High Speed LANs

- Fast Ethernet and Gigabit Ethernet: The extension of 10-Mbps CSMA/CD (carrier sense multiple access with collision detection) to higher speeds is a logical strategy, because it tends to preserve the investment in existing systems.

- Fibre Channel: This standard provides a low-cost, easily scalable approach to achieving very high data rates in local areas.

- High-speed wireless LANs: Wireless LAN technology and standards have at last come of age, and high- speed standards and products are being introduced.

Need of High Speed LANs

In recent years, two significant trends have altered the role of the personal computer, increased the volume of data to be handled over LANs, and therefore the requirements on the LAN:

- The speed and computing power of personal computers has continued to enjoy explosive growth

- MIS organizations have recognized the LAN as a viable and indeed essential computing platform, resulting in the focus on network computing.

The following are examples of requirements that call for higher-speed LANs:

- Centralized server farms: In many applications, there is a need for user, or client, systems to be able to draw huge amounts of data from multiple centralized servers, called server farms.. As the performance of the servers themselves has increased, the bottleneck has shifted to the network.

- Power workgroups: These groups typically consist of a small number of cooperating users who need to draw massive data files across the network. In such cases, large amounts of data are distributed to several workstations, processed, and updated at very high speed for multiple iterations.

- High-speed local backbone: As processing demand grows, LANs proliferate at a site, and high-speed interconnection is necessary.

Ethernet (CSMA/CD)

- The most widely used high-speed LANs today are based on Ethernet and were developed by the IEEE
- 802.3 standards committee.
- As with other LAN standards, there is both a medium access control layer and a physical layer. The media access uses CSMA/CD.
- This and its precursors can be termed random access, or contention, techniques. They are random access in the sense that there is no predictable or scheduled time for any station to transmit; station transmissions are ordered randomly.
- They exhibit contention in the sense that stations contend for time on the shared medium.

CSMA

- The foregoing observations led to the development of carrier sense multiple access (CSMA). With CSMA, a station wishing to transmit first listens to the medium to determine if another transmission is in progress (carrier sense)
- . If the medium is in use, the station must wait.
- If the medium is idle, the station may transmit. It may happen that two or more stations attempt to transmit at about the same time.
- If this happens, there will be a collision; the data from both transmissions will be garbled and not received successfully.
- To account for this, a station waits a reasonable amount of time after transmitting for an acknowledgment, taking into account the maximum round-trip propagation delay and the fact that the acknowledging station must also contend for the channel to respond.
- If there is no acknowledgment, the station assumes that a collision has occurred and retransmits. This strategy is effective for networks in which the average frame transmission time is much longer than the propagation time.
- Collisions can occur only when more than one user begins transmitting within a short time interval (the period of the propagation delay).

- If a station begins to transmit a frame, and there are no collisions during the time it takes for the leading edge of the packet to propagate to the farthest station, then there will be no collision for this frame because all other stations are now aware of the transmission.
- The maximum utilization achievable using CSMA can far exceed that of ALOHA or slotted ALOHA. The maximum utilization depends on the length of the frame and on the propagation time; the longer the frames or the shorter the propagation time, the higher the utilization.

Nonpersistent CSMA

With CSMA, an algorithm is needed to specify what a station should do if the medium is found busy. One algorithm is nonpersistent CSMA. A station wishing to transmit listens to the medium and obeys the following rules:

1. If the medium is idle, transmit; otherwise, go to step 2.
2. If the medium is busy, wait an amount of time drawn from a probability distribution (the retransmission delay) and repeat step 1.

The use of random delays reduces the probability of collisions. To see this, consider that two stations become ready to transmit at about the same time while another transmission is in progress; if both stations delay the same amount of time before trying again, they will both attempt to transmit at about the same time. A problem with nonpersistent CSMA is that capacity is wasted because the medium will generally remain idle following the end of a transmission even if there are one or more stations waiting to transmit.

1-persistent CSMA

To avoid idle channel time, the 1-persistent protocol can be used. A station wishing to transmit listens to the medium and obeys the following rules:

1. If the medium is idle, transmit; otherwise, go to step 2.
2. If the medium is busy, continue to listen until the channel is sensed idle; then transmit immediately.

Whereas nonpersistent stations are deferential, 1-persistent stations are selfish. If two or more stations are waiting to transmit, a collision is guaranteed. Things get sorted out only after the collision.

P-persistent CSMA

A compromise that attempts to reduce collisions, like nonpersistent, and reduce idle time, like 1- persistent, is p-persistent. The rules are:

1. If the medium is idle, transmit with probability p, and delay one time unit with probability (1 – p). The time unit is typically equal to the maximum propagation delay.

2. If the medium is busy, continue to listen until the channel is idle and repeat step 1.

3. If transmission is delayed one time unit, repeat step 1.

The question arises as to what is an effective value of p. The main problem to avoid is one of instability under heavy load.