MANET-Evaluation of DSDV, AODV and DSR Routing Protocol

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Abstract- A mobile Ad-Hoc network is a collection of wireless nodes that can dynamically be set up anywhere and anytime without using any pre-existing network infrastructure. It is an autonomous system in which mobile hosts connected by wireless links are free to move randomly and often act as routers at the same time. Mobile ad-hoc network have the attributes such as wireless connection, continuously changing topology, distributed operation and ease of deployment. In this paper we have compared the performance of three MANET routing protocol DSDV, AODV and DSR by using NS-2. DSDV is proactive (Table driven routing Protocol) whereas AODV and DSR share similar On Demand behavior, but the protocol's internal mechanism leads to significant performance difference. A detailed simulation has been carried out in NS-2. The metrics used for performance analysis are Routing Overload, Delivery Ratio, And Average Delay.

Keywords: MANET, UDP, Burst Time, Pause Time, Routing Overload, Delivery ratio, Avg. Delay

I. INRODUCTION

The Ad-Hoc network is set up with multiple wireless devices without any infrastructure. Its employment is favored in many environments. Thus, many efforts are put on Ad-Hoc networks at both the MAC and routing layers. Meanwhile, QoS aware issues are considered in both MAC and routing layers for Ad-Hoc networks. In Ad-Hoc networks, communications are done over wireless media between stations directly in a peer to peer fashion without the help of wired base station or access points. Lots of efforts have been done on Ad-Hoc networks. One of the important and famous groups developing Ad-Hoc networks is Mobile Ad-hoc network Group (MANET) [2]. With the popularity of Ad-hoc networks, many routing protocols have been designed for route discovery and route maintenance. They are mostly designed for best effort transmission without any guarantee of quality of transmissions. Some of the most famous routing protocols are DSDV, Dynamic Source Routing (DSR) and Ad-Hoc on Demand Vector (AODV).

A number of protocols have been developed to accomplish this task. Several performance evaluation of MANET routing protocols using UDP traffic have been done by considering various parameters such as mobility, network load and pause time. In this paper we have investigated the performance of DSDV (Proactive), AODV (Reactive) and DSR On-Demand (reactive) routing protocol for performance comparison in the scenario. The purpose of this work is to understand there working mechanism and investigate that which routing protocol gives better Performance in which situation. The rest of the paper is organized as follows. In section 2, we have given the brief introduction of DSDV, AODV and DSR routing protocol. Section 3 and 4 deals with the simulation parameters and results obtained on the execution of simulation. Finally, conclusion is drawn in section 5.

II. DESCRIPTION OF ROUTING PROTOCOL

2.1 Destination-Sequenced Distance-Vector Routing Protocol

The Destination-Sequenced Distance-Vector (DSDV) Routing Algorithm [3] based on the idea of the classical Bellman-Ford Routing Algorithm with certain improvements. Every mobile station maintains a routing table that lists all available destinations, the number of hops to reach the destination and the sequence number assigned by the destination node. The sequence number is used to distinguish stale routes from new ones and thus avoid the formation of loops. The stations periodically transmit their routing tables to their immediate neighbors. A station also transmits its routing table if a significant change has occurred in its table from the last update sent. So, the update is both time-driven and event-driven. The routing table updates can be sent in two ways: - a "full dump" or an incremental update. A full dump sends the full routing table to the neighbors and could span many packets whereas in an incremental update only those entries from the routing table are sent that has a metric change since the last update and it must fit in a packet. If there is space in the incremental update packet then those entries may be included whose sequence number has changed. When the network is relatively stable, incremental updates are sent to avoid extra traffic and full dump are relatively infrequent. In a fast-changing network, incremental packets can grow big so full dumps will be more frequent. Each route update packet, in addition to the routing table information, also contains a unique sequence number assigned by the transmitter. The route labeled with the highest (i.e. most recent) sequence number is used. If two routes have the same sequence number then the route with the best metric (i.e. shortest route) is used. Based on the past history, the stations estimate the settling time of routes. The stations delay the transmission of a routing update by settling time so as to eliminate those updates that would occur if a better route were found very soon.

