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EVALUATE THE ZONE BASED ROUTING PROTOCOL WITH STATELESS MULTICASTING FOR MANET

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Abstract: *Group communications are important in mobile Ad hoc networks. Multicast is an efficient method for implementing group communications. However, it is challenging to implement efficient and scalable multicasting in MANET due to the difficulty in group membership management, multicast packet forwarding and the maintenance of multicast structure over the dynamic network topology for large group size or network size. The existing EGMP (Efficient Geographic Multicast Protocol) protocol uses virtual-zone-based structure to implement scalable and efficient group membership management. It makes the position information to guide multicast routing. The existing protocol is designed to be comprehensive and self-contained, simple and efficient for reliable operation. The proposed method use Stateless based EGMP Routing Protocol. The stateless routing used in two nodes has the same residual energy level. An active node that is used in many data-forwarding paths consumes energy more quickly and it has a shorter lifetime than the remaining inactive node. The geographic locations of the nodes remove the need for costly state maintenance making it ideally suited for multicasting in dynamic networks. It reduces the time complexity of routing packets. The simulation results demonstrate that stateless based EGMP has higher delivery ratio under all circumstances with different moving speeds and node densities. The proposed Stateless EGMP protocol is compared with Ad-hoc On-demand Distance Vector (AODV) and EGMP. It has significantly reduced the link failure, low control overhead and multicast group joining delay. The proposed work shows more efficiency than the existing work.*

Keywords: Routing, Stateless, Wireless Networks, Multicast, Protocols.

I. INTRODUCTION

A Mobile Ad hoc Network (MANET) represents a system of wireless mobile nodes that can self-organize freely and dynamically into arbitrary and temporary network topology. Multicast is the delivery of a message or information to a group of destinations simultaneously in a single transmission using routers, only when the topology of the network requires it. For MANET unicast routing, geographic routing protocols [1] [2] [3] [4], have been proposed in recent years for more scalable and robust packet transmission. The geographic routing protocols generally assume mobile nodes that are aware of their own positions through certain positioning systems and source can obtained from the destination position through some type of location service [5] [6]. In the existing system, an efficient geographic multicast protocol EGMP [11] is used to scale a large group size and large network size. The protocol is designed to be comprehensive and self-contained, yet simple and efficient for more reliable operation. Instead of addressing only a specific part of the problem, it includes a zone-based scheme to efficiently handle the group membership management, and takes advantage of the membership management structure to efficiently track the locations of all the group members without resorting to an external location server. The zone structure is formed virtually and in the zone where a node is located can be calculated based on the position of the node and a reference origin. In contrast, there is no need to involve a big overhead to create and maintain the geographic zones used in the existing work, which is critical to support in reliable communications over a dynamic MANET. EGMP could quickly and efficiently build packet distribution paths, and reliably maintain the forwarding paths in the presence of network dynamics due to unstable wireless channels or frequent node movements. In this work we proposed a novel stateless EGMP protocol. It is virtual-tree based structure used to reduce the tree management overhead and make the transmissions much more robust to dynamics. It is used to avoid periodic flooding of the source information throughout the network. Here four parameters REFRESH, REPORT, ANNOUNCE, REGISTER are added. These parameters are used for improving the control overhead, delay time, packet delivery ratio. The simulation results demonstrate that stateless EGMP has higher delivery ratio under all circumstances with different moving speeds and node densities. The proposed Stateless based EGMP protocol is too compared with Ad-hoc On-demand Distance Vector (AODV) and EGMP. It has significantly reduced the link failure, low control overhead and multicast group joining delay.

In Section 2 discuss some related work. Section 3 presents existing method. Section 4 presents proposed Stateless based EGMP and section 5 give Experiments results. Finally section 6 concludes the work.

II. RELATED WORKS

In this section, we first summarize the basic procedures assumed in conventional multicast protocols, and then introduce a few efficient geographic multicast protocol proposed in the literature.

