

CHAPTER III

5. PROPOSAL DESIGN

Elaboration of a manual with basic concepts about Electrical Wiring and Equipment Connectivity for English Students and Teachers at Technical University of Cotopaxi during the Academic Cycle March 2012 – August 2012”

5.1 INFORMATIVE DATA:

Institute:	Technical University of Cotopaxi
Province:	Cotopaxi
Canton:	Latacunga
Parish:	Eloy Alfaro
Study Object:	Electrical wiring and Equipment connectivity.
Director:	Lic. Lidia Rebeca Yugla Lema
Researcher:	María Fernanda Aguaiza Iza
Beneficiary:	English Students.

5.2 JUSTIFICATION

The electrical wiring and the equipment connectivity are the very importance because they are going to permit and determine that the all-electrical equipment of the English Laboratory of Technical University of Cotopaxi such as: computers, modem, router, printer, etc. operate in a properly way.

All electrical installation must have an adequate electrical protection to ensure the useful life of the equipment and the telecommunications in order to convert it as an important tool for students into the teaching learning process improving the skills as reading, listening, writing and speaking, skills necessities to learn a new language.

Our English Laboratory must be suitable and sustainable along the time ensuring its optimal function and giving the opportunity as students and teachers to use it with al security and reliability.

This Electrical and Connectivity Manual has been designed with the most basic concepts and important aspects of electrical wiring and equipment connectivity that English students and teachers have to be updated in order to give maintenance to the equipment of the English Laboratory.

5.3 OBJECTIVES

GENERAL

- To provide English's students of basic knowledge into the English Interactive Laboratory through basic and specific information about Electrical Wiring and Equipment Connectivity.

SPECIFIC

- To determine the most suitable and important information related to Electrical Wiring and Equipment Connectivity in an English Interactive Laboratory.
- To set up the appropriate uses of Electrical wiring and Equipment Connectivity in an English Interactive Laboratory to have good operation improving the teaching learning process.
- To provide a manual with basic concepts, materials and forms of Electrical wiring and Equipment connectivity for English students and teachers of the Technical University of Cotopaxi.

5.4 PROPOSAL DESCRIPTION

Into the English Interactive Laboratory there are many things that we in many cases have no any idea as Electricity and Connectivity aspects but it is easy to understand because we are English students and we never been related with these terms. So, designing a manual with all important characteristics that are related with Electricity

and Connectivity will clarify some doubts that most of the English students and teacher have.

The manual of Electrical wiring and Equipment connectivity contains relevant concepts, materials, forms, characteristics, advantages and disadvantages that are important to take into account in the English Interactive Laboratory.

This manual is divided in two matters:

The first one contains concepts about Electricity that will permit us to know how electricity is conducted to home. Also, there are different characteristics about Electrical and types wires and the parts of an electrical conductor.

In the second part of the manual, there are concepts about Network that are going to give us information about how and why the computers in our English Laboratory are interconnected each other. It contains important features about network components and its function. Also, there are clear information about Transmission Media and characteristics about the network wiring.

5.5 HOW TO USE THE MANUAL

The following manual will help English students and teachers to have a basic knowledge about Electrical and Connectivity aspects since it is important to identify materials and forms that are going to become part of the English Interactive Laboratory.

The manual is easy and understandable; it contains the most relevant aspects that English students and teachers can use if they have no idea about materials, concepts of working operation into the English Interactive Laboratory.



***MANUAL OF
ELECTRICAL WIRING
AND EQUIPMENT
CONNECTIVITY***

**Basic concepts, materials and
forms for Teachers and
Students of the Technical
University of Cotopaxi**

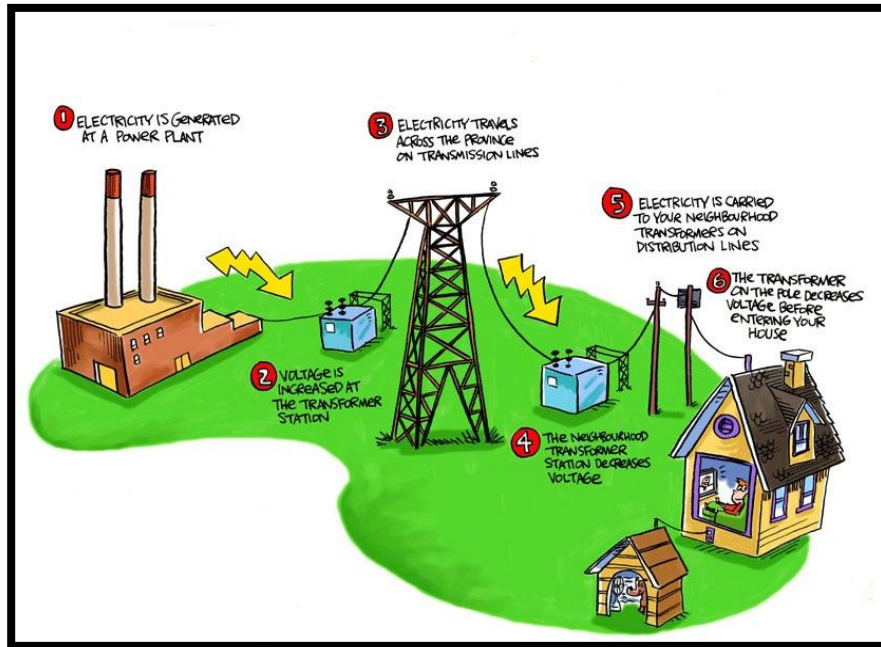
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ELECTRICAL ENERGY

