

**DESIGN OF INTRANET FOR SCHOOL OF
ENGINEERING AND IMPLEMENTATION OF SUBNETWORK OF
ELECTRICAL/COMPUTER
ENGINEERING DEPARTMENT
FEDERAL UNIVERSITY OF TECHNOLOGY,
MINNA.**


BY

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**A PROJECT SUBMITTED TO THE DEPARTMENT OF ELECTRICAL AND
COMPUTER ENGINEERING IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF BACHELOR'S DEGREE IN
ELECTRICAL AND COMPUTER ENGINEERING.**

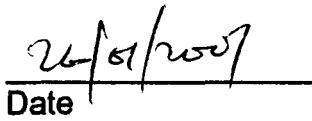
CERTIFICATION

This is to certify that this project was carried out by Adamu Babi Adamu of the Electrical and Computer Engineering Department of the Federal University of Technology, Minna under the Supervision of Engr. I.A. Danjuma



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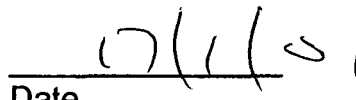


Date

Date



EXTERNAL SUPERVISOR



Date

DECLARATION

I hereby declare that this project is an original work of mine and has never been presented in any form for the award of diploma or degree certificate. All information derived from both published and unpublished work has been acknowledged.

ADAMU BABI ADAMU
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DATE

DEDICATION

I dedicate this to the Almighty Allah (The beneficent and Merciful) and to my
parents

ACKNOWLEDGEMENT

First and foremost I would like to give my profound gratitude to the Almighty Allah for all He has done for me. Thanks for sparing my life to witness this moment and thanks for giving me the courage to 'move on' after my fatal accident. Surely, without you my life is empty.

Second to the most Beneficent and merciful are my dear and loving parents. To a Dad who after all these years I have come to realize all those virtues you instilled on us. I know you've always wanted the best for us and God 'Insha Allah' will get there. To my mum who has always been there for me through the good and bad weather. I'll love you forever.

My brothers and sister who bring me so much joy just knowing they are there.

To all my loving friends, especially those that stood by me through the rough weather (you know who you are), and I pray we'll roll to my dying days.

And to all my project people, who have really worked hard to realize this.

To my supervisor who has really been very understanding and encouraging.

Last but not the least, thanks to all those that have given me a shoulder to lean on and I can only reciprocate that gesture (you all know who you are).

I pray God gives us the means for realizing our dreams.

Thanks.

ABSTRACT

This project presents a preliminary study and final methods used in the design and implementation of a Local Area Network (LAN), which uses Internet Technologies (INTRANET) to connect the various departments in the School of Engineering and Engineering Technology to the National University Network (NUNET) office. The project focuses on facilities for resource sharing, data security, internal mailing and web publishing.

The report begins with the general introduction, which features a brief historical background and a study of previous work in this field.

This is followed by a general in sight into computer networks and general concept of networking. The project then focuses on how the School of Engineering and Engineering Technology can expand its existing computer system using Internet technologies in a Local Area Network, which gives us the Intranet.

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CHAPTER ONE

1.1 INTRODUCTION

Man's constant quest to communicate has resulted in a quantum leap in technology related to data communication. For the past quarter century the maximum obtainable transmission rate on many types of communications facilities has doubled every three to five years. Accompanying to this growth and in many cases, provided the impetus for the technological developments that made such growth possible are communications dependent applications (1).

Today, data communications can be considered as the fiber that binds a modern society together. The past measurements of the strength of a nation, measured in number of tons of steel manufactured per year, has essentially been replaced by the installed base of personal computers, workstations and other types of computational facilities, as well as network structures that link these computers to one another unless one is stranded in a very remote location, you will use one or more communications facility almost everyday of your life.

The technological revolutions of the twentieth (20th) century, the gathering, processing and distribution of information, have had the most profound effect on humanity, the eighteenth (18th) century and nineteenth (19th) century were dominated by mechanical and industrial revolutions respectively. Also in the century, we saw the installation of the Worldwide telephone networks, the invention of radio and television, the birth and alarming growth of the computer industry, and the launching of communication satellites (6).

An adventure into the world of telephone networks and data communication led the computer industry into a new dimension. The old model of a single computer serving all of an organizations needs was replaced by one in which a large number of separate but interconnected computer systems now do the job (7). The birth of computer networks was thus developed. This is a much

more faster and efficient way of transferring data. Because at first, the advent of this personal computer (PC) used the floppy disk for the transfer of data. But after a while, this became 'cumbersome' due to its 'plug and play' mode of operation, because data that can be stored and moved about is limited and its efficiency is low

1.2 LITERATURE REVIEW:

During a period slightly exceeding a century, the primitive telegraph has been replaced by a wide variety of networks that are the glue, which binds our modern society together.

The first computer network success was recorded in 1949 by DR George Stibbitz, when he sent a collection of electronic signals over telegraph lines from a computer in New Hampshire to a calculation machine at Bell Laboratories (3). This event marked the starting point for data communication also networking.

The early networking years saw new strides in connecting computing equipment to existing communication facilities. A courtship of computing and communication technologies was taking place, line multiplexers, such as the IBM 270x and 370x series, and modems, provided a computer interface for several communication lines, by 1972, several computer networks had emerged (7). During this period, there was a phenomenal growth in nearly every aspect of communication network development has been the reduction in cost and improvement in speed and quality of transmission links. In the early years, terminals were connected through low-speed start-stop lines. Several innovations in communication technology have led to faster, more efficient and more reliable links. Today, terrestrial links, which are extremely, fast satellite links are being used for networks.

The Internet as we know it today was started by the Department of Defence in the United State of America. With the launching of Sputmik in 1957, President Eisenhower decided to form a group known as Advanced Research Project Agency (ARPA). In 1969, the Department of Defence commissioned ARPA for research into networking, a project that resulted in the ARPANET. The first ARPANET node was established at UCLA. Other nodes soon followed at UCSB, Stanford, and University of Utah, by 1971, there were 15 nodes with 23 hosts. In 1973, ARPANET had two international connections in England and Norway. By 1982, the Transmission Control Protocol/Internet Protocol (TCP/IP) suite was developed and implemented for ARPANET. In 1990, ARPANET ceased to exist and was taken over the other organization and developed into what we know today as the Internet (2).

Other networks that later emerged include TYMNET, DATAPAC, TELNET and ARCNET.

TYMNET: is a centrally directed packet data communications network that has been in operation since 1971 (4).

DATAPAC (Datapoint Attached Resource Computer) is the Canadian public packet switched data communication network, which began operation in 1976 and first provided commercial service a year later (4)

TELNET is the first commercial packet switching network to emerge in the United State, which began operation in 1978.

ARCNET (Attached Recourse Computer Networks) is the forerunner of token passing networks in the United States and developed by Data point corporation (4).

Networks restricted to a geographical area are referred to as LOCAL AREA NETWORK (LAN_s). A good way to think about WIDE AREA NETWORK (WAN_s) is to consider them to be the connections between two or more LAN_s. One of the best known WANS is the INTERNET, which grew out of ARPNET.

In Nigeria presently, most universities are implementing Local area Networks, which is in line with the Nigerian Universities Network (NUNET) project. This will eventually connect all universities together in a wide area network.

1.3 AIMS AND OBJECTIVES OF THE PROJECT

Now, more than ever, keeping up with the world means keeping up with computer technology and software. It is therefore important for the Engineer or Scientist to be well familiar and competent in the design, implementation and management of computer networks.

The aim of this project is the Design and Implementation of An Intranet for the School of Engineering and Engineering Technology (S.E.E.T), and connecting the intranet to the Nigerian University Networks (NUNET) office of the University.

The main objective of networks cannot be overemphasized. For this project the main objectives are:

- i. To facilitate application sharing e.g. word-processing.
- ii. To provide means of sharing of resources, examples printers and modem
- iii. To Provide Interprocess or Interpersonal communication within the various departments constituting the School of Engineering and Engineering Technology.
- iv. To protect and improve reliability of data through back up and redundancy.
- v. To provide centralized control for distributed system, which provides centralized management and allocation of resources.

- vi. To increase the departments administrative and organizational benefits by optimizing the use of limited resources.
- vii. To facilitate a reliable and efficient means of mailing within the School of Engineering and Engineering Technology (S. E. E. T.) and the NUNET office of the university.
- viii. To provide remote access to users into the Intranet.
- ix. To provide Internet access to the School of Engineering and Engineering Technology. (S.E.E.T).
- x. To create website for the school of Engineering and Engineering Technology. (S.E.E.T).

CHAPTER TWO

NETWORKING BASICS

Using computers in a professional setting without any kind of network is unthinkable these days. From the dial up connection off a consultants Laptop to the company information distributed on an Intranet via the wide area Network (WAN), networks are essential for a company's success.

2.1 LOCAL AND WIDE AREA NETWORKING

What does it take to create a network? A network i.e. two or more computers and their associated peripherals connected by a communication medium. So the computers in your office that all print to the same printer from a network, just as the computer linked together through the world form the Internet. This is of course, a very broad definition so a distinction is made between local area networks (LANs) and Wide Area Network (WANS).

2.1.1 LOCAL AREA NETWORKS (LAN)

A LAN is a collection of computers connected in a geographically close network. The location of the connected computers is the deciding factor in determining whether a network is a LAN or not. Bandwidth, the medium (the way the computer are connected), capacity, and the number of connected computers have nothing to do with it (2). For example, two computers sharing a printer from a LAN just as a network of 2000 workstations connected with high bandwidth

A LAN can be expanded by utilizing a variety of different hardware, depending on its needs. A repeater is used to strengthen the signal before passing it on to another cable length. A bridge has the same functionality as a repeater but can also filter the data it receives. This can reduce the load on the

network. Routers pass on a data packet only if it has a destination network address. Using its routing table, the router calculates the best path for the packet to go to its destination. A switched network hub opens the ending and receiving ports for communication while the other ports are delivered to the data transfers.

2.12 WIDE AREA NETWORKS

As the LAN of a company grows and expands to computer and users in other locations, it becomes a Wide Area Network (WAN). So the only thing that makes a LAN different from a WAN is the geographical scope (2).

WAN offer several advantages to organization that need far reaching networks:

- The entire business can be backed up from a centralized back up system.
- The people using the same data may be located in different states or the country or different countries around the world.
- Communication between regional offices can be improved using e-mail and file sharing.

If you want to connect a company in Kano to Lagos, you can do this in two ways. One option is to buy capacity on the WAN of a third party provider to transport your data. A WAN like that is called a PUBLIC DATA NETWORK (PDN). The provider takes care of the carrier, the routing services, across the WAN, and the protocols. You deliver the data and the provider makes sure that the data gets to its destination. You pay per packet or bandwidth. Examples of PDNS are x.25 or frame relay services.

