ISSN 2321-807X
VOLUME 12 NUMBER20
JOURNAL OF ADVANCES IN CHEMISTRY

AN APU BASED UPDATION SCHEME WITH ADDED SECURITY MEASURES

B.NEETHTHI AADITHIYA, N.SUGANTHI
Assistant professor /ECE, M.Kumarasamy College of Engineering, Karur.
neeththiaadithiyab.ece@mkce.ac.in
Assistant professor /ECE, M.Kumarasamy College of Engineering, Karur.
Suganthin.ece@mkce.ac.in

ABSTRACT

Routing with the use of location information has become one of the most suitable routing strategies in wireless mobile ad hoc network mainly due to its scalability. Position information of the nodes is primary requirement in geographic routing. Nodes for forwarding are selected among neighbors based on their location. Each node in the network should be aware of its neighbor's location in order to maintain the accuracy of local topology. Hence updation of location information through beacon is necessary. Existing mechanisms invokes periodic beacon update scheme which in turn consumes the network resources specifically when the network traffic is high it leads to packet loss and at times causes retransmission of data packet .In this work, adaptive position update is proposed which dynamically adjusts the beacon updation frequency according to the varying network conditions. APU is based on two simple principles nodes which moves with greater speed and nodes closer to forwarding paths update their positions more frequently (and vice versa).

INDEX TERMS –

Beacon information, Overhead, Node Mobility, Energy Consumption, and local topology.

INTRODUCTION

Ad hoc networks consist of mobile or stationary nodes that communicate over wireless links. There is neither fixed infrastructure to support the communication nor any centralized administration or standard support services. Nodes can self-organize dynamically in an arbitrary and temporary manner allowing people and devices to seamlessly communicate in areas with no pre-existing communication infrastructure; therefore, the nodes themselves act as routers as well [1]. There are different scenarios and environments where MANETs are employed; some of them include: military battlefields, disaster recovery and emergency rescue operations, Vehicular Ad Hoc Networks (VANETs) and Aeronautical Networks. One way of communication in such networks might seem to simply flood the entire network. However, the fact that power and bandwidth are scarce resources in such networks of low powered wireless devices necessitates more efficient routing protocols.

Therefore, there are a number of routing protocols proposed for MANETs, which can be categorized into two different approaches: *topology-based* and *position-based* routing. Topology-based routing protocols use information about the links. That is, information about the paths is maintained and routes are established based on the information of the links that exist in the network. These protocols can be further divided into *proactive, reactive* and *hybrid* approaches. Proactive protocols are more similar to the classical routing strategies such as distance-vector routing. Proactive protocols constantly discover routes and maintain them in routing tables. Hello packets are exchanged periodically by which nodes get informed of changes in the topology. This results in low route discovery latencies at the cost of imposing high overhead due to occupying the bandwidth for route maintenance.

On the other hand, reactive protocols discover and maintain routes only if needed, which results in initial delays until the routes are set up. However, the advantage of this type of routing is low overhead in terms of processing and memory along with minimum power consumption and lower bandwidth requirements. In case of topology changes, which result in link failures, route error messages are generated. Although this will be only done for the routes in use, the problem of imposing traffic at times of topology changes is not solved completely. Ad-Hoc On-Demand Distance Vector Routing (AODV) and Dynamic Source Routing (DSR) are examples of reactive protocols.

To provide more efficiency and scalability, a third group of protocols was introduced as hybrid routing protocols, which is a combination of both reactive and proactive approaches. However, the above mentioned limitations are still in place. An example of a hybrid routing protocol is Zone Routing Protocol (ZRP).

Position-based or geographic routing approaches were introduced [2] to eliminate some of the limitations of the topology-based protocols in MANETs. These routing protocols rely on having one piece of information and that is the nodes' physical location information. Thus, it is necessary for nodes to obtain their coordinates either by using a *location service* such as GPS or other types of positioning services .By employing position information, geographic routing protocols do not need to establish and maintain routes, thereby eliminating routing table construction and maintenance. Thus there arises a necessity that each node has to update their current position using beacon packets. The location updation becomes more challenging, as the local topology in MANET changes dynamically. With the use of location information for routing the need for routing table construction and maintenance are eliminated. The forwarding of packet to destination is based on location information and one hop neighbor. If there is no one hop neighbor closer to the destination then forwarding strategy fails. Recovery strategies are introduced to deal with such failures.

