TITLE PAGE

EFFECTIVENESS OF INFORMATION SHARING USING CLIENT / SERVER APPLICATION

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CERTIFICATION

This is to Certify that, this project EFFECTIVENESS OF INFORMATION SHARING USING CLIENT/SERVER APPLICATION was carried out by ASA IYOREMBER JOSEPH, of the Department of Mathematics and Computer science, in partial fulfillment of the requirements for the Award of PGD in Computer Science

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DEDICATION

This work is dedicated to the Almighty Father for his Love through all these years, and the countless things he has done for me, My Mother for always caring for me and the living Memory of my Late father.

AKNOWLEDGEMENT

I thank the Almighty God for granting me the grace to successfully complete this work.

My profound gratitude goes to Prince Badmus (My Supervisor), who painstakingly insured that this project is thorough and adequately informative.

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ABSTRACT

Client / server (Network) Application are encountered in diverse areas of human activities cutting across commerce, industry, communication, engineering etc. As result of its widespread application, a good understanding of the component of a Client / Server (Network) application will be helpful.

The project describes what Client / server application is all about, with a brief run – down of the advantages of Client / Server applications and with major deference with other kinds of Network models.

With the multidimensional benefits of using a Client/Server application considered, it becomes glaring that the advantages of implementing it far outweigh the disadvantages, and so deserves a better understanding.

TABLE OF CONTENT

CHAPTER THREE

NETWORK MODEL

CHAPTER FOUR

INSTALLATION AND CONFIGURATION OF A CLIENT/SERVER NETWORK MODEL

CHAPTER FIVE

CHAPTER ONE

NETWORK OVERVIEW

1.1 INTRODUCTION

Although computer network has received much attention in recent years, and much has been written and spoken about them, there is little agreement as to what the term precisely means. In a sense, a computer network comprises two or more computers connected to one another. But this rather simplistic definition does not really distinguish between a number of widely distributed main frame computers, totally interconnected, and a single computer system where some functions (such as input/output) are handled by autonomous processors. Indeed most definition would include the later as a network, similarly a number of terminals connected to a central computer could also be defined as a network.

In reality, there is a continuous spectrum from a single processor up to a large perhaps intercontinental network and where a network starts depends more on the context in which the term is being used rather than any absolute definition.

For the purpose of this research work, we will define a computer network as a number of computers (where the term computer is taken to include intelligent terminal) interconnected in some way, Stokes 1978, and as a set of autonomous computer systems, interconnected so as to

permit interactive resources sharing between any pair of systems, Roberts and Wessler, 1970.

Having defined what is meant by a computer network, it is perhaps instructive to consider why it is necessary to interconnect computers into networks. The two classic reasons are known as "Load Sharing and Resource Sharing". Load sharing as the name suggests, means the ability to offload work from one heavily loaded computer through the network unto another machine which is more lightly loaded.

The second justification for networks, and the one which is perhaps more valid in most cases is known as "resource sharing", Roberts and Wessler, 1970, stated that the good of the computer network is for each computer to make every local resource available to any computer in the net in such a way that any program available to local users can be used remotely without degradation. That is, any program should be able to call on the resources of other computers much as it would call a subroutine. The resources which can be shared in this way include software and data, as well as hardware.

The major use of resource sharing is to share rare or unique resources such as a large storage device, a special computer or a particular database.

1.2 INFORMATION TECHNOLOGY

Information technology basically means the technology involved in acquiring, storing, processing and distributing information by electronic means including radio, television, telephone, computers etc.

There is no gainsaying the fact that day-to-day living in contemporary time without radio-frequency systems, is very difficult to imagine. Transaction and interaction are now routinely characterised by wireless information technology, satellite transmission, telephone, television, radio, telematics, automatic traffic routine system, microphone landing system, remote monitoring of patients and medical diagnostics, computer interconnection and off course the information superhighway and related technology.

1.3 AIMS AND OBJECTIVES OF STUDY

The aims and objectives of this research work are as follows:

(i) To bring out the advantages of information sharing using a client/server application.

(ii) To show the effectiveness/efficiency of information sharing using a client/server application.

(iii) To show the multidimensional advantages of computer networks.

(iv) To show the difference between a client/server application and other kinds of networks.

1.4 SCOPE OF STUDY AND LIMITATIONS

The scope of this study is limited to client/server application (where request are made by intelligent terminals (clients) to a sort of main frame computer (server) which responds to such request).

LIMITATIONS

In undertaking the study of this nature, one is bound to be limited by certain factors. The main limitations of this study includes:

(i) TIME FRAME: The time frame within which to complete this research work is rather too short for a very comprehensive work to be done.

(ii) DEARTH OF LITERATURE: Lack of up-to-date and relevant literature and current publication in this field.

(iii) FINANCIAL CONSTRAINTS: This is also one of the limitations to this research work, since a comprehensive work of this nature requires a lot of financial strength, which is not available to the researcher.

1.5 DEFINITION OFTERMS

CLIENT: Device usually made up a display unit and a keyboard which allows entry and display of information when on-line to a central computer system.

SERVER: A dedicated computer that provides a function to a network.

NETWORK: A number of computers, Terminals and peripheral

connected together to allow communication between each.

LAN: Local area network, a network where various terminals and equipment are all within a short distance of one another (e.g. in the same building) and can be connected by cables or optical fibres.

MAN: Metropolitan Area Network, network where the various terminals are far apart (within the city, state or country).

WAN: Wide Area Network, networks where the various terminals are very far apart and are linked by radio, satellite.

NETWORK TOPOLOGY: Layout of machines (work stations) in a network (star, ring or bus)

NETWORK MEDIA: Means of communicating information within the network.

