

Track 3: Network Architectures, Management and Applications

Venue: Guilin Room, 3F

October 25

13:30–15:30

M4C • Optical Security and QKD

Presider: Yongli Zhao, Beijing Univ of Posts & Telecom, China

M4C.1 • 13:30 **Invited**

Planning Security-Aware Filterless Optical Networks, Qian Lv¹, Zuqing Zhu¹; ¹Univ of Science and Technology of China, China. We consider to leverage optical transport network (OTN) encryption to enhance the security in filterless optical networks (FONs), and solve the resulting security-aware multilayer planning .

M4C.2 • 14:00 **Invited**

The OpenQKD Testbed in Berlin, Marc Geiz¹, Ralf-Peter Braun²; ¹Deutsche Telekom AG Laboratories, Germany; ²Deutsche Telekom AG, Germany. The Berlin OpenQKD Testbed demonstrates the integration of QKD technology into a field installed network infrastructure using a PQC secured key management system and hybrid key exchange protocols to secure communication applications .

M4C.3 • 14:30 **Invited**

Resource Allocation in Quantum-Key-Distribution-Secured Datacenter Networks With Cloud-Edge Collaboration, Qingcheng Zhu², Xiaosong Yu², Yongli Zhao², Avishek Nag¹, Jie Zhang²; ¹School of Electrical and Electronic Engineering, Univ. College Dublin, Ireland; ²Beijing Univ. of Posts and Telecommunications, China. The problem of communication, computation, caching, and cryptographic (4C) resource allocation is first solved in quantum-key-distribution-secured datacenter networks with cloud-edge collaboration . Simulation shows great performances of the proposed solution considering blocking rate and key consumption .

M4C.4 • 14:45

Side Channel Attack-Aware Slice Mapping in 5G RAN, Zhengyin Liang², Guoli Feng¹, YaJie Li², Yifan Niu², Suhao Zheng², Yongli Zhao², Jie Zhang²; ¹State Grid Ningxia Electric Power Co., LTD. Information & communication Company, China; ²Beijing Univ. of Posts and Telecommunications, Beijing, China, 100876, China. A Side Channel Attack (SCA)-aware slicing algorithm is proposed to achieve secure slicing in 5G RAN . Results show that our algorithm can effectively balance the resource utilization and security performance of slices .

M4C.5 • 15:00

Time-Window Based Key Provisioning in Measurement-Device-Independent Quantum Key Distribution Secured Optical Access Networks, Yuhang Liu¹, Xiaosong Yu¹, Yongli Zhao¹, YaJie Li¹, Jie Zhang¹; ¹Beijing Univ of Posts & Telecom, China. This paper introduces a time-window based key provisioning scheme in measurement-device-independent quantum key distribution secured optical access networks . Simulation shows it achieves good performance in terms of key utilization rate .

M4C.6 • 15:15

Multi-Hop-Based Routing and Time-Slot Assignment in Centralized Quantum Entanglement Distribution Networks, Yazi Wang¹, Xiaosong Yu¹, Yongli Zhao¹, Jie Zhang¹; ¹Beijing Univ of Posts & Telecom, China. A multi-hop-based routing and time-slot assignment algorithm is proposed in centralized quantum entanglement distribution networks . Simulation results

show that it can achieve good performance .

16:00–18:00

M5C • Open and Disaggregated Optical Networks
Presider: Gangxiang Shen, Soochow University, China

M5C.1 • 16:00 Invited

Open Packet-Optical Edge Node: State of Art and Challenges [Invited], Filippo Cugini¹, Davide Scano², Alessio Giorgetti³, Andrea Sgambelluri², Francesco Paolucci¹, Piero Castoldi²; ¹CNIT, Italy; ²Scuola Superiore Sant'Anna, Italy; ³IEIT, CNR, Italy. This paper provides an overview of state of art and challenges for open packet-optical node solutions based on SONiC open operating system, coherent pluggable modules and P4-based packet switching programmability for edge networking .

