Modified Energy Aware Multipath Routing Protocol To Reduce Packet Loss In MANET

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Abstract- *Wireless Networks are getting popular due to their ease of use. Mobile Ad Hoc Networks (MANET) has become an exciting and important technology in recent years because of rapid increasing mobile devices. Mobile Ad Hoc Networks are distributed systems consisting of mobile hosts that are connected by multi-hop wireless links. Such systems are self-organized and facilitate communication in the network without any centralized infrastructure. Mobile devices in MANET are battery operated so, battery power (Energy) is important parameter in MANET. Energy Efficient Routing in MANET has evolved as an imperative research domain that enhances system performance such as PDR, Throughput, Delay etc. and it increases system capacity in the presence of mobility and large number of mobile terminals. Selection of optimal route for packet delivery is very much important because it effect on system performance. Our proposed algorithm is multipath routing protocol which selects multiple paths between source-destination pair based on Fitness Function(FF). The Fitness Function is computed considering residual energy of node, distance, present traffic load at node. Fitness Function helps to select energy efficient path for packet routing. We evaluate the performance of proposed algorithm by comparing it with an existing AOMDV. Simulation results suggest that the proposed protocol has lower energy consumption and higher packet delivery ratio.*

Keywords- AOMDV, MANET, Multipath routing, Energy Efficiency, Residual energy, Fitness Function.

I. INTRODUCTION

Wireless technologies have become popular as they have ubiquitous features, satisfying the demand of the network communication anywhere, at any time. Since portable devices like laptop computers, personal digital assistance (PDA) and mobile phones require fix infrastructure such as base station or access point. Therefore, they need an access to a static network to support their mobile device services. To provide a solution to this problem Mobile Ad Hoc Network (MANETs) have evolved.

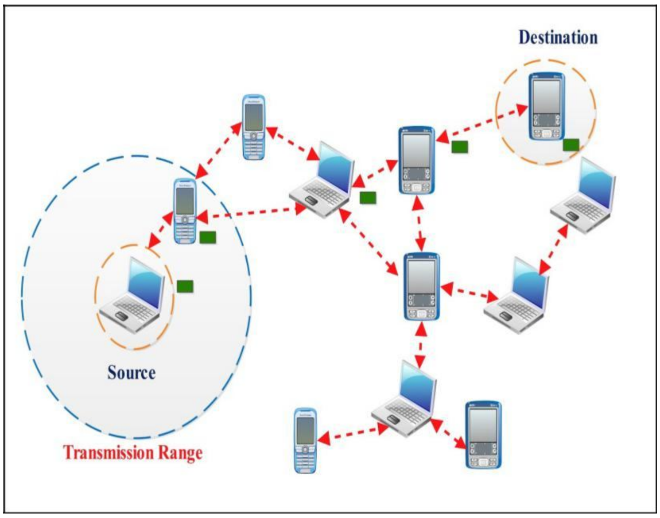

Fig. 1 Mobile Ad-hoc Networks [20]

MANETs are autonomous systems consisting of mobile hosts which are connected by multi-hop wireless links. A mobile ad hoc network (MANET) is created by mobile hosts. There is no stationary infrastructure; for instance, there are no base stations. In MANET, some mobile hosts are willing to forward packets to neighbors. These types of networks have no fixed routers; every node can behave as a router, forwarding data packets for other nodes. All nodes are able of moving and can be connected dynamically in an arbitrary manner. The individual terminals are allowed to move freely in the network. In this type of networks, some pairs of terminals may not be able to communicate directly with each other and have to rely on some other terminals so that the messages are delivered to their destinations. Such networks are often referred to as *multi-hop* networks. In mobile ad hoc network (MANET), nodes are connected together by wireless links without any fixed infrastructure. The growth of laptops and 802.11/Wi-Fi wireless networking has made MANET a popular topic for research in recent time.
Routing is the process of selecting paths in a network along which to send data packets. Efficient Routing with AOMDV protocol is an important research topic for Mobile Ad Hoc networks (MANETs). As lot of research work is already done by considering AODV routing protocol, here, AOMDV

protocol is variant of AODV protocol & it maintains multiple path from source to destination node. The suggested routing protocol adapts the continuous mobility by reflecting the position and energy of nodes, improves stability of the route, and extends the node life by making the balanced energy consumption considering residual energy of nodes.

II. BACKGROUND

Ad-hoc On-demand Multipath Distance Vector Routing (AOMDV) protocol is an extension to the AODV protocol for computing multiple loop-free and link disjoint paths [8]. 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.

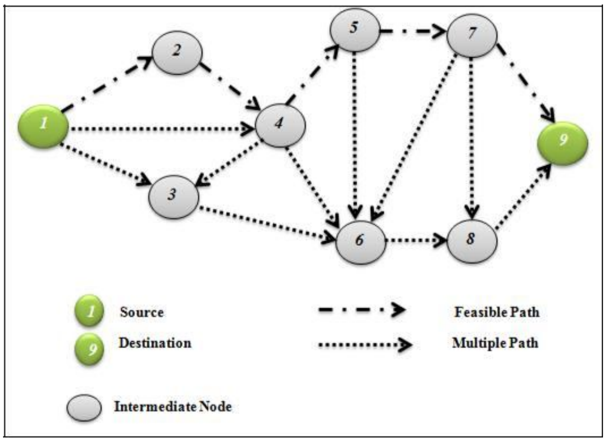

Fig. 2 AOMDV Scenarios [8]

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 [8]. 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.

