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Stateless Multicasting in Mobile Ad-Hoc Network with RSGM Protocol

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Abstract ***-A Mobile Ad hoc Network (MANET) is a system of wireless mobile nodes that dynamically self-organize in arbitrary and temporary network topologies. The main purpose of an ad hoc network routing protocol is to enable the transport of data packets from one point to another.One of the main challenges in MANET is to design the robust security solution that can protect MANET from various routing attacks. The overall goal of the security solutions for MANET is to provide security services including authentication, confidentiality, integrity, anonymity, and availability to the mobile users. In recent years very attractive and big challenges in designing a Robust and Scalable Multicasting Routing Protocol in MANET due to the difficulty in maintenance of multicast structure over the dynamic network topology for a large group size or network size. In this paper we propose a Robust and Scalable Geographic Multicast Protocol (RSGM). The RSGM protocol no need have maintained state information for robust and scalable packet transmission in dynamic environment. However, it is challenging to implement scalable, robust and efficient multicast in MANET due to the difficulty in group membership management, multicast p acket forwarding. The RSGM protocol is used to avoid the flooding in the network.Simuation will be carried out by using some simulator & one of the main intension of RSGM is to improve the performance of the network & also RSGM achieves a significantly higher delivery ratio.***

Keywords- Adhoc network, Wireless network, Packet forwarding, RSGM, Multicast routing, Mobile computing.

I. INTRODUCTION

MANETs are gaining momentum because they help realizing network services for mobile users in areas with no pre-existing communications infrastructure, or when the use of such infrastructure requires wireless extension [1, 2]. Mobile networking is one of the most important technologies supporting pervasive computing. During the last decade, advances in both hardware and software techniques have resulted in mobile hosts and wireless networking common and miscellaneous. A mobile ad hoc network is a collection of wireless nodes that can dynamically be set up anywhere and anytime without using any pre-existing network infrastructure. It is an autonomous system in which mobile hosts connected by wireless links are free to move randomly and often act as routers at the same time. The traffic types in ad hoc networks are quite different from those in an infrastructure wireless network. MANETs are vulnerable to various types of attacks including passive eavesdropping, active interfering, impersonation, and denial-of-service. MANET can be applied to different applications including battlefield communications, emergency relief scenarios, law enforcement, public meeting, virtual class room and other security-sensitive computing environments. The security issue of MANETs in group communications is even more challenging because of involvement of multiple senders and multiple receivers. At that time of multicasting, mobile ad hoc network are unprotected by the attacks of malicious nodes because of vulnerabilities of routing protocols. Some of the attacks are Rushing attack, Black hole attack, Sybil attack, Neighbor attack and Jellyfish attack. Instead of using multiple unicast transmissions, it is advantageous to use multicast in order to save network bandwidth and resources, since a single message can be delivered to multiple receivers simultaneously. Existing multicast routing protocols in MANETs can be classified into two Categories: tree based and mesh-based. In a multicast routing tree, there is usually only one single path between a sender and a receiver, while in a routing mesh, there may be multiple paths between each sender receiver pair. Routing meshes are thus suitable than routing trees for systems with frequently changing topology such as MANETs due to availability of multiple paths between a source and a destination. Multicast is an efficient method to realize group communications. The high dynamics of MANET, however, makes the design of routing protocols much more challenging than that of wired network. The conventional multicast protocols [3, 4] generally do not have good scalability due to the overhead for route searching, group membership

management, and tree/mesh structure creation and maintenance over the dynamic topology of 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. The routing protocols are mainly categorized into three categories: Proactive, Reactive & Hybrid. Hybrid protocol uses the features of reactive and proactive protocol. Most of hybrid routing protocols are designed as a hierarchical or layered network framework. One of the jobs of RSGM protocol is to make the network reliable and scalable.RSGM is also providing better multicast packet transmission in dynamic environment. The main role of RSGM is to make the network well efficient & provide the robustness to the adhoc network & improves the performance metrics term of the adhoc network. In order to support more reliable and scalable communications, it is critical to reduce the states to be maintained by the network, and make the routing not significantly impacted by topology changes. Recently, several location based multicast protocols have been proposed [5, 6, 7] for MANET.

