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Improving the Performance of AODV by Minimizing Flooding Through High Power Routing Node

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ABSTRACT: Broadcasting has been used widely in wired and wireless networks to understand the data and topology information. There are various routing protocols in MANETs rely on a flooding mechanism to broadcast data and control packets over the entire network for establishing routes between source destination pair. The simplest way of broadcasting a packet to all nodes in the network is basic flooding or blind flooding which allows each node to retransmit a packet to its neighbours, in case it has not received broadcast packet during earlier transmission. This work proposes a modified version of AODV termed as AODV_HPR where certain nodes are assumed to be high energy transmission nodes known as High Power Routing (HPR) nodes, utilized for routing. The route is established only through HPR nodes which are capable of communicating to long distance.

KEYWORDS: Flooding, AODV, AODV_HPR etc.

I. INTRODUCTION

Mobile Ad Hoc Networks (MANETs) consists of a collection of mobile nodes which are not bounded in any infrastructure. Nodes in MANET can communicate with each other and can move anywhere without restriction. This non-restricted mobility and easy deployment characteristics of MANETs make them very popular and highly suitable for emergencies, natural disaster and military operations.

There are many types of routing protocols in MANETs rely on a flooding mechanism to broadcast data and control packets over the entire network for establishing routes between source destination pair. The easiest way of broadcasting a packet to all nodes in the network is basic flooding or blind flooding which allows each node to retransmit a packet to its neighbours, in case it has not received broadcast packet during earlier transmission. The rebroadcasting process continues until all nodes in the network have received a copy of the packet. Since, topology packets pass through every possible path in parallel, it is assured that the flooding can always find the shortest path between various source and destination combinations. However, the basic nature and characteristics flooding mechanism causes a large number of packets propagation in MANETs. This will eventually overload the network and traffic is congested, which is depicted in Figure 1. In Figure 1, the centre node is the source node; nodes in the first inner circle are one-hop neighbours and the nodes in the outer circle are two-hop neighbours. While S, transmit out the packet, all the one-hop neighbours broadcast copies of the packet to all its two-hop neighbours of S at the same time. As a result, there is a heavy redundant rebroadcasting, which means same packet is being received more than once by some nodes, contention and collision that are referred to as the broadcast storm problem

Aim of the project is to design a method which will reduce the flooding as well as routing overhead in both route discovery and route maintenance, by reducing the flooding in route discovery process and to avoid broadcast storm problem. The heterogeneity of nodes makes traditional flat routing not useful and this disadvantage can be overcome by

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clustering the nodes. Here, we consider a single node having the highest power that we call as high power routing node, which takes care of most routing functions.

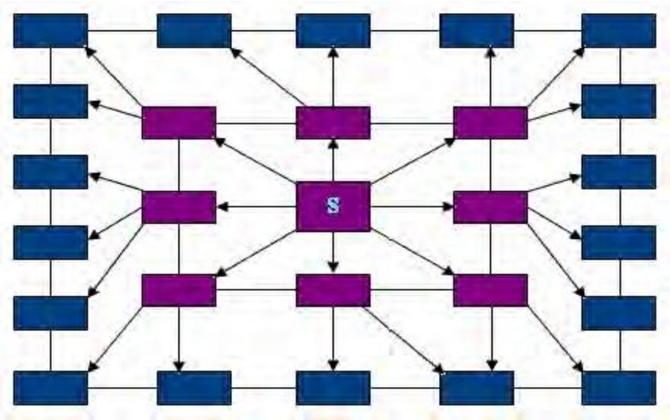

Figure 1- Sample Flooding Scenario

II. RELATED WORK

The AODV protocol is a reactive routing protocol based on the distance vector principle. It supports unicast and multicast routing, it does not require nodes to maintain routes to destinations that are not in active communication and it allows mobile nodes to respond to link breakages and changes in network topology in a timely manner. One distinguishing feature of AODV is its use of a destination sequence number for each route entry to ensure loop freedom. The ad hoc on demand distance vector (AODV) routing protocol is one of the more popular mobile ad hoc network routing protocols, . In AODV, when a connection request occurs, the source node broadcasts a route request (RREQ) message, which carries a source identifier, a destination identifier and a destination sequence number (DestSeqNum), to its neighbors. Then the neighbors flood the RREQ to other nodes for route discovery. Any intermediate node that receives the RREQ can either forward the request or send a route reply (RREP) to the source node if its routing table has a valid route entry to the destination. One of the primary advantages of AODV is that the route is built *demand*, which significantly decreases the network load, while disadvantages for AODV include higher latency for finding routes and overhead associated with sharing stale route entries [3]

Jianwei Niu el at [1] designed Reliable Reactive Routing Enhancement(R3E) to enhance existing reactive routing protocols and to provide reliable and energy-efficient packet delivery. Here they introduced a biased back off scheme during the route-discovery phase to find a robust guide path. Here If a node has data packets to send to a destination, it initiates a route discovery by flooding an RREQ message. When a node receives a non-duplicate RREQ, it stores the upstream node id and RREQ's sequence number for reverse route learning. Instead of rebroadcasting the RREQ immediately in existing reactive routing protocols, here it introduced a biased back off scheme at the current RREQ forwarding node. The aim of this operation is to intentionally amplify the differences of RREQ's traversing delays along different paths. This operation enables the RREQ to travel faster along the preferred path. Though the aim of this work is to improve the packet delivery ratio, the problem is here the route discovery starts from flooding the RREQ packets to its immediate neighbors.

