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ZONE BASED ANALYSIS OF ZRP UNDER VARYING MOBILITY AND TRANSMISSION RANGE IN MANETs

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Abstract— ***Mobile adhoc network (MANETs) is emerging wireless technology for research field that work with reactive,proactive and hybrid routing protocols. In MANETs , mobility is major issues on mobile adhoc networks, there are several problems in routing with Mobile Ad hoc Networks like asymmetric links ,routing overhead , dynamic topology and interference.This paperfocused on ZRP to designing scenario for parameters that give its best and how much effective this protocol is.NS-2.34 simulator environment has been used to analysis* the performance of ZRP for different zone radius *by varying mobility rate and communication distance along with zone radius on QoS based performance metrics*.**

Keywords— *MANETS, AODV, ZRP, NS-2, PDR,, CBR traffic*

I INTRODUCTION

Wireless networking is an emerging technology that allows users to access information and services electronically, regardless of their geographic position. Wireless networks can be classified into two types:one is infrastructure less (Ad Hoc) network which is used to form a wireless ad hoc network among users wanting to communicate with each other with no pre-established infrastructure and other is infrastructure networks, in this type of network a mobile host communicates with the network through an access point within its communication radius. An ad hoc network uses no centralized administration. Every node acts both as a host and as a router. The topology of ad hoc networks varies with time as nodes move, join or leave the network. This topological instability requires a routing protocol to run on each node to createand maintain routes among the nodes. For instance, if a node leaves the network and causes link breakages, affected nodes can easily request new routes. Although there are incremental delays, the network continues to remain operational. Wireless ad hoc networks take advantage of the inherent nature of the wireless communication medium. Ad hoc networks are useful for the applications such as disaster recovery, automated battlefields, agriculture fields, security and vigilance, search and rescue, crowd control, conferences, meetingsand lectures where central or fixedinfrastructure is not available. MANETs are characterized by the mobility ofnodes, which can move inanydirection and at any speed that may lead to arbitrary topology and frequent partition in the network. This characteristic of the network makes the development of routing protocols as one of the most challenging issue. MANETs routing protocol can be categorized into three categories as shown in figure 1.1.

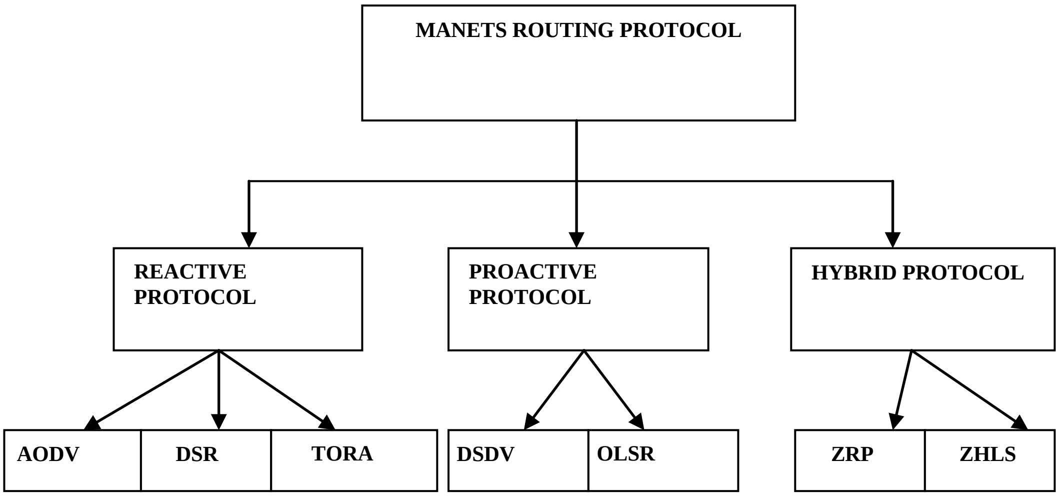


Fig. 1 Classification of Ad Hoc Network Routing Protocols

In view f the necessity of developing efficient routing protocols, the present work focuses on the performance evaluation of ZRP when mobility rate and communication distancevaries with respect to different performance metrics.

II. PROPOSED METHODOLOGY

From the literature survey it was found that lot of work has been done on ZRP, but no research work suggested us how well ZRP will adapt in MANET with respect to nodes mobility, zone size andtransmission range.From the literature review, it was found that there are several problems in routing with Mobile Ad hoc Networks like asymmetric links and interference.In asymmetric links most of the wired networks rely on the symmetric links which are always fixed. But this is not a case with ad-hoc networks as the nodes are mobile and constantly changing their position within network. But major problem is interference in which mobile ad-hoc networks as links come and go depending on the transmission characteristics, one transmission might interfere with another one and node might overhear transmissions of other nodes and can corrupt the total transmission. one node transmission might interfere with another one and node might overhear transmissions of other nodes and can corrupt the total transmission. So objective is to analyze the impact of network density on ZRP under varying mobility rate and transmission range in MANETs. Network simulator NS-2 version 2.34 is used to implement ZRP in order to achieve the desired objective.

