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A Study on Transmission Strategies in VANET

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ABSTRACT: A vehicular ad hoc network (VANET) is subclass of Mobile ad hoc network (MANET) in which vehicles act as mobile nodes. Many MANET routing protocol such as AODV and DSR are not suitable VANET .This is because VANET differs from MANET in aspects like topology and mobility model. This paper analyzes the advantages and disadvantages of different Inter Vehicular Routing protocols and mainly deals with Transmission Strategies of Routing Protocol.

KEYWORDS: Vehicular ad hoc network, Routing Protocols, MANET, Topology, Transmission Strategies.

I. INTRODUCTION

Vehicular Ad-hoc Networks or VANETs supports self-organized and self-configured ad hoc routing protocols that manage exchange of messages. This makes VANET good for safety applications.

Vehicle to vehicle communication (V2V) has two types of communication:

- One hop communication and
- Multi hop communication

VANET has special characteristics that distinguish it from other mobile ad hoc networks. The characteristics are: mobility, self-organization, distributed communication, pattern restrictions on road, and no restrictions of network size [1], [3], [5].
VANET is facing many problems such as security problems, privacy problems, Quality of service and Routing Problem. This paper will mainly focus on Routing problem in Vehicle to Vehicle Communication.
The main goal is to provide optimal feasible routing in Vehicular Environment with minimum overhead. Inter vehicular communications are used to enhance the safety of drivers and to provide the comfortable driving environment. To achieve this messages are need to be sent between vehicles.
In Section 2, Classification Strategy is checked. Section 3 describes the Transmission Strategy. Section 4 deals with Routing Information. Section 5 show comparison table
and section 6 gives the conclusion.

II. CLASSIFICATION STRATEGIES

There are different strategies available to classify the Routing Technique. Some papers classify Routing protocols into three classes such as:

- Unicast,
- Multicast and Geocast,
- Broadcast.

This is based on Routing information from source to destination.
Some other papers classified routing protocols into five classes:

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- Topology-based,
- Position-based,
- Geocast-based,
- Broadcast,
- Cluster-based

Routing protocols [1] [6].

As other papers classified VANETs routing protocols into three classes:

- Hierarchical routing,
- Flat routing and
- Position-base routing.

This classification is based on their network structures [7][8]. This is again subdivided into strategies:

- Proactive and
- Reactive.

In this paper, classification is based on Transmission strategies and Routing Information.
Classification based on Transmission strategy is given as follows:

- Unicast,
- Broadcast and
- Multicast.

Classification on Routing Information mainly focuses on:

- Topology Based,
- Position Based.

The Transmission strategies, has a direct impact in protocol design and also in performance of the network.
The routing information is used in packet forwarding.

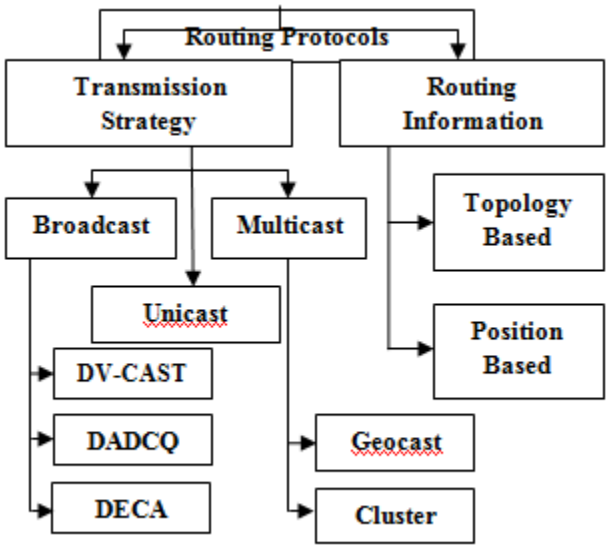

Fig1.Classification of Routing Protocols

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III. TRANSMISSION STRATEGIES

Information delivery can be classified into four types:

- Unicast,
- Broadcast,
- Multicast, and Geocast

However Geocast is a special type of multicast. The operation of multicast and geocast can be merged together in geocast.

A. Unicast

Unicast routing is the forwarding of traffic from a single location on an internetwork from a source to a destination by using routers; where the intermediate nodes are used to forward data from the source to the destination. There are several unicast protocols such as proactive, reactive and hybrid routing protocols.

- *Proactive Protocols* keep track of routes for all destinations in the ad hoc network. It is also called as Table-driven Protocols because the routes exist in the form of tables. In VANET, nodes are vehicles which have high mobility and moves with high speed. So proactive based routing is not suitable for VANET.
- *Reactive Protocols* acquire routing information only when it is actually needed. The Advantage is that due to the high uncertainty in the position of the nodes, these protocols are more suited for ad-hoc networks. Some of the Reactive Routing Protocols are AODV (Ad hoc on-demand Distance Vector), DSR (Dynamic Source Routing). Dynamic Source Routing (DSR) is an On Demand unicast routing protocol that utilizes source routing algorithm. In source routing algorithm, each packet contains complete routing information. AODV determines a route to a destination only when a node wants to send a packet to the destination. Until the source needs the routes they are maintained.
- *Hybrid routing* is the combination of proactive and reactive protocols.

B. Broadcast

Broadcasting routing enables packets to flood into the network to all available nodes within the domain. Broadcast is mainly used in the route discovery process; some protocols (like AODV) allow nodes to rebroadcast the packets received. This scheme allows packets to deliver via many nodes; however it could consume the network bandwidth by sending replicated packets.

