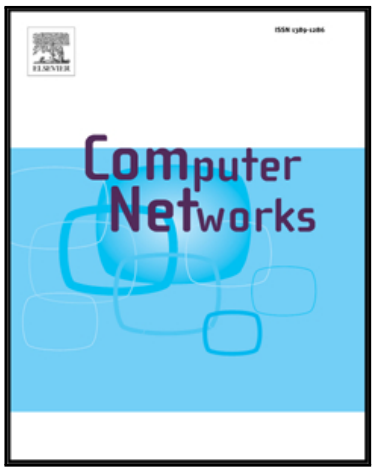

Greedy randomized adaptive search procedure for joint optimization of unicast and anycast traffic in spectrally-spatially flexible optical networks

Piotr Lechowicz, Krzysztof Walkowiak, Mirosław Klinkowski

PII: S1389-1286(18)30899-5
DOI: https://doi.org/10.1016/j.comnet.2018.09.011
Reference: COMPNW 6593

To appear in: *Computer Networks*

Received date: 13 March 2018
Revised date: 3 September 2018
Accepted date: 10 September 2018

Please cite this article as: Piotr Lechowicz, Krzysztof Walkowiak, Mirosław Klinkowski, Greedy randomized adaptive search procedure for joint optimization of unicast and anycast traffic in spectrally-spatially flexible optical networks, *Computer Networks* (2018), doi: https://doi.org/10.1016/j.comnet.2018.09.011

Greedy randomized adaptive search procedure for joint optimization of unicast and anycast traffic in spectrally-spatially flexible optical networks

Piotr Lechowicz[a,1,*], Krzysztof Walkowiak[a,1], Mirosław Klinkowski[b,2]

[a]*Department of Systems and Computer Networks, Wrocław University of Science and Technology, 27 Wybrzeze Wyspianskiego Street, 50-370, Wroclaw, Poland*
[b]*National Institute of Telecommunications, 1 Szachowa Street, 04-894, Warsaw, Poland*

Abstract

The volume of data traffic in backbone networks is increasing at a speed that exceeds the growth rates of capacities offered in currently used wavelength division multiplexing (WDM) networks. As a short term solution to the potential capacity crunch, the concept of flexible-grid elastic optical networks is nowadays implemented in many backbone networks. However, in a longer term the space division multiplexing (SDM) technology is the most promising solution for satisfying the capacity requirements in future optical networks. The combination of both technologies allows for realization of spectrally-spatially flexible optical networks (SS-FONs). In this paper, we focus on a network scenario in which two different types of traffic flows are carried over an SS-FON, namely, unicast and anycast flows. Unicast flows are used for basic one-to-one communication, while anycast flows — defined as one-to-one-of-many communication — are related to the network traffic generated in data centers and the fact that data centers placed in different network locations can provide the same service or content to network users. For provisioning of lightpaths for both types of traffic, we address the basic optimization problem in SS-FONs, which is routing, space and spectrum allocation (RSSA). The aim of this study is threefold. First, we propose an effective metaheuristic method based on the greedy randomized adaptive search procedure (GRASP) to solve the RSSA problem. Second, we compare performance of the proposed GRASP method against reference optimization approaches. Finally, we present and discuss a wide range of experiments focused on analysis of SS-FONs with joint unicast and anycast traffic. The main conclusions are: (i) the proposed GRASP algorithm provides results very close to optimal (only 0.5% optimality gap) for smaller problem instances and significantly outperforms other heuristics for larger problem instances (in average around 6.8 % better than the reference simulated annealing

*Corresponding author:
Email address: piotr.lechowicz@pwr.edu.pl

[1]The work of P. Lechowicz and K. Walkowiak was supported by National Science Centre, Poland under Grant 2015/19/B/ST7/02490.

[2]The work of M. Klinkowski was supported by National Science Centre, Poland under Grant 2016/21/B/ST7/02212.