CSE3213 Communication Networks, Winter 2010
Section: M
Instructor: Foroohar Foroozan

Time Allowed: **15 minutes**

Quiz 1

Student Name: ____Instructor Solution_____

Student Number: _____

1. [1 points]
Given that the Transport layer can detect errors, what would be the possible advantages of implementing error detection in the Data-link layer?

(c) Implementing error detection at a lower layer can improve performance. The transport layer can only detect errors at the destination, and hence the packet with the error is carried over the entire path wasting bandwidth. The retransmission has to be done over the entire path too.

Another example is that different data link layer technologies have different error characteristics, so a high error rate technology (wireless) can have strong error detection, while a low error rate technology (optical) can have weak error detection. We can thus avoid the overhead of having strong error detection over the entire path.

2. [2 points]

In a N-layer protocol hierarchy, a protocol data unit (PDU) in layer k (higher) is encapsulated in a PDU at layer k-1 (lower). Assuming the size of protocol header at each layer is **M** [bits], and the size of data in application layer is **H** [bits], what fraction of bandwidth is used to send the data? And, what fraction is wasted on the transmission of headers?
(For simplicity, assume that an indefinite number of packets are generated at the application layer and sent back-to-back over the medium.)

The structure of the N-layer protocol hierarchy should look like the following:
Layer N PDU_N **: total bits = data = H**
Layer N-1 PDU_{N-1} **: total bits =** data +header **= H+M**
Layer N-2 PDU_{N-2} **: total bits =** PDU_{N-1} +header **= H+2M**
……
Layer 1 PDU_1 **: total bits =** PDU_2 +header **= H+(N-1)M**

So the size of frame being sent to the channel (which consumes bandwidth) is H+(N-1)M.

Since the size of data is H, the fraction of bandwidth to send data is: $\frac{H}{H+(N-1)M}$

,while the fraction for the header is: $\frac{(N-1)M}{H+(N-1)M}$