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Performance Improvement of AODV Protocol In Vehicular Ad hoc Network (VANET)

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ABSTRACT: Vehicular Ad hoc Network (VANET) is a new way of communication which includes communication between vehicles moving at high speeds on the roads. Vehicular Ad-hoc Network (VANET) is a most critical class of mobile ad-hoc network (MANET) that enables roadside vehicles to intelligently interact with one another and with outside infrastructure anytime anywhere in the global network. In this paper, a new routing protocol for VANET is presented; the proposed Active Route timeout based Ad-hoc on demand Distance Vector (AODV) is named E-AODV, it uses the Active Route timeouts and hello interval parameters to select the best routing path. This paper compares the performance of the proposed E-AODV in terms of average delay, average throughput and average network load. Results reveal that E-AODV is much better than AODV.
KEYWORDS: AODV, EAODV, MANET, VANET.

INTRODUCTION

The Vehicular Ad hoc Network (VANET) is a kind of mobile ad hoc network (MANET) and is a platform to provide car safety and traffic applications VANET is the powerful technology that can provide authentic vehicle to vehicle (V2V) and vehicle to roadside infrastructure (V2I) communication that shown in fig. 1. [1]. VANETs are self configuring network where nodes are vehicle and WIFI technologies are used to establish these networks [3] [7]. VANETs consist of On Board Units (OBUs) and Roadside Units (RSUs). OBUs are installed on the vehicle to provide the facility of wireless communication with other vehicles or RSUs and RSUs are communication units located aside the road. RSUs are connected with application server and truth authority (TA) [4].

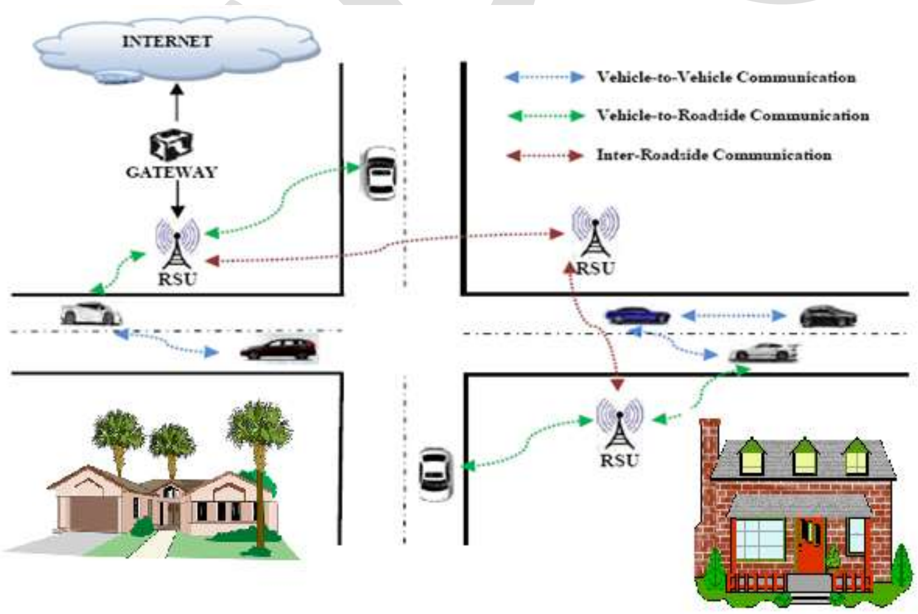

Fig. 1. Vehicular Ad hoc Network

VANETs challenges are optimize traffic management, road safety, information inaccessibility and authentication. For example, to reduce the roadside accident vehicle should exchange their speed and position information in the driving time. For this life critical information authentication is very important, which ensure that any received information is send by authorized user and has not been changed [4]. The routing protocols in VANET are categorized into three main types:-

• **Proactive Routing Protocol**-Here the mobile nodes periodically exchange routing information and maintain the network topology information in routing table. It is also called table driven routing protocol [5].

• **Reactive Routing Protocol**- Here there is no exchange of routing information periodically. Instead a necessary path is obtained when required. [t is also called on demand routing protocol [5].

• **Hybrid Routing Protocol**- It combines the features of both proactive and reactive routing protocols. A table driven approach is used within the routing zone of each node while an on demand approach is used for the nodes that are outside the routing zone [10].

