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

BY

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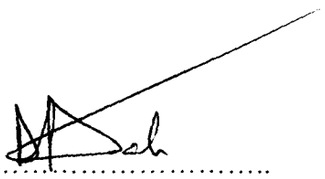
CERTIFICATION

This is to certify that this project was carried out by Tayo-Balogun Ayotunde T. of the department of Electrical And Computer Engineering, Federal University of Technology, Minna under the supervision of Engr.Danjuma Isah.



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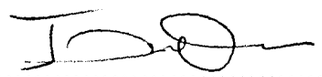

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External Examiner.

17/1/2005

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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 All information derived from published & unpublished works have been duly acknowledged.

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Tayo-Balogun A. T Date

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DEDICATION

This project is dedicated to Jehovah without whom there will be no life of any form and hence, no need for this project By whose mercy and favour I live to complete my Bachelor degree programme; and to my parents for their love and continual assistance, my mother for being my best friend.

ACKNOWLEDGEMENT

My profound gratitude goes to God, without whom a man is nothing. To my father for being there.

My gratitude goes to every member of my family for being there for me all the time. My appreciation goes to my grandparents and my mother for placing so much trust in me and letting me be myself, and for setting my feet in the right path.

My thanks go to Adesola without whose support and attention I would have finished writing in half the period I did.

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Appreciation to my friend, Fujamade the power guru, who, were it not for me would have preceded on a power project. To my other teammates Babi, Victor and Francis for being great sports.

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To Moshood, Steve, Azeez, George, Hezzy and Demola. To my Uncles: Ayodele, Ayodeji and Uncle Sheyi. My gratitude goes to so many others that space would fail me to mention here. God knows you and he will reward you accordingly.

ABSTRACT

This thesis is a report representing the preliminary study and methods used in the design and implementation of an intranet for the school of Engineering & Engineering Technology, Minna.

The objectives of this project is to provide interconnectivity for every computer system within the school of Engineering and Engineering Technology and also to provide an avenue for students to learn more about Network and Network applications so they can apply it to the internet technology and Telecommunication systems.

Evolution and a brief historical background of Networks and also the need for interconnectivity are all briefly mentioned in this report. The concept of computer networking is also treated briefly.

The implementation is effected using window NT server software or the servers and windows 95 and 98 for clients/ workstation. The cable type used is the Unshielded Twisted Pair and the procedure adopted is the Ethernet topology.

Tests were conducted and results obtained were outlined and discussed. Recommendations were made as deemed necessary.

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CHAPTER ONE

GENERAL INTRODUCTION

1.1 INTRODUCTION

Every field of human knowledge has, at least, one aspect where the application of computer technology could improve its performance, efficiency and productivity. The computer technology has useful application in Medicine, Architecture, Engineering, Banking and Psychology, just to mention a few. Computers do not all have the same capabilities: some have lots of space for storage and also will process information at very high speeds wholesome others may have lesser storage capabilities and still less processing speeds than the previous sets. Two computers may have nearly the same specifications that is storage capabilities, processing speeds, etc; while one of them runs a very important and expensive software that the other does not have.

A user working on one system may need to access some information that can only be obtained form another system, or he may need one of the resources that is only available on another system e.g a CD drive, a printer, internet access, etc. To overcome these constraints, the concept of connectivity comes into play. Connectivity, in this context, is another word for networking, and a network may be defined as a system consisting of interconnected entities.

A network could be a complex interconnection of roads, of nerves in the human body, or of circuit elements in an electrical network. In all the previously cited examples, there exists a common relationship: an entity on a network is connected to at least one other entity on the same network. In the same vein, computer network have one computer connected to at least one other computer (or other network device) on the same network, for the purpose of resource sharing and /or information exchange.

With this in mind, coupled with the fact that technology brings about improved productivity and efficiency to every level of human endeavour, it now becomes expedient

to undertake an exhaustive study of computer networking to improve efficiency productivity and reliability of computer networks.

1.1 AIMS AND OBJECTIVES.

The aims and objectives of computer network are to establish communication between the interconnected systems are devices to allow for the sharing of devices and resources e.g fax modems, expensive color printers, etc; and to facilitate information exchange.

For the design and implementation of an intranet for the school of Engineering, the aims and objectives are:-

(a) To facilitate communication among the various departments in the school of Engineering.

(b) To create avenue of self-improvement for students by making special servers available for each department in the professions for each and department are stored so students could have awareness.

(c) To create an avenue for development or students by exposing them to using web – development tools to create sites on the Internet,

(d) To enhance the ease of information dissemination for students Engineering bodies e.g NECESA, NUESA, etc,

(e) To try out the possibility of Real-time communication on the intranet

(f) To develop students' (especially the ones in Electrical and computer Engineering Department) programming skill by letting them learn how "hacking" is carried out on the intranet using the TCP/IP protocol

(g) To give an avenue for social club to disseminate information.

(h) To make the compilation of result easier for lecturers, as they would have direct access to look-up students' result in other departments.

(i) To make it possible for the various departments to have electronics libraries so that more than one person can have access to a book at the same time

1.2 LITERATURE REVIEW

Computer networks, generally speaking, is all about information transfer and communication between two or more systems (computer system, that is). We are now in the Internet age, and in using computers for data transfer and resource sharing, communication equipment plays a very important role. This is because they are responsible for conveying data/ information between computers and all attached resources.

Electrical communication began in the 1800s, when wheatstone and cook [1] invented the telegraph. This relied on the interaction of an electric current with a pivoted magnetic needle, which moved to indicate the presence and direction of an electrical signal in a line connecting the sending device to the receiving device. The demerits, however, are that there is signal attenuation with distance and there is induced electrical interference.

In 1835, Samuel Morse [1] advocated a more improved system. He was able to mark a moving strip of paper corresponding to the duration of current sent along a transmission line, through an ingenious combination of an electric magnet and an iron phringe carrying a writing device. This was referred to as the Morse Code. Morse Code was further built upon by Marconi [1] as he applied it to radio transmission.