M5C.2 • 16:30 Invited

Service Chaining in Filterless Optical Metro-Ag- gregation Networks, Omran Ayoub², Memedhe Ibrahim¹, Oleg Karandin¹, Leila Askari¹, Francesco Musumeci¹; ¹Politecnico di Milano, Italy; ²Univ. of Applied Sciences of Southern Switzerland, Switzerland. We discuss the advantages and disadvantages of the deployment of Filterless Optical Networks in metro-aggregation networks . In particular, we focus on the use case of service chaining under a filterless metro-aggregation network .

M5C.3 • 17:00 Invited

Improving Optical Control Plane Research and Development Through Synergetic Testbed Experimentation and Emulation, Marco Ruffini¹; ¹Univ. of Dublin Trinity College, Ireland. We present Mininet-Optical, an optical network emulation tool for control plane development and testing . The tool is used both for scalability studies and as sandbox for experimentation with telecommunications testbed infrastructure .

M5C.4 • 17:30

Optimized Design of Metro-Aggregation Networks Exploiting Digital Subcarrier Routing, Mohammad Mohammad Hosseini¹, João Pedro^{2,4}, Antonio Napoli³, Nelson Costa², Jaroslav E. Prilepsky¹, Sergei K. Turitsyn¹; ¹Aston Inst. of Photonics, Aston Univ., UK; ²CTO Optical Systems Group, Infinera, Portugal; ³Strategy, Architecture, and Engineering, Infinera, UK; ⁴Instituto de Telecomunicações, Portugal. We propose an Integer Linear Programming model for the CAPEX minimization of point-to-multipoint transceivers in mesh networks . The results show cost reduction of up to 40%, along with potential for further cost-savings in router interfaces .

M5C.5 • 17:45

CLONETS-DS – Clock Network Services-Design Study Strategy and Innovation for Clock Services Over Optical-Fibre Networks, Josef Vojtech¹, Lada Altmannova¹, Vladimir Smotlacha¹, Radek Velc¹, Rudolf Vohnout¹, Harald Schnatz², Tara Cubel Liebisch², Vincenzo Capone³, Tryfon Chiotis³, Guy Roberts³, Domenico Vicinanza³, Artur Binczewski⁴, Wojbor Bogacki⁴, Krzysztof Turza⁴, Paul-Eric Pottie⁵, Philip Tuckey⁵, Jerome Fils⁵, Davide Calonico⁶, Vittorio Curri⁷, Ronald Holzwarth⁸, Benjamin Sprenger⁸, Ondrej Cip⁹, Lenka Pravdova⁹, Simon Rerucha⁹, Javier Diaz Alonso¹⁰, Eduardo Ros Vidal¹⁰, Trinidad Garcia¹¹, Benoit Rat¹¹, Jan Kodet¹², Ulrich Schreiber¹², Jurgen Kusche¹³, Dieter Meschede¹³, Stefan Schröder¹³, Stefan Stellmer¹³, Pawel Nogas¹⁴, Robert Urbaniak¹⁴, Przemyslaw Krehlik¹⁵, Lukasz Sliwczynski¹⁵, Anne Amy Klein¹⁶, Nicolas Quintin¹⁷, Alwyn Seeds¹⁸, Bruno Desruelle¹⁹, Jean-Luc Gaudin¹⁹, Vincent Menoret¹⁹, Martin Rabault¹⁹; ¹CESNET, Czechia; ²PTB, Germany; ³GEANT, UK; ⁴PSNC, Poland; ⁵LNE-SYRTE, France; ⁶INRIM, Italy; ⁷Politecnico di Torino, Italy; ⁸Menlo Systems, Germany; ⁹ISI, Czechia; ¹⁰UGR, Spain; ¹¹Seven Solutions, Spain; ¹²TUM,

Germany; ¹³UNI Bonn, Germany; ¹⁴Piktime Systems, Poland; ¹⁵AGH Uni, Poland; ¹⁶LPL, France; ¹⁷RENATER, France; ¹⁸UCL, UK; ¹⁹Muquans, France. CLONETS-DS is a European Union-funded research and innovation action intended to facilitate the vision of a sustainable, pan-European fibre network for time and frequency dissemination .