RELATED WORK

In [11], authors proposed a Robust AODV protocol in which the active route is maintained by locally updating active route information to 1-hop neighbors, multiple backup routes are built and the highest priority backup route is switched to become the new active route when the current active route breaks or when it's less preferred. Maintaining the active route by locally updating active routing information allows routes to adapt to topology variations, makes them robust against mobility, and enables them to reach local optimum. The adaptation to mobility is especially obvious when the source/destination node keeps moving. In Robust AODV, the overhead is low compared with proactive routing protocols because only the active route is maintained and the route update message is only broadcasted locally to 1- hop neighbors. Its overhead is almost not affected by speed while the original AODV overhead obviously increases when the speed increases. The Improving AODV Routing Protocol with Priority and Power Efficiency (AODV-PP) [12] has a capability to determine battery of intermediate node along with the priority of the application as it selects a node with a high remaining energy to increase the lifespan of the node. The Modified Reverse Ad Hoc On Demand Distance Vector (MRAODV) routing algorithm [13] presents an Algorithm to select maximum suitable path between source and destination on the basis of energy of nodes, stability of nodes and hop-count of paths. In Optimized AODV (OAODV) routing protocol [14], the node does not forward RREQ unless there is sufficient energy (battery lifetime), and until the node density in its surrounding exceeds a particular threshold.

AD-HOC ON DEMAND DISTANCE VECTOR ROUTING PROTOCOL (AODV)

AODV is a reactive routing protocol and is the most popular and widely used routing protocol. In this route is discovered or maintain according to node request. For loop freedom and freshness of route, AODV uses destination sequence number [8].

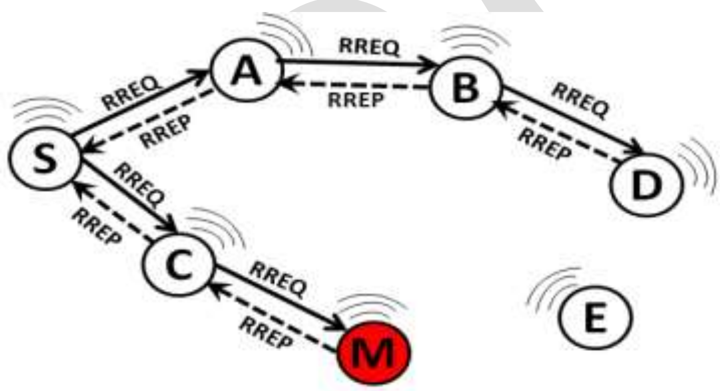

Fig. 2. Ad-hoc on Demand Distance Vector Routing Protocol Operations

It is capable for both unicast and multicast routing. Mobile nodes respond to the any change in network topology and link failures in necessary times. In case of the link failures the respective defective nodes are notified with the message, and then the affected nodes will revoke the routes using the lost link [5]. AODV uses the message types Route Request (RREQ), Route Replies (RREP) and Route Error (RERR) in finding the route from source to destination. AODV performs two operations: (1) route discovery and (2) route maintenance.

PROPOSED METHODOLOGY

Here, we present different adaptable parameters to optimize AODV routing algorithm and describe their effects on energy constraints. The parameters we target to optimize AODV routing algorithm are Active Route Timeout, Hello Interval and Hello Message loss. The Active Route time out is the lifetime of the routing table. After this period of time the VANET will not consider this route. Hello interval is the time taken by the sender node to send the hello message to the other node to make a contact with the intermediate node [7]. For each parameter, we present a discussion on how the parameter affects energy consumption through routing QoS and present an adaptation policy to reduce energy consumption by finding the appropriate value of these parameters considering the current channel conditions.

PROPOSED ALGORITHM

In our proposed algorithm EAODV we show the effect of different parameters on energy consumption through routing QoS. First we have taken Active route time out i.e. the lifetime of a routing table entry if a route is not used and refreshed within this "Active route timeout" period, AODV marks the route as "Invalid" and removes it from IP routing table.

