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An Energy Saving Multipath AODV Routing Protocol In MANET

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ABSTRACT— MANET is a infrastructure less communication network system. Power saving is the greater issue in Mobile Ad-hoc Networks because nodes are power constrained due to limited battery power supply. Pointing at energy constrained of Mobile Ad-Hoc Networks, this paper proposes an Energy Saving Multipath AODV routing protocol, which based on node residual energy and Threshold value based scheme for selecting only two paths that have maximum energy value . Choose one path from two of them that have maximum energy for communication and second path is reserve for future use as alternate route. So, when main route is no longer in use due to link failure, energy exhaustion second route is used for data transmission which conserve energy consumed in reroute initiation process. Simulation results shows that it shows better performance in terms of Packet Delivery Ratio and End-to-End delay in comparison to AODV routing protocol. The proposed work is verified using MATLAB simulator.

Keywords: MANET, AODV, Node Energy.

I. Introduction

Mobile Ad-hoc Network is a arrangement of mobile nodes connected with each other via wireless medium independent on any fixed infrastructure. In MANET routes between source and destination may potentially contain multiple hops. Mobile nodes can communicate with each other & can freely move anywhere. This non-restricted mobility characteristics of MANETs network make them very prominent in military operations, emergency rescue, conferences. In mobile Ad-hoc network nodes contain limited battery power and for maximization of network lifetime it is essential to use it efficiently.

AODV is an on-demand routing protocol including the mechanism of DSR route discovery and route maintenance, DSDV hop by hop routing and sequence number .AODV uses the routing hops, end to end delay as the routing metric, continue data transmission after routing establishment until the link occurs, it will cause some nodes to be used excessively and the energy to be consumed fast, bring the network to be segmented and the network lifetime to be shorten.

. Each node maintains its own sequence number, as well as a broadcast ID for the RREQ. The broadcast ID is incremented for every route-request initiated by nodes, and jointly with the node's IP address that uniquely identifies a route-request(RREQ).

Related Work

In MANET most of the power efficient routing protocols try to reduce power consumption by means of a power efficient routing metric. Some related previous works are mentioned in this section.

C.K. Nagpal [5] introduced the impact of transmission range in energy consumption which mainly deals with the problem of maximizing the network lifespan of a MANET, i.e. the time duration in which the network is fully working. Presented an original solution called EPAR which is basically an improvement on DSR. This study has evaluated three power-aware ad-hoc routing protocols in different network environment taking into consideration network lifetime and packet delivery ratio. Overall, the findings show that the energy consumption and throughput in small size networks did not reveal any significant differences. The EPAR algorithm outperforms the original DSR algorithm by 65%.

Bhagyashri [1] introduced proposed method which considers the node location.

In this to enhance the system life it uses multiple routes for communication, so that the life of node don't drain out easily.

Javed [3] this paper gives a better point on which method is used in different categories i.e. energy saving by variable communication power, by using power aware routing protocols, by using different power management techniques. It makes the communication more effective in terms of packet delivery ratio, end-to-end delay and throughput.

Author [5] proposed a power aware routing protocol for Mobile Ad-hoc Networks using swarm intelligence to increase the network transmission efficiency in terms of PDR, Throughput and this results minimize the power consumption.

In [6] author uses a minimum hop strategy for minimization of energy consumption in MANET, it selects the path for communication which have minimum hops for source node to destination node.

Minimum hop strategy reduces the link failure chances that automatically increases the stability of route.

Suggested Modified AODV

An Energy Saving Multi-path AODV routing protocol considered the node energy and total path energy as the routing metric. By setting the node energy threshold, the two high energy paths that consist higher energy value nodes are selected for data transmission.

AODV protocol recorded only neighbour nodes ID during routing discovery for obtaining node energy. In Energy Saving Multi-path AODV protocol modify neighbour table structure to consider the next hop node remaining energy during the routing discovery, records the neighbour nodes ID and nodes residual energy.

In Energy Saving Multi-path AODV protocol improves the routing response mechanism, and makes changes to the routing request packet RREQ and routing response packet RREP, adds the fields of Rmn_ E and Tot_ E , Rmn_ E field records the node's remaining energy of a path, the Tot_ E field stores all nodes sum energy of a path. An Energy Saving Multi-path AODV protocol adds a RREQ buffer queue in the target node, and sets a timer. Within the specified time, nodes receive the RREQ from all broadcast ID and the same source node, calculate total energy of all paths and sort two paths and destination node will send the RREP, the source node will choose the higher energy value route for data transmission.

