**CS5310.001/002, Fall 2020  
Computer Networks and Communication Systems Assignment 3**

Issued: 10/28/2020 Due: 11/18/2020

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1. (10 × 2 = 20 pts) This problem is pertaining to the CSMA/CD protocol.

1. Assume that three machines have experienced one collision with respect to each other at the same time. What is the probability that any one of the three will successfully acquire the channel without going through a second collision?

Answer: p \* (1-p)^2 🡪 One station transmits while the other two no transmit;

To make it simple, assume each station transmits with probability “**p”**.

In the first collision, the station waits for {either 0, or 1} slot time before it sends again:

For any station who want to acquire the channel, it have to resent ASAP:

* 50% to choose 0 \* 50% choose 1 \* 50% choose 1 (the other two both choose 1) = 0.5^3

And then together: (0.5^3) = 12.5%

Totally: 12.5%\*3 = 37%

(2)  In class discussions it is pointed out that for the Ethernet protocol, the higher the data rate R, the lower the channel efficiency. Explain concisely why that is the case.

Answer: channel eﬃciency = 1/(1 + 2Bτ/AF)

= P/( P + 2τ/A)

= 1/( 1 + 2BLe/CF)

Let the ‘‘frame time’’ denote the amount of time needed to transmit the standard, fixed-length frame (i.e., the frame length divided by the bit rate). Thus P = F/B.

1. Case 1 (lower efficiency): If the corresponding bandwidth B increase (because of the data rate R increase), (1 + 2Bτ/AF) will also increase, and thus 1/(1 + 2Bτ/AF) decrease. This is the case why it will lower the channel efficiency.
2. Case 2 (higher efficiency): However, if the **data rate R** do not exceed **bandwidth B**, increasing data rate R will actually increase the Frame Size, and thus increase the channel efficiency.

(data rate is conceptually different from bandwidth)

2. (20 pts) In the token ring protocol, why the token ring should have enough delay so that the entire token can be on the ring simultaneously? Explain with your own language

Answer:

* The token ring is a physical ring. The maximum time to reach the last station in the token ring network can be calculated.
* If a node transmits the token, and nobody else wants to send data, and then token comes back to the original sender. If the first bit of the token arrives the sender before the transmission of the last bit, then error situation happened – two tokens show up together (or collide)

To avoid this issue, we need to make sure: “propogation delay + transmission of n-bits (1-bit delay in each node ) > transmission of the token time”

* A station may hold the token for like 10ms (the default holding time). During this time, the station will transmit frames until time is up. When the time is up, the station will generate a new token and put it on the ring.
* The ring needs a complete token to let station to remove token and transmit data. In this case, we need to reserve enough delay to guarantee that the new token (with data) will be generated. ‘
* The monitor station will help to calculate the delay time to ensure a ( and only ) complete token exist in the ring.

3. (20 pts) In Lecture 7, we discussed that byte orders of integers and etc are important. Write a simple client/server program that verifies the byte order concepts.

Build:

Make 3\_server

Make 3\_client

Run:

./3\_server

./3\_client

Text

Description automatically generated

4. (40 pts) In class we discussed difference between file I/O and network I/O. We discussed the potential different behavior of the read function in the network I/O environment.

Write a client/server application that verifies this. Your server will be a TCP server that waits for requests from the client. The client keeps sending lines of length at least 1000 bytes to the server. The server simply calls read function, and then calls the write function to send back the value returned from the read function call. The client calls read function to receive the response and print out the value returned by each read function, followed by a mark that indicates the current string is the value of one read function call. Manually compare the replies received by the client and the input file and write your conclusions.

Code not complete…

Text

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Please follow the submission instructions for format and required documents. For each programming problem, the actual programs, together with any supplementary files, must be submitted. You cannot simply submit a text/word file for programming problems.