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DATABASES : TYPES AND GENERATIONS, SALIENT FEATURES OF SELECT BIBLIOGRAPHIC DATABASES

1.4.1 Introduction
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1.4.1 Introduction

Information sources can be categorized in a number of ways. We can categorize them as natural sources and man or machine made resources. Natural resources are any kind of information generated by nature, such as the solar system, the oceans, mountains and forests that is captured and recorded by human beings. Human beings and machines have also generated a lot of information that can also been recorded. Before the invention of printing we had recorded information sources like drawing, painting, carving, writing on clay tables parchment, cloths, leaves etc. and after invention of printing books, monographs, theses, reports, articles etc. are the main sources of recorded information. Nowadays we have information sources recorded on electronic media ranging from local or home-grown databases to online databases, CD-ROM databases and so on.

Printed information sources have been the major type of information sources for centuries and digital information sources are growing at a very rapid rate and many reference sources are now available in electronic format. The first of the e-information sources to appear was the online database. Online search services appeared in the late sixties and early seventies.

Online databases are accessible, from remote locations and are usually available through commercial search-service providers and search services brought about significant improvements in searching because they allowed users from all over the information world to access remote databases, no matter where they are located, through computer and communication facilities. Another major change in electronic information sources took place in the mid-1980s with the appearance of CD-ROM technology. Since then CD-ROM databases containing various types of information

in bibliographic and full text databases, numeric databases and of late multimedia databases.

1.4.2 Database

The term database broadly denotes an integrated accumulation of computer processible data organized in a manner suited to a wide range of applications. The data are stored so that they are independent of programmes, which use the data, a common and controlled approach is used in adding new data and modifying and retrieving existing data with in the database. The intention of database is to allow the same collection of data to serve as many applications as useful.

The word 'database' is normally used to refer to a collection of records stored on a computer. A database may describe bibliographic documents of one sort or another; factual data such as company reports, newspaper articles or legislation, known as full-text databases; or statistical information, for which the term databank is also used.

Generally speaking Databases is an organized set of records on a subject in whatever form, updated on a continual basis and available for international/national regional consumption'. The basic unit of the database is the individual record, which contains the information describing one object. The facts about this object are stored in field, so for example, a bibliographic database containing records of journal articles may well have fields including journal title, article title, volume and issue numbers, page numbers, another (S) etc.

In the literature term 'database' has been used in two different implications. In library and Information Science, there are referred to as bibliographic or inventory in nature and comprise a collection of related logical records. In computer Science this is referred to in a different sense as a database management system. In this sense a database has a logically consistence structure in which records are actually linked. Databases may be defined as a collection of works, data or material arranged in a systematic and methodological way and capable of being accesses by electronic or other means, which includes bibliographic databases and full text databases. Databases provide a very powerful way of storing and relieving information. However, as each database is likely to have a slightly different field structure, it has traditionally been difficult to search across more than one database. The Internet has added an extra and new dimension to this definition, in that it is possible to search across material available on many different sites. However, much of the most useful materials on the Internet is protected by passwords and can only be searched at the site at which it is kept.

1.4.3 Types of Databases

Database may be stored as magnetic or optical media such as disks and accessed either locally or remotely. This may includes access to an organization database

covering transaction and financial records or other databases that might be accessed remotely. Some of these databases will hold publically accessible information such as abstracting and indexing databases, full text of reports, encyclopedias and directories, while other databases will be database that are shared with in an organization or group of organization. Databases may be classified according to different characteristics - by contents, mode of access, subject scope, chronological coverage, geographical and many others. For example, a database classified according to contents may be bibliographic, textual, numeric, etc. Database may also be categorized according to subject irrespective of other modes of classification. For examples, a database on physics may contain bibliographic, numerical, textual and formula data. All the databases may also be categorized according to the mode of access such as offline or online. You should be aware that all databases do not provide the facility of online retrieval. Information collections, sharing a common characteristic such as subject discipline or type, which are published electronically by public or private sector database producers (usually on a commercial basis) and made available to a large public for interactive searching and information retrieval. Online databases are accessed via telecommunications or wide area network links to remote online host services, which normally offer many different databases. CD-ROMs are optical disks, which are mounted locally on a PC, workstation or local area network. In terms of their content, online and CD-ROM databases share many common features. Indeed, many databases are published in both formats. Other less commonly used formats for database distribution include diskette, magnetic tape and hand-held products. Online and CD-ROM databases now cover a huge range of different types of information, but the vast majority fall into one or more of the categories below :

Reference and Source Databases

Databases that might be available to information users in the public area an either remotely via online search service or more locally on CD-ROM can be categorized as either reference or source database.

Reference Database

Reference database refer or point the user to another source such as document of an organization or an individual for additional information for the full text of a documents. This database does not contain complete information, but only references. Users are referred to sources where in additional/complete information would be available. In the present day context, in comparison to other types of databases, these databases play a major role in providing library and information services. Examples are :

(a) Bibliographic Databases

Bibliographic databases contain references to published literature, including journals and newspapers articles, conference proceedings and papers, reports, government and legal publications, patents, books, etc. These databases provide bibliographic information about a document such as citations, sometimes with address of the printed documents. In contrast to library catalogue entries, a large proportion of the bibliographic records in online and CD-ROM database describe analytics (articles, conference paper, etc.) rather than complete monographic, and they generally contain very rich subject descriptions in the form of subject indexing terms and abstracts. These databases are used by libraries and information centers in various ways such as, provision of current and retrospective literature reaches, compilation of bibliographies, providing CAS and SDI, and book selection.

(b) Referral Databases

Referral databases provide references to the non-print sources, sometimes with descriptive information. The source may be organization, individuals, audio-visual materials, current research projects etc., the objective being to help the users for contacting the sources for exact information. In other words, they function as a switch to connect the users with sources, which may provide exact information.

Source Databases

In comparison to previous types, these databases comprise source data, full text of original source publications or materials, prepared specifically for electronic distribution. The source databases are produced by various types of organizations including government organizations that have the responsibility of disseminating information collected or generated by them. Some producers collect data/information from various sources, process them and make these available for dissemination after repackaging, Source databases contain the original source data, and are on type of electronic documents. After successful consultation for a source database, the user should not need to seek information in an original source (as in the case with reference database). Data are available in machine-readable form instead of or as well as printed form. The contents of such databases may be as varied as the contents of printed book and may include text, numbers tables, figures and graphics. Indeed many such databases take advantages of the fact that they are not constrained by same physical limitation. Most of them are multimedia, embracing in addition to text and numeric data, computer software, images, sound, maps and charts. These databases can be accessed through online search services on CD-ROM or via videotext and teletext. CD-ROM is the medium that has supported the initial development of the more ambitious multimedia databases because there is no need to transmit images over external communication networks.

Source database can be grouped according to their content, They are :

1) Numeric databases, which contain numerical datas of various kinds, including statistics and survey datas.
2) Full text databases of news paper items, technical specifications and software.
3) Text numeric databases which contain a mixture of textual and numeric data (such as company annual reports) and hand book data.
4) Multimedia databases, which include information stored in a mixture of different types of media, including sound, video, pictures, text and animation.

Numeric Databases

These databases contain data in numeric form generated and collected in various ways, such as scientific data obtained by research and experimentation, statistical data obtained by various means, survey data like census data, land data, etc. These contain predominantly numeric data. Examples include company accounts and financial performance indicators, commodity and stock market data, statistical data of all types, including time series, and chemical or physical properties of substances.

Full-Text Databases

These databases comprise records of the complete text of an item of information such as periodical article, newspaper item specifications, court decisions, etc. The use of these databases is gaining more and more importance from the point of view of usability of users. These contain, in addition to a Bibliographic Descriptions, the entire text of documents. For example, the majority of articles from all the UK quality newspapers are available in online format, and many are also published on CD-ROM. As the full text is normally searchable, abstracts and indexing terms may not be present.

Textual/Numeric Databases

These databases contain a combination of information consent mentioned in the above section. They contain descriptive information with statistical or properties or other types of data in numeric form. Handbook type of data such as physical and chemical properties of substances is typical example of this type. These databases are useful when further clarification; explanation about the numeric data is required. Chemsis, Chemsearch are some of the existing databases of this type. This is also known as Factual Database.

Multimedia Databases

Multimedia Databases contain a mix of different media such as text, audio, video and still graphics (photographs, diagrams and illustrations, graphs, charts, maps and even representations of works of art). Because of the limitations of current telecommunications networks in transmitting large graphics files, multimedia databases are more usually in CD-ROM format than online, though the

implementation of high-speed networks will radically alter this situation in the foreseeable future.

Full-Text Image Databases

Strictly speaking these are really full-text database. The finer distinction lies in the fact that these databases contain full-text materials that include figures, illustrations, charts, photographs and other graphic materials included in the original work. Whereas the full-text database, comprises textual material only.

Directory Databases

Directory databases contain descriptive information for entities. Different directories may list organization, individuals, electronic or printed publications, materials, chemical substances, computer software, audiovisual materials, etc.

Other Types-Recent Trends

The types of database as mentioned above are on the basis of information content. Many of these databases are available online whereas many others are not.

The libraries with their traditional holdings in print format are now being added with electronic information resources in various formats like CD-ROM, DVD- ROM databases and Online databases. The content of these sources varies from bibliographic or factual to full text.

CD-ROM Databases

CD-ROM databases are increasing day by day in almost all fields due to their many advantages in information storage and retrieval. Majority of publishes of books and journals, online vendors and various learned societies are bringing out new titled in CD format with powerful, user-friendly retrieval software. Electronic information resources in CD format include abstracting and indexing services, encyclopedias, dictionaries, directories, yearbooks, back volumes, patents, standards and many other reference works. The CD-ROM technology has given ample opportunities for information professionals to introduce more information services to end-users.

DVD-ROM Databases

The advent of DVD-Digital Video Disc or Digital Versatile Disc, with its 17GB of high data storage capacity, has made it possible to include more multimedia elements like video and sound and to integrate many reference sources on a single disc. The other features like higher quality of sound and video, higher rate of data transfer, data security etc., are making DVD more viable option than CD-ROM. But, at present due to some problems like lack of standards among the manufactures of DVDs and drives, need for extra hardware on PCs and their higher prices are making the growth of DVD technology slow. Some DVD reference sources include Britannica, Webster's International, Grolier Multimedia Encyclopedia, Eyewitness World Atlas DVD-ROM Deluxe Edition, and the Complete National Geographic on DVD-ROM etc.

Online Databases

The recent growth of Internet and the popularity and ease in use of Web are making libraries to subscribe to online information services. The online database services like Dialog (KR Information) and STN are now moving towards being webcentric. The usage of online databases against their CD-ROM counterparts has to be evaluated and decided on the basis of cost effectiveness and timeliness. Few Online information services are KR Science Base and STN the KR Science Base, which includes information sources like BIOSIS, CA Search, Elsevier Science Publishers, Reuters, etc. The STN international provides a complete collection of in-depth databases in science and technology, which gives quick, direct links to the literature, patents and chemical catalogues. Chemical Abstract Service, producer of the world's largest and most comprehensive database of chemical information, offers several databases on STN like CA plus, INSPECT, MEDLINE, SCISEARCH, TOXLIT etc.

Source databases are so varied in their nature and origins that it is difficult to make generalization. Earlier, in this lesson we divided source databases in to numerous, full text and text numeric. We might also consider referral databases in this way. Although these can be categorized as reference databases in the sense they offer a pointer to further information they are often also source databases that they might contain the full text of a directory that could be regarded as a source document. Source database then may include the full text of a journal article, newsletters, directories, dictionaries and other source materials.

Therefore, a database is an organized collection of data stored in a computer in a systematic way that can be accessed electronically. Simply, data is a single piece of information, and can include, but is not limited to, text, images, numbers, and audio video clips etc. Earlier database were containing bibliographic information only. Then they started covering references or citations etc. and now link to these citations or references are also being provided in most of the cases, e.g. Biological Abstracts and Chemical Abstract Service. There are different types of electronic databases in the world today, including statistical databases, image databases, and other. These electronic databases providing different types of information and some are in general and covers a broad range of subjects and some are subject specific and cover only certain subject areas or time periods.

1.4.4 Generations of Databases:

1.4.4.1 Zeroth generation: Record Managers 4000BC -1900

The first known writing describes the royal assets and taxes in Sumeria. Record keeping has a long history. The next six thousand years saw a technological evolution from clay tablets to papyrus to parchment and then to paper. There were many innovations in data representation: phonetic alphabets, novels, ledgers, libraries,

paper and the printing press. These were great advances, but the information processing in this era was manual.

1.4.4.2 First Generation: Record Managers 1900 -1955

The first practical automated information processing began circa 1800 with the Jacquard Loom that produced fabric from patterns represented by punched cards. Player pianos later used similar technology. In 1890, Hollerith used punched card technology to perform the US census. His system had a record for each household. Each data record was represented as binary patterns on a punched card. Machines tabulated counts for blocks, census tracts, Congressional Districts, and States. Hollerith formed a company to produce equipment that recorded data on cards, sorted, and tabulate the cards. Hollerith's business eventually became International Business Machines. This small company, IBM, prospered as it supplied unit-record equipment for business and government between 1915 and 1960.

By 1955, many companies had entire floors dedicated to storing punched cards, much as the Sumerian archives had stored clay tablets. Other floors contained banks of card punches, sorters, and tabulators. These machines were programmed by rewiring control panels (patch-boards) that managed some accumulator registers, and that selectively reproduced cards onto other cards or onto paper. Large companies were processing and generating millions of records each night. This would have been impossible with manual techniques. Still, it was clearly time for a new technology to replace punched cards and electro-mechanical computers.

1.4.4.3 Second Generation: Programmed Unit Record Equipment 1955-1970

Stored program electronic computers had been developed in the 1940's and early 1950's for scientific and numerical calculations. At about the same time, Univac had developed a magnetic tape that could store as much information as ten thousand cards: giving huge improvements in space, time, convenience, and reliability. The 1951 delivery of the UNIVAC1 to the Census Bureau echoed the development of punched card equipment. These new computers could process hundreds of records per second, and they could fit in a fraction of the space occupied by the unit-record equipment.

Software was a key component of this new technology. It made them relatively easy to program and use. It was much easier to sort, analyze, and process the data with language like COBOL. Indeed, standard packages began to emerge for common business applications like general-ledger, payroll, inventory control, subscription management, banking, and document libraries.

The response to these new technologies was predictable. Large businesses recorded even more information, and demanded faster and faster equipment. As prices declined, even medium-sized businesses began to capture transactions on cards and use a computer to process the cards against a tape-based master file.

The software of the day provided a **file-oriented record processing** model. Typical programs sequentially read several input files and produced new files as output. COBOL and several other programming languages were designed to make it easy to define these record-oriented sequential tasks. Operating systems provided the file abstraction to store these records, a job control language to run the jobs, and a job scheduler to manage the workflow.

Batch transaction processing systems captured transactions on cards or tape and collected them in a batch for later processing. Once a day these transaction batches were sorted. The sorted transactions were merged with the much larger database (master file) stored on tape to produce a new master file. This master file also produced a report that was used as the ledger for the next day's business. Batch processing used computers very efficiently, but it had two serious shortcomings. If there was an error in a transaction, it was not detected until that evening's run against the master file, and the transaction might take several days to correct. More significantly, the business did not know the current state of the database - so transactions were not really processed until the next morning. Solving these two problems required the next evolutionary step, online systems. This step also made it much easier to write applications.

1.4.4.4 Third Generation: Online Network Databases 1965-1980

Applications like stock-market trading and travel reservation need to know the current information. They could not use the day-old information provided by off-line batch transaction processing - rather they need immediate access to current data. Starting in the late 1950's, leaders in several industries began innovating with online transaction databases which interactively processed transactions against online databases. Several technologies were key to enabling online data access. The hardware to connect interactive computer terminals to a computer evolved from teletypes, to simple CRT displays, and to today's intelligent terminals based on PC technology. **Teleprocessing monitors** provided the specialized software to multiplex thousands of terminals onto the modest server computers of the day. These TP monitors collected request messages from a terminal, quickly dispatched server programs to process each message, and then dispatched the response back to the requesting terminal. **Online transaction processing** augmented the batch transaction processing that performed background reporting tasks.

Online databases stored on magnetic disks or drums provided sub-second access to any data item. These devices and data management software allowed programs to read a few records, update them, and then return the new values to the online user. Initially, the systems provided simple record lookup: either by direct lookup by record number or associative lookup by a record key.

1.4.4.5 Fourth Generation: Relational Databases and Client-server computing 1980-1995

The idea of the **relational model** is to represent both entities and relationships in a uniform way. The relational data model has a unified language for data definition, data navigation, and data manipulation, rather than separate languages for each task. More importantly, the relational algebra deals with record sets (relations) as a group, applying operators to whole record sets and producing record sets as a result. The relational data model and operators gives much shorter and simpler programs to perform record management tasks

Inspired by Codd's ideas, researchers in academe and industry experimented throughout the 1970's with this new approach to structuring and accessing databases promising dramatically easier data modeling and application programming. The many relational prototypes developed during this period converged on a common model and language. Work at IBM Research led by Ted Codd, Raymond Boyce, and Don Chamberlin and work at UC Berkeley led by Michael Stonebraker gave rise to a language called SQL. This language was first standardized in 1985. There have been two major additions to the standard since then virtually all database systems provide an SQL interface today. In addition, all systems provide unique extensions that go beyond the standard.

The relational model was well suited to Client-server computing. **Client-server** application designs divide applications in two parts. The **client** part is responsible for capturing inputs and presenting data outputs to the user or client device. The **server** is responsible for storing the database, processing client requests against a database, and responding with a summary answer. The relational interface is especially convenient for client-server computing because it exchanges high-level requests and responses. SQL's high-level language minimizes communication between client and server. Today, many client-server tools are built around the Open Database Connectivity (ODBC) protocol that provides a standard way for clients to make high-level requests to servers. In particular, procedural languages like BASIC and Java have been added to servers so that clients can invoke application procedures running at the server.

1.4.4.6 Fifth Generation: Multimedia Databases 1995-

Relational systems offered huge improvements in ease-of-use, graphical interfaces, client-server applications, distributed databases and data mining. Nonetheless, in about 1985, the research community began to look beyond the relational model. Traditionally, there had been a clear separation between programs and data. This worked well when the data was just numbers, characters, arrays, lists, or sets of records. As new applications appeared, the separation between programs and data

became problematic. The applications needed to give the data behavior. For example, if the data was a complex object, then the methods to search, compare, and manipulate the data were peculiar to the document, image, sound, or map datatype.

The traditional approach was to build the datatypes right into the database system. SQL added new datatypes for time, time intervals, and two-byte character strings. Each of these extensions was a significant effort. When they were done, the results were not appropriate for everyone. For example, SQL time cannot represent dates before the Christian Era and the multi-character design does not include Unicode (a universal character set for almost all languages). Users wanting Unicode or pre-Christian dates must define their own datatypes. These simple examples and many others convinced the database community that the database system must allow domain specialists to implement the datatypes for their domains. Geographers should implement maps, text specialists should implement text indexing and retrieval, and image specialists should implement the type libraries for images. To give a specific example, a data time series is a common object type. Rather than build this object into the database system, it is recommended that the type be implemented as a class library with methods to create, update and delete a time series. Additional methods summarize trends and interpolate points in a series, and compare, combine and difference two series. Once this class library is built, it can be "plugged into" any database system. The database system will store objects of this type and will manage the data (security, concurrency, recovery, and indexing) but the datatype will manage the contents and behavior of time-series objects.

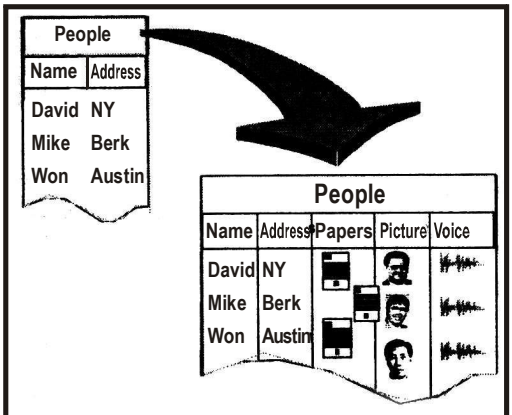

Figure : The transition of traditional database storing numbers and characters into an object-relational database where each record can contain data with complex behavior.

People coming from the object-oriented programming community saw the problem clearly: datatype design requires a good data model and a unification of procedures and data. Indeed, programs encapsulate the data and provide all the methods to manipulate the data. Researchers, startups, and established relational database vendors have labored long and hard since 1985 to either replace the relational model or unify the object-oriented and relational systems. Over a dozen Object-Oriented

database products came to market in the late 1980's, but customers were slow to accept these systems. Meanwhile, the traditional vendors tried to extend the SQL language to embrace object oriented concepts, while preserving the benefits of the relational model.

The rapid evolution of the Internet amplifies these debates. Internet clients and servers are being built around "applets" and "helpers" that capture, process, and render one data type or another. Users plug these applets into a browser or server. The common applets manage sound, image, text, video, spreadsheets, graphs. These applets are each class libraries for their associated types. Desktops and web browsers are ubiquitous sources and destinations for much of the data. Hence, the types and object models used on the desktop will drive the server class libraries that database systems must support.

To summarize, databases are being called upon to store more than just numbers and text strings. They are being used to store the many kinds of objects we see on the World Wide Web. and to store relationships among them. The distinction between the database and the rest of the web is being blurred. Indeed, each database vendor is promising a "universal server" that will store and analyze all forms of data (all class libraries and their objects).

To close on the current status of data management technology, it makes sense to describe two large data management projects that stretch the limits of our technology today. **The Earth Observation System Data/Information System (EOS/DIS)** is being built by NASA and its contractors to store all the satellite data that will start arriving from the Mission to Planet Earth satellites in 1997. The database, consisting of remote sensor data, will grow by 5 terabytes a day (a terabyte is a million megabytes). By 2007, the database will have grown to 15 petabytes. This is a thousand times larger than the largest online databases today. NASA wants this database to be available to everyone, everywhere, all the time. Anyone should be able to search, analyze, and visualize the data in this database. Building EOS/DIS will require advances in data storage, data management, data search, and data visualization. Most of the data has both spatial and temporal characteristics, so the system requires substantial advances storing those data types, as well as class libraries for the various scientific data sets. For example, this application will need a library to recognize snow cover, vegetation index, clouds, and other physical features in LandSat images. This class library must easily plug into the EOS/DIS data manager.

The emerging **world-wide library** gives another challenging database example. Many institutional libraries are putting their holdings online. New scientific literature is being published online. Online publishing poses difficult societal issues about copyrights and intellectual property, but it also poses deep technical challenges. The size and diversity of this information are daunting. The information appears in

many languages, in many data formats, and in huge volumes. Traditional or approaches to organizing this information (author, subject, title) do not exploit the power of computers to search documents by content, to link documents, and to cluster similar documents together. Information discovery, finding relevant information in the sea of text documents, maps, photographs, sounds, and videos, poses an exciting and challenging problem.

1.4.5 Salient Features of Select Bibliographic Databases

Bibliographic Databases :

These databases provide-a descriptive record of an item only, means location of actual item with some useful information but the item itself is not provided in the database. The useful information about the item which is provided, including name of author's, title subject, publisher, year of publication, etc. The information provided is called a citation. Most of the times a short summary or abstract of the item are also provided. Examples of bibliographic databases include Library and Information Science Abstract (LISA), Sociological Abstracts etc.

Sociological Abstracts :

Sociological Abstracts (San Diego, CA : Sociological Abstracts Inc., 1953-). Seven issues a year. This is one of the most important resources for accessing the research literature in sociology and its subdisciplines including; psychology, political science, philosophy, economics, education, community development, demography and medicine. Core journals in sociology are fully abstracted. Journals in related fields are selectively abstracted. Articles are screened by senior editors with backgrounds in the social sciences. Drawing information from an international selection of over 2600 journal and other serials publications, conference papers and dissertations, entries are arranged by author under a detailed classification scheme of 29 major subject headings that are further subdivided. Author, subject and reviewer indexes are included, as well as a source list giving names of all journals covered. International Review of Publications in Sociology (IRPS) is a supplement that lists reviews appearing in the same issue of Sociological Abstracts. Sociological Abstracts <www.silverplatter.com>. Sociological Abstracts (1963-) this database covers publications from 1963 to date. Records added after 1974 contain in-depth and non-evaluative abstracts of journal articles. It also contains the Social Planning/ Policy and Development Abstracts. SOPODA, database, which focuses on solutions to social problems. Coverage is from 1979 forward.

LISA : Library and Information Science Abstracts

LISA is an international abstracting and indexing tool designed for library professionals and other information specialists. It currently abstracts over 440

periodicals from more than 68 countries and in more than 20 different languages. Coverage of literature is from 1969 to current. Frequency to update the records is in every two weeks, and 500 records are added in per update. As on March 2005 over 270,000 records are recorded. Print version for Library and Information Science Abstracts is published with ISSN 0024-2179.

Features are :

- LISA is the world's best known resource for the coverage of ongoing research in all aspects of library and information studies.
- Entries keep you well informed about the different topics such as artificial intelligence, information and knowledge management, publishing and copyright, world wide web resources.
- Updated subject focus-to reflect new patterns in society, together with changing requirements in the library and information science field, five important new subject focuses have been incorporated into LISA'S coverage strategy, which are Life long learning, Knowledge management, Management issues, Information literacy, information systems management.

Library of Congress

Library of Congress (LC) online catalog <http://catalog.loc.gov/>

Library of Congress database contains approximately 12 million records of books, serials, computer files, manuscripts, cartographic materials, music, sound recordings, and visual materials representing the huge collection of materials owned by the Library of Congress. The database records reside in a single integrated database. Researchers may use the database to identify relevant literature. Besides, since each record contains full bibliographic details including LC subject headings, LC class number and DDC number, it can be a useful tool for acquisitions and cataloging departments of academic libraries for bibliographic verifications, classification and cataloging purposes, respectively.

Population Index

<http://popindex.princeton.edu/>

Population Index Covers all fields of interest to demographers, particularly the world's population. It presents an annotated bibliography of recently published books, journal articles, working papers, doctoral dissertations, and other materials on population topics, containing over 46,035 abstracts of demographic literature published in Population Index. It is searchable by author, title, subject, geographical region and/ or year. Its coverage is from 1956 to the present and updated annually. The Office of Population Research, Princeton University, maintains the database.

TOXNET (Toxicology Data Network)

< http:/ toxnet. nih. gov>

Toxicology Data Network Contains a cluster of bibliographic databases produced by the National Library of Medicine, covering various aspects on toxicology, hazardous chemicals, and related areas. The databases are Hazardous Substances Data Bank (HSDS), TOXLINE, Taxies Release Inventory (TRI), Integrated Risk Information System (IRIS), Chemical Carcinogenesis Research Information System (CCRIS), Environmental Mutagen Information Centre (EMIC), and others. For instance, TOXLINE provides extensive coverage of bibliographic information on biochemical, pharmacological, and toxicological effects of drugs and other chemicals. It contains more than three million bibliographic citations, most of them with abstracts.

Psychological Abstracts

Psychological Abstract (Washington, DC : American Psychological Association, 1927-) is the printed version of the PsycINFO database. This monthly publication contains summaries of English-Language journals, technical reports, books and book chapters relevant to psychology. The summaries include abstracts and full bibliographic and indexing information. To facilitate browsing, Psychological Abstracts is organized by subject area based on the PsycINFO classification codes. Cumulative author and subject indexes, published annually, provide quick and easy access to each year references. The primary index in the field of psychology and a larger and more comprehensive online version of PsycLit on CD-ROM and Psychological Abstracts PsycINFO includes citations and abstracts to journal articles, book chapters, technical reports, conference papers and dissertations. The database comprises more than 1.5 million references from 1887 to present. It includes literature relevant to psychology and related disciplines, including sociology, psychiatry, education, medicine and business. The database abstracts materials from over 1300 periodicals. Other useful features include the hypertext links to APA's Thesaurus of Psychological Index Terms. The database is available from a number of suppliers including: Silver Platter Information <ww.silverplatter.com> (Hard Disk, CD-ROM and Internet); and Ovid <www.ovid.com> (CD-ROM and Internet).

PAIS International

<www.pais.org/products/index/stm>

PAIS International (New York: OCLC Public Affairs Information Service, 1972). PAIS is published monthly and an annual subscription includes monthly issues, author and subject indexes, PAIS subject headings, containing 8000 indexing terms are available in the print version for users, for more effective searching of the indexed material. The subject areas covered are current events, economics, foreign affairs, government regulations, political science, public administration and social issues. The PAIS online database (now merged with OCLC to form the OCLC Public Affairs Information Service) contains 440000 indexed records and another 14,000 records

are added annually. The sources used are publications, statistical yearbooks, conference proceedings, books and reports as well as journals. All abstracts and subject headings used in indexed records are in English. One of the great strengths of PAIS is its indexing of grey literature. In 1999, PAIS indexed 951 journals, 1036 Internet document and 5600 books, reports and pamphlets. PAIS is also available on CD-ROM and can be accessed through online database hosts and fee-based services on the Internet.

International Bibliography of Sociology

International Bibliography of Sociology (London : British Library of Political and Economic Science, London School of economics, 1951-). With its sister publications-Anthropology, Economics and Political Sciences-this volume makes up the International Bibliography of Social Sciences. Material rom over 100 countries is included. Approximately 70 per cent of the records are in English, and articles in other languages are displayed with both the original language title and an English translation.

International Bibliography of Sociology is available as part of the International Bibliography of Social Sciences, as a Silver platter CD-ROM (covering 1981 to date). The database from 1951 onward is available online via the Bath Information and Data Services (BID) at <www.bids.ac.uk>. The BIDS/ingenta service offers the option of downloading the full text of some of the articles.

Discrimination and Prejudice

Discrimnation and Prejudice : an Annotated Bibliography by Halford H. Fairchild et al (San Diego, CA: Westerfield Enterprises, 1992) offers over 4000 references to books, articles, dissertations and US government documents on the subject of prejudice and discrimination. Divided into five parts - African Americans; American Indians; Asian Americans; Hispanic Americans; and multi-ethnic groups - topics such as civil rights, education, health and public services are covered. Reference are briefly annotated. Broader in coverage is Meyer Weinberge's World Racism and Related Inhumanities: a Country-by-Country Bibliography (Wesport, CT: Greenwood Press, 1992) which cites over 12000 books, articles and dissertations published worldwide on racism and related topics. Over 135 countries are included.

International Medieval Bibliography

A bibliography of over 300,000 articles, review articles, scholarly notes and similar literature on all aspects of medieval studies. The discipline areas covered include Classics, English Language and Literature, History and Archaeology, Theology and Philosophy, Medieval European Languages and Literatures, Arabic and Islamic Studies, History of Education, Art, History, Music, Theatre and Performance Arts,

Rhetoric and Communication Studies for works work published throughout Europe, the Americas and the Asia-Pacific region. The time coverage is c. 400-1500.

PsychlNFO (1887) INDEX/ABSTRACTS

Contains citations and summaries of journal articles, book chapters, books and technical reports, as well as citations to dissertations, all in the field of psychology and psychological aspects of related disciplines, such as medicine, psychiatry, nursing, sociology, education, pharmacology, physiology, linguistics, anthropology, business and law. Journal coverage includes international material selected from more than 1,400 periodicals written in over 35 languages. Current chapter and book coverage includes worldwide English-language material published from 1987-present. Over 55,000 references are added annually through monthly updates, PsycINFO is produced and copyrighted by the American Psychological Association.

Social Sciences Citation Index (1990) INDEX ; (1992) ABSTRACTS

Fully indexes more than 1,725 journals across 50 social sciences disciplines, Also indexes individually selected, relevant items from over 3,300 of the world's leading scientific and technical journals. Some of the disciplines covered include: anthropology, history, industrial relations, information science & public health, social issues, social work, sociology, substance abuse, urban studies and women's studies. Available as part of the Web of Science.

Anthropology Bibliographies

Anthropology Bibliographies: a Selected Guide edited by Margo L. Smith and Yvonne M. Damien (South Salem, NY : Redgrae Publishing Company, 1981). This has a listing of 3200 titled from the beginning of the twentieth century to the 1980s. It is broad in scope, encompassing texts from all the main subfields and in many languages. It lists both independently published monographs and journal articles, which may be difficult to trace elsewhere. Also included are filmographies of audio-visual materials and teaching aids. The main emphasis is on listing bibliographies relevant for area studies, although a subject index is also provided.

Linguistics and Language Behavior Abstracts

Linguistics and Language Behavior Abstracts (Bethesda, MD : Cambridge Scientific Abstracts) is a searchable database of over 285000 bibliographic records, covering all aspects of the study of language including: phonetics, phonology, morphology, syntax and sematics. It focuses on three fundamental areas: research in linguistics; research in language; and research in speech, language and hearing pathology. The database is updated quarterly and includes abstracts from over 1300 journals from 50 countries. It is available from a number of suppliers including: Silver Platter Information <www.silverplatter.com> (Hard Disk, CD-ROM and Internet) and Ovid <www.ovid.com> (CD-ROM and Internet).

Bibliography of Asian Studies

<bas.umdl.umich.edu/b/bas/>

Bibliography of Asian Studies (Ann Arbor, MI: Association for Asian Studies, 1971). quarterly. This index had its origins in an annual bibliography published in the Far Eastern Quarterly in 1936. The online version contains the contents of all printed editions from 1971 to the present day, with quarterly updates. It provides citations to western language Journal articles. Conference proceedings and some chapters in books covering the economic, political and social study of the region. Since 1992 monographs have been excluded. In the past, there have been considerable time lags between publication and indexing, extending in some instances to over four years, however, these are now in the process of being reduced. The database, may be searched by region, or subject keyword.

DARE

www.unesco.org/general/eng/infoserv/db/dare.html

DARE (Paris: UNESCO) is a bibliographic database that contains 11000 worldwide references to social science journals, social science research and training institutions, specialists, documentation and information services. It is provided by the Social and Human Sciences Documentation Centre of UNESCO's Information Services.

Dissertation Abstracts

<www.umi.com/hp/Support/Services/products/da.htm.>

Dissertation Abstracts this service includes citations from the first US dissertation in 1861. From 1988 onwards the references include abstracts. It is available in a variety of electronic formats including the Web via ProQuest, which offers an easy-to-use, searchable interface. Its CD-ROM version is updated quarterly and consists of a current disc (1994-) and a four-disc archival set (1861-1993). Dissertation Abstracts is also available from the following commercial services: Ovid Online; Data Star; DIALOG; EPIC and First Search; and STN International. Index To Theses <www.theses.com/> is the electronic version of the printed service mentioned above and consists of a searchable database, providing abstracts of UK theses from , 1970 onwards.

International Political Science Abstracts

International Political Science Abstracts (Paris: Foundation National des Sciences Politique, 1950) is published by The International Political Science Association from the Foundation National des Sciences Politique. It spiculated six times a year and has a comprehensive index. The key abstract sources for IPSA are international scholarly journals and yearbooks. A special emphasis is placed on countries or areas where informational is scarce. The main areas covered are : methodology and theory;

political ideas; institutions and process; international relations; and national and regional studies. CD-ROM and Internet versions are available from Silver Platter Information <www.silverplatter.com>. IPSA follows a policy of completely indexing approximately 45 core journals, through this may vary year on year. In addition, articles in another 900 journals are indexed on a selective basis. There are currently more than 64000 abstract available on the database covering the period 1989 to present. Around 7400 new abstracts are added annually. The vast majority of abstracts are in English and the remainder in French. IPSA's indexing allows records to be accessed by searching on a variety of fields including descriptors, title, journal name index and abstract.

1.4.6 References and Further Readings

1. Addyman, T. (1994). The Internet: international information highway. New Library World, 95 (1115), pp. 4-9
2. Hundie, Kebede (2202). A guide to selected and freely searchable bibliographic and full text databases on the web. Emerald, 21 (I), 2002), pp. 13-21 (http://www.emeraldinsight.com/0160-4953.htm)
3. Kumar, A. (2002). Readings on information technology, No. 2, New Delhi : Anmol Publication, pp. 434-436.
4. Kumbar, Mallinath, Rao, R.V. and Nargund (2001). Electronic information resources: A methodical approach towards introducing users. In : CALIBER-2001, 15-16. March 2001, Ahmedabad, INFLIBNET Center, pp. 247-250.
5. Pands, K.C. and Karisiddaappa, C.R. (eds.) (1993). New Dimension in information service and technology. Delhi: Parimal Publications.

1.4.7 Self check Exercise

Q1. Define database and explain the Various types of database.

Q2. Discuss the salient features of select bibliographic database.

Q3. Explain in detail the various generations of databases.

MASTER OF LIBRARY AND INFORMATION SCIENCE | **MLIS 203 INFORMATION AND COMMUNICATION TECHNOLOGY : APPLICATIONS**

LESSON NO. 1.5 | **AUTHOR : AMANDEEP**

COMMUNICATION TECHNOLOGY

Structure of the Lesson

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1.5.2 Definitions

1.5.3 Communication Hardware

1.5.4 Network Components

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1.5.4.2 Hubs

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1.5.4.4 Switches

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1.5.8.3 Microwave

1.5.8.4 Communication satellite

1.5.8.5 Optical Fibers

1.5.9 Self Check Exercise

1.5.10 Suggested Readings

OBJECTIVES

This lesson will make the learner familiar with the basic terminology and overview of computer communication.

1.5.1 INTRODUCTION

A standalone computer in today's context is not very useful, but coupled with communication technology; it opens up an enormous repository of information to its' users. Information is carried in data communication systems as signals between two or more points, which could be at a distance of a few inches or several thousand kilometers. These signals are subject to various effects while they are in which alter their characteristics to some degree. The data communication technology ensures that information between two communicating entities is transferred in a reliable and orderly manner. To understand transmission one needs to study electrical form that messages take while they are in and of media and communication technologies that ensure error free transmission. In our subsequent units we would be discussing the basic concepts of electronic communications.

1.5.2 DEFINITIONS

The definitions of commonly used terms in communications **Data** are entities that convey meaning. **Information** is obtained by processing data using desired functions. **Signals** are electric or electromagnetic encoding of data, and **signalling** is propagation of signal along suitable communication medium.

