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Efficient Routing Protocol for Update the Position of Node in MANET

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Abstract

To develop a routing protocol and optimize routing paths in mobile ad hoc networks is the challenge process. Geographic routing has become one of the most suitable routing strategies in wireless mobile ad hoc network mainly due to its scalability. In geographic routing nodes will periodic broadcasting the beacon packet to their neighboring nodes at a equal interval of time that beacon packet contain the nodes present geographic location. In this process it will increase the update cost and performance of the router low. Adaptive Position Update (APU) strategy for geographic routing, which dynamically adjusts frequency of position updates based mobility of nodes and forwarding pattern in the network. Apu is based on two principles i) nodes whose movements are harder to predict update their positions more frequently (and vice versa)(ii) nodes closer to forwarding paths update their positions more frequently (and vice versa). We embed APU into the well known Greedy Perimeter Stateless Routing Protocol (GPSR), shows that APU can significantly reduce the update cost and improve the routing performance in terms of packet delivery ratio and average end-to-end delay. Results confirm that APU significantly reduces beacon overhead without having any noticeable impact on the data throughput of the network. The process of updating node information is performed with the help of NS2 simulation

Keywords

Beacon, Routing protocol, GPSR, Geographic Routing, Broadcast

I. Introduction

In MANET each node is free to move in a subjective way. Subsequently its fundamental for nodes to maintain update position information with the immediate neighbor. Additionally there will be incessant changes in the topology of the mobile nodes. Geographic routing has been widely hailed as the most promising approach to generally scalable wireless routing.[6] It has been a big challenge to develop a routing protocol that can meet different application needs and optimize routing paths according to the topology changes in mobile ad hoc networks. With the growing popularity of positioning devices and other localization schemes geographic routing protocols are becoming an attractive choice for use in mobile ad hoc networks[1][2]. The underlying principle used in these protocols involves selecting the next routing hop from a node's neighbors, which is geographically nearest the destination. Since the forwarding decision is based on local knowledge, it need to create and maintain routes for each destination. By virtue of these aspects, position-based routing protocols are highly scalable and particularly robust to frequent changes in the network topology. The forwarding strategy employed in the aforementioned geographic routing protocols requires the following information 1) the position of the final destination of the packet 2) the position of a node's neighbors. This can be obtained by Grid Location Service[3] and quorum [5.] Nodes are mobile or when nodes often switch off and on which local topology rarely remains static. Hence, it is needed that each node broadcasts its updated location information to all of its neighbors. These location update packets are generally referred to as beacons. Adaptive Position Update Strategy (APU)[4.][7] [8]incorporates two rules for triggering the beacon update process. The first rule uses a simple mobility prediction scheme to estimate when the location information broadcast in the previous beacon becomes inaccurate. The next beacons broadcast only if the predicted error in the location estimate is greater than a certain threshold, thus tuning to update frequency to the mobility of the nodes. The second rule proposes an on-demand learning strategy, whereby beacons are exchanged in response to data packets from new neighbors in anode's vicinity. This ensures that nodes involved in forwarding data packets maintain a fresh view of the local topology. On the contrary, nodes that are not in the region of the forwarding path are unaffected by this rule and do not broadcast beacons.

II. Adaptive Position Update

Listing the assumptions that our work is built upon: (1) all nodes are aware of their own position and velocity, (2) all links are bidirectional, (3) the beacon updates includes current location and velocity of the nodes, and (4)data packets can piggyback position and velocity updates and all one-hop neighbors operate in the promiscuous mode and hence can overhear the data packet[4][8]. Initially each node broadcasts a beacon to its neighbors to inform its presences stating its current location and velocity. Adapting this each node periodically broadcasts its current location information. This information contains positions as beacons is stored at each node. Then each node continuously updates its neighbor list based on its range of transmission, current location and the position updates received from its nearby neighbors. Neighbors which are outside the communication range of nodes are not considered for data forwarding. Subsequently beacon play the important role in building the local topology.APU adapts the beacon update intervals to the mobility of the nodes and the amount of data being forwarded in the neighborhood of the nodes. APU uses two basic principles 1) nodes which are frequently changing its position are updated frequently 2) nodes which are in forwarding path are updated.

