CS 528: First Exam (Fall’05)

Answer all questions.

Problem 1: (20 points; 10 minutes)
Each of the following represents two alternatives that provide a common functionality. Explain what the functionality is, and give one advantage to each of the alternative over the other.
(a) Bridges and Routers

(b) ATM and Learning Bridges

(c) Automatic Repeat Request (ARQ) and Forward Error Correction (FEC)

(d) Distance Vector and Link State

Problem 2: (24 points; 10 minutes) You are deciding on a medium access control protocol for a directly connected local area network (LAN). The choices are a contention protocol similar to Ethernet or a reservation protocol similar to Token Bus (where the station that has the token gets to transmit the next packet).
(a) If the LAN has to span large areas, what is your choice? Explain

(b) If the LAN carries a lot of real-time traffic, what is your choice? Explain

(c) If you pick reservation, but sometimes the traffic is really light, the reservation overhead becomes too high. Suggest a solution to improve this problem
**Problem 3:** (24 points; 20 minutes)
Discuss the merits of the following statements (they can be right, wrong, pure nonsense, or something in the middle)
(a) Sequence numbers are needed in sliding window protocols to deliver packets in order

(b) Given two bloom filters from two sets, it is possible to tell the intersection of the two sets (elements occurring in both sets)

(c) In terms of resilience to router failures and speed of switching, data gram outperforms virtual circuit switching

(d) Link state routing is better than distance vector
Problem 4: (30 points; 20 minutes
Consider the following proposal. We are going to try and use an ARQ based algorithm for bulk multicast in place of the digital fountain approach. Multicast is implemented as a tree, with each node in the tree forwarding packets to its children, who in turn forward the packet to their own children recursively until the leaf nodes. Each receiver uses a bloom filter to track which packets were received. Once the multicast is finished, each receiver forwards its bloom filter to its parent in the multicast tree. The parent can multicast missing packets down to its children if it has them (deleting those from the bloom filter) and merge the remaining bloom filters and forward them to its own parent.

(a) What advantage does this approach have over just sending a list of the missing packets?

(b) What are the implications of false positives?

(c) Obviously, to be able to delete packets from the filter, accounting bloom filters are needed. In another scenario, the intermediate nodes just merge the the bloom filters without checking if they can retransmit packets locally. Is there a problem in merging counting bloom filters? If not, how would it be done? If there is a problem, explain a possible solution.

(e) What advantages/disadvantages does this approach have relative to the digital fountain approach? Do you think this is a good idea?