JOURNAL OF COMPUTATION IN BIOSCIENCES AND ENGINEERING

Journal homepage: http://scienceq.org/Journals/JCLS.php

Research Article Open Access

Performance Inquiry of AODV, DSDV And DSR Based On VANET Environment

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Received: July 14, 2014, Accepted: August 2, 2014, Published: August 12, 2014.

ABSTRACT

Vehicular ad-hoc network (VANET) is self-organizing helmed networks that facilitate communication in between high speed moving road vehicles like cars, trucks, busses etc. in VANET network each vehicle behave as a mobile terminal and can stir in any direction with varying speeds that makes extremely vibrant environment. The existing mobile ad-hoc network (MANET) routing protocol lacks in some aspects for VANET because of recurrent change in motion and topology of this network. Recently many approaches has been implemented in this area but still there is scope of modernization. Geographical information is used to transfer packets between intersections on the path, mitigation of path's consideration to individual node movements. The renovation of existing protocol or pioneering new idea of routing in VANET environment will be a milestone and the performance evaluation will be a nice approach towards that. In this paper we evaluate performance of AODV, DSDV and DSR routing protocol on the basis performance metric packet delivery ratio, end to end delay, and throughput of the network. The Simulation studies are analyzed using NS2.

Keywords: AODV, DSDV, DSR, VANET, End-to-end Delay, Throughput.

INTRODUCTION

Vehicular Ad hoc Network (VANET) are a subclass of Mobile Ad-hoc Network (MANET) where vehicles moving at high speed are the nodes which are used to exchange data in the network. In this environment vehicle can move anywhere, any direction with varying speed that make the frequent changes in the topology and mobility pattern of VANET network that present the key difference from the MANET [1, 2, 3,13]. Today all major vehicle manufacture companies and industries focus in this area for reducing communication issues in between vehicles [4,13]. Many researchers has given their contribution in in this area of research like CarNet, CarTALK 2000, DRIVE, FleetNet and COMCAR projects [5-10,13]. The performance of the routing protocol degrades with speed and size of the network, so designing of efficient routing protocols are always challenging in high mobility environment that is main characteristic of VANET.

In VANET network for exchanging data the entire mobile nodes behave as a router as well source and destination node. The DSDV (Destination-Sequenced Distance Vector) routing protocol is based on the Distributed Bellman-Ford algorithm. Each node in DSDV maintains a next-hop table, which it exchanges with its neighbors. The Dynamic Source Routing (DSR) protocol is based on secure routing method. In this algorithm the mobile node whose want to send data in network knows the complete path of destination and store that in route cache. The data packet carries the source path in the packet header. Instead depending on the intermediate mobile node routing table information this protocol use the source routing path. So the path length in between source to destination node affects the routing overheads. The broken link in this protocol does not repair locally by route maintenance process that shows shortcoming of this protocol. It has two important phases, route discovery and route maintenance [11, 12, 13]. AODV protocol combines the mechanisms of DSR and DSDV for routing. For each destination, AODV creates a routing table like DSDV and using mechanism of routing route maintenance and discovery as DSR.

Therefore, it is safe to accept that some of MANET characteristics are deployed on VANET structure. For instance, both network protocols are considered as multi-hop mobile networks which are having the dynamic topology. Additionally, there is no centralized entity to manage the packet routing across the network but the vehicles themselves route data packets from source to destination. Being infrastructure independent is counted as another specification of MANET and pure VANET. However some mobility patterns in VANET protocol make it distinguished from MANET, where the nodes are restricted to travel in specific boundaries and paths such as roads or highways and therefore not in random directions. Being limited in storage capacity and low processing power also is considered as MANET specifications while VANET is not suffering from those limitations due to deployment of vehicles which is fully guaranteed in providing sufficient storage capacity and high processing power.

Additionally vehicles are known as long range communication entities with enough battery power. Moving in high velocity and unpredictable vehicle density are other disparities between VANET and MANET that cause the lifetime communication link shorter between vehicles or mobile nodes[14, 15].

