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Geocasting and Multicasting Routing Operation in Mobile Ad Hoc Network

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Abstract: The paper considers**,** the different multicasting routing protocols in wireless mobile Ad hoc network (MANET).An Ad hoc network is composed of mobile nodes without the presence of a wired support infrastructure .In this environment routing/multicasting protocols are faced with the challenge of producing multihop router under host mobility and band constraints. Various approaches and routing protocol have been proposed to address Ad hoc networking problems and multiple standardization effort within the Internet Engineering Task Force, along with academic and industrial research projects.

In recent year, a number of new multicast protocols of different styles have been proposed for Ad hoc networks. Geocast Adaptive Mesh Environment for Routing [GAMER] is one which provides geocast communication in an Ad hoc network and it adapts to the correct network environment by dynamically changing the density of the mesh. Forwarding Group Multicast Protocol [FGMP] is based on the forward group concept and it dynamically refreshes the forward group member using a procedure to On-Demand routing.

The relative strengths, weakness and applicability of each multicast protocol to diverse situations have considered and analyzed. *Index Terms: FGMP Protocol, GAMER Protocol, MANETs, multicast, routing.*

An Ad hoc networks [1] [2], is a dynamically reconfigurable wireless network with no fixed infrastructure (or) central administration. Due to the limited radio propagation range of wireless devices, routers are often "multihop". Applications such as disaster recovery, crowd control, search, rescue and automated battlefields are typical examples of where Ad hoc networks are deployed. Nodes in these networks more arbitrary thus network topology changes frequently and unpredictably. Moreover, bandwidth and battery power are limited. These constraints, in combination with the dynamic network topology make routing and multicasting in Ad hoc networks extremely challenging.

Various multicast protocols have been newly proposed to perform multicasting in Ad hoc network. However, no operation study between them has yet been performed. The comparative analysis of Ad hoc unicast routing protocols has been reported. This paper gives a comparison study of two protocols with different characteristics: GAMER [3] and FGMP [4].

The rest of the paper is organized as follows. Section I presents an overview of the multicast protocols. The section II discusses the future enhancements, and concluding remarks are made in section III.

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I. MULTICAST PROTOCOLS OPERATION REVIEW

In this section, introduction to Ad hoc wireless multicast protocols operation is explained and then the basic operation procedures are described.

A.GAMER (Geocast Adaptive Mesh Environment for Routing)

GAMER goal is a geocast routing protocol is to deliver packets to a group of nodes that are within specified geographical area i.e the geocast region. An Ad hoc network is a set of wireless mobiles nodes (MN) that co-operatively form a network without specific user administration (or) configuration.

GAMER details for Building the mesh

While a source node in GAMER has geocast packets to transmit, a JOIN-DEMAND (JD) packet is periodically sent to the geocast region. GAMER uses JOIN-DEMAND packets, instead of conventional JOIN-

REQUEST (JR) packets of multicast protocols, to insist that all MNs in the geocast region join the geocast group. In other words, the geocast group consists of all MNs that are within the geocast region; that is, GAMER provides geo-broadcasting instead of geo-multicasting. The GAMER protocol ensures that all reachable MNs in the geocast region receive each geocast packet transmitted.

