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# Analysis of Routing Protocol Based on QoS Metrics for MANET

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**ABSTRACT:** The Analysis of routing protocol based on Quality of Service (QoS) metrics for Mobile Adhoc Network (MANET) is a critical research area aimed at providing efficient and reliable communication in dynamic and self-configuring networks. MANET is a self-configuring and dynamic network of mobile devices (nodes) that communicate with each other without any fixed infrastructure or centralized control. Routing protocols are used to enable communication between network devices. Several routing protocols are proposed in Adhoc networks among them we use Destination Sequenced Distance Vector(DSDV), Ad hoc On Demand Vector(AODV). Quality of Service (QoS) metrics refer to the measurement of network performance based on parameters such as bandwidth, latency, packet loss, and jitter. The performance of these protocols is evaluated based on QoS Metrics using NS-3 simulator.

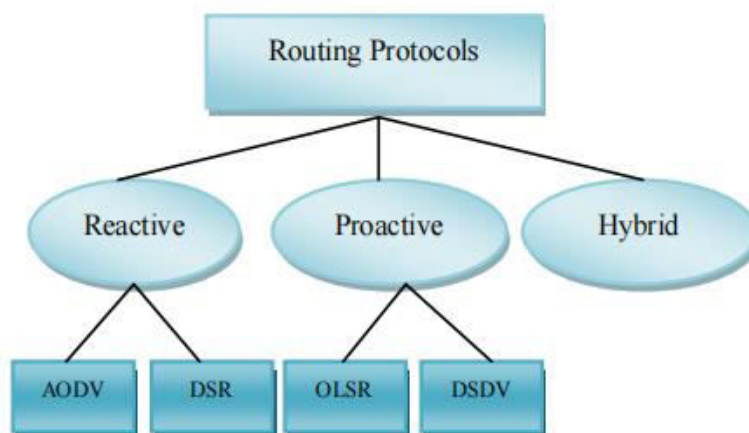
**KEYWORDS:** MANET, AODV, DSDV, QoS parameters, NS-3, routing protocol, performance analysis.

## I. INTRODUCTION

The AODV (Ad-hoc On-Demand Distance Vector) and DSDV (Destination-Sequenced Distance Vector) routing protocols are commonly used in wireless ad-hoc networks. These protocols are designed to find the most efficient path between nodes in a network, taking into account various Quality of Service (QoS) metrics such as packet loss, latency, and throughput. In order to compare the performance of these two protocols, we can use the ns3 network simulator. ns3 is a discrete-event network simulator that allows us to model and simulate various network scenarios. We can use ns3 to simulate a network consisting of nodes running either AODV or DSDV routing protocols, and then analyze the performance of each protocol using QoS metrics such as packet delivery ratio, end-to-end delay, and throughput. Here we change the number of nodes in the network and compare both the protocols. We will then use ns3's Flow Monitor module to collect QoS metrics for the network, and compare the performance of the two routing protocols based on these metrics.

There are two types of routing protocols: On Demand Routing Protocol, Table Driven Routing Protocol & Hybrid.

## II. ROUTING PROTOCOL



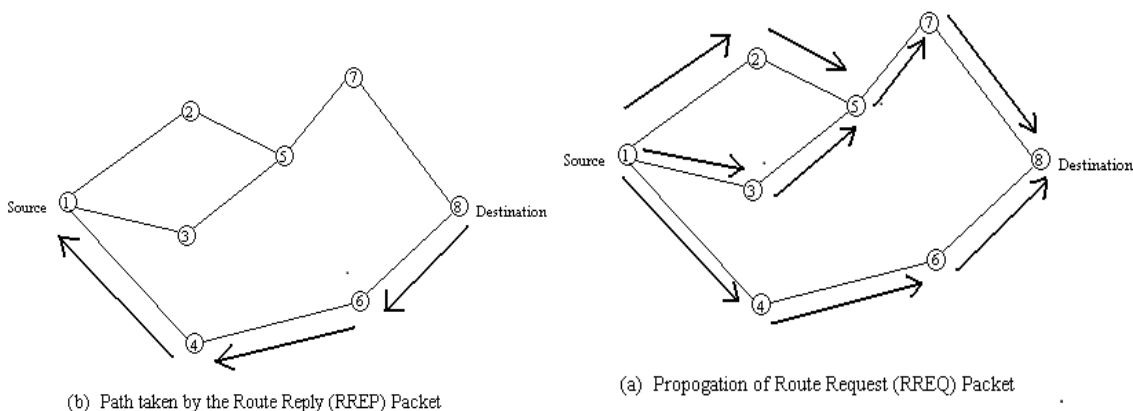


**A . On-Demand (Reactive) Routing Protocols:**

On-demand routing protocols are a type of routing protocol used in computer networks that establish routes between nodes only when needed, rather than maintaining a constant, up-to-date view of the entire network. These protocols are also called reactive routing protocols. One of the most commonly used on-demand routing protocols is the Ad-hoc On-demand Distance Vector (AODV) protocol. Other examples of on-demand routing protocols include Dynamic Source Routing (DSR), Temporally Ordered Routing Algorithm (TORA), and Zone Routing Protocol (ZRP).