With the increase in civilization, it became apparent that business and public communication demanded a set up capable of handling rapid dialogue between users or systems and also not requires translation or the intervention of a skilled operator to work. In 1876, Alexander Graham Bell [1] invented the telephone, which provided the basic technique to meet the earlier requirements. The evolution of a complex

Telecommunication network linking more than 6000 million users world wide, each capable of communicating with any other irrespective of geographical locations.

As the needs arose, for information exchange between computers and remote terminals, there arose a new dimension to electrical communication until the early 1960s, the telephone network was used, almost entirely for speech communication. The national telephone network provided a means of digital data transmission. However, one of its demerits is the inability of the telephone network to carry a dc signal level and the electrical interference present, which, although, is immaterial in speech communication, poses severe problems in digital transmission (i.e transmission of signals in discrete form as opposed to continuous form-analog).

These problems were solved by the development of modems (modulator/Demodulator), which enable digitals signals to be converted to analog forms of transmission over phone networks. The attachment of a modem to a normal (POTS-pure Old Telephone system) phone line has enabled the existing telecommunication networks to play a significant part in the connection of computers to remote terminals and other computers.

In 1969, he US Department of Defense set up the Advanced Research Project Agency Network (ARPANET) [2], which was to facilitate communication between research organizations and universities. This constituted the first major breakthrough in the world of computer networks, and the Internet emerged as an offshoot of the ARPANET.

As the need for networking increased, there arose the need to facilitate connectivity between computers made by different manufacture Based on this, the International Standards Organization (ISO) which in 1977 established a set of specifications referred to as the Open Systems Interconnections (ISO) which is a form of protocol defining a standard to be met for any system to exist on a network. [3]

With the emergence of the ISO specifications different kinds of networks were developed, mainly based on the distance covered by the physical networks. The network kinds are:

(i.) The Wide Area Network (WANs), which span an area of over fifty Kilometers (50km).

(ii.) The Metropolitan Area network (MANs) spanning between six to fifty kilometers (6 – 50km)

(iii.) The Local Area Networks (LANs) spanning about five kilometers (5km).

Based on the LANs, there are several networks standards, namely: Token Ring, Ethernet, ARCnets etc. These classifications are made based on how the computers on the network are physically interconnected and the kind of hardware employed.

For this analysis we use the Ethernet kind of network.

The Ethernet networks have a certain number of computers that could be connected on a network. If this number is exceeded, the network's performance begins to depreciate appreciably, thus an Ethernet LAN may be broken down into several parts interconnected one to another. This is called network segmentation (4). This way it is possible to connect more computers on a network without compromising the networks performance while each segment maintains its networks abilities.

When networks are implemented using the method above, where all the segments belong to the same establishment, it is called an Intranet.

CHAPTER TWO

2 NETWORK AND THE INTRANET CONEPT

2.1 Introduction.

Small Networks are easy to mange, relatively easy to maintain and usually operate as one logical connected unit. As the networks grow, more cabling is done and more computers are added. However, a point is reached when any addition to the network causes a drastic reduction in network performance and efficiency. The upper limit of any network depends on the network architecture and topology. When the performance of a network starts to drop heavily due to network traffic, the network should be broken into smaller segments.

Segmentation is the act of breaking a network into smaller sub-nets (Sub-networks) so that each sub-net can exist as a separate entity while also forming a part of a larger (parent) network.

When various sub-networks belonging to a particular organization are linked together they form a larger network referred to as an intranet. The intranet phenomenon reduces traffic problems as each sub-net may exist independent of all other and also the number of nodes on an intranet may far exceed the number that would normally exist on a single LAN.

2.2 OSI NETWORK STANDARDS AND PROTOCOLS

An intranet is made up of interconnected LANs. A LAN is made up of interconnected computers. In a LAN, there is information exchange between connected computers and consequently there has to be a set of rules governing how different parts of the network interacts to allow devices communicate with one another. These set of rules are referred to as protocols. Protocols determine what routing information is included with the transmitted data to ensure proper reception by the sending device.

Generally, protocols must be able to evaluate the network's performance, identify and try to correct errors transfer data, facilitate physical connection and enable projected expandability.

There are several existing protocols presently. A protocol suite consists of protocols that evolved together or are used in the same environment, some protocols are listed below:

(a) Network IPX/SPX protocols

(b) Internet protocols

(c) Apple Talk protocols

(d) DNA (Digital Network Architecture) protocol

(e) SNA (System Network Architecture) protocols

(f) Miscellaneous protocols.

The Internet protocol suite is the most widely used of the existing protocols. The Internet protocol (IP) suites is made up of the transmission control protocol (TCP) and the internet protocol (IP). The TCP/IP protocol is resident in the memory of a Network interface Card (NIC). TCP and IP work together. On any network using TCP/IP, IP makes sure that the transmitted data is passed through the correct part (routine while the TCP processes the sent data so that they may be comprehensive to the receiving device. [5]

The Open System Interconnection (OSI) reference model was formed by the International Standards Organization (OSI) I 1977. The term 'Open' denotes the ability of any two system conforming to the reference model and associated standards to be able to interconnect. I.e., the systems can connect because they have implemented a common set of protocols.

The OSI reference model has seven layers. Each layer is responsible to the layer directly above it i.e. it takes data/information from layer above and pass it to the layer below or vice versa as required.

(1) The physical layer

(2) Data link layer

(3) Network layer

(4) Transport layer

(5) Session layer

(6) Presentation layer

(7) Application layer

THE PHYSICAL LAYER

This layer deals with the physical interface between devise and the rules by which bits are passed form one device to another. Provides foundation other layers will build on. Concerned with fundamentals like pin connection and electric voltage levels.

THE DATA LINK LAYER

The data link layer makes it possible to move data over the physical layer, the data link layer creates a packet to hold information being transferred. Its provides low level addressing scheme and also handles the phenomenon known as the bake off algorithm, a situation that applies to Ethernet networks. The data link layer is equivalent to the network Adapter Driver [5].

THE NETWORK LAYER

This layer provides a most efficient way to communicate between networks, providing the route that a particular information will take to get to its destination. It also takes care of network traffic to prevent congestion as much as possible.

