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Weight Based Inter Zone Routing Protocol in MANET

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ABSTRACT

Ad-hoc networks are self configuring and infrastructure less wireless networks and the mobile nodes can communicate with each other in a wireless environment. Research issues in MANETs are generally categorized into several topics such as routing, fault tolerance, power management etc. The primary goal of ad hoc network routing protocols is to provide correct and efficient route establishment between pair of nodes. So the messages may be delivered on time. Routing protocols can be classified as proactive, reactive and hybrid. Proactive routing protocols are table-driven. It maintains the entire topology of the network in the routing table. Whenever route requests are made, shortest path can be formed without any time delay. Reactive or on demand routing protocols on the other hand, discover the routes when needed. This reduces considerable routing overhead when compared to proactive routing. Hybrid protocols combine the features of both proactive and reactive routing. Consequently, routing overheads and time delay gets minimized. ZRP (Zone Routing Protocol) is one such hybrid routing protocol designed for MANET. The specific characteristics of any routing protocol consider the mobility and residual energy of a node. Mobile node in an Ad-hoc network equipped with low power battery finds difficult to send and receive data more often in the network. The relay node (i.e intermediate node) selection based on the GPSR routing increases the overhead in the network. In the proposed approach the relay node is selected based on the probability of a node. Probability will be given based on the mobility, residual energy of a node in Zone Routing Protocol (ZRP). It reduces the number of broken routes, thus improves the network performance.

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INTRODUCTION

A Mobile Ad-hoc Network (MANET) is an infrastructure less and self configured network of mobile terminals connected by wireless links. Mobile terminals such as cell phones, Portable gaming devices, PDAs (Personal Digital Assistants) and tablets all have wireless networking capabilities. Algorithms for a MANET must self-configure to adjust the environment and traffic where they run, and goal changes must be posed from the user and application.

Ideally, a routing algorithm for an Ad hoc network should not only have the general characteristics of any routing protocol but also consider the specific characteristics of a mobile environment—in particular, bandwidth and energy limitations and mobility (Tavli, B., 2011). Based on the routing information update mechanism, Ad hoc wireless network routing protocols are basically divided into Pro-active routing, Re-active protocols and Hybrid protocol. The Proactive routing algorithms aim to keep consistent and up-to-date routing information between every pair of nodes in the network by proactively propagating route updates at fixed time intervals (Haiying Shen, 2009).

The pro-active routing protocol learns the network topology before a request comes in for forwarding. Since the proactive routing algorithms maintain routing tables for all nodes in the network, a route is found as soon as it is requested. But this type of routing is not well suited for very dense ad hoc networks.

Reactive or also called on-demand routing algorithms establish a route to a given destination only when a node requests it by initiating a route discovery process. Once a route has been established, the node keeps it until the destination is no longer accessible, or the route expires. The re-active routing protocol becomes active only when a node is willing to forward a request. In spite of a reactive protocol gives the low overhead of control messages, it has higher latency in discovering routes as it determine the route using flooding RREQ packet in

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the network and builds the route on demand from the responses it receives. But due to the flooding of route request packets to its neighbors, it suffers from time delay because of route discovery process.

Hybrid protocol which effectively combines the best features of both proactive and reactive routing protocol. ZRP (Zone Routing Protocol),CBRP (Cluster Based Routing Protocol) falls under the category of hybrid routing protocol. In ZRP, intra zone routing protocol (IARP) is used in the zone where a particular node employs proactive routing. The reactive routing protocol used beyond this zone is referred to as Inter Zone Routing Protocol (IERP).IERP is responsible for finding paths to nodes which are not within the routing zone (Tavli, B., 2011). IERP effectively uses the information available at every nodes in the routing zone. In IARP each node maintains the information about routes to all nodes within its routing zone by exchanging periodic route update packets.

Remainder of the paper is structured as follows. Section II describes the literature survey. Section III describes the proposed work. Section IV describes the weight based IERP protocol. Finally, conclusions are given in section V.

I. Literature Survey:

ZRP provides a hybrid framework of protocols which enables the use of any routing strategy according to various situations. Dynamic Zone Topology Routing protocol (DZTR) for scalable routing in a MANET is proposed in (Abolhasan, M. and T. Wysocki, 2007). DZTR breaks the network into a number of zones by using a GPS. The topology of each zone is maintained proactively and the route to the nodes in other zones is determined reactively. DZTR proposes a number of different strategies to reduce routing overhead in large networks and reduce the single point of failure during data forwarding (Abolhasan, M. and T. Wysocki, 2007).

