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An Optimized Broadcasting Algorithm for AODV based Mobile Adhoc Network

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Abstract— Mobile Adhoc Network consists of a large number of mobile nodes that communicate with each other in the absence of any fixed infrastructure. In such an environment each node must work as router to forward the data packets in the network. Due to a number of challenges in adhoc network, many researchers have studied and develop various techniques for providing secure routing in Mobile Adhoc Network. An existing system contains an estimated distance based routing protocols to determine route discovery, which can reduce the number of RREQ and. In this paper, Optimized Broadcasting Algorithm (OBA) was proposed for AODV based Mobile Adhoc Network. Optimized Broadcasting Algorithm calculates the relative mobility factor for all nodes in the network, and fix a probability value and calculate a distance of each node in the network, which reduces the number of RREQ packet sent for discovering shortest route in AODV protocol. It can be seen that proposed algorithm is more secure and reliable than existing distance based algorithm. Finally compare the performance of both algorithm and implemented using GLOMOSIM Simulator. Simulation results show that proposed protocol can reduce the routing overhead and improve the routing performance.

Index Terms— Mobile Adhoc Network, Broadcasting methods, Optimized Broadcasting Algorithm, AODV protocol, Glomosim simulator,Average end-end Delay, Reachability.

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1 Introduction

AN Mobile Ad hoc network is the collection of mobile nodes without any access point.A Mobile Ad hoc Network can change locations and configure itself. MANET'S are mobile they use wireless connections to connect various network. Nodes cooperate to form a communication infrastructure that extends the transmission range of every terminal without using any network devices. Broadcasting is the process in which a source node sends a message to all other nodes in MANET. Broadcasting is important in MANET for routing information discovery, for instance, protocols such as dynamic source routing (DSR), ad hoc on demand distance vector (AODV) use broadcasting to establish routes. Broadcasting MANET poses more challenges than in wired networks due to node mobility and scarce system resources. Because of the mobility there is no single optimal scheme for all scenarios.

2 Related Works

Parma nand shows that AODV performs better than other protocols in terms of packet delivery ratio and reduces new route discovery process [2]. Abderezak Touzene [3] describes about the algorithm based on logical 2 dimensional grid view of the geographical region. This algorithm is based on unicast or multicast. Suganthi [4] detect the compromised nodes in Adhoc Networks where secret message is shared by using threshold cryptography. Finally threshold cryptography and Chinese Remainder Theorem (CRT) provide the best of both in a MANET environment. Pariza Kamboj [5] proposed a multicast algorithm with dynamic mesh and updated source based data delivery tree within the mesh. Ahmad suggested a novel protocol called as Enhance Route Discovery for AODV protocol. It will improve the security of the AODV during the route discovery process so that the adverse effect caused by the attack to the network performance is reduced [6].

3 Existing Distance Based Routing Protocol

Existing system discover the route using Estimated Distance based Routing Protocol. It can reduce the number of RREQ in the network. These protocols can be divided into topology and position based protocols. Estimated Distance is the combination of EGD and ETD. Estimated Geometrical Distance (EGD)is defined as the change regularity of received signal strength (RSS) which is developed to estimate the geometrical distance between pair of nodes. ETD is called the Estimated Topology Distance, which can moderate the effect of inaccurate of EGD. The topology based routing protocols use link information to establish a path. When a node needs to discover a route, it broadcast a RREQ packet to all neighbors in the network. Due to lack of position information in the network, each node blindly rebroadcasts the received RREQ until the route is established. The source node or a neighbor node possesses distance or direction information about a destination node, then it can be used to determine the route discovery towards the general direction of the destination. The directed route discovery may restrict the broadcast of RREQ packets within a narrow region that is far away from the destination. Thus the number of RREQ packet can be reduced by this

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method. Position based routing protocols knows the physical position of the nodes, that have the ability to restrict the broadcast of RREQ packet within a narrow region. The major limitations of existing system are blindly rebroadcast, link failure due to node mobility.

