

Welcome to the 2016 Optical Fiber Communication Conference and Exhibition

On behalf of the many volunteers and professionals organizing OFC 2016, it is our sincere pleasure to welcome you to Anaheim. OFC is the foremost meeting in optical communications and networking, and this year's conference continues the tradition of providing an excellent program that captures advances in research, development and production.

In the plenary session on Tuesday morning, three excellent speakers will address recent developments and future challenges in optical communications and networking. Yasuhiko Arakawa, *Director of Institute for Nano Quantum Information, Director of Nanoelectronics Collaborative Research Center, Japan* will discuss impacts of recent advances in silicon photonics on ICT, made possible with silicon optical integrated circuits and integration of quantum dot lasers into them; Andre Fuetsch, *Senior Vice President of Architecture & Design, AT&T, USA* will discuss how AT&T is transforming their optical platforms using SDN and Open ROADMs; and Daniel Kraft, *Medicine & Neuroscience Chair, Singularity University, USA* will discuss the changing world of medicine, and how advances in every aspect of the medical field may impact us through the use of optics and drive bandwidth onto our networks.

The 2016 conference provides an exceptionally-strong technical program consisting of approximately 1000 contributed and invited papers, 18 tutorial presentations, 10 workshops, and 6 panels. The range of topics to be addressed includes optical network architecture, control and service, optical networking technologies and demonstration, FTTx technologies, deployment and applications, fibers and optical propagation effects, fiber devices and their waveguide based equivalent, optical devices for switching, filtering and interconnects, optoelectronic devices, photonic integrated digital circuits transmission systems, transmission subsystems and network elements, optical processing and analog systems, core networks, access networks and optical interconnection and networks for datacom and computercom.

The main emphasis of the OFC program is on research and development that address longer-term issues in optical communications and networking, but upcoming challenges are also highlighted. This year, the technical program includes two special symposia: one on Optical Interconnects for Large-scale Datacenters and Supercomputers and another on Technologies that will Shape the Future of Fibre Communications. On Tuesday evening, there is a rump session entitled Integrated (Black Box) vs. Disaggregated (White Box), Organized by Chris Cole, *Finisar Corporation, USA* and Robert Keys, *BTI Systems, Canada*. Poster sessions will be held on Wednesday and Thursday, providing the opportunity for in-depth discussion with the presenters. This year there will also be a Data Center Summit with 2 different panels, one on data center optics and the other on data center architectures.

Some hot topics this year include Cloud and Data Center Networking, bandwidth exhaust, space division multiplexing, 100G/400G network design and optimization, 1Tb and beyond optical networking, wavelength agile access networks, virtualization and software defined networks (SDN), high-speed photonic integration for coherent detection and silicon photonics.

The OFC Exhibit will host more than 600 exhibitors from all over the world representing every facet of the optical communications market: access/FTTx, carrier/ transport/telecom, datacom, test and measurement, green technology and optical grids. In addition to learning about the latest technologies and products, the Market Watch program and the Service

Provider Summit form the core of the business-related programming of the meeting. Market Watch includes six panels that will address the current state of the optical industry, 100G and beyond ecosystems, data center architecture and content delivery strategies, 100/400G pluggable optics and its enabling technology and PIC vs. Si photonics. The Service Provider Summit includes a keynote address by Margaret Chiosi, *Distinguished Network Architect at AT&T, AT&T, USA* on Network Function Virtualization – Hype or Reality? and two panels on packet optical convergence and network evolution. Be sure to check out the POF Symposium, FTTx Session, Ethernet Alliance Program, two OIF sessions and other programming on our show floor. Exhibit-only registration is free, and includes admission to the exhibit hall, the plenary session, Market Watch, the Service Provider Summit and other show-floor programming.

The OFC Short Course program provides attendees with an excellent opportunity to learn both the fundamentals of and the latest advances in optical communications from leading contributors in the field. The program covers a broad range of topical areas including devices and components, sub-systems, systems and networks at a variety of educational levels ranging from beginner to expert. This year there are over 45 courses to choose from.

Organizing a successful OFC conference each year is an enormous task that is undertaken by many dedicated volunteers. We are indebted to the OFC Technical Program Chairs, Martin Birk, Xiang Liu and David Richardson, for their expertise and dedication in coordinating the technical content through their respective program committees. The high quality of the OFC program is a direct result of the efforts of the technical program chairs, subcommittee chairs, and technical program committee members, all of whom dedicate a considerable amount of their valuable time to ensure the quality of the conference, and maintain the highest standards by reviewing and selecting papers, nominating invited speakers and organizing workshops and panels. It is also our pleasure to thank the staff of The Optical Society, whose ceaseless hard-work and professionalism make it possible for OFC to continue as the foremost optical communications and networking conference in the world.

Yours sincerely,



Christopher R. Doerr
*Acacia Communications,
Inc., USA*



Ken-ichi Sato
*Nagoya University,
Japan*



Kathleen Tse
AT&T, USA

Special Events

Workshops

Sunday, 20 March, 15:30–18:30

S1A • III-V Silicon Photonic Transceivers: Competition or Coexistence?

Organizers: Michael Larson, *Lumentum, USA*; Beck Mason, *Oclaro, USA*
Room Ballroom A

Silicon photonics is an important new technology that is challenging the position of traditional III-V devices as the preeminent photonic technology for fiber optic transceivers. Silicon photonics has fundamental materials limitations compared to III/Vs but huge advantages in terms of technology infrastructure, scalability and electronic integration. Will silicon come to dominate high volume low-cost transceiver applications, relegating III/Vs to low volume high performance niches or will improved electronic integration and packaging technologies enable III/V's to maintain their leadership position? What technical and economic factors play to each approach's strengths and weaknesses? How will these differentiators affect the competitive balance across datacenter, enterprise and traditional telecom markets? This workshop will bring spirited debate to the above and related topics.

Speakers:

Yuliya Akulova; *Lumentum, USA*
Robert Blum; *Intel, USA*
Andy Carter; *Oclaro, USA*
Chris Cole; *Finisar, USA*
Martin Guy; *Ciena, Canada*
Matt Traverso; *Cisco, USA*

S1B • Do We Need Anything Other Than the C-Band?

Organizers: Francesco Poletti, *University of Southampton, UK*; Oleg V. Sinkin, *TE SubCom, USA*
Room Ballroom B

Single-mode silica fibers and erbium doped fiber amplifiers have been the cornerstone of optical communications for decades, but they are now approaching fundamental limits. This workshop aims to look well beyond the immediate short-term horizon and will discuss the need for and potential of more radically new forms of optical fibers and amplifiers. The workshop will bring together fiber and amplifier end-users and manufacturers, glass scientists and network operators to exchange views on the projected requirements for future communications systems and on the anticipated capabilities of alternative fiber and amplifier technologies. Is a gradual evolution of the current technology still possible or is a revolution required at some point? Are there potentially breakthrough technologies that could enable radical cost savings and energy efficient capacity growth? What if not? Blue sky thinking will be actively encouraged.

Speakers:

Part I:

David DiGiovanni; *OFS, USA*
René-Jean Essiambre; *Nokia, USA*
David Payne; *University of Southampton, UK*
Tim Stuch; *Microsoft, USA*
Sergey Ten; *Corning, USA*

Part II:

John Ballato; *Clemson University, USA*
Evgeny Dianov; *General Physics Institute, Russia*
Yasuhiro Koike; *Keio University, Japan*
Marco Petrovich; *University of Southampton, UK*

S1C • To Serialize or not to Serialize? Practical Approaches for Coherent Transmission at and beyond 400G

Organizers Gabriella Bosco, *Politecnico di Torino, Italy*; Han Henry Sun, *Infinera Corporation, Canada*
Room: Ballroom C

Current coherent DWDM interfaces operate at 30-GBaud symbol rate delivering up to 200 Gb/s capacity per optical carrier. Several paths to 400G+ transmission are being investigated, among which the serialization path based on increasing the modulation order and/or the symbol rate and the parallelization path based on increasing the number of optical carriers represent two primary approaches.

Whilst increasing the modulation order usually comes at the expense of a loss in performance, increasing the symbol rate or the number of optical carriers does not in principle add noticeable penalty to the system. Which will be the better depends on several factors, such as the field of application (short reach or long haul), the state-of-the-art of optoelectronic components, the impact of implementation penalties, as well as complexity and cost issues. All these aspects will be discussed during the workshop, trying to find an answer to the fundamental question: "to serialize or not to serialize?"

Speakers:

Electro-optic Unit Cells for Super Channels, Ian Betty; *Ciena, Canada*

Implementing Multi-Wavelength Transceivers and Superchannel Networking, Brandon Collings; *Lumentum, USA*

ADCs and DACs for 56Gbaud and Beyond, Ian Dedic; *Socionext, United Kingdom*

DSP Challenges for Serial and/or Parallel Solutions, Chris Fludger; *Cisco, Germany*

WDM Parallelization for Terabit Implementations, Matthew Mitchell; *Infinera, USA*

High Symbol Rate Long-haul Transmission, Jeremie Renaudier; *Nokia Bell Labs, France*

Single Carrier Solutions at 400G and Above, Norman Swenson; *ClariPhy Communications, USA*

Challenges and Solutions for Application Oriented Cost Effective 400G, Zhuhong Zhang; *Huawei Technologies Canada Co. Ltd., Canada*

S1D • How will Optical Technologies Support Wireless Communications in 5G and Beyond?

Organizers: Jun-ichi Kani, NTT Access Network Service Systems Laboratories, Japan; Idelfonso Tafur Monroy, Technical University of Denmark, Denmark and ITMO University, St. Petersburg, Russia
Room: Ballroom D

Wireless communication technologies are rapidly evolving to operate at various frequency bands and in new heterogeneous networking architectures. Digital and analog optical transmission systems used in existing wireless fronthaul solutions are expected to evolve to accommodate the increasing demand for wireless bandwidth as well as to efficiently support such new networking architectures. This workshop discusses the evolution of such technologies. Key questions will include:

- What is the viable fronthaul solution to support 5G Radio Access Network (RAN) and beyond?
- How will photonic technologies help to realize ultra-high-capacity wireless communications?
- What are the potential and prospects for FSO, mmw, and THz wireless access links?
- What is the best backhaul/fronthaul solution for the remote antenna with massive MIMO and beamforming?

Speakers:

Can We Apply CPRI in 5G Fronthaul?, Morten Høgdal; *Foxconn Advanced Communication Academy, Denmark*

Massive Scale Fronthaul and C-RAN Deployments Leveraging Data Center Architecture, Jouni Korhonen; *Broadcom, USA*

Efficient Mobile Fronthaul for Supporting CoMP and Massive-MIMO in 5G, Xiang Liu; *Huawei, USA*

Kosuke Nishimura, *KDDI R&D Laboratories Inc., Japan*

5G Transport - Meeting the Challenge from Nextgeneration Mobile System, Peter Öhlén; *Ericsson, Sweden*

Optics and RF Convergence for Wireless Fronthaul/backhaul in 5G, Magnus Olson; *Infinera Metro Business Unit, Sweden*

Fronthaul/midhaul Over TWDM-PON and Ethernet Networks, Thomas Pfeiffer; *Nokia, Germany*

S1E • Will the Emergence of SDN Change how Data Centers are Built?

Organizers: Nathan Farrington, Rockley Photonics, USA; Guohui Wang, Facebook, USA
Room: Ballroom E

Attributes of software defined networking (SDN) are beginning to be deployed inside data centers. Will these attributes affect the optics used inside data centers? Will it drive down the cost of optics? Will it compel transceiver manufacturers to implement new software interfaces, and if so, what will these interfaces look like? Will it enable new types of optical circuit switching networks? Are there specific features of SDN that enable these transformations to take place or could the same cost and performance be realized without SDN?

Speakers:

Omar Baldonado; *Facebook, USA*
David Husak; *Plexxi Networks, USA*
Nolan Leake; *Cumulus Networks, USA*
James Liao; *Pica8, USA*
Anees Shaikh; *Google, USA*

Monday, 21 March, 09:00–12:00

M1A • Connected OFCity Challenge

Organizers: Jun Shan Wey, LightNotes Consulting, USA; Denis Khotimsky, Verizon Communications Inc., USA
Room Ballroom A

Around the world, municipalities have been pouring investments into broadband access infrastructure building what has become known as a smart city or connected city. This workshop intends to brainstorm the technological innovations and to examine dependencies and intricacies of such a project.

The workshop is set on a backdrop of (partially) fictitious OFCity, where the municipal Council organizes a competition to improve the broadband access infrastructure by 2020. A number of multidisciplinary teams will present and defend their proposals in an open townhall meeting, defining applications the city has to support and recommending innovative architecture and technologies to realize the interconnection. The teams consist of experts from academia, vendor companies, network and application providers. The winning proposals will be selected by a panel of judges and the popular vote.

Team 1:

Sergi Figuerola; *i2CAT, Spain*
Dimitra Simeonidou; *University of Bristol, UK*
Tomoo Takahara; *Fujitsu Labs, Japan*
Kees de Waard; *Genexis, Netherlands*
Rajesh Yadav; *Verizon, USA*

Team 2:

Liang Du; *Google Fiber, USA*
Maria-Cristina Marinescu; *Barcelona Supercomputing*
Catherine Middleton; *Information Society at Ryerson University, Canada*
Rod Tucker; *University of Melbourne, Australia*
Center, Spain
Shuang Yin; *Stanford University, USA*

Team 3:

Divanilson R. Campelo; *Universidade Federal de Pernambuco (UFPE), Recife, Brazil*
Philippe Chanclou; *Orange Labs, France*
Hal Roberts; *Calix, USA*
Luca Valcarengi; *Scuola Superiore Sant'Anna, Italy*

Team 4:

Kevin Bourg; *Corning, USA*
Eugene Dai; *Cox Communications, USA*
Tim Forde; *CONNECT, Trinity College Dublin, Ireland*
Ed Harstead; *Nokia, USA*
Marco Ruffini; *Trinity College Dublin, Ireland*

Judges:

Frank Effenberger, *Rapporteur, ITU-T Study Group 15 Question 2, USA*
Julie Kunstler; *Principal Analyst, OVUM, USA*
Peter Marx; *Chief Technology Officer, City of Los Angeles, USA*
Bidyut Parruck, *Partner, Gazak Ventures, USA*
Glenn Ricart; *Principal Investigator, US-Ignite, USA*

M1B • Do Photonic Foundries Deliver what Users really need and can they ever become Sustainable?

Po Dong, *Nokia Bell Labs, USA*; Piero Gambini, *STMicroelectronics, Italy*
Room: Ballroom B

IC industries largely benefit from the foundry model, which allows fabless companies to avoid costs of owning expensive fabrication facilities, while merchant foundries get their facilities fully utilized. The recent development of photonic ICs advocates for a photonic IC foundry model – indeed one of the most cited benefits of silicon photonics is the availability of foundries. However, as photonic and electronic ICs are fundamentally different regarding applications, volumes, complexity of circuits, there are many unresolved challenges to be faced in realizing a sustainable photonic foundry model. This workshop will review the role and operation of photonic foundries, and discuss future directions. Questions that this workshop may raise include:

1. Are photonic foundries already available for silicon photonic or III-V products?
2. How could users differentiate their products using common foundries?
3. Is the volume for optical products enough to justify the foundry model?
4. Will photonic foundries be capable of providing the industrialization services required for mass production?
5. Will a universal photonic foundry, integrating III-V with silicon photonics and even ICs and MEMS, ever be possible?
6. How will foundries deal with IP issues?

