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Resource Sharing and Networking: An Overview

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Abstract:

Resource sharing is a method of overcoming the limitations of the individual libraries in respect of their resources by way of co-operation and coordination among the participating libraries. On demand, each participating library should voluntarily come forward to share its existing resources with the other participating libraries. Thus, in this system, each library is both a giver and a receiver. There is, thus, an imperative need to develop a spirit of co-operation among the librarians, information scientists and documents lists. This spirit of sharing the resources would entail the participant libraries in a system to benefit for advancing their individual goals and objectives.

Resource sharing implies sharing of library resources by participating libraries among themselves on the basis of mutual co-operation. This can be implemented in the areas of documents, manpower, facilities, services, building, space or equipment. The advantage of this cooperative venture is that the users of participating libraries can make use of the resources of not only his own libraries but also those of all the other participating libraries. Thus the total collection of all the participating libraries will be accessible to their users. In a way, libraries can improve their library collection and extend their library and information services to a larger user community.

1. Resource Sharing-Meaning

Resource sharing is nothing but sharing of library resources by the participating libraries among themselves on the basis of the principle of co-operation.

In such a co-operative venture, it becomes possible for a user in any of the participating libraries to make use of the resources of not only his library but also the resources of others. Thus, through a resource sharing consortium, libraries can improve the total collection of reading material, consolidate their technological capabilities, improve their dissemination tools and extend their information services to a larger user community. As per Kent, the objective behind resource sharing is "obviously to make the greatest amount of best information available to the most users at the most reasonable cost possible." According to him, resource sharing denotes a mode of operation whereby, functions share in common with a number of libraries (Sujatha, 1999).

The philosophy of resource sharing is "Each for all and all for each".

2. Need for Resource Sharing

Resource sharing is considered necessary due to the following reasons:

- Recorded information and knowledge should be treated as a human resource to be shared by all - an ideal that can be met only through resource sharing of library system/networks that link "collection in the region, state, nation and the world".
- Even the larger communities are not sufficiently large and wealthy to support fully adequate library services by themselves: no library can stand alone in this age of networking and co-existence.
- There has been an explosion of information and the number of publications has increased enormously. This has posed serious problems. The information requirements of the user are becoming more and more diverse and complex. The dormant or depleting budget also threatens the libraries. Time delay is also one of the factors. Allen Kent points out the three impossibilities caused by information explosion:
 - The physical impossibility, that no individual scientist or scholar in any field can read and remember all the literature that has a reasonable probability of being useful or interesting at an unspecified later time;
 - The economic impossibility, that no individual or his organization can process for later exploitation, a major part of the literature that exhibits probable pertinent interest; and
 - The mechanized impossibility that the traditional library tools cannot cope efficiently with the detailed requirement of research workers, for information of specified relevance.

Resource sharing plays an important role in removing these impossibilities.

- D. Information technology is complex, specialized and costly and the rising cost of conventional library operations requires that information activities develop co-operative arrangements.
- E. It is only through library co-operation and resource sharing, that we can ensure rapid, effective improvement/extension of library resources to more people on a more fair/direct basis.
- F. The unsystematic and unintegrated library development often leads to wastage, duplication, and the inefficient use of the total knowledge resource.
- G. Many libraries have long been wastefully duplicating effort, performing repetitive processing, storing similar materials beyond those required to meet local everyday demands and giving incomplete or limited information/materials to the public because of lack of centralized services (ex: shared cataloguing, co-operative purchasing, and reference referral). The co-operative, time-shared, multi-institutional approach to computer usage would be the most efficient, cost-effective solution, for computer installations in the nation-wide network would carry out such vital functions.
- H. Increase of students, scholars and teaching staff in colleges have led to increase in the user population of the college libraries. Due to the increase in users' demand for diversified information, the libraries are prompted to investigate ways and means for wider range of services and collections. Resource sharing offers practical solutions to these problems.
- Users in the libraries have become more and more information-conscious and demanding more effective, quality library services. The very concept of library has undergone a great transformation. Free flow and availability of information is the user's need. The CAI (Current Awareness of Information) and SDI (Selective Dissemination of Information) repackaging would not be possible unless libraries share resources. Also, disciplinary inter-dependence calls for diverse collections of the variety of disciplines which is not within the capacities and competence of a single library.
- J. Increase in publishing output necessitates large intake in libraries to update their collection. This needs a large space to house the collections. Obsolescence of knowledge also calls for weeding of collection. Co-operative acquisition, storage and services can eliminate the problems of space, balanced collection building, efficient services, etc.
- K. Research institutions, universities, colleges, industrial and commercial organizations and other academic institutions are responsible for knowledge generation. India, nearly accounting for 15% of world's population (6.8 billion as per 2009 censuses) barely accounts for 3% of the world's book titles.

To overcome all the above problems, resource sharing offers a practical solution.

3. Resource Sharing -Planning and Procedures

For the working of a successful resource sharing programme, certain steps have to be taken and procedures are to be developed and practiced.

The first step would be to identify all the libraries subscribing to the programme. Then, an authority to control the programme is to be formed. Normally, this body is composed of members nominated by the member libraries.

To make a resource sharing programme effective and realistic, ample funds are needed. These are normally provided by the State Government and the University Grants Commission and to some extent by the participating libraries.

It is important to identify what resources are to be pooled for the sharing programme. It is more important to identify the resources which are not available for sharing. It is vital that shared and co-operative cataloguing of books should be undertaken. It is also absolutely vital that firm steps and procedures are established to ensure delivery and return of material in time.

3.1. Basic Agreements

Several basic agreements which bind the participating libraries are essential in order to operationalise a resource sharing system.