NETWORK MODEL/CONFIGURATION: Way in which the hardware and software of a computer system are planned.

NETWORK PROTOCOL: Pre-agreed signals codes and rules to be used for data exchange between systems in the network.

NETWORK SOFTWARE: Software used to establish the link between a users program and the network.

NETWORK MANAGEMENT: Organization, Planning and management of a network.

NETWORK SECURITY: Way of protecting data stored in the network.

INTERNET: A large number of computer systems terminal and networks from different countries connected together to allow transfer of information/data between them.

CHAPTER TWO

2.1 INFORMATION TECHNOLOGY

The theory of communication, the science of cybernetics and the theory of cognition each provide a definition of the concept of information and account in their own words for the existence of two different modes of information, which closely fit the classical notions of control and power. One mode of information "control", leads to a view at system as closed entities, with strictly defined structures and relations with the environment, while the other mode, "Power", requires an open system approach.

Any real world process of communication management and knowledge may be represented as dialectics between these two modes of information. Their synthesis consist of a problematique leading to the theory of open-able systems, which in turn might be properly considered as a general approach to information systems.

The coding and qualitative aspect of information have been emphasized and most of the research on information theory does not account for the qualitative and structural features of information indeed the Latin meaning of informatio is "to give a form to". In this sense, information means the same as the concept of function in biology, namely an activity which structures, and which is indistinguisheable from the result once the structuring is done. Shannon and Weaver (1949)

2.2 RULES OF INFORMATION TECHNOLOGY IN COMMUNICATION

When data are transferred from one location to another in a computer system, a set of rules must be followed governing how the information is to flow. These rules define the orders of the message path, including,

1. The ultimate definition of the data.
2. Controlled characters to mark the beginning and end
3. The data themselves and
4. A check character that enable the receiving terminal to test the incoming message for errors.

The rules also defines how a terminal acknowledges a message or if it detects an error, how its request retransmission. Finally, they specify how to cope with two simultaneous requests for access to the communication line.

Because these rules add information to the data that is not related to the data themselves, a major consideration of protocol design is how to hold those additional data to a minimum.

Most protocol in use are based on IBM binary synchronous communication (bisynch) protocol. IBM's newest protocol is called syndronous data link control (SDLC). An international effort by the consultative committee on international telephone and telegraph (CCITT)

have developed a standard protocol known as X..25/HLDLC (High Level Data Link Control). The major impact of the X.25 protocol will be in developing new data communication network. Using the X.25 protocol, these networks will make the interconnection of remote computers far less expensive and more reliable than current method can. An important contributing factor in lowering cost to data communication network is that equipment manufacturers must follow the standard if their equipment is to be connected to the networks. This differs from the current situation in which a given vendor can 'lock in' a user to their equipment by basing all communications on protocols that are unique to their products

(Edwards and Bradwell) (1982)

2.3 TELECOMMUNICATION

Telephonic, microwave, and satellite transmission of data and program has developed as complement to multiprogramming and time sharing. Users dispersed over large geographic area, even on different continents, are able to share the computational and decision making power of a single computer.

Networks of computers are being developed that users can share computing power with one another. Users processing only a small computer can hook it into a network having a large computer in order to obtain automatic access to the computing power of the large computer.

Businesses are using computers as preprocessors and data acquisition unit for large machines that may be located anywhere on the earth.

When data are entered from remote location via telephone and telegraph lines and are, perhaps operated upon and result returned over the same lines, telecommunication or teleprocessing takes place. The use of special purpose mini-computers has speeded the development of business teleprocessing systems which often have featured multiprogramming or time sharing as well. Minicomputers have been used as "front end" communication controllers for such systems. They poll the individual data or inquiring station or supervise development of a full message from one station before passing it along to the central computer over one of general high speed channels. They temporarily store output messages until the proper terminals can receive them.

Minis have also been used in multiplexors and concentrators to concentrate line use and reduce the need for transmission lines. If we think of a transmission line as a complex pipe that is divisible into smaller pipes, then we can think of one type of multiplexor, called a bandwidth multiplexor, as dividing a pipe into a systems of sub-pipes and sending simultaneous messages along each sub-pipe. This provides more message-carrying capacity per unit of time. Unfortunately the data carrying capacity (speed) of a line is proportional to its bandwidth. Dividing the lines into several parallels sub-lines divides the bandwidth

of the total line in the same way. Each line has a significantly reduced transmission capability.

A second type of multiplexor uses the full bandwidth for each message, several messages are pulsed intermittently along the line. This type is referred to as a line division multiplexor.

Line concentrators differs from multiplexors in that they accept messages from group of terminals and then pass them along (over telephone or telegraph line) to the computer. The concentrator involves buffering and may output less data in a single unit of time than it input to it during that time unit. In contrast, multiplexors are device that allow several stations to share a single line simultaneously and they accept equal and deliver output at the same rate.

Two basic types of telephone lines are available Dial-up lines provided flexibility, permitting contact with any party having access to the telephone network. Leased lines provides a continuos connection for two or more locations. These leased (private) lines can sometimes be shared with other users, which reduce the cost. In the same way dial up users can often save money by purchasing wide area telephone service (WATS), which allows unlimited calls to be placed or received within the prescribed service area without individual call tolls being paid.

The choice among standard dial-up, WATS and leased lines depends on the volume and nature of the message. If there are many short

message exchanges with numerous points, dial-up is more economical. Leased lines are used when lengthy messages must be exchanged with a few points. WATS becoming economical when messages are lengthy and frequent and are exchanged with numerous locations.