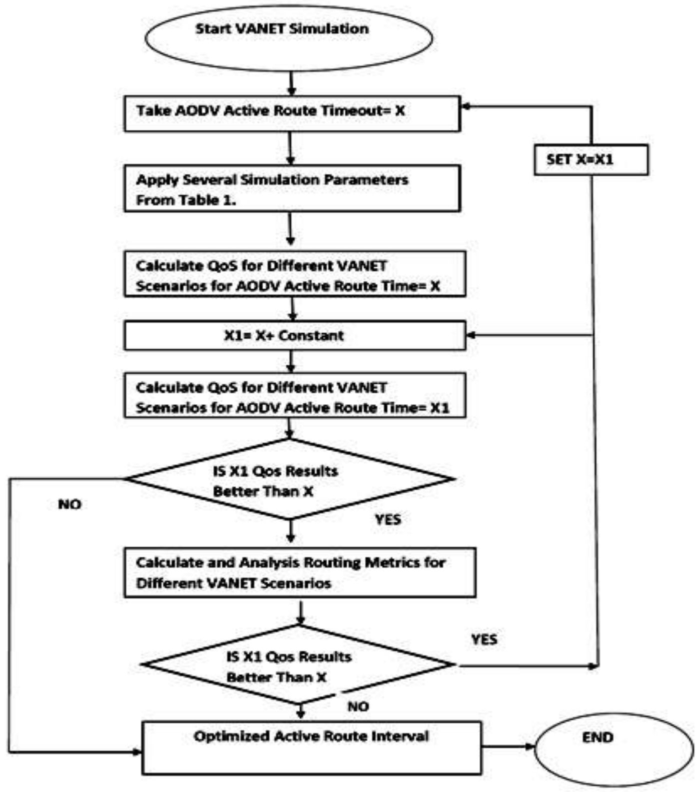

Fig. 3. Proposed Algorithm for Improvement of AODV (E-AODV)

The constant value is used to modify the values of the parameters. First of all in vehicular ad hoc network Set Active Route timeouts as any value X and then calculate the results of Quality of service and routing metrics for that value X. After taking the previous value suppose the constant value is added in this value then the value becomes XI. Then again the simulation takes place in different scenarios of vehicular ad hoc network and calculates the result of QoS for XI in vehicular ad hoc network if the result becomes better than X then calculates results for routing parameters, and if the result is not better than previous one then the value remain X. Then again simulation takes place for routing parameters if this result becomes better than X then the value of X become XI. If the result will not better than the previous one then the value of X will change. Similarly the value of Hello interval and Hello message is modified.

SIMULATION SETUP

In this work we used OPNET Modeler v14.5 Modeller simulator for simulation purpose. A campus is network was modelled for simulation within an area of 50 m x 50 m. The all mobile nodes were spread within this area. Mobility model used is random waypoint model with mobility of 100 meters, the performance of the reactive ad-hoc routing ADOV and EAODV protocol is evaluated by implementing different scenarios. The buffer size of data is set to 1024 Kbps for each mobile workstation at data rate of 54Mbps with OFDM 802.11g PHY layer & DCF MAC Protocol implementation. The traffic flows randomly between different Voice applications workstations placed at different distances. We take the different network size according to the number of node as on increasing the number of nodes in a VANET; there will obvious increase power consumption. So by changing the value of Active Route Time, Hello Loss, and Hello Interval we make a scenario (EAODV) and compare with the standard scenario (AODV). The simulation parameter of both scenarios is given in Table I and Table II.

Table: I Simulation Parameters

Examined Protocols	AODV ,	E-AODV
Number of Nodes	100,150,200,250 and 300	100,150,200,250 and 300
Types of Nodes	Mobile	Mobile
Simulation Area	50*50 km	50*50 meters
Simulation Time	3600 seconds	3600 seconds
Mobility	Uniform(10-100) m/s	Uniform(10-100) m/s
Pause Time	200 seconds	200 seconds
Performance Parameters	Throughput, Delay, Network load	Throughput, Delay, Network load
Traffic type	FTP, Http	FTP, Http
Active Route Timeout(sec)	4	24
Hello interval(sec)	1,2	3,4
Hello Loss	3	5
Timeout Buffer	2	6
Physical Characteristics	IEEE 802.11g (OFDM)	IEEE 802.11g (OFDM)
Data Rates(bps)	54 Mbps	54 Mbps
Transmit Power	0.005	0.005
RTS Threshold	1024	1024
Packet-Reception Threshold	-95	-95
Long Retry Limit	4	4
Max Receive Lifetime(seconds)	0.5	0.5
Buffer Size(bits)	25600	25600
Mobility model used	Random waypoint	Random waypoint
Data Type	Constant Bit Rate (CBR)	Constant Bit Rate (CBR)
Packet Size	512 bytes	512 bytes