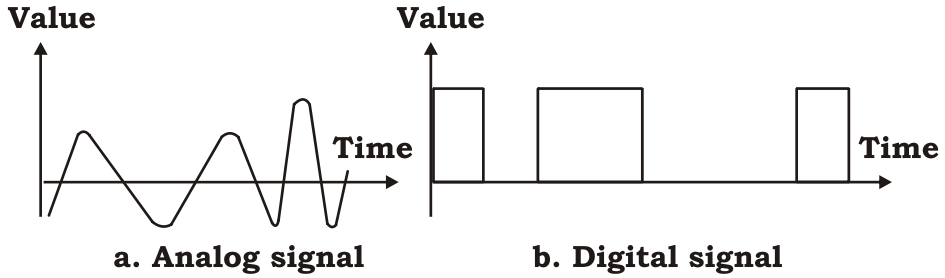
Transmission is communication of data achieved by the propagation and processing of signals.

The concept of **Data communication** evolved from sharing the computation power of a computer along with various resources available in a computer environment such as printers, Hard-disk etc.

The **speed** at which two computers exchange or transmit data is called communication rate on transmission speed. The unit of measurement of the speed is measured using bps (bits per second) or baud. Normal PC based communication station transferred, using 300 to 9600 bps, whereas a main frame computer uses 19,200 baud or more.

An **analog signal** is one that is continuous with respect to time, and may take on any value within a given range of values. Human voice, video and music when converted to electrical signal using suitable devices produce analog signals.

A **digital signal** may take on only a discrete set of values within a given range. Most computers and computer-related equipment are digital.



In **parallel data transmission,** there are multiple parallel lines connecting the transmitting and receiving units. Each wire carries a bit of information. Normally, one character is transferred in one go.

In **serial data transmission,** each bit is sent sequentially one after another and it requires only one pair of wire conductors for connecting the receiving and transmitting units.

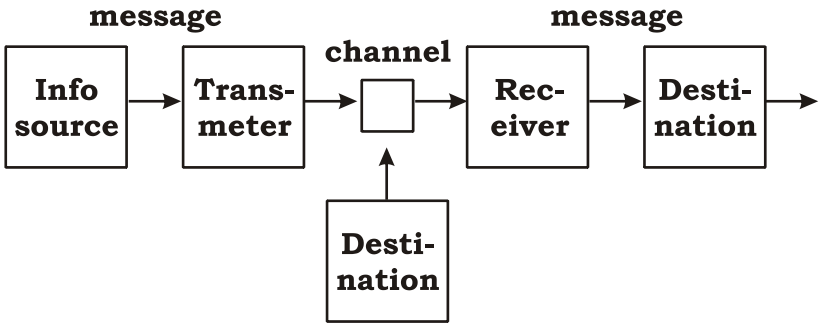
Private leased lines are permanently connected circuits between two or more points, These lines are available for private use by the leasing party.

Switched lines or dial up lines are available to any subscriber. For example, telephone connection in our home or office is a dial up lines as we dial up a number to use a particular circuit.

1.5.3 COMMUNICATION HARDWARE

For any basic data communication process, the hardware required are: Sender and Receiver Hardware, Communication Devices, Communication Channels.

The sender and receiver are normally machines, in particular computer devices. There are several types of communication devices or interface used in data communication. Some of these are modem, code etc. The most basic hardware required for communication is the media through which data is transferred. It may be telephone lines, microwave links, satellite links etc.



1.5.4 NETWORK COMPONENTS

All modern networks are created by connecting various physical devices to establish a path from the sending device to the receiving device such as cables, hubs, bridges, switches and routers.

1.5.4.1 Cables :

Cables carry the signals from one location to another. This could be across a room, or across the country. The maximum length of a cable is an important design criterion and is generally bounded by a factor called attenuation. Attenuation is the measure

of the strength of the signal as it travels over an increasingly long segment of cable, the greater the attenuation.

Shielding is another important design criterion. Some cables are shielded to prevent outside interference, like that cause by motors or fluorescent lights, from changing a signal as it passes through a cable.

The cable medium is also important. Most cables are either copper, which carries an electrical signal, or fiber-optic, which carries a beam of light. Copper-based cables are generally more durable, cheaper and easier to use, whereas fiber-optic cables can go much more distances and support much higher frequencies, which translates into more bandwidth than copper cables.

Cables are terminated by plugs. Plugs plug into jacks. Plugs and jacks are typically plastic or metal pieces that low the individual wires inside a cable to be easily connected to the corresponding wires of another cable or device, such as PC.

5.4.2 Hubs :

To connect several computers in a building cables are typically run from the PCs on people's desk back to wiring closets. Here, a special device is required to connect all the cables together. This device is typically a hub. Hubs are devices that provide a physical path for a signal to travel from one cable to another. They act as multiport repeaters. In other words, they simply regenerate an electrical signal received on one port out one or more other ports, with no changes whatsoever.

A hub simply repeats a signal without modifying the information, every port on a hub is part of the same network segment or data link.

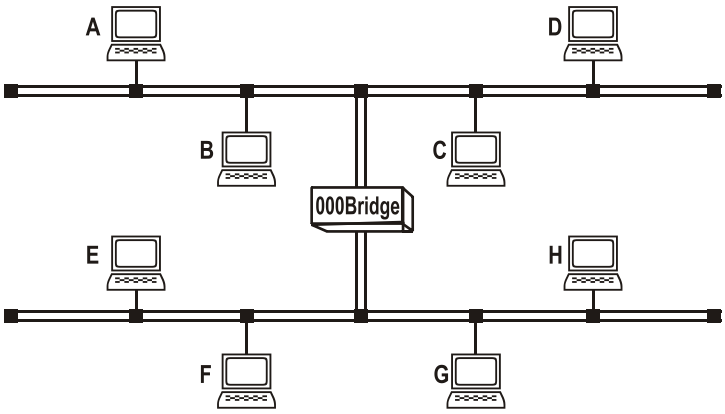
1.5.4.3 Bridges :

Once the number of users began to push the limits of single network segment, there was a need to create a new segment to link two networks together. A device called a bridge accomplished this. Originally, bridges had only two ports, one for each network. However unlike hubs, bridges actually inspect the data that passes through them and make decisions about whether to send it to other network or not. This decision is based on the MAC address in Ethenet networks, and on the ring number in Token Ring networks.

Ethernet bridges listen to traffic sent by computers and other network devices and then they recode the MAC address of the computer, which is located in the Sources Address field of the Ethernet frame header, and the port from which the-address was learned. If the bridge then receives a frame from the other network that is destined for the MAC address it learned from the first network, it will send the frame to the first network.

Token Ring bridge operate by ring numbers. Each bridge is assigned a bridge number and a ring number. Token Ring frames contain a Routing Information Field (RIF),

which is a list of the ring numbers and bridge numbers that a frame must traverse to get its destination. When a Token Ring bridge sees a frame on the one ring destined for another ring that is also attached to the same bridge, it will retransmit the frame on that ring.



1.5.4.4 Switches :

As network grew even larger, and the amount of data transmitted by each computer increased, segmenting networks became even more important. Two-port bridges were no longer sufficient. Although they have much more functionality now, switches began as multiport bridges. Most switches have 12 or 24 ports, but many are modular and can have several hundred ports.

Another-distinction is that switches can handle several conversations at the same time. Each 100 Base-TX port on a switch can send and receive frames at the same time. This means that switches have to have fairly complex backplane that allows each port to talk to every other port. Although the details of this are often published, they are not part of any technology standard, but are proprietary for each switch type. Switches also employ buffers. These buffers are memory that can be used to store frames until the frame can be transmitted. This is useful when many devices converse with a single device, and collectively send more data than the link can support in a given time. In this case, the frames would wait in the buffer until there in enough available bandwidth on the link to transmit the frame.

There are two types of switches that are commonly used.

- Store and forward switches receive the entire frame into the buffer before transmitting it .This allows a switch to read and calculate a checksum at the end to ensure that the frame is not corrupted.

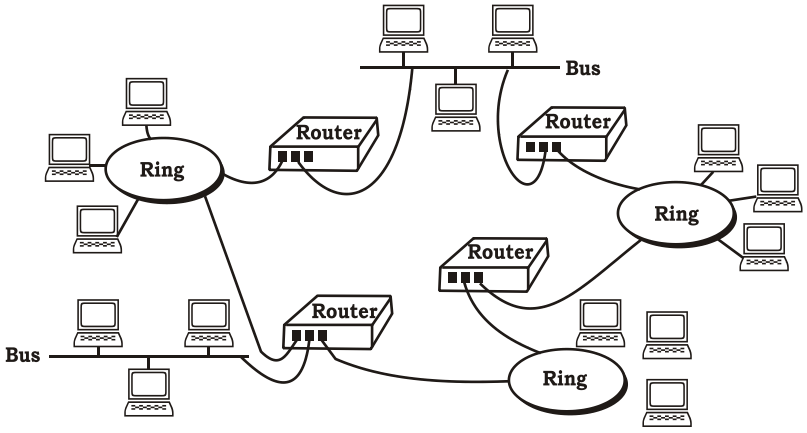
- Cut-through switches read only the destination address field before beginning to transmit. Cut-through switches do forward frames with errors and frame fragments, but are some what faster than store and forward switches.

1.5.4.5 Routers :

Although segregating network segments as helpful, all the devices attached to hubs, bridges, and switches are still in the same broadcast domain, and there are practical limits to the number of devices that can exist in any broadcast domain. So to segregate broadcast domains, routers were created. Routers act as the boundary between broadcast domains. Similar to the way bridge and switches read and act, routers read and make decisions. A router's job is to inspect each packet sent to it and determine if it belongs to the local IP or IPX network or to remote network. If the destination of the packet is a remote network, and the router knows how to reach that network, the router forwards the packet; otherwise the packet is discarded.

Routers are also used almost exclusively to connect remote networks via WAN links, but this is unrelated to the actual function of the routing. It is possible to use bridges or other devices, such as PCs, this is to connect WAN links, but rare.

Routers often use sophisticated algorithms and routing protocols to communicate with other routers to discover the best way to reach remote networks.



1.5.5 DATA TRANSMISSION SPEED

A term used to describe the data handling capacity of communication system is bandwidth. Bandwidth is the range of frequencies that is available for the transmission of data. In case of data transmission, we talk in terms of bits per second. The ASCII code uses 7 data bits per character plus a parity bit. For data communication, additional bits are needs to control the process. Although the number of bits depends

upon the communication system used, commonly encountered systems use a total of either 10 or 11 bits per character. The communication data transfer rate is measured in a unit called baud. In general usage, baud is identical to bits per second. For instance, a rate of 300 baud is 300 bits per second. However, technically baud refers to the number of signal (state) changes per second. Thus, using more sophisticated coding techniques, I baud can represent 2 or even 3 bits per second. But, with most communication systems, I baud represents only one signal change per second and thus is equivalent to 1 bit per second. Depending on their transmission speeds, communication channels (paths) are grouped into three basic categories.

Narrow band or subvoice grade channels range in speed from 45 to 300 baud. They are used for handling low data volumes and are adequate for low-speed devices.

Voice band channels handle moderate data volumes and can transmit data at speed up to 9600 baud. They are so called because their major application is for ordinary telephone voice communication.

Broadband or wideband channels are used when large volumes of data are to be transmitted at high speed. These system provide data transmission rates of 1 million baud or more.

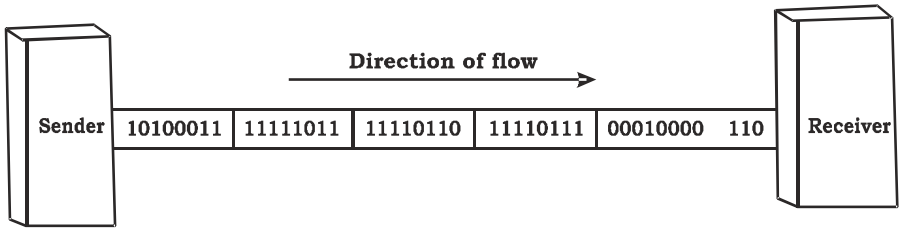
1.5.6 DATA COMMUNICATION MODES

So far, we have discussed a method of transferring information electronically and various aspects involved in it such as, data characters in a computer system are represented using codes such as ASCII or EBCDIC. The exchange of information can take place only if a facility exists to send information from one end, character by character and also to receive it at the other end in the same manner or sequence. Hence we must understand how the characters are transmitted over the transmission medium.

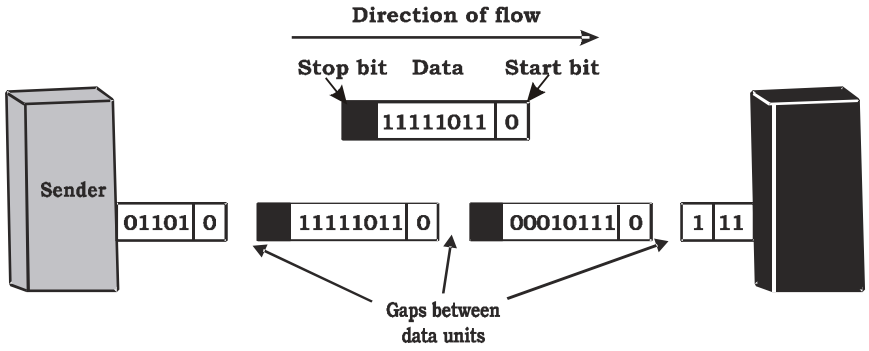
1.5.6.1 Synchronous and Asynchronous Transmission

The mode of transmission is the way in which coded characters are assembled for the process of transmission and permits the receiving devices to identify wheel the coding for each character begins and ends within the torrent of bits. When two computers communicate, they must have a way to synchronise the flow of data so that the receiving computer can read at the same speed at which the sending computer transmits. The principal modes are asynchronous and synchronous. In synchronous transmission characters are transmitted as groups, with control characters in the beginning and at the end of the bit train. The transmission and receiving intervals between each bit are precisely timed permitting the grouping of bits into identifiable characters. In synchronous mode, intervals between characters are uniform with

no space between consecutive bytes. We send bits one after another without start/ stop bit or gap.



Synchronous Transmission



Asynchronous Transmission

In asynchronous transmission, each character is transmitted separately, that is, one character at a time. Each character begins with a start bit, which tells the receiving device where the character coding begins and ends with a stop bit, which tells the receiving device where the character coding ends. Then, the next character is sent, with start and stops bits. The start and stop bits and the interval of time between consecutive characters allow the receiving and sending computers to synchronise the transmission. The parity bit is used for error checking while transmission of data.

Asynchronous communication is slower than synchronous communication; it is typically used at communication rates lower than 2400 bits per second. Asynchronous communication does not require complex and costly hardware as required by synchronous communication and is the mode most widely used with microcomputers.

1.5.6.2 Simplex, Half-duplex, Full duplex Communication

The direction in which information can flow over a transmission path is determined by the properties of both the transmitting and the receiving devices. There are three basic options :

In Simplex mode, the communication channel is used in one direction. The receiver receives the signals from the transmitting device. A typical use is to gather data from a monitoring device at a regular interval. The simplex mode is rarely used for data communication.

In Half-duplex mode, the communication channel is used in both directions, but only in one direction at a time. This requires the receiving and transmitting devices to switch between send and receive modes after each transmission. The analogous example of this mode is the old wireless system (walkie-talkie), which is used in either transmit mode or receive mode.

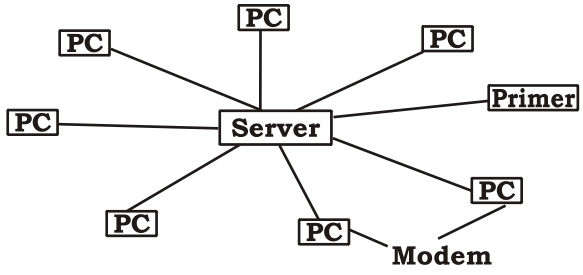
In Full-duplex mode, the communication channel is used in both directions at the same time. Typical example of this mode of transmissions is the telephone in which both parties talk to each other at the same time.

1.5.7 NETWORK TOPOLOGIES

A network is logical extension of data communication system. In a computer network, two or more computers are linked together with carriers and data communication devices for the purpose of communicating data and sharing resources. The term network topology refers to the way in which the nodes of a network are linked together. It determines the data that may be used between any pair of nodes in the network. Although the number of possible network topologies is seemingly limitless, the four major ones are the star network, the ring network, the completely connected network, and the multi access bus network.

1.5.7.1 Star network:

Following fig shows the star arrangement of computer network. In this configuration multiple computers are connected to host computer. The computers in the network are not linked directly to each other and can communicate only via the host computer. The routing function is performed by the host computer, which centrally controls communication between any two computers by establishing a logical path between them.



Advantages

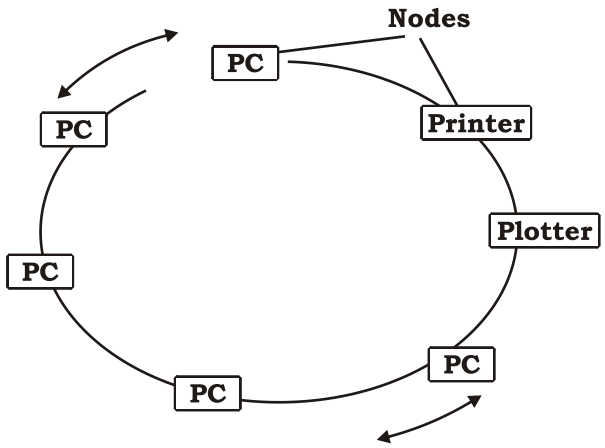
1. Star topology has minimal line cost because only n-1 lines are required for connecting in nodes.
2. Transmission delays between two nodes do not increase by adding new nodes to the 'network because any two nodes may be connected via two links only.
3. If any of the local computer fails, the remaining portion of the network is unaffected.

Disadvantage

1. The system crucially depends on the central node. If the host computer fails, the entire network fails.

1.5.7.2 Token Ring Network :

Following figure shows the circular or ring arrangement of computer network. In this configuration, each computer in the network has communicating subordinates, but within the ring there is no master computer for controlling other computers. A node receives data from one of its two adjacent nodes. The only decision a node has to take is whether the data is for its own use or not. If it is addressed to it, it utilizes it. Otherwise, it merely passes it on to the next node.



Signals travel in both directions in newer ring networks

Advantages:

1. The ring network works well there is no central site computer system.
2. It is more reliable than star network because communication is not dependent on a single host computer. If a link between any two computers breaks down, or if one of the computers breaks down, alternate routing is possible.

Disadvantages

1. In a ring network, communication delay is directly proportional to the number of nodes in the network.
2. The ring network requires more complicated control software than star network.

1.5.7.3 Completely Connected Network (Mesh) :

The completely connected network has a separate link for connecting each node to any other node. Thus, each computer of such a network has a direct dedicated link, called point to point link, with all other computers in the network. The control is distributed with each computer deciding its communication priorities.

Advantages

1. This type of network is very reliable as any link breakdown will affect only communication between the connected computers.
2. Each node of the network need not have individual routing capability.
3. Communication is very fast between any two nodes.

Disadvantage

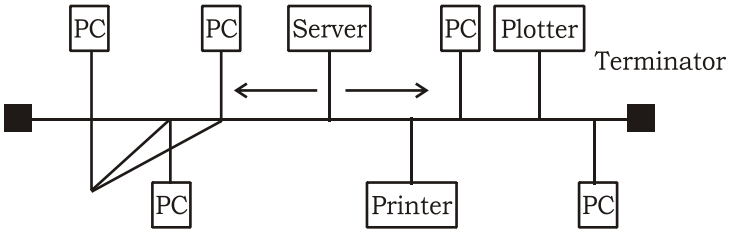
1. It is the most expensive network from the point of view of link cost. If there are n nodes in the network, then (n-l)n/2 links are required. Thus, the cost of linking the system grows with the square of the number of nodes.

1.5.7.4 Partial Mesh :

To connect all devices, to all other devices, we need n (n-l)/2 connections. It is very costly affair. A common compromise is called partial mesh. In a partial mesh, we simply remove some of the links.

1.5.7.5 Multi-access Bus network :

In this type of network, a single transmission medium is shared by all nodes. That is, the computers are attached to the same communication line. When a particular computer wants to send a message to another computer, it appends the destination address to the message and checks whether the communication line is free. As soon as the line becomes free, it broadcasts the message on the line. As the message travels on the line, each computer checks whether it is addressed to it. The message is picked up by the addressee computer, which sends an acknowledgment to the source computer and frees the line. This type of network is also multipoint or multidrop or broadcasting network. It is appropriate for use in local area network where a high speed communication channel is used and computers are confined to a small area. It is also appropriate when satellite communication is used as one satellite channel may be shared by many computers at a number of geographical locations.



Advantages

1. The main advantages of multi access bus network is the reduction in physical lines.
2. The failure of a computer in the network does not affect the network functioning for other components.
3. Addition of new computers to the network is easy.

Disadvantages

1. All computers in the network must have good communication and decision making capability.
2. If the communication line fails, the entire system breaks down.

1.5.7.6 Hybrid Network :

Different networks have their own advantages and limitations. Hence in reality, a pure star or ring or completely connected network is rarely used. Instead, an organization will use some sort of hybrid network, which is a combination of two or more different network topologies. The exact configuration of the network depends on the needs and the overall organization structure of the company involved.

1.5.8 DATA TRANSMISSION MEDIA

There are several types of communication media (physical channels) through which data can be transmitted from one point to another. Some of the most common data transmission mediums are briefly described below.

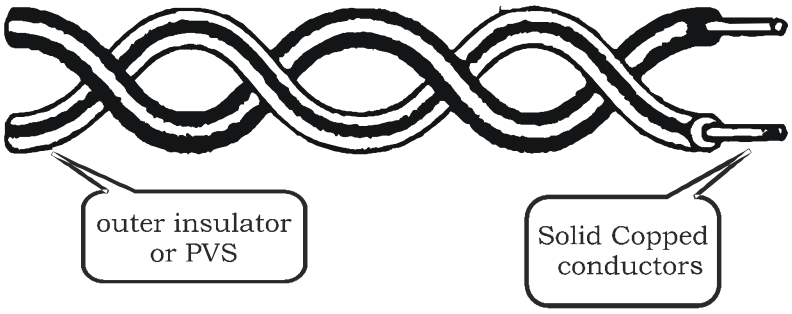
1.5.8.1 Twisted-Pair Wire

A twisted pair wire consists of two bunches of thin copper wires, each bunch enclosed separately in a plastic insulation, they twisted around each other to reduce interference by adjacent wires. It is also called unshielded twisted pair (UTP_cable because other than the plastic coating around the two individual bunches of copper wires, nothing shield it from outside interference.

UTP cables are commonly used in local telephone communication and short distance digital data transmission. They are normally used to connect terminals to the main computer if they are placed at a short distance from the main computer. Data transmission speed of up to 9600 bits per second can be achieved if the distance is

not more than 100 meters. However, for longer distance data transmission, local telephone lines are used. In this case typical speed of digital transmission is 1200 bits per second.

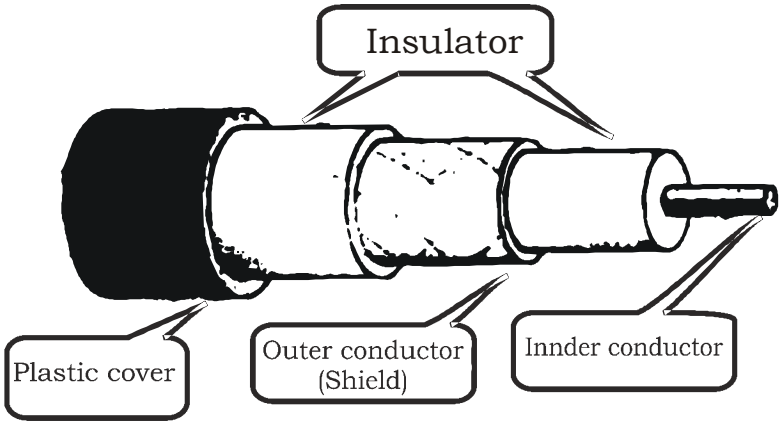
UTP cables are an inexpensive medium of data transmission. They are easy to install and use. However, their use is limited because they easily pick up noise signals, which results in high error rates when the line length extends beyond 100 meters.



1.5.8.2 Coaxial Cable

Coaxial cables are groups of specially wrapped and insulated wire lines that are able to transmit data at high rates. They consist of central copper wire surrounded by PVC installation over which a sleeve of copper mesh is placed. The metal sleeve is again shielded by an outer shield of thick PVC material. The signal is transmitted by the inner copper wire and is electrically shielded by the outer metal sleeve.

Coaxial cable offer much higher bandwidth than UTP cables and are capable of transmitting digital signals at rates of 10 mega bits per second. They are extensively used in long distance telephone lines and as cables for cable TV. They are also used by telephone companies to transmit data. In many cases, several coaxial cables are packaged into very large cable that can handle over 40,000 telephone calls simultaneously. Furthermore, coaxial cables have much higher noise immunity and can offer cleaner and crisper data transmission without distortion or loss of signal.



1.5.8.3 Microwave System

Another popular transmission medium is microwave. This is a popular way of transmitting data since it does not incur the expense of laying cables. Microwave system use very high frequency video signals to transmit data through space. However, at microwave frequencies, the electromagnetic waves cannot bend or pass obstacles like hill. Hence it is necessary that microwave transmission be in a line-of sight. In other words, the transmitter and receiver of microwave system which are mounted on very high towers, should be in a line-of-sight. This may not be possible for very long distance transmission. Moreover, the signals became weaker after travelling a certain distance and require power amplification.

In order to overcome the problem of line-of-sight and power amplification of weak signals, microwave system use repeaters at intevals of about 25-30 kms in between the transmitting and receiving stations. The first repeater is placed in line-of sight of the transmitting station and last repeater is placed in line-of-sight of the receiving station. Two consecutive repeaters are also placed in line-of sight of each other. The data signals are received, amplified, and retransmitted by each of these stations. Microwave system permit data transmission rates of about 16 giga bits per second. It can carry thousands of voice channels at the same time. The link can support 25,000 channels. The initial installation cost of microwave links being very high, they are mostly used to link big cities with heavy telephone traffic between them.

1.5.8.4 Communication Satellite

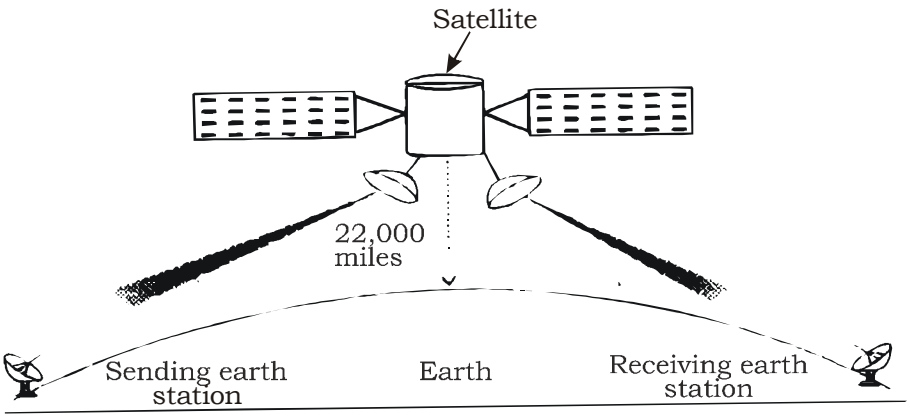
The main problem with microwave communication is that the curvature of the earth, mountains, and other structures often block line-of sight. Due to this several repeater stations are normally required for long distance transmission, which increases the cost of data transmission between two points. This problem is overcome by satellites, which are relatively newer, and more promising data transmission media.

In satellite communication, microwave signal at 6GHz or 14GHz is transmitted from a transmitter on earth to the satellite positioned in space. By the time this signal reaches the satellite, it becomes weak due to 36,000 kms travel. A transponder mounted on the satellite amplifies the weak signal and transmits it back to the earth at a frequency of 4GHz or 11 GHz. This signal is received at receiving station on the earth. It may be noted that the transmission frequency is different from the transmission frequency in order to avoid the interference of the powerful retransmission signal with the weak incoming signal.

A transponder can typically support 1200 voice channels each of 4800 bps or 400 digital channels each of 64 kbps data transmission rate. A satellite has many transponders. Therefore, a single satellite has enormous data communication capability. The use of 4GHz band of frequencies for transmission and retransmission

of microwave signals in a satellite communication system is called C-band transmission. On the other hand, the use of 11 GHz to 14 GHz band of frequencies is called the K_u - band transmission.

In order that large number of users can benefit from satellite communication, it was realized that the size and cost of the receive-transmit earth stations has to be considerably reduced so that one can easily install a private earth station. To meet this requirement, smaller dish antennas having lower power transmitters and receivers have been built for installation at user's sites. These dish antenna systems are popularly known as *VSAT* (Very Small Apertue Terminals).The aperture refers to the diameter of the dish antenna, which is about 1 to 2 meters.



1.5.8.5 Optical Fibers

Optical fibers are hair-thin threads of glass or plastic that can serve as a data transmission medium as copper wires or coaxial cables. The basic difference is that optical fibers transmit light signals instead of electrical signals. Because light travels much faster than electricity, optical fibers can transmit data at much higher speed than copper wires or coaxial cables, and also with no significant loss of intensity over very long distances.

Optical fibers are made of glass, plastic or silica, Plastic fibers are least efficient, but tend to be cheaper and more rugged. Glass or silica fibers are much smaller, and their low attenuation makes them very suited for very high capacity channels. Physically, a fiber-optic cable consists of three concentric layers- the inner core, a cladding around it, and the outer protective coating. The inner core, which has a diameter of 8 to 200 micrometers, consists of a bunch of optical fibers. The cladding around it is made of plastic or glass and has refractive index less than that of the core. The characteristics of light propagation depend primarily on the fiber size, its

construction, the refractive index profile, and the nature of light source. The outer protective coating is made up of plastic.

The main components of an optical fiber communication are follows. Towards its source side is a converter that converts electrical signals into light waves. The converter uses either a light-emitting diode (LED) or a laser diode to convert electric signals into light signals. These light waves are then transmitted over the optical fiber to the receiver's end. At the receiver's end, another converter is placed that detects the light waves and converts them back to electrical signals. It uses photoelectric diodes for this purpose. These electric signals are then amplify using an amplifier and sent to the receiver.

1.5.9 SELF-CHECK EXERCISE :

Q.1. Discuss the various network topologies. Write down their advantages and disadvantages.

Q.1. What are the various modes of data communication.

1.5.10 SUGGESTED READINGS :

1. Andres S Tanenbaum, "Computer Networks"
2. ED Tittel, "Computer Networking"
3. William Stallings, "Data Communications"

NETWORK MEDIA AND TYPES

Structure of the Lesson

1.6.1 Introduction
1.6.2 Network Concept and Classification
1.6.3 Local Area Network
1.6.3.1 LAN Topology
1.6.3.2 LAN Access Method
1.6.3.3 LAN Hardware
1.6.3.4 LAN Software/Operating Systems
1.6.4 Wide Area Network
1.6.4.1 Communication Switching Techniques
1.6.4.2 WAN Devices/Hardware
1.6.4.3 Types of Wide Area Networks
1.6.5 Metropolitan Area Network (MAN)
1.6.6 Intranet
1.6.7 Self check Exercise
1.6.8 Suggested Readings

OBJECTIVES : This lesson will make the learner familiar with the various network types and intranets.

1.6.1 INTRODUCTION

Today, Computer networks form the backbone of most enterprises big or small around the world. Computer networks allow people remote to the computer to access the information available to that computer. Computer networks are being used to provide resource sharing between systems separated from a few feet to thousands of kilometers. This technology is leading many corporations to take advantages of the reduced price and increased performance in the workplace. In this lesson we will discuss networking and how it plays an important role in information exchange. Impact of networking be it LAN or WAN and data communication has been felt across the globe, in various sectors such as education, medicine, transport, etc. This trend of information sharing in most sophisticated manner has completely revolutionised the concept of communication. It brings with it increased access to people in different fields.

1.6.2 NETWORK CONCEPT AND CLASSIFICATION

Communication using computer has brought a revolution in the world of Information Technology, particularly in the field of personal computer. We have always heard of

networking or the term network. A network is a way or means of transmitting or receiving (exchange) information from one or more sources.

As an example, car salesmen, after years in the business, have developed a network of associates. When the car salesman need to locate a car to make a sale, the car salesman calls out to his network to retrieve information on the location of the car. Employment agents also develop a network". Their customers become their networks. Employment agents will frequently keep in touch with their clientele for possible openings or to locate a candidate for an opening. Without the capability of networking, these two people would have a difficult time. It is the same in computing. Networks provide the means for locating and transporting information.

In computing networks, the origin of the information request utilises the services of a network to locate and return the information. This is done with addresses. In the two previous examples of the car salesman and the employment agent, a telephone number can be considered the address of their associate or client. Addresses in computer networking are used in the same manner. These addresses identify the network resource. There are two popular architectures for networking-hierarchical and peer.

Peer networking does not need pre-defined network addressing. Instead, each resource on the network is seen as a peer. Each network resource is a peer to the other network resources. When a new network resource joins the network it introduces itself and notifies its peer of any other network resources that it knows about - peer networks are open and share network information.

The entire computer network can be classified into three board categories.

(a) LAN (Local Area Network)

(b) WAN (Wide Area Network)

(c) MAN (Metropolitan Area Network)

1.6.3 LOCAL AREA NETWORK (LAN)

As number of systems grows within an organisation, a need is felt for sharing expensive resource and exchanging data and information between systems. This need of information exchange and resource sharing within an organisation has resulted in development of Local Area Network or LAN.

A LAN is a data communication network, which connects many computers or workstations (computers terminal, printer etc. and permits exchange of data and information among them, within a localised area, typically confined to a building, or a cluster of buildings. The distance between two communication points connected on the same LAN channels, is usually upto 02-05 kms.

LANs are not rigidly defined but tend to share most of all of the following characteristics :

(a) All the connected devices in the network share the transmission media.
(b) Each device connected in the network can either operate standalone or in the network.
(c) Area covered is small.
(d) Data transfer rates are high, usually 1 Mbps-100. (Million of bits per second)

1.6.3.1 LAN Topology

A network topology refers to the physical layout of the network in which all the devices are connected. This includes all the hardware that makes up the network. The points of connection to the network by the stations are called Nodes or link stations. There are several types of topographical design and strategies used to implement LAN. The majority of these are based on three types of topologies :

Star Topology
Bus Topology
Ring Topology

1.6.3.2 LAN Access Method

A discipline must be imposed on devices connected to the network to ensure a controlled access to the media. Access methods are the means or ways by which stations actually gain the use of the common channel to transmit messages. The right to transmit is an issue only in broadcast where workstations share a single channel.

Many techniques have been proposed, but two of these are commonly used.

(i) Carrier-Sense Multiple Access with Collision Detection (CSMA/CD)
(ii) Token passing

CSMA/CD

CSMA/CD access method is used with bus networks. The bus operates in a Multiple Access (MA) mode. A node is allowed to transmit on the bus, if it senses that the medium is free (carrier sense). Occasionally two or more nodes may simultaneously sense that the medium is free and begin to transmit. This creates a collision, as the contents of transmitted information frames will collide resulting in corruption of the information frame. This collision is detected (collision detect) by the transmitting node. The two (or more) nodes involved then wait for a further short random time interval before trying to retransmit a frame once again.

Token Passing

Another way of controlling access to a shared medium is by the use of a control (permission) token. The control token is passed from one node to another according to a defined set of rules understood and adhered to by all nodes. A node may transmit a frame when it is in possession of the token and after it had transmitted the frame, it passes the token to the next device in a predetermined sequence.

In token passing, a logical ring to all nodes connected to the physical medium is first established and a single token is generated; the control token passes from one node to another traversing the logical ring. The token keeps on circulating the logical ring until it is received by a node waiting to send an information frame. After receipt of the token, waiting station transmits the waiting frames on the physical medium after which it passes the control token to the next node in the logical ring.

For token passing, the physical medium need not be a ring topology; it can be used to control access to a bus network also.

1.6.3.3 LAN Hardware

As we have seen so far, to realise a LAN process, several functions are to be performed. These are so specialised in nature that they require hardware specially built for such purpose. Here we will discuss briefly the basic hardware components of LAN, these are :

(a) Transmission Channel

The transmission channel may be simplex, half duplex or full duplex.

(b) Network Interface Units (NIU)

Network interface units connect each device in the LAN network to shared transmission device. It contains the rules or logic to access the LAN. NIU is also used to implement LAN protocols and for device attachments. Its function depends on the type of topology used in LAN. In microcomputers, NIU may be installed as an add-on card.

(c) Servers

One of the major benefits of implementation of LAN is sharing expensive resources such as storage devices, printer etc. This is achieved through providing servers on the LAN. It is a dedicated computer, which control one or more resources. This contains both hardware and software interface for LAN. Three major categories of servers used in LANs are :

(i) File Server
(ii) Printer Server
(iii) Modem Server

In a networking file server is used to share storage space for files, Besides providing storage space for files in a LAN environment, it is used for taking periodical backup, and also to provide gateway to other servers within and between LANs. Similarly printer server is used to handle printing works of all workstation connected in the network In LAN environment also modem is required to get connected to other network or simply to use a telephone. A modem server is used to share few telephone lines and modems by all connected workstations in a network.

1.6.3.4 LAN Software/Operating System

As the name suggests, LAN Operating System is required to operate on the LAN system, manage the tremendous work load with a number of various types of server attached to it. It has basically two aspect (i) Server software (ii) workstation software. As in case of other multi-user operating systems, LAN operating system also facilitates the sharing of expensive resources such as printer, storage space etc. among all LAN users provides security for data and permits connection to other networks. There are various types of LAN operating system for example Novel Netware. WINDOWS NT, etc.

1.6.4 WIDE AREA NETWORK

As the name suggests, WAN spread across countries and continents, satellites being one of the transmission media. A Wide Area Network or WAN, is a network that links separate geographical locations. A WAN can be a public system such as the Public Switched Telephone Network (the PSTN) or one of the various packet switched services provided by the public telecommunication authorities. WANs can also use most other types of circuit including satellite networks, ISDN, Value Added Networks (VANs/ VADs).

