

## EXPERIMENT-4

**Aim:** Case Study of Ethernet (10 base 5,10 base 2,10 base T).

### **Ethernet:**

It is a frame-based computer networking technique for local area networks (LANs). The name 'Ethernet' is derived from the word *ether* and its physical concepts. It is the most widely used method of linking computers since the 1990's. The basic idea behind its design is that multiple computers have access to it and can send data any time. It is standardized as IEEE 802.3.

There are various variants of Ethernet, we are going to look into three of these variants: 10BASE2, 10BASE5 and 10BASE-T.

### **10BASE2:**

It is a variant of Ethernet that uses thin coaxial cable (RG-58 or similar) and thus is called as cheapernet, thin ethernet, thinnet, thinwire. It is terminated with BNC connectors. It was a dominant 10 Mbit/s standard for years when it came into existence, however it has now become obsolete with popularity of 802.11 wireless networks.

### *Network Design:*

In this cable each segment of the cable is connected to the transceiver using a BNC-T connector. At the physical end of the network, a terminator is required of 50 ohms. This is most commonly connected directly to the T-connector on a workstation though it does not technically have to be.

Wiring should be done carefully with cables properly connected and the appropriate terminators installed. One terminator is connected to ground through a ground wire. A failure at any point prevents any communication and bad contacts and shorts and very difficult to diagnose. And thus these networks are very difficult to maintain, and so an upgrade (10BASE-T) was required.

### *Characteristics:*

- They cannot be extended without breaking services temporarily for existing users and the presence of many joints in the cable makes them vulnerable to accidents, or malicious disruptions.
- They do have some advantages like: The low hardware cost, and thus is ideal for smaller networks involving two or more computers.



## **10BASE5**

These variants are also called as the thicknet as it a thick and stiff 0.375 inch diameter and 500 metres in length cable with an impedance of 50 ohms. It has a solid centre conductor, a foam insulating fiber, a shielding braid and an outer jacket. Since the outer sheath is yellow-to-orange in colour, they are also called as the yellow cable or the orange cable. It is obsolete in today's time but can be found in the older systems where it was used earlier.

### *Network Design*

They are designed to allow transceiver to be added while existing connections are live. It is achieved by vampire tap-a device which (with sufficient practice) clamps onto the cable, forcing a spike to pierce through the outer shielding to contact the inner conductor while other spikes bite into the outer conductor. The transceiver can also be connected by using N connectors at the end of cable segment.

The maximum number of nodes that can be connected to this cable are limited to 100 and transceivers can be installed only at 2.5 metre intervals. This distance is so chosen to avoid the reflections from multiple taps not in phase, and these points are marked on the cable with black bands. A 50-ohm resistive terminator is required at each end of the cable.

The transceiver is connected to the node using an interface called the Attachment Unit Interface (AUI), which has 15 pins, two-row d-style connector but with clips instead of the more normal screws for cable restraint.

### *Characteristics:*

- These systems are difficult to install and maintain.
- 10BASE5, is derived from 10Mbit/s (its speed), BASE (which is short for baseband signaling) and 5 stands for maximum segment length of 500 metres.
- With termination missing, or if there is a break in the cable, the signal on the bus will be reflected, rather than dissipated when it reaches the end, this reflect signal is indistinguishable from a collision and prevents any kind of communication.



## 10BASE-T

They are called as the Ethernet over twisted pair or the copper based computer networking physical connectivity methods. These are the most widely used cables, their subtypes: 10BASE-T, 10BASE-TX, 1000BASE-T run at 10Mbit/s, 100Mbit/s, 1000Mbit/s respectively. All of these three standards use the same connectors. Since these are high speed cables they can also be mixed with the older generations as well. They use 8 position modular connectors. The cables usually used are four-pair Category 5 or above twisted pair cable. Each of the three standards support both full duplex and half-duplex communication. According to the standards, they all operate over distances of up to 100 meters.

Its name is derived from several aspects of the physical media. The number refers to the theoretical maximum transmission speed in Megabits per second (Mbit/s). The BASE is short for baseband. The T designates twisted pair cable, where the pairs of wires are twisted together for purposes of reducing crosstalk.

### *Characteristics:*

- Twisted-pair Ethernet standards are such that the majority of cables can be wired 'straight-through' (pin 1 to pin 1, pin 2 to pin 2 and so on), but others may need to be wired in the 'crossover' form (receive to transmit and transmit to receive).
- 10BASE-T and 100BASE-TX only require two pairs to operate, pins 1 and 2 (transmit or TX), and pins 3 and 6 (receive or RX). Since 10BASE-T and 100BASE-TX need only two pairs and Category 5 cable has four pairs.
- This is not possible with 1000BASE-T since it requires all four pairs to operate, pins 1 and 2, 3 and 6 — as well as 4 and 5, 7 and 8. It is conventional to wire cables for 10 or 100 Mbit/s Ethernet to either the T568A or T568B standards.
- A 10BASE-T node (such as a PC) that transmits on pins 1/2 and receives on pins 3/6 to a network device is most often on a "straight-through" cable in the "MDI" wiring pattern where RX goes to RX and TX goes to TX

- Many modern Ethernet host adapters can automatically detect another PC connected with a straight-through cable and then automatically introduce the required crossover, if needed; if one or neither of the PC does not, then a crossover cable is required. If both devices being connected support 1000BASE-T according to the standards, they will connect regardless of the cable being used or how it is wired.
- To connect two hubs or switches directly together, a crossover cable can be used, but some hubs and switches have an “uplink” port used to connect network devices together, or have a way to manually select MDI or MDI-X on a single port so that a straight-through cable can connect that port to another switch or hub.
- 100BASE-TX follows the same wiring patterns as 10BASE-T but is more sensitive to wire quality and length, due to the higher bit rates.
- 1000BASE-T uses all four pairs bi-directionally and the standard includes auto MDI-X, however implementation is optional. With the way that 1000BASE-T implements signaling, how the cable is wired is immaterial in actual usage. The standard on copper twisted pair is IEEE 802.3ab for Cat 5e UTP, or 4D-PAM5; 4 Directions using PAM (pulse amplitude modulation) with 5 voltages, -2, -1, 0, +1, and +2
- Unlike earlier Ethernet standards using broadband and coaxial cable, such as 10BASE5 (thicknet) and 10BASE2 (thinnet), 10BASE-T does not specify the exact type of wiring to be used but instead specifies certain "characteristics" which a cable must meet.
- 100BASE-TX and 1000BASE-T both require a minimum of Category 5 cable (5e or 6 with 1000) and also specify a maximum cable length of 100 meters. Furthermore while 10BASE-T is more tolerant of poor wiring such as split pairs, poor terminations and even use of short sections of flat cable, 100BASE-T is not as much so, and 1000BASE-T is less tolerant still.
- Since testing of cable is often limited to checking if it works with Ethernet, running faster speeds over existing cable is often problematic. This problem is made worse by the fact that Ethernet's auto negotiation takes account only of the capabilities of the end equipment not of the cable in between.



TIA/EIA-568-A T568A Wiring			
Pin	Pair	Wire	Colour
1	3	tip	white/green
2	3	ring	green
3	2	tip	white/orange
4	1	ring	blue
5	1	tip	white/blue
6	2	ring	orange
7	4	tip	white/brown
8	4	ring	brown

10BASE-2, 10BASE-5 and 10BASE-T are all variants of ethernet. However, the former two are not used anymore. They have similarities to the ethernets but differ in the characteristics mentioned above. The picture below shows the fundamental difference between them:

