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Crowdsourcing the last mile delivery of online orders by exploiting the social networks of retail store customers

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ABSTRACT

This paper demonstrates the potential benefits of crowdsourcing last mile delivery by exploiting a social network of the customers. The presented models and analysis are informed by the results of a survey to gauge people's attitudes toward engaging in social network-reliant package delivery to and by friends or acquaintances. It is found that using friends in a social network to assist in last mile delivery greatly reduces delivery costs and total emissions while ensuring speedy and reliable delivery. The proposed new delivery method also mitigates the privacy concerns and not-at-home syndrome that widely exist in last mile delivery.

1. Introduction

Last mile delivery is one of the largest challenges in Business to Customer e-commerce. With the increasing volume of purchases made online, retailers are under pressure to provide speedy, quality product delivery to customers (Barclays, 2014). At present, many retailers offer their customers the options of home delivery and store pickup. Last mile delivery service, in which the purchased products are delivered to the doors of consumers, is presently requested by the majority of online customers. Last mile product delivery, however, still remains an expensive option for retailers. The costs of the last mile delivery of products range between 13% and 75% of total supply chain costs (Gevaers et al., 2009). With many retailers attempting to find alternative solutions to the delivery of such orders, the challenges that emerge in these efforts include "not-at-home syndrome" and the "ping-pong" effect (when agreed-upon delivery times are not met by customers), leading to high economic and environmental costs incurred due to the extra miles driven, particularly in areas of low consumer density (Slabinac, 2016).

The majority of retailers are seeking options to deliver their products more efficiently. Traditionally, these deliveries are performed by commercial carriers (e.g., FedEx). Another perspective is that customers order online and pick up at a local store. In some cases, customers do not even exit their vehicles in the case of drive-through windows or when packages are loaded by store employees. Recently, many studies have been conducted on the level of customer expectations regarding the reliability and timely delivery of products ordered online, e.g., the idea of using drones for delivery (Slabinac, 2016).

One of the more recently emerging research ideas for resolving the last mile delivery issues in urban areas lies in the exploitation of crowd logistics. Crowd logistics, which may rely on crowdsourcing (mainly being defined as outsourcing a

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task to a crowd), designates the outsourcing of logistics services to a crowd, thereby achieving economic benefits for all parties involved (Mehmann et al., 2015). The proliferation of instant communication technologies enables logistics providers to seriously consider this new opportunity in last-mile logistics. The integration of end-to-end information sharing based on customers' smartphones within the logistics process promises a competitive advantage for e-commerce. Uber and Lyft, for example, are successful crowd logistics providers for passenger transportation. Other companies are also beginning to use crowds of taxis for last mile delivery (Chen and Pan, 2015). Amazon has investigated the notion of customers who, together with their own packages, pick up other packages (Reilly, 2015) and deliver these to recipients, who could be their neighbors.

Privacy protection concerns may arise when crowdsourcing delivery is implemented. People may wish not to disclose their shopping preferences and home addresses to strangers serving as couriers. Crowd workers typically prefer to remain anonymous; however, being anonymous may easily cause one to be or become unreliable (Varshney et al., 2014). Given an anonymous pool of a large number of workers, it is often difficult to enforce the quality of low-pay work performed (Varshney, 2012). Ensuring reliability and accountability is critical to the success of crowdsourced deliveries. These issues can be addressed by leveraging crowdsourced delivery on customers' friends and acquaintances who may have daily spatiotemporal overlaps, e.g., as co-workers and neighbors. By using friends and acquaintances chosen by individuals with a certain level of friendship from within their social networks, one alleviates the privacy concerns at least in part; and a customer will always be able to opt out of crowdsourced delivery. In this manner, one can maintain high levels of accountability and reliability while protecting privacy.

Further, assisting friends with deliveries can also result in an increase in the social capital of a community, particularly through the formation of new bonds. This aspect would help build up such tangible societal assets as goodwill, sympathy, and fellowship, among others, which all bring many potential benefits. The basic idea of "social capital" is that one's family, friends, and associates constitute an important asset, one that can be called upon in a crisis, enjoyed for its own sake, and/or leveraged for material gain (Woolcock, 2001). At present, consumers can use popular social network applications, such as Foursquare and Facebook Places, to easily communicate with friends, share information about recommended and frequently visited locations, and agree to assist each other. On one hand, social network applications can inform friends of each other's real-time locations and travel routes. On the other hand, extremely underutilized personal cars (as a means for delivery) can serve a new purpose as occasional delivery service providers. Integrating these two aspects, mobile-based social media platforms can be adopted to allow consumers to post and share the information of their online orders with friends, who, in turn, can help fulfill orders that can be picked up along their regular routes. We term this proposed delivery concept "Social Transportation", which can be viewed as being part of the broader concept of "Social Commerce" (Zhang and Wang, 2012). Social Transportation-driven order fulfillment has the potential to eventually transform the manner in which people deliver and receive packages and open new pathways to increasing the efficiency of transportation and logistics services.

The goal of this paper is to model and evaluate the potential benefits of using customers' social network contacts for last mile delivery under the umbrella of Social Transportation, which implies coordinated transportation systems facilitated/optimized through the use of software applications that rely on or gather data from sophisticated real-time sensors/GPS devices to compute optimal networks to connect individuals for optimized transportation applications. The paper showcases that the times and costs of last mile product delivery can be reduced by allowing friends/acquaintances to pick up and deliver small orders to each other as part of their routine trips to the store/work/home, as represented in Fig. 1. A case study is conducted to analyze this concept in detail for the city of Alexandria, VA. This paper raises and begins to address multiple novel questions associated with implementing this idea: these questions touch on the level of friendship required for the two parties to feel comfortable delivering orders for each other, the willingness of people to perform deliveries altogether, the extra time that they would agree to spend providing this service, and the incentives that they would require or appreciate.

The rest of this paper is organized as follows. The related literature is reviewed in Section 2. Section 3 discusses the survey conducted to analyze the relationship levels required to perform the delivery and the readiness of people to assist in product delivery based on other factors such as the extra travel time involved and the incentives sought, among others. Section 4 addresses simulating the delivery process, i.e., expressing the probabilities of successful delivery events and modeling

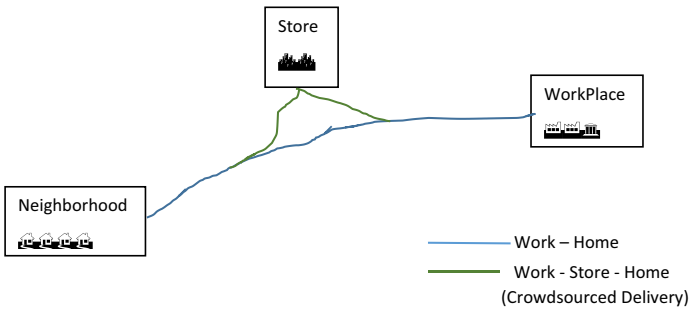

Fig. 1. Route for crowdsourced delivery.