

## An investigational analysis of DSDV, AODV and DSR routing protocols in Mobile Ad hoc Networks

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**Abstract** -- A Mobile ad hoc network is a gathering of various data transmission node. The nodes in the MANET are movable. Due to this quality of Mobile ad hoc network, the topology is highly dynamic. There is no fixed infrastructure in this type of network. Any node that wants to transmit the data from origin node to sink node in the network, the data has to promote from one node to another node to reach the destination node. In this paper we have done a comparative investigation of three routing protocols in MANET by varying the pause time. The simulations have been made by considering the three parameters throughput, packet delivery ratio and end to end delay. The simulator used for making the comparative analysis NS-2.33. The results show that the DSR protocol outperforms the other two protocols AODV and DSDV in Throughput and packet delivery ratio and DSDV outperform the AODV and DSR in end to end delay.

**Keywords**—MANETs, AODV, DSR, DSDV

### I. INTRODUCTION

A MANETs is the dynamic environment, where mobile node dramatically changes their short-life status according the network infrastructure. Every single mobile node has its own wireless hardware i.e. antenna and receiver. [1] [2] It is useful in ad hoc network to communicate each other using wireless link to transfer data to freely moving nodes, in simple every single node will act as router as well as end device. The core feature of the MANETs is self-organized, decentralized, and a dynamic change in the topology. Mobile nodes are using this kind of environment to archive multi- hop free network without any backbone support. Dealing with ad hoc environment we faced so much challenges including bandwidth also limited resource like battery, processing power and on-board memory. In the term of QoS we will provide the best practical solution for this technology through routing. The MANETs is a collection of self-configuring nodes which does not depend on any infrastructure [1][3][4]. The property of MANETs is its easy exploitation. Due to this property it can be used in military and emergency areas. Many routing protocols are proposed in MANET like AODV, DSR and DSDV [4].

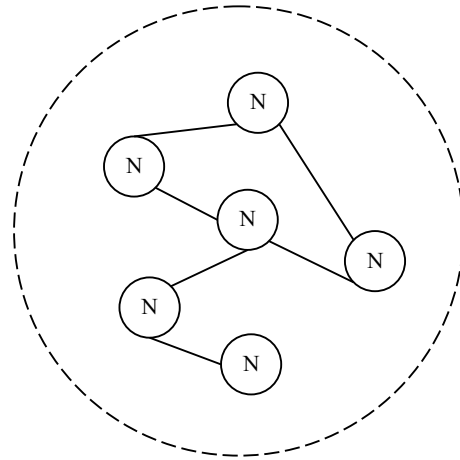


Figure 1 A six nodes mobile Ad Hoc Networks

In MANETs, all the computing resources are battery based and hence are having less powerful computing resources [3] [5] [6].

### II. ROUTING PROTOCOLS IN MANET

There are two classifications of routing protocols in MANETs

1. Table driven routing protocols.
2. Reactive or on-demand routing protocols.

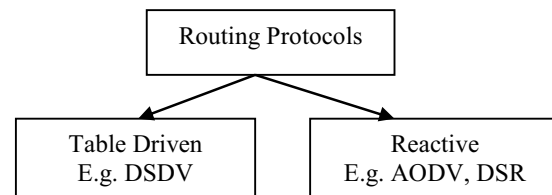


Figure 2 Basic Category of Routing Protocols.

## A. TABLE DRIVEN ROUTING PROTOCOLS

i). *Distance Sequenced Distance Vector*: In order to send packets from one node to another node the Distance Sequenced Distance Vector (DSDV) uses the routing table, from of its table-driven nature. And the routing table generally contains the next hop information with its sequence number. The DSDV algorithm is evolution of Bellman-Ford algorithm, able to provide routes which are free of loops. The mechanism used in the protocol provides single path from foundation to destination. For reducing amount of overhead transmitted through network, two type of update packet are used, First is "Full Dump", Second is "Incremental". Full dump packets carry all the available routing information and the incremental packets carries only the information change in full dump packets. Still the protocol not fit for good the reason is that it produce large amount of overhead to the network, due to the requirement of the periodic update messages, and the overhead grows according to  $O(\sqrt{N})$ , Therefore the protocol does not provide QoS in the large network [4] [5] [6] [7].