A. Simulation And Results

In this work, main aim is to simulate and analyze performance of ZRP routing protocol under varying mobility rate and communication distance. Simulations are done considering a network of 100 mobile nodes placed randomly within 1500×1500 m^2 area. Constant bit rate (CBR) data sessions among randomly chosen 40 source-destination pairs are used. However, during this data transfer process, all nodeswill operate in the background for providing the necessary support (i.e., routing/forwarding) to the ongoing communication process in the network. The data rate chosen is 2 Mbps while the data packet size chosen is 512 bytes. The data packets are sent at a rate of 4 packets/sec by each source. Each simulation is executed for 150 seconds. Multiple runs with different seeds have been conducted for each scenario and the collected data is averaged over these runs. The nodes are considered to be mobile and simulations are performed by varying the mobility rate and then communication range of the nodes.

B. Network Simulator – ns2

NS-2 is a discrete event simulator targeted at networking research. It provides substantial support for simulation of TCP routing and multicast protocols over wired and wireless networks. It consists of two simulation tools. The network simulator (NS) contains all commonly used IP protocols. The network animator (NAM) is use to visualize the simulations. NS-2 fully simulates alayered network from the physical radio transmission channel to high-level *applications.* Network Simulator (Version 2), widely known as NS-2, is simply an event-driven simulation tool that has proved useful in studying the dynamic nature of communication networks. Simulation of wired as well as wireless network functions and protocols (e.g., routing algorithms, TCP, UDP) can be done using NS-2..NS-2 consists of two key languages: C++ and Object-oriented Tool Command Language (OTcl). While the C++ defines the internal mechanism of the simulation objects, the OTcl sets up simulation by assembling and configuring the objects as well as scheduling discrete events. The C++ and the OTcl are linked together using TclCL. After simulation, NS-2 outputs either text-based or animation-based simulation results.

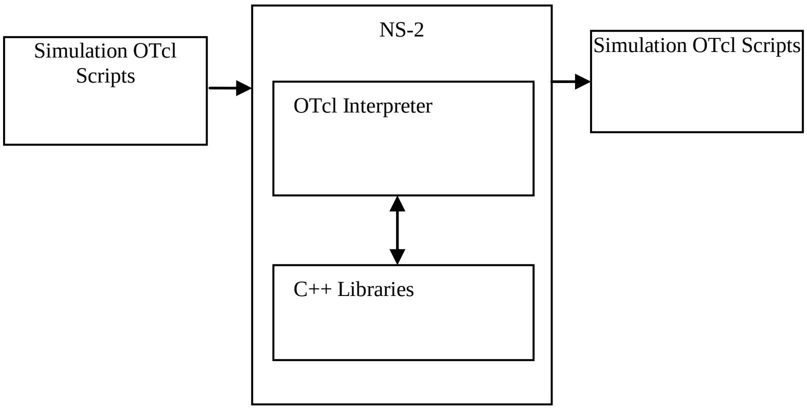


Fig. 2*Data flow for One Time Simulation*

To interpret these results graphically and interactively, tools such as NAM (Network AniMator) and XGraph are used. presentation. To analyze a particular behavior of the network, users can extract a relevant subset of text-baseddata and transform it to a more conceivable.As Fig. 2 shows, for the data flow of one time simulation in ns-2, the user input an OTcl source file, the OTcl script do the work of initiates an event scheduler, sets up the network topology using the network objects and the plumbing functions in the library, and tells traffic sources when to start and stop transmitting packets through the event scheduler. And then, this OTcl script file will be passed to ns-2. After a simulation is finished, NS produces one or more text-based output files that contain detailed simulation data, and the data can be used for simulation analysis.

