DESIGN OF INTRANET FOR THE SCHOOL OF ENGINEERING AND IMPLEMENTATION OF ELECTRICAL ENGINEERING SUBNETWORK.

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 OF ENGINEERING [B. ENG.] DEGREE IN ELECTRICAL AND COMPUTER ENGINEERING.
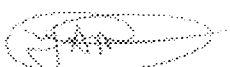
DECEMBER, 2000

CERTIFICATION

This is to certify that Fujamade Johnson Olumide of the Electrical/Computer Engineering Department of the Federal University of Technology, Minna, carried out this project under the supervision of Mr. I.A. Danjuma.

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7/1/201
DATE

DECLARATION

I hereby declare that this thesis 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 All information derived from both published and unpublished works have been acknowledged.

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Fujamade Johnson Olumide

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Date

iii

DEDICATON

This project is dedicated to the Highest God, Jesus His son, Holy Spirit, my dear father and mother.

ACKNOWLEDGMENT

The boy's head was buried in his palm, hardly did he believe that life could offer him anything good. The question that was crossing his mind was, could there be a way out? He worked with little determination that was always threatened by the fear of failure and anxiety. The boy was alone in the world of his disappointment and uncertainty. Everybody deserted him with the exception of his mum and dad. As if his parents had known earlier that better days are coming ahead, they refused to give up on their little and gentle boy who has been dealt with by the ugly side of life.

"If everybody abandons you, I will not abandon you" the man that cares said. "So there could be hope", the boy said to himself. Jehovah, Jesus and the Holy Spirit took the boy's case up. They provided his parents with the facilities needed to help the boy and they gave him the spirit to fight the battle of life like a "wounded lion". Alas! The boy has given despondency and failure a technical knock out. I wish to acknowledge the assistance of my supervisor (Mr. I.A. Danjuma), my H.O.D. and all other people that made this project a reality.

I acknowledge every bit of what my heavenly father, Jesus and Holy Spirit did to make me attain this position in life. I also acknowledge my dear parents, Mr.& Mrs Fujamade who have a great confidence in my ability. I love you mum, I love you dad. QUITERS NEVER WIN, WINNERS NEVER QUIT.

ABSTRACT

This project is centered on design of an Intranet for the school of Engineering and implementation of a sub network at the Electrical and Computer Engineering department. The major aim of the project is to facilitate sharing of information and resources within the departments by using the Internet technology [TCP/IP].

Having considered some factors, Ethernet network, unshielded twisted pair (UTP) cables, public switched telephone network (PSTN) TCP/IP, star topology and client/server configuration were used for the design. The specifications and implementation of Electrical and Computer Engineering LAN was recommended for other Engineering departments. It was also specified in the design that Electrical Engineering will be the gateway for the Intranet while the NUNET office which is linked to the Intranet by PSTN will be the gateway to the university.

Tests that could ensure the efficiency of the LAN were carried and the results obtained were properly presented and discussed.

TABLE OF CONTENTS

CHAPTER THREE

IMPLEMENTATION, TESTING, RESULTS AND DISCUSSION OF RESULTS

CHAPTER FOUR

viii

CHAPTER ONE

GENERAL INTRODUCTION

1.1 INTRODUCTION

In the 1960s, computers numbered in the tens of thousands. Today, computers numbers in the tens of millions. Information technology and its various applications are everywhere. The challenge of the future is to make information more accessible to greater number of people, range of hardware, software, and data buses. Connectivity as it is called is necessary to facilitate the electronic communication between companies, end users, as well as the free flow of information with and between organizations.

Every business organization runs on information whether the business is banking, dry cleaning, aerospace, or computer chip manufacturing. In the time past, computers had been used in the stand-alone environment. Software was used to produce data, graphics, spreadsheets document and so on, but, the information has to be printed out or put on a floppy disk before it can be shared. In order to make every computer user to concentrate on what he is doing rather than moving information around, there is need for interconnection of computers within the organization or establishment.

A network is a collection of computers and peripherals such as printers, and scanners that are connected so that every one can share applications, data and equipment. Today, computer networks are everywhere. They are found in large businesses and small ones, schools and charitable institutions, government offices and high school student's bedroom. In the mid 70s Ethernet which is one of the most common kind of networking

was developed. It uses coaxial, twisted-pair and fiber-optic cables to transmit data and employs CSMA/CD (carrier sense multiple access with collision detection) to regulate network activity.

1.2 STATEMENT OF THE PROBLEM

In Nigeria today most universities are implementing Local Area Networks. This is In line with the Nigeria Universities Network (NUNET) project. The previous work on LAN carried out in this university are:

1. Computer communication networks with emphasis on LAN by Ejechi O. Kenneth department of mathematics/statistics/computer science. February 1997.

2. The design of computer LAN in the school of science and science education by Ohineme E. Otude. DEPARTMENT OF physics/computer. February 1998.

3. Design and and implementation of LAN within the electrical/computer engineering department. By Oyinlola T.B., Banigbe O., Oladapo O. and Yahaya A. December 1998.

Although much work has been done on LAN, sufficient attention has not been paid to a network that uses Internet technology. The purpose of this is to design an Intranet for the school of engineering and implement the subnetwork at the department of electrical/computer engineering.

1.3 AIMS AND OBJECTIVES

The major aim of this project is to design an intranet for the school of engineering and implement a subnetwork at the department of electrical and computer engineering. The network also enables the following:

2

(i)   To enhance sharing of network resources.

(ii)   To ensure that the information in the hard disk of server of each department is properly secured and not made accessible to any unauthorized user.

(iii) To have central management of files within the department and to guide against loss of files by proper backup.

(iv)   To allow authorized user from any department to have access to the server of a department within school of engineering.

(v)   To ensure easy and fast link of school of engineering to Internet service in future.

(vi)   To provide a means of compatibility between dissimilar equipment and software.

(vii) To stress the need to keep up with continuous advancement in technology.

1.4   LITERATURE REVIEW

Face-to-face has been the original means of communication between persons. There was a time also when a town crier was relied upon to inform people in a village about anything and a gun was fired across a valley to pass information from one village to the other. But through time, humanity developed and so came the telephone for person to person communication. The radio and television also came for the purpose of mass communication. While the telephone allowed two way communications, the radio and television were meant to be one way communication. The letter postage service also came , then the telegram, telex and fax system as means of communication between persons. For many years, the world was connected with these established methods.

Computers soon arrived and became very cheap. Many ways of using them were developed to take advantage of its fast speed of operation. Data communication has been

one key area that came about as a result of the marriage of computers with telecommunications. The fruitful union meant that when two or more computers are connected on the telephone network, whatever is contained (stored) in each machine can be sent in a matter of seconds to the other. Distance is immaterial, once the location in which each computer is, is connected by phone.