The newest method of telecommunication involves transmission via satellite, satellites are attractive as communication links between sites inaccessible by land lines or land base microwave. Satellites can now be placed in synchronous orbit to circle the earth once in each 24 hours and thus appear to be stationery over the specific geographic location. The satellite is in a very high vacuum, out of the range of most human produced interference and is at nearly constant temperature. The ware and tear of temperature related expansion and contraction and atmospheric born corrosion is absent. Thus the expensive satellite should out perform and outlast its earth bound electronic cousins. In this way, a satellite system can be less expensive than any land based system when communicating over long distance.

When systems are expanded to provide satellite to satellite links, may spot on earth becomes accessible, the minimum number of satellites required to give total average of the earth (other than the poles) is three.

Two factors determine satellite performance. First, their power and sophistication is primarily dependent on their size. Second the

frequencies they use determine their signal-carrying capacity and the narrowness of their radiated beams.

2.4 WORK STATIONS

A workstation can be said to be a terminal or microcomputer, usually one that is connected to a mainframe and or to a network, at which a user can perform applications. It could also be defined as one or more input/output devices from which jobs can be submitted to a host system for processing and or to which completed jobs can be returned. Thirdly, a workstation could be a configuration of output/input equipment at which an operator works.

Furthermore, workstations are the individual computers hooked onto the network file server to share network information and resources. They are also referred to as nodes. The individual workstation can also work independently as a stand alone PCs.

There are diskless workstations, workstations with floppy drives only and workstations with floppy and hard diskdrives.

2.5 SERVER

A server is a computer containing the network software itself, a network adapter card and all the application files the users wish to share. There are different ranges of high performance and cost effective file servers that can provide application for up to 5, 10, 50, 250, and 1000 users. These systems may come in desktop or lower form.

There are two main types of file servers:

(i) Dedicated file servers for file serving only.

(ii) Non dedicated file server – server in workstation usage i.e. peer-to-peer network.

2.6 COMPUTER NETWORKS

A series of interconnected terminals and communication lines is said to be a Network. The so called computer utility of the future that is conceived as providing a computer terminal for every home, similar to today's gas, water, and electricity utilities, is really a network.

Computer networks may be viewed as comprising, (1) one or more computers, (2) the nodes or the connecting points of the communication channels, (3) and the communication channels.

Computers in a network may all be identical, different brands, different models of the same computer. Although there can be a wide variety of terminals in a network, the more they have in common, the simpler the communication links. Edward & Broadwell (1982).

2.6.1 NETWORK MEDIA

Network media is basically the type of medium to be used in the transfer of data or information from the workstation (clients) to the server and vice-versa. The network media to be used is to an extent, largely determined by the geographical size of the network itself. Basically there

about three main categories, local area network (LAN), Metropolitan area network (MAN), and wide area network (WAN).

2.6.1.1 LOCAL AREA NETWORK (LANs)

LANS are series of connected devices (i.e. personal computers or workstations) distributed over a small geographical area. LANs have data rates of up to 100 megabits per second. LAN involves client-server and peer-to-peer network.

LANs can be wired using cables as a medium for the purpose of communication, while it can be wireless without the use of cables. Wireless network are ideal for a number of applications, particularly in areas where cabling is difficult or hazardous e.g. proxima range LANs.

2.6.1.2 METROPOLITAN AREA NETWORK (MAN)

MAN refers to a metropolitan area network, that extends the concepts of LANs out of buildings, to substantially larger distances than LANs do today. It differs from WAN (wide area network), which refers to telecommunication for distances of many miles. The 802.6 MAN will accommodate data, digital voice, and compressed video, and is designed to serve as a LAN/WAN gateway Data rates of between 45 to 600Mbps are expected.

2.6.1.3 WIDE AREA NETWORKS (WANs)

WANS are concerned with the interconnection of computer network devices over a wide geographical area.

The public switched telephone network (PSTN) is a good example of WAN in everyday use.

WANS typically extend over distances in the region of 1,000 kilometres.

Many existing WANS have data rates approaching 100 kilobits per second. The newer digital network technologies. Such as ISDN (Integrated Services Digital Network) allow for an increase in data rates (typically in the order of 144-2048 kilobits per second.

2.6.2 NETWORK TOPOLOGIES

Topology refers to the layout of the route data travels along the network. There are basically two forms;

(a) Logical topology

(b) Physical topology

(a) LOGICAL TOPOLOGY: The nodes on a LAN handle message from node to node in a sequential logical topology (token passing) or they send the messages out to all stations simultaneously in a broadcast (contention).

(b) PHYSICAL TOPOLOGY: A physical topology is a description of the route the network cables take as they link nodes.

Theoretically, there are several ways of physically running cables connecting a group of computers. But in the real world, you can

only buy products conforming to one of the two different physical topologies.

There are four common basic topologies; star, ring, bus, loop network topology.

2.6.2.1 STAR TOPOLOGY

The star topology is also called the hub topology. In this arrangement the networkwires runs between the network node and a central wiring hub. Each devices is connected to a central point.

These central points are often called hubs, concentrators, multiport repeaters. There are 3 types of hubs, passive, active and intelligent.

The strategic advantage of a star topology is that mostly network-service, trouble-shooting and wiring changes, take place at the hub.

In star topology, you have to run a separate cable to every machine that wants to access the network. If the hub goes down, so does every station connected to it. Below is a diagrammatic representation of a star network topology.

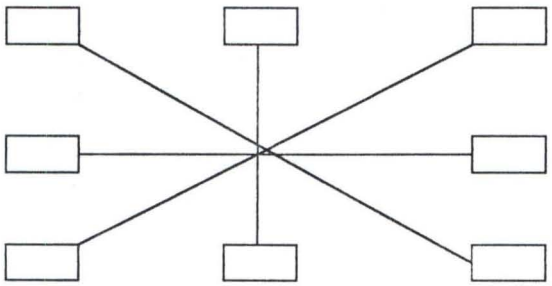

Fig. 2.6.2.1

2.6.2.2 RING TOPOLOGY

The ring network topology has intelligent nodes (or terminal) spread evenly over the network, hence central control is no longer necessary. Most ring networks have one monitoring station (normally a node in the network itself), that takes care of any error in the transmission of data.

