# Performance Enhancement of Routing Protocol for Various Mobility with VANET Environment

*** Khushboo Sisodiya**
**** Prof. Vijay Bisen**
***** Prof. Jitendra Singh Dodiya**

## ABSTRACT

A Vehicular Ad-Hoc Network or VANET is a form of Mobile Ad-Hoc Network or MANET which provides communication between vehicles and between vehicles and road-side base stations. A vehicle in VANET is considered to be an intelligent mobile node capable of communicating with its neighbors and other vehicles in the network. VANET is different from MANET due to high mobility of nodes and the large scale of networks. Security and traffic are the two main concerns in designing a VANET. Although there are many proposed solutions for improving securities in VANET but security still remains a delicate research subject. This research aims Creation of various mobility in VANET Scenario for NS-2 and then to create Different routing protocols with the use of Various performance matrices Like Packet Delivery Ratio and Overall Throughput. In this work firstly created scenario file for IEEE 802.11p standard which has to be used along with our TCL Script than created a TCL script consist of three routing protocols i.e. AODV, DSDV and DSR than a particular VANET scenario consist various mobility with dynamic nodes and the simulation time is 100sec.

**Keywords:** VANET, AODV, DSDV, DSR, Dynamic scenario and ns2.

* Khushboo Sisodiya, Research Scholar, Vikrant Institute of Technology and Management, Indore (M.P.), Khushboosisodiy77@gmail.com
** Prof. Vijay Bisen, Assistant Professor, Vikrant Institute of Technology and Management, Indore (M.P.), v.bisen@vitmindore.com
*** Prof. Jitendra Singh Dodiya, HOD, Vikrant Institute of Technology and Management, Indore (M.P.), Jitendra.dodiya@vitmindore.com

## I. INTRODUCTION:

VANET is the technology of building a robust Ad-Hoc network between mobile vehicles and each other, besides, between mobile vehicles and roadside units. As shown in figure 1, there are two types of nodes in VANETs; mobile nodes as On Board Units (OBUs) and static nodes as Road Side Units (RSUs). An OBU resembles the mobile network module and a central processing unit for on-board sensors and warning devices. The RSUs can be mounted in centralized locations such as intersections, parking lot or gas stations. They can play a significant role in many applications such as a gate to the Internet.

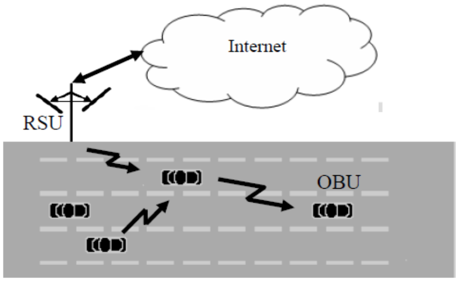


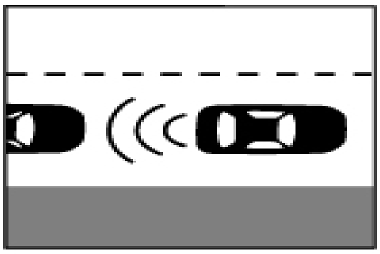

Figure 1 Node types in VANETs

## II. VANET APPLICATIONS

According to the DSRC, there are over one hundred recommended applications of VANETs. These applications are of two categories; safety and non-safety related. Moreover, they can be categorized into OBU-to-OBU or OBU-to-RSU applications. Here we list some of these applications which are as follows:

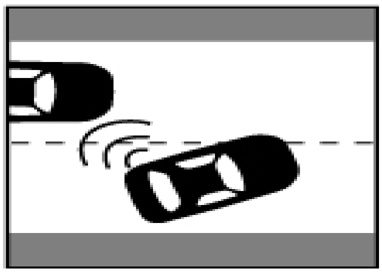
### Co-operative Collision Warning

Co-operative collision warning is an OBU-to-OBU safety application, that is, in case of any abrupt change in speed or driving direction, the vehicle is considered abnormal and broadcasts a warning message to warn all of the following vehicles of the probable danger. This application requires an efficient broadcasting algorithm with a very small latency.



