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Comparative analysis of Adhoc On Demand Multipath Distance Vector Routing Protocol and Enhanced Multipath MPR AODV Routing Protocol in MANET

Dr.M.Geetha., MCA.,MPhil.,Ph.D
dr.geethamathi@rediffmail.com

Abstract

A mobile ad hoc network (MANET) is a collection of wireless mobile nodes dynamically forming a network topology without the use of any existing network infrastructure or centralized administration. Routing is the process which transmitting the data packets from a source node to a given destination . The main classes of routing protocols are Proactive, Reactive and Hybrid. A Reactive (on demand) routing strategy is a popular routing category for wireless ad hoc routing. In this chapter an attempt has been made to compare two Reactive (on demand) routing protocols in MANETs: EMMDV and AOMDV protocol.

Keywords:-MANET,AODV,AOMDV, EMMDV and MPR.

1.INTRODUTION

MANETs are a subset of wireless networks, as they can be viewed as wireless networks not dependent on existing infrastructure [1][3].

In ad-hoc networks, the nodes are responsible for the routing and forwarding of packets. If the wireless nodes are within range of each other, no routing is necessary. But if the nodes have moved out of range of each other, and are not able to communicate directly, intermediate nodes are needed to make up the network in which the packets are to be transmitted.

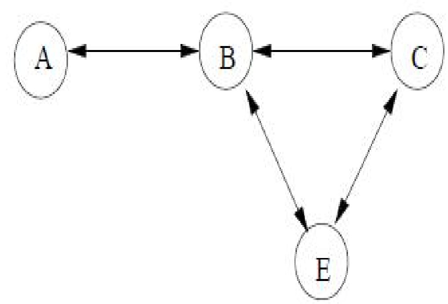

Fig.1. Mobile Adhoc Network

In fig.1. the node C and E cannot reach A directly. Both communicate with A through B.

1.1. Routing

As mobile ad hoc networks are characterized by a multi-hop network topology that can change frequently due to mobility, efficient routing protocols are needed to establish communication paths between nodes.

1.2. Routing in ad-hoc wireless networks

In a wireless ad-hoc network the nodes can be connected in a dynamic and arbitrary manner, the nodes themselves acted as routers and take part in discovery and maintenance of routes to other nodes in the network. The goal of a routing algorithm is transferring a packet from one node to another [2][3].

2. MANET ROUTING PROTOCOLS:-

Protocols are categorized into three basic types reactive, proactive and hybrid protocols

2.1. Proactive Routing Protocols

Proactive routing protocols are also known as table driven protocols. Routing information of the nodes is maintained in the tables. Each node in the proactive routing protocol has such tables containing routing information so that the data packets could be transferred to the destination. Each row in the tables contains the information about the cost of the route to be followed and the next hop for reaching a node or a subnet. As each node has table entries, it is difficult to maintain tables for each node in a large network which can cause more overhead in the tables with a large number of table entries[2].

2.2. Reactive Routing Protocols

In reactive routing protocols the routes are created as and when required. They are also known as on-demand routing protocols. In these protocols, whenever a source node wants to send the information to a destination, the route discovery mechanisms are invoked to find the path to the required destination. The routes are created on demand by flooding the network with Route Request packets[2].

2.3 Hybrid Routing Protocols

A hybrid protocol combines the features of both the proactive and reactive routing protocols. An illustration of such a protocol is the Zone Routing Protocol (ZRP). In ZRP, topology is divided into zones and look for to utilize different routing protocols within and between the zones based on the weaknesses and strengths of these protocols[2].

3. ADHOC ON DEMAND MULTIPATH DISTANCE VECTOR ROUTING (AOMDV) PROTOCOL

AOMDV is an AODV derived routing protocol. It has characteristics similar to AODV but is a multipath routing protocol, i.e., it determines multiple paths between source and destination and uses them to transmit data packets. Route determination is similar to that of AODV. When a route is required to a specific destination, a route request control packet is generated and broadcast. When a source node gets back route replies from many intermediate nodes and destination, it stores the information on possible routes instead of choosing the best among them. A similar strategy is adopted by intermediate nodes. Presence of multiple routes is an advantage. It reduces route discovery frequency and prevents best path overloading. Multiple routes to same destination are disjoint. There are 2 kinds of disjoint paths; node disjoint and link disjoint. Node disjoint means routes do not have a common node whereas link disjoint means nodes do not have common link.