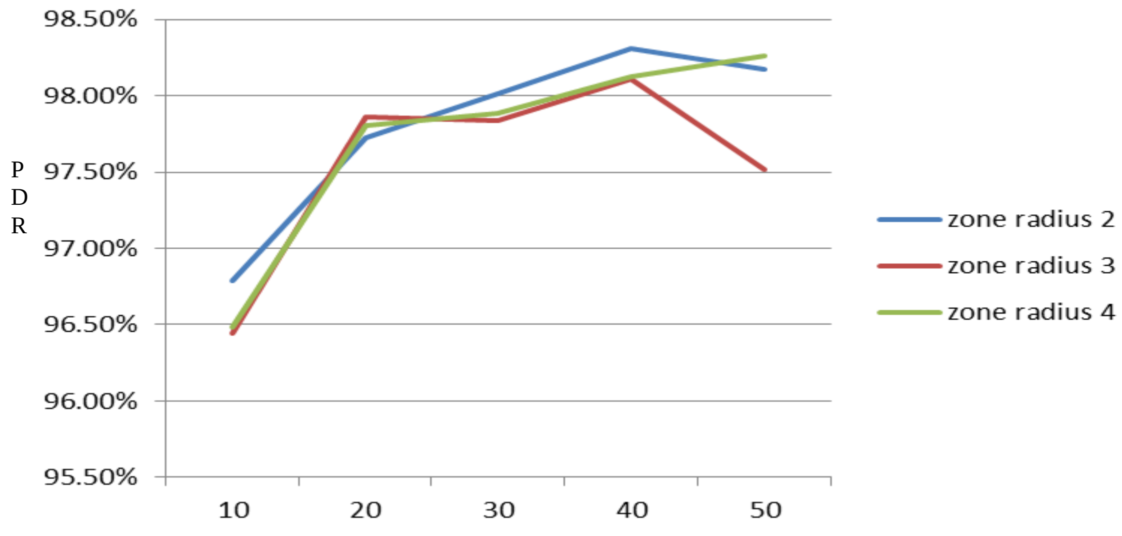
NS-2 fully simulates a layered network from the physical radio transmission channel to high-level applications.Here the basic parameters for implementing AODV, DSDV and ZRPin NS-2 are presented. Summary of salient simulation parameters taken is presented in Table 1.1.Performance evaluation of different routing protocols is analyzed for varying pause time with respect to packet delivery ratio, Average end-to-end delay, throughput and routing overhead performance metrics.

Table I *Salient Simulation Parameters*

Parameter	**Value**
Simulation Time	150 sec
Terrain Area	1500×1500 m^2
Number of Nodes	100
Node Placement Strategy	Random
Propagation Model	Two-Ray Model
Data Rate	2 Mbps
Mobility Model	Random-Waypoint
Radio Type	Accumulated Noise Model
Mobility rate	10,20,30,40 (m/s)
Communication – distance	130 to 250 (m)
Routing Layer Protocols	ZRP
Zone Radius	2, 3 and 4

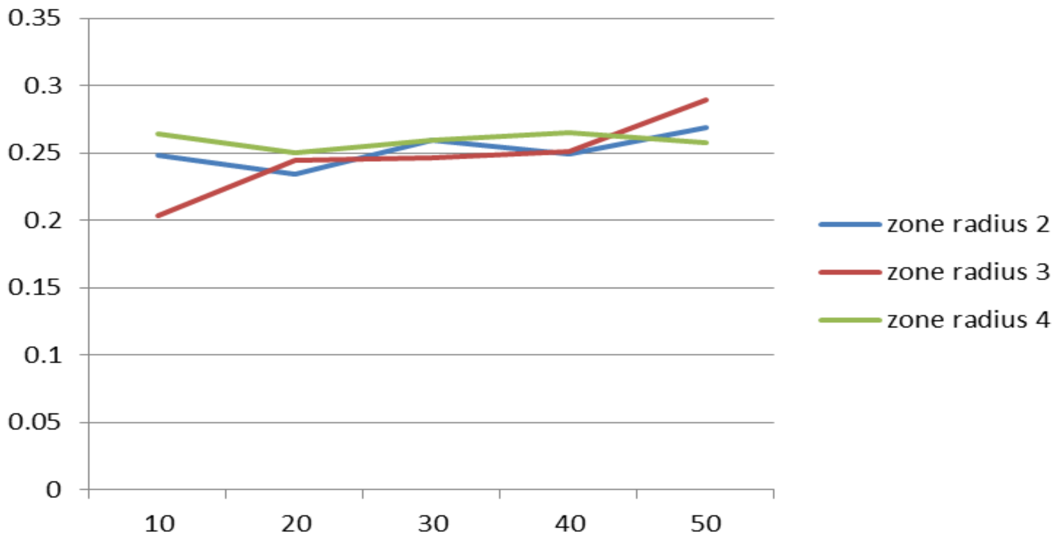
The performance of the ZRP with Constant Bit Rate (CBR) Traffic has been analyzed using NS-2.33 simulator. The performance metrics includes the following QoS parameters such as Packet Delivery Ratio (PDR), Throughput, End to End Delay and Routing Overhead

Figure 3 plotted for PDR whichis the ratio of the data packets delivered to the destinations to those generated by the CBR sources. This metric characterizes both the completeness and correctness of the routing protocol. The zone routing protocol gives better results when lower zone radius i.e 2, 3 and higher mobility rate are chosen.



