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Enhanced Hybrid Multipath Routing Protocol Using an Priority Acknowledgment Table (PAT)

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Abstract—*Route discovery and route maintenance concerns a main issue in MANET. To address this problem we propose an efficient hybrid routing technique using Priority Acknowledgement Table. Our proposed work uses both On-demand and Table driven routing protocols for continuous route discovery between source and destination in multipath and multicast environment. Here we use a Priority Acknowledgement Table technique to find the shortest alternative path. In initial stage a single route is discovered using On-Demand routing protocol. From that route each node involves in continuous discovery of another shortest path to reach destination. At that time if a node finds more than two alternate paths, then it is declared as DPN and a temporary PAT is constructed from which again a new route is discovered to reach the destination. In our proposed work if route failure occurs, route rediscovery starts from DPN instead of from original source node by which efficiency is increased.*

Keywords: MANET (Mobile Adhoc Network), PAT (priority Acknowledgment Table), DPN (Demand processing Node).

I. INTRODUCTION

Mobile Ad hoc Network (MANET) consists of many self configured mobile nodes with wireless communication that can communicate with each other without any physical infrastructure in a random fashion The Mobile ad hoc network is used in many real world scenario and applications due to its mobility in nature. Each node in Mobile Ad hoc Network (MANET) acts both as a host as well as router. Communication between the nodes occurs only if they are within the transmission range. Due to its mobility nature the path between nodes or group of nodes may change periodically. The nodes which involves in the transmission of data packets, has to discover the route to the destination using route discovery process of different routing protocols. Routing protocols are mainly used for determining optimal packet routes for sending data between source and destination. Exchanging route information, gathering information about route breaks, repairing broken routes, load balancing are also some useful features of routing protocols. There are two kinds of routing protocols, one is reactive or on demand routing protocol, and another is proactive or table-driven routing protocol. Discovering routes at the initial stage without considering the randomness of nodes leads to frequent failure and thereby to route rediscovery.

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As a result the computational overhead of the routing protocol increases considerably. Multipath Routing Protocols discover multiple routes between source and destination at the time of route discovery as alternate routes such that if there is any failure in primary path an alternate path can be used for recovery [1]. These protocols are generally extensions to unipath routing protocols. These types of routing protocols provide mechanisms to deal with faults in MANET. Due to random movements of node in MANET, it is prone to various faults like failure of nodes, failure of link, breakage of routes and congested links [2]. These protocols follow proper route maintenance mechanism to provide appropriate route recovery at the time of failure by selecting the alternate route discovered at the time of route discovery in optimal way.

II. PROBLEM STATEMENT

Traditional on demand routing produces heavy routing traffic by blindly flooding the entire network with Route Request (RREQ) packets during route discovery. The routing overhead associated with dissemination of routing packets is quite huge especially when topology changes [2] .Multipath routing protocols cache multiple routes to a destination in a single route discovery. However, in presence of mobility, multipath protocols incur additional packet drops and delay due to their dependency on potentially stale routes from caches Protocols using either limited broadcast or local recovery have focused on reducing packet drops and not on utilizing the bandwidth efficiently during route recovery [2]. Multipath routing protocols involving multipath discovery and local route recovery at the time of node mobility creates additional burden and heavy traffic load on the network by selecting recovery node as random overhearing node.

So we propose an enhanced routing protocol which provides continuous route discovery. Initial route is discovered here in on demand basis. Then each node in the route acts as router. Each node involves in route discovery. Whenever a node discovers more than two routes it is marked as a DPN node and that node maintains a temporary table called priority acknowledgement table where route information's are maintained from which we can discover another alternate route. Whenever a link or a route break occurs, a route recovery is performed which in turn invokes the alternate route selection from the nearby DPN nodes.

III. REVIEW OF RELATED WORKS

Multipath Multicasting Using Power Algorithm:

An energy-efficient mechanism for unipath routing in sensor networks called directed diffusion has been proposed. Directed diffusion is an on-demand routing approach. In directed diffusion, a (sensing) node which has data to send periodically broadcasts it. When nodes receive data, they send a reinforcement message to a pre-selected neighbor which indicates that it desires to receive more data from this selected neighbor. As these reinforcement messages are propagated back to the source, an implicit data path is set up; each intermediate node sets up state that forwards similar data towards the previous hop.