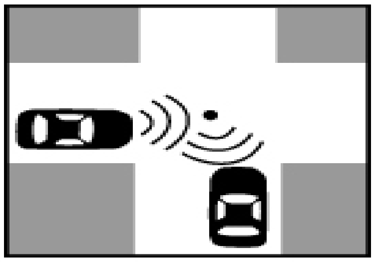
### Lane Change Warning

Lane-change warning is an OBU-to-OBU safety application, that is, a vehicle driver can warn other vehicles of his intention to change the traveling lane and to book an empty room in the approaching lane. Again, this application depends on broadcasting.



**Intersection Collision Warning**

Intersection collision warning is an OBU-to-RSU safety application. At intersections, a centralized node warns approaching vehicles of possible accidents and assists them determining the suitable approaching speed. This application uses only broadcast messages.



.

## III. VANET CHARACTERISTICS

Although VANETs, Wireless Sensor Networks and Wireless Mesh Networks are special cases of the general MANETs, VANETs possess some distinguishable characteristics that make its nature a unique one. These properties present considerable challenges and require a set of new especially designed protocols.

Although VANETs, Wireless Sensor Networks and Wireless Mesh Networks are special cases of the general MANETs, VANETs possess some distinguishable characteristics that make its nature a unique one. These properties present considerable challenges and require a set of new especially designed protocols.

- Due to the high mobility of vehicles, that can be up to one hundred fifty kilometers per hour, the topology of any VANET changes frequently and unexpectedly. Hence, the time that a communication link exists between two vehicles is very short especially when the vehicles are traveling in opposite directions. A one solution to increase the lifetime of links is to increase the transmission power, but increasing a vehicle's transmission range will increase the collision probability and degrade the overall throughput of the system. The other solution is to have a set of new protocols employing a very low latency.

- Yet another effect of the high mobility of nodes is that the usefulness of the broadcasted messages is very critical to latency. Assuming for example that a vehicle is suddenly stopping, it should send a broadcast message to worm other vehicles of the probable danger. Considering that the driver needs at least 0.70 to 0.75 sec to initiate his response [14], the warning message should be delivered at virtually zero sec latency.

## IV. ROUTING IN VANET

The routing protocols for ad-hoc network should be capable to handle a very large number of hosts with limited resources, such as bandwidth and energy. The main challenge for the routing protocols is that they must also deal with node density, meaning that nodes can appear and disappear in various scenarios. Thus, all nodes of the ad-hoc network act as routers and must participate in the route discovery and maintenance of the routes to the other nodes. For ad-hoc routing protocols it is essential to reduce routing messages overhead despite the increase of the routing table will affect the control packets sent in the network and this in turn will cause large link overheads [11].

- **Ad-hoc On Demand Distance Vector (AODV)**

The AODV protocol builds routes between nodes only if they are requested by source nodes. AODV is therefore considered an on-demand algorithm and does not create any extra traffic for communication along links. The routes are maintained as long as they are required by the sources. They also form trees to connect multicast group members. AODV makes use of sequence numbers to ensure route freshness. They are self-starting and loop-free besides scaling to numerous mobile nodes.

In AODV, networks are silent until connections are established. Network nodes that need connections broadcast a request for connection. The remaining AODV nodes forward the message and record the node that requested a connection. Thus, they create a series of temporary routes back to the requesting node.

A node that receives such messages and holds a route to a desired node sends a backward message through temporary routes to the requesting node. The node that initiated the request uses the route containing the least number of hops through other nodes. The entries that are not used in routing tables are recycled after some time. If a link fails, the routing error is passed back to the transmitting node and the process is repeated.

- **Destination-Sequenced Distance-Vector Routing (DSDV)**

If a router receives new information, then it uses the latest sequence number. If the sequence number is the same as the one already in the table, the route with the better metric is used. Stale entries are those entries that have not been updated for a while. Such entries as well as the routes using those nodes as next hops are deleted.

The availability of paths to all destinations in network always shows that less delay is required in the path set up process.

The method of incremental update with sequence number labels, marks the existing wired network protocols adaptable to Ad-hoc wireless networks. Therefore, all available wired network protocol can be useful to ad hoc wireless networks with less modification.

DSDV requires a regular update of its routing tables, which uses up battery power and a small amount of bandwidth even when the network is idle.

