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COMPUTER NETWORKING IN THE NATIONAL LIBRARY OF NIGERIA:

A PROPOSAL

BY

GBONJUBOLA OLUFEMI DADA

(NEE OLATONA)

A Master's dissertation, submitted in partial fulfilment of the requirements for the award of the Master of Arts Loughborough University of Technology.

September 1995

Supervisor: Mr. Alan J. Poulter, B.A., M.A., MSc., ALA

Department of Information and Library Studies

ABSTRACT

We live today in an era of information explosion, ever increasing inflation, limited budgets for competing national priorities, and a technology that is developing with insistent rapidity. The reality of this experience presents huge challenges for the management and organisation of the various systems that are developed within a particular environment, especially in all information aspects.

This research work is an attempt to highlight the current trends in computer networking of libraries in various parts of the world and to explain the means by which the distribution of information resources has been enhanced by the procedure. This is presented in an analytical exposition of computer networking development and application in libraries. It describes the functional characteristics of computer networking and the setting in which computer networking technology and standards networks are used. It reviews computer networking as a tool for co-ordination and co-operation among libraries and information centres. It also looks at its application in the development and efficient use of information resources, examines the structure of computer networks and the operations they perform. This research has revealed a great deal of need for computer networking in the developing countries and indicates that the National Library of Nigeria (NLN) should seek to become computer networked in order to take her rightful position among the National Libraries (NLs) in Africa as the 'giant of Africa'.
ACKNOWLEDGEMENTS

Countless people have contributed to this thesis in one way or the another. Most of them blissfully (simply) ignorant of that fact! It is impossible to fully acknowledge the help given by all in a research programme of this nature. Nevertheless, the author would like to thank:

The members of the National Library Board, especially the chairman Mr. F.Z. Ghana and the National Librarian for the opportunity given for me to travel out of my post.

Mr. Nat Oderinde who not only discovered me, but has given me encouragement and support since I entered the National Library. His advice on this research programme has been of immense value. Also my former head of department Mrs. Yemi Omolayole for her valuable insight.

Prince Dr. S.B. Aje, one of the pioneers of librarianship and the first indigenous chief executive of the National Library of Nigeria, whose standard of life and witness made a major contribution to my early explorations into librarianship. Also for his all-round support which has given me throughout this programme.
The EEC for my sponsorship and programme officers Mr. Dominic Rowe and later Ms Liselot Hertel of the British Council in the UK, for their kindness. The EEC staff in Nigeria, Ms Demi Ademola, including her staff and Mr. A. Oladapo of the Federal Ministry of Finance and Economic Development, for their individual and collective efforts to see to the approval of my sponsorship in spite of administrative and diplomatic bottlenecks that my EEC Award went through especially, for processing my flight ticket to Nigeria in time for my mother's funeral ceremony and for the extension of period granted me to complete my programme.

My tutor Mr. Alan Poulter for his active support and encouragement. He gave me helpful guidance while labouring with the thesis. As with anything that he undertook, he devoted his time, knowledge, and search for perfection to the project. It would have been impossible without the expertise and cooperation of countless librarians and computer network experts. Preparing a project like this can be a solidarity activity.

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Mrs. Janet Stevenson and Usman Abdullahi for all their prompt reading of my work and turning the manuscript into a book. This thesis benefited a lot from their clear comments, help and sustained interest through this work.

My husband and children who sacrificed a habitual family togetherness time to set me free for this adventure in my chosen profession.

My wonderful father Chief Michael Olatona, brothers and sisters. Especially my precious mother of blessed memory, who saw me physically and happily into UK and will only receive me back spiritually. Also those who prayed for me while I was giving birth to this thesis. They are the force and inspiration behind this project.

Finally and most importantly, I will ever be indebted to the Almighty and unquestionable God: 'The Rock of Ages' on whom I stand. He has always been a constant source of supply, inspiration and encouragement to me. He opens the door and no one is able to shut it. Especially for sustaining my whole family since my mother answered His Divine call.
DEDICATION

This work is dedicated to the glory of God who answers prayers always. Also to the happiness of all information suppliers, the joy of all information providers and welfare of all information seekers.
ACRONYMS AND ABBREVIATIONS

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<td>AMRS</td>
<td>Australian Marc Record Service</td>
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<td>APNET</td>
<td>African Publishers Networks</td>
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<td>ARCanet</td>
<td>Average Response Computer</td>
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<td>ARCanet</td>
<td>Automatic Relay Calculator</td>
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<td>ARPAnet</td>
<td>Advanced Research Project Agency</td>
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<td>BIC</td>
<td>Book Industry Communication</td>
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<td>BIDS</td>
<td>Bath Information and Data Service</td>
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<td>BL</td>
<td>British Library</td>
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<td>bps</td>
<td>bits per second</td>
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<td>BLAISE</td>
<td>British Library Automated Information Service</td>
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<td>BLDSC</td>
<td>British Library Document Supply Centre</td>
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<td>CABI</td>
<td>Common wealth Agricultural Bureau International</td>
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<td>CATV</td>
<td>Community Antenna Television</td>
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<tr>
<td>CCITT</td>
<td>Consultative Committee for International Telegraph and Telephone</td>
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<tr>
<td>CCLAN</td>
<td>Client-Server LAN</td>
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CD-ROM  Compact Disk Read Only Memory
CPU    Central Processing Unit
CSMA/CD Carrier Sense Multiple Access with Collision Detection
CURL  Consortium of University Research Library
DOS    Disc Operating Systems
EDI    Electric Data Interchange
E-mail Electronic-mail
ERIC   Educational Resources Information Centre
FID    International Federation for Documentation
FTP    File Transfer Protocol
ICA    International Council for Archives
ICSU   International Council of Scientific Union
IDRC  International Development Research Centre
IED    International Exchange Data
IEEE   Institute of electrical and Electronics Engineers
IFLA   International Federation of Library Association
IITA   International Institute of Tropical Agriculture
ILL    Interlibrary Lending
ISC    Information Systems Committee
ISDN   Integrated Service Data Network
ISI    Information Structure Implementation
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<tr>
<td>ISO</td>
<td>International Standard Organisation</td>
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<td>ISDN</td>
<td>Integrated Services Digital Network</td>
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<td>JANET</td>
<td>Joint Academic Network</td>
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<td>JIPS</td>
<td>Janet International Protocol Service</td>
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<td>LAN</td>
<td>Local Area Network</td>
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<td>LC</td>
<td>Library of Congress</td>
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<td>LDSC</td>
<td>Library Document Supply Centre</td>
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<td>LSP</td>
<td>Linked System Project</td>
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<td>MAN</td>
<td>Metropolitan Area Network</td>
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<td>MARC</td>
<td>Machine-Readable-Cataloguing</td>
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<td>Mbs</td>
<td>Megabits per second</td>
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<td>NATIS</td>
<td>National Information System</td>
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<td>NCIC</td>
<td>National copyright Information Centre</td>
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<td>NIDOC</td>
<td>National Information Documentation Centre</td>
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<td>NLA</td>
<td>National Library of Australia</td>
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<td>NLN</td>
<td>National Library of Nigeria</td>
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<td>NUC</td>
<td>National Union Catalogue</td>
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<td>NULOS</td>
<td>National Union List of Serials</td>
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<td>NYPL</td>
<td>New York Public Library</td>
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<td>OCLC</td>
<td>Online Computer Library Centre</td>
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<td>OPACs</td>
<td>On Line Public Access Catalogues</td>
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<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>OPTI-NET</td>
<td>Online Computer System</td>
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<td>OSI</td>
<td>Open System Interconnection</td>
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<tr>
<td>PAD</td>
<td>Packet Assembler Disassembler</td>
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<tr>
<td>PADIS</td>
<td>Pan African Development Information System</td>
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<tr>
<td>PCs</td>
<td>Personal Computers</td>
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<td>PDNs</td>
<td>Public Data Networks</td>
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<td>PPLAN</td>
<td>peer-to-peer LAN</td>
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<td>RLG</td>
<td>Research Library Group</td>
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<tr>
<td>RLIN</td>
<td>Research Libraries Information Network</td>
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<td>SAPES</td>
<td>Southern African Political Economic Series</td>
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<td>SNI</td>
<td>Standard Network Interconnection</td>
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<td>TCP/IP</td>
<td>Transmission Control Protocol/Internet Protocol</td>
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<tr>
<td>UNESCO</td>
<td>United Nations Educational Scientific and Cultural Organisations</td>
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<td>UTLAS</td>
<td>University of Toronto Library Automation System</td>
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<td>WAN</td>
<td>Wide Area Network</td>
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<td>WLN</td>
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INTRODUCTION AND METHODOLOGY

Computer networking is necessary in national libraries to improve access to information on a national and international level. This will be through the use of online facilities. Telecommunications will be required for computer networks. It will lead to the use of optical discs and technology to assist in information management. Local network will lead to the development of local use of the CD-ROM. Computer networking will increase the information flow from the library services to the users. Problems of data storage and retrieval will be overcome and it will be possible to accelerate in-house information provision.

National libraries should develop a capability to put information at the disposal of the scientific, technical, industrial and business community. National libraries in Africa have a role to play in accelerated development.

The researcher gathered various literature reviews only in English. Most of them are published and while others are grey literature. Indexing and abstracting sources on CD-ROM such as ERIC and LISA were consulted. Current periodicals on library networks were used while computer networks was scanned. Some of the journals found useful, are:

Aslib Information, Aslib guide series,
Focus on International and Comparative Librarianship,
Journal of information Science,
Journal of Librarianship and Information Science,
IT's News,

British Library annual reports

Library networking in Europe. Also the publication of Hildreth, Charles R. “Library automation in North America: a reassessment of the impact of new technologies on networking”, while the topic was simplified by Apple Computer Inc. “Understanding computer networks”. Although some of the current publications especially the periodicals were not very useful because they deal more with the advanced stages of computer networking.

The project aims to show that this analysis can be turned into reality. Conclusively, this research endeavour has undertaken a prescriptive role for the National Library of Nigeria. It attempts to design a possible model that will effectively coordinate the national information resources as well as effectively tap into the major sources of information and documentation around the world.
CHAPTER 1

COMPUTER NETWORKING

1.1 INTRODUCTION

A Network is a data communications system or channel interconnecting a set of computing devices or nodes that can communicate with each other and also link terminals, microcomputers, minis, or mainframes so that they can operate independently but also share data and other resources(1).

Networks can be considered as the information highways over which data is transported to support resource sharing and the exchange of communication. They make distance and differences between computers invisible. They give users access to an ever-growing range of resources sharing. Networks are illustrated in automated banking, airline reservations and check-outs at supermarkets.

This chapter gives a brief introduction to the technologies of computer networking. It reviews the objectives, types and applications of networks. It examines topology, protocols, software, communication and transmission media.
The basic reasons for the growth in the network applications is the increase in access to data and cost effective computer resources(2). Computer networks are excellent for transferring large files. They allow users to communicate with each other and access remote services and devices through their personal computers. Resources shared may include specialised computers, software or other devices that are expensive or unique and must be shared. A typical example is access to a corporate super computer from workstations at remote research laboratories. This is called resource sharing. Through computer networks, application sharing is also possible. Several users can have access to the same application software and everybody in the group can upgrade to the newest version of a database programme by accessing a shared storage disk.

Communication and data are conveniently exchanged using E-mail or bulletin boards irrespective of their locations. National/international communication is possible through electronic mailboxes which is a quick and paperless form of communication. There should be an adequate and proper configuration of the computer and peripheral units for the best result(3).
1.2 TYPES OF COMPUTER NETWORK

There are two basic types of networks: Wide-Area Network (WAN) and Local Area Networking (LAN).

1.2.1 Local Area Networks (LAN)

Local Area Networking (LAN) often referred to as local computer network, and established network. For the purpose of this work, Local Area Networking (LAN) will be the term of reference, because this is commonly used in the library setting. Local Area Network (LAN) links nodes that are physically close to each other and usually 'hard wired' together via cables. It often covers a distance of a hundred feet to a few miles with excellent and reliable speeds. Local area network could link microcomputers into computer information systems in environments in which the distance between devices is not more than 50 miles. The three distinguishable features of a LAN are:

- it has a limited geographical area,
- high speed data transmission in the range of 10MBPS, and
- data transmission occurs over a common medium.

Typically, LANs are used in single organisations at single sites. Organisations which use external networks may use a LAN to link to external network services. There are three
types of LANs: Zero Slot LAN(ZSLAN), peer-to-peer LAN(PPLAN) and Client-Server LAN(CCLAN)(8).

Zero Slot LAN(ZSLAN)

The Zero Slot LAN(ZSLAN) is the simplest of all the three types. It does not require a special card to be installed in every computer in the network. ZSLAN shares the printers, CD-ROM drives, and other computer peripherals. It allows access to files between nodes in the network and the transfer of files without interruption among the other nodes. It is flexible. The ordinary LANs speed is 2 to 16 Mbs (Megabits per second)(9). But the Zero Slot LAN(ZSLAN) operates at the speed of 115,200 bps (Bites per second). In ZSLAN parallel ports can be used to connect nodes, but most often serial ports are used to connect the nodes, and because it uses spare ports, the speed is slow.

Peer-to-peer LAN(PPLAN)

Peer-to-peer LANs(PPLANs) are designed for light and small use networks which consist of a maximum of ten nodes. Each node accesses the CD-ROM drives. Each node provides and shares the common resources in the network independently without interrupting any of the nodes in the network. The fewer the nodes that access the network the better the result in terms of response. Individual users have equal access to network resources
without being reliant on mainframe control of those resources. Users have independent
processing power on their own desktop, control over their own files and applications.
They have instant access to worlds of shared information resources and services. It is
reliable as the central host system can not fail and paralyse users work suddenly. PPLAN
is not highly recommended for a CD-ROM because of its poor speed.