S.J. Lee [2000] discussed about On-Demand Multicast Routing Protocol (ODMRP), a multicast routing protocol designed for ad hoc networks with mobile hosts**[7].** ODMRP is a mesh-based, rather than a conventional tree-based multicast scheme and uses a forwarding group concept. It applies on-demand procedures to dynamically build routes and maintain multicast group membership. ODMRP is well suited for ad hoc wireless networks with mobile hosts where bandwidth is limited, topology changes frequently and rapidly, and power is constrained.

B. Karp [2000] says the Greedy Perimeter Stateless Routing (GPSR), a novel routing protocol for wireless datagram networks **[3].** It uses the positions of routers and a packet’s destination to make packet forwarding decisions. It makes greedy forwarding decisions using the information about a router’s immediate neighbors in the network topology. When a packet reaches a region, if greedy forwarding is impossible, then the algorithm recovers by routing around the perimeter of the region. As the number of network destination increases, the state of the local topology is better scaled than the

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shortest path and ad-hoc routing protocols. If the mobility's of frequent topology is changed than GPSR,it uses local topology information to find correct new routes quickly.

L. Ji [2001]proposed a multicast routing protocol for mobile ad hoc networks (MANETs). The protocol DDM (Differential Destination Multicast differs from common approaches for MANET multicast routing in two ways [8]. At First, the distribution of membership is controlled throughout the network. DDM concentrates on the authority of the data sources (i.e. senders) thereby giving source knowledge of group membership. Secondly, differentially-encoded, variable-length destination headers are inserted in data packets, which are used in combination with unicast routing tables to forward multicast packets towards multicast receivers. Multicast forwarding state is stored in all participating nodes. It also provides the option of stateless multicasting, where each node has independent in choice of caching, forwarding state or having its upstream neighbor to insert the state into self-routed data packets. The protocol is best suited for small multicast groups in dynamic networks of any size.

D. Sidhu [2001] proposed a new multicast protocol for Mobile Ad Hoc networks, called the Multicast routing protocol based on Zone Routing (MZR) **[9].** It is a source-initiated on-demand protocol, in which a multicast delivery tree is created using a concept called the zone routing mechanism. It is a source tree based protocol and does not depend on any underlying unicast protocol. The protocol's reaction to topological changes can be restricted to a node's neighborhood instead of propagating it throughout the network.

H. Fubler [2003] proposed Position-Based Multicast routing protocol (PBM), which uses the geographic position of the nodes to make forwarding decisions **[10].** PBM neither requires the maintenance of a distribution structure nor resorts to flooding. PBM is a generalization of existing position-based unicast routing protocols, or Greedy Perimeter Stateless Routing (GPSR). It is common for position-based approaches to assume that the position of the destination is known to the sender, that each node knows its own position. Each node knows the position of its direct neighbors. In position-based unicast routing the forwarding node selects one of its neighbors as a next hop such that the packet makes progress toward the geographical position of the destination. It is possible that there is no neighbor with progress toward the destination while there still exists a valid route to the destination. The packet reached a local optimum. In the case of a recovery strategy it uses then the local optimum to find a path toward the destination. In order to extend position-based routing to multicast, two key problems have to be solved. The certain nodes have a multicast packet that split into multiple copies in order to reach all destinations. The recovery strategy is used to escape from a local optimum and it needs to be adapted to take multiple destinations into account.

III. EXISTING SYSTEM

The geographic routing protocols are used to assume mobile nodes of their own positions through the positioning system. The source can obtain the destination position through some types of location service. In the Local topology the geographic routing protocol considers a lot

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of attention for forwarding decisions. In the existing work, an Efficient Geographic Multicast Protocol (EGMP) is used. EGMP makes use of the position information to design a scalable virtual-zone-based scheme for efficient membership management, which allows a node to join and leave a group quickly. Geographic unicast is enhanced to handle the routing failure due to the use of estimated destination position with reference to a zone and applied for sending control and data packets between two entities so that transmissions are more robust in the dynamic environment. The simulation results showed the existing routing protocol EGMP is robust and outperform the existing geographic routing protocol.

