International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-8 Issue-12, October 2019

Performance Analysis of Various Routing Protocols for VANET Environments

N.Kumareshan, N.Prakash, N.Arun Vignesh, G.Kumaran

Abstract-Vehicular Adhoc Network (VANET) is a fast emerging and new technology that are derived from adhoc networks to provide intelligent vehicle to vehicle communication and to improve the road safety and other on road facilities. VANETs are distinct from other networks in terms of high speed movements of vehicles, unpredictable nature of vehicular density over time and specific mobility patterns associated with different scenarios. Hence designing a suitable routing protocol for VANET applications is a very critical and specific task and it is different from that of MANETs even though VANETs are derivatives of the former. In this work we discuss and compare the effectiveness of routing protocols such as, AODV, DSR and DYMO with respect to three parameters namely, throughput, average end-end delay and average jitter. The simulations were carried out in Qualnet 5.0 network simulator. From the obtained results it is concluded that DYMO edges out the other two protocols in terms of the above mentioned metrics when it comes to VANET scenarios.

Keywords : VANET, AODV, DSR, DYMO, routing.

I. INTRODUCTION

Vehicular Ad-hoc Networks (VANETs) are self organizing, infrastructure less networks that have characteristics very similar to that MANETs. VANETs are easily one of the most promising applications of the Ad-hoc networking technology and their applications are not only commercially attractive but also for road safety and management. Some very popular projects like FleetNet[5], ComCar[4], NoW[6] etc, have been successfully implemented and is proving to be very useful to the society with realistic applications. The major difference between MANETs and VANETs lies in the constituent nodes and mobility of the nodes. In this network cars and vehicles are considered to the nodes that communicate with each other in order to exchange and share information. Also the two networks are different in terms of mobility where the cars in VANET are characterized by fast movement, limited degrees of freedom in node movements and high speed variations as compared to that of the nodes in MANETs.

Revised Manuscript Received on October 30, 2019.
***** Correspondence Author
N.Kumareshan*, Associate Professor, Sri Shakthi Institute of Technology, Coimbatore, TamilNadu, India
N.Prakash, Assistant Professor, Kalaignar Karunanidhi Institute of Technology, Coimbatore, TamilNadu, India
N.Arun Vignesh, Associate Professor,Gokaraju Institute of Engineering and Technology,Hyderabad,India
G.Kumaran, Assistant Professor, Sri Shakthi Institute of Technology, Coimbatore, TamilNadu, India

In this paper we have evaluated the performance of AODV, DSR and DYMO with respect to three parameters namely throughput, average end-to-end delay and average jitter. The simulations were carried out using Qualnet 5.0 network simulator under twodifferent VANET environments that were created to mimic the urban and highway mobility patterns. The unicast routing protocols such as AODV, DSR and DYMO are discussed in rest of the paper. In Section III we present the performance evaluation of routing protocols for VANET environments and describe the scenarios modeled in detail.

II. ROUTING PROTOCOLS

Vehicular Adhoc Networks can be coined as an effective subset of Mobile Adhoc networks where most of the operating principles, characteristics and constraints are similar and mostly the difference in VANET comes in the form of high speed mobility and randomness in mobility patterns as compared to that of MANETs. Hence the routing protocols that are applicable to MANET will also support the VANET environments. It is a well known fact that AODV and DSR are the most popular and proven routing protocols supporting MANET network functionalities [1] and here we take into account one more protocol, called the DYMO protocol [2] which is essentially a modification of the AODV.

A. AODV:

Ad-hoc on demand distance vector routing protocol (AODV) is a packet routing protocol designed for wireless and mobile networks. This protocol establishes a connection between source node and destination node. In a network a node wants to sends a data to other node means it first sends a route request packet to a nearby node. A nearby node sends that packet to its all neighbor node in a network. During this transmission a particular node establishes a route table and stores the information in the route table. This type of protocol supports both unicasting and multicasting.AODV is considered as an on –demand protocol because it does not create any extra traffic for communication along links. This type of protocols is silent until establishment of connection. The intermediate nodes in the network forward the packet and store them in the route table.

