

# Performance Evaluation of AODV, FSR, and ZRP Routing Protocols in Mobile Adhoc networks using Qual Net

Mr. P. Stanley A<sup>1</sup> Er. Prateek Singh<sup>2</sup>

<sup>1,2</sup>Assistant Professor

<sup>1,2</sup>Department of Computer Science & IT

<sup>1,2</sup>SHUATS, Allahabad, UP, India

*Abstract*— Mobile Adhoc Networks (MANET) is a collection of wireless mobile nodes that dynamically form a network temporarily without any support of central administration. Mobile means moving and Ad Hoc means temporary without any fixed infrastructure. Mobile Ad-hoc networks are the collection of mobile nodes connected by a wireless link, where each node acts as a router. Ad-hoc networks are characterized by a lack of infrastructure, and by a random and quickly changing network topology thus the need for a robust dynamic routing protocol that can accommodate such an environment. In addition to this, routing protocols face many challenges like short battery backup, limited processing capability. Every node in MANET moves arbitrarily making the multi-hop network topology to change randomly at unpredictable times. Routing is a critical task in MANET where the nodes are mobile. Dynamic and reliable routing protocols are required in the ad-hoc wireless networks, as they have no infrastructure and their network topology changes. There are various protocols for handling the routing problem in the ad-hoc wireless network environment. There are several familiar routing protocols like AODV, FSR, ZRP, etc...which have been proposed for providing communication among all the nodes in the network. In this paper we have analyzed the performance of proactive, reactive and hybrid protocols using AODV, FSR and ZRP based on parameters like Throughput, End-to-End delay, Average jitter, Total message received etc. by using the Qualnet 6.1 simulator.

**Key words:** MANET, AODV, FSR, ZRP, Throughput, End-to-End delay, Average jitter, Total message received, Qualnet 6.1

## I. INTRODUCTION

Mobile Ad-hoc Network (MANET) is a wireless system that comprises mobile nodes. It is usually referred to a decentralized autonomous system. Mobile nodes engaged in MANET often work as client/servers. Nodes in the network can be either fixed or mobile. Mobile nodes include laptop, mobile phone, home computer or personal digital assistance. Nodes may be located on ships, airplanes or land, irrespective of their location as they can participate in communication. Self-connectivity and easy deployment of MANETs makes it apt for emergency, surveillance situations and rescue operations.

MANET routing protocol noticed experimental Request For Comments (RFC) since 2003. Implementation and deployment of the protocols have not properly addressed by RFCs, but the routing protocol algorithms proposed were identified as trial technology with the high probability that will result into a standard. Enormous research work have been focused on different routing

protocols such as Dynamic Source Routing (DSR), Optimized Link State routing(OLSR), Temporarily Ordered Routing Algorithm (TORA) and Ad hoc On-demand Distance Vector (AODV), for their development and standardization of routing support by MANET Working group(WG) of Internet Engineering Task Force (IETF).

MANET gradually exploited the wireless communication world as the common means for human communication. Devices are configured with Wi-Fi cards as hotspots in many places such as universities, offices, airports and hotels. It stood as a major source for communication in this modern world. This challenged the researchers around the world to enforce their research in developing MANET. In such advanced communication network, routing plays a key role as it is one of the major aspects to route the data in network. Different protocols have been proposed so far by many researchers. This exploration of wireless devices lead the path to focus our study on the large networks where hosts involved in the network engage to communicate each other in Ad hoc fashion.

As MANETs are characterized by node mobility and limited bandwidth, there is need to take into account the energy efficiency of the nodes, topology changes, unreliable communication and limited bandwidth in their design. In a MANET, mobile nodes have the ability to accept and route traffic from their neighbors towards the destination, i.e., they act as both routers and hosts. As the network grows, and coupled with node mobility, the challenges associated with self-configuration of the network become more pronounced. More frequent connection tearing and re-associations place an energy constraint on the mobile nodes.

The set of applications for MANETs is diverse, ranging from small static networks that are constrained by power sources to large-scale, mobile, highly dynamic networks. A key challenge in ad-hoc network design is to develop a high quality and efficient routing protocol which can be used to communicate using mobile nodes. Unfixed topology in ad-hoc networks results in finding the delivery path dynamically, maintain the integrity and stability of the path during data delivery process. This ensures the data packets are transferred to the destination node completely. The traditional routing mechanisms and protocols of wired network are inapplicable to ad-hoc networks, which initiated the need to use a dynamic routing mechanism in ad-hoc network.