From the beginning of its run generated at a power plant until to the centers of consumption, electrical energy is conducted through lines of transmission and distribution, formed by electrical conductors or wires.



ELECTRICAL WIRE

Wire is an electrical conductor, which is formed by a series of thread conductors that give them great flexibility; their principal objective is to carry electricity.

An electrical wire is formed for a metal wire (the conductor) and a plastic coating (insulation).

The principal materials used to produce electrical conductors are the copper and aluminum.

Although either metals have excellent conductivity, the use of one or other material as an electrical conductor will depend of their:

Electrical Characteristics



Capacity to carry electricity

Mechanical Characteristics



Resistant to wear

Specific Use

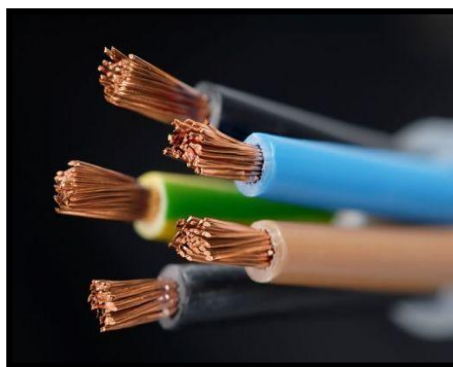


Needs

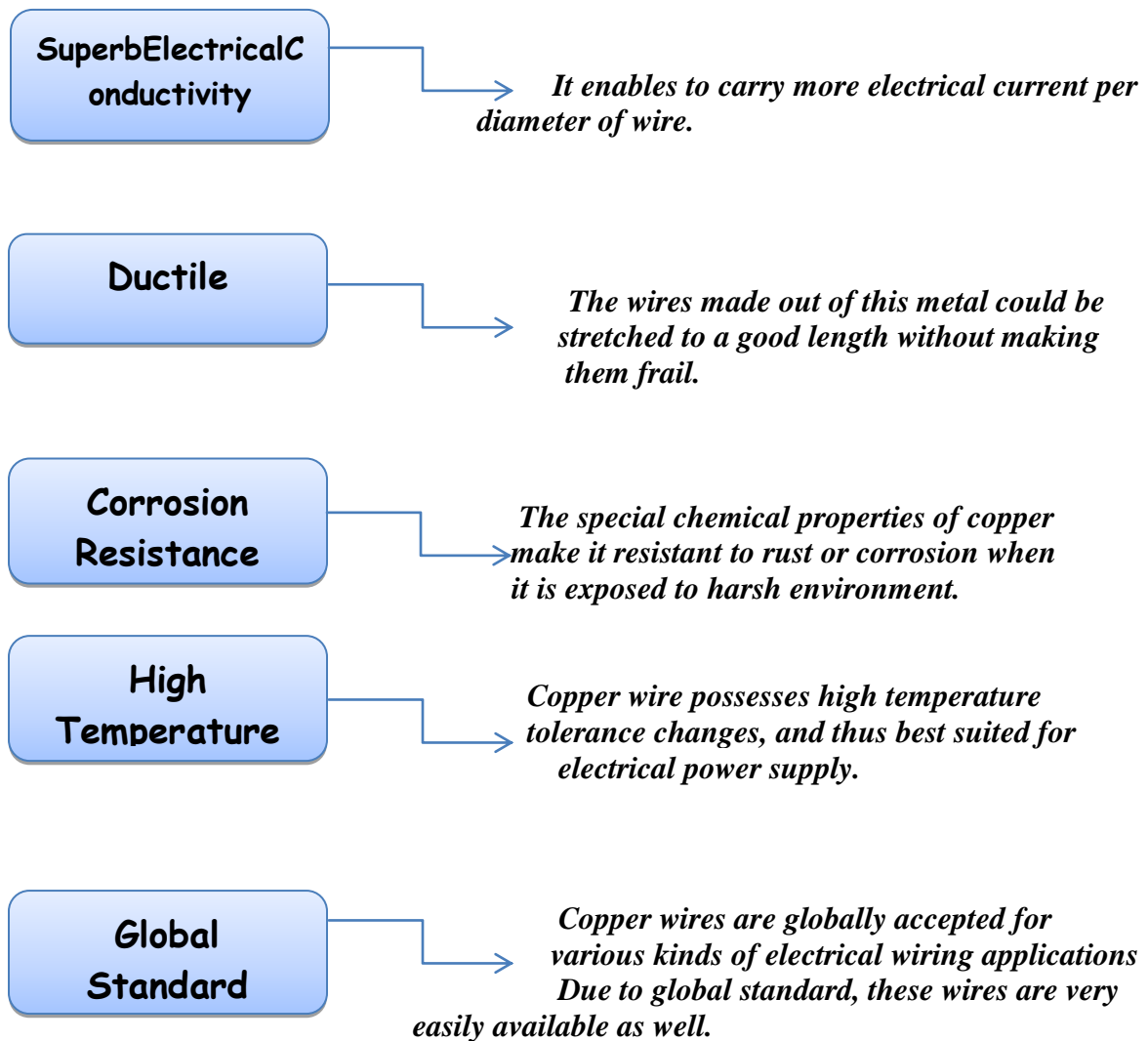
TYPES OF WIRE

COPPER WIRE

