

HEAVY-TRAFFIC ASYMPTOTICS FOR NETWORKS OF PARALLEL QUEUES WITH MARKOV-MODULATED SERVICE SPEEDS

J.L. Dorsman, Eindhoven University of Technology and Centrum Wiskunde & Informatica, The Netherlands, j.l.dorsman@tue.nl

M. Vlasiou, Eindhoven University of Technology and Centrum Wiskunde & Informatica, The Netherlands, m.vlasiou@tue.nl

B. Zwart, Centrum Wiskunde & Informatica, VU University Amsterdam, Eindhoven University of Technology, The Netherlands, and Georgia Institute of Technology, USA, Bert.Zwart@cwj.nl

Motivated by a number of real-life applications, we study queueing networks consisting of parallel single-server queues. The distinguishing feature of these networks is that the service speeds vary over time and are in addition mutually dependent. More specifically, we assume that the service speeds are modulated by a single continuous-time Markov chain. We obtain heavy-traffic limits for the joint workload, waiting-time and queue-length processes. We do so by using a functional central limit theorem approach, which requires the interchange of steady-state and heavy-traffic limits. The marginals of these limiting distributions are shown to be exponential with rates that can be computed by matrix-analytic methods. Moreover, we show how to numerically compute the joint distribution, by viewing the limit processes as multi-dimensional semi-martingale reflected Brownian motions in the non-negative orthant.