Mobility rate

Fig. 3 Impact of mobility rate on the packet delivery ratio for different Zone Radius.



Mobility rate

Fig. 4 Impact of mobility rate on the Avg. delay for different Zone Radius.

Fig. 4 plotted for end to end delaywhich is the average time taken by a data packet to reach from source node to destination node. It is ratio of total delay to the number of packets received. This shows ZRP for zone radius 3 gives better result than other zone radius considered.

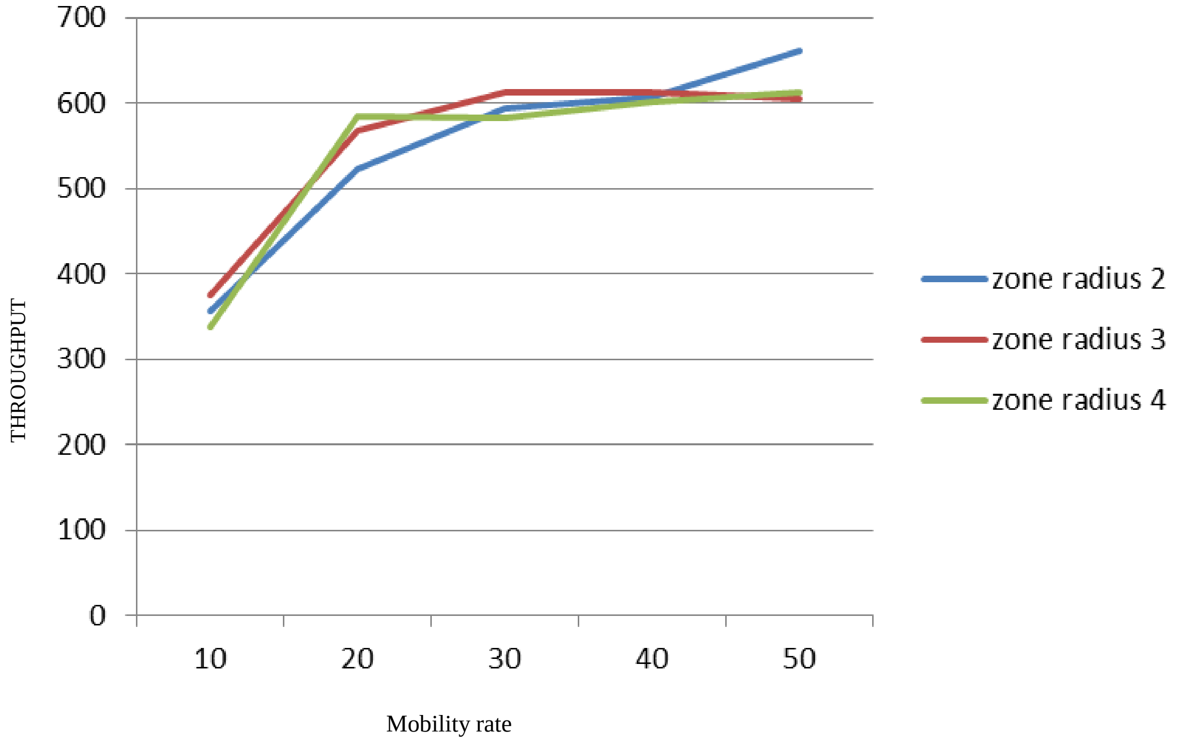


Fig. 5 Impact of mobility rate on Throughput for different Zone Radius.

Fig. 4 plotted for throughput that is the ratio of total number of delivered or received data packets to the total duration of simulation time., it is observed that ZRP for zone radius 3 gives better throughput than other zone radius considered over higher mobility rates.