08:30–10:00

T1C • Control Technology of Future

Tuesday, 26 October

Optical Networks

Presider: Yunbo Li, China Mobile

Communication Corporation R, China

T1C.1 • 08:30 Invited

Title to be Announced, Biswanath Mukherjee¹;

¹Soochow Univ., China. Abstract not available .

T1C.2 • 09:00 Invited

Towards Large-Scale Disaster-Resilient Open and Integrated Disaggregate/Legacy Optical Networks, Sugang Xu¹, Kiyo Ishii², Noboru Yoshikane³, Sifat Ferdousi⁴, Masaki Shiraiwa¹, Yusuke Hirota¹, Takehiro Tsuritani³, Yoshinari Awaji¹, Naoya Wada¹, Shu Namiki², Biswanath Mukherjee^{4,5}; ¹National Inst. of Information and Communications Technology, Japan; ²National Inst. of Advanced Industrial Science and Technology, Japan; ³KDDI Research, Inc., Japan; ⁴Univ. of California, Davis, USA; ⁵Inst. for Broadband Research and Innovation (IBRI) at Soochow Univ., China. We investigate an approach to enhance resilience of future optical networks with openness and disaggregation . We present our studies on the control and optical performance monitoring/ telemetry of optical networks with this approach in disaster recovery .

T1C.3 • 09:30

Multi-Agent Federated Reinforcement Learning for Privacy-Enhanced Service Provision in Multi-Domain Optical

Network, Lliu Haiyu¹, Rentao Gu¹, Zhekang Li¹, Yuefeng Ji¹; ¹BUPT, China. We propose a multi-agent federated reinforcement learning algorithm for privacy-enhanced service provision in multi-domain optical network . Experimental results show blocking probability is reduced from 11% to 1% and the deviation ratio is within 3% .

T1C.4 • 09:45

Sample Distribution Matching Based Transfer Learning for QoT Estimation in Optical Networks, Tangze Qin¹, Zhiquan

Gu¹, Jiawei Zhang¹, Yuhang Zhou¹, Yuefeng Ji¹; ¹BUPT, China. We propose a sample distribution matching based transfer learning approach to perform accurate QoT estimation with fewer samples . Simulation results demonstrate that the proposed method can save training samples effectively .

10:30–12:00

T2C • Physical Layer Driven Optical

Networking

Presider: Zeshan Chang, Huawei

Technology, China

T2C.1 • 10:30 Invited

Title to be Announced, Zhensheng Jia¹; ¹Cable-Labs, USA. Abstract not available .

T2C.2 • 11:00 Invited

Standardization and Application of Port- Agnostic WDM Technique in Metro Access Layer Network, Shikui Shen¹; ¹China Unicom, Hong Kong. Tunable laser based port-agnostic WDM technique was standardized and deployed in metro optical access layer network for 5G and integrated access services, and lambda as a service and pay as you grow could be achieved. The practices in China Unicom is introduced in the talk.

T2C.3 • 11:30 Invited

Title to be Announced, Liangjia Zong¹; ¹Hua-wei Technologies Co Ltd, China. Abstract not available.

13:30–15:30

T3C • Optical and Wireless Converged Networks

Presider: Huilian Ma, Zhejiang University, China

T3C.1 • 13:30 Invited

PON for Fiber to the Room, Frank Effenberger¹, Yuanqiu Luo¹; ¹FutureWei Technologies Inc, USA. Now that fiber to the home (FTTH) is commonplace, the industry looks to extend its reach into the home, and fiber to the room (FTTR) has come into focus. This paper outlines such systems, and a method to leverage the PON control plane is highlighted.

T3C.2 • 14:00

OneM2M IoT Platform for SDN Control of Optical Networks, Martina Troscia², Andrea Sgambelluri², Francesco Paolucci¹, Piero Castoldi², Paolo Pagano¹, Filippo Cugini¹; ¹CNIT, Italy; ²Scuola Superiore Sant'Anna, Italy. The first implementation of the OneM2M IoT platform used to control optical networks is presented. The platform provides remarkable scalability performance particularly as a function of the number of monitored devices.

