Searching for a black hole in (semi-) synchronous networks

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Abstract

We study how to explore efficiently an insecure network, namely a network that may contain a hostile node called black hole introduced by S. Dobrev, P. Flocchini, G. Prencipe, and N. Santoro (DISC 2001).

A black hole is a highly harmful stationary process residing in a node of a network and destroying all mobile agents visiting the node, without leaving any trace. We consider the task of locating a black hole in a (partially) synchronous network, assuming an upper bound on the time of any edge traversal by an agent. The minimum number of agents capable to identify a black hole is two. For a given graph and given starting node we are interested in the fastest possible black hole search by two agents.

For arbitrary trees, a 5/3 approximation algorithm has been given by J. Czyzowicz, D. Kowalski, E. Markou, and A. Pelc, while optimal algorithms have been given for special classes of trees (OPODIS 2004). R. Klasing, E. Markou, T. Radzik, and F. Sarracco proved that the problem is NP-hard and gave a 7/2 approximation algorithm for arbitrary graphs (SIROCCO 2005).

Keywords:
approximation algorithm, black hole, graph, mobile agent, NP-hard problem

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