The network can be a private system made up from a network of circuits leased form the local Telephone Company or set up using public systems as virtual private networks. A Virtual Private Network is one which operates in the same way as a private network but which uses public switched services for the transmission of information.

The main distinguishing feature between a WAN and LAN is that, the LAN is under the complete control of the owner, whereas the WAN needs the involvement of another authority like the Telephone Company. LANs are also able to handle very high data transfer at low cost because of the limited area covered. LANs have a lower error rate than WANS.

1.6.4.1 Communication Switching Techniques

In WAN, two computing devices are not directly connected. A network of switching nodes provides a transfer path between the two devices. The process of transferring data blocks from one node to another is called data switching. There are three switching techniques commonly employed, and these are :

Circuit Switching

In circuit switching there is a dedicated communication path between the sending and receiving devices. The dedicated path is a connected sequence of links between switching nodes. A conventional telephone network, where a dedicated path is set

between the caller and the caller party for the duration of a telephone call is an example of circuit switching.

Communication viz. circuit switching involves three steps : Circuit establishment; data transfer; and circuit termination.

Circuit switching is mainly used for voice telephone network, but is not all that effective for data communication networks, as channel capacities are not fully utilised, as data communication equipments do not generate data continuously.

Message Switching

Message switching is an alternative switching technique, where it is not necessary to establish a dedicate path between the sending and receiving devices. In Message Switching, the sending device appends the destination address to the message and passes it to the network; the message is then passed through the network from one node to another till it reaches the intended destination. Each switching node receives a message, stores it briefly and then transmits it to the next node. Examples of a message are electronic mails, computer files, telegrams and transaction queries and responses. A complete exchange may consist of several messages. The basic disadvantage of message switching is the variable delay at intermediate switching nodes.

Packet Switching

Packet Switching combines the advantages of message and circuit switching. Packet Switching is functionally similar to message switching, in which data is transmitted in block, stored by the first switching node it meets in the network and is forwarded to the next and subsequent downstream nodes until it reaches the destination. The length of data block is limited in a packet switching network. Typical maximum length of packets is between 128 bytes to 4096 bytes. There are two approaches to packet switching.

* Datagram
* Virtual circuit

In datagram approach, each packet is treated independently and may follow a different path through the network. Packets may be re-ordered, dropped or delivered in wrong sequence. The communication protocols provide the error recovery and sequencing of packets at the receiving device.

In virtual circuit approach, a fixed logical path, through the network from the sender to the receiver is established before any packets are sent. This path remains unchanged for duration of the session. This is quite like circuit switching, but no resources are reserved along the path. Packets are buffered at intermediate nodes awaiting transmission.

1.6.4.2 WAN Devices/Hardware

The switching techniques utilise the routing technology for data transfer. Routing is responsible for searching a path between two computing devices that wish to communicate and for forwarding the data packets on this path. Devices such as bridges, router and gateways provide this routing function.

While discussing the WAN devices we referred to X.25; what is it? X. 25 is a set of recommendation by International Telegraph and Telephone Consultative Committee for packet switched network. You can refer to further readings for more details.

1.6.4.3 Types of Wide Area Networks

The essential purpose of Wide Area Networks, regardless of the size or technology used, is to link separate locations in order to move data around. A WAN allows these locations to access shared computer resources and provides the essential infrastructure for developing widespread distributed computing systems. We will now discuss the different types of WAN, which are commonly used.

Public Networks

Public Networks are those networks which are installed and run by the telecommunication authorities and are made available to any organisation or individual who subscribe it. Examples include Public Switched Telephone Networks (PSTN), Public Switched Data Networks (PSDN), Value Added Services (VANs/VADs) and the Integrated Services Digital Networks (ISDN). We would be discussing the main features of these services.

Public Switched Telephone Network (PSTN)

The features of the PSTN are its low speed, the analog nature of transmission, a restricted bandwidth and its widespread availability. As PSTN is designed for telephones, modems are required when it is used for data communication.

The PSTN is most useful in wide area data communication systems as an adjunct to other mechanisms. It is seldom advisable to use PSTN as the sole communications medium for building a network system. Costs are high, as data connections last for a considerable time. Also, the links set up are unreliable and can terminate without warning.

PSTN connections are usually easy to obtain at short notice, and are widely available and cover almost every location where people live and work. PSTN is most useful for occasional user or as backup to private circuits. It is also used for facsimile (FAX) machines.

Public Switched Data Networks (PSDN)

The term PSDN covers a number of technologies, although currently it is limited to Public Packet Switched Networks available to the public. The main features of all

PSDNs are their high level of reliability and the high quality of the connections provided. They can support both low and high speeds at appropriate costs.

Like the PSTN, a PSDN is very useful and adjunct to a private network for backup and occasional access purposes. It can also be used to link computer systems and networks of one organisation to several other organisations. PSDN is very popular for connecting public and private mail systems to implement electronic mail services with other companies.

Value Added Services (VANs/VADs)

In Value Added Services, the provider of such services must process, store and manipulate the data that is carried on the network, that is, add value to it. The technique can be used in specific types of business in which it is advantageous to be able to share information with other companies in the same line.

Electronic Data Interchange (EDI) is one area for Value Added Services in which two trading partners exchange trading documents such as purchase orders, invoices, transportation etc. using electronic means. In India, Videsh Sanchar Nigam Ltd. is a service provider.

Integrated Services Digital Network (ISDN)

The ISDN is a networking concept providing for the integration of voice, video and data services using digital transmission media and combining both circuit and packet switching techniques. The motivating force behind ISDN is that telephone networks around the world have been making a ion towards utilising digital transmission facilities for many years.

Users in shops or small offices can use their digital connection to Telephone Company for transmitting both voice and data over the same twisted pair cable which connects their telephone. As information from the telephone/PC/ Stereo/TV/PABX are all seen as bit streams by the networks switch, they can be switched and transported by the same network.

Private Networks

The basic technique used in all forms of private WAN is to use private (or more usually leased) circuits to link the locations to be served by the network. Between these fixed points the owner of the network has complete freedom to use the circuits in any way they want. They can use the circuits to carry large quantities of data or for high speed transmissions.

1.6.5 Metropolitan Area Networks (MANs)

A Metropolitan Area .Network (MAN) is one of a number of types of networks. A MAN is a relatively new class of network. There are three important features which discriminate MANs from LANs or WANs.

The network size falls intermediate between LANs and WANs. A MAN typically covers an area of between 5 and 50km diameter. Many MANs cover an area the size of a city, although in some cases MANs may be as small as a group of buildings or as large as the city.

A MAN is not generally owned by a single organisation. The MAN, its communications links and equipment are generally owned by either a consortium of users or by a single network provider who sells the service to the users. This level of service provided to each user must therefore be negotiated with the MAN operator, and some performance guarantees are normally specified.

A MAN often acts as a high speed network to allow sharing of regional resources (similar to a large LAN). It is also frequently used to provide a shared connection to other networks using a link to a WAN.

A typical use of MANs to provide shared access to a wide area network.

Some technologies used for this purpose are ATM **(Asynchronous Transfer Mode),**FDDI **(fiber-distributed data interface)** and SMDS **(Switched Multimegabit Data Service).** These older technologies are in the process of being displaced by Ethernet-based MANs (e.g. Metro Ethernet) in most areas. MAN links between LANs have been built without cables using either microwave, radio, or infra-red, free-space optical communication links.

DQDB, Distributed Queue Dual Bus, is the Metropolitan Area Network standard for data communication. It specified in the IEEE 802.6 standard. Using DQDB, networks can be up to 30 miles long and operate at speeds of 34 to 155 Mbit/s.

1.6.6 Intranet

An Intranet is a communication infrastructure. It is based on the communication standards of the Internet and the content standards of the World Wide Web. Therefore, the tools used to create an Intranet are identical to those used for Internet and Web applications. The distinguishing feature of an Intranet is that access to information published on the Intranet is restricted to clients in the Intranet group. Historically this has been accomplished through the use of LANs protected by Firewalls. Like the Internet itself, intranets are used to share information. Secure intranets are now the fastest growing segment of the Internet because they are much less expensive to build and manage than private “networks based on proprietary protocols.

Tangible benefits of an intranet

Why build a corporate intranet? Developers will tell you because we can. A better answer is that it is an effective tool to combat the waste of time, effort and materials within an organization at the same time generating new opportunities for collaboration and productivity. For the first time, an organization has the ability to

put one, open standards, thin client (the Web browser) as the interface to their corporate data and business processes.

The tangible benefits, those that executives can wrap their arms around, of intranet creation can be summarized below. A good example of a tangible benefit is the reduction in paper cost from moving processes online.

Tangible Benefits

- Inexpensive to implement
- Easy to use, just point and click
- Saves time and money, better information faster
- Based on open standards
- Scaleable and flexible
- Connects across disparate platforms
- Puts users in control of their data

Intangible benefits of an intranet

It is not only the removal of paper that leads to organizational benefit. What is done with that information in this new Web-enabled environment has a huge impact. Intranets allow an organization to spend less time on things that bring no value such as chasing down the right information to solve a problem.

Productivity increases as corporate knowledge is more accessible and the data is more accurate. Flexibility in time of delivery of knowledge is gained as information is always a click away. Intranets allow for a place where boundaries are lowered and information exchange is encouraged. This leads to more informed employees with the ability to make better, faster decisions. This in turn leads to better productivity and more time for revenue generation.

Intangible Benefits

- Improved decision making
- Empowered users
- Builds a culture of sharing and collaboration
- Facilitates organizational learning
- Breaks down bureaucracy
- Improved quality of life at work
- Improved productivity

An intranet uses TCP/IP, HTTP, and other Internet protocols and in general looks like a private version of the Internet. With tunneling, companies can send private messages through the public network, using the public network with special encryption/decryption and other security safeguards to connect one part of their intranet to another. Typically, larger enterprises allow users within their intranet to

access the public Internet through firewall servers that have the ability to screen messages in both directions so that company security is maintained.

TCP/IP (Transmission Control Protocol/Internet Protocol) is the basic communication language or protocol of the Internet. It can also be used as a ommunications protocol in a private network). When you are set up with direct access to the Internet, your computer is provided with a copy of the TCP/IP program just as every other computer that you may send messages to or get information from also has a copy of TCP/IP.

HTTP (Hypertext Transfer Protocol) is the set of rules for transferring files (text, graphic images, sound, video, and other multimedia files) on the World Wide Web. As soon as a Web user opens their Web browser, the user is indirectly making use of HTTP. HTTP is an application protocol that runs on top of the TCP/IP suite of protocols (the foundation protocols for the Internet).

Tunneling, also known as "port forwarding," is the transmission of data intended for use only within a private, usually corporate network through a public network in such a way that the routing nodes in the public network are unaware that the transmission is part of a private network. Tunneling is generally done by encapsulating the private network data and protocol information within the public network transmission units so that the private network protocol information appears to the public network as data. Tunneling allows the use of the Internet, which is a public network, to convey data on behalf of a private network.

A **firewall** is a set of related programs, located at a network gateway server that protects the resources of a private network from users from other networks. (The term also implies the security policy that is used with the programs). An enterprise with an intranet that allows its workers access to the wider Internet installs a firewall to present outsiders from accessing its own private data resource's and for controlling what outside resources its own users have access to. Basically, a firewall, working closely with a router program, examines each network packet to determine whether to forward it toward its destination. A firewall also includes or works with a proxy server that makes network requests on behalf of workstation users. A firewall is often installed in a specially designated computer separate from the rest of the network so that no incoming request can get directly at private network resources.

1.6.7 SELF CHECK EXERCISE

Q.1 Write a detailed note on LAN.

Q.2 List down the various types of WAN.

1.6.8 SUGGESTED READINGS

1. Andrew S Tanenbaum, "Computer Networks."
2. ED Titel, "Computer Networking."
3. William Stallings, "Data Communications."

Type Setting By :
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MASTER OF LIBRARY AND INFORMATION SCIENCE

UNIT NO. : 1

MLIS 203
INFORMATION AND COMMUNICATION TECHNOLOGY : APPLICATIONS

LESSON NO. :

1.1 Library Automation : Planning and Implementation

1.2 Automation of House Keeping Operations

1.3 Library Packages

1.4 Data Bases : Types and Generations, Salient Features of Select Bibliographic Data Bases

1.5 Communication Technology

1.6 Network Media and Types

Department of Distance Education
Punjabi University, Patiala

LESSON No. 1.1 **AUTHOR : VISHAL SINGH**

LIBRARY AUTOMATION: PLANNING AND IMPLEMENTATION

1.1.1 Introduction
1.1.2 Need for automation
1.1.3 Objectives of library automation
1.1.4 Advantages of library automation
1.1.5 Essentials for the automation
1.1.6 Components of automation
1.1.7 Automation costs
1.1.8 Typical library system configuration
1.1.9 Planning for library automation
- 1.1.9.1 Developing a library profile
- 1.1.9.2 Developing a strategic plan
- 1.1.9.3 Setting service priorities
- 1.1.9.4 Costs
- 1.1.9.5 Turning service priorities into system specification
- 1.1.9.6 Developing a formal specifications document
- 1.1.9.7 Evaluating vendor proposals
- 1.1.9.8 Putting your system into place
- 1.1.9.9 Database
- 1.1.9.10 Conclusion

1.1.10 Implementation of library automation
- 1.1.10.1 Retrospective conversion
- 1.1.10.2 Hardware
- 1.1.10.3 Software
- 1.1.10.4 Training
- 1.1.10.5 Network
- 1.1.10.6 Site preparation

1.1.11 Summary
1.1.12 Key words
1.1.13 Self check exercise
1.1.14 Suggested readings

Objective:

The lesson provides one with a fairly good concept of library automation, its need, importance and planning and implementation of library automation.

1.1.1 Introduction: library automation

Information technology has revolutionized the information handling activities in

the research and academic libraries during the past few years. The information services of academic libraries have been largely affected by the rapid changes in the information technology. The increased availability of information in electronic from, education\training activities in the country increased demand for the user for want of information in the limited period have focused the application of new technology in the academic libraries. This resulted in the use of computer in the libraries. In order to create an advanced information society for the future, the use of sophisticated computer systems for the control and management of information has important implications for thinking about information in general and about it's storing, processing, and dissemination in particular.

Library automation means the use of computers in the routine and important services of a library. The operation of library gets the quantum jump with the introduction of computers. The retrieval of information becomes much faster and accurate. Applications of computer save a lot of labor and time speed up operations, increase, all round productivity. Ability to store and recall information when needed is the advantage of computers.

In an automated library operation environment, staffs and computer share the responsibility for performing work. For e.g. a staff member might perform the first 5 processing steps, the computer next 20 steps; the staff member the next 3 operations and so on. Thus in any automated library operation human being are assisted by a computer to accomplish the work. In other words, the computer is merely a tool, albeit a marvelous one, enabling libraries to do something more readily, more accurately, or less expensively than the manual methods.

A computerized library can facilitate the following:

1. Accurate and reliable management information.
2. Quick and effective decision.
3. Effective coordination.
4. Availability of more sophisticated techniques for review and analysis.
5. Need based further development.

1.1.2 Need for automation

The automation of library in a developing country like India is a matter of serious consideration because of the difficulties experienced in transfer of technology is seen as one of the crucial factors in dissemination of information. Information is both fugitive and a truly international resource, available to those equipped to receive and absorb it. The great demand for information both by individuals and the society and widespread availability of computers coupled with decreasing cost has enabled the building of large computerized information systems. The application of new information technology ensures that useful information will be made available to users effectively at faster speeds and saves valuable time of the users.

1.1.3 Objectives of library automation

1. To improve access to collection
2. To improve the quality of existing services
3. To reduce routine and time consuming clerical works
4. To improve the speed of cataloguing, technical processing and putting items on shelves faster
5. To offer improved range of services
6. To improve co-operation and resource sharing among libraries
7. To easily participate and utilize national and international computer networks
8. To provide more current and comprehensive reporting of library information to managers
9. To reduce the number of library staff required
10. To improve prestige and visibility of library

1.1.4 Advantages of library automation

Now let us have a cursory look at the advantages which can be accrued from the automation. The application in libraries has enormous advantages. The various function of a library can be extended further for the benefit of the users. The automation will solve all the library problems with which it is infested today. If the librarian will be able to improve over the existing set of library services the image of the library and that of the librarian will definitely go up. Therefore some of the advantages of automation are given below:

1. Increase in speed and saving of time

Library automation saves time in storing the information, information handling, information processing, information retrieval etc. because all these functions are done at enormous speed. As a result the time lag between the acquisition of documents and their availability to the user will be reduced considerably.

2. Better library management

When properly planned, per unit operating costs will normally be reduced by automation. The money saved can be utilized for some other productive purposes, such as book purchase, or starting a new serve for users etc.

3. Report production

Various types of reports about library activities and other letters follow up notices, sending of reminders etc. can automatically be generated.

4. Greater library cooperation

With the installation of computer system in libraries in the country as a whole the opportunities of library cooperation will increase. These computer systems installed in different institutions can be hooked to each other via satellite and through a central agency and thereby can know each other's collection.

5. Easy updating

Computers system will lend in updating the record files much more quickly and easily than in the manual system.

6. Staffing

In order to meet with the increasing needs for services the use of equipment can further be extended as such scope always exist in the system. There is, therefore, no need for increasing the manpower.

7. Protection of records

Inputting the records in the system in machine readable form provides them greater protection against loses of these records by fire, earthquake, and other natural disasters. Recreation of the files from the machine readable form of records is also much easier.

8. New services

Many new services can be introduced without any extra cost or manpower. And many library services can be generated only as a by product of the records already available on the system.

1.1.5 Essentials for the automation

The essential things for the library automation include:

1. Good collection
2. Finance
3. Computer hardware
4. Computer software
5. Training

1. Good collection:

Automation is not just for the sake of automation. It is meant to serve the users with better library services and to provide access to information. For this purpose, first of all the collection of the library should be good and comprehensive. If the collection is not good than what is the use of automation? For e.g. the university policy should have a book acquisition policy and norms for building good collection. Collection building is a much more difficult task than purchasing a computer system. Computer can supplement and enhance the quality of the library collection but it can not altogether replace the library collection. Hence every library should aim at the good collection building first and automate the library collection and its services next. The good collection of the university library is the logical barometer which attracts teachers, students and scholars.

2. Finance:

Finance is the backbone of any venture. UGC norms stipulate that the university library be allocated 10% of the university budget. This rule is followed more in violation. Finances are required in the university library for

a. Collection building

b. Computer system

c. Recurring expenditure

For collection building, every university in view of the rising costs of reading materials and the declining purchasing value of rupee should provide at least 15% of the university budget annually. Then only it can be felt that the university administration is really interested in the university library. Otherwise it is a farce. Secondly the university library would require a minimum recurring amount of Rs. 10-12 lakhs for establishing a computer system. Thirdly, the university library would need an amount of Rs. 3-5 lakhs annually for the maintenance of the computer system and its updating and uninterrupted power supply etc.

3. Computer hardware:

Selection and purchase of the computer system is a complex procedure. The university library should decide first what type of computer system will be needed for its work. There are variety of computers and computer makers.

A university library would require a computer system rather than a single PC. In computer systems there are LAN, WAN, etc. A university library would at least require a LAN with facilities for e-mail and internet. There are different types of firms and organizations which supply computer hardware and parts such as:

- Computer manufacturers
- Independent terminals and peripherals manufacturers
- Selling companies
- Leasing companies
- Brokers
- Retail shop

There are many computer manufacturers such as HCL, IBM, Macintosh, Wipro, Sahara, Apple etc. There are many indigenous makers and suppliers in India today. Standardization in the hardware is an important factor. Otherwise it would obsolete in no time. Fast changes are taking place in this area. Hence the librarians have to be cautious and think seriously before they decide about the computer hardware.

4. Computer software:

Computer software's are generally expensive but good software must include:

- Application software
- Data communication software
- Database management system and data dictionary software
- Additional system software
- Utilities
- Programming aids and testing aids etc

Software is generally invisible and unverifiable till it is acquired and

used in the library. There are many library software packages today in the market. Some of them are CDS/ISIS, LIBRIS, TULIPS, WHIZKID, OASIS, BASIC PLUS, etc.

5. Training :

- Involve staff members at all levels in planning activities
- Make effective use of vendor-provided training and make sure you receive enough of it to meet your needs.
- Identify any separate training programs, who will be trained, and individuals who will be responsible for any ongoing training in the area.
- Use training tips to make in-house training effective.
- Develop a plan for training users.

1.1.6 Components of automation

Basically, there are three components of automation, which can be discussed as under:

1. Aim

First component of the automation is its aim, the purpose, the reason, why the set of library activities are to be organized. This aim will be the focal point for integrating automation into the activities and for operating and manages the activities after automation.

2. Processing

Second component is the processing consisting of step by step operations performed in an orderly and performed sequence on information materials or other items to achieve the desired result or service. The vendor of the computer system may assist in translating the library's practices and procedures during series of discussions.

3. Computer system

Third component is the computer system supporting the activities. The supporting computer may be micro computer, a mini computer or a mainframe. Its size may depend upon:

I. The nature of functions to be automated.
II. The number of functions to be supported by the computer.
III. The volume of processing activity.
IV. The funds available to a library.
V. The size of the information files to be retained in marching storage.

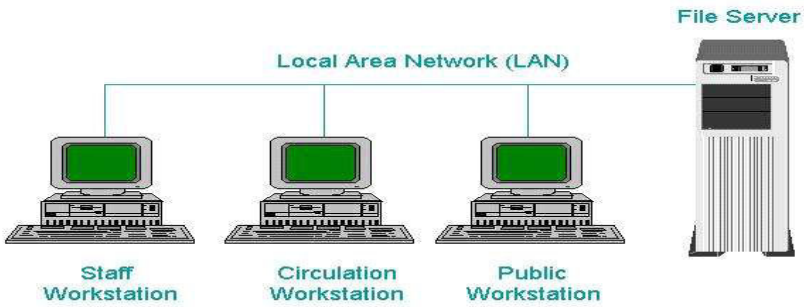
1.1.7 Automation costs

The automation cost consists of the followings:

- Purchase of the system - hardware and software.
- Purchase of network-specific hardware, software, and cabling.
- Planning and consulting costs.
- Conversion of manual records into machine-readable form.

- Maintenance of system hardware and software.
- Internet connection costs.
- Access, and subscriptions where appropriate, to external databases and systems.
- Ongoing operating costs.

1.1.8 Typical library system configuration



One File Server

- to hold the library system and database
- for access by workstations via the Intranet or the Internet

One to Two Public Workstations

- For students/teachers to access the Online Public Access Catalog (OPAC), CD-ROM network, and/or the Internet.

One Circulation Workstation

- For library staff to check-in and check-out items, etc.

One Staff Workstation

- For cataloging, acquisitions, reporting, etc.

Typical configuration

Server

- Pentium PC (e.g. Pentium III 500MHz)
- Sufficient RAM for serving the network (e.g. 512MB)
- Network card
- Operating system: Windows 2000 Server
- Backup Device (e.g. DAT tape drive)
- Optional: networked CD-ROM drives

Workstation

- Pentium PC (e.g. Pentium II 500 MHz)
- 256MB RAM
- 9GB hard disk
- Network card
- Operating system: Windows 98 or Windows 2000 Professional
- Optional: CD-ROM drive and sound card

1.1.9 Planning for library automation

Planning for library automation has been defined as planning for "integrated systems" that computerize an array of traditional library functions using a common database while this is still generally true, rapid technological change is forcing a reexamination of what it means to "automate the library". Libraries must plan for a broader and more comprehensive approach to providing automated services. Four years ago, the authors anticipated:

- vastly expanded storage of indexes, statistical data bases, and document databases within the library;
- full-text storage of documents, complete with full-text keyword searching and on-demand printing;
- access by users to library databases from home or office, with direct downloading of information and text on demand;
- the ability to access remote databases across the country and the world, and to download information and text on demand;

These capabilities and far more have become reality. Accordingly, today's integrated system must not only provide access to the traditional cataloging, circulation, public catalog (OPAC) and acquisitions modules, but must be capable of connecting through the local system into the systems of other vendors, remote bibliographic databases, CD-ROM drives on a local area network (LAN), and the Internet.

Libraries must learn all the more how to plan for the introduction of automation in an organized and systematic fashion. It is entirely a matter of building upon what you already know about your library, using tools that are readily at hand and, most importantly of all, involving the people -- staff and users -- who must live with the consequences of any automation decisions.

1.1.9.1 The first step: developing a library "profile"

One of the most important planning tools involves collecting basic statistical information on the library and its operations. You will find that the same basic data will be needed again and again -- whether for vendors from whom you are requesting cost estimates, or for other libraries with whom you may be seeking to cooperate in implementing automation.

The following are examples of commonly needed data:

- Number of titles and volumes in the collection, current and projected;
- Number of borrowers, current and projected;
- Number of materials circulated, current and projected;
- Number of new materials acquired, current and projected;
- Interlibrary loans, lent to and borrowed from other libraries;
- Description of any cooperative arrangements involving the library; and,
- Library address and hours of operation.

In addition, it is important to take stock of any existing automation in the library by compiling the following data:

- Percentage of collection that has catalog records in machine-readable form;
- Description of collection without machine-readable records, by category (e.g. monographs, audiovisuals);
- Description of currently-automated library functions (if any);
- Estimates of the location and number of workstations (to show where you intend to have equipment in any future system); and,
- Specifications for any existing equipment to be re-used with any future system (if any).

At the same time that this data is being assembled, it is important to assess user needs and set service priorities. This can be accomplished by undertaking a focused, strategic planning process designed to involve the library's "stakeholders."

1.1.9.2 Developing a strategic plan

A library planning to automate should undertake a process by which representative staff and users can identify service needs and objectives. The purpose of such an effort is to allow participants to articulate their interests and concerns. Group interaction is an important contributing factor in the success of the goal, which is to develop and sustain library automation in the years ahead.

Here are the basic steps involved in this process:

- Plan on a two-day, intensive planning effort.
- Ask participants to identify strengths, weaknesses, opportunities and threats in the library's environment that are characteristic of or that confront the library.
- Group these factors into critical issue areas that are likely to have an impact on the libraries' future in developing and sustaining automation.
- Ask participants to identify ideas and perceptions in relation to the question: "How do you see the library providing user-friendly, cost-effective automated services in five years?"
- Through a method of your own devising, ask participants to prioritize all of the ideas that come out of the above two "brainstorming" exercises.
- Ask participants to shape these priorities into the draft of a strategic "vision" for automation development consisting of a statement of purpose, goals and objectives for the library.

1.1.9.3 Setting service priorities

Your strategic vision must now provide the framework or context for the next step in the automation process, which is to determine which library functions should be automated and in what order of priority. For example, processes that are repetitive, occupy large amounts of staff time, require retrieving information from large, unwieldy files, or are high-profile functions of the library (such as the public catalog) are prime candidates for automation.

Determining the functions that you wish to automate and their priorities relative to each other is important for all sorts of reasons. If needs and priorities are clear, functions can be automated in phases and evaluations of systems and options will be easier and more productive if you are able to match your highest functional priorities against the corresponding modules available in the marketplace.

1.1.9.4 Costs

Speaking of funding, planners need to be aware that there are certain cost elements involved in the installation and operation of any automated system. These may be summarized as follows:

- PLANNING AND CONSULTING COSTS include direct, out-of-pocket costs (e.g., hiring a consultant) and indirect costs (e.g., training staff) associated with getting started.
- PURCHASE OF THE SYSTEM includes the cost of acquiring the initial system hardware and software, as well as the cost of preparing a site for the computer system.
- TELECOMMUNICATIONS costs are those fees paid to telephone companies for connecting remote terminals or workstations to a central computer system.
- CONVERSION costs are those associated with the creation of machine-readable bibliographic and, for circulation systems, patron, records.
- ON-GOING OPERATING costs include...
- maintenance fees
- utility costs
- bar code labels
- miscellaneous supply costs
- telecommunications costs
- salaries and benefits (if extra staff are hired)

1.1.9.5 Turning service priorities into system specifications

At some point, you will need to re-formulate your functional priorities into "functional specifications," which may be defined as what you want an automated system to do for you, including things that your current manual system cannot do. "Technical specifications" must also be established. These include standards that must be adhered to, system performance, operation, and maintenance, as well as infrastructure requirements, such as stable sources of electricity and telecommunications, and sufficient bandwidth.

Developing clear and accurate functional and technical specifications that are specific to your library is one of the most important, if not the most important, activity that you will engage in as you plan for your automated system. These specifications will carry you through the entire procurement process, and will ensure that the system which most closely matches them

will be the most useful and the most responsive to your needs.

1.1.9.6 Developing a formal specifications document

It is very difficult to compare systems sensibly and pragmatically solely by randomly looking at systems, talking to sales representatives, reading literature or comparing broad cost quotations. For this reason, libraries use a formal document - often known as a "Request for Proposal," or RFP -- that organizes and standardizes the information provided to and requested from the various system vendors.

Utilizing an RFP to solicit written responses from vendors makes it possible for you to systematically compare functionality, cost, maintenance, support, and all the other issues that are involved in system procurements. The process can save your money and will result in a wiser decision.

An RFP document should include these essential elements, among others:

- background information on the library;
- a description of how the proposals should be arranged and submitted;
- instructions on receiving vendor business and financial information;
- criteria the library will use to evaluate vendor proposals;
- questions regarding vendor training and documentation;
- your functional and technical specifications.

Also, vendors should be asked to describe:

- their site preparation requirements;
- their delivery and installation methodologies;
- how they will create bibliographic, item and borrower databases;
- their system maintenance programs and services;
- their system performance guarantees; and
- their pricing and cost strategies, in detail.

1.1.9.7 Evaluating vendor proposals

Upon the receipt of vendor proposals, it will be time to begin the process of system evaluation and selection. This process involves a number of key steps:

- If possible, form a project team of persons to assist with the evaluations and the selection who have some knowledge of automation or who work in the area(s) being automated.
- Try to remove proposals that are "fatally flawed," e.g., where the vendor fails to reply to any of the functional specifications or the system is missing a module for a high-priority function.
- Begin in-depth reading of the "surviving" proposals, carefully noting both deviations from the requirements as defined by the RFP and any aspect that is handled unusually well. Make a list of any parts of the response that are not clear and require further clarification.
- Schedule system demonstrations. They are an important component of the evaluation process. Allow the vendors to show off the vendor's system in the

most attractive light; however, be prepared with a list of what you want to see along with questions you would like answered. Use the same list with each vendor. This permits more effective cross-comparisons.

2 Consider using computerized spreadsheet software in order to compare and evaluate vendor cost proposals. Costs may not be what they seem at first glance.

2 Contact some of each vendor's current clients-- sites of the same library type, and of similar size, where the hardware and software modules that have been proposed to you are currently in use.

2 Assign point values to the criteria listed in the RFP and assign scores to the different proposals. The system with the highest score becomes the number one finalist, the system with the second highest score number two and so on. Remember: The selection process is not over until the contract is signed. Until that point, never let any vendors know that they have been eliminated, including those with fatal flaws.

1.1.9.8 Putting your system into place

After the system selection process is complete, there are several important steps which must occur. You and your vendor will have to negotiate and sign a contract. You will want to test the system and make sure it suits your needs. You will want to make provisions for system maintenance. Finally, you will want to train both your staff and your users as much as possible to prepare them for when the system is up and running.

With regard to training, the following must be considered: In thinking of automation planning, there is often a tendency to focus on the hardware and software aspects of planning, and to ignore the human aspects of automation-- training and public relations. Without these, however, even the most carefully designed system may not be accepted by library staff or library users.

To assure the success of your hard planning work, a training and public relations plan should be part of any automation project. Fortunately, training can begin long before the system is installed. By involving staff at all levels in the analysis of operations, the identification of needs, the setting of priorities, the development of specifications, and the evaluation of systems, staff will gain much of the knowledge they need as the planning progresses.

User acceptance for your new automated system is certainly an important ingredient in a successful planning effort. If you are implementing a public access catalog, it is probably the most important measure of success.

Public relations can allow you to accomplish three things:

2 make users aware of your new system and services;

2 motivate them to use the system; and,

2 train them in using the new system and services effectively.

1.1.9.9 Database

In the rush to acquire hardware and software, librarians often forget that their

most valuable product is the library's database. The creation of a high-quality machine-readable database provides the cornerstone upon which all present and future automation efforts rest. Vendors will come and go, hardware will become obsolete, software will be replaced, but a well-constructed, well-maintained database, will be the library's transportable and viable link from system to system. Moreover, as library users begin to access not only their local system but systems in other libraries as well, the quality of respective databases will influence both the outcome of search strategies and the availability of materials.

Database readiness has several important facets:

- Catalog records must be carefully converted from manual to machine-readable formats;
- Collections must be prepared for conversion through effective inventory programs;
- Once converted, collections must be properly maintained as titles are added, withdrawn, transferred and recataloged; and,
- Standards -- for bibliographic, item and patron records as well -- must be adhered to. In particular, adherence to well-established and accepted standards of description for bibliographic information in a machine-readable database is critical because:
- without standards, files cannot easily be transferred from one automated system to another, and,
- It is essential for libraries wishing to participate in resource sharing arrangements with other libraries, which will require such adherence as a condition of participation.

1.1.9.10 Conclusion

Computer technology and software applications are changing and evolving at an incredibly rapid pace. At current rates of development, you can expect that by the time you install your carefully planned system, capabilities will be available that were only in planning while you were evaluating vendor proposals. In general, a life cycle of five years is considered to be acceptable for a computer system before some significant upgrade (installation of additional hardware and/or software providing for increased capability or capacity) or replacement will be necessary.

Because computer and information technology represent a fundamental change in the way libraries do business, libraries must make an ongoing commitment to keeping pace with change. Therefore, like automated systems, plans must also change with time.

Plans must be regularly revisited and updated as the environment and needs change. In general, a library should conduct a major reexamination of its plan every five years, and should review its plans on an annual basis.

What are the results of good planning? You develop...

- confidence that you have selected the best possible system available, given technological and financial constraints;
- confidence that you have addressed the priority needs of your library;
- confidence that you have established a firm basis of understanding and a methodology (the planning process) for future planning;
- confidence that automation activities are being implemented as part of a clearly articulated, overall plan for the development of library services; and,
- confidence that you have the ability to respond quickly and effectively to unexpected opportunities and challenges, with a clear understanding of how these unexpected developments may be used to support the library's long range goals.

1.1.10 Implementation of Library Automation

The implementation of library automation plan should consist of the following:

1.1.10.1 Retrospective Conversion:

The title of all the books and library resources are entered into the library automation database through a process referred to as retrospective conversion, which means the process of converting existing bibliographic records from manual, human readable form such as cards in a card catalog, into machine readable format, usually by matching the old records one at a time to those contained in an authoritative database of machine readable records. Once a match is made, the cataloger download as much of the machine readable records as the library needs, usually for a modest fee.

1.1.10.2 Hardware:

The selection of computer hardware for automation involves careful planning. There are many types of computer available in the market and the libraries also have various categories. The computer to be purchased for the library should meet the specific needs of the library. The technology is changing fast, therefore, the latest computer with adequate speed and memory should be acquired from the market.

1.1.10.3 Software:

Software activates computers to perform the desired functions. A large variety of library software's are available in the market but the selection of the software depends on the nature of the library. So, software should be user friendly.

There are software's which offer management of multimedia and multilingual collections and also allows remote access not only from the libraries but also to the libraries from one's workplace. These options are costly and out of reach generally for an average library but the university library being large enough may go for them for better results. In India, such software's are still in the stage of infancy.

Some of the most commonly used library software are the following:

LIBSYS, SOUL, WINISIS etc

1.1.10.4 Training

Automation of university library is a joint venture of librarians and software engineers. The former present their requirements into a logical order and the later incorporate suitable provision to make the system work. both of them analyze the same function but there are different. Now, the work of system designing has been easier with the availability of readymade software packages for the automation of the libraries.

Library staff should be trained in handling the computer hardware, software, and perform data entry work. Earlier it was a difficult task but with the advent of user friendly software the work on computer has been made simple. The training is generally provided by the hardware and software supplying agencies.

Training of staff in maintenance of the hardware and software and also in extraction of the required data from the documents is an essential part of the work of database creation. The hardware and software suppliers undertake to impart the working knowledge about their products but the extraction of data becomes the responsibility of the libraries.

1.1.10.5 Network:

Create a network infrastructure plan that incorporate the library server and workstation into the Local Area Network Efficient resources sharing can be achieved by using recent advances in the information technology i.e. networking of libraries and information centers through Local Area Network, Metropolitan Area Network, and Wide Area Network .

Network of information sharing is to the use of the computer and telecom link for the transmission of information or data from one library to another. Keeping in view , various library networks have been established for cooperation and resource sharing among libraries. So, the library networks should include of the following:

- Promotion of resource sharing
- Creation of resource sharing tools like bibliographic databases such as union list of serials, union catalogue of books, periodicals bibliographic databases of articles and other type of materials such as CD's video recording, sound recording, theses etc.
- Delivery of documents
- Adoption of international standards for creation of records uniformity etc.

1.1.10.6 Site preparation:

Site preparation is a very important step in the implementation phase. In the website of the university we should provide a web page related to the library, which consist of information regarding all the resources available in the library

and also provide a "easy to use" interface for the users to search different books, magazines etc online.

1.1.11 Summary:

In this chapter we have discussed the meaning of library automation, its need, advantages, objectives, components and configuration for automation and mainly planning and implementation for automation.

Library automation means the use of computer in the routine and important services of a library. Its advantages are speed, saving of time; easy updating etc. essentials for automation are good collection, hardware, software, finance and training and the components of automation are aim, processing and computer system. Its objectives are very large in numbers.

Planning for library automation has been defined as planning for "integrated systems" that computerize an array of traditional library functions using a common database. Its various steps are as follows:

Developing a library profile
Developing a strategic plan
Setting system priorities
Costs
Turning service priorities into system specification
Developing a formal specification document
Evaluating vendor proposals
Putting your system into place
Database

After this, the implementation of library automation which should consist of the following :

retrospective conversion, hardware, software, training, and network and site preparation.

1.1.12 Keywords:

Automation, RPF, Vendor, OPAC, LAN, Database, Software, Hardware, Network

1.1.13 Self check exercise:

Q. What is Library Automation? Discuss the advantages of Library Automation.
Q. Explain the need for Automation of a Library?
Q. Explain briefly the various steps in Planning for Library Automation.

