# Performance Analysis of DSDV and ZRP Protocols with Mobility Variations in MANETs

Nafiza Mann
*Department of Computer Science and Engineering*
*RIMT-IET, Mandi-Gobindgarh, Punjab, India*

Abhilash Sharma
*Department of Computer Science and Engineering*
*RIMT-IET, Mandi-Gobindgarh, Punjab, India*

Anuj K. Gupta
*Department of Computer Science and Engineering*
*BGIET, Sangrur, Punjab, India*

**Abstract- Mobile Ad-Hoc Networks (MANETs) have gained keen interest of researchers in past few years. MANETs can attain dynamic infrastructure. The performance evaluation of MANETs is usually done by simulation. This paper is subjected to the work for the evaluation of an existing hybrid protocol in comparison to a proactive protocol with respect to performance metrics such as Data packet sent, Data packet received, Total Packet Loss, Packet Delivery Ratio, Throughput, Normalized Routing Load, and Average End-to-End Delay. To examine the efficiency of these protocols a detailed simulative analysis is done under network scenarios with and without mobility.**

**Keywords – MANET, DSDV, ZRP, Performance parameters, Mobility criteria.**

## I. INTRODUCTION

From 1970s, the interest in wireless networks has been growing ever since. The characteristics of the wireless networks has always made it attractive for the users. The wireless infrastructure of these networks result into ad-hoc networks which has a self-configuring nature to establish various links between mobile node which may be routers and/or hosts [8]. Ad-Hoc networks has proven to be the startup of technology revolution carrying along its simplicity basis. In ad-hoc networks, the changes in the network are unpredictable and not static, if compared to wired networks. The factors such as energy consumption, Bandwidth usage, and latency issues etc. made the MANETs to come into existence. MANETs has provide the essential features of the services required such as: Distributed operations, Multihop routing, Autonomous terminal, Dynamic topology, Light-weight terminals, Shared physical medium, Bandwidth and Energy constrained operations etc [1].

## II. MOBILE AD-HOC NETWORKS

In this, the network is formed by combining or collecting the various independent nodes (mobile). In MANETs, the mobile nodes present in the range (may or may not be specified) of each other, can perform direct communication whereas, for the rest of nodes, if communication has to perform, the intermediate nodes are taken into consideration [2]. The interface provided for the communication among these mobile nodes is wireless. These networks formed are fully distributed and can perform at any place without any help of fixed base stations or access points.

## III. ROUTING PROTOCOLS

Routing protocols for MANETs are basically categorized as:

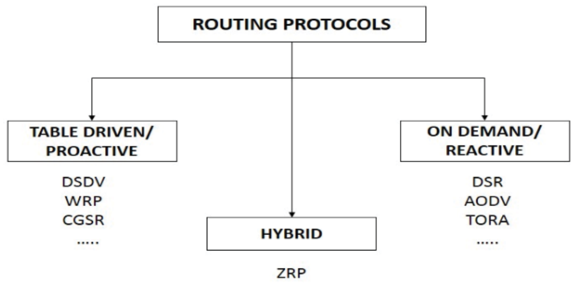



Figure 1. Categorization of Routing Protocols

*A. Table Drive Routing Protocols (Proactive)* –

In this protocols, nodes maintains up to date routes in the network. Routing information is periodically transmitted to each node present in the network so as to maintain routing table consistency. This facilitates the transmission without delay. Otherwise, if information is not already present, packets has to wait in queue [1].

*B. On Demand Routing Protocols (Reactive)* –

In this, On demand routing is performed whenever a route discovery is initiated by a node to send packets to the destination [1]. Once a route is determined, it is established and maintained by route maintenance. In this, where communication overhead is reduced, latency becomes an issue.

*C. Hybrid Routing Protocol* –

It combines both proactive and reactive Routing Protocols. These protocols use distance vector to establish best paths and report routing information whenever there is a change in topology.

## IV.OVERVIEW OF DSDV AND ZRP

Every routing protocol has its own nature, own pros and cons. We have considered two among them for the evaluation.

