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RESEARCH ARTICLE

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# PERFORMANCE OF ZRP FOR CONSTANT ZONE RADIUS IN MOBILE AD HOC NETWORKS

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**ABSTRACT**

In this paper, we are analyzing performance of Hybrid Protocol as Zone Routing Protocol (ZRP) in constant zone radius. Hybrid protocol is an important part of the wireless mobile Ad hoc network. For routing generally proactive and reactive routing method has been used but above method has some disadvantage. To overcome a new approach, hybrid routing protocol ZRP among one of them came in existence taking advantage of proactive by providing reliability within scalable size zone, constant size zone and to allow scalability beyond zone through the reactive routing. ZRP is generally framework in which proactive and reactive element are used according to the application. In this paper, we study the performance of ZRP with BRP and ZRP without BRP by having constant Zone Radius.

Keywords: MANET, ZRP, BRP, Zone Radius, Throughput, Avg end to end delay, Avg Jitter effect, Packet Loss.



## INTRODUCTION

In the last few years, we have witnessed a continuously expanding growth in the deployment of various wireless networks for mobile communication. The growth in the use of wireless communications over the last few years is quite substantial and as compared to other technologies, it's huge. The primary advantage of a wireless network is the ability of the wireless node to communicate with the rest of the world while being mobile. Two basic system models have been developed for the wireless network paradigm. The fixed backbone wireless system model consists of a large number of mobile nodes and relatively fewer, but more powerful, fixed nodes. These fixed nodes are hard wired using landlines. The communication between a fixed node and a mobile node within its range occurs via the wireless medium. However, this requires a fixed permanent infrastructure, another system model, the mobile ad hoc network.

Mobile ad hoc networks (MANET) [1] [2] are collections of mobile nodes, dynamically forming a temporary network without pre-existing network infrastructure or centralized administration. As MANET networks are infrastructure less, no dedicated routers exist there. Instead, every mobile node acts itself as a router and is responsible for discovering and maintaining routes. Furthermore,

without centralized administration, MANET can be called autonomous. To support this kind of autonomy, the routing protocol is required to automatically adjust to frequent environmental changes. The primary goal of the routing protocol is the correct and efficient route establishment to facilitate communication within the network between arbitrary nodes. To successfully fulfill this task, the routing protocol must take the unique characteristics of MANET networks into account.

There are generally purely proactive and purely reactive approaches to implement a routing protocol for a MANET but they have their disadvantage. To overcome this a new approach hybrid routing protocol ZRP among one of them come into existence by taking the advantage of both proactive and reactive in hybrid schema , taking advantage of proactive discovery within a nodes local neighborhood , and using reactive protocol for communication between these neighborhoods.

**II. Proposed Work & Methodology**

In proposed work, we simulate the ZRP in varying node density scenario by having constant Zone radius.As ZRP is framework in which proactive and reactive protocol are used according to the application.We compare the ZRP with BRP and ZRP without BRP. Metrics which we have used throughput, End-to-End Delay, Avg Jitter effect, Packet loss. In this Paper, all the simulation work is done in Qualnet wireless network simulator version 4.0. Simulation time was taken 180 seconds and it remains fixed throughout all simulation work. All the scenarios have been designed in 900m x 900m area. Mobility model used is Random Way Point (RWP).Network traffic is provided by using Constant Bit Rate (CBR) sources.

**III. MANET**

A MANET can be defined as a collection of wireless mobile nodes that are capable of communicating with each other without the use of a network infrastructure or any centralized administration. The mobile hosts are not bound to any centralized control like base stations or mobile switching centers. The idea of MANET is also called infrastructure less networking, since the mobile nodes in the network dynamically establish routing among themselves to form their own network on the fly. It is formed instantaneously, and uses multi-hop routing to transmit information.

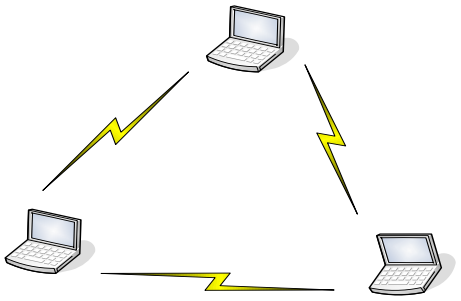

Figure 1: An example of Ad hoc Network

**IV. Zone Routing Protocol**

Zone Routing Protocol (ZRP) is a hybrid ad hoc routing protocol, which limits the scope of the proactive procedure to the node's local neighborhood. ZRP protocol divide the whole network into non-overlapping zone and runs independent protocols that study within and between the zone and IntrAzone protocol [3] (IARP) operates within a zone and learns all the possible routes proactively. So, all nodes within a zone know about its zone topology very well. IntErzone protocol [4] (IERP) is reactive and a source node finds a destination node which is not located within the same zone, by sending RREQ messages to all border nodes. This continues until destination is found.

