Analyzing the QoS Parameters in Manet for Proactive, Reactive and Hybrid Routing Protocol Using NS-2

Nafeesa Bohra, Saadullah Kalwar, Abdul Q.Ansari, Saba Kotwal

***Abstract* — Mobile Ad-hoc Networks (MANET s) are becoming an essential part of wireless communication due to the growing popularity of mobile devices. MANET has the inherent ability to be self-configured, needless infrastructure and enabling the device to device communication. In MANET each mobile node acts as a router to forward or receive the packets. Nodes are deployed at some locations and support less-infrastructure architecture. These mobile nodes that are in radio range can communicate directly, whereas the intermediate nodes are required for forward and receive purpose. This environment of MANETs has been facilitating the distributed approach over the centralized one. Moreover, the applications are diverse and have always been demanding the efficient routing algorithm. This paper proposes an efficient routing protocol by analyzing the proactive, reactive and Hybrid routing protocols. The study relates the Quality of Service parameters of MANET routing protocols i-e DSDV, DSR, AODV and ZRP using Network Simulator (NS-2). The performance has been analyzed on the basis of End to End Delay, Throughput, Packet Delivery Ratio, Packet dropped, Packet Sent and Received and Normalized Routing Load under different scenarios (varying the traffic type, packet size and the node's mobility). The study concludes that no single protocol fulfills all the requirement. A protocol may have been chosen on the basis of traffic type, packet size, node's mobility and on demand requirement of QOS parameter. The study also concludes that DSDV is better in terms of Average End to End delay. However, DSR, AODV and ZRP are best suited for Throughput. AODV shows the high (Constant) PDF value with respect to nodes and DSR scales well when the node density increases where as DSDV demonstrate the constant behavior (low in value) with varying node density. Moreover, ZRP scales well in low density mode concerning PDF.**

***Index Term* – AODV, DSDV, DSR, ZRP, QoS parameters, MANET**

I. INTRODUCTION

Ad-hoc Network creates the on-demand session that does not have need of base station, but establish the session between the devices. Ad-hoc Network is classified into two types: (i) MANET and (ii) VANET. MANETS are the mobiles that can communicate with each other on demand without any base station or access point via radio link. In MANET each mobile node acts as a router to forward or receive the packets. Nodes are deployed at some locations and support less infrastructure architecture. These mobile nodes that are in radio range can communicate directly, whereas the intermediate nodes are required for forward and receive purpose. This multi-hop scenario is distributed in nature, supports the correlated traffic and the link nodes can communicate at any time or anywhere. The distributed approach (MANET) has an edge over the centralized one. A usual demand has been set by the customer of being connected even the current user is out of the communication range of the base station. Moreover, if we set up a single session between the node (that is out of range) and the base station, there will always be a requirement of high bandwidth that can ultimately increase the cost. However, the users usually demand the solution that is cost effective. This is where Mobile Ad-hoc Networks step in. In this paper, the Quality of Service (QoS) parameters of MANET routing protocols i.e. Destination Sequence Distanced Vector (DSDV), Ad-hoc On Demand Distance Vector (AODV), Dynamic Source Routing (DSR) and Zone Routing Protocol have been analyzed on the basis of End to End Delay, Throughput, Packet Delivery Ratio (PDR) and Normalized Routing Load (NRL) under different scenarios (varying node's density).

A. *PROPOSED WORK*

To the best of our knowledge there isn't any literature in which QoS parameters of Proactive, Reactive and Hybrid routing protocols of MANET are analyzed simultaneously. In [1] & [2] proactive and reactive routing protocols have been analyzed on the basis of end to end delay, throughput, NRL and PDR. but few distinctions have been proposed in our study such as the limitation of proactive routing protocol is its scalability and bandwidth, whereas reactive protocol suffers from delay to determine the fresh path. To overcome these deficiencies, moderate approach of hybrid routing protocol has been proposed. Moreover, DSDV being a proactive routing protocol has low end to end delay value and AODV has the highest PDR value. There are some distinctions in terms of simulation parameters (Area Size, node's mobility)

