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RESEARCH ARTICLE

Enhancement the Ad-hoc On-demand Distance Vector of Network

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Abstract— Mobile Ad hoc network is network where nodes communicate without any central administration or network infrastructure. The goal of this work is to Enhancement the Ad-hoc On-demand Distance Vector of Network which we concentrate on link failure issue and its effect in the performance in Ad-hoc network. And that enhancement will be done by using AOMDV protocol. Also one of the objectives of this project stated to compare 3 popular routing protocols, AOMDV, AODV and DSR.Results show that DSR is best performance than others protocols (AOMDV and AODV) in throughput and goodput based on performance metrics Packet Delivery rate , delay , throughput and goodput.and that done by using ns2 simulator over Linux operating system environment.

Keywords— AD HOC, AODV, DSR, AOMDV, NS2

1.1 INTRODUCTION

Mobile ad hoc network (MANET), sometimes called a mobile mesh network, is a self-configuring network of mobile devices connected by wireless links. The Ad hoc networks are a new wireless networking paradigm for mobile hosts. Unlike traditional mobile wireless networks, ad hoc networks do not rely on any fixed infrastructure. Instead, hosts rely on each other to keep the network connected. It represent complex distributed systems that comprise wireless mobile nodes that can freely and dynamically self-organize into arbitrary and temporary, ''ad-hoc'' network topologies, allowing people and devices to seamlessly internetwork in areas with no pre-existing communication infrastructure. [1]

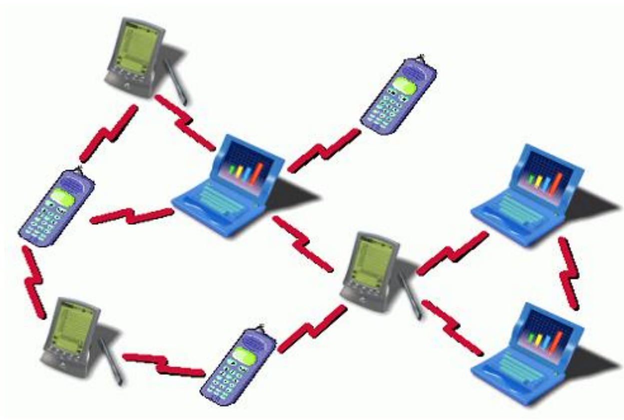

Fig. 1 connection of MANET

1.2 Mobile ad hoc network routing protocols:

1.2.1 Protocol Classifications: There are many ways to classify the MANET routing protocols Fig. 2 depending on how the protocols handle the packet to deliver from source to destination. But Routing protocols are broadly classified into three types such as Proactive, Reactive and Hybrid protocols.

1.2.2 Proactive Protocols: These types of protocols are called table driven protocols in which, the route to all the nodes is maintained in routing table. Packets are transferred over the predefined route specified in the routing table. In this scheme, the packet forwarding is done faster but the routing overhead is greater because all the routes have to be defined before transferring the packets. Proactive protocols have lower latency because all the routes are maintained at all the times.

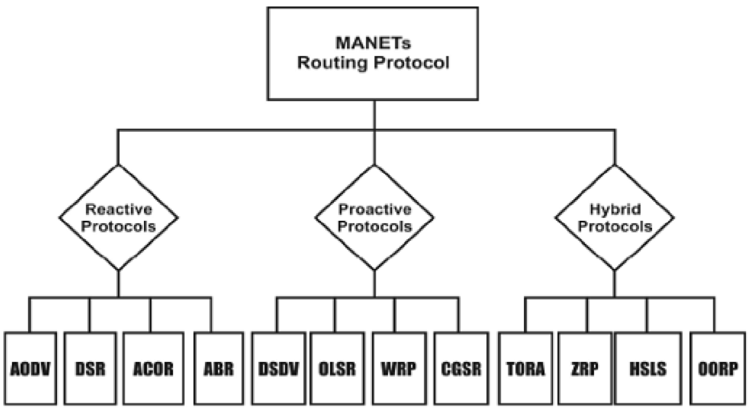

Fig. 2 MANET Routing Protocols

1.2.3 Reactive Protocols: These types of protocols are also called as On Demand Routing Protocols where the routes are not predefined for routing. A Source node calls for the route discovery phase to determine a new route whenever a transmission is needed. This route discovery mechanism is based on flooding algorithm which employs on the technique that a node just broadcasts the packet to all of its neighbors and intermediate nodes just forward that packet to their neighbours. This is a repetitive technique until it reaches the destination. Reactive techniques have smaller routing overheads but higher latency.

