KAZAKH BRITISH TECHNICAL UNIVERSITY

REPORT

Queue Problem

Basics of Computer Simulation

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Queueing theory is the mathematical study of waiting lines, or queues. A queueing model is constructed so that queue lengths and waiting time can be predicted. Here, in my simulation I used Little's Law. In queueing theory, a discipline within the mathematical theory of probability, Little's result, theorem, lemma, law, or formula is a theorem by John Little which states that the long-term average number L of customers in a stationary system is equal to the long-term average effective arrival rate λ multiplied by the average time W that a customer spends in the system.

The law applies to entire systems, as well as subsystems within a system. According to Wikipedia, the beauty is that it works for any arrival distribution and service distribution. It is useful because if you know any two of the three terms in the equation, you can estimate the third.
It only works for "stable" system, in other words systems not going through warm-up periods or cool down periods.

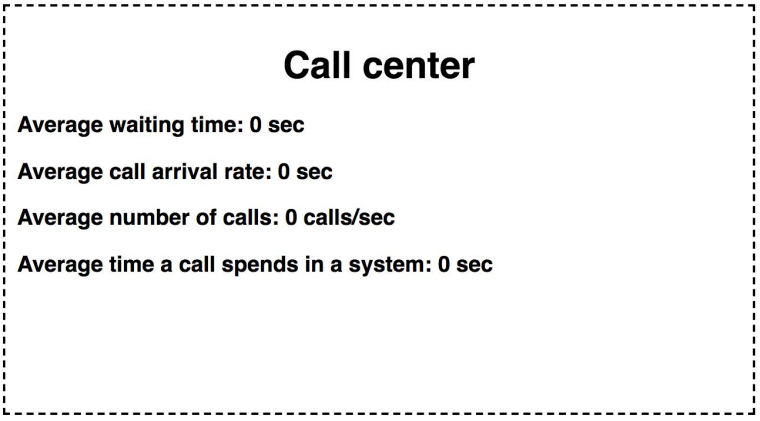
Realization:

For my model, assume we have three different incoming call streams, each of which goes to a technician for support. Each technician only handles one type of call, so they do not take each other's calls.

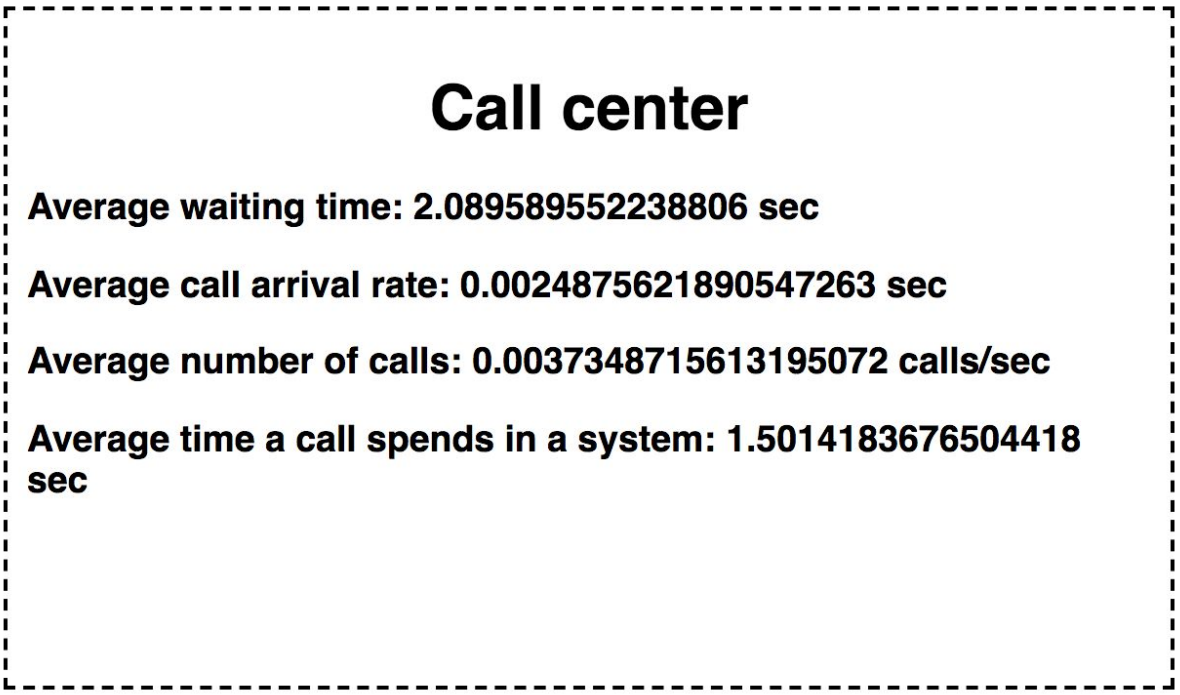
The calls have an Exponential distribution with a mean of 2 seconds between calls. Each technician takes exactly 1 second to handle each call.

Note: I did not use minutes in this example to simulate it faster.

Before starting, all values are 0.



When we run it, at first the numbers do not match the formula: they may be too high or too low. But then eventually they start to converge.



L = average number of calls
λ = average call arrival rate
W = average time a call spends in a system

$L = \lambda W$

Conclusion:

By using Little's law and simulating any stable system, we can calculate and improve our system.