Spvryan's International Journal of Engineering Sciences & Technology (SEST)
ISSN : 2394-0905

STUDY OF GEOGRAPHIC ROUTING PROTOCOLS FOR MANET

Mr.Ankur . O. Bang
Student of Second year M.E. (C.S.E.) HVPM's COET , Amravati (M.S.) .
Sant Gadge Baba Amravati University,Amravati (M.S.), India.
ankur77977@gmail.com

Mr.Prabhakar. L. Ramteke
H.O.D (I.T) and Associate Professor
HVPM's COET , Amravati (M.S.) .
Sant Gadge Baba Amravati University,Amravati (M.S.), India.

Abstract - ***The growing interest in Mobile Ad Hoc Network (MANET) techniques has resulted in many routing protocol proposals. In this paper we focus on study of geographic routing protocols for MANET, in addition to it we also reviewed some ad hoc routing strategies which includes – flat routing, hierarchical and geographic routing. The major part of this paper is about the comparative study of the popular geographic routing protocols which includes - Zone Based Routing, Global Positioning System , Location Aided Routing , DREAM and GPSR protocols.***

Key words - ***Mobile Ad hoc Network (MANET), Geographic Routing Protocols.***

I. INTRODUCTION

With the advance of the wireless communication technologies, small size and high performance computing and communication devices have been increasingly used in daily life and computing industry (e.g., commercial laptops and personal digital assistants equipped with radios). A network, called a *mobile ad hoc network (MANET)* [1], is a self-organizing and self-configuring multi-hop wireless network, where the network structure changes dynamically due to member mobility. Ad hoc networks are very attractive for tactical communication in military and law enforcement. They are also expected to play an important role in civilian forums such as convention centers, conferences, and electronic classrooms. Nodes in this network model share the same random access wireless channel. They cooperate friendly to engage in multiple-hop forwarding. Each node functions not only as a host but also as a router that maintains routes to and forwards data packets for other nodes in the network that may not be within direct wireless transmission range. Routing in ad hoc networks faces extreme challenges from node mobility/ dynamics, potentially very large number of nodes, and limited communication resources (e.g., bandwidth and energy). The routing protocols for ad hoc wireless networks have to adapt quickly to frequent and unpredictable topology changes and must be parsimonious of communications and processing resources. In this paper we mainly study the Geographic Routing protocols , which maily depends on the geographical location of nodes rather than logical address.

In the first part we mention the literature review regarding the Ad- Hoc routing protocols that includes the review of the to three main categories of Ad Hoc routing protocols they are - Flat Routing ,Hierarchical Routing and Geographic Position Assisted / Geographic Routing.

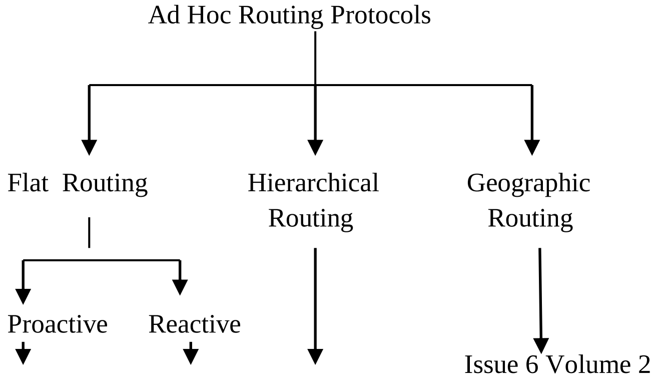
Next section deals with the comparative study of Geographic Routing Protocols which mainly includes the protocols such as - Zone Based Routing, Global Positioning System , Location Aided Routing , DREAM and GPSR protocols.

II. LITERATURE REVIEW

The Ad routing protocols are broadly classified in to three main categories they are - Flat Routing ,Hierarchical Routing and Geographic Position Assisted / Geographic Routing. The scope of this paper is limited to Geographic routing but lets have a brief introduction about each of them ,this will make our study more clear . The following chart lists the sub categories and related routing protocols included in them .

