An Efficient Route Discovery approach in Mobile Ad hoc Network

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Abstract— A mobile ad hoc network is a collection of nodes that are independent. Nodes in the network communicate to each other directly and indirectly via intermediate node. Mobile ad hoc network has major challenges such as energy consumption because of battery power is limited in mobile ad hoc network. We investigate that, simple flooding of message takes more energy. We propose a K-hop based ERS algorithm, which is appropriate for minimizing the energy consumption by using the concept of expanding ring search algorithm**.**

***Keywords*-Energy, time, expanding ring search (ERS), K-hop based ERS.**

I. INTRODUCTION

A Mobile ad hoc network consists of a collection of wireless nodes that are communicate to each other directly and independently. There is a source node, intermediate node, and destination node. Intermediate nodes are relay nodes they work as a router. The intermediate nodes need to forward the packet to other intermediate nodes. Source node initializes a communication to destination. Wireless mobile ad hoc networks have two categories that is infrastructure based and infrastructure less. In infrastructure based wireless network wireless nodes are communicate to each other by a coordinator, that is Access points. But there is no need to any central coordinator in infrastructure less network. This kind of network allows a vast range of application ranging from a conference or a business meeting to the environment like a battlefield or a nature disaster scenario.

Routing protocols are two types with respect to their routing nature; reactive and proactive protocols. The main difference between the two categories is based on the calculation of routes.

Reactive routing protocols are on demand protocols. Source initiated the route discovery process and flooding the packet in the entire network. So, it's takes more energy and take more time also create the overhead across the network. To improve the route discovery process, enhance the time delay and energy consumption and stopping the unnecessary flooding in the network. In normal flooding route request propagate in the network up to TTL value goes to 0. So normal flooding creates the broadcast storm problem [1]. Normal flooding consumes more bandwidth more energy and more time delay can be reduce to stopping the flooding of packets in the entire network. Several non-location-based reactive routing protocols for MANETs, such as DSR and AOD use flooding of ROUTE REQUEST messages to discover routes. A ROUTE REQUEST packet is flooded across the network in a controlled manner (each node broadcasts it only once).

Flooding is a basic operation and has extensive applications
in target discovery in wireless networks, such as those widely utilized in the route discovery process in several routing protocols those used in wireless sensor networks for sensor discovery, or those used in wireless ad hoc networks for service discovery. Query packets are flooded inside the network to search for a certain target node.

When the target node receives the query packet, it responds to the source node, not only to inform the source node about its existence, but also to avoid further unnecessary flooding attempts from the source node. However, even if the flooded packet reaches the target, packets flooded towards other directions continue. Different types of networks introduce different methods to control the flooding. Flooding may be controlled by setting the hop limit, which guarantees a packet will not be transmit-ted more than the maximum number of hops, or by set-ting a distance limit from the source, which guarantees a packet will not be transmitted beyond a certain geographical limit.

Using hop limit, the authors of DSR consider a mechanism called "expansion ring" to search for a target [4]. The authors claim that in this way, a node can explore for the target progressively without flooding the entire network, and the only drawback of this scheme is the increasing latency due to multiple discovery attempts. However, DSR applies a simpler scheme that searches the one-hop neighbors first and then the entire net-work. The idea of the expansion ring was implemented later in AODV [12]. An interesting question is whether or not using he expansion ring technique always reduces flooding over-head compared with flooding the network just once.

II. RELATED WORK

Broadcast storm problem [1] is very serious problem in mobile ad hoc network. This is caused by flooding. Simple way to find out the destination for flooding. The entire network but it create problems and take more energy, take more time, create more overhead in the network. It creates the contention collision and redundant rebroadcasting. So there are some mechanism to reduce these problem that are probabilistic, when node receiving the packet it rebroadcast the packet by probability P. if P=1 its sends packets in broadcast manner. another mechanism is counter based, in which c is a counter that contain the number of time packet received and another C is a threshold, if more than threshold value packet is received than stop the rebroadcasting.

Another one is distance based; if A send message to B than distance between A and B is 0 than B is not broadcasting future. if more 0 distance between them than that broadcast the message up to that distance. It reduces rebroadcasting of the messages.

Another one is location based; if we acquire the location of the destination node than we can minimize the flooding problem. Such an approach that is GPS (Global position system) receiver device that find the location of the destination. It contains the location information in the form of coordinates and defines a threshold A and compares the threshold value with the additional coverage AC. If A<AC rebroadcast the message otherwise not.