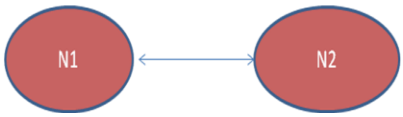

Fig .1 Unicast Transmission

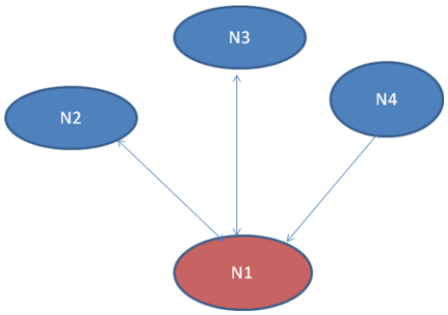

Fig. 2 Broadcast Transmission

Where N1, N2, N3 & N4 numbers represents a nodes in the adhoc network.A wireless ad-hoc network consists of a collection of "peer" mobile nodes that are capable of communicating with each other without help from a fixed infrastructure. The interconnections between nodes are capable of changing on a continual and arbitrary basis. Nodes within each other's radio range communicate directly via wireless links, while those that are far apart use other nodes as relays. Nodes usually share the same physical media; they transmit and acquire signals at the same frequency band. However, due to their inherent characteristics of dynamic topology and lack of centralized management security. In the wireless network there are basic three kevels of transmission taking place. In unicast transmission method, there is a transmission taking place between two nodes only. In broadcast transmission if there are N nodes in the network then the transmission is taking place among the all N nodes. In multicast transmission the transmission between the nodes is taking place among the specific subgroup of the nodes in the adhoc network.

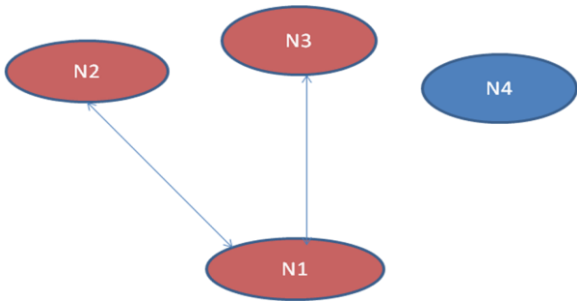

Fig. 3 Multicast Transmission

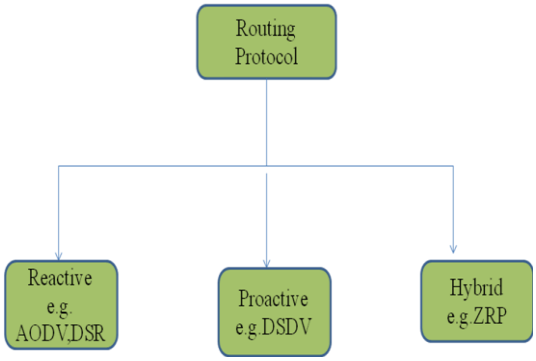

Fig. 4 Classification of routing protocol

A] MANET Features:

Mobile networking is one of the most important technologies supporting pervasive computing. During the last decade, advances in both hardware and software techniques have resulted in mobile hosts and wireless networking common and miscellaneous.

MANET has the following features:
a) Autonomous terminal. In MANET, each mobile terminal is an autonomous node, which may function as both a host and a router. In other words, besides the basic processing ability as a host, the mobile nodes can also perform switching functions as a router. So usually endpoints and switches are indistinguishable in MANET.

b) Distributed operation. Since there is no background network for the central control of the network operations, the control and management of the network is distributed among the terminals. The nodes involved in a MANET should collaborate amongst themselves and each node acts as a relay as needed, to implement functions e.g. security and routing.
c) Multihop routing. Basic types of ad hoc routing algorithms can be single-hop and multihop, based on different link layer attributes and routing protocols. Single-hop MANET is simpler than multihop in terms of structure and implementation, with the cost of lesser functionality and applicability. When delivering data packets from a source to its destination out of the direct wireless transmission range, the packets should be forwarded via one or more intermediate nodes.

d) Dynamic network topology. Since the nodes are mobile, the network topology may change rapidly and unpredictably and the connectivity among the terminals may vary with time. MANET should adapt to the traffic and propagation conditions as well as the mobility patterns of the mobile network nodes. The mobile nodes in the network dynamically establish routing among themselves as they move about, forming their own network on the fly. Moreover, a user in the MANET may not only operate within the ad hoc network, but may require access to a public fixed network (e.g. Internet).

e) Fluctuating link capacity. The nature of high bit-error rates of wireless connection might be more profound in a MANET. One end-to-end path can be shared by several sessions. The channel over which the terminals communicate is subject to noise, fading, and interference, and has less bandwidth than a wired network. In some scenarios, the path between any pair of users can traverse multiple wireless links and the link themselves can be heterogeneous.

f) Light-weight terminals. In most cases, the MANET nodes are mobile devices with less CPU processing capability, small memory size, and low power storage. Such devices need optimized algorithms and mechanisms that implement the computing and communicating functions.