4 PROPOSED OPTIMIZED BROADCASTING ALGORITHM

The topological structure of Adhoc network has dynamic characteristic in nature. Due to node mobility, collision it cause link failure then the process of data transfer became less tends to data loss. To resolve this problem, proposes a new broadcasting technique called Optimized Broadcasting Algorithm (OBA) with AODV based MANET. This algorithm will calculate the relative mobility factor and average distance for all nodes in the network. The probability value is fixed according to the relative mobility factor for each node. If the node gets high positive relative mobility factor then it fixed as probability 1 or if the node gets negative relative mobility factor then it fixed as probability 0. This means the data package could be broadcast through the shortest path with more stability and reliability manner. The proposed algorithm consists of following steps:

Step 1: On receiving HELLO message from N node.
Step 2: Each node calculates its relative mobility factor with probability value and distance of neighboring node then broadcast the RREQ to other nodes.

$RM_1, RM_2, RM_3, \ldots\ldots\ldots RM_n$

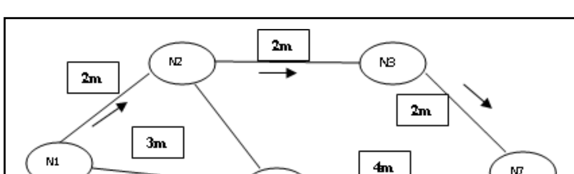
$D1, D2, D3, \ldots\ldots\ldots Dn$

Step 3: The probability value is fixed according to the relative mobility factor.
Step 4: If the relative mobility factor is positive then the probability value is fixed as 1, if the relative mobility factor value is negative then the probability value is fixed as 0.
Step 5: This process is followed until the destination is reached.
Step 6: The destination will rebroadcast RREP packet along the reverse path of RREQ.
Step 7: The source node will choose the link which contains maximum number of probability '1', maximum hop counts, and shortest distance.

Step 8: In case of link failure occurs, the source node will choose another link which contains shortest distance with probability 1 and minimum hop count.

4.1 Network Topology

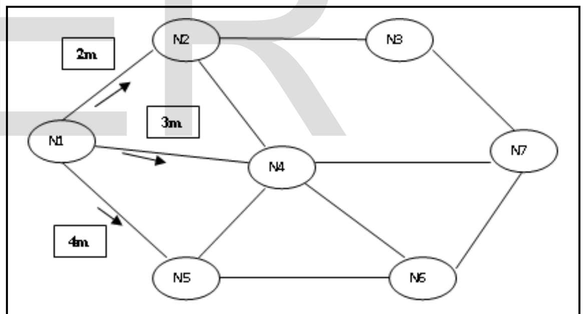
Network topology consists of seven mobile nodes which are arranged as shown in fig.4.1. Here N1 can act as a source and N7 can act as a destination. It also shows the distance of each and every node. It consists of thress links which connect the source node and destination node.



4.2 Broadcast RREQ Packet from Node N1 to all Neighboring Nodes

Source node N1 wants to send a packet to the destination node N7 using AODV protocol. Node N1 sends a RREQ packet along with Probability Value, Distance as shown in the Fig: 4.2. The probability value is fixed according to the relative mobility factor. The relative mobility factor is calculated shown below.

Relative Mobility factor = 10 log 10 (New power / Old power)

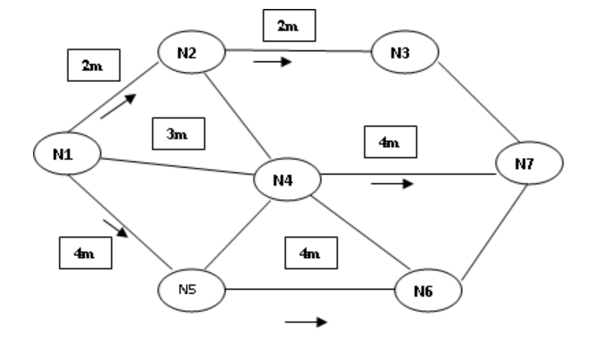


RM(N1) = 10 log 10 (P_{N2old} / P_{N2new})
RM(N1) = 10 log 10 (P_{N4old} / P_{N4new})
RM(N1) = 10 log 10 (P_{N5old} / P_{N5new})
N1 → N2 : {RREQ, IP_{N7}, D_2, P_{value}}
N1 → N4 : {RREQ, IP_{N7}, D_3, P_{value}}
N1 → N5 : {RREQ, IP_{N7}, D_4, P_{value}}
D - Distance P_{value}- Probability value

Fig : 4.2 Broadcast from source node to neighbor node

4.3 Broadcast RREQ for all intermediate nodes

When an intermediate nodes receives the RREQ message with probability value it again checks the distance and calculates the relative mobility of neighboring nodes. The relative mobility is used to find the stability of each node. To find the relative mobility factor, broadcast the RREQ messae to all intermediate nodes as shown in fig: 4.3. The RREQ packet carries with Probability value, sum of distance and IP address of destination node.