B.DSR:

Dynamic source routing protocol (DSR) is a trouble-free and proficient routing protocol for wireless networks. It is similar to AODV but it contains route discovery and route maintenance. This type of protocol allows the network to be self organized and self configurable, it does not depend on any existing network or infrastructure. During the packet transmission it does not use periodic routing message and it will generate error message due to failure in the links.

The intermediate node ID is stored in the header of dynamic source routing protocol. In AODV protocol while transmitting a packet from source node to destination node the destination address is carried by the packets but in DSR protocol the full routing information is carried by data packets.

C.DYMO:

Dynamic MANET on-demand routing protocol (DYMO) is a protocol for Mobile adhoc networks. is type of protocol work on both proactive and reactive routing protocol. A node wants to send a data to the destination node means it establishes a connection between its neighbor node, a neighbor node receives a route request and stores the packet and sends route reply to the source node. A intermediate node again sends a route request to its neighbor node and the connection is established means it receives route reply from its neighbor node. Similarly a neighbor node establishes a connection and sends the data to the destination node and receives a route reply from the destination node.DYMO provides various enhanced features like covering possible MANET-Internet gateway scenarios and implementing path accumulation.

III PERFORMANCE EVALUATION

For evaluating the performance of routing protocols mentioned above, we used the Qualnet 5.0 network simulator [10]. The simulation results were compared at the application level with respect to throughput, average end-to-end delay and average jitter. To analyze the protocol performance we considered two different types of scenarios: a scenario that resembles the traffic inside city/urban environment and another scenario that resembles the traffic in a freeway.

Scenario Characteristics

Urban scenario:

In this scenario a total of 10 nodes were considered for the simulation and they were placed at random places in the terrain of area 1000m X 1000 m. Fig. 2 shows an exemplary scenario that has been created using the Qualnet simulator.

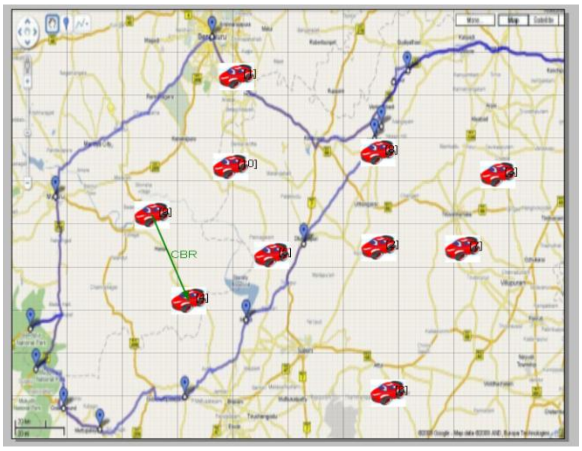

Fig. 1. Scenario for Urban traffic

In order to define the mobility for the nodes in the setup we used Random Waypoint Mobility model with a pause time of 30 seconds. The maximum speed associated with each node was set to 10mps. The total simulation time was set to 4 minutes and a single CBR connection was setup between two nodes for a length of 2 minutes. The same scenario was used to analyze the three different routing protocols namely AODV, DSR and DYMO.

TABLE I
SIMULATION SETUP FOR URBAN TRAFFIC

Simulation Area	1000m X 1000m
No. of Nodes	10
Mobility	RWP
Pause Time	30s
Application Used	CBR
Simulation Time	4 minutes

Freeway scenario:

The freeway mobility based simulation scenario was constructed with a simulation terrain of area 2000m X 2000m. An exemplary figure depicting the node placement and scenario setup is given in Fig. 2.

TABLE II
SIMULATION SETUP FOR FREEWAY TRAFFIC

Simulation Area	2000m X 2000m
No. of Nodes	10
Mobility	FWP
Application Used	CBR
Simulation Time	4 minutes