Dynamic Source Routing (DSR)

The reactive DSR Protocol was developed by [3],operation of the DSR protocol is broken into two stages; route discovery phase and route maintenance phase, these phases are triggered on demand when a packet needs routing.

Route discovery phase floods the network with route requests if a suitable route is not available in the route [4]. DSR uses a source routing strategy to generate a complete route to the destination, this will then be stored temporarily in nodes route cache [6]. DSR addresses mobility issues through the use of packet acknowledgements; failure to receive an acknowledgement causes packets to be buffered and route error messages to be sent to all upstream nodes. Route error messages trigger the route maintenance phase which removes incorrect routes from the route cache and undertakes a new route discovery phase.

Destination Sequenced Distance Vector (DSDV):

The proactive DSDV protocol based upon the Bellman-Ford algorithm to calculate the shortest number of hops to the destination . Each DSDV node maintains a routing table which stores; destinations, next hop addresses and number of hops as well as sequence numbers; routing table updates are sent periodically as incremental dumps limited to a size of 1 packet containing only new information. DSDV compensates for mobility using sequence numbers and routing table updates, if a route update with a higher sequence number is received it will replace the existing route thereby reducing the chance of routing loops, when a major topology change is detected a full routing table dump will be performed, this can add significant overhead to the network in dynamic scenarios [5].

MAODV: Multicast Ad-hoc On-Demand Distance Vector Routing Protocol

MAODV is a shared-tree-based protocol that is an extension of AODV [6] to support multicast routing. With the unicast route information of AODV, MAODV constructs the shared tree more efficiently and has low control overhead. In MAODV, the group leader is the first node joining the group and announces its existence by Group Hello message flooding. An interested node P sends a join message toward the group leader. Any tree node of the group sends a reply message back to P. P only answers an MACT message to the reply message with minimum hop count to the originator. Then a new branch to the shared tree is set up. Each node will broadcast a Hello message to its neighbors if it does not send any packet within a period of time. The lack of a Hello message indicates that the link between a node and its neighbor is broken. Then the node locally floods a join message towards the group leader. Only those tree nodes which are closer to the group leader and have fresher paths to the group leader respond to this join message. The shared tree may be partitioned due to node mobility and hence two or more group leaders may co-exist. When this happens, a group member Q whose group leader has a lower IP address than any other group leader will inform its group leader to stop the leader's role. Q then sends a message to ask the group leader with the highest IP address to be the new group leader of the final merged tree. Advantages: With the unicast route information, the multicast tree can be constructed more quickly and efficiently. Disadvantages: The group leader continues flooding Group Hello messages even if no sender for the group exists.

IV. PROPOSED WORK

A. *Route Discovery*

We propose an enhanced hybrid routing protocol which provides multipath continuous route discovery between source and destination. When the source wants to forward packets to the destination it broadcast the route request packets (RREQ) to whole network.

The RREQ propagation from source to destination establishes multiple reverse paths both at intermediate nodes and destination. The multiple paths discovered are loop free and disjoint paths. The destination node upon receiving all RREQ packets attaches the route code consisting of route bandwidth and feedback Route Reply (RREP) packets. These multiple RREPs traverse reverse paths back to from multiple forward paths to the destination at the source and intermediate node. After receiving RREP packets, the source node selects the primary route on the basis of route with higher bandwidth [10].

In this primary route again each node acts as a router and involves in continuous route discovery due to the mobility of nodes finding another alternate route based on traffic and signal strength. At this moment if a node finds more than two routes it is marked as a DPN node and a Priority Acknowledgement Table is constructed in this node maintaining the route information's. Now if DPN finds another alternate route which is efficient than the primary route then the transmission is done via the alternate route.

