A Review on Vehicular Ad-hoc Networks and Broadcasting Mechanisms

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Abstract— VANET has been developing very fast during the past decade. VANET has different mobility pattern and rapidly changeable topology. In inter-vehicle communication (IVC), vehicles exchange important information, e.g., about road conditions and hazardous situations. Having information about danger, the driver can be warned in-time, thus being able to safe life. This paper focuses on the different characteristics of VANET and applications. And also discuss about the various routing protocols and broadcast mechanism. Optimal data disseminiation of time critical information reduces the numbers of road accidents.

Index Terms— VANET, Security, Routing, Broadcast, Data Dissemination, Mobility, Flooding, Relaying.

1 INTRODUCTION

VANET (Vehicular Ad hoc Networks) is a special form of MANET; in which vehicles are nodes. There has been significant interest in improving safety and traffic efficiency. It comprise vehicle to vehicle communication and vehicle to infra communication based on wireless local area network technology. VANET have following Characteristics: [3]

Packet Loss: Packet loss varies a lot depending on various factors such as transmission power levels, interference levels and also affect by the relative position of nodes in different wireless environments, packet loss.

Capacity: Interference, fading, noise and simultaneous accessing of channel, all these factors affect the channel capacity.

Energy: Nodes do not consider energy conservation as vehicles and RSUs act as a constant supply.

Mobility: Nodes (vehicle) move at a very high speed. Therefore mobility pattern

High Dynamic Topologies: Due to the very high speed of vehicles, connectivity between them changes very rapidly.

Security: Due the wireless environment, security becomes a critical aspect. Robust security protocols are needed.

Application Distribution: In safety related application, emergency massages like collision and accident case must be reputed to other user without delay and with higher priority.

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Interaction with Onboard Sensors: Sensors help to detect the collision avoidance around intersection.

Hard Delay Constraints:
In safety related application, maximum delay will become dangerous.

Geographical type of communication: It addressed the geographical area instead if their ID's in safety applications. Unlimited transmission power: Vehicles itself can provide continues power to computing and communication devices.

Higher computational capabilities: Vehicles can afford significant computing, communication and sensing capabilities.

Potentially unbounded network size: VANET covers cities and a country due to its unbounded size .Therefore VANET should be scalable.

Anonymous Addressee: This property helps keeping privacy. No can easily trace the location of an individual.

Time sensitive data exchange: Transmission of data packets in timely manner is needed in safety related applications.

1.1 Applications of VANET

There are two types of VANET applications: Safety related application and Commercial application.

Safety related application:
This application is time critical and helps collision avoidance, lane-changing, post crash and road condition warnings etc.

Commercial application:
Commercial application is not time bounded; it is related to driver's comfort. Services come under this application is: information related to nearest fir station, petrol pumps, shopping malls etc.

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2 DATA DISSEMINATION COMPONENTS

Data dissemination in VANET between components is classified as vehicle to infrastructure (V2I) or infrastructure to Vehicle (I2V) and vehicle to vehicle (V2V). Figure 1 shows the V2I and V2V scenario [2].

2.1 Vehicle to Infrastructure (V2I)

There are two approaches for V2I (or I2V) data dissemination: Push-based and Pull-based approaches [5].

Push-based approach: The roadside unit broadcast the data to all vehicles which are in its range.

Pull based approach: Vehicles are enabled to query information about specific targets and responses are routed toward them. It is useful for acquiring individual-specific data. It generates a lot of cross traffics including contentions and collisions during packet propagation.

2.2 Vehicle to Vehicle (V2V)

For v2v there are two approaches: Flooding and relaying [1].

Flooding: It is suitable for delay sensitive applications. Data is broadcasted to neighbors. Neighbor node stores the data and forwards it to another node.

Relaying: In this mechanism relay node is used and responsible for packet forwarding. Few nodes are involves in packet forwarding. Therefore overhead become less [7].

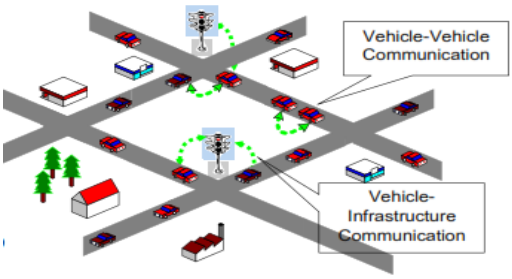

Figure 1: V2I and V2V scenario

3 FOR DATA DISSEMINATION: REQUIREMENTS OF BROADCAST PROTOCOLS

Packet delivery, end-to-end delay and overhead are very important factors for fast and reliable delivery of message to all vehicles [8].

