PERFORMANCE ANALYSIS OF MULTIPATH ON DEMAND DISTANCE VECTOR ROUTING IN WIRELESS AD HOC NETWORK

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Abstract: In this work covers the idea of single path and multipath routing scheme in our work. Main Objective of our research work is to improve the Quality of Services in both single and multipath routing protocol. For the author has used the reactive routing to ensure its efficient functioning and developed a extended AODV scheme in to Multipath AODV algorithms which have reduced the average end to end delay, increase packet receive ratio and high link stability between the nodes. The comparison of modified multipath Aodv and existing unipath Aodv has been presented in terms of average values of PDF, NRL, Delay, and Throughput. It is observed that model achieves an better results compare than existing routing scheme. The simulation carried out network simulator.

Keywords- AODV, Multipath AODV, Performance Metrics, MANET, NS-2.

I -INTRODUCTION
Due to the recent performance advancements in computer and wireless communication technologies, mobile wireless computing is becoming increasingly widespread. One type of network that is most evolving is Mobile Ad-hoc Network. It is a wireless technology where the nodes are changing their topology with respect to time. MANET's are dynamic; rapidly changing random, multihop technologies composed of bandwidth constrained wireless links. This networking fundamental is mobility of nodes which is unrealized in world of networks[4,5,6]

This concept is not new to computer science since routing was used in the networks in early 1970’s. But this concept has achieved popularity from the mid-1980’s. Routing is the process of finding a path from a source to destination among randomly distributed routers the broadcasting is inevitable and a common operation in ad-hoc network. It consists of diffusing a message from a source node to all the nodes in the network. Broadcast can be used to diffuse information to the whole network. It is also used for route discovery protocols in ad-hoc networks.

In MANETs communication between nodes is done through the wireless medium. Because nodes are mobile and may join or leave the network, MANETs have a dynamic topology. Nodes that are in transmission range of each other are called neighbors. Neighbors can send directly to each other. However, when a node needs to send data to another non-neighboring node, the data is routed through a sequence of multiple hops, with intermediate nodes acting as routers.

Due to mobility of wireless nodes, routes break frequently. The Data transmission links in wireless communication environment are inherently unreliable and error prone. A single path routing protocol suffers with these shortcomings. Multipath routing protocols overcome these disadvantages by sending the same packet on each path to improve reliability and by use of backup routes to improve fault tolerance. These protocols can also be used to provide load balancing which reduces the congestion on a single path. Multipath routing protocols discover and store more than one route in the routing table for the destination nodes. By using this thesis solve out link break problem. So
author have decided the work for multipath scheme our work. 

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The rest of this paper is organized as follows; section 2 and 3 discusses the AODV and Multipath AODV routing. In section 4,5and 6 authors have present the details of Related Work, performance matrices, simulation parameter and simulation model. We then evaluate our protocol and present the results in section 8. Finally, section 9 provides our conclusions and then last section is References.

II- AD-HOC ON-DEMAND DISTANCE VECTOR

AODV initiates route discovery whenever a route is needed by the source node or whenever a node wishes to join a multicast group. Routes are maintained as long as they are needed by the source node or as long as the multicast group exists and routes are always loop free through the use of sequence numbers. AODV maintains a route table in which the next hop routing information for destination nodes is stored.

AODV is a reactive and a single path routing protocol. It allows users to find and maintain routes to other users in the network whenever such routes are needed. The adhoc on demand distance vector routing protocol provides unicast, broadcast and multicast communications in adhoc networks[15,16]. This protocol is based on source-initiated on-demand routing. This type of routing creates routes only when desired by the source node. Route discovery process starts on demand by the source. This process is completed once a route is found or all possible routes have been explored. It is an on demand algorithm, meaning that it builds routes between nodes only as desired by source nodes. It maintains these routes as long as they are needed by the sources [12], AODV builds routes using a route request / route reply query cycle. When a source node desires a route to a destination for which it does not already have a route, it broadcasts a route request (RREQ) packet across the network. Nodes receiving this packet update their information for the source node and set up backwards pointers to the source node in the route tables. As long as the route remains active, it will continue to be maintained. A route is considered active as long as there are data packets periodically travelling from the source to the destination along that path. Once the source stops sending data packets, the links will time out and eventually be deleted from the intermediate node routing tables. If a link break occurs while the route is active, the node upstream of the break propagates a route error (RERR) message to the source node to inform it of the now unreachable destination(s). After receiving the RERR, if the source node still desires the route, it can reinitiate route discovery [13,14].

