Chapter 6

Multimedia to Digital Libraries
CHAPTER 6
MULTIMEDIA TO DIGITAL LIBRARIES

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MULTIMEDIA TO DIGITAL LIBRARIES

Introduction

In the fast emerging and evergrowing mist of information explosion, it is very difficult to retrieve particular information without wasting the time. The computers and telecommunication technologies have paved the way to the development of Information Technology which involves use of computers and information systems for storing, managing and accessing useful information in an optimized and organized way. So, to cope up with the information needs of the 21st century end users, the traditional libraries should be changed to Digital/Electronic libraries by providing Digitized Information Services. Digital Information services can be provided only by collecting and maintaining the digital resources of information like Computer Networks, CD ROMs, Internet, Multimedia, Email, Electronic Texts and Journals.

Multimedia information technology and applications have advanced rapidly in recent years. Till today the information storage and retrieval process was through a single media. But now in the era of information it is possible to integrate all the media in a single medium called as multimedia. Multimedia has the potential of new coming one of the most powerful forms of searching for information, communicating ideas and experiencing new concepts of any of communication or networking.

Multimedia computerized method of presenting information by combining audio and video components using text, sound and graphics for developing the effective and easily understandable information. Although multimedia is not a single entity but it is a combination of hardware, software and storage elements needed to develop and play presentations. Multimedia technology thus attempts a real-time integration of various media and computer data for enhanced man-machine interaction encompassing the audiovisual senses. In future, multimedia will play an
important role in the information technology by supporting many types and facilities of information for acquisition, transfer, manipulation, storage and retrieval. Some of the broad uses of multimedia are multimedia conferencing, video mail, office management, business applications, modeling, simulation, teaching and training, entertainment, publishing, high speed networking, health care, virtual reality- a buzzword for interactive real world type learning.

1 Definition

The term multimedia is formed by the combination of two-word multi and medium. Multi refers to many i.e. more than one and media is the plural form of medium. However, a linear dissemination of knowledge e.g. a television – a multimedia kit may not foot the bill but interactive multimedia with the help of computer which integrate many peripherals containing information resources is a sure way to effective learning. With proved cost-effective technology; the use of multimedia is growing rapidly in a wide area of business applications, including training, desktop video conferencing, customer service support presentation materials and 3D design systems.

To give a background to the question of definition, a definition that was given at the UIMS Workshop, Portugal, June 1990 is quoted below:

a) Multi-media is concerned with both input and output (including their combination called interaction)

b) For output, multi-media is concerned with multiple streams operating in parallel (for example, vector graphics, raster graphics, text, video, sound, etc.) Stream may not be the best word – channel, tracks or modes are alternatives.

c) For input, multi-media is concerned with simultaneous input events generated by one or several different devices (for example, key cards, foot pedals spoken commands, data glove, data suite, five
finger mouse, touch screen, eye tracker musical instruments etc.) all being used parallel.

d) On input, it is concerned with the composition of higher level input tokens in term of primitive events. For example, gesture input could be derived from a set of data glove positions.

Multimedia actually encompasses two aspects of technology

- Capability to present multiple media formats within an application.
- The enhancement of the user interface.

2 Type of multimedia

Multimedia can be of two types as below:

2.1 Non-interactive Multimedia

Corporate presentations done in multimedia and presented to an audience are usually non-interactive. Here, the audience plays a rather passive role in that they simply receive the information presented to them in the form of video, sound, images, text animations, etc. projected from the desktop directly to a large screen using a projector.

2.2 Interactive Multimedia

On the other hand interactive multimedia is oriented specifically to the individual use. Here, the user can choose precisely what he wants to know, and move from one point in the environment to another. This process is called “navigation” and is possible because the data exists in a nonlinear manner. This brings us to a concept called Hypermedia, which is the basis for interactive multimedia.

3. Need of Multimedia

- The need for a large volume digital storage system for archival management.
- The need to provide user with immediate access to the rapidly growing volume of data and information i.e. stored in digital
information system and is likely to be distributed on optical media in future.

➢ The need to provide users with access to multimedia information quickly and interactively through the integration technology.
➢ The need to transfer a large volume of data and/or files from one place to another as a resource sharing
➢ To save the time of users in searching the relevant information for his use. Multimedia can be used to create a familiar interface.
➢ Low cost of production. Any one with a equipped computer can produce effective Multimedia applications.
➢ Increased access to data – Data can provide in many forms through intuitive interfaces.
➢ Empowerment of the user. The user can now do more in a shorter time.
➢ Increased retention of the information provided. The user remembers more information for a longer period than with most other methods of information dissemination.
➢ On line network - Many users can use the multimedia system at a time.

4. Components of Multimedia

The media used in multimedia are as below:

❖ Text: Text plays a very important role and is considered as one of the most widely used multimedia component. In multimedia text can be presented in different forms like full text, abstract form, bibliographic format, etc.
❖ Still images: Still images are nothing but graphic images like photographs, drawings, graphs etc. In a multimedia CD-ROM these can be used for easy understanding the information.
❖ Audio: Audio is a major component of multimedia and is particularly important for presentations. By adding a sound card to a PC and
using a waveform audio digitizer board and a microphone one can record voice and line to a slide.

- Digital Video: It is possible to link direct video feeds but it faces a problem, as it requires massive disk space and a fast processor.
- Animation: Animation refers for moving picture or video and is widely used to prepare presentation. Many CD-ROM information sites use animation to enhance the text material for easy understanding.

5. Hypermedia

The term hypermedia has been associated with multimedia and it is generally used to refer to information containing high proportion of graphics and images and its almost always used where the information also included video sequence or any form of animated information.

The first major tool to establish hypermedia, as a practical environment for multimedia application was Apple’s HyperCard. It is based on the process of linking together multimedia data elements like graphics, image, video, animation and sound and allowing different options for getting from one to another. It is a practically powerful approach in knowledge based system, where large information resource can be explored in a fast compelling fashion that suits the natural strategies, institutions and curiosities of human mind.

A hypermedia program’s primary goal is the creation of a hypermedia documents. But, it may also support different media. Other program types may similarly be able to create their multimedia presentations.

6. Hypertext

Hypertext is concerned with the presentation of information in a non-sequential fashion. Unlike paper text where information is generally expected to be read in sequential manner, hypertext allows readers to navigate their own paths through the information. Thus, the author provides
links between the related pieces of information in a manner to choose, which links they wish to explore. Using a computer based hypertext system, students and researchers can quickly follow trials of footnotes and related materials without losing their original context. Since, the information in hypertext is both extensive and highly interlinked the hypertext system can be regarded as a means of browsing through a database of information. A hypertext system is a database management system, which permits one to connect screens of information using associative links, and by allowing users to link information together, thereby creating tracts through associated materials. The reason for multimedia technology to become popular is the facts that now wide range of multimedia add-on products for PC platforms are available at affordable costs. There is also a large range of software packages that are available to develop multimedia applications. The number of CD-ROM based end user titles have also grown exponentially in the recent past.

7. **Multimedia Database Management System (MDBMS)**

The MDBMS is the key to multimedia document storage system. The multimedia system represents integration and management of different database namely alphanumeric, figures, images, sound, etc. In a multimedia system every file containing information in the computer is an object. The object can consist of text files, images, wave form, audio files, digital video animation sequence, sound tracks, or any application software on the computer. The main feature of multimedia is 'links' i.e. any object in the computer's memory can be linked to each other.

8. **Storage Media: Optical disk, CD-ROM etc.**

Library, information and archival work generally deal with very large qualities of information. Regardless of whether information sources are in printed or electronic format, space is always a key issue and efficient storage and retrieval of reliable information are of essential importance to
the users. Now, due to advancement in electronic sector more and more users are using optical media for mass storage of the information. Optical media can be grouped into three major categories.

1. Read only media  
2. Writable media  
3. Erasable

Under each of these major categories multitude of optical storage media are available and CD-ROM is one of the main component in a multimedia system. CD-ROM is latest technology in the field of information storage and retrieval. It has superseded all other magnetic storage media and microforms. It has also overcome the high cost of telecommunication. Its potential as an informative storage media has revolutionized the concept regarding information retrieval also. Accuracy, high storage capacity, rapid data access, low cost, simplicity, standardization and robustness are the advantages of CD Technology.

CD-ROM is a high-capacity optical storage device of 12cms. diameter which can storage upto 650 MB of information; 2,40,000 pages of text or 70 minute of music or video; on a single 16gm platter on polycarbonate. CD-ROM's are used to store encyclopedias, dictionaries, studio quality, audio/video etc. and are largely used as a distribution mechanism for large packages.

Storage and retrieval in CD-ROM's is possible by converting the information into series of 0's and 1's, these digits are stored on an aluminum surface as pits and lands respectively. These pits and lands are arranged on the disc. To read a CD-ROM, a laser light is thrown on the disc surface and the light reflection gives the data. In case of PC's the CD-ROM drive passes the data on the PC, which takes over the task of conversion.

Multimedia Personal Computer (MPC):

A multimedia is a regular PC – It can be used to run non-multimedia software as the user normally using. The difference with a multimedia personal computer is that it has additional hardware, which allows to run the vast array of multimedia software that is available. In order to provide
some sort of reference for buyers of multimedia hardware and software, an organization called the MPC marketing council has established a standard for multimedia machines. This standard is called the MPC specification.

