An Implementation of Routing Protocols on Vehicular Ad-Hoc Network

***Shivani Bhayal**

****Asst. Professor Mr. Jitendra Singh Dodiya**

ABSTRACT

Today the world is moving towards wireless system. Wireless networks are gaining popularity to its peak today, as the users want wireless connectivity irrespective of their geographic position. Vehicular ad-hoc networks (VANETs) are considered to be the special application of infrastructure-less wireless Mobile ad-hoc network (MANET*)*. In these networks, vehicles are used as nodes. The thesis works is based on comparison between Ad hoc on demand Distance Vector routing protocol (AODV), Modified Ad hoc on demand distance vector routing (MAODV) and Destination sequenced distance vector routing (DSDV) in VANET on the basis of energy, packet delivery ratio, throughout and end to end delay. Researchers are continuously publishing papers on performance work on VANET hence we worked on the issue. The tool which we used for the work of performance is Network Simulator 2 (NS-2).

*Shivani Bhayal, Department of Electronics & Communication Engineering,VITM,Indore, arya.shivani1@gmail.com

**Asst. Professor Mr. Jitendra Singh Dodiya, Department of Electronics & Communication Engineering,VITM,Indor

I. INTRODUCTION:

A Vehicular Ad-Hoc Network or VANET is a technology that uses moving cars as nodes in a network to create a mobile network. VANET turns every participating car into a wireless router or node. Most of the concerns of interest to MANET are of interest in VANET, but the details differ. Rather than moving at random, vehicles tend to move in an organized fashion. VANET offers several benefits to organizations of any size. The communication area which is related with the scope of this proposal is an emerging and exciting application of an ad-hoc network where vehicles are severing as nodes. This area has certain promised aspects and activities to be offered, which are broadly related with the safety, convenience, and entertainment topics.

II. BACKGROUND

2.1 Wireless Ad-hoc Network

A wireless ad-hoc network is a decentralized type of wireless network. The network is ad hoc because it does not rely on a pre-existing infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Instead, each node participates in routing by forwarding data for other nodes, and so the determination of which nodes forward data is made dynamically based on the network connectivity. In addition to the classic routing, ad hoc networks can use flooding for forwarding the data. An ad hoc network typically refers to any set of networks where all devices have equal status on a network and are free to associate with any other ad hoc network devices in link range. Very often, ad hoc network refers to a mode of operation of IEEE 802.11 wireless networks.

2.2 Ad-hoc routing protocol

An ad-hoc routing protocol is a convention, or standard, that controls how nodes decide which way to route packets between computing devices in a mobile ad hoc network .In ad-hoc networks, nodes are not familiar with the topology of their networks. Instead, they have to discover it. The basic idea is that a new node may announce its presence and should listen for announcements broadcast by its neighbours. Each node learns about nodes nearby and how to reach them, and may announce that it, too, can reach them. The following is a list of some ad hoc network routing protocols. Choice for one or the other method requires predetermination for typical cases. The main disadvantages of such algorithms are:

1. Advantage depends on number of Math van nodes activated.

2. Reaction to traffic demand depends on gradient of traffic volume.

2.3 VANET Routing Protocols

All of the standard wireless protocol companies are experimenting with VANET. This includes all the IEEE protocols, Bluetooth, Integrated Resource Analyses (IRA) and Wi-Fi. There also are VANET experiments using cellular and satellite technologies. Dedicated Short Range Communications (DSRC) is a protocol that has been specifically for use with VANET. DSRC has several advantages: it already is operating at 5.9 GHz, it is easy to individualize and it is oriented to the idea of transmitting along a street grid framework--as opposed to the Omni-directional transmission, which is standard for most wireless protocols. Vehicular ad-hoc networks add to the complexity due to the fact that the nodes are travelling at high rates of speed. Overall, VANETs must work in all type of traffic i.e. high and low vehicle density environments in urban and rural environment respectively. This creates a challenge for the hardware design for VANETs. Because for example in low density vehicle environment the number of vehicle will be less so some vehicles will be out of rang for communication. In high density vehicle environment sharing of bandwidth is a challenge for VANET.

III. MAODV

Multicast protocol is a key technique to the group team application, which benefits in the significant reduction of network loads when packets need to be transmitted to a group of nodes. Multicast protocol must guarantee the performance requirements: adaptable to the dynamic change of network topology, timeliness, minimizing routing overhead and efficiency etc. Multicast is a communication approach for groups on information source using the single source address to send data to hosts with same group address. MAODV topology is based on multicast tree adopting broadcast routing discovery mechanism to search multicast routing, which sends data packets to each group nodes from data source.

