A Survey on Topology based Reactive Routing Protocols in Vanets

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Abstract- VANETS comes under the shadow of MANETS. It provides a prominent approach to the intelligent transport system. In this paper, we have explained the different number of topology-based reactive routing protocols for the smart transport system. Vanets provides many applications with its infrastructure less topology like traffic information, vehicle safety etc. Designing a new and efficient routing protocol for all the applications of vanets is very difficult so we have compared all the protocols with a detailed analysis so that we may find the best among them after that we may improve the routing process by considering the different types of parameters. At first, we will discuss about the basics of vanets and its characteristics later we will discuss the categories of routing protocols and their comparative analysis.

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ASURVEYONTOPOLOGYBASEDREACTIVEROUTINGPROTOCOLSINVANETS

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A Survey on Topology based Reactive Routing Protocols in Vanets

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I. Introduction

Vehicular Ad-Hoc Networks (VANET) are a particular kind of Mobile Ad Hoc Network, (MANET), in which vehicles act as nodes and each vehicle is equipped with transmission capabilities which are interconnected to form a network. The main intention of delve into VANETs is the enhancing the vehicle safety using inter-vehicular communication (IVC). VANETs have several different aspects compared to MANETs, in that the nodes move with high velocity because of which the topology changes rapidly. VANETs pretence many challenges on expertise, protocols, and refuge, which increase the need for research in this field.

The communication in these types of networks are in between vehicles to roads and vehicles to vehicles and inters road communication is used for improving the safety and to reach the goals of vanets. The following figure gives the idea of communication in vanets.

a) Types Communication in VANETS

Fascinatingly the applications of WSNs were emerged drastically, Such as accessing internet through vehicles; sharing of information among vehicles, traffic information etc. So efficient routing protocol should be used to avoid delay, packet drops and reduce frequent link breaks. Now a day's vehicles on roads are heavily increased, due to the vibrant nature of VANETs links between two vehicles would remain for a short time due to this communication would get delay which decreases network performance. Existing approaches used E-TX, link expiration time, rate estimations and flooding methods for establishing a reliable route between source and destination. But considering only expiration time and rate factors could not yield better results because if a node with high expiration time with minimum stability will not establish a proper communication.
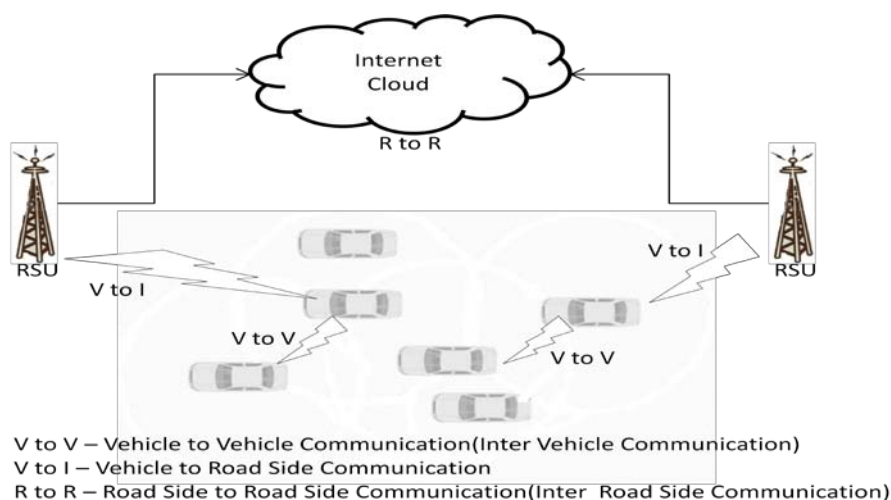

Fig. 1: Architecture of VANET

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The following are the different characteristics of VANETs which are similar to MANETs [3], but there are some specific kinds which can be categorized as follows:

(1) Highly dynamic topology
(2) Frequent disconnected network
(3) Mobility modeling and Prediction
(4) Communication Environment
(5) Hard delay constraints
(6) Interaction with onboard sensors,
(7) Unlimited Battery Power and Storage

II. Overview of Routing Protocols in Vanets

Routing is the process of transmitting the data among the nodes from one place to another here from one vehicle to another vehicle. Routing occurs at Layer 3 (network layer) of the OSI model. In VANET, The routing protocols are broadly categorized into many types [4]. Depending upon the topology, transmission strategies, position, delay tolerant, Cluster-based, Geo cast, Multicast etc. We have a vast number of routing protocols in VANETS. In this paper, we will discuss topology-based reactive routing protocols under VANETS. It comes under the category of Routing Information based Routing. Under that we have two types they are Topology based and Position based techniques.
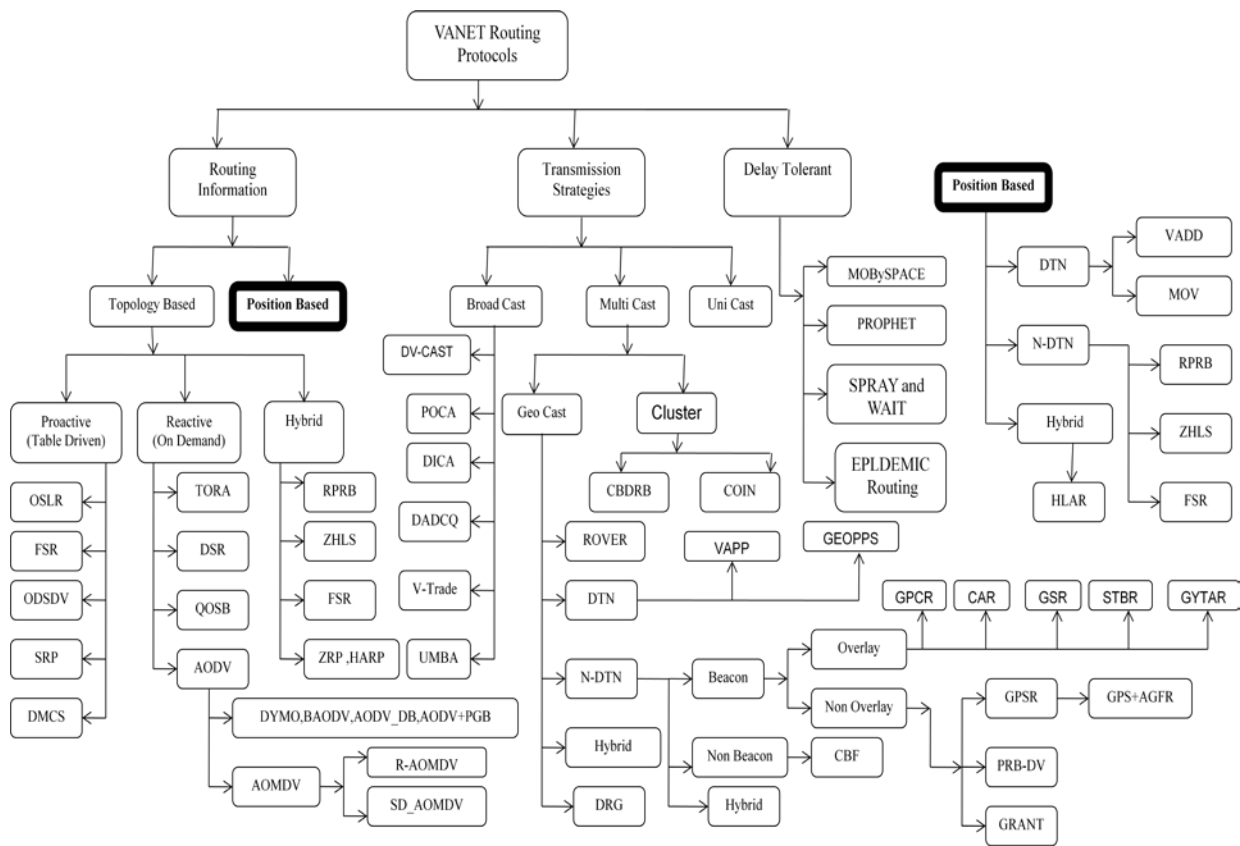

Fig. 2: Categories of Routing Algorithms

III. Topology-based Routing Protocols

These types of routing protocols use the link information that exists in the set of connections (network) to perform packet forwarding. They discover the route and retain it in a Routing table before the sender starts transmitting data. They are additional at odds into reactive, proactive and hybrid protocols. These steering Protocols are standards and used for transfer the data in the Networks. Efficient Routing protocols make dynamic routing decisions in network. Topology Based Routing schemes generally require additional node topology information during the routing decision process.
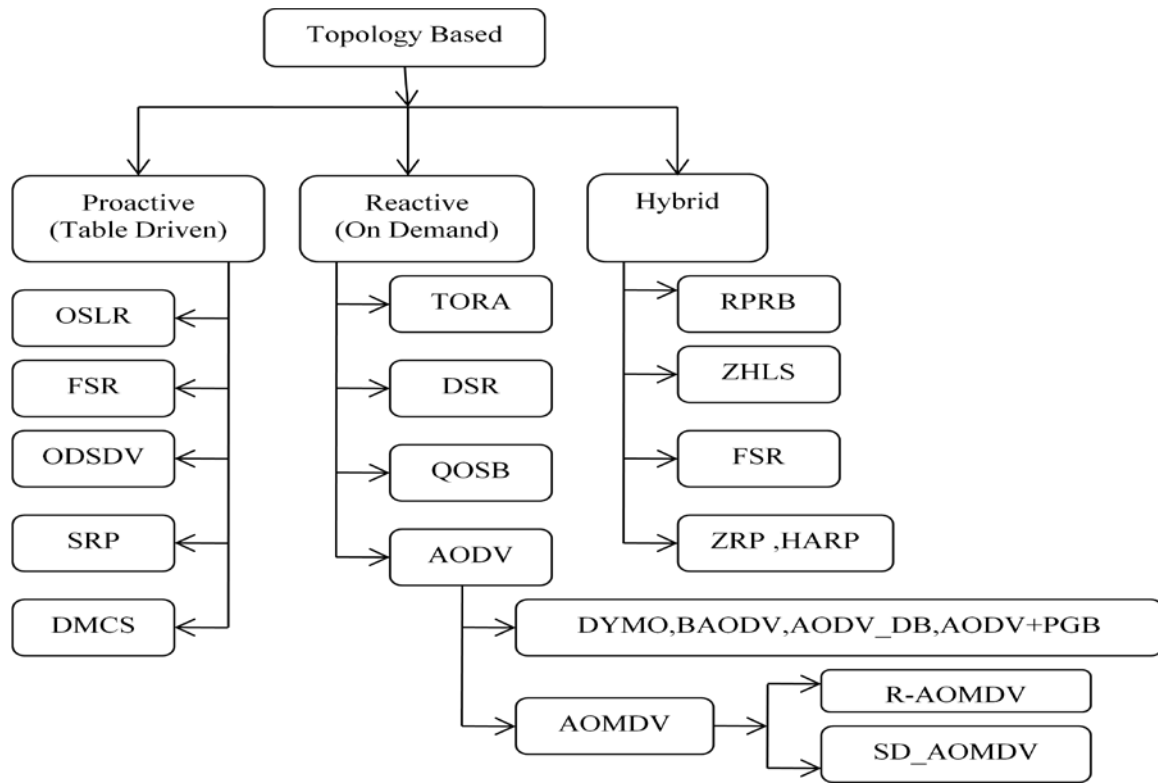
Fig. 3: Topology based routing algorithms

a) Proactive routing protocol

The proactive routing means that the routing information, like next forwarding hop is maintained in the background irrespective of communication requests.
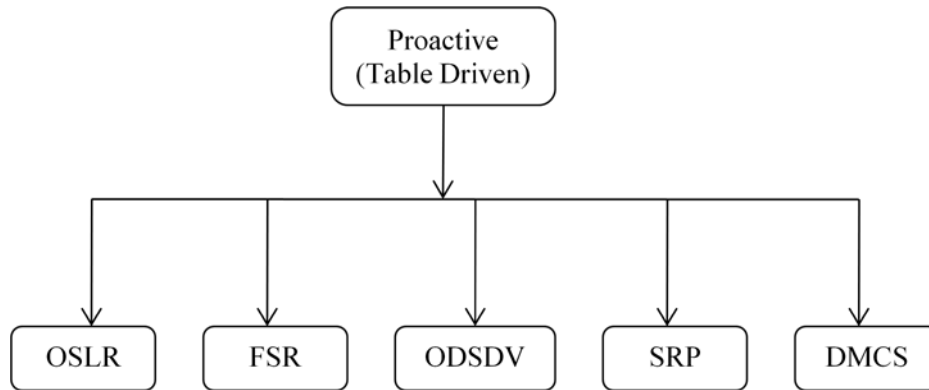

Fig. 4: Proactive routing algorithms types

- The benefit of proactive routing protocol is that there is no route detection since the destination route is stored in the backdrop, but the inconvenience of this protocol is that it provides low latency for real-time application. A routing table is constructed and maintained within a node. It also leads to the preservation of idle data paths, which causes the lessening in the available bandwidth. The proactive routing protocols care for the tables representing the topology. In these protocols the tables updating frequently and sends the information from one node to another. Proactive routing protocols also called the table driven protocols due to its nature. There are two types of updating available in proactive protocols periodic update and triggered update due to broadcast the update tables they waste power and bandwidth in the network [8].

b) Reactive routing protocols

Reactive routing opens a route only when it is necessary for a node to communicate with another node. It maintains only the routes that are currently in use, thereby reducing the burden on the network.
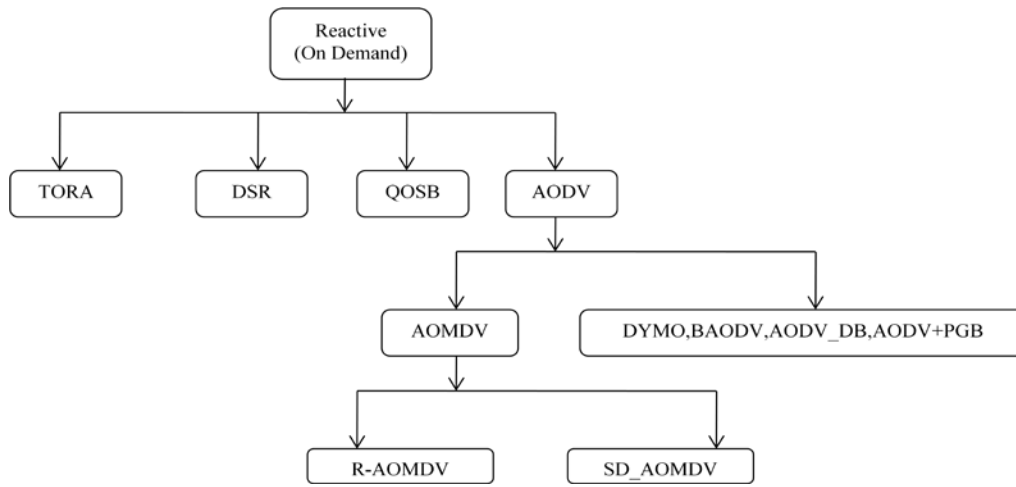
Fig. 5: Reactive routing algorithms types

Information Engineering and Applications in which the query packets are flooded into the network for the path search and this phase completes when route is found. These protocols are called as on-demand routing protocols as they periodically update the routing table, when Reactive routing consists of route discovery phase g Protocols for VANET, Journal of some data is there to send. The various types of reactive routing protocols are AODV, DSR and TORA.

i. *Temporally ordered routing algorithm*

The Temporally Ordered Routing Algorithm (TORA) is an algorithm for routing the data across the different types of Networks like Wireless Mesh Networks, Wireless Sensor Networks, Mobile Adhoc Networks and Vehicular Adhoc Networks etc. It attempts to achieve a high degree of scalability using a "flat", non-hierarchical routing algorithm.

TORA constructs and maintains a Directed Acyclic Graph (DAG) rooted at a destination with a principle of No two nodes may have the same height.

Here the information is transferred or flows from the nodes which are having the highest metrics to the nodes which are having the lowest metrics. So here the data transmission is only 'down-hill'. So, it achieves loop-free multipath routing, as the data cannot flow 'up-hill' and so cross back on itself. It mainly operates on the following three basic functions. They are:

1. Route creation
2. Route maintenance
3. Route erasure

At the time of the route creation and maintenance phases, the nodes use the height as a parameter to establish a directed acyclic graph (DAG) rooted at destination [1]. After that links are assigned based on the relative height metric of neighbouring nodes. During the changing of the nodes if the DAG is broken and the route maintenance unit comes into the picture to re-establish a DAG routed at the destination. Timing is the most important factor for TORA because

the height metric is dependent on the logical time of the link failure. TORA's route erasure phase is essentially involving flooding a broadcast clear packet (CLR) throughout the network to erase invalid routes. The algorithm [1] is described as follows.

Algorithm:
If (failure of link)
Generate reference level
Else If (all neighboring nodes are not at same reference level)
Propagate reference level
Else If (reference bit ==0)
Reflect Reference Level
Else If (Reference Level created by the user)
Clear Reference Level
Else
Generate Reference Level

ii. *Dynamic Source Routing*

The Dynamic Source Routing protocol (DSR) is a unproblematic and well-organized routing protocol intended specifically used for multi-hop wireless ad hoc networks of mobile nodes and also it was implemented for routing in vehicular networks too[5].

It allows the set of Connections (Network) to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. The protocol is bonded with the two mechanisms of Route Discovery and Route Maintenance [5], which work jointly to allow nodes to discover and maintain source routes to arbitrary destinations in the ad hoc network.

