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Improving Performance of AODV with Energy Efficient Routing in MANET

Priyanka Warwadekar
Department of Electronics and Communication Engineering
Usha Mittal Institute of Technology
Mumbai, India
e-mail: priyanka.warwadekar@gmail.com

Prof. Kavita Mhatre
Department of Electronics and Communication Engineering
Usha Mittal Institute of Technology
Mumbai, India
e-mail: kavitamhatre1@gmail.com

***Abstract*—**One of the most widely used Multi hop network is Mobile Ad hoc Network (MANET) with energy constraints, limited battery power and nodes that exhibit routing functionality. The Architectural concern is mobile ad hoc network is to build appropriate and efficient routes. In MANET, it is required to save the battery power of node as there is repeated variation in position of node which lowers battery charge of the node. Energy efficiency is an important aspect in saving energy consumption of the network. In this paper we proposed energy efficient routing protocol which reduces energy consumption and thus improves network lifetime of network. Simulation is performed using network simulator NS2 and results shows that our proposed protocol reduces delay and increases throughput, packet delivery ratio by consuming less energy compared to existing AODV routing protocol.

Keywords- *MANET, Routing Protocol, AODV, Energy Efficient Routing*

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I. INTRODUCTION

A Mobile Ad hoc network is a collection of wireless mobile nodes where nodes come together by forwarding packets and also exchange information over direct wireless range. MANET has become cost effective communication in recent years as a result of high-tech enhancement in wireless networking, effortless installation with low cost and variety of application. MANET are fully distributed, portable wireless network, self-organizing and immensely applicable for applications which associate outside events, communications in places where no wireless infrastructure is available, army service, wireless sensor network, device network. In recent communication media, MANETs can be efficiently established and have limited battery power so routing protocols cannot freely handle the purpose of MANET's applications during communication once battery power of nodes gets drained. Therefore need to save MANETS lifetime by perfectly handling the battery power of nodes. TO overcome this problem we propose Energy Efficient Routing Protocol which can minimize energy consumption and enhance lifetime of the network.

II. RELATED WORK

Various energy efficient routing approaches have been proposed in literature to handle the battery power of nodes efficiently.

The Authors [1] proposed energy efficient AODV routing protocol in which Dijkshra algorithm is enhanced to improve the overall performance of the network. This protocol finds the optimal path between source and destination and reduces the energy consumption of the nodes in the network with better performance.

The Authors [2] Presents an efficient energy management protocol E-power. It is proposed to reduce power consumption and reduce transmission latency on useless tasks. High node density significantly improves network performance with all three protocols. The reason for better performance is because when a link breaks, it becomes easier and faster to find a new link. E-power performance is better. It is also seen that the higher the node density, the better is the performance of the E-power algorithm.

The Authors [3] proposed energy efficient routing algorithm to reduce energy consumption in order to maximize the lifetime of the network. The combination of residual energy and transmission power of nodes for choosing energy efficient path.

The Authors [4] proposed a multipath routing protocol for mobile ad hoc networks called MMRE-AOMDV, which extends the Ad Hoc On-demand Multipath Distance Vector (AOMDV) routing protocol. The key idea of the protocol is to find the minimal nodal residual energy of each route in the process of selecting path and sort multi-route by descending nodal residual energy. Once a new route with greater nodal residual energy is emerging, it is reselected to forward rest data packets. It can balance individual node's battery power utilization and hence prolong the entire network's lifetime.

The Authors [5] proposed a new energy efficient scheme called optimized energy aware routing (OEAR). The proposed algorithm not only considers energy of the node while selecting the route but also takes into account the number of packets buffered in the node. The OEAR finds the most stable path out of the entire existing paths from source to destination using on-demand routing.

The Authors [6] approaches modified route request broadcast which is based on node caching. Node caching is that we cache nodes which are recently involved in data packet forwarding route request. Suggested node caching techniques can be viewed as a dynamic implementation of a connected dominating set (CDS).They overcome the drawback of CDS overuse of dominating nodes by anew load balancing scheme in which they measure the protocol fairness using as parameter distribution among nodes of the forwarding load. Work load balance technique is based on the idea by dropping RREQ packets according to load status of each node and load status is set by the value of threshold.

The Authors [7] proposed a novel MANETs routing protocol by using link lifetime based multipath mechanism to improve route stability, which is called link life time based backup routing protocol (LBR) it obtain the shortest path between source and destination through limited flooding as primary path and then sets up a local backup path for each link in the primary path concerning link lifetime. This scheme avoid

backup path being out of date prematurely and increase the availability of backup paths.

The Authors [8] presented the performance improvement techniques of routing protocols for gateway interconnection and route reversal by considering energy consumption of the nodes. In these work, the energy efficient routing protocols have been designed to improve the performance in terms of energy consumption, routing overhead, end-to-end delay, and packet delivery ratio of the networks.