1.2.4 Hybrid Protocols: Hybrid protocols are the combinations of reactive and proactive protocols and takes advantages of these two protocols and as a result, routes are found quickly in the routing zone. [2]

2.1 AODV System:

AODV (Ad-hoc On-demand Distance Vector) is a loop-free routing protocol for adhoc networks. It is designed to be self-starting in an environment of mobile nodes, withstanding a variety of network behaviors such as node mobility, link failures and packet losses. The AODV protocol consists of two important mechanisms, Route Discovery and Route Maintenance. AODV is chosen for the obvious reason that it is simple and has a low overhead and its on-demand nature does not unduly burden the networks. Ad hoc networking allows the devices to maintain connections to the network as well as easily adding and removing devices to and from the network. Sequence numbers ensure the freshness of routes and guarantee the loop-free routing.[3]

2.2.1 The optimization of AODV is based on the recent draft of the AODV specification the essential functionality of AODV includes:

- RREQ and RREP messages (for route discovery)
- RERR messages, HELLO messages, & precursor lists (for route maintenance)
- Sequence numbers
- Hop counts
- Expanding ring search

2.2.2 The following fields exist in each route table entry of AODV:

- Destination IP Address: The IP address of the destination for which a route is supplied
- Destination Sequence Number: It is associated to the route.
- Next Hop: Either the destination itself or an intermediate node designated to Forward packets to the destination
- Hop Count: The number of hops from the Originator IP Address to the Destination IP Address
- Lifetime: The time in milliseconds for which nodes receiving the RREP consider the route to be valid
- Routing Flags: The state of the route; up (valid), down (not valid) or in repair.[4]

3.1 LINK FAILURE PROBLEM:

Link failure problem is a common problem in MANET which is caused due the mobile nature of MANET nodes. When the nodes participating in communication move, they may move out of each other's coverage area. Thus causing link breakage. In the diagram below, link problem is shown where in first part of diagram A can communicate with B and B can communicate with C so there is a link between A>B>C. but in second part of diagram node moved towards C so B is out of range for A so there is a link failure occurred between A and C.[5]

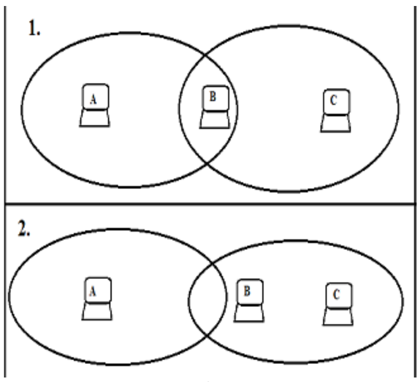

Fig. 3 Link failure problem

4.1 Ad-hoc On-demand Multi path Distance Vector Routing (AOMDV):

Ad-hoc On-demand Multi path Distance Vector Routing (AOMDV) protocol is an Extension to the AODV protocol for computing multiple loop-free and link disjoint paths. The routing entries for each destination contain a list of the next-hops along with the Corresponding hop counts. All the next hops have the same sequence number. This helps in Keeping track of a route. For each destination, a node maintains the advertised hop count, which is defined as the maximum hop count for all the paths, which is used for sending route Advertisements of the destination. Each duplicate route advertisement received by a Node defines an alternate path to the destination. Loop freedom is assured for a node by accepting alternate paths to destination if it has a less hop count than the advertised hop count for that destination. Because the maximum hop count is used, the advertised hop count therefore does not change for the same sequence number. When a route advertisement is received for a destination with a greater sequence number, the next-hop list and the advertised hop count are reinitialized.[6]

