

# Comparative Analysis of AODV and DSR Routing Protocols Using OPNET 14.0

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**Abstract:** A MANET (mobile ad-hoc network) is a network made up of mobile nodes which communicate with each other via wireless links. MANET is multi-hop network in which its out of range mobile nodes communicate with the help of several intermediate mobile nodes. The communication in MANET is possible due to its routing process so the choice of using efficient routing protocol for routing process in the network is the important concern. Due to the MANET's nature of dynamic change topology, flexibility, distributed, self configuring, infrastructureless and self deployed use of routing protocols become a challenging task. This motivates the experimental work of this paper. In this two reactive routing protocols AODV and DSR of MANET are analyzed and compared. The proposed work uses Wimax technology for the simulation of the network. For simulation, we have used OPNET Modeler 14.0 simulation tool for finding out the better routing protocol between two. The parameters for analyzing their performance are throughput, transmitted packet rate and received packet rate, packet queue size.

**Keywords:** Ad-Hoc, MANET, DSR, AODV, Routing, OPNET Modeler 14.0, Routing Protocols.

## 1. Introduction

An adhoc network is the cooperative engagement of a collection of mobile nodes without the required intervention of any centralized access point or existing infrastructure. MANET is a type of ad-hoc network that can change locations of its mobile nodes anytime and anywhere and configure itself. Because ad-hoc and MANET uses mobile nodes therefore they use wireless connections to connect to other nodes or networks. The connection can be a Bluetooth, Wi-Fi(WLAN), Wimax or another medium. Figure 1 shows a MANET structure.

Due to dynamically changing topology of ad-hoc networks, routing becomes a challenging task ever since wireless networks came into existence. Several routing protocols has been developed till now and several simulations has been done with various parameters.

WiMAX is a wireless digital communications system known as IEEE 802.16 is intended for wireless metropolitan area networks[8]. WiMAX can provide broadband wireless access (BWA) up to 30 miles (50 km) for fixed stations, and 3 - 10 miles (5 - 15 km) for mobile stations[8].

This paper is organized in different sections: Section II describes MANET's routing protocols, section III describes Performance metrics, section IV explains the simulation environment and simulation results , section V concludes the work done in this paper.

## 2. Classification of Manet's Routing Protocol

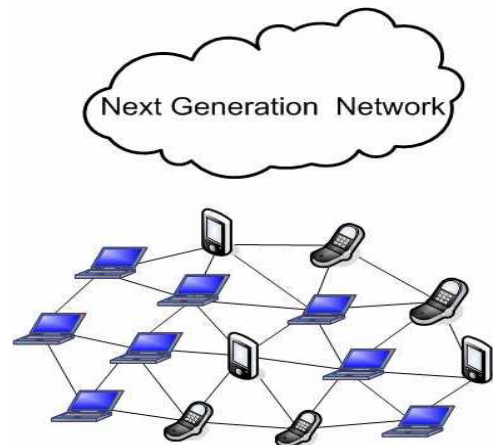


Figure 1: MANET

### A. Types of Routing Protocols Of MANET:

- 1) Reactive routing protocols: they are also called on demand routing protocols. in this a node finds a route only when it want to send a packet to some another node. It doesn't have up to date routing tables rather it uses cache route. It use route request(RREQ), route reply(RREP) and route error(RERR) commands.
- 2) Proactive routing protocols: they are also called table driven routing protocols. They find routes to destinations even when it is not required. They maintain up to date routing tables. Proactive routing protocols maintain up-to-date routing information on every node in the network periodically.
- 3) Hybrid routing protocol: combines the advantages of both reactive and proactive routing protocols. Initially proactive approach is used to have route information then reactively demand of the route is served to the needy node.

In this work an attempt is made to analyze and compare two most prominent AODV and DSR reactive routing protocols:

**1) AODV:-** An ad-hoc on-demand distance vector routing protocol is the combination of DSDV and DSR routing protocols. It adopts periodic route maintenance from DSDV and hop by hop route information from DSR protocol. It works in two mechanisms: route discovery and route maintenance.

