. This makes well–designed backup and recovery procedures essential.

Standardization

Transactions must be processed in the same way each time to maximize efficiency. To ensure this, TPS interfaces are designed to acquire identical data for each transaction, regardless of the customer.

Controlled Access

Since TPS systems can be such a powerful business tool, access must be restricted to only those employees who require their use. Restricted access to the system ensures that employees who lack the skills and ability to control it cannot influence the transaction process. For example if an organization allocates roles and responsibilities to particular employees, then the TPS should enforce and maintain this requirement. An example of this is an ATM transaction.

COMPONENTS

1. **Input:** The act of entering data into a computer is called input. Input can take a variety of forms, from commands you enter from the keyboard to data from another computer or device. A device that feeds data into a computer, such as a keyboard or mouse, is called an input device. Examples of *inputs* are customer orders, sales slips, invoices, purchase orders, employee time cards etc.

2. Processing: Processing means performing a series of operations on data in order to change it or preserve it.

3. Storage: the process of storing information in a computer memory or on a magnetic tape or disk

4. Output: It is any document generated in the system. Anything that comes out of a computer is called output. Output can be meaningful information and it can appear in a variety of forms as pictures, as printed pages. Output devices include display screens, loudspeakers, and printers. Examples of *outputs* are trial balance, financial reports, operational reports, paychecks etc.

ADVANTAGES OF TPS

The advantage is that usually transaction processing is really fast, it takes up usually a few seconds, however, if there a lot of files in queue, the time taken to process data might take a long time. Another advantage is that it makes the process of booking fairer as files are processed in order in which they had been queued. (e.g. ticket booking)

DISADVANTAGES OF TPS

The disadvantage is that there is a chance of double booking. Also, transaction processing systems need to use direct access files, serial access media such as magnetic tape cannot be used.

ENTERPRISE RESOURCE PLANNING SYSTEM

ERP is business management software that allows an organization to use a system of integrated applications to manage the business. ERP software integrates all facets of an operation, including development, manufacturing, sales and marketing.

Enterprise resource planning (ERP) systems integrate internal and external management information across an entire organization, embracing finance/accounting, manufacturing, sales and service, customer relationship management, etc. ERP systems automate this activity with an integrated software application. Their purpose is to facilitate the flow of information between all business functions inside the boundaries of the organization and manage the connections to outside stakeholders.

UNIT (IV)

ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is the intelligence of machines and the branch of computer science that aims to create it. **John McCarthy**, who coined the term in 1956, defines it as "the science and engineering of making intelligent machines."

Artificial intelligence is the branch of computer science that focuses on the development of computer systems to simulate the processes of problem solving and duplicate the functions of human brain. According to **Elaine Rich (1983)**, "Artificial intelligence is the study of how to make computers do things at which, at moment, people are better".

Artificial intelligence comprises hardware and software systems and techniques that attempt to emulate human mental and physical processes. The mental processes emulated include thinking, reasoning, decision making, data storage and retrieval, problem-solving, and learning. The physical processes include human senses and motor skills. Artificial is also called machine intelligence.

Here are three things to remember about artificial intelligence:

1. Artificial intelligence programs are creating promising business solutions. Artificial intelligence applications use voice recognition, neural network technology and diagnostic systems to solve business problems with a high level of difficulty.

2. Artificial intelligence software is used in the sciences, academic defense, engineering, banking, manufacturing and business industries.

3. AI software needs to be dynamic, highly reliable, practical and affordable to be used in the small to medium-size business markets. AI software should provide solutions to your business needs that other software does not.

APPROACHES TO ARTIFICIAL INTELLIGENCE

Approaches of AI are divided into two main lines of thought, the bottom up and the top down approach:

Neural Networks: This is the bottom up approach. It basically aims at mimicking the structure and functioning of the human brain, to create intelligent behavior. Researchers are attempting to build a silicon-based electronic network that is modeled on the working and form of the human brain! Our brain is a network of billions of neurons, each connected with the other.

At an individual level, a neuron has very little intelligence, in the sense that it operates by a simple set of rules, conducting electric signals through its network. However, the combined network of all these neurons creates intelligent behavior that is unrivaled and unsurpassed. So

these researchers created network of electronic analogues of a neuron, based on Boolean logic. Memory was recognized to be an electronic signal pattern in a closed neural network.

How the human brain works is, it learns to realize patterns and remembers them. Similarly, the neural networks developed have the ability to learn patterns and remember. This approach has its limitations due to the scale and complexity of developing an exact replica of a human brain, as the neurons number in billions! Currently, through simulation techniques, people create virtual neural networks. This approach has not been able to achieve the ultimate goal but there is a very positive progress in the field. The progress in the development of parallel computing will aid it in the future.

Expert Systems: This is the top down approach. Instead of starting at the base level of neurons, by taking advantage of the phenomenal computational power of the modern computers, followers of the expert systems approach are designing intelligent machines that solve problems by deductive logic. It is like the dialectic approach in philosophy.