9. Multimedia Applications

Main multimedia applications are as below:

- Office Management
- Business applications
- Education, teaching and training:
- Entertainment:
- Networking:
- Communications

   - Multimedia mail:
   - Conferencing:
- Virtual reality

10. Library Applications

Traditional library and information centers maintain the conventional media like books, video, films, audio, tapes, gramophone records, microfilms and microfiche which store the information material. It was not possible to many readers to view different media at a time till recently. Now it is possible to the readers of the library to view different media at a time with the invention of multimedia technology, which store vast amount of data/information in electronic media and retrieve and present in more than one media to satisfy.

- Widen the Horizon of Information: Multimedia technology widens the horizon of information. The world of graphics, sound, animation, video and hypertext is very quickly making its way into our lives, becoming accessible and affordable to an increasing number of people. The libraries are beginning the use the multimedia, letting the new technology help them expand their sphere of activities in the
information horizon. It helps in basic functions of a library i.e. acquisition, organization and dissemination of the information.

❖ Information Storage: Regardless of whether the information is in printed or electronic media, libraries store and maintain all kinds of information. Space is always the key problem to store the conventional form of information. A large amount of storage space is required to provide to the users of the library with immediate access to the exploring data/information. This problem is solved through the multimedia products, which store vast amount of data/information in different media using the authorware tools. Multimedia can be used in various library operations and services.

❖ Dissemination of Information: One of the common uses of the Internet and Web Multimedia is to make available large amounts of information in the easiest and most comprehensible way possible. Many Web sites, especially those that act as libraries of information, have turned to multimedia technology to guide the user through the maze of data. On-line electronic magazine (e-zine) is a good example to use multimedia technology to disseminate the information.

❖ Publishing: Many conventional paper magazine and newspaper published now have on-line versions, offering many features and services not available from the newsstand copy. Searching through article archives, listening to actual interviews, viewing descriptive animation, and interacting with the publication are among the many capabilities of an electronic format. These additional features are so appealing that many magazines now include CD-ROMS with the publication and many offer the entire magazine as a multimedia production in a cardboard magazine-shaped folder. The Internet version of the magazines offer publishes the capability to expand their publications readership and consequentially their advertising revenues. Multimedia converts the first line user into a regular visitor.
Electronic multimedia magazines hosted and circulated on the web are revolutionizing the publishing industry, and are yet another pointer to the possibilities of multimedia on the net.

❖ Library Networking: The phenomenal growth of Internet/WWW is the most exciting development of multimedia. Global communication facilities make it possible to connect the libraries of various countries with one another. Future libraries around the world will be able to share information resources in a way that was never possible before and satisfy the readers with information in different media.

❖ User Orientation, training etc : By developing multimedia systems proper and effective user orientation programmes can be organised for the users of the library to understand the services and facilities of the library. It also helps the library staff for understanding the latest techniques of library procedures and services in interactive mode by using multimedia CD’s.

❖ Reference Sources, Services etc.: Several reference sources such as dictionaries, encyclopedias, directories, yearbooks, magazines and journals are now available in the market in multimedia format. Through these reference sources, the information services can be provided to the users of the library in very effective manner.

❖ Solve Space Problem: Library is a growing organism and every library faces the space problem to accommodate all published information in print media. But now new technology, a single CD-ROM can store upto 650 MB of information, 2,40,000 of text, which solves the problems of space as storing in paper media format occupied huge space.

❖ Durable storage media: Information in CD-ROM disc is more durable in comparison to other media as it is free from dust, environment and other hazards.
Maintenance and Management: A large amount of information can be stored in a single digital disc, which can be easily maintained and managed than other printed formats.

11. Networks

Network is the term that is widely used to connect computers that share resources and information with each other through some type of medium. The main objective of networking is optimum utilisation of available information resources through sharing. A computer network allows user of one computer to use resources of another computer, which may be space, database, programmes or printer. Communication between computers exists under the control of a series of networking protocols or rules responsible for ensuring the safe delivery of data to its destination. Protocols govern the format of the data, how it is sent and how it is received. It allows each node on the network to receive data in a proper format so that it is understandable.

11.1 Computer Network

Based on the role played by the computer to transfer data/information, communication network can be called as computer network.

A computer network is a category of computer systems wherein multiple computers are interconnected. A computer network consist of a set of communication channels interconnecting a set of computing devices or nodes that can communicate with each other. The nodes may be computers, terminals, workstations, or communication units of various kinds distributed over different location.

11.2 Need for Computer Network

The purpose of computer network is to share the resources of all computers among various users that are connected to the network. The resources to be shared include databases, software and computing
resources not available at the computer site normally used by an organisation.

11.3. Classification of Networks

11.3.1 Based on Utility Criterion

The computer networks can be classified using the criterion of their utility. The major applications of computer networks are resource sharing, data sharing, communication and data exchange. It is possible that one network can have all these applications or one or more such applications. However, if the main purpose of the networks is, say, resource sharing and other applications are subordinate then the network is considered as resource sharing network.

❖ Resource Sharing Network: The networks can provide users with convenient access to special computing resources irrespective of the physical location of the users and the resources. The resources may include specialised computers, software or other devices that are extensive and are not affordable by an individual user. Example—a large super computer facility in an institution is accessed by several work-station situated at distance apart in the various departments/sections of the institute.

❖ Data Sharing Network: The networks provide access to unique databases from workstations situated at distance apart. Eg. Remote access to stock exchange data or hotel and airline reservation system.

❖ Communication and Data Exchange Networks: The networks allow users to exchange data, graphs or documents and to communicate with each other using such devices as electronic mail, bulletin boards etc. irrespective of their location.

11.3.2 Based on User Community:

Some times the networks can be characterised as:

❖ Private Networks: Some corporation or other entity that controls access and use of network services to its staff usually owns these networks.
Public Networks: These networks offer networking or network services to public, that is to say to any individual or organisation that becomes the member or subscribed. The familiar example is of the telephone system.

Co-operative networks: These networks are managed and support by their users. Example BITNET.

11.3.3 Based on Architectures and Protocols

Computer networks may consist of a large number of computer devices of various types, generally made by different vendor, and interconnected by a variety of transmission media, including telephone lines, satellites, digital microwaves radio, optical fibres, digital data lines etc. They may include local or wide are configuration. In this group of heterogeneous devices that are to be connected it is necessary to have compatibility of hardware and software or to have very complex interfaces to allow meaningful communication. The computer network architecture is meant for this purpose of providing connectivity, flexibility, modularity reliability, simplicity and diversity.

The network architecture generally refers to the protocols, message format and other standards, which communicate among different hardware, software and other devices, to achieve the objectives of the network. There are different standards in practice and based on these, networks were categorised as:

> Xerox Networks Systems (XNS) Architecture
> IBM's System Network Architecture
> DEC's Digital System Architecture

Network architecture refers to the arrangement of nodes and their interconnecting communication circuits, to represent the structure of networks and the significance of nodes in the network.

11.3.4 Based on the techniques used to transfer data and control, communication networks can be classified as:

> Switched Networks
> Broadcast Networks
Switched Networks: The three main types of switched networks are:

- **Circuit Switched Networks**: In circuits switched networks, the physical path between source and destination must be established before data can be transmitted. Upon establishing the connection, the circuit remains exclusively and continuously dedicated to the ongoing communication until completion.

- **Message Switched Networks**: Message switching does not require a physical path between the sender and the receiver. The message first travels from its source to the next unit in the path. When the entire message is received at the intermediate unit, the next unit becomes available. This store and forward procedure continues until the packet reached its destination.

- **Packet Switched Networks**: Packet switching is basically similar to message switching. The only difference between the two strategies is that packet switching decomposes message into smaller packet to overcome the long transmission delays inherent in message switching. Packet switching allows many packets to be transmitted simultaneously, thereby creating a pipeline effect.

Broadcast Networks: Broadcast systems have no intermediate switching nodes. All stations share a single transmission channel, packets transmitted by one station are received by all other stations. An address field within the packet specifies the destination of the packet. Packets that are intended for other stations are ignored. Two similar types of broadcast networks are packet radio and satellite networks. Another common instance of broadcasting is the Local Area Networks (LAN).

A Local Area Network (LAN) offers:

- Effective centralised control
- Multipath communication system
- Interdisciplinary in nature
- Aims at a total communication capability
Three basic ways of transmitting information are:

- Audio signals: such as voice transmission on radio
- Video signals: as used in television
- Binary digits: such as the electronic pulses in digital computers.

Each communication application has its own specifications and wiring. The task of designing a communication network is too complex to be handled as a single unit. An alternative to the single unit design of a communications protocol is a structured approach that aims at dividing the communication task into manageable parts. The approach describes the communication function in terms of an architecture. The architecture defines the relationship and interaction between network services and functions through common interfaces and protocols. This viewpoint has been adopted by the International Organisation for Standardisation (ISO) in their recommendation for a standard network architecture.

This model is referred to as Open System Interconnection (OSI). It defines a framework for the specification of protocol standards for connecting heterogeneous computers. The model defines the rules and conventions for various functions within each layer, specifies the general relation among these functions, and determines the constraints on the types of functions and their relations.

Functions of the seven layers are as follows:

- Physical Layer: Physical transmission of information bits across the network
- Data-link Layer: Transmission of frames across network links.
- Network Layer: Support connection of multiple network links.
- Transport Layer: Transfer of data along a complete network path from an origin to a destination.
- Presentation Layer: Provides for application systems to be independent of the form and representation of the data.
Session Layer: Support of communications between application systems.

Application Layer: Network access to application systems.