### A. Applications of MANET

Self reconfiguring, easy deployment, decentralized and infrastructure independent nature of MANET makes benefit for communication.

- Formerly, MANET was used for military applications for communication where the data units/armed soldiers

engaged in the battle field such as fighter planes, tankers, missile ships etc no matter air, water or land irrespective of their place and location.

- MANETs are widely used at locations where the fixed infrastructure for communication has been destroyed or impossible situations such as earthquake, flood, fire explosions plane/air crash and the areas of disaster and natural calamities.
- MANETs are playing a vital role in crowd control and surveillance.
- Flexibility of the MANET advanced its usage in the business applications such as conferences, file transfers and web application and home-automation such as to lock and unlock the doors and to operate the lights remotely.
- Other applications include easy of flight check-in procedures and traffic management.

The key issue with ad-hoc networking is how to send a message from one node to another with no direct link. The nodes in the network are moving around randomly, and it is very difficult that which nodes are directly linked together. Same time topology of the network is constantly changing and it is very difficult for routing process. A number of routing protocols are available at present; some of them are taken here for discussion purpose. Several routing protocols have been developed to suit Ad hoc networks. The routing protocols in MANETs are classified into three different categories according to their functionality and performance. They are proactive (Table driven) routing protocols, Reactive (On-demand) routing protocols and Hybrid routing protocols.

## II. OVERVIEW OF PROTOCOLS

Mobile Ad hoc Network (MANET) is a Wireless Ad-Hoc Network technology. Mobile nodes in the network will act as clients and servers. Figure 2.1 shows the decentralized MANET consisting of mobile nodes functioning as routers along with the respective mobile nodes. In Ad hoc networks, nodes do not have a prior knowledge of topology of network around them, they have to discover it. The basic idea is that a new node (optionally) announces its presence and listens to broadcast announcements from its neighbours. The node learns about new near nodes and ways to reach them, and may announce that it can also reach those nodes.

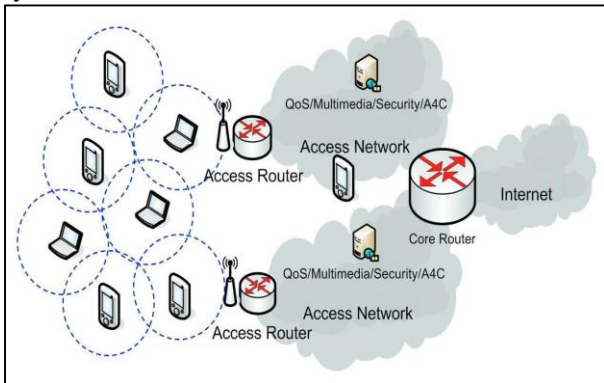


Fig. 1: Centralized MANET

As time goes on, each node knows about all other nodes and one or more ways how to reach them. Routing Protocols can be divided into three categories based on when and how the routes are discovered.

Reactive Routing or On-demand routing Protocols (AODV). Pro-active Routing or table driven Protocols (FSR). Hybrid (Pro-active / Reactive) (ZRP).

### A. Proactive Routing Protocols

In pro-active or table driven routing protocols each node maintains one or more tables containing routing information to every other node in network. All nodes update these tables so as to maintain a consistent and up-to-date view of the network. When the network topology changes the nodes propagate update messages throughout the network in order to maintain consistent and up-to-date routing information about the whole network. These routing protocols differ in method by which the topology change information is distributed across the network and the number of necessary routing-related tables.

### B. Reactive Routing Protocols

Unlike pro-active, Reactive or On-demand routing protocols take a lazy approach to routing. In contrast to Proactive Routing protocols all up-to-date routes are not maintained at every node, instead the routes are created as and when needed. When a source wants to send to a destination, it invokes the route discovery mechanism to find the path to the destination. The route remains valid till the destination is reachable or until the route is no longer needed.

### C. Hybrid Routing Protocols

Hybrid protocols combine the advantages of pro-active and reactive routing. The routing is initially established with some pro-actively prospected routes and then serves the demand from additionally activated nodes through reactive flooding.

