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Position-based Opportunistic Routing for Highly Dynamic MANETS

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Abstract— **This paper solves the problem of delivering data packets for highly dynamic mobile ad hoc networks in a timely and reliable way. Already existing ad hoc routing protocols are susceptible to node mobilty.The issue is solved by an efficient Position-based Opportunistic Routing (POR) protocol which takes the property of geographic routing. When a data packet is sent out from the source node, some of the neighbor nodes will be the forwarding candidates, and it will forward the packet if it is not forwarded by the best forwarder in a particular period of time. Communication hole is avoided by Virtual Destination-based Void Handling(VDVH) scheme .**

Index Terms— **Geographic routing, Opportunistic forwarding, Void handling.**

I. INTRODUCTION

Mobile ad hoc network is a collection of wireless mobile nodes which forms a temporary network without using any network infrastructure or centralized administration. Due to node mobility in traditional topology-based MANET routing protocols, Position-based routing protocols are achieved, since the network is highly dynamic. Maintaining a route is difficult in fastly changing network topology. If the path breaks, data packets will get lost and discovery procedures will be time consuming. Generally Ad hoc routing protocols make forwarding decisions based on geographical position of a packet's destination. Rather than destination node's position, each node have to know only its own position and the position of its neighbors to forward the packets. When the network is highly dynamic, position-based routing is used. In position-based routing a sender can know the present position of the destination. In mobile ad hoc networks (MANETS), geographic routing protocols allow stateless routing. A geographic routing protocol uses the location information of mobile nodes. It has high scalability. Without complex modification to MAC protocol, a position-based opportunistic routing is achieved.IEEE 802.11 provides collision avoidance. Communication hole is handled by Virtual Destination-based Void Handling(VDVH) scheme. This scheme uses the advantage of greedy forwarding and opportunistic routing.

II. PROPOSED METHOD

The proposed method is based on topology formation, position-based opportunistic routing, operation of POR when next forwarder fails to receive the packet.

STEP1: In the topology formation, each node will send hello packets to its neighbor node which are in its communication range to update their topology.

STEP2: In the position-based opportunistic routing, geographic routing and opportunistic forwarding is achieved. The nodes will know their own location and the position of its neighbors. When a source node wants to send a packet, it finds the location of the destination node first.
The first term shows the actual forwarding candidates expressed as

$$p\{K \ {}^{24}_{12}\ Kc\}$$

STEP3: In the third method, the operation of POR is achieved when the link failure happens in the simulation. It is expressed as

$$p1 \text{Ť} \overset{K\text{Ḣ}1}{\underset{J}{\curlywedge}} p\{Hc \text{Ť}\ j\}(1 \text{Ḣ} \overset{j}{\underset{i}{\ast}}\ Pk)$$

$$\text{Ǵ}\ P\{Hc \ {}^{24}_{12}\ H\}(1 \text{Ḣ} \coprod_{j}^{H} Pj)$$

STEP4: In the case of communication voids, there is no need of void handling mechanism in the network nodes that are created. The area free of nodes that cannot be routed through is called void. Since there is no void between the nodes, there is no need to handle the void.

STEP5: The QOS Parameters such as Throughput, Packet Drop, Packet Delivery Ratio are achieved.

III. POSITION-BASED OPPORTUNISTIC ROUTING

Before routing, a topology of network nodes consisting of 40 nodes is created. Each node will send hello packets to its neighbor node which are in its communication range to update their topology [2]. After the topology is updated by sending hello packets, geographic routing and opportunistic routing is achieved in position-based opportunistic routing. Here the nodes will know their own location and the position of its neighbors. When a source wants to send a packet it finds the location of the destination node first. Many forwarding candidates cache the packet that is received. In certain time slots if the best forwarder does not forward the packet, nearby candidates will forward the packets. If any candidate receives and forwards the packets then the data is not interrupted.

IV. GEOGRAPHIC ROUTING

For routing, the geographic ad hoc networks [8] use position information. Position-based routing is used to handle networks that have many nodes. It uses location information to forward data packets, in hop by hop routing manner. This protocol tracks the mobile node locations. It has high scalabitity.The source node should know the location of the destination node, before routing a packet using a geographic routing.

A. GREEDY PERIMETER STATELESS ROUTING

GREEDY PERIMETER STATELESS ROUTING [5] (GPSR), a routing protocol used for wireless network to find the positions of routers and a packet's destination for packet forwarding decisions. In GPSR,Geographic routing is a location based routing protocol for wireless network. The data generates a packet that has the co-ordinates of the destination node.