Transmission of data around this type of network is normally one way. Although some ring network systems can be figured for data transmission in either direction. A ring network topology is shown below.

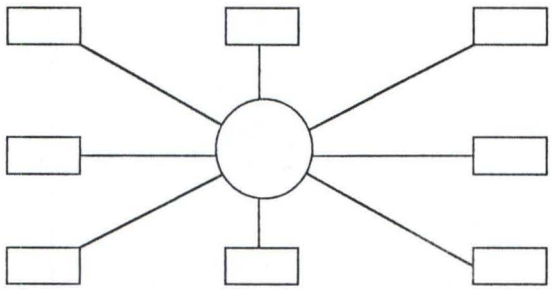

Fig. 2.6.2.2

2.6.2.3 BUS TOPOLOGY

The bus network topology consists of one bus and terminators at both ends. Devices in the network (a terminal is an example) send data along the bus. All devices quickly examine the data to look for the address, just in case it corresponds to them.

This type of network is a "passive" network, which means that the devices on the network listen for data addressed to them.

When a device wants to transmit data over the network, it "listens" to determine if the network is busy (i.e. if any data is being transmitted). When the network goes quiet for a brief moment, the device will transmit its information.

Bus network uses intelligent terminals, as its node to recognize an address, receive information and transmit messages safely.

This type of network is normally used in probabilistic systems, using a protocol such as CSMA/CD over a LAN.

The main advantage of this type of network is that it makes provision for easy installation and expansion.

Another advantage of this system is that a break in the main bus that isolates one or more devices may not cause a total network breakdown.

The disadvantages of this type of network is the expensive nature of installation and limitation in cabling.

Coax Ethernet is a well known example of a bus based network standard. A bus network topology is shown below.

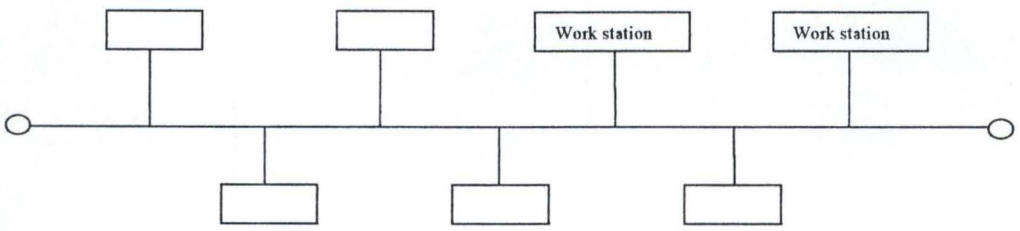

Fig. 2.6.2.3

2.6.2.4 LOOP TOPOLOGY

The loop network topology is similar to that of the ring network, except that all messages on the network must pass through an intelligent controlling node message, which is transmitted by devices polling each other on the network.

Polling is the task of constantly asking a device (at regular intervals) whether or not it needs attention (e.g. to send a message over the network etc.)

A major disadvantage is the reliance on the intelligent controller node. If this breaks down, the whole system will fail, and communication across the network would be impossible.

Another disadvantage lies on the throughput rate of the system. These types of systems tend to have low data transmission speed and hence the data throughput is somewhat restricted. A loop network topology is shown diagrammatically below.

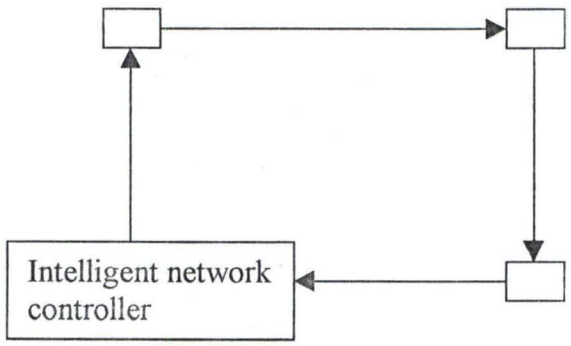

Fig. 2.6.2.4

2.7 INTERNET COMMUNCATIONS

The INTERNET is an integration and connection of many smaller units of computer networks to form a larger unit that shares global

resources of information among countless diverse communities spread all over the globe.

The Internet involves independent computer servers linked to the network via digital telecommunication lines and satellite stations. This connectivity is termed information super highway.

At the regional and local levels, there are tens of thousands of organizations of every kind that have built their own enterprise networks having connected them to the national backbone.

Access to end users is either direct, where end-users connect their computers to become part of the Internet or indirect where end-users use a "dumb terminal" to access a computer host directly connected to the Internet.

Presently, some African countries including Egypt, Ghana, South Africa and Zambia have a permanent link to the emerging global information highway.

Nigeria does not have a permanent link, but is connected to global sprint link (a world leader in international commercial Internet services) by infor communications Nigeria Limited.

Nigeria Internet group (NIG.) is warming up to be linked permanently to the information super highway. NIG comprises of Nigeria Telecommunication Plc. (NITEL), Nigeria Universities Commission

(NUC), Nigeria National Petroleum Corporation (NNPC), various oil companies in Nigeria and financial institutions in Nigeria.

Services on the Internet include electronic mail, transferring files, fax messaging and remote computer access.

There are world renowned consultants in international commercial internet services who offer a turn-key solution, including hardware, software connectivity, installation and activation to ensure a successful service launch.

