

Network Engineering - Lab Exercises

Session 5

1 Packet Delay in M/G/1 queues

Consider that a WIFI Access Point (AP) is transmitting data to 4 users. The wireless interface can be modelled by a M/G/1 queue. The AP transmission rate is $R = 26$ Mbps. There are no packet transmission errors. The traffic directed to each user has the following characteristics:

- User 1: $\lambda_1 = 4000$ packets/s. $E[L_1] = 100$ bits. $CV_1 = 0.5$.
- User 2: $\lambda_2 = 1000$ packets/s. $E[L_2] = 2000$ bits. $CV_2 = 2$.
- User 3: $\lambda_3 = 4000$ packets/s. $E[L_3] = 4000$ bits. $CV_3 = 1$.
- User 4: $\lambda_4 = 100$ packets/s. $E[L_4] = 12000$ bits. $CV_4 = 0$.

Exercises:

1. Using the function `mg1APmodel.m`, calculate the total delay for each user, i.e., $E[D_i]$ for user i .
2. Plot in the same figure all four $E[D_i]$ if the CV of User 4 increases between 0 and 20 in increments of 1. To do that, complete the function "PlotMG1delayCV.m" that uses the function `mg1APmodel.m`. Discuss the results.
3. For the initial CV_4 , plot in the same figure all four $E[D_i]$ if the traffic load of User 4 increases between $\lambda_4 = 100$ and $\lambda_4 = 600$ in increments of 50. To do that, create a new function "PlotMG1delayLambda.m" that uses the function `mg1APmodel.m`. Discuss the results.

2 M/G/1 queues with priorities

Repeat previous exercise but assigning different priority levels to each user. Complete the function `mg1APmodelprio.m` (as a first step check if the equations used to calculate the delay of each queue in the priority system are correct).

Compare the performance of the two following prioritization schemes (in both cases there are 4 queues, one for each user):

1. Priorities are assigned from the lower ρ_i (higher priority) to the higher ρ_i (lower priority).
2. Priorities are assigned from the higher ρ_i (higher priority) to the lower ρ_i (lower priority).

Compare (discuss) the results between them, and with those from the case without priorities: How priorities affect the delay of each flow?