A. Mobility Prediction (MP) Rule

This rule adapts the beacon generation rate to the mobility of nodes. Nodes which contains highly mobile need to frequently update their neighbors since their locations are changing dynamically. At the same time, nodes which move slowly do not need to send frequent updates. A periodic beacon update policy could not be satisfy both these requirements simultaneously, since a small amount of periodic update interval will be wasteful for slow nodes, whereas large update interval will lead to form inaccurate position information for the highly mobile nodes. In our scheme, obtaining beacon update from a node i, each of its neighbors, denoted by N(i)set, records its current position and velocity and continues to track node i's location using a simple prediction scheme Based on this position estimate the neighbors N(i), check whether node i is still within their transmission range and update their neighbor list accordingly. Goal of the MP rule is to send the next beacon update from node i when the error between the predicted location is greater than an acceptable value. To achieve this, node i, has to track its own predicted location in its neighbors node N(i).

$$X_p^i = X_l^i + (T_c - T_l) * V_x^i$$

$$Y_p^i = Y_l^i + (T_c - T_l) * V_y^i$$

We use a simple location prediction scheme based on the physics of motion to track a nodes current location.It refers to the location X and velocity information that was broadcast in the previous beacon from node i. Node i uses mobility prediction scheme to keep track of its predicted location among it As shown in

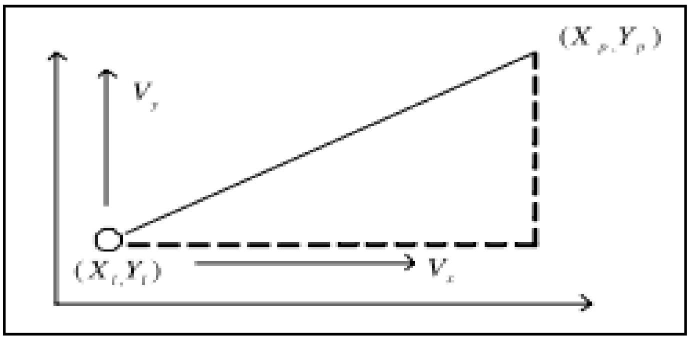

Fig. 1 An example of mobility prediction

Fig. 1, given the position of node i and its velocity along the x and y axes,s neighbors. Let denote the actual location of node It time T, its neighbors, N(i) can estimate the current position of i, by using the above equations:

Table 1: Notation for mobility prediction

Variables	Definition
(X_l^i, Y_l^i)	The coordinate of node i at time T_l (included in the previous beacon)
(V_x^i, V_y^i)	The velocity of node i along the direction of the x and y axes at time T_l (included in the previous beacon)
T_l	The time of the last beacon broadcast.
T_c	The current time
(X_p^i, Y_p^i)	The predicted position of node i at the current time

Table 1 illustrates the notations used in the rest of this discussion. Then node i computes the deviation as follows:

$$D^i_{devi} = \sqrt{(X_a^i - X_p^i)^2 + (Y_a^i - Y_p^i)^2}$$

If the deviation is greater than a certain threshold, know as the Acceptable Error Range (AER), it acts as a trigger for node i to broadcast its current location and velocity as a new beacon node. Threshold of AER is an important parameter that can affect the performance of the APU scheme. The Prediction rule maximize the effective duration of each beacon. For highly mobile node frequent beacons for the support of the rapidly changing topology.

B. On-Demand Learning (ODL) Rule

The MP rule solely may not be sufficient for maintaining an accurate local topology. Consider the example shown in Fig.2, where node A moves at a constant velocity from P1 to P2 . Now, assume that node A has just sent a beacon while at P1. Since node B does not receive this packet, it is unaware of node A. Such that AER is sufficiently large such that the MP rule is never triggered. However, as seen in Fig. 2 node A is within the communication range of node B for a significant portion If either A or B was transmitting data packets, their local topology will not be updated most often and they will exclude each other while selecting the next hop node. [4]In the worst-case, assuming no other nodes were in the nearby range, the data packets would not be transmitted at all here.