Client-Server LAN(CCLAN)

A server is a hardware device or software routine that provides predefined services on a
network. Servers allow other nodes in the networks to access defined or specific
resources. The dedicated servers are responsible for the processing of requests from
clients, while the print server provides access to printers or other output peripherals. They
receive print requests from clients and direct the request to the appropriate devices for
printing. File servers allow all the clients in the network a sequential access to the storage
space. Best result are guaranteed with powerful microprocessors like 80386 or 80486
on IBM compatible computers.

1.2.2 Wide Area Networks(WAN)

The distance of the Network determines its type. When the nodes are distributed over a
wide area of distance of hundreds or thousands of miles it is called a Wide Area
Network(WAN). It is possible to combine both WAN and LAN where the latter is widely separated in branches and connected via a WAN to the LAN in branch headquarters(13).

The origins of Wide-Area networks could be traced to the original work done under the auspices of the Department of Defence in the USA that resulted in the creation of the Advanced Research Project Agency Network(Arpanet). It is normally supported by common carrier transmission services such as regular phone lines, leased lines, a packet-switched network, (like Tymnet), and satellite communications. Text, binary files and audio and video information are available through WAN. It supports interactive video-conferencing if given sufficient bandwidth.

1.3 NETWORK TOPOLOGY

The network parameters are defined by its topology and the transmission medium used. Large and complex networks may use various combinations of these basic topologies. Topology is the physical arrangement of devices in a network, regardless of their logical relationships. It is the physical layout of the network. It prescribes the arrangement of network devices relative to one another and influences the methods of access to the network and transmission of information to each other. The types of networks topology include Daisy chain/point-to-point, linear bus, star, ring, and multiconnected(14).
1.3.1 Daisy chain/Point-to-point connection

Daisy chain connection is a direct communication link connecting two systems. It has the advantage of simplifying routing decisions among nodes, but the reliability of the network depends on the reliability of the weakest links. When there are more than two machines, it can be referred to as a daisy chain when each machine on the chain simply plugs into the next.(Fig.1.1 denotes Daisy chain)

\[ \text{Fig. 1.1: Daisy Chain Topology} \]

1.3.2 linear bus

Linear bus is an electrical transmission circuit for carrying information in which all the network nodes are connected between devices to a common transmission medium/fibre. It has two distinct ends. Devices are connected along the length of the bus by cable taps, or by drop cables that extend from the device to the bus. This is commonly used by
LAN(16). Problem with linear bus arises from a fault in the cable(17). (Fig. 1.2 denotes linear bus)

![Fig. 1.2: Linear Bus Topology](image)

1.3.3 Star

All the devices are connected through a single switching point called a hub/central node. It can be active or passive. The active one is usually used to control the entire network and it performs all the routing. It is used where a central computer communicates with remote terminals. Failure of the hub can cause problems. (Fig. 1.3 denotes Star)
1.3.4 Token Ring

This is configuration that uses a physical ring structure and in which network device access is controlled by a rotating token. This is also used by IBM Corp. in LAN. They are formed by linking network interface cards to a multistation access unit by using twisted-pair adaptor cable. Each Token controls access to that network. The net structure devices are connected in a physically closed ring point-to-point forming a closed loop. Information is passed from node to node around the ring until it arrives at the addressed node. Each node on the ring awaits the arrival of a token which is a unique sequence of bits, from the upstream node that indicates, permission to send data to the next downstream node. At each stop, the node reads the packet's destination address and interprets the packet. Only one node can transmit at a given segment because each segment is independent of the cable between the nodes.
1.3.5 multiconnected.

Nodes are connected by point-to-point. They link arbitrarily. This multiconnection makes networks more reliable, reduces congestion and makes routing complex because many paths are possible between any two nodes. (Fig. 1.5 denotes multiconnected.)
1.3.6 Tree

Tree is a network topology wherein only one route exists between any two nodes. It is a natural data structure for any data objects whose components stand in a hierarchical relation to each other (19).

![Tree Topology Diagram]

**Fig. 1.6 Tree Topology**

WAN network's topology is star. The design looks like a central hub with radiating spokes. The system could be comprised of personal computers. They are generally
connected through telecommunications links which may use a mixture of fibre optic cables and satellites.

1.4 NETWORK HARDWARE

Network hardware typically consists of network cabling, network interface cards, repeaters and other devices. Network cabling, used to link stations on a network, can be of a number of types. It sets limitations on speed, length of network and number of stations. Interface cards provide a link between the computer station and the network cabling. In some cases this hardware is built into the computer. Repeaters boost the signal strength, increasing the overall length limits of a network. Other network hardware includes bridges and gateways, which are used to link separate networks. The physical arrangement of stations on the network varies depending on the kind of network. On some networks the stations are arranged along a central trunk line. The types of hardware in a network consists of computers and 'peripherals' e.g scanners; CD-ROM drives; printers and modems. Some of these terms are represented on the example of a PC computer network shown in figure 1.7.
The technical components of a network are important parts of computer networking (20). They are:

- the central processor which is called the host computer or file server.
- a file server which is a computer dedicated exclusively to controlling the network and providing most of the data storage capacity which are put together to make the computer serve its purpose; and
the terminals, micros, or minis linked to it which are called the node (21).

The computer networking environment can comprise IBM compatibles Personal Computers (PCs) and/or, mainframes, printers, Modems and cables.

A modem is a device used to process a digital signal so that it can be transmitted on an analogue transmission line. Modems may use amplitude, frequency or phase shift modulation (22). A port is a point at which input, output, storage or communication connections can enter to, or exit from a computer (23). A hub is to be usually in LAN technology, the centre of a star topology network or cabling (24). A terminal as a keyboard and display screen through which users can access a host computer (25). This serves as a central processing unit for a number of terminals. A terminal can also be a remote input/output hardware device that is connected to a computer in a Data Communication System through which information from a remote computer is made available to an end user (26). It could be general-purpose and job oriented. A terminal is used for the required activities in the computer networking (27). When a terminal is turned on, it loads its software from a server. This could be from a Digital InfoServer or from a host computer system. The standard terminal will be 4-megabyte system logic board or 2-megabyte system logic board and 2-megabyte memory controller board. The alternative to this is a 2-megabyte memory controller board (28).
1.4.1 Types of Devices used in WAN

A repeater is a piece of telecommunication hardware that amplifies data signals. It extends the sending range of the signal by boosting its strength over periodic distances. A repeater regenerates weak signals for an additional length that is double the original length without losing signal quality. It determines the maximum length of cable length that can be used in a single network. A multiport repeater has multiple cables thus increasing flexibility.

A bridge which is another data communication device in WAN. It is a device like a VCR in shape and general appearance. It acts like a traffic cop between networks or subcomponents of networks. They are used to keep network traffic within the localized network. It allows only the appropriate messages to travel to or from that local network. A bridge works at Data level, between similar LANs and it is fast, but limited in connections. Interconnection of LAN to WAN requires bridges. Routers are like bridges, but add capabilities to route data intelligently to the correct network address. The telephone system uses routers to direct data to a four-part address code consisting of country and the area and the central office and four-digit line number. It is protocol dependent. Interconnection of LAN to WAN requires Routers like bridges.

Brouters mix bridge and router technologies. They process internet working connections quickly. They are able to handle communications and translate pockets between the
different protocols. They are slower but limited in connections. The last type of WAN devices are Gateways which are hardware devices and related software applications that connect networks. The networks could be LAN to LAN; LAN to WAN; WAN to WAN, but should have dissimilar protocols. This is the most sophisticated interconnection process and is used to connect not only private networks, but also commercial Public Data Networks (PDNs). Examples of this are: Tymnet, Telnet, CompuService and Sprintnet.

1.4.2 Transmission Media

Data communications systems use transmission media, including optical fibres, coaxial cable, twisted copper pairs and satellite links. They provide the physical communication channel to interconnect nodes in a network. Networks usually use a combination of nodes. A node is a switching point within a network. It is a point in a computer network where communication lines are interconnected. This ensures that the information reaches its specified destination. Node is called station in X.25 networks (29).

A Cable is a collection of metallic wires surrounded by an insulator through which an electric current can be passed. Cabling is the physical connection of networks by cable. The three types of cabling in LAN are coaxial, twisted-pair and fibre optic media. Coaxial cable is a form that has an inner conductor and an outer grounded shield positioned around a common axis. It is used for digital transmission up to 100 Mbps and for analogue
transmission up to 1,000MHz. It has good noise immunity. Coaxial cable typically has higher performance specifications than twisted-pair wiring. It is popular for its high speed especially with Ethernet because it has high bandwidth and low sensitivity to electrical interference. It can be used in computer networks at speeds of up to 16mbps or more. It consists of a central conductor wire surrounded by a layer of insulation, a conductive mesh sleeve, and an outer shielded insulator.

Twisted copper pairs are two insulated cables twisted together and used for transmission. Each wire is insulated and the pair is usually covered by an overall casing. The twisting creates a low level of noise elimination. There are two types, shielded and unshielded. The unshielded is the most widely used in LANs. The problem of the unshielded is that they are susceptible to electromagnetic interference, and power cable and vulnerable to crosstalk. The communication speed of the cable increases only when the radiated harmonies are controlled. The transmission error is minimised by surrounding it with a braided metal shield. The twisted-pair popularly used by IBM Token Ring network and IBM PC network is called IBM Type 1. It has a high reputation of high performance. It is popular with LAN.

Fibre optic media are a thin strands of refractive glass or plastic used as wave guides for beams of light that encode information. They use a light source at the transmitting end and a detector at the receiving end. It transmits an extremely high-speed signal through fine
fibres made of glass or class-like synthetics. The light is generated by a laser at speeds of up to 1 bps. Crosstalk is prevented by the surrounding refractive cladding material which contains the light. They are not susceptible to electromagnetic or any other electrical interference. They are better than the others because they produce uninterrupted transmission over long distances. They are characterised by their lightweight and durability. It can be too expensive for LANs.

1.5 NETWORKING SOFTWARE

For the successful transmission of any computer networking, there must be some sort of software. Network software consists of e-mail or file sharing software. It is much easier for users and staff to update retrieval software by using an optical file server, than to buy a new version. The two types of software are application and system programs. The range of the software determines what the hardware can do. The functions performed are controlled by protocols and made usable by a network interface card.

1.5.1 Protocols

A computer network is composed of communication channels which connect a set of computing nodes that can communicate with one another. Protocols are sets of rules that
are required for a common framework of routines (33). They govern the understandability of the signals that are sent between computers. Protocols open, organise, start the data transfer and checks errors, retransmits data containing errors, stops data transfer, close and control the messages that are communicated simultaneously such as clock synchronisation and the XON/XOFF. Communication protocols are rules to be observed for the best result in networking. They are technically complex. Protocols also remove the barriers between machines' own operating systems. For example, although the Apple Macintosh and IBM-PC computers are not compatible they can communicate with each other. They connect both the hardware and the software via 'ports'. The main types are the serial are bit by bit or parallel byte by byte. It is a message format and standard to which communication network software must conform to achieve the objective of the networking (34). These protocols govern the transmission of information over the network at different levels. For instance, at the lowest level, these rules govern the destination of the message and ensure error-free transmission between them. At a higher level, the protocols determine how a communication arrives in the proper sequence. At a yet higher level, protocols determine the rules of conversation. And on the highest level, protocols are the language used in the communication itself. The higher level protocols interact with a computer's operating system software and are often referred to as the network shell or network system software. This is popular with Disc Operating Systems (DOS).
The lower network protocols are referred to as the network driver software. The driver gets the communication out onto the network and looks for the response. Error-Checking is a strong point of the protocol. In Ethernet-based LANs, the speed is almost 2.5mbps and interconnects using fibre-optic cable support transmission rates reaching 100mbps. Integrated Services Digital Network(ISDN) transfers all information from source to destination in a digital form. The network is formed using a combination of circuit and packet-switched facilities. It is a proposed international Wide-Area Network standard to replace X.25. It can put voice, data, fax, and video communications on one major public network. The application program meets a specific task and the system program is any program which controls or improves the performance of a computer system. Two types of these protocols are Ethernet and ARCnet.

**Ethernet**

This is the LAN technology developed by Xerox Corporation and Intel Corporation for the linking of microcomputers. It uses the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) physical access method, coaxial cable, and 10-Mbps digital transmission. Ethernet can use all the three types of cabling i.e the coaxial, twisted-pair and fibre optic media. The data transfer rate in Ethernet is 10Mbps. The protocols are defined by the OSI. The International Standard Organisation(ISO) defines seven layers of protocols namely physical medium / physical, data link, network, transport, session,
presentation, and application. Layer 3 is responsible for 'network'. It handles problems of routing and switching(38).

1.5.2 Switching

Circuit Switching is a telecommunication network handling voice/data which provides a communication channel by linking the devices' transmissions circuit through switching exchanges on demand for exclusive use by the connected parties. When a demand ceases, the link between circuits is broken. A shortage of available links might result in a circuit being established, through successive switches, over an alternate route(39). This is the telephonic voice messages which are sent in analogue form from one circuit to another at the speed of approximately 9,600 bits to 64,000 bits per second(40).

The packet switching mode establishes connections between parties on demand via the international telephone system. It has a fixed topology. It consists of the addresses of the recipient, and the sender; a message id/sequence number data; and error checking. Information is identified and sorted out as should be received. During lapses in transmission, the line is available to other users. Data is transmitted in packets of fixed lengths frequently 64 bytes(41).
1.6 EXAMPLES OF NETWORK

1.6.1 WANS: Internet

The Internet is a global network of networks linked by means of the Transmission Control Protocol/Internet Protocol (TCP/IP) and other protocols. The system incorporates an interconnected collection of independent thousands of networks, hundreds of thousands of computers and millions of users in several dozen countries of the world. It involves private, public, government and industry sponsored nets (42). It is a global network of
networks over which no one organisation has complete control. It has a very good effect on the informational and research life of less advanced communities in the implementation of networking. Communication between the networks is made possible by each computer running programs collectively known as Internet protocols.