- Route discovery mechanism: if any source node wants to send data packet to any destination node it first searches the route in its routing table, if it exists then it send the packet but if there is no preexisting route then it initiates its route discovery mechanism in which it broadcasts a RREQ command to all the neighboring nodes it gets a route to the destination. When the destination or an intermediate node that has a route to the destination receives the RREQ, it checks the destination sequence numbers it currently knows and the one specified in the RREQ[3]. To guarantee the freshness of the routing information, a route reply (RREP) packet is created and forwarded back to the source only if the destination sequence number is equal to or greater than the one specified in RREQ[3].
- Route maintenance mechanism: In AODV, the routing information is maintained in the routing tables at all the nodes. Every mobile node keeps a next hop routing table, which contains the destinations to which it currently has a route. A routing table entry expires if it has not been used or reactivated for a pre-specified expiration time[3]. It uses RERR command for repairing the routes.

**Advantages:**

- Routes are discovered when needed only.
- For making the protocol loop free and to search the latest route to the destination, destination sequence numbers are used .
- Lower delay for connection setup[13].

**Disadvantage:**

- AODV doesn't allow handling unidirectional links[13].
- Multiple Route Reply packets in response to a single Route Request packet can lead to heavy control overhead[13].
- Unusual bandwidth consumption due to periodic beaconing for route maintenance.

**2) DSR:** Dynamic source routing protocol(DSR) uses source routing for flooding data packets. DSR is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. Using DSR, the network is completely self-organizing and self-configuring, requiring no existing network infrastructure or administration[7].It also follows two mechanisms for flooding packets: route discovery and route maintenance.

- Route discovery: it is the similar process like in AODV protocol but DSR uses multiple routing paths. Instead of searching route into the routing table DSR search out node's route cache it also uses RREQ, RREP commands in this mechanism.

- Route maintenance mechanism: Unlike AODV, it doesn't need any periodic beacons for route maintenance. Route maintenance for the route is used when the source node actually sending packet to the destination node. It also repairs the broken linkage routes by changing the route itself. Like AODV ,it also uses RERR command in this mechanism.

In DSR, Route Discovery and Route Maintenance mechanisms both operate entirely "on demand".

**Advantages:**

- There is no use of periodic beaconing for route maintenance.
- Use multiple hops for packet delivery.

**3. Performance Metric**

*a) Tables*

**Table 1:** Simulation Parameters

<i>Performance metrics</i>	<i>Description</i>	<i>Units</i>
Throughput	Represents the total number of bits forwarded from WLAN layer to higher layers in all WLAN nodes in the network.	bits per sec
Transmitted packet rate	It is the routing traffic(packets) sent in the total simulation duration	packet per sec
Received packet rate	It is the routing traffic(packets) received in the total duration	packet per sec
Packet queue size	Represents the size of packet queue in number of packets at any time during the simulation.	packets per unit time
Delay	Represents end to end delay of all the data packets that are successful received by the WLAN MAC and forwarded to the higher layer.	sec

**Table 2** Simulation Environment

<i>Attributes</i>	<i>Value</i>
Simulator	OPNET MODELER 14.0
Simulation time	10 min
No. of nodes	50
Environment size	200*200 m sq.
Traffic type	FTP
Technology(model family)	Wimax