Route Discovery is the method by which a node or a *Source vehicle* (S) wishing to send a packet to a destination node or *Destination vehicle* (D) obtains a source route to D. Route Discovery is used only when S attempts to send a packet to D and does not already know a route to D.
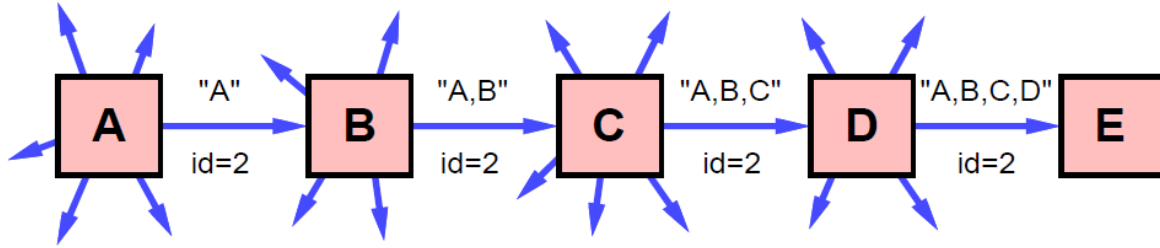
Discovery Process:

Figure 1: Route Discovery example: Node **A** is the initiator and node **E** is the target

Route Maintenance is the method by which node **S** is able to sense, while using a source route to **D**, if the network topology has transformed such that it can no longer use its route to **D** since a link along the route no longer works. When Route Maintenance indicates a source route is out of order, **S** can attempt to use any other route it happens to know to **D**, or can invoke Route Discovery again to find a new route. Route Maintenance is used only when **S** is actually sending packets to **D**.
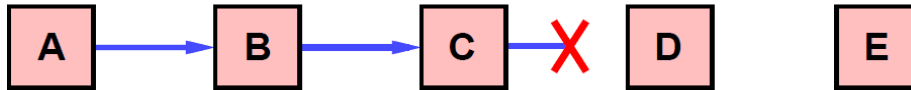
Maintenance Process:

Figure 2: Route Maintenance example: Node **C** is unable to forward a packet from **A** to **E** over its link to next hop **D**

c) *Hybrid routing protocols*

Hybrid routing protocols is combination of reactive routing protocols and proactive routing protocols which reduce the control overhead of proactive routing protocols and decrease the initial Route discovery delay in reactive routing protocols. E.g. Zone Routing protocol (ZRP), Hybrid Routing Protocol (HARP) etc. The protocols under the Hybrid Routing are as follows.
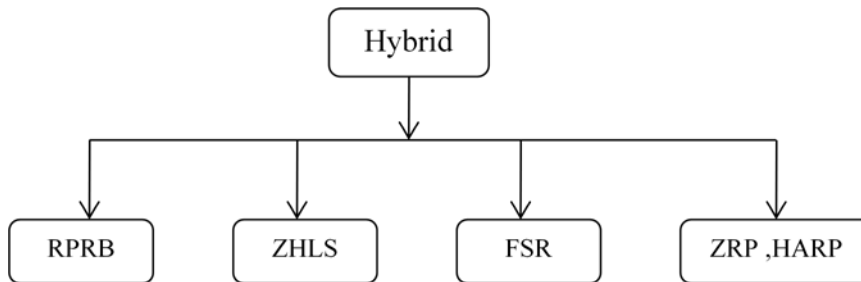

Fig. 6: Hybrid routing algorithms types

COMPARISON:

Here we have compared the protocols depending upon the following different types of parameters and the results are furnished given below.
1. Forwarding Method
2. Digital Map Requirement
3. Infrastructure Requirement
4. Realistic Traffic Flow
5. Recovery Strategy
6. Area

Table 1: Comparison of topology based Reactive routing protocol vs others protocols

Protocols	Proactive Protocols	Reactive Protocols	Position based Greedy Protocols	Delay Bounded Protocols	Cluster Based Protocols	Broadcast Protocols	Geo Cast Protocols
Prior Forwarding Method	Wireless Multi Hop Forwarding	Wireless Multi Hop Forwarding	Heuristic Method	Carry & Forward	Wireless Multi Hop Forwarding	Wireless Multi Hop Forwarding	Wireless Multi Hop Forwarding
Digital Map Requirement	NO	NO	NO	NO	YES	NO	NO
Visual Infrastructure Requirement	NO	NO	NO	NO	YES	NO	NO
Realistic Traffic Flow	YES	YES	YES	NO	NO	YES	YES
Recovery Strategy	Multi Hop Forwarding	Carry & Forward	Carry & Forward	Multi Hop Forwarding	Carry & Forward	Carry & Forward	Flooding
Scenario / Area	Urban	Urban	Urban	Sparse	Urban	Highway	Highway

IV. Conclusion

In this paper we have studied about the introduction of Vehicular ad-hoc networks and its Routing Protocols especially we have studied topology-based Reactive Routing Protocols. And we had given a table which includes the principles and techniques of different types of algorithms used in the respective category.

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