Xin Ming Zhang el at [2] proposed a method to reduce routing overhead in MANET. In a route discovery, broadcasting is a fundamental and effective data dissemination mechanism, where a mobile node blindly rebroadcasts the first received route request packets unless it has a route to the destination, and thus it causes the broadcast storm problem. Here they have proposed a neighbor coverage-based probabilistic rebroadcast protocol for reducing routing overhead in MANETs. Here rebroadcast delay, additional coverage ratio, connectivity factor are also calculated. On the basis of these parameters, the neighbors are selected for broadcasting. Here, they tried to reduce broadcast storm problem but still broadcasting is present there.

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In this network, nodes are mobile and can communicate dynamically in an arbitrary manner. The network is characterized by the absence of central administration devices like base stations and access points One of the fundamental challenges in Mobile Ad Hoc network is to discover the route with good performance and less overhead. The overhead of a route discovery cannot be neglected. Limiting the number of rebroadcasts can optimize the broadcasting. Enabling efficient rebroadcast for reducing routing overhead in Mobile Ad Hoc Network is used to reduce the number of retransmissions and routing overhead. The probabilistic rebroadcast algorithm is used to calculate the covered neighbor set and uncovered neighbor set for broadcasting. Broadcasting based on probabilistic rebroadcast algorithm can effectively discover the route by using the additional coverage ratio and connectivity factor[4].

Each and every node in MANET acts as a forward and receiver node. Performance of most of the protocols is not encouraging in a highly dynamic interconnection topology. Here, a reliable broadcast approach for MANET is proposed, which improves the transmission rate. The MANET is considered with asymmetric characteristics, where the source and forwarding nodes have different properties. In addition, there exists a non-forwarding node, which is a downstream node and never forwards a packet. The status of each node changes dynamically and thus the topology of the network is also dynamic. In this work, the number of redundant transmission is minimized by creating less number of forwarding nodes. The forwarded packet is considered as acknowledgements and the non-forwarding nodes explicitly send the acknowledgements to the source[7]. Though the proposed approach reduces the flooding, it starts from broadcasting

III. PROPOSED SYSTEM

In proposed routing scheme, as shown in Figure 4.1, the HPR nodes only will be allowed to forward the RREP and RREQ messages. In other words, between S and D, a route can be established only through HPR nodes. Since the normal nodes will not rebroadcast the RREQ or forward RREP messages, it will reduce a lot of overhead as well as transmission power. Since the HPR nodes are capable of passing messages to longer distances, it will reduce the overall path length. The reduction in path length will reduce the end to end delay. Further, the normal nodes will only need to transmit up to the next nearest HPR node where the transmission (tx) power is reduced according to that distance, which reflects in the overall power consumption and reflects in reducing the routing overhead.

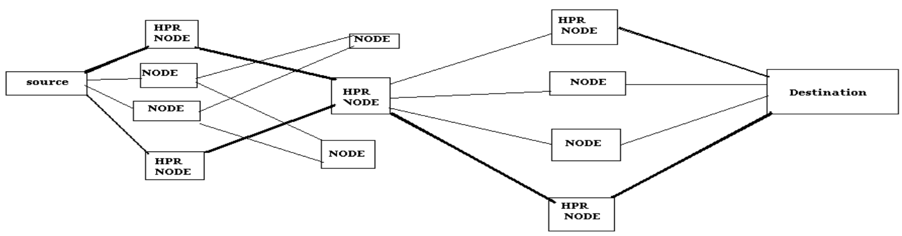

Figure 2. The proposed AODV-HPR method

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HPR Node:

HPR nodes can be assumed as higher capability nodes which are having sufficient battery power and they may be deployed as HPR nodes during the entire life of the network. Here, a HPR node can transmit or allowed to transmit to higher distance than normal nodes. HPR nodes can also be a source or destination node but anyway, a route can be established only through HPR nodes. Since there is no routing overhead for the normal nodes in the network, the end-to-end delay will be reduced very much. A route cannot be established through any arbitrary node in the network.. In a typical MANET, mobility causes link failures and results in increased overhead and reduced performance. In the proposed AODV_HPR, the HPR nodes uses little bit of higher energy, so that it is

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resistant to mobility to some extent. Since the HPR nodes are capable of communicating to high distance, little bit of mobility in individual nodes will not cause frequent link failures. Since the route is established only through HPR nodes, the other nearby normal nodes which will receive the routing packets will not process those requests and reduce the message overhead in a typical on-demand routing protocol.

Once HPR node is selected for each cluster, different scenarios are considered.

