
UNIT 8 MANAGEMENT OF LIBRARY AND INFORMATION NETWORKS

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8.0 OBJECTIVES

After reading this unit you will be able to understand :

- networking as well as the technologies, which support them;
- the major elements of network management methods;
- the network architecture; and
- the efforts the at national level and the challenges of network management.

8.1 INTRODUCTION

Computer networks are essential to the operation of libraries. Network, allow library staff to work for cataloguing of books, providing various services, and also allow access to library catalogue and web resources within the library or elsewhere. Without the functioning of a computer network, these things are not possible. Users cannot access network resources within the library or on the Internet. Since the networks

were first implemented to connect computer terminals to Online Public Access Catalogue (OPACs), their importance to libraries has continued to grow. The continuous development of information technology will make library networks even more crucial in the near future. During the next few years, as part of rapidly developing information technology, digital audio and video will have a significant impact. The increasing widespread availability of inexpensive products enable audio and video communication through Internet and create new ways to deliver information and new opportunities to enrich communication.

To support library services, a network must do more than function; it must also provide a certain level of performance. Performance degrades if the network is poorly implemented, or because it lacks the capacity needed to support all its users. These technical issues have a human impact. The Library is the place where patrons come and use Internet resources. Patrons who come to the library to access the resources may stop doing so if they find accessing web pages takes a long time. Similarly, patrons who use electronic resources stored in the library will not be satisfied if retrieving that information takes a long time. The diminished quality of service from inadequate networks poorly serves library patrons.

This unit is not written for technical networking experts or the systems librarian. This only helps the librarians to understand the principal components of their network and how they affect the ability to delivery library services. It also helps librarians become technically literate in this key area of information technology to provide improved services.

Network Applications and Their Requirements

Collectively, the performance of a network is referred to as its Quality of Service, which has two key measures; latency and jitter. Another term for latency is delay which refers to the length of time for information to cross a network or a piece of that network. Jitter is variation in latency. A network with large amount of jitter delivers information inconsistently, speeding up and slowing down unpredictably.

Latency is the product of multiple factors and the most obvious is bandwidth, which is the amount of information that can pass a point in a network in a given amount of time.

Insufficient bandwidth increases latency, because it causes information to take more time to pass through the network. Since bandwidth can have so much impact on latency, the bandwidth requirement of an application is a useful way to state the performance it requires from a network.

Bandwidth is not the only factor in the network that can cause increased latency. The receipt of information, its processing, and then retransmission by each of these devices all add to the total network latency. The delay in getting information through the network is also increased by the time needed to physically transmit information over any segment of the network. More bandwidth means more information can pass through a point in the network at the same time.

Jitter, the variation in latency, occurs because the load on the network increases and decreases. When network load increases there may be contention for network resources. If a network goes from supporting a few users needing limited bandwidth to having a large number of users demanding a lot of bandwidth, latency grows. Latency changes both because of the changing level of contention for the bandwidth

available from the network and because of the changing amounts of information that must pass through network devices. Fluctuation between heavy and lighter network loads increases jitter.

8.2 LIBRARY APPLICATIONS AND THEIR NETWORK REQUIREMENTS

Libraries use more than one type of network. They will have local area networks (LANs), networks connecting computers in a small area. One or multiple LANs are possible. Where libraries have multiple LANs, or where libraries are in one building connected to other buildings of the library's parent organization, libraries may also connect to campus or backbone networks. The LAN or the backbone of the network is connected to the Internet.

Let us first understand the networking protocol and its role in the network before we get on to Network. A protocol is an agreed way to respond to a situation or to communicate with particular kinds of requirement. A protocol is an agreed way to manage interaction between computers. But the computer network is not so simple that a single protocol can be used. Multiple tasks must be accomplished for one computer to communicate with another. These tasks are not independent, each happening in parallel. Rather, one task depends on another. These different communication tasks appear layered. This set of layered tasks that must occur for two devices to communicate is a protocol stack.

An international standard model exists for the protocol layers involved in computer networks. This model, an ISO standard, is called OSI (Open system Interconnect) Reference Model. This model specifies seven protocol layers. It is the theoretical model of how different networking tasks are handled that is frequently used in explanations of networking.

Let's understand the protocol stack for the first three layers called the bottom three layers.

