Cross-Layer Design for Multihop Wireless Networks

Ness B. Shroff

Abstract

In this talk, we will investigate the cross-layer design problem for multi-hop wirless systems by employing a new "loose-coupling" approach. By loose-coupling, we mean that the cross-layer solution only requires a minimal amount of interaction between the layers, and is robust to imperfect decisions made at each layer. We will focus on the cross-layer congestion control and scheduling problem in multi-hop wireless networks. We will show that the optimal solution to this cross-layer problem can be decomposed into a congestion control component and a scheduling component, with minimal coupling through queue-length updates. We will also investigate the impact on the performance of the cross -layer solution if the network can only use an imperfect (and potentially distributed) scheduling component that is easier to implement. We will establish desirable performance bounds for our solution with imperfect scheduling and show how the insights drawn from our analyses also enable us to design a fully distributed cross-layer congestion control and scheduling algorithm. We will also discuss how provably approximate solutions can be obtained in polynomial time.

Collaborators: Xiaojun Lin, Gaurav Sharma, and Ravi R. Mazumdar.