1.1.14 Suggested readings:

"Computer in library management" by Shamim Ahmad, APH publishing corporation, New Delhi

"Library automation" by Kochar and Sudarshan, APH publishing corporation, New Delhi

"Information technology in libraries" by G.Deverajan, ESS ESS publications, New Delhi

"Knowledge society and libraries" by Sudarshan rao ESS ESS publications, New Delhi

LESSON No. 1.2 **AUTHOR : VISHAL SINGH**

AUTOMATION OF HOUSE KEEPING OPERATIONS

1.2.1 Introduction
1.2.2 Acquisition
1.2.3 Cataloguing
1.2.4 Circulation
1.2.5 Serials Control
1.2.6 OPAC
1.2.7 Library Management
1.2.8 Keywords
1.2.9 Self Check Exercise
1.2.10 Suggested Readings.

Objective:

In this lesson, we will discuss the Automation of House keeping operations, which include Acquisition, Cataloguing, Circulation, Serials Control, Online Public Access Catalogue and Library Management.

1.2.1 Introduction: Automation of House Keeping Operations

A library, however it is either big or small, have to perform minimum number of basic operations. These operations are conventionally referred to as "house keeping operations" which include Acquisition, Cataloguing, Circulation, Serials Control, OPAC etc.

1.2.2 Acquisition:

Acquisition is an essential library operation which is critical to the library's mission. The acquisition process involves a great deal of detailed and paper extracting work; material handling in large quantities, invoices and material received and so on. Therefore we can say that acquisition is the prime candidate for Automation. Automation benefits acquisition through more accurate, timely and complete record of orders, order- status, vendors, supplier's directory and so on. Automation support for acquisition eliminates much of the 'form' preparation and paper handling required in manual system and thus reducing personal time and efforts required to do this work, a most important benefit of computerization of acquisitions work is the powerful, cost effective monitoring incapability, if affords to library management.

The major objectives of automated acquisition are as follows:

- To maintain record of all the activities involved in the acquisition.
- To reduce labour and paper intensive work involved in acquisition.
- To provide accurate financial information.
- To provide necessary management information reports.

2 To have effective and efficient control over order claiming and cancellation functions.

Functions of automated acquisition:

The various steps in the automated acquisition process are the following:

1. Ordering:

The process of library acquisition starts with the selection of material by the acquisition staff or with the arrival of request from the users. The catalogues and On-order files of the library are consulted to determine whether the item is On-order or already in its collection. A thorough checking is done to avoid duplication. If the acquisition system contain document data file, it is searched to determine whether a given item is already owned. Otherwise, the manual catalogue is consulted. Further On-order/In-process file will have to be checked to see whether the item is already on order. If the record is already there, either in On-line catalogue or in On-order file, assuming that an additional copy will be purchased. The system should support for creating a new order record just by copying automatically the relevant field.

However, for a completely new order i.e., when no matching records are either found in online catalogue or in-order file, all the details are to be filled in afresh. Each order record typically consist of some combination of the following fields, an order control number; an order data; a purchase order number; a request name or code; a vendor name or code; an indication of acquisition type (a new order, standing order, prepaid order, and so on).

A good acquisitions system supports various order types such as standing order, on-approval, prepaid order, gifts and exchange and so on. Once an order record has been generated, the system must be capable of transforming the input data into actual orders to be sent to the vendor or other sources.

2. Item Processing:

On the arrival of the item in the library the shipment must be matched to the correct order and checked in. When an item is received, the system's operator retrieves the appropriate order record to verify that the correctness and completeness of the order. Basically, the received item processing in an automated system involves updation of order to indicate the receipt of the item.

The system should efficiently handle the partial receipt of an order, receipt of the item without invoice, receipt of the items through different order types, items received but not ordered etc.

3. Invoice Processing:

To make the discussion simple, it is assumed that items and invoices are processed separately. However a close interaction between the items receipt and invoice receipt is an essential in the acquisition system

If an item is received before invoice, the receipt of the item is recorded into the system. Similarly, if the invoice is received before its item, the receipt of the invoice, along with other details are centered into the system with an indication of the non-

receipt of the item ordered for. In this case system generates claim for the item.

4. Claims:

If an order is not received with in the specified period, a claim notice has to be generated and sent to the vendor unless notification of delay has been received and noted in the system. A system should provide for both automatic claiming of ordered materials and operator initiated claims. In the former case, the system triggers claims notice production automatically and in the latter case the claims are received and released by the staff for printing. The system should have the capability to produce up subsequent claims if no response is recorded by the system within a specified period.

5. Cancellations:

An automated system should have a function to support the cancellation of the order. However this function have to be carefully monitored by the system and allow only authorized staff to carry out this functions.

Though the cancellation is usually operator-initiated function, the system can trigger cancellation function automatically, if the response to claim notices are not received within the maximum time limit specified by the library.

6. Search and Retrieval:

Access to databases is an essential requirement for an automated acquisition system. In fact one of the important advantages of an automated system is its capability to provide wide range of access points to search one or more data files in support of acquisitions. As the type and nature of search can not be predetermined there should be sufficient flexibility in this function.

It is common to combine two or more terms during searching. This, requires that the system should allow for the use of logical connectors between search terms. The most commonly used connectors are AND, OR and NOT. The relational connectives are also quite useful as search tools. The basic set of connectives include equal to (=), not equal to (<>), greater than (>), less than (<), greater than or equal to (>=), and less than or equal to (<=).

7. Routing:

This function indents to send materials to faculty, staff, researchers or other categories of clients for review prior to shelving. Routing information need to be suitably maintained by the system. But it has to be always linked with the order record. On demand, routing of selected items should be supported.

8. Fund Accounting:

Automated systems are very useful in fund accounting and audit trial. A good system maintains correct and current financial records and a good audit trial. Maintaining funds under different heads as required by the library from time to time is the main feature in this function that the system should allow.

9. Access Control:

It is very important for automated system to have access control facility to ensure

the data security. It means that only certain staff members are given the authority to have the access to and or modify the data.

System having a good access control facility may allow even the user of the library to interact with it, for simple search and retrieval from online catalogue.

10. Reporting:

One of the advantages of automated system is the relative ease with which reports can be generated. A good system should produce varieties of reports required for day to day as well as occasional work/decision making process. The system should provide statistical as well as management reports.

1.2.3 Cataloguing:

Cataloguing system is a traditional and fundamental activity practiced in the Libraries world over. Cataloguing system has two interrelated activities. Descriptive cataloguing and the production of library catalogue. Automation support to cataloguing has benefited both these aspects. Descriptive cataloguing is time consuming. As a result, many libraries experience cataloguing backlogs which slow down the flow of materials into the library. This results in library catalogues not representing the collections fully and accurately. As a labour-intensive activity requiring special training and sometimes considerable experience, the descriptive cataloguing, can prove expensive, so that the total cost of cataloguing of a given item may approach or even exceed the value of the item itself.

The objectives for Automation support for Cataloguing are as follows:

2 To speed up the processing of materials into the collection.

2 To reduce the clerical effort, stationary (work sheets, cards etc) and unit of cataloguing a work.

Automation has impact over both facets of cataloguing.

1. Automation of Descriptive Cataloguing:

Though several options are available for libraries for automating cataloguing activities, the most widely used method is the utilization of the MARC format.

MARC is an acronym stands for Machine Readable Cataloguing. It is the credit of library of congress for having recognized the need for developing a record structure and format which would greatly facilitate the exchange of bibliographic information between libraries, group of libraries and computer systems.

"MARC format " is a widely accepted structural coding scheme for a particular type of material, including monographs, serials, sound recordings, manuscripts, maps, audio-video materials, and machine readable data files. The data that can be included in MARC format include almost all the information representing on cataloguing cards such as author, title, editor etc. and a great deal of other information which is helpful for processing by the computer.

Components of Machine Readable Format:

The machine format consists of the following components.

1. Data element, which represent the lowest unit of information.
2. Field, a collection of elements for e.g. a field relating to authorship consisting of the data elements of a person's name and dates of birth and death.
   The fields are further of the following types.
   a) Fixed fields, containing data elements that are always expressed in a predetermined number of characters.
   b) Variable fields, containing data element with no predetermined length.
3. Record: The complete collection of fields treated as unit. However a record represent a particular bibliographic item i.e. book, periodical article, etc.
   A machine readable format has three major components:
   a) The structure of a records, which is the physical representation of the data on the machine readable medium and allowed its content to be transported from one centre to another
   b) The content designation of labels, which are the means of identifying the data elements or providing additional information about each data element.
   c) The contents of the record, which are the data element themselves.

The basic standard for record structure are derived from the MARC format developed by US Library of Congress. These standard include national standard such as ANSI 239-2-1971, and international standard such as ISO-2709, 1981.

MARC format

The structure, the content designators and contents are the basic aspects on which the MARC-II format is conceived. The structure which can be compared to an empty container provide the basic machine framework of the record. The content designators refer to the means by which elements in the record can be identified, while the content refers to data recorded in the fields. The component of the structure include:

1. Leader
2. Record Directory
3. Variable Field

MARC-II communication format structure has Leader, Record Directory and Variable Fields.

Each MARC record contains a leader as the first 24 characters and the leader provides information about the ensuing record such as the total length of the record code or the bibliographic level. The type of record code specifies the form of material described in the record as follows:

2 Language materials

2 Language materials, printed e.g. books manuscripts

2 Subject authority file

The second part of the format structure is the record directory. It shows what variable fields are in the record and their location in the record. There is a 12 character record directory for each variable field. It consists of the following:

- Tag-three digits identifying a variable field
- Length- four digits
- Starting character position-five digits representing the location of the field in the record.

The existence of the record directory allow one to have variable fields in any order. Updating of the record is facilitated because new fields can be added at the end of the record regardless of what the tags are. The record directory also helps in the retrieval of the selected fields from the record.

Outline of record directory entries: This has the following four parts.

Tag

Length

Starting character position

Field terminator

A variable field consist of the following:

1. Indicators-two characteristics given additional information about a field.
2. Sub fields codes-two character
3. Data-information pertaining to the field
4. Field terminator-special character indicating the end of the field.

The basic framework of the MARC format, consisting of the leader, record directory and variable field has been adopted as a standard by several organizations.

The MARC format, both by its structure and its content designators, has caused a revolution in the creation of bibliographic database worldwide. The builders of various other databases such as INIS, AGARS and INSPEC have used MARC structure as the basis for creation of their own communication formats.

2. Automation of Physical Forms of Library Catalogues:

Until the latter part of the nineteenth century, book catalogues were prevailing in the libraries. As the form suffers from becoming out-of-date very soon, card catalogues were introduced. In theory the card catalogues could be an up-to-the minute of what was held in the library collection.

So, the advent of computer helped book form of catalogue to appear again. The production of book catalogue for larger collection became more feasible than it had been earlier. In the mean time, techniques were developed that merged two technologies, viz, the computer and the microphotography. With this catalogues appeared on a new form called COM-Computer Output Microform. There are two categories of microform available to the library for the production of COM catalogues: microfilms and microfiche. The main advantage of the COM over printed book catalogues was in production and distribution costs. Some savings accrued at the stage of producing the first copy of the catalogue. COM records generally operated at speeds at least ten times greater than line printers, there by requiring only a reaction of computer time to produce the master copy.

1.2.4 Circulation:

The circulation is a most important function of a typical library. It is generally compared with the inventory control, involves a great deal of record keeping and correspondingly consumes staff time. It is highly essential that the records have to be accurate and all information has to be updated immediately after each transaction. The objectives of Automated Circulation Control are as follows:

- To have efficient and effective control over dues, fines and records.
- To accurately provide information about status of a book.
- To record timely and accurately the loan transaction data.
- To provide necessary statistical and management reports.

Functions of Automated Circulation Control:

1. Charging/Issuing:

Charge/Issues is one of the fundamental functions in a circulation control system. For charging an item, the patron identification number(PIN) and document identification number (DIN) are identified to the system through Optical Character Recognition or keying in the data or by some other means, which are eventually validated by the system for their correctness. Only if both are through with the validation check the system records the transaction and allow the patron to borrow the item. The validation should not only check whether the entered code (PIN and DIN) is correct but also see whether the total number of items borrowed is within the borrowing limit of the patron.

A good system allow multiple books to be borrowed in single transaction. This will, of course, save the time required for each transaction. If needed the system should print due date slip also. The due date calculation should be done by the system taking into account the general and special holidays as applicable to that library.

2. Discharging/Returning:

The discharge function basically involves receiving the item back into the library and updating the patron's record to reflect the returning of the item and producing an acknowledgement for returning the item, if required. As in case of charging, even in discharging the PIN and DIN are identified to the system. An efficient system allows for discharging multiple items in a single transaction.

3. Renewal:

This function allows for the patron to extend the loan period. This function may be thoroughly controlled by the patron type, material type, the reservation status of the book and other conditions as applicable to a individual library.

In case the item to be renewed has a hold or recall outstanding, the renewal should be denied, of course depending on the library policy.

4. Reservation:

This function helps the operator to reserve a document which is on loan. Is usual practice in libraries to maintain the holds queue on first cum first serve basis.

Upon the discharge of an item, the system should produce a notice to be sent to the

patron at the head of the queue. If the patron does not claim the item within a specified time, the system should automatically send the notice to the next patron in the queue.

5. Recalling:

It is not an unusual situation in libraries to recall the items borrowed by the patron. Normally an item is recalled if it is overdue and or is reserved by some pattern, there may be other conditions for recall such as that an item is required for some purpose in the library, the item has to be sent for binding and so on.

6. Overdue Charging:

An item is said to be overdue if it is not returned to the library on or before date established at the time of charge or renewal or recall. The system should detect the overdue items and produce suitable overdue notices to the patrons.

It is usual practice in libraries to levy fines against patron for failure to return items by due date. While calculating fines, it is necessary for the system to consider as per the library policy, the type of item, the patron class, and other specifications as applicable to the individual library.

7. Search and Retrieval:

It is the same step as in case of acquisitions system. The use of logical connectors AND, OR and NOT and of relational connectors are also quite useful. The basic set of connectives include equal (=), not equal to (<>), greater than (>), less than (<), greater than equal to (>=), and less than or equal to (<=). A good system provide effective searching.

8. Reporting:

One of the important advantages of automated systems is the provision of variety of reports. In particular, the circulation data provides lot of management information. Thus, the importance of generating reports in a circulation control is high. Hence the system should provide statistical as well as management reports.

1.2.5 Serials Control:

The serial control is an important part of the in-house keeping operations in a library. It is the area that is labour intensive, demanding high degree attention to accuracy and details. The benefits of the application of automation in other areas of library operation is now well established, it is a natural progression for librarians and system designers now to seek to apply the power of computer to control one of the librarianship's most troublesome process.

The major objectives of serials control system are as follows:

- To have effective and efficient control over the subscriptions claiming and cancellation activities.
- To record and maintain accurate and timely the serials holding data.
- To reduce labour and time consuming work involved in manual serials control system.
- To have a good control over binding and related activities
- To provide necessary management information reports.

2 To provide accurate and timely financial information.

Functions of Automated Serials Control:

1. Check-in : One of the most important features of a serials control system is its check-in-capability. Because it is a highly repetitive operation, it must be fast and "friendly" to be useful to the library. There are two basic methods in which the system can be devised to check-in serials. In the first method, the operator has to input the check-in data into the system every time. While, this method is very flexible, it can be inconvenient and time-consuming. In the second method, the system can predict the expected issue. If the predicted issue matches with the one in hand which is to the checked-in, with minimum number of keystrokes, the issue can be checked in. This is of course a quick method.

2. Claims : The most frequently faced problem in serials management is the non-receipt of the journal issues in time. In manual system, it is difficult and time consuming process and identify the non-receipt of journals for sending claim notices for them. With automation, identification and claiming for such issues become easy and accurate and takes much less staff time to accomplish the task.

The system should automatically identify the issues that should be claimed. Some claims may be automatic and may cause the system to trigger claim notice production without or with minimum staff intervention. Other claims will be semi-automatic in the sense that they require staff review prior to claim notice production.

The system should be able to automatically identify and produce claims notices for relevant issues on:

2 Failure to receive a new order within a library in specified period.

2 Receipt of an issue late than the expected time frame.

2 Failure to receive next issue within the expected time frame.

2 Receipt of fewer number of copies in case the library is subscribing the multiple copies.

3. Binding : This is an important function in a serials control system. It is a common practice in libraries to bind the completed volumes for storage. An automated system should be able to indicate, when an item is ready to sent for binding.

At any point of time, the system should be able to provide the list of serials that are standing for binding. Binding order should be prepared on the order of the authorized staff. The binding material may contain relevant details like type of binding (material, colour, method etc).

4. Acquisition of periodicals : Acquisition of serial control system, refers primarily to the tasks involved making new subscriptions, re-subscription, renewal and cancellation of subscription. In order to handle the acquisitions work efficiently, the system should maintain in-process file and a vendor file. The in-process file may contain the bibliographic and order data, as well as invoice data if required.

5. Search and retrieval : It is similar to searching and retrieval from database as in automated acquisition system. We can make use of the logical connectors,

AND, OR, NOT and of relational connectors are also quite useful which include equal (=), not equal to (<>), greater than (>), less than (<), greater than equal to (>=) and less than equal to (<=).

6. Fund accounting : Automated systems are particularly valuable in fund accounting and audit trial. A good system maintains correct and current financial records and a good audit trial record. Obviously, this function must be sufficiently flexible so as to operate with the library policies.

One of the main features of this function is that the system should allow maintaining funds under different budgets heads as required by the library from time to time. On a payment for the new subscription and renewal of subscriptions, the system should adjust the funds appropriately. It should record the actual price paid, postage, foreign exchange etc., as appropriate to each serial.

Maintenance of full audit trial particularly for financial transaction is essential. The audit trial detail should be recorded in such a way that they should identify the person effecting the transaction, the date, the time, nature of transaction carried out etc.

7. Reporting : A good system provides a variety of reports required for day-to-day, as well as occasional work/decision making process. The system should provide both statistical and management reports.

1.2.6 On-line Public Access Catalogue (OPAC)

OPAC is simply a computerized library catalog available to the public. OPAC may be designed for an individual library and consulted within its building or it may be available outside the library through Intranet and Internet also. Now a day OPAC are available over the Internet to the users around the world.

OPAC has over shadows all together events in the history of cataloging during the past decade. OPAC can be accessed via a computer terminal. Such catalogues allow searching the catalogue database in order to see, if the library hold specific title of document to be informed its location in the library and if the catalogue system is linked to the circulation system, the enquirer to be intimated whether the item is readily available or is on loan to other, etc.

Online public access catalogues are a computer-based replacement of the old card catalogues and its purpose and function remain the same. It supersedes the function of the traditional catalogue. It provide keyword search, Boolean search and also provide interactive instructions or search facilities to users with possibility of getting output in various formats and interaction contents they require. In a simple term, we can say that it is a machine-readable catalogue in place of card catalogue.

In a card catalogue environment, the user moves from physically visible drawer to drawer or from card to card, whereas with online catalogues he/she is faced with a sort of invisible or indiscernible universe.

OPAC should allow the users to search by author, title, subject, class no, keywords and Boolean search. OPAC is an access tool and a resource guide to the library's collection, which contain bibliographic data in machine-readable form. OPAC are

the gateways to the bibliographic information in libraries and provide facilities to browse and search and locate the information. It supported with efficient document delivery system, the OPAC serve as powerful tool, which will help realizing the resource sharing activity among the libraries.

The library use different library application software on different platforms with different formats. In this kind of a situation the computer may not be able to communicate in a networked environment to access and retrieve the bibliographic holdings of the libraries. Especially when the OPAC are made accessible over the Internet, there should be standard protocols to enable the computers to establish a connection to send the search request. Z39.50 protocol is a retrieval standard now available. The database server and clients accessing the server should be Z39.50 complaint, so that the operating system environment or the application software, even if they are different, the client can comfortably connect and send a search query and get the search result to his/her computer from the remote server.

Methods of information search:

This type of search is very useful, if you want information about any topic or person but you do not know the title or author's name.

- To find the best terms for the search by subject option try the "library of congress subject headings" (LCSH) available at the reference desk.
- If you set no results then try similar words(synonyms).
- When you are searching for materials about a person , type the last name first. For e.g. if you are searching for material related to Steve Waugh than type Waugh, Steve.
- Discuss your topic ideas with your class instructor and with the librarian.

Search by author:

This search is used for looking for works by a particular author, artist etc. invert the author's name(type last name first, first name and middle initial last). For ex, to find works by edgar allan poe, you should enter the sequence: poe, edgar, allan.

One point to be noted is that an author may be a person or an organization, so

- for an organization, enter the full name of the organization for e.g. Indian Institute of Technology.
- OPAC is not case sensitive, like most online databases, that means it does not care about capitalization of words so you can type cat, Cat or CAT.

Search by title:

The option search by title is tried to know the exact title or its belonging. For e.g. Discovering computers.

- Omit any leading characters such as: "a, an, the, un".
- You do not have to write the whole title, only first few words work for you. For e.g. while searching for a book titled: "never before, never again: The stirring autobiography of Eddie Robinson the Winningest coach in the history of college football". you may type only: "never before" and achieve similar results.

Search by keywords:

It is a method to search the full text of OPAC records for terms that might appear in the author, title, subject, notes or even publishing information of the book you are looking for.

- Use keyword search if you do not know the authorized subject heading for the term you are looking for searching.
- Keyword searches are especially good for combining author and title searches if one does not know the complete name of the author and the full text.
- Use search operator such as AND or OR to combine terms representing different aspects of your subject to narrow or broaden your search for e.g. SHAKESPEARE AND HAMLET.

1.2.7 Library Management

The Library Management should consist of the following:

1. Electronic Spreadsheets

These applications are common among business professionals. Paper spreadsheets are prepared manually, whereas electronic spreadsheets are prepared electronically with the help of computers. Spreadsheet formulas can be changed easily and values can be worked out to different configurations. The results of one spreadsheet can be carried over as input to another, and so on. The data of the spreadsheet can be used to produce pie charts, bar charts and line plots.

2. Database Applications:

A personal database application keep track of entities. A database is a record of facts and figures about entities. A database should be kept up-to-date by revising the facts and figures time to time.

Reports are generated periodically from the database. A report is a formatted presentation of data from the database. Another way is to obtain data from a database on ad-hoc basis by using the query language as and when needed.

(Database Management System).

Database Management System is a program that is used for processing a database. Most of these system include a number of easy to use tools for developing data-entry form, reports and menus. Application programmes are written to meet specific processing needs. For this purpose most DBMS products support a programming language. Knowledge and expertise of these tools and language are essential to the DBMS.

The most important DBMS are dBASE(versions- dBASE II, dBASE III, dBASE III plus, dBASE IV). Others are ORACLE, Paradox, Sybase etc.

3. Workgroup Information Systems:

A workgroup is defined as "an organized system of two or more individuals who are interrelated so that the system performs some function, has a standard set of role relationship among its members, and has a set of norms that regulate the function of a group and each of its members.

We can also say that the workgroup usually consist of 2 to 25 people who work together to achieve a common goal. Workgroups are commonly named as a department, group, office, team etc. the member of the workgroup are known to each other and work side by side in the same physical plant. They meet together periodically.

There are two types of workgroup: Homogenous and Heterogeneous Workgroups

Homogenous Workgroups: All members fulfill the same role.

Heterogeneous Workgroups: Different roles are performed by different members.

Hardware Sharing System:

The members of this workgroup are allowed to share the hardware facilities available.

4. Workgroup Communication Systems

Electronic Mail:

A most common workgroup communication application is the electronic mail(e-mail). These systems help to create, edit and dissemination intergroup communications.

Each person in the workgroup is provided a file which is generally called a mailbox. Correspondence address to the person is deposited in the mailbox. Each person in the group is expected to examine his mailbox periodically.

Email systems are mainly used with micro-computers rather than with minis and mainframes. The originator of the mail has to specify his or her identity and the identity of the person to whom the mail is addressed.

5. Group Conferencing:

It is possible to exchange information in the format of conference proceedings without member meet physically. There are different systems through which this is achieved.

Electronic Bulletin Board:

Message of interest to the workgroup are stored in a file. Users have to pursue the file periodically to get the notices. This is the simplest way of group conference.

Group Network:

It is held in real time and is interactive. When the meeting is on, all the attendees have to remain present at their terminals. Members continually receive information on their terminals. Each one will have the opportunity to put in their opinions/ statements for consideration of the whole group. The chairperson controls the order of activity and voting when necessary.

6. Workgroup Management System:

Scheduling:

When the work of different subgroups are independent. Sometimes, the work of one subgroup may be held up due to delay in the work of another subgroup. This is generally remedied by developing a work-flow scheduling by the manager. This system can calculate the impact of the delay and also warn other group or groups, so that they can plan their work accordingly.

Configuration Control System:

Configuration Control System keep track of the structure and composition of various versions, modules, subsystem and products. By giving the current status of in-development programmes, status of various projects, time required for future projects, and effectiveness of different programmes can be easily estimated.

7. Organizational Information System:

Organizational Information System brings in integration of the activities of various departments. It helps in strategic planning, operational control and management decision making. It involve many people, many functions and heterogeneous data. There are a number of sub-systems. Important one are discussed hereunder

Purchasing System:

The purchasing system generally performs the functions of acquiring goods and services; make payments for the good acquired; and maintain account for goods acquired; and maintain account for the expenses. All the department that perform these functions may store the data in common database. Each department make necessary modifications in the data. All the department can have up-to-date information and can know the items to be processed.

Personnel and Payroll System:

The system deals with recruiting/hiring, payment, accounting and administering employees. The system generally has two subsystems.

The personnel system: that deals with keeping track of jobs, people, assignments etc. And the payroll system: which deals with preparing pay bills, account of vacation and leave, deduction of taxes etc.

8. Personal Information Systems:

Integrated packages:

These are used to create visual displays of data beyond those built into spreadsheet programs. These programs create much higher quality graphics, with better resolution, more types, colour and three dimensional graphics.

Information Retrieval Programmes

A personal computer can be linked to a database using telephone lines with a modem. Bibliographic data, stock quotations, government statistics, legal information and public utility information like air and rail timings etc.

Administrative assistance programmes:

These programmes provide a menu of services with items like calculator, calendar, telephone dialer, alarm etc.

Statistical applications:

These programmes help to analyze data by formal statistical procedures like analysis of variance, regression analysis etc.

1.2.8 Keywords:

Acquisition, Cataloguing, Circulation, OPAC, MARC, Spreadsheet, Database.

1.2.9 Self Check Exercise:

Q1 Explain briefly the various functions of Automated Acquisitions.

Q2 What is Cataloguing? Write down the various components used in machine readable format. How does MARC format related to Cataloguing?

Q3 What is OPAC? Write down its benefits in Library Automation.

Q4 Write down short notes on the following:

1. Acquisitions.
2. Serials control
3. Circulation control
4. Cataloguing

1.2.10 Suggested Readings:

"Computer in library management" by Shamim Ahmad, APH publishing corporation, New Delhi

"Library automation" by Kochar and Sudarshan, APH publishing corporation, New Delhi

"Information Technology-Applications" by P.S.G Kumar, BR Publications, Delhi.

"Technological Feature of Library and Information Science" by Krishan Gopal, Authorspress, New Delhi.

LESSON NO. 1.3 AUTHOR : DR. P.C. SEHGAL &
AMANDEEP SINGH MARWAHA

LIBRARY PACKAGES

Structure of Lesson

1.3.1 LIBSYS System
- 1.3.1.1 Introduction
- 1.3.1.2 Modules of LIBSYS
  - 1.3.1.2.1 Acquisition/Ordering
  - 1.3.1.2.2 Cataloguing
  - 1.3.1.2.3 Circulation
  - 1.3.1.2.4 Serials Control
  - 1.3.1.2.5 Article Indexing and Abstracting
  - 1.3.1.2.6 OPAC
  - 1.3.1.2.7 Web OPAC

1.3.2 SOUL (Software for University Libraries)
- 1.3.2.1 Introduction
- 1.3.2.2 Hardware and Software Required
- 1.3.2.3 Modules of SOUL
  - 1.3.2.3.1 Acquisition
  - 1.3.2.3.2 Catalogue
  - 1.3.2.3.3 Circulation
  - 1.3.2.3.4 Serials Control
  - 1.3.2.3.5 OPAC and
  - 1.3.2.3.6 Administration
- 1.3.2.4 Strong Features of SOUL
- 1.3.2.5 Benefits of SOUL

1.3.3 WINISIS
- 1.3.3.1 Introduction
- 1.3.3.2 System Functions
- 1.3.3.3 Hardware Requirements
- 1.3.3.4 Running WINISIS

1.3.4 Self-Check Exercise

Objectives : In this lesson students are introduced to the following software packages which are used in libraries.

- LIBSYS
- SOUL
- WINISIS

Library Packages

1.3.1 LIBSYS SYSTEM

1.3.1.1 Introduction

"LIBSYS for library automation" software is the start of a new experience for librarians and public users. LIBSYS is an integrated library management software package designed and developed by LIBSYS Corporation New Delhi. LIBSYS is designed and tailored to serve Librarians and users of today. LIBSYS is the most comprehensive, fully integrated multi-user system designed to run on super/micro/mini computers, Library Software package available in India, today. It was initially developed in COBOL language but now converted into C language and supports almost all the activities of library related to acquisition, circulation, cataloguing, serial control, articles indexing, abstracting, OPAC etc. It has its own centralised bibliographic database based on ANSI 239.50 format. Having been in operation in a number of organizations and in many libraries in the country, LIBSYS has been accepted as the market leader and the only software solution of its kind available in the country. LIBSYS follows international standards such as CCF, MARC etc. LIBSYS is easy to operate and the library staff can begin to use it quickly without any pre-requisite programming/Computer skill. It has following special characteristics; Interactive and screen oriented, menu driven, powerful editing facilities, user defined security, help and multilingual use etc. It ensures high productivity because of minimal data entry requirements, maximum possible integration of functions and powerful search and query facilities.

LIBSYS users include National Informatics Centre (NIC), TIFR, C-DAC, INSDOC, Indian oil corporation's Library Division, Government of India's Department of Electronics, Library and Information service Divisions of Ministry of External Affairs, AIIMS, IGNOU, Planning Commission, University of Hyderabad, Space Application Centre and Parliament etc. It has more than 120 registered users in south Asian Countries since 1988.

LIBSYS can be implemented on many platforms such as WINDOWS (NT/2000 / XP), UNIX (various types) and LINUX. Besides its own database handling capabilities, any other preferred industry standard such as SQL Server, ORACLE, and MySQL etc. can be used as a back-end. LIBSYS has following salient features:

1. Based on Client-Server model
2. Multi-lingual support for Indian and International languages/

scripts

3. User-friendly Windows GUI
4. Web OPAC
5. Import/ Export of Data in Marc and non MARC
6. Supports Barcode/ Smart card for capturing of member ID and item ID
7. Interface with Digital Video Camera (to capture member's photograph
8. In-built Barcode Printing
9. Optional Back-End RDBMS (ORACLE or SQL Server or MYSQL) with ODBC connectivity.
10. Internet enabled
11. E-mail interface
12. Sophisticated Security feature

1.3.1.2 Modules of LIBSYS:

1.3.1.2.1 Acquisition / Ordering :

This feature allows an enhanced management procedure for activities that include ordering, receiving, invoicing, stocking, and dispatching capabilities. The Acquisition System of LIBSYS deals with selection and ordering of books and other library materials such as reprints of articles, audio-visual tapes, maps, etc., including duplicate check; approval process; placing order; receiving material against firm order; invoice processing; payment requisition; order follow-up, online queries by titles, orders, invoices, vendors, and budget heads; and generating various reports. It also provides a precise budget analysis and expenditure maintenance at any point of time. On selection of acquisition module, following four windows appear:

1. Ordering
    i. Enter title- To initiate procurement of a title
    ii. Request to Vendor- For titles which have not been received request letters can be generated.
    iii. Approval form- can be initiated periodically and printed
    iv. Approval status- prior to placing the order the status can be seen.
    v. Return- rejected title through approval form should be entered here.
    vi. Update Title- Title once entered can be changed or even removed.
    vii. Place Order- to develop the order for the approved titles and can be amended, deleted and printed here.

2. Invoicing
    i. Receiving- material received should be registered here.
    ii. Invoicing-allows more than one invoice for an order with facility of multiple currencies with exchange rates.
    iii. Payment requisition- can be generated after invoice amount tallies with the total.
    iv. Payment details- cheque details can be entered here.
3. Miscellaneous
    i. Records keeping - vendor records, budget heads, currency codes, exchange rates and accession details for old titles can be entered here.
    ii. Enquiries- on titles in acquisition, on orders and invoices, on vendors, and miscellaneous queries on budget head and accession register.
    iii. Reports- such as purchase order can be printed here.
    iv. System setup- allows entering library parameters like currency, vendor, budget head discount etc. and system options to select ID's for purchase order, payment requisition etc.
    v. House Keeping
4. Gifts/Grants
    i. Enter title- to enter the material received as gifts or on exchange basis.

The data flow in acquisition system is as follows:

Initiating Titles - Titles may either be requested by members or received 'on approval' from vendors etc.

- Checks for duplication of title.
- To order additional copies or new edition of existing titles existing data can be used i.e. no need to re-enter data.
- Option to download or copy bibliographic Data from CD-ROMs, international databases or vendor-supplied electronic Catalogues.

Approval Process - Involves printing of approval lists as and when required and then updating the status of each title as 'Approved' or 'Rejected'.

- The process to include specific titles in an approval form is flexible.
- Amendments can be made in approval list prior to its printing.
- Analysis of Budget and expenditure can be done.
- Titles can be categorized subject wise in the approval list.

Placing Order - Both firm orders for titles requisitioned by staff and also material received earlier 'on approval'.

- Prints purchase orders for direct mailing or for electronic transmission to the vendor.
- Flexibility to include specific approved titles in an order, or of single publisher or vendor.
- Orders can be modified or changed and can be cancelled as well.
- Special delivery instructions can be specified.
- Standing orders for annual publications can be handled.
- Provides for pre-paid orders.

Receiving - Procedure to record the details of items received. It can maintain for subsequent accessioning, an in-process file of items received 'on approval' and items ordered.

Invoice Processing - Includes accessioning of items

- It permits more than one invoice for an order.
- It maintains exchange rates of various currencies.
- It allows changes in unit price, discount, exchange rate, etc.
- Accession number can either be generated automatically by the system or it can be a user-defined number i.e. generated by user. Keeps up-to-date status of orders w.r.t. titles ordered, received, accessioned.
- It allows online updating of funds accounts.
- Separate procedure for accessioning items received gratis, in exchange.
- It has an option to accession before invoicing; or accession and invoice together or invoice before accessioning.
- It has an option to generate bar code labels of required size for sticking on material.

Payments Requisition - Provides an effective procedure for getting sanctions from the Accounts section or generating requisition to account section for making payment directly to vendor. The system allows putting more than one invoice in the payment requisition notices.

Order Follow-Up - It can be done for specific titles on order, or for an entire order

- Overdue notices/reminders can be sent periodically.
- Online printing of follow-up notices.

Online Queries - include:

- Titles in the process of acquisition.
- Pending orders, titles ordered, titles received, pending titles, its invoice and overdue orders.

- List of invoices, for a specific invoice, details of items accessioned against it and payment details, if any.
- List by vendors, giving titles received 'on approval', orders placed
- Budget analysis of titles in the acquisition process.
- Order details by Accession number.
- New arrivals.

Reports - Various reports generated by the acquisition module are

- Approval request form.
- Purchase order.
- Overdue/Follow-up notice.
- Budget and expenditure analysis.
- Payment requisition report.
- Payment cheques delivery notices.
- Bill register.
- List of recent arrivals, etc.

1.3.1.2.2 Cataloguing :

LIBSYS cataloguing module is genuine in its features, in addition to its simple screens and comprehensive nature. LIBSYS is built around its own centralised bibliographic database based on MARC format supporting different types of materials, print and non-print. It makes the various catalogues/indexes available on-line for instant reference and thus enables searching on subjects and key words. Cataloguing sub-system of LIBSYS facilitates maintaining in-process title; catalogue production either by data import or entering data; catalogue maintenance; thesaurus construction; authority files maintenance; holdings updates; holdings summary by ranges of Call No., printing 3x5 inch catalogue cards, preparing special bibliographies, list of recent arrivals and SDI facility, and import/export of bibliographic data in standard exchange (CCF, MARC, etc.) formats. It makes available various catalogues/ index's online for instant references. On selection of cataloguing module, following two windows appear :

Window 1

a) Maintenance- to maintain the bibliographic database of different types of documents.

b) Online searches-various catalogues like title, author, classified, subject, place, publisher can be accessed online and searched using Boolean operators .

c) Current awareness- new additions can be generated classified by subject or alphabetically as desired.

d) Bibliographies- to develop bibliographies on specific subjects and then print them or maintain them. Updating can be done on any

title listed.

e) SDI- allows denning various interest strategies w.r.t members defining their respective interest profiles.

Window 2

a) 3x5 cards- including main entry, title card, subject card etc. can be printed using the develop file function or new additions and then can be removed once printed.

b) Print Catalogue- such as author, title, classified, subject can be printed.

c) Reports- various formats can be generated like book slip, keyword list, subject list etc.

d) Data Import/ Export- comprehensive import and export of bibliographic data in standard MARC or non-MARC formats.

e) System set up- enables selection classification scheme.

f) House keeping- for specific selection of functions.

The capabilities of LIBSYS cataloguing system are :

Maintaining In-process File - This lists titles entered through the Acquisition system but yet to be catalogued which gets updated automatically on cataloguing each title.

Catalogue Production and Maintenance - Bibliographic data may be imported or can be entered in different formats for various types of materials.

- Titles accessioned in Acquisition can be catalogued and Bibliographic data can be updated without having to re-enter data.
- Data may be entered directly for titles not coming through Acquisition.
- No limit on field size.
- Data import/export possible in both standard format (MARC) as well as non-standard format.
- Option for different MARC formats.
- Allows changes in bibliographic data including data removal facility. **Electronic Resources -** can handle digital contents along with various multimedia files that are integrated with its search engine.

Bar Code Printing - an in-built utility to facilitate printing of Bar code labels for identification of books and other materials.