The second option to connect two distant offices is to contract a CARRIER SERVICE. When you contract a carrier service, they provide the necessary hardware like the cable and access hardware but you have to organize the routing issues. Examples of these services are leased lines, T1 lines, and T3 lines these services are usually provided by phone companies.

2.2 SHARED RESOURCES

Before networks were developed, computer users could use no other resources, hardware and data, than the one at their own workstation. Communication or taking data on a floppy disk to the computer of the other user. You can imagine that the ability to share resources and the possible use of on line communication like e-mail are good incentives for organizations to implement networks.

2.3 SHARING APPLICATIONS

Just as you can share data on a user with other users, you can also share application. A program in a shared folder on the server can be started just as if it is on your computer hard disk. Standardization of application in this way has some significant benefits. For example, if everybody in an organization uses the same word processor, it is easy to exchange documents. You only have to know one word processing application well and it reduces the number of problem a support group could encounter.

2.4 COMPARING PEER-TO-PEER AND CLIENT/SERVER NETWORKS

Different organization sizes, structures and budgets need different types of networks. Networks can be divided into peer-to-peer and server network.

2.4.1 PEER-TO-PEER NETWORKS:

In a peer-to-peer network there are no dedicated servers. There are no hierarchical differences between the workstations in the network.

The size of a peer-to-peer network or workgroup is usually limited to 10 workstations. You can operate a peer-to-peer network on operating systems like

windows for workgroups, Window NT workstation and Windows 95 and Windows 98.

2.4.2 SERVER BASED NETWORKS

When your network environments grow beyond 10 users, you may need a server-based network to ensure the security of your files and directories and to organize your resources efficiently. As your network traffic increases, you will need more servers to spread their tasks so that they all can be performed in the most efficient way.

Servers often have the following characteristics

- Large amounts of memory
- Fast hard disks
- Multiple CPUs
- Fast I/O buses
- High capacity tape drivers
- Fast network adapted
- Redundant power supplies
- Hot-swappable hade disks and power supplies.

A server-based network may have thousands of computers on it. On a peer-to-peer network, each computer user is responsible for the security of their system. On a server-base network, all security is centrally administered so the policy is the same for each user on the network (2).

2.4.3 COMBINING PEER-TO-PEER AND SERVER-BASED NETWORKS

It is possible to combine the best of both works by creating a combined peer-to-peer and server-based network. If you plan your network well and are

sure that your users are well trained, you can enable the workstations in a server-based network to share resources just as in a peer-to-peer network. Of course, this only works if the client operating system can share their workstations' resources.

SHARED PROCESSING: Is when the processing of a task is not done on only the client or only the server but on a combination of both the client and server.

SEVERAL considerations to be taken into account with regards to the client computer are: The protocol to use, the user interface, the formatting of request, and the presentation of data.

Consideration on the server side are: a multi-user-application engine and high-capacity request handling.

2.4.4 THE INTRANET AND PAGES FOR A WEB SERVER

For the user of the Internet today, there are a wide variety of resources available. One of the most commonly used technologies is electronic mail (e-mail). Internet users can compose a message and send it electronically to an e-mail address. The World Wide Web (WWW) allows us to browse various sites and access particular information.

The intranet uses the Internet technology in a local area network to support, facilitate implement and manage communication among resources on the network.

Many companies and organization, large, medium and small, even individuals are fast becoming aware of the World Wide Web (WWW) as means of publishing information over the Internet. HTML is the language used to create documents for Web browsers such as Mosaic, Netscape and the Internet Explorer. These browsers programs recognize this language as the method

used to format text, insert images, create hypertext, fill-informs, coloured background and frame.

2.5 TOPOLOGIES

Now that we have seen the functional features of networks, these sections will discuss how computers in a network are actually connected. Topology is defined as the physical layout of computers, cables and other components on a network. Any network design encountered will be a variation on or combination of the three basic networking topologies: Bus Star and Ring.

2.5.1 BUS TOPOLOGY

The Bus topology is often used when a network is small or simple or temporary. On a typical bus network, the cable is just one or more wires, with no active electronics to amplify the signal or pass it on, making this topology a passive one (7)

To prevent packets from bouncing up and down, the cable devices called terminators have to be attached to both ends of the cables.

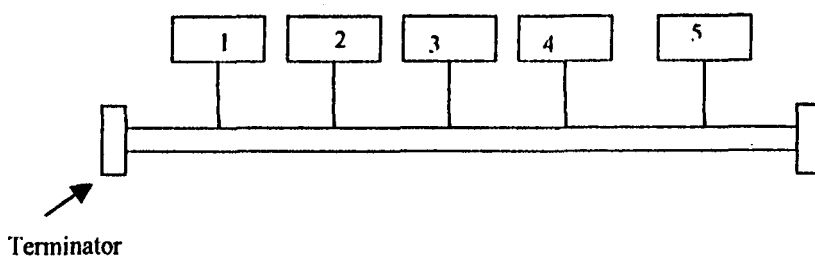


Fig 2.1 Bus Topology

2.5.2 RING TOPOLOGY

In a ring topology, all computers are connected with a cable that loops around. Like a circle that has no start and no end, terminators are not necessary in a ring topology. Signals travel in one direction on a ring, while they are passed from one computer to the next as illustrated in figure 2.2

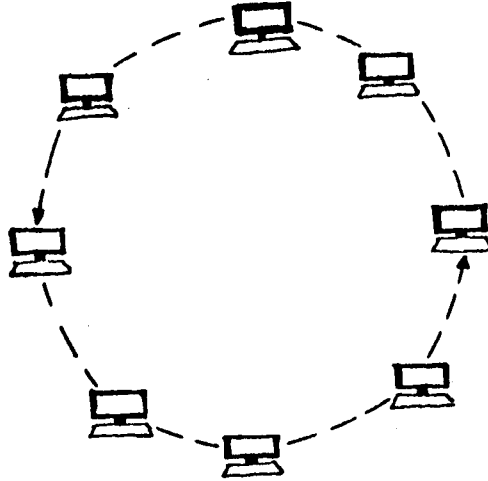


Figure 2.2 Ring Topology

2.5.3 STAR TOPOLOGY

In the early days of computing, terminals were all connect to one centralized mainframe. The star topology is derived from that system. In a star topology, all computers are connected through one central hub as illustrated in figure 2.3.

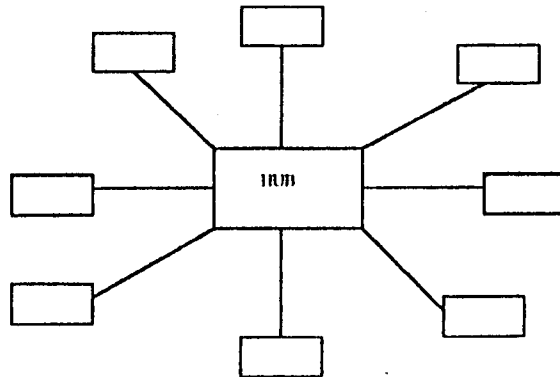


Fig 2.3 Star Topology

A star topology offers centralized resources and management. If one computer goes down, the entire network is not affected. The disadvantage of a

star topology network is that you need much more cabling than in other topologies. Also, if the hub fails, the entire network goes down.

There are two common combinations of the three topologies described: the star bus and the star ring.

(a) STAR BUS

If you replace the computer a bus topology with the hubs from star topology networks, you get a star bus topology.

(b) STAR RING:

The smaller hubs are internally wired like a ring and connected to the main hub in a star topology.

2.6 NETWORK MODELS:

Network models provide a standard framework to use when designing complex communication systems. Since all networks carry out many of the same functions, industry players have devised network models to simplify their design.

2.6.1 NETWORK COMMUNICATION BASICS:

Network communication has one very simple goal: to send 1s and 0s from one computer to another, quickly and without error.

Some networks are only concerned with end-to-end communication, meaning the two ends of the conversation deal with each other directly.

Many computer networks use point-to-point transmission methods, where there may be one to dozen of points, between the two ends (e-mail is good example of this).

When sending data across a network, error checking can be used to ensure that the data received is identical to the data that was sent originally.

2.6.2 OSI MODEL

The most common network model used in PC network is the Open System Interconnect (OSI) model. The OSI model was developed from the late 1970s to its current form in the mid-1980s by the international Standard Organization (ISO). Microsoft, Novell, and all the major PC networking giant use the OSI model as a basis for network design.

The OSI model consists of seven layers, they cover all aspect of networking, from the topmost issues ("How do I print to the network printers") all the way down to the lowest technical issue ("what voltage at what frequency do I apply to which wire"). The seven layers help break down the aspect into manageable units that Interact with one another. The layers are, from top to bottom:

- Applications
- Presentation
- Session
- Transport
- Network
- Data link
- Physical

All layers in the OSI mode work are a hierarchy. If a computer is sending data, each layer receives the data from the layer above it, performs any applicable work on that data and adds on its own information regarding that data. The layer sends the data on down to the next layer.

When a computer is sending data, each layer receives the data from the layer beneath it, processes it, and sends it to the layer beneath it. The opposite occurs on the receiving computer (2).

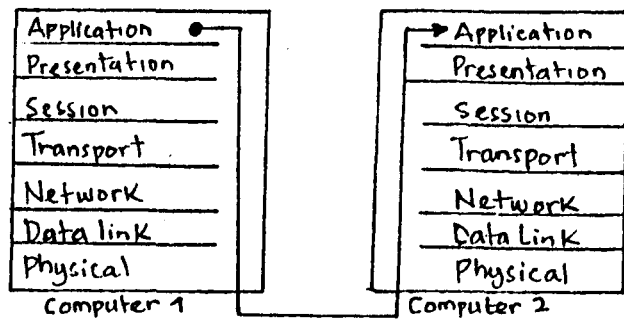


Figure 2.4 Communication through the hierarchy of the OSI model

FUNCTIONS OF THE LAYERS

While it is very easy to memorize the various layers of the OSI model from top to bottom, it is a bit easier to learn about what these layers do by taking a bottom-to-top approach.

(a) PHYSICAL

Concerned with transmitting and receiving bits. Doesn't define media, but defines physical structure of network (Physical topology), mechanical and electrical specifications or using medium, bit encoding and timing, Repeaters operate at physical layer.

(b) DATA LINK

Assemble and disassembles frames for transmission and reception. IEEE 802 breaks it down to two sublayers. Media access control (MAC) address links between devices. Control transmission method (Synchronous/asynchronous) used to access media. Maintains physical devices address (MAC) address). Provides flow control and error control for single links

between devices. Flow control determines how much data to send to avoid overwhelming receivers. Error control detects error in received frames and request re-transmission. Bridges operate at data link layer.

