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Modified Route Maintenance in AODV Routing Protocol

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Abstract – One of the popular wireless network architecture is Mobile Ad-Hoc Network (MANET). MANET will deploy easily in any kind of environment without any use of infrastructure support. MANET made of nodes which are mobile in nature. Every node in a network acts as a router. Each node provides flexibility in network topology.

There are many routing protocol in MANET[1]. Among all the protocol one ad-hoc routing protocol is on-demand routing that establishes a route to a destination only when it required. In mostly on-demand routing protocol every time re-establish a new route after route breakage. In this paper, we propose that when route break will generate at that time intermediate node send route error packet to source and source has another route in its routing table. This secondary route will work as an active route in data transfer.

Keyword – RREQ, RREP, RERR, Multipath, Local route repair.

I. INTRODUCTION

The ad-hoc networking is increasing popularity now a days because too much increase in the mobile computers such as laptops and palmtops.It does not require a static network infrastructure due to its wireless nature and can be deployed as a multi-hop packet network both rapidly andwith low expense [2]. So, Ad-hoc network convenient for emergency operations, military operations[3]. Host nodes are mobile in nature, so it has frequent varying topology in the network. So, Maintenance of the ad-hoc network is very difficult as compared to wireless networks. Sometimes it may possible that the source node or the destination node moved out of the network, or cause changing in topology of the network.

MANET has its own routing protocols, which protocols can be compromised with frequent route changes, dynamic topology, bandwidth constraint and multi-hop routing. An ad-hoc routing protocol is a convention, or standard that controls how nodes decide which manner to route data packets between calculating device in a mobile ad-hoc network[4].The routing protocol that are available for MANET comprise proactive (table driven), reactive (on demand) and hybrid routing protocols. Popular proactive routing protocols are DSDV (Destination sequenced Distance Vector) and OLSR (Optimize Link State Routing protocol) while reactive routing protocols include AODV (Ad-hoc On Demand Distance Vector) and DSR (Dynamic Source Routing). An example of hybrid routing protocol is ZRP (Zone Routing Protocol). AODV full fill the criteria of MANET requirement for dynamic, self-initiating, multi-hop routing between participating mobile nodes wishing to start and maintain ad-hoc network[5].AODV is an on demand routing protocol, that is, it builds routes as long as desired source nodes. It maintains these routes as long as they are needed by the sources[6]. Nodes maintain a route cache and use a destination sequence number for each route entry. The fact that a node in AODV seeks information about the network only when needed reduces overhead since nodes do not have to maintain unnecessary route information while the use of a sequence number ensures loop freedom.

II. RELATED WORKS AND THEIR SHORTCOMINGS

1. Route Discovery

In AODV routing protocol, when source has data to transmit to a new destination, it broadcast a RREQ for that destination to its neighbours. A node on receiving the RREQ checks if it has not received the same request before using the Route-ID. It is not the destination, it broadcasts the RREQ and at same time backward route to the source is created [7].If RREQ receiving node is destination, it creates RREP. The RREP reached at source hop by hop. When RREP broadcasts, each intermediate node establishes a route to the destination. When RREP received by source, it store the forward route to the destination and starts sending data. If the source receives multiple RREPs, the route selected with the help of less number of hop count.

In some kind of situation a link break detected, a RERR packet is sent to the source of the data hop by hop. As the RERR broadcasts towards the source, each intermediate node invalidates route to an unreachable destinations. When the source receives the RERR packet, it invalidates the route and restarts the route discovery. Sequence number in AODV is playing a key role.[8, 9]

2. Route Maintenance

Once the route is established, a route maintenance protocol is used to give feedback about the links of the route and to allow the route to be modified in case of andinterruption due to movement of one or more nodes along the route. Maintenance of the discovered/established route is necessary for two main advantages, first to achieve stability in the network and secondly to reduce the excessive overhead required in discovering new route [10]. Every time the route is used to forward a data packet. Its route expired time is updated to be the current time plus active route timeout. [5, 11]Active route timeout is a constant value that defines as to how long a new discovered route is to be kept in the routing table of a nodes in the network If a route is not used for this predefined period, a node (source or intermediate) cannot be sure whether the route is still valid or not and removes the route from its routing table, this is to ensure no unnecessary packet loss.