Furthermore, the telephone was initially meant for voice contact with the other person, but now virtually anything- a letter, a book, a photograph, x-ray film e.t.c. can be transmitted by computers over the telecommunication network. And when the normal telephone is one to one, the data in one machine can be sent simultaneously to unlimited number of others. The combination of fax technology with computer will eventually reduce postal services to the delivery of parcels alone as all written messages of a few to several pages will be faxed.[2]

1.5 EVOLUTION OF NETWORK

Robert Larry (1967) who was considered as the father of ARPANET understood the potential benefits of networking computers together. Robert believed, as J.C.R. Licklider did, that networking would encourage a community use of computers. Robert used a dedicated phone line to connect a TX-2 computer to a computer at system development corp. in Santa Monica. Through this rudimentary link permitted one computer to log on the other and run program there. It was disappointedly slow. Eventually it was Robert's dedication, design and direction that brought about the success of the ARPANET.[4]

4

In 1969, the U.S. department of defense set up the ARPANET (advance research projects agency) a network able to with stand partial destruction from bombs or other disasters and still function. Metcalfe Robert (1973), led the Xerox Palo Alto research centre. Ethernet is now a widely used local area network (LAN) protocol that connects more than 50 million computers. He later went on to find 3com, a successful global data network company.

Cerf Vinton G. (1976), the father of Internet co- developed the TCP/IP (Transmission) control protocol/ Internet protocol) networking protocol which is the language governing communication between all computers on the net. From 1976 to 1982, Cerf also played a major role in developing networking packet technologies for the advanced research project agency (ARPA) at the development of defense.[4]

In 1981, BITNET, one of the first wide area networks (WAN) was founded to serve academic institutions. The IBM introduced a prototype of the personal area network (PAN) in 1996. The PAN is a small computer on a card that sends data through a stream of electric signal throughout person's body. The body acts as a conductor that lets data travel to and from devices such as pagers, handheld computers and cellular phone.[4]

Presently, in Nigeria, most universities are implementing LANs which will eventually be connected together to form a wide area network. This project is called the Nigerian universities network (NUNET).

CHAPTER TWO

NETWORK CONCEPT AND DESIGN

2.1   INTRODUCTION

Basically a data network is a structure that enables a data user at a location to have access to some data processing functions or service available at another location. Data networks range from a small network inter connecting computers and terminals inside a building or campus like complex to a geographical distributed network interconnecting hundreds of computers of various sizes and tens of thousand terminals.

2.2   CLASSIFICATIONS OF COMPUTER NETWORK

Computer network can basically be classified by their speed, transmission media, distance covered and message transport technology or mode of information dispersion. In the scope of this project, computer based on distance covered shall be considered. Types of network based on distance covered are:

1. local area network

2. metropolitan area network

3. wide area network

2.2.1   LOCAL AREA NETWORK (LAN)

A LAN is a privately owned network that is limited in geographical scope to the range of 0.1-10km. It is a group of computers usually in one building or office physically

connected in a manner that lets them communicate and interacts with each other. It gives the ability to share files and expensive equipment such as laser printers. Networks can be connected using different combinations of topologies, protocols, software and hardware.

2.2.2 METROPOLITAN AREA NETWORK {MAN}

A network that serves an area any where from a few km to more than 50km in size, such as city or university. A MAN is bigger than LAN, which serves one building or complex, but smaller than a wide area network {WAN}, which may cover an entire country. A MAN links two or more LANs, but it often runs more quickly and has more access method.

2.2.3 WIDE AREA NETWORK {WAN}

A WAN is a connection of computer connected (or networked) to each other over a geographical area. Wide area networks usually require special arrangements with telephone companies because data is transmitted among locations (called sites) across telephone lines.

2.3 LOCAL AREA NETWORK

Local area network can be classified in a number of ways, none of which are wholly convenient for all circumstances. By:
1. physical transmission medium
2. network topology
3. transmission mode and

4. resource- sharing mechanism

2.3.1 TRANSMISSION MEDIA

A transmission channel is the facility through which electronic signals are transmitted between locations in a computer network. Data, text and digitized images are transmitted as combination of bits (1s and 0s), a channel capability is rated by the number of bits it can transmit per second. The main types of media used in LAN are:

1. twisted pair cable

2. coaxial cable

3. fibre optic cable

Twisted pair cable: This is approximately the same as the telephone that is used for voice communications. Although, the basic unit of the cable is two wires twisted around each other, it often appears as bundled multi-core cable with several pairs contained in a single sheet. The cable is susceptible to "cross talk" interference caused by magnetic fields generated by signals passing through the cable, which induces duplicate through weaker signal in the neighboring cables. This unwanted effect can cause data loss and the longer the cable the greater the interference. To combat this, twisted pair cables come in two forms;shielded twisted pair (STP) and unshielded twisted pair (UTP). The STP differs from the UTP in that individual cable pairs within the multi-core are shielded in a metallic braid which acts as a barrier to the cross-talk effect. Twisted pair cables support segment sizes of not more than 100m. UTP is available in 5 categories. The differentiating factor is the type of insulation material. The categories and their functions are listed below:

8

Table 2.1 UTP Categories and Their Functions

CATEGORIES	FUNCTIONS
1&2	For voice and low speed operations (unsuitable for LANs)
3	For voice traffic and data operations at speedup to 16Mbps (IEEE std)
4	For voice traffic and data operations at speed up to 20Mbps
5	Presently the best suited for LANs and offer the present possible speed

Coaxial cable: Coaxial cable is the same sort of cables that is used for domestic TV aerial connections. It has a heavily insulated copper core, which is sheathed in braided copper and covered in plastic thereby, allowing high-speed data transmission with a minimum of signal distortion. It is in two varieties, Thick and thin. The thick type also known as the thick-wire Ethernet is cheaper and more flexible. Supporting segment sizes of up to 185m.

Optical fibre cable: It transmits light signals rather than electrical signals. It is enormously more efficient than the other network transmission media. Each fibre has an inner core of glass or plastic that conducts light. Cladding surrounds the inner core. A plastic sheath surrounds each fibre. The sheath can either be tight or loose.

2.3.2 TOPOLOGIES

This is the physical configuration of a network that determines how the network's computers are connected. The common configurations includes-

1. Bus

2. Star

3. Ring

Bus topology: This is a type of computer network in which all of the workstations or nodes are connected to one main line. On a typical bus network the cable is just one or more wires, with no active electronics to amplify the signal or pass it along from computer to computer. Bus network is terminated at both ends to avoid signal echoing back and forth along the line (i.e ringing). The terminators absorb the electrical energy and stop the reflections.