Whenever the topology of the network changes, a new sequence number is necessary before the network re-converges; thus, DSDV is not suitable for highly dynamic or large-scale networks. (As in all distance-vector protocols, this does not perturb traffic in regions of the network that are not concerned by the topology change.)

- **Dynamic Source Routing (DSR)**

DSR is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. The protocol is composed of the two main mechanisms of "Route Discovery" and "Route Maintenance", which work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network. All aspects of the protocol operate entirely on demand, allowing the routing packet overhead of DSR to scale automatically to only what is needed to react to changes in the routes currently in use. The protocol allows multiple routes to any destination and allows each sender to select and control the routes used in routing its packets, for example, for use in load balancing or for increased robustness. Other advantages of the DSR protocol include easily guaranteed loop- free routing, operation in networks containing unidirectional links, use of only "soft state" in routing, and very rapid recovery when routes in the network change. The DSR protocol is designed mainly for mobile ad hoc networks of up to about two hundred nodes and is designed to work well even with very high rates of mobility.

## V. IMPLIMENTATION & RESULTS

We have implemented our work i.e. Creation of VANET Environment for NS-2 and then to create Different routing protocols with the use of Various performance matrices Like Packet Delivery Ratio, End to End delay and Overall Throughput. In this work firstly, we have created scenario file for IEEE 802.11p standard which has to be used along with our TCL Script than we have created a TCL script consist of various routing protocols in this case these are AODV, DSDV and DSR than a particular VANET scenario or topology in this case it consists of various node density i.e. 20 nodes, 60 nodes and 100 nodes with limited simulation time.

In this section, three scenarios are described with three different protocols which are AODV, DSDV and DSR presented in tabular form.

TABLE 1 - VANET Scenarios

| Simulation Tool | NS-2.35 |
|---|---|
| IEEE Scenario | 802.11p |
| Propagation | Two Ray Ground |
| Network area | 20 nodes, 60 nodes and 100 nodes |
| Traffic Type | TCP |
| Antenna | Omni directional antenna |
| MAC Type | IEEE 802.11p |
| Routing Protocol | AODV, DSDV and DSR |
| Queue limit | 50 Packets |
| Simulation area (in metre) | 2 KM |
| Queue type | Droptail, |

| | |
|---|---|
| | cmupriqueue |
| **Channel** | Wireless Channel |
| **Simulation time** | 100 sec. |

For our work to be done successfully we have used VANET scenario with various node density with 100 sec under dynamic scenario using various routing protocols. We have reached to the results with the help of various performance matrices for now we have used following performance matrices.

- **Packet Delivery Ratio**

This is the fraction of the data packets generated by the TCP sources to those delivered to the destination. This evaluates the ability of the protocol to discover routes.

Figure shows the Packet Delivery Ratio for 20 nodes under various node density with AODV, DSDV and DSR routing protocols.

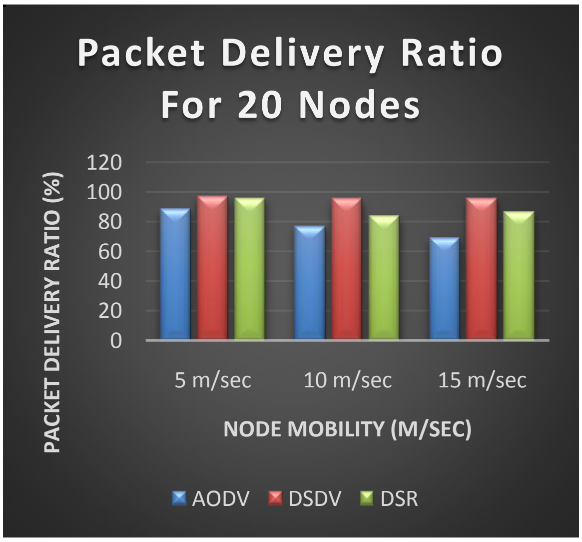



Figure 2 Packet Delivery Ratio for 20 nodes

Figure shows the Packet Delivery Ratio for 60 nodes under various node density with AODV, DSDV and DSR routing protocols.

