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A NOVEL METHOD FOR EFFICIENT DATA TRANSMISSION TECHNIQUES

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Abstract

This paper presents two efficient data transmission algorithms based on 1-hop neighbor information. In the first part of the paper, we consider sender-based data transmission algorithms, specifically the algorithm proposed by Liu et al. In their paper, Liu et al. proposed a sender-based data transmission algorithm that can achieve local optimality by selecting the minimum number of forwarding nodes in the lowest computational time complexity Oðn log nÞ, where n is the number of neighbors. We show that this optimality only holds for a subclass of sender-based algorithms. We propose an efficient sender-based data transmission algorithm based on 1-hop neighbor information that reduces the time complexity of computing forwarding nodes to OðnÞ. In Liu et al.'s algorithm, n nodes are selected to forward the message in the worst case, whereas in our proposed algorithm, the number of forwarding nodes in the worst case is 11. In the second part of the paper, we propose a simple and highly efficient receiver-based data transmission algorithm. When nodes are distributed, we prove that the probability of two neighbor nodes data transmission the same message exponentially decreases when the distance between them decreases or when the node density increases. Using simulation, we confirm these results and show that the number of broadcasts in our proposed receiver-based data transmission algorithm can be even less than one of the best known approximations for the minimum number of required broadcasts.

Objective

To increase the network efficiency in Ad hoc network by reducing the request data transmission of all nodes.

Keywords: Broadcasting, localized algorithms, mobile ad hoc networks (MANETs), mobility, simulation, system design

I. Introduction

DATA TRANSMISSION is a fundamental communication operation in which one node sends a message to all other nodes in the network. Data transmission is widely used as a basic mechanism in many ad hoc network protocols. For example, ad hoc on-demand routing protocols such as AODV [1] and DSR [2] typically use data transmission in their route discovery phase. Data transmission is also used for topology updates, for network maintenance, or simply for sending a control or warning message. The simplest data transmission algorithm is flooding, in which every node broadcasts the message when it receives it for the first time. Using flooding, each node receives the message from all its neighbors in a collision-free network. Therefore, the broadcast redundancy significantly increases as the average number of neighbors increases. High broadcast redundancy can result in high power and bandwidth consumption in the network. Moreover, it increases packet collisions, which can lead to additional transmissions. This can cause severe network congestion or significant performance degradation, a phenomenon called the broadcast storm problem [3]. Consequently, it is crucial to design efficient data transmission algorithms to reduce the number of required transmissions in the network.

A set of nodes is called a Dominating Set (DS) if any node in the network either belongs to the set or is a 1-hop neighbor of a node in the set. The set of data transmission nodes forms a Connected DS (CDS). Therefore, the minimum number of required broadcasts is not less than the size of the minimum CDS. Unfortunately, finding the minimum CDS is NP-hard, even for the unit disk graphs However, there are some distributed algorithms that can find a CDS whose size is smaller than a constant factor of the size of the minimum CDS [6], [7]. These algorithms can be employed to find a small-sized CDS that can be used as a virtual backbone for data transmission in ad hoc networks. However, this approach is not efficient in networks with frequent topology changes, as maintaining a CDS is often costly. The main objective of efficient data transmission algorithms is to reduce the number of broadcasts while keeping the bandwidth and computational overhead as low as possible. One approach to classify data transmission algorithms is based on the neighbor information they use. Some data transmission algorithms such as flooding and probabilistic data transmission algorithms [9], [10] do not rely on neighborhood knowledge.

These algorithms cannot typically guarantee full delivery and/or effectively reduce the number of broadcasts. Moreover, to decide whether or not to broadcast, they may use a threshold (such as probability of broadcast),which may not be easy to find for different network situations. In the second category, data transmission algorithms require having 2-hop or more neighbor information. The data transmission algorithms in this category can reduce the number of broadcasts in the network and guarantee full delivery [11], [12], [13]. However, they may induce high overhead in highly dynamic networks as they need to maintain 2-hop network connectivity.

