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Review and Comparision between Routing Protocols in Vehicular Ad-Hoc Networks

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Abstract: ***This paper presents a brief survey and comparison between routing protocols proposed or adapted for vehicular ad hoc networks. These protocols can be classified into five categories according to the type of information that used to make the routing decisions. Some principal protocols are described in each group as well their adaptabilities are analyzed for VANETs.***

Keywords: VANET, Routing Protocol, DSR, AODV

1. Introduction

Vehicular ad hoc network (VANET) is a specific form of MANET. This field includes vehicle to vehicle communication and vehicle to Road Side wireless communication. Vehicular Ad Hoc Network Communication is an extensive region of research in Wireless technologies. (VANET's) technically based upon the smart Transportation Systems that uses moving cars (Vehicles) as required nodes in a network to perform such an autonomous mobile network. [1]. Routing in VANET can be categorized upon transmission strategies or routing information. Unicast, broadcast, multicast are various transmission strategies. Topology Based and Position Based Routing protocols use a mixture of routing information, such as Position Based Routing Protocol required preinstalled map or route information.[2].

2. Review of routing protocols in VANET

Routing protocols in VANET is divided into two categories position information for routing and Topology Based. Topology Based Routing depends on link's information stored in routing tables for forwarding packets to destination and Position. Based Routing use node's position for forwarding packets. GPS provides position information

2.1 Topology-Based Routing

Topology-based routing protocols rely on the topology of the network. Most of the topology-based routing algorithms try to balance between being aware of the potential routes and keeping overhead at the minimum level. The overhead here refers to the bandwidth and computing time used to route a packet. Protocols that keep a table of information about neighboring nodes are called proactive protocols; while reactive protocols route a packet on the fly.[3],[4]

2.1.1Proactive topology based protocols

This type of protocols builds routing tables based on the current connectivity information of the nodes. The nodes continuously try to keep up to date routing information. Proactive- topology based Routing protocols are developed to work in low mobility environments (like MANET), such as Optimized Link State Routing (OLSR) (Clausen et al., 2001) and Destination-Sequenced Distance Vector Routing (DSDV) (Perkins & Bhagwat, 1994)[3],[4].

2.1.2 Reactive Topology Based Protocols

This type of protocols relies on flooding the network with query packets to find the path to the destination nodes. The Dynamic Source Routing (DSR) (Johnson & Maltz, 1996) is one of the reactive topology-based routing protocols. In the DSR, a node sends out a flood of query packets that are forwarded until they reach their destination. Each node along the path to the destination adds its address to the list of relay nodes carried in the packet. When the destination is reached, it responds to the source listing the path taken. After waiting a set amount of time, the source node then sends the packet from node to node along the shortest path. [3],[4].

2.2 Position-Based Routing Protocols

Perform the routing decisions based on the geographic information of the nodes. This class offers an alternative approach known to be more robust to face the mobility issues (Giordano & Stojmenovic, 2003).[5].

2.3 Map-Based Routing

The Map-based routing protocols combine the position information with topological knowledge about the road and the surroundings (GSR,SAR) Geographic Source Routing (Lochert et al., 2003) and Spatial Aware Routing (SAR) (Tian et al., 2003) [6]

2.4 Movement-Based routing

Numerous protocols enhance the basic position based scheme to optimize the routing decisions. To address this shortcoming, some approaches like Directional Greedy Forwarding (DGR) (Gong et al., 2007)& Geographic source routing(GSR)(Lochert 2007) [7]

2.4.1Destination-Sequenced Distance-Vector Routing

Ii is considered being Table driven routing protocol. As an advantage of routing protocols, Routing table simplifies the

route setup process. The route information is updated periodically so, the updates are propagated throughout network is its disadvantage. It leads to heavy control overhead during high mobility to obtain information about a destination node.[6]

2.4.2 Optimized Link State Routing OLSR
OLSR Floods the network by the topology control messages in order to disseminate the link states information throughout the entire network showing which nodes are connected to which other nodes. The drawbacks effect consumes the networks resources and wastes a part of the bandwidth which increases with rapid changes. Moreover, the use of flooding increases the network congestion and leads to loss of messages because of collision.