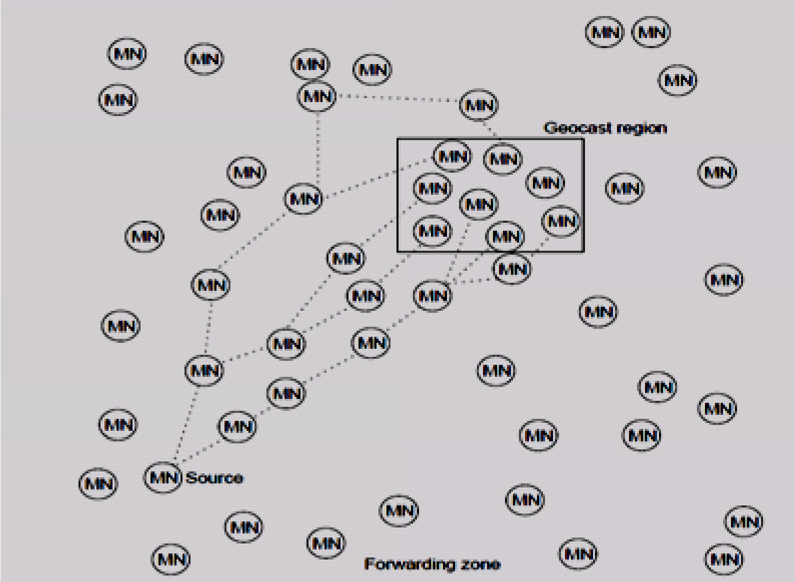

Figure 1: Mesh created by FLOOD FA

GAMER dynamically chooses (based on the current network environment) one of three different forwarding approaches (FAs) to forward JD packets to the geocast region. In one FA, JD packets are flooded throughout the entire Ad hoc network. This FA, which is similar to flooding the JR packets in ODMRP, is called FLOOD. An example of a mesh created by GAMER when using the FLOOD FA is illustrated in Figure 1. In the other two FAs, a forwarding zone is defined to reduce the area to flood the JD packets. In other words, only the MNs within the forwarding zone flood the JD packets. The other two forwarding approaches are called CORRIDOR FA and CONE FA.

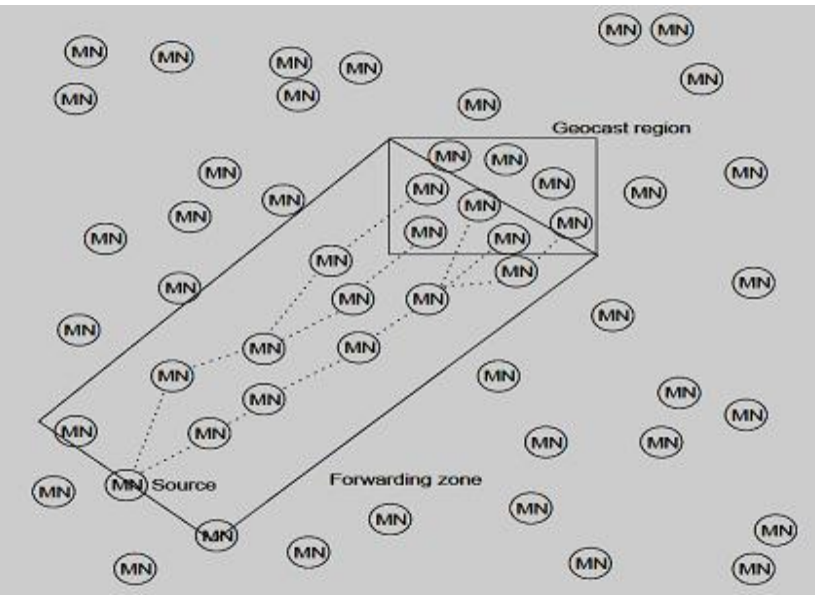

Figure 2: Mesh created CORRIDOR FA

Figure 2, shows an example of a mesh created by GAMER when using the CORRIDOR FA. The CORRIDOR FA defines the forwarding zone as the area within two parallel lines convex to the geocast region. First, imagine a center point C in the geocast region. Then, imagine a line from the center of the source node S to C: Two of the edges in the forwarding zone defined by the CORRIDOR FA are the two parallel lines, which are parallel to the line between S and C; that cross the margins of the geocast region. The other two edges of the forwarding zone defined by the CORRIDOR FA are perpendicular to the two parallel edges; one edge crosses S and the other edge crosses C: Thus, GAMER creates a rectangle forwarding zone when using the CORRIDOR FA. As Figure 1 and 2 illustrates, the forwarding zone of the CORRIDOR FA [5] is much smaller than the forwarding zone in the FLOOD FA which, therefore, creates a sparser mesh.