11.3.5 Based on Geographical Area Covered:

❖ Local Area Networks (LAN):

A Local Area Network (LAN) is a network, which is specially designed to interconnected data communicating devices within a limited geographical area. Lines allow high speed and accurate data transmission on dedicated networks. Thus, devices such as computers, storage devices, terminals, sensors, light pens and printers can be connected into a local area network. Most local area networks work within a small geographical area. LAN’s may be confined to one building, a university campus or a local neighbourhood with a range of upto 10 kilometers. Most LAN are privately owned. A single organisation will own the networks as part of its computer installation. Because the distances covered are short local area networks are characterised by high speeds and low error rates. The main advantages of LAN are the ability to share equipment, such as host computers, printers etc. and to share data and allow it to be centrally controlled and located but made available to many users. LANs are used differently in different types of organisations. Academic libraries – for example, often operate with split buildings of disc storage and other expensive central facilities such as printers etc. Also LANs may be a means of making a workstation for an OPAC (Online Public Access Catalogue) available in different locations.

❖ Metropolitan Area Networks (MAN):

A Metropolitan Area Network or MAN (plural: MANs) is basically a bigger version of a LAN and normally uses similar technology. It might cover a group of nearby corporate offices or city and might be either private or public. A MAN can support both data and voice, and might even be related to the local cable television network. A MAN just has one or two cables and does not contain switching elements, which shunt packets over.
one of several potential output lines. Not having to switch simplifies the design. A key aspect of a MAN is that there is broadcast medium to which all the computers are attached. This greatly simplifies the design compared to other kinds of networks. For example CALIBNET (Calcutta Library Network); DELNET (Delhi Library Network); ADINET (Ahmedabad Library Network)

- Wide Area Networks (WAN):

Wide Area Networks (WANs) are those networks that cover a large geographic area, spanning cities countries or even continents. Typically, a WAN consists of a number of interconnected switching nodes. A transmission from any one device is routed through these internal nodes to the specified destination device. These nodes are not concerned with the content of the data. Their purpose is to provide a switching facility that will move data from node to node until they reach their destination. Traditionally, WANs have been implemented using one of the two technologies: circuit switching and packet switching. More recently, frame relay and ATM technologies have assumed major roles. Some of the important WAN technologies are given below:

- Leased Lines
- Asymmetric Digital Subscribers Line (ADSL)
- Integrated Services Digital Networks (ISDN)
- Frame Relay
- Asynchronous Transfer Mode (ATM)

11.3.6 Based on Mode of Transmission:

- Cable Television: Broadband Networks use standard cable television technology, although the term "Broadband" is derived from the telephone world, in the computer networking context, "broadband" means any cable network using analog transmission. The cable TV has the potential to change the way in which the general public received both entertainment and information. The Cable TV offers expanded channel capacity, two-way
communication and can easily be coupled with other communication technologies.

❖ Videotex: The Videotex systems transmit text or graphics stored in computer database via the telephone network for display on a television screen. The systems make the databases stored on powerful computer systems accessible through a television set and a telephone. In order to function, Videotex systems need a telephone line, to which a television is connected via an electronic interface. This interface consists of (i) a control keyboard (for the user to use to type in response), (ii) a modem and (iii) an autodialler for calling the database computer.

❖ Teletext: The Teletext is a system designed for the general public and mass communication. The Teletext is broadbase, received and displayed by a Teletext set, which is an adapted television receiver. A keyboard/pad on the television set allows the user to select a specific frame. The best known services of Teletext in UK are BBC’s CEEFAX and ITV’s ORACLE, both of which transmit information of wide public interest.

❖ Electronic Mail (E-Mail): In the Electronic Mail system, the transmission is via telecommunication network designed for data transmission. The E-Mail software packages are offered by many software suppliers and can be run on all multi-user computer systems. They provide a substitute to paper based mail or postal services or communication via the telephone. The key features of an E-Mail system are that, two or more people are able to communicate with one another, the message is transmitted via electronic signals, and not by voice or paper. The mail in the form of message, memorandum or document will be created in a word processing or computer system on the sender’s system, and the electronically delivered to the receiver’s system. The receiver may
receive the document on VDU (Visual Display Unit) or on a local printer. E-Mail arrives within minutes.

❖ Telex: The Telex network is a well established and secure telecommunication network for communicating messages. Telex is similar to typewriter having keyboard, internal storage and printer.

❖ Facsimile Transmission: The Facsimile transmission also known as telefacsimile transmission and Fax is a means of transmitting a copy of a page of text or graphics to remote location via telecommunication network; Fax is one possible technology for electronic document delivery. For example, British Library Document supply centre is using fax for document delivery.

❖ Electronic Journals: Central characteristics of the Electronic Journal is the use of electronic network communication as an aid in writing, submitting and referring papers and in other activities associated with the compilation of a journal.

❖ Videoconferencing: INSIS (Inter-institutional Integrated Services Information System) is the result of co-operation within the EEC (Eastern European Countries) directed towards the establishment of an inter-governmental communication network. The broadband system includes hidden cameras, stereophonic sound and a flat wall screen in colour. For instance, copies of an agreement between two governments can be signed at both sides and transmitted by Telefax to the other side of countersigning.

11.3.7 Based on Network Topologies:

The term topology, in the context of communication network, refers to the way in which the end points or stations of the networks are interconnected. A topology is defined by the layout of communications links and switching elements and it determines the data paths that may be used between any pair of stations. Topologies are named for the figures created by the web wiring called data path, used for data transfer. A network can
be viewed as a simple pathway between points over which information is conveyed. There may or may not be same control element accompanying the network that allows for proper routing of information. The multipoint topology has several points connected by a common circuits (communication path or line). Communications being between the controller and points on the network, not between points on the network. Bus or ring structures suggested that any point could communicate with any other point on the network. These basic topologies can be linked together to form Hybrid networks of considerable complexity.

Table 1
Network Topologies

<table>
<thead>
<tr>
<th>S N</th>
<th>TOPOLOGY</th>
<th>CHARACTERISTIC</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Star</td>
<td>Single controller in the middle system. All Communication through controller</td>
<td>Controller inoperative the system is down for all.</td>
</tr>
<tr>
<td>2.</td>
<td>Ring</td>
<td>Neighbouring computers all messages travel in only messages travel in only one direction. Each unit serves as controller</td>
<td>When one unit is down the system could be down</td>
</tr>
<tr>
<td>3.</td>
<td>Distributed Bus</td>
<td>Open-ended general purpose multiple access data path onto which all stations are attached by short dedicated data paths. Traffic travel in both directions.</td>
<td>Requires sophisticated data transmission</td>
</tr>
<tr>
<td>4.</td>
<td>Loop</td>
<td>Combines the Star’s and Ring’s concept</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Tree</td>
<td>Specialised distributed bus which reduced the distance between frequently interactive nodes</td>
<td>Difficult to expand once established</td>
</tr>
<tr>
<td>6.</td>
<td>Hybrid</td>
<td>Combination of Star, Ring and Bus concept. Combined advantages of above.</td>
<td></td>
</tr>
</tbody>
</table>
12. **Components of Computer Networks**

A computer network is composed of two types of components. System components that support transmission and communications, and Function oriented components that provide for end user applications. The following are major components of computer network.

➢ Data Processing Computers and Software are the traditional computers that support applications software systems. For most computer networks, these are computers that are in use at the time the network is established.

➢ Network support hardware includes interface hardware between the traditional computers and the data communications links.

➢ Data communications facilities are comprised of transmission facilities such as dedicated high-speed lines, switching centres and satellite facilities.

➢ Network control software is the software system that handles the transmission and routing of communications traffic in the network. This includes the software to support the communications protocol in use in the network.

➢ Terminals, printers and microcomputers are the hardware components available to end users of the computer network.

➢ Terminal control units, multiplexors and modems are the hardware that interfaces between the terminals and printers and the networks transmission facilities.

13. **Networks in India**

The closing decades of the 20th century have been witnessing the process of transformation of human society from industrial to information oriented society. This transformation is taking place due to the application of computers, telecommunications and media technologies to almost all aspect of human activities. The industrially advanced countries of the West are already undergoing this transforming at a rapid rate. The developing
countries like India are also undergoing this transformation, though as a slower rate. In recent years there has been a growing awareness and keenness to make use of information technologies in disseminating information science and technology by establishing computer based information centres and information networks as they are potential feeders to socio-economic development. The efforts have also resulted in attempts at setting up a series of information networks, for exchange and use of information and data among nations. International bodies like UNESCO, UNDP, ESCAP, WHO, IDRC have encouraged these efforts and a number of information networks have emerged in India and other South East Asia regions.

These regional networks are on broad subject groups such as Agriculture, Medicine and Health Population, Technology Transfer, Rural Developmental Sciences, Social Sciences, etc.

Information Networks on specialised subjects pertain to Fisheries, Sorghum and Millets Coconut, Medicinal and Aromatic Plants, Renewable energy, Skill development, Trade, etc. Some of the information Networks have emerged as a result of decisions taken by Non-Aligned Movement (NAM) and Commonwealth Heads of Governments Regional Meeting (CHOGRAM) relating to policy information, modelling and general documentation.

14. Library and Information Network

A library network is broadly described as a group of libraries coming together with some agreement of understanding to help each other in order to satisfy the information needs of its users.

14.1 Need for Library and Information Networks

The growth in number and size of information and documents has created many problems for libraries. Libraries cannot dream of acquiring all the literature published world wide individually, but the users have right to access all. Thus, libraries have to cooperate to share their resources so
that very demand for documents is met not only from the libraries own collection but also from the collection of other libraries. Therefore, networking of libraries and information centres is an urgent need of the present era. After the automation of libraries, the need for library networks arose because of the following reasons:

- Library networks are the only means for the sharing of expansive resources to provide information at optimal cost. Thus, networking of libraries plays a major role for the effective transfer of information.
- Through resource sharing, an effective library network eliminates the size, distance and language barriers. Also, it reduces the cost and time in retrieving information.
- Library networks reduces the wasteful duplications of human efforts and expenses, but also increase the opportunities for improving performance of specific service through enhancing the speed coverage of information.