In AODV routing movements of nodes affect only the routes passing through the specific node and thus do not have global effects. If the source node moves while having an active session, and loses connectivity with the next hop of the route, it can rebroadcast an RREQ. When either the destination or some intermediate node moves, it initiates an RERR message and broadcasts it to its precursor nodes and marks the entry of the destination in the route table as invalid, by setting its distance to infinity [12]. An active neighbour node list is maintained to keep track of the neighbouring nodes that are using the entry to route data packets. In case link to the next hop is broken these neighbouring nodes are notified with RERR packets. Each such neighbour node, in turn forwards the RERR to its own list of active neighbours, thus invalidating all the routes using the broken link[13].

Limitation of AODV:

A large number of control packets are generated while dealing with the route-maintenance in regular AODV routing protocol, which in turn increases the congestion in the route. So, the overhead in the bandwidth increases with the increase in the number of control packets generated. Ultimately, the delay in the transfer of packets increases. [14]

III. PROPOSED WORK

In this research paper implemented 3 techniques AODV, AODV – LRR, AODV – Multipath. Basic AODV compare with local route repair techniques. When active path will break at that time local route repair procedure work and new route will be discovered using intermediate node. These first two techniques are compared in form of graphs like packet delivery ratio; normalize routing load, end-to-end delay, route repairs and throughput.

Then after AODV multipath have developed. When source wants to sends data to destination node. At that time route discovery process starts and broadcast multiple route requests using different broadcast ID. When destination receive route request from source instantly it gives reply to the source. And when another request will receive with same broadcast ID, destination discards the request of source. Otherwise, destination sends reply to source. Source receives two or more different reply with different broadcast ID.

Source store this reply in its routing table. And routing table will update. When source receives first reply, it starts sending data using this route. This route will become an active current route. Another route will be store in its routing table because one or more reply receives from destination to source.

Ad-hoc network characteristics are dynamic varying topology and mobility, due to these types of nature intermediate nodes moves in topology and current active route will break. At that time other secondary route will find out from source routing table and work as primary route and data packets will starts sends on this route.

- **Proposed Algorithm**

- **Algorithm I: Broadcasting Route Request**

1. If Source s want to sends data, then check the routing table
2.If no routes in routing table, then create an entry for reverse route
3.for each route request with same pair of source and destination
Follow steps 4 to 8
4.Set route expire time
5.If Source sequence number >= reverse route sequence number and Request hop count <reverse route hop, then update request hop count, source sequence number, route expire time
6. If Request time out > 0, then Request count = 0, Request last ttl = request hop count, Route expire time = current time + reverse route life
7.Assert Route flag = RFT_UP
8.If route flag = up, then reverse route hops!=infinity

- **Algorithm II: Route reply**

1. for each route reply with same pair of source and destination
Follows step2 to step7
2. If Destination request = index , then sequence number = destination sequence number +1
3.If sequence number %2 = 0, then sequence number incremented by 1
4.Send reply containing source address, hop count, destination address, destination sequence number, route life time, route time stamp
5.Else if route hops not equal to infinity and sequence number > destination sequence number, then request destination = destination route
6.Send reply containing request source, hop count increment by 1, destination request, request time stamp
7.Otherwise send reply containing Source address, Destination address, Hop count+1;

- **Algorithm III : When route break**

1.For each link breakage, follow step2 to step4
2.If Intermediate node N detects link break, then intermediate node N send RERR packet to source S, Source S check the routing table
3.If S find another route entry in routing table, then corresponding/buffer route will be active based on priority
4.Otherwise source S starts route discovery process again

IV. SIMULATION SCENARIO

This section compares performances of Conventional AODV, AODV local route repair and AODV multipath in different network environment.
For the simulation performed in this work, use NS2 network simulator to evaluate the performance of the improved AODV multipath.The simulation environment have are of different areas for different nodes and duration of 300 milliseconds. Transmission bit rate 2mbps. The mobility model was Random waypoint model with different mobility 1,5,10. The traffic pattern was peer-to-peer constant bit rate (CBR). Packet size is 1000 bytes. In the simulation, all the mobile nodes move randomly with 1,5,10 meters per seconds separately.