Fisheye Zone Routing Protocol (FZRP) provides the advantage of a larger zone with only a little increase of the maintenance overhead. Two levels of routing zone are defined in FZRP such as basic zone and the extended zone. Different updating frequencies of changes are associated with the basic zone and extended zone. Performance of route query control mechanisms for the ZRP for ad hoc networks is proposed in (Chun-Chuan Yang and Li-Pin Tseng, 2007).

Virtual Backbone Routing (VBR) is a scalable hybrid routing framework for ad hoc networks, which combines local proactive and global reactive routing. The Zone hierarchy is maintained through a novel distributed Virtual backbone maintenance scheme, termed the Distributed Database Coverage Heuristic (DDCH). VBR limits the proactive link information exchange to the local routing zones only (Zygmunt J. Haas and Marc R. Pearlman, 2001).

In Zone and Link Expiry Routing Protocol (ZLERP), stability of link is determined on the basis of signal strength received at periodic time interval by node which is on the periphery of other node's zone. Signal strength depends on many factors such as distance between nodes, angles between nodes, obstacles, blocked regions, noise, interference etc. ZLERP considers two main factors, distance between nodes and blocked terrains. ZLERP divides its network in different zones. (Manvi, S.S., 2010) That's the node's local neighborhood. Each node may be within multiple overlapping zones, and each zone may be of a different size. The size of a zone is not determined by geographical measurement. It is given by a radius of length, where the number of hops is the perimeter of the zone. Each node has its own zone (Manvi, S.S., 2010).

In the Anonymous Location Aided Routing Protocol in MANET (ALERT), the information of the bottom-right and upper left boundary of the network area is configured into each node when it joins in the system. This information is used to locate the positions of node in the entire area for zone partitions.

In ALERT algorithm, it first checks whether destination are in the zone. It separates the zone instead in the horizontal and vertical directions and repeats this process until itself and Z_D are not in the same zone. ALERT uses the hierarchical zone partition and randomly chooses a node in the partitioned zone in each step as an intermediate relay node (i.e. Data Forwarder) using GPSR routing. The zone division in ALERT occurs when selecting a next node, zones and messages being forwarded automatically. ALERT uses dynamic hierarchical zone partitions and random relay node selection to make it difficult for an intruder to detect the two endpoints and nodes route.

When uses GPSR routing for select RF, the reliable route selection not possible. If a node moves out of the zone then resending the Route Request (RR) can occur. So it will increase the overhead in the network. A node in a zone can register the mobility of node. It is not suggesting the reliable node as a relay node. In the proposed approach, mobility and residual energy of a node is used to select the relay node. So the rebroadcasting and network overhead will be reduced.

We observed from the literature that most of the earlier works focus on different routing strategies which efficiently find shortest route to the destination. However the main problem faced by routing protocols in very dynamic conditions is that, links may be broken soon after routes have been established. This leads to a high number of control packets and do not take into account of network overheads caused by routing. Data packets are propagating inside the network, which result in higher bandwidth contention and consequently reduced throughput.

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II. Proposed Approach:

In order to address the issue of mobility and residual energy of a node, Weight based Inter Zone Routing is used for finding the reliable route in ZRP protocol. In the proposed approach, assignment of weight to a mobile node is the combined effect of several system parameters like node degree, degree difference, residual energy. The Inter Zone node selection process is described as follows

A. Weight based Inter Zone Routing Protocol:

In the proposed approach, weight based inter zone routing algorithm has the following steps for a particular node

Step1: Calculate the arrival angle of a node 'v' such as

$$\Delta RSS_v = \Delta RSSt_2 - \Delta RSSt_1 / (t_2 - t_1)$$

Where RSS - Received Signal Strength

Step2: Initially the critical angle is $\theta_c = 45$

If arrival angle θ_a <critical angle

then factor = 1

Step3: Calculate the energy spent to transmit or receive a packet from node v to node w is given by

$E(p,v) = E_{tx}(p,v)+E_{rx}(p,w)$

Where $E_{tx}(p,v)$ = energy spent to transmit the packet from node v to node w

$E_{rx}(p,w)$ = to receive the packet at node w

Step4: Identify whether the node E(p,v) is less than or equal to the E resi. It ensures the a node have enough energy to transmit/receive a packet

$E(p,v) \leq E$ resi

Step5: Calculate the weight of a node W_v

W_v = Arrival angle factor + E(p,v)

*Step 6 :*First priority is given to the node with highest Wv

Step 7 : Second priority is given to the node with second highest W_v

Step 8 : Repeat the above steps for each zone in the network.

