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Content Download in Vehicular Networks in Presence of Noisy Mobility Prediction

Abstract:

Bandwidth availability in the cellular backhaul is challenged by ever-increasing demand by mobile users. Vehicular users, in particular, are likely to retrieve large quantities of data, choking the cellular infrastructure along major thoroughfares and in urban areas. It is envisioned that alternative roadside network connectivity can play an important role in offloading the cellular infrastructure. We investigate the effectiveness of vehicular networks in this task, considering that roadside units can exploit mobility prediction to decide which data they should fetch from the Internet and to schedule transmissions to vehicles. Rather than adopting a specific prediction scheme, we propose a fog-of-war model that allows us to express and account for different degrees of prediction accuracy in a simple, yet effective, manner. We show that our fog-of-war model can closely reproduce the prediction accuracy of Markovian techniques. We then provide a probabilistic graph-based representation of the system that includes the prediction information and lets us optimize content prefetching and transmission scheduling. Analytical and simulation results show that our approach to content downloading through vehicular networks can achieve a 70% offload of the cellular network.