Reactive Routing Protocols Evaluation for VANET with CBR and TCP Traffic Type

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ABSTRACT

A Vehicular Ad hoc Network (VANET) is a type of wireless ad hoc network that facilitates ubiquitous connectivity between vehicles in the absence of fixed infrastructure. Multi-hop routing and beaconing approaches are two important research challenges in high mobility vehicular networks. Routing protocols are divided into two categories of topology-based and position-based routing protocols. In this paper Creation of cluster based network in VANET Scenario for NS-2 and then to create Different routing protocols with the use of various performance matrices Like Packet Delivery ratio, Throughput, End to End Delay and routing Overhead with two routing protocols which are AODV and DSR.

Keywords: VANET, AODV, DSR and IEEE 802_11P.

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INTRODUCTION:

The study of Vehicular Ad-Hoc Network (VANET) has attracted attentions recently. By definition, VANET is a form of mobile ad-hoc network (MANET), to provide communication among nearby vehicles and between vehicles and nearby fixed infrastructure. Vehicles may be equipped with on board devices, which can provide them Wireless Local Area Network (WLAN) connectivity through an access point (AP) installed in a road side unit (RSU). With advancement in technology sector, vehicular network is anticipated to be on a high rise and its usage is going to increase manifold on a scale similar to the huge scalable network of World Wide Web. We need to come up with robust techniques to make VANET reliable and at the same time seamless in nature.

VANET CHALLENGES

Reliability is a key requirement for any kind of vehicular communication since one of their main applications is safety in road traffic. Regarding communication, VANET is one specific scenario of Mobile Ad hoc Network (MANET). This means VANET also has some characteristics of MANET such as, self-organizing capability, topology change due to node mobility [2] etc. The protocols for both the networks are similar. Beside some common characteristics with MANET, the VANET also has its own characteristics such as high node mobility, very frequently changing network topology, challenging aspect of end-to-end connectivity and usually more than one hop relay transmissions. For the above reasons, VANET is much more complicated than traditional wireless networks [3]. Various factors that are considered vital for VANET are listed below:

- **Velocity of the vehicles:** IEEE802.11 physical (PHY) and medium access (MAC) protocols were designed for fixed/nomadic stations. In VANET, high velocity causes a large and fast variation of the channel conditions which may lead to performance degradation if necessary measures are not taken beforehand. In order to design any model we need to take account of the density of vehicles which in turn is affected by velocity.
- **Mobility pattern:** Since the nature of network is dynamic, it is challenging to define the pattern in a deterministic way. Earlier models used in general MANETs, such as the random waypoint, are unsuitable for the VANET application, where the nodes no longer move freely in the open area. In VANET the nodes are bound to follow the road patterns, and constrained by many parameters such as route intersections, stop and traffic light signals, the presence of other vehicles in front the vehicle, and etc.
- **Distance:** IEEE 802.11p is for short range communication with up to a few hundred meters. With this limitation, we need to have several APs/Road Side Units (RSUs) to cover the road or to manage the existing RSU work in such way that their interactions with the vehicles in the range are properly polled.

The above factors along with supporting critical, time sensitive applications are the major challenges faced by researchers [4].

VANET APPLICATIONS

According to the DSRC, there are over one hundred recommended applications of VANETs. These applications are of two categories, safety and non-safety related. Moreover, they can be categorized into OBU-to-OBU or OBU-to-RSU applications. Here we list some of these applications which are as follows:-

Co-operative Collision Warning:- Co-operative collision warning is an OBU-to-OBU safety application, that is, in case of any abrupt change in speed or driving direction, the vehicle is considered abnormal and broadcasts a warning message to warn all of the following vehicles of the probable danger. This application requires an efficient broadcasting algorithm with a very small latency.

Lane Change Warning:- Lane-change warning is an OBU-to-OBU safety application, that is, a vehicle driver can warn other vehicles of his intention to change the traveling lane and to book an empty room in the approaching lane. Again, this application depends on broadcasting.

Intersection Collision Warning:- Intersection collision warning is an OBU-to-RSU safety application. At intersections, a centralized node warns approaching vehicles of possible accidents and assists them determining the suitable approaching speed. This application uses only broadcast messages.

Approaching Emergency vehicle:- Approaching emergency vehicle is an OBU-to-OBU public-safety application, that is, high-speed emergency vehicles (ambulance or police car) can warn other vehicles to clear their lane. Again, this application depends on broadcasting.

Rollover Warning:- Rollover warning is an OBU-to-RSU safety application. A RSU localized at critical curves can broadcast information about curve angle and road condition, so that, approaching vehicles can determine the maximum possible approaching speed before rollover.