Network Layer - Layer -3
Data Link Layer - Layer - 2
Physical Layer - Layer - 1

The bottom layer is the physical layer, Layer 1. The protocol at this layer has to set a standard for use of the physical media to send electrical signals between computers, delivering a stream of bits to another device.

The second layer is the data link layer. It must be able to receive the stream of bits from Layer 1 and interpret it as meaningful chunks of data. Layer 2 protocols organize data into frames. They must also support an addressing system, a way to specify the computer to which frames are being sent. With these two protocol layers specified, there is agreement on how to use cables to communicate and how to package data and send them to specific computers over a network.

Data link layer addresses offer a way to address communications to other computer on a network, but their addressing systems are flat. There is no way to create a

route for data traffic among networks based on these addresses. This requires an addressing scheme with addresses that are hierarchical, providing the assurance that a group of addresses are used by one network. The third layer provides a way to cope with more complicated networks.

The network layer specifies how to address, format, and route communications that must go among multiple networks.

The OSI protocol model is a theoretical model. It does not specify how these different layers are implemented. Many alternative protocols actually implement these protocol layers. The checklist identifies the protocols used in LANs and on the Internet to perform these layers of tasks. It describes how devices on the network interact in terms of the functional requirements these different layers represent.

Library Local Area Network Checklists:

- Local Area Network Protocol - the networking standard that is used on the LAN to govern communications
- Cabling - the kind of wiring to be used through the LAN
- Network Interface Cards - the hardware installed into computers to allow them to communicate over the LAN
- Structured cabling system - the way in which network cabling is installed in a building
- Network Topology and Connecting Devices - the logical structure of the network and the hardware to which the computers are connected by the cabling and through which communications flows
- Network Operating System and Server - the software and hardware that provides the computer with access to shared services like printers and file servers
- Wireless LAN - means for staff and patrons to work without being tied down by network cables
- Campus or backbone networks – A high speed data network running through the campus, to which the library LAN may be connected.

Actually LAN does not need all the items mentioned above. A wireless LAN is optional. Some libraries may not have a large enough infrastructure to require a backbone network.

Self Check Exercise

- 1) What are the objectives of the resource sharing network? Explain the components of the resource sharing network.

Note: 1) Write your answer in the space given below.

- 2) Check your answer with the answer given at the end of this unit.

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8.3 POLICY AND PLANNING FOR NETWORK MANAGEMENT

- 1) Each country should develop its own national policy for libraries and information services with due emphasis on the networking of libraries.
- 2) A national centre should be identified or established in each country to monitor and coordinate the development of library networking in the country and in the region.
- 3) International and local professional associations should promote the development of professional library communities through networking - such as the creation and local moderation of electronic discussion lists.
- 4) All types of library services, especially public and academic libraries, need to be enhanced and modernised to keep pace with the development, and to meet the challenges, of the Information Society.
- 5) A National agency or any other body, should convene meetings of interested parties to consider the creation of a regional consortium as an interested community emerges. This should act as a catalyst to develop leadership champions for:
 - creating a culture of sharing;
 - developing policies and guidelines;
 - encouraging collaboration with industry;
 - developing regional consortia for licensing and procurement.

Technology

- 6) International standards should be adopted by libraries to facilitate the exchange of information within the country and globally and to encourage the development of inter-operable systems.
- 7) In the modernisation of libraries international bibliographic standards, in particular MARC, AACR2, specialised thesauri and national authority databases should be adopted.
- 8) Libraries can effectively function as centres to provide for public access to electronic information and therefore should be given priority in getting Internet and other communication facilities.

Human Resources Development

- 9) Organisations operating libraries and information services must be encouraged to develop education and training to enable librarians to undertake their professional development continuously throughout their careers, eg., in information management, library networking, library standards, content creation, effective communication, information entrepreneurship etc.
- 10) Library associations, academic institutions and other organisations should develop Continuing Professional Development [CPD] programmes to allow librarians to enhance skills and develop core professional competences for the management of electronic resources eg. leadership in information infrastructure-

building, data management, electronic library management, needs assessment, etc.

