EXPERIMENTAL ANALYSIS OF AODV AND DSR WITH VARYING VEHICLE MOBILITY AND DENSITY IN VANET SCENARIO

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ABSTRACT

In last three decade ,tremendous improvement is made in research area of wireless adhoc network and now a days ,one of the most attractive research topic is inter vehicle communication i.e. realization of mobile adhoc network . A rich literature is available in vehicular networks to explore the special characteristics of VANET but all the protocols are majorly geography based. It has some unique characteristics which make it different from other adhoc routing protocols as well as difficult to define any exact mobility model and routing protocol because of their changing mobility patterns. In this research paper , the performance of two on-demand routing protocols AODV and DSR has been analysed by means of packet delivery ratio,end-to-end delay,packet loss ratio and normalised routing load with varying speed and node density under TCP connections.

KEYWORDS

MANET, VANET, routing ,VN ,AODV,DSR,NS2,etc.

1. INTRODUCTION

MANETs consist of mobile/semi mobile nodes with no existing pre-established infrastructure. They connect themselves in a decentralized, self-organizing manner and also establish multi hop routes. If the mobile nodes are vehicles then this type of network is called VANET(vehicular ad-hoc network). One important property that distinguishes MANET from VANET is that nodes move with higher avg. speed and number of nodes is assumed to be very large. Vehicular networks consist of vehicles and Road Side Units (RSU) equipped with radios. Plummeting cost of electronic components and permanent willingness of manufacturers to increase road safety and to differentiate themselves from their competitors vehicles are becoming “Computer on Wheels” rather than “Computer N/W on Wheels”. Convergence of forces from both the public and private sector implies that in not-too-distant future we are likely to see the total birth of vehicular n/w.

In 1999, U.S. federal communication Commission (FCC) allocated a block of spectrum in 5.850 to 5.925 GHz band for applications primarily intended to enhance the safety of our networks on roads systems. In fact BMW, Fiat, Renault and some other organizations have united to develop a car-to-car communication consortium, dedicated precisely to impose Vehicle to Vehicle (V2V) and Vehicle to infrastructure (V2I) communication, vehicle share safety related information and access location based services. The wealth of information that could be obtained from vehicular networks is quite enormous, ranging from location and speed of emergency alerts and request for roadside assistance. In particular, many envisioned safety related applications require that the vehicles continuously broadcast their current position and speed in so called heart beat messages.

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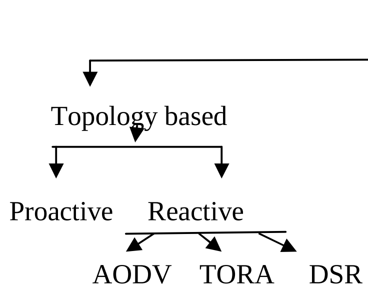
This messaging increases the awareness of vehicles about their neighbors' whereabouts and warns drivers off dangerous situations. But the very richness of information also threatens to cause deployment to come to a grinding halt if there is adverse consumer reaction to technology.

In this paper we start the discussion with the introduction of vehicular adhoc networks. Next we give an overview of routing protocols and then simulation results and analysis.we end with conclusion.

2. Overview of Routing Protocol[3]

The routing protocols for vehicular adhoc networks are categorised in following two categories.but in context with our paper we discuss only two reactive routing protocols for analysis-AODV and DSR.



2.1 Ad-hoc on demand distance (AODV) [1,2]

Adhoc on demand distance vector routing protocol is a reactive routing protocol suited mostly for mobile adhoc networks. This protocol takes some properties from DSDV and DSR. It creates routes on demand when source wants to send data to destination.It uses a destination sequence number which makes it different from other routing protocols. AODV handles route discovery with route request(RREQ) and route reply (RREP) messages. For any link failure it sends a route error (RERR) message to upstream node.when a node listens a error message a new route discovery process is initiated.

2.2 Dynamic Source Routing (DSR) [1,2]

The Dynamic Source Routing (DSR) is on demand routing protocol based on the method of source routing that is designed for adhoc networks to reduce the amount of bandwidth consumed by control packets. There are two major phases in DSR-route discovery and route maintenance. It does not generate periodic routing messages. The routes are stored in route cache. When node wants to send data to destination it checks its route cash .If the route is found it starts sending data. Whenever the data link layer detects a link failure , route error message is sent back to source node. Then again route discovery is initiated.

AODV and DSR have significant differences. In AODV when a node sends a data packet to destination node then data packet only contains the destination address. On the other hand in DSR the full routing information is contained in data packet which causes more routing overhead than AODV.