(c) NETWORK

Handles addressing and delivering packets on complex networks. Uses logical network address to route packets supports servers address to specify a channel to a specific process on a destination. Universally define service address and called well-known addresses.

Packet switching Message divided into smaller packets that contain addressing information and can be sent through switches rapidly without being stored. Two types of packets switching:

- Diagram: Each packet treated independently and they can travel different paths getting to destination.
- Virtual circuit: A well-defined path through the network is negotiated, and remains in effect until communication is done. Network looks like a physical circuit, even though none exists. There are two different nodes of communicating across the network.
- Connection-oriented: Error correction and flow control provided at internal nodes along path.
- Connectionless internal nodes along path do not deal with error correction and flow control.

When two networks are too different, a gateway is used to connect the networks. Router and brouters operate at network layer.

(d) TRANSPORT

Can implement procedures to ensure reliable delivery to messages to destinations. Allows upper layers to communicate with network while hiding network complexities. Takes on some responsibility for connection service and interact with network layers connection-oriented and connectionless services.

Segment sequencing: Connection-oriented service that requires segments for reassembly.

Error control: Detects and takes care of corrupted duplicated or lost segments.

End-to-end flow control: Uses acknowledgment to manage flow between two devices. Some transport layer protocols can request retransmission of recent segment.

(e) SESSION

Manages dialogs between two computers by establishing managing and terminating communication. There are three forms of dialogs:

- Simplex: One way data transfers
- Half-duplex: Two-way data transfers, but data can only flow in one direction at a time.
- Full-duplex: Two-way simultaneous data transfers a session is a formal dialog between a requestor and providers & must have three phase:

Connection establishment: Requestor initiates services and communication rules are agreed to.

Data transfer: Due to rules, each side knows what to do, operates efficiently, and detects errors.

Connection release: When session is done, dialog is terminated in an orderly fashions.

(f) PRESENTATION

Deals with syntax for communication between two computers. Converts systems data from the Application layer to machine-independent format for the lower layer. Receiver must convert machines independent data to the local systems format. This can include:

Bit-order translation: Either most significant digit (MSD) or least significant digit (L S D)

Byte-order translation: Determines which end of multi-byte values arrives first little endians, takes least significant bytes first, bit endians takes most significant byte first.

Character code translation: Different binary scheme for characters (ASCII/EBCDIC).

File syntax translation file formats that differ (Mac file forks Vs PC flat files).

(g) APPLICATION

Provides services on network, such as file/print, e-mail, databases, not an actual end-user application on a computer, but provides services to applications. Advertises available services to the network.

2.7 802. PROJECT MODEL

It is a fact that standards are required to govern the physical, electrical and procedural characteristics of network environment (6). As the use of LANs began to increase, standards had to be developed to define consistency and compatibility.

Many network vendors exist, each with their own ideas of how things should be done, without co-ordination, their will be total chaos, the only way out of this, is to agree on some standards. One of the most largely and well-

respected organization that define standards is the institute of Electrical and Electronic Engineers (IEEE).

The American Institute of Electrical and Electronic Engineers (IEEE) computer society in February 1980 formed its local Network standards committee, project 802(5), (after the year and month project started).

The 802 committee of the IEEE define one set of standards near to the hearts of most network professionals. 12 subcommittees of the 802 committee define low-level LAN and WAN access protocols. Most of the protocols that the 802 Committee has defined reside in the physical and data link layers of the OSI model.

802.2 Based on logical link control (LLC) sublayer

802.3 Based on the original Ethernet network from DLX (Digital Inter – Xerox),
802.3 is the standards for popular Ethernet networks to day.

802.4 The 802.4 standard defines a physical bus topology that uses tokens for media access control.

802.5 Based on IBM's token Ring network, the 802.5 standard uses a logical ring topology and implements token passing for media access control.

802.6 The 802.6 protocols define a metropolitan area network (MAN) standard known as Distributed Queue Dual Bus (DQDB).

802.12 is based on the 100 VG-AnyLAN 100 Mbps Ethernet proposal backed by AT and T, Hewlett Packard, and IBM.

2.8 LOGICAL LINK CONTROL AND MEDIA ACCESS CONTROL SUBLAYER

The 802.2 standard defines an LLC sublayer that is designed to be topology independent, this doesn't care whether the network is Ethernet, Token Ring or something else. The LLC sublayer allows Networks Layer functions to

interact with a standard LLC implementation that does not have to change because of different media. The 802.2 standard is used in conjunction with 802.3 Ethernet, 802.5 Token Ring, and other IEEE network standards.

The LLC sublayer interacts with the MAC sublayer, which defines the topology used (although not the media). The 802.3 standard can use both the star and bus physical topologies.

2.9 ETHERNET

Ethernet is the networking technology defined by the Institute for Electrical and Electronic Engineering (IEEE) as IEEE standard for 802.3. This physical layer technology is the most popular data link layer protocol because of its speed, lower cost, and worldwide acceptance. Ethernet can support nearly every protocol in use today, and can operate with any networking equipment that adheres to the IEEE standard. This openness; combined with ease of use, has made Ethernet dominant in the local area network arena. (2)

2.9.1 HISTORY

A key foundation for the Ethernet began at the university of Hawaii in the late 1960s when a wide area network (WAN) was created to connect several campus sites. This network used the CSMA/CD technology, which was the contention method for the first Ethernet network nearly 20 year ago. Xerox laboratories introduced a LAN that connected 100 workstations with a maximum speed of 3 Mbps. Ethernet did not, however, become an IEEE. Standard until the mid-1980s.

2.9.2 FEATURES

Ethernet has evolved over the years to include a number of popular specifications. These specifications are due in part to the media variety, which they employ, such as coaxial, twisted-pair and fiber-optic cabling.

(a) 10BASE 2

Called Ethernet or thinnet because the co-axial cable is thinner than that used in 10base5. It is less expensive and easier to install. It can run for about 200m, operates at 10 Mbps and base band signaling.

(b) 10 BASE T

This provides 10 Mbps performance over unshielded twisted pair (UTP) cable. There are many grades of UTP cables that vary in their ability to transmit certain types of signals. 10Base T also specifies that the LAN is wired in a physical star topology, but UTP from each station goes to connect together in a multi-station Access Unit (MAU) or Hub (7)

(c) 10 BASE 5

Called thick Ethernet (or thinnet), because co-axial cable is thick, the notation 10 Base 5 means that it operate at 10 Mbps, uses (base) band signaling can support segment up to 500 m.

This alternative is relatively expensive because it uses fiber-optic cable (which is very expensive), it however has excellent noise immunity (7). It is the best option for connecting buildings or widely spaced hubs.

2.9.3 COLLISIONS

More specifically, the 802.3 designations were given to the Ethernet technology with the formal title of "IEEE 802.3 carriers sense multiple Access with collision detection (CSMA/CD) Access method and physical layer specifications". This standard was first published in 1985 and has remained a network standard. The 802.3 standard has been updated to reflect new Ethernet advancements, such as 100Mbps as Ethernet. The Token Ring architecture is defined as IEEE standard 802.5, while ArcNet was developed before the IEEE 802.4.

Since an Ethernet network uses a shared media, it is possible to have occasions when two or more stations are trying to communicate at once. With the CSMA/CD access method, stations on the network wait for an opportune time to begin transmitting. Once they determine that the network is not in use, they begin transmitting. A collision occurs, causing the station to wait a random amount of time before they begin transmitting again. The more bandwidth that is being used by stations, the more likely the network will experience excessive collisions. This makes Ethernet more efficient in small to moderate-sized networks. As you will see in the next section, the token ring network architecture is much more efficient on large-scale networks than Ethernet is.

2.10 TRANSMISSION MEDIA

Cabling in the LANs transmission medium LANs can be connected together using a variety of cable types. Each cable type has its own advantages and disadvantages.

2.10.1 CABLING TYPES

There are three primary types of physical media that can be used at the physical layer: Coaxial, twisted pair cable and fiber-optic cable. Transmission rates that can be supported on each of these physical media are measured in millions of bits per second (Mbps).

(a) COAXIAL

Coaxial (or coax) cable looks like the cable used to bring the cable TV signal to your television. One strand (a solid-core wire) runs down the middle of the cable. Around that strand is insulation. Covering that insulation is braided wire and metal foil, which shields against electromagnetic interference as illustrated below: A final layer of insulation covers the braided wire. Coaxial cable is resistant to the interference and signal weakening that other cabling such as the unshielded twisted-pair (UTP) cable, can experience. In general, coax is better than UTP cable in connecting longer distance and or reliably supporting higher data rates with less sophisticated equipment.

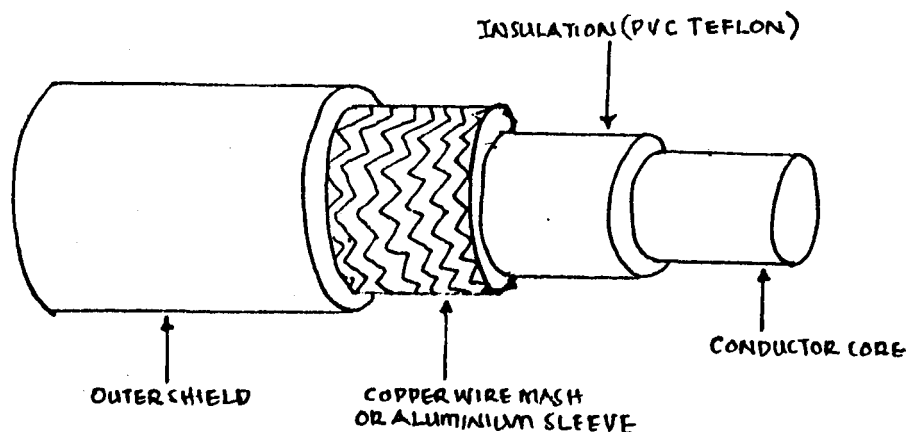


Figure 2.5 Coaxial Cable

THINNET COAXIAL CABLE

Thinnet refers to RG 58 cabling which is a flexible coaxial cable about $\frac{1}{4}$ inch thick. Thinnet is used for short distance communication and is flexible

enough to facilitate routing between workstations. Thinnet connects directly to a workstation's network adapter card using a BNC-T-connector, and uses the network adapter card's internal transceiver. 10 Base 2 refers to Ethernet LANs that use thinnet cabling.

THICKNET COAXIAL CABLE

Thicknet coaxial cable can support data transfer over longer distances better than thinnet and is usually used as a backbone to connect several smaller thinnet-based networks. The diameter of a thicknet cable is about ½ inch and is harder to work with than a thinnet cable. A transceiver is usually connected to thicknet cable using a connector known as a piercing tap. Connection from the transceiver to the network adapter card is made using a drop cable to connect to the adapter unit interface (AUI) port connector. 10 Base 5 refers to Ethernet LANs that use thicknet cabling.