Computer resources linked to the Internet vary widely, but the common bond is the Transmission protocol suite. This is used for the internet work routing and error free message delivery. It operates at the third and fourth layers of the Open System Interconnection(OSI) model. The original Internet was a US Defence Department network called 'ARPAnet'. It was designed by ARPA within the US Defense Department to support the military and research communities. It has been split into two interconnected parts, that is, Milnet for military use, and the Internet for commercial and academic use(43). Access to the Internet is generally obtainable through subscription to a local access provider and requires a modem and telephone line. It was developed by the American military to withstand the destruction of sections of the network by bomb attacks. Academics and researchers were granted access to parts of the system, by using internet protocols.

In the UK, the Joint Academic Network(JANET) began to use the Internet protocols in 1991. It became the chief provider of academic access, linking all UK Universities to the Internet. The other benefactor of the Internet in the UK is the commercial sector, with
increasing use by government and independent organisations. Each machine on the Internet has a unique global address, which is analogous to a telephone number, allowing each machine to locate any other. The services offered by Internet are e-mail, Telnet, FTP, WAIS, Gopher and World Wide Web. Different charges are incurred to put data onto a hard disk. Also for different access for the services.

1.6.2 LANS: NT server

The effective implementation of an enterprise's objectives can be achieved by network services and applications(44). Microsoft's BackOffice solution of Windows NT server has been chosen as the company's network operating system. The NT server and BackOffice applications use authorised schemes. The directories in each network environment are capable of accepting user credentials from other networks in a peer-to-peer fashion. The centralised system is trusted by all the networks. At Equitable Life of Iowa, LAN Switching has become the foundation of a corporate wide network consolidation effort. The Switches were originally installed to boost the efficiency of one division's over taxed network. Early in 1993, USG Annuity and Life Company, an Equitable Subsidiary, installed an ES/1 enterprise LAN Switch from standard Micro system corporation to eliminate congestion in its Token Ring-based network. This was to maintain service levels and keep pace with business growth(45).
The CPA firm of Landucci, Bick, Matter & Johnston, based in Woodland, CA, employs 14 people including four partners. The company runs a Novell NetWare 3.12 LAN with 17 nodes with 11 token rings, which stretches the standard definition of campus-wide networking to the full. The purpose of the network is to increase productivity through office automation for scheduling, telephone messaging, and e-mail and by sharing databases and computer peripherals. Also LAN is also used to support reductions in overhead. LANRover has accelerated the company computer networking.

The considerations for disaster recovery planning include voice and data communications backup, network recoverability, departmental processing backup, mainframe backup, and vital records in off-site storage. The architecture for LAN-based office applications developed for the IBM Corporation is used. This include Lotus Notes, E-Mail gateways to the host, a host to LAN calendar system, word processors, graphics applications, and spreadsheet applications. Local area network standards and guidelines developed by members of a company-wide IBM LAN Council is used. The company is utilizing LAN fax technology which saves the company time and money. The company used the British Aerospace's distributed token ring IBM AS/400-based enterprise network which claims to be the UK's largest token ring installation, with virtually no point-to-point connections. The system needs standard interface services before network applications and services can be effective. There is a need to work with other vendors to solve the problem of standards and effective enterprise system(46).
1.7 CD-ROM NETWORKING

CD-ROM stands for Compact Disc Read Only Memory (CD-ROM). It is a method of using currently existing optical technology to store a large amount of data on Compact Disc. The CD-ROM is 12 centimetres in diameter and has a thickness of 1.2 millimetres. Each disc can hold up to 250,000 pages of A4 text, or up to 600 megabytes of data (47).

CD-ROM was introduced by Philips/SONY in 1985. The technology is based on the adaptation of commercial audio compact disc or CD-DA (Compact Disc Digital Audio) used for digital and, apart from text, it can also store images, audio, graphics, step animation and software. The only thing it cannot store is motion (48). CD-ROM is a perfect medium for storage of data. It is called Read Only Memory since the data disks are only readable, they are not interactive. Materials held on it cannot be damaged or deleted.

The effectiveness of information retrieval from the CD-ROM is based on the laser beam used in the drive. The information track on the surface of the disk is made up of microscopical 'pits' and 'lands'. There are almost 1 billion pits in a disk (49). The surface of the CD-ROM has a reflective metal layer coated by protective lacquer.
1.7.1 The disadvantages of networking CD-ROM

CD-ROM is an expensive major option. There is need for early recognition of the implications for the time to be spent on installation of new applications, keeping existing ones running, sorting out minor problems, preservation and management of the software and the hardware, planning against disaster and recovery procedure. The single stand alone machine may go down and cause some problems though this may not be a total disaster because an application can be moved from one machine to another.

If the system has a few bugs which need fixing and which are detrimental to the running of the system, users may become disillusioned quite quickly. It will be safer to test and pilot the system before the users are introduced to it. The Network drive will highlight the problems of the different search retrieval interfaces. Many users will prefer to work on the stand-alone workstation where they will receive no help and when they run into problems they will have to run back for assistance. This may cause it to become hectic in the computer department. To train the user is more difficult because there is no indication of what the other user is doing, so it will be difficult to assist with the correct formulation of their query. This may lead to disenchantment with both the system, the database and the library.
Few networks are similar and none are identical. As a result what is done by people, what people wish to do or can do in terms of provision, access, interface, varies from one network to another. Thus it needs special attention. The licence agreement should avoid: baseband transmission as is a transmission at a single digital signalling rate whereby the information travels from source to destination in the same form in which it existed at the source(52). concurrent usage will result in problems of control on some LANs. Modern licence agreements should be based on: Institution not site; the size of the institution no of Fault-Tolerant Computing)(FTCs) and the ability to pay. The CD-ROM has increased and grown, the encroachment of copyright and data protection is an important issue.

1.7.2 The advantages of networking CD-ROM

As the old adage says 'think not that roses have thorns but thorns have roses', so it is with the computer networking CD-ROM. The advantages of CD-ROM is its flexibility especially if the drives are networked. Any database can be accessed by any workstation on the system at any time. This will reduce or nullify the queues at one or two workstations that hold up popular databases(53). If a workstation breaks down the other workstations are capable of taking up the job without any strain. It is users friendly. Training is easier to carry out on a network rather than stand-alone machines(54). This will save a lot of scarce money and precious time and energy. It assures the security of the drives and discs as it will be possible to locate the exact position either at the issue
desk, office or computer room. It protects the users from damaging them since they will not have the opportunity of touching them.

1.8 CONCLUSION

In conclusion computer networks transmit data in analogue, that is a continuous signal, or digital form. The required information is unlimitedly accessible from the most appropriate source without any delay, an example of this is the US Consular Service's database. The delay caused by providing information from elsewhere has now become a thing of the past. The information is delivered from the source to the users desk from anywhere at any time. It eliminates the purchase of peripherals for each computer. The computer networks makes the professionals to deliver precise and pressing information requirement which are in a fast moving world to the users. They know what significant new products and services are coming into the market as soon as possible, making better informed decisions. However, it is appropriate to add that librarians have access to information beyond that stored in a building.
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CHAPTER 2

COMPUTER NETWORKING IN LIBRARIES

2.1 INTRODUCTION

A library network can be defined as a group of organisations that are interconnected to form a system to accomplish some specified goal to achieve the aims of the organisation for mutual benefit. This includes exchange of publications, experience, staff, and joint plans for disaster recovery, collaboration in photocopying, microfilming, interlibrary lending, cooperative acquisition and cataloguing(1). It is an essential means of linking a variety of sources to many users. This may be supply of information about and from literature and contact with sources of information. For example the Educational Resource Information Centre(ERIC) or a clearing house which links universities, and professional organisations into a network and makes available to them all relevant research results(2). A library network can be hierarchical in structure, with the expectation that most of the needs of the library will be satisfied.

The different definitions of computer networking in libraries are based on various parameters of perception. Thus, it evokes different explanations from different people and these explanations are fashioned around the assumed functions of the networks.
Therefore, in this dissertation, the term will be applied to interconnection between libraries and information centres for bibliographic information through an on-line computerized network. It could be a Local Area Network (LAN) or Wide Area Network (WAN) which can be national or international in scope. Someday the computer network will become like the phone system. There will be nothing to worry about(3). It will be enjoyed and put to uses not foreseen by the inventors. This has now come to pass. In almost every sphere of any profession computer networking is being used and the libraries and information profession has not been slow to make use of it.

Computer networking in libraries is a specialized type of library operation for centralizing the development of cooperative programmes and services. It comprises computerised information, storage, searching and retrieval; telecommunication; data transmission, and cooperation. The characteristics of a network in libraries should include: formal organisation where many units share common information and dispersed information and also where data are rapidly interconnected; collections of documents or data in any media so that the information may move in either direction, and provision is made for each network to be a participant to send as well as receive; users usually remote from the source of information; schemes for the intellectual organisation of documents such as directories for consultation by users; methods for the delivery of resources to users; formal organisation of co-operation and groups of users and bi-directional communication networks-preferably through high speed long-distance electrical signal transmission(4).
2.2 THE AIMS OF COMPUTER NETWORKING IN LIBRARIES

The success of a library and information computer network, depends on the basic satisfaction of conditions which are related to the aims of libraries such as the provision of access to faster, cheaper, convenient, a far wider range of information; cooperation for mutual benefit; resources and software sharing; customer satisfaction; communication improvement and standardisation. These are now explained more fully:

Faster access to information

Networking provides a large number of users with more information faster by the use of OPAC and local networks; widen the range of organisations to which they can gain access for required transactions, sending files, accessing information, source materials in electronic form, electronic journals and selected scientific and image databases.

cheaper access to information

Library networking aims at connecting Online hosts to networks allowing connection without telecommunication charges.
access to a far wider range of information

The aim of networking is to access a wider range of information. To bring the users convenient access to international information through JANET, Internet and gateways.

convenient access

It is possible for several users to have access to the same application software, remote information, unique databases and upgrade to the newest version of a database programme by accessing a shared storage disk.

Encourages cooperation for mutual benefit

Networks aim at promoting cooperation and partnership in all aspects of library and information work and other bodies who are concerned with development of library networking and consult wider library and information community; to allow libraries and library users to make rapid decisions about a required document.
Facilitates resources sharing

It promotes the use and sharing of bibliographies of participating libraries; promote interlibrary loan of library resources, enable users to share connected devices regardless of the physical location of the resource and users. These resources may include specialised computers, software or other devices that are expensive or unique. An example is access to a corporate super computer from workstations at remote research laboratories. It aims at Data sharing so that users can have access to the same information and collaborate electronically on a project report with others in a group.

Promotes customer satisfaction

A library network enables libraries to provide a large number of users with more satisfactory information. It delivers information from the source to the users desk.

Improves communication

A network aims at improving communication efficiency at local, national and international levels. It enables users to search bibliographical files and read text files; to extend the range of public access to information, immediate access to the growing range of electronic
information products and services; to develop information utilities and mounting databases.

Data exchange

This is communication and data exchange using E-mail or bulletin boards irrespective of their locations.

Standardisation

This aims at encouraging large scale retrospective conversion of card catalogue data to Machine-Readable-Cataloguing (MARC) format by network and commercial ventures on behalf of libraries. It facilitates the exchange and sharing of bibliographic data among libraries in a standardized record format and brings uniformity to the library and information world in bibliographic and technical duties.

2.3 COMPUTER NETWORKING SERVICES IN LIBRARIES

A network provides a number of different services to the computer stations it links together. It also provides a better means for technical processes and services; information storage and retrieval; subject indexing; and on-line information retrieval. Computer
networks provide libraries with the opportunity to build flexibility into their rigid systems. Eventually, they can lead to interconnected networks of information resources. A library network may be organised in two ways, either among libraries in one geographical area or among libraries in speciality groups where the bond is a common subject interest. Whatever way it is organised, if interdependence for information exists among a group of participants with a common goal to be served, then such a network can be regarded as an information network. The services provided by computer networking in libraries are analysed below.

Bibliographic networks

The computer networks are affecting library services in a number of ways especially in their bibliographic services. These can be national or regional. For example, the OCLC and the BLCMP(6). A National Bibliographic Database of over 6.2 million titles is made available to users through the Western Library Network(WLN) in MARC. The computerised networks of the National Bibliographic Database has reduced the space, cost of maintenance, risk of disaster and the time of staff for upkeep.
Online Document Ordering

This is an operation that is carried on under the control of the computer's central processor for an immediate processing of orders. This is possible through an access to EMBASE database, and Information Structure Implementation(ISI). The users select from the databases the articles they need. They then have the opportunity of having the knowledge of the location, and to request the item/items on interlibrary lending or order directly from the British Library Documents Supply Centre(BLDSC) or any other supplier. The direct ordering could be delivered by post, courier or fax and can be paid for by credit card. This is possible only when a library is computer networked.

Distributed Abstracting

An example of Distributed Abstracting can be seen in the Philippines. The Excerpta medical printed journal is now on a biomedical and pharmaceutical database called EMBASE. About 3500 journal titles are read and abstracted. It is handled by 'telecottages' in the Highlands of Scotland. CROSSAIG is responsible for the training, equipment, and management. The articles are scanned in the Netherlands. The full text and illustrations are sent to the telecottages via Integrated Services Data Network(ISDN) at some 8 seconds per page. The appropriate abstracts are written directly on to the computer by
professionals and the documents are returned to the Netherlands. This is a quick and reliable process.

Digital Delivery

Digital Delivery is the scanning of documents using File Transfer Protocol (FTP). A good example is at Boston-Spa, which is a branch of the British Library. The document is scanned at 600dpi at Boston-Spa and then transmitted, using FTP on the Janet Internet Protocol Service (JIPS) to a PC in Stirling University Library, which prints them out on a Laser printer. It delivers copies of documents as good as photocopies of the original in minutes rather than days.