A) Basic Scenario

Number of nodes	Room size
50	1000 * 1000 meter^2
100	1500 * 1500 meter^2
250	2400 * 2400 meter^2
500	3450 * 3450 meter^2

B) Other Parameters

Parameter	Value
Agent	UDP
Traffic	CBR

Packet size	1000 bytes
Start time	0.0ms
Stop time	100 ms
Speed	1,5,10 m/s

Experiments and results

1) Parameter vs Nodes

A) Normalize Routing Load

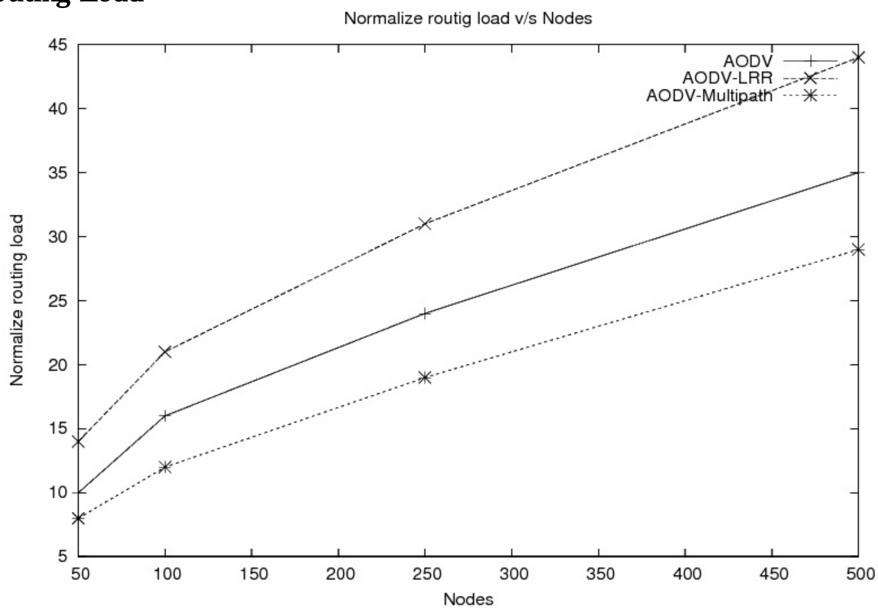

Fig. 1 Normalized routing load

Figure 1 represents "Normalized routing load" of Conventional AODV, AODV local route repair and AODV multipath strategies. Number of nodes becomes increase routing load in ad-hoc network is increased. But in fig 1 show that multipath AODV has less normalize routing load in compare to Conventional AODV and AODV local route repair strategy.