Star topology: A local area network (LAN) design in which all peripheral systems are attached directly and exclusively to the main computer, called a **hub** to which all communications are routed. A major dis-advantage of this type of network is the danger that a hub malfunctioning will cause the entire network to go down.

Ring topology: In the ring topology, the various nodes (stations) are connected together in the form of a closed loop through ring interface unit. In this topology, data travels around the ring in a unidirectional manner.

2.3.3   NETWORK ACCESS TECHNIQUE

The type of protocol used to provide medium access to a local area network (LAN) depends on the particular topology of the network. The popular medium access control protocols for LANs includes-

1. Carrier sense multiple access with collision detection (CSMA/CD)

2. Token bus

3. Token ring

Carrier sense multiple access with collision detection:

The Ethernet LAN uses CSMA/CD. This technique allows any station on the network to attempt to gain control of the network at any time. When a station wishes to send data to any other on the LAN, it first senses the communication medium to discover whether any data is presently being carried. If there is, the station defers to the passing traffic until such time as it detects silence on the network. As soon as silence occurs, the station waits for a mandatory period to allow the network settle and then begin to transmit its data. As it does so, it must again listen to the network, this time to look for a collision.

Collisions are possible because of the multiplicity of devices sharing the communication cable. If transmission occurs, the bits of data from each source will collide and cause all transmitted packets to become corrupted. Each transmitting station involved in the collision will therefore wait for a different time interval and the chances of a subsequent collision are low.

Token bus: The token bus uses a procedure of passing a token, which confers the right to transmit between stations connected to the bus. When a station, having use of the token, finishes its transmission, it must pass the token to another station. Each station maintains a pre-defined table, which is used to locate the next station in the logical transmission list. A problem with token bus is the failure of a station to pass on the token through either contention or faulty operation.

Token ring: Here, the token is passed around a ring without having to address the stations. A station wishing to transmit data needs to capture the token as it passes by and

11

to release it after the data transfer. Stations with no transmission requirement simply ignore the passing token.

2.4   LAN CONFIGURATION

Based on the operation system and the kind of network desired, LAN can be configured as-

1. Server based network

2. Peer to peer network

3. Hybrid network

Server based is also called client-server, and it contains clients and the servers that support them. The server runs network operating system such as Windows NT server or Novell Netware while the client runs client operating system such as MS-DOS or OS/2.0. The server on the network provides security and administration. The computer that serves as the server is more powerful than the clients.

In Windows NT, server based networks are organized into what are called domains. Domains are collections of networks and a client that shares security trust information. Servers called domain controllers control domain security and logon permission. No computer users can access the resources of servers in a domain until a domain controller has authenticated them.

Peer to peer network: Peer networks are defined by lack of central control over the network. There are no servers in peer network. Users simply share disk space and resources, such as printers and faxes. Peer networks are organized into workgroups. Workgroups have very little security control. There is no central login process in peer

networks. Access to individual resources can be controlled if the user who shared the resources requires a password to access it. Because there is no central security trust, the individual password for each secure shared resource to access must be known. This however creates inconveniences

Hybrid network: This type of network has client-server network that also has peers sharing resources. This means that while most shared resources are located on the servers, network users still have access to any resources being shared by peers in workgroup.

2.5 NETWORK HARDWARE

The hub: A hub is a device that connects two or more network devices in order to communicate. In other words, it is a point on the network where multiple devices are connected to each other. It may be active or passive. Passive hub is not powered and does no signal regeneration. Active hub is powered and it does signal regeneration.

Network interface card (NICs)

Network interface card is a printed circuit board containing the necessary hardware used to connect a computer to a network. Computers on network communicate through the network adapters or network interface cards that are plugged into the motherboards of the computers. Network adapters perform all the functions required to communicate on a network. They convert data from the form stored in the computer to the form transmitted or received (transceiver) on the cable and provide a physical connection to the network.

Serial data flows from the network

Network adapter card

Adapter card onto the network

Parallel data flows from the computer to the Network adapter card.
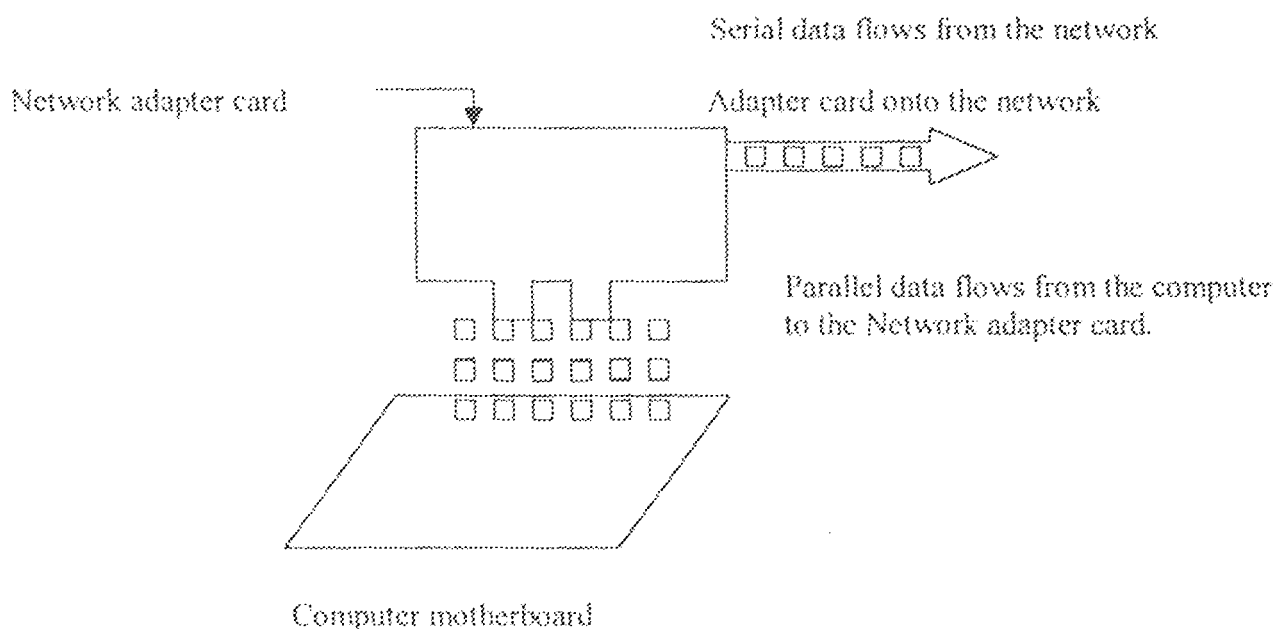
Computer motherboard

Fig. 2.1 Network interface card

WORKING PRINCIPLE OF NIC

Network adapters receive the data to be transmitted from the motherboard of the computer into a small amount of RAM called a buffer. The data in the buffer is moved into a chip that calculates a checksum value (checksum is a calculated value transmitted with data to check for error in the transmission. In a simple example, the number of bits of information is added and that number is sent with the transmission. The number of bits in the message is recalculated at the receiving end, and if it matches the original checksum, the information is considered error free) for the chunk (frame) and add address information, which includes the address of the destination card and its own address, which indicates where the data is from. Ethernet adapter address is permanently assigned when the adapter is made at the factory. In Ethernet, the adapter listens for silence on the network. When no other adapters are transmitting.It then begins transmitting the frame

one bit at a time, starting with the address information, then the chunk of data and then the checksum.