The AOMDV provides multiple paths for sending data from source to destination. If the link breakage occurs during the transmission or node is out of range, it selects the next path for sending data from the routing entry. This process continues till the packets to reach their destination. In case if no neighbors are found, the process stops in the middle and it does not send the packets to the destination.

III. LITERATURE SURVEY

Traffic loading balance is an issue which would affect the energy. A routing protocol that does not take into account of traffic load balance will result in usage of paths that are already heavy in traffic load. It will add more burdens on the energy consumption to these paths and indirectly lead to imbalanced energy consumption of the whole network. The nodes in a high traffic load path will 'die' off faster than nodes in paths that have lower traffic load. Thus load awareness routing provides not only a lower end-to-end delay, but also indirectly leads to more efficient energy distribution routing [1].

Several changes are necessary in the basic AODV route discovery mechanism to enable computation of multiple link disjoint routes between source destination pairs. Note that any intermediate node I on the route between a source S and a destination D can also form such multiple routes to D, thus making available a large number of routes between S and D. Recall that in the route discovery procedure a reverse path is set up backwards to the source via the same path the route request (RREQ) has traversed. If duplicates of the RREQ coming via different paths are ignored as before, only one reverse path can be formed. To form multiple routes, all duplicates of the RREQ arriving at a node are examined (but not propagated), as each duplicate defines an alternate route [2].

I. Improved Energy Aware Routing Protocol suggests an improved routing protocol considering position and energy in the mobile ad hoc networks environment. The suggested routing algorithm reflects positional information and the amount of energy to the process of creating routes, so that not only it finds the optimum route that could be adapted continuous mobility, but also reduces the energy deviation among nodes and prevents the energy depletion condition of a specific node by making all nodes relatively evenly spend their energy [3].
II. MC-AOMDV using Multi-Criteria Multipath Routing enlightens the critical issue of lowering the routing overhead while preserving the energy consumption in mobile ad hoc networks and presents routing scheme where ratio of residual energy of the nodes and distance is taken into account while making multiple paths between source and destination and further presents a comparison of performance of Enhanced AOMDV and proposed approach [4].
III. The location based multipath (AOMDV) can reduce the control overhead and increase the route lifetime

than AOMDV. Only the forwarding neighboring nodes are involved in routing while the non-forwarding nodes are switched to idle state. This ensures reduction in energy consumption in the network. The results of DREAM location based protocol are very effective as compare to normal AOMDV routing and energy based AOMDV routing [5].

IV. Energy-efficient stable multipath routing estimates the residual energy and stability of the links in the network. While estimating the residual energy, it also considers the receiving energy and transmitting energy of the node. Stability of the link LET is estimated; this LET is obtained by using motion parameters such as velocity and direction of the nodes. Based on these parameters, the network selects the path to transmit the data packets between the nodes. The advantage of this approach is that best path can be chosen during the routing based on all these factors. In addition, the battery level of the nodes can be taken care in the network. This results in network's good throughput and high efficiency [6].

V. Modified AOMDV Routing Protocol uses algorithm for taking a decision for best path with no link breakage. By using algorithm approach, after broadcast modified RREQ and RREP message in entire network. Transmitting of data packets has multiple bunches or in serially manner there is a chance of congestion in the network. To follow condition is there is no congestion forward the packets at multiple destination and end the simulation, if there is congestion is occurred during transmission then we should have checked a buffer length of the nodes. On the other hand, buffer length is exceeded from its precise size then we can make a new route decision of existing packet and the whole method act similarly at the end of the successful packets transmission [7].

IV. PROPOSED SYSTEM

The proposed protocol is discussed in this section. The protocol selects paths based upon a fitness function. The fitness function is a function of (i) residual battery power, (ii) distance and (iii) present traffic load. Some of the approaches consider residual battery power as the only path metric to achieve energy efficiency. However, it may not give any guarantee to enhance network lifetime. A node in a path when forward large amounts of traffic its battery will depletes faster and node dies. This will affect the network operation and lifetime. Therefore, we have included the traffic load at node along with residual battery power to compute the fitness function. The fitness function helps to select energy efficient path.

A. Proposed Algorithm

Step 1. Deploy N nodes in network.
Step 2. Selection of Source and Destination node.
Step 3. Calculate Fitness Function considering following parameters:

3.1 Residual Energy at each node,

$\mathbf{E_{Residual}=E_{Total} - E_c}$ [19]

$E_c = E_{tn} + E_{rn}$ [18]

where, E_c= Energy consumed by node
E_{tn}= Transmission energy of node
E_{rn}= Reception energy of node

$E_{tn} = \frac{Ptn * 8 * Packetsize}{Bandwidth}$ [18]

$E_{rn} = \frac{Prn * 8 * Packetsize}{Bandwidth}$ [18]

where, P_{tn}= Transmission power required by node
P_{rn}= Reception power required by node

3.2 Distance of node from its neighboring node,

$D=\sqrt{((x_2 - x_1)^2 + (y_2 - y_1)^2)}$ [19]

where (x, y) represents node position.

