Analysis of Routing Protocols of VANETs

Ramandeep Kaur,
M.Tech,
Deptt of Computer Science & Engg,
PURCITM, Mohali, India

Rachhpal Singh,
Assitant Professor,
Deptt of Computer Science & Engg,
PURCITM, Mohali, India

Abstract

The vehicular ad-hoc network is a distributed network thereby the vehicles can either join or leave whenever possible. Due to decentralized nature of the network routing is the major issue of VANETs. The VANET routing protocols are broadly classified into reactive, proactive and hybrid type of protocols. In this review paper, the various routing protocols of vehicular ad-hoc network is reviewed and analyzed in terms of certain parameters

Index terms **- VANETs, Reactive, Proactive, Position based routing**

1. INTRODUCTION

VANETs is an emerging technology widely utilized in various application, it mainly uses moving cars as nodes in a network in order to create a mobile network. With the help of VANETs every present car in a wireless router or node, allows car to connect with each other approximately 100 to 300 meters, to create a network with a wide range. When a car fall out of the signal range and drop out of the network, other cars can join in and connects with another for the creation of the mobile internet. Used fixed equipment can belong to the government or private network operators or service providers [1].

There are numerous messages transmitted across the network. However, the authentication of such messages is very important which can assure that these messages are valid and not altered by any malicious users. A scenario can be taken here in which a vehicle travelling needs some kind of help and is about to run out of resources. The vehicles might ask for help and must show its permanent identity. However, an attacker that is monitoring the communication of the network might attack this vulnerable vehicle and extract all the important information that it is present in it. Without making any direct communication with the authorities, the vehicle occupants might be stranded [2]. The vehicles will remain safe in case when the permanent identity of the vehicle is hidden from rest of the vehicles and only he authorized personnel can view the request generated by the vehicle. This mechanism can help in protecting the vehicles from being attacked by any malicious users and provide safe environment. The vehicles are also needed to be registered with particular central authority such that any node that is malicious can be recognized easily and the problem can be dealt with. All the messages generated by the nodes thus need to represent their sources which will help in authenticating the network.

1.2 Routing in VANET

The development of a dynamic routing protocol is one of the major challenges in the design of vehicular ad-hoc network [3]. This protocol provides the assistance in the dissemination of information from one node to another. There is difference between the traditional MANET and the routing in VANET due to utilized topologies is highly dynamic as compared to former. All the developed protocols for MANET environment was tested on VANET.

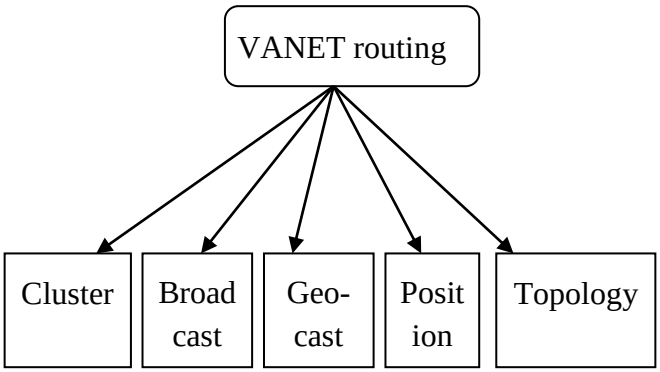

Figure 1: Routing in VANET

Hence, it remains as a challenge that how to reduce associated delays form the passing information from one node to another. These protocols can be implemented in real time applications for VANET environment by overcoming issues related to MANET protocols. The five categories of routing protocols are: • Ad-hoc or Topology Driven Protocols • Location Based Routing Protocols • Cluster Based Protocols • Broadcast Protocols • Geocast Protocols.

a. Topology Routing: The link's information within the network is used to send the data packets from source to destination in topology based routing protocol [4]. Packet forwarding is performed by using link's information existing in the present network. Topology based routing protocols are categorized into proactive (table-driven) and reactive (on-demand) routing.

b. Position Routing: Position based routing protocol has been utilized for the location purposes as it determine the exact position of source node, neighbor node and the destination node [5]. All the information about the nodes such as position is maintained by the use of GPS and it also determine the exact co-ordinates of the nodes in all directions, which lead to route discovery mechanism

c. Cluster Routing: A cluster between nodes or vehicles can be established with the help of cluster based routing protocol. Cluster is defined as the group of nodes in which a unique cluster-head is present within each cluster. This cluster is responsible for intra and inter-cluster communication. Within the cluster a cluster-head broadcasts the packet to all the nodes in the cluster based routing which improves the scalability for a large network of nodes. The various Clusters based routing protocols are HCB, CBDRP, CBLR and CBR.

d. Broadcast Routing: Broadcast routing protocol is also known as flooding based routing protocol that has been utilized in VANET for sharing information among vehicles such as when an accident or an event occurs, then it transmit the information to all nodes. An essential role is played by the broadcast routing protocol in the emergency situations when the messages have to deliver quickly and in efficient manner in almost all safety applications [6]. The broadcast routing protocol has a major disadvantage such as the hidden node problem and the high possibility of collision in the messages. Sub- parts of broadcasting protocols are BROADCOMM and DV-CAST

e. Geo Cast Routing Protocols: Geo cast routing is also known as a location based multicast routing protocol. The main objecting of this protocol is to transfer packets from source node to all other nodes within a specified geographical region. The various Geo cast routing protocols are IVG, DG-CASTOR and DRG.

