Technical Conference
Leap Forward with Breakthrough Research, Trends and Solutions

OFC
The future of optical networking and communications

TECHNICAL CONFERENCE
8 - 12 March 2020

EXHIBITION
10 - 12 March 2020

San Diego, California, USA

ofcconference.org
**Location**

San Diego Convention Center  
111 W Harbor Drive  
San Diego, California 92101  
USA

**Dates**

10 February 2020  
Advance Registration Deadline  
(23:59 EST)

14 February 2020  
Hotel Reservation Deadline

8 - 12 March 2020  
Technical Conference

8 - 9 March 2020  
Short Courses

10 - 12 March 2020  
Exhibit and Show Floor Programs

**Support**

**General Information**  
+1.202.416.1907  
+1.800.766.4672  
custserv@osa.org

**Registration**  
+1.866.486.0738  
+1.708.486.0738  
ofc@compusystems.com

**Hotel Reservations**  
+1.800.465.9101  
+1.240.439.2949  
OFC@experient-inc.com

**General Chairs**

Robert Doverspike  
Network Evolution Strategies, LLC, USA

Dan Kutcha  
IBM TJ Watson Research Center, USA

William Shieh  
University of Melbourne, Australia

**Program Chairs**

Shinji Matsuo  
NTT Device Technology Labs, NTT Corp., Japan

David Plant  
McGill University, Canada

Jun Shan Wey  
ZTE TX, USA
Dear Colleagues,

The largest optical communications conference in the world, OFC, is the event you cannot afford to miss!

OFC is more than just fiber optics. It is the only global conference that truly represents the entire ecosystem – where it is today and where it is going tomorrow. The conference offers in-depth coverage of the trending topics that are driving innovations in research, technologies and product solutions – including photonic integrated circuits, advanced digital-signal processing, quantum optics, emerging applications of optical networks in 5G, new computing and data center technologies.

Whether you are in the academic or the commercial community, OFC gives you the opportunity to learn, collaborate, see new products, conduct business, see the state-of-the-art and glimpse into the future of optical communications. You can see how today’s research may impact the future of your work – generating new ideas and solutions to resolve challenges – or evaluate the competitive landscape – to see what others are doing and what drives their solutions.

Perhaps the most valuable benefit of OFC is the professional connections you make, with numerous opportunities for face-to-face interactions with experts, peers, new vendors or customers.

And while attendance in any year is essential, joining us in 2020 will be even more meaningful as we celebrate the 50-year milestone of the first low-loss fiber and the room-temperature continuous wave diode laser – in other words, when the future of fiber optic communications began. In 2020, OFC will celebrate the discoveries of light-speed connectivity and imagine what comes next with special events and exhibits.

Join us in San Diego for OFC, and gain the knowledge and connections you need to stay ahead of the competition.

See you there!

2020 OFC Chairs
Get the Latest Advancements at OFC
The Premier Event in Telecom and Data Center

OFC is the world’s largest conference and exhibition for optical communication and networking professionals. The program is comprehensive — from research to marketplace, from components to systems and networks, from technical sessions to the exhibition.

Technical Conference
The five-day technical conference features peer-reviewed presentations and more than 120 invited speakers, the thought leaders in the industry presenting the highlights of emerging technologies. Additional technical programming throughout the week includes symposia, in-depth tutorials, workshops, panels and the thought-provoking rump session.

Training Courses
You can also take a Short Course and learn from the experts about important topics in the industry – there are 59 to choose from.

Exhibition
The show floor is buzzing with new product announcements and what’s trending in the market. Over 700 exhibitors keep you current on all the latest products and innovative solutions.

Show Floor Programs
Three theaters feature Market Watch, the Network Operator Summit, the Data Center Summit and 25 other show floor programs that cover market trends, new technologies and insight into the future. Panels of experts from global brands and key industry organizations provide high-level takes on the state of the industry, hot topics and perspectives on current and future challenges and solutions.
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<th>Event</th>
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<td>Registration*</td>
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<td><strong>Technical Conference</strong></td>
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<td>Short Courses</td>
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<tr>
<td>Lab Automation Hackathon</td>
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<td>OFC Demo Zone</td>
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<tr>
<td>Open Networking Summit</td>
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<tr>
<td>Technical Sessions</td>
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<tr>
<td>Plenary</td>
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<td><strong>Exhibition and Show Floor Programs</strong></td>
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<td>Unopposed Exhibit-only Time</td>
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<tr>
<td>Market Watch – Expo Theater I</td>
<td>10:30 – 16:00</td>
<td>15:30 – 17:00</td>
<td>10:30 – 16:00</td>
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<tr>
<td>Network Operator Summit – Expo Theater I</td>
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<tr>
<td>Expo Theater II &amp; III</td>
<td>10:15 – 17:00</td>
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<td>OFC Career Zone Live</td>
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<td><strong>Special Events</strong></td>
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<td>Awards Ceremony and Luncheon (add’l fee)</td>
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<td>Special Keynote: 50 Years of Light-speed Connections</td>
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All times reflect Pacific Time Zone

* Hours subject to change
Special Sessions

**Plenary**
The plenary speakers at OFC typically include an industrial leader and a research leader, both covering topics related to the technical core of the conference, and a visionary speaker linking topics outside OFC’s focus to the conference.

Qi Bi
*President, China Telecom Technology Innovation Center, Chief Technology Office, China Telecom Beijing Research Institute*

5G Evolution: Challenges and Opportunities

Karsten Danzmann
*Vice Managing Director, Laser Interferometry and Gravitational Wave Astronomy, Max Planck Institute for Gravitational Physics, Germany*

The Challenge and Impact of Detecting Ripples in Spacetime

Sir David Payne
*Director, Optoelectronics Research Centre, University of Southampton, UK*

Is there a Future for Silica as an Optical Material?

**Symposia**
Emerging Network Architectures for 5G Edge Cloud
This symposium provides an overview of state-of-the-art network solutions enabling dynamic smart connectivity to the edge cloud and will include topics spanning from transmission performance to security and from scalability to reliability. Industry and academic experts will provide insight on future architectures that will make pervasive use of technology a reality even at large scale.

Future Photonics Devices fJ/ bit Optical Networks Enabled by Emerging Optical Technologies
This symposium explores new photonic device technologies that enable low-power optical communication for future on-chip and off-chip communication.