THE TRANSPORT LAYER

This layer is responsible for braking information into datagrams for transmission to the destination computer over the physical layer through the network layer and also the re-assembly of datagrams received via the network layer. It sends acknowledgement signal, acknowledging the receipt of information sent by a source computer. It also performs error-corrections.

THE SESSION LAYER

This layer manages connection sessions between applications on two reputable computers and guarantees that packets are delivered successfully. The session layer provides for Data synchronization and check pointing so that in an event of network failure only data sent after the point of failure need be re-sent.

THE PRESENTATION LAYER

This layer translates data between the format the network require and what the computer expects. Does protocol conversion, data encryption and translation for the application layer. It prepares data for transmission and compresses the data to be transmitted when necessary to increase speed.

THE APPLICATION LAYER

This provides the final interface to the network that users use to access network services.

2.3 TYPES OF NETWORKS

Networks are divided into two major types based on the roles of computers attached to them. These are:

(1.) The client –server networks and

(2.) The peer to peer networks

THE CLIENT-SERVER NETWORK

This network type consists of computers which make use of the network resources (client) and a more powerful computer that provides resources, services requests from the client computers, sometimes provides file storage and printing services and so on. The latter is referred to as the server.

For large networks it may become necessary to have more than one server so that the efficiency of the network does not wane due to the inability o one server to service all

the requests if receives. It may also be necessary to have more than one server when some of the applications client computers need cannot be concurrently contained on the main server.

Some of the various server types we have are:

1. File server
2. Print servers
3. Application servers
4. Message servers

(i). FILE SERVER

This server type offer services that allow network users to share files. There services types are the network application store, retrieve and move data with this service, users can exchange, read, write and manage shared files.

(ii). **THE PRINT SERVER**

These allow users to share printers. Printers could be located anywhere on a network. Also helps achieve efficient office workstation performance by using high speed network data transfer, print queues and spooling. Allow users to share network for services. Allows multiple and simultaneous printing.

(iii) APPLICATION SERVERS

Allow clients computers to access expensive software applications residing on any shared computers. Specialized servers may be added to a network or the purpose of providing specific applications.

(iv) .**MESSAGE SERVER**

These are similar to file servers but different in the sense that data transfer between computers may take the form of digitized video, graphics, text or binary data.

THE PEER-TO-PEER NETWORK

In peer-to-peer networks computers both use and provide network resources. Unlike the client server network, peer networks are defined by a lack of central control over the network.

Peers are not optimized to share resources. When a number of users are accessing resources in a peer, the user of that peer notices a significantly degraded performance.

2.4 NETWORK TOPOLOGY

The fashion in which the devices on a network are interlinked, one to another is referred to as the network topology. Topology also describes the physical layout of a network and how cables are run between devices on the network,

The common topologies are listed below:

(a) The bus topology

(b) The star topology

(c) The ring topology

(d) The mesh topology

(a) The Bus Topology

This is often used when network is small, simple or temporary. The bus topology is a passive topology because no active electronics amplify the signal or pass it along form computer to computer. All the computers are connected in a line. When one computer sends a message all other computers on the network receive it out only the one with address matching the one encoded in message accepts the information, other discard it.

Only one computer can send a message at a time hence the numbers of computer attached to a network affects the network speed. Also, a computer has to wait until the bus is free before it can transmit. The ends of the bus network are fitted with network equipment called terminators.

These devices serve to absorb the electric signals traveling along the bus in form of message without terminating the transmitted signals bounces back and forth colliding with any other transmitted signal and corrupting it.

MERITS AND DEMERITS OF THE BUS TOPOLOGY

1. For very small networks, the bus in simple reliable, easy to use and understand.
2. The bus topology is very cheap considering cabling
3. It is easy to extend
4. A repeater can be used to extend the bus as it boosts the signal, allowing it to be able to travel further down the bus.
5. Heavy traffic slows the bus considerably
6. Each connector on the bus weakens the signal consideration
7. It is difficult to trouble shoot a bus.
8. The Star Topology

In a star topology, computers are connected by cables to a central point. The connecting device is called a hub. Each computer communicates with a central hub that resends the message to either all the computers (broadcast star network) on destination computer (switched star network). If the hub is active it to regenerates the received signal and sends it as appropriate where as passive hubs just server to link all the computers together.

MERITS AND DEMERITS OF THE STAR TOPOLOGY

1.Ease of modification and expansion of network without disturbing the rest of the network.

2.Network faults may be easily diagnosed at the centre of the star network.

3.Single computer failure does not necessarily being down the whole network.

4.Several cable types may be accommodated on the star network depending on the hub type

5. The failure of central device brings the network down
6. Network may require a device at the central point to broadcast or switch network traffic.
7. Cabling cost more as all cables must be pulled to a central location.

(c) **The Ring Topology**

In a ring topology computers are connected in a circle with one computer connected to at least two others.

In the ring network, message signal flows in one direction going from one computer to the next, until it reaches the destination computer. Each computer retransmits the message to the next computer hence; the ring is an active network. Some ring networks do token passing. Here, a short message, called token, is passed around the network and any computer wishing to transmit gets the token, adds electronic address of the receiving computer and data to be transmitted then sends the token on to the next computer which passes it one until it reaches the destination matching the electronic address it bears. The receiving computer sends a message back to indicate reception of message.

MERITS AND DEMERITS OF THE RING TOPOLOGY

1. Failure of one computer in the ring affects the whole network
2. Difficult to trouble shoot
3. Adding or removing computer disrupts the network
4. No computer cab monopolize the network
5. Fair sharing of the network allows the network to degrade gracefully more users are added.

(d) The Mesh Topology

In the mesh topology, every computer is connected to every other computer on the network. There exist redundant links between devices and this makes the network unmanageable beyond a very small number of devices.

MERITS AND DEMERITS OF MESH TOPOLOGY

1. Easy to troubleshoot and fault tolerant
2. Transmission media's failure has less impact than for other topologies
3. Redundant links makes it possible to send data over several different path
4. As number of devices increase, installation and reconfiguration gets more difficult
5. Guaranteed communication channel capacity.
6. High cost of maintaining redundancy links.

