EFFICIENT AND DYNAMIC ROUTING PROTOCOL IN VANET: A SURVEY

Ms. Apeksha Kulakarni, Mrs. Sharmila.K.P

Abstract— Vehicular Ad-Hoc Network is a special case of Mobile Ad-Hoc Network mainly used for road safety applications. VANETs have emerged as a powerful technology in the wireless networks. In VANET vehicles are used as nodes. There exist many routing protocols for different purposes. But the protocols used for MANET are not applicable to VANET because of its characteristics such as high mobility and changing communication environment as vehicles moves with different speed. This paper provides survey of different routing protocols which are suitable for VANET and also the comparison of protocols depending on their characteristics. This paper includes mainly Dynamic Source Routing (DSR) protocol, Optimized Link State Routing (OLSR) protocol and Fisheye State Routing (FSR) protocol.

Keywords: DSR, FSR, OLSR, Nodes, Routing protocol, Topology, VANET

I. INTRODUCTION

In recent days Vehicular Ad-hoc Networks (VANETs) became very popular due its usage in many applications. Still a lot of research works are going on day by day. In Vehicular ad-hoc network vehicles are treated as nodes. One node passes the messages to all other nodes which are located in the network topology. In all the applications messages are routed from source to destination. VANET is an important aspect that establishes an essential route between the vehicles. Due to rapid changing topology it is difficult to design routing protocol in the vehicles. There are three types of communication in Vehicular Ah-hoc Network as vehicle to vehicle communication (V2V), vehicle to road side or infrastructure communication (V2R or V2I) and road -side to road-side communication (R2R). In V2V communication collection and transmission of data and aggregation are done. It is very effective for faster delivery of messages directly between vehicles within the network. In V2I communication it uses technologies like global system for mobile communication for distribution of information from nodes. The basic VANET Scenario is shown in figure 1 and 2. VANET is differentiating it with MANET by its characteristics as-

- High mobility of nodes

- Road pattern restrictions

- Distributed communication

- Self-organization

- No restrictions for network size

All these characteristics made VANETs environment a challenging for developing efficient routing protocols. We have a number of ad hoc routing protocols for MANETs but when we have to deal with a VANET then we require ad hoc routing protocols that must adapt continuously to the unreliable conditions. MANET routing protocol is not suitable for VANET because MANET routing protocol has difficulties from finding stable routing paths in VANET environments.
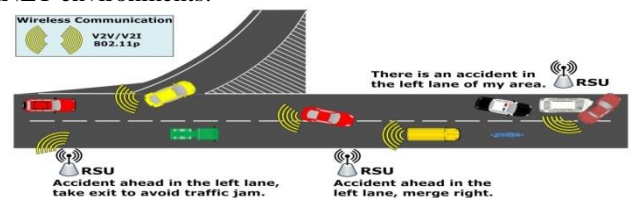

Figure 1: Vehicular Ad-hoc Network

The Figure 1 shows Vehicular ad-hoc network basic scenario. The figure explains that when an accident happens in the road, immediately the vehicles send the message to the nearest road side unit. This road side unit again leaves the messages to all nearest road side units which are in the different regions. Informing that accident has happened in the left panel so you can move to the right side or you change your path to avoid the traffic. This information can be sent to the vehicles which are in the different region from their nearest road side unit. This example shows the use of Wi-Fi between the vehicles, from vehicles to road side or road side to vehicles and between road side units to road side units. The figure 2 explains how the communications between the vehicles and road side units scenario.

VANET has many real-time application examples as described below. In Active Road-side safety applications examples such as Curve speed warning, Low bridge warning, Warning about violated traffic lights or stop signals, Vehicle based road condition warning, Infrastructure based road condition warning, Work zone warning. In public service application examples are Electronic license plate, stolen safety license, Electronic driver's license, Vehicle safety inspection.
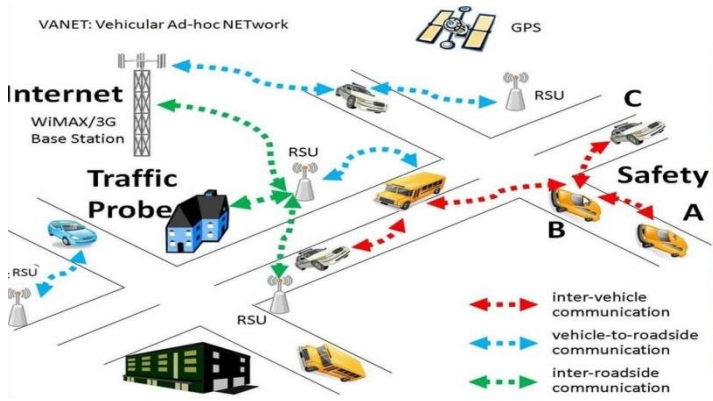
Figure 2: Vehicular ad-hoc another scenario

In improved driving application examples are Highway merge assistant, left-turn assistant, co-operative adaptive cruise control, intelligent traffic flow control, map download or update, parking spot locator service. In Business or Entertainment application examples include Wireless diagnostics, software update or flashing, safety recall notice, instant messaging, Rental car processing, Area access control, Toll collection, Parking payment, Gas payment.

Vehicular Ad-hoc Network posses number of challenges in terms of Quality of Services and its parameters. The most challenging task in VANET is Qos parameters because the network topology changes with high mobility and the Routing of data or messages in VANET is very difficult and challenging task because of moving vehicles with different speed in vehicular network topology.

So various routing protocols are available that are suitable for VANET. Some of important protocols that we considered as Dynamic source routing (DSR) protocol, Fish-eye state routing (FSR) protocol, Optimized link state routing protocol (OLSR). The Hierarchy of routing protocol is shown in figure 3.

