Volume 5, Issue 4, 2015 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Achieving Efficient Geographic Routing Via Adaptive Position Update and Mobility Based Forwarding Node Selection Schemes

Preeti*
M. Tech, CSE Deptt., IITM,
Murthal, Haryana, India

Deepender Dhull
AP, CSE Deptt, IITM,
Murthal, Haryana, India

Swati Dhull
AP, ECE Deptt, TCM,
Gannaur, Haryana, India

Abstract— Position information of the nodes is primary requirement in geographic routing. Forwarding nodes are selected among neighbors based on their location. Each node should be aware of its neighbors' location at the time of data transfer condition. Hence each node should update its location information through a message called beacon. Existing mechanisms invokes periodic beacon update scheme which consumes the network resources such as energy and bandwidth specifically when the network traffic is high it creates packet loss in the network leads to retransmission of data packet causing additional delay and energy consumption. It is necessary to regulate the frequency of each node's beacon update process. It should follow the beacon update frequency adaptively based on mobility and its forwarding topology or pattern instead of fixed ones. This work proposes the novel scheme of Adaptive Position Update (APU) including two rules named Mobility Prediction Rule (MP) and on demand Route Learning Rule (ODL).) nodes whose movements are harder to predict update their positions more frequently (and vice versa), and nodes closer to forwarding paths update their positions more frequently (and vice versa). This work contributes Mobility based forwarding node selection scheme to reduce the beacon overhead further. Performance of the proposed technique is conducted using Network Simulator. Proposed scheme achieves lesser over overhead than existing schemes.

Keywords— GPS, AODV, DSR, GLS, GPSR, APU

I. INTRODUCTION

With the growing popularity of positioning devices (e.g. GPS) and other localization schemes , geographic routing protocols are becoming an attractive choice for use in mobile ad hoc networks. The underlying principle used in these protocols involves selecting the next routing hop from amongst a node's neighbours, which is geographically closest to the destination. Since the forwarding decision is based entirely on local knowledge, it obviates the need to create and maintain routes for each destination. By virtue of these characteristics, position-based routing protocols are highly scalable and particularly robust to frequent changes in the network topology. Furthermore, since the forwarding decision is made on the fly, each node always selects the optimal next hop based on the most current topology. Several studies, have shown that these routing protocols offer significant performance improvements over topology-based routing protocols such as DSR and AODV .

The forwarding strategy employed in the aforementioned geographic routing protocols requires the following information: (i) the position of the final destination of the packet and (ii) the position of a node's neighbours. The former can be obtained by querying a location service such as the Grid Location System (GLS) or Quorum. To obtain the latter, each node exchanges its own location information (obtained using GPS or the localization schemes discussed in [1]) with its neighbouring nodes. This allows each node to build a local map of the nodes within its vicinity, often referred to as the local topology. However, in situations where nodes are mobile or when nodes often switch off and on, the local topology rarely remains static.

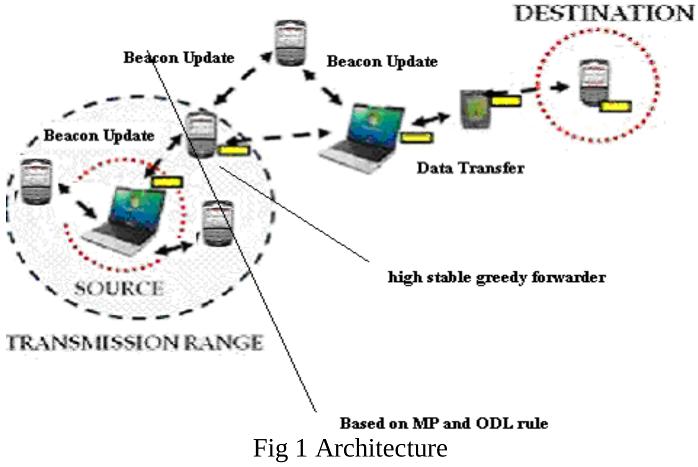

Fig 1 Architecture

Hence, it is necessary that each node broadcasts its updated location information to all of its neighbours. These location update packets are usually referred to as beacons. In most geographic routing protocols (e.g. GPSR) beacons are broadcast periodically for maintaining an accurate neighbour list at each node.

