



Modeling and optimization of spectrally-spatially flexible optical networks

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Abstract

Network traffic has been constantly increasing due to the growing popularity of various network services. The currently deployed backbone optical networks apply wavelength division multiplexing (WDM) techniques in single-core single-mode fibers (SMFs) to transmit the light. However, the capacity of SMFs is limited due to the physical constraints, and new technologies are required in the nearest future. Spectrally-spatially flexible optical networks (SS-FONs) are proposed as a scalable solution to provide a substantial capacity increase by exploiting the spatial dimension. To this end, suitably designed optical fibers are required where a signal is co-propagating in spatial modes, such as, bundles of single-core single-mode fibers (SMFBs), multi-core fibers (MCFs), multi-mode fibers (MMFs) or few-mode multi-core fibers (FM-MCFs). However, before this technology will reach maturity, various aspects need to be addressed. The fundamental problem in the design and operation of SS-FONs is routing, spectrum, and space allocation (RSSA) assignment. Having a set of requests, it refers to finding a routing path and a feasible optical corridor for each of them. RSSA problem is NP-hard as it is at least challenging as similar problems in elastic optical networks (namely, RSA problem) or in WDM networks (i.e., RWA problem). Therefore, finding optimal solution for larger problem instances is time consuming and the need for heuristic algorithms emerges. This presentation focuses on various aspects of modeling and optimization of spectrally-spatially flexible optical networks – including integer linear programming modeling, RSSA problem, network migration planning problem and network fragmentation problem.

Bio

Piotr Lechowicz received the Ph.D. degree in computer science from the Wroclaw University of Science and Technology, Poland, in 2019. Currently, he is working as an Assistant Professor at the Department of Systems and Computer Networks, Faculty of Informatics and Telecommunications, Wroclaw University of Science and Technology. His research interest is mainly focused on modeling and optimization of spectrally-spatially flexible optical, network fragmentation, and survivability. Piotr Lechowicz has been involved in several research projects related to optimization of optical networks – namely, "advanced methods for optimization of optical networks with spatial flexibility," "optimization of cognitive optical networks," "advanced methods for optimization of multilayer application-aware networks," and "traffic-aware optimization of transport optical networks". Piotr Lechowicz published more than 30 scientific papers including 9 papers in JCR journals, in the field of optimization and modeling of communication networks. Web page: <https://www.kssk.pwr.edu.pl/people/lechowicz>