B) Packet Delivery Ratio

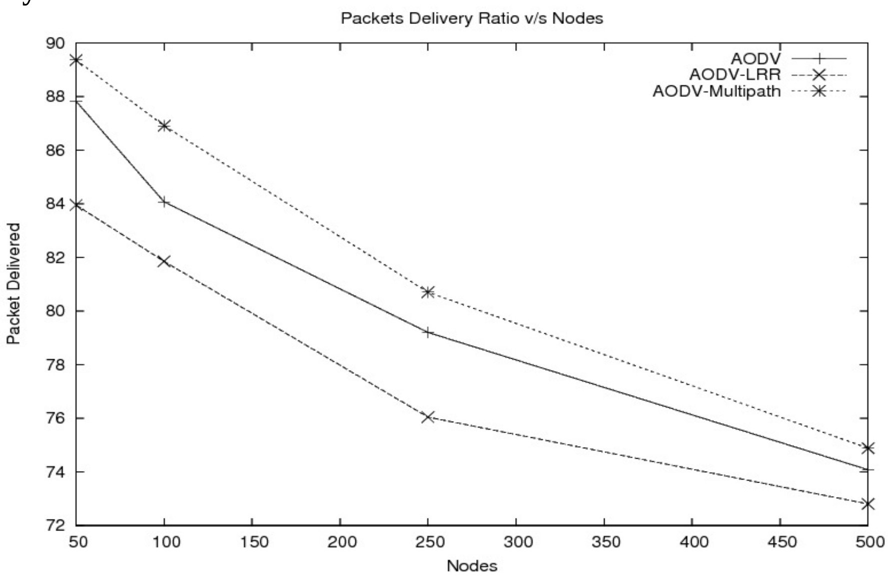

Fig.2 Packet delivery Ratio

Figure 2 represents "Packet Delivery Ratio" of conventional AODV, AODV local route repair and AODV multipath strategies. Number of nodes become increase packet delivery in ad-hoc network is decrease. But in fig 2 show that multipath AODV has more packet delivery ratio in compare to Conventional AODV and AODV local route repair strategy.

C) Throughput

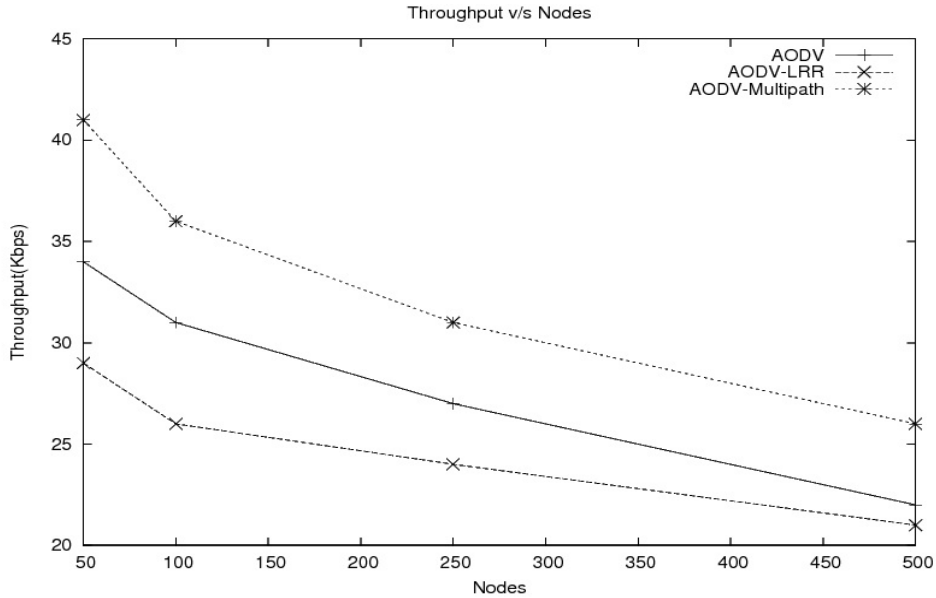

Fig.3 Throughput

Figure 3 represents “Throughput” of conventional AODV, AODV local route repair and AODV multipath strategies. Number of nodes becomes increase throughput in ad-hoc network is decrease. But here in fig 3 show that multipath AODV has more throughputs in compare to Conventional AODV and AODV local route repair strategy.