VANET is one of the latest technologies that have been used in wireless communication particularly in vehicular communication in urban areas. Road accidents seem to be inevitable with the fast growth of number of vehicles being deployed in urbanized societies. VANET protocol provides the opportunity to eliminate the accidents occurrence by providing some information about traffic congestion, lane changing and road condition. Communication between vehicles are either "unicast" by which communication is provided for vehicles that are one hop away or "multicast" by which delivering data packets to specific destination is possible through multi-hop communication. Multicasting which is more likely than the other propagation method must be done precisely due to the need of delivering packets to destinations within specific time.

VANET also known as Inter-Vehicle Communication (IVC) has severely drawn a significant interests on not only research communities but also industries. Association of Electronic Technology for Automobile Traffic and Driving[16] implemented in Japan, California PATH[17], Chauffeur of EU[18] and European Project CarTALK[19] have demonstrate the mechanisms and approaches to couple two or more vehicles in order to communicate with each other in the form of a train in addition to investigate the shortcomings related to safe and comfortable driving.

A new task group called IEEE 802.11p [20] is formed by IEEE in order to provide wireless communication in vehicular environment. Due to high velocity, dynamic topology and unreliable channel conditions, many challenging issues are proposed in VANET for further in depth investigations such as data packet delivery delay, dissemination mechanisms, data sharing and security issues. In this article, routing protocol which is considered as a very vital issue in VANET is investigated. Here we are considering AODV, DSR and DSDV routing protocol based on two parameters: vehicle velocity and the vehicle density. In the first scenario, the performance of the aforementioned routing protocols is investigated as the velocity increases. The second scenario demonstrates the performance of routing protocols based on various vehicle densities[21].

In this paper we have evaluate routing performance of AODV, DSDV and DSR routing protocol in cluster based VANET environment where number of mobile node increases the size of cluster. The performance evaluation is based on the metric of packet delivery ratio, end to end delay and throughput of the network [21].

The rest of the paper is organized as: section 1 discuss about the overview of AODV, DSDV and DSR routing protocols. Related work is present in section 2. The simulation setup and performance metric is discussed in section 3.The paper is concluded in the section 4.

RELATED WORKS

Ad Hoc on Demand Distance Vector (AODV): AODV is the on-demand (reactive) topology-based routing protocol[21] in which backward learning procedure is utilized in order to record the previous hop (previous sender) in the routing table. In the backward learning procedure, upon receipt of a broadcast query (RREQ) which contains source and destination address, sequence numbers of source and destination address, request ID and message lifespan, the address of the node sending the query will be recorded in the routing table. Recording the specifications of previous sender node into the table enables the destination to send the reply packet (RREP) to the source through the path obtained from backward learning [21].

A full duplex path is established by flooding query and sending of reply packets. As long as the source uses the path, it will be maintained. Source may trigger to establish another query-response procedure in order to find a new path upon receiving a link failure report (RERR) message which is forwarded recursively to the source. Being on-demand to establish a new route from source to destination enables AODV protocol to be utilized in both unicast and multicast routing. Figure 1 illustrates the propagation of RREQ packet and path of RREP reply packet to the source [21].

Multiple RREP messages may be delivered to the source via different routes but updating the routing entries will occur under one condition which is if the RREP has the greater sequence number. A message with higher sequence number represents the more accurate and fresh information. Several enhanced approaches were proposed to eliminate the large overhead and high latency (End-to-End Delay) which result in encountering high amount of packet loss occur in AODV routing protocol [21].

Literature offers to utilize some specific parameters such as velocity and movement direction that could be obtained by GPS device in addition to deployment of sets of on-board sensors in order to make the routing stabled. Selecting nodes with more stable link in route discovery procedure at the first step and selecting the most stable route in route selection procedure at the second step, could be considered as the two major steps in AODV enhancement project[21].

AODV with Broadcasting Data packet (AODV-BD) is proposed to reduce the end-to-end delay by establishing the route to the destination by having data packets broadcasted to destination. This approach sets up the routing along with sending data packets which decreases the delay. However, broadcasting data to the destination violates the integrity of data packet forwarding along with huge amount of bandwidth occupancy [21].

