



Chapter Three

Telecommunications and Networks

3.1 Introduction

Computer technology is truly a modern marvel that has transformed how we do business, as well as how we manage our personal, affairs. The computer's influence on today's modern competitive environment would be much diminished without the telecommunications and computer networks available today. Their development has accompanied the amazing advances in computing over the last three decades. In most firms, communication between computing technologies is just important as the computer itself.

3.2 The Telecommunications System

A telecommunication system consists of hardware and of software that transmits information from one location to another. These systems can transmit text, data, graphics, voice, document, or full –motion video information. The major components of a telecommunications system include the following:

- **Hardware** all types of Computers (e.g., desktop, server, and mainframe) and communications processes (such as modems)
- **Communications media** the physical media through which electronic signals are transmitted, including wireless media (used with satellites and cell phones)
- **Communication networks** the links among computers and communications devices.
- **Communication software** that controls the telecommunication system and the entire transmission process.

Digital signals do not have the characteristic "wave" shape that analog signals do, rather, they are discrete pulses that are either **on** or **off** .this



quality allows them to convey information in a binary form that can be clearly interpreted by computers typically cannot distinguish whether an analog wave is in an "on" mode or an "off" mode. With digital signals, the signal is clearly on or off.

- **Data communication provides** regulated utilities private firms that provide data communication services.
- **Communication protocols** the rules for transmitting information across the system.
- **Communication applications** electronic data interchange teleconferencing, video conferencing, electronic mail, as well as others.

Signals

Telecommunications media carry two basic types of signals, analog and digital. Analog signals are continuous waves that transmit information by altering the characteristics of the waves. Analog signals have two parameters, amplitude and frequency. For example, voice and all sounds are analog, traveling to human ears in the form of waves. The higher the waves (or amplitude), the louder the sounds; the more closely packed the waves, the higher the frequency. Radio, telephone, and recording equipment historically transmitted and received analog signals, but they are beginning to change to digital signals.

3.3 Communications Processors

Communications processors are hardware devices that support data transmission and reception across a telecommunication system. These devices include: modems, multiplexer, front-end processor, and concentrators.



Modems

The U.S. public telephone system (called POTS, for "plain old telephone service") was designed as an analog network to carry voice signals or sounds in an analog wave format. In order for this type of circuit to carry digital information, that information must be converted into an analog wave pattern. The conversion from digital to analog is called modulation, and the reverse is demodulation. The device that performs these two processes is called a **modem**.

Modems are always used in pairs. The unit at the sending end converts a computer's digital information into analog signals for transmission over analog lines at the receiving end; another modem converts the analog signal back into digital. Signals for the receiving computer like most communication equipment, a modem's transmission's speed is measured in bits per second (bps), typical modem speeds range from 14,400 to 56,600 bps.

Multiplexer

A multiplexer is an electronic device that allows a signal communication channel to carry data transmissions simultaneously from many sources. multiplexers lower communication costs by allowing devices to share communications channels .multiplexing thus make more efficient use of these channels by merging the transmission of several computers(e.g., personal computers)at one end of the channel ,while a similar unit separates the individual transmissions at the receiving end(e.g., a mainframe).



Front end processor

With most computers, the central processing unit (CPU) must communicate with several computers at the same time routine communication tasks can absorb a large proportion of the CPU processing time, leading to degraded performance on more important jobs in order not to waste valuable CPU time, many computers systems have a small secondary computer dedicated solely to communication. Known as front end processor, this specialize computer manages all routing communications with peripheral devices. The functions of a front end processor include coding and decoding data; detecting errors; and receiving, recording, interpreting, and processing the control information that is transmitted.

Communication media and channels

For data to be communicated from one location to another, some form of pathway or medium must be used. These pathways are called communications channels. And they include cable **media** and **wireless media**.

A) Cable media

Cable media use physical wires or cables to transmit data and information. There are three types of cable media:

1) twisted-pair wire

Is the most prevalent form of communication wiring ;it's used for all most all business telephone wiring .twisted-pair wire consists of strands of copper wire twisted in pairs .its relatively inexpensive to purchase ,widely available ,and easy to work with. And it can be made relatively an obtrusive by running it inside walls, floors, and ceilings.

However, twisted-pairs wire has some significant disadvantages .it emits Electromagnetic interference, is relatively slow for transmitting data, is subject to interference from other electrical sources, and can be easily “tapped” for gaining unauthorized access to data by unintended receivers.

