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Enhancement of AODV Protocol Based on Energy Level in MANETs

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Abstract— **Mobile ad hoc network is a ad hoc network where it has network environment which is routable. The devices are connected automatically to it as it requires no infrastructure and it is also self-configured. It has wide range of applications ranging from sensors, vehicular ad hoc communications, robotics etc. The issues what AODV (Ad hoc On-Demand Distance) faces are energy consumption, delay and throughput. Ad hoc does not rely on any kind of infrastructures such as routers or access points instead only participate in automatic forwarding of packets. The energy consumption for AODV is much higher with increased number of nodes. In this work we propose a novel methodology-NAODV (New Ad hoc On-Demand Distance Vector) for calculating the optimal path by considering the energy level of each path with more throughputs and with less delay. The simulation is carried out using NS2-2.34 simulator.**

Keywords--NAODV,PDR,throughput,overhea,scalability,energy consumption.

I.INTRODUCTION

Mobile Ad hoc network is constructed without any particular infrastructure and centralized administration. Due to delay, limited resources, dynamic topology and energy consumption the routing mechanism is a most challenging task in MANETs. Based on the way the route information is extracted, maintained and stored routing protocols are divided mainly into proactive and reactive classes. It is necessary in Ad hoc networks; and the adaptability to frequent changes is high in this protocol. In proactive routing protocols, DSDV OLSR there are number of tables to represent the whole topology of the network. The routing information will be updated in these tables regularly. The Reactive routing protocols also called as on demand routing protocol such as AODV, DSR, and TORA. These protocols fail to update information in the table frequently. The above mentioned protocols together called as Hybrid routing protocol such as ZRP where the nodes are organized in groups along with functionalities. Control overhead is reduced by reducing routing table size and size of the packet. We focus on mainly on AODV protocol, which is an on-demand routing protocol. Data transfer occurs as soon as the route is discovered and happens till the route fails. The breakage of route may happen due to movement of nodes, its dynamic nature. Route maintenance is done when the route fails. Requestor node will repair the route called as route repair. Routing Protocol has two operations:

1) Route Discovery

2) Route maintenance

1) Route Discovery

Initially Route Request (RREQ) message along with sequence number is considered to discover the route. When each node forwards the RREQ, it generates a reverse route for itself back to source using the address of the preceding hop. When a node receives a RREQ with a route a Route Reply (RREP), along with count of hops and the sequence number for that route, is sent back along reverse path.

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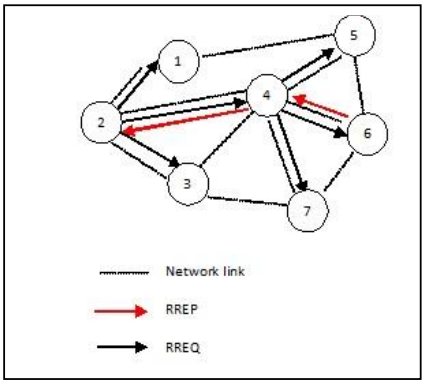

Fig.1 Example of Route Discover

2) Route maintenance

Route maintenance is a way to respond to network failures while changes happen in topology. The data is transmitted till the route fails. Due to movement of nodes and dynamicity of protocol the route may fail. Route maintenance is done when route fails. RERR (Route Error) message is send to node, and then it compares the destinations mentioned in the RERR.

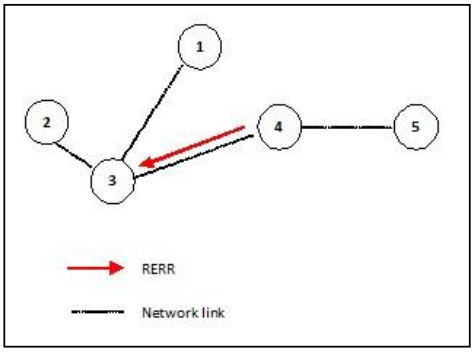

Fig.2 Example of Route Maintenance

From equation (1) when the packet travels through a path it suffers many delay such as nodal processing delay, queuing delay, transmission delay and propagation delay. The nodal delay is the time taken to inspect the packet's header and determine the exact destination. It also includes the time taken to verify the bit-level errors occurred in data packet. Whereas the queuing delay happens when the packet waits to be send over the channel. The transmission delay is the time required to send all bits of packet over the channel and propagation delay happens during the transmission the packet from source node to destination node.