2.6   PACKET SRUCTURE

Every packet transmitted has a source address, destination address, instructions that tell the computer how to pass the data along.

Table 2.2 Packet Format for the Ethernet.

Synchronization Bit (1)	Source address Field 8-bit	Destination address field 8-bit	Control field 8-bit	Data up to 400 bits	Cycle redundancy check(16-bit)

Synchronization bit- is a control bit that establishes and maintains synchronization on the link.

Cycle redundancy check (16-bit) or frame check sequence- this check for transmission error in packet or frame.

Control field- it provides the encoding of command and response to control a data link. It keeps count of the received and sent information packets.The components of packet structure can be combined into the following sections-

Header: this includes an alert signal to indicate that the data is being transmitted, source and destination address and clock information to synchronize the transmission.

Data: this is the actual data being sent.

Trailer: this typically includes a cyclic redundancy check (CRC). This helps the network to determine whether a packet has been damaged in transmission.

2.7 PROTOCOL

A protocol is a set of basic steps that both parties (or computers) must perform in right order to exchange data. A computer sending a message to another computer must break the data into small section (i.e packets), add addressing information to the packets and deliver the data to the network card for transmission over the network (encapsulation). The receiving computer accepts the data from the network adapter card, remove the transmitting information that was added by the transmitting computer, and reassemble the packets of data into original message (demultiplexing). Since intranet is private network, that uses internet technology, all the computers in the network use TCP/IP(transmission control protocol/ internet protocol) set of protocols.

TCP/IP PROTOCOL STACK (open system interconnect model)

Application layer: provides services that directly support user's application such as data base, e-mail and file transfer.

Presentation layer: this translates data between the format the network requires and the computer expects. It does protocol conversion, data translation, compression and encryption.

Session layer: this allows applications on separate computers to share a connection called a session. This layer provides services such as name lookup and security to allow two programs to find each other and establish communications link. This layer controls dialog between two processors. It also provides for data synchronization and check pointing so that in the event of a network failure, only the data sent after the point failure need to be re-sent.

Transport layer: this ensures that packets are delivered error free in sequence and with no loss or duplication. It breaks large message from the session layer to be sent to the distribution of the computer and reassembles packet into message to be presented to the layer. It sends acknowledgement to the originator for message received.

Network layer: this translates logical network address into physical machine address and it also determine the route a message will take if there are several ways a message can get to its destination.

Data link layer: this layer accepts packet from network layer and packages the information into data units called frame to be presented to the physical layer for transmission. It adds control information such as frame type, routing and segmentation information to the data being sent.

Physical layer: this layer is responsible for sending bits.

2.8   INTRANET DESIGN CONCEPT

a. Design procedure

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

b. Design assumption

The design 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 (S.E.E.T).

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 (EE)

ii.   Mechanical engineering (ME)

iii. Civil engineering (CE)

iv.   Chemical engineering (CHE)

v.   Agricultural engineering (AE)

A general site layout and Electrical/computer engineering site layout were produced as depicted by fig. 1 and fig.2 respectively.

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 and evolutionary upgrade path.

2. Scalability: all Ethernet generations are standardized.

3. High network reliability: the availability of network management and troubleshooting tools.

4. Large installed base: over 120million interconnected personal computers, workstations and servers around the world i.e about 80% of installed networks.

5. Low cost: among its competitors Ethernet is the most cost effective.

DETERMINATION OF LAN ARCHITECTURE

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

Purpose: in order to centralize all the activities of individual department and to enable easy access.

Reason:It has centralized security and administration, centralized data organization, Internet access and applications.

DETERMINATION OF TOPOLOGY

The star to star topology is employed for the design.

Reasons: star topology is employed in various LANs of the department. Star topology is also employed in the interconnection of various LANs in S.E.E.T, ease of expansion. Easier to troubleshoot, support multiple cable types by hubs.

DETERMINATION OF MEDIA/CABLE TYPE

I.   Unshielded twisted pair (UTP)

Purpose: for connecting the PCs workstations and servers within the LANs. For connecting the server of the various LANs to establish interconnectivity of LANs.

Reasons: low cost, easy to install, high speed capability and 100m coverage.

II.   Optical fibre: for the purpose of design and simulation, optic fibre 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 200m.

III.   PSTN [public switched telephone network], which is the technical name for the medium, use every day to make phone calls and send fax.

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

Reason: presently existing and readily available. Drawings 01 and 03 depict the cable layouts.

DETERMINATION OF LAN CONNECTING DEVICES

1. Hub: the design employs two hubs

Purpose: for establishing connection within the various LANs i.e parent hub. For establishing interconnection of various LANs within S.E.E.T. i.e central hub.

Reason: to achieve the star topology employed and require almost no configuration.

2. Network interface card (NIC)

Purpose: every work station and the backup domain controller (BDC) server have one 1 NIC in order to establish communication within the LANs. The primary domain controller (PDC) server have two NICs, one to achieve the purpose above and second to enable Routing of information between the various LANs in S.E.E.T. i.e. serving as a ROUTER.

Reason: it is more cost effective 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.

Reasons: PSTN is presently existing, it is inexpensive, easy to setup and maintain and support several standard vendors.

DETERMINATION OF OPERATING SYSTEM (OS)

Workstations: Windows 98

Servers: Windows NT 4.0.

Reasons: Windows NT 4.0. is optimized for file, print, and applications server for organizations ranging from workgroups to enterprise networks. It's multi user [a graphical user interface] operating system. It supports 256 remote access service (RAS) simultaneous session. Microsoft Internet information server (IIS) and fault tolerance provides and manages a secure distributed directory data base and services for end users and network administrations.

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

DETERMINATION OF PROTOCOL

TCP/IP is employed for the Intranet design.

Reason: Microsoft TCP/IP is a routable organization network protocol. Therefore, with the following configuration: a standard routable, enterprise network protocol for window NT, an architecture that facilitates connectivity heterogeneous environments, and access to the Internet and its resources.