The first part of the session focuses on low-power photonic device design, integration and manufacturing and the second part focuses on emerging optical network applications enabled by low power optical devices.

Quantum Information Science and Technology (QIST) in the Context of Optical Communications
This symposium explores and highlights the importance of quantum information science and technology and its impact and relevance with optical communications and future efforts in quantum computing, communications and sensing.

The first part of the session focuses on hardware and device aspects of QIST and the second part focuses on the architecture and systems aspects of QIST as related to optics, communications and similar disciplines.
The Role of Machine Learning for the Next-generation of Optical Communication Systems and Networks

The field of machine learning provides a new set of tools to the optical communication community. The goal of this symposium is to hear from active groups working in this area and chart the future for the application of machine learning in optical communication systems and networks.

Open Networking Summit

Optical Metro/Aggregation Networks to Support Future Services over 5G

Organizers

This session addresses the issue of whether and how the massive deployment of vertical services over 5G will change the traditional approach to building optical network infrastructures.

What are the network requirements? What does the network architecture look like and how can it be implemented? The session will also address different strategies leading to more efficient, more cost-effective and more sustainable networks.

Special Chairs’ Session

Vision 2030: Taking Optical Communications Through the Next Decade

Reflecting upon the 2010-2019 decade, OFC has led the optical communications industry and research communities to achieve significant and groundbreaking milestones. Looking forward to the next decade, we seek to answer a key question: what are the emerging hot topics and groundbreaking innovations to be anticipated?

Rump Session

When Will Co-packaged Optics Replace Pluggable Modules in the Datacenter?

A major limitation of today’s switch cards is the PCB electrical connection between the ASIC and front panel pluggable optics. With each new generation of switch ASICs, the demise of pluggable is predicted, only to be pushed out to a future generation. When will the pluggable paradigm finally run out of steam and will its replacement be co-packaging? Come to the Rump Session to discuss.
The Technical Program

Tracks and Topic Categories

OFC features an exciting roster of invited speakers and tutorial speakers to anchor the technical sessions. These experts have been carefully chosen by subcommittees of over 150 volunteers representing the 15 topic categories. They have also put together a thought-provoking program of 10 interactive workshops designed to stimulate debate and discussion on time-critical topics. Short Courses provide training from a distinguished faculty to expand your knowledge and advance your career.

The technical program and Short Courses are organized by topic category.

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<td>D3 Active optical devices and photonic integrated circuits</td>
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<td>S4 Digital and electronic subsystems</td>
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<td>N2 Optical networking for data center and computing applications</td>
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<td>N3 Architectures and software-defined control for metro and core networks</td>
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<td>N4 Optical access networks for fixed and mobile services</td>
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<tr>
<td>N5 Market Watch, Network Operator Summit and Data Center Summit (invited program only)</td>
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ofcconference.org
**D1: Advances in prototypes and product developments of components and subsystems for data centers and optical networks**

**Invited Speakers**

- **Optoelectronic Glass Substrates for Co-packaging Optics and ASICs**  
  Lars Brusberg, Corning Research & Development Corp., USA
- **Ultra-broadband Hybrid Polymer/Sol-gel Waveguide Modulators**  
  Yasufumi Enami, University of Fukui, Japan
- **Quasi-coherent Technology for Cost Efficient High Loss Budget Transmission**  
  Jesper Jensen, Bifrost Communications, Denmark
- **Development of VCSELs and VCSEL-based Links for Data Communication Beyond 50Gb/s**  
  Nikolay Ledentsov Jr., VI Systems GmbH, Germany
- **Optical Connectivities for Multi-core Fibers**  
  Ryo Nagase, Chiba Institute of Technology, Japan
- **A Single Channel 112 Gb/s PAM4 Optical Transceiver Link Based on Silicon Photonics and CMOS Electronics**  
  Haisheng Rong, Intel Corp., USA
- **Specialty Optical Fibers for Reflow Soldering Process and Other High Temperature Applications**  
  Mei Wen, OFS Optics, USA
- **Indium Phosphide Membrane Photonic Integrated Circuits on Silicon**  
  Kevin Williams, Technische Universiteit Eindhoven, Netherlands
- **Silicon Photonics for 100 Gbaud**  
  Jianying Zhou, NEOPhotonics Corp., USA

**Tutorial**

- **Reliability Qualification and Failure Mechanisms for Semiconductor Lasers and Fiber Optic Transceivers**  
  Robert Herrick, Intel Corp., USA

**Workshops**

- **Optical Components for fJ/bit Exascale Computing: How and When?**
- **Are Radical Photonic Devices and Architectures Needed for Future Data Centers?**

**Panel**

- **Devices and Systems at 130 Gbaud and Above: What Is the Outlook?**

**Short Courses**

- **SC205 Integrated Electronic Circuits for Fiber Optics**  
  Y. K. Chen, Nokia Bell Labs, USA
- **SC261 ROADM Technologies and Network Applications**  
  Thomas Strasser, Nistica Inc., USA
- **SC347 Reliability and Qualification of Fiber-optic Components**  
  David Maack, Corning, USA
- **SC357 Circuits and Equalization Methods for Coherent and Direct Detection Optical Links**  
  Alexander Rylyakov, Elenion, USA
- **SC359 Datacenter Networking 101**  
  Hong Liu and Ryohei Urata, Google, USA
- **SC428 Link Design and Modeling for Intra Data Center Optical Interconnects**  
  Petar Pepeljugoski, IBM Research, USA
- **SC431 Photonic Technologies in the Data Center**  
  Clint Schow, University of California Santa Barbara, USA
- **SC450 Design, Manufacturing and Packaging of Opto-electronic Modules**  
  Peter O’Brien, Tyndall National Institute, Ireland
- **SC462 Introduction to Pluggable Optics**  
  Robert Blum, Intel, USA
  Sharon Hall, Oclaro, USA
D2: Passive optical devices and circuits for switching and filtering

Invited Speakers

- Integrated Quantum Photonics on Silicon Platform
  Yunhong Ding, Danmarks Tekniske Universitet, Denmark

- Topological Photonics in Integrated Waveguides
  Jianwen Dong, Sun Yat-sen University, China

