EE 6340: Introduction to Telecommunications Networks

PROJECT 4

A. Performance of slotted system with Poisson and geometric arrivals.

In a slotted system, two different types of packets are arriving, i.e., type P and G. The arrival rate of type P packets follows a continuous-time Poisson process with rate λ_P. The arrival rate of type G packets follows a geometric process, i.e., one packet can arrive in a slot with probability α or no packets arrive with probability $1-\alpha$. The arrival rate of type G packets is λ_G, i.e., $\lambda_G T_s = \alpha$ being T_s the slot duration. In each slot of duration T_s, one packet can be transmitted. Different policies can be used to select the packet to transmit. Priority can be given either to type P packets or to type G packets, or First-Come First-Served (FCFS) policy can be used.

1. Under the FCFS policy, evaluate the average number of type P packets ($N_{Q,P}$) and type G packets ($N_{Q,G}$) in the buffer.
2. Under the FCFS policy, evaluate the average waiting time of type P packets (W_P) and type G packets (W_G).
3. Under the FCFS policy, evaluate the average time spent in the system by of type P packets (T_P) and type G packets (T_G).
4. Assume that the arrival rate of type G packets is proportional to the arrival rate of type P packets as $\lambda_G = K\lambda_P$. **Plot #1:** plot the average waiting time for type P and G packets (W_P and W_G) versus the utilization factor $\rho = \rho_P + \rho_G$, when $T_s = 1$, for $K = 0.5$, 1, 2 and 5.
5. From Plot #1, which type of packet shows the highest waiting time? Explain the reason.
6. **Plot #2:** plot W_P and W_G for each one of three policies to select the next packet to transmit versus the utilization factor ρ, when $\mu = 1$ and $\rho_G = \rho_P$.
7. Which policy has the smallest W_P? Which policy has the smallest W_G?