



Optimized solution for Vehicular Ad hoc Networks (VANET's) Routing Data in Real Time Simulation

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Abstract—Vehicular Ad Hoc Networks (VANETs) are special class of Mobile Ad Hoc Networks (MANETs) formed by vehicles equipped with wireless devices. The communication in VANET occurs between Vehicle to Vehicle mode and Vehicle to infrastructure (V2I) i.e. road side unit (RSU) forming an intelligent transport system (ITS). In such case the routing plays an important role in forwarding the required data to the nodes or vehicles. In this research we will study the performance evaluation of reactive routing protocols, such as dynamic source routing (DSR) and AdHoc on Demand Distance Vector AODV and proactive routing protocols such as OLSR in an urban traffic scenario using the map of Google, that is, the simulation of SUMO in real time, if the resources are available to find an appropriate protocol by using the network parameters, such as the delivery rate, performance and the delay of the packages. From the simulations we observed that AODV behaved well with respect to other routing protocols in the VANET scenarios.

Keywords: VANET's; AODV; ITS; DSR; RSU

1. INTRODUCTION

The growing demand for wireless communications and the needs of new wireless devices have tended to investigate self-generated networks without the interference of centralized or pre-established infrastructures/authorities. Networks without centralized or pre-established infrastructure are called ad hoc networks. The ad hoc networks are a collection of autonomous mobile nodes [1]. The ad hoc vehicular networks (VANET) are the sub-class of ad hoc mobile networks (MANET). VANET is one of the areas of influence for the improvement of the intelligent transport system (ITS) in order to guarantee safety and comfort to road users. VANET helps vehicle drivers communicate and coordinate with each other to avoid critical situations through vehicle-vehicle communication, e.g. traffic accidents, traffic jams, speed control, free passage of emergency vehicles and unseen obstacles, etc. In addition to safety applications, VANET also offers comfort applications to road users. For example, weather information, mobile e-commerce, Internet access and other multimedia applications [2]. The most popular applications include, "Advance Driving Assistance Systems (ADASE2) Crash Avoidance Alignment Matrices

(cAMP), and Fleet CARTALK2000 Net", developed under the cooperation of various governments and major car manufacturers [3]. Figure 1 shows the general structure of the work of VANET.

VANET belongs to wireless communication networks area. VANET is the emerging area of MANETs in which vehicles act as the mobile nodes within the network. The basic target of VANET is to increase safety of road users and comfort of passengers. VANET is the wireless network in which communication takes place through wireless links mounted on each node (vehicle) [4]. Each node within VANET act as both, the participant and router of the network as the nodes communicates through other intermediate node that lies within their own transmission range. VANET are self organizing network. It does not rely on any fixed network infrastructure. Although some fixed nodes act as the roadside units to facilitate the vehicular networks for serving geographical data or a gateway to internet etc [2]. Higher node mobility, speed and rapid pattern movement are the main characteristics of VANET. This also causes rapid changes in network topology [5]. VANET is a special type of MANET, in which vehicles act as nodes. Unlike MANET, vehicles move on predefined roads, vehicles velocity depends on the speed signs and in addition these vehicles also have to follow traffic signs and traffic signals [6]. There are many challenges in VANET that are needed to be solved in order to provide reliable services. Stable & reliable routing in VANET is one of the major issues. Hence more research is needed to be conducted in order to make VANET more applicable. As vehicles have dynamic behavior, high speed and mobility that make routing even more challenging. VANET routing protocols history starts with traditional MANET protocols such as AODV (Ad hoc on Demand Distance Vector Routing) [7] and DSR (Dynamic Source Routing) [8]. AODV and DSR have been considered efficient for Multi hop wireless ad hoc networks [1].

Various routing protocols have been proposed to make routing more efficient and reliable in VANET [9]. Multi hop routing protocols like MDDV [10] and VADD [11] uses vehicles

(nodes) on road to deliver packets. Static-Node Assisted Adaptive routing protocol in Vehicular Networks (SADV) uses static nodes to route traffic [12]. Some geographical based routing protocols (GFG and GOAFR) also have been developed [13] to provide scalable communication in VANET. Road-Based using Vehicular Traffic information (RBVT) uses real time information to route traffic. RBVT have been further extended to proactive protocol RBVT-P and reactive protocol RBVT-R to route the traffic in VANET [15].

This work is base on the routing protocol. We have consider two different types of routing that are used for VEHICULAR AD HOC NETWORK ROUTING is POSITION BASED ROUTING, GREEDY PERIMETER STATELESS

ROUTING-GPSR

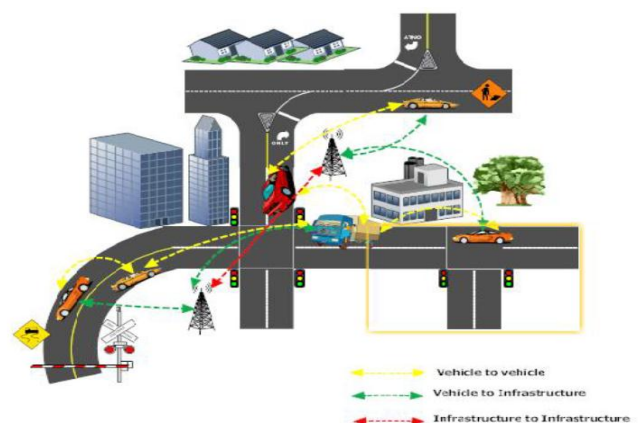


Figure 1: Vehicular Ad Hoc Network overview

2. Position Based Routing

The dynamic and highly mobile nature of VANET, where nodes behave very rapid and changes its location frequently demands such routing method that can deal with the environment of such network. These demands tend the researchers to use positions of nodes in order to provide successful communication from source to destination. Such method in which geographical positions of nodes are used to perform data routing from source to destination is called position based routing. Position based routing

assumes that each node have knowledge about its physical/ geographic position by GPS or by some other position determining services. In it each node also has the knowledge of source, destination and other neighboring nodes. As compared to topology based routing, position based routing uses the additional information of each participating node to applicable in VANET, that additional information is gathered through GPS. Position based routing provides hop-by-hop communication to vehicular networks. A position based routing protocol consists of many major components such as “*beaconing*”, “*location service and servers*” and “*recovery and*