Position updates are costly in many ways. Each up-date 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. Clearly, given the cost associated with transmitting beacons, it makes sense to adapt the frequency of beacon updates to the node mobility and the traffic conditions within the network, rather than employing static periodic update policy. For example, if certain nodes are frequently changing their mobility characteristics (speed and/or heading), it makes sense to frequently broadcast their updated position. However, for nodes that do not exhibit significant dynamism, periodic broadcasting of beacons is wasteful. Further, if only a small percentage of the nodes are involved in forwarding packets, it is unnecessary for nodes which are located far away from the forwarding path to employ periodic beaconing because these updates are not useful for forwarding the current traffic.

II. LITERATURE REVIEW

Quanjun Chen[1] proposes 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: 1) nodes whose movements are harder to predict update their positions more frequently (and vice versa), and (ii) nodes closer to forwarding paths update their positions more frequently (and vice versa).The benefits of APU are further confirmed by undertaking evaluations in realistic network scenarios, which account for localization error, realistic radio propagation, and sparse network.

Brad Karp[2] proposes Greedy Perimeter Stateless Routing (GPSR), a novel routing protocol for wireless datagram networks that uses the *positions* of routers and a packet's destination to make packet forwarding decisions. GPSR makes *greedy* forwarding decisions using only information about a router's immediate neighbours in the network topology. When a packet reaches a region where greedy forwarding is impossible, the algorithm recovers by routing around the *perimeter* of the region. By keeping state only about the local topology, GPSR scales better in per-router state than shortest-path and ad-hoc routing protocols as the number of network destinations increases. Under mobility's frequent topology changes, GPSR can use local topology information to find correct new routes quickly. Under GPSR, packets are marked by their originator with their destinations' locations. As a result, a forwarding node can make a locally optimal, greedy choice in choosing a packet's next hop. Specifically, if a node knows its radio neighbours' positions, the locally optimal choice of next hop is the neighbour geographically closest to the packet's destination. Forwarding in this regime follows successively closer geographic hops, until the destination is reached. The main advantage is that with respect to the path length, the end-to-end hops of GPSR are the largest due to the usage of perimeter mode which leads to increased latency. The major disadvantage is that the neighbour finding using beacon update incurs high overhead.

Michele Zorzi[4] proposes Geographic Random Forwarding is based on the assumption that sensor nodes have a means to determine their location and that the positions of the final destination and of the transmitting node are explicitly included in each message. In this scheme, a node which hears a message is able (based on its position toward the final destination) to assesses its own priority in acting as a relay for that message. All nodes who received a message may volunteer to act as relays and do so according to their own priority. This mechanism tries to choose the best positioned nodes as relays. In addition, since the selection of the relays is done a posterior, no topological knowledge or routing tables are needed at each node, but the position information is enough. Geographic routing is used here to enable nodes to be put to sleep and waken up without coordination and to integrate routing, MAC, and topology management into a single layer. MAC scheme based on these concepts and on collision avoidance and report on its energy and latency performance. The proposed scheme performs significantly better for sufficient node density. The overhead in this scheme is very high.