The Authors [9] proposed an energy conserving mechanism to reduce the energy expenditure due to overhearing in MANETs by using a probability based overhearing node selection technique integrated with AODV protocol to minimize energy consumption of the networks.

III. PROPOSED WORK

In MANET as node are mobile and they rely on batteries and if battery of node let down it also cause link breakage or link instability. This leads to the problem of delay in transmission resulting in more packet loss and lesser overall throughput. From the perspective of energy, the shortest path is not always the optimal path. Due to cost optimality, if the same paths are being utilized repeatedly, the nodes energy along these routes will be consumed quickly and they may exhaust their batteries faster. As a consequence, the device gets switched off and goes out of network leading to disconnected sub-networks. Therefore, energy usage should also be considered as the major metric in selecting the optimal path. [10] Data packets may be delivered to too many nodes that do not need to receive them so wastage of more energy. Rapidly Broadcasting Hello Messages when network is stable it consumes more energy. Energy efficient communication is critical for increasing the life of power limited wireless ad hoc networks.

In our proposed work we modify the existing AODV route discovery mechanism in such a way that it will show greater performance than existing AODV protocol. Existing systems are not capable of ending the shortest and energy based path among the nodes in the network if multiple nodes fail simultaneously but Proposed system checks the energy of each path available in the network .It will not only reduce the end to end delay but also gives the link more network life. The proposed AODV protocol aims to achieve better throughput, packet delivery ratio and reduced drop packets and increases network lifetime of the network.

IV. RESULTS AND ANALYSIS

We are using Network Simulator for simulation of our proposed system. We considered four important performance metrics viz. packet delivery ratio, average end-to-end delay, Energy consumption, Throughput to evaluate the performance of the routing protocols. We have observed total number of packets received at the destination, total energy consumption of MANET for all received packets, end-to-end delay of routing protocols for sending all packets from source to destination, and total number of control packets delivered for each simulation. We have compared the performance of the protocols varying nodes mobility, and the number of nodes. NS-2 is an open-source simulation tool. It is a simulator which focuses on networking research and over a substantial support for simulation of different types of protocols over wired, wireless and satellite networks. It has many advantages because of which it is a useful tool, such as support for multiple protocols and is capable of graphically describing the network traffic. Moreover, NS-2 supports several algorithms in routing and queuing.

Parameter	Value
Channel	Channel/Wireless Channel
Propagation	Propagation/ Two way Ground
Antenna	Antenna/ Omni Antenna
Simulation area	480m * 480m
Mac Type	802.11
Application Traffic	CBR
Routing Protocol	AODV
Data Payload	512 Bytes/Packet
No of Nodes	16
Transmit Power	1 Watts
Receive Power	0.5 Watts

A. Packet Delivery Ratio: The packet delivery ratio is the ratio of the number of packets received by the destination to the number of packets generated by the source node. The Proposed system performs the best in terms of packet delivery ratio followed by AODV.This is because the established route by proposed protocol are stayed alive longer time compared to that of other protocols and stable in nature. Hence, the number of packets dropped are lesser due to lack of energy at intermediate node of the route between source and destination. In contrary to AODV where packets may get dropped due to link failures which may occur for insufficient energy of nodes in an established route [11]

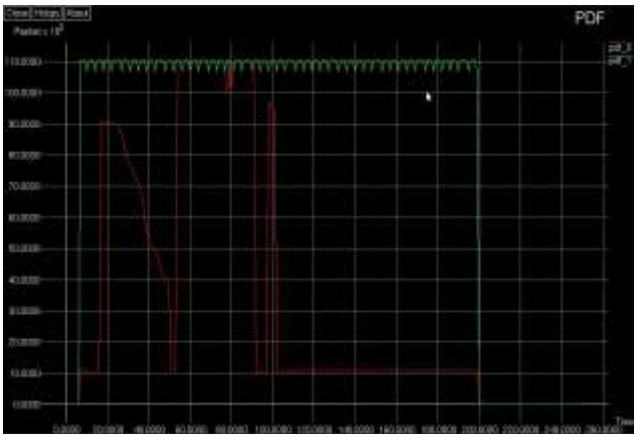

Fig 1: Packet delivery ratio

B.Average End-to-End Delay: The average end-to-end delay is the average difference of time between sending of the data packets and its receipt at the destination. This includes all possible delays caused by route discovery latency, propagation and retransmission delay in the routing layer and physical layer. The average end-to-end delay of our proposed protocol and the existing routing protocols AODV scenarios are shown in Fig. 2.It can be seen that the average end-to-end delay of proposed protocol are lesser than that of AODV. However, AODV takes more time. This happens because, during the data sending period, there is less chance for any link to break in the constructed route by proposed routing protocol. But in case of AODV there is a higher possibility of a link break to occur in

the constructed route due to power failure of nodes as there is no consideration of the nodes energy-factor [11]

