Survey on Various Routing Protocols in Mobile AdHoc Network

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***Abstract*— A mobile ad hoc network (MANET) is a continuously self-configuring, infrastructure-less network of mobile devices connected without wires. It is the collection of movable nodes where the nodes can move anywhere in the network. Topology of the nodes changes dynamically as the nodes are mobile. Broadcasting is very effective and fundamental data dissemination mechanism where each source node forwards the packets towards destination via nodes present in the network. The simple technique called flooding which is used for route discovery where a mobile node rebroadcasts blindly the received (RREQ) packet until the route is discovered for the particular packet. While data broadcasting has many advantages, it may also cause problems such as storm problem caused due to redundant retransmission, collision and contention. In order to overcome such storm problems various routing protocols are discussed which reduces the routing overhead and improve the performance.**

Keywords*— Mobile ad hoc Network; routing; broadcasting; overhead; collision

I. INTRODUCTION

There are many advances being made in wireless communication technology. In the areas where there is no or very less communication infrastructure or sometimes the existing infrastructure is inconvenient to use then ad hoc wireless networks are formed which makes communication possible. Mobile Ad hoc network is sometimes called as *mobile mesh network* consisting of modes which are also called as mobile computing devises. The nodes are free to move anywhere in the network so the network topology in MANET is always changing. In MANET broadcasting can be applied in many areas such as sending an alarm signal, paging a particular host, and finding route to particular host etc.

Mobile ad hoc network (MANET) is the collection of many nodes. These nodes are movable in a network. The topology always changes as the nodes are moving dynamically. The communication of the nodes in MANET is possible without using any access point. The Mobile nodes which are within the range can communicate directly with each other through wireless links, while those are outside the range needs routes for communication. In single hop communication direct communication is not possible so instead of using single hop communication multihop communication is used where source node sends the packet to the destination through the several intermediate nodes. MANET is the special type of the wireless network where communication is done without any backing of infrastructure and has many applications in disaster relief, battlefield and rescue. In battlefields the communication always takes place between mobile or static nodes and doesn't depend on fixed infrastructure, thus MANET is the only option to support network operation. In MANET the frequent breakage of links takes place as the nodes are moving freely in the network. This might disturb the whole network causing many problems.

Broadcasting has the high importance in MANET [1] for routing the information discovery. In broadcasting every source node broadcasts the message to all the other nodes. The protocols such as dynamic source routing (DSR)[2], Adhoc on demand distance vector (AODV) [3], location aided routing (LAR) and zonal routing protocol (ZRP) are used for establishing the routes. Due to the node mobility in MANET broadcasting poses many challenges. Blind flooding is the very basic approach of broadcasting where every node in broadcasting forwards the packets just once in the network. It is simple and guarantees a high rechability. Storm problem is caused due to redundant retransmission in which redundant packets caused contention and collision. Several schemes, such as non deterministic or probabilistic broadcast and deterministic broadcast are proposed to mitigate the broadcast storm problem. Nondeterministic schemes mitigate the network congestion by reducing the number of retransmissions.

Broadcasting techniques basically are divided into four groups: [4] simple flooding, probability based method, area-based method and neighbor-knowledge based method. In simple flooding node blindly rebroadcast the received packet until the particular destination is reached. In probability based method, certain probability is assigned to node whenever the node receives the packet and then it is forwarded to the next node. A common transmission range is assumed in area based method where a node will rebroadcast only if sufficient new area can be covered with the retransmission. Additional coverage concept is used to rebroadcast in Area coverage based method Neighbor-knowledge based method uses the neighbor information and decides whether to broadcast the packet or not.

This paper discusses the various routing protocol used to reduce the broadcast storm problem and reduce the routing overhead in the network.

The rest of the paper is organized as follows: section II includes previous work done. Section III describes the various routing protocol with neighbor knowledge method. Section IV concludes the paper.