II. PROPOSED ALGORITHM

In traditional Ad-Hoc On Demand Distance Vector(AODV) routing protocol node survival time is decreases due to route discovery and route maintenance process because it does not consider node energy which later leads to the link failure and incomplete data transmission.

Proposed algorithm an Energy Saving Multipath AODV consider two features-

(1) Consider the node energy as the routing metric i.e. higher energy nodes are participating in route discover, to avoid the low energy nodes participate in forwarding data packets by threshold value based scenario , so as to increase the node life, minimizes the delay.

(2) Rather than selecting single or multiple paths we select only two paths that have maximum energy value . When link broke occurred, using second path for data transmission reduce the network burden that was caused by routing rediscovery. Choosing the highest energy value path as the main route and the second path set as alternate route.

Proposed Algorithm an Energy Saving Multipath AODV routing protocol consider the total path energy routing metric. By considering the node energy threshold value select the best two paths for data transmission that maximizes the network lifetime And minimizes the power consumption**.** Energy Saving 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.

3. First choose the threshold value to filter out the best path where node have sufficient energy to transmit/receive packets i.e. discover path according to threshold value based scenario .

If node-energy>= threshold value

(i) Then, **Calculate energy consumed for packet transmission.** An energy consumed for packet to send/receive by a node is calculated as-

$$E_y = \sum_{X=1}^{K=1} T(n_x , n_{x+1})$$

Where,

$T(n_x , n_{x+1})$ = denotes the energy consumed in transmit/receive packets .

It is necessary to know the amount of power consumed by packets when it propagates from each and every node on the path.

(ii) Calculate Node Remaining Energy –

$$E_{remain} = E - E_{cnsm}(t)$$

E= Total Energy of Node

E_{cnsm}= consumed energy

(iii) Next calculate the Total Energy value for the every available path RREQ arrived during set timer value at destination node and choose the Two Paths which have maximum Total Energy Value. Maximum Energy bearing path selected as main route for transmission .

Total energy of path is calculated as follows-

$$\mathbf{E_{xy} = \sum_{x=1}^{Y=1} E_x}$$

where,

$\mathbf{E_{xy}}$ **=** Total Energy of a path

$\mathbf{E_x}$**=** Residual Energy of an intermediate node X

4. Else node-energy is less than threshold value then no updation is performed and during route discovery process node is not participated.

III. SIMULATION TOOL USED & RESULT

In this section the simulation results are evaluated within the AODV protocol and proposed Energy Saving Multipath AODV routing protocol using MATLAB to evaluate the protocol. Total of 100 nodes were simulated in an area of 200m x 200m. Transmission range for each node is 40m and channel capacity will be 2mbps. The initial energy of node is set randomly in network in joules.

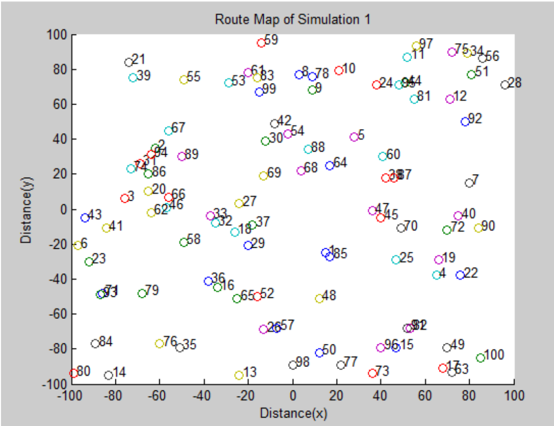

Figure 3.1 Simulation Environment

Energy Aware multipath routing mechanism are compared with following metrics:

1. Packet Delivery Ratio:

The Packet Delivery Ratio is the ratio of packets successfully received to the total sent. Higher packet delivery Ratio gives Higher throughput and vice versa.

2. Throughput:

Throughput is the rate of successful message delivery over a communication channel.

3. End-to-End Delay: End-to-End delay refers to the time taken for a packet to be transmitted across a network from source to destination.