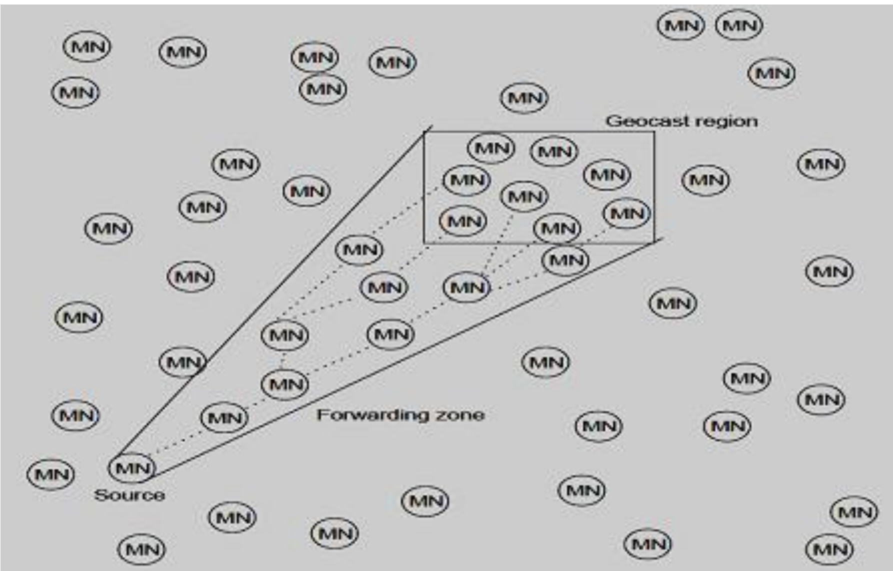

Figure 3: Mesh created by CONE FA

Figure 3, shows an example of a mesh created by GAMER when using the CONE FA. Compared to the CORRIDOR FA, the CONE FA restrains the size of the forwarding zone even further. The forwarding zone created by the CONE FA is the area enclosed by an angle whose vertex is the source node and whose sides are tangent to the geocast region. The forwarding zone created by the CONE FA is similar to the forwarding zone created in DREAM; one difference between the two is that the CONE FA does not have a minimum cone angle while the DREAM protocol has a 30% minimum cone angle.

B.FGMP (Forwarding Group Multicast Protocol)

The proposed FGMP scheme (first introduced in [6]) is reviewed here for completeness. FGMP keeps track not of links but of groups of nodes which participate in multicast packets forwarding. To each multicast group G is associated a forwarding group, FG. Any node in FG is in charge of forwarding (broadcast) multicast packets of G. That is, when a forwarding node (a node in FG) receives a multicast packet, it will broadcast this packet if it is not a duplicate. All neighbors can hear it, but only neighbors that are in FG will first determine if it is a duplicate and then broadcast it in turn

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1. FG Maintenance via Receiver Advertising (FGMP-RA)

One way to advertise the membership is to let each receiver periodically and globally flood its member information (join request) formatted as in Table 1. TTL limits the scope of flooding. Each sender maintains a member table as shown in Table 2. When a sender receives the join request from receiver members, it updates its member table.

Table 1: Format of join_request/sender_info packet

Mcast Group id	Receiver/Sender member Id	Sequence #	TTL

Expired receiver entries will be deleted from the member table. Non-sender nodes simply forward the request packet. After updating the member table, the sender creates from it the forwarding table FW shown in Table 3. Next hop on the shortest path to the receiver is obtained from preexisting routing tables. The forwarding table FW is broadcast by the sender to all neighbors; only neighbors listed in the next hop list (next hop neighbors) accept this forwarding table (although all neighbors can hear it). Each neighbor in the next hop list creates its forwarding table by extracting the entries where it is the next hop neighbor and again using the preexisting routing table to find the next hops, etc. After the FW table is built, it is then broadcast again to neighbors and so on, until all receivers are reached.

Table 2: Format of member table at the sender/receiver members

Mcast Group id	
Refresh Timer	
receiver/sender member id	timer
⋮	⋮

Table 3: Format of forwarding/joining table FW

Mcast Group id	
receiver/sender member id	next hop
⋮	⋮

Note that FW is discarded after use. The member table on the other hand is permanent. The forwarding table FW propagation mechanism essentially activates all the nodes on the source tree rooted at the sender. These nodes become part of the FG. At each step nodes on the next hop neighbor list after receiving the forwarding table enable the forwarding flag and refresh the forwarding timer. Soft state dynamic reconfiguration provides the ability to adapt to a changing topology.

Figure 4, shows an example of multicasting forwarding tables. Node 12 is the sender. Five nodes are forwarding nodes, FG = {4; 12; 16; 22; 25}, because they are in the next hop list. Only sender and internal nodes, in our case 12 and node 22, need to create a forwarding table (figure 4(a), (b)) and broadcast it. Forwarding nodes 4, 16, and 25 do not need to create their forwarding tables since they are “leaves”, i.e. all receiver members are immediate neighbors. When forwarding nodes receive new forwarding tables, their forwarding timers are refreshed; in absence of refreshes, the forwarding flag will automatically time out and the forwarding node is deleted from FG.