5.1 Dynamic Source Routing (DSR):

The Dynamic Source Routing Protocol is a source-routed on-demand routing protocol. A node maintains route caches containing the source routes that it is aware of. The node updates entries in the route cache as and when it learns about new routes. The two major phases of the protocol: Route Discovery and Route Maintenance. When the source node wants to send a packet to a destination, it looks up its route cache to determine if it already contains a route to the destination. If it finds that an unexpired route to the destination exists, then it uses this route to send the packet. But if the node does not have such a route, then it initiates the route discovery process by broadcasting a route request packet. Each intermediate node checks whether it knows of a route to the destination. If it does not, it appends its address to the route record of the packet and forwards the packet to its neighbours. A route reply is generated when either the destination or an intermediate node with current information about the destination receives the route request packet. A route request packet reaching such a node already contains, in its route record, the sequence of hops taken from the source to this node. DSR uses two types of packets for route maintenance: Route Error packet and Acknowledgements. When a node encounters a fatal transmission problem at its data link layer, it generates a Route Error packet. When a node receives a route error packet, it removes the hop in error from its route cache. All routes that contain the hop in error are truncated at that point. Acknowledgment packets are used to verify the correct operation of the route links. [7]

6.1 Methodology:

The method used in this project is Multipath routing which is generally used in ad hoc networks to improve network performance and QoS. Then have Ability to provide multiple routing options from a source to a destination (topology changes). If a node does not receive a confirmation from the next node that the packet was successfully forwarded, initiates a Route Error message back to the source. Then the data packet will be transmitted over another existing path (if multipath) or a new route discovery could be initiated. DSR is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. using the network simulator ns2 to simulate ad hoc network and enhancing the performance of AODV routing protocol with respect to Throughput ,delay, goodput and to see how to enhancement takes effects ,we will make network model with different environment in network simulator ns2 environment.

6.2 Flow chart of the research:

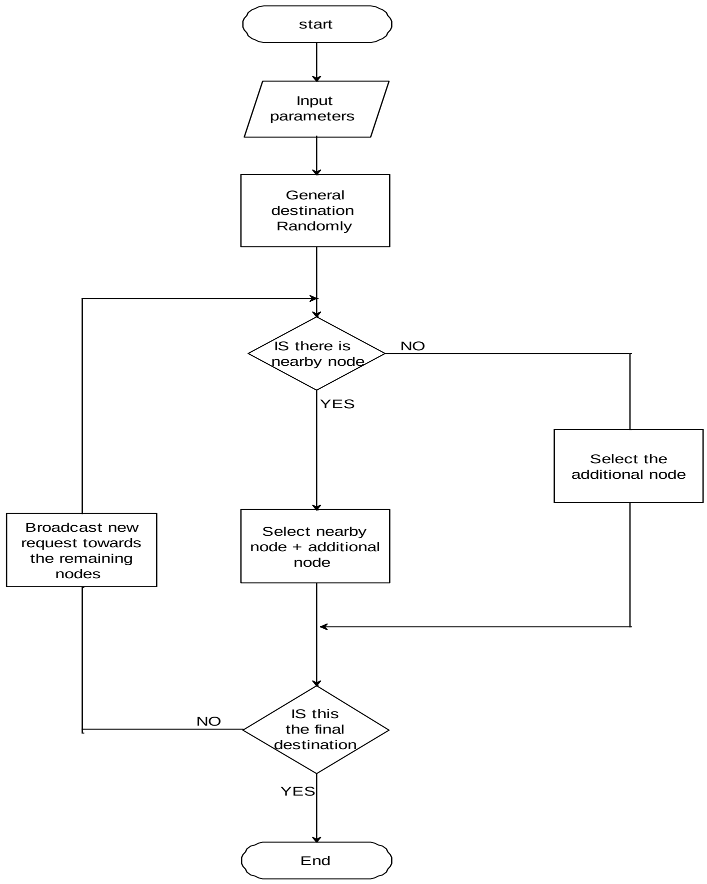

Fig. 4 flowchart of evaluating routing protocols (AODV, AOMDV, DSR)

7 Simulation scenario:

The previous section described the implementation often protocol for mobility and how a simulation was created. This section highlights on the screen shots taken during simulation and on the graphs that produced. In this chapter comparison between AODV & AOMDV and DSR was done, the comparison is based on the following parameters: Throughput and delay, and the packet delivery ratio.

