The Effective Way of Data Dissemination in Mobile Social Networks

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Abstract- **This work focus on their incorporation of into their data dissemination in mobile social networks with selfish nodes of the networks. They key challenge of their enabling incentives mechanism is to the effectively track base to their value of a message under such as an unique network setting with in intermittent connectivity and multiple interest data type in networks. We propose two data dissemination models they are: data pulling model when mobile users pull data the data providers, then data pushing model where data providers generate personalized data and push them their intended personalized users. For data pulling model, we can present effective mechanisms to estimate the expected credit reward of a given message that helps nodes to evaluate the potential reward. This can be message a communication is they formulated as their two-person cooperative game they are, whose solution is given found by a given approach which is achieves pareto optimality. They check buying process rules formulated by an online acction model to further accelerate the circulation is credits. Extensive simulations carried out based on their real-world traces are show the proposed schemes achieve to be better performance than their fully cooperative scheme ,but they significantly reduce cost. Under the data pushing model it can eliminating the needs of accurate knowledge about and they how many credits data providers should pay.**

Index Terms- **Incentive, Data Dissemination, autonomous mobile social networks, data pulling and pushing methods, secretary problem.**

I. INTRODUCTION

WITH its surging popularity among mobile users, social networking is experiencing unprecedented growth on smartphones and portable tablets. Their transmission of the social network contents between mobile users and their social network sites (such as Facebook and Twitter..) often rerly on the underlying communication infrastructure, on the Internet plus available wireless access networks (e.g., cellular,wi-fi and bluetooth). However, Internet connection is not available also anywhere anytime or can incur an undesired extra cost. In this research, we consider an autonomous mobile social network that does not depend on any infrastructure but their instead, exploits opportunistic connections among mobile users.

Specifically, portable devices can be communicate with each other and exchange social networking data via their short range radios (e.g., WiFi and Bluetooth) or licensed device-to-device (D2D) links. Such mobile device-to-device data transfer can increase network performance and reduce communication cost for both service providers and individual users [1], [2]. Due to the limited radio transmission range and unrestrained nodal mobility, the connection between mobile nodes is intermittent, forming a delay-tolerant network (DTN) setting. Therefore, the data delivery via autonomous mobile social networks may be the last resort not only for its simplicity, low-cost and convenience but also for its effective-ness, since the interaction between participants is closely cor-related to their social groups and behaviors, offering great opportunities to deliver data to the command center.

1.1 System Overview

Mobile users is an autonomous mobile social networks share or exchange data when they meet. There are two types of data dissemination models, i.e., data pulling model and data pushing model. In data pulling, mobile users pull data from data providers and disseminate data to their interested users. The data to be disseminated fall into a range of interest types, such as weather forecast, event alerts, commercial advertise-ment, movie trailers, blog updates, and various news. Such data are generated by their sources and accessible by a mobile nodes. A mobile node may wish to receive data in one or multiple interest types. When two nodes meet, they may receive messages of its own interests and share part or all of others' interests if an agreement is achieved.

An example of a joint data pulling and pushing model in an autonomous mobile social network is illustrated in Fig. 1, where Mobile User A is equipped with a smart phone and interested in action and adventure movies. He can of course download such movies via cellular channels, which is how-ever very costly. Thus, he intends to exploit the other

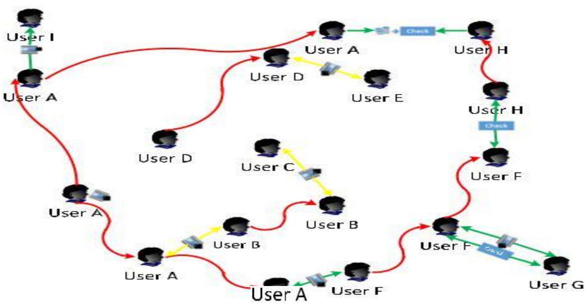

Fig. 1. An example of video dissemination in a small community where the red dotted curve arrow indicates the movement of a user, the yellow solid straight line arrow depicts communication in data pulling model, and the green solid straight line arrow depicts communication in data pushing model

Mobile users that he meets. He can receive action and adventure movies to not only satisfy himself but also share them via D2D links to other mobile users (e.g., User B) who do not have access to such contents via a trading process (to be dis-cussed later). In this way, movies can be spread.

1.2 Selfishness and Incentives

Mobile users in the real world can be either cooperative or selfish. A cooperative node carries and shares data for others altruistically. On the other hand, if a node is selfish, it aims to maximize its own benefit only. Consequently, it is often reluc-tant to consume its energy, storage and bandwidth resources for nothing, and thus, refuses

To carry any data other than the ones interested by itself. Price-of-Anarchy, which measures how the efficiency of a system degrades due to selfish behav-ior of mobile nodes, is reported in [7] under four real social mobile network data sets. It demonstrates that data delivery ratio increases linearly with the decrease of selfish nodes. In other words, the more nodes contribute to relaying messages for others, the better performance the network achieves. Thus, to support such mobile data dissemination in the real world, an efficient incentive scheme is imperative to stimulate nodal cooperation and attract more participants.

1.3 Challenges and Contributions

The key challenge of enabling incentives is to effectively track the value of a message under such a unique network setting with intermittent connectivity and multiple interest data types. Given poor end-to-end connections, credits are rewarded to the final deliverer only. Thus the value of a message for an intermediate node highly depends on its probability to deliver the message. Such probability itself is nontrivial to estimate. Moreover, a message is usually desired by multiple users. Therefore, it can be potentially "sold" multiple times to different receivers. The problem is further complicated by message duplication that is common in autonomous mobile social networks, where multiple cop-ies of a message may be delivered to the same receiver but only the first copy should be paid.