Also, Africa on-line, an indigenous internet service provider (ISP) is working in collaboration with its technical partners Pan Africa on-line communications network for software support and the international systems science corporation (ISSC), both of the United States of America for the hardware support.

The Africa on-line facilities when fully commissioned will link up all other Internet service providers (ISPs) world wide. The facilities include Internet, real time electronic mail (E-mail), news groups for special interest and multimedia video conferencing. It also has file transfer, file libraries, the global market place, domain names registration among others.

2.7.1 ELECTRONIC MAIL (E-MAIL)

Electronic mail is a system whereby text messages may be passed from one computer user to one or more other computer users. It is a kind

of computer mediated text exchange or the electronic version of the mail box, it is focused on communication between two persons asynchronously. That is, the two persons communicating do not have to be on-line at the same time.

The recipients may be on the same computer or another one. The messages passed are stored at the receiving computer until the recipients could leave messages to the other and retrieve replies at his or her convenience.

E-mail system is enhanced to forward mail to other people with or without attachment, and the ability to transmit messages to more than one mail box. Associated with this enhancement, was the ability to create a mailing list and effect a kind of many-to-many communication.

In E-mail each participant has his own inbox and outbasket-requiring stage. Users have access to only messages addressed specially to them. In some contemporary system, a user may also be addressed through a "public name" that gets general mail intended for a wide audience.

2.7.2 CONFERENCING SYSTEM

Conferencing system is used in coordinating the activities of departments involved during communication among private sector business, labour group institutions, educational institutions and government policy makers.

Conferencing system is also used in reporting and dissemination of information in a computer-based version of the voice conference call. The first conferencing system is the Emergency Management Information and Reference System (EMISARI), widely recognized today as prototype computer conferencing system

It helps in updating policy as necessary, those charged with executing were to comment and ask questions as the need arose at their convenience. Policy statements, case ruling comments and questions remained on-line for all to use, removing the geographic dispersion and time.

In the basic conference model, in a time group communication system such as EMISARI, all messages are stored as collection in sharable spaces. Participating users all read the same copy of messages, they have common access to the public copies. New users joining the conversation "catch up" by reading the stored exchange of earlier conversation.

Application softwares are used to automatically share a subconference between two or more conferences by isolating individuals conferences and all their subconferences from one another. This is analogous to the E-mail situation in which a user receives a message two or more times because he or she has more than one mail box.

Conferencing is a well developed time-sharing technology that is used in academic government in universities. As with corporate meetings it helps in bringing all interested parties together for meetings in a large university, dealing with issues of university policies involving administration. Examples of conferencing system are EMISARI, PLANNET (Planning Network).

In Nigeria, Africa on-line, an indigenous Internet service provider (ISP), has recently began a test drive on multimedia/video conferencing.

CHAPTER THREE

NETWORK MODELS

3.1 PEER – TO – PEER

A peer – to – peer network is one in which nodes may alternatively provide or receive non – dedicated services (e.g. a PC connected to another PC).

Peer - to- peer networks are easier to set up and use than Netware or NT mainly because they don't require you to jettison your familiar Dos or windows operating system in favour of a specialised network operating system.

Although Dos and Windows limit the capabilities of these networks, these networks are easier to use because you don't have to find out the ins and outs of a foreign operating system. Everything you Already know about Dos and Windows can help you when you set up a Peer - to- peer Network.

Peer – to – peer Networks don't require that you use a dedicated server computer. Any computer on the Network can function both as a Network server and as a user's workstation. They are easier to set up and use because they don't provide as many advanced features as netware or NT. They don't provide the same fault tolerance features, there security systems aren't as advanced. With fewer variables to worry about, mastering the Peer – to – peer system is easier.

However, since Peer – to - Peer Networks are Dos and Windows based, they can never manage a file server as efficiently as a real Network operating system.

3.2 SERVER BASED NETWORK

A server based Network is one in which the server (or servers) is the only source of provision of information to workstations or clients. Servers provide Application, File, database, Print, Fax, Image, Communications, Security System and Network Management services.

Application severs can provide Business functionality in the same manner that traditional host minicomputer and mainframe systems have in response to terminal or printer request. In the client/server model these services can be provided for an entire or partial business function worked through a remote procedure call (RPC). A collection of application servers may work in concert to provide an entire Business function. For example, in payroll system the employee information may be managed by one application server, earnings may be calculated by another application server, and deductions may be calculated by a third application server.

File servers provide record level data services to non database applications. Space for storage is allocated and free space is managed by the file server. Catalog functions are provided by the file server to support file naming and directory structure. File name maximum

length ranges from 8 – 256 characters, depending on the particular server operating system support.

Database servers are managed by a database engine such as Sybase, IBM Ingres, Informix or oracle. The file server provides the initial space, and the database allocates tables within the space provided by the file server.

Print servers provide support to receive client documents, queue them for printing, prioritize them, and execute the specific print driver logic required for the selected printer.

Fax servers provide support similar to that provided by prints servers. In addition, fax servers queue up outgoing faxes for latter distribution when communication charges are lower.

Communication servers provide support for wide area network communications. This support typically includes support for a subset of IBM system network Architecture (SNA), Asynchronous protocols, X.25, ISDN, TCP / IP, OSI and LAN - to – LAN NetBIOS communication protocols.

Security at the server restrict access to Software and Data accessed from the server. In most implementations the use of a server log in ID is the primary means of security.

System and network management services for the local LAN are managed by a LAN administrator, but WAN services must be provided from some central location.

3.3 PROTOCOL OF A CLIENT / SERVER BASED NETWORK

A protocol is a set rules that control how Hardware and Software systems interact together within a network to control the flow of information.

