In this thesis we investigate the impact of randomization for information dissemination on networks. We begin by studying the runtime of the so-called push algorithm for disseminating a rumor initially known by a single node to all other nodes of a network modelled by an undirected, connected graph. We upper bound the runtime of this algorithm on general and more specific networks. We also consider the relationship of the push algorithm to random walks. More precisely, we relate the runtime of the push algorithm to the mixing time (first step the distribution of the random walk is close to equilibrium) and the cover time (first step the random walk has visited all vertices). In particular, we provide a fairly tight characterization of graphs where the cover time and runtime of the push algorithm are capturing each other (neglecting small factors). We also propose and analyze a new variant of the push algorithm called quasirandom rumor spreading. Though this variant requires much less random bits, we prove that the performance is at least as good (or even better) as the classical push algorithm on two important networks. Finally, we consider smoothing networks, which are designed for load balancing of indivisible tokens in a distributed environment. Assuming a random initialization, we present a very simple network that balances the load up to an additive constant, regardless of the imbalance of the input.

Our results do not only reveal the power of randomization, but also demonstrate that small changes in the protocol may sometimes lead to surprisingly vast improvements.