2.4 TRANSMISSION MEDIA

Transmission media in networks refer to services that are used to convey information from one point to another on the network. These devices may be tangible e.g. cable or intangible i.e. wireless devices.

(a) CABLE MEDIA

With the exception of Fibre Optics, cable media have central conductor enclosed in a plastic jacket. They are typically used or connecting small LANs. The cable types are:

1. Twisted pair cables
2. Coaxial cables
3. Fibre optic cable

1. Twisted pair cables exist in two form, viz:

1. The shielded twisted pair and
2. Unshielded twisted pair

The shielded twisted pair cables consist of none or more pair of two twisted copper cables. When copper wires those are close conduct electrical signals each wire produces interference in the other. This interference is also called cross talk. Copper wires conveying electric signals are also susceptible to interference from external sources. Twisted pair cables are wound around each other so that emitted signal from one wire cancel out the one in the other wire and also blocks external interference. A twisted pair cable consists of one or more twisted pairs in a common jacket.

The unshielded twisted pair cable consist of a number of twisted pair a simple plastic casing based on quality grade, the Electrical industries Associations divides UTP (Unshielded Twisted Pair) into different categories as defined below:

* Category 1: Originally meant for voice communication but can support low data of less than 4 megabits per second (4mbps). Older telephone networks used category 1.
* Category 2: Same as in category 1
* Category 3: Suitable or most computer network. Offers data rate up to 16mbps. Currently used in most telephone installations.
* Category 4: Offers data rates up to 20mbps
* Category 5: offers 4enhancement over category 3, such as support for fast Ethernet, more insulation, and more twists per foot. It however requires compatible equipment and more diligent installation.

The shielded Twisted pair:

The shielded twisted form UTP in that there is a cable shield (in form of aluminium/polyester) between the outer jacket or casing and wires. The shield makes STP cab vulnerable to EMI because the shielded is electrically grounded. Grounding the shield properly, prevents signals form getting into or out of the cable. More reliable for LAN environment. STP costs more than UTP and thin coaxial cable (coax) but less than thick coax or Fibre optics.

Requirements for special connection make STP more difficult to install than UTP. With outside interference reduced by shielding. STP can theoretically run at 500mbps for a 100 metre cable length. However few installations run at data rates of 16mbps. Node capacity limited by hubs connecting the cables together. In a token ring network, (the most common type of STP network), useful upper limit is 200 nodes in a single ring; it also depends on data traffic types. Attenuation level is same as for UTP. Reduced EMI, vulnerability to eavesdropping.

2. The Coaxial Cable.

This has two conductors that share the same axis. A solid copper wire runs down the centre of the cable, which is surrounded by Teflon insulation, a plastic foam of insulation, surrounded by a second conductor (a wire mesh tube) metallic foil. The wire mesh acts as a shield and protect the wire from attenuation than UTP and STP. Large cable diameters are employed to achieve low transmission loss. The transmission rate for coax may be 10mbps or up to 20mbps over lengths of several hundred of meters.

3. Optical Fibre.

This cable type is made up of glass or plastic core surrounded by a cladding material having a slightly low refractive index. In Optical Fibre, a light beam is transmitted along with a binary digital signal at very high bit rates. The modulated signal at the receiving end is extracted by the use of solid state light resources (photo translucent) e.g the light emitting diodes (LEDs) or photodiodes which are used in converting the light pulses into electrical energy.

ADVANTAGES

1. High transmission capacity
2. Smaller cable sizes and lighter weights
3. Immune to interference

4. Negligible crosstalk

5. Complete electrical isolation.

WIRELESS MEDIA

The main types of wireless transmission media available are the radiowave, the microwave and the infrared wave.

Radio waves have frequencies between 10KHz and 16Hz and include the following types.

The wave, very–High–frequencies (VHF), ultrahigh. Radio waves can be broadcast omnidirectionally or directionally depending on what antenna is used.

The cost of using radiowave as a transmission medium is relatively high, installation is complex, maybe vulnerable to eavesdropping. It may be designed to have high throughput, low attenuation and cover a longer range, however, should mainly be employed where it is impractical to lay cables.

The Microwaves communication makes use of frequencies between 16Hz to 300 GHz and is composed of the Ultra-high-frequency the superhigh frequency and extremely-high-frequency. These frequencies produce better throughput and performance than radio frequencies. Microwave systems use directional antennas for transmissions and reception of signals. The two antennas must also be in the same line-of-sight.

Microwave transmission is very expensive and should only be employed in areas where cabling is impossible, due to may be distance covered etc.

Infrared transmission system transmit signals using infrared light. Light emitted diodes (LEDs) or infrared light diodes (ILDs) transmit the signals and photodiodes receive the signals.

Infrared communication may be point-to-point or broadcast. They exist in frequencies of 1 Terahertz to 30 Terahertz. Infrared communication has a high bandwidth capacity (100kbps to 16Mbps at 1 kilometer). Attenuation level depends on

the quality of emitted light and atmospheric condition e.g. fog, rain etc. Point-to-point communication is immune to eavesdropping. (5)

2.6. NETWORK INTERFACE CARDS (NIC)

Network interface cards sometimes referred to as networks adapters are peripheral cards plugged into the computer motherboard and into a network cable. Network adapters convert data from the form stored in the computer to the form transmitted or received over the network cable. The choice of NIC is influenced by the choice of network.

The NIC operates at the Data link layer of the OSI reference model.
Network adapters receive data to be transmitted from the computers motherboard into a small amount of RAM called a buffer. The data in the buffer is moved into a chip which calculates a checksum value for the data chunk, adds address information i.e source and destination address after which the chunk is passed on to the physical layer for transmission. NIC determines when to permit the data across the network to prevent collision. It also converts the binary data bits into a form suitable for transmission over the transmission media.

2.7 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 with 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)

V. Agricultural Engineering (EA)

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 order to centralize 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. DETEMINATION 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, easy to install, high-speed capacity and 100 meters coverage.