- 11) Library authorities should create a suitable environment and provide incentives to motivate library professionals to take up continuing professional education in order to become effective change agents in the information society.
- 12) The appropriate authorities must recognise that the teaching of librarianship and information science [LIS] requires the provision of IT workshops equipped with up-to-date hardware and software and Internet connectivity.
- 13) Recognising the increasingly interdisciplinary nature of LIS studies, LIS Departments should work with other disciplines to ensure that the curriculum is broadly based.
- 14) LIS Departments and national library associations should work towards the establishment of systems of professional accreditation supported, where relevant, by an international professional organisation.
- 15) The curricula of LIS departments should be revised to integrate IT applications and library networking as significant components.

8.4 NETWORK INFRASTRUCTURE

Telecommunications are playing an increasing role in the exchange of information, flow of ideas, and provision of essential services in education, business, health care and government. These technologies will have a profound impact on all citizens in the country. Access to an advanced telecommunications system is essential to ensure long-term strategic development and the quality of life of all its citizens. Computers have changed the way we think about information, the ease and speed with which it can be accessed, and the manner in which it can be assembled to create a new resource for decision makers. The libraries have to realize that the potential rests on the communication network and the readability of the bits and bytes transmitted. The applications that create and store documents and data can seamlessly share the information

Goals of a Library and Information Networks are:

- To support company-wide connectivity
- To create standardization
- To integrate data
- To implement integrated applications

8.5 MAJOR ELEMENTS OF THE MANAGEMENT METHODS - TECHNICAL ARCHITECTURE OF MANAGEMENT OF NETWORKS

An essential element in constructing an integrated environment is an efficient delivery vehicle for processing integrated applications. The design of this delivery system incorporates a complex infrastructure based on the standardization of a Technical Architecture. Technical architecture includes the methods, standards, policies and management directives.

A complex integrated technical architecture requires a highly trained staff to manage resources and provide services. This staff must perform specialized functions: managing daily operations, controlling the systems development environment, maintaining software to operate the environment, and planning for future requirements. Above all else, the technical environment must be continually monitored to ensure that it meets all business and engineering requirements.

It should be enabled that hardware, systems software, communication networks, programme development standards, and data base resources for Network operations are in place and available.

It is on an effective technical architecture that a business's ability to deliver sufficient resources to the systems users depends. The implementation of the architecture will otherwise fail. Providing appropriate types of service delivery and maintaining appropriate performance standards are essential.

The technical architecture incorporates specific services to support the system users. These services range from defining relational database management systems to installing a backbone communications network. Providing these services represents a major cost; however, the return is an effective mechanism for supporting integrated applications and integrated project requirements.

The standardization of a basic technical architecture provides strategic and economic benefits. However, because systems integration requires access to more of the hardware, software, and information resources, it exposes the organization to greater risk by allowing access to sensitive data. Although unauthorized access to information is a risk in any systems environment, the risk is even greater in a decentralized environment because of the increased access to systems and the complexity of controlling information.

The integrated systems environment is characterized by a disciplined approach where the correct information is readily available to quickly and efficiently do the job right the first time. This allows the designers and technicians to fully explore previous operating experience, customer requirements, and total cost implications of alternatives. To achieve this environment, the design function must be carefully evaluated and the identified requirements implemented in an integrated systems environment.

Historically, automation has focused on isolated "islands of automation" due to the paper-based method of information exchange. The systems recommended here will move to an online information exchange among the design groups. As this evolves, further opportunities will occur by linking the databases with new expert systems. Parametric design systems must also be evaluated. These systems have the potential to make conventional software applications, where a "rule based" repetitive design is required, obsolete. Their implications must be evaluated before a final commitment is made to conventional software applications.

- Application Planning/Administration
- Technical Infrastructure
- Service Delivery
- Security and Administration

8.5.1 Application Planning/Administration

Application Planning/Administration includes the methods, standards, policies and management directives for maintaining an integrated delivery system. The following recommendations identify the requirements for supporting an integrated environment:

Select a systems development methodology which will fit into the organization's culture and provide the necessary structure for designing and implementing all the required systems in the future. Designate responsibilities for the technical architecture development projects.

8.5.2 Technical Infrastructure

The Technical Infrastructure is the planned configuration of computing hardware and operating systems software, communication networks and databases required to support integrated applications, development functions and administration.