Paolo Casari[5] proposes Geographic forwarding in wireless sensor networks (WSN) has long suffered from the problem of by passing "dead ends". In this paper, we approach the problem of dealing with dead ends in a novel way that allows us to guarantee the delivery of packets to the sink without requiring the overhead and the inaccuracies incurred by "planar" methods. Our solution, termed ALBA–R for Adaptive Load-Balanced Algorithm, Rainbow version, is a simple, distributed scheme that is remarkably resilient to localization errors and independent of whether the network topology is modelled by a unit disk graph or not. The design of ALBA–R follows recent trends in geographic routing protocol design that demonstrated that remarkable performance improvements can be obtained by applying cross–layer techniques. ALBA–R integrates MAC and routing design. Whenever a node has to forward a packet (a typical network layer duty) all its neighbours are addressed by a relay selection message (RTS-like, to use IEEE 802.11 terminology) which initiates a competition for electing the "best" next hop relay. Each eligible node can locally compute its own suitability to serve as a relay, based on a cross–layer parameter that reflects its current status (e.g., packet error rate, transmission bit rate, residual energy, current queue occupancy, capability of fast and reliable packet forwarding, and combinations thereof) and participates to the competition. The relay node is thus elected based on the value of this parameter that is based on values and methods typical of the PHY, MAC and routing (network) layers combined. This node then receives the data packet, and forwards it to the sink (if the sink is now directly reachable) or to the next best relay. As mentioned, a problem with this simple and very efficient mechanism occurs when a node is not able to find a relay, *i.e.*, it is a dead end. ALBA–R is a simple, completely distributed and low overhead protocol. Overhead is high in this scheme.

III. PROPOSED ALGORITHM

Geographic routing scheme uses Periodical beacon broadcasting to exchange neighbours' 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 outdated neighbour from its neighbour list. The neighbour time-out interval often is multiple times of the beacon interval. Periodic beaconing can cause the inaccurate local topologies in highly mobile ad-hoc networks, which lead to performances degradation, e.g. frequent packet loss and longer delay. The outdated entries in the neighbour list are the major source that decreases the performance.

A. Mobility based forwarding node selection (Highly stable Greedy forwarding)

In Mobile Ad-hoc Networks if forwarding nodes have high mobility, may chances to make local topology inaccuracy. If the node involved in the forwarding path node moves frequently then there is the situation of frequent beacon update is required which leads to network traffic in turn packet collision. Hence it is required to select the nodes with low mobility which means selection of stable node as forwarder based on its mobility. This project with low mobility based forwarding node selection that improves routing performance more than APU.

Source node finds the distance of each neighbour from itself at particular time (t). After certain time (t+T) it finds the distance again. If the difference between the two distances is less than the threshold, the neighbour is considered as highly stable neighbour. To apply highly stable greedy forwarding distance between destination and highly stable neighbours are calculated. The neighbour which is having the minimum distance is selected as forwarder.

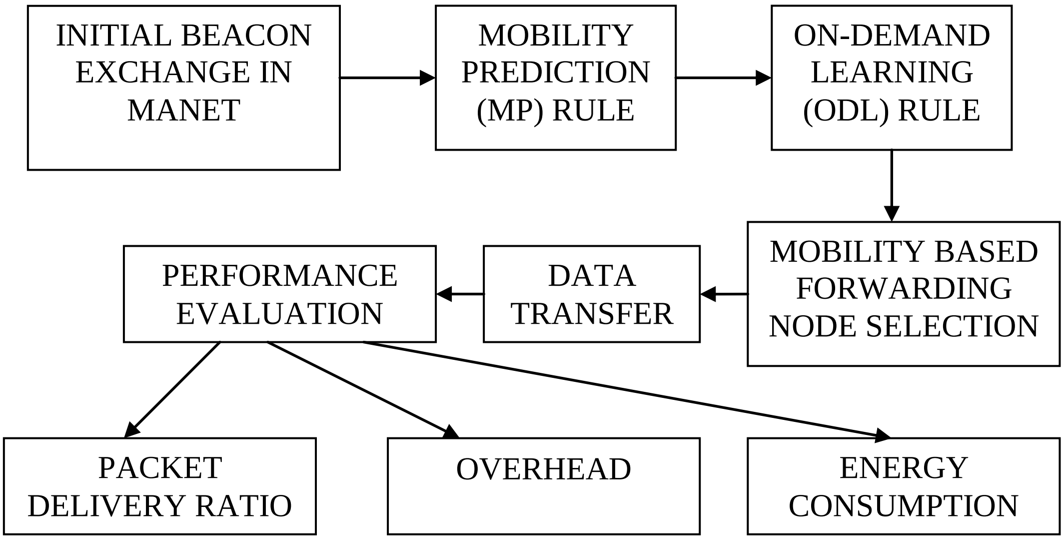

Figure 2 Block diagram to show working of the proposed system.