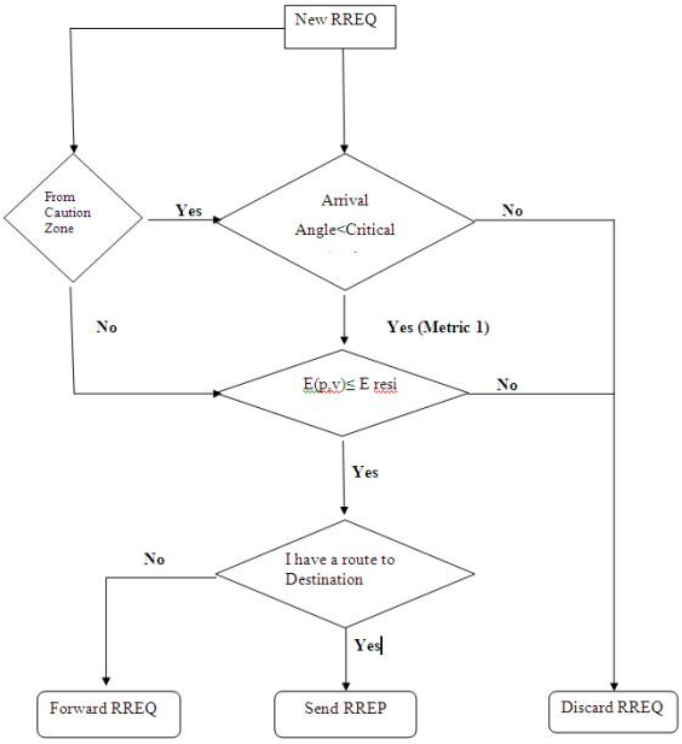

Fig. 1: Weight based Inter Zone Routing.

III. Results and Simulation:

The proposed routing scheme has been implemented over ZRP using ns-2. The waypoint mobility model has been used. In this model, a node moves from its current position to a new position by selecting a random direction and a random speed. The entire network area is a rectangle with side lengths l_A and l_B and the entire area is partitioned H times to produce a k anonymity destination zone (Reina, D.G., 2011). The size of the entire

network zone is 1000 m × 1000 m and H = 5 to ensure that a reasonable number of nodes are in a destination zone. A node will be allocated with a random speed in a range of 1 to 30 m/s. Fig. 1 shows the route discovery process using Weight based Inter Zone Routing Protocol.

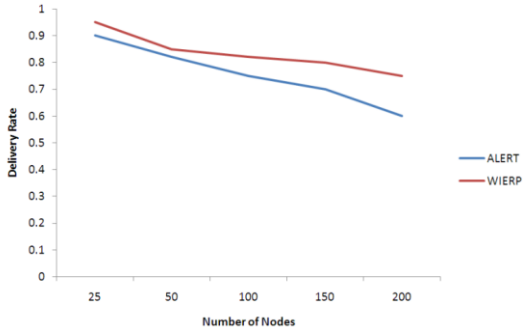

Fig. 2: Number of Nodes vs Delivery Rate.

Simulation results also show that the, ALERT delivery rate is reduced compared to the other Weight based IERP approaches, Fig. 2.

IV. Conclusion:

In the related approach, a relay node in each zones are selected based on the GPSR routing. It will not suggest the reliable route to send the data. In the proposed approach, a relay node was selected based on the weight of a node. The weight of a node is given based on two metrics such as mobility and residual energy of a node. It considers the arrival angle which is less than the critical angle and energy needed to transmit and receive the information from node v toward node w should be lower or equal to the residual energy of node i. The simulation results compared to GPSR shows that energy and mobility aware is well suited for selecting relay node in Zone Routing Protocol (ZRP). So the relay node selection based on probability of a node reduces the overhead and improves the network performance.

In the future work, the security issue will be taken to avoid the malicious node as an intermediate node (i.e Random Forwarder).

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