Speakers:

Laura Formenti; *STMicroelectronics, Italy*
Katarzyna Ławniczuk; *Technical University Eindhoven, The Netherlands*
Ted Letavic; *Global Foundries, USA*
Karen Liu; *Kaiam Corp., USA*
Patrick Lo Guo-Qiang; *IME / A*STAR, Singapore*
Tohru Mogami; *Petra, Japan*
Joris Van Campenhout; *IMEC, Belgium*
Lars Zimmerman; *IHP - Innovations for High Performance Microelectronics, Germany*

M1C • Does Elastic Coherent Bring an End to Filtered Networks?

Organizers: Michel Belanger, *Ciena, Canada*; João Pedro, *Coriant Portugal, Portugal*
Room: Ballroom C

Coherent optical transmission already enabled a first simplification of ROADM architectures via deploying low-cost optical splitter/combiners at the add/drop layer of colorless ROADMs instead of costlier wavelength selective switches. Recent proponents have come forward with Drop&Waste (D&W) network architectures, also called filter-less, which extend the deployment of splitter/combiners to the express layer, further decreasing optical node CAPEX and OPEX. In this workshop, advantages and limitations of the Drop&Waste and WSS-based architectures will be compared and discussed with the goal of identifying the best possible use of these architectures and

forecasting how they compare with upcoming technologies (e.g., photonic integrated switching devices).

For:

Fred Bartholf; *Comcast, USA*
Paul Littlewood; *Ciena Corp, USA*
Josef Roesse; *Deutsche Telekom, Germany*

Against:

Harald Bock; *Coriant, USA*
Brandon Collings; *Lumentum, USA*
Sheryl Woodward; *AT&T, USA*

M1D • Is Nonlinearity Mitigation Commercially Viable – If so, Will it be DSP or Optics Based?

Organizers: Guifang Li, *University of Central Florida, USA*; Stojan Radic, *University of California, San Diego, USA*
Room: Ballroom D

For nearly three decades, the capacity of optical fiber transmission has been limited in part by the fiber Kerr nonlinearity. With the advent of digital coherent technology and its ability to compensate linear distortions, Kerr nonlinearity has become a dominant obstacle towards achieving the ultimate capacity in optical transmission. Both electronic and optical techniques have been proposed to break the so-called “nonlinear Shannon capacity limit”. This workshop intends to provide a forum of debate between these two alternatives in an attempt to settle the question “Is nonlinearity mitigation commercially viable- if so will it be DSP or optics based?”

Speakers:

Frequency Referenced Transmission for NLC, Nikola Alic; *University of California, San Diego, USA*

Nonlinear Mitigation: An Operator's Perspective of Benefits, Vinayak Dangui; *Google, USA*

On the Potential of Multi-Channel DBP: Gains and Complexity, Robert Maher; *University College London, UK*

All-optical Multi-channel Phase Conjugation for Complete Nonlinearity Compensation, Shu Namiki; *AIST, Japan*

DSP Based Nonlinearity Mitigation, Jens Rasmunssen; *Fujitsu, Japan*

Overcoming Nonlinearity; the Final Optical Barrier, Kim Roberts; *CIENA, Canada*

Title to be Determined, Masahito Tomizawa; *NTT, Japan*

Recent Advances in the Nonlinear Fourier Transform for Optical Communications, Sergei Turitsyn; *Aston University, UK*

Digital Nonlinear Compensation: Small Gains for Large Complexity, Yet Irresistible, Fatih Yaman; *NEC Laboratories America, Inc, USA*

M1E • Will SDM Systems ever make Sufficient Financial Sense to Justify Extensive Commercial Deployment in Terrestrial Networks? If so, When, Where and Why?
Organizers: Nicolas K. Fontaine, *Nokia Bell Labs, USA*; Tiejun J. Xia, *Verizon Communications Inc., USA*
Room: Ballroom E

Research and development of space-division multiplexing (SDM) technology have made significant progress in recent years. With SDM, fiber capacity and spectral efficiency has increased by an order of magnitude over single mode fiber. At the same time, SDM related transmission and signal processing technologies have advanced considerably. Unfortunately, these extensive R&D efforts have not yet shown enough potential cost savings or performance improvements to interest SDM's user communities. It is only a matter of time until SDM finds its killer applications, just like other new technologies do. This workshop gathers both the experts and the potential users of SDM to share the latest developments and to brainstorm its possible applications with innovative thoughts.

Speakers:

Maxim Bolshtyansky, *TE SubCom, USA*

Tom Issenhuth; *Microsoft, USA*

Yongmin Jung; *Southampton University, UK*

Mingjun Li; *Corning, USA*

Dan Marom; *Hebrew University of Jerusalem, Israel*

Takayuki Mizuno; *NTT, Japan*

Peter Winzer; *Nokia Bell Labs, USA*

Special Symposia

Optical Interconnects for Large-Scale Datacenters and Supercomputers: Technologies, Packaging and Manufacturing
Monday, 21 March, 13:30–18:00
Room: Ballroom A

Organizers: Ashok Krishnamoorthy, *Oracle Corporation, USA*; Bert Offrein, *IBM Research GmbH, Switzerland*; Peter O'Brien, *Tyndall National Institute, Ireland*

This symposium will present advances in optical interconnect devices and sub-systems, taking into consideration packaging innovations and volume manufacturing processes that meet requirements for future interconnect and networking applications in large-scale datacenters and supercomputers. Current and emerging VCSEL and silicon photonic components and technologies will be reviewed, including parallel and WDM optics for 100Gb/s, 400Gb/s, 600Gb/s and beyond. Special attention will be given to critical factors including integration density, power and reach of each technology. Break-through systems applications of optics based on these advanced optical components will be showcased.

Introduction: Ashok Krishnamoorthy; *Oracle, USA*

Session I

President: Bert Offrein, *IBM, Switzerland*

Shimon Muller; *Oracle, USA*

Andy Bechtolsheim; *Arista Networks, USA*

Brad Booth; *Microsoft, USA*

Greg Young; *Luxtera, USA*

Session II

President: Peter O'Brien; *Tyndall, Ireland*

Mehdi Asghari; *Mellanox, USA*

Frank Flens; *Finisar, USA*

Dan Kuchta, *IBM, USA*

Technologies That will Shape the Future of Fibre Communications

Monday, 21 March, 13:30–18:00
Room: Ballroom B

Organizers: Katya Golovchenko, *TE Connectivity Ltd., Switzerland*; William Stewart, *University of Southampton, UK*

It is staggering just how much optical communication has changed the world and consequently almost every aspect of our everyday lives. The pace of technology change is unrelenting - with new applications and technical means to meet the ever growing data capacity demands and high levels of connectivity required always around the corner. This symposium is intended to help us imagine the future of fiber communications technology and its uses. It will bring together renowned visionaries in several key fields, both users and technology pioneers, to share their vision of the future connected world, to speculate as to the exciting things we may soon be doing, and what will be required from a technology perspective to address emerging and ever expanding user needs.

Session I

President: Katya Golovchenko; *TE Connectivity Ltd., Switzerland*

Harry Atwater; *California Institute of Technology, USA*

Johan Paul; *National Instruments, USA*

Andrew Shields; *Toshiba, UK*

Eli Yablonovitch; *UC Berkeley, USA*

Session II

President: William Stewart; *University of Southampton, UK*

David Butler; *BBC Research & Development, UK*

Nickolas Langston; *TE Connectivity, USA*

Chih-Lin; *China Mobile Research Institute, China*

Joe Salvo; *General Electronics, USA*

OSA Executive Forum

Monday, 21 March, 07:00–19:30

Hilton Anaheim Hotel, California Ballroom A

Held every year in conjunction with OFC, the OSA executive Forum features C-level panelists in an informal, uncensored setting discussing the latest issues facing companies in the business. Join more than 150 senior-level executives as they convene to discuss

key themes, opportunities, and challenges facing the next generation in optical networking and communications. Highly valued by participants for the frank and open discussions, OSA Executive Forum sessions explore emerging trends and action plans for tackling today's toughest business challenges.

Separate registration fees apply.

VIP Industry Leaders Networking Event: Connecting Corporate Executives, Recent Graduates and Students

Tuesday, 22 March, 12:00–13:30

Exhibit Hall. Free of charge and includes a box lunch*

This session bring together industry executives to share their business experience – from how they started their careers and lessons learned along the way, to using their degree in an executive position – with recent graduates and students. The program starts with information networking during lunch and then transitions into “speed meetings” – small, brief visits with each executive to discuss careers, industry trends or other career topics.

*Registration is required for this event, if you are a student or recent graduate and interested in attending please email vipevents@osa.org.

Sponsored by



Data Center Summit

Next Generation Data Center Optics

Tuesday, 22 March, 12:45–14:45

Room: Expo Theatre III

Organizers: Gary Nicholl, CISCO, Canada; Craig Thompson, Finisar, USA

This special panel event will address the emerging optics needs of the data center market. Discussion will compare and contrast the needs and solutions for the hyperscale and enterprise data center markets, for both the next wave of deployments at 25GbE and

100GbE, as well as the next generation based on 50GbE, 400GbE and possible derivatives (eg 200G).

Some of the most important questions to be addressed during the event will be:

- What are the key differences between hyperscale and enterprise data center optics?
- Which market segments and applications will dominate optics going forward?
- What role do standards play in the various market segments and applications?
- Which technologies are likely to be successful? Is there one technology that captures all needs or will reality be a lot more complicated?

Key panelists will include representatives from the hyperscale and enterprise data center segments, traditional and emerging optics suppliers and a view from a system host IC perspective.

Speakers:

Alexis Bjorlin, Intel Corporation, USA
Mitch Fields, Broadcom Ltd. (formerly Avago), USA
Katharine Schmidtke, Facebook, USA
Rob Stone, Broadcom Ltd., USA

Next Generation Data Center Architectures

Tuesday, 22 March, 16:30–18:30

Room: Ballroom B

Organizers: Adel A. M. Saleh, University of California Santa Barbara, USA; Anna Tzanakaki, University of Bristol, UK

The unceasing growth of data, of web services and of fixed and mobile cloud computing applications is creating the need for novel data center architectures that offer improved performance, energy efficiency and economics. This applies to stand-alone megascale data centers as well as to clusters of small to large data centers that are interconnected over a geographical area. Such architectures need to take full advantage of the latest advances in electronic and photonic processing, interconnect and switching technologies, data storage devices as well as control and management solutions including robust and flexible software-defined networking, and security measures. A panel of experts will address these topics, will

provide insights regarding the current technology trends and share their visions for next-generation data center architectures. Sufficient time will be provided to facilitate addressing questions and comments from the attendees.

Speakers:

Architectures for Distributed Datacenters, Achim Autenrieth; ADVA, Germany

Interconnect for Next-Generation Data Centers and Supercomputers, John Kim; KAIST, South Korea

Silicon Photonics Electro-optical Integration in Support of Scalable DC Architectures, Bert Offrein; IBM, Switzerland

Transport Technology Synergies in Next-Generation Intra/Inter-Data-Center Architectures, Loukas Paraschis; Cisco, USA

Scaling Optical Switching in Data Centers to High Port Counts with Low Port Count Switches, George Porter; UCSD, USA

Data Centre Architectures for Smart City Environments, Dimitra Simeonidou; University of Bristol, UK

Exhibitor Reception

Tuesday, 22 March, 17:30–19:00

Anaheim Convention Center, Grand Plaza

OFC 2016 exhibitors are invited to celebrate the opening of the show. Join your colleagues, customers and friends for drinks and appetizers. Exhibitor badge required for entry.

Conference Reception

Tuesday, 22 March, 18:30–21:30

Hilton Anaheim, Pacific Ballroom, Second Floor

Back by popular demand! Enjoy the live vocals of That Vibe Band, food and drinks with your friends and colleagues during the conference.

Tickets for this event are included with all full conference registrations. Additional tickets may be purchased at Registration for US \$75. Badges are required for all OFC events.

Rump Session

Tuesday, 22 March, 19:30–21:30
Hilton Anaheim Hotel, California A

Integrated (Black Box) vs. Disaggregated (white Box) Networking

Moderators: Chris Cole; Finisar Corporation, USA; Robert Keys, BTI Systems, Canada

Computing has long been disaggregated with hardware provided by one group of suppliers (white boxes), operating systems by another, and applications by a third. In contrast, networking has used hardware, operating systems and control applications developed and integrated by a single supplier from a group of several (black box). As in computing, the promise of disaggregated networks is the reduction of capex through use of low cost, commodity hardware that runs open source software, and supports many optimized applications. It also promises to improve networking through interoperability, scalability and virtualization, delivered in shorter development cycles. The Rump Session will debate reasons and drawbacks of the traditional black box approach, promises and reality of the new white box approach, and relevance of each to future networks.

Special Panel Session on AIM Photonics

Wednesday, 23 March 13:00–15:00
Room: Ballroom B

Organizers: Daniel Kuchta, IBM TJ Watson Research Center, USA; Clint Schow, University of California at Santa Barbara, USA

The American Institute for Manufacturing Integrated Photonics (AIM Photonics) was launched in 2015. This special panel session will bring together several members of the AIM Photonics leadership council to provide an overview of the Institute and to answer questions from the audience.

The National Network for Manufacturing Innovation (NNMI) is a network of research institutes in the United States that focuses on developing and commercializing manufacturing technologies through public-private partnerships between U.S. industry,

universities, and federal government agencies. The panel will discuss the technical goals, operational framework, near-term milestones, and opportunities for the broader photonics community.

Panelists:

Michael Liehr, CEO, AIM Photonics, USA
John Bowers, Deputy CEO, AIM Photonics, USA
Thomas Koch, Technical Review Board Chair, AIM Photonics, USA
Michael Watts, CTO Innovation, AIM Photonics, USA

IEEE Young Professionals Lunch & Learn

Wednesday, 23 March, 13:30–15:00
Room 207D

The IEEE Photonics Society and IEEE Communications Society are hosting an "IEEE Young Professionals Lunch & Learn" aimed for students, young professionals up to 15 years post-graduation and their professors in the photonics and optics community. This event will provide Young Professionals with an opportunity to better hone their interpersonal skills and receive professional advice beyond the classroom or lab.

Distinguished Guest Speaker, Dr. Simon Poole, will give a talk, titled, "Confessions of a Serial Entrepreneur: 30 Years of Photonic Start-ups in Academia and Industry". The presentation aims to inspire researchers who are considering how to commercialize their research to take the next steps and move out of the research lab and into the brave new world of commercialization.

Sponsored by Finisar, event includes complementary lunch. All attendees must formally register prior to event. Visit the IEEE Photonics Society or IEEE Communications Society booths for details.

OSA's Light the Future Speaker Series Explores the Next Century of Innovation in Optics and Photonics

Wednesday, March 23, Reception: 17:30 – 18:30
Program: 18:30–20:00
Hilton Anaheim, Pacific Ballroom, Second Floor

Imagine a world without fiber optic communication networks or mobile phones. A century ago these inventions were unthinkable. Today, researchers and industry leaders around the globe are perfecting such innovations and envisioning new technologies. Join OSA as we celebrate our 100th anniversary with the *Light The Future* speaker series featuring distinguished scientists, engineers and Nobel Laureates.

Speaker:

Mary Lou Jepsen; Executive Director of Engineering, Facebook, USA and OSA Fellow

Moderator:

Alan Willner; Univ. of Southern California, USA; OSA President and OSA Fellow

Postdeadline Paper Presentations

Thursday, 24 March, 18:00–20:00
Location will be announced in the Postdeadline Paper Digest

Discover the best and most cutting-edge research in optical communications. The OFC 2016 Technical Program Committee has accepted a limited number of postdeadline papers for oral presentation. The purpose of postdeadline papers is to give participants the opportunity to hear new and significant material in rapidly advancing areas. Only those papers judged to be truly excellent and compelling in their timeliness were accepted.