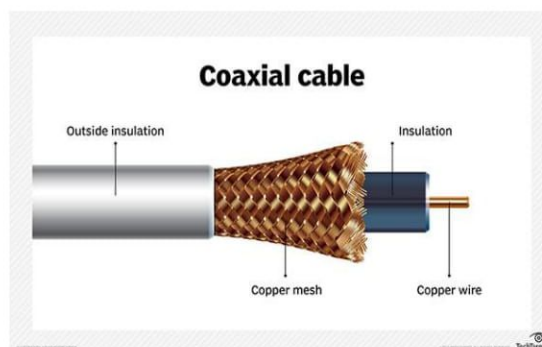
Unshielded Twisted-Pair



2) Coaxial cable

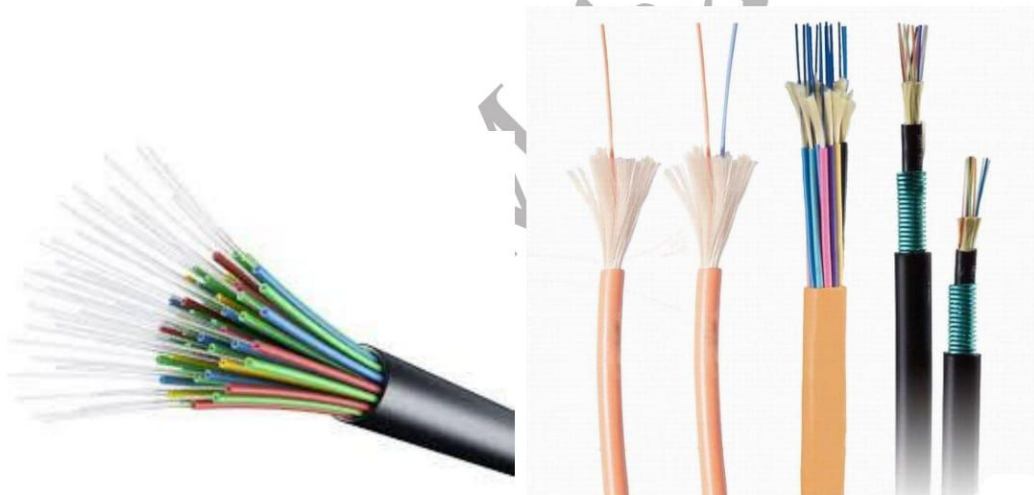
Consists of insulated copper wire .it is much less susceptible to electrical interference than is twisted pair wire and can carry much more data. For these reasons, it is commonly used to carry high –speed data traffic as well as televisions signals. However, coaxial cable is more expensive and more difficult to work with than twisted –pair wire .it is also somewhat inflexible. Data transmission over coaxial cable is divided into two basic types

- 1) Base band transmission: transmission is analog, and each wire carries only one signal at a time
- 2) Broadband transmission: transmission is digital and each wire can carry multiple signals simultaneously.



3) Fiber optical cable

Fiber optics technology combined with the invention of the semiconductor laser provides the means to transmit information through clear glass fibers in the form of light waves, instead of electric current. Fiber optic cables consist of thousands of very thin filaments of glass fibers that conduct light pulses generated by lasers at very – high – speed transmission frequencies. Fiber optic cables offer significant size and weight reduction over traditional cable media. They also provide increased speed, greater data –carrying capacity, and greater security from interference and tapping. However, the costs of fiber and difficulties installing the fiber optic cable slowed its growth.



B) Wireless media

With the exception of fiber optic cables, cables present several problems such as the expense of installation and change, as well as, fairly limited capacity. The alternative is communication over wireless media; the key to mobile communications in today's rapidly moving society is data transmission over electronic magnetic media, the "airwaves". Common wireless data transmission includes



- 1) Microwave transmissions
- 2) Communication satellite
- 3) Pagers
- 4) Cellular telephones
- 5) Radio
- 6) Infrared
- 7) Cellular radio technology
- 8) Mobile computing
- 9) Personal communication service

3.4 Networks

A set of computers connected together so that they can communicate is called a computer network. This involves installing **network cards** in each computer. Each computer is then connected through cabling to a central device called a **hub**.

Operating systems contain components that are dedicated to the task of enabling computers to communicate over a network. This software makes use of special rules of communication called **protocols**. There are many different types of protocols used for a variety of purposes. The most commonly used protocol for establishing and maintaining communication across a network is called **TCP/IP** or **Transmission Control Protocol / Internet Protocol**.

Client-server and peer-to-peer networks

Networks on which all computers have equal status are called **peer-to-peer** networks.

On most networks, certain computers have special dedicated tasks. Since these machines provide **services** to other computers, they are called



servers. The computers that make use of the services or servers are called **clients** or **workstations**. A network such as this is called a **client-server** network.

A server which is used for the central storage of files is called a **file server**. Using a file server, users can access their work from anywhere on the network. They can also make these files available to users on other computers. File servers also enable users to co-operate on a task by centralizing the results of their work.

A computer attached to a printer which users can access is called a **print server**. Having a single printer rather than a printer attached to each computer obviously saves capital.

An increasingly important type of server is an **applications server**. In the case of applications servers, application packages are not installed on the workstations but on the applications server.

A **communications server** is a computer dedicated to connecting a network to the outside world. These are often called **proxy servers**.

As the case of print servers illustrates, one of the values of having a network is that it enables **resources to be shared**.

LAN

A **LAN** or **Local Area Network** is a group of computers within the same building, or within a group of buildings that are in close proximity, that are connected together.

WAN

A **WAN** or **Wide Area Network** is a group of widely dispersed computers that are connected together. These could be across the same town or across a country or even across the world. Apart from distance,



the other feature that distinguishes as WAN from a LAN is that the WAN would make use of a range of communication technologies such as telephone, microwave and satellite links.

Network Communications Software

Communications software provides many functions in a network. These functions include

- Error checking
- Message formatting
- Communications logs (listing of all jobs and communications in a specified period of time).
- Data security and privacy.
- Translation capabilities

These functions are performed by various parts of network communications software, which includes

1-network operating system

2-network management software

3-protocols