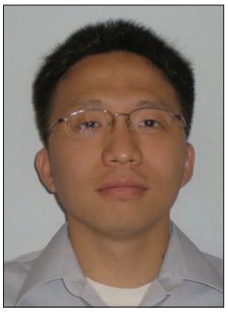
ADVANCES IN OPTICAL COMMUNICATIONS TECHNOLOGIES

Xiang Liu



Zuqing Zhu

In 2017, as fiber optic communications technologies continue to demonstrate their advantages in telecom and data center networks, we are also witnessing attractive and promising progress on optical wireless communications, which can potentially work with RF communications to meet the ever-increasing demands for higher date transmission rates and smart home networking. Meanwhile, the innovations in optical communications and networking systems can never be realized without fundamental support from the physical infrastructure layer. The recent advances on few-mode fibers open up appealing opportunities for equipment vendors and network operators to solve the capacity crunch problem using mode-division multiplexing. To integrate the momentum gained from these technical advances, an efficient and intelligent network control and management (NC&M) mechanism is essential, especially for building heterogeneous networks to support a wide range of services with various traffic patterns. Therefore, the implementation of software-defined networking (SDN) in optical communications networks appears inevitable, and we expect to see more advances in this area in 2017.

In this second Optical Communications Series (OCS) issue of 2017, we have selected four contributions that address the optical camera communication, few-mode optical fibers, YANG models for vendor-neutral optical networks, and protected converged optical access networks.

In the first contribution, "Optical Camera Communication: Motion over Camera," S. Teli, W. Cahyadi, and Y. Chung present a flexible and novel motion detection scheme over a smart device camera for optical camera communication (OCC). The motion detection or motion over camera (MoC) is designed to detect motion in terms of the user's finger movement via the camera while the OCC link is active. A simple but efficient quadrant-division-based motion detection algorithm is proposed for reliable and accurate detection of motion. Regarding key applications, it is envisioned to be applied in a smart home environment. The proposed MoC can also be considered in the context of a hybrid optical wireless communication system operable with existing RF-based systems such as Wi-Fi.

In the second contribution, "Few-Mode Optical Fibers: Original Motivation and Recent Progress," K. Kitayama and N. Diamantopoulos present their review of R&D activities on few-mode fiber, a special class of multimode optical fibers, beginning with its original motivation in the late 1970s to ease difficulty in splicing single-mode fibers, the operation principles, and the reason behind the research discontinuation in the mid-1980s. In addition to the earlier work, the article also reviews the progress of few-mode fibers after the resurgence of research in the 2010s. Recent revisiting of few-mode fibers is mainly motivated to solve the capacity crunch problem of optical fiber transmissions using mode-division multiplexing. The authors discuss difficult challenges that current research on mode-division multiplexing is facing. Such a revisit of few-mode fibers after their invention more than 30 years ago deserves showcasing for those engaged in research and development today.

In the third contribution, "YANG Models for Vendor-Neutral Optical Networks, Reconfigurable through State Machine," M. Dallaglio, N. Sambo, F. Cugini, and P. Castoldi present YANG models for optical networks, especially for those adopting flexible grids. The article first presents the YANG language and its syntax. Then it reviews some YANG models for elastic optical networks, detailing nodes, links, media channels, and sliceable transponders. Finally, the article describes and demonstrates in a control plane testbed an innovative YANG model enabling advanced transponder reconfiguration (based on a finite state machine). This work impacts the control (configuration) and management (operation, administration, and maintenance) of next generation core and metro networks by showing solutions that provide high device programmability and flexibility. It also impacts the adoption of white boxes (i.e., switching and compute nodes aggregated with modules from different vendors). The deployment of white boxes requires standard vendor-neutral solutions for control and management, and the presented YANG models go in this direction.

In the fourth contribution, "Dimensioning and Assessment of Protected Converged Optical Access Networks," A. Shahid and C. Machuca present a converged access network planning and dimensioning tool for planning and dimensioning of networks for fixed mobile convergence based on geographical information systems (GISs). This tool proposes a new clustering algorithm to decrease fiber and duct length. Furthermore, five protection schemes are proposed, modeled, and compared in dense urban, urban, and rural areas to improve connection availability to more availability-demanding endpoints.

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, California. His research focuses on optical networks, and he received the Best Paper Awards from IEEE ICC 2013, IEEE GLOBECOM 2013, IEEE ICNC 2014, and IEEE ICC 2015.

XIANG LIU [F'17] (xiang.liu@huawei.com) received his Ph.D. degree in applied physics from Cornell University in 2000. He is currently the senior director of Optical Access Networks Research at the U.S. R&D Center of Huawei Technologies, focusing on next-generation optical access technologies. He spent the early part of his career at Bell Laboratories in New Jersey, working on high-speed optical fiber transport technologies. He is a Fellow of the OSA and a Deputy Editor of Optics Express.