Parametric Analysis Of Vanet's Routing Protocols

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Abstract

VANET is a Vehicular Ad hoc Network; it is a new network technology where the cars are used as mobile nodes to form a communication network. In VANET, routing protocols have a significant role in terms of the performance because they determine the way of sending and receiving packets between mobile nodes. In this paper, we examine and analyze the performance of Ad-hoc On-Demand (AODV), Dynamic Source Routing (DSR) and Destination-Sequenced Distance Vector (DSDV) routing in terms of Packet Delivery Ratio, Average End to End Delay, Latency and Throughput. The objective of this study is to find the best routing protocol over all circumstances. Based on our validated results, AODV performs the best among all evaluated protocols.

Keywords: *AODV, DSR, DSDV, VANET, Matlab.*

I. INTRODUCTION

VANET is a Vehicular Ad hoc Network; it is a subclass of Mobile Ad Hoc Networks (MANETs). It is a new network technology where the cars are used as mobile nodes to form a communication network. VANET is an integral part of the intelligence transportation system architecture, which aims to improve road safety, optimizes traffic flow, and reduce congestion and so on. [1]. A Vehicular Ad-Hoc network provides communication among nearby vehicles and between vehicles and nearby fixed equipment i.e. roadside equipment as in figure 1.

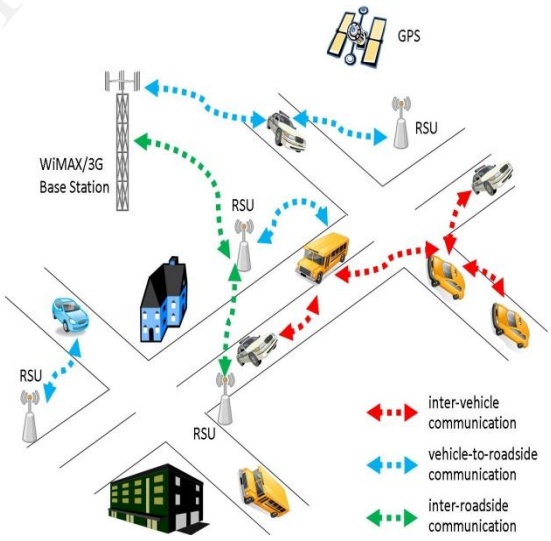

Fig.1: Vehicular Ad Hoc Network (adapted from [2])

In VANETs, vehicles are represented as network nodes. Some vehicles are represented as senders and others are represented as receivers. Communications among vehicles are provided so that they transmit and receive information. The main goal of VANET is providing safety

and comfort for passengers. Besides safety applications VANET also provide comfort applications to the road users.

This paper is organized as follows: section II introduces a brief summary about the routing protocols under, section III presents the proposed scenario, section IV includes the simulation environment, section V presents the results and last section includes the conclusion for our simulation results.

II. ROUTING PROTOCOLS

In VANET, routing protocols have a significant role in terms of the performance because they determine the way of sending and receiving packets between mobile nodes.

- **Ad-hoc On–Demand Distance Vector Routing protocol**

Ad Hoc on Demand Distance Vector Routing (AODV) [3] is an example of pure reactive routing protocol, where AODV starts discovering the routes only if there is a data packet that needs to be sent. Both route discovery and route maintenance from DSR are used in AODV routing protocol. Thus, all the routes are not maintained at all times. Therefore, AODV reduces the overhead. Moreover, a sequence number is used to ensure new routes are discovered and to avoid looping. This can be considered as a feature of AODV.

- **Dynamic Source Routing Protocol**

Dynamic Source Routing Protocol (DSR) is used to route a packet from source to destination with no need of any routing information between the intermediate nodes. DSR [4] designed for multi-hop wireless ad hoc networks. This protocol consists of two operations - Route Discovery and Route Maintenance that makes it self-configuring and self-organizing.

- **Destination Sequenced Distance Vector Routing – DSDV**

Destination Sequence Distance Vector [5] is a proactive routing protocol where every node maintains a table of information (which updates periodically or when change occurred in the network) of presence of every other node within the network. Any change in network is broadcasted to every node of the network.
It eliminates route looping, increases convergence speed, and reduces control message overhead. In DSDV, each node maintains a next-hop table, which it exchanges with its neighbours.

III. PROPOSED SCENARIO

The proposed scenario of vehicular ad hoc network is shown in fig. 2. In this RSU indicates the Roadside units, which are static in nature. H1 indicates the servers which controls the roadside units across the overall network. A red line shows the packets that are delivered from source to destination and Server is a central server which controls the all over network. Figure 2 shows a real scenario using VANET.

