# *UNIT 5: NETWORKING CONCEPT*

- Wired network
- Wireless network

# Wired Network

In a wired network, data is transmitted over a physical medium. There are three types of physical cables used in a wired network.

## 1. Twisted Pair

It consists of a pair of copper wires twisted around each other; the wires are around 1 to 2 mm thick and they are twisted to reduce the interference from the surrounding wires. Remember that a current carrying wire has a magnetic field around it that can interfere with that of another wire when in close proximity. Invented by Alexander Graham Bell, this form of wire has been in use since the 19th century and is currently the cheapest mediums available. Twisted pairs are also used in telephone wires, but they only consist of four wires or two pairs. In computer networks, eight wires or four pairs are utilized. This is also known as the Ethernet cable or RJ-45 cable. The pairs of wires are bundled together and covered by a protective shield.

## 2. Coaxial Cable

Offering better data rates and less signal attenuation, a coaxial cable consist of a central copper conductor that is surrounded by a foil shield. The foil is covered by yet another shield known as a braided shield. Unlike twisted pairs, coaxial cables only have a single copper conductor. The conductor and the foil shield are separated by a dielectric.

## 3. Fibre Optic

It is the most expensive of wired mediums and offers the highest rates of data transmission. They are often used in long distance communications and are never affected by any electromagnetic fields. This is because it involves light.

A fibre optic cable is a thin, flexible, transparent medium made of very fine glass or plastic fibres. It utilizes the principle of total internal reflection. Unlike twisted pairs or coaxial cables, a fibre optic uses light pulses generated by laser or an injection diode to transmit data. Each pulse of light represents a single bit of data.

# Wireless Network

A wireless network uses radio waves as the sole medium for transmitting and receiving data. There are no wires involved. An example is the wireless router in your home. Radio waves are electromagnetic waves which are transverse in nature and they have the longest wavelength on the electromagnetic spectrum. They travel at the speed of light and have frequencies ranging from 3 kHz to 3 GHz. Radio waves can easily be absorbed by most materials and can bend around objects as well. However, they are susceptible to nearby electromagnetic fields which can cause losses in the data rate.

## Microwave Transmission

Electromagnetic waves above 100 MHz tend to travel in a straight line and signals over them can be sent by beaming those waves towards one particular station. Because Microwaves travels in straight lines, both sender and receiver must be aligned to be strictly in line-of-sight. Microwaves can have wavelength ranging from 1 mm – 1 meter and frequency ranging from 300 MHz to 300 GHz. Microwave antennas concentrate the waves making a beam of it. As shown in picture above, multiple antennas can be aligned to reach farther. Microwaves have higher frequencies and do not penetrate wall like obstacles. Microwave transmission depends highly upon the weather conditions and the frequency it is using.