T3C.3 • 14:15

Real-Time Demonstration of Fiber-to-the-Room for >1Gb/s Home Networking With Guaranteed QoS and Fast Roaming, Xuming Wu¹, Yan Zeng¹, Jianfei Liu¹, Philippe Chanclou²; ¹Huawei Technologies Co Ltd, China; ²Orange Labs, France. We experimentally demonstrate a Gb/s-level fiber-based P2MP home network with fast roaming via coordinated multipoint. In addition, the QoS of low-latency services is guaranteed via AI-based service acceleration, reducing the end-to-end latency by over 8 times to 50 ms.

T3C.4 • 14:30

Flexible Visible Light Communication Based on Probabilistic Constellation Shaping and Orthogonal Superposition Modulation, Ruizhe Jin¹, Zhanhong Zhou¹, Yiheng Zhao¹, Sizhe Xing¹, Fangchen Hu¹, Junwen Zhang¹, Nan Chi¹; ¹Fudan Univ., China. A flexible visible light communication system based on probabilistic constellation shaping and orthogonal superposition modulation is proposed and demonstrated. Compared with non-PCS solution, it has a maximum 49% capacity improvement and achieves 3.34Gbps CoMP net-data-rate.

T3C.5 • 14:45

Neural Architecture Search-Enabled Deep Reinforcement Learning for Slice Deployment in a Converged Optical-Wireless Access Network, Ruikun Wang¹, Jiawei Zhang¹, Zhiqun Gu¹, Zhuo Chen¹, Yuefeng Ji¹; ¹Beijing Univ. of Posts and Telecommunications, China. We propose a neural architecture search-enabled deep reinforcement learning (NAS-DRL) for RAN slice deployment in a converged optical-wireless access network. Simulation results validate its superiority in resources saving and DRL retaining times.

T3C.6 • 15:00

End-to-End Multi-Connection Partial Protection Scheme Ensuring Tolerable QoS in Optical and Wireless Converged Networks, Lu Zhang¹, Xin Li¹, Ying Tang¹, Jingjie Xin¹, Ji-anhua Wei¹, Shanguo Huang¹; ¹*Beijing Univ. of Posts and Telecommunications, China*. A connectivity-aware end-to-end multi-connection partial protection scheme is proposed to ensure reliable transmission under acceptable QoS. A genetic algorithm based heuristic algorithm is developed to greatly reduce blocking probability and resource consumption than full protection.

T3C.7 • 15:15

Best Spectral Spacing for 90 GBaud WDM Carriers, Thierry Zami¹, Bruno Lavigne¹; ¹*Nokia Corporation, France*. While transponders as fast as 90 GBaud emerge in meshed WDM networks, we examine how the related most performant inter-carrier spectral spacing depends on the filtering sharpness of WSS's in OXC's that channels cross transparently

Wednesday, 27 October

08:30–12:00

W2C • Edge Optical Networks

Presider(s): Shanguo Huang, BUPT, China

W2C.1 • 08:30 Invited

Deterministic Edge Optical Networks, Jiawei Zhang¹; ¹*Beijing Univ of Posts & Telecom, China*. With MEC, most connections will be terminated at the edge, among which ultra-low latency and reliable services are dominated, which needs the edge networks to be deterministic. The topic will be discussed by this talk.

W2C.2 • 09:00

Experiment of Extended Segment Routing Enabled Fast End-to-End Service Provisioning in Multi-Domain for the Fifth Generation Fixed Network (F5G), Li Xin¹, Yongli Zhao¹, Zhuotong Li¹, YaJie Li¹, Hao Li², Gang Xie², Yi Lin², Jie Zhang¹; ¹*Beijing Univ. of Posts and Telecommunications, China*; ²*HUAWEI TECHNOLOGIES CO.LTD., China*. We propose an extended segment routing-based wisdom automatic service provisioning (SR-WASP) in multi-domain for F5G. Results show that SR-WASP can significantly reduce the blocking probability and the latency of lightpath construction.

W2C.3 • 09:15

Federated Transfer Learning-Based Data Security Assurance in Edge Optical Networks for IoT Applications, Qiuyan Yao¹, Hui Yang¹, Bowen Bao¹, Zhengjie Sun¹, Chao Li¹, Jie Zhang¹, Shanguo Huang¹; ¹*Beijing Univ of Posts & Telecom, China*. We propose a federated transfer learning framework to realize data security guarantee in edge optical networks for IoT applications. Results indicate our proposal enables efficient model training and transferring by exploiting local data.

