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A Review and Analysis of MAODV routing protocols for Mobile Ad Hoc Networks

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Abstract— Mobile Ad hoc Networks have gained significant interest and popularity due to their open architecture, capability of changing location and self-configuring as per the needs and requirements of the users. The expanding ubiquity and accessibility of portable remote gadgets has lead analysts to build up an assortment of Mobile Ad hoc Networking (MANET) Protocols. This paper presents study of various sorts of Multicast Ad hoc On-Demand Vector (MAODV) directing protocols which offers fast adjustment to dynamic link conditions, low handling and memory overheads. Multicasting sends the information to a group of host PCs by utilizing single source address. The main objective of multicasting is to support group-oriented computing, which can reduce communication costs, processing overheads and delivery delay. Finally this paper analyses various MADOV routing protocols according to particular attributes which enables to reveal the significance of the research work went on in MAODV routing protocol and summarized literature reviews and its findings are presented in tabular form.

Keywords— Wireless, Ad Hoc, Multicast, Routing.

I. INTRODUCTION

MANET is a class of wireless communication network without settled infra-structure. The MANET idea has fundamentally advanced to handle debacle circumstances like tidal wave, earthquake, fear monger exercises, battleground, land-slides, and so on. Afterward, the idea has been reached out to incorporate applications, for example, online instruction, gaming, business, and so on where the greater part of the applications require group communication to deal with the circumstances. The fundamental wellsprings of lack of quality in MANETs are because of restricted battery limit, constrained memory and processing power, shifting channel conditions, less security under flighty and high mobility of node[1]. The QoS parameters of MANETs are transmission capacity, delay, packet loss, jitter, interface strength, route stability and portability, and so on [2].

The rest of the paper is organized as follows: The Section 2 discuss the classification of Multicast routing protocols for MANETs. Section 3 discusses the functionality of Multicast Ad hoc On-demand Distance Vector routing protocol. Section 4 presents the overall review on various implementations on MAODV. Finally Section 5 provides the conclusions and Future scope. The overall comparisons of various Multicast routing protocols are given in a notation Table 1.

II. MULTICAST ROUTING PROTOCOL

Numerous multicast routing protocols have been proposed for MANETs. The current multicast routing protocols can be comprehensively grouped in to three classes in view of topology: Tree-based, Mesh-based and Hybrid based multicast routing protocols as appeared in figure 1.0. Further multicast routing protocols can also be classified based on routing scheme: proactive and responsive schemes.

A proactive scheme intermittently sends control packets to keep up a multicast tree. This approach lessens the latency for a source that transmits the multicast information packets to every destination. The support overhead is high if the multicast action recurrence is low. In this scheme, nodes ceaselessly assess the routes to every reachable node and endeavor to keep up reliable, progressive routing data. The reactive routing protocols are not requiring to upkeep the system topology when there is no traffic. The normal reactive routing protocols are ODMRP (On-Demand Multicast Routing Protocol) and the MAODV. In this scheme, routing paths are looked just when it is required.