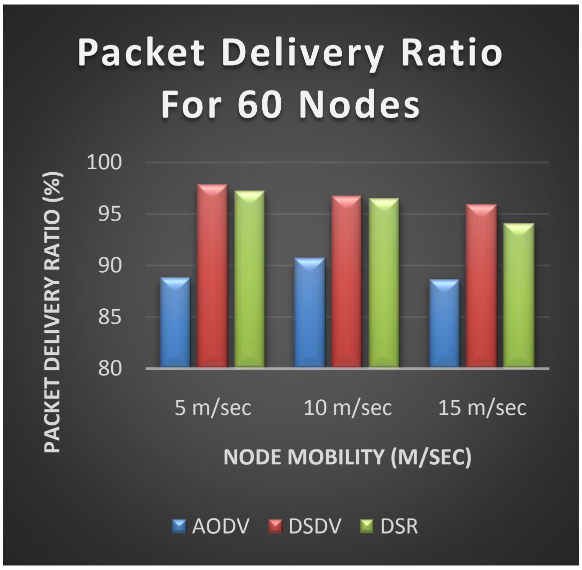



Figure 3 Packet Delivery Ratio for 60 nodes

Figure shows the Packet Delivery Ratio for 100 nodes under various node density with AODV, DSDV and DSR routing protocols.

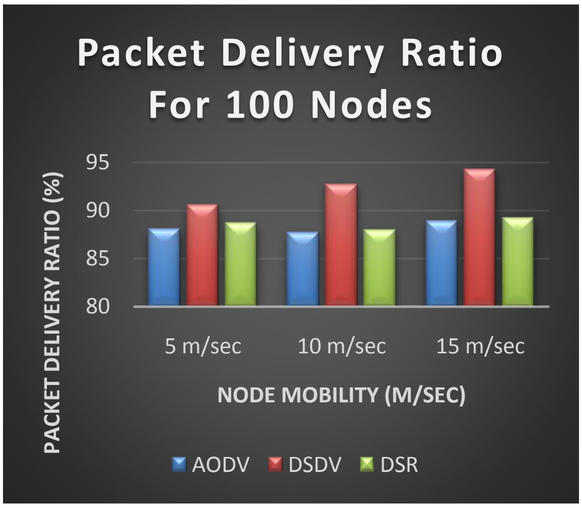



Figure 4 Packet Delivery Ratio for 100 nodes

- **Throughput**

The average rate at which the data packet is delivered successfully from one node to another over a communication network is known as throughput. The throughput is usually measured in bits per second (bits/sec). A throughput with a higher value is more often an absolute choice in every network.

Figure shows the Throughput for 20 nodes under various node density with AODV, DSDV and DSR routing protocols.

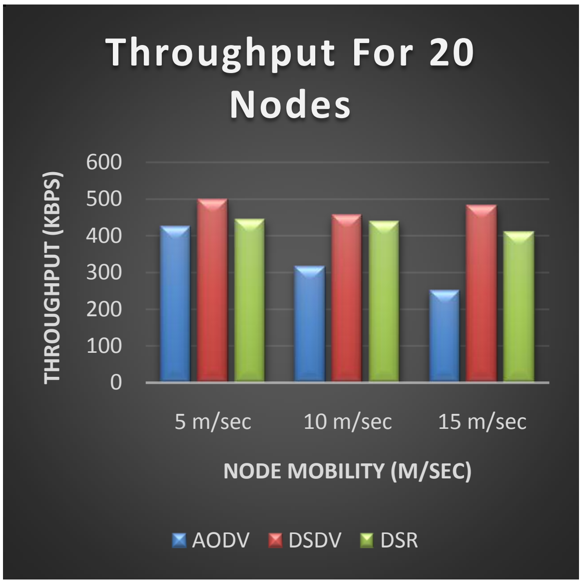



Figure 5 Throughput for 20 nodes

Figure shows the Throughput for 60 nodes under various node density with AODV, DSDV and DSR routing protocols.