II. PREVIOUS WORK DONE

The routing protocols used in MANET are categorized in two ways:

- Proactive Routing Protocol
- Reactive Routing Protocol

Proactive routing protocols are also called as table driven routing protocol. In this protocol each and every node maintains the network topology information in the form of routing tables. These tables exchange the information periodically. Whenever the topology is updated the whole network is aware about it. The routing information is flooded into the network. Any possible change in the network topology can be found out by using the network status information. Minimum initial delay is the advantage of Proactive routing protocol. The disadvantage of this protocol is it has high routing overhead. Destination- sequence distance vector (DSDV) and optimized link state routing (OLSR) are the well known examples of Proactive Routing Protocols.

Reactive routing protocols are used whenever there is any need of route establishment. Route discovery is initiated by flooding the whole network with RREQ packet. These protocols use less bandwidth for maintaining the route tables as compared to Reactive routing protocol. Unlike Table driven routing protocol, on-demand routing protocols execute the path finding process. Routing information is exchange only when the path is required by the node in order to communicate with the destination node. Ad hoc on demand (AODV) and dynamic source routing (DSR) are reactive routing protocol. Scalability in MANET can be improved by using the above mentioned protocol.

Ad hoc on demand distance vector routing protocol uses simple flooding mechanism where rebroadcasting is done until the received packet is reached to the particular destination. In AODV, source node and intermediate node stores the next hop information. Whenever the route is not available for the destination then the route request (RREQ) is flooded in the network. Topology information is not maintained. When the source node knows about the path breakage, reestablishment of the route to the destination is done. If the path breaks is observed at intermediate node, the node informs the end nodes by sending unrequested Route Reply.

III. VARIOUS ROUTING PROTOCOL WITH NEIGHBOR KNOWLEDGE METHOD

Flooding is the earliest mechanism, where every node present in the network retransmits the received packet to its neighbor. Even though flooding is simple mechanism but it can lead to very serious problem such as *broadcast storm problem* [5], which is indicated by redundant retransmission of packets.

Broadcasting is very effective mechanism for route discovery. But overheading can be caused due to broadcasting is of main concern. This may lead to various problems such as collision, redundant retransmission and contention thus affecting the network performance. The simple and effective solution is to reduce rebroadcasting so as to improve the network performance.

The various Routing Protocols with neighbor Knowledge are:

A. A Neighbor Coverage –Based Probabilistic Routing Protocol [6]

This protocol aims on reducing the routing overhead and ultimately improving the overall performance of the MANET. Neighbor knowledge has better performance than Area based and probability based method. The advantage of probabilistic method and neighbor knowledge method is combined in this approach which optimizes the broadcasting storm problem.

Rebroadcast delay and Probability is calculated in this protocol. Forwarding order of packets is determined by the Rebroadcast delay. This scheme focuses on spreading the packets to its neighbor which the nodes have received. The lower delay is possible only when any node and its neighbor node will have more common nodes.

Rebroadcast Probability consists of two parts:

1) Additional Coverage Ratio

2) Connectivity Factor

Additional coverage ratio is defined as the ratio of number of nodes cover in single broadcast to the total number of neighbor. Whereas the connectivity factor is the relationship between network connectivity and the numbers of neighbor of given node.

When the intermediate node receives the RREQ packet for the first time from the source node, initial UCN set is calculated. UCN is calculated when intermediate node compares its intermediate list and the neighbor list. On determining the forwarding order the timer is set according to the rebroadcast delay. The duplicate RREQ packet may be received by node during broadcasting and the UCN is adjusted until the timer is expired. As the time expires multiplication of additional coverage ratio and the connectivity factor calculates the Rebroadcast probability. Rebroadcasting of the packet is decided by the probability.

On average, NCPR reduces the overheading by 45.9 percent and 30.8 percent when compared with AODV and DPR protocols, respectively. Although this protocols increase the RREQ packet size but it mitigates the work collision also decreases the end to end delay.

B. Dynamic Probability Rout Discovery [7]

In fixed Probabilistic rout discovery the intermediate node receives the RREQ packets form the source node with fixed probability. In MANET forwarding probability should needs to be adjusted properly as the node density is always varying. Considering the set of covered nodes and the local density, forwarding probability of RREQ packet is determined in Dynamic probability rout discovery.