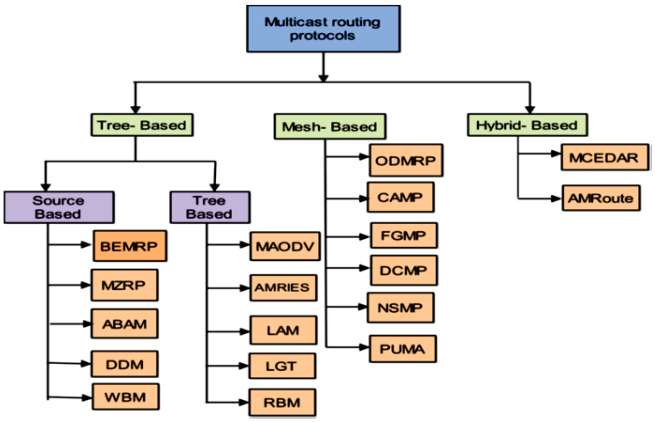

Fig. 1.0 Classification of multicast routing protocols

III. MULTICAST AD HOC ON-DEMAND DISTANCE VECTOR PROTOCOL(MAODV)

MAODV protocol was proposed by E.M. Royer et al. from University of California in 1999, and turned into an IETF Draft in 2000[3]. It is an on request multicast routing protocol outlined based on the unicast protocol AODV. MAODV routing protocol builds up a shared multicast tree structure associated all the multicast individuals for each multicast group to transmit the multicast information. One of the exceptional highlights of MAODV is its utilizing of multicast sequence numbers, and each multicast group has its own sequence number, which is initialized and kept up by the best positioned multicast group. The utilizing of these sequence numbers can ensure the connected routing to multicast group is always up-to-date. The development of multicast routing still uses the RREQ (Route Request) and RREP (Router Reply) control message of the unicast AODV routing protocol, and includes a MACT (Multicast Activation) message used to affirm the multicast routing.

A mobile node starts a RREQ message when it wishes to join a multicast group, or when it has information to send to a multicast group yet it doesn't have a route to that group. Just an individual from the coveted multicast group may react to a join RREQ. In the event that the RREQ isn't a join ask for, any node with a sufficiently new route (in light of group sequence number) to the multicast group may react[4]. On the off chance that a transitional node gets a join RREQ for a multicast group of which it isn't a member, or on the off chance that it gets a RREQ and it doesn't have a route to that group, it rebroadcasts the RREQ to its neighbours. As nodes along the way to the source node get the RREP, they include both a route table and a multicast route table entry for the node from which they got the RREP, in this way making the forward path, see Figure 2.0

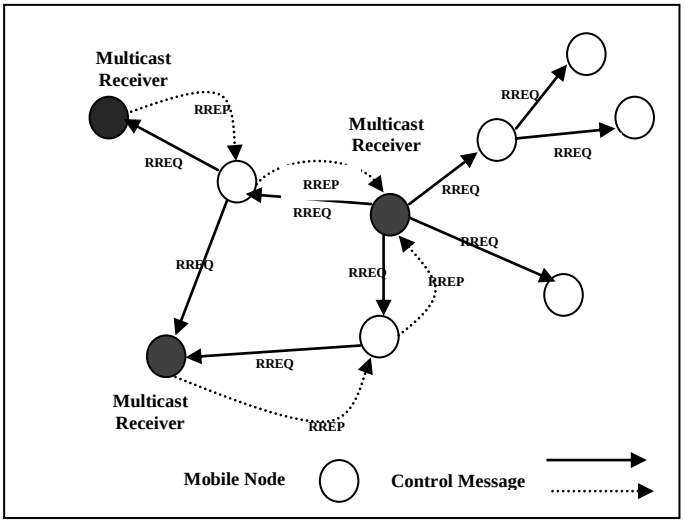

Fig 2.0 MAODV Path Discovery

IV. A REVIEW ON VARIOUS IMPLEMENTATIONS OF MAODV

Ajay Kumar Yadav et.al [2016] proposed QMRPRNS: Design of QoS multicast routing protocol [5] utilizing reliable node determination scheme for MANETs. This paper endeavours a QoS based multicast routing protocol utilizing reliable neighbour nodes choice plan (QMRPRNS). Besides, the proposed protocol additionally balances the network traffic utilizing multipath in the network. In the proposed strategy the nodes having more reliability pair factor in contrast with edge unwavering quality match factor are chosen for information transmission. This paper demonstrates the execution of the proposed protocol in a few system measurements, for example, packet delivery ratio, packet delivery delay and two sorts of overheads.

Sambhu Dahal et. al [2016] proposed an Enhanced Multicast Routing Protocol (EMRP) for MANET[6] which depends on MAODV. The proposed EMRP is worked in two stages: (I) Route Discovery and Multicast Tree Formation (ii) Multicast Tree Maintenance. EMRP chooses the path in light of node lifetime and hop count to the destination node. A component is utilized to diminish the route discovery during link break. Toward the end, the paper contrasts EMRP and MAODV and the two quantitative markers: Packet Delivery Ratio (PDR) and Latency to judge the execution.

