Volume 3, Issue 10, October 2013 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Self Adaptive Position Updates Proactive Protocol in Mobile ADHOC Network for Geographic Routing

Prof. P.L.Ramteke[1]
Associate Professor & Head,
Department of Information & Technology,
HVPM's College of Engineering & Technology,
Amravati Maharashtra State, INDIA

Dr.D.N.Chaudhari[2]
Professor & Head,
Department of Computer Science & Engineering,
Jawaharlal Darda Institute of Engg. & Technology,
Yavatmal, Maharashtra, INDIA

Abstract— ***It is a challenge to develop routing protocol that can meet different application needs and optimize routing paths according to the topology change in mobile adhoc networks. In geographic routing, nodes need to maintain up-to-date positions of their immediate neighbors for making effective forwarding decisions. Forwarding decisions are based on only on the local topology; geographic routing protocols. To maintain neighbor positions by most geographic routing protocols, periodic broadcasting of beacon packets method used which contain geographic location of nodes. However, inaccurate local topology knowledge and the outdated destination position information can lead to inefficient geographic forwarding and even routing failure. Proactive local position distribution can hardly adapt to the traffic demand. It is also difficult to pre-set protocol parameters correctly to fit in different environments. The Proposed strategy Adaptive Position Update (APU) can be effectively used in geographic routing, based on two simple principles: (1) nodes whose movements are harder to predict update their positions more frequently (and vice versa), and (2) nodes closer to forwarding paths update their positions more frequently (and vice versa, which dynamically adjusts the frequency of position updates based on the mobility dynamics of the nodes and the forwarding patterns in the network is attractive for update cost and routing performance. We have developed two self-adaptive on-demand geographic routing schemes. The local topology is updated in a timely manner according to network dynamics and traffic demands. Our route optimization scheme adapts the routing path according to both topology changes and actual data traffic requirements. Each node can determine and adjust the protocol parameter values independently according to different network environments, data traffic conditions and node's own requirements. Simulation studies have shown that the proposed routing protocols are more robust and outperform the existing geographic routing protocol. Specifically, the packet delivery latency is reduced almost four times as compared to GPSR at high mobility.***

Keywords— Mobile Ad Hoc Networks, routing path, geographic routing protocol

I. INTRODUCTION

To develop robust routing protocol for dynamic Mobile Ad Hoc Networks is a challenging job. Geographic routing protocols are generally more scalable and reliable [1][2] based routing protocols [3][4] with their forwarding decisions based on the local topology. Geographic routing assumes mobile nodes are aware of their own positions through certain positioning system and a source can obtain destination's position through some kind of location service [5]. Demanding with the growing popularity of positioning devices and other localization schemes [6], geographic routing protocols becomes an attractive choice for use in mobile ad hoc networks [7],[8],[9]. An intermediate node makes packet forwarding decisions based on its knowledge of the neighbours' positions and destination's position inserted in the packet header by source. By default, the packets are greedily forwarded to the neighbor that allows for greatest geographic progress to the destination. When no such neighbor exists, perimeter forwarding [1] is used to recover from the local void, in which the packets traverse the face of planarized local topology sub graph by applying the right hand rule until greedy forwarding can be resumed. Although better than topology-based routing, the inaccurate knowledge of local geographic topology and destination position can greatly affect geographic routing performance. To obtain the local geographic topology, each mobile node in current geographic routing protocols [1] periodically broadcasts a beacon containing its position. Such proactive mechanism not only creates a lot of control overhead when there is no traffic, but also results in "outdated" topology knowledge. Additionally, relying on only one-hop topology information in current geographic routings may lead to non-optimal forwarding and blind forwarding. Furthermore, it is hard to preset routing parameters to the correct values for any scenarios, which will impact routing performance. The underlying principle used in these protocols involves selecting the next routing hop from among a node's neighbors, 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 [7], [10] have shown that these routing protocols offer significant performance improvements over topology-based routing protocols. To summarize, our contributions in this work include:

- Analysing effect of outdated position information on the performance of geographic routing.
- Proposing two novel on-demand geographic routing protocols with different schemes to obtain and maintain topology information. One protocol purely relies on hop topology information as other geographic routing schemes; the other one assumes a hybrid scheme which combines geographic and topology-based mechanisms for more efficient routing, while avoiding the performance degradation of conventional geographic routing due to the constraints in *local* view of topology.
- Introducing route optimization schemes. This is the first geographic routing scheme that adapts the path to change of network topology and traffic demand.
- Designing an efficient position distribution mechanism that can adapt its behaviour under different dynamics and according to the routing requirements to reduce control overhead and provide more accurate and updated position information for efficient routing.
- Adapting parameter settings in both protocols according to network environments, data traffics and mobile nodes' own requirements.