In AOMDV the source node keeps several different routes from multiple RREPs. The AOMDV cannot handle the dynamic change of the network such as severe congestion caused by biased traffic [11].

3.1. Route Discovery Procedure in AOMDV

Figure 2 shows the Overview of AOMDV. In AOMDV, the route discovery procedure is initiated by RREQ when source nodes have some data for sending to the specific destination. In Fig. 2, the source node S broadcasts RREQ messages for the destination node D and then waits for RREP. When the nodes B, M, and Q receive the RREQ, they mark it in the last hop field to distinguish multiple paths. For example, the RREQ passed through the node B is marked as RREQ (B).

In addition, each RREQ message has its own sequence number and each node maintains the highest sequence number for a destination among received RREQ messages to prevent loops. When receiving a RREQ message, the intermediate nodes compare the destination sequence number between RREQ with their routing table and then flood the RREQ to others. Finally, if the RREQ reaches its destination, the destination node generates a RREP and sends it back along the reverse route. In order to form multiple paths, it generates RREP messages for every RREQ comes through disjoint path[11].

In AOMDV, the route recovery process is required in two cases as follows. First, when a link is broken due to the change of the network topology, intermediate nodes inform the route unreachability by sending a RERR message to the source node. Second, each node has a timeout field in its routing table in AOMDV. That is, AOMDV uses soft-state routes. Each node checks its routing table periodically and it rediscover a route when the route is expired. The value of the timeout is in relation of trade-off. Too small timeout causes unnecessary route discovery processes and too large timeout causes obsolete routes. Additionally, each node sends hello messages periodically in order to check the validity of the route.

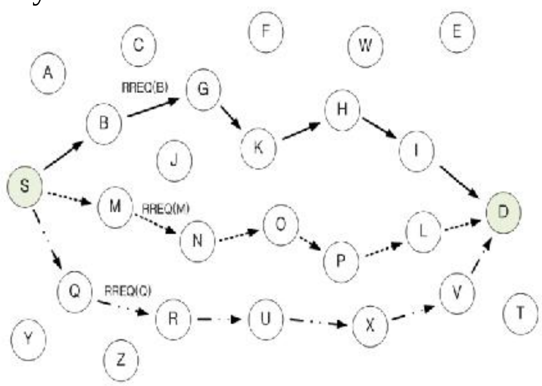

Figure.2. Route Discovery Procedure in AOMDV

3.2. Problem of AOMDV

1) Congestion and Contention: The MANET consists of various nodes in capacity.Since the route discovery selects the route has the least delay as the primary route, the nodes of high performance are easier to be included as a member of routes.

In addition, due to the characteristics of wireless communications, the more active nodes are within the communication range, the more severe contention is caused. Thus, it also degrades the performance of the bottleneck node.

2) *Limitation of static route switching*: Multiple paths have various performances in terms of response time and bandwidth. The best of them is selected as the primary route and the others are used as alternative routes. In AOMDV, when the primary route is broken, the source node selects one of the alternative routes in order to prevent additional route discovery process. However, it has the following problems.

First, since the route switching in AOMDV occurs only in case of a route error, it cannot adapt to the dynamic change of the MANET. The network condition of the MANET changes frequently and routes that have better performance than the primary route can be available any time. However, the static route switching cannot obtain the benefit of the change.

In addition, since the route switching is performed without information on current status of alternative, the performance of the alternative route cannot be guaranteed. Second, there is no method to prioritize the alternative routes. Since AOMDV has no field in the routing table suitable for managing information on the routes, the selection of the alternative routes performed without comparison of performance.