In the present times, copper is used across various industries like construction, metallurgy, medical, and more; but, copper's use in electrical industry, especially for making copper wires, is the most popular.



- There are several qualities that make copper wire ideal for electrical use; the same mentioned below:



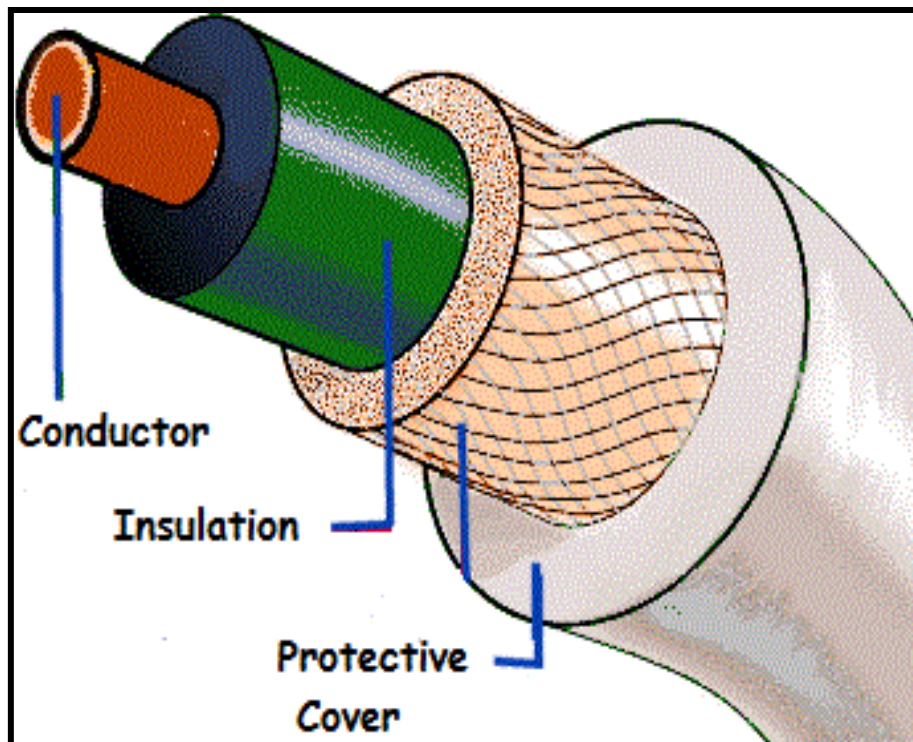
ALUMINUM WIRE

Aluminum is the third most abundant element, and the most abundant metal in the Earth's crust. Aluminum is remarkable for the metal's low density and for its ability to resist corrosion due the phenomenon of passivation. Is a good conductor of electricity and heat, it is easy to use and it is



The Electrical wires or Electrical Conductors are composed of three parts:

- The Conductor element
- The Insulation
- The Protective cover



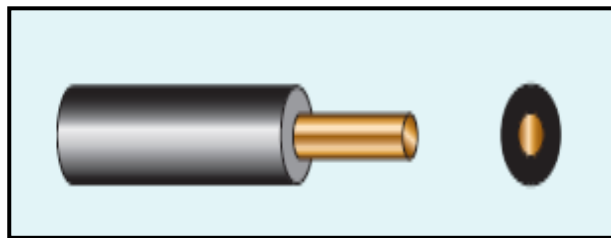
The Conductor Element

The metals used as conductors are copper and aluminum and its goal is to provide electrical energy from the Central generators to Distribution Centers as substations, to feed the different centers of consumption such as industries, houses, schools, etc.