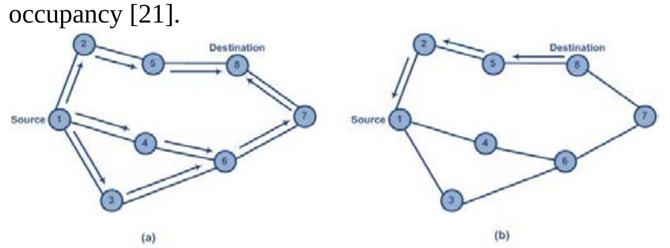

Figure-1 (a) Propagation of the RREQ, (b) RREP Path to the Source

Dynamic Source Routing (DSR): DSR is a reactive routing protocol in which the primary aspect is to store the whole path from source to destination in the routing table instead of having the next hop stored (AODV routing protocol). Therefore, the packet header must include all nodes through which the packet must travel to be delivered to the destination. Similar to AODV, the RREQ and RREP are used to perform the route discovery and delivering the reply message back to the source [21].

In this protocol, the RREQ message rebroadcast method is used if the node receiving the RREQ message does not have the destination information in its routing table. However, in DSR routing protocol, cache route mechanism is used in case of link breakage. For instance, suppose the source node S has route <S,

A, B, C, D> to destination node D, and the link <C, D> encountered a failure due to node`s movement. In such scenario, the source node S looks up in its cache route for another route to destination node D. It is noted that other routes to destination node were maintained in cache route due to overhearing the RREQ message by intermediate nodes via various routes. The cache route mechanism results in boosting up the data transmission. Upon receiving the RERR message by the source node, the new route discovery procedure will be initiated [21].

The RERR message will be originated and sent to the source by the very first node which is closer to the source than others. Thereafter, the source applying piggyback strategy based on the RERR message received and the new RREQ message will be broadcasted to all the nodes used to deploy the failed link. Figure 2 illustrates the transmission of pair of <RREQ, RREP> while performing the route discovery procedure until receiving the reply message [21].

Dashed lines represent the route stored in cache route memory for further utilization when the link breakage happens. Figuratively, the size of the packets in the DSR routing protocol increases due to adding any arrived node specifications into packet header. This can be considered as a possible drawback when the number of nodes increases. Another issue that must be taken into account is being unaware of neighbor list or their link status [21].

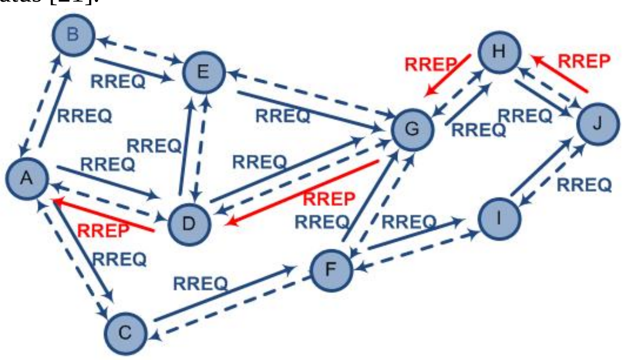

Figure-2 Route Discovery Procedure in DSR Routing Protocol

Destination Sequenced Distance Vector (DSDV): The aforementioned discussed routing protocols are all reactive protocols in which the routes are established on demands. DSDV is a proactive routing protocol which maintains the route to the destination before it is required to be established. Therefore, each node maintains a routing table including next hop, cost metric towards the destination node and the sequence number generated by the destination node. Nodes exchange their routing tables periodically or when it is required to be exchanged. Thus each node is able to utilize the updated list of nodes to communicate with. Due to being aware of the neighbor`s routing table, the shortest path towards the destination could be determined [21].

However, the DSDV mechanism incurs large volume of control traffic in highly dynamic networks such as VANET which results in experiencing a considerable amount of bandwidth consumed. In order to overcome the mentioned shortcoming, two update strategy in proposed; i. full dump strategy which is infrequently broadcasting the whole routing table, and ii. incremental dump which is exchanging the minor changes since the last full dump exchange. Figure 3 and table 1 illustrate the DSDV scenario and the possible routing table to be forwarded towards the neighbors [21].