- The first element which must be addressed is the standardization of platforms (i.e., the computing hardware and operating system software).
- The second element is a standard networking technology and communications software to support communications across varying hardware platforms, projects and locations. In order to achieve the integration between the various databases and applications, it is necessary to provide all sites with the capability to communicate either online or through file transfers.
- The third element is a database management system (DBMS).

8.5.3 Service Delivery

A technical environment is configured on the principle that the implementation of new technology is a decision based on cost/benefits and strategic positioning. The following recommendations focus on four key service areas:

Initiate a service management process. The new architecture must provide specific services to support all users. Formalize the process of capacity planning and performance management. This process measures the performance and resource consumption of systems.

Implement a support organization for the resolution of problems. The purpose of problem management is to maintain and protect the integrity of the computing environment.

8.5.4 Security and Administration

Information security and privacy are inextricably intertwined. The former refers to the physical protection of information assets, which includes everything from identifying the asset to be secured to developing relevant policies and procedures, designing a secure environment, implementing the solutions, training the staff, and testing and monitoring the system. Physical protection is concerned with more than privacy; it also serves to guarantee the integrity and availability of the data.

“Privacy” refers to the goal that secured information can be accessed and seen by authorized and certified personnel only.

Security Categories

- 1) Administrative Procedures To Guard Data Integrity, Confidentiality, and Availability

- 2) Physical Safeguards to Guard Data Integrity, Confidentiality, and Availability
- 3) Technical Security Services to Guard Data Integrity, Confidentiality, and Availability
- 4) Technical Security Mechanisms to Guard Data

The technical environment must be properly managed. The following recommendations focus on four management issues related to data security:

- Implement a security plan to assist management in protecting Library Assets.
- Centralize the management and operations of the backbone network at the corporate level. This requires a centralized function to define, monitor and control network installations, and performance monitoring.
- Initiate a structured approach to evaluate and implement changes into the installed processing environment. This function attempts to minimize the adverse impact on system integrity by planned changes.

This process identifies critical functions and precautions, which must be taken to ensure continual operation in the event of disasters.

8.6 NETWORK ARCHITECTURE

Computer networks are concerned with linking together various pieces of computer equipment and systems and telecommunication networks. One important aim in a network is to provide end-to-end compatibility so that any terminal or system can be linked to any other. It is useful to examine network architecture. A network architecture consists of:

- The protocols and standards for data encoding and transmission (Protocol, hardware and cabling)
- The topology of the way in which units are distributed through the network (Topology)
- The control and flow of information through the network (Network operating system)

Network Protocols

A protocol is a set of rules that governs the communications between computers on a network. These rules include guidelines that regulate the following characteristics of a network: access method, allowed physical topologies, types of cabling, and speed of data transfer. The most common protocols are:

1) Ethernet

The Ethernet protocol is by far the most widely used. Ethernet uses an access method called CSMA/CD (Carrier Sense Multiple Access / Collision Detection). This is a system where each computer listens to the cable before sending anything through the network. If the network is clear, the computer will transmit. If some other node is already transmitting on the cable, the computer will wait and try again when the line is clear. Sometimes, two computers attempt to transmit at the same instant. When this happens a collision occurs. Each computer then backs off and waits a

random amount of time before attempting to retransmit. With this access method, collisions are minimized. However, the delay caused by collisions and re-transmitting is very small and does not normally effect the speed of transmission on the network.

The Ethernet protocol allows for linear bus, star or tree topologies. Data can be transmitted over twisted pair, coaxial, or fiber optic cable at a speed of 10 Mbps.

2) **Local Talk**

Local Talk is a network protocol that was developed by Apple Computer, Inc. for Macintosh computers. The method used by LocalTalk is called CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance). It is similar to CSMA/CD except that a computer signals its intent to transmit before it actually does so. LocalTalk adapter and special twisted pair cable can be used to connect a series of computers through the serial port. The Macintosh operating system allows the establishment of a peer-to-peer network without the need for additional software. With the addition of the server version of AppleShare software, a client/sever network can be established.

The LocalTalk protocol allows for linear bus, star, or tree topologies using twisted pair cable. A primary disadvantage of LocalTalk is speed. Its speed of transmission is only 230kbps.

