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Efficient Location Updates for Frequently Changing Local Topology in Manet's

Harish. B
Department of CSE,
Dr. Ambedkar Institute of Technology,
Bengaluru, 560056, India,
harishb5234@gmail.com

Siddaraju
Department of CSE,
Dr. Ambedkar Institute of Technology,
Bengaluru, 560056, India,
siddaraju@dr-ait.org

Abstract: *In geographic routing, nodes need to maintain up-to-date positions of their immediate neighbors for making effective forwarding decisions. Periodic broadcasting of beacon packets that contain the geographic location coordinates of the nodes is a popular method used by most geographic routing protocols to maintain neighbor positions. In the Adaptive Position Update (APU) strategy for geographic routing, which dynamically adjusts the frequency of position updates based on the mobility dynamics of the nodes and the forwarding patterns in the network. APU is based on two simple principles: nodes whose movements are harder to predict update their positions more frequently and nodes closer to forwarding paths update their positions more frequently. We add some more cases to improve the performance of APU in terms of packet loss or drop and improved delivery rate and updated local topology at the nodes in the network.*

Keywords: *MANET, Mobility Prediction, On Demand Learning, Geographic routing*

1. Introduction

In recent years MANET has gained popularity and lots of research is being done on different aspects of MANET. It is an infrastructure less network having no fixed base stations. MANET is characterized by dynamic topology low bandwidth and low power consumption. All the nodes in the network are moving i.e. topology of the network is dynamic.

MANET is the new emerging technology which enables users to communicate without any physical infrastructure regardless of their geographical location, that's why it is sometimes referred to as an infrastructure less network. An ad-hoc network is self-organizing and adaptive. Device in mobile ad-hoc network should be able to detect the presence of other devices and perform necessary set up to facilitate communication and sharing of data and service.

Due to the mobility of wireless hosts, each host needs to be equipped with the capability of an autonomous system, or a routing function without any statically established infrastructure or centralized administration. The mobile hosts can move arbitrarily and can be turned on or off without notifying other hosts.

Position updates are costly in many ways. Each update consumes node energy, wireless bandwidth, and increases the risk of packet collision at the medium access control (MAC) layer. Packet collisions cause packet loss which in turn affects the routing performance due to decreased accuracy in determining the correct local topology (a lost beacon broadcast is not retransmitted). A lost data packet does get retransmitted, but at the expense of increased end-to-end delay.

1.1 Related Work

In geographic routing, the forwarding decision at each node is based on the locations of the node's one-hop neighbour's and location of the packet destination as well. A forwarding nodes therefore needs to maintain these two types of locations.

Many works, e.g. GLS[8], Quorum System[3], have been proposed to discover and maintain the location of destination. However, the maintenance of one-hop neighbour's location has been often neglected. Some geographic routing schemes, e.g. simply assume that a forwarding node knows the location of its neighbour's. While others, e.g.,[2][5][7] uses periodical beacon broadcasting to exchange neighbour's locations. In the periodic beaconing scheme, each node broadcasts a beacon with a fixed beacon interval.

If a node does not hear any beacon from a neighbour for a certain time interval, called neighbour time-out interval, the node considers this neighbour has moved out of the radio range and removes the out dated neighbour from its neighbour list. The neighbour time-out interval often is multiple times of the beacon interval.

2. EXISTING SYSTEM

In the Existing system, a novel beaconing strategy for geographic routing protocols called [1] Adaptive Position Updates strategy (APU). APU incorporates two rules for triggering the beacon update process.

Mobility Prediction (MP)

This rule adapts the beacon generation rate to the frequency with which the nodes change the characteristics that govern their motion (velocity and heading). The motion characteristics are included in the beacons broadcast to a node's neighbours. The neighbours can then track the node's motion using simple linear motion equations. Nodes that frequently change their motion need to frequently update their neighbours, since their locations are changing dynamically. On the contrary, nodes which move slowly do not need to send frequent updates. A periodic beacon update policy cannot satisfy both these requirements simultaneously, since a small update interval will be wasteful for slow nodes, whereas a larger update interval will lead to inaccurate position information for the highly mobile nodes.

In Mobility Prediction[1] rule, upon receiving a beacon update from a node i, each of its neighbour's records node i's current position and velocity and periodically track node i's location using a simple prediction scheme based on linear kinematics. Based on this position estimate the neighbours can check whether node i is still within their transmission range and update their neighbour list accordingly. The goal of the MP rule is to send the next beacon update from node i when the error between the predicted location in the neighbours of I and node i's actual location is greater than an acceptable threshold called *Acceptable Error Range (AER)*.

On Demand Learning (ODL)

The MP rule[1] solely, may not be sufficient for maintaining an accurate local topology. Consider the example illustrated in Fig. 1, where node A moves from P1 to P2 at a constant velocity. Now, assume that node A has just sent a beacon while at P1. Since node B did not receive this packet, it is unaware of the existence of node A. Further, assume that the AER is sufficiently large such that when node A moves from P1 to P2 the MP rule is never triggered. However, as seen in Fig.1 node A is within the communication range of B for a significant portion of its motion. Even then, neither A nor B will be aware of each other. Now, in situations where neither of these nodes is transmitting data packets, this is perfectly fine since they are not within communicating range once A reaches P2. However, if either A or B was transmitting data packets, then their local topology will not be updated and they will exclude each other while selecting the next hop node. In the worst-case, assuming no other nodes were in the vicinity, the data packets would not be transmitted at all.