Packet Delivery: This is the probability of reception of message dissemination, which must be very high.
End-to-End Delay: Delay between the initial transmission of a safety message and its reception by vehicles must be low.

Overhead: the packet overhead associated with safety applications should be minimal while maintaining acceptable delivery ratios and delay values.

4 VANET ROUTING PROTOCOLS

VANET Routing Protocols can be categories into: Topology, Geographical, Cluster, Broadcast and Geo-cast Routing. Table1 describes the name protocols and its type. Table 2 describes the working of protocols [6].

Topology based routing protocols: It uses link's information within the network to send the data packets from one node to the other.

Geographic routing: It doesn't maintain any routing table or exchange any link state information with neighbor nodes. Each node knows its positions and its neighbor's information by GPS device.

Cluster-Based Routing: Nearby vehicles forms a cluster. Each cluster has one cluster-head. Cluster head is responsible for intra and inter-cluster management functions. Intra-cluster nodes communicate with each other using direct links, whereas inter-cluster communicates with the help of cluster-headers.

Broadcast Routing: In broadcast routing, through flooding sends a packet to all nodes in the network.

Geo-cast Routing: It perform flooding of packet in the forwarding zone in order to reduce message overhead and network congestion caused by simply flooding packets everywhere.

Table 1: Protocols and its type

R O U T I N G P R O T O C O L				
Topology Based	Proactive	FSR,DSDV,OLSR,CGSR,WRP,TBRPF		
	Reactive	AODV,TORA,DSR,PGB,JARR		
Geo-graphical Based Routing Protocol	Non-DTN	Beacon	Non-Overlay	GPRS,GPRS+AGF,PBR-DV,GRANT
			Overlay	GPCR,Gpsri,CAR,GyTAR,, GSR,A-STAR,STBR, LOUVRE
		Non-Beacon	CBF	
		Hybrid	TO-GO	
	DTB	VADD GeOpps		
	Hybrid	GeoDTN+Nav		
Cluster-Based	COIN,LORA-CBF,TIBCRPH,CBDRP			
Broadcast Based	BROADCOM,UMB,V-TRADE,DV-CAST, EAEP, SRB, PBSM, PGB,DECA,POCA			
Geo-cast Based	DG-CASTOR,IVG,DRG			

Table 2: Working of Protocols

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5 BROADCASTING OPERATION

Protocols		Working
Topology Based	Proactive	Use links information that exists in the network to perform packet forwarding.
	Reactive	Source node starts a route discovery. After the message reaches the destination node, this node will send a route reply message back to the source node using unicast communication.
Geographical Based		Use geographic positioning information in order to select the next forwarding hops
Cluster-Based		Vehicles near to each other form a cluster. Each cluster has one cluster-head which is responsible for intra and inter-cluster management functions
Broadcast Based		Broadcast sends a packet to all nodes in the network, using flooding
Geo-cast Based		Defines a forwarding zone where it directs the flooding of packets.

Broadcasting is used for data transmission, which requires a broadcast routing. Broadcast routing find an efficient route before the actual transmission of data so that data can be transmitted efficiently along the route.

Existing broadcasting algorithm categorized as:

- Cluster based broadcastings
- Ad hoc broadcast algorithms
- Partial dominant Pruning algorithms

Cluster based broadcasting
In this algorithm the mobile nodes have cluster heads to forward the data. The Cluster heads are selected as: node has lowest ID value that would be selected as cluster head [6].

Ad Hoc Broadcast Process
Broadcast Relay Gateway (BRG) is used to select the number of forwarding nodes to relay the packets. This algorithm is also prominently suppressing the number of 2-hop neighbors to relay the packet. If any of the nodes is not present in the covered node set, automatically it will select another node to relay the packet immediately without any delay [10].

Partial dominant Pruning algorithm
It is further reducing the coverage of 2-hop neighbors to be covered by 1-hop neighbor in which a common neighbor is selected to relay the messages. But the algorithm does not perform the reliable communication. It does not get any acknowledgement from the receiver node [1].

In the above mentioned algorithms the forwarded node is waiting for some amount of time. This means that the node should wait for the timer's predefined time for acknowledgement. Unless otherwise it did not get any reply from the forwarding node and resend the packets for the maximum number of retries. So that latency will be increased [4].

6 CONCLUSION

This paper provides the study of different VANET Characteristics, applications, data dissemination components, VANET routing protocol and broadcasting mechanisms. This paper concluded that on the basis of routing protocols and broadcast mechnanism that VANET is a promising wireless communication technology for improving highway safety and information services to save lifes.

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