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Neighbour Knowledge and Rebroadcast Probability Retransmit for Dipping Route Overhead in Mobile Ad Hoc Networks

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***Abstract*— Applications of MANETs include battlefields or major disaster areas where networks need to be deployed immediately but without base locations or fixed network communications. In MANETS, broadcasting is a common operation because of host mobility, these manoeuvres are imagined frequently. Direct single-hop communication has various constrictions due to considerations such as radio control limitation, channel consumption, and power-saving concerns. In such case, a multi hop situation occurs, where the packets sent by the source host are relayed by several intermediate hosts before reaching the destination host.**

In order to effectively exploit the neighbour coverage knowledge, we propose a unique rebroadcast delay to resolve the rebroadcast instruct, and then we can obtain the more accurate additional coverage ratio by sensing neighbour coverage knowledge. Our proposed approach combines the advantages of the neighbor coverage knowledge as well as the probabilistic mechanism, which can significantly diminish the number of retransmissions so as to reduce the routing overhead, and can also improve the routing recital.

Keywords: Multi-hop broadcasting, rebroadcasting, rebroadcast delay, neighbor coverage .

I. INTRODUCTION

The MANET community needs to standardize a single methodology that efficiently delivers a packet from one node to all other network nodes. Network wide broadcasting, basically referred to as "broadcasting" is the process in which one node sends a packet to all other nodes in the network. Many unicast routing protocols [2] such as Dynamic Source Routing (DSR), AdHoc On Demand Distance Vector (AODV), Zone Routing Protocol (ZRP), and Location Aided Routing (LAR) [2] use broadcasting or a derivation of it to ascertain directions. The core inconveniences with Flooding [3] are that it typically causes unproductive and often harmful bandwidth congestion, as well as inefficient use of node resources. Many efficient broadcasting techniques have been proposed whose objective is to minimize the number of retransmissions while attempting to ensure that a broadcast packet is delivered to each node in the network. All broadcast protocols are distributed in nature and designed for asynchronous Medium Access Control schemes.

The basic idea behind the proposed work is that if the network layer protocol decides the packet should not be rebroadcast, it informs the MAC layer to discard the packet. Also, the delay that has to be sustained as a longer time period and keep the packet at the network layer until the delay time perishes.

II. EXISTING SYSTEM

The existing protocols for MANETS such as Ad hoc On-demand Distance Vector Routing (AODV) and Dynamic Source Routing (DSR) are on demand routing protocols, which could improve the scalability of MANETs by limiting the routing overhead when a new route is requested. Due to node mobility in MANETs, frequent link breakages occur which may lead to frequent path failures and route sighting, which could increase the overhead of routing protocols and reduce the packet delivery ratio and increasing the end-to-end delay.

The existing broadcasting protocols [4] are categorized into four classes: "simple flooding, probability-based methods, area based methods, and neighbor knowledge methods. Simple Flooding requires each node to rebroadcast all packets. Probability Based Methods use basic understanding of the network topology in order to assign a probability to a node to rebroadcast. Area Based Methods assume nodes have common transmission distances; a node will rebroadcast only if the rebroadcast will reach sufficient additional coverage area. Neighbor Knowledge Methods maintain state on their neighborhood, via “Hello” packets, which is used in the decision to rebroadcast.

Simple Flooding protocol for broadcasting and multicasting in ad hoc networks which are characterized by low node densities and/or high mobility. The probability based methods are once again classified into Counter-based schemes. The limitation of probability based schemes is that in a dense area of the network, some nodes won’t rebroadcast; in sparse areas of the network, all nodes rebroadcast. Area based schemes are categorized into Distance based schemes and Location based schemes. In these schemes, the redundancy of the packets as well as the rebroadcast rate is also high which increases the delay and also the network costs. The Neighbour knowledge methods include Scalable Broadcast algorithm, Flooding with self pruning, Multipoint Relaying, Ad hoc Broadcast protocols, CDS based broadcast algorithm, LENWB. In these schemes, the information required for that decision is knowledge of which neighbours have received a packet from the common source node and which neighbours have a higher priority for rebroadcasting. The priority is proportional to a node’s number of neighbors; the higher the node’s degree the higher the priority. Since a node relies on its higher priority neighbors to rebroadcast, it can proactively compute if all of its lower priority neighbors will receive those rebroadcasts; or else, the node rebroadcasts.

III. PROPOSED SYSTEM

The proposed implementation deals with the calculation of rebroadcast delay and rebroadcast probability. The rebroadcast delay is to determine the forwarding order for which the node having the common neighbors is assumed to have a lower delay. Since the node has common neighbors, the information is assumed to be spread for more number of nodes. The rebroadcast probability[1] maintains the information of the uncovered nodes and consists of two components. additional coverage ratio and connectivity factor. Additional coverage ratio defines the ratio of the number of nodes that should be covered by a single broadcast to the total number of neighbors. Connectivity factor, represents the relationship of network connectivity and the number of neighbors of a given node.

In order to calculate additional coverage ratio and connectivity factor for rebroadcast probability and also rebroadcast delay we maintain 1-hop information for each node and we use RREQ packets. When node ni receives an RREQ packet from its previous node s, the neighbor list in the RREQ packet is used to estimate how many of its neighbors have not been covered by the RREQ packet from s. If node ni has more neighbors uncovered by the RREQ packet from s, which means that if node ni rebroadcasts the RREQ packet, the RREQ packet can reach more additional neighbor nodes. UnCovered Neighbors set U(ni) of node ni can be calculated as follows:

$$U(n_i) = N(n_i) - [N(n_i) \cap N(s)] - \{s\}$$

Due to broadcast characteristics of an RREQ packet, there ia s probability that node ni can receive the duplicate RREQ packets from its neighbors. When a neighbor receives an RREQ packet, it could compute the rebroadcast delay according to the neighbor list in the RREQ packet and its own neighbor list. The rebroadcast delay Td(ni) of node ni is defined as follows:

$$T_p(n_i) = 1 - \frac{|N(s) \cap N(n_i)|}{|N(s)|}$$
$$T_d(n_i) = MaxDelay \times T_p(n_i),$$

where Td(ni) indicates the delay ration of node ni.

Rebroadcast Probability

The node having a larger rebroadcast delay may listen to RREQ packets from the nodes which have lower one. The U(ni) of the RREQ packet can be adjusted as follows:

$$U(n_i) = U(n_i) - [U(n_i) \cap N(n_j)].$$

The rebroadcast delay is used to determine the order of disseminating neighbor coverage knowledge to the nodes which receive the same RREQ packet from the upstream node. When the timer of the rebroadcast delay of node ni expires, the node attains the ultimate UCN set.

The additional coverage ratio (Ra(ni)) of node ni can be defined as:

$$R_a(n_i) = \frac{|U(n_i)|}{|N(n_i)|}.$$

The above ratio indicates the ratio of the number of nodes that are additionally covered by this rebroadcast to the total number of neighbors of node ni.Also, the minimum Fc(ni) as a connectivity factor for a given node can be calculated as

$$F_c(n_i) = \frac{N_c}{|N(n_i)|},$$

The rebroadcast probability can be obtained by combining the additional coverage ratio and connectivity factor, as below:

$$P_{re}(n_i) = F_c(n_i) \cdot R_a(n_i),$$

The algorithm for the Neighbor Coverage-based Probabilistic Rebroadcast for reducing routing overhead in route discovery is given as follows:

The experimental evaluation can be divided into three parts based on the performance and parameters of the routing protocols

-Number of nodes.

-Number of CBR connections.

-Random packet loss rate

Algorithm 1. NCPR

Definitions:

$RREQ_v$: RREQ packet received from node v.

$R_v.id$: the unique identifier (id) of $RREQ_v$.

$N(u)$: Neighbor set of node u.

$U(u, x)$: Uncovered neighbors set of node u for RREQ whose id is x.

$Timer(u, x)$: Timer of node u for RREQ packet whose id is x.

