



Planning of Shared Backup Path Protection

Kiese, Moritz; Stidsen, Thomas Jacob Riis; Spoorendonk, Simon; Zachariasen, Martin

Publication date:
2010

Document Version
Early version, also known as pre-print

[Link back to DTU Orbit](#)

Citation (APA):

Kiese, M., Stidsen, T. R., Spoorendonk, S., & Zachariasen, M. (2010). Planning of Shared Backup Path Protection. Abstract from The 10th INFORMS Telecommunications Conference, Montreal, Canada, May 5-7, 2010, .

DTU Library

Technical Information Center of Denmark

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Planning of Shared Backup Path Protection

Moritz Kiese

Lehrstuhl für Kommunikationsnetze
Technical University of Munich, Germany

Thomas Stidsen

Management Engineering
Technical University of Denmark
Email: thst@man.dtu.dk

Simon Spoorendonk

Management Engineering
Technical University of Denmark

Martin Zachariasen

Department of Computer Science
University of Copenhagen, Denmark

Communication needs to be reliable in order to be of real value for the customers using modern communication networks. A wellknown path protection method is Shared Backup Path Protection (SBPP) for protection of circuit-switched communication demands (e.g. MPLS paths or lightpaths in DWDM networks). When using SBPP protection, the traffic is for each customer split such that both a *working* path is established and a *backup* path is established. The working path is then used until a failure occurs which affects the working path, e.g. a cable break. Only then is the communication switched over to the backup path. Because the backup path is only used in case the working path fails, backup paths for working paths which will never fail in the same situation, can share capacity.

SBPP is an attractive protection method, given that it is already supported by standards and that it should achieve good capacity efficiency [1]. Unfortunately, routing the working and backup paths is a complex optimization problem [2].

In this presentation we will describe how the compact MIP model. We will prove that the problem is NP-hard and we will Dantzig-Wolfe decompose the model, such that the working and backup paths can be generated separately for each demand. Unfortunately, this subproblem is hard to solve, both theoretically [1] and in practice. Hence, the variables are split in working paths and backup paths. This enables a faster sub-problem solution. We further show how the branching method described in [3] and refined in [4] can be used for SBPP planning using Branch & Price. Finally we test the Branch & Price algorithm on a number of real-world networks of up to 50 nodes achieving small gaps. The tests confirm that SBPP is indeed a very efficient protection method.

References

- [1] T. Stidsen and B. Petersen and S. Spoorendonk and K. Rasmussen and M. Zachariasen, “Optimal routing with failure independent path protection”, *Networks Journal*, Vol. 55, Issue 2, pp. 125-137, 2010.
- [2] W. Grover, *Mesh-Based Survivable Networks*, Prentice Hall, Upper Saddle River, New Jersey, NY, 2004.
- [3] C. Barnhart and E. Johnson and G. Nemhauser and M. Savelsbergh and P. Vance, “Branch-and-Price: Column Generation for Solving Huge Integer Programs”, *Operations Research* 3, 316-329, 1998.
- [4] C. Barnhart and C. Hane and P. Vance, “Using Branch-and-Price-and-Cut to Solve Origin-Destination Integer Multicommodity Flow Problems”, *Operations Research* 2, 318-326, 2000.