Network Coding: A Revolution in the Making?

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Network coding, proposed by a small group of researchers eight years ago, has the potential to greatly improve the efficiency of information transmission in packet networks. The key idea of network coding is to generalize the operation of intermediate nodes in the network, changing their operation from routing to coding. Traditional network routers treat packets as fragile and distinct pieces of a message, to be switched along appropriate network pathways, and reassembled into a message at the receiver. Network coders, on the other hand, treat packets as robust and indistinct lumps of "evidence" which can be mixed together (and not just routed) at intermediate nodes. Receivers gather evidence, and can infer which message was sent when sufficiently many clues have been received. The great advantage of allowing evidence to be combined at intermediate nodes is that this evidence can then better squeeze through network bottlenecks, allowing for greater transmission efficiencies than can be achieved through routing alone.

In this talk we provide an overview of the theory and application of linear network coding in packet networks. We show how some of the ideas are being applied to create new content dissemination protocols in the Internet and in wireless networks. We also sketch some of our own work (joint with Ralf Koetter) on the problem of error- and erasure-correction in network-coded packet transmission systems.

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