Adversarial Queueing Theory Revisited
(Invited Talk)

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Abstract

We survey over a decade of work on a classical Queueing Theory problem; the long–term equilibrium of routing networks. However, we do so from the perspective of Adversarial Queueing Theory where no probabilistic assumptions about traffic patterns are made. Instead, one considers a scenario where an adversary controls service requests and tries to congest the network. Under mild restrictions on the adversary, one can often still guarantee the network's stability. We illustrate other applications of an adversarial perspective to standard algorithmic problems. We conclude with a discussion of new potential domains of applicability of such an adversarial view of common computational tasks.

Background

In 1996 Borodin et al. [9] proposed a robust model of queueing theory in network traffic. The gist of their proposal is to replace stochastic assumptions about the packet traffic by restrictions on the packet arrival rate, which otherwise can be under the control of an adversary. Thus, they gave rise to what is currently termed Adversarial Queueing Theory (AQT). In it, the time–evolution of the routing network is viewed as a game between an adversary and a packet scheduling protocol.

The AQT framework originally focussed on the issue of stability of queueing policies and network topologies. Characterizations and efficient algorithms were developed for deciding stability of a collection of networks for specific families of scheduling policies. Generalizations of the AQT framework were proposed. End–to–end packet delay issues were addressed. Time–dependent network topology variants were considered, etc.

We survey a decade of results in AQT. We point to other work where a similar adversarial approach has been successfully developed. We conclude with a discussions of other computational domains where a similar adversarial approach might be fruitfully applied.

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