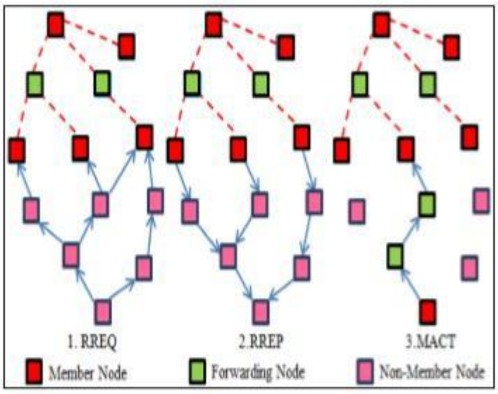

Figure 1: MAODV Protocol

3.1 Route Discovery

MAODV use route request (RREQ) and route reply (RREP) which already exist in AODV. If a node wants to join in or send messages to a multicast group while there is no path to the multicast group, it will broadcast a RREQ, any multicast group member will respond to the request message if necessary. If RREQ is not a Join Request, any node with updated (serial number is greater than RREQs) routing path can respond directly. If non-multicast node receives RREQ request, or the node is not available to the target group, it will forward RREQ directly.

3.2 Route Maintenance

a) Multicast Tree Maintenance: Group leader maintains the multicast groups' serial number by broadcasting Group Hello periodically. Group Hello is extended from the Hello message in AODV, which is consisted of multicast address, multicast serial number, hop count and TTL (Time to live).

b) Node Leave: If the node is not a tree leaf, it still can act as a router only by setting multicast address 0, else it will send Add and Prune (P marked MACT) to prune itself. When its upstream node receives P-marked MACT, it will delete this node from its multicast routing table. If the node is a multicast member or not a tree leaf, the prune process ends, else send the P-Marked MACT to its upstream node continuously.

c) Disconnection Repair: When the link is disconnected due to node mobility or other reasons, it will broadcast RREQ to re-join in the multicast group, only the member with latest serial number and its hop less than multicast group hop can respond. If the upstream node which has lost its node is not a multicast group member, and becomes the tree leaf, then it will set the timer to rebuild and if in certain period, it is still not be activated, the Add and Prune will be sent to prune the node itself. If the network is divided due to the repair failure, the divided network needs new group leader. If the nodes initiating repair is a multicast group member, then it will become the group leader, or the new group leader will be selected by sending G-Marked MACT.

d) Tree Merge: When the node receives Hello message, if it is a multicast group member and contains group members of the lower address group leader, it will initiate tree-rebuild process.

3.3 Link Repair Mechanism of MAODV

In MAODV, when a link breakage is detected, the downstream node is responsible for initiating the repair procedure. In order to repair the tree, downstream node broadcasts RREQ-J message with multicast group leader extension included. The multicast group hop count field in multicast group leader extension is set equal to node’s current distance to multicast group leader, only nodes no further to the group leader can respond. A node receiving the RREQ-J respond by unicasting a RREP-J only if it satisfy the following constraints: It is a member of the multicast tree, its record of the multicast group sequence number is at least as great as that contained in RREQ-J and its hop count to the multicast group leader is less than or equal to the contained in the multicast group hop count extension field. After waiting for RREP-J wait time, the source node selects the best path from the RREP-J messages received and subsequent route activation is performed by a MACT-J message. Once the repair is finished, it is likely that the node which initiated the repair is now at a different distance to the group leader. In this case, it must inform its downstream nodes about their new distance to the group leader. The node performs this task by broadcasting a MACT-J message with the new hop count to leader contained. When a downstream node receives the MACT-J message and determines that this packet arrived from its upstream node, it increments the hop count value contained in the MACT-J and updates its distance to the group leader. The problem associated with this link repair mechanism is that the shortest path to the group leader is not ensured and it can lead to tree partitioning.