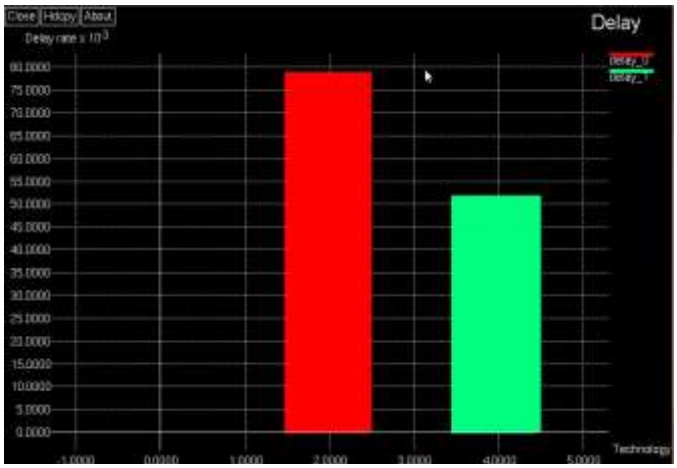

Fig 2: Average End-to-End Delay

C. Throughput: It is the average number of messages successfully delivered per unit time or it is the average number of bits delivered per second. This data may be sended over a physical or logical link, or pass through a confident network node. This is the measure of how rapidly an end user is able to receive data. It is determined as the ratio of the total data received to required promulgation time. A higher throughput will directly impact the users observation of the quality of service.

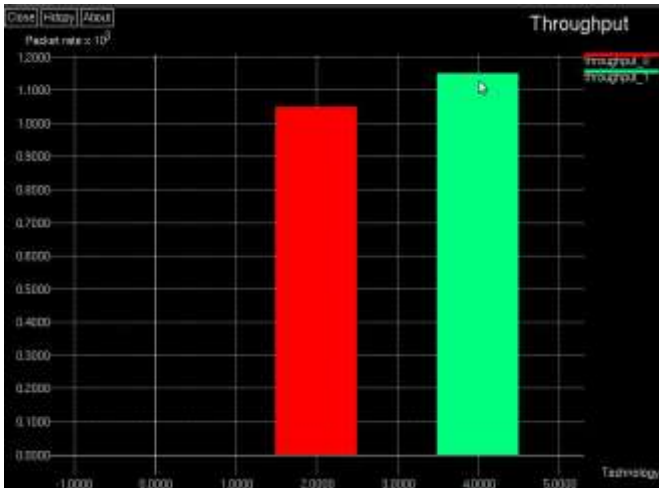

Fig 3: Throughput

D.Energy Consumption: The energy consumption is the consumed energy by the network for all packets received by the destination. It is measured as the total consumed energy divided by the total number of packets received. The energy efficiency of each protocol can be measured by this metric. Fig.4, presents average energy consumption with respect to different node density and mobility respectively. It is clear that our proposed protocol consumes lesser energy compared to that of AODV. We find that proposed system is more energy efficient. Our proposed protocol provides an uniform energy consumption environment in MANET and thus it increases MANETs lifetime.

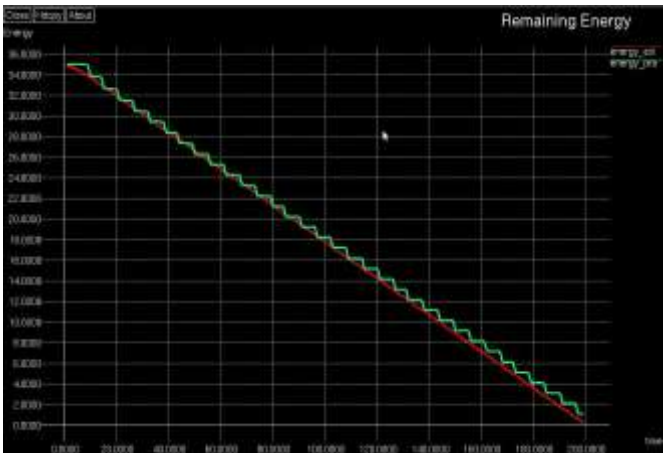

Fig 4: Average Energy Consumption

V. CONCLUSION

In this paper we provided an overview of mobile ad-hoc networks and discuss how energy is the most important constraints in the MANET. All the nodes are mobile in nature and having limited battery charge therefore it is necessary to save the battery power of those nodes to increase the lifetime of the network. So we have implemented energy efficient AODV routing protocol which finds the optimal path between source and destination and reduces the energy consumption of the nodes in the network with better performance. Simulation results shows that the established route using our proposed protocol increases packet delivery ratio, throughput and reduces average end-to-end delay by consuming lesser energy of MANET compared to the AODV protocol.

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