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Performance Analysis in Routing Protocols for VANET

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Abstract— The performance of VANET remains optimum within thousand meters and after that due to high packet loss rate communication among vehicles is not feasible. Finding optimal path is a typical task for dynamic protocols. The research objective is to study some of the important QOS metrics in VANET & vehicular traffic management solutions to improve overall safety of traffic.

Keywords— Vehicular Ad hoc Networks, Mobile Ad-hoc Network, Quality of services, Global Positing System

I. Introduction

VANET is an ad-hoc network formed between vehicles as per their need of communication. In order to develop a VANET every participating vehicle must be capable of transmitting and receiving wireless signals up to range of three hundred meters. VANET communication range is restricted up to one thousand meters in various implementations. The performance of a VANET remains optimum within one thousand meters and beyond that it is not feasible to communicate among vehicles because of high packet loss rate. Finding optimum path is typical task for dynamic protocols as management of vehicle movement is quite complex. There is a need to update entries in the route finding node.

VANET is not restricted up to Vehicle-to-Vehicle communication, it takes benefits of road side infrastructure that can also participate in communication between vehicles, but our main focus is on Vehicle-to-Vehicle communication. There are various challenges for VANET such as high speed of vehicle, dynamic route finding, building, reflecting objects, other obstacles in path of radio communication, roadside objects, different direction of vehicles, concern about privacy, authorization of vehicle, security of data and sharing of multimedia services. High speed of vehicle requires regular update of routing table whereas dynamic route finding would result into high time loss before static communication. Various user group among VANET are mostly it is used in traffic management agencies, getting popular, highway safety agencies, law enforcement agencies and emergency services.

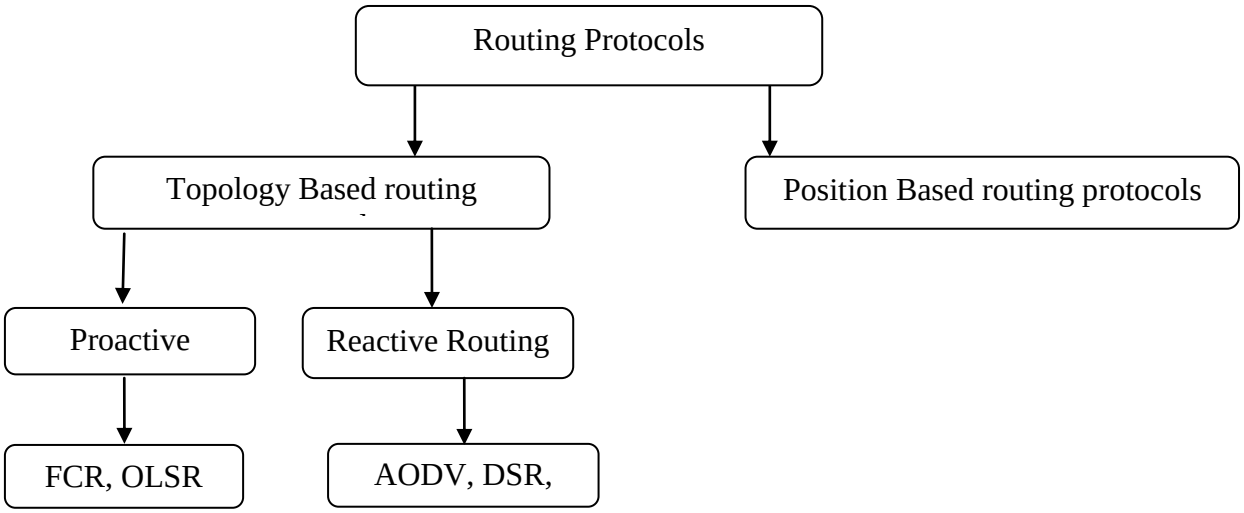
TABLE I SHOWING VARIOUS FEATURES OF VANET

Features	Descriptions
High Dynamic Topology	Since vehicle are moving at very high speed. Topology formed by vehicles is always changing
Frequent disconnected Network	The highly dynamic topology results in frequent disconnected network
Predictable Mobility	Vehicles tend to have very predictable mobility that are limited to road and traffic conditions
Propagation Model	Propagation Model is not supposed to be free space, because of presence of buildings, trees And other obstacles.
Sufficient energy and Storage	In VANET nodes are vehicle, therefore nodes having sufficient amount of energy and computing power

The main service provided through VANET is GPS navigation system, electronic payment of toll tax, authenticity of vehicle without human intervention, Internet access, traffic message, broadcasting of traffic scenario and multimedia streaming. As most of the proper ties of a Mobile Ad-hoc Network (MANET) are common with the VANET, various MANET routing protocols are used in VANET. Basic difference between MANET and VANET is that under VANET movement of vehicle is at high speed and less random as compared to MANET. Existing MANET routing protocols are not compatible with VANET.VANET routing protocols are broadly divided into two categories Table Driven protocols and Source Initiated on Demand protocol.

In Table Driven protocol each vehicle maintains a table of neighbourhood vehicles with in its communication range and any change in vehicle position is updated regularly. In Source Initiated on Demand protocol, firstly source vehicle broadcasts a query to find route up to node gets a route up to the destination node. The destination route is replied back to the source node via same path.

Figure 1 illustrates the taxonomy of these routing protocols which can be classified as topology-based and geographic (position-based) in VANET.



A. Topology-based Protocols:

These routing protocols use the link information which exists in the network to send the data packets from source to destination. They can also be classified as active (table-driven) and reactive (on demand) routing.

1) Proactive (table-driven):

Proactive protocols are used to establish the routes in advance on the basis of the periodic exchange of routing tables.

a) The protocol Optimized Link State Routing Protocol (OLSR)

OLSR is a link-state protocol, which optimizes the way of broadcast of control messages to save bandwidth consumption through the use of the concept of "multipoint relays".

b) Fisheye State Routing (FSR)

FSR is a proactive protocol link state. It assumes that a faraway topology change has not a significant influence on the calculation of the route locally. Therefore, the exchange of routing table updates is a function of the distance. More a node is faraway less it receives local topology updates. FSR does not flood the network with updates, but all nodes periodically exchange with its neighbours partial routing update information. Indeed, all links propagates hop by hop in each sends. FSR has a complete map of the network but cannot guarantee accuracy of all connections between farther nodes.

***2) Reactive (On Demand)* :**

Reactive protocols, only keep the roads in use for routing. On demand at the time of packet routing, the protocol will search through the network a route to the destination. The conventional method of route lookup is to flood the network with a query, in order to find the target station, which responds with the reverse path.

a) Dynamic Source Routing (DSR)

The DSR protocol is based on the "source routing", which means that the path travelled by the packet is included in the header of the data packet from the source to be read by routers. The DSR protocol is composed of two distinct mechanisms: the first is used to find routes on demand, and the second is responsible for the maintenance of the communication route in progress. The limitation of this protocol is that the route maintenance process does not locally repair a broken link and the performance of the protocol decreases with increasing mobility.

b) Ad Hoc On Demand Distance Vector (AODV)

AODV is a reactive protocol based on the principles of distance vector routing protocols. It borrows its mechanisms in DSR discovery and maintenance of routes and uses a hop by hop routing, and sequence numbers. AODV builds routes by using a series of queries "route request / route reply".

B. Position based protocols:

It is a routing taking into account the geographical position of the nodes. To perform a geographic routing in an ad hoc network, it is essential that: all nodes have location means: via native system such as GPS, and that the source node knows the position of the destination node.

