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Topology Based Routing Protocols in Vehicular Ad-Hoc Networks (VANET)

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ABSTRACT

Vehicular Ad-hoc network (VANET) is an exacting form of Mobile Ad-hoc Network (MANET) where the vehicles are act as nodes. Due to high mobility of nodes, high partitioned network and also dynamic changing routing protocols, the routing in Vanet is dispute one. The routing protocols functions should depends on the internal and external characteristics of VANET such as nodes mobility, road topology and obstacles which block the signal. A routing protocol is used to find the route between the nodes to communicate each other. The particular route to be selected by routing protocol. The routers have the information about the network which is directly connected to it. The routing protocol first forward the information to the immediate neighbor node, then it forward the information throughout the network. In VANET the routing protocol are classify based on topology, position of vehicle, cluster based vehicle, broadcast based routing and geocast based routing. This article explains the topology based routing protocol, especially reactive routing protocol which is a part of the topology based routing protocol.

Keywords: VANET, Topology based routing, reactive routing, AODV, DSR, TORA

1. INTRODUCTION

The vehicle which is connected to each other through ad hoc network which forms the wireless network termed as “Vehicular Ad Hoc Network”. In VANET the communication should takes place through vehicle to vehicle, vehicle to infrastructure, and infrastructure to vehicle communication. In VANET the traffic and safety efficiency among the vehicles should enhance better by integrating the communication and computing technologies into the vehicles which results the advancement of the Intelligent Transportation System (ITS). Thus this ITS will supports the drivers for safe drive and to make roads safety by falling the number of automobile accidents.

2. ROUTING PROTOCOL

Due to dynamic changing network, high mobility of network and high partitions in network, the routing protocol will broadly categorize into five groups:

- Topology based routing protocol
- Position based routing protocol
- Cluster based routing protocol
- Geocast based routing protocol
- Broadcast routing protocol

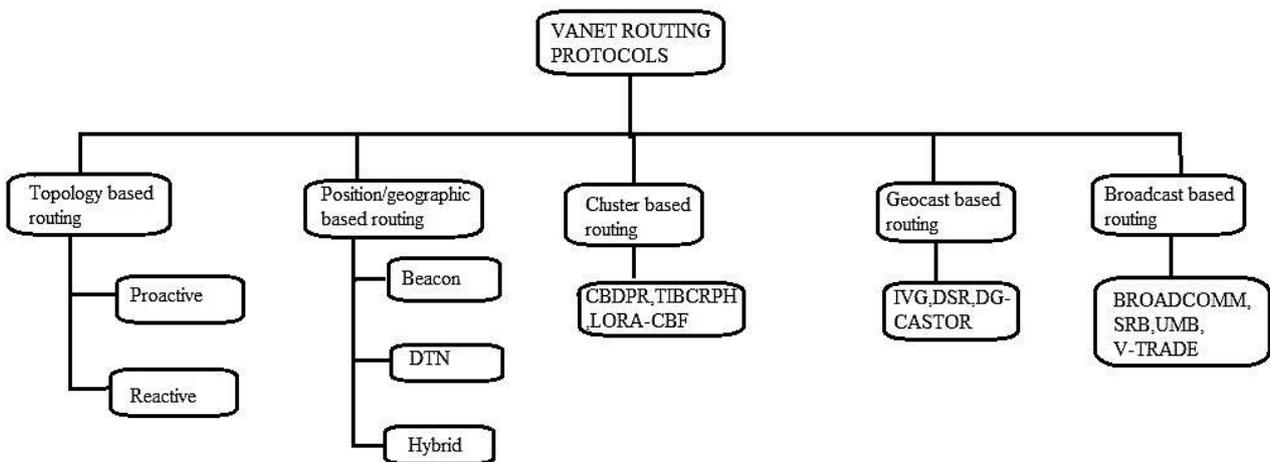


Figure 1. VANET routing protocols

2. 1. POSITION/GEOGRAPHIC BASED ROUTING PROTOCOL

Based on the geographic position of the vehicle, the routing should be decided. This type of protocol need location service about the destination. Simple Location Services (SLS),

