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AODV with Reliable and Energy Efficient Route Maintenance Phase

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***Abstract* - AODV is a much popular reactive protocol for Mobile Ad hoc Network. But the performance of AODV is comparable in the highly mobile network due to frequent route breaks. In this paper, we proposed a modified AODV protocol with reliable and energy efficient route maintenance phase. So that in case of link failure a reliable and energy efficient backup route is selected for data packet transmission. It overall increases the packet delivery ration in a highly mobile network as well as increase the throughput and network lifetime. We simulate our proposal on discrete network simulator NS2. The result shows that our proposed approach improves the performance of AODV in terms of packet delivery ratio and network lifetime. Our approach also provides the good QoS parameters when primary route fails.**

Keywords: Ad-hoc networks; AODV; Route Discovery; Route Maintenance; Reverse route; Network lifetime.

I. INTRODUCTION

A Mobile Ad-hoc Network (MANET) is a multi-hop network with dynamic topology. In MANET all nodes are self-organize to setup a network. Due to mobility of nodes routing is very challenging task in MANET. Many conventions routing mechanism are utilized for correspondence in MANET. Some of them are proactive (table driven) and some are responsive (on request). The Ad hoc On demand Distance Vector (AODV) [1] is considered most well-known on demand routing mechanism in MANET.

AODV setup the route by broadcasting the route request RREQ packets to all nearer nodes to find the path to destination. After receiving the request packet node check the table entry for the route if route is found the route reply message send to the source, otherwise request forward to nearer nodes in the vicinity. If the node gets the request is destination, send the route reply RRER message to the source using the reverse route from which the request may travel through the destination. After receiving route reply message from destination, the source node makes the entry in table and start to transmit data packets.

If a hop examinations break in path of a dynamic route, it drops the packets and erases every one of the entry concerning way close by this broken connection from the entry table and, communicate route error message to illuminate upstream hops to erase the relating sections from their table. Source hop get hold of route error message, it erases the route and also discover the new path by means of flooding route request. It might be expensive to drop information packets at moderate hops. What's more, visit route discovery may likewise development the conflict and overheads.

The goal of this paper is to upgrade the route maintenance of unique AODV convention by considering more reliable hops as secondary hops at the time of essential route inability to diminish the likelihood of incessant connection breaks and furthermore enhance the network life time by utilizing a backup route of action which has all the more outstanding energy efficiency. Because of modified approach, if route breaks between two hops then upstream hop can utilize the secondary route other than the dropping of information packet. The rest of this paper is sorted out as takes after: Section II examines some related works. Segment III talks about proposed plans. Area IV exhibits the simulation result comes about. At last, in segment V, conclusion and future bearing are introduced.

II. RELATED WORK

Reliable delivery of packets is a most critical issue in Mobile Ad hoc Network. Because of high portability rate of mobility and different difficulties regarding reliable data delivery is as yet hot region of research in MANET. Some of researchers have proposed plans to improve the throughput and reliable data delivery in AODV. A scheme is proposed by Ngo Hoai Phong and Myung-Kyun Kim as AODV-ER [3]. This scheme is utilizing reliable route hop by hop to achieve high packet delivery

rate. To enhance the reliability of the route it utilizes the packet reception rate of intermediate nodes as parameter of matrix. The cost factor is considering in terms of hop count to select the primary route. Author propose the continue process to collect the packet reception rate of each node in the route.

Another scheme known as AODV-BR (Backup direction) [5] become proposed with the aid of Sung-Ju Lee and Mario Gerla. In this scheme author proposed a mesh of structure of routes towards the destination node by listening more than one route reply message. It selects the primary route as reduced hop count, but when the route failure occurs the alternate route will be utilized.

Based on AODV-BR, another proposal in the form of AODV-ABR and AODV-ABL is proposed by Wei Kuang, Sheng-Yu Hsiao, Tuh-Chung Lin [6]. Inside the idea, mesh structure and change routes are created by means of listening control packets in addition to data. When failure is occurring, this technique locates the high-quality transmission route with the aid of the use of handshake process with its neighboring nodes. This technique dynamically changes the network topology without utilize more control packets.

