Module 2 Part 1

A ***network*** is defined as a group of computers and other devices that are connected in some or the other ways with the objective of exchanging data.

The main task of a computer network is to deliver the means to transfer user information from one network entity to another.

A set of computers that connect information through a source of common conventions, is known as "***protocols***," over the medium of communication.

Eventually, these devices will give a two-way access to a huge collection of resources on a global level of computer network.

Connecting Two Hosts

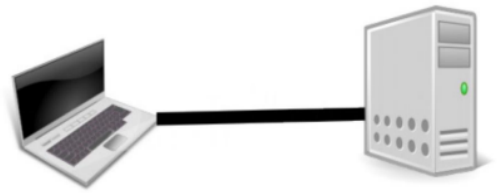


Figure 2: Connecting two hosts together

The primary step when constructing a network, even a worldwide network such as the Internet, is to attach two hosts together. This type of network is illustrated in Figure 2.

Types of physical media to exchange information

1. Electrical cable: Information can be communicated through various types of electrical cables.

Types of Electrical tables:

Twisted Pairs

-Telephone network and also in enterprise networks.

Coaxial Cables

-Cable TV networks

Classical Electrical Cable.

2. Optical fiber: are commonly used in public and enterprise networks when distance between two connecting communication devices is more than one kilometer.

Two main categories of optical fibers:

Monomode Fibers - are restricted to a distance of few kilometers while, on the other hand,

Multimode Fibers - can be used over distances that are greater than several lengths of kilometers.

In both cases, ***"repeaters"*** can be used to revive the optical signal at one endpoint of a fiber to send it to another fiber.

3. Wireless: In this type of network, a radio signal is used to encrypt the information traded between different communicating devices.

Two main types of datalink layers:

Simplest datalink layer - is present when there are only two communicating systems that are directly inter-connected through physical layer.

PPP (Point-to-Point Protocol) - is an illustration of such point-to-point datalink layer. The framework of datalink layers assists the exchange of frames.

The second kind of datalink layer is the one used in **Local Area Networks or LAN.** Conceptually, "a LAN is a set of communicating devices such that any two devices can directly exchange frames through the datalink layer."

There is one significant feature of these layers which cannot be ignored. No type of datalink layer is able to deliver frames of unrestrained size as each of the datalink layer is bounded by a maximum size of frame.

Communications and Computer Networks

The fundamental drive of a communication system is the exchange of data between two different parties.

1. When devices are very far apart, and they cannot share a dedicated link.

2. When there is a complete set of devices and each of them requires a link to connect too many other devices at various times.

The two categories under which communication networks are classified is as follows:

Local area networks (LANs) and wide area networks (WANs).

Wide Area Networks

Generally, wide area networks extend to a large geographical area, characteristically to multiple cities, countries, or continents. Usually, a WAN comprises of several interconnected switching nodes that are called as ***routers.***

1. Circuit Switching - In a circuit-switching network, a devoted communications route is recognized between two different stations through the nodes of network.

2. Packet Switching - When data is directed in a sequence of small chunks, then it is known as packets.

Local Area Networks - The range of LAN is small, that extends to a single building or a group of buildings.

Bluetooth: An important kind of wireless technology.

End devices are also known as **hosts.** They serve as the source and destination of the communication.

A ***protocol*** is a complete set of rules and resolutions between two communicating members.