Another one is cluster based; cluster formation-based algorithm is used to find the cluster head. A node periodically sends the beacon packets to advertising its presence in the network. A node that have minimal local ID selected as a cluster head and each head some member and the gateway node that pass the information from one cluster to another cluster. So, when broadcast a message if receiving node not a gateway node than stop the broadcasting of packet. After that apply the previous three techniques.

Flooding strategy for target discovery [2] in wireless network, in which take the problem of find the best flooding strategy that contains minimum time delay and take minimum energy in this paper author takes two approaches that is either flood the entire network or flood the ring wise mechanism which one is better if we apply ring mechanism how many ring is suitable to flood the network and found the destination. So, author takes two methods that are two ring and three ring mechanisms. In this paper author takes two category that are large scale network and other one is small scale network. In large scale network, ignore the edge effect, while for small scale network takes edge effects. Paper focus on cost and latency; total number of packets transmitted define cost, source node wait for the reply from the destination node take as latency two term is used that is once-for-all means the packet flood in the network only once and another one is n-ring strategy in which packet flood on the basis of ring.

In large scale network takes flooding strategy problem, and take hop limit strategy to control the flooding in the network. Source node sends the RREQ packet by setting the hop limit value if it fails to find the destination that it increases the hop limit.

In small scale network, source node sends the packet in the entire network when network is small. Here edge effect taken into account. Here taken some strategy take self location aware, if the source node knows the distance of the boarder node it can adjust the hop limit according to that distance. Author takes two ring schemes for this case. Other is self location aware, if node do not have information about the border node it simply floods the entire network. So overall, two ring schemes reduce the cost of small-scale network. In two ring schemes, set the hop limit firstly up to [m/2] and the second time take the hop limit up to m. So, it reduces the cost of the network. If take three ring scheme , set the hop limit first time 1and second time it takes the hop limit up to [m+1/2] and in third time take hop limit m. author takes DSR and take the hop limit for that 1 in first attempt and in second attempt it takes M.

In multi target discovery search for multiple destination or target but in single target discovery find the one target. So here we take multiple ring search to find the target node. Here the strategy one-out-of-m is used, in the previous method only one- route discovery but in this strategy, there are total m targets that are distributed over the network.

Optimal L value also reduces the time delay and energy consumption [3]. Here examines the behavior of L after the examine the search strategy of L.

The expanding ring search is an effective way of finding a
route between two distinct nodes (S, D) in a MANET, where S represents a source node; and D represents a destination, or a route node that can offer the route information to the destination [4]. There may be more than one route between S and D, and the ERS aims to find one with least effort. ERS conducts a breath-first like search via rebroadcasting by intermediate nodes from one level to the next level in a continuous and relay fashion. Typical control messages include RREQ (Route Requests) and RREP (Route Reply). Each of them contains some essential information for cooperation, for example, the source and destination addresses, initial hop count, and time-to-live value (TTL)DSR and AODV are the reactive routing protocols they are not operate until route from source to destination are found. Route discovery process starts on route demand from source. There are many techniques proposed to enhance the route discovery process. ERS algorithm is one of the techniques used to find the route from source to destination [5]. ERS algorithm support reactive routing protocols such as AODV and DSR. In ERS there are multiple ring, route discovery process starts from the source node. Source node sends the RREQ packet to the intermediate node that are one hop distance from the source node. Intermediate node receives the RREQ packet and check in its route cache. If there is information about destination node then sends reply back to the source node by RREP packet otherwise forward the packet to the next ring. Again, process will start of searching of the destination node from the source node until destination node will not found.

In TTL based ERS algorithm [5], To control the flooding in the entire network TTL number are predefine. Firstly, start from TTL value 1 if destination found then reply back to source node. If destination is not found than increase the TTL value by 1. We repeatedly start form the source node if destination is note found. But it creates an overhead across the source node and takes more energy and time delay.

BERS (Blocking expanding ring search) [6] have hop number and a new packet that is stop instruction or can say chase packet. When destination node is found than send the stop instruction to entire network to control the flooding of network. When RREQ packet send by the source node to intermediate node, if intermediate node has not information about the destination than flooding start from that node not from source node. In BERS each node waits for 2H time before sending packet to other node if stop instruction is receive in this time stop the broadcasting of packet if not then sends the packet to the other node. It improves the energy consumption by stopping the flooding.

BERS* (Enhanced blocking expanding ring search) [7] based on ERS algorithm and it is energy efficient but more time efficient. It takes half amount of time than BERS. In BERS each node waits for 2H time before propagate the packets but in BERS*, intermediate node takes h unit time. It minimizes the time latency approximately half than the BERS.