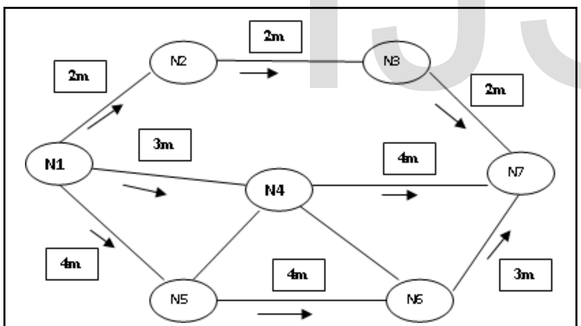


$RM(N2) = 10 \log 10 \, (P_{N3old}/\, P_{N3new})$
$RM(N4) = 10 \log 10 \, (P_{N7old}/\, P_{N7new})$
$RM(N5) = 10 \log 10 \, (P_{N6old}/\, P_{N6new})$
$N2 \rightarrow N3 : \{RREQ, IP_{N7}, D(2+2), P_{value}\}$
$N4 \rightarrow N7 : \{RREQ, IP_{N7}, D(3+4), P_{value}\}$
$N5 \rightarrow N6 : \{RREQ, IP_{N7}, D(4+4), P_{value}\}$

Fig: 4.3 Broadcast RREO to all intermediate nodes

4.4 Broadcast RREQ to all intermediate nodes with average distance and probability value

When an intermediate nodes receives the RREQ message with probability value it again checks the distance and calculates the relative mobility of neighboring nodes. The relative mobility is used to find the stability of each node. This process is followed until the destination is reached. The Broadcast as shown in fig: 4.4. The RREQ packet carries with Probability value, sum of distance and IP address of destination node.

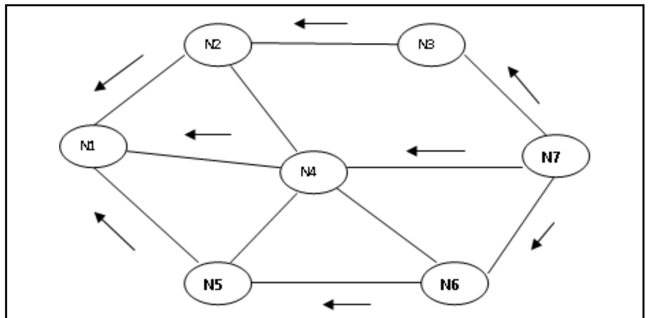


$RM(N3) = 10 \log 10 \, (P_{N7old}/\, P_{N7new})$
$RM(N6) = 10 \log 10 \, (P_{N7old}/\, P_{N7new})$
$N3 \rightarrow N7 : \{RREQ, IP_{N7}, D(2+2+2), P_{value}\}$
$N6 \rightarrow N7 : \{RREQ, IP_{N7}, D(4+4+3), P_{value}\}$

Fig : 4.4 Broadcast to Intermediate nodes

4.5 Rebroadcast RREP along the Reverse Path of RREQ

After receiving the RREQ packet, then the RREP is rebroadcast along with the reverse path of RREQ packet. The destination will calculate the distance value as shown below the fig: 4.5. By using our proposed algorithm, reduce the link failure, node mobility of the network. Rebroadcast the RREP as shown in the Fig: 4.5. The destination node will rebroadcast RREP packet to source node. The source node will contain all the information of links. Source node having Back-up table. In case of link failure occurs it won't go for new Route Discovery process, it chooses another link from the Back-up table. The source node will choose the link which having shortest distances, maximum number of probability 1s and minimum hops.



