CS 3251 Computer Networks I **Fall Semester, 1999**

Homework 9

Assigned: November 30 *Due:* **Monday, December 6, noon in CCB 215**

1. Suppose stations A, B and C all have a frame to send. Draw a timeline showing one possible sequence of transmissions, attempts, collisions and exponential backoff choices. Your timeline should meet the following criteria: initial transmission attempts are in the order A, B, C, but successful transmission are in the order C, B, A.

2. Let A and B be two stations attempting to transmit on an Ethernet. Each has a large number of frames ready to send. A's frames are numbered $A_1, A_2, \ldots$, and B's frames are numbered $B_1, B_2, \ldots$. The round trip time is denoted T.

   Suppose A and B simultaneously attempt to send frame 1, collide, and chose backoff times of $0 \times T$ and $1 \times T$, respectively. This means that A wins the "race" and transmits A_1 while B waits. At the end of the transmission, B will again attempt to transmit B_1 while A attempts to transmit A_2. These first attempts collide, but now A backs off for either $0 \times T$ or $1 \times T$, while B backs off for one of $0 \times T \ldots 3 \times T$.

   (a) There are 8 possible combinations of backoff times for A and B after this collision. How many combinations result in a win for A in this second backoff race? Explain.

   (b) Suppose A does win the second backoff race. A will transmit A_2 and then collide again with B when attempting to transmit A_3. For this third backoff race, how many combinations of backoff times result in a win for A? How many total combinations are there? Explain.

   (c) Suppose A continues to win each race. What will happen to the frame B_1?

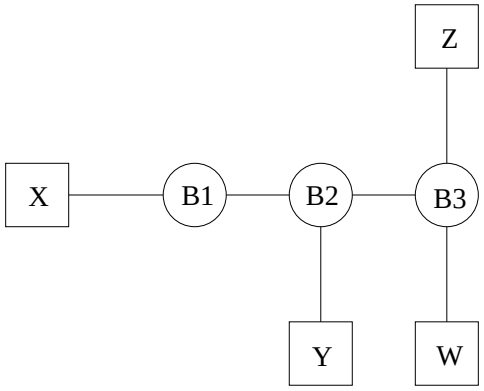
3. The scenario from the previous problem is called the "capture effect". The likelihood of one station capturing the medium in this way can be reduced by modifying the Ethernet transmission algorithm. Specifically, after each successful transmission attempt, a host waits either $1 \times T$ or $2 \times T$ before attempting to transmit again. Otherwise, the backoff algorithm works the same way.

   (a) Explain why this does not eliminate the capture effect. Describe a scenario in which A is still able to transmit A_2 before B can transmit B_1.

   (b) Propose an alternative approach to avoid capture that involves modifying the exponential backoff. What information about past history might be used in modifying the backoff algorithm?

Turn the page over!

4. Consider hosts X, Y, Z, and W, and learning bridges B1, B2 and B3, with initially empty forwarding tables, as below:



(a) Suppose X sends to Z. Which bridges learn where X is? Does Y's adapter see this packet?

(b) Suppose Z now sends to X. Which bridges learn where Z is? Does Y's adapter see this packet?

(c) Suppose Y now sends to X. Which bridges learn where Y is? Does Z's adapter see this packet?

(d) Suppose Z now sends to Y. Which bridges learn where Z is? Does W's adapter see this packet?