(II) OPTICAL 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 (PDC) 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, and G.U.I operating system and has 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 and can assist logon or be promoted to PDC in the absence of PDC.

l. 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 acts as a gateway between the remote client and the network. RAS on the client side is called Dial-up Networking, 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 used 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

Monitor = 14" SVGA

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 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, INSTALATION 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:

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. 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.

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 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 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	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 3.4 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 t0 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

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.

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.

RESULTS AND DISCUSSTION OF RESULTS

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 LANs 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

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

= 1-0.85387 = 0.46122

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

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

B = Probability of Hub(2) failure

F(t) = Probability of total Intranet failure

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

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

Annual failure rate of Intranet

Assuming Exponential function distribution:

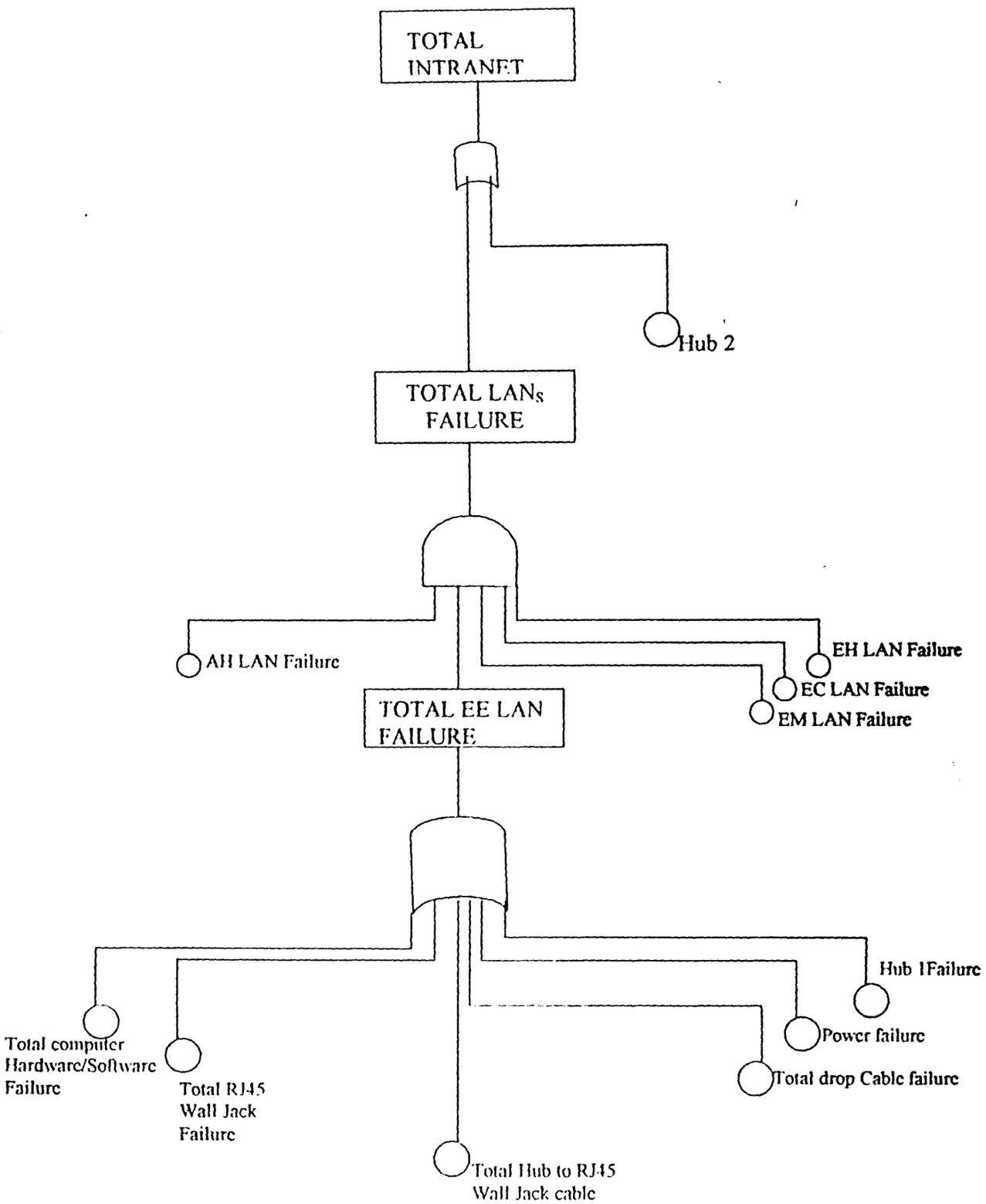
λ = failure rate t = annual period

$\lambda = -\ln R(t)/t = -\ln(0.993933)/1$

$\lambda = 0.006084$/year = 0.6084%/year

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

FAULT TREE ANALYSIS OF THE INTRANET



CHAPTER FOUR

CONCLUSION AND RECOMMENDATIONS

An intranet was designed and implemented for the School of Engineering and Engineering Technology using the 10 Base T Ethernet topology with windows NT running on the server and windows 95/98 running on the workstations.

Each department has at least one server and each of these servers are interconnected to form a present network, using a hub. The server in the department of Electrical and computer Engineering is the router/gateway linking the intranet to the NUNET office for eventual access to the Internet. As much care as possible was taken to prevent a traffic situation on the intranet without compromising the intranets efficiency.

4.1 RECOMMENDATINS

The intranet design and implementation was carried out to enhance optimum performance. In view of this, the following recommendations are preferred as they are deemed appropriate for continued efficient performance of the intranet:

i. The School should make provisions for special servers that will host different textbooks so that different people can view them at the same time.

ii. The department should introduce a course that deals with developing network applications and writing network operating systems. Students should also be encouraged to 'revise engineer' some existing network operating systems work.

iii. Due to the pace of technological innovations in Telecommunication, the intranet design and implementation should be overhauled after three years.

iv. The department should encourage the students to develop multi-player games to be run on the intranet.

v. Students should be encouraged to write programs that can protect computer systems from being hacked into a remote location on the intranet and also encourage students to develop applications that allow them to hack (gain access) into other computers systems on the intranet from remote locations.