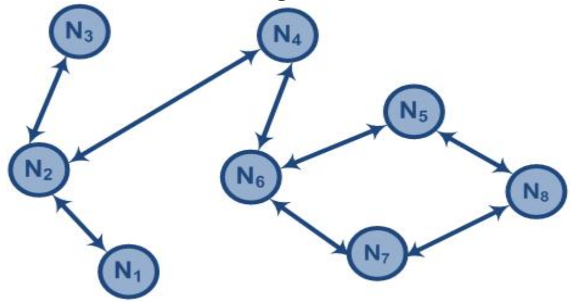

Figure-3 DSDV Structure Scenario

Table-1 Possible Forwarded Routing Table

Destination	Next Hop	Metric	Sequence number
N_1	N_4	3	S400N1
N_2	N_4	2	S300N2
N_3	N_4	3	S450N3
N_4	N_4	1	S200N4
N_5	N_5	1	S210N5
N_6	N_6	0	S800N6
N_7	N_7	1	S220N7
N_8	N_5, N_7	2	S350N8

Considering node N_6 in figure 3, table 1 depicts the possible structure of forwarding table which is maintained at N_6. The sequence number S---N_i represent the sequence number generated at node N_i.

SIMULATION WORK

Table-2 Simulation Parameters

Parameter Type	Value
Network Simulator	NS-2.35
Routing Protocol	DSDV, AODV, DSR
Simulation Time	1000 s
Simulation Area	1000 * 1000 m
Number of Nodes	10
DATA TYPE	FTP
Packets Generation Rate	80 kb
Packet Size	160 bytes
MAC Protocol	IEEE802.11
RTS/CTS	None
Channel Type	Wireless Channel
Mobility Model	Random Way Point [Fixed Path]
Antenna Type	Omni Antenna

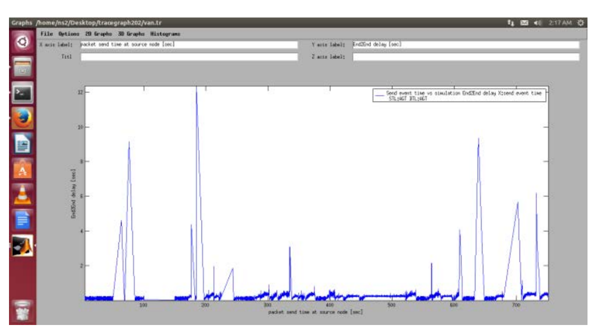

Figure-4: End-to-End Delay of AODV protocol

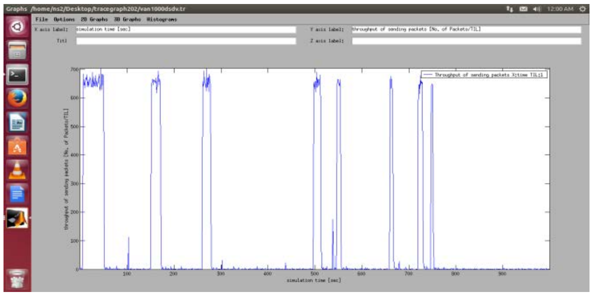

Figure-5: End-to-End Delay of DSDV protocol

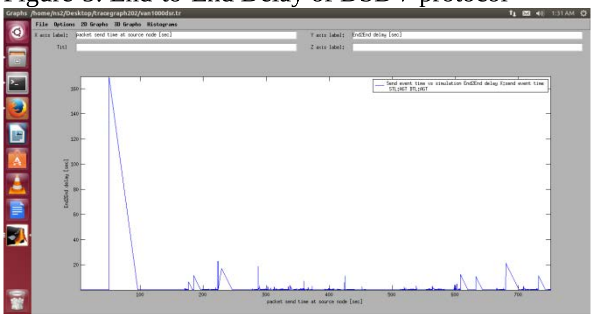

Figure-6: End-to-End Delay of DSR protocol

Fig:4,shows the End-to-end delay of AODV protocol , Fig:5, shows the End-to-delay of DSDV protocol and Fig:6, shows the End-to-delay of DSR protocol, it is obvious that DSR has the minimum delay compared to other protocols.

