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On the Payoff Mechanisms in Peer-Assisted Services With Multiple Content Providers: Rationality and Fairness

Abstract:

This paper studies an incentive structure for cooperation and its stability in peer-assisted services when there exist multiple content providers, using a coalition game-theoretic approach. We first consider a generalized coalition structure consisting of multiple providers with many assisting peers, where peers assist providers to reduce the operational cost in content distribution. To distribute the profit from cost reduction to players (i.e, providers and peers), we then establish a generalized formula for individual payoffs when a "Shapley-like" payoff mechanism is adopted. We show that the grand coalition is unstable, even when the operational cost functions are concave, which is in sharp contrast to the recently studied case of a single provider where the grand coalition is stable. We also show that irrespective of stability of the grand coalition, there always exist coalition structures that are not convergent to the grand coalition under a dynamic among coalition structures. Our results give us an incontestable fact that a provider does not tend to cooperate with other providers in peer-assisted services and is separated from them. Three facets of the noncooperative (selfish) providers are illustrated: 1) underpaid peers; 2) service monopoly; and 3) oscillatory coalition structure. Lastly, we propose a stable payoff mechanism that improves fairness of profit sharing by regulating the selfishness of the players as well as grants the content providers a limited right of realistic bargaining. Our study opens many new questions such as realistic and efficient incentive structures and the tradeoffs between fairness and individual providers' competition in peer-assisted services.