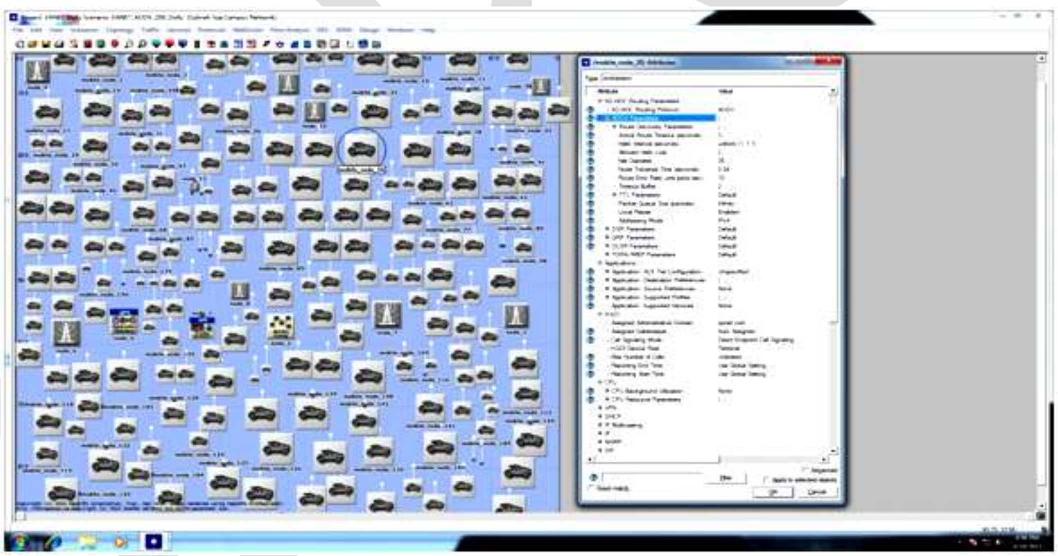

Fig. 4. VANET Scenarios

Table: II Scenarios Used

Scenarios Name	No. of Mobile Nodes	Protocol Used
Scenario 1	100	AODV
Scenario 2	100	E-AODV
Scenario 3	200	AODV
Scenario 4	200	E-AODV
Scenario 5	250	AODV
Scenario 6	250	E-AODV
Scenario 7	300	AODV
Scenario 8	300	E-AODV

SIMULATION RESULTS

To evaluate the various performances of AODV and EAODV in different scenarios we have determined the various QOS and routing parameter such as throughput, network load, End to end delay and packet delivery ratio. The figure 5 shows the average end to end delay of all nodes. It represents the end-to-end delay of all the data packets that are successfully received by the WLAN MAC and forwarded to the higher layer. Our proposed protocol has less delay. In case of 100 nodes the EAODV takes 0.112 sec and AODV takes 0.8 Seconds delay.

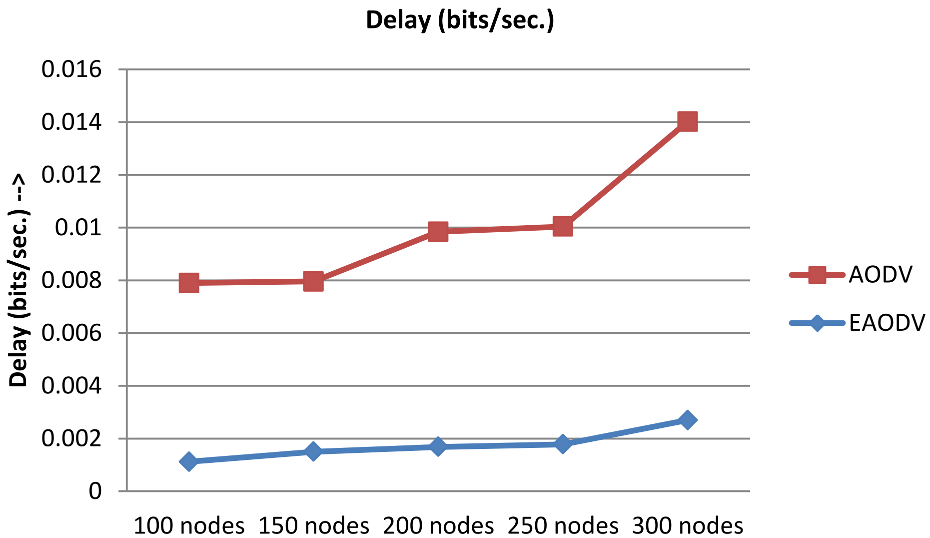

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Fig. 5. Average Delay of EAODV and AODV