14.2 Objectives of the Library and Information Networks

- The main objective of a library network is to fulfill the needs of the users, providing current and exact information within an economical cost for maximum benefit.
- Optimum utilisation of existing library and information software, their resources and services.
- Provision of information precisely and exhaustively accessible within a reasonable minimum time, in a manner, which is convenient to thesaurus.

14.3 Characteristics of Library and Information Networks

<table>
<thead>
<tr>
<th>Data</th>
<th>Bibliographic record (MARC)</th>
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<tbody>
<tr>
<td>Retrieval</td>
<td>Author/title/number (subject) keyword/code</td>
</tr>
<tr>
<td>Access</td>
<td>Telecommunication network/private network/Hard Wired network</td>
</tr>
<tr>
<td>Users</td>
<td>Librarians and library clientele</td>
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</table>
14.4 Topology used in Library & Information Science Networks

The choice of topologies depends on a variety of factors, including reliability, expandability and performance. In order to get an idea as to the best type of topology suited for library networks in India, we may refer to the following views of Shumel Server:

Centralised Process:

➤ By attempting to meet the needs of a broad range of users, it can't meet all the users' specific needs. While offering options, confusion may arise in making selection from a display menu.
➤ A specialised staff is required to maintain the system.
➤ Great risk is involved in developing such a system. It means long-term commitment of money, equipment and manpower, from which it becomes harder and harder to withdraw as time goes on.

Distributed Process:

➤ Organic and modular growth of a system.
➤ Computing power is distributed as needed.
(The micro has replaced the mainframe)
➤ It is affordable; cost efficient and less depended on sophisticated or expensive communication line.
➤ The initial costs can be modest.
➤ It serves as a training ground for the personnel who will eventually carry the brunt of large scale planning.
➤ Various components of the system can be tested in realistic conditions without disrupting the information flow.
➤ By gradual hook-up with libraries its efficiency can be checked and developed.

Efficiency of Networks:

The efficiency of a network depends on the performance of the following:

❖ hardware
❖ library software
communication infrastructure
communication software
trained manpower
user’s interest; and
financial support etc.

15. INTERNET
The Internet is the world’s largest computer network i.e. “Network of networks”. It is an outgrowth of ARPANET (Advanced Research Project Agency) started by the Department of Defense in the USA in late 60’s. The term Internet first appeared around the 1980’s and it was only in 1991 that the Internet was first opened for commercial users. Today, the Internet connects around 20 million users worldwide and is growing at an accelerated rate by more than a million users each month. It joins over 10,000 networks and over 1000 computers join the Internet each day. It was started by the National Science Foundation of the United States. ISOC or the Internet Society is the only group that controls the Internet. Internet connects Universities, federal and state government agencies, professional associations, commercial firms, colleges and secondary and even elementary schools. Thus, the Internet is community of people who work together to use the network. It is a cooperative effort of many people and organizations, all working to enhance the Net by their participation. One reason behind the development of Internet, is to help the research community by giving engineers and scientists real-time access to remote resources and to let them share information through electronic mail.

One can be connected to the Internet by getting any of the following connections:

- Direct connection: Permanents direct connection is available to a TCP/IP (Transmission Control Protocol/Internet Protocol) network. This whole network is turn gets connected to the rest of the Internet.
Direct Internet connections require huge initial investments and dedicated high-speed lines.

❖ On demand direct Internet connection: This type of connection is almost identical to the one above, except that the requirement of dedicated high-speed lines is replaced by the standard system of telephone lines and a modem. The connection protocol used is Point-to-Point (PPP). With this type of connection, the full ranges of Internet tools are available.

❖ Dial-up terminal connection: Here the connection to Internet is not direct but through an Internet service provider. The entire range of Internet tools like Gopher, Archie, etc. are available. In this one gets a dial-up connection to the service provider and the software on the service provider's computer responds and sends back its response back to you.

❖ E-Mail connections only: This is the easiest and the cheapest type of Internet connectivity and is similar to the previous category except that none of the other Internet tools are accessible.

15.1 Requirements to access the Internet

To access the Internet one need a computer that is connected to it. It could be a PC, a Macintosh or a multi-user system (UNIX based). One can be connected to the Internet via a phone line or through a dial-up connection.

The Internet has increased the vitality of and accessibility to library resources. The library catalogs, books, journals, references, periodical indexes are all available on the Internet and are accessible usable and useful and can be retrieved using software such as Gopher, Veronica, Archie and World Wide Web (WWW). Because so many resources are available on the Net, which are beneficial to library users, the need to get an Internet connection in libraries is of great concern. Many libraries all around the world is looking towards in this direction so that they can help
its users to keep current of latest happenings in the world and to provide current data on various subjects as and when required by them.

Several sources also exist to help users to keep themselves current with new resources and changes to existing ones. Hundreds of libraries around the world have plugged into the Internet, accessible to anyone who can do a remote login i.e. Telnet and can search library catalogs.

Internet is now being used by academic, corporate, public and school libraries for sending mail, cooperative research, subscription to journals and to get bibliographic and full-text resources. Resource discovery services help users to locate and retrieve information. These services contain tools for browsing, searching and organizing information distributed throughout the Internet.

The information that is available on Internet ranges from commercial databases, text of newspapers, magazines, journals, and newsletters to Net groups. One has access to fresh and recent text feeds for many newspapers, journals and columns through Campus Wide Information System (CWIS' s) or in Usenet if you subscribe to the ClariNet groups. The library and archive catalogs are searchable via RLIN and OCLC. This information may be general reference information such as the contents or encyclopedia, dictionaries and atlases or it may be real-time information such as weather readings, stock quotes and currency exchange rates.

15.2 The types of information available via the Internet can be categorized as

- Indexes, Abstracts and Full-text Information: Information such as table of contents for journals and books, newspaper headlines and article summaries are all available on the Net. Also, full text information is available for searching and retrieving either in ASCII, fonted text, graphics or audio format.
- Periodically generated information: One can get a lot of information which is generated on an hourly, daily or other basis, such as
newspaper articles, weather maps, stock quotes, magazine contents and more on the Net.

❖ Periodically revised Information: Airline schedules and prices, product information, etc. are available on the Net.
❖ Reference Information: Reference information such as dictionaries, encyclopedias, legal references, etc.
❖ Miscellaneous facts and fiction: Textbooks, novels, poetry, music, etc. are available on the Net.
❖ Online databases: Economic indices, scientific data, etc.
❖ Holdings: List of items available from institutions such as book collections, recordings, maps, etc. not available in online digitized format.

Online information services provide better access to the information and better management i.e. searching, evaluating and delivering it. These services include online databases, online search and retrieval and information brokers put the data into computer readable format and make it accessible to use from terminals computers.

15.3 Services

There are basically four services one can do on the Internet:

❖ Electronic mail, or e-mail, is one of the most important of all that happens on the Internet. It is simple service that allows two people to send messages to each other in a near-real-time manner, of course, with e-mail one is not limited to sending a message to just one person, and the same message can be sent to many people. One can also attach a document or image to the message or can retrieve documents from other

❖ Computers on the Internet by sending a command to a particular address. e-mail can also be used to retrieve documents from FTP servers and for taking part in special interest group discussions such as listservs and Usenet newsgroups. All one needs to send e-mail messages is a computer with some kind of connection to the
Internet, and software on one's computer designed for this purpose and e-mail address.

❖ File transfer Protocol, or 'FTP', refers to an Internet tool that allows one to move a file from one place to another. The world 'file' is used to include any type of digital entity – documents, images, artwork, movies, sounds and software. Anything one can store on a computer can be moved with FTP. Many computers on the Internet have 'anonymous FTP archives' containing public-access files that one can download on one's computer.

❖ Telnet, a term used to mean 'remote login', is the ability to access and control another computer somewhere on the Internet. One can 'log in' to the other computer and can then use the software on that computer. Often this service is used to search an information archive such as a public database or library resource. One can also use Telnet to log into one's own Internet computer from another computer somewhere on the Internet. For example, if one is at another place and has access to a computer on the Internet, one can telnet to one's own 'Internet account' and read e-mail.

❖ Usenet is a global 'bulletin board' service that uses the Internet as an access point. It is composed of thousand of topical grouping that one can read to keep in touch with news or discussions in those groups. A message posted to a newsgroup can be read, forwarded via e-mail, or followed up by posting a public response. A series of messages on the same topic is called a 'thread'. Document called FAQ's (Frequency Asked Questions) try to answer many of the question that someone new to the group would have to keep the discussion in the group from covering the same ground over and over again.

In addition, in recent years some new tools have emerged that expands upon these four basic activities. These do not fall really into any
one category, but rather they integrate many Internet processes in ways that can simplify and enhance the activity:

❖ Archie is a simple function that searches FTP archives on the Internet. It is accessible through both telnet and e-mail, as well as through freely available client software that one can obtain and install on one’s own computer to access the Internet. Archie is useful for finding files when one known part or all of the file’s name.

❖ Gopher is a software tool that connects a variety of computers and information archives on the Internet and displays them as a series of menu items. It was originally developed at the University of Minnesota as a campus-wide information system, but it quickly caught on as a way for anyone on the Internet to publish information and organize network resources.