(b) TWISTED-PAIR CABLES

Unshielded twisted-pair (UTP) cables are familiar if one has worked with telephone cables. Each pair of wires contained in the cable is twisted around each other. The typical twists in the wire help shield against electromagnetic interference. 10Base T refers to Ethernet LANs that use UTP cabling. UTP cable uses small plastic connectors designated as RJ-45. These are similar to phone connectors except that instead of four wires found in the home system, the network RJ 45 contains eight contacts. UTP is easier to install than coaxial because you can put it around corners more easily.

Shielded twisted pair (STP) cable differs from UTP in as it has an external shield which makes STP less vulnerable to Electro-magnetic interference because the shield is electrically grounded. This is a more reliable cable for LAN

environment, and was actually first used before the UTP came on scene (7).

STP is fairly expensive, and relatively difficult to install.

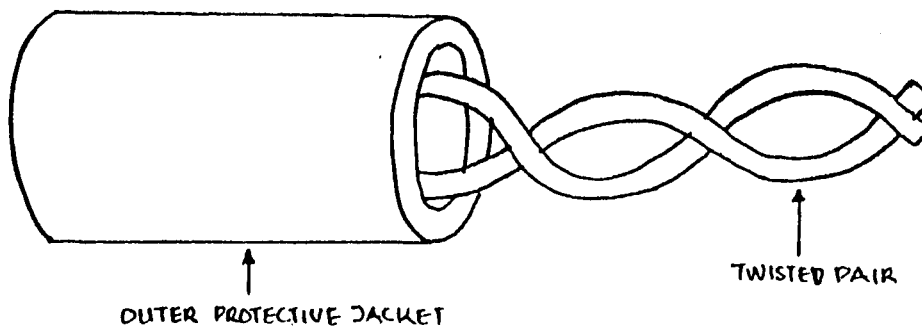


Figure 2.6 Unjacketed twisted pair cable and an RJ 45 connector

(c) FIBER OPTIC CALES

Optical fibers carry digital data signals in the form of modulated pulses of light. An optical fiber consists of an extremely thin cylinder glass, called the core, surrounded by concentric layer of glass known as cabling. There are two fibers per cable-one to transmit and one to receive. Fiber optic cable supports up to 1000 stations and can carry the signal up to and beyond 50 miles. They are also highly secure from outside interference. On the other hand, they are very expensive.

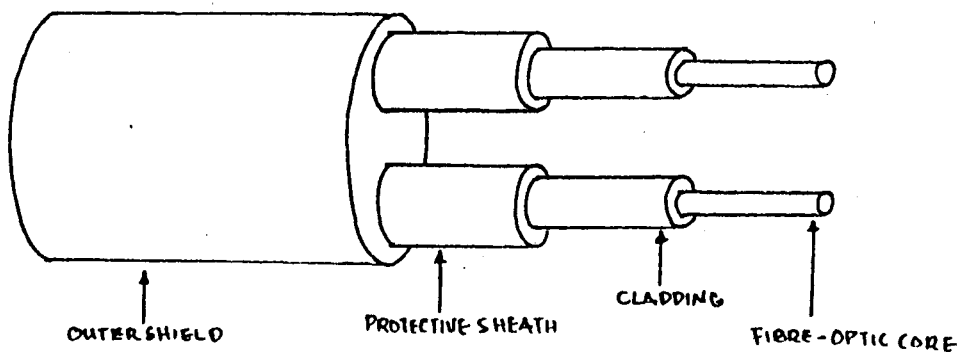


Figure 2.7 Fiber Optic cable

2.11 INTRANET DESIGN CONCEPT

An INTRANET is a network, internal to an organization that uses Internet technology, such as HTTP servers and web browsers' services to improve internal communications, information publishing or the application development process. It is also referred to as TCP/IP networking using Internet technology that is not connected to the Internet.

(a). DESIGN PROCEDURE

In order to achieve the objectives of this project, the following design procedures were carried out, after exhaustive and careful assessment, measurement and evaluation.

(b). DESIGN ASSUMPTION:

The designs and implementation as associated to Electrical/Computer Engineering department of School of Engineering and Engineering Technology (S.E.E.T) goes for every other department within the school.

(c) DETERMINATION OF AREA OF COVERAGE

The design covers the following departments in S. E. E. T and the NUNET office of the University.

- I. Electrical/Computer Engineering (EE)
- II. Mechanical Engineering (EM)
- III. Civil Engineering (EC)
- IV. Chemical Engineering (EH)

A general site layout and Electrical/Computer Engineering site layout were produced as depicted by drawing labeled 01 and 02 respectively.

(d) DETERMINATION OF NETWORK TYPES

Ethernet Network type is employed for the following reasons:

1. Ease of migration: Since the frame format and size are the same for all Ethernet technologies, thereby providing an evolutionary upgrade path.
2. Scalability: All Ethernet generation are standardized
3. High network reliability: The availability of network management and troubleshooting tools.
4. Large installed based: Over 120 million interconnected personal computers (PCs), workstation and servers around the world. i.e. about 80% of installed networks.
5. Low cost: Among its competitors Ethernet is the most cost effective.

e) DETERMINATION OF LAN ARCHITECTURE

The client server LAN architecture is employed for the various LANs.

Purpose: In other to centralized all the activities of individual departments and to enable easy access of the department through the various servers.

Reasons: Centralized security and administration, centralized data organization, Internet access and application.

f. DETERMINATION OF TOPOLOGY

The Star-to-Star topology is employed for the design:

Reasons: 1. Star topology is employed in various LANs of the department (2).

Star topology is also employed in the interconnection of various LANs in S. E. E.

T. (3). Ease of expansion,

Purpose: Easier to troubleshoot, supports multiple cable types by hubs.

g. DETERMINATION OF MEDIA/CABLE TYPE:

(I) UNSHIELDED TWISTED PAIR (UTP)

Purpose:

- (1) For connecting the PCs, workstations and servers within the LANs.
- (2) For connecting the servers of various LANs to establish interconnectivity of LANs.

Reasons: Low cost, ease to install, high-speed capacity and 100 meters coverage.

(II) OPTIC FIBRE: For the purpose of design and simulation optic fiber is employed.

Purpose: To connect the S. E. E. T Intranet to the NUNET office of the university.

Reasons: Very high speed capacity, low attenuation, no electromagnetic interference (EMI) and covers a distance of about 2000m (2Km).

III PSTN (PUBLIC SWITCHED TELEPHONE NETWORK)

Which is the technical name for the medium use every day to make phone calls and send faxes.

Purpose: To connect the S.E.E.T. Intranet to NUNET office of the University.

Reasons: Presently existing and readily available.

Drawings 01 and 03 depicts the cable layouts

h DETERMINATION OF LAN CONNECTING DEVICES

(i) HUB: The design employs two (2) hubs.

Purpose:

1. For establishing connection within the various LANs (i.e. Parent Hub)
2. for establishing interconnection of various LANs within S.E.E.T. (i.e. central Hub)

Reasons: To achieve the STAR topology employed and require almost no configuration.

(ii) NETWORK INTERFACE CARD (NIC):

Purpose:

1. Every workstations and the Back up domain controller (BDC) server have one (1) NIC in order to establish communication within the LANs.
2. The Primary Domain Controller (PCD) server have two NICs, one (1) to achieve the purpose above and the second (2) to enable Routing of information between the various LANs in S. E. E. T. i.e. serving as a ROUTER.

Reasons: It is readily available to use than using a Router Box and easy to configure.

III MODEM: Though slow, Modems are employed in the design

Purpose: To connect S. E. E. T. Intranet with the NUNET office of the University through the inexpensive PSTN.

Reason: PSTN presently exists, inexpensive easy to set up (configure) and maintain and support several standard vendors.

i. DETERMINATION OF OPERATION SYSTEM (OS)

Workstations: Windows 98

Servers: Windows NT server 4.0

Reasons:

1. Windows NT server 4.0 is optimized for file, print and applications server for organizations ranging from workgroups to enterprise networks. It is a multi-user (Graphical user Interface) operating system. It support 256 Remote Access Service (RAS) simultaneous

session, Microsoft Internet Information Server (IIS) and its fault tolerant, Provides and manages a secure, distributed directory database and services for end users and network administrators.

2. Minimum Hardware requirement: A PC with a 486DX/33 or higher microprocessor, 16 RMB of RAM and 125 MB of free disk space.

Workstations: Windows 98.

Reasons:

1. Support server based validation of log on process, high hardware and software compatibility, G.U.I operating system and have plug and play support.

j. DETERMINATION OF PROTOCOL

TCP/IP is employed for the Intranet design:

Reasons: Microsoft TCP/IP is a routable organization network protocol therefore with the following configuration: A standard, routable, enterprise network protocol for windows NT, an architecture that facilitates connectivity in heterogeneous environments and access to the internet and its resources.

k. DETERMIANTION OF NUMBERS OF COMPUTER SYSTEMS:

The design employs eight (8) personal computers of which six (6) are workstations and two (2) servers, for each department. Server roles: (1) Primary Domain Controller (PDC) which maintains the master copy of the directory database for the domain. The PDC validates user logons. (2). Backup Domain Controller (BDC) is the second server. It holds a copy of the directory database

I. DETERMINATION OF SERVICES:

The servers will contain the following services:

1. File and print services: This will enable file transfer, storage and migration, update and synchronization and achieving or backing up of files. Also, support queue-based printing and fax services and remarkable reduction in the number of printers to be purchased.
2. Remote Access Service (RAS) and Dial-up Network service: RAS enables remote clients to connect over telephone lines to the network. RAS server act as a gateway between the remote client and the network. RAS on the client side is called Dial-up Networking (DUN), which enables remote clients to Dial-up the network. RAS and Dial-up networking enable the extension of a network beyond a single location.
3. Internet Information server (IIS) Service: It provides users of computer with the ability to publish resources and services on the Internet and on Private intranets. It is use to publish hypertext web pages and client/server applications and for interactive web applications. In summary it enables web site hosting.
4. Windows messaging services: This service enable the setting up of e-mail system, which is internal or private to the network in addition, fax facilities are also established.

I. EXISTING NETWORK DESIGN OF NUNET OFFICE

1. LAN architecture = Client server
2. Network type = Ethernet Network
3. Topology = Star topology

4. Media cable type = (1) 10 BASE T category 5 (UTP) cable to connect all the PCs in the NUNET office (2) PSTN to connect NUNET office to other LANs and PCs in the university.

