

## EXPERIMENT-1

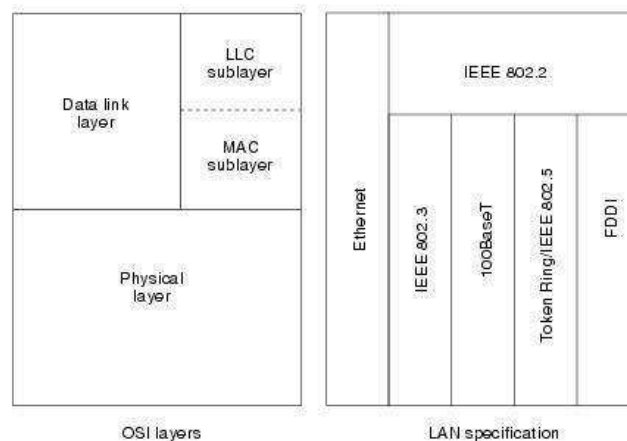
**Aim:** Introduction to Local Area Network with its cables, connectors and topologies.

### LAN

Local Area Network (LAN) is a collection of devices that are connected together within a limited area in one physical location; for example, house, school, building etc. A LAN may thus range from having a single user in a personal-home network or thousands of users in an office.

### LAN Protocols:

LAN protocols work at the two lowest layers of the OSI reference model, as shown in the figure below:



### MAC Address:

MAC stands for **Media Access Control**, which is used in a LAN to identify the network devices. They are 48 bits long and contain 12 hexadecimal digits, first six of which are administered by the IEEE and they identify the manufacturer as they consist of a OUI (Organizational Unique Identifier), the latter six digits contain the serial number, and other values. These addresses are burned in ROM and thus are also called Burned-IN Addresses (BIA), they are later copied into the RAM during initialization. These addresses are supported in the data link layer of the OSI. According to the IEEE, the second layer has two components; the MAC Layer and the Logical Link Control Layer.

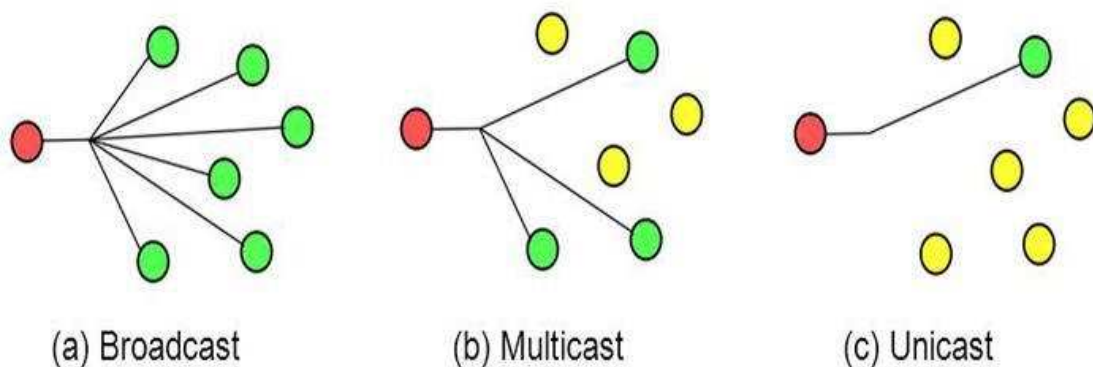
### Network Layer Addresses:

These identify the device at the network layer (third layer) of the OSI. They are also called as virtual or logical address and exist within a hierarchical address space. It has two parts; the network (of which the device is a part) and number of devices on that network which means that the devices on same network have the same network part address.

LAN transmissions are either of the following three categories:

- 1) *Unicast*: A single packet is sent from source to the destination on a network (uni=>one). The packet is addressed by using the address of the destination node, after which it is transferred to the destination network which transfers it to the final destination.
- 2) *Multicast*: A single data packet is copied and forwarded to a predefined set of nodes on the network which are in the multicast address.
- 3) *Broadcast*: Broadcast transfers the network packet to all the nodes of the network and can be useful in sending a common notification or message.

