PERFORMANCE EVALUATION OF AODV 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 networksto explore the special characteristics of VANET but all the protocols are majorly geography based.So to explore much in this context we compare from the literature ,the environment for MANET and VANET and then we choose AODV as the base protocol for evaluation.Simulation is performed on Ns-2.34.Based on the simulation results obtained ,the performance of AODV is analysed and compared in different density and velocity variants with respect to packet delievery ratio.

KEYWORDS

MANET, VANET, routing ,VN ,ITS ,AODV,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[1]. 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

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messages. 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 specify various unique characteristics of VANET that differentiate it from MANET. We then examine routing techniques for both MANET and VANET and make a comparison study. Then we describe AODV routing technique in detail and give simulation results of AODV on NS2.Finally we end with the discussion and few useful references.

2. UNIQUE VANET CHARACTERISTICS AND COMPARISON WITH MANET

2.1 Unique VANET characteristics

Though Vehicular network share common characteristics with conventional ad-hoc sensor network such as self organized and lack of central control. VANET have unique challenges that impact the design of communication system and its protocol security[2]. These challenges include-

1. Potentially high number of nodes. Regarding VANETs as the technical basis for envisioned Intelligent Transportation System (ITS) we expect that a large portion of vehicles will be equipped with communication capabilities for vehicular communication. Taking additionally potential road-side units into account, VANET needs to be scalable with a very high number of nodes.

2. High mobility and frequent topology changes. Nodes potentially move with high speed. Hence in certain scenarios such as when vehicle pass each other, the duration of time that remains for exchange of data packets is rather small. Also, intermediate nodes in a wireless multi-hop chain of forwarding nodes can move quickly.

3. High application requirement on data delivery. Important VANET applications are for traffic safety to avoid road accidents; potentially including safety-of-life. These applications have high requirements with respect to real time and reliability. An end-to-end delay of seconds can render a safety information meaningless.

4. No confidentiality of safety information. For safety application the information contained in a message is of interest for all road users and hence not confidential.

5. Privacy. Communication capabilities in vehicles might reveal information about the driver/user, such as identifier, speed, position and mobility pattern. Despite the need of message authentication and non-repudiation of safety messages, privacy of users and drivers should be respected in particular location privacy and anonymity.

2.2 Comparison of MANET and VANET

Mobile Ad-hoc networks and Vehicular Ad-hoc networks are very much similar on various technical grounds but following are some parameters on the basis of which we can contrast both environments.

Sr.No.	Parameters	MANET	VANET
1.	Cost of production	Cheap	Expensive
2.	Change in n/w topology	Slow	Frequent and very fast
3.	Mobility	Low	High
4.	Node density	Sparse	Dense and frequently variable
5.	Bandwidth	Hundred kps	Thousand kps
6.	Range	Upto 100m	Upto 500m
7.	Node Lifetime	Depends on power resource	Depend on lifetime of vehicle
8.	Multihop routing	Available	Weakly available
9.	Reliability	Medium	High
10.	Moving pattern of nodes	Random	Regular

Table1: Comparison of MANET and VANET[20]

4. ROUTING PROTOCOLS FOR VANET

In a vehicular environment three possible types of architectures are possible.See fig1

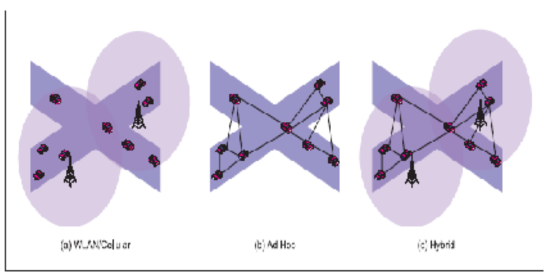
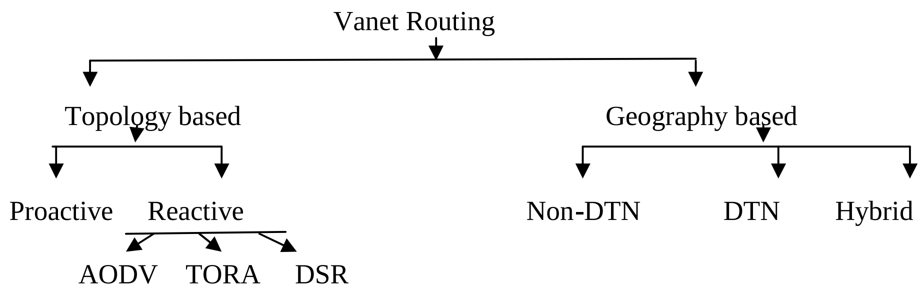