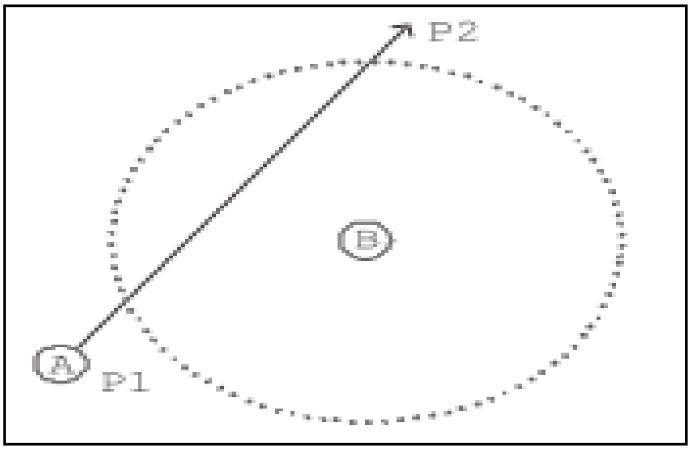

Fig 2. Illustrate drawback of MP rule

To maintain a more accurate local topology devise a mechanism in those regions of the network . This is precisely On-Demand Learning (ODL) rule aims to achieves this. As the name suggests, a node broadcasts beacons packet on-demand, i.e. in response to data forwarding node that occur in activities involve the vicinity of that node. According to this rule, whenever a node overhears a data transmission from anew neighbor, it broadcasts a beacon as a response. Node waits for a small random time interval before responding with the beacon to prevent collisions with other beacon .location updates are piggybacked on the data packets and that all nodes operate in the promiscuous mode, which allows to overhear all data packets transmitted in their vicinity.[7] In addition, since the data packet contains the location of the final destination, any node that overhears data packet also checks its current location and determines if the destination is within its transmission range.
The ODL rule allows active nodes that are involved in data forwarding to enrich their local topology beyond the basic set. Fig. 3a illustrates the network topology before node A starts sending data to node P.

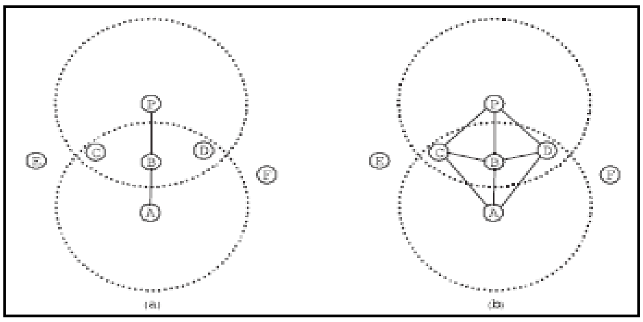

Fig. 3 An example illustrating the ODL rule.

The solid lines in the figure denote that both ends of the link are aware of each other. The initial routing path from A to P is A-B-P.

When source A sends a data packets to B, both C and D receive the data packet from A. As noted A is a new neighbor of C and D, according to the ondemand rule, both C and D will send back beacons to A. As a result, the links AC and AD will be discovered further for further processing. Then based on the location of the destination and their current locations, C and D discover that the destination P is within their one-hop neighbor of node. Same way when B forwards the data packet to P, the links BC and BD are discover Fig. 3(b) reflects the enriched topology along the routing path from A to P. Note that E and F receive beacons packet from C and D, respectively, neither of them respond back with a beacon. Since E and F not lie on the forwarding path, it is need 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

III. Performance Evaluation

The metrics have been chosen in order to evaluate the routing protocols. The following three metrics capture the most basic overall performance of Routing protocols studied in this paper

1) Packet delivery Ratio is the defined as number of packets successfully transmitted between source and destination Fig 4a shown increases ratio as compared to periodic beaconing.

