Estimating Remaining Queueing Time

Anders Carlsson, ÖeG
Jonas Enlund, ÖeG

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This paper is part of the research work preparing for implementing Project Hollywood. It discusses the problem of estimating the remaining queueing time for a person in a queue.

We have L people before us in the queue, and G people have finished queueing during the time we've waited.

The start time T_S is the time we joined the queue. The current time is denoted T_N. We also record the last time someone before us in line left the queue, T_G.

The average serving time for the people who left the queue during our wait is expressed

$$Avg_G = \frac{T_G - T_S}{G}$$

and the average serving time for the people who left the queue during our wait plus the person currently being served is

$$Avg_{G+1} = \frac{T_N - T_S}{G + 1}$$

The time we have waited for the person currently getting served is $T_N - T_G$.

If $Avg_{G+1} \leq Avg_G$ we can assume that the person currently being served will probably be taking as long as the previous people who have been served. We can then estimate the remaining waiting time to

$$Avg_G \times L - (T_N - T_G)$$

On the other hand, if $Avg_{G+1} > Avg_G$ the person currently being served is increasing the average time and the remaining waiting time is instead estimated to

$$Avg_{G+1} \times L - (T_N - T_G)$$

There is an edge case that needs to be considered. When joining the queue, the person in front has probably been standing there for some amount of time. He will therefore leave earlier than his serving time, and will skew the results.

When we join the queue we have no idea of the average serving time, and we can not give any estimate at all. When the first person leaves, the best we can do is to use the time we waited as his serving time[1], but it's probably not correct. When he leaves, we use the time the first person left the queue as our T_S and don't count the first person to leave in G.

[1] Or perhaps the waiting time $\times$ 2