- First, obviously, is the agreement to share currently owned materials (i.e., to permit access to the holdings among partners) with protocols, limitations and priorities carefully spelled out. The agreement should provide for an independent administration of resource sharing, but one which does not emasculate the goals and missions of the co-operating libraries. Funding should be based on an obligation for long-term support to permit the benefits to develop; the financial agreement should permit individual libraries to withdraw, but constrained to avoid disturbance of the system.
- Secondly, there should be agreement on acquisition policies, both to ensure consistent development of holdings and to avoid redundancy when this is judged jointly to be unproductive.
- Thirdly, there should be agreement on bibliographic control. Best is standardization, so that users of each participating library may have a consistent means of accessing the catalogue of others. If standardization is not feasible, then the second best is the provision of adequate training for users and/or access to the local reference staff to provide aid in locating materials.
- Fourthly, there should be an agreement on building up specialized collections in each participating library. A decision shall be taken jointly by the librarians whereby, each agrees to spend more money on building certain specialized collection and thereafter, sharing these collections with others.

Other necessary agreements include definition of loan periods and renewals, procedures for earlier return of materials if needed, payment for lost materials, preparation of union catalogues and other 'house-keeping' (or book-keeping) chores.

Common protocols should be developed through agreement, to enable the smooth functioning of the sharing venture.

4. Forms of Resource Sharing

Resource sharing can take various forms. Resource sharing can be found in the form of Inter-Library Loan, Co-Operative Acquisition; Co-operative Storage, Co-Operative Processing, Union Catalogue, Co-Operative Delivery of Services, Exchange of Personnel and Training Facilities, Clearing House Functions, Technical Process etc.

4.1. Inter-Library Loan

Reynolds defined Inter-Library Loan System as follows:

"It is a technique by which, one library lends its materials to any individual reader through another library".

Generally, a library and its borrower are directly related. Through an Inter-Library Loan, a library is related to its reader indirectly, through another library. By an indirect method, a library is, broadening its readership. By the same indirect method, a reader is increasing his bibliographic reach.

Inter-Library Loan Service is the most important concept to be considered in a successful resource sharing venture. The success of a sharing venture depends largely on the efficiency, efficacy and speed of one participating librarian in lending to another participating librarian. Coming to physical entities, each participating library should possess at least one copying machine.

Though the participating libraries agree in principle, to share whatever material they have, this is not always possible in practice. Any restrictions and hindrances should be identified and ways and means be found, to over-come the same. Such overcoming of restrictions would result in a successful resource sharing/network through Inter-Library Loan.

There has been a steep increase in the cost of books and rates of subscription of serials. So, it is high time that the college libraries think in terms of a concrete plan by which, if one library purchases a very costly serial set, the other university libraries in the state may be allowed to use them for a certain period of time. Inter-Library Loan among college libraries is considered to be a very important step in the field of resource sharing.

Actually, the whole process of Inter-Library Loan transactions may be considered to be an ordinary clerk's job by many; but, an accomplished librarian is also involved in two important ways:

- To negotiate the request with the individual to ensure that the specifically requested document is necessary to fulfill his information requirement; and
- To verify the bibliographic citation to be sure that the document is indeed not available in the borrowing library and to forestall the necessity of professional help at the lending library having to iron out bibliographic problems.

The information explosion and the advances made in the technological arena have changed and broadened the concept and scope of Inter-Library Loan. At present, Inter-Library Loan includes computerized, tele-type and even facsimile equipment; data or reference networks; bibliographic networks; subject networks, etc.

It is apparent that the future of a library lies in Inter-Library Loan co-operation involving computerized library routines.

Libraries represent information. In the near future, databases with bibliographic information will be common on the Inter-Library Loan circuit.

The need of the user under a Inter-Library Loan should be met without inconvenience to the regular readers on its own campus. Obviously, books in fragile condition should not be issued on Inter-Library Loan. If there is a great necessity for the reading material from fragile books, the best way is to resort to photo copying. Bulky volumes should also not be lent on Inter-Library Loan. The relevant portions may be photocopied and dispatched to the borrower. Likewise, rare collections and irreplaceable documents should be taken out of the purview of an Inter-Library Loan arrangement.

Some learned scholars advocate that the borrowing library should pay the postal and reprographic charges. But, this is not practical and entails some accounting and clerical job. It must be remembered that every library is both a lender and a borrower. So, the lending library should pay the postal and reprographic charges.

There could be some reasonable restrictions on the number of books in issue at a time to the same borrowing library. Period of loan can also be fixed reasonably.

Sub-Lending is to be avoided; so, it may be prohibited. The borrowing library will be solely responsible for the safety of the documents on loan. Time is of essence in a successful Inter-Library Loan Network. Spirit of co-operation is also a must.

After identifying and locating material of interest, an attempt to obtain a copy of the same comes next. Basically, there is clear difference between the Inter Library Loan of print and non-print material like films, slides, CD/DVDs and video cassettes. This is not only in the price but in the durability also. Films CD/DVDs and video cassettes are expensive compared to normal book material. So, generally, there is a fee for the loan of such non-book material.

An Inter-Library Loan request for book material is usually for use by an individual student, researcher or teacher. But, the audio - visual equipments are requested on loan, for the purpose of projection in the class or group-discussion. Much more care is necessary in handling and returning non-book material than in the case of book material.

4.2. Co-Operative Acquisition

Most of the college libraries spend their valuable time, money and efforts on acquisition or materials. It is here that a great deal of co-operation is possible. This is because; the procurement procedures are uniformly similar among all the college libraries.

So, when a Co-operative Acquisition programme is put into action, the individual college libraries save a lot of precious time and money. Consequently, duplicate acquisitions can be automatically avoided. Decisions can be taken on which library will specialize in which subject. Then, each library will endeavour to build its collection so as to be strong in the selected subjects. Normally, the

subject is chosen according to the academic curriculum of the college. Though only one library acquires material on one subject, the identification of the material will be done by all the Libraries in the programme, according to their requirements.