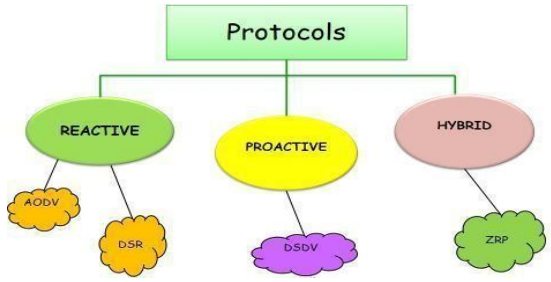

Fig. 1 Routing Protocols

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and QoS Parameters. The paper is organized as follows: MANETS routing protocols (Proactive, Reactive and Hybrid) are reviewed in Section II, while in Section III, the methodology is discussed to analyze the QoS parameters of proactive, reactive and hybrid routing protocol versus node density by using NS-2, in Section IV the results are discussed while the conclusion is in Section V.

II. MANET ROUTING PROTOCOLS

MANET routing protocols are categorized as Proactive, Reactive and Hybrid as shown in Figure.1

In proactive protocols, routes to all the nodes in the network are discovered in advance. The Whole table is broadcasted after a fixed interval of time independent of any route changes or not.

A. Destination Sequence Distance Vector (DSDV)

This algorithm uses a routing table like Distance vector (RIP), but each routing table entry is tagged by sequence number, generated by destination. To maintain consistency among routing tables in a dynamically varying topology, updates are transmitted periodically. Each mobile station advertises its own routing table to its current neighbors [3]. The entry of each mobile node in a route is identified by the unique sequence number. The explorer of the sequence number is the owner node. The owner node broadcasts its update when there is nothing to change in the topology, but the non-owner node discovers the route first and updates the table if there is a link break on that route. There are two regular updates in DSDV [4], one is called Incremental update and other one is Full Dump update. In incremental update, only that information is sent which has changed since last update but Full Dump means sending whole routing table. In order to resolve the broadcast fluctuation problem after every certain period of time, the routing table must be updated that may achieve only on the basis of receiving information from the neighbor nodes. Table I illustrates the merits and de-merits of DSDV.

TABLE 1. Merits & Demerits of DSDV

MERITS	DEMERITS
The route information is obtainable.	Unwanted broadcast fluctuation in routes increases the overhead bytes.
End to end delay is low.	Throughput has an inverse relation with the overhead bytes. Thus, throughput decreases in DSDV with the increment of overhead bytes

Reactive routing protocols are called as on-demand routing protocol i-e whenever a node wants to send data it initiates the route discovery process [5].

B. Dynamic Source Routing (DSR)

In DSR the route discovery process is established whenever the node wants to transmit the data.

DSR Mechanism

a) Route Discovery

When some node S originates a new packet destined to some other node D, it places in the header of the packet a source route, giving the sequence of hops that the packet should follow on its way to D. Normally, the S will obtain a suitable source route by searching its Route Cache of routes previously learned. In case no route is found in its cache, it will initiate the Route Discovery protocol to dynamically find a new route to D. In this case, we call S the initiator and D the target of the Route Discovery [6].

b) Route Maintenance

Each node must require confirming the receipt of next hope. In case of no acknowledgment then there is always retransmission. Table II illustrates the merits and de-merits of DSR.

TABLE 2. Merits & Demerits of DSR

MERITS	DEMERITS
No broadcast	DSR suffers with the high end to end
overloaded. Thus,	delay because it does not know about
a low Normalized	the topology.
Routing Load.	
A large throughput value.	Inclusion of packet header at each node increases the overhead bytes.

C. ADHOC-On Demand Distance Vector (AODV)

AODV is an on- Demand Routing Protocol and deals with a Route Request Message (RREQ) and Route Reply Message (RREP). If a source node wants to communicate with the node that does not lie in the communication range, then there is a transfer of data through [7] neighboring node. In that case Source initiates, the RREQ message and sends to the next node. If the next node knows about the destination address, then it sends the RREP message as an acknowledgment. If the neighbor node does not know about the destination, then it re-broadcast the RREQ message [8]. The RREQ message holds sequence number, addresses and the life of RREQ. Table III illustrates the merits and de-merits of AODV.