This is an intensive approach as opposed to the extensive approach in neural networks. As the name expert systems suggest, these are machines devoted to solving problems in very specific niche areas. They have total expertise in a specific domain of human thought. Their tools are like those of a detective or sleuth. They are programmed to use statistical analysis and data mining to solve problems. They arrive at a decision through a logical flow developed by answering yes-no questions.

Chess computers like Fritz and its successors that beat chess grandmaster Kasparov are examples of expert systems. Chess is known as the drosophila or experimental specimen of artificial intelligence.

APPLICATIONS OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence in the form of expert systems and neural networks have applications in every field of human endeavor. They combine precision and computational power with pure logic, to solve problems and reduce error in operation. Already, robot expert systems are taking over many jobs in industries that are dangerous for or beyond human ability. Some of the applications divided by domains are as follows:

1) Heavy Industries and Space: Robotics and cybernetics have taken a leap combined with artificially intelligent expert systems. An entire manufacturing process is now totally automated, controlled and maintained by a computer system in car manufacture, machine tool production, computer chip production and almost every high-tech process. They carry out dangerous tasks like handling hazardous radioactive materials. Robotic pilots carry out complex maneuvering techniques of unmanned spacecrafts sent in space. Japan is the leading country in the world in

(50)

terms of robotics research and use.

2) **Finance**: Banks use intelligent software applications to screen and analyze financial data. Software programs that can predict trends in the stock market have been created which have been known to beat humans in predictive power.

3) **Computer Science**: Researchers in quest of artificial intelligence have created spin offs like dynamic programming, object oriented programming, symbolic programming, intelligent storage management systems and many more such tools. The primary goal of creating an artificial intelligence still remains a distant dream but people are getting an idea of the ultimate path which could lead to it.

4) **Aviation**: Air lines use expert systems in planes to monitor atmospheric conditions and system status. The plane can be put on auto pilot once a course is set for the destination.

5) **Weather Forecast**: Neural networks are used for predicting weather conditions. Previous data is fed to a neural network which learns the pattern and uses that knowledge to predict weather patterns.

6) **Swarm Intelligence**: This is an approach to, as well as application of artificial intelligence similar to a neural network. Here, programmers study how intelligence emerges in natural systems like swarms of bees even though on an individual level, a bee just follows simple rules. They study relationships in nature like the prey-predator relationships that give an insight into how intelligence emerges in a swarm or collection from simple rules at an individual level. They develop intelligent systems by creating agent programs that mimic the behavior of these natural systems.

7) **Game Playing:** You can buy machines that can play master level chess for a few hundred dollars. There is some AI in them, but they play well against people mainly through brute force computation--looking at hundreds of thousands of positions. To beat a world champion by brute force and known reliable heuristics requires being able to look at 200 million positions per second.

8) **Natural Language Processing**: Natural language processing (NLP) is a field of computer science and linguistics concerned with the interactions between computers and human (natural) languages; it began as a branch of artificial intelligence. In theory, natural language processing is a very attractive method of human–computer interaction. A natural language is a spoken or written human language. Natural language is designed to accept language input, interpret and process the input, and output natural language result.
Natural language processing is divided into two sub-branches: understanding and output. Natural language understanding explores methods of computer comprehension of human language stimuli. Natural language output is the ability of computer to communicate verbally with a human. Natural language understanding is sometimes referred to as an AI-complete problem because it seems to require extensive knowledge about the outside world and the ability to manipulate it.

9) Speech Recognition: Whereas natural language processing receives commands in text format, speech recognition allows a computer to respond to voice input. The goal of speech recognition research is to simplify the process of interactive communication between human and computers. Speech recognition is accomplished by use of an electronic process which converts analog voice input into signals that can be understood by the NLP system. A process involving search and pattern recognition, and pattern matching is used. The speech recognition ability accomplished through hardware, although the use of software processes is gaining. By using a software approach, speech recognition and NLP can be combined.

10) Computer Vision: The world is composed of three-dimensional objects, but the inputs to the human eye and computers' TV cameras are two dimensional. Some useful programs can work solely in two dimensions, but full computer vision requires partial three-dimensional information, that is not just a set of two-dimensional views. At present there are only limited ways of representing three-dimensional information directly, and they are not as good as what humans evidently use.

11) Heuristic Classification: One of the most feasible kinds of expert system given the present knowledge of AI is to put some information in one of a fixed set of categories using several sources of information. An example is advising whether to accept a proposed credit card purchase. Information is available about the owner of the credit card, his record of payment and also about the item he is buying and about the establishment from which he is buying it (e.g., about whether there have been previous credit card frauds at this establishment).

12) Robotics: In contrast to AI efforts to emulate human mental abilities, robotics is concerned with engineering attempts to duplicate human physical attributes. Robots are electromechanical machines that are programmable and perform manipulative tasks. These task range from delicate to heavy-duty. A typical robot is a manipulator arm used in manufacturing to weld, paint, insert screws, lift, and move parts.

AI IN BUSINESS AND INDUSTRY

Artificial Intelligence (AI) has been used in business applications since the early eighties. As with all technologies, AI initially generated much interest, but failed to live up to the hype. However, with the advent of web-enabled infrastructure and rapid strides made by the AI development community, the application of AI techniques in real-time business applications has picked up substantially in the recent past.

AI is a broad discipline that promises to simulate numerous innate human skills such as automatic programming, case-based reasoning, neural networks, decision-making, expert systems, fuzzy logic, natural language processing, pattern recognition and speech recognition etc. AI technologies bring more complex data-analysis features to existing applications.

Business applications utilize the specific technologies mentioned earlier to try and make better sense of potentially enormous variability (for example, unknown patterns/relationships in sales data, customer buying habits, and so on). However, within the corporate world, AI is widely used for complex problem-solving and decision-support techniques (neural networks and expert

systems) in real-time business applications. The business applicability of AI techniques is spread across functions ranging from finance management to forecasting and production.

The proven success of Artificial Neural Networks (ANN) and expert systems has helped AI gain widespread adoption in enterprise business applications. In some instances, such as fraud detection, the use of AI has already become the most preferred method. In addition, neural networks have become a well-established technique for pattern recognition, particularly of images, data streams and complex data sources and, in turn, have emerged as a modeling backbone for a majority of data-mining tools available in the market. Some of the key business applications of AI/ANN include fraud detection, cross-selling, customer relationship management analytics, demand prediction, failure prediction, and non-linear control.

Numerous software vendors in the market, such as Ward Systems Group and Neural ware, provide off-the-shelf tools for ANN. However, a majority of the enterprises adopt horizontal or vertical solutions that embed neural networks such as insurance risk assessment or fraud-detection tools from HNC, or data-mining tools that include neural networks (for instance, from SAS, IBM and SPSS) as one of the modeling options.

Additionally, autonomic computing concepts derived from AI technologies, which facilitate self-healing systems, have generated a lot of hype in the recent past. Autonomic systems auto-configure for changing conditions, continuously monitor the constituent system parts and fine-tune workflow to achieve pre-determined system goals.

Of late, AI has found a home in financial services and is recognized as a valuable addition to numerous business applications. Sophisticated technologies encompassing neural networks and business rules along with AI-based techniques are yielding positive results in transaction-oriented scenarios for financial services. AI has been widely adopted in such areas of risk management, compliance, and securities trading and monitoring, with an extension into customer relationship management (CRM). Tangible benefits of AI adoption include reduced risk of fraud, increased revenues from existing customers due to newer opportunities, avoidance of fines stemming from non-compliance and averted securities trade exceptions that could result in delayed settlement, if not detected.

It is also being widely adopted in diagnostics and testing. Diagnostic systems are used to examine networks, aircraft engines, manufacturing machinery and other types of equipment, energy pipelines, hazardous materials, and so on. Similarly, in the transportation industry, which is also fast catching up with the trend, AI is being used for traffic management systems, aircraft maintenance operations, airport gate scheduling, railroad planning and forecasting assignments.

In the fiercely competitive and dynamic market scenario, decision-making has become fairly complex and latency is inherent in many processes. In addition, the amount of data to be analyzed has increased substantially. AI technologies help enterprises reduce latency in making business decisions, minimize fraud and enhance revenue opportunities.

Enterprises that utilize AI-enhanced applications are expected to become more diverse, as the needs for the ability to analyze data across multiple variables, fraud detection and customer relationship management emerge as key business drivers to gain competitive advantage. Though the financial services sector is an evangelist in the implementation of AI technologies, other sectors such as manufacturing, transportation, logistics, and healthcare have fast caught on.

According to a report from a business research company, the total worldwide AI market was $11.9 billion in 2002 and is expected to grow at an average annual growth rate of 12.2 per cent to reach $21.2 billion by 2007. Isn't this testimony to the fact that AI for business applications is truly back with a bang!

EXPERT SYSTEM

In artificial intelligence, an **expert system** is a computer system that emulates the decision-making ability of a human expert. Expert systems are designed to solve complex problems by reasoning about knowledge, like an expert, and not by following the procedure of a developer as is the case in conventional programming. The first expert systems were created in the 1970s and then proliferated in the 1980s. Expert systems were among the first truly successful forms of AI software.

According to **Peter Jackson**, "an expert system can be defined as the computer program that has the ability to represent and reason with the knowledge of some of the particular subject specialist with a view to solving problems or giving any type of the advice".

A very better view about the expert systems can be obtained by under – standing the concept of the expert system given by **Robert Barwoman and David Glover**. According to both of them, expert system can be defined as the "highly specialized computer systems having the ability of stimulating that particular element of the human specialist's knowledge and reasoning that can be formulated into the knowledge chunks, characterized by a set of the human facts and the different heuristic rules".