On the above discussed protocols, Liu Yujun and Han Lincheng proposed a modified protocol named as AODV-BRL [3]. To decide the most advantageous opportunity route at the time of route breaks, this scheme use extended hello Message. At route discovery phase path is decided through each RREP packets a properly as prolonged hello Message. Least hop count number first is applied to received primary route. This technique also utilize the modified routing table which contain alternate route.

On the equal mechanism Rakesh Kumar and K.V. Arya additionally proposed Modified AODV [4] which keep in mind some backup route information in routing table. When the primary link is failed the backup route utilize to transmit the data packets of node that face link failure. This approach also carries the descendent node information in packet itself to use when there is no backup route available at the upstream node.

One more proposal AODV-EER [13] is provided by Rakesh Kumar et al. to enhance the reliability of route. In this approach author proposed a modified route discovery process in which primary route is decided based on the reliability of nodes instead of hop count.

Dynamic Backup Routes Routing Protocol (DBRP) [14] reconstructed several routes from source to destination in order that on failure of the principle route different routes are available for packets to reach the destination. Presence of a couple of routes outcomes in less packet loss as other than the primary there are other paths through which records packets can attain the vacation spot. but, multiple paths leading to the same vacation spot may additionally cause overflowing of the identical statistics inside the system.

SMORT (Scalable Multipath on demand Routing for mobile advert hoc Networks) [15] provided intermediate nodes on the principle route with multiple routes to the destination in case the primary route fails. but, flooding inside the network because of the presence of a couple of nodes remained a concern when SMORT protocol is applied for MANETs.

III. PROPOSED SCHEME

This section describes the proposed route maintenance scheme for AODV to increase the reliable and energy efficient packet delivery while primary route fails.

The objective of this proposed route maintenance approach is to increase the packet delivery ratio by using reliable and energy efficient backup route in case of primary route failure. Proposed methodology determines the backup route by identifying nodes with reliable links as well as energy efficient node to minimize the risk of route failure due to link mobility.

The proposed approach is mainly worked as traditional AODV routing. During AODV routing when the primary route fails, the route maintenance procedure starts by finding the backup route. After route failure, an alternate route needs to be found out for transmitting data packets. Backup or alternate route is selected on the two parameters, reliability of the alternate route, and the energy efficiency of the alternate node. Based on these two parameters alternate node is selected to reroute or transmitting data packets towards destination.

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Reliability of the node is calculated by calculating average drop rate [13] of the node which is calculated as:

$$P = 1 - \frac{Total\ packets\ transmited\ to\ next\ hop}{Total\ packets\ received\ by\ hop} \quad (1)$$

In order to select energy efficient alternate node, node calculate the remaining energy for transmission by using formula [12]:

$$E(r) = Avg\left(\sqrt{{Efs}/{Et}}\right) per\ round \quad (2)$$

Where E(r) represent the remaining energy of node, Efs represent energy consumed in short distance transmission, Et represent total transmission power.

At the time of link failure, the upstream node of the broken link finds the alternate or backup route. The backup route selection process finds the node which has reliable route to the destination and also contained the energy greater than the threshold value of energy required for transmission. Reliable route selection based on formula (1) is selected if the remaining energy calculated using formula (2) is greater than the threshold value. If multiple node has the same reliability and remaining energy, then route selection is done on the basis of hop count to the destination. Backup route is selected which has less hop count to the destination.

If primary route fails, route maintenance phase started. In first step it checks the alternate route on the downstream node where the link failure occurs. If no alternative route found on that node it starts backup route selection procedure, and select an alternate node for transmission based on the node reliability and remaining energy. After selecting alternate node or backup route the data packets transmitting through this backup route. Which finally decrease the drop rate as well as increase the packet delivery ration in highly mobile network.