Lists of accepted papers with their presentation times will be posted throughout the convention center on Tuesday, 22 March. Please visit ofcconference.org and click the "Download Digest Papers" button to access these papers.

Plenary Session

OFC Plenary Session

Tuesday, 11 March, 08:00–10:00

Hilton Anaheim Hotel, Pacific Ballroom, Second Floor



Silicon Photonics and Quantum Dot Lasers

Yasuhiko Arakawa

Director of Institute for Nano Quantum Information, Director and Professor of Center for Photonics Electronics Convergence at Institute of Industrial Science, The University of Tokyo, Japan

Currently CPU-to-CPU/CPU-to-memory inter-chip bandwidths double every two years and are expected to reach ~10 Tb/s by the end of the 2010s. Electrical interconnects do not scale well to meet such bandwidths. Optical interconnects may solve this bandwidth bottleneck problem, as photons can provide wide band width, low latency, low power consumption, and low mutual interference.

In this presentation we discuss optical interconnects, emphasizing recent advances in silicon photonics and quantum-dot lasers. Advantages of silicon photonics are low cost, high yield, small size, and compatibility with electronics; and advantages of quantum-dot lasers are temperature stability and feedback-noise tolerance.

Yasuhiko Arakawa is a Professor at the Research Center for Advanced Science and Technology, University of Tokyo. He is the Director of the Institute for Nano Quantum Information, Director of the Nanoelectronics Collaborative Research Center at the Institute of Industrial Science, University of Tokyo as well as Research Professor at NTT.

His current research focuses on the growth and physics of semiconductor nanotechnologies for optoelectronic device applications such as quantum dot lasers and various nanostructure devices.

He is the recipient of many awards and has given more than 250 invited talks at various international conferences. He is currently Editor-in-Chief of Solid State Electronics and Regional Editor on New Journal of Physics (IOP). He is in charge of planning the optoelectronics technology roadmap at the OITDA.

He received B.S., M.S., and PhD degrees in electrical engineering from the University of Tokyo. In 1980, he started his academic career at the University of Tokyo as an assistant professor and was promoted to a full professor in 1993.



The Open and Flexible Optical Revolution

Andre Fuetsch

Senior Vice President of Architecture & Design AT&T, USA

AT&T has a transformation program underway that is impacting its network, technology and people. Every part of the company is focused on changing the way things have been done; moving away from proprietary hardware and vendor-based solutions and towards an open software-driven environment. To accomplish this transformation AT&T is changing its technology direction, retraining employees and developing new processes. Optical is no exception, and there are already massive changes underway to deploy optical technologies that are software configurable and controllable to allow internal and external customers to invoke bandwidth when and where it is needed. In addition optical architectures are simplified and opened up to enable interoperability. This transformation will allow AT&T to react more quickly to changing technology and develop common software-based solutions.

Andre Fuetsch is responsible for delivering the architecture and design of AT&T's future networking evolution. This transformation will utilize software-defined networking and network function virtualization to deliver products and services to the customer

with greatly reduced time to market and significant operational efficiencies. He leads a team of over 2,000 engineers and computer scientists working on programs encompassing both the business and mass market customer segments.

Since joining AT&T in 1995, he has supported and led several organizations responsible for information technology, systems and network architecture, planning and engineering, and software systems development, where he holds six patents in network traffic optimization and relational database design.

Andre earned his bachelor's degree in Industrial Engineering and Operations Research at U.C. Berkeley and completed his graduate coursework in Computer Science at Stanford University.



The Future of Health and Medicine, Where Can Technology Take Us?

Daniel Kraft

Medicine & Neuroscience Chair Singularity University, USA

The convergence of faster, smarter, smaller, cheaper and interconnected technologies is accelerating exponentially. Devices are giving us new ways to measure, track, visualize, understand and optimize our bodies, health and wellbeing. The benefits could range from low-cost genetic sequencing to the layering of distributed mobile devices and sensors, wearables and implantables. The network of devices that makes up the internet of things could bring about the internet of the body. With so much being tracked by so many devices, we will need to filter and integrate our personal data to the point where we aren't overwhelmed by it. Imagine a GPS system for your health: it knows your habits, your genomics and your goals, and can help you reach a target, whether that be to run a marathon, lose weight, manage hypertension or lower your risks for cancer. This presentation will provide insight as to how to make sense of the terabytes of data which

each of us can generate every day. Artificial intelligence and our personal dashboards will lead to an era of predictive analytics.

Daniel Kraft is a Stanford and Harvard trained physician-scientist, inventor, entrepreneur and innovator. With over 20 years of experience in clinical practice, biomedical research and healthcare innovation, Kraft has chaired the Medicine Track for Singularity University (SU) since SU's inception, and founded and is Executive Director of Exponential Medicine, a program that explores convergent, rapidly developing technologies and their potential in biomedicine and healthcare.

He recently founded IntelliMedicine, focused on enabling connected, data driven and integrated personalized medicine. He is also the inventor of the MarrowMiner, an FDA approved device for the minimally invasive harvest of bone marrow, and founded RegenMed Systems, a company developing technologies to enable adult stem cell based regenerative therapies. He has multiple patents on medical device, immunology and stem cell related research.

He has undergraduate degrees from Brown University, an MD from Stanford and is board certified in Internal Medicine & Pediatrics. He is an International Space University (ISU) graduate with research and clinical expertise in aerospace medicine with NASA with whom he was a finalist for astronaut selection.



OFC and Sponsor Awards and Honors

Awards Ceremony and Luncheon

Tuesday, 22 March, 12:00–14:00
Hilton Anaheim Hotel, California C

OFC will honor the winners of the John Tyndall Award, Tingye Li Innovation Prize, JLT Best Paper Awards, Corning Outstanding Student Paper Award, The Paul Anthony Bonenfant Memorial Scholarship, and OSA and sponsoring Societies 2016 Fellows during the Awards Lunch. The lunch is open to anyone wishing to purchase a ticket but seating is limited. Tickets can be purchased for \$35.00 at registration.

John Tyndall Award

The John Tyndall Award is presented annually to a single individual who has made outstanding contributions in any area of optical-fiber technology, including optical fibers themselves, the optical components used in fiber systems, as well as transmission systems and networks using fibers. The contributions which the award recognizes should have met the test of time and should have been of proven benefit to science, technology, or society. The contributions may be experimental or theoretical.

First presented in 1987, this award is jointly sponsored by the IEEE Photonics Society and The Optical Society (OSA) and is presented at OFC. The award is endowed by Corning, Inc., and consists of a specially commissioned crystal sculpture, a scroll, and an honorarium.

The 2016 recipient is Alan H. Gnauck, Nokia, recognized for sustained pioneering research contributions that drove commercialization of high-speed, high-capacity lightwave communication systems.



Alan Gnauck joined Bell Laboratories in 1982, where he is currently a Member of Technical Staff in the Transmission Systems Research group. He has performed record-breaking optical transmission experiments at single-channel rates of from 2 to 400 Gb/s. He has investigated coherent detection, chromatic-

dispersion compensation techniques, CATV hybrid fiber-coax architectures, parametric optical signal processing, wavelength-division-multiplexed (WDM) systems, and system impacts of fiber nonlinearities. He is presently involved in the study of WDM systems with single-channel rates of 100 Gb/s and higher, using advanced modulation formats, polarization multiplexing, spatial multiplexing, coherent detection, and digital signal processing. He has authored or co-authored over 250 journal and conference papers, and holds 29 patents in optical communications.

Gnauck is a Fellow of The Optical Society (OSA), a Fellow of the Institute of Electrical and Electronic Engineers (IEEE), a Bell Labs Fellow, and a member of the National Academy of Engineering. He was an Associate Editor for IEEE Photonics Technology Letters from 2000 to 2009. He was a technical subcommittee member for the Optical Fiber Communications Conference (OFC) in 2000, 2001, and 2003, and served as subcommittee chair in 2004. He received the OSA Engineering Excellence Award in 2003.

IEEE Photonics Society 2016 Fellows

Katsumi Kishino; *Sophia University, Japan*

Shinji Matsuo; *NTT Device Technology Laboratories, Japan*

David Moss; *Swinburne University of Technology, Australia*

Rajeev Ram; *MIT - Massachusetts Institute of Technology, USA*

Gregory Raybon; *Bell Labs, USA*

The Optical Society 2016 Fellows

José Azaña; *INRS-Energie Matériaux et Telecom, Canada*

Andrea Galtarossa; *Università degli Studi di Padova, Italy*

Jian-Jun He; *Zhejiang University, China*

Cedric F. Lam; *Google, USA*

Clint L. Schow; *University of California, Santa Barbara, USA*

Hwa-yaw Tam; *The Hong Kong Polytechnic University, Hong Kong*

Masahito Tomizawa; *Nippon Telegraph & Telephone Corp., Japan*

Wenbing Yun; *Sigray, Inc., United States*

IEEE/OSA Journal of Lightwave Technology - (JLT) 2013 Best Paper Award

The IEEE/OSA Journal of Lightwave Technology's 2013 Paper Award is awarded by the Journal's Coordinating and Steering Committees to the top-cited original papers published in the Journal in 2013, as determined by a variety of citation metrics and databases.

Title: **Time- and Wavelength-Division Multiplexed Passive Optical Network (TWDM-PON) for Next-Generation PON Stage 2 (NG-PON2)** by: Luo, Yuanqiu; Zhou, Xiaoping; Effenberger, Frank; Yan, Xuejin; Peng, Guikai; Qian, Yinbo; Ma, Yiran

The Corning Outstanding Student Paper Award

The winners of the Corning Outstanding Student Paper Competition will be announced during the conference.

The top finalist will receive a grand prize of \$1,500 USD, and the two runners-up will receive \$1,000 USD. This award, endowed through the OSA Foundation by a grant from Corning, recognizes innovation, research excellence and presentation abilities in optical communications.

Congratulations to our 2016 finalists:

Nicklas Eiselt; *Technical University of Denmark, Denmark*

Justin Lavrencik; *Georgia Institute of Technology, USA*

Zahoor Sanjabieznaveh; *University of Central Florida, USA*

Jing Wang; *Georgia Institute of Technology, USA*

Stefan Wolf; *Karlsruhe Institute of Technology, Germany*

OSA
Foundation

The Paul Anthony Bonenfant Memorial Scholarship

Established in 2011 in memory of Paul Anthony Bonenfant, this scholarship enables undergraduate students enrolled in engineering and/or physical science programs to attend semester abroad programs offered through their accredited college or university.

The goal of the scholarship is to provide international experience to students as they prepare for professional lives that promote global engagement and collaboration.

This \$8,000 USD scholarship will rotate among several universities including The California Institute of Technology, Cornell University, and The Ohio State University. For more information on this scholarship and its recipients, please visit www.osa.org/Bonenfant.

OSA
Foundation

The Tingye Li Innovation Prize

The Tingye Li Innovation Prize, established in 2013, honors the global impact Dr. Li made to the field of Optics and Photonics. This prize is presented to a young professional with an accepted paper that has demonstrated innovative and significant ideas and/or contributions to the field of optics. The recipient of this prize receives a \$3,000 USD stipend, a special invitation to the Chairs' Reception, and special recognition at the conference.

Congratulations to our 2016 recipient:

Kohki Shibahara; *NTT, Japan*

OSA
Foundation



Short Course Schedule

Sunday, 20 March

09:00–12:00

SC177 High-Speed Semiconductor Lasers and Modulators, John Bowers; *Univ. of California at Santa Barbara, USA*

SC205 Integrated Electronic Circuits and Signal Processing for Fiber Optics, Y. K. Chen, Noriaki Kaneda; *Nokia Bell Labs, USA*

SC266 Quantum Cryptography and Quantum Information, Richard Hughes¹, Thomas Chapuran²; ¹*Los Alamos Natl. Lab, USA*, ²*Applied Communication Sciences, USA*

SC328 New Developments in Optical Transport Networking (OTN), Stephen Trowbridge; *Nokia, USA*

New! SC428 Link Design for Short Reach Optical Interconnects, Petar Pepeljugin; *IBM Research, USA*

09:00–13:00

SC105 Modulation Formats and Receiver Concepts for Optical Transmission Systems, Peter Winzer, Chandrasekhar Sethumadhavan; *Nokia, Bell Labs, USA*

SC114 Passive Optical Networks (PONs) Technologies, Frank J. Effenberger; *Futurewei Technologies, USA*

SC341 OFDM for Optical Communications, Sander L. Jansen¹, Dirk van den Borne²; ¹*ADVA Optical Networking, USA* ²*Juniper Networks, Germany*

SC359 Datacenter Networking 101, Cedric Lam, Hong Liu; *Google, USA*

SC384 Background Concepts of Optical Communication Systems, Alan Willner; *Univ. of Southern California, USA*

SC395 Hands On: Basic Modeling and Simulation of Coherent Fiber-Optic Communication Systems, Robert Palmer, Harald Rohde; *Coriant, Germany*

13:00–16:00

SC216 An Introduction to Optical Network Design and Planning, Jane M. Simmons; *Monarch Network Architects, USA*

SC217 Optical Fiber Based Solutions for Next Generation Mobile Networks, Dalma Novak; *Pharad, LLC., USA*

SC373 Specialty Fiber Splicing and Interconnection, Andrew Yablon; *Interfiber Analysis, USA*

SC385 Optical Interconnects for Extreme-scale Computing, John Shalf¹, Keren Bergman²; ¹*Lawrence Berkeley National Laboratory, USA*, ²*Columbia University, USA*

New! SC433 Photodectors for Optical Communications, Joe C. Campbell¹; ¹*University of Virginia, USA*

13:00–17:00

SC203 100 Gb/s and Beyond Transmission Systems, Design and Design Trade-offs, Martin Birk¹, Benny Mikkelsen²; ¹*AT&T Labs, Res., USA*, ²*Acacia Communications, USA*

SC288 Fundamentals of Polarization, PDL, and PMD, Nick Frigo; *US Naval Academy, USA*

17:00–20:00

SC267 Silicon Microphotonics: Technology Elements and the Roadmap to Implementation, Lionel Kimerling; *MIT, USA*

SC372 Building Green Networks: New Concepts for Energy Reduction, Rod S. Tucker; *Univ. Melbourne, Australia*

SC411 Multi-layer Interaction in the Age of Agile Optical Networking, Ori A. Gerstel; *Sedona Systems, Israel*

SC420 Characterization of Components for Coherent Communication Systems, Robert Palmer, Harald Rohde; *Coriant, Germany*

New! SC429 Flexible Networks, David Boertjes; *Ciena, Canada*

Monday, 21 March

08:30–12:30

SC101A Hands-on Workshop on Fiber Optic Measurements and Component Testing, Caroline Connolly¹, Chris Heisler¹, Keith Foord², Loic Chereil³; ¹*OptoTest Corp., USA*, ²*Greenlee Communications, USA*, ³*Data-Pixel, France*

SC102 WDM in Long-Haul Transmission Systems, Neal S. Bergano; *TE Subcom, USA*

SC178 Test and Measurement of High-Speed Communications Signals, Greg D. Le Cheminant; *Keysight Technologies, USA*

SC325 Highly Integrated Monolithic Photonic Integrated Circuits, Chris Doerr; *Acacia Communications, USA*

SC347 Reliability and Qualification of Fiber-Optic Components, David Maack; *Corning, USA*

SC389 Network Modeling and Design, Dominic Schupke; *Airbus Group Innovations, Germany*

SC390 Introduction to Forward Error Correction, Frank Kschischang; *Univ. of Toronto, Canada*

SC392 Digital Coherent Optical Systems 1: Transceiver Technology and Performance, Maurice O'Sullivan; *Ciena, Canada*