*A. Destination-Sequenced Distance Vector (DSDV)* –

The problems raised in Distance-Vector routing can be solved by pure proactive nature routing protocol i.e. DSDV. The problem being solved by DSDV are like: count-to-infinity, by using destination sequence numbers [3]. In this, each node advertise its routing table to all the nodes in the network. The DSDV routing protocol is based on the principle of Bellman-Ford Algorithm. In this, each node maintains a routing table consisting of all the information about each and every node present in the network. A periodic broadcasting of routing table is performed to keep the routing table updated [4]. On receiving this message, the neighbor node compare the current link cost value to the previous one and will update the routing table in case of any change. The main contribution of this protocol is the facility of loop-freeness. The routing information is distributed between nodes by sending full dumps infrequently and smaller incremental updates more frequently [5].

In analysis, the proposed efficient DSDV shows low packet delivery. It happens due to presence of stale (fake) route in presence of broken links [6].
DSDV is well known protocol for ad hoc routing but still has many problems [5].

*B. Zone Routing Protocol (ZRP)* –

ZRP is among most popular hybrid routing protocols. Zone Routing Protocol is a prominent protocol combining both proactive and reactive nature of routing.

*1. ZRP Architecture* –

ZRP acts as a framework for other protocols. Size of the zone in ZRP is defined as the count of number of hops it takes to reach to its peripheral nodes called 'Zone Radius' [7]. This hybrid behavior suggest and decides to follow the technique among both. This initiates route-determination procedure on demand but at limit search cost [8]. The proactive nature of this protocol minimizes the waste count associated to this technique. The Zone Routing Protocol consists of several components, which only together provide the full routing benefit to ZRP [9].

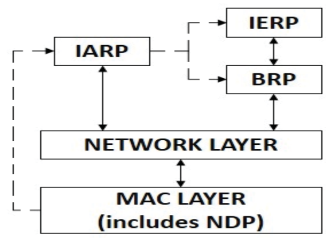



Figure 2. Architecture of ZRP

IARP is responsible for proactive maintenance while IERP for the reactive one. Bordercasting leverages IARP's up-to-date view of local topology to efficiently guide route queries away from the query source [9].

- Intra-Zone Routing Protocol (IARP) –
  This protocol communicates with interior nodes of the zone. Zone radius limits the zone size. In IARP, the change in topology results in change in local neighborhood. It always desires to update the routing information [10]. IARP helps in removal of node redundancy along with tacking to link-failures.
- Inter-Zone Routing Protocol (IERP) –
  It is the global reactive routing component of ZRP. With the help of knowledge gained about local topology, IERP perform the on-demand routing mechanism [1]. In presence of route, it issues route queries. Bordercasting helps to minimize the delay caused by route discovery.
- Bordercast Resolution Protocol (BRP) –
  Whenever route is requested with the global reactive technique, BRP is used to nonstop it and maximizes its effectiveness. IARP routing information is used by BRP. It maintains the redundancy removal phenomenon by pruning the nodes it has already covered (received the query) [7].
- Query Control Mechanism –
  As per ZRP strategy, querying performing is more efficient than directly flooding the route requests but due to heavy overlapping, multiple forwarded route requests can result into more control traffic than flooding. Thus a collection of query control mechanism is introduced by ZRP.
  - *QD1/QD2* –With the help of BRP, the relaying nodes in the tree becomes able to detect the query which is redundant (QD1) [9].
  - *Early Termination (ET)*
  - *Random Query Processing Delay (RQPD)*

Further Performance of ZRP protocol can be enhanced as per done in [11], where various parameters are taken into consideration and observed. Multicast ZRP makes on-demand route requests by Multicast Inter zone routing protocol with an efficient query mechanism [12].

## V. SIMULATION

The simulation has been performed using Network Simulator (NS-2). The traffic source considered is Continuous Bit Rate (CBR). The model is in a rectangular area of 3000m x 3000m with 30 nodes. Model has wireless channel.
During simulation, nodes started the transmission and in between mobile nodes have changed their positions which results in change of configuration and topology of the network. It further affected the network traffic and transmission. The model parameters used are as follows:

Table -1 Model Parameters

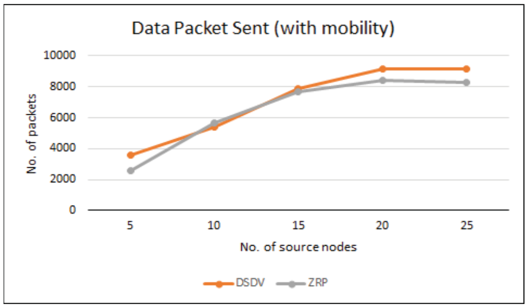
| **Parameters** | **Value** |
|---|---|
| **Simulator** | **NS2** |
| **Protocol** | **DSDV, ZRP** |
| **Channel** | **Channel / Wireless Channel** |
| **Propagation Model** | **Propagation / Two way Ground** |
| **Network Interface** | **Phy / WirelessPhy** |
| **MAC Type** | **Mac/802_11** |
| **Interface Queue type** | **Queue / Droptail / Priqueue** |
| **Link Layer Type** | **LL** |
| **Simulation Time** | **30sec** |
| **Simulation Area** | **3000 x 3000** |
| **Transmission Range** | **250m** |
| **Traffic Type** | **CBR (TCP)** |
| **No. of source nodes** | **5, 10, 15, 20, 25** |
| **No. of mobile nodes** | **2, 4, 7, 9, 13** |
| **Speed of Mobile nodes** | **50m/s** |
| **Packet Size** | **100** |

## VI. RESULTS

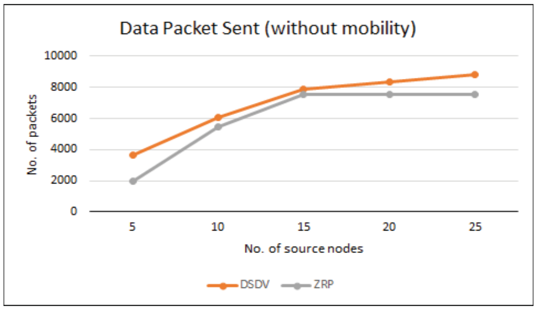
In this paper, the analysis and comparison of DSDV and ZRP is done. The comparison of various parameters has been performed among these protocols. The results of various simulated parameters are observed as described:

### *A. Data Packet Sent –*

It is the count of only data packets been sent throughout the network.




(a)

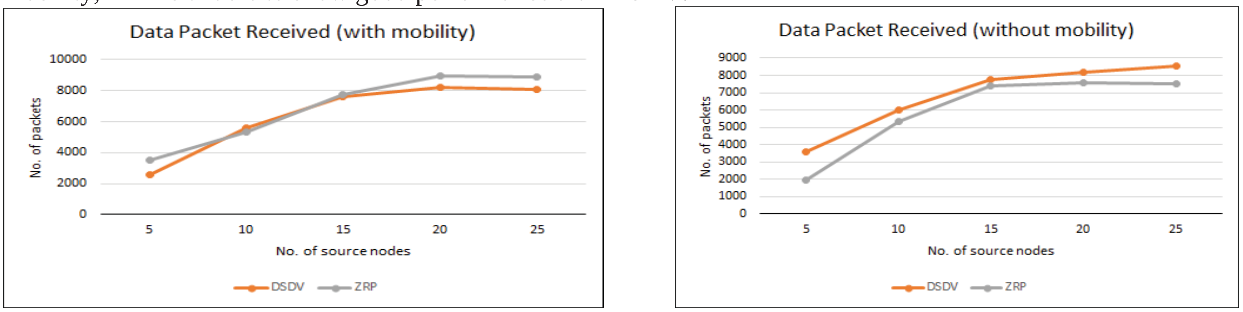



(b)

Figure 4. (a) Data Packet sent with mobility (b) Data Packet sent without mobility

### *B. Data Packet Received –*

It is the count of only data packets been received throughout the network. In mobility as well as in absence of mobility, ZRP is unable to show good performance than DSDV.