DETERMINATION OF NUMBER OF COMPUTER SYSTEMS

The design employs 8 PC's of which 6 are workstations and 2 are servers for each department.

Server roles: primary domain controller (PDC) which maintains the master copy of the directory database for the domain. The PDC facilitates user logon.

Backup domain controller (BDC) is the second server. It holds a copy of the directory database and can assist logon or is promoted to (PDC) in the absence of (PDC).

DETERMINANT OF SERVICES

The server will contain the following services-

(a) File and print services: this will enable file transfer, storage and migration, update and synchronization and backing up of files. Also, support queue-based printing and fax services and remarkable reduction in the number of printers to be purchased.

(b) RAS (Remote Access Service) server and dial-up network services: RAS enables remote client to connect over telephone line to the network. RAS server acts as a gateway between the remote client and the network. RAS on the client side is called **dial-up networking** (DUN) which enables remote client to dial-up the network. RAS and dial-up networking enables the extension of a network beyond a single location.

(c) Internet information server (IIS) service: IIS provides users of computer with the ability to publish resources and services on the Internet and on private Intranets. IIS is used to publish hyper web pages and client/server applications, and for interactive web applications. In summary, it enables web site hosting.

(d) Windows messaging services: this service enables the setting up of e-mail system, which is internal, or privates to the network in addition fax facilities are also established.

22

EXTENSION NETWORK DESIGN OF NUNET OFFICE

1. LAN architecture = client-server

2. Network type = Ethernet network

3. Topology =star topology

4. Media/cable type = (a)10 base T category 5 (UTP) cable to connect all the PCs in the NUNET office (b) PSTN to connect NUNET office to other LANs and PCs in the university.

5. Number of computer systems and roles: seven workstations, two servers: a primary domain controller (PDC) and a backup domain controller (BDC). Total number of computer system in NUNET office are nine.

6. Workstation specification.

Hard disk capacity 2GB

RAM capacity 64MB

Processor speed Pentium II 300MHz

Network interface card (NIC) 10/100 3 com fast Etherlink XL

Internal Modem :Rockwell soft 56 data, fax speaker, phone PCI modem 56.6kbps.

Monitor: 14" SVGA

Operating system (OS) windows 95/98

Protocol :TCP/IP

File system: File allocation table (FAT)

7. Server specifications

Compaq prosignal

Processor speed: Pentium 400MHz

RAM capacity:196MB

Hard disk capacity: 4.8GB

Monitor:14"SVGA

Network interface card (NIC):10/100 3com fast Etherlink XL.

Operating system (OS): Windows NT 4.0

Protocol: TCP/IP

File system: New technology file system (NTFS)

8   Number of external modems is nine.

One attached to the BDC for the purpose of internal access. The other eight are connected via a digital port 8em to the PDC for the purpose of communication within the university (Intranet).

9. NUNET office services

i.   File and print server services

ii.   RAS server services

iii.   Messaging [e-mail and fax] services

iv.   Internet services

v.   Gateway services for the university networks

vi.   Web site hosting. Drawing of depicts cable and site layout of NUNET OFFICE.

CHAPTER THREE

IMPLEMENTATION, TESTING, RESULTS AND DISCUSSION OF RESULTS

3.1   INTRODUCTION

Successful implementation 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   PREPARATION, INSTALLATION AND CONFIGURATION OF SERVERS

(A)   PREPARATION 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 NIC = 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 CD-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:

1.   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. Wire 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 compatible transports protocols 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, EEDOMAIN was typed in the Domain filed.

V. To finish installation, the time zone and date, were corrected and closed. Next the video adapter were tested and the ERD was 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   =   NIL

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

IP address consist of 32 bits in groups of octets (8-bit), it's used 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: Its 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 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

(E)   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 selected then OK. Next, the Workgroup, Post office, User mail account, Account Profile and Microsoft inbox in the control panel.

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

(F).   INSTALLATION AND CONFIGURATION OF WORKSTATIONS

All the six workstations were upgraded by adding NIC to each.

(a)   INSTALLATION AND CONFIGURATION PROCESS.

I.   The workstations were shut down then the NICs were placed in the PCI expansion slots. 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 systems were restarted, Network Neighourhood 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 was achieved by enabling obtaining IP address from DHCP server.

(b) HARDWARE CONFIGURATIONS

Clone systems were used for all workstations

Processor speed = Pentium 233MHZ MMX Tech.

Memory (RAM) Capacity = 32 MB

Hard disk capacity   = 4GB

10Mbps full duplex Ethernet NIC (upgraded)

(G) 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 service tab was 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 as "YEARBOOK" was placed into the WWW root home directory on the web server.

(H) 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.

(I) ESTABLISHING CONNECTION BETWEEN COMPUTER SYSTEMS WITHIN EELAN.

These include the choice of cable, the preparation, installation of cables, hubs, types of wall plates and data outlets.

(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 measurement and location 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.

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 (labeled 03) was taken after considering the location and number of computer system and data outlet to enable easy visibility and accessibility.

32

Twohubs (9-ports 10baseT Hub) were installed 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, and radio frequency sources. During installation and 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 |
CABLE LABEL	CABLE LENGTH (M)	CABLING TYPE	JACK 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

33

SF = single face RJ45 wall Jack

DF = double face RJ 45 wall jack

Number of SF = 8

Number of DF = 4

3.3.2 NETWORK ADMINSTRATION.

Network Administration is a process of maintaining, operating and enhancing the network Administration tasks are 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 Manager for Domains.

Three groups accounts were created, each has its 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 Tables of Accounts

Group User account Account	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	Nwolu		
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 3.4 for testing and result of continuity test

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 DOMAIN 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

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 3.6).

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

37

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

Table 3.7   **RESULTS OF PINGING COMPUTER B (LAN 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 "yearbook 2000" located in the directory \WWW 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. HTTP./WWW EE.FUT.EDU. Enter was clicked to execute URL.

