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Issues and Challenges in Multicast Routing in Mobile Ad Hoc Networks (MANETs)

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Abstract:

Research in mobile area ADHOC-networks (MANETs) and its application has covered a wide spectrum of modern technology. Although a MANET can be implemented in a limited geographical area, applications of it are numerous in fay-to-day life. However, challenges to its accurate implementation have become the major concern for the researchers and scientists. Nature of Service (QoS) mindful rouing in MANET is one of the significant difficulties. Directing in a MANET can be acted in different manners and multicast steering is one of such varieties in directing in MANET. In multicast directing, a solitary hub can effectively send to various hubs in a MANET a solitary duplicate of message. Multicast steering is generally helpful for explicit applications wherein a subset of nodesd in the MANET can be related with. Right now, endeavor to lead a complete sutvey through the writing relating to multicst steering in MANET.

Keywords: *MANET, Multicast Routing Protocols, Reactive Routing, Proactive Routing;*

1 Introduction

Uses of Mobile Ad-hoc Networks (MANETs) have discovered tremendous fame among the specialists right now. The job of directing conventions in MANET present the significant test for productive usage of MANET applications. Multicast directing specifically is one of the steering strategies wherein a hub in the MANET can send to a subset of hubs in the system (Fig.1). Be that as it may, in multicast directing in MANET, the significant test develops around the erratic just as incessant changes in the system topology coming about because of versatility of hubs in the system. Multicasting is executed inside a gathering of hubs called multicast bunch for applications, for example, community figuring, sound/video conferencing, etc. Here a multicast bunch is recognized by an extraordinary location called multicast address and inside a MANET there may exist various multicast gatherings. Further, a multicast gathering may contain a lot of customers and server. A real world example of multicast group is a military group comprising of a commander and few soldiers in a battle field [1]. The members within a multicast group may change dynamically in time as existing members may leave or new members may join the group by virtue of mobility. A node can participate in multiple multicast groups and to send packets to a group, a node need not be a member of the group. The principal goal of multicasting

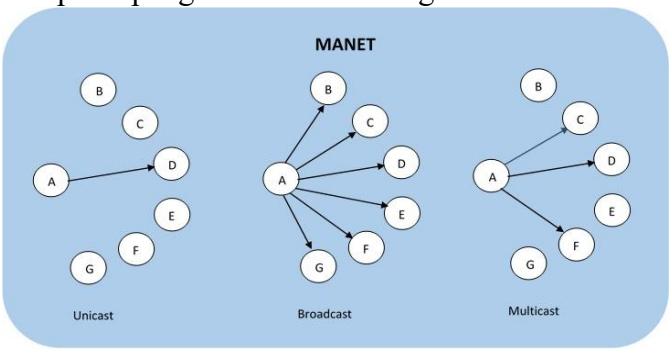

Fig.1: MANET Routing Patterns

is to connect a group of nodes thereby assuring the Quality of Service (QoS) as well as reliability aspects [2].

As mentioned earlier, multicast routing faces a set of challenge due to frequent changes in network topology and network dynamics as well as resources. The basic difference in MANET routing protocols from the traditional infrastructure based routing protocols lies in its self-configuring nature.

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Heterogenity of nodes in a MANET makes the rouitng more difficult too as compared to traditional network routing.

In this paper, we focus on a taxonomy of multicast rouitng protocols for MANET as

- Proactive routing based multicast routing protocols;
- Reactive routing based multicast routing protocols;
- Hybrid rouing based multicast routing protocols;
- Cluster based multicast routing protocols;

The rest of the paper is sorted out as follows. Multicast Rouitng Problem is definite in Section 2. Segment 3 presents a conversation of different proactive rouitng based multicast steering conventions. Reactive routing based, hybrid routing based and cluster based rouitng protocols are elaborated in sections 4, 5 and 6. Section 7 concludes the paper with futurework.

2 Multicast Routing Problem

Multicast Rouitng Problem (MRP) is defined to minimize a sepecified cost function during multicast communication in a group. It can characterized as a Steinet Tree Problem wherein the individuals from the multicast bunch speak to the leaf hubs in the Steiner Tree [3]. The undertaking of getting a Steiner Tree should be NP-finished wherein each connection has a unit cost [4,5]. The base spreading over tree issue that is for the most part utilized for broadcasting can likewise be helpful in displaying multicast issue too [6,7]. Further, Steiner dominated dominating set problem also can be used for designing multicast routing protoolcs [8,9].