7.1 Throughput:

Throughput is defined as; the ratio of the total data reaches a receiver from the sender. The Time it takes by the receiver to receive the last message is called as throughput .Throughput is expressed as bytes or bits per sec (byte/sec or bit/sec). Some factors affect the throughput as; if there are many topology changes in the network, unreliable communication between nodes, limited bandwidth available and limited energy . A high throughput is absolute choice in every network. Throughput can be represented mathematically as in equation:

$$Throughput = \frac{\text{Number of delivered packet} * \text{Packet size} * 8}{\text{total duration of simulation}}$$

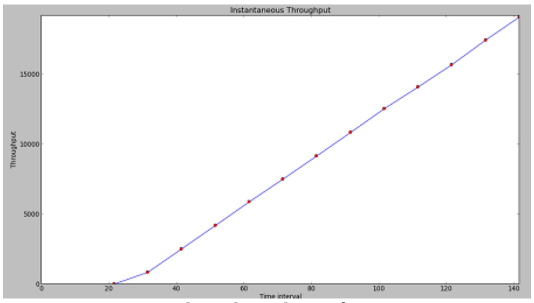

Fig. 5 show throughput of AODV

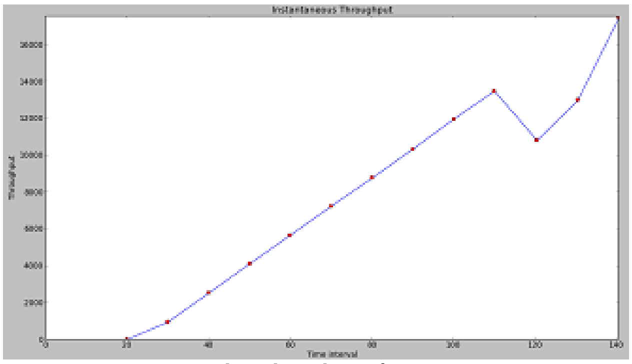

Fig. 6 show throughput of AOMDV

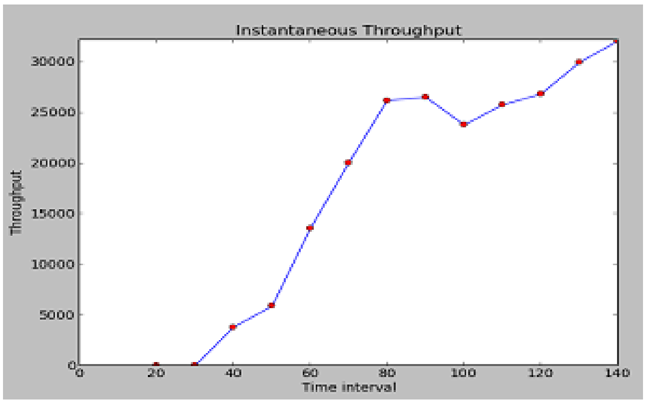

Fig. 7 show throughput of DSR

Table 1 throughput of AODV&AOMDV& DSR

OUTPUT THROUGHPUT	AODV	AOMDV	DSR
20	0.00208675	7.97964	0.639124
30	837.845	943.586	2.46559
40	2511.84	2522.03	3815.91
50	4187.58	4107.29	5876.84
60	5870.87	5669.9	13587.4
70	7497.96	7238.75	20071.8
80	9157.62	8765.59	26241.7
90	10834.8	10341.7	26553.5
100	12537.5	11970.6	23811.8
110	14085.4	13494.3	25796.6
120	15682.5	10815.9	26871.1
130	17444	13000.6	29992.8
140	19097.5	17460.6	32115

Table 2 average throughput of AODV&AOMDV&DSR

Average throughput	AODV	AOMDV	DSR
start time	10	10	10
stop time	149	149	149
received packet	32109	31827	44248
Avg tput	9808.06	8924.67	19186