Case 1: **When Destination is immediate neighbour of source:**

This is the very first scenario in which it is considered that the destination is the immediate neighbour of source. Here the source first traverses the neighbours and checks whether the destination is present in its neighbour list or not. If it is so, then rather than broadcasting the packet to all of its neighbouring nodes it directly transfers the packet to its destination.

Case 2: **When source and destination is in same cluster:**

This is the scenario in which the destination is not an immediate neighbour of source but is present in the same cluster in which the source is present. This is the first case where the role of high power routing node is getting illustrated. Here if source node has data packet to send, it first check out for the destination in its immediate neighbour list.In this case destination is not present in neighbour list but is present in same cluster .Now rather than broadcasting the packet to its neighbours, the source directly sends the packet to the High Power Routing node i.e. HPR node of that cluster. The HPR node then checks ,wheather destination is present in that cluster or not. And if destination is found in that cluster then HPR sends that packet to that destination without involving any other node in this communication. So here the route is from source to HPR node and HPR node to destination.

Case 3: **When source is present in one cluster and destination in different cluster:**

This is the third scenario in which the source node is present in one cluster and the destination node is present in some other cluster. So here transmission of packet from source to destination is carried out in three different stages. In very first stage source forwards the packet to the HPR of the same cluster without any broadcasting. Here source first checks whether destination is among its immediate neghbour list .If not, then it forwards the packet only to HPR of the same cluster. In second stage, HPR checks whether the destination is present in the same cluster or not.If the destination node is not found within same cluster, then it forwards the packet to HPR of all of its neigbouring clusters that are within its transmission range. Here also the packets are directly sent to HPR nodes without involving any other nodes in communication. Now in third stage, HPR nodes of the those clusters where packet is reached , checks their own clusters to see if the destination is present in their clusters. If the destination is found , then HPR of the cluster in which the destination is present forwards the packet to that destination. Here also other nodes are not involved in communication.

Criteria for Clustering:

Here clustering is done by considering following steps**:**

Step 1:

Broadcast a signal to all its neighbor nodes within the transmission range by considering the Transmission Speed = 20 kb.

Step 2:

Process the signals received from the neighbor nodes in the network and form the connection matrix, A.

Step 3:

One by one add the nodes to the clusters and mark one of the node of each cluster as high power routing node by setting different properties of that node.

IV. Simulation Results

The results for the Implementation of High Power Routing Node for Minimizing Flooding In MANET is simulated on NS2 i:e Network simulator -2 i.e. the result of an on-going effort of research and development that is administrated by research at Berkeley.

The comparison of AODV and AODV-HPR is taken by considering various parameters like throughput, end to end delay and packet delivery ratio.

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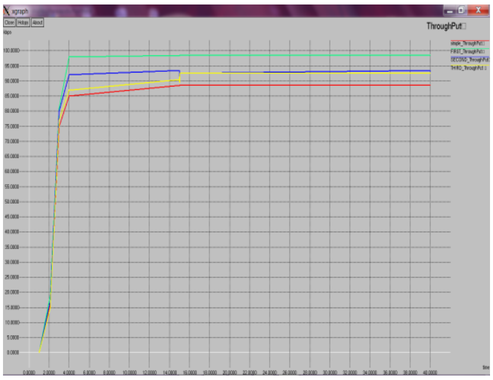

Figure 1: Thruput

Figure 2: Packet Delivery Ratio

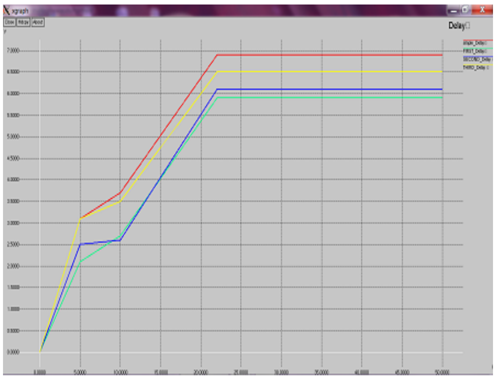

Figure 3: Delay

V. CONCLUSION AND FUTURE WORK

The simulation results showed that the proposed AODV-HPR performs better with parameter like throughput, end to end delay and packet delivery ratio than traditional AODV. The performance of AODV is improved by identifying certain nodes as HPR nodes which involve in routing and the rest of the normal nodes which receive the routing packets are not allowed to process those requests acting as only the simple neighboring nodes. Here by improving the performance of AODV means minimization of flooding which eventually causes minimization of routing overhead and thereby improves packet delivery ratio. HPR nodes can be assumed as higher capability nodes which are having sufficient battery power and they may be deployed as HPR nodes. A HPR node can transmit or allowed to transmit to higher distance than normal nodes. HPR nodes can also be a source or destination node but, a route can be established only through HPR nodes.

As the focus of the proposed system is just on minimizing flooding and thereby reducing routing overhead, in future the proposed system can be extended to add security features so that along with improvement in performance of AODV, security concerns can also be taken into account.

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