D) End-to-end Delay

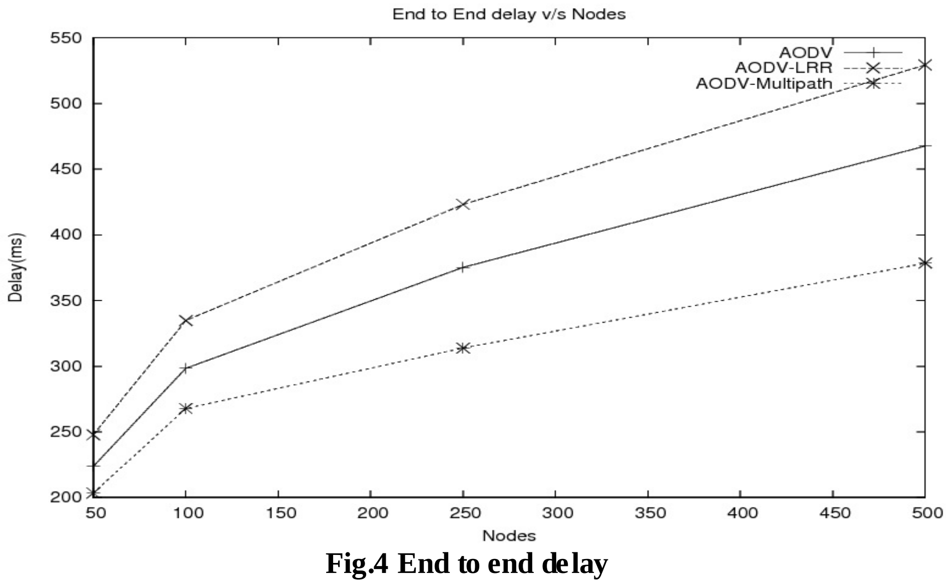

Fig.4 End to end delay

Figure 4 represents “End to end delay” of conventional AODV, AODV local route repair and AODV multipath strategies. Number of nodes becomes increase end to end delay in ad-hoc network is increase. But in fig 4 show that multipath AODV has less end to end delay in compare to Conventional AODV and AODV local route repair strategy.

E) Route repairs

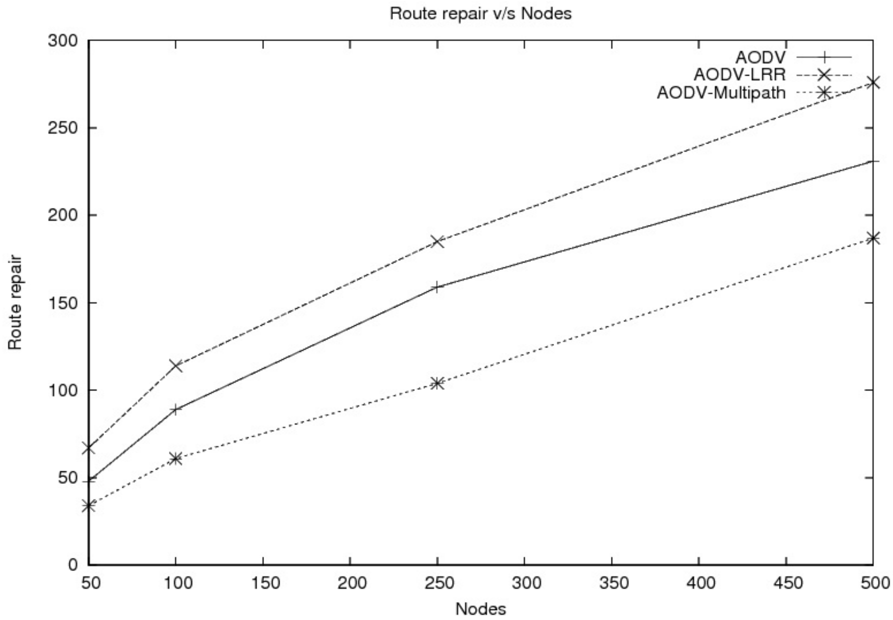

Fig.5 Route repair

Figure 5 represents "Route repair" of conventional AODV, AODV local route repair and AODV multipath strategies. Number of nodes becomes increase repairing of routes in ad-hoc network is increase. But in fig 5 show that multipath AODV has less repairing of routes in compare to Conventional AODV and AODV local route repair strategy.