II. LITERATURE REVIEW

According to [1] Yi Wang. Krishnamachari and Konstantin's Posunis Lee discussed about QoS metrics for unicast routing in VANETs, what specific characteristics VANET routing protocols should possess. He shed light on the issues-proposed solutions achieves optimum performance in both sparse and dense environment as well as urban and highway. Analyze some of the most important QoS metrics in VANET. Namely, the upper performance bound for connection duration, end-to-end delay, packet delivery ratio and in jitter communication for unicast typical highway and urban VANET environments. According to its results, delay and jitter in VANET would be adequate for most of the envisioned

unicast-based applications, whereas ratio the packet delivery and connection duration might not meet the requirements for most unicast-based applications.

According to [2] Bo Xu, Aris Ouksel and Ouri Wolf son discussed about Performance evaluation of a application for VANETs using IEEE 802.11p. WAVE (wireless access in vehicular environment) is described in IEEE 802.11p and VANETs follow them. Access for Vehicular Environment (WAVE) dedicated to vehicle-to-vehicle and vehicle-to-roadside communications. The major objective has clearly been to improve the overall safety of promising traffic, vehicular traffic management solutions. The wireless network was setup to be based on the IEEE802.11b standard, which is commonly used in VANET simulations.

According to [3] Lin Yand, Jindua Guo describes various issues and concept related to wireless ad hoc networks, its features, types, advantages. Ad hoc Network (VANET) using wireless technology to communicate with each other without any redeployed infrastructure. VANETs are a special case of Mobile Ad hoc Networks (MANETs), where the mobile nodes are vehicles. Vehicular Ad hoc Networks (VANETs) are self-organizing ad hoc networks that are specifically designed for communication among vehicles where vehicles are themselves the nodes. Although routing protocols have already been analysed and compared in the past for Mobile Ad hoc Networks (MANETs), simulations and comparisons of routing protocols for VANETs have almost always been done considering random motions with non-urban specific parameters.

According to [10] Christoph Sommer, The NCTUns 4.0 simulator use to compared the DSDV, AODV and DSR performance of routing protocol and the same fashion of work MOVE and NS-2 simulator used to performance analysed of OLSR,AODV and DSR routing protocol on basis of PDR and end to end delay. Mobility scenarios which can be exported to network simulators such as ns-2, Qual Net and others. It includes a myriad of mobility models such as Manhattan grid, Chain model, and Reference Point Group Mobility model (RPGM). The Bonn Motion mobility generator is used to generate ns-2 compatible mobility traces for the Manhattan Grid model.

According to [11] Nils Aschenbruck,Elmar G. Padilla, Raphael Ernst, Matthias Schwa born, "Bonn Motion evaluated the performances of DSR, AODV, FSR .and TORA for the Manhattan mobility model and concluded that TORA is completely unsuitable for vehicular environments, whereas FSR, DSR and AODV show promising results in city scenarios. The parameters for different comparison used from those used in our study Jerome ET al.Routing protocol AODV, DSDV and DSR performance analyze in highway scenario on the basis of vehicle speed and the density of traffic.

According to Guoyou He [13], DSDV is a hop-by-hop distance vector routing protocol requiring each node to periodically broadcast routing updates. In the network each node maintains routing information in a routing table. Each routing table entry contains a destination node, the destination to the next hop, a metric and the sequence number. The sequence number is an important feature of DSDV using which it avoids routing loops by eliminating stale entries. In the network the frequent changes need to be updated in the routing tables of the nodes.

Analysis Result for Routing Protocol in VANET:

No. Of Nodes	Routing Protocol	Throuput	end to end Delay	Packet Deliver Ratio
75	**AODV**	410	300	97
	DSR	350	310	97.5
	DSDV	310	810	99
	AVERAGE	356.7	473	97.8

III Conclusion

According to survey, delay and jitter in VANET would be adequate for most of the envisioned unicast-based applications, whereas ratio the packet delivery and connection duration might not meet the requirements for most unicast-based applications. In simulation study of DSR, AODV, FSR .and TORA for the Manhattan mobility model concluded that TORA is completely unsuitable for vehicular environments, whereas FSR, DSR and AODV show promising results in city scenarios.

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