

Asymptotic Equivalence of Peak Age of Information in M/M/N and M/M/1 Systems with the Same Total Service Rate

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We study the Peak Age of Information in FCFS M/M/N and M/M/1 queueing systems with the same total service rate. The heavy-traffic regime with a fixed number of servers is considered. In the multi-server system, out-of-order packet delivery is taken into account by distinguishing informative updates that actually reduce the age at the monitor. We show that, as the load approaches one, the mean Peak Age of Information values in the two systems are asymptotically equivalent. Moreover, after appropriate scaling, the Peak Age of Information distributions in both systems converge to the same standard exponential distribution. In particular, the Kolmogorov distance between the unscaled Peak Age of Information distributions tends to zero. These results show that, in heavy traffic, the single-server and multi-server systems are asymptotically equivalent in terms of Peak Age of Information.