The forwarding strategy employed in the aforementioned geographic routing protocols requires the following information: 1) the position of the final destination of the packet and 2) the position of a node's neighbors. To obtain the latter, each node exchanges its own location information 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. Hence, it is necessary that each node broadcasts its updated location information to all of its neighbors. These location update packets are usually referred to as beacons. In most geographic routing protocols (e.g., GPSR [7],[15],[16]), beacons are broadcast periodically for maintaining an accurate neighbor list at each node. But Position updates are costly in many ways; it 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. The propose system include a novel beaconing strategy for geographic routing called Adaptive Position Updates strategy [17].

II. REVIEW AND RELATED WORK

At each node of geographic routing forwarding decision is based on locations of node's one-hop neighbors and other packet destination. The nodes need to maintain these two types of locations. Many works have been proposed to discover and maintain the location of destination. However maintenance of one-hop neighbours' location has been often neglected. Some geographic routing schemes assume forwarding node knows the location of its neighbors. While others e.g., [7], [15], use periodical beacon broadcasting to exchange neighbours' locations. In periodic beaconing scheme, each node broadcasts beacon with fixed interval. If node does not hear any beacon from a neighbor for certain time interval, called neighbor time-out interval, the node considers this neighbor has moved out of radio range and remove the outdated neighbor from its neighbor list. The neighbor time-out interval often is multiple times of beacon interval. Heissen buttel et al. [18] have shown that periodic beaconing can cause the inaccurate local topologies in mobile ad-hoc networks, which leads to performances degradation, i.e. frequent packet loss and longer delay. The proposed several simple optimizations that adapt beacon interval to node mobility or traffic load, including distance-based beaconing (DB), speed-based beaconing and reactive beaconing.

The adaptive position update (APU) strategy proposed in this work which dynamically adjusts the beacon update intervals based on mobility dynamics of nodes and forwarding patterns in the network. The beacons transmitted by nodes contain their current position and speed. Nodes estimate their positions periodically. If the predicted location is different from the actual location, new beacon is broadcast to inform the neighbors about changes in node's mobility characteristics. But an accurate representation of the local topology is particularly desired at those nodes that are responsible for forwarding packets. Therefore APU seeks to increase the frequency of beacon updates at those nodes that overhear data packet transmissions. As a result, nodes involved in forwarding packets can build an enriched view of the local topology. The traditional on-demand routing protocols [3] [4]) often involve flooding in route discovery, which limits the scalability shown in fig.1. To reduce overhead reduces the flooding range by making use of the nodes' position information. Unlike topology-based routing protocols, geographic routing is based on mobile nodes' positions.

Packet collisions cause packet loss which in turn affects the routing performance due to decreased accuracy in determining the correct local topology.

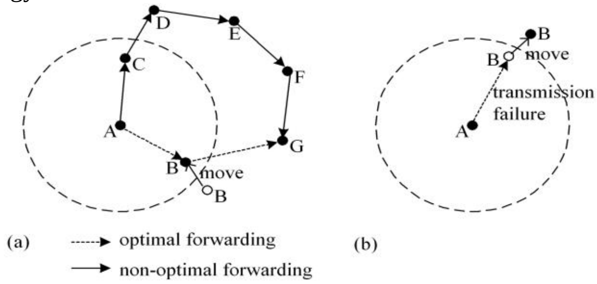

Fig. 1. Negative effects of outdated topology on geographic routing:
(a) Non-optimal routing (b) forwarding failure

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. 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 a static periodic update policy. Example if certain nodes are frequently changing their mobility characteristics such as speed and/or heading, then it makes sense to frequently broadcast their updated position. However for nodes that do not exhibit significant dynamism, periodic broadcasting of beacons is wasteful.

III. ANALYSIS ON IMPACT OF POSITION INACCURACY ON GEOGRAPHIC ROUTING

Fixed-interval beaconing adopted in current geographic routing protocols may result in outdated local topology knowledge at the forwarding node, which leads to *non-optimal routing* and *forwarding failure*. 1) *Non-optimal Routing*. Fig. 1 (a) shows an example of non-optimal routing due to the outdated local topology knowledge. Node B just moved into A's transmission range, which is unknown to A. Without knowing any neighbor closer to the destination G, A will forward the packet to node C then D by using perimeter forwarding. The resulted path has five hops, while the optimal path between A and G should have only two hops after B bridges the void between A and G. 2) *Forwarding failure*. In literature work [1], a node will keep a neighbour's information until timeout even when the neighbor has moved out of its transmission range and the timeout interval is often set as multiple beaconing intervals. Forwarding failure will happen when the node forwards packets to such a "false" neighbor (e.g., Fig. 1 (b)) and result in packet dropping or rerouting [1]. More seriously, before detecting the unreachability, the continuous retransmissions at MAC layer will reduce the link throughput and fairness, and increase the collisions. This will further increase delay and energy consumption.