Routing In Flat Network

This protocols fall into two categories, namely, proactive routing (Table-Driven) and Reactive (on-demand routing). Many proactive protocols come from conventional link state routing. On-demand routing, on the other hand, is a new emerging routing philosophy in the ad hoc area. The difference between them and conventional routing



FSR	AODV	HSR	GeoCast
FLSR	DSR	CGSR	LAR
OLSR		ZRP	DREM
TBRPF		LANMAR	GPSR

Fig 1

protocols in that no routing activities and no permanent routing information is maintained at network nodes if there is no communication, thus providing a scalable routing solution to large populations

Hierarchical Routing Protocols

Typically, when wireless network size increase (beyond certain thresholds), current "flat" routing schemes become infeasible because of link and processing overhead. One way to solve this problem and to produce scalable and efficient solutions is hierarchical routing Wireless hierarchical routing is based on the idea of organizing nodes in groups and then assigning nodes different functionalities inside and outside of a group. Both routing table size and update packet size are reduced by including in them only part of the network (instead of the whole), thus control overhead is reduced. The most popular way of building hierarchy is to group nodes geographically close to each other into explicit clusters. Each cluster has a leading node (*cluster head*) to communicate to other nodes on behalf of the cluster. An alternate way is to have implicit hierarchy. In this way, each node has a local scope. Different routing strategies are used inside and outside the scope.

Geographic Position Information Assisted /Geographic Routing Protocols

The advances in the development of Global Positioning System (GPS) nowadays make it possible to provide location information with a precision in the order of a few meters. They also provide universal timing. While location information can be used for directional routing in distributed ad hoc systems, the universal clock can provide global synchronizing among GPS equipped nodes. Research has shown that geographical location information can improve routing performance in ad hoc networks. Additional concern must be taken into account in a mobile environment, i.e., locations may not be accurate by the time the information is used.

Up till now we are clear about different Ad hoc – Routing Protocols The further part includes the comparative study and review of Geographic Routing Protocols .A number of research has been conducted on the geographic routing in MANET but still current result are not appropriated for MANET and geographic routing for MANET is still an open problem for research work. In the next section , we briefly present our comparative study for various Geographic Routing protocols in MANETs.

III. COMPARATIVE STUDY OF GEOGRAPHC ROUTING PROTOCOLS.

A. Geographic Addressing and Routing

Geographic Addressing and Routing (GeoCast) [5] allows to send messages to all nodes in a specific geographical area using geographic information instead of logical node addresses . A geographic destination address is expressed in three ways: point, circle (with center point and radius) and polygon (a list of points, e.g., P(1), P(2),...,P(n-1),P(n), P(1)). A point is represented by geographic coordinates (latitude and longitude) When the destination of a message is a polygon or a circle, every node within the geographic region of the polygon/circle will receive the message. A geographic router (*GeoRouter*) calculates its *service area* (geographic area it services) as the union of the geographic areas covered by the networks attached to it .This service area is approximated by a single closed polygon. GeoRouters exchange service area polygons to build routing tables. This approach builds hierarchical structure (possibly wireless) consisting of GeoRouters. The end users can move freely about the network. Data communication starts from a computer host capable of receiving and sending geographic messages (*GeoHost*). Data packets are then sent to the local *GeoNode* (residing in each subnet), which is responsible for forwarding the packets to the local GeoRouter.

A GeoRouter first checks whether its service area intersects the destination polygon. As long as a part of the destination area is not covered, the GeoRouter sends a copy of the packet to its parent router for further routing beyond its own service area. Then it checks the service area of its child routers for possible intersection. All the child routers intersecting the target area are sent a copy of the packet. When a router's service area falls within the target area, the router picks up the packet and forwards it to the GeoNodes attached to it.. As GeoCast is designed for "group" reception, multicast groups for receiving geographic messages are maintained at the GeoNodes. The incoming geographic messages are stored for a lifetime (determined by the sender) and during the time, they are multicast periodically through assigned multicast address. Clients at GeoHosts tune in to the appropriate multicast address to receive the messages.

B. Location-Aided Routing

The Location-Aided Routing (LAR) protocol presented in [6] is an on-demand protocol based on source routing. The protocol utilizes location information to limit the area for discovering a new route to a smaller "request zone". As a consequence, the number of route request messages is reduced. LAR performs the route discovery through ”limited flooding”, i.e., floods the requests to a *request zone*. Only nodes in the request zone will forward route requests. LAR provides two schemes to determine the request zone.

Scheme1: The source estimates a circular area (*expected zone*) in which Limited Flooding of route request. the destination is expected to be found at the current time. The position and the size of the circle is calculated based on the knowledge of the previous destination location, the time instant associated with the previous location record and the average moving speed of the destination.

