



Course: SEG3155/CEG3185
Semester: Winter 2012

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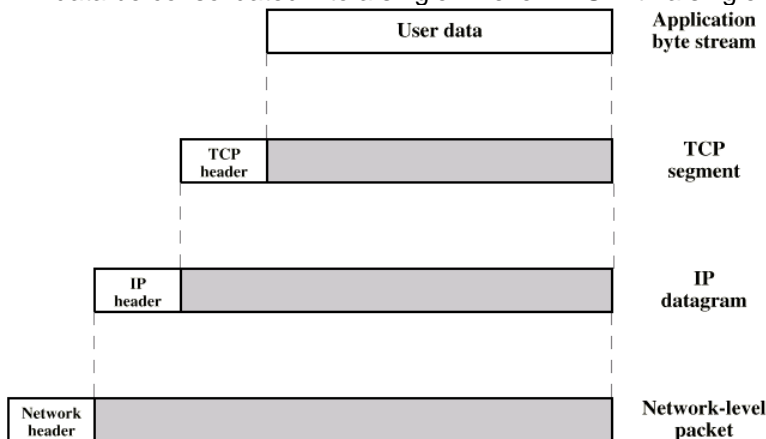
Assignment 1

Weight: 5%

Posted: January 16, 2012

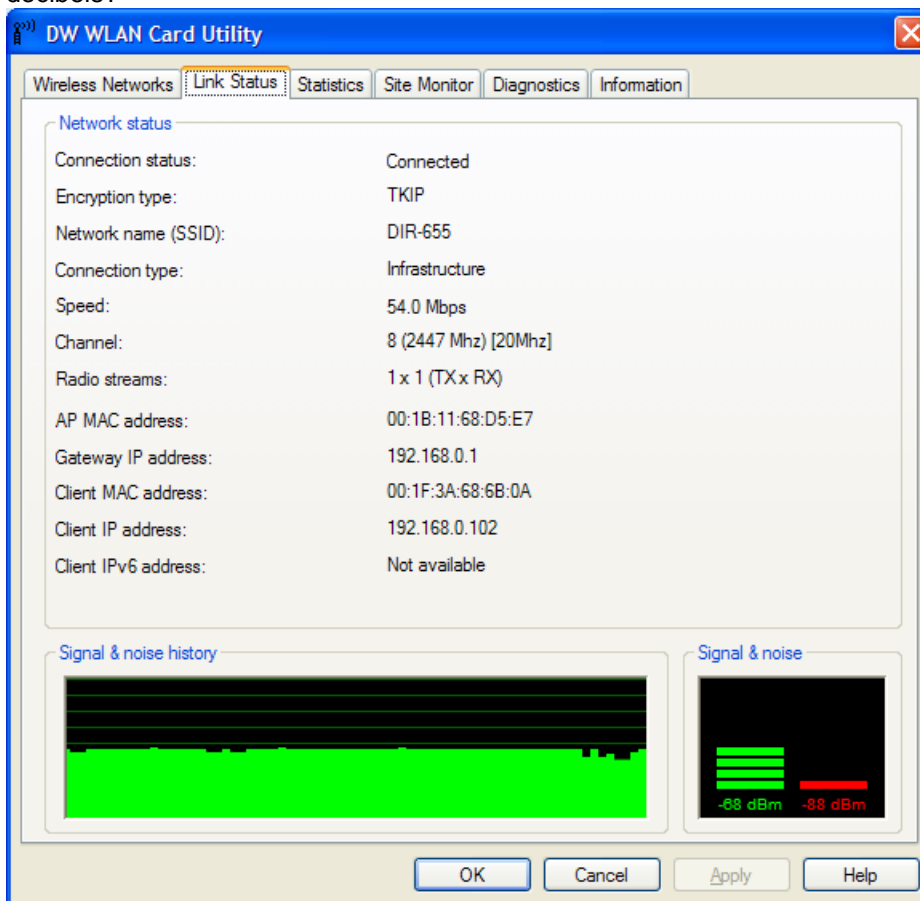
Due: January 30, 2012, 12:00 pm (noon)

- 1) **[10 marks]** Universal Serial Bus (USB) can be considered as a physical layer standard. Use 200 words to describe USB in terms of mechanical, electrical, and functional characteristics.
- 2) **[10 marks]** Two blue armies are each poised on the opposite hills preparing to attack a single red army in the valley. The red army can defeat either of the blue armies separately but will fail to defeat both blue armies if they attack simultaneously. The blue armies communicate via an unreliable communication system (a foot soldier). The commander of one of the blue armies would like to attack at noon. His problem is this: If he sends a message to the other blue army, ordering the attack, he cannot be sure it will get through (e.g. the foot soldier could get killed or captured). He could ask for acknowledgement, but that might not get through either. Is there a protocol that the two blue armies can use to avoid defeat?
- 3) **[10 marks]** In the following figure, 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?



- 4) **[10 marks]** A TCP segment consisting of 1500 bytes of data and 160 bits of header is sent to the IP layer, which appends another 160 bits of header. This is then transmitted through two networks, each of which uses a 22-byte frame header and 4-byte frame trailer. The destination network has a maximum frame size of 1500 bytes plus the header and trailer. How many bits, including headers and trailers, are delivered to the second layer protocol at the destination?

- 5) **[10 marks]** A regular telephone line normally has bandwidth of 3000 Hz (300 Hz to 3300 Hz). The signal-to-noise ratio is usually 3162 (35 dB). Calculate the theoretical highest bit rate (capacity) of this regular telephone line.
- 6) **[10 marks]** Given that the speed of light is 3×10^8 m/s. A satellite is at geosynchronous orbit. How long would it take for a signal to go from the earth station to the satellite (minimum time)? Assume that the height of the satellite is 35,863 km.
- 7) **[10 marks]** Determine the height of an antenna for a TV station that must be able to reach customer up to 80 km away.
- 8) **[10 marks]** The following figure shows the strength of signal and noise for a wireless network. $P(\text{signal}) = -68$ dBm, $P(\text{noise}) = -88$ dBm. What are the signal-noise-ratio and the signal-noise-ratio in decibels?



- 9) **[20 marks]** A microwave transmitter has an output of 0.1 W at 2 GHz. Assume that this transmitter is used in a microwave communication system where the transmitting and receiving antennas are parabolas, each 1.2 m in diameters.
 - a) What is the gain of each antenna in decibels?
 - b) Taking into account antenna again, what is the effective radiated power of the transmitted signal?
 - c) If the receiving antenna is located 24 km from the transmitting antenna over free space path, find the available signal power out of the receiving antenna in dBm units.

Important Note:

Type or write neatly; save a hard or soft copy of your submission, in case it is lost; and keep your marked submissions till the end of the semester.