According to **Bruce Buchanan and Reid Smith**, an expert system can be defined as the computer programs that –

1. Has the ability to explain both what it knows and the reasons for its answers.
2. Performs well in the problem area.
3. Reasons with the domain – specific knowledge.
4. Uses the domain – specific methods that are heuristic in the nature and are also following the different types of the procedures that are algorithmic.
5. Has the ability to retain the flexibility.

In general an expert system can be referred to as the technology that has the ability to make the computer programming very easier in the nature and also very effective in the working. The expert system also helps in carrying out the transformation in the computing with the help of the

movement of the various programming techniques beyond the numerical programming into a realm of the logical, symbolic programming.

An expert system is a computer application or programme that is used to represent the knowledge of human experts in a specialized area like genetic engineering, medical sciences etc. Using an ES, a non-expert can achieve performance comparable to an expert in that particular area or domain. Sometimes the problem solving capabilities of such systems are as good as or even better than those of human experts.

ES in practical use	
Task Domain	**Expert System**
Medical consultancy	MYCIN
Financial planning	PLANMAN
Molecular structure	DENDRAL

For example, the doctor seeks additional expertise from a specialist for diagnosis and prescription for an ailment with which the doctor is not familiar.

The accountant in recommending a business plan for a client will seek specialist advice from a tax consultant.

Before finalize a major contract with another company a business executive will require expert advice on that company's financial health.

STAGES IN ES DEVELOPMENT

In a typical development of an ES there are two distinct phases.

1) Development phase
2) Consultation phase

In the development phase, the expert and the knowledge engineer work together to get the knowledge base. The knowledge base is then given to an inference engine which is built for a specific application. A user interface consisted with the knowledge representation scheme is prepared to provide a consultation phase where the user can use the system to get the expert advice.

COMPONENTS OF AN ES

1) **User Interface:** The human computer interface or user interface technology allows users to interact with the system. The user presents the problem and has the conclusions. A significant feature of some expert systems is that they can justify the conclusion reached as well as explain that while certain options were used or discarded.

2) **Inference Engine:** The inference engine is that part of the programme which reasons and determines how to apply the knowledge in the knowledge base to the facts and premises presented at the user interface. The Inference engine performs this task in order to deduce new facts which are then used to draw future conclusion. The inference engine is the active component of an ES. The aim of the inference engine is to mimked human reasoning so that the user can understand why the system has chosen the steps is has. There are various inference technique for different reasoning methods. These include backward and forward chaining. Backward Chaining consider a diagnostic expert. He would start with a hypothetical fault and then reason backwards to arrive at possible symptoms. In forward chaining the reverse action is taken i.e. it works from the known facts to establish possible conclusions or goals.

3) **Knowledge Base:** this is the most important element of an expert system since it holds the expert's problems solving knowledge. It is that component of an ES where the knowledge elicited from the Expert is stored. It is very easier to add or change knowledge. The key to the knowledge base is now the knowledge is represented. The Knowledge acquired from the experts has to be represented formally. There are several types of representation techniques used such as

   I) Production Rules System

   ii) A Structured Object

   iii) Predicate Calculus or Logic

   The choice of representation for a particular application depends on the problems to be solved and also the form in which the knowledge can be most easily describe and used.

THE APPLICATIONS OF EXPERT SYSTEMS

The spectrum of applications of expert systems technology to industrial and commercial problems is so wide as to defy easy characterization. The applications find their way into most areas of knowledge work. Applications tend to cluster into seven major classes.

1) Diagnosis and Troubleshooting of Devices and Systems of All Kinds

This class comprises systems that deduce faults and suggest corrective actions for a malfunctioning device or process. Medical diagnosis was one of the first knowledge areas to which ES technology was applied (for example, see Shortliffe 1976), but diagnosis of engineered systems quickly surpassed medical diagnosis. There are probably more diagnostic applications of ES than any other type. The diagnostic problem can be stated in the abstract as: given the evidence presenting itself, what is the underlying problem/reason/cause?

2) Planning and Scheduling

Systems that fall into this class analyze a set of one or more potentially complex and interacting goals in order to determine a set of actions to achieve those goals, and/or provide a detailed temporal ordering of those actions, taking into account personnel, materiel, and other constraints. This class has great commercial potential, which has been recognized. Examples involve airline scheduling of flights, personnel, and gates; manufacturing job-shop scheduling; and manufacturing process planning.

3) Configuration of Manufactured Objects from Subassemblies

Configuration, whereby a solution to a problem is synthesized from a given set of elements related by a set of constraints, is historically one of the most important of expert system applications. Configuration applications were pioneered by computer companies as a means of facilitating the manufacture of semi-custom minicomputers (McDermott 1981). The technique has found its way into use in many different industries, for example, modular home building, manufacturing, and other problems involving complex engineering design and manufacturing.