## III. SIMULATION SETUP

The simulator used for the performance measurement in this paper is Qualnet 6.1. It is a simulator used to analyze the performance of wired, wireless, and heterogeneous networks. It allows designing network models easily, efficiently coding protocols, and run models that present real-time statistics. In this dissertation simulation is carried out on Qualnet version 6.1.I have evaluated the performance variation of Adhoc Routing Protocols AODV, FSR and ZRP in a Mobile Adhoc networks (MANET).

### A. Simulation Parameters

TABLE 3.1 shows the parameters for new simulation design of the scenarios.

Parameters	Value
Area of simulation	1500*1500m <sup>2</sup>
Physical layer protocol	802.16 Radio ,802.11n Radio
Mac protocol	802.16e , 802.11e
Path loss model	Two Ray
Routing protocols	AODV,FSR, ZRP
Traffic source	Constant Bit Rate
Simulation Time (Sec)	0,5,10,15 20
Packet Size	512 bytes
Number of nodes	20, 50

Table 1: Simulation Parameters

**B. Scenario Description**

In this paper simulation is carried out on QualNet version 6.1. I have evaluated the performance variation of Adhoc Routing Protocols AODV, FSR and ZRP in a Mobile Adhoc networks.

**1) Scenario 1:**

It consists of 20 nodes with random nodes placement is shown. The nodes were randomly distributed in area of 1500×1500 m<sup>2</sup>. Among various nodes application of Constant Bit Rate is applied. The nodes 3, 13, 18(as source) and 5, 12, 16(as destination) were connected. The simulation time was run for 20 seconds. The routing protocols taken were AODV, FSR, and ZRP.

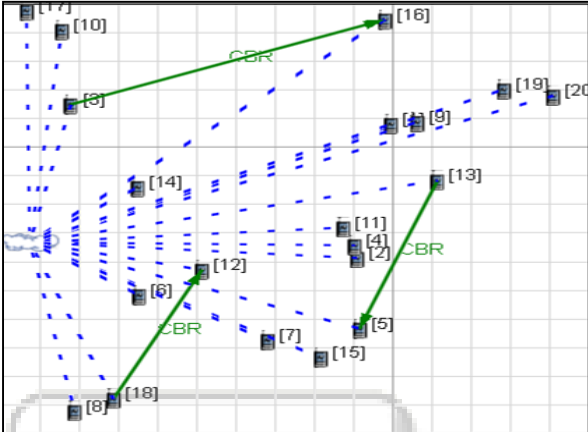


Fig. 2: Snapshot For The Simulation 20 Nodes Using Qualnet 6.1

**C. Scenario 2:**

It consists of 50 nodes with random nodes placement is shown. The nodes were randomly distributed in area of 1500×1500 m<sup>2</sup>. Among various nodes application of Constant Bit Rate is applied. The nodes 3,29,30 as source and 5,6,27 as destination were connected. The simulation me was run for 20 seconds. The routing protocols taken were AODV, FSR and ZRP.

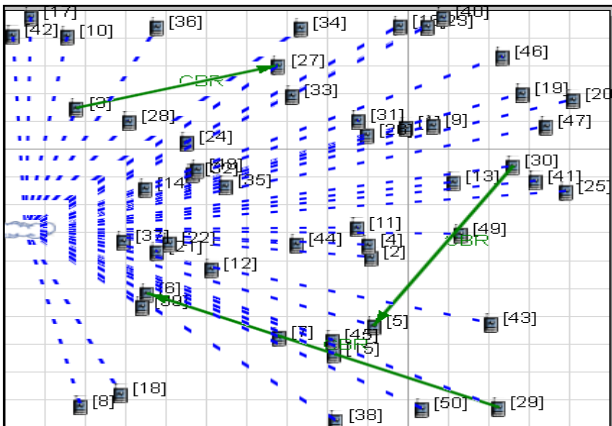


Fig. 3: Snapshot For The Simulation 50 Nodes Using Qualnet 6.1

**IV. RESULTS**

This paper presents a performance evaluation of AODV, FSR and ZRP routing protocols in Mobile Adhoc networks. We measured the throughput, average jitter, average end to end delay, & total messages received as performance metrics. Our simulation result showed that for 20 nodes below.

