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Adaptive Beaconing Technique for Efficient Routing in Mobile Ad Hoc Networks

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Abstract: ***Mobile Ad hoc network(MANET) consists of dynamically changing network, where mobile nodes moving randomly. Routing protocols are used for the data transfer from source to the destination. In MANET nodes communicates with each other by forming a temporary network. In geographic routing[14], different adaptive beacon broadcast techniques are used to get appropriate neighbor list and transfer of data from source to destination. This paper illustrates the routing in MANETs with the help of different beacon update strategies and different performance parameters that affect the routing.***

Index Terms: ***beacon, MANET, geographic routing, routing protocols***

I. INTRODUCTION

Geographical routing[14] works on principal of routing data on the basis of the positions of the nodes in the network. In wireless networks nodes are changing their locations very randomly. Node movements are very unpredictable and therefore they can't form any fix infrastructure. Each node in a network has to maintain a rich neighbor list, which acts as routers and help in data transfer. In Mobile ad hoc networks neighbor list is maintained by broadcasting a beacon packet.

In Mobile ad hoc networks different beaconing techniques are present, according to the node mobility. In geographic routing[14], communication takes place through intermediate neighbors which are acting as a router. As periodic broadcast of beacons is not efficient, beacon broadcast interval is decided in each beaconing technique. Adaptive beaconing techniques play an important role for efficient routing in mobile ad hoc networks. In this paper we have used Adaptive position update(APU)[1] technique for adjusting the beacon interval. A dynamic beaconing technique APU is evaluated using NS2 simulator. The routing performance parameters such as, average energy consumption, beacon overhead and routing overhead are calculated for APU.

II. RELATED WORK

In Mobile ad hoc networks geographic routing is used for the communication. Geographic routing use locations of the nodes for transmission of the data from source to the destination. Many location sensing techniques are proposed to maintain the locations of the nodes such as GLS[23], Quorum System[24].Different beaconing techniques have been proposed for routing in wireless networks such as periodic beaconing, speed based beaconing, distance based beaconing.

In periodic beaconing[10] technique, beacons are broadcast consistently after a fix time period. Each periodic broadcast will consume more node energy and also cause more beacon overhead. As mobile ad hoc network consist of dynamically moving nodes, each node moving with random speed, so frequent beacon broadcast is not efficient. In speed based[10] beaconing speed of each node is considered while broadcasting a beacon. As node movements are random beacon broadcast intervals are adjusted according to the speed of the node. According to this technique a fast moving node will broadcast a beacon more frequently while, a slow moving node will broadcast a beacon less frequently with the help of node time out interval. But fast moving nodes are unaware of the slow moving nodes as they broadcast beacons after long time.

In distance based beaconing[10] technique, beacon broadcast is depends upon the distance travelled by each node. A beacon is broadcast when node travels a fixed distance d. A fast moving node will travel distance d more frequently and accordingly broadcast a beacon. A slow moving node will travel a distance d less frequently and accordingly broadcast a beacon. But for the slow moving nodes neighbor list is not rich as that of fast node because many neighbor nodes may have change their positions. In Adaptive position update technique[1], drawbacks of above three techniques are overcome. This technique broadcast a beacon according to the node mobility and on demand also. According to this technique data transfer will take place through optimal path.

III. PROJECT WORK

The proposed system use an adaptive beaconing technique known as Adaptive Position Update (APU)[1]. In this technique a beacons is broadcast according to the nodes changing mobility and dynamic nature of the network. In this work we have made certain assumptions regarding nodes in the network, given as, all nodes are interconnected by the bidirectional links, after each beacon broadcast nodes will get a updated neighbour list and all nodes are aware of their respective positions and velocity. APU works on two rules namely MP rule[1] and ODL[1] rule.

Mobility Prediction (MP) Rule-

In Mobile ad hoc networks node position is unpredictable as nodes moves from one location to the other very randomly. According to the MP rule a beacon is broadcast as per the mobility of the nodes in the network. In this rule a beacon broadcast takes place when a node covers a particular acceptable range. In this scenario we can avoid the frequent packet loss.

On Demand Learning (ODL) Rule-

On Demand Learning Rule comes in action when any node transfers a data. In this scenario when a data transfer action is takes place every node in the radio range will respond to the beacon broadcast and update their neighbour list. Thus, if a new neighbour comes in to the radio range in the data sending node then it will get a more updated neighbour list.

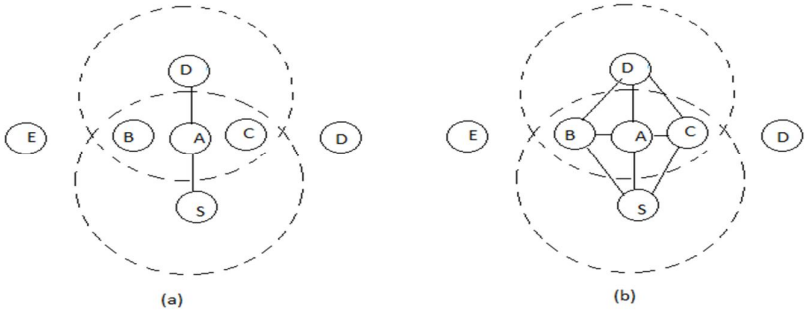

Fig.1.An example of ODL rule

Above example in Fig.1 shows a mobile ad hoc network with some moving nodes. In first part i.e.Fif.1. (a), the routing path is already established between source S and the destination D i.e. S –A –D. Nodes B,C,D,E are new neighbours of the nodes S,A and D. When S transmit a packet to the D, C and B will receive beacon as they are in the vicinity of the node A. So nodes C and B will update their neighbour list as they come to know that nodes S, A, D are in their radio range and one hop neighbours. Now as in Fig.1.(b) Node S can transmit data through different routing path as S –A- D,S –C –D and S –B –D. Here nodes D and E are not in routing path so they are free from beacon overhead as that of routing path. Thus we have evaluated adaptive beaconing technique and according to that calculated different parameters which affects the routing process.