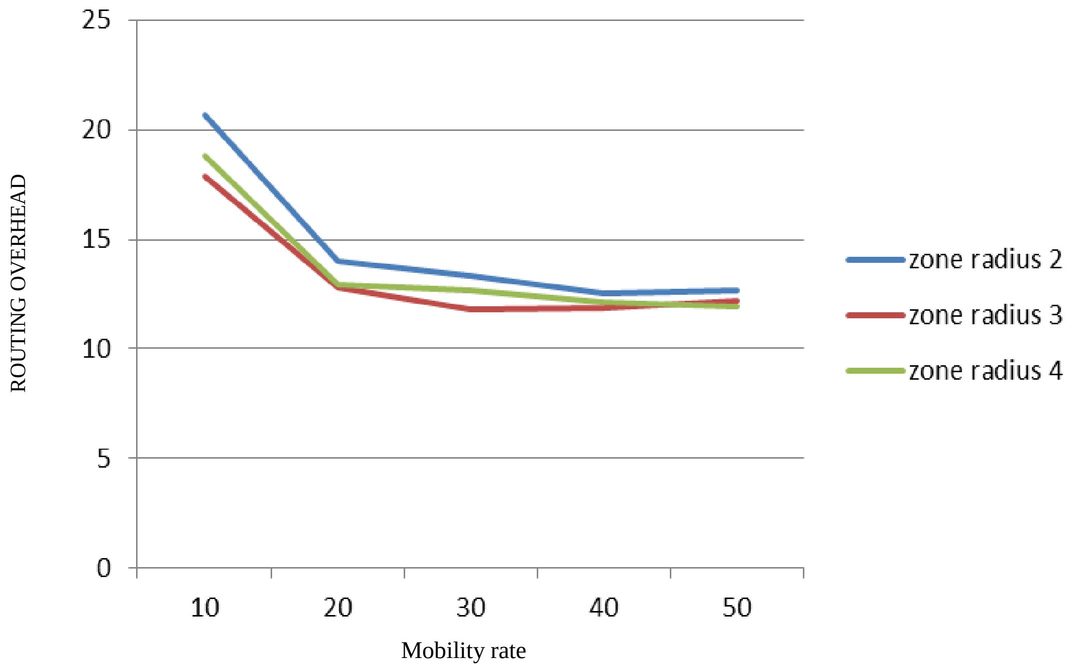


Fig. 6 Impact of mobility rate on the routing overhead for different Zone Radius

In case of routing overhead, it is observed that ZRP under lower zone radius and higher mobility rate performs betters.

Performance of ZRP is also evaluated with respect to varying communication range. This is also calculated with respect to PDR, end-to-end-delay, throughput and routing overhead and shown all the scenarios.

Fig. 7 Impact of communication distance on packet delivery ratio for different Zone Radius.

As per from the figure 7, this is shown that ZRP for lower zone size performs better when transmission range is greater than 210 m.

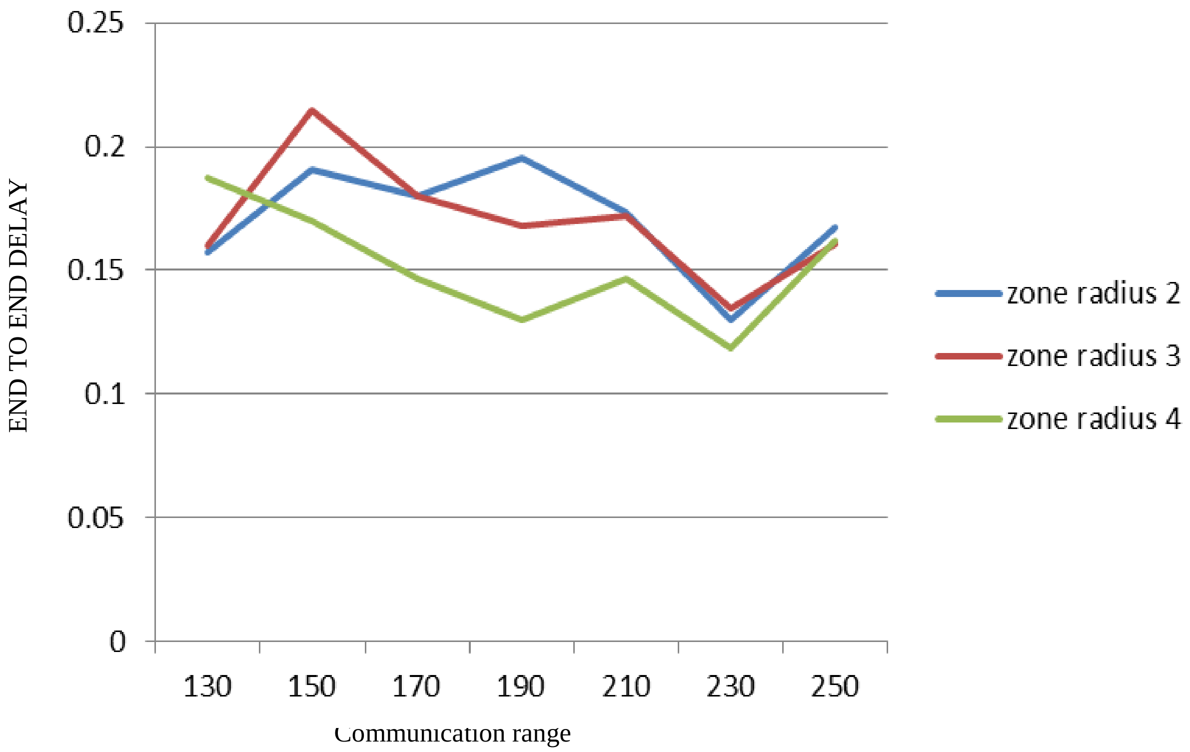


Fig 8 Impact of communication distance on the Avg. end to end delay for different Zone Radius

Figure 8 illustrates the impact of comm. distance on end-to-end delay. In this ZRP gives better results for zone radius 3 and transmission range – 230m.

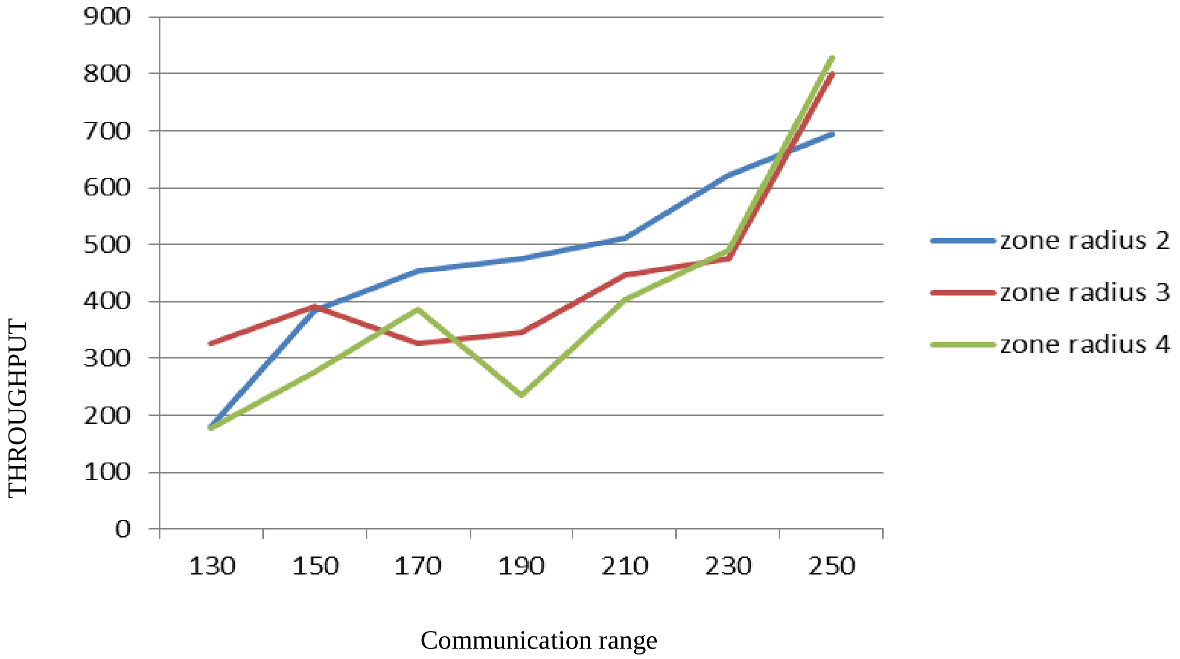


Fig. 9 Impact of communication distance on the throughput for different Zone Radius

Figure .9 it is cleared that when communication range is high, ZRP for higher zone radius gives better results.