❖ Veronica is a companion tool to Gopher. Veronica lets the user perform keyword searches of ‘gopherspace’. The results of the searches are presented as a menu with items leading to more specific information. One can access veronica through a gopher server, just like gopher itself.

❖ There are a number of computers on the Internet that provide free or for-fee access to online databases. These are most often accessed using the telnet function. Depending on their purpose and format, online database can be broadly grouped into a variety of categories; Wide Area Information Services (WAIS), Campus Wide Information Services (CWIS), Online Public Access Catalogues (OPAC) and Commercial online services.

❖ The World Wide Web (WWW) is probably the newest and fastest growing Internet function. It is an ingenious front end to much of the information already on the Internet using the concept of hypertext to link information. Hypertext refers to a system of ‘point-and-click’ connections between information that allow the user to jump from one information source to another on the Internet without even
thinking about it. All of the technical aspects of moving from computer to computer are hidden, leaving the researchers free to explore without interference.

15.4 Commercial Services

❖ DIALOG Information Services: It is used by researchers and Librarians.

❖ DELPHI, CompuServe, etc.: They provide quick online access to stock quotes, the online Airline guide, encyclopedias and other information.

❖ Library Catalogue, Reference and Related services: OCLC (Online Computer Library Centre) and RLIN (Research Libraries Information Network) provide searching facility for library holding. RLIN is an online database service from the Research Libraries Group (RLG), RLIN has an online bibliographic database containing description of the catalogued holdings of special collections, research libraries and archives. OCLC databases include archival and manuscript records from many state, museum and society archives. Information from the U.S. Library of Congress is available via the Internet. LOCIS (Library of Congress Information System) is available via TelNet.

15.5 The Library resources available on the Internet

❖ Library Catalogs: Now many academic libraries; a large number of public libraries and a small number of school libraries can access library catalogs using telnet access. The easiest way to access library catalogs is to connect one site that already has collected this information and provide links to the catalogs. Such a resource is included on many Gophers and WWW servers.

❖ Books: Many books are available on the Internet on Gopher, FTP and WWW. amazon.com is the site to access books. You can place order directly.

❖ Periodicals: The advantage of periodicals on Internet is their full-text searching capabilities. They are free publications available through
discussion lists. FTP telnet, Gopher, WWW and e-mail requests. These periodicals are on commercial services with Internet access such as DIALOG and EXIS/NEXIS.

❖ Periodical Indexes: They are the most important features of a library. Location what articles have written on a subject or by a particular author is vital to research. Some of these indexes are located on Gopher or WWW server, whereas other are located on library catalogs that are accessible via Telnet. Some sites offer full-text searching of electronic journals, but usually the searching must be done one journal (or even issue) at a time.

❖ Reference Sources: The reference collection of the library is available on the Net. Directories, dictionaries, guides, gazetteers, maps, etc. Are available on the Internet. These sources are updated frequently and they can be made full-text searchable. Two excellent examples are weather forecasts and currency exchange rates. Both of these are located on the Internet in forms that are updated at least one a day.

❖ Current services: They are various sources available to keep current including discussion lists, Gopher sites and WWW pages.

15.6 Categories of Organization who provide Internet Access

While there are a growing number of organization who provide Internet access, they can be divided into three basic categories:

❖ Internet Service Providers (ISP) or public-access Internet hosts are regional or national organizations that sell various degrees of access to the Internet, primarily for individual users;

❖ Commercial Online Services where users have access to services provided and maintained by the vendor, as well as ‘gateways’ to some of the Internet activities. These services usually require installation and use of software developed to connect and navigate their computer system. The major commercial online services are CompuServe, America Online, Genie, and Delphi.
Bulleting Boards are usually locally sponsored computer systems that offer e-mail, file exchange, and areas for electronic discussions as well as varying degree of access to the Internet. These are usually pay or partially free services.

16. INTRANET:

An Intranet can be described as an internal network or internal Internet. Intranet uses the same technology of Internet but the main difference is that Internet can be accessed by anyone but Intranet access is restricted to a defined user group. According to the Durlacher Intranet report 1997, an Intranet is an organized set of applications installed on a company's internal network. These applications use Internet technologies to public, distribute and display information for anyone directly connected to the network. Benett defines Intranet as, "a private computer network based on the data communication standards of the public Internet".

16.1 Evolution of Intranet

Internet is the mother of all networks. Internet actually started off in the late 1960's and has been growing ever since. In 1993, things changed a lot, with the introduction of a new technology, called the WWW. Slowly and slowly we have reached to Intranet. Coverage for Intranet is increasing day by day. Privatization of Internet services will definitely motivate the corporate sector to go for organization-wide Intranet in a very big way. The evolution of Intranet is not stopped and is still continuing with change in technology. Netscape, Microsoft and Novell are only three of the many organization capitalizing on the growth of Intranets. More than half of Netscape's revenues come from Intranet Consultancy and the same is on the rise.

16.2 Advantages of Intranet

Intranet provides significantly more flexibility over other means of information dissemination - including LANs, WANs and paper-based publication. Intranet offers the following advantage and benefits.
Higher efficiencies
Rapid development
Low learning curve
Lower costs to supply chain management
Investment protection on existing infrastructure
Inter operability at the network level
Improved relationship with customer and suppliers
Central management
Low overall cost of implementation
Open standards and flexibility
Saving on salaries and supplies.

16.3 Problem of Intranet
- Setting up and effective running of Intranet requires skilled personnel
- Maintenance is one of the big problems posed by Intranets. Setting up an Intranet it easy but proper maintenance and updating is a difficult task.
- Though information is available and accessible from their desk, people won't use it more as they are not used to it. So, changing people's mind to use and utilize Intranet has to be taking care.
- Both the staff members and users should be trained properly for effective use of Intranet.
- Security is another important problem posed by the Intranet. Care should be taken that users are not misusing the Intranet.

16.4 Applications of Intranet: Three Categories
- Primitive Applications
- Commercial Applications
- Customer-based Applications

Now, let's enumerate all these types of applications of Intranet all together. Few important of these applications are as under.
- Video-conferencing
- One-to one communication
Group Discussion
- On-line Electronic forms
- Telecommuting
- Information and Demand

Few other applications of Intranet include:
- Research and Development
- Sales and marketing application
- Extending the Intranet to customers and suppliers
- Electronic commerce
- Real-time audio and video communication
- Live and recorded audio and video presentation on demand
- Customized orders on demand
- Database and legacy application access
- Information publishing and sharing
- Searching database through Intranets
- Application software on demand
- Navigation and full text indexing and searching
- Directory of people and resources
- Human resources applications
- Financial applications
- Financial trading

16.5 INTRANET and Libraries

As the Intranet can be accessible from any place by its users, a public library which has many branches or libraries of an organization with many branches or the libraries of each department within a University campus can form an Intranet and make use of information effectively.

17. EXTRANETS

The infrastructure, where specific trading partner forming parts of the extended enterprise are given selective access to the organization's Internet is known as an “Extranet”.

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17.1 Definitions

According to Microsoft Bookshelf Computer and Internet Dictionary-
"An extension of a corporate intranet using World Wide Web technology to facilitate communication with its suppliers and customers. An extranet allows customers and suppliers to gain limited access to a company’s intranet in order to enhance the speed and efficiency of their business relationship”. According to British Telecom Intranet services jargon buster “Secure interconnection between two or more intranets to facilitate joint working between identified users on these separate systems”. Extranet is a community of interest created by “extending an intranet” to selected entities external to an organization.

In the definition, we are very careful to keep the relationship between various entities at a more general level, since a relationship could exist between any two libraries, private, public or combination thereof. Though the definition is generic, almost all early implementations of extranets have been in the private sector. These private sector extranets have been designed to foster corporate library-to-library relationships between vendors, user and libraries. Most of these extranets have been set up over public network infrastructure using Internet technologies like TCP/IP and the Web. Given the choice of ATM, frame relay, and Internet-based switched-network infrastructure, the Inter-based extranet implementations have been most popular due to their low cost of implementation, ubiquitous access, and improved security offerings based on global standards.

Providing entry to corporate information via on Extranet introduce security issues requiring action to be taken to restrict unauthorized access to specific applications and information (normally on made available to employees) using some or all the following measures:

- System passwords
- Router filtering
- Challenge/response authentication
- Firewall techniques
17.2 Development of Web Technologies

Extranet are a logical progression for organizations, which already have a well-established intranet. There are a number of distinct stages in the development of web technologies, as illustrated below:

```
Internet
↓
Intranet
↓
Extranet
```

The primary motivation to implement Intranet is to improve the flow and timely access to information within an organization as well as to facilitate collaborative working on corporate projects. Use of Internet technologies offers cost-wise savings over competing alternatives as well as reducing the training time for implementation. One-to-many publishing applications can significantly reduce the cost of producing, printing, shipping, and updating corporate information. Two many transaction driven applications can improve information quality and provide a highly efficient alternate to paper-based library processes. Finally, many-to-many interaction facilities the exchange of information between interested individuals. Perhaps, forming a part of a newsgroup or workgroup. Whilst an Internet services the internal organization and Extranet extends the capability to major trading partners. It is quite likely that at some point open access to the Internet will be required.

17.3 Applications of Extranet

- Access to legacy database and mainframe;
- Enterprise resource planning (ERP) and supply chain management;
- Collaborative applications like schedule management, interactive conferencing, and discussion groups;
- User service
- Bulletin boards and closed user groups (CUG);
- User's "self-service" applications;
- On-line financial transactions
17.4 Advantages of Extranet

Extranet brings many advantages and benefits to these library applications. For example:

➢ Better user results in increased user loyalty, while user “Self-service” applications provide quality 7 x 24 support throughout the year at a lower cost.