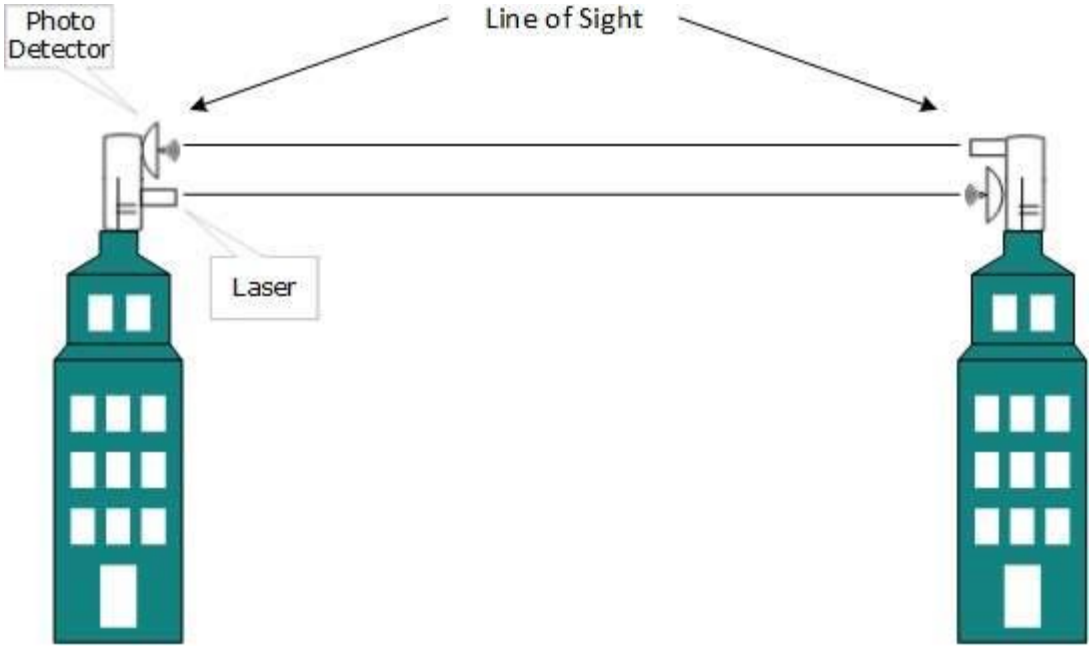
## Infrared Transmission

Infrared wave lies in between visible light spectrum and microwaves. It has wavelength of 700-nm to 1-mm and frequency ranges from 300-GHz to 430-THz.

Infrared wave is used for very short-range communication purposes such as television and it's remote. Infrared travels in a straight line hence it is directional by nature. Because of high frequency range, Infrared cannot cross wall-like obstacles.

## Light Transmission

Highest most electromagnetic spectrum which can be used for data transmission is light or optical signalling. This is achieved by means of LASER. Because of frequency light uses, it tends to travel strictly in straight line. Hence the sender and receiver must be in the line-of-sight. Because laser transmission is unidirectional, at both ends of communication the laser and the photo-detector needs to be installed. Laser beam is generally 1mm wide hence it is a work of precision to align two far receptors each pointing to lasers source.




Laser works as Tx (transmitter) and photo-detectors works as Rx (receiver).

Lasers cannot penetrate obstacles such as walls, rain, and thick fog. Additionally, laser beam is distorted by wind, atmosphere temperature, or variation in temperature in the path. Laser is safe for data transmission as it is very difficult to tap 1mm wide laser without interrupting the communication channel.

## Internet

Internet is defined as an Information super Highway, to access information over the web. However, It can be defined in many ways as follows:

- Internet is a world-wide global system of interconnected computer networks.
- Internet uses the standard Internet Protocol (TCP/IP).
- Every computer in internet is identified by a unique IP address.
- IP Address is a unique set of numbers (such as 110.22.33.114) which identifies a computer location.
- A special computer DNS (Domain Name Server) is used to give name to the IP Address so that user can locate a computer by a name.
- For example, a DNS server will resolve a name **http://www.tutorialspoint.com** to a particular IP address to uniquely identify the computer on which this website is hosted.
- Internet is accessible to every user all over the world.