While the above proper-ties apply to both data pulling and pushing, there exists a fundamental difference between them. In data pulling model, a receiver intends to pull and consume data, and thus, should pay for the final deliveries; while in data push-ing model, a data provider intends to disseminate its per-sonalized data, and thus, is deemed as the payer. However, it does not know how many nodes will involve in packet delivery and which node it should pay for. These character-istics together make the development of incentive mecha-nisms a unique, interesting, and challenging problem.

II. RELATED WORK

Early studies on DTNs predominantly focus on routing. Information dissemination is first addressed in People-Net [11], which mimics the way people disseminate infor-mation in real life via social contacts. It is based on epidemic dissemination, assuming nodes are under nonuni-form mobility patterns. In [12], a social centrality metric is introduced based on social contacts and user interests to improve the efficiency of data dissemination. Optimal dynamic content distribution [13] addresses the problem of how to allocate bandwidth optimally to make the content at users as fresh as possible. In [14], a contact aware duplica-tion algorithm is proposed for data sharing in inter-connec-tivity mobile networks. Separately, FleaNet is proposed [15] for information sharing among people onboard vehicles. A probabilistic one-ownership forwarding algorithm is pro-posed in [16] to preserve privacy of electronic coupon [17] distribution. [18] proposes a probability based delay con-strained protocol to support efficient data query in mobile ad-hoc social networks. However, all of these dissemination schemes assume nodal cooperation in DTNs.

III. PRELIMINARIES

To facilitate our exposition, we first introduce several basic definitions that serve as the basis for the proposed incentive schemes.

Definition 1. Aninterestis the type of data that a node wishesto acquire or disseminate.

The examples of interest include blog updates, serial publication in installments, weather forecast, event alerts, commercial advertisement, and various news.

Definition 2. Asource of an interestis a node that generatesdata messages that match the corresponding interest.

Definition 3. Asink of an interestis a node that wishes to acquire and consume data messages that match the correspond-ing interest.

A node may serve as the sources or sinks for multiple interests. At the same time, the data messages of a particular interest may be supplied by multiple sources, and multiple nodes may become the sinks of the same interest.

Definition 4. Thetightnessof Node n in Interest inrepresent show of often.The node n contacts a sink of Interest i directly or indi-rectly within an interval of D, when the timer expires, a timeout event is generated.

IV. INCENTIVE SCHEMEFOR DATA PULLING MODEL

In this section, we propose an incentive scheme for data pulling model to stimulate the cooperation among mobile nodes and to find the best strategy for each selfish node.

The participants in such a network can be either coopera-tive or selfish. If all nodes are cooperative, each of them car-ries messages for others voluntarily. On the other hand, if a node is selfish, it may be reluctant to consume its energy, buffer and bandwidth resources for other nodes, and thus refuse to carry any messages other than the ones interested by itself. In the worst case where every node is selfish, data are not shared at all among mobile nodes, leading to poor net-work performance. In this work, we consider selfish nodes with rational behavior. More specifically, a node is driven by its interests. It performs data transmission only if it gains ben-efit. We propose a credit-based incentive scheme to promote nodal collaboration. Given poor end-to-end connections, credits are rewarded to the final deliverer only. Moreover, a message is usually desired by multiple users. Therefore, it can be potentially “sold” multiple times to different receivers. Meanwhile, while more than one copies can be created dur-ing the transmissions of a message, a particular receiver “pays” for the first received copy only. We formulate nodal communication as a two-person cooperative game, and a game theory is applied to reach optimal solution.

V. INCENTIVE SCHEME FOR DATA PUSHING MODEL

In the data pulling model, it is the receivers’ responsibilities to pay for delivery service directly since they are wishing to get their own interested data from the deliverers. However, in data pushing model, it is the data providers who wish to disseminate their personalized data to the intended users and are willing to pay for delivery service. Therefore, a deliv-erer can only get credit from the data provider that generated that message. In autonomous mobiel social networks, how the data provider can know which node helps deliver the message and how the deliverer can get the credit timely are key challenges we need to solve in data pushing model. In this section, we discuss the proposed incentive mechanism for data pushing model, where data providers generate per-sonalized data and push the data to the intended users.

As discussed in Section 1.1, both data packets and signed checks can be traded between two mobile nodes during data dissemination. However, it is nontrivial to reach an agree-ment between them to decide which data packet or signed check should be transmitted. Since nodes are all selfish, a node always tries to maximize its own benefit, which how-ever may hurt the interest of the other node. For example, when a node acquires a copy of a packet from the other node, the former obviously increases its potential credits (because it adds a valuable packet into its inventory), but the latter suf-fers with a decreased potential benefit (since it just created a competitor, given a receiver only awards the first deliverer a signed check).

VI. CONCLUSION

In this work we have to studied the problem of data dissemi-nation in autonomous mobile social networks with selfish nodes and multiple interest data types. We have proposed two data dissemination models from two different perspec-tives: the data pulling model where mobile users are pull data from data providers, and they data pushing model where data providers generate personalized data and push the data to the intended users. For data pulling, we have presented effective way mechanisms to estimate the expected credit reward of a message that helps intermediate nodes to evalu-ate the potential reward of a message. We have to formulated nodal message communication as a two-person cooperative game, whose solution is found by an heuristic approach which achieves Pareto optimality. Under these data pushing model, we have introduced a key idea of "virtual checks" to eliminate the needs of accurate knowledge about whom and how many credits data providers should pay. We have formulated the check buying process is an online action model to further accelerate the circulation of they credits. Exten-sive simulations have been carried out for evaluation and performance comparison under real-world mobility traces.

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