Loop free paths is one the advantages of DSDV protocol. DSDV also reduces the count to infinity problem present in the network. Incremental updates used in the network are very helpful in avoiding the extra paths in the network. A large amount of space in routing table is saved by storing a single path from source to destination rather than using the multiple paths to destination [5] [8].

Also, Bandwidth wastage in DSDV is one of the major disadvantage as it wastes its most of the bandwidth in routing the advertisement information. Another major disadvantage is multi path routing facility is not available in DSDV protocol. It is difficult for the wider networks to maintain properly the networks routing advertisement information [9] [10].

## B. REACTIVE ROUTING PROTOCOLS

ii). *AODV (ADHOC on-Demand Routing Protocol)*: AODV is one of the routing protocols which is initiated by source and reactive in nature. The protocol is based on the concept of DSDV Protocol. There are two phases in which AODV protocol works. [6]

- Discovery of route phase
- Maintenance of route phase when required

i). *Discovery of route phase*: AODV is a protocol which is initiated by source node by sending a route request to the neighboring nodes in the network and neighboring nodes in turn forwards the packets to other nodes in the network and expecting a route reply message until one of the nodes send the reply to the route to show the most appropriate path from the source to send the packets/data. In some cases, a route error message is also sent to the source node if no valid route is possible from source to sink. In ideal scenario three kinds of control packets are used to implement this procedure. [6] [7].  
Route\_Request\_Packet (RREQ)

Route\_Reply\_Packet (RREP)

Route\_Error\_Packet (RRER)

The protocol uses the RRER packets to signal the network regarding disconnecting of links between the nodes or when the protocol is not able to find a valid path from source to destination.

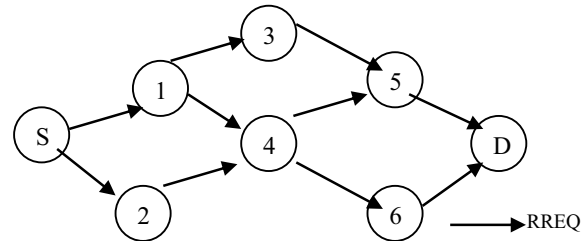


Figure 3 Discovery of route in AODV.

ii). *Route Maintenance Phase*: One of the important part of AODV protocol is the maintenance of route in the event when network receives a RRER message signaling the source node regarding the disconnecting of links between the nodes. The phase repairs the path/link and trying to establish the link between disconnecting nodes. [11] [12].

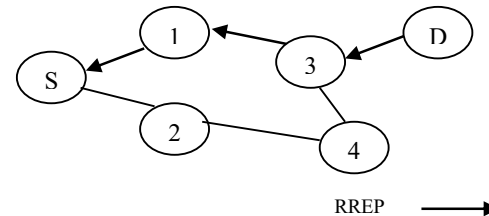


Figure 4 Sending of reply message through valid route in AODV.

iii). *Distance Source Routing*: Distance Source Routing (DSR) is one of the reactive routing protocols which is initiated by source node of the network. In this protocol, each packet takes all routing data/packets to the all the neighboring nodes. That means more traffic and not suitable for the large networks. The amount of working overhead of the protocol increases as the network size in terms of number of nodes increases and hence consumes more bandwidth in highly active and larger network than the small and passive networks. However this protocol has very bright side for small networks compared to AODV, this protocol can perform very effective in small network. One of the advantages of this protocol is that it saves and use the routing information stored in the protocol route cache and this information can be utilized while searching for next path from source to final node in the network, as route cache contains information about the multiple routes between the two said nodes. [13] [14] [15].

This protocol does not need to flood the network with update routing table information which is required in traditional table driven approach as DSR protocol uses reactive approach to send the data packets in the network. The protocol uses on-demand approach which means it establish a connection or route from source to destination when it is required otherwise the protocol remains inactive. [7] [8]

The main disadvantage of DSR protocol is that it does not allow the route maintenance phase to locally repair the broken links or connection between the nodes. Inconsistencies can also occur during route reconstructions due to stale route cache information. Another disadvantage of the protocol is that the stability of the protocol decreases with increasing mobility [16] [17].