RESULT AND DISCUSSION OF RESULT

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

3.6   RELIABILITY ANALYSIS

The aim of this analysis is to find out the probability that the intranet will 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 Hardware/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

CALCULATION FROM FAULT TREE ANALYSIS (F. T. A)

Assumption: Total EELAN failure is equivalent to other LANs failure

A_1 = Probability of EELAN failure

A_1 = 1 – [1-0.006][1-0.012][1-0.012][1-0.002][1-0.031][1-0.09]

$\qquad$ =   1-0.85387   =   0.46122

A_2 = Probability of Total LANS failure = $[A_1]^5$

A_2 = $[0.146122]^5$ = 6.66152×10^{-5}

B = Probability of Hub(2) failure

F(t) = Probability of total Intranet failure

F(t) = 1- [1-A_2][1-B] = 1-[1-6.66152 x 10^{-5}][1-0.006] = 1-0.993933 = 6.0662×10^{-3}

R(t) = Reliability of Intranet = 1-6.0662 x 10-3 = 0.993933 = 99.39%

Annual failure rate of Intranet

Assuming Exponential function distribution

λ = failure rate $\qquad\qquad$ t = annual period

λ = -lnR(t)/t = -ln(0.993933)/1

λ = 0.006084/year = 0.6084%/year

Mean Time Between Failure (MTBF) = $1/\lambda$ = 164.3 years

40
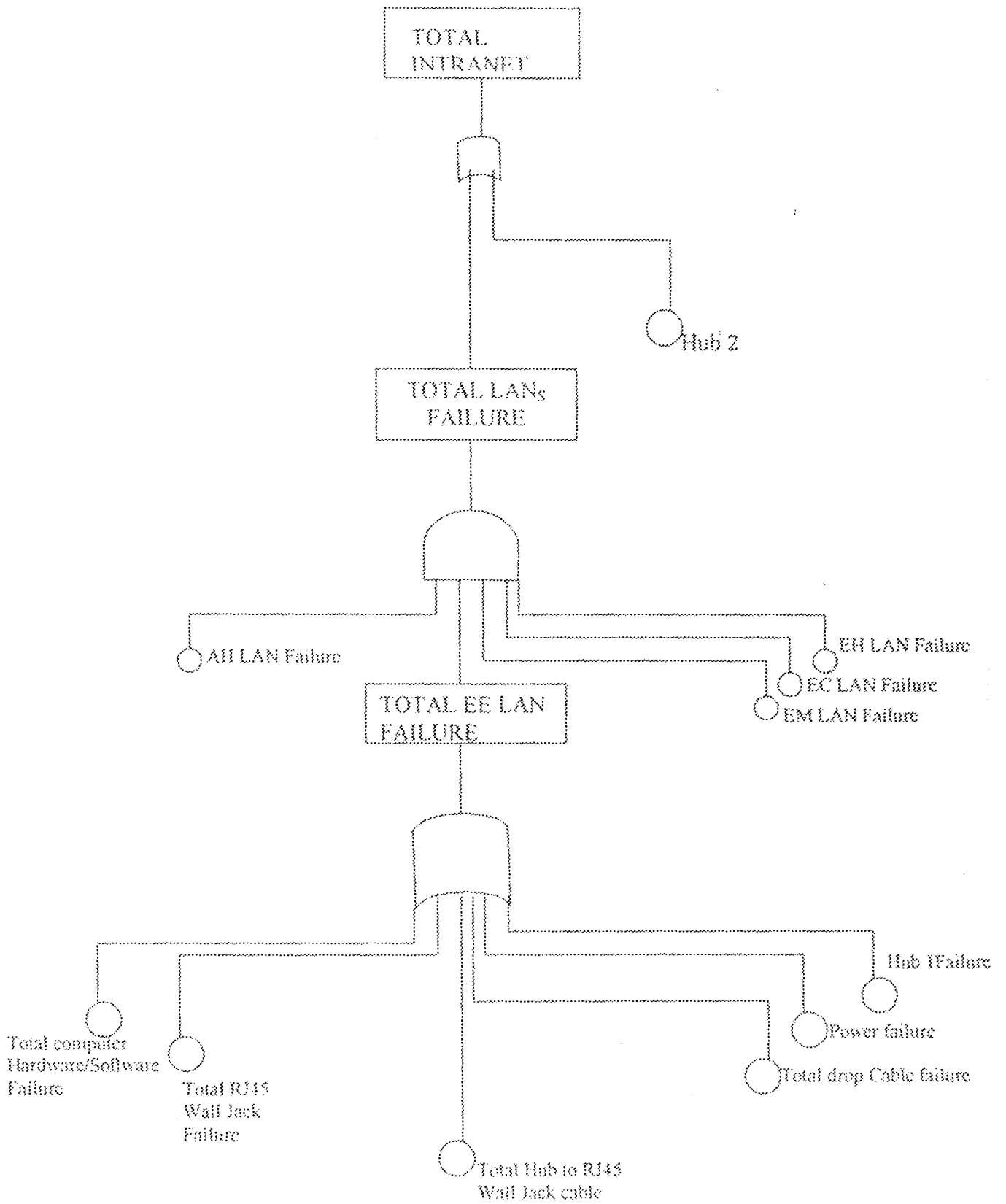
CHAPTER FOUR

CONCLUSION AND RECOMMENDATIONS

4.1 CONCLUSION

After proper configuration of the available systems and installation of the Window 98 and Window NT (New Technology), a peer to peer network and client server network were accomplished at the Electrical and Computer Engineering Department. The design of the Intranet was done based on the available facilities.

4.2 RECOMMENDATIONS

In order to understand the complexity of technology involved in data communication, the department should have a library that will be furnished with books that are up to date in data communication.

The networking available at the department should be used as instructional materials to teach students on the rudiment of networking. Since the implementation of the design could not be presently realized due to financial constraint, the university should sponsor students who may develop interest in its implementation, in the nearest future.

Moreover, in order to eradicate the idea of sending files and document manually by hand from one department to another in the school of engineering, the implementation of the Intranet should be executed very fast.

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   PP 5, 14-16, 76-86, 105-107.

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GENERAL SITE LAYOUT
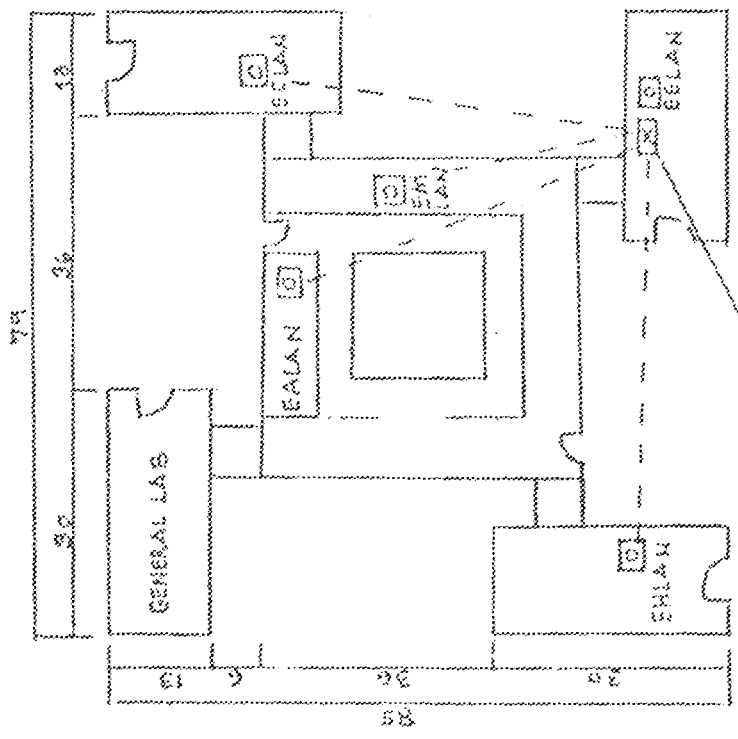
GENERAL LAB