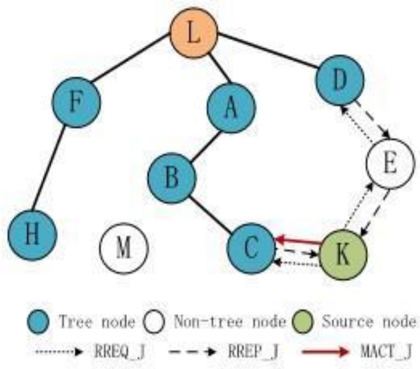

Figure 2 : Link Repair Mechanism of MAODV

IV. PERFORMANCE MATRICES

To evaluate the performance of a protocol for an ad-hoc network, it is necessary to test the protocol under realistic conditions, especially including the movement of the mobile nodes. Surveys of different mobility models [33] [34] have been done. This includes the Random Waypoint Mobility Model that is used in our work.

1. Packet Delivery Ratio: This is the fraction of the data packets generated by the sources to those delivered to the destinations. This evaluates the ability of the protocol to discover routes.

2. Throughput: There are two representations of throughput; one is the amount of data transferred over the period of time expressed in kilobits per second (Kbps). The other is the packet delivery percentage obtained from a ratio of the number of data packets sent and the number of data packets received.

3. End to end Delay: This is the average delay between the sending of the data packet by the source and its receipt at the corresponding receiver. This includes all the delays caused during route acquisition, buffering and processing at intermediate nodes.

4. Residual Energy: It is the remaining energy in the network when the communication is completed between the nodes in the network.

V. IMPLEMENTATION & RESULTS

5.1 Implementation

For better understanding of our work i.e. evaluation of routing protocol under MANET environment we have framed our work in three scenarios which consist of some energy efficient protocol for now we have taken AODV, DSDV, MAODV in consideration and performed a comparative study by implementing respective protocols on a custom generated topography. Then we have analyzed the results on the basis of various performance matrices such as Packet

Delivery Ratio, Throughput, End to End Delay and Residual Energy. This whole has been done using an open source Network Simulator NS-2. In our work we have performed 3 simulations First scenario is with a normalized AODV protocol. Second is for DSDV Protocol then with the MAODV Protocol on a standard MANET environment. The simulation is done using NS-2 simulator, to analyze the performance of the network by applying various types of data flow following parameters has used to evaluate the performance of the work done which are as given below:

5.2 Results

For our work to be done successfully we have used VANET scenario with varying speed of 15, 25, 35 and 45 nodes under dynamic scenario using various routing protocols.

1. Packet Delivery Ratio: Figure shows the PDR under varying mobility of nodes i.e. 15, 25, 35 and 45 nodes under AODV, DSDV and MAODV Protocols.

Table 1: Packet Delivery Ratio

PDR	AODV	DSDV	MAODV
15 NODES	98.98	97.81	99.03
25 NODES	98.43	96.76	99.53
35 NODES	98.18	95.71	99.15
45 NODES	98.37	93.92	99.28

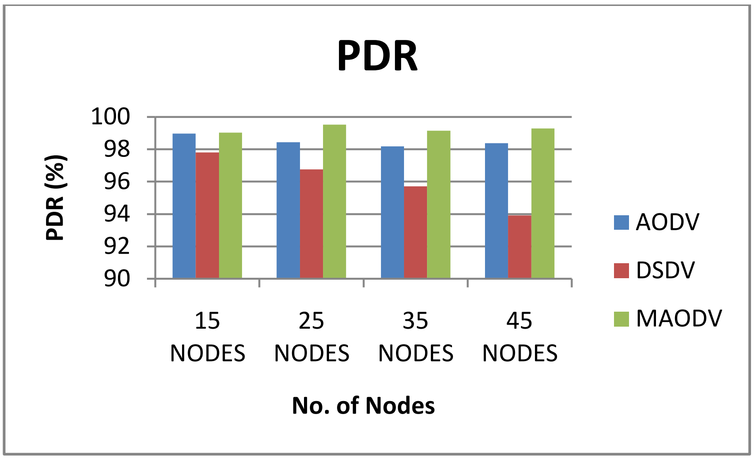

Figure 3: Packet Delivery Ratio

2. Throughput: Figure shows the Overall Throughput in Kbps under varying mobility of nodes i.e. 15, 25, 35 and 45 nodes under of AODV, DSDV and MAODV Protocols.