DSR	Flat	Talking about advantage the DSR node can store the multiple route information in their route cache, its means that it can very effective when its initiative route discovery process, just check the route cache.	A large amount of bandwidth is wasted due to overhead generated in network which is more prone to changes and considerably large.
DSDV	Flat	In DSDV algorithm distance vector routing algorithm is used for selecting the path from source to destination which helps the algorithm to reduce the routing overhead within the network.	A large amount of overhead is generated due to periodic messages passing mechanism used in the AODV protocol. The overhead increases with the size of network. So for bigger network the AODV protocol does not support QoS.

TABLE I. TIME COMPLEXITY ANALYSIS OF AODV, DSR, DSDV

Time Complexity		
Protocol	Route Discovery	Route Maintenance
AODV	$O(2D)$	$O(2D)$
DSR	$O(2D)$	$O(2D)$
DSDV	$O(D-I)$	$O(D-I)$

D - Diameter of Network, I - Ideal number of routing table update.

TABLE II. COMMUNICATION COMPLEXITY ANALYSIS OF AODV, DSR, DSDV

Communication Complexity		
Protocol	Route Discovery	Route Maintenance
AODV	$O(2N)$	$O(2N)$
DSR	$O(2N)$	$O(2N)$
DSDV	$O(N)$	$O(N)$

N- Number of nodes in the network

TABLE III. ADVANTAGES/DISADVANTAGES OF AODV, DSR, DSDV ALONG WITH ROUTING STRUCTURE

Protocol	Routing Status	Advantages	Disadvantages
AODV	Flat	In AODV routing algorithm, the packets carry only single piece of information which is destinations' address. This helps the protocol to reduce the overhead and size of packet which in response increases the network capacity to work better. Second benefit of AODV is that it is highly bendable to the changing requirements of the network.	The protocol experiences the large delay during the network construction in AODV protocol. Failure of link in the network also adds up the delay in the network due to initiation of route discovery again. Another disadvantage of AODV is that with the increase in network size the protocol consumes more bandwidth.

### III. PARAMETERS USED FOR SIMULATION

The following parameters are used for simulation

I. *Throughput*: Throughput may be defined as the total practical packet size acknowledged by all the destination nodes in a specific period of time [5]. In networks throughput is calculated in Kilobits per second (Kbps).

II. *Packet Delivery Ratio*: It may be defined as total data packets received by all the destination nodes to those generated by constant bit rate source node [5].

III. *End to End Delay*: End to End delay may be defined as the sum of all the delays encountered at each node and all the delays caused at link on the path in a network [6].

### IV. SIMULATION TECHNIQUE

The network has been simulated using Network Simulator 2 (Ns-2.33). Constant bit rate has been used as traffic source for simulation results. Different pause time have been taken for simulation are 3,6,9,12. The number of nodes was kept constant 30 in a simulation area of 600\*600 m. The random way point model has been used for the simulation purpose. In random way point model node start moving in random direction with a specific speed and then after reaching the destination it stop for a specific time and starts again.

TABLE IV. SIMULATION PARAMETER

Parameter	Values
Number of nodes	30
Simulation Time	80
Protocols taken	AODV, DSR and DSDV
Propagation Model	Two-Way model
Pause Time	3,6,9,12
Mobility Model	Random Way Point
Simulation Area	600*600 m <sup>2</sup>
Maximum Speed	1000m/s
Traffic used	CBR on UDP

## V. OUTCOMES AND DISCUSSION

During the simulation we have used three routing protocols AODV, DSR and DSDV. We have compared the protocols by varying the pause time. The simulation has been repeated for three times for three pause time 3, 6, 9, 12. The number of nodes in the network is 30. The mobility model used is Random Way Point Model.

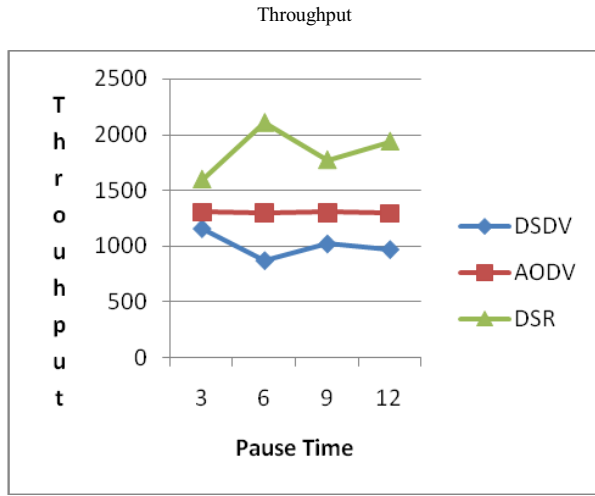


Figure 5 Throughput versus Pause time.

