Improved AODV Routing Protocol for MANETs

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***Abstract*—Initially, wireless networks had many difficulties because of their main characteristics such as dynamic topology and bandwidth limitations, energy and others. There are two classes of wireless networks; networks with infrastructure which generally use the model of cellular communication, and without infrastructure networks called ad hoc. Nodes failure based on power deficiency could affect the overall network lifetime. In this paper, an enhanced version of the basic AODV protocol, using high energy-efficient paths, is introduced. We have included a new formula to control the packet residence time of packets inside queues. Simulations have been conducted to compare the enhanced version of AODV protocol with the basic protocol in terms of network lifetime as well as packet delivery ratio. Simulation results show that QAODV outperforms basic AODV.**

Keywords—MANETs, Routing Protocols, AODV, Performance Evaluation.

I. INTRODUCTION

Ad Hoc network (MANET) [3] is a group of mobile devices with a wireless transceiver nodes, the communication between wired base stations do not rely on traditional, but by wireless mobile nodes with their neighbors to exchange information, support for dynamic reconfigurable Multi-hop ad hoc networks, in the case of no central infrastructure, the number of mobile users by the formation of self-organizing multi-hop wireless mobile network, the system is fully distributed, without using constraints, each node not only receives And to send information terminals, but also can act as a router for communication between other nodes, nodes via multi-hop wireless link to communicate[5]. Because of its great flexibility, it can be widely used in military preparedness, economic development, and personnel cannot reach high-risk areas and other occasions, has broad application prospects.

I have two objectives in this work, the reduction of energy consummation environment the location of all nodes, which implies amelioration at lifetime, for the second objective it's an improvement in the ratio of packet sent over the packet received.

Improvements mentioned in my goals are achieved by acting on the processing time in the queue which implies an increase in the number of packet to process and applying a control on the choice of the most energetic node.

II.RELATED WORK

. In mobile ad-hoc network, limited energy of batteries is the biggest restriction. Much research has been done to improve energy efficiency of the protocol. Authors of [12] present an Energy Mean Value algorithm to maximize network lifetime. Parma nand shows that AODV performs better than other pro-tocols in terms of packet delivery ratio and reduces new route discovery process [13].

III.OVERVIEW OF AODV

• The AODV protocol [2] is essentially an improvement of the DSDV algorithm. The AODV protocol reduces the number of broadcasts of messages, and in that when creating the paths necessary, unlike the DSDV, which maintains all the paths.
• The principles AODV uses sequence numbers at the end to maintain the consistency of routing information.
• Because of the mobility of nodes in ad hoc networks, roads change frequently so that the roads maintained by some nodes become invalid. The sequence numbers allow the use of the newest ways (fresh roads).
• In the same way as in the DSR [14], the AODV uses a route request in order to create a path to a certain destination. However, the AODV [2] maintains a distributed paths maintaining a routing table at each gateway node belonging to the searched path way.
• A node broadcasts a route request (RREQ) in the case where he would need to know a path to a certain destination and such a route is not available. This can happen:

- ✓ If the destination is not known in advance, or

- ✓ If the life of the existing path to the destination path has expired or is become faulty.

• When the destination receives this message, it responds with an RREP.

• The sequence number of the RREQ destination field contains the last known value of the sequence number associated with the destination node. This value is copied from the routing table. If the sequence number is not known, the value zero is assumed. Number of RREQ source sequence contains the value of the sequence number of the source node.

• At the end of maintaining consistent routes, periodic transmission of "HELLO" is performed. If three messages "HELLO" are not consecutively received from a neighbor node, the link in question is considered to be faulty.

• The AODV protocol does not present a routing loop, it also avoids the problem "counting to infinity" Bellman-Ford, which provides fast convergence when the ad hoc network topology changes.

IV.AODV PROTOCOL

Q- AODV protocol is a reactive protocol based on AODV protocol. As stated above, in AODV protocol the processing time of packets stored in nodes queues increases as the number of packets increases. In fact, an intermediate node relaying a RREQ request if the available bandwidth is greater than the paths previously received or if the time is less than the paths previously received. If the time or bandwidth path fails to comply with any of these constraints the RREQ query is deleted.