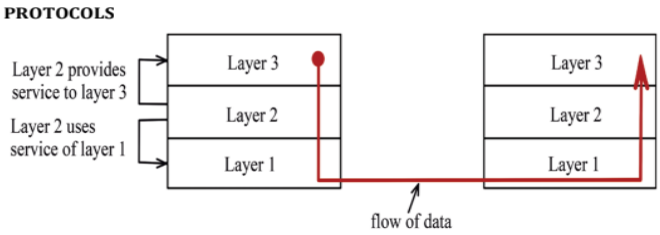


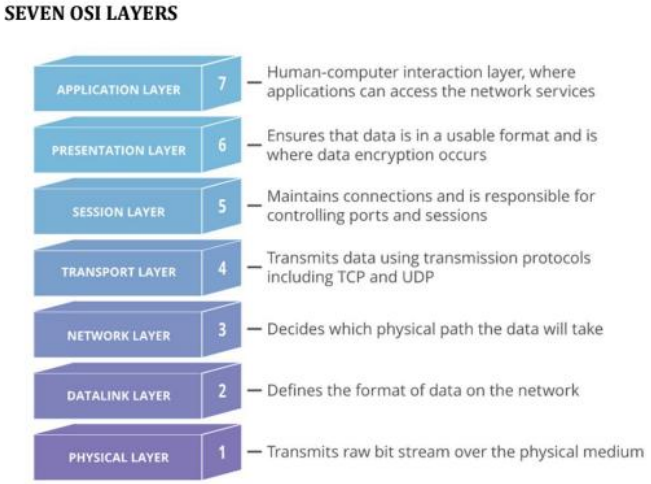
Figure 12: A simple Protocol Stack

Advantages of Protocol Layering

1. The facilities offered by a given layer are specific and well defined in nature.

2. Consecutively more valuable functionality can be supplemented to a stack of protocol by adding several layers and applications, without looking for how the fundamental underlying services can be implemented.

3. For the reasons stated above, a layer that offers a precise service to its users of upper layer, and also operates the well-defined services of its lower layer supplier, can easily engage a substitute protocol without doing any alternations in either the upper layer or lower layer protocols.



The ***open systems interconnection (OSI)*** model is a conceptual model created by the International Organization for Standardization which enables diverse communication systems to communicate using standard protocols. In plain English, the OSI provides a standard for different computer systems to be able to communicate with each other.

Module 2 Part 2

In a data transmission system, the medium for the transmission is the physical path available between transmitter and receiver.

Bandwidth: All factors associated to network remaining constant, the higher the bandwidth of a signal, the greater the data transfer rate that can be attained.

Transmission Impairments: Impairments, like attenuation, disturb the distance. For guided media system, twisted pair ideally suffers higher impairment as compared to coaxial cable, which usually suffers higher than the optical fiber.

Interference: Interference from contending signals in overlapping frequency bands can twist or wipe out a signal.

Number of receivers: A guided network system-based medium can be utilized to develop point-to- point link or shared link with multiple attachments.

Data Transmission Modes: Transmission mode represents to the instrument of data transfer between two devices associated over a network.

Three kinds of transmission modes:

1. Simplex - In this sort of transmission mode, data can be sent to just one direction, i.e., communication is unidirectional.

2. Half-Duplex: Data transmission through half-duplex means that data can be transmitted in both the directions on a carrier of signal, but that is not at the same time.

3. Full-Duplex: In full duplex network of communication people can transfer data in both the directions as this network is bidirectional simultaneously in other words, data can be transferred in both directions at the same time.

Factors to be taken care of while opting an appropriate transmission medium:

1. Transmission/Data Rate - Data rates define the speed of data transmission in wireless communication.

2. Cost and Ease of Installation - Ease of installation of the communication medium is relatively simple to define. Generally, all communication media require care when being installed.

3. Distances - A single run of cable is designed to work at a maximum distance of 100 meters, or 328 feet.

CLASSES OF TRANSMISSION MEDIA

1. Guided Media - This kind of transmission media is also known as wired otherwise bounded media. In this type, the signals can be transmitted directly & restricted in a thin path through physical links.

2. Unguided Media - It is also known as unbounded otherwise wireless transmission media. It doesn't require any physical medium to transmit electromagnetic signals.

Antennas - An antenna can be characterized as an electrical conductor or arrangement of conductors utilized either to radiate electromagnetic vitality or for collecting electromagnetic vitality.

Propagation Methods - A signal radiated from an antenna travels along one of three routes: ground wave, sky wave, or line of sight (LOS). This section shows in which frequency range each predominates.

a. Ground Wave Propagation - Ground wave propagation more or less goes through the contour of the earth and can propagate considerable distances, well over the visualized horizon.

b. Sky Wave Propagation - Sky wave propagation is utilized for beginner radio, CB radio, and worldwide broadcasts, for example, BBC and Voice of America.

c. Line-of-Sight Propagation - "Above 30 MHz, neither ground wave nor sky wave propagation modes operate, nor must communication be by line of sight.

Radio Waves - Radio waves are used for multicast communications, such as radio and television, and paging systems.

Omnidirectional antenna - An antenna can be characterized as an electrical conductor or arrangement of conductors utilized either to radiate electromagnetic vitality or for collecting electromagnetic vitality.