$$D_{nodal} = d_{processing} + d_{queue} + d_{transmission} + d_{propagation} \quad (1)$$

Given the packet length is L bits and data rate from a source node to destination node is R bits/sec the delay can be expressed as L/R. Let 'a' denotes the average rate at which packet arrives in queue i.e., a bits/sec,

BEGIN:
Traffic intensity=La/R (2)
IF(La/R<=1) THEN (3)
Delay = n*(La/R) (4)
ELSE
Delay =infinity (5)
END

Thus, the traffic intensity should be always less than 1. When traffic intensity approaches 1 packet will have no place to stand in queue and the router will drop the packet. This may also occur due to more number of nodes present thus scalability also plays an important role in performance which is present in further discussion.

We consider the problem of energy consumption of AODV protocol compared with DSR where the route discovery mechanism is followed along with the performance, throughput and overhead constraints. This paper is structured as six sections where in section 2 we discuss the related works regarding the proposed methodology. The section 3 consists of proposed work along with algorithm. The section 4 gives a brief idea on the simulation environment ns2 and its parameters followed by results and discussions in section 5. Finally section 6 presents the conclusion.

II. RELATED WORKS

Arushi Sharma, Sarabjeet (2016) [1] proposed a novel methodology for increasing the QOS parameter. The T-AODV assures trust by ensuring quality with respect to delay, throughput, Energy consumption, PDR, Network routing load. The route having highest trust value is chosen for transmission. In this way, the stability of the selected route is promised. Their proposed TAODV protocol shows that it is more effective for data transmission in comparison of other traditional routing protocol in MANET.

Gulhane S.P, Joshi A.A. and Chavan K.L (2012) [2] proposed analysis of AODV routing protocol which depicted that delay of AODV protocol is higher than that of their proposed protocol, AODV_OBD protocol. Also the it reduces the packet delay. They make use of history of hop-distance to enhance the route history.

Mon Zonghua, Meng Xiaojing [3] devised a new modified AODV routing protocol called MAODV which focus on route stability to establish path. They concluded that MAODV outperforms AODV under conditions of increasing node mobility and traffic load. Also packet delivery is improved and reduces normalized route overhead.

Shwetha Singh, Gopal Singh (2017) [4] focused on battery power constraint. They found AODV and DSR are better than DSDV with increased scalability. The network overhead increases as the movement of mobile nodes are increases.

Ahmed Bisengar, Ouadoudi Zytoune, Mohamed Rziza, Mohamed Ouadou, and Driss Aboutajdine (2014) [5] proposed a novel methodology for the measurement of an active link using a metric called Link Duration(LD).They make use of two schemes for prediction namely, Mobility prediction using Linear model and using Linear Autoregressive models. But only the former model is analysed in their paper. They made a conclusion that the model they

proposed i.e., MPAODV could reduce the number of broken links and dropped packets and thus it gives a higher data packet delivery rate than AODV.

Ms Anjali Sharma, Prof. Alpna Singh (2013) [6] proposed methodology establishing the connection using TTL and dynamic threshold value in long route and also measure the varying queue length technique by that if size of buffer is full, no packet is dropped.

P Srinivasan, Dr. P. Kamalakkannan (2013) [7] proposed a new protocol by the enhancement of AODV, Route stability and Energy Aware Ad hoc (RSEA-AODV) .This also increased packet delivery ratio. In this paper among possible routes RSEA selects route with highest reliability and the performance is compared with PERRA and AODV.

Andraws Swidan, Eng. Haytham Bani Abdelghany, Dr. Ramzi Saifan, Dr. Zeljko Zilic.(2016) [8] proposed a new reactive protocol called Tree-based Mobility Aware which aims to provide mobility and direction factors in ad hoc network. It achieves less route loss, delivery ratio is high and energy is compared with AODV. MDA-AODV generate delay and reinitiating of RREQ packets resulting in less route losses. Energy consumed is also reduced resulting in high performance in terms of reliability and delivery ration.