3 Proactive Routing Based Multicast Rouitng Protocols for MANET

In proactive rouitng strategy, nodes in a MANET rely on a routing table in order to perform rouitng and thus, this strategy is also called as table driven routing. Frequent updates are brought in routes stored in the routing table due to rfequent movement of nodes in the network. Here we detail some multicats directing conventions for MANET dependent on proactive/table-driven steering methodology.

3.1 Multicast Core-Extraction Distributed Ad Hoc Routing (MCEDAR)

Entropy-based Genetic Algorithm to Support QoS Multicast Routing (EQMGA) proptocol was proposed by authors in [12] wherein Fuzzy-controlled optimized parameters are chosen making use of Genetic Algorithm (GA). The basic intention behind devising this protocol is to minimize reconstructions of routes. In this GA approach, chromosomes incorporate integral queuing along with a method for coding of routing information. The route with optimal performance possesses the highest fitness value. As claimed by the authors, the results of simulation justify its effectiveness in estimation as well as evaluation of stability of a route, thus minimizing reconstructions of routes.

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3.3 Hierarchical QoS Multicast routing using GA in MANET(HQMGA)

Existing QoS multicast directing conventions need calculation of multicast trees that could fundamentally fulfill numerous QoS necessities simultaneously. Various leveled QoS Multicast directing utilizing GA in MANET(HQMGA) proposed by creators in [13] is equipped for tending to this issue ideally in a MANET progressively.

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This convention permits dynamic development of semi-ideal multicast trees that can fulfill numerous QoS requirements at the same time. Such a semi-ideal multicast tree utilizes GA as GA is equipped for creating new multicast trees and taking care of the combinatorial issue simultaneously. Here, the hubs in a MANET are part into different groups as in Open Shortest Path First (OSPF) convention. Sub-trees are defined within a cluster in order to colect topological information and compute trees as well. This method as claimed by the authors can optimally reduce the power consumption during routing.

3.4 Genetic Algorithm for Energy-Efficient Based Multicast Routing on MANETs (EGA)

During routing in a MANET, nodes suffer from energy overhead that results from limited and unbalanced battery power at the nodes. This bottleneck is conveniently settled by Genetic Algorithm for Energy-Efficient Based Multicast Routing on MANETs (EGA), proposed by the creators in [14] in which GA executes the possibility of "natural selection" that essentially adds to the motivation behind this convention. Utilizing this methodology, a multicast spreading over tree can be developed with the postpone segment being limited that prompts the expansion of the lifetime of the meeting. It ought to be noticed that the hubs with higher leftover battery force can just share the all out vitality of the multicast tree. A hub with lower vitality level can be supplanted by that with a higher vitality level in this manner lessening the level of the hub. Consequently the vitality required by the multicast tree is contributed by the hubs with more significant level of lingering battery power. Authors claim to have achieved extended lifetime of the multicast service.

3.5 Ant-Colony Algorithm Based on Orientation Factor for QoS Multicast (MACO)

A changed Ant Colony Algorithm (MACO) is proposed by creators in [15] that speaks to a blend of Ant Colony Algorithm (ACA) and area based steering. Here, GPS is utilized for acquiring the area data that is utilized for deciding the pursuit course of ACA. This calculation will in general merge prior due to biogger topology of the system that further prompts neighborhood streamlining. The likelihood of finding the following bounce is determined from a direction factor. So as to speedup the union of the calculation, Tabu pursuit and reenacted tempering calculations are additionally coordinated alongside the direction factor.

4 Reactive Routing Based Multicast Routing Protocols

In reactive rouitng strategy, also called as on-demand routing, a route is established between the communicating nodes as and when required. Here, no routing table is used for the purpose of route establishment. In the beginning, the source sends aroute request (RREQ) packet that is broadcast to all the neighbours. Each neighbour on receiving this packet, broadcasts further and this processis iterated untilthe RREQ packetreaches the desired destinationnode.

4.1 QoS-aware Minimum Energy Multicast (QoS-MEM)

The lifetime of a hub exclusively relies upon battery power at the hub and a legitimate administration of intensity is vital so as to agree to the QoS necessity as required by the separate MANET application. A force mindful directing convention called QoS-mindful Minimum Energy Multicast (QoS-MEM) proposed by creators in [16] actualizes a limitation plan model that considers transmission capacity as the main QoS parameter alongside a minimization of vitality utilization during steering. So as to accomplish powerful information move from a source hub to a gathering of hubs in the system, the ideal information are sent along a multicast tree created by the source itself. The power consumed for receiving and processing a data packet at an intermediate node is eliminated from consideration.

