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Reducing Routing Overhead In Manet Using Neighbor Coverage-Based Probabilistic Rebroadcast And Local Broadcast Algorithm

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ABSTRACT

The mobility of the nodes in MANET causes frequent link breakage problem which also leads to data loss. We propose a neighbor coverage-based probabilistic rebroadcast protocol for reducing routing overhead in MANETs by which the node can send the route request to the other nodes till the destination is reached. So that the node can determine the exact path to send the data. We are implementing a next hop node monitoring by which we can check whether the next node is able to transmit the packet. If any of the intermediate node leave the network or disconnected from the network, the data will transmitted to the destination via alternate path automatically. So that the data can be effectively transmitted. Also for security purpose we are encrypting the data packets during transmission.

Index Terms- Broadcast, MANETS, Routing, Packets

1 INTRODUCTION

Mobile ad hoc networks (MANETs) are self-organizing mobile wireless networks that do not rely on a preexisting infrastructure to communicate. Nodes of such networks have limited transmission range, and packets may need to traverse multiple other nodes before reaching their destination. Research in MANETs was initiated 20 years ago by DARPA for packet radio projects [13], but has regained popularity nowadays due to the widespread availability of portable wireless devices such as cell phones, PDAs and WiFi / Bluetooth enabled laptops. Because of the ever-changing topology of MANETs, broadcasting is a fundamental communication primitive, essential to ad hoc routing algorithms for route discovery. The usual approach for broadcasting is through flooding. Flooding is well suited for MANETs as it requires no topological knowledge. It consists in each node rebroadcast a message to its neighbors upon receiving it for the first time.

As the results of advances in wireless communication technology, portable computers with wireless interfaces can communicate among themselves. It is argued that future wireless network will be converged to be more easily reconfigurable situations such as *Mobile Ad hoc network* (MANET). MANET is a special type of wireless mobile network in which mobile hosts can communicate without any aid of established infrastructure and can be deployed for many applications such as battlefield, disaster relief and rescue, etc. Broadcasting is to transmit a message from a source to all the other nodes in the network. It is widely used to resolve many network layer problems. In a MANET, in particular, due to host mobility, broadcastings can be applied to many areas, such as paging a particular host, sending an alarm signal, and finding a route to a particular host, etc. Several ad hoc network protocols assume that the broadcasting service is basically available. For instance, AODV (Ad Hoc On-demand Distance Vector Routing) protocol adopts broadcasting mechanism as a route request in MANET.

Many approaches are proposed for broadcasting in MANET. But none of them have been considered as an optimal method for the broadcasting. The simplest one to achieve broadcasting is through flooding. Even though flooding is very simple and reliable approach, it produces a high overhead in the network. Therefore, it leads to excessive contention, collision and redundant rebroadcasts. More sophisticated solutions such as probability-based, counter-based, distance-based, location-based, and neighbor knowledge- based approaches have been proposed to overcome the drawbacks of flooding. Probability-based approach is another simple one. It depends upon pre-defined fixed probability to determine whether it rebroadcast the packets or not. One problem of the probabilistic approach is how to set the rebroadcast probability. It is demonstrated in that the optimal rebroadcast probability is around 0.65. Intuitively, this value does not seem globally optimal for different node density and relative location from the sender. For example, the mobile hosts close to sender will have more neighbors whose coverage areas significantly overlasp. So, the rebroadcast probability of a node in MANET should be set dynamically according to its circumstances.

2 RELATED WORKS

One direction to optimize flooding is to take a probabilistic approach. In order to flood, a node in the network broadcasts a message with probability p and takes no action with probability 1− p. In our paper we explore the possibility of applying a phenomenon well studied in percolation theory and random graphs, phase transition, as a basis for selecting p. Above a certain threshold for p, in graphs of a certain size for random graphs and lattices of a certain density for percolation, an infinite spanning cluster abruptly appears instead of a set of finite clusters. An infinite spanning cluster is a unbounded connected component, which if transposed to a MANET would translate in the very high probability of the existence of a multi-hop path between any two nodes within the network. To the best of our knowledge, besides , previous publications having studied probabilistic broadcast for flooding in MANETs have not done so within the context of phase transition. This paper contributes in a first stage to a better understanding of the various factors that influence phase transition in ideal MANET environments. By opposition to traditional theoretical phase transition analysis and simulation, we specifically consider factors that would typically intervene within probabilistic algorithms deployed on MANETs. In a second stage, we illustrate the consequences of considering realistic effects such as packet collisions and node mobility. To the contrary of [12], we concentrate on pure flooding in order to understand the variations in performance due solely to the parameters simulating realistic MANET environments. Our results therefore provide a general understanding of the behavior to be expected from probabilistic flooding.