V.PROPOSED SOLUTION

In order to avoid this delay, we have proposed a model based on queuing theory. The principle of this model is as follows. A wireless node can be seen as a buffer, which is filled by incoming packets from higher layers. Thus a single server provides treatment required for these packets. We can model this by a system M/M/1/K waiting queue as shown in Figure 3, having the following properties:

- The arrival of packets follows an exponential distribution with parameter *lamda*..
- The treatment of incoming packets also follows an exponential distribution with parameter μ.
- There is a single server for processing incoming packets.
- The queue size is bounded by the value K. When a packet arrives and there is already a K packets in the system,, other coming packets will be droped.

The delay of a packet in the waiting queue of the transmitter is simply the average time a customer rated R arriving in the queue, given by Little's Law[7] :

$$R = \frac{\rho}{1-\rho}\frac{1-(K+1)\rho^K + K\rho^{K+1}}{1-\rho^K}\frac{1}{\lambda}$$

Avec $\rho = \frac{\lambda}{\mu}$.

VI.PERFORMANCE EVALUATION

In this section, the evaluation study is performed using the discrete-event simulator, ns2 [[3]]. In the rest of this section, simulation parameters, to mobility scenarios, and to traffic that imitates the applications are presented. Performance metrics together with simulation results are also reported.

A. Simulation parameters and metrics

The simulation environment consists of nodes 100 and the simulation time ranges from 3 ms to 200 ms. Each node use IEEE 802.11 MAC protocol, operating at 2Mbps, to send and receive messages. We used two-ray ground model for radio propagation and the transmission range is 100m. The simulation parameters are described in Table 1.

Table 1. Simulation parameters.

Simulation Parameter	Value
Network range	1000x1000 m^2
Transmission range	100 m
Number of nodes	100
Nodes speed	1
Bandwidth	2Mbps
Message size	1000 bytes
Simulation time	200 ms
Channel type	Channel/WirelessChannel
Radio-propagation model	Propagation/TwoRayGround
Antenna type	Antenna/OmniAntenna
Link layer type	LL
Interface queue type	Queue/DropTail/PriQueue
Max packet in ifq	50
Network interface type	Phy/WirelessPhy
MAC type	Mac/802_11
Number of mobilenodes	100
Routing protocol	AODV
Initial Energy du noeud	40 Joules

The performance of the enhance AODV is evaluated and compared against basic AODV under different node speeds and densities. The following performance metrics have been used:

- Packet Delivery Ratio: is the ratio of number of packets received at the destination to the number of packets sent from the source. The performance is better when packet delivery ratio is high. Mathematically, it can be defined as: PDR= S1/S2, where, S1 is the sum of data packets received by the each destination and S2 is the sum of data packets generated by the each source.
- Average end-to-end delay: is the average time delay for data packets from the source node to the destination node. To find out the end-to-end delay the difference of packet sent and received time was stored and then dividing the total time difference over the total number of packet received gave the average end-to-end delay for the received packets. The performance is better when packet end-to-end delay is low. Mathematically, it can be defined as: Avg. EED=S/N, where S is the sum of the

time spent to deliver packets for each destination, and N is the number of packets received by the all destination nodes.

- Energy: it is the average energy consumption of all nodes in sending, receiving and forward operations.

B. Simulation results

Pause Time	E2E AODV	E2E QAODV
3	0,210	0,182
50	0,370	0,157
100	0,217	0,297
150	0,224	0,240
200	0,240	0,356