➢ Collaborative extranet applications to foster better team spirit among user and library improving the speed of communication.

➢ User access to internal library data and their participation of internal library processes helps in building loyalty, streamlining development cycles.

➢ Participation in extranets also brings access to new library. If a library could not afford the high cost of electronic data interchange (EDI) transaction in the past, new Internet-based extranet EDIs can make company participation affordable and bring new libraries and users where the user could not compete before.

18. Future of Networking

As networking technology becomes pervasive, opportunities arise for using it in newer and more creative way. One example is of using data networks rather than circuit switched networks to carry voice and video traffic. The generic term for this kind of use is converged networking. Converged networking offers many benefits including integrated multimedia applications. The converged networking is the emerging trend like:

➢ Payload convergence is that aspect of converged networking wherein different data types are carried in the same communications format. For example, while in the past audio and video traffic was carried over circuit switched networks as Layer 1 bit streams, while bursty data traffic was carried over packet switched networks in
Layer 3 datagrams, payload convergence describes the trend to carry both audio/video and bursty data traffic in Layer 3 datagrams. Note, however, that payload convergence does not prohibit the network from handling packets differently, according to their service requirements.

- Application Convergence represents the appearance of applications that integrate formerly separate functions. For example, Web browsers allow the incorporation of plug-in application that allow Web pages to carry multimedia content such as audio, video, high-resolution graphics, virtual reality graphics and interactive voice.

- Technology Convergence signifies the move toward common networking technologies that satisfy both LAN and WAN requirements. For example, ATM can be used to provide both LAN and WAN services.

19. Digital Library

Digital libraries is the latest development, evolved through a cycle of fast technological developments in order to cater to the needs of individuals with varying interests in various fields. Digital library has been described loosely by the librarians and information technologists while centering around with their limited interests. In the recent past some other terms like 'Virtual Library' or Electronic Library' has also got good attention of the library professionals. The shift of the term 'Electronic Library' to 'Digital Library' is perhaps because of the growing interest in digital networks, digital audio and digital video relative to electronic publishing. The concept of 'Virtual Library' has emerged simultaneously perhaps because all the information at present we are enjoying through networked libraries at the desktop, quite virtually without the physical existence of the books on shelves. These terms also can be taken equivalent to 'Digital Library' provided the information is completely digitized, which is a step ahead of the earlier used concepts in this regard. Preservation, search and
access, content creation, storage and retrieval are essential functional attributes of digital libraries, which should meet the above requirement and should also exhibit the intended characteristics of the digital libraries. Depending upon the individual perception with confined interests, there are numerous ways of defining a digital library. Digital libraries are defined as "the new way of carrying out the functions of libraries encompassing the following:

- new types of information resources
- new approaches to acquisition
- new approaches to classification and cataloguing
- intensive use of electronic systems and networks and
- dramatic shifts in intellectual, organizational and electronic practice.

The term "Digital Library" may be understood in different ways and named differently. The terms used to describe digital library, to denote a subset or a superset or sometimes to denote a rather different concept of digital libraries, are described below. In a Traditional/Real Library, holdings are in hard copy form and there is not any type of computerization, in terms of products, operations or services. Virtual Library/Library without walls/Library is a library with little or no physical presence of books, periodicals, reading space or support staff, but one that disseminates information directly to the distributed users, usually electronically. Hybrid Library/ Gateway Library/ Complex Library, as a continuum from traditional library to the digital library, with electronic and paper-based sources used along side one another, may be viewed as a transitional stage towards a truly digital library. in Digital libraries, the services are fully automated where all resources are in Digital form.

19.1 Definition

Digital Library is an Electronic Library in which a large number of geographically distributed users access the contents of large and divers repositories of electronic objects using computer networks. Yarkey defines Digital Library as Electronic Library in which large number of users across
the world can access information in the form of Network Electronic texts, images, maps, sounds, videos, catalogues, Government publications, hypertext, hypermedia and multimedia compositions etc..

"Digital library is a global virtual library – 'The Library of thousands of networked electronic libraries" as given by Ray R. Larson, CSTR Electronic Library project group, Univ. of California, Berkeley, 1994. According to Larson, there will be a vast population of users scattered around the globe who are able to access, easily and conveniently, the complete contents of thousands of large and small repositories containing texts, images, sound recordings, videos, maps, scientific and business data, as well as hypermedia combinations of these elements. The library must, therefore be a network based distributed system with local servers responsible for maintaining individual collections of digital documents ranging from sets of electronic texts to video-on-demand services. The US Association of Research Libraries (ARL) identified five elements common to all definitions of the digital library, in October 23, 1995.

☞ The digital library is not a single entity
☞ The digital library requires technology to link the resources
☞ Linkages between digital libraries and information services are transparent to users
☞ Universal access to digital libraries must be a goal
☞ Digital library collections are not restricted to document surrogates but include digital artifacts that have no printed equivalent

In a broader sense, we can define ‘Digital libraries' as organizations that provide the resources, including the specialized staff, to select, structure, offer intellectual access to, interpret, distribute, preserve the integrity of, and ensure the persistence over time of collections of digital works so that, they are readily and economically available for use by a defined community or set of communities. Digital Libraries offer such benefits as equitable access, reduced barriers of distance, timeliness, shared resources and content delivery. Digital libraries have been the
prerogative of the developed world, and due to the advancements and affordability in computer and communication technology, they are, though slowly, getting importance in other countries.

19.2 Components of Digital Library

In digital environment, only digital information is disseminated; software is produced locally, and most of the information is obtained by remote accesses and much of this information is less permanent in nature. In order to establish a good digital library, it must be properly equipped so as to disseminate the desired information accessed out of the digital storage medias or digital databases. There are mainly three components of digital libraries and these are as under:

a) Documents (Print, audio, video)
b) Technology
c) Operations (Research, education and others)

Documents

Documents is the most basic component of the digital library. Digital library collections contain fixed and permanent records. Not only current libraries have more dynamic collections but the digital libraries will enable handling of fast changing and/or transient information, such as stock market data, manuals, etc.

Technology

Dissemination of digital information in the absence of proper and appropriate technology is not possible. Digital libraries are based on digital technologies. Digital libraries not only consist purely digital information but non-digital information also. For example, paper-based information also co-exist in digital libraries.

Operations

Digital libraries are to be used by individuals working alone. The prevalent model of digital library use is one of the lone researcher sitting at
workstation and performing operations like browsing, scanning, searching, retrieving, reading and writing. Such a model is in contrast with observed work practice in a range of settings.

19.3 Features of Digital Library

The differentiation of a digital library from a traditional library can be made on the basis of the following characteristics:

a) *Document Collection*: In the digital environment, document must be available in the electronic media also. Digital library collections contain fixed permanent documents available in the digital format. It is expected that the acquisition process will be instant through dynamic document collection and its quick processing to have immediate access.

b) *Used Technology*: Though the underlying assumption is that the digital library will contain only digital materials, in the present day context both digital and non digital information belong to digital library, are to be handled using Information Technology. In the other words, digital libraries are based on digital technologies.

c) *Work & Services*: Digital libraries are to be used by individuals working alone. Professionals should have undergone an orientation cum training to enhance their skills to perform better work to render effective services in the digital environment.

d) *Transbordering of Information*: To satisfy global resources sharing, digital library is able to transfer data within and outside the countries breaking the physical boundaries of data.

Hence digital libraries, in addition to computerization of traditional and routine work, have to have several additional features; viz:

(i) A digital library should provide the opportunity of accessibility to every piece of information of any format from any where. Even during travel also user should be able to access.

(ii) Sometime it becomes very difficult to collect and maintain a large amount of information physically. Digital library is
expected do overcome this barrier through remote accessing to rare and expensive material of large quantity.

(iii) To facilitate the accessibility by user independently, digital library should provide a powerful user friendly interface having unique referencing to digital objects to support effective search and retrieval.

(iv) Obviously, intertwining among all or some forms such as text, data, graphics, animations, audio, video must be supported as far as possible by digital library to increase the degree of user satisfaction.

(v) A digital library should support traditional library missions of collection development, processing and preservation to ensure user access.

(vi) Media integration technology should be employed to handle data, text, audio, video, graphics, image etc. form of information.

(vii) As variety of system functions are to be carried out by means of coordination and management, well trained manpower is another essential component.

Thus, if these major points are fulfilled, the digital library environment will promissingly enrich user service effectively and efficiently. Of these features, two main items-multimedia and communications i.e. network especially Internet, are important technologies without which perhaps it would not be possible to conceive digital library.

19.4 Digital Information Users

As a matter of fact, users of digitised information in India can be broadly divided into following four groups:

1) Those who have started using the latest technology and digitalised information.

2) Those who have been using these technologies and digitalised information and are expanding it rapidly.
3) Those who have the fear of using new technologies for information retrieval.

4) Those who are intermixed between the above three groups, but have no training to use the technology for accessing global information.

19.5 Evolution of Digital Libraries

Digital libraries have been in use for the last two decades. There has been a constant change and improvement in the technology used by digital libraries. In the 1970's, they were based on minicomputers and used to provide basic services of remote access and online search and retrieval. In the 1980's, sophisticated information storage and retrieval systems came into light. Digital libraries used different techniques to share bibliographic records and link different remote systems.