5. Number of computer system and roles: Seven (7) workstations

Two (2) servers: A primary Domain Controller (PDC) and a Back up Domain Controller (BDC). Total number of computers system in NUNET office = 9

6. Workstation configuration.

Compaq Deskpro

Hard disk capacity = 2GB

RAM capacity = 64 MB

Processor speed = Pentium II 300 MHZ

Network Interface Card (NIC) = 10/100 3 com fast Etherlink X L

Internal Modem = Rockwell soft 65 Data, fax, speaker Phone PCI
modem 56.6 Kbps

Monitor = 14" SVGA

Operation system (OS) = windows 95/windows 98

Protocol = TCP/IP

File system = file Allocation Table (FAT)

(7) SERVER CONFIGURATION

Compaq Prosignia

Processor speed = Pentium II 400MHZ

RAM capacity = 196 MB

Hard disk capacity = 4.8GB

Network Interface card (NIC) = 10/100 3 com fast Etherlink X L

Operating system (OS) = Windows NT server 4.0

Protocol = TCP/IP

File system = New Technology file system (NTFS)

(8) Number of External Modems = Nine (9). One attached to the BDC for the purpose of Internet access (Extranet). The other eight are connected via a Digi ports/8EM to the PDC for the purpose of communication within University (Intranet)

(9) NUNET OFFICE SERVICE

- (1) File and print server services
- (2) RAS server services
- (3) Messaging (e-mail and fax) services
- (4) Internet services
- (5) Gateway services for the university networks
- (6) Web site hosting.

Drawing 04 depicts cable and site layout of NUNET office.

CHAPTER THREE

IMPLEMENTATION, TESTING, RESULTS AND DISCUSSION OF RESULTS

3.1 INTRODUCTION

Successful implantation of networks requires careful planning. The basic networking rules are that "the network will always outgrow initial expectations". Networks are modularize, once built on a solid base, additional network needs can easily be added.

After intensive and extensive planning and careful network design consideration with resources available the following implementation and testing were carried out with subsequent discussion of results.

3.2 TOOLS USED

Crimping tool

A set of Screw Driver

Digital Multimeter

Cutter

Tape rule

Hammer

Chisel

3.3 IMPLEMENTATION

3.3.1 PREPATATION, INSTALATION AND CONFIGURATION OF SERVERS

(A) PRERATATION AND SPECIFICATION OF SERVERS

In order to achieve higher performance and project objectives, the servers were upgraded by addition of Network Interface card (NIC) and Modem.

Hardware configuration of servers: All the computers used for this project are clone system.

Processor speed = Pentium 233 MHZ MMX Tech.

Memory (RAM) capacity = 32MB

Hard disk capacity = 4GB'

Two 10Mbps Ethernet NICs = Primary Domain controller (upgraded).

One 10Mbps Ethernet NICs = Backup Domain Controller (upgraded)

Modem (1) = 56.6 Kbps Data, Fax/Voice Modem (upgraded)

(b) INSTALLATION AND CONFIGURATIONS

(a) PREPARATION OF HDD

The hard disk with capacity of 4GB was partitioned into primary and Extended DOS partitions drive C and D respectively. This was achieved by using windows 98 start up disk containing FDISK and FORMAT commands. Drive C was formatted with File Allocation Table (FAT) file system and drive D with New Technology file system (NTFS). The capacity of C and D are 2GB each, with windows 98 and Windows NT servers 4.0 installed respectively.

b. INSTALLATION AND CONFIGURATION OF WINDOWS NT SERVER 4.0

Windows NT server 4.0 CR-ROM, four floppy diskettes, three for creating setup disks, and one for creating the emergency repair disk (ERD) were made available. Steps taken in achieving installation:

- I. The command winnt/ox was use to create the three setup diskettes, the computer was then restated with setup Boot Disk label #1 in drive A. When prompted disk # 2 was inserted, next when prompted disk # 3 was inserted. The windows NT End user license Agreement was accepted by pressing F8 key.
- II. Drive D was selected and formatted using New Technology file system (NTFS). Next, enter to confirm the directory of WINNT setup files were copied to one hard disk. When prompted, the disk was removed from drive A. Next, Enter to restart the computer.
- III. After the restart, Windows NT server setup wizard appeared. Next, was clicked to gather computer information. Electrical/Computer Department and F.U.T. MX were typed into the name and organization field. Next, the server name EESERVER 1 and EESERVER 2, for PDC and BDC respectively were typed. Next, PDC was selected for EESERVER 1 and BDC for EESERVER 2. Next, the respective passwords were entered.
- IV. Wired to the network was confirmed, Next, click start search for the windows NT server set up to detect the NIC. Next, was clicked to confirm the NIC detected subsequently TCP/IP, NWlink IPX/SPX were checked. Next, the appropriate configuration of the NIC were configured as shown in the section NIC configuration for PDC. For the BDC the NIC was configured using the

Dynamic Host Configuration Protocol (DHCP). Next, EEDOMIAN was typed in the Domain field.

- V. To finish installation, the time zone, Date, time were corrected and closed. Next the video adapter were tested and the ERD were created. Lastly the computer was restarted.

C. NETWORK INTERFACE CARD (NICS) CONFIGURATION OF EESERVER 1

NIC 1

- (a). TCP/IP configuration

IP address = 192.168.0.1

Subnet mask = 255.255.0.0

Default gateway = 192.168.2.1

- (b). Media Access Control (MAC)/Physical address = 00-A0-24-11-AB-11

NIC 2(Router)

- (a.) TCP/IP configuration

IP address = 192.168.2.1

Subnet mask = 255.255.255.0

Default gateway = NIC

- (b) Media Access Control (MAC) address = 00-A0-24-13-AC-12

IP address consist of 32 bits in our groups of octets (8-bit) use to identify each computer on the network.

Subnet mask: is used to identify the Network part and Host part of the IP address.

Default gateway is the IP address of the default router out of the network or subnetwork.

(d) INSTALLATION OF EESERVER 1 SERVICES

I Dynamic Host Configuration (DHCP) server service: Centralizes and manages the allocation of TCP/IP configuration information by automatically assigning IP addresses to computers that have been configured to use DHCP.

II Domain Name System (DNS) server services: is a name resolution service that resolve a Fully Qualified Domain Name (FQDN) to IP address that is then used in the network.

To install the two network services above. The Network Icon in the control panel was double clicked. On the service tab, Add was clicked then the Microsoft DHCP server and DNS server services were selected, then OK click, after which the computer was restarted.

DHCP CONFIGURATION

Start IP address = 192.168.0.2
End IP address = 192.168.0.250
Subnet mask = 255.255.0.0
Default gateway = 192.168.2.1

DNS CONFIGURATION

Domain name = EEFUTMX. EDU
Host name = EESERVER 1

(B) ESTABLISHING AN E- MAIL SERVER VIA WINDOWS MESSAGING

Installation process: From the Add/Remove Program icon in the control panel, Windows NT setup tab was selected, next windows Messaging check box was checked, then Post office, User mail account, and the control panel.

The purpose of establishing an e-mail server is to facilitate the dissipation of information within the INTRANET.

(C). INSTALLATION AND CONFIGURATION OF WORKSTATIONS

All the workstations six number were upgraded by adding NIC.

INSTALLATION AND CONFIGURATION PROCESS.

- I. The workstations were shutdown then the NICs were placed. Next the systems were restarted. Window 98 detected the NICs and the drivers were loaded from the Driver Diskette provided by the NICs manufacturer. After, the system were restarted, Network Neighbourhood icon appeared on the desktop where the network User name and Password were provided.
- II. Under network component configuration, services was selected, then file and print sharing enabled. User access level was selected under Access control tab to enable log on to the servers.
- III. All the NICs were configured using TCP/IP protocol to ensure conformance with the server(s) or TCP/IP configuration were archived by enabling obtain IP address from DHCP server.

(b) HARDWARE CONFIGURATIONS

Clone system were used for all workstation

Processor speed = Pentium 233MHZ MMX Tech.

Memory (RAM) Capacity = 32 MB

Hard disk capacity = 4GB

10Mbps. Full duplex Ethernet NIC (upgraded)

(D) ESTABLISHING WEB SERVER VIA MICROSOFT INTERNET INFORMATION SERVER (IIS).

Internet Information Server is a high-performance web server that allows publishing documents over the Internet and Intranet.

Installation steps: Open the Network icon, through start/setting/control panel then the service tab selected.

Add was clicked and Microsoft IIS was selected. The Internet services were selected (WWW and FTP) subsequently their directories were also selected. Setup copied the necessary files for IIS Setup and Finish was click to finish installation.

PUBLISHING World Wide Web (WWW)

A home directory was created and HTML (Hypertext Markup Language) files known "YEARBOOK" was placed into the WWW root home directory on the web server.

(E) ESTABLISHING CONNECTION BETWEEN EELAN AND NUNET OFFICE VIA REMOTE ACCESS SERVICES (RAS)

Remote Access Service (RAS) provides the computer EESERVER 1 with WAN in bound and outbound connectivity to server and/or network via public switched Telephone Network (PSTN).

INSTALLATION OF RAS DEVICE (MODEM).

The Modem icon in the control panel was double clicked. Install New Modem wizard appeared, subsequently modem was selected. The needed device driver's files were loaded by clicking Have disk button. The communication (COM) port to be used by the modem was then selected and finish button clicked.

INSTALLATION OF DIAL-UP NETWORKING (DUN)

RAS client Dial-up networking allows connectivity to dial-up server in the NUNET office using point-to-point protocol (PPP) as transport mechanism allowing TCP/IP network access over analog modem.

Installation process:

DUN icon was double clicked through double clicking my computer on the desktop, next the Install button was clicked. The necessary files were then copied from the Windows NT CD-ROM and all the necessary information entered. Ok was clicked to finish installation.

INSTALLATION OF REMOTE ACCESS SERVICE

From the control panel, Network icon was double clicked and the Network Setting Screen opened then the service tab selected and the Add button clicked.

Remote Access Service was selected and ok clicked. The necessary files needed for the installation were copied from the Windows NT server CD-ROM.

The Communication (COM) port of the Modem device was configured for dial out and receive call. TCP/IP protocol selected for network access. Next, ok was clicked to finish the setup.

With RAS set up in EELAN, connectivity of other computer/LANs is possible with EELAN.

(F) ESTABLISHING CONNECTION BETWEEN COMPUTER SYSTEM WITHIN EELAN.

These include the choice of cable, the preparation, installation of cables

(A) CHIOCE OF CABLE

Unshielded Twisted Pair (UTP) 10BaseT Category 5 cable was adopted to achieve the Ethernet Network which is being implemented for the purpose of this project. Table 3.1 depicts colour coding for the cable.