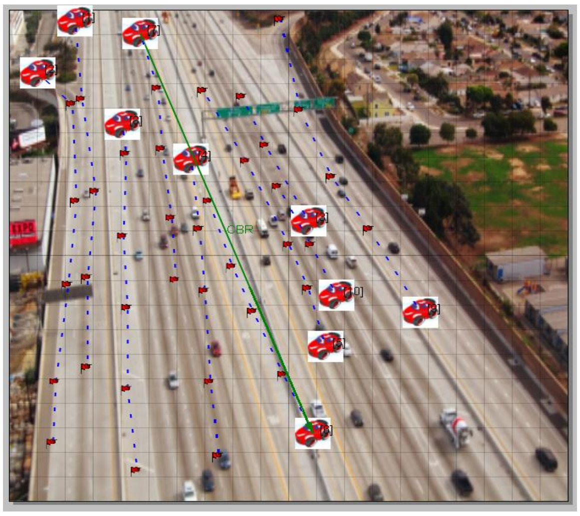

Fig. 2. Scenario for Freeway traffic

Similar to the urban mobility based simulation the number of nodes was set to 10 with a total simulation time of 10 minutes. A single CBR connection of time length 4 minutes was set between two nodes. We employed fixed waypoint mobility to all the nodes considered for simulation and a mobility pattern that is analogous to vehicular movement along two opposite lanes in a highway was achieved.

The nodes were made to move along fixed flag points at constant speed although the speed of individual nodes differ from each other just like as the cars that are travelling along a freeway. The same scenario was used to test the three different routing protocols AODV, DSR and DYMO.

Retrieval Number: L3904081219/2019©BEIESP
DOI: 10.35940/ijitee.L3904.1081219
Journal Website: www.ijitee.org

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-8 Issue-12, October 2019

IV SIMULATION RESULTS

Three different set of simulations were carried out on both the scenarios, urban mobility based model and freeway mobility based model. Each of the simulation was done corresponding to one of the three routing protocols, AODV, DSR and DYMO. The simulation was analyzed with respect to three parameters associated with the application layer namely Throughput, Average end-to-end delay and Average jitter.