The positioning devices such as Global Positioning System (GPS) and Grid Location Systems (GLS) are used in the geographical routing protocols to find the exact location of nodes. GLS serve nodes with location information by splitting entire network into small squares known as grids. A common beaconing approach is proactive beaconing to maintain the location information and local topology. All the nodes in the network update the location information to all other nodes using beacon packets. Thus the proactive mechanisms results in higher overhead in highly dynamic networks. If the nodes in the network move frequently then their updates must be transferred to the neighbors. On the other hand slow nodes need not update their location frequently. Thus there is an increased necessity for different location updation schemes

LITERATURE REVIEW

a. Periodic Beaconing

In the periodic beacon based location updation schemes the beacon information about the nodes is transferred periodically [3]. The beacons in turn contain the location information of the particular node at the particular instance of time and the last seen position and also about the mobility nature with which it is moving.

The beacon update about a node thus conveys the entire location information about the node and thus routing of data is made easier with the gained beacon update. Periodic beaconing is the earliest and most commonly used beacon updation scheme and it is employed in the GPSR geographical routing for MANETs. The main advantage is the accurate local topology information and which in turn increases the overhead.

b. Beaconless Routing

Beaconless routing was introduced to reduce the drawbacks of periodic beaconing. The periodic beaconing consumes more bandwidth. As bandwidth is a scarce resource it has to be utilized effectively. Thus in the proposed [4] beaconless routing some assumptions are made that each node is aware of its own position with the help of the location servers.

The basic principle behind the scheme is that if a node wants to transfer a packet to destination, first it finds the position of the destination and it stores the information about the route and geographical coordinates in its packet header [5].

When a node on the route to destination receives a packet it has to replace the previous node position with its current position. This scheme does not suit well for the highly dynamic network conditions and it does not provide the accurate local topology information. This reduces the use of scarce resources and also reduces the interference with the regular data transmission.

c. Distance Based Beaconing

In the highly mobile and dynamic adhoc network environment the periodic beaconing will result in the excessive overhead [6]. Thus the alternative distance based beaconing was proposed. Initially all the nodes will update its location and after some time when the node moves away from the radio range of its one hop neighbors it has to update.

The basic principle behind the scheme is that if a node wants to transfer a packet to destination, first it finds the position of the destination and it stores the information about the route and geographical coordinates in its packet header. When a node on the route to destination receives a packet it has to replace the previous node position with its current position. This reduces the use of scarce resources and also reduces the interference with the regular data transmission.

d. Speed Based Beaconing

Distance based beaconing applied in the geographical routing results in high overhead when the network is highly dynamic. Thus the speed based beaconing was proposed [7].The updation about the location information of a node is dependent on the speed with which it travels.

A node determines its beacon interval from a predefined range with value chosen being inversely proportional to its speed. The timeout is calculated to avoid outdated updation information. The timeout interval for a neighbor is k times its beacon interval. Every time when a beacon packet arrives it checks for the timeout. Thus it avoids outdated routing. It also suffers from the same disadvantage as distance based beaconing i.e., fast nodes are not aware of the slow nodes existence.

e. Time Based Beaconing

In time based beaconing, every node updates its neighbor's information per T time unit. The unit time is the network parameter and it is easy to determine under the dynamic network topology. According to the on demand data transmission the beacon interval time T is determined [8] [9]. There is need for a node that maintains the local clocks to commence the beaconing.

