

Pricing in networks, an update

The tariff setting problem on a network involves an operator and clients. Some arcs in the network are owned by the operator. Being the owner of an arc the operator can set the price for renting capacity on the arc. The tariffs of arcs not owned by the operator are fixed, and do not generate any revenue for the operator. After all tariffs are fixed, the clients will select a path (with necessary capacity) in the network at minimum cost. The costs of the customer on arcs owned by the operator make up the operator's revenues. This problem is a so-called Stackelberg game on a network.

A linear bilevel model is a very natural and elegant formulation of the problem, proposed in [1]. NP-hardness has been proved in [2]. We remodel the underlying network of the problem for deriving several results:

1. a Branch-and-Bound algorithm that uses elegant processing ideas for solving the problem quickly.
2. a polynomial-time algorithm in case the number of tariff arcs is a fixed parameter.
3. the remodeled version is APX hard, but allows approximation logarithmic in the demand in case of uniform tariffs.

Work of other research groups is also discussed briefly:

1. cutting-plane algorithms;
2. a variant of the problem where the subgraph of the customer is a tree instead of a path.

[1] M. Labbé, P. Marcotte, G. Savard. A bilevel model of taxation and its application to optimal highway pricing. *Management Science*, 44:1608-1622, 1998

[2] S. Roch, P. Marcotte, G. Savard. Approximation Algorithm for Stackelberg Network Pricing. *Networks* 46(1): 57-67, 2005

[3] Stan van Hoesel, Anton F. van der Kraaij, Carlo Mannino, Gianpaolo Oriolo. Polynomial cases of the tarification problem (in preparation)

[4] Stan, van Hoesel An overview of Stackelberg pricing in networks. *European Journal on Operational Research* 189(3) 1393-1402, 2008.

[5] Mustapha Bouhtou, Alexander Grigoriev, Stan van Hoesel, Anton F. van der Kraaij, Frits C.R. Spieksma, Marc Uetz. Pricing Network Edges to Cross a River, *Naval Research Logistics* 54(4), 411,422, 2007

[6] M. Bouhtou, S. van Hoesel, A. van der Kraaij, J.L. Lutton. Tariff Optimization in Networks, *INFORMS journal on computing*, volume 19(3), 458-469, 2007