Runping Yang et.al [2015] proposed a routing protocol Distensible Multicast Ad Hoc on Demand (DMAODV) [7] which is based on MAODV. It adds new feature on flooding message control, put forward a kind of "Self restrain flood" to suppress the MAODV GRPH and RREQ broadcast traffic. DMAODV is proposed to improve MAODV by Self-repression flooding algorithm which is applied in GRPH and RREQ packet. The specific approach is to extend GRPH and RREQ header information to include adjacent nodes. In DMAODV, It make full use of the broadcast feature of

wireless medium, and allow all nodes in the network send multicast packets. Thereby it can reduce the delay when a lot of packets are loss, and improve the packet delivery ratio further. The paper states that in DMAODV, the speed of packets transmission will increase and delay will decrease, less control overhead and higher scalability.

Xeuming Wang [2015] proposed a routing protocol Distensible Multicast Ad Hoc on Demand (DMAODV) [8] which depends on MAODV. It includes new element flooding message control, set forward a sort of "Self restrain flood" to stifle the MAODV GRPH and RREQ broadcast traffic. DMAODV is proposed to enhance MAODV independent from anyone else self-repression flooding algorithm which is connected in GRPH and RREQ packet. The particular approach is to expand GRPH and RREQ header data to incorporate adjoining nodes. In DMAODV, It make full utilization of the broadcast feature of remote medium, and permit all nodes in the system send multicast packets. Along these lines it can lessen the delay when a considerable measure of packets are loss, and enhance the packet delivery ratio further. The paper expresses that in DMAODV, the speed of packets transmission will increment and delay will diminish less control overhead and higher scalability.

LI Xut, LIU Tianjiaot et.al [2014] proposed Optimized Multicast Routing Algorithm Based on Tree Structure in MANETs[9], which enhances vigour of the MAODV protocol by consolidating preferences of the tree structure and the mesh structure. It can refresh shorter tree branches as well as build a multicast tree with reinforcement branches. The key thought of MAODV-BB is to make full utilization of GRPH messages that the group leader broadcast intermittently to refresh shorter tree branches and build a multicast tree with reinforcement branches. It upgrades the tree structure as well as lessens the recurrence of tree recreation.

N.-C. Wang [2012] proposed Power-aware Dual-Tree-based multicast routing protocol (PDTMRP) for MANETs [10]. In this approach, all nodes are randomly arranged into two kinds, group-0 and group-1. To accomplish the load balance, two multicast trees (tree-0 for group 0 and tree-1 for group-1) are built. In the route discovery, this scheme not only just enhances the route soundness of multicast routing, yet in addition accomplishes the load balance of information transmission. Along these lines the control overhead for route development and the quantity of route recreations can be diminished. Also, the activity load can be adjusted and the system lifetime can be drawn out.

Jin LuI, Dongfeng ZhaoI et.al [2011] proposed a "Family Particle Swarm Optimization for QoS Multicast Routing" in Ad hoc [11]. This protocol joining a new particle swarm optimization algorithm and MAODV multicast routing discovery algorithm, which separated the arrangement of multicast trees into families. Family history ideal solution and global ideal solution would decide the ideal decision for each emphasis procedure, until global convergence. The algorithm performed better system stability and load flexibility, and could optimize network performance adequately. This protocol will utilize an enhanced PSO algorithm relied upon customary multicast routing scheme under particular limitations of system QoS prerequisites to accomplish ideal solution of multicast routing scheme step by step through global optimization.

FengHe [2010] proposed a multicast protocol "S-MAODV:A Trust Key Computing Based Secure Multicast Ad-hoc On Demand Vector Routing Protocol" for Mobile Ad hoc networks[12]. S-MAODV takes full favourable position of trusting computing technology, joined with the Secure Node Authentication and security indicator bit-set system. The validation structure prevents un-trusted nodes to be a piece of a multicast tree or join a multicast tree. To prevent outsiders from meddling, just group trusted nodes can start route requests. S-MAODV protocol guarantees that multicast information is delivered from the source to the members of the multicast group, even within the sight of Byzantine attackers, as long as the group members are reachable through non-ill-disposed path . Also, we think of a productive secure multicast system to beat the potential attacks either routing discovery or maintenance stage. S-MAODV is as yet proficient in finding secure routes compared with MAODV protocol.

