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ZIH-Kolloquium

Titel: Maximizing Network Coverage under Resource Constraints

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Abstract:

Information management in distributed systems ranging from social networks and the Internet to wireless ad-hoc, peer-to-peer (P2P), sensor and mesh networks requires search dissemination and gathering of information. However, all real-world networks work under inherent resource constraints. Limiting resources range from battery power in wireless sensor or ad-hoc networks to communication bandwidth in P2P networks. This brings forward the interesting problem of maximal coverage given a particular resource constraint. Although randomized coverage algorithms have been thoroughly studied in the domain of networks science as well as physical sciences, however a systematic understanding of the implications of resource constraints on service performance as well as of the optimal utilization of the allocated resources is highly desired but currently lacking.

To address the above issue we define the following fundamental and novel extended coverage problem: Starting from a single node and without memory of visited nodes, maximize node coverage in a given time T under resource constraint B . Using methods from statistical mechanics, we develop a randomized coverage algorithm with proliferating message packets and temporally modulated proliferation rate. We present the solution to the network-challenge for regular grids. The new algorithm performs as efficiently as a single random walker but $O(B(d-2)/d)$ times faster, resulting in significant service speed-up on a regular grid of dimension $d > 2$.

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gez. Prof. Dr. Wolfgang E. Nagel