Module 5

Local Area Networks

Lesson

15

LAN Topologies, Access Mechanisms And Media

5.1.1 INTRODUCTION

Microelectronics brought a great revolution in computer technology. While the processing power of the computer increased considerably, the size and the cost also decreased greatly. The Personal Computer (PC) was a result of this technological advancement. They became affordable and hence very popular. With the increasing usage of PC and other computers a need was felt to interconnect them foe sharing data and information. The idea was to make the offices paperless and increase the productivity in cutting down the delayed movement of physical files and access to information. The scientific and other applications of PC were growing in any case. This interconnection of computers was achieved at a relatively low cost. Further it was felt necessary that the computer network in an organization should be free from any government and public regulations and control. Such requirements resulted in the birth of local area networks (LAN). The LANs have the advantage that they are totally under the control of the management of the organization and do not have any intervention from outside agencies. The organizations are free to choose any configuration and any components in designing their LANs depending on their requirements. Various topologies were proposed and different media were chosen in different LANs. The topologies and media are discussed in more detail in the later lessons. It may be important to mention here that the bus, ring and star topologies were favoured in practical LANs. The bus topology became popular under the tradename ‘Ethernet’. The ring topology is normally used with

token passing. The bus topology with tokens has also found many applications. For quite some time the star topology with the Ethernet standard has gained tremendous deployment. Most of these LAN topologies support the user in the shared mode. Even though the overall bitrate available with the LANs range from several Megabits per second to few Gigabits per second, the individuals effectively get much lower bit rates because of sharing, switched LANs have been developed to provide high bitrates to users without sharing. The LANs are confined to a few kms. Because of the growing use of LANs their cost has come down considerably.

MAC

As mentioned earlier, to make the LAN inexpensive, a single medium is generally used for all the users. As a result, two users can't send their data to respective destinations simultaneously over the same medium. This brings in the necessity to control the access to the medium so that the signals of two users do not clash, which otherwise would lead to loss of information. Many medium access control techniques have been proposed, studied, and implement. For the wireless LANs (WLAN) there are two efficient MAC schemes. One is the Carrier Sense Multiple Access/Collision Detection (CSMA/CD). In this scheme the users first check whether the medium is free or not. They transmit only when they sense the medium to be idle to avoid collisions and loss of data. The other scheme employs token passing, where the network generates a token and it is passed from one user to the other in a definite sequence. Only the holder of the token can transmit its data. In this scheme too, collisions do not occur practically. The specific MAC scheme will be discussed along with the LAN standards in subsequent lessons. Due to the growing popularity of the LANs and for the convenience of the users the IEEE has formulated various LAN standards which will be discussed later on.

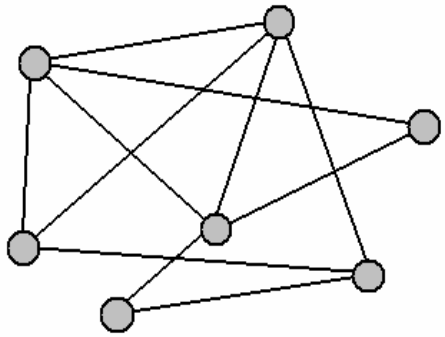
- LANs became popular after the PC revolution
- They have a limited geographical coverage
- The ownership is private or of an enterprise
- The network architecture is the choice of the owner

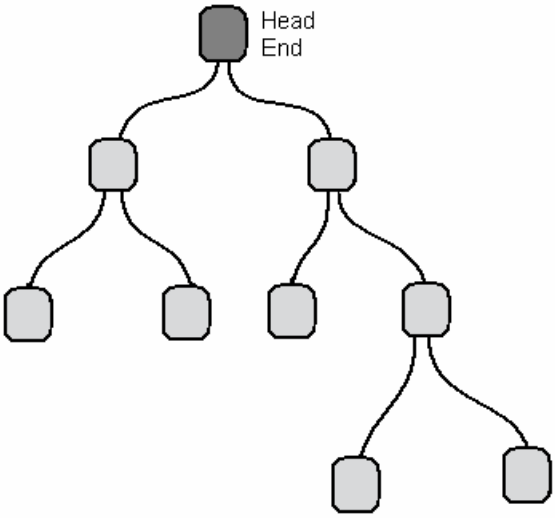
- Speed available is 10 Mbps or higher
- The complete control of the network i.e. technical, economic, business, lies with the owner.

