CHAPTER 11 : Data Link Control

Solutions to Selected Review Questions

Review Questions

1. In this chapter, we discussed three protocols for noisy channels: the ***Stop-and-Wait ARQ, the Go-Back-N ARQ, and the Selective-Repeat ARQ.***

2. Only Go-Back-N and Selective-Repeat protocols use pipelining.

3. In a ***byte-oriented protocol***, data to be carried are 8-bit characters from a coding system. Character-oriented protocols were popular when only text was exchanged by the data link layers. In a ***bit-oriented protocol***, the data section of a frame is a sequence of bits. 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.

4. The data link layer needs to pack bits into *frames*. Framing divides a message into smaller entities to make flow and error control more manageable.

5. In the ***Go-Back-N ARQ Protocol***, we can send several frames before receiving acknowledgments. If a frame is lost or damaged, all outstanding frames sent before that frame are resent. In the ***Selective- Repeat ARQ protocol*** we avoid unnecessary transmission by sending only the frames that are corrupted or missing. Both Go-Back-*N* and Selective-Repeat Protocols use ***sliding windows***. In Go-Back-*N* ARQ, if m is the number of bits for the sequence number, then the size of the send window must be at most 2_m-1; the size of the receiver window is always 1. In Selective-Repeat ARQ, the size of the sender and receiver window must be at most 2_{m-1}.

6. ***In this chapter, we discussed two protocols for noiseless channels: the Simplest and the Stop-and-Wait.***

7. The two main functions of the data link layer are ***data link control*** and ***media access control***. Data link control deals with the design and procedures for communication between two adjacent nodes: node-to-node communication. Media access control deals with procedures for sharing the link.

8. 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.

9. **Piggybacking** is used to improve the efficiency of bidirectional transmission. When a frame is carrying data from A to B, it can also carry control information about frames from B; when a frame is carrying data from B to A, it can also carry control information about frames from A.

10. Character-oriented protocols use **byte-stuffing** to be able to carry an 8-bit pattern that is the same as the flag. Byte-stuffing adds an extra character to the data section of the frame to escape the flag-like pattern. Bit-oriented protocols use **bit-stuffing** to be able to carry patterns similar to the flag. Bit-stuffing adds an extra bit to the data section of the frame whenever a sequence of bits is similar to the flag.

11. **Flow control** refers to a set of procedures used to restrict the amount of data that the sender can send before waiting for acknowledgment. **Error control** refers to a set of procedures used to detect and correct errors.

12. **HDLC** is a *bit-oriented protocol* for communication over point-to-point and multipoint links. **PPP** is a byte-oriented protocol used for point-to-point links.