UACEE International Journal of Advances in Computer Networks and its Security – IJCNS
Volume 3 : Issue 3 [ISSN 2250 – 3757]
Publication Date : 09 September 2013

Comparative Reliability Analysis of AODV and DSR Protocols in VANET using ESTINET Simulator

Sanjay Batish, Devan Thakur, Amardeep Dhiman, Sanjeev Sofat

***Abstract* - Vehicular Adhoc Network (VANET) is an emerging field of networks which enables inter-vehicle communication.**

Reliability is one of the most important factors in VANET. Many times, the messages exchanged between the vehicles are emergency messages. It is very important that such emergency messages reach concerned vehicles in time otherwise the consequences might be disastrous. In this paper we study and compare reliability of two important protocols – AODV and DSR using ESTINET simulator in different traffic density scenarios. Finally we conclude which protocol performs better in different scenarios.

***Keywords* - AODV, DSR, VANET Reliability, Drop packets, collision, ESTINET**

I. Introduction

VANET [1] is a fast emerging and promising technology as far as intelligent and safe transportation systems are concerned. It can be expected that soon in near future vehicles will come equipped with support for VANET. The need for VANET is majorly derived by increasing number of vehicles and hence road accidents taking toll of a million lives every year.

VANET enables communication among vehicles moving on the road. Vehicles can communicate among themselves and share information about their surroundings. For example if a vehicle meets with an accident on a highway, it can send an emergency message to the vehicles following behind. These vehicles can relay this message further behind, thus preventing the vehicles following from crashing into each other.

Sanjay Batish, Head, Comp. Center
PEC University of Technology
Chandigarh, India

Devan Thakur, M.E. , Comp. Sc. Deptt.
PEC University of Technology
Chandigarh, India

Sanjeev Sofat, HOD, CSE Deptt.
PEC University of Technology
Chandigarh, India

Amardeep Dhiman, HOD, Comp. Sc. Deptt.
UCOE, Punjabi University
Patiala, India

VANET is a part of Mobile Adhoc Network (MANET), but with different requirements. Different requirements emerge due to different environmental conditions like high mobility and varying vehicle densities. However, since both are related to mobile communication, MANET protocols like AODV [2] and DSR [3] can be applied to VANET as well. Handshakes and acknowledgements are avoided in VANET because communication in VANET is generally very short and may last a few seconds or even microseconds. So it's very important that more and more messages get delivered in time, even without any support for acknowledgement.

Vehicle density is a major factor affecting the delivery of messages. Low and high density scenarios may have a higher packet loss as compared to moderate traffic density conditions. This is because in low density scenario, vehicles might rarely be in each other's range whereas in high traffic density there is too much interference leading to high packet loss.

Reliability of a protocol directly depends on the packets delivered by that protocol. Or in other words, reliability of a protocol inversely depends on the packets lost by that protocol during some communication period. Here in this paper, we compare the packets dropped and number of collisions in AODV and DSR routing protocols during a communication period in different traffic density scenarios.

The rest of this paper is organized as follows. In section II, we describe related work in this area. Section III presents the background and reliability parameters. In section IV simulation setup is described and section V shows the results. Finally we come to a conclusion in section VI.

II. Related Work

There are a number of research papers that have compared AODV and DSR protocols but most of them have been focused on MANET. The others based on VANETs focus on overall performance comparison of these protocols.

N. Liu et al. compared performance of AODV, DSR and DSDV protocols in VANET on a freeway scenario [4]. Sanjay Batish et al. compared performance of AODV, DSR and DSDV with and without deploying road side units (RSU) [5]. Tajinder Kaur et al. compared performance of AODV and DSR in two traffic density scenarios [6]. S S Manvi et al. compared AODV, DSR and SWARM

Intelligence based routing protocol by varying mobility, load and size of the network [7].

In this paper, we focus on studying reliability performance of AODV and DSR protocols in a UDP based environment by varying traffic densities.

III. Background

In this paper we have used two important reliability parameters – Drop packets and collisions to compare AODV and DSR protocols in case of VANET.

Since acknowledgements are generally avoided in VANET, we don't use a reliable protocol like TCP. UDP does not have acknowledgment functionality, so the source never knows which packets were lost while on the way to destination. So the selection of a protocol in VANET must be such that the protocol enables maximum packet delivery rate.

Number of packets dropped and collision packets are two important parameters used to study reliability of a protocol.

Number of packets dropped: It indicates the number of packets that did not reach the destination successfully. They might have lost in the path from source to destination due a number of reasons like congestion, queue overflow, faults in hardware etc. Lower packets dropped means better reliability of the protocol.

Number of collision packets: It indicates the number of packets that were lost as a result of collision among them. Lower collisions mean better reliability.

A. *AODV (Adhoc On Demand Distance Vector)*

In AODV, communication starts with route discovery. To discover a route to the destination, the source node sends a broadcast RREQ (Route Request) message. On receiving this message, a node records its previous hop in its routing table and broadcasts it further. The recording of the previous hop is termed as backward learning. The intermediate nodes keep on broadcasting the RREQ until the destination is reached. The destination sends back a RREP (Request Reply) message through the same path using the nodes recorded by the process of backward learning. Again while sending the RREP, the previous hop is recorded by each of the node until the source is reached, thus, forming a forward path to the destination. The source and destination can now communicate using this established path. When the path breaks, a new RREQ broadcast takes place.