Work Zone Warning:- Work zone warning is an OBU-to-RSU safety application. A RSU is mounted in work zones to warn incoming vehicles of the probable danger and warn them to decrease the speed and change the driving lane.

Coupling/Decoupling:- Coupling/decoupling system is an OBU-to-OBU non-safety application that is designed to link multiple buses or trucks into a train to minimize the headway distance and traveling time and to decrease rear-end crashes. In August 2003, California PATH project practically tested this application on a three-bus platoon [7].

ROUTING IN VANET

The routing protocols for vehicular ad hoc wireless network should be capable to handle a very large number of hosts with limited resources, such as bandwidth and energy. The main challenge for the routing protocols is that they must also deal with node speed, meaning that nodes can appear and disappear in various scenarios. Thus, all nodes of the ad hoc network act as routers and must participate in the route discovery and maintenance of the routes to the other nodes. For vehicular ad hoc routing protocols it is essential to reduce routing messages overhead despite the increasing number of nodes and their mobility. Keeping the routing table small is another important issue, because the increase of the routing table will affect the control packets sent in the network and this in turn will cause large link overheads [11].

Ad Hoc on Demand Distance Vector (AODV):- In AODV, the network is silent until a connection needed. At that point the network node that needs a connection broadcasts a request for connection. Other AODV nodes forward this message, and record the node that they heard it from, creating an explosion of temporary routes back to the needy node [14]. When a node receives such a message and already has a route to the desired node, it sends a message backward through a temporary route to the requesting node. The needy node begins using the route that has the least number of hops through other nodes. Unused entries in the routing tables are recycled after a time. When a link fails, a routing error is passed back to a transmitting node, and the process repeats. Much of the complexity of the protocol is to lower the number of messages to conserve the capacity of the network. For example, each request for a route has a sequence number. Nodes use this sequence number so that they do not repeat route requests that they have already passed on. Another such feature is that the route requests have a "time to live" number that limits how many times they can be retransmitted. Another such feature is that if a route request fails, another route request may not be sent until twice as much time has passed as the timeout of the previous route request [15].

Dynamic Source Routing (DSR):- The Dynamic Source Routing Protocol (DSR) is one of the most reliable and effective protocols in the VANET. DSR adopts a similar on-demand approach as AODV regarding the route discovery and maintenance processes. A fundamental difference of DSR from AODV and other on demand protocols is the use of source routing, where the source node indicates the complete sequence of intermediate nodes for each data packet to reach its destination. The source-route information is contained by the header of the data packet. The protection of source routing is that no additional mechanism is needed to detect routing curve. The obvious disadvantage is that data packets must carry source routes. The data structure DSR uses to store routing information is route cache, with each cache entry storing one exact route from the source to a destination. DSR makes very aggressive use of the source routing information [14].

In this paper implemented work i.e. Creation of VANET Scenario for NS-2 and then to analyze Different routing protocols with the use of various performance matrices Like Packet Delivery Ratio, End to End delay and Overall Throughput. In this work firstly created scenario file for

IEEE 802.11p standard which has to be used along with TCL Script than created a TCL script consist of various routing protocols in our case these are AODV & DSR with CBR and TCP traffic type than a particular VANET scenario which consist of 44 movable nodes with two ray ground model and various speed of i.e. 20m/sec, 40m/sec & 60m/sec. Implementation consists of typical installation process of ns-2 complexity of topography creation 2KM environment size.

PERFORMANCE MATRICS

Packet Delivery Ratio:- This is the fraction of the data packets generated by the TCP sources to those delivered to the destination. This evaluates the ability of the protocol to discover routes.

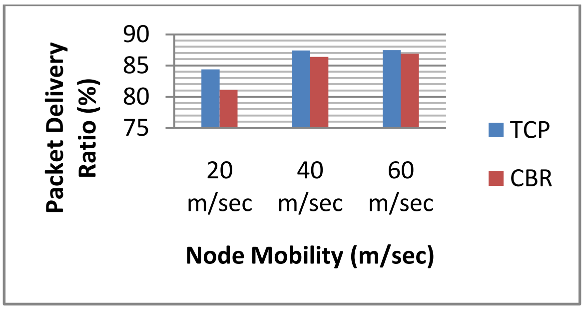

Fig. 1 Packet Delivery Ratio for AODV routing protocol

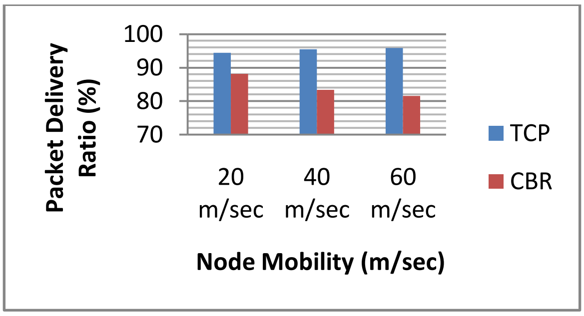

Fig. 2 Packet delivery ratio for DSR routing protocol

Throughput:- It is the amount of data transferred over the period of time expressed in kilobits per second (Kbps).