In this paper, we propose two data transmission algorithms based on 1-hop neighbor information. The first proposed algorithm is a sender-based algorithm. In sender-based algorithms, the data transmission nodes select a subset of their neighbors to forward the message. We compare our proposed data transmission algorithm to one of the best sender-based data transmission algorithms that use 1-hop information [8]. In [8], Liu et al. propose a data transmission algorithm that reduces the number of broadcasts and achieves local optimality by selecting the minimum numberof forwarding nodes with minimum time complexity Oðn log nÞ, where n is the number of neighbors. We show that this optimality only holds for a subclass of sender based data transmission algorithms employing 1-hop information and prove that our proposed sender-based algorithm can achieve full delivery with time complexity OðnÞ. Moreover, Liu et al.'s algorithm selects n forwarding nodes in the worst case, while our proposed algorithm selects 11 nodes in the worst case. Based on our simulation results, our sender-based algorithm results in fewer broadcasts than does Liu et al.'s algorithm. All these interesting properties are achieved at the cost of a slight increase in end-to-end delay. Thus, our first proposed algorithm is preferred to Liu et al.'s algorithm when the value of n is typically large, and it is important to bound the packet size. We also propose a receiver-based data transmission

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algorithm in this paper. In receiver-based algorithms, the receiver decides whether or not to broadcast the message. The proposed receiver-based algorithm is a novel data transmission algorithm that can significantly reduce the number of broadcasts in the network. We show that using our proposed receiver-based algorithm, two close neighbors are not likely to broadcast the same message. In other words, we prove that the probability of broadcast for a node NA exponentially decreases when the distance between NA and its data transmission neighbor decreases or when the density of nodes increases. Based on our experimental results, the number of broadcasts using our receiver-based algorithm is less than one of the best known approximations for the minimum number of required broadcasts. The rest of this paper is organized as follows:

II. Module

2.1 Creating Nodes

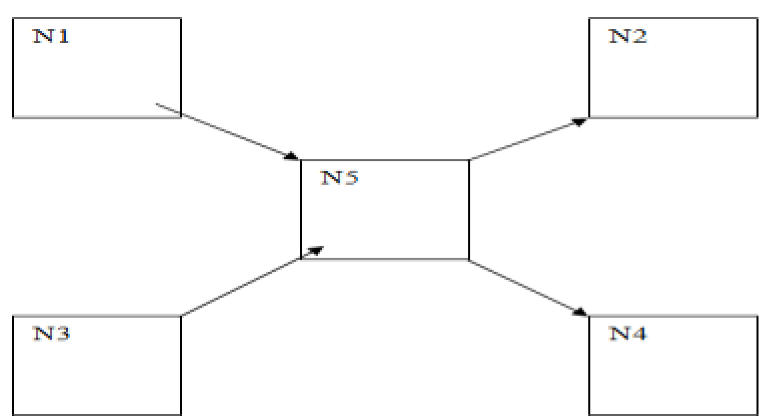
2.2 Data transmission Route request

2.3 Data Sending

Module Description

2.1 Creating Nodes

In this module we create node in the form of GUI using java swing and connect the independent nodes.



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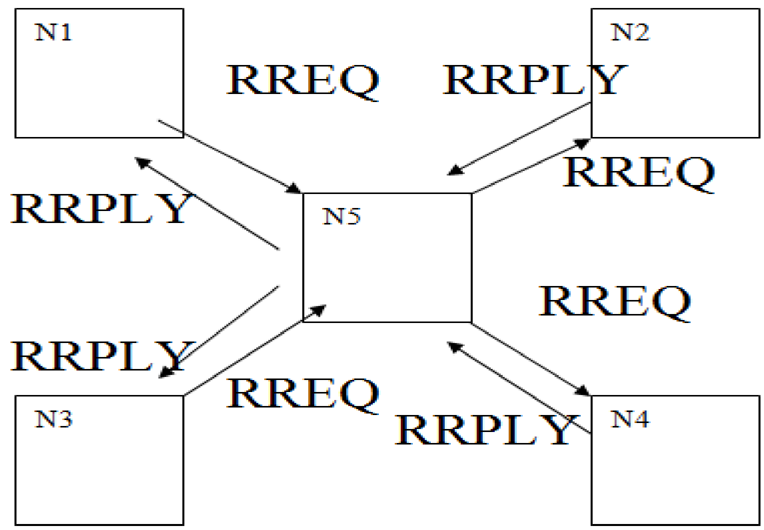
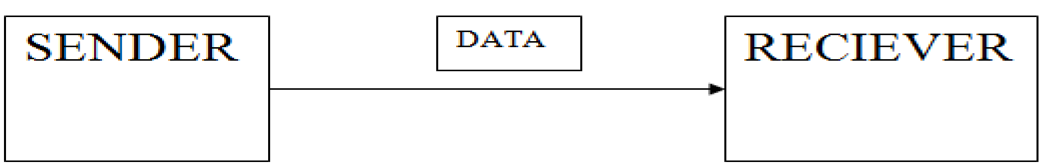
2.2 Data transmission Route request