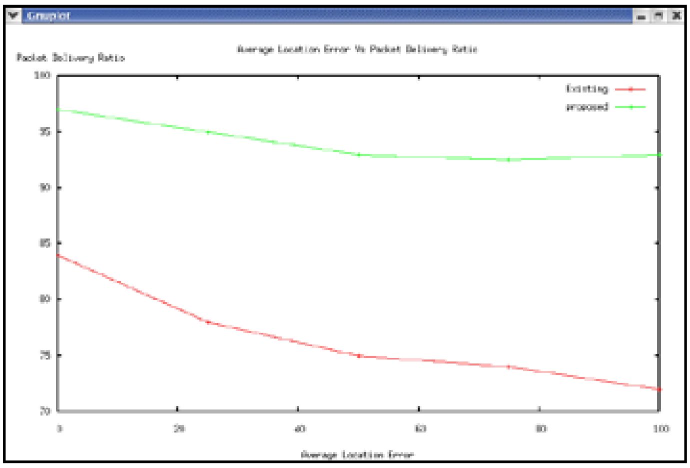

Fig. 4a: packet delivery ratio

2) Average End-to-End delay of data packets (E2E Delay).The end-to-end delay is defined as time between the point in time the source want to send a packet and the moment the packet reaches it destination. in Fig 4b decrease the delay while performing in GPSR protocol.

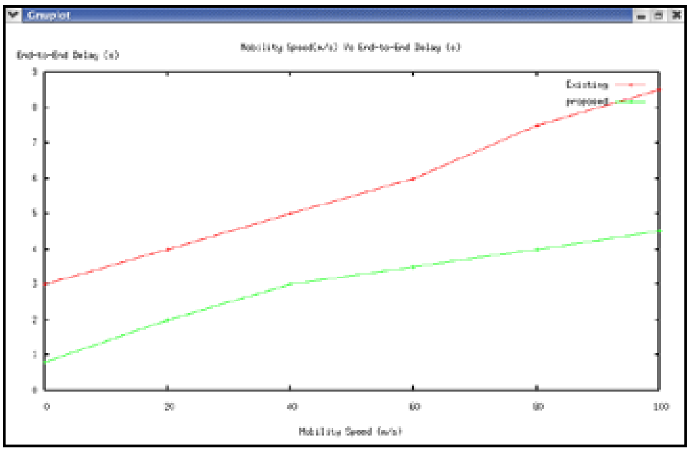

Fig. 4b: End to End delay

3). Beacon overhead is evaluated depends on sending and receiving beacon packet.

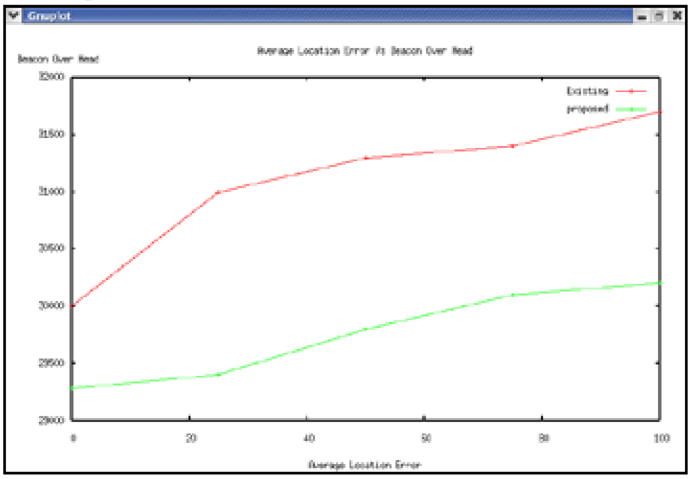

Fig. 4c Beacon overhead

Fig. 4c shown that it decrease the overhead as compare in existing periodic broadcasting method

IV. Conclusion

In this paper, we have identified the need to adapt the beacon update policy employed in geographic routing protocols to the node mobility and the traffic load . Adaptive Position Update (APU) strategy evaluate these. The MP rule uses mobility prediction to estimate the accuracy of the location estimate and adapts the beacon update interval . The ODL maintain an accurate view of the local topology APU Scheme for dynamically adjust the frequency for beacon update by using GPSR protocol for geographic routing. Future work includes the analysis of various geographic routing protocols using the above prediction scheme for beaconing and to find optimal protocol parameters such as optimizedprotocol which shows multi path and self adaptive on demand protocol for for future analysis.

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