Vehicular Ad Hoc Networks Analysis in Network Layer

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***Abstract*— To achieve further advancement in mobile communication technology, research in Vehicular Ad hoc Network (VANETS) in done using routing management, information security. A VANET is a special case of Mobile Ad-hoc Network (MANET) to provide communication among nearby vehicles and roadside equipment. VANETS uses cars as mobile nodes are used in a MANET to create a mobile network. A VANET turns every participating car into a wireless router or node, allowing cars approximately 100 to 300 meters of each other to connect and, in turn, create a network with a wide range. The main objective of VANETS is to build a robust network so that the mobile vehicles can communicate for the safety of the human beings, decrease travelling time, and enhance traveler's mobility. In this paper, we have used Network Simulator for scalable networks to perform simulation of routing protocols in network layer. We analyze the performance of the routing protocols like AOMDV (Ad-hoc On Demand Multipath Distance Vector) and DSDV (Destination Sequenced Distance Vector) of network layer protocols by using performance metrics in VANET like delay and throughput by using Network Simulator version2(NS2).**

Index Terms*— *VANETS, AOMDV, DSDV, NS2, delay, throughput.

I. INTRODUCTION

A. VANET - In Vehicular ad-hoc networks, vehicles are interconnected together to form a network and each vehicle has its own transmission capabilities. Each vehicle communicates with another in the form of messages. Vehicles can receive urgent notifications in short time. The topology of VANETs is highly dynamic in nature. VANETs have navigation scheme to guide the shortest path to the driver and also give online road and weather information to the driver. The navigation system makes use of the geographical location and routes the messages the destination. VANETs can communicate with other vehicles and road side equipment by using V2V (vehicle to vehicle), V2R (vehicle to roadside equipment) , V2I(vehicle to infrastructure) communications. VANETs are expected to implement dedicated short range communications by using Wi-Fi, WiMAX IEEE 802.16, Bluetooth and zigbee. VANETs require GPS (global positioning system) to find out the next available node on the network where as GPSR (Greedy Perimeter Stateless Routing) is used to provide better performance for vehicles in an urban environment by establishing a route between the source and destination. The purpose of using VANET find the real-time road conditions to compute a better route and at the same time the information can be properly authenticated.

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VANETs have unique characteristics like:-

- Dynamic topology.
- Frequent disconnection of networks.
- Real time traffic and weather conditions can be known.
- Interaction with onboard sensors
- Unlimited battery power.
- Better communication environment.

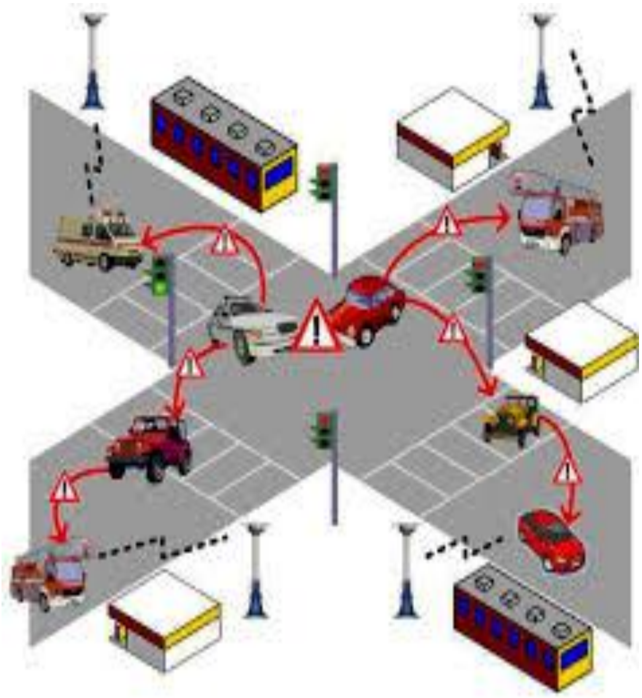

Fig 1.1: Vehicles passing urgent notifications

B. VANETs Applications - VANETs are mainly used for the following applications [4]:

- *Safety applications*: It includes real time traffic monitoring, weather and road conditions.
- *Commercial applications*: User is provided with web access, streaming audio and video.
- *Convenience applications*: It includes route diversions for convenience of user.
- *Productive applications*: It includes time utilization, fuel saving and computation of shortest route.

