Networks Assignment

1. Identify the OSI reference model layer for each of the following concepts.

CSMA/CD: Physical layer

Manchester Encoding: Physical layer

Internet Protocol: Network layer

HTTP: Application layer

2. What key improvement did Ethernet make over Aloha?

The key improvement is a mechanism that detects when a collision occurred (collision detection). The system also included a “listen before talk” protocol, in which stations listened for activity (carrier sense) before transmitting, and supported access to a shared channel by multiple stations (multiple access).
Aloha could achieve a maximum channel utilization of about 37%, due to the rapidly increasing rate of collisions under increasing load whereas ethernet developed a more sophisticated backoff algorithm, which, in combination with the CSMA/CD protocol, allowed the Ethernet system to function at up to 100% load.

3. Compare how exponential backoff is used in CSMA/CD versus CSMA/CA. Briefly describe how the exponential backoff algorithm works.

CSMA/CD uses exponential backoff after a collision is detected. If a collision occurs after two hosts try to transmit, hosts wait for some time (determined by exponential backoff) before transmitting again.

CSMA/CA uses exponential backoff before a collision occurs (in an attempt to avoid collisions completely). The host listens for any interference in the medium and when it detects that the medium is in use, the host waits for some time (determined by exponential backoff) before listening again.

Exponential backoff algorithm:

It is primarily used to schedule retransmissions after collisions.

After n collisions, a random number of slot times between 0 and $2^n - 1$ is chosen. i.e After the first collision, each sender will wait 0 or 1 slot times. After the second collision, the senders will wait anywhere from 0 to 3 slot times (inclusive). After the third collision, the senders will wait anywhere from 0 to 7 slot times (inclusive), and so forth.

As the number of retransmission attempts increases, the number of possibilities for delay increases exponentially and the collision probability decreases exponentially.

4. A host receives the following bit message: 11010110111110. Assume the sending and receiving hosts agreed in advance to use the same CRC polynomial: $x^4 + x + 1$ **.**

a. What is the degree of the CRC polynomial?

The degree of CRC polynomial is 4.

b. Which bits of the bit message correspond to data and which bits correspond to the CRC checksum?

Binary pattern for the given CRC generator: 10011

Number of bits (n) : 5

When the message is divided by the number 10011,

Data : 1101011011

CRC checksum added: 1110

c. Was there an error in the transmission of this bit message? Show your work.

There is no error in the transmission of the bit message.

Steps: