Computer Networks Fall 2016
Project 2: Part 1
Simulation of a Single Server Finite Buffer Queue

1 Project Overview

This is the first part of a 2-part project. The first part is the simulation of a simple queueing system with a finite buffer to study the packet loss probability as a function of the buffer size and the traffic intensity. The second part is the simulation of the random access LAN MAC protocol. This will be described in a separate document. We will implement both project in Python using SimPy. You will find the required documentation at the following site `https://simpy.readthedocs.org/en/latest/contents.html#`. The site contains instructions to install SimPy and many examples.

2 Part 1

Figure 1 shows a simple queueing system model of output port of a router.

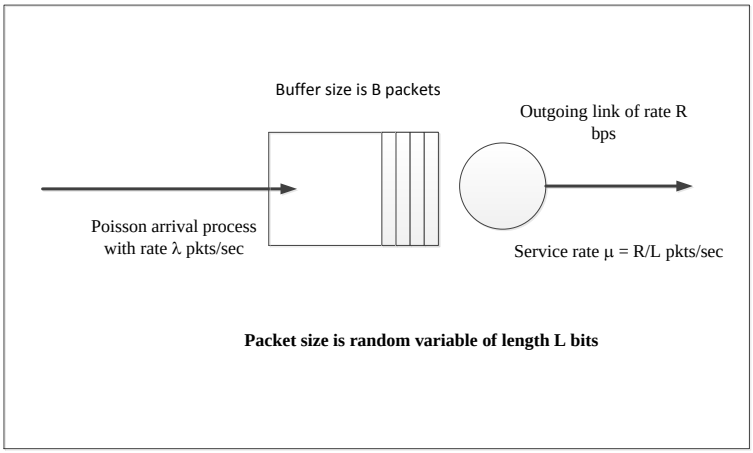

Figure 1: A finite buffer queue

Packets arrive following a Poisson process with rate λ packets per seconds (pkts/sec). Packets are of variable length and transmitted on the link of rate R bps. We will assume that the effective service time of a packet is negative exponentially distributed with rate parameter μ pkts/sec. To keep things simple we will assume that $\mu = 1$ pkts/sec. The buffer size if B packets.

You are required to write a Python code using SimPy to simulate the above system. To help you along this process, we have given you the Python code that simulates a infinite buffer queue that we had studied in class. Here are the following steps:

1. Run the given code for different values of $\lambda = 0.2, 0.4, 0.6, 0.8, 0.9, 0.99$ pkts/sec and obtain the mean delay. Make a table the compares the simulated value with the theoretical value using the formula that we had derived in class.

2. Using the Markov Chain method derive the packet loss probability P_d as a function of buffer size B packet, arrival rate λ pkts/sec, and service rate μ pkts/sec.

3. Modify the given simulation code to simulate a finite buffer system with buffer size B. For $\lambda = 0.2, 0.4, 0.6, 0.8, 0.9, 0.99$ and $B = 10, 50$, using the simulation, determine the packet loss probability P_d.

4. Compare the above results using the theoretical formula derived in Step 2.

2.1 Deliverables for Part 1

1. Group size: 2. One submission per group.

2. Due date for Part 1: 11/8/2016 by 4 PM.

3. Report should include 1) the derivation of the theoretical formula to calculate P_d, 2) the simulation code, and 3) tables (or plots) of the results.

4. Submit a hard copy in the homework box in Kemper 2131.