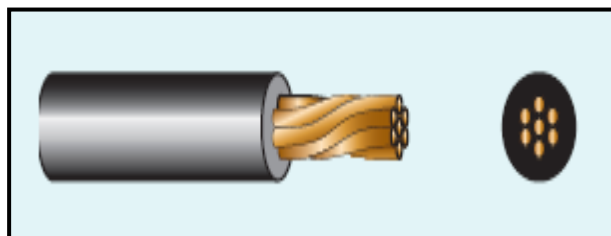
The conductive elements are classified:

According their constitution:

Wire. -It is an electrical conductor that is formed by a single element or thread.

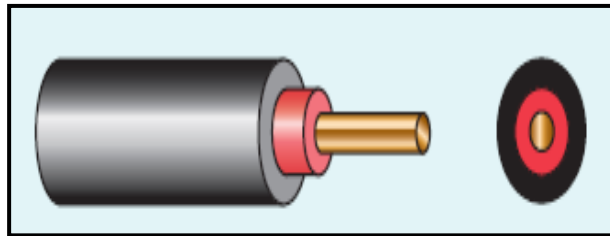


Cable. -It is an electrical conductor that is formed by a series of conductor threads, which give a great flexibility.

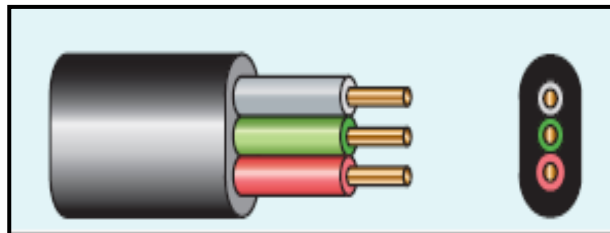


According their conductor's number

Single Conductor. -It is an electrical conductor with a single conductor core, insulated and with protective cover.



Multi conductor. -It is an electrical conductor of one or more conductors cores insulated from each other, each one wrapped by their respective insulating layer and with one or more protective covers.



The Insulation

The electrical insulation is a non-conducting material that provides electric isolation of two parts at different voltages.

Its principal objective is to prevent that the electrical energy that flowing through it, have contact with people or objects into an installation.

Electric insulation is generally a vital factor in both the technical and economic feasibility of complex power and electronic systems.

The generation and transmission of electric power depend critically upon the performance of electric insulation.

There are several types of insulating materials such as:

- Polyvinyl Chloride (PVC)
- Ethylene Propylene Rubber (EPR)
- Cross Linked Polyethylene (XLPE)

POLYVINYL CHLORIDE (PVC)



The electrical wires sheathing with PVC, are the simplest use wires, considered wires of general application. These kinds of wires are designed for installations in places without special requirements of fire safety. As an example it may serve in installations

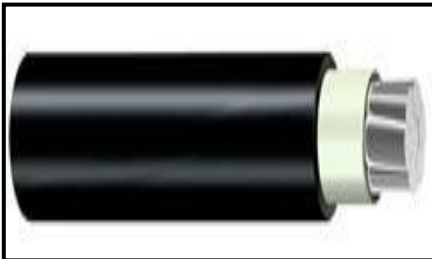
at home or offices.

ETHYLENE PROPYLENE RUBBER (EPR)



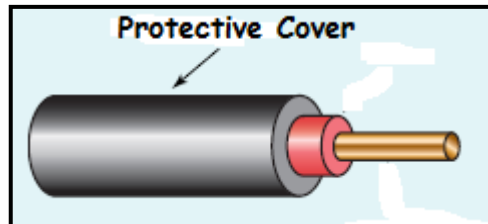
It is a material used as electrical insulation in power wires for high voltage. It has better thermal properties than other insulating materials used in traditional wires. This wire is flexible and suitable.

CROSS LINKED POLYETHYLENE (XLPE)



It is material formed into tubing, and is used predominantly in building services pipework systems, hydronic radiant heating systems, domestic water piping and insulation for high tension (high voltage) electrical wires.

The Protective Cover



The main purpose of this part of the core conductor is to protect the integrity on the insulation and the conductive element against mechanical damage such as scratches, bumps, etc...

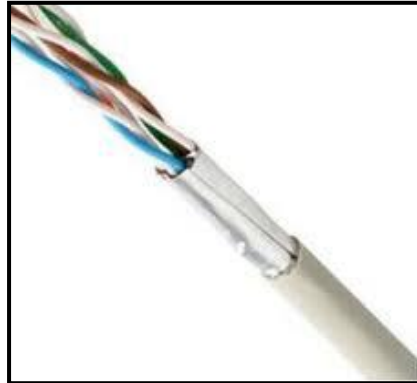


If the mechanical protections are steel, brass or other resistant material it is called “armor”. The “armor” can be an insulating tape or twisted wires.



The electrical conductors may also be able to be equipped with an electrical type protection composed of aluminum or copper strips.