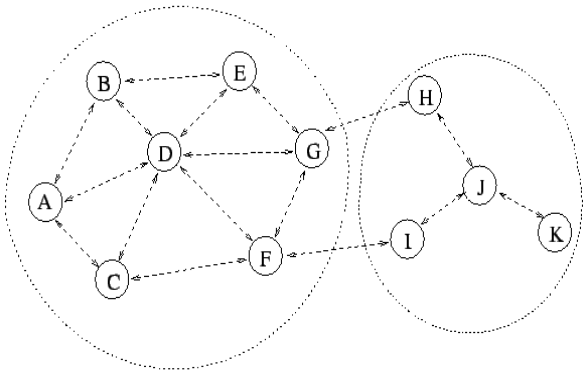


Figure 2 : An example of ZRP Scenario

**V. Bordercast Resolution Protocol**

Bordercasting is an efficient multicast packet delivery service which is used for guiding queries through whole network. Bordercasting used in the ZRP to direct the route requests initiated by the global reactive IERP to the peripheral nodes, thus removing redundant queries and maximizing efficiency. Then the peripheral nodes perform the bordercasting again if they cannot reply this query. Finally, the query will be spread throughout the network. In order to perform the bordercasting, there are two approaches: one is called "root

directed bordercast"; the other is called "distributed bordercast". The root directed bordercast needs the source node and the peripheral nodes to construct their multicast trees and append the forwarding instructions to the routing query packet. This results in additional routing overhead and increases when the zone radius increases, obscuring the benefits of ZRP. BRP keeps track of which nodes a query has been delivered to, so that it can cut short the bordercast tree of nodes that have got the query already.

**VI. Simulation Environment and Performance**

In this paper, all the simulation work is done in Qualnet wireless network simulator version 4.0. Simulation time was taken 180 seconds and it remains constant through whole simulation work. All scenarios are designed in 900m x900m area. Mobility model used is Random Way Point (RWP). In this model a mobile node is initially placed in a random location in the simulation area, and then moved in a randomly chosen direction between [0, 2] at a random speed between [Speed Min, Speed Max]. The movement proceeds for a specific amount of distance or time, and the action is repeated predetermined times. We chose Minimum speed = 0 m/s, Maximum speed = 20m/s, and pausing time = 30s. Network traffic is offered with the use of Constant Bit Rate (CBR) sources.

**Simulation Parameters**

**Table 1. Network Parameters**

| | |
|---|---|
| Network Size | 900×900 ($m^2$) |
| Transmission Radius | variable |
| Transmission Rate | 2 Mbps |
| Node Speed | 0 m/s (min. speed)<br>20 m/s (max. speed) |
| Number of Nodes | variable |
| Data Packet Size | 512 byte |
| Pause Time | 30s |
| Data Generating Rate | Constant |
| Simulation time | 180 seconds |

successfully transmitted to their final destination per unit time. It is the ratio between the numbers of sent packets vs. received packets [5] [6].

Average End to End Delay signifies the average time taken by packets to reach one end to another end (Source to Destination) [7].

Avg Jitter Effect signifies the Packets from the source will reach the destination with different delays. A packet's delay varies with its position in the queues of the routers along the path between destination and source, and this position can differ unpredictably.

Packet loss [8], is the Ratio of transmitted packets that may have been discarded or lost in the network to the total number of packet sent.