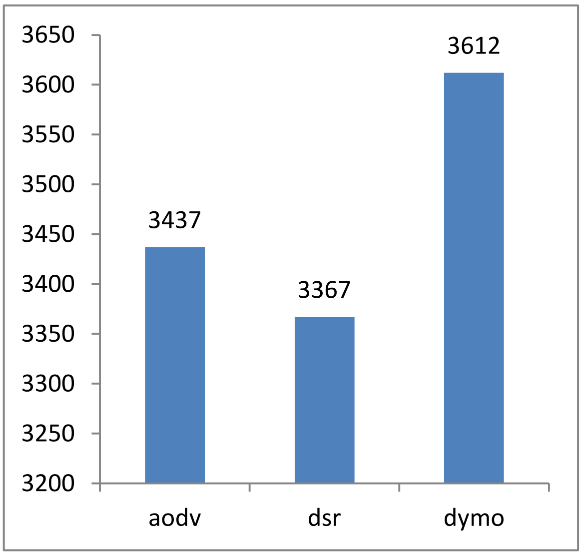

Fig.3: Throughput for Freeway mobility based model

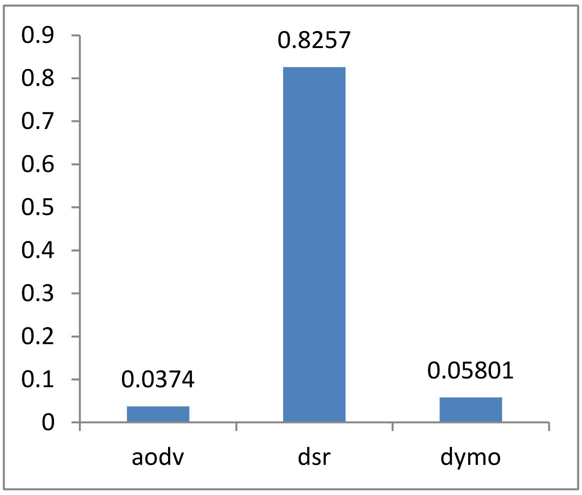

Fig.4: Average End-to-End Delay for Freeway mobility based model

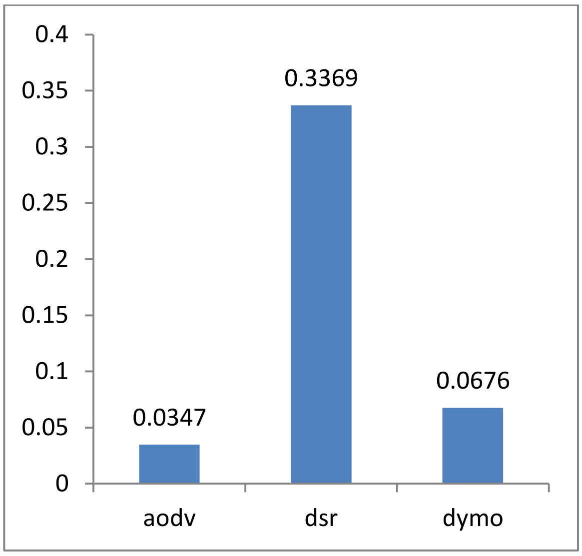

Fig.5: Average jitter for freeway based mobility model

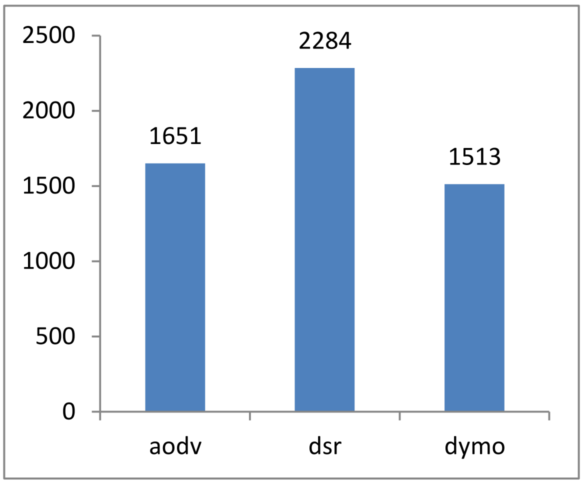

Fig.6: Throughput for urban based mobility model

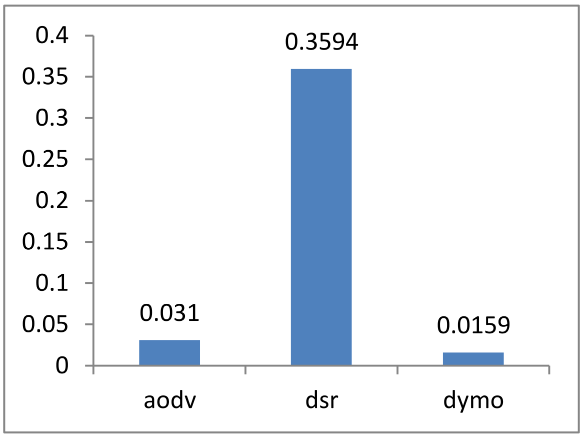

Fig.7: Average End-to-End delay for urban based mobility model

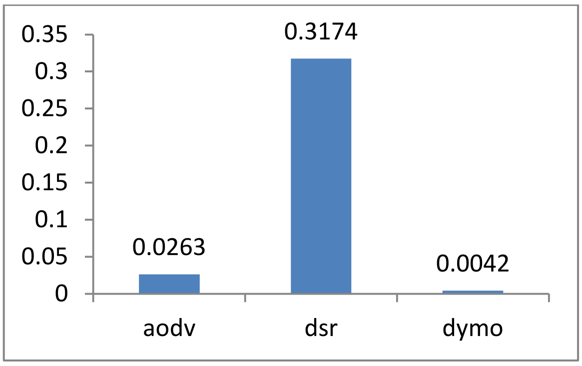

Fig.8: Average Jitter for urban based mobility model

V CONCLUSIONS

From the results obtained it is clear that DYMO protocol is best suited for VANET environments, especially in the scenario for freeway traffic where DYMO easily overtakes AODV and DSR in terms of throughput, end-to-end delay and jitter. A good routing protocol should have a high degree of throughput while the average end-to-end delay and average jitter should be very minimal. The Throughput of DYMO was found to be 3612 bits/second whereas AODV and DSR achieved around 3437 and 3367 bits/second respectively. DYMO protocol worked with the least of delays of all the three protocols and it was around 0.05801 seconds. Surprisingly, the throughput for DSR protocol slightly overtakes the other two routing protocols in the scenario resembling urban traffic but still this cannot be taken as a single parameter to validate the effectiveness of that particular routing protocol over the other two since DSR suffers from huge end-to-end delay and average jitter of around 0.3594 and 0.3174 seconds respectively, which is not suitable for VANET. So when we take into consideration the combination of all the above mentioned parameters DYMO comes out as the preferable and best suited routing protocol for VANET environments.