- Ultrafast Laser-written Sub-components for Space Division Multiplexing
  Simon Gross, Macquarie University, Australia

- Automated Optical Waveguide Design Based on Wavefront Matching Method
  Toshikazu Hashimoto, NTT Device Technology Labs., NTT Corp., Japan

- Deep-neural Networks for Designing Integrated Photonics
  Keisuke Kojima, Mitsubishi Electric Research Labs, USA

- Recent Progress on Wavelength Selective Switch
  Yiran Ma, Finisar Corp., Australia

- On-chip Optical Isolators
  Tetsuya Mizumoto, Tokyo Institute of Technology, Japan

- Large-scale Integrated Photonic Cross-connects for Optical Communication and Computation
  Patty Stabile, Technische Universiteit Eindhoven, Netherlands

Tutorial

- Non-volatile Photonic Applications with Phase Change Materials
  Matthias Wuttig, Rheinish Westfalische Tech Hoch Aachen, Germany

Workshops

- Are Radical Photonic Devices and Architectures Needed for Future Data Centers?
- Trends and Perspectives in Space-division Multiplexed Transmission and Related Devices
- Automotive Communications and Technologies for 10G and Beyond

Short Courses

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

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

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

SC432 Hands-on: Silicon Photonics Component Design & Fabrication
  Lukas Chrostowski, University of British Columbia, Canada

SC454 Hands-on: Introduction to Silicon Photonics Circuit Design
  Wim Boegarts, University of Ghent, Belgium

SC473 Photonic Switching Systems
  Benjamin Lee, IBM, USA
  David Neilson, Nokia Bell Labs, USA

D3: Active optical devices and photonic integrated circuits

Invited Speakers

- Si PIC Based on Photonic Crystal for Lidar Application
  Toshihiko Baba, Yokohama National University, Japan

- Next-gen High-speed VCSEL Design, Fabrication, and Characterization
  Laura Giovane, Avago Technologies, USA

- Routes toward Feedback-intensive Semiconductor Lasers
  Frederic Grillot, Institut Polytechnique de Paris, France

- III-V Micro- and Nano-lasers Grown on Silicon Emitting in the Telecom Band
  Kei May Lau, Hong Kong University of Science and Technology, Hong Kong SAR, China

- Optical Interconnects Using Single Mode and Multi Mode VCSEL and Multi Mode Fiber
  Nikolay Ledentsov Jr., VI Systems GmbH, Germany

- VCSELs for 3D Sensing Applications
  Chun Lei, Lumentum, USA
Tutorials
Graphene and Related Materials for Photonics and Optoelectronics
Andrea Ferrari, University of Cambridge, UK
Data Center Links beyond 100 Gbit/S Per Wavelength
Joseph Kahn, Stanford University, USA

Workshop
Optical Components for fJ/bit Exascale Computing: How and When?

Panel
Devices and Systems at 130 Gbaud and Above: What is the Outlook?

Short Courses
SC177 High-speed Semiconductor Lasers and Modulators
John Bowers, University of California Santa Barbara, USA
SC205 Integrated Electronic Circuits for Fiber Optics
Y. K. Chen, Nokia Bell Labs, USA
SC267 Silicon Microphotonics: Technology Elements and the Roadmap to Implementation
Lionel Kimerling, MIT, USA
SC325 Highly Integrated Monolithic Photonic Integrated Circuits
Chris Doerr, Acacia Communications, USA
SC357 Circuits and Equalization Methods for Coherent and Direct Detection Optical Links
Alexander Rylyakov, Elenion, USA
SC431 Photonic Technologies in the Data Center
Clint Schow, University of California Santa Barbara, USA
SC432 **Hands-on**: Silicon Photonics Component Design & Fabrication
Lucas Chrostowski, University of British Columbia, Canada
SC433 Introduction to Photodetectors and Optical Receivers
Joe Campbell, University of Virginia, USA
SC454 **Hands-on**: Introduction to Silicon Photonics Circuit Design
Wim Boegarts, University of Ghent, Belgium
SC486 Optoelectronic Devices for LIDAR and High-BW or 3D Sensing **NEW**
Martin Zirngibl, Krzysztof Tatarczak, Finisar, USA

D4: Fiber and propagation physics

Invited Speakers
Progress on Quantum Key Distribution Using Ultralow Loss Fiber
Alberto Boaron, University of Geneva, Switzerland
Linear and Nonlinear Characteristics of Few-mode Fibers with Partial Coupling between Groups of Quasi-degenerate Modes
Filipe Ferreira, Aston University, UK
Non-linear Impairments in Mmfs for Mode Division Multiplexing
Peter Krummrich, Technische Universität Dortmund, Germany
SM VCSEL Transmission over Graded-index Single Mode Fiber Around 850nm
Ming-Jun Li, Corning Research & Development Corp, USA
Distributed Measurement of Mode Dispersion of SDM Fibers
Shingo Ohno, NTT Access Service Systems Laboratories, Japan
Deep Learning Imaging through Specialty Multi-mode Fibers
Axel Schülzgen, University of Central Florida, USA

Tutorials
Physics and Applications of Photonic Crystal and Microstructured Fibres
Philip Russell, Max Planck Institute for the Science of Light and Department of Physics, Friedrich Alexander University, Germany
Advances in Few-mode Fiber Design and Manufacturing
Pierre Sillard, Prysmian Group, France

Workshop
Trends and Perspectives in Space-division Multiplexed Transmission and Related Devices

Short Courses
SC208 Optical Fiber Design for Telecommunications and Specialty Applications
David J. DiGiovanni, OFS Labs, USA
SC347 Reliability and Qualification of Fiber-optic Components
David Maack, Corning, USA
SC453A and B Hands-on: Fiber Optic Handling, Measurements and Component Testing
Steve Baldo, Seikoh Giken, USA
Chris Heisler, OptoTest Corporation, USA
Steve Lane, Data-Pixel, France
Julien Maille, Data-Pixel, France

SC465 Transmission Fiber and Cables
Chris Towery and Michael Ellwanger, Corning Optical Communications, USA

SC459 Multimode Photonic Devices, Components and Characterization
Nicolas Fontaine, Nokia Bell Labs, USA

