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A SURVEY OF EFFICIENT AND SCALABLE MULTICASTING OVER MOBILE AD-HOC NETWORKS

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Abstract - Multicast is an efficient method for implementing group communication that is important in MANET. This project proposes a novel Efficient Geographic Multicast Protocol (EGMP). EGMP uses a virtual-zone-based structure to implement scalable and efficient group membership management to an efficient and scalable packet processing framework for continuous information transmission. A dynamic environment communication model is introduced as a general mechanism for quickly and efficiently learning about changes occurring in the environment in a fault tolerant manner. For purposes of scalability, multiple dynamic environment servers store user, device, and, for each geographic region, context information. In order to efficiently disseminate information from these components to applications, a dynamic collection of multicast groups is employed. 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 over head for route searching and tree structure maintenance. 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. Several strategies have been proposed to further improve the efficiency of the protocol.

Keywords- Multicast, Routing, Mobile Ad hoc networks, Protocol

I. INTRODUCTION

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. In this paper, propose a novel Efficient Geographic Multicast Protocol (EGMP). EGMP uses a virtual-zone-based structure to implement scalable and efficient group membership management. A Mobile Ad Hoc Network (MANET) is a collection of mobile nodes (hosts) which communicate with each other via wireless links either directly or relying on other nodes as routers. The operation of MANETs does not depend on preexisting infrastructure or base stations. Network nodes in MANETs are free to move randomly. Therefore the network topology of a MANET may change rapidly and unpredictably.

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Specifically, nodes may participate in the route discovery and maintenance process of forward data packets. The network nodes are randomly distributed over the entire network area. The source and destination of each transaction are chosen randomly among all nodes.

II. RELATED WORK

A. In this paper we propose a multicast routing protocol for mobile ad hoc networks (MANETs). The protocol termed Differential Destination Multicast (DDM) differs from common approaches proposed for MANET multicast routing in two ways. Firstly, instead of distributing membership control throughout the network, DDM concentrates this authority at the data sources (i.e. senders) thereby giving sources 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. The protocol is best suited for use with small multicast groups operating in dynamic networks of any size. The result is a flexible, efficient and robust protocol suitable for small multicast groups. The simulation results show that DDM is very efficient both in terms of data forwarding and control channel access. The simulation also shows that DDM is more sensitive to network traffic level compared to protocols using redundant forwarding path. This is because data packet loss has more serious consequence on protocol performance. When data packet loss occurs, the DDM control information embedded in data packets is also lost. With no redundant data forwarding, packet loss also reduces packet delivery ratio. In future studies, different modes and options of the DDM protocol will be explored. Improvements to the protocol, especially those targeting at reducing data packet vulnerability and the impact of data packet loss will be attempted.

B. In this paper we propose a new multicast protocol for multi hop mobile wireless networks. Instead of forming multicast trees, a group of nodes in charge of forwarding multicast packets is designated according to members' requests. Multicast is then carried out via "scoped" flooding over such set of nodes. The forwarding group is periodically refreshed to handle topology/membership changes. Multicast using forwarding group takes advantage of wireless broadcast transmissions and reduces channel and storage overhead, thus improving the performance and scalability. In this paper we introduce a novel multicast scheme for a mobile, multi hop wireless network with no fixed infrastructure. Various multicast schemes have been proposed for such an environment. One scheme creates a per-source multicast tree for each sender source. Packets are multicast on the tree using Reverse Path Forwarding (RPF) for duplicate detection. We will show that RPF is not very effective in high mobility environments. Another is using a shared tree spanning the members in the multicast group. Data sent to the shared tree are forwarded to all receiver members. For the shared tree multicast, it is necessary to maintain a "core" or Rendezvous Point (RP) for sender and receiver paths to meet. RP mobility may affect multicast efficiency. Some schemes use sets of RPs to direct multicast routing and resource reservation. The mobile RPs tends to increase the overhead of RP selection and thus reduce multicast efficiency.