Scheme2: The source calculates the distance to the destination based on the destination location known to it. This distance, along with the destination location, is included in a route request massage and sent to neighbors. When a node receives the request, it calculates its distance to the destination. A node will relay a request message only if its distance to the destination is less than or equal to the distance included in the request message

C. Distance Routing Effect Algorithm for Mobility

Distance Routing Effect Algorithm for Mobility (DREAM) [7] is a proactive type routing protocol using location information. It provides distributed, loop-free and multi-path routing and is able to adapt to mobility. It minimizes the routing overhead by using two new principles for the routing update frequency and message lifetime. The principles are *distance effect* and *mobility rate*. With the distance effect, the greater the distance separating two nodes, the slower they appear to be moving with respect to each other. With the mobility rate, the faster a node moves, the more frequently it needs to advertise its new location. Using the location information obtained from GPS, each node can realize the two principles in routing. In DREAM, each node maintains a *Location Table (LT)*. The table records locations of all the nodes. Each node periodically broadcasts control packets to inform all other nodes of its location. The distance effect is realized by sending more frequently to nodes that are more closely positioned. In addition, the frequency of sending a control packet is adjusted based on its moving speed. With the location information stored at routing tables, data packets are partially flooded to nodes in the direction of the destination. The source first calculates the direction towards the destination, then it selects a set of one-hop neighbors that are located in the direction. If such set is empty, the data is flooded to the entire network. Otherwise, the set is enclosed in the data header and transmitted with the data. Only nodes specified in the header are qualified to receive and process the data packet. They repeat the same procedure by selecting their own set of one-hop neighbor, updating the data header and sending the packet out. If the selected set is empty, the data packet is dropped. When the destination receives the data, it responses with an ACK to the source in a similar way. However, the destination will not issue an ACK if the data is received via flooding. The source, if it does not receive an ACK for data sent through a designated set of nodes, retransmits the data again by pure flooding.

D. Greedy Perimeter Stateless Routing

Greedy Perimeter Stateless Routing (GPSR) [8] is a routing protocol that uses only neighbor location information in forwarding data packets. It requires only a small amount of per-node routing state, small routing message complexity and works best for dense wireless networks. In GPSR, beacon messages are periodically broadcast at each node to inform its neighbors of its position, which results in minimized one-hop only topology information at each node. To further reduce the beacon overhead, the position information is piggybacked in all the data packets that a node sends. GPSR assumes that sources can determine through separate means the location of destinations and include such location in the data packet header. A node makes forwarding decisions based on the relative position of destination and neighbors. GPSR uses two data forwarding schemes: *greedy forwarding* and *perimeter forwarding*. The first one is the primary forwarding strategy while the second will be used in the regions where the primary one fails. Greedy forwarding works this way: when a node receives a packet with the destination’s location, it chooses from its neighbors the node that is geographically the closest to the destination and then forwards the data packet to it. This local optimal choice repeats at each intermediate node until the destination is reached. When a packet reaches a dead end, i.e., a node whose neighbors are all farther away from the destination than itself, the perimeter forward is performed.

Further we have provided a table which will give the readers a very clear idea about the major characteristics of different well known Geographic routing Techniques .

Geographic routing Techniques	Major Characteristics
Zone Based Routing	• Use a fix zone based partition scheme to partition the network • Usages a source based routing • Route discovery is done by source based routing request • ZBR has a good scalability • It has low overhead , lower probability of breakage of link • It has a high throughput • But being proactive is consumes higher brandwidth
Global Positioning System	• GPS – free has been developed that provides knowledge of the geometric location of node in a MANET • It uses optimization technique for Route discovery
Location Aided Routing	• Region stability is based on the expected zone as well as request zone • It has minimized the size of the route discovery process by defining the range of the destination node • But control complexity is higher then GPSR
DREAM Protocol	• Data packet is flooded in a restricted directional range without sending a routing packet • This kind of forwarding effectively guarantees delivery • Energy used is notably high, specially when used in large-scale networks • Route discovery is done by using discount factor for RREQ • Packet loss ratio is higher then GPSR
GPSR Protocol	• Data forwarding overhead is low • It include a great amount of traffic • Group Leader is single point of failure • Packet delivery ratio of GPSR is less than EGR

Table 1

IV. CONCLUSION

We have started this work by a simple thing keeping in mind to study the geographic routing protocols for ad – hoc networks . This paper described basic characteristics of geographic routing techniques and we also reviewed the work carried out in the areas of MANET. The paper reviews major techniques in this area and also put the comparative study of few of them. In future there is a need to develop more enhanced and efficient geographic routing protocols which will overcome the drawbacks of the existing protocols . Thus the paper gives a path for further research in this field .