NINET OFFICE

K E Y

☒	17 PORT HUB
◎	LAN
∿	MODEM CONNECTION
----	10 BASE T CONNECTION

EELAN SITE LAYOUT

Project Title:
DESIGN AND IMPLEMENTATION OF INTERNET WITHIN E.E.E. FLAT MX

Department:
ELECTRICAL/COMPUTER ENGINEERING

Names:

	No:
ABU H.F.	92/4391 EE
VICTOR Y.S.	95/4466 EE
ADAMU B.A.	95/4391 EE
FASHADE J.O.	95/4494 EE
TAYO B.A.K.	95/4633 EE

Supervisor:
Engr. I.A. DANJUMA

Course Code: EEE 515/525

Date: December 2000

Drawing no: 02
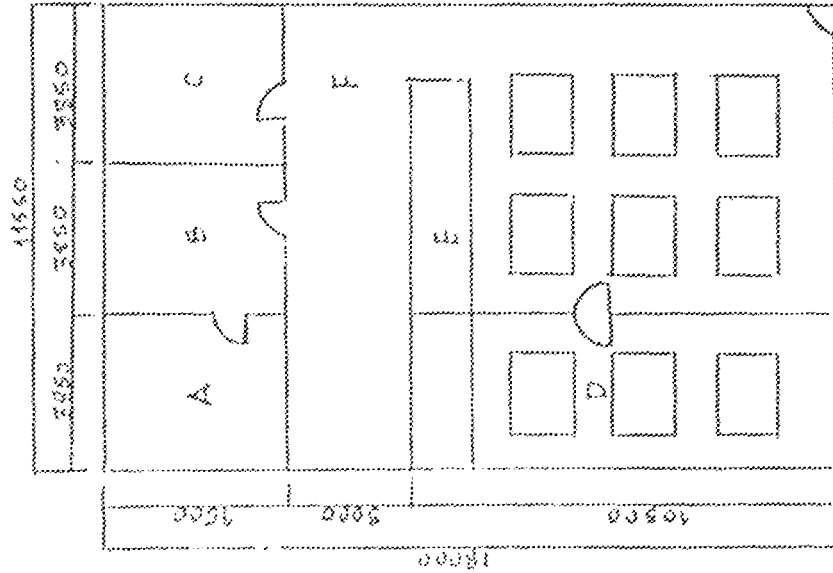
K E Y	
A	Lecturer's Office
B	Secretary's Room
C	Technician's Office
D	Computer Center
E	General Classroom
F	Machine's Laboratory

E_LAN CABLING LAYOUT

KEY
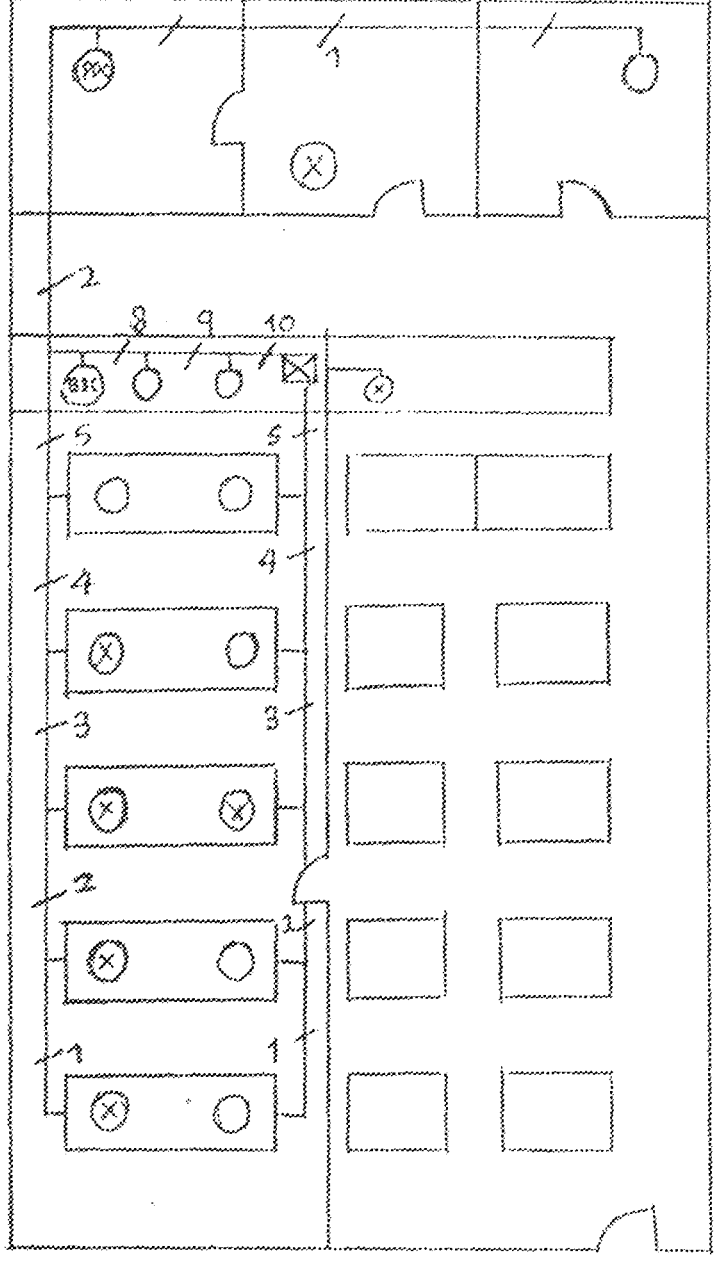
Symbol	Description
X	17 PORT HUB
⊗	EXPECTED COMPUTER
O	EXISTING COMPUTER
(PDC)	PRIMARY DOMAIN CONTROLLER
(BDC)	BACKUP DOMAIN CONTROLLER
⌐	NUMBER OF CABLES