W2C.4 • 09:30

Deep Reinforcement Learning Based DNN Model Partition in Edge Computing- Enabled Metro Optical Network., Suhao Zheng¹, Xiao Xiao², YaJie Li¹, Zebin Zeng¹, Zhengyin Liang¹, Yongli Zhao¹, Jie Zhang¹; ¹*Beijing Univ. of Posts and Telecommunications, China*; ²*Univ. of Colorado Boulder, USA*. A deep reinforcement learning based DNN model partition and deployment algorithm is proposed between edge nodes and cloud in metro optical network. Simulation results show that the algorithm can deploy more DNN tasks than heuristics.

W2C.5 • 09:45

Transfer Learning Based Parallel Computation Offloading Scheme Between MEC Servers in Metro Optical Networks, Lihao Liu¹, Shan Yin¹, Liyou Jiang¹, Zhenhao Wang¹, Shanguo Huang¹; ¹*State Key Lab of Information Photonics and Optical*

Communications, Beijing Univ. of Posts and Telecommunications, China. Aiming at the computing task offloading between MEC servers, this paper proposes a transfer learning based scheme with high applicability, which can keep low blocking probability and quickly adapt to different optical network topologies .

13:30–15:15

W3C • Data Center Optical Networks

Presider(s): Shanguo Huang, BUPT, China

W3C.1 • 13:30 Invited

Towards IPoDWDM for Data Center Interconnects: Coherent Pluggables and Open Line Systems, Jianqiang Li¹; ¹*Kuaishou Technology, USA*. Recently, small-form-factor 400ZR/ZR+ coherent pluggables is a main driver and enabler to the renaissance of IPoDWDM . IPoDWDM is quite native for metro data center interconnects where open line systems have been widely deployed .

W3C.2 • 14:00 Invited

IM/DD Transmission for Data Center Optical Interconnects, Gordon N . Liu¹, Ji-awang Xiao¹, Caoyang Liu¹, Gangxiang Shen¹; ¹*Soochow Univ., China*. The demand for data rate of client-side transceivers is increasing due to the development of data center optical interconnect . To meet the high-speed requirement, the recent intensity modulation and direct detection transmission technologies are discussed .

W3C.3 • 14:30

Optimizing Tradeoff Between Signal Impairment of All-Optical Wavelength Conversion and Flexibility of Wavelength Resource Allocation in Optical Networks, Xinxin Bu¹, Ningning Guo¹, Gangxiang Shen¹, Biswanath Mukherjee¹, Shuiping Jie², Xiaodong Fu²; ¹*Soochow Univ., China*; ²*Zhongtian Broadband Technology, China*. We compare performance of three strategies for converter placement that take into account signal impairment of all-optical wavelength conversion . Simulations show effectiveness of the proposed approaches to improve lightpath blocking performance .

W3C.4 • 14:45

Mastering Parameter Uncertainty in Monitoring-Enabled Optical Networks Using Bayesian Inference, Matteo Lonardi¹, Petros Ramantanis¹, Antonio Massaro¹; ¹*Nokia Bell Labs, France*. We refine optical network parameters by jointly leveraging the components' a priori information and the monitored quality of transmission . The updated uncertainty and correlation properties can be used in design tools to establish new lightpaths .

W3C.5 • 15:00

Delivering Distributed Machine Learning Services in All-Optical Datacenter Networks With Torus Topology, Jiemin Lin¹, Gangxiang Shen¹, Zhenwei Zhai¹, Danyang Zheng¹, Yongcheng Li¹, Zeshan Chang², Liangjia Zong², Ning Deng², Tianhai Chang²; ¹*Soochow Univ., China*; ²*Huawei Technologies Co., Ltd., China*. We propose a WSS based all-optical DCN in Torus topology . A heuristic algorithm is proposed to deliver DML services . Simulation results show the proposed approaches achieve short service execution time and low lightpath signal loss .