Fluid Queues, On-Off Processes and Teletraffic Modeling

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Abstract

Fluid queues have frequently been used as models for telecommunication networks. Consider the "leaky bucket" model where water leaks from a bucket at rate r. This corresponds to a server working off the load at constant rate r. Consider a fluid queue being fed by (a) a single on-off renewal process, (b) k such on-off models, (c) an infinite number of sources. In models (a) and (b) sources turn on at renewal time points and in (c) sources turn on at Poisson times. Transmissions last for iid periods governed by a long-tailed distribution of session lengths. The heavy tails induce long range dependence in the system and result in performance deterioration. We study the time it takes until such fluid queues with finite but large holding capacity reach overflow. The expected time until overflow, as a function of capacity L, increases only polynomially fast, and so overflows happen much more often than in the "classical" light tailed case, where the expected overflow time increases as an exponential function of L.