Authority Files - are structured to be suitable for all fields. LIBSYS authority files include the following fields : By source, publisher, author, series, keywords to safeguard uniformity of data and finally subject. Its unique structure easy to use data entry enriches the process of cataloguing.

Holdings Updates - Provision to specify copies for reference or for circulation.

- Addition of new copies.

- Transferring from reference to circulation and vice-versa.
- Withdrawals of copies.

Catalogue Cards - Prints complete set of 3x5 cards as per AACR-2 standards.
Book Slips - Containing Class no. and Accession no. of books and other materials.
Current Awareness Services - List may either be in alphabetical order by author, title or classified under subject targeted to cater even to specialized interests of users

- List of recent arrivals.
- Special bibliographies.
- SDI facility.

1.3.1.2.3 Circulation :

As part of LIBSYS software, circulation allows full management over members database with regards to front desk operations such as issues, returns, renewals, reserves/ holds; membership records keeping; collection updates including monitoring of items on display and in bindery; overdue follow-up and recall facility; inter-library loans; stock verification; flexibility in operations including option for use of bar codes scanner for borrower and material identification; comprehensive statistics on circulation; reporting capabilities which includes list of highly reserved titles, statistics on number of issues by title/ borrower, list of delinquency cases, non-circulating material list, etc., and keeping log of all the circulation transactions providing suitable checks at every stage. It maintains up-to-date membership records and the latest status of the collection meant for circulation. This feature can also utilize the data to be analyzed statistically for reporting purposes. On selection of circulation module, following two windows appears:

Window 1

a) Member records- various functions like registration, renewal, cancellation, issuing duplicate membership card.
b) Collection updates- record of documents on display, in bindery, withdrawn or missing etc.
c) Check-out- adopting lending policies and entering manually or through bar codes member ID and Accession no.
d) Check-in- a document may be reported as damaged or lost and also compute fines.
e) Renewal- allows policies for renewal.
f) Reservations- not available on shelf can be put on reserve by more than one member
g) Recall/follow up-to generate recall notice.
h) Inter library Loan

Window 2

a) Inquiries- can be specific like on members, collection, various statistics, transaction log and serial circulation.

b) Reports- for members, specific notices like overdue reminder etc., checking-in and checking-out of documents.

c) System set-up - can set parameters related to members options, accession no options, SDI, etc.

d) House keeping- log files, fine file, cancelled records, reservations etc.

e) Serial circulation-user interface of circulation of accessioned volumes/ loose series.

f) Fine collection- is based on Member ID.

Various functions in circulation are:

Front Desk Operations - Include issues, renewals, returns, reserves.

- Operations handled efficiently with least possible data entry
- Suitable blocks both on member and item
- Use of bar code technology is allowed.
- Option to display photograph of the member (in-built image option)

Membership Records Keeping - Registration record and membership updates.

- Option to photograph from digital camera and generate an ID card of required size with photograph and bar code number.
- Lost or stolen cards can be invalidated immediately.
- Issuance of duplicate membership cards.
- Institutional borrower records for inter-library loans.

Collection Updates - While cataloguing collection records meant for circulation are created automatically.

- Monitoring of items on display and in bindery.
- Keeps track of lost, missing, damaged, written-off, withdrawn items. **Overdue Follow-up and Recalls -** Generates overdue reminders and makes possible recalling checked out material before the due date.
- Number of reminders and period between reminders based on membership category.
- Online printing of recall notice for a specific title.

Inter-library Loans - Keeps record of both inward and outward loans to other libraries and institutions.

Stock Verification - For the purpose of stock verification generates list of the collection in the library and items currently checked out. This list is verified with the material present on shelf, thus, getting the list of material not accounted for.

Management Reporting -

- List of highly reserved titles and comparison with present no. of copies in collection for planning future acquisition
- Title/Borrower-wise statistics in relation to the number of check-outs
- Non-circulating material list for weeding out the collection periodically
- Overall circulating statistics broken down further yearly/ monthly/hourly, by subjects and borrower category

Reports - The system provides for the following reports.

- Overdue, collect, and recall notices.
- List of 'no responses'.
- List of highly reserved titles.
- List of non-circulating material.
- Checkouts to a borrower.
- Stock verification list.
- Delinquency records.
- Statistics on no. of issues by specific title/borrower.
- Statistics by subject/borrower category.

Transactions Log - Maintains a record of all the circulation related transactions that may either be viewed on screen or printed.

1.3.1.2.4 Serials Control :

The serials module enables your library to track, ordered, and receipt journals under coded serial titles. It includes check in process that indicates the next issue expected and the total number of copies due for that particular issue. It is an independent subsystem providing for new subscription; subscription renewal; subscription extension; invoice processing; budget and expenditure analysis, recording of issues received (Kardex update); claims monitoring which include generating notices for 'not received' overdue and damaged/ soiled issues, missing issues, various indexes/lists, online queries on various aspects of serials control including serial holdings; and circulation of loose issues and bound volumes. It maintains the record of budget sanctioned for serials under different categories, thus providing complete budgetary control. This system also handles periodicals received on gratis or in exchange. Various reports generated by serial system include list of current serials, approval form, subscription order, bindery order, overdue notice, bill invoice register, etc. The records keeping functions include history status of serials, budget heads, vendor records, subscription modes, etc. Various functions related are

a) New subscription - New serials initiated, goes through the approval process and ordering.

- Duplication Check.
- Prints approval lists.
- Prints Purchase Orders for direct mailing.
- Provides for monitoring the status of each serial until the first issue is received.
- Accepts subscription details as and when they become available.

b) Subscription Renewal- Initiates approval process for subscription renewals, followed by ordering. The process of renewing subscription of current serials involves the following functions.

- General renewal request/ approval form printed either by Department/ Centre or Library, based on subscription expiry date.
- Enter approved serials.
- Ordering.
- Update subscription details.
- Status of renewed serials updated as 'Approved' or 'Rejected'.
- Receiving.

c) Invoice processing- Both for new subscription and subscription renewal.

- Allows more than one invoice for an order.
- Allows changes in subscription, period, and volumes, etc.
- Accepts supplementary invoices for any title.

d) Receiving issues (issue) - repetitive function performed in the simplest manner.

- Recording of issues by volume/issue number or date, whichever applicable for the serial.
- Facility to record receipt of regular issues, special issues and additional issues.
- Makes note of damaged and faulty issues for subsequent replacement.

e) Claims monitoring - timely follow-up of'not received', overdue and/or damaged journals numbers.

- Schedule updates
- Reminder notices printed automatically based on periodicity of each serial
- Received status inquires takes into account feedback received from vendor or publisher about delayed, out-of-print, and out-of-stock and already mailed issues. Irregular issues monitored by entering expected schedule of publication.
- Display reminders
- Online printing of reminder/follow-up notice for a specific issue/ number of any serial.

f) Bindery management - Alerts when a serial is to be sent for binding and

provides for its continued monitoring through the bindery and back.

- Generates volumes completion report to initiate binding process
- Flexibility in generating the bindery order
- Keeps track of volumes sent to bindery and their receipt on/when return

g) Circulation - User-defined routing of issues registered, along with circulation of bound volumes and loose issues.

- Borrowers records keeping
- Checking-out
- Checking-in
- Routing of an issue immediately on arrival may be defined, before it is displayed or circulated

h) Online Queries - Serials related queries are:

- By title - new serials, renewed serials, and subscribed serials, giving the current status of each title.
- By vendor - giving the current status of orders placed with the vendor and list of invoices received.
- By department budget heads - list of serials and expenditure analysis by department or section and budget details.
- Titles in bindery
- Recent arrivals

i) Reports - Reports generated by Serial System are:

- Approval request form
- Subscription order form
- Alphabetic list of serials
- List of current serials
- Serials by special issues
- List of missing/ overdue issues
- Subscription renewal order
- Notices for 'not received', 'overdue', 'damaged' issues
- List of duplicate issues
- List of completed volumes
- Bindery order
- Accession register (for bound volume collection)
- Current arrival
- Classified and specialised indexes and lists of serials, as required
- Budget & Expenditure analysis

1.3.1.2.5 Article Indexing and Abstracting :

Article Indexing system provide the facility to maintain a separate database containing the articles in journals received in the library. Articles Alert

facilitates the indexing and abstracting of articles from various journals which include entry of article data, update of Boolean searches; periodic documentation list, personalised SDI, and bibliographies on specific subjects. Various functions of article indexing module are:

Maintenance Functions - To build the articles database.

- Adding a new article.
- Modifying details of an article.
- Removing an article.
- Listing article details and option to print the same.

Database Searches - Article may be searched by browsing any of the following indexes: -

- Author
- Title
- Subject/Keyword
- Searching by Title keywords.
- Combination searches using Boolean Operators (like 'OR', 'AND' and 'NOT" based on words from any field).

Current Awareness Services - Generating lists of the latest additions.

- Options to generate CAS by Author/Title alphabetically or by classified subjects or by subject/keywords.

Bibliographies - A list of articles on a specific subject can be generated with the 'Bibliography' function. The selected entries are automatically stored in a user defined 'Biblio' file. Following functions facilitate generating bibliographies :

- Searching
- Update 'Biblio' file
- Print search lists
- 'Biblio' file maintenance

Selective Dissemination of Information (SDI) - To generate user specific list of articles based on subject profile. It matches subject interest profiles with either or full or part of the articles database.

1.3.1.2.6 OPAC: Online Public Access of Catalogue (OPAC) provides various catalogues/indexes such as author catalogue, title catalogue, subject catalogue, classified catalogue, Boolean searches using logical connectors 'OR', 'AND', and 'NOT; electronic mail facility for outline reserves, personalized SDI, notices and messages. It is the hub of all information resources that provides a single point of access to the world of information. To find a record via OPAC is an effortless experience, the Patrons in the library can search the bibliographic database and find specific information online, either by choosing out of the browse list or simply entering a term or phrase in search feature. The search facility also tells the user about the availability of each item for

circulation, including current status of individual copies of a title and reserve status. It also shows titles on order displaying current status in acquisition. Other services from OPAC Client - Updating subject interest profile for SDI by users themselves; request for acquisition of a document; while browsing / searching various catalogues, facility to develop request online for putting a specific title on reserve, etc. Various services are:

Online Catalogues - makes available following catalogues on-line:

- Title Catalogue
- Author Catalogue
- Subject Catalogue
- Classified Catalogue
- KWIC Index
- Publisher
- Conference Place

Searches - The use of the logical connectors 'OR', 'AND' and 'NOT' is allowed (using Boolean Search). There is option to conduct searches on specific bibliographic fields or on all the fields. It can be limited by specific publishing period or/and document type. The search results may either be viewed on screen or printed.

Recent Additions - Makes available new additions to the library.

Current Serials - To provide online information on holdings of current journals including recent issues received.

Images / Full text Retrievals - Full text images or images from a specific portion of a document can be browsed in multi-windows interface.

1.3.1.2.7 Web OPAC :

The search results are displayed in a list of titles with author, title, year of publication and call number. For a selected title, complete details along with the number and status of copies are given. There are following facilities available:

- Simple Search
- Advance Search
- Additional Search
- Browse
- Journals
- New Arrivals
- Patrons

Simple search - Enter word(s) from any of the searchable fields such as author, title, subject, etc. The search could be restricted to a specific field with option to form a phrase or use 'OR' and 'AND' operators between words.

Advance search - This interface allows for development of complex search strategies using Boolean operators 'OR', 'AND' and 'NOT' between keywords in

various fields.

Additional search - Another interface to develop search strategies using word(s) from various searchable fields with an implied 'AND' operator.

Browse - Alphabetic lists of author, title, subject, publisher and conference place may be browsed. By entering the initial characters of the required word, the list or catalogue scrolls till it positions the string at the beginning of the display screen.

Journals - The serials list may be browsed, and on selecting a journal, holdings in both bound volumes and loose issues are displayed.

New Arrivals - A list of recent additions to the library collection, both books and journals, may be seen.

Patrons - Patrons are provided facilities to list the items they have checked out, the titles they have reserved, request for acquisition of new titles and change their password.

1.3.2 SOUL (Software for University Libraries)

1.3.2.1 Introduction

The SOUL is Windows based, state-of-the-art library automation software designed and developed by the INFLIBNET Centre, an IUC of university grants commission Ahmedabad. It is user-friendly software i.e. it is easy to work with and works under client-server environment. It is flexible software used for automating typical functions of all types for academic libraries for library management and complete automation of the library. It has been designed taking into account the international standard, bibliographic formats, networking protocols, and typical functions of all types and sizes of libraries, particularly practiced in the university libraries. The in-built network features of the software will allow multiple libraries of the universities of function together and access to distributed databases installed at various university libraries and union catalogue mounted at INFLIBNET using VSAT network. SOUL-Library Automation Software is a very powerful tool that is suitable for any library including university and college libraries and can also be used in Special or Public libraries.

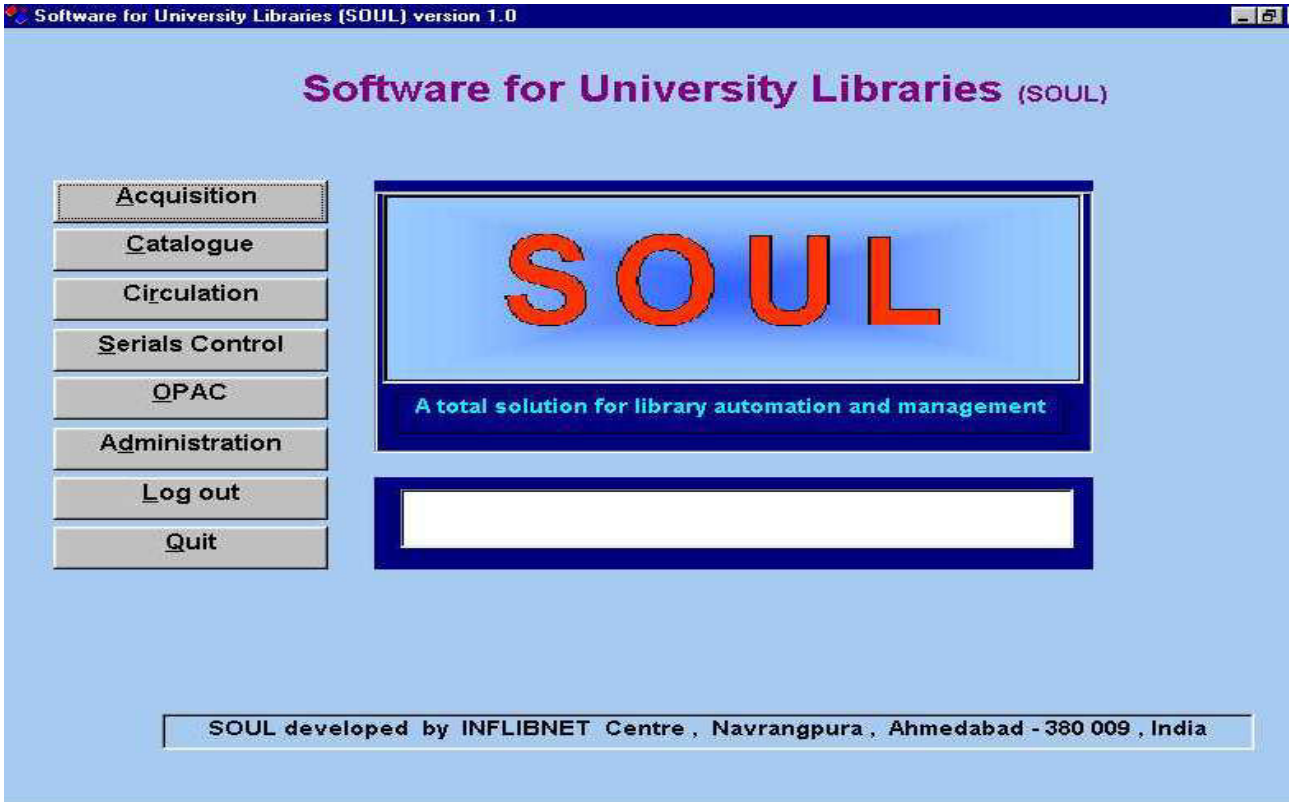
1.3.2.2 Hardware And Software Required:

The minimum hardware and software configuration required to use the SOUL is given below.

Server :	Client :
Pentium @233 MHz with 64 MB RAM	Pentium @233 MHz with 32 MB RAM
1.2 GB HDD,32 x CDROM Drive	1.2GB HDD with 10MB Free space
1.44" Floppy Drive	1.44" Floppy Drive
Colour Monitor (SVGA)	Colour Monitor (SVGA)
Ethernet card 10/100 Mbps	Ethernet card 10/100 Mbps
Windows-NT Operating System	Windows-95 Operating System
MS-SQL Server 7.0	

1.3.2.3 Modules of SOUL

- Acquisition
- Catalogue
- Circulation



1.3.2.3.1 Acquisition

The Acquisition module provides facilities to enable library staff to procure books from different publishers. It handles the following major functions related to acquisition of library material starting from suggestion/ recommendation by faculty till accessioning, invoice processing.

These functions are :

a) Suggestions management

This sub-module enables creation/updating of databases of new items suggested by a faculty member along with bibliographical details. Books received through placement of purchase orders as well as those received as gratis are handled from this module.

The steps involved are :

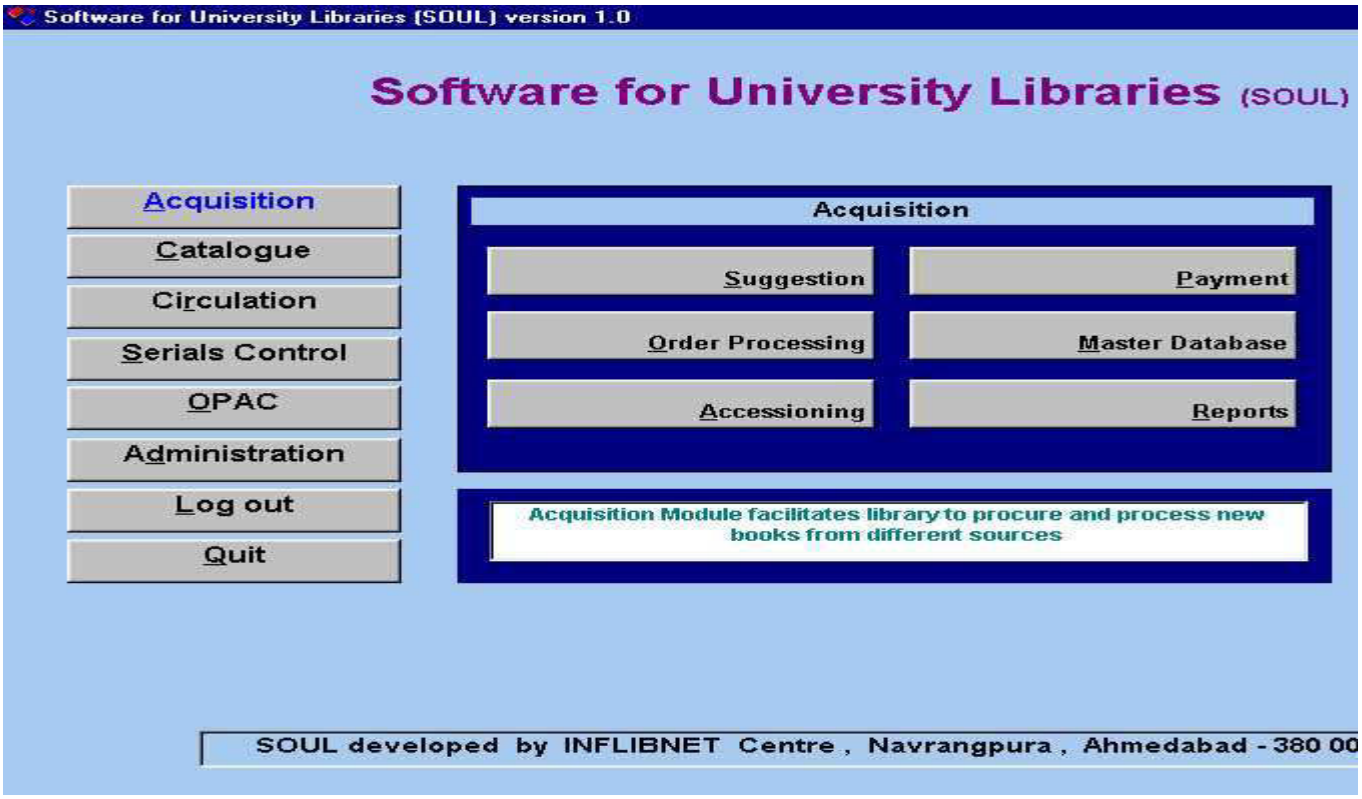
Update Request

New Request

Data import from other sources

Request for item from vendor/Publisher:

Select for approval.



b) Order Processing

The various titles approved can be ordered to different publishers by assigning order and reference number, setting deadlines for supply and other details can be done under this sub-module. The various processes that can be carried out here are to update order, file printing of order, cancelling the order, reordering, checking order status, and to send reminders.

c) Accessioning and Receive Management

This feature allows the library staff to receive the books from the publishers against various orders. The books can be received by selecting the particular order number and then an accession number has to be given to books. This function supports cross checking with order, receiving partial / full supply of items listed in order, duplicate checking with an existing title by matching the record with same bibliographic information.

d) Payment Management

When the books have been received and accessioned the invoice details are matched with the ordered details. After the details match invoice can be

processed for payment and sent to accounts section for release of payment. This feature also allows modifying the price of books if the price of the books changes when invoice has been generated including conversion rates, handling charges discounts etc. Searching the status of payment and generation of reports are other strong features added in this sub-module.

e) Master Database

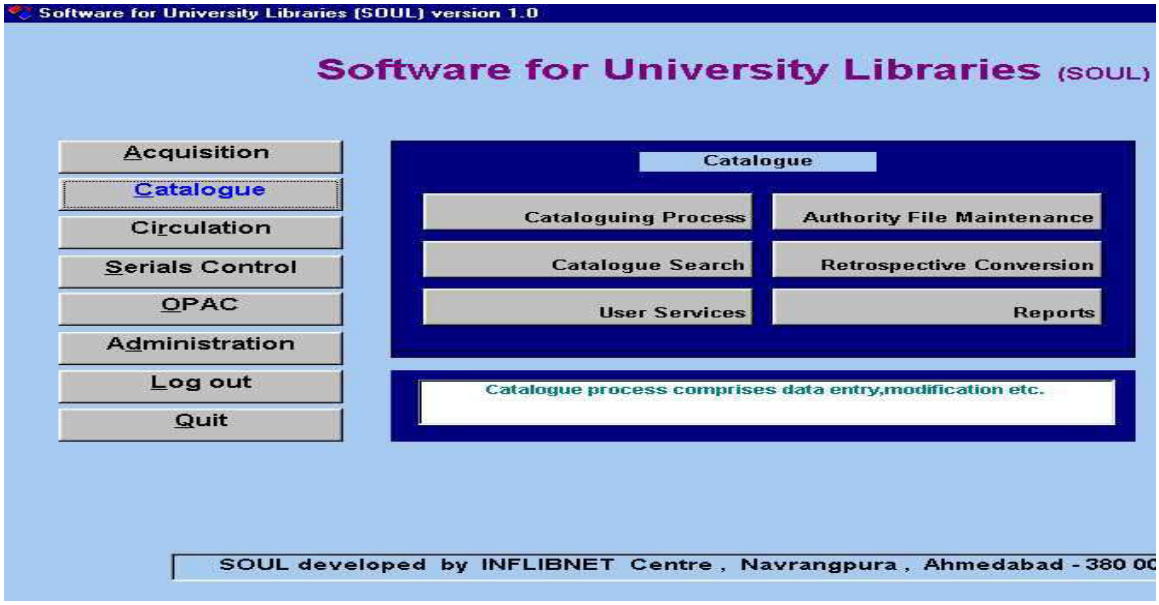
This sub module helps to maintain different databases like: Publisher/ vendor, Currency, Budget codes (both source wise and department wise), etc.Updation and deletion of all this is possible from here.

f) Reports : All types of reports can be prepared by this software regarding the set of items requested by various departments for order processing. There are 13 major reports relating to acquisition that can be created with number of parameters like List of suppliers, items received, invoice register etc. These reports assist in reviewing information about acquisition process.

Through the acquisition module library staff can search the entire database of library holdings for handling almost every function that is being carried out in acquisition division of university libraries.

1.3.2.3.2 Catalogue

Catalogue module is used for retrospective conversion of books, technical processing of books, printing a range of records for verification, searching by title and accession numbers, authority files for publishers etc. that have already been accessioned in the previous module. A comprehensive database covering almost every field facilitates data entry of all types of books, conference proceedings, thesis etc. in the different regional languages, using respective scripts is also provided. This module allows the library staff to conduct comprehensive searches for existing items before cataloguing new items and has provision of import and export of records and retrospective conversion. This module includes following functions :



a) Catalogue Process function picks up the accessioned item for cataloguing purpose. Remaining information as per specified standards, such as additional bibliographical information, subject headings, classification number etc can be added. To maintain consistency editing of existing records can also be done.

b) Catalogue Search allows searching the existing items, its status, identifying duplication etc. for day-to-day cataloguing purpose.

c) User Services sub module has three major functions viz., generating current awareness list (by date, subject etc), compiling of bibliographies with various combinations and alert services to individual users.

d) Authority File Maintenance serves the function of creation, updating and use of major authority files for names such as publisher, languages, corporate, meetings, authors, physical media, and types of material and also for subject descriptors. This is an important feature added to this software taking into account the consistency that each library needs to maintain while creating records.

e) Retrospective Conversion includes two major functions i.e. data entry of old collection with minimum information without going to first sub-module and import and export of data from and to external sources. This function allows the libraries to download the matched records from INFLIBNET union catalogue or other sources and export the records for contributing to union catalogue etc. A versatile IS02709 interface developed at INFLIBNET, which is built-in to this module, enables to carry out the job.

f) Reports module includes generation of catalogue cards as per AACR-II, generation of recent editions reports subject and class number wise and other related reports. The catalogue module basically supports all major functions relating to technical processing and has been designed as per the international standards.

1.3.2.3.3 Circulation

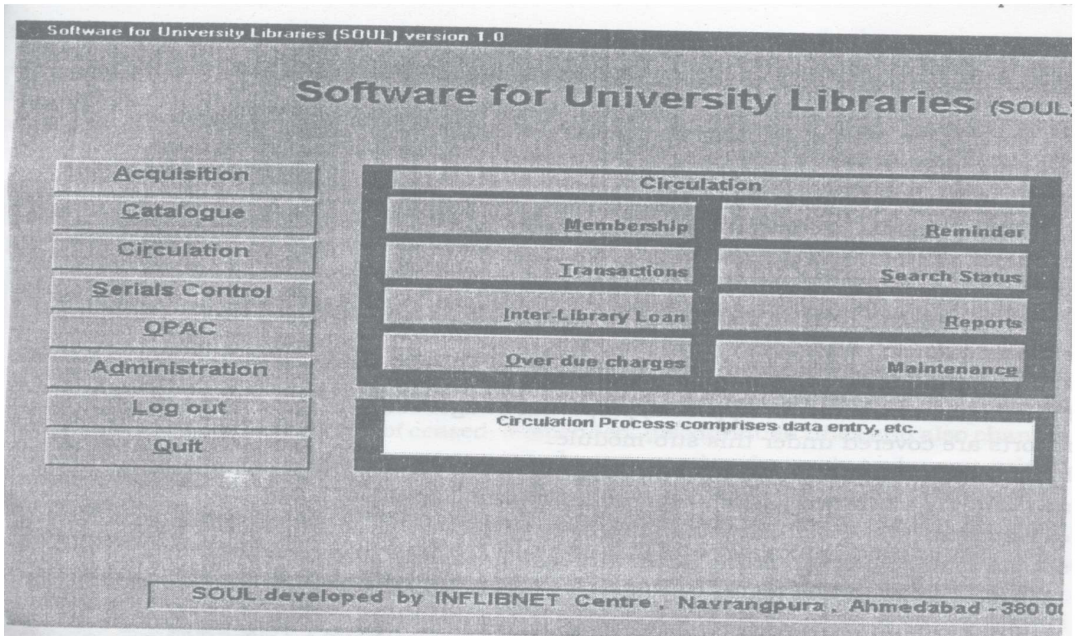
This module is the heart of Library as it deals with all the transactions between member and library holdings. The circulation transactions viz. issue, return, renewal, reserve, recall, hold can be successfully done. Some complex functions like fine management for each category of user and material wise category can also be effectively managed. Important functions like Inter library loan, searching the status of every member or library item are possible. Reminders for overdue material, generation of various reports have also been covered.

Circulation module can be broadly categorized into the following Sub-Modules :

a) Membership sub-module allows the entry of a new member. The facility to create all types of member records, assigning membership codes, borrowing

privileges, renewal, issue of no-due certificates, master databases for codes etc, searching the status of membership or an item, terminating the membership and generating related reports are provided.

b) Transactions provides all major functions such as issue, return, renewal, reservation, recall or reminder of an item, reserve cancellation, recall/ reminder to borrowed items,



lost and missing documents, member detail status, etc. This sub module also includes the Book Search feature. Transaction sub module is based on Accession number and Member code. It also supports generating and reading of barcode labels. A unique facility in this module allows one to see simultaneously the details of members, items borrowed, dues etc. while the transaction process is on. The counter staff as well end-user is able to know the exact status of the members borrowing.

c) Inter Library Loan deals with lending of items to specified member library and also borrowing items from other libraries. It takes care of all the details of user libraries, individuals and items loaned.

d) Fine management facilitates collection of overdue charges from the members, providing receipts, keeping up-to-date accounting. Generation of daily, weekly, monthly reports to find out as to how much overdue charges have been collected is possible.

e) Reminder module allows generation of reminders for all overdue materials. Comprehensive listing of materials that are overdue can also be generated within a specific period giving from and to dates.

f) Search status provides information of items which are either issued to member or issued on ILL or has been withdrawn from collection. It also shows the status of overdue items.

g) Maintenance Management covers binding, lost and cost recovery of books, damaged books, withdrawn books etc.

h) Reports sub-module allows the generation of as many as 16 major reports and with many combinations. All possible reports that a large library expects are provided for. This module is capable of handling large transactions. If various functions built in this module are effectively used, the library staff will save lot of time and will help to avoid repetitive jobs.

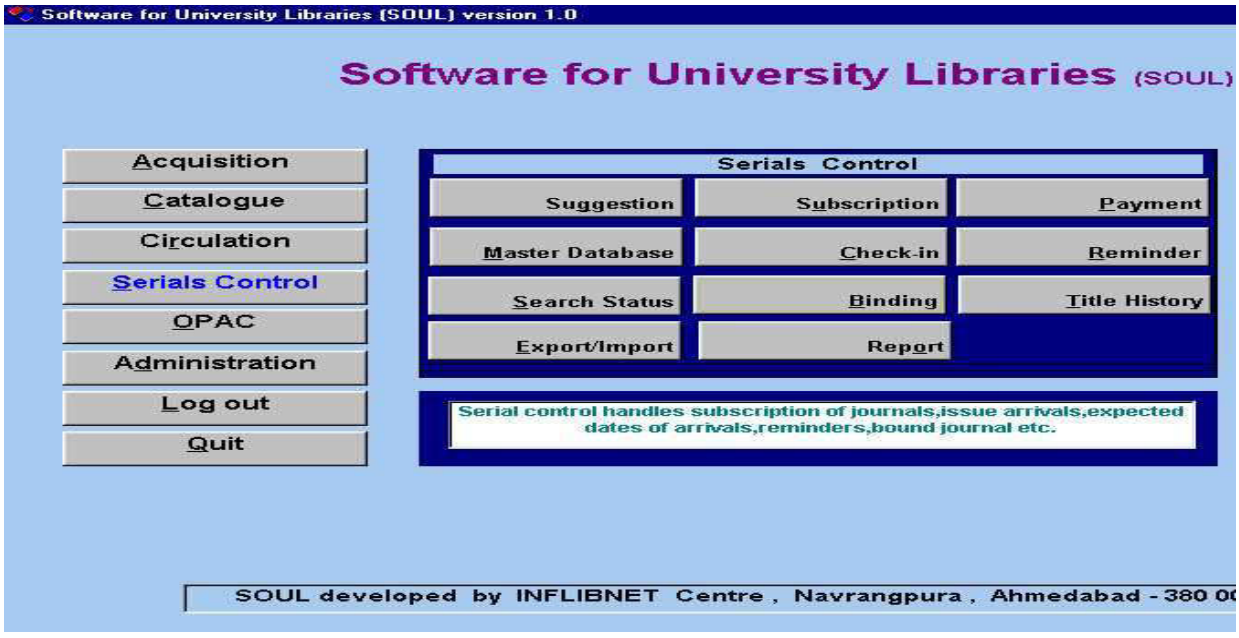
1.3.2.3.4 Serials Control

This module keeps track of serials easily and effectively. It maintains data about journals, annual reports, newsletters, etc which the library receives periodically. SOUL minimizes data entry required for serial controls. Once a bibliographic detail is entered in the system, all further processing is updated from time to time. This module broadly handles following functions:

a) Suggestion Sub-module keeps track of the suggestions received for subscribing serials. Selection of these titles for approval, preparing budget estimates and generation of related reports are covered under this sub-module.

b) Subscriptions module allows ordering/renewal of serials, follow-up relating to the same and sending reminders, generating orders by supplier or publisher.

c) Payment function processes and records all details relating to each invoice, including supplementary invoice, credit notes processing, reports generation etc.



d) Master Database allows to create a large number of frequently used master databases viz. title entry, language, class number, publisher, binder, country, department, currency, frequency, budget heads, binding type, delivery modes, reports etc. Of these, title entry is main in which the creation of database for each title with bibliographic information begins in the serial module.

e) Check-in module records the receipt of each issue of serial and its accompanying material. To record the issues, there is a facility to generate schedule in advance for each title by providing necessary inputs like volume no., frequency, date of publication of first issue, mode of delivery, total number of issues etc.

f) Sending reminders module allows to send reminders on not receiving of issues or issues that are overdue etc for single or all titles by supplier, publisher etc.

g) Binding sub module supports making sets, generating order, payments, accessioning bound volumes etc.

h) Status search option facilitates one to find the status of every thing starting from subscription to check-in of issues.

i) Title history keeps the record of ceased, suspended, discontinued titles and also changes in title, splits, and mergers along with holdings information for each and every title in the database.

j) Export/Import of data in IS02709 format is also provided which allows the library to transfer the existing records in to SOUL and also contribute data to INFLIBNET union database.

k) Reports sub module has more than 15 built-in reports of all types with different combinations. This adds to the strength of serial module.

Serial module is designed to handle large number of titles, with many options giving maximum flexibility to user libraries.

1.3.2.3.5 OPAC

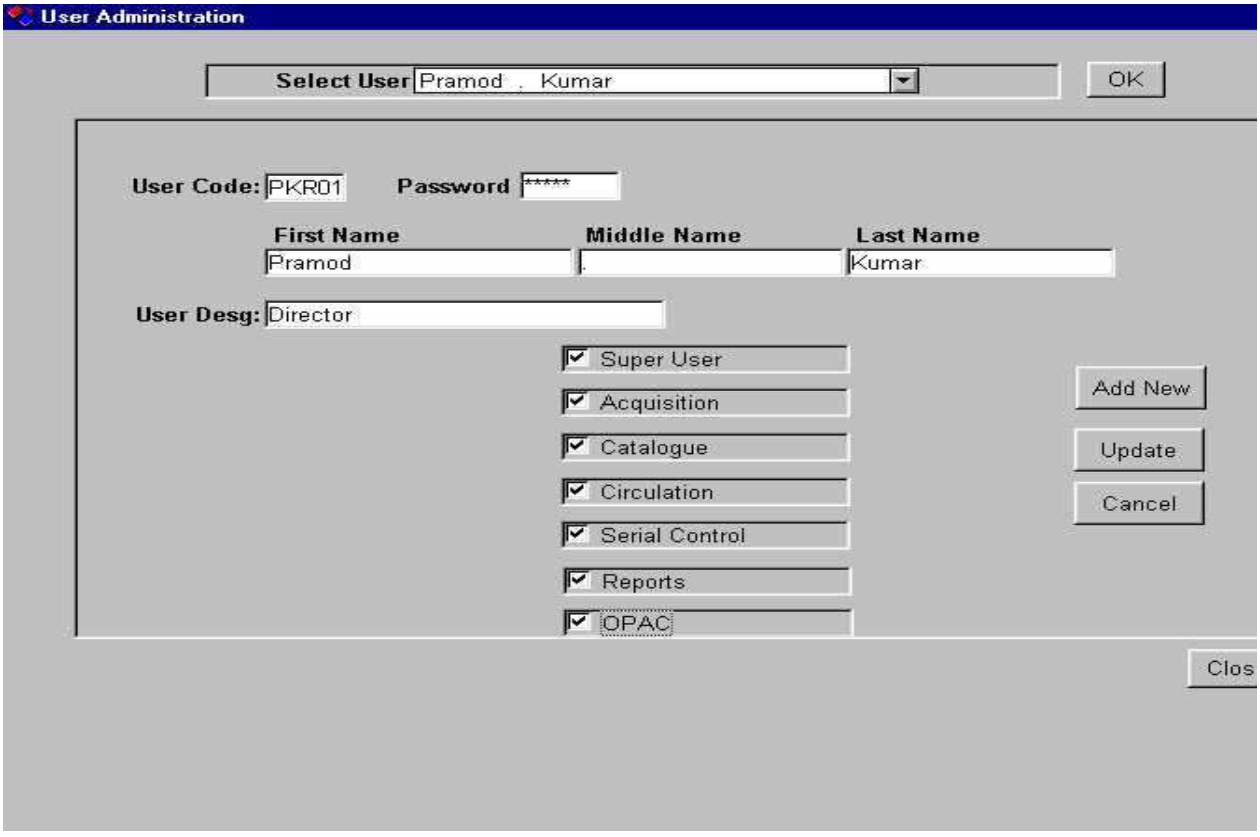
SOUL has a major attraction of having a fully functioned OPAC (Online Public Access Catalogue) that is a window to the library collection. It has user friendly menus through which a user can search for an item available in the library by author, title, corporate author, conference name, subject descriptors, class number etc. OPAC is a dynamic information desk that allows library staff to post library calendar, library rules and regulations, announcements, or any other information of user interest. SOUL allows the users to access the internal as well as external resources of the library. Library can keep entire collection available at users' fingertips. This powerful, yet easy-to-use and user friendly searching tool allows user to quickly find the materials in the library. Some of the major features of OPAC are :

- Use of Boolean operation when more than one search option is to be used.