In EERS, [8] when node sends packet to other node, if the node receives the packet first time it will takes the message and propagate to another node, if node receive the packet more than one time it will discards the packet. But in EERS, when intermediate node receives the packet second time than before discarding the packet it will takes the information about the neighbor node. In EERS some node in active state and other node in rest state. There is a predecessor field in message through which nodes decide that relay or not. Every packet in this contain the predecessor value suppose A send the message to B than A send the predecessor value in that message suppose A is source node it send the packet to intermediate node B and sends own address as a predecessor to B it compare its own address with predecessor value if they are matches than node relay the message to other node if not than not relay the message and goes to silent mode. Now B sends the message to C than A is predecessor for C because the message from B contains the A as predecessor than check B's address with A. There are two phases that is collecting neighbor's information and second is reducing the overhead of flooding.

In the first phase each node sends the message to all the nodes without taking the relay variable. Relay is set to true and set to false according to the node state. So, in second phase node relay the message after the first phase some node have the value of relay as false and some has value as true. If node has value as false and not relay the packet otherwise not relay the packet.

AODV based ERS [9] algorithm, a hop-based prediction Scheme is used in which hop is predicted that is for the destination on the basis of select good TTL value. Good TTL value select on the basis of predict the destination node. So, based on the previous hop number or the destination number find the new destination. In this scheme takes the source node, destination node, hop count to the destination node and find out the mean of previous hop count of some destination and there is a hop table in which destination node, number of records to some destination, mean value of hop to some destination, hop count of latest route request, time of latest record so use the hop table to predict the destination it reduce the time latency.

DTC (Dual tier channel) [10] have two tier approach, based on virtual channel that is not actual channel. Two channels are used here that takes two different speeds one speed is slow and one is fast and no node waits before broadcasting the message to the other node, every node broadcast the message without waiting so RREQ packet broadcast beyond the network because no node wait for chase packet. Hc and Ht term is used in DTC Hc the ring in which the RREQ packet caught and Ht the ring where the speed is changed. v1 and v2 two speeds, v1 speed is fast and v2 speed is slow. Source node broadcast the RREQ packet at the v1 speed up to threshold value that is ht after that the speed is converted into v2 so easily catch when sending the chase packet, chase packet speed is also v1 to catch the flooding. So, it reduces the time latency. Compare both the strategy BERS and DTC. In BERS each node waits for 2H time after 2H time node broadcast the message so its take more time but reduce the energy consumption. The intermediate node decides the location of in terms of hop distance. The main difference between BERS and DTC in their chase strategies.

Factors/ Papers	Energy consumption	Time Delay	Overhead
1	YES	YES	NO
2	YES	YES	NO
3	YES	NO	NO
4	YES	YES	YES
5	NO	YES	NO
6	YES	YES	NO
7	NO	YES	NO
8	YES	NO	NO
9	YES	YES	NO
10	NO	YES	NO

Table1: Parametric Evaluation

III. ISSUE AND CHALLENGES

Energy constraint and time delay are the major issues of routing protocols and these have some challenges.

Bandwidth constraint: In wired network there is abundant bandwidth available. But in wireless network the radio band is limited. This requires that the routing protocols use the bandwidth optimally by keeping the overhead optimally as low as possible. The limited bandwidth also imposes a constraint on routing protocols in maintain the topological information.

Resource constraint: Two essential and limited resources that form the major constraint for the nodes in ad hoc wireless network are battery and processing power. Increasing the battery power and processing ability makes node bulky and less portable.

IV. PROBLEM STATEMENT

The flooding of network is main problem in the mobile ad hoc protocols. When packet send from the source node to the intermediate node if destination not found than flood the packet to the entire network. That consumes more energy and takes more time delay and overheads. So, we are focusing to reduce these terms.

We are proposing the “An efficient reactive route discovery approach in mobile ad hoc network with minimum energy or time delay.

V. PROPOSED WORK

In BERS algorithm source node sends the RREQ packet to each node that all are one hop distance from the source node. Intermediate node receives the RREQ packet and check in its route cache, if intermediate node has information about the destination node sends RREP to the source not if not then send RREQ packet to next intermediate node. Each node waits for 2H time before sending the RREQ packet.