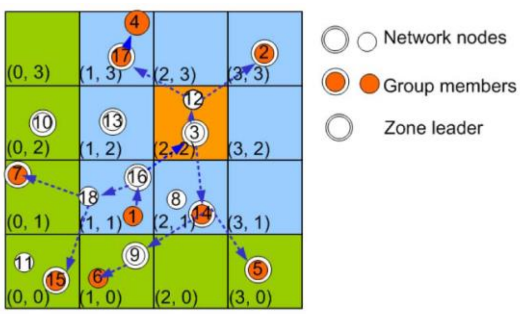

Fig 1 Zone Structure and multicast session example

IV. PROPOSED SYSTEM

The proposed research generates a novel Stateless based EGMP protocol. It is virtual-tree based structure which is used to reduce the tree management overhead and makes the transmissions much more robust in dynamic system. It is used to avoid periodic flooding of the source information throughout the network. Here the parameters REFRESH, REPORT, ANNOUNCE and REGISTER are used and are described below:

- ***REPORT*** is used to find the empty zone and the non-empty zone using broadcasting and it reports the nodes from source to destination. It calculates the bandwidth for moving the nodes. And also it has a table and it contains all the information about the zone leader.
- ***REGISTER*** is used to register the new zone ID in the neighbor table. Messages that send from source home will carry the sequence number. A forwarding node will update its recorded source home information.
- ***ANNOUNCE*** it helps to inform the node to find which path is reliable to move from the source into the network.
- ***REFRESH*** updates the information about the zone. A new joining process to start by unicast REFRESH message carries the information of source.

These parameters are used for improving the control overhead, delay time, packet delivery ratio. Our simulation results demonstrate that stateless EGMP has higher delivery ratio under all circumstances with different moving speeds and node densities. The proposed Stateless EGMP protocol is compared with Ad-hoc On-demand Distance Vector (AODV) and EGMP. It has significantly reduced the link failure, lowers control overhead and multicast group joining delay.

V. EXPERIMENTAL RESULTS

The packet delivery ratio in terms of speed, control overhead, and delay time are examined. Compared with existing protocol, the results are more efficient in the proposed method.

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The Table I shows the packet delivery ratio in various methods.. Packet Delivery Ratio (PDR) measures the percentage of data packets generated by nodes that are successfully delivered. Packet delivery ratio is calculated using this formula,

$$\frac{\text{TOTAL NUMBER OF PACKETS SUCCESFULLY DELIVERED}}{\text{TOTAL NUMBER OF PACKETS SENT}} \text{X100\%}$$

It is calculated considering the time of the network.

Table I Comparison of the proposed method and existing method in terms of improving Packet Delivery Ratio

Time (MilliSeconds)	*Existing AODV (PROTOCOL) (%)*	*Standard EGMP (PROTOCOL) (%)*	*Proposed STATELESS-EGMP (PROTOCOL) (%)*
0-10	**0.91**	**0.98**	**0.98**
10-20	**0.87**	**0.96**	**0.98**
20-30	**0.85**	**0.92**	**0.97**
30-40	**0.79**	**0.82**	**0.95**
40-50	**0.75**	**0.80**	**0.90**

The Table II shows the control overhead.

Table II Comparison of the proposed method and existing method considering control overhead

Time (MilliSeconds)	*Existing AODV (PROTOCOL) (sec)*	*Standard EGMP (PROTOCOL) (sec)*	*Proposed STATELESS-EGMP (PROTOCOL) (sec)*
0-10	**5.1**	**0.98**	**0.91**
10-20	**5.7**	**1.36**	**1.14**
20-30	**5.5**	**1.42**	**1.36**
30-40	**6.8**	**2.29**	**2.24**
40-50	**7.0**	**2.87**	**2.68**

The Table III represents the delay time.Delay time is calculated as follows

$$\frac{\text{INTERVAL BETWEEN FIRST PACKET TIME + SECOND PACKET TIME}}{\text{TOTAL DATA RECEIVED TIME}}$$

Table III Comparison of the proposed method and existing method in terms of time delay

Time (MilliSeconds)	*Existing AODV (PROTOCOL) (sec)*	*Standard EGMP (PROTOCOL) (sec)*	*Proposed STATELESS-EGMP (PROTOCOL) (sec)*
0-10	**2.1**	**1.21**	**0.83**
10-20	**3.7**	**1.46**	**1.16**
20-30	**4.5**	**1.52**	**1.22**
30-40	**5.2**	**1.79**	**1.29**
40-50	**5.4**	**1.97**	**1.32**

The Table 1V represents packet delivery ratio considering node density.