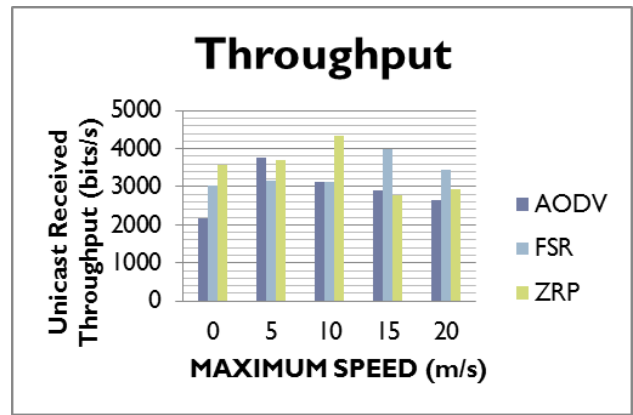


Fig. 4: Throughput in bits/sec for 20 nodes

Fig. 4.1 shows that ZRP has increases initially and reduces when the time increases. The throughput value of FSR maintains its value initially and slowly increases when the time increases. So FSR performs better than other two protocols.

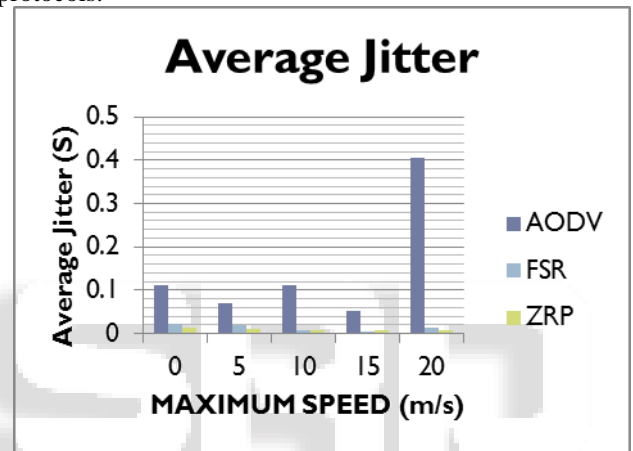


Fig. 5: Average Jitter in secs for 20 nodes

Fig. 4.2 shows that AODV has performed better than other two protocols.

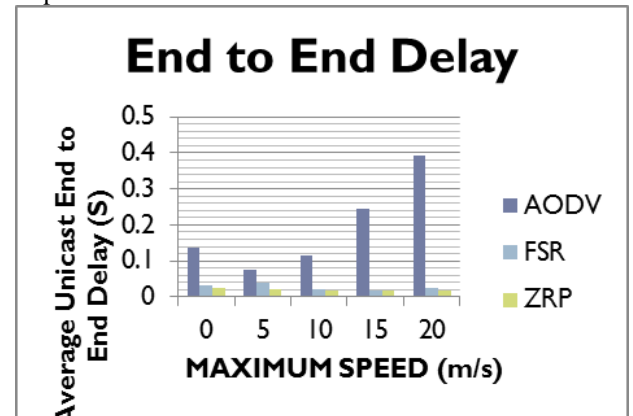


Fig. 6: Average End to End Delay in secs for 20 nodes

Fig. 4.3 shows that AODV has performed better than other two protocols.

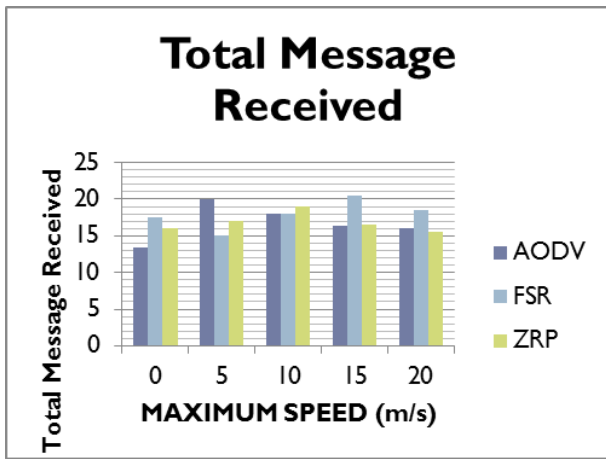


Fig. 7: Total Messages Received in bytes for 20 nodes

Fig. 4.4 shows that FSR protocol has performed better than other two protocols.