Table 3.1 Colour code for CAT 5 UTP cable

WIRE ID	COLOUR CODE	ABBREVIATION
1	White – blue	W – BL
2	Blue	BL
3	White – Orange	W – O
4	Orange	O
5	White – Green	W – G
6	Green	G
7	White – Brown	W – BR
8	Brown	BR

(B) PREPARATION OF CABLES

After site and location measurement of communication equipment, the 10BaseT CAT 5 UTP cables were cut in accordance with the measurements. Each CAT 5 UTP of four pair cables were crimped to RJ 45 Jack at both ends for Drop cable (Patch Cable). The length of Drop cable is 3m. Eight Drop cables were produced.

Eleven hub to wall plate Data outlet were produced by crimping one end of CAT5 UTP cable to RJ 45 Jack and the other end terminated in the data outlet wall plates. Drawing label (06) depicts the connection of the Hub to data outlet.

Each Hub to wall jack cables was clearly labeled for proper identification and troubleshooting. Printed self-laminated wrap around labels were employed.

(C) LOCATION AND INSTALLATION OF HUB:

The position of Hub as shown in cabling layout produced (labeled 03) was taken after considering the location and number of computer system and data outlet to enable easy visibility and accessibility.

Two: Hubs were installed 9-parts 10BaseT Hub to achieve connection within computer systems in the EELAN and 8-parts to achieve future Intranet Implementation and EELAN expansion.

(D) INSTALLATION OF CABLES

After cable preparation, they were installed from the Hub to RJ45 wall Jack via different method of cabling. These methods are the overhead cabling, surface cabling and metallic conduit cabling. Two types of data outlet were used, the single face (SF) and double face (DF) RJ45 wall jack. See table 3.2 for the various cabling types, RJ 45 wall jack type and the length.

During installation process, careful considering was given to the proximity of cabling to nearby sources of electromagnetic interference such as fluorescent lighting, radio frequency sources. During installation and subsequently care was taken to prevent damage to the cabling, where possible surface cabling was avoided to prevent exposure. Special precautions were taken to reduce damage in case of surface cabling. Rough edges were avoided as much as possible.

Table 3.2 Cable label, length and Type used.

HUB TO RJ45WALL JACK			RJ45WALL JACK TYPE
CABLE LABEL	CABLE LENGTH (M)	CABLING TYPE	
01*	11.00	Overhead	SF
02	14.80	Metallic conduit	SF
03*	5.95	Overhead	"
04	2.0	Surface	"
05	3.0	"	DF
06	3.0	"	"
07*	4.08	"	SF
08*	7.45	"	"
09*	9.30	"	"
10	11.9	Overhead	DF
11	11.9	"	"
12	5.5	"	SF
13	12.3	Metallic conduit	DF
14	12.3	"	"
15	13.3	"	"
16	13.3	"	"

* = Existing Hub to RJ 45 wall jack configuration

SF = single face RJ45 wall Jack DF = double face RJ 45 wall jack

Number of SF= 8 Number of DF = 4

3.3.2 NETWORKING ADMINISTRATION.

Network Administration is a process of maintaining, operating and enhancing the network. Administration tasks are a continuous process. A few of these tasks are absolutely necessary and were adequately taken care of.

(A) CREATION OF USER AND GROUP ACCOUNTS

In addition to the existing user and group account the following group and user account were created through the user Manger for Domains.

Three groups accounts were created, each have it rights and privileges in accordance with the functions performed by each group

- I. Academic Staff group
- II. Student group
- III. Non-academic group

Similarly, new user account were created and assigned to various group accounts as illustrated in table 3.3.

Table 3.3 Table of Accounts

User account Account	Group	Academic staff Group	Student group	Non- academic Staff group
1		Adediran	Abu	Raji
2		Danjuma	Victor	Suleiman
3		Rumala	Suuny	Adamu
4		Kolo	Babi	Ahmed
5		Shehu	Johnson	
6		Pinne	Cyril	
7		Jedna	Tayo	
8		Attah	500level	
9		Abraham		
10		Nwohu		
11		Raji		

(B) CREATING A NEW USER ACCOUNT

The user Manager or Domains from Administrative Tools program group was opened. Next, in the User Pull-down menu, New User was selected. A window opened, where the Username, Full Name, Description, Password were entered, Next, Add button was clicked to finish creation.

(C) CREATING A NEW GROUP ACCOUNT

At User Manager or Domains, from Administrative Tool Program group, the User pull-down menu was selected. Next, New Group was selected. As the window opened the Group Name and Description were entered.

3.4 TESTING, RESULTS AND DISCUSSION OF RESULTS

Series of tests were carried out on the network during the implementation and after the network was up and running, these includes:

3.4.1 CABLE TESTS

Continuity test was employed to ensure the cables are in good condition of operation.

TYPE OF METER USED: Digital Multimeter

METER SPECIFICATION: Diode scale

- (a) Drop cable Test: An RJ45 pin-to-pin test was carried out on the drop cables using the digital Multimeter.
- (b) Hub to RJ45 wall Jack test: A pin-to-pin test was carried between the RJ45 wall jack and RJ45 jack going into the Hub. See table 3.3 for

Table 3.4 Hub to RJ45 Wall jack continuity test and results.

Pin tested	Hub to RJ 45 wall jack connections											Meter result	Comment	
	02	04	05	06	10	11	12	13	14	15	16			
1 to 1	"	"	"	"	"	"	"	"	"	"	"	"	BEEP	PASS
2 to 2	"	"	"	"	"	"	"	"	"	"	"	"	"	"
3 to 3	"	"	"	"	"	"	"	"	"	"	"	"	"	"
4 to 4	"	"	"	"	"	"	"	"	"	"	"	"	"	"
5 to 5	"	"	"	"	"	"	"	"	"	"	"	"	"	"
6 to 6	"	"	"	"	"	"	"	"	"	"	"	"	"	"
7 to 7	"	"	"	"	"	"	"	"	"	"	"	"	"	"
8 to 8	"	"	"	"	"	"	"	"	"	"	"	"	"	"

Table 3.5 Drop cable test and result.

Pin tested	DROP CABLES								Meter Result	Comment
	1	2	3	4	5	6	7	8		
1 to 1	"	"	"	"	"	"	"	"	BEEP	PASS
2 to 2	"	"	"	"	"	"	"	"	"	"
3 to 3	"	"	"	"	"	"	"	"	"	"
4 to 4	"	"	"	"	"	"	"	"	"	"
5 to 5	"	"	"	"	"	"	"	"	"	"
6 to 6	"	"	"	"	"	"	"	"	"	"
7 to 7	"	"	"	"	"	"	"	"	"	"
8 to 8	"	"	"	"	"	"	"	"	"	"

(c) DISCUSSION OF RESULTS OF CABLE TEST

The pin-to-pin test shows that there was a beep; hence there is continuity, which indicate proper functioning of cable.

3.4.2 CONNECTIVITY TEST OF EELAN

Connectivity test was carried out to ensure communication between the computer systems within EELAN. Ping utility was employed. The ping utility is used to test connectivity to target system. It does this by sending one ICMP echo packets and waits up to one second by default listening for the reply.

(A) CONNECTIVITY TEST PROCESS

Workstations and Backup Domain Controller (BDC) were set as the sender. The Primary Domain Controller (PDB) as the target system

At the workstation and BDC, the PDC were pinged

C:\> ping-n 3 192.168.0.1

(B) RESULTS OF PINGING THE PRIMARY DOMIAN CONTROLLER (PDC)

Table 3.6 Result of Pinged PDC

Pinging 192.168.0.1 with 32 bytes of data:

Reply from 192.168.0.1: bytes = 32 time = 150ms TTL = 244

Reply from 192.168.0.1: bytes = 32 time = 130ms TTL = 244

Reply from 192.168.0.1: bytes = 32 time = 220ms TTL = 244

The n-count parameter is used to specify the number of packets to

TTL = Time To Live

(C) DISCUSSION OF RESULTS

When the PDC with IP address 192.168.0.1 was pinged from the various workstations and BDC. There was proper reply indicating that there is communication between the sender and the target system (see Table 3.5).

3.4.3 LAN TO LAN CONNECTIVITY TEST

This test was carried to establish the possibility of ensuring connectivity between LANs using two NICs. One for the purpose of routing and the other for communication within the LANs.

(a) TESTING PROCEDURE

Two computers, Computer A and Computer B each with two NICs were configured as follows:

COMPUTER A (LAN A)

Routing (NIC 1)

IP Address = 192.168.0.0

Subnet mask = 255.255.255.0

Default gateway = NIL

NIC 2

IP Address = 192.168.0.1

Subnet Address = 255.255.0.0

Default gateway = 192.168.0.0

COMPUTER B (LAN B)

Routing (NIC1)

IP Address = 192.168.0.0

Subnet mask = 255.255.255.0

Default gateway = NIL

NIC 2

IP Address = 192.158.0.1

Subnet Address = 255.255.0.0

Default gateway = 192.168.0.0

COMPUTER A = sender system

COMPUTER B = Target system

SYNTAX

C:\> Ping - n 3 192.158.0.1

RESULTS OF PINGING COMPUTER B (LAN B)

Fig 3.1 Result of pinging computer B

Pinging 192.158.0.1 with 32 bytes of data:

Reply from 192.158.0.1: bytes = 32 time = 150ms TTL = 244

Reply from 192.158.0.1: bytes = 32 time = 130ms TTL = 244

Reply from 192.158.0.1: bytes = 32 time = 220ms TTL = 244

DISCUSSION OF RESULTS

Since there is reply from Computer B which is on a different network or LAN. It implies that the connectivity between LANs can be established using two NICs, one for routing and the other for internal connectivity.

3.5 WEB TESTING

With HTML file "year book 2000" located in the directory 1WWW of the server. The Internet Brower was started to connect to the Internet. Next the URL for the home directory of the server was typed i.e. HIIP:/WW EE.FUT.EDU Enter was clicked to execute URL.

RESULTS AND DISCUSSTION OF RESULTS

The home page appeared which indicated successful set up of the webser.

3.6 RELIABILITY ANALYSIS

The aim of this analysis is to find out the probability that the intranet swill function within specified limit, under specified environmental conditions, within a specified limit of time.

We looked at the causes of TOTAL INTRANET FAILURE, this occur if there are:

- (a) Total LAN_s failure
- (b) Hub failure
- (a) Total LANS failure occurs if there are:
 - 1. Total EE LAN failure
 - 2. Total EH LNA failure
 - 3. Total EC LAN failure
 - 4. Total EM LAN failure
 - 5. Total EA LAN failure
- (b) Total EE LAN failure occurs if there are:
 - 1. Total Hub (1) failure
 - 2. Total drop cable failure
 - 3. Total Hub to RJ45 wall cable failure

4. Total RJ 45 Wall Jack failure
5. Total Hard ware/Software failure
6. Total power failure.

Failure problems were assumed using the factor-of-influence method.

Total Hub failure = 0.006

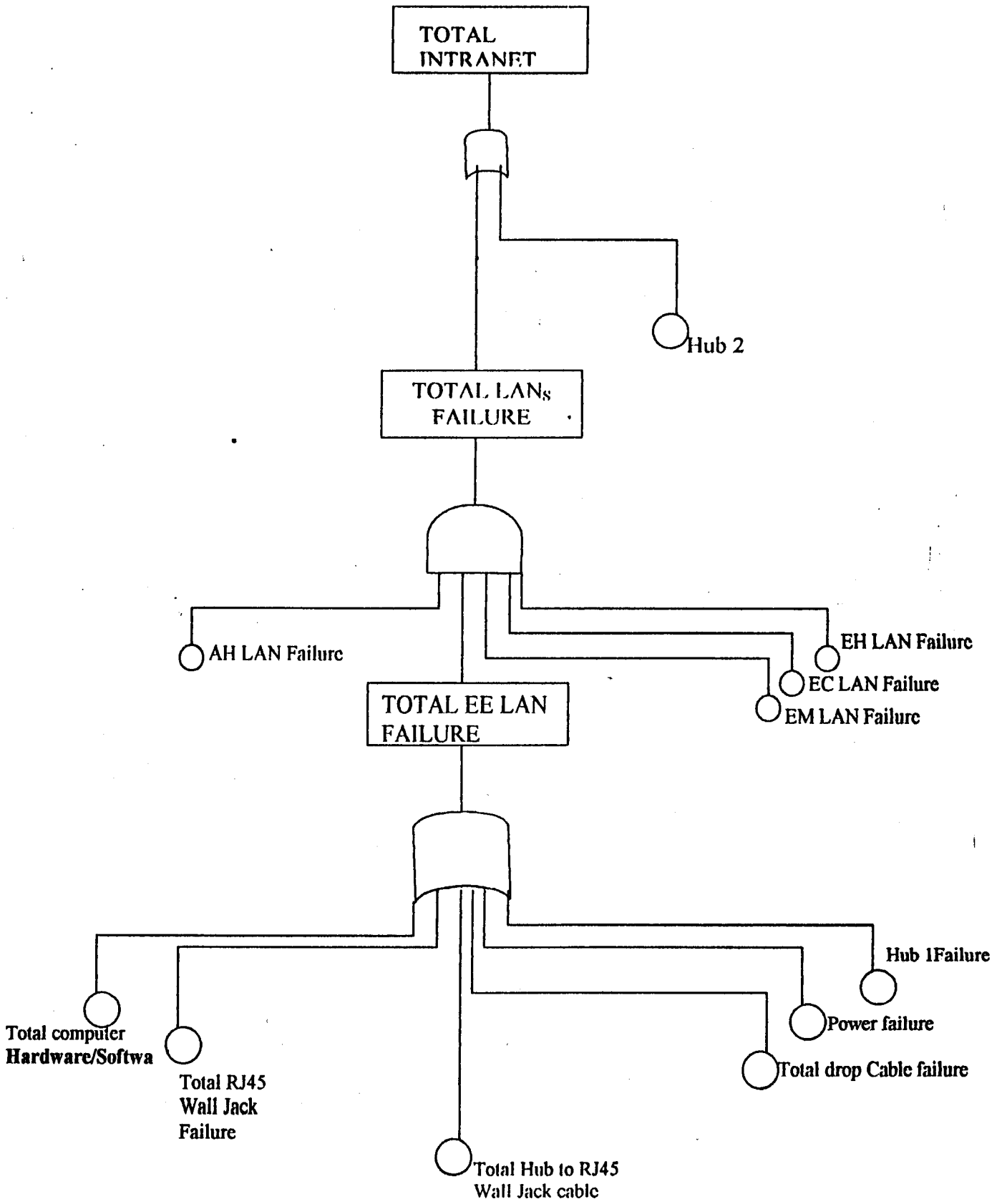
Total drop cable failure = 0.012

Total Hub to RJ wall Jack cable failure = 0.012

Total RJ 45 Hardware/software failure = 0.031

Total power failure = 0.09

FAULT TREE ANALYSIS OF THE INTRANET



CHAPTER FOUR

4.0 CONCLUSION AND RECOMMENDATION

4.1 CONCLUSION

The objective of this project, although achieved was highly demanding and challenging. But after all said and done we were able to successfully Design and implement an Intranet for the School of Engineering and Engineering Technology.

At the end of the project, the network was found to have met all the stipulated requirements, viz: sharing of resources and applications internal mailing system and web publishing. This technology was implemented for EELAN and EELAN to the NUNET office of F.U.T. Minna.

Although the network is functional, it could be made more efficient and faster if higher configurations of the computer systems were available.

Two Hubs (one an eight port and nine port Hub) were used respectively and the Ethernet Network was the major protocol used for the project.

4.2 RECOMMENDATIONS

My major recommendation is to do with the upgrade of systems in the various departments. This type of project demands efficiency.

I will also recommend that this project should be fully implement. Life would be much more easier in the university if the entire school was wire.

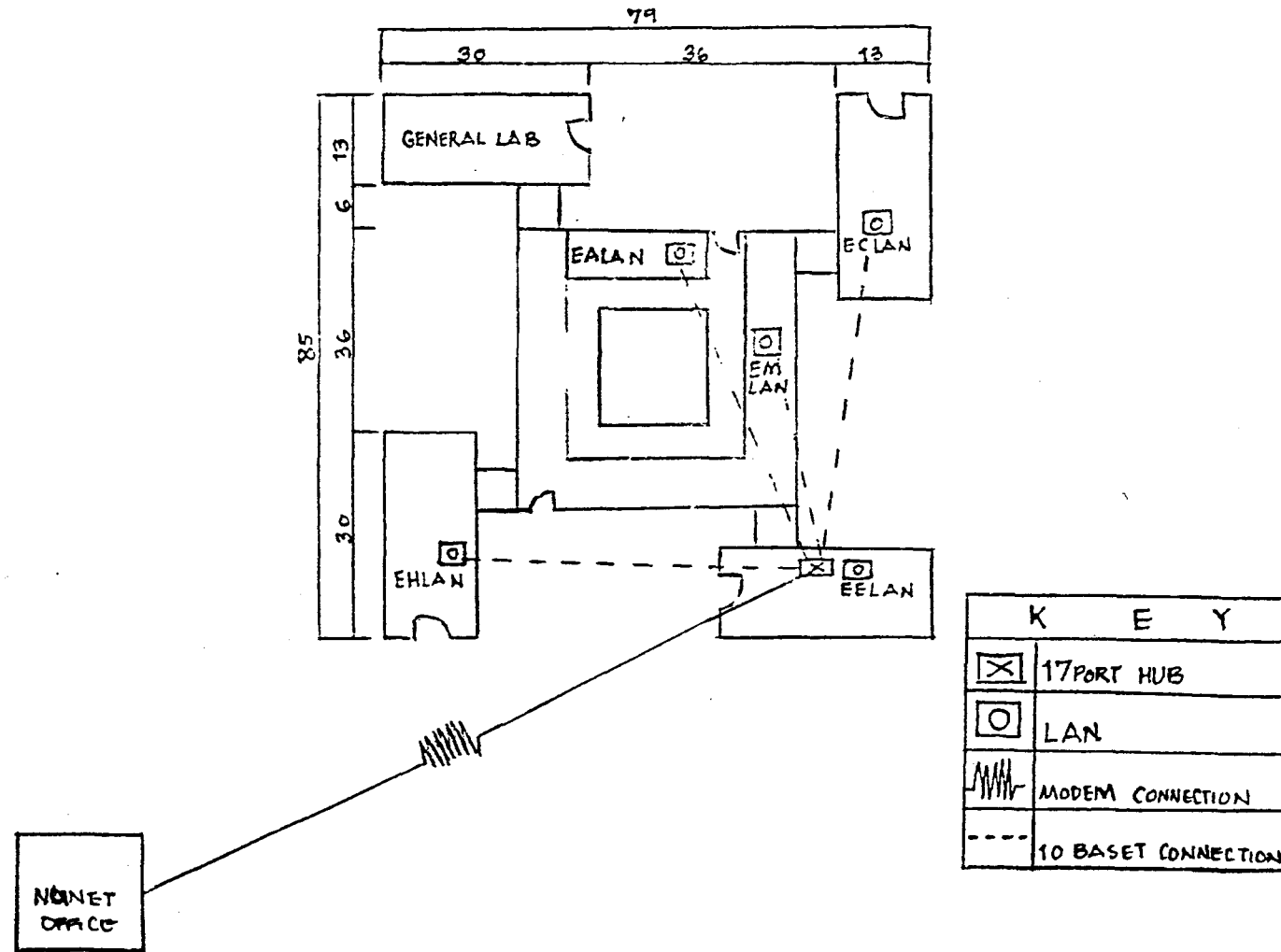
Information technology (IT) is known to be the booming industry today. The university should encourage and build up people's interest in this field by:

- Organizing seminar, workshops etc.
- Course sponsorships
- Subsidizing IT based projects.

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GENERAL SITE LAYOUT



K E Y	
	17 PORT HUB
	LAN
	MODEM CONNECTION
	10 BASET CONNECTION

Project title
DESIGN AND IMPLEMENTA-
TION OF INTERNET WITHIN
S.E.E.T. FUT MX

Names:	no:
ABU. H.F.	95/4381EE
VICTOR Y.S.	95/4425EE
ADAMU. B.A.	95/4391EE
FUDAMADE. J.A.	95/4491EE
TAYO. B.A.T.	95/4633EE

Department
ELECTRICAL/COMPUTER
ENGINEERING

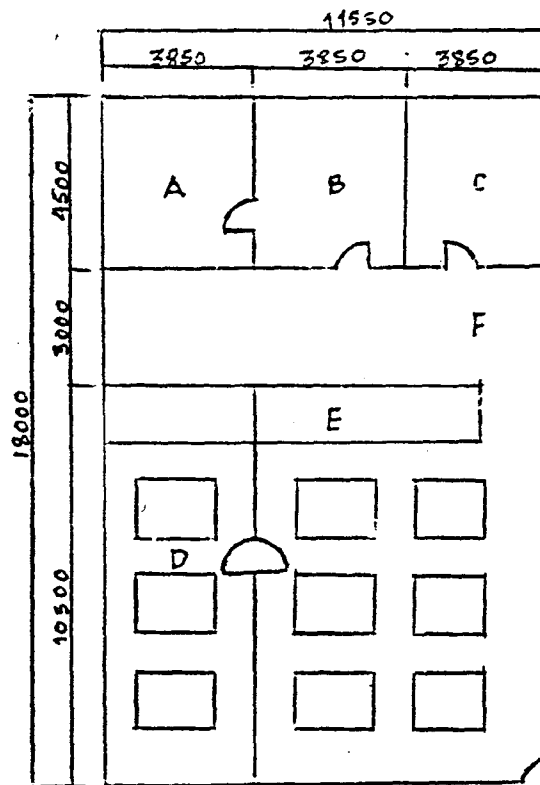
Supervisor
Engr. I. A. DANJUMA

Course code
EEE 515/525

Date
December 2000

Drawing no:
01

EELAN SITE LAYOUT



K E Y	
A	Lecturer's Office
B	Secretary's Room
C	Technician's Office
D	Computer Center
E	General Classroom
F	Machine's Laboratory

