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How system performance is affected by the interplay of averages in a fluid queue with long range dependence induced by heavy tails. (English) Zbl 1059.60505

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Summary: We consider a fluid queue with sessions arriving according to a Poisson process. A long-tailed distribution of session lengths induces long range dependence in the system and causes its performance to deteriorate. The deterioration is due to occurrence of load regimes far from average ones. Nonetheless, the extent of this performance deterioration is shown to depend crucially on the average values of the system parameters.

MSC:

60K25 Queueing theory (aspects of probability theory)

60F10 Large deviations

60K30 Applications of queueing theory (congestion, allocation, storage, traffic, etc.)

68M20 Performance evaluation, queueing, and scheduling in the context of computer systems

90B22 Queues and service in operations research

Cited in 7 Documents

Keywords:

Fluid queue; heavy tails; long range dependence; performance of a queue; $M/G/\infty$ queue; time until overflow; large deviations; association

Full Text: [DOI](#)

References:

- [1] Bingham, N., Goldie, C. and Teugels, J. (1987). Regular Variation. Cambridge Univ. Press. · [Zbl 0617.26001](#)
- [2] Boxma, O. and Dumas, V. (1996). Fluid queues with long-tailed activity period distributions. Special Issue of Stochastic Analysis and Optimization of Communication Systems.
- [3] Burton, R. and Waymire, E. (1985). Scaling limits for associated random measures. Ann. Probab. 13 1267-1278. · [Zbl 0579.60039](#) · [doi:10.1214/aop/1176992810](#) ·
- [4] Duffield, M. and O'Connell, N. (1995). Large deviations and overflow probabilities for the general single-server queue, with applications. Math. Proc. Cambridge Philos. Soc. 118 363-374. · [Zbl 0840.60087](#) · [doi:10.1017/S0305004100073709](#)
- [5] Embrechts, P. and Goldie, C. (1982). On convolution tails. Stochastic Process. Appl. 13 263-278. · [Zbl 0487.60016](#) · [doi:10.1016/0304-4149\(82\)90013-8](#)
- [6] Embrechts, P., Klüppelberg, C. and Mikosch, T. (1997). Modelling Extreme Events for Insurance and Finance. Springer, Berlin. · [Zbl 0873.62116](#)
- [7] Erramilli, A., Narayan, O. and Willinger, W. (1996). Experimental queueing analysis with long-range dependent packet traffic. IEEE/ACM Trans. on Network Computing 4 209-223.
- [8] Esary, J., Proschan, F. and Walkup, D. (1967). Association of random variables, with applications. Ann. Math. Statist. 38 1466-1474. · [Zbl 0183.21502](#) · [doi:10.1214/aoms/1177698701](#) ·
- [9] Heath, D., Resnick, S. and Samorodnitsky, G. (1997). Patterns of buffer overflow in a class of queues with long memory in the input stream. Ann. Appl. Probab. 7 1021-1057. · [Zbl 0905.60070](#) · [doi:10.1214/aop/1043862423](#) ·
- [10] Heath, D., Resnick, S. and Samorodnitsky, G. (1998). Heavy tails and long range dependence in on/off processes and associated fluid models. Math. Oper. Res. 23 145-165. JSTOR: · [Zbl 0981.60092](#) · [doi:10.1287/moor.23.1.145](#) · [links.jstor.org](#)
- [11] Jelenković, P. and Lazar, A. (1998). Subexponential asymptotics of a Markov-modulated random walk with queueing applications. J. Appl. Probab. 35 1-23. · [Zbl 0913.60048](#) · [doi:10.1239/jap/1032192851](#) ·
- [12] Liu, Z., Nain, P., Towsley, D. and Zhang, Z.-L. (1997). Asymptotic behavior of a multiplexer fed by a long-range dependent process. Technical Report CMPSRI 97-16, Univ. Massachusetts, Amherst.
- [13] Resnick, S. (1987). Extreme Values, Regular Variation and Point Processes. Springer, New York. · [Zbl 0633.60001](#)
- [14] Resnick, S. (1992). Adventures in Stochastic Processes. Birkhäuser, Boston. Resnick, S. and Samorodnitsky, G. (1997a). Activity periods of an infinite server queue and performance of certain heavy tailed fluid queues. Queueing Systems Theory

- Appl. To appear. Resnick, S. and Samorodnitsky, G. (1997b). Performance decay in a single server exponential queueing model with long range dependence. *Oper. Res.* 45 235-243. · [Zbl 0762.60002](#)
- [15] Ruy, B. and Lowen, S. (1995). Modeling, analysis and simulation of self-similar traffic using the fractal-shot-noise-driven Poisson process. In *Proceedings of IASTED International Conference on Modeling and Simulation*, Pittsburgh, PA.
- [16] Vamvakos, S. and Anantharam, V. (1998). On the departure process of a leaky bucket system with long-range dependent input traffic. *Queueing Systems Theory Appl.* 28 191-214. · [Zbl 0907.90150](#) · [doi:10.1023/A:1019155307901](#)
- [17] Willinger, W., Taqqu, M., Sherman, R. and Wilson, D. (1997). Self-similarity through high variability: statistical analysis of ethernet LAN traffic at the source level (extended version). *IEEE/ACM Trans. on Networking* 5 71-96.

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