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VANET: A Review of Routing Protocol

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ABSTRACT

Vehicul a rad hoc network is one of the most promising application of VANET that anointer communication system. In VANET nodes whichareVehiclescanmovesafetywithhighspeedand generally must communicate quickly reliably. VANET is a sub class of Mobile Adhoc Network which provides a distinguished approach

Keywords: VANET, Routing Protocol, ITS,ADOV, TORA•

I.INTRODUCTION

Vehicular ad hoc network is special form of MANET which is vehicle to vehicle road side wireless communication network.It is autonomous and self-organizing wireless communication network, where nodes in vanet involve themselves as servers and clients for exchanging information [4]. VANET allow vehicles to avoid problem either by taking any desired action orbyalerting drivers. Besides the road safety enhancement that VANETs will bring,theyalsoopensdoortoomanyapplicationtoenhance the driving and traveling comfort ,like internet access from car. Themaingoal of VANETisproviding safety and comfort for passengers. Each vehicle equipped with VANET device will be a node in the ad hoc network and can receive and relay other message through the wireless network. Collision warning,road Vanetprovideubiquitousconnectivityontheroadtomobile users.

Intelligent Transportation System(ITS) provide efficient vehicle to vehicle communication in VANET.

ITS has variety of application like co operative traffic monitoring, control of traffic flows, blind crossing and collision prevention. Comfortapplicationistheapplicationtoallowthepassenger to communicate with other vehicles and with internet host, which improves passengercomfort.

VANET provide internet connectivity to vehicular nodes while on the movement so that watch passenger can download musicandsendemails,onlinemoviesandcanonlinechatting etc.

VANET provide the payment service application is very suitable for toll collection without even decelerating thecar or waiting online.signalarmsandinplacetrafficviewwillgivethe driveressential tool to decide the best path along the way event or bad traffic areas. VANET has unique characteristic like high mobility with constraintofroadtopology,initiallylowmarketpenetrationratio,unboundednetworksize,infrastructuresupportsthatdifferentiate it from MANET [1]. The network architecture of vanet can be classified into 3 categories: Pure cellular/WLAN, pure ad hoc, and hybrid. Due to new technology it has taken huge attention fromgovernment,academy&industry.Therearemany researchprojectaroundtheworldwhicharerelatedwith VANETsuchas COMCAR,DRIVE,FleetNet[10]andNoW[12].(Networkson Wheels) CarTALK 2000, CarNet [4]. The Routing Protocol in VANETareCategorizedintovarioustypeslikesTopologybased, Position based, Geocast Based, Broad castbased.

II. FEATURES OF VEHICULAR AD-HOCNETWORK

VANETassistsvehicledriverstocommunicateandtocoordinate among themselves in order to avoid critical situation through VehicletoVehiclecommunicatione.g.roadsideaccident,traffic jams etc. Due to highly mobile and dynamic behavior, VANET have following features:

foraIntelligent Transportation System (ITS).The survey of routing protocol in VANET is important and necessary for smart ITS.

• This technology will beuseful for Police and fire vehicles to communicate with each other for safety purpose.

Vehicular Adhoc Network architecture and cellular technology to achieve intelligent communication and improve road traffic safety and efficiency. To organize their in vehicular computing system, vehicletovehicle adhoc networks, hybrid architecture with special properties such as high

mobility network portioning and constrained topology. Vanet can perform effective communication by utilizingrouting The nodes in VANET are vehicles and road side unit. The movement of these nodes is very fast.

The motion patterns are restricted by road topology . Vehicles act as transceivers i.e. sending and receiving at the same time while creating a highly dynamic network, which is continuously changing.

The vehicular density varies from time to time for instance their density might increase during peak office hours and decrease at night hours.

information. This paper discusses the advantages/disadvantages and the application of various routing protocols for VANET. This paper explore on focusing on significant features, performance improvement incomparisons of routing protocol for vehiculard hoc network (VANET).

III. APPLICATION OF VEHICULAR AD-HOCNETWORK

Majorapplication of VANET include providing safety information, traffic management, toll services, location based services and infotainment. VANET application can be divided into following category [1]:-

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IV. NETWORK ARCHITECTURE AND CHARACTERISTIC OF VANET

Wireless ad hoc network do not depend on fixed infrastructure, access point or infra structure less network for communication and dissemination of information. The architecture of VANET consists of 3categories:

[4].Purecellular/WLAN,PureadhocandHybrid.

VANET may used fixed cellular gateways and WLAN/WiMax access points at traffic intersection or for routing purpose. This network architecture is pure cellular network and WLAN. VANET can compile both cellularnetwork and WLAN to form the network stationery or fixed gateway sarea and the road sidealso provides connectivity to vehicles.In such as cenarioallvehiclesandroad side device form pure MANET. Hybrid architecture consists of both infrastructure network and ad hoc network together. Some of distinguishing features of VANET[4].

