External Awards

IEEE VTC2016-Spring Best Paper Award

Winner: Katsuyuki Haneda, Aalto University; Lei Tian, BUPT; Yi Zheng, CMCC; Henrik Asplund, Ericsson; Jian Li, Yi Wang, and David Steer, Huawei; Clara Li and Tommaso Balercia, Intel; Sunguk Lee and YoungSuk Kim, KT Corporation; Amitava Ghosh and Timothy Thomas, Nokia; Takehiro Nakamura, NTT DOCOMO; Yuichi Kakishima, DOCOMO Innovations; Tetsuro Imai, NTT DOCOMO; Haralabos Papadopoulas, DOCOMO Innovations; Theodore S. Rappaport, George R. MacCartney Jr., Mathew K. Samimi, and Shu Sun, NYU WIRELESS; Ozge Koymen, Qualcomm; Sooyoung Hur, Jeongho Park, and Charlie Zhang, Samsung; Evangelos Mellios, University of Bristol; Andreas F. Molisch, University of Southern California; Saeed S. Ghassamzadeh and Arun Ghosh, AT&T
Date: May 17, 2016
Organization: The Institute of Electrical and Electronics Engineers (IEEE) Vehicular Technology Society

For "5G 3GPP-like Channel Models for Outdoor Urban Microcellular and Macrocellular Environments."
Published as: K. Haneda, L. Tian, Y. Zheng, H. Asplund, J. Li, Y. Wang, D. Steer, C. Li, T. Balercia, S. Lee, Y. Kim, A. Ghosh, T. Thomas, T. Nakamura, Y. Kakishima, T. Imai, H. Papadopoulas, T. S. Rappaport, G. R. MacCartney Jr., M. K. Samimi, S. Sun, O. Koymen, S. Hur, J. Park, C. Zhang, E. Mellios, A. F. Molisch, S. S. Ghassamzadeh, and A. Ghosh, "5G 3GPP-like Channel Models for Outdoor Urban Microcellular and Macrocellular Environments," Proc. of the 2016 IEEE 83rd Vehicular Technology Conference (VTC 2016-Spring), Nanjing, China, May 2016.

OECC/PS 2016 Best Paper Award

Winner: Koh Ueda, Yojiro Mori, and Hiroshi Hasegawa, Nagoya University; Hiroyuki Matsuura, Kiyo Ishii, Haruhiko Kuwatsuka, and Shu Namiki, National Institute of Advanced Industrial Science and Technology; Toshio Watanabe, NTT Device Innovation Center; Ken-ichi Sato, Nagoya University, National Institute of Advanced Industrial Science and Technology
Date: July 7, 2016
Organization: The 21st Optoelectronics and Communications Conference/International Conference on Photonics in Switching 2016 (OECC/PS 2016) organizing committee

For "Demonstration of 1,440x1,440 Fast Optical Circuit Switch for Datacenter Networking."
Published as: K. Ueda, Y. Mori, H. Hasegawa, H. Matsuura, K. Ishii, H. Kuwatsuka, S. Namiki, T. Watanabe, and K. Sato, "Demonstration of 1,440x1,440 Fast Optical Circuit Switch for Datacenter Networking," OECC/PS 2016, WF1-3, Niigata, Japan, July 2016.

IPSJ SIG SE Excellent Research Award

Winner: Shinobu Saito and Yukako Iimura, NTT Software Innovation Center; Hirokazu Tashiro, NTT DATA; Aaron K. Massey, University of Maryland; Annie I. Antón, Georgia Institute of Technology
Date: September 2, 2016
Organization: Information Processing Society of Japan (IPSJ) Special Interest Group (SIG) on Software Engineering (SE)

For "Visualizing the Effects of Requirements Evolution."
Published as: S. Saito, Y. Iimura, H. Tashiro, A. K. Massey, and A. I. Antón, "Visualizing the Effects of Requirements Evolution," Proc. of the 38th International Conference on Software Engineering, pp. 152–161, Austin, USA, May 2016.