IV. PROPOSED WORK AND OBJECTIVES

APU incorporates two rules for triggering the beacon update process. The first rule, referred as Mobility Prediction (MP), uses a simple mobility prediction scheme to estimate when the location information broadcast in the previous beacon becomes inaccurate. The next beacon is broadcast only if the predicted error in the location estimate is greater than a certain threshold, thus tuning the update frequency to the dynamism inherent in the node's motion. The second rule, referred as On-Demand Learning (ODL), aims at improving the accuracy of topology along the routing paths between communicating nodes. ODL uses an on-demand learning strategy, whereby a node broadcasts beacons when it overhears the transmission of data packet from new neighbor in its vicinity. This ensures that nodes involved in forwarding data packets maintain more up-to date view of the local topology. On the contrary, nodes that are not in vicinity of forwarding path are unaffected by this rule and do not broadcast beacons very frequently. The objective of this strategy is to remove the drawbacks of other beaconing schemes and to achieve less or similar amount of beacon overhead and better packet delivery ratio, average end-to-end delay and energy consumptions.

V. SELF ADAPTIVE ON DEMAND GEOGRAPHIC ROUTING PROTOCOL

We first propose two Self-adaptive On demands Geographic Routing (SOGR) protocols, and then introduce our route optimization schemes. In both protocols, we assume every mobile node is aware of its own position, a source can obtain the destination's position through some kind of location service, and promiscuous mode is enabled on mobile nodes' network interfaces. In the following presentation, except when explicitly indicated, F represents the current forwarding node, D is the destination, N denotes one of F's neighbors, *posA* is the position coordinates of A and *dis*(*A*,*B*) is the distance between node A and B. *A. Scheme 1: SOGR with Hybrid Reactive Mechanism* In SOGR-HR, we use a geographic and topology-based combined mechanism to reactively search for the next-hop. By incorporating topology-based path searching, information of a larger range topology can be obtained when necessary to build more efficient routing path. *1) Geographic-based greedy forwarding:* Normally F will attempt to forward a packet greedily to a neighbor closest to D and closer to D than itself. With no next hop to D cached buffers the packet first and broadcasts a request message *REQ*(*D, posD, posF , hops*) with *hops* = 1 to restrict the searching range to one-hop neighbors. A neighbor node N closer to D than F will send back a REPLY. F will record N as the next hop to D with transmission mode as *greedy* and unicast the data packet to N. To avoid collisions, N will wait for a backoff period before sending the REPLY and the pending REPLY will be cancelled if it overhears a REPLY from another neighbor closer to D than itself. To make sure the neighbor closer to D responds sooner and suppresses others' REPLYs, the backoff period should be proportional to *dis*(*N,D*) and bounded by the max value *hops*×*Intvalbackoff* , where *Intval backoff* is a protocol parameter, and *hops* = 1 in greedy forwarding. The backoff period is calculated as: *backoff* = *hops* × *Intvalbackoff* × (1 −*dis*(*F,D*) − *dis*(*N,D*) *hops* × *R*), (1)where *R* is the transmission range of mobile nodes.*2) Topology-based recovery forwarding:* F may not have neighbors closer to D, resulting in a local "void". We use a recovery strategy with expanded ring search, which is normally used in path searching in topology-based routing [4] [3].

VI. DESIRED IMPLICATIONS

Instead of periodic beaconing, APU adapts the beacon update intervals to the mobility dynamics of the nodes and the amount of data being forwarded in the neighbourhood of the nodes. This scheme eliminates the drawbacks of periodic beaconing by adapting to the system variations. The simulation results will show that APU can adapt to mobility and traffic load well. APU generates less or similar amount of beacon overhead as other beaconing schemes but achieve better performance in terms of packet delivery ratio, average end-to-end delay and energy consumption. The main reason for all these improvements in APU is that beacons generated in APU are more concentrated along the routing paths, while the beacons in all other schemes are more scattered in the whole network. As a result, in APU, the nodes located in the hotspots, which are responsible for forwarding most of the data traffic in the network have an up-to-date view of their local topology, thus resulting in improved performance.

VII. FUTURE SCOPE

Future work includes utilizing the analytical model to find the optimal protocol parameters (e.g., the optimal radio range), studying how the proposed scheme can be used to achieve load balance and evaluating the performance of the proposed scheme on TCP connections in Mobile Ad hoc Networks.