7.2 Delay

The packet end-to-end delay is the time of generation of a packet by the source up to the destination reception. So this is the time that a packet takes to go across the network. This time is expressed in sec. Hence all the delays in the network are called packet end-to-end delay, like buffer queues and transmission time. Sometimes this delay can be called as latency; it has the same meaning as delay. Some applications are sensitive to packet delay such as voice is a delay sensitive application. So the voice requires a low average delay in the network. The FTP is tolerant to a certain level of delays. There are different kinds of activities because of which network delay is increased. Packet end-to-end delay is a measure of how sound a routing protocol adapts to the various constraints in the network to give reliability in the routing protocol. We have several kinds of delays which are processing delay (PD), queuing delay (QD), transmission delay (TD) and propagation delay (PD). The queuing delay (QD) is not included, as the network delay has no concern with it. Mathematically it can be shown as equation:

$$d_{end-end} = N[d_{trans} + d_{prop} + d_{proc}]$$

Where:

$d_{end-end}$ = End to end delay

d_{trans} = Transmission delay

d_{prop} = Propagating delay

d_{proc} = Processing delay

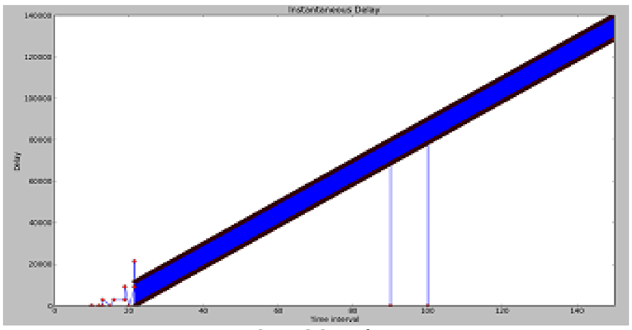

Fig. 8 show delay of AODV

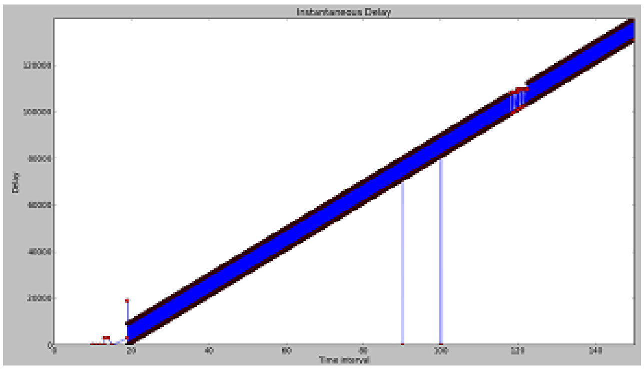

Fig. 9 show delay of AOMDV

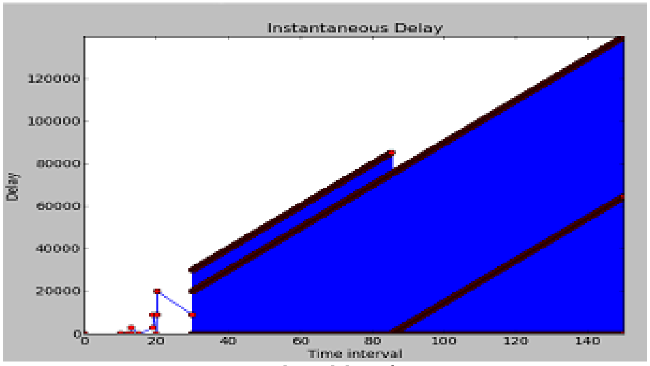

Fig. 10 show delay of DSR

Table 3 show delay comparison between AODV&AOMDV&DSR

output DELAY	AODV	AOMDV	DSR
10	0	0	0
10	-10000	-10000	-10000
10	0	0	0
10	0	0	0.0076
11	0	0	0.0417
12	0	0	0.0174
13	0	0	0
13	3000	3000	3000
13	9000	3000	3000
14	0	3000	0
15	0	3000	0
19	3000	3000	3000
19	9000	9000	9000

Table 4 show average delay comparison between AODV&AOMDV&DSR

Average delay	AODV	AOMDV	DSR
Avg delay	134245	135490	102318

7.3 Goodput:
is the application level throughput, i.e. the number of useful information bits, delivered by the network to a certain destination, per unit of time. The amount of data considered excludes protocol overhead bits as well as

retransmitted data packets. This is related to the amount of time from the first bit of the first packet is sent (or delivered) until the last bit of the last packet is delivered.