Moreover we measured the throughput, average jitter, average end to end delay, & total messages received as performance metrics for 50 nodes. Our simulation result showed that for 50 nodes below.

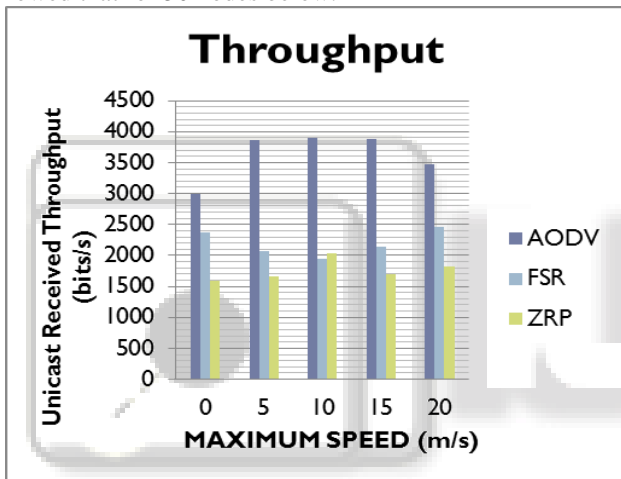


Fig. 8: Throughput in bits/sec for 50 nodes

Fig. 4.5 shows that AODV protocol has performed better than other two protocols.

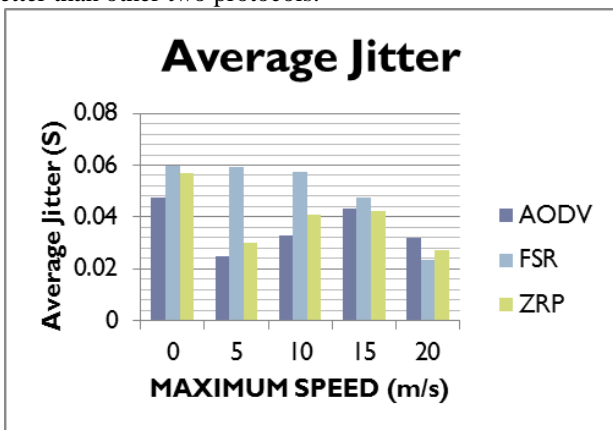


Fig. 9: Average Jitter in secs for 50 nodes

Fig. 4.6 shows that FSR protocol has performed better than other two protocols.

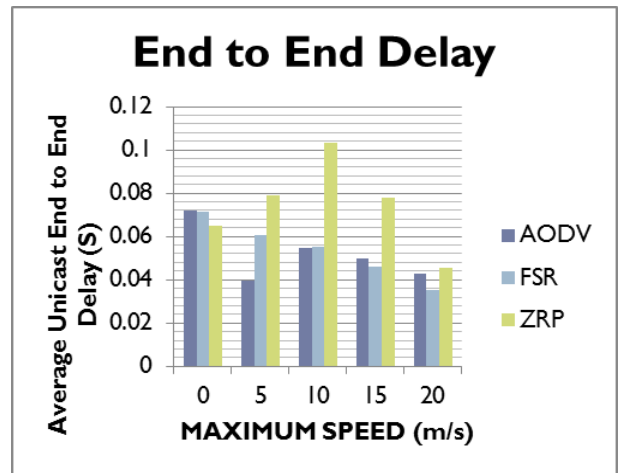


Fig. 10: Average End to End Delay in secs for 50 nodes

Fig. 4.7 shows that ZRP protocol has performed better than other two protocols.

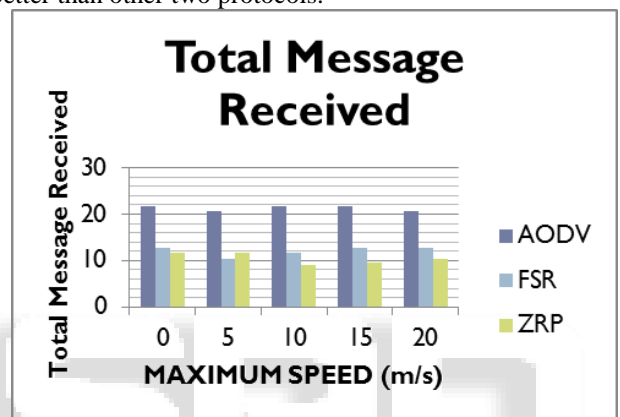


Fig. 11: Total Messages Received in bytes for 50 nodes

Fig. 4.8 shows that AODV protocol has performed better than other two protocols.