The Farmington Plan and the Midwestern Inter-Library Centre (MILC) in the USA, as well as the Deutsche Forschungsgewierschaft in Germany are the most well-known examples of useful and effective programmes of Co-operative Acquisition. The Farmington Plan is a successful co-operative venture in acquisition and is limited to acquiring books and publications from overseas. The MILC in U.S.A. is a co-operative exercise in not only acquisition but also in storage. It has been remarkably cost-effective.

4.3. Co-Operative Storage

Publications have been increasing in number, far beyond practical limits of easy storage. This has been happening with respect to publications on every subject and in every discipline.

Storage costs money. Co-operative storage would result in economy of space and money. It would also keep track of catalogue entries and help avoid duplication. The concept of co-operative storage can be put into practice at least in respect of less frequently used material like certain books and back volumes of serials.

Photo copies of extracts of these stored materials can be made available at various individual libraries to meet the more urgent needs of the readers. Needless to mention, the cost of such a storage system may be shared by all the participating libraries.

In 1949, ten university libraries in the United States of America got together and organized the Mid-Western Inter -Library Centre (MILC) with the purpose of increasing library resources of the member institutions.

The first storage library in India was established in 1974 at the Inter-Library Resources Centre in New Delhi, under the patronage of the Indian Council of Social Science Research (ICSSR). Back issues of periodicals make up the bulk of the collection at the repository. However, the concept has not yet caught up with the imagination of the library professionals in India.

4.4. Co-Operative Processing

Next to the acquisition of material, another phase of library operations which involves time and expenditure is processing of material. Computers and other automated processes can be used to meet their cataloguing needs of books.

4.5. Union Catalogues

For a satisfactory resource sharing programme, it is most essential that each participating librarian should know the resources available with the other libraries. In short, the Union Catalogue should be readily available with each participant library. A Union Catalogue is the most useful location tool with a librarian participating in a Inter- Library Loan programme.

Such Union Catalogues could be prepared and updated periodically, say once every quarter. It is also important to note that a Union Catalogue is different from a collective catalogue. A Collective Catalogue is simply a collection of the catalogues of all the libraries, one after another. It may include duplicate entry for the same book, if it is available with more than one library. However, in a Union Catalogue, all the titles held by all the libraries, are listed in an alphabetical order, showing the location of the same.

A well prepared Union Catalogue serves many useful purposes as listed here-under:

- It shows at a glance, the total document resources of the libraries participating in a lending programme.
- It serves as a major bibliography in its own right.
- It helps in identifying the material to be discarded because of less or no use.

Regularly updated catalogues and supplements should be circulated to all the participating libraries, to enable the most effective exploitation of the common resources. Due to the compilation of a Union Catalogue, compilation of bibliography and location of materials will be easier.

Certainly, the use of a computerized environment would be most ideal for such activity, as regular revisions could be made cheaply. In this context, the efforts made by National Institute of Science Communication and Information Resources (NISCAIR) to produce several regional and local union catalogues of scientific and technical periodicals and serials may be mentioned. In fact, these catalogues will eventually form the basis of the proposed National Union Catalogue.

Further, the National Social Science Documentation Centre (NASSDOC), New Delhi, under the Indian Council of Social Science Research (ICSSR), has also published a series of union catalogues in the field of Social Sciences, covering many major libraries in India.

It is essential that there is a uniform practice in compilation of union catalogues. The various factors to be considered while compiling a union catalogue are as follows:

- The scope and coverage
- Which libraries are participating?
- Which libraries have lending out policies and what type of documents are covered in that arrangement?
- Whether libraries are linked with computing system and do they have computer readable catalogue and tapes or CDs/DVDs can be supplied for inclusion?
- Sufficient stationery, staff, building, computing, publications, etc.
- The rates of expenditure to be borne by the participating libraries
- The catalogue
- Form of union catalogue
- Circulation at cost/complimentary to participants/charges to others

It is important that the participating libraries should ensure the updation of both additions and deletions to their collections, in the union catalogue.

4.6. Co-Operative Delivery of Services

In a regular Inter-Library Loan exercise, the required book moves from one library to another library. It is at this second library that the user receives the book from the librarian. This involves time and expenditure to the library establishments.

However, in a system of co-operative delivery of services, expenditure to the establishment is dispensed with, though it may mean expenditure to the user. The user directly goes to the library actually having the volume sought by him and takes it on loan. This form of co-operation is not in vogue in the libraries in India.

4.7. Exchange of Personnel & Training Facilities

Exchange of personnel implies sharing of expertise. Most of the time, recruitment of an expert on permanent basis may be unnecessary. Such expertise may be required only for a short period.

Borrowing the services of an expert from another library would automatically enable the training of in-house staff. The exercise (such as a new concept in cataloguing) started by the expert can be easily carried on by the in house staff.

4.8. Clearing House Functions

Like in a core banking system, clearing house functions would form a part of a successful Inter-Library Loan arrangement.

4.9. Technical Process

Till recently, centralized cataloguing and processing work was thought of as not feasible in the college libraries. But now, the situation has changed with the advent of computers, copying machines and Internet. But, preparation of union catalogues and reference and bibliographic tools is now possible and must be taken up.

5. Network

5.1. Meaning

In the world of computers, networking is the practice of linking two or more computing devices together for the purpose of sharing data. Networks are built with a combination of computer hardware and computer software. Some explanations of networking found in books and tutorials are highly technical, designed for students and professionals, while others are geared more to home, business and education uses of computer networks.

A computer network, often simply referred to as a network, is a collection of computers and devices interconnected by communications channels that facilitate communications among users and allows users to share resources. Networks may be classified according to a wide variety of characteristics.