Routing protocol	Throughput (KB/sec)	Packet drop
AODV	5043	16712
GPSR	12209	13877

forwarding strategies”

3. Greedy Perimeter Stateless Routing-GPSR.

Greedy Perimeter Stateless Routing (GPSR) [17] is one of the best examples of position based routing. GPSR uses closest neighbor’s information of destination in order to forward packet. This method is also known as greedy forwarding. In GPSR each node has knowledge of its current physical position and also the neighboring nodes. The knowledge about node positions provides better routing and also provides knowledge about the destination. On the other hand neighboring nodes also assists to make forwarding decisions more correctly without the interference of topology information. All information about nodes position gathered through GPS devices. GPSR protocol normally devised in to two groups:

- Greedy forwarding: This is used to send data to the closest nodes to destination.
- Perimeter forwarding: This is used to such regions where there is no closer node to destination. In other words we can say it is used where greedy forwarding fail

4. Results and discussion

We discussed and analyzed the simulation results of our study. We selected throughput and packet drop performance metrics for the evaluation of routing protocols. To check the performance of routing protocols in VANET we designed two different networks and named them as highway and city. For the highway scenario we have selected AODV and GPSR and evaluate them in the presence of low and high node’s speed on highways. While in city scenario we selected AODV, GPSR and A-STAR routing protocols to check their performance in the large city environment in the presence of radio obstacles.

The results of various routing protocols for both highway and city scenarios in VANET in terms of throughput and drop packets has shown in the tabulated form below.

Table 1: Highway scenario results with node's speed 20 m/s

Routing protocol	Throughput (KB/sec)	Packet drop
AODV	5043	16712
GPSR	12209	13877

Table 2: Highway scenario Results with node's speed 30 m/s

The following are the result that we is obtain from the tables

- The above results shows that GPSR out performs AODV in both scenarios of highway in terms of throughput. There was no significant effect in the throughput rate of GPSR with the increment in nodes speed. On the other hand AODV performance in terms of throughput affected by the nodes high speed.
- Above results shows that when nodes moved with 20 m/s there was slight difference in the performance of both protocols in terms of drop packets.

While drop packet rate of GPSR became lower with the increment in nodes speed. However, a little increment in drop packets of AODV with node's high speed.

- So we realized that GPSR completely outperform AODV in terms of throughput and rapid movement of nodes does not affect its performance. From results we also realized that AODV performance suffers with nodes speed which reduced its throughput rate. Furthermore, increment in speed reduces the drop packet rate of GPSR.

Routing protocol	Throughput (KB/sec)	Packet drop
AODV	9921	7573
GPSR	13859	6495
A-STAR	190081	2457

Table 3: City scenario Results

As compared to highway scenarios the node's speed was very low in city scenario. That's why all three protocols perform well in this scenario.

- Table 3 results shows that A-STAR completely outperformed AODV and GPSR in terms of throughput and drop packets. While GPSR also had better throughput rate than AODV. We realized that throughput rate of A-STAR was higher than AODV and GPSR. However, slight difference in the performance of AODV and GPSR in terms of drop packet.

From above results we realized that A-STAR provides scalable results in city environments of VANET. We also realized that there was slight difference in performance of GPSR and AODV in terms of drop packets. However, GPSR provides higher throughput than AODV in the presence of radio obstacle.

5. Conclusion

The main goal of this thesis is to identify different issues in ad hoc routing protocols and to evaluate these routing protocols against each other in VANET. In this study we focused from traditional ad hoc routing protocols to recently proposed position based routing protocols. We have examined how different routing protocol suffers from the highly mobile nature of VANET.

From the conducted study, we suggest that position based routing protocols are more promising than traditional ad hoc routing protocols for VANET. Although position based routing is scalable for VANET but it is hard to suggest any single routing protocol that can deal with different scenarios of VANET. The selection of a single routing protocol is hard in VANET because the protocol performance depends on vehicle speed, driving environment etc that may vary from one environment of network to another.

6. Future work

In wireless network community VANET received attention of many researchers due to its unique nature. Although amount of research has been devoted to the various routing issues in VANET but still there are some areas that need more attention. Due to time constraint, we only focused on traditional ad hoc and position based routing protocols but still there are some areas in these routing protocols that need more attentions. These are the few future work that need to be improve.

- Secure routing is one of the challenging areas. Due to the unsecure and ad hoc nature of VANET, there is prone to several security attacks that may lead to devastating consequences. So security attacks should be investigated with respect to different attacks in VANET.
- Several other routing methods such as broadcast, geocast and cluster based routing methods can be consider for the evaluation of routing protocols in VANET.

- New algorithms should be proposed to provide reliable QoS for safety and comfort applications in VANET.

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