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Extended Zone Routing Protocol

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***Abstract* -**In Ad hoc wireless networks nodes that can move freely have become key research areas in past and continued to dominate now also. Mobile ad-hoc network are infrastructure-less network in which nodes are mobile but these nodes have limited battery power and signal strength. In mobile ad-hoc network (MANET) no fixed base station so in MANET nodes behaves like router and host. In this paper Extended Zone Routing Protocol is the extension of Zone Routing Protocol (ZRP). Zone routing protocol combines the benefits of each Proactive and Reactive protocol therefore it's a hybrid routing protocol. In ZRP routing within the zone is processed by Proactive routing protocols and out of the zone is completed by Reactive routing protocols. Extended Zone Routing Protocol contains additional routing table called Neighbour Routing Table.

***Keywords*-**Proactive Routing, Reactive Routing, Neighbour routing Table, Border cast

I. INTRODUCTION

In MANET nodes are liberal to move or they're mobile thus it's really troublesome to take care of or establish the path between nodes. Numbers of protocols are given for MANET and new protocols are continuously added to this protocol domain. Since there's no fixed base station in MANET so nodes have to work as each as a router and host which adds additional complexity in MANET. That is nodes act as a router to take care of routing table and once it acts as a host, nodes ought to maintain routing table for forwarding the packets. Many protocols are proposed for MANET, based on its routing zone, transmission capacity, nodes mobility and others. ZRP addresses the problem of MANET by maintaining a Zone. In ZRP every node maintains a routing zone. ZRP divides the topology into zones and uses totally different routing protocols in zone and outside the zone.
Each Zone in ZRP features a predefined zone length, ZRP maintains a zone around every node that contain the entire node within "**k**" hope distance form that node. Zone length is not fastened for every node it may be different. For node discovery within the Zone: it uses Proactive routing protocols and for those nodes that don't seem to be within the routing zone uses Reactive routing protocols.

II. ROUTING PROTOCOLS

Routing is used to find the path form source to destination. When the nodes are in the direct transmission range, they communicate directly and if not then communicate through intermediate node. In MANET protocols are sub-divided into Proactive Routing Protocol, Reactive Routing Protocol and Hybrid Routing Protocol.

Proactive Routing Protocols:-When any node makes a routing zone of **k** hope, it generates request which is a transmitted to all or any nodes within the routing zone, each node within that routing zone replies to the requesting node, and requesting node maintains a proactive routing table of all the nodes which are present in that specific zone. When node has to forward data it just searches in its proactive routing table and forwards the data to that specific destination.

Proactive Routing Protocol invariably maintains up-to-date information of routes from every node to other alternative node within the network. These protocols endlessly learn the topology of the network by exchanging topological knowledge with the Zone. Thus, when any node need to forward data to any other node within the specific zone, this node not need to search that destination node again in that zone, the forwarding node simply checks its proactive routing table and it gets the path to that destination node.
Some of the proactive routing protocols are there

- DSDV
- OLSR
- WRP
- TSRPF
- CGSR

Reactive Routing Protocol:-Reactive routing is on demand routing protocol. When destination moves away from the proactive routing zone or destination node not respond due to any reason then in that scenario proactive routing gets failed to find the destination node. In that case Reactive Routing Protocol searches that destination node outside the specific routing zone and if destination is found it sets the

link so as to send and settle for the packet from a sender node to destination node. Route discovery method is employed in on demand routing by using any of the methods: bordercasting the route request **(RREQ)** packets throughout the network and by flooding [1].
Some of the reactive routing protocols are

- AODV
- DSR
- TORA
- DYMO

Hybrid routing Protocol:-Proactive and Reactive routing protocol work best in oppositely different scenarios and hybrid method uses both. It is used to find the balance between both protocols.[1]
Some of the hybrid routing protocols are

- ZRP
- HARP
- ZHLS

Zone Routing Protocol: - ZRP provides a framework for the working of other protocols. Neighbour Discovery Protocol will be used for the detection process. The size of the zone are going to be reckoning on the strength of the signal, power which is available, node reliability etc. Zone Routing Protocol or ZRP was the primary hybrid routing protocol preserve both a proactive and a reactive routing properties [1]. In an ad-hoc network, it may be assumed that the biggest a part of the traffic is directed to nearby nodes. Since ZRP defines a zone node, so for node discovery inside the zone it applies Intra Zone Routing Protocol (IARP) which is a family of limited-depth, proactive link-state routing protocols and Inter Zone Routing Protocol (IERP) which is a family of reactive routing protocols that offer enhanced route discovery and route maintenance services based on local connectivity monitored by IARP [2][3].