2.2 Ad-Hoc on Demand Distance Vector (AODV).

Ad-Hoc On-demand Distance Vector Routing (AODV) [6] is an improvement on the DSDV algorithm discussed in section 2.1. AODV minimizes the number of broadcasts by creating routes on-demand as opposed to DSDV that maintains the list of all the routes. To find a path to the destination, the source broadcasts a route request packet. The neighbors in turn broadcast the packet to their neighbors till it reaches an intermediate node that has recent route information about the destination or till it reaches the destination. A node discards a route request packet that it has already seen. The route request packet uses sequence numbers to ensure that the routes are loop free and to make sure that if the intermediate nodes reply to route requests, they reply with the latest information only. When a node forwards a route request packet to its neighbors, it also records in its tables the node from which the first copy of the request came. This information is used to construct the reverse path for the route reply packet. AODV uses only symmetric links because the route reply packet follows the reverse path of route request packet. As the route reply packet traverses back to the source, the nodes along the path enter the forward route into their tables. If the source moves then it can reinitiate route discovery to the destination. If one of the intermediate nodes move then the moved nodes neighbor realizes the link failure and sends a link failure notification to its upstream neighbors and so on till it reaches the source upon which the source can reinitiate route discovery if needed.

2.3 Dynamic Source Routing Protocol (DSR)

The Dynamic Source Routing Protocol [5] is a source-routed on-demand routing protocol. Anode maintains route caches containing the source routes that it is aware of. The node updates entries in the route cache as and when it learns about new routes.

The two major phases of the protocol are: route discovery and route maintenance. When the source node wants to send a packet to a destination, it looks up its route cache to determine if it already contains a route to the destination. If it finds that an unexpired route to the destination exists, then it uses this route to send the packet. But if the node does not have such a route, then it initiates the route discovery process by broadcasting a route request packet. The route request packet contains the address of the source and the destination, and a unique entification number. Each intermediate node checks whether it knows of a route to the destination. If it does not, it appends its address to the route record of the packet and forwards the packet to its neighbors. To limit the number of route requests propagated, a node processes the route request packet only if it has not already seen the packet and it's address is not present in the route record of the packet. A route reply is generated when either the destination or an intermediate node with current information about the destination receives the route request packet. A route request packet reaching such a node already contains, in its route record, the sequence of hops taken from the source to this node.. Creation of record route in DSRP As the route request packet propagates through the network, the route record is formed. If the route reply is generated by the destination then it places the route record from route request packet into the route reply packet. On the other hand, if the node generating the route reply is an intermediate node then it appends its cached route to destination to the route record of route request packet and puts that into the route reply packet. To send the route reply packet, the responding node must have a route to the source. If it has a route to the source in its route cache, it can use that route. The reverse of route record can be used if symmetric links are supported. In case symmetric links are not supported, the node can initiate route discovery to source and piggyback the route reply on this new route request. DSRP uses two types of packets for route maintenance: - Route Error packet and Acknowledgements. When a node encounters a fatal transmission problem at its data link layer, it generates a Route Error packet. When a node receives a route error packet, it removes the hop in error from it's route cache. All routes that contain the hop in error are are truncated at that point. Acknowledgment packets are used to verify the correct operation of the route links. This also includes passive acknowledgments in which a node hears the next hop forwarding the packet along the route

III. SIMULATION PARAMETERS

Parameter	Value
Simulator	NS-2.35
Protocols	DSDV,AODV,DSR
Traffic Source	UDP
Radio Model	Two Ray Ground Propagation
Mobility Model	Model Random Way Point
Application Agent	CBR
Number Of Nodes	25
Max. Simulation Time	100 Sec
MAC	802.11
Antenna	Omni Directional Antenna
Simulation Area(in meter)	500 X 500

Table 1 Performance Parameters

IV RESULTS FOR 25 NODES AND 500M*500M AREA AND 100SEC SIMULATION TIME

4.1. Effect of Varying Burst Time

Burst Time may be another varying parameter. Burst time is the time when source generates packets for sink side. It plays important role in performance.

