1. The three categories of multiple access protocols discussed in this chapter are random access, controlled access, and channelization.
2. In random access methods, no station is superior to another station and none is assigned the control over another. Each station can transmit when it desires on the condition that it follows the predefined procedure. Three common protocols in this category are ALOHA, CSMA/CD, and CSMA/CA.
3. In controlled access methods, the stations consult one another to find which station has the right to send. A station cannot send unless it has been authorized by other stations. We discuss three popular controlled-access methods: reservation, polling, and token passing.
4. Channelization is a multiple-access method in which the available bandwidth of a link is shared in time, frequency, or through code, between different stations. The common protocols in this category are FDMA, TDMA, and CDMA.
5. **Explain why collision is an issue in a random-access protocol but not in controlled access or channelizing protocols?**

In random access methods, there is no access control (as there is in controlled access methods) and there is no predefined channels (as in channelization). Each station can transmit when it desires. This liberty may create collision.

1. **Compare and contrast a random-access protocol with a controlled access protocol.**

In a random-access method, there is no control; access is based on contention. In a controlled access method, either a central authority (in polling) or other stations (in reservation and token passing) control the access. Random access methods have less administration overhead. On the other hand, controlled access method is collision free.

1. **Compare and contrast a random-access protocol with a channelizing protocol.**

In a random-access method, the whole available bandwidth belongs to the station that wins the contention; the other stations need to wait. In a channelization method, the available bandwidth is divided between the stations. If a station does not have data to send, the allocated channel remains idle.

1. **Compare and contrast a controlled access protocol with a channelizing protocol.**

In a controlled access method, the whole available bandwidth belongs to the station that is granted permission either by a central authority or by other stations. Ina channelization method, the available bandwidth is divided between the stations. If a station does not have data to send the allocated channel remains idle.

**9. Do we need a multiple access protocol when we use the 1ocalloop of the telephone company to access the Internet? Why?**

We do not need a multiple access method in this case. The local loop provides a dedicated point-to-point connection to the telephone office.

**10. Do we need a multiple access protocol when we use one CATV channel to access the Internet?**

We do need a multiple access, because a channel in the CATV band is normally shared between several neighbouring customers. The cable company uses the random-access method to share the bandwidth between neighbours.

**11. In what situations contention-based MAC protocols are suitable?**

Contention based MAC protocols are suitable for bursty nature of traffic under light to moderate load. These techniques are always decentralized, simple and easy to implement.

**12. What is vulnerable period? How it affects the performance in MAC protocols?**

The total period of time when collision may occur for a packet is called vulnerable period. Let, all packets have a fixed duration λ. Then vulnerable period is 2λ in pure ALOHA scheme and λ in slotted ALOHA scheme. If vulnerable period is long, probability of the occurrence collision increases leading to reduction in throughput.

**13. How throughput is improved in slotted ALOHA over pure ALOHA?**

In pure ALOHA vulnerable period is 2λ. So, S/G = e-2G or throughput S = G e-2G , where G is the total number of packets. Maximum value of G = 0.5 or maximum throughput Smax = 1/2e. In slotted ALOHA, vulnerable period is λ and S/G = e-G or throughput S = G e-G . Here, maximum value of G is 1 and maximum throughput Smax = 1/e.

**14. What is the parameter ‘a’? How does it affect the performance of the CSMA protocol?**

The efficiency of CSMA scheme depends on propagation delay, which is represented by a parameter ‘a’ as defined below. propagation delay a = propagation delay/ packet transmission time.

Smaller the value of propagation delay, lower is the vulnerable period and higher is the efficiency. If propagation delay is zero, collision cannot occur in CSMA scheme. But in practice, there is some delay and depending on the value of ‘a’ collision occurs.

**15. How performance is improved in CSMA/CD protocol compared to CSMA protocol?**

In CSMA scheme, a station monitors the channel before sending a packet. Whenever a collision is detected, it does not stop transmission leading to some wastage of time. On the other hand, in CSMA/CD scheme, whenever a station detects a collision, it sends a jamming signal by which other station comes to know that a collision occurs. As a result, wastage of time is reduced leading to improvement in performance.

**IEEE 802.3- ETHERNET**

1. **List the functions performed by the physical layer of 802.3 standard?**

Functions of physical layer are:

i) Data encoding/decoding (To facilitate synchronization and efficient transfer of signal through the medium).

ii) Collision detection (It detects at the transmit side)

iii) Carrier sensing (Channel access senses a carrier on the channel at both the transmit and receive sides)

iv) Transmit/receive the packets (Frame transmitted to all stations connected to the channel)

v) Topology and medium used (Mediums are co-axial cable, twisted pair and fibre optic cable)

1. **Why do you require a limit on the minimum size of Ethernet frame?**

To detect collision, it is essential that a sender continue sending a frame and at the same time receives another frame sent by another station. Considering maximum delay Version 2 CSE IIT, Kharagpur with five Ethernet segments in cascade, the size of frame has been found to be 64 bytes such that the above condition is satisfied.

1. **What are the different types of cabling supported by Ethernet standard?**

Types of cabling are:

i) 10 BASE 5 - Maximum cable length is 500 meters using 4” diameter coaxial cable.

ii) 10 BASE 2 - Maximum cable length is 185 meters using 0.25” diameter CATV cable.

iii) 10 BASE T - Maximum cable length is 100 meters using twisted-pair cable (CAT-3 UTP).

iv) 10 BASE FL - Maximum cable length is 2 Km using multimode fibre optic cable (125/62.5 µm).

**4. What are the advantages of dividing an Ethernet LAN with a bridge?**

A bridge can increase the bandwidth and separate the collision domains on an Ethernet LAN.

**5. What is the relationship between a switch and a bridge?**

A layer-2 switch is an N-port bridge with additional sophistication that allows

faster handling of packets.

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A layer-2 switch is an N-port bridge with additional sophistication that allows faster handling of packets. A switch allows each station on an Ethernet LAN to have the entire capacity of the network to itself

**6. Why is there no need for CSMA/CD on a full-duplex Ethernet LAN?**

In a full-duplex Ethernet, each station can send data without the need to sense the

line.

In a full-duplex Ethernet, each station can send data without the need to sense the line. Full-duplex mode doubles the capacity of each domain and removes the need for the CSMA/CD method. In Fast Ethernet, auto-negotiation allows two devices to negotiate the mode or data rate of operation.

**7. What is the purpose of an NIC?**

An NIC provides an Ethernet station with a 6-byte physical address. Most of the

physical and data-link layer duties are done by the NIC.

An NIC provides an Ethernet station with a 6-byte physical address. Most of the physical and data-link layer duties are done by the NIC.