To Achieve Group Communication Using Mobility Model Based on Position Information in Manet

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ABSTRACT – There is an increasing demand and a big challenge to design more scalable and reliable multicast protocol .In this paper, we proposed a novel Efficient Geographic Multicast Protocol (EGMP). 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 network wide zone-based bi-directional tree is used to achieve efficient membership management and multicast delivery. EGMP supports scalable and reliable membership management and multicast forwarding through a virtual zone- based structure. A leader is elected in a zone to manage the local group membership. The zone-based tree is shared for all the multicast sources of a group. This reduces the forwarding overhead and delay. It is Very difficult to maintain the tree structure using these conventional tree-based protocols. In this paper EGMP is compared with SPMP and AODV.The proposed metrics assumes a typical mobility model RPGM is used to construct and maintain multicast structure more efficiently .Our results indicate that EGMP is used to achieve more scalable and reliable multicast transmissions in the presence of constant topology change of MANET and EGMP has high throughput and less delay.

Keywords: EGMP; zone-based bi-directional tree; zone depth; location information.

I. INTRODUCTION

A given the increasing demand for flexibility as well as technological advances in mobile communication devices such as wireless LANs, laptop computers and smart phones, wireless communications are becoming more and more common. There are several advanced efforts to enable wireless communication over mobile networks. Multicasting is one such effort that strives to provide support for wireless communication in mobile networks. Mobile Ad-Hoc Network (MANET) [1] is a group of wireless mobility nodes which is self organized into a network without the need of any infrastructure. It is a big challenge in developing a robust multicast routing protocol for dynamic Mobile Ad-Hoc Network (MANET). Multicast is a fundamental service for supporting information exchanges and collaborative task execution among a group of users and enabling cluster-based computer system design in a distributed environment [2]. Although it is important to support multicast in a mobile ad hoc network (MANET), which is often required by military and emergency applications, there is a big challenge to design a reliable and scalable multicast routing protocol in the presence of frequent topology changes and channel dynamics.

Commercial and military applications have motivated the expeditious development of MANET environments since the mobile nodes can move freely. Typical examples of applications, as shown in, include military battlefield communications, disaster rescue scenarios, ad hoc meetings, remote medical therapy, and wireless personnel home networks, etc. In wireless environments, since the mobile nodes within wireless environments usually have low processing capabilities. In addition, a mobile ad hoc network (MANET) [1][2] allows arbitrary nodes to move in or out freely and thus the topology of the network changes quickly and makes it difficult to guarantee the packet transmission of the wireless network.

Conventional topology-based multicast protocols include tree-based protocols and mesh-based protocols in which 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. 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. Although number of efforts were made to develop the scalable topology-based routing protocols. Now, 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 [5] 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

In this work, we propose a Mobility model of Efficient Geographic Multicast Protocol, EGMP[3], which can be extended to a large group size and large network size and this protocol will provide efficient multicast packet transmissions in a dynamic mobile ad hoc network environment. We introduce several scenarios for more robust and scalable membership management and packet forwarding in the presence of high network dynamics due to unstable wireless channels and frequent node movements. Both the data packets and control messages will be transmitted along efficient tree-like paths, however, different from other tree-based protocols, there is no need to explicitly create and maintain a tree structure. A virtual-tree structure can be formed during packet forwarding with the guidance of node positions. Furthermore, EGMP makes use of position information to support reliable packet forwarding. The protocol is designed to be comprehensive and self-contained [4]. Instead of addressing only a specific part of the problem, it introduces 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 any external location server. The zone structure is formed virtually and the zone where a node is located can be calculated based on the position of the node and a reference origin.

II. RELATED WORK

Compared to the traditional protocol SPBM and AODV, EGMP might realize much elevated liberation ratio in all conditions, with respect to the dissimilarity of mobility, node density, group size and network range. However, compared to EGMP, SPBM incurs several times of control overhead, outmoded packet transmissions and multicast crowd combination stoppage. Although SPBM[6][7] is premeditated to be scalable to the assembly size, it has very low packet release ratio when the group size is small without an unwavering membership in each level of quad-tree square, and cannot achieve well underneath a large network size due to the use of multi-level network-wide flooding of control messages. SPMP [4][5]takes improvement of dissemination to accomplish more efficient packet forwarding, but the transmissions are much more defective due to its involvedness of maintaining forwarding mesh under mobility, which leads to a lower packet delivery ratio. In AODV protocols routes may change due to the movement of a node within the path of the route. In such a case, the upstream neighbor of this node generates a 'link failure notification message' which notifies about the deletion of the part of the route and forwards this to its upstream neighbor. Our results indicate that geometric information can be used to more efficiently construct and maintain multicast structure, and to achieve more scalable and reliable multicast transmissions in the presence of constant topology change of MANET. Our simulation results demonstrate that EGMP [8] has high packet delivery ratio, and low control overhead and multicast group joining delay under all cases studied, and is scalable to both the group size and the network size. Compared to the geographic multicast protocol EGMP, it has significantly lower control overhead, data transmission overhead, and multicast group joining delay.

