Energy Based Adhoc On-Demand Single And Multipath Routing For Energy And Overhead Optimisation

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***Abstract*—In a typical adhoc network, mobile nodes come together for a period of time to exchange information. While exchanging information, the nodes may continue to move, and so the network must be prepared to adapt continuously. Sensor nodes are battery-powered devices, which have limited battery power and energy efficiency becomes an important parameter. After the deployment of sensor nodes in the network, it is not possible to replace each and every battery. So the most common method to achieve energy efficiency is, node transmits the data packets to its nearest neighbour which is at minimum power level, but this scheme minimizes only the transmission power within the node's neighborhood and energy efficiency at the link level is only possible. With this method it is not possible to minimize the overall consumed energy and overhead of the network. So an analysis has been made and that results has been proved that instead of using low transmission power, only selected nodes are to be allowed to receive and process this routing request based on battery power of the node and that selected nodes are previously assigned by the sender node itself, by doing this the overall consumed energy and overhead of the network can be minimized. In this paper, both single and multipath is performed, and their performance is analysed based on energy consumption and overhead.**

***Index Terms*—MANET, Multi-Hop Adhoc Network, Transmission Power, Energy Efficiency, AODV, AOMDV**.

I. INTRODUCTION

Energy efficiency is considered to be a major issue in wireless sensor network. The energy is wasted due to idle listening, collision, overhearing and control overheads. Routing techniques are useful for conservation of energy, by transmitting only the required information through a shortest path from the source to the destination. So to overcome this problem, certain nodes are allowed to processing the routing messages, by using this method consumed energy and communication overhead is reduced [1]. The performance of an ad-hoc network is dependent on the routing scheme employed. Unlike the cellular wireless networks, several mobile nodes need to be present in order to organize themselves into an ad hoc wireless network. In this research, a novel approach to maximize the battery life called Conditional Max-Min Battery Capacity Routing (CMMBCR) Scheme [2]. In CMMBCR, all nodes have possible routes between a source and a destination, but it's having the sufficient remaining battery capacity. Our suggested conditional max-min battery capacity routing (CMMBCR) scheme aims to strike a balance in minimizing power usage level and maximizing the lifetime of an ad-hoc mobile network. However, these power-aware routing schemes have a tendency to select longer paths, which increase the average relaying load at each node and therefore, reduce the lifetime of most nodes. Exponential bandwidth scaling has a major reason for the growth and popularity of the Web-network.

However, increases in bandwidth results in increases in consumed energy. To address this problem, we suggest power-awareness in the system-design, network management, and in the design and implementation of protocols used in wired networks [3]. However, depends solely on system design techniques to limit the power consumption of high speed equipment will likely not be enough to avoid expensive heat dissipation solutions such as liquid cooling. Very few power aware MANET routing protocols are found in the literature and they select a route that will minimize the total transmission power between the sender and the receiver. Power aware multi-access protocol (PAMAS) [4] is an energy aware MAC routing protocol mainly designed for energy efficiency in mobile ad hoc networks. In this approach the transmission power is set as the link cost and the minimum cost route is found. The minimum cost route becomes the minimum energy route path which is the collective energy of the intermediate nodes.

II. THE PROPOSED AODV AND AOMDV

a) AODV:

Nodes in a MANET usually transmit up to a fixed range/distance with its default transmission power. But if we change this routing process and only allow selected nodes to receive and process this routing messages based on the battery power and that selected nodes are previously assigned by the sender node itself. So it will reduce the path lengths in terms of number of hops. Interference free transmissions are also

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possible and the overall consumed energy and overhead is reduced. AODV is an on-demand routing protocol, that is used to initiate a route discovery process when source node is needed the route. A source node S wants to send a data to destination node D, but it cannot find a route in its routing table, it broadcasts a Route Request (RREQ) message to its neighbours. The next hop then broadcasts the RREQ message to their neighbors if they do not have a routing information to the destination node. This process continues until the RREQ message reaches the destination node that has the routing information. Every node has its own sequence number and RREQ ID. The destination node accepts only the 1st copy of a RREQ message, and drops the other duplicated copies. Each node that forwards the ROUTE REQUEST creates a reverse route for itself, after accepting a RREQ message the destination updates its reverse route using the neighbor from which it receives the RREQ message. The reverse route is used to send the Route Reply (RREP) message to the source node.

