We construct a generic, simple, and efficient scheduling policy for stochastic processing networks, and provide a general framework to establish its stability. Our policy is randomized and prioritized: with high probability it prioritizes jobs which have been least routed through the network. We show that the network is globally stable under this policy if there exists an appropriate quadratic 'local' Lyapunov function that provides a negative drift with respect to nominal loads at servers. Applying this generic framework, we obtain stability results for our policy in many important examples of stochastic processing networks: open multiclass queueing networks, parallel server networks, networks of input-queued switches, and a variety of wireless network models with interference constraints. Our main novelty is the construction of an appropriate 'global' Lyapunov function from quadratic 'local' Lyapunov functions, which we believe to be of broader interest.

Talk 4: Large deviations of mean-field interacting particle systems

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We establish a sample path large deviations principle for the empirical measure of finite-state mean-field weakly interacting particle systems. The rates of the empirical measure process diminish to zero as the boundary is approached and, hence, existing theorems on large deviations do not apply. Instead, we use a weak convergence approach to establish the result. We also discuss the implications of this large deviation principle for the long-time stability of such particle systems.

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Optimal routing of customers in polling systems

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We consider a simple polling system with two stations, no switchover times and exhaustive service discipline. The service times are iid exponential and arrival processes are Poisson. The waiting cost in the station being served is more than the waiting cost in the station that is not being served. When a customer arrives, he is routed to one of the two stations, based on the queue-lengths at the two stations and the position of the server. We consider both the individually optimal and socially optimal policies minimize the expected waiting costs. We consider fluid model approximation to derive the socially optimal costs and derive linear switching curve policies.

Stationary analysis of the shortest queue polling model

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We consider a two-node polling model in which customers upon arrival join the shorter of two queues. Customers arrive according to a Poisson process and the service times in both nodes are independent and identically distributed random variables having the exponential distribution. The two-dimensional process of the numbers of customers at the queue where the server is and at the other queue is a two-dimensional Markov process. We derive its equilibrium distribution using two methodologies: the compensation approach and a reduction to a boundary value problem.