Computer Networks and Distributed Systems

Datalink protocol-framing and Ethernet

Based on textbook "*Conceptual Computer Networks*" by José María Foces Morán and José María Foces Vivancos

Context

- Based on this lecture presentation:
  http://paloalto.unileon.es/cn/lect/CN-Ch2-2018-Section1.pdf

  To date, we have only explained through slide no. 34; we'll finish Ethernet on the next lecture (4th/May/2018)

- Topic outline:
  - Bit-oriented and byte-oriented protocols
  - Framing: BiSync, HDLC, PPP
  - Ethernet System, CSMA/CD and Exponential Backoff

Exercises

1. What is the essential difference between a bit-oriented protocol and a byte-oriented one? State the difference in a precise manner.

2. HDLC is bit-oriented protocol that uses the following sentinel whose name is *flag:* 01111110. The flag marks the start of a new HDLC frame and is also used to mark the end a the frame, much in the style of the quotation mark used for the start and the end of constant string in the C language. Ethernet is also a bit-oriented protocol since it allows a payload of any size, not necessarily a multiple of 8 (One byte). Let's recall the structure of an Ethernet frame (Consult slide no. 35 in the presentation mentioned above):

   [Preamble] [Dest MAC] [Src MAC] [Ethertype] [PAYLOAD] [CRC]

   The preamble is a 64-bit pattern much like HDLC's flag, but longer; the preamble is the Ethernet's sentinel that marks the start of a new frame.

   a. What field in the Ethernet frame constitutes the sentinel marking its end?

   b. If you can't identify the end of frame sentinel in the Ethernet frame, can you speculate how the receiver discovers the end of the received frame?

For all the following questions, assume an original Ethernet System network (Shared media Ethernet)

3. Explain the transparency mechanism at use in the HDLC protocol.

4. One of the stations that comprise an HDLC point-to-point link wishes to transmit the bit-string 10111011011111010101O to the station on the other end. Explain what the transmitter sends on the line and what the receiver's behavior is.

5. Explain the transparency mechanism at use in the BiSync protocol

6. One of the stations that comprise a BiSync link wishes to send the following Byte-string (Each bracket space contains a Byte): [H] [E] [L] [L] [O] [ETX] [!] [SYN]. Explain what the transmitter sends on the line and the receiver's behavior is.

7. Explain the responsibilities of the Transceiver and the NIC in the Ethernet technology. Which one is responsible for computing Ethernet's CRC-32?

8. What does Shared Link mean in the context of the Ethernet system? Then, what does Switched Ethernet mean?

9. Do the two forms of Ethernet mentioned above correspond to the multiplexing technique known as *Statistical Multiplexing?* Justify your response.

10. What is the Rtt of a maximally shared-medium Ethernet (2500m)?

11. The transmission speed of the original Ethernet system is 10Mbps. Calculate how many bits fit the Rtt of a maximally-configured Ethernet.

12. Assume a number of hosts (H1, H2,…) are connected to an original Ethernet; host H1 transmits a frame and wishes to prevent other hosts from receiving the frame. Is this possible? Make some suggestion.

13. What topology is implemented by the network based on coaxial cable used in 10BASE-2 and 10BASE-5? What is the topology used in 10BASE-T? What's is the acronym that represents the access protocol in the three cases?

14. Ethernet's datalink frame structure is explained in slide no. 64, what's the minimum size of the payload field? Considering the other fields's sizes except the preamble, what's the resulting minimum size of the Ethernet frame? Is there a maximum Ethernet frame's size?

15. Does there exist an Ethernet MAC address that represents all the hosts belonging to one network? What's the bit pattern of that special MAC address? What's its name?

16. What's the sentinel that marks the *end of frame* in the Ethernet system?

17. Host H1 in an Ethernet has a number of frames to transmit. Assume no other hosts on the same network want to transmit for the time being, only H1 wants to transmit a frame now, therefore no carrier will be present in the medium when H1 checks CS (Carrier Sense). After H1 finishes transmitting the first of the backlog of frames it wishes to transmit the second frame: How long after the first is finished? (Skim slide no. 113).

18. The 32-bit Jamming Sequence sent by a host when it determines that a collision took place is a fixed bit pattern? Discuss this.

19. Why does the Ethernet system specify that minimum frame length is 512 bits? Consider the number of bits that fit the Rtt that you calculated above (Skim slides 120:123).

20. In slide no. 123, observe the behavior of node D, which detects a collision earlier than node B. When the collision's wavefront arrives at D (Marked as "collision detect/abort time") it makes sure a collision is taking place: recall D (a transmitter) *continuously* monitors the average signal power as it transmits, it convinces itself that a collision is taking place since the power associated with the yellow/red wavefront is much higher than that of the red wavefront (Its own transmitted wavefront). What does D do after the "collision detect/abort time"? Indicate where in the diagram is D's Jamming Sequence sent.

21. An institution has a maximally configured original Ethernet whose length is 2500m and needs to extend it to 3000m. Calculate the minimum Ethernet frame length that allows the access algorithm (CSMA/CD) to function correctly.

22. Explain the collision timing diagram in slide no. 52. Provide a substantial explanation that allows to check whether the idea you have about collisions is correct. We seek your writing about collisions, whether it is an accurate or simply approximate explanation.