Are Protocols needed for Data Communication? Justify your answer.

Yes, Protocols are needed for Data Communication. The purpose of it to facilitate timely and accurate communication between multiple devices with different configurations.

What is the propagation time if the distance between the two points is 12,000 km? Assume the propagation speed to be 2.4 × 10⁸ m/s in cable.

$$\text{Propagation time} = \frac{12,000 \times 1000}{2.4 \times 10^{8}} = 50 \text{ ms}$$

A telephone line normally has a bandwidth of 3000. The signal-to-noise ratio is usually 3162. For this channel, compute the capacity.

$$C = B \log_2 (1 + \text{SNR}) = 3000 \log_2 (1 + 3162) = 3000 \log_2 3163$$
$$= 3000 \times 11.62 = 34,860 \text{ bps}$$

You have two computers connected by an Ethernet hub at home. Is this a LAN, a MAN, or a WAN? Justify your answer.

Connecting two computers by an Ethernet hub at home is a LAN, because the geographical area spanned by the network would be very small, connects two computers locally.

Compare and contrast byte-oriented and bit-oriented protocols. Which category has been popular in the past (explain the reason)? Which category is popular now (explain the reason)?

The main difference between byte oriented and bit oriented protocols: the main difference between byte oriented and bit oriented is in a byte oriented protocol, data to be carried are 8 bit characters from a coding system such as Ascii. whereas in a bit oriented protocol, the data section of a frame is a sequence of bits to be interpreted by the upper layer as text, graphic, audio, and video and so on. Bit oriented protocols are more popular today because we need to send text, graphic, audio and video which can be better represented by a bit pattern than a sequence of characters/

Define the type of the following destination addresses:

a. 4A:30:10:21:1O:1A

b. 47:20:1B:2E:08:EE

c. FF:FF:FF:FF:FF:FF

Solution

To find the type of the address, we need to look at the second hexadecimal digit from the left. If it is even, the address is unicast. If it is odd, the address is multicast. If all digits are Fs, the address is broadcast.

a. This is a unicast address because A in binary is 1010 (even).

b. This is a multicast address because 7 in binary is 0111 (odd).

c. This is a broadcast address because all digits are Fs in hexadecimal.

List out the sublayers of DLL and also define the purpose of it.

The data link layer is further divided into two sub-layers, which are as follows:

- Logical Link Control (LLC):

This sublayer of the data link layer deals with multiplexing, the flow of data among applications and other services, and LLC is responsible for providing error messages and acknowledgments as well.

- Media Access Control (MAC):

MAC sublayer manages the device's interaction, responsible for addressing frames, and also controls physical media access.

What is the purpose of hamming code?

Hamming code is an error correction system that can detect and correct errors when data is stored or transmitted. It requires adding additional parity bits with the data. It is commonly used in error correction code (ECC) RAM.

What is the difference between connectionless and connection-oriented services? Which type of service is provided by IPv4? Which type of service is provided by IPv6?

S.NO	Connection-oriented Service	Connection-less Service
1.	Connection-oriented service is related to the telephone system.	Connection-less service is related to the postal system.
2.	Connection-oriented service is preferred by long and steady communication.	Connection-less Service is preferred by bursty communication.
3.	Connection-oriented Service is necessary.	Connection-less Service is not compulsory.
4.	Connection-oriented Service is feasible.	Connection-less Service is not feasible.
5.	In connection-oriented Service, Congestion is not possible.	In connection-less Service, Congestion is possible.
6.	Connection-oriented Service gives the guarantee of reliability.	Connection-less Service does not give a guarantee of reliability.
7.	In connection-oriented Service, Packets follow the same route.	In connection-less Service, Packets do not follow the same route.

IPv6 is connection-oriented

IPv4 is connection-less

Change the following IPv4 addresses from binary notation to dotted-decimal notation.

a. 10000001 00001011 00001011 11101111

b. 11000001 10000011 00011011 11111111

Solution
We replace each group of 8 bits with its equivalent decimal number and add dots for separation.
a. 129.11.11.239
b. 193.131.27.255

For n devices in a network, what is the number of cable links required for a mesh, ring, bus, and star topology?
Mesh: n * (n-1) / 2
Ring: n
Bus: n + 1 (n for cables, 1 for backbone)
Star: n

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.

Define the type of the following destination addresses:
a. 4A:30:10:21:1O:1A
b. 47:20:1B:2E:08:EE
c. FF:FF:FF:FF:FF:FF
Solution
To find the type of the address, we need to look at the second hexadecimal digit from the left. If it is even, the address is unicast. If it is odd, the address is multicast. If all digits are Fs, the address is broadcast.
a. This is a unicast address because A in binary is 1010 (even).
b. This is a multicast address because 7 in binary is 0111 (odd).
c. This is a broadcast address because all digits are Fs in hexadecimal.

Analyze the reason for moving from the Stop-and-Wait ARQ Protocol to the Go-Back-N ARQ Protocol.
"Go-Back-N ARQ is more efficient than Stop-and-Wait ARQ. The second uses pipelining, the first does not. In the first, we need to wait for an acknowledgment for each frame before sending the next one. In the second we can send several frames before receiving an acknowledgment."

Change the following IPv4 addresses from binary notation to dotted-decimal notation.
a. 10000001 00001011 00001011 11101111

b. 11000001 10000011 00011011 11111111

Solution

We replace each group of 8 bits with its equivalent decimal number and add dots for separation.

a. 129.11.11.239

b. 193.131.27.255