2. Parameter v/s speed

A) Normalize Routing Load

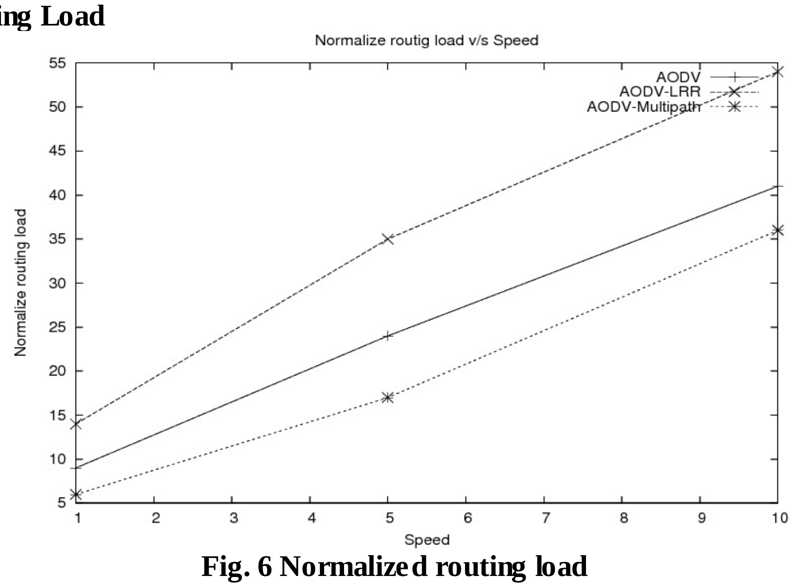

Fig. 6 Normalized routing load

Figure 6 represents "Normalized routing load" of Conventional AODV, AODV local route repair and AODV multipath strategies. Movement or speed of nodes becomes increase routing load in ad-hoc network is increased. But in fig 6 show that multipath AODV has less normalize routing load in compare to Conventional AODV and AODV local route repair strategy.

B) Packet Delivery Ratio

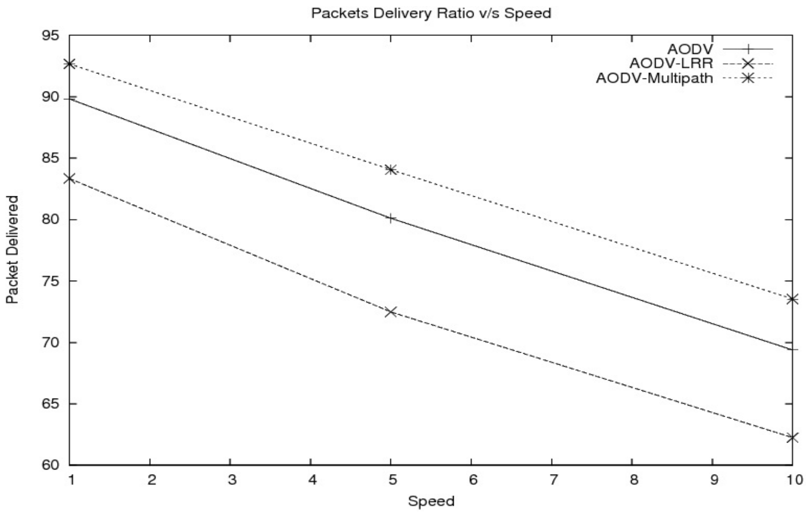

Fig.7 Packet Delivery Ratio

Figure 7 represents "Packet Delivery Ratio" of conventional AODV, AODV local route repair and AODV multipath strategies. Movement or speed of nodes become increase packet delivery in ad-hoc network is decrease. But in fig 7 show that multipath AODV has more packet delivery ratio in compare to Conventional AODV and AODV local route repair strategy.

