Performance of Proactive & Reactive Routing Protocol in VANET Using NS3

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Abstract*-Inter-vehicle communications (IVC) technologies helps to improve driving safety and enable infotainment applications, empirical testing within large-scale deployments remains cost-prohibitive, thus highlighting the need for accurate simulation models. While using current models, simulation practitioners limit future extensions and produce in- consistent results by choosing different design assumptions, thus motivating the following research objective: the goal of this research is to assess VANET network effectiveness by highly parameterizing in simulation mobility, radio propagation, that realistically represent VANET scenarios. We develop a simulation script for ns-3 that we execute for several realistic VANET scenarios and compare routing protocols throughput, end-to-end delay, and safety message packet delivery ratio (PDR) to assess routing protocol performance of AODV and DSDV. We find that Vehicular Ad-Hoc Networks (VANETs) envisage supporting services on Intelligent Transportation Systems (ITSs), as collective monitoring of traffic, collision avoidance, vehicle navigation, control of traffic lights, and traffic congestion management by signaling to drivers. VANETs comprise vehicles and roadside equipments owning wireless interfaces able to communicate among them by wireless and multi-hop communication.*

Keywords-VANET; routing protocol; performance; ns-3

I. INTRODUCTION

Vehicular ad hoc network is a special form of MANET which is a vehicle to vehicle & vehicle roadside wireless communication network.

It is responsible for the communication between moving vehicles in a certain environment. A vehicle can communicate with another vehicle directly which is called Vehicle to Vehicle (V2V) communication, or a vehicle can communicate to an infrastructure such as a Road Side Unit (RSU), known as Vehicle-to-Infrastructure (V2I).

Architecture of VANET consist of mainly two components

- On-Board Units (OBUs) - OBUs are sensors integrated in vehicle to enable short-range wireless communication network and forming ad hoc networks among vehicles. They are connected with GPS units to enable reliable navigation.
- Road Side Units (RSUs) - RSUs acts as relays at the roadside to increase the coverage, and to make the communication robust. RSUs have the capacity to collect, store, and process data and information , and act as gateways to the Internet.

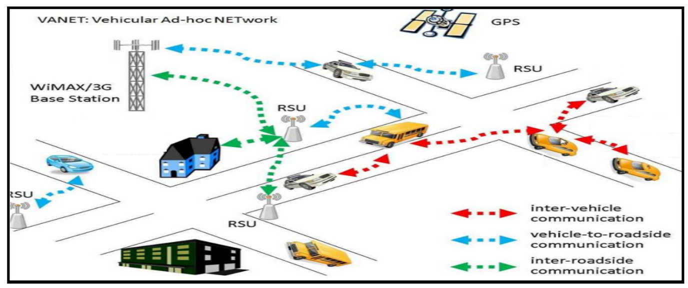


Fig1.1 : Architecture of VANET

The data collected from the sensors on the vehicles can be displayed to the driver, sent to the RSU or even broadcasted to other vehicles depending on its nature and importance. VANETs offer the potential for fast and accurate driving information (e.g. traffic, accidents and emissions) that would otherwise be more difficult to disseminate. Possible applications for such networks can be generally classified as safety and non-safety applications [6]. Safety applications include accident avoidance and cooperative driving. Non-safety applications include traffic information, toll service, Internet access, cooperative entertainment, etc

VANETs have several properties that distinguish them from other MANETs. Nodes (vehicles) in VANETs are highly mobile, the probability of network partitions is higher, and end-to-end connectivity is not guaranteed . However, although VANETs do have dynamic topologies, they are not completely random. The movement of nodes in a VANET is relatively predictable because it is restricted to the roads on which the vehicles travel. Most of the vehicles provide sufficient computational and power resources, thus eliminating the need for introducing complicated energy- aware algorithms. Vehicles will not be affected by the addition of extra weight for antennas and additional hardware . The advantages and disadvantages of these properties make VANETs a hot research area all over the world, and attract great academic attention. This dissertation mainly focus on performance evaluation of popular routing protocols of VANET , reactive routing protocol, AODV[3] and Proactive routing protocol, DSDV for CBR traffic by changing the number of nodes and simulation time . The performance is measured for both protocols under varying number of nodes and simulation time. The objective behind this work is to identify, the behavior of each protocol, how they performing in different scenarios and to find, which protocol performs better under a particular situation.

II. RELATED WORK

[4]. J. Bu and M. Liu. Has worked onEvaluation of Wireless Access in Vehicular Environments(WAVE) &VANET performance using ns-3.His research objective was to assess VANET network effectiveness by highly parameterizing in simulation mobility, radio propagation, and MAC/PHY models that realistically represent VANET scenarios[4].

[5].R.Chaudhary, S.Sethi, R.Keshari, S.Geol has worked on study of network simulator 2 & network simulator 3.They study that network simulators is extremely useful because it often allows research questions,real time simulations and prototypes to be explored at relatively lesser cost and time than that required to experiment with real implementations and networks.The network simulators allow one to model an arbitrary computer network by specifying both the behavior of the network nodes and the communication channels. It provides a virtual environment for an assortment of desirable features such as modeling a network based on a specific criteria and analyzing its performance under different scenarios. The newly proposed network simulator NS-3 supports coupling, interoperability, good memory management, debugging of split language objects, coding in C++ and object oriented concepts, as well as supports models supported by NS-2 and most suitable for wireless networks.

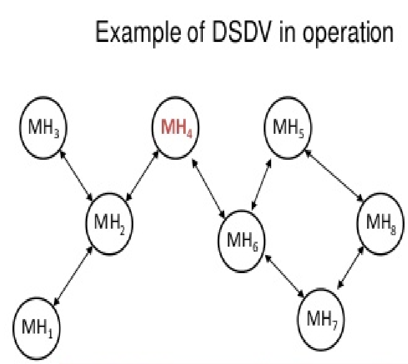
III. DSDV (DESTINATION SEQUENCED DISTANCE VECTOR ROUTING)

This protocol is based on traditional Bellman-Ford routing algorithm. Each node in the network maintains a list all destinations and number of hops required to reach to the destination. All the entry is notified with a sequence number. The DSDV routing protocol uses the full dump or incremental update approach in order to reduce network traffic generated by route updates. The broadcast of route updates is delayed by settling time.

In DSDV, a sequence number is associated to a target node, and typically is originated by that node (the owner). In case when a non owner node detects a line break in the route it can update the sequence number of the route. An owner node always uses even-numbers for numbering the sequence number and a non-owner node always uses odd-numbers. With the addition of sequence numbers, routes for the same target node are chosen based on the following policy: 1) a path with a newer sequence number is chosen; 2) in the case that two paths have a identical sequence number, the one with a higher cost metric is preferred. The list which is maintained is called routing table. The entries within the routing table are as follows:

1) IP Address of the entire available destination
2) IP address of next hop
3) Number of hops required to reach the destination
4) The Sequence number that are assigned by the destination node
5) Install time

The sequence number is used to make a distinction among out of date routes from new ones and thus avoid the creation of loops. The nodes transmit their routing tables to their direct neighbors periodically. Nodes can also transmit its routing table to others if a significant change in its table from its last update occurs.



Routing Table at M4

Destination	Next Hop	Cost
MH_4	MH_4	0
MH_1	MH_2	2
MH_2	MH_2	1
MH_3	MH_2	2
MH_5	MH_6	2
MH_6	MH_6	1
MH_7	MH_6	2
MH_8	MH_6	3

Fig. 3.1 : Routing Table of DSDV

IV. AODV (ADHOC ON DEMAND DISTANCE

VECTOR ROUTING)

Ad hoc On-Demand Distance Vector (AODV) routing is a routing protocol for VANETs and other wireless ad-hoc networks. It is jointly prepared in Nokia Research Centre of University of California, Santa Barbara and University of Cincinnati by C. Perkins and S. Das. AODV is based on the principle of an on-demand and distance-vector routing protocol, means in this protocol path is established from a target or destination node only on when required or demand. AODV[19][20] has the capability of both uni-casting and multicasting. It keeps these paths as long as they are wanted by the sources. The sequence numbers are used by AODV to ensure the freshness of routes. It is free from loops, self-starting, and scales to huge numbers of mobile nodes. AODV defines three types of control messages for route maintenance:

RREQ- A route request message is transmitted by a source node to the target or destination node. The expanding ring technique is employed for flooding of messages in case of optimization of AODV.

RREP- A route reply message is a unicast message which is transmitted back to the source or originator of the RREQ message if the receiver is either the node using the requested address, or it has a valid path to the requested address. The reason behind one can unicast the message back to the source is based on the concept that every route forwarding a RREQ caches a route back to the originator.

RERR- All thenodes monitor the link status of next hops in active path. As soon as any line breakage in the active route is identified or discovered a RERR message is transmitted to notify other nodes in the network about the breakage of the link. In order to facilitate this reporting method, each node maintains a precursor list which contains the IP address for each its neighbors' that are likely to use it as a next hop towards each destination.

The AODV protocol uses RREP and RREQ messages to create its path or route. When a source node needs a route to a target node or destination node for which it does not have any path it broadcasts a route request (RREQ) packet across the network. As the nodes receives this message they update their information for the source node and place a backwards pointers to the source node in the route tables. Apart from the source node's IP address, current sequence number, and broadcast ID, the RREQ message also contains the most recent sequence number for the destination of which the source node is aware. As the node receives the RREQ message it send a route reply (RREP) message back to the node which is either the destination or if it has a route to the destination with corresponding sequence number greater than or equivalent to that contained in the RREQ. In this is the case then it unicast the RREP message back to the source otherwise again initiate the procedure by transmitting or broadcasting the RREQ message. All the nodes keep record of the RREQ's source IP address and broadcast ID. If they receive a RREQ message which they have already processed, they discard the RREQ and do not forward it. As the RREP message propagates back to the source, each nodes set up forward pointers to the target node .

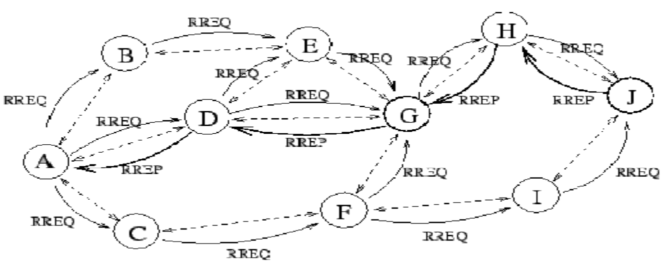


Fig.4.1: A possible path for a route replies if A wishes to find a route to J.

The above Figure 5.3 illustrates an AODV route lookup session. Node A wants to commence traffic to node J for which it has no path. A RREQ message is transmitted which is flooded to all nodes in the network. As the request is received at node H form node, node J generates a RREP message. This RREP is then unicasted to the source node A by using the cached entries stored in nodes H, G and D.

V. EXPERIMENTAL SETUP & RESULTS

From the VANET literature, ns-3 was chosen over other open source and proprietary simulators because of its diverse set of suitable and architecturally-decoupled models that ease model selection and parameterization

Parameter	**Value**
Examined Protocol	**AODV and DSDV**
Number of Nodes	**02,20 and 50**
Simulation Time	**500sec**
Simulation Area	**150mX150m**
Network Traffic	**CBR**
Packet Size	**512 Bytes**
Simulator	**NS 3.25**

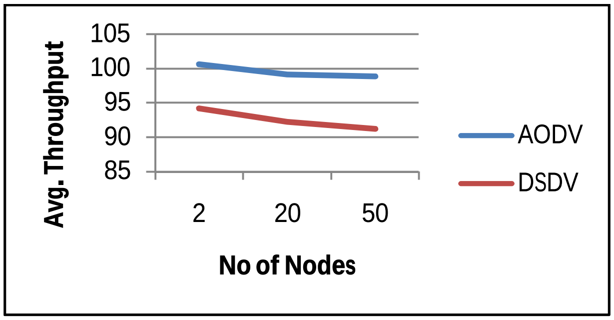


Fig 5.1 : Average Throughput

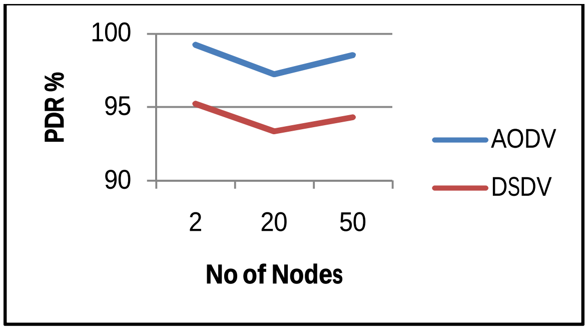


Fig.5.2 : PDR (in %)

VI. CONCLUSION

The above fig5.1 shows that the throughput decreases with increasing number of nodes. The fig. 5.2 shows that the packet delivery ration decreases for 20 nodes but again it increases with the increase in nodes.

The overall results reveals that the performance of AODV is much better in terms of throughput and PDR as compared to DSDV.

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