TABLE 3. Merits & Demerits of AODV

MERITS	DEMERITS
The use of the sequence	the old sequence number
number helps to find	finds the old route
the best route	
minimized the end to	
end delay value	
low NRL value as	Multiple RREP message
compare to DSDV	in response to single RREQ message
	Increases the routing

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D. Zone Routing Protocol (ZRP)

ZRP (Zone Routing Protocol) is a hybrid protocol incorporating the merits of on-demand and table driven protocol [9]. A routing zone is similar to a cluster with the exception that every node [10] acts as a cluster head and a member of another cluster. Zones can overlap. Each node specifies a zone radius in terms of radio hops. The size of a chosen zone can, therefore affect ad hoc communication performance [11]. The nodes within the zone use the proactive approach of routing protocol, whereas those nodes which lies outside has an effective method of on-demand routing updates [12].

ZRP is further divided into three sub protocols [13].

- Intra Zone Routing Protocol (Proactive-IARP)
- Inter Zone Routing Protocol(Reactive-IERP)
- Border Cast Resolution Protocol(BRP)

IARP – uses a routing table. Any route to the destination within the zone can be immediately found from routing cache. This is done by IARP.

IERP- relies on border nodes to search for the on-demand query of exterior node [14] as shown in Figure 2. It is observed that K and L are exterior nodes whereas C, D, J, E and H are the interior nodes. Table IV illustrates the merits and de-merits of ZRP.

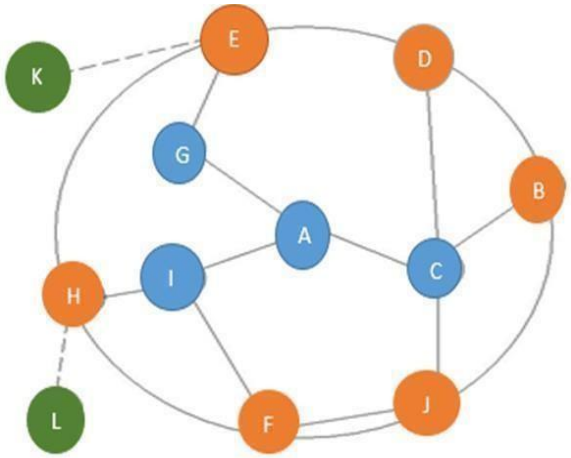

Fig. 2 Zone Routing Protocol

TABLE 4. Merits & Demerits of ZRP

MERITS	DEMERITS
Highest	ZRP is no longer suited for nodes greater
throughout value	than 50.
at 30 and 50 no:	
of nodes.	
Low end to end delay value as compare to DSR.	Has the larger end to end delay for the nodes greater than 90.

III. QUALITY OF SERVICE PARAMETERS

This describes the experiment session to compare the Quality of Service Parameters by using the Network Simulator tool (NS-2). Simulation has been performed with varying nodes [15] using DSDV, DSR, AODV and ZRP. The movement of nodes is given as follows:

- Nodes move with a random speed from 105m/s to185m/s
- There are five CBR connection with pause time equal to zero
- The difference of the start and stop time of each CBR connection is 10 Second
- Peer-to-peer connections started at times uniformly distributed between 0 and 0seconds.

TABLE 5. Parameters and Values

Parameters	Value
Antenna type	Omni directional
Area	3000 x 3000
Node's mobility	30 50 70 90 100
Packet size	512 bytes
Traffic type	CBR
MAC Protocol	IEEE 802.11
Routing Protocols	DSDV, DSR, AODV, & ZRP
No:of traffic Connections	5
Mobility Model	Random Way Point
Performance Metrics	Packet Delivery Ratio (PDR), Normalized Routing Load (NRL), Average Throughput, End-to-End Delay

Performance matrices are defined in figure 3.

