Chapter 5: Link Layer

1. What is the layer # of the Link Layer protocols in the ISO/OSI reference model and the Internet protocol stack?

2. What are the basic services provided by Link Layer protocols?

3. Where do the link layer protocols actually execute on a host?

4. How is bit error quantified?

5. What is independent bit-error and what is burst error?

6. Give typical values of bit errors for various kinds of transmission media, namely, wireless, copper, and fibre.

7. Explain the general idea in error detection.

~~8. What are the two fundamental strategies for performing error correction at receivers?~~

~~9. What is meant by flow control?~~

10. What is one-dimensional parity checking? Explain its advantage(s) and limitation(s).

11. What is two-dimensional parity checking? Explain its advantage(s) and limitation(s).

12. Explain the idea of Cyclic Redundancy Check (CRC)? Assume a block of data bits, a block of generator bits, and calculate the corresponding CRC bits.

13. What is the advantage of CRC based error detection?

14. In practice, what are typical lengths of CRC bits for Ethernet and WiFi based LANs?

15. What is a broadcast medium?

16. What is a medium access control (MAC) protocol? In other words, what does a MAC protocol do?

17. Where does frame (packet) collision occur? Why is it important for a transmitters to detect collision?

18. What are the characteristics of an ideal MAC protocol?

19. What are the three broad classes of MAC protocols? Explain those three broad classes at a high-level, without going through their operational details.

20. What is meant by channel partitioning? Where are channel-partitioning based MAC protocols used?

21. What is meant by random access MAC protocols? Where are random-access based MAC protocols used?

22. What is meant by taking-turns in medium access? Where are taking-turns MAC protocols used?

23. Explain the pure Aloha protocol in brief.

24. Explain the slotted Aloha protocol in brief.

25. How does slotted Aloha differ from pure Aloha?

26. What is the efficiency of pure Aloha?

27. What is the efficiency of slotted Aloha?

28. Why does slotted Aloha give you better efficiency?

29. What is Binary Exponential Backoff (BEB)?

30. What is carrier sensing in a CSMA protocol?

31. Explain the CSMA/CD protocol by means of a flow-chart and identify its performance enhancing features.

32. Why is collision detected while transmitting in the CSMA/CD protocol?

33. List five key fields in Ethernet frames.

34. How long are MAC addresses in Ethernet frames?

35. What is the broadcast MAC address in Ethernet frames?

36. Where is the purpose of using the broadcast MAC address?

37. What does the Address Resolution Protocol (ARP) do?

38. Briefly explain the ARP protocol.

39. Show the structure of an ARP table. Where are ARP tables created and managed: hosts, hubs, switches, routers?

40. While an IP packet moves from a host on LAN1 to a host belonging to a different LAN through a sequence of routers, what happens to the MAC addresses in the frames containing the IP packet?

41. Compare the bus topology and the star topology of LANs in terms of installing and managing LANs.

42. What is a MAC table? A MAC table is also called a CAM (content-addressable memory) table in the networking industry.

43. Who creates and manages a MAC table: hosts, switches, routers?

44. Compare ARP tables with MAC tables.

45. Give an outline of the algorithm to create/manage MAC tables.

~~46. What happens if switches are arbitrarily connected to form larger LANs? How is the problem resolved in practice?~~

47. What is a wireless LAN?

48. What is a Basic Service Set (BSS), an Independent BSS (IBSS), and an Extended (BSS)?

49. What are the major differences among the members of the following family of WLAN protocols: IEEE 802.11/b/a/g/n/ac? What is their common element?

50. What are the two basic modes of operations of a WiFi network (WLAN running an IEEE 802.11)?

51. What is the PCF mode of operation of a WiFi network? What is the usefulness of the PCF mode of operation?

52. What is the DCF mode of operation of a WiFi network? What is the usefulness of the DCF mode of operation?

53. Who performs the PCF/DCF mode switching in a WLAN and how is it done?

54. What is the handshake mode of operation of a WLAN? What is its advantage? What is its overhead?

55. What is the without-handshake mode of operation of a WLAN? What is its advantage? What is its disadvantage?

56. Who decides when a frame is going to be transmitted in the handshake mode?

57. Explain the basic operation of the handshake mode of data transmission.

58. Explain the basic operation of the without-handshake mode of data transmission.

59. Explain the hidden terminal problem.

60. Explain the exposed terminal problem.

61. What is carrier sensing and what is virtual carrier sensing in WLAN?

62. How is virtual carrier sensing implemented in WLAN?

63. What is NAV (Network Allocation Vector) and how is a NAV incremented and decremented?

64. What are the important fields in RTS and CTS frames? How long are the RTS and CTS frames?

65. What are the four timing intervals in WLAN? How are they related in terms of length?

66. How is the hidden terminal problem solved?

67. Explain the importance of SIFS < PIFS < DIFS.

68. What condition must hold and for how long if a node (computer or AP) wants to transmit an RTS frame?

69. In the without-handshake mode of operation a node does not transmit RTS/CTS frames. However, it must process those frames. What is meant by a node processing RTS/CTS frames in the without-handshake mode, and what is the need for processing those frames?

70. Explain all the frame transmissions in a WLAN as a result of a *CF Poll+Data* frame transmitted by an AP.

71. Explain the process of broadcasting in a WLAN. Why do nodes not send ACKs in response to a DATA frame while the AP is broadcasting?

72. Why are DATA frames ACK'ed in the CSMA/CA protocol, whereas there is no concept of ACK in CSMA/CD?

73. How does an AP enable the computers around itself to enter the DCF mode of operation?