1) Distributed Vehicular Broadcast Protocol (DV-CAST): DV-CAST is a broadcast routing protocol uses multiple hops to transfer information. In this protocol, each node monitors the neighboring connectivity status all the time, to broadcasts to them. DV-CAST deals different classes according to many aspects. It uses the beacon messages periodically to get information about the network topology. In a small amount of the connected nodes, the node can be rebroadcast the message by using the nodes that moves in the same way. The DV-CAST protocol minimizes the broadcasting overhead. So, the protocol is appropriate for both of sparse and dense traffic situations. However, this protocol could cause a highly control overhead and increase the delay in the transmission of data [8][9].

2) Distribution-Adaptive Distance With Channel Quality (DADCQ): DADCQ aims to provide a well performed adaptive multi hop broadcast protocol for large networks with wide node distribution. Based on the information related to position, it selects forwarding nodes to rebroadcast packets. In rebroadcast decision, when a packet is received in a node, it first checks its distance from the destination. If the node is very close there then no need for rebroadcast. But, if this distance is large, then the packet has to be rebroadcasted by the node. DADCQ has a minimum transmission overhead [4][5]. However it may cause a large message overhead.

3) Density-Aware Reliable Broadcasting Protocol (DECA): DECA is a density aware protocol; it uses beacon messages to get knowledge about its neighboring nodes and to share information. It is a reliable broadcast protocol uses store and forward scheme for transmission. When a node wants to broadcasts a packet, it always chooses a next hop to rebroadcast the packet initially. The selection is based on the amount of node information. After the next hop selection, the node adds the next hop ID, to the packet and then broadcast the packet. Other nodes, should store the packet and startup a waiting timer; if the time is over and no rebroadcast packet received then they rebroadcast the packet by themselves [2]. Mainly, DECA protocol doesn't use any global position information in its processes; that help it to be more flexible.

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However, transmission of beaconing periodically could cause a broadcast storm problem which increases the network overhead and decreases the performance.

C. Multicast

A multicast group is composed of senders and receivers. The process of sending message from one node to many other nodes is called Multicast. Generally, a sender initially floods a join message to all nodes in the network. Interested nodes reply to the sender via the reverse path.

1) Geocast-Based Routing Protocol: Geocast routing protocols is a subclass of a multicast routing protocol which based on sending packets from a source to a group of destinations which is selective in nature. Some publications remark geocast routing is actually a multicast position-based routing [1]. Nodes are elements in one group, if they located in the same geographical area. The membership of the node is changed when the node moves out of the defined geographical area scope. In this case it drops the packet. Zone Of Forward aims to achieve a reliable packet's delivery in highly changing topology. Network changes are deal with periodic transmission. The one drawback of geocast is packet transmission delay that caused by disconnection of network. There are a variety of proposed Geo cast routing protocols available. ROVER and MOBICAST are the examples of Geocast-Based Routing Protocol.

2) Cluster-Based Routing Protocol: This protocol divides the network to clusters. Clusters of the same group will have the same characteristics, like same direction or same velocity. Each cluster has a cluster head. Its task is to manage communication process inside, and outside the cluster. Nodes inside the cluster communicate by directly, but their communication with other nodes outside the cluster is achieved only by their cluster head. This scheme can provide a good scalability for large networks [1].

IV. ROUTING INFORMATION

This Routing Information is divided into two subclasses:

- Topology-based routing protocols,
- Position-based routing protocols.

In topology-based routing, each node should be aware of the network layout. Each node should be able to forward packets using information about available nodes and links.

In contrast, position-based routing is aware of the node locations for packet forwarding.

A. Topology-Based Routing Protocol

Topology-based routing protocol is traditionally MANET routing protocol. It uses link's information which is stored in the routing table as a basis to forward packets from source node to destination. It is commonly categorized into three categories based on architecture [2][3]:

- Proactive (periodic)
- Reactive (on-demand) and
- Hybrid

B. Position-Based Routing Protocol

Position or geographic routing protocol is based on the positional information in routing process. In these protocols the source sends a packet to the destination using its geographic position than using network address. In this protocol each node is able to decide its location and the location of its neighbors through the Geographic Position System (GPS) assistance. The neighbor node is identified as a node if it is located inside the node's radio range. When the packet is need to send by the source node, it stores the position of the destination in the packet header. It will help in forwarding the packet to the destination without route discovery, route maintenance, or even aware of topology of the network [3], [9].

Thus the position routing protocols are more stable and suitable for VANET [3].

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TABLE I. COMPARISON TABLE

Routing Protocols	**Information Delivery**	**Pros**	**Cons**
Unicast	Single source and destination	Minimum overhead and delay More privacy	Difficult to maintain link High Packet loss Less reliable
Broadcast	Flooding to all nodes in a domain	Reliability Less packet loss	More Bandwidth Forms loop and congestion occur Less Throughput High Delay
Multicast	From source to destination by Geocast and cluster	Less Throughput Less Delay Easy to implement Efficient Routing Minimum network consumption	Overhead is high More Bandwidth Forms loop

V. CONCLUSION

In this paper, the pros and cons of different Transmission Strategy in VANET have been investigated. This paper illustrates the motivation and characteristics and studied in detail VANETs routing problem, mainly vehicle to vehicle (V2V) communication, provides two classifications of VANETs routing protocols that exist in the recent years. Comparison also can be done among even more different routing protocols.

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