3. SIMULATION SETUP AND PERFORMANCE METRIC

For simulation purpose we used ns2.34 which is discrete event simulation and open source. To measure the performance of AODV and DSR we used same scenario for both protocols.[4,5,6]

3.1 Simulation Parameters

The simulation parameters are summarised in Table 1.

Parameter	values
Networks simulator	Ns-2.34
Channel	WirelessChannel
Mobility model	Random way point(RWP)
Mac Layer	Mac/802_11
Interface Queue	Queue/Droptail/PriQueue
Link Layer	LL
Antenna	Antenna/OmniAntenna
X ,Y dimension of topography	1000,1000
Number of nodes	10,30,70
Simulation time	600s
Routing Protocol	AODV , DSR

3.2 Performance Metric

There are several performance metrics at which routing protocols can be evaluated for network simulation . We use following metrics for our purpose:

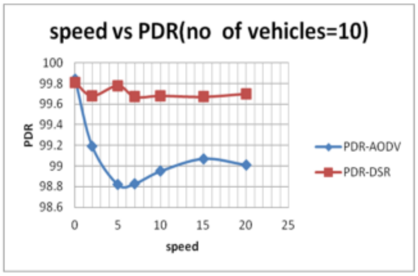
1.Packet Delivery Ratio
2. End-to-end Delay
3.Packet Loss ratio
4.Normalised routing Load

4. SIMULATION RESULTS AND ANALYSIS

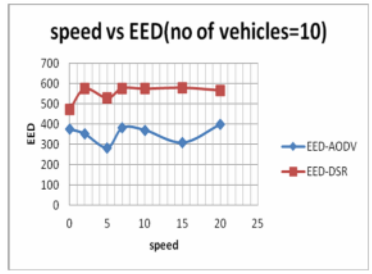
The simulation is divided into two categories
1.vehicle mobility (i.e. varying speed)
2.vehicle density (i.e. varying number of vehicles with constant speed)[7,8,9,10]

4.1.Vehicle Mobility

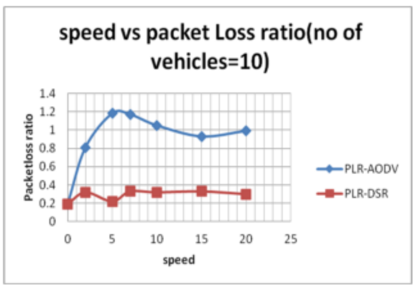
fig.1(a,b,c,d) shows the simulation results of varying vehicle mobility for low density(less no of vehicles)



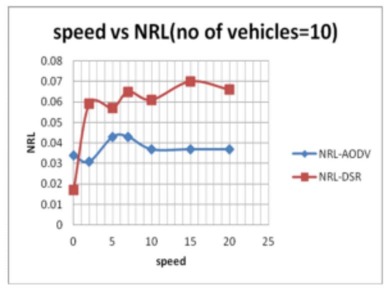
(a)packet delivery ratio



(b)end to end delay



(c) packet loss ratio

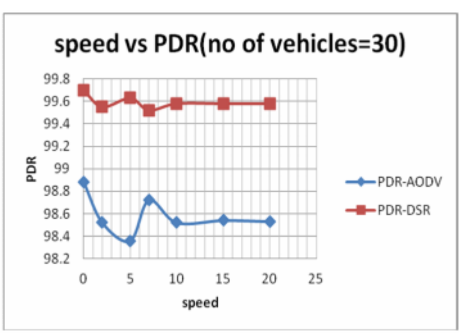


(d) normalised routing load

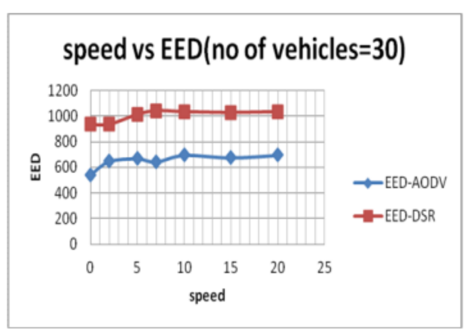
Fig.1

By analysing results with varying vehicle mobility as shown in fig.1 (a)it is concluded that At low speed both protocols shows similar results. But as the speed increases AODV performance consistently drops down and then take a small rise. but DSR remains almost stable with speed variation. At high speed (20m/s) there is only .70% of difference in both the protocols.. Fig.(b) shows that EED of DSR is more than AODV for all speed changes. Packet loss ratio(PLR) is same for both protocols at low speed and 69%high for AODV than DSR at high speed.(fig.c). Fig(d) reveals that NRL of AODV is 78% high than DSR at maximum speed.