The main benefit of this scheme is the minimum computational cost. The main disadvantage in the time based beaconing is that it incurs unnecessary beaconing per T time interval under low mobility network. This kind of beaconing does not consider the data communication delay so; it is not suitable for delay sensitive applications. In addition, it is easy to implement under various MANET environments, but it results in unnecessary signaling traffic degrades the routing performance.

f. Reactive Beaconing

Reactive beaconing location updation is a on demand beaconing scheme. In this scheme the beacon packets which conveys the location information is transferred only on request. The request packets (REQ) are transmitted by a node if it needs to forward a packet.

Data packet forwarding is accomplished with the request packet and beacon packet exchange. This results in certain amount of delay for each transmission [10]. The major advantage of this scheme is the accurate local topology.

Table 1. Comparisons of different beacon update schemes

Location Updation Schemes	**Advantages**	**Limitations**
Periodic updation	Accurate local topology information and Loop free routing	Increased overhead due to periodic beaconing. Periodic beaconing induces frequent packet loss and longer data delay in highly dynamic network.
Distance based beacon updation.	Memory is reduced as the node information is removed when it moves away say k times "d"	Because of infrequent updates fast nodes are not aware of the slow nodes. Slow nodes may have many outdated neighbors
Speed based location updation	Overcomes the disadvantage of distance based beaconing-reduces the no of outdated neighbors for slow mobility nodes.	Suffers same as distance based beaconing – fast node may not detect the slow node existences.
Reactive beaconing	Reduces the communication cost as it limits the rate of beaconing.	It results in data packet loss.
Time based beacon updation.	Minimum computational cost	Not suitable for delay sensitive applications. Incurs unnecessary beaconing per T time interval under low mobility network.

PROBLEM STATEMENT

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 neighbor's location at the time of data transfer condition. Hence each node should update its' location information through a message called beacon. The common beaconing scheme design for location updation to get the accurate local topology in MANETs requires to meet various mobility model scenarios and also should offer the optimized beacon overhead which is more challenging, since each node has its own mobility model .the general approach for distributing the beacon packets which carry the location information us the proactive beaconing and it induces high overhead even when the traffic is not so high.

Whereas the decrease in beaconing interval will cause an increase in the routing overhead which will provide good results for fast moving nodes but not for the slow nodes. It is not possible to decide the common beaconing interval for all nodes as each node employs different mobility models. 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. Thus in order to provide efficient location updation information to the neighbors the scheme which adapts to the mobility dynamics of node has been proposed.

PROPOSED SYSTEM

Adaptive position update

The beacon contains the location information about the neighboring node is stored at each node and which is used to represent the neighbour list for the node. Thus beacons play an important role in maintaining the accurate local topology. The above updation schemes resulted in high overhead and higher energy consumption. In order to overcome those drawbacks Adaptive position update has been proposed [11][12][13]. As name implies the beacon packets carrying the location information about the nodes are updated adaptively according to the motion of nodes in the network. The adaptive position update suits well for the dynamically varying network.

The APU is based on the mobility dynamics of the node and the nodes which moves frequently will update their location information to through beacons frequently and the nodes which are one hop neighbors to the forwarding path will update its beacons with no cost of mobility prediction .the APU makes use of two simple rules namely mobility prediction and on demand learning rule.

a. Mobility Prediction Rule

Mobility prediction rule adapts the beacon generation rate according to the mobility dynamics of the node. The transmitted beacons by the nodes contain the current location and velocity with which it is travelling. Nodes estimate their positions periodically by employing a simple mobility prediction. Prediction is based on linear kinematics. The following Fig.1 illustrates the Mobility Prediction of node *i* given the position and its velocity along the x and y axes at time T_l , its neighbors can estimate the current position of *i*, by using the following equations:

$$X_p^i = X_l^i + (T_c - T_l) * V_x^i \quad (1)$$

$$Y_p^i = Y_l^i + (T_c - T_l) * V_y^i \quad (2)$$

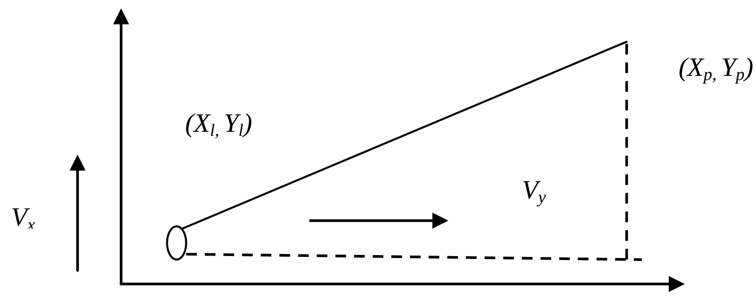


Fig 1: An example of mobility prediction.