B. OPERATION OF OPPORTUNISTIC FORWARDING

I. A Method by which the data is relied to its neighbor-based on network information.
II. The neighboring nodes receive the packet successfully respond with CTS packets that has the signal to noise ratio of the RTS.Based on the routing layer, the source node chooses the forwarder [6].
III. The candidate forwarding nodes will send the CTS frames continually by causing collisions.
IV. In the link layer, the path diversity is an improvement in the protocol so that the forwarders respond in a priority order.

V. GREEDY FORWARDING

In the greedy forwarding method,the node which has more positive progress towards the destination will be selected as the next hop forwarder. The neighbor which is away from the sender is chosen as the next hop, in the operation of greedy forwarding.

VI. MAC MODIFICATION

Due to collisions, packet loss will dominate the performance of multicast-like routing protocols. Some modification has been made in the packet transmission. The packet is sent through unicast in the network layer to the best forwarder that is elected by greedy forwarding as the next hop.

VII. EXPERIMENTAL RESULTS

The experimental results show the simulation results of the topology formation, position-based opportunistic routing, and the operation of POR when the next hop fails to receive the packet. The Qos parameters such as Throughput, Packet Drop, and Packet Delivery Ratio are achieved with their graphs.

A. OPERATION OF POR

Some of the nodes will be selected as forwarding candidates, only the nodes in the forwarding area will be the backup nodes. The sender and the next hop node select the area to be forwarded.

B.OPERATION OF POR AFTER LINK FAILURE

Suppose if a node fails to deliver a packet, the nearby nodes in the forwarding candidate which has the highest priority will send the packet forward and avoid the lower priority candidates that is forwarding. If a packet is pulled back from the Mac layer it will not be routed again.