Document Delivery

All enquirers enjoy the provision of information about the documents they need. Network information retrieval is done through electronic mail (E-mail) lists, bulletin boards, teleconferencing, conferencing discuss, Information gateway, library catalogue and electronic journal. It is being used to attach databases of record, archives of library text and statistical data and inventories of museum objects. Network information retrieval is like the document delivery.
National Network Database

EMBASE is a UK database. It is available on Janet. Its host is Bath Information and Data Service (BIDS). BIDS is a small data centre set up with UK government funding to mount such datasets. The end users are subscribing institutions. The services are free and are licensed for subscribers unlimited access. It needs no intermediary. Searches on one of the BIDS services are now around 3,000 per day (7).

Name Authority Records

In addition to MARC bibliographic records, authority records are distributed for both names and subjects. The Name Authority records are distributed on a weekly basis. The Name Authorities weekly service includes new, revised, and converted retrospective headings for personal, corporate, conference, and geographic names; uniform titles; and series established by national libraries, or any member of the Name Authorities Cooperative Project. The Name Authorities retrospective file includes all records between a given date. All these are stored in the database and can be accessed freely.
Subject Authorities

The subject authorities that are in existence are machine-readable versions of the printed Library of Congress Subject Headings of the latest edition. The file holds records only for those heading-subdivision combinations appearing in the printed book. This is updated through a new subscription service while the distribution is in progress.

Retrospective Service

Retrospective Service handles requests for MARC records prior to the current subscription year. The Complete Service for all records in all formats covers a specific period. Accuracy, up to date information and consistency is suggested.

Exchange of records

The exchange of records between national libraries in different countries has been affected by recent events. Countries outside the U.S. have taken measures which could place restrictions on the distribution of bibliographic data within the recipient's countries(8). In the past, agreements between national libraries included the distribution of the originator's data within the recipient's country, now several national agencies have expressed unwillingness to have their data distributed within the recipient's country or organisations
that also provide products and services to other agencies. The National Library of Canada for example distributed its CAN/MARC machine-readable bibliographic database under Crown copyright, which in Canada is essentially copyright owned by the government of Canada. But the Canadian Copyright Act permits an owner to "grant any interest in the right by license." Whereas, the British Library has taken the licensing approach to control the distribution of UK MARC machine-readable records in other countries.

In the late 1980s, the International Federation of Library Association (IFLA) and the International MARC Network Committee started working on the development of compatible approaches among members to agreements that will govern the international exchange of data. The University of Toronto Library Automation System (UTLAS) and OCLC are able to by-pass the national libraries in their countries and provide access abroad to (USMARC, REMARC, and CAN/MARC records), as well as to acquire records directly from other countries' national libraries. This ability dims the prospects that a uniform approach to contacts and agreements governing the exchange of data among countries can be developed.

Electrical Data Interchange (EDI) Book Ordering

MARC is very reliable for exchange of bibliographic information in electronic form. In the 1980s BEDIS was established to explore Book Trade Electronic Data Interchange Standards, and in 1990, agreement was reached for EDI standards in the UK, which was
based on TRADCOMS EDI format. It deals with information about books on order. Among the pioneers to use it among libraries was the Paisley University Library, and among the booksellers is John Smith of London. This suggested a one way channel of business through the Book Industry Communication (BIC). As a result, the British Library (BL) set up BEDIS in 1991 and promoted EDI standards for books. In 1992, the 'FIRST EDition' organisation set up a gateway. This increased book ordering across the network.

Campus Wide Information Service (CWIS)

This stands for a community information service on the campus. Access could be local or remote via gateways. It includes information held on a number of different servers. For example, the OPAC, and the X500 Directory Service. There is also another type called the Campus Information Server. This is based on the University software, an example can be found at Bristol University. The software carries brief time-critical information, static documents and Safety Regulations. A library may need to modify its own system to satisfy the expectations of its users and librarians.
2.4 CONCLUSION

The computer networked library is the 'invisible library' which gets and delivers information from a distance to a distance. Thus the provision of convenient access to computer networking has to meet a specific standard for uniformity and convenience of the users. The use of computer networking and telecommunication technologies in the exchange of information, is an important tool for both local and global developments. Computer networking services provide a means by which all countries can begin to participate in international information exchange. These On-line communications can be used as a first stage of local development, including international database searching, electronic mail, and on-line conferencing. Linked with the local storage capabilities of personal computers, these products and services provide a way for developing countries to participate in integrated information networking with minimal equipment and training. Without adequate documentation and thorough literature searches before any research project is started, there will always be duplication of effort, wastage of revenue and frustration on the part of the researcher especially when he/she finds out that what he/she had wasted years on, had been discovered years back! Computer networking minimises wastage and quicken results.
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6. Hildreth, ref. 1.
7. Perry, ref. 2.

8. Ibid.

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CHAPTER 3

COMPUTER NETWORKING IN NATIONAL LIBRARIES

3.1 INTRODUCTION

The traditional historic role of the national library was to collect and store recorded information and make it available to users. The emphasis was on collection and preservation. However, during the nineteenth century, this role was enlarged and changed to include organisation of the collections and the provisions of service to users. This led to the development of classification systems. During the last twenty years, the techniques for information handling involves a combination of computer and telecommunication techniques, and electronics(1). Networking is gaining ground in the developed countries but it has yet to find its ground in the developing countries. For a better insight of the situation in the developed world, this section reviews the present 'state of the art' of computer networking in some National libraries.

The decision of the writer of this research to choose these particular libraries lies in the fact that these libraries demonstrate different approaches with maximum success. The
differences in locations, hardware and software used also provide good parameters for their choices.

3.2 NATIONAL LIBRARIES

There are 106 national libraries in the world which can be called NLs according to their official titles and/or the characteristics of their functions(2). All NLs have a leading role compared with other libraries in their countries. They hold encyclopedic collections and have specialised department and services. This section will lay emphasis on the specific objectives and services which are related and relevant to networking.

3.2.1 The British Library (BL)

The British Library (BL) is a remarkable example of computer networking. It is a great store house of knowledge, which underpins the work of academic, public, commercial and other special libraries. The catalogue of the BL holdings provides for Keyword searching on CD-ROM, and Current Serials Received, and the BLAISE-LINK online information retrieval service. Details of every article in 10,000 articles are made available through Bath Information and Data Services (BIDS) and on JANET to academic institutions. They are also available on CD-ROM. The BL provides an extensive publishing programme
providing information on the range of literature in the collections, this is available online, as microfiche, printed publications and also as CD-ROM.

Most titles are searched for by using the Online Public Access Catalogue (OPAC). This is an interactive computer retrieval system which allows the user to request and reserve titles. It is self-explanatory as users can search by author, title, pressmark, classmark, ISSN and keyword. The screen is designed with on-screen instructions in several European languages. Materials on open access are easily retrieved from the shelves, while closed access use the Automated Book REquest System linked to the OPAC. The system allows for truncation. The system allows browsing. The records can be printed or saved and the result of the finding can be manipulated through the edit feature. The computer facilities are provided and maintained by the BL Computing and Telecommunications directorate.

3.2.2 The Library of Congress, USA

It is impossible for libraries to be self-sufficient—nor has this ever been possible in modern times. There are no reasonable alternatives to effective resource sharing. In the United States of America (USA), there are three NLs. The largest is the Library of Congress (LC) which is the concern of this dissertation because of its role in computer networking in libraries. In 1899 (3) it became a NL by spearheading efforts to centralize cataloguing
processes which later developed to the printing of the National Union Catalogue (NUC) and ultimately led to machine readable cataloguing (MARC). In 1968, Library of Congress (LC) started the MARC Distribution Service. This MARC format was adopted by libraries as the standard for encoding cataloguing data in bibliographic records. A Network Advisory Committee was formed by LC and issued a planning paper in 1977 (4), that included a recommendation for assigning priority to the linking of various library systems in the USA. The Linked System Project developed as an effort to link LC and the bibliographic utilities in order to avoid duplication in distribution of on-line records. The initial LSP implementation was the standardization of the access points used to retrieve bibliographic records. The LSP uses Standard Network Interconnection (SNI) based on the Open Systems Interconnection (OSI) seven-layer protocol. The vendors sophisticated systems helped it to expand and integrate acquisitions, on-line public access catalogue (OPAC) and circulation control functions. During the 1980s, microcomputer workstations developed.

3.2.3 The National Library of Australia (NLA)

The National Library of Australia (NLA) was established in 1902 as the library of the Commonwealth Parliament. It took the Library of Congress as its model in 1907. In 1968, it was accepted as a National Library (NL). It has the Australian Marc Record Service (AMRS) and operated a nationwide online resource-sharing network: the
Australian Bibliographic Network (ABN). Together with the Commonwealth Department of Health, the library also operates the Australian MEDLINE service and provides batch-mode support, under contract to the World Health Organisation (WHO) to countries in the Western Pacific (5). The NLA has a clear government support and architectural merit. It runs a National Preservation, National Document and Information Service Project jointly with the National Library of New Zealand, this replaces the network services provided by the Australian Bibliographic Network (ABN) and KIWINET in New Zealand. There is a Distributed National Collection being promoted by the Australian Council of Library and Information Services (ACLIS). They do not merely derive benefits from the network but also use it as a means of disseminating information about activities and research. This was made possible by the establishment of a Centre for Network Information Publishing run jointly by the library and the computer unit and which co-ordinates the University World Wide Web (WWW) Home page and other network dissemination activities. Australia supports its local publishers and periodicals. It is currently running many conferences on on-line and CD-ROM services and products focusing on the impact of networking and the Internet. The Australian Business Information network (AUSINET) is moving into computer networking, a lot will be learnt from them. There was an international event and an annual conference in Australia early in 1995. Several presentations directly relating to issues of communication with different kinds of rural communities and problems and solutions of the third world. The use of the Internet was also discussed. The difficulties Australia had in the initial stages of adopting an automated system and the implementation
of a National Information Strategy and the acceptance of the opportunity at the initial stage has a great deal to teach the world(6).

3.2.4 The National Library of Latvia

The setting of the National Library of Latvia could be ideal for any national library of a developing nation. The NLL was established in 1919. However, automation did not begin until 1990. In 1994, NLL and other research libraries and interested institutions of Latvia started a project of an open library information network called LATLIBNET for an electronic union catalogue of libraries and an integrated system of databases with the already developed user service. To implement this, NLL purchased the international software from the VTLS company based in Virginia, USA. It provides an automated solution for all the library functions(7). VTLS supports full MARC bibliographic record format. It offers cataloguing interfaces with OCLC, RLIN, selected CD-ROM products and supports the standard functional library sub-systems. It also provides regular upgrades of the system, data migration and record conversion possibilities. It provides a training and consulting service which is an important function of a national library.

There are two separate local networks in NLL for 10 separate or stand alone users in two different building. The VTLS the library is currently using supports the TCP/IP protocol
allowing access to the Internet. The System is available on several hardware platforms: HP and IBM mainframe as well as on IBM compatible micro-computers. NLL also possesses graphical user interfaces and an Intelligent Work station that ensures entering bibliographic records and EasyPac for information retrieval in OPAC.

3.2.5 The Institute of Science and Technical Information in China

The Institute of Science and Technical Information in China was founded in 1956(8). One of its important programmes was the establishment of an organisation to carry out scientific and technical information in a Chinese version. It then had the responsibility to coordinate and disseminate all information work in China. The network in China is hampered by the internal telecommunications system, which they accept as creaking at the joints. China’s situation would have been ideal in the world of networking but they have a negative aspect of trying to do their things their own way(9). This can be seen from their educational point of view, their education and training on information processing and computer applications are based on in-house training. In China every organisation is responsible for giving in-service training to their staff. Services obtainable through the computer networking have some good effects on the library environment in general. This has meant that they have not been able to communicate or develop networks with other countries and is a situation to be avoided by developing countries.
3.3 CONCLUSION

Computer networking has increased the information flow from the national library services to the users. Problems of data storage and retrieval has been overcome and has accelerated in-house information. Computer networking in the libraries makes a 'world' of difference to the technical process and services; information storage and retrieval; subject indexing; on-line information retrieval; searching; computerised information storage and retrieval; telecommunication; data transmission; cooperation and international cooperation. It should be possible to gain free access to all the systems and this will help to create a literate community. The compilation of the best range of data resources for users and presenting them in a way the users will find convenient is the concern of professional librarians and information officers. The special roles played by each of these libraries are worth noting. They represent the applicability and workability of the pioneers and the best standard of the national libraries of the world. These will give the library managers the opportunity needed to make good choices by understanding the different alternatives, implications, solutions, and advantages of each system and approach.
However, since the theme of the research is computer networking in the national library of a developing nation, this research now looks at the state of the art of computer networking in Africa.
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4. Ibid.

5. Ralston Anthony and Edwin D. Reilly eds., ref. 2.


9. **Evans, ref. 8.**
CHAPTER 4.

NETWORKING IN AFRICAN NATIONAL LIBRARIES

4.1 INTRODUCTION

In Africa the development of national libraries has taken place only recently after the Independence period in 1950-1963(1). Computers are available in African libraries but can only be accessed through parent bodies. They are only used for management information and library house keeping duties. Computer networking in libraries is a new revolution 'struggling to survive' because of poverty and instability of government. The introduction of Compact Disc-Read Only Memory (CD-ROM) has increased the use of journal collections, inter-library loan services and microfiche collections and cooperative ventures for shared library resources. There is a CD-ROM directory of 1992 which lists a number of databases which are appropriate to developing countries especially in Africa(2). They include agriculture and fisheries; biomedicine; health and nursing; science and technology; library and information science and life science.