#### 4. Simulation Environment and Results

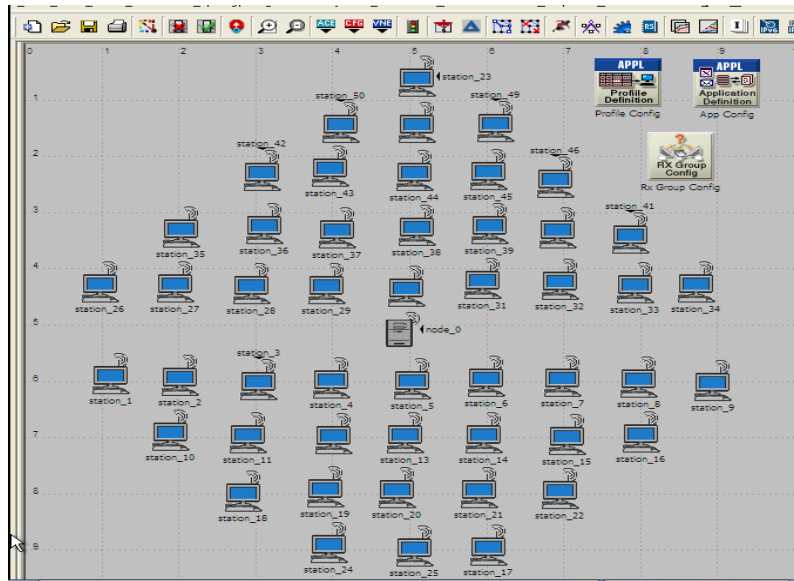


Figure 3: Simulation environment

##### a) Simulation Results

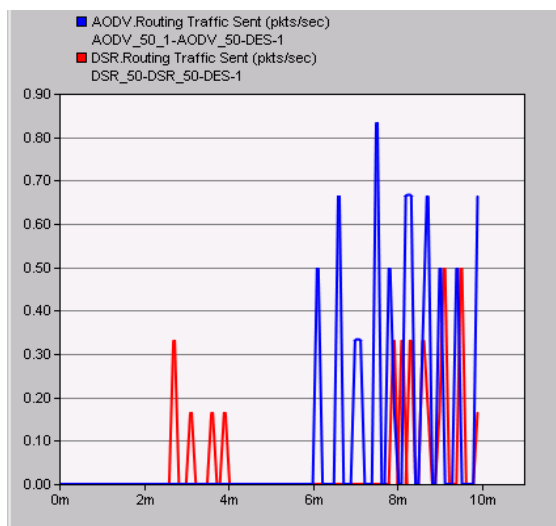


Figure 3(a): Total Traffic sent packets per second

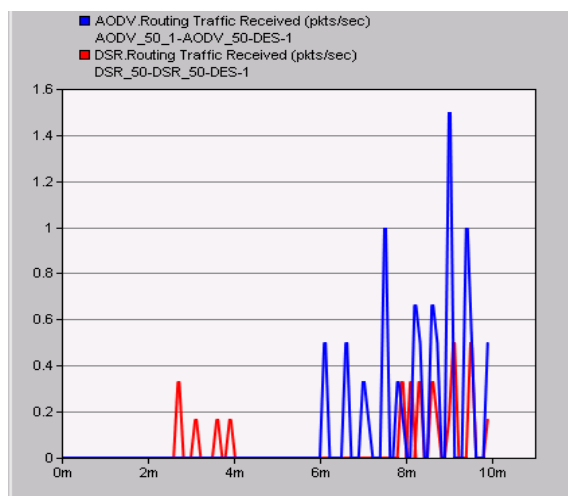


Figure 3 (b): Total Traffic received packets per second

From simulation results figure 3(a) and 3(b) it has been concluded that in terms of traffic sent and received for data in packets per second is larger in figure for AODV as compared to DSR protocol, DSR protocol performs better in MANET .