Table 2: Throughput

Throughput	AODV	DSDV	MAODV
15 NODES	711.98	696.98	726.49
25NODES	711.9	695.8	723.38
35 NODES	710.4	695.62	723.65
45 NODES	711.65	693.44	722.11

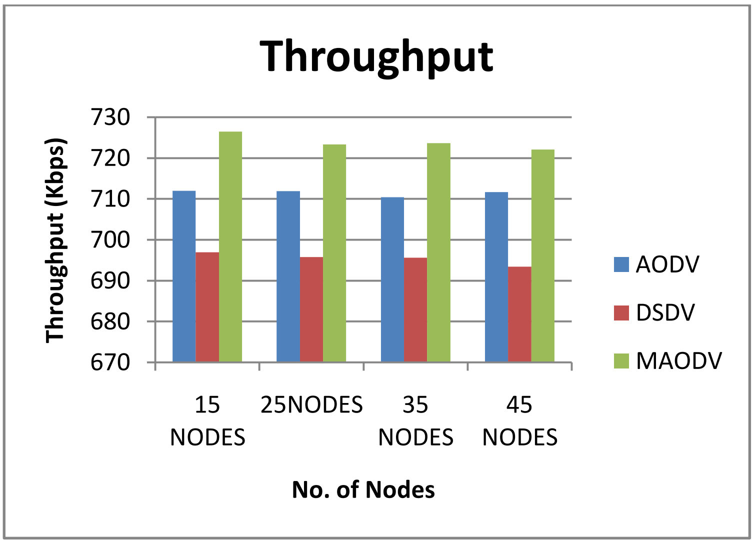

Figure 4: Throughput

3. End to End Delay: Figure shows the average End to End Delay in milliseconds under varying mobility of nodes i.e. 15, 25, 35 and 45 nodes under AODV, DSDV and MAODV protocols.

Table 3: End to End Delay

E-2-E Delay	AODV	DSDV	MAODV
15 NODES	222.597	196.704	202.633
25 NODES	142.818	261.295	124.504
35 NODES	210.927	188.467	193.458
45 NODES	234.85	174.538	210.979

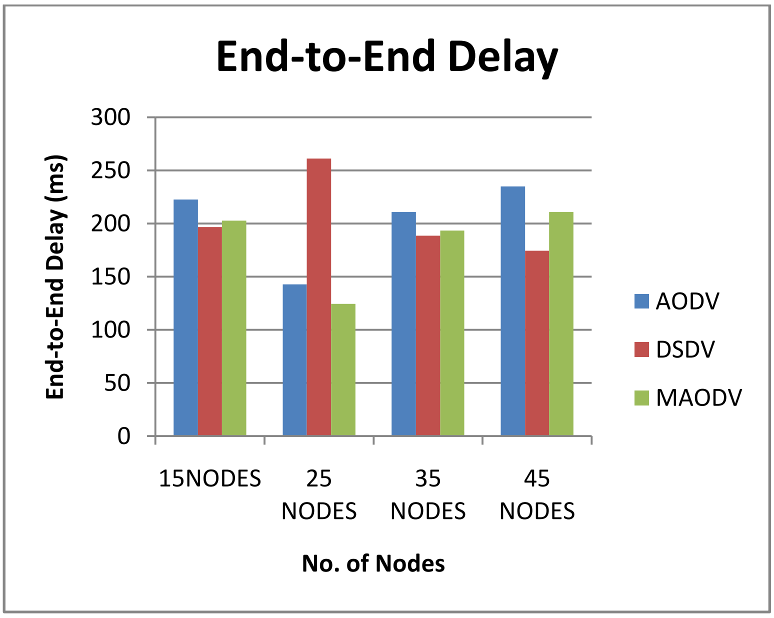

Figure 5: End to End Delay

4. Residual Energy: Figure shows the Residual Energy under varying mobility of nodes i.e. 20, 40, 60 nodes under of AODV, DSDV and MAODV.

