Packet routing problems on plane grids

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Abstract

In the (ℓ, k)-routing problem, each processor is the origin of at most ℓ packets and the destination of no more than k packets. The goal is to minimize the number of time steps required to route all packets to their respective destinations, under the under the store-and-forward Δ-port model. The permutation routing problem is the particular case when $\ell = k = 1$.

Wireless mesh networks are based on plane tessellations that divide the area into cells and give rise to triangular, square, and hexagonal grids. We study routing algorithms that work on finite convex subgraphs of basic grids. These algorithms are implemented independently at each node, without assuming any global knowledge about the network. I.e., distributed algorithms.

We describe an optimal permutation routing algorithm for subgraphs of triangular grids that need ℓ_{max} (the maximum over the length of the shortest path of all packets) routing steps. We also describe an optimal permutation routing algorithm on hexagonal grids performing in $2\ell_{max} - 1$ steps. Finally, we give some ideas about the $(1 - k)$ and the $(l - k)$-routing problem.