In case of that protection, instead of insulating tape it made up of copper wires, is called “screen” or “shield”



Computer Networking

A computer network is a system of networks where computers are interconnected via peer-to-peer connection or client-server connection to share data, information and resources. Networking is the engineering discipline, which concerns itself with the communication between computer systems and devices. It is not an independent science since it extensively derives most of its theoretical and practical aspects from other communications technology disciplines like telecommunications, information technology, computer science and computer engineering



It is an interconnection of many computers with the help of some network components. There are many types of networks, classified as per the geographical location of the computers and the network components. The type of connection used for connecting the computers and the network components used, decides the type of the computer network

Network Components

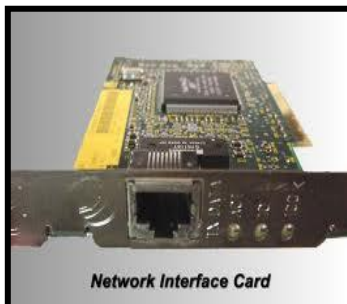
A network operation needs devices that are designed to handle certain network functions. The devices are often called networking devices or equipment and specifically referred to as network components.

Each network component has a name that is related to its functions. For example, a network adapter works to "adapt" a computer message that is going to be sent to a network, to a format that is defined by the network.



Network Adapter or Network Interface Cards (NIC)

Network Adapter or Network Interface Card is the most important device in building network. These adapters are the most common part of computers.



Network adapter or NIC works as an interface between a computer or device and a network. Network adapter converts a

computer message into electrical or optical signals for transmission across the network.

A network adapter is identified in a network through a Mac address that is hard-coded onto the hardware by its manufacturer



MODEM

Modem means modulator - demodulator. At the sending end, a modem modulates a carrier with the data (base band signal) to prepare it for transmission. At the receiving end, the modulated carrier is demodulated (i.e. converted back to the original shape) and the data is extracted.

We must connect the computer to a modem or install an internal modem inside the computer when we want to connect to the Internet. The type of modem that we need depends on the Internet access method that we choose.

Modem will communicate with the corresponding modem at ISP during an Internet connection.

- There are many types of modem here some of the most important:

Voice Band Modem



Cable Modem



ADSL Modem



GPRS Modem.



HG530 Modem



HUBS, SWITCHES AND ROUTERS



HUB



SWITCH



ROUTER

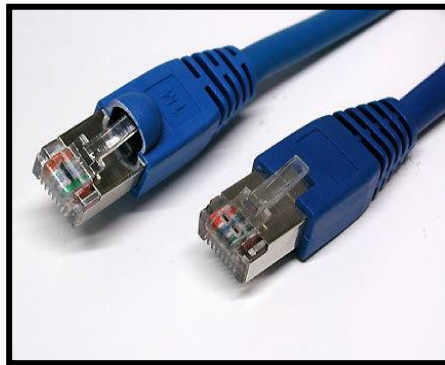
Hubs, switches and routers are devices with several RJ-45 ports for Ethernet cables. These devices are responsible for linking all of the network's Ethernet cables at a central location and directing traffic to the other devices on the network, such as the cable or DSL modem, printer or server. Some routers have antennae, enabling computers with wireless adapters to connect without using Ethernet cable.

If we talk about networks on larger scale they are required to build network. All computers are connected directly to one of them as hub performs as centralized device the network.

When data is sent to the hub, switch or router they broadcast the data to all the ports of the hub and then it is sent to destination computer on the network.

ETHERNET CABLE

An Ethernet cable contains many small copper wires twisted together in pairs. Each end has an RJ-45 connector. On wired Ethernet networks, Ethernet cables join all the components together.



Types of Network

Into the Computer network, each computer in the network is connected through a transmission media such as Ethernet cable wiring.

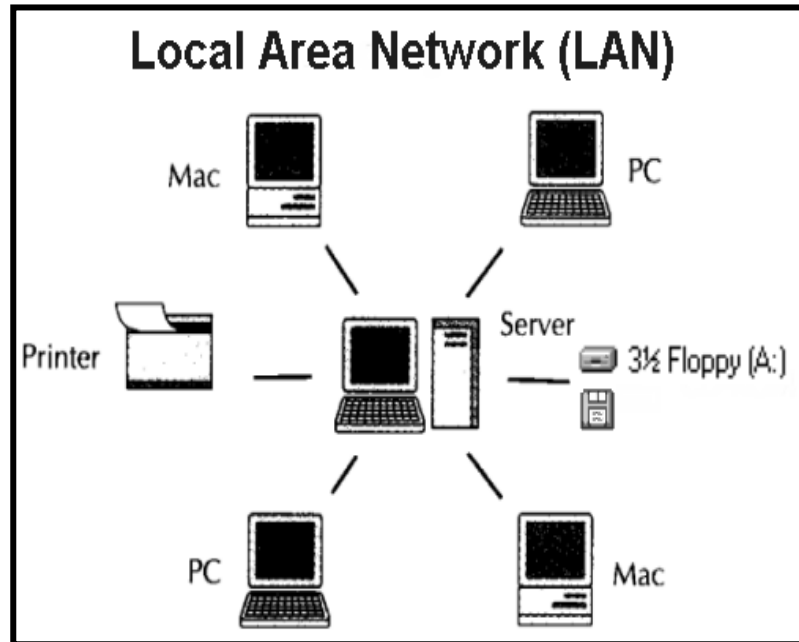
There are many different kinds of computer networks, such as:

- LAN
- MAN
- WAN

Here we have a chart with brief information and parameters of the different kinds of computer network

Parameter	LAN	WAN	MAN
Area Covered	Covers small area	Covers large area	Covers Larger than LAN, smaller than WAN
Error Rates	Lowest	Highest	Moderate
Transmission Speed	High Speed	Low speed	Moderate Speed
Equipment Cost	Uses Inexpensive equipment	Most Expensive equipment	Uses moderately expensive equipment

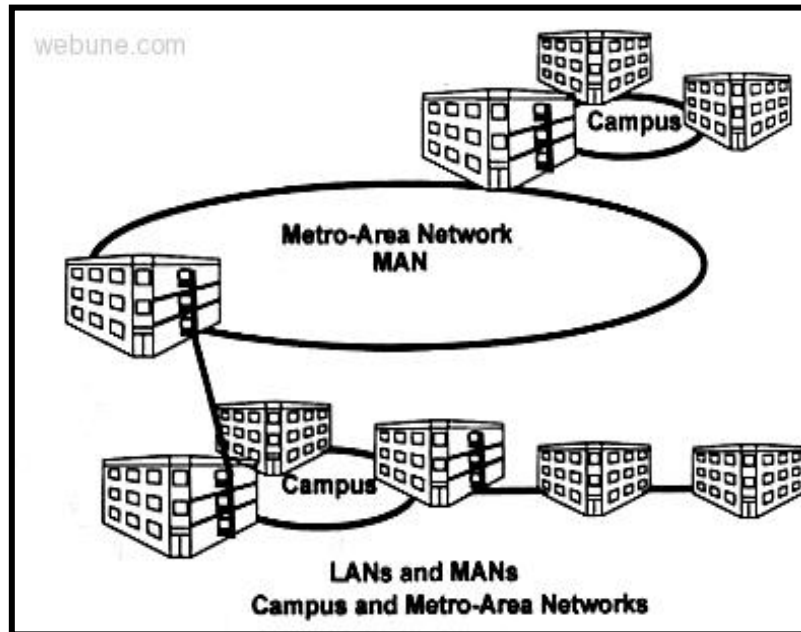
LAN (Local Area Network)



A local area network (LAN) has computers interconnected along with some other resources, like, printers, modems, floppy disks and hard disks. LAN is restricted to a building or an office or can be a residential network connecting the computers and resources to each other.

With the help of computer network in LAN, the above stated resources can be accessed and shared by all the computers in the network. The computer that manages and offers these resources is called a server computer.

MAN (Metropolitan Area Network)



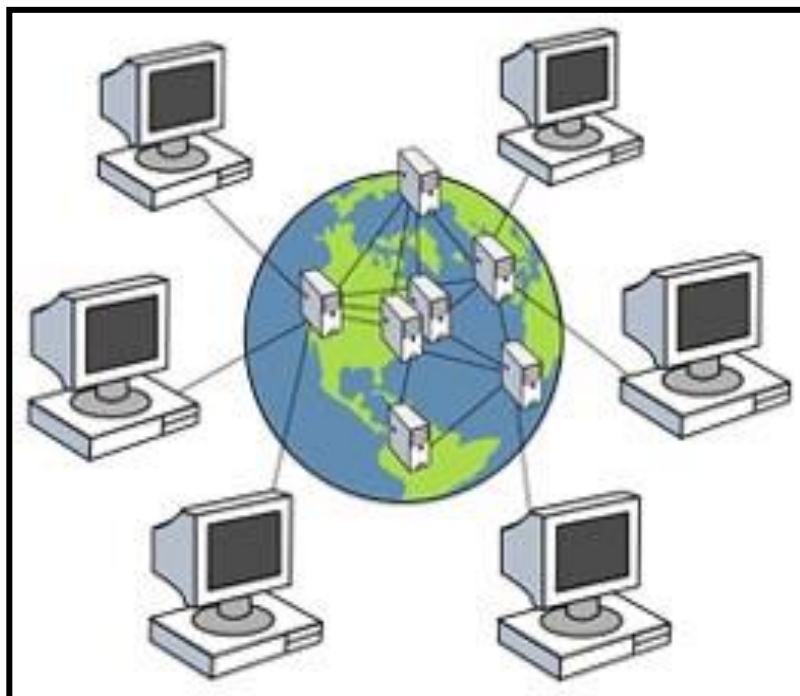
The metropolitan area network is spread over an area with a diameter varying from 5 to 50 km. MAN is not owned by a single organization; instead it is an interconnection of many LANs.