- According to Encyclopedic Dictionary of Library and Information Science:
Network: Refers to series of inter-connected computers, peripherals and/or terminals which are communicating with each other.
- According to Information Technology Dictionary:
Network: In communications, a loosely defined term applied to any system consisting of terminals, nodes and inter-connecting media. In general a network is a collection of resources used to establish and switch communication paths between its terminals. The inter-connections can include line telecommunications, trunks, satellites, microwave communications and medium/long wave radio transmission.
- According to McMillan Dictionary of Information Technology:
Network:
A series of interconnected points.
In communications a system of interconnected communication facilities.
In data structures a structure in which any node may be connected to any other mode, compare tree, see node.
- According to Webster's Third New International Dictionary
Network:
A fabric or structure of threads, cards, or wires that cross each other at regular intervals and are knotted or secured at the crossings.
A system of lines or channels that interlace or cross like the fabric of a net.
An interconnected or interrelated chain.
- According to Oxford English Dictionary:
Network:
Work in which threads, wires or similar materials are arranged in the fashion of a net.
A piece of work having the form or conformation of a net a collection or arrangement resembling a net.

5.2. Definition

- According to Encyclopedia of Library and Information Science :
The network contains nodes and links. A node is a point or place; it can be represented by a storage register in a computer, or by a dot or small circle in a diagram. A link is a pair of nodes, in a computer it is represented by storing the address of one member of the pair in the register that represents the other member: in a diagram a link is a line connecting the two nodes.
Ex: Each node represents a city; each link stands for a highway connecting two cities. The network is a map.
Ex: Each node represents a person. A link signifies that one person is the child of another. The network is a collection of generologies.
- According to Dictionary of Computer:
In communication, Network a rather loosely defined term applied to a system that consists of terminals, nodes, and interconnection media that can include lines or trunks. Satellites, microwave medium and long wave radio etc. In general, a network is a collection of resources used to establish and switch communication paths between its terminals.
- According to International Encyclopedia of Information and Library Science:
Networking can be done for the computers owned by an organization at one site. Such a network is known as a local area network (LAN).
- According to Miller:
Network is a co-operative system established by Librarian and information centers which are brought together by common subject, geographic proximity to save and share informational resources, human resources and all other elements essential for providing effective information services.
- According to him, Network can be existed with the help of co-operation and coordination between libraries and information units brought together by common subject. Synchronizing the geographical nearness or making global village to avoid duplications in information resources, human resources and to provide pin pointed information service to the users without wasting the time.
- According to Green Berger the term Network as a node of sharing resources and linking otherwise incomparable procedure and format of different systems and organizations.

5.3. Purpose

Computer networks can be used for a variety of purposes:

- Facilitating communications. Using a network, people can communicate efficiently and easily via email, instant messaging, chat rooms, telephone, video telephone calls, and video conferencing.
- Sharing hardware. In a networked environment, each computer on a network may access and use hardware resources on the network, such as printing a document on a shared network printer.
- Sharing files, data, and information. In a network environment, authorized user may access data and information stored on other computers on the network. The capability of providing access to data and information on shared storage devices is an important feature of many networks.
- Sharing software. Users connected to a network may run application programs on remote computers.
- Information preservation.
- Security and
- Speed up.

6. History of Computer Networks

Before the advent of computer networks that were based upon some type of telecommunications system, communication between calculation machines and early computers was performed by human users by carrying instructions between them. Many of the social behaviors seen in today's Internet were demonstrably present in the nineteenth century and arguably in even earlier networks using visual signals.

In September 1940 George Stibitz used a teletype machine to send instructions for a problem set from his Model at Dartmouth College in New Hampshire to his Complex Number Calculator in New York and received results back by the same means. Linking output systems like teletypes to computers was an interest at the Advanced Research Projects Agency (ARPA) when, in 1962, J.C.R. Licklider was hired and developed a working group he called the "Intergalactic Network", a precursor to the ARPANet.

In 1964, researchers at Dartmouth developed the Dartmouth Time Sharing System for distributed users of large computer systems. The same year, at MIT, a research group supported by General Electric and Bell Labs used a computer DEC's to route and manage telephone connections.

Throughout the 1960s Leonard Kleinrock, Paul Baran and Donald Davies independently conceptualized and developed network systems which used datagrams or packets that could be used in a network between computer systems.

1965 Thomas Merrill and Lawrence G. Roberts created the first wide area network (WAN).

The first widely used PSTN switch that used true computer control was the Western Electric introduced in 1965.

In 1969 the University of California at Los Angeles, SRI (in Stanford), University of California at Santa Barbara, and the University of Utah were connected as the beginning of the ARPANET network using 50 Kbit/s circuits. Commercial services using X.25 were deployed in 1972 and later used as an underlying infrastructure for expanding TCP/IP networks.

Computer networks and the technologies needed to connect and communicate through and between them, continue to drive computer hardware, software, and peripherals industries. This expansion is mirrored by growth in the numbers and types of users of networks from the researcher to the home user.

Today, computer networks are the core of modern communication. All modern aspects of the Public Switched Telephone Network (PSTN) are computer-controlled, and telephony increasingly runs over the Internet Protocol, although not necessarily the public Internet. The scope of communication has increased significantly in the past decade and this boom in communications would not have been possible without the progressively advancing computer network.

7. Types of Networks Based on Physical Scope

Common types of computer networks may be identified by their scale.

- **Local Area Network**

A local area network (LAN) is a network that connects computers and devices in a limited geographical area such as home, library, school, computer laboratory, office building, or closely positioned group of buildings. Each computer or device on the network is a node. Current wired LANs are most likely to be based on Ethernet technology. LAN technologies operate at speeds up to 10 Gbit/s. This is the data transfer rate.

