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Improving Performance Using Narrow Request Zone in MANET

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***Abstract*—**Control overhead is the overhead took by network to maintain the connections within the network. For efficient communication, the control overhead in the network should be less. Therefore reducing control overhead is major factor considered while designing routing protocols. Usually the control overhead is increases due to the flooding of route request packet and location beacon packets. To deal with this, the location based routing protocols are designed. In such protocols route request packets are forwarded in the direction of destination node. Due to this number of routing packet are reduced hence the control overhead. In location aided routing, request zone includes the expected zone of destination. But if the location of destination is known then size of request zone can be reduced further, can be said as narrow request zone. Using narrow request zone control overhead can be reduced to the great extent by forwarding the route request packets through very narrow area.

***Key terms* - MANET, LAR, Expected Location, Request zone, Narrow zone**

1, INTRODUCTION

Mobile Ad hoc Network is autonomous system of wireless mobile nodes connected by wireless links. Each node can operate as an end system and as a router for all other nodes in the network. A mobile Ad hoc Network is a self configuring network of wireless mobile routers connected by wireless links.

Due to such features of MANET the task of finding and maintaining routes is became nontrivial. Many protocols have been proposed for mobile ad hoc networks, with the goal of achieving efficient routing. These proposed algorithms differ in the approach used for searching a new route and modifying a known route, when node moves. This protocol decreases overhead of route discovery by utilizing location information of mobile hosts. Such location information may be obtained using the global positioning system (GPS). The LAR protocols use location information (past information) to reduce the search space for a desired route. Limiting the search space results in fewer route discovery messages, it is called as the routing overhead [5].

There are many location based routing protocols available today. In improved hybrid location based routing protocol, for local communication that means within specific hop limit, the topology based routing is used otherwise the geographical based routing is used [1]. Also some location based routing protocols like ALERT provides security mechanisms in terms of source, destination and route anonymity [4]. In LARDAR the concept of dynamic adaptive request zone is used. Here the flooding area is decided by every forwarding node adaptively [7].

Location based routing protocols are specially designed for reduction of routing overhead. They also work well in packet delivery fraction and end to end delay. But there are many problems to it like location estimation, holes in request zone etc. To get location information is very critical problem in MANET because there are some limitations on using GPS. We can't use GPS to get location information of nodes within the MANET in some cases. For indoor network GPS can't be used because there is a problem of GPS range inside the houses or offices. For smaller wireless devices or sensor node it is difficult to install GPS hardware and antenna over it.

GPS is very expensive for such small devices or networks. In standard GPS there is location error up to 20-30 meters. For MANET such error can't be tolerated. If MANET is highly dense, that means nodes are very close to each other within network then GPS can't be used in such cases [9][10].

2, RELATED WORK

2.1 LAR(Location Aided Routing)

One of geographical-based routing protocol is location-aided routing (LAR). The main objective of LAR is to limit flooding of routing request packets in a small group of nodes which belong to a request zone. Compared with other routing protocols such as AODV or DSR, in which routing packets are flooded throughout the network, LAR saves considerable bandwidth and leaves those mobile nodes that are not between the source and destination untouched.

The area of network in which current location of destination is expected to be is known as “expected zone” and the area through which request packet has to travel is called as “request zone”. By using location information, the Location-Aided Routing (LAR) protocols limit the search for a new route to a smaller “request zone” of the ad hoc network. This results in a significant reduction in the number of routing messages. There are two schemes which decide the request zone in LAR.

To construct the request zone, the expected zone of the destination needs to be obtained first. Suppose both the average speed (say v) and the location of the destination at time t0 (say L) are known to the source, the expected zone of the destination at time t1 is the circle with center at L and radius of v(t1 - t0).

Two different schemes are brought to construct the request zone: (1) a rectangular request zone which contains the location of source and the expected zone of the destination; or (2) the group of the nodes closer to the destination than the source.

Variations to request Zone

As shown in fig.1 it is alternative definition to the request zone in LAR scheme1. In this fig.it is seen that request zone includes only expected zone circle. But in LAR scheme1 it considers the whole rectangle containing source node coordinates as one end of diagonal of rectangle and other end encompassing expected zone. In fig.1, rectangular request zone shown is the request zone considered in LAR scheme1. If we compare these two request zones then it can be seen that the area of alternative request zone is less than rectangular request zone in LAR scheme1. That means the routing overhead in alternative request zone is less than the rectangular request zone.

