# Simulation of Different Routing Protocols in MANET Using NS2

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***Abstract-*** Mobile Ad hoc Network (MANETs) is an infrastructure – less network which is created by deploying the mobile nodes carrying wireless devices, able to route the data through multi hop fashion. MANETs uses distributed routing approach. In this paper, analysis of different classification of routing protocols such as: Reactive (AODV, DSR) Proactive (DSDV) and Hybrid protocols ZRP (Zone Routing Protocols) has been done using NS2 simulator. The above work analysis has been done on the following QoS parameters such as: Packet Delivery Ratio, Average Throughput, Routing Overhead and Average Delay.

***Index Terms***- AODV, DSDV, DSR, ZRP and MANET.

## I. INTRODUCTION

MANET (Mobile Ad-hoc Network) is a kind of wireless network which is self-configuring by mobile routers (and associated hosts) connected by wireless links – the union of which forms an arbitrary topology. The participating nodes act as router, and are free to move randomly and manage themselves arbitrarily in the router. Thus, may change rapidly in the wireless network topology. Such a network might be connected to the larger Internet [1]. The main objective of QoS provisioning is to attaining network behaviors which are more deterministic, so that information carried by the network can be better delivered and resources of the network can be utilized better [2]. In this paper, we analyze the Simulation of Different Routing Protocols in MANET by using NS2 and there has been variation in number of nodes. We simulate various routing protocols such as: proactive, reactive and hybrid approach, AODV, DSDV, DSR and ZRP where DSDV (Destination sequenced distance vector) is Proactive approach, AODV (Ad-hoc on demand routing protocol) and DSR (Dynamic source routing) are Reactive and ZRP (Zone routing protocol) are Hybrid approach. In MANET, every mobile node not only operates as a host but also operate as a router, to forward the packets, other nodes might not be within direct transmitted range of wireless networks to one another. So that, there have been other routes for discovery and maintenance of nodes. So, the design of routing protocols for MANET is much more challenging than wired networks.

## II. RELATED WORK

The Performance of DSR, AODV (Reactive), DSDV (Proactive) on different parameters like PDF, Average end-to-end delay, and Routing Overheads and Packet Loss Their results has evaluated that AODV performed better in dense environment except packet loss. DSR and AODV both performed well. AODV and DSR are proved to be better than DSDV [3].The authors in [4] compares three routing protocols AODV, DSDV and DSR Protocols, the metrics used for this performance analysis are throughput and normalized routing load. Their assumed scenario shows that DSR shows best performance than AODV and DSDV in terms of Throughput and Normalized Routing Load. In [5] they describes the potential applications of Ad-hoc Network and the technological challenges and also the impact of comparison and classification of different routing protocol viz. AODV, CGSR, DSR, WRP, DSDV and SSR etc in term of different parameters. All the routing protocols are doing good performance in wireless network but reactive protocol doing better performance. Because this reactive protocol path finding protocol perform new path discovery and path maintenance. In [6] their analysis on some widely used routing protocols with varying range, speed of mobility, distance, and number of nodes. They focus on the analysis of varying a range of the transmission in terms of mobility speed and number of nodes in the network. Their results can be used to determine the proper radio transmission range in different mobility speed environments for the proactive routing protocol such as DSDV and reactive routing protocols such as AODV and DSR in wireless Ad-hoc networks without degrading a system performance. In [7], they analyze performance of ZRP protocol and Using Network Simulator (NS-2) tool to analysis performance of ZRP and doing sensitivity analysis by varying node density and transmission range on different parameter like throughput, average e-to-e delay, and Normalized Routing load. Their analysis of result shows that performance of ZRP will increase in case of throughput and decrease in case of normalized routing load and e-to-e delay while varying node density and transmission range but after varying transmission range and better result than default transmission range.

## III. OVERVIEW OF ROUTING PROTOCOLS IN MANET

In Mobile Ad-hoc networks the nodes topology in the network is dynamic, they do not assume all the nodes to be in the direct transmission range of each other in these kinds of networks. These protocols are classified as proactive, reactive and hybrid approach.