TRACK S: SYSTEMS AND SUBSYSTEMS

S1: Digital subsystems and systems for data centers

Invited Speakers
More than Communication: Environment Monitoring Using Network Infrastructure
Yoshiaki Aono, NEC Corp., Japan
Low Power Data Center Transponders Enabled by Micrometer-scale Plasmonic Modulators
Benedikt Baueerle, Polariton Technologies Ltd. and ETH Zurich, Switzerland
Role of Optics in AI Infrastructure
Brad Booth, Microsoft Corp., USA
Why Data Science and Machine Learning Need Silicon Photonics
Larry Dennison, NVIDIA Corp., USA
Maximizing throughput via Vertical Optimization of the Digital Optical Network
Robert Maher, Infinera Corp., USA
Co-packaged TeraPHY Optical I/O Enables Next Generation of Data Center Applications
Vladimir Stojanovic, Ayar Labs Inc. and University of California Berkeley, USA

Tutorials
Performance Oriented DSP Design for Flexible Coherent Transmission in Data Centers
Chris Fludger, Cisco Systems Inc., Germany
Optics in Computing: Network on Chip and Chip-to-chip Interconnects
Ashok Krishnamoorthy, Axalume, Inc., USA

Workshops
What Will Drive the Transition to Coherent Intra-data-center Optics?
What ROADM/OXC Technologies Will Cost-effectively Enable Dynamic and Reconfigurable Optical Networks in 5G Era?
Does Disaggregation Support Data Center Evolution?

Panels
Devices and Systems at 130 Gbaud and Above: What is the Outlook?
How Can Machine Learning or, More Broadly, Artificial Intelligence Help Improve Optical Networks?

Short Courses
SC178 Test and Measurement for Data Center/Short Reach Communications
Greg D. Le Cheminant, Keysight Technologies, USA

SC203 400 Gb/s and Beyond Transmission Systems, Design and Design Trade-offs
Martin Birk, AT&T Labs, USA
Benny Mikkelsen, Acacia Communications, USA

SC205 Integrated Electronic Circuits for Fiber Optics
Y. K. Chen, Nokia Bell Labs, USA

SC328 New Developments in High Speed Optical Networking: OTN beyond 100G, 100G/200G/400G Ethernet, Flex Ethernet
Stephen Trowbridge, Nokia Bell Labs, USA

SC357 Circuits and Equalization Methods for Coherent and Direct Detection Optical Links
Alexander Rylyakov, Elenion, USA

SC428 Link Design and Modeling for Intra Data Center Optical Interconnects
Petar Pepeljugoski, IBM Research, USA

SC461 High-capacity Data Center Interconnects
Sander L. Jansen, ADVA Optical Networking, Germany
Dirk van den Borne, Juniper Networks, Germany

SC462 Introduction to Pluggable Optics
Sharon Hall, Oclaro, USA
Robert Blum, Intel, USA

S2: Optical, photonic and microwave photonic subsystems

Invited Speakers
Hardware Components for Photonic Neural Network Computing Systems
Stefan Abel, IBM Research GmbH, Switzerland

Technology Trends for Mixed QKD/WDM Transmission up to 80 km
Romain Alléaume, Télécom ParisTech, France

High-resolution Microwave Photonics Using Strong On-chip Brillouin Scattering
Amol Choudhary, Indian Institute of Technology, Delhi, India

Low-loss LiNbO3 for MWP
Marko Loncar, Harvard University, USA

Phase Reconstruction Scheme Using Dispersive Media in Direct Detection
Masayuki Matsumoto, Wakayama University, Japan

Photonic Integration for RF Beamforming in Phased Array Systems
Paul A. Morton, Morton Photonics Inc., USA

Narrowband and Low-noise Brillouin Amplification for Coherent Communications
Mark Pelusi, AIST Tokyo, Japan

Tutorials
Silicon Photonic Waveguide Bragg Gratings
Lukas Chrostowski, University of British Columbia, Canada

New Opportunities for Integrated Microwave Photonics
David Marpaung, Universiteit Twente, Netherlands

Short Courses
SC160 Microwave Photonics
Vince Urick, DARPA, USA

SC443 Optical Amplifiers: From Fundamental Principles to Technology Trends
Lu Li, SubCom, USA
Michael Vasilyev, University of Texas at Arlington, USA
S3: Radio-over-fiber, free space and sensing systems

Invited Speakers

Enabling Techniques for Optical Wireless Communication Systems
Chi-Wai Chow, National Chiao Tung University, Taiwan

Li-Fi for Industrial Applications
Volker Jungnickel, Fraunhofer Institute Nachricht Henrich-Hertz, Germany

Optically Controlled Beam-steering Wireless Systems
Ton Koonen, Technische Universiteit Eindhoven, Netherlands

5G mmWave Commercial Trial for Vertical Applications
Jongsik Lee, KT, South Korea

Radio-over-fiber Technology: Present and Future
Christina Lim, University of Melbourne, Australia

THz Communications, 5G Backhaul
Sebastian Randel, Karlsruhe Institute of Technology, Germany

Visible Light Communications for Automotive Intelligence
Takaya Yamazato, Nagoya University, Japan

Tutorial

Recent Trends of Free-space Laser Communications for Satellites Communications and Future Prospects
Morio Toyoshima, National Institute of Information and Communications Technology, Japan

Short Course

SC217 Applications of Radio-over-fiber Technologies including Future 5G Networks
Dalma Novak, Pharad, LLC., USA

S4: Digital and electronic subsystems

Invited Speakers

FSO Communications over Lunar Distances for the NASA Orion Spacecraft
David Geisler, Massachusetts Institute of Technology Lincoln Lab, USA

Nonlinearity Compensation via Machine Learning: Learned DBP and Learned PMD Compensation
Christian Häger, Chalmers Tekniska Hogskola, Sweden

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Nonlinear Frequency Division Multiplexing: Immune to Nonlinearity but Oversensitive to Noise?
Marco Secondini, Scuola Superiore Sant’Anna, Italy

Applications of MIMO Equalization Techniques in Optical Fiber Transmission Systems
Benn Thomsen, Microsoft Corp, UK

Performance and Power of Soft-decision FEC (SDFEC) for 100G-800G Applications
Zhiyu Xiao, Huawei Technologies Co., Ltd., USA

DSP-aided Telemetry in Monitoring Linear and Nonlinear Optical Transmission Impairments
Qunbi Zhuge, Shanghai Jiao Tong University, China

Tutorials

Machine Learning and its Applications in Optical Communication Systems
Alan Pak Tao Lau, Photonics Research Center, Department of Electrical Engineering, The Hong Kong Polytechnic University, Hong Kong SAR, China

Few-mode Fiber Transmissions
Guifang Li, University of Central Florida, USA

Workshop

800G and Beyond: Will Coherent Prevail at Short-reach Distances?