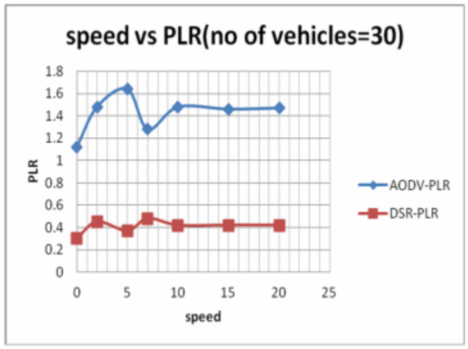
Fig.2(a,b,c,d) shows the simulation results of varying vehicle mobility for average density(avg.no of vehicles).

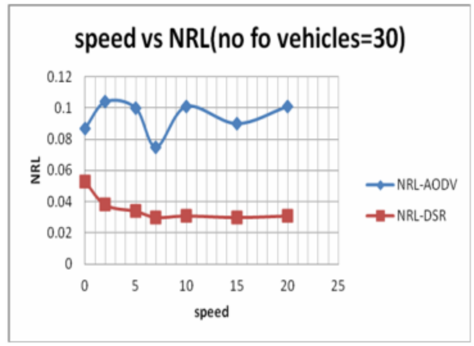


(a)packet delivery ratio



(b) end to end delay



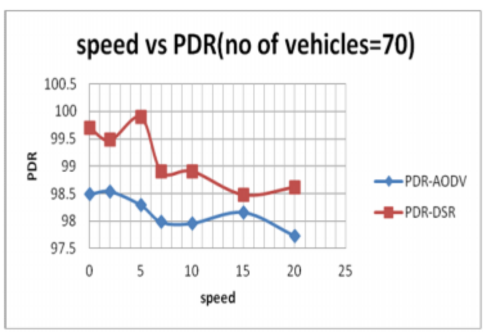


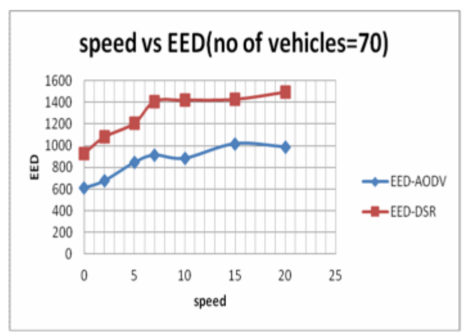
(c)packet loss ratio (d)normalised routing load

Fig.2

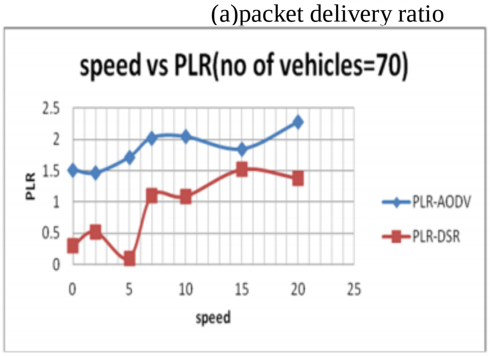
By analysing results with varying vehicle mobility as shown in fig.2 (a)it is concluded that as the speed increases AODV performance consistently drops down and then take a small rise and remains constant afterwords. but DSR remains almost stable with speed variation. At high speed (20m/s) there is only 1.070% of difference in both the protocols.. Fig.(b) shows that EED of DSR is more than AODV for all speed changes.both the protocols don't show much change with speed change..PLR is high for AODV than DSR at high speed.(fig.c). Fig(d) reveals that NRL of AODV is high than DSR at maximum speed.

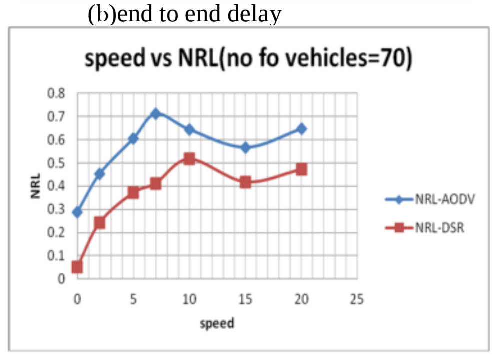
Fig.3(a,b,c,d) shows the simulation results of varying vehicle mobility for high density(high.no of vehicles).





(a)packet delivery ratio (b)end to end delay





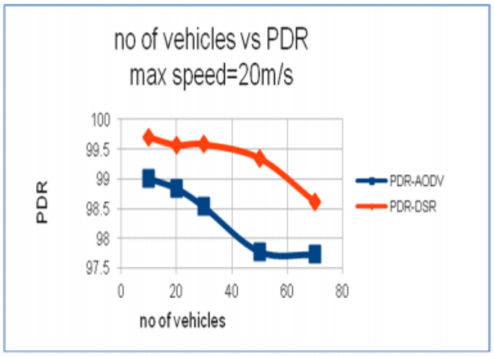
(a)packet loss ratio (b)normalised routing load

Fig3.

