WiOpt 2016 – Invited Talk

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Title:
Scheduling using Interactive Optimization Oracles

Abstract:
Ever since Tassiulas and Ephremides (1992) proposed the maximum weight scheduling algorithm of throughput-optimality for constrained queueing networks that arise in the context of communication networks, extensive efforts have been devoted to resolving its most important drawback: high complexity. In this work, we propose a generic framework for designing throughput-optimal and low-complexity scheduling algorithms for constrained queueing networks. Under our framework, a scheduling algorithm updates current schedules by interacting with a given oracle system that generates an approximate solution to a related optimization task. One can utilize our framework to design a variety of scheduling algorithms by choosing an oracle system such as random search, Markov chain, belief propagation, and primal-dual methods. The complexity of the resulting scheduling algorithm is determined by the number of operations required for an oracle to process a single query, which is typically small. We provide sufficient conditions for throughput-optimality of the scheduling algorithm in general constrained queueing network models. The linear-time algorithm of Tassiulas (1998) and the random access algorithm of Shah and Shin (2012) correspond to special cases of our framework using random search and Markov chain oracles, respectively. Our generic framework, however, provides a unified proof with milder assumptions. This is a joint work with Tonghoon Suk (Gatech).