In this module we broadcast route request messages based on sender based and reciever based data transmission



2.3 Data Sending

In this module we forward the data to destination after finding the route.



III. Screen Shot:

Network Monitor

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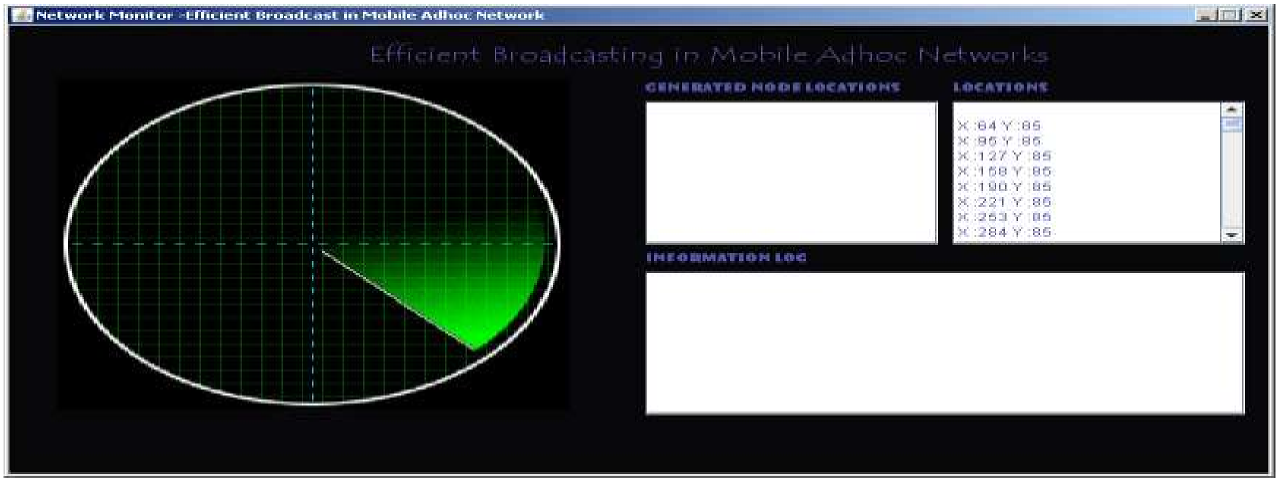
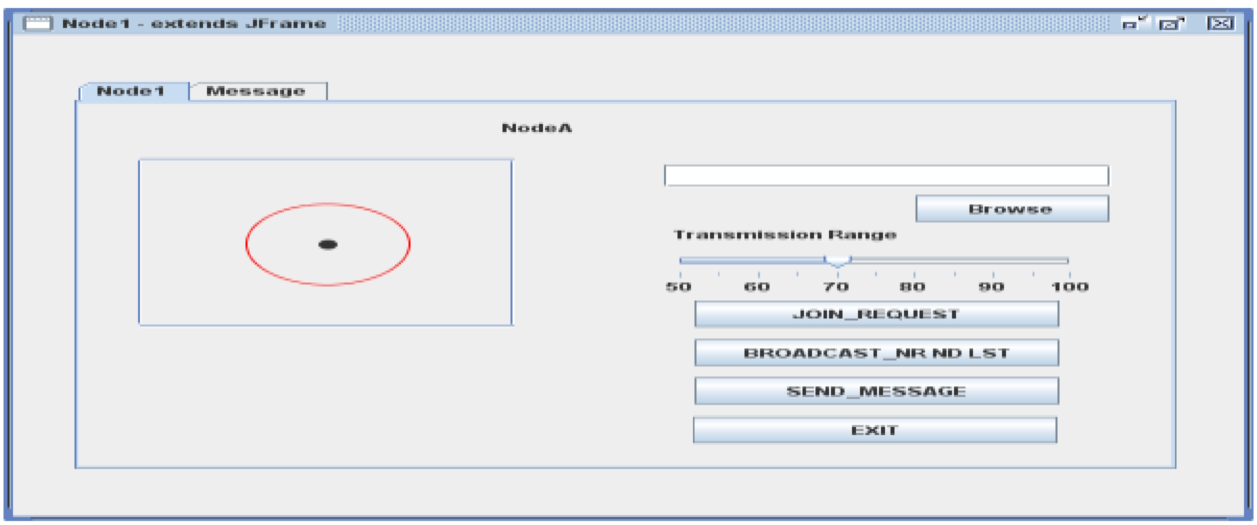


