

Optimal Placement of Add/Drop Multiplexers: Heuristic and Exact algorithms

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Abstract

We study a problem that has arisen recently in the design of telecommunications transmission networks at France Telecom. Given a set of centers in a city or conglomeration linked together on a ring architecture, given the expected demands between the centers and an essentially unlimited availability of rings of fixed capacity on the network, assign demand pairs and corresponding add/drop multiplexers to the rings so as to satisfy the demands and minimize the number of "costly" multiplexers installed.

Heuristics based on simulated annealing have been developed for the basic problem and several variants. France Telecom is particularly interested in validating the effectiveness of the heuristics. An exact algorithm based on integer column generation is shown to provide tight performance guarantees, and in most cases to give provable minimum cost solutions. Column generation is used even though the subproblems are strongly *NP*-hard and are solved by standard mixed integer programming software. In addition the Master Problems involve both integer columns and integer variables, whereas these are 0 – 1 in most reported applications.

Subject Classification: (Tele)communications, Assignment of Equipment, Comparison of Safety Policies, Integer Programming, Heuristics and Decomposition Algorithms.

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