DREAM Location Service (DLS), Global Position System (GPS), and Reactive Location Services (RLS) are some of the location services. The packet should deliver to the one-hop neighbor which is nearer to the destination without any knowledge of digital map. The position of the vehicle should be identified by sending the beacons among themselves. This type of protocol will be applicable to the environment which needs peak delivery ratio then topology routing. It offers good scalability and minimum delay. The protocol comprises:

- Non Delay Tolerant Network (Non DTN)
- Delay Tolerant Network (DTN)
- Hybrid routing protocol

2. 2. CLUSTER BASED ROUTING PROTOCOL

This type of protocol is used in cluster. The node which is selected as cluster head will broadcast the information to the other nodes in cluster. In a highly mobile environment, this type of network will have high delay and overhead because of the formation of cluster. The cluster based routing protocols include:

- COIN
- LORA-CBF
- TIBCRPH
- CDBRP

2. 3. GEOCAST BASED ROUTING PROTOCOL

It is a location dependent multicast routing. In a particular geographical region which is said to be a Zone of Relevance (ZOR), the source node will send the information to all other nodes. The network overhead and network congestion should be reduced by directing the packets in a particular route. The geocast routing protocol includes:

- IVG
- DG-CASTOR
- DRG

2. 4. BROADCAST BASED ROUTING PROTOCOL

Flooding is the well-known method which is used for broadcast all the nodes in the network and again the message will be re-broadcast to other nodes in network. It is mainly used for exchanging weather, traffic information, and emergency information, road conditions among the vehicles and also delivering announcements along with advertisements to all the vehicles. The broadcast routing protocols which are used are:

- BROADCASTMM
- UMB
- V-TRADE
- DV-CAST

2. 5. TOPOLOGY BASED ROUTING PROTOCOL

This type of protocol will make routing decision based on communication links information and determine the network topology by using the global information. The routing protocol will further classified into

- Proactive routing
- Reactive routing
- Hybrid routing

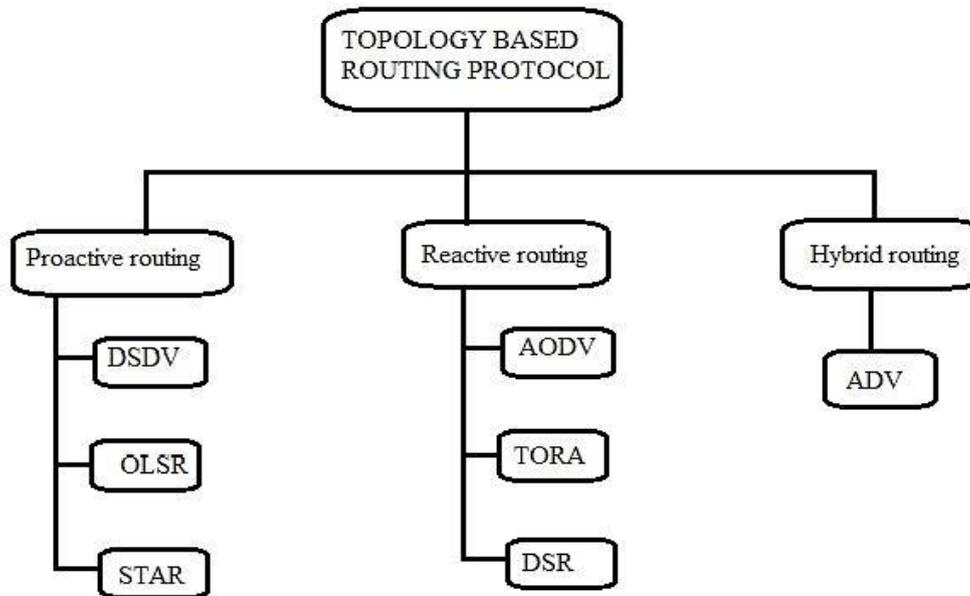


Figure 2. Topology Based Routing Protocol

2. 5. 1. PROACTIVE ROUTING PROTOCOL

Another name of this protocol is said to be table-driven protocol, because it needs a table (which contains the topology information) to send the data between the nodes. The periodic and triggered update is the two kinds of update which is used to broadcast the table, this leads to wastage of bandwidth and power in the network. When the number of nodes increases in the network the table size also increases which provides increasing the load in the network. The table also contains the information about the nodes which is not currently participating in the network for communication. Thus the proactive based routing protocol is not favor for broad network for the reason of overhead in routing tables.

