International Research Journal in Global Engineering and Sciences. (IRJGES)
ISSN: 2456-172X | Vol. 4, No. 4, December 2019 - February 2020 | Pages 21-26

Efficient Multicasting Support over MANET using EGMP

S.Saravanan[1],S.Jayanthi[2], V.Kumaran[3], JVN Ramesh[4]

Department of Computer Science and Engineering,

Agni College of Technology , Thalambur.

Abstract - Group communications are important in Mobile Ad hoc Networks (MANETs). Multicast is an efficient method for implementing group communications. However, it is challenging to implement efficient and scalable multicast in MANET due to the difficulty in group membership management and multicast packet forwarding over a dynamic topology. We propose a novel Efficient Geographic Multicast Protocol (EGMP). EGMP uses a virtual-zone-based structure to implement scalable and efficient group membership management. A network wide zone-based bidirectional tree is constructed to achieve more efficient membership management and multicast delivery. The position information is used to guide the zone structure building, multicast tree construction, and multicast packet forwarding, which efficiently reduces the overhead for route searching and tree structure maintenance. Several strategies have been proposed to further improve the efficiency of the protocol. Finally, we design a scheme to handle empty zone problem faced by most routing protocols using a zone structure. The scalability and the efficiency of EGMP are evaluated through simulations and quantitative analysis. Our simulation results demonstrate that EGMP has high packet delivery ratio, and low control overhead and multicast group joining delay under all test scenarios, and is scalable to both group size and network size.

Keywords- Routing, wireless networks, mobile ad hoc networks, multicast, protocol.

I. INTRODUCTION:

There are increasing interests and importance in supporting group communications over Mobile Ad Hoc Networks (MANETs). Example applications include the exchange of messages among a group of soldiers in a battle field, communications among the firemen in disaster area, and the support of multimedia games and teleconferences. With a one-to-many, many-to-many transmission pattern, multicast is an efficient method to realize group communications. However, there is a big challenge in enabling efficient multicasting over a MANET whose topology may change constantly.

Conventional MANET multicast protocols can be ascribed into two main categories, tree-based and mesh-based. However, due to the constant movement, it is very difficult to maintain the tree structure using these the conventional tree-based protocols like (e.g.,MAODV, AMRIS, MZRP and MZR).

The mesh-based protocols (e.g.,FGMP, Core-Assisted Mesh protocol ,and ODMRP) are proposed to enhance the enhance the robustness with the use of redundant paths

between the source and the destination pairs. Conventional multicast protocols generally do not have good scalability due to the overhead incurred for route searching, group

movement of the frequent network joining and leaving membership management, and creation and maintenance of the tree/mesh structure over the dynamic MANET. Similarly, to reduce the topology maintenance overhead and support more reliable multicasting, an option is to make use of the position information to guide multicast routing.

In this work, we propose an efficient geographic multicast protocol, EGMP, which can scale to 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 the zone where anode is located can be calculated based on the position of the node and a reference origin. In topology-based cluster construction, a cluster is normally formed around a cluster leader with nodes one hop or k-hop away, and the cluster will constantly change as network topology changes. In contrast, there is no need to involve a big overhead to create and maintain the geographic zones proposed in this work, which is critical to support more efficient and reliable communications over a dynamic MANET. By making use of the location information, 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.

II.RELATED WORK:

In this section, we first summarize the basic procedures assumed in conventional multicast protocols, and then introduce a few geographic multicast algorithms proposed in the literature. Conventional topology-based multicast protocols include tree-based protocol and mesh-based protocols. Tree-based protocols construct a tree structure for more efficient forwarding of packets to all the group members. Mesh-based protocols expand a multicast tree with additional paths which can be used to forward packets when some of the links break. Although efforts were made to develop more scalable topology-aware protocols the topology-based multicast protocols are generally difficult to scale to a large network size, as the construction and maintenance of the conventional tree or mesh structure involve high control overhead over a dynamic network. The protocol,which allows it a better scalability to group size. In contrast, EGMP uses a location-aware approach for more reliable membership management and packet transmissions, and supports scalability for both group size and network size. As the focus of our paper is to improve the scalability of location-based multicast, a comparison with topology-based protocols is out of the scope of this work.

