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Studies on Epidemic Routing in Delay/Disruption-Tolerant Networking

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In the last decade, DTN (Delay/Disruption-Tolerant Networking) has been attracting significant amount of attention as a solution for realizing emergency and/or low-cost communication infrastructure. In order to design an efficient information diffusion strategy in communication networks like DTN, we tackled to solve four research issues.

First, to realize high-speed and efficient DTN routing, it is crucial to deliver a message to the destination node immediately, and to delete copies of the delivered message from the network quickly. Building the Markov model of epidemic routing with broadcasting ACKs, we derive the average message delivery delay of epidemic routing with multiple messages, each of which competes for the network bandwidth.

Second, we propose a novel mechanism called *restrained epidemic routing*, which improves the performance of conventional epidemic broadcasting with broadcasting ACKs. However, for restrained epidemic routing to work efficiently, the timing for suppressing the message forwarding probability must be appropriately determined. We therefore investigate the characteristics of restrained epidemic routing under given system parameters (the number of nodes, the contact rate between nodes, and the message generation rate from nodes) by describing the dynamics of restrained epidemic routing as a continuous time system.

Third, we analyze the characteristics of restrained epidemic routing when the contact relation between nodes is given by a general contact model such as complex networks. Specifically, we describe the dynamics of restrained epidemic routing on a complex network with a given degree distribution as differential equations using the degree-based mean field approximation.

Forth, we focus on value of location information of the destination node. By describing the average behavior of a message generated at an arbitrary point on the field moving toward the destination node, we derive the average message delivery delay with the single-copy position-based DTN routing using location information.