The metropolitan area network has many applications and can form many networks, like, the banking network, military network, stockbroker's network and airline reservation network.

These networks require a lease line that is to be taken from a telephone company. The speed of the data line varies from 2 Mbps to 600 Mbps.

WAN (Wide Area Network)

The wide area network connects all the metropolitan area networks (MAN). The wide area network is a larger version of the local area network (LAN). Internet is an example of the wide area network.



Transmission Media

The means through which data is transferred from one place to another is called transmission or communication media. There are two categories of transmission media used in computer communications bounded and unbounded.

The bounded media are those media in which communication takes place through wires. The unbounded media comprises wireless communication.

Bounded Transmission Media

Bounded media are the physical links through which signals are confined to narrow path. These are also called guide media. Bounded media are made up of an external conductor(Usually Copper) bounded by jacket material.

Bounded media are great for LABS because they offer high speed, good security and low cost. However, sometimes they cannot be used due distance communication.



- Three common types of bounded media are used of the data transmission. These are:

COAXIAL CABLE

Coaxial cable is very common and widely used commutation media. For example TV wire is usually coaxial.

Coaxial cable gets its name because it contains two conductors that are parallel to each other. The center conductor in the cable is usually copper. The copper can be either a solid wire or stranded martial.

Outside this central Conductor is a non-conductive material. It is usually white, plastic material used to separate the inner Conductor form the outer Conductor.

CHARACTERISTICS OF COAXIAL CABLE

- Low cost
- Easy to install
- Up to 10Mbps capacity
- Medium immunity form EMI
- Medium of attenuation



ADVANTAGES OF COAXIAL CABLE

- Inexpensive
- Easy to wire
- Easy to expand
- Moderate level of EMI immunity

DISADVANTAGE OF COAXIAL CABLE

- Single cable failure can take down an entire network

TWISTED PAIR CABLE

The most popular network cabling is twisted pair. It is light weight, easy to install, inexpensive and support many different types of network. It also supports the speed of 100 mps. Twisted pair cabling is made of pairs of solid or stranded copper twisted along each other

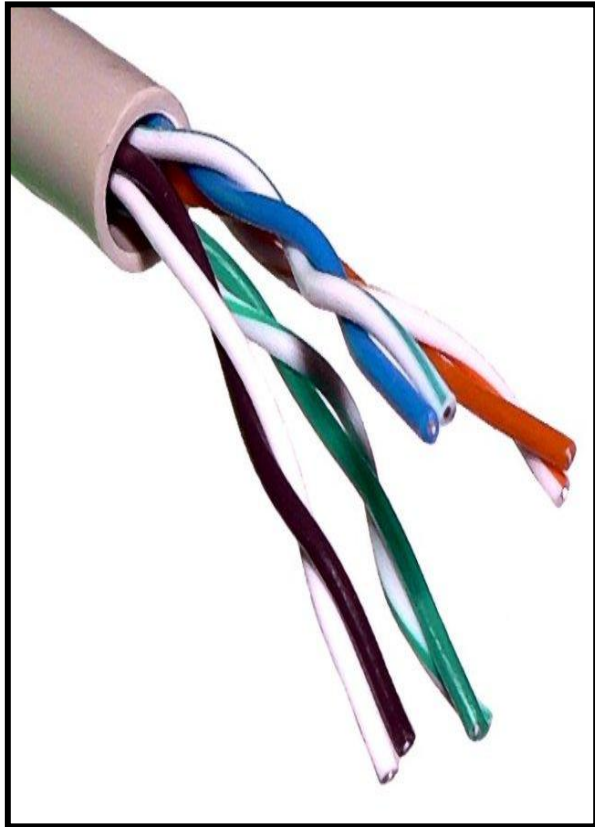
- There are two types of twisted pairs wiring:

UNSHIELDED TWISTED PAIR (UTP)

UTP is more common. It can be either voice grade or data grade depending on the condition. UTP cost less than STP and easily available due to its many use.

