CHAPTER 18

Virtual Circuit Switching: Frame Relay and ATM

Review Questions

1. See Table 18.1. The control field is missing in the Frame Relay because flow and error control are left to upper layers.

Table 18.1

Fields	*HDLC*	*Frame Relay*
Flag	X	X
Address	X	X
Control	X	
Information	X	X
FCS	X	X

2. The control field in HDLC frame is used for flow and error control. Since Frame Relay does not provide flow or error control other than BECN and FECN, this field is not needed.
3. I-frame.
4. Frame Relay does not use flow and error control, which means it does not use the sliding window protocol. Therefore, there is no need for sequence numbers.
5. DLCIs are unique only for a particular interface. A switch assigns a DCLI to each virtual connection in an interface. This way two different connections belonging to two different interfaces may have the same DLCI.
6. T-lines provide point-to-point connections, not many-to-many. In order to connect several LANs together using T-lines, we need a mesh with many lines. Using Frame Relay we need only one line for each LAN to get connected to the Frame Relay network.
7. In a PVC, two DTEs are connected permanently through a virtual connection. In a SVC, a virtual circuit needs to be established each time a DTE wants to be connected with another DTE.

8. Frame Relay does not define a specific protocol for the physical layer. Any protocol recognized by ANSI is acceptable.
9. If data packets are different sizes there might variable delays in delivery.
10. A UNI (user network interface) connects a user access device to a switch inside the ATM network, while an NNI (network to network interface) connects two switches or two ATM networks.
11. A TP (transmission path) is the physical connection between a user and a switch or between two switches. It is divided into several VPs (virtual paths), which provide a connection or a set of connections between two switches. VPs in turn consist of several VCs (virtual circuits) that logically connect two points together.
12. An ATM virtual connection is defined by two numbers: a virtual path identifier and a virtual circuit identifier.
13. The Application Adaptation Layer allows existing networks to connect to ATM facilities by mapping packet data into fixed-sized ATM cells. The ATM layer provides routing, traffic management, switching, and multiplexing services.

Multiple-Choice Questions

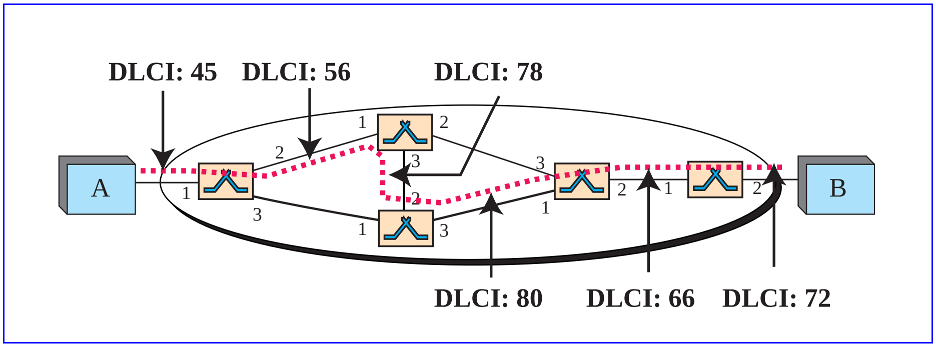
14. c
15. b
16. b
17. a
18. c
19. d
20. c
21. a
22. b
23. d
24. d
25. c
26. b
27. a
28. d
29. c
30. c
31. a
32. a
33. b

Exercises

34. 705

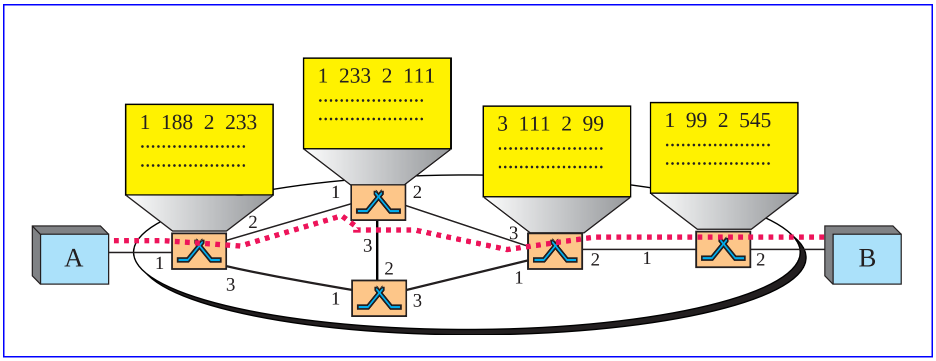
35. Not valid, there is only 15 bits instead of 16 bits
36. 48632
37. 2C 21
38. See Figure 18.1.

Figure 18.1 *Exercise 38*



39. See Figure 18.2.

Figure 18.2 *Exercise 39*



40. 2 Mbps = 200 Kilobytes /second. Using AAL1, each cell carries only 47 bytes of user data, which means almost 5320 cells per second are created.
41. The efficiency of ATM using AAL1 is 47/ 53 or 89%.
42.
    a. 33 bytes of padding
    b. 1087 data units
    c. 1087 cells
43. Yes. The efficiency depends on the size of the packet. Larger packets are more efficient.
44.

a. The minimum number of cells is 1 (no data, 36 bytes of padding and 8 bytes of header and trailer in the CS sublayer).
b. The maximum number of cells is 1490.

45.
a. The minimum number of cells is 1 (no data, 40 bytes of padding and 8 bytes of header in the CS sublayer).
b. The maximum number of cells is 1366.

46. AAL1 takes a continuous stream of bits from the user without any boundaries. The other AALs take a bounded packet from the upper layer.
c. When the number of bytes in the final segment is exactly 40.
d. The number of data bytes in the last unit is 0.
e. The final segment has 41 bytes.

47.
a. The number of bytes in the final segment is 40.
b. The number of bytes is 0.
c. The last unit has 41 bytes.

48.
a. 47
b. 45
c. 44
d. 48

49. See Table 18.2.

Table 18.2 *Exercise 50*

Sublayer	*AAL1*	*AAL2*	*AAL3/4*	*AAL5*
SAR	47	45	44	48

50. 2^{24} in a UNI and 2^{28} in an NNI.