8.1 BASIC ISSUES

8.1.1 TOPOLOGY

The various LAN topologies are as shown in the figure below

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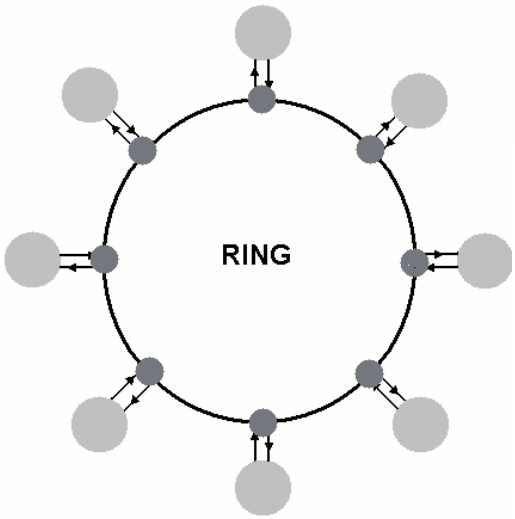
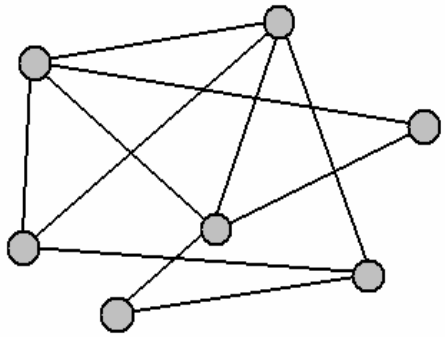
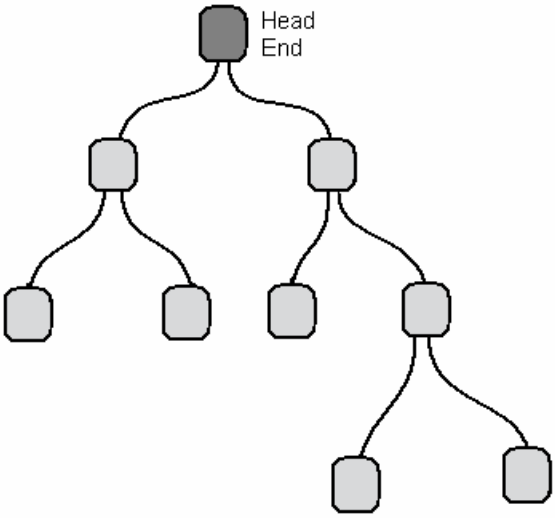

RING

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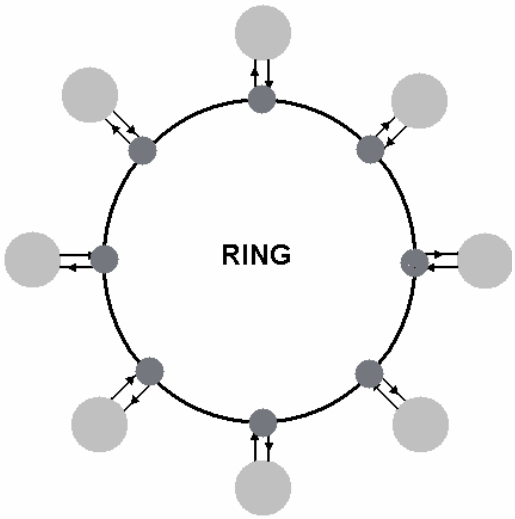
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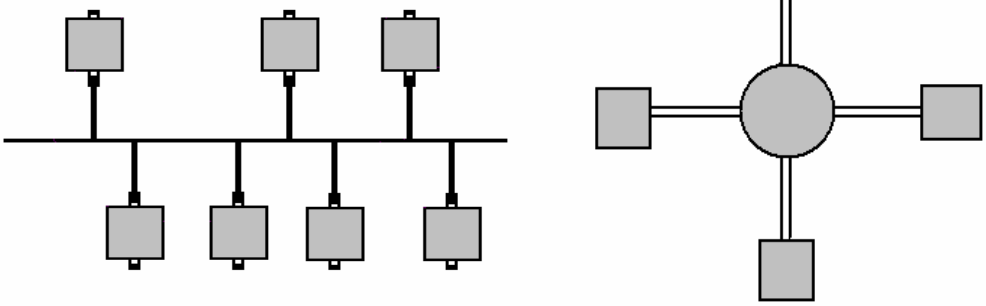


STAR

1. Sceptical people
2. High wiring costs
3. If the center node fails then restoration of the network is difficult.

TREE

1. Identical as star but with a Head end node
2. No direct path between any two stations.

MESH

1. High reliability with full / partial connectivity
2. Costliest among all the topologies
3. Complex wiring.

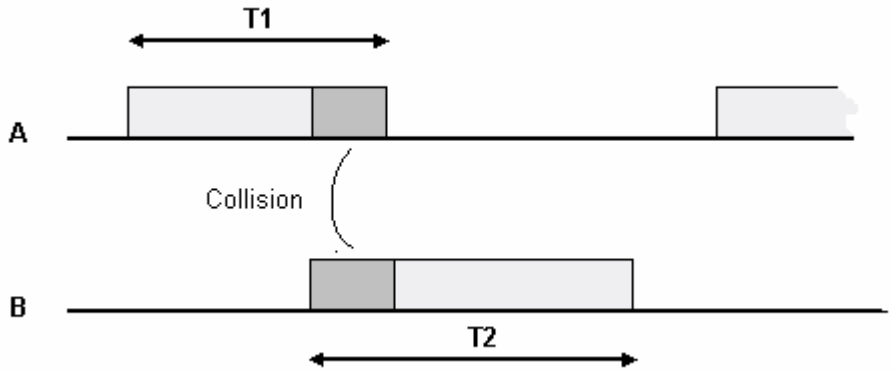
BUS

1. Minimum wiring
2. No master station required

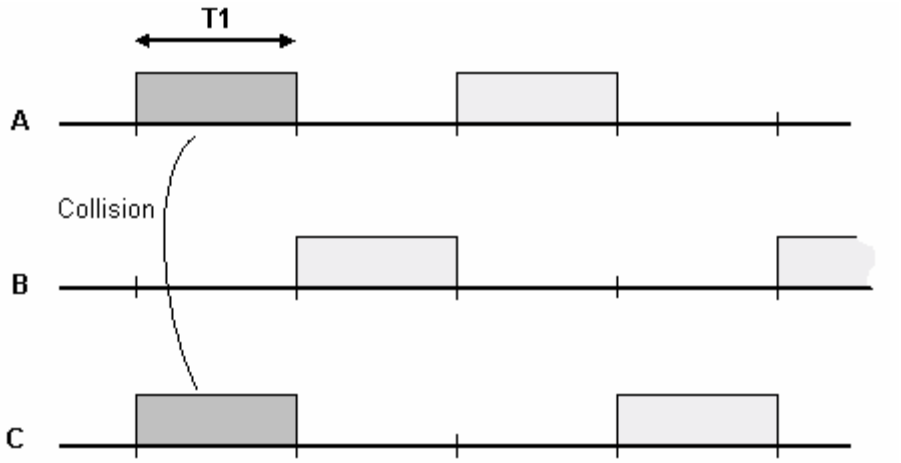
RING

1. Less costly
2. Simplest wiring connection
3. No master station required

In 1972 the University of Hawaii took up a plan to implement a computer network between the islands. Implementation had to be devoid of cables. Prof. Abramson. thought of wireless or radio LAN which was named ALOHA. A single frequency was allocated to all the stations. Abramson solved the apparently improbable situation of several stations wanting to transmit at the same time through the single radio channel. He mathematically proved that 18% throughput can be achieved in theory. ALOHA was a very simple network with no wires and no access control. It is based on the principle of bursty traffic and hence probability of collision is less. Throughput and delay are the two parameters that determine the quality of the network.



In normal ALOHA, the maximum wasted time is $T_1 + T_2$ i.e. 2 packet times, as during this no transmission could take place. As it is a random access technique so time frequency or code is allocated. To improve upon the maximum wasted time in normal ALOHA, the time axis is divided in to slots of fixed width. The users can transmit as and when they wish however the transmission has to start at the start of the slot or epoch. As a result the wasted time is that of a single slot. This is half of that in normal ALOHA, so throughput is doubled, i.e. up to 36% throughput is obtained.



☞ In mobile communication the user requests for a slot, using random access technique (ALOHA).

Objective Questions

15.01

Subjective Questions

15.11

Level 2 Questions

15.21