Distance Calculation D = (sum of node distance of each link / No. of hops of each link)

Link 1 - $N7 \rightarrow N3 \rightarrow N2 \rightarrow N1 : \{RREP, IP_{N1}, D_{2m}, P_{Value}\}$
Link 2 - $N7 \rightarrow N4 \rightarrow N1 : \{RREP, IP_{N1}, D_{4m}, P_{Value}\}$
Link 3 - $N7 \rightarrow N6 \rightarrow N5 \rightarrow N1 : \{RREP, IP_{N1}, D_{3.6m}, P_{Value}\}$

Fig: 4.5 Rebroadcast RREP

4.6 Link Failure

In case of link failure occurs it does not generate a new route discovery process, it chooses another link from Back-up table as shown in Fig.4.6, which having maximum hop count, maximum number probability 1s and shortest distance.

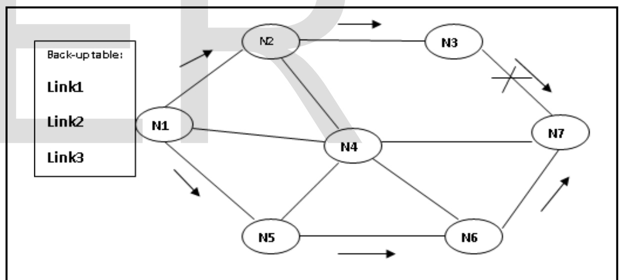


Fig: 4.6 Link Failure

5 PERFORMANCE EVALUATION

We compare the performance of our proposed algorithm with that of existing algorithm using Glomosim simulator. The following simulation parameters are used to estimate the reliability of Optimized Broadcasting Algorithm (OBA).

5.1 Broadcast Packets Sent

With the varying speed of the mobile nodes from 10 to 50 mps the performance of the Optimized Broadcasting Algorithm technique on AODV is analyzed. In simulation analysis it is observed that Optimized Broadcasting technique relays less broadcasts packets which are averaged over 50 simulations for the route discovery in comparison to the AODV. The proposed technique uses optimized broadcast to control rebroadcasting of the broadcast packets and hence some of the RREQ packets are dropped as shown in fig 5.1.

TABLE: 5.1 SIMULATION PARAMETER

PARAMETER	VALUES
Network Area	1000 x 1000m
No. of Node	20
Simulation time	100s
Mobility Speed	5m/s, 15m/s, 20m/s
CBR packet size	512 bytes
Routing Protocols	AODV – OBA

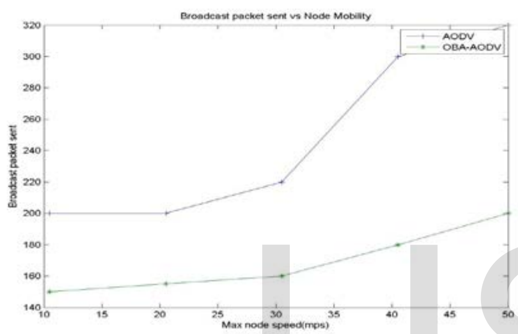


Fig: 5.1: Broadcast Packets Vs Node Mobility

5.2 Broadcast Packets Overhead Saved

With the proposed Broadcasting technique, number of overhead RREQ packets is saved without compromising the route discovery process from source to destination. The saved overhead broadcast packets are ranging from 18% to 25% as shown in fig.5.2. The savings are more when the speed of mobile nodes is relatively less. The overhead savings are decreasing as the speed of mobile nodes is increased because at higher speed either the routes are broken or not found. This requires initiation of fresh route discovery process.

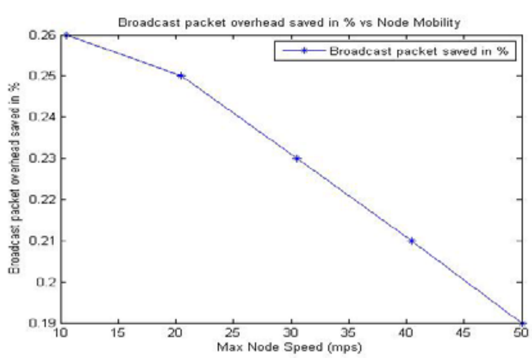


Fig: 5.2: Broadcast Packets overhead saved in % vs Node Mobility

In comparison to rebroadcast of RREQ packets in AODV, the RREQ packets of optimized based Broadcasting technique are controlled while rebroadcasting using dynamic optimized algorithm and the traffic load of the network is reduced. It reduces queuing and propagation delays and hence average end-to-end delay. This improves routing performance of the proposed protocol as show in Fig. 5.3.

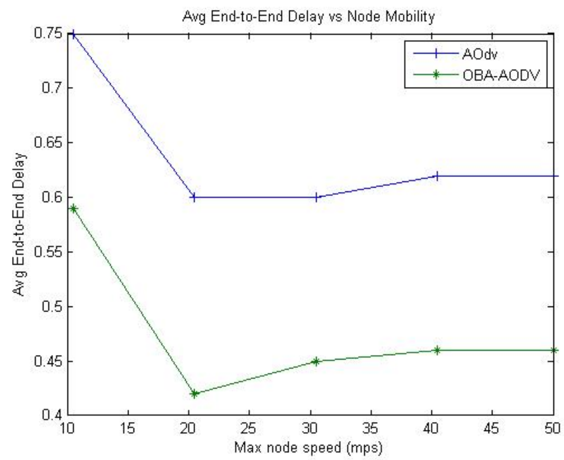


Fig: 5.3: Average End-to-End Delay vs Node Mobility

5.4 Improved End-to-End Delays

As the number of broadcast packets is dropped while rebroadcasting the average end-to-end delays are decreasing in case of Probability based Broadcasting technique (Fig.5.3). The improvements in average end-to-end delays because of Optimized based Broadcasting technique are shown in fig.5.4. It is observed that average end-to-end delay in case of Optimized Broadcasting Algorithm technique is reduced by 12 to 23 % in comparison to AODV.

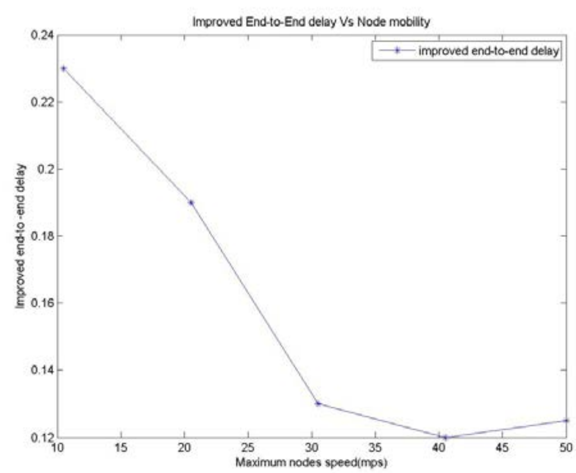


Fig: 5.4: Improved End-to-End Delay vs Node Mobility

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5.5 Reachability

In order to save redundant rebroadcasting of packets as per the policy of optimized broadcast algorithm number of re-broadcast packets is dropped. This saves the network from congestion and collision as less control packets are contesting for the channel but this will lead to the reachability problem as shown in fig. 5.5. It is observed that this problem is more in case of less node density scenario than in case of medium or dense node density scenario. It is because of the reason that in denser cases the average neighbors per unit area is more than sparse area.

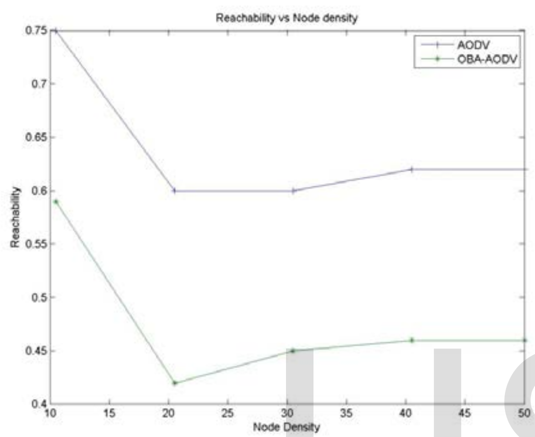

Fig: 5.5: Reachability vs node density

6 Conclusion

Finally, Optimized Broadcasting Algorithm reduces the number of RREQ packet in AODV, which consumes less energy, processing time, end-to-end delay. This technique is analyzed on AODV routing protocol for the mobile adhoc network. The proposed algorithm controls rebroadcast packets and drops number of it based on broadcasting that result in much less overhead than AODV. It is observed through simulated results that the proposed algorithm ensure broadcasting coverage with less number of redundant RREQ packets than that of normal AODV protocols. This reduction in overhead of re-broadcast packets improves average end-to-end delay in network. Therefore, proposed algorithm enhances broadcasting performance significantly, and finds less overhead to improve average end-to-end delay in network, and hence it can be more adaptive to the MANET environment.

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