VI. FUTURE WORK

This work gives a preliminary idea about the VANET environments in both urban and freeway based traffic but cannot be considered as an accurate one hence in future more realistic mobility models like the SUMO mobility generated can be used to model the traffic and mobility patterns for urban and freeway based traffic more accurately and then the simulations may be carried out to verify this preliminary work.

REFERENCES

1. Asma Tuteja, Rajneesh Gujral and Sunil Thalia, "Comparitive Performance Analysis of DSDV, AODV and DSR Routing Protvols in MANET using NS2", 2010 IEEE International Conference on Advances in Computer Engineering, pp.330-333
2. Christoph Sommer and Falko Dressler, "The DYMO Routing Protocol in VANET Scenarios", 66th IEEE conference on Vehicular Technology, 2007, pp. 16-20.
3. Jerome Harri, Fethi Filali, Christian Bonnet, "On Meaningful Parameters for Routing in VANETs Urban Environments under Realistic Mobility Patterns", AutoNet 2006 1st IEEE workshop on Automotive Networking and Applicaions (in conjunction with IEEE Globecom 2006).
4. Ericson, "Communication and Mobility by Cellular Advanced Radio", ComCar project, www.comcar.de, 2002.
5. W. Franz, H. Hartenstein, and M. Mauve, Eds., Inter-Vehicle-Communications Based on Ad Hoc Networking Principles-The Fleet Net Project. Karlshue, Germany: Universitatverlag arlsuhe,November 2005.
6. The Network on Wheels Project, http://www.informatik.uni-mannheim.de/pi4/lib/projects/now
7. C. Perkins, E. Belding-Royer, and S. Das, "Ad hoc On-Demand Distance Vector (AODV) Routing," RFC 3561, July 2003.
8. Johnson, D. B. and Maltz, D. A. (1996), "Dynamic Source Routing in Ad Hoc Wireless Networks," Mobile Computing, T. Imielinski and H. Korth, Eds., Ch. 5, Kluwer, pp. 153–81.
9. Chakeres, I., Belding-Royer, E., Perkins, C.: Dynamic MANET On-Demand (DYMO) Routing. Internet-Draft, draft-ietf-manet-dymo-06.txt (2006).
10. Qualnet 5.0 Network Simulator, www.scalable-networks.com/products/qualnet.
11. Kumareshan, N, Poongodi, P. "Improve the Quality of Experience (QOE) using Rotating Cluster Head Technique in Distributed Network" American Scientific Publishers, Sensor letters, Volume 13, Number 12, December 2015, pp. 1028-1034(7).
12. Poongodi, P, Kumareshan, N "Analysis of Dynamic Overlay Architecture for the Quality of Experience (QoE) Improvement in Wireless Networks" Springer, Wireless Personal Communications, September 2016, Volume 90, Issue 2, 2016, pp 503–514.
13. Kumareshan, N, Poongodi, P, "Dynamic Mobility Management Architecture to Improve Quality of Experience (QoE) in Wireless Networks" IEEE Xplore,
14. DOI: 10.1109/ISCO.2016.7726964.

BIOGRAPHY

Dr.N.Kumareshan received his Bachelor's degree in Electronics and Communication Engineering from SNS College of Technology at Anna University in 2009. He received master degree in Communication Systems from Bannari Amman Institute of Technology at Anna University in 2011. He received Doctor of Philosophy in Information and Communication Engineering at Anna University in 2016.He is currently an Associate Professor in Sri Shakthi Institute of Engineering and Technology. His main areas of research interest are Wireless Communications and Networking.

Mr.N.Prakash received his Bachelor's degree in Electronics and Communication Engineering from Bannari Amman Institute of Technology at Anna University in 2012. He received master degree in Embedded Systems from Kumaraguru College of Technology at Anna University in 2014. He is currently an Assistant Professor in Kalaignar Karunanidhi Institute of Technology. His main areas of research interest are Embedded Systems and Wireless networks.