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Location Updation for Highly Dynamic and Scalable Ad Hoc Network in Geographic Routing

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Abstract

In geographic routing each node needs location information about other nodes in the network to forward data packets to the destination. If a node maintains location information about all the nodes in the network then it is difficult to maintain the location information when the network is highly populated with many number of nodes. So that a highly scalable protocol needed to maintain location information thus a GPSR protocol maintains only information about their neighbor it does not bother about the number of nodes in the network. For highly dynamic ad hoc network the location information need to be updated very frequently to update the changes in the network nodes. The adaptive location updation strategy is used for more frequent updation with a scalable GPSR protocol is used for highly dynamic network to update the changes.

Keywords: Ad Hoc Network, Routing

Introduction

Geographic routing protocols needs location information about the nodes to forward the data packets such as LAR, Location based routing [3]. This location information are exchanged via small control packets called beacon packets. This beacon packet also consumes some amount of nodes energy, so we need to reduce the control packets as much as possible. MANET contains mobile and wireless devices so that the topology will not remain static it will be changing dynamically, so it is necessary to update the location of the nodes for efficient packet delivery.

Earlier periodic updations are done in a specific time interval this will cause high inaccurate neighbors ratio solution [11]. Because during this periodic time interval many nodes change their location those location information are not reflected in the location database on that period. If any one of the node tries to forward packets to the neighbor that neighbor is already moved out of that location, this will cause packet loss and unwanted retransmission of data packets. This periodic updations are useful for the networks where nodes periodically goes to a sleep or active state.

Many approaches maintain this location information in a central database. In this if the central server fails then the location information about all nodes will be unavailable. The quorum system contains the location information about nodes in a distributed manner in that a common database used for more than one nodes location information with replica information of all database, so that if one database fails we can get the location information from other nodes in the network [8]. Most of the geographic routing protocol maintains per node location information about the nodes. Per node location information is not suitable if the network is highly dense. Instead of maintaining all nodes location information GPSR protocol needs only information about their neighbors to forward the data packets in a greedy manner [1]. This leads to a scalable database by maintaining only neighbor location information.

Earlier perimeter algorithms forward the data packets to destination by face routing algorithm but it fails to forward packets to neighbors that are very closer to the destination [1]. Planar perimeter algorithms effectively find the closer neighbors between perimeter node and the destination.
In ad hoc mode the idle power consumption is needed for every node [15] but compare to other networks power consumption that are periodically goes to a sleep or active state the idle power consumption of an ad hoc network is less. So that we can reduce the cost of data forwarding with ad hoc mode.

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Related Work

Many updation schemes are already available such as adaptive beacon, reactive beacon and periodic beaconing solution [13]. Adaptive beaconing scheme has two methods speed based beaconing and distance based beaconing. The distance based beaconing will updates the location of the nodes if the node changes their location. It has one disadvantage that is the slow moving node unnecessarily send beacon updations and fast moving nodes send only minimum number of updations. So that the slow moving node cannot predict the fast moving nodes. In speed based beaconing scheme if a node speed changes then it will broadcast a beacon packet. This adaptive beaconing scheme is useful for highly dynamic network where a node dynamically change their location, this speed based beaconing will cause more inaccurate neighbors ratio.

Reactive beaconing scheme updates the location information when they want to contact to other nodes in the network [13]. Upon receiving updations from neighboring node the node will send the control message to neighbors to indicate that the node will ready to receive the packets. This reactive beaconing scheme useful for low traffic network.

Different updation schemes for geographic routing protocols

Periodic Updation

Periodic beaconing scheme updates the location of the nodes in a periodic manner [12]. These periodic updations wastes bandwidth if there is no change during this interval. These updations are more helpful for networks where nodes periodically goes to an active or sleep state. But ad hoc mode does not goes to active or sleep state, it is in idle state before transmission or receiving of a packet.

Reactive updation

In reactive beaconing before a call is made to another node in the network the node needs to update its location information in the location database. This kind of updations are more suitable for low traffic networks [12].

Adaptive updation:

Distance based

In distance based beaconing if a node crosses some distance then those nodes needs to update its information. It has one disadvantage that slow moving node cannot predict location information about fast moving nodes, because the slow moving node send updations more frequently and fast moving node will send only small number of updations [12].

Speed based

To avoid limitation in distance based beaconing scheme the speed based beaconing scheme is used with distance based beaconing. Speed based beaconing scheme used to know the speed and distance of the nodes [12]. The mobility prediction rule is used for this approach. If the speed or distance changes the node will broadcast a beacon packet with speed and direction. This is useful to predict when that node will move out of the transmission range. It has disadvantage that it has more unknown and false neighbors.

The mobility prediction rule is used to predict the location information about other nodes in the network. It will be used to calculate location information based on the updation time, velocity of the node and location information.

The drawback of mobility prediction scheme is shown in Figure 1 if a node A moves from position L1 to L2. In this the transmission range specified as a circle. If a node A enters into another transmission range for some period of time other nodes will not predict the new neighbor node A because no information available about node A.

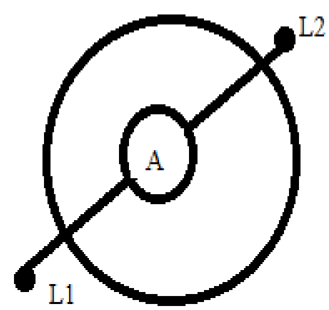

Figure-1. Node A from position L1 to L2

On Demand learning rule Updation

This unknown neighbors and false neighbors will be increased because the new node that enters into the transmission range will not be known by other nodes in the network and the nodes that enters out of the transmission range will be present in the neighbors list, this will cause more inaccurate neighbors.

This will be avoided by on demand learning rule i.e. if a new node enters into the transmission range on hearing the data transmission from new neighbor the node will send a beacon updation to all other nodes. This will be more useful to reduce unknown neighbors.

The false neighbors ratio reduced by setting timeout interval for beacon updation, if the node will not send a beacon updation for a particular timeout period the nodes location information will be deleted from the neighbors list it will reduce the false neighbors. This will be shown in Figure 2 that is when a node A moves from one transmission range into another the node B on hearing transmission from node A it will updates its neighbors list by triggering beacon packets.

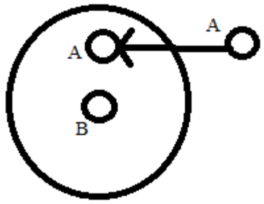

Figure-2. Node A moves into transmission range of node B.

This on-demand learning rule updation are more suitable for networks for highly dynamic network with less inaccurate neighbors ratio. This will also increase the packet delivery ratio[11].

Result

The analysis of different beaconing scheme shows that adaptive beaconing with on-demand learning rule provides higher packet delivery ratio also when the speed of a node increases than other beaconing scheme [11,12]. This results are taken from the analysis of different beaconing scheme on highly dynamic ad hoc network.

Conclusion and Future Work

Periodic beaconing are useful for networks where node periodically goes to a sleep or active state. Reactive beaconing scheme useful for low traffic network where a small number of senders. Adaptive updation scheme useful for highly dynamic network but with many inaccurate neighbors. Adaptive beaconing with on demand learning rule updation scheme useful for highly dynamic networks with less inaccurate neighbors and high packet delivery ratio and it is scalable by maintaining only information about neighbor instead of the entire network nodes. In this the beacon overhead also reduced more by broadcast beacon packets only there is a change in the network.

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