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**Motivating Human-enabled Mobile Participation for Data Offloading**

**Abstract:**

The exploding popularity of mobile devices enables people to enjoy benefits brought by various interesting mobile apps. However, the ever-increasing data traffic has exacerbated the congestion on current cellular networks, which results in users’ dissatisfaction, especially in crowded areas. Hence, how to alleviate data traffic in cellular networks becomes a challenging problem. Traditional methods rely on mobile offloading techniques to deviate the data traffic originally targeted to cellular networks, such as the small cell, Wi-Fi, and opportunistic communication. Unfortunately, mobile users still experience severe congestion when a large number of users request for data. Facing these challenges, we introduce the concept of mobile participation to assist data offloading by leveraging the mobility of users and the social features among a group of users. A mobile caching user, who pre-caches a certain amount of contents, will roam around congested areas to participate in content dissemination in order to satisfy users’ requests, which is expected to benefit both himself and users in the crowd simultaneously. To motivate such human-enabled mobile participation for data offloading, a Stackelberg game is deployed with joint considerations on social effect and delay effect. Based on detailed performance analysis, we demonstrate the feasibility and efficiency of the proposed approach.

**Existing System:**

Both academia and industry, we are still lacking effective methods. For example, utilizing small cells is not an effective method due to the scarcity of licensed spectrum bandwidths. Even worse, deploying more small cells will incur significant costs. RegardingWi-Fi offloading, the service provider has access to much larger free spectrum to cater the Wi-Fi deployment. However, Wi-Fi offloading cannot provide guaranteed QoS, and Wi-Fi-enabled devices may experience increased battery drainage since it has to operate on two different radio interfaces. To perform mobile offloading, opportunistic communication has been identified as another approach, which increases communication chances by utilizing the potential social connections among users and thus is beneficial to deliver contents.

In particular, some works apply social-based approaches to help data dissemination among social ties or users with similar social profiles. Apparently, the opportunistic communication is not reliable for data delivery in an ad hoc mode because there is lack of incentives for source users to coordinate the data dissemination. Clearly, mobile offloading has not been well developed nor widely applied.

**Proposed System:**

We propose a new data offloading scheme that takes advantages of both homophily phenomenon and mobile participation to greatly reduce the congestion in crowded areas where users with similar interests are normally grouped together.

Specifically, we consider two system models: the delay-tolerant model and the delay-sensitive model. In both models, by considering RUs’ interactions, we formulate the communication between the MCU and RUs as a two-stage Stackelberg game. In Stage I, the MCU chooses a unit payment to maximize his total revenue. In Stage II, each RU chooses a requested content level given the unit payment to maximize his satisfaction on the received contents.

For the delay-tolerant scenario, the interactions between RUs bring social effect. We first give an assumption under which we show the existence and uniqueness of the Nash equilibrium in Stage II. Then, we present an effective algorithm to compute the unique Stackelberg equilibrium in Stage I, at which the revenue of the MCU is maximized, and none of the RUs continue requesting contents by unilaterally deviating from his current strategy

For the delay-sensitive scenario, the interactions between RUs not only bring social effect but also delay effect. We extend the Stakelberg game to the delaysensitive model. To alleviate the serious delay effect, we propose two improved delay-sensitive models by taking advantages of users’ mobility, where the first one considers the queueing delay and the other introduces multiple MCUs.