OPTICAL COMMUNICATIONS AND NETWORKS


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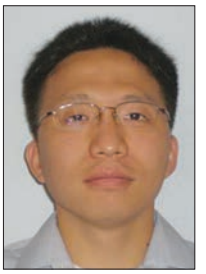
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In this third issue of the Optical Communications and Networks Series in 2020, we have selected four articles that present the most recent advances in optical communications and networking. These advances and innovations are aimed at making the optical infrastructure of the future Internet more secure, energy-efficient, universal, and intelligent.

More specifically, we have published four contributions that address:

- Attack models and the corresponding countermeasure for photonic network-on-chip.
- Universal optical performance monitoring (OPM) based on low-bandwidth coherent receivers for intelligent optical networks.
- An all-spectra fiber-wireless integrated radio access network (RAN) architecture.
- A dynamic low-power photonic network-on-chip architecture.

The first article, entitled "Potential Threats and Possible Countermeasures for Photonic Network-on-Chip" by P. Guo *et al.*, summarizes the potential attack models in photonic network-on-chips (PNoCs), and proposes a novel countermeasure against these potential threats. The countermeasure can provide a security barrier for PNoCs and alleviate the information leakage caused by malicious attacks. Therefore, this work provides insights on how to achieve security guarantee for the practical applications of PNoCs in the field of high-performance computing and datacenter networks.

The second article, entitled "Toward Universal Optical Performance Monitoring for Intelligent Optical Fiber Communication Networks" by D. Wang *et al.*, presents a technical solution toward universal optical performance monitoring (OPM) based on low-bandwidth coherent receivers. By obtaining and processing the complex spectrum slices of tapped signals at network nodes, various optical parameters can be estimated within a unified hardware framework. The authors also discuss several practical use cases, including physical layer monitoring for software-defined optical networks, early fault warning and identification for both metro and submarine fiber networks.

The third article, entitled "Key Enabling Technologies for Post-5G Era: Fully Adaptive, All-Spectra Coordinated Radio Access Network with Function Decoupling" by Y. Chen *et al.*, presents a fiber-wireless integrated radio access network (RAN) architecture, in which all data-carrying channels, e.g., lower RF, 5G new radio (NR), sub-THz, and lightwave, could be delivered via the same fiber infrastructure for serving diverse applications efficiently depending on key performance requirements and physical channel properties. The authors highlight optical wireless communication as one of the promising extensions toward the 6G era. In addition, fully coordinated networking systems with function decoupling have been developed to improve network resource utilization in a balance of throughput, channel condition, and hardware/software complexity.

Finally, the fourth article, entitled "On the Exploration of Low-Power Photonic Network Architecture" by J. Wang *et al.*, presents a dynamic low-power photonic network-on-chip (NoC) architecture that can save energy and improve network resource utilization based on runtime traffic characteristics, and designs a laser control technology to enable dynamic network resource partition and management via traffic-aware bandwidth provisioning. The authors also lay out a power-efficient NoC-based router to alleviate the impact of power loss on traversing signals due to the intermediate modulator and photo-detector arrays.

As Series Editors, we hope that *IEEE Communications Magazine* readers will find these articles interesting and informative. We will continue to do our best to select similarly outstanding papers for our future issues. We would like to thank all the authors for submitting their important results to this series, the reviewers for their high-quality reviews that provide valuable feedback and comments to the authors, and the publication staff members as well as the Editor-in-Chief of *IEEE Communications Magazine* for their guidance and support.

BIOGRAPHIES

MOHAMED-SLIM ALOUINI [F'09] (slim.alouini@kaust.edu.sa) received his Ph.D. degree in Electrical Engineering from the California Institute of Technology (Caltech), Pasadena, CA, USA in 1998. He served as a faculty member at the University of Minnesota, Minneapolis, and then at Texas A&M University at Qatar, Education City, Doha, before joining King Abdullah University of Science and Technology (KAUST), Thuwal, Makkah Province, Saudi Arabia, as a Professor of Electrical Engineering in 2009. His current research interests include the modeling, design, and performance analysis of wireless communication systems.

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