

Routing Protocols In Vehicular Ad-hoc Network (VANET)

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ABSTRACT

VANET i.e Vehicular ad-hoc network is the medium for the vehicles to communicate with each other, to share the information among them. Vehicular ad-hoc network becoming apparent technology for the vehicular communication. In Vehicular ad-hoc network there is a major role of fixed infrastructure for communication which are deployed on the road those infrastructure is called as RSU (Road Side Unit). We can say in Vehicular ad-hoc network the communication can be of two types the communication between two vehicles and between the fixed infrastructure and vehicles. In Vehicular ad-hoc network for communication there are certain rules, so those rules are called as protocols. There are many protocols available in Vehicular ad-hoc network for communication, each protocol is having different set of rules and they behave according to that rules. There are some advantages and disadvantages in existing routing protocols. In this paper we present the problems and the advantages of the existing routing protocols in Vehicular ad-hoc network.

Keywords: VANET, AODV, FSR, ZRP.

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I. INTRODUCTION

Wireless ad-hoc network is a network having the collection of nodes which are of different types. In Wireless ad-hoc network there is no dependency on the fixed infrastructure , in fact there is no fixed infrastructure in Wireless ad-hoc network. The communication between nodes happens directly, one node may need help of other intermediate nodes for communication and to deliver the packets to the intended node.

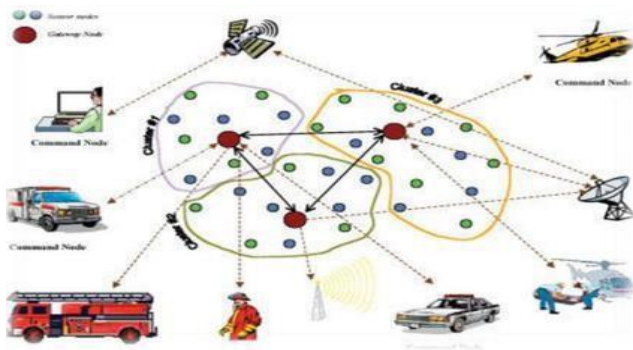


Figure 1.0: Wireless ad hoc Networks

The communication on WANET will happen smoothly when the network size is small, but when the network size becomes large then there may be problem in communication between nodes. When the packet needs to travel from the many nodes there may be chances of packet drop because of frequent disconnection between nodes. So the large network may be divided into the smaller networks for easy communication. The major concern in WANET is it should be reliable and scalable.

II. VEHICULAR AD-HOC NETWORK

VANET i.e Vehicular ad-hoc network is the medium for the vehicles to communicate with each other, to share the information among them. Vehicular ad-hoc network becoming apparent technology for the vehicular communication. In Vehicular ad-hoc network there is a major role of fixed infrastructure for communication which are deployed on the road those infrastructure is called as RSU(Road Side Unit). We can say in Vehicular ad-hoc network the communication can be of two types the communication between two vehicles and between the fixed infrastructure and vehicles. In Vehicular ad-hoc network for communication there are certain rules, so those rules are called as protocols. There are many protocols available in Vehicular ad-hoc network for communication, each protocol

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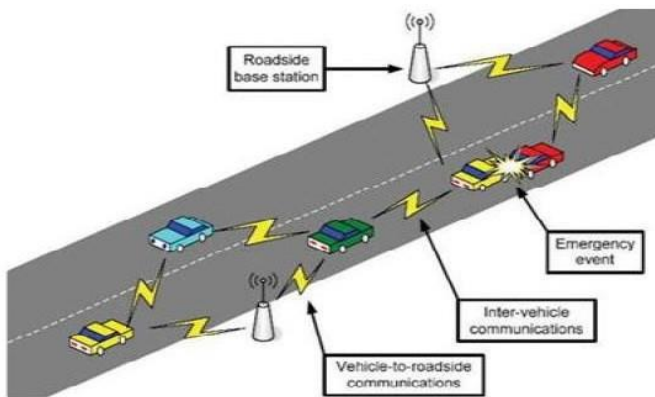


Fig 2. VANET

VANET is the addition in the Mobile ad-hoc network for the communication between the vehicles and between vehicle and roadside unit. Each node in vehicular ad-hoc network can act as a server and also a client. As shown in fig 2, there are vehicles moving on the road, and the fixed infrastructure deployed on the roadside called RSU. The vehicle can communicate and send packet to other vehicles directly or they can take help of intermediate vehicles or RSU. RSU periodically sends signals to the vehicles related to road conditions and traffic and safety beacons. Roadside unit is important element in the vehicular ad-hoc network to utilize network fully.