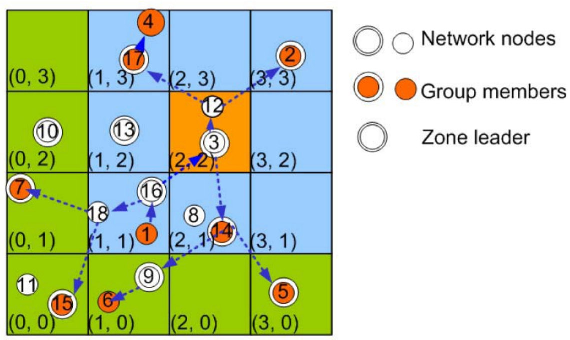

Fig. 1. Zone structure and multicast session example.

However, we note that at the similar mobility and system setup, the delivery ratio is much lower than that of EGMP, and the delivery ratio in varies significantly as the group size changes. In addition, topology-based routing by nature is more vulnerable to mobility and long path transmission, which prevents topology-based protocols from scaling to a large network size. Finally, a lot of work have been done on geocasting Different from general multicasting in which the destinations are a group of receivers, the destination of geocasting is one or multiple geographic regions (squares are normally defined). When packets reach the destined region, they will be sent to the nodes in the region through flooding or other methods. There is no need of forming multicast infrastructure to deliver packets to group members that may distribute widely in the whole network domain and change their positions as nodes move.

we proposed an efficient and robust geographic multicast protocol for MANET. In this paper, we further introduce zone-supported geographic forwarding to reduce the routing failure, and provide mechanism to handle zone partitioning. In addition, we introduce a path optimization process to handle multiple paths, and provide a detailed cost analysis to demonstrate the scalability of the proposed.

III.PROPOSED SYSTEM:

EFFICIENT GEOGRAPHIC MULTICAST PROTOCOL:

In this section, we will describe the EGMP protocol in details. We first give an overview of the protocol. Protocol Overview.

EGMP supports scalable and reliable membership management and multicast forwarding through a two-tier virtual zone-based structure. At the lower layer, in reference to a pre determined virtual origin, the nodes in the network self organize themselves into a set of zones as shown in Fig. 1,and a leader is elected in a zone to manage the local group membership. At the upper layer, the leader serves as a representative for its zone to join or leave a multicast group as required. As a result, a network wide zone-based multicast tree is built. For efficient and reliable management and transmissions, location information will be integrated with the design and used to guide the zone construction, group membership management, multicast tree construction and maintenance, and packet forwarding.At the upper layer,t he multicast packets will flow along the multicast tree both upstream to the root zone and downstream to the leaf zones of the tree. At the lower layer, when an on-tree zone leader receives the packets, it will send them to the group members in its local zone. Multicast Tree Construction In this section, we present the multicast tree creation and maintenance schemes. In EGMP, instead of connecting each group member directly to the tree, the tree is formed in the granularity of zone with the guidance of location information, which significantly reduces the tree management overhead. With a destination location, a control message can be transmitted immediately without incurring a high overhead and delay to find the path first, which enables quick group joining and leaving. In the following description, except when explicitly indicated, we use G, S, and M, respectively, to represent a multicast group, a source of G and a member of G. Multicast Session Initiation and Termination When a multicast session G is initiated, the first source node S (or a separate group initiator) announces the existence of G by flooding a message NEW SESSION G; zone ID into the whole network. Multicast Group Join When a node M wants to join the multicast group G, if it is nota leader node, it sends a JOIN REQ M; message to its zLdr, carrying its address, position, and group to join. The address of the old group leader Mold is an option used when there is a leader handoff and a new leader sends an updated JOIN_REQ message to its upstream zone. If M did not receive the NEW_SESSION message or it just joined the network, it can search for the available groups by querying its neighbors. If a zLdr receives a JOIN_REQ message or wants to join G itself, it begins the leader joining procedure as shown in Fig. 2. If the JOIN_REQ message is received from a member M of the same zone, the zLdr adds M to the downstream node list of its multicast table. If the message is from another zone, it will compare the depth of there questing zone and that of its own zone. If its zone depth is smaller, i.e., its zone is closer to the root zone than the requesting zone, it will add the requesting zone to its downstream zone list; otherwise, it simply continues forwarding the JOIN_REQ message toward the root zone.

```
Procedure LeaderJoin (me, pkt)
  me: the leader itself
  pkt: the JOIN_REQ message the leader received

  BEGIN
  if (pkt.srcZone == me.zoneID ) then
     /* the join request is from a node in the local zone */
     /* add the node into the downstream node list of the multicast table */
     AddNodetoMcastTable(pkt.groupID , pkt.nodeID );
  else
     /* the join request is from another zone */
     if (depth_me < depth_pkt ) then
        /* add this zone to the downstream zone list of the multicast table
        */
        AddZonetoMcastTable(pkt.groupID , pktzoneID );
     else
        ForwardPacket(pkt);
        return;
     end if
  end if
  if (!LookupMcastTableforRoot(pkt.groupID )) then
     /* there is no root-zone information */
     SendRootZoneRequest(pkt.groupID );
  else if (!LookupMcastTableforUpstream(pkt.groupID )) then
     /* there is no upstream zone information */
     SendJoinRequest(pkt.groupID );
  else
     SendReply;
  end if
  END
```