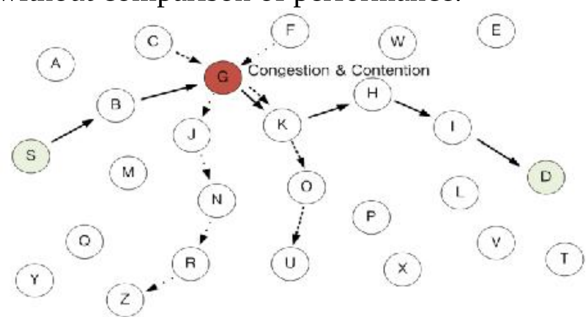

Fig.3.Congestion problem in AOMDV

4. ENHANCED MULTIPATH AND MPR BASED AODV (EMMDV) PROTOCOL

In Mobile Ad hoc Networks (MANETs) traditional routing protocols use flooding technique to propagate the destination, which may cause an overhead in the network. Recent proposals have resolved this issue in various methods. A Modified Dynamic Multi Point Relay is proposed in order to improve the route discovery process and reduce the overhead. Trigger Agent (TA) is key initiative which burst the process thread on destination node and it is propagating till Meeting Point (MP)[6][7].

This proposal [EMMDV] is obtaining more efficiency than AOMDV. A Mobile Ad Hoc Network (MANET) is a collection of wireless nodes that move arbitrarily and use multi-hop protocols to communicate between each other. A recent proposal EMMDV had highlighted several possible modifications of AODV routing protocol based on selected features available in other routing protocols. The EMMDV protocol is proposed for intra-net communication environment. Trigger Agent initiate the process thread in the destination node towards source node. The simulation result shows that our proposal outperforms in most of the cases than MMDV protocol

The main aim of this research is to modify the Dynamic MPR feature in Multipath and MPR based AODV (MMDV) protocol to obtain Enhanced Multipath and MPR based AODV (EMMDV) protocol. Here, an algorithm with the newly developed concept of “backward navigation from destination node” is proposed. This method allows the source and destination node to become active and create the link between them through the intermediate nodes.

AODV, DynMPR feature and Multipath feature have given rise to Multipath and MPR based AODV (MMDV) protocol. Modified Dynamic Multi Point Relay (MDMPR) protocol helps to improve the route discovery process and reduce the overhead. Trigger Agent (TA) is key initiative which burst the process thread on destination node and it is propagating till Meeting Point (MP). This proposal is obtaining more efficiency than AOMDV[11][8].

The proposed approach was simulated in NS-2 simulation environment and the results were analyzed based on the performance of the AOMDV and EMMDV protocol.

4.1. WORKING PRINCIPLE OF EMMDV PROTOCOL

The Architecture of the proposed Enhanced Multipath and MPR based AODV (EMMDV) protocol contains three processes namely Trigger Agent (TA), Destination-To-Source (DTS), and Meeting Point (MP). In Fig.4. the Trigger Agent (TA) contains process thread which informs core router to search whether destination node is within its range. If meets the criteria, the Trigger Agent (TA) tries to propagate and burst the process thread in destination node[9][10].

The initiated process thread invokes the Destination-To-Source (DTS) scheme which will terminate the process prioritized by Meeting Point (MP). The Meeting Point (MP) contains hand shaking mechanism; it transforms the Destination-To-Source (DTS) path to regular MPR travelling from source to destination and kills the Destination-To-Source (DTS) process thread. Thereby it reduces the propagation time and improves delivery ratio.

Initially, the source node selects its MPR set, which will enable each node in the set to reach out to all the neighbors within the two-hop range. As well as the destination node will select its own MPR set to reach out its two-hop neighbors.

Whenever the connection is needed between source and the destination, the MMDV protocol flood the RREQ to their neighbors in the MPR set, the other nodes that are not in the MPR set can read the message, but not retransmit the message. CR (Core router) acts as a central medium which contains information about all connected nodes.