II. SYSTEM ARCHITECTURE

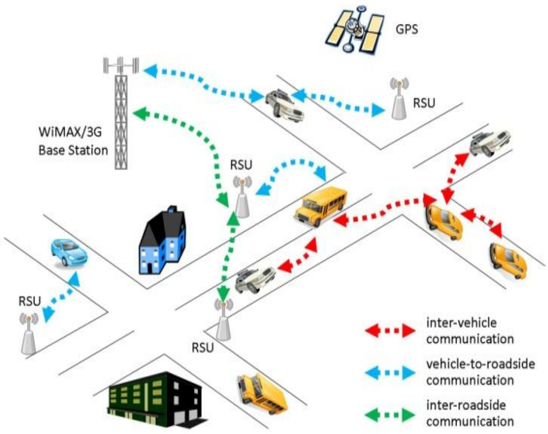

Fig 2.1: Architecture of VANET

III. ROUTING PROTOCOLS

Routing is a process of exchanging information from one node to another node within the network. Routing mechanism is used to forward packet from source to destination using most efficient path [1], [6].

Classification of routing protocols:

Routing Protocols are classified into 3 types [1] :
1. Table driven (or) proactive protocols
2. On demand driven (or) reactive protocols
3. Hybrid protocols.

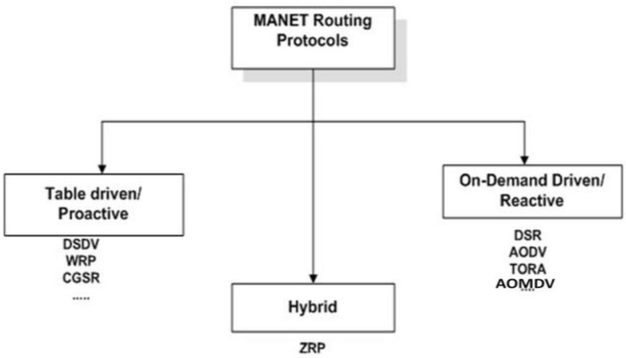

Fig 3.1:Classification of routing protocols

A. AOMDV

AOMDV is a reactive routing protocol which means Ad-hoc on-demand multipath distance vector routing. AOMDV is the extension of AODV protocol to discover the multiple paths between source and destination. Multiple paths in the AOMDV are loop-free and disjoint.[2] , [7]

In AOMDV when a source wants to communicate with the destination first it initiates a route discovery process by sending a RREQ packet. The RREQ packet transmission from the source to destination establishes a multiple reverse paths. The RREQ first sets up a reverse path to the source using the previous hop values of the RREQ. It is the next hop to the node in the reverse path. If the route is valid then the intermediate node generates a route reply packet otherwise RREQ is rebroadcast. Each entry in the routing table consists of [5]:

- All available destinations
- Next hop towards each destination
- No of hops required to reach destination
- A destination sequence number

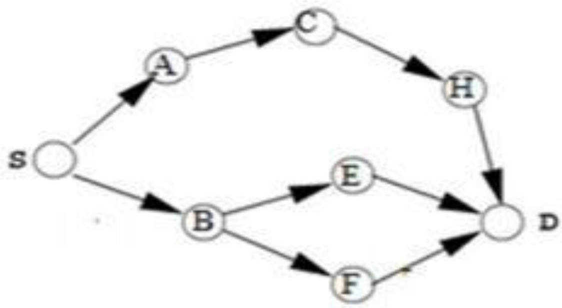

Fig 3.2: AOMDV network

AOMDV			
Node S's Routing table			
Destination	Next Node	Hops	Sequence number
D	A	4	11
D	B	3	11