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   F.U.T. Minna

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   Mathew S.(1996) Networking Essentials
   Microsoft Cooperation Pp 365, 103–104

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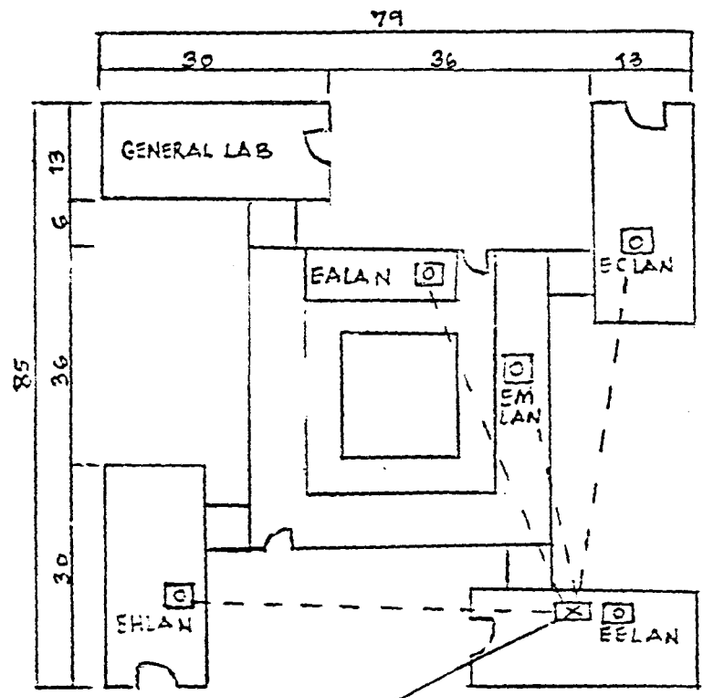
   Que www.techrepublic.com.

GENERAL SITE LAYOUT



K E Y	
⊠	17PORT HUB
▣	LAN
⫴	MODEM CONNECTION
----	10 BASET CONNECTION

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

Names:	no:
ABU. H.F.	95/4391EE
VICTOR Y.S.	95/[illegible]
ADAMU. B.A.	95/4391EE
FUJAMADE. J.B.	95/4491EE
TAYO. B.A.T.	95/4633EE

Department
ELECTRICAL/COMPUTER ENGINEERING

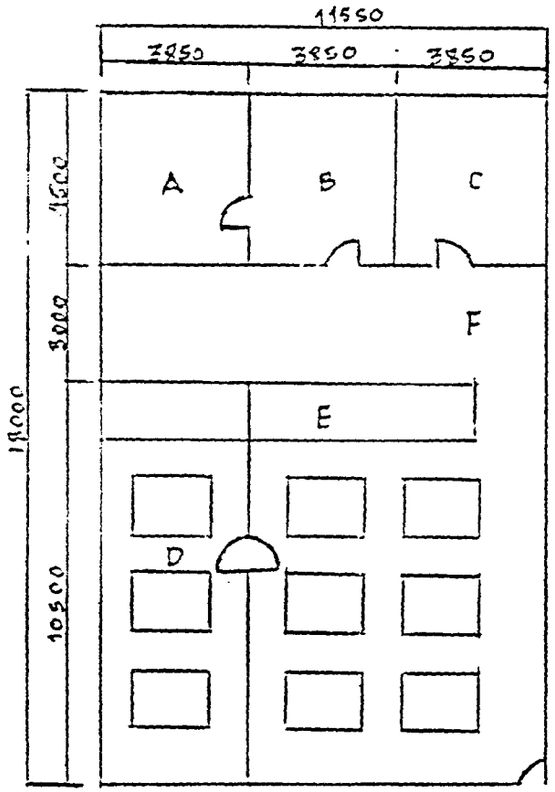
Supervisor
Engr. I. A. DANJUMA

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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Supervisor:

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Course Code

EEE 515/525

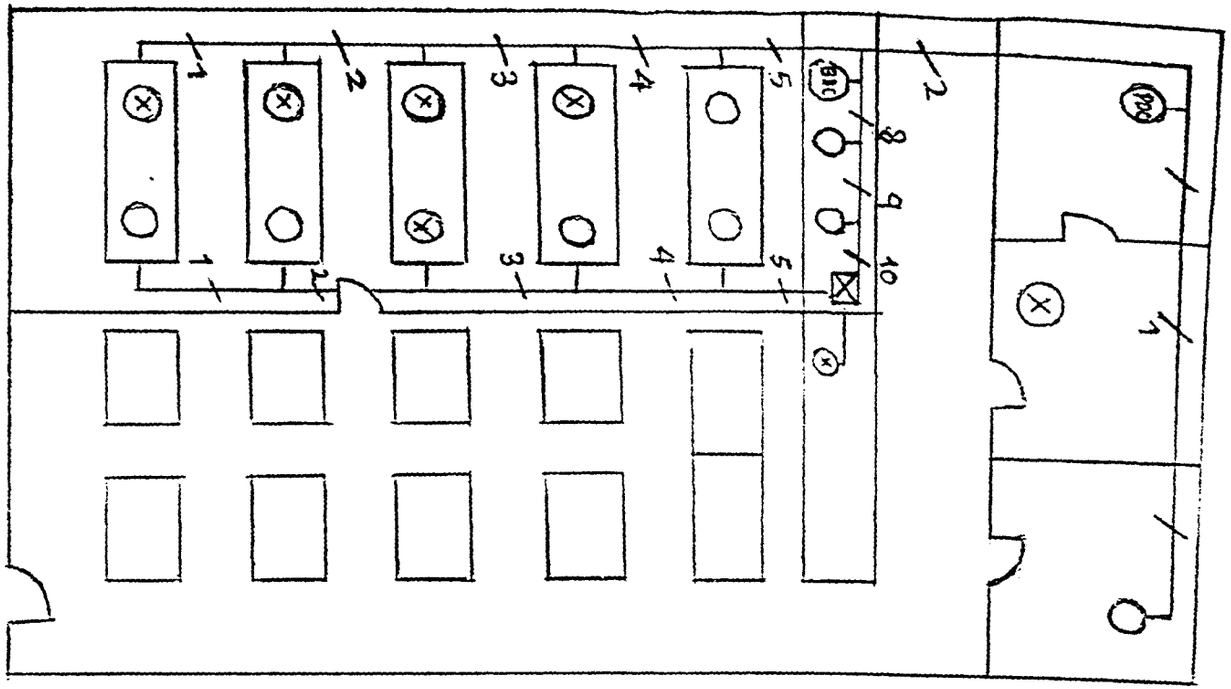
Drawing no:

02

Date

December 2000

EELAN CABLING LAYOUT



K E Y	
	4T PORT HUB
	EXPECTED COMPUTER
	EXISTING COMPUTER
PDC	PRIMARY DOMAIN CONTROLLER
BDC	BACKUP DOMAIN CONTROLLER
	NUMBER OF CABLE

Project Title
DESIGN AND IMPLEMETATION OF INTERNET WITHIN S.E.E.T. FUTMX

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

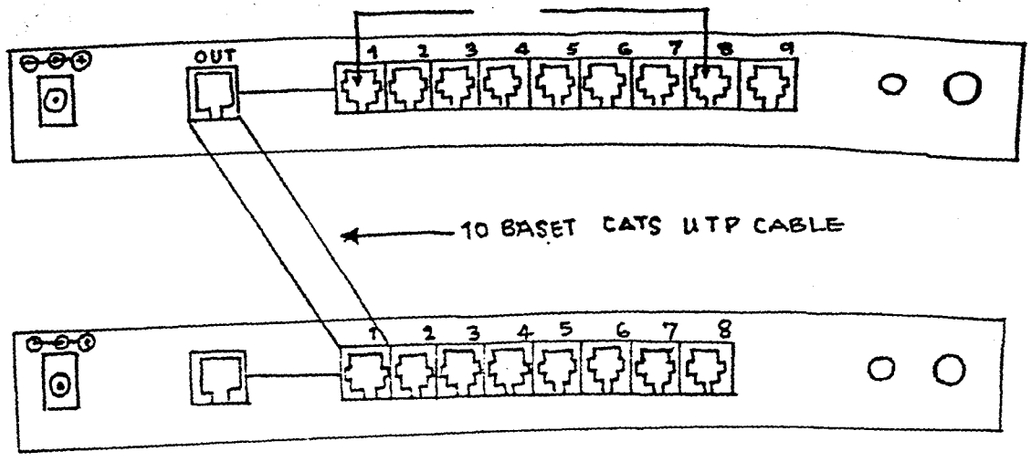
Department
ELECTRICAL/COMPUTER ENGINEERING

Supervisor:
Engr. I.A. DANJUMA

Course Code

Drawing no

CASCADING OF HUBS



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

names:	no
ABU.F.H.	95/4381 EE
VICTOR.Y.S.	95/4656 EE
ADAMU.B.A.	95/4391 EE
FUJAMADE.J.O.	95/4491 EE
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Department
ELECTRICAL/COMPUTER ENGINEERING