Table 2. Notations for Mobility Prediction.

Variables	***Definitions***
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

The next beacon broadcast is triggered only when the difference between the predicted location and the location obtained by the GPS servers are greater than the certain threshold called acceptable error range (AER). The MP rule, thus, tries to maximize the effective duration of each beacon, by broadcasting a beacon only when the predicted position information based on the previous beacon becomes inaccurate. This in turn extends the effective duration of the beacon for nodes that moves slowly, and results in reduced number of beacons. Further, highly mobile nodes can broadcast frequent beacons to ensure that their neighbors are aware of the rapidly changing topology. Node i, then computes the deviation as follows

$$D^i_{devi} = \sqrt{((X^i_a - X^i_p)^2 + (Y^i_a - Y^i_p)^2)} \quad (3)$$

b. On Demand Learning Rule

Mobility prediction rule solely may not be sufficient to maintain the accurate local topology information about the nodes in the networks. Consider the example illustrated in the Fig.2. Where the node A initially updates its beacons when it is at P1 and the node B does not receives the beacon. Now the node A starts moving to the location P2 with the constant velocity and the AER is sufficiently large and the MP rule is never triggered. Thus the nodes A and B are not aware of each other. This is not a problem when the nodes do not involve in the data transmission but when the nodes involve in data transfer then the there is a problem with the accurate local topology.

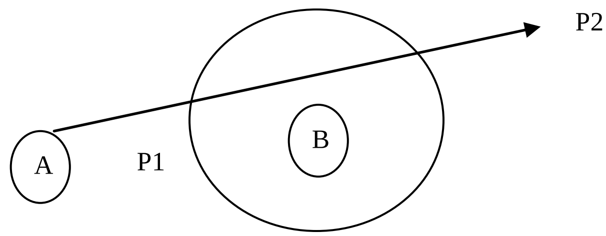


Fig 2: An example illustrating a drawback of the MP rule.

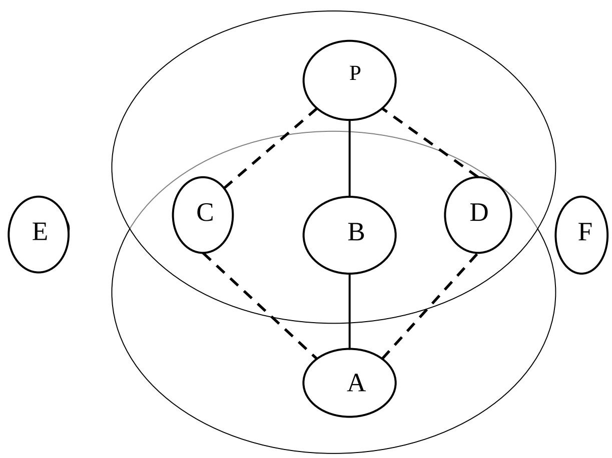
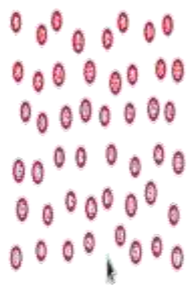


Fig 3: An example illustrating the ODL rule.