In Local Density the density of the region in a network can be estimated by the use of local neighborhood

information of the region. The neighborhood information is collected by using 'hello' protocol. On receiving the hello packet from neighbor, the node creates its entry in the table if it does not have, else it updates the table. If the node does not receive hello packet from its neighbor then the entry is deleted from the table.

Communication bandwidth and the overall network throughput can be dissipated by hello size packet and the rate at which it is transmitted. Collision is introduced in the network if the packet sending rate is high.

In Covered Nodes every node has ability to determine its forward probability with respect to its local density and the neighbors which are covered in broadcast. When the node sends the RREQ packet including its neighbor list, the intermediate node searches' through the list to determine its neighbor set. Probability is set low if maximum number of neighbor is covered otherwise it is set low.

In this performance of DRP-AODV and FRP-AODV is done using AODV as base routing protocol. DRP-AODV mitigates the routing overhead during the route discovery process, especially in dense network. In low and medium dense network the overheading is reduced by 56 percent in DRP-AODV when compared to conventional AODV. Under the same network condition the overhead is reduced by 30 percent when compared to FRP-AODV.

C. Probabilistic Broadcasting with Coverage Area and Neighbor Conformation [8]

The protocol focuses achieving the high reachability and reducing the number of rebroadcast. In Probabilistic method, the Probability is fixed for all the nodes. But the problem arises in setting the rebroadcast probability. Being sparse or dense the topologies n MANET are continuously changing. As the reachability is directly depended on the rebroadcast probability, so it's very important to set the rebroadcasting probability according to the node.

This protocol is based on the shadowing effect which reduces the number of rebroadcasting packets. If the source node and the neighbors are far away from each other then the retransmission probability is high else it is low. The coverage area can be determined from the distance of the sender and the receiver. The distance can be estimated by the signal strength or global positioning system (GPS). Depending weather the node is inner or outer the coverage area is decided. Rebroadcasting probability is calculated from the coverage area.

A confirmation that all the neighbors are receiving the RREQ packet is done depending upon the coverage ratio and the rebroadcast probability. The performance of this approach is measured by using the flooding approach which assures that all the node receiving the broadcast packets. This approach can considerably reduce the number of rebroadcast with mobility and no mobility, collision packets as compared to flooding. In this the performance analysis is done with the simple flooding where the collision packet is reduced by 50 percent as compared to flooding.

D. Bounding algorithm for the broadcast storm problem in Mobile Adhoc Networks [9]

In this re-broadcasting bounding algorithm is proposed which is based on both counter-based and distance-based scheme. In distance based scheme, the receiving node which is located farther than given threshold can rebroadcast the packet and prevents other nodes from doing it. Whereas the counter-based scheme the nodes which is hearing the same message repeatedly is restricted from rebroadcasting.

In this the nodes are allowed to rebroadcast before the time expires. If the sending and receiving nodes are located far away from the given threshold then their waiting time allows rebroadcasting the message before other nodes time expires. The nodes which are located within the threshold distance. Those nodes are not allowed to rebroadcast.

In extreme cases if the count of reception is exceeds the counter threshold then node abstains from rebroadcasting. This protocol promises to increase reachability by limiting the redundancy. This protocol is the hybrid approach by using both the distance-based and counter-based approach, thus satisfying the two goals, namely high reachability and low redundancy Excessive rebroadcasting is be avoided by using the counter based constrain.

IV. CONCLUSION

The MANET (Mobile ad hoc network) has been the research area from past few years. Broadcasting is the very important issue which needs to be focused. The problem rises in how to minimize the number of rebroadcasting which probably decrease the routing overhead in the network. Though the large rebroadcast caused high rechability it causes high bandwidth wastage and many packet collisions.

This problem can be managed by using good routing protocols. This paper presents the recent routing protocols in MANET based on neighbor knowledge method. This method is a type of broadcasting technique which overcomes simple flooding thus reducing the number of retransmissions and collisions in the network. Survey of these routing protocols show that routing can improve the overall performance of the network by regulating the routing overhead, packet deliver ratio and end to end delay. Analysis of these protocols indicates that these protocols are most efficient among the other existing routing protocol.

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