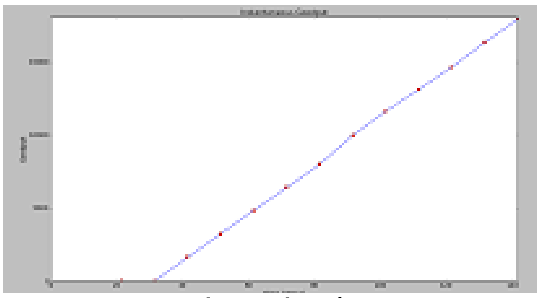

Fig. 11 show goodput of AODV

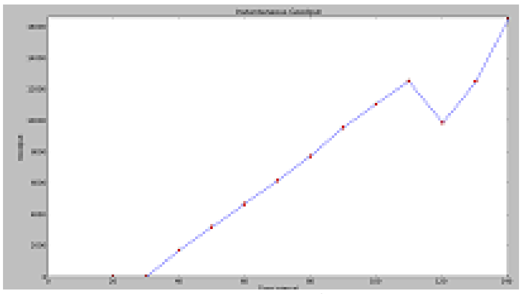

Fig. 12 show goodput of AOMDV

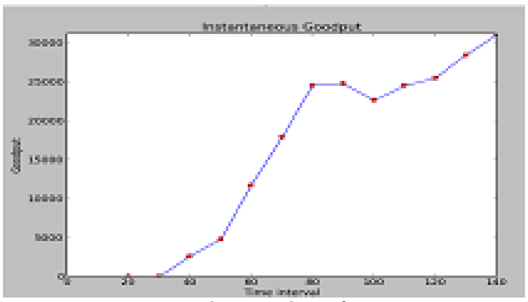

Fig. 13 show goodput of DSR

Table 5 show goodput comparison between AODV&AOMDV& DSR

OUTPUT goodput	AODV	AOMDV	DSR
20	0	0	0
30	0	0	0.799219
40	1611.19	1684.83	2576.8
50	3221.85	3182.9	4745.67
60	4839.3	4662.9	11700.4
70	6404.39	6144.63	17900.7
80	8000.93	7730.09	24554.2
90	9984.9	9533.23	24810.2
100	11638.6	11057.6	22642.3
110	13129.6	12508.5	24514.5
120	14656.6	9868.29	25487.6
130	16347.3	12481.7	28473.7
140	17944.4	10515.9	31049.2

Table 6 show average goodput comparison between AODV&AOMDV& DSR

Average goodput	AODV	AOMDV	DSR
start time	100	100	100
stop time	116	116	116
Avg goodput	0	0	0

7.4 Packet delivery ratio:

is defined as the ratio of data packets received by the destinations to those generated by the sources. Mathematically, it can be defined as: PDR= S1÷ S2 Where, S1 is the sum of data packets received by the each destination and S2 is the sum of data packets generated by the each source. Graphs show the fraction of data packets that are successfully delivered during simulations time versus the number of nodes

Table 7 show packet delivery ratio comparison between AODV&AOMDV& DSR

packet delivery Ratio	AODV	AOMDV	DSR
Generated packet	4	4	4
Received packet	32109	31827	44248
packet delivery	802725	795675	1106200
total dropped	0	0	0

8.1 Conclusion:

This project compared the 3 routing protocols AODV, AOMDV, DSR in the same environment which each protocol has own mechanism when the link failure happen. When revise simulation results we founded that when we use AODV or AOMDV there are no great difference in the performance but when we use DSR there are great enhancement in the performance in all parameters such as in Throughput, goodput, Packet delivery ratio unless in delay the AODV is the best than others (AOMDV and DSR).

8.2 Recommendation and future directives:

1- We recommended for more studies to increase numbers of nodes.
2- We recommended to applying hybrid protocols.

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