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The Complexity of Distributed BFS in ad hoc Networks

In the talk we are going to study time and message complexity of the problem of building a BFS tree in ad hoc network by a spontaneously awaken node. In the model computation is in synchronous rounds, and messages are sent via point-to-point bi-directional links. Network topology is modeled by an undirected graph. Each node knows only its own id and the id's of its neighbors in the network. We are going to present a deterministic algorithm that trades time for messages, mainly, with time complexity $O(\text{diam} \cdot \min(\text{diam}, n/f(n)) \cdot \log \text{diam} \cdot \log n)$ and with the number of point-to-point messages sent $O(n \cdot (\min(\text{diam}, n/f(n)) + f(n)) \cdot \log \text{diam} \cdot \log n)$, for any monotonically non-decreasing sub-linear integer function f. This yields the first BFS-finding deterministic algorithm in ad hoc network working in time $o(n)$ and with $o(n^2)$ message complexity, for suitable function $f(n) = \omega(\text{diam} \log^2 n)$, provided diam $= o(n/\log^2 n)$.

This is joint work with Dariusz Kowalski.