B. Algorithm for selection of forwarder

Step1: Find distance [d(t)] of each neighbor from source at time T
Step2: Find distance [d(t+T)] of each neighbor from source at time (T+t)
Step3: If {[d(t+T)] ~[d(t)] < Threshold }→ Select the neighbor as high stable link
Step4: Find distance D_{des} between destination and the node having high stable link
Step5: Link having minimum D_{des} is selected as next hop

IV. SIMULATION AND RESULTS

The adaptive position update and mobility based forwarding node selection schemes can be simulated and tested in a simulated environment with the help of a network Simulator tool. To test the performance of our work, we ran simulations using ns-2.35. We use the IEEE 802.11 MAC protocol in RTS/CTS/Data/ACK mode with a channel data rate of varied from 1.0 to 2.0. The packet size used in our simulations is 1500 bytes. The topologies vary according to the different Simulation purposes.

A. Simulation Parameters

SIMULATOR	Network Simulator 2
NUMBER OF NODES	48
INTERFACE TYPE	Phy/WirelessPhy
MAC TYPE	802.11
QUEUE TYPE	Droptail/Priority Queue
QUEUE LENGTH	200 Packets
ANTENNA TYPE	Omni Antenna
PROPAGATION TYPE	Two ray Ground

ROUTING PROTOCOL	DSR
TRANSPORT AGENT	UDP
APPLICATION AGENT	CBR
TRANSMISSION POWER	1.0watts
RECEPTION POWER	1.5watts
SLEEP POWER	0.01watts
IDLE POWER	0.0watts
INITIAL ENERGY	100Joules
SIMULATION TIME	40seconds

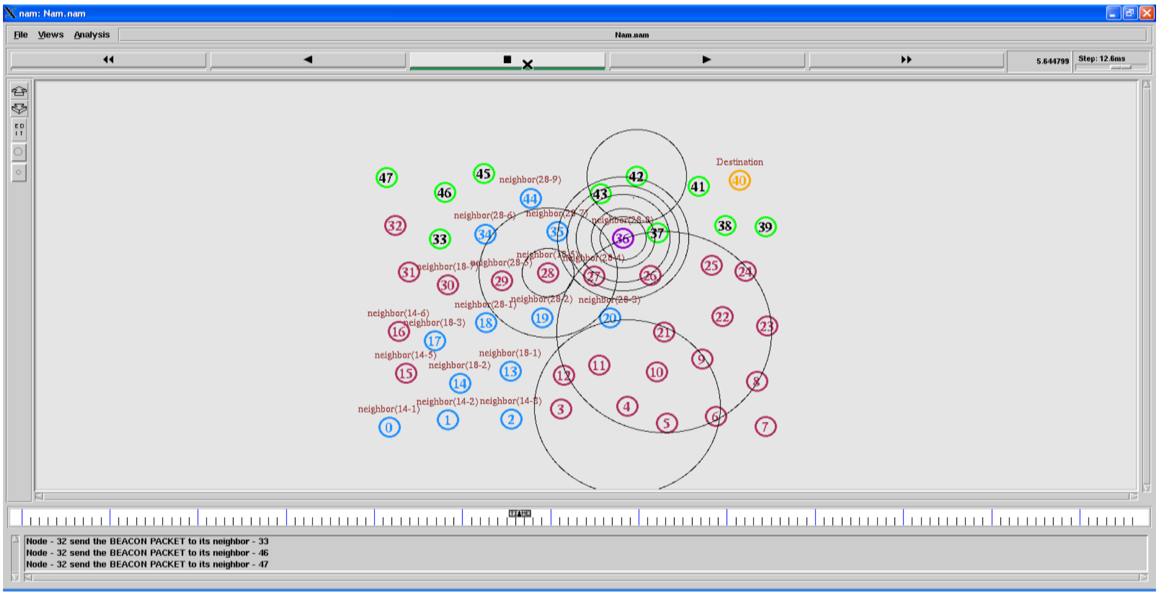

Fig.3 Simulation Screenshot

Performance Evaluation Parameters

PDR

PDR is the proportion to the total amount of packets reached the receiver and amount of packet sent by source. If the amount of malicious node increases, PDR decreases. The higher mobility of nodes causes PDR to decrease.

