This talk seeks to illustrate the interplay between theoretical development and engineering implementation, with a personal slant. It centers on Network Coding (NC), a modern information theoretic development that leverages algebraic data manipulation during transport through a network to enhance resource usage. The addition of data manipulation to network modeling went beyond traditional graph theoretic considerations, allowing a significant relaxation of constraints that had original been treated as essential and, consequently, to the circumvention of impasses. The new model afforded opportunities for improved resource usage in existing networks through developments such as our Random Linear Network Coding (RLNC). While RLNC provided provably optimal throughput within standard theoretical frameworks, introducing it into the most common Internet transport protocol, Transmission Control Protocol (TCP), required an inventive reinterpretation of TCP’s control signals. Our recent theoretical results in Equivalence Theory show there is no benefit, in terms of throughput, in combining NC with the type of coding commonly used to palliate mistransmissions in error-prone media such as wireless links. These results confirm the sense behind current operational practice, but contradict long-standing folk-theorems regarding the benefit of joint coding. However, when other performance metrics such as energy consumption are taken into account, in practice we have shown that combining NC with coding for wireless links leads to marked, cumulative gains. We shall conclude the talk with open challenges and research directions driven by the coming convergence of data storage and networking. No background knowledge will be assumed.

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