4) Financial Decision Making

The financial services industry has been a vigorous user of expert system techniques. Advisory programs have been created to assist bankers in determining whether to make loans to businesses and individuals. Insurance companies have used expert systems to assess the risk presented by the customer and to determine a price for the insurance. A typical application in the financial markets is in foreign exchange trading.

5) Knowledge Publishing

This is a relatively new, but also potentially explosive area. The primary function of the expert system is to deliver knowledge that is relevant to the user's problem, in the context of the user's problem. The two most widely distributed expert systems in the world are in this category. The first is an advisor which counsels a user on appropriate grammatical usage in a text. The second is a tax advisor that accompanies a tax preparation program and advises the user on tax strategy, tactics, and individual tax policy.

6) Process Monitoring and Control

Systems falling in this class analyze real-time data from physical devices with the goal of noticing anomalies, predicting trends, and controlling for both optimality and failure correction. Examples of real-time systems that actively monitor processes can be found in the steel making and oil refining industries.

7) Design and Manufacturing

These systems assist in the design of physical devices and processes, ranging from high-level conceptual design of abstract entities all the way to factory floor configuration of manufacturing processes.

"Expert systems also called "knowledge-based" systems are computer programs that use expertise to assist people in performing a wide variety of functions, including diagnosis, planning, scheduling and design. Thousands of systems are now in routine use worldwide, and span the full spectrum of activities in business, industry and government.

Economic gain has been realized along many dimensions: speed-up of professional work, internal cost savings on operations, return on investment, improved quality and consistency of decision making, new products and services, captured organizational know-how, improvements in the way a company does its business, crisis management, and simulation of innovation."

BENEFITS OF EXPERT SYSTEM

1) **Conversational**

Expert systems offer many advantages for users when compared to traditional programs because they operate like a human brain.

2) **Quick availability and opportunity to program itself**

As the rule base is in everyday language (the engine is untouchable), expert system can be written much faster than a conventional program, by users or experts, bypassing professional developers and avoiding the need to explain the subject.

3) **Ability to exploit a considerable amount of knowledge**

The expert system uses a rule base, unlike conventional programs, which means that the volume of knowledge to program is not a major concern. Whether the rule base has 10 rules or 10 000, the engine operation is the same.

4) **Reliability**

The reliability of an expert system is the same as the reliability of a database, i.e. good, higher than that of a classical program.

5) **Scalability**

Evolving an expert system is to add, modify or delete rules. Since the rules are written in plain language, it is easy to identify those to be removed or modified.

6) **Completeness**

An expert system can review all the transactions, a human expert can only review a sample.

7) **Documentation**

An expert system can provide permanent documentation of the decision process

8) **Pedagogy**

The engines that are run by a true logic are able to explain to the user in plain language why they ask a question and how they arrived at each deduction. In doing so, they show knowledge of the expert contained in the expert system. So, user can learn this knowledge in its context. Moreover, they can communicate their deductions step by step. So, the user has information about their problem even before the final answer of the expert system.

9) **Preservation and improvement of knowledge**

Valuable knowledge can disappear with the death, resignation or retirement of an expert. Recorded in an expert system, it becomes eternal. To develop an expert system is to interview an expert and make the system aware of their knowledge. In doing so, it reflects and enhances it.

10) **New areas neglected by conventional computing**

Automating a vast knowledge, the developer may meet a classic problem: "combinatorial explosion" commonly known as "information overload" that greatly complicates his work and results in a complex and time consuming program. The reasoning expert system does not encounter that problem since the engine automatically loads combinatorics between rules. This ability can address areas where combinatorics are enormous: highly interactive or conversational applications, fault diagnosis, decision support in complex systems, educational software, logic simulation of machines or systems, constantly changing software.

DISADVANTAGES OF EXPERT SYSTEM

1) **Common sense:** In addition to a great deal of technical knowledge, human experts have common sense. It is not yet known how to give expert systems common sense.

2) **Creativity:** Human experts can respond creatively to unusual situations, expert systems cannot.

3) **Learning**: Human experts automatically adapt to changing environments; expert systems must be explicitly updated. Case-based reasoning and neural networks are methods that can incorporate learning.

4) Sensory **Experience**: Human experts have available to them a wide range of sensory experience; expert systems are currently dependent on symbolic input.

5) **Degradation** - Expert systems are not good at recognizing when no answer exists or when the problem is outside their area of expertise.

NEURAL NETWORK

In information technology, a neural network or artificial neural network is a system of programs and data structures that approximates the operation of the human brain. An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements (neurons) working in unison to solve specific problems. ANNs, like people, learn by example. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process. Learning in biological systems involves adjustments to the synaptic connections that exist between the neurons.

