JOURNAL OF
Optical Communications
and Networking

Introduction to the Future Optical Networks and Communications Symposium Special Issue

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Received 22 August 2023; published 24 August 2023

This special issue contains a collection of invitation-only extensions based on papers presented at the Future Optical Networks and Communications Symposium in the IEEE Future Network World Forum held 12–14 October 2022 in Montreal, Canada. We present a brief introduction followed by an overview of the topics covered in the papers. © 2023 Optica Publishing Group

https://doi.org/10.1364/JOCN.504006

Nowadays, as applications require higher speeds and performance, optical networks and communication systems are transforming, taking on new functionality and being used in new contexts. The network backbone has expanded to include data-center interconnect systems that run fully loaded at high capacity point to point between warehouse scale data-centers (DCs). Within the DC, optical networks reach into the package and onto the chip through co-packaged optics. Enhanced wireless network capabilities are being enabled by optical systems in edge cloud networks that carry radio signals at different stages of radio processing. High-speed optical signals are finding applications in access networks, in-building networks, and satellite communications. These trends, together with new technological advances, will shape the future of optical networks and communications.

In this special issue, we include six papers that were extended from the conference papers presented at the Future Optical Networks and Communications Symposium in the IEEE Future Network World Forum 2022.

In the first contribution, entitled "Cost- and energy-efficient filterless architectures for metropolitan networks," C. Tremblay *et al.* investigate the performance of filterless optical networks in metropolitan core and aggregation networks. They compare their results with a conventional metro network based on active switching, which confirms that the filterless architecture is an attractive alternative for metro network deployments.

In the second contribution, entitled "Fiber-to-the-room: a key technology for F5G and beyond," D. Zhang *et al.* review the current progress on fiber-to-the-room (FTTR). Several experiments that demonstrate FTTR's two essential features for the first time are presented, providing references for future technical developments. Future trends and perspectives of FTTR are also discussed.

In the third contribution, entitled "5G/6G optical fronthaul modeling: cost and energy consumption assessment," A. Fayad *et al.* show how to evaluate the total cost of ownership of 5G and beyond radio access networks while taking various fronthaul architectures into consideration. They also answer the question of how much energy is needed to run a network using each of the considered architectures.

In the fourth contribution, entitled "Cost-effective network capacity upgrade by heterogeneous wavelength division multiplexing density with bandwidth-variable virtual direct links," K. Hayashi *et al.* adopt cut-set analysis to identify the links likely to be heavily congested for network capacity upgrade, and propose a simple-path-search based graph splitting method to solve the problem time-efficiently. Their results confirm that efficient network capacity upgrade can be achieved while keeping existing facilities unchanged (i.e., hitless network capacity upgrade can be realized in operation).

In the fifth contribution, entitled "Design and deployment of optical x-haul for 5G, 6G, and beyond: progress and challenges," C. Ranaweera *et al.* review the studies that have been carried out to investigate the optical x-haul network in a hybrid fiber-wireless system to cater for the next generation wireless networks. Specifically, they survey the research on open radio access network architecture, coordination functionalities in radio-over-fiber networks, optimization frameworks that can be used to jointly optimize the wireless and optical network deployments, and reconfigurable optical x-haul.

In the last contribution, entitled "Impairment- and fragmentation-aware, energy-efficient dynamic RMSCA for SDM-EONs," J. Ravipudi and M. Brandt-Pearce present a routing, modulation, spectrum, and core allocation (RMSCA) algorithm for space-division-multiplexing-based elastic optical networks (SDM-EONs). A network state-dependent route and core selection method is proposed using a multi-attribute

decision-making method. It is followed by a spectrum allocation algorithm using a weighted score function to rate and select the best spectrum blocks, where physical layer impairments are considered alongside fragmentation and energy consumption.

We, as the guest editors, hope that our readers will find these articles interesting and informative. Meanwhile, we would like to thank all the authors for submitting their papers to the special issue, the reviewers for their high-quality and timely reviews that provide valuable feedback to the authors, and the staff and Editor-in-Chief of the *Journal of Optical Communications and Networking* for their support.

Guest Editors:

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