Hence there arises the need to develop the rule to maintain the accurate local topology information. This is what the on demand learning rule aims to achieve. According to the ODL rule whenever the node overhears the data transmission from the new neighbor which is not in its neighbor list it will transfer the beacon packet to the nodes without the cost mobility prediction. The one hop neighbors of a node which transfers data will operate in the promiscuous mode and can overhear the data transferred.Fig.3 illustrates the network topology and The solid lines indicates the data transmission between node A and P through B i.e., A-B-P. When the node B receives the data nodes C and D can overhear the data and checks whether the destination is within the radio range and if it is a new neighbor adds it to the neighbor list and the nodes C and D transfers the beacons to the P. Thus there occurs the new path A-C-P and A-D-P which is expressed as dotted lines in Fig.3. The node E and F does not overhears as their not the one hop neighbors of node B.

SIMULATION RESULTS

The simulation is performed using the network simulator ns2 (v2.33) with a network containing an average of 45 stationary nodes (numbered 0 to 44). We chose a rectangular network area to obtain a longer path. The movement of nodes follows the improved random waypoint mobility model. The routing protocol used is DSR



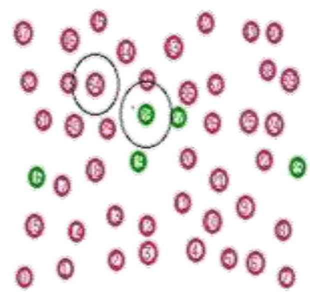


Fig 4a: Initial periodic beacon update. **Fig 4b: Adaptive beacon update.**

The Fig 4a: shows the initial periodic beacon updation of nodes to all its neighbors informing its initial location and Fig 4b: shows the adaptive position update of nodes.

Packet Delivery Ratio

PDR is the proportion to the total amount of packets reached the receiver and amount of packet sent by source. The high mobility of nodes causes PDR to decrease. The following Fig 5: shows the results obtained for PDR under varying mobility. It is obvious that the PDR ratio increases with time and outperform the existing approaches.

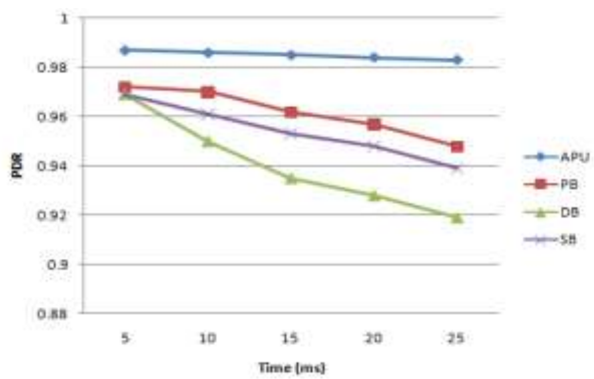


Fig 5: Packet Delivery Ratio.

Energy Consumption

The Energy Consumption depends on the amount of energy consumed by the sensors for the data transmission over the network. Fig 6: shows that the energy consumed by each node is less compared to the existing approaches.

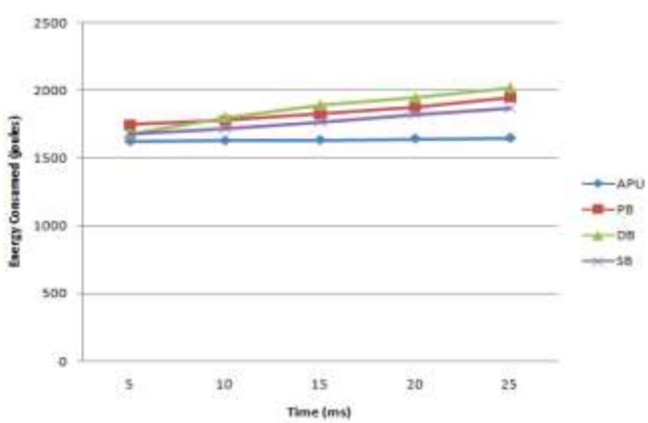


Fig 6: Energy consumption.

ENHANCEMENT

The proposed technique has its own number of limitations; one such limitation includes poor security. To improve the security AES Encryption [14] and collaborative attack detection scheme namely REAct system [15] for reducing packet drops can be used. AES encryption method is used to avoid the eaves drop attack by offering the encrypted data transfer. The REAct system tries to identify individual misbehaving nodes in MANETs that refuse to forward packets because of Selfishness or maliciousness. The source knows the identity of every intermediate node on the path and a pair wise key can be used to protect the communication between the source and a intermediate node. This makes the network and data transfer secure.