2. LITERATURE SURVEY

Reza Shahidi, et.al (2017) presented for the calculation of the probability distribution, they introduced the first analytical framework and the end-to-end delay in multi-lane one-way highway vehicular ad-hoc networks (VANETs). Due to this transmission of the data is guaranteed in a given time frame. In this paper, there is extension in the previous work as they extend the two-way multi-lane highways in which vehicles are travelling in both directions [7]. They calculated the end-to-end delay of the probability distribution and their dependency on the system parameters. These parameters are analyzed such as speed distributions in the two directions, communication range, and vehicle densities. In order to verify the analytical model, computer simulations were utilized. As per performed experiments and obtained simulation results and the analytical calculations, it is demonstrated that the proposed analytical model provides better correctness and accuracy as compared to other methods.

Ali Jalooli, et.al (2017) presented Vehicular ad-hoc networks provide the fundamental security to the road safety and traffic efficiency when they are implemented in the real time vehicle-to-vehicle and vehicle to- infrastructure communications. An important role is played by the Roadside Units in the vehicular environments in terms of connectivity, routing, and transmission delay [8]. But, it is not feasible o provide a universal coverage within an area by deploying RSUs. In this paper, they proposed a Safety-Based Disconnected RSU Placement algorithm (S-BRP) by which dissemination delay in some areas is reduced. They also studied the performance of message dissemination in VANET environments. With the help of extensive simulation studies, they evaluated the S-BRP algorithm. As per performed experiments, it is concluded that proposed algorithm has better performance as compared to other methods in terms of dissemination delay and traffic flow.

Seung-Seok Kang, et.al (2017) presented a road traffic simulator known as SUMO and a computer network simulator is bns-3 for the construction of the VANET. An ad hoc routing algorithm is required for VANET, in order to set up communication between the car and road infrastructures [9]. Packets in the network are transferred at the optimal rate with the help of AODV as bandwidth provided in the network. Among the three algorithms, the performance of the DSR was worst as it has low throughput. This is due to facts that routing information is maintained by sending car frequently and sender has to rebuild the updated route

that results in the degradation of the packet delivery rate. There is decrease in the average throughput, when the car moves faster and there is increase in the standard deviation.

Ilker BASARAN, et.al (2016) presented the safety and soothe of driving in highways and urban streets has been improved due to Vehicular ad hoc networks (VANETs). It has seen the positive effects of the conventional measures on the decline of injuries due to accidents. Still, there are number of accidents occurred in daily basis [10]. This issue is overcome by VANETs by providing additional information to the driver with the help of which driver took immediate action in the adverse situations. Hence, for the transmission of message among vehicles, VANETs requires efficient routing protocols. In this paper, performances of four essential non-delay tolerant routing protocols, namely GPSR, GPSR+AGF, GSR, and GPSRJ+ was evaluated. All these protocols are outdated but initially they inspire many routing methods and used as comparison benchmark when it is required to introduce a new routing protocol. Packet Delivery Ratio, Average Delay, Traffic Control Overhead, and Average Hop Count were the evaluation metrics.

Chen, Q.B, et.al (2013) proposed an Intersection- based using time delay factor to forecast road weight Routing Protocol (IWRP) which is the fundamental part of vehicular ad hoc networks (VANETs). Packets are transferred to the intersection nodes by the routing strategy as these nodes have required cache and powerful computational abilities. Poisson distribution is obeyed by the random distribution of vehicles due to which it becomes easy to get the optimal connection distance and the connection probability [11]. Hence, for the prediction of the road weight, the time-delay factor is calculated by the intersection node. Optimized greedy algorithm with carry-forward mechanism was utilized to minimize the issue of abrupt link interruptions and also to improve the performance of packet delivery ratio and delay. NS-2.35 simulator was utilized for the validation of the accuracy of the model. As per performed experiments, it is concluded that IWRP is more superior to GPSR (carry-forward) in terms of packet delivery rate and average delay.

Khemchand Shakyawar, et.al (2016) presented it becomes easy to decrease the death rate which occur due to poor information exchange in real time by improving throughput and decreasing he packet delay in VANET environment [12]. They performed various simulation results in this paper for the evaluation purpose. As per simulation results presents the failed messages out of total numbers of created messages. Hence, for the improvement in the network topology they determine the overall throughput and packet delay ratio in this paper.