III-MULTIPATH AODV

Ad hoc On-demand Distance Vector Routing protocol, which was issued as RFC by the IETF MANET working group, is one of the most popular routing protocols for MANETs. Like other MANET routing protocols, AODV support unipath mean single path. due to mobility failed the single path or create the link break situation, after this situation continuously data loss so solve out this issue using multipath scheme. [18,20]This work extended single path into multipath using algorithm in given below. In multipath routing called alternate path routing. In alternate path routing, each source node and destination node have a set of paths (or multipath) which consist of a primary path and
one or more alternate paths. Alternate path routing was proposed in order to decrease the link breaking probability and increase overall network utilization.

In alternate path routing, the shortest path between exchanges is typically one hop across the backbone network; the network core consists of a fully connected set of switches. When the shortest path for a particular source destination pair becomes unavailable (due to either link failure or full capacity), rather than blocking a connection, an alternate path, which is typically two hops, is used. Well known alternate path routing schemes such as Dynamic Nonhierarchical Routing and Dynamic Alternative Routing are proposed and evaluated in [21,22].

In multipath AODV, RREQ propagation from the source towards the destination establishes multiple reverse paths both at intermediate nodes as well as the destination. Multiple RREPs traverse these reverse paths back to form multiple forward paths to the destination at the source and intermediate nodes. AOMDV[9] also provides intermediate nodes with alternate paths as they are found to be useful in reducing route discovery frequency. On demand multipath protocols discover multiple paths between the source and the destination in a single route discovery process. A new route discovery is needed only when all these paths fail. In contrast, a single path protocol has to invoke a new route discovery whenever the only path from the source to the destination fails. Thus, on demand multipath protocols have fewer interruptions to the application when routes fail [4]. Modified routing Algorithm an Saving data in Multipath AODV routing protocol consider the total path energy routing metric. By considering the node energy threshold value selects the best two paths for data transmission that maximizes the network lifetime[7] The Multipath AODV routing algorithm is as follows–

1. When Source node has some data for transmission, it first checks that the route is available from source to destination or not. If route already exist in source routing table then start transmission on that route.
2. Else sends RREQ to initiate route discovery process for finding reliable path for communication.

Modification in Ad hoc on demand distance vector routing Source Code

The ns-2 network simulator contains implementations of the AODV protocol. The author implements four types of the simulations which needs to modify the code as below. The solve out link break problem and efficient data transmission and reduced delay used this modification in AODV routing scheme.

STEP-1 In the route table file, create a new type of object called multiple route entry. The multiple route entry is an array to keep route entries. The objective of multiple route entry is to keep the routes to the same destination.

STEP-2 Every method in the AODV main file should change “finding route to the destination” to “finding multiple routes” to the destination.

STEP-3 The receive request method should be modified to receive the RREQ with the same ID as previous one in order to create the multiple reverse routes.

STEP-4 The receive reply method should be modified to accept the multiple route reply to create the multiple forward routes.

STEP-5 The receive reply method should be modified to forward RREP packet to every reverse routes.

STEP-6 The receive error method should be modified to check if the node still has another active route to the destination. If the node still has another active route to the destination, the node no needs to forward the RERR packet.

STEP-7 Route resolve method for source node should be set to switch from one active path to another active path and switch back in next transmission. The multiple paths will be used to transmit the data packet.
IV RELATED WORKS

There are many routing protocols for ad hoc networks. One of the most important of them is AODV is an on demand routing protocol used in thesis work. This protocol finds routes for a node only when it has data packet for transmission. AODV routing consists of three phases: route discovery, data transmission and route maintenance. Route discovery phase starts when a node wants to transmit data and has no route to destination. Now, AODV call route discovery process. In this phase, source node broadcasts a Route Request Packet to its neighbor. Nodes that receive RREQ packets divide into three categories: the receiver node is the destination of route, the node that has a route to destination or none of both. In the two first situations, receiver unicast a Route Reply packet to the route that received Route Request packet from it. The route that RREP packet traverses, selected as one of the main routes for source that has been sent RREQ packet. In the last situation receiver generate another RREQ packet and broadcast it to its neighbors. The Last situation repeats until one of the first two situations occurs.