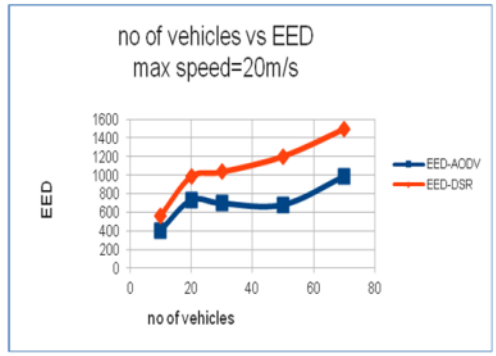
By analysing results with varying vehicle mobility as shown in fig.3 (a)it is concluded that as the speed increases PDR for both protocols consistently drops down .At high speed (20m/s) there is only .91% of difference in both the protocols. Fig.(b) shows that EED of DSR is more than AODV for all speed changes. PLR is 39%high for AODV than DSR at high speed.(fig.c). Fig(d) reveals that NRL of AODV is 26% high than DSR at maximum speed.

4.2.Vehicle Density

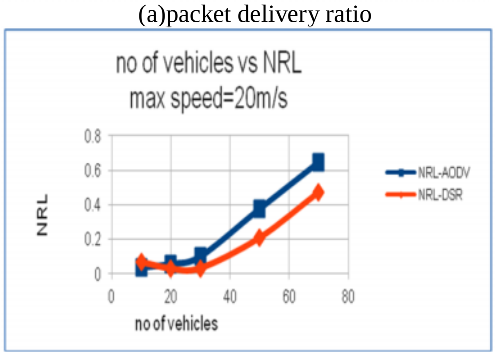
Fig.4(a,b,c,d) shows the simulation results of varying vehicle density with a maximum speed of 20m/s.



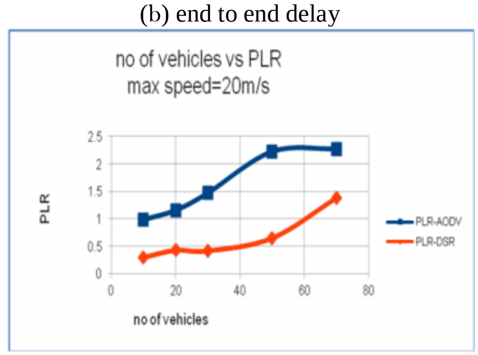
(a)packet delivery ratio



(b) end to end delay



(c)normalised routing load



(d)packet loss ratio

By analysing results with varying vehicle density as shown in fig.4 (a)it is concluded that as the number of nodes increases PDR for both protocols consistently drops down .Fig.(b) shows that EED of DSR is more than AODV there is 51%of difference between two.PLR is 26%high for AODV than DSR when there are maximum no of nodes.(fig.d). Fig(c) reveals that NRL of AODV is high than DSR at maximum density.

5.CONCLUSION

From our experimental analysis it has been concluded that in low density and low speed the data packets received are maximum. It has been measured as packet delivery ratio(PDR). Fig.1 reveal that PDR of both the protocols AODV and DSR is high when the speed is very low. But When the speed increases PDR of AODV drops down .But on an average PDR of both the protocols is said to be avg to high.Packet loss ratio(PLR) and normalised routing load/overhead(NRL) has been seen to be almost average in low to high speed. This can be seen in fig. (c) and (d) . End-to-end delay for AODV is high for low to high speed and low for DSR.(fig.(b)). The poor delay performance of DSR is mainly attributed to aggressive use of caching and lack of any mechanism to expire stale routes or to determine the freshness of routes when multiple route choices are available.PLR for AODV is high than DSR but it does not mean that all the packets are dropped. The delivery ratio is sufficiently high.

In high density when there are more number of nodes,at low speed PDR of AODV is high but avg for high speed. It is shown in fig.3(a).NRL is average for both the protocols in all speed variations.(fig.3(d)).Packet loss ratio(PLR) for AODV is high from low to high speed and for DSR it is average at low speed and high at high speed.(fig.3(c)). Fig.3(b) shows that the End-to end delay of DSR is more than AODV from low to high speed.

Based on the important metrics PDR and EED and after analysis of tables we can conclude that AODV is candidate protocol for real traffic connections. We can choose AODV as our base protocol for optimization for future work.

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