- Search results can be sorted according to the preference of search item.
- User has option to select variety of display formats.
- Display of records according to AACR-II format.
- Easy and quick searches with options.
- Status of each book starting from acquisition module is reflected.
- Search key fields, such as, author, title, keywords, class number, accession number, etc.
- Accessible through the GUI based web browsers like Netscape Communicator, Internet Explorer etc.,
- User can see the status of currently borrowed items by entering his/her borrower number.
- Search results can be saved and printed.
- Selection of databases can be made according to the choice of users.

1.3.2.3.6 Administration

Administration module is used for creating new users and to give them right for accessioning different modules. The system administrator assigns login and password to use each module of the system. The security function, backups, recovery of data and other utility functions are some of the features added



1.3.2.4 STRONG FEATURES OF SOUL

Following are few of the strong features of SOUL:

1. It is a Windows based user-friendly software with well-designed screens.
2. It is based on client server architecture allowing scalability to the users.
3. It uses RDBMS concepts to organize and query the data.
4. One can begin using it easily without an extensive training.
5. It is specially designed to work in the large academic libraries i.e. it is capable of handling large number of records.
6. It is multi-user software and there is no limit on simultaneous accesses.
7. Supports internationally known standards such as CCF and AACR II etc.
8. It allows export and import facility of data and adheres to ISO 2709 format.
9. It includes all required features to work in a networked environment i.e. LAN and WAN.
10. SOUL has been fully tested at a number of university libraries and critically evaluated by team of experts and practicing librarians.
11. It provides comprehensive list of reports, master databases and authority files.
12. It provides facility to create, view and print records in regional languages.
13. Available at affordable cost.
14. OPAC is versatile, accessible over the web using any GUI based browsers.

1.3.2.5 Benefits of SOUL

- Available at nominal cost to university libraries.
- Software designed and developed exclusively to work under university environment.
- Network feature of the software will allow multiple libraries of university to function together using this software.
- Exhaustive training at INFLIBNET supported by comprehensive manual.
- Also facility of On-site training.
- Free updation /modification and free technical assistance.

1.3.3 WINISIS

1.3.3.1 Introduction

WinISIS is a Windows version of the CDS/ISIS system (Computerized Information Service / Integrated Scientific Information System) which was originated in the early 60's and since 70's is maintained and developed by UNESCO(the United Nations Educational, Scientific and Cultural Organization). Since 1989, when most new microcomputers were supplied with

a new operating system called Microsoft Windows, it was inevitable that the users of CDS/ISIS would call for a Windows version, and UNESCO began to develop one in 1995. The first Windows version was distributed for testing in May 1995 and the first WinISIS version 1.31 was launched in November 1998. Unlike the DOS version, ISIS for Windows is not written in Pascal but in a combination of languages, primarily C and C++. CDS/ISIS for windows is a menu-driven generalised Information Storage and Retrieval system designed specifically for the computerised management of structured non-numerical databases containing mainly texts. From the outset, it was created as multi-lingual software, providing integrated facilities for the development of local linguistic versions. Thus, although UNESCO distributes only the English, French and Spanish versions of the package, user-developed versions exist in virtually all languages, including special versions which UNESCO helped in developing, for Arabic, Chinese and Korean.

CDS/ISIS for Windows is, as its name implies, a Windows-based system. Windows programs have many distinctive features as a result of the Windows operating system. Microsoft Windows is described as a graphical user environment which gives more control over the way you work as well as enabling you to use more of the power of the computer. It allows you, for example, to run more than one program at the same time. Thus it allows you to have more than one database open. One of the major advantages offered by the generalised design of the system is to manipulate an unlimited number of databases, each of which may consist of completely different data elements. Although some features require some knowledge of and experience with computerised information systems, once an application has been designed persons having little or no prior computer experience may use the system. It is not a relational database system, although it does provide some relational facilities.

1.3.3.2 System functions

- Define databases containing the required data elements, the handling of variable length records, fields and sub fields, thus saving disk space and making it possible to store greater amounts of information.
- Enter new records into a given database
- Modify or delete existing records, a data entry component for modifying data through user-created data base specific worksheets
- Display the records according to requirements
- Sort the records in any sequence desired allowing the user to easily create any desired printed products, such as catalogues,

indexes, directories, etc.

- Retrieve records by their contents, through a sophisticated search language providing for field-level and proximity search operators, in addition to the traditional and/or/not operators, as well as free-text searching
- Automatically build and maintain fast access files for each database in order to maximise retrieval speed
- Print partial or full catalogues and/or indexes
- Develop specialised applications using the integrated programming facility. To build relational data bases, though it is not based over a relational model.

1.3.3.3 Hardware Requirements

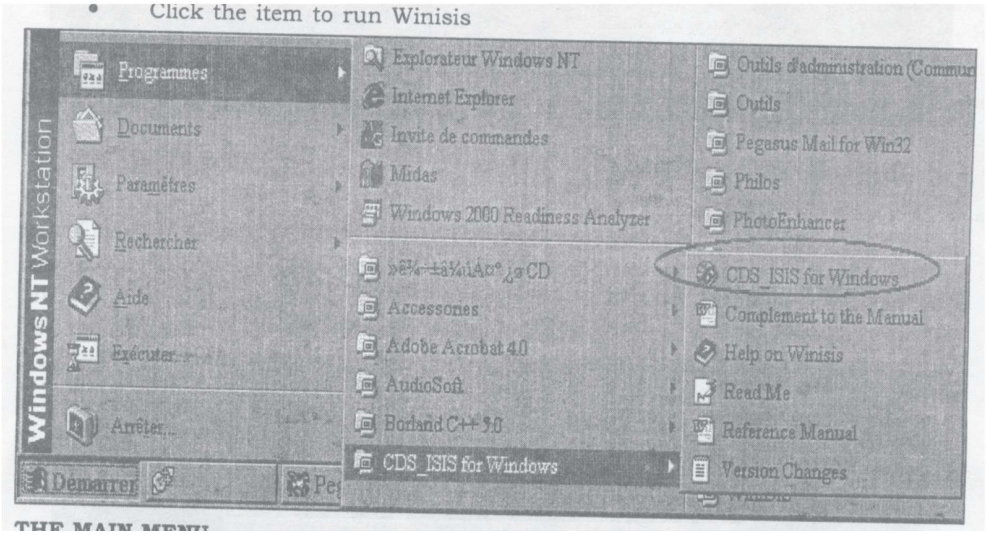
The minimum and recommended hardware requirements for running are the following:

CPU : 486 processor at 40Mhz (Pentium at lOOMhz or higher recommended)
RAM : 8Mb (16Mb or more recommended)
1 floppy disk unit
1 hard disk (with at least 4Mb free)
1 VGA 640x480 colour screen (super VGA 800x600 or higher recommended)
1 printer (optional)
Windows 95 and Windows NT

1.3.3.4 Running WINISIS

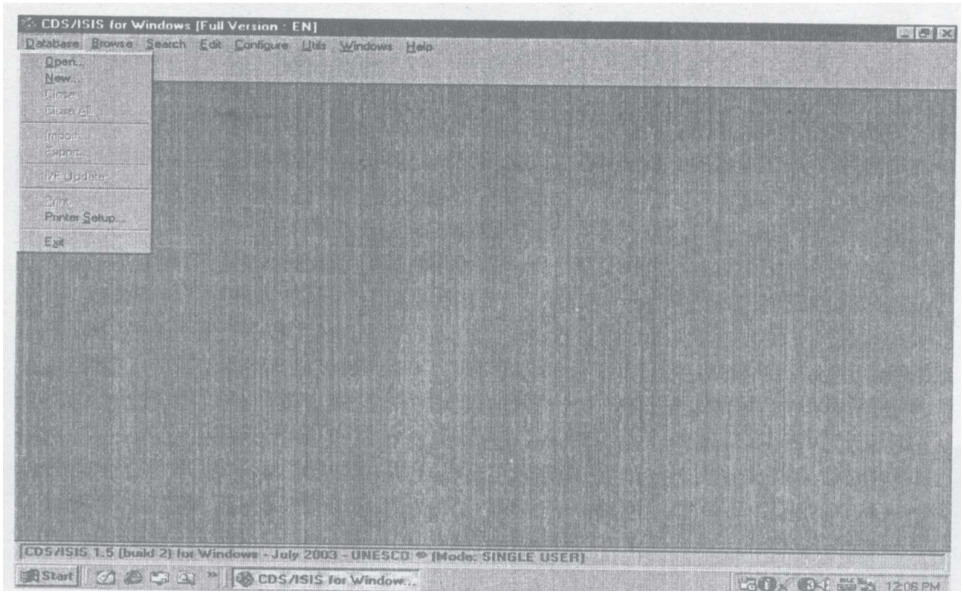
To launch the CDS/ISIS for Windows (Winisis):

- Locate the program shortcut. In Windows it is in the Start menu, folder Programs...
- Click the item to run Winisis



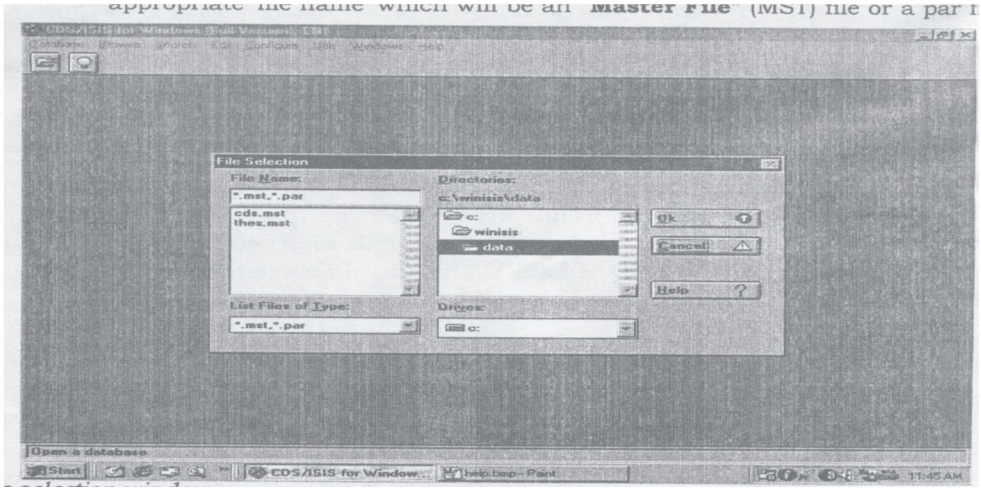
THE MAIN MENU

Let us look at the drop-down menus from left to right. Database leads to the functions associated with a database. If you have just opened the program by clicking on the WINISIS icon, you will have only four options, Open, New, Printer Setup and Exit. Other options are *greyed out*



Opening Screen with database drop-down menu

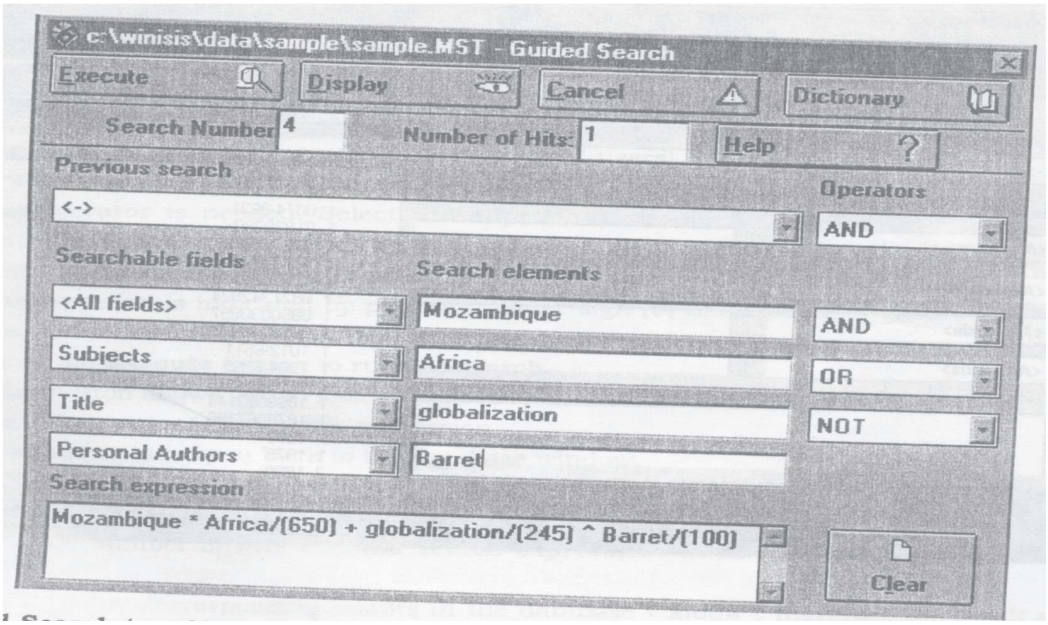
* To open a database, choose Open or the icon on the very left of the tool bar, a picture of an open card file. This brings up a Window entitled File Selection. This gives the possibility of browsing through drives and folders to find the appropriate 'file name' which will be an **"Master File"** (MST) file or a par file.



File selection window

Close and Close All are self explanatory and result in the closing of one or all databases. The other functions which become available are Import, Export, I/F Update (i.e. Inverted File Update) and Print. Print is conventionally found on the left hand drop down menu in Windows applications and the other options here are for file maintenance, adding to a file, extracting a file and indexing the database. Exit will close the CDS/ISIS for Windows program and take you back to the Windows desktop.

Browse ({Alt b} from the menu bar) has nine functions which cannot be operated unless a database has been opened. Click on Database to view the records in a database in database order. Click on Search results... to go to a list of previous searches Choose Search {Alt s} and you will have access to two kinds of search, Expert Search or Guided Search. It also allows you to go back to a previously saved search (the search may have been saved at any previous occasion) Recall saved search or to save the results of the present search for future use: Save search. Close Search Window is no mystery: it allows you to close the expert or guided search window when you wish to look through the records you have retrieved.



Guided Search (provides a simplified search interface)

Searchable fields boxes: select the appropriate field(s) for each keyword you wish to search, or leave the default value <A11 fields>.

Search elements boxes : type in the desired keyword **(s).** Select the appropriate Boolean operator(s). The default value is <AND>.

Search expression box shows the expression you formulated.

Right-truncation is indicated by placing a dollar sign ($) immediately after the last root character.

Click on **Execute** to run the search.

Display button allows you to look at the retrieved records.

Cancel button takes you back to the database window.

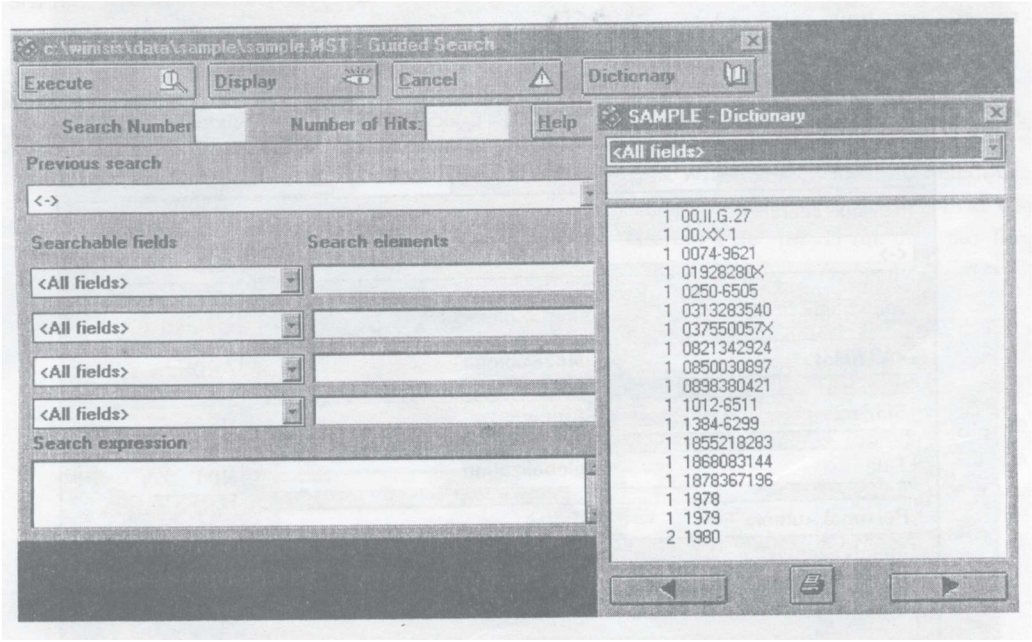
Number of hits box shows the result of your search.

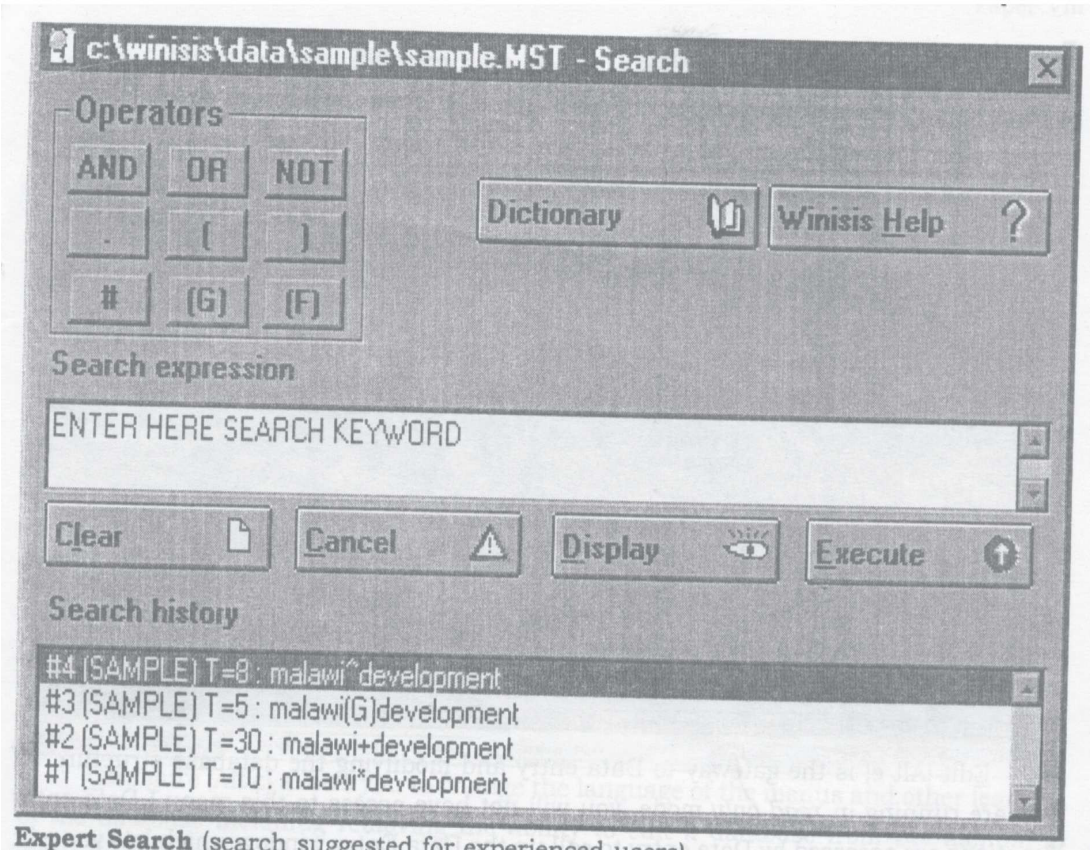
Clear button erases the search expression.

Guided search (with Dictionary display)

Dictionary button displays the alphabetical indexes from which you may select search terms to drag and drop into the Search elements boxes. The Dictionary contains terms from all indexed fields.

To select the field click on the pull down menu under <A11 fields>.





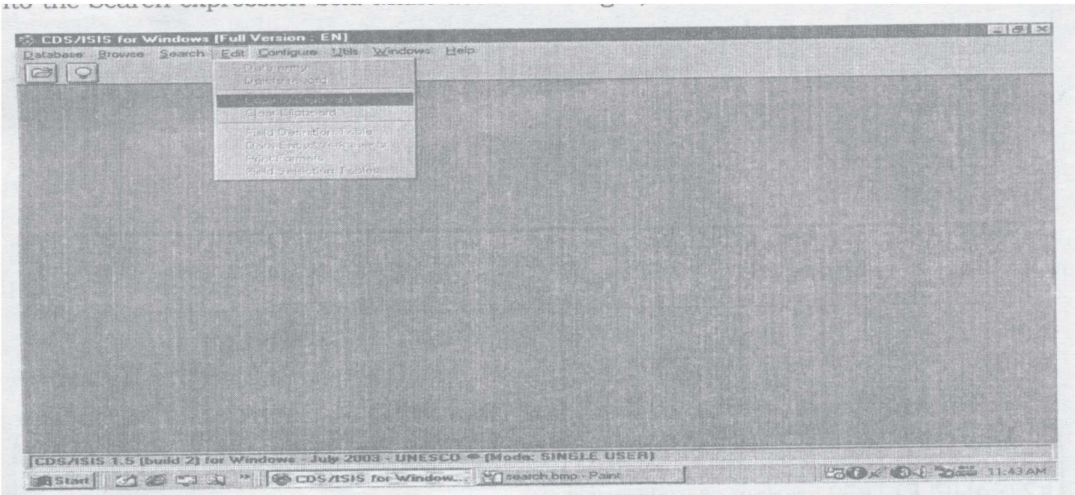
Expert Search (search suggested for experienced users)
Type your search in the **Search expression** box. When more than one term is used, a logical operator is needed. Select the appropriate Boolean operator(s) or proximity operator(s). Proximity operator(s) restrict the search to a field **or** to a limited number of words and can be used alone or in conjunction with the Boolean operator(s).
Right-truncation is indicated by placing a dollar sign **($)** immediately after the last root character.
Click on the **Execute** button to run the search.
Display button allows you to look at the retrieved records
Clear button erases the search expression.
Cancel button takes you back to the database window.
The **Search history** window lists the search expressions executed in the current session. For each expression it displays the set number, in parenthesis the database name, the number of hits and the search expression. Each new search is added to this list.

To display the corresponding results in the database window : highlight the result set and click on the Display button; or double click on an element of this list.

To rerun a search, click on it and the set number will reappear in the search expression box;

Execute

To refine a search, drag the whole search expression from the Search history list and drop it into the Search expression box. Make desired changes, remove set number and re-execute.

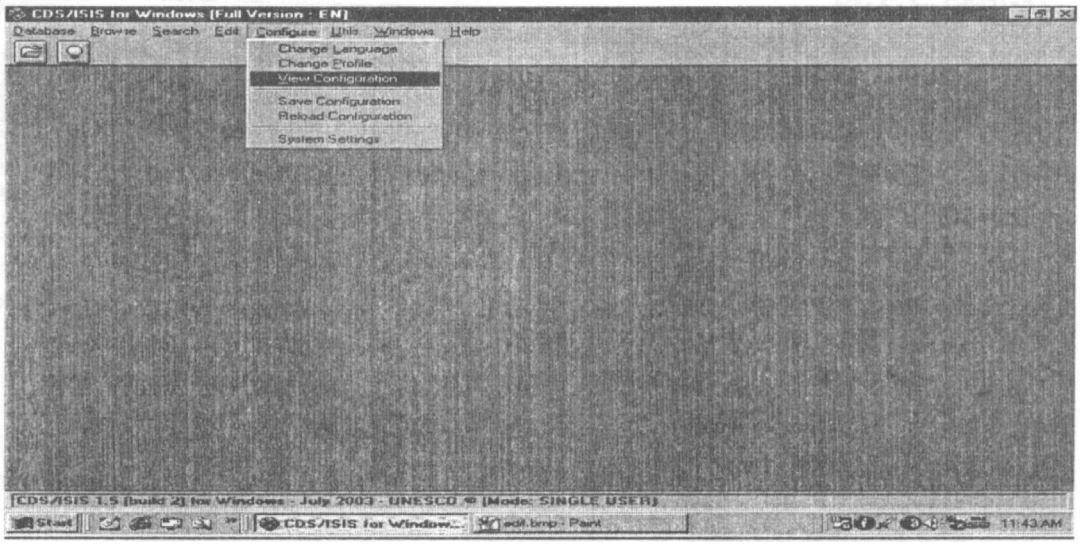


Edit {Alt e} is the gateway to Data entry and modifying the database structure. (If you are running in *read only* mode, you will not have access to this menu.) Data entry functions are accessed by Data entry to call up the Data Entry window which lets you edit the record you were looking at in the browse or search window or lets you create a new record. Delete will delete the record you are looking at in the data entry window. You can also copy the record you have on screen into the Windows clipboard with Copy to clipboard or clear the clipboard by choosing Clear clipboard.

- This window also enables access to further options:
- Creation of new records
- Deletion of existing records
- Add./Deletion of fields, new repetitions, etc...
- When editing a record, the system will **automatically** check for some kind of errors, for example:
- Attempt to insert invalid subfield elements

- Attempt to repeat non-repeatable fields
  Other validation restrictions foreseen by the database manager
- Each time the record is **stored** (saved) to the disk, the new content becomes available for browsing
- You must ensure that the **Inverted File** has been updated in order to be able to search for terms in the new record
- Several **Data Entry worksheets** may be available for a given database, in order to insert different data elements.

From this drop down menu, you can modify the database you are in via the Field Definition Table or Field Selection Tables. You can also edit or add new Print Formats.



Configure {Alt c} allows you to change the language of the menus and other features of the database including removing the ability to edit a database from the menus, to make the database read-only for that user. (The ability to read and write to the database will return next time the software is run.) You can also change many other system settings.

Utilities {Alt u} includes global additions and deletions based on record number or a previous search. Also included is the facility to compile ISIS/Pascal programs (in CDS/ ISIS for Windows these are all print format programs). You can also export records to an XML file and unlock databases or records. These unlocking functions will be greyed out and inaccessible if Data entry is open.

Windows {Alt w} allows the windows open to be arranged on the screen. This is the usual Windows program facility. The windows on the screen may be arranged from left to right (horizontally) one above the other (vertically) or

cascaded (one above the other but diagonally offset so that all may be seen in part and the top one in full).

Finally there is a Help drop down menu in the usual Windows style with a contents list and a keyword search. At the time of writing, the Help text is considerably lagging behind the current version.

1.3.4 Self-Check Exercise

1. Discuss salient features of WINISIS, LIBSYS and SOUL.
2. Discuss the similarities and dissimilarties between WINISIS, LIBSYS and SOUL Library Software.

LESSON NO. 1.4 **AUTHOR : DR. AMAR NATH**

DATABASES : TYPES AND GENERATIONS, SALIENT FEATURES OF SELECT BIBLIOGRAPHIC DATABASES

1.4.1 Introduction
1.4.2 Database
1.4.3 Types of Databases
1.4.4 Generations of Databases
1.4.5 Salient Features of Select Bibliographic Databases
1.4.6 References and Further Readings
1.4.7 Self check exercise

1.4.1 Introduction

Information sources can be categorized in a number of ways. We can categorize them as natural sources and man or machine made resources. Natural resources are any kind of information generated by nature, such as the solar system, the oceans, mountains and forests that is captured and recorded by human beings. Human beings and machines have also generated a lot of information that can also been recorded. Before the invention of printing we had recorded information sources like drawing, painting, carving, writing on clay tables parchment, cloths, leaves etc. and after invention of printing books, monographs, theses, reports, articles etc. are the main sources of recorded information. Nowadays we have information sources recorded on electronic media ranging from local or home-grown databases to online databases, CD-ROM databases and so on.

Printed information sources have been the major type of information sources for centuries and digital information sources are growing at a very rapid rate and many reference sources are now available in electronic format. The first of the e-information sources to appear was the online database. Online search services appeared in the late sixties and early seventies.

Online databases are accessible, from remote locations and are usually available through commercial search-service providers and search services brought about significant improvements in searching because they allowed users from all over the information world to access remote databases, no matter where they are located, through computer and communication facilities. Another major change in electronic information sources took place in the mid-1980s with the appearance of CD-ROM technology. Since then CD-ROM databases containing various types of information

in bibliographic and full text databases, numeric databases and of late multimedia databases.

1.4.2 Database

The term database broadly denotes an integrated accumulation of computer processible data organized in a manner suited to a wide range of applications. The data are stored so that they are independent of programmes, which use the data, a common and controlled approach is used in adding new data and modifying and retrieving existing data with in the database. The intention of database is to allow the same collection of data to serve as many applications as useful.

The word 'database' is normally used to refer to a collection of records stored on a computer. A database may describe bibliographic documents of one sort or another; factual data such as company reports, newspaper articles or legislation, known as full-text databases; or statistical information, for which the term databank is also used.

Generally speaking Databases is an organized set of records on a subject in whatever form, updated on a continual basis and available for international/national regional consumption'. The basic unit of the database is the individual record, which contains the information describing one object. The facts about this object are stored in field, so for example, a bibliographic database containing records of journal articles may well have fields including journal title, article title, volume and issue numbers, page numbers, another (S) etc.

In the literature term 'database' has been used in two different implications. In library and Information Science, there are referred to as bibliographic or inventory in nature and comprise a collection of related logical records. In computer Science this is referred to in a different sense as a database management system. In this sense a database has a logically consistence structure in which records are actually linked. Databases may be defined as a collection of works, data or material arranged in a systematic and methodological way and capable of being accesses by electronic or other means, which includes bibliographic databases and full text databases. Databases provide a very powerful way of storing and relieving information. However, as each database is likely to have a slightly different field structure, it has traditionally been difficult to search across more than one database. The Internet has added an extra and new dimension to this definition, in that it is possible to search across material available on many different sites. However, much of the most useful materials on the Internet is protected by passwords and can only be searched at the site at which it is kept.

1.4.3 Types of Databases

Database may be stored as magnetic or optical media such as disks and accessed either locally or remotely. This may includes access to an organization database

covering transaction and financial records or other databases that might be accessed remotely. Some of these databases will hold publically accessible information such as abstracting and indexing databases, full text of reports, encyclopedias and directories, while other databases will be database that are shared with in an organization or group of organization. Databases may be classified according to different characteristics - by contents, mode of access, subject scope, chronological coverage, geographical and many others. For example, a database classified according to contents may be bibliographic, textual, numeric, etc. Database may also be categorized according to subject irrespective of other modes of classification. For examples, a database on physics may contain bibliographic, numerical, textual and formula data. All the databases may also be categorized according to the mode of access such as offline or online. You should be aware that all databases do not provide the facility of online retrieval. Information collections, sharing a common characteristic such as subject discipline or type, which are published electronically by public or private sector database producers (usually on a commercial basis) and made available to a large public for interactive searching and information retrieval. Online databases are accessed via telecommunications or wide area network links to remote online host services, which normally offer many different databases. CD-ROMs are optical disks, which are mounted locally on a PC, workstation or local area network. In terms of their content, online and CD-ROM databases share many common features. Indeed, many databases are published in both formats. Other less commonly used formats for database distribution include diskette, magnetic tape and hand-held products. Online and CD-ROM databases now cover a huge range of different types of information, but the vast majority fall into one or more of the categories below :

Reference and Source Databases

Databases that might be available to information users in the public area an either remotely via online search service or more locally on CD-ROM can be categorized as either reference or source database.

Reference Database

Reference database refer or point the user to another source such as document of an organization or an individual for additional information for the full text of a documents. This database does not contain complete information, but only references. Users are referred to sources where in additional/complete information would be available. In the present day context, in comparison to other types of databases, these databases play a major role in providing library and information services. Examples are :

(a) Bibliographic Databases

Bibliographic databases contain references to published literature, including journals and newspapers articles, conference proceedings and papers, reports, government and legal publications, patents, books, etc. These databases provide bibliographic information about a document such as citations, sometimes with address of the printed documents. In contrast to library catalogue entries, a large proportion of the bibliographic records in online and CD-ROM database describe analytics (articles, conference paper, etc.) rather than complete monographic, and they generally contain very rich subject descriptions in the form of subject indexing terms and abstracts. These databases are used by libraries and information centers in various ways such as, provision of current and retrospective literature reaches, compilation of bibliographies, providing CAS and SDI, and book selection.

(b) Referral Databases

Referral databases provide references to the non-print sources, sometimes with descriptive information. The source may be organization, individuals, audio-visual materials, current research projects etc., the objective being to help the users for contacting the sources for exact information. In other words, they function as a switch to connect the users with sources, which may provide exact information.

Source Databases

In comparison to previous types, these databases comprise source data, full text of original source publications or materials, prepared specifically for electronic distribution. The source databases are produced by various types of organizations including government organizations that have the responsibility of disseminating information collected or generated by them. Some producers collect data/information from various sources, process them and make these available for dissemination after repackaging, Source databases contain the original source data, and are on type of electronic documents. After successful consultation for a source database, the user should not need to seek information in an original source (as in the case with reference database). Data are available in machine-readable form instead of or as well as printed form. The contents of such databases may be as varied as the contents of printed book and may include text, numbers tables, figures and graphics. Indeed many such databases take advantages of the fact that they are not constrained by same physical limitation. Most of them are multimedia, embracing in addition to text and numeric data, computer software, images, sound, maps and charts. These databases can be accessed through online search services on CD-ROM or via videotext and teletext. CD-ROM is the medium that has supported the initial development of the more ambitious multimedia databases because there is no need to transmit images over external communication networks.

Source database can be grouped according to their content, They are :

1) Numeric databases, which contain numerical datas of various kinds, including statistics and survey datas.
2) Full text databases of news paper items, technical specifications and software.
3) Text numeric databases which contain a mixture of textual and numeric data (such as company annual reports) and hand book data.
4) Multimedia databases, which include information stored in a mixture of different types of media, including sound, video, pictures, text and animation.

Numeric Databases

These databases contain data in numeric form generated and collected in various ways, such as scientific data obtained by research and experimentation, statistical data obtained by various means, survey data like census data, land data, etc. These contain predominantly numeric data. Examples include company accounts and financial performance indicators, commodity and stock market data, statistical data of all types, including time series, and chemical or physical properties of substances.

Full-Text Databases

These databases comprise records of the complete text of an item of information such as periodical article, newspaper item specifications, court decisions, etc. The use of these databases is gaining more and more importance from the point of view of usability of users. These contain, in addition to a Bibliographic Descriptions, the entire text of documents. For example, the majority of articles from all the UK quality newspapers are available in online format, and many are also published on CD-ROM. As the full text is normally searchable, abstracts and indexing terms may not be present.

Textual/Numeric Databases

These databases contain a combination of information consent mentioned in the above section. They contain descriptive information with statistical or properties or other types of data in numeric form. Handbook type of data such as physical and chemical properties of substances is typical example of this type. These databases are useful when further clarification; explanation about the numeric data is required. Chemsis, Chemsearch are some of the existing databases of this type. This is also known as Factual Database.

Multimedia Databases

Multimedia Databases contain a mix of different media such as text, audio, video and still graphics (photographs, diagrams and illustrations, graphs, charts, maps and even representations of works of art). Because of the limitations of current telecommunications networks in transmitting large graphics files, multimedia databases are more usually in CD-ROM format than online, though the

implementation of high-speed networks will radically alter this situation in the foreseeable future.

Full-Text Image Databases

Strictly speaking these are really full-text database. The finer distinction lies in the fact that these databases contain full-text materials that include figures, illustrations, charts, photographs and other graphic materials included in the original work. Whereas the full-text database, comprises textual material only.

Directory Databases

Directory databases contain descriptive information for entities. Different directories may list organization, individuals, electronic or printed publications, materials, chemical substances, computer software, audiovisual materials, etc.

Other Types-Recent Trends

The types of database as mentioned above are on the basis of information content. Many of these databases are available online whereas many others are not.

The libraries with their traditional holdings in print format are now being added with electronic information resources in various formats like CD-ROM, DVD- ROM databases and Online databases. The content of these sources varies from bibliographic or factual to full text.

CD-ROM Databases

CD-ROM databases are increasing day by day in almost all fields due to their many advantages in information storage and retrieval. Majority of publishes of books and journals, online vendors and various learned societies are bringing out new titled in CD format with powerful, user-friendly retrieval software. Electronic information resources in CD format include abstracting and indexing services, encyclopedias, dictionaries, directories, yearbooks, back volumes, patents, standards and many other reference works. The CD-ROM technology has given ample opportunities for information professionals to introduce more information services to end-users.

DVD-ROM Databases

The advent of DVD-Digital Video Disc or Digital Versatile Disc, with its 17GB of high data storage capacity, has made it possible to include more multimedia elements like video and sound and to integrate many reference sources on a single disc. The other features like higher quality of sound and video, higher rate of data transfer, data security etc., are making DVD more viable option than CD-ROM. But, at present due to some problems like lack of standards among the manufactures of DVDs and drives, need for extra hardware on PCs and their higher prices are making the growth of DVD technology slow. Some DVD reference sources include Britannica, Webster's International, Grolier Multimedia Encyclopedia, Eyewitness World Atlas DVD-ROM Deluxe Edition, and the Complete National Geographic on DVD-ROM etc.

Online Databases

The recent growth of Internet and the popularity and ease in use of Web are making libraries to subscribe to online information services. The online database services like Dialog (KR Information) and STN are now moving towards being webcentric. The usage of online databases against their CD-ROM counterparts has to be evaluated and decided on the basis of cost effectiveness and timeliness. Few Online information services are KR Science Base and STN the KR Science Base, which includes information sources like BIOSIS, CA Search, Elsevier Science Publishers, Reuters, etc. The STN international provides a complete collection of in-depth databases in science and technology, which gives quick, direct links to the literature, patents and chemical catalogues. Chemical Abstract Service, producer of the world's largest and most comprehensive database of chemical information, offers several databases on STN like CA plus, INSPECT, MEDLINE, SCISEARCH, TOXLIT etc.

Source databases are so varied in their nature and origins that it is difficult to make generalization. Earlier, in this lesson we divided source databases in to numerous, full text and text numeric. We might also consider referral databases in this way. Although these can be categorized as reference databases in the sense they offer a pointer to further information they are often also source databases that they might contain the full text of a directory that could be regarded as a source document. Source database then may include the full text of a journal article, newsletters, directories, dictionaries and other source materials.

