Home assignment set 2

September 8, 2018

Set 2: Medium Access Control

Problem 1

Imagine that in a slotted ALOHA network delay sensitive traffic is transmitted as follows: once a node has a packet to transmit, it attempts transmission in the coming time slot. If collision happens, packets are lost and will not be retransmitted, since they would arrive late to the destination anyway. A large number of nodes are in the network, and altogether they generate packets according to a Poisson process with intensity λ. Packet transmission times (that are the same as the time slot lengths) are one time unit.

a) Assume, the sources can tolerate a packet loss probability of 0.1. What is the maximum allowed arrival intensity?

b) To cope with the packet losses, so called forward error correction is introduced in the ALOHA system described above. It means that each piece of information is transmitted twice, in two separate packets, with random delay in between. Due to the random delays the packet generation process can still be modeled as Poisson. Give an analytic model of the system, expressing the probability that the information is received. Can such a solution increase the probability that a piece of information is received by the destination?

Problem 2

Consider the slotted ALOHA model described from the bottom of page 50 to page 52 in the Rom-Sidi book. Assume that the time slots are 1ms, the packet arrival intensity is 0.2 packets per ms. The packet transmission time is one time slot. Calculate the average length of the idle periods, the average length of the busy periods, the average number of useful slots in a busy period, and finally the throughput. Double check the result using $S = Ge^{-G}$.

Problem 3

Describe the traffic models that have been used for the ALOHA and CSMA analysis in class as well as in the Rom-Sidi book. Compare it with the traffic model used for the CSMA/CA analysis in the Bianchi paper.

Considering the Bianchi paper, try to collect the assumptions that are made for the throughput analysis.