New! SC432: Hands on: Silicon Photonics Design & Fabrication, Lukas Chrostowski¹, Chris Doerr²; ¹*University of British Columbia, Canada*, ²*Acacia Communications, USA*

09:00–12:00

SC176 Metro Network: The Transition to Ethernet, Loudon Blair; *Ciena Corp., USA*

SC208 Optical Fiber Design for Telecommunications and Specialty Applications, David J. DiGiovanni; *OFS Labs, USA*

SC409 Safety in Fiber Optics: From Components to Systems, Larry Johnson; *The Light Brigade, USA*

New! SC430 SDN Standards and Applications, Lyndon Y. Ong, Raghu Ranganathan; *Ciena, USA*

13:30–16:30

SC261 ROADM Technologies and Network Applications, Thomas Strasser; *Nistica Inc., USA*

SC369 Test and Measurement of Complex Modulated Optical Signals, Bernd Nebendahl¹, Michael Koenigsmann¹; ¹*Keysight, Germany*

SC386 The Evolution of WAN Transport towards SDN Architectures and Cloud Service Delivery, Loukas Paraschis; *Cisco Systems, Inc., USA*

New! SC431 Photonic Technologies in the Datacenter, Clint Schow; *University of California, USA*

13:30–17:30

SC101B Hands-on Workshop on Fiber Optic Measurements and Component Testing, Caroline Connolly¹, Chris Heisler¹, Keith Foord², Tony Nicholson³; ¹*OptoTest Corp., USA*; ²*Greenlee Communications, USA*; ³*Connected Fibers, USA*

SC185 Hands-on Polishing, Inspection and Testing of Connectors, Steve Rounds¹, Steve Baldo², Loic Chere³; ¹*Light Brigade Inc., USA*, ²*Seikoh Giken Co. Ltd., USA*, ³*Data-Pixel, France*

SC327 Modeling and Design of Fiber-Optic Communication Systems, Rene-Jean Essiambre; *Nokia Bell Labs, USA*

SC357 Circuits and Equalization Methods for Short Reach Optical Links, Alexander Rylyakov; *Coriant, USA*

SC393 – Digital Coherent Optical Systems 2: Digital Signal Processing, Chris Fludger; *Cisco Optical GmbH, USA*

SC408 Space Division Multiplexing in Optical Fibers, Roland Ryf; *Bell Labs, Alcatel-Lucent*

14:00–18:00

SC160 Microwave Photonics, Vince Urlick; *NRL, USA*

Short Course Descriptions**Sunday, 20 March 2016****09:00–12:00**

SC177 High-Speed Semiconductor Lasers and Modulators

Instructor: John Bowers; Univ. of California at Santa Barbara, USA

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Compare different technologies.
- Make informed decisions on the design of optical transmitters and their incorporation into optical networks.
- Explain the performance of high-speed transmitters.

Intended Audience:

Attendees should have some knowledge of semiconductor and device physics. A basic knowledge of laser operation is also needed.

SC205 Integrated Electronic Circuits and Signal Processing for Fiber Optics

Instructors: Y. K. Chen, Noriaki Kaneda; Nokia Bell Labs, USA

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Describe the functions and performance of high-speed electronics for optic fiber terminals.
- Evaluate the design and implementation of physical layer electronic circuits.
- Describe commonly used circuit architectures.
- Compare the merits among different IC technologies.
- Justify advanced electronic equalization techniques.
- Compare implementation complexity of various DSP techniques for optical transmission.

Intended Audience:

This course is intended for engineers, scientists or managers who must make or understand the choice of electronic circuits for optical transmission products or evaluate electronic solutions used in purchased products.

SC266 Quantum Cryptography and Quantum Information

Instructors: Richard Hughes¹, Thomas Chapuran²; ¹Los Alamos Natl. Lab, USA, ²Applied Communication Sciences, USA

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Identify benefits of quantum key distribution techniques.
- Determine free-space and fiber based applications.
- Describe single photon sources and compute their expected characteristics.

- Describe concepts of quantum entanglement.
- Determine appropriate networking applications for quantum communications.

Intended Audience:

The audience may include optical networking and optoelectronic technology researchers with an interest in quantum communications, managers of research groups, and engineers who want a glimpse of a new and forward-looking technology. An undergraduate-level understanding of quantum mechanics is helpful.

SC328 New Developments in Optical Transport Networking (OTN)

Instructor: Stephen Trowbridge; *Nokia, USA*

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Discuss the concepts that form the basis for an OTN based on G.709
- Apply the capabilities of the OTN standards to manage client signals and wavelengths.
- Identify the mapping mechanisms used by OTN to transport major client signals.
- Utilize the new flexibility of the latest standard for efficient bandwidth management.
- Know where to look to find more information about G.709.
- Learn about the new interfaces provided in the latest revision of the standard.

Intended Audience:

This course is intended for anyone who designs, operates, or supports metro and/or long haul optical networks and who need to understand the new interfaces and capabilities in ITU-T Recommendation G.709 and how they can be used.

SC428 Link Design for Short Reach Optical Interconnects

Instructor: Petar Pepeljuginoski, *IBM Research, USA*

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Discuss the components of short multimode fiber links
- Describe the basic elements of power budget and possible trade-offs
- Choose suitable models for various components of the link to be use in the design phase
- Get in depth insight in multimode fiber propagation, including launch conditions and connector effects
- Explain impact of signal dependent noises in multimode links
- Learn the advantages and disadvantages of advanced modulation formats in short optical interconnects

Intended Audience:

This beginner-intermediate course is intended for engineers and scientists working on short optical interconnects in data centers as well as those working on components and subsystems interested in developing an expertise in link design. The course also addresses academic researchers and graduate students with basic knowledge on multimode fiber modeling and propagation, and link power budgeting. Some basic understanding of optical communication systems is helpful, but is not a pre-requisite.

This course is a complement to SC327 and SC357.

9:00–13:00

SC105 Modulation Formats and Receiver Concepts for Optical Transmission Systems

Instructors: Peter Winzer, Chandrasekhar

Sethumadhavan; *Nokia Bell Labs, USA*

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Identify key objectives of high-capacity and high-speed optically routed network design.
- Describe the basic concepts behind optical modulation and multiplexing techniques.
- Generate advanced optical modulation formats using state-of-the-art opto-electronic components and DSP.
- Explain the basic concepts of optical receiver design, including direct and coherent detection as well as related digital signal processing techniques.
- Recognize and discuss the interplay between modulation format, transceiver design, and transmission impairments.
- Get an insight into future trends in research and product commercialization of optical transport systems enabled by advanced modulation and multiplexing techniques, software-defined transceivers, and flexible WDM architectures.

Intended Audience:

This advanced-beginner course is intended for a diverse audience including lightwave system researchers and engineers as well as opto-electronic subsystem designers. Some basic knowledge of optical modulation and detection technologies will help in better understanding the course but is not a prerequisite. Past attendees will find substantial updates to this course, which we continuously adapt to reflect the latest trends in research as well as in product development, and may hence find it useful to attend again.

SC114 Passive Optical Networks (PONs) Technologies

Instructor: Frank J. Effenberger; *Futurewei Technologies, USA*

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Compare the capabilities and advantages of different PON technologies.
- Describe the practical limitations of real-world G-PON and EPON systems for broadband access.
- Explain the motivations behind the Full-Service-Access-Network initiative and the related IEEE P802.3 and P1904 projects.
- Identify the commercial issues surrounding fiber access, and how PON works to address these.
- List and compare the possible future evolution paths that PON technology may take.
- Begin to plan PON applications and deployments.

Intended Audience:

This course is intended for engineers, network planners and product designers involved with broadband access and a need to understand passive optical networks.

SC341 OFDM for Optical Communications

Instructors: Sander L. Jansen¹, Dirk van den Borne²; ¹ADVA Optical Networking, USA ²Juniper Networks, Germany

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Describe the concept of orthogonal frequency division multiplexing (OFDM) and implementations such as discrete multi-tone (DMT).
- List different flavors of optical OFDM and detail the advantages and disadvantages of each method to generate an OFDM signal.

- Appreciate the design trade-offs of the cyclic prefix, FFT-size, etc. with respect to for instance the dispersion tolerance and oversampling.
- Explain the multi-input, multi-output (MIMO) technique that is required to equalize a polarization division multiplexed (PDM) or a mode division multiplexed signal.
- Describe concepts such as IQ imbalance mitigation and phase noise compensation.
- Illustrate the advantage that OFDM can bring in the generation of super channels for next-generation 400G/1T transport networks.
- Discuss the different implementation of OFDM and DMT for access and data center applications, and appreciate the relative complexity of the transmitter and receiver architecture.
- Explain the influence of fiber nonlinearity on OFDM and describe methods to optimize the nonlinear tolerance of optical OFDM.

Intended Audience:

This course is intended for engineers, researchers and technical managers who would like to gain a better understanding of optical OFDM and its applications in next-generation optical transport networks. Apart from the theory and concepts behind optical OFDM, the implementation and system design will be discussed in detail, such that the participants can obtain a good level of understanding for the different design trade-offs. Participants should have a comprehensive knowledge in the field of fiber-optic transmission systems; no previous knowledge of OFDM is required. Past attendees of the course will find substantial updates and new information, and are encouraged to attend again.

SC359 Datacenter Networking 101

Instructors: Cedric Lam, Hong Liu; *Google, USA*

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Define warehouse-scale computer (WSC) and describe its structure
- Describe the engineering principles and philosophies behind scalable mega-datacenter infrastructures
- Compare different datacenter cluster topologies and switching technologies.
- Compare the differences and similarities between traditional telecommunication networks and booming data-communication networks
- Identify the challenges for intra-datacenter and inter-datacenter communications
- Select suitable optoelectronic interconnect technologies
- Explain the roles of optics in transmission, multiplexing and switching
- Identify designs to realize energy efficient data networks

Intended Audience:

This course is beneficial to optoelectronic engineers, fiber optic transceiver designers and optical transmission engineers who would like to understand the requirements of datacenter networking. It also benefits network engineers with the knowledge of high-speed optical communication technologies used to realize various datacenter network applications. For network planners and architects, this course provides outlooks in optical network technology developments in the next 3 to 4 years.

SC384 Background Concepts of Optical Communication Systems

Instructor: Alan Willner; Univ. of Southern California, USA

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Discuss basic concepts of an optical communication system.
- Identify different types of modulation and multiplexing formats.
- Compute a simple optical power budget.
- Explain key differences between direct and coherent detection systems.
- Attend more advanced OFC short courses and understand better the conference technical sessions.

Intended Audience:

This introductory course is intended for an audience with at least some technical background in engineering, physics or related disciplines, and is ideally suited for engineers who want to learn more about optical fiber communication systems. The audience should gain valuable knowledge enabling them to take more advanced courses as well as understand better the conference technical sessions.

SC395 Hands On: Basic Modeling and Simulation of Coherent Fiber-Optic Communication Systems

Instructors: Robert Palmer, Harald Rohde; Coriant, Germany

Level: Advanced Beginner

Benefits and Learning Objectives:

This course will enable participants to design and program a numerical simulator for a coherent optical transmission system. Within the course Matlab is used, but the course content can be applied to any other programming language as well.

Intended Audience:

This course is targeted for researchers and students who want to learn how to build a simulation tool for coherent optical transmission systems. Familiarity with Matlab is a pre-requisite as well as a basic knowledge of transmission system related mathematics, e.g. Fourier transforms. Basic communication theory knowledge is also required.

The participants shall bring their own laptop computers, including a Matlab installation. Alternatively, the code also runs under Octave. Participants without a computer or without Matlab/ Octave can follow the instructions and the tutorial part of the short course but might be idle during the hands on parts.

13:00–16:00

SC216 An Introduction to Optical Network Design and Planning

Instructor: Jane M. Simmons; Monarch Network Architects, USA

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Compare O-E-O and optical-bypass technology.
- Compare the architectures of various optical network elements.
- Describe the colorless, directionless, contentionless, and gridless attributes of ROADMs.
- Describe the basics of routing traffic, including strategies for load balancing and protection.
- Describe the basics of wavelength assignment.
- Enumerate some of the networking principles as well as physical effects that determine where regeneration is required in a network.
- Enumerate the advantages and disadvantages of a gridless network
- Compare real-time vs. long-term network planning.

Intended Audience:

This course is intended for network planners and architects in both carriers and system vendors who are involved in planning optical networks and selecting next-generation optical equipment. The discussion of networking elements and algorithms should be helpful to vendors who are developing optical systems, as well as to carriers who are modeling network evolution strategies. The course is introductory level, although a basic understanding of networking principles is assumed.

SC217 Optical Fiber Based Solutions for Next Generation Mobile Networks

Instructor: Dalma Novak; Pharad, LLC., USA

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Explain the motivation for the integration of next generation mobile communication systems with optical fiber networks;
- Identify the technical challenges related to the application of photonics and optical networking concepts to wireless communications;
- Discuss and compare physical layer technologies that enable the integration of wireless and optical networks;
- Identify technologies that can improve the performance of integrated optical and wireless networks;
- Establish the trade-offs with alternative integrated network architectures

Intended Audience:

This is an advanced beginner course for people working in either the optical or wireless telecommunication fields who wish to broaden their knowledge and learn how optical fiber solutions are playing a role in the realization of emerging integrated optical/wireless networks.

SC373 Specialty Fiber Splicing and Interconnection

Instructor: Andrew Yablon; Interfiber Analysis, USA
Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Improve the quality of your fusion splices
- Compare competing interconnection technologies
- Select equipment for optical fiber interconnection
- Estimate interconnection performance
- Test and measure optical fiber interconnections
- Avoid problems with splice reliability
- Evaluate and apply special fusion splicing strategies

Intended Audience:

This course is intended for engineers and scientists who are concerned about the problem of optical fiber interconnection and are looking for practical solutions to their problems. This course presupposes a familiarity with contemporary optical fibers and their theory of operation.

SC385 Optical Interconnects for Extreme-scale Computing

Instructors: John Shalf¹, Keren Bergman²; ¹Lawrence Berkeley National Laboratory, USA, ²Columbia University, USA
Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Summarize how new computing technologies enable real-world applications
- Discuss trends in high performance computing architecture

- Describe innovative technologies on the horizon, such as hybrid memory, optical interconnects, multicore processors and accelerators, and petascale supercomputers.
- Compare technologies and solutions for real-world applications such climate modeling, biological sciences, and materials discovery
- Point to opportunities for dramatic improvements in performance for data-movement limited applications

Intended Audience:

This lecture is designed to introduce students how to use parallel computers to efficiently solve challenging problems in science and engineering, where very fast computers are required either to perform complex simulations or to analyze enormous datasets. The lecture is intended to be useful for students from different backgrounds. The presenter has a strong track record of presenting similar tutorials to academic and industrial audiences, and this material will be accessible by researchers, implementers, innovators, and executives.

SC433 Photodetectors for Optical Communications

Instructor: Joe Campbell, University of Virginia, USA
Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Explain the fundamental operation of different types of photodetectors and compare their relative merits
- Obtain a broad overview of the photodetectors that are widely deployed in optical communications
- Describe the state-of-the-art for p-i-n, avalanche, and single-photon photodiodes

- Understand design guidelines and tradeoffs for specific photodetector applications
- Specify appropriate detectors.

Intended Audience:

This course is intended for those interested the fundamentals of photodetectors. For example, what are the factors that determine the maximum bandwidth of a photodiode? What are the current “champion” results and what are the inherent tradeoffs with other performance parameters? The device physics will be presented at a high level although some background in semiconductor devices will be beneficial. The course is intended for those who are new to the area, while providing useful information to workers in the field.

