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Routing Protocols Proposed MANET Using Shortest Routing in Hop Count Data Transmission

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ABSTRACT

A mobile ad-hoc network consists of mobile nodes that can move freely in open environment. To develop a routing protocol that can meet different application needs and optimize routing paths according to the topology change in mobile ad hoc networks is a challenging task. This paper aims to optimize routing such that increasing the packet delivery ratio, throughput and delay using geographic routing. Different routing protocols such as topology based routing protocol and position based routing protocol are taken into consideration. Our simulation studies have shown that the proposed routing protocol are more robust and improve the packet delivery ratio, throughput and decreases the packet loss.

Index terms- Throughput, Packet delivery ratio, packet loss.

I. INTRODUCTION

The devices that do not depend upon centralized or organized connectivity has led to the development of MANET. These are infrastructure-less network where each node is mobile and independent of each other. Due to the unorganized connectivity and dynamic topology, routing in the MANET becomes the challenging task. Moreover constraints like lower capacity of wireless links, error prone wireless channels, and limited battery capacity of each mobile node. Heavy loaded nodes may cause congestion and large delays or even deplete their energy quickly. Routing protocols that can evenly distribute the traffic among mobile nodes and hence improve the performance of MANET are needed.

Many routing protocols have been proposed for mobile Ad-hoc networking can be classification as reactive and proactive protocols. In Reactive are only discovered when they are actually needed. In contrast, in proactive routing each node continuously maintain route between pair of nodes [1]. Routing protocols in MANET are classified in three categories proactive, reactive and hybrid routing protocols. Prominent routing protocols use AODV, DSR [3] and use hop count as the route selection metric. It may not be the most efficient route when there is congestion in the network. It may lead to undesirable effects such as longer delays and lower packet delivery and high routing overhead. Also some nodes that may lie on multiple routes spend most of the energy in forwarding packets and deplete their energy quickly.

In MANET, consider a packet lifetime constraint, packet delivery ratio and the corresponding delivery cost performance [2] which is defined as the fraction of packets that can be recovered at the destination node before their lifetime expires and the corresponding expected transmission and receiving power consumed, respectively.

In this paper, MANET focuses on distributing the traffic on basis of combination of forwarding three metrics.

1. Hop count.

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2. Traffic.
3. Average number of packets queued up in the interference queue of a node lying on the path from source to destination/traffic queue.

Geographic routing (also called geo routing or position-based routing) is a routing principle that relies on geographic position information. It is mainly proposed for wireless networks and based the idea that the source sends a message to the geographic location of the destination instead of using the network address. Geographic routing requires that each node can determine its own location and that the source is aware of the location of the destination.

II. MANET CHALLENGES

Mobile Ad Hoc networks are becoming a major emerging technology in mobile computing. The features of MANET introduce several challenges in the networking environment [10].

Dynamic topology: The nodes are free to move arbitrarily in the network environment. Network topology is the arrangement of various elements of a computer network. Links of the network vary timely and are based on the proximity of one node to the other node.

Limited Bandwidth: Bandwidth in bits is used to achieve throughput, i.e., the average rate of successful data transfer through communication path.

Routing overhead: protocol overhead refers to network routing information sent by an application , which uses the available bandwidth of a communication protocol.

Packet loss due to transmission errors: Ad hoc networks experience a higher packet loss due to factors such as increased collisions due to the occasion of hidden terminals, presence of interference, uni-directional links and frequent path breaks due to mobility of nodes.

Mobility-induced route changes: The network topology in an ad hoc network is highly dynamic due to the movement of nodes; hence an on-going session suffers frequent path breaks. This situation often leads to frequent route changes.

Battery constraints: Devices used in these networks have restrictions on the power source in order to maintain portability, size and weight of the device.

Security threats: MANETs brings new security challenges to the network design. As the wireless medium is vulnerable to eavesdropping and ad hoc network functionality is established through node cooperation, mobile ad hoc networks are essentially exposed to numerous security attacks.

III. MANET ROUTING PROTOCOLS

This section includes various routing protocols [12] that are used to simulate and also to analyze the packet delivery ratio, throughput and end-to-end delay.

