Abstract

We consider a multi-level aggregation problem in a weighted rooted tree, studied recently by Bienkowski et al. in (Marcin Bienkowski, Martin Böhm, Jaroslaw Byrka, Marek Chrobak, Christoph Dürr, Lukáš Folwarczný, Lukasz Jez, Jirí Sgall, Nguyen Kim Thang, and Pavel Veselý, *Online algorithms for multi-level aggregation*, ESA 2016). In this problem requests arrive over time at the nodes of the tree, and each request specifies a deadline. A request is served by sending it to the root before its deadline at a cost equal to the weight of the path from the node in which it resides to the root. However, requests from different nodes can be aggregated, and served together, so as to save on cost. The cost of serving an aggregated set of requests is equal to the weight of the subtree spanning the nodes in which the requests reside. Thus, the problem is to find a competitive online aggregation algorithm that minimizes the total cost of the aggregated requests. This problem arises naturally in many scenarios, including multicasting, supply-chain management and sensor networks. It is also related to the well studied TCP-acknowledgement problem and the online joint replenishment problem. We present an online $O(D)$-competitive algorithm for the problem, where D is the depth, or number of levels, of the aggregation tree. This result improves upon the $D^2 2^D$-competitive algorithm obtained recently by Bienkowski et al. in in (Marcin Bienkowski, Martin Böhm, Jaroslaw Byrka, Marek Chrobak, Christoph Dürr, Lukáš Folwarczný, Lukasz Jez, Jirí Sgall, Nguyen Kim Thang, and Pavel Veselý, *Online algorithms for multi-level aggregation*, ESA 2016).