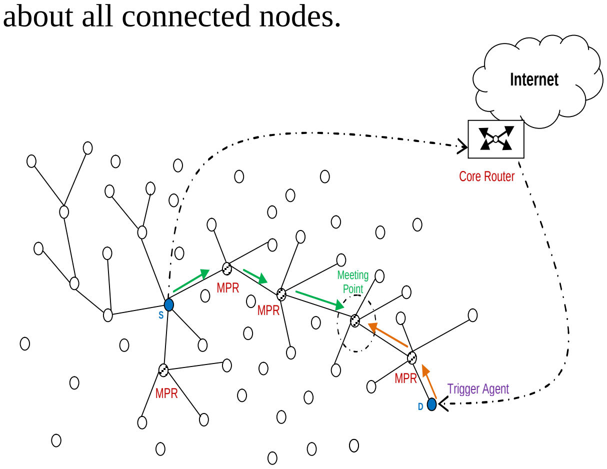

Fig.4. EMMDV protocol routing Architecture

Core router (CR) is nothing but Internet Gateway (IGW). In our proposal, Core router (CR) first searches whether the destination signature is present in the current network. If available, the Core router (CR) sends the message to destination about source node and executes the Trigger Agent (TA) from destination to source else it discards the TA. Thus source node searches destination node through Dynamic Multipoint Relay (DynMPR) based flooding method; similarly destination also searches for source node. Parallel execution of this architecture helps to reduce the discovery time and improve the packet delivery ratio (PDR).

5. PERFORMANCE ANALYSIS OF AOMDV AND EMMDV

The comparison of the AOMDV and EMMDV Routing Protocols is done by using the NS-allinone-2.34 Simulator. The number of nodes is considered by changing their number as 10, 20, 30, 40,50,60,70 and 80 with same propagation model. The routing protocol AOMDV and EMMDV are used which routes the packet towards its destination on its call. The mobility model used is static with movement maximum speed is 1.5 m/s and minimum speed is 0.5 m/s. The network type is wireless with 50 packets in interface queue. The constant bit rate is transferring the constant rate of bits for a particular time. The performance of AMODV and EMMDV protocols are compared according to the following metrics.

1) Packet delivery Ratio
2) End-to-End delay
3) Packet Loss

The following fig.5. Shows the Screenshot of EMMDV protocol.

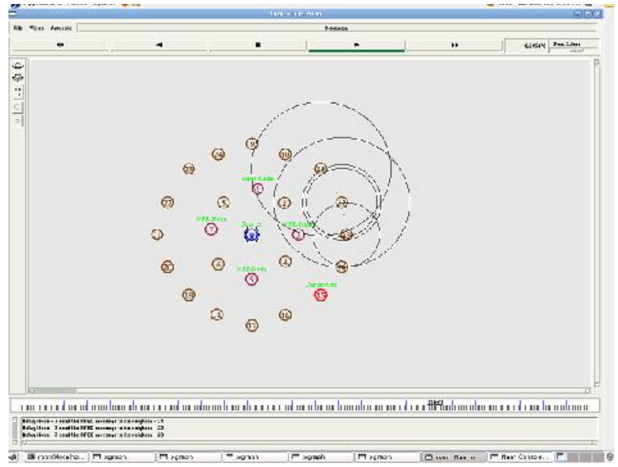

Fig.5.Screenshot for EMMDV protocol

5.1. Packet delivery Ratio

Fig.7. and Fig.8. Depicts the Xgraph values of both AOMDV and EMMDV. The X axis represents number of nodes and Y axis represents PDR value (10^3). It is clear from the figure that the value for average PDR of EMMDV is higher with respect to the number of nodes, which is increasing from 10 to 80. In figure; EMMDV has a better value when compared to AOMDV for each set of connections. This is because in the time waited at a node, EMMDV can find an alternate route if the current link has broken, whereas AOMDV is rendered useless at that point.