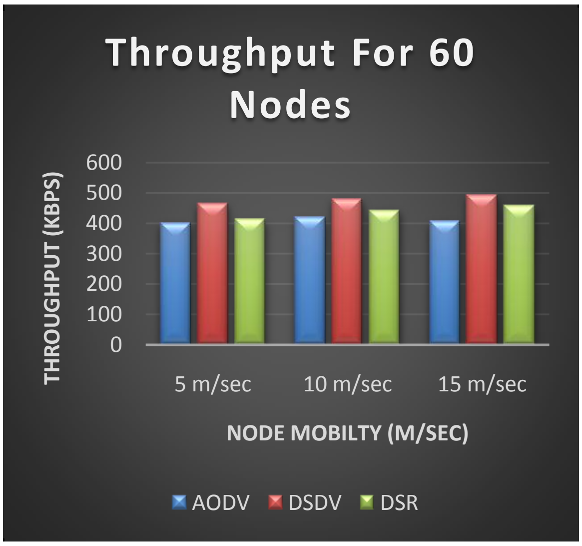



Figure 6 Throughput for 60 nodes

Figure shows the Throughput for 100 nodes under various node density with AODV, DSDV and DSR routing protocols.

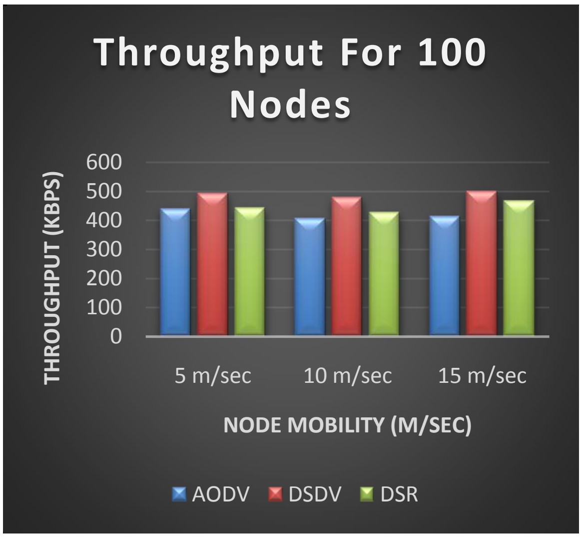



Figure 7 Throughput for 100 nodes

## VI. CONCLUSION & FUTURE WORK

Work has been done and it is concluded that Packet Delivery ratio and Throughput are high in DSDV routing protocol as compare to the AODV and DSR routing protocols.

End-to-End Delay of DSDV routing protocol is better as compare to the AODV and DSR routing protocols. From the above figure it is analyzed that DSDV has better Packet Delivery ratio as compare to AODV and DSR routing protocols for 20 nodes, 60 nodes and 100 nodes. As well as it is also analyzed that DSDV has better Throughput as compare to AODV and DSR routing protocols for 20 nodes, 60 nodes and 100 nodes.

We see many areas for future work that can expand this research. We identify four different areas for more research and where existing research can be integrated into ours:

- Complex traffic modeling and driving behaviors (mobility models) that incorporate lane changing and multiple entry and exit points can be integrated to our simulation framework to validate and evaluate our algorithm in more complex scenarios, taking them closer to real world applications.
- Inner-city traffic where more complex topologies exist and external events such as traffic lights need to be considered.
- Efficient broadcasting protocols for VANETs including hybrid protocols that use V2V and V2I communications.