Ben Liang, Zygmunt J. Haas [9] addressed the issue of minimizing the delay by optimizing Time to Live (TTL) interval of route caching. They compute the expected route delay and determine optimal route, thus resulting in a performance gain.

Sanjeev K. Prasad, Karamjit Bhatia [10] proposed methodology for avoiding the link breakage and also determining the stable route. They focused on life time, end–to-end delay, packet delivery ratio, normalized routing load and throughput parameters. Their work concluded that the proposed RSAODV protocol reduce the packet loss rate and enhance the utilization of network resources by increasing the throughput and average life time.

III. PROPOSED WORK

Our proposed work focuses on comparing AODV and DSR with constraints such as packet delivery ratio, throughput and overhead control thus proposed a novel protocol NAODV. The above mentioned constraints are then compared in NAODV protocol with an aim of increasing the throughout by reducing packet loss and less energy consumption.

A. PROPOSED ALGORITHM

INPUT:
(RREQ, Min Energy, Max Energy, Cost, Time-To-Live)
OUTPUT: Min Energy, Max TTL Value
BEGIN:

Step 1: Set RREQ Packet
Set
Min Energy =’initial’,
Max Energy=’transmission’,
TTL, Cost
Threshold Value
Step 2: IF (RREQ Packet=Min Energy && MinTTL Value) THEN
Select RREQ from route table
ELSE
Drop RREQ Packet

Step 3: ELSEIF(TTL Value > Max Energy)THEN
TTL Value=1
ELSE
TTL Value=TTL+1

Step 4: ELSEIF (Threshold Value >Min Energy) THEN
Calculate energy at each packet
ELSE
Drop RREQ Packet
END

IV. SIMULATION ENVIRONMENT

A. NS2 SIMULATOR

Network Simulator (NS2) is a simulator mainly used in teaching and research purposes. It is open source run in Linux. Also provides maintain routing, multicast protocols and IP Protocols such as UDP, TCP etc on both wired and wireless networks. It has a capability of representing network traffic in graphical form.Ns2 stands as a variant of simulator which is used for dynamic behavior of congestion and flow control schemes in packet-switched data networks.

In our simulations, we make use of NS2-2.34 simulator and nodes are placed within 800 X 800 square area. We used 50 to 100 nodes for simulation. Each node is send at a rate of 20 milliseconds with a mobility of 20 m/s. Table 1 represents the simulation parameters used in this evaluation.

Table I Simulation Parameters

Simulator	NS2-2.34
Network Area	800m x 800m
Number of nodes	50 to 100 nodes
Typing Model	VBR,CBR
Mobility	20 m/s
Packet rate	20 packets/sec
Data payload	256 bytes/packet

V. RESULTS AND DISCUSSIONS

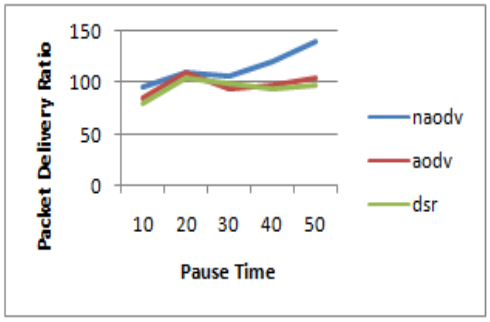

Fig.3(a) Packet Delivery Ratio for 50 Nodes

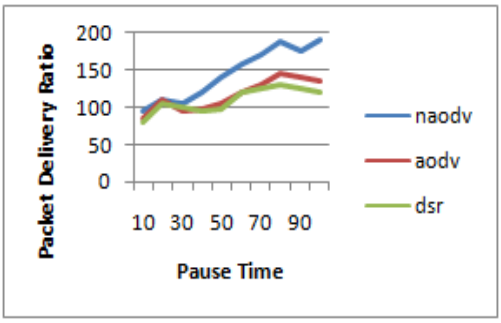

Fig.3(b) Packet Delivery Ratio for 100 Nodes

Figure 3(a) shows the packet delivery ratio of NAODV ,AODV and DSR protocols. It is observed that the packets are transimitted at a rate of 20 packets/sec with a size of 256 bytes/sec. As and when the pause time increases the PDR is higher in NAODV than that of AODV and DSR. In AODV and DSR the packet loss rate is comparatively high. But in NAODV , it chooses the route which has less cost and consumes less energy which increases the packet delivery ratio.