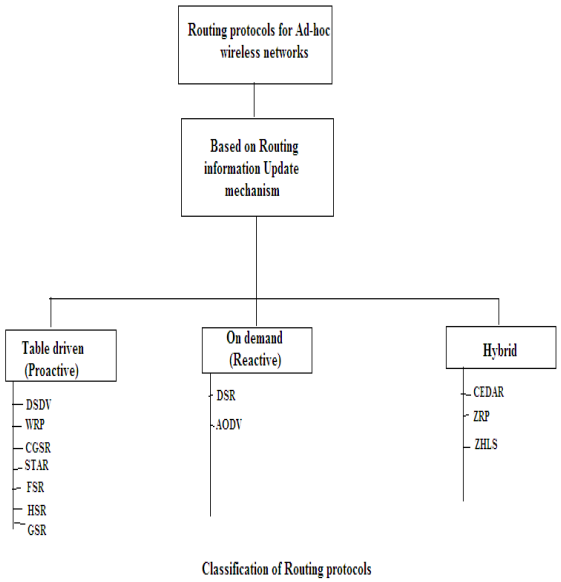


**Figure 1 Classification of Routing protocols [8]**

## A. PROACTIVE ROUTING PROTOCOLS

Proactive routing protocols are table driven approach and every node has the information of the routes which is latest to any other node in the network. In this, every node transmits the routing information in periodic manner to its neighbor for building a view of the network topology global**.** There are several examples for this such as: Destination Sequenced Distance Vector (DSDV), Fisheye State Routing Protocol (FSR).

- **DSDV (DESTINATION SEQUENCED DISTANCE VECTOR)**

Destination Sequenced Distance Vector [19] is a routing protocol which is loop free and calculation of shortest-path is based on the Bellman-Ford algorithm. Between the nodes the data packets are transmitted by using routing tables stored at each node. In the network, each routing table contains all the destinations which are possible from a node to another node and also the number of hops to each destination. There are three main attributes in this protocol: To avoid the loops in network, resolving the problem for "count to infinity", and to reduce the high routing overhead. Every node assign a sequence number which is joined to every new update message of routing-table and it can uses two several types of routing-table updates, namely "full dumps" and "incremental" respectively, to minimize the number of control messages in the network. To keep the tables up-to-date they can exchanged between neighboring nodes at uniform intervals or when a significant topology changes can be observed.

## B. REACTIVE ROUTING PROTOCOLS

Reactive routing protocols are on demand routing protocols and the route information continually updates with the latest route topology. It floods a query into the network to obtain the path to destination instead of the source node wants to transmit a packet. There are several examples for Reactive routing protocols such as: Ad-hoc on demand Distance Vector Routing (AODV) and Dynamic Source Routing (DSR).

- **AODV (AD-HOC ON DEMAND DISTANCE VECTOR)**

This protocol can performs Route discovery when a node wants to send packets to destination by using control messages route request (RREQ) and route reply (RREP). It can reinitiate route when the route error (RERR) message is received by source node. With the help of broadcasted hello packets, neighborhood information is obtained. AODV inclined to reduce the control traffic messages overhead at the cost of latency which is increased in finding the new routes. This protocol is a loop free and to avoid the count to infinity problem, it uses sequence numbers which is representative for the distance vector routing protocols which is classical [20].

- **DSR (DYNAMIC SOURCE ROUTING)**

Dynamic source routing protocol (DSR) is an on-demand protocol designed to restrict the bandwidth consumed by control packets in Ad-hoc wireless networks by eliminating the periodic table-update messages required in the table-driven approach. The source routing is a technique in which the source of the packet determines the complete sequence of nodes n through which to forward the data packets. The source routing has the benefit that there is no need to maintain the routing information by the intermediate hops. Due to routing decision of source it is different from link-state routing and table driven routing [1]. The DSR protocol has route discovery and route maintenance mechanisms that work together in the Ad-hoc network. There is Route Discovery that means the mechanism in which source node wish to send a packet to destination.. Route Maintenance When originating or forwarding a packet to destination the mechanism is used for detecting the network topology. Each node is responsible to detect, if its next hop has broken, during the transmission.

## C. HYBRID ROUTING PROTOCOLS

This protocol is a combination of (proactive + reactive) protocols. ZRP (Zone Routing Protocol) have been a classic example in which the allover topology is divided into a zones hierarchy. Proactive routing is used within each zone locally, while reactive routing protocol used beyond the zone. All nodes within r hops radius are considered a zone [16] [17].

- **ZRP (ZONE ROUTING PROTOCOL)**

Zone Routing Protocol or ZRP was the first hybrid routing protocol with both a proactive and a reactive routing component in wireless networking [13] [14]. In ZRP, a zone is defined with single configurable variable n hops from it for every node. The parameter is known as Zone Radius. In this protocol, every node proactively maintains routes with in a local region, which is called as routing zone. Using a query reply mechanism, creation of route is done [15] [16]. There are three elements available in ZRP: IARP, IERP and BRP. There is Intra zone Routing Protocol (IARP) "A node routing zone is defined as a nodes collection whose minimum distance in hops from the node is not greater than a parameter referred to as Radius of Zone" [17]. Secondly, Inter zone Routing Protocol (IERP) the global reactive routing is termed as "Inter zone Routing Protocol" (IERP). By using IERP, ZRP discover routes to destination beyond a node's routing zone

reactively [17].Third one is BRP (**Border cast Resolution Protocol**) is used instead of traditional broadcasting to improve the efficiency of a global reactive routing protocol. Such as IERP, IARP and BRP is not a complete a routing protocol, it simply works as a packet delivery service [13] [14].

## IV. SIMULATION ENVIORNMENT AND PERFORMANCE PARMETERS

In this section, The Simulation environment used for analysis is shown in table 1. Figure 2 and figure 3 depict the scenario or 75 nodes for AODV and ZRP protocol.

Table 1: shows the simulation parameters

| **Parameter** | **Value** |
|---|---|
| Number of Nodes | 25, 50, 75, 100 |
| Traffic | CBR |
| Network Size | 1200 x 1200 |
| Simulation Time | 10 sec |
| Path loss Model | Two- Ray Propagation Model |
| Antenna Type | Omni-directional |
| Physical Layer Protocol | PHY802.11 |
| Data Link Layer | MAC 802.11 |

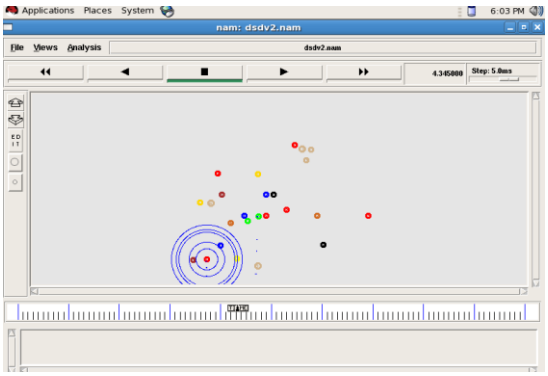


**Figure 2 Scenario of 75 Mobile nodes for AODV**

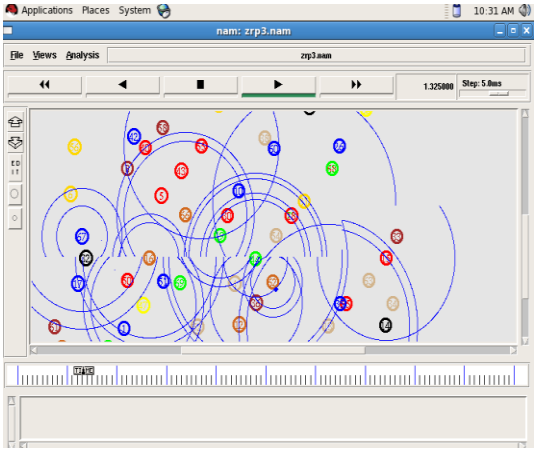


**Figure 3 Scenario of 75 Mobile nodes for ZRP**

### B. SIMULATION BASED PERFORMANCE PARAMETERS:

The performance parameters used for the simulation are as follow: Packet delivery ratio, Average throughput, Routing overhead and Average Delay.