Jamal Toutouh, et.al (2012) presented the advance technology which gave rise to vehicular ad hoc networks (VANETs) widely used in various applications. This network has the limited coverage of the Wi-Fi and with the change in the topology and fragmentations it generates high mobility of nodes. Due to this reason there is no central controller and routing packets through the network becomes a challenging task. Hence, it is very difficult to deploy efficient routing strategy in VANETs. The OLSR is the method which deals with these optimal parameters, called as mobile ad-hoc network routing protocol by defining an optimization problem [13]. They studied the Meta heuristic algorithms in this paper in order out optimal configurations of this routing protocol. As per observation, it is demonstrated that OLSR configurations shows optimal results as compared to other methods and agreed for the utilization of VANETs configurations.

Celimuge Wu, et.al (2014) presented two most important metrics widely utilized in the field of vehicular ad hoc network applications. These two metrics are Packet delivery ratio and end-to-end delay. In this paper, they proposed a MAC layer protocol in order to provide a high packet delivery ratio, low end-to-end delay, and high fairness for various circumstances [14]. In order to adjust the contention window size, the proposed algorithm utilized the Q-Learning algorithm. This algorithm was utilized to provide an efficient channel access scheme for various network situations. As per simulation results, it is demonstrated that proposed protocol has more advantages as compared to other methods.

Author's Name	Year	Description	Outcomes
Reza Shahidi, Mohamed H. Ahmed	2017	Presented for the calculation of the probability distribution, they introduced the first analytical framework and the end-to-end delay in multi-lane one-way highway vehicular ad-hoc networks (VANETs) and they extend the two-way multi-lane highways in which vehicles are travelling in both directions.	As per performed experiments and obtained simulation results and the analytical calculations, it is demonstrated that the proposed analytical model provides better correctness and accuracy as compared to other methods.

Ali Jalooli, Min Song, Xiaohua Xu	2017	Proposed a Safety-Based Disconnected RSU Placement algorithm (S-BRP) by which dissemination delay in some areas is reduced. They also studied the performance of message dissemination in VANET environments.	As per performed experiments, it is concluded that proposed algorithm has better performance as compared to other methods in terms of dissemination delay and traffic flow.
Seung-Seok Kang, and Ye-Eun Chae, Seunguk Yeon	2017	Presented a road traffic simulator known as SUMO and a computer network simulator is bns-3 for the construction of the VANET. An ad hoc routing algorithm is required for VANET, in order to set up communication between the car and road infrastructures.	Among the three algorithms, the performance of the DSR was worst as it has low throughput. This is due to facts that routing information is maintained by sending car frequently and sender has to rebuild the updated route that results in the degradation of the packet delivery rate.
Ilker BASARAN, Hasan BULUT	2016	In this paper, performances of four essential non-delay tolerant routing protocols, namely GPSR, GPSR+AGF, GSR, and GPSRJ+ was evaluated.	Packet Delivery Ratio, Average Delay, Traffic Control Overhead, and Average Hop Count were the evaluation metrics.
Chen, Q.B, Fu , Y.K, Wang, D.J, Tang L	2013	Proposed an Intersection- based using time delay factor to forecast road weight Routing Protocol (IWRP) which is the fundamental part of vehicular ad hoc networks (VANETs).	NS-2.35 simulator was utilized for the validation of the accuracy of the model. As per performed experiments, it is concluded that IWRP is more superior to GPSR (carry-forward) in terms of packet delivery rate and average delay.
Khemchand Shakyawar, Sandeep K. Tiwari	2016	Presented it becomes easy to decrease the death rate which occur due to poor information exchange in real time by improving throughput and decreasing he packet delay in VANET environment.	As per simulation results presents the failed messages out of total numbers of created messages. Hence, for the improvement in the network topology they determine the overall throughput and packet delay ratio in this paper.
Jamal Toutouh, Jos´e Garc´ıa-Nieto, and Enrique Alba	2012	Presented the advance technology which gave rise to vehicular ad hoc networks (VANETs) widely used in various applications. This network has the limited coverage of the Wi-Fi and with the change in the topology and fragmentations it generates high mobility of nodes.	As per observation, it is demonstrated that OLSR configurations shows optimal results as compared to other methods and agreed for the utilization of VANETs configurations.
Celimuge Wu and Satoshi Ohzahata, Yusheng Ji, Toshihiko Kato	2014	In this paper, they proposed a MAC layer protocol in order to provide a high packet delivery ratio, low end-to-end delay, and high fairness for various circumstances. In order to adjust the contention window size, the proposed algorithm utilized the Q-Learning algorithm.	As per simulation results, it is demonstrated that proposed protocol has more advantages as compared to other methods.

CONCLUSION

In this paper, it is concluded that vehicular adhoc network is the self configuring type of network in which vehicle nodes can join or leave the network when they want. The routing protocols are broadly classified into location addict routing protocols. In this

review paper, various routing protocol are reviewed and analyzed in terms of certain parameters. In future, the broadcasting approach will be converted into multicasting for path establishment from source to destination

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