Fig.1-source[12]

While it is all but impossible to come up with a routing approach that can be suitable for all VANET applications and can efficiently handle all their inherent characteristics, attempts have been made to develop some routing protocols specifically designed for particular applications like safety applications, content delivery in future vehicular networks, provision of comfort applications. Many routing techniques have been proposed for traditional ad-hoc networks but due to different characteristics of VN , they fail to fit in the scenario. In this paper we classify the routing into these categories:



4.1 Ad-hoc routing and analysis of AODV for VANET

As mentioned earlier MANET and VANET share the same principles, thus most ad-hoc routing protocols are applicable such as AODV and DSR. however most of the studies have shown that both these protocols suffer from highly dynamic nature of nodes i.e. they give low communication throughput.here we give detailed mechanism of AODV and after simulation studies and analysis present the results.

4.1.1 AODV Mechanism

Route Discovery-AODV[21] performs route discovery by broadcasting RREQ to all its neighboring nodes.The broadcasted RREQ contains address of source ,destination their sequence numbers,broadcast id and a counter which counts how many times RREQ has been generated for a particular node.when a source broadcast a RREQ it acquires a RREP from its neighbours or that neighbours rebroadcast RREQ to their neighbours by incrementing in the hop count.node drops repeated RREQ to make the communication loop free.

4.1.2 AODV Route Table management

AODV route table management is needed to avoid those entries of nodes that do not exists in the route from source to destination.Route table management is done with the help of destination sequence numbers.

4.1.3 AODV Route Maintenence

When a node detects that a route is not valid anymore for communication it deletes all the related entries from the routing table for those invalid routes.It then sends the RREP to current neighbouring nodes that route is not valid anymore.

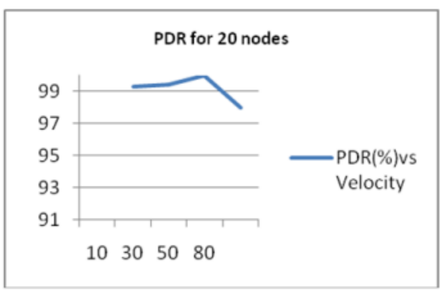
5. SIMULATION ENVIRONMENT

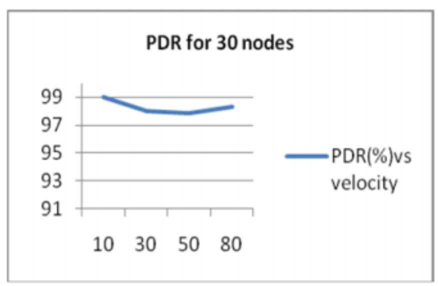
The ns-2 simulator is used for the experiments. It is a discrete event simulator developed by theUniversity of California at Berkeley. Following are the configuration set .

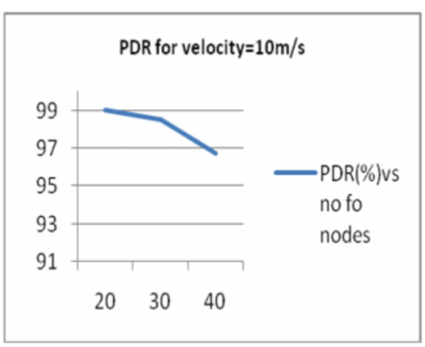
Parameter	values
Channel	Channel/WirelessChannel
Propagation model	Propagation/TwoRayGround
Network Interface	Phy/WirelessPhy
Mac Layer	Mac/802_11
Interface Queue	Queue/Droptail/PriQueue
Link Layer	LL
Antenna	Antenna/OmniAntenna
X dimension of topography	500
Y dimension of topography	500
Number of nodes	20 or 30 or 40
Seed	3.0
Simulation time	1000s
Routing Protocol	AODV

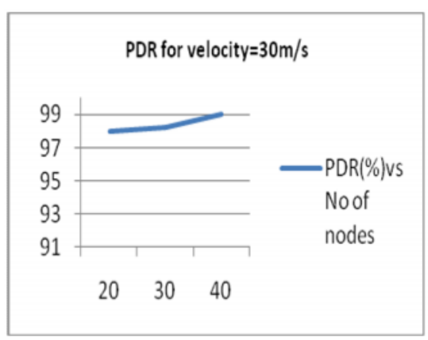
6. RESULTS AND ANALYSIS

Simulations were conducted by keeping the number of nodes constant and varying the maximum velocity of the nodes. The PDR obtained for 20, 30 nodes are depicted in figures 1 and 2. As we can observe, AODV performs consistently better for increasing number of nodes. Another set of simulations were performed by varying the number of nodes, keeping the maximum velocity of the nodes constant. The PDR obtained for V-max = 10, 30 m/s are shown in figures 3,4 respectively. We can notice that, again, AODV provides a better PDR in most cases. Thus, reactive routing can be trusted to provide reliable delivery of packets for varying number of nodes.