3) **Token Ring**

The Token Ring protocol was developed by IBM in the mid-1980s. The access method used involves token-passing. In TokenRing, the computers are connected so that the signal travels around the network from one computer to another in a logical ring. A single electronics token moves around the ring from one computer to next. If a computer does not have information to transmit, it simply passes the token on to the next workstation. If a computer wishes to transmit and receive , it attaches data to the token. The Token then proceeds around the ring until it comes to the computer for which the data is meant. At this point, the data is captured by the receiving computer.

The TokenRing protocol requires a wired ring using twisted pair of fiber optic cable. It can operate at transmission speeds of 4Mbps of 16Mbps. Due to the increasing popularity of Ethernet; the use of TokenRing in library/information center environments has decreased.

4) **FDDI**

Fiber Distributed Data Interface (FDDI) is a network protocol that is used primarily to interconnect two or more local area networks, often over large distances. The access method used by FDDI involves token passing.

FDDI uses a dual ring physical topology. Transmission normally occurs on one of the rings; however, if a break occurs, the system keeps information moving by automatically using portions of the second ring to create a new complete ring. A major advantage of FDDI is speed. It operates over fiber optic cable at 100Mbps.

5) **ATM**

Asynchronous Transfer Mode (ATM) is a network protocol that transmits data at a speed of 155Mbps and higher. ATM works by transmitting all data in small packets of a fixed size; whereas, other protocols transfer variable length packets. ATM

supports a variety of media such as video, CD-quality audio, and imaging. ATM employs a star topology, which can work with fiber optics as well as twisted pair cable.

ATM is most often used to interconnect two or more local area networks. It is also frequently used by Internet Service Providers to utilize high-Speed access to the Internet for their clients. As ATM technology becomes more cost-effective, it will provide another solution for constructing faster local area networks.

Network Topology

In network computers are connected to each other. The way in which the connections are made is called the topology of the network. It is important to select the right topology for how the network will be used. Bus, star, ring, and mesh are the four most common topologies.

The term topology or more specifically network topology, refers to the arrangement or physical layout of the computers, cables and other components on the network. A network topology affects its capabilities.

A network topology implies a number of conditions. For examples, a particular topology can determine not only the type of cable used but how the cable is run through floors, ceiling and walls. Topology can also determine how computer communicate on the network. Different topologies require different communication methods and have a great influence on the network.

The type of network installed will depend on a number of factors, including the:

- Network budget
- Network size
- Level of security required
- Physical lay out
- Type of business
- Amount of network traffic.

8.7 NETWORK MANAGEMENT

The terminology “network management” may have many meanings but the definitions given below may be considered for clarifications. Network managements means deploying and coordinating resources in order to plan, operate, administer, analyse, evaluate, design and expand communications networks to meet service-level objectives at all times, at a reasonable cost, and with optimum capacity.

Network management involves planning, organizing, monitoring, accounting, and controlling of network activities and resources. Network management is the process of using hardware and software by trained personnel to monitor the status of network components and line facilities, interacting with end-users and carrier personnel, and implementing or recommending actions to alleviate outages and/or improve communication performance as to well as conduct administrative tasks associated with the operation of the network.

Need for Network Management

The relentless growth in the information processing needs of organizations has been accompanied by rapid development in computer and data networking technology to support those needs, and explosion in the variety of equipment and networks offered by vendors. Gone are the days when an organization would rely on a single vendor and a relatively straightforward architecture to support its needs. The world is no longer divided into the pure mainframe-based, IBM-computable centralized environment and the PC-based, single-LAN-type, distributed environment. Today's typical organization has a large and growing, but amorphous architecture, with a variety of local area networks (LANs) and wide area networks including PCs, workstations, and servers.

Objectives of Networking

The very objective of networking is to promote maximum utilization of information through sharing of resources by a group of libraries. It coordinates efforts towards, suitable collection development and reduces unnecessary duplication of costly books, periodicals, etc. The network establishes referral centres to monitor catalogue search and maintain a central online union catalogue of books, serials and non-book materials of all the participating libraries. It implements computerization of operations and services in the libraries for fast communication of information. It also coordinates with other regional, national & international networks for exchange of information and documents. Another function is to evolve standards for uniform guidelines in techniques, methods, procedures, hardware, software, services, etc., in order to facilitate sharing and exchange of resources.

Benefits of Networking

Networks can do anything a multi-user system can, and are better at processor and screen intensive tasks, such as spreadsheets and graphics applications, which are run locally (at the workstation). The following may be the advantages of installing a network.