RELATED BROADCAST SCHEMES

In this section we argue for our selection of broadcast schemes to which we compare to DRB and DCCB. There exist only two deterministic timer based broadcast schemes in the literature: Scalable Broadcast Algorithm (SBA) and the Stojemnovic scheme. Indeed, a timer-based approach brings about inherent elements of randomness which are easier to handle in a probabilistic scheme where full reach ability does not have to be guaranteed. A comprehensive comparison of the entire host of existing probabilistic schemes is beyond the scope of the paper and would distract from the actual objective of demonstrating the benefits of a hybrid backbone. For a list of probabilistic schemes [2],and existing comparative work see [3], [4] and references therein. Area- and distance-based schemes [2], e.g., use actual geographic information about the nodes which naturally changes the tradeoff game.

Notably, counter- and color-based schemes are probabilistic and timer-based but use only the explicit or implicit information provided by overheard broadcast packets. The more recent color-based schemes exhibit performance similar to the counter-based ones. At last, a new scheme was proposed most recently, where non-random timers are set depending on neighbor locations such as to optimize efficiency or latency. We do not include this scheme in our comparison since their timers are non-random.

SBA scheme

The SBA scheme of Peng and Lu reduces the number of broadcast nodes as follows. When a node v receives a broadcast packet, instead of forwarding the packet immediately, it waits for a random time. Denote the set of neighbors of node v by N(v). For each of its neighbors w that has forwarded the broadcast packet, node v removes w and N(w) from N(v). If the resulting set of nodes does not become empty after the random time, node v forwards the broadcast node; otherwise node v does not forward the packet.

Dynamic Reflector Broadcast (DRB)

The DRB algorithm assumes that a WCDS has been computed and that all network nodes know their WCDS neighbors. The nodes of the WCDS are called dominators; further, the network nodes which have more than one dominator as neighbor are called reflectors. The scheme works as follows.

Dynamic Reflector Broadcast

1) The broadcast may be initiated by any node by simply broadcasting a packet to all its neighbors.

2) Any dominator that hears a particular broadcast packet for the first time rebroadcast the packet after a short delay. It also appends to the packet the list of all neighboring dominators and removes any other appended list. A typical setting is a delay uniformly distributed in the interval.

3) Any reflector that hears a particular broadcast packet for the first time starts a timer of random duration. A typical setting is a uniform distribution in the interval [0; TR] where TR is much larger than TD. Until its timer expires the reflector listens to all rebroadcasts of the same packet and logs as ”done” the sending dominators corresponding the target dominators listed in the packet. Upon expiration of the timer it checks whether any of its neighboring dominators is not logged as ”done”. If not, it takes no further action. If so, it rebroadcasts the packet to all its neighbors. It also appends to the packet the list of all its neighboring dominators and removes any other appended list, in order to inform all neighboring reflectors.

3 OUR WORK

NEIGHBOR COVERAGE-BASED ROBABILISTIC REBROADCAST

We calculate the rebroadcast delay and rebroadcast probability of the proposed protocol. We use the upstream coverage ratio of an RREQ packet received from the previous node to calculate the rebroadcast delay, and use the additional coverage ratio of the RREQ packet and the connectivity factor to calculate the rebroadcast probability in our protocol, which requires that each node needs its 1-hop neighborhood information.

LOCAL BROADCAST ALGORITHM

Suppose each node has a list of its 2-hop neighbors (i.e., nodes that are at most 2 hops away). This can be achieved in two rounds of information exchange. In the first round, each node broadcasts its id to its 1-hop neighbors (simply called neighbors). Thus, at the end of the first round, each node has a list of its neighbors. In the second round, each node transmits its id together with the list of its neighbors.

The proposed broadcast algorithm is a hybrid algorithm, hence every node that broadcasts the message may select some of its neighbors to forward the message. In our proposed broadcast algorithm, every broadcasting node selects at most one of its neighbors. A node has to broadcast the message if it is selected to forward. Other nodes that are not selected have to decide whether or not to broadcast on their own. This decision is made based on a self-pruning condition called the coverage condition.

4 CONCLUSIONS

This neighbor coverage knowledge includes additional coverage ratio and connectivity factor. We proposed a new scheme to dynamically calculate the rebroadcast delay, which is used to determine the forwarding order and more effectively exploit the neighbor coverage knowledge. Simulation results show that the proposed protocol generates less rebroadcast traffic than the flooding and some other optimized scheme in literatures. Because of less redundant rebroadcast, the proposed protocol mitigates the network collision and contention, so as to increase the packet delivery ratio and decrease the average end-to-end delay. The simulation results also show that the proposed protocol has good performance when the network is in high density or the traffic is in heavy load. We have studied a purely probabilistic approach to flooding attempting to exploit the phase transition phenomenon. Our results show that there is a major difference between the behavior obtained in ideal situations inspired from random graphs and percolation theory and simulations undertaken in MANETs prone to packet collisions. For the latter, the success rate for probabilistic flooding does not exhibit a bimodal behavior as percolation theory and random graphs would suggest. The success rate curve for probabilistic flooding tends to become linear for MANETs of low average node degree, and resembles a bell curve for MANETs of high average node degree.

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