- **Personal Area Network**

A personal area network (PAN) is a computer network used for communication among computer and different information technological devices close to one person. Some examples of devices that are used in a PAN are personal computers, printers, fax machines, telephones, PDAs, scanners, and even video game consoles. A PAN may include wired and wireless devices. The reach of a PAN typically extends to 10 meters. A wired PAN is usually constructed with USB and Fire wire connections while technologies such as Bluetooth and infrared communication typically form a wireless PAN.

- **Home Area Network**

A home area network (HAN) is a residential LAN which is used for communication between digital devices typically deployed in the home, usually a small number of personal computers and accessories, such as printers and mobile computing devices. An important function is the sharing of Internet access. It can also be referred to as an office area network (OAN).

- **Campus Network**

A campus network is a computer network made up of an interconnection of local area networks (LAN's) within a limited geographical area. The networking equipments (switches, routers) and transmission media are almost entirely owned (by the campus tenant/owner: an enterprise, college, university, government etc.).

In the case of a college campus-based campus network, the network is likely to link a variety of campus buildings including; academic departments, the college library and student residence halls.

- **Wide Area Network**

A wide area network (WAN) is a computer network that covers a large geographic area such as a city, country, or spans even intercontinental distances, using a communications channel that combines many types of media such as telephone lines, cables, and air waves. A WAN often uses transmission facilities provided by common carriers, such as telephone companies.

- **Metropolitan Area Network**

A Metropolitan area network is a large computer network that usually spans a city or a large campus.

- **Enterprise Private Network**

An enterprise private network is a network build by an enterprise to interconnect various company sites, e.g., production sites, head offices, remote offices, shops, in order to share computer resources.

- **Virtual Private Network**

A virtual private network (VPN) is a computer network in which some of the links between nodes are carried by open connections or virtual circuits in some larger network (e.g., the Internet) instead of by physical wires. The data link layer protocols of the virtual network are said to be tunneled through the larger network when this is the case. One common application is secure communications through the public Internet, but a VPN need not have explicit security features, such as authentication or content encryption. VPNs, for example, can be used to separate the traffic of different user communities over an underlying network with strong security features.

- **Internetwork**

An internetwork is the connection of two or more private computer networks via a common routing technology using routers. The Internet is an aggregation of many internetworks; hence its name was shortened to Internet.

- **Backbone Network**

A Backbone network (BBN) A backbone network or network backbone is part of a computer network infrastructure that interconnects various pieces of network, providing a path for the exchange of information between different LANs or sub networks. A backbone can tie together diverse networks in the same building, in different buildings in a campus environment, or over wide areas. Normally, the backbone's capacity is greater than the networks connected to it.

A large corporation that has many locations may have a backbone network that ties all of the locations together, for example, if a server cluster needs to be accessed by different departments of a university that are located at different geographical locations. The pieces of the network connections (for example: Ethernet, wireless) that bring these departments together is often mentioned as network backbone. Network congestion is often taken into consideration while designing backbones.

- **Global Area Network**

A Global Area Network (GAN) is a network used for supporting mobile communications across an arbitrary number of wireless LANs, satellite coverage areas, etc. The key challenge in mobile communications is handing off the user communications from one local coverage area to the next.

- **Internet**

The Internet is a global system of interconnected governmental, academic, corporate, public and private computer networks. It is based on the networking technologies of the Internet Protocol Suite. It is the successor of the Advanced Research Projects Agency Network (ARPANET) developed by DARPA of the United States Department of Defense. The Internet is also the communications backbone underlying the World Wide Web (WWW).

- **Intranets and Extranets**

Intranets and extranets are parts or extensions of a computer network, usually a local area network.

An intranet is a set of networks, using the Internet Protocol and IP-based tools such as web browsers and file transfer applications that are under the control of a single administrative entity. That administrative entity closes the intranet to all but specific, authorized users. Most commonly, an intranet is the internal network of an organization. A large intranet will typically have at least one web server to provide users with organizational information.

An extranet is a network that is limited in scope to a single organization or entity and also has limited connections to the networks of one or more other usually, but not necessarily, trusted organizations or entities-a company's customers may be given access to some part of its intranet-while at the same time the customers may not be considered trusted from a security standpoint.

- **Overlay Network**

An overlay network is a virtual computer network that is built on top of another network. Nodes in the overlay are connected by virtual or logical links, each of which corresponds to a path, perhaps through many physical links, in the underlying network.

- **Wireless Networks (WLAN, WWAN)**

A wireless network is basically the same as a LAN or a WAN but there are no wires between hosts and servers. The data is transferred over sets of radio transceivers. These types of networks are beneficial when it is too costly or inconvenient to run the necessary cables.

The most common WLANs cover, depending on antennas, ranges from hundreds of meters to a few kilometers. For larger areas, either communications satellites of various types, cellular radio, or wireless local loop all have advantages and disadvantages.

8. Network Topology

Network topology is the layout pattern of interconnections of the various elements (links, nodes, etc.) of a computer network. Network topologies may be physical or logical. Physical topology means the physical design of a network including the devices, location and cable installation. Logical topology refers to how data is actually transferred in a network as opposed to its physical design.

Topology can be considered as a virtual shape or structure of a network. This shape does not correspond to the actual physical design of the devices on the computer network. The computers on a home network can be arranged in a circle but it does not necessarily mean that it represents a ring topology.

Any particular network topology is determined only by the graphical mapping of the configuration of physical and/or logical connections between nodes. The study of network topology uses graph theory. Distances between nodes, physical interconnections, transmission rates and/or signal types may differ in two networks and yet their topologies may be identical.

A local area network (LAN) is one example of a network that exhibits both a physical topology and a logical topology. Any given node in the LAN has one or more links to one or more nodes in the network and the mapping of these links and nodes in a graph results in a geometric shape that may be used to describe the physical topology of the network. Likewise, the mapping of the data flow between the nodes in the network determines the logical topology of the network. The physical and logical topologies may or may not be identical in any particular network.