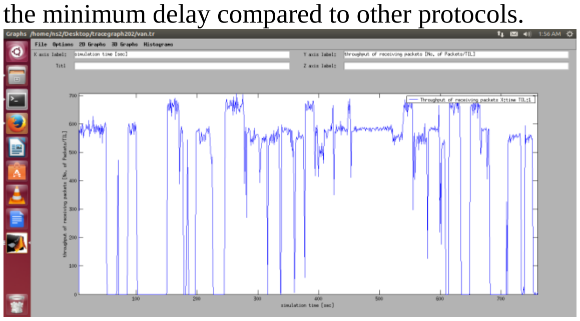

Figure-7: Throughputs of Receiving Packets in AODV protocol

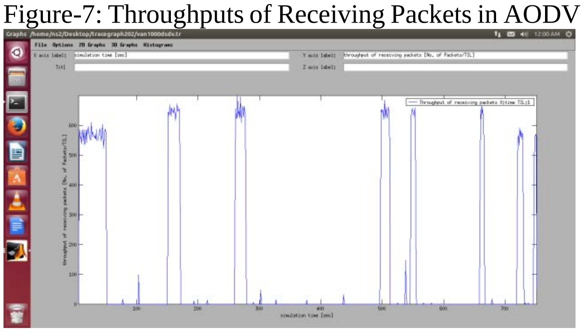

Figure-8: Throughputs of Receiving Packets in DSDV protocol

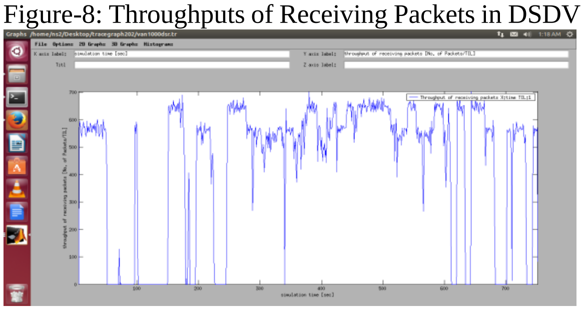

Figure-9: Throughputs of Receiving Packets in DSR protocol

Fig:7,shows the Throughput of Receiving Packets in AODV protocol , Fig:8, shows the Throughput of Receiving Packets in DSDV protocol and Fig:9, shows the Throughput of Receiving Packets in DSR protocol, it is obvious that DSR has the Maximum Throughput of Receiving Packets compared to other protocols.

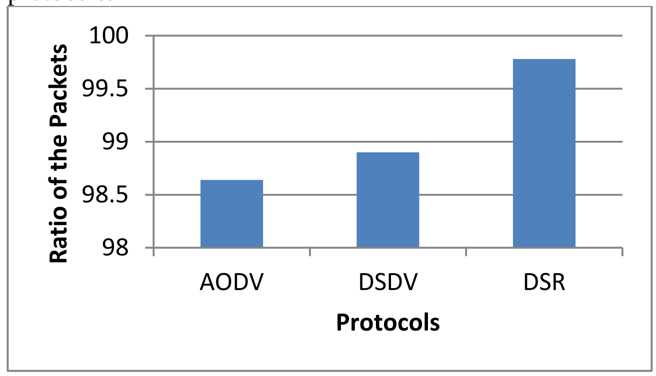

Figure-10: Ratio of AODV, DSDV, DSR Protocols

CONCLUTION

From the criterions such as End to End delay, Throughput and ratio we obtained by comparing AODV, DSDV and DSR protocols, DSR outperforms the other two protocols. In future we enhance our criterion level for comparison. We also compare some other protocols with DSR, DSDV and AODV protocols by using mobility models.