Weiliang Li et. al[2010] proposed multipath routing protocol in light of MAODV[13]. This paper exhibits an approach to enhance the throughput of the framework and diminish the quantity of mobile nodes taking an interest in multicast routing algorithm, which will altogether lessen the routing - related control overhead. It utilizes self-pruning flooding rather than the visually impaired flooding to decrease the overhead, and utilizes mobility prediction to begin sending route request to set up a new link before a link breaks. The enhanced protocol decreases the cost, and expands the packet delivery rate and additionally the protocols scalability adequately. It is demonstrated that this protocol has better scalability when the size of system is extensive and more grounded flexibility when more nodes join the multicast tree.

Rui Yang et.al [2010] proposed An Energy Entropy-based Power-saving Multicast Routing of Ad Hoc Networks [14]. The key thought of the protocol is to locate the minimal nodal remaining energy of each route during the time spent choosing path by descending nodal residual energy. It can adjust singular nodes battery power use and henceforth draw out the whole systems lifetime. The paper expresses that the proposed approach and parameters give a precise and productive strategy of estimating and evaluating the route stability in dynamic mobile networks.

Srinivas Sethi et.al [2009] proposed a shared tree based Improved Multicast Ad-hoc On Demand Distance Vector

(IMAODV)[15] which has multicasting and solid capacity in high versatility rate and extensive network zone. IMAODV makes bi-directional shared multicast trees and these trees are kept up insofar as group members exist inside the associated bit of the network. Each multicast group has a group leader that keeps up the group sequence number, which is utilized to guarantee freshness of routing data. IMAODV performs better regarding Packet Delivery Ratio (PDR), average End-to-End delay and Network Routing Load (NRL) contrasted with both AODV and MAODV for high portability rate and expansive network grid size. IMAODV protocol is appropriate for reliable and time delicate multicasting in MANET environment.

Hua Chen et.al [2009] present an Entropy-based long-life multicast routing protocol in MAODV (EMAODV)[16]. The key thought of EMAODV algorithm is to develop the new metric-entropy and select the long-life multicast routing with the assistance of entropy metric to decrease the quantity of route recreation in MANET.

Xiaoyan ZHU and Jin LIAN[2008] proposed A QoS multicast routing protocol with mobile prediction in light of MAODV in MANETs[17] which presents QoS routing issue and several mobile forecast procedures. The routes are steadier in MPMRPQ and the versatile forecast mechanism is applied to the MAODV. This approach can decrease multicast packet loss, organize over-load and optimize the delivery path. The objective of this protocol is to exhibit a QoS multicast routing protocol with mobile forecast in view of MAODV which can be appropriate to the systems with uncertain parameters.

Zhao Guo-feng et.al [2008] proposed a MAODV-based Energy Saving Multicast Routing Algorithm for WANET, which brings the energy anticipating into the foundation of multicast tree and joins energy utilization and hops for path selection. This approach presents a multicast routing algorithm called PPEF [18] for energy sparing. Energy forecast method is proposed for multicast tree develop. To choose RREPs, PPEF considers the hops, as well as the energy utilization rate of every node. The outcomes demonstrate that PPEF gets a superior energy saving. The lifetime and information delivery rate in PPEF likewise have great impact contrasted with MAODV. In this way, it will be advantage from applying PPEF in WANET, which with constrained energy in every node.

Sun Baolin & Li Layuan[2006] proposed QoS-aware multicast routing protocol for Ad hoc networks[19] which gives solution in light of lower layer specifics like delay, bandwidth and packet loss estimation. Here the QoS routes are followed node by node and the proposed routing scheme utilized as augmentations of the MAODV. This paper confirms that, the proposed protocol can enhance the end-to-end delay, transfer speed and packet loss on a route in a large portion of the cases.

Table I: Review of recent research on MAODV

S.No.	Authors	Title	Methodology	Applications	Outcomes
1.	Ajay Kumar Yadav et. al[2016]	QMRPRNS	QoS based multicast routing using reliable neighbour node selection scheme	Suitable for Mobile ad hoc network applications	Increase PDR, decrease packet delivery delay and reduce control over head. And also balance the network traffic load
2.	Sambhu Dahal et. al [2016]	EMRP	Selecting the path based on node life time and hop count. And a node uses the two hop neighbour information to repair the link	Suitable for Mobile ad hoc network applications	Higher throughput
3.	Runping Yang et. al [2015]	DMAODV	Suppressing the broadcast traffic by using self repression flooding algorithm	Suitable for vehicular ad hoc networks with high nobility and density	Increase data transmission, decrease delay and control over head, and higher scalability
4.	Xeuming Wang et. al [2015]	RCQ-MAODV	Based On Constrains/indicators in route selection	Suitable for Mobile ad hoc network applications	Increasing data transfer rate , data delivery rate and reducing the cost of the network
5.	Xu Li et. al [2014]	MAODV-BB	Constructing multicast tree with Backup Branches and combining MAODV protocol with the tree ,mesh structures	Suitable for Mobile ad hoc network applications	Reduces frequency of tree reconstruction, improves the network performance and better PDR, end-to-end delay
6.	N. -C. Wang[2012]	PDTMRP	Dual-Tree-based method in which all nodes are randomly	Suitable for Mobile ad hoc network	Better PDR, Packet delivery delay, control

