Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X

IJCSMC, Vol. 4, Issue. 4, April 2015, pg.130 – 136

RESEARCH ARTICLE

Scalability and Robustness in MANET

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Abstract: In Mobile Ad hoc Network (MANET) there is a challenge in packet delivery ratio and the maintenance of network structure. In this nodes are created where as it has been splitted into virtual zone structures. Here Robust and Scalable Geographic Multicast Protocol(RSGM) is used for maintaining a group membership management over the other existing protocols such as On Demand Multicast Routing Protocol(ODMRP),.Packet delivery ratio is reduced by using Ad hoc On demand Distance Vector(AODV) routing protocol. It can be done for both unicasting and multicasting. Packets can be forwarded in high network dynamics due to unstable wireless channels and the movement of nodes. It increases the speed and reduces the packet delivery ratio.

Keywords-- packet delivery ratio, virtual zone structure, multicasting, wireless channels, robust and Scalable Geographic Multicast Protocol

I. INTRODUCTION

Wireless Networking is an emerging technology that allows users to access information and services electronically, regardless of their geographic position. In this, ad-hoc network is a collection of wireless mobile nodes dynamically forming a network infrastructure or centralized administration. There are many different types of setups that could be called MANETs [1] and the potential for this sort of network is still being studied.

MANETs can be characterized as having a dynamic, multihop, potentially rapid changing topology. Wireless ad-hoc networks are also called Mobile ad-hoc multihop networks without predetermined topology or central control. This is because MANETs can be characterized as having a dynamic, multihop, potentially rapid changing topology. The aim of such networks is to provide communication capabilities to areas with limited or no existing communication infrastructures. A MANET is usually formed by mobile nodes using wireless communications. It uses a peer-to-peer multihop routing instead of a static network infrastructure to provide network connectivity. Geographic forwarding is used to achieve further scalability and robustness [2][3].Mobility has a large impact on the behavior of ad hoc networks.

II. ROUTING PROTOCOLS

There are two types of routing protocols. They are Proactive and Reactive. The Reactive protocol are used in this system

1) AODV Routing

Ad hoc on demand distance vector routing (AODV) is the combination of DSDV and DSR. In AODV, each node maintains one routing table [13]. Each routing table entry contains:

a) Active neighbor list: a list of neighbor nodes that are actively using this route entry.
Once the link in the entry is broken, neighbor nodes in this list will be informed.
b) Destination address
c) Next-hop address toward that destination
d) Number of hops to destination
e) Sequence number: for choosing route [7][8] and prevent loop
f) Lifetime: time when that entry expires

Routing in AODV consists of two phases: Route Discovery and Route Maintenance [20]. When a node wants to communicate with a destination, it looks up in the routing table. If the destination is found, node transmits data in the same way as in DSDV [10]. If not, it start Route Discovery mechanism: Source node broadcast the Route Request packet to its neighbor nodes, which in turns rebroadcast this request to their neighbor nodes until finding possible way to the destination. When intermediate node receives a RREQ [21], it updates the route to previous node and checks whether it satisfies the two conditions: (i) there is an available entry which has the same destination with RREQ (ii) its sequence number is greater or equal to sequence number of RREQ. If no, it rebroadcast RREQ. If yes, it generates a RREP message to the source node. When RREP is routed back, node in the reverse path updates their routing table with the added next hop information. If a node receives a RREQ that it has seen before (checked by the sequence number), it discards the RREQ for preventing loop. If source node receives more than one RREP, the one with greater sequence number will be chosen. For two RREPs with the same sequence number, the one will less number of hops to destination will be chosen. When a route is found, it is maintained by Route Maintenance mechanism: Each node periodically send Hello packet to its neighbors for proving its availability. When Hello packet is not received from a node in a time, link to that node is considered to be broken. The node which does not receive Hello message will invalidate all of its related routes to the failed node and inform other neighbor using this node by Route Error packet. The source if still want to transmit data to the destination should restart Route Discovery to get a new path. AODV has advantages of decreasing the overhead control messages, low processing, quick adapt to network topology change, more scalable up to 10000 mobile nodes [11][16]. However, the disadvantages are that AODV only accepts bi-directional link and has much delay when it initiates a route and repairs the broken link.

III. DESIGN PROCESSES

A. Topology Formation

Virtual zones are used as references for the nodes to find their zone positions in the network domain. The zone is set relative to a virtual origin located at (x0; y0), which is set at the network initialization stage as one of the network parameters [14]. The length of a side of the zone square is defined as zone size. Each zone is identified by a zone ID (zID). A node can calculate its zID (a, b) from its pos (x, y) as follows:

$$\begin{cases} a = \left\lfloor \dfrac{x - x_0}{zone\_size} \right\rfloor, \\ b = \left\lfloor \dfrac{y - y_0}{zone\_size} \right\rfloor. \end{cases}$$

For simplicity, we assume all the zone IDs are positive. A zone ID will help locate a zone, and a packet destined to a zone will be forwarded toward its center [12]. The center position (xc, yc) of a zone with zID (a,b) can be calculated as:

$$\begin{cases} x_{center} = x_0 + (a + 0.5) \times zone\_size, \\ y_{center} = y_0 + (b + 0.5) \times zone\_size. \end{cases}$$

On-Demand Leader Election

A leader will be elected in a zone only when the zone has group members in it to avoid unnecessary management overhead. When a multicast group member M just moves into a new zone, if the zone leader (zLdr) is unknown, M queries the neighbor node in the zone for the leader. When failing to get the leader information, M will announce itself as a leader by flooding a LEADER message into the zone. In the case that two leaders exist in a zone, e.g., due to the slight time difference of leader queries and announcements, the one with the larger ID will win and be selected as the leader. A zone leader floods a LEADER in its zone every time interval $Intval_{refresh}$ to announce its leadership until the zone no longer has any members. If no LEADER message [15] is received within the interval 2 x $Intval_{refresh}$, a member node will wait for a random period [17] and then announce itself as the zone leader when no other node announces the leadership.