Some Other Definitions of a Neural Network include:

Dr. Robert **Hecht-Nielsen defines a neural network as:**

"...a computing system made up of a number of simple, highly interconnected processing elements, which process information by their dynamic state response to external inputs.

In "Neural Network Primer: Part I" by Maureen Caudill, AI Expert, Feb. 1989

ANNs are processing devices (algorithms or actual hardware) that are loosely modeled after the neuronal structure of the mamalian cerebral cortex but on much smaller scales. A large ANN might have hundreds or thousands of processor units, whereas a mamalian brain has billions of neurons with a corresponding increase in magnitude of their overall interaction and emergent behavior. Although ANN researchers are generally not concerned with whether their networks accurately resemble biological systems, some have. For example, researchers have accurately simulated the function of the retina and modeled the eye rather well.

Although the mathematics involved with neural networking is not a trivial matter, a user can rather easily gain at least an operational understanding of their structure and function.

According to the DARPA Neural Network Study (1988, AFCEA International Press, p. 60):

... a neural network is a system composed of many simple processing elements operating in parallel whose function is determined by network structure, connection strengths, and the processing performed at computing elements or nodes.

According to Haykin, S. (1994), Neural Networks: A Comprehensive Foundation, NY: Macmillan, p. 2:

A neural network is a massively parallel distributed processor that has a natural propensity for storing experiential knowledge and making it available for use. It resembles the brain in two respects:

1. Knowledge is acquired by the network through a learning process.
2. Interneuron connection strengths known as synaptic weights are used to store the knowledge.

WHY USE A NEURAL NETWORK?

Neural networks, with their remarkable ability to derive meaning from complicated or imprecise data, can be used to extract patterns and detect trends that are too complex to be noticed by either humans or other computer techniques. A trained neural network can be thought of as an "expert" in the category of information it has been given to analyze. This expert can then be used to provide projections given new situations of interest and answer "what if" questions.
Other advantages include:

1. **Adaptive learning:** An ability to learn how to do tasks based on the data given for training or initial experience.
2. **Self-Organization:** An ANN can create its own organization or representation of the information it receives during learning time.
3. **Real Time Operation:** ANN computations may be carried out in parallel, and special hardware devices are being designed and manufactured which take advantage of this capability.
4. **Fault Tolerance via Redundant Information Coding:** Partial destruction of a network leads to the corresponding degradation of performance. However, some network capabilities may be retained even with major network damage.

APPLICATIONS OF NEURAL NETWORKS

Neural networks are applicable in virtually every situation in which a relationship between the predictor variables (independents, inputs) and predicted variables (dependents, outputs) exists, even when that relationship is very complex and not easy to articulate in the usual terms of "correlations" or "differences between groups." A few representative examples of problems to which neural network analysis has been applied successfully are:

- **Detection of medical phenomena**

  A variety of health-related indices (e.g., a combination of heart rate, levels of various substances in the blood, respiration rate) can be monitored. The onset of a particular medical condition could be associated with a very complex (e.g., nonlinear and interactive) combination of changes on a subset of the variables being monitored. Neural networks have been used to recognize this predictive pattern so that the appropriate treatment can be prescribed.

- Stock market prediction

Fluctuations of stock prices and stock indices are another example of a complex, multidimensional, but in some circumstances at least partially-deterministic phenomenon. Neural networks are being used by many technical analysts to make predictions about stock prices based upon a large number of factors such as past performance of other stocks and various economic indicators.

- **Credit assignment**

A variety of pieces of information are usually known about an applicant for a loan. For instance, the applicant's age, education, occupation, and many other facts may be available. After training a neural network on historical data, neural network analysis can identify the most relevant characteristics and use those to classify applicants as good or bad credit risks.

- **Monitoring the condition of machinery**

Neural networks can be instrumental in cutting costs by bringing additional expertise to scheduling the preventive maintenance of machines. A neural network can be trained to distinguish between the sounds a machine makes when it is running normally ("false alarms") versus when it is on the verge of a problem. After this training period, the expertise of the network can be used to warn a technician of an upcoming breakdown, before it occurs and causes costly unforeseen "downtime."

- **Engine management**

Neural networks have been used to analyze the input of sensors from an engine. The neural network controls the various parameters within which the engine functions, in order to achieve a particular goal, such as minimizing fuel consumption.

- **Neural network in practice**

Neural networks have broad applicability to real world business problems. In fact, they have already been successfully applied in many industries.

Since neural networks are best at identifying patterns or trends in data, they are well suited for prediction or forecasting needs including:

- sales forecasting
- industrial process control
- customer research
- data validation
- risk management
- target marketing

But to give you some more specific examples; ANN are also used in the following specific paradigms: recognition of speakers in communications; diagnosis of hepatitis; recovery of telecommunications from faulty software; interpretation of multimeaning Chinese words; undersea mine detection; texture analysis; three-dimensional object recognition; handwritten word recognition; and facial recognition.