The Open System Interconnection (OSI) reference model is a reference model for network protocol specified by ISO Network access protocols or access method defines how device on the network access the medium and transmit data.

3.3.1 TRANSMISSION CONTROL PROTOCOL/INTERNET (TCP/IP) PROTOCOL

Transmission control protocol/Internet protocol (TCP/IP) was developed for the United States military's advanced research projects network. The internet is a Worldwide interconnected network of the universities and research establishments, including NSFnet, Defence data Network (DDN), and network from agencies e.g. NASA The TCP/IP is the glue that ties these different networks together.

TCP/IP has now been used in many commercial applications outside of the government sector. It is particularly evident in internetworking between different LAN environments. TCP supports the

transport layout of the OSI model and is specifically designed to handle communication through unreliable subnetwork interfaces and packet radio environments. Packet networks allow messages to be broken up into small blocks (packets) and transmitted for re-assembly at the receiving station.

3.3.2 TCP/IP AND LANs

Interestingly, the LAN environment exhibits many of the same characteristics found in the environment for which TCP/IP was designed. In particular, the LAN environment exhibits the following characteristics.

Routing: LANs do not usually route; they assume that every station will see every message and acquire those that are addressed to it.

Connections Versus Connectionless: LAN activity is rarely call oriented. Application software running on a LAN usually assumes that it is talking to a local resource, such as a disk or printer-a resource to which no call is necessary.

Administrative load sensitivity – A LAN administrative support is usually limited. If it is not usually feasible to maintain routing tables and lists of names to be used by a network router such as those that IBM's SNA requires in the host environment.

Missing and Extra Data – LANs do not typically lose or duplicate data, but bridges and Internet routers may sometimes provide multiple paths among environments, causing both conditions.

Networks of Networks – LAN based networks typically involve multiple LANs interconnected with a WAN. They are well suited for subnet definitions, with network and host addresses.

Vendors have successfully layered the OSI protocols with TCP/IP to implement production quality versions of the file transfer and management (FTAM) protocol, the common applications services element (CASE), and the X.400 message exchange protocol. At the lower levels, the similarity between the Ethernet implementation and ARPANET parameters means the most current implementations are with Ethernet.

3.4 ADVANTAGES OF CLIENT/SERVER COMPUTING

The client/server computing model provides the means to integrate personal productivity application for an individual employee or manager with specific business data processing needs to satisfy total information processing requirements for the entire enterprises.

3.4.1 ENHANCED DATA SHARING

Data that is collected, and maintained on a server, is immediately available to all authorized users. The use of the structural query language (SQL) to define and manipulate the data provides support for open access from all client processors and software. Transparent network services ensure that the same data is available with the same currency to all designated users.

3.4.2 INTEGRATED SERVICES

In the client/server model, all information that the client (user) is entitled to use is available at the desktop. There is no need to change into terminal mode or log into another processor to access information. For example, creation of customized document is done using only desktop tools and the mouse to select and drag information from either source into the document.

3.4.3 SHARING RESOURCES AMONG DIVERSE PLATFORMS

The client/server computing model provide opportunities to achieve true open system computing. Applications may be created and implemented without regard to the hardware platforms or the technical characteristics of the software.

Thus, users may obtain client service and transparent access to the services provided by database, communications, and applications servers. Operating systems software and platform hardware are independent of the application and masked by the development tools used to build the application.

3.4.4 DATA INTERCHANGEABILITY AND INTEROPERABILITY

SQL is an industry-standard data definition and access language. This standard definition has allowed many vendors to develop production- class database engines to manage data as SQL tables. Almost all of the development tools used for client/server development, expect to

reference a back-end database server accessed through SQL Network services provide transparent connectivity between the client and local or remote servers. With some database products, such as lugres star, a view of data that is distributed between heterogeneous platforms may be defined.

3.4.5 MASKED PHYSICAL DATA ACCESS

When SQL is used for data access, users can access information from databases anywhere in the network. From the local PC, local server, or wide area network (WAN) server, data access is supported with the developer and user using the same data request.

The use of new data types such as binary large objects (BLOBs) enables other types of information such as images, video, and audio to be stored and accessed using the same SQL statements for data access.

CHAPTER FOUR

INSTALLATION AND CONFIGURATION OF A CLIENT/SERVER NETWORK MODEL

4.1 INTRODUCTION

This chapter covers very brief fundamentals of installation and configuration of a client/server network model including its general administration using Novell netware concept. It involves step by step operation in setting up communication with in an integrated computer network.

4.2 HARD AND SOFTWARE REQUIREMENTS FOR A LAN

TECHNICAL SPECIFICATION

The server PC No. 7 (MiniLab) 486-with 64kb RAM expandable to 229kb RAM,

1 Ethernet card, 144 megabyte 3.5" floppy drive and a 3 megabyte hard drive. A colour VGA monitor and graphic adaptor and a multi I/O card containing 1 serial port and 1parellel port. ISA (AT-BUS) PC With1 megabyte of RAM expandable to 64MB of RAM.

WORKSTATIONS: PCs WITH AT LEAST 640KB RAM

MINIMUM SPECIFICATION:

File serverPC:376 sx with 4mB of RAM and a hard drive.

WORKGROUP FILE –SERVER PACKAGES:

Novell Netware 386 operating system 3.11 and MSDOS version 6.0

OTHER EQUIPMENT: A tape backup drive in one of the workstation and a UPS (Uninterrupted Power Supply) for the file server to plugged into BNC T-connector, Thin-Earth Net cables and terminators.

MEMORY ADDRESS, 1/0 PORTS AND INTERRUPTS REQUIREMENT

Memory Address:

I/O PORTS: 300h, 2 serial ports and 1 parallel port.

