CSE316
Assignment 3 Solutions

Chapter – 9

Problems: Q9-3, P9-6, P9-10, P9-13

Q9-3

Two hosts in two different networks can theoretically have the same link-layer address because a link-layer address has only local jurisdiction. However, the tendency is to avoid this for the future development of the Internet. Even today, manufacturers of network interface cards (NIC) use different set of link-layer addresses to make them distinguished

P9-6

We can think of one journey with three links in this case: home-to-airport, airport-to-airport, and airport-to-home

a.

End-to-end addresses (the whole journey)
Source: 2020 Main Street, Los Angeles
Destination: 1432 American Boulevard, Chicago

b.

First Link
Source: 2020 Main Street
Destination: Los Angeles Airport
Second Link
Source: Los Angeles Airport
Destination: Chicago Airport
Third Link
Source: Chicago Airport
Destination: 1432 American Boulevard

P9-10

a.

Router R1 gets the frame received from interface L2, decapsulates the network-layer packet (N1, N2, Data). The router then consults its routing table to find what is the next router for destination N2. It finds that the packet should be delivered to router R2. It sends an ARP packet to find the link layer address of R2, which is L5. Router R1 now encapsulates the network layer packet in a frame with source address L4 and destination address L5.

b.

Router R2 gets the frame received from interface L5, decapsulates the network-layer packet (N1, N2, Data). The router then consults its routing table to find what is the next router or host for destination N2. It finds that the packet should be delivered to host N8. It sends an ARP packet to find the link-layer address of N8, which is L8. Router R1 now encapsulates the network-layer packet in a frame with source address L6 and destination address L8.

P9-13

Two approaches can be used. In the first approach, system A has a table to match the network-layer addresses to data-link addresses, it can use the table to find the data-link address of system B. In the second approach, system A has only the list of all data-link layer addresses, it can send unicast ARP packet to all stations to find out the one which matches the network-layer address. None of the approaches are practical because a host may change its data-link layer address without notice. Some networks support tunneling, in which the network encapsulates a broadcast or multicast packet in a unicast packet and send them to all stations.

Chapter – 23

Problems: Q23-3, Q23-7, P23-3, P23-5, P23-9, P23-12

Q23-3. Although any port number can be used for the client and server and they can be the same in this private communication, it is recommended to follow the division specified by ICANN:

a. The client port number should be chosen from the dynamic range, 49,152 to 65,535.

b. The server port number also should be chosen from the dynamic range, 49,152 to 65,535.

c. It is advisable to choose different port numbers for the server and the client to be able to better debug the programs.

Q23-7. We describe the advantage and disadvantage of each first:

a. 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.

b. 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.

P23-3. The sequence number of any packet can be found using the following relation:

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

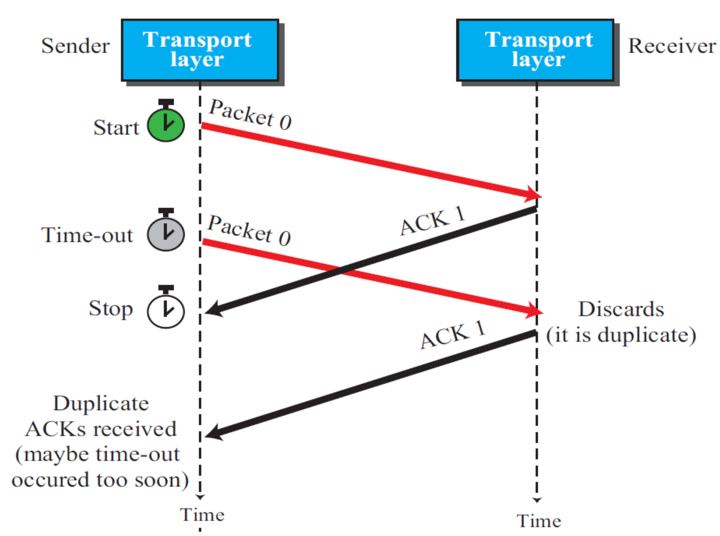
in which m is the number of bits used to define the sequence number. The sequence number in this case is

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

P23-5.

Protocol	**Max Send W_{size}**	**Max Receive W_{size}**
Stop-and-Wait:	1	1
Go-Back-*N*:	$2^5 - 1 = 31$	1
Selective-Repeat:	$2^5 / 2 = 16$	$2^5 / 2 = 16$

P23-9. The following figure shows the case. It happens when an ACK is delayed and the time-out occurs. The sender resends the packet that is already acknowledged by the receiver. The receiver discards the duplicate packet, but resends the previous ACK to inform the sender that there is a delay in the network.



P23-12. The following figure shows the flow diagram: