耐延遲網路下結合社會網絡之資料傳播技術

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Content

This project considers the delay- or disruption-tolerant networking (DTN) technologies that are characterized by high node mobility, uncertainty of node existence, and intermittent connectivity. Data dissemination in DTNs resorts to new routing paradigms instead of traditional end-to-end routing paradigms in mobile ad hoc networks (MANET).

The third-year research focuses on social mobility pattern and aggregation phenomenon of nodes for message routing schemes. We now obtain three research efforts: (A) analyzing the influence of mobile social communities on data dissemination in DTNs, (B) social-based routing with human mobility patterns in DTNs, and (C) message forwarding with dynamic cluster awareness in DTNs

Part A

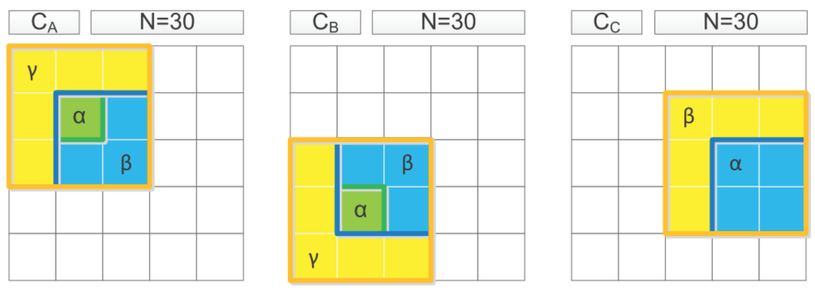
A1. Introduction

This study employs the time-variant community mobility (TVC) model to formulate the relationship between user mobility and social community in the definite time horizon. TVC model incorporate two important mobility characteristics, skewed location visiting preferences and periodical re-appearance. Simulation results show that the TVC model with extensions is able to present nodes' mobility patterns associated with various social relationships in a time dimension, and interpret many movement characteristics such as contact duration and contact times.

A2. TVC-Based DTN Design

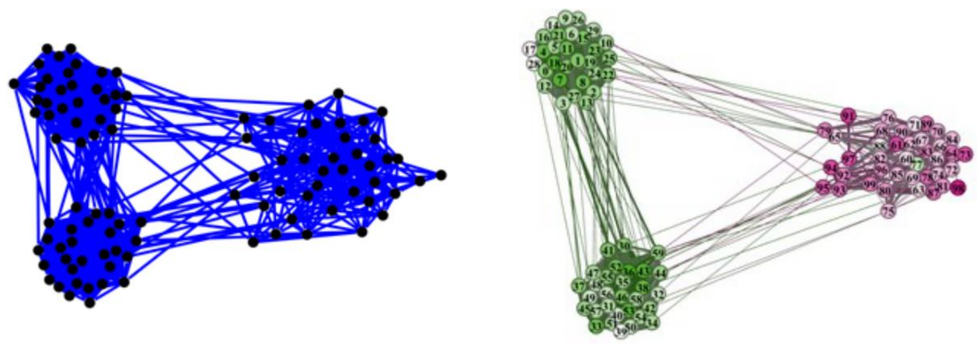
(1) Each community has different probabilities to move around in different subareas.

(2) Nodes rotate different probabilities in different time periods



A3. Simulation result

- Visualization graph of contact times with Graphviz vs. Gephi



Part B

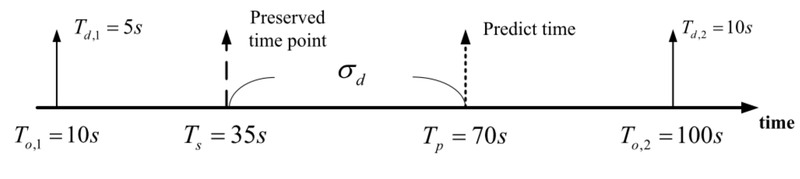
B1. Introduction

This study proposes a novel routing scheme which uses local information of temporal and periodic contacts in DTNs from the effort of Part A . This design refers to human features of mobility patterns in daily life, and then can predict periodic contact between nodes in a network. Furthermore, this design does not need a global view of network, while nodes themselves can collect information by inter-meeting others at the past.