Also from figure 1 we can observe that reactive protocols performed better in terms of average delay among which AODV performed better than DSR.

From figure 3 we can observe that routing overload for all protocols decreased with increase in burst time with DSR performing better than others.

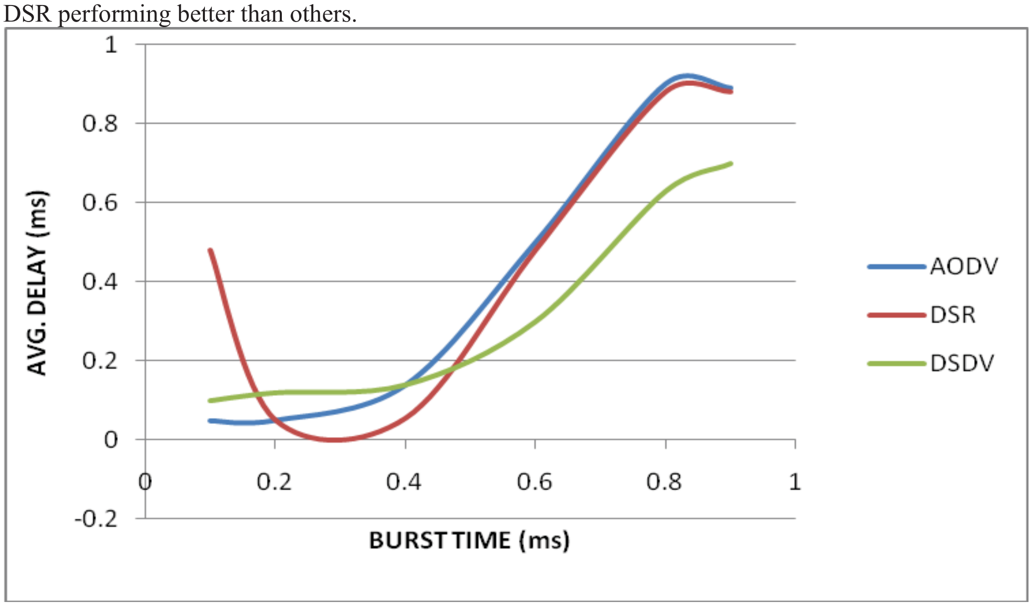

Fig 1: AVG. DELAY (ms) VS BURST TIME (ms)

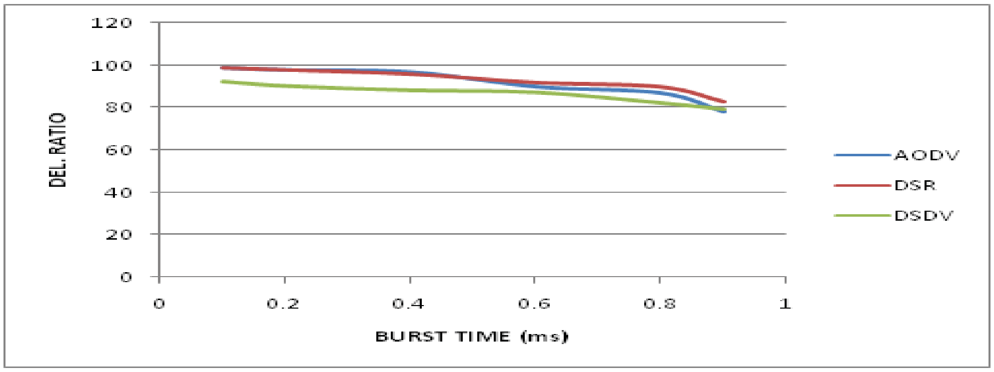

Fig 2: Del. RATIO VS BURST TIME (ms)