## V. CONCLUSION

This paper presents a performance difference of AODV, FSR and ZRP routing protocols we measured the throughput, average jitter, average end to end delay, total messages received as performance metrics. This paper concludes several results such as our simulation result showed that AODV had the best throughput when the node increases but when the node decreases FSR had the best throughput. The Average jitter was found that FSR had the best while higher nodes but the lower nodes AODV is best. The Average end to end delay is better in AODV when the nodes are less but the nodes are more ZRP is best. The total messages received in bytes are highest in AODV in higher nodes and FSR is best when the nodes are less. After analysis in different situations of network it can be practical that AODV perform glowing than other two protocols.

In the future the work may be focused on security, mobility, clustering of nodes, modulation techniques of the MANET networks. Moreover, in the future by varying the network size, the number of source nodes, the mobility models and the speed of the mobile nodes we can analyze these protocols.

## REFERENCES

- [1] Prem Chand and Deepak Kumar (2011). "Performance Comparison of two on demands routing protocols for

- Mobile Adhoc networks” International Journal of Advanced Engineering and Technology (IJAET) Vol. 1, Issue 4, pp. 283-289, September 2011.
- [2] DharamVir, S.K.Agarwal, S.A.Imam (2012). “A Simulation Study on Node Energy Constraints of Routing Protocols of Mobile Ad hoc Networks use of QualNet Simulator” International journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering” Vol. 1, Issue 5, November 2012.
- [3] Nilesh P. Bobade, Nitiket N. Mhala.(2012) “Performance evaluation of aodv and dsr on-demand routing protocols with varying manet size” International Journal of Wireless & Mobile Networks (IJWMN) Vol. 4, No. 1, February 2012.
- [4] Anuj k. Gupta, Jatinder Kaur, sandeep Kaur (2011)“Comparison of dymo, aodv, dsr and dsdvmanet routing protocols over varying traffic”,International Journal of Research in Engineering and Applied science (IJREAS) Vol. 1, Issue 2, October 2011.
- [5] P.Manickam, T. Guru Baskar, M. Girija, D. Manimegalai (2011) “Performance comparisons of routing protocols in mobile ad hoc networks”, International Journal of Wireless & Mobile Networks (IJWMN) Vol. 3, No. 1, February 2011.
- [6] Ajay Kumar, Aswani Kumar Singla (2011)“Performance evaluation of manet routing protocols on the basis of TCP traffic pattern” , International Journal of Information Technology Convergence and Services (IJITCS) Vol.1, No.5, October 2011.
- [7] Mukesh K. Garg, DharamVir, S.K. Agarwal (2013) “Simulation analysis of aodv, dsr and zrp routing protocols in manet using qualnet 5.0 simulator” International Journal of Scientific and Research Publications, Volume 3, Issue 3, March 2013.
- [8] AmmarOdeh, EmanAbdelFattah , MuneerAlshowkan (2012)“performance evaluation of aodv and dsr routing protocols in manet networks”International Journal of Distributed and Parallel Systems (IJDPS) Vol.3, No.4, July 2012.
- [9] N. Arora (2013) “performance analysis of aodv, dsr and zrp in manets using qualnetsimulator” Journal of Engineering Science and Technology Review 6 (1) (2013) 21- 24 , 15,January 2013.
- [10] VikasDahiya, RohitSangwan, ManojDuhan, KusumDalal (2013)“OLSRv2 Implementation and Performance Evaluation over OLSRv1 in MANET using QualNet”International Journal of Scientific & Engineering Research, Volume 4, Issue 7, July-2013.
- [11] B.V.RamNaresh Yadav, K. Priyanka, Syed Sameeruddin, S. Harish (2012) “Performance Analysis of Routing Protocols in MANETs” International Journal of Electronics.