B. *DSR (Dynamic Source Routing)*

In DSR, the source decides the path to be used to route data to the destination. The path is copied into each of the packet sent to the destination. This enables the packets to follow the path specified by the source. DSR uses AODV style broadcast method to discover a route to the destination. But it does not use backward learning. The RREQ packet records each of the nodes it traverses from source to the destination. The destination uses this recorded route from the RREQ packet to route RREP packet to the source. The destination then extracts this route from RREP and uses it further to send any data packets to the destination. The destination can send multiple RREP packets for different paths. Thus, the source may have different options for routes leading to the destination. When one route breaks an alternate route can be used by the source.

IV. Simulation Setup

The simulations have been performed in ESTINET [8] simulator. ESTINET provides a convenient way to design the topology and apply relevant protocols to the simulations.

The given table shows the various parameters for the simulation.

TABLE I. SIMULATION SETUP

Parameters	**Traffic Density**		
	Low	***Moderate***	***High***
Vehicle count	10	20	30
Simulation Area	700m X 500m		
Vehicle Speeds	0 – 20 m/sec		
Simulation Time	50 seconds		
Simulator	ESTINET		
Vehicle Type	802.11p (agent-controlled)		

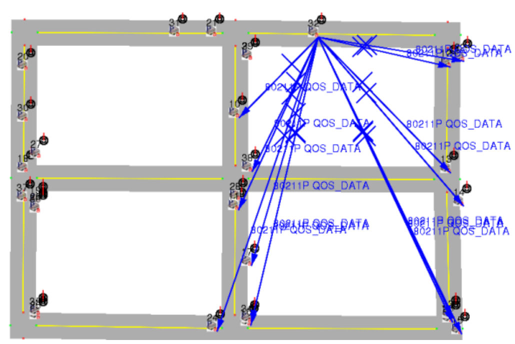

Figure 1. Topology design in ESTINET Simulator

V. Simulation Results

We simulated AODV and DSR in three traffic density scenarios: low, moderate and high. Other than these two protocols, we also considered a case where no specialized VANET routing protocol was used. This particular case is represented by W/O in the following graphs.

A. *Drop Packets*

In the following graphs we have plotted the number of packets dropped against time for the two protocols - AODV, DSR and the third case i.e. without applying a specialized VANET protocol for different traffic density scenarios.

1) Low Density Traffic

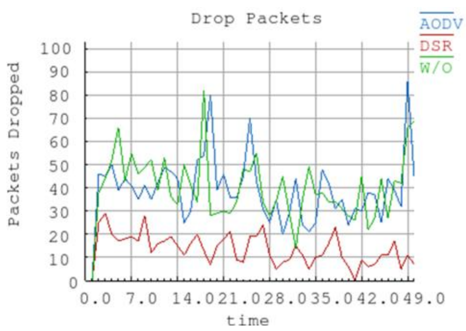

Figure 2. Packets dropped in low vehicle density scenario

2) Moderate Density Traffic

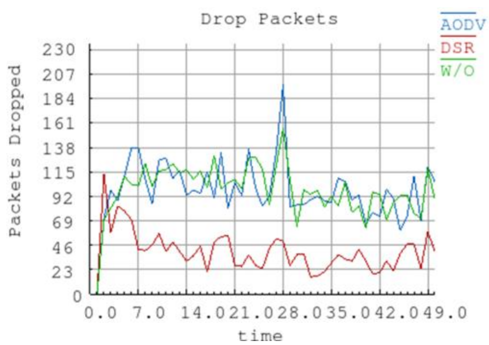

Figure 3. Packets dropped in moderate vehicle density scenario

3) High Density Traffic

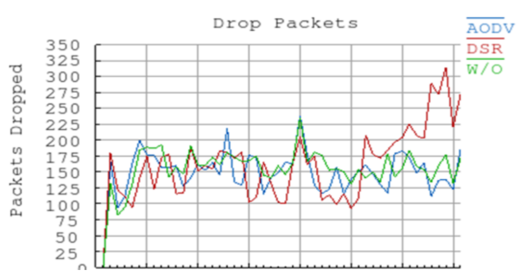

Figure 4. Packets dropped in high vehicle density scenario

TABLE II. NODES V/S PACKETS DROPPED

Nodes/Protocol	AODV	DSR	Without Protocol
10	1962	879	2008
20	4926	2036	4910
30	7494	8550	7838

B. *Number of Collisions*

The following graphs show a plot of number of collisions against time for different traffic density scenarios.