- i) **Distributed Processing:** Programmes are downloaded from a central point (i.e., the file server) and run locally. The network system does no processing, but merely provides storage space for data and programmes.
- ii) **Security:** A workstation doesn't need disc drives, so one can stop people from stealing one's data and/ or software and one can keep viruses out.
- iii) **Backing Up:** Where data is centralized, backing up procedures are more convenient and can be more closely controlled.
- iv) **Shared Resources:** Equipment that would normally be kept idle for long periods can be utilised more effectively when several people share the use of it.
- v) **Communication:** By networking, sending replies will become easy. Files can be attached to messages, saving papers. Appointments can be arranged between groups of people, so one can use the system like an alarm clock.

An important function of successful networking is to ensure that the right information is accessed by the right person at the right time, meaning thereby that one should get a network that suits one's circumstances rather than change the way you work.

Future trends of Network Management

Networks are becoming increasingly critical to the majority of corporations for various reasons, such as providing faster and more reliable end-user application services; inter-linking with other corporations and service providers; distributing computing intelligence and database; providing total connectivity across communications forms, network architectures, and network components; supporting brands new applications which require the multiple of presently available bandwidth; and as a combination of all the preceding corporations saying they offer the ultimate advantage over their competitor. For supporting these ambitious goals, new network components and services provided by a considerably high numbers of suppliers have to be carefully considered. But new networking solutions, installation of new components, and implementation of new services will fail if there is no adequate network management solutions.

8.8 NETWORKING IN INDIA

Forced by the circumstances and by design, there has been a spurt in activities on library network development in the recent past. Some of the factors responsible for the promotion and support of such efforts in India are:

- Increased awareness of the need for resource sharing
- Resource crunch
- Increased installation of computers and access facilities in a library environment and enhancement of computer literacy among the library professionals
- Improvement in computer communication facilities within and across geographical regions, and availability of general data networks like National Informatics Network (NICNET) of MIT, INDONET(CMC Ltd), Education and Research Network -ERNET (MIT) and I-NET(Department of Telecommunications) and VSNL for the Internet.

Considerable study has been conducted as to why and how networking has preceded the efforts to implement and establish library networks in the country. Some of them are:

- i) The report of the networking group of the Planning Commission on modernization of library services and informatics for the 7th Five Year plan, 1985-90 suggests measures to establish networks of important libraries in the country to enable sharing of resources for the benefit of their user communities.
- ii) The National Policy on the Library and information System document (1986) accepted by the Ministry of Human Resources Development, Govt. of India, has many recommendations emphasizing the need for the national libraries in the country to form part of one integrated system so that they make a functional whole.
- iii) The report of the National Policy on University Libraries, Prepared by the Association of Indian Universities (1987), and the seminar on National Policy on University Libraries held on 30th Sept.,1986. recommends a network of university research and other libraries in the country so that the barriers of time, space and language are eliminated.

- iv) The UGC report on Information and Library Network (INFLIBNET) recommended the establishment of a National Network to link Libraries in universities, colleges and documentation and information processes. Beside these documents many seminars and conferences have also recommended the creation of library and information networks at various levels and coordination of their activities through modernization of the library and information process.
- v) Various metropolitan networks have been established with the support of NISSAT of DST and the Planning commission like DELNET, CALIBNET, ADINET, BONET, etc.

8.9 NETWORK SELECTION CRITERIA AND THE CHALLENGES IN NETWORK MANAGEMENT

Having decided to participate in a network, an intending library/information centre is faced with the questions of selecting the most suitable network. The following factors help in making the choice:

- Available network options.
- Criteria to be used in deciding the network.
- Method of evaluating competing networks.
- Selection of functions of the network to be used.
- Reliability of system.
- Quality control standards decided by the network.
- Cost

A network may fail if the basic objectives are not properly formulated. Reasons for network failure can be listed as:

- Emphasis on only a single function (e.g. inter-library loan in library network) which is difficult to justify on the basis of the cost-effect criterion.
- Lack of attention to the use of appropriate technology.
- Lack of attention to formal system design, derived from stated goals and objectives.
- No specification in developing functions.
- Not translating network bylaws into specific operating procedures.
- Unrealistic budgeting and lack of expertise in developing long term funding.

