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Survey on Optimal Configuration for Zone Routing Protocol

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Abstract—Mobile Ad-Hoc networks are self configuring wireless network which are infrastructurless in nature, mobile nodes are independent to move in MANETS. Various routing protocols are available in MANETS i.e proactive, reactive and hybrid. ZRP was the first hybrid routing protocol presented which employs both proactive and reactive routing strategies. Transmission range, zone radius and speed are important factors to be considered for ZRP .In this our objective is to to analyze that what speed, transmission range and how much zone radius ZRP will be able to perform efficiently. The performance of ZRP is to be analyzed on various QoS parameters i.e Packet Delivery Ratio (PDR), Throughput, End to End Delay, Routing Overhead.

Keywords-- Mobile Ad-Hoc networks(MANETS), ZRP, CBR, VBR, PDR, QoS

I. INTRODUCTION

Wireless networking is an emerging technology with enormous advantage that ir allows users to access information and services electronically regardless of their physical position i.e users don't have to stick to particular position to access the network. Wireless networks can be divide as[10]:-

- Infrastructure networks
- infrastructureless (Ad hoc) networks.

Infrastructured network are those that contains fixed and wired gateways [4].
An ad hoc wireless networks comes under the category of infrastructureless network and are defined as the category of wireless networks that utilize multihop radio relaying and are capable of operating without the support of fixed infrastructure[10].
The routing protocols which works well in fixed networks do not performs adequately in mobile ad hoc networks rather in these networks routing protocols should be more dynamic so that they quickly respond to topological changes[10].
Based on the routing information ,update mechanism these could be classified into three major categories[10]:-

- Proactive or Table driven protocols
- Reactive or On-Demand protocols
- Hybrid routing protocols

II. ZONE ROUTING PROTOCOL

Zone routing protocol was the first hybrid routing protocol with both a proactive and a reactive component. It was first introduced by Haas in 1997. ZRP was proposed to reduce the control overhead that of proactive routing protocols and decrease the latency as caused in routing discover in reactive routing protocols[6] Routes are easily available for nodes inside the zone, but a route discovery process has to be employed by ZRP for nodes outside the zone. The routing zones of neighboring nodes overlap with each other's zone. Each routing zone has a radius ρ that is expressed in hops . The zone includes the nodes whose distance from the source node is at most ρ hops. Routing zone of radius 2 hops for node A is shown as in fig.1. All the nodes except node L are included in the routing zone, because It lies outside the routing zone node A. The routing zone is not expressed as physical distance, rather is defined in hops. In ZRP nodes in a routing zone can be categorized as[4]:- :

- Peripheral Nodes - nodes with minimum distance to central node that is exactly equal to the zone radius p
- Interior Nodes - nodes with minimum distance less than the zone radius ρ

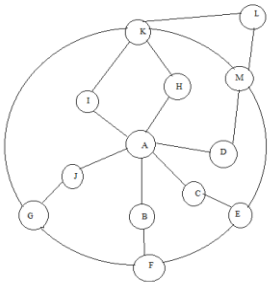

Fig. 1. Routing Zone of Node A with Radius ρ=2 hop

In Fig. 1, The peripheral nodes are E, F, G, K, M and the interior Nodes are B, C, D, H, I, J and node L is outside the routing zone of node A.[4]

A route request is sent by source node to the peripheral nodes of its zone, it contains source address, the destination address and a unique sequence number. Each peripheral node checks its corresponding local zone for the destination. The peripheral node adds its own address to the route request packet if the destination is not a member of the local zone, and thus forwards the packet to its own peripheral nodes. If the destination is a member of the local zone, a route reply packet is sent on the reverse path back to source. Source node uses the path saved in the route reply packet to send data packets to the destination. Numbers of nodes in the routing zone can be regulated by the adjustment of transmission power of the nodes.[4]

ZRP is formed by two sub protocols, a proactive routing protocol i.e. Intra-zone routing (IARP), is used inside routing zones, and a reactive routing protocol i.e. Inter-zone routing protocol(IERP), is used in between routing zones, respectively. IARP establishes a route to a destination within the local zone from the proactively cached routing table of the source by IARP. Thus if the source and destination are in the same zone the packet would be delivered immediately. Route discovery happens reactively.for routes that are beyond the local zone, The source node sends a route request packet to its border nodes, containing, the destination address, its own address and a unique sequence number. Border nodes are the nodes which are exactly at the maximum number of hops to be defined local zone away from the source. The border nodes checks their local zone for the destination. The node adds its own address to the route request packet If the requested node is not a member of their local zone, and forwards the packets to its border nodes. While if the destination is a member of the local zone of the node it sends a route reply on the reverse path back to the source. The source node uses the path that is saved in the route reply packet to send data packets to the destination. ZRP partitions the complete network into number of zones. Due to overlapping of these zones ZRP is also referred as a flat protocol. Network congestion is thus reduced and optimal routes are therefore detected with the use of these overlapping zones. [6].

III. LITERATURE REVIEW

A. Optimizing ZRP and Analyzing It Over Performance Metrices

Jitender Grover et al in**[2]** analyzed the impact of Transmission Ranges and Scalability by varying Mobility rate along with Zone Radius on QoS based performance metrics simulating the environment using NS2.33 Simulator. The objective of their work was to analyze that at what speed and by taking how much zone radius ZRP will be able to perform efficiently and effectively for Mobile Ad hoc Networks. **Anil Manohar** et al in **[1]** focused on ZRP to design scenario for parameters that give its best and determine the effectiveness of this protocol .NS-2.34 simulator environment was used to analyise the performance of ZRP for different zone radius by varying mobility rate and communication distance along with zone radius on QoS based performance metrics. **Sandeep Kaur** et al in**[4]** provides the overview of ZRP by presenting its functionality, analyzing the performance of ZRP (Zone Routing Protocol) on the basis of QoS parameters i.e Throughput, Load, Data Dropped and Delay using simulator OPNET 14.0. **Vishal Polara** et al in **[13]** did simulation based study in order to analyze performance of ZRP protocol and used Network Simulator (NS-2) tool for simulation and did sensitivity analysis by varying node density and transmission range on different parameter like Normalized Routing load, average end to end delay, and throughput. **Marc R. Pearlman** et al in **[12]** demonstrated the effects of relative node density,node velocity, network span, and user data activity on the performance of the ZRP. Also they introduced two different schemes ("min searching" and "traffic adaptive") that allow individual nodes to identify and accordingly react to changes in network configuration, based only on that of the information derived from the amount of received ZRP traffic. Through test-bed simulation, they demonstrated that these radius estimation techniques can allow the ZRP to operate within 2% of the control traffic resulting from perfect radius estimation

B. Comparison of Various Routing Protocols

M. Senthil Kumar et al in**[10]** evaluated the performance of FSR (Proactive), AODV (Reactive) and ZRP (Hybrid) routing protocols with respect to node density and pause time. The simulation is done using Qual net simulator. **Sandeep Kaur** et al in **[5]** analyzed the performance of three hybrid routing protocols ZRP (Zone Routing Protocol), SHARP (Sharp Hybrid Adaptive Routing Protocol) and ZHLS (Zone Hierarchical Link State) and compared them on the basis of parameters Load, Data Dropped, Delay and Throughput, using simulator OPNET 14.0. **Ria Ranjanet. Al in[15]** discusses different routing protocols, namely FSR, LAR1 & ZRP on the basis of Average End to end delay, Received Through-put and Average Jitter. An outline of these protocols had been presented by comparing their characteristics,functionality, limitations, benefits, and analysis. RWP (random waypoint) mobility model had been used and simulations were performed using QualNet 6.1 version Simulator from Scalable Networks.

C. ZRP Enhancement

M.N SreeRanga Raju et al in **[9]** performed their research with motto of upgrading the existing ZRP Model with enhancement of namely MDVZRP, SBZRP, QCS to achieve better performance. The design goals of ZRP enhancement were to enhance the performance in the area such as route acquisition ,quick route reconfiguration, delay, and low mobility scenarios considering the all possible way of routing in inter as well as intra zone. **Anne-Marie Poussardx** et al in **[11]** proposed a Binary Error Rate (BER) based approach of ZRP (BER-ZRP) for better exploitation of network. With BER-ZRP, all phases of link state recording and routing tables calculation were under Quality of Service control so that better paths in terms of BER were preferred. The overhead induced by route maintenance and route discovery processes was better managed. This approach allowed to improve ZRP Packet Delivery Ratio and Normalized Oversize Load.

D. Comparison Of Various Routing Protocol With Varying Data Traffic

Shubhangi Mishra et.al in **[6]** discusses the effect of different Mobility models and Data traffic on the basis of different routing protocols OLSR,AODV and ZRP. The performance of these routing protocols is analyzed by three metrics i.e. End to end delay, Jitter and Through-put. The effect, of mobility models on the performances of routing protocols OLSR, AODV and ZRP by using in the first the CBR (Constant Bit Rate) and secondly a multiservice VBR (Variable Bit Rate) traffic had been studied. Random Waypoint Mobility model (RWP) and Group Mobility Model were used. Simulations were performed using QualNet6.1 version Simulator from Scalable Networks. **B. Satya Sravani** et al in **[14]** did analysis to find the efficiency of a variety of protocols[1] like proactive, reactive and hybrid basing on the comparative study of different performance differentials like throughput, end-to-end delay and jitter. Simulation results of various scenarios with varying data traffic and mobility patterns using the Qualnet 6.1 network simulator were derived and ascertained the protocol which was efficient in defined metrics.

Table I Summary of related work

Study	**Year**	**Traffic Type**	**QoS Metrices**	**Protocols**	**Simulator Used**	**Mobility Model used**
M. Senthil Kumar et. al	2010	CBR	Average End to End Delay, Packet Delivery Ratio, Throughput	FSR, AODV, ZRP	QualNet	Random Waypoint
Jitender Grover et. Al	2013	CBR	Packet Delivery Ratio, End to End Delay, Throughput, Routing Overhead	ZRP	NS-2.33	Random Waypoint
Sandeep Kaur, et. al	2013	Kept constant	Throughput, Load, Data Dropped	ZRP	OPNET 14.0	Random Waypoint
Supreet Kaur et. al	2013	Kept constant	Throughput, Load, Data Dropped, Delay	ZRP, SHARP, ZHLS	OPNET 14.0	Random Waypoint
Shubhangi Mishra et. al	2013	CBR, VBR	Throughput, Average End to End Delay, Average Jitter	AODV, OLSR, ZRP	QualNet	Random Waypoint and group mobility models
Ria Ranjan et. al	2013	CBR	Throughput, Average End to End Delay, Average Jitter	FSR, LAR, ZRP	QualNet 6,1	Random Waypoint
Manohar Dogra et. al	2014	CBR	Packet Delivery Ratio, End to End Delay, Throughput, Routing Overhead	ZRP	NS-2.33	Random Waypoint
Vishal Polara1 et. Al	2014	CBR	Throughput , Average End to End Delay, Normalized routing load	ZRP	NS-2.	Random Waypoint
B. Satya Sravani1 et. al	2014	CBR,VBR	Throughput, End to End Delay, Average Jitter	OLSR, AODV, ZRP	QualNet 6.1	Random Waypoint and group mobility models

IV. CONCLUSION

In this review an outline of ZRP has been presented by its functionality, limitation and mobility model and various enhancements of existing ZRP such as MDVZRP, SBZRP, QCS have been studied. Simulation results of various scenarios with varying data traffic and mobility patterns using the network simulator are derived and analyzed. The performance is thus analyzed on various QoS parameters like Packet Delivery Ratio (PDR), Throughput, End to End Delay, Routing Overhead, Jitter, Data Dropped.

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