			classified into two types, group-0 and group-1	applications	over head, power consumption and prolonged network life time
7.	Jin Lu et.al [2011]	FPSO	Dividing the set of multicast trees in to families and achieve global convergence quickly	Suitable for Mobile ad hoc network applications	Meeting QoS requirements, Find multicast routing tree with minimal cost, better network stability and load adaptability
8.	Feng He et al [2010]	S-MAODV	Trusted computing technology, combined with the Secure Node Authentication and security indictor bit-set mechanism	Suitable for Mobile ad hoc network applications	This routing protocol works significantly well even in the presence of some malicious nodes
9.	Weiliang Li et. al [2010]	MP-MAODV	It uses self-pruning flooding instead of the blind flooding to reduce the overhead, and uses mobility prediction to start sending route request to establish a new link before a link breaks.	This protocol is suitable for diverse situation applications	Better PDR, effectively reduce Latency and network control over head
10.	Rui Yang, et. al[2010]	EEMAODV	The key idea of the protocol is to find the minimal nodal residual energy of each route in the process of selecting path by descending nodal residual energy.	Suitable for Mobile ad hoc network applications	Balance individual nodes battery power utilization and prolong entire Network life time
11.	Srinivas Sethi et. al [2009]	IMAODV	Shared tree based method which creates bi-directional shared multicast trees and these trees are maintained as long as group members exist within the connected portion of the network	Suitable for reliable and time sensitive multicasting in MANET environment.	Better PDR , end-to-end delay and network routing load than AODV, MAODV.
12.	Hua Chen et. al [2009]	EMAODV	Construct the new metric-entropy and select long life multicast routing	Suitable for Mobile ad hoc network applications	Reduce the no. of route reconstruction
13.	Xiaoyan Zhu et. al [2008]	MPMRPQ	QoS multicast routing with multiple QoS constraints (Delay, Bandwidth and Packet-loss) by using Mobile Prediction Mechanism	Suitable for timely data transmission application	Reduce the Packet-loss network over load and optimize the delivery path
14.	Guo-feng Zhao et. al [2008]	MAODV-PPEF	Energy Saving Multicast Routing by using Power-Efficient Preferred Energy Forecast Method	Suitable for Mobile ad hoc network applications	Energy Saving
15.	Sun Baolin et al [2006]	QoS-aware MRP	QoS multicast routing with multiple QoS constraints (Delay, Bandwidth and Packet-loss)	Suitable for Video, multimedia broad casting and education, etc.	Minimizing End-to-End Delay, Bandwidth and packet-loss

V. CONCLUSION

We surveyed the recent research works carried out on MAODV by investigating several mechanisms attempting to solve different issues. Extensive efficient transmission between the mobile nodes for a variety of applications requires considering resource constraint environment and different traffic scenarios. We draw the conclusion that most of the works concentrated to enhance MAODV performance by incorporating efficient energy conservation schemes, security solutions; improved route discovery techniques and performance optimization techniques using various parameters like QoS, node life time, hop count, multicast trees, flooding etc. Most of the methodologies have considered less than three parameters/constraints for optimisation. MANETs are becoming an integral part for several critical applications and with that many issues are emerged which require more than three parameters for optimisation.

FUTURE SCOPE

We are planning to analyses issues of MANETs in the area of energy conservation schemes and routing efficiency schemes. The factors that we are considering multiple constraints for our research are energy, , Link Life time, Packet Delay, distance among nodes. Further, an optimal searching technique is going to introduce for optimal path selection in MANET.

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