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Agent Based Dynamic Routing System for Mobile Ad Hoc Networks

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ABSTRACT

Mobile ad-hoc networks, MANETs, are infrastructure-less networks composed of mobile nodes over wireless links. All nodes can be freely and dynamically self-organized into arbitrary and temporary ad-hoc network topologies, allowing people and devices to seamlessly inter-network. The dynamics of wireless ad-hoc networks, as a consequence of mobility and disconnection of mobile hosts, pose a number of problems in designing proper routing schemes for effective communication. The limited propagation range of MANETs and lack of central management as well as the unpredictable mobility within scalable networks, still remain challenging points to the routing protocols' designers.

Network topology in MANETs is subjected to continuous and abrupt change. The highly dynamic topology, limited bandwidth availability and energy constraints make the routing problem a challenging one. Routing protocols, which are among the most important network key issues, are responsible for determining the best route between two communicating nodes. In MANETs, where no central network management exists, mobile devices can take an active role in the routing process. Mobile agent technology offers a promising solution to routing problems, where it is used to implement more flexible and decentralized network architecture. Mobile agents are in use for various purposes, ranging from adaptive routing, distributing topology information, offline message transfer and distributed information management.

In this thesis, we propose a mobile agent-based framework to address the aspect of topology discovery in ad hoc wireless network environments. We have designed a multi-agent based protocol, which makes nodes in the network topology aware. The primary goal is to collect all topology-related information from each node in the network and distribute them periodically to other nodes, using mobile agents. ARPM - Agent-base Routing Protocol for MANET - is proposed to benefit from agent characteristics, which ensures high packet delivery ratio and overcomes routing latency, with minimal routing overhead.

ARPM has been implemented using the QualNet simulator. The performance evaluation of ARPM has been assessed versus four investigated protocols that represent reactive, proactive and hybrid categories; these are AODV, DSR, OLSR and ZRP. To provide a sound validation of the algorithms; we have considered many different scenarios varying over a wide number of aspects.

ARPM’s results have confirmed its routing enhancements via two main routing attributes: reliability and scalability. Regarding reliability, ARPM has introduced the least end-to-end delay times at highly mobile and highly traffic networks. Also, it has improved the packet delivery ratio at these network environments. The first and most important contribution of ARPM is its high reliability at harsh environment networks.

Scalability is another important criterion affecting the performance of routing protocols. The results have shown that ARPM is negatively responsive to highly scalable networks with longer delay, lesser delivery ratio and more control overhead. One of the most important contributions of ARPM is its quality of service (QoS), characteristic, where it is highly stable and settles rapidly against network changes.

Controlling some of the agent parameters, as agent population and migration time, may influence ARPM performance. As the agent population is a factor of the number of network nodes, ARPM performance can be improved at scalable networks.