II. LITERATURE REVIEW & RELATED WORK

Security of *MANET* routing protocols is envisioned to be a major "roadblock" in commercial application of this technology, only a limited number of works has been published in this area. Such efforts have mostly concentrated on the aspect of data forwarding, disregarding the aspect of topology discovery. In this we are mainly summarized the process that have been already mention in conventional multicast protocols. Then we discuss stateless protocol in geographic multicast in detail manner in literature. The multicast packets are forwarded along the pre-built tree or mesh structure, which is vulnerable to be broken over the dynamic topology, especially in a large network with potentially longer paths. A topology-based multicast protocol generally has the following inherent Components that make them difficult to scale:

a) Group membership management: The group membership changes frequently as each node may join or leave a multicast group randomly, and the management becomes harder as the group size or network size increases.

b) Membership management at network range: After the Membership information is aggregated in the local zone, a source only needs to track the member zones (mZones).

The geographic multicast protocols presented in [5] need to put the information of the entire tree or all the destinations into packet headers, which would create a big header overhead when the group size is large and constrain these protocols to be used only for small groups. GPSR [8] as an underlying unicast protocol to support the packet transmissions. The protocol, however, does not depend on a specific geographic unicast routing protocol. The HRPM [9] and Scalable Position-Based Multicast protocol (SPBM) are more related to our work, as the two share the essence as RSGM in improving the scalability of location-based multicast by using hierarchical group management. HRPM decompose a huge group into a hierarchy of recursively organized manageable-sized subgroups, and uses distributed geographic hashing to construct and maintain such a hierarchy. RSGM can be scalable to both the group size and the network size.

III. STATELESS MULTICASTING

The general meaning of word Stateless means there is no record of previous interactions and each interaction request has to be handled based entirely on information that comes with it. Multicast is similar to broadcast where there is one sender and multiple receivers. The difference is that with multicast the receiver can opt-in to a specific multicast group. Multicast is stateless, meaning you cannot use TCP for multicasting. This sucks because you lose the reliability and content can get lost. Multicast is an efficient method to realize group communications. The high dynamics of MANET, however, makes the design of routing protocols much more challenging than that of wired network. 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. Multicasting plays an important role in the typical applications of ad hoc wireless networks, namely emergency search and rescue operations and military communications. In such an environment, nodes from group to carry out certain tasks that

require point to multipoint and multipoint to multipoint voice and data communication The traditional wired networks multicast protocols such as core base trees (CBT) ,protocol independent multicast (PIM) do not perform well in adhoc network because tree based protocol is highly unstable and needs to be frequently readjusted to include broken links .The use of single channel connectivity among the node in a multicast group results in a tree shaped multicast routing topology .such topology provides high multicast efficiency with low packet delivery ratio due to frequent tree breaks. The mesh shaped multicast routing structure may work in high mobility environment.

The major issues in developing in the multicast routing protocols are: [10]

a) Robustness: The multicast routing protocol must be able to recover and reconfigure quickly from potential mobility include link breaks thus making it suitable for use in highly dynamic environment.

b) Efficiency: A Multicast protocol should make minimum number of transmissions to deliver a data packet to all the group members.

c) Control overhead: The scare bandwidth availability in adhoc network demands minimal control overhead for multicast session.

d) Quality of service: QoS support is essential in multicast routing because, data transferred in a multicast session is time sensitive.

e) Efficient group management: It is refer to the process of multicast session members and maintaining the connectivity among them until session expires. This process must be performed with minimal exchange of control message.

f) Scalability: The multicast routing protocol should be able to scale for a network with a large number of nodes.

g) Security: Authentication of session members and prevention of non-members from gaining unauthorized information play a major role in military communications.