3.3 Present traffic load at node,

Present traffic load $= \frac{\text{current packet number in buffer queue}}{\text{maximum load level in buffer queue}}$ [18]
Therefore,

Fitness Function $= \text{Residual energy} + \frac{1}{\text{Distance}} + \frac{1}{\text{Traffic load}}$

Step 4. Fitness Function helps to select energy efficient path with nodes having higher residual energy, shorter distance, low present traffic load at node for packet routing between source-destination pair.
Step 5. Stop

V. RESULT ANALYSIS

The implementation of the proposed routing protocol i.e. Modified Energy Aware Routing Protocol is performed successfully and this section provides the detailed discussion about the results obtained during the different experimentation. The obtained results given here are provided by the evaluation of the simulation trace files under different simulation environment.

A. Throughput

Throughput is the rate at which the messages are delivered successfully over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node. It is measured in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per time slot. Fig. 3 shows the simulation results of the PDR of Proposed AOMDV and existing AOMDV at 60 number of nodes. The throughput for Proposed AOMDV is higher compared to existing AOMDV.

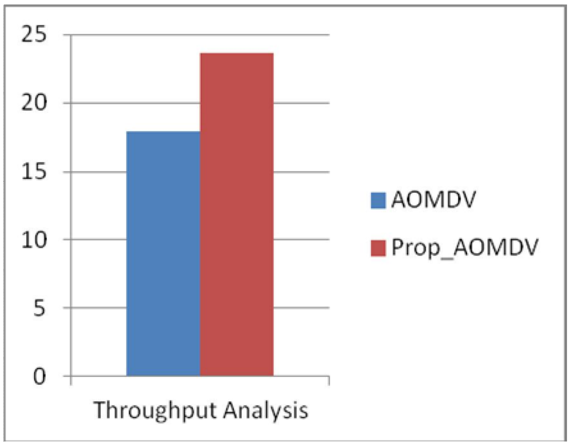

Fig. 3 Throughput at 60 numbers of node

B. Packet Delivery Ratio (PDR)

It is the ratio of total number of packets successfully delivered to the destination nodes to the total number of packets send by the source nodes. It basically describes the percentage of packets that reach at the destination successfully. Fig. 4 shows the simulation results of the PDR of Proposed AOMDV and existing AOMDV at 60 number of nodes. The packet delivery ratio for Proposed AOMDV is higher compared to existing AOMDV.

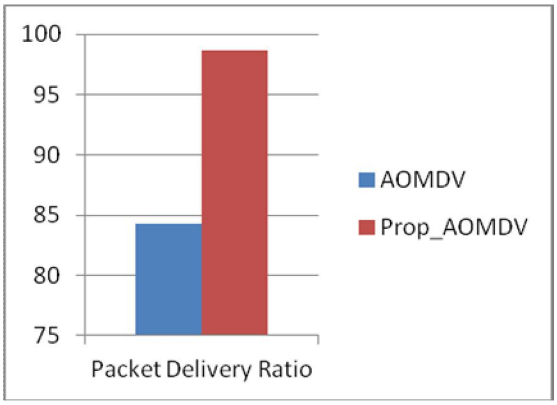

Fig. 4 PDR for 60 numbers of node

C. Residual Energy

This metric measures the amount of residual energy or battery life for each node at the end of simulation time. Fig. 4 shows the simulation results of available residual energy of Proposed AOMDV and existing AOMDV at 60 number of nodes. The simulation results clearly show that, Proposed AOMDV is the winner as it has higher amount energy.

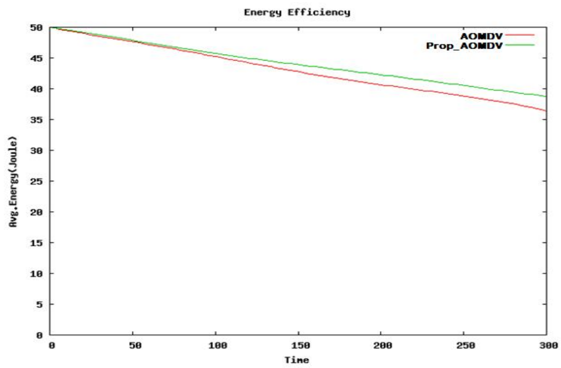

Fig. 4 Residual energy at 60 numbers of node

VI. CONCLUSION

In this paper, a new approach i.e. Modified Energy Aware Multipath Routing Protocol is proposed. This proposed protocol uses Fitness Function (FF) which considers residual energy of node, distance of node, present traffic load at node. Simulation was done using network simulator 2.34 and results are compared with an existing AOMDV protocol and it is found that our proposed algorithm performs better in terms of higher packet delivery ratio, higher throughput and higher energy efficiency.

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