Meanwhile, it updates the sequence number of the source node in its routing table. Route maintenance is done with Route Error (RERR) messages. If a node detects a route failure in an working route, it sends out a RERR message to its neighbors that use it as the next hop in the failure route. When a node receives a RERR message from its intermediate nodes, it further forwards the RERR message to its previous route. All the other routing messages and Data packets are handled normally. If it is RREQ message then it is checked if it is the destination then the RREP message is sent to the sender. If it already exists then the request is dropped. Then the node processing RREQ request. RREP (route reply) is sending via the same path where route request is processed. Then the DATA is transmitted through the same route. Same procedure is followed for multipath and the results are analysed.

b) AOMDV:

The idea behind this multi-path routing is finding multiple routes between a source and a destination. The multi-path routing protocol discovers multiple paths during the single route discovery process. These multiple paths can be used for long time as they needed by the source or as backup routes when the primary route fails. AOMDV is a multi-path extension of AODV. In AODV when a source wants to communicate to a destination it initiates a route discovery process by flooding a Route Request (RREQ) packet for destination through the network. Duplicate RREQs are recognized, and deleted, using sequence numbers. An intermediate node, receiving a non-duplicate RREQ packet, first sets up a reverse path to the source using the previous hop of the RREQ as the next hop on the reverse path. If a valid route to the destination is available in its routing table, then the intermediate node generates a route reply (RREP) packet, otherwise the RREQ is rebroadcast. When the destination receives a non-duplicate RREQ, it also generates RREP. The RREP is routed back to the source via the reverse path, a shortest route is found, and then DATA is transmitted.

Table 1: Parameters And Description

Channel type	Wireless channel
Propagation model	Two ray propagation
Antenna model	Omni directional
Topological area	1400*800
Number of nodes	30
Transmission range	0.28183815W ≈ 250m
Rx power	0.2819W
Initial node energy	1,000 J
Mac type	802.11
Node speed	10m/s
Pause time	10s
Transport protocol	UDP
Packet size	1000 bytes
Threshold	12W

III. ALGORITHM

- Select the number of nodes.
- Arrange the nodes randomly.
- Assign battery power (12w) for all the nodes.
- After completing the handshaking process, source node sends the route request to the destination.
- Set threshold as 5w, for each transmission 0.2w is reduced.
- Based on the battery power of the node, the route is previously assigned.
- If the route request is received by the destination, it sends route response to the source via same intermediate nodes.
- Finally, Shortest path is selected, data is transmitted.

IV. SIMULATION RESULTS

The simulations are done with ns2-network simulator under REDHAT-OS. We used the ns2 version ns2.34. Ns2 implementation of AODV has been improved to behave as AODV and AOMDV. Table-1 shows some of the important parameters of the simulation.

Metrics Considered for Evaluation

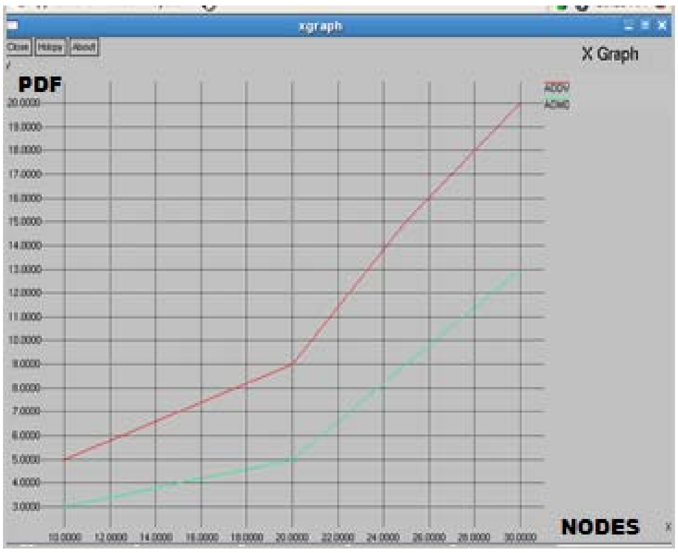
The following protocol performances are considered for evaluation of the ad hoc network routing protocols AODV and AOMDV.

Packet delivery fraction/ratio (PDF/PDR):

Packet delivery fraction is the defined as the ratio of the number of packets successfully received by all destinations to the total number of packets introduced into the network by all sources.