Interrupt: 4

Cable: Connecting cable

4.3 INSTALLATION PROCEDURES

In order to install and set up a network in the computer, we must comply with the manufacturer installation. Therefore, we need to:

(i) Verify that the hardware, such as the network card, cables, connectors and other items needed during installation are available.

(ii) Install the server hardware and software.

(iii) Configure the network card so that it will work with the computer after placing the network card, and then connect them to the other computers on the network.

(iv) Install the workstation

(v) Setting up the users

(vi) Installing the network printers

(vii) Setting up applications

All the above steps will be accomplished using the Novell netware 386 3.11 to activate the hardware installed in the file server and the workstation in order to establish and maintain communications.

4.3.1 CHOICE OF INSTALLATION SITE

i. Availability of large Desktop area.

ii. Availability and easy access to all the documentation and manuals for the hardware and software.

iii. Availability of extra tape devices in backing-up file servers.

iv. Choosing a dedicated power in order to prevent any power surges or drains.

v. Use of power conditioning equipment e.g. UPS to protect spike, brown out and retain power supply

vi. Keeping the environment in a controlled humidity e.g. using air conditioning equipment to keep the area cool.

4.3.2 INSTALLATION TOOLS

i. A good PC diagnostic program.

ii. Software disks that were included with the network card.

iii. Manuals or documentations included with the system's hardware.

iv. Computer configuration disks included with the computer

v. Anti-virus software

vi. A tape backup unit in one of the workstations

vii. Cable, connectors, terminators and other cabling hardware compatible with the network card.

viii. A screw driver.

4.3.3 CONFIGURATION OF THE SYSTEM

Before getting started, there are some terms that we should be familiar with:

i. Jumper- This is a pair of copper pins that are connected via a small block of plastic With copper inside.

ii. DIP switch- A DIP switch is a row of switches in a line Federal University of Technology, which normally has two positions, either on or off.

iii. Access rights- Permissions granted to users to access certain directory files, or resources on the file server.

iv. MAP- A process by which the user is insulated from a long, complex directory structure by replacing it with a letter designation.

v. Groups- A collection of users who will be using the same application, printers etc.

vi. User- The individual at his/her computer who needs to access certain directories and printers.

vii. Bindery- A group of hidden files on the file servers that contain information relating to users, printers configuration and other network related item.

viii. Print server- A PC (either the file server or dedicated PC) that handles the printing of reports and/documents that did not originate from the PC.

4.3.4 INSTALLATION OF THE HARDWARE

To install the network card in a computer,

i. Locate an unused bus expansion slot in the computer either an 8-bit or 16-bit slot or 32-bit slot after removing the covers of the PC's chasis and plugging power off.

ii. Comply with the Ethernet card manufacturers installation instruction to install it.

iii. Cover the chasis back and screw tightly.

iv. Plug everything back and screw tightly.

The network card to be used must be an Ethernet card which is Novell's NE 2000 card that is set for interrupt 4, I/O port 300.

4.3.5 INSTALLATION OF THE SERVER SOFTWARE

System-1 and system-2 of the NOVELL netware 386 3.11 will be used.

1. From the hard drive C. Prompt, we will make a directory called the server from the root directory

MD\SERVER and press [ENTRE]

We will make the current directory

CD\SERVER and press [ENTER]

We will copy the following files from the system-1 diskette to the hard drive.

SERVER.EXE

NUT.NLM

From the system-2 diskette we will copy the following files

INSTALL.NLM

VREPAIR.NLM

NMAGNET.NLM

To install the network interface card

Copy the NE 2000.LAND driver

To install the hard drive controller driver

Copy the ISADISK .DSK driver

Now the directory will contain the following,

SERVER.EXE, NUT.NLM, NE2000.LAN, ISADISK.DSK

To create a server boot disk:

i. Copy the files from the server directory on the hard drive C>to the floppy diskette [drive A:]

ii. Copy the following from Dos directory. FDISK.EXE and FORMAT.COM

To start the file server:

i. Insert the server boot disk into the A>drive and power on the server and monitor.

ii. Boot NOVELL from the hard disk drive C> by typing: F DISK and press [ENTER]

To create the file server to boot from hard drive:

i.Format the hard drive C> for the Dos operating system by typing FORMAT C:/S [ENTER].

ii.Reset the server and boot from the hard drive C> to confirm.

iii.At the C>prompt copy the content of the server booth diskette to the hard drive.

iv.Start up the PC confirm

To load the file server, type the following:

i. SERVER and press [ENTER]

ii. Name it e.g. RN-KEN or use of a period (.) is not allowed in memory to avoid converting the name to upper case letter.

iii. Enter the internal network number by choosing number 0 through 9 or letter A through F as hexadecimal numbers, i.e. 2001. The hard drive adapter must be initialized in order to activate the hard drives:

i. At C> prompt type: LOAD ISA DISK and press [ENTER]

ii. Type: LOAD INSTALL and press [ENTER]

Choose main menu option, disk, volume and system option for the installation, by inserting the following disk in the following order sysytem-2, sysytem-1, sytem-3, upgrade, Dosutil-1, Dosutil-2, Dosutil-3, Dosutil-4, Backup-1, Backup-2, Print-1, Print-2, help-1, help-2,,halp-3, Btreve. Then, about by pressing <f7> key and [ENTER] to create START UP NCF FILE and save it.

To load the network driver type:

LOAD NE 2000 [ENTER]

Specify the number NIC and interrupt by entering the number 300 once again enter the number 4

In order to establish communication with Dos, workstation via IPX type:

BIND IPX TO NE 200 NEE=99 and press [ENTER]

To confirm: type down and press [ENTER]

Return to Dos by typing Exit and press [ENTER]

At C>prompt type the flowing:

Copy CON AUTOEXEC. BAT and press [ENTER]

@ ECHO OFF and press [ENTER]

SERVER and press [ENTER]

Press <F_6> or <ctr/z-> and [ENTER]

To save the file.