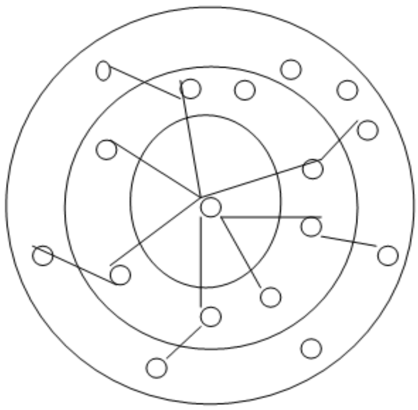

Figure1: Expanding Ring Search

Each node communicates to other node directly in multi ring in ERS algorithm. To take the advantage of ERS algorithm we propose the K-hop based ERS scheme. In this method every node contains the information about h neighbor node. When RREQ packet sends by source node to intermediate node that are 1 hop distance from the source node each node contains a table and each table contains the information up to 2 hops. if any information in its table about the destination node it sends reply to the source node to stop the flooding.

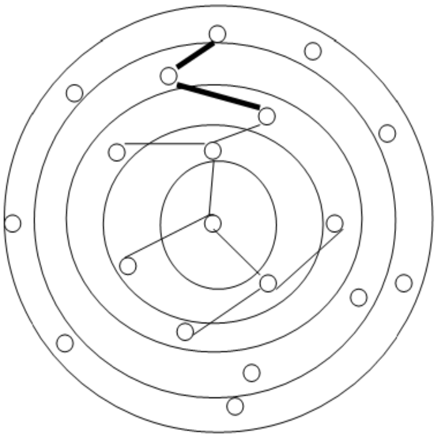

Figure 2: K-Hop based ERS

So, by using this method energy and time both saving but increase some storage capacity.

Algorithm 1 Source node
1: broadcast 'RREQ, H = 1 and max H'
2: wait until a RREP is received
3: broadcast the 'stop instruction' and H to everyone within the ring.
4: use the 1st RREP for the data packet and save 2nd RREP as a backup
5: drop any later RREPs

Algorithm 2 Intermediate node
1: listen to RREQ
2: check the max j after receiving the RREQ
3: if the H is bigger than the max j then
4: drop the RREQ
5: else
6: check the hop table after receiving the RREQ
7: if there is route information in the hop table then
8: send a RREP and H to the source node
9: else
10: wait for a period of 'waiting time' (Hop Number)
11: while waiting do
12: if receive a 'stop instruction' then
13: call the blocking procedure
14: erase the source-destination pair in the route cache
15: else if receives a 'RREP' then
16: forward it to the source node
17: end if
18: end while
19: if receives no 'stop instruction' then
20: increase the hop serial number by 1 and rebroadcast RREQ
21: end if
22: end if
23: end if

Algorithm 3 Route node
1: wait for the first arriving RREQ
2: if receive a RREQ then
3: send the RREP and the H to the source route (contained in the RREQ packet)
4: end if

Algorithm 4 Procedure of blocking
1: compare Hr with H
2: if Hr is bigger then
3: forward the stop instruction and
4: erase the source-destination pair in the route cache
5: else
6: drop the stop instruction and
7: stop rebroadcasting and

8: erase the source-destination pair in the route cache

VI. CONCLUSION

There are many proposed algorithms some reduce latency, overhead and some reduce energy consumption. BERS introduce for rout discovery process. Reduces the energy by using the stop instruction the energy and hop count but increase the time delay. BERS* takes half amount time so it reduces the time at the same level of amount of energy. We propose the K-hop method that reduces the time delay and overhead. Each node contains the information about neighbor node and node id of each neighbor node. So, it reduces the time delay and also save the energy.

VII. RESULT

We have use network simulator-2 that is event driven simulator used for only network research. So figure shows the different states of result. In our simulation we take 20 nodes and in figure 3 shows the network in which source and destination is defined. Figure 4 shows the ring that defines the communication range. Figure 5 shows the communication between source and destination.

Figure 3: Define Source And Destination

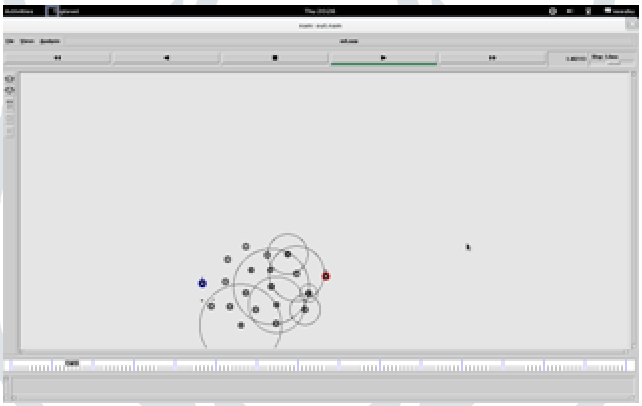

Figure 4: Ring Form In The Network

Figure 5: Packet Transmission Between The Source And Destination

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