3.1 Topology based routing protocols:

Topology Based Routing Protocols further divided into Proactive approach, e.g., DSDV, Reactive approach, e.g., DSR, AODV, TORA and Hybrid approach, e.g., Cluster, ZRP. A reactive routing protocol tries to find a route from S to D only on-demand, i.e., when the route is required, for example, DSR and AODV are such protocols. The main advantage of a reactive protocol is the low overhead of control messages. However,

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reactive protocols have higher latency in discovering routes. A proactive protocol maintains extensive routing tables for the entire network. As a result, a route is found as soon as it is requested. The main advantage of a proactive protocol is its low latency in discovering new routes. However, proactive protocols generate a high volume of control messages required for updating local routing tables.

3.1.1 AODV

Ad Hoc On-Demand Distance Vector (AODV) is a topology based routing protocol in MANET. It is one of the reactive protocols. It can determine multiple routes between a source and a destination, but implements only a single route because i) Difficult to manage multiple routes between same source and destination pair. ii) If one route breaks, it's difficult to know whether other routes are available or not. It provides both unicast and multicast communication.

3.1.2 DSR

Dynamic Source Routing protocol (DSR) is one of the topology based routing protocol in MANET. It is similar to AODV in that it forms a route on-demand when a transmitting node requested one. However, it uses source routing instead of relying on the routing table at each intermediate device. It has only two major phase's route discovery and route maintenance.

3.2 Position based routing protocols:

In Geographic Routing, nodes need to maintain up-to-date positions of their immediate neighbours for making effective forwarding decisions. The forwarding strategy employed in the geographic routing protocols requires the following information: (A) the position of the final destination of the packet and (B) the position of a node's neighbours. The former can be obtained by querying a location service such as the Grid Location System (GLS) or Quorum. To obtain the latter, each node exchanges its own location information (obtained using GPS or the localization schemes) with its neighbouring nodes. This allows each node to build a local map of the nodes within its neighbourhood, often referred to as the local topology.

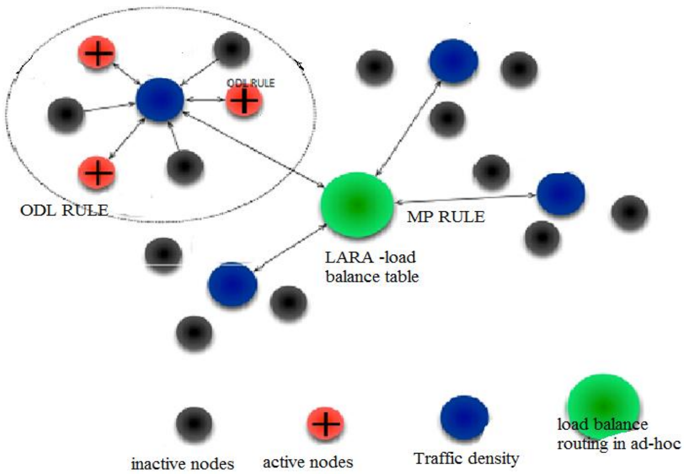

Fig1: Load balance table in traffic density rules

IV. PROBLEM DEFINITION

It is notable that, each coded packet is delivered to only one relay node and the performance improvement there is obtained by increasing the number of separate coded packets [2].However, increasing the number of coded packets will lead to higher computational complexity in encoding and decoding operations. Based on a

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combination of erasure coding and packet replication techniques can improve the efficiency of data communication.

The impact of the packet lifetime constraint is largely neglected in the delivery delay in the sense that all packets will ultimately arrive at their destination node regardless of whether the information they contain has expired or not. However, delivering expired packets carrying useless information will dissolve a lot of communication resources in MANETs. Therefore, the packet lifetime constraint will affect the packet delivery performance of MANETs. The intermittent route causes the link breakages and the route failures [15][2]. This leads to rediscover the new routes due to route failures.

V. PROPOSED SCHEMES

The proposed scheme is that a number of routing protocols proposed for MANET use shortest route in terms of hop count for data transmission. It may lead to quick reduction of resources of nodes falling on the shortest route. It may also result in network congestion resulting in poor performance. The required parameters used are defined in the following

1. Route energy: (RE) the route energy of a path is the minimum of residual energy of the nodes falling on the route. Higher the route energy lesser is the probability of the route failure due to the exhausted nodes.
2. Traffic queue: (TQ) the traffic queue of a node is number of packets queued up in the node interface. Higher the value, more number of nodes is occupied.
3. Average Traffic Queue: (ATQ) it is the mean of traffic queue of the node from the source to destination node. It indicates load on a route and helps in determining the heavy loaded route.
4. Hop Count: (HC) The Hop Count is number of hops for a feasible path.