**i . AODV(Adhoc On Demand Vector):**

AODV (Ad-hoc On-Demand Distance Vector) is a reactive routing protocol designed for wireless ad-hoc networks. AODV only discovers routes when they are needed. In AODV, when a node needs to send a packet to a destination for which it does not have a valid route, it broadcasts a Route Request (RREQ) packet to all its neighbors. Each node that receives the RREQ packet forwards it to its neighbors, unless it has a valid route to the destination already. When the RREQ packet reaches the destination node, it sends a Route Reply (RREP) packet back to the source node, containing the sequence number of the destination and the hop count to reach the destination. AODV also implements a mechanism to handle link failures and route changes. Each node maintains a sequence number for each destination it knows about, and includes this sequence number in the RREQ and RREP packets. If a node receives a packet with a higher sequence number than the one it knows about, it updates its routing table with the new information.

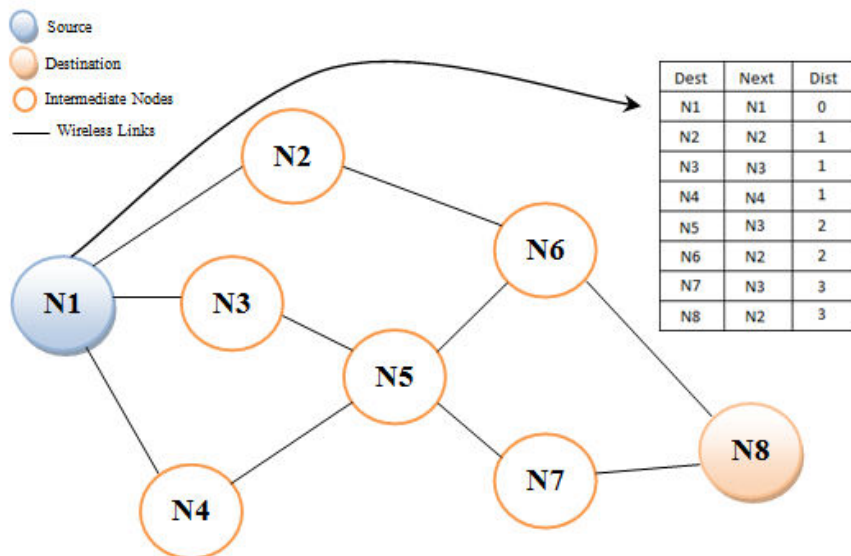


**B. Table Driven (Proactive) Routing Protocols:**

Table-driven routing protocols are also known as proactive protocols, as they continuously update routing tables even when there is no traffic. The advantage of this approach is that routes can be quickly established when traffic starts flowing. Examples of table-driven routing protocols include the Optimized Link State Routing (OLSR) protocol, the Destination-Sequenced Distance Vector (DSDV) protocol, and the Wireless Routing Protocol (WRP).

**ii. DSDV (DESTINATION SEQUENCED DISTANCE VECTOR):**

Destination-Sequenced Distance Vector is a routing protocol used in computer networks. It is a distance vector protocol, which means that each node maintains a table of the distance and direction (vector) to every other node in the network. DSDV is a proactive routing protocol, meaning that it tries to maintain a consistent, up-to-date view of the entire network at all times, rather than waiting for changes to occur before updating its routing tables. To accomplish this, DSDV uses a sequence number for each route, which is incremented every time a route changes. This ensures that the most up-to-date route is always used for a given destination. DSDV is often used in mobile ad hoc networks (MANETs), which are networks of mobile devices that communicate with each other without the use of a fixed infrastructure. In such networks, the topology can change rapidly and unpredictably, and DSDV's proactive approach helps ensure that routes are always available and up-to-date.



