On the Complexity of Information Spreading in Dynamic Networks

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We study how to spread distinct items of information (tokens) stored at a subset of nodes in a network to all nodes of the network. This basic gossip problem can be completed in a linear number of communication rounds in any *static* network. The central question of our study is: can this gossip problem be solved in a linear number of rounds on any connected *dynamic* network, the edges of which may change in every communication round? Our focus is on forwarding algorithms, which do not manipulate tokens in any way other than storing, copying and forwarding them.

We present a nearly *quadratic* lower bound on the gossip time in a strong adaptive adversary model, in which the adversary sets the edges of a connected network in each round with knowledge of the algorithm's moves. This establishes a near-linear factor separation between forwarding algorithms and network-coding approaches for such dynamic network models. Our lower bound motivates the study of weaker adversarial dynamics. We show that under a weak adaptive adversary, a natural local protocol completes gossip in near-linear rounds if the initial token distribution is "well-mixed". Time permitting, we will also present a centralized algorithm that solves the gossip problem in near-linear rounds for every initial distribution in the offline setting where the network dynamics is known to the algorithm in advance.

(Joint work with Chinmoy Dutta, Gopal Pandurangan, Zhifeng Sun, and Emanuele Viola.)