III. ROUTING PROTOCOLS IN VANET

Protocol is nothing but the set of defined rules. In VANET the different rules are defined in form of protocols for the communication between the vehicles i.e nodes. In those protocols the rules are defined for how the packet should travel from the source node to the destination node. Following are the types of routing protocols in vehicular ad-hoc network:

A. Proactive Routing Protocol

Proactive routing protocol is also called as table driven protocol. In this protocol each node will have the routing table which will have the routing information for the other nodes. This routing table is updated on the periodic basis and the node will send the information to all other nodes. The name of routing protocol itself says that the routing information will already made available for each node even before the node wants to communicate to other nodes. This protocol is suitable for small networks because if the network size increases the routing table size also increases and this will put overhead on the network. Fisheye State Routing Protocol (FSR) comes under proactive routing protocol.

B. Fisheye State Routing Protocol:

FSR is an implicit hierarchical routing protocol. FSR uses Fisheye technique in which the information required is decreased to represent the data in graphical format. The eye of the fish captures the information with the high details which is the near to the focal point and will captures the less details when the distance from the focal point increases. FSR follows same principle, the node maintain the more accurate details about the nodes which are near to them and will maintain the less details about the nodes which are away from them.

FSR is similar to the Link State Routing Protocol but the main difference in Link State Routing Protocol and FSR is in Link State Routing Protocol whenever the network topology changed the node will send the link state packet to all the nodes in the network, but in case of FSR the link state instead of flooding the link state packets each node will maintain the link state routing table and on the basis of the information which is received from the neighbour nodes the link state routing table will updated and the table will be shared with the all the neighbour nodes.

There are three tasks in the Fisheye Routing Protocol:

1. Each node will send the HELLO message to each of its one hop neighbors to establish the connection with its neighbor nodes.
2. Each node will send the Link State Announcement Message to each node in the network having the information about its neighbor nodes.
3. On the basis of the information available in the Link State Announcement messages the route to any node in the network can construct. Shortest path algorithm will use to find the path to other node

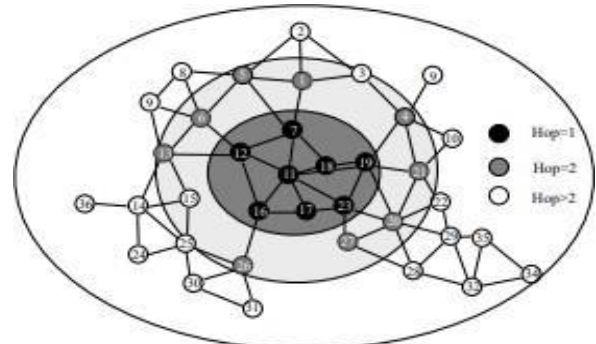


Figure 3. FSR Overview

Figure 3. is described the scope of nodes in the network. Each node will have the correct information about its neighbor and less information about the nodes which are far away from the node.

C. Reactive Routing Protocol

In Reactive Routing Protocol instead of discovering the routes initially the routes will be discovered when there is the node wants to communicate with other node. Reactive routing protocol is also called as on demand routing protocol. The main advantage of the Reactive Routing Protocol is the less network overhead than Proactive Routing Protocol because the difference in the route discovery process. But the main disadvantage of Reactive Routing Protocol is that this will take the more time to find

the best route. AODV (Ad-hoc On Demand Distance Vector) routing protocol falls under the Reactive Routing Protocol.

D. Ad hoc On-demand Distance Vector Routing (AODV):

Ad-hoc On Demand Distance Vector routing protocol falls under the reactive routing protocol. In this protocol the route will be establish whenever the one node wants to communicate with other node. Due to this nature the network overhead will reduce. Ad-hoc On Demand Distance Vector routing uses the destination sequence number.

In this protocol there are three stages:

- 1) The Source node will send Route Request (RREQ) packet to each neighbor which contain the information about the destination node and the broadcast ID. Each time the packet received the broadcast id will be incremented and when the route request received the packet will be forwarded to the next neighbor nodes if the node is not the destination node and the node does not have the destination node's address. If the node is the destination node or the node knows the destination node's address then the node will send RREP packet to the source node.
- 2) Once the route information is received by the source node , the node will send the packet to the destination nodes.
- 3) While communicating if the data transmission gets fail then the route will need to recover then the route maintenance process will takes place.