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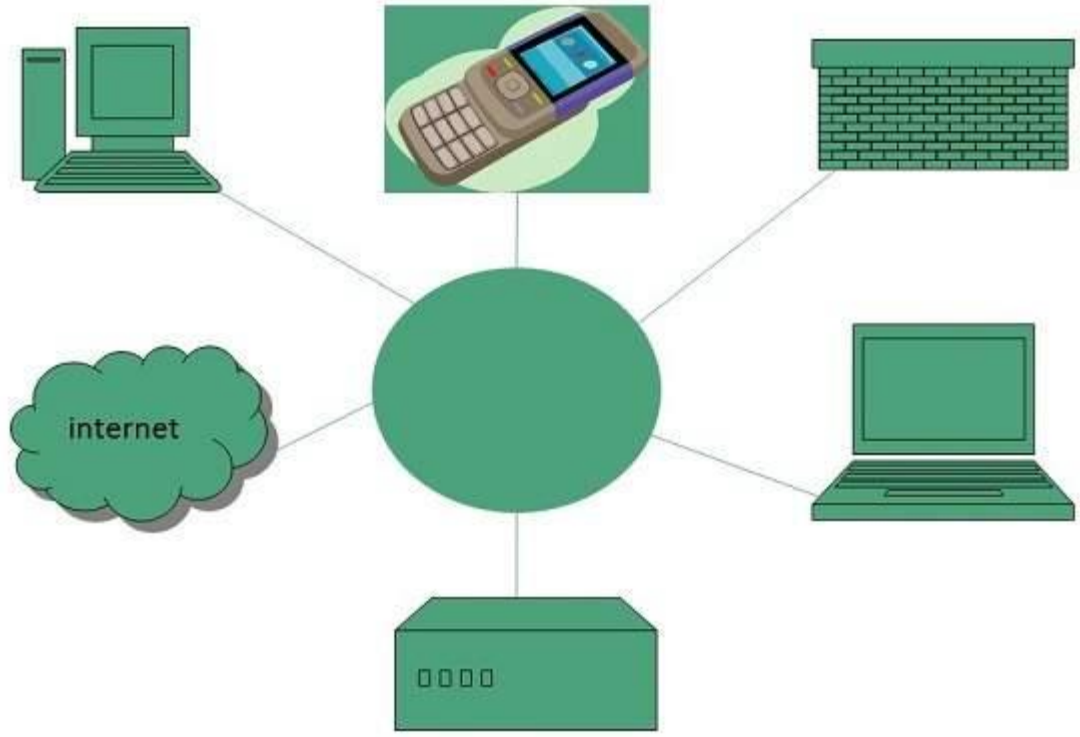


## Evolution

The concept of Internet was originated in 1969 and has undergone several technological & Infrastructural changes as discussed below:

- The origin of Internet devised from the concept of **Advanced Research Project Agency Network (ARPANET).**
- **ARPANET** was developed by United States Department of Defense.
- Basic purpose of ARPANET was to provide communication among the various bodies of government.
- Initially, there were only four nodes, formally called **Hosts.**
- In 1972, the **ARPANET** spread over the globe with 23 nodes located at different countries and thus became known as **Internet.**
- By the time, with invention of new technologies such as TCP/IP protocols, DNS, WWW, browsers, scripting languages etc., Internet provided a medium to publish and access information over the web.

HARDWARE AND SOFTWARE REQIUREMENT FOR LAN

**What is a LAN?**

The typical definition of Local Area Network (LAN) is "two or more connected stations (PCs, servers, computer…) in the same limited area, sharing data and peripheral devices, and operating at the speed of 1 Mbps (Million bits per second) to about 1 Gbps (Billion bits per second)." The most popular LANs include 10 Mbps & 100 Mbps Ethernet, 4 Mbps & 16 Mbps Token Ring.

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## What are the hardware components of a LAN?

The hardware components of a LAN consist of:

- PCs/workstations and servers
- Network Interface Card (NIC)
- Cabling and connectors, for example, coaxial cable and BNC connector, Unshielded Twisted Pair (UTP) and RJ-45 connector
- Hub, concentrator, and more complicated network devices such as Bridge, LAN Switch and Router

## What are the software components of a LAN?

The software components of a LAN can be grouped into two categories:

1. Inside PCs/workstations and servers

- NIC Drivers
- Network Operating System for servers, for example, Novell® Netware 4.1 or Microsoft Windows® NT
- Network Operating System for clients (PCs/workstations), for example, Novell® Netware 4.1 client or Microsoft Windows® 95
- Networking protocol software, for example, TCP/IP, Novell® IPX
- Application software, for example, emails, Internet Web Browser

2. Inside network devices (Hub/Bridge/LAN Switch/Router)

- Network Management Software, for example, Simple Network Management Protocol (SNMP), Remote Network Monitoring (RMC)
- Forwarding/routing & control software, for examples, transparent bridging, spanning tree and IP routing software

# Types of Network Topology

The arrangement of a network which comprises of nodes and connecting lines via sender and receiver is referred as network topology. The various network topologies are:

### a) Mesh Topology:

In mesh topology, every device is connected to another device via particular channel.