B. Splitting the Network into Zones

In this module, we'll split the network into several zones. Every zone has a Zone Leader. Each and every node of the zone is connected to other nodes in the same zone. In order to join and leave a multicast group, the nodes in the network need to have the source information.

As a source can move in a MANET, it is critical to quickly find the source when needed and efficiently track the location of the source node [19]. RSGM incorporates mechanisms for session creation and efficient source discovery. Session Initiation A multicast session (G) is initiated and terminated by a source (S).

C. Group Membership Management

The group membership is managed at two tiers. RSGM takes advantage of the virtual-zone-based structure to efficiently track the group membership and member positions. 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.

Local Group Membership Management The group membership is first aggregated in the local zone and managed by the zone leader. When joining or leaving a group, a member M sends a message REFRESH (groupIDs, posM) immediately to its zone leader to notify its membership change, where posM is its position and groupIDs are the addresses of the groups in which M is a member. M also needs to unicast a REFRESH message to its zone leader every time interval $Intval_{refresh}$ to update its position and membership information. A member record will be removed by the leader if not refreshed within 2 x

$Intval_{refresh}$. When M moves to a new zone, its next periodic REFRESH [10]u will be sent to the zone leader in the new zone. It will announce itself as the leader if the new zone does not have one. The moving node will still receive the multicast data packets from the old zone before its information is timed out at the leader of the old zone, which reduces the packet loss during the moving. For a leader node, if its distance to the zone border is shorter than a distance threshold and the zone is still a member zone, it will hand over its leadership by unicasting a LEADER message (carrying all the current group information) to the neighbor node [18] in its zone which is closest to the zone center. The LEADER message will continue being forwarded toward the zone center until reaching a node which has no neighbour closer to the zone center than itself, and the node will take over the leadership and flood a LEADER within the zone.

D. Multicast Packet Delivery

A source needs to send the multicast packets reliably to the group members. With the membership management, the member zones are recorded by source S, while the local group members and their positions are recorded by the zone leaders. Multicast packets will be sent along a virtual distribution tree from the source to the member zones, and then along a virtual distribution tree from the zone leader to the group members. A virtual distribution tree is formulated during transmission time and guided by the destination positions. The multicast packets are first delivered by S to member zones toward their zone centers [4][5]. S sends a multicast packet to all the member zones, and to the member nodes in its own zone through the zone leader. For each destination, it decides the next hop by using the geographic forwarding strategy described. After all the next hops are decided, S unicasts to each next-hop node a copy of the packet which carries the list of destinations that must be reached through this hop. Only one copy needs to be sent when packets for different destinations share the same next hop node. Thus, the packets are forwarded along a tree-like path [6][9] without the need of building and maintaining the tree in advance. For robust transmissions, geographic unicast is used in packet forwarding. The packets can also be sent through broadcast to further reduce forwarding bandwidth, at the cost of reliability. When an intermediate node receives the packet, if its zone ID is not in the destination list [21], it will take a similar action to that of S to continue forwarding the packet. If its zone is in the list, it will replace its zone ID in the destination list with the local members if it is a zone leader, or replace the ID with the position and address of the zone leader otherwise. The intermediate node will find the next hop node to each destination and aggregate the sending of packets that share the same next-hop node as source S does.

IV. EXPERIMENTS

The Experiments are done for 25, 50,100,150,200,300 nodes for one to one, one to many and many to many packet delivery.

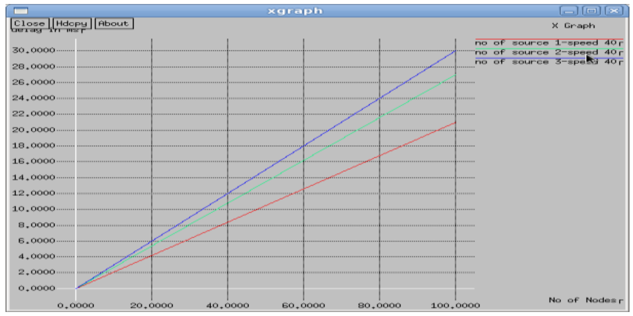

Fig 1. Delivery Ratio for 25 nodes

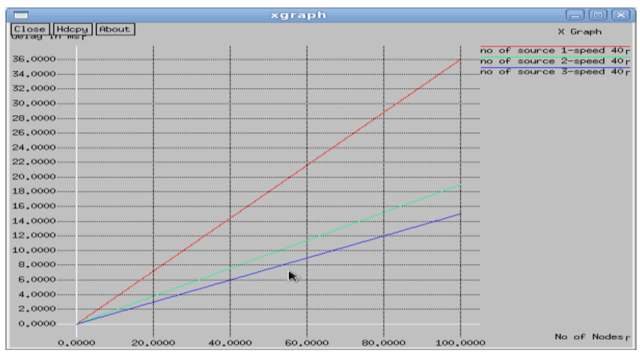

Fig 2. Delivery Ratio for 50 nodes

V. CONCLUSION

Data packets and control messages are transmitted along efficient tree-like paths without the need of explicitly creating and maintaining a tree structure. Scalable membership management is achieved through a virtual-zone-based two-tier infrastructure. Membership management can be efficient by using zone based scheme. Delay ratio will be reduced.

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