Panels

Automotive Communications and Technologies for 10G and Beyond

Pluggable Coherent Optics for Short-haul/Edge Applications and Beyond

How Can Machine Learning or, More Broadly, Artificial Intelligence Help Improve Optical Networks?

Short Courses

SC105 Modulation Formats and Receiver Concepts for Optical Transmission Systems
Peter Winzer and Xi Vivian Chen, Nokia Bell Labs, USA

SC114 Technologies and Applications for Passive Optical Networks (PONs) Technologies
Yuanqiu Luo, Futurewei Technologies, Huawei R&D, USA

SC205 Integrated Electronic Circuits for Fiber Optics
Y. K. Chen, Nokia Bell Labs, USA
SC328 New Developments in High Speed Optical Networking: OTN beyond 100G, 100G/200G/400G Ethernet, Flex Ethernet
Stephen Trowbridge, Nokia Bell Labs, USA

SC341 Multi-carrier Modulation and Superchannels for Terabit-class Transceivers
Sander L. Jansen, ADVA Optical Networking, Germany
Dirk van den Borne, Juniper Networks, Germany

SC357 Circuits and Equalization Methods for Coherent and Direct Detection Optical Links
Alexander Rylyakov, Elenion, USA

SC369 Hands-on: Test and Measurement for Signals with Complex Optical Modulation
Michael Koenigsmann and Bernd Nebendahl, Keysight Technologies, Germany

SC384 Background Concepts of Optical Communication Systems
Alan Willner, University of Southern California, USA

SC390 Introduction to Forward Error Correction
Frank Kschischang, University of Toronto, Canada

SC393 Digital Signal Processing for Coherent Optical Transceivers
Chris Fludger, Cisco Optical GmbH, Germany

SC395 Modeling and Simulation of Optical Transmitter and Receiver Components
Harald Rohde and Howard Wang, Elenion, Germany

SC408 Space Division Multiplexing in Optical Fibers
Roland Ryf, Nokia Bell Labs, USA

SC446 Hands-on: Characterization of Coherent Opto-electronic Subsystems
Harald Rohde and Howard Wang, Elenion, Germany

SC452 FPGA Programming for Optical Subsystem Prototyping
Robert Elschner, Fraunhofer HHI, Germany
Noriaki Kaneda, Nokia Bell Labs, USA

SC460 Digital Coherent Optical System Performance Basics
John Cartledge, Queen’s University, Canada
Maurice O’Sullivan, Ciena, Canada

SC468 Advanced FEC Techniques for Optical Communications
Laurent Schmalen, Nokia Bell Labs, USA

SC469 Laboratory Automation and Control Using Python (Beginner)
Binbin Guan, Acacia Communications, USA
Roland Ryf, Nokia Bell Labs, USA
Jochen Schröder, Chalmers University of Technology, Sweden

SC483 Hands-on: Machine Learning in Optical Networks NEW
Massimo Tornatore, Politecnico di Milano, Italy
Darko Zibar, DTU FOTONIK, Denmark

SC487 Hands-on: Laboratory Automation and Control Using Python (Advanced) NEW
Nicolas Fontaine, Nokia Bell Labs, USA
Binbin Guan, Acacia Communications, USA
Jochen Schröder, Chalmers University of Technology, Sweden

S5: Digital transmission systems

Invited Speakers
Capacity-approaching Ultra-wideband Nonlinear Optical Fiber Transmission System
Lidia Galdino, University College London, UK

Advanced Nonlinear Perturbation Theory in Coherent WDM Systems
Amirhossein Ghazisaeidi, Nokia Bell Labs France, France

Advanced DSP for Monitoring and Mitigation in Optical Transport Networks
Takeshi Hoshida, Fujitsu Laboratories Ltd., Japan

1-Tb/s per Channel Full C-band Long-haul Transmission
Takayuki Kobayashi, NTT Network Innovation Laboratories, Japan

Extreme Values in Optical Fiber Communication Systems
Seb Savory, University of Cambridge, UK

Entanglement-based Fiber Optic and Satellite QKD Systems
Rupert Ursin, Austrian Academy of Sciences, Austria

Machine Learning Techniques for Classical and Quantum Optical Communication Systems
Darko Zibar, Technical University of Denmark, Denmark
Tutorials
Ultra-wideband and Broadband Transmission Technologies
Fukutaro Hamaoka, NTT Network Innovation Laboratories, Japan
SDM Power-efficient Ultra-high Capacity Long-haul Transmission Systems
Alexei Pilipetskii, TE SubCom, USA

Workshop
Network Analytics in the Age of Machine Learning: How to Share Data and Maximize Synergies Among Transport Systems and Network Operators
Panels
Will SDM Truly Revolutionize the Submarine Communication Industry?
How Can Machine Learning or, More Broadly, Artificial Intelligence Help Improve Optical Networks?

Short Courses
SC102 WDM in Long-haul Transmission Systems
Neal S. Bergano, Retired, USA
SC203 400 Gb/s and Beyond Transmission Systems, Design and Design Trade-offs
Martin Birk, AT&T Labs, USA
Benny Mikkelsen, Acacia Communications, USA
SC327 Modeling and Design of Long-haul Fiber-optic Communication Systems
Rene-Jean Essiambre, Nokia Bell Labs, USA
SC341 Multi-carrier Modulation and Superchannels for Terabit-class Transceivers
Sander L. Jansen, ADVA Optical Networking, Germany
Dirk van den Borne, Juniper Networks, Germany
SC384 Background Concepts of Optical Communication Systems
Alan Willner, University of Southern California, USA
SC408 Space Division Multiplexing in Optical Fibers
Roland Ryf, Nokia Bell Labs, USA
SC429 Advances in Flexible Photonic Networks and Open Architectures
David Boertjes, Ciena, Canada
SC460 Digital Coherent Optical System Performance Basics
John Cartledge, Queen’s University, Canada
Maurice O’Sullivan, Ciena, Canada
SC469 Laboratory Automation and Control Using Python (Beginner)
Binbin Guan, Acacia Communications, USA
Roland Ryf, Nokia Bell Labs, USA
Jochen Schröder, Chalmers University of Technology, Sweden
SC470 Secure Optical Communications
Helmut Griesser, ADVA Optical Networking SE, Germany
Andrew Shields, Toshiba Research Europe Ltd., UK
SC487 Hands-on: Laboratory Automation and Control Using Python (Advanced) NEW
Nicolas Fontaine, Nokia Bell Labs, USA
Binbin Guan, Acacia Communications, USA
Jochen Schröder, Chalmers University of Technology, Sweden