9. Basic Topology Types

This classification is based on the interconnection between computers - be it physical or logical.

The physical topology of a network is determined by the capabilities of the network access devices and media, the level of control or fault tolerance desired, and the cost associated with cabling or telecommunications circuits.

Networks can be classified according to their physical span as follows:

- LANs (Local Area Networks)
- Building or campus internetworks
- Wide area internetworks

10. Classification of Network Topology

There are also two basic categories of network topologies:

- Physical topologies
- Logical topologies

10.1. Physical Topology

The mapping of the nodes of a network and the physical connections between them such as the layout of wiring, cables, the locations of nodes and the interconnections between the nodes and the cabling or wiring system.

10.1.1. Classification of Physical Topologies

Point-to-point

The simplest topology is a permanent link between two endpoints (the line in the illustration above). Switched point-to-point topologies are the basic model of conventional telephony.

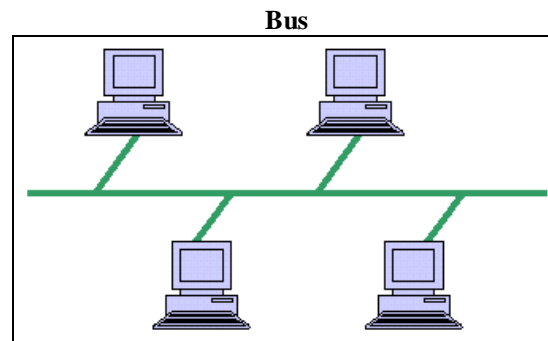


Figure 1: Bus Topology

In local area networks where bus topology is used, each machine is connected to a single cable. Each computer or server is connected to the single bus cable through some kind of connector. A terminator is required at each end of the bus cable to prevent the signal from bouncing back and forth on the bus cable. A signal from the source travels in both directions to all machines connected on the bus cable until it finds the IP address on the network that is the intended recipient. If the machine address does not match the intended address for the data, the machine ignores the data. Alternatively, if the data does match the machine address, the data is accepted. Since the bus topology consists of only one wire, it is rather inexpensive to implement when compared to other topologies. However, the low cost of implementing the technology is offset by the high cost of managing the network. Additionally, since only one cable is utilized, it can be the single point of failure. If the network cable breaks, the entire network will be down.

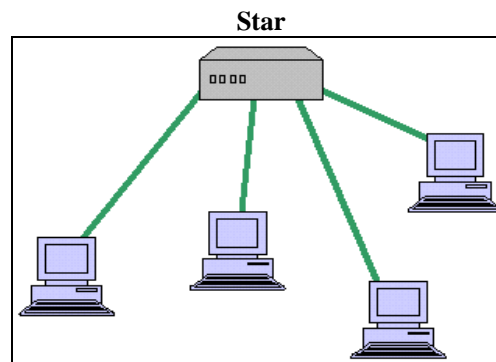


Figure 2: Star Topology

In local area networks with a star topology, each network host is connected to a central hub. In contrast to the bus topology, the star topology connects each node to the hub with a point-to-point connection. All traffic that traverses the network passes through the central hub. The hub acts as a signal booster or repeater. The star topology is considered the easiest topology to design and implement. An advantage of the star topology is the simplicity of adding additional nodes. The primary disadvantage of the star topology is that the hub represents a single point of failure.

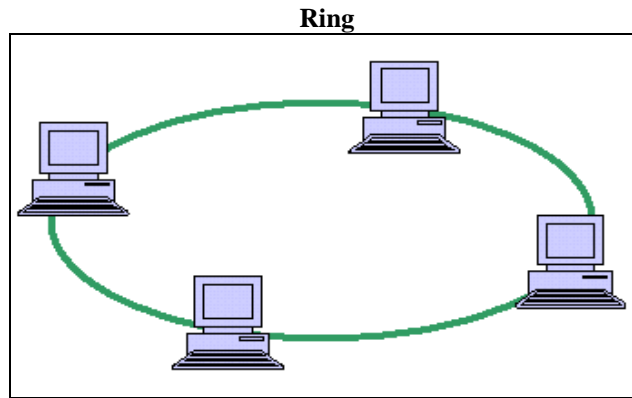


Figure 3: Ring Topology

A network topology that is set up in a circular fashion in which data travels around the ring in one direction and each device on the ring acts as a repeater to keep the signal strong as it travels. Each device incorporates a receiver for the incoming signal and a transmitter to send the data on to the next device in the ring. The network is dependent on the ability of the signal to travel around the ring.

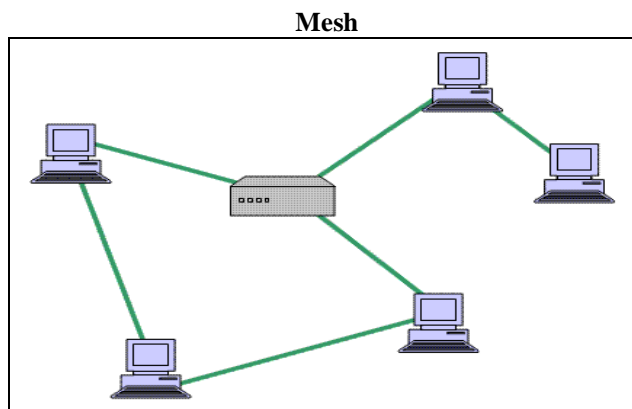


Figure 4: Mesh Topology

The value of fully meshed networks is proportional to the exponent of the number of subscribers, assuming that communicating groups of any two endpoints, up to and including all the endpoints.