**Packet Delivery Ratio: -** It is defined as the ratio of number packets received by the destination to the number of packets originated by the source. For better performance of a routing protocol, it should be better [20].

**Average Throughput:-** It is defined as the total amount of data a receiver receive from the sender divided by the time it takes for the receiver to get the last packet [21].

**Routing Overhead:** It is the total number of routing packets transmitted over the network, expressed in bits per second or packets per second.

Routing overhead= total no. of packets transmitted over network / packets per sec.

**Average Delay:** A specific packet is transmitting from source to destination and calculates the difference between time of sending and the time of receiving. Delays due to route discovery, propagation or transfer time are included in the delay metric. Delay can be defined as:

Packet Delay = Packet receive time – packet send time

## V. SIMULATION RESULTS AND DISCUSSION

The performance of AODV, DSDV, DSR and ZRP has been analyzed with number of nodes. The parameters used for simulation are summarized in Table 1 and positioning of different nodes illustrated in Figure 2, Figure 3 and results such as packet delivery ratio, average throughput, routing overhead, average delay are shown in Figure 4 to Figure 7.

**Packet Delivery Ratio:**

Packet delivery ratio versus number of nodes for AODV, DSDV, DSR and ZRP routing protocols has been shown in figure 4. It has been observed that AODV has better performance in case of Packet delivery ratio. As the number of nodes increases the neighbor density increases hence the value of Packet Delivery Ratio increases for all on demand routing protocols. So, it shows that AODV has better performance among all the routing protocols, where as DSDV has worst case because DSDV generates almost constant overhead due to proactive nature.

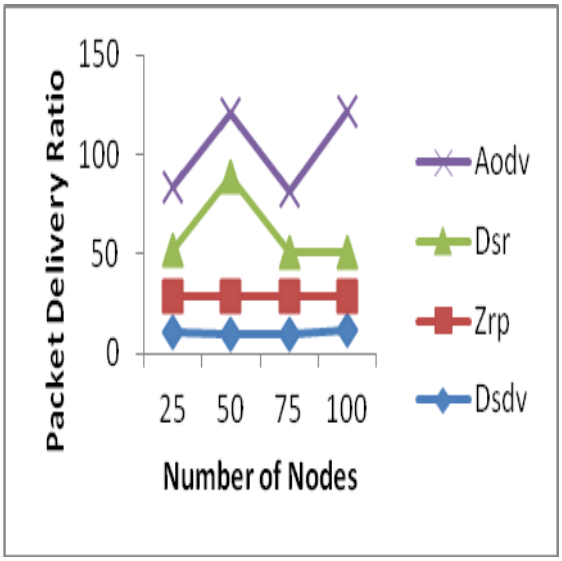


**Figure 4 Packet delivery ratio vs. number nodes for Different protocols**

**Average Throughput:**

Average throughput versus number of nodes for AODV, DSDV, DSR and ZRP MANET routing protocols is depicted in figure 5. It has been observed that AODV has better performance followed by DSR because the throughput slightly increases with increase in number of nodes for all the on demand the routing protocols and it delivers more packets as compare to other routing protocols. Here AODV has maximum throughput so it is best among all the protocol and DSDV is worst among all the protocols because of its table driven approach and periodic table exchange. So it has minimum throughput and it is the worst case among all the protocols.