The performance of packet delivery ratio is increased and simultaneously the control overhead and delay is reduced.

Table IV Comparison of the proposed method and existing method in terms of packet delivery ratio

Node Density (no of nodes/Km^2)	*Existing AODV (PROTOCOL) (%)*	*Standard EGMP (PROTOCOL) (%)*	*Proposed STATELESS-EGMP (PROTOCOL) (%)*
10-25	**0.53**	**0.65**	**0.72**
25-50	**0.67**	**0.73**	**0.75**
50-75	**0.77**	**0.76**	**0.77**
75-100	**0.81**	**0.84**	**0.85**
100-125	**0.87**	**0.92**	**0.94**

Table V and VI are shown below considering Node Density.

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Table 5 Comparison of the proposed method and existing method considering control overhead

Node Density (no of nodes/Km^2)	*Existing AODV (PROTOCOL) (sec)*	*Standard EGMP (PROTOCOL) (sec)*	*Proposed STATELESS-EGMP (PROTOCOL) (sec)*
10-25	**1.23**	**0.98**	**0.93**
25-50	**1.43**	**1.26**	**1.25**
50-75	**1.65**	**1.3**	**1.27**
75-100	**1.85**	**1.44**	**1.32**
100-125	**2.11**	**1.47**	**1.34**

Table 6 Comparison of the proposed method and existing method in terms of time delay

Node Density (no of nodes/Km^2)	*Existing AODV (PROTOCOL)*	*Standard EGMP (PROTOCOL)*	*Proposed STATELESS-EGMP (PROTOCOL)*
10	**2.1**	**0.21**	**0.20**
25	**2.7**	**0.46**	**0.46**
50	**3.4**	**0.52**	**0.50**
75	**3.5**	**0.79**	**0.77**
100	**3.6**	**0.97**	**0.98**

The simulation results demonstrate that stateless EGMP has higher delivery ratio under all circumstances with different moving speeds and node densities.

Fig 2 shows packet delivery ratio based on moving speed. Fig 2 (a) shows that Stateless EGMP keeps a stable movement and 98% delivery ratio under all the mobility cases.

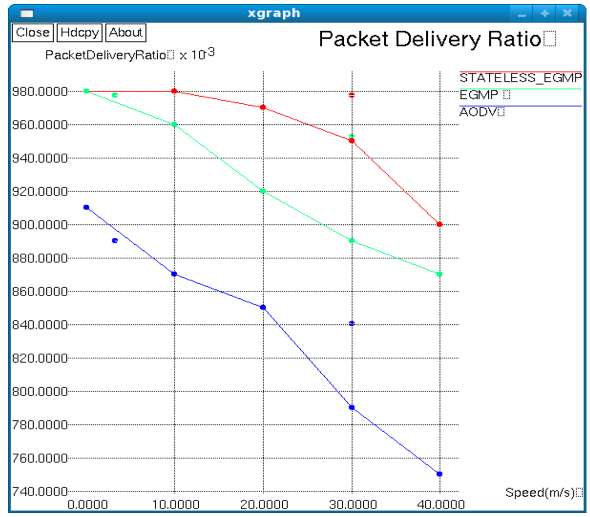

Fig 2 (a) Packet Delivery Ratio

Fig 2.(b) (c) shows control overhead , delay time of Stateless EGMP. The proposed Stateless EGMP protocol -is compared with Ad-hoc On-demand Distance Vector (AODV) and EGMP. Fig 3 (a),(b),(c) shows the results considering Node Density.