## REFERENCES

1. IEEE P802.11p, “Amendment 3: wireless access in vehicular environments (WAVE),”Draft D0.26, January 2006.
2. N. Balon, and J. Guo, “Increasing Broadcast Reliability in Vehicular Ad Hoc Networks,”In Proc. of the 3rd ACM Int. Workshop on Vehicular Ad Hoc Networks VANET'06, NY,USA, pp. 104-105, 2006.
3. H. Alshaer and E. Horlait, “An optimized adaptive broadcast scheme for inter-vehiclecommunication,” In Proc. of the 61st Int. IEEE Vehicular Technology Conf. VTC’05,vol.5, pp. 2840–2844, 2005.
4. G. Korkmaz, E. Ekici, F. Özgüner, and U. Özgüner, "Urban multi-hop broadcast protocolfor inter-vehicle communication systems," In Proc. of the 1st ACM Int. Workshop onVehicular Ad Hoc Networks VANET'04, NY, USA, pp. 76-85, 2004.
5. J. Harri, F. Filali, and C. Bonnet, “Mobility models for vehicular ad hoc networks: a survey and taxonomy,” The InstitutEurecom Department of Mobile Communications,FRANCE, 2007.
6. GM advanced technology, Vehicle-to-Vehicle technology, http://media.gm.com:8221/us/gm/en/technology/advanced_technology/safety_telematics/V2V_communications.htm
7. “Assessment of the applicability of cooperative vehicle-highway automation systems tobus transit and intermodal freight: case study,” California Partners for Advanced Transitand Highways (PATH), 2004. http://repositories.cdlib.org/cgi/viewcontent.cgi?article=1629&context=its/path
8. “London Congestion Charging Technology Trials,” Transport for London, Feb 2005. http://www.tfl.gov.uk/assets/downloads/technology-trials.pdf.
9. G. Korkmaz, E. Ekici, F. Özgüner, and U. Özgüner, "Urban multi-hop broadcast protocolfor inter-vehicle communication systems," In Proc. of the 1st ACM Int. Workshop onVehicular Ad Hoc Networks VANET'04, NY, USA, pp. 76-85, 2004.
10. B. Parno, and A. Perrig “Challenges in securing vehicular networks,” In Proc. of the Int.Workshop on Hot Topics in Networks (HotNets-IV), 2005.
11. A. Huhtonen, “Comparing AODV and OLSR Routing Protocols”, session on Internetworking, April 2004.
12. A. Aaron and J. Weng, “Performance Comparison of Ad-hoc Routing Protocols for Networks with Node Energy Constraints”, IEEE INFOCOM, Hong Kong, 2004.
13. Elizabeth M. Royer, Chai-KeongToh, “A Review of Current Routing Protocols for Ad Hoc Mobile Wireless Networks”, IEEE Personal Communications, April 1999.
14. C. E. Perkins and P. Bhagwat, “Highly Dynamic Destination-Sequenced Distance Vector Routing (DSDV) for Mobile Computers”, Comp. Comm. Rev., Oct. 1994, pp. 234-44.
15. J. Broch, D. A. Maltz, D. B. Johnson, Y. Hu and J. Jetcheva, “A Performance comparison of multi-hop wireless ad hoc network routing protocols,” in Proc. ACM/IEEE Int. Conf. on Mobile Computing andNetworking, pp. 85-97, October 1998.
16. C. Adjih, M. Pascale, M. Paul, B. Emmanuel and P. Thierry, "QoS support, security and OSPF interconnection in a MANET using OLSR," Ad Hoc Networks Journal, 2008.
17. Alex Vallejo, Guiomar Corral, JaumeAbella and Agustin Zaballos, "Ad hoc routing performance study using OPNET modeler," University Ramon Llull, Barcelona ,Spain, 2006.
18. C. Adjih, M. Pascale, M. Paul, B. Emmanuel and P. Thierry, "QoS support, security and OSPF interconnection in a MANET using OLSR," Ad Hoc Networks Journal, 2008.

19. T. Clausen, P. Jacquet, A. Laouiti, P. Minet, P. Muhlethaler, A. Qayyum, and L. Viennot, "Optimized Link State Routing Protocol(OLSR)," RFC 3626 (Experimental), IETF, October 2003.
20. S. Murphy, J. J. Garcia-Luna-Aceves, “An efficient routing protocol for wireless networks,” ACM Mobile Networks and Applications Journal, pp. 183-197, Nov.1996.
21. C. E. Perkins and E. M. Royer, “Ad-hoc On-Demand Distance Vector Routing”, Proc. 2nd IEEE Wksp. Mobile Comp. Sys. And Apps., Feb. 1999, pp. 90-100.
22. D. Johnson, Y. Hu and D. Maltz, "Dynamic Source Routing Protocol (DSR) for mobile ad hoc networks," RFC 4728 (Experimental), IETF, Feb. 2007.
23. A. Seddik-Ghaleb, Y. Ghamri-Doudane, and S. M. Senouci, "Effect of ad hoc routing protocols on TCP performance within MANETs," in Proceedings of 3rd Annual IEEE Communications Society on Sensorand Ad Hoc Communications and Networks, 2006, SECON '06, vol. 3, pp. 866-873, January 2007.
24. C. Mbarushimana, A. Shahrabi, and H. Larijani, "The effect of routing protocol dynamics on TCP performance in mobile ad hoc networks," in Proceedings of the First International Conference onNetwork-Based Information Systems, NBiS 2007, Regensburg, Germany, 2007, pp. 20-29, 2007.