13:00–17:00

SC203 100 Gb/s and Beyond Transmission Systems, Design and Design Trade-offs

Instructors: Martin Birk¹, Benny Mikkelsen²; ¹AT&T Labs, Res., USA, ²Acacia Communications, USA
Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Identify key requirements and drivers for 100Gb/s applications
- Explain key building blocks of coherent systems
- Describe the availability and performance of 100Gb/s.
- Discuss 100Gb/s transmission limitations
- Summarize 100Gb/s standards activities
- Describe drivers and technologies for systems beyond 100Gb/s
- Discuss applications of flex rate systems

Intended Audience:

The course is intended for engineers and technical managers who want an up-to-date overview of 100Gb/s transmission systems, including applications, line-card designs, and fiber transmission limitations. This year this course has been extended to 4 hours to accommodate more questions and more material beyond 100Gb/s. The course requires some understanding of basic optical transmission systems.

SC288 Fundamentals of Polarization, PDL, and PMD

Instructor: Nick Frigo; US Naval Academy, USA

Level: Intermediate

Benefits and Learning Objectives:

This course should enable you to:

- Describe the major representations of polarization states
- Perform simple calculations of polarization evolution in birefringent media.
- Explain the mechanisms underlying PMF and estimate splice tolerances
- Discuss polarization-dependent loss sources and effects
- Explain the physical origin of PMD
- Describe the dominant effects of PMD on transmission systems

Intended Audience:

The course is intended for engineers, technicians, and managers who would like a fundamental survey of polarization effects in devices or systems. The participant should have a basic understanding of how matrices multiply column vectors in order to follow the Jones formalism.

17:00–20:00**SC267 Silicon Microphotonics: Technology Elements and the Roadmap to Implementation**

Instructor: Lionel Kimerling; MIT, USA

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Identify trends in the optical components industry.
- Explain the power of a standard platform.
- Discuss the benefits of electronic-photonics integration.
- Evaluate the latest silicon photonic devices.
- Summarize the findings of the Communications Technology Roadmap.

Intended Audience:

This course is for executives and technologists in the optical components industry to include planners, engineers, and scientists participating in the optical components technology supply chain.

SC372 Building Green Networks: New Concepts for Energy Reduction

Instructor: Rod Tucker; Univ. Melbourne, Australia

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Compare networks from the perspective of energy efficiency.
- Compute an estimate of the energy efficiency of network equipment, designs and architectures (in Joules/bit).
- Explain the principles of energy efficiency in telecommunications networks

- Identify key factors and leverage points for improving the energy efficiency future networks
- Describe the key determinants of network energy efficiency

Intended Audience:

Telecommunications engineers, managers, policy makers, researchers and educators. A basic knowledge of telecommunications networks and equipment will be advantageous. Little or no knowledge of energy efficiency issues in telecommunications networks is required.

SC411 Multi-layer Interaction in the Age of Agile Optical Networking

Instructor: Ori A. Gerstel; Sedona Systems, Israel

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Describe IP layer behaviors which affect multi-layer networking
- Explain types of multi-layer interactions (physical integration, control plane, SDN, mgmt plane)
- Define multi-layer functionality (restoration, reoptimization of various kinds, disaster recovery...)
- Quantify the value for multi-layer functionality
- Describe the interaction between IP layer protection and optical restoration
- Explain how multi-layer interaction affects the planning process
- Explain how elastic flexgrid networking benefits from multi-layer interaction
- Discuss possible centralized/distributed control plane architectures and their pros/cons

Intended Audience:

The audience for this course includes system and network architects and engineers in network operators and equipment vendors, as well as researchers wanting to understand realistic methodologies for modeling multi-layer networks. The course assumes some familiarity with optical network architectures and basic understanding of the role of higher layer networks and how they connect to the optical layer.

SC420 Characterization of components for coherent communication systems

Instructor: Robert Palmer, Harald Rohde; *Coriant, Germany*

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Understand the properties of key optical components for coherent communication systems
- Measure those properties and evaluate the results in the right context
- Describe component specifications
- Specify components

Intended Audience:

This course targets researchers and system designers who want to get a better insight into the depths of component properties and to understand the properties' interdependencies.

SC429 Flexible Networks

Instructor: David Boertjes, *Ciena, Canada*

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to understand the following concepts:

- CD and CDC ROADM technologies
- flexible grid
- routing and spectrum assignment
- flexible modulation format
- on-demand vs. end-of-life planning

- capacity optimization
- network defragmentation

Intended Audience:

This course is intended for individuals with a working knowledge of ROADM networks and coherent modems. It will be of value for industrial professionals (system designers, managers) who need to understand the tradeoffs of performance and capacity in the design and deployment of optical networks, as well as for researchers who are new to the field.

Monday, 21 March 2016

08:30–12:30

SC101A Hands-on Workshop on Fiber Optic Measurements and Component Testing

Instructors: Caroline Connolly¹, Chris Heisler¹, Keith Foord², Loic Chere³; ¹*OptoTest Corp., USA*; ²*Greenlee Communications, USA*; ³*Data-Pixel, France*

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Explain the fundamental optical differences and applications of single-mode fiber (SMF) vs. multimode fiber (MMF), including the different fiber types and fiber sizes.
- Identify the different connector types and understand their specific performance features (i.e., E2000, FC, LC, Mil-Styles, MTP, SC, ST, etc.) plus the various end-face options (i.e. Expanded Beam, UPC and APC).
- Test connectors, cable assemblies, and fiber links for insertion loss (IL) and return loss (RL), while also understanding how these measurements can be affected by wavelength and launch conditions.
- Explain characterization measurements on passive optical components.
- Measure end face geometry and the importance that plays in a fiber connection.

- Make OTDR measurements and avoiding common pitfalls.

Intended Audience:

This course is valuable to technicians, engineers, and managers interested in measurement and characterization of fiber optic components. Some familiarity with fiber optic test cables and equipment is assumed. Class size is limited to 16.

SC102 WDM in Long-Haul Transmission Systems

Instructor: Neal S. Bergano; *TE Subcom, USA*

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Explain the tradeoffs made in the design of an amplifier chain.
- Summarize the tradeoffs made in the selection of fiber types.
- Explain Q-factor.
- Discuss the concept of margin in fiber optic transmission systems.
- Identify the important polarization effects in long-haul transmission systems.
- Compare the different methods of performing long-haul transmission experiments.
- Discuss circulating loop experiments.
- Discuss the future trends in long-haul transmission systems.
- Gain insight into the optical propagation of data signals over long distances.

Intended Audience:

This course is intended for the student who wants an understanding of how information is transmitted over long distances using fiber optic transmission lines, with emphasis on undersea cable transmission systems. This includes new entrants into the fiber optic field with an engineering background, engineers with fiber optics exposure, people in the fiber optic telecommunications industry, and fiber optic research and development management.

SC178 Test and Measurement of High-Speed Communications Signals

Instructor: Greg D. Le Cheminant; Keysight Technologies, USA

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Determine the relationships between BER, eye-diagrams and jitter tests.
- Avoid common mistakes that degrade measurement accuracy.
- Define the relationship between Q-factor and BER.
- Identify ways to increase test efficiencies.
- Develop test strategies to verify compliance to industry standards.
- Compare the different approaches to characterizing jitter and recognize what the results imply in a systems context.

Intended Audience:

This course is appropriate for engineers, technicians and scientists who have a basic or higher knowledge of high-speed communications systems and signals. A basic knowledge of common laboratory measurement instrumentation will be helpful.

SC325 Highly Integrated Monolithic Photonic Integrated Circuits

Instructor: Chris Doerr; Acacia Communications, USA

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Design optical waveguide structures.
- Simulate optical waveguide structures.
- Design complex photonic integrated circuits.
- Simulate photonic integrated circuits.
- Explain some of the device physics.

- Predict future abilities and costs of photonic integrated circuits.
- Debug problems in photonic integrated circuits.

Intended Audience:

This course is intended for anyone who has basic electromagnetics knowledge (e.g., know Maxwell's equations but do not have them memorized) and basic optical communications knowledge (e.g., know what optical fiber is but do not have to know what 16-QAM is) but wants to learn more about photonic integrated circuits.

SC347 Reliability and Qualification of Fiber-Optic Components

Instructor: David Maack; Corning, USA

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Learn the importance, tools, methodologies, mathematics and benefits of reliability programs
- Explain the requirements, tests, benefits and limitations of qualification programs
- Learn the strategic and tactical differences between qualification testing and reliability modeling.
- Review the multitude of roles, contributions, tools and functions of a reliability group
- Discuss and learn what constitutes a complete qualification program and get the author's interpretation of the "letter of the law" for the most popular standards
- See charts comparing different qualification standards
- Determine why and when reliability testing and modeling needs to be done.
- Describe the limitation of both reliability modeling and qualification testing.
- Learn how to establish appropriate reliability tests and gather meaningful data.

- Learn the ways to calculate the reliability of a device using accelerated testing data.
- Find information on standards, components, reliability software and other reference materials.

Intended Audience:

This course is intended for a general audience including non-technical persons with no particular background except an interest in or need for knowledge of reliability and qualification of photonic components. It is meant to impart valuable information to audiences of all levels.

SC389 Network Modelling and Design

Instructor: Dominic Schupke; Airbus Group Innovations, Germany

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

This course will enable you to:

- Describe the process for optimizing a network using optimization software
- Formulate linear optimization models for network problems
- Explain the differences between the various modeling approaches
- Discuss the pros and cons of solving approaches (heuristics, branch-and-bound algorithms, ...)
- Identify key parameters influential in modeling complexity, solving time, and computation results
- Hands-on implementation of network modeling and design examples

Intended Audience:

The course requires only basic knowledge in mathematics (calculus and linear algebra), communication networks, and programming (recursions, iterations, ...)

SC390 Introduction to Forward Error Correction

Instructor: Frank Kschischang; *Univ. of Toronto, Canada*

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- define the key parameters of an error-correcting code
- explain the system-level benefits provided by FEC
- convert between generator-matrix and parity-check-matrix descriptions of a code
- encode and decode a binary Hamming code
- encode a cyclic code using a generator polynomial
- describe the key parameters of Reed-Solomon codes
- combine two or more codes into a product-code or concatenation
- describe iterative decoding methods for low-density parity-check codes

Intended Audience:

This course is intended for systems engineers, system operators and managers who need to understand the costs and benefits in applying physical-layer error-control coding in a communications link, and those who wish to prepare themselves for the more advanced courses. No previous background in information theory or algebra is assumed.

SC392 Digital Coherent Optical Systems 1: Transceiver Technology and Performance

Instructor: Maurice O'Sullivan; *Ciena, Canada*

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Explain optical field amplitude, phase, polarization and intensity

- Distinguish IMDD from coherent detection and field modulation
- Describe the role of DSP in standard coherent transmission
- Gain exposure to electro-optic technologies used for coherent transmission
- Learn standard implementations of electric field transmitters and coherent receivers
- Estimate Q and BER for BPSK, QPSK and 16 QAM modulations
- Anticipate relative performances of coherent phase modulated channels vs. dispersion map and WDM channel spectrum

Intended Audience:

This course is intended for those interested in the workings and estimates of performance of commercial coherent solutions in a multi-span amplified WDM system. It is recommended to its audience as prerequisite to SC393.

SC432 Hands on: Silicon Photonics Design & Fabrication

Instructor: Lukas Chrostowski¹, Chris Doerr²; ¹*University of British Columbia, Canada*; ²*Acacia Communications, USA*

Level: Intermediate

Benefits and Learning Objectives:

This course should enable you to:

- Design silicon photonic integrated circuits (PICs)
- Participate in a step-by-step design methodology to design ring resonators, including identifying target specifications, analytic modeling, photonic circuit modeling for choosing parameters, waveguide modeling, directional coupler design, manufacturing variability analysis, design of experiment, layout for fabrication, and finally, experimental data analysis.
- Discuss the design methodology for a polarization splitting rotator based on sub-wavelength grating (SWG) waveguides.

Intended Audience:

This course is targeted for researchers and students who want to learn how to model and design silicon photonic components. Familiarity with optics and electromagnetics is a pre-requisite, as well as general knowledge photonic integrated circuits. No previous silicon photonic design experience is required.

Participants shall bring their own laptop computers, with the required software pre-installed. Licenses and instructions for installing Lumerical Solutions MODE, FDTD, and INTERCONNECT, and mask layout software, will be provided prior to the course.

09:00–12:00

SC176 Metro Network: The Transition to Ethernet

Instructor: Loudon Blair; *Ciena Corp., USA*

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Describe how new services are changing metro network traffic characteristics.
- Describe the impact that these new services will have on metro network traffic patterns and network equipment capacity in both aggregation and core metro networks.
- Describe the meaning of Carrier Ethernet and discuss different implementation approaches.
- Describe the key networking technologies used to build next generation metro networks, including DWDM, OTN, and IP/MPLS.
- Discuss the role of Carrier Ethernet in new metro architectures and how it operates in combination with other key technologies.
- Describe how packet and optical technologies are converging to form packet-optical transport and switching systems.
- Discuss how packet-optical systems may be used in different metro application scenarios, including new cloud network architectures.

Intended Audience:

This course is intended for network architects and planners from service providers, engineering and marketing staff to network equipment providers, technologists with an interest in the evolution of networks, industry analysts, and financial analysts.

SC208 Optical Fiber Design for Telecommunications and Specialty Applications

Instructor: David J. DiGiovanni; *OFS Labs, USA*

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Explain how certain fiber attributes, like attenuation, modal area and dispersion can impact current and next-generation high speed communications technologies
- Describe the wide array of optical fibers available and discuss how their designs have been engineered for particular applications
- Compare the benefits of different materials in fiber design, including different glass dopants.
- Design simple fibers for various applications, such as amplifiers, dispersion compensators, sensors and component pigtailed
- Determine whether particular applications can benefit from modified or novel optical fiber.
- Discuss the potential offered by fiber engineering which may be exploited to improve existing applications or create new functions.

Intended Audience:

This course is intended for the technical community seeking to understand the potential of optical fiber and waveguide design. Basic understanding of optical fiber properties is desirable though not required. The course will provide an understanding of the operating principles of fiber while also exploring the limits of waveguide and materials engineering. Specific designs for high speed transmission, optical amplification and dispersion compensation will be studied, among others.

SC409 Safety in Fiber Optics: From Components to Systems

Instructors: Larry Johnson, Ken Barat; *The Light Brigade, USA*

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Identify the various ANSI and IEC classifications of laser categories as defined by the ANSI and IEC laser safety standards
- Identify the laser types used in fiber optic communication systems and the potential safety concerns associated with each
- Identify the types of optical amplifiers used in fiber optic communication systems and the potential safety concerns involved at different power levels
- Describe the difference between APR and APS in fiber optic communication systems
- Apply the properties of DWDM with the associated power levels of optical amplifiers
- Identify potential problem areas where skin and possible eye punctures can occur and what remedies are available to minimize potential occurrences
- Explain the various types of test, measurement, and inspection equipment and their limitations with high-powered laser transmitters
- Develop a list addressing safety concerns towards the development of a fiber optic safety program as it pertains to fiber optic outside plant installations

Intended Audience:

This course is designed for those from an advanced beginner level. This is applicable to safety officers, supervisors, managers, and technicians who work with lasers, chemicals, fiber, transmission systems, and outside plant installations. For safety officers, the goal is to enhance or develop a safety program that addresses potential safety issues and concerns.

