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Vehicular Ad-hoc Network: A Survey

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ABSTRACT: Less than a century since the automobile was made affordable enough for the general public, hundreds of millions of vehicles now travel along highways and streets around the world. Innovations in safety, comfort, and convenience have made vast improvements in automobiles during that time, and now new technologies promise to change the face of vehicular travel once again. One such new technology is the vehicular ad hoc network or VANET, which provides the ability for vehicles to spontaneously and wirelessly network with other vehicles nearby for the purposes of providing travelers with new features and applications that have never previously been possible.

Keywords: VANET, ad hoc network, MANET.

1. INTRODUCTION

Less than a century since the automobile was made affordable enough for the general public, hundreds of millions of vehicles now travel along highways and streets around the world. Innovations in safety, comfort, and convenience have made vast improvements in automobiles during that time, and now new technologies promise to change the face of vehicular travel once again. One such new technology is the vehicular ad hoc network or VANET, which provides the ability for vehicles to spontaneously and wirelessly network with other vehicles nearby for the purposes of providing travelers with new features and applications that have never previously been possible.

1.1 About VANET

A VANET is a wireless network that is formed between vehicles on an as-needed basis. To participate in a VANET, vehicles must be equipped with wireless transceivers and computerized control modules that allow them to act as network nodes. Each vehicle's wireless network range may be limited to a few hundred meters, so providing end-to-end communication across a larger distance requires messages to hop through several nodes. Network infrastructure is not required for a VANET to be created, although permanent network nodes may be used in the form of roadside units. These roadside units open up a wide variety of services for vehicular networks, such as acting as a drop point for messages on sparsely populated roads, serving up geographically-relevant data, or serving as a gateway to the Internet.

VANETs are a special class of mobile ad hoc networks (MANETs) with their own unique characteristics. Most nodes in a VANET are mobile, but because vehicles are generally constrained to roadways, they have a distinct controlled mobility pattern that is subject to vehicular traffic regulations. In urban areas, gaps between roads are often occupied by buildings and other obstacles to radio communication, so communication along roads is sometimes necessary. Vehicles generally move at higher rates of speed than nodes in other kinds of MANETs. Speeds of vehicles moving in the same direction are generally similar, and they can therefore remain in radio contact with one another for much longer periods of time than with vehicles moving in the opposite direction.

Routing is the process of sending information across an inter-network from the source to destination.it can be defined as the process of choosing a path to send the packets. The other term is bridging. The difference between both of them is bridging occur at the layer 2(data link layer) whereas routing in network layer occur at layer 3. Routing algorithm decides the next intermediate node for the packet. Router is the device used for routing information. Some of properties of router for best routing are correctness and simplicity. The packets which are travelling from source node to the destination node is to be correctly delivered. The best is the routing algorithm [7, 8], the better and precise it is. Robustness is another feature that the router has to deliver the packets via the same route even in the case of failures. If any problem occur, it still send the packets to destination via opting any route.

1.2 VANET Applications

VANET facilitates communications among nearby vehicles and between the vehicles and nearby fixed devices. All type of vehicles benefit from VANET. Roadside devices are generally maintained by government agencies, but operations are privatized in some countries. The different type of VANET applications are as follows:

Safety application: The safety applications enhance the protection of passengers by sending and receiving information pertinent to vehicles safety. Generally these alerts such as co-operative collision warning, change warning, emergency video streaming and incident management are directly sent to the drivers or are received by the automatic active safety system.

Comfort applications: Comfort applications are the VANET applications associated with the comfort level of the traveler such as electronic toll collection, parking lot payment and traffic management.

2. NETWORK ARCHITECTURE AND CHARACTERISTICS

VANET's may use fixed cellular gateways and WLAN access points at traffic intersections to connect to the internet, gather information or for routing purposes. The architecture of VANETs falls within three categories:

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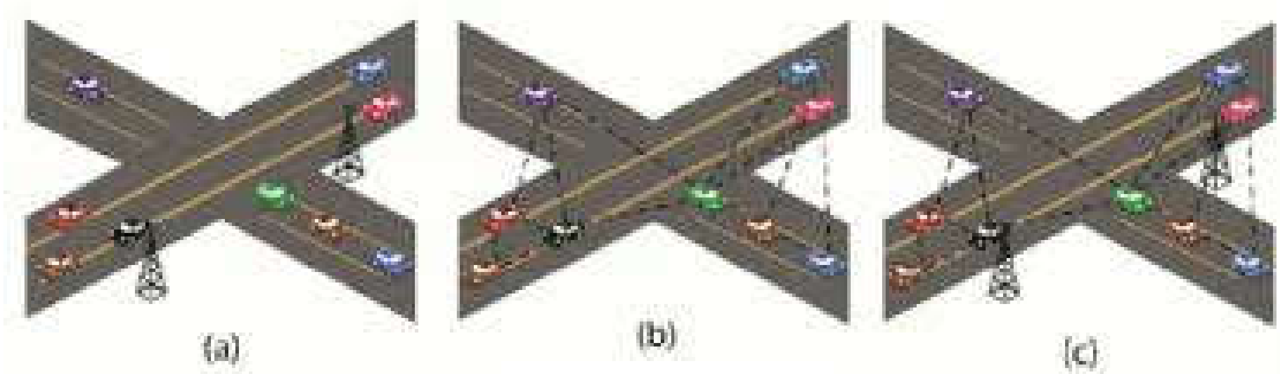

Figure 1. Three possible architectures of VANETs a)Pure cellular/WLAN (b)Pure ad hoc (c)Hybrid

3. UNIQUE VANET CHALLENGES

VANETs may use fixed cellular gateways and WLAN access points at traffic intersections to connect to the internet, gather information or for routing purposes. As shown in figure (a) VANET combine both cellular network and WLAN to form the networks so that a WLAN is used where an access points or 3G connection is available. Stationary or fixed gateways around the sides of roads could provide connectivity to vehicles (nodes) but are eventually unfeasible considering the infrastructure costs involved. In such a scenario, all vehicles and roadside wireless devices can form a mobile ad hoc network (Figure 1(b)) to perform vehicle-to-vehicle communications and achieve certain goals, such as blind crossing (across without light control).A hybrid architecture (Figure 1(c)) of combining cellular, WLAN and ad hoc networks together has also been a possible solution for VANETs.

Highly dynamic topology. Due to high speed of movement between vehicles, the topology of VANETs is always changing. For example, assume that the wireless transmission range of each vehicle is 250 *m*, so that there is a link between two cars if the distance between them is less than 250 *m*. In the worst case, if two cars with the speed of 60 mph (25 m/sec) are driving in opposite directions, the link will last only for at most 10 *sec*.

■ **Frequently disconnected network.** Due to the same reason, the connectivity of the VANETs could also be changed frequently. Especially when the vehicle density is low, it has higher probability that the network is disconnected. In some applications, such as ubiquitous Internet access, the problem needs to be solved. However, one possible solution is to pre-deploy several relay nodes or access points along the road to keep the connectivity

■ **Sufficient energy and storage:** A common characteristic of nodes in VANETs is that nodes have ample energy and computing power (including both storage and processing), since nodes are cars instead of small handheld devices.

■ **Geographical type of communication:** Compared to other networks that use unicast or multicast where the communication end points are defined by ID or group id ,the VANET often have a new type of communication which addresses geographical areas where packets need to be forwarded (*e.g.*, in safety driving applications).

■ **Mobility modelling and predication:** Due to highly mobile node movement and dynamic topology, mobility model and predication play an important role in network protocol design for VANETs. Moreover, vehicular nodes are usually constrained by prebuilt highways, roads and streets, so given the speed and the street map, the future position of the vehicle can be predicated.

■ **Various communications environments:** VANETs are usually operated in two typical communications environments. In highway traffic scenarios, the environment is relatively simple and straightforward (*e.g.*, constrained one-dimensional movement); while in city conditions it becomes much more complex. The streets in a city are often separated by buildings, trees and other obstacles. Therefore, there isn't always a direct line of communications in the direction of intended data communication.

■ **Hard delay constraints:** In some VANETs applications, the network does not require high data rates but has hard delay constraints. For example, in an automatic highway system, when brake event happens, the message should be transferred and arrived in a certain time to avoid car crash. In this kind of applications, instead of average delay, the maximum delay will be crucial.