Node



IV. Conclusion

An efficient receiver-based algorithm and showed why it significantly reduces the number of forwarding nodes in the network. We also relaxed some system model assumptions that are typically used in the data transmission algorithms. Interestingly, the 2-hop-based version of our proposed receiver-based algorithm can guarantee constant approximation to the optimal solution (minimum CDS).

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In the first part of this paper, we proposed a forwarding nodes election algorithm that selects at most 11 nodes in OðnÞ, where n is the number of neighbors. This limited number of nodes is an improvement over Liu et al.'s algorithm, which selects n nodes in the worst case and has time complexity Oðn log nÞ. Moreover, we showed that our proposed forwarding-node selection algorithm results in fewer broadcasts in the network. In the second part of the paper, we proposed an efficient receiver-based algorithm and showed why it significantly reduces the number of forwarding nodes in the network. We also relaxed some system model assumptions that are typically used in the data transmission algorithms. Interestingly, the 2-hop-based version of our proposed receiver-based algorithm can guarantee constant approximation to the optimal solution (minimum CDS). As far as the authors know, this is the first data transmission algorithm that constructs a CDS "on the fly" and can guarantee both full delivery and a constant approximation ratio to the optimal solution. As part of our future work, we will investigate the necessary conditions to guarantee both full delivery and constant approximation ratio to the minimum CDS.

V. Future Enhancements

We will investigate the necessary conditions to guarantee both full delivery and constant approximation ratio to the minimum CDS.

Ad hoc Networks are gaining popularity as a result of advances in smaller, more versatile and powerful mobile computing devices. The distinguishing feature of these networks is the universal mobility of all hosts. This requires re-engineering of basic network services including reliable multicast communication. This paper studies efficient routing mechanisms for multicast and broadcast in ad hoc wireless networks taking into consideration that, number of packet forwarding is the more important factor which has to be optimized than the number of links in the ad hoc network. As constructing minimum cost multicast tree is hard, two new coding methods, self pruning and dominant pruning are described. Both methods utilize neighbour information to reduce redundant transmissions. Performance analysis shows that both methods perform significantly better than blind coding which is considered as alternative for reliable multicast.

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Ad Hoc network is a big collection of wireless mobile hosts forming a temporary network without the aid of any centralized administration, in which individual nodes cooperate by forwarding packets to each other to allow nodes to communicate beyond direct wireless transmission range. Routing is a process of exchanging information from one station to other stations of the network. Routing protocols of mobile ad-hoc network tend to need different approaches from existing Internet protocols because of dynamic topology, mobile host, distributed environment, less bandwidth, less battery power. Ad Hoc routing protocols can be divided into two categories: table-driven (proactive schemes) and on-demand routing (reactive scheme) based on when and how the routes are discovered. In Table-driven routing protocols each node maintains one or more tables containing routing information about nodes in the network whereas in on-demand routing the routes are created as and when required. Some of the table driven routing protocols are Destination Sequenced Distance Vector Routing protocols (DSDV), Clusterhead Gateway Switching Routing Protocol (CGSR), Hierarchical State Routing (HSR), and Wireless Routing Protocol (WRP) etc. The on-demand routing protocols are Ad Hoc On-Demand Distance Vector Routing (AODV), Dynamic Source Routing (DSR), and Temporally Ordered Routing Algorithm (TORA). There are many others routing protocols available. Zone Routing Protocol (ZRP) is the hybrid routing protocol.

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