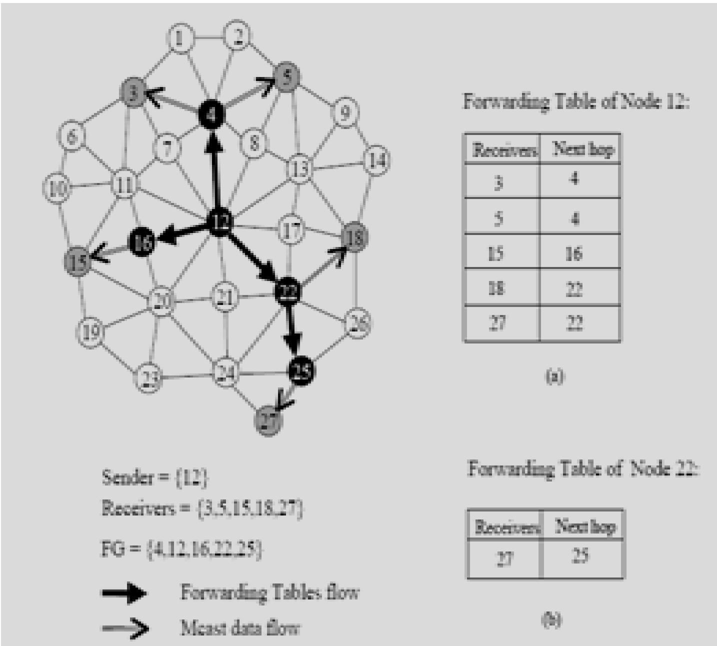

Figure 4: Example of forwarding tables for FGMP-RA

2. FG Maintenance via Sender Advertising (FGMP-SA)

Another way to advertise the membership is to let senders flood sender information. Sender advertising is more efficient than receiver advertising if the number of senders is less than the number of receivers. Most multicast applications belong to this category. Like in receiver advertising, senders periodically flood the sender information. Receivers will collect senders’ status,then periodically broadcast “joining tables” to create and maintain the forwarding group FG. The “joining table” has the same format as the “forwarding table” except that the joining table contains the sender IDs while the forwarding table contains receiver IDs. Forwarding flag and timer are set when a node receives the joining table. Forwarding group is maintained (soft state refresh) by the senders in receiver advertising scheme and by the receivers in sender advertising scheme.

Member table and forwarding table size poses a scaling limitation when the multicast group grows to hundreds or even thousands of nodes. A possible solution (which we are currently exploring) is to dynamically (and randomly) elect a small set of"core" nodes which lie on the path between senders and receivers. These core nodes advertise (at a fairly low frequency) their presence, i.e., their ID, to all nodes. Senders and receivers alike send short join messages to each of the core nodes, activating the FG flag in all the nodes encountered along the path. The scheme scales well in both storage and channel O/H. It does not however guarantee shortest paths between all senders and receivers. It also introduces the additional complexity of core node elections. Then are evaluating some of this tradeoff in our current research.

II. FUTURE ENHANCEMENTS

As a future enhancement, an evaluation other version of GAMER that chooses the FA based on another network environment feature (e g the location of the source node to the Geocast region) can be considered. In addition, adding more features to GAMER, such as allowing the protocol to mark more efficient paths in the mesh as higher priority. When a path in the mesh fails, the MN's local to the failure will attempt to fix the failure locally. At low speeds, the passive GAMER has lower control overhead and lower network –wide data load than the active GAMER.

The FGMP in future defined Quality of service (Qos) extension for AODV to enable route establishment between nodes that have certain well defined traffic flow. The solution includes large membership size and methods for the integration of the multicast-On-Demand route search with existing On -Demand unicast routing protocol.

III. CONCLUSION

In the work, the performance of the Geocast adaptive mesh environment for Routing (GAMER) protocol has been investigated. GAMER dynamically chooses one of three forwarding approaches based on the current network environment by dynamically changing the density of the mesh.

Thus, when nodes are highly mobile, a dense mesh is created ;when the nodes are moving slowly ,a spare mesh is created .Two version of GAMER exist; the passive GAMER and the active GAMER. The active GAMER is more active in increasing the size of its forwarding zone than the passive GAMER.

In FGMP novel approaches to wireless, Ad hoc multicasting is based on forwarding groups and On-Demand routing. Preliminary simulation results show that the proposed scheme is much more robust to mobility than the forwarding group version based on a global routing structure. It also outperforms conventional tree based multicast schemes such as DVMRP and shared tree. The reasons for this superior performance must be sought in lower control overhead and in more agile recovery from path breakage. Storage scalability is also greatly enhanced by On-Demand routing, especially in large networks.

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