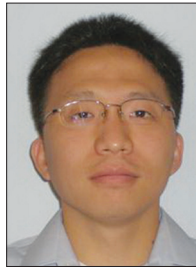


ADVANCES IN OPTICAL COMMUNICATIONS TECHNOLOGIES



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The field of optical communications and networking technologies is gaining new momentum from artificial intelligence (AI) and quantum communications, while there has been continuous attention on emerging topics such as TWDM/WDM passive optical networks (PONs), software-defined networking (SDN), and smart cities. In this second Optical Communications Series (OCS) issue of 2018, we have selected six contributions that address CMOS time-to-digital converter for optical time-of-flight sensing systems, light sources for TWDM/WDM PONs, resource allocation in optical networks secured by quantum key distribution (QKD), networks for future services in a smart city, software-defined wireline-wireless cross-networks, and knowledge-based autonomous service provisioning in multi-domain elastic optical networks (EONs).

In the first contribution entitled “A CMOS Time-to-Digital Converter for Real-Time Optical Time-of-Flight Sensing System,” Y. Li *et al.* present a time-to-digital converter (TDC) designated for time-of-flight (TOF) signals. The TDC incorporates a two-level self-locking scheme to stabilize measuring accuracy, so that it entirely eliminates the need for a separate calibration phase and at the same time allows continuous measurement with a relatively large dynamic range (i.e., a long time span). TDC measuring accuracy is experimentally proven as less than 40 ps, for which reason optical sensing systems utilizing the proposed TDC as a core telemetry device would potentially obtain an improved depth extraction resolution down to a few centimeters.

In the second contribution entitled “Colorless- and Tunable-Light-Source Schemes for TWDM and WDM PONs,” Z. Zhang *et al.* present colorless and tunable light-sources used in the optical network units (ONUs) for time-and-wavelength-division-multiplexed (TWDM) and wavelength-division-multiplexed (WDM) PONs. The architectures of the corresponding PON systems are also presented. Meanwhile, the transmission performance of various colorless and tunable light-sources has been analyzed and compared, as well as their features, characteristics, and applicability. This paper provides valuable guidance on how to select colorless and tunable light-sources for TWDM/WDM PONs, and thus would promote the development of next-generation PONs (NG-PONs).

In the third contribution entitled “Resource Allocation in Optical Networks Secured by Quantum Key Distribution,” Y. Zhao *et al.* present a novel optical network architecture secured by quantum key distribution (QKD). The architecture is based on software-defined networking (SDN). The SDN controller is in charge of allocating three types of channels (i.e., TDCh, QSCh, and PICH) on different wavelengths exploiting wavelength-division multiplexing (WDM).

In the fourth contribution entitled “Networks for Future Services in a Smart City: Lessons Learned from the Connected OFCity Challenge 2017,” D. Lavery *et al.* describe the key outcomes from a special workshop, “The Connected OFCity Challenge,” which was held during the Optical Fiber Communication Conference and Exhibition (OFC) 2017. This workshop sought technical solutions to meet the stringent requirements that advanced user applications will bring to optical access networks. Using just a few challenging, but relevant, case studies, this contribution shows both why and how future optical access networks will provide high data rates, while simultaneously assuring low latency and high reliability.

In the fifth contribution entitled “Software Defined Wireline-Wireless Cross-Networks: Framework, Challenges and Prospects,” S. Fu *et al.* present the framework of integrated wireline-wireless cross-networks. By employing software defined cross-networks, wired routing and wireless transmission can be controlled in an integrated and centralized way. Intelligent algorithms can thus be used for effective implementation of joint design with low delay, powerful network control, and high energy efficiency across the networks.

In the sixth contribution entitled “Knowledge-Based Autonomous Service Provisioning in Multi-Domain Elastic Optical Networks,” X. Chen *et al.* present a knowledge-based autonomous service provisioning framework for multi-domain elastic optical networks (EONs). By introducing a broker plane into a higher network control and management (NC&M) hierarchy and bringing in data analytics, the proposed framework enables multi-domain EONs to operate cognitively according to an observe-analyze-act cycle and therefore to realize self-adaptive and cost-effective service provisioning. The paper describes a promising perspective of the next-generation Internet infrastructure and also provides useful insights for current network operators to develop and incorporate intelligent service provisioning schemes in their NC&M systems.

BIOGRAPHIES

ZUQING ZHU [SM'12] (zqzhu@ieee.org) received his Ph.D. degree from the University of California, Davis, in 2007. He is currently a full professor at the University of Science and Technology of China. Prior to that, he worked in the Service Provider Technology Group of Cisco Systems, San Jose. His research focuses on optical networks, and he has received Best Paper Awards from IEEE ICC 2013, IEEE GLOBECOM 2013, ICNC 2014, IEEE ICC 2015, and ONDM 2018.

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