IV. PERFORMANCE EVALUATION

In this segment, we can discuss simulation parameters to research the overall performance of proposed technique towards conventional AODV protocol.

(A) Simulation Environment

The discrete event system the Network Simulator (NS2) [6] [7] is utilized to implement proposed approach. The random waypoint mobility model is used with constant bit rate. Random selection used for source and destination. The traffic rate is four packets per second. The payload size is 512 bytes. The mobility of the nodes is between zero and 10 m/s. After a pause time node change the position. After a pause time hop change the position. We changed the delay time to accomplish distinctive degrees of portability. Variety in delay time causes the variety in portability. Lower pause time implies higher versatility and longer pause time suggests lower down mobility of hops.

(B) Result and Analysis

The proposed approach is implemented in NS2.35. The performance of the network is analyzed based on three parameters namely end to end delay, packet delivery ratio, and remaining energy in the network.

This modified AODV with reliable and energy efficient route maintenance mainly concerned with reliability of backup route by utilizing more reliable routes to deliver data packets. It's also increases the packet delivery ratio by providing reliable backup route while primary route fails. Finally, it increases the life time of network through energy balancing of the nodes.

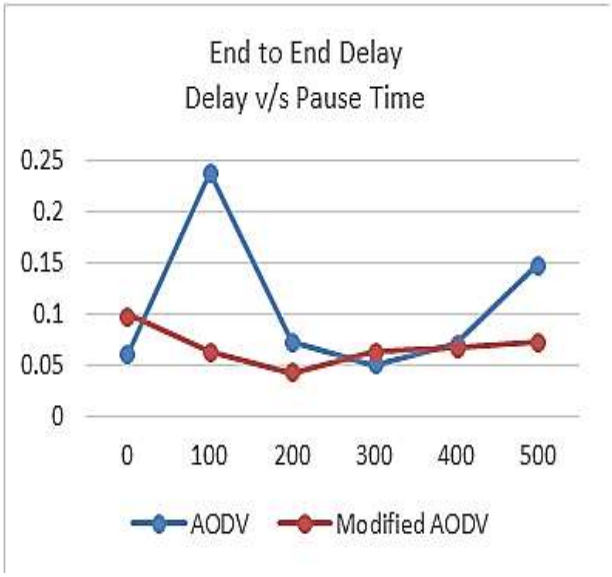

Figure 1(a) plot between Modified AODV and original AODV for number of nodes 100

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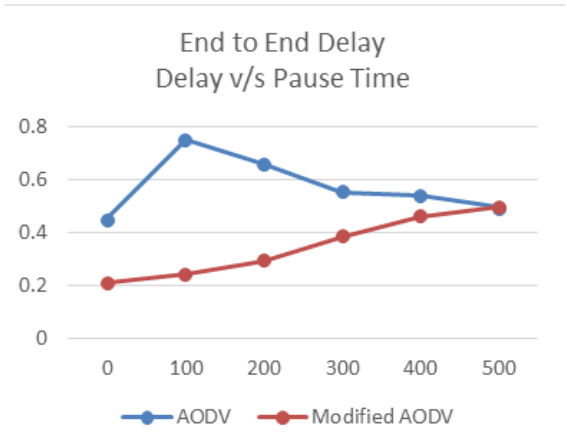

Figure 1(b) plot between Modified AODV and original AODV for number of nodes 200

The plot in Figure 1(a) shows the comparison of Modified approach with AODV in terms of End to End delay with a network of 100 nodes. It shows that modified approach is perform much better for the network of 100 nodes in highly mobile network. Figure 1(b) shows the plot for End-to-End delay against pause time for networks of 200 nodes, which also depict the better preformation of Modified approach over AODV.

Similarly, the plot in Figure 2(a) and 2(b) shows the comparison of Packet Delivery Ratio between Modified AODV and original AODV protocol. These plots analyze the packet delivery ratio of modified AODV and AODV for different pause time. Modified approach works better and provide more reliable delivery of data packets than AODV.