■ **Interaction with on-board sensors:** It is assumed that the nodes are equipped with on-board sensors to provide information which can be used to form communication links and for routing purposes. For example, GPS receivers are increasingly becoming common in cars which help to provide location information for routing purposes. It is assumed that the nodes are equipped with on-board sensors to provide information which can be used to form communication links

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4. ROUTING PROTOCOLS

Because of the dynamic nature of the mobile nodes in the network, finding and maintaining routes is very challenging in VANETs. Routing in VANETs (with pure ad hoc architectures) has been studied recently and many different protocols were proposed. We classify them into five categories as follows: ad hoc, position-based, cluster based, broadcast, and geocast routing:

Ad Hoc Routing: The most commonly used are AODV, DSR and DSDV. The basic idea of these protocols are that they maintain routes and update tye routing table when it is needed and they are disconnected otherwise. Due to high Dynamic nature of VANET these protocols gives the poor throughput and utilize more time and delay rate is high.

Position based routing: This protocol use the geographical information location (GIL). This gives the information about the current position of nodes by using which route can be maintained.

Cluster based routing: This protocol use the strategy of establishing a virtual infrastructure. Virtual network is formed by clustering of nodes where each cluster has its own cluster head, which is responsible for transferring the packets to the destined node inside its own cluster.it has a good information propagation rate but the only obstacle it faces is the fastest changing topology of VANET due to this formation of cluster is very difficult.

Broadcast based routing: this topology use the flooding technique for broadcasting. Each node forwards the packets to all its neighbors except the one from which it received the packet. This protocol is very suitable for small network but risk of collision is very high in case of dense and large network. Due to which data packets are lost. Thus for the bust and large network this protocol shows poor performance rate.

Geocast routing: In this routing each source node has its own specified geographic region. The main aim of source node is to pass the packets to all nodes under the geographic region. The main task of this protocol is to decrease the collision rate and to reduce the number of rebroadcasting. The main feature of this protocol is that source node does not rebroadcast the received packet immediately but wait for a certain time period to make the decision for transfer of packet. The main idea behind this protocol is to increase the message transmission rate.

5. RELATED WORK

Through this extensive survey, we can conclude that the main distinguishing factor among the various VANET protocols is the means of identifying and organizing routes between the source and destination pairs. A number of routing protocols have been proposed to solve the most critical problems in VANET technology. Most of these protocols cannot address the highly dynamic topology and frequently disconnected network, which are considered as major challenges. We highlighted certain issues related to these protocols and proposed corresponding solutions. Numerous studies have focused on developing VANET routing protocols to support effective and efficient communication between vehicles. However, we found that several key challenges have not been resolved and therefore require extensive research. Network disconnection, bandwidth limitation, security, scalability, driver behavior are more issues need to be solved further.

REFERENCES

[1] Yao H. Ho, Ai H. Ho and Kien A. Hua,"Routing protocols for intervehicular networks: A comparative study in high mobility and large obstacles environments ", Computer communication 31, pp.2767-2780, 2008.
[2] J.Bernsen and D. Manivannan,"Unicast routing protocols for vehicular ad hoc networks: A critical comparison and classification", Pervasive and Mobile computing, pp. 1-18, 2009.
[3] H. Saleet ,R. Langar, K.Naik,Raouf Boutaba, Member, A. Nayak and N. Goel ,"Intersection-Based Geographical Routing Protocol for V ANETs: A Proposal and Analysis",IEEE Transaction on vehicular Technology,VoI.60, pp. 4560-4574, 2011.
[4] T. A. Abbasi, B. Nazir, A. Abbasi, S.M. Bilal and SA Madani," A traffic flow-oriented routing protocol for V ANETs ",Eurasip jounal on wireless communication and networking, pp.I-14,2014
[5] Y. Zhu, R. Jiang, J.Yu, Z. Li and Minglu Li,"Geographic routing based on predictive locations in vehicular ad hoc networks", Journal of Network and Computer Applications ,pp.I-9,2014
[6] S. M. Bilal, Carlos Jesus Bernardos and Carmen Guerrero, "Position based routing in vehicular networks: A survey", Journal of Network and Computer Applications, Vol.36, pp. 685-697, 2013.
[7] S. Biswas and Robert Morris, "Opportunistic Routing in Multi-Hop Wireless Networks", ACM SIGCOMM Computer Communications Review, Vol. 34, No.1, pp. 69-74, 2004
[8] A. Boukerche And Amir Darehshoorzadeh, "Opportunistic Routing in Wireless Networks: Models, Algorithms, and Classifications", ACM Computing Surveys, Vol. 47, No. 2, Article 22, 2014.