4.2 On-Demand QoS Multicast for MANETs (ODQMM)

An on-request MANET directing convention approached Demand QoS Multicast for MANETs (ODQMM) is proposed by creators in [17] that is

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intended for data transfer capacity reservation in a TDMA arrange wherein transmission capacity data is made accessible to the hubs in a multicast gathering. Here, the RREQ parcel conveys extraordinary banners that speaks to the data about asset reservation that alludes to the measure of transfer speed should have been held at the hubs having a place with the multicast gathering. Right now, hub needs to keep up a gathering of tables to be specific, Reservation Table, Route Table, Multicast Route Table and Group Leader Table. The control messages utilized right now RREQ, RREP, Group Hello Message (GRPH), Multicast Activation (MACT), QoS Error and Keep Alive. A Route Request technique is started at whatever point a hub searhces for a way to a multicast gathering. Connection disappointment is seen at whatever point a hub doesn't get bundles from its neighburs after a fixed period.

4.3 Call- Admission Multicast Protocol for MANETs (M_CAMP)

Authors in [18] propose a reactive routing based MANET multicast protocol that ensures estimation of available bandwidth needed for admission control of multimedia based applications in a MANET. Since it relies on a group based procedure and peer to peer communication strategy, the underlying wireless network does not affect its operations. In does not need any updates of status information of the nodes in the network. It gurantees the issues of scalability as well as energy saving since nodes need to comply with the QoS constraints during forwarding packets.

4.4 QoS Ad Hoc On-Demand Distance Vector Routing (QoS-AODV)

With delay as the QoS requirement, an on-request MANET routiong porotocol named QoS Ad Hoc On-Demand Distance Vector Routing (QoS-AODV) is proposed by the creators in [19] wherein every hub needs to mantain a clock. Courses are found utilizing on-request approach. The clock runs beginning from the second when the RREQ bundle is created and consolidated into it. Each moderate hub on accepting RREQ parcel, computes the deferral concerning the clock esteem. The time parts considered right now transmission time, lining time, crash shirking time and control overhead time. It is worth noting that node mobility does not affect the performance of this protocol. This protocol is support the advantage that it reduces communication cost effectively.

4.5 Ad Hoc QoS Multicasting (AQM)

In order to support QoS along with multicasting features, authors in [20] have proposed a MANET rouitng protocol called Ad Hoc QoS Multicasting (AQM) protocol wherein multicsting efficiency has been achieved as claimed by the authors by virtue of optimal resource management. With reference to the earlier reservations, AQM tends to verify the availability of desired amount of bandwidth in the neighbourhood of a node and successfully chooses the route with the specified QoS having been complied with. AQM operates with simplified and homogeneous network structures thereby avoiding the networks with more complex structures. It implements multicast routing with proactive session management along with reactive QoS verification mechanism..

4.6 Quality of service for Multicast in MANETs (QAMNet)

All together for development of QoS consistence in multicast steering, a convention named Quality of administration for Multicast in MANETs (QAMNet) is proposed by creators in [21]. It speaks to an augmentation of work arranged multicast directing with the presentation of traffic privatization, confirmation control component, circulated asset arranging, dynamic control of traffic rate for non-continuous bundles concerning the criticism instrument joined at MAC layer so as to accomplish decreased deferral and expanded throughput for constant traffic.

5 Hybrid Routing Based Multicast Routing Protocols

Hybrid multicst MANET routingprotocols have been devised with the combination of the advantages of reactive and proactive routingprotocols. Proactive routing isused here in order to limit the set of forwarding nodes for

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destinations that are closer to the sender and reactive routing is used for limiting the set of forwarding nodes for destinations that lie farther from the sender. In this section, we discourse few multicast MANET routing protocolsproposed inthe literature that use hybrid routing strategy.

5.1 Multicasting Routing Protocol (QMR-QoS)

Ensuring QoS for real time applications such as multimedia applications running on a MANET becomes extremely challenging. This issue has been successfully adressed in a proposed by authors in [22] protocol called Multicasting Routing Protocol (QMR-QoS). It implements a mechanism for sharing the reserved bandwidth in order for achieving QoS compliance in multicast routing. It uses forwarding nodes for multicasting initiated by the source node thereby achieving proper load balancing.