SC430: SDN Standards and Applications

Instructors: Lyndon Y. Ong, Raghu Ranganathan, Ciena, USA

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

This course will enable you to:

- Explain the basic architecture of SDN for transport networks
- Describe common service provider SDN Use Cases
- Diagram the components of an SDN-enabled transport network
- Compare the potential protocol options for SDN, including OpenFlow
- Describe OpenFlow and its extensions for optical networking
- List the roles of different SDN-related standards and industry groups and compare their different approaches to SDN
- Review the status of standards and implementation for SDN and optical networks
- Explain new developments such as the ONF Core Information Model and Intent-based Interfaces and how these affect future interoperability

Intended Audience:

The audience for this course includes system and network architects and engineers in network operators and equipment vendors, as well as researchers wanting to understand directions for introducing SDN into wide area networks. The course assumes some familiarity with optical network technologies and basic understanding of the role of higher layer networks and how they connect to the optical layer.

13:30–16:30

SC261 ROADM Technologies and Network Applications

Instructor: Thomas Strasser; *Nistica Inc., USA*

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Describe the network level benefits of ROADM systems.
- Define the different ROADM technology approaches competing in the market.
- Summarize the functionality differences between competing ROADM technologies, including which are most likely to succeed in the long term and why.
- Compare the incremental cost of a ROADM to the network level savings it enables.
- Discuss the types of networks that most fully benefit from ROADM technology and why.
- Explain the contradictory statements made about ROADM in trade literature.

Intended Audience:

Anyone interested in more fully understanding the functionalities and benefits of ROADMs, including students, researchers, engineers, managers, and executives involved in ROADM development, network design, network planning, and network operations

SC369 Test and Measurement of Complex Modulated Optical Signals

Instructors: Bernd Nebendahl, Michael Koenigsmann; *Keysight, Germany*

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Compare the quality of various transmitters through the use of EVM measurements
- Determine the relationships between EVM, BER, and Q-factor
- Compare the different techniques used for complex modulation analysis and determine which provide optimum results for a given measurement scenario
- Relate details of constellation diagrams to specific device and/or measurement system impairments
- Identify the root causes of measurement degradation and uncertainty
- Develop test strategies to validate the accuracy of test results

Intended Audience:

This short course is intended for engineers who start to work or already have experience in manufacturing and development of transmitters, links and receivers operating with complex modulated signals. Attendees should be aware of basic concepts of optical transmission and polarization of light. Research and manufacturing managers as well as technical buyers will get a profound background in order to make optimal decision for their test and measurement needs. Students will extend their knowledge in complex signal analysis to setup optimal test concepts.

SC386 The Evolution of WAN Transport towards SDN Architectures and Cloud Service Delivery

Instructor: Loukas Paraschis; *Cisco Systems, Inc., USA*

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Explain the interplay between SDN architectures, and wireline transport technology innovations during the evolution of the public and private cloud WAN infrastructure
- Discuss current wireline network evolution
- Describe the evolution in wide-area networks (WAN) focusing specifically in the synergies of routing and optical transport with data-center based service delivery, and the recent innovations in software and routing control plane.

Intended Audience:

This short course is primarily intended for researchers, students, and industry professionals in optical transport that wish to obtain a perspective on current wireline network evolution, with a particular focus on the implications of SDN, and cloud service delivery.

SC431: Photonic Technologies in the Datacenter

Instructor: Clint Schow, *University of California, USA*

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Compare the different optical technologies used in data centers today and identify their strengths and limitations
- Define the requirements for photonic links at different levels of network hierarchy in terms of reach, power, cost, and density
- Describe the factors that have driven the current implementation of systems and future trends that will drive technologies

- Discuss research efforts in the worldwide community aimed at increasing the role of photonics in data centers
- Explain current networking topologies and identify the technology capabilities that drove their adoption

Intended Audience:

This course is for anyone interested in learning about the underlying technology platforms that underpin the optical networks in data centers. In particular, network engineers involved in designing next-generation systems, researchers working on photonic interconnects and switching, and managers making product decisions will gain insight into the main strengths, limitations, and future prospects of photonic platforms.

Basic knowledge of fiber optic systems, including fiber transmission basics, optical link budgets, and characterization of high-speed links is beneficial but not required.

13:30–17:30

SC101B Hands-on Workshop on Fiber Optic Measurements and Component Testing

Instructors: Caroline Connolly¹, Chris Heisler¹, Keith Foord², Tony Nicholson³; ¹*OptoTest Corp., USA*; ²*Greenlee Communications, USA*; ³*Connected Fibers, USA*

Level: Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Explain the fundamental optical differences and applications of single-mode fiber (SMF) vs. multimode fiber (MMF), including the different fiber types and fiber sizes.
- Identify the different connector types and understand their specific performance features (i.e., E2000, FC, LC, Mil-Styles, MTP, SC, ST, etc.) plus the various end-face options (i.e. Expanded Beam, UPC and APC).

- Test connectors, cable assemblies, and fiber links for insertion loss (IL) and return loss (RL), while also understanding how these measurements can be affected by wavelength and launch conditions.
- Explain characterization measurements on passive optical components.
- Measure end face geometry and the importance that plays in a fiber connection.
- Make OTDR measurements and avoiding common pitfalls.

Intended Audience:

This course is valuable to technicians, engineers, and managers interested in measurement and characterization of fiber optic components. Some familiarity with fiber optic test cables and equipment is assumed. Class size is limited to 16.

SC185 Hands-on Polishing, Inspection and Testing of Connectors

Instructors: Steve Rounds¹, Steve Baldo², Loic Cherel³; ¹*Light Brigade Inc., USA*, ²*Seikoh Giken Co. Ltd., USA*, ³*Data-Pixel, France*.

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Measure optical attenuation measurements and expected variations at 1310/1550/1625nm.
- Measure optical return loss and define its relationship to connector polishes, polishing procedures and test methods.
- Identify contaminants, their cause, and how to resolve contamination issues with a variety of cleaning products.
- Identify and discuss the fundamentals of the polishing processes and their impact on attenuation and reflection.
- Identify and determine how to adjust variables that affect end-face geometry.

- Measure scratches using automatic analysis equipment.
- Apply the criteria for pass/fail in quality assurance programs and applications.
- Determine how the immediate feedback from the interferometer will help control the manufacturing process, creating higher performance terminations and increased production yields.

Intended Audience:

This course is applicable to those involved with fiber optic terminations from the novice to production engineers and managers involved with laboratory, manufacturing, and field disciplines. A basic knowledge of fiber optics is expected.

SC327 Modeling and Design of Fiber-Optic Communication Systems

Instructor: Rene-Jean Essiambre; *Nokia, Bell Labs, USA*

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Develop a functional understanding of the basic building blocks of fiber-optic communication systems.
- Learn the basic elements of optical transmission modeling.
- Develop a detailed understanding of how to model nonlinear transmission over fibers, especially how to navigate through the numerous pitfalls of nonlinear transmission modeling.
- Choose a suitable technique for modeling specific systems, such as systems using advanced modulation formats.
- Compare the performance of various amplification technologies.
- Explain the basic technical issues faced when configuring optical networks with complex topologies.
- Estimate the ultimate limit to fiber capacity.

Intended Audience:

This course is intended for engineers and scientists working on fiber-optic transmission as well as those working on components and subsystems interested in developing an expertise at the transmission level. The course also addresses academic researchers and graduate students with basic knowledge on optical or digital communication interested in developing a detailed knowledge of fiber-optic transmission modeling and in understanding system implications of advanced technologies.

SC357 Circuits and Equalization Methods for Short Reach Optical Links

Instructor: Alexander Rylyakov; Coriant, USA

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Outline overall transceiver architectures of typical wireline and optical short reach links
- Explain functionality and performance requirements of all key front-end I/O building blocks
- Evaluate and compare the efficiencies of wireline and optical short reach interconnects
- Compare SiGe bipolar and CMOS circuits for short reach optical and electrical links
- Describe and compare equalization techniques (CTLE, FFE, DFE)
- Discuss benefits and tradeoffs of equalization
- Make an educated choice between an optical and electrical solution for short reach interconnect

Intended Audience:

This course is for anyone interested in learning the basic transmitter and receiver circuit architectures for both optical and electrical short reach interconnects. The course will help gain the insight into the main tradeoffs involved in choosing between the optical and electrical links, as well as the integrated circuit topologies and technologies used in the transceiver circuits. The overview of advanced equalization

techniques will be also of interest to audience already familiar with the basics of short reach interconnect.

SC393 – Digital Coherent Optical Systems 2: Digital Signal Processing

Instructor: Chris Fludger; Cisco Optical GmbH, Germany

Level: Intermediate

Benefits and Learning Objectives:

This course should enable you to:

- Describe the principle building blocks in a coherent optical transceiver.
- Explain the function of frequency and time-domain filters and their advantages and disadvantages.
- Explain the implementation of pulse shaping and CD filters.
- Describe techniques for frequency and carrier phase estimation
- Summarize the importance of clock recovery and describe clock recovery methods.
- Describe the components of polarization tracking filters.
- Explain how channel parameter estimation may be performed in coherent transceivers.
- Explain the options for achieving flexible capacity including implications for the network.
- Quantify the effectiveness and complexity of non-linear compensation.

Intended Audience:

This course is intended for individuals having an intermediate knowledge of digital lightwave transmission systems. The introductory course (SC392) is recommended a prior knowledge. It will be of value for industrial professionals (system designers, managers) who need to understand the different components in digital coherent transceivers, as well as for researchers who are new to the field.

SC408 Space Division Multiplexing

Instructor: Roland Ryf; Nokia, Bell Labs, USA

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Compare space-division multiplexing to other multiplexing techniques, and list key advantages and potential fields of application
- Design optical components that support multiple modes and explain how the basic design differs from single-mode components
- Measure components with multiple-input and/or multiple-output ports and extract key parameters like mode-dependent loss and differential group delay
- Discuss strategies to reduce the complexity of the receiver digital signal processing in space-division multiplexed transmission
- Describe digital signal processing techniques to calculate bit-error rate and multiple-input multiple-output impulse responses from raw receiver data
- Summarize key advantages and limitations of different fiber designs
- Explain the origin of coupling or cross-talk between light paths or modes in multi-mode and multi-core fibers
- List the key principles used to build mode-couplers and how the insertion loss and the mode dependent loss scale as function of number of modes

Intended Audience:

This course is intended for engineers, scientists, managers, technicians and students who want to understand space-division multiplexing in optical fibers. No specific previous knowledge of optics is assumed and only basic math knowledge in linear algebra and differential equations is suggested. By the end of the course, these techniques will allow the design and analysis of simple space-division multiplexed systems.

14:00–18:00

SC160 Microwave Photonics

Instructor: Vince Urick; NRL, USA

Level: Advanced Beginner

Benefits and Learning Objectives:

This course should enable you to:

- Analyze microwave photonic components, sub-systems and systems.
- Discuss, relate and contrast analog and digital fiber optics.
- Design optical systems for microwave applications.
- Identify microwave systems which may benefit from utilizing analog optics.

Intended Audience:

The course attendee should have a basic understanding of lasers, photodetectors, and fiber optics. A bachelor's degree in physics or electrical engineering, or an equivalent level of experience, is prerequisite.



What's Happening on the Show Floor?

The OFC exhibit floor is the perfect place to build and maintain professional contacts and to broaden your knowledge about the companies that lead our industry in product development and technological advances. 600+ exhibits showcase the entire continuum of the supply chain – from communications systems and equipment to network design and integration tools and to components and devices. In addition to the 600+ exhibits, three exhibit hall theaters feature presentations by experts from major global brands and key industry organizations. Get high-level perspectives on hot topics like Cloud Services, SDN and FTTx. Learn about the state of the industry, emerging trends and recommended courses of action for how to tackle today's toughest business challenges.

Exhibition

Exhibit Halls A - C

Schedule plenty of time to roam the Exhibit Hall, visit with the hundreds of companies represented and see the latest products and technologies.

Exhibit Hall Regulations

- All bags are subject to search.
- Neither photography nor videotaping is permitted in the exhibit hall without the express written consent of OFC Show Management. Non-compliance may result in the surrendering of film and removal from the hall.
- Children under 18 are not permitted in the exhibit hall during set-up and teardown.
- Children 12 and under must be accompanied by an adult at all times.
- Strollers are not allowed on the show floor at any time.
- Soliciting in the aisles or in any public spaces is not permitted.
- Distribution of literature is limited to exhibitors and must be done from within the confines of their booths.
- Smoking is only permitted in designated exterior areas of the facility.
- Alcohol is not permitted in the exhibit hall during set-up and tear-down.

Exhibit Hall Coffee Breaks

The exhibit floor is the perfect place to build and maintain professional contacts, and these breaks provide ideal networking opportunities. Complimentary coffee will be served in the Exhibit Hall at these times:

	Exhibit Hours	Coffee Breaks
Tuesday, 22 March	10:00–17:00	10:00–10:30, 16:00–16:30
Wednesday, 23 March	10:00–17:00	10:00–10:30, 15:00–15:30
Thursday, 24 March	10:00–16:00	10:00–10:30, 15:00–15:30

Market Watch, *Exhibit Hall C, Expo Theater I*

This three-day series of panel discussions engages the latest application topics and business issues in the field of optical communications. Presentations and panel sessions feature esteemed guest speakers from industry, research and the investment community. See Page 35 for schedule and complete information.

POF Symposium and Technology Pavilion, *Exhibit Hall B, Booth 2761*

The Plastic Optical Fiber Trade Organization (POFTO) is organizing a POF Symposium that covers recent developments in POF technology, applications, technical standards, industry progress and new markets. POFTO is also organizing a POF Technology and Applications Pavilion where member companies demonstrate their products and technologies during the show. See page 40 for symposium details.

Poster Presentation and Interactive Demo Presentations, *Exhibit Hall B, Rear*

Poster presentations are an integral part of the technical program and offer an opportunity for lively discussion between the poster presenters and attendees. OFC has expanded its presentation modes to include a select number of interactive demonstrations. These featured displays can range from live software demonstrations to the showcasing of research prototypes (subsystems or devices) that form the core of the related research paper. Beverages and light snacks are served during poster sessions. See page 43 for full description.

Product Showcases, *Expo Theater III, Exhibit Hall A*

Exhibitors highlight their newest developments, products and services in 30-minute presentations on the show floor. Refer to page 42 or the OFC Mobile App for presentation schedule.

Service Provider Summit, *Exhibit Hall C, Expo Theater I*

Join your colleagues for this dynamic program with topics and speakers of interest to CTOs, network architects, network designers and technologists within the service provider and carrier sector. The program includes panel discussions, a keynote presentation, exhibit time and networking time.

VIP Industry Leaders Networking Event: Connecting Corporate Executives, Recent Graduates and Students, *Exhibit Hall C, Rear, Tuesday, 23 March 12:00–13:30*

This session brings together Industry Executives to share their business experience – from how they started their careers and lessons learned along the way, to using their degree in an executive position – with Recent Graduates and Students. See page 13 for full description.

Sponsored by 

Please refer to your OFC Buyers' Guide and Addendum for more details on the exhibition and other activities on the show floor, including participating company information, a map of the Exhibit Hall and specific presentation schedules for many of the programs. Check the Mobile App for regular updates to show floor programming (see page 8 for details on the app).

Show Floor Programming and Activities

OFC START UP Pavilion

Show floor between Exhibit Halls B and C

Open Exhibit Hall Hours

Visit the OFC START UP Pavilion, which showcases entrepreneurs from around the globe, who have developed innovative cutting edge optics and photonics technologies.

Expo Theater I Programming, Exhibit Hall C

Market Watch

Market Watch is located on the exhibit floor, so attendees can easily attend the sessions and tour the exhibit hall. Audience members are encouraged to participate in the question and answer segments that follow the presentations.