PDR (%) = Number of packets successfully delivered to destination / Number of packets generated by source node

Energy Consumption

It is the amount of energy consumed by the nodes for the data transmission over the network

Energy Consumption= Sum of energy consumed by each node

Overhead

Overhead = Number of messages involved in beacon update process

From the trace obtained from the data transmission from source to destination, performance metrics such as energy consumption, overhead, and packet delivery ratio are obtained using the awk script. Awk script processes the trace file and produces the result. Using the results obtained from awk script graph is plotted for performance metrics using xgraph tool available in ns-2.

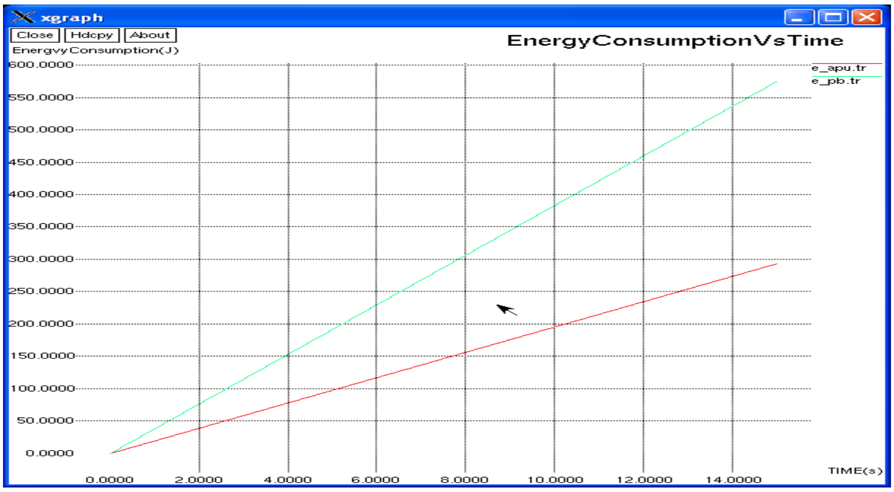

Fig.4 Energy Consumption versus Time

Energy consumption in Periodic beacon scheme is high compared to APU since periodic beacon causes high energy consumption in the nodes. APU saves energy by avoiding unnecessary beacon update and do the beacon update adaptively.

Fig.5 Beacon Overhead versus Time

Beacon overhead in Periodic beacon scheme is high compared to APU due to periodic beacon. APU reduces the beacon overhead by avoiding unnecessary beacon update and only does the beacon update process adaptively.

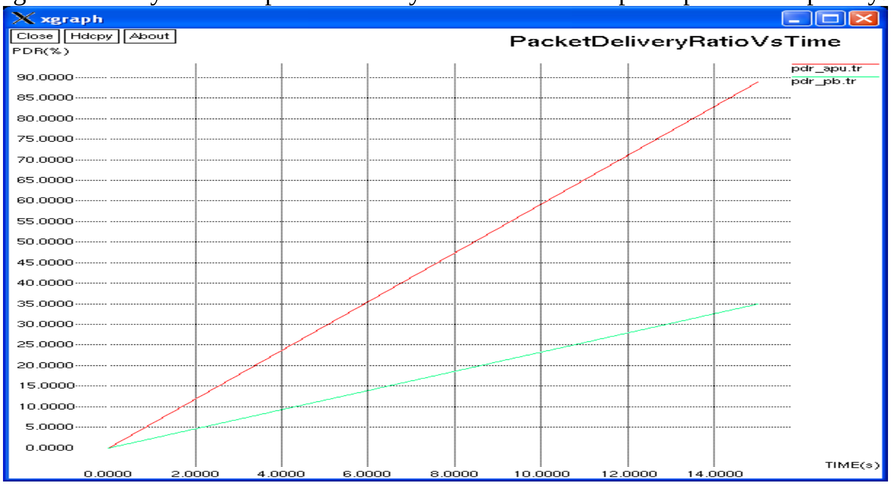

Fig.6 Packet Delivery Ratio versus Time

Packet delivery ratio of APU is high compared to Periodic beacon scheme. Since network traffic in APU is reduced due to adaptive beacon update instead of periodic beacons in the case of periodic beacon scheme. In PB data gets dropped due to high traffic in the network.

