Home assignment set 1

September 8, 2018

Set 1: Traffic models

Problem 1

a) You would like to model the traffic flow a voice source with a two state Markov modulated fluid model. After extensive measurements, you see that high-bitrate and silent periods follow each other, and you have the following statistical data. In high-bitrate periods the source generates data with 64kbit/s. The average length of the high-bitrate periods is 10 sec, the average length of the silent periods is 30 sec.

Define the Markov modulated fluid model that describes the flow. Give the state transition intensities and the "fluid generation rate" in the two states. What is the probability that the source is silent at an arbitrary point of time?

b) Evaluate the effect of multiplexing such traffic flows. Increase the number of flows transmitted on a link, at the same time increasing the link transmission capacity. Assume, that there are no buffers, that is, data if lost, if the data generation rate is higher than the link transmission capacity. (This may sound stupid, but is a rather good solution, if late arriving packets needs to be dropped anyway).

Consider the specific case, where for n multiplexed flows the link capacity is set to $n \cdot 32$kbit/s. Prepare a graph that shows the probability that data is lost at an arbitrary point of time, as a function of the number of sources multiplexed.

(Note, from these results we actually do not know how much data is lost, but let us assume, we do not care about that.)

Problem 2

In this assignment you need to prepare a statistical analysis of a packet arrival trace. The trace gives the packet arrival times in seconds to a 10 Mbps Ethernet link (it also gives the packet sizes in the second column, but we are not interested in that now.) Analyse the trace considering the properties we discussed in the first two lectures. You can select freely what properties you want to discuss and how you want to analyse them. See the link to the trace on the web.

Problem 3

When we discussed short range dependence, we have stated that for a two state, continuous time on-off Markov process with parameters α and β the auto-correlation decays Exponentially, according to $r(t) = e^{-(\alpha+\beta)t}$. Present a derivation of this result. (Does not have to be your own derivation if you can find it in the literature.)