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Modeling and Analysis of Heavy-Tailed Distributions via Classical Teletraffic Methods

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Abstract

We propose a new methodology for modeling and analyzing heavy-tailed distributions in communication networks. The basis of our approach is a fitting algorithm which approximates a heavy-tailed distribution by a hyperexponential distribution. This algorithm possesses several key properties. First, the approximation can be achieved within any desired degree of accuracy. Second, the fitted hyperexponential distribution depends only on a few parameters. Third, only a small number of exponentials are required in order to obtain an accurate approximation over many time-scales. Once equipped with a fitted hyperexponential distribution, we have an integrated framework for analyzing queueing systems with heavy-tailed distributions. We consider the M/G/1 queue and show how our approach allows to derive both quantitative numerical results and asymptotic closed-form results. This derivation shows that classical teletraffic methods can be employed for the analysis of heavy-tailed distributions.