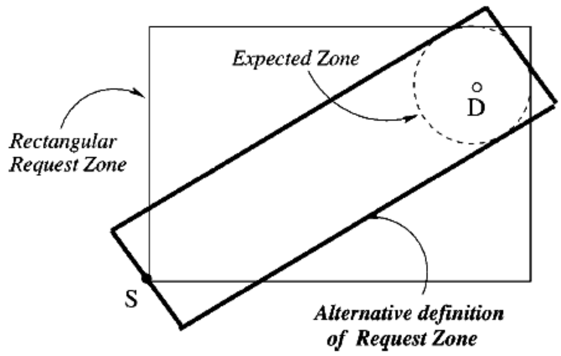

Fig.1. Alternative definitions of request zone for LAR scheme 1 [5].

As shown in fig.2 it is alternative definition to the request zone in LAR scheme2. In this fig.2 it is seen that request zone (outer circle) includes expected zone circle and source node on the circle of request zone. But in LAR scheme2 it considers the whole circle containing source node coordinates as on it and encompassing expected zone as request zone. In fig.2 initial circular request zone shown is the request zone considered in LAR scheme2. But in alternative request zone the request zone is adaptively considered. That means when request comes to inner node I then to forward request by I it considers the request zone calculated by node I that means inner circle shown in fig.2. That means request zone adaptively changing while request is moving towards destination. Also the area of request zones is going decreasing. If we compare these two request zones then it can be seen that the area of alternative request zone is less than initial request zone in LAR scheme2. That means the routing overhead in alternative request zone is less than the initial request zone.

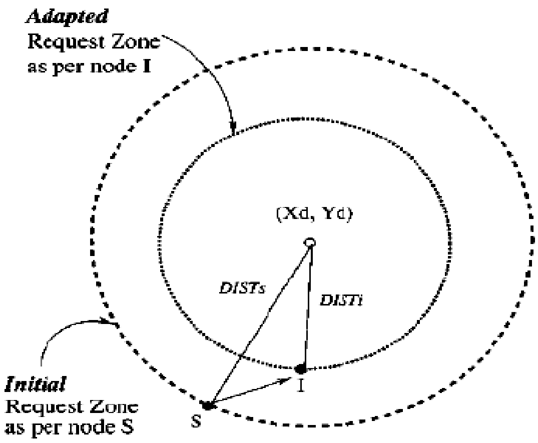

Fig.2. Alternative definitions of request zone for LAR scheme 2 [5].

2.2 . ARZAODV(Adaptive request zone protocol)

In Adaptive Request Zone, request zones are based on the variation of distance between source node and destination node while both nodes are mobile [6].

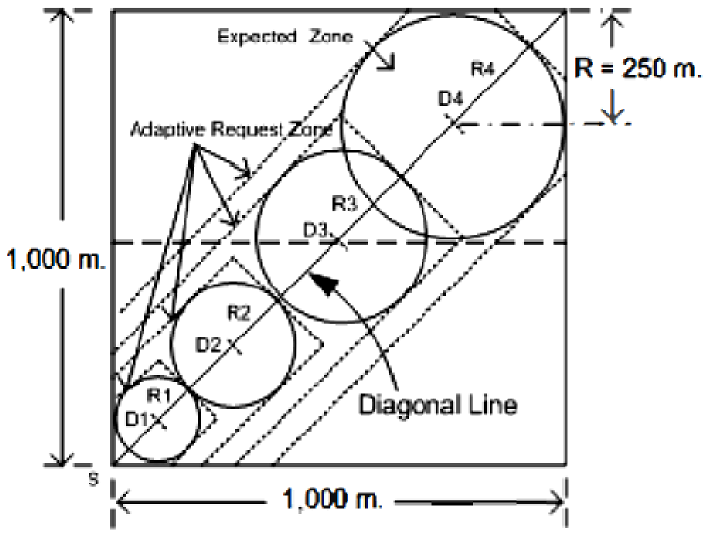

Fig.3. adaptive request zones in ARZAODV [2].

The request zones are adaptively chosen depending on the distance between source node and destination node and radius of expected zone as shown in the Fig.3. The area of 1,000 X 1,000 meters is considered. If distance between source node and destination node is larger than or equal to three fourth of the diagonal line (S- >D4), the maximum of radius R4 =250 m is taken for calculating the expected zone and also increase the request zone respectively. If the distance between source node and destination node is larger than or equal to a half of the diagonal line (S->D3), the maximum of radius R3 =187.5 m is taken. If the distance between source node and destination node is larger than or equal to one fourth of the diagonal line (S->D2), the minimum of radius

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R2 = 125 m is taken. If source node and destination node locates very close like node S and node Dl, the minimum of radius Rl = 62 m will be taken. It divides the variation of the distance to adapt the radius of expected zone four parts based on the diagonal line. [2]

