CS 4231 Midterm

1. (10%) How does ICSA (International Computer Security Association) classify firewall? Briefly describe how does each type of firewall work.
2. (5%) In Figure 1, exactly one protocol data unit (PDU) in layer N is encapsulated in a PDU at layer (N-1). It is also possible to break one N-level PDU into multiple (N-1)-level PDUs (segmentation) or to group multiple N-level PDUs into one (N-1)-level PDU (blocking).
   a. In the case of segmentation, is it necessary that each (N-1)-level segment contain a copy of the N-level header?
   b. In the case of blocking, is it necessary that each N-level PDU retain its own header, or can the data be consolidated into a single N-level PDU with a single N-level header?

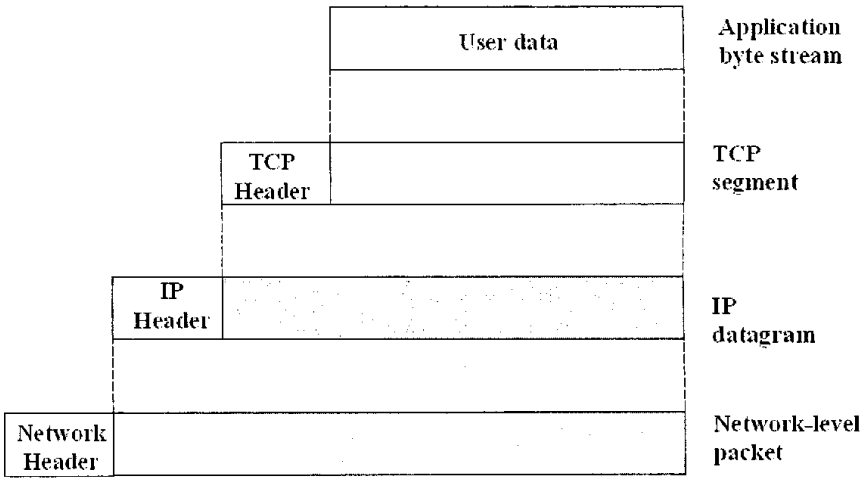


Fig. 1

3. (5%) Use examples to explain how *multiplexing* is achieved in Direct Sequence Spread Spectrum (DSSS).
4. (5%) Use examples to explain why Frequency Hopping Spread Spectrum (FHSS) is not easy to intercept?
5. (5%) Briefly explain the difference between *bridge* and *LAN switch.*
6. (5%) Briefly explain why CSMA can improve the performance of ALOHA protocols? Why CSMA/CD can further improve the performance of CSMA?
7. (5%) What is the major difference between *persistent* and *nonpersistent* CSMA?
8. (5%) Consider a baseband bus with a number of equally spaced stations with a

data rate of 10 Mbps and a bus length of 1 km.

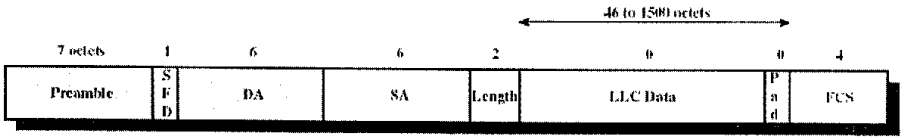
a. What is the mean time to send a frame of 1000 bits to another station, measured from the beginning of transmission to the end of reception? Assume a propagation speed of 200 m/us.

b. If two stations begin to transmit at exactly the same time, their frames will interfere with each other. If each transmitting station monitors the bus during transmission, how long before it notices an interference, in seconds? In bit times?

9. (5%) Briefly explain how *n (number of stations)* and *p (transmission probability)* affect the performance of p-persistent CSMA.

10. (5%) In CSMA/CD, can we guarantee a frame be transmitted successfully within a given time? Justify your answer.

11. (5%) The following figure shows the Ethernet frame format. There's a filed called *Pad*. What's the purpose of *Pad*? Where is the payload of the frame in the figure?



SFD = Start of frame delimiter
DA = Destination address
SA = Source address
FCS = Frame check sequence

12. (5%) Comparing IEEE 802.3 CSMA/CD and IEEE 802.11 CSMA/CA, do they go to the backoff state under the same condition? That is, when does each of them perform the backoff procedure?

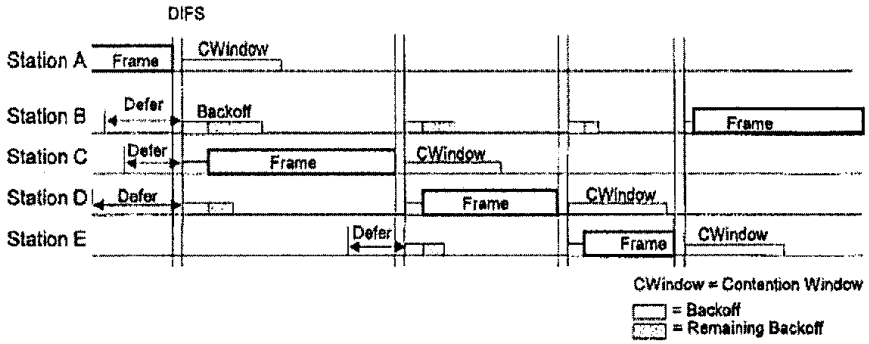
13. (5%) In IEEE 802.11, how does a station receive frames when it is in power saving (sleep) mode?

14. (5%) We say that the privacy (encryption) in IEEE 802.11 is "station-to-station" rather than "end-to-end". What does that mean?

15. (5%) In IEEE 802.11 CSMA/CA, why a station with a frame to be transmitted still needs to wait for DIFS even though the channel is sensed idle? Answer this question by answering (a) What kind of collision **can** be avoided if the station waits for DIFS when the channel is sensed idle? (b) What kind of collision **cannot** be avoided even though the station waits for DIFS when the channel is sensed idle?

16. (5%) In IEEE 802.11 CSMA/CA, if a station transmits a frame successfully and has another frame waiting to be transmitted, the next frame cannot be transmitted immediately. How long does the next frame need to wait? Why use such design?

(*Hint:* use the following figure to illustrate.)



17. (5%) When "CSMA/CA + ACK + RTS + CTS" is used in IEEE 802.11 DCF, (a) Can a station transmit data if it senses RTS? (b) Can a station transmit data if it senses CTS? Use examples and figures to show your answers.
18. (10%) Use the following figure as an example to explain the handoff procedure in IEEE 802.11. What is *ping-pong effect* in handoff?