Home Based Optimistic Addressing In MSN
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Abstract:
Mobile social networks (MSNs) are a kind of delay tolerant network that consists of lots of mobile nodes with social characteristics. Recently, many social-aware algorithms have been proposed to address routing problems in MSNs. However, these algorithms tend to forward messages to the nodes with locally optimal social characteristics, and thus cannot achieve the optimal performance. In this paper, we propose a distributed optimal Community-Aware Opportunistic Routing (CAOR) algorithm. Our main contributions are that we propose a home-aware community model, whereby we turn an MSN into a network that only includes community homes. We prove that, in the network of community homes, we still can compute the minimum expected delivery delays of nodes through a reverse Dijkstra algorithm and achieve the optimal opportunistic routing performance. Since the number of communities is far less than the number of nodes in magnitude, the computational cost and maintenance cost of contact information are greatly reduced. We demonstrate how our algorithm significantly outperforms the previous ones through extensive simulations, based on a real MSN trace and a synthetic MSN trace.

I. Introduction:
Mobile social networks (MSNs) are a special kind of delay tolerant network (DTN), in which mobile users move around and communicate with each other via their carried short-distance wireless communication devices. Typical MSNs include pocket switch networks, mobile vehicular networks, mobile sensor networks, etc [1]. As more users exploit portable short-distance wireless communication devices (such as smart phones, iPads, mobile PCs, and sensors in vehicles) to contact and share data between each other in a cheap way, MSNs attract more attention. Since MSNs experience intermittent connectivity incurred by the mobility of users, routing is a mainly concerning and challenging problem. Recently, some social-aware routing algorithms that are based on social network analysis have been proposed, such as Bubble Rap, SimBet, and algorithms. Two key concepts in social network analysis are:
(i) Community, which is a group of people with social relations; (ii) centrality, which indicates the social relations between a node and other nodes in a community. Based on the two concepts, these algorithms detect the communities and compute the centrality value for each node. Messages are delivered via the nodes with good centralities. Since social relations of mobile users generally have long-term characteristics and are less volatile than node mobility, social-aware algorithms outperform traditional DTN algorithms, such as flooding-based algorithms and probability-based algorithms. Despite this, these algorithms tend to forward messages to the nodes with locally best centralities.
II. Related Work

The CAOR algorithm consists of two phases: the initialization phase and the routing phase. The initialization phase simplifies the network with $|V|$ nodes to the network with $|L|$ community homes through the social network modeling. Then, under the simplified network, the routing phase delivers messages based on the optimal opportunistic routing rule. Based on the social network modeling and the optimal opportunistic routing rule, CAOR can achieve the optimal performance with a small cost. More specifically, the basic idea of CAOR is presented as follows. The first phase simplifies the network and the second phase computes the minimum expected delivery delay and makes the routing decision (Algorithm 4). Both of the phases are implemented in the distributed way.

A. The Initialization Phase

In the initialization phase, each community home $l$ collects the optimal betweenness set of each pair of community homes and uses this information to locally construct a contact graph of these homes. First, each community home $l$ determines the optimal betweenness sets for the message deliveries from itself to other community homes.

Algorithm

**Ensure:** $G=(L;W)$, where $W = \{ (_l;l';D'_l;l') | l' \in L \}$

**For** each community home $l \in L$ **do**

1: Collect $_v;l$, $_v;l'$ for each $v \in C_l$ and $l' \in L - \{l\}$;  
2: Use Algorithm 1 to produce $\sim S_l;l'$ and $(_l;l';D'_l;l')$;  
3: Create the virtual link $\rightarrow ll'$ : $(_l;l';D'_l;l')$ for each $l' \in L - \{l\}$ and send the link weights to other homes;  
4: Receive the link weights from other homes;  
5: Construct the contact graph $G=(L;W)$

B. The Routing Phase

The routing phase computes the minimum expected delivery delays and makes the routing decision based on the optimal opportunistic routing rule when a node $v$ visits a community home.

Algorithm

**For** each node $v \in V$ **do**

1: if $v$ visits a community home $l \in L$ **then**  
2: for each message of $v$ and $l$, $v$ **do**  
3: Extract destination (d) information;  
4: Get $G+$ by adding $v$ and $d$ to $G$ in home $l$;  
5: Compute $D_v;d$ and $D_l;d$ through Algorithm 3;  
6: if $D_v;d < D_l;d$ **then**  
7: Let $v$ hold the message;  
8: **else**  
9: Let $l$ hold the message;