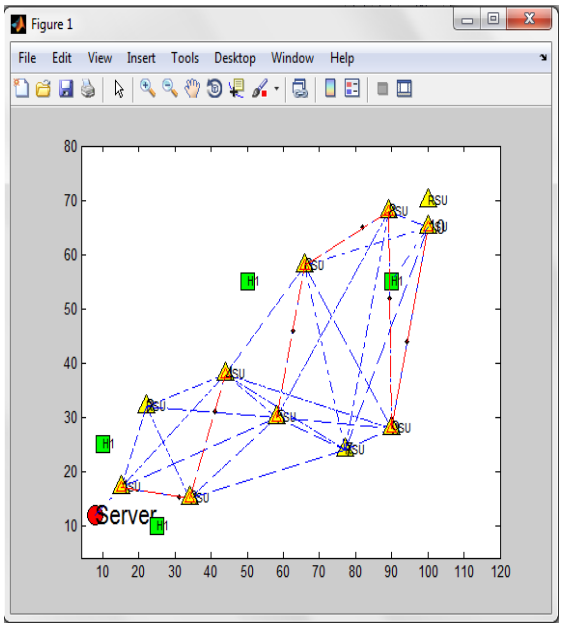

Fig. 2: Proposed Scenario of VANET

IV. SIMULATION ENVIRONMENT

- **Simulation Set Up**

In our simulation, we have taken 11 RSU's that are static in nature. The simulation area of 80 m × 120 m is used. Different packet sizes in the range from 50 byte to 400 bytes are used. Three routing protocols are examined; AODV, DSR and DSDV. Table 1 shows the input parameters that we have used in our simulation using mat lab.

Table 1: Input Parameters

Parameter	Value
Protocols	AODV, DSR, DSDV
Number of RSU's	11
Packet size	50 to 400 bytes
Node type	Highly mobility nodes (vehicles)
Environment size	80 m × 120 m
Performance metrics	Throughput, Latency, E2E Delay, PDR

- **Simulator Used**

Matlab is a technical computing language used mostly for high-performance numeric calculations and visualization. It can be widely used to analyze data, modelling, simulation and statistics. The language, tools, and built-in math functions enable you to explore multiple approaches and reach a solution faster than with spreadsheets or traditional programming languages, such as C/C++ or Java. MatLab 7.10 has been used for the implementation of routing protocols. It provides the real time environment to the vehicular ad hoc network.

V. RESULTS

In this section, we analyze the performance of the selected routing protocols; AODV, DSR, and DSDV. In this analysis, we consider the following measured parameters: Packet Delivery Ratio, Average End to End Delay, Latency and Throughput with respect to different packet size.

- **Throughput:**

It is the rate of data being received at the destination to the transmitted data rate.

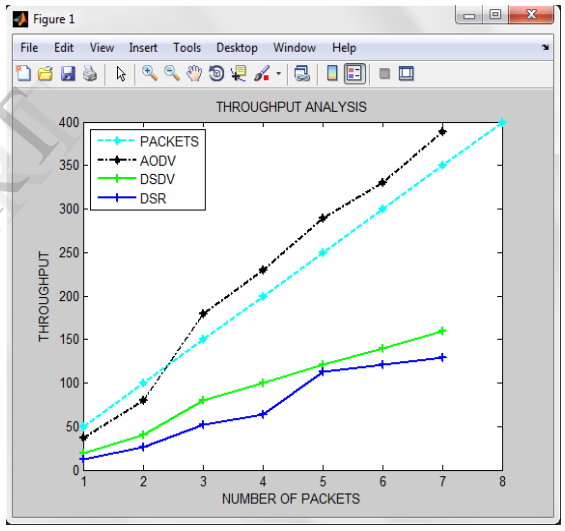

Fig. 3: Throughput of AODV, DSDV and DSR

Fig3. shows the comparison of AODV, DSDV and DSR routing protocols in terms of throughput. More is the throughput of sending and receiving packets, better is the performance. With the increase in packet size of vehicular nodes, throughput is also increases in all cases of AODV, DSDV and DSR routing protocol. But in case of AODV, throughput varies in high as compare to DSR and DSDV. So, the performance of AODV routing protocol is better.

- **Latency:**

It is the time taken for the packets being created at the source to the being received at the destination. VANET needs a small latency to deliver quick messages.