Therefore, a database is an organized collection of data stored in a computer in a systematic way that can be accessed electronically. Simply, data is a single piece of information, and can include, but is not limited to, text, images, numbers, and audio video clips etc. Earlier database were containing bibliographic information only. Then they started covering references or citations etc. and now link to these citations or references are also being provided in most of the cases, e.g. Biological Abstracts and Chemical Abstract Service. There are different types of electronic databases in the world today, including statistical databases, image databases, and other. These electronic databases providing different types of information and some are in general and covers a broad range of subjects and some are subject specific and cover only certain subject areas or time periods.

1.4.4 Generations of Databases:

1.4.4.1 Zeroth generation: Record Managers 4000BC -1900

The first known writing describes the royal assets and taxes in Sumeria. Record keeping has a long history. The next six thousand years saw a technological evolution from clay tablets to papyrus to parchment and then to paper. There were many innovations in data representation: phonetic alphabets, novels, ledgers, libraries,

paper and the printing press. These were great advances, but the information processing in this era was manual.

1.4.4.2 First Generation: Record Managers 1900 -1955

The first practical automated information processing began circa 1800 with the Jacquard Loom that produced fabric from patterns represented by punched cards. Player pianos later used similar technology. In 1890, Hollerith used punched card technology to perform the US census. His system had a record for each household. Each data record was represented as binary patterns on a punched card. Machines tabulated counts for blocks, census tracts, Congressional Districts, and States. Hollerith formed a company to produce equipment that recorded data on cards, sorted, and tabulate the cards. Hollerith's business eventually became International Business Machines. This small company, IBM, prospered as it supplied unit-record equipment for business and government between 1915 and 1960.

By 1955, many companies had entire floors dedicated to storing punched cards, much as the Sumerian archives had stored clay tablets. Other floors contained banks of card punches, sorters, and tabulators. These machines were programmed by rewiring control panels (patch-boards) that managed some accumulator registers, and that selectively reproduced cards onto other cards or onto paper. Large companies were processing and generating millions of records each night. This would have been impossible with manual techniques. Still, it was clearly time for a new technology to replace punched cards and electro-mechanical computers.

1.4.4.3 Second Generation: Programmed Unit Record Equipment 1955-1970

Stored program electronic computers had been developed in the 1940's and early 1950's for scientific and numerical calculations. At about the same time, Univac had developed a magnetic tape that could store as much information as ten thousand cards: giving huge improvements in space, time, convenience, and reliability. The 1951 delivery of the UNIVAC1 to the Census Bureau echoed the development of punched card equipment. These new computers could process hundreds of records per second, and they could fit in a fraction of the space occupied by the unit-record equipment.

Software was a key component of this new technology. It made them relatively easy to program and use. It was much easier to sort, analyze, and process the data with language like COBOL. Indeed, standard packages began to emerge for common business applications like general-ledger, payroll, inventory control, subscription management, banking, and document libraries.

The response to these new technologies was predictable. Large businesses recorded even more information, and demanded faster and faster equipment. As prices declined, even medium-sized businesses began to capture transactions on cards and use a computer to process the cards against a tape-based master file.

The software of the day provided a **file-oriented record processing** model. Typical programs sequentially read several input files and produced new files as output. COBOL and several other programming languages were designed to make it easy to define these record-oriented sequential tasks. Operating systems provided the file abstraction to store these records, a job control language to run the jobs, and a job scheduler to manage the workflow.

Batch transaction processing systems captured transactions on cards or tape and collected them in a batch for later processing. Once a day these transaction batches were sorted. The sorted transactions were merged with the much larger database (master file) stored on tape to produce a new master file. This master file also produced a report that was used as the ledger for the next day's business. Batch processing used computers very efficiently, but it had two serious shortcomings. If there was an error in a transaction, it was not detected until that evening's run against the master file, and the transaction might take several days to correct. More significantly, the business did not know the current state of the database - so transactions were not really processed until the next morning. Solving these two problems required the next evolutionary step, online systems. This step also made it much easier to write applications.

1.4.4.4 Third Generation: Online Network Databases 1965-1980

Applications like stock-market trading and travel reservation need to know the current information. They could not use the day-old information provided by off-line batch transaction processing - rather they need immediate access to current data. Starting in the late 1950's, leaders in several industries began innovating with online transaction databases which interactively processed transactions against online databases. Several technologies were key to enabling online data access. The hardware to connect interactive computer terminals to a computer evolved from teletypes, to simple CRT displays, and to today's intelligent terminals based on PC technology. **Teleprocessing monitors** provided the specialized software to multiplex thousands of terminals onto the modest server computers of the day. These TP monitors collected request messages from a terminal, quickly dispatched server programs to process each message, and then dispatched the response back to the requesting terminal. **Online transaction processing** augmented the batch transaction processing that performed background reporting tasks.

Online databases stored on magnetic disks or drums provided sub-second access to any data item. These devices and data management software allowed programs to read a few records, update them, and then return the new values to the online user. Initially, the systems provided simple record lookup: either by direct lookup by record number or associative lookup by a record key.

1.4.4.5 Fourth Generation: Relational Databases and Client-server computing 1980-1995

The idea of the **relational model** is to represent both entities and relationships in a uniform way. The relational data model has a unified language for data definition, data navigation, and data manipulation, rather than separate languages for each task. More importantly, the relational algebra deals with record sets (relations) as a group, applying operators to whole record sets and producing record sets as a result. The relational data model and operators gives much shorter and simpler programs to perform record management tasks

Inspired by Codd's ideas, researchers in academe and industry experimented throughout the 1970's with this new approach to structuring and accessing databases promising dramatically easier data modeling and application programming. The many relational prototypes developed during this period converged on a common model and language. Work at IBM Research led by Ted Codd, Raymond Boyce, and Don Chamberlin and work at UC Berkeley led by Michael Stonebraker gave rise to a language called SQL. This language was first standardized in 1985. There have been two major additions to the standard since then virtually all database systems provide an SQL interface today. In addition, all systems provide unique extensions that go beyond the standard.

The relational model was well suited to Client-server computing. **Client-server** application designs divide applications in two parts. The **client** part is responsible for capturing inputs and presenting data outputs to the user or client device. The **server** is responsible for storing the database, processing client requests against a database, and responding with a summary answer. The relational interface is especially convenient for client-server computing because it exchanges high-level requests and responses. SQL's high-level language minimizes communication between client and server. Today, many client-server tools are built around the Open Database Connectivity (ODBC) protocol that provides a standard way for clients to make high-level requests to servers. In particular, procedural languages like BASIC and Java have been added to servers so that clients can invoke application procedures running at the server.

1.4.4.6 Fifth Generation: Multimedia Databases 1995-

Relational systems offered huge improvements in ease-of-use, graphical interfaces, client-server applications, distributed databases and data mining. Nonetheless, in about 1985, the research community began to look beyond the relational model. Traditionally, there had been a clear separation between programs and data. This worked well when the data was just numbers, characters, arrays, lists, or sets of records. As new applications appeared, the separation between programs and data

became problematic. The applications needed to give the data behavior. For example, if the data was a complex object, then the methods to search, compare, and manipulate the data were peculiar to the document, image, sound, or map datatype.

The traditional approach was to build the datatypes right into the database system. SQL added new datatypes for time, time intervals, and two-byte character strings. Each of these extensions was a significant effort. When they were done, the results were not appropriate for everyone. For example, SQL time cannot represent dates before the Christian Era and the multi-character design does not include Unicode (a universal character set for almost all languages). Users wanting Unicode or pre-Christian dates must define their own datatypes. These simple examples and many others convinced the database community that the database system must allow domain specialists to implement the datatypes for their domains. Geographers should implement maps, text specialists should implement text indexing and retrieval, and image specialists should implement the type libraries for images. To give a specific example, a data time series is a common object type. Rather than build this object into the database system, it is recommended that the type be implemented as a class library with methods to create, update and delete a time series. Additional methods summarize trends and interpolate points in a series, and compare, combine and difference two series. Once this class library is built, it can be "plugged into" any database system. The database system will store objects of this type and will manage the data (security, concurrency, recovery, and indexing) but the datatype will manage the contents and behavior of time-series objects.

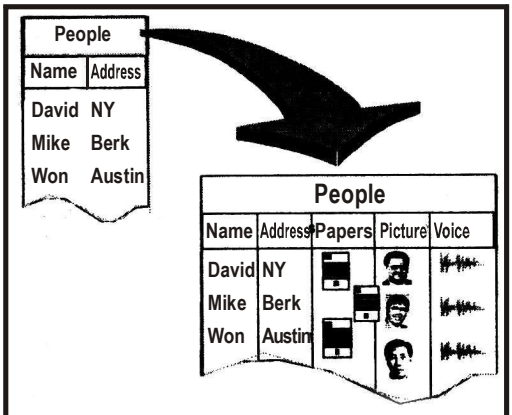


Figure : The transition of traditional database storing numbers and characters into an object-relational database where each record can contain data with complex behavior.

People coming from the object-oriented programming community saw the problem clearly: datatype design requires a good data model and a unification of procedures and data. Indeed, programs encapsulate the data and provide all the methods to manipulate the data. Researchers, startups, and established relational database vendors have labored long and hard since 1985 to either replace the relational model or unify the object-oriented and relational systems. Over a dozen Object-Oriented

database products came to market in the late 1980's, but customers were slow to accept these systems. Meanwhile, the traditional vendors tried to extend the SQL language to embrace object oriented concepts, while preserving the benefits of the relational model.

The rapid evolution of the Internet amplifies these debates. Internet clients and servers are being built around "applets" and "helpers" that capture, process, and render one data type or another. Users plug these applets into a browser or server. The common applets manage sound, image, text, video, spreadsheets, graphs. These applets are each class libraries for their associated types. Desktops and web browsers are ubiquitous sources and destinations for much of the data. Hence, the types and object models used on the desktop will drive the server class libraries that database systems must support.

To summarize, databases are being called upon to store more than just numbers and text strings. They are being used to store the many kinds of objects we see on the World Wide Web. and to store relationships among them. The distinction between the database and the rest of the web is being blurred. Indeed, each database vendor is promising a "universal server" that will store and analyze all forms of data (all class libraries and their objects).

To close on the current status of data management technology, it makes sense to describe two large data management projects that stretch the limits of our technology today. **The Earth Observation System Data/Information System (EOS/DIS)** is being built by NASA and its contractors to store all the satellite data that will start arriving from the Mission to Planet Earth satellites in 1997. The database, consisting of remote sensor data, will grow by 5 terabytes a day (a terabyte is a million megabytes). By 2007, the database will have grown to 15 petabytes. This is a thousand times larger than the largest online databases today. NASA wants this database to be available to everyone, everywhere, all the time. Anyone should be able to search, analyze, and visualize the data in this database. Building EOS/DIS will require advances in data storage, data management, data search, and data visualization. Most of the data has both spatial and temporal characteristics, so the system requires substantial advances storing those data types, as well as class libraries for the various scientific data sets. For example, this application will need a library to recognize snow cover, vegetation index, clouds, and other physical features in LandSat images. This class library must easily plug into the EOS/DIS data manager.

The emerging **world-wide library** gives another challenging database example. Many institutional libraries are putting their holdings online. New scientific literature is being published online. Online publishing poses difficult societal issues about copyrights and intellectual property, but it also poses deep technical challenges. The size and diversity of this information are daunting. The information appears in

many languages, in many data formats, and in huge volumes. Traditional or approaches to organizing this information (author, subject, title) do not exploit the power of computers to search documents by content, to link documents, and to cluster similar documents together. Information discovery, finding relevant information in the sea of text documents, maps, photographs, sounds, and videos, poses an exciting and challenging problem.

1.4.5 Salient Features of Select Bibliographic Databases

Bibliographic Databases :

These databases provide-a descriptive record of an item only, means location of actual item with some useful information but the item itself is not provided in the database. The useful information about the item which is provided, including name of author's, title subject, publisher, year of publication, etc. The information provided is called a citation. Most of the times a short summary or abstract of the item are also provided. Examples of bibliographic databases include Library and Information Science Abstract (LISA), Sociological Abstracts etc.

Sociological Abstracts :

Sociological Abstracts (San Diego, CA : Sociological Abstracts Inc., 1953-). Seven issues a year. This is one of the most important resources for accessing the research literature in sociology and its subdisciplines including; psychology, political science, philosophy, economics, education, community development, demography and medicine. Core journals in sociology are fully abstracted. Journals in related fields are selectively abstracted. Articles are screened by senior editors with backgrounds in the social sciences. Drawing information from an international selection of over 2600 journal and other serials publications, conference papers and dissertations, entries are arranged by author under a detailed classification scheme of 29 major subject headings that are further subdivided. Author, subject and reviewer indexes are included, as well as a source list giving names of all journals covered. International Review of Publications in Sociology (IRPS) is a supplement that lists reviews appearing in the same issue of Sociological Abstracts. Sociological Abstracts <www.silverplatter.com>. Sociological Abstracts (1963-) this database covers publications from 1963 to date. Records added after 1974 contain in-depth and non-evaluative abstracts of journal articles. It also contains the Social Planning/ Policy and Development Abstracts. SOPODA, database, which focuses on solutions to social problems. Coverage is from 1979 forward.

LISA : Library and Information Science Abstracts

LISA is an international abstracting and indexing tool designed for library professionals and other information specialists. It currently abstracts over 440

periodicals from more than 68 countries and in more than 20 different languages. Coverage of literature is from 1969 to current. Frequency to update the records is in every two weeks, and 500 records are added in per update. As on March 2005 over 270,000 records are recorded. Print version for Library and Information Science Abstracts is published with ISSN 0024-2179.

Features are :

- LISA is the world's best known resource for the coverage of ongoing research in all aspects of library and information studies.
- Entries keep you well informed about the different topics such as artificial intelligence, information and knowledge management, publishing and copyright, world wide web resources.
- Updated subject focus-to reflect new patterns in society, together with changing requirements in the library and information science field, five important new subject focuses have been incorporated into LISA'S coverage strategy, which are Life long learning, Knowledge management, Management issues, Information literacy, information systems management.

Library of Congress

Library of Congress (LC) online catalog <http://catalog.loc.gov/>

Library of Congress database contains approximately 12 million records of books, serials, computer files, manuscripts, cartographic materials, music, sound recordings, and visual materials representing the huge collection of materials owned by the Library of Congress. The database records reside in a single integrated database. Researchers may use the database to identify relevant literature. Besides, since each record contains full bibliographic details including LC subject headings, LC class number and DDC number, it can be a useful tool for acquisitions and cataloging departments of academic libraries for bibliographic verifications, classification and cataloging purposes, respectively.

Population Index

<http://popindex.princeton.edu/>

Population Index Covers all fields of interest to demographers, particularly the world's population. It presents an annotated bibliography of recently published books, journal articles, working papers, doctoral dissertations, and other materials on population topics, containing over 46,035 abstracts of demographic literature published in Population Index. It is searchable by author, title, subject, geographical region and/ or year. Its coverage is from 1956 to the present and updated annually. The Office of Population Research, Princeton University, maintains the database.

TOXNET (Toxicology Data Network)

< http:/ toxnet. nih. gov>

Toxicology Data Network Contains a cluster of bibliographic databases produced by the National Library of Medicine, covering various aspects on toxicology, hazardous chemicals, and related areas. The databases are Hazardous Substances Data Bank (HSDS), TOXLINE, Taxies Release Inventory (TRI), Integrated Risk Information System (IRIS), Chemical Carcinogenesis Research Information System (CCRIS), Environmental Mutagen Information Centre (EMIC), and others. For instance, TOXLINE provides extensive coverage of bibliographic information on biochemical, pharmacological, and toxicological effects of drugs and other chemicals. It contains more than three million bibliographic citations, most of them with abstracts.

Psychological Abstracts

Psychological Abstract (Washington, DC : American Psychological Association, 1927-) is the printed version of the PsycINFO database. This monthly publication contains summaries of English-Language journals, technical reports, books and book chapters relevant to psychology. The summaries include abstracts and full bibliographic and indexing information. To facilitate browsing, Psychological Abstracts is organized by subject area based on the PsycINFO classification codes. Cumulative author and subject indexes, published annually, provide quick and easy access to each year references. The primary index in the field of psychology and a larger and more comprehensive online version of PsycLit on CD-ROM and Psychological Abstracts PsycINFO includes citations and abstracts to journal articles, book chapters, technical reports, conference papers and dissertations. The database comprises more than 1.5 million references from 1887 to present. It includes literature relevant to psychology and related disciplines, including sociology, psychiatry, education, medicine and business. The database abstracts materials from over 1300 periodicals. Other useful features include the hypertext links to APA's Thesaurus of Psychological Index Terms. The database is available from a number of suppliers including: Silver Platter Information <ww.silverplatter.com> (Hard Disk, CD-ROM and Internet); and Ovid <www.ovid.com> (CD-ROM and Internet).

PAIS International

<www.pais.org/products/index/stm>

PAIS International (New York: OCLC Public Affairs Information Service, 1972). PAIS is published monthly and an annual subscription includes monthly issues, author and subject indexes, PAIS subject headings, containing 8000 indexing terms are available in the print version for users, for more effective searching of the indexed material. The subject areas covered are current events, economics, foreign affairs, government regulations, political science, public administration and social issues. The PAIS online database (now merged with OCLC to form the OCLC Public Affairs Information Service) contains 440000 indexed records and another 14,000 records

are added annually. The sources used are publications, statistical yearbooks, conference proceedings, books and reports as well as journals. All abstracts and subject headings used in indexed records are in English. One of the great strengths of PAIS is its indexing of grey literature. In 1999, PAIS indexed 951 journals, 1036 Internet document and 5600 books, reports and pamphlets. PAIS is also available on CD-ROM and can be accessed through online database hosts and fee-based services on the Internet.

International Bibliography of Sociology

International Bibliography of Sociology (London : British Library of Political and Economic Science, London School of economics, 1951-). With its sister publications-Anthropology, Economics and Political Sciences-this volume makes up the International Bibliography of Social Sciences. Material rom over 100 countries is included. Approximately 70 per cent of the records are in English, and articles in other languages are displayed with both the original language title and an English translation.

International Bibliography of Sociology is available as part of the International Bibliography of Social Sciences, as a Silver platter CD-ROM (covering 1981 to date). The database from 1951 onward is available online via the Bath Information and Data Services (BID) at <www.bids.ac.uk>. The BIDS/ingenta service offers the option of downloading the full text of some of the articles.

Discrimination and Prejudice

Discrimnation and Prejudice : an Annotated Bibliography by Halford H. Fairchild et al (San Diego, CA: Westerfield Enterprises, 1992) offers over 4000 references to books, articles, dissertations and US government documents on the subject of prejudice and discrimination. Divided into five parts - African Americans; American Indians; Asian Americans; Hispanic Americans; and multi-ethnic groups - topics such as civil rights, education, health and public services are covered. Reference are briefly annotated. Broader in coverage is Meyer Weinberge's World Racism and Related Inhumanities: a Country-by-Country Bibliography (Wesport, CT: Greenwood Press, 1992) which cites over 12000 books, articles and dissertations published worldwide on racism and related topics. Over 135 countries are included.

International Medieval Bibliography

A bibliography of over 300,000 articles, review articles, scholarly notes and similar literature on all aspects of medieval studies. The discipline areas covered include Classics, English Language and Literature, History and Archaeology, Theology and Philosophy, Medieval European Languages and Literatures, Arabic and Islamic Studies, History of Education, Art, History, Music, Theatre and Performance Arts,

Rhetoric and Communication Studies for works work published throughout Europe, the Americas and the Asia-Pacific region. The time coverage is c. 400-1500.

PsychlNFO (1887) INDEX/ABSTRACTS

Contains citations and summaries of journal articles, book chapters, books and technical reports, as well as citations to dissertations, all in the field of psychology and psychological aspects of related disciplines, such as medicine, psychiatry, nursing, sociology, education, pharmacology, physiology, linguistics, anthropology, business and law. Journal coverage includes international material selected from more than 1,400 periodicals written in over 35 languages. Current chapter and book coverage includes worldwide English-language material published from 1987-present. Over 55,000 references are added annually through monthly updates, PsycINFO is produced and copyrighted by the American Psychological Association.

Social Sciences Citation Index (1990) INDEX ; (1992) ABSTRACTS

Fully indexes more than 1,725 journals across 50 social sciences disciplines, Also indexes individually selected, relevant items from over 3,300 of the world's leading scientific and technical journals. Some of the disciplines covered include: anthropology, history, industrial relations, information science & public health, social issues, social work, sociology, substance abuse, urban studies and women's studies. Available as part of the Web of Science.

Anthropology Bibliographies

Anthropology Bibliographies: a Selected Guide edited by Margo L. Smith and Yvonne M. Damien (South Salem, NY : Redgrae Publishing Company, 1981). This has a listing of 3200 titled from the beginning of the twentieth century to the 1980s. It is broad in scope, encompassing texts from all the main subfields and in many languages. It lists both independently published monographs and journal articles, which may be difficult to trace elsewhere. Also included are filmographies of audio-visual materials and teaching aids. The main emphasis is on listing bibliographies relevant for area studies, although a subject index is also provided.

Linguistics and Language Behavior Abstracts

Linguistics and Language Behavior Abstracts (Bethesda, MD : Cambridge Scientific Abstracts) is a searchable database of over 285000 bibliographic records, covering all aspects of the study of language including: phonetics, phonology, morphology, syntax and sematics. It focuses on three fundamental areas: research in linguistics; research in language; and research in speech, language and hearing pathology. The database is updated quarterly and includes abstracts from over 1300 journals from 50 countries. It is available from a number of suppliers including: Silver Platter Information <www.silverplatter.com> (Hard Disk, CD-ROM and Internet) and Ovid <www.ovid.com> (CD-ROM and Internet).

Bibliography of Asian Studies

<bas.umdl.umich.edu/b/bas/>

Bibliography of Asian Studies (Ann Arbor, MI: Association for Asian Studies, 1971). quarterly. This index had its origins in an annual bibliography published in the Far Eastern Quarterly in 1936. The online version contains the contents of all printed editions from 1971 to the present day, with quarterly updates. It provides citations to western language Journal articles. Conference proceedings and some chapters in books covering the economic, political and social study of the region. Since 1992 monographs have been excluded. In the past, there have been considerable time lags between publication and indexing, extending in some instances to over four years, however, these are now in the process of being reduced. The database, may be searched by region, or subject keyword.

DARE

www.unesco.org/general/eng/infoserv/db/dare.html

DARE (Paris: UNESCO) is a bibliographic database that contains 11000 worldwide references to social science journals, social science research and training institutions, specialists, documentation and information services. It is provided by the Social and Human Sciences Documentation Centre of UNESCO's Information Services.

Dissertation Abstracts

<www.umi.com/hp/Support/Services/products/da.htm.>

Dissertation Abstracts this service includes citations from the first US dissertation in 1861. From 1988 onwards the references include abstracts. It is available in a variety of electronic formats including the Web via ProQuest, which offers an easy-to-use, searchable interface. Its CD-ROM version is updated quarterly and consists of a current disc (1994-) and a four-disc archival set (1861-1993). Dissertation Abstracts is also available from the following commercial services: Ovid Online; Data Star; DIALOG; EPIC and First Search; and STN International. Index To Theses <www.theses.com/> is the electronic version of the printed service mentioned above and consists of a searchable database, providing abstracts of UK theses from , 1970 onwards.

International Political Science Abstracts

International Political Science Abstracts (Paris: Foundation National des Sciences Politique, 1950) is published by The International Political Science Association from the Foundation National des Sciences Politique. It spiculated six times a year and has a comprehensive index. The key abstract sources for IPSA are international scholarly journals and yearbooks. A special emphasis is placed on countries or areas where informational is scarce. The main areas covered are : methodology and theory;

political ideas; institutions and process; international relations; and national and regional studies. CD-ROM and Internet versions are available from Silver Platter Information <www.silverplatter.com>. IPSA follows a policy of completely indexing approximately 45 core journals, through this may vary year on year. In addition, articles in another 900 journals are indexed on a selective basis. There are currently more than 64000 abstract available on the database covering the period 1989 to present. Around 7400 new abstracts are added annually. The vast majority of abstracts are in English and the remainder in French. IPSA's indexing allows records to be accessed by searching on a variety of fields including descriptors, title, journal name index and abstract.

1.4.6 References and Further Readings

1. Addyman, T. (1994). The Internet: international information highway. New Library World, 95 (1115), pp. 4-9
2. Hundie, Kebede (2202). A guide to selected and freely searchable bibliographic and full text databases on the web. Emerald, 21 (I), 2002), pp. 13-21 (http://www.emeraldinsight.com/0160-4953.htm)
3. Kumar, A. (2002). Readings on information technology, No. 2, New Delhi : Anmol Publication, pp. 434-436.
4. Kumbar, Mallinath, Rao, R.V. and Nargund (2001). Electronic information resources: A methodical approach towards introducing users. In : CALIBER-2001, 15-16. March 2001, Ahmedabad, INFLIBNET Center, pp. 247-250.
5. Pands, K.C. and Karisiddaappa, C.R. (eds.) (1993). New Dimension in information service and technology. Delhi: Parimal Publications.

1.4.7 Self check Exercise

Q1. Define database and explain the Various types of database.

Q2. Discuss the salient features of select bibliographic database.

Q3. Explain in detail the various generations of databases.

MASTER OF LIBRARY AND INFORMATION SCIENCE | **MLIS 203 INFORMATION AND COMMUNICATION TECHNOLOGY : APPLICATIONS**

LESSON NO. 1.5 | **AUTHOR : AMANDEEP**

COMMUNICATION TECHNOLOGY

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OBJECTIVES

This lesson will make the learner familiar with the basic terminology and overview of computer communication.

1.5.1 INTRODUCTION

A standalone computer in today's context is not very useful, but coupled with communication technology; it opens up an enormous repository of information to its' users. Information is carried in data communication systems as signals between two or more points, which could be at a distance of a few inches or several thousand kilometers. These signals are subject to various effects while they are in which alter their characteristics to some degree. The data communication technology ensures that information between two communicating entities is transferred in a reliable and orderly manner. To understand transmission one needs to study electrical form that messages take while they are in and of media and communication technologies that ensure error free transmission. In our subsequent units we would be discussing the basic concepts of electronic communications.

1.5.2 DEFINITIONS

The definitions of commonly used terms in communications **Data** are entities that convey meaning. **Information** is obtained by processing data using desired functions. **Signals** are electric or electromagnetic encoding of data, and **signalling** is propagation of signal along suitable communication medium.

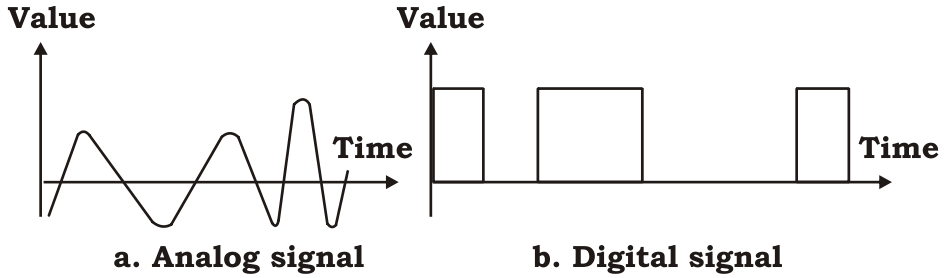
Transmission is communication of data achieved by the propagation and processing of signals.

The concept of **Data communication** evolved from sharing the computation power of a computer along with various resources available in a computer environment such as printers, Hard-disk etc.

The **speed** at which two computers exchange or transmit data is called communication rate on transmission speed. The unit of measurement of the speed is measured using bps (bits per second) or baud. Normal PC based communication station transferred, using 300 to 9600 bps, whereas a main frame computer uses 19,200 baud or more.

An **analog signal** is one that is continuous with respect to time, and may take on any value within a given range of values. Human voice, video and music when converted to electrical signal using suitable devices produce analog signals.

A **digital signal** may take on only a discrete set of values within a given range. Most computers and computer-related equipment are digital.



In **parallel data transmission,** there are multiple parallel lines connecting the transmitting and receiving units. Each wire carries a bit of information. Normally, one character is transferred in one go.

In **serial data transmission,** each bit is sent sequentially one after another and it requires only one pair of wire conductors for connecting the receiving and transmitting units.

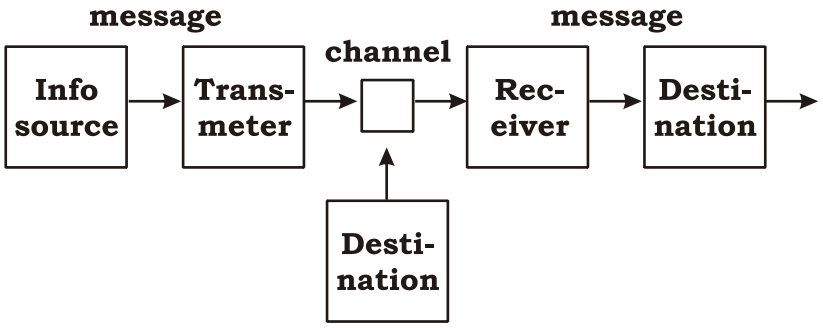
Private leased lines are permanently connected circuits between two or more points, These lines are available for private use by the leasing party.

Switched lines or dial up lines are available to any subscriber. For example, telephone connection in our home or office is a dial up lines as we dial up a number to use a particular circuit.

1.5.3 COMMUNICATION HARDWARE

For any basic data communication process, the hardware required are: Sender and Receiver Hardware, Communication Devices, Communication Channels.

The sender and receiver are normally machines, in particular computer devices. There are several types of communication devices or interface used in data communication. Some of these are modem, code etc. The most basic hardware required for communication is the media through which data is transferred. It may be telephone lines, microwave links, satellite links etc.



1.5.4 NETWORK COMPONENTS

All modern networks are created by connecting various physical devices to establish a path from the sending device to the receiving device such as cables, hubs, bridges, switches and routers.

1.5.4.1 Cables :

Cables carry the signals from one location to another. This could be across a room, or across the country. The maximum length of a cable is an important design criterion and is generally bounded by a factor called attenuation. Attenuation is the measure

of the strength of the signal as it travels over an increasingly long segment of cable, the greater the attenuation.

Shielding is another important design criterion. Some cables are shielded to prevent outside interference, like that cause by motors or fluorescent lights, from changing a signal as it passes through a cable.

The cable medium is also important. Most cables are either copper, which carries an electrical signal, or fiber-optic, which carries a beam of light. Copper-based cables are generally more durable, cheaper and easier to use, whereas fiber-optic cables can go much more distances and support much higher frequencies, which translates into more bandwidth than copper cables.

Cables are terminated by plugs. Plugs plug into jacks. Plugs and jacks are typically plastic or metal pieces that low the individual wires inside a cable to be easily connected to the corresponding wires of another cable or device, such as PC.

5.4.2 Hubs :

To connect several computers in a building cables are typically run from the PCs on people's desk back to wiring closets. Here, a special device is required to connect all the cables together. This device is typically a hub. Hubs are devices that provide a physical path for a signal to travel from one cable to another. They act as multiport repeaters. In other words, they simply regenerate an electrical signal received on one port out one or more other ports, with no changes whatsoever.

A hub simply repeats a signal without modifying the information, every port on a hub is part of the same network segment or data link.

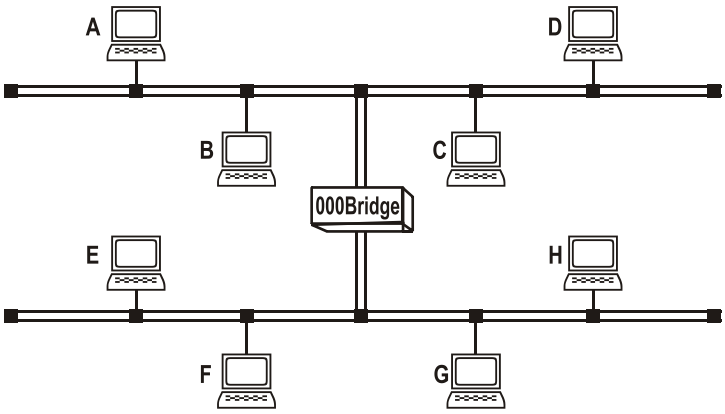
1.5.4.3 Bridges :

Once the number of users began to push the limits of single network segment, there was a need to create a new segment to link two networks together. A device called a bridge accomplished this. Originally, bridges had only two ports, one for each network. However unlike hubs, bridges actually inspect the data that passes through them and make decisions about whether to send it to other network or not. This decision is based on the MAC address in Ethenet networks, and on the ring number in Token Ring networks.

Ethernet bridges listen to traffic sent by computers and other network devices and then they recode the MAC address of the computer, which is located in the Sources Address field of the Ethernet frame header, and the port from which the-address was learned. If the bridge then receives a frame from the other network that is destined for the MAC address it learned from the first network, it will send the frame to the first network.

Token Ring bridge operate by ring numbers. Each bridge is assigned a bridge number and a ring number. Token Ring frames contain a Routing Information Field (RIF),

which is a list of the ring numbers and bridge numbers that a frame must traverse to get its destination. When a Token Ring bridge sees a frame on the one ring destined for another ring that is also attached to the same bridge, it will retransmit the frame on that ring.



1.5.4.4 Switches :

As network grew even larger, and the amount of data transmitted by each computer increased, segmenting networks became even more important. Two-port bridges were no longer sufficient. Although they have much more functionality now, switches began as multiport bridges. Most switches have 12 or 24 ports, but many are modular and can have several hundred ports.

Another-distinction is that switches can handle several conversations at the same time. Each 100 Base-TX port on a switch can send and receive frames at the same time. This means that switches have to have fairly complex backplane that allows each port to talk to every other port. Although the details of this are often published, they are not part of any technology standard, but are proprietary for each switch type. Switches also employ buffers. These buffers are memory that can be used to store frames until the frame can be transmitted. This is useful when many devices converse with a single device, and collectively send more data than the link can support in a given time. In this case, the frames would wait in the buffer until there in enough available bandwidth on the link to transmit the frame.

There are two types of switches that are commonly used.

- Store and forward switches receive the entire frame into the buffer before transmitting it .This allows a switch to read and calculate a checksum at the end to ensure that the frame is not corrupted.

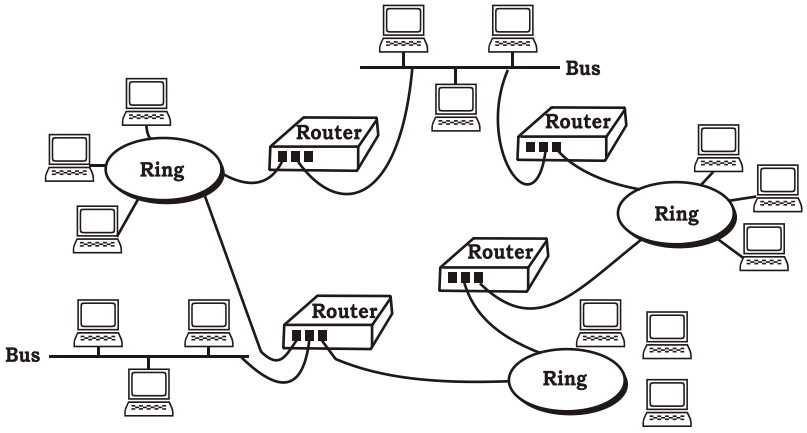
- Cut-through switches read only the destination address field before beginning to transmit. Cut-through switches do forward frames with errors and frame fragments, but are some what faster than store and forward switches.

1.5.4.5 Routers :

Although segregating network segments as helpful, all the devices attached to hubs, bridges, and switches are still in the same broadcast domain, and there are practical limits to the number of devices that can exist in any broadcast domain. So to segregate broadcast domains, routers were created. Routers act as the boundary between broadcast domains. Similar to the way bridge and switches read and act, routers read and make decisions. A router's job is to inspect each packet sent to it and determine if it belongs to the local IP or IPX network or to remote network. If the destination of the packet is a remote network, and the router knows how to reach that network, the router forwards the packet; otherwise the packet is discarded.

Routers are also used almost exclusively to connect remote networks via WAN links, but this is unrelated to the actual function of the routing. It is possible to use bridges or other devices, such as PCs, this is to connect WAN links, but rare.

Routers often use sophisticated algorithms and routing protocols to communicate with other routers to discover the best way to reach remote networks.



1.5.5 DATA TRANSMISSION SPEED

A term used to describe the data handling capacity of communication system is bandwidth. Bandwidth is the range of frequencies that is available for the transmission of data. In case of data transmission, we talk in terms of bits per second. The ASCII code uses 7 data bits per character plus a parity bit. For data communication, additional bits are needs to control the process. Although the number of bits depends

upon the communication system used, commonly encountered systems use a total of either 10 or 11 bits per character. The communication data transfer rate is measured in a unit called baud. In general usage, baud is identical to bits per second. For instance, a rate of 300 baud is 300 bits per second. However, technically baud refers to the number of signal (state) changes per second. Thus, using more sophisticated coding techniques, I baud can represent 2 or even 3 bits per second. But, with most communication systems, I baud represents only one signal change per second and thus is equivalent to 1 bit per second. Depending on their transmission speeds, communication channels (paths) are grouped into three basic categories.

Narrow band or subvoice grade channels range in speed from 45 to 300 baud. They are used for handling low data volumes and are adequate for low-speed devices.

Voice band channels handle moderate data volumes and can transmit data at speed up to 9600 baud. They are so called because their major application is for ordinary telephone voice communication.

Broadband or wideband channels are used when large volumes of data are to be transmitted at high speed. These system provide data transmission rates of 1 million baud or more.