A prototype disc was produced with a total of 187,000 complete records from the CAB Abstracts databases of the Bureau of Hygiene and Tropical Diseases(3). The disc was sent
to a selected group of 40 libraries which were already using either CABI's printed database and or online services. This included twenty-four developing countries including Nigeria(4). Bower Optical Directory of 1987 published some CD-ROM databases in the form of indexes/abstracts and full-text or numerical, while some are encyclopedic databases. The application of CD-ROM in Africa has some impact on the users, staff and services. For the users, there is an improved access to CD-ROM multi-volume indexes such as Educational Resources Information Centre (ERIC). This database comprises international sources. Users search the CD-ROM freely or with minimum charge.

These CD-ROM are initiated by external database vendors, producers and donor agencies. This is possible by the introduction of projects involving the production, delivery and application of CD-ROM. A good example of this is the Commonwealth Agricultural Bureau International (CABI). An agricultural database producer which devised a project on CD-ROM technology, aimed at how best to assist libraries in developing countries in the application of CD-ROM technology and products. The project was assisted by International donors and organisations. Staff assist in complex search and solving other problems of a workstation. The staff has become more knowledgeable about the operating systems. The use of CD-ROM has enabled users to be more independent of staff. This has meant that staff can concentrate on their professional duties. Hopefully CD-ROM networking will soon be in use in Africa.
This chapter presents a selective overview of the historical trends in National Library network development in Africa. It links up with the most current type of computer networking such as may be designed to serve statewide/multistate. It looks at the contributions of some international bodies and the important issues which these libraries face.

4.2 INTERNATIONAL ORGANISATIONS

In recent months conflict in Somalia, Sudan and Angola has brought African poverty to the notice of the world again. But these are also opportunities for recovery and for building on the resourcefulness of the people to fight poverty. Access to information through networks is a weapon in this fight. There are networking systems African libraries. This encompasses all the library activities.

There is an information explosion in Africa. Handling, access and transfer of large amounts of information has created problems. There are also disparities between countries in their ability to handle information. The international organisations like UNISIST and NATIS have recognised the disparities. They aim to promote the use and sharing of bibliographies of participating libraries; to enhance retrospective conversion of card catalogues to Machine readable Catalogue (MARC) format and facilitate sharing and
exchange of bibliographic data among libraries in standardised record format. These organisations are sponsored by UNESCO.

UNISIST is the guidelines into the feasibility study for the inquiry of a world science information system. In 1966, it was sponsored by United Nations Educational, Scientific and Cultural Organisation (UNESCO) and International Council of Scientific Union (ICSU). It is a name for a number of concepts. UNISIST stands for the unimpeded exchange of published or publishable scientific information and data among scientists of all countries for the international exchange of scientific information (5). UNISIST is also referred to as the Intergovernmental Conference for the Establishment of a World Science Information system. It concentrated on the development of a world science and technological information system. Its goal is to improve the effectiveness and decrease the costs of providing science information services through programmes which encourage the sharing of functional responsibilities and products.

The second programme of UNESCO is the National Information System (NATIS). It encompassed all services involved in the provision of information for all sectors of the community and for all categories of users. UNESCO with the cooperation of the International Federation for Documentation (FID), the International Federation of Library Associations (IFLA) and the International Council for Archives (ICA) organised the Intergovernmental Conference on the Planning of National Documentation, Library and
Archives Infrastructures. They met in Paris and adopted recommendations supporting the concept and objectives of the National Information System (NATIS). NATIS identified the action needed to create national infrastructures for providing library and information, including archives services, in such a way that they could be fully integrated into and could contribute to national plans for social progress and economic development. The national programme rests on the premises that information is general and therefore scientific and technical information is only a part. Later on, UNISIST and NATIS, were merged within the General Information Programme (PGI) division of UNESCO.

PGI led to the formation of a central body to co-ordinate the functions of all documentation, library and archives services. The integration of UNISIST and NATIS schemes into the PGI reinforced UNESCO's activities in the fields of information, documentation and archives, in order to increase opportunities for the use of the global information output. The purpose of the coordinating bodies is to encourage governments who believe in the need for a development of a national information system as an indispensable tool for their countries economic progress. A library network is then envisaged as a 'comprehensive system in which every library may use as an access point. The writer of this research feels that UNESCO should be lobbied to extend their efforts to assist the developing countries by pilot studies to conduct and establish the systems design requirements for computer networks in Africa.
The international bodies have recognised the problems of publishing in Africa. This has led to the formation of the Publishers Network (APNET). APNET is the African Publishers Network. It is made up of the African Publishing Review and APNET publishing Resource Centre (APRC). These are provided by contract arrangement. Offices are based in Nairobi and Lome while the secretariat is in Zimbabwe. APNET has basic computer equipment and software comprising PCs and printers. It is networked in Harare and separate for AOR, API and APRC. This presents a poor communication problem which is unique in Africa. Members are from Botswana, Cameroon, Ethiopia, Ghana, Kenya, Zambia, Zimbabwe and Nigeria. (Appendix 1). The donors African Education Working Group on Textbooks and Libraries has selected APNET as the African counterpart. This is to study the Economics of Textbook publishing in Africa. APNET aims at book fairs where feasible. It has just concluded agreements with UNESCO to participate in UNESCO’s 1995 reading campaign in Africa through acquisition of African children’s books. It undertakes a study into APNET and African Publishing and has contributed to the Education for All Initiative on Basic Learning Materials (EFA-BLM). It is been helped by the World Bank in textbook provision in African and has contact with IFLA and ILO and develop relation at different levels with World Bank projects and staff. APNET recruits personnel for MOI University in Kenya in its degree course in publishing. It has entered into negotiations with major International Suppliers of photocopiers and computer hardware and software to supply these at reduced rates to African Publishers. Also the
Voluntary Service Overseas to produce skilled personnel. Plans are been made for Nigeria, Kenya and Zimbabwe concerning these skilled personnel(6).

4.3 THE SITUATION OF THE NATIONAL LIBRARIES IN AFRICA

The Africa in the next century depends on the type of the services provided by the National libraries. These national libraries should be able to: monitor research or innovative developments in other countries; capable in their various disciplines of collecting, evaluating, analysing, coding and disseminating information; have access to data to assist government ministries and departments in correct decision making. The structure of industries on productivity of operations; return on investment, establishment of industries, and assessment of technology should be considered as important and urgent. Only a few libraries in South Africa are able to deliver documents digitally. However for the success of the computer networking education in the 'IT' is vital.

4.4 EDUCATION IN 'IT'

Education in library automation are conducted by the higher institutions of learning, libraries, and professional fora. The subject is usually treated as a course or as part of a course in Library and Information Studies, Information Science and Computer Science Programmes. Only the fundamentals are covered in these courses. The course is expected
to solve specific practical problems(7). The strength of an organisation depends on the personnel. Such programmes do not produce specialists and that their benefactors do not learn enough to enable them to engage in intelligent dialogue with experts in information technology and management(8).

In Africa, library school courses in automation have a limited chance of making adequate contributions towards the development of functional skills and abilities. This is because the computer and telecommunication facilities required for a meaningful instruction and illustration is not in place. However, where it is in place but not adequate, the technology changes rapidly rendering the use of it obsolete(9). Therefore professional librarians should have a regular up dating of knowledge of IT in the form of seminars and workshops.

The International Institutes of Tropical Agriculture(IITA) have played an important role in Africa in trying to fill this gap between the professional librarians and the technicians who have up to date knowledge of IT but no knowledge of the need of the librarians. This is in form of practical demonstrations, lectures, discussions, seminars, conferences and workshops. Programmes were run for organisations, groups and individuals(10). Training is based on the trainee's need, goals and objectives. One of the common problems with the trainees is that when they return to their respective libraries there are no computers to let them practise what they have learnt.
In 1984, an Automated Library and Information Services for tropical Agriculture(ALISRTA) information system was created. This was the conversion of the library card catalogue to an Online Public Access Catalogue(OPAC). This has given rise to the simultaneous search of all the records in the library. It was based on BASIS software.

4.5 Problems Attributed to Networks in Africa

The major problems facing networks in Africa are the rapid growth and the handling of large amounts of information, which have created disparities among countries in the field of information. Another is telecommunications. This prevents many libraries from having adequate access to information. Some countries like China and Egypt have made efforts to consult the developed countries with search requests, but the results are returned by mail. The delays and inability to interact with the library personnel can be frustrating. The only alternative can be carried out through telex and again this is slow and expensive. Other basic problems are the unreliability of electricity, transportation, communication, and climate.

The application of computer networks to man's most pressing problems has proved their real worth, as computer networks are tools that can help one overcome ones human
inability to perform rapid mental calculations and to digest masses of information. Thus, having access to library materials through computer networking will be an advantage for national libraries where networks are still at the traditional/manual stage.

Unfortunately most of the national libraries had almost the same problem about starting up and developing. For example, the records in Zimbabwe were not opened to the public for thirty years, those of Zambia and Malawi took almost fifty years(11). Only in South Africa can computer technologies be found. These are referred to as the Central Computer Service which are meant to benefit the government departments(12). Since computerisation of the Cape Provincial Library Service many public libraries have grasped the opportunity to link into the Cape Provincial Administration Library System(13). In 1993, the Eastern and southern Africa Development Information System(ESADIS) to provide bibliographic databases in development information stated operation in Lusaka. Its services are yet to be established. The reason why some libraries have not invested in computers is because they believed they cannot afford them. Therefore the absence of computer terminals and telecommunication networks makes the provision of linkages between libraries and remote computer containing vital information very difficult. The lack of optical disk technology is also having a negative effect on information management. The introduction of new ways of recording, distributing and storing of information, particularly on the CD-ROM is conspicuously absent. Therefore, large reference publications such as encyclopedias, bibliographies, directories, and serials abstracts can
not be stored and accessed on the CD-ROM. The price of CD-ROM drives and subscriptions to various databases could be quite high for libraries in developing countries.

Africa libraries encounter almost the same problems with their Information Technology development and government funding. Therefore it will be appropriate to look at specific countries which can be used to represent the others. This is because of limitation of this exercise. Zambia will be taken as an example from the south because of the economic and political changes taken place there. Nigeria will be taking from the west because it has a popular demand for information accessibility, for democracy and accountability. The northern governments have failed to seize the opportunity created by the positive changes in Africa. Therefore gains stability and democracy are threatened and they are not included here. First the situation in Zambia will be described.

4.6 Computer networking in Zambia

The introduction of Information Technology in libraries is slowly gaining ground in Zambia’s special and academic libraries which are better funded. Computers were initially confined to their traditional use, that is the processing of numerical data. However computer application to information management in these libraries is mostly limited to word processing and bibliographical database management. CD-ROM, networking and
desktop publishing have only just started to emerge. This can be attributed to lack of computer knowledge and skills among the librarians(15).

However there are notable installations of CD-ROM drives in Zambia at Mount Makulu Agricultural Research Station, the Tropical Disease Research Centre, the British Library and the Martin Luther King Jr. Memorial Library. The Copperbelt University of Zambia has also started using CD-ROM databases with the acquisition of seven databases funded by the American Association for the Advancement of Science(AAAS). The librarians in Zambia are aware of the way computer networking has proliferated in developed countries. They are also aware of the disadvantages their libraries service are placed under because they are not computer networked. In 1987, the information professionals led by the librarians presented to the government a National Information Policy Draft Proposal, in which it was recommended that it should be the policy of the government to encourage the adoption and application of information technology in the processing and management of information, so as to facilitate information generation, collection, storage, dissemination and utilization and to enhance the activities of information sharing at national and international levels(16). It was hoped that this would eventually lead to installation of computers. However, most of the computers installed in Zambia are microcomputer stand alone systems. No library at the moment can claim to have online access to remote databases. This may be due to the absence of major electronic databases in Zambia or organisations providing database services. An Electronic Mail network in Zambia has been
established, but the libraries have no access to it. It has its centre in the University of Zambia Computer Centre and a lot of private, Non Governmental Organisations(NGOs), and research institutions are using it for the transmission of messages in and outside Zambia. The unfortunate thing about the e-mail is the exorbitant telecommunication tariffs charge by the country's Post and Telecommunications Corporation(PTC). This is a barrier to WAN and in some case LAN. The provision of data communication lines is also very expensive.

It is interesting to note that Zambia has acquired software for bibliographic applications. Micro Computerised Documentation System/Integrated Set of Information Systems(Micro CD/ISIS) software has gained ground in Zambia libraries as the main software for library house-keeping. This is distributed free of charge by UNESCO. Also UNESCO and the German Foundation for International Development (DSE), the Pan Africa Development Information System (PADIS) and the Zambia Micro CDS/ISIS users group organised various training courses. Therefore a lot of librarians and documentalists have attended training courses. Most libraries in Zambia have access to computer facilities, but this fact is overshadowed by the fact that a good number of librarians and information specialists are not well conversant with the applications for which computers can be used in libraries and information work.
This chapter has pointed out the major problems presented by the rapid production of information to librarians and information officers in Africa. It has also identified the problem created by the handling and transfer of large amount of information and need for 'IT' education. The part played by the International organisations in order to reduce disparities among countries in the field of information was highlighted. Zambia was sited as an example.

The writer suggests that a traditional library networks can be compared to the pre-civilisation age where information was not readily available because of the rigidity of dos and don'ts. However, these can be referred to as 'potential networks'. They are still pathways, while the computer networks can be referred to as information roads and highways over which data is transported to support resource sharing, data sharing, and communication and data exchange applications.


5. Salanje, ref. 4.


11. Salanje, ref. 4.

13. Salanje, ref. 4.


16. Chisenga, ref. 15.

17. Ibid.
CHAPTER 5

COMPUTER NETWORKING IN THE NATIONAL LIBRARY OF NIGERIA (NLN)

5.1 INTRODUCTION

Development and use of computer networks are at present severely limited in Nigeria. This chapter considers the possibilities for developing a system and propose a plan to guide information services in Nigeria through the NLN as a starting point. This is to improve the inadequacies and weakness of the present traditional network and hopefully satisfy the information needs of the users.