CONCLUSION

Designing of a routing protocol for mobile adhoc network is a challenging task, due to the dynamic topology and its error prone shared radio channel. The position updation of nodes plays a major role in geographic routing. In literature we discussed about the existing updation schemes and their drawbacks. As a solution to these drawbacks adaptive position update has been proposed and its features are explained in detail. Performance of APU routing scheme is evaluated using extensive NS-2 simulations for varying node speeds and traffic load. Results indicate that the APU routing scheme generates less amount of beacon overhead as other beaconing schemes but achieve better packet delivery ratio, less overhead and energy consumption.

ACKNOWLEDGMENT

I would like to thank authors, mentioned in the references which are citied below for their valuable research works which helped me to gain knowledge.

REFERENCES

[1] M. Frodigh, P. Johansson, P. Larsson,"Wireless ad hoc networking-The art of networking without a network", Ericsson Review, Vol. No.4, pp. 248-263, 2000.

[2] Ivan Stojmenovic and University of Ottawa,"Position-Based Routing in Ad Hoc Networks", IEEE Communications Magazine,pp. 2-8, 2002.

[3] Ivan Stagmenovic, "Home Agent Based Location Update and Destination Search Schemes in Ad Hoc Networks", 1999.

[4] S. Lee, B. Bhattacharjee, and S. Banerjee, "Efficient geographic routing in multihop wireless networks," Proc. 6th ACM international symposium on Mobile ad hoc networking and computing - MobiHoc '05, pp.230-241, 2005.

[5] M. Heissenbuttel, T. Braun, T. Bernoulli et al. "BLR: Beacon-Less Routing Algorithm for Mobile Ad-Hoc Networks", in Computer Communications, vol,27, pp. 1076-1086, July 2004.

[6] J. Ho and I. F. Akyildiz, "Mobile user location update and paging under delay constraints," ACM/Baltzer J. Wireless Networks, Vol. 1, No. 4, pp. 413–425, 1995.

[7] Q. Chen, S. Kanhere, M. Hassan, and K.Lan, "Adaptive Position Update in Geographic Routing", IEEE International Conference on Communications, pp. 4046–4051, 2006.

[8] G. Y. Lee and Y. Lee, "Numerical analysis of optimum timer value for timebased location registration scheme," IEEE Commun. Lett., Vol. 6, No. 10, pp. 431–433,2002.

[9] C. Rose, "Minimizing the average cost of paging and registration: A timer based method," Wirel Netw, Vol. 2, No. 2, pp. 109–116, 1996.

[10] X. Shi and K. Liu, "A contention-based beaconless geographic routing protocol for mobile ad hoc networks", Third International Conference on Communications and Networking, pp. 840 – 843, 2008.

[11] Quanjun Chen, Salil S. Kanhere, and Mahbub "Adaptive Position Update for GeographicRouting in Mobile Ad Hoc Networks", IEEE transactions on mobile computing, vol. 12, no. 3, march 2013.

[12] Goo Yeon Lee, Yong Lee, and Zygmunt J.Haas, "Hybrid Location-Update Scheme for Mobile Networks", IEEE Transactions On Vehicular Technology, Vol. 58, No. 1, pp.338-348, 2009.

[13] S. H. Shah and K. Nahrstedt, "Predictive location-based QoS routing in mobile ad hoc networks," IEEE International Conference on Communications, Vol.2, pp. 1022-1027, 2002.

[14] *Advanced Encryption Standard (AES)*. FIPS. November 23, 2001.http://csrc.nist.gov/publications/fips/fips197/fips-197.pdf.

[15] M. Khatib, K. Masmoudi, and H. Afifi, "An on-demand key establishment protocol for MANETs," International Conference on Advanced Information Networking and Applications (AINA), 2006.