III. MOBILITY MODELS

A. Reference Point Group mobility (RPGM)

This model is used to model group mobility. Each group has a logical “center” called a reference point and group members (nodes). Each reference point moves according to the RWP model with V1 [m/s] (maximum speed) and S1 [s] (pause time). In each group, nodes are uniformly distributed within a certain radius R from the reference point. To achieve this, we assume that each node moves according to the RW model with V [m/s] (maximum speed) within that range. Specifically, a node’s movement vector is composed by adding the movement vector based on the RW model for the node to that based on the RWP model for the reference point.

IV. EFFICIENT GEOGRAPHIC MULTICAST PROTOCOL

A. Protocol Overview

In this subsection, we describe the multicast tree creation and maintenance schemes. In EGMP[8], 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. However, there are many challenges in implementing an efficient and robust geographic multicast scheme in MANET [9]. A straightforward way to extend the geography based transmission from unicast to multicast is to put the addresses and positions of all the members into the packet header, however, the header overhead will increase significantly as the group size increase, which constrains the application of geographic multicasting only to a small group.

1. Topology-Based Multicast Routing Protocols

Topology-based multicast protocols for mobile ad-hoc networks can be categorized into two main classes: tree-based and mesh-based protocols. The tree-based approaches build a data dissemination tree that contains exactly one path from a source to each destination. Topological information is used for its construction. The trees can be sub-classified further into source trees and shared trees.

2. Position-Based Unicast and Multicast Routing Protocols

The forwarding decisions in position-based routing are usually based on the node's own position, the position of the destination, and the position of the node's direct radio neighbors. Since no global distribution structure such as a route is required, position-based routing is considered to be very robust to mobility. It typically performs best when the next-hop node can be found in a greedy manner by simply minimizing the remaining distance to the destination. However, there are situations where this strategy leads to a local optimum, and no neighbor can be found greedily to forward the packet further, although a route exists [10]. This paper deals with the "Location-Guided Tree Construction Algorithms", the sender includes the addresses of all destinations in the header of a multicast packet. In addition,
the location of all destinations is included as well. It remains open how the sender is able to obtain the position information, and the scaling limitations.

3. Location-Based Multicast Protocols

Two approaches may be used to implement location based Multicast: First, maintain a multicast tree, all nodes within multicast region at any time belong to the multicast tree. The tree would need to be updated whenever nodes enter or leave the multicast region. Second, do not maintain a multicast tree. In this case, the multicast may be performed using some sort of "flooding" scheme. This paper considers multicast group members send a packet to specific multicast region.

B. Zone-Supported Geographic Forwarding

With a zone structure, the communication process includes an intrazone [9][10] transmission and an interzone transmission. In our zone structure, as nodes from the same zone are within each other's transmission range and aware of each other's location , only one transmission is required for intra zone communications. Transmissions between nodes in different zones may be needed for the network-tier forwarding of control messages and data packets. In EGMP, to avoid the overhead in tracking the exact locations of a potentially large number of group members, location service is integrated with zone – based membership management without the need of an external location server. In previous, the underlying geographic unicast protocol (e.g. GPSR) will forward the packet to node 18 greedily as it closer to the destination. The perimeter mode may be used to continue the for-warding. This still cannot guarantee the packet to arrive at node 7, as the destination is a virtual reference point. Such a problem is neglected by the previous geographic protocols that use a region as destination [7].

C. Zone Leader Election

A zone leader is elected through the cooperation of nodes and maintained consistently in a zone [11]. When a node appears in the network, it sends out a beacon announcing its existence. Then, it waits for an Intvalmax period for the beacons from other nodes. Every Intvalmin a node will check its neighbor table and determine its zone leader under different cases: 1) the neighbor table contains no other node in the same zone; it will announce itself as a leader. 2) The flags of all the nodes in the same zone are unset, which means that no node in the zone has announced the leadership role. If the node is closer to the zone center than other nodes, it will announce its leadership role through a beacon message with the leader flag

D. Multicasting Tree Construction

In this section, we present the multicasting tree creation and maintenance schemes. In EGMP [12], instead of connecting each group member directly to the tree, the tree is formed in the granularity of zone with 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[17] 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.

E. Multicast Data Forwarding

Maintain the multicast table, and the number zones normally cannot be reached within one hop from the source .When a node N has a multicast packet to forward to a list of destinations (D1; D2; D3;:), it decides the next hop node towards each destinations using the geographic forwarding strategy

.After deciding the next hop nodes, N inserts the list of next hop nodes and the des-tinations associated with each next hop node in the packet header. An example list is (N1;D1;D3;N2:D2;:)[13] where N1 is the next hop node for the destinations D1 and D3 , and N2 is the next hop node for D2.Then N broadcasts the packet promiscuously[12][14] . Upon receiving the packet, a neighbor node will keep the packet if it is one of the next hop nodes or destinations [15][16], and drop the packet otherwise. When the node is associated with some downstream destinations, it will continue forwarding packets similarly as done by node N.