By the 1990's the technology has made it possible for digital libraries to include different text, image, audio and video. Nowadays, visual information systems are getting more popular as compared to text-based information systems. Therefore, digital libraries are becoming more graphical in nature. Also the concept of hypertext has been introduced in digital libraries.

We need digital library technology to manage large amounts of digital content such as thousands of images or hundreds of audio clips, and also to perform searches that are impractical manually. There are electronic tools, which enable this to be done quickly and easily by text search. Libraries and archives with unique collections are digitizing these materials to not only preserve them, but also provide more extensive access to their content from multiple locations, and provide a way to enrich the teaching and learning environment, which is not possible with traditional printed materials. Also the growing use of multimedia data has introduced new challenges in storage and communication of diverse multimedia objects like video, audio and images. The World Wide Web (WWW) makes it easier to transfer such information over national and
international networks. Academia, libraries, publishers, system developers and diverse user populations are collaborating in exciting new ways to create digital library models and technologies.

Digital Libraries (DLs) provide access to digital information collections. Information content in DLs includes a combination of structured/unstructured text/numeric data scanned images graphics, audio and video recordings, etc. Digital librarians to select, acquire, organise, make accessible, and preserve digital collections. Digital libraries are also being used as stand alone systems; the focus is on integrating them with existing integrated library systems and collection management systems so that users can access the content through a single interface. Also these are decentralized and easily extensible, able to support inter-operability between different tools, applications and systems; able to support a rich information seeking environment; and scaleable in terms of the size of the system. As digital library is a relatively new technology, one of the ways to ensure success using this technology is through development and implementation of a technology strategy plan.

Before implementing any new technology, it is very important, first of all to develop a strategic technology plan. The plan should be very systematic, keeping in mind the present and future needs and also the goals of the institution and department.

19.6 Multimedia in Digital Libraries

Multimedia is one of the important components for a digital library. Multimedia approach, conceived in mid 1940s, has helped in thinking about digital libraries and its application has been accelerated to step further. In the present day context, it must be remembered that large amount of information in the form of photographs, artefacts, audio recording, textual material are also available in libraries. Multimedia technology can help librarians in integrating all information in such various formats. Now-a-days several important books, journals are available as multimedia products.
Librarians should not confine themselves only as the end user of the product. Rather they must acquire knowledge of designing and creating multimedia products. Also they should enhance their skills through proper practice in this regard. A short term training to gather knowledge relating to different multimedia components like Text, Sound, Still pictures, 2-D Sketches, 3-D Objects, Live Video Clippings and Animation will be helpful for this purpose.

A multimedia database makes a tremendous impact on its user than ordinary database. A librarian can efficiently develop database incorporating the multimedia components. It will provide an importance for library profession. In activities relating to repackaging, consolidation and presentation of information, multimedia holds much promise and proves its potentiality. User guides in libraries, interactive products for reference services, multimedia based online catalogue can be developed easily to provide effective user services.

19.7 Networking and Digital Libraries

Another major step towards digital library is establishing telecommunication network among participating libraries with a view to improve its service efficiency. In the digital environment, libraries apply suitable technology to allow remote access to every piece of information available in different libraries throughout the world by breaking down the physical barriers through national and international computer based network, especially through the Internet.

19.8 INFLIBNET as Indian Academic and Special Digital Libraries

Basically INFLIBNET is established to provide catalogue based services, access to databases and document supply services and facilities over computer based network. It has launched union databases services for different type of documents having online access facilities to them. Financial assistance is provided to universities to expedite the process of producing their database and putting them to INFLIBNET database.
However, two main facilities must be incorporated and extended to its participants. Facilities of providing full text services are to be launched. And internet facilities must be available to the participating libraries through INFLIBNET. In these days of digital information (INFLIBNET) has a long way to reach the goal. We believe that this project will be operating successfully in true sense when fulfilled. INFLIBNET still has to fulfill the mission of digital libraries combining all libraries/ information centres irrespective of their physical location. In fact it is likely to function as special and academic digital libraries in India.

19.9 Information Infrastructure

As we know, infrastructure plays an important role in the development and expansion of the facilities and services in an industrial society to a large extent. For this reason, government and corporate world always give priority to promote the projects and initiatives for infrastructural development in all sectors. These days due to increased importance of information in the society, the central government is also giving priority to finance infrastructural projects including the IT sector in the country. In this regard, various international tie-ups and collaborations are also being explored to seek adequate resources for IT sectors. It is true fact that IT has an added advantage to contribute substantially to other activities in a society. Pursuant to this infrastructural facilities of the institute include the central library. With this objective, the director has constituted the following tasks forces:

1) Task Force on Improving Interaction with the Outside Environment.
2) Task Force on Information Technology.
3) Task Force on Performance Appraisal and Professional Development Faculty.
4) Task Force on Professional and Career Development for Staff.
5) Task Force on Teaching-Learning Processes.
6) Task Force on Technology Upgraduation of Institute Infrastructure.
19.10. Merits and Challenges

Compared to the analog form of graphic representation, digital imaging stands out as a wonder tool in the hands of the information technologists due to the following merits:

- It permits direct and exact controls of numerous parameters, right on the monitor.
- It has essentially abandoned film technology in document copying, color reproduction, microfilm duplicating and graphic arts.
- It produces detailed image information for immediate utilization.
- With 1 to 3 million pixel CCD’s (charged couple devices) digital cameras provide high-quality picture.
- Digital reconstruction of faded photographs, maps, manuscripts and other library materials of archival value is much easier.
- It is a powerful teaching tool; prototype could be presented by simulation which helps to visualise the actual process.
- It has the capability to integrate different forms of data into a new form of representation.

The digital imaging technology is not without limitations. As this is a newly emerging field, it is facing a few challenges and some of them are mentioned below:

- Digital imaging is not likely to replace conventional film-based methods completely.
- The technology faces more difficulty with moving objects and this is being addressed constantly.
- The reformatting projects in libraries currently involve high cost and labour.
Digital imaging consumes higher bandwidth which is limited in most of the networks. This factor restricts easy transport of data while networking.

Digital imaging emerged so quickly, that the technical and quality issues need to be addressed further.

It offers limited capabilities for demanding applications such as high speed, high resolution; and continuous tone imaging unlike in silver-based photographic systems.

The extent of usage of digital databases depends on the power of cataloging/indexing system, which is still a concern.

The hardware and software becomes obsolete so fast that the preservation of digital images require a constant file refreshing and migration.

Digitised video consumes large quantities of computer power (processing and storage) as each minute of digital video represents a large depository of data.

It is temporarily inhibited by cost, performance, user experience and supporting systems.

Librarians will continue to play a crucial role in collecting, cataloging, indexing and retrieving of information, despite the pattern of information transfer and processing becoming complex.

20. E-mail

It is the most commonly used application on the Internet. The main attraction of e-mail lies in its speed, it is much more powerful than paper mail (or "snail-mail"). With the e-mail we can send and receive anything we use or create on computer; words, documents, programs, photos, images and sounds. Electronic mail, popularly known as E-mail, is the fastest, most economical and highly used modes of communication by a large number of people in their day-to-day professional and personal activities. In fact, the number of users of E-mail exceed those of the entire Internet.
itself. The users of Indian libraries are almost using only E-mail services rather than the other services of Internet, where these facilities are available. E-mail is an electronic message sent from one computer to another while sharing time, effort, money, paper and other resources. Through E-mail you can communicate the message quickly and more easily to millions of people around the world, any more easily to millions of people around the world, any time of the day or night at the cost of a local phone call. E-mail is available on all ‘networks’. E-mail is a necessary service for libraries and information centres. If any library does not provide E-mail services to its staff and users, it is considered a backward library. It becomes a necessity for Indian libraries, specifically academic and research libraries, that their users must use the E-mail services and update knowledge and information. It also becomes necessary that the staff of the library and its users must be trained through some courses on how to use E-mail.

The history of E-mail began with the history of Internet. In 1969, when the ARPANET was introduced by the Department of Defence Advanced Research Project Agency (ARPA) in USA, E-mail was the first service which came into existence and was more popularly used by those users who used time sharing computers and ARPANET’s local networks. ARPANET creators believed that the network would mainly be used for remote logins and file sharing but the most popular service of their network the E-mail but the users were using it without disclosing it. In 1970, the first known and recorded ARPANET E-mail message was actually sent. After this E-mail services steadily increased.

E-mail is growing very common among information seekers because it is much easier cheaper and faster than the conventional mail or fax. You can send E-mail to anyone with an E-mail address, anywhere in the world. Short notes are good to send through E-mail. It is not easy to send any attachments like formatted documents or graphics before the invention of MIME. With the advancement of technology, you can send messages
electronically along with other documents, photographs, sound files and video films as attachments with the help of Multipurpose Internet Mail Extension (MMIE) and incoding scheme like UUencode, etc.

With E-mail you can send...

- message to specific individuals; many individuals at a time; a predefined list of users; text files; programs; graphics; word processed files; spread sheets; attachments in the form of audio/video files; distribute electronic magazines; broadcast announcements, etc.

The working of the electronic mail is quite simple. Any library or Information Centre who wants to use the E-mail services must have a computer, a modem and one STD telephone connection. There are two main types of programs whose activities define the working of E-mail. (a) User Agent Programs (or E-mail Client); (b) Mail Delivery Agent Program (or E-mail Server). E-mail works on Store and Forward Technology. When a mail server receives a message, it makes a copy (stores) of it and then passes it on (forwards) it to the most appropriate 'next hop'. In E-mail services you have to first type your message in the desired 'message box, key-in the recipient’s E-mail address and press the send button of your E-mail program. Once the E-mail is addressed and sent, it gets encoded by a modem and is sent down the phone lines as an analog single to the mail server of the sender's ISP. The mail is sent worldwide and overseas via the Internet. The mail is received by the recipient’s provider and is sent to the provider’s mail server where it will be delivered to the recipient’s mailbox and it will remain there until the recipient next connects through Internet. Finally the recipient’s modem and computer decode the data and he/she can read your E-mail message.

