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GUEST EDITORIAL

Advanced in Optical Network Control and Management

Mahmoud Daneshamand · Chonggang Wang · Wei Wei · Keping Long

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Optical networks are currently undergoing several attractive evolutions, ranging from 100G per channel transmission, integrated OTN-based WDM transmission and core switching, and flexible colorless/directionless/gridless ROADM to advanced control plane and management plane technologies. On the other hand, new services such as bandwidth virtualization and VPN impose new challenges to carriers, pushing them to rethink optical network design, planning, control and management issues. In order to support delivery of highly efficient packet services, highly reliable circuit services in emerging optical networks simultaneously, intelligent and automatic optical network design, planning, and control solutions are really important.

This special issue features recent and emerging advances in optical networks control and management. Six papers were selected for publication, which cover topics including network reconfiguration control, multi-layer survivability, cross-layer fault-tolerant design, optical network virtualization, optical network real-time monitoring techniques, and network planning and operation tools.

M. Daneshamand
Middledown, NJ, USA
e-mail: daneshmand@research.att.com

C. Wang (✉)
King of Prussia, USA
e-mail: cgwang@ieee.org

W. Wei
Dallas, TX, USA
e-mail: wwei@ieee.org

K. Long
Beijing, China
e-mail: longkeping@ustb.edu.cn

The first article, "Forward-Looking WDM Network Reconfiguration with Per-Link Congestion Control", co-authored by Jing Wu, James Zhang, Gregor v. Bochmann and Michel Savoie investigates the reconfigurations of wavelength-routed WDM networks in response to changes of lightpath demands, with the objective of providing service to more lightpath demands without additional network resources from a long-term network operation point of view. The proposed model allows a natural separation between the operation of the optical layer and the user traffic layer (predominantly the IP-layer. Simulation results show that by properly controlling resource allocations in the current session using their proposed mechanism, greatly reduces the rejections in future sessions.

Multi-layer optical protection and restoration is an interesting topic in OTN-based WDM networks. The second article, "Multilayer Protection with Availability Guarantees in Optical WDM Networks", co-authored by Massimo Tornatore, Diego Lucerna, Biswanath Mukherjee, Achille Pattavina investigates the problem of survivable dynamic connection provisioning in the mesh backbone networks. Differentiated services where connections may have different availability requirements are assumed, and here protection (if needed) is provisioned based on availability requirements and the current network state. The authors in this article proposed new multilayer routing strategies that perform effective availability-guaranteed grooming of sub-wavelength connections. These strategies jointly considered connection availability satisfaction and resource optimization and are developed under two different practical hypotheses: guaranteed target, i.e., a connection is routed only if its availability target is satisfied and best-effort target, a connection is always routed and, when the availability target cannot be guaranteed, the path with the best possible availability is provisioned. Numerical results are reported and discussed for the two approaches mentioned above. In both cases, the results show high effectiveness of their provisioning strategy.

The third article is about fault tolerant policy design in optical networks, titled "Cost Efficient Fault Tolerant Design in Mesh Optical Networks with the Load Aware Method", co-authored by Ruyan Wang, Dapeng Wu, Sheng Huang, Keping Long. The authors designed a set of cost efficient fault tolerant mechanisms. The main objective is the minimization of the total number of required wavelengths. Furthermore, based on the method of the Integer Linear Program (ILP), shared-path protection and shared-link protection strategies are achieved, respectively. Moreover, the objective of minimizing the load imbalance is used to ensure that the network resources are utilized efficiently, and then the wavelength contention can be mitigated by selecting the working path and backup path reasonably.

The next one, "Adaptive Fault Monitoring in All-Optical Networks Utilizing Real-Time Data Traffic", co-authored by Dong Shen, Kam-Hon Tse and Chun-Kit Chan, proposed a novel fault detection and localization scheme for all-optical networks with the information of real-time data traffic. The studied adaptive fault localization framework is based on combining passive and proactive monitoring solutions, together with adaptive management in two phases. Numerical results indicate that the proposed scheme has good scalability, in terms of the number of fault monitors required.