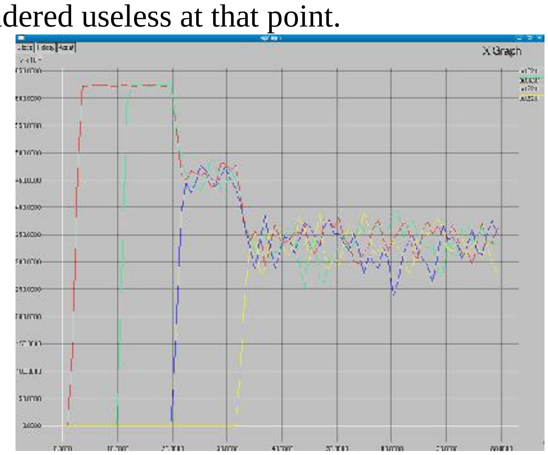

Fig.6. AOMDV Packet Delivery ratio

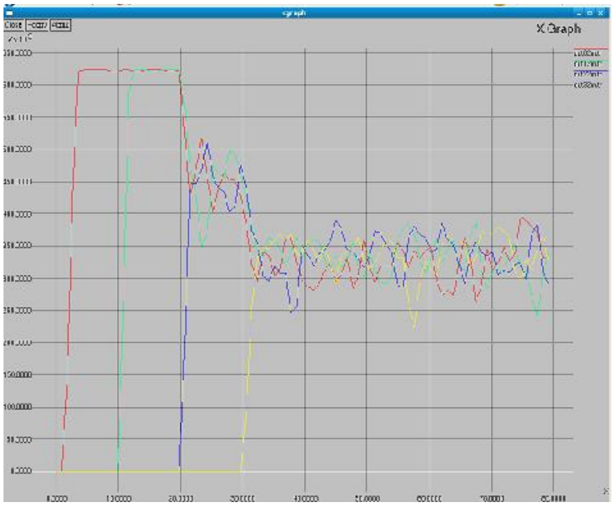

Fig.7. EMMDV Packet Delivery ratio

5.2. End-to-End Delay

Fig.8and Fig.9 depicts the Xgraph values of both EMMDV and AOMDV. The X axis represents number of nodes and Y axis represents PDR value (10^3). In the graph EMMDV has a better average delay than AOMDV due to the fact if a link break occurs in the current topology, EMMDV would try to find an alternate path from among the backup routes between the source and the destination node pairs resulting in additional delay to the packet delivery time.

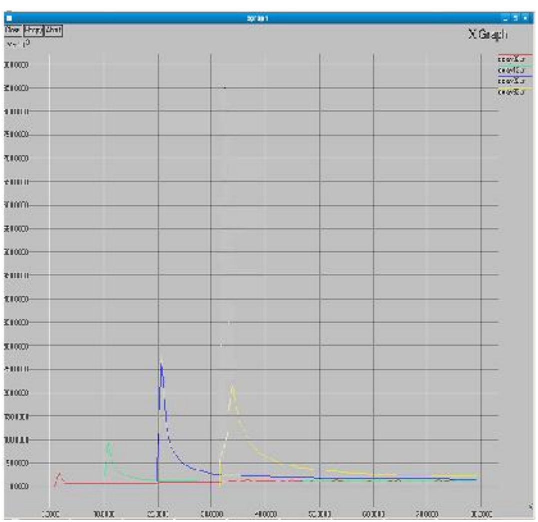

Fig.8. EMMDV Delay

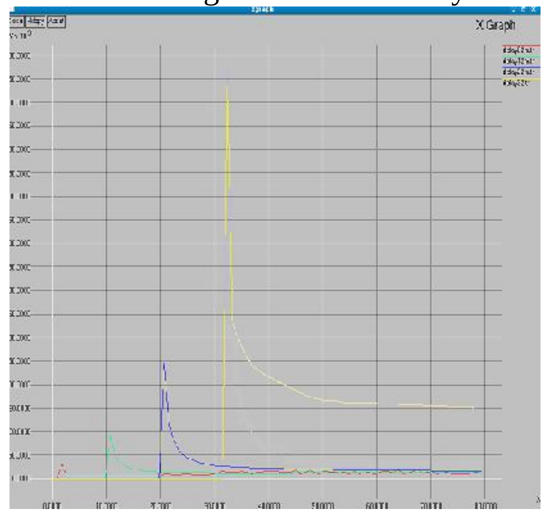

Fig.9. AOMDV Delay

5.3. Packet Loss

Fig.10 and Fig.11 depicts the Xgraph values of both EMMDV and AOMDV. The X axis represents number of nodes and Y axis represents dropped packet value (10^3). The number of packets dropped in AOMDV is more than the number of packets dropped in EMMDV. While in case of lower mobility, EMMDV performs better than AOMDV.