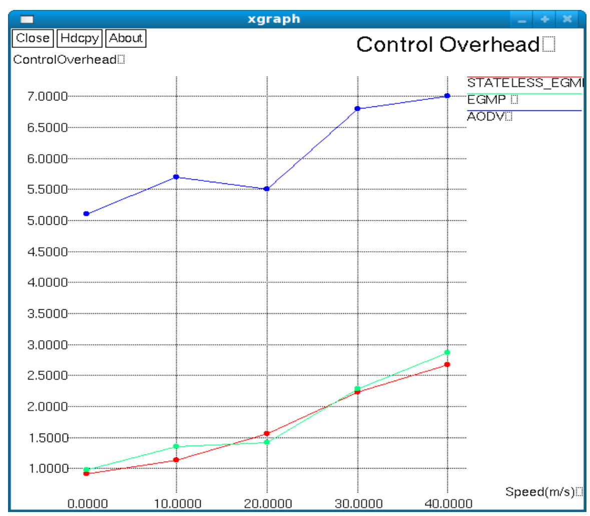

Fig 2 (b) Control Overhead

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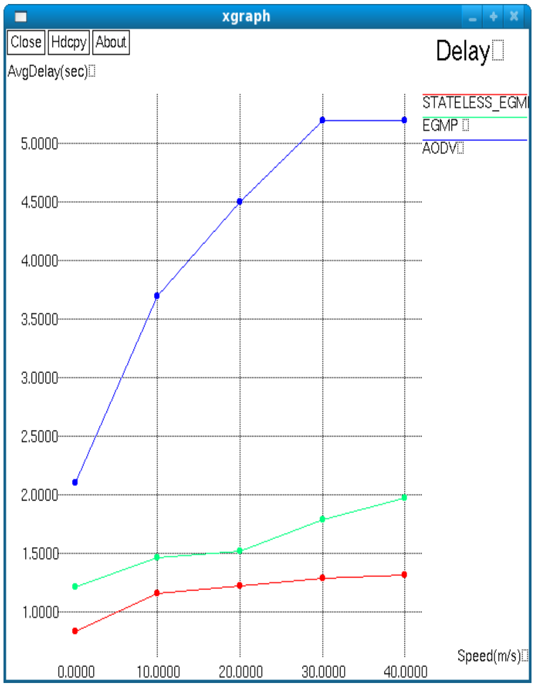