SITE AND WIRING LAYOUT FOR ENGINE FUTURE

INTERNET

PDC

W W

BDC

W

W W

9000

11500

3500

16000

Project Title

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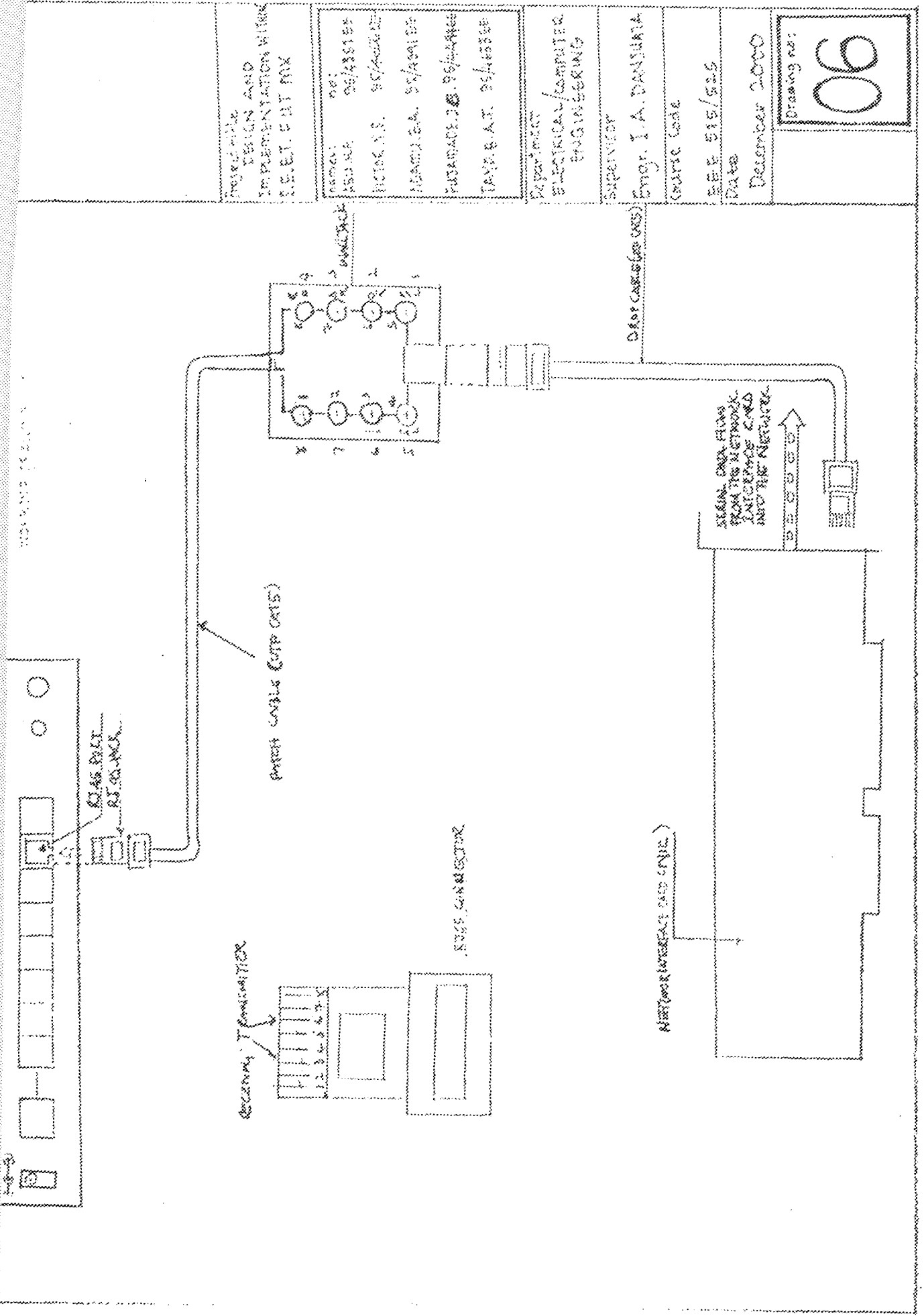FUT MX

names:
ABU H.P.   95/43818B
VICTOR Y.S.   95/44562CD
ADAMU B.A.   95/43811EE
EDSAMAGE J.O   95/44949EB
TAYO B.A.T   95/46355C

Department
ELECTRICAL/COMPUTER
ENGINEERING

Supervisor
Engr. I.A. DANJUMA

Course Code
EEE 515/515

Date
December 2000

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

10 BASET CAT5 UTF CABLE
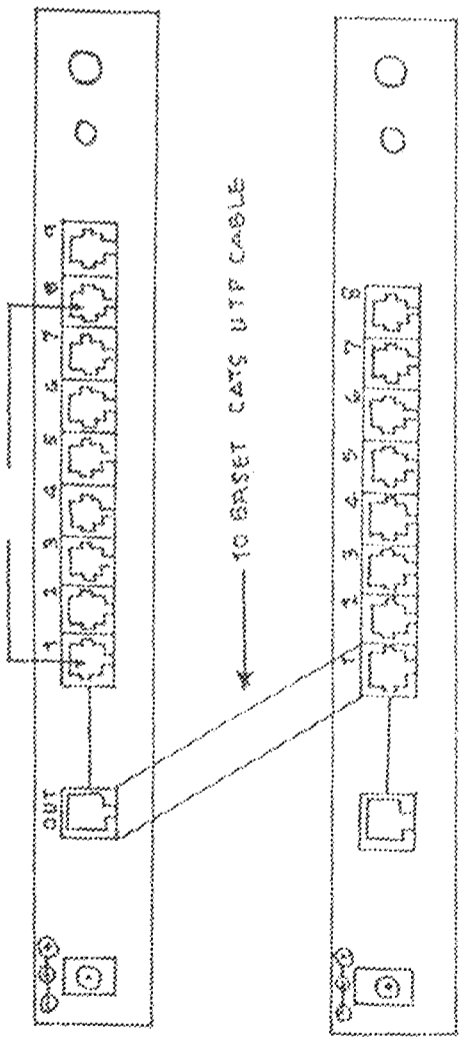
Project title:	
DESIGN AND IMPLEMENTATION OF INTERNET WITHIN F.U.T. MX	
Names:	no
A.SU.F.M.	95/4351 EE
VICTOR. V.S.	95/4456 EE
ADAMU.G.A.	95/4431 EE
FUGAMADE J.R.	95/4449 EE
TAYO. G.A.T.	95/4453 EE
Department:	
ELECTRICAL/COMPUTER ENGINEERING	
Supervisor	
Engr. I. A. DANJUMA	
Course Code	Drawing no:
EEE 515/525	05
Date	
December 2000	

50 OHM RJ45 JACK

PATCH CABLE (UTP CAT5)

BINARY TRANSMITTER

RJ45 CONNECTOR

NETWORK INTERFACE CARD (NIC)

D type cable (for VDU)

SERIAL DATA FLOW FROM THE NETWORK INTERFACE CARD INTO THE NETWORK