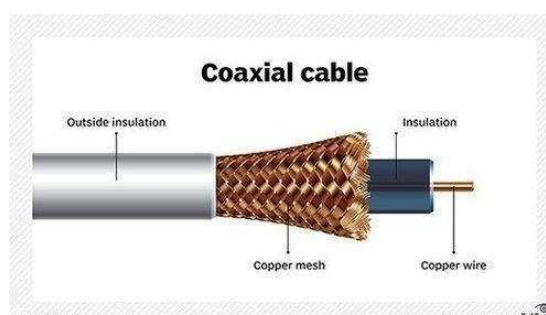
The following figure shows the depiction of the three types:



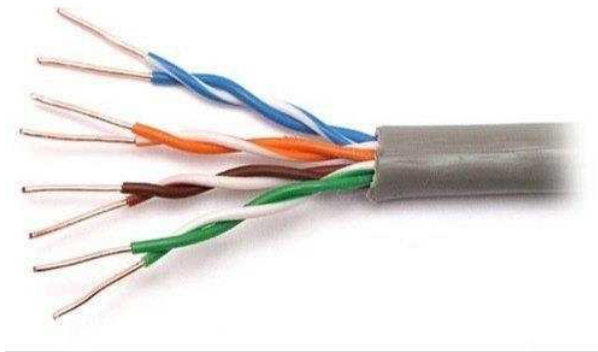
### LAN Cables:

The LAN makes use of the different cabling for connecting the various nodes of the network. The three most commonly used cables in LAN are: Coaxial, Twisted pair and Fibre optic cables.

- 1) *Coaxial cabling*: In a coaxial cable there is an inner conductor that runs down through the middle of the cable and is called the core. This conductor is surrounded by a layer of insulation which is surrounded by a copper conducting mesh. All of which is surrounded by an insulation called as the sheath. This setup prevents any outside interference. It can be of two types: thinnet and thicknet. The maximum transmission speed is 10 Mbps. However, they are not used as much nowadays and are replaced by the twisted pair cables.

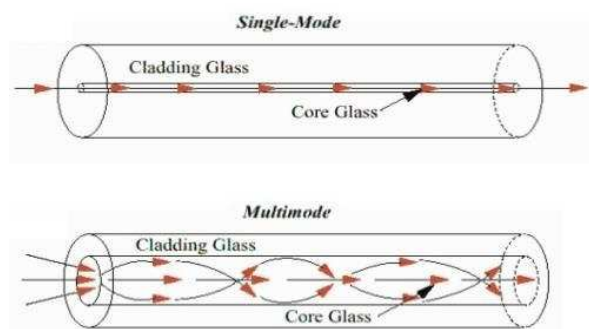


- 2) *Twisted pair cables*: This cable is primarily developed for computer networks and is also called as the ethernet cable. It is the most widely used cable by the modern day LANs. It consists of colour coded pair of twisted copper wires. There are usually four pairs of insulated copper and they are of two types: UTP (Unshielded Twisted pair), in which all the pairs are wrapped into a single plastic sheath and STP (Shielded Twisted Pair) in which each pair is additionally shielded by a metal shield and then they are wrapped into a single plastic sheath.



- 3) *Fiber Optic cable*: This cable consists of core, the thin strand carrying data over long distances and made up of glass or plastic; the cladding, it wraps the core and reflects the light back to the core; the buffer, which wraps the cladding and protects against any leakage of the light and jacket, which wraps buffer and protects the cable from any physical damage.

The Fibre Optic cable are the fastest cables that use the light to send data over forty kilometres at a speed of 100 Gbps. They are however quite costly and thus are not in use everywhere. Based on the beams of light transmitted at a given time, they can be classified as SMP (Single Mode Fibre) and MMF (Multi Mode Fibre).



### **LAN Connectors:**

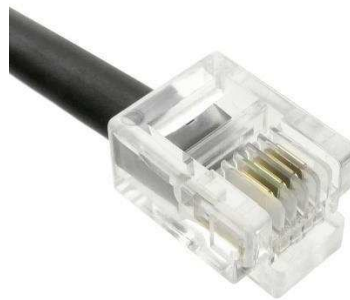
LAN makes use of different connectors for connecting the networks. The most common connectors are:

- 1) *USB*: It stands for the Universal Serial Bus and is used to eliminate the guesswork in connecting peripherals to a PC. A single port can be used for connecting up to 127 peripherals devices (such as mouse, speaker, keyboard etc.). It is expected to replace the serial and parallel ports.

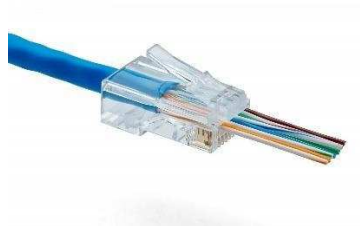


- 2) *RJ-11*: Registered Jack-11 has four wires (RJ-12 has six), used for connecting telephone equipment. The following table lists the signals of the four wires:

RJ-11 Pin	Signal Name
1	VCC
2	Power Ground
3	One Wire data
4	One Wire Ground



- 3) *RJ-45*: Registered Jack-45 is an eight wires connector commonly used for connection of computers to a LAN. Even though they are larger than RJ-11 they can still be used for telephone equipment.



- 4) *MT-RJ*: Mechanical Transfer Registered Jack are often used with both single and multimode optical cables and are constructed with a plastic housing and provide an accurate alignment via metal guide pins and plastic ferrules.



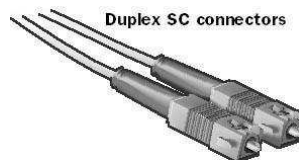
- 5) *Fibre LC*: Local Connectors are used for single and multimode fibre cables. They offer precise positioning with respect to transmitter's optical source emitter and receiver's optical detector.



- 6) *F-Type*: It is a kind of Rf connector used mainly for satellite television. It is inexpensive and offers good performance. The reason of its low cost is that it uses the centre wire of the coaxial cable as a pin of the male connector (which are cheaper than female connectors).



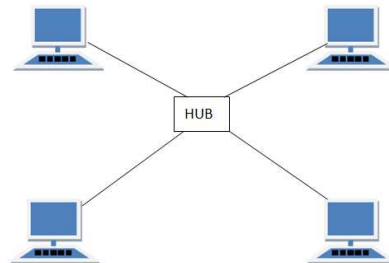
- 7) *ST and SC*: Both of these connectors are based on the concept that network requires two fibre cables; one for transmission and other for receiving. Each end is fitted with a plug that can be connected to a hub or switch. In North America SC's are used (Subscriber Connector/Standard Connector) while Europeans use round ST's (straight Tips).



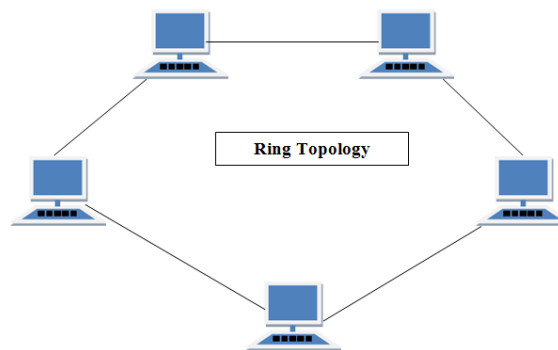
## LAN Topologies:

Topology refers to how the devices are connected to each other; in LAN there are four major topologies:

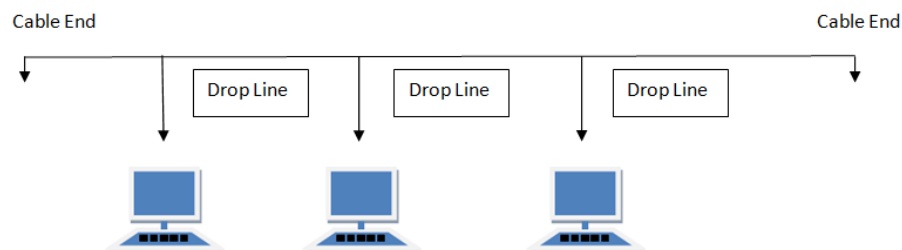
- 1) *Star Topology*: In this topology all the nodes are connected to a central point by cables like Shielded twisted Pair (STP), Unshielded twisted Pair (UTP), etc.



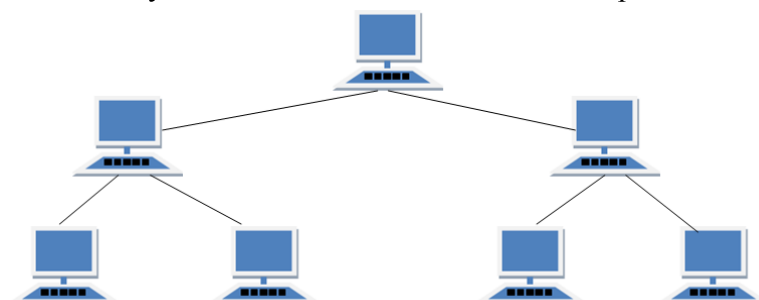
- 2) *Ring Topology*: All stations form a ring or a loop and consist of repeaters. There is no start or end of this networking.



- 3) *Bus Topology*: It makes use of a single length cable attached to all the LAN stations, which is its biggest weakness that if this single cable is broken the whole system fails.



- 4) *Tree topology*: It is an extension of the bus topology in a logical manner. There is a hierarchical structure and the network begins at the root node and there is only one active path between any two nodes and so there can be no loops.



Thus, we learnt about LAN through the various cables, connectors and topologies it uses and can conclude the following points:

- LAN allows sharing of resources and data.
  - It helps establish client server relationships.
  - It provides easy and a fast way of communication.
  - It provides data security.
  - Even though it can only be used for a limited area, it provides a strong connection within the area.
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