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A Review on Routing Overhead in Broadcast Based Protocol on VANET

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Abstract*— The next generation VANET systems are more dense and it supposed to handle high traffic rate as well as frequent interrupt in connection. It should consume less power and utilize bandwidth efficiently. At the same time, the VANET nodes must be simple, cheap, smaller in size and efficient enough to handle traffic. In wireless environment, the quality of received signal level degraded due to path-loss and shadowing from various obstacles in propagation path. In addition to this, nodes use flooding mechanism in which it unconditionally floods data packets in all the directions. Which is going to harm network in terms of bandwidth wastage, collision, energy consumption.Effect of flooding can be suppressed by eliminating or dropping certain nodes. Hence, reliability of communication can be improved. In VANET system Vehicles need to communicate with the other node, for that node continuously sending RTS-CTS signals. As if number of signals increases, there is high probability of collision. Collision damages data packets .so it requires retransmission, this paper presents different routing protocols through which overhead can be reduced.

***Index Terms*—VANET Architecture, Routing Protocols, VANET Characteristics.**

I. INTRODUCTION TO VEHICULAR AD-HOC NETWORK

A Vehicular Ad-Hoc network is a form of Mobile ad-hoc Networks, to provide communication among nearby vehicles and between vehicles and nearby fixed equipment i.e. roadside equipment. The main goal of VANET is providing safety and comfort for passengers. Each vehicle equipped with VANET device will be a node in the Ad-hoc network and can receive & relay other messages through the wireless network. Collision warning, Road signal arms and in place traffic view will give the driver essential tool to decide the best path along the way. VANET or Intelligent Vehicular Ad-Hoc Networking provides an intelligent way of using vehicular Networking. With the sharp increase of vehicles on roads in the recent years, driving becomes more challenging and dangerous. Roads are saturated; safety distance and reasonable speeds are hardly respected. The leading car manufacturer decided to jointly work with govt. agencies to develop solution aimed at helping drivers on the roads by anticipating hazardous events or bad traffic areas. VANETs comprise of radio-enabled vehicles which act as mobile nodes as well as routers for other nodes. In addition to the similarities to ad hoc networks, such as short radio Transmission range, self-organization and self management, and low bandwidth, VANETs can be distinguished from other kinds of ad hoc networks as follows:

A. Highly Dynamic Topology

Due to high speed of movement between vehicles, the topology of VANETs is always changing. For example, assume that the wireless transmission range of each vehicle is 250 m, so that there is a link between two cars if the distance between them is less than 250 m. In the worst case, if two cars with the speed of 60 *mph* (25 *m/sec*) are driving in opposite directions, the link will last only for at most 10 sec.

B. Frequently Disconnected Network

Due to the same reason, the connectivity of the VANETs could also be changed frequently. Especially when the vehicle density is low, it has higher probability that the network is disconnected. In some applications, such as ubiquitous Internet access, the problem needs to be solved. However, one possible solution is to pre-deploy several relay nodes or access points along the road to keep the connectivity.

C. Sufficient Energy and Storage

A common characteristic of nodes in VANETs is that nodes have ample energy and computing power (including both storage and processing), since nodes are cars instead of small handheld devices.

D. Geographical Type of Communication

Compared to other networks that use Unicast or multicast where the communication end points are defined by ID or group ID, the VANETs often have a new type of communication which addresses geographical areas where packets need to be forwarded (*e.g.*, in safety driving applications).

E. Mobility Modelling and Predication

Due to highly mobile node movement and dynamic topology, mobility model and predication play an important role in network protocol design for VANETs. Moreover, vehicular nodes are usually constrained by prebuilt highways, roads and streets, so given the speed and the street map, the future position of the vehicle can be predicated.

F. Various Communications Environments

VANETs are usually operated in two typical communications environments. In highway traffic scenarios, the environment is relatively simple and straightforward (*e.g.*, constrained one-dimensional movement); while in city conditions it becomes much more complex. The streets in a city are often separated by buildings, trees and other obstacles.