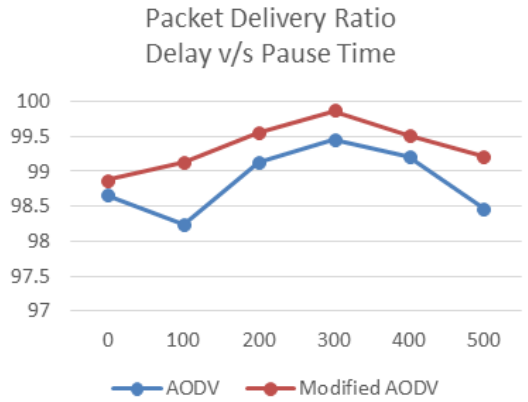

Figure 2(a) plot between Modified AODV and original AODV for number of nodes 100

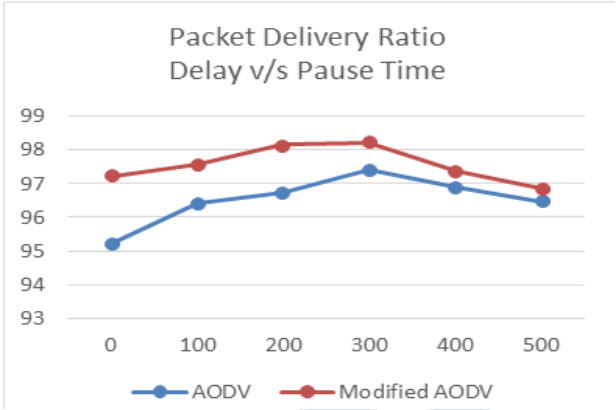

Figure 2(b) plot between Modified AODV and original AODV for number of nodes 200

The plot in Figure 3 represent the comparison of remaining energy node wise in Modified AODV and original AODV protocols. Plot shows that Modified AODV outperform the original AODV in terms of remaining energy of nodes. Modified AODV enhanced the lifetime of network through energy balancing among nodes.

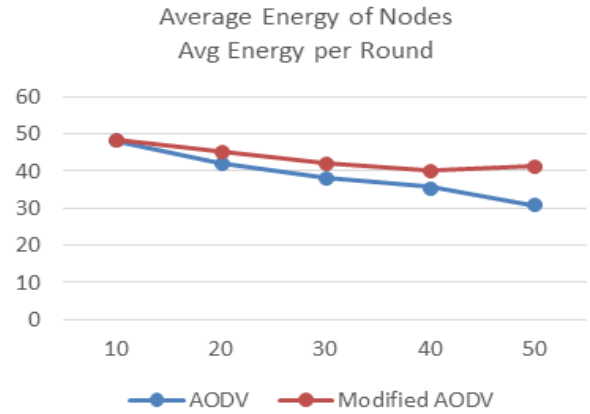

Figure 3 plot between Modified AODV and original AODV for number of nodes 100

The simulation on NS2 for modified AODV on original AODV protocol certainly depict that the proposed scheme enhances the route maintenance, reliability and network lifetime.

CONCLUSION

Reliability is taken into consideration as maximum crucial thing that influences the overall performance of routing protocol ad-hoc networks. In this article, we suggest a

technique to modify traditional AODV with reliable and energy prone route protection to enhance the reliability under route maintenance phase of AODV protocol. To enhance the reliability of statistics conversation, we endorse a new route renovation method which considers hop with more reliability and more remaining energy, in place of hop count. The primary route to destination is chosen as per original. The mechanism of modified route maintenance starts when primary route fail. Besides dropping data packets as original AODV, this modified route maintenance scheme uses backup route decided on the basis of two parameters route reliability and remaining energy of the alternate node which is used to forward data packets towards destination. Simulation results shows that this modified approach increases the network lifetime in terms of energy balancing and increases the packet delivery ratio in comparison to original AODV protocol.

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