CS485/ECE440: Homework 3b

October 7, 2008

General

- This homework is (mostly) about material covered in Chapter 2 of the text book.
- The answers to this homework are **due October 14, 2008**.
- Submit via e-mail to `riesen@cs.unm.edu` (Mail it before class on the 9th.) Your subject line must say: "Homework 3 Submission" (and nothing else).
- Your answers to the questions below must be in a PDF or plain text file attached as file named Homework3.pdf or Homework3.txt according to its format. (Not Hwk3.pdf, and no Microsoft Word or image files, such as jpeg, please.)
- Keep your answers (and programs) succinct.
- Obey the University rules on plagiarism. In particular, do use libraries and the web to find information you need to answer the questions, but do not copy whole answers or programs. Reference your sources. The work you turn in must be *your* work.

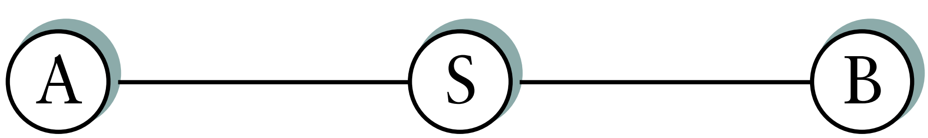
Exercise 1: Sliding window size [20 points]

A ground control station is connection to a transmission station 10 km away with a 1 Gb/s link. The transmission station transmits data to a similar station on the moon. The Earth/moon link operates at 1 Mb/s over the 385,000 km distance. The transmission station on the moon is connected to a lunar colony, which is 1 km away, via a 4 Mb/s link.

Assume there is no buffering in the transmission stations and the frame size is 1500 bytes. What is the minimum number of bits needed in the sequence number field of each packet header?

Exercise 2: Sliding window protocol [30 points]

Consider the following figure:



Assume the switch in the middle is "smart" and interacts with each host as if it were an end host. If host A sends a packet to the smart switch S, S will forward the packet to B and also send an acknowledgement back to A. If S doesn't receive an ACK within the timeout period, it will resend the packet toward B.

Assume that the switch S needs 1 ms to process each packet before it can forward the packet to A or B. Further assume that it takes 0.25 ms for a packet to traverse one link and get stored at the destination. I.e. A packet from A to B would spend 0.25 ms on the first link, 1 ms inside S, and another 0.25 ms on the second link. Total transmission time would be 1.5 ms.

Assume all send and receive timeouts are the same in A, B, and S. What should that value be?

Compare this setup with one were S behaves like a traditional switch and simply forwards packets without interacting at the protocol level with A or B. The queuing delay is still the same 1 ms. Which one of the two schemes is more efficient? Why? Provide a timing analysis for each scheme when no packets are dropped, and provide an example for each scheme where a packet between A and S is dropped.

Exercise 3: Protocol frame format [10 points]

The ATM cell header does not have a length field for the payload. How can protocols that use ATM know how much of the payload in a cell is data and how much of it is padding?

Exercise 4: Token ring monitor [10 points]

Through a malfunction, two stations on a token ring believe they are currently the monitor. What can go wrong with packets traveling across such a ring? Assuming no other malfunctions, can this situation persist, or would it eventually correct itself? Explain!

Exercise 5: 2-D parity detection [30 points]

Consider the 2-D parity detection from Section 2.4.1 in our textbook. It can detect all 3-bit errors, but has problems with some 4-bit errors. Have a look at Figure 2.19 in the textbook. Let as add an additional bit on the right side, creating 9-bit “bytes” in each row. You now have two bits for error detection in each row: the original parity bit plus the one we just added.

Come up with a detection scheme that makes use of the additional bit. Describe how it works: how are the bits set at the sender, and how does the receiver determine that an error has occurred? Does your new scheme detect 4-bit errors? What is the overhead of your new scheme compared to the original 2-D parity?