G. Hard Delay Constraints

In some VANETs applications, the network does not require high data rates but has hard delay constraints. For example, in an automatic highway system, when brake event happens, the message should be transferred and arrived in a

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certain time to avoid car crash. In this kind of applications, instead of average delay, the maximum delay will be crucial.

H .Interaction With On-Board Sensors

It is assumed that the nodes are equipped with on-board sensors to provide information which can be used to form communication links and for routing purposes. For example, GPS receivers are increasingly becoming common in cars which help to provide location information for routing purposes. It is assumed that the nodes are equipped with on-board sensors to provide information which can be used to form communication links and for routing purposes. For example, GPS receivers are increasingly becoming common in cars which help to provide location information for routing purposes.

II. MOBILITY MODEL

A. Freeway Mobility Model (FMM)

Freeway is a generated-map -based model. The simulation area, represented by a generated map, Includes many freeways, each side of which is composed of many lanes as shown in the *Fig.1*. No urban routes, thus no intersections are considered in this model. At the beginning of the simulation, the nodes are randomly placed in the lanes, and move using history-based speeds. A security distance should be maintained between two subsequent vehicles in a lane. If the distance between two vehicles is less than this required. Minimal distance, the second one decelerates and let the forward vehicle moves away. The change of lanes is not allowed in this model. The vehicle moves in the lane it is placed in until reaching the simulation area limit, then it is placed again randomly in another position and repeats the process. This scenario is definitely unrealistic.

B. Manhattan Mobility Model (MMM)

Generated-map-based model to simulate an urban environment. Before starting a simulation, a map containing vertical and horizontal roads is generated as shown in the Fig Each of these latter includes Two lanes, allowing the motion in the two directions .At the beginning of a simulation, vehicles are randomly put on the roads. They then move continuously according to history –based speeds (following the same formula like the freeway model). When reaching a crossroads, the vehicle randomly chooses a direction to follow. That is, continuing straightforward, turning left, or turning right.

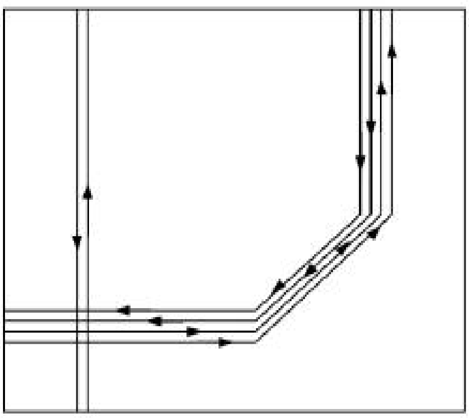

Fig 1: Freeway Mobility Model

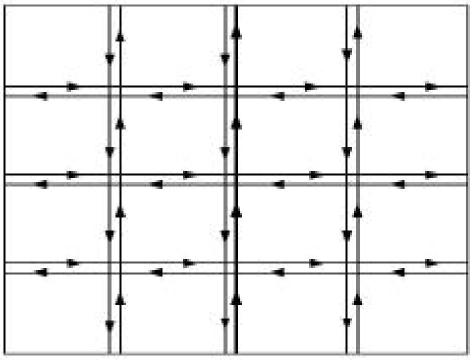

Fig 2: Manhattan Mobility Model

III. VANET ARCHITECTURE

VANET may use fixed cellular gateways and WLAN/WIMAX access points at traffic intersection to connect to the internet, gather traffic information or for routing purposes. This network architecture is called pure cellular or WLAN. *[Fig.3]*VANET can comprise both cellular network and WLAN to form a network. Stationary or fixed gateways around the roadside also provide connectivity to vehicles. In such a scenario all vehicles and road side devices form pure mobile ad-hoc networks. *[Fig. 4]*Hybrid architecture consists of both infrastructure network and ad hoc network together. No centralize authority is required in VANET as nodes can self Organize and self manage the information. *[Fig.5]*

IV. CHARACTERISTICS

A. Highly Dynamic Topology

The topology formed by VANET is always changing as vehicles are moving at high speed .on highways, vehicles are not moving at constant speed.