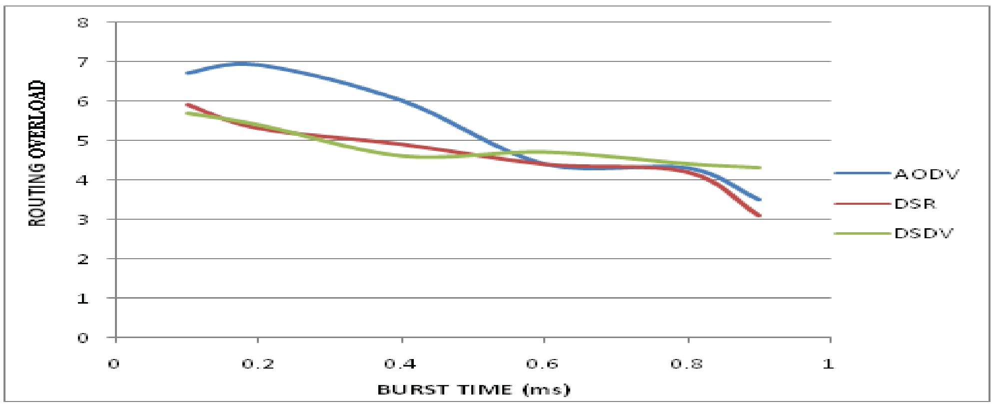

Fig 3: ROUTING OVERLOAD VS BURST TIME (ms)

For reactive protocols route expiry has become less common thus reducing routing overload while for proactive which give constant overload irrespective of load, increasing burst increased data packet thus reduced normalized overhead. Also from figure 2 it can be seen that with increase in burst time delivery ratio decreases for all protocols as queue overflow might have started. In this case DSDV has outperformed all. Also Average Delay for various Protocols also increased with burst time as packet has to wait more in the queue. In this case DSDV performed better than others.

4.2. Effect of Varying Pause Time

As in MANETs nodes are move from one position to other position. Time for which a node waits on a first destination before moving to second destination is called Pause Time. We used this as a parameter as it is measure of mobility of nodes. Low pause time means node will wait for less time thus giving rise to high mobility scenario. From figure 1 we can observe that routing overload for DSDV is almost constant. This is because of their proactive nature due to which they offer constant routing overhead in all cases. While for reactive protocols considered here as we increased pause time routing overload has decreased .This is because as routing pause time increases mobility decreases and thus link breakage become rare which in turn will decrease number of route request from sources and hence decreasing overhead. Also DSR outperformed AODV as it maintains multiple routes to a destination. In case of failure in one route other route will be used rather than initiating route request. Also from figure 6 we can see that average delay for proactive protocol was better at high mobility as they use route already in the table, and no time is required to find route as opposite to reactive protocols as they will wait for route formation. But at lower mobility, we can observe that reactive protocols performed better in terms of average delay among which AODV outperformed DSR. This is because DSR may not use optimum path always unlike AODV. While we can see in figure 5 delivery ratio for DSR and AODV was near to 100% with DSR performing better because of multiple path information in its route cache (AODV always stores best path). Also proactive protocols performed poor in case of high mobility.

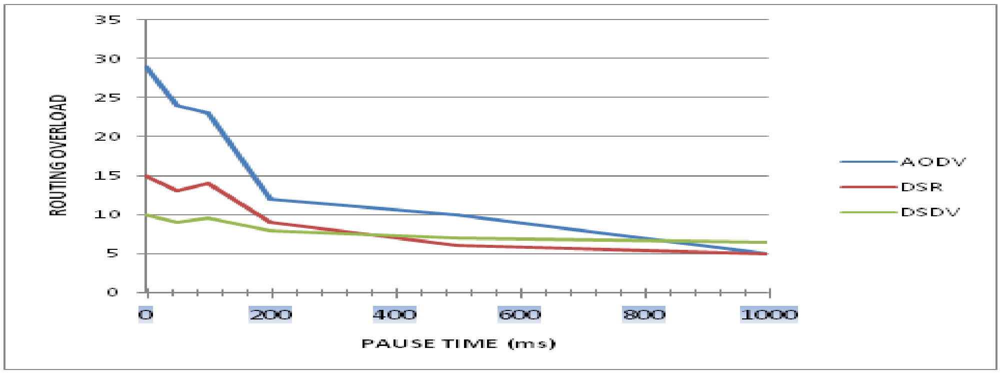

Fig 4: ROUTING OVERLOAD VS PAUSE TIME (ms)