Ad-hoc On-demand Distance Vector (AODV) is an on demand routing algorithm. When a node needs to send data to a specific destination it creates a Route Request and broadcast. When the request reaches a destination node it creates again a Reply which contains the number of hops that are require to reach the destination. All nodes forwarding this reply to the source node create a forward route to destination [1][12]. Dynamic source routing (DSR) allows nodes to maintain and discover the routes to its destination.

Formally, p (u,v) = {p0,p1,….pn} where each path pi is a candidate path between u and v.

Let HC(pi) be the hop count corresponding to the path pi between u and v. Weight of the path pi between U and V. Weight of the path pi defined as

W(pi) = w1* RE(pi) – w2 * ATQ(pi) – w3 * HC(pi). -->(1)

Where RE(pi)=min ($re_{n1,}re_{n2},\ldots,re_{nm)}$ and n1,n2,……nm are the nodes making up the path.

ATQ(pi)=(tq(n1)+tq(n2)+…..tq(nm))/m-1 →(2)

The field having adverse contribution to traffic distribution is built into negative coefficient in equation 1. Also the weighted values are calculated such as w1+w2+w3=1.

A source node initiates the route discovery process by broadcasting a route request (RREQ) packet whenever it wants to communicate with another node for which it has no routing information in its table. On receiving a RREQ packet, a node checks its routing table for a route to the destination node. If the routing table contains the latest route to the destination node, the intermediate node sends a destination node sends a RREP packet along the reverse path back to source node also appending the weight value for the route. When a source node receives more than one RREP packet for RREQ, it compares the weight value of the route and selects the route with

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maximum weight [10]. However, if an intermediate node has no information of the destination node, it adds its own traffic queue value, compare and finds the minimum of residual battery capacity field of RREQ packet, increments the hop count by one and rebroadcast the route discovery packet when destination mode receives a route request packet, it waits for a certain amount of time before replying with a RREP packet in order to receive other RREQ packets. Then destination node computes ATQ and the weight value for each feasible path using equation 2 and using weight function as given in equation 1 respectively. The route with highest weight value is selected as the routing path and a RREP packet is sent back towards the source node and the selected path. The different topology based routing protocols are compared to optimize the packet delivery ratio using geographic routing.

VI. SIMULATION RESULTS

The simulations were carried out using NS-2 simulator. Our solution has been compared against topology based and position based routing protocols. Analyzing the packet delivery ratio at two states: fixed and dynamic. Simulation consists of 10 nodes moving with the maximum speed of 10.0m/s with an average pause between movements being 2s. The boundary range is about 500 x 500. A number of these cached routes overlap existing routes. Nodes that are the part of multiple routes become congested and cannot deliver the packet further resulting in poor performance of AODV. The effectiveness of load balancing is not salient compared with our schemes. The performance of proposed schemes is almost similar. The reason for lower packet delivery fraction in the network is to find out a route to the destination because of the restricted number of RREQ packets. The results also show that the packet delivery fraction increases with decrease in load in the network.

The following metrics are analyzed to perform the packet delivery ratio, throughput and packet loss using AODV and DSR protocols.

Packet delivery ratio: The ratio of packets that are successfully delivered to a destination compared to the number of packets that have been sent out by the sender. The simulation result shows that the packet delivery ratio increases to 89 percent.

End-to-end delay: The average time taken by a data packet to reach its destination. The proposed algorithm have much improved average end to end delay than AODV and other two load balanced routing protocols, DLAR and LARA. The packet now has to wait longer in the interface queue before being transmitted. Here, AODV suffers maximum delay as it topology as well. This behaviour is as anticipated because delay mainly occurs in queuing and medium access control processing. These delays are reduced in proposed schemes by routing the packets toward nodes that are less occupied also taking into account more efficient node in terms of energy.

VII. CONCLUSION

In This Paper route optimization scheme adapts the routing path according to both topology changes and actual data traffic requirements. Each node can determine and adjust the protocol parameter values independently according to different network environments, data traffic conditions and node’s own requirements. The simulation studies have shown that the proposed routing protocols are more robust and outperform the existing geographic routing protocol. In future, other quality of service such as bandwidth, jitter, reliability is incorporated.

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