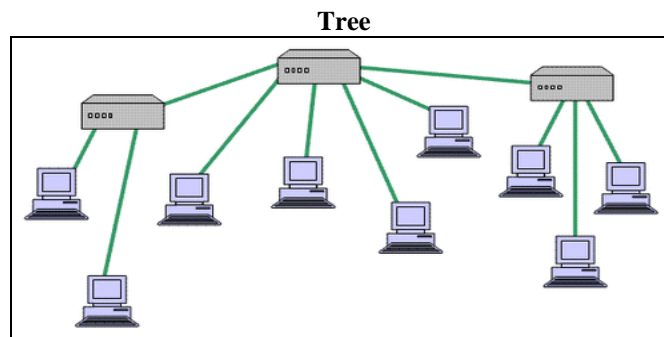


Figure 5: Tree Topology

It is also known as a hierarchical network. The type of network topology in which a central 'root' node (the top level of the hierarchy) is connected to one or more other nodes that are one level lower in the hierarchy (i.e., the second level) with a point-to-point link between each of the second level nodes and the top level central 'root' node, while each of the second level nodes that are connected to the top level central 'root' node will also have one or more other nodes that are one level lower in the hierarchy (i.e., the third level) connected to it, also with a point-to-point link, the top level central 'root' node being the only node that has no other node above it in the hierarchy (The hierarchy of the tree is symmetrical.) Each node in the network having a specific fixed number, of nodes connected to it at the next lower level in the hierarchy, the number, being referred to as the 'branching factor' of the hierarchical tree. This tree has individual peripheral nodes.

10.2. Logical Topology

The logical topology, in contrast to the "physical", is the way that the signals act on the network media, or the way that the data passes through the network from one device to the next without regard to the physical interconnection of the devices. A network's logical topology is not necessarily the same as its physical topology.

11. Advantages of Computer Networking

Network usually consists of a formal agreement/arrangement whereby materials, information and services provided by a variety of libraries and/or other organizations are made available to all potential users. Libraries may be at different places but agree to serve one another on the same basis as each serves its own clientele. Computers and telecommunication are important among the tools used for facilitating communication among them. The goal of networking shall be to eventually provide every individual and organization with equal opportunity of access to the total information resources available which will satisfy the individual's educational, working, cultural and leisure time needs and interests, regardless of the individual's location, social or physical condition or level of intellectual achievement.

Susan Martin defined the Library Network as "a group of individuals or organizations that are interconnected. The linking must include a communications mechanism and many networks exist for the express purpose of facilitating certain types of communication among their members. In the library world, institutions form networks primarily to achieve better sharing of resources-resources consisting of bibliographic information and of collections and better service to patrons."

Aims and objectives of a successful library network vary according to the changing scenario and varying priorities. The following objectives of resource sharing and networking of library systems are currently in vogue.

- To increase the availability and accessibility of resources: clientele of each participating library should have access to resources available in all the libraries. Resources can be moved from one library to another manually or through modern means. This provides an easy access to and free flow of information. Resource sharing should result in an increase in the range and depth of services offered by the member libraries.
- To diminish cost: Resource sharing helps in building specialized collection and all participating libraries need not duplicate the procurement of similar material. This facilitates availability of larger collection and even the basic material required by the users can be obtained without much delay.
- To exploit Resources: Resource sharing advocates that the reading material of one library should be made available to the clients of other libraries, thus exposing the reading materials to a wider group of users. Similarly, the services of a library can be exploited by the users of other libraries.
- To promote co-operative activities like acquisition, exchange, storage, binding, training, reference and documentation services, inter-library loans, etc.
- To eliminate record duplication
- To prepare union catalogue
- To rationalize the collection development
- To obtain improved bibliographic control
- To enhance the efficacy of exchange agreements
- To achieve a regular Document Delivery System
- To promote the exchange of information with other co- operative networks
- To create authority files
- To extend service to a wider user community and. to promote programme for increased use of library resources
- To assist member libraries in selection, purchase, catalogue and processing of library materials
- To stimulate the improvement of library facilities and services
- To co-operate in the development of library personnel.
- To provide resources beyond the reach of individual libraries
- To achieve economies in the use of resources, human and material
- To facilitate sharing of material among members of the group
- To provide cost effective information storage and maintenance
- To enable the optimum utilization of existing library, information system
- To provide current awareness services with minimum delay
- To give access to information resources within the state and other states
- To evolve a state standard for information handling
- Promotion of research, development and innovation in information technology
- Provision of document transmission facility.

These objectives should be achieved without harm to the missions of participating libraries, although their methods of operation invariably must be adjusted. Similarly, the goals are realizable only with some changes in the habits of users.

12. Network Functions and Services

The knowledge that the primary reason for establishment of a network is to provide extensive access to a universe of library materials to the user's/member libraries more and, makes it possible to classify the functions of a network. The functions of a network can be categorized into the following three primary classes.

- Those that serve the users/patrons.
- Those that serve the member libraries directly and the patron indirectly.
- Those that support the network structure.

The above three basic network functions can be further elaborated as under:

12.1. Functions That Serve the Users

- Interlibrary loan
- Reference and referral
- Education
- Access to databases

12.2. Functions That Serve the Member Libraries Directly and the Users Indirectly

- Acquisition
- Co-operative cataloguing
- Circulation and control
- Storage and delivery
- Standardization
- Processing and preparation
- Marketing
- Systems development and support

12.3. Functions That Support the Network Administration

- Management and Administration
- Recruitment and training of personnel
- Evaluation of network
- Communication
- Cost analysis

A careful perusal of the above functions indicates that the library networks perform a vast array of functions, including a mix of technological procedures, each of which requires varying degrees of skills and expertise.

Brief descriptions of the services from networking are discussed hereunder.