Tab 3.1: Routing table of AOMDV

B. DSDV

DSDV [8] is a proactive routing protocol it is extension of bellman-ford routing algorithm. In DSDV each node maintains a routing table consists of entries for all the nodes within the network. The routing table updates periodically when the topology changes are detected. Each node sends the broadcasting message to its neighboring nodes and updates the packets. After receiving packet the neighboring node updates their routing table with incrementing the metric by one and it retransmit the update packet to all its neighbors. The will be repeated until all the nodes in the network receives a copy of the update packet with a corresponding metric. The route selection will be done basing on three steps [5] -

- The update information will be compared to its own routing table.
- Select route with higher destination sequence no.
- Select route with better metric when sequence no's are equal

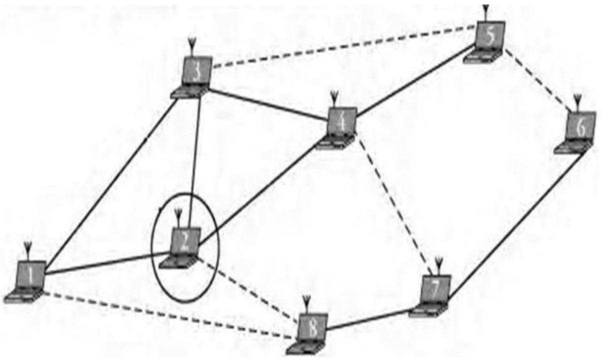

Fig 3.3: DSDV network

Routing Table for Node 2

Destination	Next Hop	Metric	Dest. Seq. No.
1	1	1	123
2	0	0	516
3	3	1	212
4	4	1	168
5	4	2	372
8	1	INF	432

Tab 3.2: Routing table of DSDV

IV. METRICS FOR PERFORMANCE COMPARISION

VANETS uses a multiple number of metrics to evaluate the performance of protocols in the network. In the paper we have considered many of the metrics to calculate the network performance [5].

1. Throughput- It is used to calculate the average throughput of the application traffic between the nodes.

Throughput = Total received bytes/Elapsed time

Simply the time taken for a packet to travel from source to destination when it reaches the destination that particular time is said as a throughput.

2. End-To-End Delay- The average time taken by a data packet to reach its destination. It also includes the delay triggered by route discovery process and the queue in the data packet transmission. Only the data packets that such victoriously delivered to destinations were counted.

AED= Σ (Received time – sent time)/Total data packets Received

V. RESULT ANALYSIS

We performed simulation of AOMDV, DSDV protocols in NS2 for different number of nodes. After simulation is done we obtained the following graph Fig 5.1 which shows the simulation and transfer of packets for AOMDV routing protocol and similarly Fig 5.2 shows the simulation and transfer of packets for DSDV routing protocol.

