Proximal Labeling for Oblivious Routing in Wireless Ad Hoc Networks

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Abstract. For an adhoc network with n nodes, we propose a proactive routing protocol *without* routing tables which uses $O(\log n)$ bits per node for the location service tables. The algorithm is based on 1-dimensional virtual coordinates, which we call labels. The decision of where to forward a packet is oblivious and purely local, depending only on the labels of the immediate neighbours and the label of the destination: the packet is forwarded to the neighbour whose label is closest to that of the destination. The algorithm is based on mapping the network to an ordered list where each node has one or more integer labels. This labeling can be produced by any arbitrary traversal of the network visiting all the nodes, in particular by a depth-first search of a flood tree which gives a $2n$ length traversal. We show experimentally that, in terms of hop number, our routing algorithm is far superior to geographic protocols in randomly generated networks and for sparse networks produces routes of length very close to those of the shortest path.

1 Introduction

An ad hoc wireless network is a network of wireless nodes cooperating among themselves to forward messages without a fixed, centralized infrastructure. Each node in the network has a unique identifier (ID) and can interchange packets only with a subset of the network, the node's neighbors, usually the nodes within radio range but possibly only a subset of these. The network is modeled as a graph of n nodes, where two nodes share an edge if and only if they can communicate directly. The problem of routing consists in discovering a path from source node s to destination node t through a set of intermediate nodes. Each node decides locally to which node(s) to forward the packet. The decision is determined by the routing algorithm based on the ID of the destination node, the local topology (and possibly geometry) of the network, extra information stored in each node about the routes (the routing tables) and information contained in the packet itself.

The many routing protocols which have been proposed since the advent of ad hoc wireless networks may be generally divided into two classes, those which are reactive (i.e., on-demand) and those which are proactive (i.e, pre-calculated). In the former class (see early work by [3], a route is found dynamically whenever it is

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