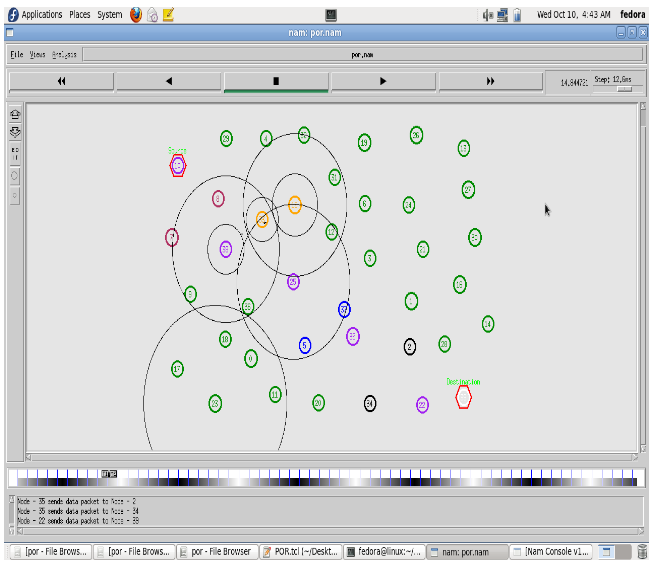

Figure 1. Operation of POR

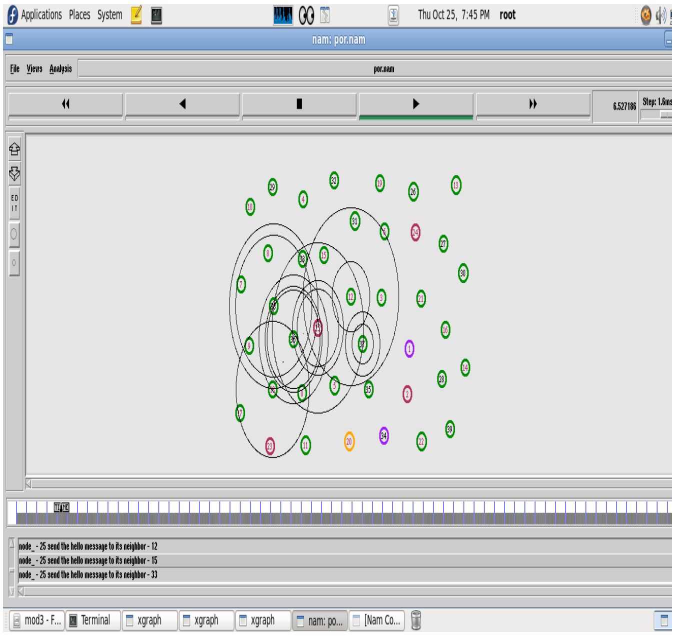

Figure 2 Operation of POR after link failure

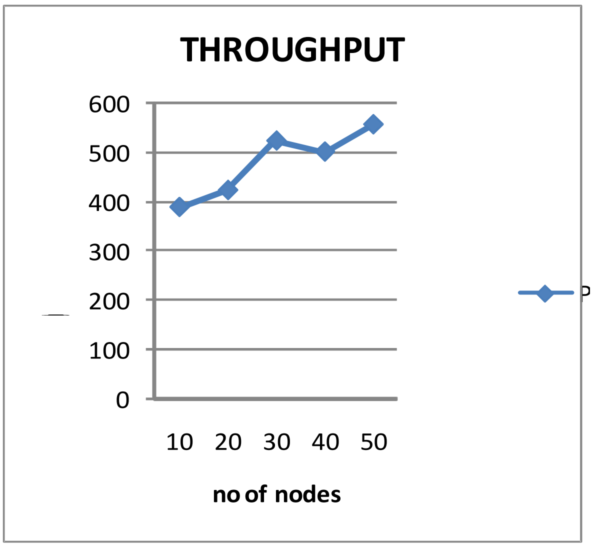

Figure 3 Throughput

Over a communication channel, the average rate of successful message delivery is the throughput that is shown in figure 3.The total number of packets dropped during the transmission is shown in figure 4.As the number of node increases the number of packet drop will also increase. The ratio of the number of data packets received at the destinations to the number of data packets sent by the sources is known as the packet delivery ratio that is shown in figure 5.

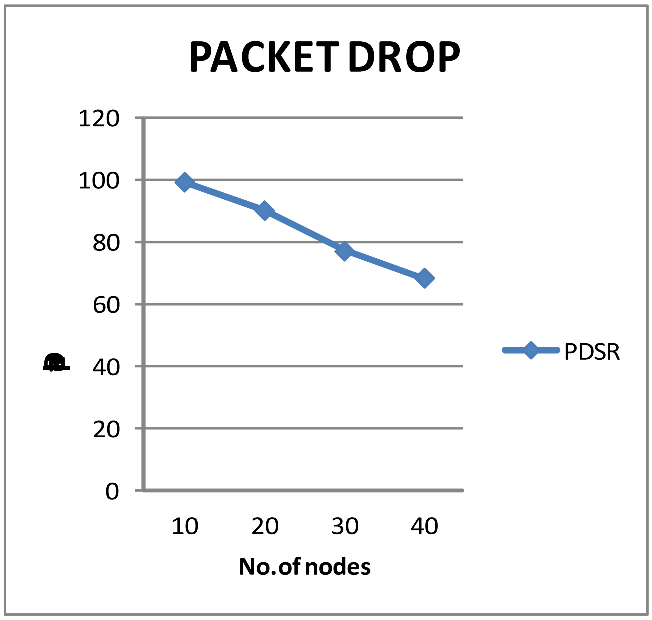

Figure 4 Packet Drop

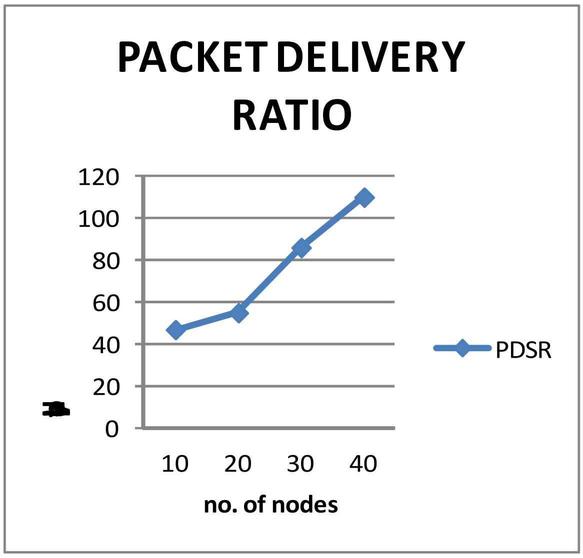

Figure 5 Packet Delivery Ratio

VIII. CONCLUSION

In this work, the problem of delivering data packets for highly dynamic mobile ad hoc networks is solved. Already existing topology based routing protocols have node mobility. This issue is solved by an efficient position-based opportunistic routing (por) protocol which takes the property of geographic. When a data packet is sent out from the source node some of the neighbor nodes will be the forwarding candidates, and it will forward the packet. If it is not forwarded by the best forwarder in a particular period of time, the nearby nodes which has higher priority towards the destination will forward the packet. If communication hole is there it is avoided by Virtual-

Destination based void-handling. Here the VDVH Scheme is not needed since there is no void (communication hole) between the nodes that is created. The problem in this approach is, the node that is elected as the best forwarder is not checked whether it is secured or it has the trust value or not. In the future work, the nodes which have the higher trust value is considered as the best forwarder.

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