**VII. Simulation Results**

**(A) Calculation of Throughput in ZRP with BRP, ZRP without BRP**

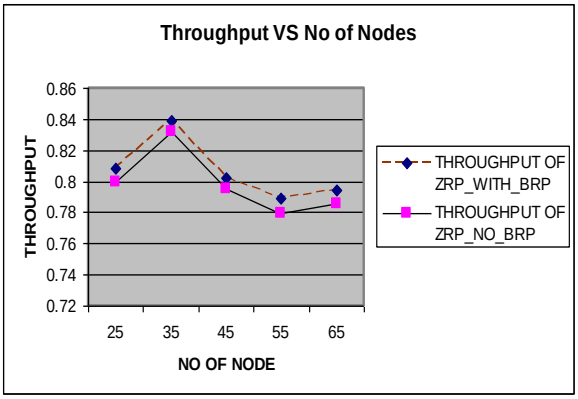


Figure 3 : Throughput vs No of Nodes

**(B) Calculation of End to End delay in ZRP with BRP, ZRP without BRP**

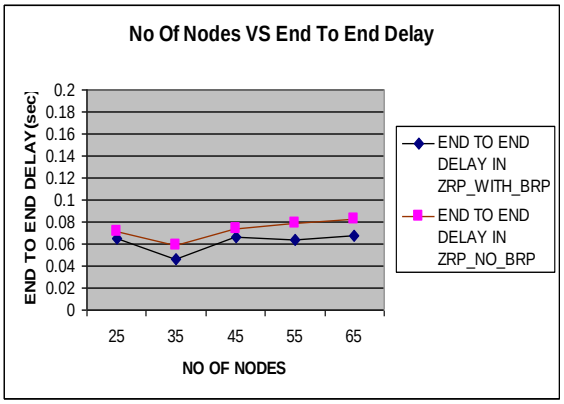


Figure 4 : No of Nodes VS End to End Delay

**(C) Calculation of Avg Jitter Effect in ZRP with BRP, ZRP without BRP**

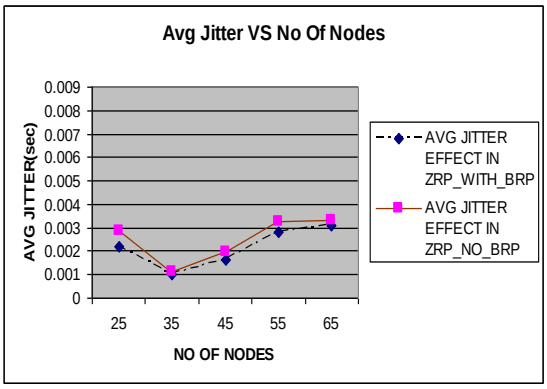


Figure 5 : Avg Jitter Effect Vs No of Nodes

**(D) Calculation of Packet loss in ZRP with BRP, ZRP without BRP**

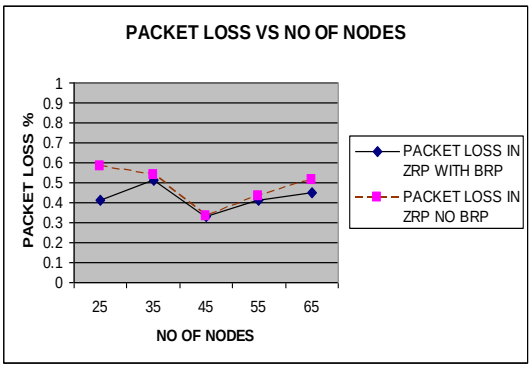


Figure 6 : Packet Loss VS No of Nodes

We have taken No. Of nodes 25, 35, 45, 55, 65 for all scenarios. We found from figure (3) that, as we increase the No. of nodes, performance of Throughput of ZRP with BRP is better than Throughput of ZRP without BRP because of the BRP reduces the time to forwarding the query packet. Throughput in ZRP with BRP are 0.8087, 0.8392, 0.8026, 0.7892, 0.7941 and Throughput in ZRP without BRP are 0.7992, 0.8323, 0.7954, 0.7797, 0.7856 with respect to No. of nodes 25, 35, 45, 55, 65. We can see from figure (4) that, as we increase No. of nodes , performance of end to end delay in ZRP with BRP is less than ZRP without BRP as BRP reduces search time to get destination.end to end delay in ZRP with BRP are 0.0655, 0.0462, 0.0668, 0.0641, 0.0681 and ZRP without BRP are 0.0711, 0.0591, 0.0742, 0.0782, 0.0821 with respect to No. of nodes 25, 35, 45, 55, 65. We found from figure (5) that, Avg. Jitter Effect in ZRP with BRP is less than in ZRP without BRP as we increases No. of nodes when zone radius is constant. In this case, there is a possibility that we lose some packets due to Jitter effect. Avg. Jitter Effect in ZRP with BRP are 0.00219, 0.00101, 0.00163, 0.00281, 0.00311 and ZRP without BRP are 0.00289, 0.00112, 0.00197, 0.00329, 0.00331 with respect to No. of nodes 25, 35, 45, 55, 65. We can see from figure (6) that, Packet loss in ZRP with BRP is less than the Packet loss in ZRP without BRP on increasing no. of nodes. Packet loss in ZRP with BRP are 0.41, 0.51, 0.33, 0.41, 0.45 and ZRP without BRP are 0.58, 0.54, 0.33, 0.43, 0.51 with respect to No. of nodes 25, 35, 45, 55, 65.

**VII. CONCLUSION AND FUTURE WORK**

In this Paper, we conclude that Hybrid Protocol performance is better with Border cast Routing Protocol than without Border cast Routing Protocol on increasing no. of nodes with constant zone radius.

As a part of our future work, we will simulate ZRP by varying zone radius with different Routing Protocols of MANET.

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