{Note that, in the actual implementation of NCPR protocol, every different RREQ needs a UCN set and a Timer.}

if n_i receives a new $RREQ_s$ from s **then**
  {Compute initial uncovered neighbors set $U(n_i, R_s.id)$ for $RREQ_s$:}
  $U(n_i, R_s.id) = N(n_i) - [N(n_i) \cap N(s)] - \{s\}$
  {Compute the *rebroadcast delay* $T_d(n_i)$:}
  $T_p(n_i) = 1 - \frac{|N(s) \cap N(n_i)|}{|N(s)|}$
  $T_d(n_i) = MaxDelay \times T_p(n_i)$
  Set a Timer(n_i, $R_s.id$) according to $T_d(n_i)$
end if

while n_i receives a duplicate $RREQ_j$ from n_j before Timer(n_i, $R_s.id$) expires **do**
  {Adjust $U(n_i, R_s.id)$:}
  $U(n_i, R_s.id) = U(n_i, R_s.id) - [U(n_i, R_s.id) \cap N(n_j)]$
  discard($RREQ_j$)
end while

if Timer(n_i, $R_s.id$) expires **then**
  {Compute the *rebroadcast probability* $P_{re}(n_i)$:}
  $R_a(n_i) = \frac{|U(n_i, R_s.id)|}{|N(n_i)|}$
  $F_c(n_i) = \frac{N_c}{|N(n_i)|}$
  $P_{re}(n_i) = F_c(n_i) \cdot R_a(n_i)$
  if Random(0,1) $\le P_{re}(n_i)$ **then**
    broadcast($RREQ_s$)
  else
    discard($RREQ_s$)
  end if
end if

The routing overhead for the different routing protocols is as given below:

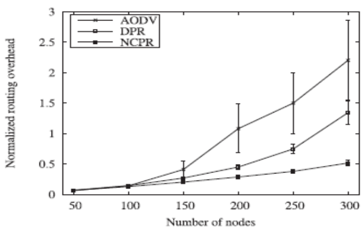

Fig 1: Normalized routing overhead with varied number of nodes

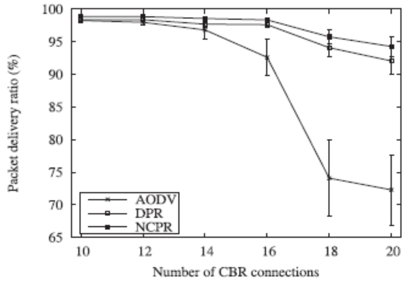

Fig 2: Normalized routing overhead with varied number of CBR connections

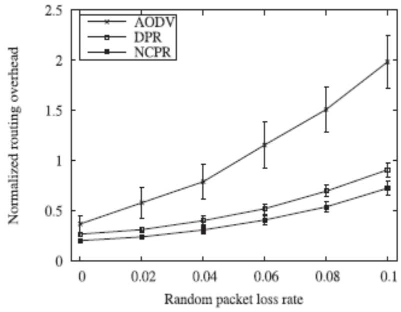

Fig 3: Normalized routing overhead with varied random packet loss rate

From the above results, it is clear that as the packet loss increases, there will be more link breakages and route discoveries, and then there will be more routing overhead. Also, As the traffic load increases, the packet drops of the conventional AODV protocol without any optimization for redundant rebroadcast are more severe. The redundant rebroadcast increases delay because 1) it incurs too many collisions and interference, which not only leads to excessive packet drops, but also increases the number of retransmissions in MAC layer so as to increase the delay; 2) it incurs too many channel contentions, which increases the backoff timer in MAC layer, so as to increase the delay.

IV. CONCLUSION

The implemented Neighbor coverage-based probabilistic rebroadcast (NCPR) protocol is a probabilistic based broadcast protocol effectively exploits the neighbor coverage knowledge, using rebroadcast delay to determine the rebroadcast order, and thus obtain more accurate additional coverage ratio; this system dynamically calculates the rebroadcast delay. This scheme generates less rebroadcast traffic than the flooding and other existing optimized schemes. This protocol mitigates the network collision and contention, so as to increase the packet delivery ratio and decrease the average end-to-end delay.

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