C. COMPARISON:

Features	Reactive	Proactive	Hybrid
Routing Structure	Flat	Flat/Hierarchical	Hierarchical
Route Acquisition	On demand	Table driven	Combination of both
Routing Overhead	Low	High	Medium
Latency	High due to flooding	Low due to routing tables	Inside zone Low outside similar to reactive protocols
Scalability	Not suitable for large networks	Low	Designed for large networks
Routing information	Available when required	Always available	Combination of both
Periodic Updates	Not needed	Yes whenever the topology of the network changes	Yes
Mobility	Route Maintenance	Periodic updates	Combination of both



### III. PARAMETERS

Parameters	Values
Number of nodes	10,30,50,100,200
Routing Protocol	AODV and DSDV
Channel	Wireless
MAC	802.11
Simulation Start time	100 Seconds
Simulation End time	200 Seconds
Node speed	20 m/s
Mobility Model	Random Way Point
Propagation Model	Free space

### IV. SIMULATION TOOL

Network Simulator is an open-source network simulator that is widely used for academic and research purposes. It is a discrete-event simulator that can simulate various types of networks, including wired and wireless networks, as well as various network protocols and applications. ns-3 is written in C++, and it provides a Python binding for scripting and simulation control. It also offers a range of tools for visualizing simulation results and analyzing network performance. ns-3 is a powerful tool for network researchers and developers to simulate, test, and evaluate new network technologies, protocols, and applications.

#### a . Network Animator (NetAnim):

NetAnim is an offline animation tool based on the Qt toolkit. It animates an XML trace file which is created during the simulation. George F Riley developed the first version . It animates packets over wired and wireless networks provided inadequate support for LTE traces. It does not provide any support for Ipv6 . It provides the flow of data transmission from a particular source to destination. It is basically the output of any simulation.

#### b . Flow Monitor:

The Flow Monitor module goal is to provide a flexible system to measure the performance of network protocols. The module uses probes, installed in network nodes, to track the packets exchanged by the nodes, and it will measure a number of parameters. Packets are divided according to the flow they belong to, where each flow is defined according to the probe’s characteristics (e.g., for IP, a flow is defined as the packets with the same {protocol, source (IP, port), destination (IP, port)} tuple. The statistics are collected for each flow can be exported in XML format. Moreover, the user can access the probes directly to request specific stats about each flow.

#### c . GNU Plot:

Gnuplot is a portable command-line driven graphing utility for Linux, OS/2, MS Windows, OSX, VMS, and many other platforms. It was originally created to allow scientists and students to visualize mathematical functions and data interactively, but has grown to support many non-interactive uses such as web scripting. It is also used as a plotting engine by third-party applications like Octave. Gnuplot has been supported and under active development since 1986.

#### d. Benefits of ns3 simulator:

- In NS-3, models may be enabled/disabled, users may maintain their own models separately and several external animators, data analysis and visualization tools can be used with NS-3 which makes it highly modular in compared to NS-2 .
- NS-3 is flexible in comparison to other simulators. Changing the existing codes is much easier in comparison to NS-2.
- NS-3 is planned for integration into test-bed and virtual machine environment .
- Integration with real networks is done with the help of a special feature called emulation mode . Simulators can be amalgamated with and connected to real networks to send and receive traffic of these networks .



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- NS-3 is widely used in the extension, modification and optimization of existing models.

### V. STIMULATION RESULTS

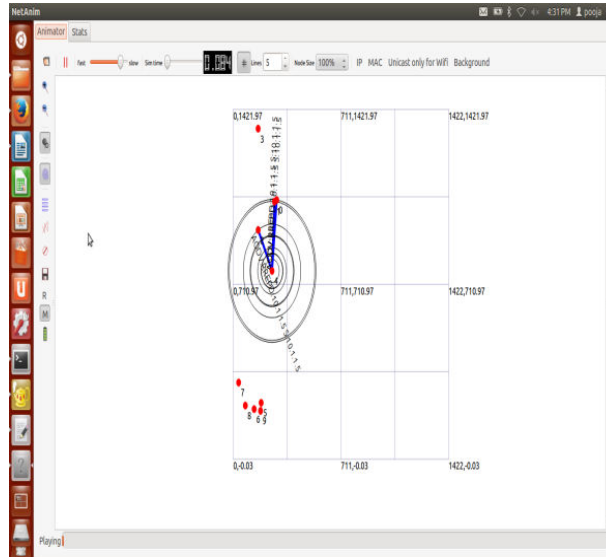


Fig. Running Network with AODV protocol

Fig. represents that network with AODV protocol is running with the help of GUI based network simulator.

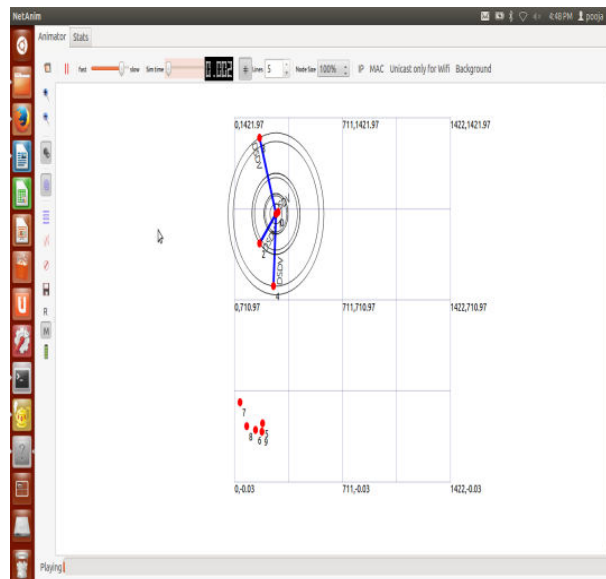


Fig. Running network with DSDV protocol

As we can see in this Fig, network with DSDV protocol is simulating on the GUI based network simulator named NetAnim.



## VI. PERFORMANCE METRICS

There are various performance matrices to evaluate the routing protocols for MANET simulation but here we discuss the following metrics.

### A. Throughput:

It measures how well the network can constantly provide data to the destination.

$$\text{Throughput} = \left( \frac{\text{Received bytes}}{*8} \right) \div \left( \frac{\text{Simulation time}}{1024 * 1024} \right)$$

It is derived in Mbps. For achieving better performance it should be high.

### B. Packet Delivery Ratio:

The ratio of the number of data packets delivered to the destination nodes and the number of data packets sent by source nodes.

$$\text{Packet delivery ratio} = (\text{Received packet} / \text{Sent packet}) * 100\%$$

The performance would be better when it is high.

### C. End to end delay:

The average time interval between the generation of packets in a source node and successfully delivery of it in a destination node.

$$\text{End to end delay} = \text{Delay sum} / \text{Received packets}$$

The performance would be better when it is low.

### D. Jitter:

It describes standard deviation of packet delay between all nodes.

### E. Packet loss ratio:

The number of data packets that is not successfully delivered to the destination during transmission.

## VII. PERFORMANCE COMPARISON ANALYSIS

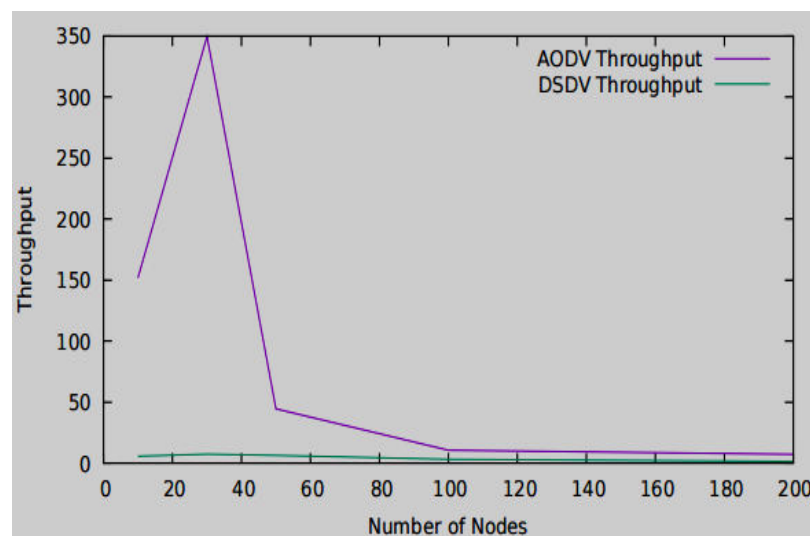


Fig. Throughput vs No. of nodes



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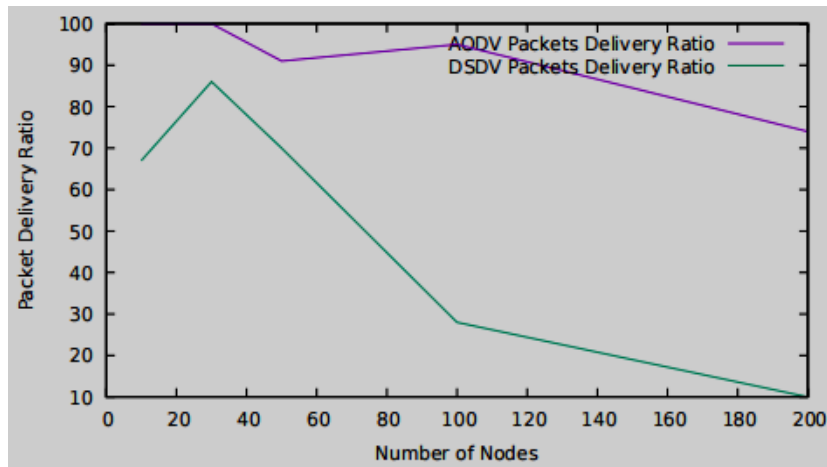


