Distance Based Termite Algorithm for Mobile Ad-Hoc Networks

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Abstract. Providing Quality of Service (QoS) in Mobile Ad-Hoc Networks (MANET's) is difficult due to dynamic nature of its topology. Today's research trends show that Swarm Intelligence (SI) can be used effectively to provide QoS in MANET and also MANET is not much explored in the area of SI. Motivated by their self organizing behavior and robustness many routing algorithms have been proposed for both wired and wireless networks. SI routing algorithms are driven by mainly two functions, Pheromone update-decay functions and Forwarding functions. In this paper, a new pheromone update and decay function for Termite algorithm is proposed for MANET which reflects the current context of the network that is the distance between the Mobile Nodes at the time of transmitting the packets. Received Signal Strength (Pr) from Physical Layer is used to find the distance and it is made visible at the Network Layer through Cross Layer Model. The proposed model is simulated and the results are compared with the existing methods and the metric used for the comparison are throughout and control packet overhead. The results show that the new distance based pheromone update and decay methods perform better than the other existing methods.

Keywords: MANET, Pheromone Update/Decay Methods, Routing Algorithm, Swarm Intelligence, Termite.

1 Introduction

The dynamic nature of the MANETs topology, lack of centralized coordination or organization structure and real world implementation restrictions have made providing Quality of Service (QoS) more challenging in MANET's than in wired networks thus limiting the usefulness of MANET's. As a result current research trends are focusing more towards providing best QoS in MANET's. A pool of independent wireless Mobile Nodes (MN's) forms a MANET working together to deliver the message from source MN to destination MN. Despite lack of central coordination MN's are able to coordinate together to achieve global task. MANET works on hop by hop basis, thus every MN has to relay on its fellow MN to deliver the message. These fellow MN's receive and forwards the messages towards the destination and are called as intermediate or relay nodes. Thus all

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MN's in MANET play a dual role, a terminal node and router. Due to mobility these MN's are free to move anywhere making the topology of MANET dynamic in nature. This nature of MANET makes route setup and maintenance a difficult job. Due to frequent link breakups source MN has to spend most of its time in route setup and maintenance than sending the messages thus MANET suffers from low throughput and more control packet overhead. Finding the best path in terms of resource richness and stableness between the source MN to destination MN is the main concern. Recent trends in research have incorporated Swarm Intelligence (SI) for finding the best possible path in MANET and have found that it is giving the best results. SI routing algorithms are driven by mainly two functions, Pheromone update functions and Forwarding functions. In this paper, pheromone update and decay function is proposed which reflects the current status of the network in terms of distance between the two MN's. A comparative study has been done on different pheromone update and decay functions in terms of the throughout and control packet overhead.

MANET is not much explored under SI based routing algorithms. The behavior of the ants and bees has attracted more researchers than other social insects. Only a few notable works has been done in an effort to incorporate the intelligence of social insect *termite* in MANET. In [1], Vivekananda Jha et.al. have done a extensive comparative study on different SI inspired routing protocols for MANET. Authors have highlighted the work done in different category of SI in different sections. Also authors have highlighted the advantages and disadvantages of these protocols. In [2], Sharvani G.S et. al. have done a survey on Ant Colony based routing algorithms and also authors have highlighted the principles, characteristics and merits of SI. In [3], Hamideh Shokrani et.al. have explained the operation of ant-based routing algorithms for MANET's along with the survey on SI based routing algorithms mentioning importance of selections of parameter values. Authors have also mentioned that implementation of these algorithms should be done carefully. In [4], Martin Ruth and Stephen Wicker proposed a SI based routing algorithm for MANET called *Termite.* Termite is a per packet, multipath, adaptive routing protocol which works on *stigmergy* to achieve robustness. Termite achieves high data good put while reducing the control packet overhead. But Termite algorithm has still many open questions to be answered. The same authors in [5] have explained the termite algorithm in detail. In [6], Martin Roth has presented a Markov chain model for soft routing algorithm. Author has used Ant Colony Optimization and Termite algorithm for the analysis. The tradeoff between sensitivity, noise, network sample rate and threshold is derived based on the expected cost. The same author extended the work in [7]. In [8], Martin Roth and Stephen Wicker have shown the undesirable behavior of the Termite algorithm that is not taking the full advantage of multipath. Authors have used analytical model to prove the point. Also authors have given a solution for the same. The same authors in [9] have given a analytical justification for three different pheromone update methods for termite namely pheromone filter, Joint Decay IIR Filter (IIR2) and pDijkstra Pheromone update methods. The mean pheromone over a system of single link and two links is studied and