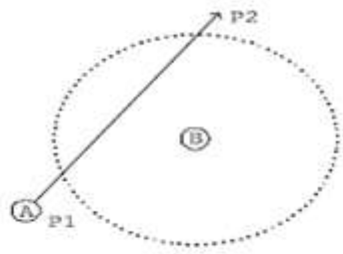

Figure 1. *Drawback of MP rule*

This is precisely what the *On- Demand Learning (ODL)* rule aims to achieve. According to this rule, whenever a node overhears a data transmission from a *new* neighbour, it broadcasts a beacon as a response. By a *new* neighbour, we imply a neighbour who is not contained in the neighbour list of this node. In reality, a node waits for a small random time interval before responding with the beacon to prevent collisions with other beacons.

Fig. 2(a) illustrates the network topology before node A starts sending data to node P. The solid lines in the figure denote that both ends of the link are aware of each other. The initial possible routing path from A to P is A-B- P. Now, when source A sends data packets to B, both C and D receive the data packet from A. As A is a new neighbour of C and D, according to the ODL rule, both C and D will send back beacons to A.

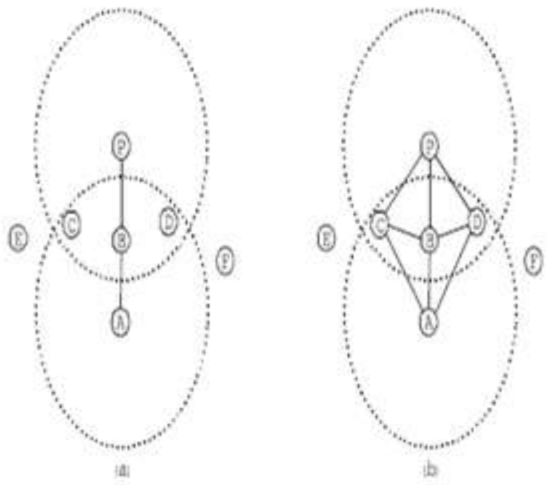

Figure 2. *ODL rule*

As a result, the links AC and AD will be discovered. Further, based on the location of the destination and their current locations, C and D discover that the destination P is within their one-hop neighbourhood. Similarly when B forwards the data packet to P, the links BC and BD are discovered. Fig. 2(b) reflects the enriched topology along the routing path from A to P.

Note that, though E and F receive the beacons from C and D, respectively, neither of them responds back with a beacon. Since E and F do not lie on the forwarding path, it is futile for them to send beacon updates in response to the broadcasts from C and D. In essence, ODL aims at improving the accuracy of topology along the routing path from the source to the destination, for each traffic flow within the network.

2.1 Proposal System to Enhance the Performance of Existing System

Case 1:

Consider the above topology, where nodes A, B, C, D, and E all are in the radio range of each other and F will be out of range.

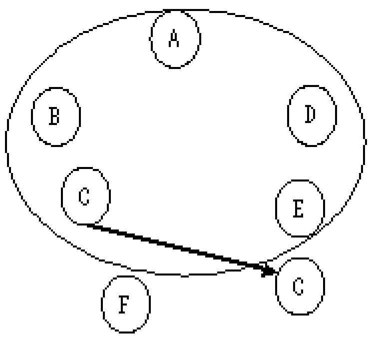

Figure 3. *Node C is moving*

Assume A is the source node and F will be the destination. Suppose A wants to transfer some data to F, then, A will checks its neighbour list for geographic closest to F, it will found that C is the nearest neighbour and closest to F, but C already moves out of radio range of A, B, D and it cannot update its new position to all these nodes who are staying right in the middle, but C can update its new position to E, because it lies in the perimeter of its radio range. Now if A sends the data packet to C, This will lead to packet drop and needs to be recovered.

So, whenever nodes in the perimeter receives a beacon from its existing topology nodes from different location as compared to its previous beacon update with exceeding AER, it should broadcast the same beacon packet to all the nodes in its vicinity i.e. whenever E receives beacon from the C about its new location, E should broadcast the same beacon update to only those nodes which are neighbours of E as well as previous neighbours of C i.e., now E can send the beacon update packet of C to A,B,D. This will somewhat decreases the packet drop and recovery and gives more update topology than APU.

Case 2:

Consider a scenario, where nodes A,B,C within the radio range of each other and everyone knows the exact location of each other and D is reachable from both B and C but not from A. Now A wants to send a packet to D. Suppose the distance between A to B and A to C is same as well as distance between B to D and C to D is also same. At this time A will break the ties by considering some amount of previous beacon updates of both B and C and select the one by considering which ever node is least mobility.

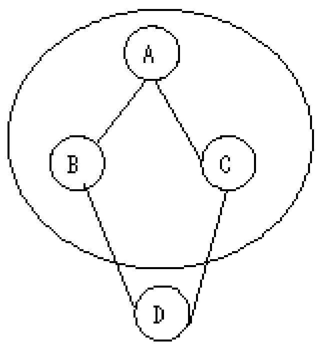

Figure 4. *Same distance along the path*

So whenever selecting a node for packet transmission, better to select low mobility node from its neighbor list rather than high mobility node whose locations frequently updated. This will somewhat decrease packet drop and increase in performance in terms of packet delivery.

3. Conclusion

In this paper, we have identified the need to adopt the beacon update policy employed in geographic routing to the nodes mobility dynamics and the traffic load. The Adaptive Position Update (APU) strategy to address these problems. The APU scheme employs two mutually exclusive rules. The MP rule uses mobility prediction to estimate the accuracy of the location estimate and adapts the beacon update interval accordingly, instead of using periodic beaconing. The ODL rule allows nodes along the data forwarding path to maintain an accurate view of the local topology by exchanging beacons in response to data packets that are overheard from new neighbours. In addition to that we have tried to add two cases where we can improve the performance APU in terms of less packet loss or drop and high packet delivery rate and improved local topology at the neighbours.

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