Project Title:

DESIGN AND IMPLEMENTATION
OF INTERNET WITHIN S.E.E.T.
FUT MX

Department:

ELECTRICAL/COMPUTER
ENGINEERING

names:

no:

ABU H.F.	95/4381 EE
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ADAMU B.A.	95/4391 EE
FUJAMADE J.O.	95/4494 EE
TAYO .B .A.T.	95/4633 EE

Supervisor:

Engr. I. A. DANJUMA

Course Code

EEE 515/525

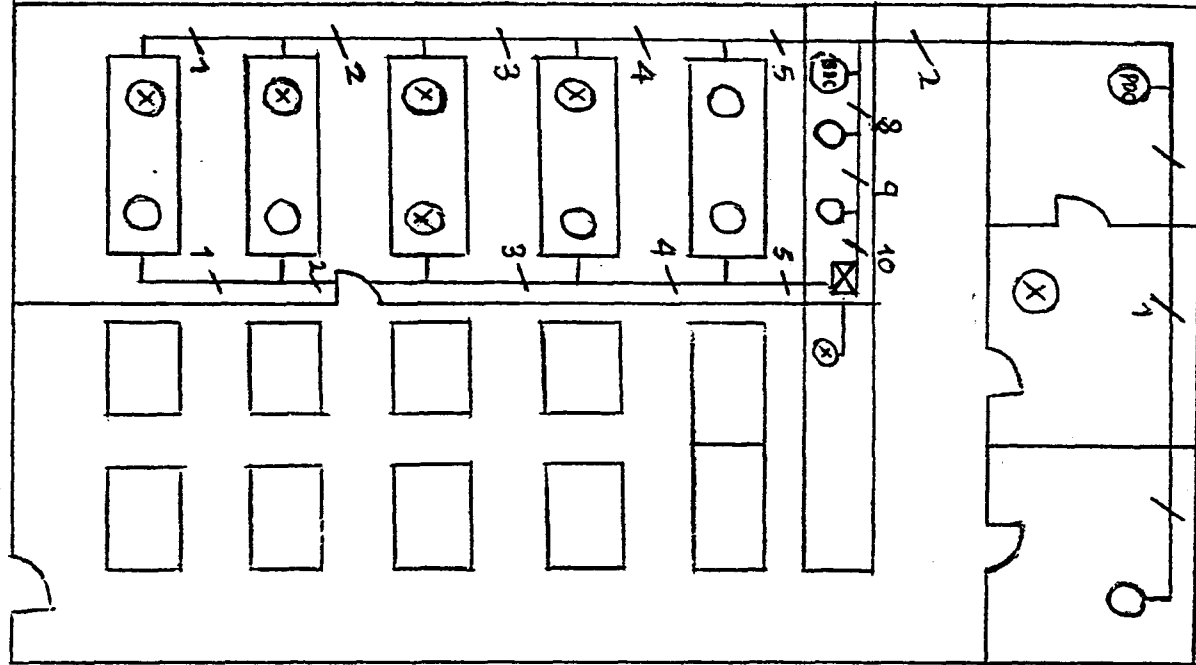
Date

December 2000

Drawing no:

02

EELAN CABLING LAYOUT



K E Y	
	17 PORT HUB
	EXPECTED COMPILER
	EXISTING COMPUTER
	PRIMARY DOMAIN CONTROLLER
	BACKUP DOMAIN CONTROLLER
	NUMBER OF CABLES

Project Title
 DESIGN AND IMPLEMENTATION
 OF INTERNET WITH
 F U T M X

names	no
ABU.H.F.	95
VICTOR.Y.S.	95
ADAMU.B.A.	95
FUJAMADE.J.A.	95
TAYO.B.A.T.	95

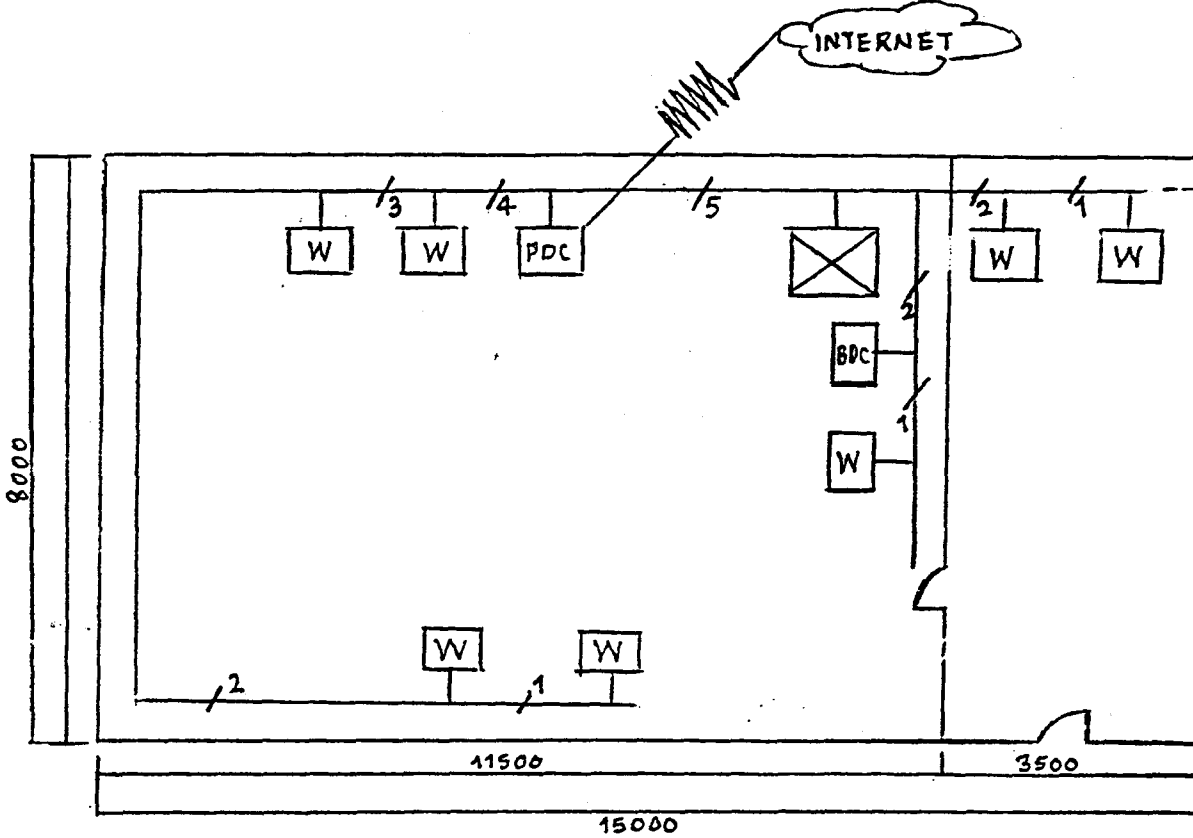
Department
 ELECTRICAL/COMPUTER
 ENGINEERING

Supervisor:
 Engr. I.A.DAN

Course Code
 EEE 515/525

Date:
 November 2000

SITE AND CABLING LAYOUT FOR NUNET OFFICE



Project Title
 DESIGN AND IMPLEMENTATION
 OF INTERNET WITHIN S.E.E.T.
 FUT MX

NAME:	NO:
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 ENGINEERING

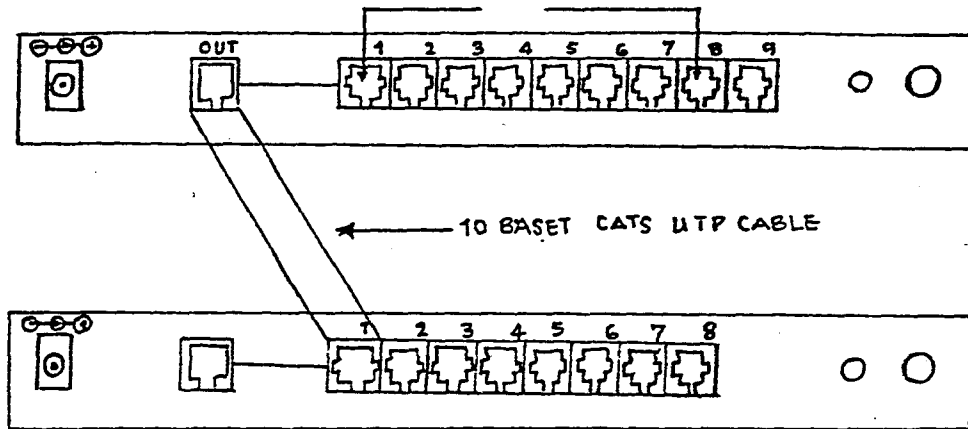
Supervisor
 Engr. I.A. DANJUMA

Course Code
 EEE 515/518
 Date

Drawing no:
04

K	E	Y
W	WORKSTATION	
X	HUB	
PDC	PRIMARY DOMAIN CONTROLLER	
BDC	BACKUP DOMAIN CONTROLLER	
/	NUMBER OF CABLE	
~~~~~	INTERNET CONNECTION	

# CASCADING OF HUBS



Project title  
 DESIGN AND IMPLEMENTATION  
 OF INTERNET WITHIN S.E.E.T.  
 FUT MX

names:	no
ABU.F.H.	95/4381 EE
VICTOR.Y.S.	95/4656 EE
ADAMU.B.A.	95/4391 EE
FUJAMADE.J.A.	95/4491 EE
TAYO.B.A.T.	95/4633 EE

Department  
 ELECTRICAL/COMPUTER  
 ENGINEERING

Supervisor  
 Engr. I. A. DANJUMA

Course Code  
 EEE 515/525  
 Date

Drawing no:  
 05

December 2000

Project title DESIGN AND IMPLEMENTATION WITHIN S.E.E.T. F.U.T. MX	
names:	no:
ASU.XF.	95/4381EE
VICTOR.Y.S.	95/4382EE
ADAMU.B.A.	95/4381EE
FUJAMADE.J.A.	95/4411EE
TAYO.B.A.T.	95/4633EE
Department ELECTRICAL/COMPUTER ENGINEERING	
Supervisor Engr. I. A. DANJUKA	
Course Code EEE 515/525	
Date December 2000	Drawing no: <b>06</b>