V. SIMULATION ENVIRONMENT

A. Simulation Model

Here we perform the experiments for the evaluation of the performance of Ad Hoc routing protocol EGMP. We have 30 simulation run in total out of which 15 trace files has been generated. We tested all performance metrics in our experiment under varying mobility speed of node (10 to 50m/sec) and while other parameters are constant.

B. NS-2 simulator

The network simulations have been done using network simulator NS-2. The network simulator NS-2 is discrete event simulation software for network simulations. It simulates events such as receiving, sending, dropping and forwarding packets. The ns-allinone-2.34 supports simulation for routing protocols for ad hoc wireless networks such as EGMP. NS-2 is written in C++ programming language with Object Tool Common Language. Although NS-2. 34 can be built on different platforms, for this paper, we chose a Linux platform i.e. FEDORA 13, as Linux offers a number of programming development tools that can be used with the simulation process. To run a simulation with NS-2.34, the user must write the OTCL simulation script. Moreover, NS-2 also offers a visual representation of the simulated network by tracing nodes events and movements and writing them in a file called as Network animator or NAM file.

V SIMULATION RESULTS AND ANALYSIS

A. Evaluation Metrics

In the simulations presented in this paper the following parameter are analyzed to study the effects of mobility on each of the multicast routing protocols:

1. Delay: The difference between the time when the packet is sent by the source and when it is received by a receiver.

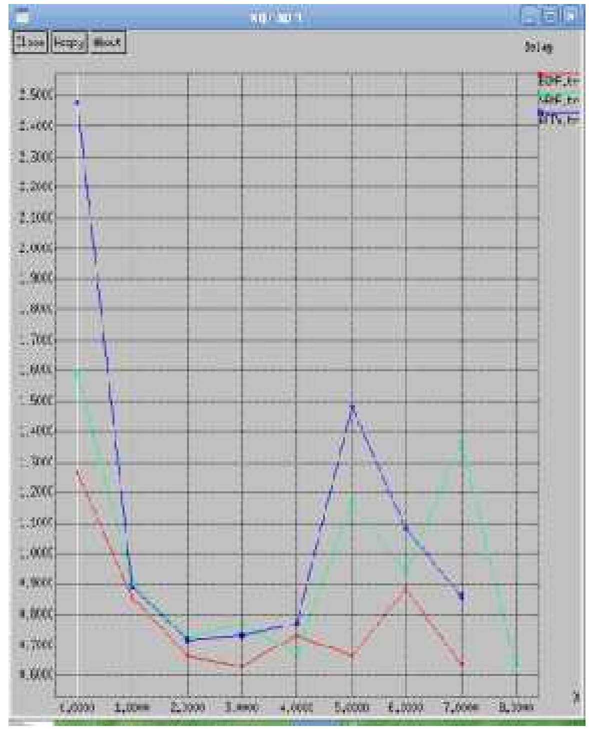

Fig. 1 Delay of Packets vs Time

The delay ratio of the protocols is compared and the graph says the EGMP has the less delay than the other protocols.

2. Throughput: The ratio of the number of packets received to the number of packets sent.

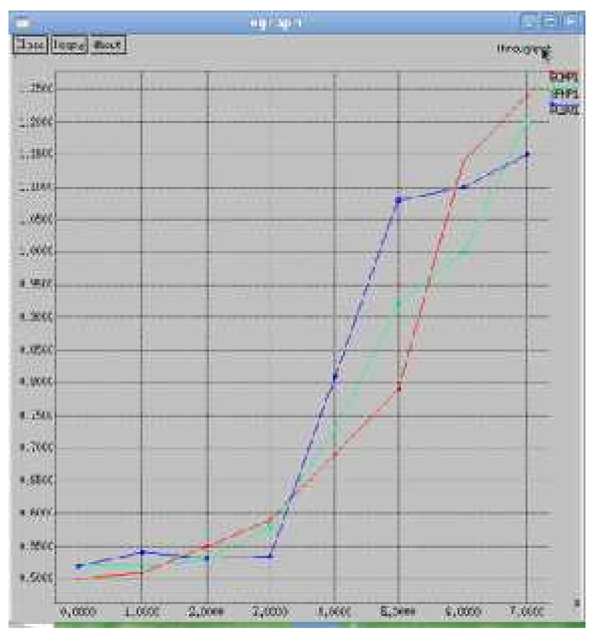

Fig. 2 Throughput of Packets vs Time.

The throughput ratio of the protocols is compared and the graph says the EGMP has the best packet delivery ratio than the other protocols.

VI.CONCLUSION

We have designed an efficient and robust geographic multicast protocol for MANET in this paper. This protocol uses a zone structure to achieve scalability, and relies on un-beneath geographic unicast routing for reliable packet transmissions. The position information is used in the protocol to guide the zone structure building, multicast tree construction and multicast packet forwarding and 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. The results of experiments shows that the EGMP protocol have the less delay and high throughput.. Simulation results show our protocol can achieve higher packet delivery ratio in a large – scale network.

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