To verify at the colon prompt (:) type VOLUMES and press [ENTER]

CONFIG and press [ENTER]

Next view the system console, Netware 386 print server and monitor screen by using <ALT> <ESCAPE> key to cycle through the current screens and list a screen by using <CTRL> <ESCAPE> key after typing the number of screen to view.

4.3.6 CONNECTION CABLES.

When we have finished installation and configuration of the network card, the next step is to connect the cables that link the computer to the other computers in the network.

4.4 SYSTEMS ADMINISTRATION

Like many things in life, the principle of "do it right the first time" applies to the long term Success of ones client/server application. It is important to ensure that client/server hardware is assembled according to organizational standards and works are expected. Software should be loaded by trained staff and tested to ensure that it works as expected. The largest number of user problem are caused by incorrect installation and faulty equipment at installation.

4.4.1 AVAILABILITY

Availability means the ability of the system to be available for processing information and doing its expected work whenever called on. Minicomputers and mainframe data centres should provide at least 99.5% availability with today's technology.

4.4.2 RELAIBILITY

Reliability requires availability factors to be resolved, it requires application to be protected from over writing each other and shared memory to be accessed only by authorized tasks.

4.4.3 SERVICEABILITY

Most minicomputers and mainframe operating systems and hardware provide diagnostic services that pinpoint the location of failures. Transient errors are noted so that preventive maintenance can correct problems before they affect availability.

4.4.4 SOFTWARE DISTRIBUTION

The centralized minicomputer and mainframe environment share executable software from a single library. Software maintenance and enhancement are accomplished by changes to a single location. In the distributed client/server model, executable software is resident on servers located throughout the organisation. Changes to system and application software must be replicated across the organisation. This presents a tremendous complication in serviceability of these applications.

4.4.5 PERFORMANCE

In the centralized minicomputer and mainframe environment, trained technical support personnel and operations staff monitor performance on an ongoing basis. Sophisticated monitoring tools, such as candle corporations omegamon MVS, track the systems day-to-day performance. If trend show that performance is degrading, adjustments are made, soon enough to improve performance before it affects the user community.

In the client/server environment, certain tools such as Network General's Sniffer are available to monitor the LAN traffic.

4.4.6 NETWORK MANAGEMENT

Network Management tools such as IBM's Netview, etc, provide a level of remote monitoring that can track response time network loading.

4.4.7 HELP DESK

The most efficient and effective way to provide support to client/server users is through the use of the help desk. A help desk is a set of systems and procedures used by staff of one or more technical people on a rotating basis, to provide support to end-users in areas ranging from basic problem determination to advanced trouble shooting and diagnosis. This type of support may be provided using remote PCs, voice-only assistance over the telephone, or in-person assistance via an on-sight help request. This provides immediate feedback for simple problems and an

early and complete audit trail of problems. Proper follow-up is essential to get user recognition of the utility of the help desk.

4.5 NETWORK SECURITY

In application environment, managers must assess the security requirements. It is necessary to walk a thin line between enough security and over-bearing security measures. Users should find security to be invisible when they are authorized for a function and unpenetrable when they are unauthorized. Security of the server should start by placing physical barriers arround unauthorized access because users do not need physical access to the database and application servers, both should be placed in a locked room.

Every user of a client/server application should be assigned a personal ID and password. The ID can be used to assign authority and track access. Customized procedures can be built for each individual ID to manage backup, access times and prompting.

CHAPTER FIVE

IMPLEMENTATION CONCLUSION AND RECOMMENDATION

5.1 IMPLEMENTATION

The implementation of a client/server application in LAN must involve the social and technical approach. The social dimension involves people with various roles, behaviour etc. while the technical dimensions involves jobs, task and technology.

Great consideration should be given to users to participate in the operation and use of the LAN in the design and implementation of decision making.

These forms of participation will embrace consultation approach, democratic approach and responsibility approach.

During consultation, participants should provide input into the system design process in the aspect job satisfaction and needs. Also participants should have an equal say in the decision affecting the systems development, but the implementation of the decision should be left in the hands of the management

Finally in making decisions, participants must assume full responsibility in the development and implementation process by providing the moral and financial support.

5.2 CONCLUSION

This project covers very brief fundamentals of clients/server networks and networking technologies using NOVELL concept in general. It involves step by step definition or description of key terms and elements involved in a client server/application in LAN.

The subject of client/server application in LAN has generated a lot of interest during the past several years in some institutions of higher learning in Nigeria, articles has been published, seminars have been given, products have been released and standard have been produced. Yet it cannot be said that every one knows what a client/server application in a LAN is. To date only a small number of LANs have been installed, compared with the enormous numbers of computer systems of all types which has been implemented during this period. In Nigerian institutions of higher learning, the subject is still quiet new, however and so far the commercial exploitation of this new technology has lagged behind the amount of attention received.

Client/server application in a LAN, is providing a cost effective medium for rapid communications and resource sharing between computers and other devices.

5.3 RECOMMENDATIONS

Against the backdrop of the numerous advantages of the use of a client/server application which includes:

Enhanced data sharing integrated service, sharing resources among diverse platforms, interchangeability and interopability etc. and its cost- effectiveness, I will recommend its implementation to organizations and institutions alike.

Further more, implementation of a client/server application will provide management with accurate, reliable and timely information pertaining to the operations of the organization.

It will also minimize to a great extent the level of fraudulent practices especially in financial institutions.

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