The importance of availability of current and up-to-date information led the Nigerian government to establish the National Library of Nigeria. Library networking is a natural evolution of traditional concepts of cooperation in form of bibliographic resource sharing with the basic objective of optimising the use of funds in providing services to all users. In Nigeria many factors have worked together to encourage library co-operation such as economic recession, information explosion, shrinking budgets, government involvement,
rapid developments in technology, market economies, cost of information, ever-increasing tide of inflation and library networking evolution(1). The latest and most significant factor is the rapid development in technology which has been discussed in chapter 1. The result have been that library housekeeping activities has moved from being passive to active(2).

5.2. (TRADITIONAL) NETWORKING IN THE NATIONAL LIBRARY OF NIGERIA(NLN)

In the National Library of Nigeria(NLN), the lack of computer networking has undermined the level of cooperation. As a result, Oderinde(3) came up with the resolution that a feasibility study of a cooperative acquisitions scheme embracing the National Library and the University libraries be drawn up for the country. (Appendix 2). Nigeria was divided into: North Western Zone, North Eastern Zone, South Eastern Zone, and South Western Zone. This can be called a Regional network. (Appendix 3). However the political unrest, the creation and recreation of states and poor communications systems in the country have jeopardised the complete success of this plan so the results have not been encouraging and its impact has not been thoroughly felt. In 1974, the application of National Standards in Bibliographical description and the use of Standard Book Numbers
and Serial Numbers were introduced by Aje(4). Also seminars and conferences on Co-operative acquisition were organised and a cooperative acquisition programme was launched in the 1980s. The system depends on traditional telecommunication systems which are not totally reliable. Linking with the participating libraries and full exploitation of the resources is at a slow and unsteady stage. The effect of inflation and increases in the price of library materials have also made this programme unfelt! It hinders the end users' ability to have quick and direct access to materials in other libraries. Government activities and education at all levels have recently increased and progressed. This has led to a great deal of information need and information generation. The NLN should be able to lead Africa in information provision and become a recognised network hub like the British Library and Library of Congress(5).

5.3 THE NATIONAL LIBRARY OF NIGERIA (NLN)

National libraries are the knowledge bases of nations, providing governments and their people with access to its documentations as well as international knowledge bases in the world. For the NLN to do this effectively it needs network of computers. Inadequate infrastructure and lack of technology are the most pressing problems hindering the use of computer networks by the national libraries(6).
Librarianship and information work does not exist in a vacuum(7). Computerisation has been considered with varying degrees of enthusiasm, but apart from the sporadic production of the microfiche and computers bought by the Bibliographic Department which are almost outdated now no progress was made until the early 1990s. Hopefully this will act in favour of the NLN when it finally comes to computer networking as they will be able to do so unencumbered by the shortcomings of systems based on older technology. The services of the traditional library networking of Nigeria have felt threatened by the development of Information Technology (IT). This cut down drastically the communication between Nigeria and the rest of the world on which Nigeria relied for almost everything especially information. Very soon the nation will be compelled to face the injurious economic consequences arising from its neglect of scientific research. Developed countries have met this challenge and are currently actively supporting all aspects of research. Business and industry are similarly active in research supported by computerised access to information. The planning and development process of the economy, industrial and other sectors is dependent upon the availability of reliable information. Top level decision making also depends upon the availability of reliable and accurate information if they are to make meaningful policy, administrative and managerial decisions. Finally, there is a growing awareness of the importance of information in Nigeria.
5.4 THE ORGANISATIONAL STRUCTURE OF THE NATIONAL LIBRARY OF NIGERIA

The National Library of Nigeria (NLN) was founded in 1964(8) but was only established by Decree No 29 in 1970. (Appendix 4). The headquarters is situated in Lagos but will soon move to Abuja the present Federal capital. (Appendix 5). Library services, support and administrative functions are provided from five static stations in Lagos. The national library has a similar structure to the British Library arising from colonisation by Britain. The organogram of the national libraries are similar. Hence the N.L.N’s organogram. (Appendix 6).

The (NLN) has a branch in each of the 21 state capitals in the Federation, where readers' services are represented. In Lagos all the departments are represented beginning with the Acquisitions where all the materials are acquired through purchase, gift and exchanges; Cataloguing where the processing takes place; the Reference and Readers Services where all enquiries are satisfied; the Accounts and Personnel for the administration. Present also are the Planning Research and Statistics Department which is responsible for the
preparation of the format for all activities for the reports, paper presentation, memo, brochure activities for publication amongst other things. The Computerized Data System Centre (CDSC) is another department. The activities of the CDSC helps out with the computerization of the operations of every other department in the NLN. Also it acts as overseer and coordinator of the activities from other departments of the NLN until such time as each department will have its own computers.

5.4.1 National Information and Documentation Centre (NIDOC)

In 1989, it was recommended by UNESCO that NL should act as a National Focal Point for information, documentation and dissemination. In 1992, NIDOC assumed duties with the approval of the Honourable Minister of Education as a major department of the NLN after formal approval by the management and Board of the National Library of Nigeria. NIDOC is funded by the Federal Government and UNESCO. The conception of NIDOC was as a result of the responsibilities of the National Library Decree No. 29 of 1970 section 2(2) and 4. NIDOC is a separate unit within the National Library servicing PADIS. It is a National/World Information accessing Centre. It represents a giant nerve centre for accessing world information.
NIDOC lays emphasis and focuses its attention on sources and formats of intellectual output, especially the ephemeral works. It is expected that both NIDOC and National Bibliography of Nigeria (NBN) will share the same software which will enable NBN to feed information into NIDOC for world access. NIDOC is expected to down-load the data generated by the NBN. Foreign Governments and researchers also look up to it for information. It is the objective of the NIDOC to provide active computerised information retrieval, current awareness services, selective dissemination of information, analysis and information consultancy services. Services across the country is mobilised for use by everyone by NIDOC. It co-ordinates documentation and dissemination of locally generated information in all subject areas for use in timely decision making and project implementation in line with the National Development efforts and is the national access point to selected international information sources and databases. It also examines the costs and technical data sheets for each system with a view to evaluating their work-load and the excess capacity needed to cope with the demands envisaged for the system when fully operational at Abuja. NIDOC has been established to lead in the information revolution by forging partnerships and exploring new methods and technologies that advance open and democratic access to information. Therefore NIDOC is essential in the NLN's computer networking for Information Consultancy, Documentation, Bibliographic Database, Information Marketing, Information Analysis and Consolidation, and Document Delivery.
5.5 PROPOSED ACTIVITIES OF THE NETWORKED NATIONAL LIBRARY OF NIGERIA

The proposed computer networking in the NLN should lead to the following services which have been fully covered in 2.2 of this research namely: Online Document Ordering, Document Delivery, Retrospective Service, Electrical Data Interchange (EDI) Book Ordering, Co-operative, Online Shared Cataloguing Facilities, National Network Database. Although the Exchange of records, Name Authority Records, Subject Authorities and a National Union Catalogue (NUC) The National Bibliography of Nigeria (NBN) are already in place, but is not on a computer network. After careful consideration the NLN can make a choice between the systems operating in Australia and the British Library.
National Library of Nigeria proposed system

For the success of this programme the National Library of Nigeria should need an internal system approach. (Fig. 5.1).

FIG. 5.1: NATIONAL LIBRARY NETWORK: PROPOSED INTERNAL APPROACH

KEY:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.L. BOARD</td>
<td>National Library Board</td>
</tr>
<tr>
<td>F &amp; S</td>
<td>Finance &amp; Supply</td>
</tr>
<tr>
<td>PM</td>
<td>Personnel Management</td>
</tr>
<tr>
<td>CD</td>
<td>Collection Development</td>
</tr>
<tr>
<td>NIDOC</td>
<td>National Information Documentation Centre</td>
</tr>
<tr>
<td>NBC</td>
<td>National Bibliographic Control</td>
</tr>
<tr>
<td>PRS</td>
<td>Planning Research &amp; Statistics</td>
</tr>
<tr>
<td>RS</td>
<td>Reader Services</td>
</tr>
</tbody>
</table>
Hopefully, this will lead to the External computer networking of the Nigerian Institutional Information Structure. (Fig. 5.2).
Figure 5.2: NIGERIAN INSTITUTIONAL INFORMATION STRUCTURE:
PROPOSED EXTERNAL SYSTEMS APPROACH

NIDOC's network within the NLN will also be required. (Fig. 5.3).

Figure 5.3: NIDOC'S NETWORK WITHIN THE NATIONAL LIBRARY
The success of all the other networks will eventually lead to the international network. (fig. 5.4).

Figure 5.4: NIDOC's INTERNATIONAL NETWORK
Hopefully, this will lead to a National Library/NIDOC Database. (fig. 5.5)

**FIGURE 5.5: NATIONAL LIBRARY OF NIGERIA: DATABASE STRUCTURE**

**KEY:**

- **PRF**: Potential Requirement File
- **BNB**: British National Biography
- **LC**: Library of Congress
- **NLA**: National Library of Australia
- **BDLSC**: British Library Document and Supply Centre
- **NL MARC**: National Library Machine Readable Catalogue

**Files**

**Database**
This will enable the NLN to solidify the existing exchange programme between her and other National Libraries in the world. The NLN should have retrospective, serials, monographs, references and music. These should feed into the filing tables which will be made available and accessible on the local catalogues. These records from the member libraries of NLN should be fed into the Union Database. There should also be a control file of the number of searches which should hold these records and all the potential requirement files of British Library, and National Library of Australia in particular including records of Whitaker and NIDOC.

Effective use of the information databases publications and services available on the networks nationally and internationally can only be achieved by the development of standard network tools such as directories and resources guides showing what information is available on the networks and their relevance. This enables cooperation to flourish at all levels through the terminal access for interactive services. For computer networking of the NLN, three phases can be suggested for the implementation. The first phase of the project can concentrate on the replacement of the equipment used by the secretaries. Priorities can be determined by the project group and PCs can be purchased through the computing unit. The second phase could be the installation of the network within the headquarters which is the main administration building(10). While the third phase can be the installation of the network with the different departments. (appendix 8). Nigeria needs to start to develop its
professional personnel to lead the information role of the national libraries into the future information super-highway. She needs system librarians who will manage computerized library systems, identify needs of the library for automated systems, cause these systems to be implemented and analyze the operations of the library(11).

5.6 CONCLUSION

This research has attempted to follow the history and development of libraries networking from available recent records, especially the theses of Oderinde(12) and Adeyemi(13) and aims to update the literature on networking. The National Library of Nigeria as the 'giant in Africa' should reflect the countries significance and take the leadership role in computer networking not only in Nigeria, but also in Africa taking the advantage of the establishment of NIDOC. There is likely to be an exciting future for library and information professionals. There will be changes of emphasis, new skills to learn, new technologies to understand, new legislations to observe.
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12. Oderinde, ref. 3.

CHAPTER 6

RECOMMENDATION AND CONCLUSION

6.1 INTRODUCTION

There is firm evidence to show positive acceleration between the extent of scientific and technical information in a country and the stage of its economic and industrial development\(^1\). The higher the degree of development the greater the need for information services. Therefore, information plays an important role in accelerating a nation's development\(^2\).

Recommendations by the author in the light of social, economic and technological developments in a changing environment in a developing nation are presented in this chapter. It is personal and cannot claim to cover the context in which all members of the profession find themselves. They reflect the impressions gained from computer networked specialists and researcher consulted. The suggestions are not the only ideal solution but a guide. They are also based on reviewed literature. The type of network depends on the type of library, its services and funding. System specialists should be consulted before...
networking a national library in a developing country. However, for a successful implementation computer network in a library, the strength, weaknesses, opportunities and threats (SWOT) must be identified and properly planned, as this improves effectiveness.

6.2 PLANNING AND PRESENTATION

There is an urgent need to improve awareness and understanding of the nature of application, and impact of computer networking in libraries. Computer networking of a National Library of Nigeria requires a coherent national policy and planned investment by government. There is a need for proper planning and presentation. The library and information community is very diverse and networking is a complex area involving numerous organisations and individuals, if a coherent national information networking policy is to result (3). The problems associated with developing such a policy are as much economic, legal, political and social as they are technical. Therefore, it is important to understand the diversity for computer network planning. The computer network in a national library has a national information role. National libraries will affect other departments within and outside its organisation by the efficient and effective services delivery, and so they contribute to the overall success of the entire the nation.
In a developing world IT is challenging the entire community and causing changes in the environment. It is natural for such a project to cause fear and many human beings resist changes in any working environment. Therefore, there is need for a good management of change. This must involve staff training in the use of IT at senior management, professional and non-professional levels, as well as training in customer care. The potential benefits would increase efficiency and effectiveness, eliminating routine tasks for better management of staff time and potentials. Librarians must become familiar with the electronic resources through a thorough training effort and by daily use as an information tool. A lot of short studies and International seminar schemes have been organised to widen and broaden the experience of researchers and keep professionals and librarians and information scientists up to date with the developments from other countries. However, environments are changing. Therefore processes, systems, the service and its method must change in parallel. Libraries are surrounded by other companies whose requests change with the business of the day. The type of change must be analyzed and captured. The national libraries of the developing countries can learn to use the Matrix structure for the management of the computer networking. This will lead to greater fluidity and flexibility to meet the demands of users and carry the libraries into the 21st century and beyond.
Devolved management should be encouraged so that managers at all levels will be better able to deploy, develop and motivate their staff and have specific training and specialist advice needed to improve their skills. Employees too, will gain by having improved job satisfaction and career growth. Roles will be redefined and this will increase more links with the nation. Quality and productivity are achieved through people, so respect for individual and developing human resources should influence and be related to the delivery of service (5). The heads of departments and members of staff must be formally informed and involved with the changes, to avoid any leakage which could lead to fear and anxiety. This will ensure their cooperation and security. Staff will need to be in positions for effective action. This means deployment, recruitment, and retention of staff, revision of ineffective organisational structure, training staff and becoming more cost effective. This must be timely and properly presented and communicated to both the staff and users.