Table 1: Showing Various Features of Vanet

Features	Description
Highly Dynamic topology	Vehicle are moving VANET is always changing at high speed, by formed network topology.
Frequently disconnected network topology	Changing node density due to occurs when highly dynamic topology frequently disconnected network.
Unlimited Battery power and storage capacity	Nodes of VANET are not subject to power and storage limitation in sensor networks. Nodes have limited amount of energy and computing power.
On Board Sensor networks	VANET routing protocols consists of many nodes of sensors network which provide useful information for many GPS unit which provides location information of nodes.

V. ROUTING PROTOCOL IN VEHICULAR AD-HOC NETWORK

InVANETtheRoutingprotocolsareclassifiedinto5categories: To pology based routing Protocol,

PositionBased Routing Protocol, Cluster Based Routing Protocol, Geocast Routing Protocol and Broadcast Routing Protocol.Theseprotocolarecharacterizedon the basis of area/application where they are mostsuit.

A. Topology BasedRouting

Several MANET Routing Protocol have used topology based routing approach. Topology based Routing Protocols use link's information within the network to send the data packets from source to destination [7]. Topology based Routing Protocol which discover the route and maintain routing information in a table , the sender starts transmission data. They are divides in to3 categories

1. Proactive RoutingProtocol
2. Reactive RoutingProtocol
3. Hybrid RoutingProtocol

1. Proactive RoutingProtocol

Theseprotocolaremostlybasedonshortestpathalgorithm.They keepinformationofallconnectednodesinformoftables because these protocol are table based. furthermore, these tablesarealsosharedwiththeirneighbors.Wheneveranychangeoccursinnewtopologyeverynodeupdateitsroutingtable.Allthenodesofthe network in proactive protocol or table driven routing protocols periodicallyexchangingtheknowledgeoftopology.Theproactive protocol do not have initial route discovery delay butconsumes lot of bandwidth for periodic updates of topology [4,7].

(i). DSDV: Destination-Sequenced Distance-Vector Routing [4,7]

DSDVistable-drivenroutingschemeforadhocmobilenetworks based on the Bellman-Ford algorithm. It was developed by C.Perkins and P.Bhagwat in 1994. It eliminates route looping, increase convergence speed, and reduces control message overhead.InDSDV, eachnodemaintainanext-hoptable,which it exchanges with itsneighbors.

(ii). OLSR:OptimizedLinkStateRoutingProtocol [4,7]Itisanoptimizationofapurelinkstateprotocol formobileadhocnetworks.Eachnodeinthenetworkselectsasetofneighbornodescalledas Multipoint Relay(MPR)whichtransmitsitspackets.The neighbor nodes which are not in its MPR set can only read and process the packets. This procedure reduces the number of retransmission in a broadcast procedure.

iii). STAR: Source-Tree Adaptive Routing

STARisanotherlinkstateprotocol.InSTAR,preferredroutestoeverydestinationaresavedineachrouter.Itreducesoverhead onthenetworkbyeliminatingperiodicupdates.Thereisnoneed of sending updates, unless any event occurs. This protocolcanbesuitableforlargescalenetworkbutitneedlargememoryandprocessingbecauseithastomaintainlargetreesforwholenetwork [4,7].

2. Reactive RoutingProtocol

On demand and reactive routing protocols were designed in such a manner to overcome the overhead that was created by proactive routing protocols. This overcome maintaining by only those routes that are currently active. Routes are discovered and maintained for only those nodes that are currently being used to send data packets from source to destination. These protocolare periodically update the routing table ,when some data is there to send. When use flooding process for route discovery, which course more routing overhead and also suffers from the initials route discovery process which makes them unsuitable for safety application inVANET.

(i). AODV:Ad-HoconDemandDistanceVector

In AODV routing, upon receipt of a broadcast query(RREQ), nodes record the address of the node sending the query in their routing table. This procedure of recording its previous hop is calledbackwardlearning.Uponarrivingatthedestination,areply packet (RREP) is then sent through the complete path obtained from backward learning to thesource.

(ii). DSR: Dynamic SourceRouting

DSR uses source routing, that is, the source indicates in a data packet's sequence of intermediate nodes on the routing path. In DSR, the query packet copies in its header the IDs of the intermediate nodes that it has traversed. The destination then retrieves the entire path from the query packet, and uses it to respond to thesource.

(iii). TORA:TemporallyOrderedRoutingAlgorithmTORAroutingbelongstoafamilyoflinkreversalroutingalgorithms where a Directed Acyclic Graph (DAG) toward the destination is built based on the height of the tree rooted at the source. The directedacyclicgraphdirectstheflowofpacketsandensuresreach ability to all nodes. When a node has a packets to send, it broadcasts the packet. Its neighbor only broadcasts the packet if it is the sending node's downward link based on DAG.

3. Hybrid RoutingProtocol

HybridRoutingcombinescharacteristicsofbothreactiveandproactiveroutingprotocolroutingprotocoltomakeroutingmorescalableandefficient.Mostlyhybridprotocolsarezonebased,itmeansthenumberofnodesisdividedintodifferentzonetomake route discovery and maintenance more reliable forVANET.

(i). ZRP: Zone Routing Protocol

Inthisthenetworkisdividedintooverlappingzones.Thezoneis defined as a collection of nodes which are in a zone radius.Thesizeofazoneisdeterminedbyaradiusoflengthαwhereαisthenumberofhopstotheperimeterofthezone.InZRP,aproactive routing protocol (IARP) is used in intra-zone communication, source sends data directly to the destination if both are in same routing zone otherwise IERP reactively initiates a route discovery.