Table 6: Residual Energy

Energy	AODV	DSDV	MAODV
10 NODES	76.42684	76.950281	76.442735
20 NODES	76.180076	76.81329	76.435113

30 NODES	76.218575	77.017147	76.428635
40 NODES	76.42321	76.927407	76.472758

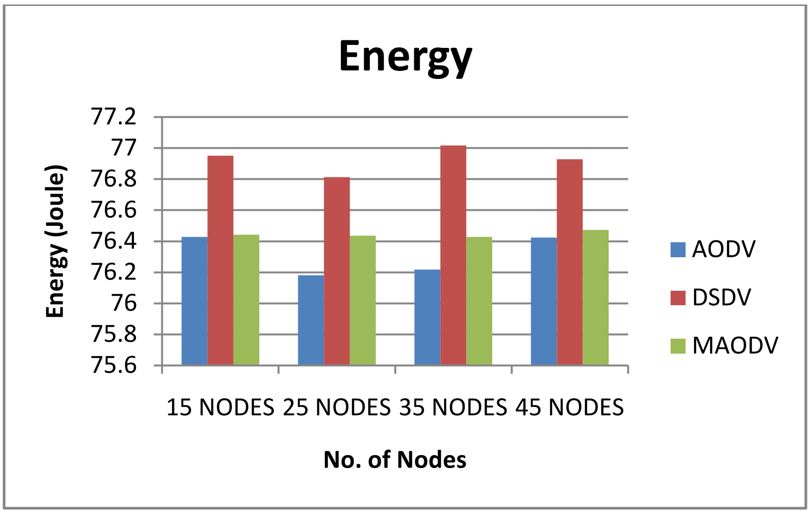

Figure 4: Residual Energy

VI. CONCLUSION:

In the proposal for upcoming thesis with theme of analyzing routing protocols in VANET, various explorations along with certain achievable are prepared. From brief overview of problem identification to study objectives and scope, multiple motivational and questionable arguments had been identified. Further a detailed discussion investigated the related and interrelated work done in VANET domain with different considerations like mobility and reliability over routing protocols. In methodology, a scalable flow of simulation along with their inputs and outputs and how to analyze results are argued. Finally with simulation design, the result of implementation AODV, DSDV and MAODV it is concluded that MAODV shows better results as compared to AODV and DSDV in terms of PDR and Throughput.

REFERENCES

1. http://en.wikipedia.org/wiki/VANET.
2. Schoch, E. Ulm Univ., Ulm Kargl, F.Weber,M. Leinmuller, T. “Communication patterns in VANETs” Volume: 46 , Issue: 11 Page(s): 119- 125,Dated on Nover 2008.
3. Saleet, H. Dept. of Syst. Design Eng., Univ. of Waterloo, Waterloo, ON, Canada Basir,O.,Langar,R.,Boutaba,R.“Region-BasedLocation-Service-Management Protocol for VANETs” Volume: 59 , Issue: 2 Page(s): 917- 931,Dated on Feb. 2010.
4. Tin-Yu Wu, Wei-Tsong Lee, Chih-Heng Ke “A Novel Geographic Routing Strategy over VANET” Page(s): 873- 879.

5. Suriyapaibonwattana, K. Fac. of Inf. Technol., King Mongkut's Inst. of Technol. Ladkrabang, Bangkok Pomavalai, C. "An Effective Safety Alert Broadcast Algorithm for VANET" Page(s): 247- 250 Dated on 21-23 Oct. 2008.
6. Abedi, O. Iran Univ. of Sci. & Technol., Tehran Fathy, M. ; Taghiloo, J. "Enhancing AODV routing protocol using mobility parameters in VANET" Page(s): 229- 235,Dated on March 31 2008-April 4 2008.
7. Abedi, O. Comput. Eng. Dept., Iran Univ. of Sci. & Technol. (IUST), Tehran, Iran Berangi, R. ; Azgomi, M.A. "Improving Route Stability and Overhead on AODV Routing Protocol and Make it Usable for VANET" Page(s): 464- 467.
8. Manvi, S.S. Dept. of Inf. Sci. Eng., REVA Inst. of Technol. & Manage., Bangalore, India Kakkasageri, M.S. ; Mahapurush, C.V. ," Performance Analysis of AODV, DSR, and Swarm Intelligence Routing Protocols In Vehicular Ad Hoc Network Environment", Page(s): 21- 25
9. Juan Angel Ferreiro-Lage ,Cristina Pereiro Gestoso, Oscar Rubiños Fernando Aguado Agelet,"Analysis of Unicast Routing Protocols for VANETs", Dated on April 20-April 25.
10. http://en.wikipedia.org/wiki/List_of_ad_hoc_routing_protocols.
11. http://en.wikipedia.org/wiki/Wireless_ad_hoc_network.
12. http://en.wikipedia.org/wiki/Mobile_ad-hoc_networks.
13. http://en.wikipedia.org/wiki/VANET.
14. http://www.ehow.com/list_6670042_vanet-routing-protocols.html.
15. http://en.wikipedia.org/wiki/AODV.
16. http://en.wikipedia.org/wiki/DSDV.