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## Connectivity and Reliability of Mobile Ad-Hoc Networks

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**Abstract** Mobile ad hoc networks (MANETs) are characterized as a network with free, cooperative, and mobile nodes, self-organized in random topologies, and without any kind of infrastructure. An inherent property of these networks is that the communication between two nodes usually occurs over a multihop path.

First we derive the probability distribution of the number of hops required for a source node to reach a destination node in a two-dimensional mobile ad hoc network when a fixed number of nodes are uniformly distributed in a finite region under the nearest- and furthest distance routing protocols. The analysis is based on the Poisson randomization technique.

Once a multihop path is established, the functionality of the network depends on the reliability of communication paths. We present an analytical framework to characterize the random behavior of a multihop path and derive path metrics to characterize the reliability of paths. This is achieved through the modeling of a multihop path as a PDMP (piecewise deterministic Markov process). Two path based metrics are obtained as expectations of functionals of the process: the mean path duration and the path persistence. We show that these metrics are the unique solution of a

set of integro-differential equations and provide a recursive scheme for their computation.

Finally, numerical results illustrate the shape of the hop count distribution for both protocols and the computation of the metrics for the path reliability.

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