C) Throughput

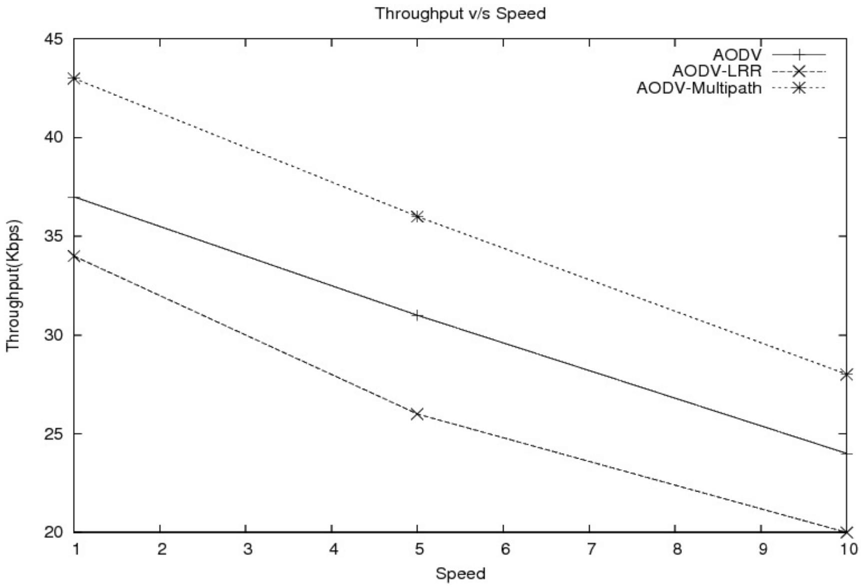

Fig.8 Throughput

Figure 8 represents "Throughput" of conventional AODV, AODV local route repair and AODV multipath strategies. Movement or speed of nodes becomes increase throughput in ad-hoc network is decrease. But in fig 8 show that multipath AODV has more throughputs in compare to Conventional AODV and AODV local route repair strategy.

D) End-to-end Delay

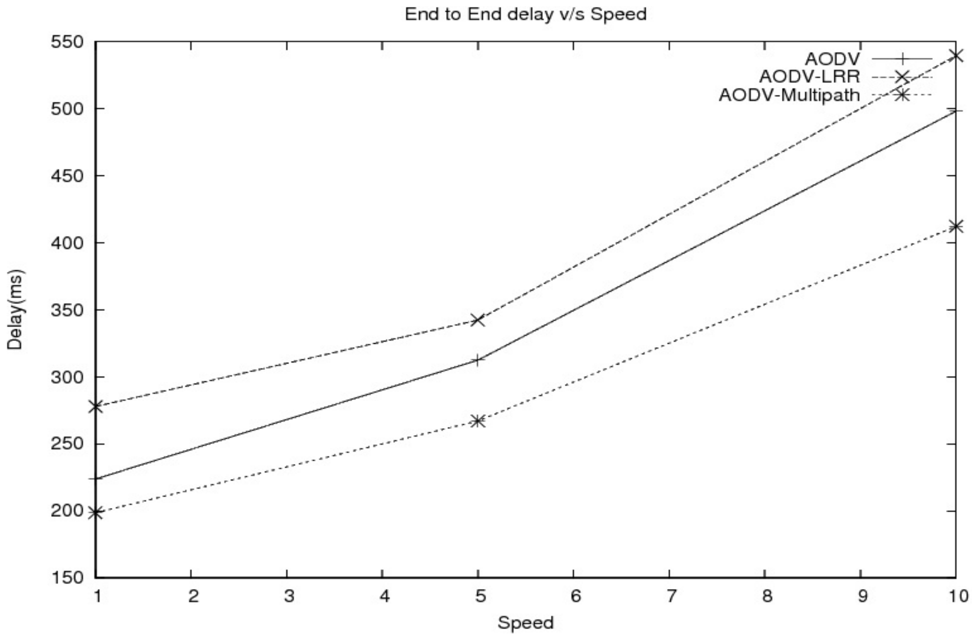

Fig.9 End to end Delay

Figure 9 represents "End to end delay" of conventional AODV, AODV local route repair and AODV multipath strategies. Movement or speed of nodes becomes increase end to end delay in ad-hoc network is increase. But in fig 9 show that multipath AODV has less end to end delay in compare to Conventional AODV and AODV local route repair strategy.

