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A Survey on Ad Hoc On-Demand Multipath Distance Vector Routing Protocol

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Abstract: Mobile Ad hoc Network (MANET) are wireless networks consisting of a collection of mobile nodes with no fixed infrastructure. Since mobile ad hoc networks change their topology frequently, routing is one of the challenging task. To avoid frequent route discovery and link failures, various multipath routing protocol has been proposed based on the existing single path routing protocol in ad hoc networks. Ad hoc On-demand Multipath Distance Vector (AOMDV) is one of the well-known multipath protocol which extends the prominent Ad hoc On Demand Distance Vector **(**AODV) to discover multiple link-disjoint paths between the source and the destination. In this paper, we survey on various protocol which improvise and modify AOMDV protocol in order to resolve various issues like route cut-off, energy efficiency and helps to achieve better performance.

Keywords: AOMDV, MANET, LOAOMDV, E-AOMDV, Routing, Multipath.

I. INTRODUCTION

A Mobile Ad hoc Network (MANET) is a collection of mobile nodes relying neither on fixed communication infrastructures nor on any base stations to provide connectivity [1, 2]. Each node in the MANET acts both as a host and a router. If two nodes are not within the transmission range of each other, other nodes are needed to serve as intermediate routers for the communication between the two nodes. The hosts are free to move around randomly, and hence the network topology may change dynamically over time. Therefore, the routing protocols for a MANET must be adaptive and capable of maintaining routes as the characteristics of the network connectivity change. Designing an efficient and reliable routing protocol for such networks is a challenging issue [1, 2]. For this reason, many routing protocols have been developed, trying to accomplish this task efficiently. Since mobile ad hoc networks change their topology frequently, routing in such networks is a challenging task. Multipath routing may improve system performance through load balancing and reduced end-to-end delay. New route discovery is needed only when all paths fail. This reduces both route discovery latency and routing overheads. The Ad hoc On-demand Multipath Distance Vector (AOMDV) routing protocol[14] extends AODV to build and store several paths in the routing table without finding additional information, so that when one route is broken, it does not necessarily result in a new flood of route request packets. Instead, the source node can simply select the next available route from its tables. But the existing multipath routing protocols have not fully used the route stability to carry on the multipath routing. In this paper we discuss various modified versions of existing AOMDV protocol which provide solution to various problems occur in routing. These protocols resolve issues like route cut-off problem, energy efficiency of nodes and route stability.
The remainder of this paper is organized as follows. In section II we discuss various routing protocols based on existing AOMDV protocol. Finally, in section III we concluded the paper.

II. ROUTING PROTOCOLS

In this paper we will study various modified versions of AOMDV routing algorithm which resolves various issues like route cut off problem , energy efficiency etc. hence these various improvisation of AOMDV protocol improves its performance.

A. Ant Colony Optimization and Ad-hoc On-demand Multipath Distance Vector (AOMDV) Based Routing Protocol
An ant colony optimization and ad-hoc on-demand multipath distance vector based routing protocol (ACO-AOMDV) for ad hoc networks was proposed by Xun-bing Wang et al [4]. In this algorithm ant packets deposit simulated pheromone as a function of multiple parameters corresponding to the information collected each path visited, such as average link count of path, average load of path, hop count and the current pheromone the nodes possess and so on, and provide the information to the visiting nodes to update their pheromone tables by endowing the above different parameters corresponding to different information with different weight values. Selecting the transmission path dynamically through regular updating the pheromone of transmission path and backup paths, which improves the

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routing performance. Its simulation result shows that ACO-AOMDV performs effectively in terms of packet delivery fraction, end-to-end delay and route discovery frequency compared with ARA and AOMDV.

B. Link Optimization Ad-hoc On-Demand Multipath Distance Vector Routing for Mobile Ad-hoc Networks
Link Optimization Ad-hoc On-Demand Multipath Distance Vector Routing (LOAOMDV) was proposed by Bo Xue et al [6]. The main objective of this scheme is to find out the omitted reverse path and establish the more disjoint path. It adds 4 bits control information in RREP packet and change the process of RREP replying in LOAOMDV. The routing protocol establishes the omitted reverse path and reduces the number of common node in several paths. This protocol can reduced the end-to-end delay, extend the network lifetime, and salvages packet timely, reduces the ratio of packet chaotic sequence.

C. An Optimized Ad-hoc On-demand Multipath Distance Vector(AOMDV) Routing Protocol
An Optimized AOMDV (OAOMDV) was proposed by YuHua Yuan et al [7]. It is designed to solve the route cut-off problem. It has modified AOMDV to find a pair of link-disjoint paths without "route cut-off" problem. In fact, if there are two link-disjoint paths with one or more common intermediate nodes between the source and destination, two reverse paths and two forward paths ought to be formed. For example in Figure 1, two forward paths (S-A-C-E-D and S-B-C-F-D), and two reverse paths (D-E-C-A-S and D-F-C-B-S) are possible. However, AOMDV detects the two forward paths and only one reverse path (D-E-C-A-S). The other reverse path (D-F-C-B-S) is cut off. To avoid this kind of "route cut-off", it proposed a scheme, in which a routing packet RREP_ACK (Route Reply Acknowledgement) is added to be transmitted along the forward path (S-B-C-F-D). Once an intermediate node receives the packet, a reverse path to the source will be set up. So, when destination D receives the packet, the omitted reverse path (D-F-C-B-S) will be achieved.