TRACK N: NETWORKS, APPLICATIONS AND ACCESS

N1: Advances in system, network and service developments and field trials in commercial data centers and networks
Invited Speakers
Artificial Intelligence in Optical Networks
Shirshendu Bhattacharya, Google Zürich, Switzerland
Metro-haul Project Vertical Service Demo: Video Surveillance Real-time Low-latency Object Tracking
Annika Dochhan, ADVA Optical Networking, Germany
Real-time Demonstration of 500Gbps/Lambda and 600Gbps/ Lambda WDM Transmission on Field-installed Fibers
Hideki Maeda, NTT Network Service System Laboratories, Japan
Standardizing Performance Metrics for Submarine Transmission Paths
Priyanth Mehta, Ciena Canada, Canada
Record Ultra-high Full-fill Capacity Transatlantic Submarine Deployment Ushering in the SDM Era
Pierre Mertz, Infinera Corp., USA
Progress in 100G Lambda MSA Based on 100G PAM4 Technology and Next-generation PAM Technology
Mark Nowell, Cisco Systems Inc., Canada

Leveraging Photonic Flexibility in Multi-layer Resilient Networks
John Oltman, Ciena Corp., USA

Optical Node Disaggregation Management and Interoperability
Emilio Riccardi, Telecom Italia Lab, Italy

Coherent Technologies and Requirements in Next-generation MSO Networks
Matthew Schmitt, CableLabs, USA

Tutorials
From the Acceptance of Turnkey Systems to Open Networks with G-SNR
Leong Rivera Hartling, Facebook Inc., USA

Toward a Scalable Hybrid Quantum Cloud
Maria Spiropulu, California Institute of Technology, USA

Panels
As we Approach Shannon Limit, How do we Precisely Assess the Performance of Coherent Transponders for Field Deployment?
Will SDM Truly Revolutionize the Submarine Communication Industry?

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

SC328 New Developments in High Speed Optical Networking: OTN beyond 100G, 100G/200G/400G Ethernet, Flex Ethernet
Stephen Trowbridge, Nokia Bell Labs, USA

SC429 Advances in Flexible Photonic Networks and Open Architectures
David Boertjes, Ciena, Canada

SC447 The Life Cycle of an Optical Network: From Planning to Decommissioning
Andrew Lord, BT Labs, BT, UK

SC461 High-capacity Data Center Interconnects
Sander L. Jansen, ADVA Optical Networking, Germany
Dirk van den Borne, Juniper Networks, Germany

SC463 Optical Transport SDN: Architectures, Applications and Actual Implementations
Achim Autenrieth and Jörg-Peter Elbers, ADVA Optical Networking SE, Germany

SC464 SDN Inside and In Between Data Centers
David Maltz, Microsoft, USA

SC472 Hands-on: Controlling and Monitoring Optical Network Equipment
Ricard Vilalta, CTTC, Spain
Noboru Yoshikane, KDDI Research, Japan

N2: Optical networking for data center and computing applications

Invited Speakers
Control and Networks for Sub-microsecond Optical Circuit Switched Data Centres
Joshua Benjamin, University College London, UK

Datacenter Networks
Nihel Benzaoui, Nokia Bell Labs, France

Scalable Photonic Neural Networks Based on Diffractive Coupling
Daniel Brunner, CNRS, France

Optical Accelerators
Nicholas Harris, Lightmatter, USA

Multi-layer Network Slicing for Accelerating Business Velocity for Edge Computing
Akihiro Nakao, University of Tokyo, Japan

Scalable And Superconducting Neuromorphic Photonic Neural Networks
Alexander Tait, National Institute of Standards & Technology, USA

Advanced Software Architectures and Technologies in High Performance Computing and Data Centers
Juan Jose Vegas Olmos, Mellanox Technologies, Denmark

Tutorial
Neuromorphic Photonics
Paul Prucnal, Princeton University, USA

Workshops
Does Disaggregation Support Data Center Evolution?
Optics for Neuromorphic Computing and Machine Learning: Status, Prospects and Challenges
Short Courses
SC359 Datacenter Networking 101
Hong Liu and Ryohei Urata, Google, USA

SC448 Software Defined Networking for Optical Networks: a Practical Introduction
Ramon Casellas, CTTC, Spain

SC464 SDN Inside and In Between Data Centers
David Maltz, Microsoft, USA

SC472 Hands-on: Controlling and Monitoring Optical Network Equipment
Ricard Vilalta, CTTC, Spain
Noboru Yoshikane, KDDI Research, Japan

N3: Architectures and software-defined control for metro and core networks

Invited Speakers
Supporting Low-latency Service Migrations in 5G Transport Networks
Jiajia Chen, Chalmers University of Technology, USA

Demonstration of Joint Operation across Open ROADM Metro Network, OpenFlow Packet Domain, and OpenStack Compute Domain
Andrea Fumagalli, The University of Texas at Dallas, USA

Spatial Channel Networks
Masahiko Jinno, Kagawa University, Japan

Multi-layer Optimization with Low Margins Exploiting Autonomous Network Management
Daniela Moniz, Infinera/Instituto de Telecomunicações, Portugal

Network Control and Orchestration in SDM and WDM Optical Networks
Raul Muñoz, CTTC, Spain

Architecting Flexible Optical Network with Whitebox
Hideki Nishizawa, NTT Communications Corp., Japan

Realization, Practical Applications and Use Cases of TransLambda Function in Optical Networks
Muhammad Sarwar, Fujitsu Network Communications Inc, USA

Design and Control in Open Disaggregated Optical Networks
Takehiro Tsuritani, KDDI R&D Laboratories, Japan

Tutorials
Open Optical Systems
Martin Birk, AT&T Labs, USA

Reliable Machine Learning Models for Quality of Transmission Estimation
Rui Morais, Coriant, Portugal

Workshops
What ROADM/OXC Technologies Will Cost-effectively Enable Dynamic and Reconfigurable Optical Networks in 5G Era?