V. CONCLUSIONS

In this work, the need to adapt the beacon update is identified and the corresponding policy is employed in geographic routing protocols to the node mobility dynamics and the traffic load. The Adaptive Position Update (APU) strategy is proposed 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. Performance of APU is evaluated using extensive NS-2 simulations for varying node speeds and traffic load. Results indicate that the APU strategy generates less or similar amount of beacon overhead as other beaconing schemes but achieve better packet delivery ratio, less overhead and energy consumption.

REFERENCES

[1] Quanjun Chen, Member, IEEE," "Adaptive Position Update for Geographic Routing in Mobile Ad Hoc Networks", IEEE Transactions on mobile computing,vol.12,No.3,March-2013

[2] B. Karp and H.T. Kung, "GPSR: Greedy Perimeter Stateless Routing for Wireless Networks," Proc. ACM MobiCom, pp. 243-254, Aug. 2000.

[3] L. Blazevic, S. Giordano, and J.-Y. LeBoudec, "A Location Based Routing Method for Mobile Ad Hoc Networks," IEEE Trans. Mobile Computing, vol. 4, no. 2, pp. 97-110, Mar. 2005.

[4] M. Zorzi and R. Rao, "Geographic Random Forwarding (GeRaF) for Ad Hoc and Sensor Networks: Energy and Latency Perfor-mance," IEEE Trans. Mobile Computing, vol. 2, no. 4, pp. 349-365, Oct.-Dec. 2003.
[5] P. Casari, M. Nati, C. Petrioli, and M. Zorzi, "Efficient Non Planar Routing around Dead Ends in Sparse Topologies Using Random Forwarding," Proc. IEEE Int'l Conf. Comm. (ICC), pp. 3122-3129, June 2007.
[6] C. Perkins, E. Belding-Royer, and S. Das, Ad Hoc On-Demand Distance Vector (AODV) Routing, IETF RFC 3561, July 2003.
[7] J. Li, J. Jannotti, D.S.J.D. Couto, D.R. Karger, and R. Morris, "A Scalable Location Service for Geographic Ad Hoc Routing," Proc. ACM MobiCom, pp. 120-130, Aug. 2000.
[8] Z.J. Haas and B. Liang, "Ad Hoc Mobility Management with Uniform Quorum Systems," IEEE/ACM Trans. Networking, vol. 7, no. 2, pp. 228-240, Apr. 1999.
[9] A. Rao, S. Ratnasamy, C. Papadimitriou, S. Shenker, and I. Stoica, "Geographic Routing without Location Information," Proc. ACM MobiCom, pp. 96-108, Sept. 2003.
[10] S. Lee, B. Bhattacharjee, and S. Banerjee, "Efficient Geographic Routing in Multihop Wireless Networks," Proc. ACM MobiHoc, 230-241, May 2005.
[11] Q. Chen, S.S. Kanhere, M. Hassan, and K.C. Lan, "Adaptive Position Update in Geographic Routing," Proc. Int'l Conf. Comm. (ICC '06), pp. 4046-4051, June 2006.
[12] M. Heissenbuttel, T. Braun, M. Walchli, and T. Bernoulli, "Evaluating of the Limitations and Alternatives in Beaconing," Ad Hoc Networks, vol. 5, no. 5, pp. 558-578, 2007.
[13] Y. Kim, R. Govindan, B. Karp, and S. Shenker, "Geographic Routing Made Practical," Proc. Second Conf. Symp. Networked Systems Design and Implementation, pp. 217-230, May 2005.