Microwaves - Microwaves are used for unicast communication such as cellular telephones, satellite networks, and wireless LANs.

Satellite Microwaves - A correspondence satellite is, as a result, a microwave relay station.

Applications of Satellite Microwave

The communication satellite is a technological revolution as important as fiber

optics. Among the most important applications for satellites are the following:

- **Television distribution**
- **Long-distance telephone transmission**
- **Private business networks**

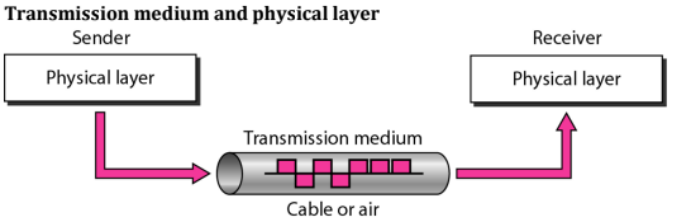
The following factors must be considered to design the transmission media like the following.

1. Bandwidth - The bandwidth mainly refers to the capacity of data-carrying in a medium otherwise a channel.

2. Radiation - The radiation refers to the signal leakage from the medium because of its unwanted electrical characteristics.

3. Absorption of Noise - The absorption of noise refers to the vulnerability of the media to exterior electrical noise.

4. Attenuation - Attenuation refers to the energy loss when signal broadcasts externally.



Physical transmission media used in communications include twisted-pai cable, coaxial cable, and fiber-optic cable. These cables typically are used withir or underground between buildings. Ethernet and token ring LANs often use physical transmission media.

1. GUIDED MEDIA

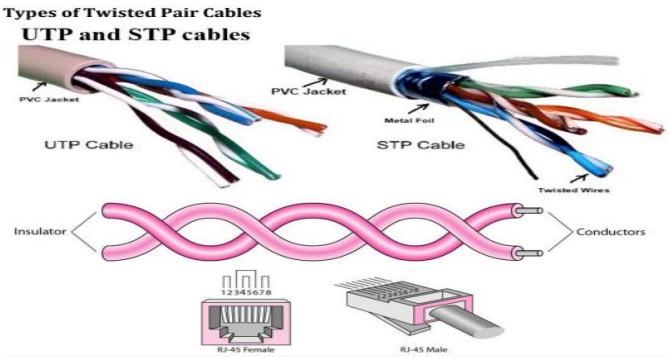
Guided media, which are those that provide a conduit from one device tc another, include twisted-pair cable, coaxial cable, and fiber-optic cable.

a. Twisted-Pair Cable - One of the more commonly used transmission media for network cabling and telephone systems is twisted-pair cable.

Physical Description of twisted-pair cable - A twisted pair comprises of two insulated copper wires organized in a standard spiral pattern.

Applications of this twisted pair-cable - Usually, the most basic transmission medium for analog and digital both type of signals is twisted pair.

Types of Twisted Pair Cables



1. UTP (Unshielded Twisted Pair) - This UTP cable has the capacity to block interference.

2. STP (Shielded Twisted Pair) - STP cable includes a particular jacket for blocking outside interference.

b. Coaxial Cable - Coaxial cable, often referred to as coax (pronounced KO-ax), consists of a single copper wire surrounded by at least three layers: (1) an insulating material, (2) a woven or braided metal, and (3) a plastic outer coating.

Physical Description of Coaxial Cable - Coaxial cable, as twisted pair, comprises of two conductors, however is developed contrastingly to allow it to work over a more extensive range of frequencies.

Applications of Coaxial Cable - Coaxial cable is usually the most versatile medium of transmission and is enjoying widespread usage in a wide variety of applications. The most important of these usages are:

- **Television distribution;**
- **Long-distance telephone transmission;**
- **Short-run computer system links;**
- **Local area networks.**

c. Fiber Optic - This cable uses the notion of light reflected through a core that is made with plastic or glass. The core is enclosed with less thick plastic or glass and it is known as the cladding, used for large volume data transmission.

Physical Description of Fiber Optic Cable - An optical fiber is a thin, adaptable medium fit for managing an optical beam.

Applications of Fiber Optic - A standout amongst the most noteworthy innovative achievements in data transmission has been the advancement of down to earth fiber optic communication frameworks.