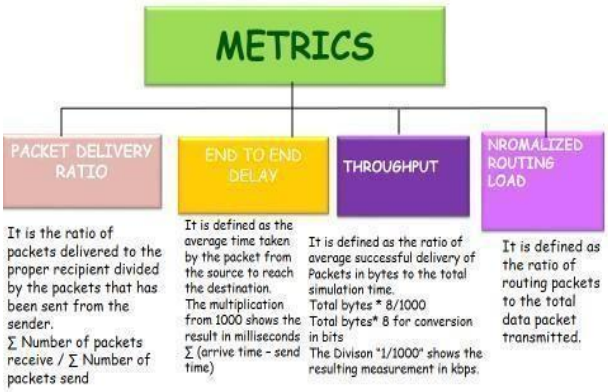

Fig. 3 QoS Parameters

IV. RESULTS AND DISCUSSIONS

As an initial experiment the QoS analysis for proacti protocols verses nodes has been taken into consideration with the help of the simulation parameters shown in Table V and the analysis are discussed as follows:

A. Nodes vs Packet Delivery Ratio

Figure 4a and 4b show the comparative result of packet delivery ratio among DSDV, DSR, AODV and ZRP. It is

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observed that AODV shows the high (constant) PDF value with respect to nodes. Whereas, DSR scales well when the node density increases. However, DSDV demonstrate the constant behavior (low in value) with varying node density. Among all the protocols ZRP scales well up to 50 no. of nodes

B. Nodes vs Average Throughput

Figure 5a and 5b shows the comparative analysis of Nodes vs Average Throughput among DSDV, DSR, AODV and ZRP. It is analyzed that the increase in the routing load decreases the throughput ratio. Thus, DSDV suffers with lower throughput value. However, AODV has the largest throughput value among all. Whereas, ZRP shows better Performance when the no: of nodes are 30 and 50.

C. Nodes vs End to End Delay

Figure 6a and 6b shows the comparative analysis of Nodes vs End to End Delay among DSDV, DSR, AODV and ZRP. DSR and AODV both are un-aware about the Network Topology, but the use of the sequence number in AODV helps to find the best route that minimizes the End to End delay. In DSDV the concerned information about the route can be obtained due to constant updates of the routing table. ZRP has the shortest average End to End delay value due to the proactive approach. Moreover, the delay can be increased or decreased with the varying zone size

D. Nodes vs Normalized Routing load

Figure 7a and 7b shows the comparative result for Normalized Routing Load among DSDV, DSR, AODV and ZRP. It can be observed that for DSDV protocol there are unwanted periodic updates of regular intervals. These updates are broadcasted among all routes that may increase the routing load so as the NRL. For DSR and AODV, there are no regular updates and it follows the Multicast over broadcast. ZRP demonstrate the low NRL value. BRP passes the RREQ message to border node.