The well known proactive protocol includes:

- Destination Sequence Distance Vector Routing (DSDV)
- Optimized Link State Routing Protocols (OLSR)
- Fisheye State Routing Protocol (FSR)

2. 5. 2. REACTIVE ROUTING PROTOCOL

In this protocol, the route should be determined only when there is need for a node to communicate which reduces the network overhead. In highly mobile regions and frequently topology changes network will use this reactive routing protocol. The route discovery process is also takes place in this protocol, where the source node floods the route request message to all other nodes in the network, once it reaches the destination. Then the destination node will send the route reply message to the source node. The source routing and hop-by-hop routing are the two methods of routing.

In Source routing, the path information from the source to destination is available, but in the hop-by-hop routing, the packet contains information about the next hop address and destination information. The protocols in reactive routing include.

- Ad Hoc On Demand Distance Vector (AODV)
- Dynamic Source Routing (DSR)
- Temporally Ordered Routing Algorithm (TORA)

2. 5. 2. 1. AD HOC ON DEMAND DISTANCE VECTOR (AODV)

This type of protocol will useful in both unicast and multicast routing. Only where there is a need for communication the route will be created. It has the routing table which includes the sequence number of destination that makes to prevent the routing loops. Thus the route redundancy and memory requirements will be reduced. It includes the three main types of packets, they are Route request message (RREQ), Route Reply message (RREP), Route Error Message (RERR).

The RREQ is used to demand the route between the nodes. RREP is used to send reply message among the nodes. RERR is used to send notification among the nodes, when there is any link loss occurs.

2. 5. 2. 2 DYNAMIC SOURCE ROUTING (DSR)

The node should communicate among any destination in multiple networks by predicting the route dynamically. The source node copies the request query in its header and sends the packet, once it reaches the destination, then the destination will get the path by sending the query in the header to the source node. The route discovery and the automatic route maintenance take place in this network. It is useful for multihop wireless network.

2. 5. 2. 3. TEMPORALLY ORDERED ROUTING ALGORITHM (TORA)

It is an on demand routing protocol which mainly based on the Directed acyclic graph (DAG). The graph should be build based on the height of the tree from the source to destination. If a node want to send the packet to destination, then the neighbor which is in the DAG only broadcast the packet towards the downward link.

2. 5. 3. HYBRID ROUTING PROTOCOL

It's a mixture of proactive and reactive protocols. It is mainly used to reduce the delay which is occurs in the route discovery process and control overhead which is occur in the proactive protocol. This type of protocol partition the network into many zones which leads to

high reliable in route maintenance and discovery process. It is high scalable than proactive and reactive protocol.

2. 5. 3. 1. ZONE ROUTING PROTOCOL

This protocol is used to decrease the overhead and delay which is heavily occurred in the route discovery process, by partition the network into zones. Based on the hop distance, power of transmission, signal strength, speed and depends on many other factors the zones should be created. The Zone routing protocol use the reactive routing and proactive routing in outside and the inside zone respectively.

3. CONCLUSIONS

This paper provides the outline of different routing protocols and highlights the various protocols which are used mainly in the topology based routing. The main problem which is occurred in route discovering and route maintaining are overhead, due to highly mobile region of non-coordinated vehicles. After analyzing the survey of topology based routing, the hybrid protocol will provide the better route discovery and route maintenance with low overhead. Then according to the performance the position based routing is better. Thus the vehicle safety communication in routing is a challenging approach. In future, we are focusing proactive based protocol in comparison with reactive based protocol in topology routing.

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