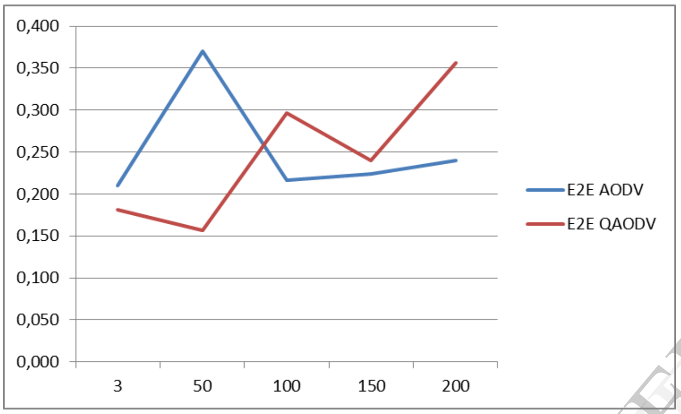

Fig.3.Average_end_to_end_delay Vs Pause_Time

Pause Time	PDR AODV	PDR QAODV
3	0,4335	0,4062
50	0,4175	0,4467
100	0,4266	0,4539
150	0,3773	0,4194
200	0,3289	0,4225

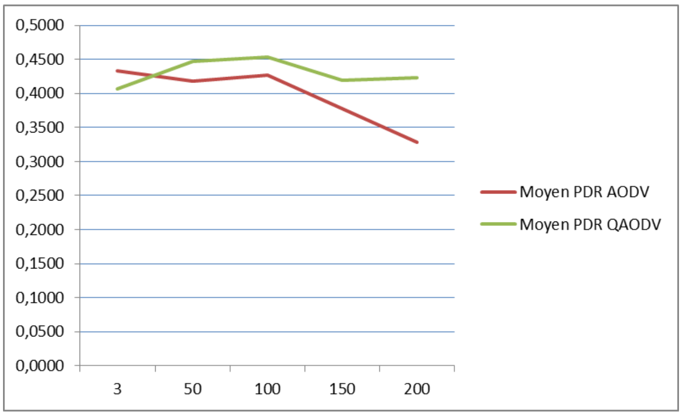

Fig.4. Packet Delivery Ratio Vs Pause_Time

Pause Time	Energie AODV	Energie QAODV
3	8,632	9,490
50	8,260	8,703
100	9,542	9,691
150	9,096	9,586
200	9,251	9,711

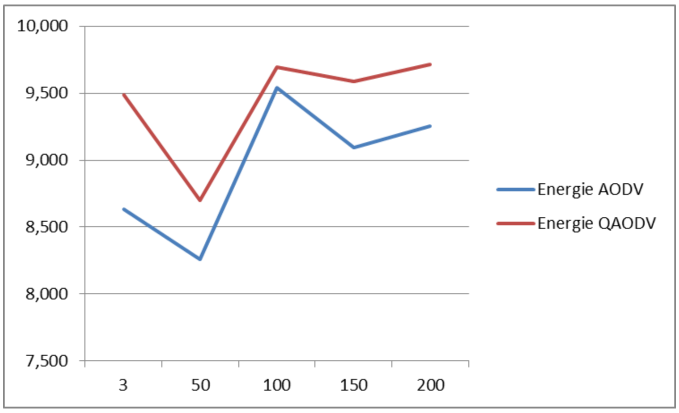

Fig.5.Energy Vs Pause_Time

Fig3 : Shows that the delay from one end of the Q-AODV protocol compared to standard AODV increases from the value of 100 break time which implies that if a high mobility Q- AODV and mesh we have .

Fig4 : Shows a comparison between the routing protocols on the basis of packet delivery ratio as a function of pause time and using CBR (UDP) traffic source with both routing protocols AODV and An Enhanced AODV.It clearly shows that the performance of AODV and Q-AODV is different. Pause of 3 means the maximum movement and 200 represent less movement . It shows the three pause Lao is much lower , its about 94 % in both protocols. PDR metric shows a positive change of Q-APDD compared to standard AODV

Fig5 : Shows that the energy consumed by prortocole standard AODV is large compared to that consumed by Q- AODV , suddenly we see that the control of enregie applied to the packet REEQ a posistif effect on the life of neouds

VII.CONCLUSION

In this paper we have observed the working of AODV routing protocol over MANET, we have seen during simulation over NS-2 environment that for our purpose solution the PDR should be high. The energy Should be high. And the EndToEndDelay should be low then basic AODV. Control packet applied at the queue to reduce the number of lost packet and reduce the total energy of the node that is an increase in the lifetime of all nodes.

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