Quiz 3 Solution - Faculty: Dr. Tarem Ahmed

Data Communications and Networking (Independent University, Bangladesh)

CSE 316
Quiz-3
Solutions

Problem 1. **Marks: 6 X 2 = 12**

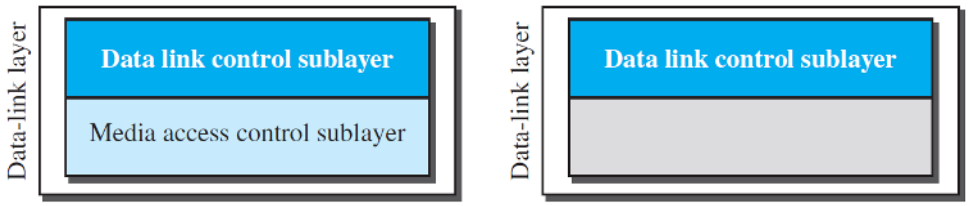
i. Distinguish between communication at the network layer and communication at the data-link layer.

Solution:

Communication at the network layer is host-to-host; communication at the data-link layer is node-to-node.

ii. What are the two sub layers for data link layer and which sub layers deal issues of a) broadcast links and b) point-to-point links

Solution:



a. Data-link layer of a broadcast link

b. Data-link layer of a point-to-point link

iii. A sender sends a series of packets to the same destination using 5-bit sequence numbers. If the sequence numbers start with 0, what is the sequence number of the 100th packet?

Solution:

2^5 =32, So, starting sequence number 0 and ending sequence number 31. 32nd packet sequence number is 31, 64th Packet number is 31, 96th packet number is 31, So 97th packet is 0, 98th packet is 1, 99th packet is 2 and **100th packet is 3**. We can also use the following equation to solve the problem:

$$\textbf{seqNo} = (\textbf{starting seqNo} + \textbf{packet number} - 1) \bmod 2^m$$

$$\textbf{seqNo} = (0 + 100 - 1) \bmod 2^5 = 99 \bmod 32 = 3$$

iv. In Stop-and-wait protocol, minimum how many packets can have independent sequence numbers before wraparound occurs?

Solution:

In the Stop-and-Wait protocol, m = 1, every 2^m = 2 packets have the same sequence number

v. If the pipe (communication media) has Bandwidth of 1 Mbps and sender to receiver RTD (round trip delay) 20 ms. Determine the number of packets that can be in the pipe (communication media) during the RTD, when each packet size is 1000 bits

Solution:

bandwidth-delay product = 1 Mbps × 20 ms = 20,000 bits

Number of packets = 20,000/1000 = 20

vi. What are the responsibilities of Error control at the transport layer

Solution:

Error control at the transport layer is responsible for:

1. Detecting and discarding corrupted packets.

2. Keeping track of lost and discarded packets and resending them.

3. Recognizing duplicate packets and discarding them.

4. Buffering out-of-order packets until the missing packets arrive.

Problem 2 **Marks: 4 + 4 + 5 = 13**

(i) What is ARP? Briefly describe the ARP operation.

(ii) Describe the advantage and the disadvantage of using the Go-Back-N and the Selective-Repeat protocol. What other network criteria should be considered to select either of these protocols?

(iii) Create a Selective-Repeat scenario (figure) if the sender sends 5 packets (0, 1, 2, 3, and 4). Packets 0, 1, and 2 are received in order and acknowledged, one by one. Packet 3 is delayed and received after packet 4. Show all the steps properly with proper sequence number and window sliding also mention the timer in the figure. (assume 3 bit sequence number and maximum sliding window size).

Solution

(i) Address Resolution Protocol (ARP) is one of the auxiliary protocols defined in the network layer, maps an IP address to a logical-link address. ARP accepts an IP address from the IP protocol, maps the address to the corresponding link-layer address, and passes it to the data-link layer.

Anytime a host or a router needs to find the link-layer address of another host or router in its network, it sends an ARP request packet. The packet includes the link-layer and IP addresses of the sender and the IP address of the receiver. Because the sender does not know the link-

layer address of the receiver, the query is broadcast over the link using the link-layer broadcast address. Every host or router on the network receives and processes the ARP request packet, but only the intended recipient recognizes its IP address and sends back an ARP response packet. The response packet contains the recipient's IP and link-layer addresses. The packet is unicast directly to the node that sent the request packet.

(ii) **The advantage** of using the Go-Back-N protocol is that we can have a larger send window size. We can send more packets before waiting for their acknowledgment. **The disadvantage** of using this protocol is that the receive window size is only 1. The receiver cannot accept and store the out-of- order received packets; they will be discarded. Discarding of the out-of-order packets means resending these packets by the sender, resulting in congestion of the network and reducing the capacity of the pipe. So the advantage seen by a larger send window may disappear by filling the network with resent packets.

The advantage of using the Selective-Repeat protocol is that the receive window can be much larger than 1. This allows the receive window to store the out-of-order packets and avoids resending them to congest the network. **The disadvantage** of this protocol is that the send window size is half of the Go-Back-N, which means that we can send fewer packets before waiting for the acknowledgment.

We can conclude that if the bandwidth-delay product of the network is large, the reliability is good, and the delay is low, we should choose the Go-Back-N protocol to use more of the network capacity. On the other hand, if the bandwidth- delay product is small, or the network is not very reliable, or the network creates long delays, we need to use Selective-Repeat.

(iii)