2.4.3 Fisheye state routing (FSR)
FSR is a proactive routing protocol. FSR reduces significantly the consumed bandwidth as it exchanges partial routing update information with neighbors only and reduces routing overhead are the advantages of FSR. Disadvantages are said to be the poor performance in small ad hoc networks and the less knowledge about distant nodes and the increase in network size of the storage complexity. [9].

2.4.4 Ad hoc On Demand Distance Vector routing (AODV)
AODV is a distance vector routing protocol, when a node wants to establish new communication with another node, it searches for an available path to the destination node in its routing table .AODV is an ad hoc on demand routing protocol. That means the routes are only established when need to reduce traffic overhead. AODV supports unicast broadcast and also multicast.[11].

2.4.5 Greedy perimeter stateless routing (GPSR)
(GPSR) requires that each node is able to obtain its current location e.g. through a GPS receiver as it is becoming standard equipment in vehicles. To make the routing decisions, a source node needs to know the position of the destination packets can reach node that has no neighbor which is closer to the destination than itself. This problem known as local maximum is likely to happen in case of sparse networks.[8]

2.4.6 Dynamic Source Routing Protocol (DSR)
(DSR) On demand protocol designed to restrict the bandwidth consumed by control packets in hoc wireless network. It is beacon-less and hence doesn't require periodic hello packet transmissions which are used by a node to inform its neighbors of its presence. During the route construction phase, it establishes a route by flooding Route Request packets in the network. The destination node, on receiving a Route Request packet, responds by sending a Route Request packet back to the source. [10].

2.5Traffic-aware routing

The traffic-aware routing protocols suggest the use of available data about vehicular traffic density and flows in addition to spatial information. Thus, only streets where vehicles are moving will be used for packet forwarding. The following sub-section examines examples of such routing solution which are designed using traffic information[12].

3. Method of Routing Protocol in VANET

Unicast routing one to one communication takes place using multihop scheme; where intermediate nodes are used to forward data. This is the widely used class in ad hoc network. most of the topology based routings are Unicast such as AODV , DSR , GPSR ,DIR[14]

Multicast routing one to many communication take place. This can be further partitions into geocast and cluster based. In cluster based routing, nodes automatically divided into clusters and one cluster head is selected and all outgoing and incoming communication take place through it.

Geocast routing, message delivery to other nodes lie within a specific geographic area, like area where accident takes place. Mobicast, ZOR (Zone of Relevance) are geocast protocols.[13].

Broadcast routing[11] one to all communication take place. Flooding is most frequently used routing protocol in VANET especially to communicate safety related message. Simplest of broadcast method is carried by flooding in which each node rebroadcast the message to other nodes. But larger density of nodes, this causes exponential increase in bandwidth

4. Results and Discussion

Table 1: comparison between routing protocol in VANET net work

	AODV	DSR	GPSR	DGR	DIR
Forwarding Strategy	Greedy Forwarding	Optimum Forwarding	Greedy Forwarding	Optimum forwarding	Greedy Forwarding
Scenario	Urban	Urban	Urban	Urban	Urban
Mobility	NO	YES	NO	YES	YES
Infrastructure Requirement	No	No	No	Yes	No
Road direction	Single direction	dual direction	Single direction	dual direction	dual direction

in order to set similarities between routing protocol in table (1) it is obvious that AODV,GPSR and DIR use Greedy Forwarding unlike DSR and DGR that use Optimum forwarding .As for scenario in urban area all these protocols are used .DSR,DGR and DIR provide mobility in VANET but AODV and GPSR do not provide this mobility. one of the fundamental of VANET is that is does not require Infrastructure therefore; all these protocols are based on this setting except DGR. In road direction AODV and GPSR are use to be single direction Road but DSR ,DGR and DIR are dual direction Road .

5. Conclusion

Designing an efficient routing protocol for all VANET applications is a complex process that requires all the relevant information to be handled upon. Hence survey of different VANET protocols, comparing the various features is absolutely essential to come up with network proposals for VANET. Unicast, multicast, and broadcast routing operations are key issues in the network layer for VANETs. This work surveys present unicast, multicast, and broadcast protocols for VANETs. The unicast routing protocols are split into min-delay and delay-bound approaches. The min-delay unicast routing protocols construct a minimum-delay routing protocol as soon as possible.

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