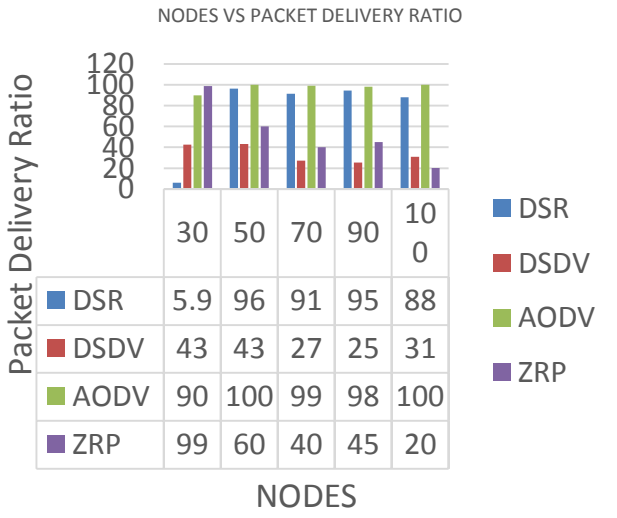

Fig. 4a Nodes vs Packet Delivery Ratio

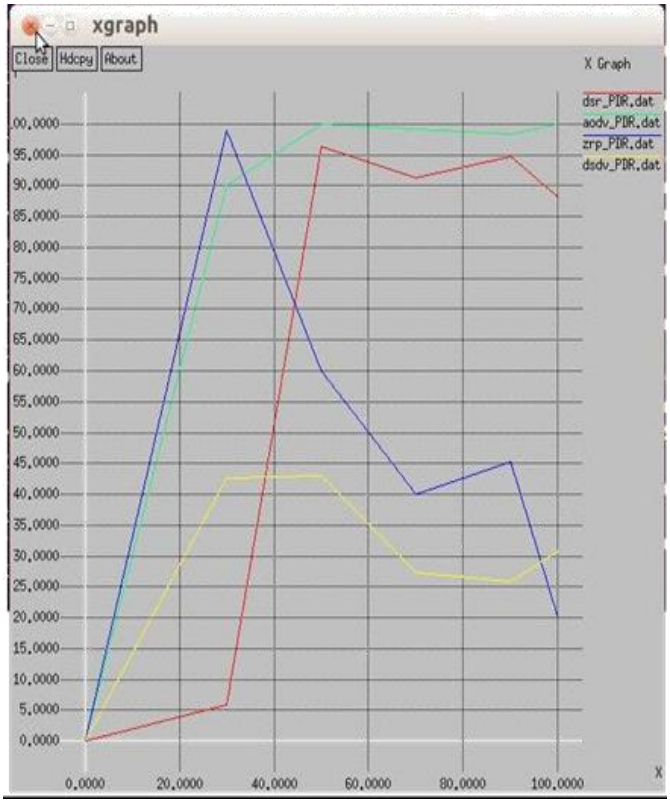

Fig. 4b Xgraph of Nodes vs Packet Delivery Ratio

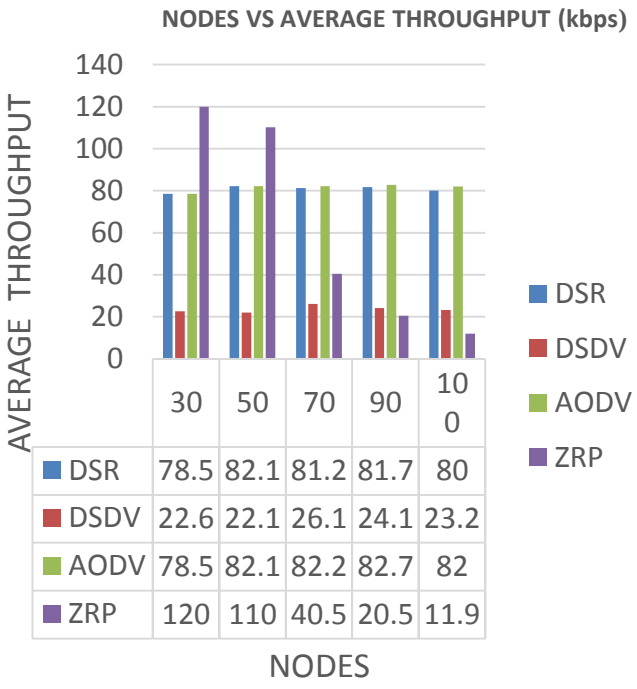

Fig. 5a Nodes vs Average Throughput

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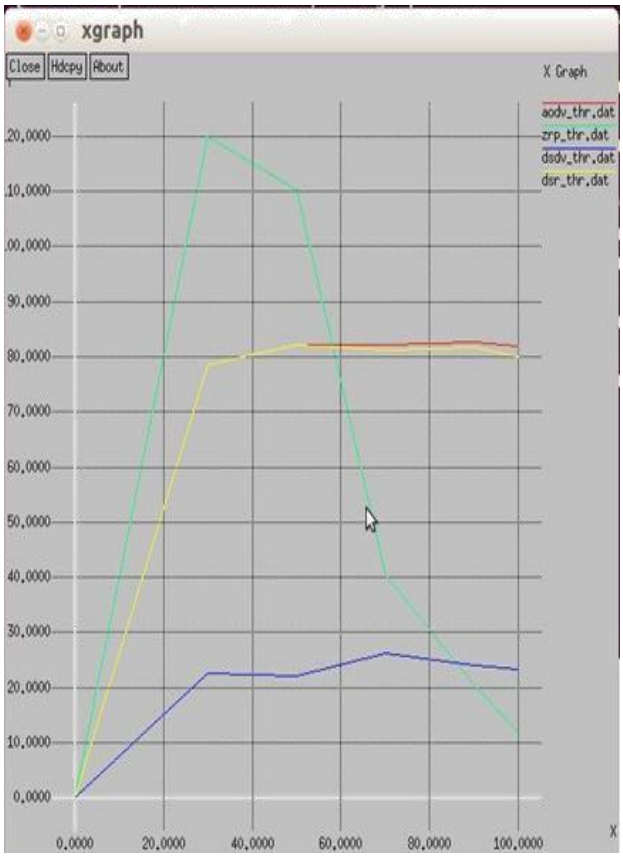