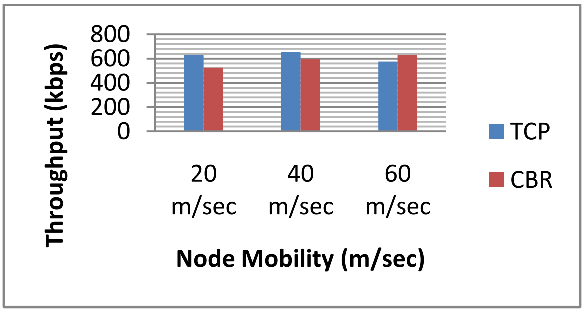

Fig. 3 Throughput for AODV routing protocol

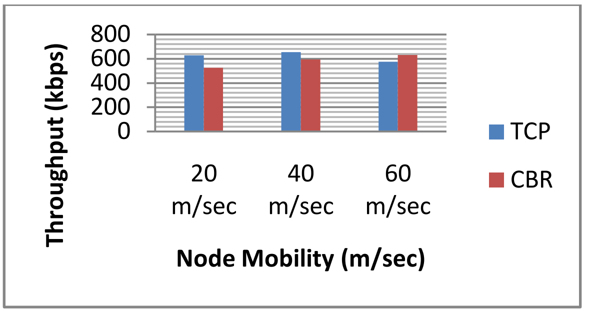

Fig. 4 Throughput for DSR routing protocol

End to End Delay:- It is the average delay between the sending of the data packet by the TCP source and its receipt at the corresponding TCP receiver.

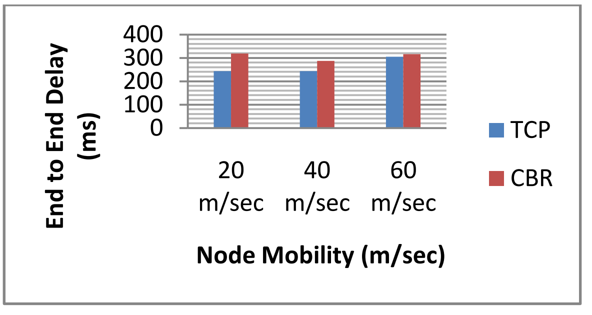

Fig. 5 End to End Delay for AODV routing protocol

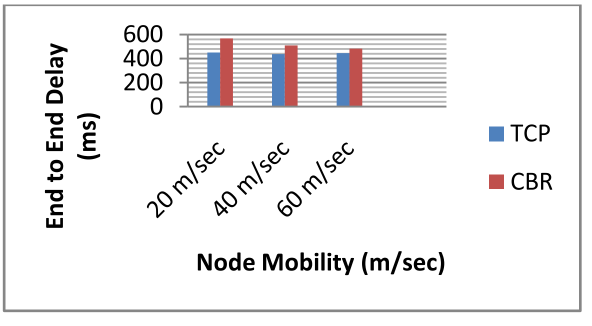

Fig. 6 End to End Delay for DSR routing protocol

Routing Overhead:- It is the ratio of overhead bits to the delivered data bits. The transmission at each hop along the route is counted as one transmission in the calculation of this metric.

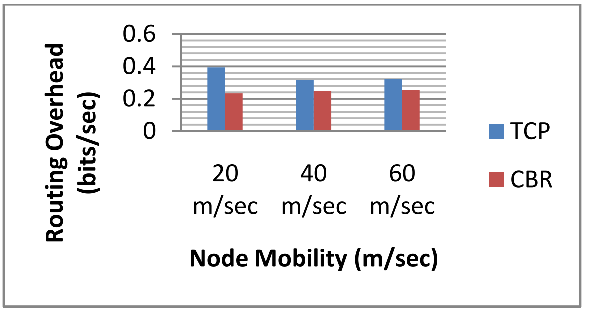

Fig. 7 Routing Overhead for AODV routing protocol

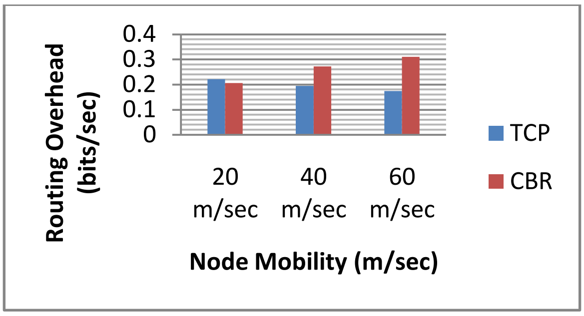

Fig. 8 Routing Overhead for DSR routing protocol

CONCLUSION

In this work we addressed the problem of identifying misbehaving of network that refuse to forward packets in vehicular ad hoc network and give the mechanism to handle them. The impact of such nodes decreases network performance, lowering the network average throughput. To mitigate the problem of misbehaving packet dropping, this work proposed a feasible solution for it on the top of clustering in TCP to avoid the misbehaving and our solution presents good performance in terms of Packet Delivery Ratio and Throughput but moderate performance in terms of end to end delay and Routing Overhead.

