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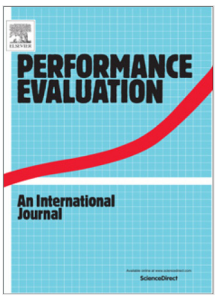

Multi-server preemptive priority queue with general arrivals and service times

Alexandre Brandwajn, Thomas Begin

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Multi-server preemptive priority queue with general arrivals and service times

Alexandre Brandwajn
Baskin School of Engineering
University of California Santa Cruz
USA
alexb@soe.ucsc.edu

Thomas Begin
LIP UMR CNRS - ENS Lyon - UCB Lyon 1 - INRIA 5668
France
thomas.begin@ens-lyon.fr

ABSTRACT

We present a simple approximate solution for preemptive-resume queues with multiple servers, general (phase-type) service and general (phase-type) interarrival time distributions. In our solution, priority levels are solved one at a time in the order of decreasing priorities. Each priority level is solved approximately using a reduced state description. The complexity of our approximate solution in terms of the number of equations solved grows linearly with the number of servers and priority levels.

We studied a large number of numerical examples with a range of values for mean service times and offered loads across priority levels, varying the number of servers from 8 to 48. Discrete-event simulation was used to assess the accuracy of our approximate solution. Overall, in the case of Poisson and quasi-Poisson arrivals, expected relative error for the mean number of customers in the system was below 2% while the corresponding median relative error was below 0.25%. The good accuracy of our approximation appears to extend to the case of phase-type times between arrivals, with expected relative errors for the mean number in system below 5% even for a Pareto-like distribution of interarrival times with a large coefficient of variation. Our numerical results indicate that the proposed approximation provides a relatively simple and generally accurate approach to preemptive-resume queues with larger numbers of servers and general distributions of service and interarrival times.

Keywords: Multiple servers, priority, preemptive-resume, general service, general arrivals, *Ph/Ph/c/N* queue, reduced-state approximation, linear complexity.