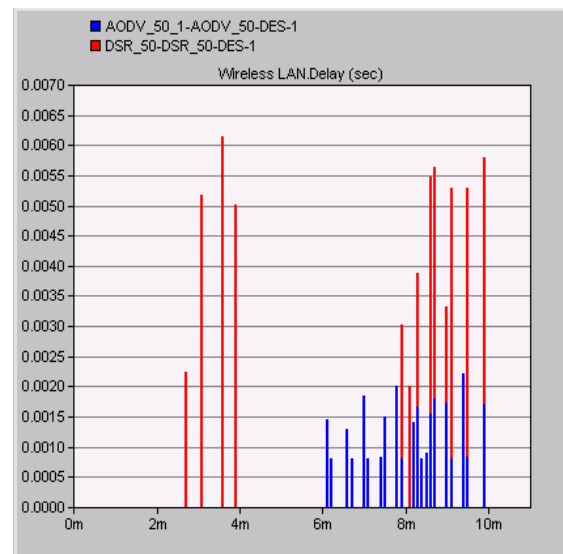
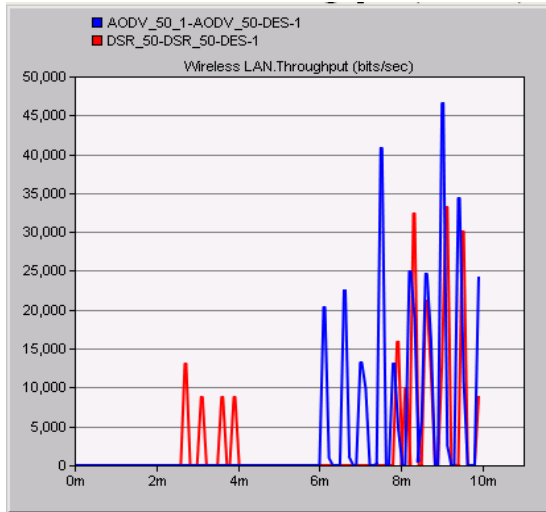


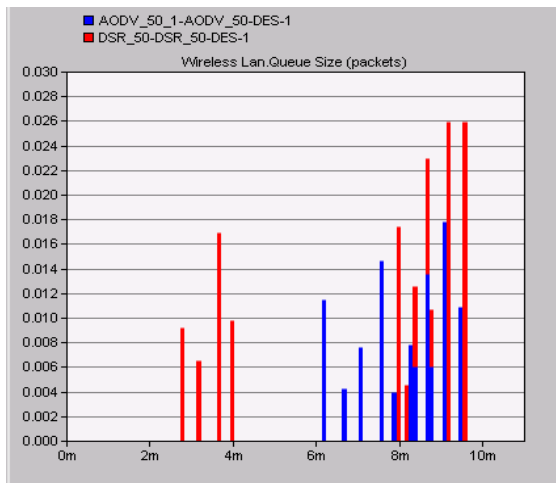
Figure 3 (c): Delay in second

From the above results, it has been concluded that data delay in DSR is maximum whereas AODV protocol is having less in MANET.. Hence from simulation results it has been conclude that DSR protocol is not suitable for WLAN in terms of delay packet per second.



**Figure 3(d):** Throughput Variation in bits/sec

Throughput analysis in above figure shows that performance of AODV is better as compared to DSR protocol in MANET.



**Figure 3(e):** Packet queue size

In above figure packet queue size which is related to the traffic according to the priority(which type of priority) of the packet is also analyzed.

**Table 3:** Comparison of DSR and AODV Protocols for various QoS parameters

S.No.	Parameter	DSR	AODV
1.	Delay (sec)	0.0062	0.0022
2.	Throughput (bits/sec)	34000	45500
3.	Packet Queue Size	0.026	0.018
4.	Traffic sent (packet/sec)	0.5	1.5
5.	Traffic received (packet/sec)	0.6	1.4

## 5. Conclusion

In this paper, Mobile Ad hoc network have been developed with 50 nodes and each network has been configured for static data transmission. The network performance has been compared for DSR and AODV protocols using QoS parameters, which are Throughput, packet queue size, Transmitted and Received packet rate. Both the protocols show their superiority for different parameters and selection

of parameters can be done on the basis of system requirements.

Thus, from the obtained results it could be concluded that AODV performs efficiently in terms of delay and throughput, but performance is poor if traffic sent/received is considered, but overall performance of MANET is good if AODV protocol is utilized.

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