In AODV protocol the route discovery will takes place when there is demand. When one node wants to send data to other node then the route will discover at that time because of this the network overhead will reduce. The node will use the Route Request(RREQ) and Route Reply (RREP) packets for route discovery process.

E. Hybrid Routing Protocol

As the name depicts the Hybrid routing protocol is the combination of the both Proactive and the Reactive Routing Protocols. This protocol combines the facilities of the proactive and the reactive routing protocols. It is difficult to maintain the network as whole, so In this protocol the large network will break into the smaller networks called zones. Because the network divided into smaller groups the overhead of route discovery in the proactive routing protocols and the time required will reduced in the hybrid routing protocol. In this type of protocols if the destination node is in the same zone then the proactive routing protocol will be used and if the node is present outside of the zone then the reactive routing protocol will be used. The Zone Routing Protocol (ZRP) falls under the hybrid routing protocols.

F. Zone Routing Protocol:

Zone Routing Protocol is the hybrid routing protocol which divides the large network into the smaller parts called zones. The network is divided into the zones based on the node's signal strength, transmission power etc. The nodes which are in the range of the node are called the node inside the zone and the nodes which are not in the range of the node is called the node outside of the zone. For

the destination node which is inside of the zone it uses proactive routing protocol and the delay is minimum for inside zone node, but for the destination node which is outside of the zone it will use the reactive routing protocol. The node will send the packet to the node at the border of the zone, and then the border node will forward the packet to the node which lies in the other zone. Each packet will have the unique sequence number, the destination node address and the source node address. When the packet arrive at the border node of the zone then if the destination node is present in its zone then the packet will be forward to the destination node else the packet will pass to its border node. When the destination node send the reply and the reply is received by the source node then the source node will send the data to the destination node.

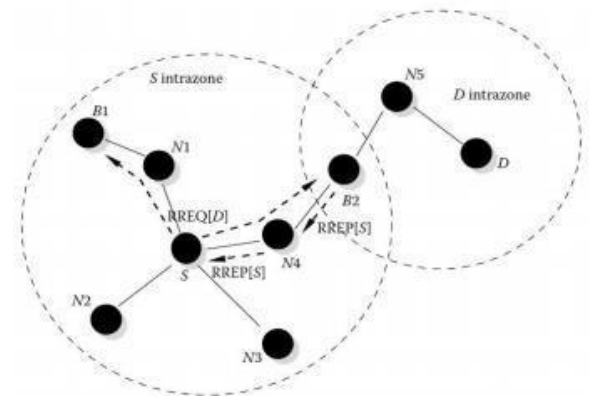


Figure 4. Routing in ZRP

Figure 4. showing the scenario in the routing in the zone routing protocol. Here the node having name 'S' wants to communicate with the node having the name 'D'. Then the node 'S' will first identify whether the node 'D' is available inside its zone, if yes then the packet will send to the node 'D' directly, if the node is available outside the zone then the node 'D' will send the packet to its border node i.e B2,N2 etc. then the border nodes will check whether the destination node is present in there zone, so the node 'D' is present in the zone of the node 'B2' then the node 'B2' will forward the packet to the node 'D'. Then node 'D' will send the reply to the source node, after receiving the reply node 'S' will send the data to the node 'D' by the established route.

IV. COMPARISION

Difference Between Proactive, Reactive And Hybrid Protocols.

Parameters	Reactive Routing	Proactive Routing	Hybrid Routing
Routing overhead	Low	High	Medium
Latency	High	Low	Inside the zone is low
Scalability	Designed for small network, up to 100 nodes	More than 100 nodes.	Designed for large network, more than 1000 nodes
Periodic updates are	No	Yes	Inside the zone, yes

Routing information availability	Information is available when required	Always available	Combination of both
Control traffic	Low	High	Lower than both
Storage requirement	Depend upon no of route maintenance	Higher	Depend upon the size of zones

V. CONCLUSION

In the recent years, the motivation towards the research on the issues in the VANET because of the increasing use of the VANET in daily life. The main issue in the VANET we are facing is the routing. There is need of efficient routing protocol in VANET. In this paper we have explained the different topology based routing protocols(FSR,AODV and ZRP) and their comparison. These routing protocols are differentiates with each other on the basis of the finding and maintaining the routes between the nodes. Based on the comparison the AODV protocol seems good option for future because of the less network overhead. Also some enhancement can be made into the AODV to decrease the end-to-end delay in communication.

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