Security issues will need to be resolved. This is to prevent unauthorised access to information. Passwords and user names will be given to protect privacy within different levels. Another security device is data encryption, this is a code between computer sharing the same code. It reduces unauthorised access but does not eliminate it. The appropriate features of a national library should include: variable and flexible field structure; strong
retrieval commands and indexing system; flexible menu-driven system; various information printing possibilities; integrated programming language; availability software that is distributed free of charge for use in non-profit conditions; open system, easily transferable to national languages; and continuously upgraded according to the trends of technology in the world.

6.3.1 Communication

The computer networking in national libraries improves communication of the organisation within and outside the structure and the nation. The most popular means of communication with the outside world is through the International Direct Dialling System (IDDS). For any library to link with the outside world, it has to go through the National Telephone Corporation Network. This is time consuming. Changing from traditional networking to computer networking will reduce time constraints. Computer networking will revise the consultation and communication arrangements of employees with the management, giving increased flexibility, changing organisation structure and roles for every staff. This will lead to work force reductions.
The National Electricity Power Supply in most developing countries is not reliable, some are even erratic! The resultant effect of this is that staff and users lose a lot of man-hours in trying to communicate with each other (because communication is 'the life-blood of every organisation'). The computer networking will need an uninterruptible power supply, this will improve the communication strategy of the organisation.

Most people in the developing world are beginners in computer networking, but librarians must be in the forefront to take up the challenge of showing others the way to the information resources (6). The users will in return have better services leading to a well informed society. Management Information System (MIS) or Decision Support System (DSS) is required for providing information and information processing to support organisational activities, competitive strategy, management functions, SWOT analysis of the system and the organisation. This would increase intelligent decision design and choice especially in discovering problems and opportunities. It will enhance program specification of input, output, major functions performed, communication, rules, editing, actions to be taken in error or exceptional conditions and special tables or formulae. All these must be monitored and controlled to harness the power of technology, achieve sustained customer satisfaction and release the potential of people. For the success and management of the change to take place effectively, the Federal and State government, the top management
and the chief executives must also be properly informed and fully involved to gain their full support in terms of finance, staff and other resources.

6.3.2 Marketing

The aim of marketing is to know and understand the customer so well that the product or service fits him/her and sells. One of the key roles of a marketer is the ability to use the '6Ps' in the marketing mix to optimize corporate performance. These variables are product, or service, in the case of a library, price, place, promotion, planning and personnel(7). Occasionally, National libraries embark on advertisements in various media, especially when there are new products to be marketed. The NLN has its own car stickers, T-shirts, plus seasonal and festive greeting cards as a forum of advertisement. From the foregoing, the (NLN) is not only familiar with the concept of marketing, it applies the tools of marketing in furtherance of its corporate goals and objectives. The NLN has tried to fulfil what Shapiro said of marketing as an appropriate attitude, an approach that matches products with market segment needs, and a set of tools, techniques and concepts(8).

The NLN needs to do more advertising especially in the new field of computer networking so that it can keep its image in the minds of both its previous and potential customers. This
will enable the NLN to implement principles of librarianship in the present revolution in the world that is leading to a global information village, and stand out of competition, more so because the NLN is younger than most libraries in Nigeria. These are only attainable with good funding and support of the government.

6.4 FUNDING

Funding has become the most important factor for the success of any programme. In recent years funding for the libraries has decreased, so in order to keep the good quality of services being delivered, many library managers have reassessed the way in which their libraries are being organised and managed. Special provisions should be made in the budget of NLN for capital expenditure and running costs of the network.
6.5 SUPPORT

Finally, there should be a Network Advisory Committee (NAC). Membership should be at the invitation of the National Library of Nigeria (NLN). This should include representatives on network-related organisations, various libraries, publishing professional societies and members of bibliographic utilities, federal libraries and individual library systems. The objectives of NAC would be to provide a forum for discussion of computer network issues. While the mission would be to advise NLN on its computer networking central role and to provide input to the NLN. The mission of NAC would be to advise the NLN on its role in the planned computer network and suggesting and or imposing programmes and standards. Also to advise on the model of configuration, evaluation of new technologies in and among libraries, coordinate networking and improving access to materials and preservation and improved library management. It would also look at how it should be governed.

6.6 IMPLEMENTATION

The National Library of Nigeria should investigate the reliability of other systems. They should visit and speak to people to find out their opinions. Their findings discussed, and voted for the selection of the best system for the library. They should attend exhibitions,
seminars and conferences. The following are the factors which should be considered during implementation in the NLN.

**Hardware:** hardware must be purchased to run the selected software. It will be necessary to have processors, which can access servers and printers at each network point. A Hardware maintenance contract is valuable, to ensure technical support.

**Software:** in any software life cycle, it has been determined by US-based market research and industry analysis that 80 per cent of costs occur after the installation and during the maintenance phase(9). Careful examination of methods and tools used by the software vendor could result in real cost savings. The system and the methods must work together for the full benefit of each to be realised. Then a system based on an analysis of the customer's needs and the library practice can be devised.

There can be two types of printers. DOS spoolers and UNIX spoolers, although one printer can satisfy both roles via a switch box. Alternatively if a product called Flex/IP runs on the Novell server, all Novell printers will be made accessible as UNIX spoolers. This could be used also from DOS on an MIS supported Work station.

**Standardisation:** the standardisation of the MIS Supported Workstation will enable the system to be tested and document the configuration as a routine procedure.
Standardisation would be seen as an enabler of functionality rather than as a restriction. Organisation, method and automation must be used to counter the increasing demands. As discussed earlier, there are three popular standards. It could be argued that the vendor standard is not flexible and the library should not be stocked by a vendor. Rather the library should get a vendor to supply the standard specified by the library. However, a combination of industrial and International standards would be even better.

**Connectors:** there are two types of network cables. Both models have two network connectors. One has a Thin wire and a thick wire connector. The other model has a twisted-pair and a thick wire connector(10). For the NLN it is recommended that the twisted pair is most suitable.

**Terminal:** the standard terminal could be a 4-megabyte system logic board or 2-megabyte system logic board and 2-megabyte memory controller board. The alternative to this is a 2-megabyte memory controller board. The terminals could cause difficulties if the allocations are more than the locations at which the terminals are used. To solve this problem extra cables will need to be bought, taking care that they are compatible and correctly connected.
Dealers: computer network software dealers try to improve their products continuously, therefore in purchasing the software for the networking, it is suggested that the library buys the complete network software that combines all the essential services for the work group such as file sharing, electronic mail system, and network printing capabilities and connectivity for increased productivity. The library will be at an advantage if the installation is a simple system that can be easily installed and start communicating in a matter of minutes. This will require no outside help or special training. It will have easy menu-driven installation, on-line help screens and desk accessory access to all functions to simplify networking. It is also important to know what is installed and running on the network and what the users need or require. The system should allow the user to call the tune and provide integrated and centralised control from one location. It should allow the automatic distribution of software across the entire network. There are a lot more facilities which do not need a dedicated server. Some networks share and exchange files and resources regardless of the computer they are using, allowing for growth. Some can add computers and connect to other networks, over LocalTalk, Ethernet or Token Ring; the user can communicate within work groups, between departments and throughout the organisation. This will save a lot of time and maximize the investments.
Package: When the package is bought it should have some agreement like testing, maintenance and how it will be upgraded. Once it is bought the terminal is unpacked, inspected and the terminal's components are checked. It is important to ensure that the standard parts checklist items are correct especially the network board. The components should be inspected for shipping damage. Terminal servers provide a cost-effective way to connect terminals and printers to hosts. Each device connected can access services on nodes connected to the Local Area Network (LAN). The shipping components should be saved in case the terminal needs to be reallocated.

Installation: it is important to note that the installation of the networking system requires a feasibility study and documented information and instructions for both the supplier and the organisation. The information required in terms of reference, including the installation of the cable, for which the starting, completion and acceptance dates must be given. It will also include the terms and conditions of contract which should be given, negotiated before the submission of tenders. The suppliers are given specific instructions which may be mandatory and must be met by the supplier. The supplier should be given an accurate description of the requirement, but they must form their own conclusions about the methods and the resources needed to meet the requirement. The supplier is required to have a proven capability of installing similar data cabling. A good example is that of Boston Spa. After the component is installed and the cables are connected the
terminal should be tested and displayed. The brightness, contrast, and viewing angle of the monitor must be set.

**Recovery times:** there should be a trained network specialist available to help with the product, identify problems quickly and so reduce recovery times and help with other complex networking problems and free staff to concentrate on other jobs. In some cases there could be no-one in the library with sufficient expertise to decide what sort of network is required. This means hiring a specialist. This, places the library staff at a disadvantage, because they will not be in a position to agree or disagree, they merely have to accept. Ideally the computer network specialist should be a member of staff of the library.

**Problems:** the decisions made in any computer networking, the compromises which the implementors arrive at, and the problems arising from it are likely to be common to a number of installations. This illustrates the way in which, in reality, the flexibility for which a network was chosen may come to be circumscribed and reduced in practice. For example, the wiring and the rewiring of the locations can cause problems. If the computers often need plugging and unplugging, there will be need for many extra sockets. All departments should have their own stations. This will minimise the problems for the staff.
of the computer department. There is also the need for flexibility to be able to cope with the introduction of more equipment into the library and expansion of the system.

**Packet switching mode:** this is recommended instead of Circuit switching because it permits the storing and rerouting of the data packets. There is no message switch in WAN. The packet consists of the addresses of both the recipient, and the sender; a message id/sequence number data; and error checking. The ARPAnet is a WAN using packet-switching. This would be suitable in the case of the National Library of Nigeria (NLN).

**Data Communication:** careful consideration should be given to the connectivity, simplicity, modularity, reliability, flexibility, and diversity of the system to be used. There are five types of data communication in WANs: a repeater, a bridge, routers, Brouters and gateways. These are known as the linking networks as already discussed. **Brouters** are recommended because they mix bridge and router technologies. They process internet working connections quickly. They are able to handle communications among networks with different protocols, that is, translate pockets between the different protocols. They are slower than bridges, but less limited in connections. It cuts down network traffic as the user does not need to see all the data on the networks. They make networks more reliable.
with fewer delays. This is an important requirement if the network is aimed at efficiency and effectiveness. This is recommended for any national library network especially where funding is one of the major problems.

**Mixed Operating Systems (MOS):** in the past and even recently, some computers of different types could not effectively share data or services on a local area network. The operating system of one type of computer was unable to communicate with the operating system of another type. This meant that it was virtually impossible to link DOS, Macintosh, and UNIX based computers on a single network. Simply stated, the computers all spoke different languages. The latest existing networks now provide good communication between similar computers such as IBM, PCs and PC compatibles, but there is no practical way to link PCs, Macintosh and UNIX-based computers on one network.

**Conversion:** some network incompatibility has been solved recently for example Tops network has developed network software that translates between different operating systems. It is possible for a PC to share information with a Macintosh: the translation between operating systems occurs in the background and is transparent to the users. It is worth noting that TOPS networking software translates between operating systems, it does not translate different applications or data formats. For example, a MacWrite
document created on a Macintosh can not be edited simply by loading it directly into WordPerfect on the PC. A special application, such as translators, is required to perform the conversion needed to share files in this way. In a developing country where computer networking is still very new or at primary level, it can be argued that the networks that can run on both LocalTalk and Ethernet cabling systems are more appropriate. That means the system software should sit on top of and communicate with both local and Ethernet driver software.

**Distributed services**: an important aspect of networking is whether the network is based on centralised or distributed services. With centralised services one computer on the network is designated to provide file services, printer services and so on, to all the other computer stations on the network. The station that provides these services is called the server. The other stations on the network, which utilize these services, are called clients. A centralised file server, for example, typically has a large hard disk. It may be a highly specialised dedicated server unit. This means it runs only networking software or a PC or other than non-dedicated computer running network file server software. The central server can share its files with all the other computer stations or clients on the network. Failure of this device causes failure of the entire network. With distributed services, on the other hand, any station on the network has the capacity to function as a server. There may be several servers on the network. Clients stations can access the services of any available
server on the network. A distributed network helps avoid traffic delays, because all users
are not sharing one disk, and failure of a single server does not bring down the entire
network. From the above, it can be argued that the distributed services are more
appropriate to any computer networking library especially in developing countries where
electricity supply is unevenly distributed and unpredictable.

Topology: the topology of the system is very important if technology is to be successful.
It is also used for organisational efficiency. The network could be LAN to WAN or WAN
to WAN but should have dissimilar protocols. It can be argued that the networking of a
library within a building or geographical area can be LAN to LAN in each building, while
the connection of these LANS is WAN. LAN can also be used within each department and
then connect the LANs with the WAN for the entire organisation. This is the system used
by the British Library(13).

Most proprietary networks have stabilised on a particular configuration. Thus if one has
decided to use an IBM product, for example, the only option currently available will be a
Bus arrangement. Where other factors do not dictate the topology to be used, that is,
where there are two or more products satisfactory in other respects which utilise different
topology, the factors to be considered are: length of cable runs, flexibility of the network
in terms of expansion, and resilience of the network in the event of partial failure. This is
why it could be dangerous for a library in a developing country to use a ring. Network
topology includes point-to-point, linear bus, star, ring, and multi-connected. The
multi-connected connection makes networks more reliable, reduces congestion but makes routing complex because many paths are possible between any two nodes. It is important that the suitable equipment such as the servers, modems, routers, cables and communication software are purchased. The library would not be able to access other networks like Janet and even other libraries for inter-library loan unless it has a suitable view data-compatible terminal and modem.

**Star:** the primary role of a library which is the 'timely' communication of information. In 1986 Singapore Integrated Library Automation Service (SILAS) developed a 'star' network topology based on the Systems Network Architecture (SNA) of IBM. This is a good example for libraries in developing countries especially the National Library of Nigeria.

