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PREDICTION BASED ROUTING WITH EPIDEMIC PROTOCOL FOR CLUSTERING IN DELAY TOLERANT MOBILE NETWORKS

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Abstract

The mobile nodes of a DTMN with similar mobility pattern are grouped into a cluster. The cluster can then interchange their resources and reduce the overload and maintain the load balancing. The main problem behind the clustering in DTMN is the frequentl breakage of the route due to dynamic mobility of nodes. So we use a prediction based routing protocol to overcome the route breaking. In this paper we introduce an epidemic routing protocol to improve the transmission rate between the source and destination without any failure.

Keywords: Clustering, delay tolerant networks, Prediction based routing, Epidemic routing.

Introduction

Delay tolerant network is a wireless network. So it is impossible to establish end-to-end connections for data delivery. Based on nodal contact probabilities, routing are done in these networks. The main factor in this design is how to efficiently maintain and update these probabilities. Clustering is the best approach to improve scalability by reducing network overhead. Clustering is the process of grouping mobile nodes with similar mobility pattern into a group. This group is known as cluster. The nodes in a cluster share their resources. This helps in efficient routing in DTMN by reducing the overhead. Various algorithms are used for clustering in mobile and ad hoc networks. The main problem behind the clustering in DTMN is the frequent breakage of the route due to dynamic mobility of nodes. So we use a prediction based routing protocol to overcome the route breaking.

Distributed Clustering: The main task in the transmission of message in delay tolerant mobile network is to build clusters among mobile nodes. One of the clustering algorithms is distributed clustering algorithm, in which the mobile nodes of similar mobility pattern are group into a cluster. The distributed clustering algorithm is performed in two

stages. In the first stage each node's direct contact probabilities to other nodes is computed. In the second stage based on its contact probabilities to other members of that cluster, each node decides to join or leave a cluster. Our aim is to group all nodes into a cluster. If node's contact probabilities to all existing members are greater than a threshold value, then the node joins a cluster. Otherwise the node leaves the current cluster.

Cluster-Based Routing

Once the clustering procedure is finished, each node in the network is associated with a cluster. For any two clusters whose members have the contact probability greater than the threshold value are connected by means of a pair of gateway nodes. There are three types of cluster based routing. They are intra-cluster routing, one-hop inter clustering routing, and multi-hop inter-clustering routing. If node *i* wants to send a message to node *j*, then node *i* looks up its cluster table to find the cluster ID of node *j*. According to the cluster ID of node *j*, one of the routing is done

Prediction Based Routing Protocol

Prediction based routing protocol predicts how long routes will last and creates new path before the old one break. A path between the two nodes is recognized by sending a route request packet with a time-to-time value. The route request packet is send if and only if there is no path exist between two nodes which want to communicate. This is identified by checking its routing table. The path is established by forwarding the route request packet to all its neighboring nodes. A route reply packet is sent to the source node through the sequence of nodes in the route request packet by the destination node. This path is used by the source node to supply its application packets. If the source node get route request packet from numerous nodes, it chooses the route which have shortest distance and maximum predicted route lifetime.

The route reply packet is used to collect information to predict the lifetime of the route after establishing a route by sending a route request packet. The accessible node adds the information about location and velocity and maintains a *lifetime* field in the route reply packet header equal to some value which is greater than *maxlifetime*. The maxlifetime is the minimum of all link lifetimes along the route. When the packet traverses from the destination to the source, each transitional node does the following. The node predicts the lifetime of the connection between the two nodes using the prediction algorithm based on the velocity and location information of its predecessor and that of itself. If this predicted value is smaller than the present *lifetime value* included in the route reply packet, the *lifetime* field of the packet is changed to this new value. Otherwise the present value in the packet is left unchanged and forwarded toward the source. In this way the source node gets the predicted lifetime of the route. The route's predicted lifetime is indicated in the *lifetime* field of the route reply packet. In this work we investigate an epidemic routing protocol along prediction based

routing protocol to improve the transmission rate between the source and destination without any failure. Epidemic routing protocol distributes application messages to hosts within connected portion. In DTMN the connection between the clusters are maintained by prediction based routing. Epidemic routing distributes messages quickly through connected networks. Epidemic routing maximizes message delivery, minimize message delivery latency and also minimize system consumed in message delivery.

Epidemic Routing Protocol

In epidemic routing all nodes always send a duplicate of message to all nodes it encounters. Epidemic Routing chains the final delivery of messages to random destinations with negligible assumptions concerning the original topology and connectivity of the underlying network. To ensure eventual message delivery, only periodic pair-wise connectivity is required. Epidemic routing have some characteristics-i) it efficiently distribute messages through partially connected networks, ii) it minimize the amount of resources consumed in the delivery of any single message, and iii) it maximize the percentage of messages that are eventually delivered to their destination

In epidemic routing, each packet generated is assigned a unique ID .The list of all the packets IDs is stored in a node's buffer called the summary vector. When two nodes congregate, they exchange their summary vector. All data packets that are stored in one node are ordered on a first come first serve basis to be transmitted to the other node. The packets are transferred till the nodes meet together. The *Epidemic* routing guarantees the delivery of all the packets to their destinations through its unlimited buffer size, long enough contact durations, and unlimited lifetime for the data packets. Each packet is routed on all possible paths from the source, and one of the copies will be on the shortest path. So epidemic routing guarantees the lowest end-to-end delay

Epidemic Routing supports the ultimate delivery of messages to uninformed destinations with negligible assumptions concerning the primary topology and connectivity of the underlying network. Only intermittent pair-wise connectivity is necessary to guarantee ultimate message transfer. The epidemic protocol depends on the transitive sharing of messages through delay tolerant mobile networks, with messages finally reaching their intention. Each node keep an area which consists of messages originated from it and also messages receive from other nodes. These messages are stored in a hash table and a unique identifier is associated with each message for easy searching.

The Epidemic routing protocol uses all accessible message paths to convey the messages and makes redundancy at each node. This protocol is simple, but it uses more storage, more bandwidth and nodes power due to sending the same message many times. It drops the messages at receiver when the resources reach the peak level. It is especially useful

when the Topology information is not known. To reduce these issues, we use anti-packet, encounter count, Time to Live along with epidemic protocol

Epidemic with Anti- Packets: These packets act as acknowledgements. These anti-packets may tell the source about which packets the destination received or which packet that it wants to receive.

Epidemic with Encounter Count (EC): The EC value tells how many number of times a particular packet arrives at a node. Each node will decide whether the packet to be accepted or discarded according to the EC value when the buffer gets full.

Epidemic with Time To Live (TTL): The nodes will discard bundles according to TTL value. Every bundle has the TTL value, and once they are transmitted and stored in buffer, their TTL value gets reduce for every second.

Conclusion

Clustering in Delay Tolerant Mobile Network is unique and non-trivial, because the network is not fully connected. For efficient and scalable routing in DTMN, distributed clustering scheme and a cluster-based routing protocol is used, in which the mobile nodes with similar mobility pattern are group into a cluster. To avoid frequent route breakages prediction-based routing (PBR) protocol is used. The PBR uses predicted route lifetimes to preemptively create new routes before existing ones fail. Here we use an epidemic routing protocol to improve the transmission rate between the source and destination without any failure.

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