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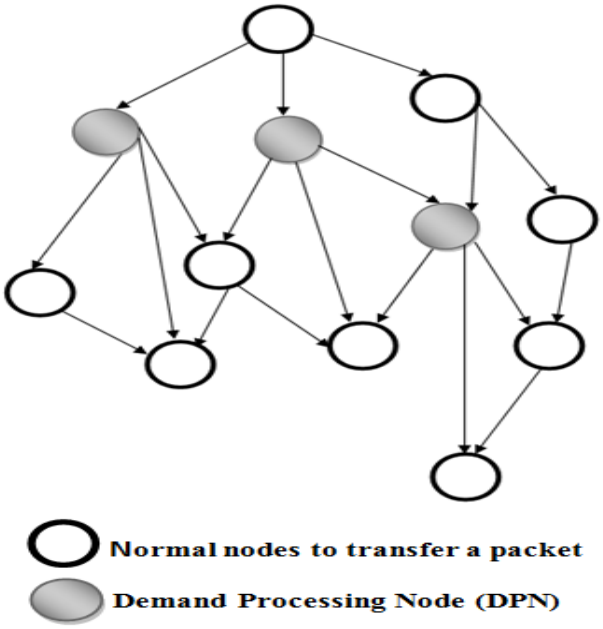

Fig.1. Route Discovery

B. *Route Maintenance*

At the time of route failure in primary route the recovery node is selected from the neighboring DPN by the node detecting failure by performing route discovery from node detecting failure. Now the node detecting failure starts route discovery. In the mean time send Stop Transmission till route recovery packet to source node through reverse path to control congestion. The neighboring node which is maintained in the PAT nearer to the node detecting failure is selected as recovery node. As soon as new path is selected a start transmission packet is sent to source to start transmission again and updates its cache by storing new route for transmission.

DPN node formation is temporary since if more than one DPN node can be determined in a same route, the previous DPN route data can be destroyed as soon as the creation of new DPN.

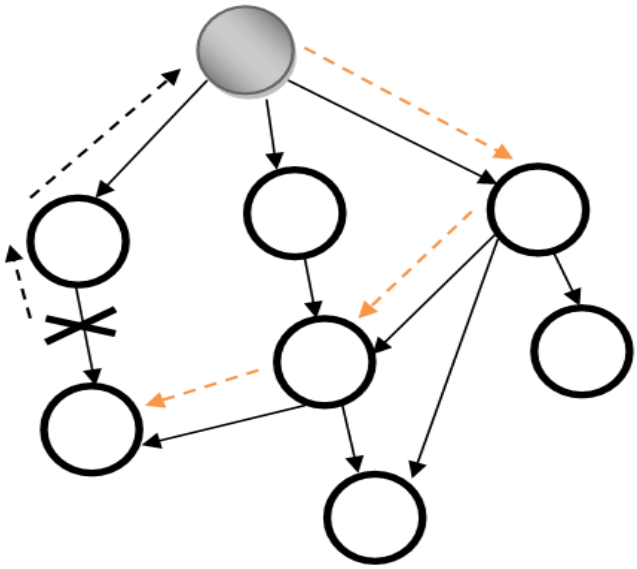

Fig.2. Route Rediscovery

C. *DPN (Demand Processing Node)*

Whenever a node discovers more than two routes the node is marked as a Demand Processing Node (DPN). The DPN constructs a Priority Acknowledgement Table with it. Only the DPN nodes maintain the PAT table. At the time of route failure, the alternate route for the retransmission is selected from the nearby DPN. Instead, of maintaining route information in all the nodes, is maintained only in the DPN.

D. *PAT (Priority Acknowledgment Table)*

When a node searches for a route, it can find the route based on the priority acknowledgment. The optimized route can be determined based on the flow of an data traffic, signal ratio and no of hop counts. Based on the above parameters the table called Priority Acknowledgement Table is constructed if the node finds more than two routes. Otherwise the PAT table is not formed.

V. CONCLUSION

In this paper we have proposed "Enhanced Hybrid Multipath Routing Protocol using Priority Acknowledgement Table", a routing protocol which provides continuous route discovery between source and destination. The proposed protocol is efficient in overcoming the problem of route failure in multipath routing protocols. Also proposed protocol provides hybrid multipath routing protocols that will provide feature of fault tolerance at the time of node failure.

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