CHARACTERISTICS OF UTP

- Low cost
- Easy to install
- High speed capacity
- High attenuation
- Effective to EMI
- 100 meter limit



ADVANTAGES OF UTP

- Easy installation
- Capable of high speed for LAN
- Low cost

DISADVANTAGES OF UTP

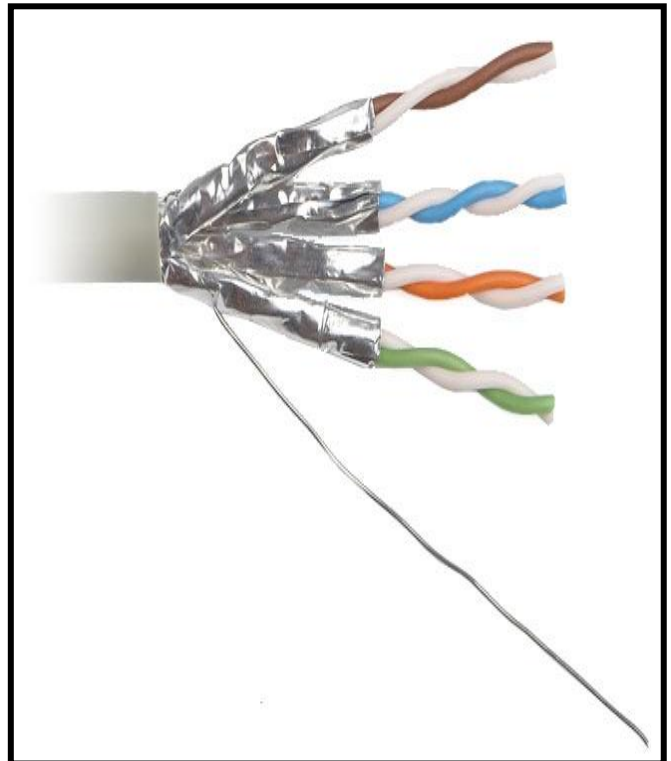
- Short distance due to attenuation

SHIELDED TWISTED PAIR (STP)

It is similar to UTP but has a mesh shielding that's protects it from EMI which allows for higher transmission rate.

CHARACTERISTICS OF STP

- Medium cost
- Easy to install
- Higher capacity than UTP
- Higher attenuation, but same as UTP
- Medium immunity from EMI
- 100 meter limit



ADVANTAGES OF STP:

- Shielded
- Faster than UTP and coaxial

DISADVANTAGES OF STP:

- More expensive than UTP and coaxial
- More difficult installation
- High attenuation rate

OPTICAL FIBER WIRE

Fiber optic cable uses electrical signals to transmit data. It uses light. In fiber optic cable light only moves in one direction for two-way communication to take place a second connection must be made between the two devices.

It is actually two stands of cable. Each stand is responsible for one direction of communication. In the center of fiber cable is a glass stand or core.

CHARACTERISTICS OF OPTICAL FIBER:

- Expensive
- Very hard to install
- Capable of extremely high speed
- Extremely low attenuation
- No EMI interference

ADVANTAGES OF OPTICAL FIBER:

- Fast
- Low attenuation
- No EMI interference



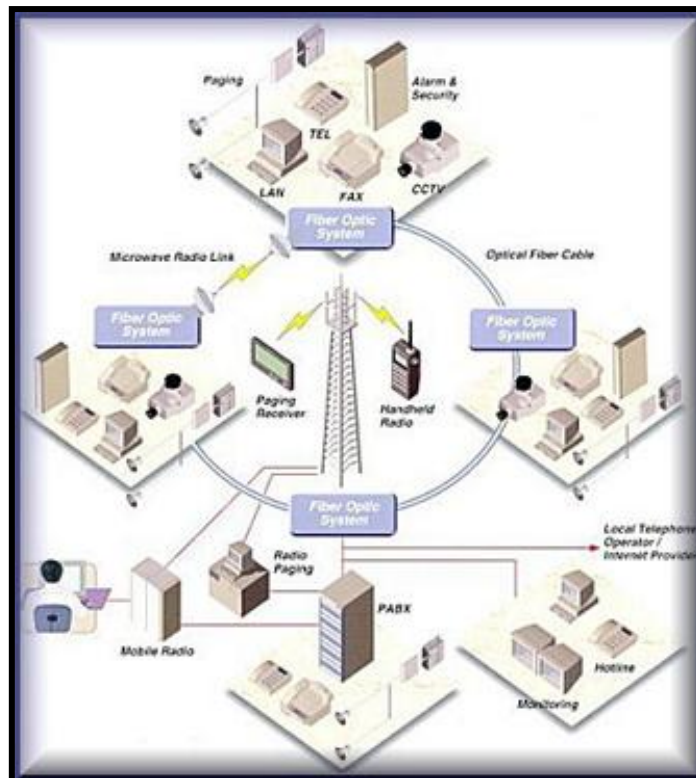
DISADVANTAGES OF OPTICAL FIBER:

- Very costly
- Hard to install

Unbounded Transmission Media

Unbound transmission media are the ways of transmitting data without using any cables. These media are not bounded by physical geography.

RADIO LINKS (MICROWAVE)



Microwaves have been used in data communications for a long time. They have a higher frequency than radio waves and therefore can handle larger amounts of data. Microwave transmission is line of sight transmission. The transmit station must be in visible contact with the receive station.

INFRARED

Infrared offers a great unbound photonic solution. Like fiber-optic cabling, infrared communications use light, so they are not bound by the limitations of electricity.