III. ARCHITECTURE

Zone routing protocol as the name implies it based on the concept of zone. A routing zone is maintained for every node on an individual basis and therefore the neighbouring zone and neighbouring node overlaps [4].

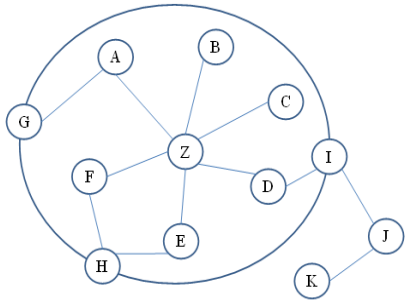

Fig.1 Example Routing Zone with radius k=2

The routing zone of radius **k** is expressed in hops. It should however be stated that the zone is defined in hops, not by a physical distance. Nodes are divided into interior node and peripheral nodes, where the nodes whose maximum distance is smaller than the radius k, are interior node and the node with distance **k,** are peripheral nodes[5][6].

Here is an example of routing zone: fig.1: where A, B, C, D, E, F, Z are interior node and G, H, I are peripheral node and node J and K are nodes outside the routing zone of "Z".

Basically the routing is performed by IARP and IERP. First thing which is necessary for IARP is to periodically compute the routes of every node which are within the routing zone of a hosting node and maintain this record in its database called IARP routing table [7]. For maintaining this routing table, IARP relies on Neighbour discovery protocol (NDP) which is provided by Media access layer (MAC). NDP periodically transmit a "HELLO" message to all the nodes of the specific zone, the nodes in that zone are bound to reply for this message. Nodes which do not respond for "HELLO" message are aloof from the IARP table. And like wise IARP table is updated [8] and for node discovery outside the routing zone IERP is used. For node discovery IERP has two mechanism i.e. flooding or broadcasting and bordercasting. The Broadcasting is similar to typical reactive protocols, while bordercasting leverages IARP up-to-date view to direct query request to the peripheral node. By this, it directly removes the area which is already covered. ZRP provides this service by Bordercast resolution Protocol (BRP)[9][10].

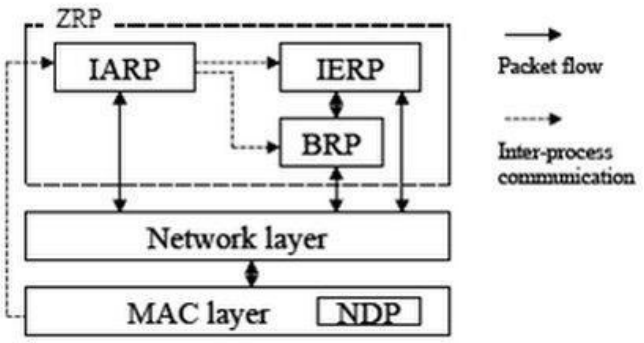

Fig.2 Architecture of Zone Routing protocol

Routing: -A node that contains a packet to send, it initially checks whether the destination is in its native zone or not, by exploring the data given by IARP routing table. If destination node is present inside the zone, then the IARP routing table must have a valid route to the destination. So in this case, the packet is routed proactively to the Interzone destination.
Therefore Reactive routing is employed if the destination is outside the zone.

