Dynamic Resource Control in a Stochastic Network: Limiting Regimes and Asymptotic Optimality

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Abstract
We study a class of stochastic networks with concurrent occupancy of resources, which, in turn, are shared among jobs. For example, streaming a video on the Internet requires bandwidth from all the links that connect the source of the video to its destination; and the capacity of each link is shared, according to a certain protocol, among all source-destination connections that involve this link. Another example is a multi-leg flight on an airline reservation system: to book the flight, seats on all legs must be committed simultaneously. We focus on a class of dynamic resource control on this type of networks, where the link capacities are allocated among the job classes, in each state of the network, according to the solution to a utility maximization problem. We derive fluid and diffusion limits of the network under this type of (myopic) control policy. Furthermore, we identify a cost function that is minimized in the diffusion regime, thereby justifying the asymptotic optimality of the control. (Joint work with Hengqing Ye.)

Biography
David Yao is a Professor of Industrial Engineering and Operations Research at Columbia University. He is an IEEE Fellow and INFORMS Fellow, and a recipient of the SIAM Outstanding Paper Prize (2003), the Franz Edelman Award (1999) from INFORMS, the IBM Outstanding Technical Achievement Award (1999) from IBM, the Guggenheim Fellowship (1991/92), and the Presidential Young Investigator Award (1987-92) from NSF. He is an author/coauthor of over 170 refereed publications, three books and five edited volumes; and a holder of five U.S. patents in manufacturing and supply chain logistics. He served as Stochastic Models Area Editor of Operations Research from 1995-2005.

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