Papers Published in Technical Journals and Conference Proceedings

Maximizing Lifetime of Multiple Data Aggregation Trees in Wireless Sensor Networks

H. Matsuura

Proc. of NOMS 2016 (2016 IEEE/IFIP Network Operations and Management Symposium), pp. 605–611, Istanbul, Turkey, April 2016.

Sensor data aggregation trees in a wireless sensor network (WSN) are used to gather data from an area that the WSN covers. In this paper, a hierarchical sensor network routing is proposed in which a base station (BS) cooperates with its underlying multiple cluster heads (CHs) to determine the best routes in each tree-cluster. A routing metric proposed in this paper represents the rate of energy increase on a tree when a new sensor is connected to the tree, and the BS can always select the smallest metric route among all the trees; thus, the architecture can reduce the energy consumption of the trees and extend their lifetime significantly. In addition, the proposed routing sets a backup route for each primary route on a tree by choosing the second smallest metric route after the primary route. Therefore, the lifetime of aggregation trees even after some percentage of sensors die is longer compared with other routings.

Impact of Highly Adaptive Elastic Optical Paths on Dynamic Multi-layer Network Planning

T. Tanaka, T. Inui, A. Kadohata, and W. Imajuku

Proc. of iPOP 2016 (the 12th International Conference on IP + Optical Network), Yokohama, Japan, June 2016.

We incorporated a frequency slot resizing scheme into a multilayer network planning method. Firstly, the method assigns optical path demands to existing optical paths that are provisioned in previous phases. Frequency slot resizing is applied if the optical path demand cannot be assigned without resizing, and the removal of unused optical paths is applied after all optical path demands are assigned. Additional optical paths are provisioned if optical path demands cannot be assigned using the proposed approaches. In the evaluations that examined various combinations of transponder types and traffic models, we quantified the effectiveness of the frequency slot resizing scheme on transponder count and spectrum requirements.

Multiperiod IP-over-Elastic Network Reconfiguration with Adaptive Bandwidth Resizing and Modulation

T. Tanaka, T. Inui, A. Kadohata, W. Imajuku, and A. Hirano

Journal of Optical Communications and Networking, Vol. 8, No. 7, pp. A180–A190, July 2016.

Elastic optical networks (EONs) represent a promising network architecture that accommodates a wide variety of traffic demands in the optical layer. Thanks to the functionality of bandwidth flexibility of elastic optical paths, we can now accommodate Internet protocol (IP) traffic directly into the optical layer by configuring, for example, the modulation format and subcarrier counts to client demands (optical path demands). At the same time, to accommodate temporally and geographically changing IP traffic demands efficiently in optical networks, cooperation between the IP and optical layers is essential. This paper proposes a multilayer network reconfiguration algorithm that supports periodically changing IP traffic patterns. We incorporate two schemes, which make IP over EONs more flexible, into the heuristic iterative multilayer network reconfiguration (IMNR) algorithm. The first scheme involves bandwidth resizing achieved through subcarrier expansion and reduction, and the second employs energy-efficient adaptive modulation according to the data rate and distance of the client demands. We evaluated the impact of the following on energy efficiency: the IMNR algorithm, the proposed adaptive bandwidth resizing and modulation schemes, and some multicarrier-based transponder architectures including a bandwidth-variable transponder (BVT) and sliceable BVT (SBVT). The evaluation results show that the IMNR algorithm with the proposed schemes significantly reduces the energy consumption compared with traditional network planning schemes and equipment.

A Static Traffic Grooming Algorithm for Elastic Optical Networks with Adaptive Modulation

T. Tanaka, T. Inui, and W. Imajuku

Proc. of OECC2016 (the 21st Optoelectronics and Communications Conference), TuA1-3, Niigata, Japan, July 2016.

We propose a novel static traffic grooming algorithm for elastic optical networks, which are aware of multiple modulation formats. An evaluation showed the algorithm significantly saves optical paths compared to other algorithms in various network conditions.

Rapid Restoration Sequence of Fiber Links and Communication Paths from Catastrophic Failures

A. Kadohata, T. Tanaka, W. Imajuku, F. Inuzuka, and A. Watanabe

IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences, Vol. E99-A, No. 8, pp. 1510–1517, August 2016.