C**.** In this paper it has been a big challenge to develop routing protocol that can meet different application needs and optimize routing paths according to the topology change in mobile ad hoc networks. Basing their forwarding decisions only on the local topology, geographic routing protocols have drawn a lot of attentions in recent years. However, inaccurate local topology knowledge and the outdated destination position information can lead to inefficient geographic forwarding and even routing failure. Proactive local position distribution can hardly adapt to the traffic demand. It is also difficult to pre-set protocol parameters correctly to fit in different environments. We have developed two self-adaptive on-demand geographic routing schemes. The local topology is updated in a timely manner according to network dynamics and traffic demands. Our route optimization scheme adapts the routing path according to both topology changes and actual data traffic requirements. Each node can determine and adjust the protocol parameter values independently according to different network environments, data traffic conditions and node's own requirements. We have developed two self adaptive on-demand geographic routing schemes. The local topology is updated in a timely manner according to network dynamics and traffic demands. Our route optimization scheme adapts the routing path according to both topology changes and actual data traffic requirements. Each node can determine and adjust the protocol parameter values independently according to different network environments, data traffic conditions and node's own requirements. Proposing two novel on-demand geographic routing protocols with different schemes to obtain and maintain topology information. One protocol purely relies on one hop topology information as other geographic routing schemes; the other one assumes a hybrid scheme which combines geographic and topology-based mechanisms for more efficient routing, while avoiding the performance degradation of conventional geographic routing due to the constraints in local view of topology. The simulation results show that our protocols can efficiently adapt to different scenarios and perform better than the existing geographic routing protocols. Nearly four times delay reduction has been observed in high mobility case.

III. 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, the 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.

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. COST ANALYSIS

In this section, we will quantitatively analyze the per node cost of the protocol, which is defined as the average number of control messages transmitted by each node per second. The notations to be used in this section are listed in Table1.The cost of the overall protocol consists of the following three components: zone building and geographic routing, tree construction, and tree maintenance. Cost for Zone Building and Geographic Routing. The zone is virtual and determined by each node based on its position and the reference origin, without the need of contributed with a flag inserted in the beacon messages of the underlying geographic unicast routing protocol. Therefore, the per node cost of the zone building and geographic routing is impacted by the beaconing frequency 1=Intval min introduced in , and the cost is as follows: Cost unicast _1Intval min ¼ Oto1:Cost for Tree Construction. The tree construction process is associated with the multicast session initiation and termination, and the member joining and leaving the multicast tree. This indicates that the per node control overhead involved in multicast tree construction remains relatively constant with respect to network size and group size.

TABLE.1
Notations Used in the Cost Analysis

N	total number of mobile nodes within the network
r	zone size, the length of a side of the square zone
R	network size, assuming a square network terrain with a side length R
v	average moving speed of the mobile nodes
T	the lasting time of the multicast session
M_n	total number of group member nodes
M_z	total number of multicast tree zones.

We summarize the per node cost of the protocol and validate our quantitative analysis through simulations.

V. 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.

VI. PROPOSED ARCHITECTURE

I propose an efficient geographic multicast protocol(EGMP),which can scale to a large group size and large network size, the working of the EGMP is shown in the architecture diagram (see in Fig:1).

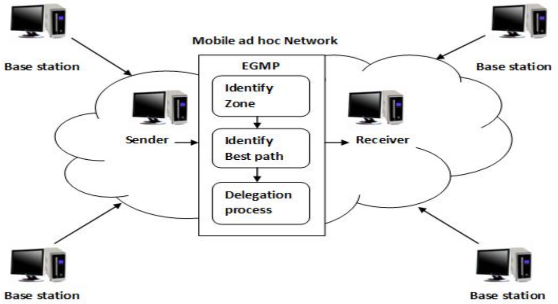

Fig: 1. System Architecture

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 group membership management. Scalable geographic multicast protocol also needs to efficiently manage the membership of a possibly large group. It will work as High packet delivery ratio and low control overhead. The Data transmission is having the structured form, High reliability and it gives the accurate measurement, compare to the other this one is low cost.

VII. CONCLUSION

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, 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.

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