Fig 2 (c) End-to-End Delay

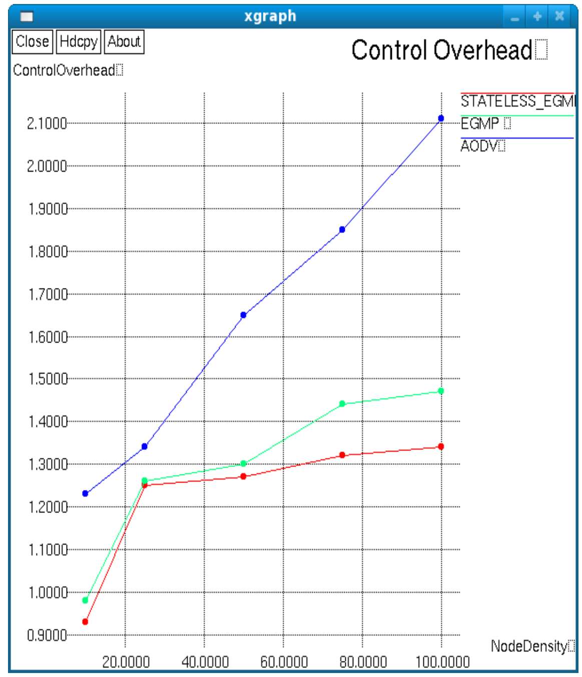

Fig 3 (b) Control overhead for Node Density

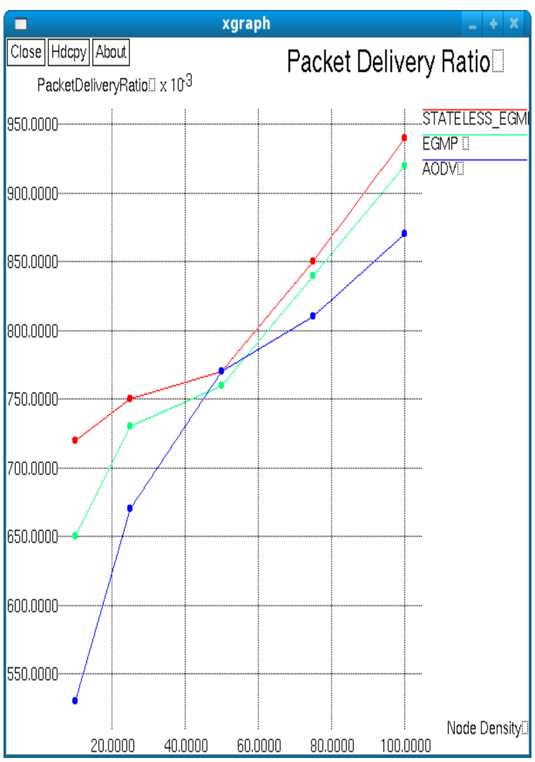

Fig 3 (a) packet delivery ratio for Node Density

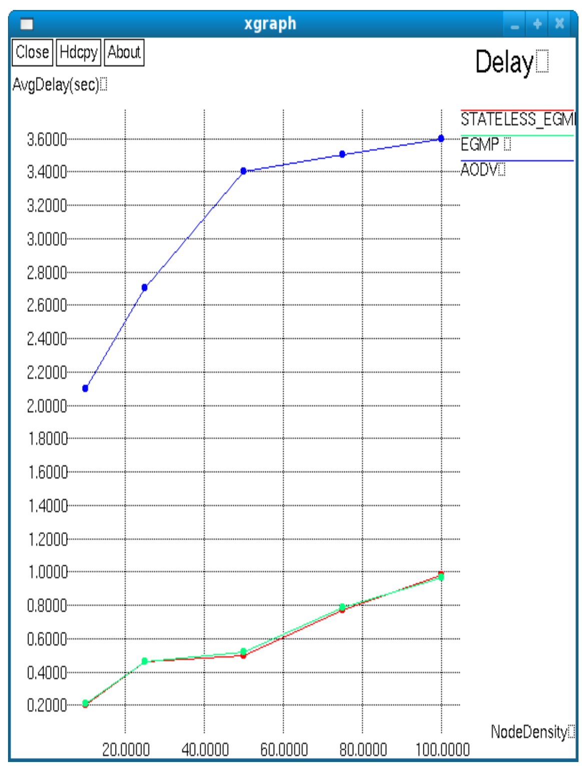

Fig 3 (c) Delay Time for Node Density

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VI. CONCLUSIONS

The proposed Efficient Geographic Multicast Protocol (EGMP) using stateless multicast routing is achieved through a virtual-zone-based two-tier infrastructure. A zone-based bi-directional multicast tree is built at the upper tier for more efficient multicast membership management and data delivery, while the intra-zone management is performed at the lower tier to realize the local membership management. The position information is used in the protocol to guide the zone structure building, multicast tree construction, maintenance, and multicast packet forwarding. Compared to conventional topology based multicast protocols the use of location information in Stateless protocol significantly reduces the tree construction and maintenance overhead, and enables quicker tree structure adaptation to the network topology change. The Simulation results demonstrate that Stateless based EGMP has higher delivery ratio under all circumstances with different moving speeds and node densities. The proposed Stateless EGMP protocol is too compared with Ad-hoc On-demand Distance Vector (AODV) and EGMP. The proposed Stateless Efficient Geographic Multicast Protocol reduced the link failure, low control overhead and multicast group joining delay. Stateless based EGMP is more robust and outperform the existing geographic routing protocol.

VII FUTURE WORK

In future, an effective path based on fuzzy cost can be considered instead of path selection by allotting rank to achieve high transmission rate and optimal distribution.

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