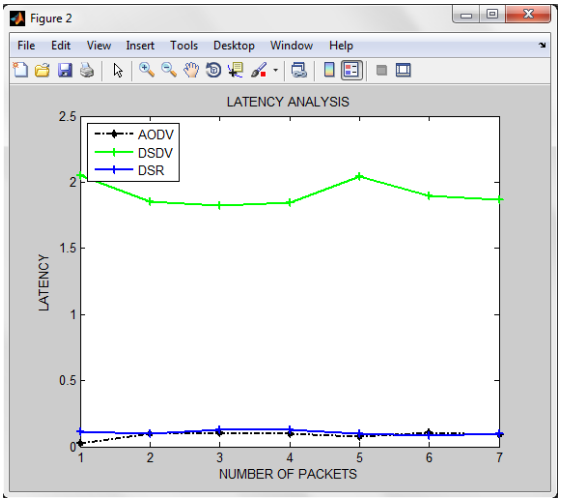

Fig. 4: Latency of AODV, DSDV and DSR

In fig.4, AODV occupy small latency as compared to both DSDV and DSR, so it delivers packets more quickly as compare to both of them. So, the result shows that AODV is best protocol. And latency of DSR is small as compare to DSDV, so DSR routing protocol is best then DSDV to deliver packets more quickly.

- **Packet Delivery Ratio:**

It is the ratio between the number of packets delivered to the receiver and the numbers of packets sent by the source. Higher the percentage, more privileged is the routing protocol. In fig.5, PDR of AODV, DSDV and DSR is increases as the packet size increases, but in case of AODV, it increases in large number than DSDV and DSR. In case of DSR, it increases in small value than AODV and DSDV, and PDR of DSDV is increases in small value than AODV but large value than DSR. So, AODV is more suitable routing protocol than DSDV and DSR.

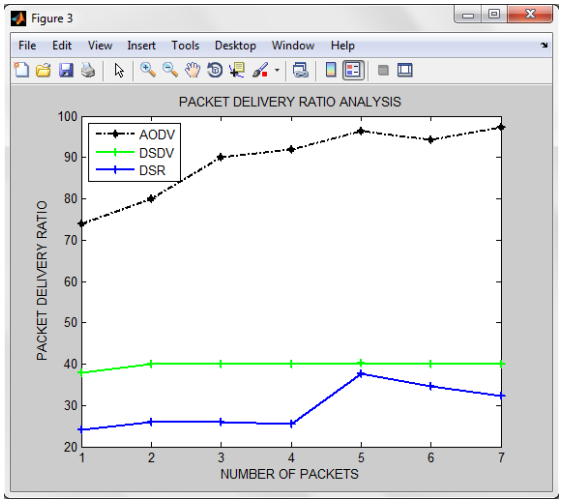

Fig. 5: Packet Delivery Ratio of AODV, DSDV and DSR

- **End-to-End Delay:**

This metric gives the overall delay, from packet transmission by the application agent at the source node till packet reception by the application agent at the destination node. Lower the time taken, more privileged the routing protocol is considered. In Fig.6, End-to-End delay is less in case of AODV as compared to DSR and DSDV, so AODV is more suitable for VANET. In case of DSR and DSDV, end-to-end delay of DSDV is less than DSR, so from DSDV and DSR, DSDV is better.

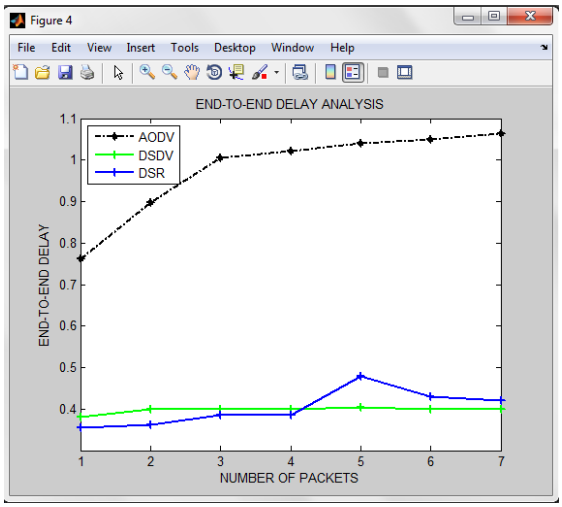

Fig. 6: End-to-End Delay of AODV, DSDV and DSR

VI. CONCLUSION

VANET is an active research field these days. This paper has been carried out the simulation of AODV, DSDV and DSR routing protocols in VANET as in more realistic manner. The simulation is done in Mat lab with respect to various parameters like throughput, packet size, end-to-end delay etc. The simulation result shows that AODV performs better than DSDV and DSR in terms of throughput, end-to-end delay, latency and packet delivery ratio. And from DSR and DSDV, DSDV is best.

In future, the simulation can be done for integrated protocol and compared with existing routing protocols with more performance metrics like delivery cost, normalized routing load, packet drop etc. Here the implementation has been done by using matlab. Further, the implementation can be done using Qualnet, NS2, NCTUns, GlomoSim etc.

References

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