VIII. CONCLUSION

In this work, we propose two self-adaptive on-demand geographic routing protocols. They adopt different schemes to obtain and maintain local topology information on data traffic demand. One protocol purely relies on onehop topology information for forwarding as other geographic routing schemes; the other one combines both geographic and topology-based mechanisms for more efficient path building. With parameter adaptation schemes, each node can determine and adjust the protocol parameter values independently according to different network environments, data traffic conditions and mobile nodes' own requirements. To alleviate the negative effects of outdated local topology information on geographic routing, we design more efficient position distribution mechanisms to update the local topology knowledge in time and adaptively based on demand. We also develop a set of route optimization schemes in which a forwarding node and its neighbors can collaborate to adapt the path to both topology change and traffic demand. The simulation results show that our protocols can efficiently adapt to different scenarios and perform better than the existing geographic routing protocols. Nearly four times delay reduction has been observed in high mobility case.

REFERENCES

[1] B. Karp and H. T. Kung, "*Greedy perimeter stateless routing for wireless networks*," in *ACM/IEEE MOBICOM*, August 2000, pp. 243–254.

[2] Y. Ko and N. Vaidya, "*Location-aided routing in mobile ad hoc networks*, "in *ACM/IEEE MOBICOM*, August 1998.

[3] C. E. Perkins and E. M. Royer, "*Ad-hoc on-demand distance vector routing*," in *Proc. 2nd IEEE Workshop on Mobile Comp. Sys. and Apps.*, February 1999, pp. 99–100.

[4] D. B. Johnson and D. A. Maltz, "*Dynamic source routing in ad-hoc wireless networks*," *Mobile Computing, T. Imielinski and H. Korth, Eds.,Kluwer*, pp. 153–81, 1996.

[5] J. Li and et al, "A *scalable location service for geographic ad hoc routing,* "in *ACM/IEEE MOBICOM,* 2000, pp. 120–130.

[6] J. Hightower and G. Borriello, "*Location Systems for Ubiquitous Computing*," Computer, vol. 34, no. 8, pp. 57-66, Aug. 2001.

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

[8] 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.

[9] Y. Ko and N.H. Vaidya, *"Location-Aided Routing (LAR) in Mobile Ad Hoc Networks,*" ACM/Baltzer Wireless Networks, vol. 6, no. 4,pp. 307-321, Sept. 2002.

[10] T. Camp, J. Boleng, B. Williams, L. Wilcox, and W. Navidi "*Performance Comparison of Two Location Based Routing Protocols for Ad Hoc Networks*," Proc. IEEE INFOCOM,pp. 1678-1687, June 2002.

[11] D. Johnson, Y. Hu, and D. Maltz, "*The Dynamic Source Routing Protocol (DSR) for Mobile Ad Hoc Networks for IPv4*", IETF RFC 4728, vol. 15, pp. 153-181, Feb. 2007.

[12] C. Perkins, E. Belding-Royer, and S. Das, "*Ad Hoc on-Demand Distance Vector (AODV) Routing*", IETF RFC 3561, July 2003.

[13] 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.

[14] Z.J.Haas , "Ad *Hoc Mobility Management with Uniform Quorum Systems*," IEEE/ACM Trans. Networking, vol. 7, pp. 228-240, Apr. 1999.

[15] A. Rao, S. Ratnasamy, C. Papadimitriou, S. "Geographic Routing without Location Information," Proc. ACM MobiCom, pp. 96-108, Sept. 2003.

[16] Bhattacharjee, and S. Banerjee, "*Efficient Geographic Routing in Multihop Wireless Networks,*" Proc. ACM MobiHoc,pp. 230-241, May 2005.

[17] 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.

[18] T. M. Walchli, and T. Bernoulli "*Evaluating of Limitations and Alternatives in Beaconing,Ad Hoc Networks",* vol. 5, no. 5, pp. 558- 578, 2007.

[19] 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.

BIOGRAPHY

Prof. P.L.Ramteke[1] is Associate Professor & Head of Department of Information Technology. He has completed Bachelor & Master Degree of Engineering in Computer Science & Engineering from SGB Amravati University Amravati, M.Phil in Computer Science and pursuing Ph.D in Mobile Technology. He is member of various technical Institutions like IEI, ISTE, and IAPT etc. He has published various research papers in journals. His research interests include Mobile Computing, Modelling & Simulation & Expert System.

Dr.D.N.Choudhary[2] is Professor & Head of Department of Computer Science & Engineering at Jawaharlal Darda Institute of Engineering & Technology, Yavatmal. He is Master of Engineering in Computer Science & Engineering and Ph.D in Computer Science Ph.D supervisor in Computer Sci. & Engineering at SGB Amravati University, Amravati (Maharashtra)-INDIA and member of various National & International technical Institutions like ISTE, IEI etc .He has published many research papers in various National, International reputed Journals and Expertise in Data Mining, Mobile Technology.