In the fifth one, "A Cost Efficient Design of Virtual Infrastructures with Joint Node and Link Mapping", co-authored by Hongfang Yu, Vishal Anand, Chunming Qiao, Hao Di, Xuetao Wei, the authors studied the problem of cost efficient VI mapping and proposed a novel approach called the virtual infrastructure mapping algorithm (VIMA) that jointly considers node mapping and link mapping. Such a close coordination between the link and node mapping stages increases the efficiency of the VIMA algorithm. The authors also compared the performance of the proposed VIMA algorithm with other VI mapping algorithms such as NSVIM, vnmFlib and R-ViNE under various performance metrics using simulation. The simulation results and analysis show that the VIMA algorithm outperforms the other algorithms in terms of both VI mapping costs and path lengths of VI links.

The last article, "DICONET NPOT: An Impairments Aware Tool for Planning and Managing Dynamic Optical Networks", co-authored by Siamak Azodolmolky, Panagiotis Kokkinos, Marianna Angelou, Emmanouel (Manos) Varvarigos, Ioannis Tomkos, introduced a network planning and operation tool, called NPOT, which supports physical layer impairment-aware network design. The architecture and key building blocks including network description repositories, QoT estimator, IA-RWA engines, component placement algorithms, and failure localization modules were presented as well. More importantly, the authors also gave several experimental results for NPOT, evaluating the performance of its impairment-aware routing and wavelengths assignment engines.

Finally, we would like to take this opportunity to thank our reviewers for their effort in reviewing the manuscripts. We also thank the Edit-in-Chief, Dr. Deep Medhi for his supportive guidance during the entire process.

Author Biographies

Mahmoud Daneshmand PhD, is a Distinguished Member of Technical Staff, AT&T Labs Research; Executive Director of University Collaborations Program and Assistant Chief Scientist of the AT&T Labs; Adjunct Professor of CS at the Stevens Institute of Technology. He has more than 35 years of teaching, research & publications, and management experience in academia and industry including Bell Laboratories, AT&T Labs, and University of California at Berkeley, University of Texas at Austin, Tehran University, Sharif University of Technology, National University of Iran, New York University, and Stevens Institute of Technology. He has published more than 80 journal/conference papers and book chapters. Co-authored two books, and has given several keynote talks, and served as general chair and TPC chair of many IEEE conferences. His current areas of teaching and research include Artificial Intelligence; Knowledge Discovery and Data Mining; Complex Networks Analysis, Sensor Networks and RFID Systems reliability & performance and data mining of sensor and RFID data. He has a PhD and MA in Statistics from the University of California, Berkeley, and MS and BS in Mathematics from the University of Tehran.

Chonggang Wang received his Ph.D. degree in computer science from Beijing University of Posts and Telecommunications. He is currently with InterDigital Communications and previously conducted research with NEC Laboratories America, AT&T Labs Research, and University of Arkansas, in different areas including future Internet, machine-to-machine (M2M) communications, wireless networks, device/network/service management, and Internet of Things (IoT). He (co-)authored more than 100 journal/conference articles and book chapters. He has been on the editorial board for several journals including IEEE Communications Magazine, IEEE Transactions on Service and Networks Management, and ACM/Springer Wireless Networks Journal. He has served as chair/TPC member for numerous IEEE conferences. He is a senior member of the IEEE.

Wei Wei is a staff R&D engineer at Huawei Technologies. Before joining Huawei, he had conducted optical networking R&D work with Ciena Corporation and NEC Laboratories America. His research interests include packet optical transport system, optical access, network design and optimization. He has published more than 60 journal/conference articles and book chapters. He also has rich engineering experiences in developing and designing broadband optical networks and IP networks. He is the holder of three patents with five others pending. He has served as a TPC member for several IEEE conferences including Globecom and ICC. He received his Ph.D. degree in electrical engineering from Shanghai Jiao Tong University. He is a senior member of the IEEE.

Keping Long is currently a professor at school of Computer and Communication Engineering (CCE), University of Science and Technology Beijing (USTB), and the dean of CCE of USTB. He is the IEEE senior member, and the Member of Editorial Committee of Sciences in China Series F. He is also the TPC and the ISC member for COIN2003/04/05/06/07/08/09/10, IEEE IWCN2010, ICON04/06, APOC2004/06/08, Co-chair of organization member for IWCMC2006, TPC chair of COIN2005/2008, TPC Co-chair of COIN2008/2010, He was awarded for the National Science Fund for Distinguished Young Scholars of China in 2007, selected as the Chang Jiang Scholars Program Professor of China in 2008. His research interests are in Optical Internet Technology, New Generation Network Technology, Wireless Information Network, Value-added Service and Secure Technology of Network. He has published over 200 papers, 18 keynotes speaks and invited talks in the international conferences and local conferences.