Fig.2.The pseudo code of the leader joining procedure.

If new nodes or zones are added to the downstream list, the leader will check the root-zone ID and the upstream zone ID. If it does not know the root zone, it starts an expanded ring search. As the zone leaders in the network cache the root-zone ID, a result can be quickly obtained. With the knowledge of the root zone, if its upstream zone ID is unset, the leader will represent its zone to send a JOIN_REQ message toward the root zone; otherwise, the leader will send back a JOIN_REPLY message to the source of the JOIN_REQ message (which may be multiple hops away and the geographic unicasting described in Section 3.3 is used for this transmission). When the source of the JOIN_REQ message receives the JOIN_REPLY, if it is a node, it sets the is Acked flag in its membership table and the joining procedure is completed. If the leader of a requesting zone receives the JOIN_REPLY message, it will set its upstream zone ID as the ID of the zone where the JOIN_REPLY message is sent, and then send JOIN_REPLY messages to un acknowledged downstream nodes and zones. Multicast Group Leave When a member M wants to leave G, it sends a LEAV E M;G message to its zone leader. On receiving a LEAVE message, the leader removes the source of the LEAVE message from its downstream node list or zone list depending on whether the message is sent from an intra zone node or a downstream zone. Besides removing a branch through explicit LEAVE, a leader will remove anode from its downstream list if it does not receive the beacon from the node exceeding 2 _ Interval max.

IV.PERFORMANCE EVALUATION:

We implemented the EGMP protocol using Global Mobile Simulation, and compare it with ODMRP which is widely used and considered to be robust over a dynamic network, and the geographic multicast protocol SPBM which is designed to improve the scalability of position-based multicast. The SPBM is a quad tree-based protocol as introduced in Section 2. ODMRP is a mesh-based on-demand non geographic multicast protocol and takes a soft-state approach to maintain multicast group members. A multicast source broadcasts a Join-Query messages to the entire network periodically. An intermediate node stores the source ID and the sequence number, and updates its routing table with the node ID (i.e.,backward learning) from which the message was received for the reverse path back to the source.

A receiver creates and broadcasts a Join Reply to its neighbors, with the next hop node ID field filled by extracting information from its routing table. The neighbor node whose ID matches the next hop node ID of the message realizes that it is on the path to the source and is part of the forwarding group. It then broadcasts its own Join Table built upon matched entries. This whole process constructs (or updates) the routes from sources to receivers and builds a mesh of nodes, the forwarding group. The simulations were run with 400 nodes randomly distributed in an area of 2;400 m _ 2;400 m. The nodes moved following the modified random waypoint mobility model. The moving speed of nodes are uniformly set between the minimum and maximum speed values which are set as 1 m/s (with pause time as 100 seconds) and20 m/s, respectively, except when studying the effect of mobility. We set the MAC protocol and radio parameters according to the Lucent Wave LAN card, which operates at a data rate 11 Mbps and radio frequency 2.4 GHz with a Nominal transmission range 250 m. IEEE 802.11b was used as the MAC layer protocol. Each simulation lasted 500 simulation seconds. Each source sends CBR data packets at8 Kbps with packet length 512 bytes. The CBR flows start at around 30 seconds so that the group membership management has time to initialize and stop at 480 seconds. By default, there is one source, and one multicast group with 100 members. A simulation result was gained by averaging over six runs with different seeds.