B. Frequently Disconnected Networks

The highly dynamic topology results in frequently disconnected network since the link between two vehicles can quickly disappear while the two nodes are transmitting information. The problem is future worsened by varying node density where there are different frequency of nodes for different roads and highways. A robust routing protocol is hence needed to recognize the frequent disconnectivity and to provide an alternate link.

C. Pattern Mobility

Vehicles follow a trail or certain mobility pattern which is a function of underlying roads, the traffic lights, the speed limits traffic conditions and driving behaviours of driver, because of particular mobility Pattern, evaluation of VANET routing protocols only makes sense from traces obtained from pattern.

D. Propagation Model

The propagation model in VANET is not usually assumed to be free space because of presence of buildings, trees, vehicles, and other obstacles. A VANET propagation model should well consider the effect of static object as well as potential interference of wireless communication from other vehicle.

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E. Unlimited Battery Power and Storage

The nodes in VANET are not subject to power and storage limitations as in sensor networks, another class of ad hoc network where nodes are mostly static. Nodes are assumed to have ample energy and computing power and hence the optimizing duty cycle is not as relevant it is in sensor network.

V. VANET CATEGORIES

Wireless ad hoc networks have the characteristic to be infrastructure-less and do not depend on fixed infrastructure for communication and dissemination of information. The architecture of VANET consists three categories: pure cellular/WLAN, pure ad hoc and hybrid

A. WLAN / Cellular

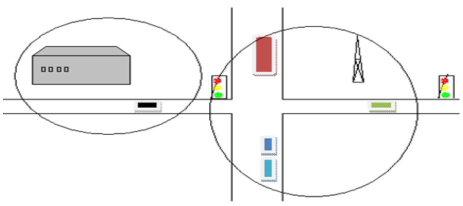

Fig 3: WLAN / Cellular [2]

B. Pure Ad-Hoc

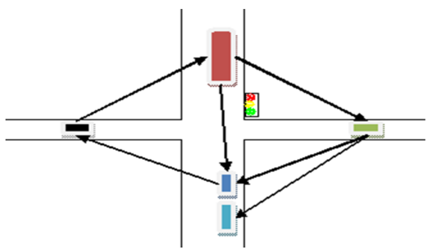

Fig 4: Pure Ad-Hoc [2]

C. Hybrid

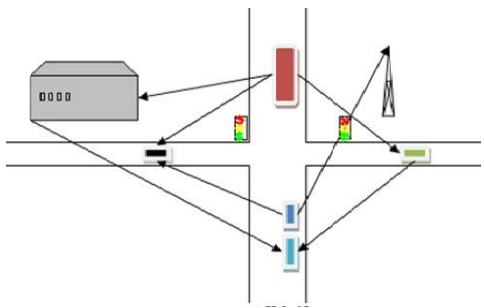

Fig 5: Hybrid [2]

VI. VANET ROUTING PROTOCOLS

A. Topology Based Routing Protocols

These routing protocols use links information that exist in the network to perform packet forwarding. They are further divided into Proactive and Reactive.

B.Position Based Routing Protocols

Position based routing consists of class of routing algorithm. They share the property of using geographic positioning information in order to select the next forwarding hops. The packet is send without any map knowledge to the one hop neighbor which is closest to destination. Position based routing is beneficial since no global route from source node to destination node need to be created and maintained. Position based routing is broadly divided in two types: Position based greedy V2V protocols, Delay Tolerant Protocols.

C.Broadcast Routing Protocols

Broadcast routing is frequently used in VANET for sharing, traffic, weather and emergency, road conditions among vehicles and delivering advertisements and announcements. Broadcasting is used when message needs to b disseminated to the vehicle beyond the transmission range i.e. multi hops are used. Broadcast sends a packet to all nodes in the network, typically using flooding. This ensures the delivery of the packet but bandwidth is wasted and nodes receive duplicates. In VANET, it performs better for a small number of nodes. The various Broadcast routing protocols are BROADCOMM, UMB, V-TRADE, and DV-CAST.