The reactive routing technique is split into two phases: the route request phase and the route reply. In the route request, the source sends a route request packet to its peripheral nodes using BRP. If the receiver of a route request packet is aware of destination, it responds by forwarding a route reply back to the source node [11]. Otherwise, it continues searching destination node means of bordercasting. By this process, the route request message is spread all the nodes of network. The reply is sent by any node that has a path to the destination node. With the intention to ship the respond back to the supply node, routing records have to be accumulated while the request is despatched via any node of the network. The knowledge about the path is recorded either within the route request packet (source routing approach), or as next-hop addresses within the nodes along the path similar to Ad-Hoc On-Demand Distance Vector (AODV). In the first case, the nodes forwarding a route request packet append their address and relevant node/link metrics to the packet. Once the packet reaches the destination, the sequence of addresses is reversed and copied to the route reply packet. The sequence is employed to forward the reply back to the source node and in the second case, the forwarding nodes record routing information as next-hop addresses, which are used when the reply is sent to the source. This approach can save transmission resources, as the request and reply packets are smaller.

IV. PROPOSED WORK

As we know each node in ZRP forms its own routing zones due to which each node have to manage their routing table and database also. We are going to assign a Leader in each zone and zone leader has all the permission to manage the zone. In a zone no other node has a permission to make a routing zone except leader node. Each zone radius must be of "k" length ("k" hops). By this problem of overlapping Zone is removed. Each Leader node manages three routing table proactive routing table, reactive routing table and neighbour routing table. Proactive routing table has a database of all the nodes in its routing zone. Neighbour Routing Table maintains the database of Neighbour zone. Reactive routing table has a database of all the destination nodes which was queried by any node in this zone and the destination found by bordercasting.

Neighbour Routing table: -Neighbour Routing Table is stored in each zone leader database. Every zone forwards its proactive routing table to the adjacent zone leader and adjacent leader update its Neighbour Routing Table with that Proactive table.
As shown in the figure 2, each column contain zone leader and after that all the nodes in that leader zone.

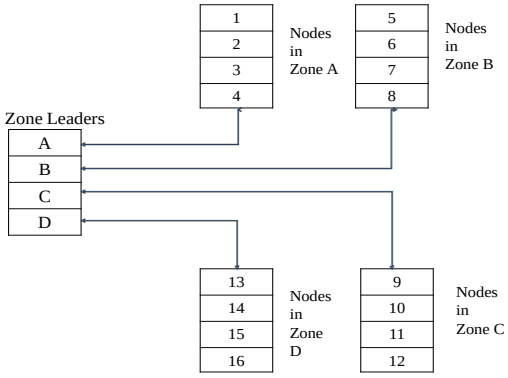

Fig 3. Neighbour Routing table

Routing: If query is generated by any node, node appends its node id and query id and forward it to the Zone Leader. Zone Leader first checks its Proactive Routing Table, if destination is found, Zone Leader replies back the destination path and if not then Zone Leader checks Neighbour Routing Table for the destination. Since Neighbour Routing Table contains information of all the nodes which are present in the adjacent zone, so less query is required to search the node which is present in the adjacent zone. If still destination is not found then Zone Leader searches for the destination in the Reactive Routing Table, if destination is found Zone Leader replies back the path of the destination node to the querying node. If destination is not found in Reactive Routing Table then lastly zone leader appends zone leader id (Zone id and zone leader id are same) and Neighbour zone id and bordercast it to the neighbour zone. Neighbour zone does not check its proactive table it simply checks in Reactive routing table and Neighbour Routing Table only for those zone which are not mentioned in query and Bordercast it continuously till destination is not found. Zone which generates query, searches for limited zone first and waits for response and if response does not come in particular time limit then it sends query with no zone limit.
Each zone leader updates its routing zone by Periodic update process. And Neighbour Routing Table is update by Triggered update process. By this proactive routing table and Neighbour Routing Table both get updated.

V. CONCLUSION

Extended Zone routing protocol targeted for large network. Zone leader update database by proactive protocol, reactive protocol, Neighbour discovery protocol, and by bordercasting. Extended zone routing protocol perform well under certain conditions i.e. when node speed is not high.

VI. FUTURE SCOPE

This work can be extended to analyze the performance of Extended Zone routing Protocol for different performance metrics such as Average End to End Delay, Throughput, and Jitter.

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