REFERENCES

1. Mohamed Watfa, Advances in Vehicular Ad-Hoc Networks: Developments and Challenges, IGI Global, 2010.
2. Ganesh S. Khekare and Apeksha V. Sakhare, “Intelligent Traffic System for VANET: A Survey”, International Journal of Advanced Computer Research, vol. 2, Number-4, no. 6, pp. 99-102, December 2012.
3. Rakesh Kumar and Mayank Dave, “A Review of Various VANET Data Dissemination Protocols”, International Journal of u- and e- Service, Science and Technology, vol. 5, no. 3, pp. 27-44, 2012.
4. Sherali Zeadally, Ray Hunt, Yuh Shyan Chen, Angela Irwin and Aamir Hassan, “Vehicular ad hoc networks (VANETS): status, results and challenges”, Springer Science, Business Media, LLC, p. 25, 2010.
5. Manjot Kaur, Sukhman Kaur and Gurpreet Singh, “Vehicular Ad Hoc Networks”, Journal of Global Research in Computer Science, 2012.
6. Prassant Mohapatra and Srikanth V. Krishnamurthy, “Ad Hoc Networks: Technologies and Protocols”, Boston, USA: Springer, 2005.

7. Mohammad Jalil Piran, G. Rama Murthy and G. Praveen Babu, “Vehicular Ad Hoc and Sensor Networks; Principles and Challenges”, International Journal of Ad hoc, Sensor & Ubiquitous Computing (IJASUC), vol. 2, no. 2, pp. 38-49, 2011.
8. Lochert, C., Mauve, M., F¨ussler, H. and Hartenstein, H., “Geographic routing in city scenarios”, SIGMOBILE Mob. Comput. Commun. Rev., vol. 9, no. 1, pp. 69–72, 2005.
9. R. A. Santos, “Performance evaluation of routing protocols in vehicular ad hoc networks”, 2005.
10. Pei, G., Gerla, M. and Chen, T.-W. (2000), “Fisheye State Routing: A Routing Scheme for Ad Hoc Wireless Networks”, Proc. ICC 2000, New Orleans, LA, June 2000.
11. 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, 1996, pp. 153–81.
12. Perkins, C.; Belding-Royer, E.; Das, S. (July 2003) “Adhoc On-Demand Distance Vector (AODV) Routing”.
13. O. K. Tonguzet al, “DV-CAST: A distributed Vehicular broadcast protocol for vehicular ad-hoc networks”, IEEE wireless communication, vol. 17April 2010, pp. 47-57.
14. Marwa Altayeb, Imad Mahgoub, “A Survey of Vehicular Ad hoc Networks Routing Protocols”, ISSR Journals, 2013, Vol. 3, No. 3, pp. 829-846.
15. Piyush Chouhan, Shivani Shukla and Manish Sharma, “Performance Evalution Of Reactive & Proactive Routing Protocols For Vehicular Adhoc–Networks With Varying Speed Of Nodes”, Int. Journal of Engineering Research and Applications Vol. 4, Issue 5(Version 5), May 2014, pp.87-91.
16. Piyush Chouhan, Shivani Shukla and Manish Sharma, “Performance Analysis Of Reactive & Proactive Routing Protocols For Vehicular Adhoc–Networks With Varying Speed Of Nodes”, International Journal of Research in Engineering & Technology (IMPACT: IJRET) Vol. 2, Issue 5, May 2014, pp.261-270.
17. Karp B, Kung HT., “GPSR: greedy perimeter stateless routing for wireless networks”, ACM/IEEE MobiCom 2000.
18. Kartik Pandit, Dipak Ghosal, H. Michael Zhang, and Chen-Nee Chuah, “Adaptive Traffic Signal Control With Vehicular Ad hoc Networks”, IEEE Transactions on Vehicular Technology, vol. 62, no. 4, pp. 1459-1471, May 2013.
19. Dedicated Short Range Communication (DSRC) Home. (2014, February) [Online].http://www.leearmstrong.com/DSRC/DSRCHomeset.html.