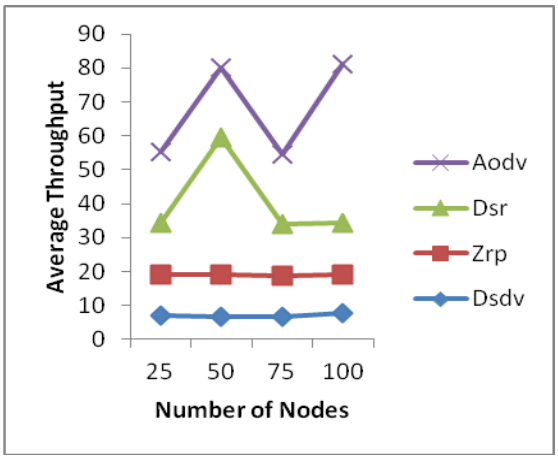


**Figure 5 Average Throughput vs. number of nodes for different routing protocols**

**Routing Overhead:**

Figure 6 depicts the Routing overhead versus number of nodes for AODV, DSDV, DSR and ZRP MANET routing protocols. It has been observed that ZRP has better performance because ZRP having smaller zone radius, so the zone density also decreases. Due to which it has minimum Routing Overhead that shows better performance of ZRP and DSR is worst because it replies to all the requests reaching a destination from a single request cycle. The major contribution to routing overhead is from RREP. So DSR is worst among all the protocols.

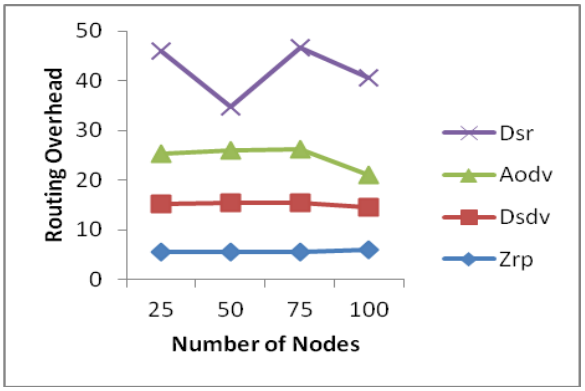


**Figure 6 Routing overhead vs. number of node for Different protocols**

**Average Delay:**

Figure 7 depicts the Average Delay versus number of nodes for AODV, DSDV, DSR and ZRP MANET routing protocols. It has been observed that ZRP has better performance due to its minimum delay and it decrease due to decrease in zone Density and AODV is worst because of higher drop rates, it drop packets when route expires and a new route must be found.

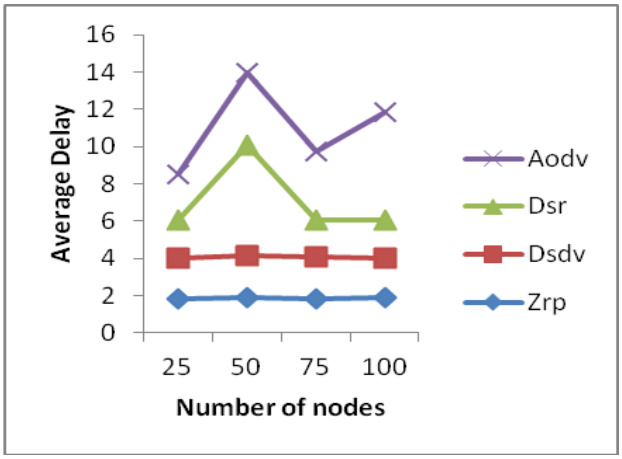


**Figure 7 Average Delay vs. number of node for Different protocols**

## VI. CONCLUSION

This study has been conducted to simulate the performance of MANET Routing Protocols i.e. AODV, DSDV, DSR and ZRP based on Packet Delivery Ratio, Average Throughput, Routing Overhead, Average Delay. The work can be summarized as: It can be found that Packet Delivery Ratio and Average Throughput are better in case of AODV routing protocol with increase in number of nodes and Average Delay, Routing

Overhead are better in case of ZRP routing protocol as we increase the number of nodes.

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