EFFECTIVE BROADCASTING IN MOBILE AD HOC NETWORKS USING GRID BASED MECHANISM

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ABSTRACT

Broadcasting in a Mobile Ad Hoc Network means to send a message to every node in the network. The task of broadcasting can be naively achieved by flooding the entire network with the message to be broadcast. In flooding, upon receiving a broadcast packet, a node simply retransmits the packet to all directions in its neighborhood. This approach causes a number of serious problems. To ensure scalability and reliability to broadcast a message in entire network is a very difficult problem for any broadcasting protocol. In this proposed protocol, we suggest a reliable, efficient and scalable approach to broadcast a packet in the network. There is no need to flood the message in the whole network rather using smart grid forwarding a broadcast packet can be sent to all the nodes in the network. The rest of the work is done by the very first node receiving the packet destined for that particular grid. This node has now the responsibility to update its own grid with the broadcast packet. Simulation is carried out using NS 2 and results show that our proposed algorithm is reliable, scalable, and also outperforms some other promising broadcasting protocols.

Keywords: Mobile ad-hoc network (MANET); Neighbor Allocation Table (NAT)

1. INTRODUCTION

A mobile ad-hoc network (MANET) is a self starting dynamic network comprising of mobile nodes, where each and every participation node voluntarily transmit the packets destined to some remote node using wireless (radio signal) transmission. An ad hoc network doesn’t have any centralized arbitrator or server. In MANET each and every mobile node is assumed to be moving with more or less relative speed in arbitrary direction. Because of that there is no long term guaranteed path from any one node to other node. MANET have very enterprising use in emergency scenarios like military operations & disaster relief operation where there is need of communication network immediately following some major event, or some temporary requirement like conference & seminar at new place where there is no earlier network infrastructure exist and need alternative solution. For the successful
operation of ad hoc networks, there are many tasks with broadcasting of administrative information as their basic building blocks, such as routing, energy-saving, clustering, and others. The task of flooding gives us the easy way of broadcasting in the network. But it forwards the packets to all other nodes and as a result it wastes the energy as well as time. Hence to overcome this problem we propose a method in which repeated forwarding can be avoided and efficiency can be increased.

The rest of paper is organized as follows. Section 2 deals with related works and section 3 will give the system model and section 4 deals with the protocol. Section 5 is dedicated for results and discussion and finally conclusion and future work is mentioned.

2. RELATED WORKS

A numerous research efforts have been devised to find efficient and reliable broadcasting methods for Mobile Ad Hoc Networks [1, 2]. In contention-based schemes, the mobile nodes do not maintain route information, but they execute a contention process each time they select the next hop. The contention process uses suppressing strategies to avoid collisions and to ensure that only one node is elected as the next relay. Grid random forwarding uses a region-based priority suppression mechanism to randomly choose a relaying node [3], [4]. Flooding is the most well known straight forward method to broadcast a packet in the entire network which has an adverse effect of frequent message losses and network congestion. The problems pertaining to flooding is known as broadcast storm problem which is addressed in [5]. Ho et al. [6] and Jetcheva et al. [7] proposed broadcast in a network which is very dynamic in nature. Some research results use probabilistic calculations to forward a broadcast packet to its neighbors. If the probability to forward a packet is above a certain threshold probability $P$, then the node forwards the packet. Otherwise it does not forward the packet. Ni et al. [5] in their paper provide various probabilistic approaches to lessen broadcast storm problem in MANETs.

3. SYSTEM MODEL

In this paper we introduce a new and effective broadcasting mechanism which will be minimal cost and more efficient than the existing flooding methods. We have designed our system such that it can be applicable from a smaller network to a very large network in effective way.

3.1 Grid forwarding

Grid Forwarding is used as the basis of routing packets from one node to another in our proposed protocol. In grid forwarding a node knows its position with correct position and high precision. Every node then periodically informs about its existence to all of its neighbors by broadcasting HELLO distance. A neighbor node, upon reception of the HELLO message, allocates an entry for the source of the HELLO message into its Neighbor Allocation Table (NAT, hereafter) along with the source’s IP, position, and time of the last HELLO message received. Now consider a scenario where node $A$ wants to communicate with another node $C$ and has the location information of node $C$. Before sending a message to node $C$, node $A$ appends $C$’s IP address and $C$’s current grid position in the packet header. Then node $A$ looks up its Neighbor Allocation Table to find a node $B$ which is gradually closest to node $C$. If
the node $C$ and node $B$ is the same node, then node $A$ sends the packet to node $C$ directly. Otherwise node $A$ forwards the packet to an intermediate node $B$. This process is then repeated again in node $B$ and in all subsequent nodes until the packet is received by node $C$.

3.2 The Architecture

![Figure 1: Grid based approach](image)

To reduce packet duplicity and hence network congestion in broadcasting a packet in the whole network, we exploit the quad tree grid architecture. In this architecture the entire network topology is divided into several hierarchical grid structures. The grids are organized with squares of increasing sizes.

4. PROTOCOL

Grid forwarding is based upon the forwarding of packets, node by node, towards the location of the destination. Each node in the path forwards packets to the neighbor that is closer to the destination (or better according to some other criterion), using reasonably accurate knowledge of the location of its immediate (directly connected) neighbors and less accurate knowledge of the location of the destination. Note that for the purpose of this review we will use the term **grid forwarding** for strategies that use location information to forward packets node by node towards the destination (and therefore only provide a partial routing solution due to failure at a local minimum where no neighboring nodes exist which are closer to the destination). We will use the term **grid routing** for strategies that use grid forwarding, but also incorporate a backup routing strategy on grid forwarding failure at a local minima to provide 100% path completion (in static networks). The protocol is called reliable in a sense that it ensures to fulfill the basic requirement of broadcasting that every node in the wireless network must receive the broadcast packet within a shortest possible time.

5. RESULTS AND DISCUSSION

Initially we have chosen 100 nodes in a network and start broadcasting. Centre node is chosen as a reference node from which broadcast has to begin this is shown in figure 2. Then unlike flooding the node 0 will search for the neighboring node and will start the operation. The neighboring node once they receive the message they will check out for the destination ,if they feel that they are the destination they will forward the packets to their neighboring nodes leaving the one from which they have received the packets. This process will continue until further more broadcasting is not possible condition. Few nodes highlighted are the nodes for which packets cannot be reached since they are out of the coverage area.
Figure 2: Initially 100 nodes have chosen as a network

Figure 3: One node is highlighted from which broadcasting will start
Figure 4: Grid based broadcast begins by sending request for the neighbors

Figure 5: Grid broadcasting is achieved without flooding
Figure 6: Some nodes are identified that they are far from source node

Figure 7: Green nodes indicate that they are far away from the source node
Figure 8: In the final stage a packet is sent in the network and performance is analyzed

Figure 9: Performance analysis of grid based approach
6. CONCLUSION AND FUTURE WORK

To effectively route packets around local minima some knowledge of the network topology is required. The overhead of obtaining and maintaining this information must be the minimum. Grid forwarding offers a low overhead distributed routing strategy that does not require nodes to maintain any link state information other than the location of directly connected neighbors. Performance and throughput is analyzed and found that they are better than the flooding mechanism. In future we are trying to improve the throughput and concentrate for better performance.

7. REFERENCES