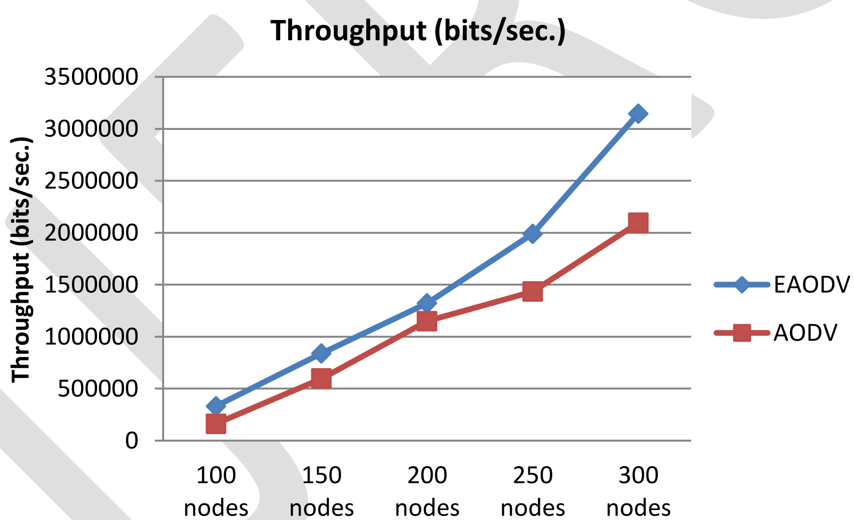

Fig. 6. Average Throughput of EAODV and AODV

Figure 6 shows the comparison of throughput between AODV and EAODV at different number of nodes. EAODV has higher throughput as compared to AODV to discover the route. In case of 100 nodes the EAODV have 102034 bits/sec. and AODV takes 90890 bits/sec. The value of throughput increases with increase in the number of nodes in VANET. Figure 7 shows the network load, at the initial state the value of network load in case of EAODV is more because the less number of nodes.

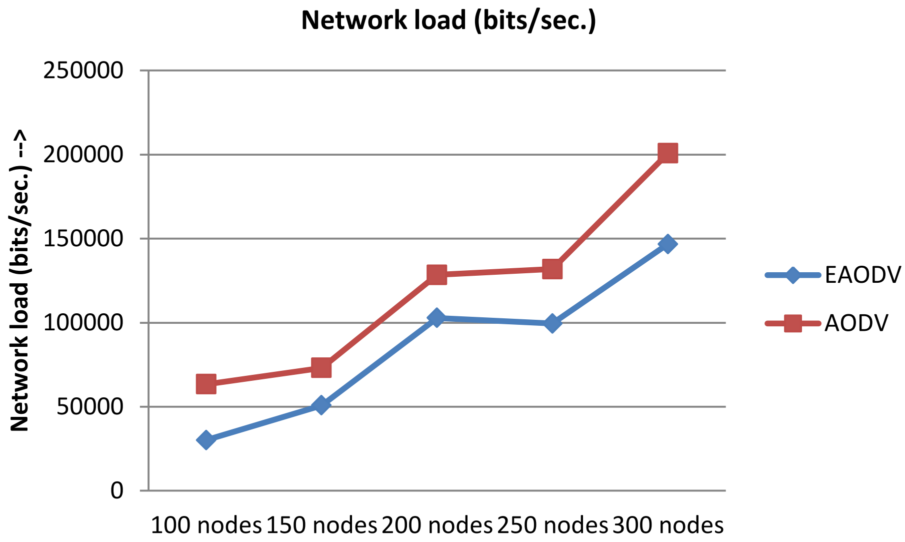

Fig. 7. Average Network Load of EAODV and AODV

VIII. CONCLUSION AND FUTURE WORK

The simulation model of VANET network is simulated using OPNET 14.5 simulator and analyzed for AODV and EAODV routing protocol. We applied some methodology to improve the performance of AODV protocol by modifying the values of parameters like Active Route Timeout, Hello Message loss and Hello Interval and make E-AODV routing protocol. We applied this modified AODV (E-AODV) to different numbers of nodes like 100, 150, 200, 250 and 300 and concluded that this is effective in all the cases. It is concluded that E-AODV has better Quality of service and Routing results than AODV protocol. In future work we will further improve the AODV protocol for large scale environment.

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