5.2 Lantern-Tree-based QoS Multicast (LTM)

For effective usage of QoS multicasting the accessible bandwidh at the hubs of the multicast bunch should be higher than the base required. A convention called Lantern-Tree-based QoS Multicast (LTM) is proposed by creators in [23] that actualizes CDMA-over-TDMA model at the MAC layer. A lamp tree model is utilized right now request to fulfill to a specufied transfer speed necessity that ensures dependable correspondence.

5.3 Hypercube-based Virtual Dynamic Backbone (HVDB)

QoS in multicast steering is tested by two fundamental factors, for example, constrained data transmission at multicast hubs and habitually changing system topology. Creators in [24] proposed a QoS mindful multicast steering convention called Hypercube-based Virtual Dynamic Backbone (HVDB) that guarantees accessibility of plentiful assets along these lines rpoviding ideal productivity in directing for enormous scope MANETs. Right now, CH is chosen with a higher likelihood that shows up closer to the focal point of the group. A three level methodology actualized here involves Mobile Node Tier (MNT), the Hypercube Tier (HT) and the Mesh Tier (MT). MNT bunches the hubs which are part into various groups. Every hub here requirements to characterize a Virtual Circle (VC) wherein the area data can be kept up. HT keeps up a k-dimensional hypercubes that establishes of CHs. MT speaks to a 2-dimensional work wherein each hypercube speaks to a work hub. HVDB fundamentally is a nearby intelligent area based multicast directing calculation.

5.4 Hybrid QoS Multicast Routing Protocol (HQMRP)

Cross breed QoS Multicast Routing Protocol (HQMRP), proposed in [25] targets limiting start to finish delay with the execution of a source tree based multicast appropriation system. It utilizes recipient started way remaking approach so as to conquer the issue of way breakages. It depends on Integrated Services (IntServ) model for formation of association orinted virtual circuits for the streams admitted to the MANET. Data identifying with accessibility of transmission capacity are kept up at every hub in the MANET. Based on data transfer capacity data, source picks an ideal way to all goals in the MANET. Extraordinary control bundles are utilized for keeping up QoS consistence data. This convention depends on occasional connection state data so as to minimiza start to finish delay.

6 Cluster Based Multicast Routing Protocols

Bunch put together directing conventions depend with respect to the way that the MANET is part into a few bunches wherein each bunch contains a gathering of hubs. Hubs are allowed to join or leave a specific group during the lifetime of the MANET. A hub may have a place with various bunches at various moments of time because of portability. Hubs having a place with the visitor of a bunch take an interest in intercluster racket sending. Each group includes a bunch head (CH) and hubs impart through the CH as it were. Right now, detail a couple of bunch based multicast rouing conventions for MANET proposed by various creators.

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6.1 Multicasting Routing Protocol (QMR-QoS)

In order for improvement of QoS duirng routing, a distributed clustering approach has been proposed by authors in [26] that makes use of a combined weight metric for the purpose. The parameters such as transmission coverage area, node degree, mobility and node's available energy are taken into consideration in this approach. Here, CH is choosen with reference to these parameters. A cluster based technique wherein CH is chosen by virtue of combination of weighted parameters like energy level, stability and connectivity has been proposed by authors in [27]. A review of some existing cluster based algorithms has been conducted by teh authors in [28] thereby proposing a Flexible Weight Based Clustering Algorithm (FWCA) for MANETs.

6.2 Lantern-Tree-based QoS Multicast (LTM)

A cross layer based directing convention (CBRP) has been proposed by creators in [29] that thinks about physical, MAC and system layers for the structure of the convention. The presentation of the convention is estimated as for the data traded among these layers. Here, each hub sends "Hi" messages to its neighborhood so as to declare its reality. On accepting this message, each hub in the local updates its directing table. A hub with the least ID turns into the CH. A weighted grouping calculation for production of bunches alongside portability forecast inside a bunch has been proposed by creators in [30]. Guide messages are traded here among the hubs so as to communicate the presence in the system. The hub with most reduced weight is picked as the CH.

7 Conclusion and Futurework

Routing in a MANET presents the major challenges in efficient implementation of the applications on it. Multicast routing is one of the routing strategies that is application specific and provides an optimal usage of network resources. Right now, have plainly characterized the multicast issue and definite a scientific classification of multicast MANET steering conventions that contains four distinct classifications, for example, proactive directing based, responsive directing based, mixture steering based (a blend of the upsides of the past two systems) and bunch based directing conventions. Directing conventions proposed by different creators have been expounded with their significances. The substance of this paper might be very valuable for specialists right now completing further research and conceiving novel answers for the issue of multicasting.

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