Fig. 5b Xgraph of Nodes vs Average Throughput

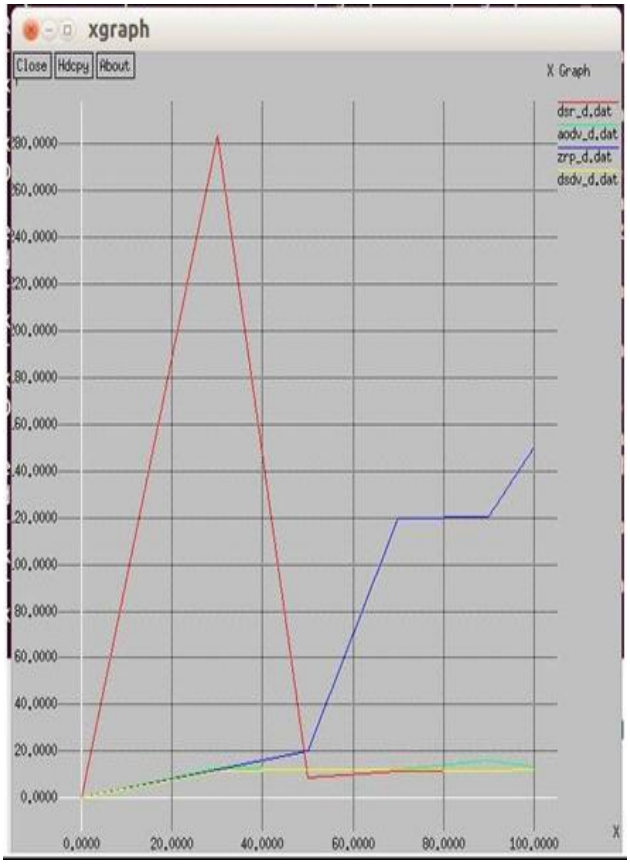

Fig. 6b Xgraph of Nodes vs End to End Delay

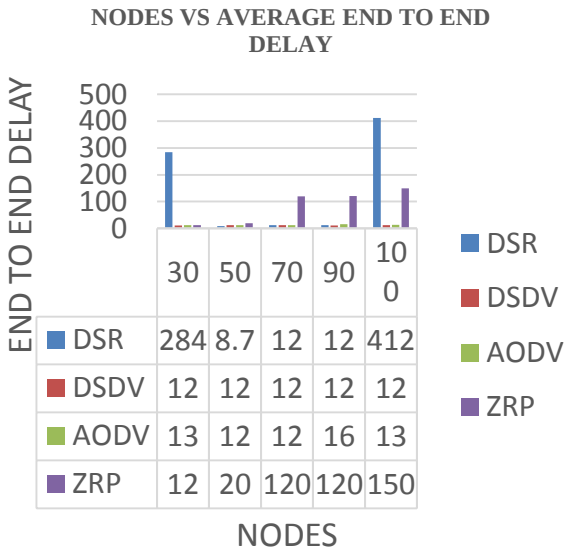

Fig. 6a Nodes vs End to End Delay

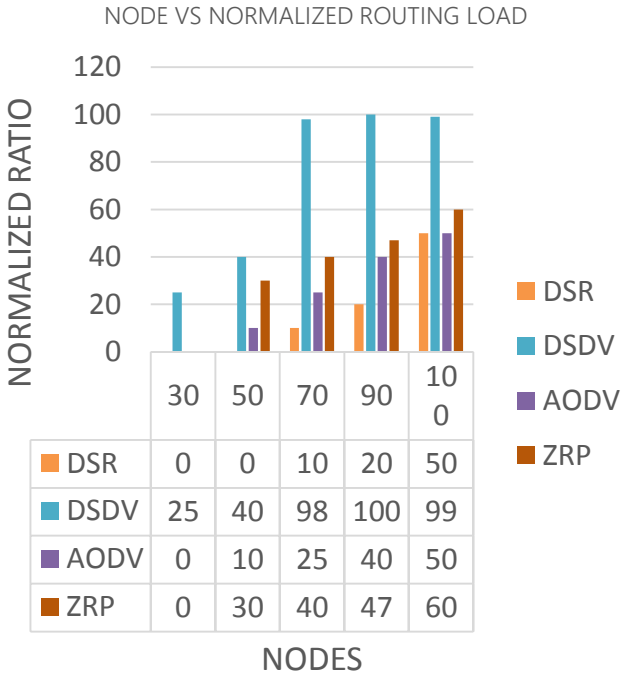

Fig. 7a Nodes vs Normalized Routing Load

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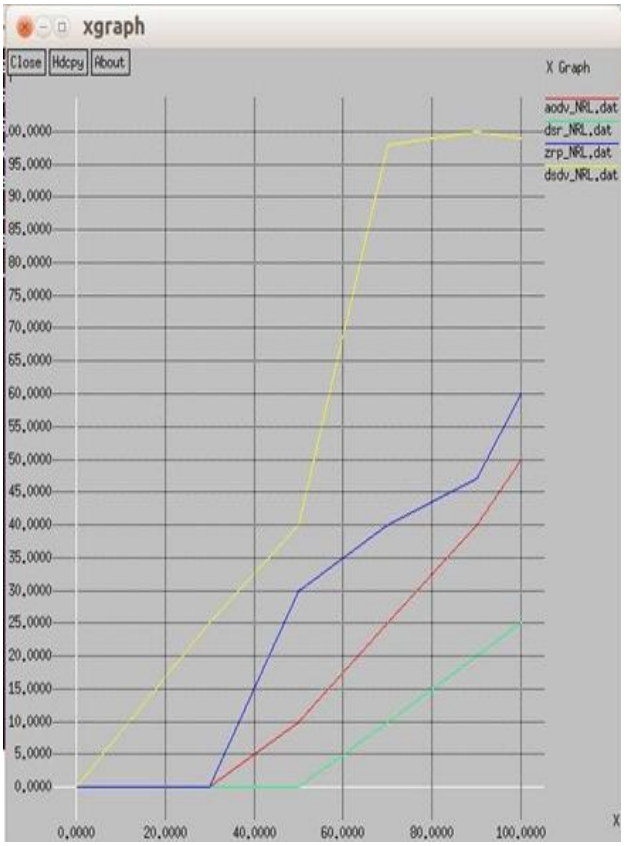

Fig. 7b Xgraph of Nodes vs Normalized Routing Load

V. CONCLUSION

Three categories of routing protocols for MANET, namely, proactive, reactive and hybrid are reviewed. The limitation of proactive routing protocol is its scalability and bandwidth, whereas reactive protocol suffers from delay to determine the fresh path. To overcome these deficiencies, moderate approach of hybrid routing protocol has been proposed. The study concluded that ZRP as per hybrid has high throughput and low delay value in varying no: of nodes. DSDV keeps the consistency in terms of delay with varying no: of nodes. However, the delay of DSR and AODV has been afflicted by nodes. The high sequence number in AODV helps to find the best route that decreases the end to end delay value when compared with DSR. The constant periodic updates after every certain interval of time increases the NRL value of DSDV. AODV and ZRP stood at low values in terms of the average end to end delay. Hence it is concluded that AODV and ZRD works better than DSDV and DSR with varying nodes. However, as future extension we are working over a scenario with varying time to analyze the QoS parameters for DSDV, DSR, AODV, and ZRP. We are also planning to perform experiments where FTP traffic has been shared with varying nodes. Due to the limited page number we have restricted ourselves only to initial experiment (Nodes vs QoS parameters) as mentioned above

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