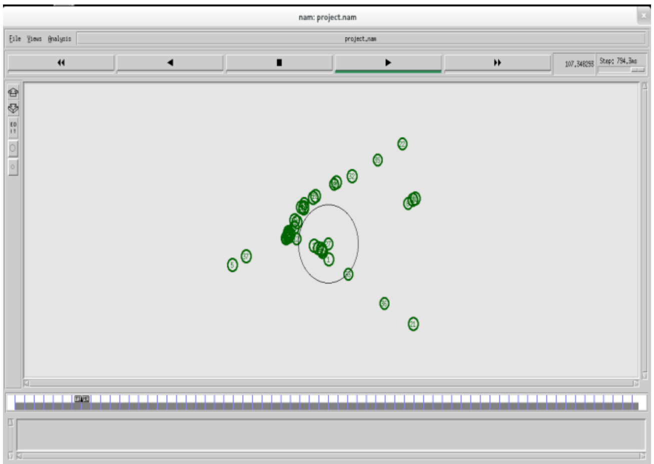

Fig 5.1 simulation of AOMDV protocol at 40 nodes

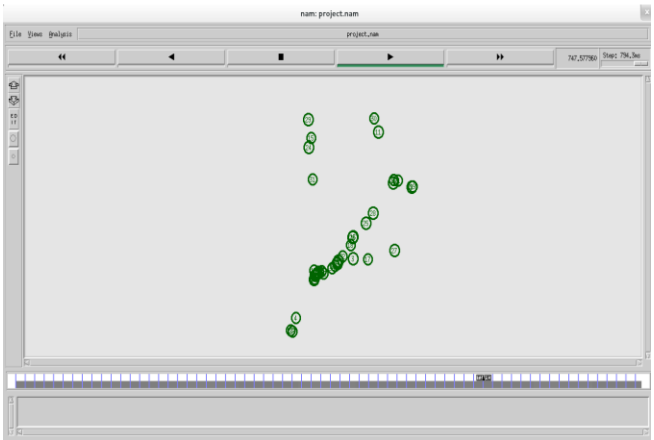

Fig 5.2 Simulation of DSDV protocol at 40 nodes

After the simulations are performed at different ranges of nodes we plot a graph to find the performance of the two routing protocols, AOMDV and DSDV. **Fig 5.3** shows throughput shows the graph of throughput with number of nodes varying from 20 to 100 nodes for AOMDV, DSDV. Throughput of AOMDV is better than DSDV. For AOMDV, as the number of nodes is increasing, the value of throughput is also increasing.

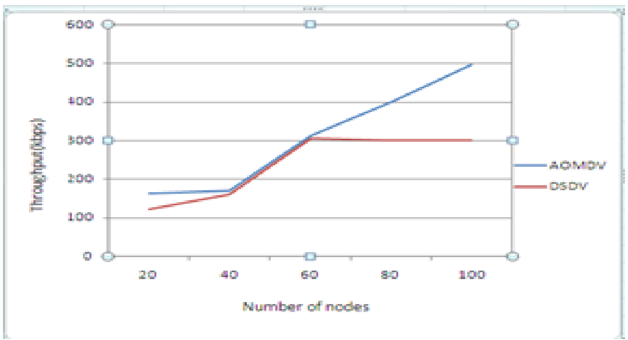

Fig: 5.3 Analysis of Throughput

From **Fig 5.4** we can observe the graph which shows End-to-End delay for AOMDV and DSDV for different number of nodes ranging from 20 to 100. We can observe that initially delay is high for AOMDV which keeps on reducing as the number of nodes increases whereas initially delay in DSDV is low but as the node number increase End-to-End delay is high.

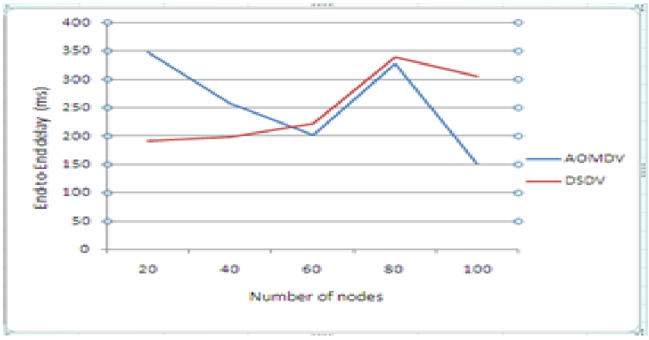

Fig 5.4 Analysis of End-to-End delay

VI. CONCLUSION

The simulation results indicate that AOMDV has higher performance when compared to DSDV. AOMDV yields better throughput even if the number of nodes increases and End-to-End delay is also very less for AOMDV when compared to DSDV. Finally we conclude that AOMDV shows better performance for routing in VANETs.

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