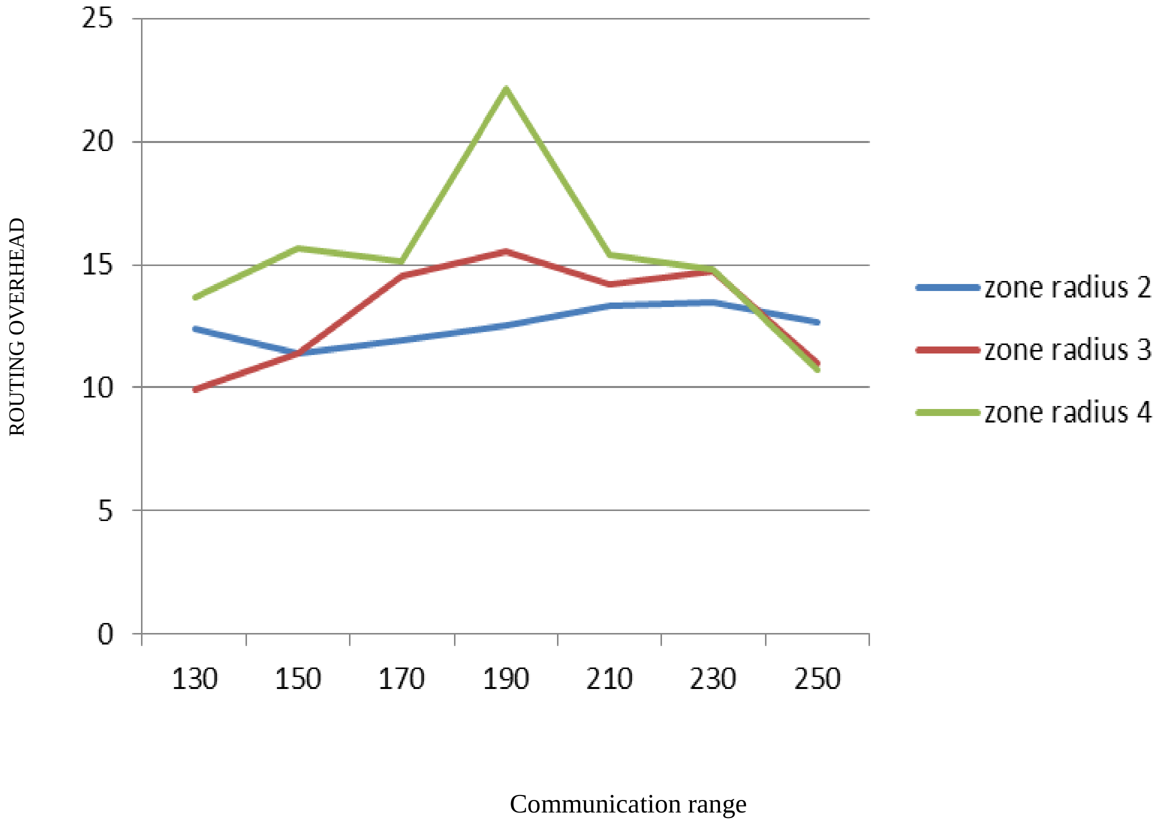


Fig. 10 Impact of communication distance on the routing overhead for different Zone Radius

Figure 1.10 shows that ZRP for lower zone radius gives better results as compare to higher zone radius under different comm. r ange.

IV. LITERATURE REVIEW

Routing in MANETs: A lot of research has been done on routing in MANETs and a number of routing protocols have been designed and developed. Some of them are popularly used and always been the areas of study. In [1] a survey on MANET routing protocols has been done categorizing unicast, multicast and broadcast routing algorithms. Unicast algorithms are further categorized as reactive, proactive and hybrid routing algorithms. If source and destination mobile nodes are within each other's transmission range, they can communicate with each other directly; otherwise, the intermediate nodes in between have to forward the packets for them. In such a case, every intermediate mobile node has to function as a router to forward the packets for others. Thus, routing is a basic operation for the MANET. [10] provided a broad classification of ad hoc network routing protocols. To overcome the problems associated with the link-state and distance-vector algorithms a number of routing protocols have been proposed for MANETs. These protocols can be categorized into three categories : ondemand/reactive, global/proactive and hybrid routing protocols. In reactive protocols, routes are determined when they are required by the source using a route discovery process. In proactive routing protocols, the routes to all the destination are determined at the start up, and maintained by using a periodic route update process. Hybrid routing protocols combine the best properties of the first two classes of protocols into one. That is, they are both reactive and proactive in nature.

Ashish K Maurya et al. in [5] showed the evaluation of ZRP in variable pause time and variable number of nodes. The performance of AODV, ZRP and FSR has been compared with QUALNET simulator. From the simulation, it has analyzed with respect to pause time that FSR in scenario 1 and ZRP in scenario 2 show lowest end to end delay. In both scenarios, ZRP has less average jittering than AODV and FSR. T Ravi Nayak et al. in [6] an extension for ZRP protocol (AZRP) has been proposed that can adapt well to the complicated network with nodes moving non-uniformly. AZRP utilizes the excellent performance of the hybrid-driven manner of ZRP. The simulation comparison between DSDV, DSR, ZRP and AZRP are done for 5, 10, 20 and 30 nodes on packet delivery ratio, the overhead of routing and latency. Their results show the better performance for AZRP with these parameters.

Dr. Rajneesh Kumar et al. in [7] analyzed the impact of scalability on various QoS parameters for MANET proactive (DSDV) routing protocol and reactive on reactive routing protocols. They observed simulation from eight different scenarios and analyzed AODV protocol in QoS ware routing protocols under the effect of scalability in terms of variation in number of nodes, mobility and packet intervals.

Preeti Arora and GN Purohit in [8] studied and compared the performance of AODV, DSR, ZRP for mobile WiMAX environment under assumption that each of the subscriber station has routing capabilities within its own network. They showed that ZRP and AODV protocols outperform DSR and applications are growing rapidly as it provides freedom to subscribers to be online using variety of mobile and nomadic devices.

