Chapter 9
Location Update Improvement Using Fuzzy Logic Optimization in Location Based Routing Protocols in MANET

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ABSTRACT

Several position-based routing protocols have been developed for mobile ad hoc networks. Many of these protocols assume that a location service is available which provides location information on the nodes in the network. This paper introduces a new schema in management of mobile nodes location in mobile ad hoc networks. Fuzzy logic optimization is applied to a better management of location update operation in hierarchical location services. Update management overhead is decreased without significant loss of query success probability. One-hop-chain-technique is used for Auto compensation. A new composed method can update mobile nodes location when the nodes cross a grid boundary. The proposed method uses a dynamic grid area that solves the ping-pong problem between grids. Simulation results show that these methods are effective. The algorithms are distributed and can keep scalability in the scenario of increasing nodes density. The described solutions are not limited to a special network grid ordering, and can be used in every hierarchical ordering like GLS if the ordering can be mappable on these methods.

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1. INTRODUCTION

Ad Hoc networks consist of autonomous nodes that collaborate in order to transport information. Usually, these nodes act as end systems and routers at the same time (Mauve, Widmer, & Hartensteinm, 2001). Due to node mobility, the network topology changes frequently which makes the design of a scalable and robust routing protocol with low message overhead, one of the challenging task in this kind of networks. Routing a packet from a source to a destination in a mobile ad hoc network is a challenging problem, since nodes in the network may move and cause frequent, unpredictable topological changes (Camp, Bolengm, & Davies, 2002). Location services are used in mobile ad hoc and hybrid networks either to locate the geographic position of a given node in the network or to locate a data item. One of the main usages of position location services is in location based routing algorithms.

2. RELATED WORK

Figure 1 shows the classification of the location services proposed so far. Location services can be divided into flooding-based and rendezvous-based approaches. Flooding-based protocols can be further divided into dissemination and reactive approaches. In the dissemination approach, each node periodically floods its location to all nodes in the network. Thus, when a given node requires location information on another node, the information is found in the node's location table, i.e., the dissemination services usually do not send query messages. They can be classified as an all for-all approach. In the reactive approach, nodes do not send update messages; instead they query location information of a specific node only if needed. The location query is flooded to the whole network. The reactive services belong to all-for some category. In rendezvous-based approach, all nodes agree on the set of location servers. Reactive and dissemination services represent the two extremes of the update strategy and they are not scalable. We focus in the following on the rendezvous based services. Two approaches are used to select the location servers, quorum-based and hashing based (Camp, Boleng, & Wilcox, 2001; Luo, X., Camp, & Navidi, 2005).

One of the main problems in location service problem is time of sending of location update packets. As per available methods, we can classify those to: 1) Time based, 2) Distance based, 3) Distance deviation based, 4) Combination based, 5) Grid based and 6) parametric based methods. The proposed classification is available in Figure 2.

2.1. Time Based (Periodic)

In this category, after a special time each node generates a packet (with new location information) and sends that. We can address ADLS (Seet, Pan, Hsu, & Lau, 2005), DQS (Bae, 2007) and DREAM (Basagni, Chlamtac, Syrotiuk, & Woodward, 1998). It is possible that a node sends a packet (after a special time) but without long passed distance.

(Basagni, Chlamtac, Syrotiuk, & Woodward, 1998) has proposed the Distance Routing Effect Algorithm for Mobility (DREAM) in which nodes maintain a location table using the distance effect. Nodes maintain location information of all other nodes in the network proactively. However, the location of a node is updated (by the node) to its nearer neighbors more frequently than nodes that are farther. To send a packet to the destination a source node estimates the expected zone of the destination based on the destinations' location (using its location table) and floods data packets within the expected region. An intermediate node upon receiving the packet re-broadcasts the data packet if it is within the expected region and this continues until the destination receives the packet.

(Seet, Pan, Hsu, & Lau, 2005) proposes ADLS, an Adaptive Demand-driven Location Service