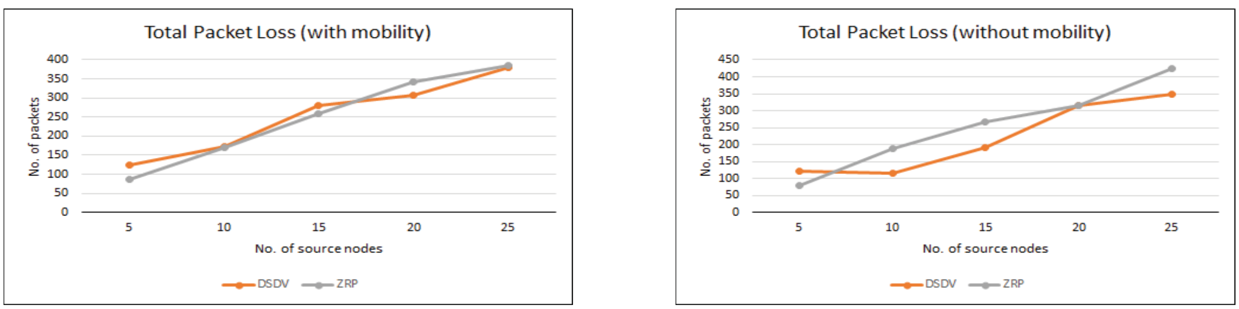

(a) (b)

Figure 5. (a) Data Packet received with mobility (b) Data Packet received without mobility

### *C. Total Packet Loss –*

It is the count of all packets (data packets + routing packets) lost during the transmission.

Total Packet Loss = Total no. of Packets sent – Total no. of packets received



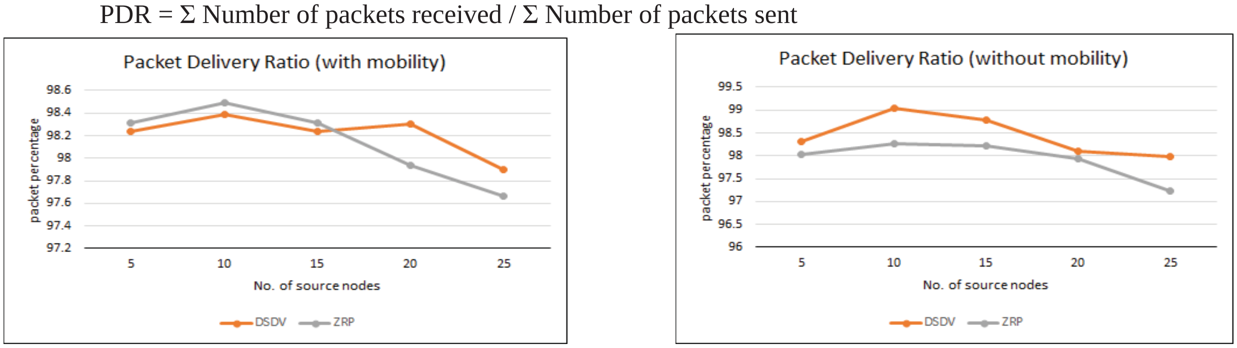

(a) (b)

Figure 6. (a) Total Packet loss with mobility (b) Total Packet loss without mobility

### *D. Packet Delivery Ratio –*

It can be defined as the ratio that is used to calculate the number of packets transmitted by source node to the number of packets received by destination node [13].

PDR = Σ Number of packets received / Σ Number of packets sent

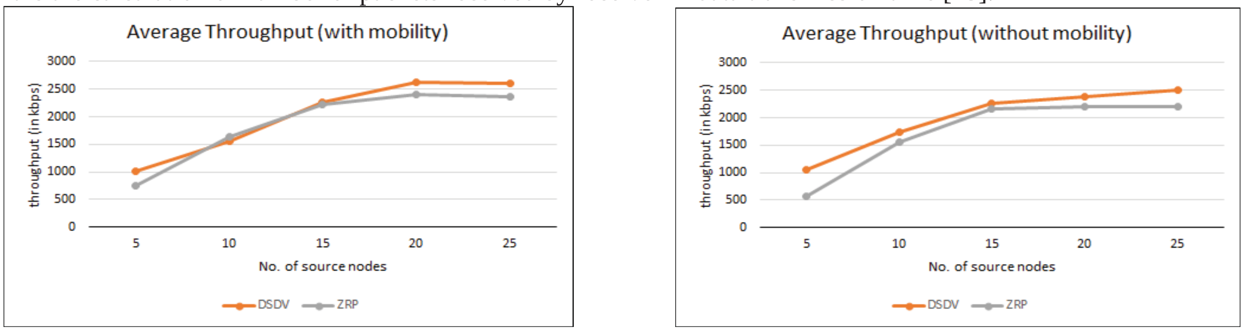



(a) (b)

Figure 7. (a) Packet Delivery Ratio with mobility (b) Packet Delivery Ratio without mobility

### *E. Average Throughput –*

It is the calculation of number of packets received by receiver in data transmission time [13].