Parameters and Metrics:

We focus on the studies of the scalability and efficiency of the protocol under the dynamic environment and the following metrics were used for the multicast performance evaluation:

1. Packet delivery ratio:

The ratio of the number of packets received and the number of packets expected to receive. Thus, for multicast packet delivery, the ratio is equal to the total number of received packets over the number of originated packets times the group size.

2. Normalized control overhead:

The total number of control message transmissions divided by the total number of received data packets. Each forwarding of the control message was counted as one transmission. Different from ODMRP, EGMP, and SPBM are based on some underlying geographic unicast routing protocol which involves use of periodic beacons. To provide more insight on the performance of different protocols, we measured both the total overhead (including multicast overhead and unicast overhead) and multicast overhead for EGMP and SPBM .

3. Normalized data packet transmission overhead:

The ratio of the total number of data packet transmissions and the number of received data packets.

4. Joining delay:

The average time interval between a member joining a group and its first receiving of the data packet from that group. To obtain the joining delay, the simulations were rerun with the same settings except that all the members joined groups after the source began sending data packets.

V.CONCLUSIONS:

There is an increasing demand and a big challenge to design more scalable and reliable multicast protocol over a dynamic ad hoc network (MANET). In this paper, we propose an efficient and scalable geographic multicast protocol, EGMP, for MANET. The scalability of EGMP is achieved through a two-tier virtual-zone-based structure, which takes advantage of the geometric information to greatly simplify the zone management and packet forwarding. A zone-based bidirectional 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 EGMP significantly reduces the tree construction and maintenance overhead, and enables quicker tree structure adaptation to the network topology change. We also develop a scheme to handle the empty zone problem, which is challenging for the zone-based protocols. our results indicate that the per node cost of EGMP keeps relatively constant with respect to the network size and the group size. We also performed extensive simulations to evaluate the performance of EGMP. Compared to the classical protocol EGMP could achieve much higher delivery ratio in all circumstances, with respect to the variation of mobility, node density, group size, and network range.

VI.REFERENCES:

[1] H. Kopka and P.W. Daly, A Guide to LaTeX, third ed. Addison-Wesley, 1999.

[2] L. Ji and M.S. Corson, "Differential Destination Multicast: A MANET Multicast Routing Protocol for Small Groups," Proc. IEEEINFOCOM, Apr. 2001.

[3] E.M. Royer and C.E. Perkins, "Multicast Operation of the Ad Hoc On-Demand Distance Vector Routing Protocol," Proc. ACM/IEEE MobiCom, pp. 207-218, Aug. 1999.

[4] C. Wu, Y. Tay, and C.-K. Toh, "Ad Hoc Multicast Routing Protocol Utilizing Increasing Id-Numbers (AMRIS) Functional Specification,"Internet draft, Nov. 1998.

[5] X. Zhang and L. Jacob, "Multicast Zone Routing Protocol in Mobile Ad Hoc Wireless Networks," Proc. Local Computer Networks(LCN '03), Oct. 2003.

[6] C.-C. Chiang, M. Gerla, and L. Zhang, "Forwarding GroupMulticast Protocol (FGMP) for Multihop Mobile Wireless Networks,"ACM J. Cluster Computing, special issue on mobilecomputing, vol. 1, no. 2, pp. 187-196, 1998.

[7] J.J. Garcia-Luna-Aceves and E. Madruga, "The Core-Assisted Mesh Protocol," IEEE J. Selected Areas in Comm., vol. 17, no. 8,pp. 1380-1394, Aug. 1999.

[8] M. Gerla, S.J. Lee, and W. Su, "On-Demand Multicast Routing Protocol (ODMRP) for Ad Hoc Networks,"Internet draft, draftietf-manet-odmrp-02.txt, 2000.