D Geocast Routing

Geocast routing is basically a location based multicast routing. Its objective is to deliver the packet from source node to all other nodes within a specified geographical region (Zone of Relevance ZOR). In Geocast routing vehicles outside the ZOR are not alerted to avoid unnecessary hasty reaction. Geocast is considered as a multicast service within a specific geographic region. It normally defines a forwarding zone where it directs the flooding of packets in order to reduce message overhead and network congestion caused by simply flooding packets everywhere. In the destination zone, unicast routing can be used to forward the packet. One pitfall of Geocast is network partitioning and also unfavorable neighbors which may hinder the proper forwarding of messages. The various Geocast routing protocols are IVG, DG-CASTOR and DRG The routing protocol of VANETs fall into two major categories of topology-based and position-based routing. There are many advantages and disadvantages of these routing protocols. The detailed coverage of relevant routing protocols and their impact on overall VANET architecture is incomplete without knowledge of VANET applications

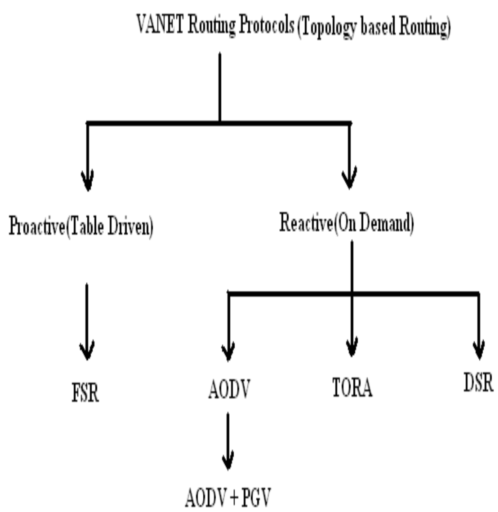

Fig 6: Classification of VANET Routing Protocols [1]

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1. Fisheye State Routing(FSR)

This is an efficient link state routing that maintains a topology map at each node and propagates link state update with only immediate neighbors not the entire network furthermore the link state information is broadcast in different frequencies for different entities depends on their hope distance to the current node. Entries that are closer are broadcasted with larger frequency. The routing gets corrected as packets approach progressively closer to the destination due to the reduction in broadcast overhead.

2. AODV (Ad Hoc On Demand Distance Vector Routing)

In this routing upon receipt of broadcast query (RREQ) nodes record the address of the node sending the query in their routing table or the previous hop and is called backward learning. Upon arriving at the destination, a reply packet (RREP) is then sent through the complete path obtained from backward learning to the source.et each step of the path the node records its previous hop and establishes the forward path from the source.

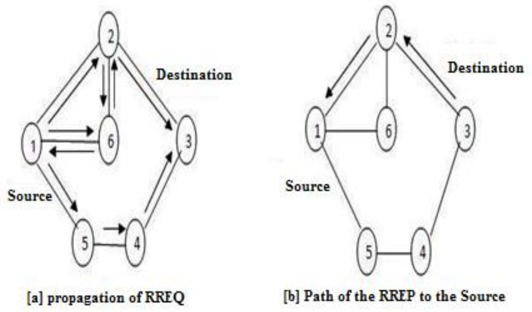

Fig 7: AODV [1]

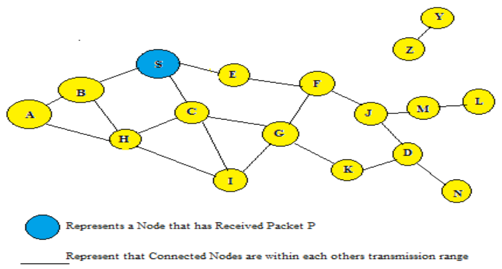

Fig 8: AODV Mechanism [2]

3. AODV+ PGB (Preferred Group Broadcasting)

This is a broadcast mechanism and is aimed at reducing broadcast overhead associated with AODV'S route discovery and thus provides route stability which is important in VANET. The receivers then determine whether they are in the preferred group and which one in the group to broadcast on the basis of received signal. As only one node is allowed to broadcast and the preferred group is not necessarily the one that makes progress towards the destination, the route discovery might take longer than before. Broadcast can discontinue if the group is found to be empty due to presence of sparse network. Packet duplication can also happen as two nodes in preferred group can broadcast at the same time.