III. Optimistic Mobile Social Networks

Personal mobile devices have become ubiquitous and an inseparable part of daily lives. These devices have evolved rapidly from simple phones and SMS capable devices to smart phones that we use to connect, interact and share information with our social circles. The smart phones are used for traditional two-way messaging such as voice, SMS, multimedia messages, instant messaging or email.
Moreover, the recent advances in the mobile application development frameworks and application stores have encouraged third party developers to create a huge number of mobile applications that allow users to interact and share information in many ways such as Bluetooth and WiFi leading to complicated communication by the multiple wireless interfaces. Some examples are networked games, location based services and online social networking (tweeting, status and location updates, reviews, recommendations, photo sharing and so forth). [1] The popularity of smart phones and applications would not have been possible without the availability of Internet connectivity. Typical smart phones come equipped with multiple radio interfaces including cellular radio (2G, 3G or emerging 4G technologies), 802.11 (WiFi), Bluetooth and Infrared. In addition to the global Internet connectivity, some of the available interfaces (notably Bluetooth and WiFi) can be used for local device discovery and direct device-to-device data communications. Today, this functionality remains mostly unused or is very limited to applications such as synchronization of data with a PC or manual file transfers. All of the smart phone applications follow instead the traditional Internet application development paradigm and depend on some type of infrastructure based communication service. The local context, mobility or opportunistic contacts between mobile devices are practically never taken into account. The social networking applications have proven their popularity in the current Internet and many compelling opportunistic networking applications are naturally about social networking (introduction services, friend finders, recommendations, content sharing, gaming). Human mobility, on which the opportunistic networks rely for forwarding, is directly related to social behavior of people. Opportunistic mobile social networks that we define as decentralized opportunistic conventional Internet protocols, considering the duration of the disconnections as an additional cost of the links.

IV Methodology: Optimal Opportunistic Routing

The optimal opportunistic routing scheme means that each message sender delivers messages via its optimal relay set (i.e., delivers messages via the first encountered relay in this set). The key problem is to determine whether a relay belongs to the optimal relay set for each message sender. To this end, we derive an optimal opportunistic routing rule. Without loss of generality, we consider an opportunistic routing from a message sender \(i\) to the destination \(d\) via some candidate relays \(\{a_i; i; u > 0\}\). Here, the message sender \(i\) might be a mobile node or a home. Each \(u\) is a one-hop relay of \(i\), i.e., \(i; u > 0\), but it does not must be a one-hop relay of the destination. The optimal relay set, denoted by \(\sim R_i\), is given by the following formula:

\[
\sim R_i = \arg\min_{S \subseteq \{a_i; u > 0\}} \sum S \leq d(S)
\]

\(d(S)\) is the expected delay for \(i\) delivering messages to \(d\) via the relay set \(S\). Moreover, for simplicity, we let \(d(S) = d(S)\) then, the optimal opportunistic routing rule is presented as follows.

Optimal Opportunistic Routing Rule:

the message sender always delivers messages to the encountered relay that has a smaller minimum expected delay to the destination than itself. Concretely, a relay \(u\) belongs to the optimal relay set \(\sim R_i\) for the delivery from \(i\) to \(d\), if and only if, \(D_u; d < D_i; d\), i.e.,

\[
u \in \sim R_i \iff D_u; d < D_i; d
\]
we only need to compute and compare the minimum expected delivery delays from the message sender and the relay to the destination. Then, we can determine whether the relay belongs to the optimal relay set of the sender.

VII. Opportunistic Communication In Mimo Wireless Link

In wireless communication systems multiple antennas at transmitter side and receiver side increase the transmission capacity (or bit rates) and improving the spectrum efficiency. Orthogonal Frequency Division Multiplexing can be applied in a multiuser applications leading to a highly flexible, efficient communications system. OFDM is a multicarrier multiplexing technique that divides an OFDM signal which is a sum of several sinusoids channel with a higher relative data rate into several orthogonal sub-channels with a lower data rate and has become one of the standard choices for high-speed data and multiuser transmission.

V. Goal For Opportunistic Mobile Networks

The goal for opportunistic mobile networks is to use opportunistic algorithms for maximizing the throughput that can be provided by opportunistic algorithms. The global knowledge of network including context information would enable optimal routing. The opportunistic mobile networks goals can be realized by alleviating first of all the communication problems including bottlenecks and gaps in spectrum utilization that are often the root causes of resource shortages. [10] The another goal of opportunistic mobile networks is analysis of human mobility like time user spend at specific locations, node mobility information, history of node behavior as dynamic routing of information is used in opportunistic communication. Opportunistic mobile network’s performance improves when more knowledge about the expected topology of the network can be exploited.

Results:

VIII. Conclusion

In this paper, we presented an overview of opportunistic mobile networks. We highlighted the main challenges and solutions for opportunistic mobile networks, and discussed the potential applications of opportunistic mobile networks. We also provided an overview of the existing opportunistic mobile network systems and their performance.

A communication system comprising Nt transmit (TX) and Nr receive (RX) antennas will be considered with MAPU = Multi Antenna Processing Unit. Fast and efficient algorithms are used to determine the optimal selection of antennas opportunistically at transmitter and receiving side. Opportunistic communication forming MIMO links gives advantage of multiuser diversity.
VIII. Conclusions:

We model an MSN into some overlapping home-aware communities, simplify the routing problem among many mobile nodes into the problem among some static communities, and propose the CAOR algorithm to achieve optimal opportunistic routing. Through theoretical analysis, we find out that optimal opportunistic routing only depends on a few nodes in the network. A change in behavior of most nodes would not affect the routing performance. We can thus achieve the optimal routing performance at a very low maintenance cost. Compared with previous social-aware algorithms, the optimal and predictable routing performance is the biggest advantage of the CAOR algorithm.

References


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