B2. Scheme Design

The system assumes that nodes follow periodical mobility in a rotation time T_r. A contact event consists of two fields: occurring time $T_{o,i}$ and contact duration $T_{d,i}$. According to a list of n contacts, a node can calculate the predicting time T_p by:

$$T_p = \frac{\sum_{i=1}^{n}(T_{o,i} \times T_{d,i})}{\sum_{i=1}^{n} T_{d,i}}$$



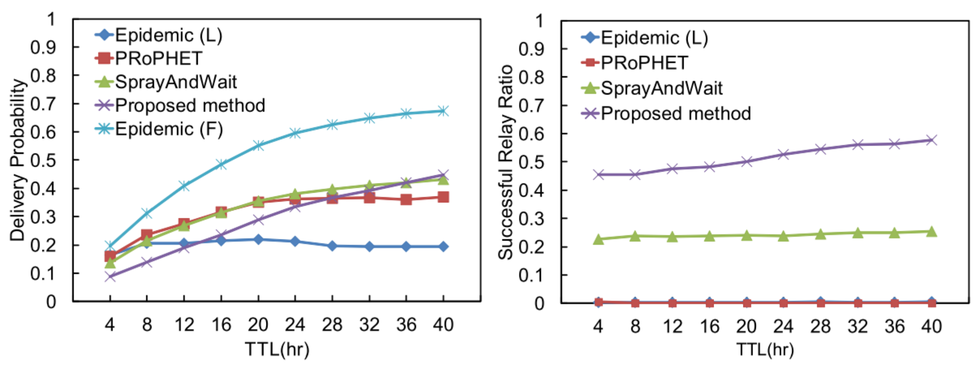
For scheduling forwarding messages in buffer, a node measures the preserved time T_s used to enforce messages received in time by nodes before the contact event happens. The value of T_s is defined as $T_s = T_p - \sigma_d$is related with the standard deviation of $T_{o,i}$

$$Utility = \begin{cases} \frac{T_r-(T_s-t)}{T_r}, & 0 < t \leqslant T_s, \\ \frac{T_r-(t-T_s)}{T_r}, & T_s < t \leqslant T_r. \end{cases}$$

A specific utility function is designed with T_r, T_s, and the current time t for conducting the message forwarding decision.

B3. Simulation result

Experimental results on Cambridge data set



Part C

C1. Introduction

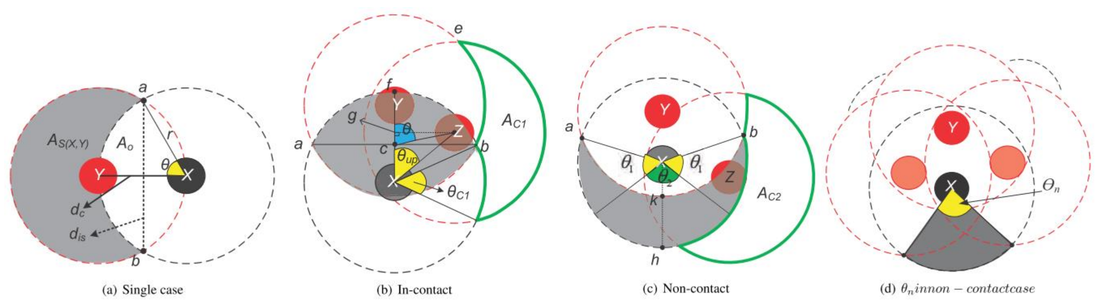
In real life, people in hot spots will form clusters where they have high frequency to visit. If messages can be delivered to these clusters and kept in these clusters, the delivery probability to destinations can be improved potentially. This study proposes a novel message routing scheme with dynamic cluster awareness (MDCA) that can resolve the delivery service in both the clusters that are formed in a hot spot and among hot spots.

C2. Scheme Design

(1) MDCA firstly estimates the expected value of the communication area of contacted nodes, the situation which involves direct and indirect connections in a network

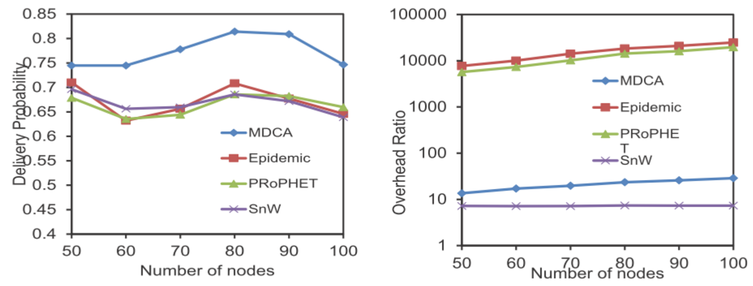
(2) MDCA decides that a node in a cluster should replicate or forward a message based on the density of a message in a cluster

(3) If a node has the last copy of a message in a cluster and is aware that it will leave the cluster soon, it will forward this message copy to another node that will stay in this cluster



C3. Simulation result

- TVCM in this study are based on the NCU campus area



(a) Delivery probability (b) Overhead ratio

Summary

We have conducted this research project in a serious and responsible fashion for three years. This project achievement results in a set of seven novel mechanisms that can be integrated or coupled systematically for efficient data dissemination in DTNs.