4. DSR (Dynamic Source Routing)

This uses source routing, as the sequence of intermediate nodes on the routing path is maintained in a data packet of the source in DSR the ID'S of intermediate nodes that it has traversed are copied in the query packet, and uses it to respond to the source. As a result a source establishes a path to the destination. If the destination is allowed to send multiple route supplies, the source node may receive and store multiple routes from the destination. When some link in current route breaks then an alternate route is used. In a network with low mobility, this is an advantage over AODV as the alternative route can be tried before the DSR initiates another flood for route discovery. The first difference between AODV and DSR is that in AODV data packets carry the destination address, whereas in DSR data packets carry s full routing information's which shows that DSR has potentially more routing overhead than AODV.As the network diameter increases, the amount of overhead in the data packet continues to increase. The second difference is that in AODV, route reply packet carry the destination address and the sequence number, while in DSR, the route reply packets carry the address of each node along the route.

5. TORA

Temporally ordered routing algorithm belongs to the family of link reversal routing algorithm where the height of the tree rooted at the source is used to build a direct acyclic graph (DAG) towards the destination which directs the flow of packet and ensure their reach ability to all the nodes.

VII. CONCLUSION

This study provides the different routing protocols on VANET which provides reliable and efficient way for vehicle to vehicle communication. These protocols improve the overall performance of the network in terms of deduction of bandwidth wastage, collision, energy consumption.

REFERENCES

[1] "Balancing Wireless Data Broadcasting And Information Hovering For Efficient Information Dissemination" Christos Liaskos, Graduate Student Member, IEEE, Andreas Xeros, Georgios I. Papadimitriou, Senior Member, Ieee, Marios Lestas, Member, Ieee, And Andreas Pitsillides, Senior Member, Ieee(March 2012).

[2] "Comparative Study of Manet and Vanet Routingprotocols", Byprabhakar, Rajan&Kamalkantahirwar, Amity University, Noida (Acct 2011).

[3] "Vanet's Mobility Models And Overtaking: An Overview" By Djamel Djenouri, Wassim Soualhi, Elmalik Nekka, Algeria(2010).

[4] "Capacity, Collision And Interference Of Vanet With Ieee 802.11 Mac", By Wu Ming,Yang Lin Tao, Li Cheng-Yi,Jiang Hao,China 2008.

[5] "Urban Multi-Hop Broadcast Protocol For Inter Vehicle Communication Systems" By Gikhan Kormaz,Eylem Ekici,Fusun Ozguner,Umit Ozguner,U.S.A (October 2004) .

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 2, Issue 5, November 2012

[6] "The Broadcast Strom Problem In A Mobile Ad Hoc Network",By Sze-Yao Ni,Yu-Chee Tseng,Yuh-Shyan Chen,And Jang-Ping Sheu,Seattle Washington U.S.A 99.

[7] "Smart Broadcast Of Warning Messages In Vehicular Ad-Hocnetworks",Byc-Fchiasserini,E.Fasolo,R.Furiato,R.Gaeta,M-Gareatto,M-Gribaudo,M-Sereno,A.Zenela.

[8] "VANET's mobility models and overtaking: an overview", by djaamel Djenouri, wassim soualhi, elmalik nekka, Algeria.

[9] "Double-covered broadcast (DCB): a simple reliable broadcast algorithm in MANETs", by Wei lou and jie wuflorida, IEEE 2004.

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