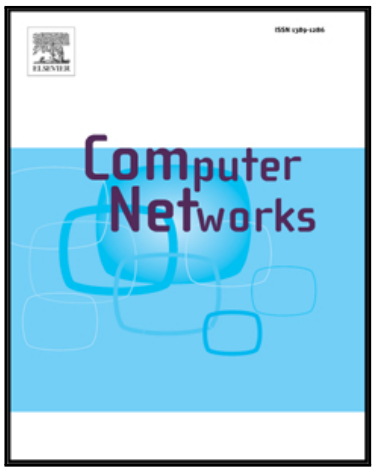

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ILP Formulation of the Exact Solution of Multi-Constrained Minimum Cost Multicast

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Abstract

Multimedia applications such as videoconferencing and collaborative applications require the satisfaction of several Quality of Service constraints (QoS). The routing with respect to QoS constraints was proposed in order to satisfy the user requirement and guarantee a certain level of performance to a data flow. As the communication architecture of these applications is often multicasting, the problem of finding a multicast route satisfying the QoS constraints proves to be challenging. In this paper we propose an Integer Linear Program (ILP) for finding the multicast route respecting a set of QoS constraints with minimum cost. Since the problem is NP-hard, we propose an efficient pretreatment algorithm (ArcReduce) to accelerate the resolution time. The pretreatment process can even answer in polynomial time, whether the problem has a solution or not, before starting the resolution process. The computation of the exact solution also allows for comparison of the heuristic solutions to the exact solution. We conduct an analysis of the ILP and the ArcReduce with various sizes of input data regarding the execution time, the success rate and the quality of the generated multicast route.

Keywords: Multicast routing, quality of service, multi-constrained Steiner problem, hierarchy, partial minimum spanning hierarchy.

1. Introduction

Multicast routing with Quality of Service (QoS) in networks is considered as an important field of research worldwide. With the appearance of next-generation multimedia Internet applications, much of work has been done on this subject to meet the requirements of users and to improve the communication in networks. The significant increase of connected users in Internet involves accessing large volume of data, often with QoS requirement which made these tasks more challenging [2][17].

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