(a) (b)

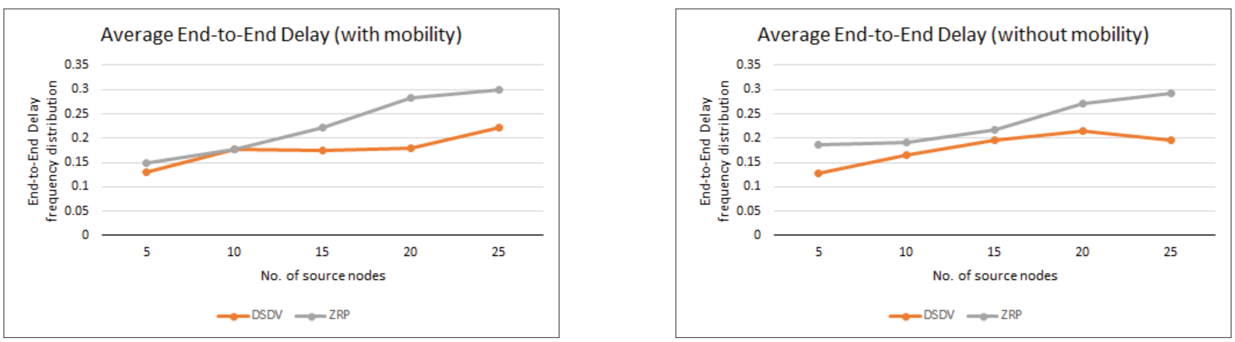
Figure 8. (a) Average Throughput with mobility (b) Average Throughput without mobility

### *F. Average End-to-End Delay –*

It is the total time taken by packet from source node to the destination node [13].

$$\text{Av. End-to-End Delay} = (\text{Start-time}_{ij} - \text{End-time}_{ij}) / N$$

Where ij is the time when sending/receiving of packet j at node i starts/stops and N is the total number of nodes.



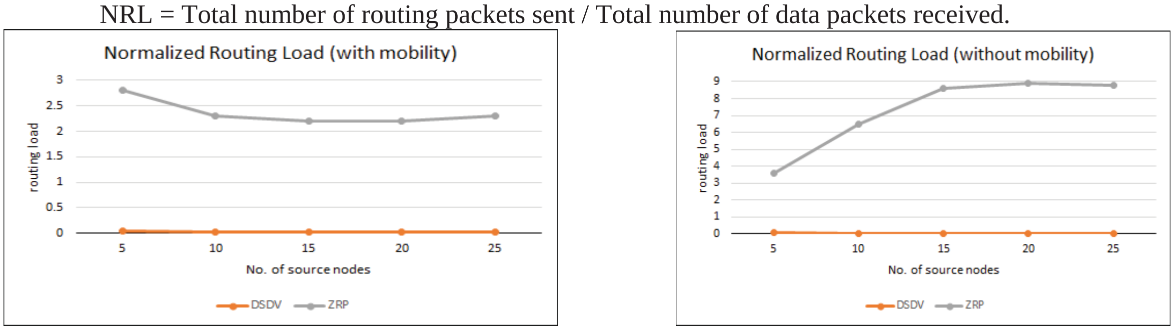

(a) (b)

Figure 9. (a) Average End-to-End Delay with mobility (b) Average End-to-End Delay without mobility

### *G. Normalized Routing Load –*

The normalized routing load is defined as the fraction of all routing control packets sent by all nodes over the number of received data packets at the destination nodes. In other words, it is the ratio between the total numbers of routing packets sent over the network to the total number of data packets received.

NRL = Total number of routing packets sent / Total number of data packets received.




(a) (b)

Figure 10. (a) Normalized Routing Load with mobility (b) Normalized Routing Load without mobility

## VII. CONCLUSION

As subjected by this paper, a comparison between Destination-Sequenced Distance Vector (DSDV) Routing Protocol and Zone Routing Protocol (ZRP) is done after the parametric analysis of DSDV and ZRP. This analysis has performed on simulator by increasing the number of source nodes and in presence and absence of mobility in the nodes for DSDV and ZRP. This is how, the better protocol among these two has been evaluated on the basis of data packets sent, data packets received, total packet loss, packet delivery ratio, throughput, and average end-to-end delay and normalized routing load. The results clearly show that in case of small network size Zone Routing Protocol performs well but not in case of large network size. However, Destination Sequenced Distance Vector Routing Protocol (DSDV) has shown a better performance where the network size is large. In case of mobility, both the protocols perform moderately but in absence of mobility DSDV shows far better performance than ZRP. It is observed that the average throughput and packet delivery ratio in DSDV has a greater value than ZRP in both the scenarios.

## REFERENCES


[1] Anuj K. Gupta, *Member, IACSIT*, Dr. Harsh Sadawarti, Dr. Anil K. Verma, “Performance analysis of AODV, DSR & TORA Routing Protocols”, IACSIT International Journal of Engineering and Technology, Vol.2, No.2, April 2010 ISSN: 1793-8236.

[2] Anuj K. Gupta, Harsh Sadawarti, Anil K. Verma, “Performance Analysis of MANET Routing Protocols in Different Mobility Models”, *I.J. Information Technology and Computer Science,* 2013, 06, 73-82, 2013 MECS.

[3] P. Chenna Reddy, Dr. P. ChandraSekhar Reddy, “Performance Analysis of Adhoc Network Routing Protocol”, 2006 IEEE.

[4] Anuj K. Gupta, Harsh Sadawarti, Anil K. Verma, “A Review of Routing Protocols for Mobile Ad Hoc Networks”, WSEAS TRANSACTIONS on COMMUNICATIONS, ISSN: 1109-2742, Issue 11, Volume 10, November 2011.

[5] Jaya Bhatt, Naveen Hemrajani, “Effective Routing Protocol (DSDV) for Mobile Ad Hoc Network”, International Journal of Soft Computing and Engineering (IJSCE), ISSN: 2231-2307, Volume-3, Issue-5, November 2013.

[6] Khaleel Ur Rahman Khan, A Venugopal Reddy, Rafi U Zaman, K. Aditya Reddy, T Sri Harsha, “An Efficient DSDV Routing Protocol for Wireless Mobile Ad Hoc Networks and its Performance Comparison”, 2008 IEEE.

[7] Shaily Mittal, Prabhjot Kaur, “Performance Comparison of AODV, DSR and ZRP routing protocols in MANET’s”, 978-0-7695-3915-7/09 *IEEE* 2009.

[8] Zygmunt J. Haas, Marc R. Pearlman, “The Performance Of A New Routing Protocol For The Reconfigurable Wireless Networks”, School of Electrical Engineering, Cornell University, Ithaca, NY, 14853, *IEEE* 1998.

[9] Zygmunt J. Haas, Marc R. Pearlman, “The Performance of Query Control Schemes for the Zone Routing Protocol”, *Senior Member, IEEE*, IEEE/ACM TRANSACTIONS ON NETWORKING, VOL. 9, NO. 4, AUGUST 2001.

[10] Harjeet Kaur, Manju Bala, Varsha Sahni, “Performance Evaluation of AODV, OLSR and ZRP routing protocol under the Black Hole attack in MANET”, Vol. 2, Issue 6, June 2013.

[11] A. Loutfi, M. Elkoutbi, “Evaluation and enhancement of ZRP performances”, *IEEE* 2010.

[12] Xiaofeng Zhang, Lillykutty Jacob, “Multicast Zone Routing Protocol in Mobile Ad HocWireless Networks”, Proceedings of the 28th Annual IEEE International Conference on Local Computer Networks (LCN’03) 0742-1303/03 *IEEE* 2003.

[13] Reena, Rekha Pandit, Vineet Richariya, “ Performance Evaluation of Routing Protocols for Manet using NS2”, International Journal of Computer Applications (0975 – 8887) Volume 66– No.24, March 2013.