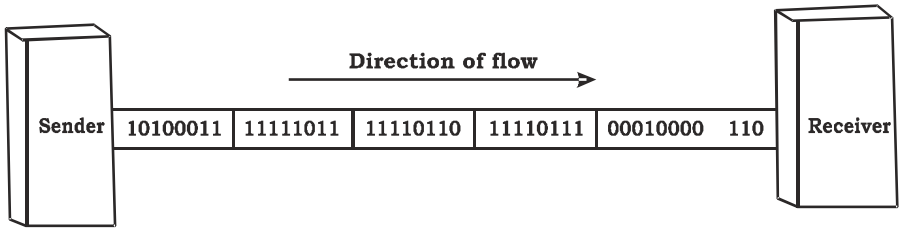
1.5.6 DATA COMMUNICATION MODES

So far, we have discussed a method of transferring information electronically and various aspects involved in it such as, data characters in a computer system are represented using codes such as ASCII or EBCDIC. The exchange of information can take place only if a facility exists to send information from one end, character by character and also to receive it at the other end in the same manner or sequence. Hence we must understand how the characters are transmitted over the transmission medium.

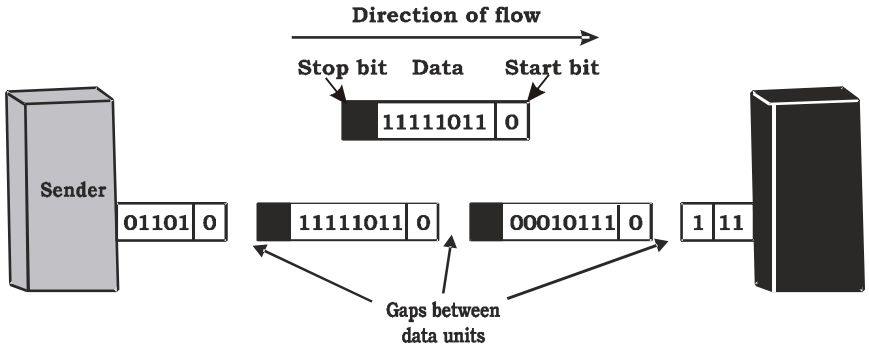
1.5.6.1 Synchronous and Asynchronous Transmission

The mode of transmission is the way in which coded characters are assembled for the process of transmission and permits the receiving devices to identify wheel the coding for each character begins and ends within the torrent of bits. When two computers communicate, they must have a way to synchronise the flow of data so that the receiving computer can read at the same speed at which the sending computer transmits. The principal modes are asynchronous and synchronous. In synchronous transmission characters are transmitted as groups, with control characters in the beginning and at the end of the bit train. The transmission and receiving intervals between each bit are precisely timed permitting the grouping of bits into identifiable characters. In synchronous mode, intervals between characters are uniform with

no space between consecutive bytes. We send bits one after another without start/ stop bit or gap.



Synchronous Transmission



Asynchronous Transmission

In asynchronous transmission, each character is transmitted separately, that is, one character at a time. Each character begins with a start bit, which tells the receiving device where the character coding begins and ends with a stop bit, which tells the receiving device where the character coding ends. Then, the next character is sent, with start and stops bits. The start and stop bits and the interval of time between consecutive characters allow the receiving and sending computers to synchronise the transmission. The parity bit is used for error checking while transmission of data.

Asynchronous communication is slower than synchronous communication; it is typically used at communication rates lower than 2400 bits per second. Asynchronous communication does not require complex and costly hardware as required by synchronous communication and is the mode most widely used with microcomputers.

1.5.6.2 Simplex, Half-duplex, Full duplex Communication

The direction in which information can flow over a transmission path is determined by the properties of both the transmitting and the receiving devices. There are three basic options :

In Simplex mode, the communication channel is used in one direction. The receiver receives the signals from the transmitting device. A typical use is to gather data from a monitoring device at a regular interval. The simplex mode is rarely used for data communication.

In Half-duplex mode, the communication channel is used in both directions, but only in one direction at a time. This requires the receiving and transmitting devices to switch between send and receive modes after each transmission. The analogous example of this mode is the old wireless system (walkie-talkie), which is used in either transmit mode or receive mode.

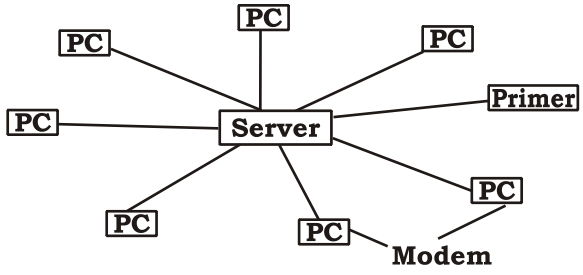
In Full-duplex mode, the communication channel is used in both directions at the same time. Typical example of this mode of transmissions is the telephone in which both parties talk to each other at the same time.

1.5.7 NETWORK TOPOLOGIES

A network is logical extension of data communication system. In a computer network, two or more computers are linked together with carriers and data communication devices for the purpose of communicating data and sharing resources. The term network topology refers to the way in which the nodes of a network are linked together. It determines the data that may be used between any pair of nodes in the network. Although the number of possible network topologies is seemingly limitless, the four major ones are the star network, the ring network, the completely connected network, and the multi access bus network.

1.5.7.1 Star network:

Following fig shows the star arrangement of computer network. In this configuration multiple computers are connected to host computer. The computers in the network are not linked directly to each other and can communicate only via the host computer. The routing function is performed by the host computer, which centrally controls communication between any two computers by establishing a logical path between them.



Advantages

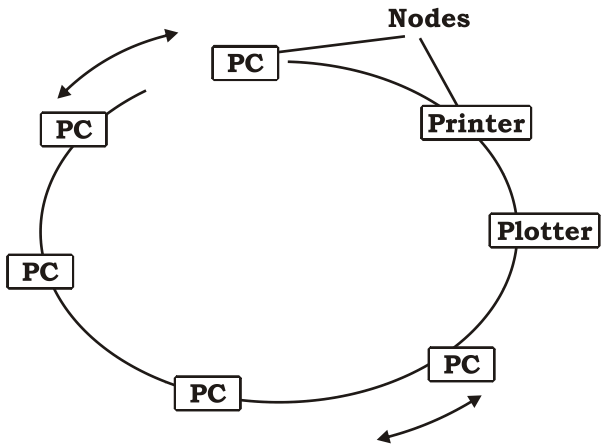
1. Star topology has minimal line cost because only n-1 lines are required for connecting in nodes.
2. Transmission delays between two nodes do not increase by adding new nodes to the 'network because any two nodes may be connected via two links only.
3. If any of the local computer fails, the remaining portion of the network is unaffected.

Disadvantage

1. The system crucially depends on the central node. If the host computer fails, the entire network fails.

1.5.7.2 Token Ring Network :

Following figure shows the circular or ring arrangement of computer network. In this configuration, each computer in the network has communicating subordinates, but within the ring there is no master computer for controlling other computers. A node receives data from one of its two adjacent nodes. The only decision a node has to take is whether the data is for its own use or not. If it is addressed to it, it utilizes it. Otherwise, it merely passes it on to the next node.



Signals travel in both directions in newer ring networks

Advantages:

1. The ring network works well there is no central site computer system.
2. It is more reliable than star network because communication is not dependent on a single host computer. If a link between any two computers breaks down, or if one of the computers breaks down, alternate routing is possible.

Disadvantages

1. In a ring network, communication delay is directly proportional to the number of nodes in the network.
2. The ring network requires more complicated control software than star network.

1.5.7.3 Completely Connected Network (Mesh) :

The completely connected network has a separate link for connecting each node to any other node. Thus, each computer of such a network has a direct dedicated link, called point to point link, with all other computers in the network. The control is distributed with each computer deciding its communication priorities.

Advantages

1. This type of network is very reliable as any link breakdown will affect only communication between the connected computers.
2. Each node of the network need not have individual routing capability.
3. Communication is very fast between any two nodes.

Disadvantage

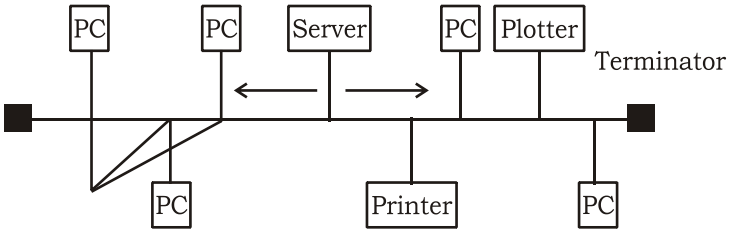
1. It is the most expensive network from the point of view of link cost. If there are n nodes in the network, then (n-l)n/2 links are required. Thus, the cost of linking the system grows with the square of the number of nodes.

1.5.7.4 Partial Mesh :

To connect all devices, to all other devices, we need n (n-l)/2 connections. It is very costly affair. A common compromise is called partial mesh. In a partial mesh, we simply remove some of the links.

1.5.7.5 Multi-access Bus network :

In this type of network, a single transmission medium is shared by all nodes. That is, the computers are attached to the same communication line. When a particular computer wants to send a message to another computer, it appends the destination address to the message and checks whether the communication line is free. As soon as the line becomes free, it broadcasts the message on the line. As the message travels on the line, each computer checks whether it is addressed to it. The message is picked up by the addressee computer, which sends an acknowledgment to the source computer and frees the line. This type of network is also multipoint or multidrop or broadcasting network. It is appropriate for use in local area network where a high speed communication channel is used and computers are confined to a small area. It is also appropriate when satellite communication is used as one satellite channel may be shared by many computers at a number of geographical locations.



Advantages

1. The main advantages of multi access bus network is the reduction in physical lines.
2. The failure of a computer in the network does not affect the network functioning for other components.
3. Addition of new computers to the network is easy.

Disadvantages

1. All computers in the network must have good communication and decision making capability.
2. If the communication line fails, the entire system breaks down.

1.5.7.6 Hybrid Network :

Different networks have their own advantages and limitations. Hence in reality, a pure star or ring or completely connected network is rarely used. Instead, an organization will use some sort of hybrid network, which is a combination of two or more different network topologies. The exact configuration of the network depends on the needs and the overall organization structure of the company involved.

1.5.8 DATA TRANSMISSION MEDIA

There are several types of communication media (physical channels) through which data can be transmitted from one point to another. Some of the most common data transmission mediums are briefly described below.

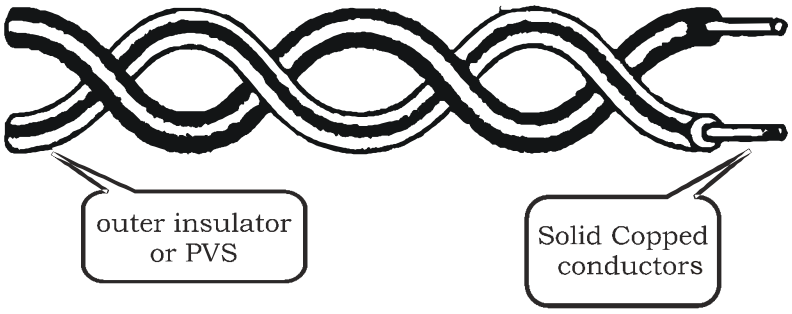
1.5.8.1 Twisted-Pair Wire

A twisted pair wire consists of two bunches of thin copper wires, each bunch enclosed separately in a plastic insulation, they twisted around each other to reduce interference by adjacent wires. It is also called unshielded twisted pair (UTP_cable because other than the plastic coating around the two individual bunches of copper wires, nothing shield it from outside interference.

UTP cables are commonly used in local telephone communication and short distance digital data transmission. They are normally used to connect terminals to the main computer if they are placed at a short distance from the main computer. Data transmission speed of up to 9600 bits per second can be achieved if the distance is

not more than 100 meters. However, for longer distance data transmission, local telephone lines are used. In this case typical speed of digital transmission is 1200 bits per second.

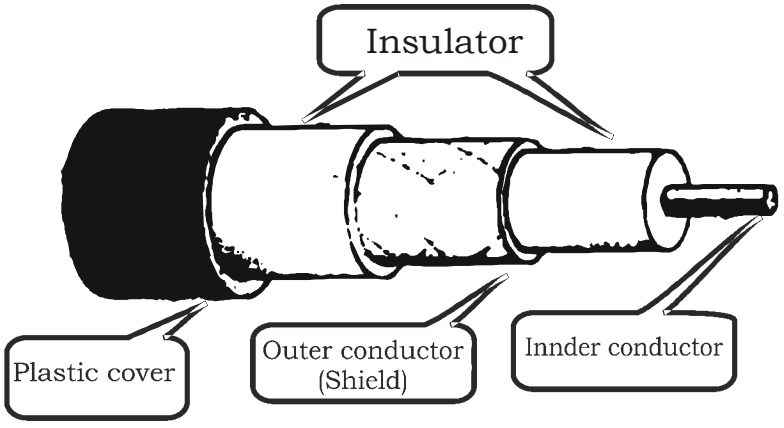
UTP cables are an inexpensive medium of data transmission. They are easy to install and use. However, their use is limited because they easily pick up noise signals, which results in high error rates when the line length extends beyond 100 meters.



1.5.8.2 Coaxial Cable

Coaxial cables are groups of specially wrapped and insulated wire lines that are able to transmit data at high rates. They consist of central copper wire surrounded by PVC installation over which a sleeve of copper mesh is placed. The metal sleeve is again shielded by an outer shield of thick PVC material. The signal is transmitted by the inner copper wire and is electrically shielded by the outer metal sleeve.

Coaxial cable offer much higher bandwidth than UTP cables and are capable of transmitting digital signals at rates of 10 mega bits per second. They are extensively used in long distance telephone lines and as cables for cable TV. They are also used by telephone companies to transmit data. In many cases, several coaxial cables are packaged into very large cable that can handle over 40,000 telephone calls simultaneously. Furthermore, coaxial cables have much higher noise immunity and can offer cleaner and crisper data transmission without distortion or loss of signal.



1.5.8.3 Microwave System

Another popular transmission medium is microwave. This is a popular way of transmitting data since it does not incur the expense of laying cables. Microwave system use very high frequency video signals to transmit data through space. However, at microwave frequencies, the electromagnetic waves cannot bend or pass obstacles like hill. Hence it is necessary that microwave transmission be in a line-of sight. In other words, the transmitter and receiver of microwave system which are mounted on very high towers, should be in a line-of-sight. This may not be possible for very long distance transmission. Moreover, the signals became weaker after travelling a certain distance and require power amplification.

In order to overcome the problem of line-of-sight and power amplification of weak signals, microwave system use repeaters at intevals of about 25-30 kms in between the transmitting and receiving stations. The first repeater is placed in line-of sight of the transmitting station and last repeater is placed in line-of-sight of the receiving station. Two consecutive repeaters are also placed in line-of sight of each other. The data signals are received, amplified, and retransmitted by each of these stations. Microwave system permit data transmission rates of about 16 giga bits per second. It can carry thousands of voice channels at the same time. The link can support 25,000 channels. The initial installation cost of microwave links being very high, they are mostly used to link big cities with heavy telephone traffic between them.

1.5.8.4 Communication Satellite

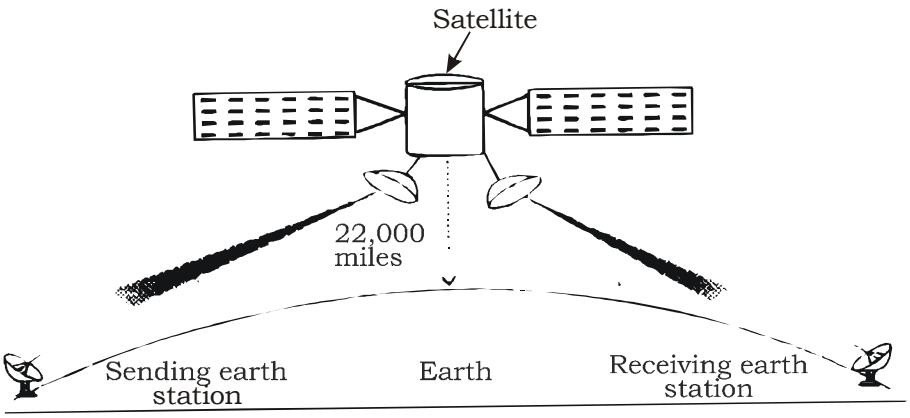
The main problem with microwave communication is that the curvature of the earth, mountains, and other structures often block line-of sight. Due to this several repeater stations are normally required for long distance transmission, which increases the cost of data transmission between two points. This problem is overcome by satellites, which are relatively newer, and more promising data transmission media.

In satellite communication, microwave signal at 6GHz or 14GHz is transmitted from a transmitter on earth to the satellite positioned in space. By the time this signal reaches the satellite, it becomes weak due to 36,000 kms travel. A transponder mounted on the satellite amplifies the weak signal and transmits it back to the earth at a frequency of 4GHz or 11 GHz. This signal is received at receiving station on the earth. It may be noted that the transmission frequency is different from the transmission frequency in order to avoid the interference of the powerful retransmission signal with the weak incoming signal.

A transponder can typically support 1200 voice channels each of 4800 bps or 400 digital channels each of 64 kbps data transmission rate. A satellite has many transponders. Therefore, a single satellite has enormous data communication capability. The use of 4GHz band of frequencies for transmission and retransmission

of microwave signals in a satellite communication system is called C-band transmission. On the other hand, the use of 11 GHz to 14 GHz band of frequencies is called the K_u - band transmission.

In order that large number of users can benefit from satellite communication, it was realized that the size and cost of the receive-transmit earth stations has to be considerably reduced so that one can easily install a private earth station. To meet this requirement, smaller dish antennas having lower power transmitters and receivers have been built for installation at user's sites. These dish antenna systems are popularly known as *VSAT* (Very Small Apertue Terminals).The aperture refers to the diameter of the dish antenna, which is about 1 to 2 meters.



1.5.8.5 Optical Fibers

Optical fibers are hair-thin threads of glass or plastic that can serve as a data transmission medium as copper wires or coaxial cables. The basic difference is that optical fibers transmit light signals instead of electrical signals. Because light travels much faster than electricity, optical fibers can transmit data at much higher speed than copper wires or coaxial cables, and also with no significant loss of intensity over very long distances.

Optical fibers are made of glass, plastic or silica, Plastic fibers are least efficient, but tend to be cheaper and more rugged. Glass or silica fibers are much smaller, and their low attenuation makes them very suited for very high capacity channels. Physically, a fiber-optic cable consists of three concentric layers- the inner core, a cladding around it, and the outer protective coating. The inner core, which has a diameter of 8 to 200 micrometers, consists of a bunch of optical fibers. The cladding around it is made of plastic or glass and has refractive index less than that of the core. The characteristics of light propagation depend primarily on the fiber size, its

construction, the refractive index profile, and the nature of light source. The outer protective coating is made up of plastic.

The main components of an optical fiber communication are follows. Towards its source side is a converter that converts electrical signals into light waves. The converter uses either a light-emitting diode (LED) or a laser diode to convert electric signals into light signals. These light waves are then transmitted over the optical fiber to the receiver's end. At the receiver's end, another converter is placed that detects the light waves and converts them back to electrical signals. It uses photoelectric diodes for this purpose. These electric signals are then amplify using an amplifier and sent to the receiver.

1.5.9 SELF-CHECK EXERCISE :

Q.1. Discuss the various network topologies. Write down their advantages and disadvantages.

Q.1. What are the various modes of data communication.

1.5.10 SUGGESTED READINGS :

1. Andres S Tanenbaum, "Computer Networks"
2. ED Tittel, "Computer Networking"
3. William Stallings, "Data Communications"

NETWORK MEDIA AND TYPES

Structure of the Lesson

1.6.1 Introduction
1.6.2 Network Concept and Classification
1.6.3 Local Area Network
1.6.3.1 LAN Topology
1.6.3.2 LAN Access Method
1.6.3.3 LAN Hardware
1.6.3.4 LAN Software/Operating Systems
1.6.4 Wide Area Network
1.6.4.1 Communication Switching Techniques
1.6.4.2 WAN Devices/Hardware
1.6.4.3 Types of Wide Area Networks
1.6.5 Metropolitan Area Network (MAN)
1.6.6 Intranet
1.6.7 Self check Exercise
1.6.8 Suggested Readings

OBJECTIVES : This lesson will make the learner familiar with the various network types and intranets.

1.6.1 INTRODUCTION

Today, Computer networks form the backbone of most enterprises big or small around the world. Computer networks allow people remote to the computer to access the information available to that computer. Computer networks are being used to provide resource sharing between systems separated from a few feet to thousands of kilometers. This technology is leading many corporations to take advantages of the reduced price and increased performance in the workplace. In this lesson we will discuss networking and how it plays an important role in information exchange. Impact of networking be it LAN or WAN and data communication has been felt across the globe, in various sectors such as education, medicine, transport, etc. This trend of information sharing in most sophisticated manner has completely revolutionised the concept of communication. It brings with it increased access to people in different fields.

1.6.2 NETWORK CONCEPT AND CLASSIFICATION

Communication using computer has brought a revolution in the world of Information Technology, particularly in the field of personal computer. We have always heard of

networking or the term network. A network is a way or means of transmitting or receiving (exchange) information from one or more sources.

As an example, car salesmen, after years in the business, have developed a network of associates. When the car salesman need to locate a car to make a sale, the car salesman calls out to his network to retrieve information on the location of the car. Employment agents also develop a network". Their customers become their networks. Employment agents will frequently keep in touch with their clientele for possible openings or to locate a candidate for an opening. Without the capability of networking, these two people would have a difficult time. It is the same in computing. Networks provide the means for locating and transporting information.

In computing networks, the origin of the information request utilises the services of a network to locate and return the information. This is done with addresses. In the two previous examples of the car salesman and the employment agent, a telephone number can be considered the address of their associate or client. Addresses in computer networking are used in the same manner. These addresses identify the network resource. There are two popular architectures for networking-hierarchical and peer.

Peer networking does not need pre-defined network addressing. Instead, each resource on the network is seen as a peer. Each network resource is a peer to the other network resources. When a new network resource joins the network it introduces itself and notifies its peer of any other network resources that it knows about - peer networks are open and share network information.

The entire computer network can be classified into three board categories.

(a) LAN (Local Area Network)

(b) WAN (Wide Area Network)

(c) MAN (Metropolitan Area Network)

1.6.3 LOCAL AREA NETWORK (LAN)

As number of systems grows within an organisation, a need is felt for sharing expensive resource and exchanging data and information between systems. This need of information exchange and resource sharing within an organisation has resulted in development of Local Area Network or LAN.

A LAN is a data communication network, which connects many computers or workstations (computers terminal, printer etc. and permits exchange of data and information among them, within a localised area, typically confined to a building, or a cluster of buildings. The distance between two communication points connected on the same LAN channels, is usually upto 02-05 kms.

LANs are not rigidly defined but tend to share most of all of the following characteristics :

(a) All the connected devices in the network share the transmission media.
(b) Each device connected in the network can either operate standalone or in the network.
(c) Area covered is small.
(d) Data transfer rates are high, usually 1 Mbps-100. (Million of bits per second)

1.6.3.1 LAN Topology

A network topology refers to the physical layout of the network in which all the devices are connected. This includes all the hardware that makes up the network. The points of connection to the network by the stations are called Nodes or link stations. There are several types of topographical design and strategies used to implement LAN. The majority of these are based on three types of topologies :

Star Topology
Bus Topology
Ring Topology

1.6.3.2 LAN Access Method

A discipline must be imposed on devices connected to the network to ensure a controlled access to the media. Access methods are the means or ways by which stations actually gain the use of the common channel to transmit messages. The right to transmit is an issue only in broadcast where workstations share a single channel.

Many techniques have been proposed, but two of these are commonly used.

(i) Carrier-Sense Multiple Access with Collision Detection (CSMA/CD)
(ii) Token passing

CSMA/CD

CSMA/CD access method is used with bus networks. The bus operates in a Multiple Access (MA) mode. A node is allowed to transmit on the bus, if it senses that the medium is free (carrier sense). Occasionally two or more nodes may simultaneously sense that the medium is free and begin to transmit. This creates a collision, as the contents of transmitted information frames will collide resulting in corruption of the information frame. This collision is detected (collision detect) by the transmitting node. The two (or more) nodes involved then wait for a further short random time interval before trying to retransmit a frame once again.

Token Passing

Another way of controlling access to a shared medium is by the use of a control (permission) token. The control token is passed from one node to another according to a defined set of rules understood and adhered to by all nodes. A node may transmit a frame when it is in possession of the token and after it had transmitted the frame, it passes the token to the next device in a predetermined sequence.

In token passing, a logical ring to all nodes connected to the physical medium is first established and a single token is generated; the control token passes from one node to another traversing the logical ring. The token keeps on circulating the logical ring until it is received by a node waiting to send an information frame. After receipt of the token, waiting station transmits the waiting frames on the physical medium after which it passes the control token to the next node in the logical ring.

For token passing, the physical medium need not be a ring topology; it can be used to control access to a bus network also.

1.6.3.3 LAN Hardware

As we have seen so far, to realise a LAN process, several functions are to be performed. These are so specialised in nature that they require hardware specially built for such purpose. Here we will discuss briefly the basic hardware components of LAN, these are :

(a) Transmission Channel

The transmission channel may be simplex, half duplex or full duplex.

(b) Network Interface Units (NIU)

Network interface units connect each device in the LAN network to shared transmission device. It contains the rules or logic to access the LAN. NIU is also used to implement LAN protocols and for device attachments. Its function depends on the type of topology used in LAN. In microcomputers, NIU may be installed as an add-on card.

(c) Servers

One of the major benefits of implementation of LAN is sharing expensive resources such as storage devices, printer etc. This is achieved through providing servers on the LAN. It is a dedicated computer, which control one or more resources. This contains both hardware and software interface for LAN. Three major categories of servers used in LANs are :

(i) File Server
(ii) Printer Server
(iii) Modem Server

In a networking file server is used to share storage space for files, Besides providing storage space for files in a LAN environment, it is used for taking periodical backup, and also to provide gateway to other servers within and between LANs. Similarly printer server is used to handle printing works of all workstation connected in the network In LAN environment also modem is required to get connected to other network or simply to use a telephone. A modem server is used to share few telephone lines and modems by all connected workstations in a network.

1.6.3.4 LAN Software/Operating System

As the name suggests, LAN Operating System is required to operate on the LAN system, manage the tremendous work load with a number of various types of server attached to it. It has basically two aspect (i) Server software (ii) workstation software. As in case of other multi-user operating systems, LAN operating system also facilitates the sharing of expensive resources such as printer, storage space etc. among all LAN users provides security for data and permits connection to other networks. There are various types of LAN operating system for example Novel Netware. WINDOWS NT, etc.

1.6.4 WIDE AREA NETWORK

As the name suggests, WAN spread across countries and continents, satellites being one of the transmission media. A Wide Area Network or WAN, is a network that links separate geographical locations. A WAN can be a public system such as the Public Switched Telephone Network (the PSTN) or one of the various packet switched services provided by the public telecommunication authorities. WANs can also use most other types of circuit including satellite networks, ISDN, Value Added Networks (VANs/ VADs).

The network can be a private system made up from a network of circuits leased form the local Telephone Company or set up using public systems as virtual private networks. A Virtual Private Network is one which operates in the same way as a private network but which uses public switched services for the transmission of information.

The main distinguishing feature between a WAN and LAN is that, the LAN is under the complete control of the owner, whereas the WAN needs the involvement of another authority like the Telephone Company. LANs are also able to handle very high data transfer at low cost because of the limited area covered. LANs have a lower error rate than WANS.

1.6.4.1 Communication Switching Techniques

In WAN, two computing devices are not directly connected. A network of switching nodes provides a transfer path between the two devices. The process of transferring data blocks from one node to another is called data switching. There are three switching techniques commonly employed, and these are :

Circuit Switching

In circuit switching there is a dedicated communication path between the sending and receiving devices. The dedicated path is a connected sequence of links between switching nodes. A conventional telephone network, where a dedicated path is set

between the caller and the caller party for the duration of a telephone call is an example of circuit switching.

Communication viz. circuit switching involves three steps : Circuit establishment; data transfer; and circuit termination.

Circuit switching is mainly used for voice telephone network, but is not all that effective for data communication networks, as channel capacities are not fully utilised, as data communication equipments do not generate data continuously.

Message Switching

Message switching is an alternative switching technique, where it is not necessary to establish a dedicate path between the sending and receiving devices. In Message Switching, the sending device appends the destination address to the message and passes it to the network; the message is then passed through the network from one node to another till it reaches the intended destination. Each switching node receives a message, stores it briefly and then transmits it to the next node. Examples of a message are electronic mails, computer files, telegrams and transaction queries and responses. A complete exchange may consist of several messages. The basic disadvantage of message switching is the variable delay at intermediate switching nodes.

Packet Switching

Packet Switching combines the advantages of message and circuit switching. Packet Switching is functionally similar to message switching, in which data is transmitted in block, stored by the first switching node it meets in the network and is forwarded to the next and subsequent downstream nodes until it reaches the destination. The length of data block is limited in a packet switching network. Typical maximum length of packets is between 128 bytes to 4096 bytes. There are two approaches to packet switching.

* Datagram
* Virtual circuit

In datagram approach, each packet is treated independently and may follow a different path through the network. Packets may be re-ordered, dropped or delivered in wrong sequence. The communication protocols provide the error recovery and sequencing of packets at the receiving device.

In virtual circuit approach, a fixed logical path, through the network from the sender to the receiver is established before any packets are sent. This path remains unchanged for duration of the session. This is quite like circuit switching, but no resources are reserved along the path. Packets are buffered at intermediate nodes awaiting transmission.

1.6.4.2 WAN Devices/Hardware

The switching techniques utilise the routing technology for data transfer. Routing is responsible for searching a path between two computing devices that wish to communicate and for forwarding the data packets on this path. Devices such as bridges, router and gateways provide this routing function.

While discussing the WAN devices we referred to X.25; what is it? X. 25 is a set of recommendation by International Telegraph and Telephone Consultative Committee for packet switched network. You can refer to further readings for more details.

1.6.4.3 Types of Wide Area Networks

The essential purpose of Wide Area Networks, regardless of the size or technology used, is to link separate locations in order to move data around. A WAN allows these locations to access shared computer resources and provides the essential infrastructure for developing widespread distributed computing systems. We will now discuss the different types of WAN, which are commonly used.

Public Networks

Public Networks are those networks which are installed and run by the telecommunication authorities and are made available to any organisation or individual who subscribe it. Examples include Public Switched Telephone Networks (PSTN), Public Switched Data Networks (PSDN), Value Added Services (VANs/VADs) and the Integrated Services Digital Networks (ISDN). We would be discussing the main features of these services.

Public Switched Telephone Network (PSTN)

The features of the PSTN are its low speed, the analog nature of transmission, a restricted bandwidth and its widespread availability. As PSTN is designed for telephones, modems are required when it is used for data communication.

The PSTN is most useful in wide area data communication systems as an adjunct to other mechanisms. It is seldom advisable to use PSTN as the sole communications medium for building a network system. Costs are high, as data connections last for a considerable time. Also, the links set up are unreliable and can terminate without warning.

PSTN connections are usually easy to obtain at short notice, and are widely available and cover almost every location where people live and work. PSTN is most useful for occasional user or as backup to private circuits. It is also used for facsimile (FAX) machines.

Public Switched Data Networks (PSDN)

The term PSDN covers a number of technologies, although currently it is limited to Public Packet Switched Networks available to the public. The main features of all

PSDNs are their high level of reliability and the high quality of the connections provided. They can support both low and high speeds at appropriate costs.

Like the PSTN, a PSDN is very useful and adjunct to a private network for backup and occasional access purposes. It can also be used to link computer systems and networks of one organisation to several other organisations. PSDN is very popular for connecting public and private mail systems to implement electronic mail services with other companies.

Value Added Services (VANs/VADs)

In Value Added Services, the provider of such services must process, store and manipulate the data that is carried on the network, that is, add value to it. The technique can be used in specific types of business in which it is advantageous to be able to share information with other companies in the same line.

Electronic Data Interchange (EDI) is one area for Value Added Services in which two trading partners exchange trading documents such as purchase orders, invoices, transportation etc. using electronic means. In India, Videsh Sanchar Nigam Ltd. is a service provider.

Integrated Services Digital Network (ISDN)

The ISDN is a networking concept providing for the integration of voice, video and data services using digital transmission media and combining both circuit and packet switching techniques. The motivating force behind ISDN is that telephone networks around the world have been making a ion towards utilising digital transmission facilities for many years.

Users in shops or small offices can use their digital connection to Telephone Company for transmitting both voice and data over the same twisted pair cable which connects their telephone. As information from the telephone/PC/ Stereo/TV/PABX are all seen as bit streams by the networks switch, they can be switched and transported by the same network.

Private Networks

The basic technique used in all forms of private WAN is to use private (or more usually leased) circuits to link the locations to be served by the network. Between these fixed points the owner of the network has complete freedom to use the circuits in any way they want. They can use the circuits to carry large quantities of data or for high speed transmissions.

1.6.5 Metropolitan Area Networks (MANs)

A Metropolitan Area .Network (MAN) is one of a number of types of networks. A MAN is a relatively new class of network. There are three important features which discriminate MANs from LANs or WANs.

The network size falls intermediate between LANs and WANs. A MAN typically covers an area of between 5 and 50km diameter. Many MANs cover an area the size of a city, although in some cases MANs may be as small as a group of buildings or as large as the city.

A MAN is not generally owned by a single organisation. The MAN, its communications links and equipment are generally owned by either a consortium of users or by a single network provider who sells the service to the users. This level of service provided to each user must therefore be negotiated with the MAN operator, and some performance guarantees are normally specified.

A MAN often acts as a high speed network to allow sharing of regional resources (similar to a large LAN). It is also frequently used to provide a shared connection to other networks using a link to a WAN.

A typical use of MANs to provide shared access to a wide area network.

Some technologies used for this purpose are ATM **(Asynchronous Transfer Mode),**FDDI **(fiber-distributed data interface)** and SMDS **(Switched Multimegabit Data Service).** These older technologies are in the process of being displaced by Ethernet-based MANs (e.g. Metro Ethernet) in most areas. MAN links between LANs have been built without cables using either microwave, radio, or infra-red, free-space optical communication links.

DQDB, Distributed Queue Dual Bus, is the Metropolitan Area Network standard for data communication. It specified in the IEEE 802.6 standard. Using DQDB, networks can be up to 30 miles long and operate at speeds of 34 to 155 Mbit/s.

1.6.6 Intranet

An Intranet is a communication infrastructure. It is based on the communication standards of the Internet and the content standards of the World Wide Web. Therefore, the tools used to create an Intranet are identical to those used for Internet and Web applications. The distinguishing feature of an Intranet is that access to information published on the Intranet is restricted to clients in the Intranet group. Historically this has been accomplished through the use of LANs protected by Firewalls. Like the Internet itself, intranets are used to share information. Secure intranets are now the fastest growing segment of the Internet because they are much less expensive to build and manage than private “networks based on proprietary protocols.

Tangible benefits of an intranet

Why build a corporate intranet? Developers will tell you because we can. A better answer is that it is an effective tool to combat the waste of time, effort and materials within an organization at the same time generating new opportunities for collaboration and productivity. For the first time, an organization has the ability to

put one, open standards, thin client (the Web browser) as the interface to their corporate data and business processes.

The tangible benefits, those that executives can wrap their arms around, of intranet creation can be summarized below. A good example of a tangible benefit is the reduction in paper cost from moving processes online.

Tangible Benefits

- Inexpensive to implement
- Easy to use, just point and click
- Saves time and money, better information faster
- Based on open standards
- Scaleable and flexible
- Connects across disparate platforms
- Puts users in control of their data

Intangible benefits of an intranet

It is not only the removal of paper that leads to organizational benefit. What is done with that information in this new Web-enabled environment has a huge impact. Intranets allow an organization to spend less time on things that bring no value such as chasing down the right information to solve a problem.

Productivity increases as corporate knowledge is more accessible and the data is more accurate. Flexibility in time of delivery of knowledge is gained as information is always a click away. Intranets allow for a place where boundaries are lowered and information exchange is encouraged. This leads to more informed employees with the ability to make better, faster decisions. This in turn leads to better productivity and more time for revenue generation.

Intangible Benefits

- Improved decision making
- Empowered users
- Builds a culture of sharing and collaboration
- Facilitates organizational learning
- Breaks down bureaucracy
- Improved quality of life at work
- Improved productivity

An intranet uses TCP/IP, HTTP, and other Internet protocols and in general looks like a private version of the Internet. With tunneling, companies can send private messages through the public network, using the public network with special encryption/decryption and other security safeguards to connect one part of their intranet to another. Typically, larger enterprises allow users within their intranet to

access the public Internet through firewall servers that have the ability to screen messages in both directions so that company security is maintained.

TCP/IP (Transmission Control Protocol/Internet Protocol) is the basic communication language or protocol of the Internet. It can also be used as a ommunications protocol in a private network). When you are set up with direct access to the Internet, your computer is provided with a copy of the TCP/IP program just as every other computer that you may send messages to or get information from also has a copy of TCP/IP.

HTTP (Hypertext Transfer Protocol) is the set of rules for transferring files (text, graphic images, sound, video, and other multimedia files) on the World Wide Web. As soon as a Web user opens their Web browser, the user is indirectly making use of HTTP. HTTP is an application protocol that runs on top of the TCP/IP suite of protocols (the foundation protocols for the Internet).

Tunneling, also known as "port forwarding," is the transmission of data intended for use only within a private, usually corporate network through a public network in such a way that the routing nodes in the public network are unaware that the transmission is part of a private network. Tunneling is generally done by encapsulating the private network data and protocol information within the public network transmission units so that the private network protocol information appears to the public network as data. Tunneling allows the use of the Internet, which is a public network, to convey data on behalf of a private network.

A **firewall** is a set of related programs, located at a network gateway server that protects the resources of a private network from users from other networks. (The term also implies the security policy that is used with the programs). An enterprise with an intranet that allows its workers access to the wider Internet installs a firewall to present outsiders from accessing its own private data resource's and for controlling what outside resources its own users have access to. Basically, a firewall, working closely with a router program, examines each network packet to determine whether to forward it toward its destination. A firewall also includes or works with a proxy server that makes network requests on behalf of workstation users. A firewall is often installed in a specially designated computer separate from the rest of the network so that no incoming request can get directly at private network resources.

1.6.7 SELF CHECK EXERCISE

Q.1 Write a detailed note on LAN.

Q.2 List down the various types of WAN.

1.6.8 SUGGESTED READINGS

1. Andrew S Tanenbaum, "Computer Networks."
2. ED Titel, "Computer Networking."
3. William Stallings, "Data Communications."

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