This paper addresses the issue of implementing a sequence for restoring fiber links and communication paths that have failed due to a catastrophe. We present a mathematical formulation to minimize the total number of steps needed to restore communication paths. We also propose two heuristic algorithms: Minimum spanning tree-based degree order restoration and Congestion link order restoration. Numerical evaluations show that integer linear programming based order restoration yields the fewest number of restoration steps, and that the proposed heuristic algorithms, when used properly with regard to the accommodation rate, are highly effective for real-world networks.

Shallow Quantum Circuits with Uninitialized Ancillary Qubits

Y. Takahashi and S. Tani

arXiv:1608.07020 [quant-ph], August 2016.

We study the computational power of shallow quantum circuits with n input qubits, one output qubit, and two types of ancillary qubits: $O(\log n)$ initialized and $O(\mathrm{poly}(n))$ uninitialized qubits. The initial state of the uninitialized ancillary qubits is arbitrary, and we have to return their state into the initial one at the end of the computation. First, to show the strengths of such circuits, we consider a class of symmetric functions on n bits, including those (such as threshold functions) for which it is not known whether there exist shallow quantum circuits with only $O(\log n)$ initialized ancillary qubits. We show that there exists an $O(\log^2 n)$-depth quantum circuit for any function in the class with $O(\log n)$ initialized and $O(n \log^2 n)$ uninitialized ancillary qubits. Its existence shows the possibility that augmenting uninitialized ancillary qubits increases the computational power of shallow quantum circuits. The depth decreases to $O(\log n)$ when we use unbounded fan-out gates and unbounded Toffoli gates. Then, we consider the limitations of shallow quantum circuits with uninitialized ancillary qubits, which include unbounded fan-out gates and unbounded Toffoli gates. We show that, when the number of qubits on which unbounded fan-out gates act is $O(\mathrm{poly}(\log n))$, for any constant $0 \le \delta < 1$, there does not exist an $O(\log^\delta n)$-depth quantum circuit for the parity function on n bits with $O(\log n)$ initialized and $O(\mathrm{poly}(n))$ uninitialized ancillary qubits.

Smooth Motion Parallax Projection Displays for Highly Realistic Applications

M. Date

Proc. of IMID 2016 (the 16th International Meeting on Information Display), p. 204, Jeju, Korea, August 2016.

The image quality of displays has advanced greatly so that almost everyone is satisfied with displayed 2D images or videos. Though 2D displays cannot reproduce directional information due to the Mona Lisa effect, it is an advantage for entertainment use. However, when users communicate through electronic displays, the lack of directional information is a severe problem because users cannot understand who a remote user is addressing. Using a smooth and exact motion parallax display, users can only see the facial direction but can also perceive the direction of interest, a slight change of mind, a sense

of material, and a feeling of existence. In this presentation, a conceptual demonstration system of Space Composite Telecommunication, which can connect remote and local places, is shown. It uses a life-size glasses-type 3D projection display with smooth motion parallax by head tracking of remote and local users. Our recent trial with glasses-free displays is also demonstrated.

Drive-amplitude-independent Auto Bias Control Circuit for QAM Signal and Its Demonstration with InP Based IQ-modulator

H. Kawakami, S. Kuwahara, and A Hirano

Proc. of ECOC 2016 (the 42nd European Conference on Optical Communication), Düsseldorf, Germany, September 2016.

A novel auto bias control technique for various types of IQ modulators is proposed. The technique can generate any order quadrature amplitude modulation signals with no dependence on drive amplitude. The measured penalty was found to be almost negligible.

Video Extrapolation Method Based on Time-varying Energy Optimization and CIP

H. Sakaino

IEICE Transactions on Image Processing, Vol. 25, No. 9, pp. 4103–4115, September 2016.

This paper proposes a physics-based method to extrapolate new videos from a few images with data compression free under image energy constancy. State-of-the-art methods rely on data compression and no physical rules, where significant image degradations, i.e., blur and artifacts, and insufficient motion changes, have been generated. With highly detailed image features, our proposed video extrapolation method shows the effectiveness of physics-based equations and CIP (constrained interpolation profile) with less computation cost.