Single path abstraction in routing protocols means that multiple routes could be detected due to routing discovery process and one route of them (the optimal) should be maintained in a source node routing table. AODV are examples of single path routing protocols. In multipath routing protocols, multiple routes could be detected due to routing discovery process and all of these routes should be maintained in a source node routing table. All of these routes could be used for data transmission between source and destination nodes.

Many multipath extensions of AODV have been developed to improve the performance of AODV protocol especially in high mobility scenarios where link failures increase so that launching a route discovery process frequently causes more routing overhead and more consuming of bandwidth and power. In such situations, there is a need for backup routes by applying a sort of route maintenance. Examples of such extensions are Ad hoc On-demand Multipath Distance Vector [23], AODV Backup Routing, Multiple Next Hops and Multiple Route AODV. Criteria that have been used in this work for comparing single-path routing and multi-path routing in MANETs are the average routing discovery overhead and the (the average number of received data packets).

V- PERFORMANCE METRICES

These parameter shows the performance of Routing Protocol is as follows:

- **Packet Delivery Ratio (Fraction)**- It is calculated by dividing the number of packet received by destination through the number packet originated from source.
- **Average end-to end delay**- It is defined as the time taken for a data packet to be transmitted across an MANET from source to destination.
- **Normalized Routing Overhead**- It can also be defined as the ratio of routed packets to data transmissions in a single simulation. It is the routing overload per unit data delivered successfully to the destination node
- **Throughput** - It is the average number of messages successfully delivered per unit time.

VI- SIMULATION PARAMETER

In this section mention table of parameters used in this work.

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulator</td>
<td>NS-2</td>
</tr>
<tr>
<td>Routing protocol</td>
<td>AODV, Multipath AODV</td>
</tr>
<tr>
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<td>Packet size</td>
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<tr>
<td>Simulation time</td>
<td>1000s (Constant)</td>
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<tr>
<td>Pause time</td>
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<tr>
<td>Maximum Speed</td>
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<td>-------------------------------</td>
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<tr>
<td>propagation model</td>
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<tr>
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</tbody>
</table>

**VII- SIMULATION MODEL**

In this section, we describe the mobility and traffic scenarios, input parameters and performance metrics used in the simulation process. To execute the simulations, the same movement models have been used for all simulations using NS2 for AODV and Multipath AODV routing protocols, the mobility model used was the random waypoint model in a rectangular area. Coverage area used for the simulation is 1000m x 1000m with 40 nodes scattered randomly. Based on random waypoint model, each node moves from a random location to a random destination with a speed from 10, 20, 30, 40, 50 m/s chosen randomly, node pauses from 1.0, 2.0, 3.0, 4.0, and 5.0 for a while and then removes to another random location within the specified area. The parameter shown in above.

**VIII SIMULATION RESULTS ANALYSIS**

In this section we can compare the performance of AODV and Multipath AODV but we focus on few of them. With the help of these performance metrics we get some useful outcome. In the following section we explain various performance metrics like as PDF, Delay etc. and compare both routing protocols with different set of parameters. It is clear that every time we are not getting the same result generated during simulation because we know that there are various factors that affect the result and they are not under our controls. With the same parameters if we perform simulation on different personal computer we will get different results because of different configurations. The explanation for each performance metric will be given in below.

In the presence of high mobility and security issues like as attacks etc, link failure can happen very frequently. Link failures trigger new route discoveries in AODV since it has almost one route per destination in its routing table. Thus the frequently occurrences of route discoveries in AODV is directly proportional to the number of route breaks. So on variations of time increases the packet delivery ratio so will also increase the throughput. The results present graphical method and mention values of metrics.

![Figure 1: Packet Delivery Fraction with Variations of speeds.](image)

![Figure 2: Normalized routing Load with Variations of speeds.](image)

![Figure 3: Average End To End Delay with Variations of speeds.](image)
Figure 4: Average Throughput with Variations of speeds.

IX CONCLUSION

The conclusion of this research paper, the motivation of multipath routings is clearly to reduce the overhead and to guarantee a better network performance. Many studies have been conducted comparing AODV to Multipath AODV routing protocols in terms of Packet delivery ratio, Average end-to-end delay, Average throughput etc. subjected to change in no. of speeds in CBR traffic type. One such simulation result is shown in previous section of simulation and results. The multipath AODV discussed average values of results increase the 28% packet received ratio and reduces delay with variation of speeds. The finally analysis of multipath routing scheme its better performed than unipath or single pat scheme.

REFERENCES


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