REFERENCES

[1] S. Corson and J. Macker, "Mobile Ad hoc Networking (MANET): RoutingProtocol Performance Issues and Evaluation Considerations," *RFC 2501*, Jan. 1999.

[2] E. M. Royer and C.-K. Toh, "A Review of Current Routing Protocols for Ad-Hoc Mobile Wireless Networks", *IEEE Personal Communications*

[3] C.-K. Toh, "Associativity-Based Routing For Ad Hoc Mobile Networks," *Wireless Personal Communications Journal*, Special Issue on Mobile Networking and Computing Systems, Kluwer Academic Publishers, vol. 4, no. 2, Mar. 1997, pp. 103-139.

[4] D.B. Johnson and D.A. Maltz, "Dynamic Source Routing in Ad Hoc Wireless Networks," *Mobile Computing*, edited by T. Imielinski and H. Korth, Chapter 5, Kluwer Publishing Company, 1996, pp. 153-181.

[5] J. C. Navas and T. Imielinski, "Geographic Addressing and Routing," *Proc. of the Third ACM/IEEE International Conference on Mobile Computing and Networking (MobiCom'97)*, Budapest, Hungary, September 26-30 1997.

[6] Y.-B. Ko and N. H. Vaidya, "Location-aided routing(LAR) in mobile ad hoc networks", in *ACM/IEEE International Conference on Mobile Computing and Networking (Mobicom98)*, 1998, pages 66-75.

[7] S. Basagni, I. Chlamtac, V. R. Syrotiuk, and B. A. Woodward, "A distance routing effect algorithm for mobility (DREAM)," in *ACM/IEEE International Conference on Mobile Computing and Networking (Mobicom98)*, 1998,pages 76 - 84.

[8] B. Karp and H. T. Kung, "GPSR: Greedy Perimeter Stateless Routing for Wireless Networks," *Proc. 6th Annual International Conference on Mobile Computing and Networking (MobiCom 2000)*, Boston, MA, USA, 2000, pp. 243-254.

[9] J. Li, J. Jannotti, Douglas S. J. De Couto, D. R. Karger, R. Morris, "A Scalable Location Service for Geographic Ad Hoc Routing," *ACM Mobicom 2000*, Boston, MA.

[10] S.Corson and J. Macker, "Routing Protocol Performance Issues and Evaluation Considerations," Naval Research Laboratory, Jan.1999.

[11] B. Karp and H. Kung, "GPSR: Greedy perimeter stateless routing for wireless networks," in the Proceedings of the 6th Annual ACM/IEEE International Conference on Mobile Computing and Networking (MOBICOM), pp.243-254, Boston, August 2000.

[12] Ko Y, aidya NHV. Location-aided routing (LAR) in mobile ad hoc networks. Proc. The ACM/IEEE International Conference on Mobile Computing and Networking, 1998. 66{75}.

[13] Ma XL, Sun MT, Zhao G, et al. An efficient path pruning algorithm for geographical routing in wireless networks. IEEE Trans. Vehicuar Technology, 2008, 57(4): 2474{2488}.

[14] Kim Y J, Govindan R, Karp B, et al. Geographic routing made practical. Proc. the 2nd Symposium on Networked Systems Design and Implementation, 2005. 217{230}.

[15] Watanabe M, Higaki H. No-Beacon GEDIR: Location-Based Ad-Hoc Routing with Less Communication Overhead. Proc. the International Conference on Information Technology, 2007

[16] Basagni S, Chlamtac I, Syrotiuk VR. A distance routing e®ect algorithm for mobility (DREAM). Proc. the ACM/IEEE International Conference on Mobile Computing and Networking, 1998.

[17] Y. -C. Tseng, S. -L. Wu, W. -H. Liao and C. -M. Chao, "Location Awareness in Ad Hoc Wireless Mobile Networks,"IEEE Computer, Vol. 34, No. 6, June 2001, pp. 46-52

Mr.Ankur O. Bang

Student of Second year M.E. (Computer Science And Engineering) HVPM's College Of Engineering And Technology , Amravati –Sant Gadge Baba Amravati University ,Amravati (M.S) ,India .

Mr.Prabhakar L. Ramteke

ISSN : 2394-0905

H.O.D (I.T) HVPM’s College Of Engineering And Technology ,Amravati - Sant Gadge Baba Amravati University ,Amravati (M.S),India.