Simulation and Analysis of AODV and DSDV Routing Protocols in Vehicular Adhoc Networks using Random Waypoint Mobility Model

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Abstract

Vehicular Adhoc Networks (VANETs) are the subset of Mobile Ad-hoc Networks (MANETS). Mobile Ad-hoc network is a decentralized and infrastructure less network. The topology changes rapidly. So routing is considered to be a major factor and Routing protocols play a vital role by sending and receiving packets from source node to the destination nodes. In this paper our focus is to study Reactive (Adhoc On Demand Distance Vector) and Proactive (Destination Sequence Distance Vector) protocols based on random waypoint mobility model. Performance of two types of routing protocols (AODV and DSDV) based on packet dropped, sent and received at all nodes, throughput and Jitter are evaluated.

Keywords— *VANET, AODV, DSDV*

I. INTRODUCTION

Wireless communication technologies are becoming increasingly available and inexpensive. Users are becoming connected nearly everywhere: at work, at home, and even on roads. In addition to the cellular networks and wireless local area networks (WLANs), vehicular ad hoc networks (VANETs) promise Intelligent Transportation Systems (ITS) new attractive and cost effective services that can definitely benefit users (drivers and passengers). In VANETs, vehicles or nodes, are equipped with wireless communication devices that create wireless links between these nodes [1].

A node (vehicle) can send data directly to another node (vehicle) which is located within its transmission range, without depending on an expensive fixed infrastructure. A node can also send data to another node that is not located within its transmission range with the help of intermediate nodes, forming a process of multihop message routing.

Message routing is a challenging problem in VANETs due to the inherent high degree of mobility of a large number of nodes. To enable message routing, the source node should be able to locate the destination node (node localization), and it can build a reliable route towards the destination node.

VANETs can provide a viable alternative in situations where existing infrastructure communication systems become overloaded, fail (due for instance to natural disaster), or inconvenient to use. The way, messages are routed between sources and destinations is considered to be very important. Without an effective message routing strategy VANETs' success will continue to be limited.

In order for messages to be routed to a destination effectively, the location of the destination must be determined. Since vehicles move in relatively fast and in a random manner, determining the location (hence the optimal message routing path) of (to) the destination vehicle constitutes a major challenge.

II. ROUTING PROTOCOLS

Routing is a mechanism to establish and to select a specific path in order to send data from source to destination. There are various routing algorithm designed for ad-hoc networks. The routing protocols for VANETs are classified into three main categories:

- Ad Hoc Routing protocols (developed for MANETs),
- Position-Based routing protocols,
- Cluster-Based routing protocols

A. Ad- Hoc routing Protocols

Because MANETs and VANETs have many similar characteristics, hence early studies about VANETs made use of the routing protocols developed for MANETs. Ad hoc routing protocols are classified into two main categories: proactive and reactive.

Proactive routing protocols continuously update the routing table, thus generating sustained routing overhead, whereas reactive routing protocols do not periodically update the routing table [5]. Instead, when there is some data to send, they initiate route discovery process through flooding which is their main routing overhead. AODV, DSR and TORA are the examples of reactive routing protocols whereas OLSR, TBRPF and FSR are the examples of proactive routing protocols.

B. Position Based Routing Protocol

Position-Based Routing is a routing principle that relies on geographic position information. Position based routing states that each node knows its own location by using the Global Positioning System (GPS) or by other localization technique. When a source wants to send a packet to a destination, it uses the destination's location to find a neighbor that is closest in geographical distance to the destination, and closer than itself, and forwards the packet to that neighbor.

The neighbor repeats the same procedure and until the packet makes it to the destination. The location of potential destination nodes is assumed to be available via a location service. Geographic Routing requires that each node can determine its own location and that the source is aware of the location of the destination. With this information a message can be routed to the destination without knowledge of the network topology or a prior route discovery.

C. Cluster Based Routing Protocols

The Cluster Based Routing protocols mainly follows clustering of similar nodes in the network and transmission of data within the cluster. Nodes that are similar will form a cluster. Each cluster is administered by a Cluster head. All the nodes in the cluster can communicate with the Cluster Head. Nodes in the Cluster will route the message to Cluster Head which in turn forwards the message to the Base Station. By clustering nodes into groups, the protocol efficiently minimizes the flooding traffic during route discovery and speeds up this process as well.

III. DESTINATION SEQUENCE DISTANCE VECTOR (DSDV)

The DSDV routing protocol is a proactive routing Protocol based on the Bellman-Ford routing algorithm [2]. It provides solution for shortest path between two nodes. DSDV is an enhancement of distance vector routing.

The main contribution of the algorithm was to solve the Routing Loop problem. It uses sequence number for each routing table entry of entire network to avoid the formation of routing loops. Routing table is updated periodically throughout the network to maintain consistency in the table. To maintain the up-to-date view of the network, the tables are exchanged at regular interval of time.

It is quite suitable for creating ad hoc networks with small number of nodes. DSDV requires a regular update of its routing tables, which uses up battery power and a small amount of bandwidth even when the network is idle. Whenever the topology of the network changes, a new sequence number is necessary before the network re-converges; thus, DSDV is not suitable for highly dynamic networks.

In this protocol, the drawback is that node has to wait for a table update message initiated by the same destination node in order to obtain information about a particular destination node. It also causes unnecessary traffic and prevents nodes from saving battery power.

IV. ADHOC ON-DEMAND DISTANCE VECTOR ROUTING PROTOCOL (AODV)

The Ad Hoc On-demand Distance Vector Routing (AODV) routing algorithm is a reactive unicasting routing protocol designed for Adhoc mobile networks. It builds routes between nodes only as desired by source node. In AODV, routing information is maintained in routing tables at nodes. Every mobile node keeps a next-hop routing table, which contains the destinations to which it currently has a route. [5]

AODV builds routes using a route request/route reply query cycle. Route Request is responsible for generating route between source and destination node. Route Reply is responsible for the maintenance of the path generated during route discovery phase. A routing table entry expires if it has not been used or reactivated for a prespecified expiration time.

V. SIMULATION SCENARIO

Ns-2 is extensively used by the networking research community. It provides substantial support for simulation of TCP, routing, multicast protocols over wired and wireless (local and satellite) networks, etc. The simulator is event-driven and runs in a non-real-time fashion. It consists of C++ core methods and uses Tcl and Object Tcl shell as interface allowing the input file (simulation script) to describe the model to simulate.

Different performance metrics are used to check the performance of routing protocols in various network environments. In our study we have selected throughput, number of packets dropped, sent and delivered at all nodes and jitter for the vehicles (nodes) to check the performance of VANET routing protocols against each other.

In our scenario, we consider 25 nodes .The simulation is done using NS-2, to analyse the performance of the network. In the following table the configuration parameters assumed for simulation i.e. given as follows:

Table I Simulation Parameters

Parameter	Values
No.ofNodes (Vehicles)	25
Scenario	Urban
Traffic Type	TCP
Data Type	CBR
Data Packet Size	512 bytes
Mobility Model	Random Way Point
Routing Protocol	AODV ,DSDV
Mac Layer	802.11
Performance Metrics	Throughput ,Jitter

VI.RESULT AND ANALYSIS

A. *SCENARIO 1: USING AODV*

Fig. 1 NAM For 25 Nodes

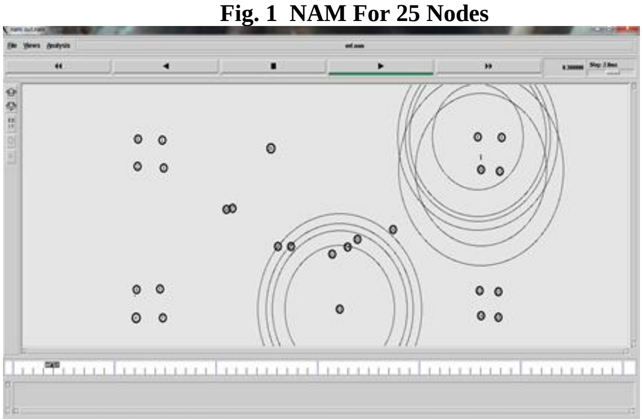
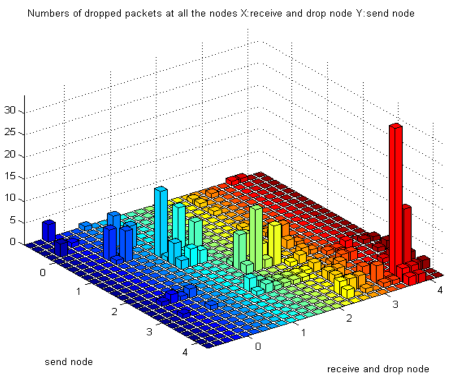
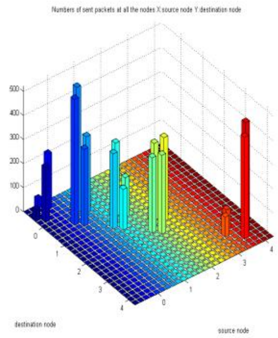


Fig. 2 Number of Packets Dropped at All the Nodes



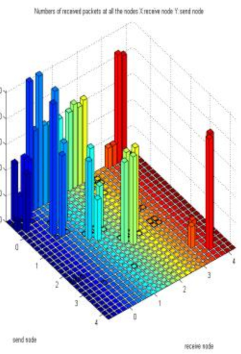
The above graph shows the number of packets dropped at all the nodes. Packet loss is measured as a percentage of packets lost with respect to packets sent.

Fig.3 Number of Sent Packets at All the Nodes



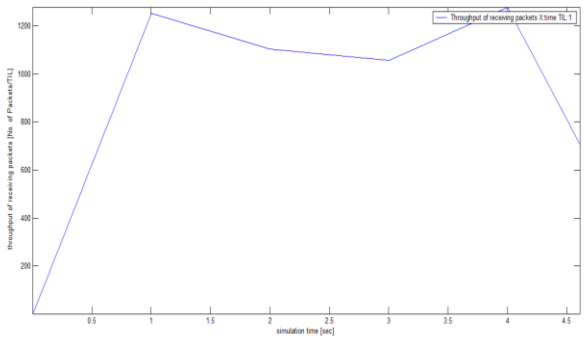
The above graph shows the number of packets sent at all the nodes.

Fig.4 Number of Received Packets at All the Nodes



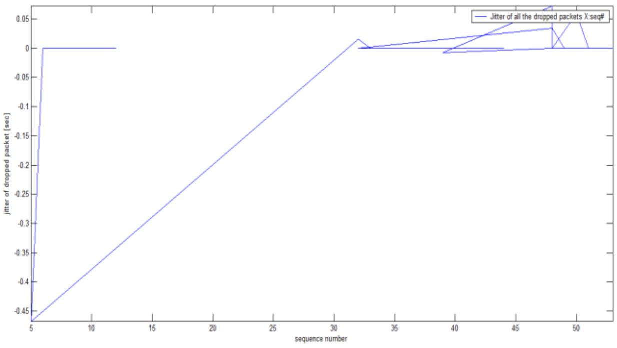
The above graph shows the number of packets delivered at all the nodes. Number of received packets refer to the number of delivered data packet to the destination.

Fig.5. Througput



The graph shows the Simulation result of throughput of receiving packets with respect to simulation time in seconds.

Fig.6. Jitter



The above graph shows the jitter of all dropped packets. It is defined as the mean deviation of the packets from source to destination for number of vehicles.

B. SCENARIO 2: USING DSDV

Fig.7. NAM for 25 Nodes

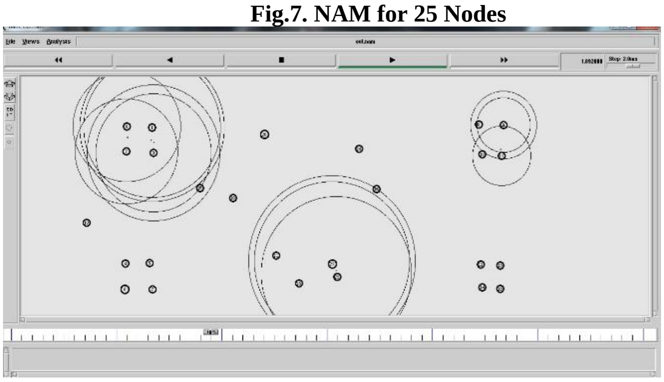
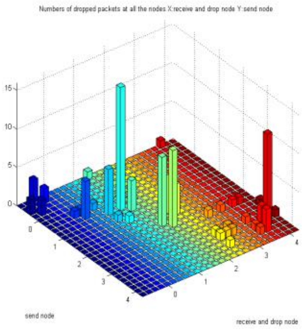
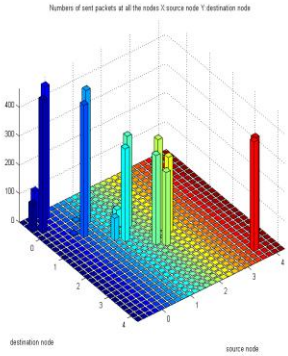


Fig. 8 Number of Packets Dropped at All the Nodes



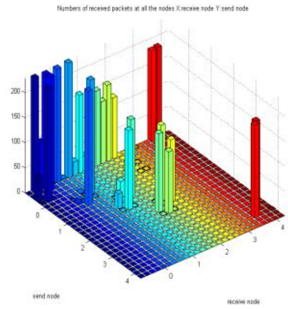
The above graph shows the number of packets dropped at all the nodes. The reason for packet drop may arise due to congestion, faulty hardware and queue overflow etc.

Fig.9 Number of Sent Packets At All The Nodes



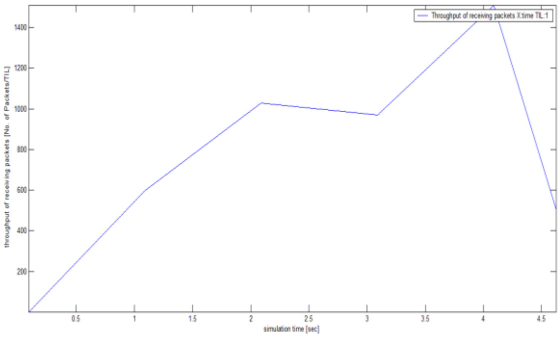
The above graph shows the number of packets sent at all the nodes.

Fig.10 Number of Received Packets at All the Nodes



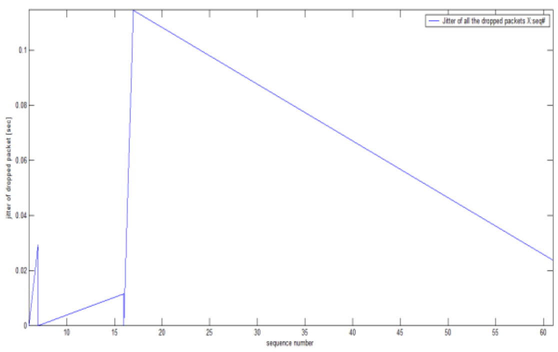
The above graph shows the total number of packets received by destination node during the simulation.

Fig.11. Througput



The graph shows the Simulation result of throughput of receiving packets with respect to simulation time in seconds.

Fig.12 Jitter



The above graph shows the jitter of all dropped packets. Jitter is caused primarily by delays and congestion in the packet network.

VII. CONCLUSIONS

In this paper, behaviour of reactive routing protocol (AODV), proactive routing protocol (DSDV) have been analysed under the Random waypoint mobility model. The evaluations made on these protocols bring out some important characteristics of these protocols when they are used in VANET. From the obtained results, it is observed that reactive protocol (AODV) performed well because mechanisms of route discovery, route maintenance and elimination of periodic broadcasting are used by AODV and by almost all reactive protocols.

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