B. Position Based RoutingProtocol

Position Based Routing consists of class of routing algorithm, which issharing the propertyofgeographicpositioninginformation in order to select the next forwarding hops [2]. The packets is sendwithoutanymapknowledgetotheonehopneighborwhich is doesn't to destination. Position based routing provide better performancebecausethereisnoneedtobecreatedandmaintained global route from source node to destination node [5]. Position based routing assumes that each node have knowledge about its physical/geographic position by GPS or by some other position determining services. In it each node also has theknowledgeofsource,destinationandotherneighboringnodes.Ascomparedtotopologybasedrouting,positionbasedroutingusestheadditional information of each participating node to applicable in VANET, that additional information is gathered through GPS, here we discuss some popular position based routingtechniques:-

(i). GPSR: Greedy Perimeter StatelessRouting

InGreedyPerimeterStatelessRouting(GPSR)anodeforwardsapacketstoanimmediateneighborwhichisgeographicallyclosertothedestinationnode.Thismodeofforwardingistermedgreedymode.Whenapacketsreachesalocalmaximum,arecoverymodeisusedtoforwardapackettoanodethatisclosertothedestinationthanthenodewherethepacketsencounteredthelocalmaximum [3-4].

(ii). GSR: Geographic SourceRouting

EarlierGSRwasusedinMANET.Thenitwasimprovedtousein VANET scenario by incorporating in to it greedy forwardingofmessagestowardthedestination.Ifatany hoptherearenonodesinthedirectionofdestinationthenGPSRutilizearecoverystrategy known as perimeter node [3, 5].

(iii). A-STAR: Anchor Based Street and Traffic Aware Routing[4]

AStarissimilartoGSRinthatpacketsareroutedthroughanchorpointsoftheoverlay.However,ASTARistraffic aware:thetraffic ontheroaddetermineswhethertheanchorpointsoftheroadwill be considered in the shortest path. A-STAR routes based on two kindsofoverlaidmaps:astaticallyratedmapandadynamically rated map. A statistically rated map is a graph that displaysbusroutes that typically imply stable amount of traffic.

C. Geo cast BasedProtocol

Geo cast routing is basically a location based multicast routing usedtosendamessagetoallvehiclesinapre-definedgeographical region.Itismainobjectivetodeliverthepacketfromsourcenode to all other nodes within a specifiedgeographicregionZoneofrelevanceZOR.Ingeocastroutingvehiclesoutsidethe ZORarenotalertedtoavoidunnecessaryhastyreaction.Itnormallydefinesaforwardingzonewhereitdirectsthefloodingofpacketsinorder to reduce messageoverhead and network congestion caused by simplyfloodingpacketseverywhere.Inthedestination zone,unicastroutingcanbeusedtoforwardthepacket.Onepitfallof Geocastisnetworkpartitioningandalsounfavorableneighborswhich may hinder the proper forwarding of message [1, 4].

D. Cluster BasedProtocol

Each cluster has one cluster-head, which is responsible for intra and inter-cluster management function. Intra-cluster nodes communicateeachotherusingdirectlinks,whereasinter-cluster communication is performed via cluster headers. In cluster- based routing protocol the formation of cluster the selection of cluster-headisanimportantissue.InVANETduetohighmobility dynamic cluster formation is a towering process [1, 4].

E. Broadcast BasedRouting

Broadcastisbasedonhierarchicalstructureforhighway network.Inbroadcastthehighwayisdividedintovirtual cellswhichmovelikevehicle.Thenodesinthehighwayareorganizedintotwolevelofhierarchy;thefirstlevelhierarchyincludesallthenodesinacell,thesecondlevelhierarchyisrepresentedbycellreflectors,whicharefewnodeslocatedclosedtogeographicalcenterofcell.Some cell reflected behaves for certain interval of time as cluster head

andhandlestheemergencymessagecomingfromsame members of the cell or nearby neighbor. This protocol performs similarto flooding base routing protocols for message broadcasting and routing overhead [1, 4].

VI. CONCLUSION

RoutingisanimportantcomponentinVehiclet oVehicle(V2V)andInfrastructuretoVehicle(I2V)com munication.ThispaperdiscussvariousRoutingprotoco lsofVANET.Designinganefficientroutingprotocolfora llVANETapplicationverydifficult.Proactivebasedpr otocolmaynotbesuitablehighmobilitynodesbecaused istancevectorroutingtakesmuchbandwidthtostorerou tinginformation withneighbors.DuetohighmobilityofVANETnode's proactive based routing protocol may fails in VANET due to consumption of more bandwidth and large table information. As compared to proactiveroutingreactiveroutingprotocolsuchas(AO DV&DS) focus on features and comparison of different protocols require less space to store the routing information and also consumed less bandwidth to communicate among neighbors for the highly mobile adhoc network. Thus this paper focus on features and comparison of different categories of VANET routingprotocols. Such as position based Geo cast and Cluster based protocol are more reliable for most of application inVANET.

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