3, NARROW REQUEST ZONE

In proposed method the prime motive is to reduce control overhead. It is basically depend on size of request zone in location based routing protocols. Here location aided routing protocol is considered and variation to the request zone is made. As shown in Fig.4 S be the source node and D is the destination node. D_{t0} is the location of destination at time t_0. We have to send data packet to the destination at time t_1. If V is the average speed of destination node then according to LAR the expected zone can be calculated as, Radius (expected zone) = V (t1 - t0)

In Fig.4 circle of radius V (t1 - t0) is shown as expected zone. That means the destination node at time t1 is expected to be within that circle. To find destination node source node uses conical request zone as it as lower routing overhead than rectangular request zone. So it can be say that the shaded region shown in Fig.4 is the overall request zone. If it is assumed that nodes are uniformly distributed within network then it can be say that area of shaded region is proportional to routing overhead.

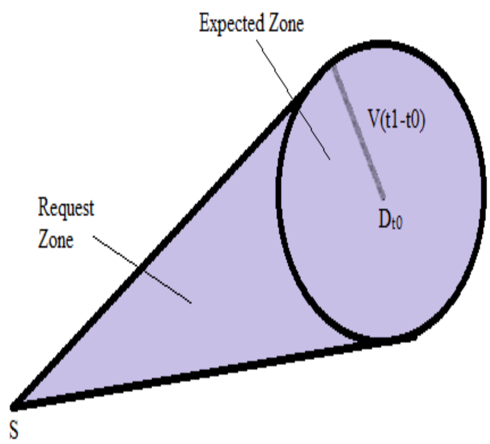

Fig.4. Conical request zone in LAR.

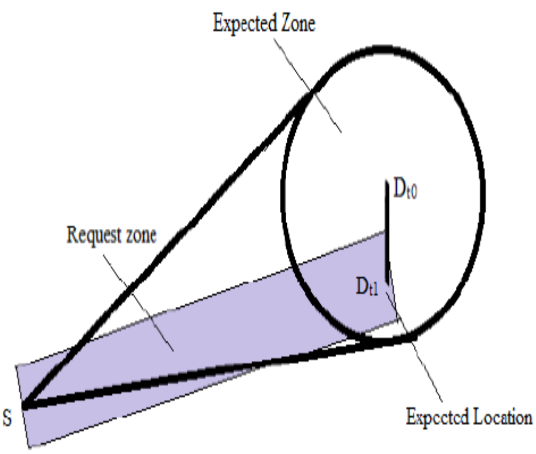

Fig.5. Narrow request zone.

As shown in Fig.5 D_{t0} is the destination location at time t_0. If source node S wants to communicate with destination node at time t_1 then the location of destination node should be known at time t_1. In earlier methods the expected zone is calculated and request is flooded within the request zone. But in proposed method it is going to be calculating approximate location of destination node. For this purpose following things are required.

- Position of destination node at time t_0
- Speed of destination node
- Direction of destination node

If these things are known then the approximate location of destination node can be calculated using mathematical calculations. 5

Distance traveled = V (t1-t0), Angle of direction = Θ Using these two things location D_{t1} is found out. If the location of destination is known then the request zone can be adjusted to optimum size. This can be cleared from Fig.5. In Fig.5 the shaded region is the request zone. It includes source node location and destination node location with defined rectangle. If shaded region in Fig.4 is compared to shaded region in Fig.5 then it can be concluded that Area (shaded region in Fig.5) < Area (shaded region in Fig.4) Routing overhead in Fig.5 < Routing overhead in Fig.4 It is assumed that nodes are uniformly distributed within network. Ultimately it means that reduction to shaded region or request zone is reduction to routing overhead. But narrowing the request zone affect the other routing factors like packet delivery fraction and end to end delay. Due to narrow request zone there may be possibility of holes within the request zone. To avoid this problem the size of request zone should be kept optimum.

4, SIMULATION AND RESULTS

4.1 Simulation model and parameters

We have evaluated the performance of AODV, ARZAODV and NRZ by using network simulator. The parameters are set as shown in table 1.

Table.1 Simulation Parameters

Simulation Area	1000 X 1000 sq. meters
Moving Pattern	Random Waypoint
Speed	10 meters/second
Simulation Time	100 seconds
Transmission Range	250 meters (m)
Pause Time	2 seconds
Interface Queue	50 packets
Initial energy	100

4.2 Simulation results

In this paper, we have evaluated performance metrics such as packet delivery fraction, delay, total energy consumption and Control overhead. We have compared NRZ with ARZAODV and AODV. In Fig.6, we show the control overhead versus number of nodes. We can see that NRZ takes the lowest control overhead as compared to ARZAODV and AODV. In fig.7 the total energy consumption of network versus number of nodes is shown. From the graphs it can be concluded that NRZ consumes low energy compared to other protocols. In fig.8 end to end delay versus number of nodes is shown. NRZ has lower end to end delay compared to AODV.