IV. BASIC OF RSGM PROTOCOL

RSGM Stands for Robust and Scalable Geographic Multicast Protocol .RSGM is used in the mobile adhoc network area. Its can scale to a large group size and network size and provide robust multicast packet transmissions in a dynamic environment. RSGM uses more efficient zone-based structure to allow nodes to quickly join and leave the group. Additionally, RSGM introduces Source Home to facilitate quick source discovery and avoid network wide, Flooding of source information. As RSGM does not use any periodic network-wide, flooding and uses stateless virtual-tree-based structures for control and data transmissions. RSGM supports a two-tier membership management and forwarding structure. At the lower tier, a zone structure is built based on position information and a leader is elected on demand when a zone has group members. A leader manages the group membership and collects the positions of the member nodes in its zone. At the upper tier, the leaders of the member zones report the zone membership to the sources directly along a virtual reverse-tree-based structure. If a leader is unaware of the position or addresses of the source, it could obtain the information from the Source Home. With the knowledge of the member zones, a source forwards data packets to the zones that have group members along the virtual tree rooted at the source. After the packets arrive at a member zone, the leader of the zone will further forward the packets to the local members in the zone along the virtual tree rooted at the leader.

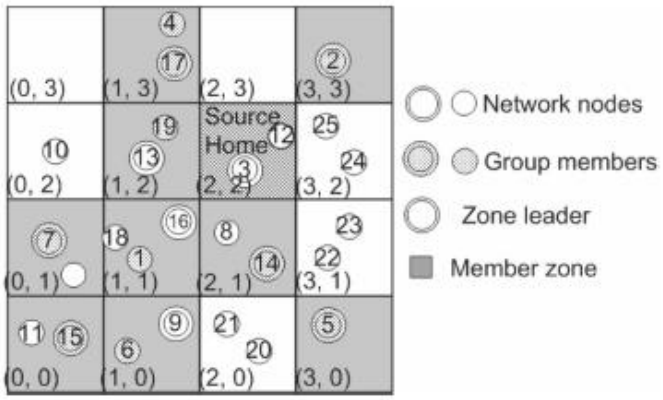

Fig. 5 Zone Based Structure for RSGM [11]

In RSGM, the zone structure is virtual and calculated based on a reference point. Therefore, the construction of zone structure does not depend on the shape of the network region, and it is very simple to locate and maintain a zone. 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.

a=x-xo/ Zone_size

b=y-yo/Zone_size

For simplicity, we assume the entire zone IDs is positive. zID will also help locate a zone. In our scheme, a packet destined to a zone will be forwarded towards its center. The center position (*xc*, *yc*) of a zone with zID (a, b) can be calculated as:

$xc = x0 + (a + 0.5) \times zone\ size,$

$yc = y0 + (b + 0.5) \times zone\ size.$

The length of a side of the zone square is defined as zone size. Each zone is identified by a zone ID (zID). On-demand leader election, A leader will be elected in a zone only when the zone has group members in it. After the membership information is aggregated in the local Zone, a source only needs to track the

IDs of the member Zones that have group members. The leaders of the member zones are responsible for the sending of the zone membership information to the source. When a zone changes from a member zone to a nonmember zone of G or vice versa, the zone leader sends a REPORT message immediately to S to notify the change. After the membership information is aggregated in the local zone, a source only needs to track the member zones (mZones). A zone may become empty when all the nodes move away. When a mZone of G is becoming empty, the moving out zLdr will notify S immediately to stop sending packets to the empty zone. If the moving out zLdr fails to notify S (e.g., zLdr suddenly dies), the packet forwarded to the empty zone will finally be dropped without being able to be delivered. The node which drops the packet will notify S to delete the zone from its zone list. A false deletion will be corrected when S receives the periodic membership reporting from the corresponding 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. RSGM incorporates mechanisms for session creation and efficient source discovery.

V. CONCLUSION

In this paper, we mainly focus on the stateless multicasting and the role of RSGM protocol in the adhoc networking. In RSGM, stateless virtual transmission structures are used for simple management and robust forwarding. Both data packets and control messages are transmitted along efficient tree-like paths without the need of explicitly creating and maintaining a tree structure. RSGM scales well with the group size, and achieves more percent delivery ratio under all the group sizes compared with the other protocol. The position information is used in RSGM to guide the zone structure building, membership management and packet forwarding, which reduces the maintenance overhead and leads to more robust multicast forwarding upon the topology changes. We also handle the empty zone problem using RSGM. Our study is related with the performance of the network is stll in progress. Future work will mainly focus on achieving the robust, reliable & efficient multicast packet delivery and improve the performance of the adhoc network by using some simulator.

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