Network Analytics in the Age of Machine Learning: How to Share Data and Maximize Synergies Among Transport Systems and Network Operators

Panel
Pros and Cons of Low-margin Optical Networks
Short Courses
SC216 An Introduction to Optical Network Design and Planning
Jane M. Simmons, Monarch Network Architects, USA

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

SC328 New Developments in High Speed Optical Networking: OTN beyond 100G, 100G/200G/400G Ethernet, Flex Ethernet
Stephen Trowbridge, Nokia Bell Labs, USA

SC429 Advances in Flexible Photonic Networks and Open Architectures
David Boertjes, Ciena, Canada

SC447 The Life Cycle of an Optical Network: From Planning to Decommissioning
Andrew Lord, BT Labs, BT, UK

SC448 Software Defined Networking for Optical Networks: a Practical Introduction
Ramon Casellas, CTTC, Spain

SC463 Optical Transport SDN: Architectures, Applications and Actual Implementations
Achim Autenrieth and Jörg-Peter Elbers, ADVA Optical Networking SE, Germany

SC472 Hands-on: Controlling and Monitoring Optical Network Equipment
Ricard Vilalta, CTTC, Spain
Noboru Yoshikane, KDDI Research, Japan

SC483 Hands-on: Machine Learning in Optical Networks NEW
Massimo Tornatore, Politecnico di Milano, Italy
Darko Zibar, DTU FOTONIK, Denmark

SC484 Transport Evolution due to Cloud Services and Network Resiliency NEW
Loukas Paraschis, Infinera, USA

N4: Optical access networks for fixed and mobile services

Invited Speakers
Opportunities and Challenges When Using Low Bandwidth Optics for Higher Capacity PON Systems
Roberto Gaudino, Politecnico di Torino, Italy

Progress and Status of IEEE NG-EPON: Lesson Learned and Next Steps
Curtis Knittle, CableLabs, USA

Gigabit/s Optical Wireless Access and Indoor Networks
Ampalavanapilla Thas Nirmalathas, University of Melbourne, Australia

Software OLT Architecture
Keita Nishimoto, NTT Communications Corp., Japan

Aspects of 5G Radio and Use Cases that Influence Optical Network Solutions
Mark Watts, Verizon Communications Inc., USA

Applications of Machine Learning In High-speed Pons
Lii Li, Shanghai Jiao Tong University, China

Tutorials
The Telco Cloudification, from Opencord to SDN-enabled Broadband Access (SEBA)
Saurav Das, Open Networking Foundation, USA

Transceiver Technologies for Next-generation PON Networks
Dora van Veen, Nokia Corp., USA

Workshop
Converged 5G and Heterogeneous Services Access Networks: How to Achieve Ultra-low Latency and High Reliability?

Panel
Is It Time to Shift the Research Paradigm in Access Networks from a Focus on More Capacity?

Short Courses
SC114 Technologies and Applications for Passive Optical Networks (PONs)
Yuanqiu Luo, Futurewei Technologies, Huawei R&D, USA

SC444 Optical Communication Technologies for 5G Wireless
Xiang Liu, Futurewei Technologies, Huawei R&D, USA

SC483 Hands-on: Machine Learning in Optical Networks NEW
Massimo Tornatore, Politecnico di Milano, Italy
Darko Zibar, DTU FOTONIK, Denmark

SC485 Advanced Fiber Access Networks NEW
Cedric F. Lam and Shuang Yin, Google, USA
## Short Courses

Get in-depth training from industry experts. Registration fees are required.

Find complete course descriptions, objectives and instructor biographies at ofcconference.org/shortcourse

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<th>Time</th>
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<td>08:30 – 12:30</td>
<td>SC102 WDM in Long-haul Transmission Systems</td>
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<td>SC473 Photonic Switching Systems</td>
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<td>SC483 <strong>Hands-on:</strong> Machine Learning in Optical Networks <strong>NEW</strong></td>
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<td>SC114 Passive Optical Networks (PONs) Technologies</td>
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<td>SC450 Design, Manufacturing and Packaging of Opto-electronic Modules</td>
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<td>SC465 Transmission Fiber and Cables</td>
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<td>SC486 Optoelectronic Devices for LiDAR and High-BW or 3D Sensing <strong>NEW</strong></td>
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<td>SC429 Advances in Flexible Photonic Networks and Open Architectures</td>
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<td>SC459 Multimode Photonic Devices, Components and Characterization</td>
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<td>SC325 Highly Integrated Monolithic Photonic Integrated Circuits</td>
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<td>SC327 Modeling and Design of Long-haul Fiber-optic Communication Systems</td>
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<td>SC347 Reliability and Qualification of Fiber-optic Components</td>
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<td>SC451 Optical Fiber Sensors</td>
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New Courses

Stay current in your field by taking a Short Course at OFC. Learn from the experts. These half-day Short Courses are a good way to get clear, concise overviews of important topics in optical communications and networking. Hands-on courses provide demonstrations and the opportunity to use optical equipment.

**SC483 Hands-on: Machine Learning in Optical Networks**
Monday, 9 March
08:30 - 12:30

**INSTRUCTORS**
Massimo Tornatore, Politecnico di Milano, Italy
Darko Zibar, DTU FOTONIK, Denmark

**DESCRIPTION**
This course introduces the fundamental concepts and principles of ML, both from theoretical and industrial viewpoints. It surveys existing work on various applications in the optical networking domain, ranging from predictive maintenance to quality of transmission estimation and discusses the integration of advanced ML models into the network control and management architecture. Finally, the course provides a hands-on tutorial for participants who are interested in real-world application of ML in optical networks including a general overview of the key problems, common formulations, existing methodologies and future directions.