In fig.9 packet delivery ratio versus number of nodes is shown. As the number of nodes increase the packet delivery ratio gets down but NRZ has better PDR than AODV.

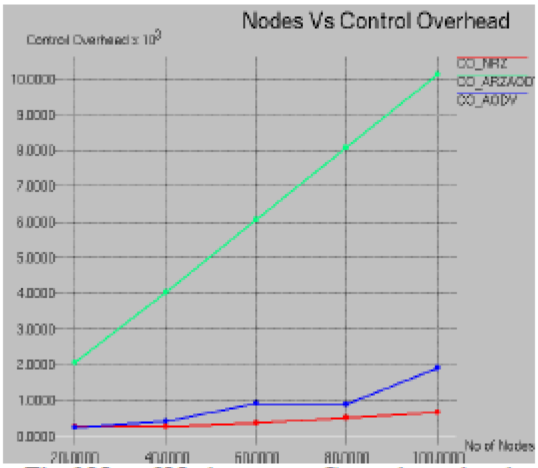

Fig.6 No. of Nodes versus Control overhead

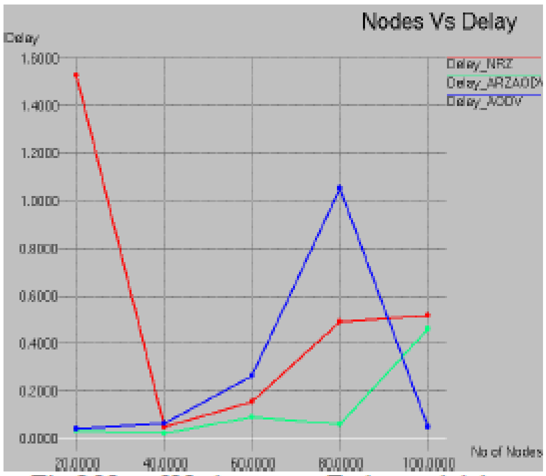

Fig.8 No. of Nodes versus End to end delay

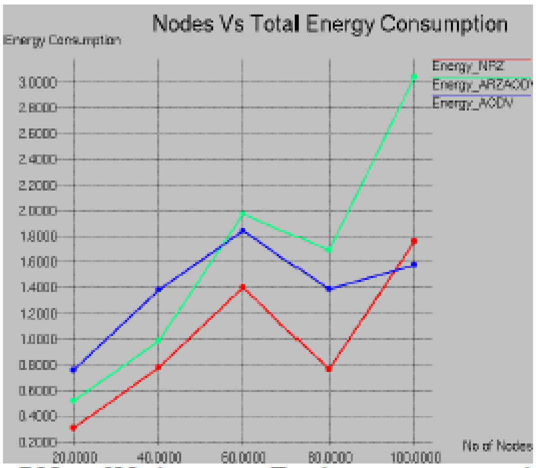

Fig.7 No. of Nodes versus Total energy consumption

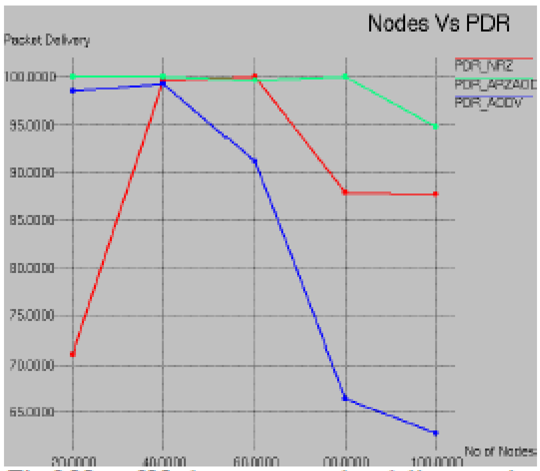

Fig.9 No. of Nodes versus packet delivery ratio

5. CONCLUSION

In location based routing protocols, the main goal is to reduce the flooding area by using request zone. In this design the flooding area is reduced as much as possible using narrow request zone. Due to this request zone or forwarding region becomes narrow and packet forwarding is highly directional. Making request zone narrower, the control overhead gets reduced to a great extent. That results into less energy consumption of network. As the request zone becomes narrower there may be chances of holes in the request zone which results in to increased packet drops and end to end delay.

6. FUTURE SCOPE

In MANET and WSN there are many issues related with the routing and energy. In the environment of dense MANET with lower mobility the designed protocol will work best. In the future it will be possible to communicate with low overheads, lower energy and greater throughput by keeping optimum size of narrow request zone.

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