OPTICAL NETWORK ARCHITECTURES

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In the first quarter of this year, the optical communications industry's major event, OFCNFOEC '13, was held in Anaheim, California, with global participation (in excess of 12,000 attendees) in the conference's technical program and exhibit (more than 550 exhibiting companies). More than 800 technical presentations covered a broad range of optical communications technologies from advances in high-speed optical transport, software-defined networking (SDN), silicon photonics to optical interconnects in future computing systems, as well as progress in optical test and measurement. As we have witnessed in the past years, a vibrant global optical communications industry was in display at this year's OFCNFOEC.

In this issue, we have selected three contributions that address multilayer and multidomain optical network architectures, centralized control plane for filterless networks, and high-speed component development for use in single-wavelength 100 Gb/s transmission.

In the first contribution entitled "DREAM: Dual Routing Engine Architecture in Multilayer and Multidomain Optical Networks," Yongli Zhao, Jie Zhang, Min Zhang, Yuefeng Ji, and Wanyi Gu present a novel dual routing engine architecture in multilayer and multidomain scalable and constraint-aware policy-enabled optical networks (DREAM). With the development of large-scale multilayer and multidomain optical networks, the path computation process has become increasingly complex in light of various policies and constraints. In particular, to meet the rigid performance requirements of multilayer and multidomain networks, dynamic routing has become a critical issue in generalized multiprotocol label switching (GMPLS)/automatically switched optical (ASON) networks. In this article, the proposed new architecture is aimed at exploiting the advantages of both the GMPLS control plane and the path computation element (PCE). The cooperation of a group engine (GE) and a unit engine (UE) effectively optimizes the path computation process, especially under multiple constraints. Functional compositions of dual routing engines, core elements of DREAM, are described in detail. Six cooperation modes between the GE and UE are investigated. Two different routing schemes (DRE-FPC and HDRE-BRPC) are proposed and evaluated on a DREAM-based testbed that is able to support over 1000 nodes divided into 20 or more domains. Numerical results are given and analyzed based on the testbed performance results. Discussion and exploration of future developments are also presented.

In the second contribution, "PCE-Based Centralized Control Plane for Filterless Networks " Guillaume Mantelet, Christine Tremblay, David V. Plant, Paul Littlewood, adn Michel P. Bélanger present the concept of a filterless optical network from a control plane perspective, defining the network and showing to what extent a control plane could be adapted to it. Then they propose a control plane architecture and report their study of its performance. Filterless networks act as passive broadcast and select networks, in which active switching elements, such as the wavelength selection switch, are replaced by passive optical splitters and combiners, and the network agility is provided by tunable transceivers. They introduce the concept of unfiltered channels, and that of backward and forward ports, and show how they impact topological performance and, in particular, the increased wavelength usage with a shrinking protection ratio.

In the third contribution, "Cost-Efficient High-Speed Components for 100-Gb/s Ethernet Transmission on One Wavelength Only: Results of the HECTO Project," Rainer H. Derksen, Urban Westergren, Marek Chaciński, Colja Schubert, Heinz-Gunter Bach, Rachid Driad, Robert E. Makon, Volker Hurm, Jie Li, and Andreas G. Steffan describe a special project, HECTO, for the development of components for single-wavelength 100 Gb/s transmission. In 2010, the 100GbE standard was approved; this standard specifies the transmission of 100 Gb/s via four wavelength channels of 25 Gb/s capacity each. A solution based on a 100-Gb/s single-wavelength channel promises significant cost reductions with the availability of the required components. In this article, they present the project organization,

objectives, potential impacts, and results, including their successful demonstration in a final field trial. A complete electrical time-division multiplexing system utilizing the monolithically integrated transmitter and receiver modules developed in the project was built to transmit 112 Gb/s over a 42 km standard single-mode fiber-based span. They also explore higher-capacity Ethernet transmission beyond 100GbE and discuss prospects for standardization.

We thank all the authors and reviewers for their contributions to this OCS issue.

BIOGRAPHIES

OSMAN S. GEBIZLIOGLU [SM] (osman.gebizlioglu@huawei.com) joined Huawei Technologies USA as a principal consultant for optical distribution network technology research in February 2011. From 1987, when he joined Bellcore, until his departure from Telcordia Technologies at the end of January 2011, he was involved with the development of performance and reliability assurance requirements for optical communications components. In addition to his work to support the implementation of optical communications technologies in major service provider networks, he has been involved in failure analysis and reliability assurance efforts on aerospace and defense communications networks. He holds B.Sc and M.Sc degrees in chemical engineering (Middle East Technical University, Ankara, Turkey), and a Ph.D in chemical engineering and polymer materials science and engineering (Princeton University, New Jersey). Before joining Bellcore in 1987, he held Monsanto and ExxonMobil postdoctoral fellowships and research scientist appointments in mechanical engineering (Mechanics of Materials Division), chemical engineering (Microstructural Engineering Division), and the Center for Materials Science & Engineering at Massachusetts Institute of Technology, Cambridge. He has been an active member of the American Chemical Society, Materials Research Society, SPIE — International Society for Optical Engineering, Optical Society of America, IEEE Photonics Society, and IEEE Communications Society. He holds five U.S. patents and chaired the Telecommunications Industry Association TR-42.13 Subcommittee on Passive Optical Devices and Fiber Optic Metrology. He serves as Co-Series Editor of the *IEEE Communications Magazine* Optical Communications Series.

VIJAY JAIN serves as chief technology officer in Sterlite Network Ltd. based in Mumbai, India. He held the position of general manager in Bharti Airtel prior to joining Sterlite. He was Fiber Optic Components Independent Test Laboratories program manager at Verizon to support Verizon's FTTP initiative before his move to Bharti Airtel. He has over 15 years of experience in the telecom industry, and has worked in Canada, the United States, and India. He held management positions in telecom equipment manufacturers and product test laboratories prior to joining Verizon. During the last 15 years, he has worked in engineering, R&D planning, and strategic business development roles. His achievements include designing and testing GSM/CDMA-based wireless antennas, DSP-based VLSI chips, NMS for optical and wireless technologies, fiber optic components, and high-speed transport systems. He holds Master's degrees, one in telecom engineering specializing in wireless technology from the Indian Institute of Technology and the other in DSP technology from Concordia University in Canada.

JOHN SPENCER [SM] (john.spencer@optelian.com) is a telecom industry veteran with over 37 years' experience. He worked 29 years with BellSouth, 14 of those years as a member of technical staff in the Science & Technology Department. During that time he was involved in the introduction of SONET and erbium doped fiber amplifiers, and had a team leader role for the introduction of DWDM technology in the BellSouth network. He worked for four years as regional director of product marketing engineering for Mahi Networks, Petaluma, California. He is currently business and technology strategist for Optelian Access Networks, where he manages industry and customer direction to Optelian's product line as well as playing a key role in Optelian's AT&T account management. He was Conference Co-Chairman for NFOEC in 1991 and 1998. He has served on the NFOEC Technical Program Committee for 10 years. He served as Secretary and Chairman of ANSI accredited committee T1X1, Digital Hierarchy and Synchronization, which developed the standards for SONET. He is a graduate of Georgia Institute of Technology (B.E.E.) and is a registered Professional Engineer (PE) in the State of Alabama. He currently serves on the NFOEC/OFC Technical Program Committee.