**Users' expectations:** the users expect a production of high quality, and provision of training and documentation to enable them to use spreadsheet and Word process and programmes to access the databases. Provision of a user-friendly specialist reporting tool such as Impromptu or IQ will also help them. A lot of security will be expected by professional users. Such security will need the type of software which will not need a replacement when a new version is produced but can be easily upgraded. It should be
flexible and accommodating. The response speed should be highly reliable and the system must be able to detect failures.

**Linkwork:** this seamlessly integrates users into a single, efficient work unit, regardless of their hardware and software platform. Linkwork simply links departments with different hardware and software incompatibilities. In a library setting where a mixture of systems and applications are being used within different departments, Linkwork can be the solution. It can save the loss of precious time when different departments have to collaborate on a project.

**Transmission:** there are two other major technical differences between types of network: that is, the type of cable used, and the system for ensuring the uncorrupted transmission of data. The two types of cable in common use are 'twisted pair' and coaxial cable which has been touched on earlier. Some very small networks, largely intended for sharing printers between micro-computers, use ribbon cable as an alternative. Twisted pair cable is cheaper than coaxial cable but beyond that, it is difficult to see many advantages in its use. Coaxial cable can be suggested because of its advantages over the others (Appendix 8). Such advantages are that a single cable can be used to carry data, voice and video, an important
economic consideration if wiring a new building or intending to install a number of new services (16).

**Uninterrupted Power Supply (UPS):** this is a battery generated machine. When the power is off, it closes the server and sends a signal to the file server. This is very important for the servers in networking. The other alternative in a developing country where power failure is common is an electricity generator. There are two kinds: manual and automatic. The automatic generator is better because it switches on and off automatically. This will not only save the files on the computer but also protect the software.

**Cooperation:** a network cooperation created to share resources could be multi-layered, multi-purpose, or multi-type. There could be a Library Researcher Group which will look into specific problems of the institutions which the multi-type library resources cannot fully cater for. They could also create bibliographic records for cataloguing tools for searching the databases, authority files, and acquisition systems. This will eventually lead to interlibrary lending, electronic mail (e-mail), and other special databases mentioned in the earlier chapter.
National indexing: another research group can look into the national indexing and abstracting services which will give the nation a national and international visibility.

Telecommunication: It is important for librarians and information scientists in libraries to be aware of the customers' requirements and customers perceptions of the service which is currently provided in the search for information to cater for these requirements. The usefulness of the CD-ROM cannot be over emphasised! Many developing countries have come to realise that information is crucial for their development. They also recognise that underdevelopment and the poor information infrastructure in developing countries has been a major bottleneck in accessing literature generated in developing countries. Because of poor telecommunication systems as well as high costs, the developing countries have been unable to access the international information systems and take full advantage of online searching. It is therefore suggested that Machine Readable Catalogue(MARC) project has been successfully completed. MARC provides the basis of the Bibliographic Service Division's range of Computer-based Services. Many libraries in developing countries have been able to search off-line locally available CD-ROM databases. These few libraries have benefited tremendously from the advent of CD-ROM and have expanded and enhanced their services. They have taken into consideration the prevailing information technology environment, end-user requirements, ever growing and changing user needs and expectations, ease of installation and use, hardware, software,
communications, networking compatibility and price. This a good lesson for any library in a developing country especially in Africa and Nigeria in particular.

**Maintenance**: maintenance of hardware and updating and upgrading of software is very important, and computer networking needs specialised, automatic testing techniques. It will undergo a cycle of repair, check-out, operational readiness, failure, and back to repair. There must be methods to reduce and or eliminate users inconveniences, dissatisfaction and stabilise their confidence in the system. Because of all these, a maintenance contract with the system manufacturer is suggested. This is the practice in the BL, LC and NLA even though this may generate a strong argument for designing dependability, maintainability and serviceability of the system. Taking funding as a major problem decisions such as types, quality, and quantity of spare parts to stock have to be faced. Preventive maintenance is argued for unexpected system failure. This will provide scheduled downtimes which are less destructive. Diagnosis should be increased to detect failures of all kinds. This can be done on a weekly basis. Prepared diagnoses may run on hardware and software and programs. Peripherals may be serviced by oiling, removing dust, and replacing ribbons. Hand books are available on maintenance prediction techniques.
6.7 IMPLICATIONS

Standardisation has practical implications in that most British academic library catalogues are now available over JANET and could therefore be easily accessed by NLN. CD-ROM databases have been acquired by British academic libraries, thus opening up the use of online databases to all students. Stand alone CD-ROM's limitations have been realised and many libraries now deliver databases to the user's desk top in some cases they are bridged into networks, which have a one-off charge for unlimited usage.

Information Networking News has been published and circulated on an electronic journal. It is basically a network information service. One can access the contents of the journal if the full text is not available. This also could become available worldwide.

6.8 SUGGESTIONS AND SUMMARY

It is worth summarising some of the above to assess the impact of computer networking on document delivery. While this view is based on the British Library in the United Kingdom, the Library of Congress in the United States of America and the National
Library of Australia there is little doubt that it is the indicative of the approach that will be taken by many document suppliers in the developing countries in the near future.

Increasingly, requests for documents and the supply of those documents will travel through the same networks: the former through the increasing e-mail, the latter through the availability of journals in electronic form provided by publishers, and through agreements with publishers to allow digital scanning of hard-copy journals. The publishers will use their skills to create information packages and librarians and information workers will use their skills to make these packages as widely available as possible, while the computer networks technologists will make it accessible to the right users.

Supply by electronic means will inevitably result in royalty payments being regarded as an integral component of the cost of document supply. The range of materials available will widen considerably. It will be possible for example, to obtain a journal article on an aspect of music, an image of the music manuscript, and a sound file of the actual music through the same communication channel.
In developing countries, it is clear that planning for the most effective use of the facilities available through computer networking will be complex. Although the technology is making rapid strides, there is still a great deal of expense involved in providing a national library which is adequately equipped to make use of services available on computer networks.

A further working assumption is that the services available through the national library computer networks in the developing nations especially the National Library of Nigeria will be priced at a sufficiently attractive rate for users.

Above all, it will be vital to reconceptualise the role of the national library. Far from being a passive collector of national and international materials, ready to supply to users just in case they need it, the national library will become a catalyst for new ways of accessing information, a dynamic provider of new products and services, and an educator in how best to utilise the facilities available through the computer networks. This will involve a considerable recognition of national library structure in order to carry out this role. There is no doubt that the computer network will greatly enlarge the spectrum of services that will be offered to the end-users. Furthermore, they will provide a new basis on which to determine the role of not only the national library but also all other libraries and
information centres in the 21st century. Above all, they will enable the relationship between users and providers of information to converge on the basis of a new level of service provision. This will, of course, provide enormous benefits to both information users and providers for the overall benefit of all the human race!

6.9 CONCLUSION

This research attempts to describe the network as a visible collection of hardware and software, systems and operations, cables and connectors, conventions and agreements that allow multiple computers to share resources and to communicate with each other and also allow the data to flow; Networks arose from the fact that in many work environments, computer users need to have access to the same information. That is sharing of hardware resources such as disk, storage devices, printers, backup units and modems. It provides different services like file servers, print servers, e-mail, backup and spooling. This is made possible by the cabling system, repeater and other devices like bridges and gateways which link other networks. All these link up the stations and make communication possible.

This project is about turning computer networking of the National Library of Nigeria into a reality. Therefore, it must recognise internal and external marketing. A certain amount of 'cultural change' will be needed to get endorsement of a computer network and turn it into reality. This is part of the process of moving to a market-led organisation with its
attendant difficulties. However, the organisation executive recognises the role of the National Library of Nigeria with one of its corporate mission statements thus: a decree enjoins the Board to provide and to set up a national library that will provide the best quality services as are usually provided by a national library of the highest standing.

Networking can be seen to increase safety, security, efficiency, productivity and supervision. It reduces pilfering, vandalism, accidents and loss of time. This will remove the geographical barriers to knowledge, due to the advances in telecommunications technology, and will also ensure economy of means, preventing duplication of resources and materials and improve the existing services and offer new ones. It will ensure the availability of and accessibility of information to the whole community as and when it is needed. For a network to be successful, it must be properly designed. The design process should include the choice of the appropriate architectures, topologies, transmission media, communication control unit and software. This will make all the devices intercommunicate seamlessly and transparently. Taking into consideration the services provided and the users they serve, the technologies used and their administration and maintenance.

Conclusively, this research endeavour has undertaken a prescriptive role in its attempt to design a possible model that will effectively coordinate the national information resources.
as well as effectively tap into the major sources of information and documentation around the world.

It is the hope of this writer that this research endeavour will provide benefit to organisations, individuals that seek to undertake or understand the basic aspect and concept of computer networking in libraries. It is particularly directed at the National Library of Nigeria (NLN) where the needs for computer networking are particularly highlighted.

This project has endeavoured to answer some ‘queries’ and solve some of the ‘problems’ of the users of computer networking, such as how to:

- devise a client-server strategy to deliver the required network performance
- obtain adequate capacity for your \(\text{LAN}, \text{WAN}, \text{routers or servers} \)
- chose the right network architecture
- assess the impacts of adding new applications or more users to your network
- evaluate the end-to-end performance of your applications
estimate what service parameters you need.

What the researcher has tried to establish is that:

- the sales talk and the installation can bring about practical constraints;

- that genuine choices have to be made;

- sometimes it is impossible for reasons politics, finance or practical constraints to go down the path which seems best;

- it is important to be clear about the library priorities and

- to be able to establish contact with the outside world with the network.

To conclude, the computer networking of the national libraries of the developing world, should be the priority of every nation. The national libraries are the bases of the needed knowledge of the nations for the economic, educational, social and political advancement. It is through them that all the publications generated in or about the nation nationally and internationally are accessed.
If Nigeria wishes to take its rightful position in the world of information particularly in Africa, the NLN should become more efficient, effective and economical. The solution to this is the computer network which will link the whole nation to the information world. Hopefully, the implementation of the project will generate further discussion, investigation and research among experienced librarians and top executives to carry out further investigations as to its implementation and effectiveness.

It is hoped that the Federal Government of Nigeria will borrow a leaf, from this project for implementation and considerable improvement to information standard. And if this happens it will be to the glory of God.
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APPENDIX

Appendix 1  Members of APNET in Africa.

Appendix 2  Regional network of the NLN.

Appendix 3  Cooperative acquisition programme of the NLN.

Appendix 4  Decree No 29 in 1970 of the NLN.

Appendix 5  21 state capitals (Lagos the former capital and Abuja the present Federal capital.)

Appendix 6  Organogram of the NLN.

Appendix 7  Proposed network structure for NLN.

Appendix 8  Media comparable table of cables.
Appendix 1  Members of APNET in Africa.
Appendix 2  Regional network of the NLN.
Appendix 3  Cooperative acquisition programme of the NLN.
Section 4

(1) The publisher of every book published in Nigeria shall within one month after the publication deliver at his own expense to the National Library three copies of the book, two of which shall be kept in the National Library for permanent preservation and one of which shall be sent by the Director to the Ibadan University Library.

(2) The copies of the book delivered to the National Library under section (1) above -

(a) shall be perfect copies of the whole book with all maps and illustrations belonging thereto, finished and coloured in the same manner as the best copies of the book are published, and

(b) shall be bound, sewed or stitched together and on the best paper on which the book is printed.

(3) Where any printed matter (other than matter of such descriptions as the Director may specify from time to time) is published by or on behalf of any department of government of the Federation or a State, it shall be the duty of the official in charge of the department to deliver forthwith to the Director for the purposes of the National Library -

(a) twenty-five copies of the publication, if it is published by or on behalf of a department of government of the Federation, or

(b) ten copies of the publication, if it is published by or on behalf of a department of government of a State, or such smaller numbers of copies as the Director may determine in any particular case.

(4) If a publisher fails to comply with any provision of subsection (1) or (2) above, he shall be guilty of an offence and on conviction shall be liable to a fine not exceeding £50; and the court before which he is convicted may in addition order him to deliver to the Director three copies of the book in question or to pay to the Director the value of those copies.
(5) The Federal Executive Council may by order in the Federal Gazette exclude any publisher or book, or any class of publisher or book, from the operation of subsections (1) and (2) above.

(6) The obligations imposed by this section are additional to any similar obligations which may be imposed by any law in force in a State other than this Decree.

(7) In this section -

"book" includes —

(a) all literary works such as books, pamphlets, sheets of music, maps, charts, plans, tables, and compilations,

(b) dramatic works,

(c) collective works such as encyclopaedias, dictionaries, year books or similar works, newspapers, magazines and similar periodicals,

(d) any work written in distinct parts by different authors or in which a part or parts of work of different authors is or are incorporated, and every part or division of such a work, and

(e) all forms in which documentary or oral records are published;

"publisher", in relation to a book, means any person authorizing or causing the book to be printed and distributed in Nigeria, excluding the Federal Military Government and the Military Governor of a State (or any person acting on its or his behalf), a public officer acting in his capacity as such and any person distributing in Nigeria a book published elsewhere.
Appendix 5 Organogram of the NLN.
Appendix 6

21 state capitals (Lagos the former capital and Abuja the present Federal capital.)
Appendix 7 Proposed network structure for NLN.
## Media comparison table

<table>
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<th>Characteristics</th>
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<th>Coaxial</th>
<th>Optical fiber</th>
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<td>Bandwidth</td>
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<tr>
<td>Immunity to interference</td>
<td>Low (unshielded)</td>
<td>Moderate to high</td>
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<td></td>
<td>Moderate (shielded)</td>
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<td>Difficult</td>
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<td>Ease of installation</td>
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<tr>
<td>Reliability</td>
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Appendix 8  Media comparable table of cables.