REFERENCES

1. Yun-Wei Lin, Yuh-Shyan Chen, And Sing-Ling Lee, “ Routing Protocols in Vehicular Ad Hoc Networks: A Survey and Future Perspectives”, JISE-2009-1
2. Xiong Wei , Li Qing-Quan, “Performance Evaluation Of Data Disseminations For Vehicular Ad Hoc Networks In Highway Scenarios”, The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. Vol. XXXVII. Part B1. Beijing 2008
3. D.Rajini Girinath, S.Selvan, “A Novel Cluster based Routing Algorithm for Hybrid Mobility Model in VANET” International Journal of Computer Applications (0975 - 8887) Volume 1 – No. 15, 2010
4. Martin Koubek, Olivia Brickley, Susan Rea, Dirk Pesch, “ Application Driven Routing for Vehicular Ad Hoc Networks – A Necessity”, ISVCS 2008, July 22 - 24, 2008, Dublin, Ireland. ISBN 978-963-9799-27-1
5. Ericson, “Communication and Mobility by Cellular Advanced Radio”, ComCar project, www.comcar.de, 2002.
6. W. Franz, H. Hartenstein, and M. Mauve, Eds., Inter-Vehicle-Communications Based on Ad Hoc Networking Principles-The Fleet Net Project. Karlshue, Germany: Universitatverlag Karlsuhe,November 2005.
7. A. Festag, et. al., “NoW-Network on Wheels: Project Objectives,Technology and Achievements”, Proceedings of 6th InternationalWorkshop on Intelligent Transportations (WIT), Hamburg, Germany,March 2008.
8. Reichardt D., Miglietta M., Moretti L., Morsink P., and Schulz W.,“CarTALK 2000 – safe and comfortable driving based upon inter-vehicle-communication,” in Proc. IEEE IV’02.
9. Morris R., Jannotti J., Kaashoek F., Li J., Decouto D., “CarNet: A scalable ad hoc wireless network system,” 9th ACM SIGOPS European Workshop, Kolding, Denmark,

Sept. 2000
10. D. Johnson, B.D.A. Maltz, and Y.C.Hu, “The Dynamic Source Routing Protocol for Mobile Ad Hoc Networks (DSR)”, draft-ietf-manet-dsr-10.txt, 2004.
11. C.E.Perkins and E. M. Royer. Ad-Hoc On Demand Distance Vector Routing, Proceedings of the 2nd IEEE Workshop on Mobile Computing Systems and Applications (WMCSA), pp. 90-100, 1990
12. Yatendra Mohan Sharma, Saurabh Mukherjee”Comparative Performance Xploration Of Aodv, Dsdv & Dsr Routing Protocol In Cluster Based Vanet Environment”, International Journal of Advances in Engineering & Technology, Sept 2012.
13. Xiong Wei , Li Qing-Quan, “Performance Evaluation Of Data Disseminations For Vehicular Ad Hoc Networks In Highway Scenarios”, The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. Vol. XXXVII. Part B1. Beijing 2008
14. D.Rajini Girinath, S.Selvan, “A Novel Cluster based Routing Algorithm for Hybrid Mobility Model in VANET” International Journal of Computer Applications (0975 - 8887) Volume 1 – No. 15, 2010
15. Fujii H., Hayashi O. and Nakagata N., Experimental research on inter-vehicle communication using infrared rays, *IEEE*, (1996)
16. Shladover S.E., The california path program of ivhs research and its approach to vehicle-highway automation, *IEEE*, (1992)
17. Gehring O. and Fritz H., Practical results of a longitudinal control concept for truck platooning with vehicle to vehicle communication, *IEEE*, (1997)
18. Reichardt D., et al. CarTALK 2000: Safe and comfortable driving based upon inter-vehicle-communication, *IEEE*, (2002)
19. Jiang D. and Delgrossi L., IEEE 802.11 p: Towards an international standard for wireless access in vehicular environments, *IEEE*, (2002)
20. Das S.R., Belding-Royer E.M. and Perkins C.E., Ad hoc on-demand distance vector (AODV) routing (2003)
21. Amirhossein Moravejosharieh, Hero Modares, Rosli Salleh and Ehsan Mostajeran “Performance Analysis of AODV, AOMDV, DSR, DSDV Routing Protocols in Vehicular Ad Hoc Network” Research Journal of Recent Sciences, 2013.

Citation: C.Chandrasekar, et al.. (2014). Post Trauma Aspects of Disasters: Causes, Effects and Challenges: A Psychological Perspective. J. of Computation in Biosciences and Engineering. V1I3. DOI: 10.15297/JCLS.V1I3.11