N5 Service Provider Summit and MarketWatch Sub-Committee Chair:

Eve Griliches, Cisco Systems, USA

Sponsored by:



Schedule-at-a-Glance

Tuesday, 22 March	
10:30–12:00	Panel I : State of the Industry – Analyst Panel
12:30–14:00	Panel II: Intercontinental Networks – Technology Opportunities in the Submarine Interconnection of Datacenters
14:30–16:00	Panel III: The Promising Market of 100G and Beyond Pluggable Devices – Talk with Experts
Wednesday, 23 March	
15:30–17:00	Panel IV: The Global Colocation Market – Are Worlds Colliding?
Thursday, 24 March	
10:30–12:00	Panel V: A Rational Assessment of 400G Ethernet
12:30–14:00	Panel VI: Sanity check – Where are we on 25GE and 50GE?

Panel I : State of the Industry – Analyst Panel

Moderator: Eve Griliches, Cisco, USA

This Market Watch panel is one of the of the most highly attended panels at OFC, where industry and financial analysts give their interpretation of where the markets are going, what research they have been presenting and what to expect for the year to come. Top trends in all markets will be presented with a focus on specific calculate and reported market data points that are helpful to all.

Speakers:

Lisa Huff, Chief Tech Analyst, Discerning Analytics, USA

Ronald Kline, Research Director, Ovum, USA

George Notter, Managing Director, Equity Research, Jeffries & Company, USA

Sterling Perrin, Senior Analyst, Heavy Reading, USA
Andrew Schmitt, Founder, Signal AI, USA

Panel II: Intercontinental Networks – Technology Opportunities in the Submarine Interconnection of Datacenters

Moderator: Lisa Bickford, Google, USA

This panel will begin with a very short primer on the undersea market. Large end-users such as Google, Microsoft, Amazon, and Facebook are increasingly using submarine facilities for intercontinental connection of their data center networks. This panel will point out the fiber exhaust problems today and will take a look at the need for technology upgrades to older SLTE infrastructure. Discussions on:

- To what degree is the old style wet plant changing to new types of solutions like wavelength switching?
- What new strides need to be made in restoration to ensure no part of the global economy is disconnected?
- Is undersea is optimized for 100G? Will 400G meet the distance requirement?
- In order to increase spectral efficiency, what is the rate of migration to smaller than 50-GHz spacing?
- What about new undersea fiber?
- What percentage of subsea networks has not been upgraded to 100G, yet?

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Speakers:

Herve Fevrier, *Xtera Communications, USA*

Mattias Fridström, *Vice President, Technology, TeliaSonera, Sweden*

Jamie Gaudette, *Sr. Manager, Transport Technology and Architecture, Microsoft, USA*

Tim King, *Sr Director, Global Subsea Product Management, Level 3, USA*

Erik Kreifeldt, *Senior Analyst, Telegeography, USA*

Andy Lumsden, *Head of Network Services, Telstra International, Hong Kong*

Panel III: The Promising Market of 100G and Beyond Pluggable Devices – Talk with Experts

Moderator: Shamim Akhtar, Apple, USA

100G transceivers are used for three major types of connections: intra- and inter-datacenter, transport client, and metro/access – all of which have improved significantly lately.

Photonic integration has been plodding along, and has started to play an important role in reduction of power, footprint, and cost of the pluggable. The detailed designs of the devices, however, have many flavors such as: four-wave or four-fiber 28GBd NRZ, two-wave 28GBd PAM4, single-wave 56GBd PAM4, single-wave DMT, and so on. At the same time, there are various form factors to be considered as well including QSFP, CFP4, SFP+, and even as passive ports on boards directly. This panel of industry experts will strive to determine the potential winning technology from the wide variety of options as well as answer the following questions:

- Is it reasonable to expect that the price tag of a 100G pluggable can drop from about \$30K several years ago to under \$1K, which means \$10/Gbps, in a couple of years?
- With further improvement if the cost of a \$1/Gbps for high-speed transceivers is achievable in foreseeable future, what will vendor margins look like?
- How can the market serve a reach distance of 2km at one end and 40/80km at the other?
- In addition to NRZ LR4, what are the strengths and weaknesses of the PAM4 approach versus DMT?
- Will demands of different types of data center operators be adequately accommodated?
- When will a 400G pluggable be available and how much does it cost?

Speakers:

Sudeep Bhoja, *CTO, InPhi, USA*

Mitch Fields, *VP, Fiber Optics Products Division, Avago Technologies, USA,*

Kenneth Jackson, *Product Marketing Director, Sumitomo Electric Device Innovations, USA*

Yves LeMaitre, *President of Optical Connectivity Business, Oclaro, USA*

Matt Traverso, *TMG Engineering, Cisco, USA*

Panel IV: The Global Colocation Market – Are Worlds Colliding?

Moderator: Vinay Rathore, Infinera, USA

The Global colocation market is a \$26 billion market today and is estimated to grow to \$43 billion in 2018 (Synergy Research). Colocation providers come in many flavors these days, those that focus on space and power and define themselves as ‘Carrier Neutral’, while others are beginning to offer more service provider like services like Cloud Exchange/Cloud Connect.

Initially driven by simple cross connects – copper and fiber, new options within the colocation data center are emerging, primarily Layer 2 cross connect switching. Now that content providers are entering colocation sites in more and more metro locations, and CDN players are establishing themselves in the same sites, has the mix of the colocation site moved from the traditional ‘buyer’ – the Enterprise moving to the cloud – to now add a ‘sellers’ market of content/cloud/CDN providers within the entire connectivity site?

This will be a combination of an educational panel as well as one that introduces new services like Cloud Exchange/Connect and what new optical technologies like ROADMs colocation providers will need in the next few years.

Speakers:

Robert Keys, *CTO, BTI Systems, USA*

Phill Lawson-Shanks, *Chief Solutins Architect, EdgeConneX, USA*

Rao Lingampalli, *Senior Manager, Optical Network Architecture Equinix, USA*

Hunter Newby, *Allied Fiber, USA*

John Sarkis, *NTT America, USA*

Mark Thiele, *EVP Ecosystem Evangelis, SUPERNAIP, USA*

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Panel V: A Rational Assessment of 400G Ethernet

Moderator: Julie Eng, *Finisar, USA*

This panel takes a close look at the current architecture, economics, applications and uncertainties surrounding 400G Ethernet. Work to define a 400 Gbit/s Ethernet standard is well under way and various 400GbE optical architectures are being debated. While solutions to make 400GbE work are on the horizon from a technical perspective, the declining costs of 100GbE present those in pursuit of this faster technology with a moving target for commercial success. This panel seeks to examine the possible technical approaches and realistic timelines for successful introduction of 400GbE in volume, or discuss niche applications that provide this nascent technology with a foothold for significant production. This panel is aimed to answer the following questions:

- When will 400GE be available for deployment?
- What are, if any, deployment issues with electrical, optical and mechanical interfaces? Is mechanically and electrically interchangeable product critical?
- What are the deployment scenarios, architectures and use cases in cloud data centers?
- Where are we at with 400G Ethernet standardization?
- What are the alternatives – Flex Ethernet? And when will Flex Ethernet ‘cost in’?

Speakers:

Chris Cole, *Finisar, USA*

Scott Kipp, *Director of Engineering, Brocade, USA*

Panel VI: Sanity check – Where are we on 25GE and 50GE?

Moderator: Daryl Inniss, *Director New Business Development, OFS, USA*

In July 2014, as a cost-cutting measure, Microsoft spearheaded the effort to push 25G and 50G devices for server connections within the data center. The first products are supposedly expected in early 2016. Some of the questions addressed in this panel will include:

- What is a realistic timeframe for commercial availability of components and when will they be actually used in networks?
- What percentage of these connections will be copper versus optical?
- What will be the key use cases for both data rates? What will be the impact on 10G/40G markets?
- How much progress on standards is the IEEE making?
- Where is the business case for the rest of the vendors? If it turns out that 400GE is not around the corner in terms of significant deployment, is there really a necessity for 50GE?

Speakers:

Samuel Liu, *Director of PLM, Nokia, USA*

Siddharth Sheth, *VP, Networking BU, InPhi, USA*

Rob Stone, *Technical Director, Broadcom, USA*

Rang-Chen(Ryan) Yu, *Molex, USA*

Service Provider Summit

The Service Provider Summit is open to all Conference Attendees and Exhibits Pass Plus Attendees!

Service Provider Summit is located on the exhibit floor, so attendees can easily attend the sessions and tour the exhibit hall. Audience members are encouraged to participate in the question and answer segments that follow the presentations.

N5 Service Provider Summit and MarketWatch Sub-Committee Chair:

Eve Griliches, *Cisco Systems, USA*

Sponsored by:



Schedule-at-a-Glance

Wednesday, 23 March	
10:00–10:30	Coffee Break Sponsored by Juniper Networks
10:30–11:00	Keynote Presentation Network Function Virtualization – Hype or Reality?
11:00–12:30	Panel I: Vertically Integrated WDM Platforms vs. Open Line Systems
12:30–13:30	Networking Lunch Sponsored by Juniper Networks
13:30–15:00	Panel II: Optical Layer Flexibility with Next Generation ROADMs
15:00–15:30	Coffee Break Sponsored by Juniper Networks

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Keynote Presentation



Network Function Virtualization – Hype or Reality?

Margaret Chiosi, *Distinguished Network Architect at AT&T, AT&T, USA*

Talk will focus on the realities and current challenges of implementing Software Defined Networks through virtualization and control technologies, the current state of standards and open source as well as AT&T's progression to an SDN enabled cloud for 75% of the targeted network by 2020.

Margaret Chiosi, Distinguished Network Architect AT&T Labs, has been involved in data networking for 30+ years. Margaret's current focus is on implementing AT&T's User Defined Network Cloud (UDNC) which is based on SDN and Virtualization building blocks. She has led large organizations responsible from concept through development and deployment of emerging global network services, development of data networking equipment, and strategic direction for data services and products. Margaret was one of the key members in the creation of the ETSI ISG – Network Virtualization Forum as well as the Linux Foundation Open Platform for NFV, OPNFV.

Panel I: Vertically Integrated WDM Platforms vs. Open Line Systems

Moderator: Zeljko Bulut, Coriant, USA

The measure of the competitiveness in optical transport has always been the cost per bit transported. The vertical integration strategy has been seen as the single path to deliver on that objective. As a result, over the last several years we have witnessed a rise in innovative technology and components in this space. Although vertical integration has great potential, end users were not always getting the cost benefits anticipated, as the insourcing increasingly has led to technology fragmentation and numerous proprietary solutions that no longer profit from economies of scale.

More and more requests for an open transport platform are coming from both traditional and alternative service providers. The purpose is to deliver fully interoperable network functions such as an open line system, programmable ROADMs, transponders and pluggables. The notion is that such open architectures would entice even more competition and take full advantage of the economy of scale to lower the cost per bit. Given such a low price of pluggable interfaces, for example 10G SFP+, is it realistic to expect that the industry can deliver further price breaks.

This panel will discuss the pros and cons of each approach and seek to understand which of these two business and network implementation strategies will eventually prevail and why, or if they will coexist over a longer period of time. What incentive will systems vendors have to differentiate?

Speakers:

Tom Issenhuth, *Optical Network Architect, Microsoft, USA*

Shoukei Kobayashi, *Senior Research Engineer, NTT, Japan*

Bikash Koley, *Distinguished Engineer & Director, Network Architecture and Engineering, Google, USA*

John Paggi, *AT&T, USA*

Glenn Wellbrock, *Verizon, USA*

Panel II: Optical Layer Flexibility with Next Generation ROADMs

Moderator: Tiejun J. Xia, Verizon Communications Inc., USA

The next generation ROADMs which support colorless, directionless, and even contention-less functions, have begun to be deployed in service providers networks. With this advancement it makes a lot of sense to introduce an SDN type of control to form an orchestration layer to manage all of the network resources. This panel of carriers will explore the vast

and newer applications of next generation ROADMs. Interesting aspects investigated will be the potential enablement of new services, which will benefit both networking service providers and their customers. The panel will provide comprehensive answers to the following questions:

- For incumbent service providers, how to will you leverage the opportunities of SDN optical transport?
- Which types of applications will be benefit first with the introduction of flexible optics?
- How soon can networks recognize new efficiencies delivered by these new features such as reliable traffic restoration, spectrum defragmentation, and fast capacity re-allocation?
- Will flex grid and superchannels have an impact on reconfigurable architectures?

Speakers:

Vinayak Dangui, *Google, USA*

Mitsunori Fukutoku, *NTT, Japan*

Jeff Jockman, *Director - Transport Strategy & Development, CenturyLink, USA*

Andrew Lord, *Core Optical Transport, BT Exact, United Kingdom*

Dan Marom, *Associate Professor, Applied Physics Department, Hebrew University, Israel*

Glenn Wellbrock, *Verizon, USA*

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Expo Theater II Programming, Exhibit Hall B

Sponsored by:



Schedule at-a-Glance

Tuesday, 22 March	
10:30–11:30	CEI-56G - Signal Integrity to the Forefront
11:30–13:00	Carrier Grade SDN
14:00–15:00	Optical Integration with DC & Cloud Hyper Scale Growth <i>Sponsored Commercial Session</i>
15:00–16:00	Multilayer SDN Programmability, Automation and Analytics <i>Sponsored Commercial Session</i>
16:00–17:00	Customer Voice: Benefits in Deploying a Metro IP Transit Architecture <i>Sponsored Commercial Session</i>
Wednesday, 23 March	
10:30–12:00	COBO - What It Is and Why Should You Care?
12:30–14:00	System Disaggregation in Next-Generation Transport Networks
14:30–15:30	The State of Ethernet Optics
16:00–17:00	Ethernet Fiber Optic Cabling Trends
Thursday, 24 March	
10:00–13:00	POF Symposium
13:30–14:30	IoT Industrial Deployment

CEI-56G – Signal Integrity to the Forefront

Session Organized by the OIF
Moderator: Nathan Tracy, OIF Technical Committee Chair, TE Connectivity, USA

Panelists:

Tom Palkert, OIF Physical & Link Layer Working Group Vice Chair – Electrical, USA

David Stauffer, OIF Physical & Link Layer Working Group Chair, Kandou Bus., USA

Carrier Grade SDN

Session Organized by the Open Networking Foundation (ONF)

Presenters:

Marc Cohn, ONF Market Area Director, Senior Vice President, ClearPath Networks, USA

Lyndon Ong, Chair of the ONF Open Transport Working Group, Ciena Fellow, USA

Optical Integration with DC & Cloud Hyper Scale Growth

(Sponsored Commercial Session)

Presenter:

Amit Bhardwaj, Director of Product Management, Juniper Networks, USA

Multilayer SDN Programmability, Automation and Analytics

Sponsored Commercial Session

Presenter:

Colby Barth, Distinguished Engineer, Juniper Networks, USA

Customer Voice: Benefits in Deploying a Metro IP Transit Architecture

Sponsored Commercial Session

Presenter:

To Be Determined

COBO – What It Is and Why You Should Care?