Challenges

- 1) Availability – probably the most important concern in any network management services is the easy availability or the uptime of the network resources.
- 2) Easy manageability – Status indication of network and centralised management of all the resources.
- 3) Proactive bandwidth planning.

- 4) Cost effectiveness of the operations
- 5) Stability of the operations and network resources.

How much down time can you live with?

A customized support plan is possibly a chief information officer's only true defence against unexpected outage.

8.10 SUMMARY

As a rule, networking in library and information services is still at the primary stage and is not as well developed as that in other sectors such as banking, civil aviation, customs, public telecommunication and other industrial departments. The major reasons for this, apart from the social and political ones mentioned above, may be that: 1) before networking can be implemented, individual libraries must move to the computerization stage and a range of viable databases must be available; 2) financial constrains make it difficult for libraries to establish their own dedicated networks, and to afford the communication fees for other networks.

In spite of all these difficulties, Indian librarians still have made efforts and have achievements to their credit.

8.11 ANSWERS TO SELF CHECK EXERCISES

- 1) The Local Area Network involves the following :
 - Local Area Network Protocol - the networking standard that is used on the LAN
 - Cabling - the kind of wiring to be used through the LAN
 - Network Interface Cards - to allow them to communicate over the LAN
 - Structured cabling system - in which the network cabling is installed.
 - Network Topology and Connecting Devices - the logical structure of the network and the hardware to which the computers are connected by the cabling and through which communications flows.
 - Network Operating System and Server - the software and hardware that provides the computer with access to shared services like printers and file servers.
 - Wireless LAN - means for staff and patrons to work without being tied down by network cables.
 - Campus or backbone networks - networks connect to library LAN's or connect to campus networks.
- 2) Network management means deploying and coordinating resources in order to plan, operate, administer, analyse, evaluate, design and expand communications networks to meet service-level objectives at all times, at a reasonable cost, and with optimum capacity. Network management involves planning, organizing, monitoring, accounting, and controlling of network activities and resources.

Network management is the process of using hardware and software by trained personnel to monitor the status of network components and line facilities, interact with end-users and carrier personnel, and implement or recommend actions to alleviate outages and/or improve communication performance as well as conduct administrative tasks associated with the operation of the network.

The very objective of networking is to promote maximum utilization of information through sharing the resources by a group of libraries. It coordinates efforts to suitable collection development and reduces unnecessary duplication of costly books, periodicals, etc. Network establishes referral centres to monitor catalogue search and maintain a central online union catalogue of books, serials and non-book materials of all the participating libraries. Networks can do anything a multi-user system can, and are better at processor and screen intensive tasks, such as spreadsheets and graphics applications, which are run locally (at the workstation). The following may be the advantages of installing a network.

- 3) Participation in the network involves a thorough study of the network and there are number of criteria which help to take appropriate decisions at the right time in the right direction. A network may fail if the basic objectives are not properly formulated. Hence the following criteria may be of use for network selection.
 - Consider the available network options.
 - Evaluate competing networks.
 - Select the functions of the network to be used.
 - Study the reliability of the system.
 - Know the quality control standards decided by the network and the cost.

Challenges of the network include:

- Easy availability of network resources
- Easy management of all the resources
- Proactive bandwidth planning
- Ensuring cost effectiveness of the operations
- Stability of the operations and network resources etc.

8.12 KEYWORDS

Local Area Network(LAN) : A LAN is a combination of computer hardware and software linking together intelligent computing devices in a building or over a small campus.

Wide Area Network(WAN) : A WAN is a combination of computer hardware and software which provides data communications services between agencies, geographically separated locations, computer systems, and local networks.

- Hardware** : All the physical components of a computer system, including printers, network cards, monitors, and peripherals like scanners.
- Network** : A group of computers and peripherals connected by a communications channel capable of sharing files and other resources between several users.
- Protocol** : The specification that defines the procedures to follow when transmitting data.
- Software** : A file or files containing instructions that tell the computer what to do.
- TCP/IP** : The rules used by computers to communicate via the Internet. TCP/IP stands for transmission control protocol/Internet protocol.
- Architecture** : Design, or the way components fit together. It can be used to describe any system, as in “software architecture” or “network architecture”.

8.13 REFERENCES AND FURTHER READING

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