Improving Multi Cast Routing in Ad Hoc Networks using Group based Relaying

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ABSTRACT

Mobile Ad Hoc Network (MANET) is a collection of wireless mobile nodes dynamically forming a temporary network without the use of any existing network infrastructure or centralized administration. Ad Hoc Networks have the attributes such as wireless connection, continuously changing topology, distributed operation and easy of deployment. Each node operates not only as an end system, but also as a router to forward packets. Routing in Ad Hoc Networks has been a challenging task ever since the wireless networks came into existence. The major reason for this is continue changes in network topology because of high degree of node mobility. A number of protocols have been developed to accomplish this task. Ad hoc networks are extensively used in military and civilian applications. In the paper, we address the routing problem in multi cast routing protocols for ad hoc networks. We have introduced the concept of group based relaying that works efficiently in multicast routing protocols.

Keywords

Ad hoc networks, AODV, multicast, group based relaying, packet loss, and packet received.

1. INTRODUCTION

A wireless ad hoc network is based on the nodes that are mobile and have capabilities of communicating each other with packet radios over a shared wireless medium. The limited radio propagation causes the route to be multi hop [1] [2] [7] [8]. The applications of such networks can be search and rescue, automated battlefields, disaster recovery, crowd control and sensor networks. The routing protocol must have the ability to manage the frequent topology changes caused by the mobility of nodes and these need to be efficient as compared on basis of efficiency in terms of bandwidth and power as well as on basis of load transmission [11]. With the advent of On-demand routing, the tables are not maintained and the topological views are also rescued and the routing totally becomes dynamic [11]. Existing on demand routing protocols such as DSR (Dynamic Source Routing), AODV (Ad-hoc on demand distance vector routing) are the shortest path based routing protocols, also these don't consider the packet size and the antenna range of the nodes as a performance metric due to which there is a problem of long delays and congestions in the routing path and the whole set up of the nodal structure enters in to the dead state [10]. Also, on demand protocols that use the shortest paths as performance metric suffer from performance degradation as the network traffic increases [10]. In the paper [6], the energy of the nodes is the major area of concerned for the research to be carried on in this field. In this paper, a routing algorithm

has been suggested that selects the path form the source to the destination on basis of the path that consumes the least energy [10]. Also the receiver consumption can be improved by using the cross layer design including the effects of the power amplifier used at the transmitter end [8]. The transport efficiency of an ad hoc network was defined considering the transmitter energy and the receiver's processing energy [9] [10]. Thus the energy consumption for the packet transmission and the large number of hops is considered [6]. For the networks that have energy as their limiting resource, the network lifetime related to the energy is one of the significant performance metrics [6].

Further, the problem regarding routing in multicast may arise due to improper relaying of data between the transmitter and the receiver. This problem has been discussed and the solution to optimize the problem has been proposed in the paper.

2. PROBLEM DEFINITION

Multi cast is termed to sending data to more than one node at same instant of time. This is quite hectic and security based task as non reliable and the unsubscribed node may route data at same instant thus, leaving to non suitable environment for complete routing of packets between the actual source and the receiver. This, problem thus, causes slowing down of the network structure and decreases the link reliability to much extent leaving an adverse performing network. The previous work shows formation of member nodes and member router for transmission of packets as shown in fig 1.
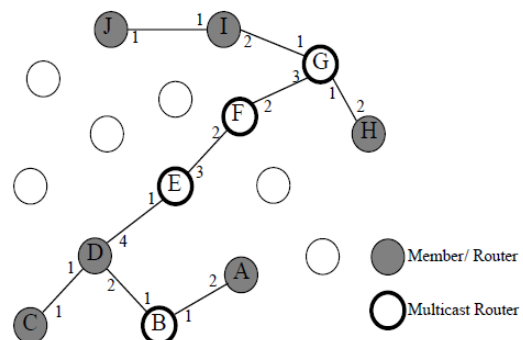

Fig. 1 Normal Transmission

The above figure shows the normal state transmission in Ad Hoc Networks in multi cast routing protocols. The figure shows the formation of member nodes that are the actual transmitter and intermediate relaying nodes. But the actual relaying is carried out by the member routers that are implanted at different sites depending upon the number of

nodes relaying at that particular instant of time. This is the traditional method of relaying in multi cast routing protocols. Thus, this leads to poor performance as routers are also consuming energy and memory for transmission purposes that also increases the routing time and network traffic takes much time than expected to move on to correct path towards the destination. This problem has been addressed by us throughout the paper and we have implemented a group based routing algorithm that resolves the issue regarding multi cast routing protocol.

3. MULTI CAST ROUTING ON GROUP BASED RELAYING

Multi cast routing has been implemented by us as a group formation technique in which, the source nodes generates a special number termed as a routing number that is used for purpose of group identification and judgement. In this approach, each node, that has to act as relaying node or that has to receive the data, will capture this group number and will join group till transmission and will leave group on successful transmission. This leads to tremendous amount saving in the time of routing and also the amount of packets correctly arrives at the destination. The algorithm for working of multi cast routing on group based relaying can be shown as follows:

1. Perform multiple ring searches and maintain table.

2. Select source and destination node and maintain table for intermediate relaying nodes.

3. Selection of group number by source or the transmitting node.

4. Capture group number and join group.

5. Transmit and receive data.

6. Leave group.

7. Perform the above steps depending upon the number of packets and data to be transmitted.

The performance of this can be shown with the help of following snap shots from the animator.
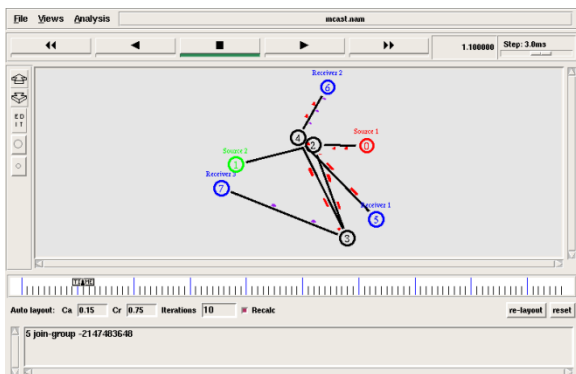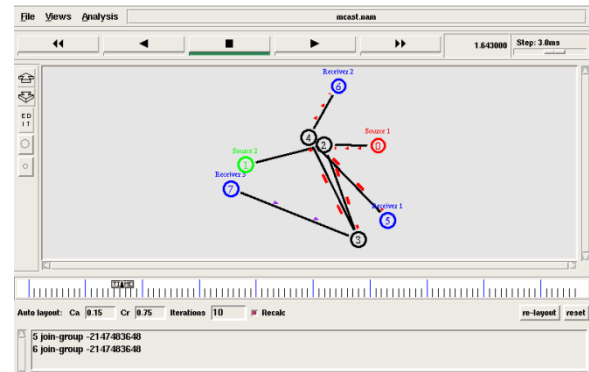

Fig. 2

Fig. 3

Fig. 4

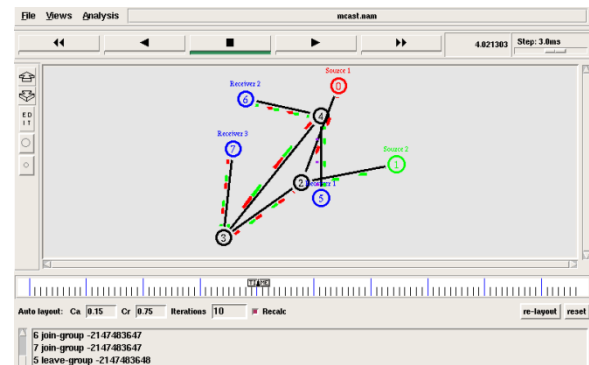### A. Performance Metrics

We simulated the typical Ad Hoc Networks for hop and calculated the results for bandwidth, energy, throughput of the network structure taking mobility and the antenna range as the basis of the technique. We have taken values as constant to compute our results. The simulation has been performed for the area ranging over 1000x1000. We concentrated on the following performance metrics:

- **Packet Lost:** The packet lost and received ratio is checked in the process of black hole detection and correction. This includes actual number of packet reaching the destination node.
- **Transmission Rate:** transmission is the number of bits transferred during the transmission process. It is calculated as bits transferred per unit time. For our analysis the time considered is the simulation time.
- **Mobility:** Mobility is the new parameter that is highlighted in this paper. The readings have been taken by considering the scenario to be mobile and animations has also been recorded for the mobile nodes.
- **Link Reliability:** It is the signal strength in terms of effective rate achieved by the network during transmission of packets.

4. SIMULATION RESULTS AND ANALYSIS

The simulations of the above technique are carried out using NS-2 simulation and the graphical result of the analysis is shown below:
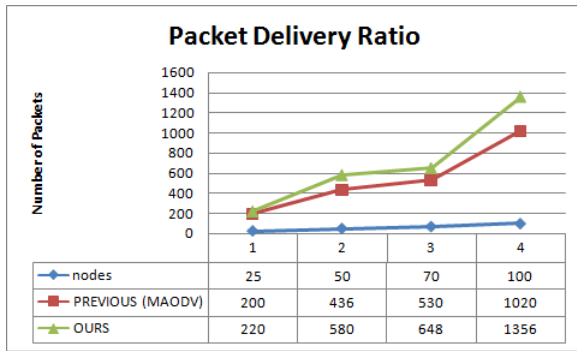
Fig. 6 Packet Delivery Ratio

The above graph shows the relation between the numbers of packet lost and received along with the number of nodes taken for different scenario of transmission.
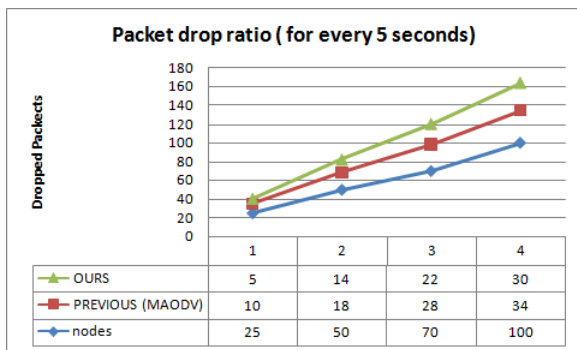

Fig. 7 Packet Drop Ratio

The above graph shows the comparison of number of packets dropped for every 5 seconds of transmission.
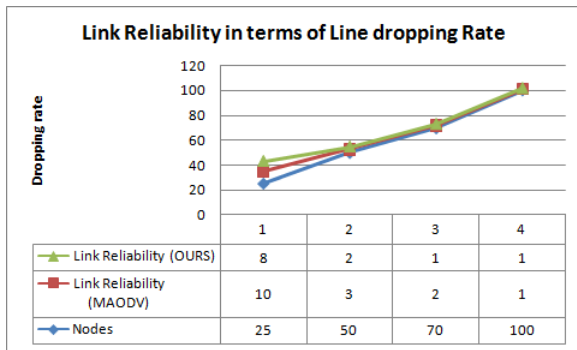

Fig. 8 Link Reliability

The above graph shows the comparison of link reliability in terms of number of times the line breaks during transmission process.
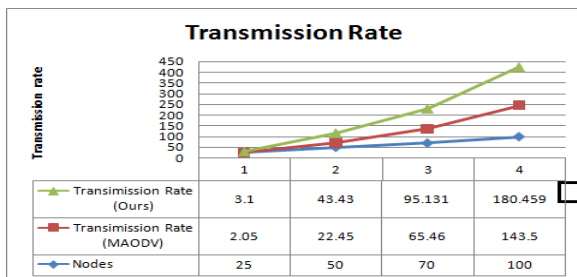

Fig. 9 Transmission Rate

The above graph shows the comparison of transmission rate for previous and our protocol for multi cast routing.

5. CONCLUSION

In the paper, we proposed the multi cast routing protocol that works on principle of group based relaying approach for purpose of transmission between the source and the destination. The paper shows that our work showed tremendous improvement in process of transmission during multiple routing sources and multiple accepting nodes. Thus, for future, more metrics like cost and routing overheads can be considered and the technique can be used for practical scenario as it has been tested on network simulator only.

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