BENEFITS OF NEURAL NETWORK

- **Problem Solving:** Neural networks can help solve problems that are too complex for conventional technology that relies on finding an algorithmic solution. Real-world problems that require adaptable thinking include sales forecasting, industrial process control, customer research, risk management, target marketing and texture analysis. Neural networks help in these areas because of their ability to derive meaning from complicated and imprecise data.
- **Real-Time Operation:** Unlike conventional serial computers, neural networks do not execute programmed instructions. Instead, they respond in parallel to the pattern of inputs presented to them. Neural networks create their own organization or representation of information fed into them during the learning time. Memory isn't stored separately but across the whole network. The "knowledge" of the network is, therefore, greater than the sum of its individual parts.

- **Fault Tolerance:** If a neural network is partly destroyed, some areas will have a degradation of performance. Unlike traditional networks, however, some capabilities of a neural network are maintained even with major damage. This is much the same as when a person suffers localized brain damage that affects only certain cognitive abilities.

- **Flexibility:** Artificial neural networks have the ability to generalize and learn. They acquire knowledge from their surroundings by adapting to internal and external parameters. The network learns from examples and adapts to situations based on its findings. It generalizes knowledge to produce adequate responses to unknown situations. Artificial neural networks solve complex problems that are difficult to manage by approximation.

- **Non-Linearity:** A computational neuron can produce a linear or a non-linear answer. A non-linear artificial network is made by the interconnection of non-linear neurons. Non-linear systems have inputs that are not proportional to the outputs. This function allows the network to efficiently acquire knowledge through learning. This is a distinct advantage over a traditionally linear network that is inadequate when it comes to modeling non-linear data.
- **Adaptive Learning:** An artificial neuron network is based around the concept of abstract learning. Three learning paradigms function to equip the network for adaptive learning. These are reinforcement learning, unsupervised learning and supervised learning. Neuron networks can be trained via specialized algorithms including non-parametric methods, expectation maximization, simulated annealing and evolutionary methods. The neurons of an artificial neuron network are flexible enough to be attuned to various input signal patters and acclimatize to a diverse array of unknown situations. They are constantly

accepting and replacing previously learned information, keeping their repository of problem solving techniques updated.

- **Neurobiological Analogy:** Biological neural networks are extremely complex, and humans have yet to understand them completely. However, their understanding has critical applications in medical and psychological science, including but not limited to behavioral analysis and treatment of diseases and defects of the nervous system. Artificial neural networks help as research tools in developing understanding by simulating those networks. Significant developments in the field of neuroscience have been made by research involving artificial neural network models.

- **Self Repair:** The fault tolerance capability is best put to use in the self-repair of a neural network. This entails the surviving part of the network detects any fault or disruption and attempts to repair the failed components using retained data about the overall network. This is a major application in artificial intelligence and saves a lot of effort in debugging the network, as most crashes are handled by the network itself. Furthermore, it also provides useful insight on the self-repairing mechanism of biological neural networks and helps develop techniques to accelerate or aid the natural self-healing process rather than employing artificial healing, which often has negative side effects.

INTELLIGENT AGENT

In artificial intelligence, an **intelligent agent (IA)** is an autonomous entity which observes through sensors and acts upon an environment using actuators (i.e. it is an agent) and directs its activity towards achieving goals (i.e. it is rational). Intelligent agents may also learn or use knowledge to achieve their goals. They may be very simple or very complex: a reflex machine such as a thermostat is an intelligent agent, as is a human being, as is a community of human beings working together towards a goal.

Intelligent agents in artificial intelligence are closely related to agents in economics, and versions of the intelligent agent paradigm are studied in cognitive science, ethics, the philosophy of practical reason, as well as in many interdisciplinary socio-cognitive modeling and computer social simulations.

Intelligent agents are also closely related to software agents (an autonomous software program that carries out tasks on behalf of users). In computer science, the term *intelligent agent* may be used to refer to a software agent that has some intelligence, regardless if it is not a rational agent by Russell and Norvig's definition. For example, autonomous programs used for operator assistance or data mining (sometimes referred to as *bots*) are also called "intelligent agents".

Intelligent agents have been defined many different ways. According to Nikola Kasabov, IA systems should exhibit the following characteristics:

- accommodate new problem solving rules incrementally
- adapt online and in real time
- be able to analyze itself in terms of behavior, error and success.
- learn and improve through interaction with the environment (embodiment)
- learn quickly from large amounts of data
- have memory-based exemplar storage and retrieval capacities
- have parameters to represent short and long term memory, age, forgetting, etc.

- One definition: An (intelligent) **agent** perceives it environment via sensors and acts rationally upon that environment with its effectors. Hence, an agent gets percepts one at a time, and maps this percept sequence to actions.
- Another definition: An agent is a computer software system whose main characteristics are situatedness, autonomy, adaptivity, and sociability.