**SC484 Transport Evolution due to Cloud Services and Network Resiliency**
Sunday, 8 March
17:00 - 20:00

**INSTRUCTOR**
Loukas Paraschis, Infinera, USA

**DESCRIPTION**
This course reviews the main innovations in technology, system and network architecture that have facilitated the scaling of the cloud transport evolution and compares the different cloud service delivery models. It identifies how software innovations advance network automation and vendor-agnostic declarative configuration management and how they have been leveraged to advance new “open” transport and resiliency architectures. The course also explores the potential value, synergies and trade-offs from network optimization, traffic engineering and analytics. Finally, emerging innovations, standards and related research topics will be summarized.

**SC485 Advanced Fiber Access Networks**
Sunday, 8 March
09:00 - 12:00

**INSTRUCTORS**
Cedric F. Lam, Google, USA
Shuang Yin, Google, USA

**DESCRIPTION**
This course describes the architectural and traffic characteristics of modern broadband access networks and how fiber access networks help operators solve their techno-economic problems. The course looks at fiber access networks from the perspective of a complete end-to-end operator network and explains the technology choices in relation to the challenges faced by operators.
**SC486 Optoelectronic Devices for LIDAR and High-BW or 3D Sensing**  
Monday, 9 March  
09:00 – 12:00  

**INSTRUCTORS**  
Martin Zirngibl, *Finisar, USA*  
Krzysztof Szczerba, *Finisar, USA*  
Anna Tatarczak, *Finisar, USA*  

**DESCRIPTION**  
This course reviews the various problems of 3D sensing/LIDAR and discusses the optical technologies that are best suited to solve each. The first part of the course reviews technologies used for 3D sensing and augmented reality. The last part of the course covers LIDAR for automotive applications and compares the use of direct detection vs. coherent detection technologies. It also reviews the various techniques for beam steering, that many LIDARs require. The course provides an overview of the current industry landscape, the driving forces behind vertical versus horizontal integration, as well as a look at the future ecosystem that could sustain 3D sensing everywhere on everything all the time.

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**SC487 Laboratory Automation and Control Using Python (Advanced)**  
Monday, 9 March  
08:30 – 12:30  

**INSTRUCTORS**  
Nicolas Fontaine, *Nokia Bell Labs, USA*  
Binbin Guan, *Acacia Communications, USA*  
Jochen Schröder, *Chalmers University of Technology, Sweden*  

**DESCRIPTION**  
This course aims to provide participants with the tools and knowledge to create sustainable automation of their experiments using the Python programming language. This is an advanced course which assumes participants have significant programming experience with other languages or have experience with Python and the scientific modules (NumPy, Scipy, Matplotlib). The course covers automated data acquisition, writing instrument driver interfaces and user interfaces, using automated testing to check code and applying programming practices such as version control and documentation.  

**Note:** If you do not have experience with Python, consider taking SC469, a similar course for beginners.
Exhibition

The World’s Largest Exhibit Hall in the Industry

Over 700 participating companies will showcase solutions to build your competitive edge. See what’s new and identify technology must-haves for your business. Only OFC offers the size and scope to compare and contrast vendors, giving you the information you need to make all your technology purchasing decisions in one place.

In addition to the exhibits, OFC offers educational programs on the show floor covering market trends, new technologies and insight into the future. Hear from industry groups such as COBO, Ethernet Alliance, IEEE, OIF, ON2020, OpenConfig, TIP and more.
Show Floor Programs

**Market Watch**
This three-day series of panel discussions engages the latest application topics and business issues in the field of optical communications – featuring esteemed speakers from industry and the research and investment communities.

**PANEL I**
State of the Industry

**PANEL II**
5G and Re-thinking Access Networks

**PANEL III**
Impact of Machine Learning on Network Architectures

**PANEL IV**
What is Next for Data Center Interconnects (DCIs)?

**PANEL V**
Inside the Data Center

**PANEL VI**
Advanced Packaging and Photonic Integration

**PANEL VII**
IP+WDM Architecture Evolution

**Network Operator Summit**
What is next in meeting the needs of network operators? Get the inside perspective from network operators and service providers – their issues and drivers and how their requirements may impact the industry’s future.

**KEYNOTE**
Chih-Lin I
CMCC Chief Scientist of Wireless Technologies, China Mobile Research Institute, China

**PANEL I**
Next Generation Access Network

**PANEL II**
Transport on a Plug

**Data Center Summit**
This program focuses on next generation optical technologies for intra and/or inter data center connectivity. It discusses evolving data center requirements for technologies, equipment, applications and deployment scenarios in hyperscale and enterprise.

**KEYNOTE**
Jeff Cox
Partner Director Network Architecture, Microsoft, USA

**PANEL I**
Data Center 2020 – Less Hyperscale and More Co-location and Compute at the Edge?

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Special Events

Celebrating 50 Years of Light-speed Connections

In 1970, two significant technical achievements led to the development of practical fiber optical communications: the demonstration of low-loss fibers (16db/km) and the first CW room-temperature semiconductor laser. Since then, numerous other breakthroughs have led to increasing the bandwidth and reach of fiber links, enabling the World Wide Web, video streaming, trans-oceanic high-capacity links, high-capacity wireless communications and many other data services.

At the 2020 OFC Conference and Exhibition, come celebrate the successes of the OFC community that have facilitated light-speed connections between individuals across geographic and oceanic boundaries.

Highlights include:

Special Keynote
The evolution of technology is often a history of firsts. The initial demonstration of low-loss fibers and CW diode lasers have led to other important developments including; the first electrically pumped VCSEL, the first transatlantic fiber cable, commercial WDM systems, the deployment of InP photonic integrated circuits and the commercialization of silicon photonics to mention a few. This special presentation from one of our industry’s leaders looks back at 50 years of discovery and concludes with an overview of how these technologies have impacted our world – from instant, worldwide communication to enabling 5G, the Internet and the Internet of Things.

The Timeline of Innovation
As we look back at the discoveries of years past and speculate about what is yet to come, OFC unveils a unique show-floor exhibit that surveys 50 years of optical fiber innovations – from the first demonstration of low-loss fiber in 1970 to efficient 400GbE transport at any distance today. Browse the timeline of milestones, and see the progression of invention through artifacts and imagery.

Conference Reception
The special keynote will be followed by an enhanced, themed conference reception featuring an array of food and drink.

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<th>On or Before 10 Feb. (US$)</th>
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<th>Hotel Name</th>
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