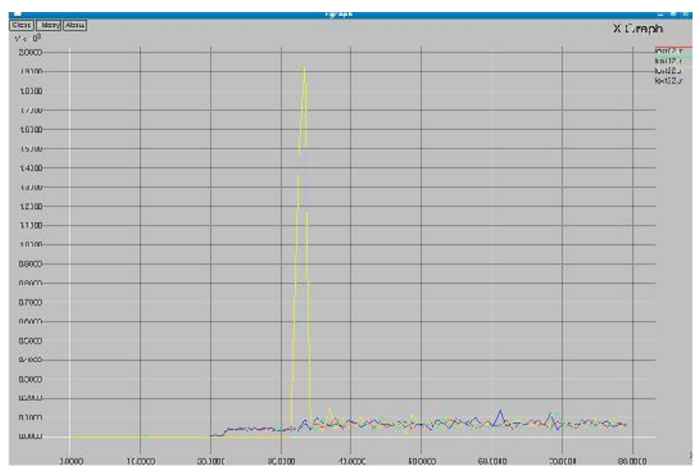

Fig.10. EMMDV Packet Loss

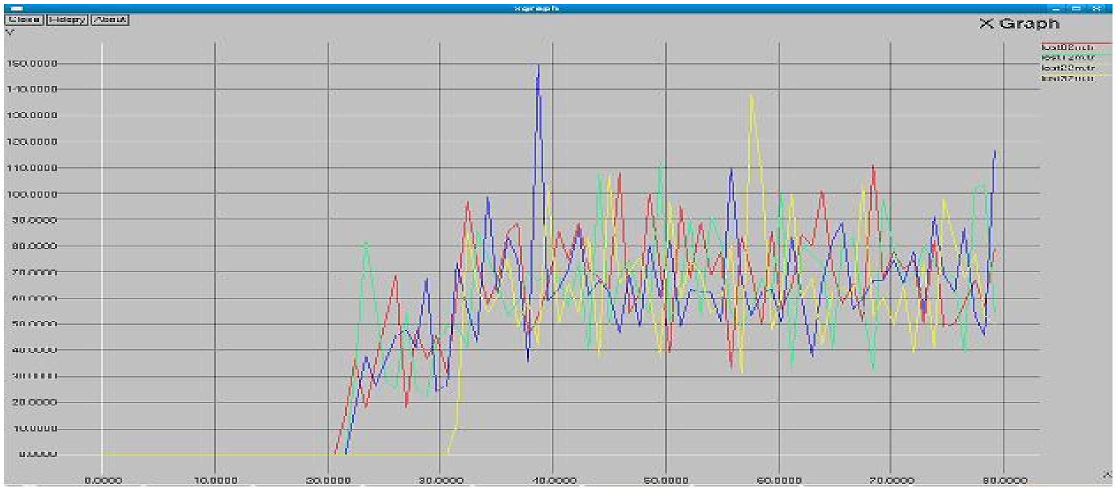

Fig.11. AOMDV Packet Loss

6. SUMMARY

The AOMDV has more routing overhead than EMMDV for any range of pause time. AOMDV is a multipath routing protocol.So it searches for alternate paths if the current route breaks by flooding the message to the network with multiple RREQ packets. Hence AOMDV incurs more routing overhead than EMMDV. The EMMDV protocol providing multipath and MPR based flooding. This protocol consists of both proactive and reactive components. In a proactive phase, nodes compute their MPR lists and compute paths to their two hop neighbors. In a reactive phase, nodes compute two paths for each destination. EMMDV protocol finds the path between the source and destination based on gateway discovery process. This gateway process finds the path between the source and destination. In the use of EMMDV protocol the route discovery is made very fast and the flooding overhead will be reduced which leads to decrease in delivery time and increase in delivery ratio.

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