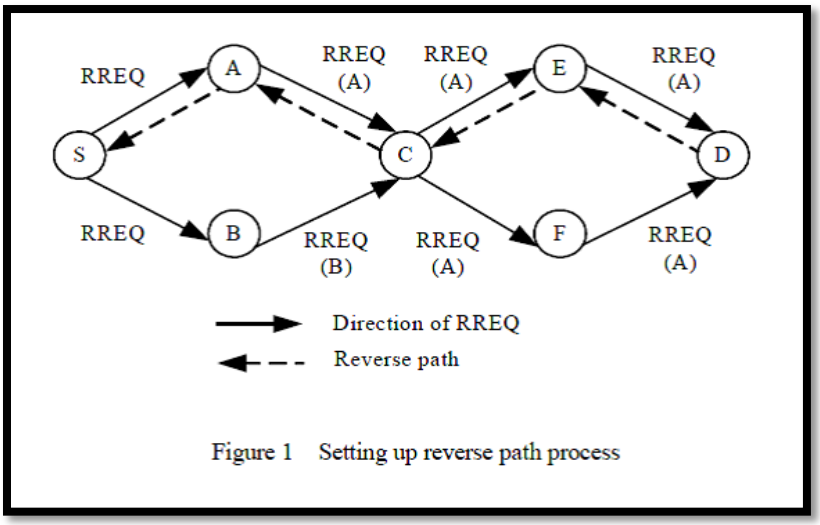

Figure 1 Setting up reverse path process

D. Formal verification of a new version of AOMDV in ad hoc network
The idea is to improve AOMDV by minimizing the communication phases [5]. It adds the strengths of AODVM to AOMDV to create a hybrid version of the two containing their benefits. In this version, new functionalities in ROUTE DISCOVERY and ROUTE MAINTENANCE has been added to achieve energy efficiency, packet overhead minimization and latency reduction.
It is almost the same steps as AOMDV, except in case where a broken link is detected and there's no other route stored, a RERR packet will be sent only to the nodes whose address were stored in RREQ_LIST in multicast way (to avoid disturbing nodes not concerned) and the DATA packet will be sent back to the last one who have transmitted it. This last node will choose another route in its table (if it exists) otherwise the DATA will be sent to the earlier one. If the DATA reach the source node, this one will wait a while before restarting a new ROUTE DISCOVERY.

E. Energy Efficient Load Balancing Approach to Improve AOMDV Routing in MANET
This scheme proposed by [12] consider both the shortest path and the energy conservation in multipath way with proposed energy based multipath routing (E-AOMDV). It defines an energy factor which will use the products of the energy factors of all the nodes along different paths as the selection criteria. It takes the amount of energy left at neighbour nodes into consideration when selecting one route from multiple paths route. To achieve this, each node needs to report its energy level to its neighbours. The multi-path selection thus takes all the next hops from available

paths, and checks the associated normalized remaining energy levels known to the node. The next hop with the highest energy level is selected. The life times of proposed E-AOMDV is limited but improves routing as compare to AOMDV protocol. The performance of proposed scheme is better in limited life time.

F. Delay Remaining Energy for AOMDV Protocol (DRE-AOMDV)

A new algorithm called DRE-AOMDV (Delay Remaining Energy for AOMDV routing protocol) was proposed [13] to find the maximal nodal remaining energy of each route in the process of selecting path with respect of the end-to-end constraint. it concentrates especially on route failures due to lack of energy.

This protocol exploits the remaining battery capacity of each node and the delay parameter in the route selection process. It is a multipath routing protocol that designed primarily for node battery-limited and dynamic ad hoc networks where link failures and route breaks occur frequently. Each node in the network estimates its quality of links with its one-hop neighbours.

TABLE I SUMMARY OF ROUTING PROTOCOLS USED IN THIS STUDY

PROTOCOL	WORKS ON	MECHANISM
ACO- AOMDV	Stable path	Pheromone table
LOAOMDV	Omitted reverse path	Use REV and NUM bit in RREP process
OAOMDV	Route cut-off problem	Use new control packet RREP_ACK
Enhanced AOMDV	Minimize communication phase	Modify route discovery and route maintenance process
E-AOMDV	Energy efficient path and load balancing	Calculate energy and load at each node
DRE AOMDV	Maximum nodal remaining energy	Delay information is used in routing packets

III.CONCLUSION

This paper review various modified versions of AOMDV protocol which have been developed to enhance the overall performance. These protocols consider various problems of AOMDV protocol which is faced during routing in network. Different mechanism is applied to resolve these issues which improves the routing performance.

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