IV. SIMULATION RESULTS

In this paper Dynamic beaconing technique APU is evaluated using NS2 simulator. The routing performance parameters such as, average energy consumption, beacon overhead and routing overhead are calculated for APU. The different performance parameters of APU are compared with other beaconing techniques[10][1], (i)Periodic beaconing, (ii) Distance based beaconing and (iii) Speed based beaconing. The respective graphs and simulation parameters are listed below.

TABLE I
Simulation parameters

No.	Parameter	Value
1	Simulator	NS2
2	Network size	1050x850
3	No. of nodes	5, 10, 15, 20, 25
4	Traffic	CBR
5	Path loss model	Two-ray propagation model
6	Antenna type	Omni-directional
7	Physical layer protocol	PHY 802.11
8	Data link layer	MAC 802.11

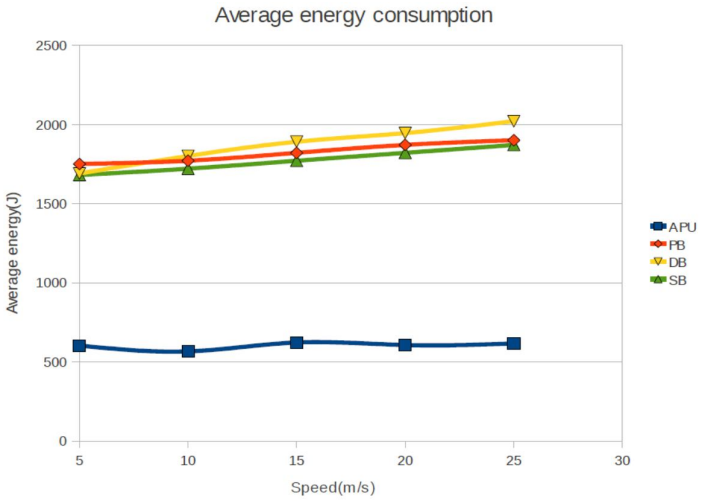

Fig.2: Average energy consumptions Vs Speed for different beaconing techniques.

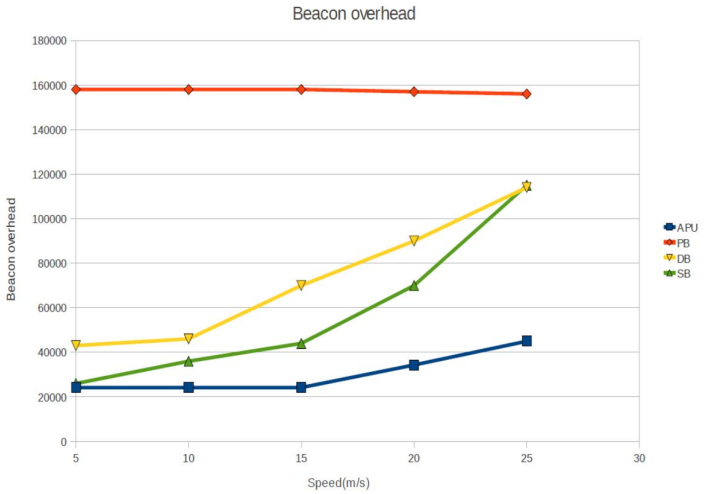

Fig.3: Beacon overhead Vs Speed for different beaconing techniques.

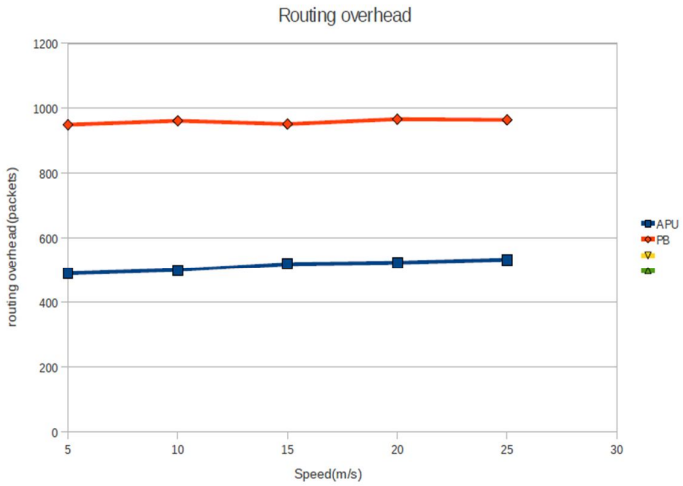

Fig.4: Routing overhead of APU and PB Vs. Speed

V. CONCLUSION

In this paper a dynamic beaconing technique i.e. APU(Adaptive Position Update)[1] is explained. The different routing parameters are evaluated using NS2 simulator. The different performance parameters of APU are compared with other beaconing techniques[10][1], (i)Periodic beaconing, (ii) Distance based beaconing and (iii) Speed based beaconing with the help of routing parameters namely, average energy consumption and beacon overhead and routing overhead. Since APU provides more updated view of local network topology, each node forwarding packet get appropriate next neighbor node. APU forwards packets along optimal path than other techniques therefore it achieves energy consumption. In MANET network topology is dynamic and as speed increases beacon packets increases, so all beaconing techniques shows increasing beacon overhead as increase in speed. As a result of ODL rule APU provides minimum beacon overhead as compare to other techniques. Also, the routing overhead of APU is less than that of PB. The results show that, the APU provides better accuracy and efficient routing in Mobile Ad Hoc Networks.

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