1) Low Density Traffic

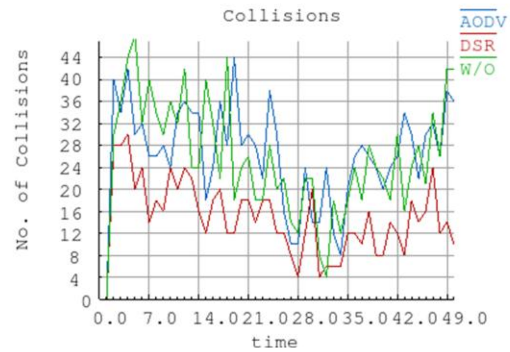

Figure 5. Number of collisions in low vehicle density scenario

2) Moderate Density Traffic

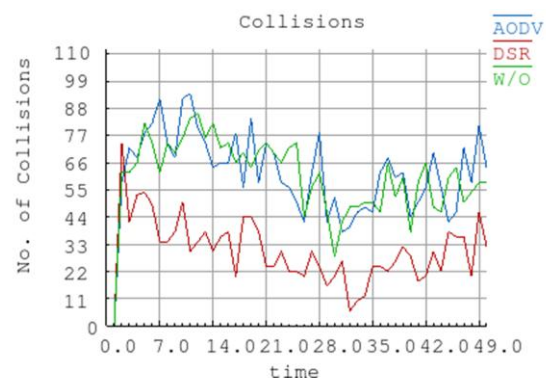

Figure 6. Number of collisions in moderate vehicle density scenario

3) High Density Traffic

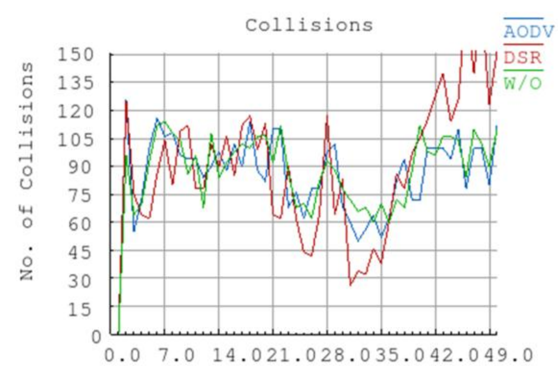

Figure 7. Number of collisions in high vehicle density scenario

TABLE III. NODES V/S COLLISIONS

Nodes/Protocol	AODV	DSR	Without Protocol
10	1326	774	1301
20	3113	1556	3033
30	4312	4732	4423

VI. Conclusion

The results above show that in low to moderate traffic density scenarios, DSR provides better reliability than AODV and with no protocol cases. However, when the traffic density increases the reliability of DSR degrades badly in comparison to AODV. AODV performs better in cases with high traffic density scenarios.

So to conclude DSR is more reliable and hence more suited in low to moderate traffic density scenarios. However, in cases of high density AODV provides better reliability than DSR.

References

[1] VANET, available online at http://en.wikipedia.org/wiki/Vehicular_ad-hoc_network
[2] C. E. Perkins, E. M. Royer, "Ad-hoc on-demand distance vector routing", the proceedings of Second IEEE Workshop on Mobile Computing Systems and Applications, WMCSA '99, pp. 90-100, 25-26 Feb. 1999
[3] D. B. Johnson, D. A. Maltz, and Y-C. Hu., "The dynamic source routing (DSR) protocol for mobile ad hoc network", IETF MANET Working Group, Internet Draft, July 2004.
[4] N. Liu, H. Qian, J. Yan, Y. Xu, "Performance analysis of routing protocols for vehicle safety communications on the freeway", Anti-counterfeiting, Security, and Identification in Communication, 2009. On page(s): 85 – 88.
[5] Monika, S. Batish, A. Dhiman, "Comparative Study of AODV, DSDV and DSR Routing Protocols in Vehicular Network Using EstiNet Simulator", International Journal of Scientific & Engineering Research, Volume 3, Issue 6, June-2012.
[6] T. Kaur, A.K. Malhi, A.K. Verma, "Simulation and Comparison of AODV and DSR Routing Protocols in VANETs", International Journal of Computing, Intelligent and Communication Technologies (IJCICT), Volume 1, Issue 1, October 2012.
[7] S.S. Manvi, M.S. Kakkasageri, C.V. Mahapurush, "Performance Analysis of AODV, DSR, and Swarm Intelligence Routing Protocols In Vehicular Ad Hoc Network Environment", International Conference on Future Computer and Communication, pp.21-25, 3-5 April 2009
[8] ESTINET, available online at www.estinet.com, http://www.estinet.com/university03.php?lv1=1&PageID=2

About Author (s):

Sanjay Batish is currently pursuing Ph.D from UCOE, Punjabi University, Patiala. He is currently working as the Head of Computer Center at PEC University of Technology, Chandigarh..

Devan Thakur is a B.Tech and is currently pursuing M.E. from PEC University of Technology, Chandigarh.

Amardeep Dhiman is currently the Head of Department, Computer Science Engineering at UCOE, Punjabi University, Patiala. He has handled a number of research projects governed by UGC and has publications in a number of international journals.

Sanjeev Sofat is currently the HOD at CSE Department, PEC University of Technology, Chandigarh. He has handled many projects of Department of Information Technology and has published a number of papers in International Journals.