7. REFERENCES

[1] Bryan Parno, Adrian Perrig, "Challenges in Securing Vehicular Networks", Poster presented at USENIX Security Symposium,August-04.
[2] Emanuel Fonseca,A.Festag,"A survey of Existing approaches for secure ad-hoc routing and their applicability to VANET", NEC Network Laboratories,March 2006.
[3] Frank Kargl "Secure Routing for Vehicular Networks.". SEVECOM Kick-off Workshop,2nd Feb,2006.
[4] M.Abolhasan,T.Wysocki,E.Dutkiewicz,"A review of routing protocols for mobile ad-hoc networks",www.elseviercomputerscience.com
[5] C.liu,J.Kaiser,"A survey of mobile adhoc network routing protocols"university of Ulm technical report series,No.2003-08,germany 2005.
[6] Y.B.Ko,N.H.Vaidya,"Location Aided Routing in mobile ad-hoc networks",proceedings ACM/IEEE Mobicomm,oct 1998.
[7] Mahdipour, E. Rahmani, A.M. Aminian, E. ," Performance Evaluation of Destination-Sequenced Distance-Vector (DSDV) Routing Protocol", Proceeding March 2009 , page(s): 186 – 190, ISBN: 978-0-7695-3567-8.
[8] Z.Hass,"Zone routing protocols for adhoc networks",internet draft,draft-ietf-manet-zrp-02.txt.
[9] Martin Mauve, et al, "A Survey on position based routing in ad-hoc networks ", IEEE Network Magazine 15 (6), pp. 30-39, November 2001.
[10] R.Dube,C.D.Rais,K.Wang,S.Tripathi,,"Signal stability based adaptive routing (SSA) for ad-hoc mobile networks",computer science technical report,TR-3646,pages 22,1996.
[11] Elizabeth M. Royer,"Multicast Ad hoc On-Demand Distance Vector (MAODV) Routing",internet draft,mobile ad-hoc networking group,march 2000.
[12] Fan li,Yu Wang,"Routing in vehicular adhoc networks:A survey",IEEE vehicular technology magazine,june 2007.
[13] V. Namboodiri, M. Agarwal, and L. Gao, "A study on the feasibility of mobile gateways for vehicular ad-hoc networks," in Proceedings of the First International Workshop on Vehicular Ad Hoc Networks, pp. 66–75, 2004.
[14] B. Karp and H.T. Kung, "GPSR: Greedy perimeter stateless routing for wireless networks," in Proceedings of the ACM/IEEE International Conference on Mobile Computing and Networking (MobiCom), 2000.
[15] C. Lochert, M. Mauve, H. Füßler, and H. Hartenstein, "Geographic routing in city scenarios," ACM SIGMOBILE Mobile Computing and Communications Review (MC2R), vol. 9, no. 1, pp. 69–72, Jan. 2005.
[16] J. Blum, A. Eskandarian, and L. Hoffman, "Mobility management in IVC networks," in IEEE Intelligent Vehicles Symposium, 2003.
[17] R.A. Santos, A. Edwards, R. Edwards, and L. Seed, "Performance evaluation of routing protocols in vehicular adhoc networks," The International Journal of Ad Hoc and Ubiquitous Computing, vol. 1, no. 1/2, pp. 80–91, 2005.
[18] M. Durresi, A. Durresi, and L. Barolli, "Emergency broadcast protocol for intervehicle communications," in ICPADS '05: Proceedings of the 11th International Conference on Parallel and Distributed Systems—Workshops (ICPADS'05), 2005.
[19] G. Korkmaz, E. Ekici, F. Özgüner, and Ü. Özgüner, "Urban multi-hop broadcast protocol for inter-vehicle communication systems," in ACM International Workshop on Vehicular Ad Hoc Networks, pp. 76–85, 2004.
[20] T.H.Kim,W.K.Hong,H.Kim,"An effective multihop broadcast in vehicular adhoc networks", proceedings 20th International Conference on Architecture of Computing Systems, ARCS 2007, March 2007,springer.
[21] C.Perkins,S.Das,"Adhoc on demand distant vector routing(AODV),"IETF,RFC 3561,2003.

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