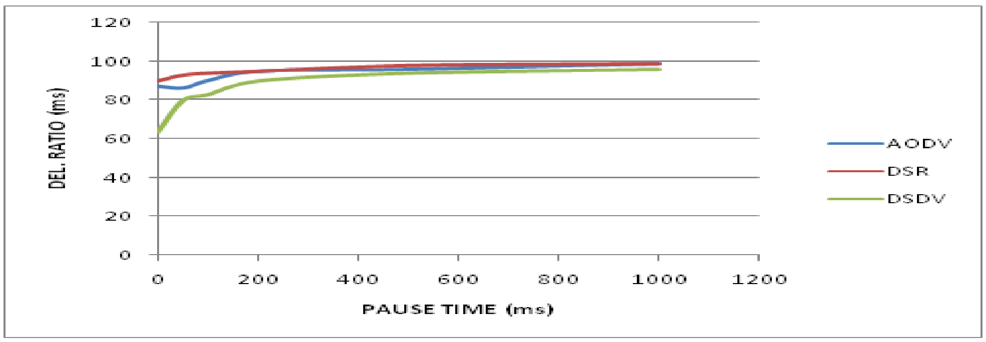

Fig 5: DEL. RATIO (ms) VS PAUSE TIME (ms)

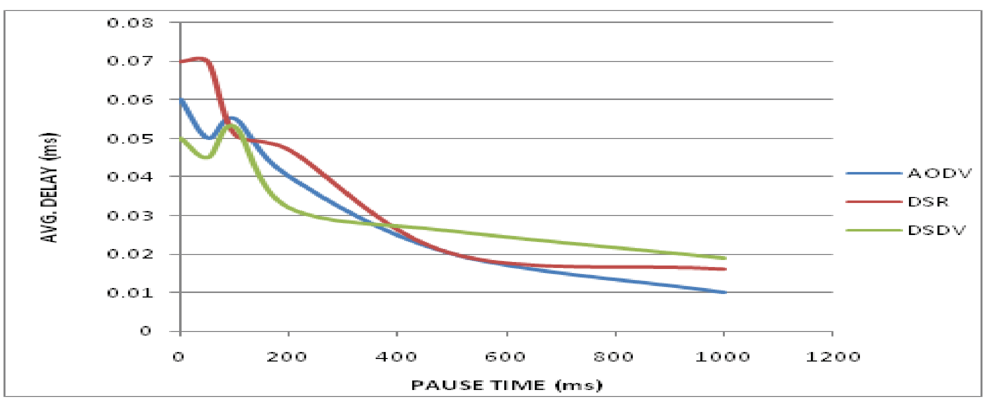

Fig 6: AVG. DELAY (ms) VS PAUSE TIME (ms)

V. CONCLUSION

This project compared the performance of DSDV, AODV, and DSR routing protocols for Ad-hoc networks using ns-2 simulation.We have presented a detailed performance comparison of important routing protocols for mobile Ad-Hoc wireless networks. AODV and DSR are reactive protocol while DSDV proactive protocols. Both reactive protocols performed well in high mobility scenarios than proactive protocol. High mobility result in highly dynamic topology i.e. frequent route failures and changes. Both proactive protocols fail to respond fast enough to changing topology. Routing overhead in Proactive protocols remains almost constant.

Both AODV and DSR use reactive approach to route discovery, but with different mechanism. DSR uses source routing and route cache and does not depend on their timer base activity. On other hand AODV uses routing tables, one route per destination, sequence number to maintain route. The general observation from simulation is that DSR has performed well compared to all other protocols in terms of Delivery ratio while AODV outperformed in terms of Average delay. DSR however generates lower.

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