Network Design: Optimization and Algorithmic Game theory
August 14–16, 2006

Myopic Dynamics for a Network Formation Game with Routing

Ramesh Johari
ramesh.johari@stanford.edu
Dept. of Management Science and Engineering
Stanford University
Terman Engineering Center, Rm. 319, 380 Panama Way
Stanford, CA 94305-4026
USA

Abstract

We consider a network formation game where a finite number of nodes wish to send traffic to each other. Nodes contract bilaterally with each other to form bidirectional communication links; once the network is formed, traffic is routed along shortest paths (if possible). Cost is incurred to a node from four sources: (1) routing traffic; (2) maintaining links to other nodes; (3) disconnection from destinations the node wishes to reach; and (4) payments made to other nodes. We assume that a network is stable if no single node wishes to unilaterally deviate, and no pair of nodes can profitably deviate together (a variation on the notion of pairwise stability).

We study such a game under *myopic best response dynamics*. In choosing their best strategy, nodes optimize their single period payoff only. We characterize a simple set of assumptions under which these dynamics will converge to a star network centered at a node with minimum cost for routing traffic. Further, we show that these assumptions are satisfied by a contractual model motivated by bilateral Rubinstein bargaining.

This is joint work with Esteban Arcaute (Stanford), Eric Dallal (McGill), and Shie Mannor (McGill).