12.4. Catalogue Based Services

Under this area, shares cataloguing service, union catalogue of books, serials and other non-book material, online catalogue access and catalogue production, book processing and preparation services are notable. Under shared cataloguing service, a librarian will use the catalogue information available in a major, nearby college library for cataloguing new publications added to his library. The union catalogue of books, serials and non-book materials, services will provide a union catalogue of books, serials and other materials held in different libraries with mechanism for maintaining it up to date all the time. From this, a user will be able not only to locate precisely the library where his required document can be had but also can limit his search to a particular geographical region which is proximate to him. The on-line catalogue access will provide identifying availability of one or more books and for the purpose of shared cataloguing among participating libraries. Catalogue production can be in the form of card, book, and magnetic tape/floppy/CD C ROM/DVD form.

12.5. Database Services

Under this head bibliographic database service database of projects/institutions/specialists are important. The bibliographic database service would enable the library staff to search for the bibliography database developed/created at one or more libraries in order to disseminate current information. And retrieve the retrospective information. These services can be classified into three types i.e. retrospective data bases in core areas built on the computer facility retrospective databases in peripheral/low usage areas available through international search systems like DIALOG, BRS and ESA, etc.; retrospective databases on CD-ROM for secondary information. The number of searches of database of projects/institutions/specialists will make the participating libraries to capture the information from a unified database stored at one of the libraries through networking. The users and library staff can access through networking. The users and library staff will be able to search the database by various search elements.

12.6. Document Supply Service

Document supply service assumes a great importance in a network system as dissemination of information is of no use unless they are backed by actual provision of copy of source document. The user would be invariably interested in the original source document of his interest. This service can be met through inter-library loan requests, document delivery through fax; E-mail, etc. Under the inter-library loan request service, a librarian would be able to request another librarian through the network for one or more books of another library on loan basis for meeting the demand of his/her users. Success of this service will depend on the cooperative spirit of participating libraries. Through document delivery a librarian would be able to request another librarian for copy of a document to be transmitted through tele facsimile. This service is generally used for transmitting a few pages from documents.

12.7. Collection Development

This service will help the libraries to identify and select publications which are worth acquiring. After examining the strength and weakness in document collections in the libraries as well as duplication and based on the specialization of libraries, the network can be used to evolve a co-operative acquisition system. Through this, the libraries will be able to develop their collection on the basis of mutually agreed and assigned profiles to each of them and avoid duplication in their acquisition. The network can also assist the libraries in the process of procurement by providing vital information on purchases like supplier, cost, ISBN number, local agencies, currency conversion, discount rates, etc.

12.8. Communication Based Service

This service can be particularly classified into referral service, electronic mail, bulletin board and academic communication. In the matter of referral service, the users are informed of the source to be approached to get the required information. To give this service, the libraries will be required to maintain a stock of referral directories and tertiary sources. The communication system of the network will be used to send referral queries and receive answers. Under the electronic mail service, the participants in the network would be able to transfer/receive messages among themselves. This is a very important service and facility through which other services like inter-library loan requests, location searching, union catalogue, document delivery requests, transmission, referral and reference service are implemented. The service will reduce communication deals among the participating libraries. Under the Bulletin Board Service, a facility will be created to display on an electronic bulletin board, news, announcements, etc. with constant upgradation of information. The proposed network will be an important utility to meet the communication requirements of the scientific and academic community. This can be achieved through E-mail, file transfer and bulletin boards. Further, computer conferencing can also be carried out through the network and if more sophisticated and latest instruments are available in the network, facilities and services like teleconferencing can also be arranged.

13. Disadvantages of Computer Networking

There are many advantages of computer networks. Remember that the Internet is a computer network. But talking about disadvantages here, so here are some categories where computer networking could be a problem.

13.1. Information Security

If a computer is connected to a network, it is much easier to send any secret information stored on that computer to some other computer on the network.

13.2. Vulnerability to Remote Exploits

If a computer is on a network, not only can it send information to any other computer on the network, it is also able to receive messages from any other computer on the network. Because the people who write computer software are human and make mistakes, sometimes the software will have bugs in it that allow someone on a different computer on the network to send data to the computer with the buggy software in such a way as to attack it - make it lock up or crash, make it slow down, or even take control of it.

13.3. Rapid Spread of Computer Viruses

Computer viruses are programs designed to take advantage of buggy software to spread copies of them. When computers are connected by a network, the virus can spread itself electronically, at computer speeds. Without a network, it can only spread as fast as the sneaker net can operate (as fast as people can carry disks between the computers).

13.4. Configuration Management

Sometimes (such as in medical equipment) it is important for a computer's software configuration to be predictable and stable. If a computer is connected to a network, it's easier to download and install software from the network onto the computer. This includes automatic software updates, so this can happen without any human intervention. If the new software hasn't been tested, it could cause unpredictable behavior and possibly endanger lives.

13.5. Computer Networks Can Fail

Computer networks can be so powerful and useful that it is common for them to be used for more and more purposes. A network might start out as a small convenience, but later may become mission-critical - the computer can no longer do its job without a

properly functioning network. If the network was originally only a convenience, there may not be any attention given to what might happen if the network were to fail, even after the network becomes indispensable. All of the computers in an office building might become completely useless if a single network component fails.

14. Conclusion

The new challenges posed by the growing knowledge economy are the need to network knowledge more vigorously and dynamically. Resource sharing within the libraries is very important and plan accordingly to switch over to new technology time to time. In the present era it's a full of challenges to establish strong networking to share the resources. In the other end establishment the national knowledge commission of the Government of India has identified many networks in India share the resources among the libraries. Many libraries in India developed institutional repositories to support establishment of knowledge centers in India. Plans are under consideration to establishing a central institutional repository for member libraries in order to tap the tacit knowledge available with the researchers, scholars and the faculty members.

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