Sree Ranga Raju et al. in [9] considered protocols of AODV and DSR as a reference for analyzing ZRP and used QUALNET simulator. They observed ZRP uses additional time as it uses IARP, IERP by studying ZRP operation of route discovery. They took different parameters for performance analysis like end to end delay, packets received etc.

Brijesh Patel et al. in [10] an analytical model that allows us to determine the routing overhead incurred by the scalable routing framework ZRP. In order to make ZRP adaptive, the mechanisms must be devised for detecting the non-optimality of zone radius setting. In addition to that, the cost-benefit analysis must be done to understand the tradeoff involved between the optimality detection cost and additional overhead cost incurred due to non-optimality.

Ayyaswamy Kathirvel et al. in [11] compared the performance of DSR, AODV, FSR and ZRP with respect to propagation model. Reactive routing protocols (AODV and DSR) have got good packet delivery ratio. When compared with proactive and hybrid routing protocols, hybrid routing protocol have got next higher packet delivery ratio. Similarly reactive routing protocols have got less delay and jitter

Zygmunt J Haas et al. in [12] studied the performance of route query control mechanism for the ZRP for Ad hoc networks. Their proposed query control scheme exploit the structure of the routing zone to provide enhanced detection and prevention of overlapping queries. This query control mechanism allowed ZRP to provide routes to all accessible network. Jan Schaumann in [13] analyzed the ZRP in MANET and showed the effects on Routing and observed the problems due to rapidly dynamic topology of Ad hoc networks. He proved IARP traffic grows with the no of nodes in a given zone.

Nicklas Beijar in [14] discussed the problem of routing in Ad hoc network and also described the working of protocol with eg. Niclklas discussed the architecture and route maintenance but didn't show the practical results for mobility Routing protocols for mobile Ad hoc networks have to face the challenge of frequently changing topology, low transmission power and asymmetric links. The Zone Routing Protocol (ZRP) combines the advantages of the proactive and reactive approaches by maintaining an up-to-date topological map of a zone centered on each node. Within the zone, routes are immediately available. Therefore, ZRP reduces the proactive scope to a zone centered on each node. In a limited zone, the maintenance of routing information is easier..ZRP refers to the locally proactive routing component as the IntrA-zone Routing Protocol (IARP). The globally reactive routing component is named IntEr-zone Routing Protocol (IERP). IARP maintains routing information for nodes that are within the routing zone of the node. IERP offers enhanced route discovery and route maintenance services based on local connectivity monitored by IARP. The bordercast packet delivery service is provided by the Bordercast Resolution Protocol (BRP). In order to detect new neighbor nodes and link failures, the ZRP relies on a Neighbor Discovery Protocol (NDP) provided by the Media Access Control (MAC) layer.

V CONCLUSION AND FUTURE WORK

Our experiment and Simulation have shown that mobility and transmission range do have impact on zone routing protocol. By performing the simulations on NS-2 simulator we observed that mobility and transmission range do have impact various zone radius of zone routing protocol. ZRP uses proactive routing within the zone as zone size gets increased then delay keeps on reducing destination nodes can come under the routing zone. We also concluded; for default transmission range, when mobility rate is maximum then performance parameters gives better results for zone radius2 and zone radius 3 ;for fixed mobility rate, when transmission range is maximum, then performace perameters such as throughput, average delay, packet delivery ratio and routing overhead show better results for zone radius 3 and zone radius 4.

TABLE 2*RESULTS SHOWING THE IMPACT OF VARYING MOBILITY RATE AND DEFAULT TRANSMISSION RANGE*

METRICS USED	**CONCLUSION**	
	BEST PERFORMANCE	**WORST PERFORMANCE**
Packet Delivery Ratio	ZONE RADIUS 2	ZONE RADIUS 3
Average End-to-End Delay	ZONE RADIUS 3	ZONE RADIUS 4
Throughput	ZONE RADIUS 3	ZONE RADIUS 4
Routing Load	ZONE RADIUS 3	ZONE RADIUS 2

TABLE 3*RESULTS SHOWING IMPACT OF DIFFERENT TRANSMISSION RANGE AND FIXED MOBILITY RATE i.e. 40 m/s*

METRICS USED	**CONCLUSION**	
	BEST PERFORMANCE	**WORST PERFORMANCE**
Packet Delivery Ratio	ZONE RADIUS 4	ZONE RADIUS 2
Average End-to-End Delay	ZONE RADIUS 4	ZONE RADIUS 2
Throughput	ZONE RADIUS 4	ZONE RADIUS 2
Routing Load	ZONE RADIUS 2	ZONE RADIUS 4

Further in this direction our aim is to evaluate the performance of ZRP protocols when the traffic generator is other than CBR like FTP, TELNET, HTTP. Because these traffic generators are the representatives of the traffic in the real scenario.

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