Fig. Packet delivery ratio vs No. of nodes

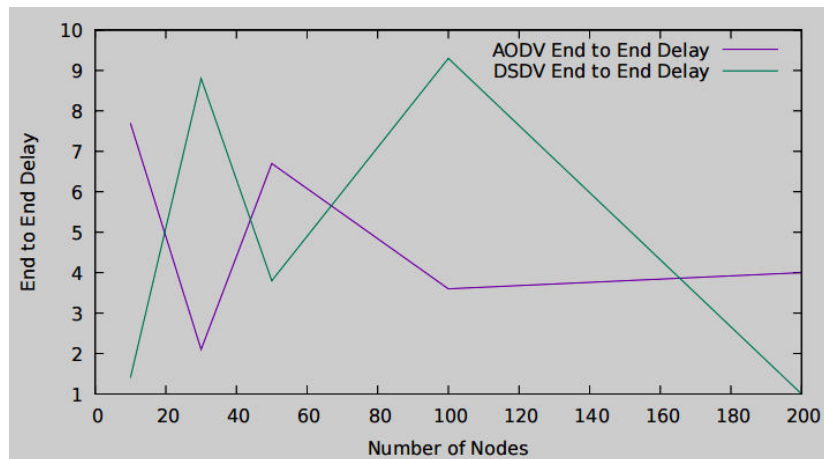


Fig. Delay vs No. of nodes

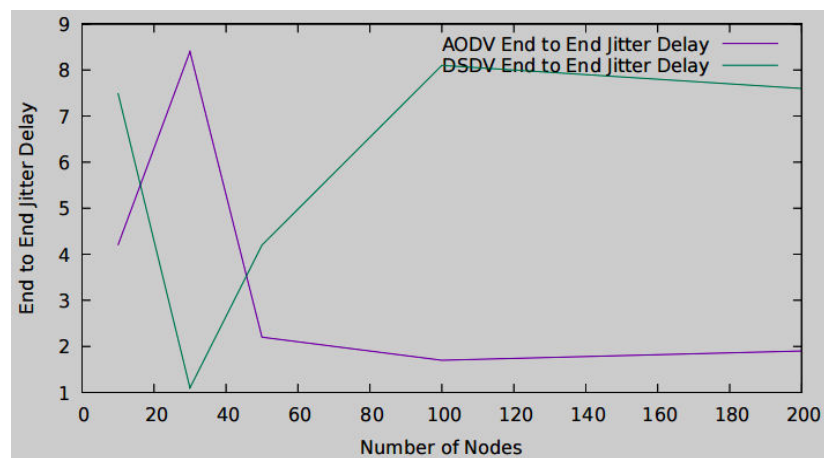


Fig. Jitter vs No. of nodes



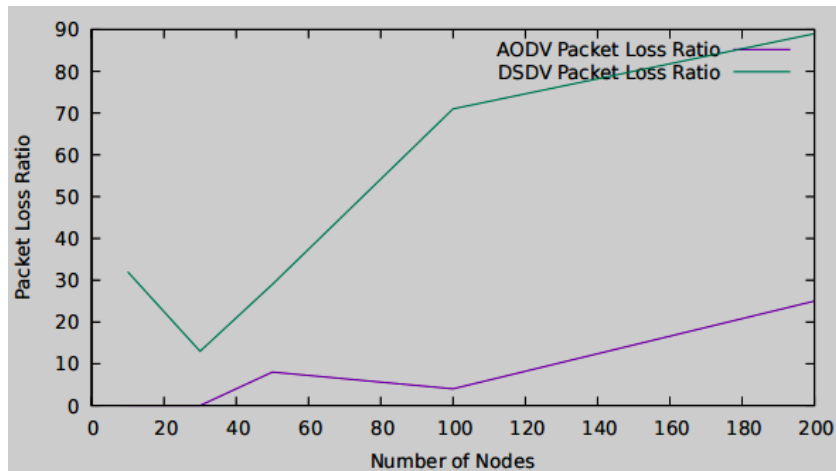


Fig. Packet loss ratio vs No. of nodeS

### VIII. CONCLUSION

This paper includes the study and performance comparisons of two protocols (AODV & DSDV) with respect to the metrics packet delivery ratio, end to end delay, packet dropped, jitter and throughput. The result of simulation indicates that performance of AODV is certainly superior to the other protocols in terms of QoS metrics for network having varying number of nodes.

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