SIMULATION RESULT

Simulation result of figure 3.2 shows the better performance of an Energy Saving Multipath AODV protocol as compare to AODV. An Energy Saving Multipath AODV protocol provides considerable improvement of packet delivery ratio when its performance compared with AODV routing protocol

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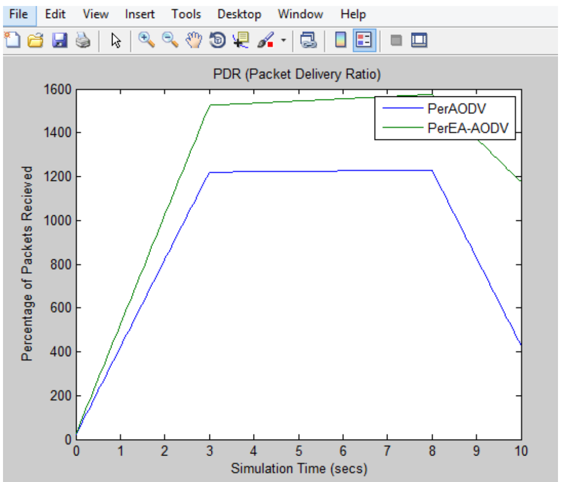

Figure 3.2 Packet delivery ratio

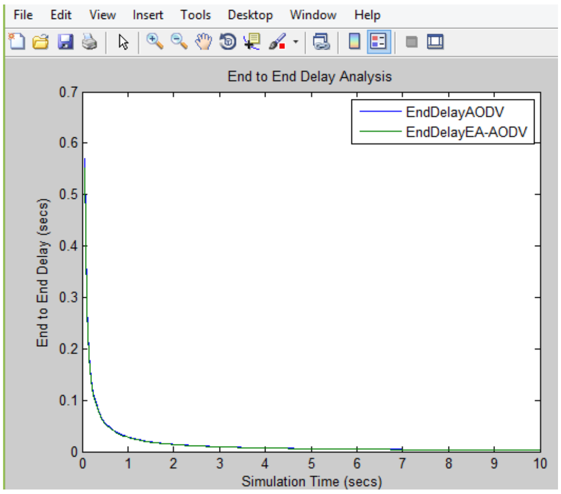

Figure 3.3 End-to-End delay

Figure 3.3 graph shows that Energy Saving Multipath AODV slight improved in the end-to-end delay in comparison to basic AODV.

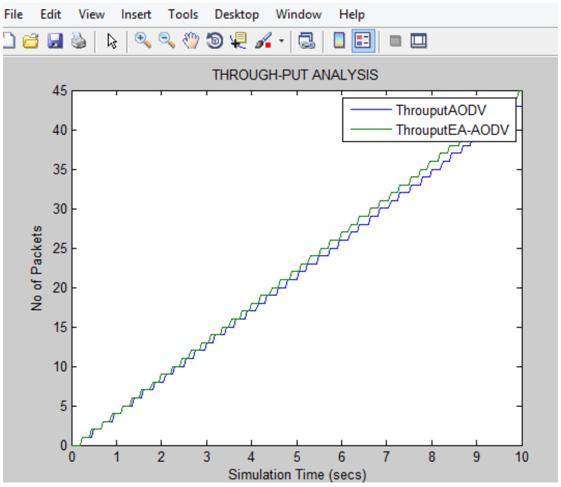

Figure 3.4 Throughput

In figure 3.4 it shows that an Energy Saving Multipath AODV protocol shows considerable improvement of throughput.

IV. CONCLUSION

Dynamic network topology caused by the mobility of nodes and limited battery power is the important feature of Mobile Ad-hoc network so power consumption is the main problem of Ad-hoc Network. An Energy Saving Multipath AODV protocol proposed in this paper is a threshold value based multipath routing protocol that uses node energy and total energy of path as main criteria to choose only two paths for communication which have maximum energy. An Energy Saving Multipath AODV protocol selects the first path as main route for transmission that have maximum total energy value from two of them. And the second route is reserve as alternate route for transmission in case when first route is break or show some error. So besides initiating reroute discovery reserve second alternate route is used for communication. This saves the battery power consumed in reroute discovery process and increase the network lifetime. The simulation results show that the performance matrices in case of proposed Energy Saving Multipath AODV routing protocol is better as compared to AODV. An

Energy Saving Multipath AODV protocol balances the power consumption of network nodes, lengthens the network lifetime and improves the average end-to-end delay, packet delivery ratio & network throughput.

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