CLASSES OF INTELLIGENT AGENTS

A general learning agent Russell & Norvig (2003) group agents into five classes based on their degree of perceived intelligence and capability:

1. simple reflex agents
2. model-based reflex agents
3. goal-based agents
4. utility-based agents
5. learning agents

Simple reflex agents: Simple reflex agents act only on the basis of the current percept, ignoring the rest of the percept history. The agent function is based on the *condition-action rule*: if condition then action.

This agent function only succeeds when the environment is fully observable. Some reflex agents can also contain information on their current state which allows them to disregard conditions whose actuators are already triggered.

Infinite loops are often unavoidable for simple reflex agents operating in partially observable environments. Note: If the agent can randomize its actions, it may be possible to escape from infinite loops.

Model-based reflex agents: A model-based agent can handle a partially observable environment. Its current state is stored inside the agent maintaining some kind of structure which

describes the part of the world which cannot be seen. This knowledge about "how the world works" is called a model of the world, hence the name "model-based agent".

A model-based reflex agent should maintain some sort of internal model that depends on the percept history and thereby reflects at least some of the unobserved aspects of the current state. It then chooses an action in the same way as the reflex agent.

Goal-based agents: Goal-based agents further expand on the capabilities of the model-based agents, by using "goal" information. Goal information describes situations that are desirable. This allows the agent a way to choose among multiple possibilities, selecting the one which reaches a goal state. Search and planning are the subfields of artificial intelligence devoted to finding action sequences that achieve the agent's goals.

In some instances the goal-based agent appears to be less efficient; it is more flexible because the knowledge that supports its decisions is represented explicitly and can be modified.

Utility-based agents: Goal-based agents only distinguish between goal states and non-goal states. It is possible to define a measure of how desirable a particular state is. This measure can be obtained through the use of a *utility function* which maps a state to a measure of the utility of the state. A more general performance measure should allow a comparison of different world states according to exactly how happy they would make the agent. The term utility, can be used to describe how "happy" the agent is.

A rational utility-based agent chooses the action that maximizes the expected utility of the action outcomes- that is, the agent expects to derive, on average, given the probabilities and utilities of each outcome. A utility-based agent has to model and keep track of its environment, tasks that have involved a great deal of research on perception, representation, reasoning, and learning.

Learning agents: Learning has an advantage that it allows the agents to initially operate in unknown environments and to become more competent than its initial knowledge alone might allow. The most important distinction is between the "learning element", which is responsible for making improvements, and the "performance element", which is responsible for selecting external actions.

The learning element uses feedback from the "critic" on how the agent is doing and determines how the performance element should be modified to do better in the future. The performance element is what we have previously considered to be the entire agent: it takes in percepts and decides on actions.

The last component of the learning agent is the "problem generator". It is responsible for suggesting actions that will lead to new and informative experiences.

Other classes of intelligent agents

According to other sources, some of the sub-agents (not already mentioned in this treatment) that may be a part of an Intelligent Agent or a complete Intelligent Agent in themselves are:

- **Decision Agents** (that are geared to decision making);
- **Input Agents** (that process and make sense of sensor inputs – e.g. neural network based agents);
- **Processing Agents** (that solve a problem like speech recognition);
- **Spatial Agents** (that relate to the physical real-world);
- **World Agents** (that incorporate a combination of all the other classes of agents to allow autonomous behaviors).
- **Believable agents** - An agent exhibiting a personality via the use of an artificial character (the agent is embedded) for the interaction.
- **Physical Agents** - A physical agent is an entity which *percepts* through sensors and *acts* through actuators.
- **Temporal Agents** - A temporal agent may use time based stored information to offer instructions or data *acts* to a computer program or human being and takes program inputs

AGENT CHARACTERISTICS

- **Situatedness**
  The agent receives some form of sensory input from its environment, and it performs some action that changes its environment in some way. Examples of environments: the physical world and the Internet.
- **Autonomy**
  The agent can act without direct intervention by humans or other agents and that it has control over its own actions and internal state.
- **Adaptivity**
  The agent is capable of (1) reacting flexibly to changes in its environment; (2) taking goal-directed initiative (i.e., is pro-active), when appropriate; and (3) learning from its own experience, its environment, and interactions with others.
- **Sociability**
  The agent is capable of interacting in a peer-to-peer manner with other agents or humans.
- **Communication**: The agent could interoperate with humans, other agents, legacy systems, and information sources. The agent could interact with the users to receive tasks or to specify the instruction through the agent-user interface, and could collaborate together in communities to achieve common goals.

- **Intelligence:** The agent could monitor its environment to response or perform the task autonomously, and could have the ability to inference, reasoning to make appropriate decision of operation, and could sometimes learn from the reactions or interaction with the user to improve itself, could dynamically adapt to and learn about their environment. They are adaptive to uncertainty and change.
- **Mobility:** The agent could transport itself from one machine to the other, across different architectures and platforms, taking advantages of the Internet.