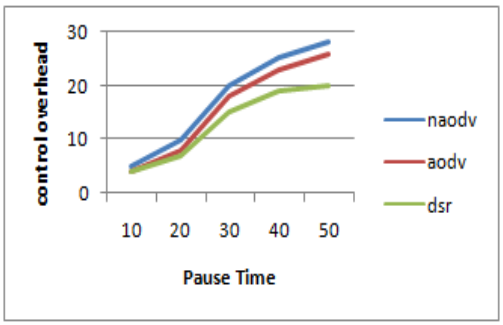

Fig.4(a) Control overhead for 50 nodes

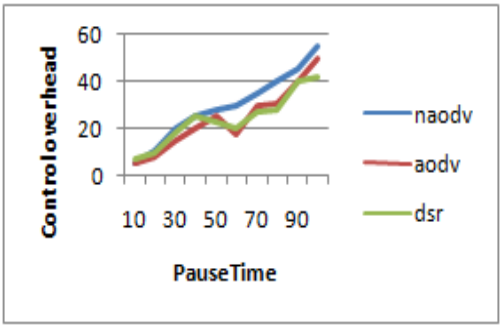

Fig.4(b) Control overhead for 100 nodes

Figure 4 (a) depicts that NAODV protocol has higher control overhead than that of AODV and DSR. This signifies that as the energy consumption is comparatively less in NAODV which reduces the link breakage within the nodes and results in less packet loss. As the number of nodes are increased there is relatively some changes occurring in AODV and DSR but NAODV still proves to be having high control overhead represented in figure 4(b).

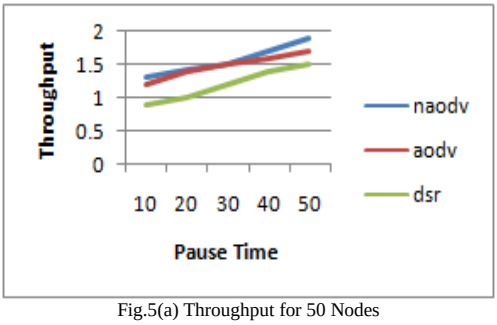

Fig.5(a) Throughput for 50 Nodes

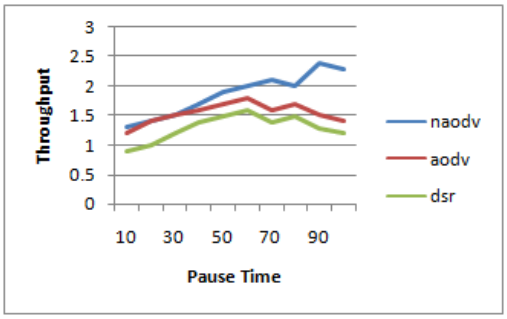

Fig.5(b) Throughput for 100 nodes

Figure 5 shows comparison of NAODV, AODV and DSR protocols on the basis of throughput measured in m/s. The figure 5 (a) represents the throughput with respect to pause time. The traffic pattern is 20 packets/sec with a size of 256 bytes/packet. The NAODV achieves higher throughput as compared to AODV and DSR in all simulation trials. It is again compared with higher number of nodes from 50 to 100

which proves NAODV has higher scalability than that of AODV and DSR.

VI. CONCLUSION

Now a day, routing protocols plays an important role in networks. This work considers packet delivery ratio, control overhead and throughput. Our proposed protocol NAODV will minimize the packet loss and increase the throughput depending on the consumption of energy level. NAODV also performs well with more number of nodes resulting in high scalability. Finally proposed work is executed using simulator for improving network Quality Of Services, performance.

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