BOSTON UNIVERSITY

Boston University Statistics and Probability Seminar Series

Some Long Time Stability and Control Problems for Stochastic Networks in Heavy Traffic

Chihoon Lee
Department of Statistics and Operations Research,
University of North Carolina

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Mathematics and Computer Science (MCS) Building, Room B46
111 Cummington Street, Boston

Tea and Cookies at 3:30pm in MCS 153

Abstract: Stochastic processing networks arise commonly from applications in computers, telecommunications, and large manufacturing systems. Study of stability and control for such networks is an active and important area of research. In general the networks are too complex for direct analysis and therefore one seeks tractable approximate models. Heavy traffic limit theory yields one of the most useful collection of such approximate models. Typical results in the theory say that, when the network processing resources are roughly balanced with the system load, one can approximate such systems by suitable diffusion processes that are constrained to live within certain polyhedral domains (e.g., positive orthants). Stability and control problems for such diffusion models are easier to analyze and, once these are resolved, one can then infer stability properties and construct good control policies for the original physical networks. In this talk I will consider three related problems concerning stability and long time control for such networks and their diffusion approximations.

In the first part of the talk I will present results on long time asymptotic properties, in particular geometric ergodicity, for limit diffusion models obtained from heavy traffic analysis of stochastic networks. The results will address the rate of convergence to steady state, moment estimates for steady state, uniform in time moment estimates for the process and central limit type results for time averages of such processes. In the second part of the talk I will consider invariant distributions of an important subclass of stochastic networks, namely the generalized Jackson networks (GJN). It is shown that, under natural stability and heavy traffic conditions, the invariant distributions of GJN converge to unique invariant probability distribution of

the corresponding constrained diffusion model. The result leads to natural methodologies for approximation and simulation of steady state behavior of such networks. In the final part of the talk I will consider a rate control problem for stochastic processing networks with an ergodic cost criterion. It is shown that value functions and near optimal controls for limit diffusion models serve as good approximations for the same quantities for certain physical networks that are heavily loaded.

For directions and maps, please see *http://math.bu.edu/research/statistics/statseminar.html.*