Supervisor
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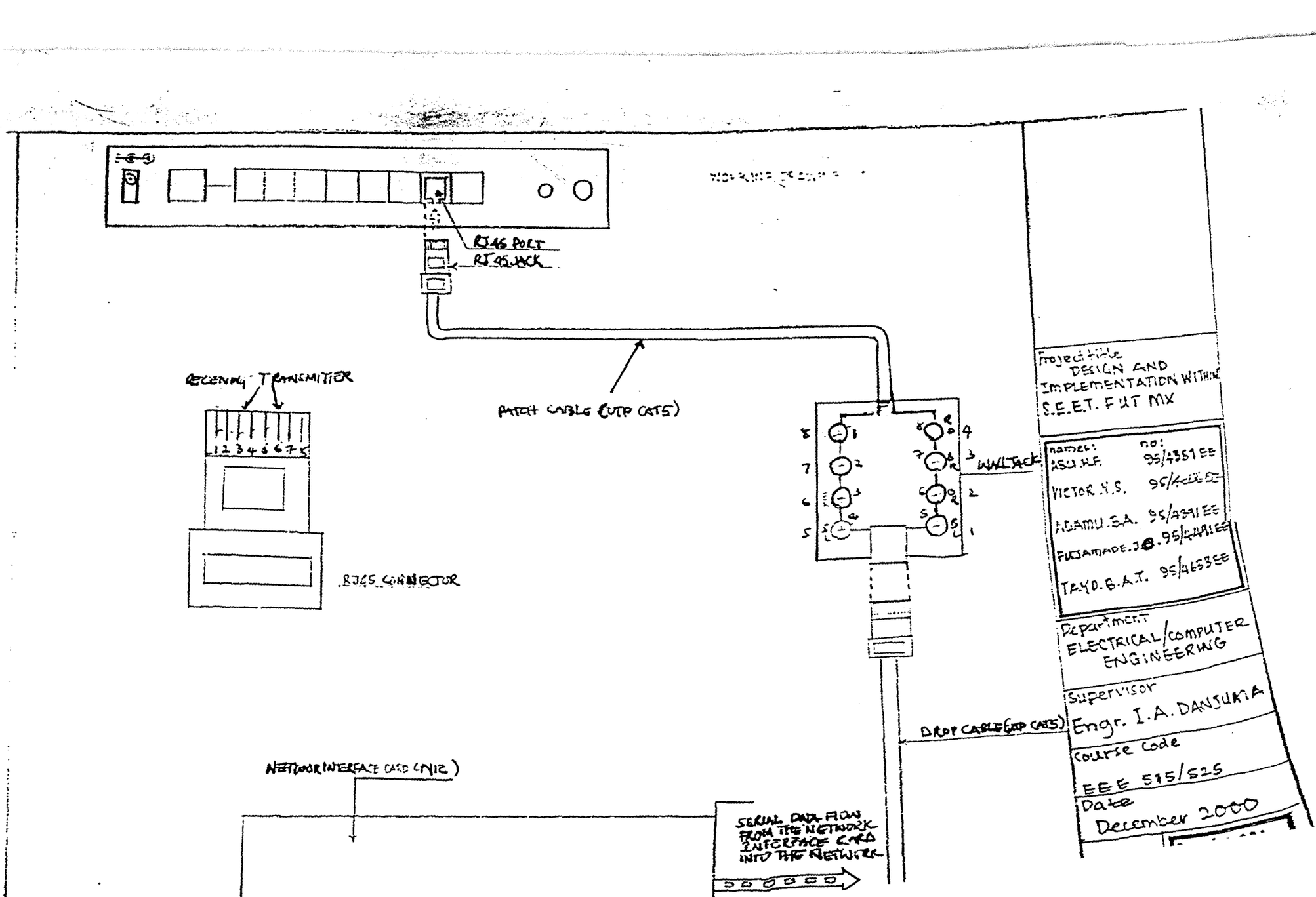
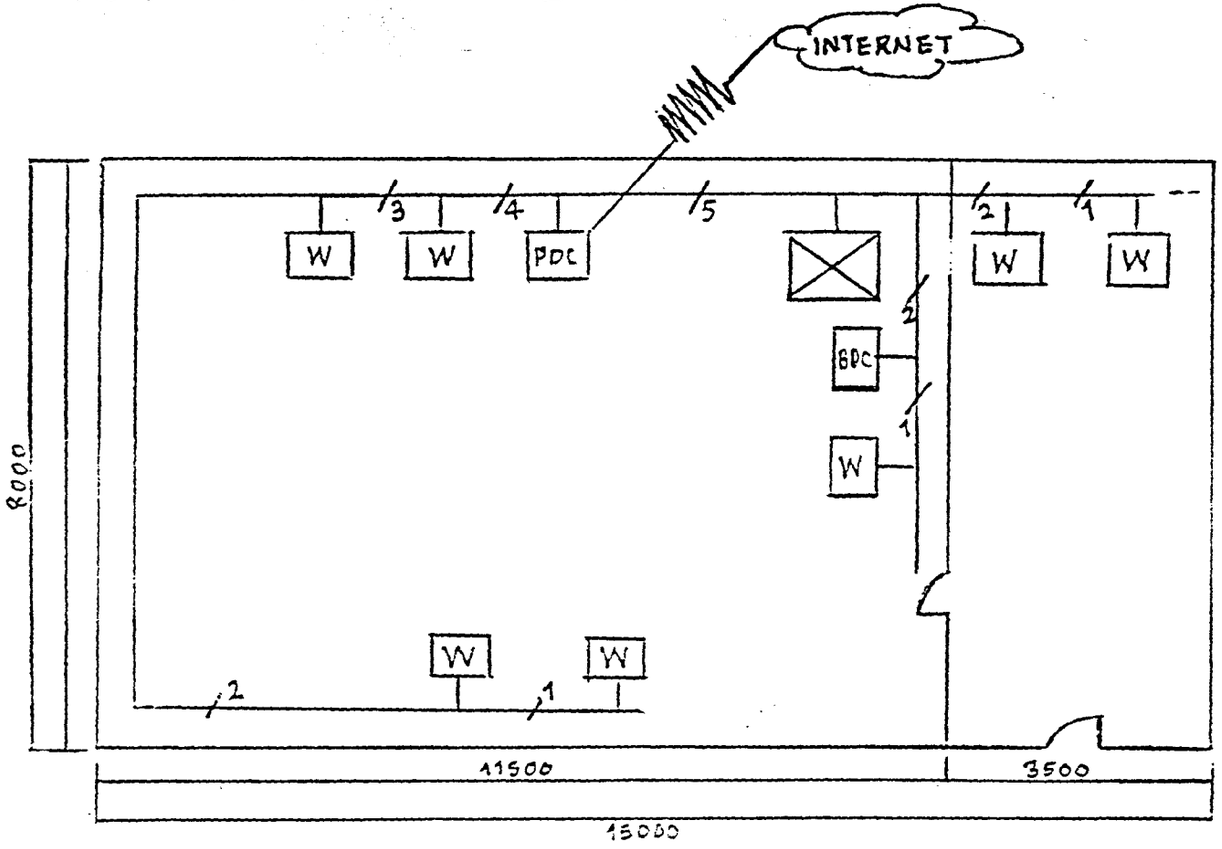
Course Code
EEE 515/525

Drawing no:
05


RJ45 PORT
RJ45 JACK
RECEIVING TRANSMITTER
1 2 3 4 5 6 7 8
PATCH CABLE (UTP CAT5)
RJ45 CONNECTOR
WALL JACK
DROP CABLE(UTP CAT5)
NETWORK INTERFACE CARD (NIC)
SERIAL DATA FLOW FROM THE NETWORK INTERFACE CARD INTO THE NETWORK
Project title
DESIGN AND IMPLEMENTATION WITHIN S.E.E.T. FUT MX
names: no:
ASU H.F. 95/4351EE
VICTOR Y.S. 95/4
ADAMU S.A. 95/4391EE
FUJAMADE.J.O. 95/4481EE
TAYO B.A.T. 95/4633EE
Department
ELECTRICAL/COMPUTER ENGINEERING
Supervisor
Engr. I.A. DANJUMA
Course Code
EEE 515/525
Date
December 2000

SITE AND CABLING LAYOUT FOR NUNET OFFICE



K	E	Y
W	WORKSTATION	
X	HUB	
PDC	PRIMARY DOMAIN CONTROLLER	
BDC	BACKUP DOMAIN CONTROLLER	
/		

Project Title

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

names:	no:
ABU. H.F.	95/4381 EE
VICTOR Y.S.	95/4654 EE
ADAMU. B.A.	95/4391 EE
FUJAMADE. J.O	95/4491 EE
TAYO B.A.T	95/4633 EE

Department

ELECTRICAL/COMPUTER ENGINEERING

Supervisor

Engr. I.A. DANJUMA

Course Code

Drawing no: 04