II. CLASSIFICATION OF ROUTING PROTOCOLS

Routing mechanism plays an important role in the network topology. Routing of data in the VANET is very difficult and challenging task due to continuously varying speed of the moving vehicles in the network. The aim of the routing is to establishing the route from one node to other nodes, forwarding the packets in the topology and also maintaining and updating the routes and also recovering from the failures.

The VANET has many types of routing protocols based on network structure as Topology Based routing protocols, Position Based routing protocols and Hierarchical Based routing protocols. Topology based routing is further categorized as Proactive and Reactive routing protocols.

Reactive protocols are on demand protocols. Each node in a network discovers or maintains a route based on-demand. Which are mostly used protocols due to high

mobility and density, which reduces network and traffic and saves bandwidth also uses route discovery.
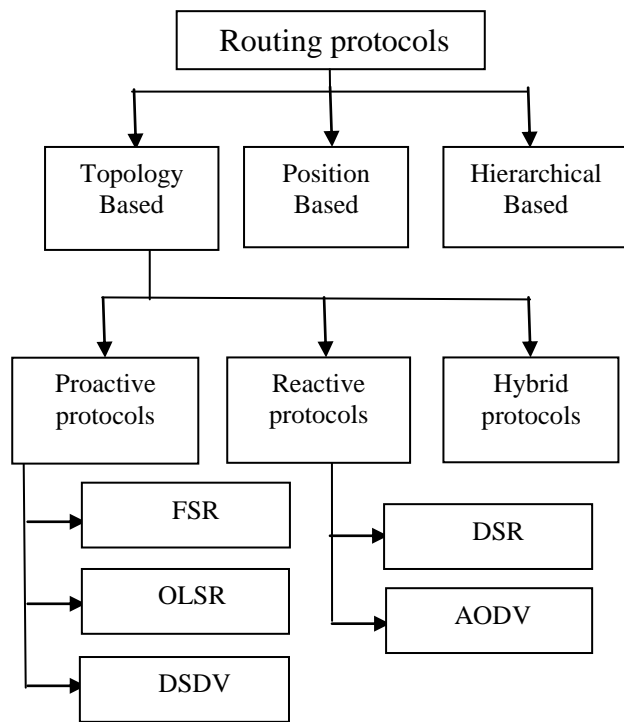

Figure 3: Classifications of routing protocol

Proactive protocols are table driven in which each node in a network maintains one or more routing tables and which are updated regularly. These protocols based on shortest path algorithms. These have low latency for real time applications. This paper concentrated on two proactive routing protocols as FSR and OLSR and one reactive protocol DSR.

III. COMPARISON OF ROUTING PROTOCOLS

The survey of paper includes the all characteristics of selected protocols and which is described below. Also the comparison of these protocols is shown in Table 1.

DSR protocol is having important property that it is network type flexibility. DSR is a multi hop protocol; it decreases the network overhead by reducing periodic messages. This protocol consists of two operations "Route Discovery" and "Route Maintenance" that makes it self-configuring and self-organizing. In DSR protocol, there is no need of periodic updates to send over the network about neighbors or link state information. This reduces overhead on the network by eliminating the periodic updates send on the network. DSR make it possible that nodes with different network types can participate in ad hoc networks. DSR protocol does not send periodic updates to nodes that make it less use of bandwidth. DSR has another feature that it correctly delivers all packets to its destination even in the network where nodes move very rapidly such as VANET. The benefit of DSR protocol is a network with low mobility

because it can use alternative route before starts a new process for route discovery.

OLSR protocol keeps a routing table contains information about all possible routes to network nodes. But once network topology is changed each node sends its updated information to some selected nodes, which retransmit this information to its other selective node. The nodes which are not in the selected list can just read and process the packet. OLSR may cause network congestion because of frequent control packets which sent to handle topology changes moreover OLSR ignore the high resources capabilities of nodes.

PROTOCOL PARAMETERS	DSR	OLSR	FSR
Type	Topology	Topology	Topology
Subtype	Reactive	Proactive	Proactive
Routing method	Source or Secure routing method	Link state strategy	Scope routing or basis of link state and global routing
Throughput	High	More than FSR	Less
Routing table	Not Necessary	Necessary	Necessary
Route Discovery	Required	Not Required	Not Required
Network Overhead and Bandwidth	Reduces overhead and saves bandwidth	Reduces overhead	Increases overhead when unused routes consume bandwidth
Periodic update of routing information	Required	Required	Required

Table 1: Comparison of routing protocols

In FSR routing protocol, the node periodically updates its table based on the latest information received from neighboring nodes. The problem with FSR is that, the growing network sizes will also increase the routing table, also if the topology changes increased, the route to a remote destination becomes inaccurate. Moreover if the destination moves out of scope of source node then it cannot discover the route.

IV.CONCLUSION

In this paper, we investigated with DSR, OLSR and FSR routing protocols in VANET. In this paper, survey of different routing protocols and classification is presented. With the characteristics analysis of all the protocols it is concluded that among the three protocols, DSR is the good example for reactive protocol as compared to OLSR and FSR. In DSR, there is no need of periodic updates to send over the neighbor nodes but OLSR needs to update the information as topology changes and also FSR needs periodic updates of nodes in the routing table. Another important characteristic of DSR is that it is used as Wi-Fi routing protocol in the short range communication.

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Apeksha.Kulakarni
 Pursuing M.Tech final year Digital Electronics in CMRIT Bangalore.
Participated in "National level paper presentation" held by Jyothy Institute of Technology
 Mrs.Sharmila.K.P
Assoct.Prof and HOD of Telecom Dept CMR Institute and Technology,Bangalore.