Maximizing Network Lifetime in MANET using Average Energy Flooding

Thriveni J, Prakash G L, K R Venugopal, L M Patnaik

aDepartment of Computer Science and Engineering, University Visvesvaraya College of Engineering, Bangalore University, Bangalore 560 001, India. Contact: thrivenigowda@yahoo.co.in

bMicroprocessor Applications Laboratory, Indian Institute of Science, Bangalore, India

Wireless mobile Ad Hoc stations have limited battery capacity, hence, Ad Hoc routing protocols ought to be energy conservative. Route discovery is a common operation in routing to resolve many issues relating to battery capacity. In a Mobile Ad Hoc Network (MANET) in particular, due to host mobility, such operations are expected to be executed more frequently. As radio signals are likely to overlap with others in a geographical area, a straightforward broadcasting by flooding is usually very costly and will result in serious redundancy, contention, and collision, resulting in broadcast storm problem. In this paper, an algorithm is proposed to improve the flooding performance of an Ad Hoc On-Demand Distance Vector (AODV) routing protocol called, Probabilistic-Average-Energy-flooding (PAEF) which periodically performs an averaging algorithm Calculate-Average-Energy (CAE) to estimate the average energy $E_{avg}$. This algorithm is used in route discovery process to make a rebroadcast decision by the node. Route request message is rebroadcast with a probability that depends on the difference between the residual energy $E_r$ and the calculated average energy. Our simulation results show an improvement in the network lifetime and the throughput compared to traditional AODV.

1. Introduction

MANETs are self-creating, self-organizing and self-administering without deploying any kind of infrastructure. Mobile Ad hoc are multi hop, wireless, infrastructure less collection of mobile hosts. The hosts are dynamic in nature i.e., they are free to move randomly, join or leave the network without notice and without disrupting the existing communication links. These networks can be created and used anywhere and anytime and intrinsically fault resilient as they do not operate under a fixed topology. They offer special benefits and versatility for wide applications in military i.e., battlefields, sensor networks, distributed mobile computing, disaster discovery systems, educational environments such as conferences, conventions, etc., where fixed infrastructure is not easily acquired.

Ad Hoc networks allows direct communication between any two nodes when adequate radio propagation range exists between these two nodes. Two nodes communicate directly if they are within transmission range of each other. Otherwise, nodes must communicate via a multi-hop route. To find such a multi-hop route, MANETs commonly employ on demand routing algorithms that use flooding or broadcast messages.

Flooding mechanism must balance both the requirements of the application and constraints of both the device and the MANET. Excessive computation due to complicated flooding mechanisms, unnecessary full power broadcasts contribute to the drain on a mobile devices limited power source and the reduction of channel utilization. Flooding mechanism is used by reactive routing protocols such as AODV [1] and DSR (Dynamic Source Routing) [2] to obtain route information. Although many protocols have been proposed for efficient flooding to reduce the redundant message forwarding, most of them do not take the remaining energy of each node into account. Energy consumption issue should be considered when making decisions about whether to rebroadcast or not at each node during route discovery. A simple idea is that nodes with more energy capacity should be responsible for forward-
movements of the node and random generation of battery capacities for the nodes.

7. CONCLUSIONS

One critical issue of almost all kinds of portable devices supported by batteries is power saving. Battery power is a limited resource, hence, the lifetime of batteries is an important issue, especially for MANET, supported by batteries. In this paper, we present an energy efficient algorithm PAEF which utilize a localized averaging algorithm CAE to estimate the average energy. The node determine an appropriate rebroadcast probability for forwarding a route request message in route discovery using the average energy. As compared to the existing AODV, our proposed schemes in forwarding a route request are more effective in reducing the flooding overhead and increase the network lifetime and throughput thereby decreasing the network latency. There exists a trade-off between the energy saving and the throughput according to the value of threshold probability $P_t$. Future, we need to determine an appropriate $P_t$ and the effect of this algorithm for different mobility models and compare with other energy aware routing protocols.

REFERENCES

INFOCOM’02 IEEE, pages 1707-1716, June 2002.


Triveni J is an Associate Professor with the Department of Computer Science and Engineering of Acharya Institute of Technology, Bangalore, India. She received her B.E and M.E degrees in Computer Science and Engineering, from Bangalore University, Bangalore. She is presently pursuing her Ph.D programme in the area of Wireless Adhoc Networks.

Prakash G L is an Assistant Professor with the Department of Computer Science and Engineering of Alpha College of Engineering, Bangalore, India. He received his B.E and M.E degrees in Computer Science and Engineering from Bangalore University, Bangalore. He is presently pursuing his Ph.D programme in the area of Wireless Sensor Networks in Bangalore University.

K R Venugopal is currently the Principal and Dean, Faculty of Engineering, University Visvesvaraya College of Engineering, Bangalore University, Bangalore. He obtained his Bachelor of Engineering from University Visvesvaraya College of Engineering. He received his Masters degree in Computer Science and Automation from Indian Institute of Science Bangalore. He was awarded Ph.D. in Economics from Bangalore University and Ph.D. in Computer Science from Indian Institute of Technology, Madras. He has a distinguished academic career and has degrees in Electronics, Economics, Law, Business Finance, Public Relations, Communications, Industrial Relations, Computer Science and Journalism. He has authored 23 books on Computer Science and Economics, which include Petrodollar and the World Economy, C Aptitude, Mastering C, Microprocessor Programming, Mastering C++ etc. During his three decades of service at UVCE he has over 150 research papers to his credit. His research interests include computer networks, parallel and distributed systems, digital signal processing and data mining.

L M Patnaik is a Professor since 1986 with the Department of Computer Science and Automation, Indian Institute of Science, Bangalore. During the past 35 years of his service at the Institute he has over 400 research publications in in refereed International Journals and Conference Proceedings. He is a Fellow of all the four leading Science and Engineering Academies in India; Fellow of the IEEE and the Academy of Science for the Developing World. He has received twenty national and international awards; notable among them is the IEEE Technical Achievement Award for his significant contributions to high performance computing and soft computing. His areas of research interest have been parallel and distributed computing, CAD for VLSI and computational neuroscience.