PDF = Data packet delivered to all sources / Data packet send by all sources

The graphs in the Fig.1, shows the performance of the AODV & AOMDV in terms of packet delivery ratio (PDR). The PDR in AODV is low and decreasing with respect to the increase in nodes. The proposed AOMDV performs well when compared to normal AODV.



. Fig. 1. AODV VS AOMDV

Energy consumption:

The average of the total consumed energy of all the nodes of the network. Its unit is Joules. The graphs in the Fig.2, shows the performance of the AODV & AOMDV in terms of energy consumption.

The consumed energy in the case of AODV is high and increasing with respect to the increase in nodes. The proposed AOMDV performs well and consumed less energy than normal AODV.

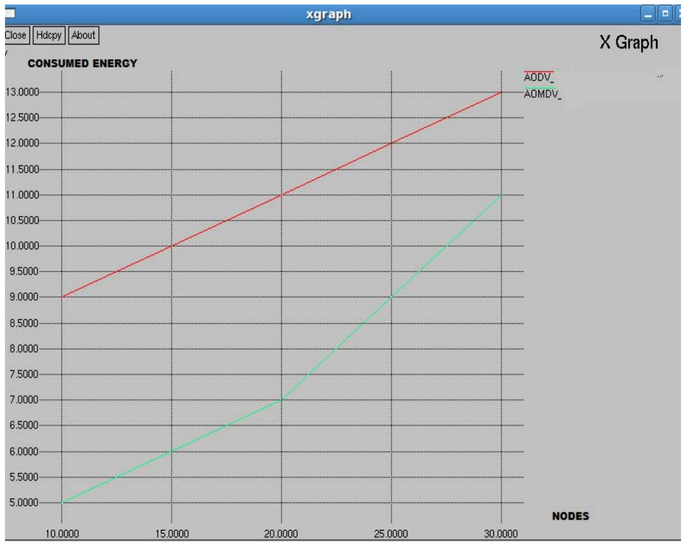


Fig. 2. AODV VS AOMDV

Overhead:

Overhead is the number of generated and forwarded routing messages and is used as a separate metric to understand the communication overhead.

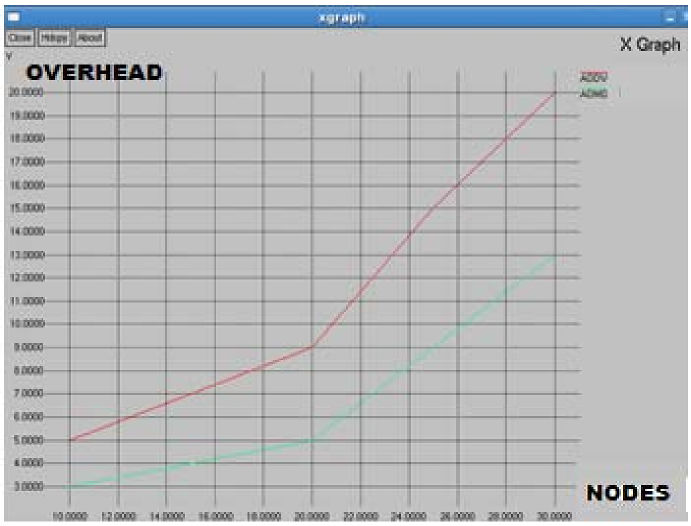


Fig. 3. AODV VS AOMDV

The graphs in the Fig.3, shows the performance of the AODV & AOMDV in terms of overhead. The communication overhead in the case of AODV is high and seems to be increasing with respect to the increase in nodes. In our proposed AOMDV the RREQ is prevented from flooding. This results in reduction of routing overhead. The proposed AOMDV performs well and has less no of overhead than normal AODV.

V. CONCLUSION

Our solution is to improve the multipath functionality in normal AODV protocol that will help to improve the performance of routing protocol for selecting best route and identification of misbehaving routes. Our objective is to reduce the consumed energy and overhead in MANET. However fast changing topology, limited bandwidth and battery power in MANET environment gives big challenges to the reliability and robustness of its routing protocol without relying on pre-existing backbone infrastructure. The proposed AOMDV and AODV algorithm is successfully simulated using NS2.34. The performance of the proposed system has evaluated on different network sizes. The results show that better improvement in performance and reduction in overheads.

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