A STUDY AND PERFORMANCE ANALYSIS OF DSR ROUTING PROTOCOL IN VANET

R.Jeevitha[1] *M.Chandra Kumar*[2]

ABSTRACT

Vehicular Ad-hoc Networks (VANETs) is an emerging technology that has been recently attracting an increasing attention from both research and industry communities. VANET is a collection of wireless vehicle nodes forming a temporary network without using any centralized Road Side Unit. VANET is a subset of MANET. Routing is the important component of communication protocols in VANETs. Packets are routed from source node to destination node. Because of frequent topology changes and routing overhead, selection of routing protocol in VANET is a great challenge. There are various routing protocols available for VANET. This paper involves study of Dynamic Source Routing protocol and performance metrics are analyzed with the help of NS2 Simulator.

Index Terms—VANET, MANET

I. INTRODUCTION

Vehicular adhoc network is a form of MANET. Each and every node is considered as vehicles. It provides wireless communication among vehicles and vehicle to road side equipment. The communication between vehicles is used for safety and for entertainments as well. The performance of communication depends on how better the routing takes place in the network. Routing of data depends on routing protocol being used in network. It allows an automobile to become both a wireless node and a router. It can communicate with each other, with roadside infrastructure nodes which may, in turn connect to the internet, as well as with pedestrians equipped with wireless devices such as a smart phones or PDAs [1][2].

Integrating a network interface, GPS receiver, different sensors and on-board computer gives an opportunity to build a powerful car-safety system, capable of gathering, processing and distributing information. Numerous applications can be deployed in a network established with such equipped vehicles and proper infrastructure. Generally, from the connectivity point of view they could be divided into four main groups: car-to-car traffic, car-to infrastructure, car-to-home and routing based applications. These applications are either safety related or comfort-related.

Basic applications are aimed at improving road safety (collision warnings, weather and road hazard alerts) as well as providing driver convenience (notification of real time traffic information, parking availability, and location based services).

[1]Assistant Professor, Department of Computer Applications Karpagam University Coimbatore, India

[2]HOD, Department of Computer Applications, SNMV College of Arts and Science, Coimbatore, India

There are different types of routing protocol in VANET such as proactive routing protocol, reactive routing protocol, hybrid routing protocol, topology based routing protocols and position based routing protocols. Existing unicast routing protocols of VANET has some disadvantages and is not capable to meet every traffic on highway road scenarios [11].

II. Dynamic Source Routing Protocol (DSR)

Dynamic Source Routing (DSR) is an On Demand unicast routing protocol that utilizes source routing algorithm. In source routing algorithm, each data packet contains complete routing information to reach its dissemination. In DSR each node uses caching technology to maintain route information. For example, the intermediate nodes cache the route towards the destination and backward to the source. Furthermore, because the data packet contains the source route in the header, the overhearing nodes are able to cache the route in its routing cache [8] [11].

A. Route Discovery

The source node broadcasts request-packets to all the neighbours in the network containing the address of the destination node, and a reply is sent back to the source node with the list of network-nodes through which it should propagate in the process. Sender initiates the route record as a list with a single element containing itself followed by the linking of its neighbour in that route[6][7].

A request packet also contains an identification number called request-id, which is counter incremented only when a new route request packet is being sent by the source node [8]. To make sure that no loops occur during broadcast, the request is processed in the given order.

If the pair (source node address, request-id) is found in the list of recent route requests, the packet is discarded. If the host's address is already listed in the request's route record, then also the packet is discarded ensuring the removal of later copies of the same request that arrive by using a loop. When a destination address in the route request matches the host's address, a route reply packet is sent back to the source node containing a copy of this route. Otherwise, add this host's address to the route record field of the route request packet and rebroadcast the packet [11].

B. Route Reply

A route reply is obtained in DSR by two ways:

1) Symmetric links (bidirectional),
2) Asymmetric-links (unidirectional)

Symmetric links in which the backward route is followed again to catch the source node. Asymmetric-links needs to discover the route up to the source node in the same manner as the forward route is discovered. [8]

C. Route Maintenance

Route Maintenance can be accomplished by two ways:

1) Hop-by-Hop acknowledgement at the data link layer.

2) End-to-End acknowledgements.

III. Simulation Scnerio

NS2 is mainly used in MANET researches [3]. NS2 is developed as a collaborative environment. It is distributed freely and it is open source. Using NS2, DSR routing protocol is analyzed in VANET environment.

Table 1.0 Simulation Parameters

Parameter	Values
Number of nodes	30
Routing protocols	DSR
MAC layer	802.11
Mobility model	Random Direction Model
Applications	CBR
Applicationpacket size	512 bytes
Simulation Time	100 s
Maximum Speed	10 m/s

IV. Result and Analysis

In the first scenario, throughput of sending bits vs Minimal End 2 End delay are considered. End 2 End delay is the average time interval between the generation of packets in a source node and successfully delivery of it in a destination node. The performance would be better when it is low.

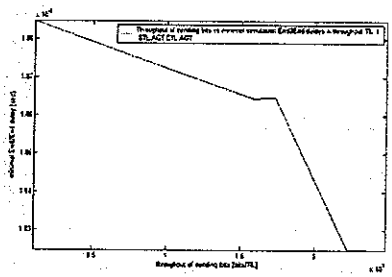

Fig. 1. Throughput of Sending bits vs Minimal End 2 End delay

Throughput vs Delay graph shows throughput (bits) on X axis and delay on Y axis. DSR end to end delay increases at high mobility speed because it suffers from stale route cache problem.

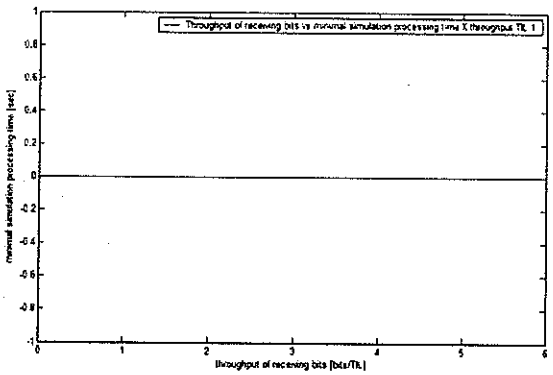

Fig. 2. Throughput of Receiving bits vs Minimal Simulation Processing time

Throughput measures how well the network can constantly provide data to the destination. Throughput vs Processing time graph shows throughput (bits) on X axis and processing time on Y axis.

Throughput and minimal processing times are calculated every time interval. Throughput of receiving bits and processing times can be calculated at Current node or in the whole network (simulation processing time).

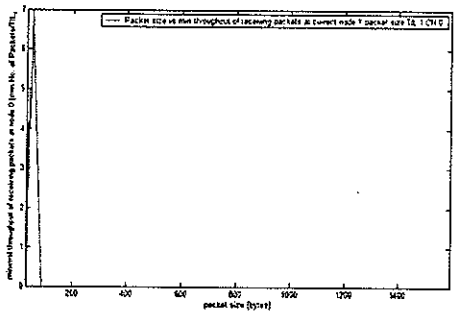

Fig. 3. Packet Size vs Minimal throughput of receiving packets

For achieving better performance throughput should be high. Graph delays of received packets are calculated in the same time intervals as throughput is calculated.

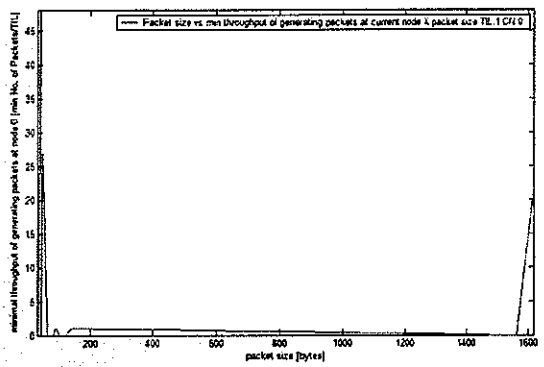

Fig. 4. Packet Size vs Minimal throughput of generating packets

Packet size vs Throughput graph shows packet size on X axis and minimal throughput on Y axis. Throughput is calculated in each time interval and then minimal is calculated from all the time intervals.

V. Conclusion

In this paper, the performance of DSR is analyzed using simulation tool NS2. The protocol has been tested on NS2 simulator by using metrics - throughput, average end-to-end delay, processing time and packet size. This work can further be extended by performing simulation with different traffic scenarios and by comparing it with cluster based routing protocol for VANETs.

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Author's Biography

R.Jeevitha is currently pursuing her Master of Philosophy in Computer Science in Bharathiar University, Coimbatore, India. Her field of interests include Mobile Computing and Computer Networks. She is currently working as Assistant Professor in dept of Computer Applications, Karpagam University, Coimbatore. She has seven Publications in International Journals to her credit. She has also presented three papers in International Conference and five papers in National Conferences.

Chandra Kumar is currently working as the Head of Computer Applications Department in SNMV College of Arts and Science, Coimbatore, India. He has more than 14 years of Experience in Teaching. His field of interests include data mining. He has more number of Publications in International Journals to his credit. He has also presented papers in International and National Conferences. He is currently guiding 5 M.Phil Scholars.