In figure 5 a comparison of three routing protocols AODV, DSDV and DSR have been made by varying the pause time. The results show that DSR perform well in all the simulation setup. The AODV protocol shows average performance if we talk about the throughput of the network. In the end DSDV underperform all the routing protocols due to routing table overheads.

## Packet Delivery Ratio

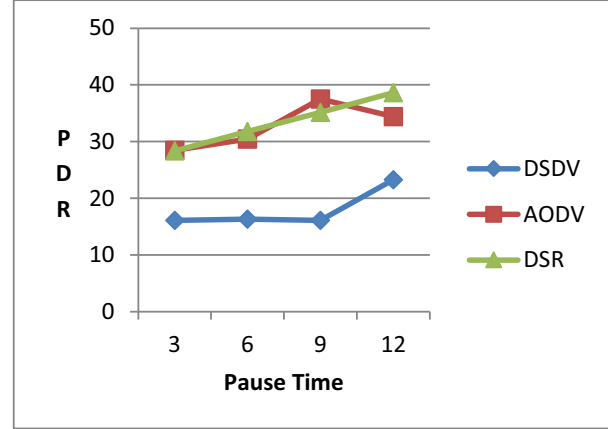


Figure 6 PDR versus Pause Time.

In figure 6 packet delivery ratio of three routing protocols have been compared by varying the pause time of the nodes. It has been observed from the results that the DSR and AODV protocols outperform the DSDV routing protocol. The AODV protocol gives the approximate the same reading as that of DSR. In some simulation setup DSR outperform AODV as well. Hence we can say that DSR gives better PDR than AODV and DSDV.

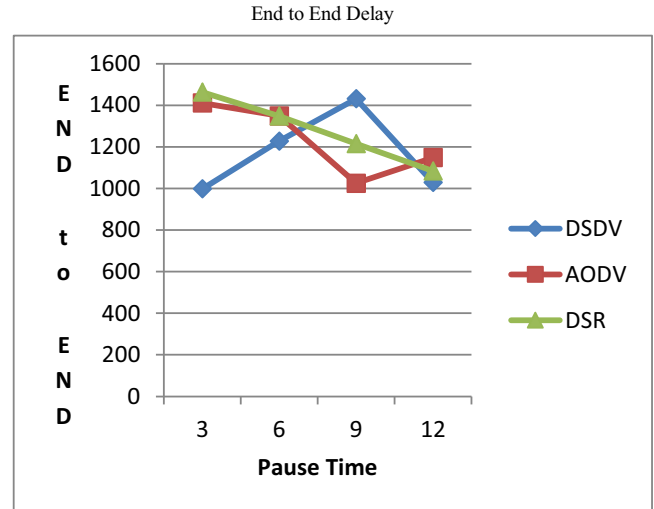


Figure 7 End to End Delay versus Pause time.

In figure 7 the end to end delay of three routing protocols has been compared against pause time. The results show that DSDV outperform all the routing protocol i.e. it delivers the lesser delay than AODV and DSR. On the other hand, DSR shows the maximum delay. This is due to the fact that DSR stores the entire route to the destination. Hence packet becomes

quite heavy. Time taken to segmentation and reassembly causes greater delay. AODV shows the average performance in case of delay.

## VI. CONCLUSION AND FUTURE WORK

In this paper an investigational performance analysis of three well known routing protocols is carried using a network simulator by varying the pause time of the nodes used in the network. It has been watched carefully from the results and discussion that DSR protocol outperforms the AODV and DSDV in throughput and PDR. AODV and DSDV show the good performance in End to End delay. AODV being the reactive protocol gives average performance in all the simulation setup. In we can extend the protocols for wireless sensor network, vehicular Ad Hoc networks etc. and parameters to be evaluated for making the extended comparative study of routing protocol.

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