E) Route repairs

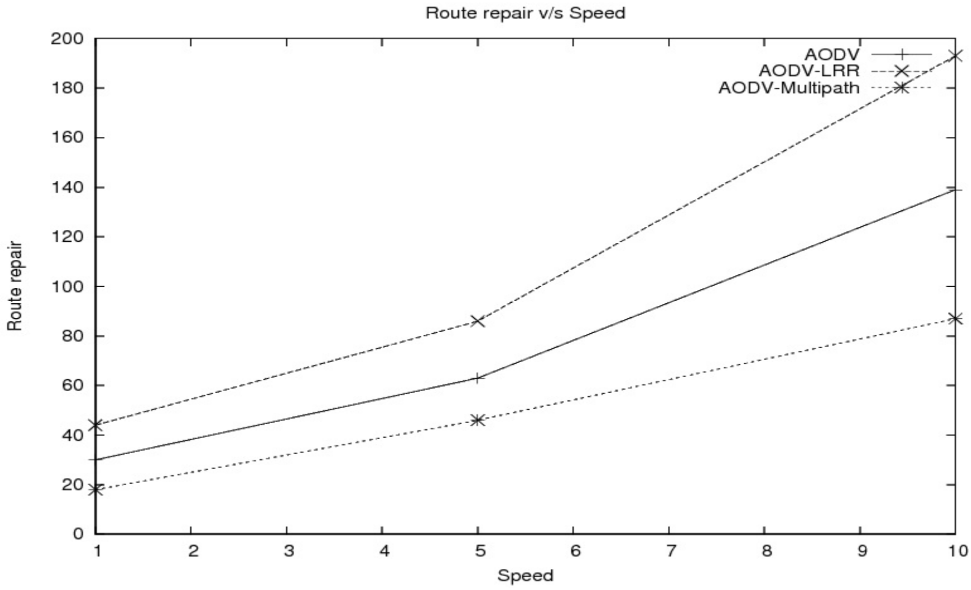

Fig.10 Route repair

Figure 10 represents "Route repair" of conventional AODV, AODV local route repair and AODV multipath strategies. Movement or speed of nodes becomes increase repairing of routes in ad-hoc network is increase. But here in fig 6.10 show that multipath AODV has repairing of routes in compare to Conventional AODV and AODV local route repair strategy.

V. FUTURE WORK

Research work consists of conventional AODV, AODV local route repair and AODV multipath. Basically, which find the number of routes and stores in routing table. Many other techniques are available, which are not covered in this work. One of the available techniques is to never find out or focus on any static node available in topology. If static node is available, this node is used as core node. Because as, it's a static node so route info will be stored only once and may improve the results. Amongst all, second one is checking the energy of mobile node. If some nodes have energy less than threshold then, those nodes are avoided. Hence find out the node with better energy. As sometimes if route breaks then secondary route will work as a primary route and if it contains low energy node then, it will increase the possibilities of more route breaks. In future, the two methods mentioned here can be applied in multipath AODV to get good results in terms of throughputs, end to end delay and packet delivery ratio.

VI. CONCLUSION

In this, context proposed multipath strategy helps in terms of better stability of node, less use of energy at node, and quickly use other route which store as secondary route in routing table. Overall objective leads to achieve better route connection between breakage (i.e. source-intermediate-destination) links which leads to give efficient and effective connection between nodes for data transfer in ad-hoc network.Based on the implementation and graphs generated, we conclude AODV shows improvement as compared to other two techniques. In multipath AODV, it stores secondary routes in routing table. When link breakage is generated, it use secondary route as primary route for data transfer. During link breakage no RREQ will be broadcasted to find other route so normalize routing load is decreased in AODV multipath compared to conventional AODV and AODV local route repair. Also, secondary route is available in routing table so during link breakage secondary route work as active route and data transfer process will continue. So, Packet delivery ratio is also higher as compared to conventional AODV and AODV local route repair. Data communication process continues after link breakage because secondary route will get converted to active route, hence there will be no delay in data communication process. So, end-to-end delay is less as compared to conventional AODV and AODV local route repair. In AODV multipath, during route discovery, routes are backed up in routing table. Hence, repair of route will get avoided. So, Route repair is less as compared to conventional AODV and AODV local route repair.

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