Session organized by the Consortium for On-Board Optics (COBO)
Moderator: Jeff Demain, Strategic Marketing Director, Silicon Photonics Solutions, Intel, USA

Panelists

Brad Booth, Principal Architect, Azure Networking, Microsoft, USA

Yannick Lize, Director of Product Development, Silicon Photonics Solutions Group, Intel, USA

Jeffrey Maki, Distinguished Engineer II, Juniper Networks, USA

Christophe Metivier, VP Manufacturing and Platform Engineering, Arista Networks, USA

System Disaggregation in Next-Generation Transport Networks

Session organized by the IEEE Cloud Initiative
Moderator: Loukas Paraschis, Senior Architect, Cisco System, USA

Panelists:

Bikash Koley, Distinguished Engineer & Director, Network Architecture and Engineering, Google, USA

Peter Löthberg, Network Architect, Deutsche Telekom, Germany

Hans-Juergen Schmidtke, Director of Engineering, Facebook, USA

Amy E. Wheelus, AVP – D2.0 Technology Realization, AT&T, USA

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The State of Ethernet Optics

Session organized by the Ethernet Alliance
 Moderator: Scott Kipp, Ethernet Alliance President,
 Principal Hardware Engineer, Brocade, USA

Panelists:

Chris Cole, Director, Transceiver Engineer, Finisar, USA

Brad Smith, Director of Marketing, LinkX Team, Mellanox, USA

Ethernet Fiber Optic Cabling Trends

Session organized by the Ethernet Alliance
 Moderator: Doug Coleman, Manager of Technology Standards, Corning, USA

Panelists:

Paul Kolesar, Engineering Fellow, CommScope, USA

Brett Lane, Director of Technology, Panduit, USA

Greg McSorley, Technical Business Development Manager, Amphenol, USA

POF Symposium

Session organized by the Plastic Optical Fiber Trade Organization (POFTO)
 Organizer and Program Chair:
 Hui Pan, Chief Economist Plastic Optical Fiber Trade Organization (POFTO) & Information Gatekeepers, Inc., USA

Keynote:

Advanced POF Technology for 8K Era, Yasuhiro Koike, Director, Keio Photonics Research Institute and Professor, Keio University, Japan

Presenters:

Boeing Commercial Airplanes Fiber Optic Evolution- Applications of POF in Commercial Aircraft, T. Kien Truong, Technical Fellow - Avionics & Fiber Optics, The Boeing Company, USA

GaN LEDs for Gigabit Data Communication over POF, Juri Vinogradov, POF-Application Center, TH-Nuernberg, Germany

Graded-Index POF in Active Optical Cables and Other Applications, Whitney White, Co-Founder, Board Member, President & CTO, Chromis Fiberoptics, Inc., USA

POF Sensors for Aircraft Engine Monitoring, Joseba Zubia, Professor, University of the Basque Country, UPV/EHU, Spain

IoT Industrial Deployment

Session organized by the IEEE Cloud Initiative
 Organizer: Latif Ladid, IPv6 Forum President,
 Moderators: Roberto Minerva, IEEE Internet of Things Initiative Chair, Telecom Italia, Italy
 Doug Zuckerman, IEEE BigData Initiative Steering Committee, Applied Communication Sciences, USA

Presenters:

Internet of Things and Big Data
 Mahmoud Daneshmand, IEEE Big Data Initiative Standards Leader, Industry Professor, Stevens Institute of Technology, USA

The Impact of IoT on ISPs and the Telecom World
 Roberto Minerva, IEEE IoT Initiative Chair, Telecom Italia, Italy

Application Scenarios in Internet of Things
 Geoff Mulligan, Chair, ISPO Alliance, USA

Security and Privacy Challenges in EU IoT Projects
 Antonio Skarmeta, University of Murcia, Spain

Expo Theater III Programming, Exhibit Hall A

Schedule-at-a-Glance

Tuesday, 22 March	
10:15–10:45	Product Showcase - Evolution of the Cloud Edge, Huawei USA
11:00–12:30	Start-up Pavilion Presentations
12:45–14:45	Next Generation Data Center Optics (see page 13 for details)
14:45–15:45	Transport SDN - Getting Down to Business
16:00–17:00	The LSO Progress Report: Multi-Operator Carrier Ethernet Service Orchestration from Months to Minutes
Wednesday, 23 March	
10:15–10:45	Product Showcase - PON Products for Giga Access, Futurewei Technologies Co., Ltd., UK
11:00–12:00	Launching and Getting Funding for Start-up Companies: A Fireside Chat with Drew Perkins
12:00–12:30	Product Showcase - The vision of the Virtuoso Platform-Based Design Flow for Electronic / Photonic ICsTLE, Cadence, Lumerical, and Phoenix BV
12:30–13:00	Product Showcase - Jabil AOC Technologies, USA
13:00–13:30	Product Showcase - FlexE and Flexible Optical Transport with All Programmable FPGAS, Xilinx, USA
13:30–14:00	Product Showcase - Realize Beyond 100G (B100G) Deployment with Xilinx All Programmable Muxponder Subsystems, Xilinx, USA

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14:00–14:30	Product Showcase - Achieving 400G and Beyond Compact NRZ-based Applications, ColorChip, Israel
14:30–15:00	Product Showcase - The Role of Machine Learning, AI and Optimization in Orchestration in SDN/NFV Networks, Aria Networks, UK
15:00–15:30	Product Showcase - Next-Gen Digital Phase LCoS Product (1.2" 4K Backplane) Plan for WSS Application, Jasper Display Company, Taiwan
15:30–16:00	Product Showcase - Integration of 40 1×12 Wavelength Selective Switches into a Compact Module Using a Single Digital LCOS Device, ROADmap, UK
16:00–17:00	Understanding Back Reflectance
Thursday, 24 March	
10:15–10:45	Product Showcase - Embracing T-SDN to Build up Transport Open Ecosystem, Huawei USA
11:00–12:30	Impact of Mega Data Centers on the Industry Supply Chain
13:00–14:00	Understanding Optical Signal-to-Noise Ratio

Transport SDN – Getting Down to Business

Session organized by the OIF
 Moderator: Dave Brown, Director, Optical Networking Product Marketing, Nokia; Board Member and Vice President of Marketing, Optical Internetworking Forum (OIF), USA

Panelists:

Lyndon Ong, OIF Market Awareness & Education Co-Chair-Networking, Ciena, USA

Jonathan Sadler, OIF Technical Committee Vice Chair, Coriant, USA

Vishnu Shukla, Carrier Working Group Chair for the Optical Interworking Forum, USA

The LSO Progress Report: Multi-Operator Carrier Ethernet Service Orchestration from Months to Minutes

Session organized by the MEF
 Presenter: Abel Tong, Sr. Director, Solutions Marketing, & MEF Member, Ciena, USA

Launching and Getting Funding for Start-up Companies: A Fireside Chat with Drew Perkins

Drew Perkins, Serial Entrepreneur, USA

Understanding Back Reflectance

Presenter: Larry Johnson, Director & Founder, The Light Brigade, USA

Impact of Mega Data Centers on the Industry Supply Chain

Moderator: Vladimir Kozlov, Founder and CEO of LightCounting Market Research, USA

Panelists:

Osa Mok, CMO, Innolight, China

Yuval Bachar, Principal Engineer, Global Infrastructure Architecture and Strategy, LinkedIn, USA

Chongjin Xie, Chief Optical Architect Network, Alibaba Group, USA

Understanding Optical Signal-to-Noise Ratio

Larry Johnson, Director & Founder, The Light Brigade, USA

Product Showcases

Expo Theater III, Exhibit Hall A

Exhibitors highlight their newest developments, products and services in 30-minute presentations on the show floor. Refer to the OFC Buyers' Guide and OFC Mobile App for presentation updates.

Evolution of the Cloud Edge

Tuesday, 22 March 2016, 10:15–10:45

Dr. Sean Long, Director, PLM for Transmission Network, Huawei USA, USA

Cloud and datacenter is changing the architecture of the network. The evolution of the cloud edge becomes more and more important for the efficient new services support. This presentation will review Huawei's latest cloud edge solution offerings.

PON products for Giga Access

Wednesday, 23 March 2016, 10:15–10:45

Dr. Frank J. Effenberger, Vice President of Access R&D, Futurewei Technologies Co., Ltd., UK

On the requirement of the 4KTV and HDTV ultra-broadband services, Huawei released the new Giga access platform MA5800 and 10G PON ONT terminal. MA5800 support concurrent 16,000 4K users online with no blocking, support virtualized OLT to satisfy different services requirement (residential, business and mobile haul).

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Cadence, Lumerical, and PhoeniX Software present: The vision of the Virtuoso Platform-Based Design Flow for Electronic /Photonic ICsTLE

Wednesday, 23 March 2015, 12:00–12:30

Gilles S.C. Lamant, Distinguished Engineer, Cadence, USA

This presentation outlines the vision of the Virtuoso Platform-Based Design Flow for Electronic /Photonic ICs that improves productivity by enhancing the Virtuoso environment with photonic integrated circuit layout and simulation capabilities.

Product Showcase

Wednesday, 23 March 2016, 12:30–13:00

Jabil AOC Technologies, USA

FlexE and Flexible Optical Transport with All Programmable FPGAS

Wednesday, 23 March 2016, 13:00–13:30

Faisal Dada, *Wired Solutions Architect, Xilinx, USA*

FlexE is an OIF standard to carry flexible Ethernet rates. This presentation will explore FlexE enabled applications like data center interconnect and OTN switching in light of next generation dynamic transport systems.

Realize Beyond 100G (B100G) Deployment with Xilinx All Programmable Muxponder Subsystems

Wednesday, 23 March 2016, 13:30–14:00

David Yeh, Sr. *OTN Product Marketing Manager, Xilinx, USA*

Beyond 100G and bandwidth-on-demand are two emerging requirements in optical transport networks. This presentation will uncover how Xilinx's 400G OTUCn Muxponder Subsystem enables fast deployment of one 400G, two 200G or one to four 100G optical transmissions with future upgradability to support flexible OTN and flexible Ethernet.

Achieving 400G and Beyond Compact NRZ-based Applications

Wednesday, 23 March 2016, 14:00–14:30

Yigal Ezra, *CEO, ColorChip, Israel*

The presentation will discuss ColorChip's unique approach to addressing Data Centers requirements for cost effective \$/Gbps through NRZ-based solutions achieved via a cutting-edge modulator incorporated with ColorChip SystemOnGlass™ - a hybrid, multilane, Photonic Integrated Circuit. This groundbreaking technique facilitates the realization of cost-effective, high density and scalable hyper-scale single-mode, pluggable transceivers and OEMs.

The Role of Machine Learning, AI and Optimization in Orchestration in SDN/NFV Networks

Wednesday, 24 March 2015, 14:30–15:00

Dr. Jay Perrett, *Chief Technology Officer, Aria Networks, UK*

A key role of the orchestration function is optimization. The industry is rapidly coming to share our opinion that machine learning and AI is a key enabler to that function. Our view of orchestration is extensible to the optical layers and a full multilayer domain. This presentation shows how all these fit together.

Next-Gen Digital Phase LCoS Product (1.2" 4K Backplane) Plan for WSS Application

Wednesday, 24 March 2015, 15:00–15:30

Mike Stover, *Vice President, Marketing and Engineering, Jasper Display Company, Taiwan*

Jasper Display Corp. (JDC), a leading designer of SLM (Spatial Light Modulators) and has the next generation digital phase LCoS product plan (1.2" 4K Backplane) for WSS application. Jasper Display's digital LCoS has precise control of multi-level phase modulation which in turn helps to increase optical efficiency and to obtain better noise control in ROADMs.

Integration of 40 1×12 Wavelength Selective Switches into a Compact Module Using a Single Digital LCOS Device

Wednesday, 24 March 2015, 15:00–15:30

Brian Robertson, *Lead Technologist, ROADmap, UK*

Roadmap Systems presents an innovative module allowing up to 40 independent 1×12 Wavelength Selective Switches (WSSs) to operate with a single 4K digital LCoS device. Crosstalk suppression uses a combination of novel hardware and hologram optimization techniques. This flexible module can also be reconfigured as a 12×12 WSS.

Embracing T-SDN to Build up Transport Open Ecosystem

Thursday, 24 March 2016, 10:15–10:45

Dr. Young Lee, *Technical Director, Network Architecture of SDN, Huawei USA*

Transport networks are now facing challenges from the evolution of DCI, 5G Transport and 4K/8K video technologies in the ICT era. Huawei's T-SDN solution aims at building up transport network in an open environment, which enables horizontal interoperation among vendors and industry verticals for transport innovations.

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Interactive Demonstrations

The interactive demo presentation is a new type of presentation that complements oral/poster presentation. This new trial aims at enhancing interactions between presenters and audience by allowing oral and/or poster presenters to showcase table-top live demonstration of actual devices and/or system softwares. The interactive demo presentations are co-located with poster presentations. This year, we feature the presentations as listed in the following:

Wednesday, 23 March 10:00–12:00

M3F.2 • A New Factory Splice-On Fiber Optic Connector with High Performance and Reliability by Machine Automation, David Chen¹, Steve Zimmel², Yu Lu², Erik Gronvall²; ¹Verizon Communications Inc, USA; ²CommScope, Inc., USA.

W3E.3 • High Peak-Power, Narrow Linewidth, 1.5 μm Fiber Gas Source Generation by Stimulated Raman Scattering of Ethane, Yubin Chen¹, Zefeng Wang¹, Bo Gu¹, Jianqiu Cao¹, Qisheng Lu¹, Fei Yu², Jonathan C. Knight²; ¹College of Optoelectronic Science and Engineering, National Univ. of Defense Technology, China; ²Centre for Photonics and Photonic Materials, Dept. of Physics, Univ. of Bath, UK.

W4E.5 • Integrated Ultra-Low-Loss Silicon Nitride Waveguide Coil for Optical Gyroscopes, Sarat Gundavarapu¹, Taran Huffman¹, Michael Belt¹, Renan Moreira¹, John Bowers¹, Daniel Blumenthal¹; ¹Univ. of California, Santa Barbara, USA.

Th3E.5 • Mode Selective 10-Mode Multiplexer based on Multi-Plane Light Conversion, Guillaume Labroille¹, Pu Jian¹, Nicolas Barré¹, Bertrand Denolle¹, Jean-François Morizur¹; ¹CAILabs, France.

Thursday, 24 March 10:00–12:00

W2A.45 • Network Function Virtualization in Software Defined Optical Transport Networks, Yongli Zhao¹, Yajie Li¹, Rui Tian¹, Wei Wang¹, Jie Zhang¹, Yuefeng Ji¹, Xinbo Wang²; ¹Beijing Univ of Posts & Telecom, China; ²Univ. of California, USA.

W4D.1 • Simultaneous all-optical transparent phase multiplexing/de-multiplexing based on FWM in a HNLF, Yu-Hsiang Wen¹, Jia-Wei Ho¹, Kai-Ming Feng^{1,2}; ¹National Tsing Hua Univ. (NTHU), Inst. of Photonics Technologies, Taiwan; ²National Tsing Hua Univ. (NTHU), Inst. of Communications Engineering, Taiwan.

Th1E.2 • Transponder Pool Planning for Wavelength on Demand Services, Weisheng Xie¹, Qingya She¹, Kirsten Rundberget¹; ¹Fujitsu Network Communications, USA.

Th1I.3 • Demonstration of a Real-Time 25- Gb/s TDM-PON System with 25- Gb/s Downstream Based on Optical Duobinary and 10-Gb/s Burst-Mode Upstream Based on NRZ, Shengping Li¹, Zhicheng Ye¹, Ning Cheng², Xiang Liu²; ¹Huawei Technology Co. LTD, China; ²Huawei R&D USA, Futurewei Technologies, USA.

Th1I.4 • 28-Gb/s/ λ TDM-PON with Narrow Filter Compensation and Enhanced FEC Supporting 31.5 dB Link Loss Budget after 20-km Downstream Transmission in the C-band, Tao Minghui¹, Lei Zhou¹, Shuchang Yao¹, Ding Zou², Shengping Li¹, Huafeng Lin¹, Xiang Liu²; ¹Advance Optical Access Network Research Center, Huawei Technologies, China; ²Huawei US R&D Center, USA.

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D1: Advances in Deployable Optical Components, Fibers and Field Installation Equipment

Track D: Optical Components, Devices and Fiber

OFC D1: Advances in Deployable Optical Components, Fibers and Field Installation Equipment

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Track S: Photonic Systems and Subsystems

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