The Internet mail system works based on Simple Mail Transfer Protocol (SMTP). SMTP is a part of the TCP/IP suite of protocols. SMTP is a protocol or set of rules that enables electronic mail to move smoothly...
through the Internet. Because of SMTP a UNLX machine can send mail to a PC or Macintosh Computer and vice versa.

The E-mail address plays a very important role in delivering the mail to the right recipient. It identifies the address holder as unique in the whole world. An E-mail address identifies a person and the computer for the purpose of exchanging electronic mail message. The E-mail consists of three parts:

⇒ User ID;
⇒ Fully Qualified Domain Name;
⇒ 'Country Code'

@ the 'at the rate' of sign is used mainly as a separator. The Basic Structure of an E-mail Address is: username@host-subdomain.second-level-domain.first-level-do-main.country code.

It is very important to enter the recipient's address. If the computer trying to deliver your message does not recognise the mailing address, it will automatically send you a message informing you that the mail could not be delivered indicating the problem that occurred.

20.1 Free Mailbox Services

There are several companies/agencies which offer mailbox service for personal E-mail account, absolutely free. You have to register yourself with them and define an E-mail ID and give a password. You can access these mailboxes from anywhere, provided you have an Internet connection. Some of the sites that offer these services are:

Hotmail (http://www.hotmail.com)
Lifetime E-mail (http://www.lema.com)
Rocketmail (http://www.rocketmail.com)

20.2 Tools of E-mail Addresses

There is some E-mail services that find E-mail addresses free of cost. Even though there are many directory services available, there is no comprehensive and reliable one for the Internet. These directories contain
the listing of people who have registered their names. Some of the search and reference tools of Email addresses are:

- Look UP! Directory Services
  (http://www.lookup.com)
- Inter NIC Directory Services
  (http://www.internic.net)
- Netfind
  (http://www.nova.edu)
- NetPages
  (http://www.aldea.com)
- OKRA : net.citizen Directory Services
  (http://okra.ucr.edu)
- Four 11 Directory Services
  (http://www.fourll.com)
- Internet Address Finder
  (http://www.iaf.net)

There are so many E-mail programs available on various platforms, namely MSDOS, Window 3.1, Window-NT, etc. A few of the popular E-mail packages/software include E-mail, Pine, MS-Internet Mail, Netscape Mail, Eudora, etc. The Department of Electronics (DOE) is offering Email software to various University Libraries of the country including ours as well. If you have a Shell account then you can use E-mail software available with VSNL, called Pine. Most of the E-mail programs like Microsoft Internet Mail, NetsCape Mail, Eudora, etc. Have many things in common, even though there will be slight differences. If you know how to customise you site on one package then it is very easy to do the same with others. Pine is quite different from the other programs but it is a very popular one available at UNIX platforms.
21. Changing Library Scenario

The digital revolution has altered the way society function at the global, local and personal level. In this revolution, we have seen certain changes in information field, especially in relation to collections, storing, processing and transmitting of information. Digital libraries require undoubtedly digital technologies. The digital libraries are a heterogeneous library, which contains hard copy to online systems. The full-fledged digital libraries are one in which all the information is available in the digital form. This may however be difficult to achieve. Until recently, the digital libraries consisted of mostly electronic documents, which are of reference type. Nowadays, most of the documents are primary in nature.

Digital Libraries require well-tested and proven information technologies including the multimedia kit. Much of the work in digital libraries is achieved through e-mail service, by participating in Usenet(s), by accessing the databases or severs through networks, like Internet. Locally developed databases will contribute a lot to develop digital libraries. In other words, the components of digital libraries are:

Local library system, with adequate PCs having LAN, local databases in machine readable form, CD-ROMs etc., provision to provide e-mail service, access to servers, and to remote databases, etc.

- Networks, including the network of networks.
- A variety of system functions to coordinate, manage the entry and to retrieve date.
- Well-trained manpower.
- The highest priority of a library, digital or any other, is to serve the research needs of clientele. The development, maintenance and extension of its collection and its technologies must be supportive as well as subordinate to this primary objective. However, in digital library environment the following need to be focused
- Functions of authors, publishers, vendors and users, etc., will vary. Both information professional and user will do the work of collection,
storage, dissemination and organisational work. The user's work is however called the personal file collection. An author, merely by posting messages to an online discussion group, becomes a publisher. In such an environment, information appears one day and can be altered or disappears the next day. In this situation, how to give a citation? How to collect a copy of the required information?

- How to organise the information? These are the debatable questions.

- Only digital information is disseminated; some are produced locally, and most information are less permanent in nature. In these circumstances, it is very difficult for the professional to decide: What should be organised? Who should do it? What standards should be followed?

- Users only locate the information; information is not usually structured, no rules or codes are followed and no one controls the information that is made available.

- The data or information will be of different types. To organise these data or information, we require cataloging practice and it calls for an appropriate data model for organising data with a standard format. The tools like Gopher, Mosaic, etc., help in cataloging, searching and retrieval of information from these digital libraries.

- Specialised technologies are needed for compressing as well as for organisation of information. Database management methods, whether extended relational or object oriented, not only are needed to support direct use of data collection in digital libraries, but also will help to handle catalog, royalty administration, security control and other services. Text analysis and information retrieval techniques are crucial for converting, indexing, representing, searching and presenting desired information.

The electronic media, by their very nature and characteristics, provide new and exciting opportunities for libraries. For instance, in the
electronic environment, the library need not own publications to be readily accessible. Many of the sources available in electronic form can be made available to the user community by developing electronic information access facilities. Another interesting feature of electronic publications is its speed and quality. The information can be accessed and delivered without much delay. The searching options for an item in electronic environment are easier and simplified if one is familiar with the structure, organisation, the search facilities and software, provided they are user-friendly. The location of that of the printed media.

The challenges ahead of academic libraries in India, to make best use of electronic media in order to meet the needs and requirements of clienteles, are many. Whether to own electronic publications or to develop infrastructural facilities to have access to information without owning the publications is an important issue to be decided by the libraries. Obvious challenge for academic libraries in India is the problem of how to integrate traditional forms with electronic resources as they have developed mostly along with traditional lines where the print media predominates.

Another challenge is the cost factor involved in developing and providing access to electronic sources. These are not always adequately bibliographically controlled. Some-times they are not easily locatable and reviewed. They are fluid, interactive and changed frequently, and most often not owned by any library. The concept of evaluation in order to assess the relevance of information available in electronic format is another major challenge; as it requires a different approach altogether form that of the print media.

More than collection development, it is the provision of access which has gained significance now in the context of the electronic information era and networking environment. The nature and characteristics, different types and varieties of electronic publications, also pose challenges for professionals in India for their organisation and maintenance in libraries.
Another major challenge faced by academic libraries is to educate and train the professionals working in academic libraries to:

a) create computer culture,
b) use a computer to print on paper,
c) handle, develop, organise and distribute electronic versions of print-on-paper publications and publications existing only in electronic form,
d) use computer conferencing to facilitate collaborative authorship,
e) produce new textual presentations and devise new types of publications employing movement, sound and other capabilities of the electronics media.

There is also a challenge to educate and train the end-users in using the tools and services, retrieval tools, browsers, bookmarks, notepad facilities, copy-and-paste facilities, online help, tutorial modes, glossaries and dictionaries, traces, collectors, back-track facilities and navigation tools in making possible to use the information available in electronic publications through user-education programs, as they are used to conventional books all these years.

The information explosion and information technology (IT) revolution has led to the emergence of the electronic information era. Rapid advances in information processing, storage and communication technologies have revolutionised the role of worldwide libraries in disseminating information services to their users. As a result, libraries are facing new challenges, new competitors, new demands, new expectations and a variety of information services from users tailored to there wants and needs. Libraries are reconsolidating their positions, redesigning their services, and information products, incorporating new technologies, upgrading information resources, training people, changing information objects, modes of communication and information and to satisfy the changing information needs of user community.
Libraries provide information services that must fulfil the information needs of present and future library users. They want to supplement the printed information with more dynamic electronic multimedia documents. The uses' demands for information delivery in digital form at their desktop are increasing in recent time. In the present resources being published and transmitted through the electronic media, libraries must take proactive measures to develop digital collections to cater for digital information needs of their users.

India has to be in the 'Information Highway' as a sea of information is knocking at its doors. India has the human expertise to meet the challenge and to set up digital libraries in the country. We are at the threshold of breaking into Cyberspace and navigate through Internet and World Wide Web. Through Internet it has now become possible to be a part of the "Global Village" and exchange information instantly. World Wide Web (WWW) is the most advanced browsing and searching system deployed on Internet based on hypertext paradigm. It allows one to explore a seemingly unlimited worldwide digital "WEB" of human knowledge. With all these facilities it is possible to access hundreds of databases and make the information available to the user community in the country. Availability of CD-ROM databases accessible through LAN and WAN is an added advantage.

References:


17 Wilson, Tom, In the beginning was the word ...; Social and economic factors in scholarly electronic communication, ASLIB Proceedings, 47(9), 1995, p.195-202.
30 Smith, K. E., Hypertext linking to the future, On line, 12(2), 1988, p.32-40.